



## **2020-2022 Indian Challenger / Pursuit Service Manual**

### **FOREWORD**

The information printed within this publication includes the latest product information at time of print. The most recent version of this Service Manual is available in electronic format at [www.polarisdealers.com](http://www.polarisdealers.com).

This Service Manual is designed primarily for use by certified Indian Motorcycle Master Service Dealer® technicians in a properly equipped shop and should be kept available for reference. All references to left and right side of the vehicle are from the operator's perspective when seated in a normal riding position.

Some procedures outlined in this manual require a sound knowledge of mechanical theory, tool use, and shop procedures in order to perform the work safely and correctly. Technicians should read the text and be familiar with the service procedures before starting any repair. Certain procedures require the use of special tools. Use only the proper tools as specified. If you have any doubt as to your ability to perform any of the procedures outlined in this Service Manual, contact an authorized dealer for service.

We value your input and appreciate any assistance you can provide in helping make these publications more useful. Please provide any feedback you may have regarding this manual. Authorized dealers can submit feedback using 'Ask Polaris'. Click on 'Ask Polaris', and then click on 'Service Manual / Service Literature Question'.

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## **SAFETY WARNINGS**

The following signal words and symbols appear throughout this manual and on the vehicle. Your safety is involved when these words and symbols are used. Become familiar with their meanings before reading the manual.

### **DANGER**

DANGER indicates a hazardous situation which, if not avoided, **WILL** result in death or serious injury.

### **WARNING**

SAFETY ALERT WARNING indicates a hazardous situation which, if not avoided, **COULD** result in death or serious injury.

### **CAUTION**

SAFETY ALERT CAUTION indicates a hazardous situation which, if not avoided, **COULD** result in minor to moderate injury.

### *NOTICE*

NOTICE provides key information by clarifying instructions.

### **IMPORTANT**

IMPORTANT provides key reminders during disassembly, assembly and inspection of components.

## TRADEMARKS

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Some Indian Motorcycle factory publications can be downloaded from [www.polarisindustries.com](http://www.polarisindustries.com), purchased from [www.purepolaris.com](http://www.purepolaris.com) or by contacting the nearest Indian Motorcycle dealer.

## REVISION INDEX 9940277

REV	DATE	CHANGES
R01	12/30/2021	Initial Release
R02	2/22/2022	Pursuit Content Added
R03	4/28/2022	Updated Engine Compression Test Updated Engine Compression Test (Wet) Updated Engine Compression Specification Updated Wiring Diagrams
R04	6/7/2022	Elite Models Added

## Feedback Form - Service Manual (9940277)

A feedback form has been created for the technician or consumer to provide Indian Motorcycle with an overall satisfaction rating for this service manual, provide comments on your experience or upload pictures/video. This feedback form is viewable on a mobile device by scanning the QR code or by clicking **HERE** if viewing this document electronically.



# **2020-2022 Indian Challenger / Pursuit**

## Service Manual

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# CHAPTER 1

## GENERAL / SPECIFICATIONS

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GENERAL / SPECIFICATIONS

**VEHICLE INFORMATION**  
**MODEL NUMBER DESIGNATION**

Example: N21LCACCA1

GRP	MY	TYPE	MODEL	LINE	DISP	NET BRAKE HP	MARKET CONFIG	COLOR
1st digit	2nd/ 3rd digit	4th digit*	5th digit*	6th digit*	7th digit*	8th digit	9th digit**	10th digit
N= Indian Motorcycle	20= 2020 21= 2021	L= Touring (Liquid Cooled)	C=CMF Bagger	A=Limited (w/ ABS) B=Standard (w/ ABS) D=Dark (w/ ABS) E=Limited Edition (w/ABS)	R= 1768cc (108ci) Legend	C = 122 HP (91 kW)	A = 49 State (49S) B = 50 State (50S) C = Canadian (CAN) E = EU (WVTA) J= Japan (JPN) K = Braxil CKD (BRZ) X = China (XNA)	A = Thunder Black G = Willow Green / Cream H = Black Smoke L = Bronze Smoke R = Indian Red T = Brilliant Blue W = Pearl White X = Steel Gray Z = Unpainted 1= Thunder Black Pearl 2= Deep Water Metallic 3= Indian Red Pearl 4= Sandstone Smoke 5=Red Blaze
* = digits that would transfer to 17 digit VIN and are used in digits 4–8 respectively. ** = 9th digit will be used on color / featured versions of models (not including base). First 3 digits and 9th digit are used in model number only. They are not used with the 17 digit VIN.								

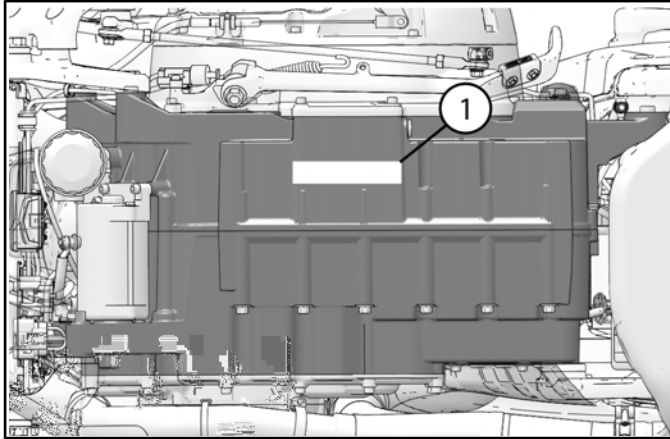
**VEHICLE IDENTIFICATION NUMBER (VIN) DESIGNATION**

Example: 56KTCAA0E3000024

World Mfg. ID			Vehicle Descriptors						Vehicle Identifiers							
			Chassis	Type	Disp	HP	Series	Check Digit	MY*	Mfg	Individual Serial No.					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
5	6	K	C	C	A	A	A	0	E	3	0	0	0	0	0	0
* Model Year: L = 2020																

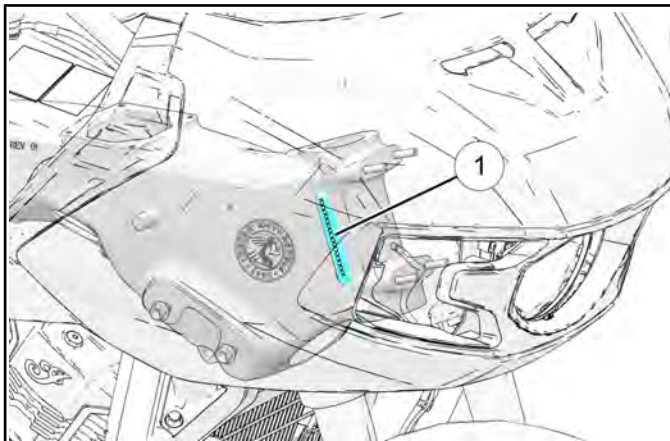
### ENGINE NUMBER LOCATION

The engine number ① is stamped into the bottom of the LH engine case.. The stamping identifies the engine model and serial number.



### VIN / PIN LOCATION

The vehicle identification number (VIN) ① is stamped on the right side of the steering head.



### MANUFACTURER LABEL

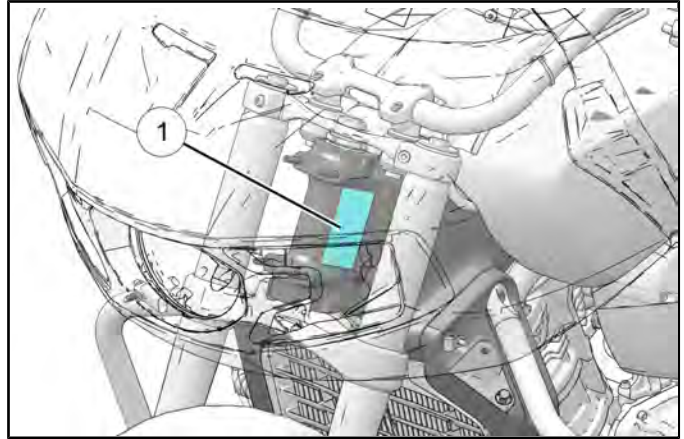
The manufacturer label ① located on the left side of the steering head contains the following information:

Vehicle Identification Number / Product Identification Number (VIN / PIN)

Gross Vehicle Weight Rating (GVWR)

Gross Axle Weight Rating (GAWR)

Tire Type and Load Information.



### TIRE INFORMATION LABEL

See **Manufacturer Label page 1.3** for tire information.



GENERAL / SPECIFICATIONS

**GENERAL SPECIFICATIONS**  
**2020 MODEL SPECIFICATIONS**

YEAR	MODEL NUMBERS	PAINT COLOR / CODE	MODEL IMAGE
<b>Dark Horse</b>	N20LCDRRA4 N20LCDRRAH N20LCDRRB4 N20LCDRRBH N20LCDRRBL N20LCDRRC4 N20LCDRRCH N20LCDRRCL N20LCDRRE4 N20LCDRREL N20LCDRRAL N20LCDRREH N20LCDRRA4	Thunder Black Smoke = P-463 White Smoke = P-675 Sandstone Smoke = P-773	
<b>Base</b>	N20LCBRRAT N20LCBRRBT N20LCBRRCT N20LCBRRET	Titanium Metallic = P- 653	
<b>Deluxe</b>	N20LCARRA1 N20LCARRB1 N20LCARRC1 N20LCARRA2 N20LCARRB2 N20LCARRC2 N20LCARRA5 N20LCARRB5 N20LCARRC5 N20LCARRE1 N20LCARRE2 N20LCARRE5	Thunder Black Pearl = P-666 Deep Water Metallic = P-727 Ruby Metallic = P-759	

GENERAL / SPECIFICATIONS

MODEL 2020	BASE	DARK HORSE	PREMIUM
<b>DIMENSIONS</b>			
Overall Length	98.5 in (2500.7 mm)		
Overall Width	39 in (990.2 mm)		
Overall Height	53 in (134.6 mm)		
Unladen Seat Height	26.5 in (672 mm)		
Wheelbase	65.7 in (1667.8 mm)		
Ground Clearance	5.4 in (137.3 mm)		
Rake (Frame)/Trail	25 Degrees		
<b>WEIGHT</b>			
Dry Weight (without Fuel/ Fluids)	796 lbs (361 kg)		805 lbs (365 kg)
Wet Weight (with Fuel/ Fluids)	831 lbs (377 kg)		840 lbs (381 kg)
Gross Vehicle Weight Rating (GVWR)	1385 lbs (628 kg)		
<b>CAPACITIES</b>			
Radiator Coolant	2.4 qts (2.3 L)		
Engine Oil	<b>5.0 qts (4.7 L)</b>		
Fuel (Total Usable)	6.0 gal (22.7 l)		
Fuel Reserve (fuel light on)	1.0 gal (3.8 l)		
<b>WHEELS / TIRESr</b>			
Front Wheel Size / Type	19" x 3.5" Cast		
Rear Wheel Size / Type	16" x 5" Cast		
Front Tire Type / Size	130/60B19 66H / Metzeler Cruisetec		
Rear Tire Type / Size	180/60R16 80H (I) / Metzeler Cruisetec		
Tire Pressures	<b>Front: 36 psi (248 kPa) Rear: 41 psi (283 kPa)</b>		
<b>CHASSIS</b>			
Front Suspension Type / Travel	Inverted Telescopic Fork / 5.12" (130 mm)		
Front Suspension Diameter	43 mm		
Rear Suspension Type / Travel	Single shock with hydraulic adjuster / 4.5" (114 mm)		
Front Brakes	Dual / 320 mm Semi-floating Rotor / 4 Piston Caliper		
Rear Brakes	Single / 298 mm Floating Rotor / 2 Piston Caliper		




MODEL 2020	ALL MODELS
<b>ENGINE</b>	
Engine Type	Power Plus 108
Displacement	108 cid (1768 cc)
Compression Ratio	11.0:1
Valve Train	4 Valves per cylinder, SOHC, Hydraulic lifters
Bore and Stroke	108 mm x 96.5 mm



## GENERAL / SPECIFICATIONS

Fuel System / Throttle Body Bore	Closed loop fuel injection / 52 mm dual bore
Exhaust System	Two O2 sensors, one each bank, single three-way catalyst
Rev Limit	6500 RPM
Idle RPM	850 RPM +/- 50 RPM
Lubrication System	Semi-Dry Sump
Spark Plug Type Spark Plug Gap	NGK LZMAR8AI-1 0.039 in (1.0 mm)
Thermostat Opening	Starts to open at 82° C (+/- 2°) Fully open at 95° C
Cooling Fan	Turns on at 98° C Turns off at 94° C
<b>DRIVETRAIN</b>	
Primary drive	Gear Drive Wet Clutch
Crank Gear	55 Tooth
Clutch Gear	86 Tooth
Clutch Type	Wet, Multi-Plate, Assist
Primary Reduction Ratio	1.564:1
Transmission Type	6 Speed / Constant Mesh / Foot Shift
1st Gear Ratio	2.733:1
2nd Gear Ratio	1.864:1
3rd Gear Ratio	1.385:1
4th Gear Ratio	1.103:1
5th Gear Ratio	0.943:1
6th Gear Ratio	0.811:1
Gear Shift Pattern	1 Down / 5 Up
Final Drive Type	Belt Drive , 152 Tooth
Final Drive Ratio	2.379:1
Overall Gear Ratio	
1st Gear	10.169:1
2nd Gear	6.933:1
3rd Gear	5.151:1
4th Gear	4.105:1
5th Gear	3.508:1
6th Gear	3.017:1

**2021 MODEL SPECIFICATIONS**

YEAR	MODEL NUMBERS	PAINT COLOR / CODE	MODEL IMAGE
<b>Dark Horse</b>	N21LCDRRAH N21LCDRRAW N21LCDRRA4 N21LCDRRBH N21LCDRRBW N21LCDRRB4 N21LCDRRCH N21LCDRRCW N21LCDRRC4 N21LCDRREH N21LCDRREW N21LCDRRE4 N21LCDRRJH N21LCDRRJW N21LCDRRJ4	Thunder Black Smoke = P-463 White Smoke = P-675 Bronze Smoke = P-731	
<b>Base</b>	N21LCBRRAA N21LCBRRAT N21LCBRRBA N21LCBRRBT N21LCBRRCA N21LCBRRCT N21LCBRRFA N21LCBRRJ N21LCBRRJA N21LCBRRJT	Thunder Black Pearl = P-666 Titanium Metallic = P- 653	
<b>Premium</b>	N21LCARRAA N21LCARRA2 N21LCARRA5 N21LCARRBA N21LCARRB2 N21LCARRB5 N21LCARRCA N21LCARRC2 N21LCARRC5 N21LCARREA N21LCARRE2 N21LCARRE5 N21LCARRJA N21LCARRJ2 N21LCARRJ5	Thunder Black Pearl = P-666 Deep Water Metallic = P-727 Ruby Metallic = P-759	



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## GENERAL / SPECIFICATIONS

MODEL 2021	BASE	DARK HORSE	PREMIUM
<b>DIMENSIONS</b>			
Overall Length	98.5 in (2500.7 mm)		
Overall Width	39 in (990.2 mm)		
Overall Height	53 in (134.6 mm)		
Unladen Seat Height	26.5 in (672 mm)		
Wheelbase	65.7 in (1667.8 mm)		
Ground Clearance	5.4 in (137.3 mm)		
Rake (Frame)/Trail	25 Degrees		
<b>WEIGHT</b>			
Dry Weight (without Fuel/ Fluids)	796 lbs (361 kg)	805 lbs (365 kg)	
Wet Weight (with Fuel/ Fluids)	831 lbs (377 kg)	840 lbs (381 kg)	
Gross Vehicle Weight Rating (GVWR)	1385 lbs (628 kg)		
<b>CAPACITIES</b>			
Radiator Coolant	2.4 qts (2.3 L)		
Engine Oil	<b>5.0 qts (4.7 L)</b>		
Fuel (Total Usable)	6.0 gal (22.7 l)		
Fuel Reserve (fuel light on)	1.0 gal (3.8 l)		
<b>WHEELS / TIRES</b>			
Front Wheel Size / Type	19" x 3.5" Cast		
Rear Wheel Size / Type	16" x 5" Cast		
Front Tire Type / Size	130/60B19 66H / Metzeler Cruisetec		
Rear Tire Type / Size	180/60R16 80H (I) / Metzeler Cruisetec		
Tire Pressures	<b>Front: 36 psi (248 kPa) Rear: 41 psi (283 kPa)</b>		
<b>CHASSIS</b>			
Front Suspension Type / Travel	Inverted Telescopic Fork / 5.12" (130 mm)		
Front Suspension Diameter	43 mm		
Rear Suspension Type / Travel	Single shock with hydraulic adjuster / 4.5" (114 mm)		
Front Brakes	Dual / 320 mm Semi-floating Rotor / 4 Piston Caliper		
Rear Brakes	Single / 298 mm Floating Rotor / 2 Piston Caliper		

MODEL 2021	ALL MODELS
<b>ENGINE</b>	
Engine Type	Power Plus 108
Displacement	108 cid (1768 cc)
Compression Ratio	11.0:1
Valve Train	4 Valves per cylinder, SOHC, Hydraulic lifters
Bore and Stroke	108 mm x 96.5 mm

GENERAL / SPECIFICATIONS

Fuel System / Throttle Body Bore	Closed loop fuel injection / 52 mm dual bore
Exhaust System	Two O2 sensors, one each bank, single three-way catalyst
Rev Limit	6500 RPM
Idle RPM	900 RPM +/- 50 RPM
Lubrication System	Semi-Dry Sump
Spark Plug Type Spark Plug Gap	NGK LZMAR8AI-1 0.039 in (1.0 mm)
Thermostat Opening	Starts to open at 82° C (+/- 2°) Fully open at 95° C
Cooling Fan	Turns on at 98° C Turns off at 94° C
<b>DRIVETRAIN</b>	
Primary drive	Gear Drive Wet Clutch
Crank Gear	55 Tooth
Clutch Gear	77 Tooth
Clutch Type	Wet, Multi-Plate, Assist
Primary Reduction Ratio	1.564:1
Transmission Type	6 Speed / Constant Mesh / Foot Shift
1st Gear Ratio	2.733:1
2nd Gear Ratio	1.864:1
3rd Gear Ratio	1.385:1
4th Gear Ratio	1.103:1
5th Gear Ratio	0.943:1
6th Gear Ratio	0.811:1
Gear Shift Pattern	1 Down / 5 Up
Final Drive Type	Belt Drive , 152 Tooth
Final Drive Ratio	2.379:1
Overall Gear Ratio	
1st Gear	10.169:1
2nd Gear	6.933:1
3rd Gear	5.151:1
4th Gear	4.105:1
5th Gear	3.508:1
6th Gear	3.017:1



**2022 MODEL SPECIFICATIONS**

YEAR	MODEL NUMBERS		PAINT COLOR / CODE	MODEL IMAGE
<b>Dark Horse</b>	N22LCCRRAH N22LCCRRBH N22LCCRRCH N22LCCRREH N22LCCRRJH N22LCCRRAF N22LCCRRBF N22LCCRRCF N22LCCRREF N22LCCRRJF N22LCCRAA1 N22LCCRRB1 N22LCCRRC1 N22LCCRRE1 N22LCCRRJ1	N22LCCRRAW N22LCCRRBW N22LCCRRCW N22LCCRREW N22LCCRRJW N22LCCRAK N22LCCRRBK N22LCCRRCCK N22LCCRREK N22LCCRRJK N22LCCRAA3 N22LCCRRB3 N22LCCRRC3 N22LCCRRE3 N22LCCRRJ3	Indy Red / Black Metallic = P- 293 Black Smoke = P-866 Bronze Smoke = P-831 Stealth Gray Azure Crystal = P-834 Riot Orange Smoke = P-871 Storm Blue / Black Metallic = P-849	
<b>Base</b>	N22LCBRRAA N22LCBRRBA N22LCBRRCA N22LCBRREA N22LCBRRJA	N22LCBRRAT N22LCBRRBT N22LCBRRCT N22LCBRREA N22LCBRRJT	Black Metallic = P-800 Titanium Smoke = P-632	
<b>Limited</b>	N22LCARRAA N22LCARRBA N22LCARRCA N22LCARREA N22LCARRJA N22LCARRAM N22LCARRBM N22LCARRCM N22LCARREM N22LCARRJM	N22LCARRA2 N22LCARRB2 N22LCARRC2 N22LCARRE2 N22LCARRJ2 N22LCERRA5 N22LCERRB5 N22LCERRC5 N22LCERRE5 N22LCERRJ5	Black Metallic = P-800 Maroon Metallic = P-711 Spirit Blue Metallic = P-694 Indy Red / Stealth Gray = P- 293	
<b>Elite</b>	N22LCERRA5 N22LCERRB5 N22LCERRC5 N22LCERRE5 N22LCERRJ5		Stealth Gray / Onyx Black = P-2049 Stealth Gray = P-804 Onyx Black = P-800	

YEAR	MODEL NUMBERS		PAINT COLOR / CODE	MODEL IMAGE
<b>Pursuit Dark Horse</b>	N22LDDRRAH	N22LDDRRAC	Onyx Black Smoke = P-866 Spirit Blue = P-872 Silver Quartz Smoke = P-870 Ruby Metallic = P-759	
	N22LDDRRBH	N22LDDRRBC		
	N22LDDRRCH	N22LDDRRCC		
	N22LDDRREH	N22LDDRREC		
	N22LDDRRJH	N22LDDRRJC		
	N22LDDRRAB	N22LDDRRA8		
	N22LDDRRBB	N22LDDRRB8		
	N22LDDRRCB	N22LDDRRC8		
	N22LDDRREB	N22LDDRRE8		
	N22LDDRRJB	N22LDDRRJ8		
<b>Pursuit Limited</b>	N22LDGRRJD	N22LDGRRJ6	Onyx Black Metallic = P-800 Alumina Jade = P-822 Maroon Metallic = P-759 Deepwater Metallic = P-727	
	N22LDGRRAA	N22LDGRR9		
	N22LDGRRBA	N22LDGRRB9		
	N22LDGRRCA	N22LDGRRC9		
	N22LDGRREA	N22LDGRRE9		
	N22LDGRRJA	N22LDGRRJ9		
	N22LDGRR6	N22LDGRRAD		
	N22LDGRRB6	N22LDGRRBD		
	N22LDGRR6	N22LDGRRCD		
	N22LDGRRE6	N22LDGRRED		
<b>Pursuit Dark Horse with Premium Package</b>	N22LDFRRAH	N22LDFRRAC	Onyx Black Smoke = P-866 Spirit Blue = P-872 Silver Quartz Smoke = P-870 Ruby Metallic = P-759	
	N22LDFRRBH	N22LDFRRBC		
	N22LDFRRCH	N22LDFRRCC		
	N22LDFRREH	N22LDFRREC		
	N22LDFRRJH	N22LDFRRJC		
	N22LDFRRAB	N22LDFRRA8		
	N22LDFRRBB	N22LDFRRB8		
	N22LDFRRCB	N22LDFRRC8		
	N22LDFRREB	N22LDFRRE8		
	N22LDFRRJB	N22LDFRRJ8		
<b>Pursuit Limited with Premium Package</b>	N22LDHRRAA	N22LDHRR9	Onyx Black Metallic = P-800 Alumina Jade = P-822 Maroon Metallic = P-759 Deepwater Metallic = P-727	
	N22LDHRRBA	N22LDHRRB9		
	N22LDHRRCA	N22LDHRRC9		
	N22LDHRR6	N22LDHRR6		
	N22LDHRRJA	N22LDHRRJ9		
	N22LDHRR6	N22LDHRRAD		
	N22LDHRRB6	N22LDHRRBD		
	N22LDHRR6	N22LDHRRCD		
	N22LDHRR6	N22LDHRR6		
	N22LDHRRJ6	N22LDHRRJ6		

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## GENERAL / SPECIFICATIONS

MODEL 2022	BASE	DARK HORSE	LIMITED	PURSUIT	PURSUIT PREMIUM
<b>DIMENSIONS</b>					
Overall Length	98.5 in (2501 mm)			102.7 in (2608.7 mm)	
Overall Width	39 in (990 mm)				
Overall Height	53 in (134.6 mm)			56.8 in (1444 mm)	
Unladen Seat Height	26.5 in (672 mm)				
Wheelbase	65.7 in (1667.8 mm)				
Ground Clearance	5.4 in (137.3 mm)				
Rake (Frame)/ Trail	25 Degrees				
<b>WEIGHT</b>					
Dry Weight (without Fuel/ Fluids)	796 lbs (361 kg)		804 lbs (365 kg)	877 lbs (398 kg)	882 lbs (400 kg)
Wet Weight (with Fuel/Fluids)	831 lbs (377 kg)		840 lbs (381 kg)	912 lbs (413 kg)	917 lbs (416 kg)
Gross Vehicle Weight Rating (GVWR)	1385 lbs (628 kg)				
<b>CAPACITIES</b>					
Radiator Coolant	2.4 qts (2.3 L)				
Engine Oil	<b>5.0 qts (4.7 L)</b>				
Fuel (Total Usable)	6.0 gal (22.7 l)				
Fuel Reserve (fuel light on)	1.0 gal (3.8 l)				
<b>WHEELS / TIRES</b>					
Front Wheel Size / Type	19" x 3.5" Cast				
Rear Wheel Size / Type	16" x 5" Cast				
Front Tire Type / Size	130/60B19 66H / Metzeler Cruisetec				
Rear Tire Type / Size	180/60R16 80H (I) / Metzeler Cruisetec				
Tire Pressures	<b>Front: 36 psi (248 kPa) Rear: 41 psi (283 kPa)</b>				
<b>CHASSIS</b>					
Front Suspension Type / Travel	Inverted Telescopic Fork / 5.12" (130 mm)				
Front Suspension Diameter	43 mm				
Rear Suspension Type / Travel	Single shock with hydraulic adjuster / 4.5" (114 mm)			Single Shock with electronically controlled adjuster / 4.5" (114 mm)	
Front Brakes	Dual / 320 mm Semi-floating Rotor / 4 Piston Caliper				
Rear Brakes	Single / 298 mm Floating Rotor / 2 Piston Caliper				

GENERAL / SPECIFICATIONS

MODEL 2022	ALL MODELS
<b>ENGINE</b>	
Engine Type	Power Plus 108
Displacement	108 cid (1768 cc)
Compression Ratio	11.0:1
Valve Train	4 Valves per cylinder, SOHC, Hydraulic lifters
Bore and Stroke	108 mm x 96.5 mm
Fuel System / Throttle Body Bore	Closed loop fuel injection / 52 mm dual bore
Exhaust System	Two O2 sensors, one each bank, single three-way catalyst
Rev Limit	6500 RPM
Idle RPM	900 RPM +/- 50 RPM
Lubrication System	Semi-Dry Sump
Spark Plug Type Spark Plug Gap	NGK LZMAR8AI-1 0.039 in (1.0 mm)
Thermostat Opening	Starts to open at 82° C (+/- 2°) Fully open at 95° C
Cooling Fan	Turns on at 98° C Turns off at 94° C
<b>DRIVETRAIN</b>	
Primary drive	Gear Drive Wet Clutch
Crank Gear	55 Tooth
Clutch Gear	77 Tooth
Clutch Type	Wet, Multi-Plate, Assist
Primary Reduction Ratio	1.564:1
Transmission Type	6 Speed / Constant Mesh / Foot Shift
1st Gear Ratio	2.733:1
2nd Gear Ratio	1.864:1
3rd Gear Ratio	1.385:1
4th Gear Ratio	1.103:1
5th Gear Ratio	0.943:1
6th Gear Ratio	0.811:1
Gear Shift Pattern	1 Down / 5 Up
Final Drive Type	Belt Drive , 152 Tooth
Final Drive Ratio	2.379:1
<b>Overall Gear Ratio</b>	
1st Gear	10.169:1
2nd Gear	6.933:1
3rd Gear	5.151:1
4th Gear	4.105:1
5th Gear	3.508:1
6th Gear	3.017:1



## VEHICLE LOADING

### GROSS VEHICLE WEIGHT RATING (GVWR)

 **WARNING**

Exceeding the gross vehicle weight rating of your motorcycle can reduce stability and handling and could cause loss of control. NEVER exceed the gross vehicle weight rating of your motorcycle.

The *maximum load capacity* of your motorcycle is the maximum weight you may add to your motorcycle *without exceeding the GVWR*. This capacity is determined by calculating the difference between your motorcycle's GVWR and wet weight.

Refer to the specification section of this manual or the Manufacturing Information / VIN/PIN label on the motorcycle frame for model-specific information. Refer to Information label section in this manual for location on the motorcycle.

When determining the weight you will be adding to your motorcycle, to ensure you do not exceed the maximum load capacity, include the following:

- operator body weight
- passenger body weight
- weight of all riders' apparel and items in or on apparel
- weight of any accessories and their contents
- weight of any additional cargo on the motorcycle

**PUBLICATIONS & TECHNICAL LITERATURE****PUBLICATIONS PART NUMBERS**

Some Indian Motorcycle publications, such as Owner's Manuals and Parts Books may be available on-line at the Indian Motorcycle website; <http://www.indianmotorcycle.com/>

Service Manuals and Owner's Manuals can be purchased through any authorized Indian motorcycle dealer. The part numbers are listed in the following table.

<b>MODEL YEAR / MARKET</b>	<b>MODEL</b>	<b>SERVICE MANUAL PART NUMBERS</b>	<b>OWNER'S MANUAL PART NUMBERS</b>
2020-2022 Indian Motorcycle Challenger (U.S)	Base	9940277	9940129
	Dark Horse		
	Limited		
2020-2022 Indian Motorcycle Challenger (CAN)	Base	9940277	9940130
	Dark Horse		
	Limited		

## EMMISSIONS INFORMATION

### EMISSION CONTROL SYSTEMS

The U.S. Environmental Protection Agency and California Air Resources Board (CARB) require manufacturers to certify that their motorcycles comply with applicable exhaust emissions standards during their useful life, and that motorcycles built after January 1, 1983 comply with applicable noise emission standards for one year or 6,000 km (3,730 mi) after the time of sale to the ultimate purchaser, when operated and maintained according to the instructions provided.

### EMISSION SOURCES

An internal combustion engine produces carbon monoxide and hydrocarbons during operation. Hydrocarbons must be controlled because under some conditions hydrocarbons react with sunlight to produce photochemical smog. Carbon monoxide must be controlled because it is toxic.

### EXHAUST EMISSION CONTROL

Indian Motorcycles have an electronic engine management system which controls fuel delivery and ignition timing to control hydrocarbon and carbon monoxide emissions. If components are replaced that affect idle speed, no adjustments should be made to the system. The Electronic Fuel Injection (EFI) and Electronic Throttle Control (ETC) systems control idle speed.

### NOISE EMISSION CONTROL

Tampering with Noise Control Systems is Prohibited. Federal law prohibits the following acts or causing thereof:

1. The removal or rendering inoperative by any person other than for purposes of maintenance, repair or replacement, any device or element of design incorporated into the motorcycle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, or
2. The use of the motorcycle after such device or element of design has been removed or rendered inoperative.  
Among those acts presumed to constitute tampering are the acts listed below:
3. Removal of, or puncturing the muffler, baffles, header pipes or any other component which conducts exhaust gases.
4. Removal or puncturing of any part of the intake system.
5. Lack of proper maintenance.

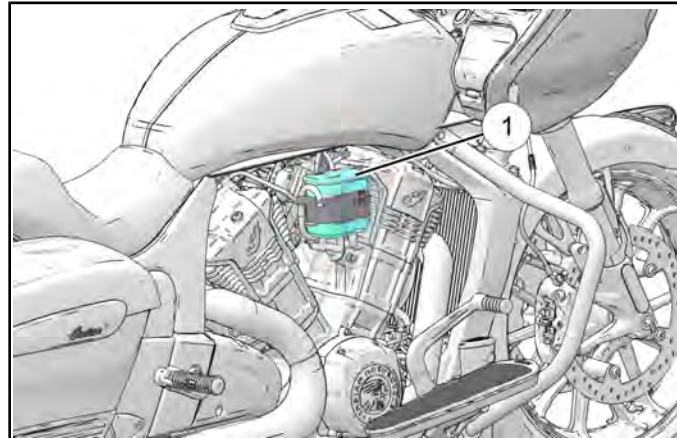
6. Replacing any moving part of the motorcycle or parts of the exhaust / intake system with parts other than those specified by the manufacturer.

### CRANKCASE EMISSION CONTROL

The crankcase emission control system is comprised of a closed system that routes crankcase emissions through the air cleaner into the combustion chamber.

### EVAPORATIVE EMISSION CONTROL (CALIFORNIA AND INTERNATIONAL MODELS)

California and International models are equipped with a carbon canister ①. Activated carbon inside the canister temporarily stores fuel system vapors until the engine is started and the motorcycle is driven. The Electronic Control Module (ECM) automatically opens a Purge Control Valve under certain conditions, and engine intake vacuum draws vapors out of the canister.



## SPECIAL TOOLS USING SPECIAL TOOLS

Special tools have been designed exclusively for servicing the specialized components found on Indian Motorcycles. By using these tools, service technicians can maximize efficiency and minimize the likelihood of causing damage to the motorcycle during service.

### How To Use This Book

The *Special Tools Index* located in this chapter provides a comprehensive list and pictorial representation of the special tools used throughout this service manual. The *Special Tools* section at the beginning of each chapter provides a short list of the tools required to perform procedures specific to that chapter.

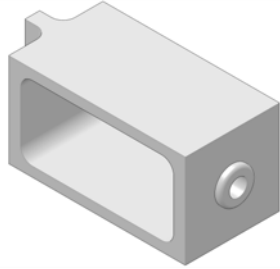


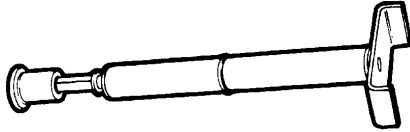
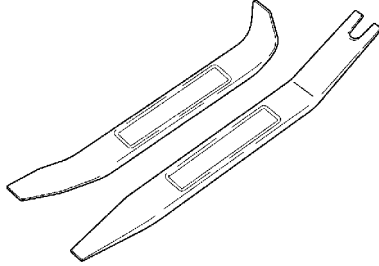
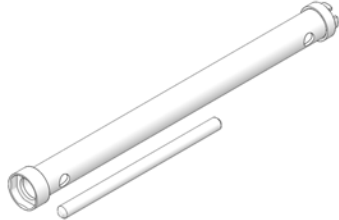
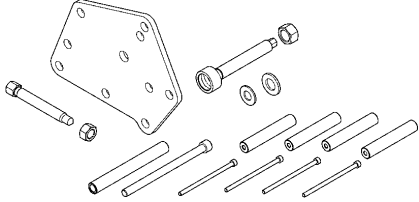
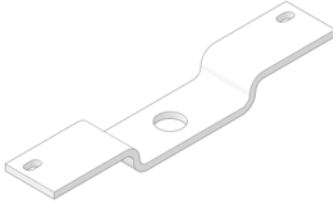
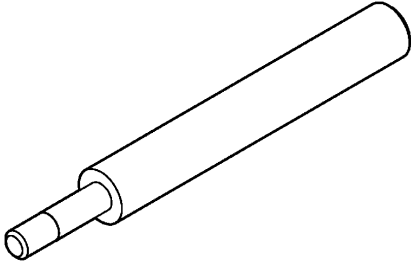



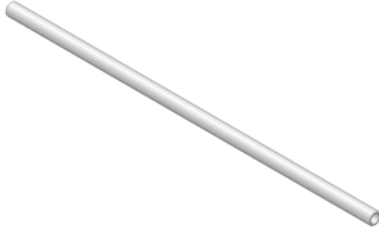

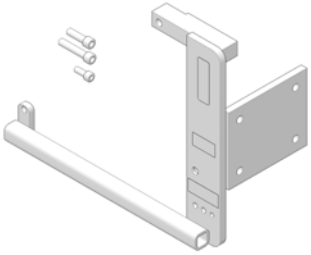

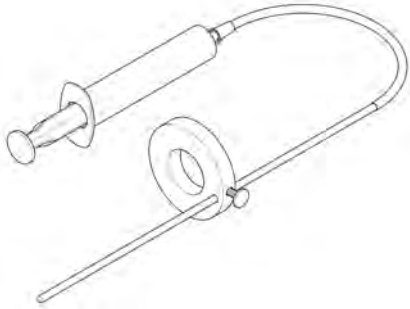
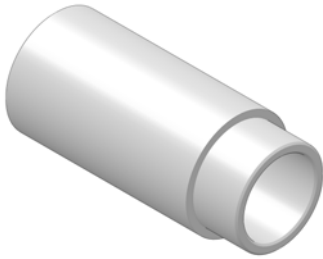
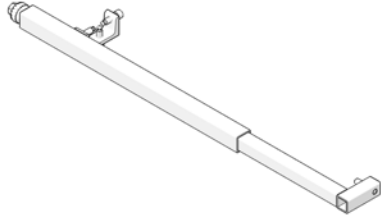
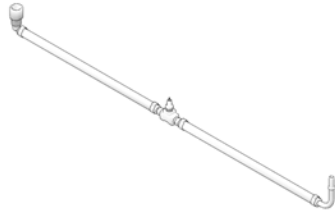
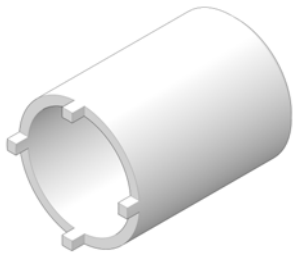
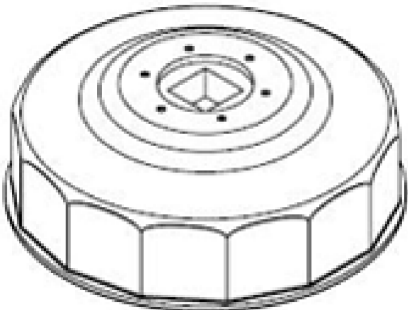

## TOOL ORDERING INFORMATION

Special tools may be required while servicing this vehicle. Some of the tools listed or depicted are mandatory, while other tools may be substituted with a similar tool, if available. Indian Motorcycle recommends use of the Special Tools referenced in the chapters of this service manual when servicing any Indian Motorcycle product. Dealers may order special tools through Indian Motorcycle's official tool supplier, Bosch Automotive Service Solutions, by phone at 1-800-328-6657 or on-line via your dealer website.

The screenshot shows the POLARIS COMPUTERCHECK (DIS) web portal. At the top, there is a navigation bar with the POLARIS logo, a home icon, and an 'Ask Polaris' button. The main header includes 'COMPUTERCHECK (DIS)' and '5432100 - COMPUTERCHECK'. Below this is a secondary navigation bar with categories like 'Marketing', 'Finished Goods', 'Pure Polaris', 'Service and Warranty', 'Accounting and Finance', and 'Dealer Management'. The left sidebar contains a 'Follow-up' section with 'You have 5 New Leads!', a 'News, Forms & Links' section with a search bar and a list of links with dates, and a 'Program Summary' section with a table for 'Product' and dates 'March', 'April', 'May', 'June'. The main content area is titled 'Special Alerts' and features a 'FOR WEBINAR' box, a list of alerts including 'XP Sales Event Webinar', 'The Legendary 'Indy' Na...', and 'Pure Polaris for 2013: Premium Collections of Riding Gear!'. Each alert has a 'Click here' link for details.

**SPECIAL TOOLS INDEX**



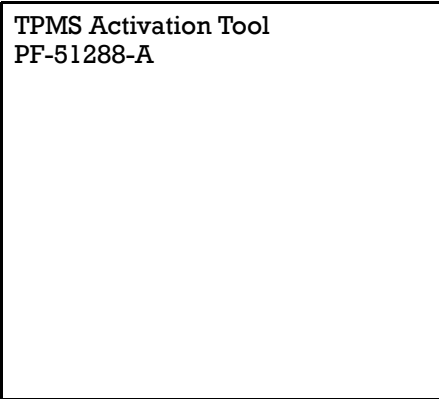
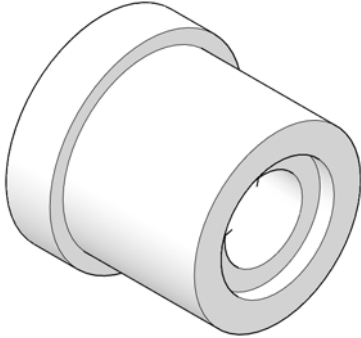
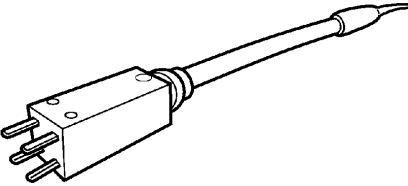


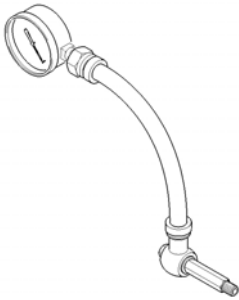
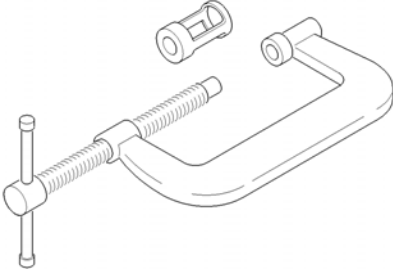
<p>ABS Tool (Brake Lever Reserve) PV-50104</p> 	<p>Battery Tester PU-50296</p> 	<p>Bearing Removal Kit PF-51324</p> 
<p>Belt Tension Meter PV-43532</p> 	<p>Body Panel Tool Kit PV-49955</p> 	<p>Cartridge Shaft Tool PV-49452</p> 
<p>Crankcase Tool PF-51234-A</p> 	<p>Clutch Shaft Holding Tool PF-51232</p> 	<p>Crankshaft Locking Pin PF-52135</p> 

<p><b>Crankshaft Rotation Tool</b> PF-51239</p> 	<p><b>Damper Rod Holder</b> PV-49453</p> 	<p><b>Electrical Tester Kit</b> PV-43526</p> 
<p><b>Engine Stand Adapter</b> PF-51240</p> 	<p><b>Fork Spring Compressor Adapter</b> PV-49464</p> 	<p><b>Fork Oil Level Tool</b> PV-59000-A</p> 
<p><b>Fork Seal Tool</b> PV-49494</p> 	<p><b>Fork Spring Compressor</b> PV-49463</p> 	<p><b>Fuel Pressure Adapter</b> PV-48656</p> 
<p><b>Spanner Socket (Stem)</b> PV-43508</p> 	<p><b>Oil Filter Wrench</b> PU-50105</p> 	<p><b>Fuel Pressure Gauge</b> PU-43506-A</p> 





**GENERAL / SPECIFICATIONS**

<p><b>Swing-Arm Bushing Tool</b> PF-51237</p>  A collection of white plastic and metal parts including a long thin rod, a cylindrical bushing, a ring, and several smaller components.	<p><b>TPMS Activation Tool</b> PF-51288</p>  A black plastic carrying case with a handle and a small black electronic device with a screen and buttons.	<p><b>TPMS Activation Tool</b> PF-51288-A</p>  A black rectangular electronic device with a screen and buttons, similar to the one in the previous cell.
<p><b>Output Shaft Seal Tool</b> PF-51243</p>  A large, hollow, cylindrical metal tool with a flange on one end.	<p><b>Relay Bypass Tool</b> PU-49466</p>  A long, thin metal probe with a rectangular base containing three electrical pins.	<p><b>USB to Serial Adapter</b> PU-50621</p>  A black USB to serial adapter cable with a USB-A connector on one end and a serial connector on the other.
<p><b>Rocker Arm Compression Tool</b> PF-52939</p>  A grey metal tool with a flat base and two vertical supports, used for compressing a rocker arm.	<p><b>Oil Pressure Gauge</b> PV-43531</p>  A circular gauge with a needle and a flexible hose attached to a metal fitting.	<p><b>Valve Spring Compressor Tool</b> PV-1253</p>  A metal tool with a U-shaped frame and a threaded rod with a handle, used for compressing valve springs.

