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Viewed:	5366		

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Title: Cooling System Flush Procedure

Applies To: All Engines

CHANGE LOG

2017/01/03 - Updated with the new engine systems cleaning solution part number
2015/09/14 - Revised verbiage in steps - Medium duty SRTs coming soon. SRTs link to repair times, rather than listing (approx. repair time given).
2015/08/10 - [Major Update] Revised steps, added pictures, included (missing) rinse procedures, added part numbers
2015/04/14 - Added warning regarding cleaning solution flammability.
2015/04/10 - Added warning regarding mixing water with cleaning solution, before heating.

DESCRIPTION

In the event of an oil cooler failure, engine oil may have entered the cooling system and mixed with the engine coolant. This document will guide the user to properly flush the contaminated cooling system. This procedure may be used on all engines, however; for demonstration purposes this article uses a MaxxForce 13L Engine.

SYMPTOMS

Customer Observations or Concerns:
- Contaminated cooling system
- Coolant hose swelling or softening

SPECIAL TOOLS

Tool Description	Tool Number	Comments	Instructions
Coolant Flush Adapter Kit	09-889-02		Link
Coolant Management System	KL5007NAV		Link
Cleaning Management System	12-353-01A		Link
International Reprogramming Harness	406010	SCR Equipped Only	
International Electronic Engine Terminal Test Kit	ZTSE4435C	SCR Equipped Only	
Breakout Harness	ZTSE4827	SCR Equipped Only	

SERVICE PARTS INFORMATION

Kit Description	Part Number	Qty	Notes
Fluid, Engine System Cleaner	2514295C92	1	

			One 5 gallon pail (Transbrite 985)
Coupling, Heat Exchanger Quick Connect	3688493C2	1	Only if it is **not** Installed
Oil Cooler	3007508C92	1	
Thermostats	3006444C3	2	
Coolant Filter	WF2077	1	Only If Equipped

REPAIR STEPS

NOTE:

This procedure uses the tooling (sizes) required to perform these steps on certain vehicles. Some vehicles may require a different size tool. These tools can be found in the Coolant Flush Adapter Kit as there are multiple sizes of the same tooling.

NOTE:

When draining any contaminated fluid from the system components, make sure to drain into a drain pan, NOT the Coolant Management System (CMS).

WARNING:

GOVERNMENT REGULATION: Engine fluids (oil, fuel and coolant) may be hazard to human health and the environment. Handle all fluids and other contaminated materials (e.g. filters, rags) in accordance with applicable regulations. Recycle or dispose of engine fluids, filters and other contaminated materials according to applicable regulations.

WARNING:

The Engine System Cleaner is a flammable liquid. It is CRITICAL that 15 gallons of water is mixed with 2.5 gallons of Engine System Cleaner (6:1 ratio) prior to usage.

NOTE:

Make sure the filter sock on the CMS (cleaning management system) is removed prior to performing this procedure.

BEFORE BEGINNING:

Understand what components are affected by a contaminated cooling system. Review the following checklist to ensure all components are accounted for.

System Flush Checklist	Y/N?
Engine/Radiator	
Heater Core (s)	
Diesel Exhaust Fluid (DEF) Heater Hoses	
Optional Heaters	

Optional Auxiliary Power Unit (APU)	
Aftermarket Equipment (non-warranty)	

PREPARATION:

- Inspect coolant hoses for swelling and/or softening from oil contamination
- If cooling system is full, start engine and allow coolant temperature to reach 120°F (48.8°C), to aid in draining cooling system contaminants.
- If cooling system is empty, fill the system with water following the proper fill procedure (IK0900017), then start engine and allow coolant temperature to reach 120°F (48.8°C).

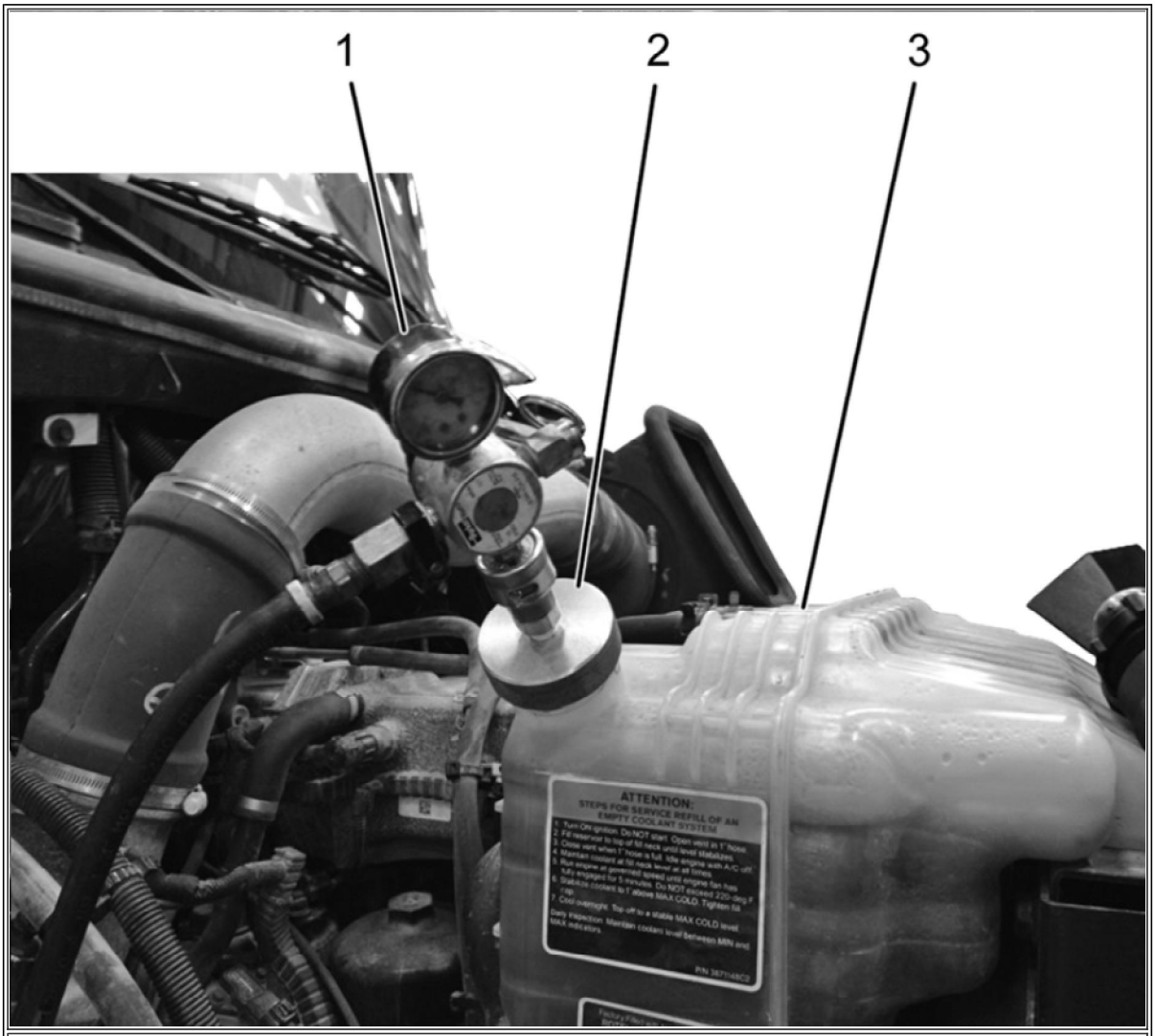

Figure 1: Deaeration Tank and Pressure Module

Item 1: Pressure Module (KL5006NAV)
Item 2: Cap Adapter (KL5006NAV)
Item 3: Deaeration Tank

1. Install cap adapter (**Figure 1,** Item 2) and pressure module (**Figure 1,** Item 1) onto deaeration tank (**Figure 1,** Item 3)

