



TEAM TIP

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Model Year(s): 2020-2022

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IMPORTANT

If you are working with a printed copy, please verify you have the most current version of this document.

SUBJECT: MISFIRE AND RUNABILITY DIAGNOSTICS

PURPOSE

Indian Motorcycles is releasing a guide to aid in misfire diagnosis on heavyweight air and liquid cooled motorcycles.

This Team Tip provides additional details on the systems and components that may contribute to misfire or runability concern, along with how to repair them.

AFFECTED MODELS

MODEL YEAR	MODELS
2020-2022	Chieftain (Thunderstroke Engine)
	Roadmaster (Thunderstroke Engine)
	Springfield (Thunderstroke Engine)
	Chief (Thunderstroke Engine)
	Challenger (PowerPlus Engine)
	Pursuit (PowerPlus Engine)

MISFIRE FAULT DETAILS

An engine misfire is when an engine is not in sync or one of the systems vital to keep it running has a malfunction for at least one cycle on one or more cylinders. There are three different codes for misfires.

MISFIRE CODES	DESCRIPTION
P0301	Cylinder 1 Misfire (Front)
P0302	Cylinder 2 Misfire (Rear)
P0314	Misfire Confirmed

AFTERMARKET ACCESSORIES

When diagnosing misfires, always inspect a motorcycle for aftermarket modifications. If the motorcycle has aftermarket parts installed that are not supported by Indian Motorcycle, return the motorcycle back to OEM or Indian validated configuration before beginning or continuing diagnosis. Aftermarket modifications can adversely affect the vehicle's performance, durability, and drivability.

BATTERY

If a battery does not have enough voltage or load capacity, it can cause the motorcycle to have decreased functionality in parts required to keep an engine running properly, like the fuel pump, ignition system, electronic controllers, and more.

The battery must have at least 12.5 volts and pass a load test using a Polaris battery tester.

ENGINE	MINIMUM VOLTAGE	CHARGING VOLTAGE THRESHOLD
Thunderstroke 111 and 116	12.5 Volts	13.4 - 14.8 Volts
PowerPlus 108	12.5 Volts	14.3 - 14.7 Volts

ECM (ENGINE CONTROL MODULE)

The ECM is responsible for all engine function on Indian Motorcycles. If the ECM does not have the correct, current calibration, it can cause the engine to run poorly or misfire.

1. Use Digital Wrench to check if the motorcycle's software is up to date in the ECM.
- **If no**, perform an ECM update to the motorcycle.
 - **If yes**, continue to the next step.

NOTICE
If a stage kit is installed, confirm that it uses the correct calibration.

2. Inspect the ECM Connector to confirm the locking pin is fully closed and not held open by zip-tie interference.

INTAKE

THROTTLE BODY

The throttle body controls how much air the engine is allowed. A throttle body not in specification can cause an engine to run poorly or misfire.

THROTTLE LEARN CONDITIONS

NOTICE

Throttle adaptation during the use of the motorcycle will make minor corrections per run cycle. During test rides, after performing a throttle adaptation, best results will come from multiple short rides with a full power down period (130 seconds) between rides.

- The engine must be shut off and the vehicle must be stopped.
- Throttle not actuated (don't twist the throttle from power up until this is complete).

INTAKE AIR TEMPERATURE

Minimum	5°C (41°F)
Maximum	140°C (284°F)

ENGINE COOLANT TEMPERATURE

Minimum	5°C (41°F)
Maximum	100°C (212°F)

BATTERY VOLTAGE

Minimum	10V
Maximum	16V

THROTTLE LEARN PROCEDURE

1. Turn the power on the motorcycle with the run/stop switch to the following:
 - PowerPlus (Challenger and Pursuit) to the **STOP** position.
 - Thunderstroke (Chieftain, Roadmaster, Springfield, Chief) to the **RUN** position.
2. Wait 35 seconds with no changes to controller inputs (don't move the throttle or change any switch positions).
3. Power the motorcycle off.
4. Wait 130 seconds with no changes to controller inputs (don't move the throttle, start the motorcycle, or change any switch positions).
5. Throttle adaptation is reset to base values and the motorcycle should be driven under normal load to further develop (fine tune) the throttle adaptation. Abnormal throttle operation such as revving the engine in neutral or with the clutch pulled in (no load) will be counterproductive to throttle adaptation.

