Driver Instructions

Hydraulic Launch Assist™
(HLA®)
TRDR1200
September 2011
Warnings and Cautions Definitions

Throughout this manual there are sections that are marked Warning, Caution or Important. These special paragraphs contain specific safety information and must be read, understood and heeded before continuing the procedure or performing the step(s).

**Warning** indicates you will be severely Injured or Killed if you do not follow the indicated procedure.
Service and Maintenance

**CAUTION**

Caution indicates an Immediate Hazard, which could result in Severe Personal Injury if you do not follow the indicated procedure.

**IMPORTANT**

Important indicates Vehicle or Property Damage could occur if you do not follow the indicated procedure.

**Note:** Note indicates additional detail that will aid in the service or repair of component or system.
Hydraulic Launch Assist (HLA) Warnings and Cautions

**WARNING**

Improper service and maintenance will cause vehicle damage or personal injury. Do not repair, service or maintain the HLA system without the service manual or proper training and tools.

HLA system will not stop vehicle. Driver must be prepared to apply brakes anytime the HLA system is in regenerative braking.

Do not check accumulator precharge with key on and stored oil in accumulator.

Do not use liquid nitrogen, oxygen or compressed shop air to charge accumulator.

Do not cut accumulator or high pressure tube and hose assembly.

In the event of an accident, the accumulator should be removed for inspection and replacement.

High pressure accumulator under high pressure reaches 5000 psi. Follow venting and drain procedures to relieve pressure.

High pressure accumulator has both stored oil and nitrogen gas under pressure. Nitrogen gas remains under pressure even when stored oil has drained.

Do not cut, hammer or weld to the accumulator shell or high pressure fittings attached to the accumulator.
Thermal relief fuse cap must be in good condition and properly installed.

Failure to properly install the thermal relief fuse cap could result in an accumulator burst event if the accumulator becomes overheated.

Avoid suffocation. Nitrogen asphyxiates. Move to ventilated area upon opening the vent. See MSDS for more information on nitrogen gas.

Do not use automotive type valve cores in high pressure hydraulic accumulator gas port.

Wear hearing protection. Venting accumulator nitrogen gas may make a loud whistle noise.

Vent accumulator nitrogen gas precharge prior to servicing accumulator. Follow "Venting Nitrogen Gas from Accumulator" procedure.

Prior to any work on the HLA system, perform the HLA service and maintenance shutdown procedure and lockout/tagout in accordance with local facility.

Vent accumulator nitrogen gas in a well ventilated area.

Before servicing the HLA system, allow accumulator to depressurize for five minutes minimum with the key off.

HLA components and surfaces get hot during operation. Avoid contact. May cause burn and/or other injury.
Service and Maintenance

Escaping nitrogen gas is extremely cold and may freeze skin. Avoid skin contact with the nitrogen gas to prevent freezing damage to skin tissues.

IMPORTANT

For proper operation. Use only dry industrial grade nitrogen to charge accumulator.

Read the entire manual before operating HLA system.

Battery (+) and (-) must be disconnected prior to any type of welding on any Hybrid equipped vehicle.

Do not use HLA mounting frame or components as a jack support.

Driveshaft behind the transfer case or axles must be removed before towing vehicle.

Use only original Eaton HLA replacement parts and fluids.
Service and Maintenance

Emergency Procedures

Use the relief valve manual release to relieve any pressurized oil in the HLA system. See “Manual Relief Valve Drain” procedure.

Do not cut, hammer or torch accumulator shell. Accumulator maintains gas pressure when HLA pressurized oil is removed.

Towing

When towing vehicle, do not allow output shaft of the HLA system to spin or turn. If vehicle is towed with drive wheels still in contact with road surface, remove or disconnect vehicle axle shafts or driveline.

WARNING

Serious internal transmission damage and damage to HLA system can result from improper vehicle towing.

Preferred

Must remove driveshaft between HLA transfercase and rear axle
Driver Display Module

The driver display module is mounted in the dashboard as a visual aid for the driver and is used to monitor the HLA system operation. At key on, all lights will flash as self-check. Only those applicable will remain illuminated.

