Residential, TG-2000 and Commercial MagStop® Clutch/Brake

Installation & Operation Instructions

P-1177-WE
819-0457

This Manual covers Magstop Product Families as outlined below:

<table>
<thead>
<tr>
<th>Series</th>
<th>Reference Name</th>
<th>Torque Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>5217 Series</td>
<td>RMS</td>
<td>60 &amp; 80 ft-lb.</td>
</tr>
<tr>
<td>5218 Series</td>
<td>CMS</td>
<td>175 &amp; 200 ft-lb.</td>
</tr>
<tr>
<td>5228 Series</td>
<td>CMS 250</td>
<td>225 &amp; 250 ft-lb.</td>
</tr>
</tbody>
</table>

Warner Electric
Altra Industrial Motion
This guide applies to Warner Electric MagStop® clutches and clutch/brakes used on power equipment.

Residential, TG-2000, and Commercial MagStops are available in a range of torque capacities. The MagStop® name comes from the permanent magnet brake (magnetic stopping) rather than conventional spring activated mechanical brakes. In addition to these general procedures, any applicable OEM general and safety procedures must also be followed.

**WARNING** Failure to follow these instructions may result in product damage, equipment damage, and serious or fatal injury to personnel.
Components: (See Figure 1 on page 4.)

1. **Rotor Assembly**
   Generally, the input of the clutch. Includes a keyed hub which mates with the keyway in the crank shaft. The rotor transmits the torque from the crankshaft (driving shaft) to the armature assembly (output).

2. **Armature Assembly**
   Generally, the output of the clutch. Consists of a disk, springs and pulley (or output flange). With power applied the armature transmits torque from the rotor to the driven load. Power from the armature disk is transmitted to the pulley or flange by means of the leaf springs.

3. **Field Assembly**
   The clutch “power” source contains the coil which generates magnetic attractive force.

4. **Brake Poles**
   The two permanent magnets and plates fixed to the field shell provide the brake torque when the clutch is disengaged. Brake poles are not present if the assembly is a clutch only.

5. **D-drive Spacer**
   A hub that is inserted into either armature or field bearing (see Figure 2). The head has flats that can be held with a wrench to prevent rotation of the crankshaft when tightening the mounting bolt (see Figure 5). This hub also takes the place of the standard retaining washer.

6. **Anti-rotation Slot**
   Anti-rotation Slot (used with OEM’s anti-rotation device) prevents MagStop from rotation with crankshaft. If the field is bolted rigidly or if its axial movement is restricted the bearing in the field assembly will be improperly loaded and may fail. Use OEM supplied anti-rotation.

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**Optional Washer**
A single .250 inch (6.35 mm) minimum thick steel washer must be used between the clutch and the crank shaft retaining bolt if the D-drive spacer is not used.

**WARNING** A washer less than .250 inch (6.35 mm) thick will deform and allow the clamping load to be lost, resulting in damage to the clutch and/or the crankshaft and possible personal injury due to clutch separating from the shaft. Multiple thinner washers are not acceptable.
**MagStop® Components**

![Diagram](image)

**Figure 1**

**D-drive Spacer Removal/Installation**

![Diagram](image)

**Figure 2**

D-drive spacer may be installed on either end of clutch by OEM.

**CAUTION** D-drive spacer must be removed or installed using an arbor press or equivalent. On installation, opposite bearing INNER race must be supported or bearing damage may occur. On removal, adjacent bearing OUTER race must be supported or bearing damage may occur.
REQUIREMENTS
for a Successful Clutch Application/Installation

Critical Requirements

The two most important requirements for a successful clutch application or installation are:

1. Antirotation device must allow both axial and radial free-play!

   Failure to allow this free-play will result in field bearing failure. The greater the restriction the faster the bearing will fail!

2. Mounting bolt torque to be minimum of:

   - 3/8 -24 UNF use Grade 8 bolt torqued to 45-49 lb.-ft.
     (Grade 5 bolt is unacceptable)

   - 7/16-20 UNF Grade 5 or 8 bolt torqued to 55-60 lb.-ft.
     (Grade 5 or 8 bolt is acceptable)

   - M 10 X 1.50 Class 10.9 torqued to 55-65 N-m

   Note: All values are for dry (unlubricated) plated bolts, please consult fastener manufacturer if any type of locking element (thread lock compound, patch etc.) is to be used.

