TT411B: Big Twin Oil Carry-Over Diagnostics

December 7, 2010

Engine

APPLIES TO	SYMPTOMS
1999 and Later Big Twin Models	• Excessive Oil Consumption • Fluid or Oil Leaks • Oil Pressure and Circulation Concerns • Engine Oil at the Air Cleaner

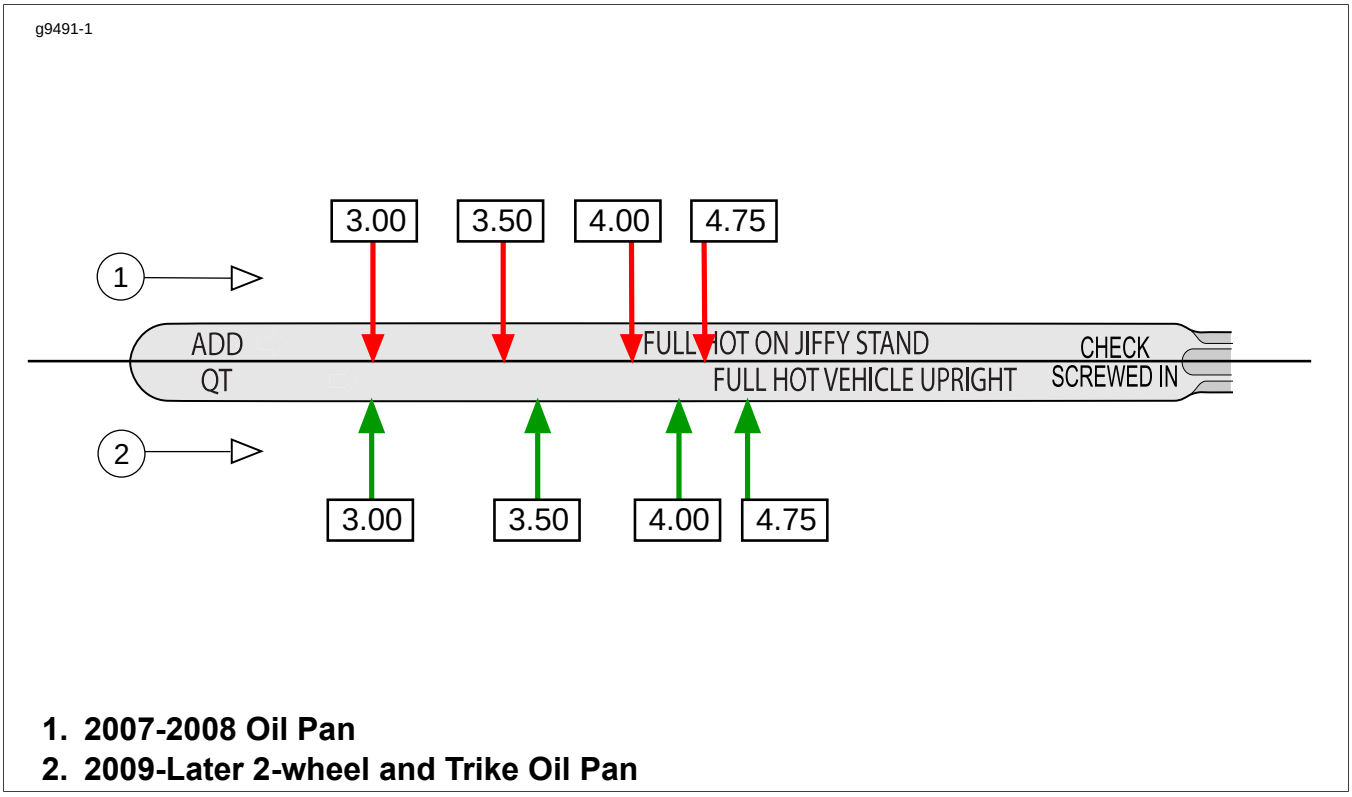
Engine Oil Carry-Over into the Air Cleaner