NOTICE

The further development (fine tuning) of the throttle adaptations is done in small increments. Multiple short rides with city riding conditions will be more of a benefit compared to long highway/interstate rides in the first few rides performing throttle adaptation.

THROTTLE BODY PROCEDURE - POWERPLUS (CHALLENGER AND PURSUIT) ONLY

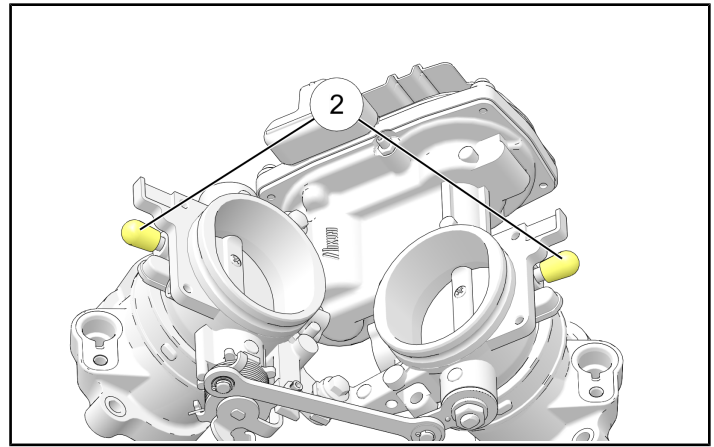
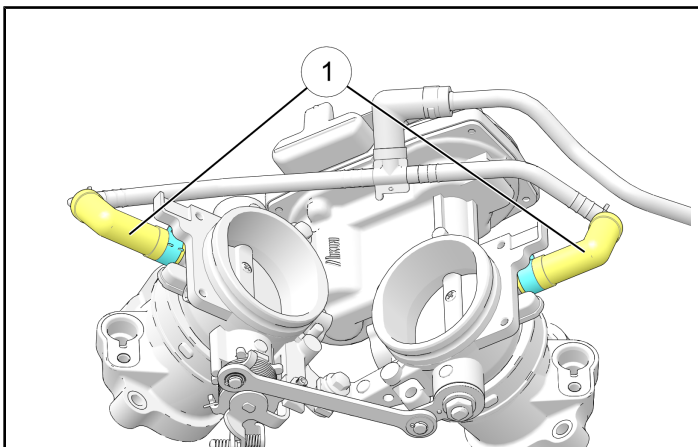
Measure and record throttle body balance using the appropriate tool at the evap ports, with the engine up to operating temperature at Idle.

Use Synchronizing Tool RMI-TO-007 for the following procedure.

1. If the gauges on synchronizing tool RMI-TO-007 do not read zero at atmospheric pressure, as shown in the image below, remove the plastic cover and carefully adjust the adjustment screw until needles are in the center of the white strip.



2. Start the motorcycle and allow the engine to run until the cooling fan turns on.
3. Turn off the motorcycle.
4. Working from the right-hand side of the motorcycle, use a long needle-nose pliers to remove both purge lines ① **OR** evap port plugs ② from the throttle body.



5. Connect both rubber hoses of the throttle body sync tool, RMI-TO-007, to the throttle body purge ports using a set of long needle-nose pliers.
6. Start the motorcycle again and allow the engine to run until the cooling fan turns on.
7. Adjust the needle valves ① on both lines to achieve less than 1 inch Hg fluctuation on the gauge (outer graduations). Maintain some gauge flutter to make sure the valve is not closed entirely.



8. Read both gauges in relation to each other. Determine the difference in the readings.
 - a. The throttle body is in specification if the difference in readings between each side is **BELOW** 1.5 inches Hg.

NOTICE

To confirm the gauge is zeroed correctly: After recording the first readings, swap the lines on the gauge so it is reading the opposite side of the throttle body, and record the second reading. Add the value of both readings together and divide by two, then compare the two averaged readings.

