

014-010 Crankcase Blowby, Measure

General Information

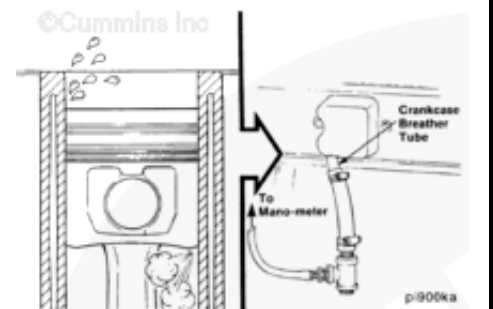
Excessive crankcase blowby can indicate an engine or engine-related component malfunction that allows combustion gases or air to enter the crankcase. This results in the buildup of higher than normal crankcase pressure, which results in increased levels of blowby.

This procedure describes how to measure crankcase blowby and how to determine what component is malfunctioning.

Blowby is typically measured for the following situations:

- Verifying engine break-in after an engine rebuild
- Troubleshooting for excessive lubricating oil out of the crankcase breather tube, commonly referred to as oil carryover (for open crankcase ventilation systems)
- Troubleshooting oil in the air intake system (for closed crankcase ventilation systems)
- Troubleshooting high crankcase pressure (for engines equipped with a crankcase pressure sensor)
- Troubleshooting possible internal engine damage (worn piston rings, valve stem seals, or guides, turbocharger, air compressor, etc.).

NOTE: For specific crankcase gases (blowby) symptom information and



direction, reference the Crankcase Gases (Blowby) Excessive troubleshooting symptom tree in Section TS of the appropriate engine service manual.

The following measure step will give general guidelines for measuring blowby relative to the above situations.

NOTE: Some illustrations in this procedure do not show actual engine configurations. However, the procedure is the same.

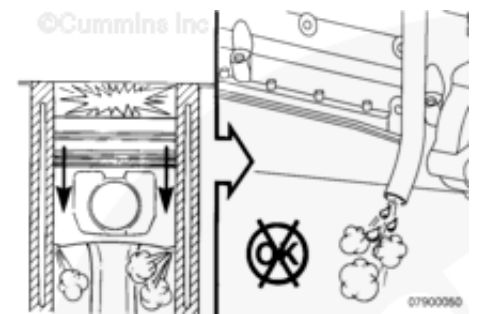
It is important to note that the terms blowby and carryover (oil out of the breather tube) are commonly used interchangeably.

When measuring blowby, and there is an excessive amount of oil coming out of the breather tube, the quantity of oil can affect the blowby measurement.

The blowby measurement is affected by the oil collecting on the orifice of the blowby measurement service tool. This reduces the size of the orifice, which results in higher than actual blowby measurements.

If this occurs, it will be necessary to:

- Find a different location on the engine to measure blowby (oil fill, oil fill cap, unused turbocharger drain location, etc.)
- Clean any oil residue from the breather and dry thoroughly before measuring blowby
- Determine if there is an issue causing the breather to be flooded with oil, for example:
 - Incorrect oil level
 - Vehicle operation (excessive angularity, excessive engine side-to-side movement)
 - Internal engine components deflecting oil toward the breather cavity (piston cooling nozzles, accessory oil drains, etc.)
- Determine if another breather option is available for the engine being serviced.

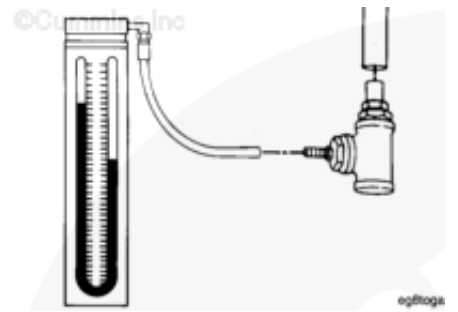


The tools used to measure blowby are similar in design. The difference between the tools is in the size of the orifice. Different size orifices are available to more accurately measure blowby by accommodating the wide variety of engine configurations and ratings. This is due to the fact that engine blowby is dependent on the volume of intake airflow.

For example:

If measuring blowby on two identically configured and sized engines, but the horsepower ratings and rated speed are different, the maximum blowby values measured will be different.

The engine with the higher horsepower rating and rated speed will have a higher volume of intake airflow, which will result in higher blowby. This means that if the smaller orifice blowby tool was used on the engine with a higher horsepower rating and rated speed, the measurement can exceed the limits of the pressure measuring tool.



Blowby Tool Part Number	Orifice Size mm [in]
3822476	5.61 mm [0.221 in]
3822566	7.67 mm [0.302 in]

To measure the crankcase blowby pressure, connect a Cummins® water manometer, Part Number ST1111-3, or equivalent, pressure gauge, or transducer to the blowby tool.

NOTE: Cummins® water manometer, Part Number ST1111-3, can measure a maximum of 944 mm [36 in] of water.

The following charts show the relationship of measured pressure to flow rate, depending on the blowby tool used.

Blowby Conversion Table (5.61-mm [0.221-in] orifice, Blowby Tool, Part Number 3822476)

mm [in] of H₂O	Liter [cfm] per Minute
25.4 [1]	27 [0.953]
50.8 [2]	40 [1.413]
76.2 [3]	48 [1.695]
101.6 [4]	58 [2.048]
127 [5]	64 [2.260]
152.4 [6]	71 [2.507]
177.8 [7]	76 [2.684]
203.2 [8]	81 [2.860]
228.6 [9]	86 [3.037]
254 [10]	90 [3.178]
279.4 [11]	94 [3.320]
304.8 [12]	98 [3.461]
330.2 [13]	102 [3.602]
355.6 [14]	105 [3.708]
381 [15]	109 [3.849]
406.4 [16]	112 [3.955]
431.8 [17]	115 [4.061]
457.2 [18]	118 [4.167]
482.6 [19]	121 [4.723]
508 [20]	124 [4.379]
533.4 [21]	128 [4.520]
558.2 [22]	131 [4.626]
584.2 [23]	135 [4.767]
609.6 [24]	137 [4.838]
635 [25]	140 [4.944]
660.4 [26]	144 [5.085]
685.8 [27]	147 [5.191]
711.2 [28]	150 [5.297]
736.6 [29]	154 [5.438]
762 [30]	157 [5.544]
787.4 [31]	160 [5.650]

