Eaton Automated Transmissions
TRIG0020
July 2007

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EH-8E406A-UP
EH-8E406A-UPG
EH-8E406A-T
EH-8E406A-CDG
EH-8E406A-CDR
EH-8FA0406A-PSB
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Flywheel Housing Sealing Requirements

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This Eaton publication is intended to be a reference guide for the installation of RTO-11, 13,14, 16109-AT/ATE CEEMAT series transmissions. As much general vehicle and transmission information has been given as practical for covering the wide range of applications. The information given will benefit the OEM installer to insure correct installation procedures therefore providing the utmost in satisfactory operation and long service life. For additional CEEMAT information see the publications section of this booklet. For specific engine information contact engine OEM.

Specific Truck O.E.M Installation Requirements are shown shaded in each section and also restated in Appendix I.

Failure to adhere to Eaton Installation Requirements may effect CEEMAT™ performance and/or warranty coverage.

All CEEMAT™ transmissions installed at O.E.M Facilities must meet the application requirements specified in Transmission Application Approval Form FUL-219.
Diagnostic Tools For CEEMAT Transmission

OTC Tool & Equipment Division, SPX Corporation

Eaton
Part No. Description
5505011 Monitor HD Diagnostic Tool w/cable & QR cards
5505012 CEEMAT Software Cartridge
5505027 Volt OHM Meter
5505030 Hydraulic Tool Kit
5505032 Transmission Cradle
5505033 Adaptor Plate

For ordering in U.S. and Canada use 1-800-533-0492
(In Minnesota call 507-455-7010.)

MPSI Micro Processor Systems, Inc.

MPSI
Part No. Description
104004 Pro-Link Main
205040 MPC Cartridge
805001 MPC Eaton Systems Software
205043 MPC J1939 Daughter Board
404025 J1939 Adapter

MPSI Phone Order Use 1-800-639-6774
NOTE: MPSI Pro-Link 9000 Diagnostic tools will be available for use in 1996.

Recommend Literature

Eaton
Part No. Description
TRTS-0020 Troubleshooting Guide
TRDR-0020 Drivers Instructions
TRSM-0020 Service Manual
TRIP-0023 (11109) Illustrated Parts List
TRIP-0025 (13109) Illustrated Parts List
TRIP-0022 (14109) Illustrated Parts List
TRIP-0026 (16109) Illustrated Parts List

Videos

Eaton
Part No. Description
TROV-0301A Driving Instructions
TRSV-0301B Theory of Operation
TRSV-0301C Fault Code Diagnostics

For more information, phone 1-800-826-HELP (826-4357)
The CEEMAT™ Line Inspection checklist, found in Appendix III, was developed as an installation tool for line personnel to insure the correct operation of each vehicle and to assist the vehicle O.E.M to identify transmission quality related issues as well as O.E.M line quality issues. Used correctly, this checklist identifies transmission issues and aids in tracking the problem until corrected.

The recommended use of the checklist is as follows:

1. A separate checklist should be filled out for each vehicle built with a CEEMAT.

2. The section, identified as PRE-START CHECKS should be performed prior to the initial start-up of the vehicle. This section insures the CEEMAT has the correct power supplies, air supply, sufficient oil for transmission function, and can be operated safely when the engine is started. You will find instructions on page 8.

3. The section POST-START CHECKS should be performed after the engine is first started to insure the transmission is filled with oil to the correct level and to insure proper operation of the interface systems prior to actually driving the vehicle. You will find instructions on page 8.

4. At this point the checklist should be reviewed and if necessary corrective action taken prior to the dyno or road test.

5. The DYNO/ROAD TEST section is used to verify that all CEEMAT systems are functional, the driver information is supplied in the cab, and to insure that all assembly related fault codes have been cleared. You will find instructions on page 9.

6. The O.E.M now has a record of transmission related information and repairs made to each unit and is able to track and correct repeated quality issues.

7. A copy of the checklist should be supplied to Eaton Automated Products Application department for installation history. O.E.M line personnel should become familiar with the checklist and the CEEMAT hand-held diagnostic tool operation prior to a scheduled build. Eaton Automated Products Applications department can coordinate training and information to expedite this process.

This checklist represents a generic system which can be tailored to the individual O.E.M to achieve the best possible method of CEEMAT installation. Eaton recommends the use of this system to maintain the utmost in satisfactory operation and long service life.

Each CEEMAT installed at the O.E.M must pass the on-line checklist requirements per Eaton CEEMAT™ Line Inspection Form, Appendix III, prior to shipment from the O.E.M plant.
Refer to the CEEMAT Line Inspection form in Appendix III while performing the following procedure.

Pre-Start Checks

1. To verify CEEMAT Battery Power and Ignition Power are correctly wired to the appropriate source. The shift lever must be in NEUTRAL, turn the key switch on, then turn it to the off position and wait 15 seconds. An audible click or clunk sound should be heard from the top of the transmission as it powers down.

   If this condition does not occur then check power @ main transmission harness with voltmeter.

   Using standard volt/ohm meter, disconnect transmission main 19 pin harness connector and touch black lead to Pin B and red lead to Pin K, meter reading should be within .6 volts of battery voltage (with the key on only). Now touch black lead to Pin C and red lead to Pin L, meter reading should be within .6 volts of battery voltage (with key on or off).

2. Visually verify the CEEMAT Battery Power is protected by a 30 AMP in line fuse. Visually verify the Ignition Power is protected by an Automatic Resetting Circuit Breaker, 15 AMP for 12 volt power supply and 10 AMP for 24 volt supply.

3. Air Supply - Visually verify that the CEEMAT air supply (Minimum 3/8" ID.) is plumbed directly from the front or rear service brake air tank (A or B tank) and not to the wet tank or tee’d into another component’s supply line. CEEMAT minimum air requirement - 90 PSI. An air dryer is required.

4. Oil Fill - Verify that a minimum of 7 gallons of CEEMAT approved oil has been added to the CEEMAT before attempting to start the engine. Failure to add sufficient oil could damage the transmission.

5. Hand-held tool checks - Attach the CEEMAT diagnostic tool to the transmission diagnostic port in the dash and turn the key switch to the “on” position but do not start the engine. Follow the instructions called out on the screen, push number 1 to get to the main menu. Now, using the down arrows, select the appropriate test from the checklist. Perform each pre-start test per procedures specified in the CEEMAT Troubleshooting Guide, TRTS-0020, to verify proper operation.

6. Service Light - Verify that the transmission service light momentarily lights up when the key switch is turned on. It should light up for 1 second then go off unless an active code is present. The service light may also light up when the starter button is depressed if so equipped. This is acceptable.

Post-Start Checks

7. Oil Fill - As soon as possible, following initial vehicle start-up, the transmission should be filled with the remaining oil required to arrive at the correct operating level. This process must be done with the engine running at idle. Slowly add oil to obtain the proper oil level at the appropriate temperature band on the dipstick. Reference Drivers Instruction TRDR-0020 for additional information.

   NOTE: Do not place the CEEMAT shift lever in drive gear position until the transmission oil fill is at the minimum fill level mark on the dipstick.

8. Hand-held Tool checks with the engine running - Attach the hand-held tool to the transmission diagnostic port mounted in the dash and proceed to the appropriate test specified on the post-start checklist. Perform the tests per procedures specified in the CEEMAT Troubleshooting Guide, TRTS-0020.
Dyno/Road Test

9. With the engine not running, place the shift control in drive and attempt to start the engine. Repeat for each of the drive and reverse gear positions to verify the engine will not start.

10. With the engine running, depress the service brake pedal and select each drive gear position and verify that engagement is felt for each position. Use hand-held in Monitor Mode to verify top gear (9th).

11. Verify through normal operation that the transmission temperature gauge is functional.

12. Check transmission oil level with the engine idling and the transmission in neutral to verify the correct level at the proper temperature band.

13. Visually check for oil drips or residue on the transmission and related cooler lines.

14. Make sure that CEEMAT dash label is present and that a CEEMAT driver’s instruction booklet is included with other vehicle information.

15. Attach the hand-held tool to the transmission diagnostic port in the dash and proceed to CLEAR INTERMITTENT CODES which may have appeared during the build process.

Optional Features

The OEM must provide the appropriate wire/s from the 19 pin transmission connector and deadhead the other end into a connector. If the OEM or Body Builder is responsible for completely wiring one or more of these features then follow the appropriate sections in the Installation Guide pertaining to each feature.


   This is a 12V output signal directly from the transmission, which is generated only when the transmission is in neutral. This feature is used extensively in vocational applications where a neutral signal is required to activate or enable a remote throttle.

17. Auto Neutral 24 Way Electronic Shift Lever Pin B10 (Software not required)

   This feature uses the electronic shifter auxiliary input to neutralize the transmission. This is accomplished when this input is grounded. This function is usually tied into the parking brake via a pressure switch. When the park brake is applied, the input is grounded, thus neutralizing the transmission. To de-active Auto Neutral, the operator must release the parking brake while the lever is in neutral.

18. Quick to Neutral QTN Transmission Connector Pin R (Software required)

   Sometimes called forced neutral, this function uses a 12V input to the transmission to neutralize the transmission disengaging the torque converter, leaving the gearbox engaged. Once the signal is switched off, the converter can engage. For engagement, the engine must be below 1000 rpm and the engagement must be within 5 seconds from release of the brake signal. If this time window is surpassed, the operator must select neutral and then place the lever back in gear. This feature is for special vocational applications where frequent stopping is required without movement of the shift lever. Activation of this circuit is usually controlled by a "enable" switch located on the dash panel. Note that this function is only operational at road speeds below 6 mph.

   Pump Model Transmission Connector Pin R (Software required)

   This feature is used in conjunction with split shaft PTO operation. The CEEMAT senses engagement of the PTO via a spare electrical input to the transmission, and thus will engage high range direct gear when the shift lever is placed in "D".

19. Engine Brake Disable Output Pin F (Software not required)

   This is a 12V output signal directly from the transmission, verify through normal operation that the engine brake functions (if equipped) correctly per manufacturers requirements. AT Only. The normally closed contacts of the relay must be used. Refer to Page 105 for more information.

Checklist Instructions
Two types of flywheel designs are used depending on the specific engine application:

a) Separate bolt on drive ring and pilot adaptor, see figure 1. For additional information contact Eaton Engineering or Engine O.E.M.

b) One piece flywheel with integral drive ring, see figure 2.

The flywheel and drive ring must be an Eaton Approved design and must be installed per the appropriate Eaton or Engine O.E.M specifications.

1. Check the engine crankshaft seal to insure it is an approved double lip design (see “Starter and Engine Crankshaft Sealing Requirements”).

2. Check the starter to insure it is a sealed configuration (see “Starter and Engine Crankshaft Sealing Requirements”).

3. Handle the flywheel and drive ring carefully to avoid damage to the mating surfaces.

4. The installed flywheel must meet the engine O.E.M specifications for concentricity. Refer to engine specifications for runout limits.

5. Install the flywheel onto the engine crankshaft, using the hardware and mounting specifications specified by the engine manufacturer.

6. **Pilot Adapter:** When using the bolt-on drive ring adapter, a center pilot adapter must also be used. Care should be used to insure the adapter is completely seated into the flywheel, see figure 2 for dimensional information.

7. Install the bolt-on drive ring (see figure 2) using the following Hardware:

   **Inch Design** - (12) capscrew and washer assembly
   \[ \frac{7}{8}-14 \times 1\frac{1}{4} \text{ SAE grade 5 zinc chromate with sealant, torque 37-50 Lb·ft.} \]

   **Metric Design** - (12) flanged shouldered capscrew
   \[ M10 \times 1.5 \times 35 \text{ ISO class 12.9 zinc chromate with sealant, torque 50-55 Lb·ft use with hardened steel flatwasher} \]

**NOTE:** Do not tighten any flywheel capscrews until all of the capscrews have been installed and finger tightened.
WARNING Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.

---

**Flywheel Installation**

**Bolt-On Drive Ring With Pilot Adaptor**

**Figure 1**

Flywheel Housing

Rear of Engine Block

Approved Double Lip Rear Engine Crankshaft Seal

Pilot Adapter (Eaton Supplied)

Flywheel Suitable For Use With 15.5 Inch [393.7 MM] - 2 Plate Clutch
(Spicer Model AS-1552)
(LIPE Model 15 1/2-2PL)

Typical SAE #1 Wet Type Flywheel Housing

---

**Eaton Drive Ring Kit Numbers for most popular engines**

<table>
<thead>
<tr>
<th>Detroit Diesel</th>
<th>Caterpillar</th>
<th>Caterpillar</th>
<th>Cummins</th>
<th>Cummins</th>
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<th>Cummins</th>
<th>Mack</th>
<th>Mack</th>
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</thead>
<tbody>
<tr>
<td>DDS60 &amp; 8V92</td>
<td>3176 &amp; 3406</td>
<td>3306</td>
<td>N14</td>
<td>L10/M11</td>
<td>8.3</td>
<td>E7</td>
<td>E6</td>
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<tr>
<td>Kit Includes:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Drive Ring</td>
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<tr>
<td>Pilot Adaptor</td>
<td>4301169</td>
<td>4300741</td>
<td>4301946</td>
<td>4301169</td>
<td>4301946</td>
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<td>4300197</td>
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<tr>
<td>Instruction Letter</td>
<td>L-1891</td>
<td>L-2490</td>
<td>L-3593</td>
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<td>L-4690</td>
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</tbody>
</table>

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20001-4/92

22006-8/95
Single Piece Flywheel Assembly

Figure 2

Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
1. The engine flywheel housing must be approved for “wet” applications, including a double lip rear engine crankshaft seal. The housing must provide a completely sealed environment for the torque converter area.

2. The vehicle O.E.M is responsible for sealing all holes in the flywheel housing/converter housing area (use metal plugs only) including starter, mounting pads, transmission mounting, speed pickups, etc. See figures 3 and 4.

3. Speed Sensors mounted in the flywheel housing must use a sealing jam nut, O-ring, or equivalent sealing method.

NOTE: The installation sketches shown in this section represent typical sealing locations only. Other sealing requirements may be needed in each unique application. Special care should be taken to insure a sealed design.

Starter & Engine Crankshaft Sealing Requirements

1. Approved starters must effectively contain the oil in the flywheel housing.

2. Gasket, seal ring, or equivalent sealing method along with sealed fasteners must be used when mounting the starter to the flywheel housing.

Approved engine crankshaft seals must not allow the transfer of oil between the engine and the transmission. The flywheel and torque converter housing will not build internal pressure if sealed correctly.
Flywheel Housing Sealing Requirements

Figure 3

Transmission to Flywheel Housing Mounting Bolts

Approved Double Lip Rear Engine Crankshaft Seal

Apply Sealant to Any Plugs, Cap Screws, or Threaded Sensors Located on Either Flywheel Housing or Torque Converter Housing. Use metal plugs only.

Standard "Wet" Type Flywheel Housing

View Z
Scale 4/1
Recommended Conformance To SAE J1172

20002-4/92

⚠️ WARNING ⚠️ Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Flywheel Housing Sealing Requirements

Figure 4

- All Tapped Through Holes Must Be Sealed At:
  - Engine Mounting Pads
  - Torque Converter
  - Nodal Mounts

- Standard "Wet" Type Flywheel Housing

- Sealed Starter With Gasket
  - Secured By Adhesive/Sealant Coated Capscrews

- Any Plugs, Caps, Speed Pickups, Capscrews or Other Through Holes in Flywheel Housing Must Be Securely Sealed.

**WARNING**

Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Handling

1. Handle the transmission carefully to avoid damage to the transmission components and to surrounding vehicle components.

2. Never set the transmission directly on the oil pan. If the pan is damaged or bent inward, the internal suction screen should be inspected for damage.

3. Use a hoist or transmission jack that permits precise control of transmission movement during installation, see figure 5.

**NOTE:** A special transmission jack cradle (with adaptor for 9109 series) is available from Eaton - P/N 5505032 cradle and 5505033 adaptor.

Mounting To Engine

1. Use the transmission lifting eyes provided, see figure 5.

2. Use a three point lift chain with a minimum capacity of 1 TON, see figure 5.

3. Adjust lift chain or transmission jack to obtain the same relative angle as the engine.

4. Lubricate the transmission torque converter center pilot and the transmission O-ring seal with soluble grease or equivalent, see figure 6.

5. Align the converter splines and the flywheel splines to mesh and push the transmission into the flywheel ring and housing. Pushing by hand should be the only force required to seat the transmission O-ring into the housing. If interference is encountered, move the transmission away from the engine to investigate the cause, see figure 6.

6. Align the converter housing bolt holes with the engine flywheel housing bolt holes and install all the capscrews finger tight.

**NOTE:** The converter housing must be flush against the engine flywheel housing before tightening any capscrews. **DO NOT USE THE CAPSCREWS TO SEAT THE HOUSING.**

7. Tighten four mounting capscrews at 90° intervals around the converter housing, then tighten the remaining transmission mounting capscrews using the recommended torque specifications.

**NOTE:** Do not tighten any mounting capscrews until all capscrews have been installed and finger tightened.

8. Recommended hardware for mounting the transmission to the engine flywheel housing as follows: (see figure 6)

   **Inch Design -**

   (12) Hex head flanged capscrews
   7/16-14 X 1 1/4 SAE grade 5 minimum
   zinc Chromate with sealant
   torque to 37-50 Lbf·ft.

   (12) Hex head flanged capscrews
   3/8-16 X 1 1/4 SAE grade 5 minimum
   zinc chromate with sealant
   torque to 26-32 Lbf·ft.
   use with hardened steel flatwashers (12)
Metric Design—
(12) 12 point flanged shoulder capscrews
M10 X 1.5 X 35 ISO class 12.9
zinc chromate with sealant
torque to 26-35 Lb-ft,
use with hardened steel flatwashers (12)

Transmission Mounting Typical Lift Points

Figure 5

Note: The CEEMAT comes equipped with special sealed washers at the ECU cover mounting capscrew locations (see illustration), these capscrews must not be removed or replaced. Standoff brackets or hose clamps can not be used at any of the ECU capscrew locations.

WARNING
Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Transmission To Flywheel Assembly

Figure 6

⚠️ WARNING

Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Using Rear Supports

1. A rear transmission support is required for all installations where the nodal mount supports are not used. The O.E.M is responsible for this design.