- b. Install both purge lines / plugs.
- c. The throttle body is not synchronized if the difference in readings between each side is **AT OR ABOVE** 1.5 inches Hg.
- d. Replace the throttle body.

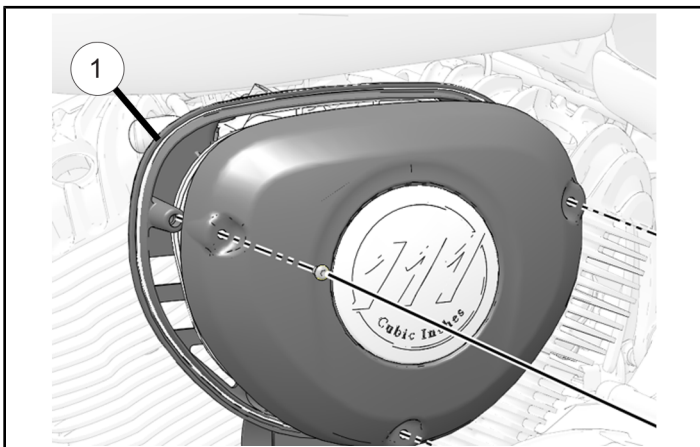
JUNCTIONS OR SEAL POINTS

If the intake has a leak and the engine is receiving air that was not accounted for in the throttle body, it can cause an engine to run lean, causing an engine to run poorly or misfire.

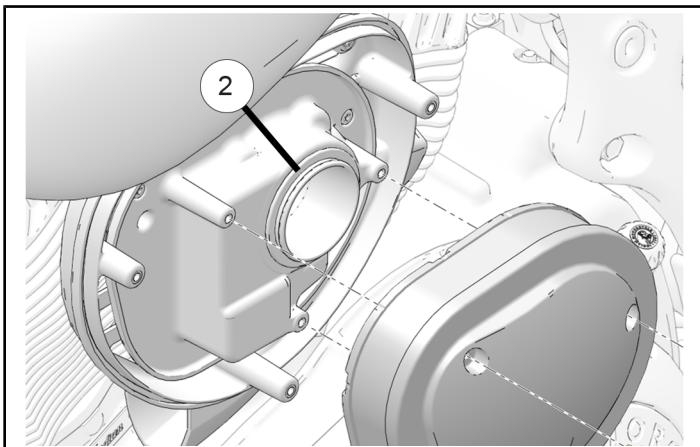
Check for leaks on the intake system by spraying starting fluid on junctions or seal points of the intake while the engine is idling, and check for engine speed changes. See the following images for specific locations.

THUNDERSTROKE (CHIEFTAIN, ROADMASTER, SPRINGFIELD, CHIEF)

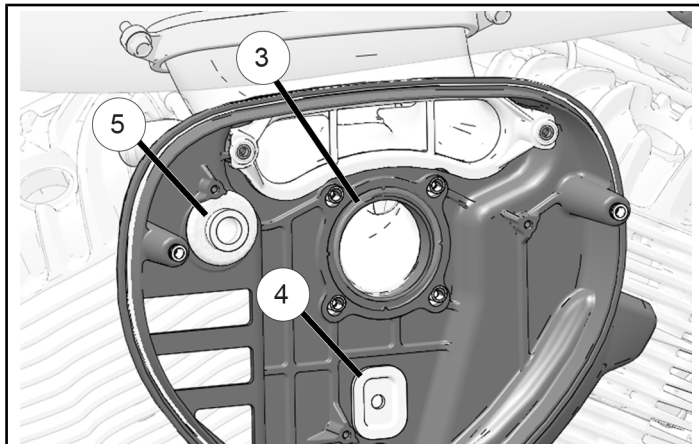
Airbox base and airbox cover seal ①.



