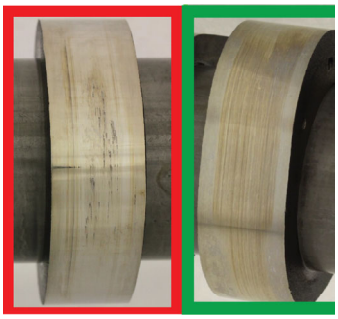
KENWORTH
A PACCAR COMPANY

Technical Information Bulletin

E252



Section

Engine

Subject

EPA2017 MX-13 Camshaft Inspection

Release Date

1/24/2020

Revision

01/28/2020: Chassis list has been updated.

Condition

There may be:

- Excessive/unusual noise from camshaft.
- Damage is observed to the camshaft follower and/or camshaft lobe peaks.
- Metallic debris in the oil filter.

Chassis Affected

Specific chassis with EPA2017 MX-13 engines. See the chassis list.

Action

Campaign

Service all chassis affected that enter your dealership, even if the customer has no issue with the chassis.

1. Review the attached chassis list for your dealer code and schedule your customer(s) for service if their chassis is on the list.
2. If you are not using Service Management to start repair orders, review SIR for "Complete" or "In Process" next to the "E252" campaign code prior to performing this repair.
3. Follow the procedures below to inspect the camshaft and repair as necessary.
4. Refer to bulletin E256 to educate the customer about oil change intervals.

NOTE

There will be several phases and combinations of Camshaft Inspection, Oil Thermostat, and Oil Filter Cap campaigns; therefore, check SIR for chassis specific OPEN campaigns to avoid over-repair.

CAUTION

Dealers that release trucks on the chassis list without completing the actions described below may face liability for progressive damage.

Warranty

For repairs completed by 02/01/2021, Kenworth will pay for parts at dealer net plus applicable mark-up and labor:

The chassis list will indicate if the chassis is SFFA or Non-SFFA.

Inspections Only

If the engine will be replaced as a result of this inspection, DO NOT perform E258 if it is open. E258 will be closed by Kenworth as part of the engine ordering process.

Non-SFFA Chassis

- 1.8 hours for Non-SFFA chassis **under** 100,000 miles (160,934 km) to **inspect the camshaft** and reinstall the oil pan, reusing the oil pan gasket (SRT 045-657 and 045-860) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252A.
- 1.8 hours for Non-SFFA chassis **over** 100,000 miles (160,934 km) to **inspect the camshaft** and reinstall the oil pan, using a new oil pan gasket (SRT 045-657 and 045-860) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252B.
- 2.3 hours for Non-SFFA chassis **under** 100,000 miles (160,934 km) to **inspect the camshaft and lower main bearings a**nd reinstall the oil pan, reusing oil pan gasket (SRT 045-657, 045-860 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252E.
- 2.3 hours for Non-SFFA chassis **over** 100,000 miles (160,934 km) to **inspect the camshaft and lower main bearings a**nd reinstall the oil pan, using a new oil pan gasket (SRT 045-657, 045-860 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252F.

SFFA Chassis

- 2.2 hours for SFFA chassis **under** 100,000 miles (160,934 km) to **inspect the camshaft** and reinstall the oil pan, reusing the oil pan gasket (SRT 045-657, 045-860 and 045-861) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252C.
- 2.2 hours for SFFA chassis **over** 100,000 miles (160,934 km) to **inspect the camshaft** and reinstall the oil pan, using a new oil pan gasket (SRT 045-657, 045-860 and 045-861) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252D.
- 2.7 hours for SFFA chassis **under** 100,000 miles (160,934 km) to **inspect the camshaft and lower main bearings** and reinstall the oil pan, reusing the oil pan gasket (SRT 045-657, 045-860, 045-861 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252G.
- 2.7 hours for SFFA chassis **over** 100,000 miles (160,934 km) to **inspect the camshaft and lower main bearings** and reinstall the oil pan, using a new oil pan gasket (SRT 045-657, 045-860, 045-861 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim E252H.