812.8 [32]	163 [5.756]
838.2 [33]	166 [5.862]
863.6 [34]	169 [5.968]
889 [35]	172 [6.074]

Blowby Conversion Table (7.67-mm [0.302-in] orifice, Blowby Tool, Part Number 3822566)	
mm [in] of H ₂ O	Liter [cfm] per Minute
25.4 [1]	50 [1.766]
50.8 [2]	84 [2.966]
76.2 [3]	103 [3.637]
101.6 [4]	119 [4.202]
127 [5]	133 [4.697]
152.4 [6]	145 [5.121]
177.8 [7]	155 [5.474]
203.2 [8]	164 [5.792]
228.6 [9]	172 [6.074]
254 [10]	180 [6.357]
279.4 [11]	187 [6.604]
304.8 [12]	193 [6.816]
330.2 [13]	200 [7.063]
355.6 [14]	206 [7.275]
381 [15]	211 [7.451]
406.4 [16]	217 [7.663]
431.8 [17]	222 [7.840]
457.2 [18]	226 [7.981]
482.6 [19]	229 [8.087]
508 [20]	235 [8.299]
533.4 [21]	239 [8.440]
558.8 [22]	242 [8.546]
584.2 [23]	246 [8.687]
609.6 [24]	248 [8.758]

The following chart contains general blowby specifications for MidRange engines. Due to		
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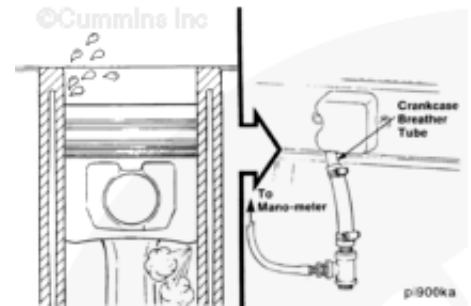
the wide variety of engine types, configurations, and ratings, these specifications are intended to **only** be used as a guide to help identify if a problem exists. These specifications are **not** intended to be used as engine condemnation limits.

NOTE: If internal engine damage is suspected to be the cause of the excessive blowby condition, other steps can be taken to confirm this.

Measuring blowby **must only** be considered when confirming engine break-in after a rebuild or if another symptom is present. These symptoms can include:

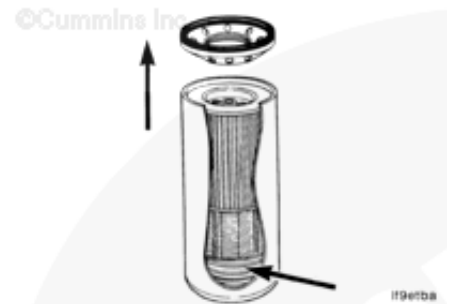
- Excessive carryover (oil out of the crankcase breather tube)
- High crankcase pressure (for engines equipped with a crankcase pressure sensor)
- Low power
- Oil consumption
- Exhaust smoke.

If no other symptom is present, blowby measurements need **not** be taken.



If internal engine damage is suspected to be the cause of the excessive blowby condition, other steps can be taken to confirm this. The steps include:

- Confirm engine maintenance practices
- Cut the oil filter open and check for debris
- Take an oil sample and inspect for contamination.



MidRange Blowby Specifications Chart

	Blowby Specification For New or Rebuild - mm [in] H ₂ O		Blowby Specification For Troubleshooting - mm [in] H ₂ O	
	Blowby Tool	Blowby Tool	Blowby Tool	Blowby Tool

Engine Model	3822476-5.61 mm [0.221 in] Orifice	3822566-7.67 mm [0.302 in] Orifice	3822476-5.61 mm [0.221 in] Orifice	3822566-7.67 mm [0.302 in] Orifice
A1400 and A1700 (Naturally Aspirated)	25.4 [1]		25.4 [1]	
A2000 and A2300 (Naturally Aspirated)	25.4 [1]		38.1 [1.5]	
A2000 and A2300 (Turbocharged)	38.1 [1.5]		50.8 [2]	
ISF2.8	147.3 [5.8]		711.2 [28]	
ISF3.8		71.1 [2.8]		254 [10]
B3.3 Tier 1, 2		50.8 [2]		101.6 [4]
B3.3, QSB3.3 Tier 3		101.6 [4]		152.04 [6]
B3.3, QSB3.3 Tier 4 Interim (Less than 74 HP)		50.8 [2]		101.6 [4]
B3.9, QSB3.9-30, B4.5, QSB4.5-30, and B4.5 ^s (Naturally Aspirated) (Less than 250 hp)	25.4 [1]		76.2 [3]	
B3.9, QSB3.9-30, B4.5, QSB4.5-30, and B4.5 ^s (Turbocharged) (Less than 250 hp)	101.6 [4]		431.8 [17]	
B3.9, QSB3.9-30, B4.5, QSB4.5-30, and B4.5 ^s (Turbocharged) (Greater than 250 hp)		25.4 [1]		127 [5]
B5.9 (Naturally Aspirated)	50.8 [2]			
B5.9, and QSB5.9-30, (Less than 250 hp)	228 .6 [9]		863.6 [34]	
B5.9, and QSB5.9-30, (Greater than 250 hp)		50.8 [2]		228.6 [9]
ISB, ISB ^e , QSB ^e , ISD ^e , QSB5.9-44, ISB6.7, and QSB6.7		101.6 [4]		254 [10]
C8.3		203 [8]		457 [18]
ISC, ISC ^e , QSC8.3, ISL, ISL ^e , and QSL9		203.2 [8]		304.8 [12]
B Gas International, B Gas Plus, B LPG Plus, B5.9G,	228.6 [9]		889 [35]	

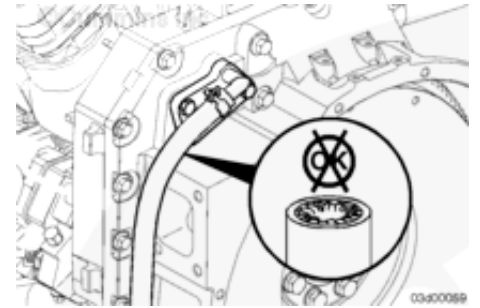
B5.9 LPG				
C8.3G, C Gas Plus, ISL G, L Gas Plus		203 [8]		457 [18]
ISB4.5 CM2350 B104	152.4		330.2	

Initial Check

NOTE: The location and type of crankcase breathers vary by engine configuration (Front Gear Train or Rear Gear Train) and/or engine application (Marine, Industrial, and Automotive).