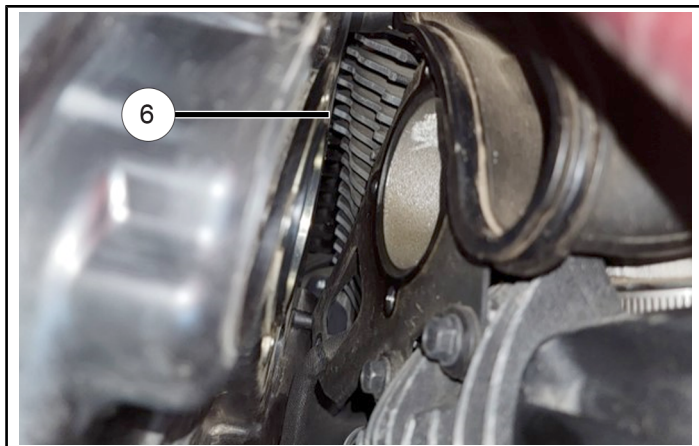
Seal ② on the air filter retainer plate and throttle body.



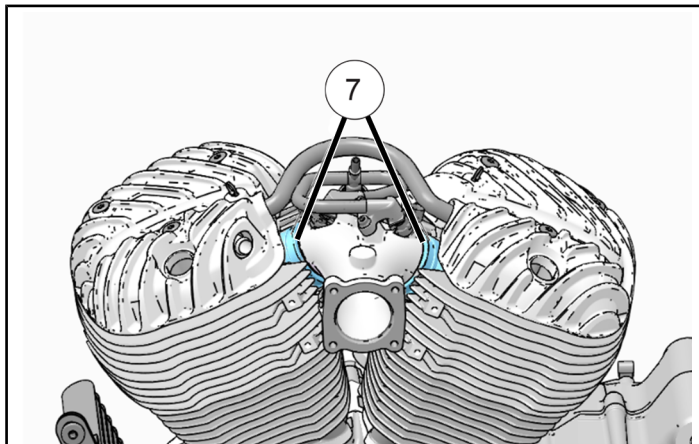
O-ring between the throttle body and airbox base ③, throttle body wire harness grommet ④, and breather hose ⑤.



Gasket ⑥ in between the airbox base and the intake manifold.

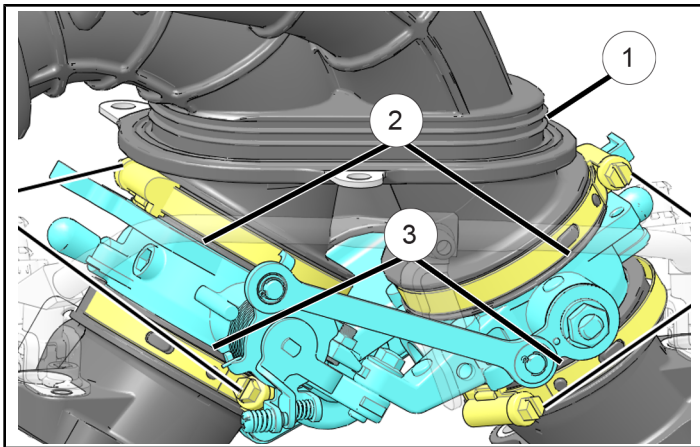


The back of the flange ⑦ between the intake manifold and the cylinder.



POWERPLUS (CHALLENGER AND PURSUIT)

Air intake adaptor on the motorcycle frame ①, air intake adaptor on the top of the throttle body ②, and air intake adaptor at the base of the throttle body ③ and where the intake manifolds meet the cylinder heads.



FUEL

A restriction in fuel flow may cause an engine to run poorly or misfire. Like in the Intake section, it can cause an engine to run lean. All engines by Indian Motorcycle are high compression engines. This means that the required fuel must be a higher octane.

FRESH FUEL

Make sure the motorcycle has the correct fuel of 91 Octane. If the fuel is suspected to be incorrect, old, contaminated or there are any doubts of it's quality, drain the fuel tank and add the correct fuel.

FUEL FILTER

Inspect and confirm the fuel filter is clean and not contaminated from previous poor fuel. Replace the fuel filter as needed.

The fuel filter may need to be replaced more frequently than the recommended maintenance period if it is old, contaminated, or oxygenated fuels are used.

FUEL PUMP

1. Check and document fuel pressure in each of the following positions. Verify the value is within the following specifications.