Cam or Engine Replacement

- 27.1 hours for Non-SFFA chassis or 27.5 hours for SFFA chassis to inspect the camshaft and lower main bearings and replace the camshaft (SRT 045-657, 045-658, 045-860 and 045-660, and for SFFA only 045-861). File long form claim.
- 26.1 hours labor for Non-SFFA chassis or 26.5 hours for SFFA chassis to inspect the camshaft and lower main bearings and replace the

long block (SRT 045-657, 045-658, 045-860 and 045-295). File long form claim.
- 20.1 hours for Non-SFFA chassis or 20.5 hours Non-SFFA chassis to inspect the camshaft and lower main bearings and replace the complete engine (SRT 045-657, 045-658, 045-860 and 045-290). File long form claim.

File the claim within 14 days in accordance with Warranty Policy C-A-009.

Kenworth dealers may perform E252 repairs on Peterbilt chassis, but Quick Claims do not apply. For Peterbilt chassis repairs, use the long claim input form in DWWC selecting "Draft/Offline Claims", the "General" tab, and in the "Type of Claim" drop down box, select "PACCAR Engine Claim," then manually enter claim codes (Campaign #, Failure type, and SRT).
Direct Fleets and Dealer Sponsored Fleets (DSF) are not eligible to perform this campaign.

Take-Off Parts Disposition: Hold parts until the claim is paid. After the claim is paid, parts may be returned for cores.

CLAIM CODING			
Failure Location:	045-008-098	Work Accomplished:	35
Failure Type:	700	Responsibility Code:	01
SRT Code:	**044-051** 0.2 hrs. Filter Element Only, Spin-On (one) - R & R. Includes: Oil, fuel or water **045-860** 1.1 hrs. oil pan R & R **045-657** 0.5 hrs. Inspect and photo cam lobes **045-861** 0.4 hrs. Time to jack up truck **045-658** 0.5 hrs. Inspect lower main bearings. **045-660** 25.0 hrs. R & R Cam (includes 2-tech time for removing and installing tappets) **045-295** 24.0 hrs. Long block R & R **045-290** 18.0 hrs. R & R complete engine	Claim Type:	F

Parts

Parts are available from PACCAR Parts.
All parts included in the below lists that do not have AR (As Required) must be ordered.
Parts list not provided for engine replacements.

Table 1 Camshaft Inspection Only parts

Quantity	Part Number	Description
47 qts	Source Locally	Engine Oil (qts)
1	2234788PE	Oil Filter
1*	2111441PE	Engine oil pan gasket
Only required for chassis **over** 100,000 miles (160934 km)		

Table 2 Camshaft Replacement parts

Quantity	Part Number	Description

1	2245295PE	Camshaft
1	2259718PE	Camshaft Replacement Kit
1	1858032PE	Usit ring for Air compressor oil tube plug
2	1844625PE	seal ring for fuel lines
1	EC3501 U.S. EC7501 Canada	Engine Coolant (gallon) to top off cooling system
1	D42-1005	Gasket, Turbo to CAC Pipe
1	1844896PE	Gasket, Exhaust Flex Pipe
8	W34-1158	Flange Bolts M16x2, Rear Engine Mount
1	079340-21453	LOCTITE 542, 50 ML, FINE THREAD SEALANT
1	079340-43900	LOCTITE 243, 0.5 ML, THREADLOCKER
1	079340-51031	LOCTITE 510, 50 ML, GSKT ELIM, SEALANT
AR*	1930520PE	Fuel Injection Pipe
AR, up to 2 qts	Source locally	Power Steering Fluid
47 qts	Source locally	Engine Oil (qts)
* Only needed if the fuel line fails the “Evaluate the injector back leak” test.		