   Failure to adhere to these requirements will result in the failure of the clutch!
If the field is bolted rigidly or if its axial movement is restricted, the bearing in the field assembly will be improperly loaded and may fail. Use only factory installed anti-rotation device.

**Note:**
Must have faces parallel to each other (within .003”) and be perpendicular to the bore.

**Ground drive pulley or spacer must be chamfered to clear this radius on the engine shaft shoulder.**

**Shaft end and D-drive spacer must not touch**

**Thread size** | **Grade Class** | **Torque ft.lbf.** | **Torque N·m**
---|---|---|---
3/8-24” UNF | Grade 8 | 45-49 ft.lbf. | 61-66 N·m
7/16-20” UNF | Grade 5 or 8 | 55-60 ft.lbf. | 75-81 N·m
M 10 X 1.50 | Grade 10.9 | 40-48 ft.lbf. | 55-65 N·m

**Note:** All values are for dry (unlubricated) plated bolts, please consult fastener manufacturer if any type of locking element (thread lock compound, patch etc.) is to be used.

**WARNING**
Failure to torque bolt to requirements will degrade clamping and can allow the clutch to separate from the shaft, causing risk of personal injury.

**CAUTION**
Always bottom the clutch against a flat surface; never against radius.

**CAUTION**
If the field is bolted rigidly or if its axial movement is restricted, the bearing in the field assembly will be improperly loaded and may fail. Use only factory installed anti-rotation device.

**Figure 3**
Typical Engine Installation with Ground Drive Pulley

**Figure 4**
See Anti-Rotation Examples on pages 8-13
Anti-Rotation Example

Attached To Frame

Incorrect

Do Not Orient So That Bracket Will Bind In Slot

Do Not Bottom In Slot

Correct

.030 Min. Loose Fit

.060 Min. Worst Case Stackup Must Not Allow Bottoming In Slot
Anti-Rotation Example

Make Sure That This Area Does Not Contact Field Shell

.125 Min.

Do Not Orient So That Bracket Will Bind In Slot

Do Not Bottom In Slot

Incorrect

.030 Min. Loose Fit

Correct

.060 Min., Worst Case Stackup Must Not Allow Bottoming In Slot
Anti-Rotation Example

Make Sure That Twisted Area Does Not Contact Field Shell

Do Not Orient So That Bracket Will Bind In Slot

Do Not Bottom In Slot

Correct

Incorrect

.030 Min. Loose Fit

.060 min., Worst Case Stackup Must Not Allow Bottoming In Slot
Anti-Rotation Example

- .030 Min. Loose Fit
- Screw Must Be Free To Move

Anti-Rotation Example
Anti-Rotation Example

Aircraft Cable, .030 Min. Slack
Anti-Rotation Example
 Anti-Rotation Example

.030 Min. Loose Fit

.060 Min., Worst Case Stackup Must Not Allow Bottoming In Slot
## Troubleshooting Checklist

### A. Symptom: Clutch will not engage

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Blown fuse                                   | • Low coil resistance  
• Defective battery  
• Faulty charging system  
• Bad wiring or connections, PTO switch | • Replace with new MagStop unit  
• Replace  
• Repair or replace  
• Repair or replace |
| Low voltage supply (Less than 12 VDC at clutch) | • Defective battery  
• Faulty charging system  
• Bad wiring or connectors, PTO switch | • Replace  
• Repair or replace  
• Repair or replace |
| Incorrect coil resistance (see Step 1, page 17) | • Damaged coil | • Replace with new MagStop unit |
| Inadequate current supply                    | • Broken clutch lead wire  
• Faulty electrical system | • Repair  
• Measure clutch coil resistance and supply voltage at the clutch. If both are correct, electrical system is faulty. Repair or replace. |
| Rotor/armature airgap too large (greater than .125 inch/3.18mm) | • Rotor/armature wear; end of usable life | • Replace with new MagStop unit |

### B. Symptom: Brake will not engage

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armature/brake poles wore out</td>
<td>• End of usable life</td>
<td>• Replace with new MagStop unit</td>
</tr>
</tbody>
</table>
| Contaminated friction surfaces               | • Engine oil leak on brake                           | • Repair  
• Replace with new MagStop unit             |