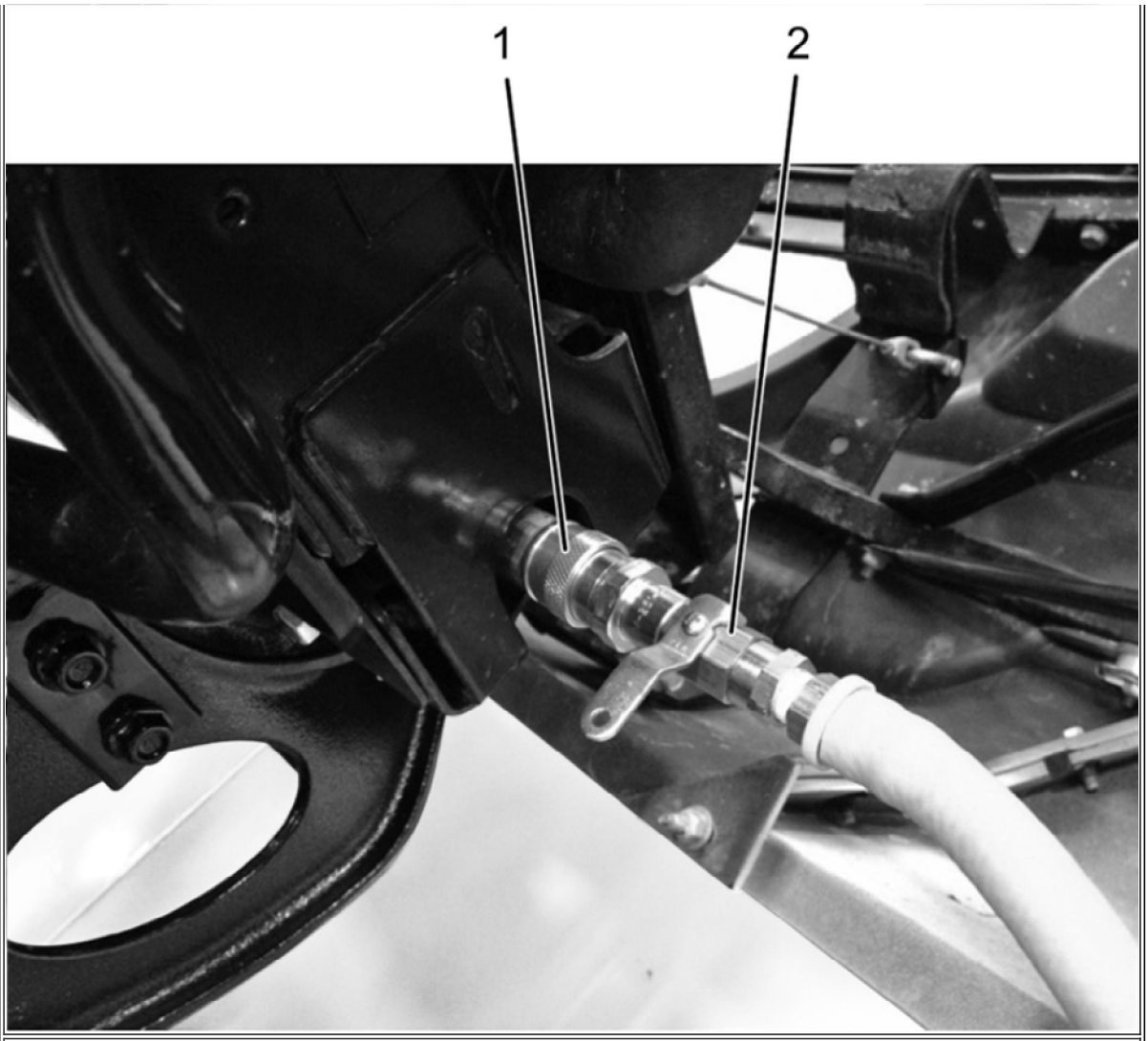

Figure 2: Radiator Discharge Hose

Item 1: Radiator Drain Coupler
Item 2: Radiator Discharge Hose (09-146-01)

2. Connect radiator discharge hose (**Figure 2,** Item 2) onto radiator drain coupler (**Figure 2,** Item 1)

3. Pressurize cooling system with shop air and drain contaminated fluid from discharge hose (**Figure 2,** Item 2). If viscosity of contaminated fluid is too thick, drain from lower radiator hose.

NOTE:

If contaminated fluid is too thick to drain out of radiator discharge hose, remove lower radiator hose.

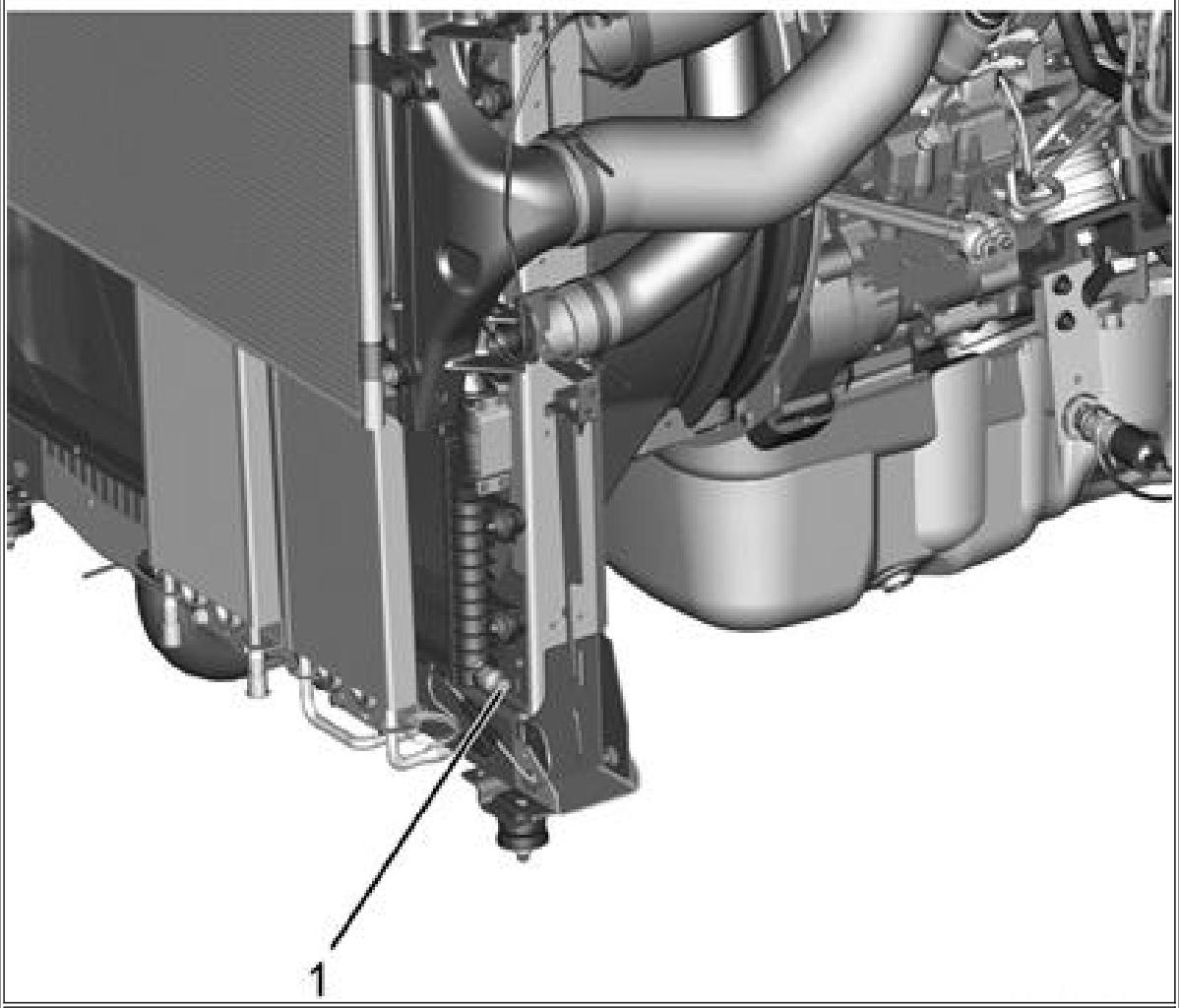

Figure 3: Low-Temperature Radiator (LTR) Drain Coupler

Item 1: LTR Drain Coupler (3688493C2)

NOTE:

If LTR radiator drain coupler is not installed, install LTR drain coupler

4. Connect radiator discharge hose (**Figure 2,** Item 2) onto low-temperature radiator (LTR) drain coupler (**Figure 3,** Item 1)