Straightedge, Feeler Gauge Commercially Available		



**REFERENCE**

**MASTER TORQUE TABLE**

<b>CHAPTER 2: MAINTENANCE</b>	
<b>ITEM</b>	<b>TORQUE</b>
Airbox Filter Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Battery Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Battery Terminal Fastener	<b>48 in-lbs (5 N·m)</b>
Chin Fairing Fastener	<b>36 in-lbs (4 N·m)</b>
Clutch Cable Jam Nut	<b>48 in-lbs (5 N·m)</b>
Oil Drain Plug	<b>15 ft-lbs (20 N·m)</b>
Oil Filter	<b>Approximately 3/4 turn after seal has contacted the filter adapter.</b>
Shift Rod Jam Nut	<b>84 in-lbs (10 N·m)</b>
Sidestand Pivot Fastener	<b>37 ft-lbs (50 N·m)</b>
Sidestand Mount Fastener	<b>45 ft-lbs (61 N·m)</b>
Spark Plug	<b>84 in-lbs (10 N·m)</b>

<b>CHAPTER 3: ENGINE / COOLING / EXHAUST</b>	
<b>ITEM</b>	<b>TORQUE</b>
ACG Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Battery Box Fastener	<b>18 ft-lbs (24 N·m)</b>
Breather Fastener	<b>84 in-lbs (10 N·m)</b>
Bypass Tube Fastener	<b>84 in-lbs (10 N·m)</b>
Camshaft Chain Tensioner	<b>15 ft-lbs (20 N·m)</b>
Camshaft Sprocket Fastener	<b>159 in-lbs (18 N·m)</b>
Camshaft Thrust Plate Fastener	<b>62 in-lbs (7 N·m)</b>
Chain Guide Fastener (All)	<b>84 in-lbs (10 N·m)</b>
Connecting Rod Fastener	<b>1. Torque to 19 ft-lbs (26 N·m) 2. Torque angle to 105 °</b>
Camshaft Chain oil Jet Fastener	<b>62 in-lbs (7 N·m)</b>

Cooling Fan Fastener	<b>36 in-lbs (4 N·m)</b>
Coolant Line Fastener	<b>84 in-lbs (10 N·m)</b>
Crankcase Fastener	<b>22 ft-lbs (30 N·m)</b>
Cylinder Head Bolt	<b>84 in-lbs (10 N·m)</b>
Cylinder Head Nut	<b>1. Torque fasteners to 15 ft-lbs (20 N·m) 2. Back off 90 ° 3. Torque all fasteners to 26 ft-lbs (35 N·m) 4. Torque angle all 360 °</b>
Cylinder Stud	<b>25 ft-lbs (34 N·m)</b>
Dash Closeout Fastener	<b>36 in-lbs (4 N·m)</b>
Knock Sensor	<b>15 ft-lbs (20 N·m)</b>
Engine Mount Fastener	<b>45 ft-lbs (61 N·m)</b>
Exhaust Clamp	<b>7 ft-lbs (9 N·m)</b>
Exhaust Manifold Stud	<b>15 ft-lbs (20 N·m)</b>
Fairing Louver Fastener	<b>36 in-lbs (4 N·m)</b>
Filter Adapter	<b>22 ft-lbs (30 N·m)</b>
Flywheel Fastener	<b>112 ft-lbs (152 N·m)</b>
Headpipe Nut (2021+)	<b>1. Torque front header lower nut to 7 ft-lbs (9 N·m) 2. Torque front header upper nut to 7 ft-lbs (9 N·m) 3. Torque rear header bottom nut to 7 ft-lbs (9 N·m) 4. Torque rear header top nut to 7 ft-lbs (9 N·m) 5. Torque front header nuts (starting with lower) to 15 ft-lbs (20 N·m) 6. Torque rear header nuts (starting with lower) to 15 ft-lbs (20 N·m)</b>
Heat Shield Clamp	<b>31 in-lbs (3 N·m)</b>
Heat Shield Fasteners, Lower	<b>84 in-lbs (10 N·m)</b>

Intake Manifold Fasteners (left-hand side)	<b>84 in-lbs (10 N·m)</b>	Sidestand Switch Fastener	<b>43 in-lbs (5 N·m)</b>
Intake Manifold Fasteners (right-hand side installed with special tool 5264374)	<b>74 in-lbs (9 N·m)</b>	Speaker Assembly Fastener	<b>36 in-lbs (4 N·m)</b>
Input Shaft Feed Tube Fastener	<b>84 in-lbs (10 N·m)</b>	Sprag Clutch Fastener	<b>84 in-lbs (10 N·m)</b>
Lower Fairing Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>	Stator Fastener	<b>84 in-lbs (10 N·m)</b>
Muffler Clamp	<b>40 ft-lbs (54 N·m)</b>	Thermostat Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Muffler Fastener	<b>18 ft-lbs (24 N·m)</b>	Thermostat Mounting Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Oil Filter Adapter Fastener	<b>84 in-lbs (10 N·m)</b>	Transmission Feed Rail Fastener	<b>84 in-lbs (10 N·m)</b>
Oil Pickup Fastener	<b>84 in-lbs (10 N·m)</b>	Valve Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Oil Pressure Feed tube Fastener	<b>84 in-lbs (10 N·m)</b>	Water Pump Chain Tensioner Fastener	<b>84 in-lbs (10 N·m)</b>
Oil Pressure Switch	<b>115 in-lbs (13 N·m)</b>	Water Pump Fastener	<b>84 in-lbs (10 N·m)</b>
Oil Pump Fastener	<b>84 in-lbs (10 N·m)</b>	Water Pump Sprocket Fastener	<b>84 in-lbs (10 N·m)</b>
Oil Pump Scavenge Tube Fastener	<b>84 in-lbs (10 N·m)</b>		
Oil Scavenge Tube Fastener	<b>84 in-lbs (10 N·m)</b>		
Oxygen Sensor	<b>14 ft-lbs (19 N·m)</b>		
Piston Cooling Jet Fastener	<b>62 in-lbs (7 N·m)</b>		
Radiator Mount Fastener	<b>84 in-lbs (10 N·m)</b>		
Recovery Bottle Fastener (Lower)	<b>84 in-lbs (10 N·m)</b>		
Recovery Bottle Fastener (Upper)	<b>36 in-lbs (4 N·m)</b>		
Resonator Mount to Frame / Transmission Shield Fastener (M8)	<b>18 ft-lbs (24 N·m)</b>		
Resonator Mount to Frame Fastener / Transmission Shield Fastener (M6)	<b>84 in-lbs (10 N·m)</b>		
Resonator to Resonator Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>		
Rocker Shaft Cap Fastener	<b>27 ft-lbs (37 N·m)</b>		
Scavenge Oil Inlet Screen Fastener	<b>84 in-lbs (10 N·m)</b>		

## GENERAL / SPECIFICATIONS

<b>CHAPTER 4: FUEL DELIVERY / EFI</b>	
<b>ITEM</b>	<b>TORQUE</b>
Airbox Hatch Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Airbox Filter Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Crankshaft Position Sensor Fastener	<b>84 in-lbs (10 N·m)</b>
Cylinder Head Temperature Sensor	<b>15 ft-lbs (20 N·m)</b>
Fuel Access Plate Fastener	<b>44 in-lbs (5 N·m)</b>
Fuel Cap Fastener	<b>44 in-lbs (5 N·m)</b>
Fuel Injector Fastener	<b>84 in-lbs (10 N·m)</b>
Fuel Rail Fastener	<b>62 in-lbs (7 N·m)</b>
Fuel Tank Console Fastener	<b>84 in-lbs (10 N·m)</b>
Fuel Tank Mounting Fastener	<b>18 ft-lbs (24 N·m)</b>
Hose Clamp	<b>26 in-lbs (3 N·m)</b>
Ignition Coil Fastener	<b>84 in-lbs (10 N·m)</b>
Ignition Coil Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Pinion Shaft Retention Fastener	<b>62 in-lbs (7 N·m)</b>
Reed Plate Fastener	<b>62 in-lbs (7 N·m)</b>
Throttle Body Inlet Adapter Fastener	<b>84 in-lbs (10 N·m)</b>
TMAP Sensor Fastener	<b>18 in-lbs (2 N·m)</b>
V-Cover Fastener	<b>84 in-lbs (10 N·m)</b>
V-Cover Bracket Fastener	<b>84 in-lbs (10 N·m)</b>

<b>CHAPTER 5: CLUTCH / PRIMARY / SHIFT</b>	
<b>ITEM</b>	<b>TORQUE</b>
Clutch Cable Mount Fastener	<b>84 in-lbs (10 N·m)</b>
Cold Start Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Clutch Stake Nut	<b>125 ft-lbs (170 N·m)</b>
Detent Lever Fastener	<b>84 in-lbs (10 N·m)</b>
Locking Plate Fastener	<b>84 in-lbs (10 N·m)</b>
Primary Cover Fastener (Inner)	<b>84 in-lbs (10 N·m)</b>
Primary Cover Fastener (Outer)	<b>84 in-lbs (10 N·m)</b>
Primary Drive Gear Fastener	<b>83 ft-lbs (112 N·m)</b>
Shift Star Fastener	<b>84 in-lbs (10 N·m)</b>
Stopper Plate Fastener	<b>84 in-lbs (10 N·m)</b>

<b>CHAPTER 6: TRANSMISSION / CRANKSHAFT</b>	
<b>ITEM</b>	<b>TORQUE</b>
Balance Shaft Gear Fastener	<b>59 ft-lbs (80 N·m)</b>
Balance Shaft Shield Fastener	<b>62 in-lbs (7 N·m)</b>
Balance Shaft Retainer Fastener	<b>84 in-lbs (10 N·m)</b>
Balance Shaft Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
Bearing Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
Crankshaft Blind Plug	<b>15 ft-lbs (20 N·m)</b>
Crankshaft Tone Ring Fastener	<b>18 ft-lbs (24 N·m)</b>
Connecting Rod Fastener	<b>1. Torque to 19 ft-lbs (26 N·m) 2. Torque angle to 105 °</b>
Input Shaft Oil Plug	<b>13 ft-lbs (18 N·m)</b>

<b>CHAPTER 7: FRAME / BODY</b>	
<b>ITEM</b>	<b>TORQUE</b>
ABS Mount Bracket Fastener (Allen Head)	<b>84 in-lbs (10 N·m)</b>
ABS Mount Bracket Fastener (Hex Head)	<b>84 in-lbs (10 N·m)</b>
Air Deflector Fastener	<b>36 in-lbs (4 N·m)</b>
Antenna Harness Fastener (Touring)	<b>27 in-lbs (3 N·m)</b>
Antenna Mount Fastener (Touring)	<b>27 in-lbs (3 N·m)</b>
Brake Pedal Pad Fastener (2022+)	<b>84 in-lbs (10 N·m)</b>
Cylinder Head Bracket Fastener	<b>75 ft-lbs (102 N·m)</b>
Dash Closeout Fastener	<b>36 in-lbs (4 N·m)</b>
Dash Fastener	<b>25 in-lbs (3 N·m)</b>
Dash Support Fastener	<b>36 in-lbs (4 N·m)</b>
Dash Trim Fastener	<b>36 in-lbs (4 N·m)</b>
Display Bezel Fastener	<b>36 in-lbs (4 N·m)</b>
Enclosure Fastener	<b>36 in-lbs (4 N·m)</b>
Fairing Bracket Nut	<b>18 ft-lbs (24 N·m)</b>
Fairing Support to Downcast Fastener	<b>18 ft-lbs (24 N·m)</b>
Fairing Support to Fairing Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>
Fairing Tray Fastener	<b>36 in-lbs (4 N·m)</b>
Fender Closeout Lower Fastener	<b>84 in-lbs (10 N·m)</b>
Fender Closeout Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Fender Fastener (Front)	<b>18 ft-lbs (24 N·m)</b>
Fender Fastener (Rear) M6	<b>84 in-lbs (10 N·m)</b>
Fender Fastener (Rear) M8	<b>18 ft-lbs (24 N·m)</b>
Floorboard Base Fastener	<b>18 ft-lbs (24 N·m)</b>
Floorboard Bracket Fastener	<b>35 ft-lbs (47 N·m)</b>

Fog Light Bracket Fastener	<b>36 in-lbs (4 N·m)</b>
Footpeg Fastener	<b>35 ft-lbs (47 N·m)</b>
Front Downcast Fastener	<b>45 ft-lbs (61 N·m)</b>
Fuel Tank Mount Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>
Fuse Block Mount Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Grabstrap Fastener	<b>36 in-lbs (4 N·m)</b>
Headlight Bezel Assembly Fastener	<b>36 in-lbs (4 N·m)</b>
Headlight Fastener (Torx)	<b>36 in-lbs (4 N·m)</b>
Headlight Bracket Fastener	<b>36 in-lbs (4 N·m)</b>
Highway Bar Fastener	<b>45 ft-lbs (61 N·m)</b>
Highway Bar Clamp Fastener	<b>36 in-lbs (4 N·m)</b>
Hinge Cover Fastener	<b>36 in-lbs (4 N·m)</b>
Inner Duct Fastener	<b>15 in-lbs (2 N·m)</b>
Latch Hoop Fastener	<b>36 in-lbs (4 N·m)</b>
Leaf Hinge Fastener	<b>36 in-lbs (4 N·m)</b>
Limiter Fastener	<b>15 in-lbs (2 N·m)</b>
Lower Fairing Fastener	<b>36 in-lbs (4 N·m)</b>
Lower Fairing Cubby Fastener	<b>36 in-lbs (4 N·m)</b>
Lower Side Cover Accent Fastener	<b>84 in-lbs (10 N·m)</b>
Midcast Fastener (M12)	<b>75 ft-lbs (102 N·m)</b>
Midcast Fastener (M10)	<b>35 ft-lbs (47 N·m)</b>
Outer Duct Fastener	<b>36 in-lbs (4 N·m)</b>
Outer Fairing Fastener	<b>36 in-lbs (4 N·m)</b>
Passenger Floorboard Pivot Fastener (2022+)	<b>19 ft-lbs (25 N·m)</b>
Passenger Floorboard Mount Fastener (2022+)	<b>33 ft-lbs (45 N·m)</b>
Pivot Shaft	<b>50 ft-lbs (68 N·m)</b>
Power Supply Fastener	<b>84 in-lbs (10 N·m)</b>
Rear Lower Subframe Fastener	<b>18 ft-lbs (24 N·m)</b>

## GENERAL / SPECIFICATIONS

Ride Command Display Fastener	<b>36 in-lbs (4 N·m)</b>
Saddlebag Fastener	<b>18 ft-lbs (24 N·m)</b>
Saddlebag Lock Fastener	<b>62 in-lbs (7 N·m)</b>
Saddlebag Mount Fastener	<b>84 in-lbs (10 N·m)</b>
Saddlebag Spool Fastener	<b>32 ft-lbs (43 N·m)</b>
Seat Bracket Fastener	<b>52 in-lbs (6 N·m)</b>
Seat Fastener	<b>18 ft-lbs (24 N·m)</b>
Seat / Trunk Harness Cover Fastener	<b>36 in-lbs (4 N·m)</b>
Seat Pan Fastener	<b>84 in-lbs (10 N·m)</b>
Shift Linkage Fastener	<b>84 in-lbs (10 N·m)</b>
Sidestand Stop Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Speaker Fastener	<b>25 in-lbs (3 N·m)</b>
Sprocket Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Storage Door Fastener	<b>36 in-lbs (4 N·m)</b>
Tipover Cover Fastener	<b>18 ft-lbs (24 N·m)</b>
Trunk to frame Fastener	<b>12 in-lbs (1 N·m)</b>
Trunk Lock Fastener	<b>12 in-lbs (1 N·m)</b>
Trunk to Frame Arm Fastener	<b>12 in-lbs (1 N·m)</b>
Trunk Luggage Rack Fastener	<b>84 in-lbs (10 N·m)</b>
Trunk Latch Hoop Fastener	<b>36 in-lbs (4 N·m)</b>
Trunk Lock Actuator Fastener	<b>13 ft-lbs (18 N·m)</b>
Trunk Bezel Fastener	<b>12 in-lbs (1 N·m)</b>
Trunk Tail Light Fastener	<b>12 in-lbs (1 N·m)</b>
Trunk Speaker Cover / Backrest Fastener	<b>36 in-lbs (4 N·m)</b>
Turn Signal Bezel Fastener	<b>15 in-lbs (2 N·m)</b>
Turn Signal Fastener	<b>15 in-lbs (2 N·m)</b>
Under-Seat Wire Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Upper Duct Fastener	<b>15 in-lbs (2 N·m)</b>

Visor Top Fastener	<b>36 in-lbs (4 N·m)</b>
VCM2 Fastener	<b>15 in-lbs (2 N·m)</b>
Wire Cover Fastener	<b>15 in-lbs (2 N·m)</b>
Wire Guide Fastener (Lower)	<b>15 in-lbs (2 N·m)</b>
Wire Guide Fastener (Upper)	<b>84 in-lbs (10 N·m)</b>
Windshield Fastener	<b>36 in-lbs (4 N·m)</b>
Windshield Support to Link Fastener	<b>84 in-lbs (10 N·m)</b>
Windshield Support to Motor Fastener	<b>84 in-lbs (10 N·m)</b>
Windshield Link to Pivot Fastener	<b>84 in-lbs (10 N·m)</b>
Windshield Motor Fastener	<b>84 in-lbs (10 N·m)</b>

<b>CHAPTER 8: STEERING / SUSPENSION</b>	
<b>ITEM</b>	<b>TORQUE</b>
Axle Nut (Rear)	<b>65 ft-lbs (84 N·m)</b>
Belt Guard Fastener	<b>96 in-lbs (11 N·m)</b>
Cartridge Screw	<b>17 ft-lbs (23 N·m)</b>
Clutch Cable Routing Clip Fastener	<b>84 in-lbs (10 N·m)</b>
Clutch Perch Fastener	<b>96 in-lbs (11 N·m)</b>
Drive Sprocket Lock Washer Fastener	<b>84 in-lbs (10 N·m)</b>
Drive Sprocket Nut	<b>165 ft-lbs (224 N·m)</b>
Fork Cap Nut	<b>12 ft-lbs (16 N·m)</b>
Fork Cap	<b>17 ft-lbs (23 N·m)</b>
Front Axle	<b>52 ft-lbs (70 N·m)</b>
Front Axle Pinch Fastener	<b>19 ft-lbs (26 N·m)</b>
Gusset Plate Fastener	<b>96 ft-lbs (130 N·m)</b>
Handlebar Riser Clamp Fastener	<b>18 ft-lbs (24 N·m)</b>
Handlebar Riser Fastener (M12)	<b>60 ft-lbs (81 N·m)</b>
Lower Fork Clamp Fastener	<b>18 ft-lbs (24 N·m)</b>
P-clamp Fastener	<b>84 in-lbs (10 N·m)</b>
Rocker Fastener	<b>96 ft-lbs (130 N·m)</b>
Rotation Sensor Fastener	<b>16 ft-lbs (22 N·m)</b>
Seat Fastener	<b>18 ft-lbs (24 N·m)</b>
Shock Adjuster Bracket Mount Fastener M8	<b>18 ft-lbs (24 N·m)</b>
Shock Adjuster Bracket Mount Fastener M6	<b>96 in-lbs (11 N·m)</b>
Shock Adjuster Fastener	<b>18 ft-lbs (24 N·m)</b>
Shock Fastener	<b>96 ft-lbs (130 N·m)</b>
Steering Head Nut	<ol style="list-style-type: none"> <li>1. Torque to <b>29 ft-lbs (39 N·m)</b></li> <li>2. Turn assembly lock to lock 5 times</li> <li>3. Loosen 60°</li> <li>4. Install Triple clamp and tighten top nut <b>72 ft-lbs (98 N·m)</b></li> </ol>

Steering Lock Fastener	<b>18 ft-lbs (24 N·m)</b>
Swing-Arm Pivot Shaft	<b>96 in-lbs (11 N·m)</b>
Swing-Arm Pivot Jam Nut	<b>75 ft-lbs (101 N·m)</b>
Swing-Arm Pivot Nut (Nylock)	<b>65 ft-lbs (88 N·m)</b>
Switch Cube Cover Fastener	<b>12 in-lbs (1 N·m)</b>
Switch Cube Fastener	<b>12 in-lbs (1 N·m)</b>
Tire Pressure Sensor Fastener	<b>72 in-lbs (8 N·m)</b>
Top Triple Clamp Nut	<b>72 ft-lbs (98 N·m)</b>
Upper Fork Clamp Fastener	<b>18 ft-lbs (24 N·m)</b>
Valve Stem Nut	<b>53 in-lbs (6 N·m)</b>

<b>CHAPTER 9: BRAKES</b>	
<b>ITEM</b>	<b>TORQUE</b>
ABS Module Fastener	<b>84 in-lbs (10 N·m)</b>
Banjo Bolt	<b>18 in-lbs (24 N·m)</b>
Bleed Screw	<b>53 in-lbs (6 N·m)</b>
Brake Caliper Fastener (Front)	<b>35 ft-lbs (47 N·m)</b>
Brake Caliper Fastener (Rear)	<b>31 ft-lbs (42 N·m)</b>
Brake Caliper Guide Pin (Rear)	<b>106 in-lbs (13 N·m)</b>
Brake Caliper Retainer Fastener (Rear)	<b>20 ft-lbs (27 N·m)</b>
Brake Lever Pivot Pin (Front)	<b>9 in-lbs (1 N·m)</b>
Brake Lever Pivot Pin Nut (Front)	<b>52 in-lbs (6 N·m)</b>
Brake Pad Retaining Pin (Front)	<b>53 in-lbs (6 N·m)</b>
Brake Pad Retaining Pin (Rear)	<b>150 in-lbs (17 N·m)</b>
Brake Rotor Screw	<b>22 ft-lbs (30 N·m)</b>
Junction Block Fastener	<b>84 in-lbs (10 N·m)</b>
Master Cylinder Banjo Bolt	<b>18 ft-lbs (24 N·m)</b>



## GENERAL / SPECIFICATIONS

Master Cylinder Clamp Fastener (Front)	<b>96 in-lbs (11 N·m)</b>
Master Cylinder Cover Fastener (Front)	<b>18 in-lbs (2 N·m)</b>
Master Cylinder Cover Fastener (Rear)	<b>18 in-lbs (2 N·m)</b>
Master Cylinder Fastener (Rear)	<b>18 ft-lbs (24 N·m)</b>
Under-Seat Bracket Fastener	<b>84 in-lbs (10 N·m)</b>

<b>CHAPTER 10: ELECTRICAL</b>	
<b>ITEM</b>	<b>TORQUE</b>
Battery Box Fastener	<b>18 ft-lbs (24 N·m)</b>
Clutch Switch Fastener	<b>6 in-lbs (1 N·m)</b>
Clutch Switch Cover Fastener	<b>6 in-lbs (1 N·m)</b>
Drive Sprocket Shield Fastener	<b>88 in-lbs (10 N·m)</b>
Gear Position Sensor Fastener	<b>44 in-lbs (5 N·m)</b>
Headlight Carrier Fastener	<b>12 in-lbs (1 N·m)</b>
Headlight Retention Ring Fastener	<b>12 in-lbs (1 N·m)</b>
Headress Fastener	<b>36 in-lbs (4 N·m)</b>
Horn Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
IMU Fastener	<b>84 in-lbs (10 N·m)</b>
J-Case / Voltage Regulator Fastener	<b>84 in-lbs (10 N·m)</b>
License Plate Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
License Plate Light Assembly Fastener	<b>84 in-lbs (10 N·m)</b>
License Plate Light Fastener	<b>16 in-lbs (2 N·m)</b>
Puddle Light Fastener	<b>84 in-lbs (10 N·m)</b>
Stator Cover Fastener	<b>84 in-lbs (10 N·m)</b>
Stator Fastener	<b>84 in-lbs (10 N·m)</b>
Starter Mount Fastener	<b>84 in-lbs (10 N·m)</b>
Starter Solenoid Fastener	<b>84 in-lbs (10 N·m)</b>

Starter Solenoid Terminal Fastener	<b>44 in-lbs (5 N·m)</b>
Starter Terminal Fastener	<b>84 in-lbs (10 N·m)</b>
Tail Light Mount Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
Turn Signal Fastener (Front)	<b>15 in-lbs (2 N·m)</b>
Turn Signal Fastener (Rear)	<b>84 in-lbs (10 N·m)</b>
VCM 1 Fastener	<b>84 in-lbs (10 N·m)</b>
VCM 2 Fastener	<b>15 in-lbs (2 N·m)</b>

**SAE TAP DRILL SIZES**

THREAD SIZE / DRILL SIZE		THREAD SIZE / DRILL SIZE	
#0-80	3/64	1/2-13	27/64
#1-64	#53	1/2-20	29/64
#1-72	#53	9/16-12	31/64
#2-56	#51	9/16-18	33/64
#2-64	#50	5/8-11	17/32
#3-48	5/64	5/8-18	37/64
#3-56	#45	3/4-10	21/32
#4-40	#43	3/4-16	11/16
#4-48	#42	7/8-9	49/64
#5-40	#38	7/8-14	13/16
#5-44	#37	1-8	7/8
#6-32	#36	1-12	59/64
#6-40	#33	1 1/8-7	63/64
#8-32	#29	1 1/8-12	1 3/64
#8-36	#29	1 1/4-7	1 7/64
#10-24	#24	1 1/4-12	1 11/64
#10-32	#21	1 1/2-6	1 11/32
#12-24	#17	1 1/2-12	1 27/64
#12-28	#15	1 3/4-5	1 9/16
1/4-20	7	1 3/4-12	1 43/64
1/4-28	3	2-4 1/2	1 25/32
5/16-18	F	2-12	1 59/64
5/16-24	I	2 1/4-4 1/2	2 1/32
3/8-16	O	2 1/2-4	2 1/4
3/8-24	Q	2 3/4-4	2 1/2
7/16-14	U	3-4	2 3/4
7/16-20	25/64		

**METRIC TAP DRILL SIZES**

TAP SIZE	DRILL SIZE	DECIMAL EQUIVALENT	NEAREST FRACTION
3x.50	#39	0.0995	3/32
3x.60	3/32	0.0937	3/32
4x.70	#30	0.1285	1/8
4x.75	1/8	0.125	1/8
5x.80	#19	0.166	11/64
5x.90	#20	0.161	5/32
6x1.00	#9	0.196	13/64
7x1.00	16/64	0.234	15/64
8x1.00	J	0.277	9/32
8x1.25	17/64	0.265	17/64
9x1.00	5/16	0.3125	5/16
9x1.25	5/16	0.3125	5/16
10x1.25	11/32	0.3437	11/32
10x1.50	R	0.339	11/32
11x1.50	3/8	0.375	3/8
12x1.50	13/32	0.406	13/32
12x1.75	13/32	0.406	13/32

1

**DECIMAL EQUIVALENTS**

1/64 in = .0156 in	39/64 in = .6094 in
1/32 in = .0312 in [1 mm = .0394 in]	5/8 in = .625 in [16mm=. 6299 in]
3/64 in = .0469 in	41/64 in = .6406 in
1/16 in = .0625 in	21/32 in = .6563 in [17 mm = .6693 in]
5/64 in = .0781 in [2 mm = .0787 in]	43/64 in = .6719 in
3/32 in = .0938 in	11/16 in = .6875 in
7/64 in = .1094 in [3 mm = .1181 in]	45/64 in = .7031 in [18 mm = .7087 in]
1/8 in = .1250 in	23/32 in = .7188 in
9/64 in = .1406 in	47/64 in = .7344 in [19 mm = .7480 in]
5/32 in = .1563 in [4 mm = .1575 in]	3/4 in = .75 in
11/64 in = .1719 in	49/64 in = .7656 in
3/16 in = .1875 in [5 mm = .1969 in]	25/32 in = .7813 in [20 mm = .7874 in]
13/64 in = .2031 in	51/64 in = .7969 in
7/32 in = .2188 in	13/16 in = .8125 in [21 mm = .8268 in]
15/64 in = .2344 in [6 mm = .2362 in]	53/64 in = .8281 in
1/4 in = .25 in	27/32 in = .8438 in
17/64 in = .2656 in [7 mm = .2756 in]	55/64 in = .8594 in [22 mm = .8661 in]
9/32 in = .2813 in	7/8 in = .875 in
19/64 in = .2969 in	57/64 in = .8906 in [23 mm = .9055 in]
5/16 in = .3125 in [8mm=. 3150 in]	29/32 in = .9063 in
21/64 in = .3281 in	59/64 in = .9219 in
11/32 in = .3438 in [9 mm = .3543 in]	15/16 in = .9375 in [24 mm = .9449 in]
23/64 in = .3594 in	61/64 in = .9531 in
3/8 in = .375 in	31/32 in = .9688 in [25 mm = .9843 in]
25/64 in = .3906 in [10 mm = .3937 in]	63/64 in = .9844 in
13/32 in = .4063 in	1 in = 1.0 in
27/64 in = .4219 in [11 mm = .4331 in]	
7/16 in = .4375 in	
29/64 in = .4531 in	
15/32 in = .4688 in [12 mm = .4724 in]	
31/64 in = .4844 in	
1/2 in = .5 in [13mm = .5118 in]	
33/64 in = .5156 in	
17/32 in = .5313 in	
35/64 in = .5469 in [14 mm = .5512 in]	
9/16 in = .5625 in	
37/64 in = .5781 in [15 mm = .5906 in]	
19/32 in = .5938 in	

**FAHRENHEIT TO CELSIUS**

$^{\circ}\text{C}$  to  $^{\circ}\text{F}$ :  $9 (^{\circ}\text{C} + 40) \div 5 - 40 = ^{\circ}\text{F}$

$^{\circ}\text{F}$  to  $^{\circ}\text{C}$ :  $5 (^{\circ}\text{F} + 40) \div 9 - 40 = ^{\circ}\text{C}$

DEGREES F	DEGREES C
32	0
41	5
50	10
59	15
68	20
77	25
86	30
95	35
104	40
113	45
122	50
131	55
140	60
149	65
158	70
167	75
176	80
185	85
194	90
203	95
212	100

GENERAL / SPECIFICATIONS

**MEASUREMENT CONVERSION CHART**

UNIT OF MEASURE	MULTIPLIED BY	COVERTS TO
ft-lbs	x 12	= in-lbs
in-lbs	x.0833	= ft-lbs
ft-lbs	x 1.356	= Nm
in-lbs	x.0115	= kg-m
Nm	x.7376	= ft-lbs
kg-m	x 7.233	= ft-lbs
kg-m	x 86.796	= in-lbs
kg-m	x 10	= Nm
in	x 25.4	= mm
mm	x.03937	= in
in	x 2.54	= cm
mile	x 1.6	= km
km	x.6214	= mile
Ounces (oz)	x 28.35	= grams (g)
Fluid Ounce	x 29.57	= CCs
grams (g)	x.035	= Ounces (oz)
cc's	x.03381	= Fluid Ounces (oz)
lbs	x.454	= kg
kg	x 2.2046	= lbs
Cubic Inches	x 16.387	= Cubic Centimeters
Cubic Centimeters	x.061	= Cubic Inches
Imperial pints	x.568	= liters (l)
liters (l)	x 1.76	= Imperial pints
Imperial quarts	x 1.137	= liters (l)
liters (l)	x.88	= Imperial quarts
Imperial quarts	x 1.201	= US quarts
US quarts	x.833	= Imperial quarts
US quarts	x.946	= liters
liters	x 1.057	= US quarts
US gallon	x 3.785	= liter
liter	x .264	= US gallon

UNIT OF MEASURE	MULTIPLIED BY	COVERTS TO
Pounds force per square inch (psi)	x 6.895	= Kilo pascals (kPa)
Kilo pascals (kPa)	x .145	= Pounds force per square inch (psi)
Kilo pascals (kPa)	x .01	= Kilograms force per cm <sup>2</sup>
Kilograms force per cm <sup>2</sup>	x 98.1	= Kilo pascals (kPa)
p (3.14159) x R <sup>2</sup> x H (height)		= Cylinder Volume

# CHAPTER 2 MAINTENANCE



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**MAINTENANCE QUICK REFERENCE GUIDE**  
**SPECIFICATIONS - MAINTENANCE**

**GENERAL SPECIFICATIONS**

ITEM	STANDARD	SERVICE LIMIT
Battery Type / CCA	12 Volt / 18 AH / 310 CCA	—
Brake Pad Thickness, Front	.16 in (4.0 mm)	.04 in (1.0 mm)
Brake Disc Thickness, Front	.20 in (5.0 mm)	.18 in (4.5 mm)
Brake Pad Thickness, Rear	.25 in (6.5 mm)	.04 in (1.0 mm) Minimum
Brake Disc Thickness, Rear	.28 in (7 mm)	.26 in (6.5 mm)
Clutch Lever Freeplay	.019–.059” (0.5–1.5 mm)	—
Compression Pressure (Cylinder)	85-115 psi (586-763 kPa)	Below 80 psi (552 kPa)
Drive Belt Deflection (with 10 lbs force)	0.6” (15 mm) - New Belt 0.79” (20 mm) - Belt with 1000+ miles	—
Fuel Pressure (KOEO)	58 psi (400 kPa)	Minimum fuel pressure: 51 psi (350 kPa)
Idle Speed / Fast Idle Speed	900 RPM	±50 RPM
Oil Pressure, Lubrication @ 3000 rpm	60 PSI (414 kPa) ± 15% Engine at operating temperature.	30 PSI (207 kPa)
Ride Height (Rear Spring Pre-Load)	See adjustment procedure outlined in this chapter	—
Spark Plug Type Spark Plug Gap	NGK LZMAR8AI-1 0.039 in (1.0 mm)	—
Tire Pressure	FRONT: 36 PSI (248 kPa)	—
	REAR: 41 PSI (276 kPa)	—
Tire Tread Depth (Minimum)	—	.063 in (1.6 mm)
Valve Lash (Int. / Ex.)	NOT ADJUSTABLE (Lash is self-adjusting via hydraulic lifters)	—

**FLUID SPECIFICATIONS**

DESCRIPTION	FLUID TYPE	CAPACITY
Brake Hydraulic Fluid	DOT 4	—
Engine / Transmission Oil	Semi-Synthetic 15W60 Engine Oil	<b>5.0 qts (4.7 L)</b>
Coolant	50/50 Premix Extended Life Antifreeze	2.5 qts (2.4L)
Fork Oil	Indian Motorcycle Fork Oil	2020: 16.4 oz (485 cc) per leg 2021-2022: 18.1 oz (535 cc) per leg
Fuel	91 Octane (Recommended)	Total Usable: 6.0 gal (22.7 L) / Reserve 1.0 gal (3.8 L)

**INDIAN MOTORCYCLE SERVICE PRODUCTS  
AND LUBRICANTS**

**MAINTENANCE PRODUCT PART NUMBERS**

<b>PRODUCT</b>		<b>PART NUMBER</b>
All Purpose Grease	14 oz	2872187
Anti-Freeze, 50/50 Extended Life	1 quart (32 oz)	2880966
Brake Fluid, DOT 4	12 oz	2880016
Carbon Cleaner, Fuel	12 oz	2881911
Crankcase Sealant (Loctite Ultra Black 598)		Commercially Available
Fork Oil	1 quart	2884244
Starter Grease	2 oz	2871460
Oil Change Kit	15W-60	2884171
Synthetic 15W-60 Engine Lubricant	1 quart	2880187
	55 gal drum	2880188
Synthetic Transmission Oil (Pre 2013)	1 quart	2880014





## MAINTENANCE

### MAINTENANCE INTERVALS

The maintenance interval charts outline required maintenance and inspection based on vehicle miles. Each table states the number of miles that service is required on the vehicle. Some items or components may need to be serviced more often due to severe use. When the vehicle goes beyond 50,000 miles, return to the 500 mile chart and start the interval process over.

#### 500 MILE (800 KM) SERVICE

ITEM		REMARKS
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
D	Drive Belt	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Engine Mount Fasteners	Inspect; tighten, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary. Check and re-torque all sealed exhaust joints
D	Fuel System	Inspect
	Key Fob Battery	Replace at specified interval or every 2 years
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Inspect; lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Inspect
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)



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## MAINTENANCE

### 2,500 MILE (4,000 KM) SERVICE

ITEM		REMARKS
XU	Air Filter	Inspect; clean
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Inspect; adjust if necessary, lubricate with proper lubricant as directed
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Inspect; adjust if necessary, lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)

**5,000 MILE (8,000 KM) SERVICE**

ITEM		REMARKS
XU	Air Filter	Inspect; clean
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Inspect; adjust if necessary
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Inspect; lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Replace at specified interval or every 2 years
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Inspect; adjust if necessary, lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)



## MAINTENANCE

### 10,000 MILE (16,000 KM) SERVICE

ITEM		REMARKS
XU	Air Filter	Replace
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
D	Engine Compression	Inspect
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary. Check and re-torque all sealed exhaust joints
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
D / E	Spark Plugs	Inspect; torque to specification
	Battery	Check terminals; clean; test
D	Brake Fluid	Replace (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Replace at specified interval or every 2 years
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Gear Position Switch	Inspect; clean. See Gear Position Switch Replacement page 10.165
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)

**15,000 MILE (24,000 KM) SERVICE**

ITEM		REMARKS
XU	Air Filter	Inspect; clean
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Inspect; adjust if necessary
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Inspect; adjust if necessary
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Replace
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Inspect; adjust if necessary, lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)



## MAINTENANCE

### 20,000 MILE (32,000 KM) SERVICE

ITEM		REMARKS
XU	Air Filter	Replace
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
D	Engine Compression	Inspect
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary. Check and re-torque all sealed exhaust joints
D	Fuel System	Inspect
	Key Fob Battery	Replace
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
D / E	Spark Plugs	Inspect; torque to specification
	Battery	Check terminals; clean; test
D	Brake Fluid	Replace (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Inspect
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Gear Position Switch	Inspect; clean. See Gear Position Switch Replacement page 10.165
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)

**25,000 MILE (40,000 KM) SERVICE**

ITEM		REMARKS
XU	Air Filter	Inspect; clean
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Inspect; adjust if necessary
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Inspect; adjust if necessary
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Inspect
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Inspect; adjust if necessary, lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)





## MAINTENANCE

### 30,000 MILE (48,000 KM) SERVICE

ITEM		REMARKS
XU	Air Filter	Replace
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Replace
	Engine Coolant	Inspect fluid level, add coolant if necessary
D	Engine Compression	Inspect
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary. Check and re-torque all sealed exhaust joints
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
D / E	Spark Plugs	Replace
	Battery	Check terminals; clean; test
D	Brake Fluid	Replace (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Lubricate with proper lubricant as directed
D	Front Fork Oil	Replace
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Gear Position Switch	Inspect; clean. See Gear Position Switch Replacement page 10.165
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)

**35,000 MILE (52,000 KM) SERVICE**

ITEM		REMARKS
XU	Air Filter	Inspect; clean
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary
D	Fuel System	Inspect; Replace fuel filter using PN <b>2207067</b>
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Inspect; adjust if necessary
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Inspect; adjust if necessary
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Inspect
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)



## MAINTENANCE

### 40,000 MILE (64,000 KM) SERVICE

ITEM		REMARKS
XU	Air Filter	Replace
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
D	Engine Compression	Inspect
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary. Check and re-torque all sealed exhaust joints
D	Fuel System	Inspect
	Key Fob Battery	Replace
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
D / E	Spark Plugs	Inspect; torque to specification
	Battery	Check terminals; clean; test
D	Brake Fluid	Replace (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Inspect
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Gear Position Switch	Inspect; clean. See Gear Position Switch Replacement page 10.165
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)

**45,000 MILE (72,000 KM) SERVICE**

ITEM		REMARKS
XU	Air Filter	Inspect; clean
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Inspect fluid level, add coolant if necessary
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
	Battery	Check terminals; clean; test
D	Brake Fluid	Change every two years (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Inspect; lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Lubricate with proper lubricant as directed
D	Front Fork Oil	Replace
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Inspect; adjust if necessary
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)



## MAINTENANCE

### 50,000 MILE (80,000 KM) SERVICE

ITEM		REMARKS
XU	Air Filter	Replace
D	Cooling System / Radiator	Inspect
D	Crankcase Ventilation System	Inspect; tighten, clean, adjust
	Damper, Cushion Drive	Visual inspection for cracks or deformation is required whenever the rear wheel is removed. Replace if damage is found.
D	Drive Belt	Inspect; tighten, clean, adjust
	Engine Coolant	Replace
D	Engine Compression	Inspect
D	Engine Mount Fasteners	Inspect; tighten, adjust
XU	Engine Oil & Filter Change	Change oil and filter, inspect used oil for contaminants
E	Evaporative Emission Control System	Inspect; clean
E	Exhaust System	Inspect; adjust; correct; replace if necessary. Check and re-torque all sealed exhaust joints
D	Fuel System	Inspect
D	Oil Lines / Oil System Inspection	Inspect; clean, adjust if necessary
D / E	Spark Plugs	Inspect; torque to specification
	Battery	Check terminals; clean; test
D	Brake Fluid	Replace (DOT 4)
XU / D	Brake Pads	Inspect pad wear; replace if worn beyond service limit
D	Clutch Lever	Lubricate with proper lubricant as directed
D	Clutch Cable Freeplay	Inspect; adjust if necessary
D	Control Cable Ends	Lubricate with proper lubricant as directed
D	Fasteners	Inspect; tighten if necessary
D	Front Brake Lever	Adjust if necessary, lubricate with proper lubricant as directed
D	Front Fork Oil	Inspect
D	Front Forks and Front Axle	Inspect; adjust if necessary
D	Gear Shift Pedal	Inspect; adjust if necessary
D	Gear Position Switch	Inspect; clean. See Gear Position Switch Replacement page 10.165
D	Head Light	Inspect; adjust if necessary
D	Rear Brake Pedal	Inspect; adjust if necessary
D	Rear Shock Absorber	Replace
D	Rear Wheel Alignment	Inspect; adjust if necessary
	Road Test	Perform Road Test
D	Sidestand	Lubricate with proper lubricant as directed
D	Steering Bearings	Inspect
D	Suspension Linkage, Rear	Inspect
D	Swing Arm and Rear Axle	Inspect
D	Tires / Wheels	Inspect tread depth, sidewall cracking, wear patterns

XU - Perform these procedures more often for vehicles subjected to severe use.

D - Have an authorized Indian Motorcycle dealer perform these services.

E - Emission Control System Service (California / International)

When the vehicle goes beyond 50,000 miles, return to the 500 mile chart and start the interval process over.

## GENERAL INFORMATION

### SERVICE NOTES – MAINTENANCE

#### Periodic Maintenance Overview

Inspection, adjustment and lubrication of important components are explained in the periodic maintenance chart.

Inspect, clean, lubricate, adjust and replace parts as necessary. When inspection reveals the need for replacement parts, use genuine Indian Motorcycle parts available from your Indian Motorcycle dealer.

IMPORTANT
Service and adjustments are critical. If you're not familiar with safe service and adjustment procedures, have a qualified dealer perform these operations.

### SPECIAL TOOLS – MAINTENANCE

TOOL DESCRIPTION	PART NUMBER
Brake Lever Reserve Tool	PV-50104
Battery Tester	PU-50296
Belt Tension Meter	PV-43532
Oil Filter Wrench	PU-50105

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

### BREAK-IN PROCEDURE

Engine break-in for Indian Motorcycles occurs in the first 500 miles (800 km) of operation. Indian Motorcycles are manufactured using the best possible materials and manufacturing techniques, but the final machining process is the break-in. During this break-in period, critical engine parts wear and polish to correct operating clearances. Read, understand and follow all break-in procedures to ensure the long-term performance and durability of the engine.

⚠ CAUTION
Failure to properly follow the engine break-in procedures outlined in this manual can result in serious damage to the engine. Follow all break-in procedures carefully. Avoid full throttle operation and other condition that may place an excessive load on the engine during the break-in period.

Observe the following precautions during the break-in period:

- Upon initial start-up, do not allow the engine to idle for long periods as overheating can occur.
- Avoid fast starts with wide open throttle. Drive slowly until the engine warms up.
- Avoid running the engine at extremely low RPM in higher gears (lugging the engine).

#### Break-In Guidelines

ODOMETER	BREAK-IN PROCEDURE
0–90 Miles (0–145 km)	Do not operate for extended periods above 1/3 throttle or at any one throttle position. Vary engine speed frequently.
91–300 Miles (146–483 km)	Do not operate for extended periods above 1/2 throttle or at any one throttle position. Vary engine speed frequently.
301–500 Miles (484–805 km)	Do not operate for extended periods above 3/4 throttle.
<b>500 Miles (805 km)</b>	Perform the break-in maintenance procedure outlined in the Periodic Maintenance Interval Table located in this chapter.