2. Many O.E.M rear support designs are already being used for standard Eaton Roadranger transmissions. These same rear supports can be used with the CEEMAT system. Eaton recommends the vehicle O.E.M follow SAE Guidelines for rear support design (Reference SAE SP-479). See figure 7 for typical rear support designs.

3. Optional long or short rear support studs are available when ordering the CEEMAT, see figure 7.

4. Rear support should be mounted in a way as not to interfere with transmission air hoses.

Using Transmission Nodal Mounts

1. The transmission nodal mounting pads are approved to be used as a rear engine support location. Using these support pads requires special sealing requirements when installing the mounting capscrews. See figure 8.

2. The nodal mount tapped holes must be sealed if used. The CEEMAT comes equipped with sealed capscrews at the required location along with warning labels to remind the technician that these locations require capscrews with thread sealant if replaced, see figure 8.

   Recommended sealant for nodal mount capscrews is Loctite® #567 pipe sealant (teflon type) or equivalent.

3. The O.E.M is responsible for the nodal mount design and sealing the required capscrews at the nodal mount location. See figure 8.

4. See figure 9 for nodal mount dimensions for SAE NO.1 Torque Converter housing.

5. Torque transmission nodal mount capscrews (3/4-10 UNC) to 180-190 Lb·ft of torque.
Typical Rear Support Designs

Figure 7

Crossmember or Leaf

Transmission Rear Support Studs

Single Leaf

Provide Clearance For Air Lines

WARNING

Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.

20006-4/92
Using Transmission Nodal Mounts

Figure 8

Nodal Mount Sealing
Bolts Supplied
By Eaton

Right Side View

WARNING

Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Nodal Mount Dimensions

Figure 9

Transmission To Flywheel Housing Mounting Face

7.38 [187.5]
For 14 Inch Converter Models

7.84 [199.1]
16 Inch Converter Models

.469 [11.89]

4 x 3/4 - 10 UNC-3B

4.50 [114.3]

4.00 [101.6]

Typical Both Sides

Dimensions For SAE No. 1 Torque Converter Housing

8.25 [209.6]

8.25 [209.6]

Recommended Thread Sealant: Loctite® #567 Pipe Sealant (Teflon Type) or Equivalent

WARNING
Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
The Linear Type Throttle Position Sensor (TPS), shown on the following page, and the integral rotary style, now available on the Williams Control, Inc. air throttle, are currently being used with mechanically controlled engines.

This throttle sensor mechanism is needed only with "AT" versions of the CEEMAT.

1. The sensor body must be mounted to a solid flat frame member not on the engine or power package. Locate sensor where temperatures will not exceed 250°F. The connector port of the sensor body must point downward to prevent moisture contamination, see figure 10.

2. M6 or 1/4" capscrews are recommended for mounting the TPS body, torque to 7-10 Lb-ft.

3. The TPS mating connector must consist of the following Packard Weather Pack Part Numbers:
   - (1) Body 12015793
   - (3) Pin 12089305
   - (3) Seal 12015193

4. Anchor cable housing securely to the engine with an O.E.M supplied bracket and clamp to prevent movement of the cable housing. The mounting configuration is the responsibility of the individual O.E.M but cable travel and offset loading restrictions apply as shown, see figure 10. A slotted (axial) position adjustment of .5" is recommended to compensate for system mounting tolerance.

5. Attach cable end of TPS to O.E.M supplied fuel lever bracket to provide desired travel and acceptable loading. The actual configuration is up to the individual O.E.M, but the cable end must slide freely in fuel lever to permit fuel lever to return to the closed position even when the cable end remains extended. See figure 10 for operating tolerance.

6. The cable itself cannot have less than a 6.00" radius, see figure 10.

7. Cable stroke cannot be less than .630" or more than .870", see figure 10.

8. Mounting dimension from center of cable housing anchor groove to cable attachment on fuel lever in the zero throttle position should be not more than 3.950" or less than 3.780", see figure 10.

9. The cable end must not exceed a 10 degree conical operating angle, see figure 10.

10. The Eaton Hand-Held Diagnostic Tool (5505011) is recommended to verify correct adjustment of the Throttle Position Sensor per the procedure called out in the CEEMAT Troubleshooting Guide (TRTS-0020).
Linear Throttle Position Sensor Installation

**Figure 10**

**Mating Connector**
- (1) Connector Body: 12015793
- (3) Pin: 12089305
- (3) Cable Seal: 12015193

**Warning:**
Mount to a solid frame member not on engine or power package. Locate sensor where temperatures will not exceed 121°C (250°F) (149°C [300°F] intermittent).

**Wire Table**

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W10</td>
<td>TPS (-)</td>
<td>U</td>
</tr>
<tr>
<td>W11</td>
<td>TPS (SIG)</td>
<td>T</td>
</tr>
<tr>
<td>W12</td>
<td>TPS (+)</td>
<td>J</td>
</tr>
</tbody>
</table>

With an OHM meter measure the resistance from pin U & T and the resistance should increase as the throttle pedal is depressed.

![Diagram showing linear throttle position sensor installation](Image)
Air Throttle Position Sensor Interface

An integral rotary style throttle position sensor is now available from Williams Control, Inc. It must, however, be used in conjunction with the air throttle controls offered by Williams. This TPS system is approved for use with CEEMAT transmissions. The integral TPS/air throttle system is preferred over the previously shown linear TPS system since it requires fewer brackets and hardware to install and no final adjustment is necessary at the OEM level.

The integral TPS/air throttle pedal system shown below is currently being used with mechanically governed engines. A throttle position sensor system is needed with "AT" versions of the CEEMAT only.

Contact Williams Controls, Inc. for more information on pricing and availability. (See Appendix VI for vendor information.)

TPS harness length may be affected by changing from linear TPS system (shown previously) to air throttle TPS system (shown below). Connector interface remains the same for both systems.

Figure 11

![Diagram of throttle position sensor interface]
Most Commonly Used Linear Throttle Sensors

<table>
<thead>
<tr>
<th>Eaton Part Number</th>
<th>Cable Length mm [inch]</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-2874</td>
<td>1149.35 [45.250] ± 3.18 [.125]</td>
</tr>
<tr>
<td>K-2876</td>
<td>768.35 [30.250] ± 3.18 [.125]</td>
</tr>
<tr>
<td>K-2875</td>
<td>1530.35 [60.250] ± 3.18 [.125]</td>
</tr>
</tbody>
</table>
The purpose of the CEEMAT defuel system is to momentarily interrupt fuel supply during a transmission shift sequence to allow for synchronization of the mechanical gear box.

The defuel control is a necessity on "AT" CEEMAT'S with mechanical engines. The defuel control is not necessary on "ATE" CEEMAT'S with electronic engines.

1. If required, the engine defuel system must be Eaton or Engine O.E.M approved.
2. Air Throttle control must be installed per Williams Control, Inc. specifications and this manual.

Air Throttle/Electro-Pneumatic System

The Air Throttle Defuel system shown in Figure 15 is the preferred defuel system since it requires no additional bracketry to install and no final adjustment is required.

This system must be used with an air throttle control. The electronically controlled valve momentarily interrupts the driver throttle input by quickly exhausting the throttle control air allowing the pump to return to the idle position.

1. The engine or vehicle OEM is responsible for mounting the interrupt valve on the throttle control cylinder. Fitting size and port identification are shown in Figure 15.
2. Pedal supply air must be non-regulated (full system pressure).
3. Minimum throttle control air line size when used with CEEMAT defuel system is 1/4" I.D. Air line must be installed with no sharp bends or tie wraps that restrict air flow.
4. The throttle control air line length when used with CEEMAT defuel should be as short as possible with a maximum length of 30’.
5. OEM throttle return springs must be mounted securely to the engine fuel pump throttle arm, not on the throttle control or linkage.
6. When using the air throttle defuel system shown in Figure 15, the integral throttle position sensor system must also be used to insure proper shift quality. Reference page 31.
7. Reference manufacturers specifications for installing air throttle control system.
Fuel Interrupt Functional Test (AT Models)

Normal engine deceleration rate and the engine deceleration rate when controlled by the transmission, should be the same. The transmission looks at information from its own internal speed sensors and must see the engine drop a minimum of 250 RPM/second before it will start to make a shift.

Symptoms for improper installation or adjustment of the fuel interrupt control (throttle dip) may include: no shifting unless the driver lifts foot from accelerator pedal, active fault code #32 (Throttle Dip Solenoid), harsh, jerky, or slow shifting.

Generally, faster engine decel rates will result in quicker and smoother shift quality from the CEEMAT transmission.

a. To determine if the engine deceleration rate falls within an acceptable range for the CEEMAT, manually increase engine speed to governor RPM by pushing on the throttle pedal. When a governor RPM is obtained, quickly remove foot from throttle and measure time it takes engine speed to fall a 1000 RPM. The use of a stopwatch or other accurate means of measurement is recommended. If engine decel rate does not fall within the 250 RPM/second range or a maximum time of 4 seconds to drop from governor RPM down a 1000 RPM, contact engine OEM for possible fuel pump adjustment.

b. To determine if CEEMAT fuel interrupt system is functioning correctly, connect the Eaton hand-held diagnostic tool (P/N 5505011) to the diagnostic (J-1587) port on the dash and select "Throttle Dip Test" from the "Perform Tests" menu. Increase engine speed to governor RPM by manually pushing on the throttle pedal. When a steady governor RPM is obtained, continue holding steady pressure on the throttle and press the number one on the diagnostic tool to activate the CEEMAT throttle dip. Measure the time it takes the engine to fall a 1000 RPM as in step a. If the decel rate does not equal the engine decel rate as measured in step a, adjust or inspect system.
Defuel Control Wiring Diagram

Figure 14

GROUND

DE-FUEL CONTROL

Packard Connector
P/N 12015792
Socket P/N 12010182
Cable Seal P/N 12015193

MECHANICALLY GOVERNED
ENGINES ONLY

Packard Connector
P/N 12015792
Socket P/N 12010182
Cable Seal P/N 12015193

W9

W13

W14

J - 1

21001-6/93
Cooler Requirements

General Requirements:

1. An external transmission cooler must be used with the CEEMAT™ transmission. The cooler sizing must meet application approval requirements specified in FUL-219.

2. The maximum allowable pressure drop through the oil cooler circuit is 30 PSI.

3. The cooler return line must be routed into the Eaton supplied backpressure valve (Eaton PN A-5754). This valve can be located on either side of the CEEMAT™. See Figures 15 and 16.

4. Either Air-To-Oil or Water-To-Oil coolers are acceptable. Sizing must meet Eaton application guidelines. See cooler application guidelines this section. Refrain from using Air-To-Oil coolers on vehicles in slow or stationary vehicle applications.

5. A minimum SAE #12 cooler hose or comparable tubing must be used for the CEEMAT™ cooler circuit. See Figures 15 and 16.

6. The oil cooler and cooler connecting lines should be free of debris, dirt, grease, etc. before being attached to the transmission. If these conditions exist, cooler and lines must be flushed or cleaned.

7. Cooler connecting lines should be routed in such a way as to prevent kinks or leaks from rubbing on other components. Use high temperature protection as required to protect against heat deterioration.

8. A transmission cooler bypass circuit is not recommended with the use of CEEMAT™ transmissions.

Cooler Application Guidelines

The cooling requirements for the CEEMAT™ transmission models are less severe than a conventional automatic transmission due to the significant increase in mechanical ratio coverage provided with the CEEMAT™ transmission. Each application is screened to identify whether the vehicle under the maximum GCW and gradeability requirements will go into lockup in the starting gear (3rd or 4th gear). This leaves 2nd and 1st (LO) gear for more severe conditions.

The acceptance criteria by Eaton relative to proper cooler sizing is that the vehicle cooling system must be able to maintain a maximum of 300°F converter outlet temperature when operating continuously based on maximum GCW and gradeability specified in FUL 219 (CEEMAT™ Application Approval Form) in the "D" shift lever position with minimum cooling at 1500 BTU/MIN and minimum gradeability in "D" of 8%. The matchup point for most applications falls between the 85% and 87% efficiency point shown on the converter match data (ambient air ≤ 100°F – ram air ≤ 15 mph). This compares to the 80% or 70% point for a conventional automatic depending on vocation. Contact Eaton Applications Department for more information on cooler testing and availability of special tools to allow cooler testing flexibility in Direct ratio locked/unlocked and overdrive ratio locked/unlocked.

For most applications, 4th is the highest available starting gear. Applications failing to provide sufficient cooling capacity to allow for the use of 4th as a starting gear will be required to increase cooler sizing or 3rd can be designated as the highest starting gear. Applications which do not have sufficient cooling in 3rd gear will be required to increase cooler sizing. The highest starting gear appropriate for the application will be specified on the Application Approval Form (FUL219). The CEEMAT system will be configured to provide the appropriate starting gears prior to shipment to the OEM. The minimum cooling capacity required for the application will also be specified on the Application Approval Form (FUL219).

NOTE: Figures 15 and 16 show typical water-to-oil and air-to-oil systems only, the actual configuration may vary depending on the application.
Cooling Requirements Oil To Water

Figure 15

Torque Converter Cooling System Without Remote Bypass

*NOTE: Optional cooler return located on left side of torque converter housing. Back-pressure relief valve must be located at cooler return location.

**WARNING** Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Transmission Cooling System With Remote Bypass

For certain applications, the recommended transmission cooler routing is to bypass the engine thermostat system. With this type of cooler routing, transmission oil temperature is more directly related to engine oil temperature. Listed below are conditions which may require the use of a thermostat bypass:

1. Under certain conditions, such as extreme cold temperature operation or extended periods of low speed operation, the engine alone may not generate the amount of heat required to open the thermostat. Without a thermal bypass system, no cooling is provided if needed for the transmission under these conditions.

2. The thermal bypass system will provide faster warming of the transmission oil during cold weather warm-up by circulating the warmer engine block coolant through the transmission cooler.

*NOTE:* Optional cooler return located on left side of torque converter housing. Back-pressure relief valve must be located at cooler return location.

**WARNING** Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
External Transmission Filters

1. The CEEMAT™ transmission uses an internal high pressure oil filter system which utilizes a 25 micron (nominal) replaceable cartridge filter and a .016 wire diameter coarse pick-up screen for larger particles. The high pressure filter cartridge is located down-stream of the pump. Pump flow is maintained in the event of a restricted filter with the use of an internal filter bypass valve.

2. The use of an external transmission filter system is not required or recommended but may be used if a filter bypass system is provided. Cooler flow or minimum delta pressure of 10 PSI @ 1800 RPM must be maintained in the event of a restricted filter. Reference Cooler Flow Verification this section.
Cooling Requirements Oil To Air

![Diagram of oil cooling system]

*NOTE: Optional cooler return located on left side of torque converter housing. Back-pressure relief valve must be located at cooler return location.

**WARNING** Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Temperature Gauge

![Stewart-Warner Temperature Gauge P/N 467-ED Sender P/N 334AD]

**NOTE:** A temperature gauge in combination with an over temperature alarm is required by Eaton. The maximum gauge temperature is 325°F.

- **100 - 250** Green Normal Operating Range
- **250 - 300** Yellow Intermittent Range
- **Above 300** Red Unacceptable Operating Range

* Consult Driver's Instructions “Special Features” For Increased Cooling

**WARNING** Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.

**Transmission Temperature Gauge/Alarm/Sender**

1. A transmission temperature gauge with a maximum range of 325°F and an over temperature alarm set at 300°F with sender/sender switch mounted in the torque converter outlet port is required. See Figures 15, 16, and 17.

2. Although both a temperature gauge and over temperature alarm are required, the CEEMAT™ provides only one port in the torque converter cooler outlet fitting to insert a sending unit or switch. One way to accomplish the addition of both a gauge sender and overtemp. alarm switch is to add a Tee or Cross fitting in the cooler “out” line to create additional ports. Another option is to utilize a temperature module which allows multiple outputs to run a gauge and alarm from a single temperature sender. See Figure 18 "Transmission Temperature Module Circuit" and Figure 19 "Temperature Control Module". Supplier information for the Pacific Insight Electronics temperature control module is listed in Appendix VI (vendor list). In addition to the standard two output module (TW1), Insight Electronics also has model TF1, which provides four outputs to run a gauge, alarm, clutch fan, and engine shut down. Contact Pacific Insight Electronics for specific information and pricing.

3. Normal operating temperature, when sensed from the torque converter outlet port, should be below 250°F; however intermittent operating temperatures to 300°F do not harm the transmission.
Transmission Temperature Module Circuit

Figure 18

+12 VOLTS IGNITION

OVER TEMP BUZZER SWITCH POINT AT 300°F

ENGINE SHUT DOWN MODEL TF1 ONLY

CLUTCH FAN MODEL TF1 ONLY

TEMP SENSOR

CONVERTER OUTFITTING
Temperature Control Module

Figure 19

<table>
<thead>
<tr>
<th>CAV</th>
<th>GA</th>
<th>COLOR</th>
<th>DESCRIPT</th>
<th>FUNCTION</th>
<th>TW1</th>
<th>TF1</th>
<th>TERMINAL</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>18</td>
<td>YELLOW</td>
<td>FAN SOL OUT</td>
<td>GND • 250°F</td>
<td>X</td>
<td></td>
<td>12034047</td>
</tr>
<tr>
<td>B</td>
<td>18</td>
<td>WHITE</td>
<td>GAUGE OUTPUT</td>
<td>ANALOG OUTPUT</td>
<td>X</td>
<td>X</td>
<td>12034047</td>
</tr>
<tr>
<td>C</td>
<td>–</td>
<td>BROWN</td>
<td>SENSOR INPUT</td>
<td>+ SENSOR INPUT</td>
<td>X</td>
<td>X</td>
<td>12034047</td>
</tr>
<tr>
<td>D</td>
<td>18</td>
<td>BLUE</td>
<td>ENG SHUT DOWN</td>
<td>GND • 310°F</td>
<td>X</td>
<td></td>
<td>12034047</td>
</tr>
<tr>
<td>E</td>
<td>18</td>
<td>BLACK</td>
<td>GROUND</td>
<td>SYSTEM GROUND</td>
<td>X</td>
<td>X</td>
<td>12034047</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>GREEN</td>
<td>ALARM OUTPUT</td>
<td>GND • 300°F</td>
<td>X</td>
<td>X</td>
<td>12034047</td>
</tr>
<tr>
<td>G</td>
<td>18</td>
<td>PINK</td>
<td>IGN. INPUT</td>
<td>+12V IGN CN</td>
<td>X</td>
<td>X</td>
<td>12034047</td>
</tr>
<tr>
<td>H</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Oil Cooler Return Options For Low-Profile Oil Pan

All require the use of back pressure valve - A-5754 (provided):

1) Left front top edge of oil pan - pointing straight up (standard location)

2) Optional right front oil pan location - points toward front of trans. Back pressure valve must be relocated to this position.