Common Causes of Oil Carry-Over

- Over-filled engine oil
- Engine wet sumping
- After-market air cleaner
- Excessive piston ring blow-by
- Breather umbrella valve not seating properly
- Drain-back passage blocked or restricted
- Breather bolts have been drilled out

Diagnostic Tips to Isolate Root Cause of Oil Carry-Over

1. Interview the customer and document oil consumption and carry-over condition details.
   a. Gain an understanding of under what conditions the issue occurs.
   b. Ask questions about riding style and habits such as city riding, touring, 2-up riding, etc.
2. Note installed accessories.
3. Note all modifications: exhaust type, air cleaner type and all engine modifications including tuning type and calibration.
4. Test ride and verify condition.
5. Verify oil level and condition. Figure 1 shows the oil level on the dipstick relative to the amount of oil in the oil pan for 2007-2008 and 2009-later FL models.



1. **2007-2008 Oil Pan**
2. **2009-Later 2-wheel and Trike Oil Pan**

Figure 1. Oil Levels for Quantities of Oil in the Oil Pan

NOTE

Figure 1 shows approximate oil levels for various quantities of oil in the oil pan with the motorcycle in an upright position and is for illustration purposes only. The arrows compare the differences relative to model years and models. Although measuring in the upright position differs from the standard method of measuring the oil level with the motorcycle resting on the jiffy stand, it illustrates the approximate difference between designs.

