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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, 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.

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

- Clutch Assembly
- Coupler
- Hub Assembly (Pulley and Bracket)
- Clutch Mounting Hardware (6X Hex Bolts)
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
Part number 1090-09900-01xx has a 5-inch diameter fan pilot and uses a housing cover to protect the inside of the clutch assembly from foreign debris. The housing cover may be removed to gain access to the clutch mounting hardware by removing 3 nuts, 3 lock-washers, and 3 flat-washers (see images above). Retain the housing cover and associated hardware as these components are not sold separately. When reinstalling the housing cover, torque each nut to 37 Nm (28 lbf-ft).
## Clutch Kit Part Numbers

<table>
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<th>Part Number</th>
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Caution: K30 Steel Clutch components should never be interchanged with K30 Aluminum Clutch components. Interchanging these components may cause the clutch to fail.
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:

1. Are 6 Access Holes in Clutch Housing Aligned with 6 Bolts that Attach Clutch to Hub?
   - YES: Align 6 Access Holes in Clutch Housing with 6 Bolts that Attach Clutch to Hub.
   - NO: Manually Apply 90-110 PSI Air Pressure to Drive.

2. Is Clutch Disengaged?
   - YES: See Pg 14 to Troubleshoot “Clutch Will Not Disengage”.
   - NO: Remove Both the Clutch and the Hub as a Single Assembly.

3. Is Clutch Disengaged?
   - YES: Remove 6 Bolts that Attach Clutch to Hub, and Pull Clutch Away from Hub.
   - NO: Remove 6 Bolts that Attach Clutch to Hub, and Pull Clutch Away from Hub.
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:

1. Remove the Drive Belt From the Pulley of the Hub Assembly

2. Grasp the Pulley Near the Outer Diameter, and Attempt to ‘Rock’ the Pulley on its Shaft

3. Does the Pulley Have Play?
   - YES: Hub May Have Suffered a Pulley Bearing Failure (See Pg 20); Replace Hub and clutch
   - NO: Install the Drive Belt On the Pulley of the Hub Assembly Per Manufacturer’s Specifications

4. Grasp the Pulley Near the Outer Diameter, and Attempt to Rotate the Pulley on its Shaft

5. Does the Pulley Have Rough, Irregular, or ‘Gritty’ Motion?
   - YES: The Pulley Bearings are Acceptable for Continued Use
   - NO: Install the Drive Belt On the Pulley of the Hub Assembly Per Manufacturer’s Specifications
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

Remaining liner life may be checked by using the Service Alert Tool. This tool is available for no cost at 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 18 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

1. Is Air Pressure Supplied to Drive?
   - YES: Clutch is Disengaged When Supplied Air Pressure; Release Air Pressure and Restart the Troubleshooting Process
   - NO: Liner is Worn; Install Liner Kit

2. Liner is Worn; Install Liner Kit
   - NO: Is Clutch Shaft Discolored or Is Liner Residue Visible? *(See Pg 18)*
     - YES: Identify Root Cause *(See Pg 19)*
     - NO: Hub May be Reused

3. Hub May be Reused
   - NO: Inspect Pulley For Play *(See Pg 9)*; Does Pulley Have Play?
     - YES: Hub May Have Suffered a Pulley Bearing Failure *(See Pg 20)*; Replace Hub
     - NO: Clutch May Be Physically Damaged *(See Pg 23)*, or Clutch May Have Suffered a Needle Bearing Failure *(See Pg 22)*; Replace Clutch

4. Release Air Pressure and Monitor Clutch Housing
   - YES: Did Clutch Housing Move Rearward?
     - NO: Did Clutch Housing Move Forward?
     - YES: Release Air Pressure and Monitor Clutch Housing
     - NO: Did Clutch Housing Move Forward?

5. Did Clutch Housing Move Forward?
   - NO: Is Clutch Engaged Now?
     - YES: Concern Resolved
     - NO: Manually Apply 90-110 PSI Air Pressure and Monitor Clutch Housing

6. Manually Apply 90-110 PSI Air Pressure and Monitor Clutch Housing
   - NO: Check Remaining Liner Life with Service Alert Tool *(See Pg 11)*

7. Check Remaining Liner Life with Service Alert Tool *(See Pg 11)*
   - NO: Does Liner Need to be Replaced?
     - YES: Does Liner Need to be Replaced?
     - NO: Release Air Pressure and Monitor Clutch Housing

8. Release Air Pressure and Monitor Clutch Housing
   - YES: Did Clutch Housing Move Rearward?
     - NO: Did Clutch Housing Move Forward?
     - YES: Release Air Pressure and Monitor Clutch Housing
     - NO: Did Clutch Housing Move Forward?
Troubleshoot: Fan Drive Has An Air Leak