### C. Symptom: Clutch slip

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Solution</th>
</tr>
</thead>
</table>
| Low voltage supply (less than 12 VDC at clutch) | • Defective battery  
• Faulty charging system  
• Bad wiring or connectors, PTO switch | • Replace  
• Repair or replace  
• Repair |
| Inadequate current supply                    | • Broken clutch lead wire  
• Faulty electrical system | • Repair  
• Measure clutch coil resistance and supply voltage at the clutch. If both are correct, electrical system is faulty. Repair or replace. |
| Overloaded clutch                            | • Clogged deck, back spindle, etc.                   | • Remove excess grass  
• Replace spindle |
| Contaminated friction surfaces               | • Engine oil leak on clutch                          | • Repair leak  
• Replace with new MagStop unit             |
Troubleshooting Checklist (Continued)

D. Symptom: Noisy clutch/Vibration

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed bearing</td>
<td>• Loose mounting (bolt not torqued properly)</td>
<td>• Replace (see Mounting Figure 3, page 6)</td>
</tr>
<tr>
<td></td>
<td>• Field assembly movement restricted</td>
<td>• Confirm proper Anti-rotation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(see Anti-rotation, Figure 4, page 6)</td>
</tr>
<tr>
<td>Adapter plate rattles against anti-rotation pin</td>
<td>• Some noise is normal</td>
<td>• If noise is excessive, repair or replace</td>
</tr>
<tr>
<td></td>
<td></td>
<td>anti-rotation device. (Follow OEM’s Specifications. See Anti-rotation, Figure 4, page 6).</td>
</tr>
<tr>
<td>Clutch loose on shaft</td>
<td>• Loose mounting (bolt not torqued properly)</td>
<td>• Tighten mounting bolt to specification. See</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mounting, Figure 3, page 6.</td>
</tr>
<tr>
<td></td>
<td>• Mounting bolt too long and bottoms</td>
<td>• Use correct length bolt (see Mounting page 6,</td>
</tr>
<tr>
<td></td>
<td>in engine shaft before clamping clutch</td>
<td>Figure 3)</td>
</tr>
<tr>
<td></td>
<td>• Mounting washer too thin and deforms during</td>
<td>• See Figure 1 and Warning on page 4.</td>
</tr>
<tr>
<td></td>
<td>bolt is tightened.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Shaft bottoms on D-drive</td>
<td></td>
</tr>
<tr>
<td>Clutch not mounted square</td>
<td>• Ground Drive Spacer mounting shoulder not</td>
<td>• Replace</td>
</tr>
<tr>
<td></td>
<td>squared. See Mounting Figure 3.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Clutch integral key hitting end of keyway</td>
<td>• Space clutch away from radius in shaft keyway.</td>
</tr>
<tr>
<td></td>
<td>in engine shaft</td>
<td>• Increase chamfer on ground drive spacer. See</td>
</tr>
<tr>
<td></td>
<td>• Incorrect or no chamfer on ground drive</td>
<td>Caution, Figure 3, page 6.</td>
</tr>
<tr>
<td></td>
<td>spacer.</td>
<td></td>
</tr>
<tr>
<td>Broken Spring</td>
<td>• Loose mounting</td>
<td>• Replace clutch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⚠️ WARNING ⚠️ A clutch with broken rivets or springs may separate from the shaft and cause personal injury.

Burnishing Procedure when installing a new MagStop® Clutch/Brake

This procedure should be performed with the load attached (mowing deck, snowblower, pump etc.)

Note: Do NOT add additional load (e.g. cutting grass).

1. Run engine at full throttle and engage load bringing load to full speed then disengage load.

2. Let load come to a full stop then engage again.

3. Repeat these procedures (1 and 2) 10 times. After burnish procedure is complete, to maximize deck drive train life, always engage clutch at half throttle.
Electrical Evaluation

Step 1. How to Measure Clutch Coil resistance
(See Figure 5)

1. Turn engine and PTO switch off.
2. Disconnect clutch at clutch connector.
3. Select meter setting for ohm reading.
4. Connect meter leads to clutch.
5. Check meter reading and refer to the chart below for correct clutch resistance reading.
   (values are @ 68°F.)

   If reading falls in acceptable range proceed to step 2, if not replace the clutch.

Step 2. Measure the supply voltage at the clutch
(See Figure 6)

1. Turn engine off.
2. Connect meter leads at the clutch connector.
3. Select meter setting for voltage reading.
4. Make sure wires will not become entangled in rotating components of clutch.
5. Start engine and engage PTO switch.
6. Measure voltage across the leads at the connectors.
7. Voltage should be 12-14 volts DC. If clutch still fails to operate, replace clutch.
8. If voltage is not within 12-14 volt range consult EOM’s service manual.