3) Optional right front top edge of oil pan - pointing straight up, only available if left side dipstick tube is used. Back pressure valve must be relocated to this position.

Figure 20
Cooler Flow Verification

The CEEMAT transmission supplies a minimum of 12 GPM oil flow to the transmission cooler @1500 RPM if cooler restriction falls within Eaton limits. For new cooler installations, the following test is used to check cooling system restriction.

Test Tools Required

0-100 PSI pressure gauge on LUBE circuit
0-100 PSI pressure gauge on CONVERTER OUTLET circuit

Test Conditions

70-120°F Transmission Oil Temperature
Transmission shift control in Neutral

<table>
<thead>
<tr>
<th>Engine RPM</th>
<th>Lube Press</th>
<th>Conv Out Press</th>
<th>Delta Press</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>1600</td>
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<td></td>
</tr>
<tr>
<td>1800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gov. RPM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Acceptance Criteria

Calculate Delta Pressure:

(Lube Press - Conv Out Press = Delta Press)

Minimum Delta pressure @ 1800 RPM of 10 PSI.

If Delta pressure is less than 10 PSI cold, warm transmission in drive at stall (< 1500 RPM) until transmission temperature warms to 180°F. Minimum Delta pressure should be 10 PSI at 1800 RPM (in neutral).
1. The dipstick and fill tube design must provide an acceptable means of filling and checking the transmission oil level. New dipstick and tube designs require approval and/or validation by Eaton engineering if supplied by the O.E.M.

2. A supporting bracket to eliminate vibration is required at the upper end of the dipstick tube. The bracket must be attached to the transmission or engine and not to the frame or body. See figure 27.

NOTE: Support bracket hardware is provided on all CEEMATs as shown in figure 27. Alternate designs/hardware may be required to provide adequate tube support.

3. A minimum overall vertical rise of 14” must be maintained above the converter housing oil pan mounting surface for oil filling.

NOTE: An initial oil fill of seven gallons (minimum) is required prior to starting the engine. This level as well as the static oil level is approximately 12” above the converter housing oil pan mounting surface.

4. The first section of the dipstick tube must be vertical from the oil pan connector to a minimum of 2.5” above the converter housing oil pan mounting surface to insure accurate level readings.

NOTE: Completely full, hot and running the transmission oil level is approximately 1.25” above the converter housing oil pan mounting surface.

5. Horizontal or near horizontal runs, sharp tight and excessive bends are discouraged in the tube design as they adversely affect oil fill time and accurate level readings.

6. Torque dipstick tube fitting (1 5/8-12) to 60-70 Lb-ft. See figure 27.

7. Torque dipstick tube nut (1 5/16-12 JIC 37°) to 50-60 Lbf-ft. See figure 27.

8. Actual oil level must be within Eaton specifications according to the dipstick readings.

NOTE: The reference drawing in this section shows typical dipstick and tube installation. Bracket hardware shown is standard on all CEEMAT models, but may be omitted if alternate support design is used.

NOTE: Optional left side tube mounting is available, contact sales account manager for additional information.

9. A label identifying OEM filled oil is recommended near oil fill opening. See Figure below for example.
Standard Aluminum (Deep) Stick - 5501004

**Figure 21**

**NOTE:** Ø 1.00 [25.4] X .049 [1.24] wall welded and cold drawn low carbon steel tubing per SAE J525. Coat with zinc chromate per ASTM B-633-78 SC2 type II, optional: prime paint per TES-095, except for interior and -B-

Make sure oil is within dipstick marks for the corresponding oil temperature. Oil should be checked at idle speed in the neutral position using the corresponding temperature band. Cold checks can be performed when the oil temperature is 60–120°F. The oil level should be within the dipstick "cold" band. Additional checks can be made with the transmission at operating temperature by using the "hot" band on the opposite side of the dipstick. The "hot" band temperature range is 180–220°F.

Standard Aluminum (Deep) Tube - 5500503

**Figure 22**

**NOTE:** Ø 1.00 [25.4] X .049 [1.24] wall welded and cold drawn low carbon steel tubing per SAE J525.

Coat with zinc chromate per ASTM B-633-78 SC2 type II, optional: prime paint per TES-095, except for interior and -B-

Bend radii and locations ±12 [3.0]

20053-7/93
Standard Low Profile Oil Pan Dipstick - 5501016

Figure 23

Standard Low Profile Oil Pan Dipstick Tube - 5500511

Figure 24
Dipstick Validation

Test Equipment: (available from Eaton application group)
- Oil
- “See-thru” Tubing 1 inch I.D. = 8 Inch Long
- Hose Clamp - Adjustable up to 1 1/4 Inch Diameter
- SAE 070202 Male Elbow (JIC 37 Degree)
- Dipstick Sample
- Tube Sample
- Scale
- Reference figure 25

Procedure:

1. Securely clamp the “see-through” tubing to the 3/4 - 18 pipe male end of the elbow.
2. Mark the dimension on the “see-through” tube per figure 25 using the proper transmission model requirements.
3. Affix the elbow/tube assembly in a suitable vice or other clamp orienting the axis of the 1 5/16 JIC 37 degree male flare horizontally. The “see-through” tube must be oriented vertically.
4. Attach the dipstick tube to the elbow orienting the dipstick tube to the elbow per the proper O.E.M installation drawing or instructions, then tighten adequately to seal and retain this orientation. See figure 25.
5. Pour oil into the open “see-through” tubing until the level reaches the appropriate mark determined in step 2 above.
6. Insert the dipstick into the tube fully.
   6a. Did the oil level rise in the “see-through” tube as the stick was inserted?
      Yes ___ >1/8 inch  No ___<1/8 inch
      If Yes - A means must be provided to vent the stick.
      If No - Proceed to step 6b.
6b. Remove the dipstick from the tube and observe the oil witness mark.
    The oil witness should be at the “FULL” line of the dipstick “HOT” range. If the witness is within 1/8 inch from this line, the dipstick is considered validated. If the oil witness is greater than 1/8 inch from the “FULL” line of the dipstick “HOT” band, the parts and/or drawings must be changed.
7. The corresponding “LOW” line of the dipstick “HOT” range should be 1 inch below the oil witness.
8. The “FULL” line of the dipstick “COLD” range should be 1 5/8 inch below the oil witness.
9. The corresponding “LOW” line of the dipstick “COLD” range should be 2 5/8 inch below the oil witness.
Dipstick Validation Standard Low Profile Oil Pan

Figure 26

Alternate Dipstick tubes can be used but must meet tube requirements.

Dipstick calibration procedure for all models w/low profile oil pan are shown in the illustration below:

Dipstick Validation Rotated Pan

Figure 27
Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
**Lubrication Requirements**

Before working on a vehicle, place the transmission in neutral, set the parking brakes, and block the wheels.

1. Make sure oil is within dipstick marks for the corresponding oil temperature.

   **NOTE:** Oil should be checked at idle in neutral using the corresponding temperature band.

2. Cold checks can be performed when the oil temperature is 60-120°F. The oil level should be within the dipstick “cold” band.

3. When the vehicle is at operating temperature 180-220°F, the oil level should be within the dipstick “hot” band located on the opposite side of the dipstick.

4. The operational level should always be within the appropriate temperature bands on the dipstick. The exact amount of oil depends on the transmission inclination and model.

5. Insufficient oil damages the pump and other components and can affect the function and reduce the life of the transmission.

6. **DO NOT OVERFILL.** This causes overheating, loss of fuel economy and possibly not shifting.

7. When adding oil, types and brands of oil should not be mixed because of possible incompatibility.

8. When changing oil viscosity to Arctic oil or alternate viscosity ranges, follow the recommended transmission oil flush procedure outlined in the CEEMAT service manual.

9. Use clean oil and clean containers when filling the transmission. Containers that have been used for anti-freeze or water should not be used for transmission oil.

10. Oil must meet MIL-L-2104E specifications or Dexron® II. Oil must be filled to the proper oil level prior to O.E.M shipment.

11. A label identifying OEM filled oil is recommended near oil fill opening. See Figure below.

---

**WARNING**

CHECK OIL LEVEL AT ENGINE IDLE IN NEUTRAL

FACTORY FILLED WITH DEXRON® II LUBRICANT

Eaton® Fuller® Transmissions
Oil Fill Procedure

1. Remove the dipstick and add a minimum of seven (7) gallons (27 liters) of the prescribed oil through the fill tube (dipstick tube).

2. Place the transmission in neutral position and apply the parking brakes. Start the engine and let idle for five (5) minutes, (this allows the oil to circulate and fill the torque converter, main case, and cooling system).

3. Add oil as needed to obtain the correct level at the proper temperature range.

NOTE: Approximate total oil quantity needed is 44 quarts (42 liters), this varies depending on cooling system capacity. See chart below.

4. Increase the engine idle slowly to 1500 RPM for two (2) minutes. Now check the oil level at normal idle speed in neutral, add or drain oil to obtain a level at the proper temperature range on the dipstick.

5. Replace the dipstick and tighten securely.

### Transmission Oil Capacity

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial fill</td>
<td>42.1 Liters or 89 pints or 11.1 gals</td>
</tr>
<tr>
<td>Refill</td>
<td>34.1 Liters or 72 pints or 9 gals</td>
</tr>
</tbody>
</table>

### Vehicle Cooling System Capacity

Varies depending upon application

### Total Transmission Oil Capacity (OEM Responsibility)

Varies depending on oil cooler capacity
Lube Recommendations

### Lubrication Change and Inspection

#### HIGHWAY USE

<table>
<thead>
<tr>
<th>Mileage/Time</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 1,000 to 1,500 miles</td>
<td>Change transmission oil, filter, and strainer on new units.</td>
</tr>
<tr>
<td>Every 2,500 miles</td>
<td>Inspect lubrication level. Check for leaks.</td>
</tr>
<tr>
<td>Every 50,000 miles or 1 year</td>
<td>Change transmission lubricant and filter. Check the strainer for dirt.</td>
</tr>
</tbody>
</table>

#### OFF-HIGHWAY USE

<table>
<thead>
<tr>
<th>Mileage/Time</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>First 30 hours</td>
<td>Change transmission oil, filter, and strainer on new units.</td>
</tr>
<tr>
<td>Every 40 hours</td>
<td>Inspect lubrication level. Check for leaks.</td>
</tr>
<tr>
<td>Every 500 hours</td>
<td>Change transmission lubricant and filter. where severe dirt conditions exist.</td>
</tr>
<tr>
<td>Every 1,000 hours</td>
<td>Change transmission lubricant and filter. (Normal off-highway use.)</td>
</tr>
</tbody>
</table>

### Recommended Lubricant

<table>
<thead>
<tr>
<th>Type</th>
<th>Grade (SAE)</th>
<th>Fahrenheit (Celsius) Ambient Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4 Type MIL-L-2104E</td>
<td>10W</td>
<td>Above 0°F (-32°C)</td>
</tr>
<tr>
<td>Dexron® II</td>
<td></td>
<td>Above 0°F (-32°C)</td>
</tr>
<tr>
<td>Arctic Oil</td>
<td>0W-20</td>
<td>Below 0°F (-32°C)</td>
</tr>
</tbody>
</table>

Minimum Temperature For Operating Transmission

- SAE 10W or Dexron® II & III
- SAE 0W-20

-25°F, -31.67°C
- SAE 0W-20

0°F, -17.78°C
- SAE 10W or Dexron® II & III
Air Supply/Dryer Requirements

1. A high quality commercially available air dryer is required in the air supply line before the CEEMAT transmission.

2. Minimum air requirement for the CEEMAT transmission is 90 PSI.

3. A minimum of 3/8 inch diameter air supply line is required for the CEEMAT.

4. The CEEMAT air supply is required to be routed from the air tank which supplies air to either the front or rear vehicle service brakes with a gauge indicator in the cab. See figure 29.

5. Transmission air lines should not be routed or attached to bottom air tank fittings to avoid any chance of ingesting moisture.

6. Care must be used when routing the air supply to avoid kinks and close contact to heat sources.

7. The CEEMAT air supply must be connected to the air filter/regulator mounted on the ECU cover, see figure 29.

**NOTE:** The filter/regulator should not be removed during installation.

8. Air additives such as alcohol or deicer should not be permitted to enter the CEEMAT air supply. Additives could cause damage to air system components which could lead to degraded transmission performance.
Air Supply/Dryer Requirements

Figure 29

Failure to use proper parts or failure to follow installation instructions could lead to personal injury or property damage.
Shift Control Installation (Electronic Shifter)

The CEEMAT Electronic Shifter provides many benefits over conventional mechanical (cable) systems. Along with simplified installation and the elimination of adjustment problems, the CEEMAT Electronic Shifter provides several features such as: dual station capability, automatic neutral (quick-to-neutral), and application specific inputs and outputs such as auto pac mode for refuse trucks.

1. The CEEMAT Electronic Shifter should be situated in the cab in a functional, easily accessible location in relation to the driver.

2. The shift tower and shift lever should not interfere with other vehicle related controls or accessory features located on the dash or surrounding area.

3. The CEEMAT Electronic Shifter was designed to fit into existing common shift control towers. The dimensions for the CEEMAT Electronic Shifter are shown on the next page.

4. The OEM is responsible for providing the electrical wiring harness for the CEEMAT Electronic Shifter. Harness requirements are listed throughout the following section. Key requirements are repeated in Appendix I.
Electronic Shifter

Packard 24-Way Connector
Mating Connector Parts No. 12110088
Secondary Lock Part No. 12047900
Secondary Lock Part No. 12047901
Terminal Part No. 12089649

20068-10/94
Shown below are the CEEMAT Electronic Shift Levers currently available. Other configurations are available, subject to approval.

Examples:

> A 3 position L - N - RL lever (useful for remote locations where a creep gear is required).

> Drive configured for 7th gear max (useful for limiting road speed in refuse work stations).

Contact Eaton CEEMAT Application Engineering for details:

Phone: (616) 342-3475 FAX: (616) 342-3487

<table>
<thead>
<tr>
<th>Eaton Assy No.</th>
<th>Lever Configuration</th>
<th>Drive Gears Mounting</th>
<th>Orientation</th>
<th>Reverse</th>
<th>Tower Assy No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-6573</td>
<td>RH RL N D 3 2 1</td>
<td>4-O.D. Right</td>
<td>Front</td>
<td>A-6695</td>
<td></td>
</tr>
<tr>
<td>A-6574</td>
<td>RH RL N D 3 2 1</td>
<td>3-O.D. Right</td>
<td>Front</td>
<td>A-6667</td>
<td></td>
</tr>
<tr>
<td>A-6575</td>
<td>1 2 3 D N RL RH</td>
<td>4-O.D. Left</td>
<td>Front</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A-6576</td>
<td>1 2 3 D N RL RH</td>
<td>3-O.D. Left</td>
<td>Front</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A-6596</td>
<td>RL N D 3 2 1</td>
<td>4-O.D. Right</td>
<td>Front</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A-6597</td>
<td>1 2 3 D N RL</td>
<td>4-O.D. Right</td>
<td>Rear</td>
<td>A-6696</td>
<td></td>
</tr>
<tr>
<td>A-6598</td>
<td>RH RL N D H 2 1</td>
<td>4-O.D. Right</td>
<td>Front</td>
<td>A-6694</td>
<td></td>
</tr>
<tr>
<td>A-6599</td>
<td>1 2 H D N RL RH</td>
<td>4-O.D. Right</td>
<td>Rear</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A-6600</td>
<td>RL N D 3 2 1</td>
<td>3-O.D. Right</td>
<td>Front</td>
<td>A-6697</td>
<td></td>
</tr>
<tr>
<td>A-6615</td>
<td>1 2 3 D N RL RH</td>
<td>4-O.D. Right</td>
<td>Rear</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A-6616</td>
<td>1 2 3 D N RL</td>
<td>4-O.D. Left</td>
<td>Front</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>A-7120</td>
<td>RL N D 3 2 1</td>
<td>4-7 Right</td>
<td>Front</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

Note: H = Hold (No Upshifts or Downshifts, 3rd gear start)

Mounting orientation designates hand used to operate lever.
The CEEMAT electronic shift control can be supplied to the OEM mounted in a shift tower. This package includes the following: 1) shift tower, 2) wire harness with bulkhead connector that will be mounted in the floorboard, and 3) electronic shift control. The bulkhead connector is a Deutsch (Part No. HD36-18-14PN). The mating connector is a Deutsch (Part No. HD34-18-14SN) and the terminal (Part No. 0462-201-16141). Below is a pin out of the OEM vehicle interface harness.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Battery Bus</td>
</tr>
<tr>
<td>B</td>
<td>Ignition Bus</td>
</tr>
<tr>
<td>C</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>D</td>
<td>Lamp Ground</td>
</tr>
<tr>
<td>E</td>
<td>+J-1922 Data Link</td>
</tr>
<tr>
<td>F</td>
<td>-J-1922 Data Link</td>
</tr>
<tr>
<td>G</td>
<td>Dimmer Control</td>
</tr>
<tr>
<td>H</td>
<td>Start signal from Ignition Switch</td>
</tr>
<tr>
<td>J</td>
<td>Starter Solenoid</td>
</tr>
<tr>
<td>K</td>
<td>+12vdc (back-up)</td>
</tr>
<tr>
<td>L</td>
<td>Back-up</td>
</tr>
<tr>
<td>M</td>
<td>Auto Neutral (Aux Input)</td>
</tr>
<tr>
<td>N</td>
<td>Trans-In-Gear (Aux Output 1)</td>
</tr>
<tr>
<td>P</td>
<td>Service Light (Push Button Only)</td>
</tr>
</tbody>
</table>

20073-7/95
Electronic Shifter — Single Station

Figure 31

Typical Wiring Harness
Wire Diagram For Electronic Shifter

Figure 32

OEM Responsibility

NOTE: ALL WIRES ARE TO BE 16 GAUGE GXL

BATTERY POWER
(UNSWITCHED POWER)
RUN TO THE BATTERY OR STARTER.

