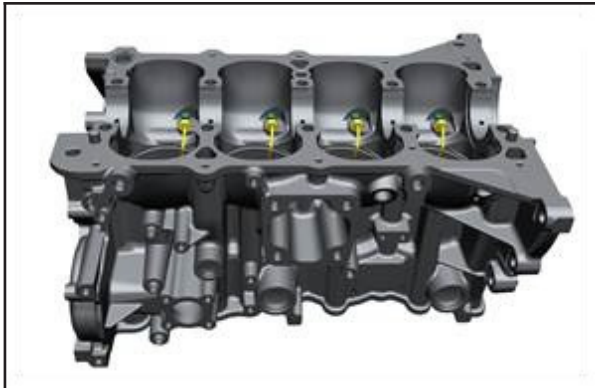


## PRECAUTIONS TO ENSURE LEAK PROOFING FOR ENGINE OIL

1. Assemble piston cooling nozzle with gasket to cylinder block. Apply specified torque on fasteners. (Please check "Torque sheet" for values).



2. Apply adhesive sealant (loctite 5900) in between bed plate and block interface.

### CAUTION

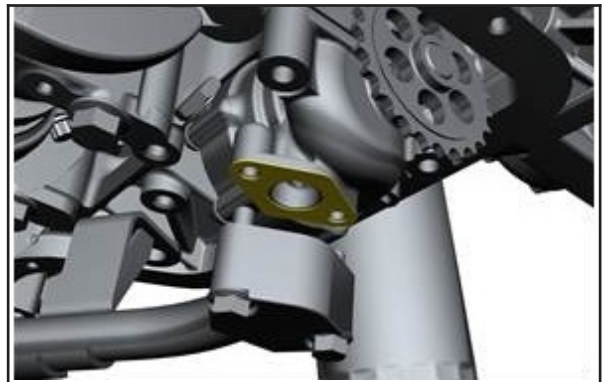
- Ensure that sealant is not applied to oil hole (elliptical shape) on bed plate.



3. Assemble specified "O" ring in between oil pump and bed plate.



4. Assemble gasket between strainer boss and oil pump.

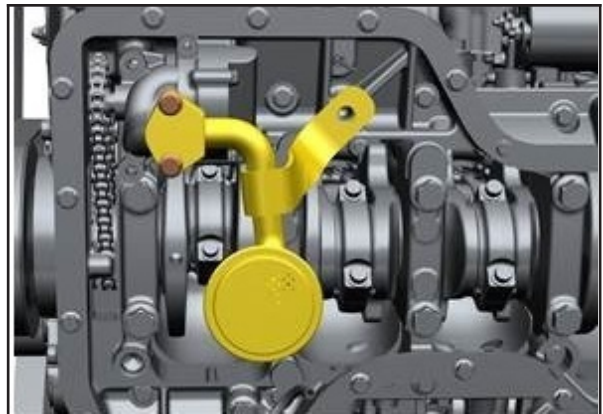


5. Apply specified torque to oil strainer fasteners. (Please check "Torque sheet" for values).

**Non AC Bus LP712/912 (12V)**

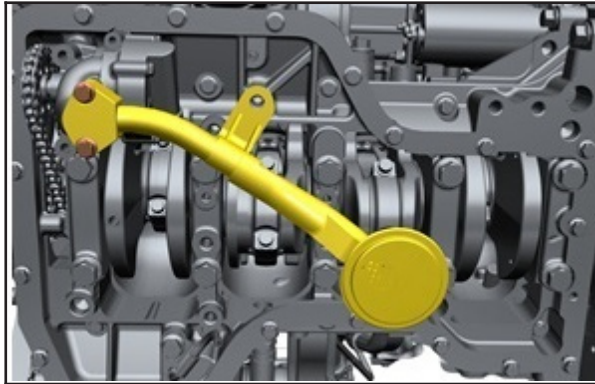
**LP 712/912 Bus (24V)**

**LPO 10.2T Bus (24V)**



Truck LPT 1412 (12V)

Ultra 1415 (12V)



6. Apply specified torque to oil pump fasteners. (Please check "Torque sheet" for values).
7. Assemble specified "O" ring to oil separator pipe along with torque. (Please check "Torque sheet" for values).