Procedure

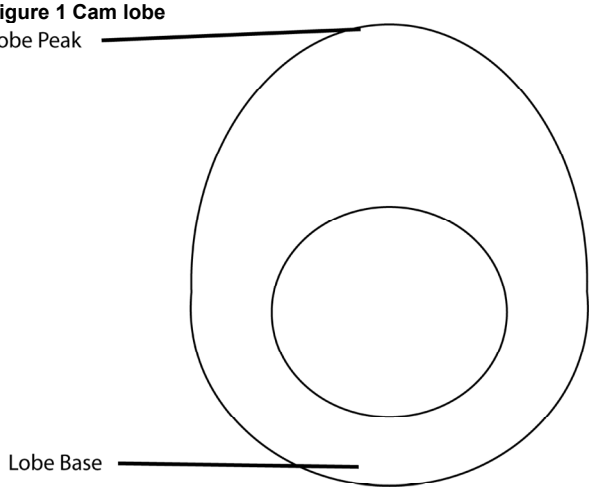
Camshaft lobe inspection

This inspection process will determine one of the following:

- No further repair required.
- If the camshaft shows slight wear and the lower main bearings are ok, the engine will be reassembled and released to the customer. An additional inspection will be made in 200,000 miles (321,868 km) (approximately 6,000 engine hours).
  - A select group of chassis will be asked to return for an additional inspection at 50,000 miles (80,467 km) (approximately 1,500 engine hours).
- Camshaft replacement required.
- Long block or complete engine replacement required.

1. Remove the oil pan and inspect the camshaft exhaust lobes.
   a. Disconnect the batteries.
   b. Drain the oil.
   c. Remove the electrical harness bracket from the driver’s side front of the engine block and oil pan.
   d. Use cable ties to hold the harness away from the pan.
   e. Remove the oil pan bolts and remove the oil pan.
2. Refer to the Camshaft Inspection Photo Guide to take clean, clear, and in focus photos of the **PEAK** of the **EXHAUST** camshaft lobes. The exhaust cam lob is the wider lobe.
   a. Open the Camshaft Inspection Photo Guide document and save it as a new file. Use the naming convention of “*last 8 digit of VIN* Cam Inspection”.
   b. After you take the photos, insert the photos into the appropriate open cells of the Camshaft Lobe Photos table.

Figure 1 Cam lobe



3. Start a TCS365 case. See the TCS365 Case Creation Guide section below for instructions to create the case. Attach the Camshaft

Inspection Photo Guide to the case. The Vehicle Support Center (VSC) will analyze the camshaft lobe photos and inform you of the next repair step.

- If VSC directs you that the camshaft is ok, reassemble the engine per RMI and replace the engine oil filter and fill with new oil.
- If VSC directs you to inspect the lower main bearings, continue with this procedure.

4. Remove Main Bearing Cap numbers 3, 4, and 5.
   a. Remove the oil pickup tube from the fixing frame.
   b. Remove the fixing frame from the engine block.
   c. Remove the oil pump.
   d. Break loose the main cap bolts with hand tools.
   e. Remove the main cap bolts for main bearing journal locations 3, 4, and 5 (an air/electric impact tool can be used).
   f. Remove and inspect only the lower bearing shells of 3, 4, and 5. Leave the upper bearing shells in place.

      IMPORTANT: Keep the bearings organized. Make note of the location of each bearing. If the bearings look like Ratings 1 or 2, they will be reused. They MUST be installed in the same location that they were removed from.

   g. Place the bearing caps on a clean piece of paper or cardboard and label the bearing locations.
   h. Take clear and in focus photos of the bearings.
5. Inspect the condition of the bearings and attach the bearing photos to the TCS365 case and update the Diagnostic Details of the case with “inspected and attached #3, 4, & 5 main bearing photos”. VSC will provide final direction of repair.

Figure 2 Example of main bearing photos

Unit Pump to High Pressure Fuel Rail Lines

The high pressure fuel rail lines should only be disconnected during a camshaft or engine replacement.

If the ends of the lines are corroded as shown below, replace the fuel lines.

Figure 3 Corroded Fuel Lines

TCS365 Case Creation Guide

Follow this guide to create the TCS365 case for this bulletin to ensure the case is flowed to the appropriate personnel.