IGNITION POWER
(SWITCHED POWER)
RUN TO THE MAIN POWER LEAD THAT FEEDS THE IGNITION BUS.

RUN TO START SIGNAL FROM IGNITION SWITCH
START ENABLE RELAY

RUN TO STARTER SOLENOID
REVERSE RELAY

RUN TO +12 OR +24 VDC
RUN TO BACKUP LIGHT OR WARNING DEVICE

AUX OUTPUT 1
AUX OUTPUT 2

ELECTRONIC SHIFTER ECU

BOSCH RELAY SOCKET:
See appendix for part numbers.

PACKARD CONNECTOR:
See appendix for part numbers.
Power Lead Connections

Figure 33

NOTE: Circuit Breaker type 1 or 2 are acceptable. Chassis ground can be tied to the Cab ground instead of CEEMAT ground as shown. If the CEEMAT circuit breakers are not accessible use 5 AMP circuit breakers. Wire as shown above.

NOTE: Main vehicle battery cable (+) or (-) must be disconnected prior to any type of welding on vehicle.

CAUTION: Main vehicle battery cable (+) or (-) must be disconnected prior to any type of welding on vehicle.

Ignition Bus Circuit Breakers (Automatic Resetting Type Required)
- 15 AMP for 12 Volt System
- 10 AMP for 24 Volt System
- Battery Bus Fuse
- 30 AMP In Line Fuse

Unless the CEEMAT circuit breakers are not accessible then use 5 AMP.
Start Enable Relay

Figure 34

Shifter will come with Start Enable Relay mounted on its side. See shifter diagram in appendix for mating socket and terminals. The OEM can remotely mount the Start Enable Relay. The relay must still be wired the same as in the diagram. However Pin B2 “Ground for Relay” can be omitted and relay can be grounded on chassis.

The Start Enable relay will allow the engine to crank when the shift lever is in "N" (neutral) AND the transmission is in NEUTRAL. The NS_LATCH will keep the Start Enable relay energized during engine crank if the voltage drops below the required level to keep the shift lever powered.
Shifter will come with REVERSE Relay mounted on its side. See shifter diagram in appendix for mating socket and terminals. The OEM can remotely mount the REVERSE Relay. The relay must still be wired the same as in the diagram. However, Pin B6 "+ POWER for Relay" can be omitted and relay can be wired to ignition power.

**WIRE TABLE**

<table>
<thead>
<tr>
<th>WIRE CODE</th>
<th>WIRE DESCRIPTION</th>
<th>PIN LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV_SPLY</td>
<td>+12VDC FOR RELAY</td>
<td>B6</td>
</tr>
<tr>
<td>REV_RLY</td>
<td>GND output</td>
<td>B5</td>
</tr>
</tbody>
</table>

PACKARD CONNECTOR: See appendix for part numbers.
Dimmer Control Input

Figure 36

Connect VDASH to the dash lights. This input will dim the light on the shift lever. Pin B12 "LAMP_GND" can be omitted if the shift lever chassis is grounded.

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDASH</td>
<td>Dimmer Control</td>
<td>B4</td>
</tr>
<tr>
<td>LAMP_GND</td>
<td>Lamp ground</td>
<td>B12</td>
</tr>
</tbody>
</table>

Packard Connector:
See appendix for part numbers.

21017-7/95
Auxiliary Inputs and Outputs

Figure 37

- **TRANS IN GEAR OUTPUT**
- **AUX OUTPUT**
- **AUTO NEUTRAL**

PACKARD CONNECTOR:
See appendix for part numbers.

### Wire Table

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUX_OUT2</td>
<td>AUX OUTPUT</td>
<td>A4</td>
</tr>
<tr>
<td>AUX_OUT1</td>
<td>TRANS IN GEAR</td>
<td>A3</td>
</tr>
<tr>
<td>AUX_IN</td>
<td>AUTO NEUTRAL</td>
<td>B10</td>
</tr>
</tbody>
</table>

### Pin Table

<table>
<thead>
<tr>
<th>Pin Location</th>
<th>Wire Description</th>
<th>Function</th>
<th>Input/Output</th>
<th>Software Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>Aux Out 1</td>
<td>Trans In Gear</td>
<td>Output +12V @ 1A/ +24V @ .5A</td>
<td>No</td>
</tr>
<tr>
<td>A4</td>
<td>Aux Out 2</td>
<td>Application Specific</td>
<td>Output +12V @ 1A/ +24V @ .5A</td>
<td>Yes</td>
</tr>
<tr>
<td>B10</td>
<td>Aux 3_IN</td>
<td>Auto Neutral</td>
<td>Input Ground</td>
<td>No</td>
</tr>
</tbody>
</table>
Auto Neutral Feature

An active input signal here will command the CEEMAT to neutralize, (such as the application of the park brake). When auto neutral is requested, the CEEMAT will neutralize the transmission, will shift to neutral, and disengage the interrupt clutch.

Trans In Gear Output

Trans in gear output will have an active +12 VDC/+24 VDC whenever the CEEMAT shift lever is not in neutral.
Electronic shifter communication enable pin must be connected to ground in order to make the shaft lever active. In a dual station application, a switch will be incorporated. See "Dual Station" for more information.
J-1922 Data Link

The diagram above is a recommended method of connecting the J-1922 Data Link when using a mechanically governed engine.

The J-1922 Data Link must be a twisted pair with one twist per inch.

WIRE TABLE

<table>
<thead>
<tr>
<th>WIRE CODE</th>
<th>WIRE DESCRIPTION</th>
<th>PIN LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>+J1922</td>
<td>+ J1922 DATA LINK</td>
<td>A10</td>
</tr>
<tr>
<td>-J1922</td>
<td>- J1922 DATA LINK</td>
<td>A9</td>
</tr>
</tbody>
</table>
J-1922 Data Link (Electronically Governed Engines)

The diagram above is a recommended method of connecting the J-1922 Data Link when using an electronically governed engine. The J-1922 Data Link must be a twisted pair with one twist per inch. For more information on connecting the J-1922 Data Link to electronically governed engines refer to the CEEMAT Installation Guide, TRIG-0020.

21021-7/95
Electronic Shifter — Dual Station

Figure 43
Wire Diagram Dual Station

Figure 44

For start enable relay, reverse relay, and aux input, refer to the wiring diagrams in this section.

The J-1922 Data Link can use the same splice pack as illustrated for J-1922 Data Link (electronically governed engines).

21022-7/95
**ESL_ENABLE For Dual Station**

**Figure 45**

SWITCH LOCATED ON DASH SPDT (LOW CURRENT)

#1 CAB RIGHT       #2 WORK LEFT

<table>
<thead>
<tr>
<th>B9</th>
<th>B3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRONIC SHIFT CONTROL</td>
<td>ELECTRONIC SHIFT CONTROL</td>
</tr>
<tr>
<td>STATION #1</td>
<td>STATION #2</td>
</tr>
<tr>
<td>CAB OR (RIGHT)</td>
<td>WORK OR (LEFT)</td>
</tr>
</tbody>
</table>

PACKARD CONNECTOR:  
See appendix for part numbers.

**WIRE TABLE**

<table>
<thead>
<tr>
<th>WIRE CODE</th>
<th>WIRE DESCRIPTION</th>
<th>PIN LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESL_COMM</td>
<td>ESL_COMM-ENABLE</td>
<td>B9</td>
</tr>
<tr>
<td>AUX_GND</td>
<td>ESL GROUND</td>
<td>B3</td>
</tr>
</tbody>
</table>

For a Dual Station configuration ESL_Enable Pin B9 must be connected to ground through a switch as shown in the diagram above. The active station has Pin B9 grounded.

21023-7/95
Start Enable Relay For Dual Station

Figure 46

RUN TO START SIGNAL FROM IGNITION SWITCH

RUN TO STARTER SOLENOID

WIRE TABLE

<table>
<thead>
<tr>
<th>WIRE CODE</th>
<th>WIRE DESCRIPTION</th>
<th>PIN LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS_LATCH</td>
<td>Latch for Relay</td>
<td>A2</td>
</tr>
<tr>
<td>N_START</td>
<td>+Start Relay Coil</td>
<td>A1</td>
</tr>
<tr>
<td>AUX_GND</td>
<td>Ground for Relay</td>
<td>B2</td>
</tr>
</tbody>
</table>

PACKARD CONNECTOR:
See appendix for part numbers.

21024-7/95
Reverse Relay For Dual Station

Figure 47

RUN TO +12 OR +24 VDC

RUN TO BACKUP LIGHT OR WARNING DEVICE

1 2

WIRE TABLE

<table>
<thead>
<tr>
<th>WIRE CODE</th>
<th>WIRE DESCRIPTION</th>
<th>PIN LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>RV_SPLY</td>
<td>+ POWER FOR RELAY</td>
<td>B6</td>
</tr>
<tr>
<td>REV_RLY</td>
<td>GND output</td>
<td>B5</td>
</tr>
</tbody>
</table>

PACKARD CONNECTOR:
See appendix for part numbers.

21025-7/95
Overview—Available PTO Locations and Requirements

**Mechanically Governed Engines / CEEMAT AT**

The CEEMAT transmission provides both a 6-bolt and an 8-bolt SAE PTO opening on the main case. Both of these openings are rated at 500 Lb·ft of torque.

![Figure 48](image)

**NOTE:** Examine PTO installation at 8-bolt location for envelope interference with sump return tube. **Do not remove sump return tube for PTO installation.**

**Electronically Governed Engines / CEEMAT ATE**

The CEEMAT provides an opening in the rear auxiliary section for mounting an extended rear countershaft power take-off and either/or (one of the two but not both) the 6-bolt or 8-bolt openings depending on where the transmission inertia brake assembly is mounted. The 8-bolt opening is the standard location for the inertia brake if not specified. Reference figure on page 79 for inertia brake locations.

PTOs mounted in these positions are normally intended to be used with the transmission in neutral. The transmission interrupt and lockup clutches are engaged when the PTO ball switch is engaged; for this reason transmission electrical interface is required with countershaft driven PTO systems. The transmission will not engage a drive gear position until the PTO is disengaged or vehicle speed is under 3 m.p.h. If the PTO is engaged while in a drive position, the transmission shifting will be inhibited until the PTO is disengaged.
The normal sequence for engagement and operation of a countershaft driven PTO is as follows:

1. The operator stops the vehicle with the shift selector in a drive position or selects a drive position from neutral to stop the rotation of the main-case drive gearing.

2. With the main-case gearing (PTO drive gear) stopped, the operator engages the PTO and then selects neutral. The proper engine speed for driving the accessory equipment can then be obtained.

3. To drive the vehicle after PTO operation is complete, the PTO must be disengaged to allow for transmission drive gear engagement.

4. For limited mobile operation with a countershaft driven PTO the transmission can be shuttle shifted between reverse/neutral/drive if the vehicle speed is under 3 m.p.h.

Reference "Space Claim" section for specific space limitations for vehicle frame rails, exhaust routing, transmission case, etc. Reference manufacturer's information section or your local PTO supplier for specific model and parts availability.

Model ATE (Electronic Engine) PTO Locations

Figure 49
Engine Driven PTO's

A 6 bolt SAE PTO opening is available if an optional SAE #1 non-nodal mount converter housing is used. This “live” PTO opening is rated at 250 Lbf·ft of torque. This option is available on both AT and ATE CEMAT models.

PTOs mounted in this location are normally used where unlimited mobile PTO operation is needed. The PTO is driven through an idler gear off the impeller pump drive gear which provides operation independent of the transmission. This type of PTO configuration requires no electrical interface with the transmission and can be engaged whenever PTO operation is needed regardless of what gear the transmission is in (pending PTO limitations). Hydraulic interface with the transmission may be needed depending on PTO requirements, contact PTO manufacturer for additional information.

Typical applications which may require unlimited mobile operation are refuse packers, snow plows, spreaders, dump trucks, sweepers, etc.

Reference Space Claim section for specific space limitations for vehicle frame rails, cab floor, etc. Reference Manufacturer's information section or your local PTO supplier for specific model and parts availability.

Figure 50

NOTE: Low profile (90°) strain relief harness connector must be used at main transmission connector location.
Split-Shaft PTO Interface with CEEMAT™

Split shaft PTOs for pumper/vacuum operations require special consideration when used with CEEMAT transmissions.

1. The transmission must be specifically ordered for this application to allow the direct ratio function while in pumper/vacuum mode. The CEEMAT must be configured with the proper electronic software prior to shipment from Eaton.

2. A specific pressure switch or ball switch must be used on the PTO to supply the transmission with an electrical signal when in pump/vacuum mode (see electrical interface requirements this section).

Power Take-Off Availability w/Low Profile Oil Pan Option

Power take-offs are not available at the 8-bolt bottom location when using the low profile oil pan option due to pan interference.

Available locations are as follows:

Figure 51

CEEMAT “AT” Models
6-bolt (right side) countershaft opening
6-bolt (converter housing) engine driven opening.

CEEMAT “ATE” Models
6-bolt (right side) countershaft opening
6-bolt (converter housing) engine driven opening.
Rear (thru-shaft) countershaft driven location.
PTO Selection

1. What application is the vehicle being purchased for? Proper thought should be given at the OEM level to properly engineer and prepare the vehicle for the best possible PTO for the job.

2. Determine what type of PTO is best for the job. Special requirements? Does the torque and horsepower capability meet the requirements? Get the PTO manufacturer involved to determine available models compatible with the CEEMAT.

3. Determine where the PTO must be mounted (Top - engine driven, bottom left, bottom right).

4. Consider vehicle space restrictions, PTO space requirements. Cab floor height, frame rail clearance, exhaust, etc., should be taken into consideration.

5. Indirect PTOs; i.e.: front engine, rear engine PTOs (REPTO), split shaft PTOs, etc., must be verified compatible with CEEMAT prior to planned installation. Specific options may be necessary to align CEEMAT with these systems.

6. Consider the possibility for propeller shaft clearance if a remote-mount PTO pump is to be used.

7. Interface harness and two-pole dash light switch must be used with CEEMAT counter shaft driven PTOs.

Figure 52

**Single speed-single gear:** the simplest and least expensive PTO. Used where speed and rotation are satisfactory and torque capability meets requirements. Single gear PTOs often encounter transmission obstructions.

**Reversible PTOs:** used in product pump applications where two-way pumping is desirable. Reverse rotation may be inhibited by shift rod clearance when used with CEEMAT.

**Single speed-double gear:** PTO for SAE 8-bolt opening, easy to assemble and reassemble into many configurations, available in many speed ratios. Also available with direct mounted pump options.

**Clutch-pack-type:** provides added protection against transmission gear damage during initial PTO engagement. (Engine driven top opening).
Model ATE Inertia Brake Locations

Figure 53

8-Bolt Position (STD)

and

6-Bolt Position (Optional)
### Chart of Recommended Vocations

<table>
<thead>
<tr>
<th>PTO Applications</th>
<th>6-Bolt Engine Driven</th>
<th>*8-Bolt C/S Bottom</th>
<th>*6-Bolt C/S Right Side</th>
<th>*Thru-Shaft C/S Rear Mounted (ATE Only)</th>
<th>*Split Shaft Driveline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumps-mobile operation</td>
<td>X fully mobile</td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td></td>
</tr>
<tr>
<td>Dumps-stationary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refuse packers front/rear</td>
<td>X fully mobile</td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td></td>
</tr>
<tr>
<td>Roll-offs</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Refuse packers side loaders</td>
<td>X fully mobile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk delivery tankers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumpers/vacuum stationary</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Pumpers/vacuum mobile</td>
<td></td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td></td>
</tr>
<tr>
<td>Utility-crane, aerial devices, etc.</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Road repair, stripers, etc. (mobile)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire, emergency, mobile pumpers, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Car carriers</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Wreckers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snow blowers</td>
<td></td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td>X limited mobile</td>
<td></td>
</tr>
<tr>
<td>Spreaders-salt, fertilizer, etc.</td>
<td>X fully mobile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous duty-stationary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy haulers/lowboys</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* requires transmission electrical interface

**Note #1:** Contact PTO manufacturer for specific application information and availability. This chart represents a general overview for reference purposes only.

**Note #2:** All PTO information affecting transmission installation or operation must be included, if available, on Eaton Automated Transmission Application Approval Form FUL-219.
Electrical Interface Requirements

Countershaft driven PTO's:

All countershaft driven Power Take-off's (including rear mounted throughshaft PTOs) mounted on CEEMAT transmissions must provide electrical interface with the transmission. A two-wire ball switch must be used in place of the standard single wire switch normally used to signal the PTO dash light. Contact PTO manufacturer for CEEMAT interface switch kit. Reference figure below for countershaft driven PTO electrical interface diagram.

A two wire transmission harness extension is normally provided for countershaft PTO interface. This connector should be located near the main transmission interface connector located at the top, front, left (drivers side) of the transmission.

The CEEMAT transmission must have an input signal from the countershaft driven power take-off when it is active. In this active state, the torque converter clutch is activated to drive the transmission main box countershafts. All upshifting will be inhibited. Countershaft driven PTOs are normally used in stationary applications although shuttle shifting between drive-neutral-reverse is allowed at vehicle speeds under 3 m.p.h. to provide limited mobile operation. Incorrect or no PTO interface signal to the transmission will result in no torque converter engagement and therefore no PTO operation.

![Diagram](image)

**NOTE:** If a countershaft P.T.O. is not used, tie P.T.O. connector out of way. This P.T.O. input is not used with an engine P.T.O.