ENGINE	NORMAL FUEL PRESSURE	MINIMUM FUEL PRESSURE
Thunderstroke 111 and 116	58 psi (400 kPa)	54 psi (372 kPa)
PowerPlus 108	58 psi (400 kPa)	51 psi (352 kPa)

2. Start and run the motorcycle.
3. Record the fuel pressure.
4. Turn off the motorcycle and record the fuel pressure after 15 seconds.
5. Let the motorcycle sit for 10 minutes, then record the fuel pressure.

NOTICE

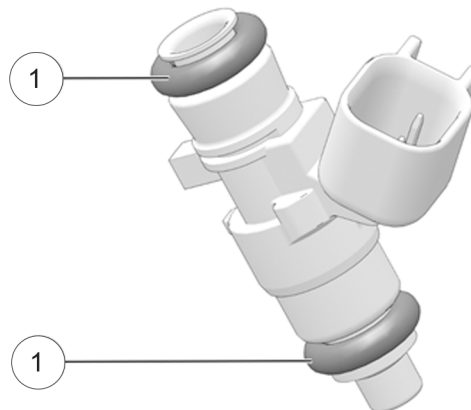
It is expected to see less than a 10 psi drop from the 15 seconds shut down pressure to the 10-minute mark pressure.

FUEL INJECTORS

1. Verify injectors are correct.

NOTICE

Replace O-rings ① anytime injectors are removed. Confirm the old O-ring remained on the injector, not in the manifold, when removed.



Thunderstroke Only (Chieftain, Roadmaster, Springfield, Chief): Stage kit injectors (116 STG2 only) have a **white** dot on them indicating they are for the stage configuration.

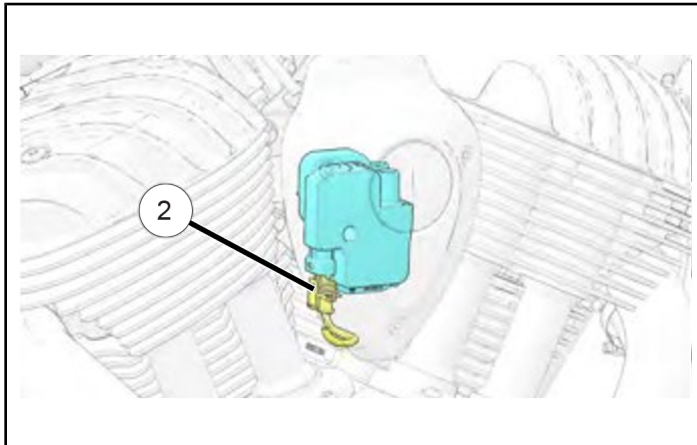
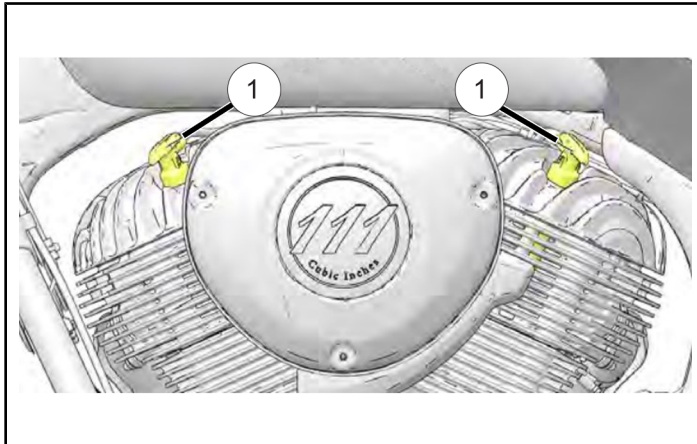
2. Test the resistance of the fuel injectors. Verify the resistance value is within the following specifications.