Prior to measuring blowby pressure, check the crankcase breather tube for obstructions.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and



Repair Manual, Bulletin 4021418. [Refer to Procedure 003-018 in Section 3.](#)

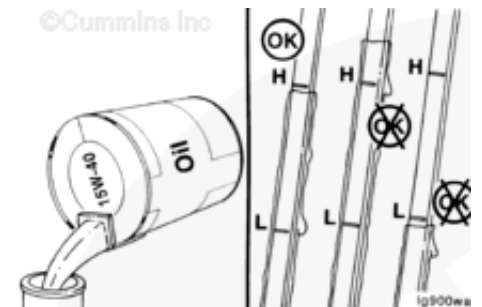
- Use the following procedure in the B3.3 and QSB3.3 CM2150 Service Manual, Bulletin 4021540. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 003-018 in Section 3.](#)
- Reference the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704.
 - Use the following procedure for Open Crankcase Ventilation systems. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure for Closed Crankcase Ventilation systems. [Refer to Procedure 003-024 in Section 3.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the B4.5s and B6.7s Series Engines Troubleshooting and Repair Manual, Bulletin 4095243. [Refer to Procedure 003-018 in Section 3.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220E, ISF2.8 CM2220 AN and ISF2.8 CM2220 IAN

- Service Manual, Bulletin 4022178. [Refer to Procedure 003-024 in Section 3.](#) [Refer to Procedure 003-026 in Section 3.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 003-024 in Section 3.](#)
 - Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 003-024 in Section 3.](#)
 - Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the ISF3.8 CM2220 L110 Service Manual, Bulletin 4358480. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. [Refer to Procedure 003-018 in Section 3.](#)
 - Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. [Refer to Procedure 003-018 in Section 3.](#)

If troubleshooting a complaint of excessive oil out of the breather tube, it can be necessary to remove the breather components to clean and remove any lubricating oil buildup before performing any blowby measurements.

Check the engine oil level and, if necessary, proper calibration of the dipstick. If the level is too high, it can cause a higher than normal blowby pressure and/or excessive carryover.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the B3.3 and QSB3.3 CM2150 Service Manual, Bulletin 4021540. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 007-011 in Section 7.](#)



- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISFF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220E, ISF2.8 CM2220 AN, and ISF2.8 CM2220 IAN Service Manual, Bulletin 4022178. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 007-043 in Section 7.](#)
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 007-043 in Section 7.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 007-011 in Section 7.](#)

- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. [Refer to Procedure 007-037 in Section 7.](#)
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. [Refer to Procedure 007-037 in Section 7.](#)
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. [Refer to Procedure 007-011 in Section 7.](#)
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. [Refer to Procedure 007-037 in Section 7.](#)
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. [Refer to Procedure 007-037 in Section 7.](#)
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. [Refer to Procedure 007-037 in Section 7.](#)

Measure

Choose the appropriate blowby measurement service tool to use for the engine being serviced. Reference the MidRange Blowby Specifications Chart in this procedure and determine the appropriate blowby measurement service tool to use, based on

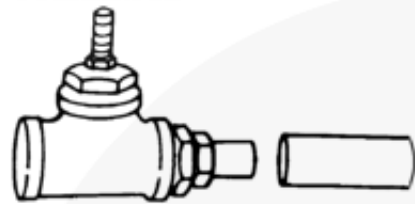


engine type and/or horsepower.

Blowby Tool Part Number	Orifice Size mm [in]
3822476	5.61 mm [0.221 in]
3822566	7.67 mm [0.302 in]

NOTE: Either service tool can be used to measure blowby, as long as the blowby measurement is correctly matched to the correct flow rate. Reference the flow rate conversion tables in this procedure for the correct orifice.

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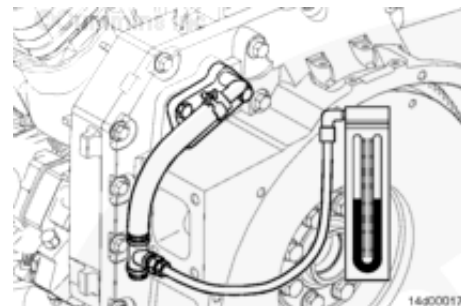
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To measure the crankcase blowby pressure, connect a water manometer, Part Number ST1111-3, pressure gauge, or transducer to the blowby measurement service tool.

NOTE: The location of the crankcase breather tube can vary by engine configuration (front gear train or rear gear train) and/or application (Marine, Industrial, and Automotive). See Section E for crankcase breather tube locations.

Install the appropriate blowby service tool(s):

- For typical open crankcase breather/ventilation systems, connect the appropriate blowby service tool to the end of the crankcase breather tube. Connect a water manometer, pressure gauge, or transducer to the blowby service tool.
- For engines with closed crankcase ventilation systems (without a crankcase ventilation filter), disconnect the breather tube and plug the intake manifold or turbocharger compressor housing port. Connect the appropriate blowby service tool to the end of the crankcase breather tube. Connect a water manometer, pressure gauge, or transducer to the blowby service tool.
- For crankcase breather/ventilation

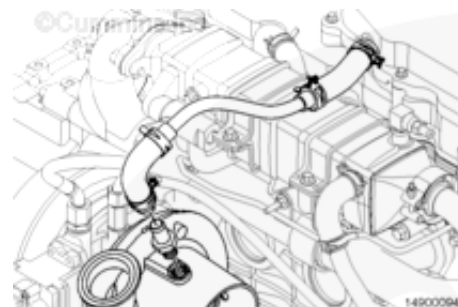


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systems with crankcase ventilation filters, follow the proceeding steps on connecting the blowby measurement equipment.

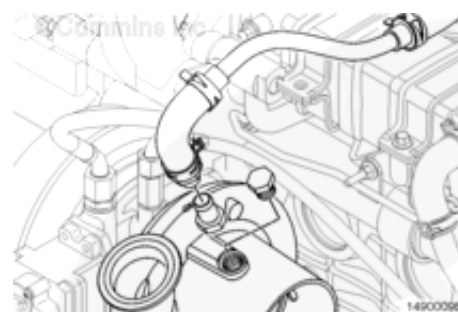
For ISB CM2150 engines that have the crankcase ventilation filter located on top of the rocker lever cover, use the following steps to connect the blowby measurement tools.