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W5</td>
<td>P.T.O. D</td>
<td></td>
</tr>
<tr>
<td>W1A</td>
<td>P.T.O. (+)</td>
<td>Splice with Pin K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PTO Type</th>
<th>Chelsea Kit #</th>
<th>Muncie Kit #</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 &amp; 8 Bolt Mech Shifted</td>
<td>440, 340, 35 &amp; 488 Series</td>
<td>TG6S/TG8S 48MK1434-14</td>
</tr>
<tr>
<td>6 &amp; 8 Bolt Air Shifted</td>
<td>230 &amp; 270</td>
<td>329135X</td>
</tr>
<tr>
<td>Rear Aux Countershaft</td>
<td>540 Series</td>
<td>329107X</td>
</tr>
<tr>
<td>Splitshaft</td>
<td>912 Series</td>
<td>329185X</td>
</tr>
</tbody>
</table>
Countershaft PTO Wiring Diagram

Figure 55
Split-Shaft PTO's

All split-shaft power take-off's for pump/vacuum applications with CEEMAT must provide electrical interface (electrical signal) to the transmission.

Split shaft PTOs for pumper/vacuum operations require special consideration when used with CEEMAT transmissions.

1. The transmission must be specifically ordered for Split Shaft PTO application to allow the direct ratio function while in pumper/vacuum mode. The CEEMAT must be configured with the proper electronic software prior to shipment from Eaton.

2. A specific pressure switch or ball switch must be used on the PTO to supply the transmission with an electrical signal when in pump/vacuum mode (see electrical interface requirements this section).

Split-Shaft PTO Wiring Diagram

![Figure 56 Split-Shaft PTO Wiring Diagram](image)
PTO Space Claims

Transmission Mounted - Engine Driven PTO

Notes:  
1. Standard SAE 6-bolt mounting flange  
2. Eaton rating for this location is 250 Lb-ft torque  
3. PTO shown for illustrative purpose only  
4. See PTO manufacturer for speeds, ratings, and model availability  
   (direct mount pump option shown)

Figure 57

"XK" Hydraulic Pump Mount - Assembly 5 Shown

SECTION Z - Z  

SECTION Y - Y  

PTO Adapter Assembly  
See PTO Manufacturer For Availability

PTO Adapter Gear  

PTO Gear

Pump Drive Gear  
(66 Teeth)

Torque Converter

OEM Connector Interface

225.43 [8.875]
Transmission Countershaft Driven PTO's

Notes:
1. Standard 6 & 8-bolt SAE mounting flanges
2. Eaton torque ratings: 500 Lb-ft torque @ 6 & 8-bolt openings
3. Minimum vehicle component clearance of 1" required with PTOs and transmission cases.
4. Heat shielding required if exhaust clearance is less than 2"
5. Transmission sump return tube must not be removed when mounting PTO at 8-bolt location.

Figure 58
**PTO Manufacturer’s Information**

**Typical Power Take-Off Applications for Eaton® Fuller® CEEMAT™ Transmissions**

---

**RTO-11109A**  
RTO-13109A  
RTO-14109A  
RTO-16109A

**PTO Series**  
**Ratio**  
**Torque Rating in Lb., ft.**

<table>
<thead>
<tr>
<th>Series</th>
<th>Speed</th>
<th>Ratio</th>
<th>With Lube</th>
<th>Without Lube</th>
</tr>
</thead>
<tbody>
<tr>
<td>230/270</td>
<td>A</td>
<td>109</td>
<td>91</td>
<td>119</td>
</tr>
<tr>
<td>230/270</td>
<td>A</td>
<td>151</td>
<td>176</td>
<td>184</td>
</tr>
<tr>
<td>230/270</td>
<td>A</td>
<td>209</td>
<td>210</td>
<td>247</td>
</tr>
<tr>
<td>230/270</td>
<td>U</td>
<td>292</td>
<td>292</td>
<td>292</td>
</tr>
<tr>
<td>230/271</td>
<td>A</td>
<td>247</td>
<td>247</td>
<td>247</td>
</tr>
<tr>
<td>230/271</td>
<td>B</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>231/271</td>
<td>U</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
</tbody>
</table>

---

**Electrical Interface Kits**

For Above PTOs: 469MK1434-14

**For Application Assistance call 1-800-for-pto (367-7867)**

---

**New Additions and Changes to the 230, 231, 270, and 271 Series**

---

**Bottom Opening - SAE 8-Bolt**

**SINGLE SPEED-TWO GEAR**

<table>
<thead>
<tr>
<th>PTO</th>
<th>PTO Output Shaft speed percent to Engine Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTO-11109B</td>
<td>RTO-13109B</td>
</tr>
<tr>
<td>230/270</td>
<td>109</td>
</tr>
<tr>
<td>230/270</td>
<td>151</td>
</tr>
<tr>
<td>230/270</td>
<td>209</td>
</tr>
<tr>
<td>230/271</td>
<td>292</td>
</tr>
<tr>
<td>231/271</td>
<td>346</td>
</tr>
</tbody>
</table>

---

**For Application Assistance call (419) 866-3900**

**Supplied By Muncie**

---

**Top Opening Left Side Engine Driven - SAE 6-Bolt**

**SINGLE SPEED-TWO GEAR**

<table>
<thead>
<tr>
<th>PWG-B90105-1BDP</th>
<th>PWG-B90105-1BDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>101</td>
</tr>
</tbody>
</table>

---

**For Application Assistance call 1-800-for-pto (367-7867)**

---

**New Rotatable Pump Flange**

This new option will benefit the installer by giving them the ability to rotate the pump to clear interference problems that have been typically caused by the following:

1. Frame rail interference.
2. Transmission interference.
3. Hose routing.

The new option can be ordered directly on the 440, 230, 231, 270, 271, and 276 series. The designator for this option is "RA" or "RB" placed in the output option. The "RA" (440XQAH-X-WG9A) is for the SAE "B"-2 bolt option and the "RB" (440XQAH-X-W9R) is for the SAE "B"-4 bolt option. Conversion kits are available to change from the standard output shaft of Chelsea to the rotatable flange of your choice.

---

**New Eight-Bolt PTO Series 880**

- Slip fit idler pin for easier installment of the input gear.
- Removable shaft cover for easier backlash setting.
- Available as a kit PTO.
- Tapered cone bearings for excellent load bearing capability.
- Revers housings, shift forks, output gears and shafts needed to service your customers.
- New removable and reusable name tag fasteners.
- Available in three shift types, eight gear ratios and nine output types.
Typical Wire Harness

Figure 59

- J1
- J2
- J3
- J4
- J5
- J6
- J7
- J8
- J9
- J10

- W4 ATA (+)
- W3 ATA (-)
- W7 Eng Brake
- W15 Aux 1 Input
- W16 Service Light Gnd
- W1B Service Light (+)
- W6 Service Brake
- W1C Service Brake (+)
- W1 Ignition Power

20019-8/95
Power Lead Connections

Figure 61

Ignition Power
(Switched Power)
Run To Main Power Lead That
Feeds The Ignition Bus.

CAUTION Power lead (W1) must be connected as shown for proper transmission operation.

NOTE: Circuit Breaker type 1 or 2 are acceptable.

WIRE TABLE

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Ign Bus</td>
<td>K</td>
</tr>
<tr>
<td>W2</td>
<td>Bat Bus</td>
<td>L</td>
</tr>
<tr>
<td>W13</td>
<td>GND</td>
<td>C</td>
</tr>
<tr>
<td>W14</td>
<td>GND</td>
<td>B</td>
</tr>
</tbody>
</table>

Main vehicle battery cable (+) or (-) must be disconnected prior to any type of welding on vehicle.
Power Circuits Wiring Diagram

Figure 62

NOTE: The CEEMAT ground circuits must be on separate ring terminals. Electrical power to the CEEMAT transmission is very important. Redundant power and ground is required to be supplied to the CEEMAT. Redundant power through circuits W2 pin-L (battery bus) and W1 pin-K (ignition bus). Redundant ground through circuits W14 pin-B and W13 pin-C. Do not connect the ground circuits to a signal ring terminal. Do not splice W14 pin-B and W13 pin-C together with one wire running to ground. This will create a signal point power failure. This is not acceptable. Total loss of electrical power will cause the CEEMAT to shift to neutral. The CEEMAT ground circuits W14 pin-B and W13 pin-C must be connected to separate ring terminals.
Both ground wires (W13 & W14) must be connected to battery ground using separate ring terminals. The diagram above shows a typical truck ground circuit. The CEEMAT must not be grounded to the cylinder head ground stud because it can introduce noise transients affecting control system performance.

With an ohmmeter measure the resistance from pins B & C to the negative battery post. It should not be more than .3 ohms.

To insure proper functioning of the vehicle and transmission electrical systems, there must be a direct wire path from the CEEMAT ground pins B & C to the battery negative post. Failure to do so reduces the effectiveness of the connection. Eaton does not recommend a connection from the engine ground stud to the main frame rail at a connection point different than where the "(-) Battery" connection is made. A two (2) point frame rail connection method depends on frame rail connections. Manufacturing process of frame rail connection is difficult to control. This multiple frame rail connection scheme is also more difficult to troubleshoot.
The CEEMAT transmission system requires isolated clean power for both the ignition and battery bus. The typical constant current draw for the CEEMAT at 12 volts is 5 amps (2.5 amps for 24 volts). The CEEMAT can draw up to 12 amps (6 amps for 24 volts) for a short period. The CEEMAT requires redundant power, both the ignition and battery bus must be able to carry the max current load. If the CEEMAT is equipped with Electronic Shifter, the CEEMAT ECU and the electronic shifter can share the same circuit breaker. Refer to the "Shift Control System (Electric)" section in this guide. Other vehicle electrical systems can not be connected to the same circuit breaker as the CEEMAT.

**CAUTION**

This Vehicle Is Equipped With Electronic Controls The Following Precautions Must Be Taken When Welding:

* Disconnect The Wiring Harness Connectors At The Transmission Electronic Control Unit (ECU).
* Disconnect The Main Vehicle Battery Cable (+) And (-) And Any Electronic Ground Wires Connected To The Frame Or Chassis.
* Cover Electronic Control Components And Wiring To Protect From Hot Sparks, Etc.
* Do Not Connect Welding Cables To Electronic Control Components
Brake Switch Connections

Figure 64

Install a second brake switch (must be normally open and actuate at 6 P.S.I. ± 2)

Transmission Connector

WIRE TABLE

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W6</td>
<td>SER BRK</td>
<td>E</td>
</tr>
<tr>
<td>W1C</td>
<td>SER BRK (+)</td>
<td>Splice with pin K</td>
</tr>
</tbody>
</table>
Brake Switch Wiring Diagram

Figure 65

IGNITION POWER
SWITCHED POWER
RUN TO MAIN POWER LEAD THAT
FEEDS THE IGNITION BUS

W1
W1C
W6

CEMAT SERVICE
BRAKE SWITCH
NO-IPS v-2

GENERAL ELECTRICAL SYSTEM REQUIREMENTS

21005-6/93
Transmission Service Light Using Eaton Service Light

Figure 66

NOTE: Transmission service light can be an OEM supplied part. Lens color red.

NOTE: Transmission service light must not exceed .35 amps. Transmission service light must be in plain view of driver.

NOTE: If push button control is used, no transmission service light is needed. Service light is mounted in push button control.

WIRE TABLE

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W16</td>
<td>SERV LIGHT GND</td>
<td>G</td>
</tr>
<tr>
<td>W1B</td>
<td>SERV LIGHT (+)</td>
<td>Splice with pin K</td>
</tr>
</tbody>
</table>
Transmisson Service Light Wiring Diagram

Figure 67

Transmission Service Light
..35 AMP MAX
LOCATE IN PLAIN VIEW OF DRIVER

IGNITION POWER (SWITCHED POWER)
RUN TO MAIN POWER LEAD THAT FEEDS THE IGNITION BUS

TRANSMISSION SERVICE LIGHT

IGNITION POWER (SWITCHED POWER)

W16

W1

21006-6/93
Diagnostic Connections

Figure 68

| WIRE TABLE |
|-----------------|-----------------|-----------------|-----------------|
| Wire Code       | Wire Description| Pin Location    | Pin Location    |
| W3 ATA (–)      |                 | B               | 2               |
| W4 ATA (+)      |                 | A               | 1               |

SAE has two (2) approved connectors, Eaton recommends the Deutsch 6-way

Deutsch 6-way P/N-HD10-6-12P
Pin P/N - 0460-220-1231
Protective Cap P/N HDC 16-6

AMP 8-way
P/N A-206433-4
Terminal P/N A-205201-5
Strain Relief P/N A-206062-1
Sealing Cap P/N A-208800-1

For Transmission Diagnostics J-1587
Connector must be accessible, mount in or under the dash on a separate connector.
J-1587 Diagnostic Connector Diagram

Figure 69
Auxiliary Inputs and Outputs

The CEEMAT has spare inputs and output connections that are located under the dash. These features are application specific. All wires that are not used must be insulated by the use of a closed end splice.

**Figure 70**

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W7</td>
<td>Engine Brake Disable</td>
<td>F</td>
</tr>
<tr>
<td>W15</td>
<td>Aux 1_In</td>
<td>R</td>
</tr>
<tr>
<td>W8</td>
<td>Aux 2_In</td>
<td>S</td>
</tr>
<tr>
<td>W22</td>
<td>Trans_Neutral</td>
<td>V</td>
</tr>
<tr>
<td>W11</td>
<td>Analog In</td>
<td>T</td>
</tr>
</tbody>
</table>

"Analog In" is a spare input on ATE units only

**Trans_Neutral** output is not used to drive a start enable relay. The purpose of the neutral output is to signal vehicle systems, such as throttle boost, that the transmission is in neutral. This output will activate when the operator requests neutral (via the shift lever or QUICK TO NEUTRAL) and the transmission mode is neutral. Trans_Neutral output: +12 volts @ 2 amp (+24 volts @ 1 amp)

**Aux 1 Input:** Can be used for the following:
- Split-Shaft PTO: Application specific software is required. Refer to the "Power Take-Off" section in this guide.
- Quick-To-Neutral: Application specific software is required. Available only with electronic shift lever.
### Auxiliary Inputs and Outputs Wiring Diagram

**Figure 71**

<table>
<thead>
<tr>
<th>ECU Pin</th>
<th>Wire Description</th>
<th>Function</th>
<th>Input/Output</th>
<th>Software Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>PTO</td>
<td>Countershaft PTO</td>
<td>Input +12 V/+24 V</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>Engine Brake</td>
<td>Engine Brake</td>
<td>Output +12V @2A/+24V @1A</td>
<td>No</td>
</tr>
<tr>
<td>R</td>
<td>Aux 1 Input</td>
<td>Quick-To-Neutral</td>
<td>Input +12 V/+24 V</td>
<td>Yes</td>
</tr>
<tr>
<td>R</td>
<td>Aux 1 Input</td>
<td>Pump Mode (Split Shaft PTO)</td>
<td>Input +12 V/+24 V</td>
<td>Yes</td>
</tr>
<tr>
<td>S</td>
<td>Aux 2 Input</td>
<td>Application Specific</td>
<td>Input +12 V/+24 V</td>
<td>Yes</td>
</tr>
<tr>
<td>T</td>
<td>Analog Input</td>
<td>Application Specific</td>
<td>Input 0-5 V</td>
<td>Yes</td>
</tr>
<tr>
<td>V</td>
<td>Trans Neutral</td>
<td>Trans Neutral Output</td>
<td>Output +12 V @2A/+24V @1A</td>
<td>No</td>
</tr>
</tbody>
</table>

---

**Auxiliary Inputs and Outputs Wiring Diagram**

21008-6/93
Transmission Neutral Output Feature

Transmission neutral output is not used to drive a start enable relay. The purpose of the neutral output is to signal vehicle systems, such as throttle boost, that the transmission is in neutral. This output will activate when the operator requests neutral (via the shift lever or quick to neutral) and the transmission mode is neutral.

Quick To Neutral Feature

An active QTN input signal here will command the CEEMAT to neutralize, (such as the application of the work brake). When QTN is requested while in a starting gear the CEEMAT will neutralize by disengaging only the interrupt clutch. When the CEEMAT is not in a starting gear, the transmission will shift to neutral and disengage the interrupt clutch. Selecting, then deselecting QTN while the shift lever is in drive will re-engage the starting gear. Deselecting QTN while in reverse will keep the transmission in neutral until the operator selects neutral, then reverse. (Electronic Shift Lever Only)
J-1922 Communication Link

**Figure 74**

Packard Connector  
P/N 12010973  
Pin P/N 12089305  
Cable Seal P/N 12015193

Packard Connector  
P/N 12015792  
Socket P/N 12010182  
Cable Seal P/N 12015193

**WIRE TABLE**

<table>
<thead>
<tr>
<th>Wire Code</th>
<th>Wire Description</th>
<th>Pin Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>W17</td>
<td>J-1922 (+)</td>
<td>A</td>
</tr>
<tr>
<td>W18</td>
<td>J-1922 (−)</td>
<td>P</td>
</tr>
</tbody>
</table>

20033-6/93

**NOTE:** If the J-1922 link is connected incorrectly to the engines ECM transmission will stay in starting gear.

W17 and W18 are a twisted pair
Location of the J-1922 Control Data Link on Cummins Engines

Figure 75

Mating Connector
Packard 2-Way
P/N 12010973
Pins P/N 12089305
Cable Seal P/N 12015193
Location of the J-1922 Control Data Link on the Caterpillar 3176A Engine

Figure 76

J7 Mating Connector
Deutsch DRC 16-405A

Packard Connector
P/N 12015792
Socket P/N 12010182
Cable Seal P/N 12015193

Packard Connector
P/N 12010973
Pin P/N 12089305
Cable Seal P/N 12015193

Electrical
Requirements
For J-1922
Communication Link
Location of the J-1922 Control Data Link on the Caterpillar 3406E and 3176B Engines

Figure 77

 ECM Connector J1/P1
 Electronic Control Module (ECM)
 Personality Module Cover

J1 Mating Connector
Deutsch P/N AEC16-405A

Packard Connector
P/N 12010973
Pin P/N 12089305
Cable Seal P/N 12015193

20040-6/93
Location of J-1922 Control Data Link on Detroit Diesel DDECII

Figure 78

NOTE: J-1587 & J-1922 share the same twisted pair. J-1922 data link from the CEEMAT™ must connect as diagramed.

