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TECHNICAL



REFERENCE:
ENG 3/2014/7

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Model : Prado 150

Subject : Engine failure 1KD- FTV



Introduction

Technical service would like to inform the dealer network of the countermeasure details implemented to resolve the above mentioned concern.

Customer Complaint

Customers might complaint of the vehicle losing power and excessive smoking.

Fig 1: Picture one depicts a cracked piston on a 1KD engine which results in the above condition.



Investigation

Failed Part Inspection

- All failed parts that were recovered for inspection revealed that the Pistons had cracked across the crown.
- In some cases the crack migrates from the crown down to the piston skirt through the gudgeon pin area.
- On some of the pistons a hole had developed on the lip of the combustion chamber recess.
- Small pin hole cavities were found on the surface of the piston crowns which are directly exposed to combustion.
- Close inspection of the cracked piston showed that each case, the crack started from a cavity located on the lip of the piston combustion chamber.
- The crack then spread across the piston crown and down the skirt.

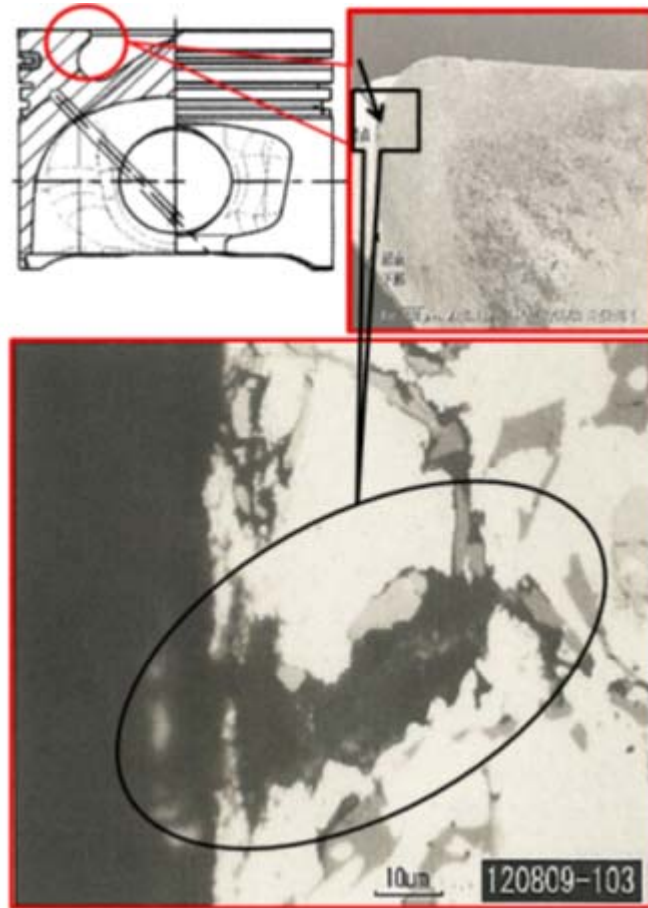
Piston Cavity Inspection

- Two types of cavities' were identified.
 1. Cavities caused during piston machining.
 2. Cavities caused by combustion action.
- Failed and unaffected pistons both showed machining and combustion cavities
- However, failed pistons had combustion cavities which formed on the lip of the piston crown combustion chamber.
- Unaffected pistons did not show combustion cavities on the lip of the combustion chamber.
- Therefore machining cavities were ruled out as a cause of failure.

Problem Replication

- New pistons with machining cavities were fitted to a test engines
- Artificial combustion cavities were created on the new pistons to determine the role in causing the piston cracks.
- The engines were run on engine test dynamometers under controlled conditions to simulate the actual vehicle operating conditions.
- The engine operating conditions were varied by continually changing.
 1. Engine Speed.
 2. Fuel injection quantity.
 3. Pilot injection timing.
 4. Pilot injection quality.
- After running the simulation tests, no crack formation occurred.
- No combustion cavities formed as a result of test operation.
- The engine testing was then done at high speed for 300 Hours.
- After this test the formation of the combustion cavities had occurred on the pistons.

Fig 2: Diagram showing a combustion cavity of the lip of the piston combustion chamber.



Root Cause

The formation of the combustion cavities occurs under high speed, high load and long durations operating conditions.

The formation of these cavities is a normal occurrence. However, when they form on the lip of the piston combustion chamber, they causes a weak point from which a thermal stress crack may propagate.

The crack then leads to the eventual failure of the piston.

Countermeasure

To increase the piston strength and ensure its durability despite combustion cavity formation, the piston shape has been change and the crown section thickened.

Countermeasure Detail

| Model | Engine | VIN Brake Point | Effective Date |
|--------------------------|---------|-------------------|-----------------|
| Land Cruiser 150 KDJ150R | 1KD-FTV | JTEBH3FJ70K125161 | 4 December 2013 |

Field Fix Part Information

| Part Description | Old part Number | New Part Number |
|------------------------|-----------------|-----------------|
| PISTON SUB ASSY, W/PIN | 13101-30150 | 13101-30200 |

Hint

Please refer to the repair manual for the correct procedure when ordering the pistons, main and big end bearings as well as the cylinder head gasket to order the correct grade components.

Once you have determined the correct grading please consult the EPC as to the correct part number to order.

Piston part numbers as quoted in the bulletin 13101-30200 would be followed by the grading 01, 02 and 03. **Example** 13101-30200**01/02/03**

Claim Procedure

| TECHNICAL CLAIMS PROCEDURE REQUEST | | |
|------------------------------------|--------------------------------------|-----------------------------|
| DATE: | 05-Mar-14 | |
| REQUESTED BY: | | |
| MODEL: | PRADO 150 | 1KD-FTV ENGINE FAILURE |
| TC CODE: | 2A | |
| OFPN: | 131013015001 | PISTON SUB-ASSY, W/PIN |
| MAIN OPE CODE: | OPE CODE APPLICABLE TO REPAIR METHOD | |
| COMPONENT CODE: | AF001 | PISTON SUBASSEMBLY WITH PIN |
| T1 CODE: | 05 | Lack Loss of Power |
| T2 CODE: | 16 | Cracked |
| COMPLAINT: | LOSS OF POWER AND EXCESSIVE SMOKING | |
| CAUSE: | THERMAL STRESS CRACK ON PISTON | |
| REMEDY: | R AND R PISTONS | |
| LABOUR OPE CODE: | OPE CODE APPLICABLE TO REPAIR METHOD | AS PER FLAT RATE TIME |
| LABOUR COMMENTS: | | |
| SUBLET CODE: | | |
| SUBLET COMMENTS: | | |