- Disconnect the crankcase ventilation line from the turbocharger/original equipment manufacturer (OEM) intake plumbing. If the crankcase ventilation line is connected to the turbocharger housing, remove the inlet fitting.

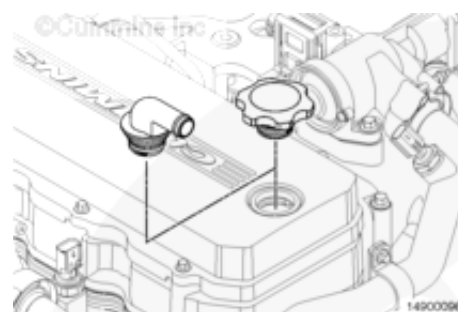


- If the crankcase ventilation line is connected to the turbocharger housing, install a straight thread plug, Part Number 3089567. Plug the crankcase ventilation line with a suitable fitting.

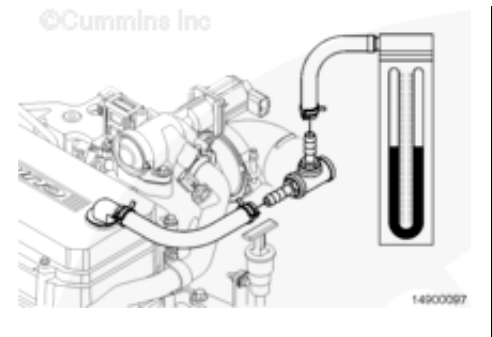
NOTE: If the crankcase ventilation line is connected to the OEM intake plumbing (not shown), use a suitable fitting to plug the port in the intake plumbing. Also plug the crankcase ventilation line coming from the engine with a suitable fitting.



- Remove the oil fill cap from the rocker lever cover. Install an oil fill adapter, Part Number 3990099.

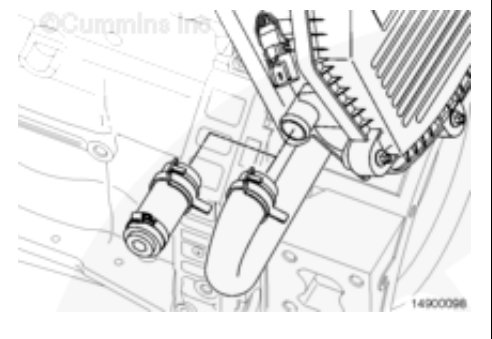


- Connect the appropriate blowby service tool to the outlet of the oil fill adapter. Connect a water manometer, pressure gauge, or transducer to the blowby service tool.

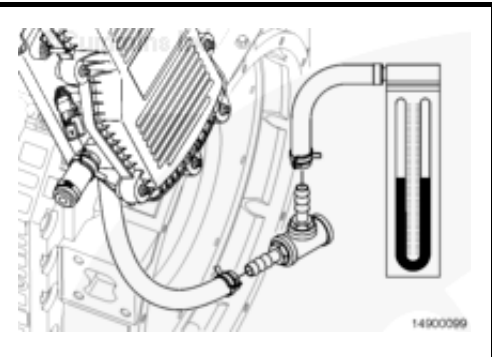


For ISB CM2150 engines that have the crankcase ventilation filter located at the rear of the engine, use the following steps to connect the blowby measurement tools.

- Disconnect the crankcase ventilation line from the crankcase ventilation filter housing. Plug or cap the crankcase ventilation filter housing.

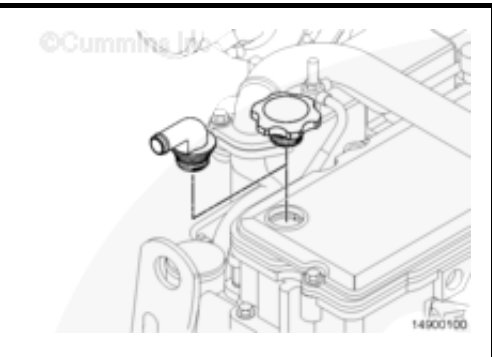


- Connect the appropriate blowby service tool to the crankcase ventilation line exiting the flywheel housing. Connect a water manometer, pressure gauge, or transducer to the blowby service tool.

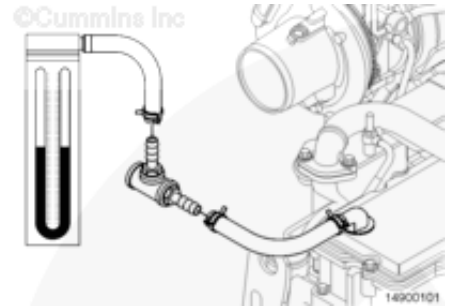


For ISC and ISL CM2150 and QSL CM2250 engines, use the following steps to connect the blowby measurement tools.

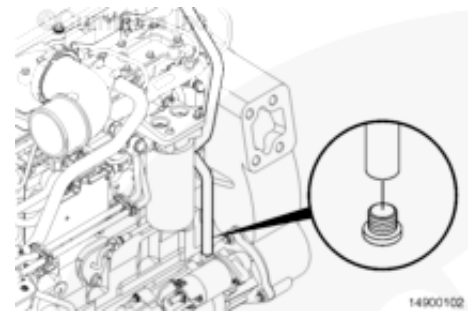
- Remove the oil fill cap from the rocker lever cover. Install an oil fill adapter, Part Number 3990099.



- Connect the appropriate blowby service tool to the outlet of the oil fill adapter. Connect a water manometer, pressure gauge, or transducer to the blowby service tool.



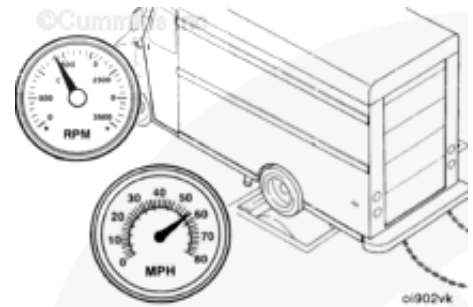
- Use a suitable fitting to plug the crankcase breather tube.



Engine Blowby Contribution:

Operate the engine at rated speed and under load by:

- For engine run-in, a chassis dynamometer or engine dynamometer.
- For engine testing, a chassis dynamometer or engine dynamometer.
- A stall speed test (for engines equipped with automatic transmissions **only**).