*i* NOTE

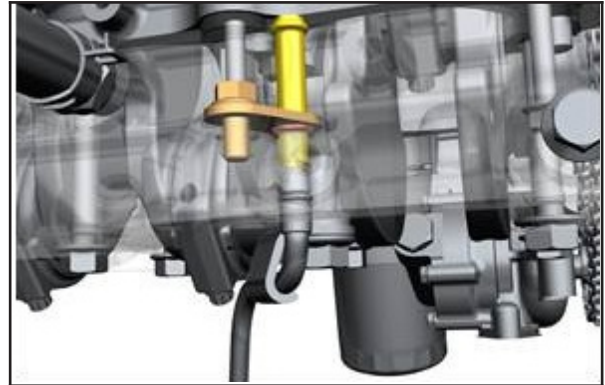
- Use of wrong "O" rings will lead to seepages.



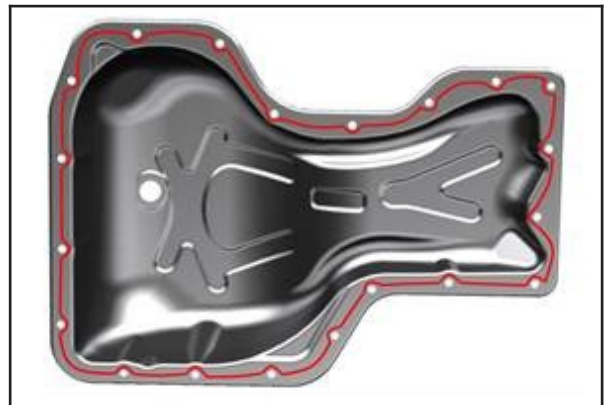
8. Assemble specified "O" ring to drain seal pipe along with torque. (Please check "Torque sheet" for values).

*i* NOTE

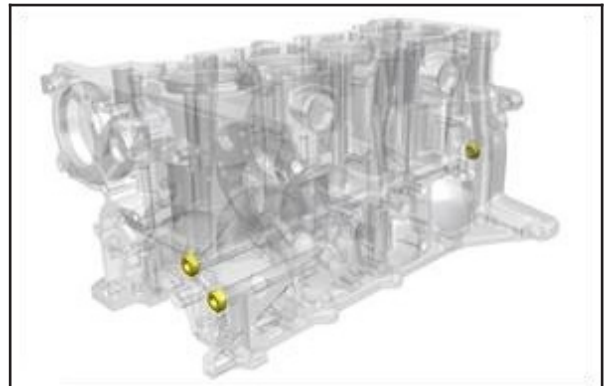
- Use of wrong "O" rings will lead to seepages.



9. Apply loctite 5900 as per the specified path in between sump and bed plate interface.



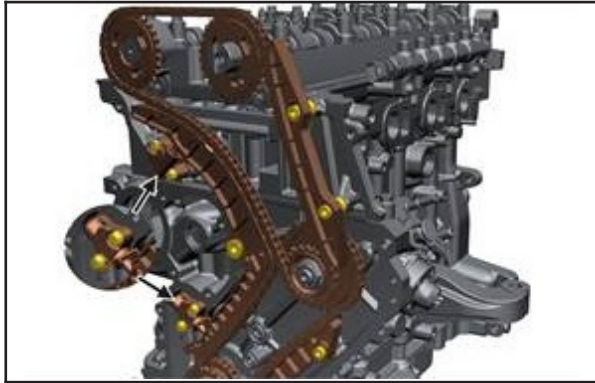
10. Apply thread locker to threaded plugs. Assemble thread locker at oil gallery locations on crankcase as shown with specified torque. (Please check "Torque sheet" for values).



*i* NOTE

- Ensure proper fitment of sealing cap with adhesive bearing retainer HS TS: 25408 near hydraulic tensioner on cylinder head.