5. Pressurize coolant system with shop air and drain contaminated fluid from LTR into pan

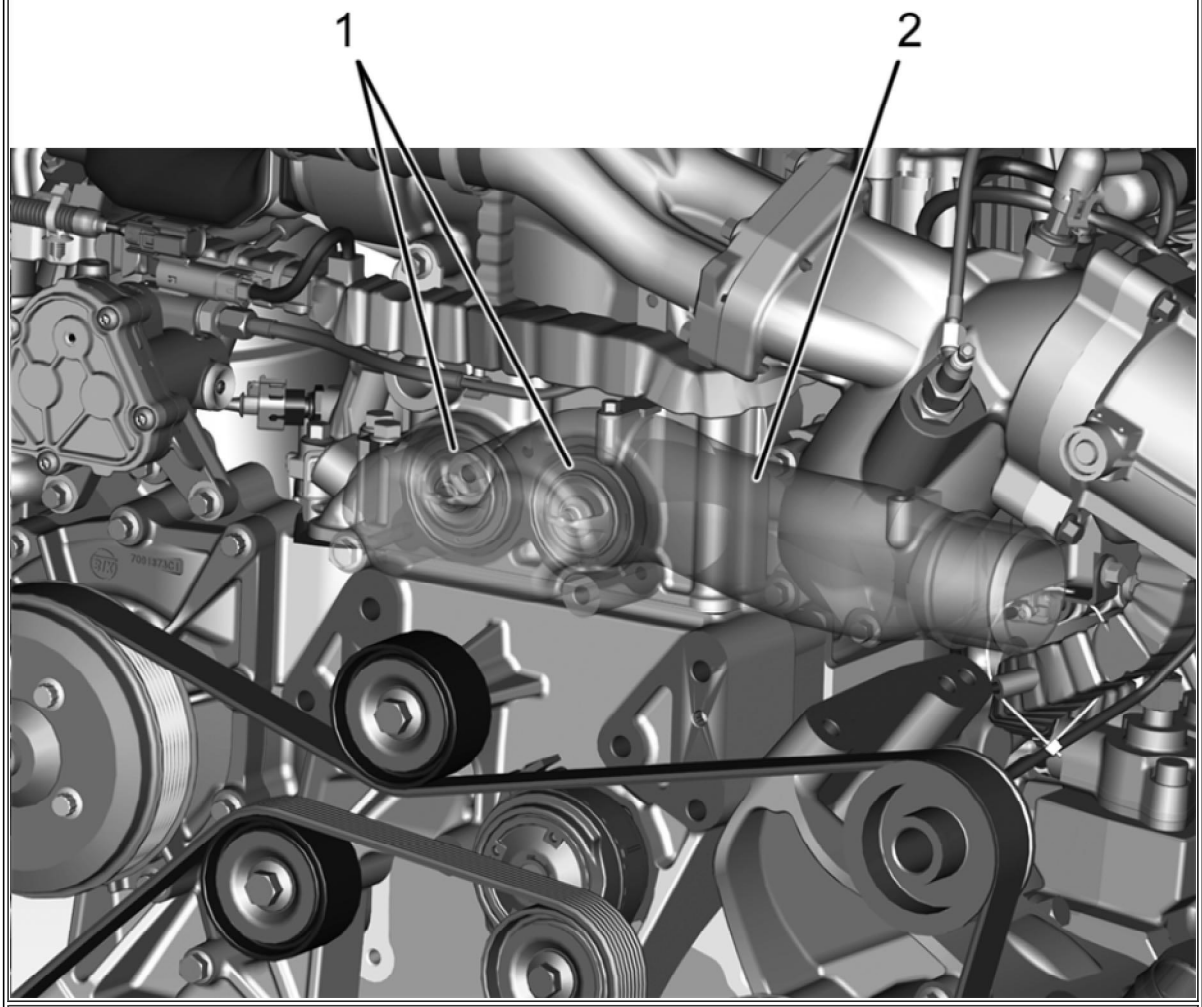

Figure 4: Thermostat Housing

Item 1: Thermostats
Item 2: Thermostat Housing

6. Remove thermostat housing (**Figure 4,** Item 2) and thermostats (**Figure 4,** Item 1)

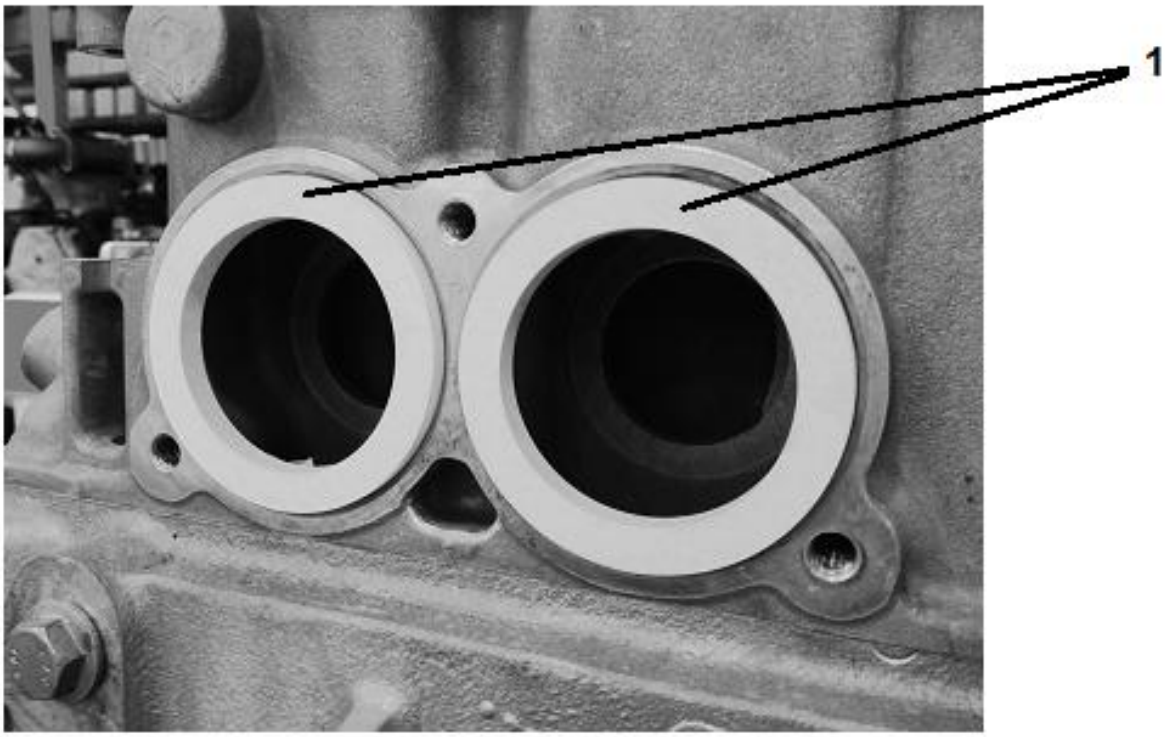

Figure 5: Gasket Installation

Item 1: Gaskets (09-889-02-05

7. Install two rubber gaskets (**Figure 5,** Item 1) and re-install thermostat housing (**Figure 4,** Item 2) and radiator hoses

Only perform steps 8 - 10 if equipped with a coolant filter

8. Remove passengers side inner fender

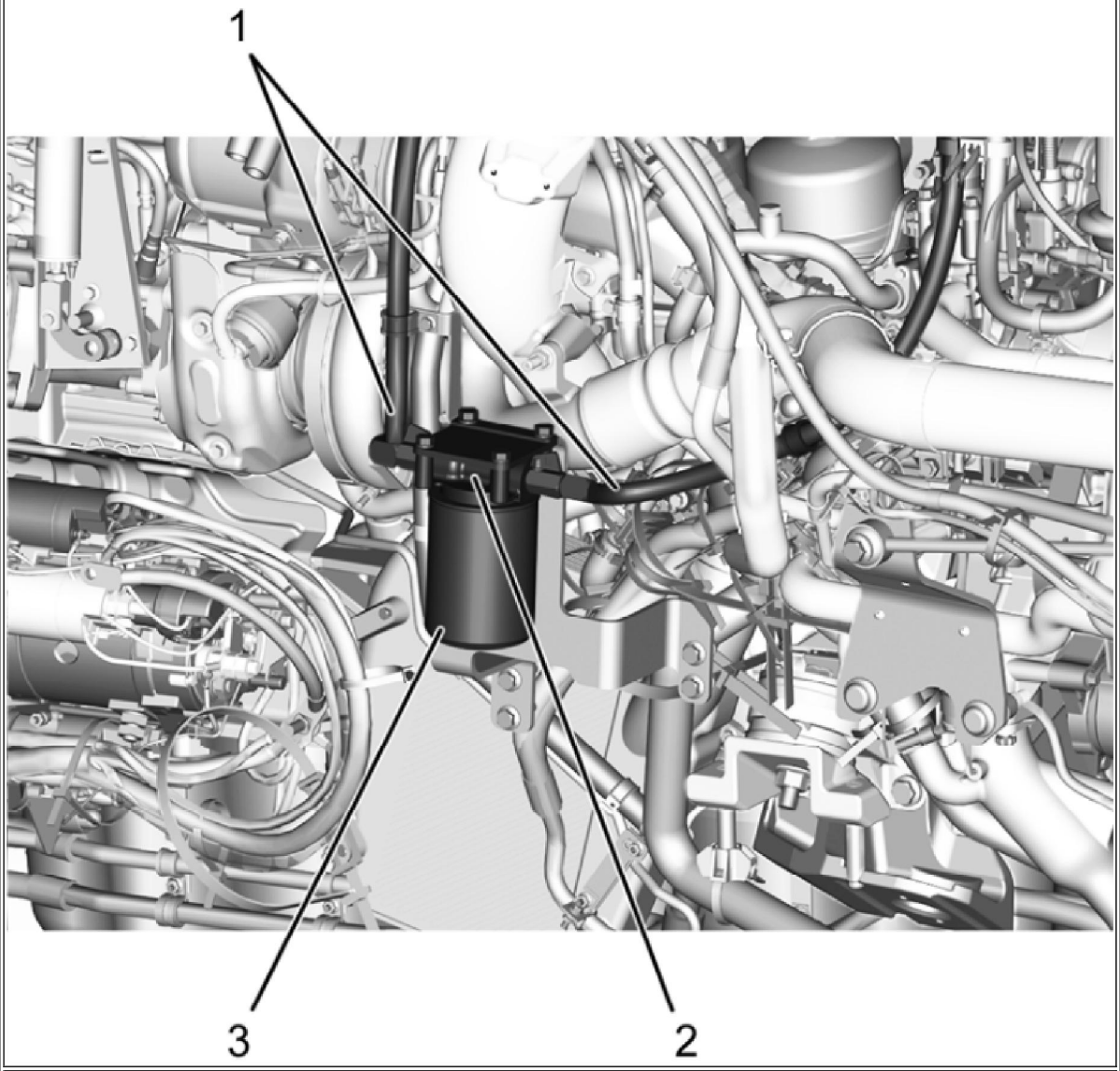

Figure 6: Coolant Filter Assembly

Item 1: Filter Clamp Locations
Item 2: Coolant Filter Housing
Item 3: Coolant Filter

9. Remove and discard coolant filter (**Figure 6,** Item 3) from housing (**Figure 6,** Item 2) - Clean housing

10. Install fitting (09-889-02-07) into hoses and disconnect from coolant filter

11. Vacuum fill coolant system with 2.5 gal. of Engine System Cleaner and 15 gal. of water using the Coolant Management System (KL5007NAV)

12. Start engine and run for approximately 30 - 45 minutes at 1200 rpm

13. Drain radiator and LTR (Low temperature radiator) using the discharge hose (**Figure 2**, Item 2)

Low Temperature Radiator (LTR) and Engine Flush

NOTE:

Prior to flushing, water and cleaner mixture should be heated to 115°F (46°C) minimum. Use hot water if available.