CAUTION

When measuring blowby and there is an excessive amount of oil coming out of the breather tube, the quantity of oil can affect



the blowby measurement.

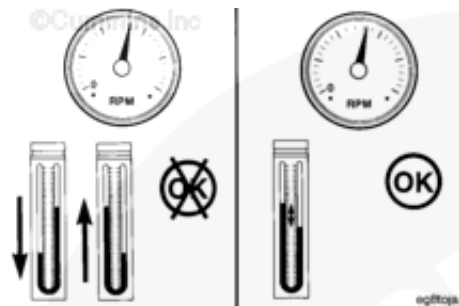
Operate the engine at rated rpm and full load until a steady reading is obtained.

NOTE: When measuring blowby, the value can “spike” initially as the engine reaches peak power and rated speed. Wait for the blowby measurement to stabilize before taking a reading.

NOTE: For engine run-in, if a sudden increase in blowby occurs, or if blowby exceeds the maximum allowable limit during any run-in step, return to the previous step and continue the run-in. If blowby does not reach an acceptable level, discontinue the run-in and determine the cause.

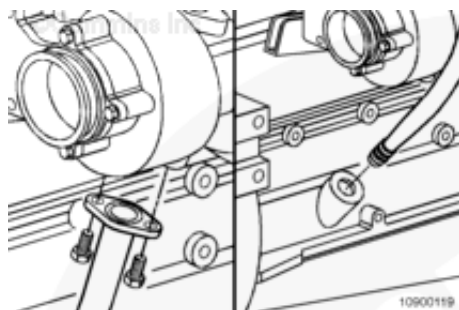
Record the steady blowby measurement.

Remove the engine blowby service tool and the water manometer, pressure gauge, or transducer, if the blowby is within specification.



Turbocharger Blowby Contribution:

NOTE: For engines equipped with dual turbochargers, the Turbocharger Oil Drain Line Isolation Test may need to be conducted twice to determine which turbocharger is contributing high blowby. The first test should be conducted with both turbocharger drain lines isolated. If the blowby contribution is above specifications, conduct a second test with only the low pressure turbocharger oil drain line isolated. If the blowby contribution is within specification, inspect the compressor and turbine areas of the low pressure turbocharger for signs of an oil leak. Replace the low pressure turbocharger, if necessary. If the blowby contribution is out of specification, replace the high pressure turbocharger.



With the engine blowby service tool and water manometer or pressure gauge still installed:

- Isolate the turbocharger, if equipped, to determine if the high blowby pressure is due to turbocharger seal leakage.
- To measure the turbocharger blowby contribution, disconnect the turbocharger oil drain line.
- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the B3.3 and QSB3.3 CM2150 Service Manual, Bulletin 4021540. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 010-045 in Section 10.](#)

- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the B4.5s and B6.7s Series Engines Troubleshooting and Repair Manual, Bulletin 4095243. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220E, ISF2.8 CM2220 AN and ISF2.8 CM2220 IAN Service Manual, Bulletin 4022178. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure](#)

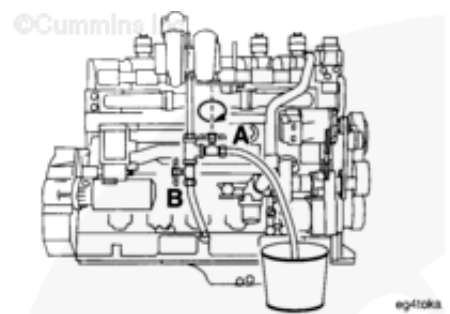
010-045 in Section 10.

- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. Refer to Procedure 010-045 in Section 10.

Preferred Turbocharger Isolation Method:

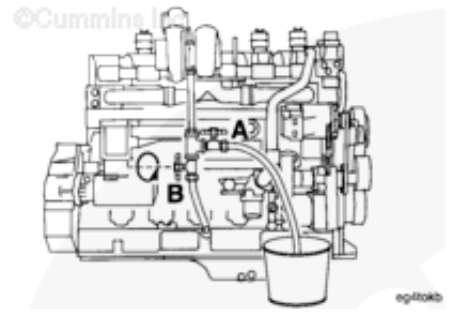
Install a hose assembly with two shutoff valves (A and B), as shown in the illustration, between the turbocharger and turbocharger drain line location in the cylinder block. The valves **must** have a minimum inside diameter of 19 mm [0.75 in]. Place the other hose in a 8 to 9 liter [2 to 3 gal] container.

NOTE: Some turbocharger oil drain tubes are a single one piece tube. It can be necessary to create a turbocharger isolation tool. Use a new or used turbocharger drain line and cut a middle section out of the turbocharger drain line to fit the check valves and hoses.



Close the valve (A) that allows oil to drain into the bucket.

Open the valve (B) that allows oil to drain into the engine.

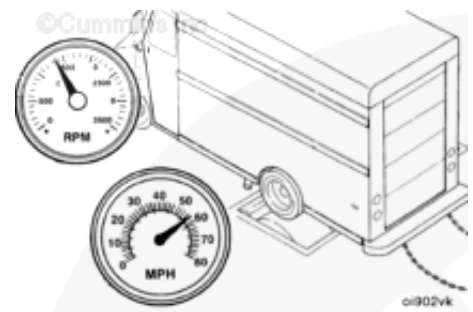


Operate the engine at rated speed and under load by either:

- For engine testing, a chassis dynamometer or engine dynamometer
- A stall speed test (for engines equipped with automatic transmissions **only**).

Operate the engine at rated rpm and full load until a steady reading is obtained.

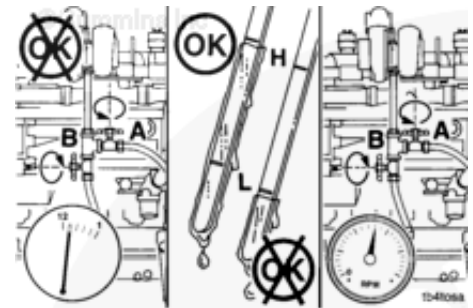
NOTE: When measuring blowby, the value can “spike” initially as the engine reaches peak power and rated speed. Wait for the blowby measurement to stabilize before taking a reading.



WARNING

To reduce the possibility of personal injury, keep hands, long hair, jewelry, and loose fitting or torn clothing away from fans and other moving parts.