1. Open TCS365 in Google Chrome or Microsoft Edge.
2. Select **Vehicle Support** | **Technical Assistance**.
3. Select *Case Type* **Powertrain Support** and *Case Category* **Engine Diagnostics**.
4. On the Powertrain Support page, fill in the following fields as follows and fill in the other fields as appropriate:
   - Subject: E252
   - Description: E252
   - Complaint/Verification Results: Inspected Camshaft per E252
   - Did you perform the required steps: Yes
   - Did you attach a PDF log file: No
   - Warranty Dependent Case: No
   - Repairs and Parts Replaced: Photographed camshaft exhaust lobe peaks
   - Diagnostic Details: Photographed camshaft exhaust lobe peaks
   - Upload File: Upload the Camshaft Inspection Photo Guide that you inserted the camshaft lobe photos in.

Attachments

Camshaft Inspection Photo Guide

Chassis List

Authored by: OF

Service Bulletin

E252

Section

45- Engine-MX

Description

EPA2017 MX-13 Camshaft Inspection

Release Date

1/10/2020

Revision History

01/29/2020 - Updated chassis list

01/24/2020 - Updated chassis list

01/24/2020 - Added corroded fuel rail lines and added under "Inspections Only" If the engine will be replaced as a result of this inspection, DO NOT perform E258 if it is open. E258 will be closed by Peterbilt as part of the engine ordering process.

01/16/2020 - Updated chassis list with configuration and added the correct part number for the oil filter.

01/15/2020 - Removed non-essential main bearing pictures.

01/15/2020 - Updated SRT with times and level information.

Introduction

Peterbilt has selected vehicles manufactured with MX-13 EPA2017 engines for Camshaft and Follower durability Inspection.

There may be:

- Excessive wear
- Damage is observed to the camshaft follower and/or camshaft lobe peaks.
- Metallic debris in the oil filter.

Resolution

Campaign

Service all chassis affected that enter your dealership, even if the customer has no issue with the chassis.

1. Review the attached chassis list for your dealer code and schedule your customer(s) for service if their chassis is on the list.
2. If you are not using Service Management to start repair orders, review SIR for "Complete" or "In Process" next to the "E252" campaign code prior to performing this repair.
3. Follow the procedures below to inspect the camshaft and repair as necessary.
4. Refer to bulletin E256 to educate the customer regarding oil change intervals.

NOTE
There will be several phases and combinations of Camshaft Inspection, Oil Thermostat, and Oil Filter Cap campaigns; therefore, check SIR for chassis specific OPEN campaigns to avoid over-repair.

CAUTION
Dealers that release trucks on the chassis list without completing the actions described below may face liability for progressive damage.

Warranty

For repairs completed by 02/01/2021, Peterbilt will pay for parts at dealer net plus applicable mark-up and labor:

Inspections Only

If the engine will be replaced as a result of this inspection, DO NOT perform E258 if it is open. E258 will be closed by Peterbilt as part of the engine ordering process.

- 1.4 hours for Non-SFFA chassis **under** 100,000 miles (160,934 km) to inspect the camshaft lobes and reinstall the oil pan, reusing the oil pan gasket (SRT 045-689) and replace oil filter and fill with new oil (044-051) . No related repairs necessary. Use Quick Claim **E252A**.
- 1.8 hours for SFFA chassis **under** 100,000 miles (160,934 km) to inspect the camshaft lobes and reinstall the oil pan, reusing the oil pan gasket (SRT 045-689, 045-861) and replace oil filter and fill with new oil (044-051) . No related repairs necessary. Use Quick Claim **E252B**.
- 1.8 hours for SFFA chassis **over** 100,000 miles (160,934 km) to inspect the camshaft lobes and reinstall the oil pan, using a new oil pan gasket (SRT 045-689, 045-861) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim **E252C**.
- 1.4 hours for Non-SFFA chassis **over** 100,000 miles (160,934 km) to inspect the camshaft lobes and reinstall the oil pan, using a new oil pan gasket (SRT 045-689) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim **E252D**.
- 1.9 hours for Non-SFFA chassis **under** 100,000 miles (160,934 km) to inspect the camshaft lobes and lower main bearings and reinstall the oil pan, reusing oil pan gasket (SRT 045-689 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim **E252E**.
- 2.3 hours for SFFA chassis **under** 100,000 miles (160,934 km) to inspect the camshaft lobes and lower main bearings and reinstall the oil pan, reusing oil pan gasket (SRT 045-689, 045-861 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim **E252F**.
- 1.9 hours for Non-SFFA chassis chassis **over** 100,000 miles (160,934 km) to inspect the camshaft lobes and lower main bearings and reinstall the oil pan, using a new oil pan gasket (SRT 045-689, 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim **E252G**.
- 2.3 hours for SFFA chassis chassis **over** 100,000 miles (160,934 km) to inspect the camshaft lobes and lower main bearings and reinstall the oil pan, using a new oil pan gasket (SRT 045-689, 045-861 and 045-658) and replace oil filter and fill with new oil (044-051). No related repairs necessary. Use Quick Claim **E252H**.