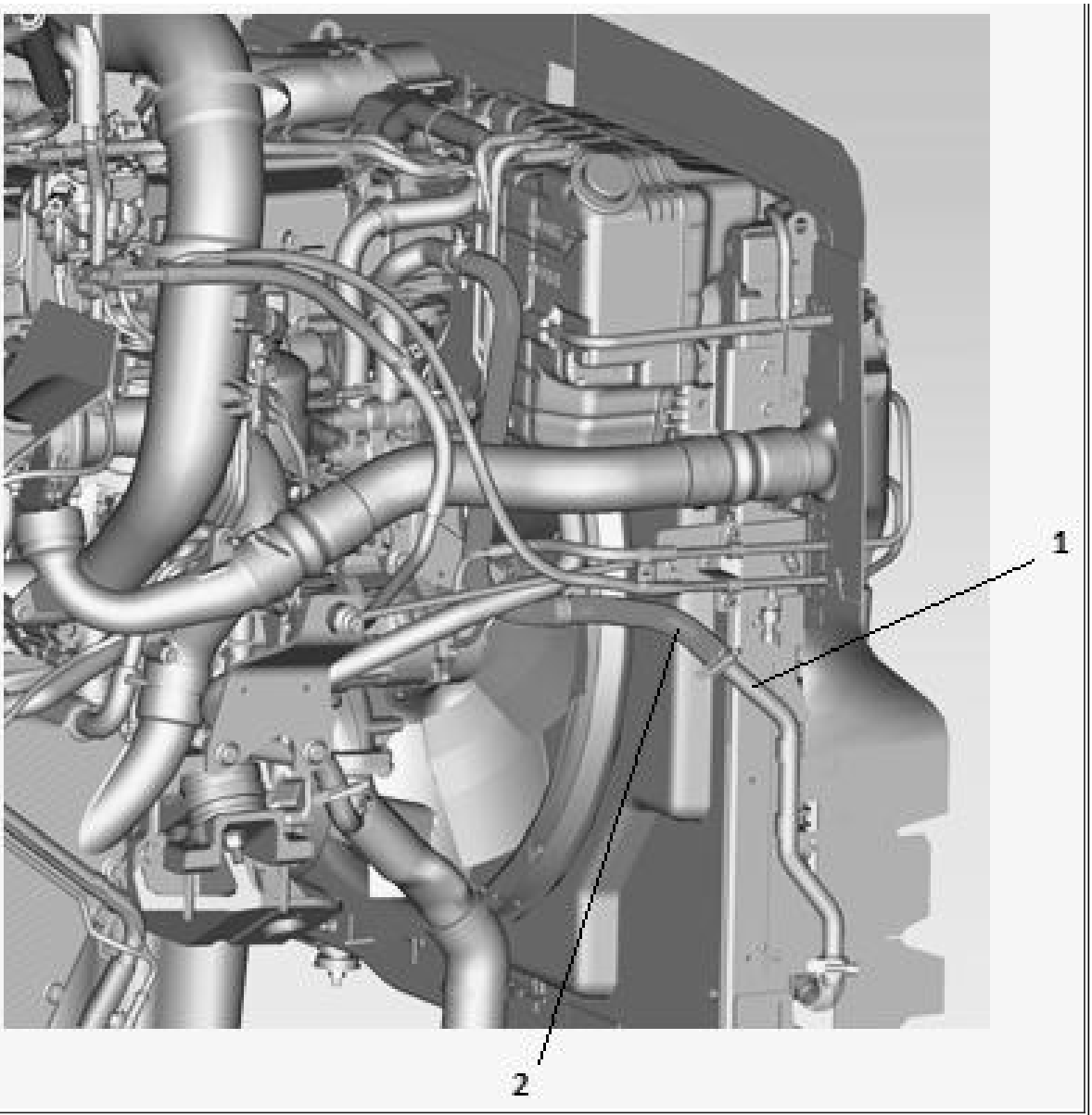

Figure 7: Low Temperature Radiator Tube and Coolant Control Valve Hose

Item 1: LTR Lower Tube
Item 2: Coolant Control Valve (CCV) Hose

1. Disconnect the coolant control valve hose illustrated above (**Figure 7**, Item 2) and install two small coolant flush adapters (**Figure 8**, Items 2 and 3)

2. Using cap (**Figure 8**, Item 4), cap off adapter on Coolant Control Valve Hose (**Figure 7**, Item 1)

Figure 8: Dearation Tank

Item 1: Deaeration Tank
Item 2: Deaeration Tank Adapter (09-889-02-03)
Item 3: Cleaning Management System Hose
Item 4: Cap (12-353-01-06)
Item 5: Small Coolant Flush Adapter (09-889-02-02)

3. Install Deaeration Tank Adapter (**Figure 8**, Item 2) onto deaeration tank (**Figure 8**, Item 1)

4. Connect Cleaning Management System (12-353-01A) hoses (**Figure** 8 Items 3 and 5) to adapters and run for approximately 15 minutes

5. Switch the cap (**Figure 8**, Item 4) and CMS hose (**Figure 8**, Item 5) and run Cleaning Management System (12-353-01A) for an additional 15 minutes

6. Remove small flush adapter (**Figure 8**, Item 5) and cap (**Figure 8,** Item 4), hoses and clamps

7. Install rubber cap from adapter kit onto the metal LTR line and install plug into rubber hose for LTR securing with clamps

Low Temperature Radiator (LTR) UPPER Flush

NOTE:

Prior to flushing, water and cleaner mixture should be heated to 115°F (46°C) minimum. Use hot water if available

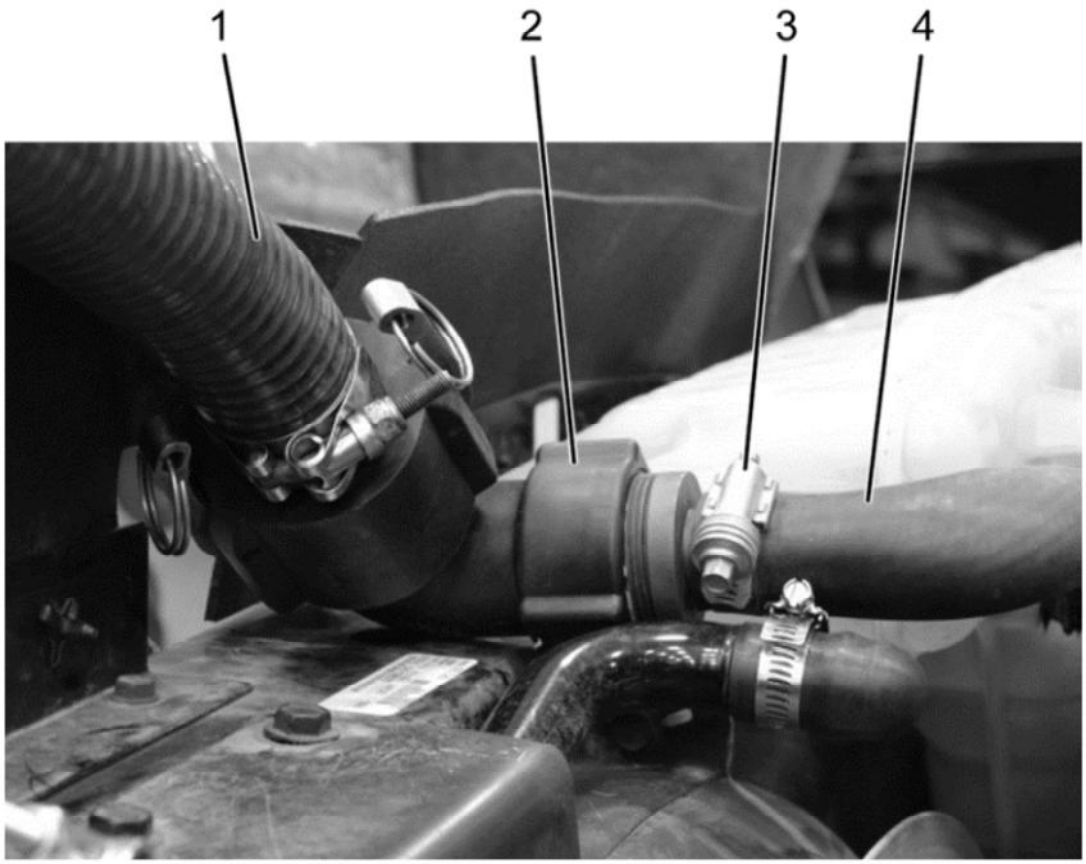

Figure 9: LTR Upper Hose Connections

Item 1: CMS Hose to Small Adapter
Item 2: Small Coolant Flush Adapter (09-889-02-02)
Item 3: Hose clamp
Item 4: LTR Upper Hose

1. Disconnect LTR upper hose from LTR tube

2. Install rubber cap onto LTR Tube with clamp

3. Install small coolant flush adapter (**Figure 9,** Item 2) into LTR upper hose (**Figure 9,** Item 4) with hose clamp (**Figure 9,** Item 3)

4. Connect CMS hose (**Figure 9,** Item 1 and **Figure 8**, Item 3) onto small coolant flush adapters (**Figure 9,** Item 2 and **Figure 8**, Item 2) and flush for 15 minutes

5. Reverse hoses (**Figure 10**) and run cleaning management system for an additional 15 minutes

NOTE:

When reversing the hoses, you will have to install plug into LTR upper hose with hose clamp along with a hose onto LTR tube with clamp. See Figure 10 below