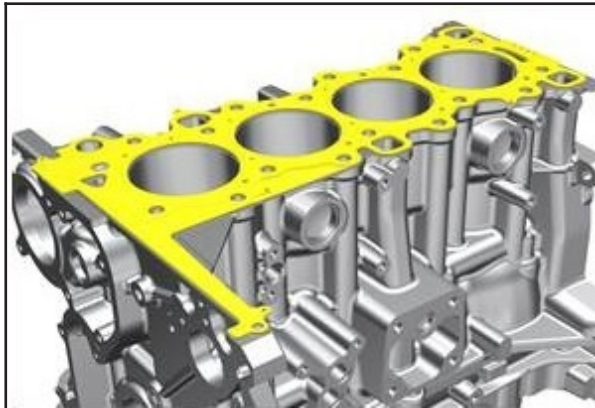
11. Apply loctite 5188 between block and hydraulic tensioner.



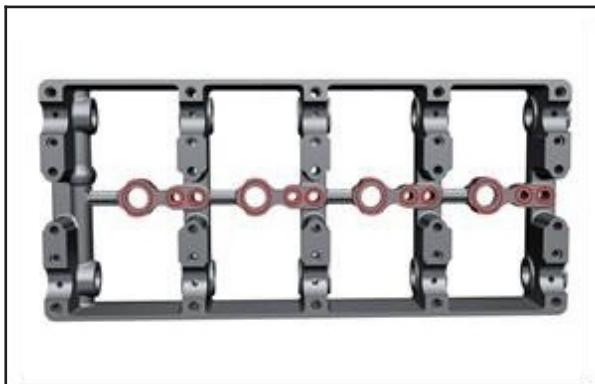
12. Assemble cylinder head gasket between cylinder head and block.

**⚠ CAUTION**

- Place cylinder head gasket in such a way that its face should not protrude beyond front faces of cylinder head and block.



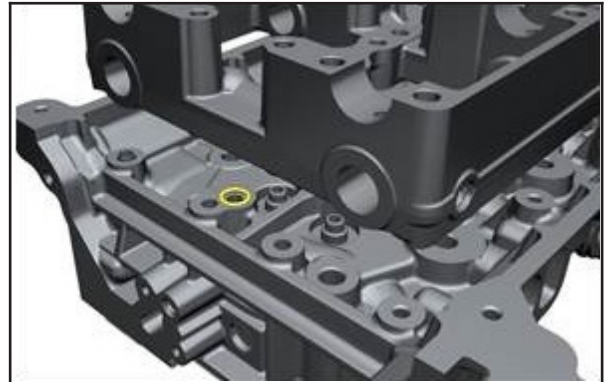
13. Apply loctite 5188 on cam carrier and loctite 5900 around area of injector sleeves.



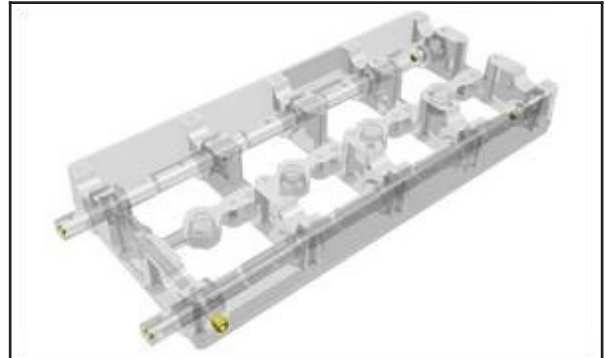
14. Assemble “O” ring between cylinder head and cam carrier.

**⚠ CAUTION**

- Missing of “O” ring will lead to engine oil pressure drop.



15. Apply thread locker to threaded plug to assemble at oil gallery location on cam carrier.
16. Apply adhesive bearing retainer HS TS: 25408 to core plugs (nos. 4).
17. Assemble core plugs (nos. 4) on rocker shafts.