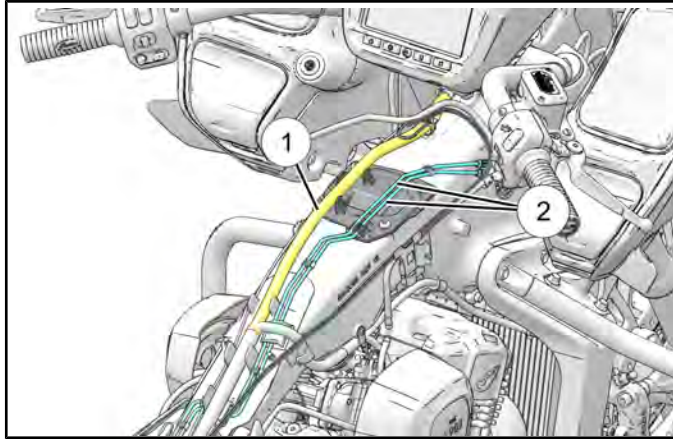
**ROUTINE MAINTENANCE PROCEDURES**

**AIR FILTER REPLACEMENT**

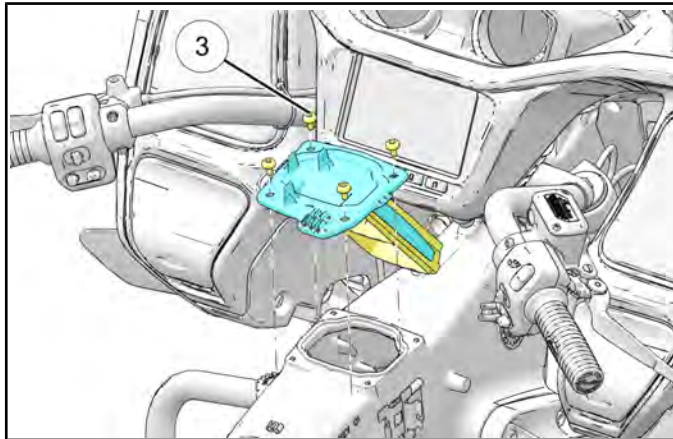
**NOTICE**

If the motorcycle is operated in wet or dusty conditions, more frequent servicing is required. The air filter element cannot be cleaned. Replace the filter when necessary.

1. Remove fuel tank. See **Fuel Tank Removal (2020)** page 4.23.
2. Disconnect wiring harness ① from airbox filter cover.



3. Disconnect brake lines ② from airbox filter cover.
4. Remove the airbox filter cover fasteners ③ and remove from the unit.



5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Airbox Filter Cover Fastener:  
**84 in-lbs (10 N·m)**

**ENGINE OIL & FILTER CHANGE**

**IMPORTANT**

Engine **MUST BE COLD** while performing the following procedure.

**IMPORTANT**

The total amount of oil required for a oil and filter change is approximately 5 qts. (4.7 L). Follow all instructions carefully. Do not overfill.

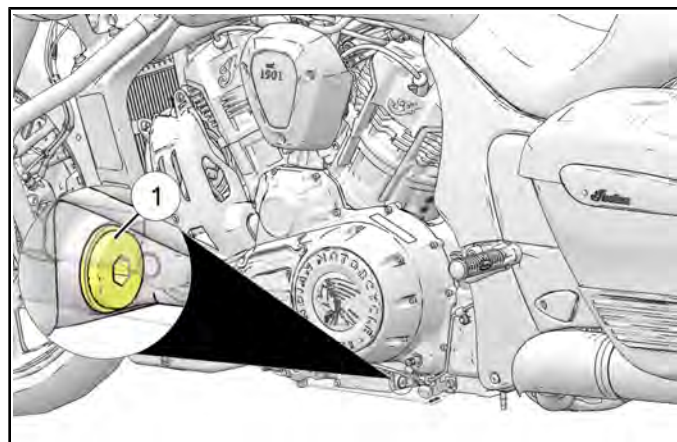
**CAUTION**

After an oil change, the low oil pressure indicator may illuminate when the engine is started. If this occurs, do not increase RPM above idle speed until the indicator turns off. Operating above idle speed could result in damage to the engine.

1. Change the oil and filter when the engine is warm. if the engine is cold, start the engine and allow it to run at idle for at least 5 minutes.
2. Park the motorcycle with the sidestand down on a firm, level surface. If using a service lift, the motorcycle should be centered.
3. Clean the area around the scavenge drain plug ①. Place a drain pan under the drain plug.

**CAUTION**

Hot oil can cause burns to skin. Do not allow hot oil to contact skin.

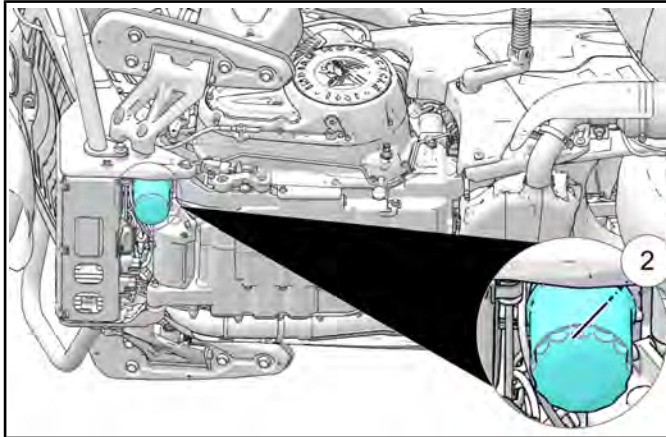


4. Remove the drain plug. Allow the oil to drain completely.
5. Install new sealing washer and o-ring on the drain plug. The sealing surfaces on drain plug and engine should be clean and free of burrs, nicks, or scratches.

- Reinstall the drain plug.

<b>TORQUE</b>
Drain Plug: <b>15 ft-lbs (20 N·m)</b>

- Place a drain pan beneath the oil filter ②. Use an oil filter wrench and remove the oil filter.



- Use a clean dry cloth to clean the filter sealing surface on the engine.
- Lubricate the o-ring on the new filter with a film of fresh engine oil. Check to make sure the o-ring is in good condition.
- Install oil filter.

<b>TORQUE</b>
Oil Filter: <b>Approximately 3/4 turn after seal has contacted the filter adapter.</b>

- Remove the dipstick. Add only 4 qts (3.8 L) of Indian Motorcycle 15-W60 oil. Do NOT overfill.
- Reinstall the dipstick securely.
- With the unit in an upright, centered position. Start the engine and idle for 30 seconds.
- Stop the engine and add an additional 1 qts (0.95 L) of oil.

<b>⚠ CAUTION</b>
Do NOT overfill. Overfilling can result in loss of engine performance and an oil saturated air filter. Use a suction device to remove excess oil if overfilled.

- To ensure the oil level is within the safe operating range, Re-check the oil level. See **Engine Oil Level** page 2.20.

<b>⚠ CAUTION</b>
After an oil change, the low oil pressure indicator may illuminate when the engine is started. If this occurs, do not increase RPM above idle speed until the indicator turns off. Operating above idle speed could result in damage to the engine.

- Dispose of used filter and oil properly.
- Reset the oil change life in the instrument gauge.

2



## MAINTENANCE

### ENGINE OIL LEVEL

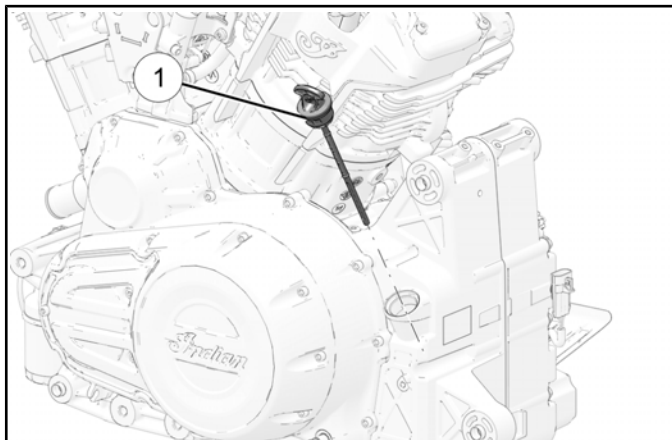
With the semi-dry sump lubrication system, the engine oil level on the dipstick will fluctuate, depending on the motorcycle's position and engine temperature when checked. To ensure a proper reading of the engine oil level, follow all inspection procedures closely.

#### **⚠ WARNING**

Operating with insufficient, deteriorated or contaminated engine oil will cause accelerated wear and may result in engine or transmission seizure, which could result in loss of control and serious injury or death. Check the oil level frequently.

Always check the oil after running a cold engine at idle for 30 seconds. The oil fill/dipstick is located on the left side of the engine. Always use the recommended oil.

1. Position the motorcycle on level ground in the fully upright and centered position.
2. Start the engine (from cold) and allow it to idle for 30 seconds. Stop the engine.
3. Remove the dipstick ① and wipe it clean.



4. Thread the dipstick until fully seated.
5. Remove the dipstick and view the oil level.

#### **⚠ CAUTION**

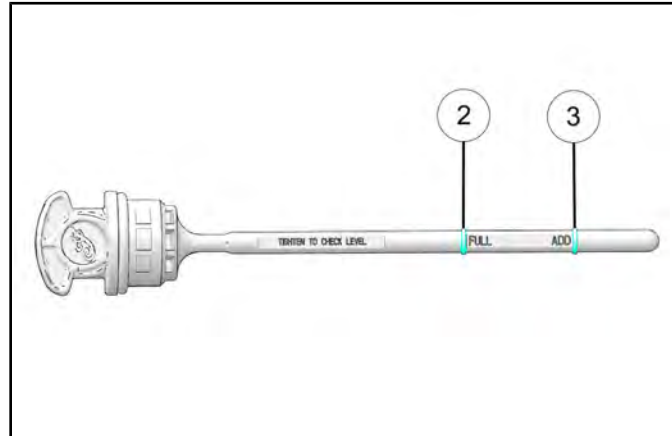
Do not overfill. Overfilling can result in loss of engine performance and an oil-saturated air filter. Use a suction device to remove excess oil if overfilled.

6. Add the recommended oil as needed to bring the level between the ADD and FULL marks. Do not add oil if between the ADD and FULL marks.

#### **NOTICE**

Oil should be added only if the proper oil check procedure is followed and the level is below the safe mark.

7. The approximate volume between the FULL ② and ADD ③ marks on the dipstick is 32 oz. (.94 L)



8. Reinstall the dipstick securely.

### TIRE PRESSURE / SPECIFICATIONS

#### TIRE INSPECTION

#### **⚠ WARNING**

Indian motorcycles are produced using the designated tires listed below as original equipment. This includes field testing to ensure stability and superior handling. The use of tires other than original equipment may cause instability. See Steering / Suspension chapter for a review of all tire related Warnings.

1. Inspect tires for weather checking, cuts, imbedded foreign objects, etc.
2. Inspect front and rear wheels for damage.
3. Measure tread depth at center of tread.
4. Measure in 3-4 places equally spaced around the tire and record the smallest measurement.

#### **⚠ WARNING**

**It is dangerous to ride with a worn tire. When a tire reaches the minimum tread depth listed below, replace the tire immediately.**

**MINIMUM TREAD DEPTH (ALL MODELS)**

MINIMUM TREAD DEPTH	
Front Tire Minimum Tread Depth	.063 in (1.6 mm)
Rear Tire Minimum Tread Depth	.063 in (1.6 mm)

**TIRE PRESSURE TABLE (COLD)**

**NOTICE**  
Also refer to Manufacturing Information label.

TIRE PRESSURE	
FRONT: Metzeler Cruisetec (130/60/B19)	<b>Front: 36 psi (248 kPa)</b>
REAR: Metzeler Cruisetec (180/60R16 80H (I))	<b>Rear: 41 psi (283 kPa)</b>

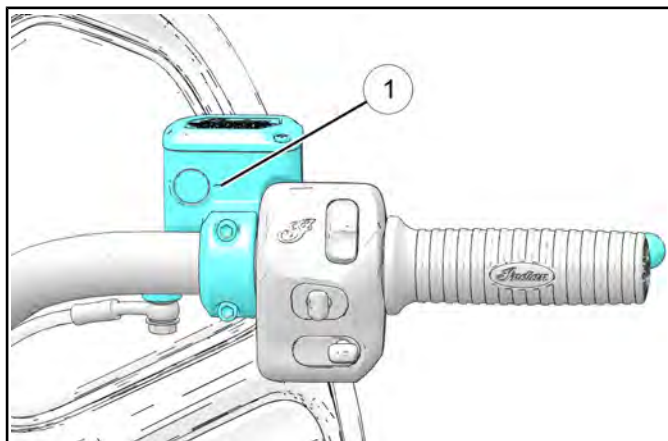
**BRAKE FLUID LEVEL INSPECTION**

**IMPORTANT**

The brake fluid level in the reservoir will go down as brake pads wear. If you notice a constant or sudden lowering of the brake fluid level, inspect brake pads for wear and brake system for leaks.

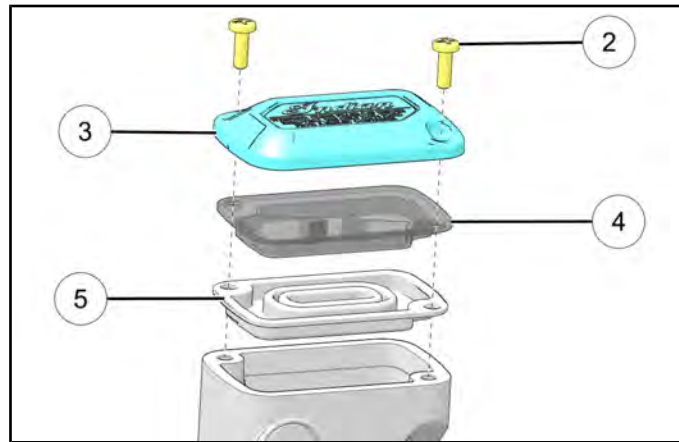
**FRONT BRAKE FLUID INSPECTION**

1. Turn handlebars or adjust the motorcycle until top of reservoir is level.
2. View front brake fluid level through sight glass. The fluid should be clear and at or above the LOW level mark ①.



3. Wipe area around reservoir cover with a clean cloth.

4. Wipe brake fluid container with a clean cloth.
5. Remove fasteners ②, reservoir cover ③, diaphragm plate ④, and diaphragm ⑤. If diaphragm is extended, return it to the neutral position.



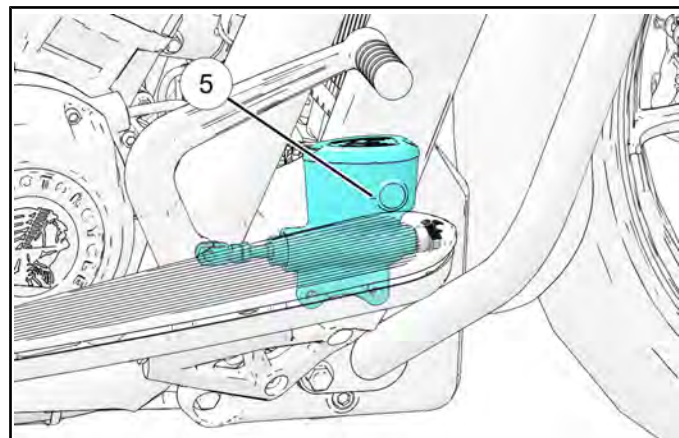
6. Carefully add enough DOT 4 brake fluid to bring level to the upper edge of the sight glass.
7. Reinstall reservoir diaphragm and cover and torque fasteners to specification.

**TORQUE**

Master Cylinder Cover Fasteners (Front):  
**18 in-lbs (2 N·m)**

**REAR BRAKE FLUID INSPECTION**

1. Fluid level is checked at the rear brake master cylinder reservoir.
2. View fluid level through reservoir sight glass ⑤. The fluid should be clear and at a level between UPPER and LOWER level marks.

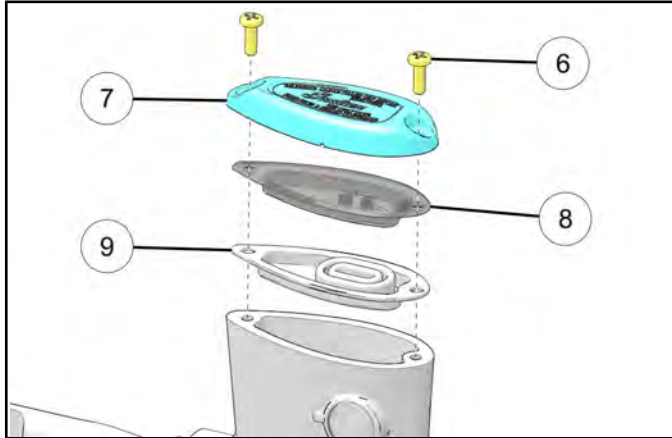


3. Wipe area around reservoir cover with a clean cloth.
4. Wipe brake fluid container with a clean cloth.

2

## MAINTENANCE

5. Remove fasteners ⑥, reservoir cover ⑦, diaphragm plate ⑧, and diaphragm ⑨. If diaphragm is extended, return it to the neutral position.



6. Carefully add enough DOT 4 brake fluid to bring level to the upper edge of the sight glass.
7. Install diaphragm and cover. Tighten cover fasteners to specification.

### TORQUE

Master Cylinder Cover Fasteners (Rear):  
**18 in-lbs (2 N·m)**

## SPARK PLUG INSPECTION / GAP

### CAUTION

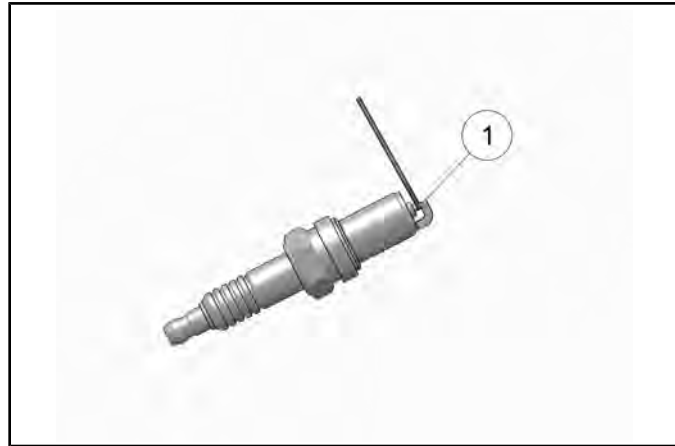
A hot engine can cause serious burns. Allow engine to cool or wear protective gloves when removing the spark plugs.

1. Remove spark plugs. See **Spark Plug Removal page 3.4**.
2. Inspect electrodes for wear and carbon buildup. Look for a sharp outer edge with no rounding or erosion of the electrodes.
3. Clean with electrical contact cleaner or a glass bead spark plug cleaner only.

### CAUTION

A wire brush or coated abrasive (sandpaper) should not be used to clean electrodes.

4. Measure electrode gap with a wire gauge ①. Adjust gap if necessary by carefully bending the grounding electrode until the specified gap is achieved.



**Spark Plug Type:**  
NGK LZMAR8AI-1

**Spark Plug Gap:**  
0.039 in (1.0 mm)

## BATTERY CHARGING AND MAINTENANCE

### AGM BATTERY CHARGER RECOMMENDATIONS

Indian Motorcycle recommends using the BatteryMINDER® 2012 AGM - 2 AMP battery charger (PN 2830438) to charge and maintain AGM batteries. The charger can be found on the Polaris PG&A website and ordered in DEX – Item Availability.

Batteries that fall below 12.5V run the risk of sulfation, a condition whereby sulfate crystals form inside the battery and significantly reduce performance. AGM chargers are designed specifically for charging AGM type batteries and use high frequency pulses to partially reverse sulfation.

### IMPORTANT

The use of non-AGM battery chargers or non-AGM battery tenders may result in a misleading “battery not found” or “open cell” fault message. Please ensure you are using the recommended AGM charger when charging AGM type batteries.

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**INDIAN MOTORCYCLE RECOMMENDED AGM BATTERY TESTING PROCEDURE:**

1. Test battery using the battery tester PU-50296.
2. If the tester indicates a test result other than “Good Battery,” follow the steps below before replacing the battery:

- a. Connect battery to the recommended battery charger. If charging sequence begins as normal, fully charge battery and proceed to step 3.

The time listed on the PU-50296 battery tester printout is an estimate. The recommended automatic charger will indicate when the battery is fully charged on its display.

- b. If charging sequence does not initialize, refer to **AGM Battery Charging Recommendations – Deeply Discharged (below 3 volts)** to attempt to restore the deeply discharged battery. If charging sequence will not finish as intended, the battery needs to be replaced.
3. Re-test battery. If the test results show that battery failed, proceed with battery replacement.

### **AGM BATTERY CHARGING RECOMMENDATIONS – LOW CHARGE**

The nominal voltage for an Indian Motorcycle battery is 12.8 Volts when fully charged. The battery will self-discharge when disconnected from a vehicle, and will discharge at a faster rate when connected. If the battery voltage falls below 12.5V, it should be charged immediately using the recommended battery charger. Listed below are the recommended battery inspection schedules.

- Batteries which are not connected to a vehicle should be inspected every 60 days. The battery must be charged if found to be below 12.5 volts.
- Batteries which are connected to motorcycles should be inspected when they arrive at your dealership and at least once every month thereafter. The battery must be charged if found to be below 12.5 volts.
- Showroom bikes used to demonstrate radio, display and infotainment features should be charged daily. If possible, these bikes should be connected to the recommended battery charger continuously.

Always use the recommended automatic battery charger, and wait for the charger to complete the charge cycle before disconnecting it.

**AGM BATTERY CHARGING RECOMMENDATIONS – DEEPLY DISCHARGED (BELOW 3 VOLTS)**

AGM batteries discharged to a voltage of 3 volts or less may not be recognized by the recommended automatic battery charger. (The minimum voltage threshold recognized by other battery chargers may be as high as 10.5 volts). Often times deeply discharged batteries can be restored by attaching another, fully-charged, battery to “jump start” the low battery. Follow the steps below to restore a deeply discharged battery.

1. Carefully connect the two batteries’ positive terminals, then the negative terminals using jumper cables.
2. Connect the recommended battery charger to the low battery and initiate the charging sequence.

<b>⚠ WARNING</b>
Always check to ensure the positive cables are connected to the positive terminals before powering the charger on. Reversing polarity when charging can damage electrical components and risk personal injury. Be careful not to let battery cable clamps touch each other.

3. After the charging sequence has initiated, disconnect the fully-charged battery. Always disconnect the fully-charged battery positive first, followed by low battery positive, low battery negative, and finally fully-charged battery negative
4. Proceed with charging both batteries to full capacity. Listed in the table below are the approximate charging times for deeply discharged batteries. Always use the recommended automatic battery charger, and wait for the charger to complete the charge cycle before disconnecting it. The recommended automatic charger will indicate when the battery is fully charged on its display.

BATTERY PN	CHARGING TIME	BATTERY CAPACITY	CHARGING RATE
4011496	11 hours	18 AH	2 amps
4014770	8 hours	12 AH	2 amps



## MAINTENANCE

### AGM BATTERY MAINTENANCE TIPS

1. If the motorcycle will not be driven for more than 2 weeks, maintaining the battery with the BatteryMINDER® 2012 AGM - 2 AMP charger (PN 2830438) is recommended.
2. To help prolong battery life, it is recommended to remove the battery from vehicles stored ONE month or longer. To maximize the life of stored batteries, they should be kept in a cool / dry location. Batteries will self discharge more rapidly when stored in extreme temperatures. Batteries should be maintained using the recommended battery charger while in storage.
3. Batteries will self-discharge more quickly when dirty. Periodic cleaning of the battery terminals using a terminal brush will help maximize battery life. Wash terminals with a solution of one tablespoon baking soda and one cup water. Rinse well with tap water and dry off with clean shop towels. Coat the terminals with dielectric grease or petroleum jelly.
4. Battery connections should be tightened to the correct torque during installation. This will reduce voltage drop and ensure a reliable connection between the regulator/rectifier and battery.
5. Models are conveniently equipped with a SAE bullet style connector for quick access to charging the battery. The recommended BatteryMINDER® 2012 charger comes with the mating connector for easy plug and play maintenance.

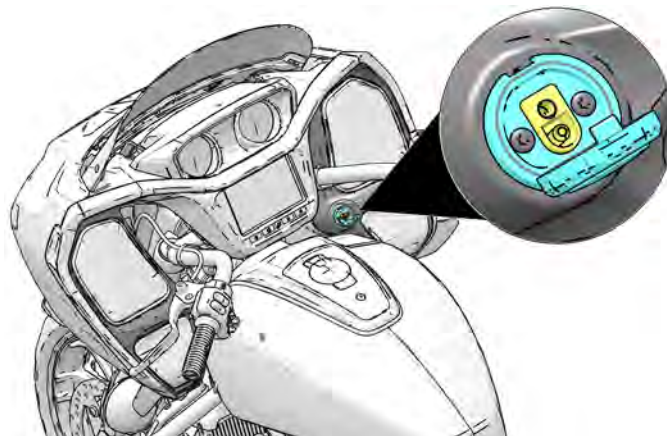
**2020**

The connector is on the left side of the unit near the fuse box.



**2021+**

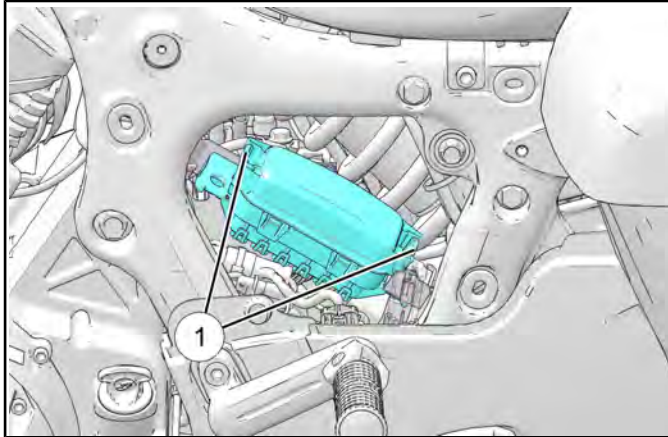
The connector is located on the right hand fairing dash.



## FUSE REPLACEMENT

Fuses and relays are located in the fuse box under the Left-Hand upper side cover.

1. Remove Left-Hand upper side cover.  
See **Side Cover (Upper), Removal / Installation page 7.27.**
2. Squeeze fuse box tabs ① together and lift cover off of fuse box.



3. If any fuse is blown, turn off main switch. Install new fuse of specified amperage. Turn on switches and see if system operates correctly. Repeat fuse failure indicates an electrical problem.

### ⚠ CAUTION

Do not use fuses of a higher amperage rating than what is specified.

If the correctly rated fuse continues to blow, something is wrong and needs to be corrected. Substituting a higher amperage fuse can lead to extensive electrical system and vehicle damage.

MAIN ENGINE RELAY 4016819	START RELAY 4016819	25A VCM1 401653	FUEL PUMP RELAY 4016819	25A ABS 401653	SWITCHED POWER RELAY 4016819
15A EFI 2410280	10A EFI2 2434016	10A SPARE 2434016	5A GAUGE 401652	25A AUDIO1 401653	10A SWITCHED1 2434016
7.5A IGN 401068	10A WCM 2434016	25A VCM2 401653	25A VCM3 401653	25A AUDIO2 401653	10A SWITCHED2 2434016

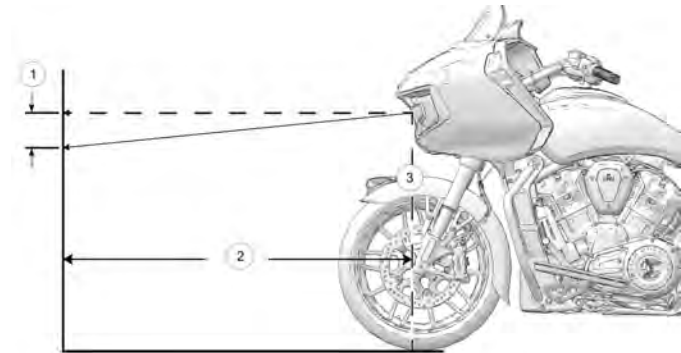
## HEADLIGHT AIM INSPECTION

Adjust headlight aim when there is a change in load (rider, cargo, accessories, etc.) or after suspension adjustment.

### HEADLIGHT INSPECTION PROCEDURE

1. Check and adjust the tire pressure to specification. See **Service Specifications – Tires page 8.92.**
2. Verify suspension ride height (preload) is set to specification. See **Rear Shock Preload Adjustment page**
3. Move the motorcycle to a clear area with a level floor and dim lighting, and place it so the top front edge of the headlight housing is 32 ft. 10 in (10.0 m) from the wall.
4. With the rider and passenger (if applicable) on board, bring the motorcycle to a fully upright position. Center the handlebars in a straight ahead position.
5. Start the engine and switch on the HIGH beam. Observe the headlight aim on the wall.
6. Make any necessary adjustments to center the brightest portion of the high beam straight ahead.
7. Switch the headlight to LOW beam. Observe the headlight aim on the wall.
8. Make any necessary adjustments to headlight aim per the diagram table.

### LED HEADLIGHTS

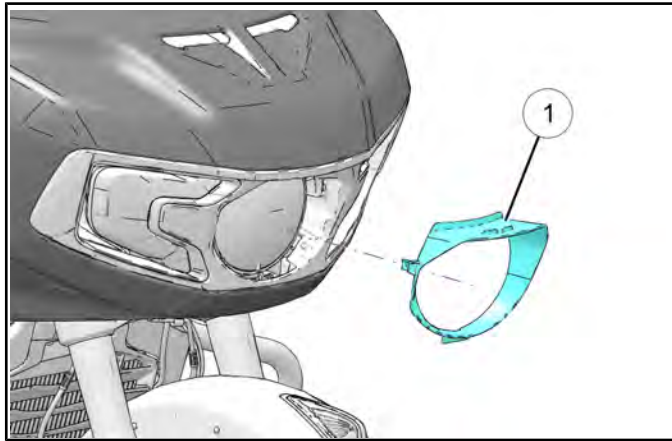


NUM-BER	DESCRIPTION
①	4 in (10 cm) to top cut-off of beam
②	Measure distance = 32 ft. 10 in (10.0 m)
③	Headlight Center

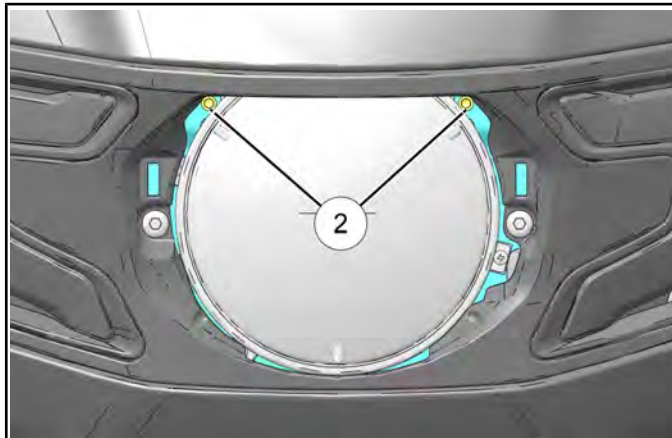


## HEADLIGHT AIM ADJUSTMENT

1. Remove headlight bezel ①.



2. To adjust the headlight vertically, both adjustment fasteners ② must be turned in or out equally. Turn fasteners in (clockwise) to lower the beam. Turn fasteners out (counter-clockwise) to raise the beam.



3. To adjust the headlight horizontally, turn the left adjustment fastener out (counter-clockwise) to adjust the beam to the left. Turn the right adjustment fastener out (counter-clockwise) to adjust the beam to the right.

**MAJOR MAINTENANCE PROCEDURES****IMPORTANT**

Reference the **Maintenance Intervals** page 2.4 for details on how often to perform each procedure.

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Idle Speed / Fast Idle Speed	<b>Idle Speed / Fast Idle Speed</b> page 3.4
Spark Plug Removal	<b>Spark Plug Removal</b> page 3.4
Spark Plug Installation	<b>Spark Plug Installation</b> page 3.5
Engine Compression Test	<b>Engine Compression Test</b> page 3.5
Engine Compression Test (Wet)	<b>Engine Compression Test (Wet)</b> page 3.6
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Fuel Tank Vent Inspection	<b>Fuel Tank Vent Inspection</b> page 4.5
Evaporative Emission Control System	<b>Evaporative Emission Control System – 50 State / INTL</b> page 4.7
Fuel Supply Hose (Fuel Rail) Inspection	<b>Fuel Rail Inspection</b> page 4.8
Clutch Cable Inspection / Lubrication	<b>Clutch Cable Inspection / Lubrication</b> page 5.4
Clutch Lever Lubrication	<b>Clutch Lever Lubrication</b> page 5.5
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Drive Belt Adjustment	<b>Drive Belt Adjustment</b> page 8.6
Sprocket Inspection	<b>Sprocket Inspection</b> page 8.8
Fork / Steering Head Inspection	<b>Steering Head / Front Wheel Inspection</b> page 8.8
Swingarm Inspection	<b>Swing-Arm Inspection</b> page 8.8
Rear Shock Preload Inspection	<b>Rear Shock Preload Inspection</b> page 8.9
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Rear Shock E-Preload Adjustment	<b>Rear Shock E-Preload Adjustment</b> page
Shock Analysis	<b>Shock Analysis</b> page 8.12
Sidestand Inspection	<b>Sidestand Inspection</b> page 8.12
Sidestand Removal / Installation	<b>Sidestand Removal / Installation</b> page 8.13
Front Brake Lever Inspection	<b>Front Brake Lever Inspection</b> page 9.4
Front Brake Lever Lubrication	<b>Front Brake Lever Lubrication</b> page 9.4

## MAINTENANCE

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<b>MAINTENANCE PROCEDURE</b>	<b>LOCATION</b>
Front Brake Lever Reach	<b>Front Brake Lever Reach page 9.5</b>
Brake Pedal Inspection	<b>Brake Pedal Inspection page 9.5</b>
Brake Pedal Lubrication	<b>Brake Pedal Lubrication page 9.5</b>
Front Brake Pad Inspection	<b>Front Brake Pad Inspection page 9.6</b>
Rear Brake Pad Inspection	<b>Rear Brake Pad Inspection page 9.6</b>
Battery Removal	<b>Battery Removal page 10.6</b>
Battery Installation	<b>Battery Installation page 10.6</b>

# CHAPTER 3

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## ENGINE / COOLING / EXHAUST

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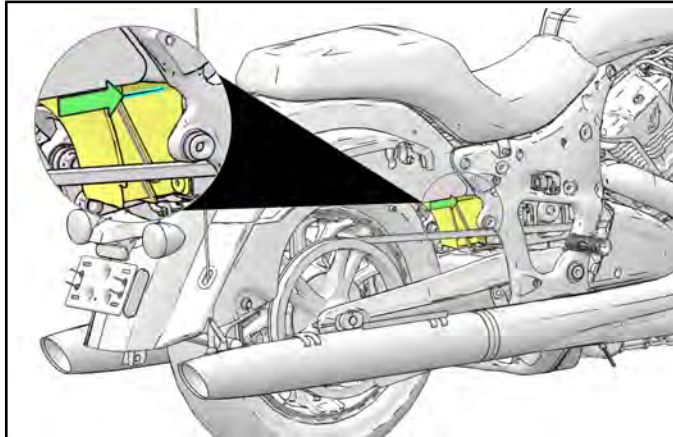
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## ENGINE / COOLING / EXHAUST MAINTENANCE

### COOLANT LEVEL INSPECTION

1. Remove lower right side cover. See **Side Cover (Lower), Removal / Installation** page 7.28.
2. Inspect the recovery bottle level.



3. To add coolant reference **Coolant Drain / Fill / Bleed** page 3.37.

### IDLE SPEED / FAST IDLE SPEED

#### NOTICE

Idle speed is continuously monitored and adjusted by the ECM.

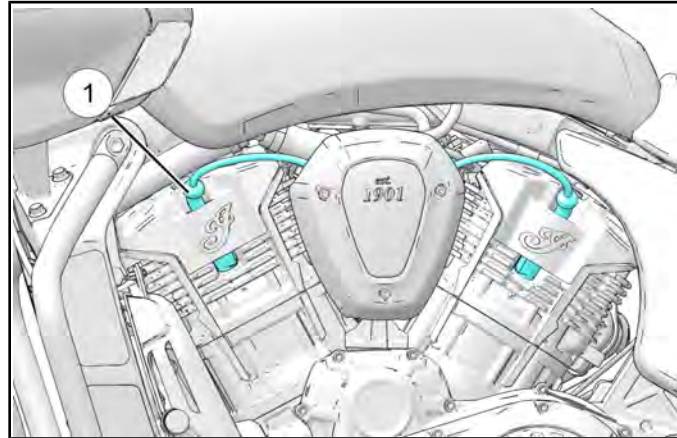
### SPARK PLUG REMOVAL

#### CAUTION

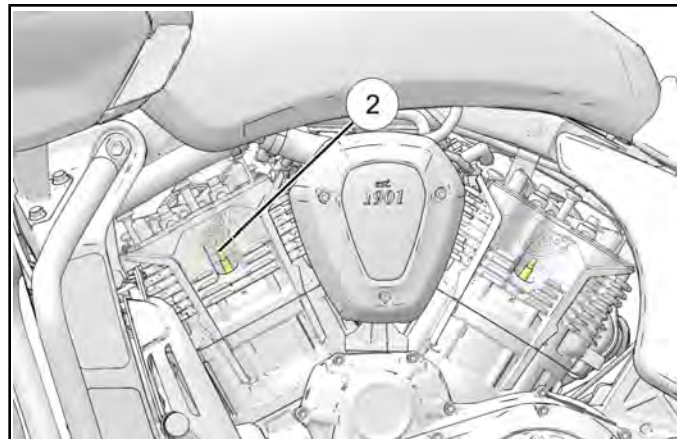
#### HOT COMPONENTS

Wear insulated gloves and/or allow engine and exhaust to cool before handling these parts.

1. With the engine at room temperature, grasp the spark plug boot ① and rotate back and forth slightly to release from the spark plug. **DO NOT** pull on the wire or spark plug wire may be damaged.



2. Grabbing only the base of the spark plug boot, pull straight out of spark plug well.
3. Clean out spark plug wells with compressed air to remove any loose dirt or debris.
4. Using a 3" extension and a 5/8" spark plug socket, remove spark plugs ②.



**SPARK PLUG INSTALLATION**

1. Inspect spark plug gap with a wire gauge. If gap adjustment is necessary, bend ground electrode carefully using a spark plug gap tool.

**Spark Plug Type:**  
NGK LZMAR8AI-1

**Spark Plug Gap:**  
0.039 in (1.0 mm)

2. Apply anti-seize compound sparingly to spark plug threads, avoiding the bottom 2 - 3 threads.
3. Torque spark plugs to specification.

**TORQUE**

Spark Plug:  
**84 in-lbs (10 N·m)**

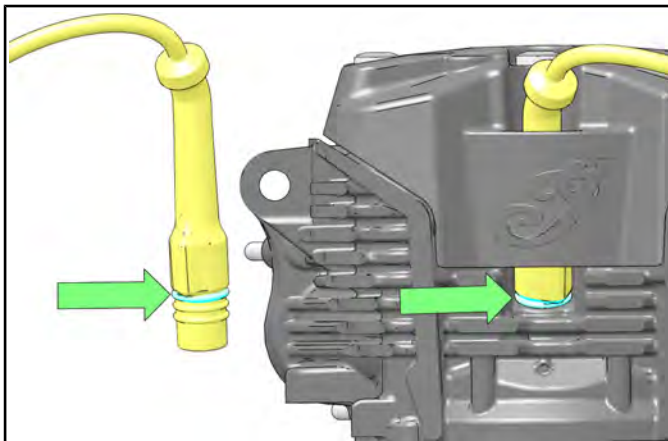
**⚠ CAUTION**

Do not over tighten spark plugs. Damage to the cylinder head or spark plug may result.

4. Install spark plug wire boots securely over the plugs.

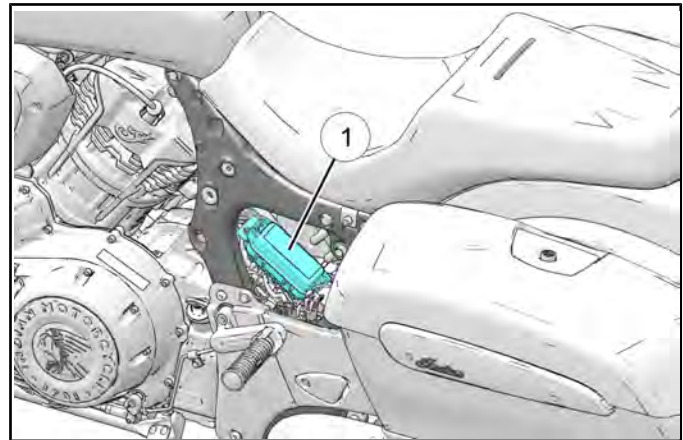
**IMPORTANT**

The spark plug boot is fully seated when the third rib on the boot is level with the spark plug hole as shown.

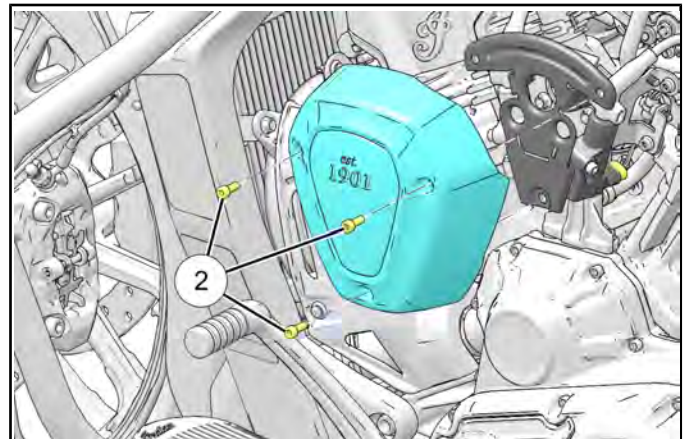
**ENGINE COMPRESSION TEST**

1. Warm engine to operating temperature.
2. Shift transmission into neutral and stop engine.
3. Remove the LH upper side cover to access the fuse box ①.

See **Side Cover (Lower), Removal / Installation page 7.28.**



4. Remove the Fuel Pump Relay to disable fuel pump.
5. Remove the V-cover by removing its fasteners ②.



6. Disconnect the ignition coil electrical connector to disable ignition system.
7. Disconnect ignition cables from both spark plugs.
8. Remove spark plug from cylinder to be tested. See **Spark Plug Removal page 3.4.**
9. Crank engine for 5 seconds to allow hydraulic lash adjusters to pump up with oil.
10. Install compression tester in the spark plug hole following manufacturer's instructions.
11. Open throttle and crank engine until needle on compression gauge stops rising (about 5 seconds).



12. Repeat procedure on remaining cylinder.

IMPORTANT
<p>Compression should be <b>88–115 PSI (586 – 793 kPa)</b>.                      If compression is low, see wet compression test. See <b>Engine Compression Test (Wet) page 3.6</b>.</p>

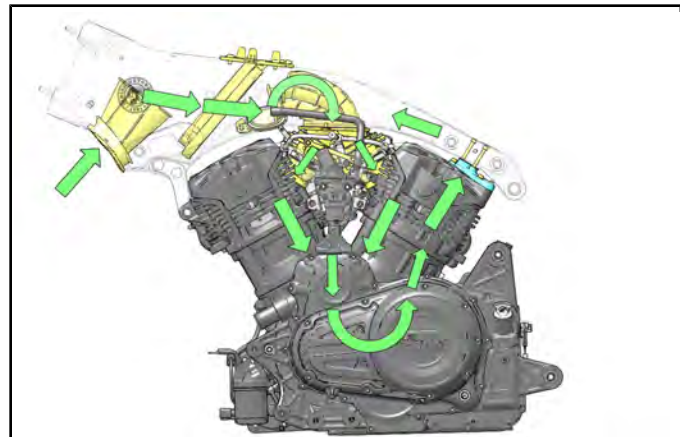
## ENGINE COMPRESSION TEST (WET)

IMPORTANT
<p>Indian Motorcycle strongly recommends using the cylinder leakdown method to determine how well the combustion chamber is sealing.</p>

1. Pour 3-5 cc of clean engine oil into each cylinder through spark plug hole. Repeat cylinder compression test. See **Engine Compression Test page 3.5**.
2. If compression increases substantially, inspect cylinder, piston, and rings.
3. If compression is low but no change with wet test, investigate cam timing (decomp event late). If compression is high, investigate camshaft timing (decomp event early), hydraulic lash adjuster condition, camshaft decompression mechanism functionality, and lube system pressure.

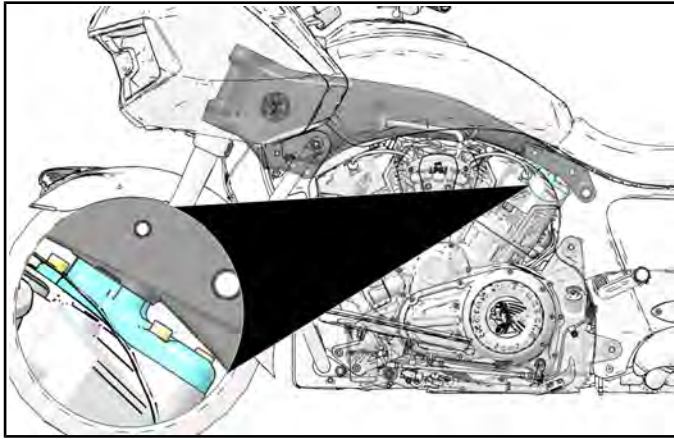
## CRANKCASE VENTILATION SYSTEM

The crankcase ventilation system routes blow-by gasses from the engine back into the intake tract.