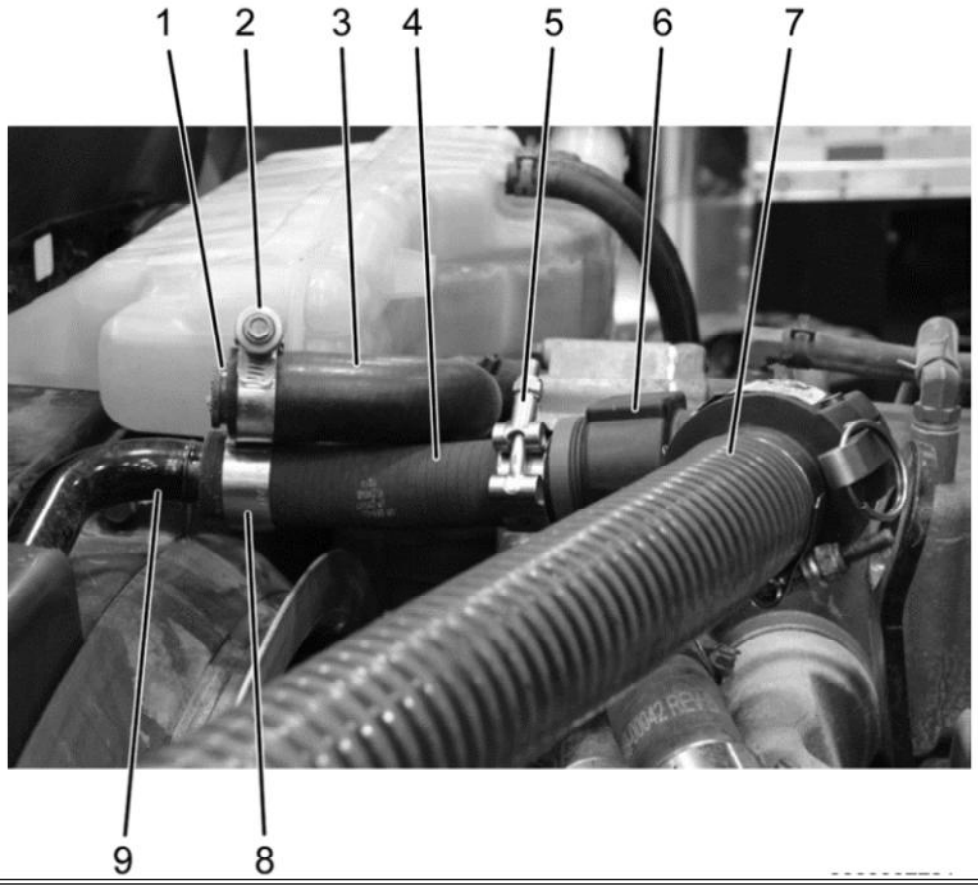

Figure 10: LTR Upper Hose Connections (Reverse)

Item 1: Plug (09-889-02-27)
Item 2: Hose Clamp
Item 3: LTR Upper Hose
Item 4: Hose (09-889-02-11)
Item 5: Clamp
Item 6: Small Coolant Flush Adapter (09-889-02-02)
Item 7: CMS Hose to Small Adapter
Item 8: Clamp
Item 9: LTR Tube

6. Remove small flush adapters, hoses and clamps

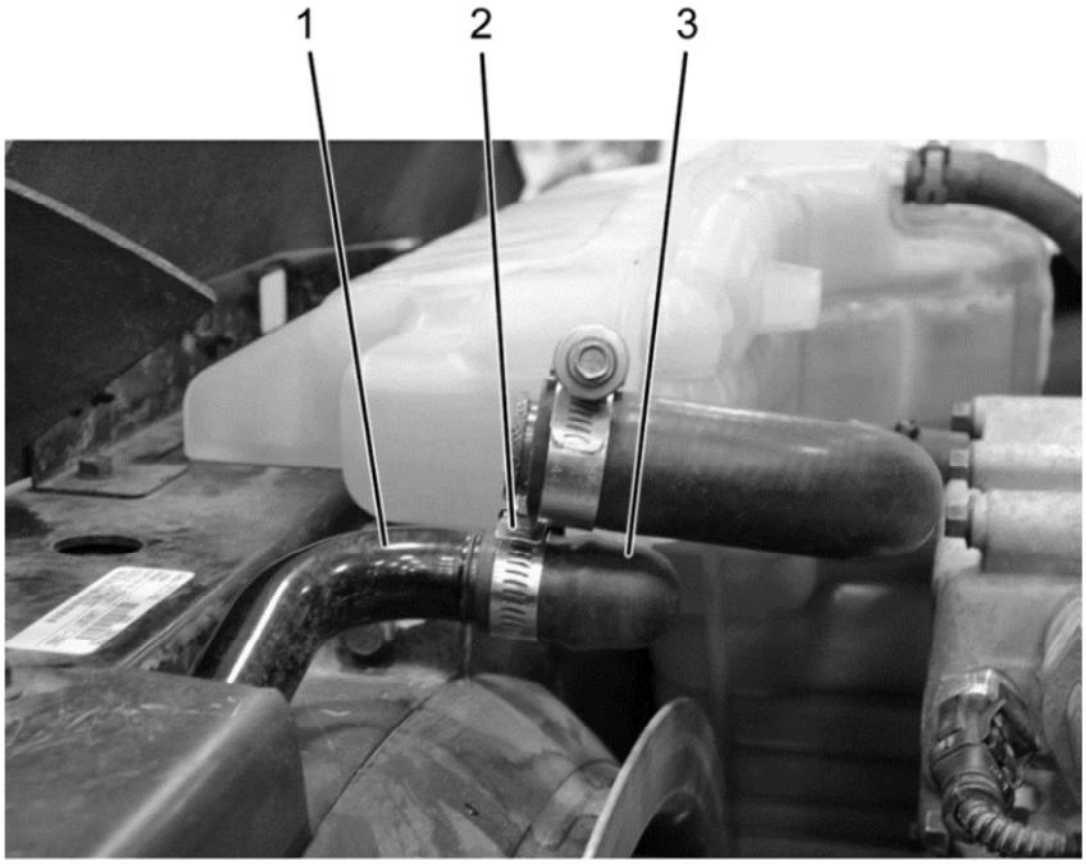

Figure 11: LTR Tube Plug

Item 1: LTR Tube
Item 2: Clamp
Item 3: Rubber Cap (09-889-02-30)

7. Install rubber cap from adapter kit onto LTR tube (**Figure 11,** Item 3) and install plug into rubber LTR hose (**Figure 11,** Item 1) securing with clamps

8. Install deaeration tank (radiator) cap

NOTE:

Check condition of fluid, if fluid has a dark "blackish" color, empty contents and fill with 15 gallons of water and 2.5 gallons of Engine System Cleaner.

Radiator and Engine Flush

NOTE:

Prior to flushing, water and cleaner mixture should be heated to 115°F (46°C) minimum. If available, fill container with hot water.

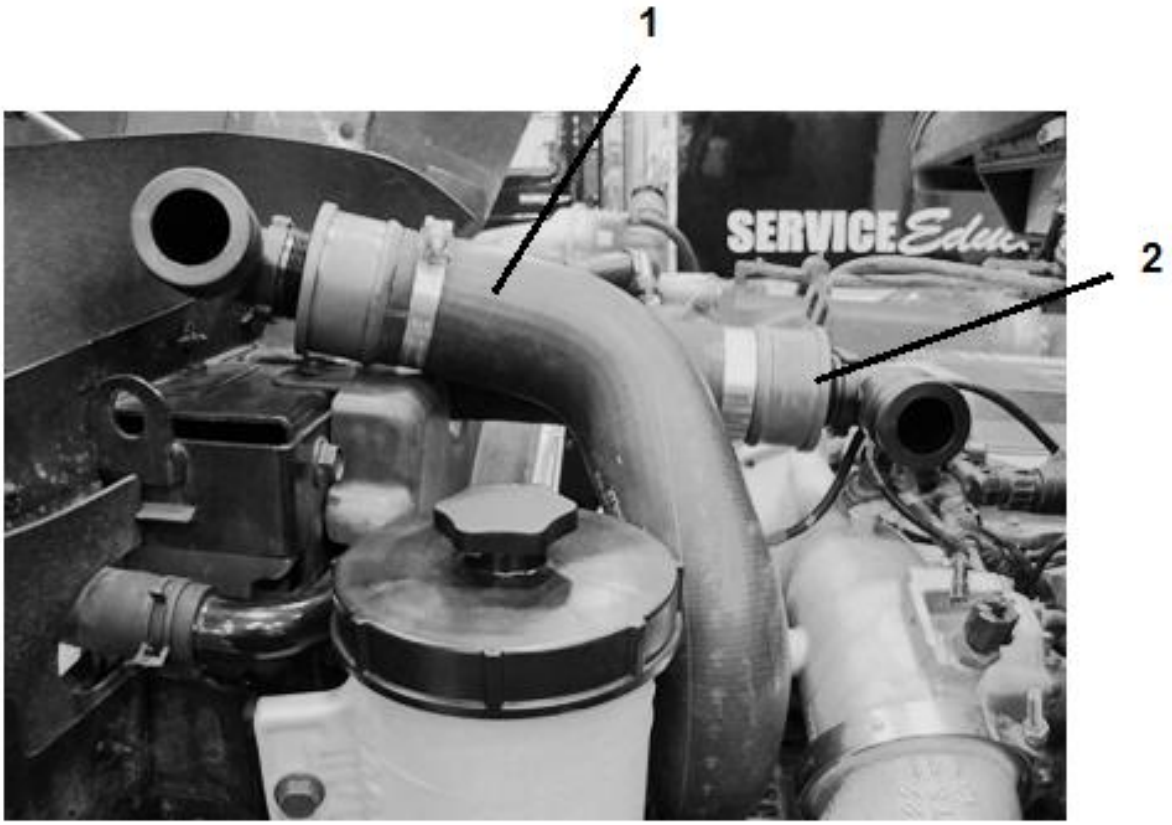

Figure 12: Upper Radiator Hose

Item 1: Thermostat Housing Hose
Item 2: Large Coolant Flush Adapter (09-889-02-01)

1. Disconnect upper radiator hose and install both Large Coolant Flush Adapters
2. Connect Cleaning Management System (12-353-01A) hoses to adapters and flush for 15 minutes
3. Reverse the hoses and run Cleaning Management System (12-353-01A) for an additional 15 minutes
4. Using a cap from the EGR flushing kit, cap both large coolant flush adapters. (May also use cap from CMS tool as an extra cap)

NOTE:

Check condition of fluid, if fluid has a dark "blackish" color, empty contents and fill with 15 gallons of water and 2.5 gallons of Engine System Cleaner.