ENGINE	RESISTANCE THRESHOLD
Thunderstroke 111 and 116, and PowerPlus 108	11.4 - 12.6 Ω

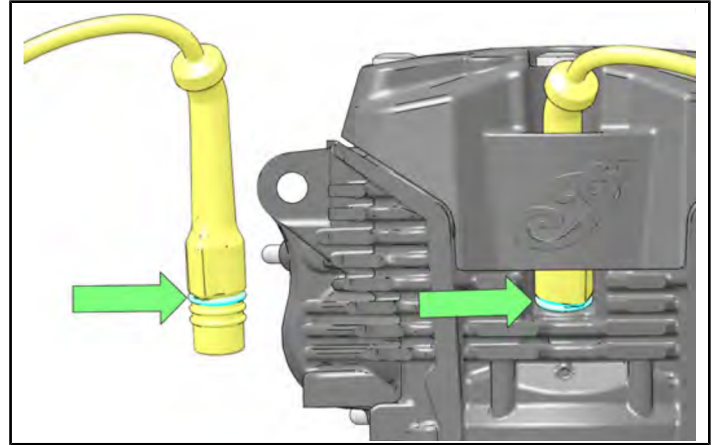
IGNITION

If an ignition system is not providing voltage when it is required on the power stroke, it can cause the engine to run poorly or misfire. Spark plugs may cause an engine to run poorly or misfire if the porcelain is cracked, causing the charge from the coils to escape, or if they are fouled out meaning the center and ground electrodes can no longer allow electricity to arc across. The ignition wires, if not seated properly, will also cause misfires if the power from the coils cannot reach the spark plugs. If a coil can no longer create the voltage needed to arc the spark plug, it will cause an engine to run poorly or misfire.

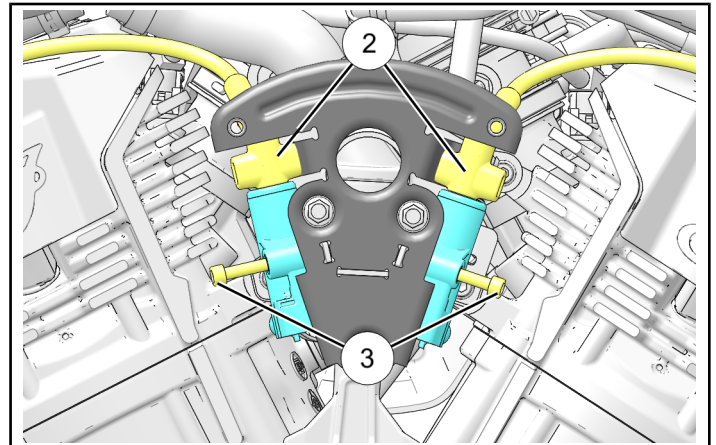
Thunderstroke (Chieftain, Roadmaster, Springfield, Chief) spark plug ① and coil ②.



PowerPlus (Challenger and Pursuit) ignition wire on the spark plug.



PowerPlus (Challenger and Pursuit) ignition wire on the coil.



SPARK PLUGS

1. Inspect spark plugs.



2. If the spark plugs are in poor condition, replace them, and then inspect other systems on the motorcycle that may attribute to the poor condition of the spark plugs.
3. Confirm the correct spark plugs are installed, and gapped and torqued to specification.

ENGINE	SPARK PLUG	SPARK PLUG GAP	TORQUE
Thunderstroke 111 and 116	NGK DCPR8E	.034 in (0.9 mm)	13 ft-lbs (17 N·m)
PowerPlus 108	NGK LZMAR8-AI-1	.039 in (1.0 mm)	84 in-lbs (10 N·m)

4. Confirm the ignition wires are seated firmly on the spark plugs and coils.

IGNITION WIRE

Perform an ignition wire resistance test. Confirm the value is within the following specification.

ENGINE	RESISTANCE THRESHOLD
Thunderstroke 111 and 116	7300Ω +/- 15%
PowerPlus 108	

PRIMARY COIL

Perform a primary coil resistance test. Confirm the values are within the following specifications. When measuring low resistance values, remember to subtract the resistance of the meters leads.

ENGINE	RESISTANCE THRESHOLD
Thunderstroke 111 and 116	0.4 - 0.6 Ω
PowerPlus 108	0.58Ω ± 10%

SECONDARY COIL

Perform a secondary coil resistance test. Confirm the values are within the following specifications.