The crankcase breather ① can be located on the rear cylinder. The crankcase ventilation system is integrated into the main frame member.

The breather can be visually inspected by looking for leaks or cracks.



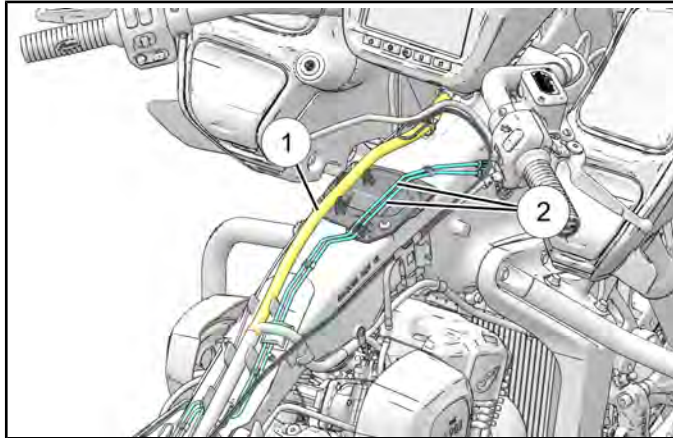
3

## AIR CLEANER SERVICE AIR FILTER REPLACEMENT

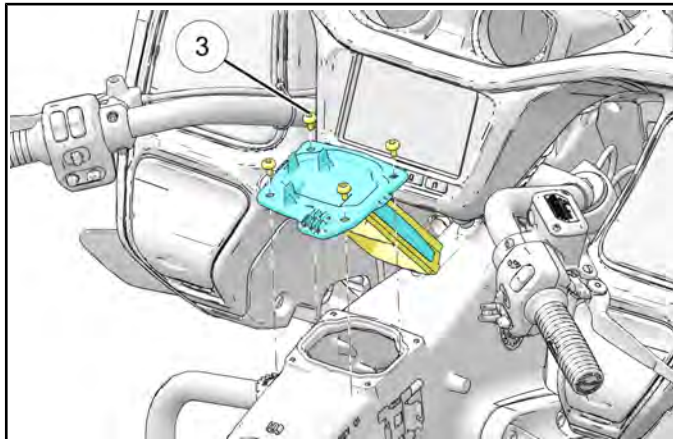
### NOTICE

If the motorcycle is operated in wet or dusty conditions, more frequent servicing is required. The air filter element cannot be cleaned. Replace the filter when necessary.

1. Remove fuel tank. See **Fuel Tank Removal (2020) page 4.23.**
2. Disconnect wiring harness ① from airbox filter cover.



3. Disconnect brake lines ② from airbox filter cover.
4. Remove the airbox filter cover fasteners ③ and remove from the unit.



5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

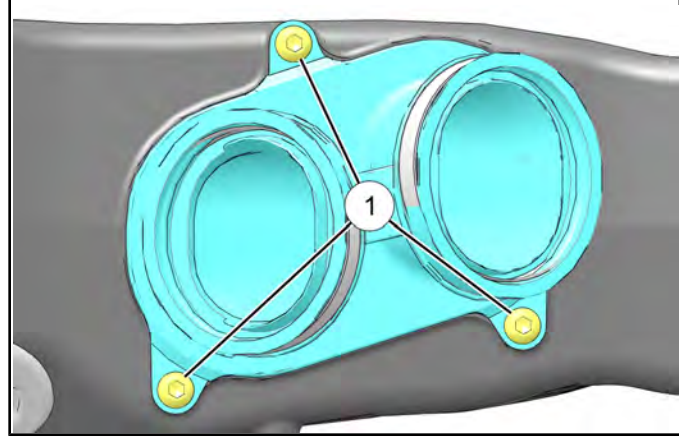
### TORQUE

Airbox Filter Cover Fastener:  
**84 in-lbs (10 N·m)**

## INLET ADAPTER REMOVAL / INSTALLATION

### REMOVAL

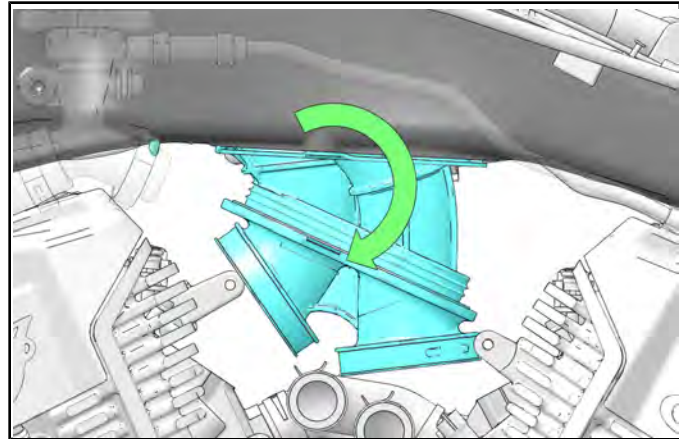
1. Remove throttle body. See **Throttle Body Removal / Installation page 4.63,**
2. Remove inlet adapter fasteners ①.



### NOTICE

Image is shown looking up at inlet adapter.

3. Remove the inlet from the frame.



### INSTALLATION

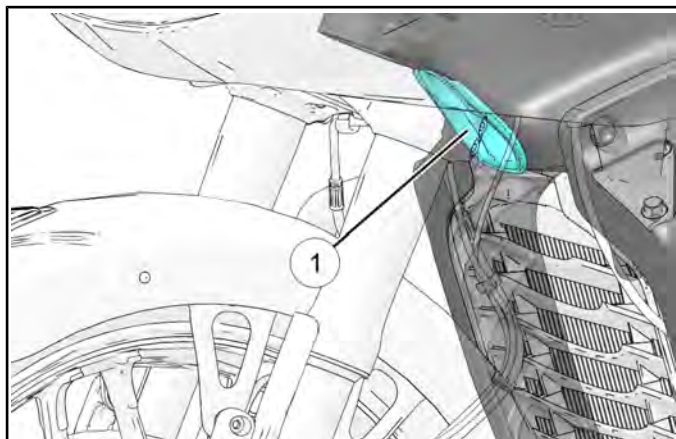
1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

### TORQUE

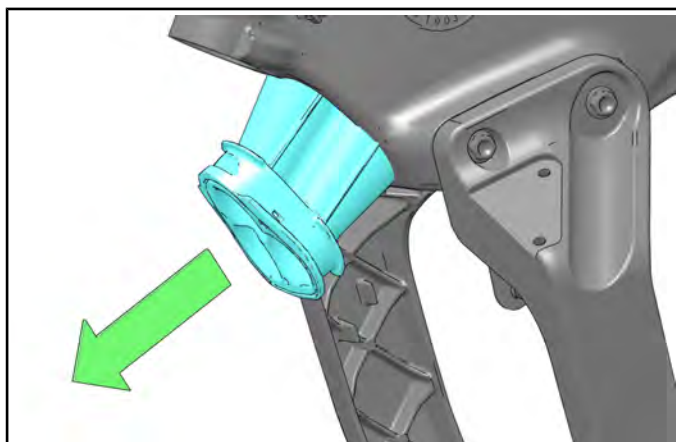
Inlet Adapter Fastener:  
**84 in-lbs (10 N·m)**

## INLET TUBE REPLACEMENT

1. Locate the inlet tube ①.



2. Remove the inlet from the frame.



3. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**ENGINE REMOVAL / INSTALL****GENERAL INFORMATION****SERVICE NOTES – ENGINE REMOVAL / INSTALL**

A floor jack or commercially available motorcycle engine lift or hoist is required for engine removal. Arrange for assistance when removing and installing the engine.

Once the engine is removed from frame, an engine stand is recommended for engine disassembly and assembly.

Engine removal and installation methods may differ slightly depending on available equipment, but always be sure the engine and chassis are securely supported at all times.

<b>REQUIRES ENGINE REMOVAL FOR SERVICE</b>	<b>CAN BE SERVICED WITH ENGINE IN FRAME</b>
Camshaft(s) / Bearings	Airbox Removal
Crankshaft & Crankshaft Component Service	Camshaft Chain / Guide / Tensioner Assembly
Cylinder Heads	Fuel Injectors / Throttle Body / Fuel Rail
Cylinders	Voltage Regulator, Stator, Rotor (Flywheel)
Oil Pump	Clutch
Valve Covers *The engine does not need to be fully removed for service but does need to be lowered enough to remove component.	Gearshift Linkage (External)
Balance Shaft	Ignition System
Piston/Cylinder	Oil Pump Drive
Transmission/All Internal Transmission Parts	Output Shaft Seal
	Torque Compensator Assembly
	Starter, Starter One-Way Clutch, Starter Torque Limit Clutch

**SERVICE SPECIFICATIONS – ENGINE REMOVAL / INSTALLATION**

<b>ITEM</b>	<b>SPECIFICATIONS</b>
Engine Dry Weight	Approximately 268 lbs (122 kg)
Oil Capacity (Dry Fill)	Approximately <b>5.0 qts (4.7 L)</b>

**SPECIAL TOOLS – ENGINE**

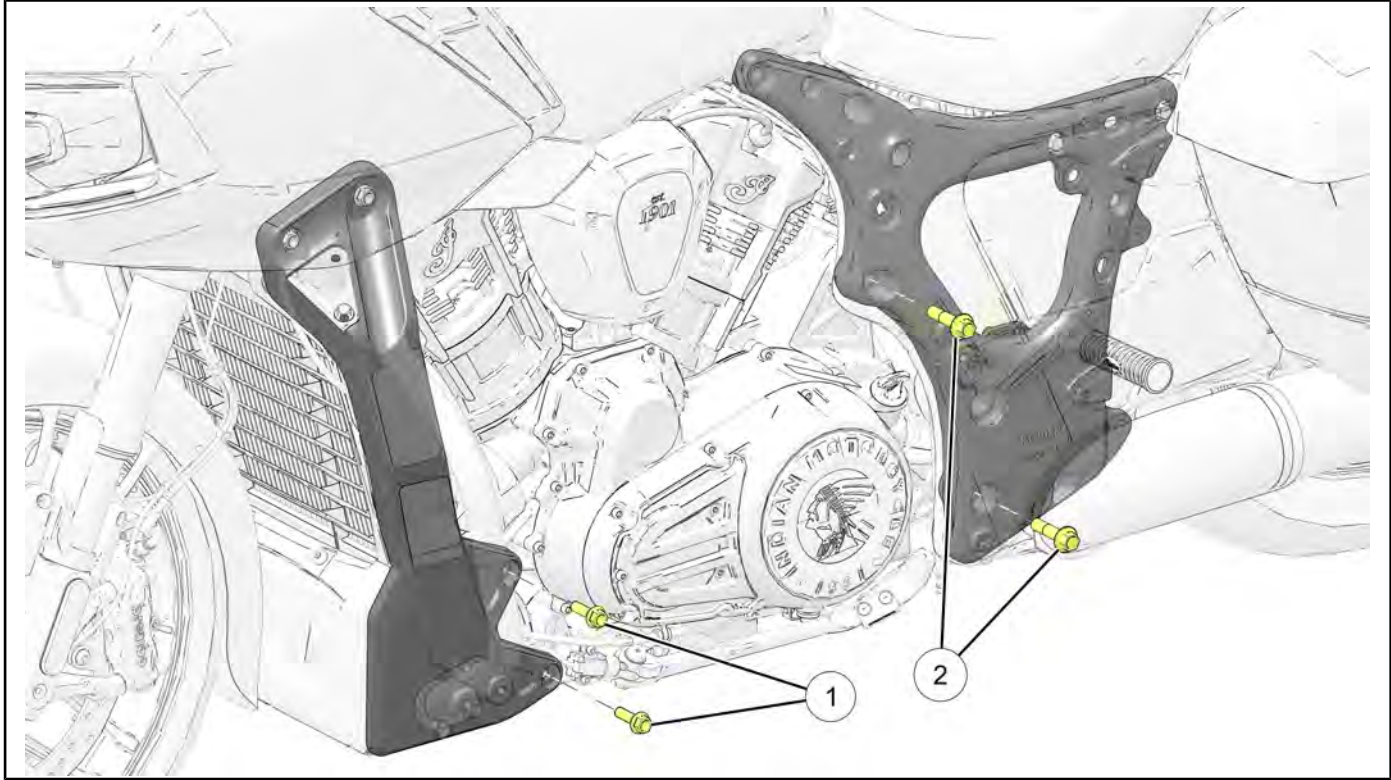
<b>TOOL DESCRIPTION</b>	<b>PART NUMBER</b>
Engine Stand Adapter	PF-51240
Crankshaft Locking Pin	PF-52135
Motorcycle Table Lift / Wheel Vise	Commercially Available
12"x12" Platform Jack	Commercially Available
Engine Hoist (Cherry Picker)	Commercially Available
Engine Stand	Commercially Available

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

**ASSEMBLY VIEWS**

**ENGINE BRACKETS / FASTENERS**

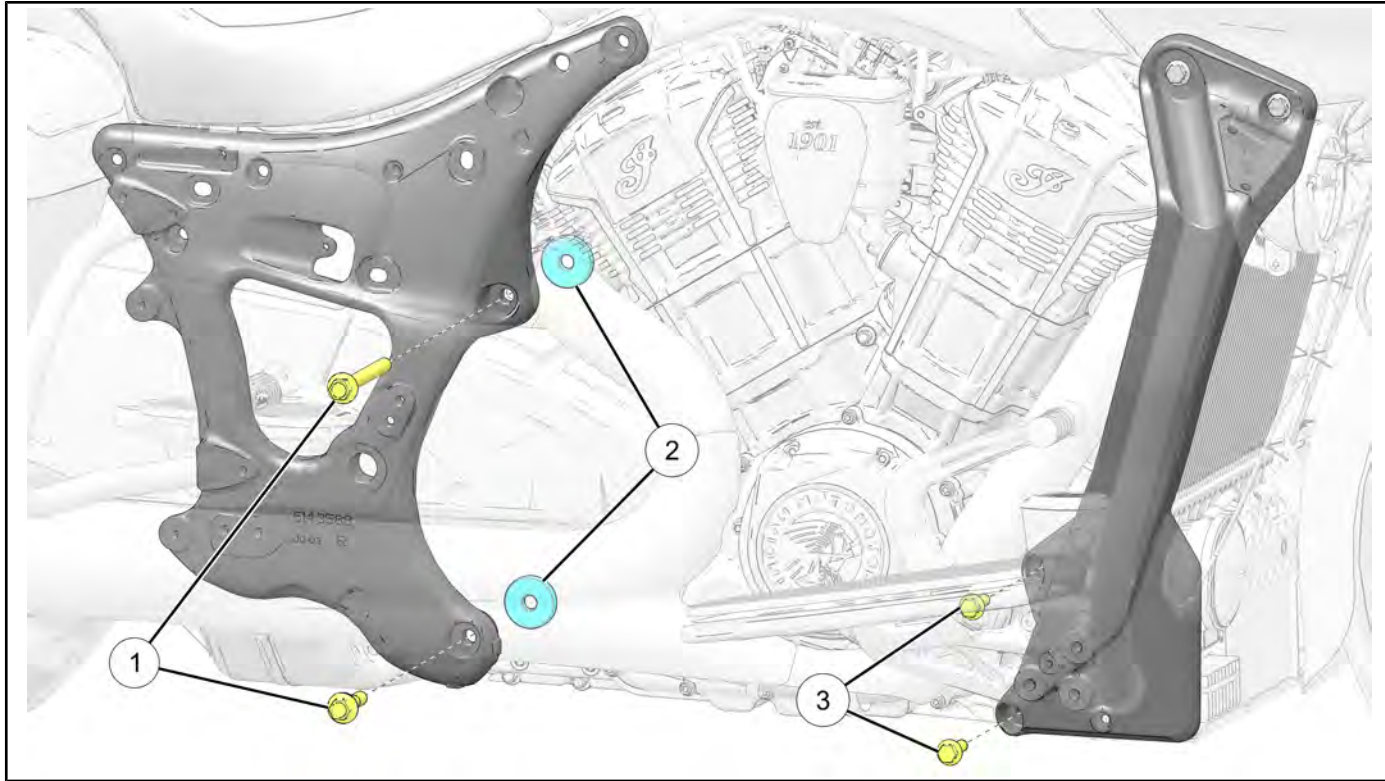
**LEFT SIDE BRACKETS / FASTENERS**



**3**

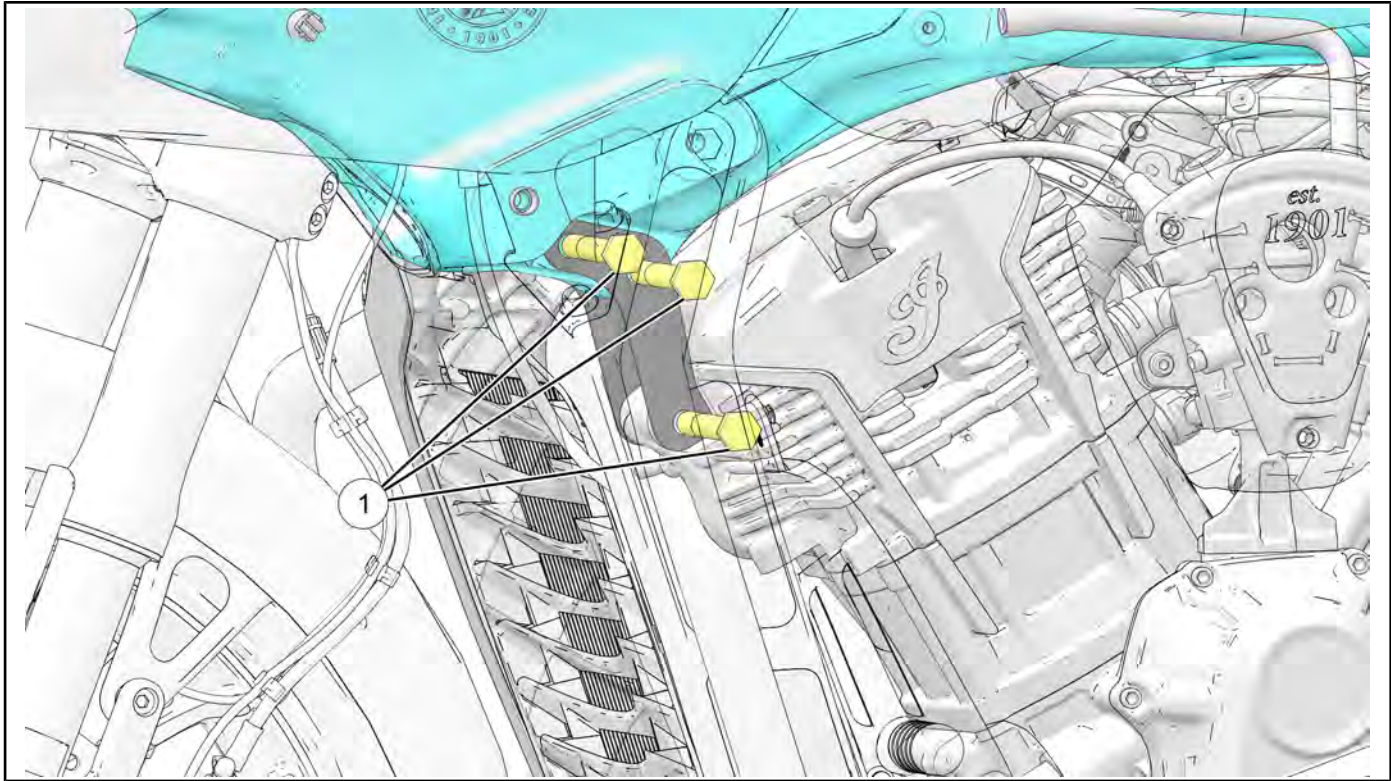
NUMBER	DESCRIPTION	TORQUE
①	Front Downcast Fastener	<b>45 ft-lbs (61 N·m)</b>
②	Midcast M12 Fastener	<b>75 ft-lbs (102 N·m)</b>

**RIGHT SIDE BRACKETS / FASTENERS**



NUMBER	DESCRIPTION	TORQUE
①	Midcast M12 Fastener	<b>75 ft-lbs (102 N·m)</b>
②	Engine / Frame Spacer	—
③	Front Downcast Fastener	<b>45 ft-lbs (61 N·m)</b>

**CYLINDER HEAD BRACKET / FASTENER**



**3**

NUMBER	DESCRIPTION	TORQUE
①	Cylinder Head Bracket Fastener	75 ft-lbs (102 N·m)



## ENGINE REMOVAL / INSTALLATION

### PREPARATION FOR ENGINE REMOVAL

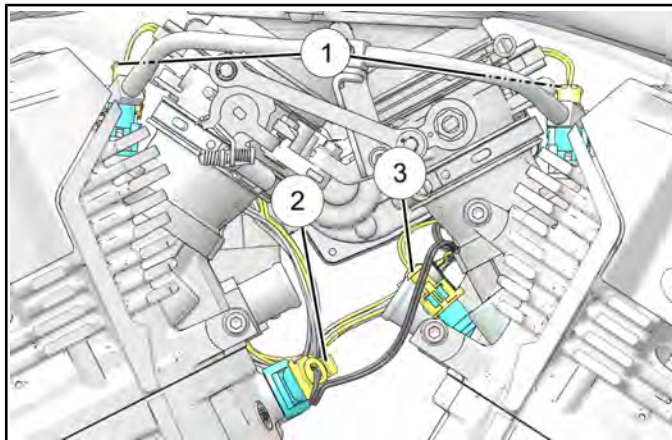
#### NOTICE

Different methods can be used to remove the engine depending on the equipment available to the technician. All methods require the front wheel to be held securely in an upright position.

#### IMPORTANT

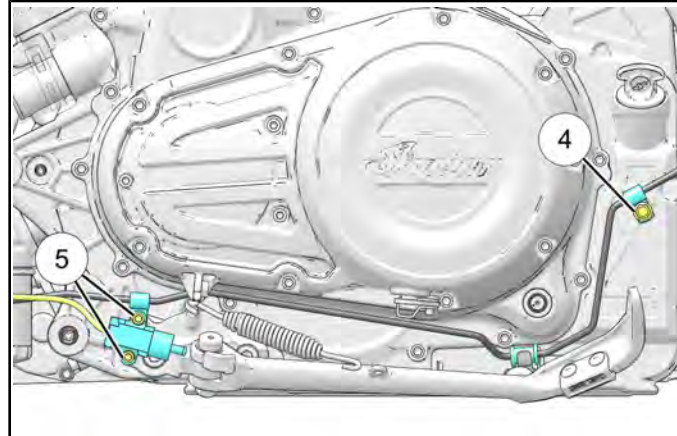
Some procedures require the engine to be completely removed for service. In some instances lowering the engine can be sufficient.

1. Secure motorcycle securely in an upright position. Clamp front tire securely in a wheel vise.
2. Remove fuel tank. See **Fuel Tank Removal (2020) page 4.23.**
3. Remove radiator. See **Radiator Removal / Installation page 3.38.**
4. Remove head pipe. See **Headpipe Removal / Installation page 3.112.**
5. Remove driver's floorboard. See **Floorboard Removal / Installation page 7.29.**
6. Disconnect drive belt from drive sprocket. Reference **Drive Belt Removal page 8.59.**
7. Remove thermostat assembly. See **Thermostat Removal / Installation page 3.43.**
8. Disconnect electrical connector for:



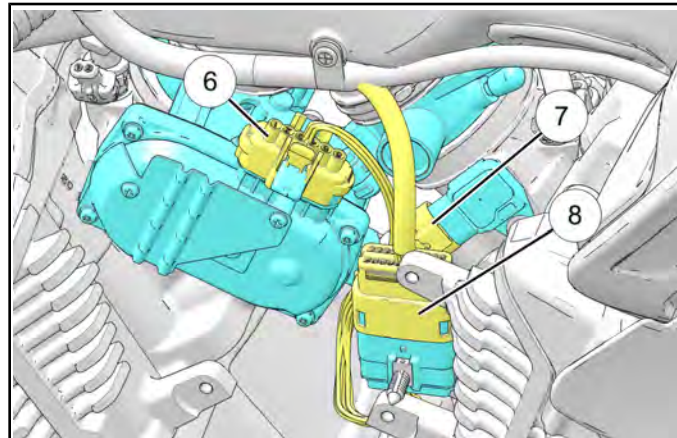
- Fuel injectors ①
- Knock sensor ②
- Cylinder head temperature sensor ③

9. Remove brake line fastener ④.



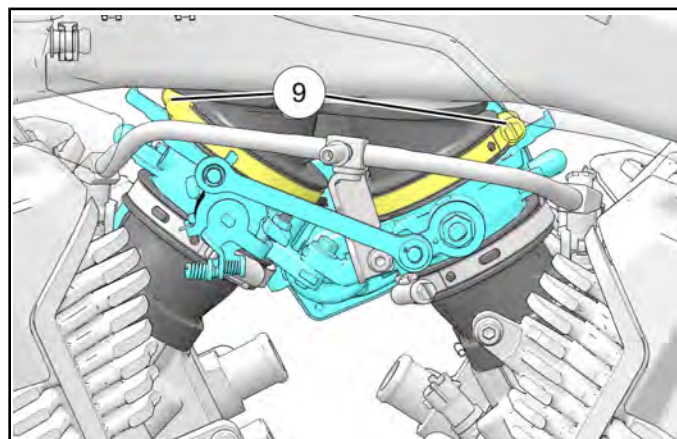
10. Remove sidestand switch by removing its fasteners ⑤.

11. Disconnect electrical connector for:

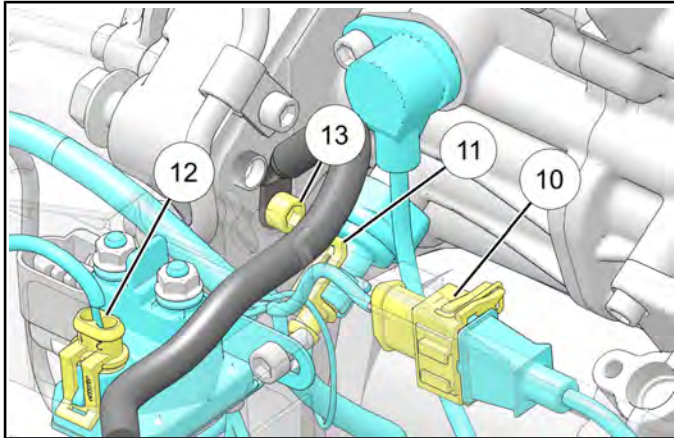


- Throttle body assembly ⑥
- TMAP ⑦
- Chassis ⑧

12. Loosen throttle body to inlet adapter clamps ⑨.



13. Near the battery box, disconnect electrical connector for:

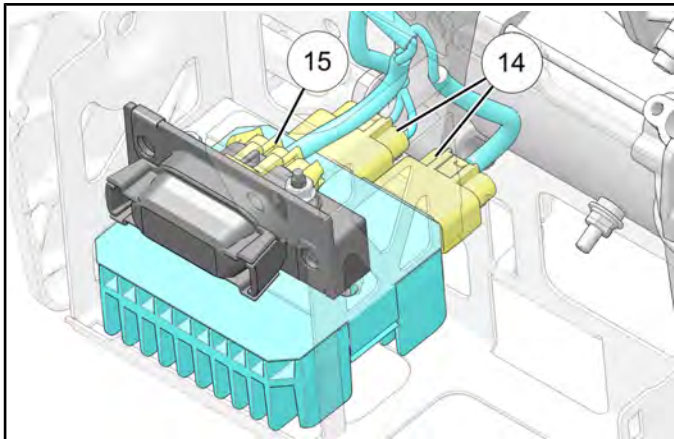


- Crankshaft Position Sensor ⑩
- Oil Pressure Switch ⑪
- Starter Relay ⑫

14. Disconnect fastener securing ground ⑬.

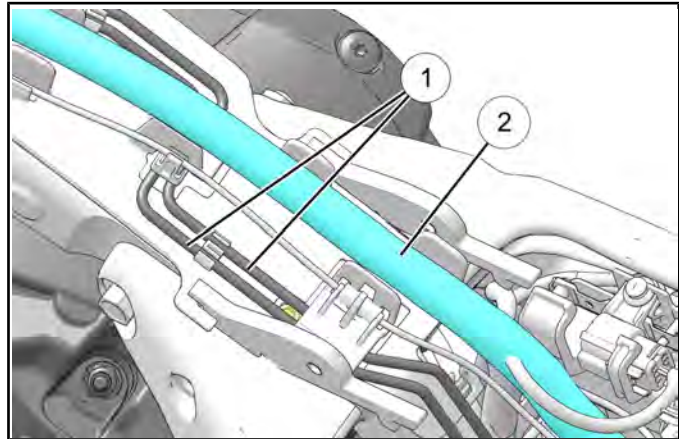
15. Disconnect starter terminal fastener.

16. Disconnect stator electrical connectors ⑭ and J-Case ⑮ connector.

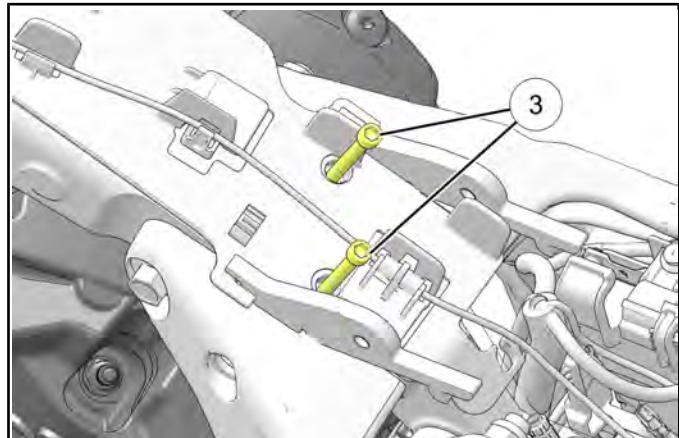


### REMOVING ENGINE FROM FRAME

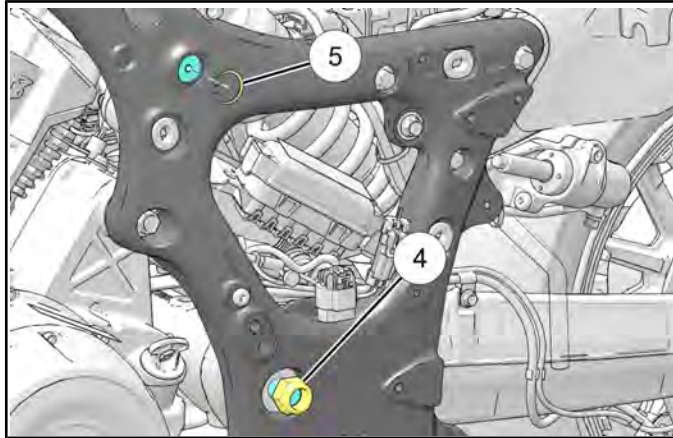
1. Perform the preliminary engine removal steps outlined in this chapter. See **Preparation For Engine Removal** page 3.14.
2. Remove fasteners securing ABS module bracket from engine. Reference **ABS Module Replacement** page 9.34.
3. Place a platform jack beneath the engine and raise enough to support crankcase (Jack should just be touching the crankcase).
4. At the rear of the mainframe, move brake lines ① and electrical harness ② to expose fasteners beneath.



5. Remove fasteners ③ securing mainframe to breather.

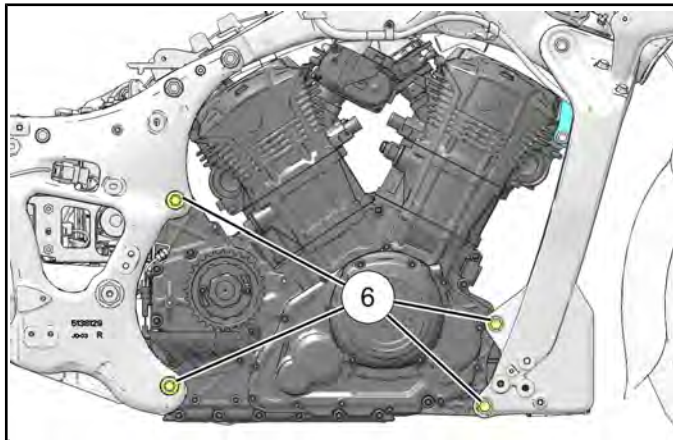


6. Loosen the swingarm axle nut ④.

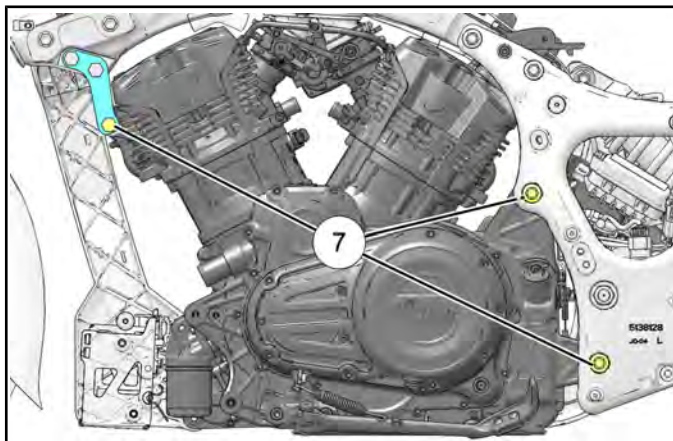


7. Remove shock rocker pivot shaft snap ring ⑤.

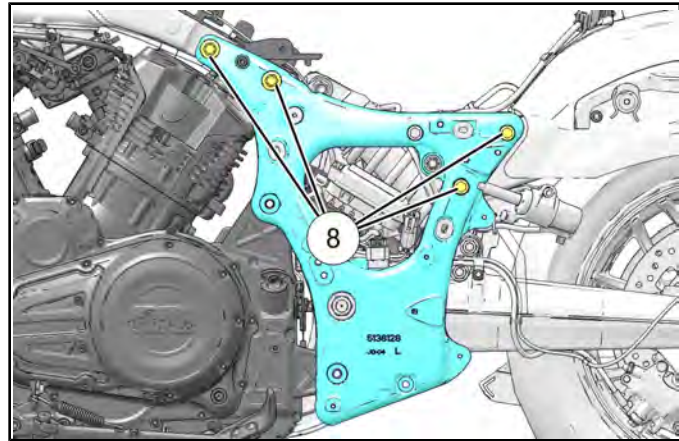
8. Remove the right side engine fasteners ⑥.



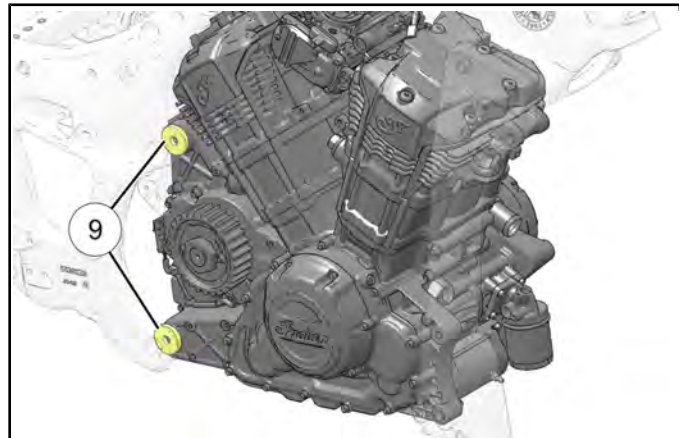
9. Remove the engine mount remaining fasteners ⑦ on the left side.



10. Loosen left hand Midcast fasteners ⑧. Repeat step for remaining side.



11. During removal, ensure to retrieve frame / engine spacers ⑨.



12. Separate engine from alignment dowels. With an assistant, lower the engine from the frame and remove from unit.

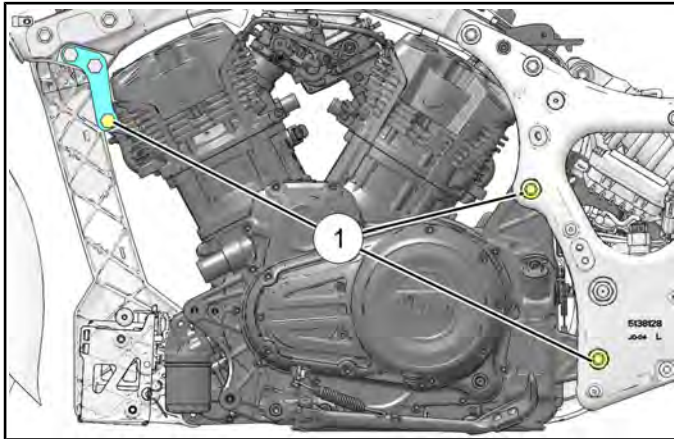
**ENGINE INSTALLATION**

1. Lift engine into position with a scissor jack.

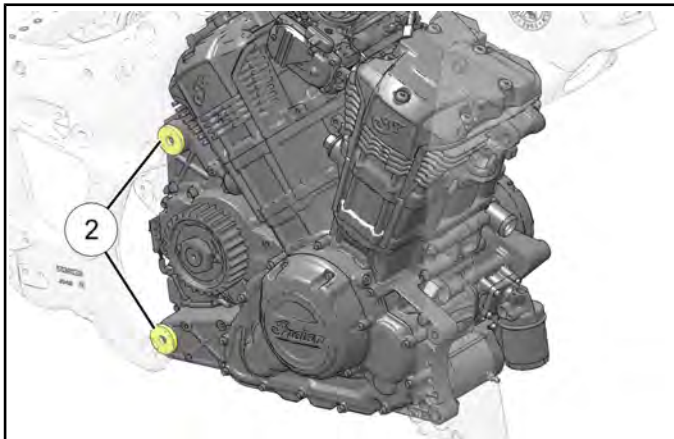
**IMPORTANT**

While positioning the engine, guide throttle body assembly into inlet adapters.

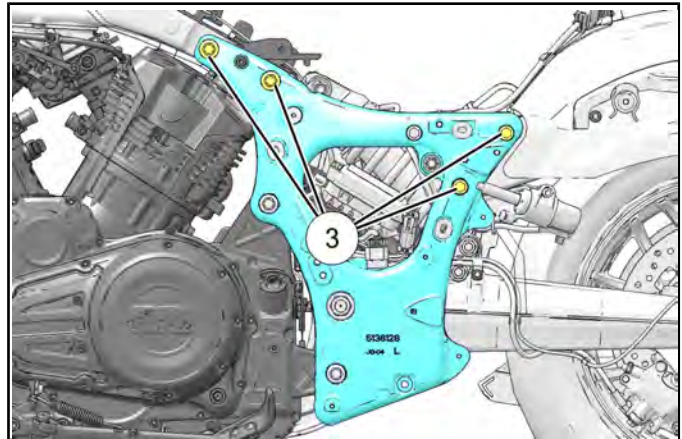
2. Install engine mount fasteners ① hand tight.



3. Ensure frame/engine spacers ② are in place on the right side.



4. Tighten midcast fasteners ③. Ensure the midcast is inserted in the alignment dowels.



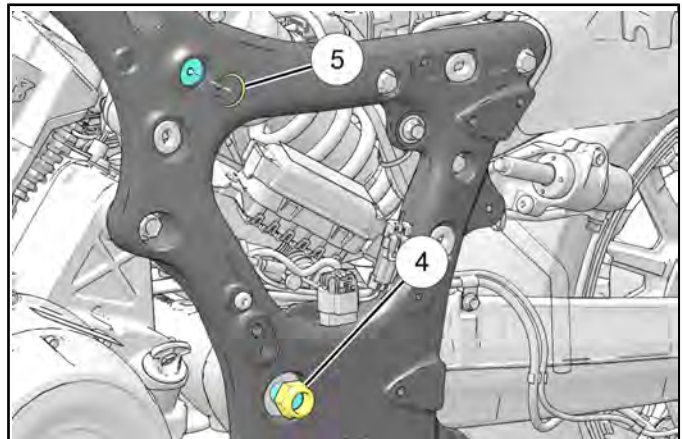
**TORQUE**

Midcast M10 Fastener:  
**35 ft-lbs (47 N·m)**

**TORQUE**

Midcast M12 Fastener:  
**75 ft-lbs (102 N·m)**

5. Tighten Swing-Arm axle nut ④.



**TORQUE**

Swing-Arm Axle Nut:  
**65 ft-lbs (88 N·m)**

6. Install shock rocker pivot shaft snap ring ⑤.

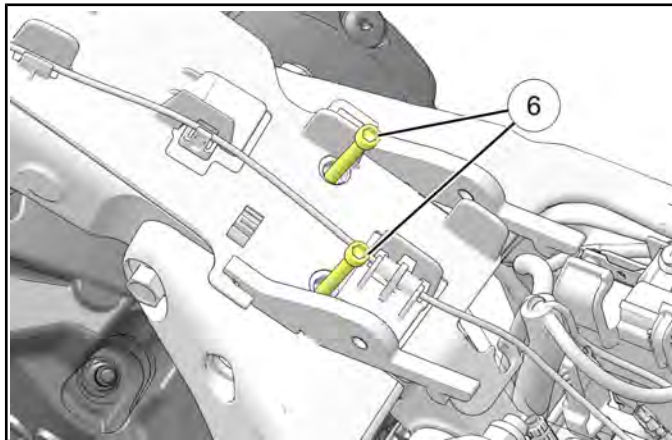
3

7. Tighten engine mount fasteners.

TORQUE
Engine Mount Fastener: <b>45 ft-lbs (61 N·m)</b>

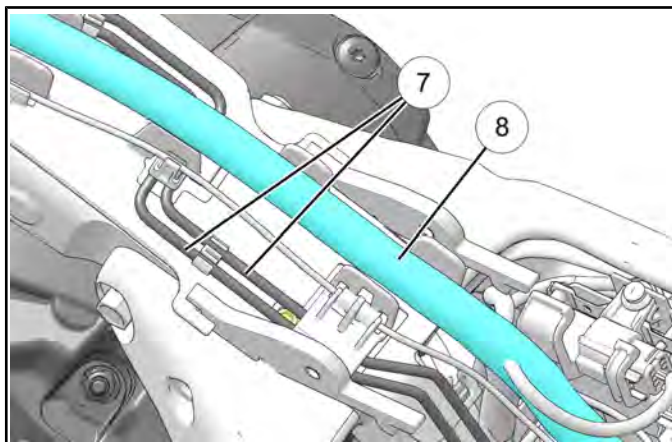
TORQUE
Cylinder Head Bracket Fastener: <b>75 ft-lbs (102 N·m)</b>

8. Install breather fastener ⑥.



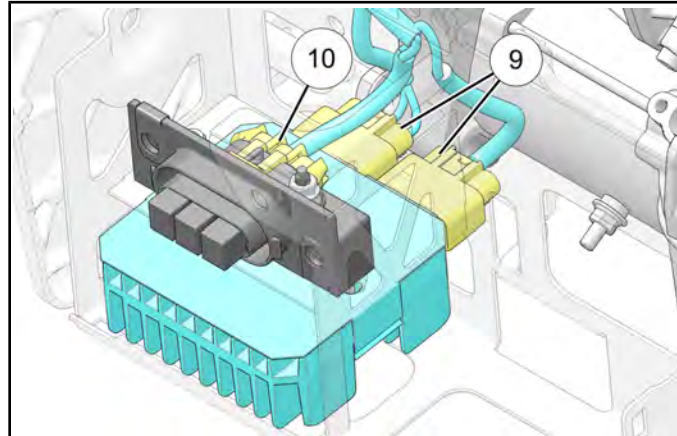
TORQUE
Breather Fastener: <b>84 in-lbs (10 N·m)</b>

9. Move brakes lines ⑦ and electrical harness ⑧ into designated routing guides.

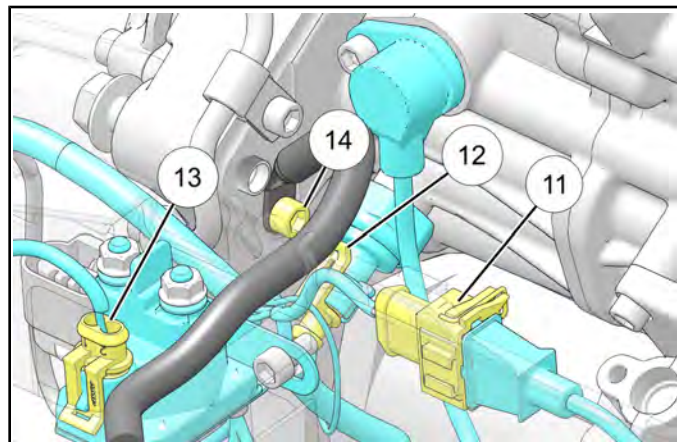


10. Install fasteners securing ABS module bracket to engine. Reference **ABS Module Replacement** page 9.34.

11. Connect the stator electrical connectors ⑨ and J-Case ⑩ connector.



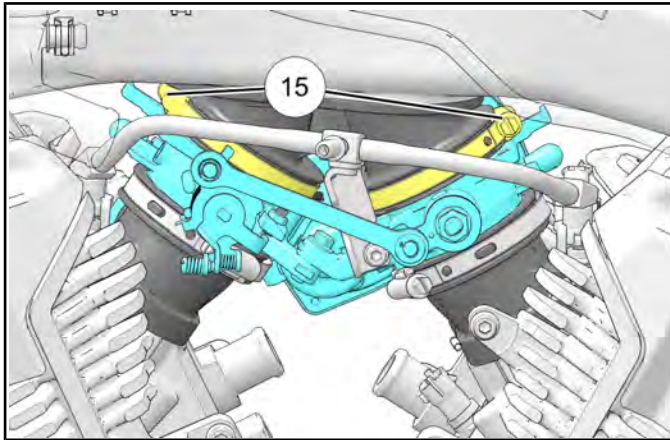
12. Connect electrical connector for:



- Crankshaft Position Sensor ⑪
- Oil Pressure Switch ⑫
- Starter Relay ⑬

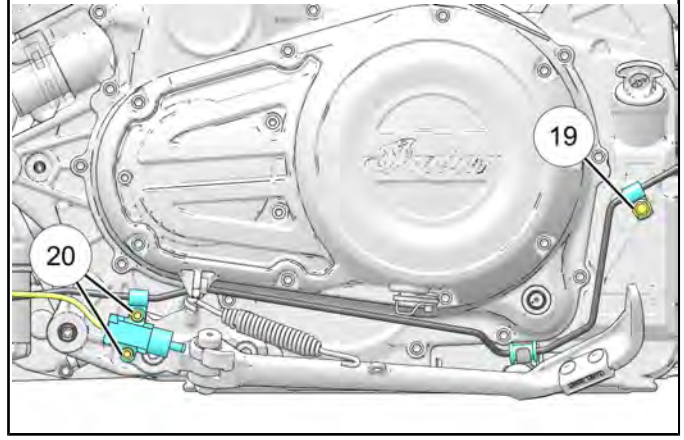
13. Connect fastener securing ground ⑭.