Fault Code
In the event there is a problem with the HLA system, the driver display will present a fault code that can be looked up in the service manual. The display is blank when the HLA system is functioning properly.

Note: Note the driving condition under which the problem occurred.

State of Charge Bar
The eight segments of the display represent the current amount of stored energy. All eight segments are illuminated at maximum stored energy, i.e., the accumulator is full. The illuminated portion of the bar will decrease when accelerating and increase when retarding. The optimum use of the HLA system will occur when the state of charge indicator goes from empty to full during each braking event of the cycle.
**Driver Display Module**

**Mode(s)**
In Economy mode the engine is held at idle RPM during acceleration until the stored energy is depleted. However, if the driver demand is greater than what the HLA system can provide, the engine will assist the launch. In Productivity mode the HLA system assists the engine. Both are combined for maximum launching power.

**Service Light**
Amber light. The HLA system has been disabled and a fault code will appear. The HLA system requires service. The vehicle may be driven. Record fault number and conditions at time of the fault.

**Stop Light**
Red light. The HLA system has malfunctioned. Do not drive the vehicle. Tow the vehicle to service center.

**Note:** The rear drive shaft must be removed prior to towing the vehicle.
Operation

Start-Up

1. Turn the ignition key to “ON” and allow the HLA system to power-up.
2. Start the engine.
3. Check the HLA driver display module for any fault codes.
4. Apply service brake.
5. Select the desired mode and starting gear on the shift console.
6. Release the service brake and apply accelerator.

Notes:

- If the vehicle speed exceeds HLA system limits the system will disengage. The transfer case will not re-engage until the vehicle has come to a complete stop unassisted by the HLA system. The speed of disengagement will vary depending on gear ratio at approximately 25 MPH.
- The HLA system is not active in Reverse. It will disengage when not in drive, cruise controls on, or parking brake set.

Driving

The HLA system is automatic and will engage and be active without driver interaction within the following system parameters:

- The engine is running.
- The vehicle is in drive.
- The vehicle speed is below 22 MPH.
- The HLA system will assist acceleration when accelerator pedal is pressed and there is energy available in the accumulator.
Coast Feature
Lightly holding the accelerator pedal allows the vehicle to coast by keeping HLA regeneration on standby. The HLA system will retard the vehicle once the accelerator pedal is released if the HLA system is active and engaged.

Note: If the vehicle speed exceeds HLA system limits the system will disengage. The transfer case will not reengage until the vehicle has come to a complete stop unassisted by HLA. The speed of disengagement will vary depending on gear ratio approximately 25 MPH.

Note: HLA is not active in Reverse. HLA will disengage when not in drive, cruise control on or parking brake set

Vehicle Braking / Regeneration
The HLA system on the vehicle uses regenerative braking to capture and store energy in the hydraulic accumulator. When the accelerator pedal is released regenerative braking will start when the HLA system is active, has no faults, and has available oil storage capacity. The regeneration will feel as if the brake pedal is being lightly applied. During regeneration oil is being pumped into the accumulator capturing the vehicle kinetic energy. The load of the pump helps slow the vehicle. The full power of the service brake is always available to the driver.

The HLA system will automatically shut off regenerative braking when the accumulator is fully charged. The chassis service brakes are always available.

Regenerative braking is automatically shut off if a system fault occurs.

Regenerative braking is automatically shut off during an anti-lock braking (ABS) event (e.g. skidding on black ice while trying to brake the vehicle.)

Be prepared to apply the service brakes any time the HLA system is in regenerative braking.

Power Down

- Select Neutral on the shift control.
- Set the vehicle parking brakes.
Operation

- Turn off the ignition key and allow the engine to shut down.

Note: Any oil stored in the accumulator as HLA energy will drain back to the reservoir once the ignition is turned off.
Service and Maintenance

Inspect HLA System Daily
Inspect HLA system daily during vehicle pre-trip inspection. The following is a list of routine checks.