ENGINE	RESISTANCE THRESHOLD
Thunderstroke 111 and 116	2.0 - 2.5 Volts DC
PowerPlus 108	9.6 kΩ

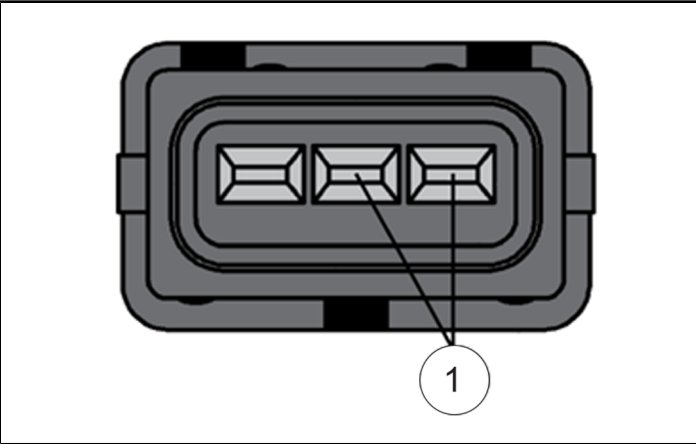
SENSORS

If a faulty sensor exists on an engine, it may affect engine performance and cause the ECM to not use the correct parameters when the engine is running, resulting in poor runability or misfires.

CRANKSHAFT POSITION SENSOR

- 1. Using a multimeter, measure the resistance.

ENGINE	RESISTANCE
Thunderstroke 111 and 116	1050Ω +/- 10% @ 20°C (68°F)
PowerPlus 108	



- 2. If the resistance measured is incorrect, check to see that the sensor is mounted properly, and that the tone wheel has not been damaged and is securely mounted to the crankshaft assembly.

TMAP SENSOR

The TMAP sensor monitors atmospheric pressure, intake air temperature, and engine load for closed loop feedback to the ECM.

Swap the TMAP sensor with either a new or known working sensor to determine if that improves overall runability.

COMPRESSION

If the compression of an engine is too low in either one or both cylinders, it can cause the engine to not run as efficiently as designed and vary the timing of the engine enough to cause running issues. If the compression is too high, it can cause starting issues like the starter not being able to turn over the engine.

- 1. Using a compression tester, measure the compression of both cylinders.

Compression values higher than the values in the table below mean the decompression system may not be functioning properly. This could cause the starter to not be able to turn the engine over or make it very difficult/slow to turn over. Low compression values can be caused by multiple internal engine components. Some examples are excessive blow-by past worn piston and rings or the intake or exhaust valves not sealing properly.

NOTICE

Small variance between cylinders is to be expected.

ENGINE	COMPRESSION THRESHOLD
Thunderstroke 111	90 - 110 psi (621 - 758 kPa) (service limit 80 psi (552 kPa))
Thunderstroke 116	110 - 130 psi (758 - 896 kPa) (service limit 87 psi (600 kPa))
PowerPlus 108	88 - 115 psi (607 - 793 kPa)

EXHAUST

Exhaust leaks can cause engine misfires. Depending on the location of the leak it can give O2 sensors incorrect readings, causing the engine to run less efficiently. An exhaust leak can also cause decreased engine performance and cause internal engine damage as the exhaust temperature is actually raised and can burn valves and valve seats, leading to low compression and high leak down past the exhaust valve if not addressed in a timely manner. A loss of pressure in the system can create a loss of power output.

Check for any exhaust leaks. **Common indicators of exhaust leaks:**

- Discoloration on the exhaust pipes, including bluing and scorch marks.
- Decreased power and acceleration.
- Higher-than-normal exhaust noise levels when running the motorcycle. Sometimes these noises can be confused as a ticking noise from the top end of the engine.
- A burning smell could be from exhaust gases burning the materials surrounding the exhaust.

Modified exhaust, catalytic converter deletion, can create changes in back pressure and have the same negative effect as an exhaust leak. Changes that affect EPA regulations prevent Indian Motorcycle technical service from providing diagnostic support to the dealer network.