14. Tighten throttle body to inlet adapter clamps ⑮.



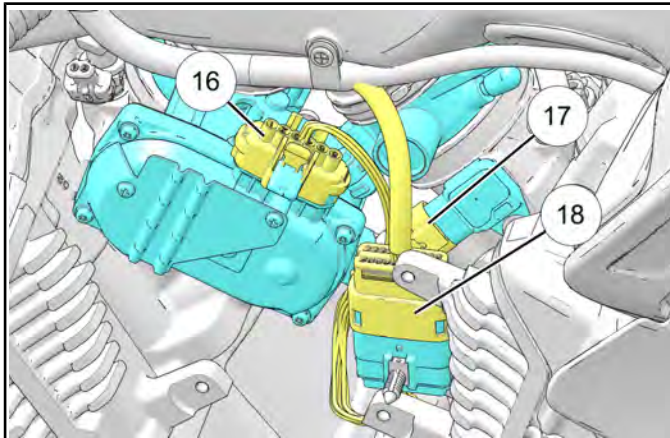
**TORQUE**  
Hose Clamp:  
**26 in-lbs (3 N·m)**

16. Install brake line fastener ⑲.



**TORQUE**  
P-clamp:  
**84 in-lbs (10 N·m)**

15. Connect electrical connector for:

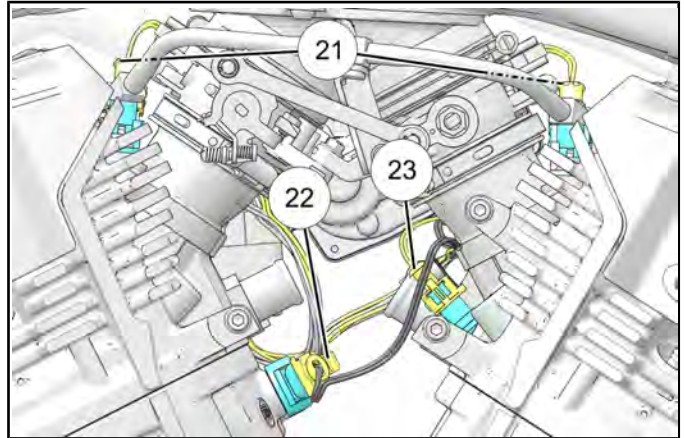


- Throttle body assembly ⑮
- TMAP ⑰
- Chassis ⑱

17. Install sidestand switch and secure with its fasteners ⑳.

**TORQUE**  
Sidestand Switch Fastener  
**43 in-lbs (5 N·m)**

18. Connect electrical connector for:



- Fuel injectors ⑳
- Knock sensor ㉑
- Cylinder head temperature sensor ㉒

19. Install thermostat assembly. See **Thermostat Removal / Installation page 3.43.**

20. Install drive belt. Reference **Drive Belt Installation page 8.59.**

3

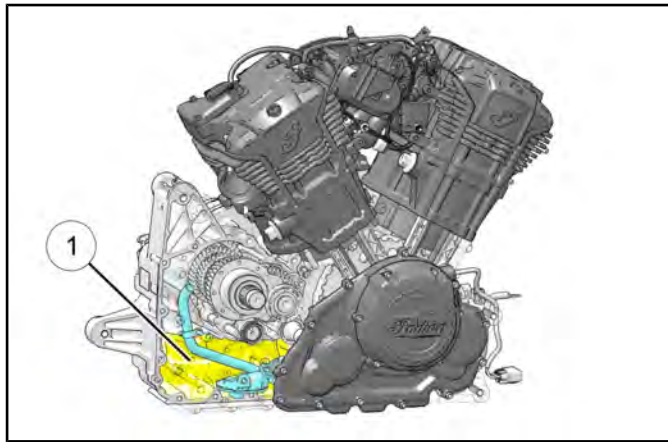
21. Install driver's floorboard. See **Floorboard Removal / Installation page 7.29.**
22. Install head pipe. See **Headpipe Removal / Installation page 3.112.**
23. Install radiator. See **Radiator Removal / Installation page 3.38.**
24. Install fuel tank. See **Fuel Tank Installation (2020) page 4.32.**

## LUBRICATION / COOLING

### GENERAL INFORMATION

#### SERVICE NOTES – COOLING

The **Power Plus 108** uses a semi-dry sump lubrication system. The engine oil is housed in a separate chamber within the engine cases ① as shown in the image below.



The oil pump has two sets of internal gerotors. One set provides lubrication pressure and the second set provides the scavenge. The oiling system pressure relief valve is also located inside the oil pump.

If the engine is making irregular noises that appear to be coming from rotating parts, check the lubrication side oil pressure. Check the oil pressure before engine disassembly, and recheck the oil pressure after a repair.

#### TROUBLESHOOTING

LOW OIL PRESSURE	HIGH OIL PRESSURE
Incorrect oil being used or low oil level Engine temp above test temperature range Damaged O-rings or leaks at pipes or fittings Damaged or worn oil pump or oil pump drive Pressure relief valve stuck open Damaged engine bearings/excessive engine wear. Restricted oil filter, oil filter screen or passages	Incorrect oil being used Additives added to oil to increase viscosity Engine temp below test temperature range Restricted oil passages Incorrect oil filter Pressure relief valve stuck closed

#### SPECIAL TOOLS – COOLING

TOOL DESCRIPTION	PART NUMBER
Oil Pressure Gauge	PV-43531

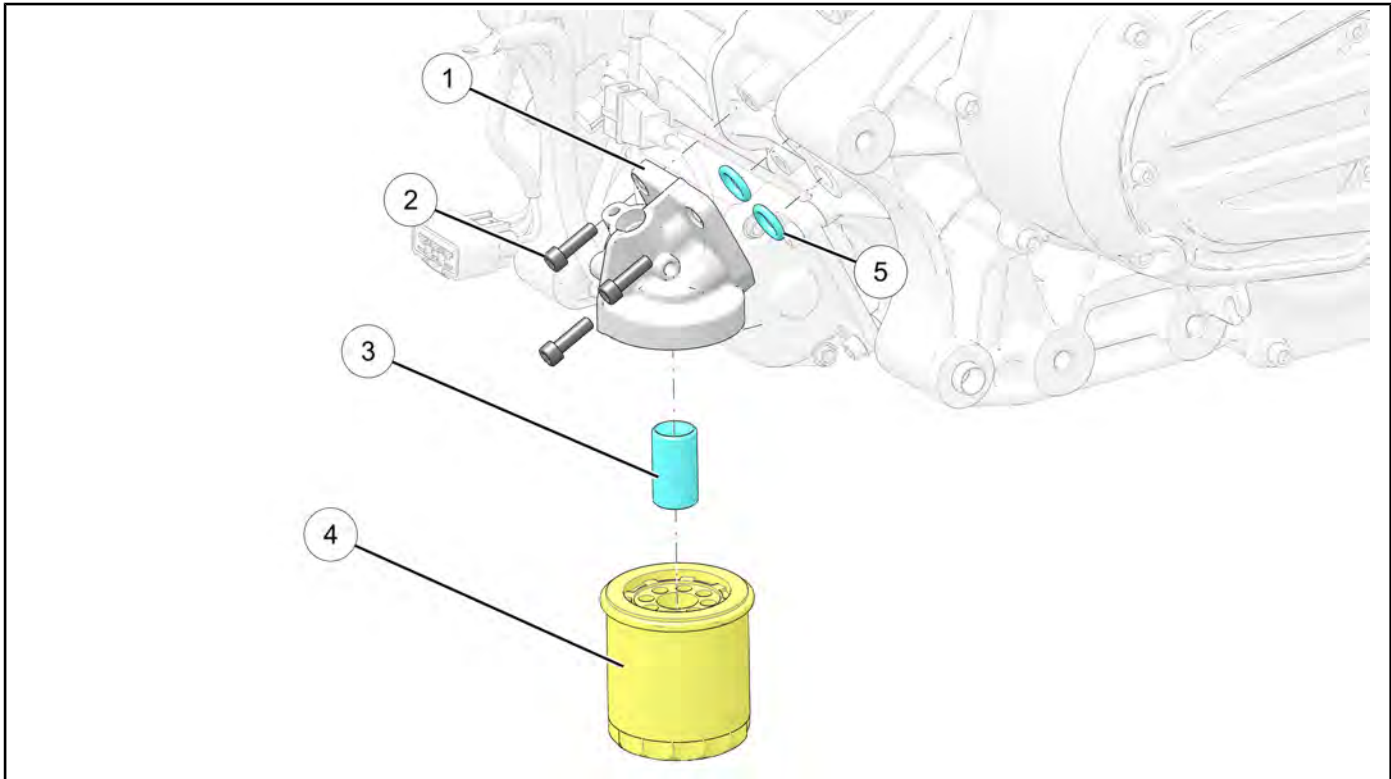
**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>



**SERVICE SPECIFICATIONS – COOLING**

ITEM	STANDARD	LIMIT
Engine Oil Capacity (After Disassembly)	5.5 U.S. qts (5.2 L)	Not Applicable
Engine Oil Capacity (At Change with Filter) Follow the oil change procedure outlined in the Maintenance chapter.	<b>5.0 qts (4.7 L)</b>	Not Applicable
Recommended Engine Oil if Indian Motorcycle 15W60 is not available, use motorcycle oil with same specifications.	Indian Motorcycle Semi-Synthetic 15W60	Not Applicable
Oil Pressure @ 3000 rpm (supply side) <b>Engine at operating temperature and specified Indian Motorcycle Engine Oil</b>	60 psi (513.7 kPa) Readings should be within 20% of the specification.	MINIMUM PRESSURE: 30 psi (206.8 kPa)
Radiator Coolant	2.4 qts (2.3 L)	Not Applicable
Thermostat Opening	Starts to open at 82° C (+/- 2°) Fully open at 95° C	Not Applicable
Cooling Fan	Turns on at 98° C Turns off at 94° C	Not Applicable
OIL PUMP CLEARANCES		
Scavenge Gerotor OD to Oil Pump Body	.006"-.010" (.15 mm-.25 mm)	.015" (.381 mm)
Feed Gerotor OD to Oil Pump Body	.006"-.010" (.15 mm-.25 mm)	.015" (.381 mm)
Oil Pump End Clearance	.0014"-.0032" (.036 mm-.081 mm)	.008" (.203 mm)
Gerotor Tip Clearance	.003"-.005" (.076 mm-.127 mm)	.007" (.178 mm)

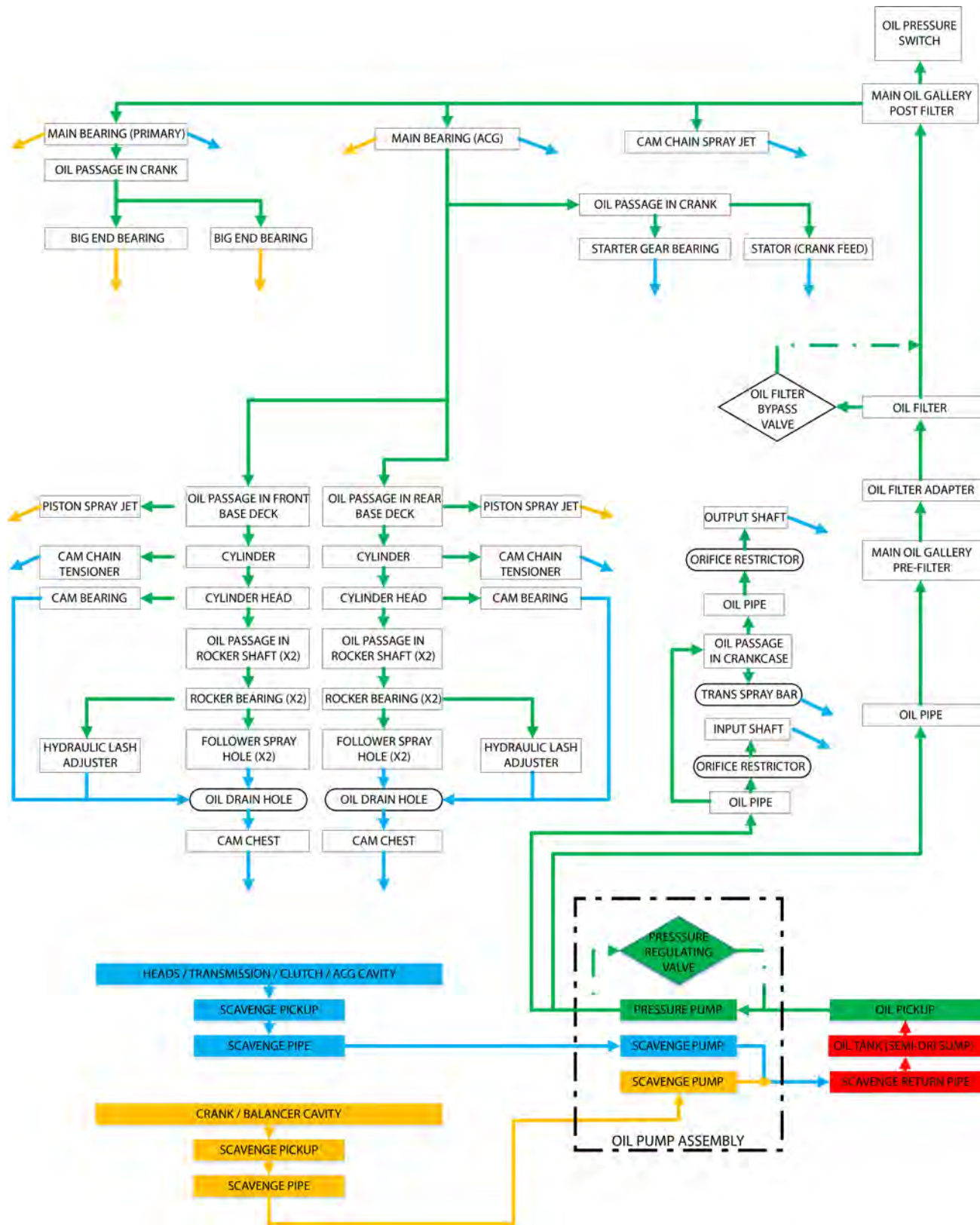
**ASSEMBLY VIEWS**  
**FILTER ADAPTER**

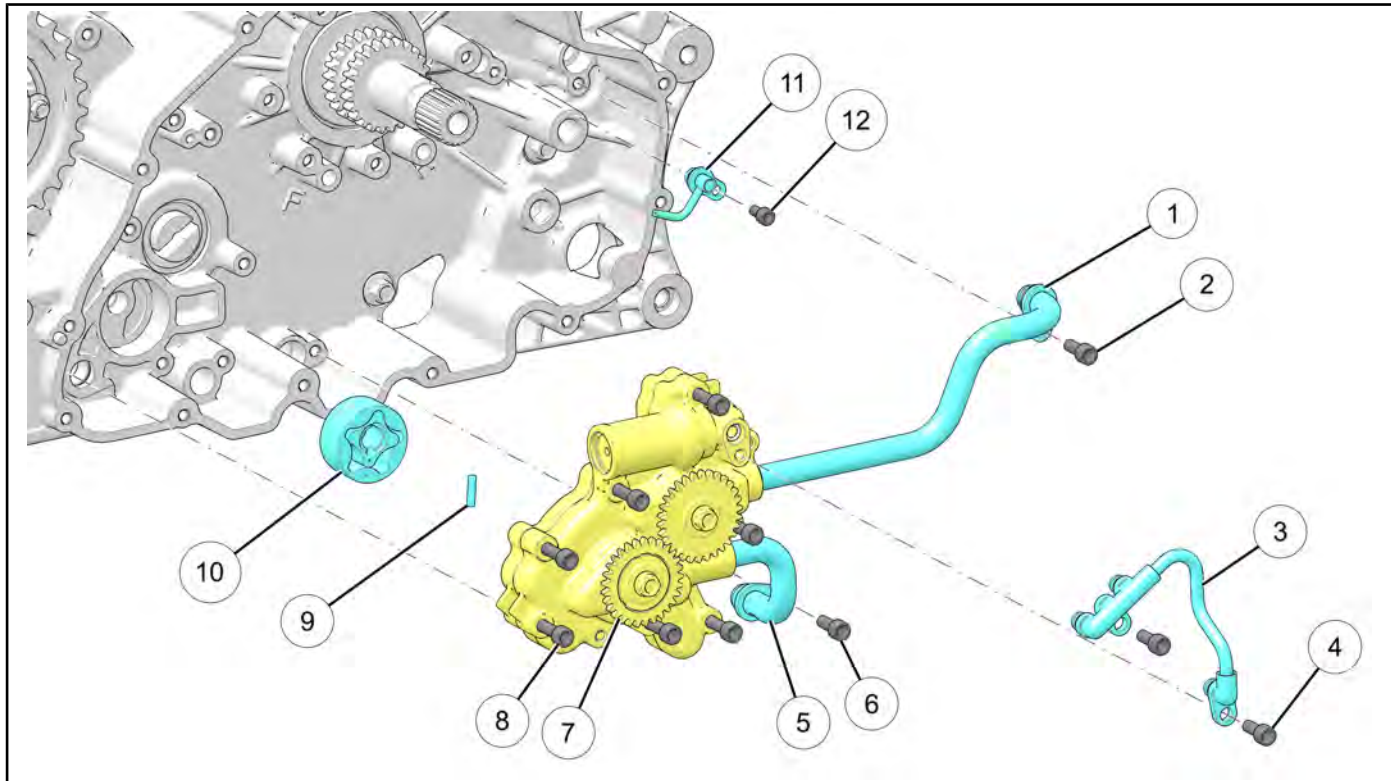


**3**

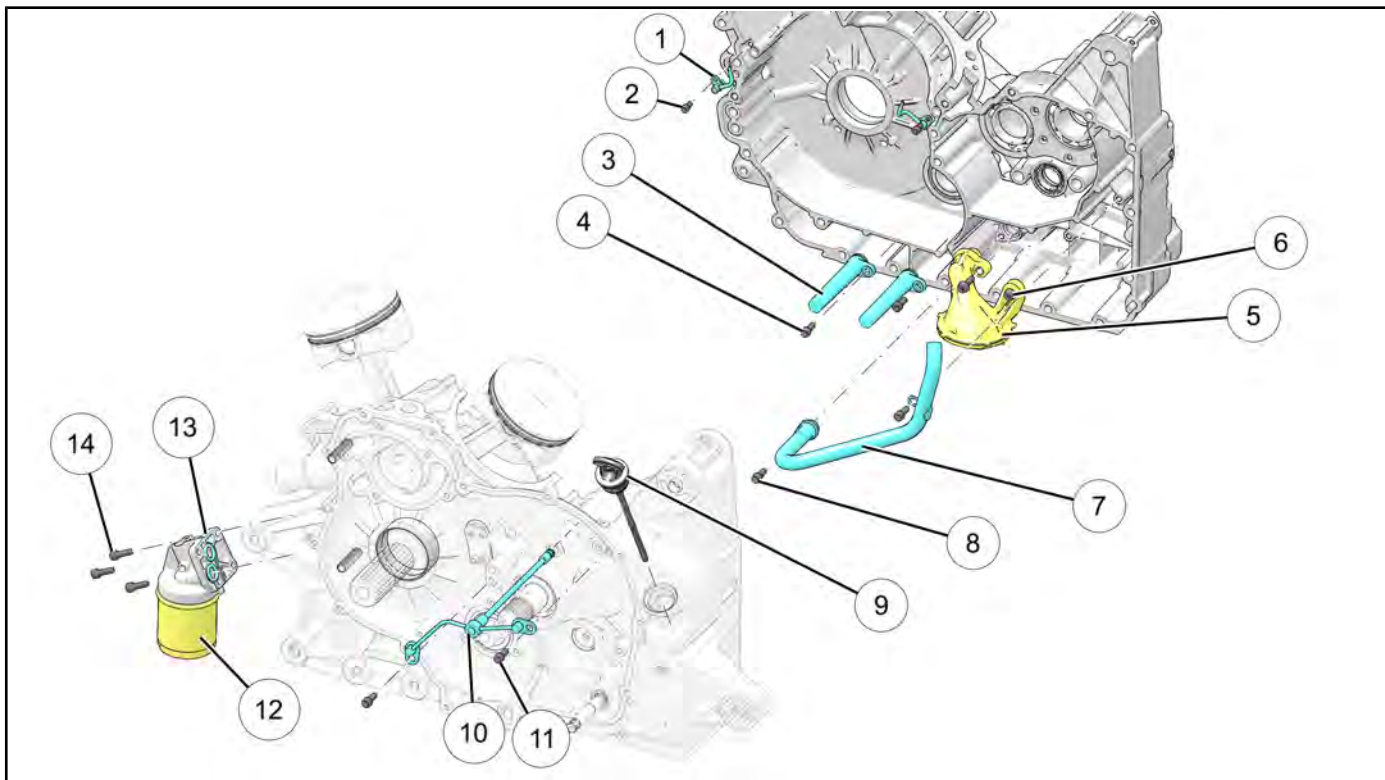
REF	DESCRIPTION	TORQUE
①	Oil Filter Adapter	—
②	Oil Filter Adapter Fastener	<b>84 in-lbs (10 N·m)</b>
③	Filter Adapter	<b>22 ft-lbs (30 N·m)</b>
④	Oil Filter	<b>Approximately 3/4 turn after seal has contacted the filter adapter.</b>
⑤	O-Ring	—

**OIL FLOW DIAGRAM**

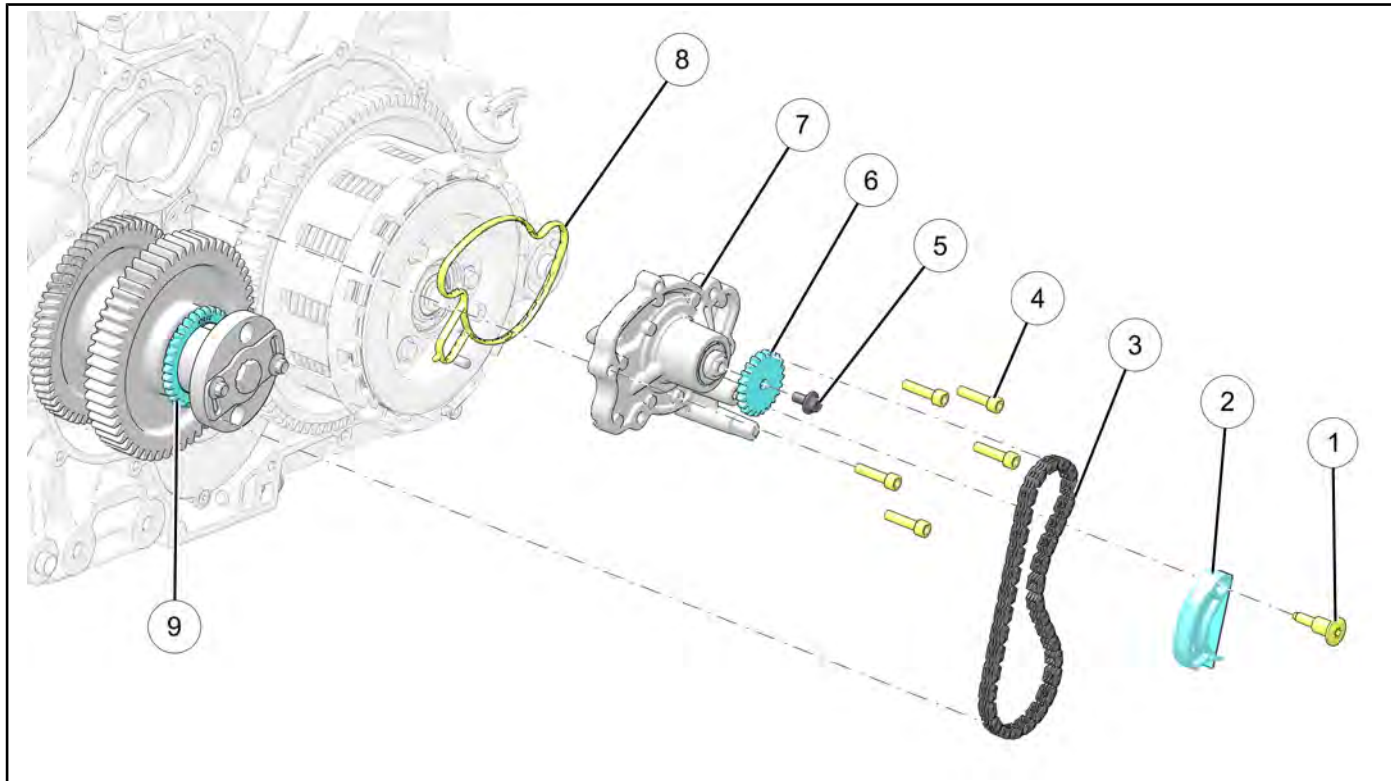


**LUBRICATION SYSTEM****3**

REF	DESCRIPTION	TORQUE
①	Oil Pressure Feed Tube	—
②	Oil Pressure Feed Tube Fastener	<b>84 in-lbs (10 N·m)</b>
③	Input Shaft Feed Tube	—
④	Input Shaft Feed Tube Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	Oil Pump Scavenge Tube	—
⑥	Oil Pump Scavenge Tube Fastener	<b>84 in-lbs (10 N·m)</b>
⑦	Oil Pump	—
⑧	Oil Pump Fastener	<b>84 in-lbs (10 N·m)</b>
⑨	Pin	—
⑩	Gerotor	—
⑪	Camshaft Oil Jet	—
⑫	Camshaft Chain Oil Jet Fastener	<b>62 in-lbs (7 N·m)</b>

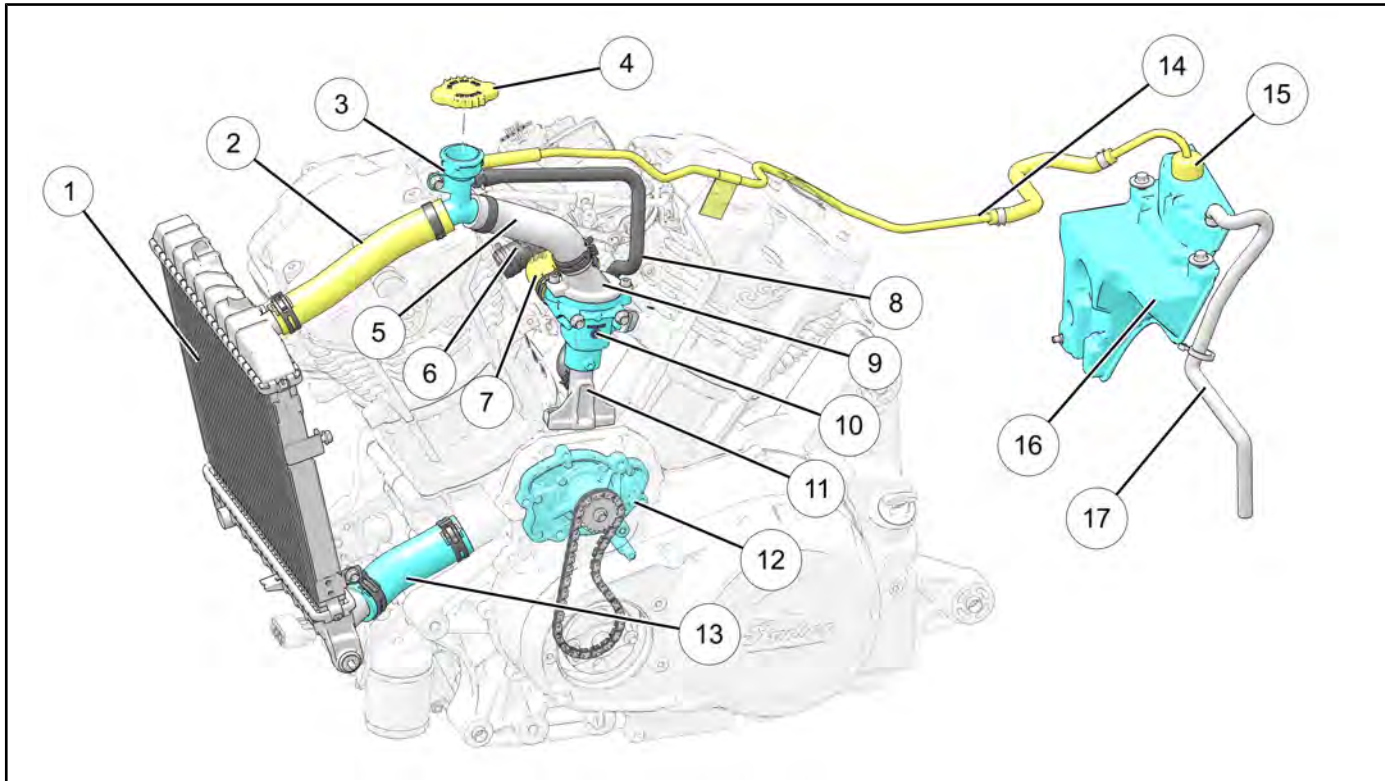


REF	DESCRIPTION	TORQUE
①	Piston Cooling Jet	—
②	Piston Cooling Jet Fastener	<b>62 in-lbs (7 N·m)</b>
③	Scavenge Oil Inlet Screen	—
④	Scavenge Oil Inlet Screen Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	Oil Pickup	—
⑥	Oil Pickup Fastener	<b>84 in-lbs (10 N·m)</b>
⑦	Oil Scavenge Tube	—
⑧	Oil Scavenge Tube Fastener	<b>84 in-lbs (10 N·m)</b>
⑨	Oil Dipstick	—
⑩	Transmission Feed Rail	—
⑪	Transmission Feed Rail Fastener	<b>84 in-lbs (10 N·m)</b>
⑫	Oil Filter	<b>Approximately 3/4 turn after seal has contacted the filter adapter.</b>
⑬	Oil Filter Adapter	—
⑭	Oil Filter Adapter Fastener	<b>84 in-lbs (10 N·m)</b>

**WATER PUMP ASSEMBLY VIEW**

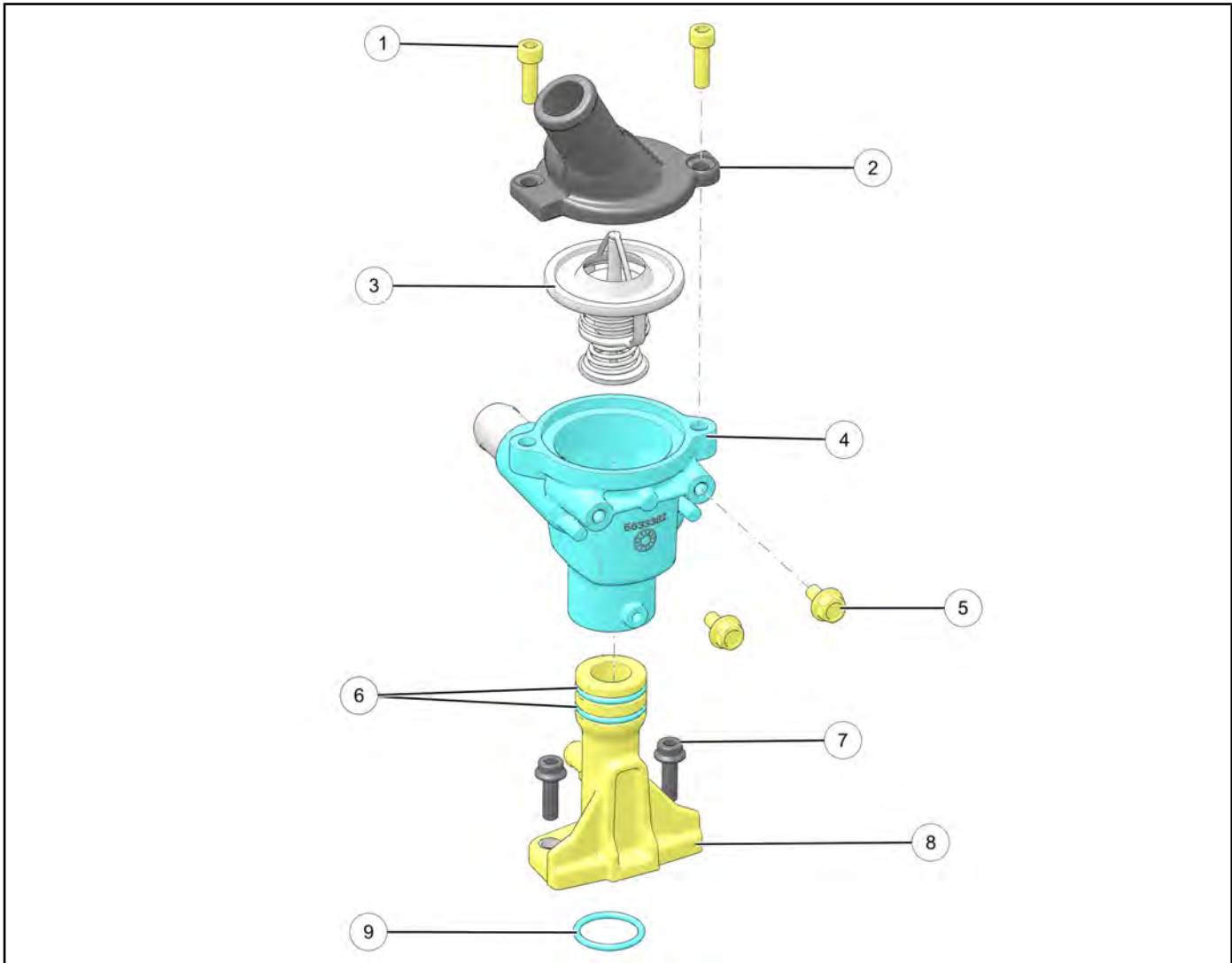
REF	DESCRIPTION	TORQUE
①	Water Pump Chain Tensioner Fastener	<b>84 in-lbs (10 N·m)</b>
②	Water Pump Chain Tensioner	—
③	Water Pump Chain	—
④	Water Pump Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	Water Pump Sprocket Fastener	<b>84 in-lbs (10 N·m)</b>
⑥	Water Pump Sprocket	—
⑦	Water Pump	—
⑧	Water Pump Gasket	—
⑨	Water Pump Drive Sprocket	—

**COOLING SYSTEM**



REF	DESCRIPTION	REF	DESCRIPTION
①	Radiator	⑩	Thermostat housing
②	Radiator Hose (In)	⑪	Bypass Tube
③	Coolant Remote Filler	⑫	Water Pump
④	Pressure Cap	⑬	Radiator Hose (Out)
⑤	Thermostat Hose	⑭	Recovery Bottle Return Hose
⑥	Cylinder Coolant Hose (Front)	⑮	Recovery Bottle Cap
⑦	Cylinder Coolant Hose (Rear)	⑯	Coolant Recovery Bottle
⑧	Coolant Return Line	⑰	Coolant Overflow Hose
⑨	Thermostat Cover		

**THERMOSTAT**

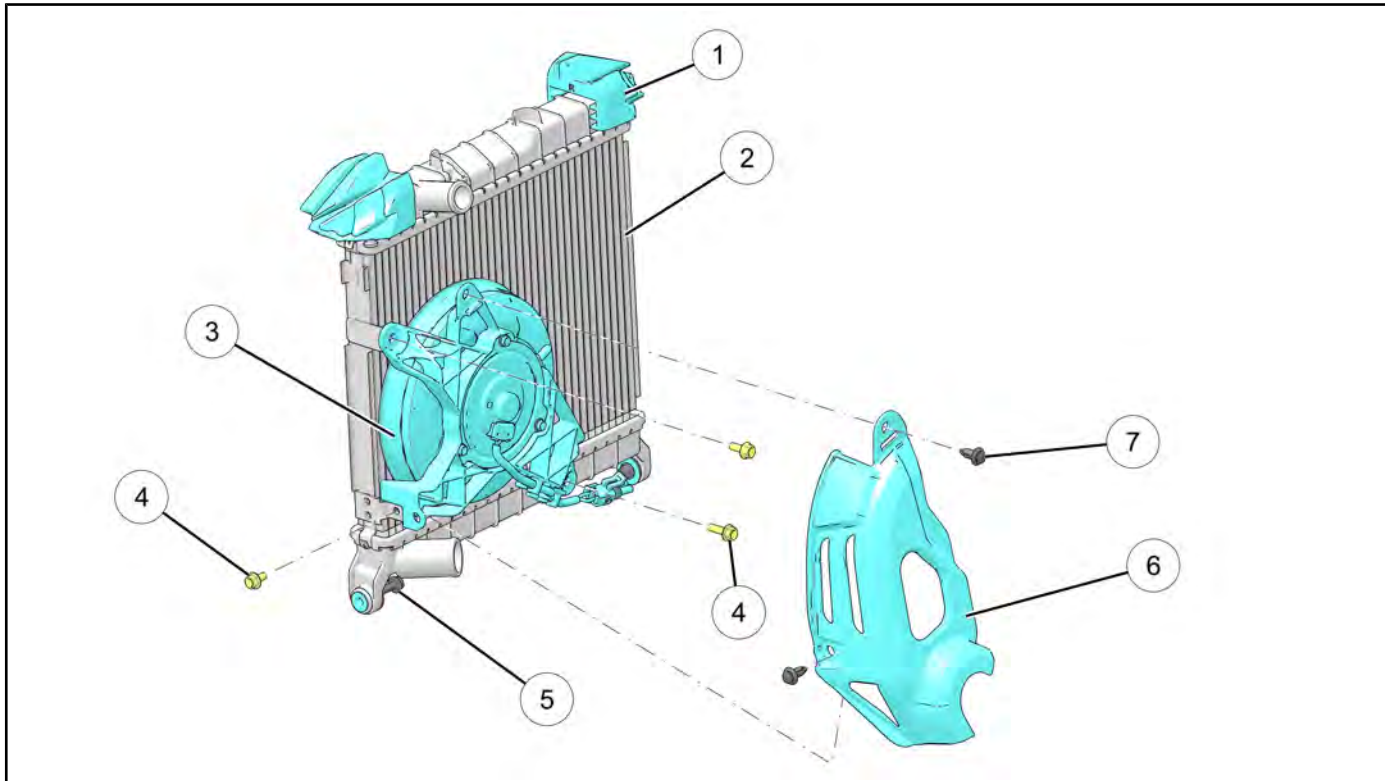


3

REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Thermostat Cover Fastener	<b>84 in-lbs (10 N·m)</b>	⑥	O-Ring	—
②	Thermostat Cover	—	⑦	Bypass Tube Fastener	<b>84 in-lbs (10 N·m)</b>
③	Thermostat	—	⑧	Bypass Tube	—
④	Thermostat Housing	—	⑨	O-Ring	—
⑤	Thermostat Mounting Bracket Fastener	<b>84 in-lbs (10 N·m)</b>			



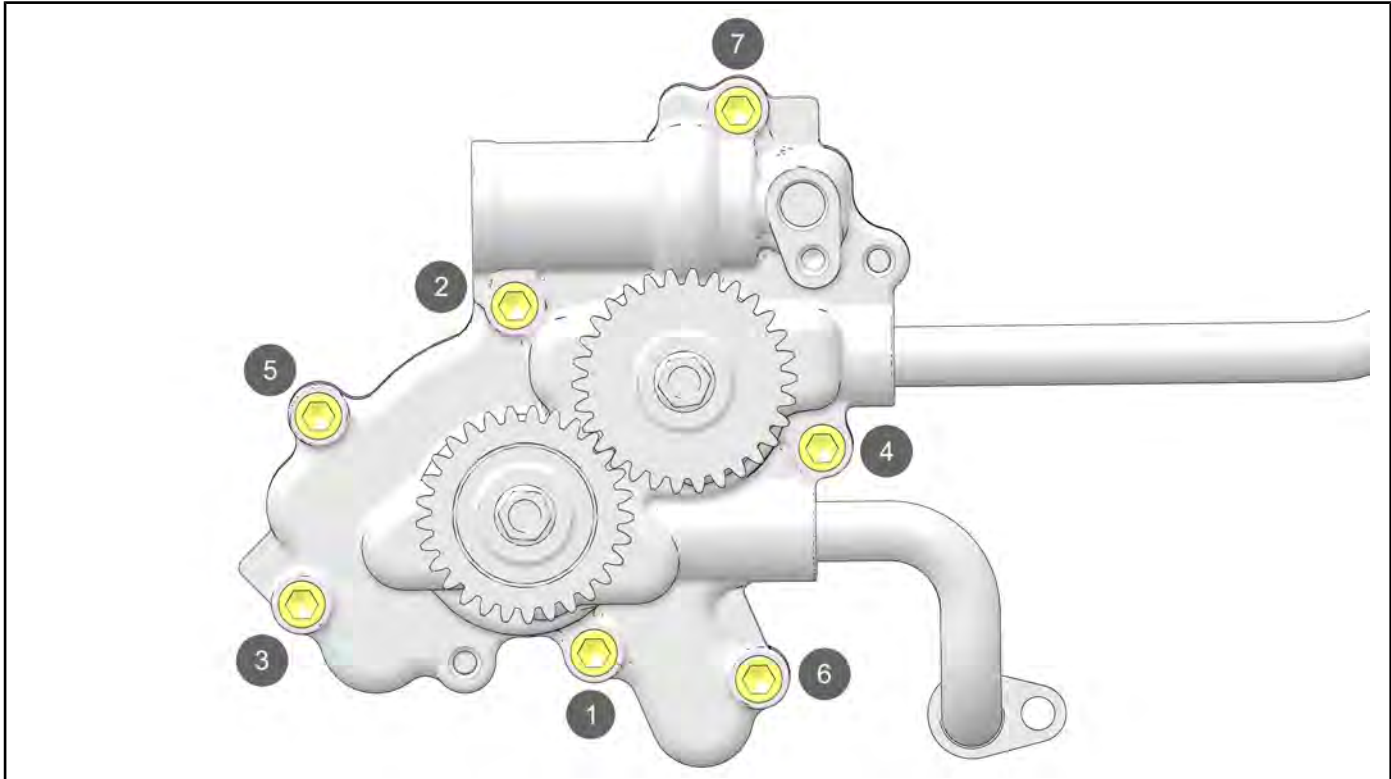
**RADIATOR**



REF	DESCRIPTION	TORQUE
①	Upper Radiator Mount	—
②	Radiator	—
③	Cooling Fan	—
④	Cooling Fan Fastener	<b>36 in-lbs (4 N·m)</b>
⑤	Radiator Mount Fastener	<b>84 in-lbs (10 N·m)</b>
⑥	Fan Shroud	—
⑦	Push Pin	—

**TORQUE SEQUENCE - LUBRICATION / COOLING**

**OIL PUMP**



## OIL PRESSURE INSPECTION

### OIL PRESSURE

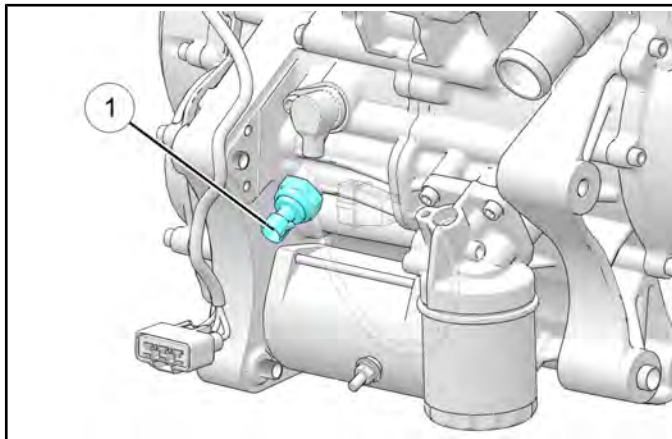
**CAUTION**

Use caution when working around hot engine oil.