Table 1

<table>
<thead>
<tr>
<th>Model</th>
<th>Torque Rating</th>
<th>Resistance at 68-70°F (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS - 60</td>
<td>60 ft-lb.</td>
<td>6.59 - 7.28</td>
</tr>
<tr>
<td>MS - 80 AL</td>
<td>80 ft-lb.</td>
<td>2.86 - 3.17</td>
</tr>
<tr>
<td>MS - 80 CU</td>
<td>80 ft-lb.</td>
<td>3.36 - 3.71</td>
</tr>
<tr>
<td>TG - 105</td>
<td>105 ft-lb.</td>
<td>2.89 - 3.20</td>
</tr>
<tr>
<td>TG - 125</td>
<td>125 ft-lb.</td>
<td>2.65 - 2.92</td>
</tr>
<tr>
<td>CMS - 175</td>
<td>175 ft-lb.</td>
<td>2.34 - 2.59</td>
</tr>
<tr>
<td>CMS - 200</td>
<td>200 ft-lb.</td>
<td>1.74 - 1.93</td>
</tr>
<tr>
<td>CMS - 225</td>
<td>225 ft-lb.</td>
<td>1.66 - 1.83</td>
</tr>
<tr>
<td>CMS - 250</td>
<td>250 ft-lb.</td>
<td>1.71 - 1.89</td>
</tr>
</tbody>
</table>

Note: If bench tested with 12 volts applied, armature may not pull away from brakepoles. Rotational motion is required to engage clutch.
Re-gap Adjustment Procedure

When to remove shim:

When clutch has worn to the extent that the existing air-gap is too large to allow for complete clutch engagement (clutch may engage easily when cold but has problems engaging when hot), brake shim can be removed to restore air gap and allow the clutch to continue to function.

(With engine off, key removed and clutch disengaged)

Procedure:
Consult the operator’s manual for all related procedures & safety practices.

Using a pneumatic line, blow out any debris from under the brake pole and around the aluminum spacers (Figure 2).

Check the air gap between rotor & armature with feeler gage. If the gap is less than 0.70”, then follow the trouble shooting procedure outlined on pages 14, 15 and 16 of this installation trouble shooting guide. If the air gap is over 0.70”, proceed with procedure outline below (Figure 3).

Be certain that the gap between the rotor and armature face is greater than .070 prior to shim removal.
Re-gap Adjustment Procedure (Continued)

1. Loosen both brake mounting bolts ½ to 1 full turn as shown below (Figure 4).

   **Note:** Do not remove brake pole from field shell/armature – brake pole tracks match with clutch off and brake on and need to continue to match after shim is removed to ensure proper brake torque.

   ![Figure 4](image)

2. Using needle nose pliers, or by hand, take hold of the tab and remove shim (Figure 5).

   ![Figure 5](image)

3. Using a pneumatic line, blow out any debris from under the brake pole and around the aluminum spacers (Figure 2).

4. Re-torque each bolt (M6 X 1) to 10 ft-lbs +/- .5 ft-lbs.

5. Confirm that a minimum air gap of .015 is present between rotor and armature face at both ends of the brake pole using a feeler gage as shown (Figure 6).

   ![Figure 6](image)

6. If no gap is present, or one smaller than .015, the clutch must be replaced (Figure 7).

   ![Figure 7](image)

7. If adequate gap is present, start engine and cycle clutch 10 consecutive times. Refer to burnish procedure on page 15.
Re-gap Adjustment Procedure (Continued)

8. PERFORM SAFETY CHECK:

a. Be sure to observe deck from position on mower seat to be certain deck is not engaged with PTO switch “off” or clutch de-energized, with engine running

If clutch was removed from the tractor be sure to torque the mounting bolt to the specified torque value:

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Grade Class</th>
<th>Torque lb-ft</th>
<th>Torque N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8-24” UNF</td>
<td>Grade 8</td>
<td>45-49 ft.lbf</td>
<td>61-66 N·m</td>
</tr>
<tr>
<td>7/16-20” UNF</td>
<td>Grade 5 or 8</td>
<td>55-60 ft.lbf</td>
<td>75-81 N·m</td>
</tr>
<tr>
<td>M 10 x 1.50</td>
<td>Grade 10.9</td>
<td>40-48 ft.lbf</td>
<td>55-65 N·m</td>
</tr>
</tbody>
</table>

Note: All values are for dry (unlubricated) plate bolts, please consult fastener manufacturer if any type of locking elements (thread lock compound, patch etc.) is to be used.
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