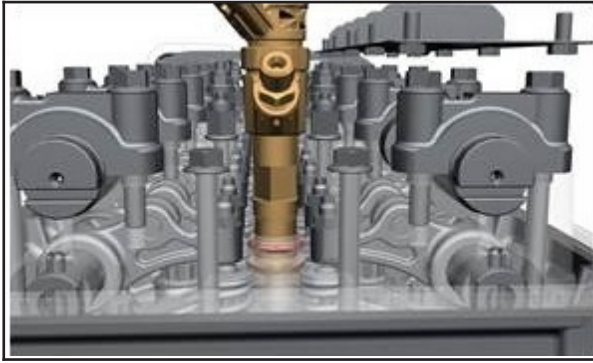


18. Assemble three “O” rings on each injector. One on inside to injector sleeve, two on outside to seal water jacket on cylinder head.

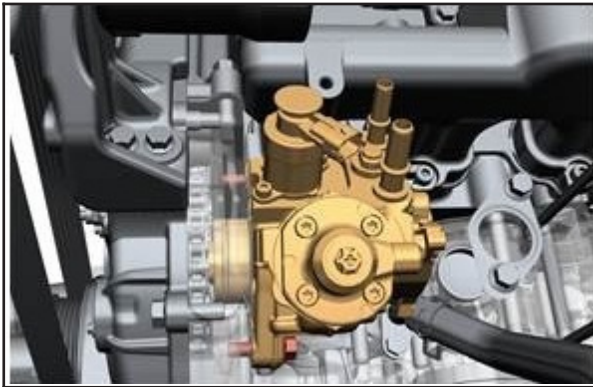




19. Assemble "O" rings in cam carrier at four locations between injector and cam carrier.



20. Apply thread locker on FIP mounting bolts (nos. 3). Assemble specified "O" ring on FIP. Tighten the bolts with specified torque. (Please check "Torque sheet" for values)



21. Apply Loctite 5188 front cover as shown.



**⚠ CAUTION**

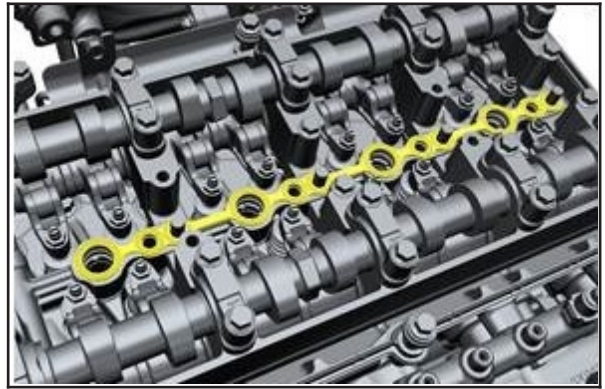
- Ensure that liquid sealant should not protrude and fall inside assembly.

22. Assemble specified "O" ring in front cover and apply torque on front cover to block bolts.

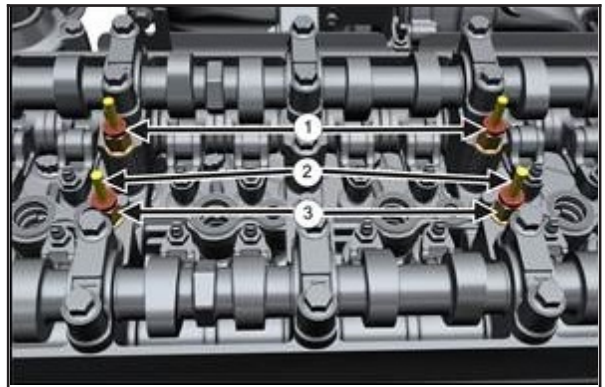
23. Apply thread locker to cover plate stud and nyloc nut. Assemble "O" rings between front cover and cover plate.