Heater Core and DEF Hose Flush

NOTE:

Prior to flushing, water and cleaner mixture should be heated to 115°F (46°C) minimum. Use hot water if available

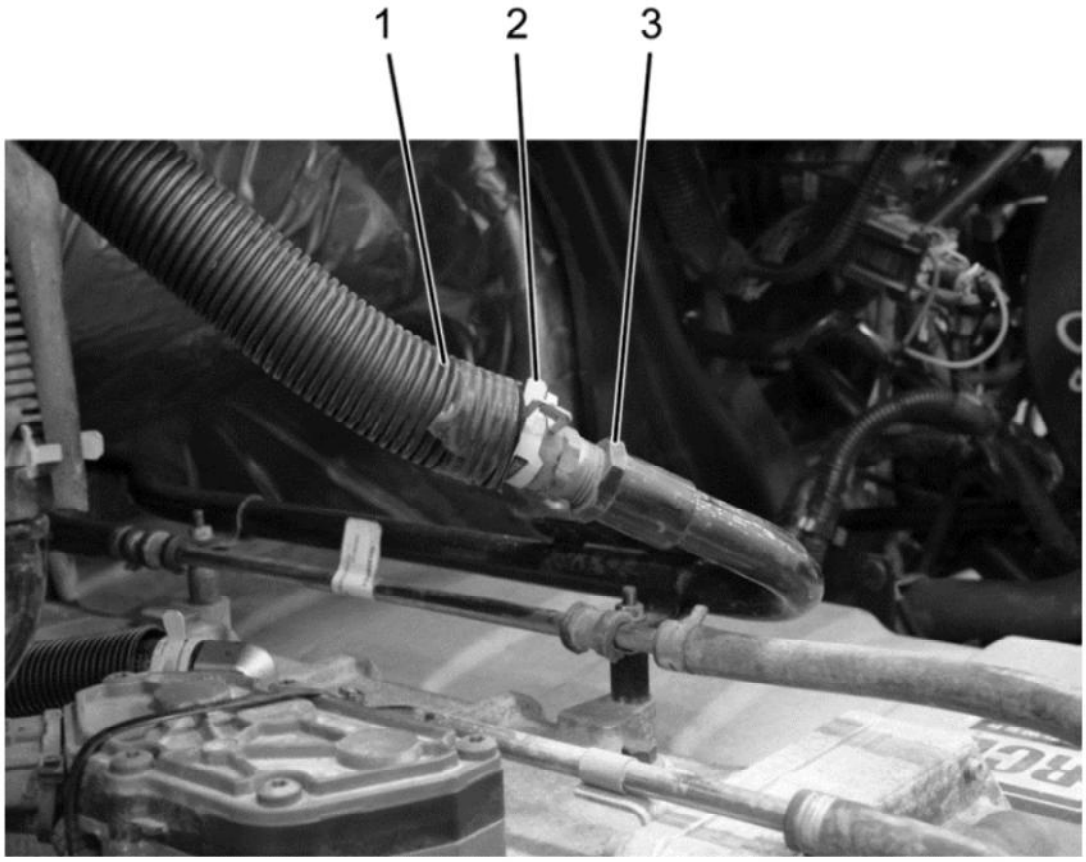

Figure 13: Front Heater Core

Item 1: Front Heater Core Input Hose
Item 2: Hose Clamp
Item 3: Front Heater Core Tube

1. Disconnect Heater Core Input Hose (**Figure 13**, Item 1) and install two Small Coolant Flush Adapters (**Figure 14**, Items 2 and 3)

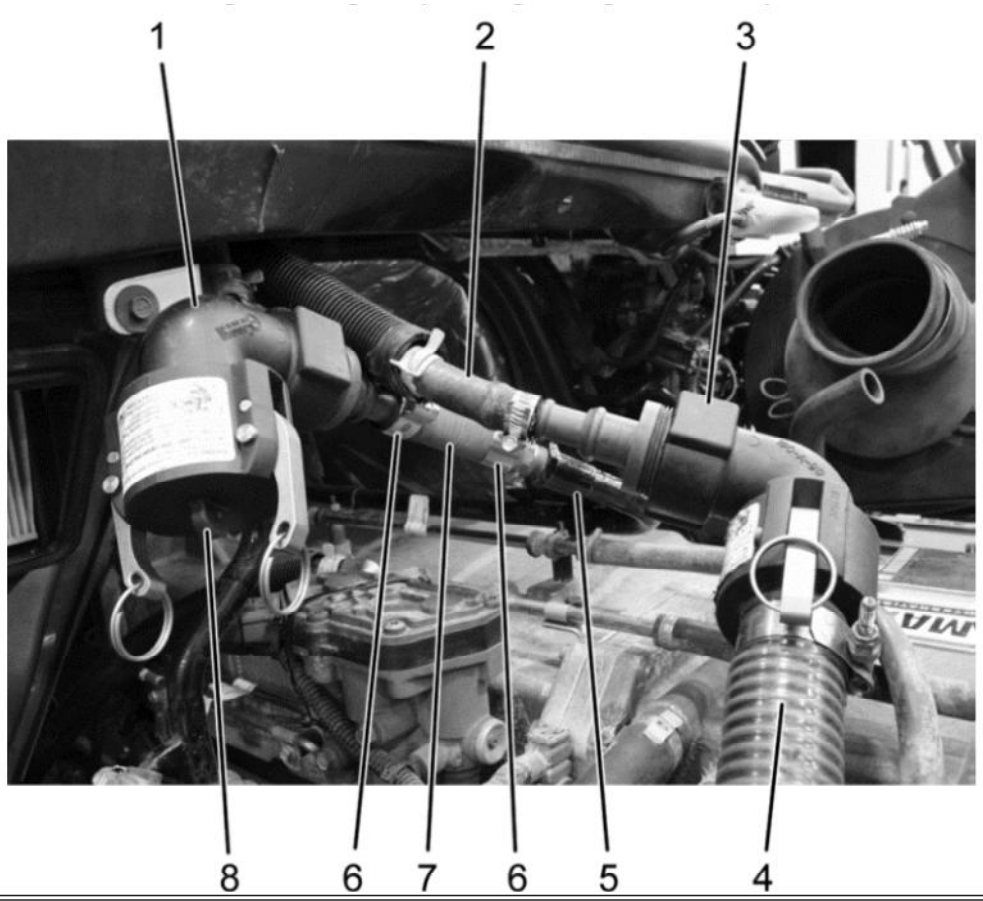

Figure 14: Front Heater Core Connections

Item 1: Small Coolant Flush Adapter (09-889-02-02)
Item 2: Front Heater Core Input Hose
Item 3: Small Coolant Flush Adapter (09-889-02-02)
Item 4: CMS hose to small adapter
Item 5: Front Heater Core Tube
Item 6: Clamp
Item 7: Hose (09-889-02-09)
Item 8: Cap (12-353-01-06)

2. Connect Cleaning Management System (12-353-01A) hose to small coolant flush adapter (**Figure 14**, Item 4) and cap (**Figure 14**, Item 8)

3. Install small coolant flush adapter to deaeration tank (**Figure 8**, Item 2) and return hose (**Figure 8**, Item 3) and flush for 15 minutes

4. Remove CMS return hose and cap (**Figure 14**, Item 4 and 8) and install cap onto adapter (**Figure 14,** Item 3) and install hose into adapter (**Figure 14**, Item 1) and flush for 15 minutes

5. Remove small flush adapters, hoses and clamps

6. Install rubber cap from adapter kit onto input heater core tube (**Figure 13,** Item 3) and install plug into rubber input hose (**Figure 13,** Item 1) securing with clamps

7. Repeat steps 1 thru 5 while flushing the DEF hoses and Auxiliary Heater Core if applicable

NOTE:

Check condition of fluid, if fluid has a dark "blackish" color, empty contents and fill with 15 gallons of water and 2.5 gallons of Engine System Cleaner.