Cam or Engine Replacement

- 27.1 hours for SFFA chassis to inspect the camshaft and lower main bearings and replace the camshaft (SRT 045-689, 045-658, 045-861 and 045-660). File long form claim.
- 26.7 hours for Non-SFFA chassis chassis to inspect the camshaft and lower main bearings and replace the camshaft (SRT 045-689, 045-658 and 045-660). File long form claim.
- 25.7 hours labor for Non-SFFA chassis to inspect the camshaft and lower main bearings and replace the long block (SRT 045-689, 045-658 and 045-295). File long form claim.
- 26.1 hours for SFFA chassis to inspect the camshaft and lower main bearings and replace the long block (SRT 045-689, 045-658 045-861 and 045-295). File long form claim.
- 19.7 hours for Non-SFFA chassis to inspect the camshaft and lower main bearings and replace the complete engine (SRT 045-689, 045-658 and 045-290). File long form claim.
- 20.1 hours SFFA chassis to inspect the camshaft and lower main bearings and replace the complete engine (SRT 045-689, 045-658, 045-861 and 045-290). File long form claim.

- File the claim within 14 days in accordance with Warranty Policy Federal Safety Recall and Field Campaigns

Direct Fleets and Dealer Sponsored Fleets (DSF) are not eligible to perform this campaign

Peterbilt dealers may perform E252 repairs on Kenworth chassis, but Quick Claims do not apply. For Kenworth chassis repairs, file a long form claim and use the claim codes below.

Take-Off Parts Disposition: Hold parts for 30 days after is paid. After the claim is paid, parts may be returned for cores.

For Field...	Enter...
Failure Location	045-008-098
Failure Type	700
Claim Type	A
Campaign Number	E252
	045-689 1.2 hrs. Cam Lobe inspection

Labor	(includes oil drain and fill, oil pan R&R, fixing frame and oil pump R&R **045-658** 0.5 hrs. Inspect the main bearings if damage is found on the camshaft. **044-051** 0.2 hrs. Filter Element Only, Spin-On (one) - R & R. Includes: Oil, fuel or water **045-660** 25.0 hrs. R&R Cam (includes 2-tech time for removing and installing tappets) **045-295** 24.0 hrs. Long block R&R **045-290** 18.0 hrs. R&R complete engine **045-861 -** 0.4 hrs. SFFA to jack up truck

Parts

Parts are available from PACCAR Parts.

Table 1 Camshaft Inspection Only parts

Quantity	Part Number	Description
1*	2111441PE	Oil Pan Gasket
47 quarts	Source Locally	Engine Oil (qts)
1	2234788PE	Oil Filter Element
* Only required for chassis **over** 100,000 miles (160,934 km)		

Table 2 Camshaft Replacement parts

Parts are available from PACCAR Parts.
All parts included in the below list that do not have AR (As Required) must be ordered.
Parts are not provided for engine replacements.