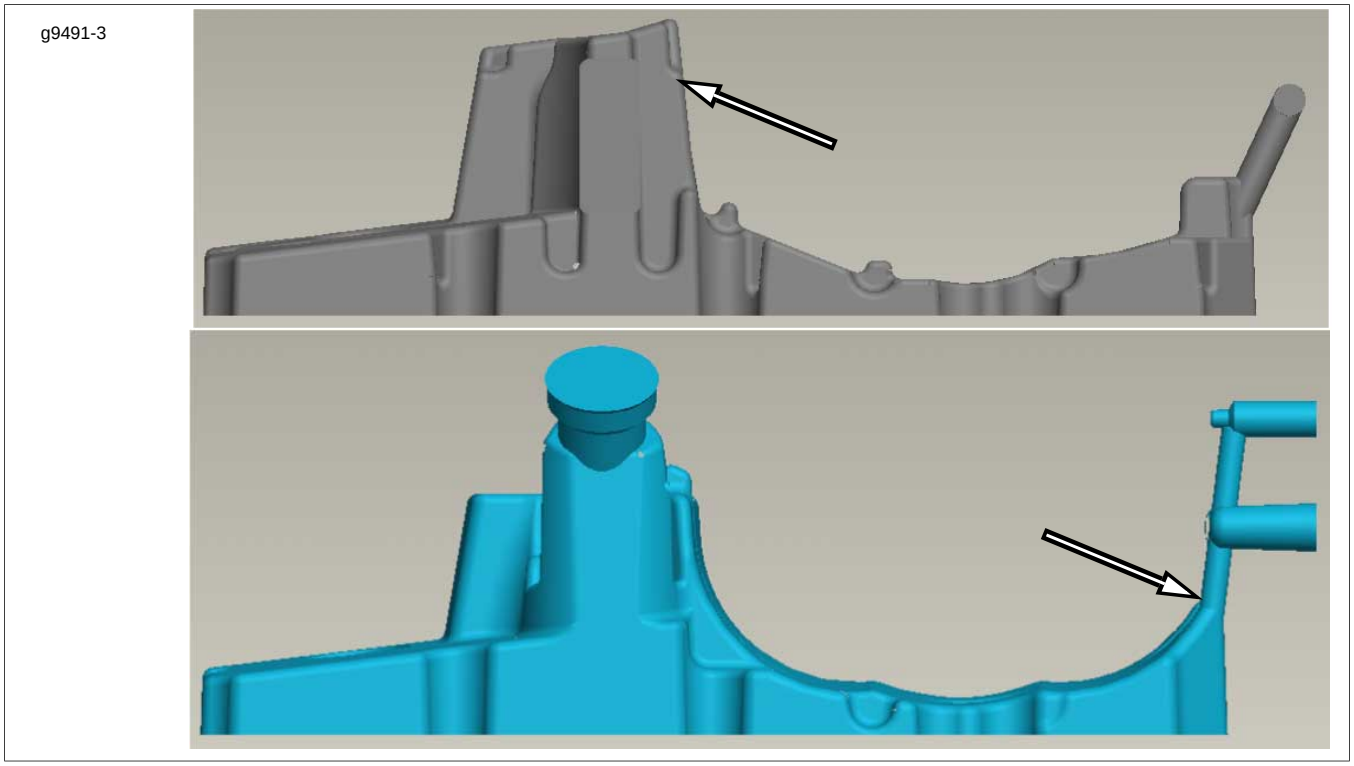


Figure 2. Oil Pan Vent Design: pre-2007 (top), 2007 and Later (bottom)

NOTE

See Figure 2. The oil pan vent was relocated on the 2007 models to a lower location than the earlier model year oil pans. This increases the sensitivity to overfill in the MY07 and later FL vehicles.

6. Verify and note the integrity of the top-end components by performing compression and leak-down tests. Record the results.
7. Check the condition of the breather umbrella valves:
   a. With the oil dipstick installed tightly, remove the drain plug from the oil tank or pan and observe the flow of oil as it drains.
   b. If oil drains quickly, an issue with the breather assemblies in the rocker boxes may exist.
   c. If oil drains slowly, loosen the dipstick and observe oil flow. If the flow increases, the breather assemblies are functioning correctly.
   d. Allow oil to drain completely. Once drained, add one quart of oil into the oil tank or pan. Start the motorcycle and let it idle for 1-2 minutes on the jiffy stand. Drain the oil again and fill to within 0.5 qt (0.237 L) of the recommended capacity. Run the engine on the jiffy stand for 1-2 minutes. Check the oil level and add oil to reach the full mark.
8. Verify that the breather passages are clear. Do not drill the breather bolts. Verify the appropriate breather bolts are installed for either a P&A or OE-style air cleaner.

⚠WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

9. Blow low pressure air (7 psi maximum) back through the breather tubes to test umbrella valve operation. Air should not pass.
10. Perform an oil pressure test with engine at operating temperature. Document the readings at idle and 2000 RPM.

NOTE

If the tapered plug is difficult to remove, skip step 10 to avoid crankcase damage.

11. To verify the crankcase is not wet sumping, operate the engine to normal operating temperature, turn the ignition switch OFF and remove crankcase plug located directly below the cam cover.
    a. A normal amount of hot oil should drain from bottom end. This will be approximately 6-12 oz (0.177-0.355 L).
    b. If more than 6-12 oz (0.177-0.355 L) drains from the passage, determine if the sump port from flywheel compartment to oil pump is plugged:
        1) Temporarily install the crankcase plug and tighten finger-tight.
        2) Remove the CKP sensor and pour approximately 0.5 qt (0.473 L) of oil through hole.
        3) Remove the crankcase plug and observe how much oil comes out and how fast.
        4) If the oil drains at a slow rate, there may be a restriction in the oil passage from the left case to the right case causing a wet sump issue.
    c. Apply LOCTITE® 565 Thread Sealant (Part No. 99818-97 or equivalent) to drill passage plug and tighten to 120-144 **in-lbs** (13.5-16.3 Nm).
12. On earlier-style Twin Cam engines, verify proper routing of oil lines and check for pinches in vent line. Change the line(s) in question if the vehicle has a history of leaking.
13. The O-ring between the oil pump and crankcase can be out of position or damaged. If it does not properly seal the passage to the oil pump, wet sumping issues can result.

Cylinder Head Modification

If the above diagnostics do not resolve the issue, increasing the opening of the drain-back passage in the cylinder heads will, in most cases, alleviate the issue. The time to modify both heads after they have been removed and disassembled is approximately 45 minutes.