NOTE:

When flushing the DEF hoses (if applicable) you will need to override the DEF Solenoid to flush the DEF hoses completely. Please see the steps below to open the DEF Solenoid

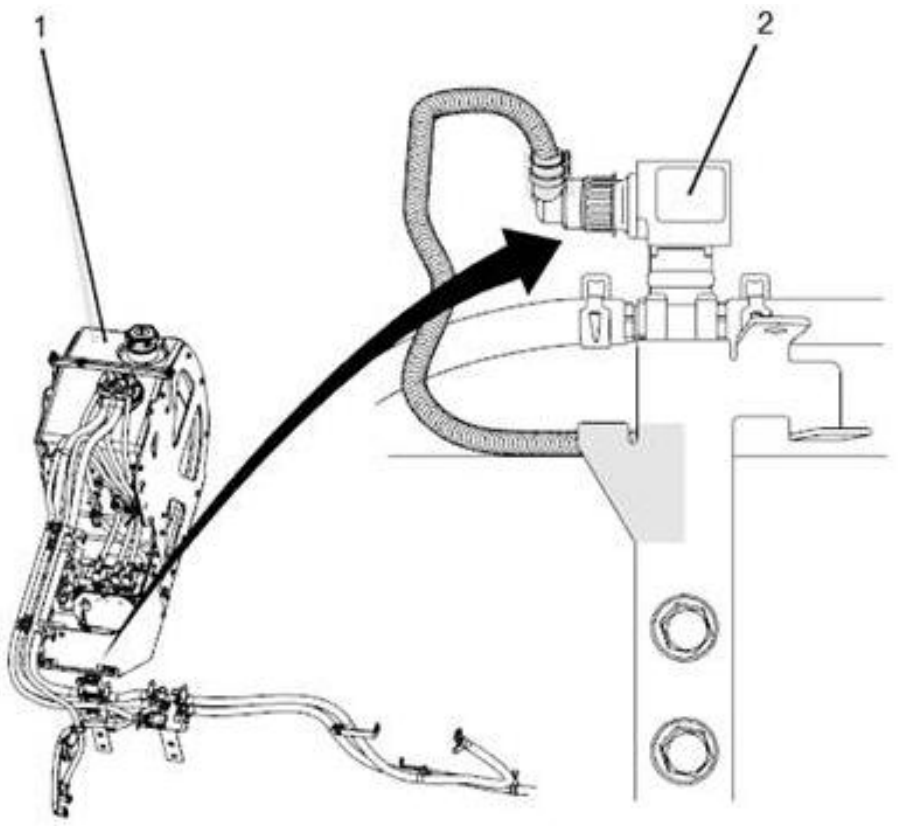

Figure 15: DEF Solenoid Location

Item 1: Diesel Exhaust Fluid (DEF) Tank
Item 2: Diesel Exhaust Fluid Tank Heater Valve (DEFTHC)

1. Located the DEFTHC, and disconnect the electrical connection

2. Connect ZTSE4827 (breakout harness), leave harness side disconnected

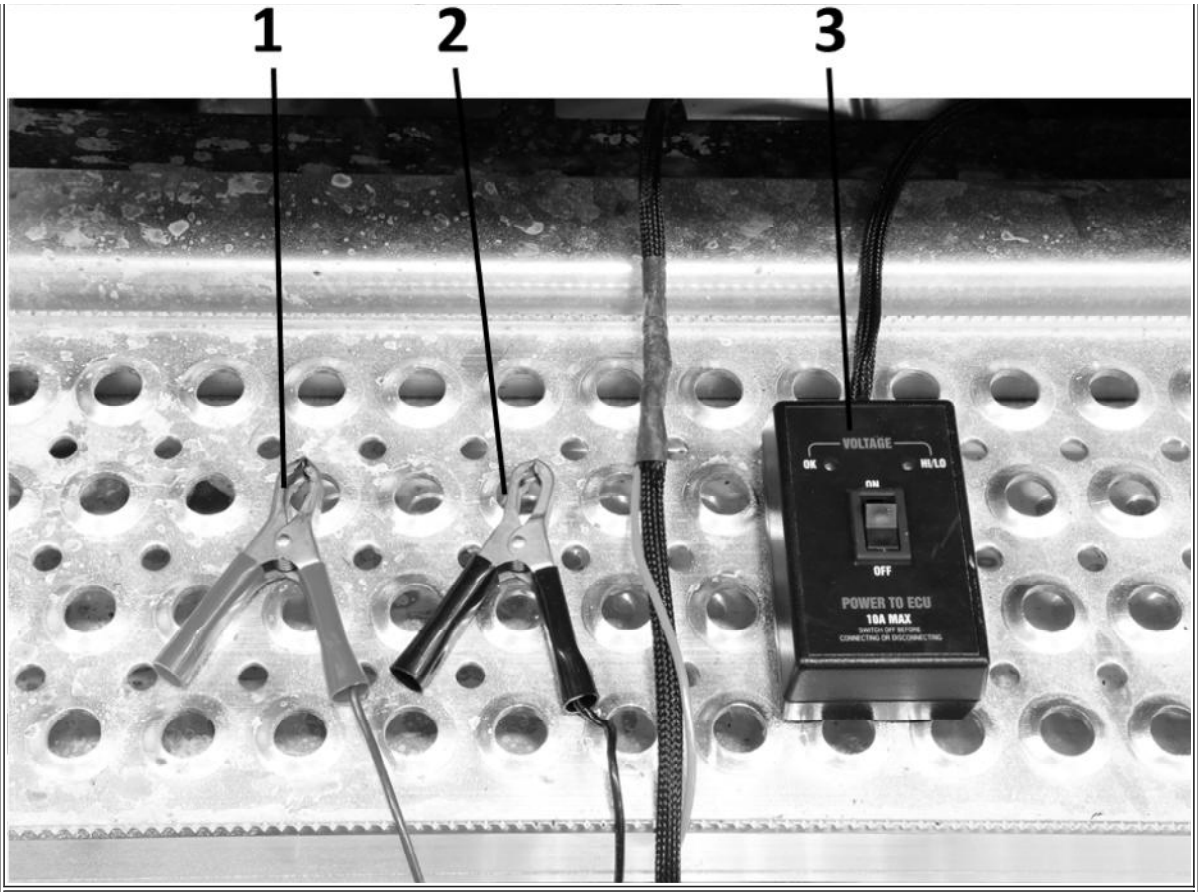

Figure 16: ECM Programming Harness (406010)

Item 1: Positive Cable Hookup
Item 2: Ground Cable Hookup
Item 3: 12 Volt Supply

3. Hook up 406010 using terminal kit ZTSE4435C

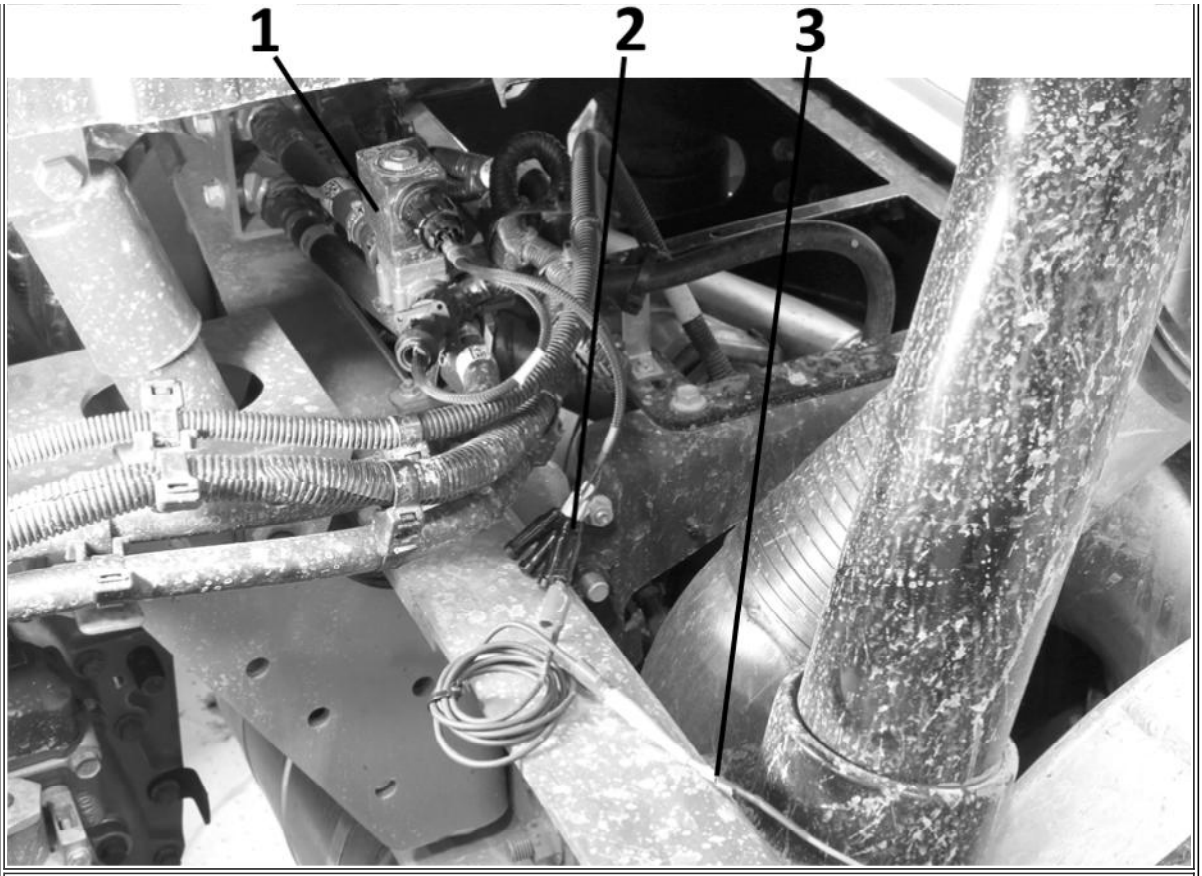

Figure 17: ECM Programming Harness

Item 1: Diesel Exhaust Fluid Tank Heater Valve (DEFTHC)
Item 2: ZTSE4827 (breakout harness)
Item 3: Power/Signal from 12 volt supply