ECM Vehicle Harness Connector
P/N 12034398

Packard Connector
P/N 12010973
Pin P/N 12089305
Cable Seal P/N 12015193

Packard Connector
P/N 12015792
Socket P/N 12010182
Cable Seal P/N 12015193

Electronic Control Module (ECM)

12 Pin DDL J-1587 Diagnostic Connector P/N 12020043
Location of the J-1922 Control Data Link on Detroit Diesel DDECIII

Figure 79
Pressure Switch Location For Optional Engine Brake

Figure 80

[Diagram showing the connections and components related to the engine brake system, including wiring, switches, and electrical components such as relays and diodes.]
Rotated Pan — Right Side View

Figure 81

NOTE: Shown with side slot kit (mounted in 6-bolt PTO location)

20055-7/93

NOTE: Model ATE — PTO only available at thru-shaft location and engine driven.

Model AT — PTO only available at 8-bolt and engine driven location.

"AT" Rotated Pan — Rear View

Figure 82

20056-7/93
Left View

Figure 83

Rear View

Figure 84
Optional Right Hand Sump Return

Figure 85

Figure 86

20058-4/94
Installation Requirements

All CEEMAT™ transmissions installed at OEM Facilities must meet the application requirements specified in Transmission Application Approval Form FUL-219.

Line Inspection

1. Each CEEMAT installed at the OEM must pass the on-line checklist requirements per Eaton CEEMAT™ Line Inspection Form, Appendix I, prior to shipment from the OEM plant.

Flywheel Installation

1. The flywheel and drive ring must be an Eaton approved design and must be installed per the appropriate Eaton or Engine OEM specifications.

2. Pilot Adapter: When using the bolt-on drive ring adapter, a center pilot adapter must also be used. Care should be used to insure the adapter is completely seated into the flywheel, see figure 2 for dimensional information.

Flywheel Housing Sealing Requirements

1. The engine flywheel housing must be approved for “wet” applications, including a double lip rear engine crankshaft seal. The housing must provide a completely sealed environment for the torque converter area.

2. The vehicle OEM is responsible for sealing all holes in the flywheel housing/converter housing area including starter, mounting pads, transmission mounting, speed pickups, etc.

3. Gasket, seal ring, or equivalent sealing method along with sealed fasteners must be used when mounting the starter to the flywheel housing.

Transmission Mounting

1. The CEEMAT comes equipped with special sealed washers at the ECU cover mounting capscrew locations (see illustration), these capscrews must not be removed or replaced. Standoff brackets or hose clamps can not be used at any of the ECU capscrew locations.

Transmission Support Requirements

1. A rear transmission support is required for all installations where the transmission nodal mount supports are not used.

2. The CEEMAT comes equipped with special sealed washers at the ECU cover mounting capscrew locations. These capscrews must not be removed or replaced. Standoff brackets or hose clamps can not be used at any of the ECU capscrew locations.

Throttle Sensor Mounting

1. The sensor body must be mounted to a solid flat frame member; not on the engine or power package.

Fuel Interrupt Mounting

1. If required, the engine defuel system must be Eaton or Engine OEM approved.

2. Electro-Pneumatic control must be installed per specifications in this manual.

3. Electro-Hydraulic control must be installed per engine OEM specifications and this manual.
4. Air Throttle control must be installed per Williams Control, Inc. specifications and this manual.

5. Pedal supply air must be non-regulated (full system pressure).

6. Minimum throttle control air line size when used with CEEMAT defuel system is 1/4" I.D. Air line must be installed with no sharp bends or tie wraps that restrict air flow.

7. The throttle control air line length, when used with CEEMAT defuel, should be as short as possible with a maximum length of 30'.

8. OEM throttle return springs must be mounted securely to the engine fuel pump throttle arm, not on the throttle control or linkage.

9. When using the air throttle defuel system shown in Figures 11 and 15, the integral throttle position sensor system must also be used to insure proper shift quality. Reference page 25.

**Cooler Requirements**

1. An external transmission cooler must be used with the CEEMAT™ transmission. The cooler sizing must meet application approval requirements specified in RUL-219.

2. A minimum pressure drop through the transmission of 10 PSI @ 1800 RPM is required (converter lube apply pressure - converter lube outlet pressure). See reference "Cooler Requirements" section.

3. The cooler return line must be routed into the Eaton supplied back-pressure valve (Eaton P/N A-5754). This valve can be located on either side of the CEEMAT.

4. The oil cooler and cooler connecting lines should be free of debris, dirt, grease, etc. before being attached to the transmission. If these conditions exist, cooler and lines must be flushed or cleaned.

5. A temperature gauge with a maximum range of 325°F and an over temperature alarm set at 300°F is required. Sensors for the gauge and alarm must be located in the torque converter outlet stream before the cooler.

**Dipstick and Dipstick Tube Information**

1. New dipstick and tube designs are required to be approved and/or validated by Eaton engineering if supplied by the OEM.

2. A supporting bracket to eliminate vibration is required at the upper end of the dipstick tube. The bracket must be attached to the transmission or engine and not the frame or body. See figure 29.

3. A minimum overall vertical rise of 14" must be maintained above the converter housing oil pan mounting surface for oil filling.

4. The first section of the dipstick tube must be vertical from the oil pan connector to a minimum of 2.5" above the converter housing oil pan mounting surface to insure accurate level readings.

5. Actual oil level must be within Eaton specifications according to the dipstick readings.

**Lubrication Requirements**

1. Oil must meet MIL-L-2104E specifications or Dexron® II. Oil must be filled to the proper oil level prior to OEM shipment.
Air Supply/Dryer Requirements
1. A high quality commercially available air dryer is required in the air supply line before the CEEMAT transmission.
2. Minimum air requirement for the CEEMAT Transmission is 90 PSI.
3. A minimum 3/8 inch diameter air supply line is required for the transmission.
4. The CEEMAT air supply is required to be routed from the air tank which supplies air to either the front or rear vehicle service brakes with a gauge indicator in the cab. See figure 30.

Shift Control System (Cable)
1. Maximum installed system (cable and control combined) backlash must not exceed ±.175 from center.
2. $\frac{5}{16}$" diameter (60 Series) cable must be used of cable length > 96". $\frac{1}{4}$" diameter cable can be used if cable length ≤ 96".

Power Take-Off
1. All split-shaft power take-off’s for pump/vacuum applications with CEEMAT must provide electrical interface (electrical signal) to the transmission.
2. The transmission must be specifically ordered for Split Shaft PTO application to allow the direct ratio function while in pumper/vacuum mode. The CEEMAT must be configured with the proper electronic software prior to shipment from Eaton.
3. A specific pressure switch or ball switch must be used on the PTO to supply the transmission with an electrical signal when in pump/vacuum mode (see electrical interface requirements this section).

General Electrical System Requirements
1. The CEEMAT transmission system requires isolated clean power for both the ignition and battery bus. The typical constant current draw for the CEEMAT at 12 volts is 5 amps (2.5 amps for 24 volts). The CEEMAT can draw up to 12 amps (6 amps for 24 volts) for a short period. The CEEMAT requires redundant power, both the ignition and battery bus must be able to carry the max current load. If the CEEMAT is equipped with Electronic Shifter, the CEEMAT ECU and the electronic shifter can share the same circuit breaker. Refer to the “Shift Control System (Electric)” section in this guide. Other vehicle electrical systems can not be connected to the same circuit breaker as the CEEMAT.
2. The CEEMAT ground circuits must be on separate ring terminals. Electrical power to the CEEMAT transmission is very important. Redundant power and ground is required to be supplied to the CEEMAT. Redundant power through circuits W2 pin-L (battery bus) and W1 pin-K (ignition bus). Redundant ground through circuits W14 pin-B and W13 pin-C. Do not connect the ground circuits to a signal ring terminal. Do not splice W14 pin-B and W13 pin-C together with one wire running to ground. This will create a single point power failure. This is not acceptable. Total loss of electrical power will cause the CEEMAT to shift to neutral. The CEEMAT ground circuits W14 pin-B and W13 pin-C must be connected to separate ring terminals.
3. All wires to transmission must be 14 gage (SXL). All wires to shift lever must be 16 gage (SXL).
4. Isolated, clean power. 15 Amp resetting circuit breakers required for 12 volt systems, 10 Amp for 24 volt system.

5. CEEMAT™ grounds must be in separate ring terminals and bolted to the vehicle frame rail where the battery or starter is grounded.

6. Independent service brake pressure switch required to interface with the transmission. 6 PSI, (± 2 PSI) normally open switch.

7. Transmission service light must be mounted in the dash board in plain view of the driver, lamp must not exceed .35 AMPS. Service light must be labeled “SERVICE TRANSMISSION”.

8. SAE-1708 diagnostic connector must be located in an easily accessible place inside the cab.


10. All unused wires must be insulated by the use of a closed end splice.

11. If optional engine brake is used, voltage flyback diodes must be installed across engine brake solenoid valves.

12. If optional engine brake is used with a mechanically governed engine, a normally open pressure switch with a set point of 115 PSI must be used.

13. Wiring must meet requirements as stated in this guide.

14. Main vehicle battery cable (+) or (-) must be disconnected prior to any type of welding on vehicle.

15. DDEC II and CAT 3176A must be specified with J-1922 active.
Installation Quick Reference

Engine Section

A. Double Lip Engine Rear Crankshaft Seal Required
   Source approved seal per the engine OEM recommendations.

B. Engine Flywheel Housing Sealing Required
   Engine flywheel runout to conform to engine OEM specs.
   Ordered per appropriate engine OEM option number.
   • Sealing at: Flywheel housing mounting face, threaded fasteners, covers, sensors,
     engine support mounts and transmission SAE O-Ring pilot.

C. Sealed Engine Starter Required
   Ordered per appropriate engine OEM option number.
   • Sealing at: Mounting face, starter motor, threaded fasteners.

D. Flywheel and Torque Converter Pilot

   NOTE: Spline drive feature with no direct coupling! Ordered per appropriate engine
   OEM option number or Eaton number.
   • See appropriate Eaton installation drawing for flywheel threaded fastener installa-
     tion.
   • See appropriate Eaton engine installation drawing for integral or separate con-
     verter pilot.

E. Transmission O-Ring and Sealed Threaded Mounting Fasteners Required
   Use only 3 point lifting chain for transmission. O-Ring supplied with transmission
   per SAE sealed flywheel housing size.
   • Sealing at: Threaded mounting fasteners (when through tapped holes encoun-
     tered at the flywheel housing).

F. Transmission Mounting - Nodal & Rear Supports
   • Sealed threaded fasteners required at the transmission nodal pads identified with
tags.
   • Rear support required when nodal mounts not used. Support to conform to SAE
     SP - 479 specification.

G. Engine Fuel Control Required (Mech. governed engines only)
   Ordered per appropriate engine OEM option number or Eaton number.
   • Electro-Pneumatic control installed per Eaton drawing 71054. Electro-Hydraulic
     Valve installed per engine OEM requirements.

H. Transmission Dipstick and Tube Required
   Stick & Tube set must comply with Eaton drawing requirements.
   • Oil per MIL-L-2104E SAE 10 Wt. or Dexron® II
   • Oil fill - Must be checked in neutral engine at idle.

Chassis Section

I. Throttle Position Sensor Required (Mech. governed engines only)
   Installed per Eaton drawing 5556005.
   • Harness terminals W10, W12, W13.
   • Mounted on body or chassis, not engine package
Appendix I

J. Transmission Cooler, Circuit, and Sensors Required

- Cooler sized per application approval.
- Sensors installed per Eaton approval.
- Gauge per Eaton approval. Maximum reading of 325°F required.

<table>
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<th>Below 250°F</th>
<th>250°F - 300°F</th>
<th>Above 300°F</th>
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</thead>
<tbody>
<tr>
<td>Green band</td>
<td>Yellow band</td>
<td>Red band</td>
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</tbody>
</table>

- Warning device per Eaton approval actuated at 300°F.
- Circuit pressure drop per Eaton approval (5/8 inch line minimum).

K. Shift Control Required

- Control assembly to conform to Eaton Installation Guide, TRIG-0020.
- Cable control system to conform to Eaton Installation Guide, TRIG-0020.
- Installation must meet criteria per Eaton Installation Guide, TRIG-0020.

L. Transmission Air Supply Circuit Requirements

An air dryer is required in the vehicle pneumatic system. The supply must originate from the dry side primary circuit.
- 3/8 inch line minimum, 90 PSI minimum

M. Exhaust

Exhaust pipe must be at least 1” away from transmission

Electrical Section

N. Electrical Dual Power Required

Other vehicle electrical systems can not be connected to the same circuit breaker as the CEEMAT.
- 12 V power from 15 amp auto-rest circuit breaker - ignition
  Ignition connection to harness terminal W1
- 12 V power from 15 amp auto-rest circuit breaker - battery
  Battery connection to harness terminal W2
- 24 V power from 10 amp auto-rest circuit breaker - ignition
  Ignition connection to harness terminal W1
- 24 V power from 10 amp auto-rest circuit breaker - battery
  Battery connection to harness terminal W2

O. Electrical Grounds Required

Dual independent terminals W13 & W14 at battery ground to frame.
Max. resistance from pins B & C to negative battery post .3 ohms.

P. “Service Transmission” Light & Diagnostic Connector Required

Service light .35 amps maximum per Eaton approval. Diagnostic SAEJ-1708 connector with easy in cab access.
- Terminated at harness W13a, W4, W3, & W2a.

Q. J-1922 Interface Required w/Electronic Governed Engines

Cab Section

R. CEEMAT Vehicle Service Brake Sensor Required

Independent service brake switch terminated at harness W6.
- 4 PSI - Normally open

S. Neutral Start & Reverse Back Up Switches

- Switches incorporated into the shift control lever assy.
Torque Specifications

a. Flywheel Adaptor Ring bolts:
   - inch design (7/16-14) - 37-50 Lbf·ft
   - metric design (M10-35) - 50-55 Lbf·ft

b. Flywheel bolts (with integrated drive ring):
   - follow engine manufacturers specifications

c. Transmission-to-engine bolts:
   - inch design (7/16-14) - 37-50 Lbf·ft
   - inch design (3/8-16) - 25-32 Lbf·ft
   - metric design (M10-35) - 26-35 Lbf·ft

d. Transmission nodal mount bolts: (3/4-10 UNC) - 180-190 Lbf·ft
   (nonpermanent thread sealant at through hole locations required. Use Loctite #567 pipe sealant or equivalent.)

e. Output yoke nut - 450-500 Lbf·ft

f. PTO mounting bolts:
   - 6-bolt opening - 20-25 Lbf·ft
   - 8-bolt opening - 50-65 Lbf·ft

g. Torque converter outlet fitting (1 5/8-12) - 60-70 Lbf·ft

h. Oil cooler line fittings (1 1/16-12) - 50-60 Lbf·ft

i. Oil cooler line nut (1 1/16-12 JIC37°) - 45-55 Lbf·ft

j. Dipstick tube fitting (1 5/8-12) - 60-70 Lbf·ft

k. Dipstick tube nut (1 5/16-12 JIC37°) - 50-60 Lbf·ft

l. Speedometer body in rear cover - 35-50 Lbf·ft

m. Speedometer drive cable nut - 50 Lbf·in

n. Speedometer electronic sensor (3/4-16) - 10-15 Lbf·ft

o. Oil drain plugs:
   - converter pan (1/2-20 std. thd. with washer) - 15-20 Lbf·ft
   - converter pan (3/8 NPT) - 20-25 Lbf·ft
   - main case (3/4 NPT) - 45-55 Lbf·ft

p. Oil temperature sensor (1/2-14 NPTF) - 16-20 Lbf·ft

q. Lifting bracket bolts (3/8-16) - 25-32 Lbf·ft

r. Throttle position sensor mounting bolts (1/4-20) - 7-10 Lbf·ft

s. Shift cable u-bolt nuts (1/4-20) - 8-14 Lbf·ft

t. Shift cable swivel nut (5/16-24) - 8-14 Lbf·ft

u. Rear support nuts (5/8-18) - 170-185 Lbf·ft

v. Hydraulic Valve mounting bolts (3/8 - 16 grade 5) 35-45 Lbf·ft

* * THREAD ADHESIVE/SEALANT REQUIRED
## Publications and Drawings

### Publications

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<th>Number</th>
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<tbody>
<tr>
<td>TRTS-0020</td>
<td>CEEMAT Troubleshooting Guide</td>
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<tr>
<td>TRDR-0020</td>
<td>CEEMAT Drivers Instructions</td>
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<tr>
<td>TRSM-0020</td>
<td>CEEMAT Service Manual</td>
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<tr>
<td>TRIP-0023</td>
<td>Illustrated Parts List - 11109</td>
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<td>Item #0838</td>
<td>Ordering And Shipping Information for Diagnostic Tools</td>
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<td>TCFM-0018</td>
<td>Product Literature Order Form</td>
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<tr>
<td>TRIG-0020</td>
<td>CEEMAT OEM Installation Guide</td>
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<tr>
<td>OSP-100</td>
<td>Product Literature - Eaton® Fuller® CEEMAT™</td>
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### Drawing Numbers

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<td>Shift Control Chart drawing</td>
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<td>5503500</td>
<td>Shift Cable drawing</td>
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<td>71052</td>
<td>Installation drawing. Shift Control</td>
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<td>5500503</td>
<td>Dipstick Tube Detail-SAE #1 Applications</td>
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### Miscellaneous Drawings

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<td>4300809</td>
<td>Straight Torque Converter Outlet Fitting</td>
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<td>5556035</td>
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<td>5561000</td>
<td>Linear Throttle Position Sensor</td>
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<td>Installation Instructions for Linear TPS</td>
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<td>CEEMAT Yoke Options</td>
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<td>Electronic Shift Lever Options</td>
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<td>5504300</td>
<td>ESL Tower Assembly Options</td>
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Line Inspection Form
Pre-Start Checks

1. Verify power down after 15 seconds.
   If not, then check power @ Main transmission harness with voltmeter
   A. PIN K and PIN B (power with key on only) within .6V batt.
   B. PIN L and PIN C (battery power) within .6V batt.
2. CEEMAT Circuit Breakers -
   Battery Power = 30 AMP Inline Fuse
   Ignition Power = 15 AMP/12 Volt - 10 AMP/24 Volt system (auto reset type)
3. Air Supply-
   Plumbed Direct From Front or Rear Service Brake Tank
4. Oil Fill - 7 Gals. (27 Liters) minimum before starting
5. Hand-held Diagnostic Tool Checks -
   A. Shift Lever Test
   B. Air System Test
   C. Vehicle Interface Test
6. Verify Service Light Operation