24. Assemble injector seal gasket between injector and camshaft carrier.



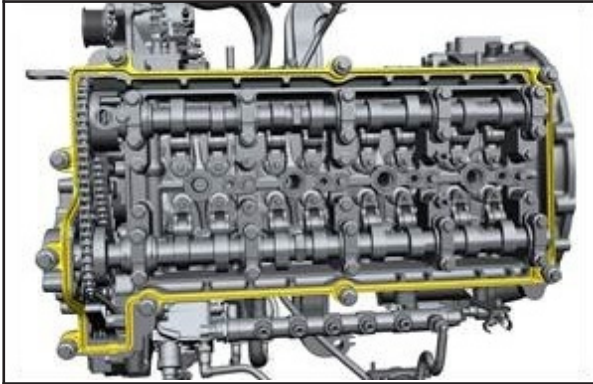
25. Assemble cylinder head cover with cam carrier bolts (3), rubber bushes (1) and studs (2) with applying sealant 638 at four locations.



26. Assemble cylinder head cover with gasket on cylinder head. Tighten the bolts with specified torque.

*i* NOTE

- More or less torque than specified will lead to leakages.



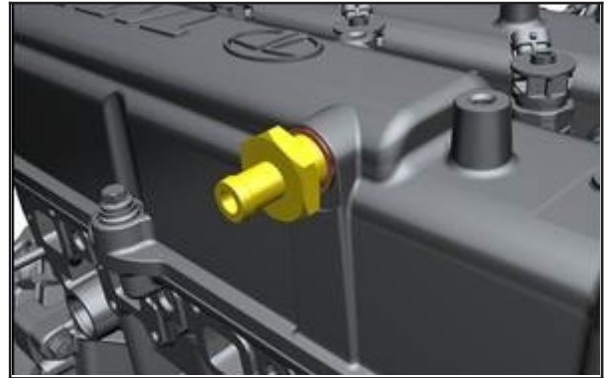
**! CAUTION**

- All head covers should be x-ray / metallographic / ultra-sonic tested for any casting defects in head cover wall so as to avoid oil seepages.

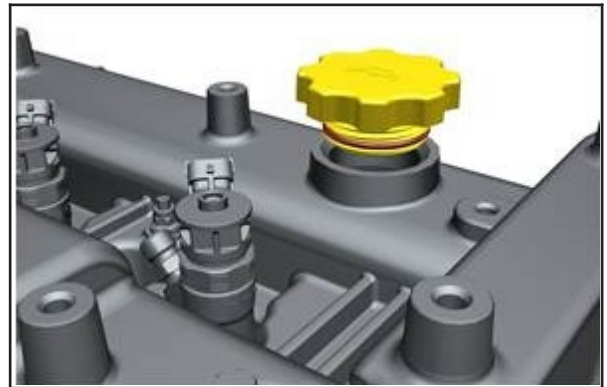
27. Assemble cylinder head cover with washer and nyloc nuts. Ensure assembly of cylinder head cover central clamping fasteners with copper sealing washers and nylon nuts applying sealant loctite 638 as shown at four locations.



28. Apply thread locking adhesive-tp-anabond on adapter. Assemble adapter with sealing washer to cylinder head cover.



29. Assemble oil filler cap with "O" ring to cylinder head cover.



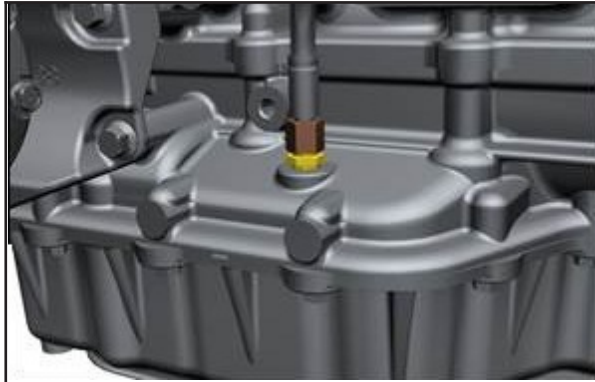
*i* NOTE

- Ensure proper butting of cam sensor before tightening the bolt.