1. Inspect Pulley for Play (See Pg 9); Does Pulley Have Play?
   - YES: Hub May Have Suffered a Pulley Bearing Failure (See Pg 20); Replace Hub and clutch
   - NO: Remove Clutch from Hub, and Inspect Base Of Piston Rod on Clutch (See Pg 20)

2. Is Piston Rod Worn or Damaged?
   - YES: Clutch May Have Suffered a Needle Bearing Failure (See Pg 22); Replace Clutch
   - NO: Attempt to Rotate Cylinder Cap; Does Cylinder Cap Rotate Freely?
     - YES: Clutch May Be Physically Damaged (See Pg 23), or Clutch May Have Suffered a Needle Bearing Failure (See Pg 22), or Clutch May Have Suffered a Rear Bearing Failure; Replace Clutch (Clutch Bearing Failures are Warrantable if Technician Comments Indicate Proper Diagnosis and Repair)
     - NO: Hub Air Passage May Have Been Damaged by Clutch Piston Rod; Replace Hub if Necessary

3. Is There Corrosion or Contamination in the Air Passage of the Piston Rod?
   - YES: Clutch Air Seals Have Failed Due to System Contamination (See Pg 17); Replace Clutch
   - NO: Clutch has an Air Leak; Repair Clutch with Seal Kit (Failed Seals are Warrantable If Technician Comments Indicate Proper Diagnosis and Repair)
Troubleshoot: Clutch Will Not Disengage (If Air Leak, See Pg 13)

Release Air Pressure, then Manually Apply 90-110 PSI Air Pressure and Monitor Clutch Housing

Is Air Pressure Supplied to Drive?

YES

Supply 90-110 PSI Air Pressure to the Drive and Restart the Troubleshooting Process

NO

Did Clutch Housing Move Rearward?

NO

Liner May be Rusted to Clutch Shaft; Tap on Clutch Housing With a Rubber Mallet

YES

Maintain 90-110 PSI Air Pressure

Did Clutch Housing Move Rearward?

YES

Concern Resolved

NO

Is Clutch Disengaged Now?

YES

Did Clutch Housing Move Rearward?

NO

Inspect Pulley for Play (See Pg 9); Does Pulley Have Play?

NO

Hub May be Reused

YES

Hub May Have Suffered a Pulley Bearing Failure (See Pg 20); Replace Hub

Concern Resolved

Clutch May Be Physically Damaged (See Pg 23), or Clutch May Have Suffered a Needle Bearing Failure (See Pg 22); Replace Clutch
Troubleshoot: Fan Drive Has Play

1. Grasp the Pulley Near the Outer Diameter, and Attempt to ‘Rock’ the Pulley on its Shaft
   - Does the Pulley Have Play?
     - YES: Hub May Have Suffered a Pulley Bearing Failure (See Pg 20); Replace Hub and Clutch
     - NO: Does the Pulley Have Rough, Irregular, or ‘Gritty’ Motion?
       - YES: The Pulley Bearings are Acceptable for Continued Use
       - NO: Clutch May Have Suffered a Needle Bearing Failure (See Pg 22); Replace Clutch

2. Grasp the Pulley Near the Outer Diameter, and Attempt to Rotate the Pulley on its Shaft
   - Fan Drive Has No Trouble

3. Remove the Drive Belt From the Pulley of the Hub Assembly

4. Install the Drive Belt On the Pulley of the Hub Assembly Per Manufacturer’s Specifications

5. Inspect Clutch Play Exceed the BorgWarner Guideline (See Pg 10)

6. The Clutch Play May Have Suffered a Needle Bearing Failure (See Pg 22); Replace Clutch
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:

- Air System Contamination ........................................ Page 17
- Control System Issue .................................................. Page 18
- Control System Issue (Root Causes) ............................... Page 19
- Evidence of Pulley Bearing Failure ................................. Page 20
- Improper Installation .................................................. Page 21
- Needle Bearing Failure ................................................ Page 22
- Physical Damage ....................................................... Page 23
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.**
A control system issue (potential root causes identified on Pg 19) 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)

Any failure due to a control system issue is not warrantable through BorgWarner – check with the OEM for possible warranty coverage. Control system issues, which may cause the clutch to overheat, include any of the following root causes:

Incomplete clutch disengagement (liner still in contact) due to a source air pressure holding 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 weak air pump. 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 plugged air vent (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).

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).

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.

Clutch slippage caused by partial or full restriction of the fan motion, such as a physical obstruction.
Evidence of Pulley Bearing Failure

Damage to the base of the piston rod or o-ring may be caused by a pulley bearing failure. A rounded-out or melted coupler may also be caused by a pulley bearing failure. Inspect for play or rough motion in the pulley bearings (See Pg 9). If a clutch is damaged by a hub failure, and the hub is still under warranty, then both the clutch and hub must be returned to BorgWarner for warranty consideration.
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 failures are rare, but can occur. **If a needle bearing fails due to a hub failure (see Pg 20), 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.
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.**