**NOTICE**

**Oil pressure switch activates at 5.5 psi  $\pm$  2 psi.**

1. Start the engine and run until operating temperature is reached.
2. Turn the engine OFF.
3. Remove oil pressure switch ①.



4. Install oil pressure gauge.
5. Use the dipstick to check the engine oil level and add recommended oil, if necessary.
6. Start engine and check oil pressure at 3000 rpm.
7. Compare reading to oil system specifications.
8. Once testing is completed, inspect o-ring and reinstall switch.

**TORQUE**

Oil Pressure Switch:  
**115 in-lbs (13 N·m)**

**OIL PUMP SERVICE****OIL PUMP REMOVAL / INSTALLATION**

To watch a video of this procedure, scan the QR code or click [HERE](#).



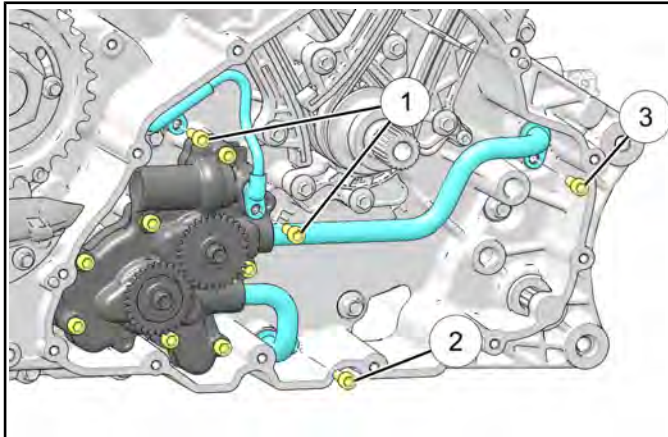
<https://vimeo.com/343258502/ed02a058f8>

**REMOVAL**

1. Remove Primary inner cover. See **ACG Cover Removal / Installation page 10.34**
2. Remove fasteners ① securing input shaft feed tube. Remove tube and o-rings.

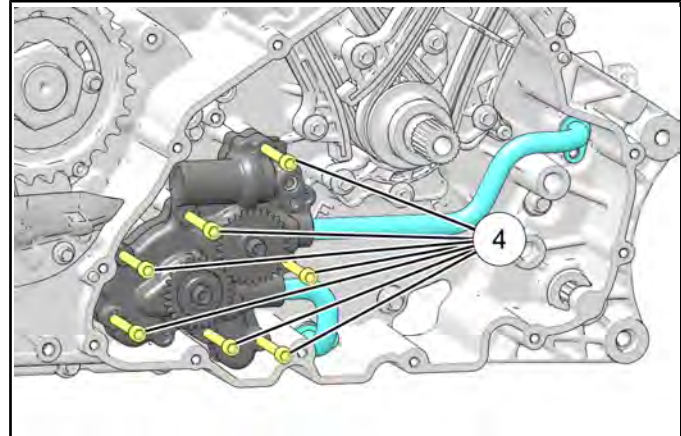
**IMPORTANT**

Ensure o-rings are removed.

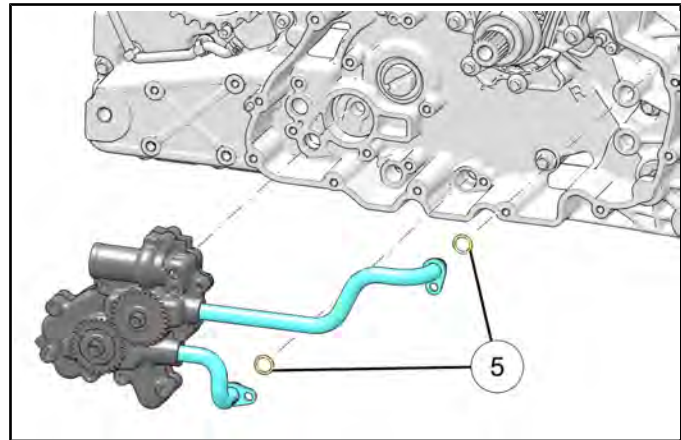


3. Remove oil scavenge tube fastener ②.
4. Remove oil pressure feed tube fastener ③.

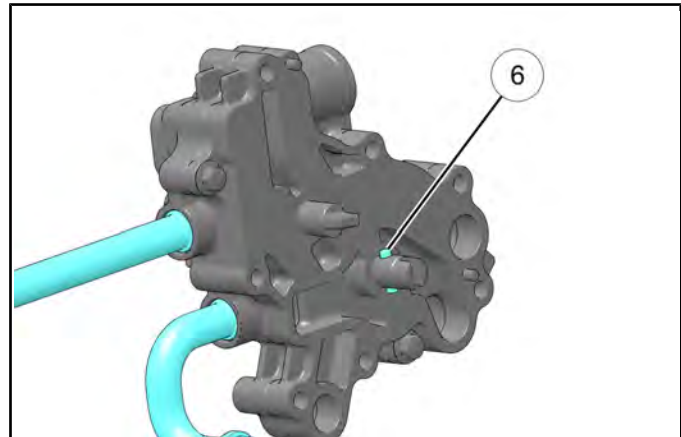
5. Remove oil pump fasteners ④.



6. Ensure o-rings ⑤ are removed.

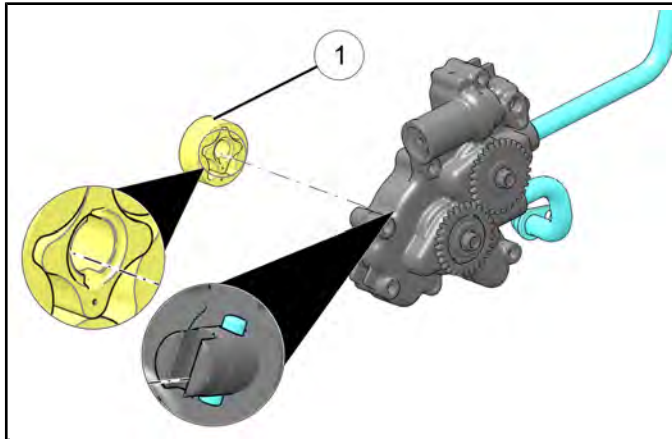


7. Ensure the pin ⑥ is with the oil pump upon removal.

**INSTALLATION****CAUTION**

Inspect all o-rings prior to installation. Replace any damaged o-rings, failure to do so can result in oil pressure loss and possible engine damage.

1. Install the gerotor ① onto the oil pump assembly so the pin fits in the recess in the gerotor.



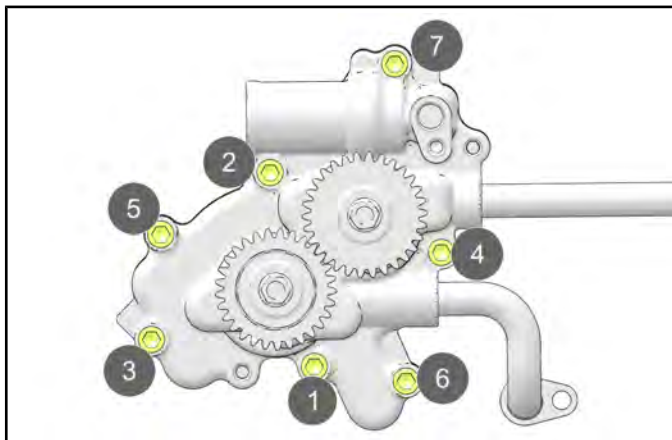
2. Install the oil pump.

**NOTICE**

To aid in alignment, the oil pump gear can be moved back and forth to seat the gerotor into the casehalf.

3. Torque the oil pump to specification in the sequence as shown.

TORQUE
Oil Pump Fastener <b>84 in-lbs (10 N·m)</b>



4. Torque fasteners to specification.

TORQUE
Oil Pressure Feed Tube Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Input Shaft Feed Tube Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Oil Pump Scavenge Tube Fastener: <b>84 in-lbs (10 N·m)</b>

5. Install ACG Cover. See **ACG Cover Removal / Installation** page 10.34.

TORQUE
ACG Cover Fasteners: <b>84 in-lbs (10 N·m)</b>

## TRANSMISSION FEED RAIL

### TRANSMISSION FEED RAIL REMOVAL / INSTALLATION

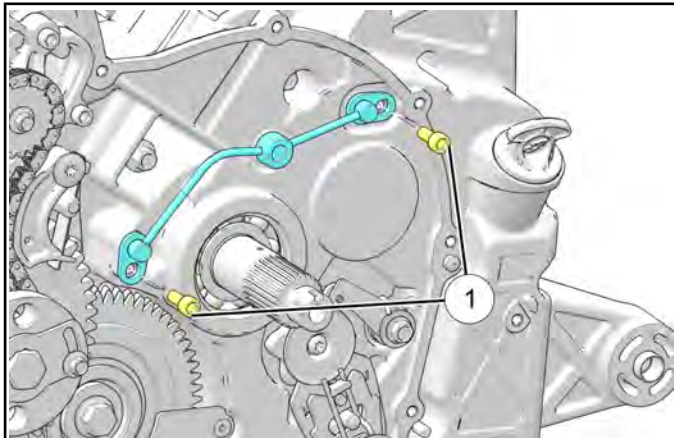
To watch a video of this procedure, scan the QR code or click [HERE](#).



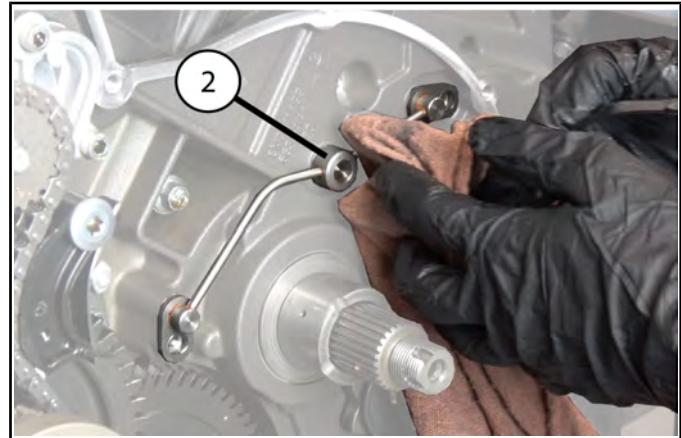
<https://vimeo.com/340722321/8d83972c4b>

#### REMOVAL

1. Remove clutch. See **Clutch Removal** page 5.21.
2. Remove fasteners ① securing feed rail.



3. Using a pliers with a rag in the jaws, gently remove feed rail ②.



#### CAUTION

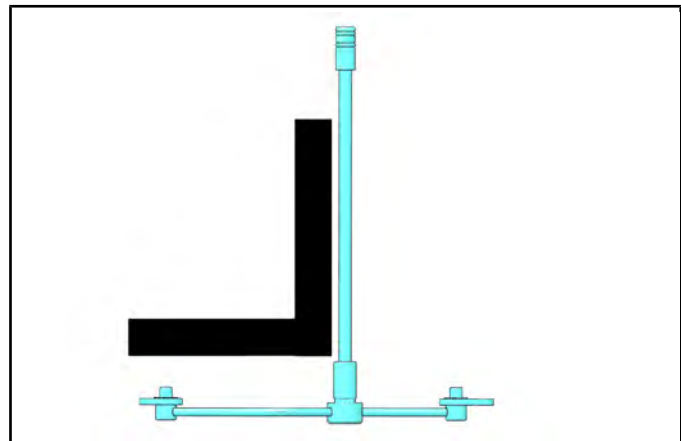
Do NOT pry out the feed rail. If the feed rail is damaged upon removal, it may not install properly and cause major engine damage.

#### IMPORTANT

Ensure the o-rings are removed with the feed rail.

#### INSPECTION

1. Ensure transmission feed rail does not show any signs of damage or cracking.
2. Check the straightness of the feed rail with a straight edge.



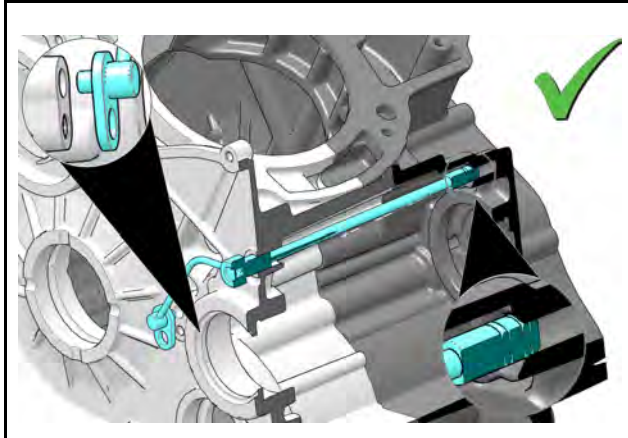
3. Replace the transmission feed rail if it is bent or damaged.

**INSTALLATION**

<b>⚠ CAUTION</b>
<ul style="list-style-type: none"> <li>• The transmission feed line goes through the left case half and into the right case half into a tapered hole. There is a potential for incorrectly installing the transmission feed rail. If installed incorrectly, severe engine damage may occur.</li> <li>• Inspect O-rings prior to installation. Replace if damage is found and lubricate.</li> </ul>

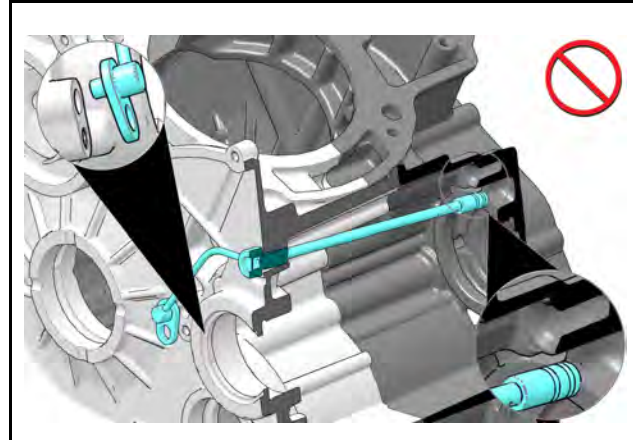
1. Install the transmission feed rail. Reference the table below.

<b>CORRECT</b>
<ul style="list-style-type: none"> <li>• Some resistance can be felt with the final 0.5–1" from the o-ring seating in the pilot hole.</li> <li>• The feed rail mounting tabs will be parallel with the case as shown.</li> </ul>



**INCORRECT**

- There will **NO** be no resistance felt due to the o-ring not seating in the pilot hole.
- The feed rail mounting tabs will **NOT** be parallel with the case as shown.



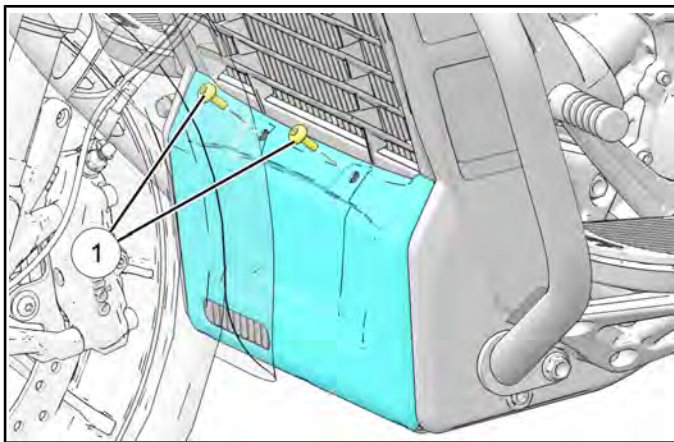
<b>TORQUE</b>
Transmission Feed Rail Fastener: <b>84 in-lbs (10 N·m)</b>

2. Install clutch. See **Clutch Installation page 5.25.**

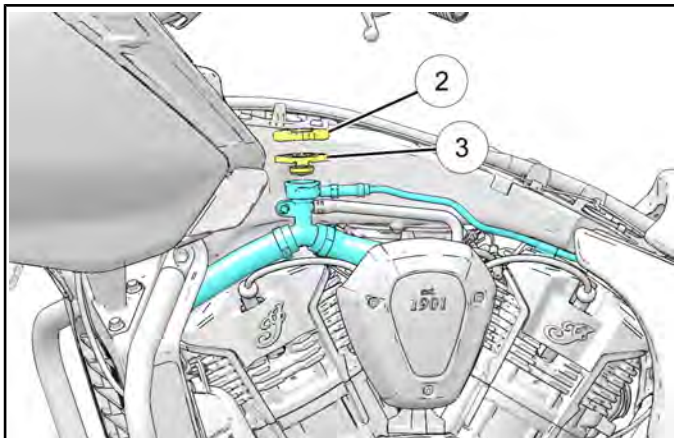
**COOLING SYSTEM SERVICE****COOLANT DRAIN / FILL / BLEED****DRAIN****⚠ WARNING**

Engine, coolant, and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wait for components to cool sufficiently before working on the machine.

1. Remove fuel tank. See **Fuel Tank Removal (2020) page 4.23.**
2. Remove chin fairing by removing its fasteners ①.



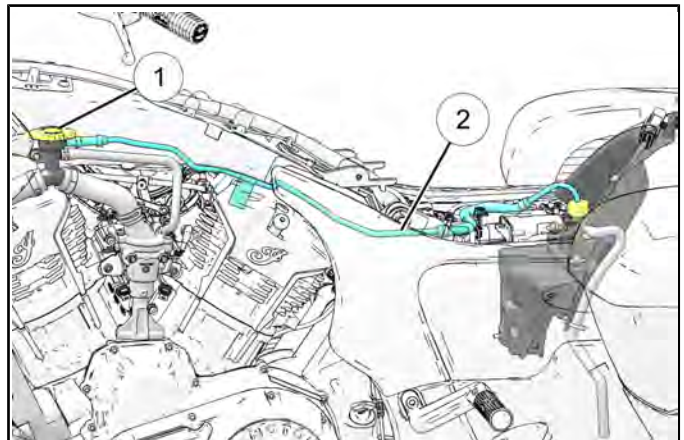
3. Remove pressure cap cover ② and radiator cap ③.



4. Loosen the radiator drain.

**FILL / BLEED**

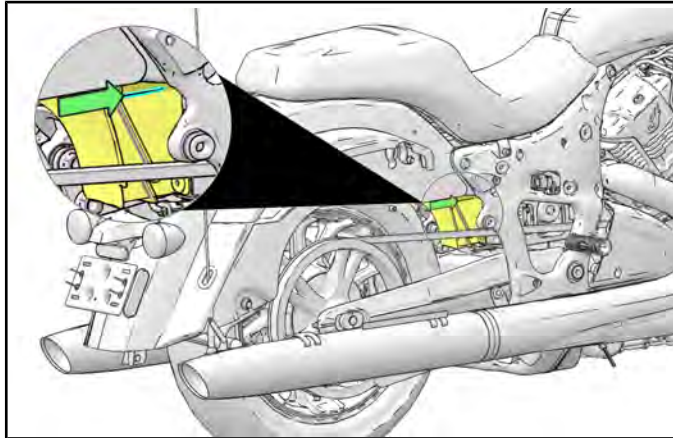
1. Install radiator drain plug.
2. Remove pressure cap ①.



3. Use pinch pliers (commercially available) to pinch off the coolant line ② between the coolant reservoir and pressure cap.
4. Install a cooling system vacuum fill tool (commercially available) on the pressure cap opening to create a vacuum in the cooling system.
5. Using the vacuum bleeder, draw in Indian Motorcycle extended life 50/50 engine coolant to fill the cooling system.
6. Remove the vacuum bleeder and install the pressure cap.
7. Remove the pinch pliers from the coolant line between the reservoir and thermostat housing.



8. Fill the recovery bottle to the line indicated on the side of the bottle.



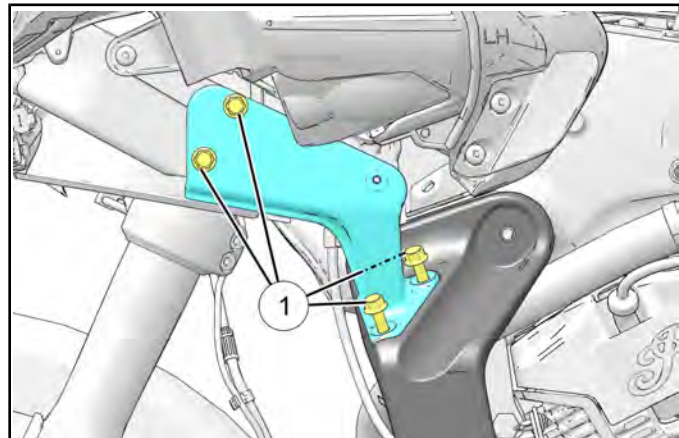
## RADIATOR REMOVAL / INSTALLATION

### WARNING

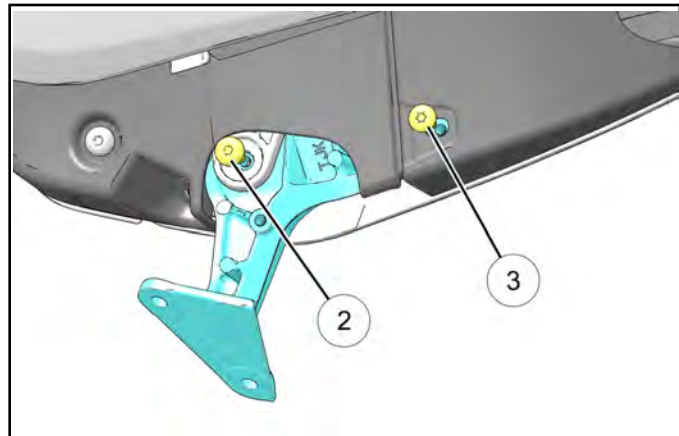
Engine, cooling, and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wait for components to cool sufficiently before working on the machine.

### REMOVAL

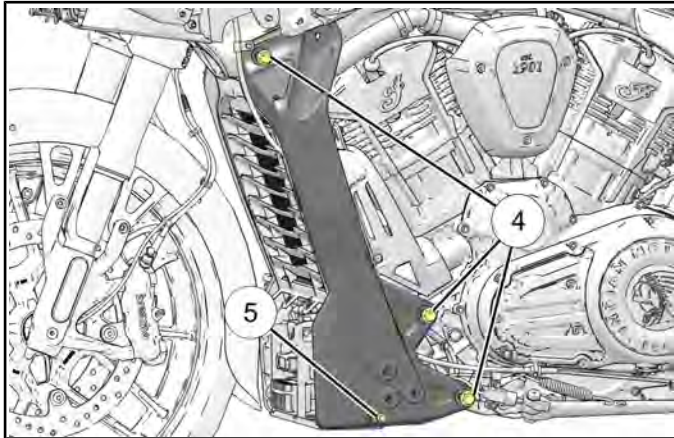
1. Remove outer fairing. Reference **Fairing Disassembly page 7.40**.
2. Remove battery. See **Battery Removal page 10.6**.
3. Remove highway bar. See **Highway Bar Removal / Installation page .**
4. Remove driver floorboard assembly. See **Floorboard Removal / Installation page 7.29**.
5. Drain engine coolant. See **Coolant Drain / Fill / Bleed page 3.37**.
6. Remove lower fairing bracket fasteners ①.



7. On the inside of the fairing bracket, remove the speaker assembly fastener ②, and the dash closeout fastener ③. Remove the bracket.



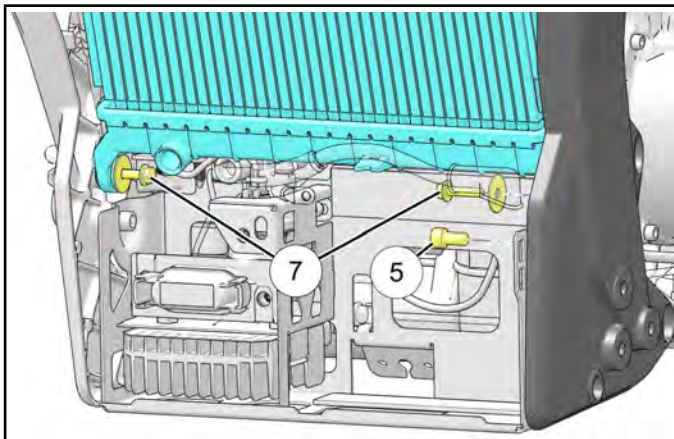
8. Remove downcast fasteners ④ and battery box fastener ⑤.



9. Remove fairing louver by removing its fasteners ⑥.

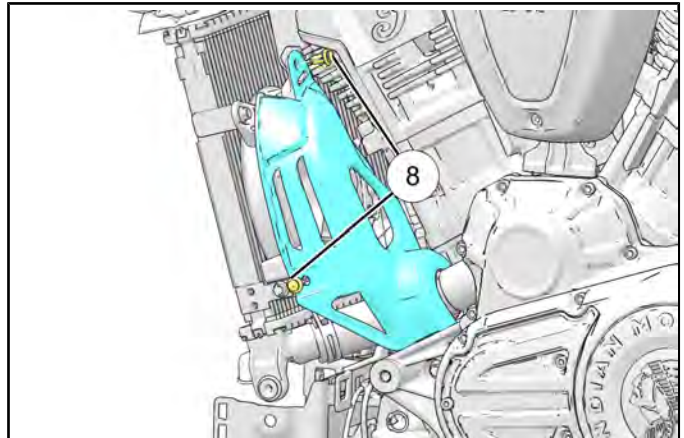


10. Remove radiator fasteners ⑦ and inner battery box fastener ⑤.



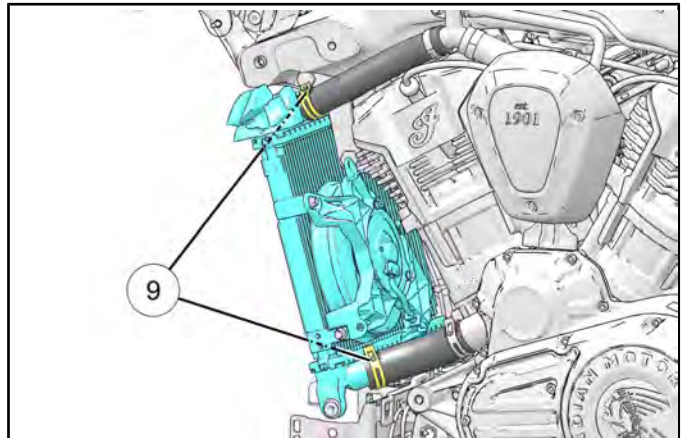
11. Remove left hand downcast.

12. Remove fan shroud by removing two push pins ⑧.



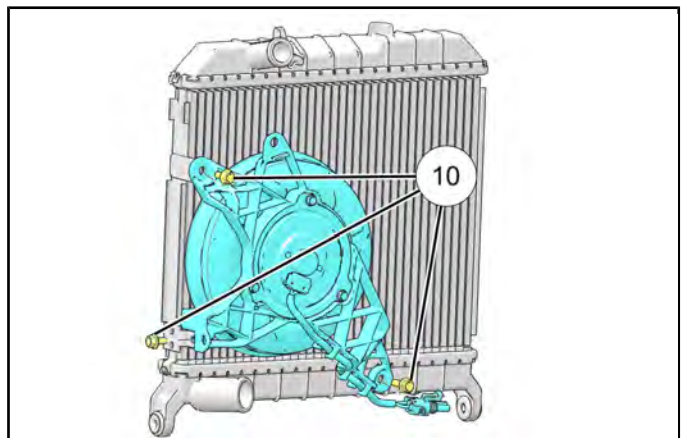
13. Disconnect the fan electrical connector.

14. Disconnect the upper and lower radiator hoses by removing the spring clamps ⑨.



15. Remove assembly.

16. Remove fasteners ⑩ securing fan to radiator.



3

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Cooling Fan Fastener: <b>36 in-lbs (4 N·m)</b>

TORQUE
Radiator Mount Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Battery Box Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Fairing Louver Fastener: <b>36 in-lbs (4 N·m)</b>

TORQUE
Front Downcast Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
Speaker Assembly Fastener: <b>36 in-lbs (4 N·m)</b>

TORQUE
Dash Closeout Fastener: <b>36 in-lbs (4 N·m)</b>

TORQUE
Lower Fairing Bracket Fastener: <b>18 ft-lbs (24 N·m)</b>

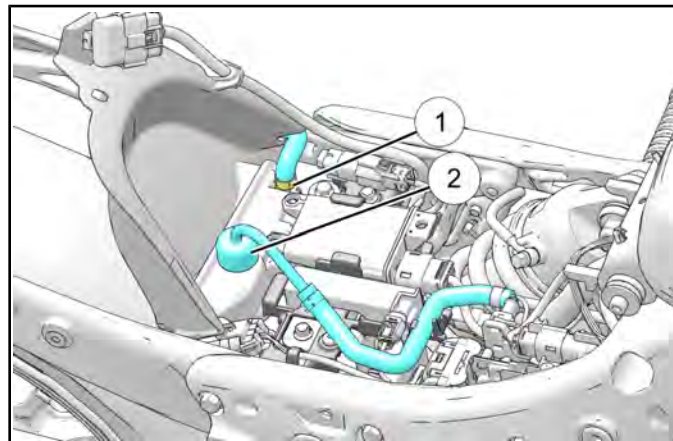
2. Bleed coolant system. See **Coolant Drain / Fill / Bleed page 3.37**

**COOLANT RECOVERY BOTTLE REMOVAL / INSTALLATION**

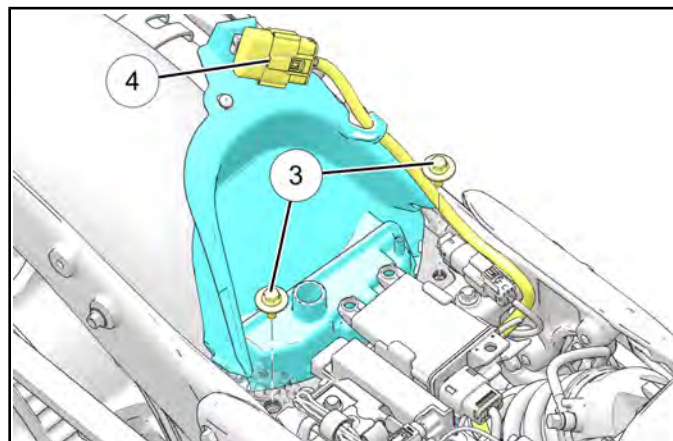
**REMOVAL**

⚠ WARNING
Engine, cooling, and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wait for components to cool sufficiently before working on the machine.

1. Remove seat. See **Seat Removal / Installation page 7.32.**
2. Remove saddlebags. See **Saddlebag Removal / Installation page .**
3. Remove rear fender. See **Rear Fender Removal / Installation page 7.38.**
4. Remove coolant overflow line ① and coolant pickup line ② from recovery bottle..

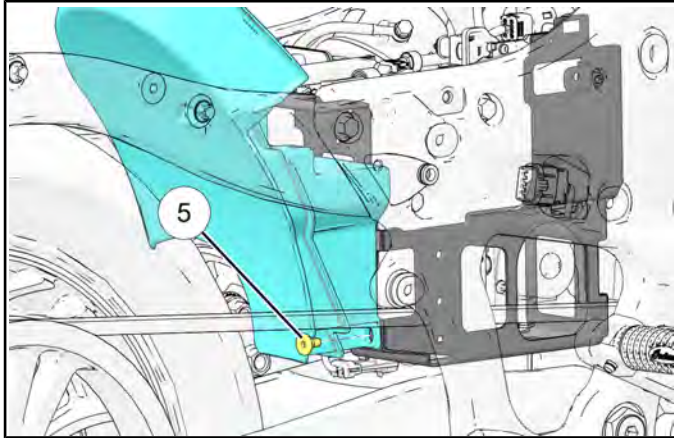


5. Remove upper recovery bottle fasteners ③.



6. Disconnect harness termination clip ④.

7. Remove lower recovery bottle fastener ⑤.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Recovery Bottle Fastener (Lower):  
**84 in-lbs (10 N·m)**

**TORQUE**

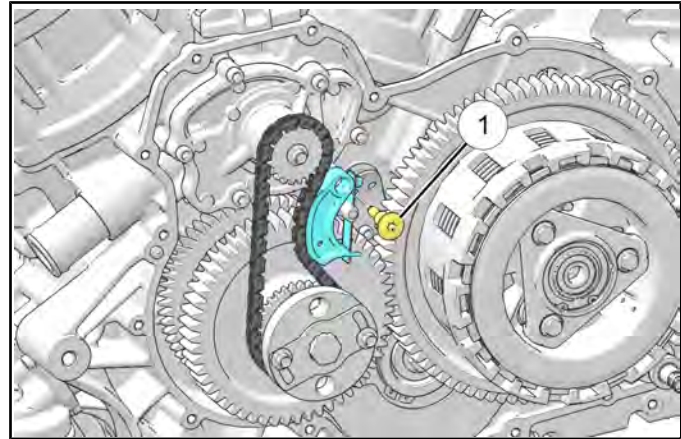
Recovery Bottle Fastener (Upper):  
**36 in-lbs (4 N·m)**

2. Install rear fender. See **Rear Fender Removal / Installation page 7.38.**  
 3. Install saddlebag. See **Saddlebag Removal / Installation page .**  
 4. Install seat. See **Seat Removal / Installation page 7.32.**

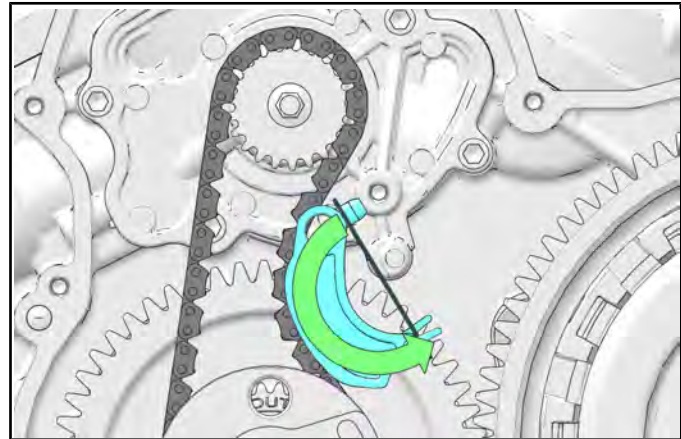
**WATER PUMP REMOVAL / INSTALLATION**

**REMOVAL**

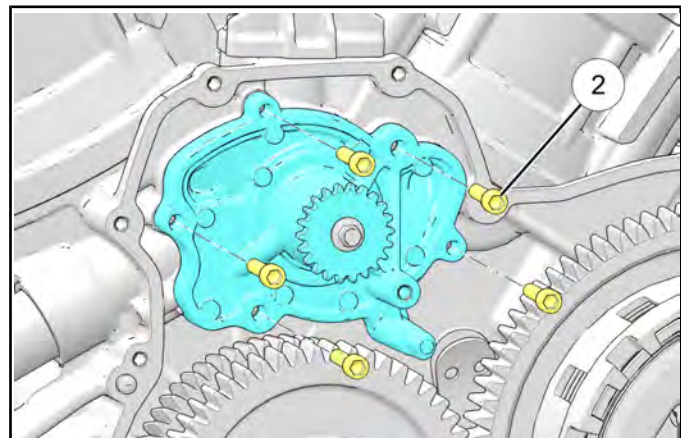
1. Remove primary cover. See **Primary Cover Removal page 5.13.**  
 2. Remove the fastener ① retaining the water pump chain tensioner.



3. Rotate the chain tensioner down and out.

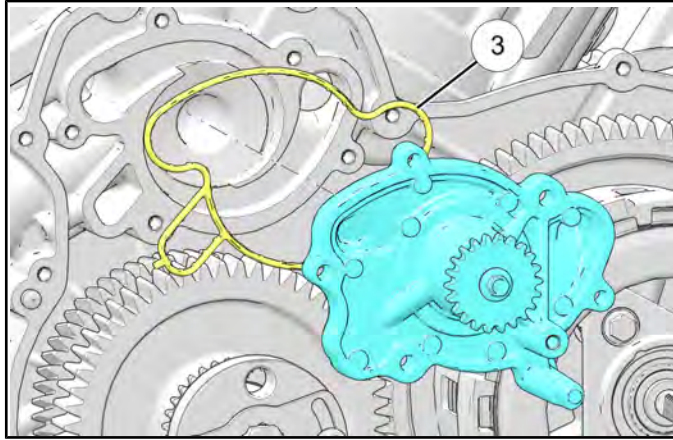


4. Remove the water pump chain.  
 5. Remove the fasteners ② securing the water pump.



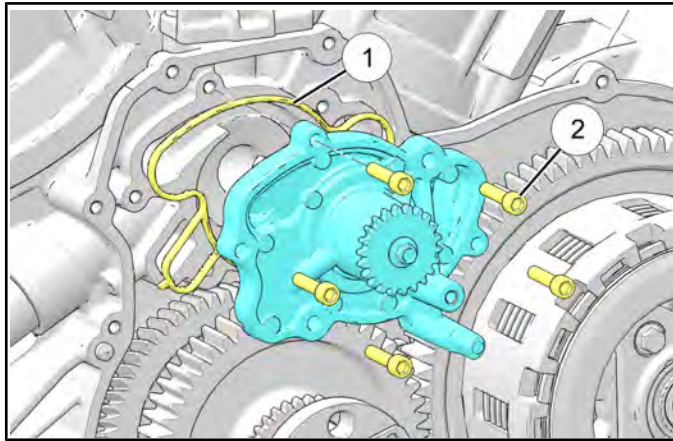
3

6. Remove the water pump and water pump gasket ③.



**INSTALLATION**

1. Inspect the water pump gasket ① and replace if necessary.

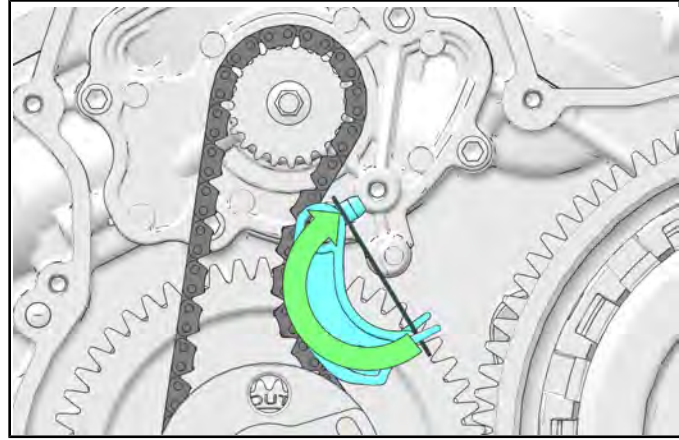


2. Install the water pump and gasket. Secure the water pump with its fasteners ②.

TORQUE
Water Pump Fastener: <b>84 in-lbs (10 N·m)</b>

3. Install the water pump chain.

4. Install the water pump chain tensioner by rotating it upward into position.



5. Secure tensioner with its fastener.

TORQUE
Water Pump Chain Tensioner Fastener: <b>84 in-lbs (10 N·m)</b>

6. Install primary cover. See **Primary Cover Installation** page 5.19.

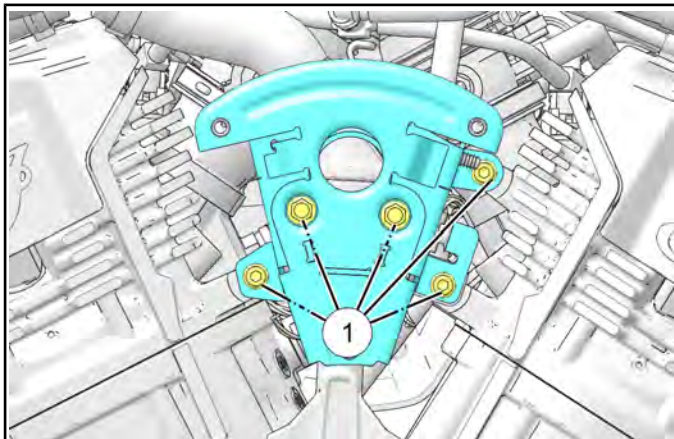
**THERMOSTAT REMOVAL / INSTALLATION**

**⚠ WARNING**

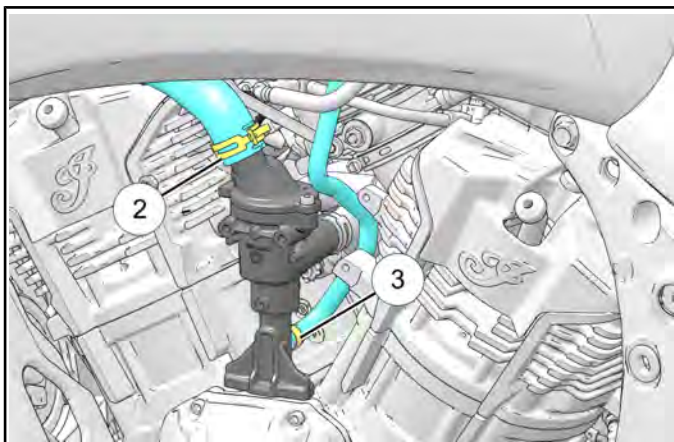
Engine, cooling, and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wait for components to cool sufficiently before working on the machine.

**REMOVAL**

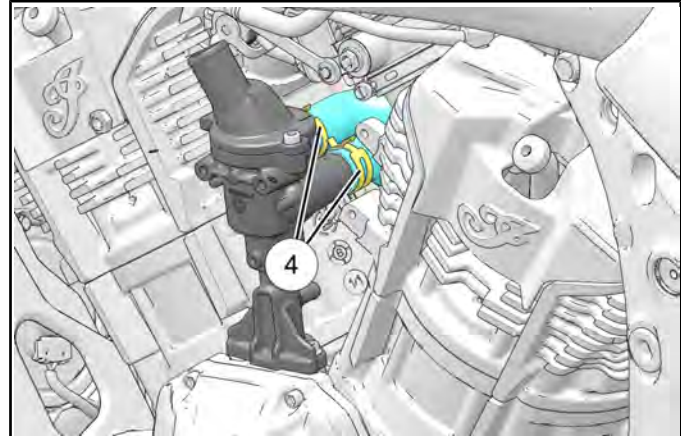
1. Drain engine coolant. See **Coolant Drain / Fill / Bleed page 3.37.**
2. Remove ignition coils. See **Ignition Coil Removal / Installation page 10.52.**
3. Remove fasteners ① securing ignition coil bracket.



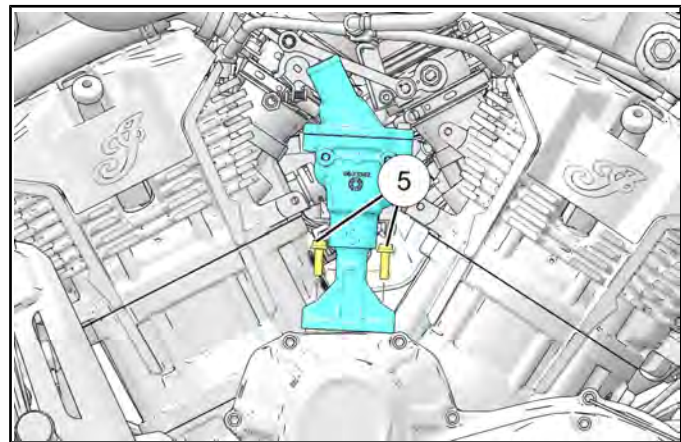
4. Disconnect the wiring harness and coolant return line hose from the ignition coil bracket.
5. Disconnect thermostat hose clamp ② and coolant return line clamp ③.