30. Assemble crank sensor with "O" ring. Tighten the bolt with specified torque.



31. Apply sealant loctite 638 dipstick tube adapter.
32. Assemble the dipstick with coupling nut.



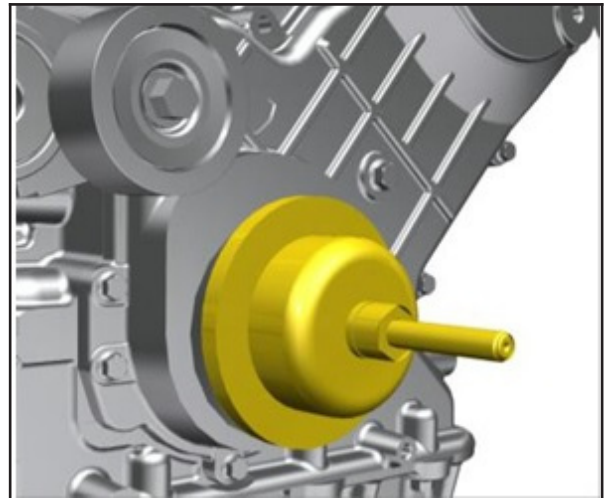
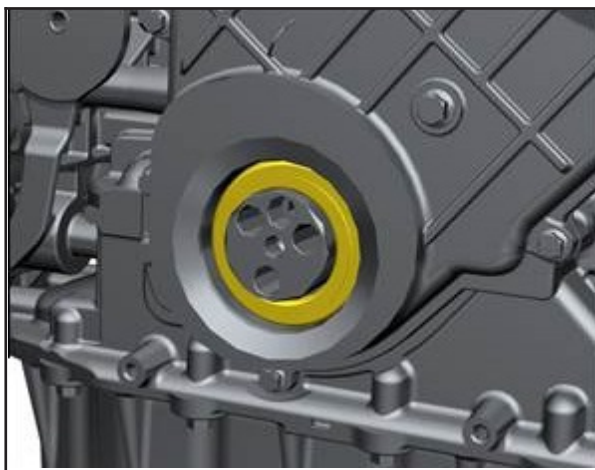
**! CAUTION**

- No application of sealant to bed plate bore and undersize tube adaptor will lead to heavy oil seepages.

33. Assemble front oil seal on crankshaft with the help of special tool (Part number: 5507 5890 0632).

**i NOTE**

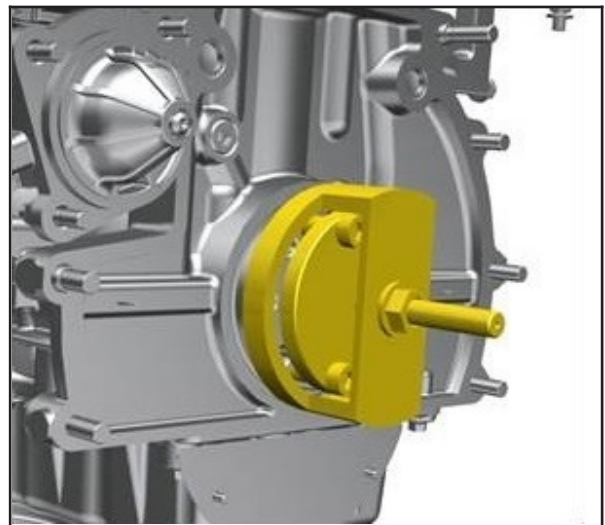
- Cocking (Face runout) distance should be 0.25mm maximum of seal to be ensured after fitment.