Part Number	Description	Qty
2245295PE	Camshaft	1
2259718PE	Camshaft Replacement Kit	1
1858032PE	Usit ring for Air compressor oil tube plug	1
1844625PE	seal ring for fuel lines	2
EC3501	Engine Coolant (gallon) to top off cooling system	1
EC7501	Canadian Vehicles Engine Coolant (gallon) to top off cooling system	1
D42-1005	Gasket, Turbo to CAC Pipe	1
1844896PE	Gasket, Exhaust Flex Pipe	1
W34-1158	Flange Bolts M16x2, Rear Engine Mount	8
079340-21453	LOCTITE 542, 50 ML, FINE THREAD SEALANT	1
079340-43900	LOCTITE 243, 0.5 ML, THREADLOCKER	1
079340-51031	LOCTITE 510, 50 ML, GSKT ELIM, SEALANT	1
*1930520PE	Unit Pump To High Pressure Fuel Rail Lines	AR
Source locally	Power Steering Fluid	AR, up to 2 qts

Source locally	Engine Oil (qts)	47 qts
*Only needed if the fuel line fails the "Evaluate the injector back leak" test		

Procedure

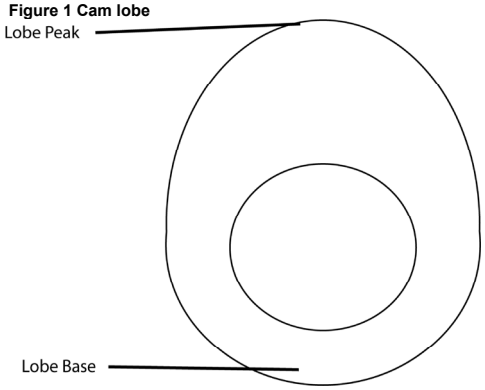
- **Camshaft lobe inspection**

This inspection process will determine one of the following:

- No further repair required.
  - VSC may indicate that the vehicle should have this inspection performed in approximately 200,00 miles.
- Camshaft replacement required.
- Long block or complete engine replacement required.

1. Remove the oil pan and inspect the camshaft exhaust lobes.
   a. Disconnect the batteries.
   b. Drain the oil.
   c. Remove the electrical harness bracket from the driver's side front of the engine block and oil pan.
   d. Use cable ties to hold the harness away from the pan.
   e. Remove the oil pan bolts and remove the oil pan.
2. Refer to the Camshaft Inspection Photo Guide to take clean, clear, and in focus photos of the **PEAK** of the **EXHAUST** camshaft lobes. The exhaust cam lob is the wider lobe.
   a. Open the Camshaft Inspection Photo Guide document and save it as a new file. Use the naming convention of "*last 8 digit of VIN* Cam Inspection".
   b. After you take the photos, insert the photos into the appropriate open cells of the Camshaft Lobe Photos table.

Figure 1 Cam lobe



3. Start a TCS365 case. See the TCS365 Case Creation Guide section below for instructions to create the case. Attach the Camshaft Inspection Photo Guide to the case. The VSC will analyze the camshaft lobe photos and inform you of the next repair step.
   - If VSC directs you that the camshaft is ok, reassemble the engine per RMI and replace the engine oil filter and fill with new oil.
   - If VSC directs you to inspect the lower main bearings, continue with this procedure.
4. Remove Main Bearing Cap numbers 3, 4, and 5.
   a. Remove the oil pickup tube from the fixing frame.
   b. Remove the fixing frame from the engine block.
   c. Remove the oil pump.

d. Break loose the main cap bolts with hand tools.
e. Remove the main cap bolts for main bearing journal locations 3, 4, and 5 (an air/electric impact tool can be used).
f. Remove and inspect only the lower bearing shells of 3, 4, and 5. Leave the upper bearing shells in place.

IMPORTANT: Keep the bearings organized. Make note of the location of each bearing. If the bearings look like Ratings 1 or 2, they will be reused. They MUST be installed in the same location that they were removed from.

g. Place the bearing caps on a clean piece of paper or cardboard and label the bearing locations.
h. Take clear and in focus photos of the bearings.

5. Inspect the condition of the bearings and attach the bearing photos to the TCS365 case and update the Diagnostic Details of the case with “inspected and attached #3, 4, & 5 main bearing photos”. VSC will provide final repair direction.