4. When hooking up jumpers, power (coming from 12volt supply box) will be #1 on the ZTSE4827 breakout harness and ground will be #4 on the breakout harness

5. When ready to flush the DEF Lines, switch the 12 volt supply switch to the ON position.

Individual Component Rinse (post cleaning)

Front and Rear (if applicable) Heater Core Rinse

1. Fill CMS with 20 gallons of clean water

2. Loosen hose clamps and remove plugs from heater core return hose

3. Install small coolant flush adapters into rear heater core return hose and rubber cap over rear heater core return tube (**Figure 14**, Items 1 and 3) and tighten hose clamps

4. Install cap plug onto small coolant flush adapter (**Figure 14**, Item 8) and CMS hose to deaeration adapter (**Figure 8**, Item 3) and run into drain or bucket

5. Connect CMS hose to small coolant flush adapter (**Figure 14**, Item 4)

6. Connect and open drain valve on radiator discharge hose running it into a drain or bucket

7. Run CMS and flush with clean water

8. When water level gets low, turn off CMS

9. Close drain valve on radiator discharge hose

10. Fill CMS with 20 gallons of clean water

11. Disconnect CMS hose from small coolant flush adapter (**Figure 14**, Item 4)

12.Remove and install cap (**Figure 14**, Item 8) onto small coolant flush adapter on rear heater core return hose (**Figure 14**, Item 3)

13. Install CMS hose (**Figure 14**, Item 4) onto small coolant flush adapter (**Figure 14,** Item 1)

14. Open drain valve on radiator discharge hose

15. Run CMS and flush with clean water

16. When water level gets low, turn off CMS

17. Close drain on radiator discharge hose

18. Disconnect CMS hose from small coolant flush adapter

19. Remove clamps, hoses, caps and small flush adapters from engine

20. Connect heater core return hose to engine hose and tighten hose clamp

Upper LTR and Engine Rinse

1. Fill CMS with 20 gallons of clean water

2. Loosen and remove clamp and plug from LTR upper hose

3. Install small coolant flush adapter (**Figure 9**, Item 2)) into LTR upper hose (**Figure 9**, Item 4) with clamp

4. Connect CMS hose (**Figure 9**, Item 1) onto small coolant flush adapter (**Figure 9**, Item 2)

5. Connect small coolant flush adapter (**Figure 10**, Item 6 and 8) to LTR Tube and install adapter cap

6. Connect radiator discharge hose (**Figure 2**, Item 2) on LTR drain coupler (**Figure 3**, Item 1) and open drain valve. Run discharge hose into drain or bucket

7. Connect adapter to deaeration tank (**Figure 8**, Item 2) and connect CMS hose to adapter (**Figure 8**, Item 3) and run hose into drain or bucket

8. Run CMS and flush with clean water

9. When water level gets low turn off CMS

10. Close drain valve on radiator discharge hose

11. Fill CMS with 20 gallons of clean water

12. Disconnect CMS hose (**Figure 9**, Item 1) from small coolant flush adapter (**Figure 9**, Item 2) and replace with adapter cap

13. Connect CMS hose (**Figure 10**, Item 7) onto small coolant flush adapter (**Figure 10**, Item 6)

14. Open drain valve on radiator discharge hose

15. Run CMS and flush with clean water

16. When water level gets low turn off CMS

17. Close drain valve on radiator discharge hose

18. Disconnect CMS hose from small coolant flush adapter

19. Remove clamp and small coolant flush adapter from LTR tube

20. Loosen hose clamp and remove small coolant flush adapter from LTR upper hose

21. Connect LTR upper hose to LTR tube with hose clamp

Lower LTR and Engine Rinse

1. Fill cleaning management system with 20 gallons of clean water

2. Install radiator discharge hose **(Figure 2**, Item 2) onto LTR drain coupler (**Figure 3**, Item 1) (if not already installed)

3. Loosen hose clamp and remove plug from lower LTR hose

4. Install small coolant flush adapter (**Figure 8**, Item 5) into lower LTR hose (**Figure 7**, Item 2) and tighten hose clamp

5. Connect CMS hose onto small coolant flush adapter (**Figure 8**, Item 5) on lower LTR hose

6. Connect small flush adapter and cap to lower LTR tube (**Figure 8**, Item 4)

7. Install deaeration tank adapter **(Figure 8**, Item 2) and connect CMS hose to adapter. Run CMS hose into a drain or bucket

8. Open drain valve on radiator discharge hose

9. Run CMS and flush with clean water

10. when water level gets low, turn off CMS

11. Close drain valve on radiator discharge hose

12. Fill CMS with 20 gallons of clean water

12. Disconnect CMS hose from small coolant flush adapter (**Figure 8**, Item 5)

13. Install cap (**Figure 8**, Item 4) onto small coolant flush adapter (**Figure 8**, Item 5)

17. Connect CMS hose to small coolant flush adapter (**Figure 8**, Item 5) on LTR lower tube (**Figure 7**, Item 1)

18. Open drain valve on radiator discharge hose

19. Run CMS and flush with clean water

20. When water level gets low turn off CMS

21.Close drain valve on radiator discharge hose

22. Disconnect CMS hose from small coolant flush adapter

23. Loosen hose clamp and remove small coolant flush adapter, clamp and hose from LTR lower tube

24. Connect LTR lower hose (**Figure 7**, Item 2) to LTR lower tube (**Figure 7**, Item 1) with hose clamp

25. Connect electrical connector to high-pressure A/C switch and install new tie strap

Radiator and Engine Rinse

1. Fill CMS with 20 gallons of clean water

2. Remove radiator discharge hose (**Figure 2**, Item 2) from radiator drain coupler (**Figure 3**, Item 1) on LTR

3. Install radiator discharge hose onto radiator drain coupler (**Figure 2**, Item 1)

4. Remove cap from large coolant flush adapter on upper radiator outlet

5. Connect CMS hose to large coolant flush adapter (**Figure 12,** Item 2) on upper radiator outlet

6. Open drain valve on radiator discharge hose

7. Run CMS and flush with clean water

8. When water level gets low turn of CMS

9. Close drain valve on radiator discharge hose

10. Fill CMS with 20 gallons of clean water

11. Disconnect CMS hose from large coolant flush adapter (**Figure 12**, Item 2) on upper radiator outlet

12. Install cap onto large coolant flush adapter (**Figure 12**, Item 2) on upper radiator outlet

13. Remove cap from large coolant flush adapter (**Figure 12**, Item 1) on thermostat housing hose

14. Connect CMS hose to large coolant flush adapter (**Figure 12**, Item 1) on thermostat housing hose

15. Open drain valve on radiator discharge hose

16. Run CMS and flush with clean water

17. When water level gets low turn off CMS

18. Close drain valve on radiator discharge hose

19. Disconnect CMS hose from large coolant flush adapter on thermostat housing hose

20. Loosen V-clamp and remove large coolant flush adapter (**Figure 12**, Item 1) from thermostat housing hose

21. Remove two clamps, large coolant flush adapter (**Figure 12**, Item 2) and hose from upper radiator outlet

22. Connect thermostat housing hose (**Figure 12**, Item 1) to upper radiator outlet with V-clamp or new heat shrink clamp as required.

Final Rinse

1. Ensure CMS is clean

2. Fill CMS with clean water

3. Ensure all hoses are connected (if equipped with coolant filter install new filter) and backfill cooling system with water using appropriate fill procedure found in IK0900017

4. Start engine and run for approximately 30 - 45 minutes at 1200 rpm

5. Shut down engine and drain (rinse 3 times, steps 1-3, or until clear fluid comes out)

NOTE:

If there are still dark traces of oil left in the cooling system, replace all rubber hoses for cooling system as they may soaked with oil and repeat flushing procedures as necessary.

6. Remove thermostat housing and remove two rubber gaskets

7. Replace the thermostats using new parts and install thermostat housing

8. Re-connect all loose hoses and connections

WARRANTY INFORMATION

Warranty Claim Coding:

Group:	12000 - Engine
Noun:	686 - Cooler, Oil

Standard Repair Times:

Description	Chassis	SRT	Hours
Cooling System, Flush	ProStar Sleeper	R09-1022U-21	Cooling System Flush (SRTs)
Cooling System, Flush	ProStar Daycab	R09-1022U-22	
Cooling System, Flush	7600	N09-1022U-21	
Cooling System, Flush	Transtar	Q09-1022U-21	
Cooling System, Flush	5000	T09-1022U-21	
Cooling System, Flush	CAT CT660	TC09-1022U-21	

A typical repair will take between 9 and 10 hours.

Alternatively, the SRT code can be searched for, HERE.

OTHER RESOURCES

Master Service Information Site
MaxxForce® 11 and 13 Engine Diagnostic Manual (EPA 10, HD-OBD) Revision 8 (Supersedes EGES-470)
MaxxForce® 11 and 13 Engine Service Manual (EPA 10), Revision 6, (Supersedes EGES-465)
MaxxForce® 11 and 13 (EPA 07) Engine Diagnostic Manual (Revision 2)
MaxxForce® 11 and 13 (EPA 07) Engine Service Manual (Revision 2)

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