34. Assemble crankshaft rear oil seal on crankshaft.

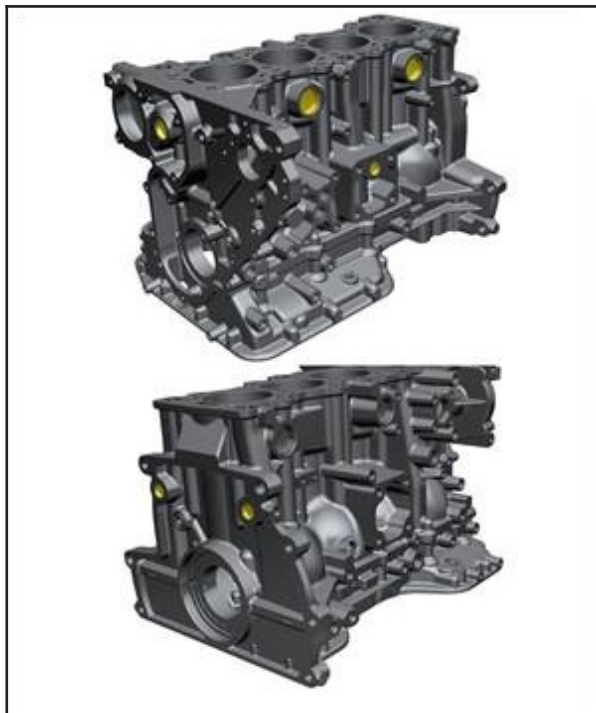
**i NOTE**

- Cocking (Face runout) distance should be 0.25mm maximum of seal to be ensured after fitment.

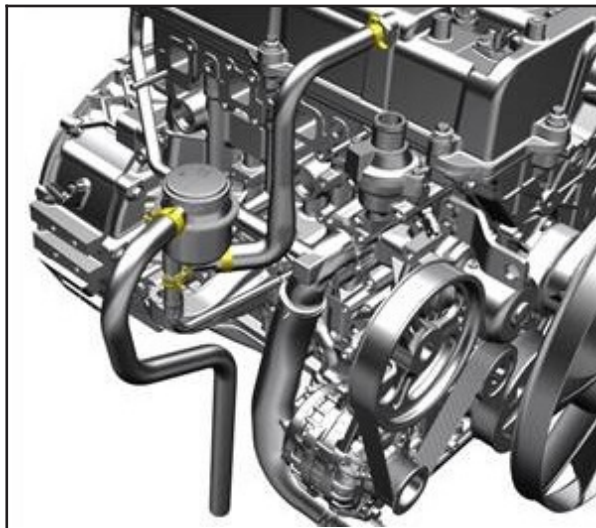


35. Assemble sealing caps with sealant to cylinder block.





36. Assemble oil separator. Tighten the clamps for oil separator hoses at four specified locations.



37. Assemble two “O” rings between oil filter head and cylinder block.



38. Assemble pressure switch with washer to oil filter head. Tighten the switch at specified torque.



**⚠ CAUTION**

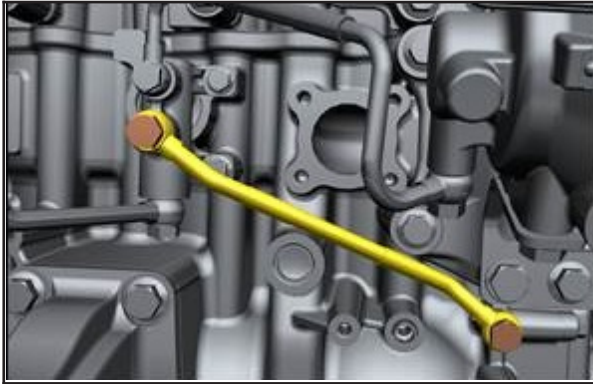
- Ensure oil filter and oil cooler “O” rings are not damaged before fitment.
- Apply thread locking adhesive-TP anabond on spigot in head.

***i* NOTE**

- Visual inspection of oil cooler and oil filter to be done for any damages before and after fitment.
- Thread rolling to be ensured on oil filter head.

39. Assemble sealing copper washers below and above pipe union bolt for block to reservoir oil line.

40. Tighten the pipe union bolt at specified torque.



41. Assemble sealing washers below and above pipe union bolt for reservoir to compressor oil line.

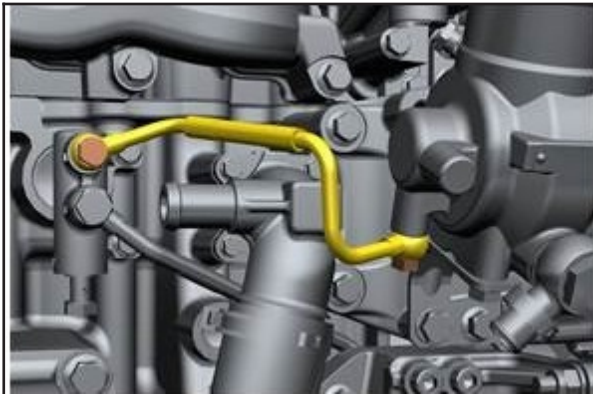
42. Tighten the pipe union bolt at specified torque.