This modification was implemented in production as a running change in May 2010. All 2011 and later Big Twin equipped motorcycles will receive engines having this improvement.

NOTE

The following process only applies to 88, 96 and 103 cu in. engines with OE cylinder heads built prior to the running change. Screamin' Eagle cylinder heads do not require this modification.

1. Remove and disassemble the cylinder heads.

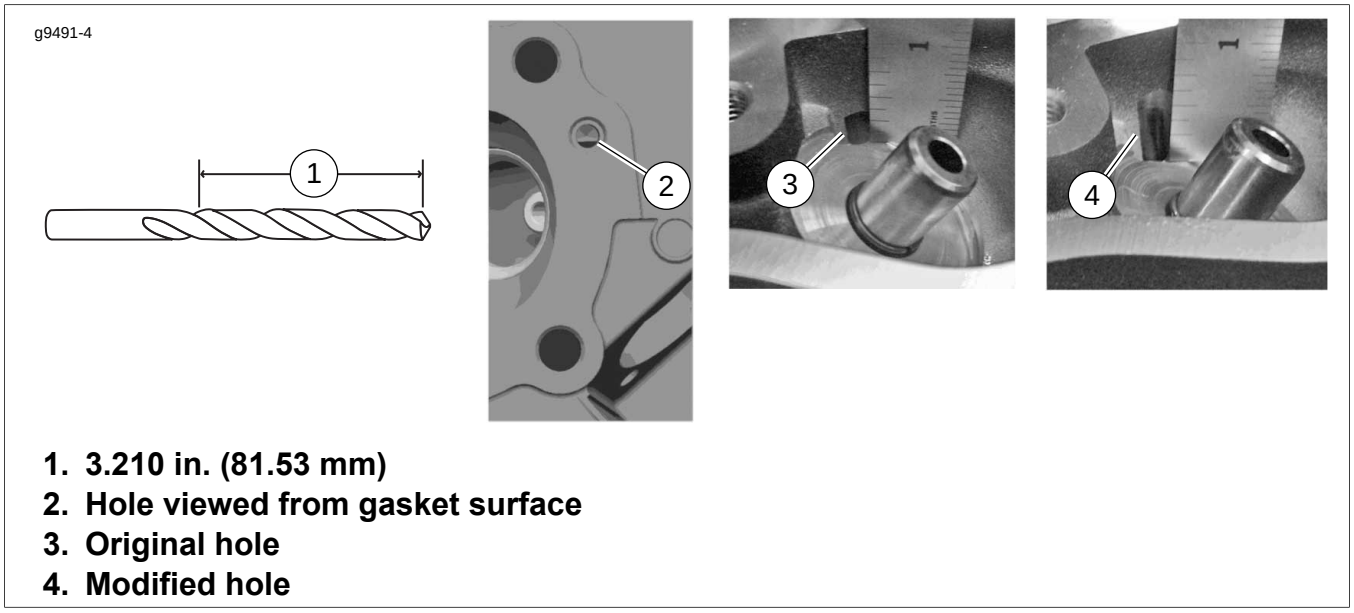
2. See Figure 3. Obtain a 5/16 in. (7.90 mm) diameter drill bit. Measure from the shoulder of the cutting edge up the shank 3.210 in. (81.53 mm) (1) and mark it with a piece of tape.
3. Locate the drain down hole (2) on the exhaust side of the head.

NOTE

Although this operation can be performed with a hand-held drill, it is recommended that a drill press be used.

4. Drill out the hole until the tape is even with the head gasket surface of the head. Figure 3 shows the original (3) and modified (4) cylinder head.
5. Clean out any chips and debris.
6. Assemble and install the cylinder heads.

If the issue has not been resolved at this point, verify that all results from the tests have been documented and contact Technical Service for further instructions.



1. 3.210 in. (81.53 mm)
2. Hole viewed from gasket surface
3. Original hole
4. Modified hole

Figure 3. Oil Drainback Hole