WARNING



Troubleshooting presents the risk of equipment damage, personal injury, or death. Troubleshooting must be performed by trained, experienced technicians.

⚠ CAUTION ⚠

Do not operate the engine with valve (A) open and valve (B) closed for more than 1 minute. Monitor the amount of oil accumulating in the bucket. The engine can run out of lubricating engine oil and severe engine damage will occur.

Continue operating at rated speed and load.

Open valve (A) and close valve (B).

Record the blowby pressure reading.

⚠ CAUTION ⚠

Do not operate the engine for more than 1 minute. Monitor the amount of oil accumulating in the container. The engine can be run out of lubricating engine oil and severe engine damage will result.

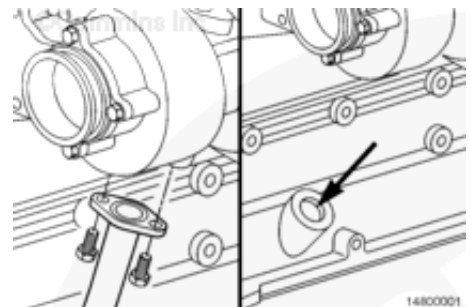
Alternate Turbocharger Isolation Method:

With the turbocharger oil drain line disconnected from the cylinder block, run the turbocharger drain line into a large container.

Plug the turbocharger oil drain port in the cylinder block.

Operate the engine at rated speed and under load by either:

- For engine testing, a chassis dynamometer or engine dynamometer
- A stall speed test (for engines equipped with automatic transmissions **only**).



Record the peak blowby pressure measurement.

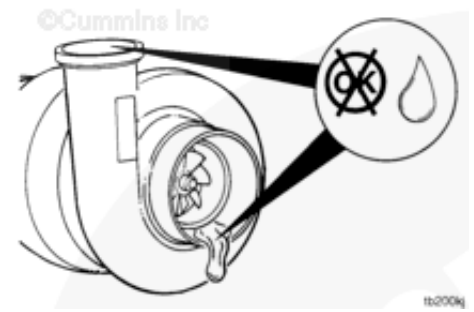
Determine the turbocharger blowby pressure contribution by determining the difference in the blowby pressure measurement with the turbocharger drain isolated, valve (A) open, and turbocharger drain **not** isolated, valve (A) closed.

Blowby Pressure Differential

Turbocharger Blowby Contribution	Maximum: 30 percent
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If the turbocharger blowby contribution is out of specification, inspect the compressor and turbine areas of the turbocharger for signs of an oil leak. Replace the turbocharger, if necessary.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and



Repair Manual, Bulletin 4021418. [Refer to Procedure 010-033 in Section 10.](#)

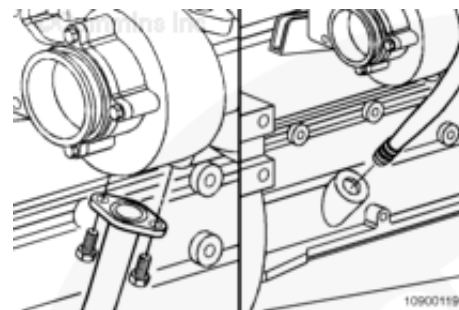
- Use the following procedure in the B3.3 and QSB3.3 CM2150 Service Manual, Bulletin 4021540. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 010-033 in Section 10 \(single turbocharger\).](#) [Refer to Procedure 010-034 in Section 10 \(dual turbocharger\).](#) [Refer to Procedure 010-035 in Section 10 \(dual turbocharger\).](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and (dual turbocharger applications) ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the B4.5s and B6.7s Series Engines Troubleshooting and Repair Manual, Bulletin 4095243. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220E, ISF2.8 CM2220 AN and ISF2.8 CM2220 IAN Service Manual, Bulletin 4022178 for single turbocharger applications. [Refer to](#)

[Procedure 010-033 in Section 10.](#)

- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. [Refer to Procedure 010-033 in Section 10.](#)
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. [Refer to Procedure 010-033 in Section 10.](#)

If installed, remove the turbocharger oil drain line assembly and shutoff valves.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the B3.3 and QSB3.3 CM2150 Service Manual, Bulletin 4021540. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISLe



CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 010-045 in Section 10.](#)

- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the B4.5s and B6.7s Series Engines Troubleshooting and Repair Manual, Bulletin 4095243. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220 E, ISF2.8 CM2220 AN and ISF2.8 CM2220 IAN Service Manual, Bulletin 4022178. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 010-045 in Section 10.](#)
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. [Refer to Procedure 010-045 in Section 10.](#)

- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. Refer to Procedure 010-045 in Section 10.
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. Refer to Procedure 010-045 in Section 10.

Check the engine oil level and add oil, if necessary.

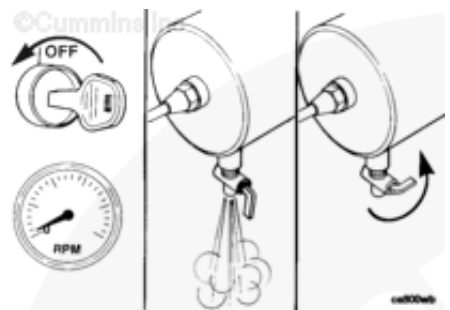
⚠ WARNING ⚠

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Air Compressor Blowby Contribution:

With the engine blowby service tool and the water manometer, pressure gauge, or transducer still installed, isolate the air compressor, if equipped, to determine if there is internal damage to the air compressor contributing to high engine crankcase pressure. The air compressor can be isolated by unloading the air compressor.

With the engine shut off, bleed the vehicle's air



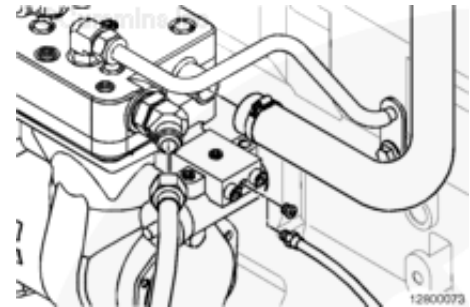
system down by opening the drain cock on the wet tank to release compressed air from the system.

NOTE: The air compressor governor/unloader location can vary on each engine application. The air governor/unloader can be air compressor mounted or chassis mounted.

Disconnect the air signal line from the air compressor governor/unloader air signal port.

Disconnect the air compressor discharge line and air intake hose from the air compressor.