**Non AC Bus LP712/912 (12V),**

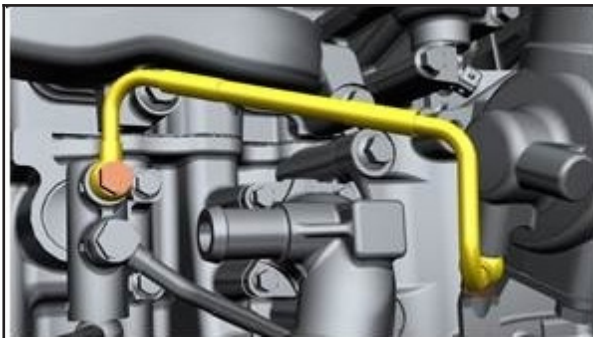
**Truck LPT 1412 (12V),**

**LP 712/912 Bus (24V),**

**LPO 10.2T Bus (24V)**

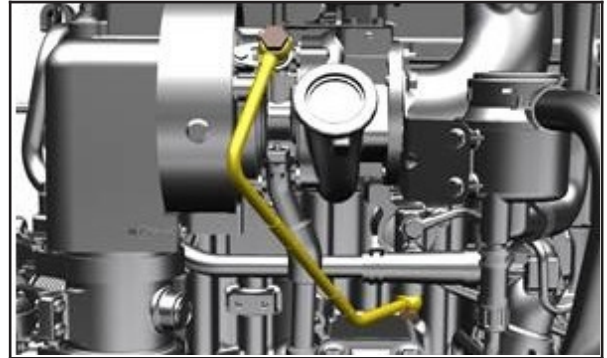


**Truck Ultra 1415 (12V)**



43. Assemble sealing washers below and above pipe union bolt for reservoir to turbo charger oil line.

44. Tighten the pipe union bolt at specified torque.



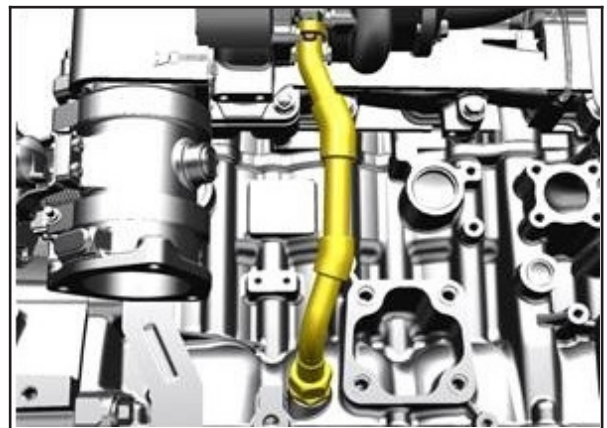
45. Assemble sealing washers below and above pipe union bolt on compressor side oil return line. Tighten the pipe union bolt at specified torque.

46. Apply thread locker and assemble copper washer at socket on bed plate.

47. Assemble compressor oil return line with two appropriate clamps.



48. Assemble gasket at turbo side and sealing copper washer on adapter at block side with appropriate clamp for set turbo charger oil return.





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**GENERAL GUIDE LINES:**

- Complete engine to be leak tested with air. Leakage values to be confirmed on production engines.

<b>REGION</b>	<b>PRESSURE (BAR)</b>	<b>LEAKAGE (CC/MIN) MAX.</b>
Air side	0.125	100
Water side	0.7	10

- Surface finish, flatness and perpendicularity on sealing surfaces to be ensured as per specifications.
- All those leakage points to be closely monitored in engine testing.