6. Disconnect cylinder coolant hose clamps ④.



7. Remove bypass tube fasteners ⑤.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Bypass Tube Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Ignition Coil Bracket: <b>84 in-lbs (10 N·m)</b>

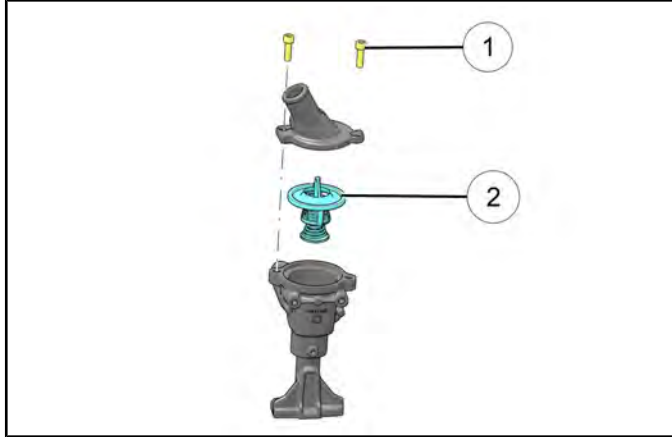
2. Fill and bleed the cooling system. See **Coolant Drain / Fill / Bleed page 3.37.**

3

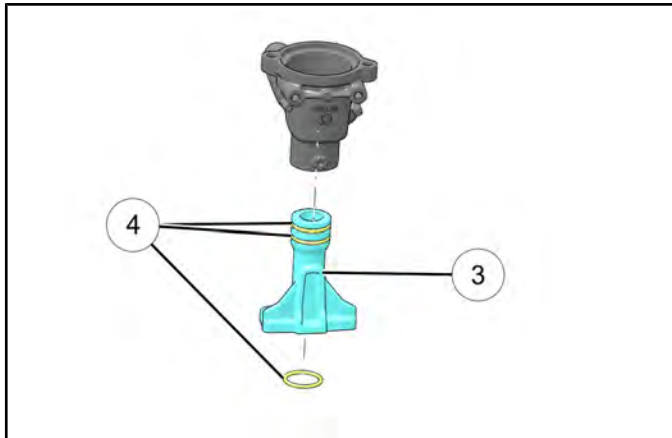
## ***THERMOSTAT DISASSEMBLY / ASSEMBLY***

### **DISASSEMBLY**

1. Remove thermostat cover by removing its fasteners ① and remove thermostat ②.



2. Remove coolant bypass tube ③.



3. Inspect O-rings ④ for damage and replace if necessary.

### **ASSEMBLY**

1. **ASSEMBLY IS PERFORMED BY REVERSING THE DISASSEMBLY PROCEDURE.**

#### **IMPORTANT**

Replace any damaged o-rings prior to assembly.

#### **TORQUE**

Thermostat Cover Fastener:  
**84 in-lbs (10 N·m)**

**CYLINDER HEAD / VALVES****GENERAL INFORMATION****SERVICE NOTES – CYLINDER HEAD**

- This chapter covers service of the cylinder heads, camshafts, cam chain and tensioner, cam chain guide and roller / rocker arms.
- Refer to Engine / Cooling / Exhaust chapter for engine removal and installation.
- If cylinder heads are removed the cylinder base gasket must be replaced also.
- Mark and store all mating parts for correct engine assembly.
- Use Moly Assembly Paste - P/N: 2871460 or Indian Motorcycle Synthetic 15W/60 Engine Oil to lubricate parts where indicated.
- Handle and store all parts in such a way that they will not be damaged or contaminated.
- Some fasteners have a pre-applied locking agent, and must be replaced if loosened or removed. Always replace fasteners that have a pre-applied locking agent or as directed in this service manual.
- There are some precision machining steps to be performed in this section. If you are not sure of your capabilities in these areas, have a competent machinist perform these operations.
- Valve guide and seat reconditioning should be performed by a technician proficient in cylinder head reconditioning techniques using high quality equipment with grinding stones. Do not attempt cylinder head repair without the proper equipment or experience in cylinder head reconditioning techniques.
- The intake and exhaust valves cannot be re-faced.
- Cleanliness of parts is critical to engine life and accurate parts inspection. Use clean solvent to clean all disassembled parts. Dry parts with compressed air and lubricate before engine inspection and engine assembly.

**SPECIAL TOOLS – CYLINDER HEAD**

TOOL DESCRIPTION	PART NUMBER
Valve Spring Compressor	PV-1253
Crankshaft Locking Tool	PF-51235
Crankshaft Rotation Tool	PF-51239
Rocker Arm Compression Tool	PF-52939

\*Special Tool PF-51455-A includes both PF-51455 AND PF-52544

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>



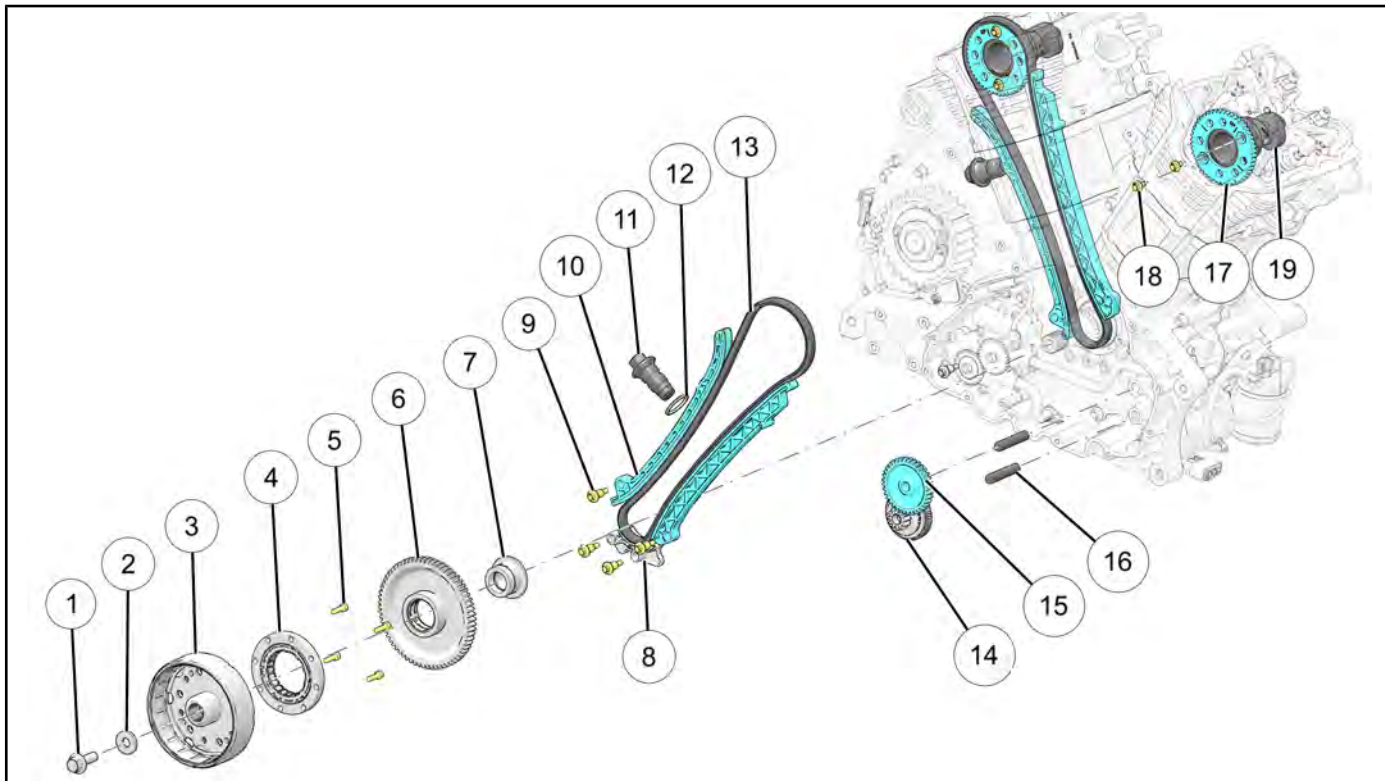
**SERVICE SPECIFICATIONS – CYLINDER HEAD****CAMSHAFT DATA**

	<b>DESCRIPTION</b>	<b>SPECIFICATION</b>
<b>CAMSHAFT DATA</b>	Valve Train	Over Head Valve / 4 valves per cyl 2 Intake Valve / 2 Exhaust Valve
	Intake Valve Opens At 1 mm Lift	1.0° BTDC
	Intake Valve Closes At 1 mm Lift	39.0° ABDC
	Exhaust Valve Opens At 1 mm Lift	46.5° BBDC
	Exhaust Valve Closes At 1 mm Lift	5.5° ATDC
	Max Lobe Lift INTAKE EXHAUST	(7.70 mm) (7.25 mm)
	Max Valve Lift INTAKE EXHAUST	(10.4 mm) (9.80 mm)

## CYLINDER HEAD &amp; VALVE TRAIN DATA

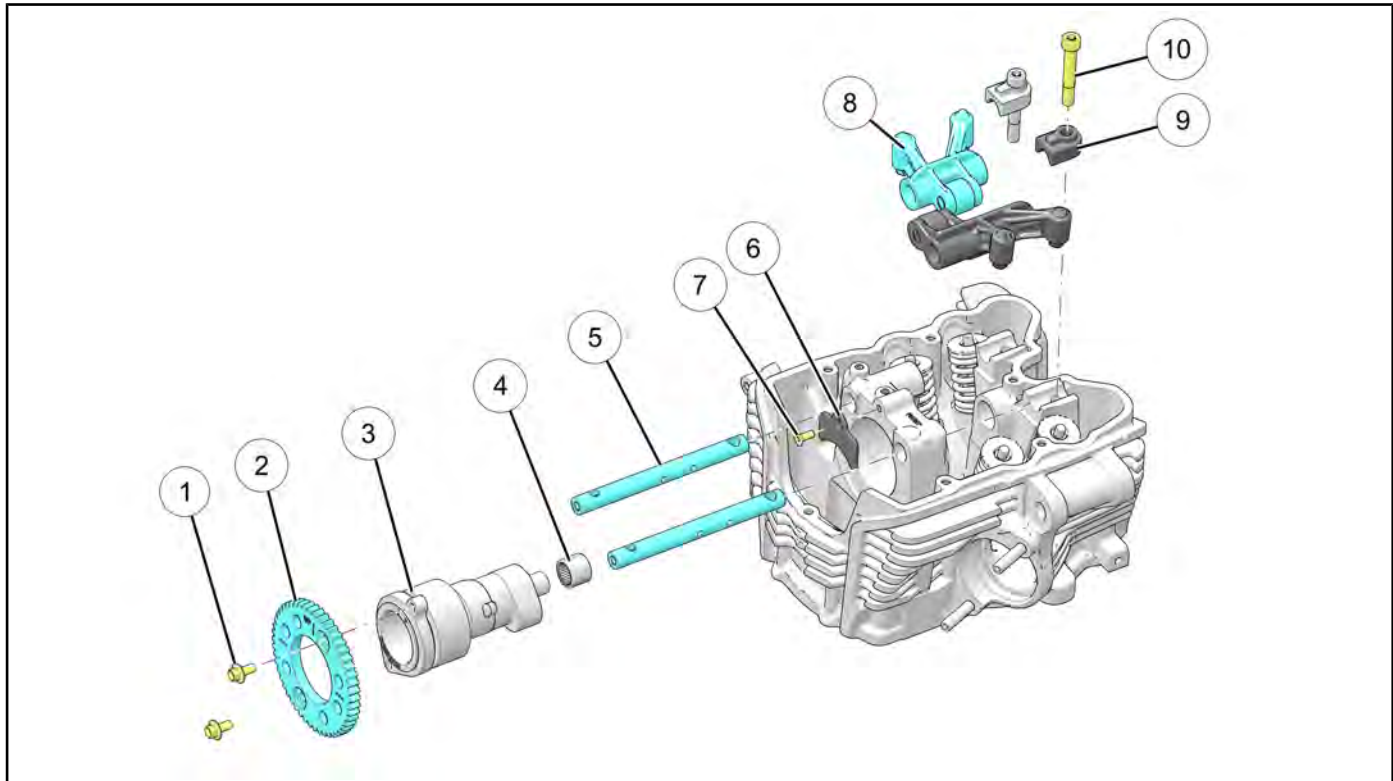
ITEM		STANDARD	SERVICE LIMIT
Cam Shaft	Lobe Height INTAKE EXHAUST	1.7991" (45.699 mm) 1.78165" (45.254 mm)	1.7952" (45.599 mm) 1.7778" (45.154 mm)
	Journal O.D. (Large)	2.244 +/- .00039" (57.00 +/- 0.01 mm)	2.2433" (56.98 mm)
	Journal O.D. (Small)	.6244 - .6250" (15.862-15.875 mm)	.6241" (15.852 mm)
Cylinder Head	Warpage (Distortion)	-	.004" (.10 mm)
Rocker Arm, Shaft, & Lifter	Rocker Arm: IN/EX	Non-Serviceable. Replace as an assembly.	Non-Serviceable. Replace as an assembly.
Valve, Valve Guide, Valve Seat	Valve Clearance	Hydraulic/Self Adjusting	-
	Valve Guide Installed Height	0.577 — 0.594" (14.68 — 15.08 mm)	-
	Valve Stem O.D. INTAKE	0.272 — 0.274" (6.918 — 6.953 mm)	0.2724" 6.918 mm
	Valve Stem O.D. EXHAUST	0.271 — 0.273" (6.885 — 6.933 mm)	0.2715" 6.896 mm
	Valve Stem Deflection (INTAKE & EXHAUST)	-	.005" (.13 mm)
	Valve Seat Width INTAKE EXHAUST	.047" (1.2 mm) .053" (1.35 mm)	0.049" (1.25 mm) 0.078" (2.00 mm)
	Valve Stem Runout	-	.0005" (.013 mm)
	Valve Head Radial Runout	-	.002" (.05 mm)
	Valve Installed Height INTAKE EXHAUST	2.06" (52.4 mm) 2.07" (52.6 mm)	- -
Valve Spring	Free Length (INTAKE & EXHAUST)	<b>2.1120" (53.70 mm)</b>	2.0354" (51.70 mm)
	Intake Valve Maximum Lift	.409" (10.4 mm)	-
	Exhaust Valve Maximum Lift	.386" (9.8 mm)	-
	Spring Installed Height	1.73" (44.00 mm)	-

**ASSEMBLY VIEWS**  
**CAM CHAIN**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Flywheel Fastener	<b>112 ft-lbs (152 N·m)</b>	⑪	Cam Chain Tensioner	<b>15 ft-lbs (20 N·m)</b>
②	Washer	—	⑫	Cam Chain Tensioner Seal	—
③	Flywheel	—	⑬	Cam Chain	—
④	Sprag Clutch Hub Starter	—	⑭	Torque Limiting Gear	—
⑤	Sprag Clutch Fastener	<b>84 in-lbs (10 N·m)</b>	⑮	Starter idle Gear	—
⑥	Starter Gear Clutch	—	⑯	Starter Gear Shaft	—
⑦	Starter Spacer	—	⑰	Camshaft Sprocket	—
⑧	Lower Chain Guide	—	⑱	Camshaft Sprocket Fastener	<b>159 in-lbs (18 N·m)</b>
⑨	Chain Guide Fastener (All)	<b>84 in-lbs (10 N·m)</b>	⑲	Camshaft	—
⑩	Chain Guide	—			

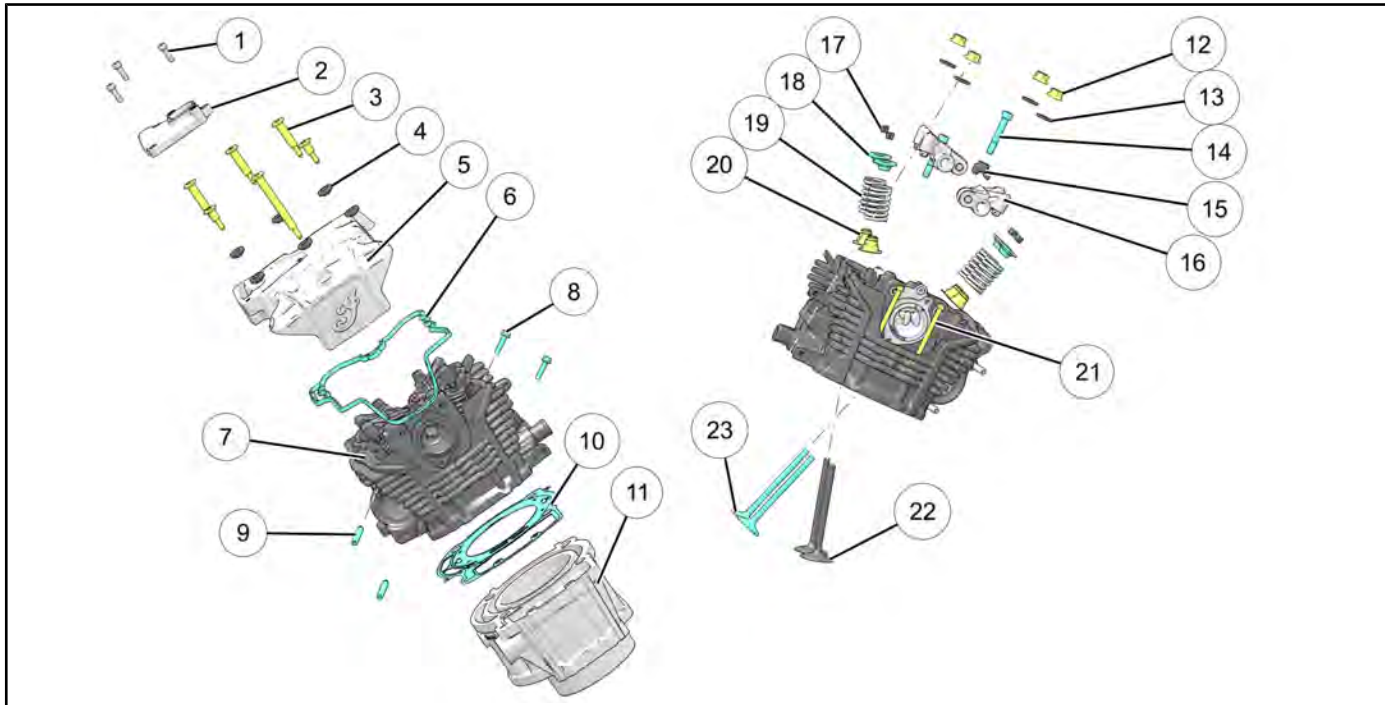
**CAMSHAFTS**



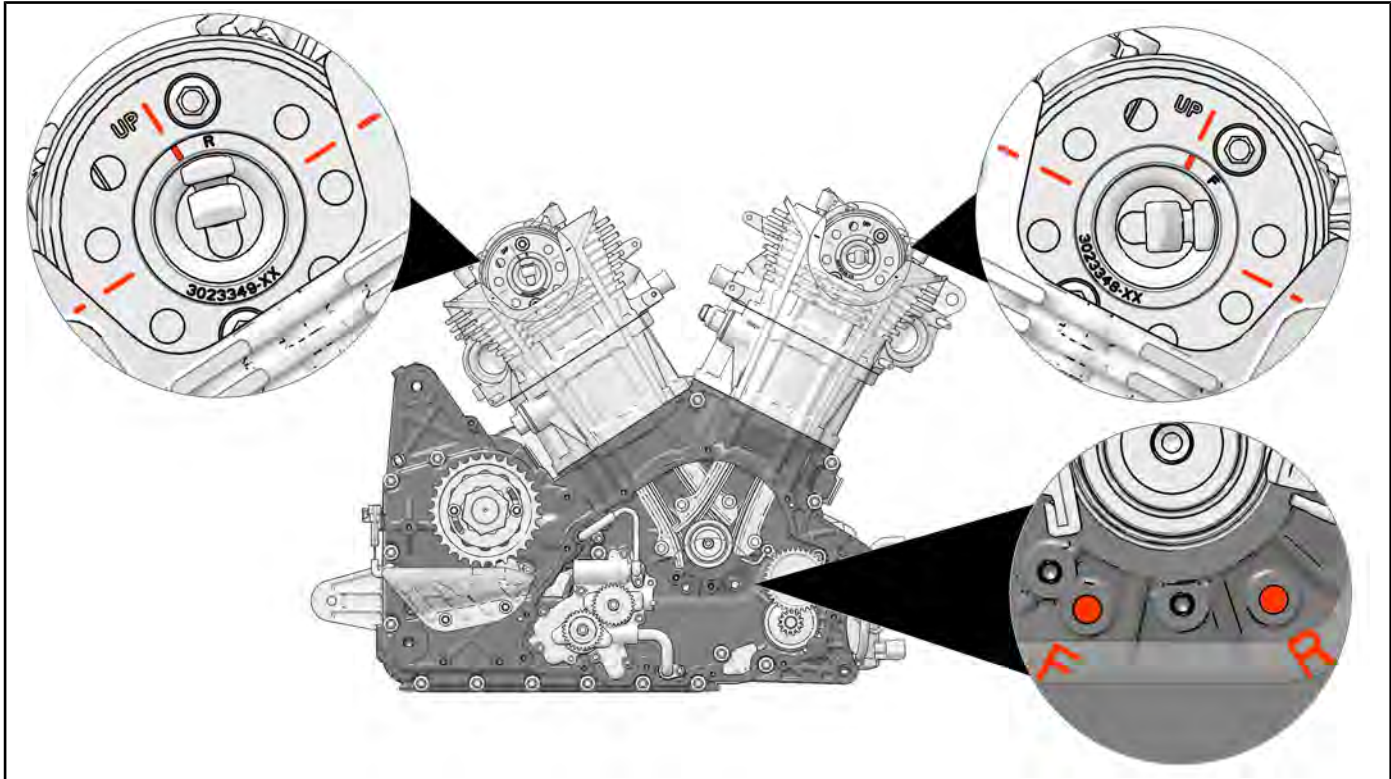
3

REF	DESCRIPTION	TORQUE
①	Camshaft Sprocket Fastener	<b>159 in-lbs (18 N·m)</b>
②	Camshaft Sprocket	—
③	Camshaft	—
④	Camshaft Bearing	—
⑤	Rocker Shaft	—
⑥	Camshaft Thrust Plate	—
⑦	Camshaft Thrust Plate Fastener	<b>62 in-lbs (7 N·m)</b>
⑧	Rocker Arm Assembly	—
⑨	Rocker Shaft Cap	—
⑩	Rocker Shaft Cap Fastener	<b>27 ft-lbs (37 N·m)</b>

**CYLINDER HEAD**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Breather Fastener	84 in-lbs (10 N·m)	⑬	Cylinder Head Washer	—
②	Breather Assembly	—	⑭	Rocker Shaft Cap Fastener	27 ft-lbs (37 N·m)
③	Valve Cover Fastener	84 in-lbs (10 N·m)	⑮	Rocker Shaft Cap	—
④	Valve Cover Isolator	—	⑯	Rocker Arm Assembly	—
⑤	Valve Cover	—	⑰	Keepers	—
⑥	Valve Cover Gasket	—	⑱	Valve Spring Retainer	—
⑦	Cylinder Head (Rear)	—	⑲	Valve Spring	—
⑧	Intake Manifold Fastener	See Intake Removal / Installation procedure.	⑳	Valve Stem Spring Seat	—
⑨	Exhaust Stud	15 ft-lbs (20 N·m)	㉑	Cylinder Head Bolt	84 in-lbs (10 N·m)
⑩	Head Gasket	—	㉒	Intake Valve	—
⑪	Cylinder (Rear)	—	㉓	Exhaust Valve	—
⑫	Cylinder Head Nut	<b>1. Torque fasteners to 15 ft-lbs (20 N·m)</b> <b>2. Back off 90 °</b> <b>3. Torque all fasteners to 26 ft-lbs (35 N·m)</b> <b>4. Torque angle all 360 °</b>			

**CAMSHAFT TIMING****IMPORTANT**

When Timing an engine, start with the rear cylinder first.

**CAUTION**

Failure to properly time the camshafts can lead to engine damage.

For setting camshaft timing, refer to cam chain installation. See **Cam Chain Removal / Installation** page 3.55.

**Rear Cylinder Alignment**

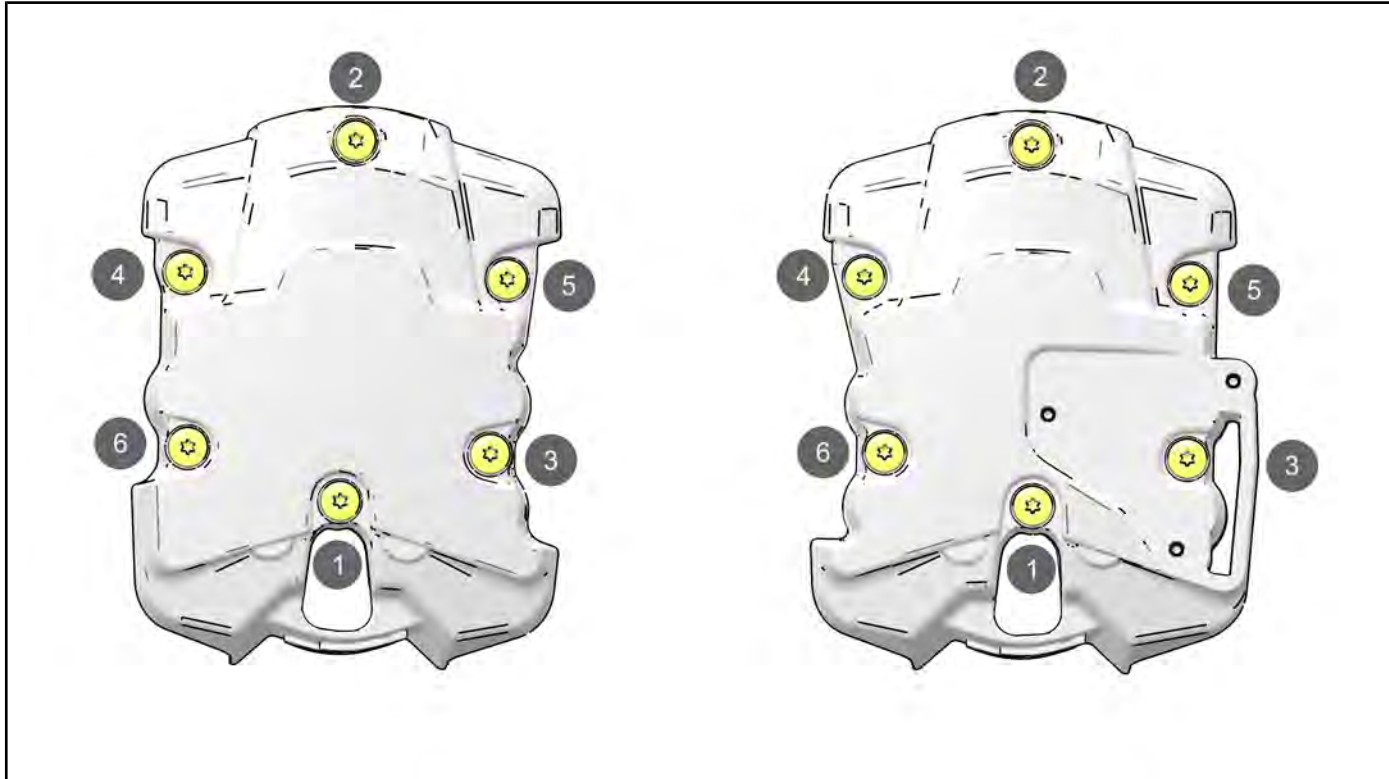
1. Align and lock crankshaft to rear crankcase alignment hole.
2. The camshaft alignment marks should line up with the marks on the cylinder head.

**Front Cylinder Cam Driven Sprocket Timing**

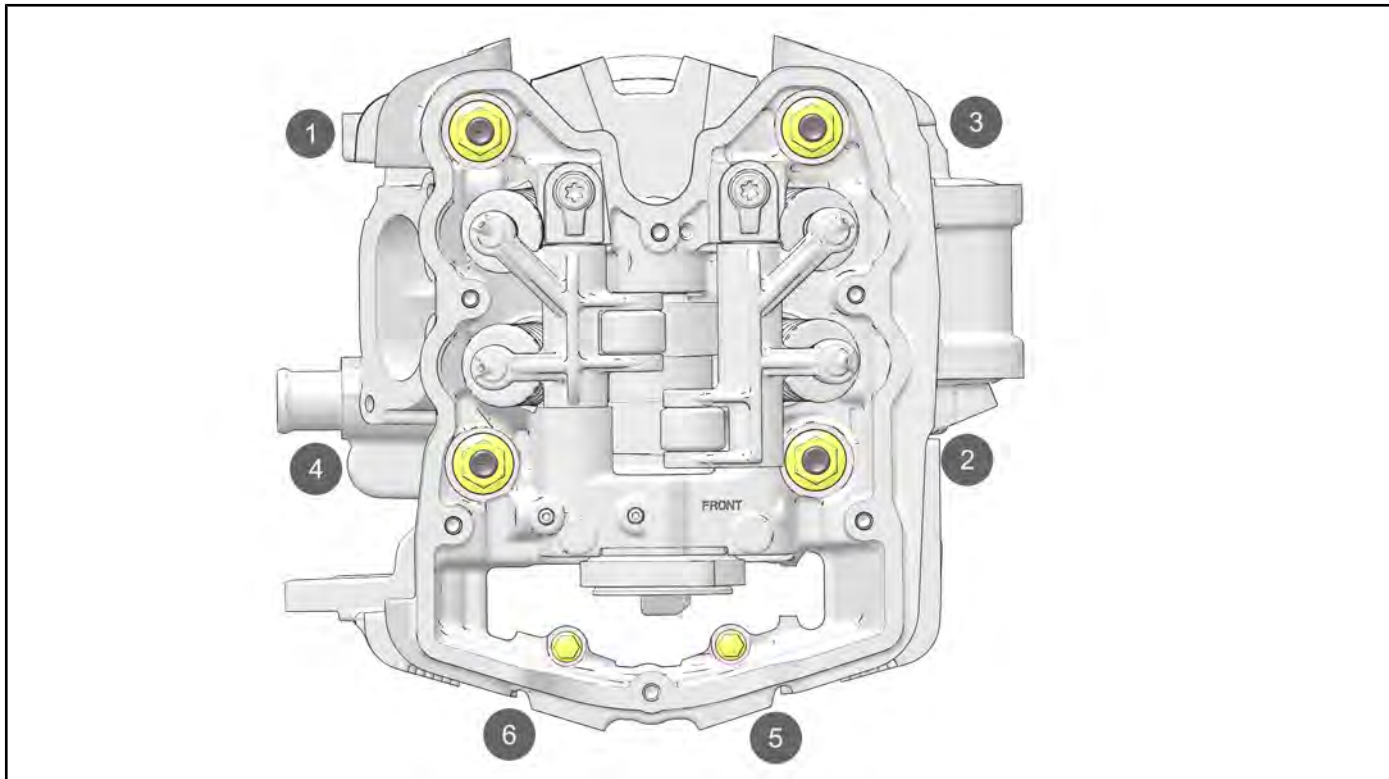
1. Align and lock crankshaft to front crankcase alignment hole.
2. The camshaft alignment marks should line up with the marks on the cylinder head.

**TORQUE SEQUENCE - CYLINDER HEAD / VALVES**

**VALVE COVER**



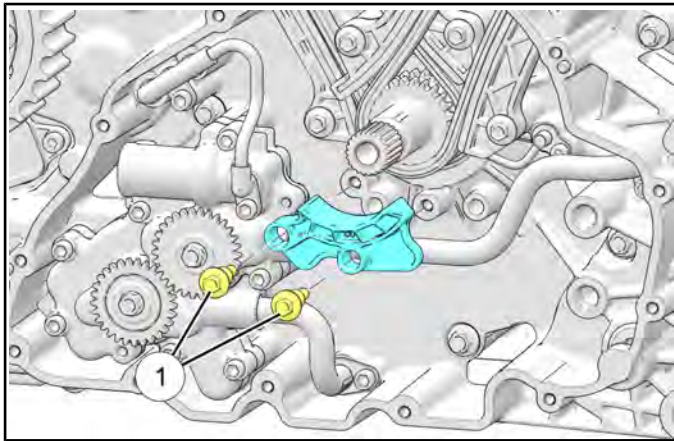
**CYLINDER HEAD**



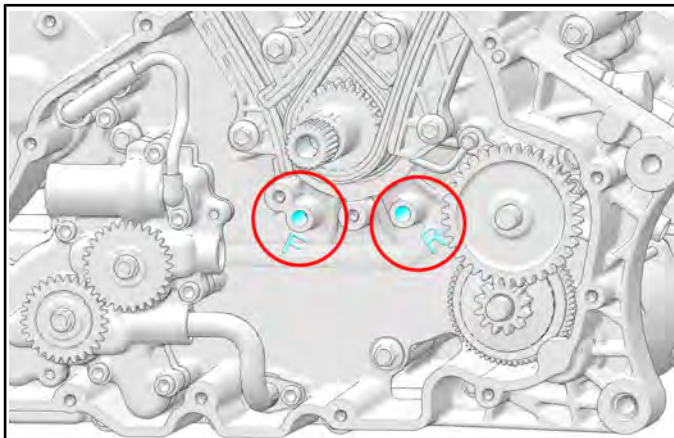
**CAM CHAIN SERVICE****LOCKING THE CRANKSHAFT FOR SERVICE****LOCKING THE CRANKSHAFT**

This procedure describes how to lock the crankshaft in the Top Dead Center (TDC) position using commercially available hand tools.

1. Remove spark plugs. See **Spark Plug Removal page 3.4**
2. Remove ACG cover. See **ACG Cover Removal / Installation page 10.34.**
3. Remove flywheel. See **Flywheel Removal / Installation page 3.54.**
4. Remove lower chain guide by removing its fasteners ①.



5. Rotate the crankshaft counterclockwise (primary side) until the front piston is at TDC.
6. Lock the crankshaft by inserting crankshaft locking pin **PF-52135** or a 5/16" pin punch (or equivalent) into the locking hole .

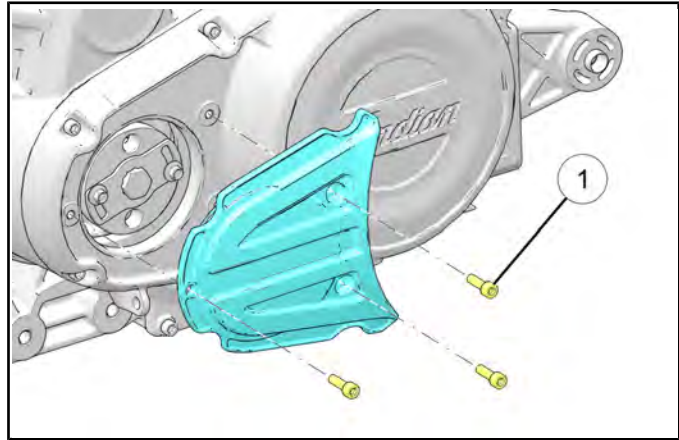


7. It may be necessary to rotate the crankshaft slight forward or back to properly align holes.

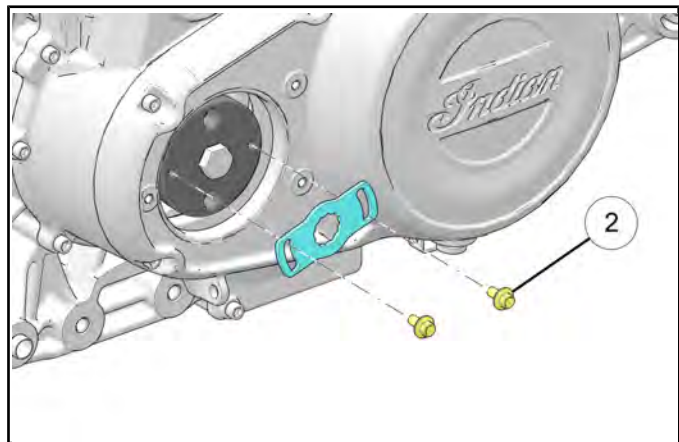
**HOLDING THE CRANKSHAFT**

The crankshaft / rotating assembly can be held in place by an alternative method, however this method **does NOT** lock it in place.

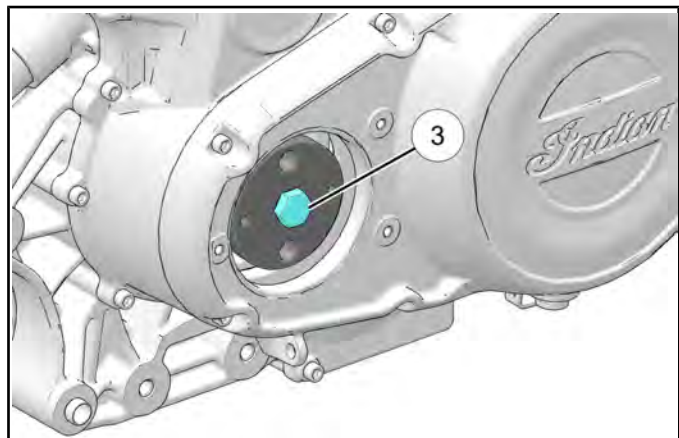
1. Remove the cold start cover by removing its fasteners ①.



2. Remove the locking plate by removing its fasteners ②.



3. Use a socket and wrench to hold the cold test adapter fastener ③.

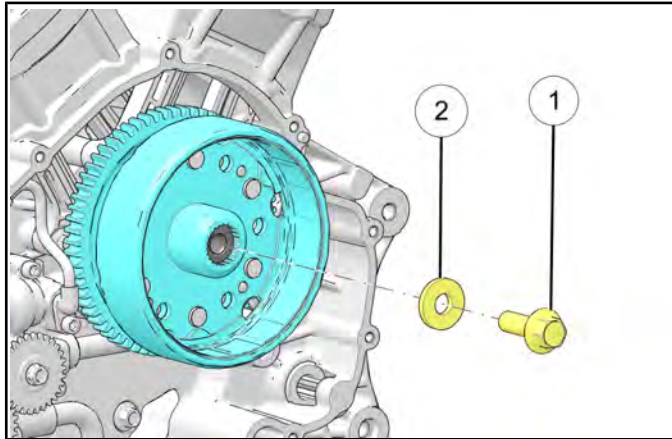
**3**



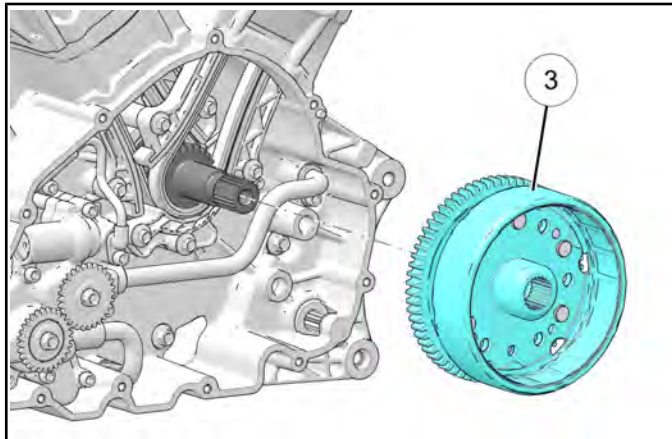
**FLYWHEEL REMOVAL / INSTALLATION**

**REMOVAL**

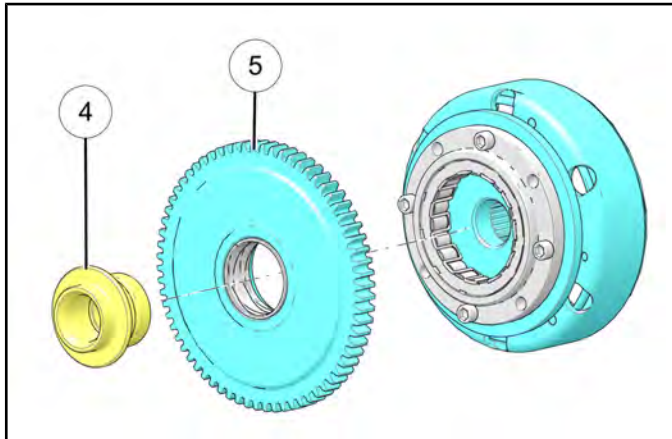
1. Remove stator. See **Stator Removal / Installation page 10.34.**
2. Remove ACG Cover. See **ACG Cover Removal / Installation page 10.34.**
3. Remove flywheel bolt ① and washer ②.



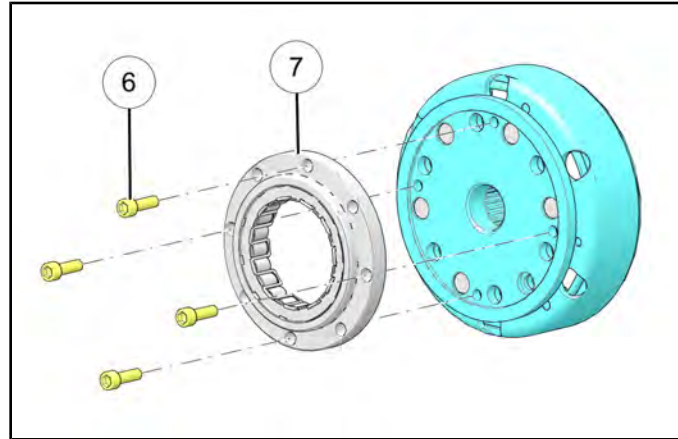
4. Remove flywheel assembly ③.



5. Remove starter/ACG spacer ④.



6. Remove starter clutch gear ⑤.
7. Remove sprag clutch hub ⑦ by removing its fasteners ⑥.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

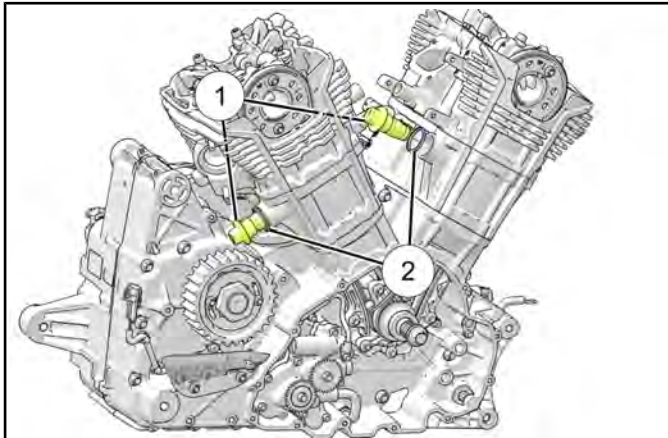
TORQUE
Sprag Clutch Hub Fastener <b>84 in-lbs (10 N·m)</b>

TORQUE
Flywheel Fastener <b>112 ft-lbs (152 N·m)</b>

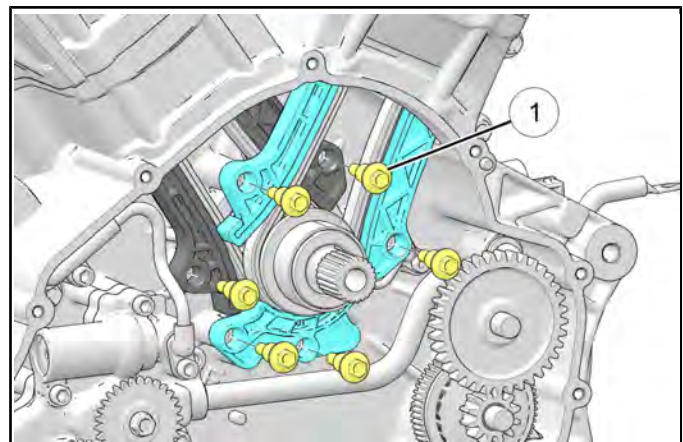
**CAM CHAIN TENSIONER REMOVAL****CAUTION**

Do not rotate engine with tensioner(s) removed.

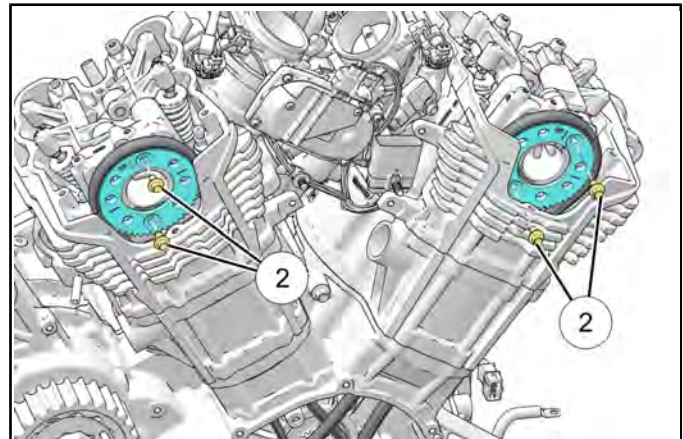
1. Remove valve cover. See **Valve Cover Removal page 3.83**
2. Lock crankshaft for service with the front piston at TDC on the compression stroke. See **Locking the Crankshaft for Service page 3.53**.
3. Remove tensioner ① and sealing washer ②.