Figure 2 Example of main bearing photos

Unit Pump to High Pressure Fuel Rail Lines

The high pressure fuel rail lines should only be disconnected during a camshaft or engine replacement. If the ends of the fuel lines are corroded as shown below, replace the fuel lines.

Figure 3 Corroded Fuel Lines

TCS365 Case Creation Guide

Follow this guide to create the TCS365 case for this bulletin to ensure the case is flowed to the appropriate personnel.

1. Open TCS365 in Google Chrome or Microsoft Edge.
2. Select **Vehicle Support | Technical Assistance**.
3. Select *Case Type* **Powertrain Support** and *Case Category* **Engine Diagnostics**.
4. On the Powertrain Support page, fill in the following fields as follows and fill in the other fields as appropriate:
   - Subject: E252
   - Description: E252

- Complaint/Verification Results: Inspected Camshaft per E252
- Did you perform the required steps: Yes
- Did you attach a PDF log file: No
- Warranty Dependent Case: No
- Repairs and Parts Replaced: Photographed camshaft exhaust lobe peaks
- Diagnostic Details: Photographed camshaft exhaust lobe peaks
- Upload File: Upload the Camshaft Inspection Photo Guide that you inserted the camshaft lobe photos in.

Attachments

E252 Chassis List

Camshaft Inspection Photo Guide

E252 Workflow

Authored by: DKH

PACCAR Inc REPAIR PROCEDURE

Camshaft Inspection Photo Guide

The purpose of this document is to provide an example of a good camshaft inspection photo. Technicians using a basic cell phone camera can achieve these pictures. Below you will see a complete camshaft inspection with poor quality pictures on the left and good quality pictures on the right.

Save the Camshaft Inspection Photo Guide as a new file, using the naming convention "*last 8 digits of VIN* Cam Inspection". After you take the photos, insert the photos into the appropriate open cells of the Camshaft Lobe Photos table below.

Follow the steps needed to obtain clear pictures.

1. Rotate the engine over so the connecting rod and piston assembly are out of the way and you **CAN SEE THE PEAK OF THE EXHAUST CAMSHAFT LOBE** you are photographing.

NOTE
The exhaust lobe is the wider cam lobe.

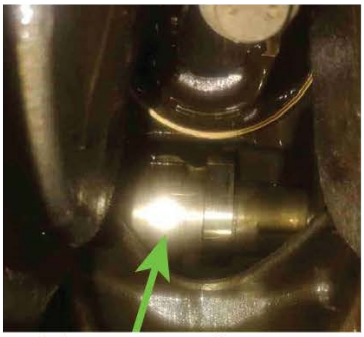
Crank marking	Lobe to take a picture of
TDC	2 and 6
2-5	3 and 4
3-4	1, 5 and 6

2. Clean all oil off the camshaft lobe being photographed.
3. Make sure camera flash is on. If your camera does not have a flash, use a flashlight to provide light to the lobe being photographed.
4. Load pictures to the appropriate cells of the table below.

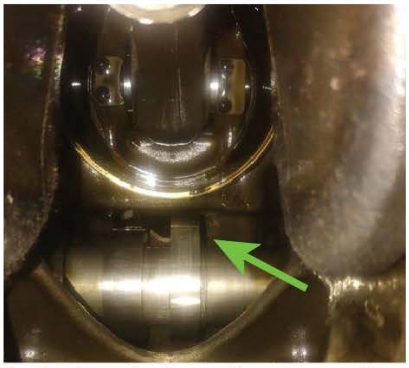
Table 1 Camshaft Lobe Photos

Cylinder 1 exhaust	
Cylinder 2 exhaust	
Cylinder 3 exhaust	
Cylinder 4 exhaust	
Cylinder 5 exhaust	
Cylinder 6 exhaust	

Example of poor quality photos



Excess glare on the exhaust cam lobe



Intake lobe facing liner. Exhaust lobe base exposed. The crankshaft needs one full revolution.

Example of good quality photo

Intake lobe facing away from liner. Exhaust cam in correct position.