Post-Start Checks

7. Oil Fill - complete oil fill at neutral idle
8. Hand-held Diagnostic Tool Checks -
   A. Throttle Dip Test  "AT" Only

DYNO/Road Test Checks

9. Verify engine does not start with transmission in gear
10. Verify all drive positions and top gear can be obtained
11. Verify transmission temperature gauge functional
12. Recheck and verify transmission oil level is correct
13. Verify no transmission oil leaks
14. Verify CEEMAT shift label and drivers book in cab
15. Verify no transmission FAULT CODES

Optional Features (If Equipped and Provided)

16. Verify neutral output  NA
17. Verify auto neutral  NA
18. Verify quick to neutral (QTN) Or Verify Pump Mode  NA
19. Verify engine brake works correctly (if equipped)—"AT" Only  NA

Comments

Final Inspection Date  Please send copy to: Eaton Corp. FAX # (616) 342-3487
Signature  P.O. Box 4013, Kalamazoo, MI 49003 Attn: Autom. Prod. Dept. 12
Line Inspection Form
## CEEMAT™ Line Inspection

### OEM

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### Pre-Start Checks

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   - **Battery Power** = 30 AMP Inline Fuse<br>
   - **Ignition Power** = 15 AMP/12 Volt - 10 AMP/24 Volt system (auto reset type)<br>
3. **Air Supply**<br>
   - Plumbed Direct From Front or Rear Service Brake Tank<br>
4. **Oil Fill** - 7 Gals. (27 Liters) minimum before starting<br>
5. **Hand-held Diagnostic Tool Checks**<br>
   - **Shift Lever Test**<br>
   - **Air System Test**<br>
   - **Vehicle Interface Test**<br>
6. **Verify Service Light Operation**

### Post-Start Checks

7. **Oil Fill** - complete oil fill at neutral idle<br>
8. **Hand-held Diagnostic Tool Checks**<br>
   - **Throttle Dip Test**<br>
   - "AT" Only

### DYNO/Road Test Checks

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### Optional Features (If Equipped and Provided)

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Vendor List

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<tr>
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<td>P.O. Box 3608, Harrisburg, PA 17105-3608</td>
<td>1-800-522-6752</td>
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<tr>
<td>Armada Tube</td>
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<td>(Dipstick Tubes)</td>
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<tr>
<td></td>
<td>74000 Cryderman Rd., Armada, MI 48005</td>
<td>(313) 784-9191</td>
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<tr>
<td>DANA</td>
<td>DANA</td>
<td>Chelsea PTO Division</td>
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<tr>
<td></td>
<td>5800 Sibley Rd., Chelsea, MI 48118</td>
<td>(313) 475-8641</td>
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<tr>
<td>Deutsch</td>
<td>Deutsch</td>
<td>(Connectors)</td>
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<tr>
<td></td>
<td>Industrial Products Division</td>
<td>37140 Industrial Ave.</td>
</tr>
<tr>
<td></td>
<td>Hemet, CA 92545</td>
<td>(909) 765-2250</td>
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<tr>
<td>Furon</td>
<td>Furon</td>
<td>(Shift Controls and Cables)</td>
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<tr>
<td></td>
<td>P.O. Box 68, Holmesville, OH 44633</td>
<td>(216) 279-3711</td>
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<tr>
<td>Genair Strain Reliefs</td>
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<td>(Shift Controls and Cables)</td>
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<td>1211 Airway, Glendale, CA 91201-2497</td>
<td>(818) 247-6000</td>
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<td>Grote &amp; Hartman</td>
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<td>(Terminals)</td>
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<td>32036 Edward, Madison Heights, MI 48021</td>
<td>(313) 588-1022</td>
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<td>IMO</td>
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<tr>
<td></td>
<td>21 Clinton St., Hudson, OH 44236</td>
<td>(216) 653-7739</td>
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<tr>
<td>Kysor of Cadillac</td>
<td>Kysor of Cadillac</td>
<td>(Temperature Switches)</td>
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<tr>
<td></td>
<td>1100 Wright Street, Cadillac, MI 49601</td>
<td>(616) 779-7500</td>
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<tr>
<td>Muncie Power Products</td>
<td>Muncie Power Products</td>
<td>(Power Take-Offs)</td>
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<tr>
<td></td>
<td>342 N. Pershing Dr., Muncie, IN 47305</td>
<td>(317) 284-7721</td>
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<tr>
<td>Pacific Insight Electronics Corp.</td>
<td>Pacific Insight Electronics Corp.</td>
<td>(Temperature Module)</td>
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<tr>
<td></td>
<td>624 Lakeside Dr., Nelson, B.C. V1L 5S7</td>
<td>(604) 354-1155</td>
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<tr>
<td>Packard Electric</td>
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<td>(Connectors)</td>
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<tr>
<td></td>
<td>Packard Electric, Pioneer-Standard Electronics, Inc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Packard Branch, 5440 Naiman Parkway, Solon, OH 44139</td>
<td>1-800-PACKARD</td>
</tr>
<tr>
<td>Quadrastat Corporation</td>
<td>Quadrastat Corporation</td>
<td>(Shift Controls and Cables)</td>
</tr>
<tr>
<td></td>
<td>1701 Pearl St-Unit 7, Waukesha, WI 53186</td>
<td>(414) 544-4204</td>
</tr>
<tr>
<td>Raychem</td>
<td>Raychem</td>
<td>(Heat Shrink Boot)</td>
</tr>
<tr>
<td></td>
<td>Deanco Inc.</td>
<td>Meag Division</td>
</tr>
<tr>
<td></td>
<td>25W 624 St. Charles Road, Wheaton, IL 60188</td>
<td>(708) 665-6214</td>
</tr>
<tr>
<td>Robert Bosch Corporation</td>
<td>Robert Bosch Corporation</td>
<td>Kent-Moore Division</td>
</tr>
<tr>
<td></td>
<td>2800 South 25th Avenue, Broadview, IL 60153</td>
<td>(708) 865-5301</td>
</tr>
<tr>
<td>SPX Corporation</td>
<td>SPX Corporation</td>
<td>Kent-Moore Division</td>
</tr>
<tr>
<td></td>
<td>29784 Little Mack, Roseville, MI 48066-2298</td>
<td>(1-800-328-6657)</td>
</tr>
<tr>
<td>Stewart-Warner Hobbs Corporation</td>
<td>Stewart-Warner Hobbs Corporation</td>
<td>(Pressure Switch)</td>
</tr>
<tr>
<td></td>
<td>580 Slawin Court, Mount Prospect, IL 60056-2183</td>
<td>(708) 803-0200</td>
</tr>
<tr>
<td>Stewart Warner Instrument Corporation</td>
<td>Stewart Warner Instrument Corporation</td>
<td>(Temperature Gauge)</td>
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<tr>
<td></td>
<td>170 Evergreen Road, Oconto, WI 54153</td>
<td>(414) 834-4418</td>
</tr>
<tr>
<td>Unlimited Services</td>
<td>Unlimited Services</td>
<td>(Caps &amp; Buss Bars)</td>
</tr>
<tr>
<td></td>
<td>14100 SW 72nd Avenue, Portland, OR 97224</td>
<td>(503) 684-8608</td>
</tr>
<tr>
<td>Williams Controls, Inc.</td>
<td>Williams Controls, Inc.</td>
<td>(Air Throttle)</td>
</tr>
<tr>
<td></td>
<td>Williams Controls, Inc.</td>
<td>14100 SW 72nd Avenue</td>
</tr>
<tr>
<td></td>
<td>Portland, OR 97224</td>
<td>(503) 684-8608</td>
</tr>
</tbody>
</table>
Troubleshooting

Check for proper air pressure → Check for proper oil level → Check transmission power circuit (fuses, circuit breakers)

For low air: Verify CEEMAT's air system, see page 49. For low oil level, see page 46. For power: Reset/replace fuses, circuit breakers and verify the ground circuit, see pages 57 & 86-89.

Is the transmission performing properly?  
NO  YES

Do any of the following conditions exist?  Resume operation.

NO  YES

Call for OEM service help.

Transmission does not engage a gear.  
Transmission does not upshift from starting gear

Verify shift control system is operating correctly, see pages 51-70. Verify by performing the Shift Lever Test on the hand held diagnostic tool.

Verify fuel interrupt is installed correctly, see pages 27-29. Verify by performing the Throttle Dip Test on the hand held diagnostic tool.

Verify J-1922 link is connected correctly. Verify the engine has its J-1922 link active, see pages 64, 65 & 99-104. Verify by performing the Throttle Position Test on the hand held diagnostic tool.

Is transmission performing properly?  
NO  YES

Select Throttle Dip Test from the hand held tester. Locate engine communication connector in the vehicle harness. Disconnect the transmission from the engine and place a voltmeter positive lead on pin A and negative lead on pin B. Measure the voltage between the pins of the transmission connector. The voltage should equal: +3.0-4.0 volts. Press key 1 on the hand held tester to toggle the communication link voltage. The voltage should toggle from: +3.0-4.0 volts to -3.0-4.0 volts.

Does transmission check out Okay?  
NO  YES

Call for OEM service help.  Resume operation, problem is not with transmission.
Wiring Harness

1. J2 is only used for electronically governed engines. J2 connects to the engine ECM.
2. J4 & J5 are used only for mechanically governed engines. J4 connects to the throttle position sensor and J5 connects to the defuel control.
3. J9 is the 1587 diagnostic connector located on the dash.
4. J7 & J8 are ground ring terminals.
5. Dimension "J" is the location the harness enters the cab.

<table>
<thead>
<tr>
<th>CONNECTOR/TERMINATION DESCRIPTION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1 - DEUTCH GLIDER RAYCHEM</td>
<td>ECU</td>
</tr>
<tr>
<td>J2 - PACKARD</td>
<td>J1922</td>
</tr>
<tr>
<td>J3 - PACKARD</td>
<td>P.T.O.</td>
</tr>
<tr>
<td>J4 - PACKARD</td>
<td>T.P.S.</td>
</tr>
<tr>
<td>J5 - PACKARD</td>
<td>DE-FUEL</td>
</tr>
<tr>
<td>J6 - PACKARD</td>
<td>NEUTRAIL</td>
</tr>
<tr>
<td>J10 - PACKARD</td>
<td>FUSE</td>
</tr>
<tr>
<td>J11 - PACKARD</td>
<td>P.S.I. SENSE</td>
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</table>

<table>
<thead>
<tr>
<th>WIRE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-A J2-A 1922 (+)</td>
</tr>
<tr>
<td>J1-B J7 GND 1</td>
</tr>
<tr>
<td>J1-C J8 GND 2</td>
</tr>
<tr>
<td>J1-D J3-B P.T.O.</td>
</tr>
<tr>
<td>J1-E W6 SERV BRK</td>
</tr>
<tr>
<td>J1-F W7 AUX OUT</td>
</tr>
<tr>
<td>J1-G W16 SERV LRT GND</td>
</tr>
<tr>
<td>J1-H J5-A DEFUEL</td>
</tr>
<tr>
<td>J1-J J4-C TPS (+)</td>
</tr>
<tr>
<td>J1-K W1 IGN BUS</td>
</tr>
<tr>
<td>J1-L J10-B BAT BUS</td>
</tr>
<tr>
<td>J1-M W3 ATA (-)</td>
</tr>
<tr>
<td>J1-N W4 ATA (+)</td>
</tr>
<tr>
<td>J1-P J2-B 1922 (-)</td>
</tr>
<tr>
<td>J1-R W15 SPARE IN</td>
</tr>
<tr>
<td>J1-S J11-B PRESS</td>
</tr>
<tr>
<td>J1-T J4-B ANALOG IN</td>
</tr>
<tr>
<td>J1-U J4-A TPS (-)</td>
</tr>
<tr>
<td>J1-V J6 NEUT CUT</td>
</tr>
<tr>
<td>J9-A SPICE W1 P.T.O (+)</td>
</tr>
<tr>
<td>J9-B SPICE W7 DE-FUEL</td>
</tr>
<tr>
<td>W1B SPICE W1 SERV LRT (+)</td>
</tr>
<tr>
<td>W1C SPICE W1 SERV BRK (+)</td>
</tr>
</tbody>
</table>

From Connector - Location or Termination

| Connector - Location
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-A</td>
</tr>
<tr>
<td>J2-A</td>
</tr>
<tr>
<td>J3-B</td>
</tr>
<tr>
<td>J4-C</td>
</tr>
<tr>
<td>J5-A</td>
</tr>
<tr>
<td>J6-B</td>
</tr>
<tr>
<td>J7</td>
</tr>
<tr>
<td>J8</td>
</tr>
<tr>
<td>J9</td>
</tr>
<tr>
<td>J10</td>
</tr>
<tr>
<td>J11</td>
</tr>
</tbody>
</table>

20048-8/95

22001b-6/93 22001a-6/93
Specifications for Wiring Harness

Harnesses can be supplied to meet the dimensional requirements for an installation. You specify the dimensions and a wiring harness will be made for your vehicle.

Step 1
Dimension units: Meter Feet (circle one)
NOTE: All dimensions should be rounded off to the nearest 0.1 meter (3 inches).

Step 2
Mechanically governed engine, skip Step 5. Engine Model: _______________________________
Electronically governed engine, skip Step 4. Engine Model: _______________________________

Step 3
Size of ring terminals J7, J8 & J9: 1\(\frac{1}{2}\)" 3\(\frac{3}{8}\)" (circle one, 1\(\frac{1}{2}\)" for starter, 3\(\frac{3}{8}\)" for battery)

Step 4

<table>
<thead>
<tr>
<th>DIM “C”</th>
<th>DIM “D”</th>
<th>DIM “E”</th>
<th>DIM “F”</th>
<th>DIM “G”</th>
<th>DIM “H”</th>
</tr>
</thead>
</table>

Step 5

<table>
<thead>
<tr>
<th>DIM “A”</th>
<th>DIM “B”</th>
<th>DIM “G”</th>
<th>DIM “H”</th>
</tr>
</thead>
</table>

NOTE: The harness enters the cab through the firewall at dimension “G”.
If the harness enters the firewall through a grommet, supply dimension “H” and skip Step 6.
If the harness enters the firewall through a connector, omit dimension “H” and supply the information in Step 6.

Step 6
Connector(s) manufacturer and part number:

<table>
<thead>
<tr>
<th>From Connector Location</th>
<th>To Connector Location</th>
<th>Wire Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-F</td>
<td>Aux out*</td>
<td></td>
</tr>
<tr>
<td>J1-G</td>
<td>Serv Light Gnd</td>
<td></td>
</tr>
<tr>
<td>J1-K</td>
<td>Ign bus</td>
<td></td>
</tr>
<tr>
<td>J1-M</td>
<td>ATA (-)</td>
<td></td>
</tr>
<tr>
<td>J1-N</td>
<td>ATA (+)</td>
<td></td>
</tr>
<tr>
<td>J1-R</td>
<td>Spare in*</td>
<td></td>
</tr>
<tr>
<td>J1-S</td>
<td>Aux in*</td>
<td></td>
</tr>
<tr>
<td>J1-V</td>
<td>NEUT CUT</td>
<td></td>
</tr>
<tr>
<td>Splice with W2</td>
<td>Diag (+)</td>
<td></td>
</tr>
<tr>
<td>Splice with J8</td>
<td>Diag (-)</td>
<td></td>
</tr>
<tr>
<td>Splice with W1</td>
<td>Serv Light (+)</td>
<td></td>
</tr>
<tr>
<td>Splice with W1</td>
<td>Serv Brake (+)</td>
<td></td>
</tr>
</tbody>
</table>

* If required
### Typical Wiring Harness

**Electronic Shifter — Single Station**

**Diagram**

![Typical Wiring Harness Diagram](image)

**Legend**

- **W1**: VGN
- **W2**: VBAT
- **W3**: GND
- **W4**: LAMP GND
- **W5**: AUX IN
- **W6**: AUX OUT1
- **W7**: AUX OUT2
- **W28**: VGN
- **W27**: VBAT
- **J10**: A
- **J13**: B
- **J12**: C
- **J11**: D

<table>
<thead>
<tr>
<th>From Connector Location</th>
<th>To Connector Location</th>
<th>Wire Description</th>
<th>Twisted Pairs</th>
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</thead>
<tbody>
<tr>
<td>J4-A12</td>
<td>J1922 (+)</td>
<td></td>
<td>J1922 (+)</td>
</tr>
<tr>
<td>J4-A11</td>
<td>J1922 (-)</td>
<td></td>
<td>J1922 (-)</td>
</tr>
<tr>
<td>J4-A10</td>
<td>J1922 (+)</td>
<td></td>
<td>J1922 (+)</td>
</tr>
<tr>
<td>J4-A9</td>
<td>J1922 (-)</td>
<td></td>
<td>J1922 (-)</td>
</tr>
<tr>
<td>J4-A8</td>
<td>J1922 (+)</td>
<td></td>
<td>J1922 (+)</td>
</tr>
<tr>
<td>J4-A7</td>
<td>J1922 (-)</td>
<td></td>
<td>J1922 (-)</td>
</tr>
<tr>
<td>J4-A6</td>
<td>J1922 (+)</td>
<td></td>
<td>J1922 (+)</td>
</tr>
<tr>
<td>J4-A5</td>
<td>J1922 (-)</td>
<td></td>
<td>J1922 (-)</td>
</tr>
<tr>
<td>J4-A4</td>
<td>J1922 (+)</td>
<td></td>
<td>J1922 (+)</td>
</tr>
<tr>
<td>J4-A3</td>
<td>J1922 (-)</td>
<td></td>
<td>J1922 (-)</td>
</tr>
<tr>
<td>J4-A2</td>
<td>J1922 (+)</td>
<td></td>
<td>J1922 (+)</td>
</tr>
<tr>
<td>J4-A1</td>
<td>J1922 (-)</td>
<td></td>
<td>J1922 (-)</td>
</tr>
<tr>
<td>J4-B12</td>
<td>W4</td>
<td>LAMP GND</td>
<td></td>
</tr>
<tr>
<td>J4-B11</td>
<td>W5</td>
<td>AUX IN</td>
<td></td>
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<tr>
<td>J4-B10</td>
<td>W4</td>
<td>AUX OUT1</td>
<td></td>
</tr>
<tr>
<td>J4-B9</td>
<td>J4-B8</td>
<td>ESL_ENABLE</td>
<td></td>
</tr>
<tr>
<td>J4-B8</td>
<td>J4-B7</td>
<td></td>
<td></td>
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<tr>
<td>J4-B7</td>
<td>J4-B6</td>
<td></td>
<td></td>
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<td>J4-B6</td>
<td>J4-B5</td>
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<td>J4-B4</td>
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<td>J4-B4</td>
<td>J4-B3</td>
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<td>J4-B3</td>
<td>J4-B2</td>
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<td></td>
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<tr>
<td>J4-B2</td>
<td>J4-B1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J4-B1</td>
<td>W5</td>
<td>GND</td>
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<tr>
<td>J13-A</td>
<td>J13-B</td>
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<tr>
<td>J13-B</td>
<td>J13-C</td>
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<td></td>
</tr>
<tr>
<td>J13-C</td>
<td>J13-D</td>
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</tr>
<tr>
<td>J13-D</td>
<td>J13-E</td>
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</table>

**Connector Terminal Description**

<table>
<thead>
<tr>
<th>J4</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) CONNECTOR BODY: 12110068 (LEVER)</td>
<td></td>
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<tr>
<td>(1) CONNECTOR BODY: 12047900</td>
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<tr>
<td>(1) CONNECTOR BODY: 12047901</td>
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<tr>
<td>(16) TERMINAL: 12086959</td>
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<tr>
<td>(1) CONNECTOR SEAL: 12010155</td>
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</tr>
<tr>
<td>(2) SOCKET: 12010162</td>
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</tr>
<tr>
<td>(2) CABLE SEAL: 12015233</td>
<td></td>
</tr>
</tbody>
</table>

**Switches**

- **J1922**: Shifter
- **J1922**: REV RLY
- **J1922**: ST RLY

**Description**

- **J4**: Shifter
- **J1922**: REV RLY
- **J1922**: ST RLY
- **J13**: Switches

**Diagram Notes**

- **Scale 2:1**: AS VIEW FROM WIRE SIDE
- **Dimensions**: 127.0 [5.00], 152.4 [6.00], 101.6 [4.00], 2X 101.6 [4.00], 2X 152.4 [6.00]

20060-4/94
Wire Harness

Harnesses CAN be supplied to meet the dimensional requirements of each installation. You must specify the dimensions from which a wiring harness can be fabricated for your vehicle.