- Check reservoir oil level with ignition key off.
- Check reservoir breather indicator.
- Check for oil leaks under vehicle.
- Check for loose or low hanging hoses or wires.
- Check accumulator thermal relief cap is installed.
- Check Cooler Screen and Clean/Remove any Debris
- Check driver display for faults.

Note: Report and correct any defects prior to operation of HLA system. Additional inspections are listed in the service and inspection interval chart located in the service manual.

Maintenance
Regular maintenance is important for the safe and reliable operation of the HLA system. A preventative maintenance schedule should be set up as indicated.
## Service and Maintenance

<table>
<thead>
<tr>
<th>Component</th>
<th>Maintenance</th>
<th>Part #</th>
<th>Pre-trip Inspection</th>
<th>P1A Interval Inspections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hose</td>
<td>Visually inspect for hose abrasion or wear</td>
<td></td>
<td></td>
<td>3000</td>
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<tr>
<td>T-Case Oil</td>
<td>Check oil level</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td></td>
<td>Change transfer case oil (75W-90 Synthetic, 1.9 gallons)</td>
<td>FE/75W-90 Synthetic</td>
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<td>X</td>
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<tr>
<td>Sub-Frame</td>
<td>Visually inspect mounting frame and check for cracks in welds</td>
<td></td>
<td>X</td>
<td>X</td>
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<td></td>
<td>Inspect mounting bolts, retorque as needed</td>
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<tr>
<td></td>
<td>Inspect mounts (abvertisers) for wear</td>
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<tr>
<td>System</td>
<td>Record HLA serial number with chassis VIN</td>
<td></td>
<td>X</td>
<td>X</td>
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<td></td>
<td>Inspect pump and components for leakage</td>
<td></td>
<td>X</td>
<td>X</td>
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<td></td>
<td>Inspect warning labels, replace if damaged or missing</td>
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<td>X</td>
<td>X</td>
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<td></td>
<td>Check HLA mode: use service tool and set to Econ or Prod</td>
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<td>X</td>
<td>X</td>
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<td></td>
<td>Check for driver display module function and no codes</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Reservoir Breather</td>
<td>Check breather indicator, replace if not</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td></td>
<td>Replace breather</td>
<td>Part # 5998865-001</td>
<td></td>
<td>X</td>
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<tr>
<td>Fittings</td>
<td>Check for loose fittings, hose and connections</td>
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<td></td>
<td>X</td>
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<tr>
<td>HLA System Oil</td>
<td>Check oil level in reservoir</td>
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<td></td>
<td>Capture oil sample and analysis</td>
<td>Kit # 894277</td>
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<tr>
<td>Filter</td>
<td>Change oil (0.1 gallons)</td>
<td>HLA Oil</td>
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<td></td>
<td>Change system oil filter</td>
<td>Part # 005270-001</td>
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<td></td>
<td>Change secondary (POU) oil filter</td>
<td>Part # 5904113-001</td>
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<tr>
<td>Accumulator</td>
<td>Check nitrogen precharge</td>
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<td></td>
<td>Visually inspect accumulator</td>
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<tr>
<td></td>
<td>Replace bladder</td>
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<td></td>
<td>Mark bladder tag with in service date</td>
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<td></td>
<td>Check thermal relief cap installation and condition</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>Cooler</td>
<td>Check intake screen and fan for debris and blockage; clean as needed</td>
<td></td>
<td></td>
<td>X</td>
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</table>
Service and Maintenance

Typical Configuration

Transfer Case
Pump/Motor
Reservoir
Accumulator
Cooler
Filter
## Service and Maintenance

### Daily Pre-trip Inspection

<table>
<thead>
<tr>
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<th>Fix</th>
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### PM Inspection 300 Hours (include above inspection)

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### PM Inspection 600 Hours (include 300 hour inspection)

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### PM Inspection 1200 Hours

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Annual Inspection—refer to Service Manual for oil and filter change procedures.