NOTE: On turbocharged air compressors, make sure to plug the air intake hose connected to the engine intake manifold or the engine will not reach full power during test.



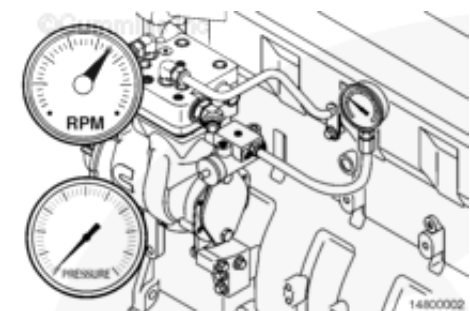
To unload the air compressor, determine the pressure needed at the governor/unloader air signal port to start and stop the air compressor from pumping.

NOTE: Typical 621 kPa [90 psi] of air pressure is the set point between starting and stopping of the air compressor pumping. Refer to the OEM service manual.

Connect a regulated shop air pressure line, with pressure gauge, to the air compressor governor/unloader air signal port.

NOTE: When performing the test, make sure that the air system pressure does not exceed the manufacturer's maximum allowable pressure.

Run the engine and increase the signal pressure to the air governor/unloader to



determine when the air compressor will stop pumping (system pressure stops rising at this point). Record the signal line pressure.

Reduce the signal pressure to determine when system pressure starts the air compressor pumping again (system pressure will begin to rise again at this point). Record the signal line pressure.

NOTE: Allow the air compressor to pump long enough to build enough pressure in the system to release and operate the air brakes.

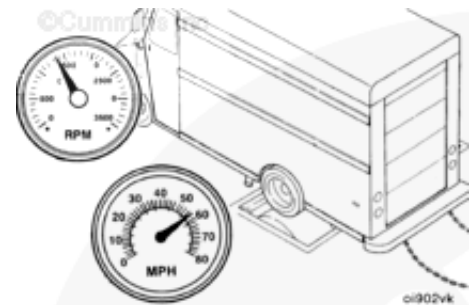
With the regulated shop air pressure line still connected to the air compressor governor/unloader air signal port, regulate the signal pressure so that the air compressor starts pumping (system pressure will begin to rise again at this point). Use the pressure value recorded previously as a set point.

Operate the engine at rated speed and under load by either:

- For engine testing, a chassis dynamometer or engine dynamometer.
- A stall speed test (for engines equipped with automatic transmissions **only**).

Operate the engine at rated rpm and full load until a steady reading is obtained.

NOTE: When measuring blowby, the value can “spike” initially as the engine reaches peak power and rated speed. Wait for the blowby measurement to stabilize before taking a reading.



Continue operating the engine at rated speed and load.



Increase the signal pressure (system pressure

stops rising at this point). Use the pressure value recorded previously as a set point.

Operate the engine at rated rpm and full load until a steady reading is obtained.

NOTE: When measuring blowby, the value can “spike” initially as the engine reaches peak power and rated speed. Wait for the blowby measurement to stabilize before taking a reading.



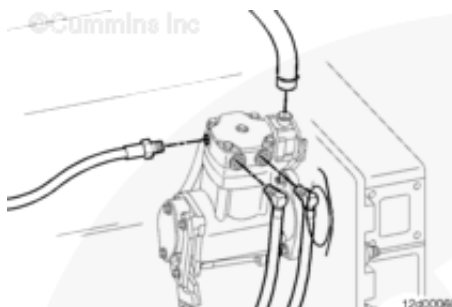
Determine the air compressor blowby pressure contribution by determining the difference in the blowby pressure measurement with the air compressor pumping and the air compressor **not** pumping.

Blowby Pressure Differential

Air Compressor Contribution	Maximum: 30 percent
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If the air compressor blowby contribution is out of specification, replace the air compressor.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines



Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 012-014 in Section 12.](#)

- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB6.7

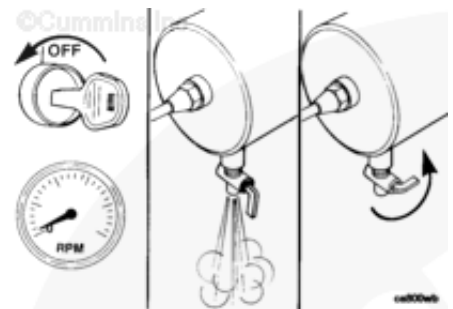
CM2350 B103 Service Manual, Bulletin 4332641. Refer to Procedure 012-014 in Section 12.

- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. Refer to Procedure 012-014 in Section 14.
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. Refer to Procedure 012-014 in Section 12.

⚠ WARNING ⚠

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

With the engine shut off, bleed the vehicle's air system down by opening the drain cock on the wet tank to release compressed air from the system.



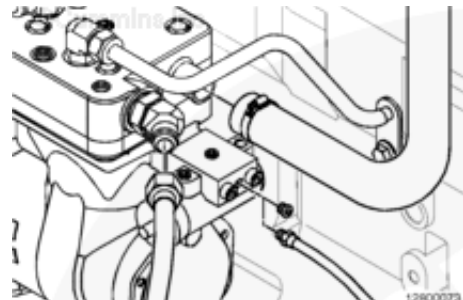
Disconnect the regulated shop air pressure line, with pressure gauge, from the air compressor governor/unloader air signal port.

Connect the air signal line. Refer to the OEM service manual.

Remove the engine blowby service tool and water manometer or pressure gauge if the blowby is within specification.

NOTE: On turbocharged air compressors, make sure to remove the plug previously installed in the air intake hose connected to the engine intake manifold.

Connect the air compressor discharge line and air intake hose from the air compressor.

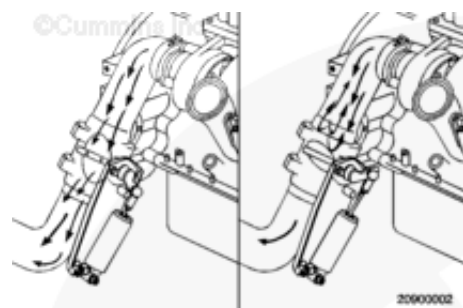


Exhaust Brake Blowby Contribution:

NOTE: Not all vehicles are equipped with an exhaust brake.

With the engine blowby service tool and the water manometer, pressure gauge, or transducer still installed, measure blowby pressure during exhaust brake operation, if equipped.