STEP 1

Dimension units: ________ Meters: ________ Feet:

NOTE: All dimensions should be rounded off to the nearest 0.1 meter (3 inches).

STEP 2

Single Station (Omit Dim "A" and "F") ________
Dual Station ________

STEP 3

DIM “A” ________  NOTE: Dimension “C” is the location the harness exits the cab through the firewall.
DIM “B” ________
DIM “C” ________  Dimension “A” and “F” are for Dual Station only.
DIM “D” ________
DIM “E” ________
DIM “F” ________
Fuel Control Functional Test
(For Mechanically Governed Engines)

Normal engine acceleration and deceleration rates and the engine acceleration/ deceleration rates when controlled by the transmission should be the same. The transmission looks at information from its own internal speed sensors and must see the engine drop a minimum of 250 RPM/second before it will start to make a shift.

Symptoms of improper installation of the fuel control (throttle dip and throttle boost solenoids) may include: no shifting unless the driver lifts his foot from the accelerator pedal, an active fault code #35, (engine control failed), harsh, jerky, or slow shifting.

Generally, faster engine acceleration and deceleration rates will result in quicker and smoother shift quality from the CEEMAT transmission.

a. To determine if the engine deceleration and acceleration rates fall within acceptable ranges for the CEEMAT (the use of a stopwatch or other accurate means of measurement is recommended):

1. Manually increase the engine speed to governed rpm by depressing the throttle pedal. When a steady governed rpm is obtained, quickly remove foot from the throttle and measure the time it takes for the engine speed to decrease by 1000 rpm. If the engine speed does not drop 1000 RPM in less than 4 seconds (250 rpm/sec), contact engine OEM for possible fuel pump adjustment.

2. Starting at idle, fully depress the throttle pedal. Measure the time required for the engine to reach governed speed.

b. To determine if the CEEMAT fuel control system is functioning properly, connect the Eaton hand-held diagnostic tool (P/N 5505011) to the J1587 diagnostic port on the dash and select “Throttle Control Test” (or “Throttle Dip”) from the “Perform Tests” menu, and perform the following:

1. Increase engine speed to governed rpm by manually pushing on the throttle pedal. When a steady governed rpm is obtained, continue holding steady pressure on the throttle and press and hold the number “1” on the diagnostic tool to activate CEEMAT throttle dip. Measure the time it takes the engine speed to decrease 1000 RPM as in step a. Release the “1” key.

2. With no pressure on the throttle pedal (engine at idle) press and hold the number “1” on the diagnostic tool to activate CEEMAT throttle boost. Measure the time it takes for the engine to reach governed speed. Release the “1” key.
"AT" Model Without Power Synchronizer

- Kit S-2254 (12V) - Kit S-2474 (24V)
- Control Exhaust Signal

80 PSI MAX

- Cylinder
- Throttle Control

1/8-27NPT 1/8-27NPT 1/8-27NPT 1/8-27NPT

1/8-27NPT

1/8-27NPT

MATING CONNECTOR
Packard Connector
P/N 12016752
Socket P/N 12010182
Cable Seal P/N 12015193

PNEUMATIC THROTTLE PEDAL
(OEM SUPPLIED)

THROTTLE CONTROL
CYLINDER
(OEM SUPPLIED)

PNEUMATIC THROTTLE PEDAL
(OEM SUPPLIED)

80 PSI MAX

1/8-27NPT AIR INLET PORT
"A" OR "1" IDENTIFICATION

1/8-27NPT AIR SUPPLY PORT
"A" OR "1" IDENTIFICATION

1/8-27NPT EXHAUST PORT
"B" OR "2" IDENTIFICATION

1/4-18NPT TO 1/8-27NPT REDUCER NIPPLE
(OEM SUPPLIED)

1/8-27NPT "B" ON ECU COVER
CEEMAT Application Guidelines

The CEEMAT is a fully automated transmission. The following are some general guidelines which should be considered when specifying a CEEMAT.

The OEM must submit an application approval request (FUL 219) for all new CEEMAT applications. This request must be approved by TCONA prior to the sale of the transmission to the OEM. Applications outside North America require service support verification.

Engines

The following engines have been confirmed to be compatible with the CEEMAT:

<table>
<thead>
<tr>
<th>Make</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caterpillar</td>
<td>3116**, 3306, 3176, 3406C*, 3406E*</td>
</tr>
<tr>
<td>Cummins</td>
<td>C8.3**, L10, M11, N14* (mech. and elec.)</td>
</tr>
<tr>
<td>Detroit Diesel</td>
<td>Series 60, 8V92*</td>
</tr>
<tr>
<td>Mack</td>
<td>E7, EM7</td>
</tr>
</tbody>
</table>

* - 1650 Lb·ft max
** - Air throttle required

Inquiries on other engines should be directed to the engine manufacturer to address engine/CEEMAT interface hardware availability and to TCONA to address CEEMAT compatibility issues.

CEEMAT Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. Torque</th>
<th>Max. Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTO-11109A-AT (E)</td>
<td>1150 Lbf·ft</td>
<td>330 hp</td>
</tr>
<tr>
<td>RTO-11109B-AT (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT-11109A-AT (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTO-13109A-AT (E)</td>
<td>1350 Lbf·ft</td>
<td>370 hp</td>
</tr>
<tr>
<td>RTO-13109B-AT (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT-13109A-AT (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTO-14109A-AT (E)</td>
<td>1450 Lbf·ft</td>
<td>450 hp</td>
</tr>
<tr>
<td>RTO-14109B-AT (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT-14109A-AT (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTO-16109A-AT (E)</td>
<td>1650 Lbf·ft</td>
<td>600 hp</td>
</tr>
<tr>
<td>RTO-16109B-AT (E)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AT = Mechanically Governed Engines
ATE = Electronically Governed Engines

Oil Pans

<table>
<thead>
<tr>
<th>Type</th>
<th>Vocations</th>
<th>Max. Opr. Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Standard</td>
<td>Forward - 20%</td>
</tr>
<tr>
<td>Rotated</td>
<td>All Wheel Drive</td>
<td>Forward - 40%</td>
</tr>
<tr>
<td>Low Profile</td>
<td>Vehicles with Oil Pan</td>
<td>Forward - 20%</td>
</tr>
<tr>
<td>Low Profile</td>
<td>Ground Clearance Issues</td>
<td>Side - 15%</td>
</tr>
</tbody>
</table>

* - Side Slope Kit Required

PTO's

<table>
<thead>
<tr>
<th>Transmission</th>
<th>Type</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT</td>
<td>6 Bolt Engine Driven*</td>
<td>250 Lb·ft</td>
</tr>
<tr>
<td></td>
<td>6 Bolt C/S Driven</td>
<td>500 Lb·ft</td>
</tr>
<tr>
<td>ATE</td>
<td>6 Bolt Engine Driven*</td>
<td>250 Lb·ft</td>
</tr>
<tr>
<td></td>
<td>6 Bolt C/S Driven (STD)</td>
<td>500 Lb·ft</td>
</tr>
<tr>
<td></td>
<td>8 Bolt C/S Driven</td>
<td>500 Lb·ft</td>
</tr>
<tr>
<td></td>
<td>Thru-Shaft</td>
<td>500 Lb·ft</td>
</tr>
</tbody>
</table>

* - Not available on nodal mount torque converter housings.
** - Available only if inertia brake is moved to 6 bolt C/S location.

Cooling Requirements

The CEEMAT normally requires a cooler with a heat rejection rate \(\geq 1500\) BTUs/minute (85%-87% efficiency). The heat rejection rate will be increased for severe duty vocations based on application analysis.
Body Builder Guide For Tapping Into Electrical Systems

Body builder electrical systems that are to be interconnected with the CEEMAT electrical system should adhere to the latest recommendations of SAEJ1292. In addition to SAE J1292, the following recommendations should be followed:

1. All wiring terminals should be properly insulated to prevent "short circuits". All terminals should be of insulation grip design to provide a reliable connection and to prevent terminal fatigue.

2. Terminals and splices that are connected outside the body should be moisture resistant design. Molded insulator for ring terminals should be used. Molded connector/insulators are recommended for use with blade or pin type terminals.

3. Wires must be routed to provide at least 75mm [3.00"] clearance to moving parts, unless positively fastened or protected by conduit.

4. Wire routing should avoid areas where temperatures exceed 80 degrees C [180 degrees F] and a minimum clearance of 150mm [6.00"] should be maintained from exhaust system components. Where compliance with this requirement is not possible, heat insulation and heat shields are required.

5. Wire routing and component mounting (switches, relays, etc.) should be located to be easily removed for service. Do not surround the components with body structure that will prevent removal for service.

6. Wiring to all circuit components (switches, relays, etc.) in exposed locations shall provide a drip loop to prevent moisture from being conducted into the device via the wire connection.

7. Routing wiring into wheel splash areas should be avoided. When such routing cannot be avoided, adequate clipping or protective shielding is required to protect wiring from stone and ice damage.

8. Routing wires under the frame side-members or at points lower than the bottom frame flange should be avoided to prevent damage to the wires in off-road operations.

9. The wire retainers and grommets installed by the assembly plant are designed to accommodate only the OEM installed wires. Additional wiring or tubing must be retained by additional clips. When added wires to tubes are routed through sheet metal panels, new holes must be used (with adequate wire protection and sealing).

10. All wiring connections to components of the factory-installed system must be accomplished by using the correct mating wire termination. (Connections on studs and ground connections must use ring type terminations).

11. When it is necessary to splice wires, the splice must be adequately crimped to provide a good mechanical and electrical connection. And double wall heat shrink tubing should be used where the outer wall will provide adequate electrical insulation and the inner wall melts and seals the splice from the environment.
12. Chassis harnesses are provided with connections to permit body builders to interface features and ancillary devices such as:

- Transmission Neutral Output (for Remote throttles)
- Quick to Neutral
- Engine Brake Disable
- Trans in Gear
- Auto Neutral
- Countershaft P.T.O.
- Split-Shaft P.T.O.

13. Never add another circuit or splice into the CEEMAT ignition or battery power supplies.

The fuses and circuit breakers installed at the assembly plant are designed to protect the wiring and electrical components from overloads. Never remove a factory installed fuse or circuit breaker and replace with a high value device. If the added electrical device causes “fuse blow”, or circuit breaker cycling, it indicates the total load is too high for the factory-installed circuit protection and requires revisions in the added circuit; not an increase in fuse or circuit breaker size.

In this case, the items to be added cannot be added directly to the circuit, but must be connected through a separate hang-on switch or relay of the correct capacity, using added wiring of the correct gauge. Failure to adopt this precaution will lead to switch contacts burning. The following wire table suggest wire gauges for various maximum current draws and will aid in the selection of the correct wire size. The current capacity of a given wire varies with temperature and type of insulation, but the following values are generally acceptable.

If the total electrical load on the circuit, after the addition of electrical equipment, is less than the fuse protection in that circuit or less than the capacity of some limiting component (switch, relay, etc.), the items to be added can be connected directly to that circuit. The connection points and allowable loads are normally found in the owner's manual. However, you may want to contact the OEM. Never add another circuit or splice into the CEEMAT ignition or battery power supplies.

### Wire Gauge Table

<table>
<thead>
<tr>
<th>Wire Gauge</th>
<th>Maximum Current Capacity (Crosslink Polythene Copper Wire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>14 Amps</td>
</tr>
<tr>
<td>18</td>
<td>18 Amps</td>
</tr>
<tr>
<td>16</td>
<td>24 Amps</td>
</tr>
<tr>
<td>14</td>
<td>34 Amps</td>
</tr>
<tr>
<td>12</td>
<td>42 Amps</td>
</tr>
<tr>
<td>10</td>
<td>58 Amps</td>
</tr>
<tr>
<td>8</td>
<td>80 Amps</td>
</tr>
<tr>
<td>6</td>
<td>110 Amps</td>
</tr>
</tbody>
</table>

Ceemat Inputs and Outputs

14. Service Brake switch is an air pressure switch in the brake line which detects the application of the service, work or trailer brakes. The switch is normally open at low pressure. It closes its contacts on increasing air pressure; the threshold is 4 psig. The switch is connected to the low pressure control side of the pneumatic brake system and must be located so that application of either the service, work or the trailer brakes increases air pressure to the switch. Parking brakes alone must not activate this switch. Do not remove replace or splice into this circuit. If an additional brake signal is needed for any reason an additional brake switch must be added. Service Brake is an input (+12 Volts when active) Pin E of the CEEMAT ECU.

15. Transmission Neutral output is a +12 Volt 2 Amp output which is active when the operator requests neutral (via the shift lever or Quick to Neutral) and the transmission mode is neutral. This output is not used to drive a start enable relay. The purpose of the neutral output is to signal vehicle systems, such as throttle boost, that the transmission is in neutral. Pin V of the CEEMAT ECU.
16. Trans In Gear is a 12 Volt 1 Amp output which is active whenever the CEEMAT shift lever is not in neutral. Pin 10 of the Electronic Shift Lever (ESL). Pin A3 of the Push Button Control.

17. Countershaft P.T.O. is either a two (2) wire ball switch or an air pressure switch which is normally open. The switch must close whenever the P.T.O. is engaged. This is an input (+12 Volts when active). When this input is active the CEEMAT will hold current gear and turn on the lock-up and interrupt clutches in the torque converter. Pin D of the CEEMAT ECU.

18. Split-Shaft P.T.O. is either a two (2) wire ball switch or an air pressure switch which is Normally open. The switch must close whenever the P.T.O. is engaged. This is an input (+12 Volts when active). When this input is active the CEEMAT will shift to direct when the shift lever is moved to "D" and turn on the lock-up and interrupt clutches in the torque converter. The CEEMAT will shift to neutral only when the shift lever is moved to "N". Pin R of the CEEMAT ECU. This feature must be enabled at the factory.

19. Engine Driven P.T.O. that utilizes the 6-bolt opening on the torque converter does not require any electrical interface to the CEEMAT transmission.

20. Quick to Neutral switch is an air pressure switch in the brake line which detects the application of the work brakes. The switch is normally open at low pressure and closes its contacts on increasing air pressure; the threshold is 4 psig. The switch is connected to the low pressure control side of the pneumatic work brake system and must be located so that application of the work brakes increases air pressure to the switch. Parking brakes alone could be used to activate this switch. In some systems a toggle switch wired in series may be used to disable Quick to Neutral while using the work station. When QTN is active it will keep the CEEMAT in gear while disengaging the interrupt clutch. The Interrupt clutch is the main clutch, it connects the impeller of the torque converter to the input shaft causing torque transfer to transmission output shaft. Quick to Neutral is an input (+12 Volts when active). If Quick to Neutral is used an additional pressure switch must be used. Do NOT use the service brake switch for this feature. Pin R of the CEEMAT ECU. This feature must be enabled at the factory.

21. Auto Neutral switch is an air pressure switch in the parking brake line which detects the application of the parking brakes. The switch is normally closed at low pressure and opens its contacts on increasing air pressure; the threshold is 4 psig. The switch is connected to the low pressure control side of the parking brake system and must be located so that application of the parking brakes decreases air pressure to the switch. When Auto Neutral is active it will Disengage the Interrupt clutch and shift the CEEMAT to neutral. Auto Neutral is an input (grounded when active) Pin 15 of the Electronic Shift Lever (ESL). Pin B10 of the Push Button Control.

22. Engine Brake Disable is a +12 Volt 2 Amp output which is active when ever the CEEMAT is in neutral or the torque converter is not in lock up. Engine Brake Disconnect would turn on a relay to disconnect the engine brake. The normally closed contacts of the relay would be wired in series with the engine brake system. Engine Brake Disconnect would only be used with mechanically governed engines. Engine Brake Disconnect would eliminate the need for a pressure switch in the lock-up port of the torque converter and a pressure switch on the air throttle system as illustrated in the CEEMAT Installation Guide TRIG 0020. Pin F of the CEEMAT ECU.
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