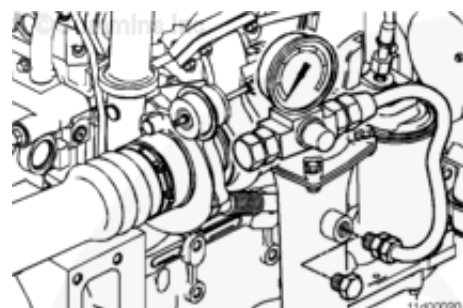
Operate the vehicle going down a long inclined road such as a highway or interstate off ramp. Begin exhaust brake operation at rated engine speed while measuring blowby pressure during exhaust brake operation.



Also, measure exhaust back pressure during exhaust brake operation.

Operate the engine until a steady reading is obtained.

NOTE: When measuring blowby, the value can “spike” initially as the engine reaches



peak power and rated speed. Wait for the blowby measurement to stabilize before taking a reading.

If blowby pressure is above specification during exhaust brake operation and exhaust back pressure is above specification, repair or replace the exhaust brake. See the manufacturer's instructions.

If the blowby pressure is above specification during exhaust brake operation and the exhaust back pressure is within specification, check the turbocharger blowby contribution. Reference the turbocharger oil drain isolation step previously in this procedure.

Remove the engine blowby service tool and the water manometer, pressure gauge, or transducer.

Remove the pressure gauge used to measure exhaust back pressure during exhaust brake operation.

Install a plug in the test port.

Base Engine Component Blowby Contribution:

Base engine components can also be contributing factors of increased crankcase blowby and higher than normal crankcase pressure. Reference the Crankcase Gases (Blowby) Excessive troubleshooting symptom tree in Section TS of the appropriate engine service manual to evaluate the remaining possible causes for increased blowby and higher than normal crankcase pressure. The following are listed as possible base engine component causes:



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Valve stem clearance is excessive or the valve stem seals are damaged.

- Use the following procedure in the C

Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 002-004 in Section 2.](#)

- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin

4021704. [Refer to Procedure 002-004 in Section 2.](#)

- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220 E, ISF2.8 CM2220 AN and ISF2.8 CM2220 IAN Service Manual, Bulletin 4022178. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. [Refer to Procedure](#)

002-004 in Section 12.

- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. Refer to Procedure 002-004 in Section 2.

Cylinder head valve guides are excessively worn.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual,

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Bulletin 4021578. [Refer to Procedure 002-004 in Section 2.](#)

- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220E, ISF2.8 CM2220AN and ISF2.8 CM2220 IAN Service Manual, Bulletin 4022178. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 002-004 in Section 2.](#)
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin

4332796. Refer to Procedure 002-004 in Section 2.

- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. Refer to Procedure 002-004 in Section 12.
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. Refer to Procedure 002-004 in Section 2.
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. Refer to Procedure 002-004 in Section 2.

Air compressor is malfunctioning.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. Refer to Procedure 012-014 in Section 2.
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193. Refer to Procedure 012-014 in Section 12.
- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. Refer to Procedure 012-014 in Section 12.

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- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISF3.8 CM2220 Service Manual, Bulletin 4021704. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. [Refer to Procedure 012-014 in](#)

[Section 12.](#)

- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. [Refer to Procedure 012-014 in Section 12.](#)
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. [Refer to Procedure 012-014 in Section 14.](#)
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. [Refer to Procedure 012-014 in Section 12.](#)

Piston or piston rings are worn or damaged.

- Use the following procedure in the C Series Engines Troubleshooting and Repair Manual, Bulletin 3666003. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the B3.9, B4.5, B4.5 RGT, and B5.9 Service Manual, Bulletin 3666087. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISB and QSB5.9-44 Engines Troubleshooting and Repair Manual, Bulletin 3666193.

[Refer to Procedure 001-043 in Section 1.](#)

- Use the following procedure in the ISBe, ISB, and QSB (Common Rail Fuel System) Service Manual, Bulletin 4021271. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the Industrial QSB3.9-30, QSB4.5-30, and QSB5.9-30 Series Engines Troubleshooting and Repair Manual, Bulletin 4021398. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISC, ISCe, QSC8.3, ISL, ISLe3, ISLe4 and QSL9 Engines Troubleshooting and Repair Manual, Bulletin 4021418. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISC and ISL CM2150 Service Manual, Bulletin 4021569. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISB CM2100 and CM2150 Service Manual, Bulletin 4021578. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISBe and ISDe CM2150 Service Manual, Bulletin 4021597. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISLe CM2150 Service Manual, Bulletin 4021630. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISL G CM2180 Service Manual, Bulletin 4021649. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISF3.8 CM2220, ISF3.8 CM2220 AN and ISF3.8 CM2220 IAN Service Manual, Bulletin 4021704. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISB4.5, ISB6.7, ISD4.5 and ISD6.7 CM2150 SN Service Manual, Bulletin 4022188. [Refer to Procedure 001-043 in Section 1.](#)
- Use the following procedure in the ISF2.8 CM2220, ISF2.8 CM2220 E, ISF2.8 CM2220 AN and ISF2.8 CM2220 IAN

Service Manual, Bulletin 4022178. Refer to Procedure 001-043 in Section 1. Refer to Procedure 001-043 in Section 1.

- Use the following procedure in the ISB6.7 Service Manual, Bulletin 4022254. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the ISB6.7 CM2350 B101 Service Manual, Bulletin 2883567. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the ISB4.5 CM2350 B104 Service Manual, Bulletin 4332646. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the ISB6.7 CM2350 B103 Service Manual, Bulletin 4332641. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the QSB6.7 CM2350 B105 Service Manual, Bulletin 4332778. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the QSL9 CM2350 L102 Service Manual, Bulletin 4332796. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the ISF3.8 CM2220 F110 Service Manual, Bulletin 4358480. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the ISL9 CM2350 L101 Service Manual, Bulletin 4310787. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the QSL9 M CM2250 L106 Service Manual, Bulletin 4358343. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the QSB6.7 CM2350 B112 Service Manual, Bulletin 4358498. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the ISB/ISD6.7 CM2880 B126 Service Manual, Bulletin 4383693. Refer to Procedure 001-043 in Section 1.
- Use the following procedure in the QSL9 CM2250 L115 Service Manual, Bulletin 4388626. Refer to Procedure 001-043 in Section 1.

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