**CAM CHAIN REMOVAL / INSTALLATION****REMOVAL**

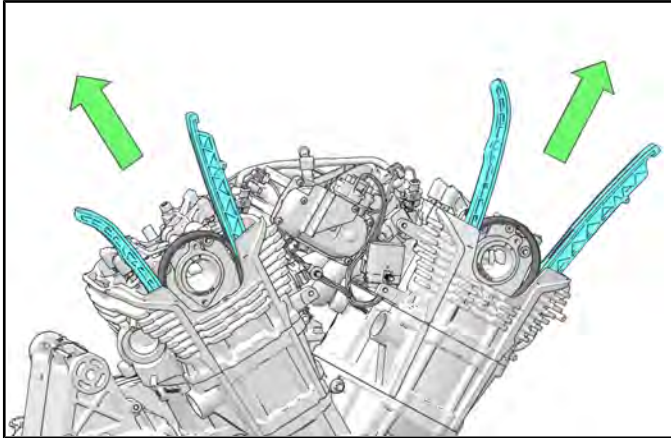
1. Remove valve cover. See **Valve Cover Removal page 3.83**.
2. Lock crankshaft for service. See **Locking the Crankshaft for Service page 3.53**.
3. Remove cam chain tensioners. See **Cam Chain Tensioner Removal page 3.55**.
4. Remove ACG cover. See **ACG Cover Removal / Installation page 10.34**.
5. Remove Flywheel. See **Flywheel Removal / Installation page 3.54**.
6. Remove cam chain guide fasteners ①.



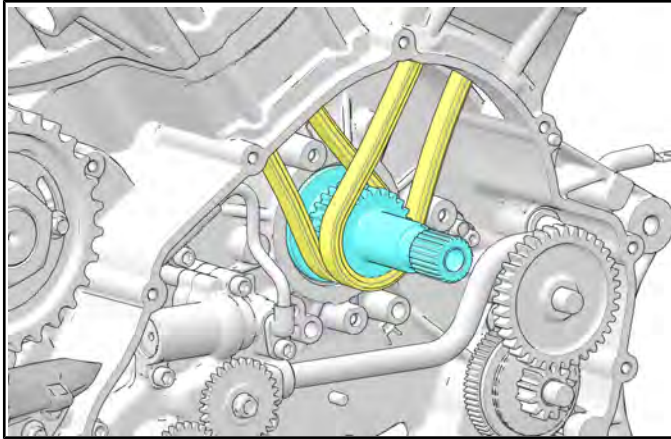
7. Remove fastener ② securing camshaft sprocket.



8. Remove cam chain guides.

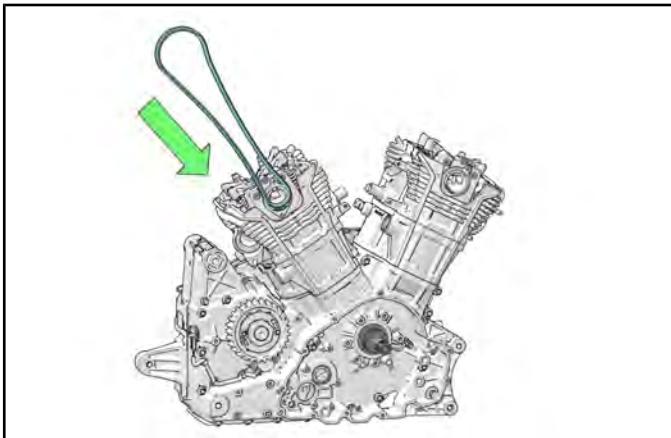


9. Remove cam chains off of crankshaft and remove.

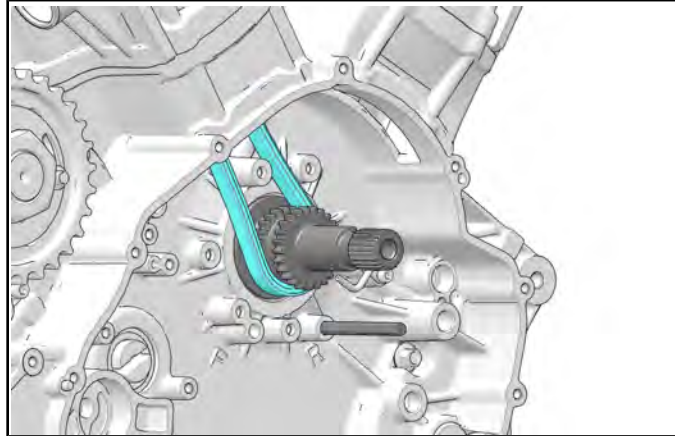


**INSTALLATION**

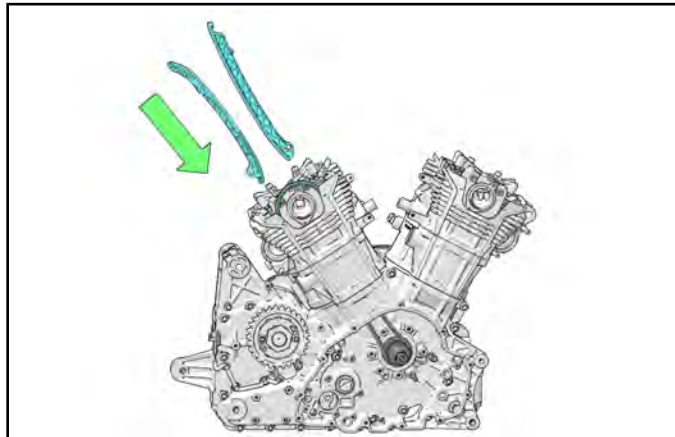
1. Lock the rear cylinder for service. See **Locking the Crankshaft for Service** page 3.53.
2. Install the rear cam chain through its slot in the cylinder head.



3. Connect the chain to the inside sprocket on the crankshaft.

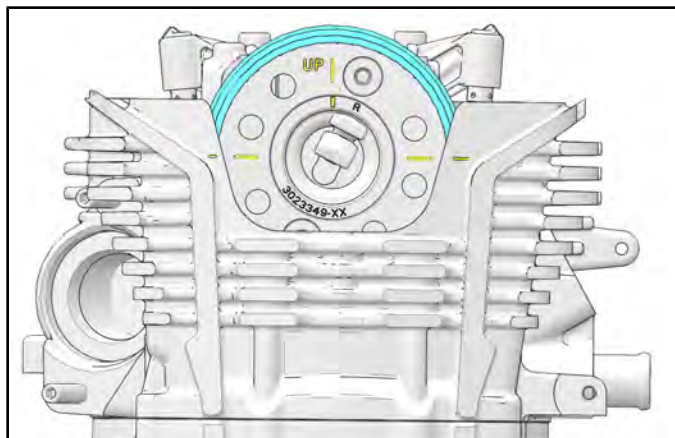


4. Install rear cylinder chain guides and hand tighten fasteners.

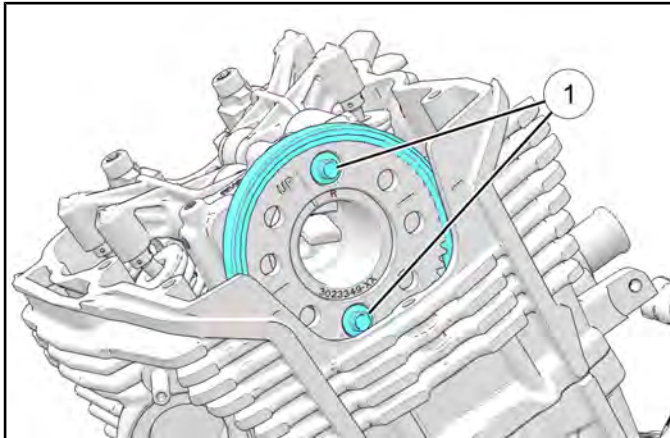


5. Align the camshaft sprocket as shown.

**CAUTION**  
Failure to properly time the camshafts can lead to engine damage.



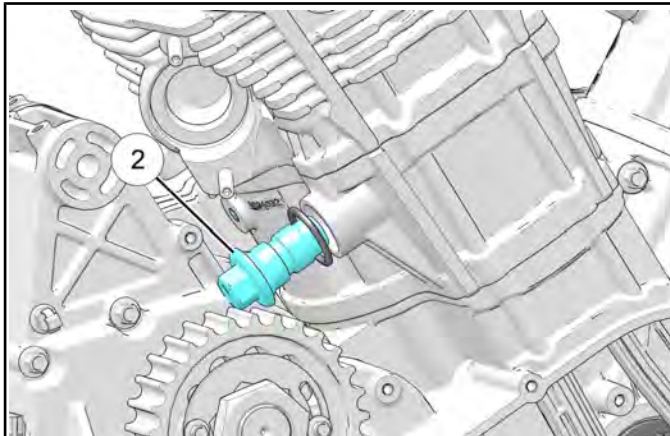
6. Install the camshaft sprocket fasteners ①.



**TORQUE**

Camshaft Sprocket Fastener:  
**159 in-lbs (18 N·m)**

7. Install the rear cam chain tensioner ②.

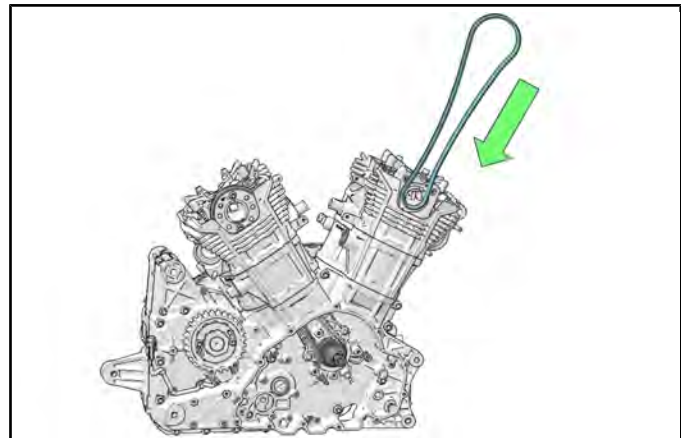


**TORQUE**

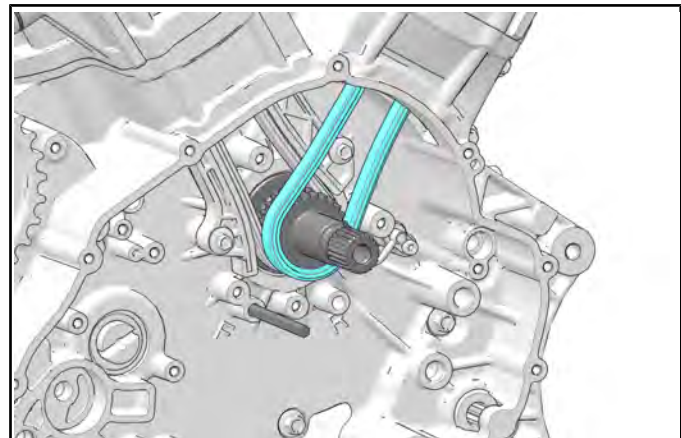
Cam Chain Tensioner:  
**15 ft-lbs (20 N·m)**

- 8. While viewing from the right side of the engine, Rotate the crankshaft clockwise 360° then an additional 60°.
- 9. Lock the front cylinder for service. See **Locking the Crankshaft for Service** page 3.53.

10. Install the front cam chain through its slot in the cylinder head.



11. Connect the chain to the outside sprocket on the crankshaft.

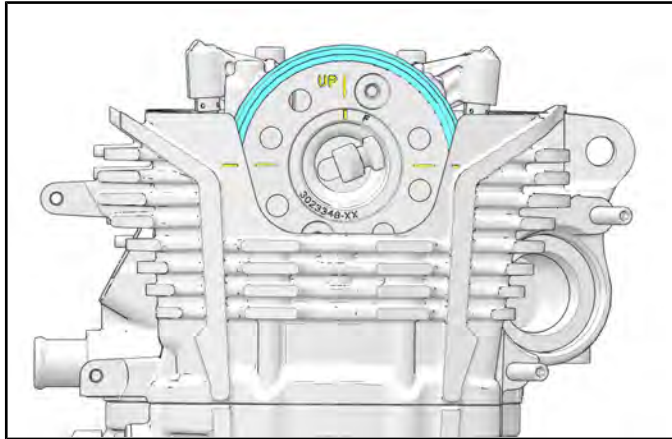


12. Install front cylinder chain guides and hand tighten fasteners.

3

13. Align the camshaft sprocket as shown.

<b>⚠ CAUTION</b>
Failure to properly time the camshafts can lead to engine damage.



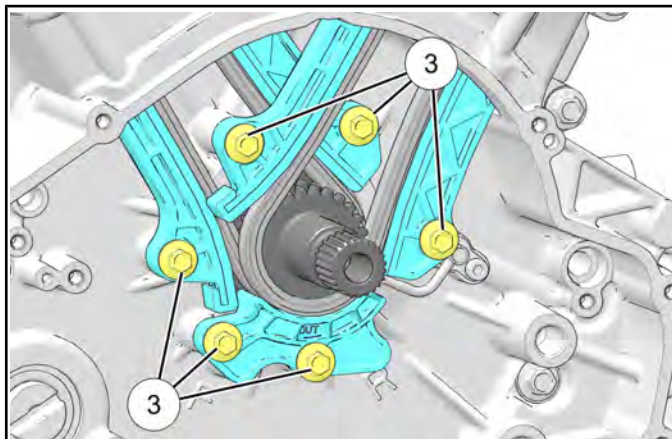
14. Install the camshaft sprocket fasteners.

<b>TORQUE</b>
Camshaft Sprocket Fastener: <b>159 in-lbs (18 N·m)</b>

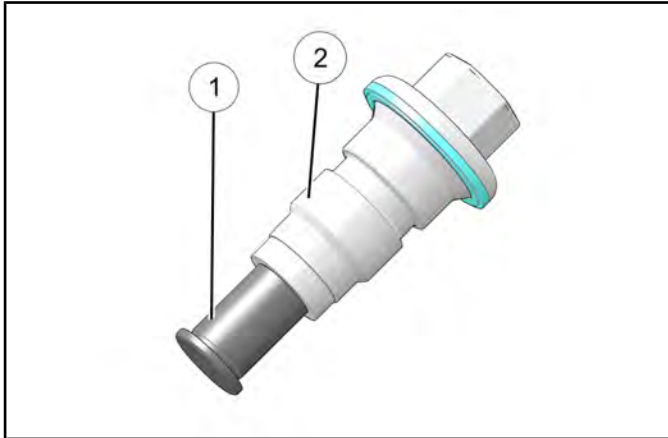
15. Install the front cam chain tensioner.

<b>TORQUE</b>
Cam Chain Tensioner: <b>15 ft-lbs (20 N·m)</b>

16. Torque all chain guide fasteners ③ to specification.



<b>TORQUE</b>
Chain Guide Fastener (All): <b>84 in-lbs (10 N·m)</b>

**CAM CHAIN TENSIONER INSPECTION**

1. Visually inspect inner plunger ① for damage, scoring, or burns.
2. Lubricate inner plunger with engine oil. Move plunger in and out of outer plunger ② to check for smooth movement without binding.
3. Verify the oil passage opening is free from debris.
4. Replace tensioner seal upon assembly.
5. Replace tensioner assembly if worn or damaged.

**CAMSHAFT SPROCKET REMOVAL / INSTALLATION**

1. Place motorcycle in an upright position with front wheel clamped in a wheel vise.
2. Remove valve cover(s). See **Valve Cover Removal page 3.83**.
3. Remove primary cover. See **Primary Cover Removal page 5.13**.
4. Rotate the crankshaft to expose sprocket bolts and loosen 1/2 turn.

**NOTICE**

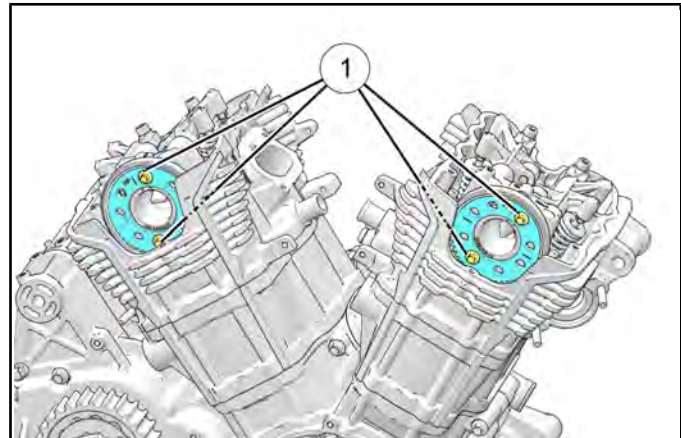
Use a piece of nylon webbing or rope to create an interference between the crank drive gear and clutch gear, thus locking the crankshaft while loosening sprocket bolts.

5. Rotate crankshaft so the front piston is TDC on the compression stroke and lock in position. See **Locking the Crankshaft for Service page 3.53**.
6. Remove the cam chain tensioners. See **Cam Chain Tensioner Removal page 3.55**.

**CAUTION**

Do not rotate the crankshaft with tensioners removed. Engine damage may occur.

7. Remove the camshaft sprocket bolts ① completely.

**IMPORTANT**

It will be necessary to use a thin 10 mm spanner to remove the sprocket bolts that are not exposed. the bolts cannot be completely removed until the sprocket is out of the cylinder head.

8. Remove sprockets from camshafts using care not to drop the chain into the cam chain gallery.

9. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Cam Sprocket Fastener: <b>159 in-lbs (18 N·m)</b>

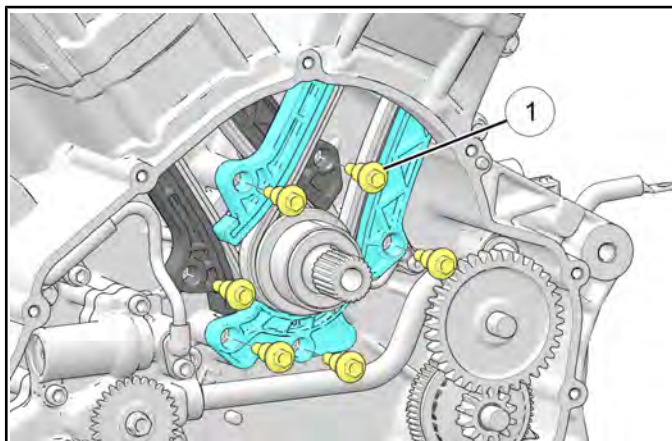
**CAM CHAIN TENSIONER INSTALLATION**

1. Verify that the engine is at TDC and the timing marks are properly aligned. See **Locking the Crankshaft for Service page 3.53.**
2. Install the tensioner(s) with new sealing washers and torque to specification.

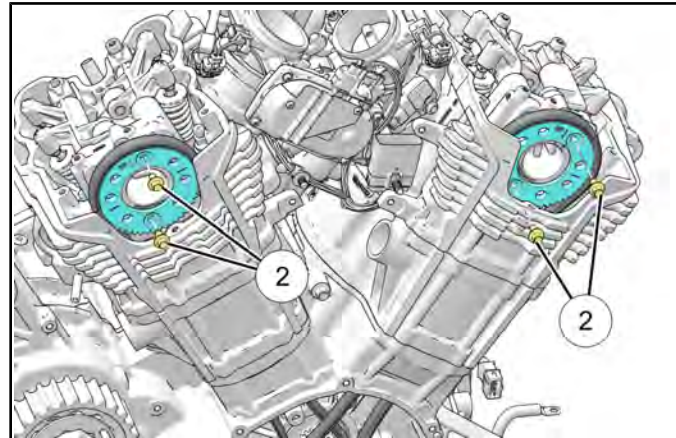
TORQUE
Cam Chain Tensioner: <b>15 ft-lbs (20 N·m)</b>

**CAM CHAIN GUIDE REMOVAL**

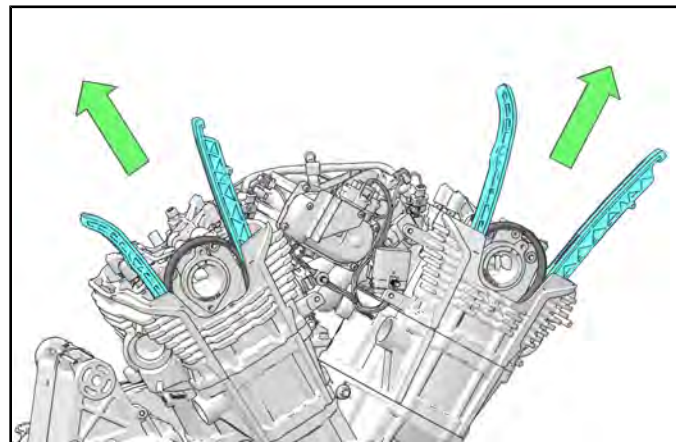
1. Remove valve cover. See **Valve Cover Removal page 3.83.**
2. Lock crankshaft for service. See **Locking the Crankshaft for Service page 3.53.**
3. Remove cam chain tensioners. See **Cam Chain Tensioner Removal page 3.55.**
4. Remove ACG cover. See **ACG Cover Removal / Installation page 10.34.**
5. Remove Flywheel. See **Flywheel Removal / Installation page 3.54.**
6. Remove cam chain guide fasteners ①.



7. Remove fastener ② securing camshaft sprocket.

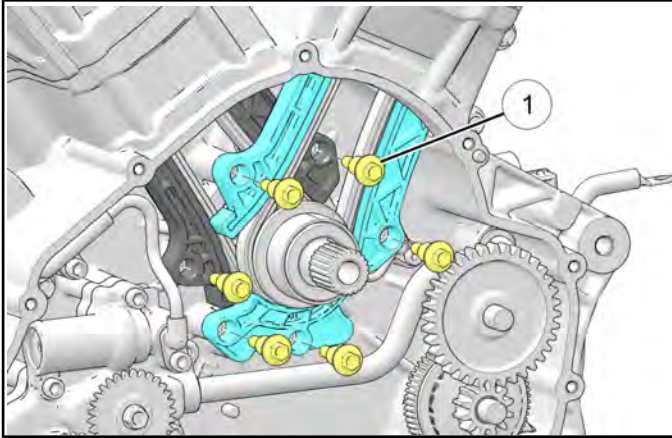


8. Remove cam chain guides.



**CAM CHAIN GUIDE INSTALLATION**

1. Install chain guides from top of cylinder.
2. Install fasteners ① and torque to specification.

**TORQUE**

Chain Guide Fastener (All)  
**84 in-lbs (10 N·m)**

3. Install Flywheel. See **Flywheel Removal / Installation page 3.54.**
4. Install stator. See **Stator Removal / Installation page 10.34.**
5. Install ACG cover. See **ACG Cover Removal / Installation page 10.34.**
6. Install cam chain tensioners. See **Cam Chain Tensioner Installation page 3.60.**
7. Install valve cover. See **Valve Cover Installation page 3.84.**



## CAMSHAFT SERVICE

### CAMSHAFT REMOVAL

#### IMPORTANT

Camshaft removal requires:

- **Special Service Tools:**
  - Camshaft Service Tool, P/N PF-52939
  - Crankshaft Locking Pin, P/N PF-52135

### PREPARATION

#### IMPORTANT

Protect all finished surfaces during these operations.

Take careful notes of wire routing and cable tie locations during disassembly to ensure proper reinstallation.

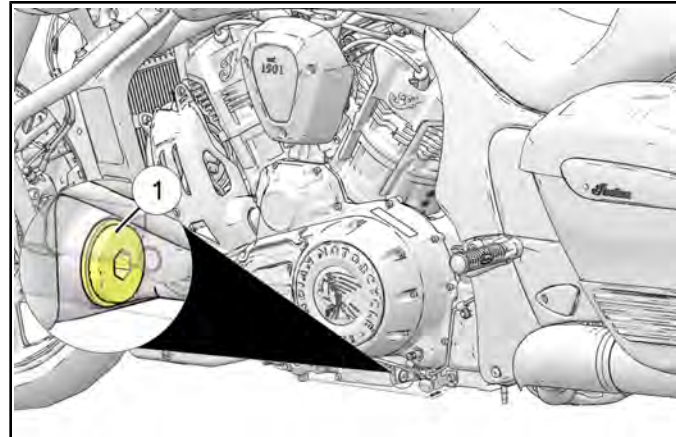
Special care should be taken on higher mileage bikes during disassembly. Especially when removing fasteners threaded into engine block and cylinder heads (For example: Exhaust manifold bolts, Primary cover bolts, etc.) Thread repair kit may be necessary if threads become damaged.

1. Turn key or ignition switch to OFF position and remove key. If equipped with keyless fob, remove fob from proximity of vehicle.
2. Ensure motorcycle is parked on a flat surface, kickstand is fully extended, and vehicle is stable prior to installation.
3. Support motorcycle securely in an upright position. Clamp front tire securely in a wheel vise.
4. Drain engine oil.

- Clean the area around the scavenge drain plug
- ①. Place a drain pan under the drain plug.

#### ⚠ CAUTION

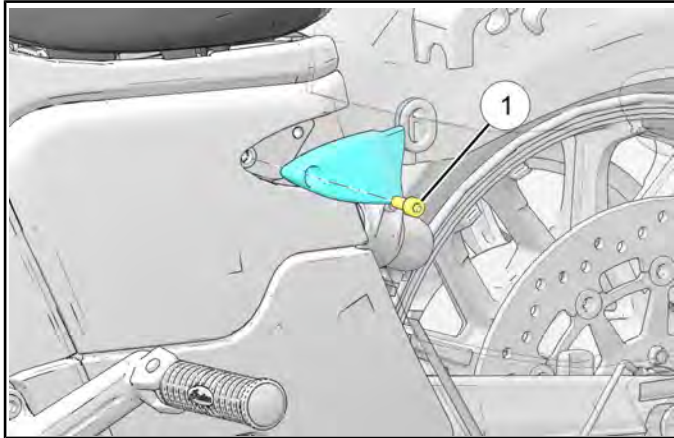
Hot oil can cause burns to skin. Do not allow hot oil to contact skin.



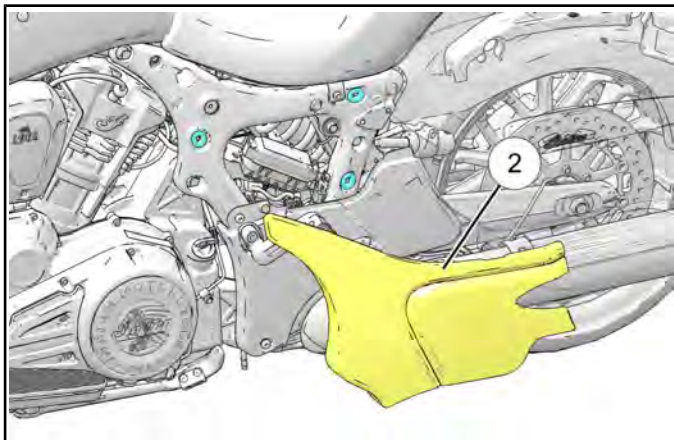
- Remove the drain plug. Allow the oil to drain completely.
5. Remove and retain upper and lower side covers and saddlebags.

**SEAT REMOVAL**

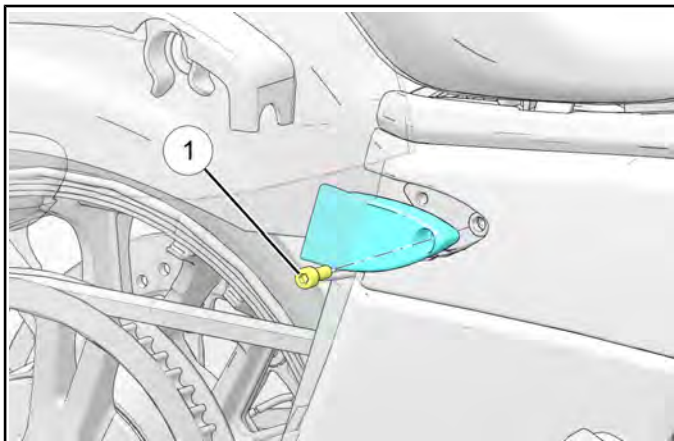
1. Remove tipover cover by removing its fastener ①.



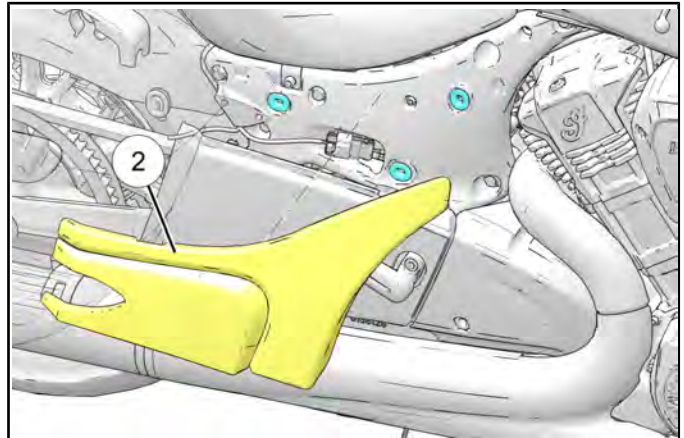
2. Remove upper side cover ②.



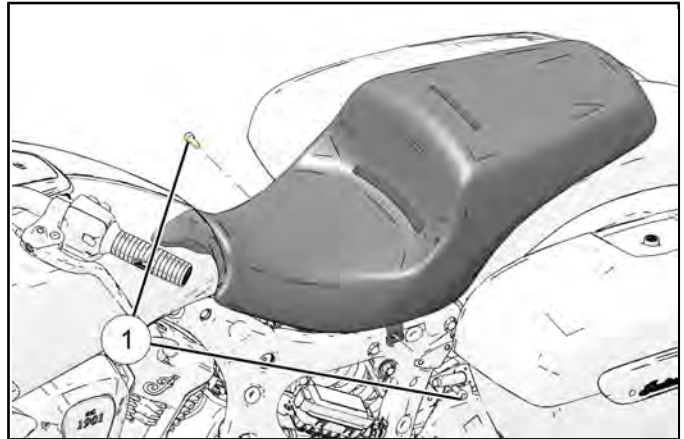
3. Remove tipover cover by removing its fastener ①.



4. Remove upper side cover ②.

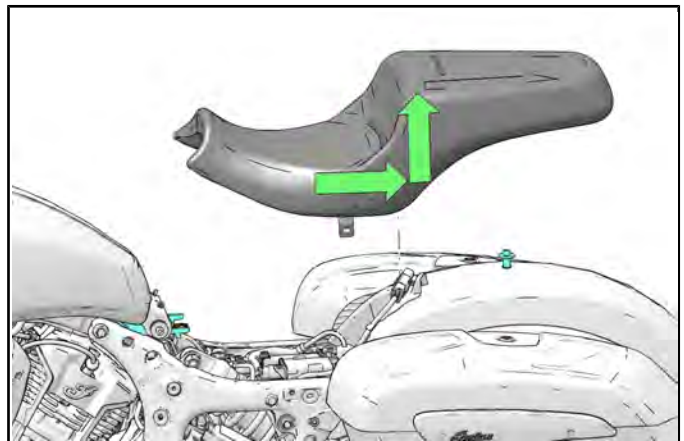


5. Remove seat fastener ①.



6. If equipped, disconnect seat electrical connector.

7. Remove the seat backward and up to remove.



3

**DEPRESSURIZE THE FUEL SYSTEM**

**⚠ WARNING**

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Wear eye protection.

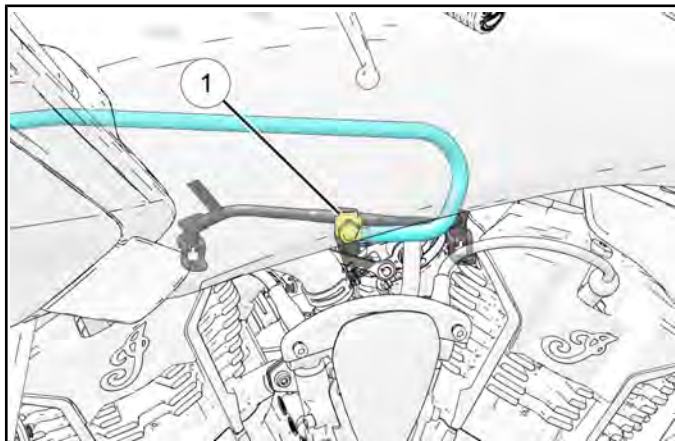
1. Locate the fuel pump relay.

MAIN ENGINE RELAY 4016819	START RELAY 4016819	25A VCM1 401653 10A SPARE 2434016	FUEL PUMP RELAY 4016819	25A ABS 401653 25A AUDIO1 401653	SWITCHED POWER RELAY 4016819
15A EFI1 2410280	10A EFI2 2434016	10A TENDER 2434016	5A GAUGE 401652	25A SPARE 401653	10A SWITCHED1 2434016
7.5A IGN 401685	10A WCM 2434016	25A VCM2 401653	25A VCM3 401653	25A AUDIO2 401653	10A SWITCHED2 2434016

2. Pull the fuel pump relay and crank the engine over for 5 seconds to release fuel pressure.
3. Wrap a clean shop towel around fuel line fitting ①.
4. Squeeze both release buttons (one on each side of fitting) and hold. Gently slide fitting straight off fuel rail.

**⚠ CAUTION**

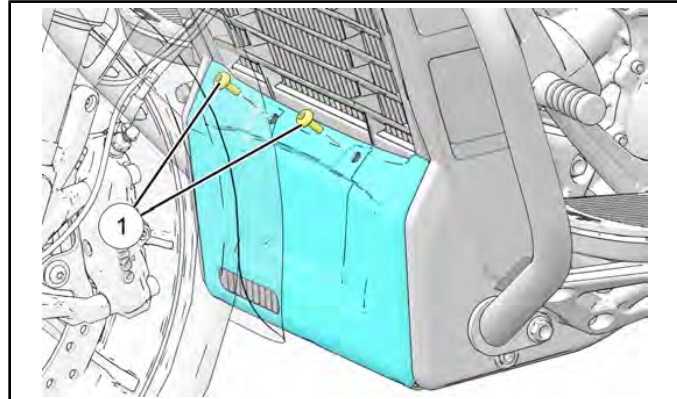
Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.



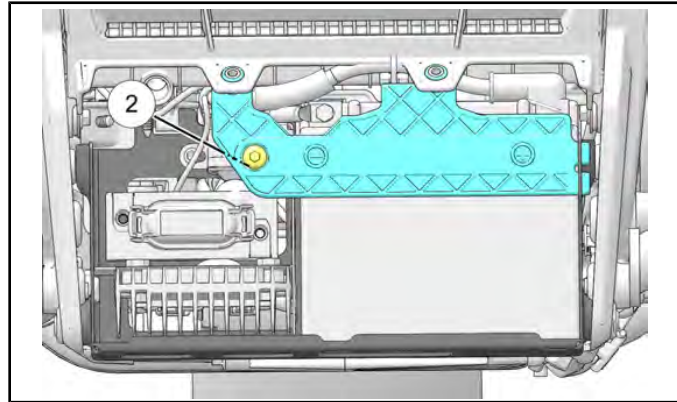
5. Cover fuel fittings to keep debris out.

**DISCONNECT THE BATTERY**

1. Remove chin fairing by removing its fasteners ①.



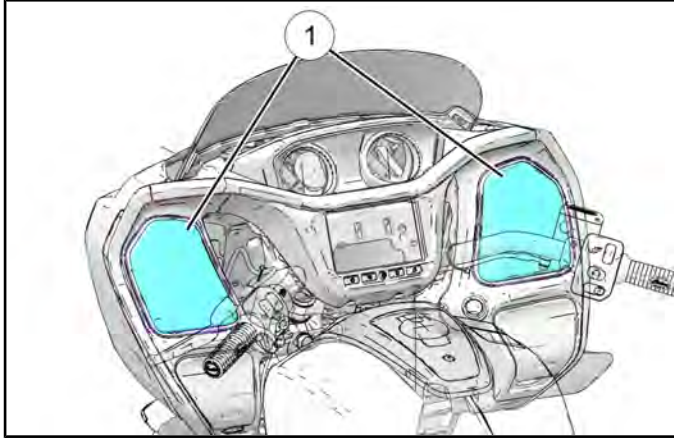
2. Remove battery bracket by removing its fastener ② and sliding the bracket out of its retention feature.



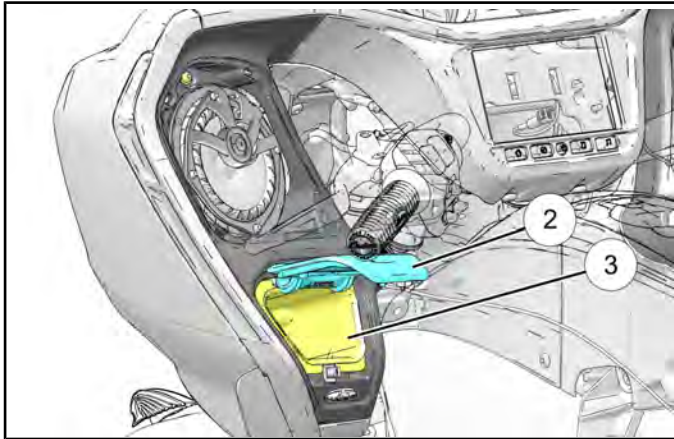
3. Remove negative (-) terminals bolt. Position the cable well clear of the terminal.

**REMOVE OUTER FAIRING**

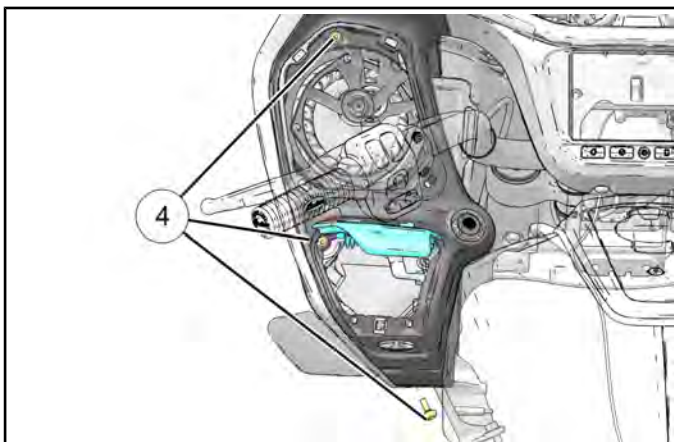
1. Carefully pry off speaker bezels ① with Body Panel Tool Kit PV-49955.



2. Open storage door ② and remove storage liner ③.

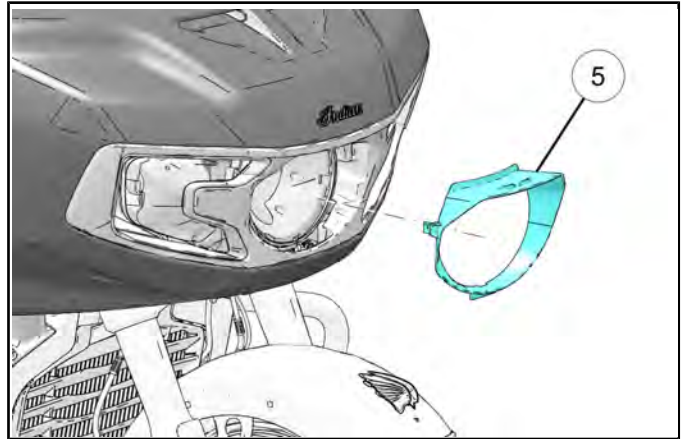


3. Remove outer fairing fasteners ④.

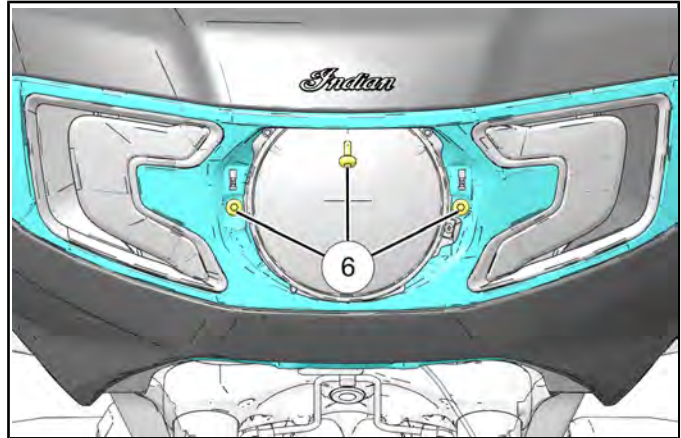


4. Repeat steps 2–3 for the remaining side.

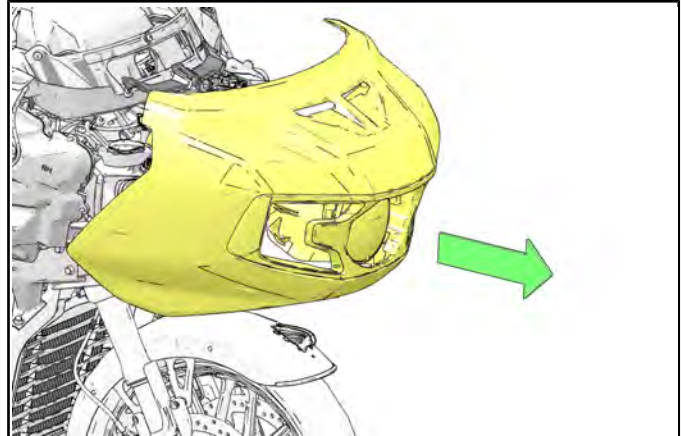
5. Using Body Panel Tool kit PV-49955, remove headlight bezel ⑤ by prying down at the top center to release the snap and then pull forward to release the side body clips.



6. Remove outer fairing fasteners ⑥.



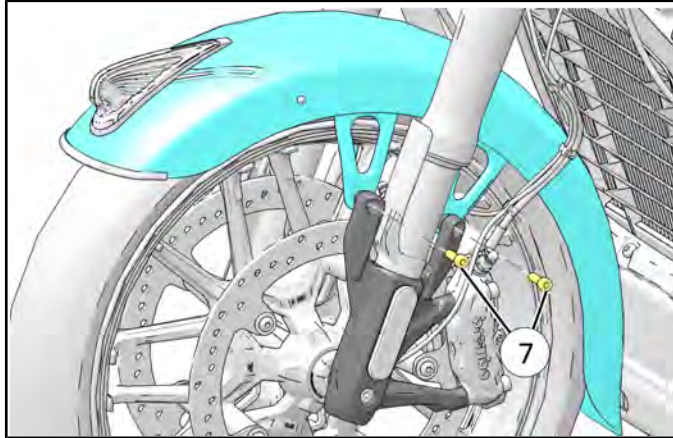
7. Carefully move the outer fairing forward and unplug the headlight and turn signal electrical connection.



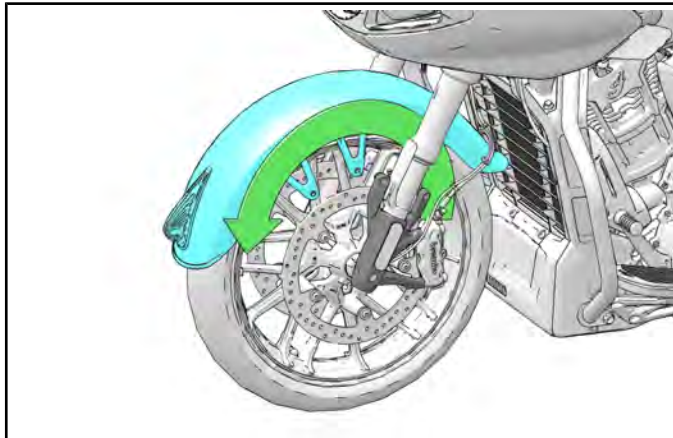
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**REMOVE FRONT FENDER**

1. Remove fasteners ⑦ from each side of the motorcycle securing the fender.

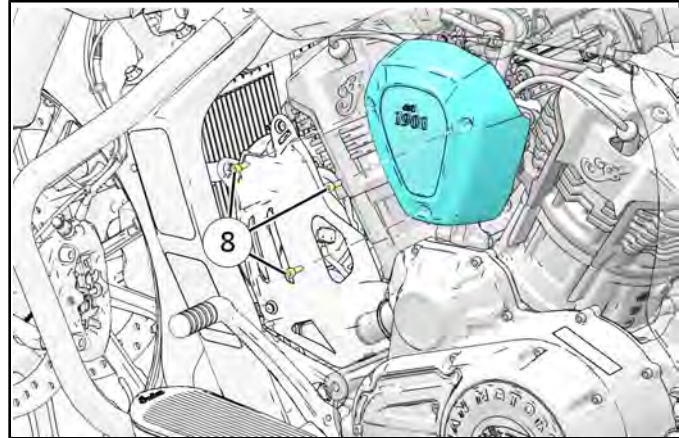


2. Follow the fender light harness up into the fairing, locate the connector and disconnect.
3. Rotate the fender forward and remove.

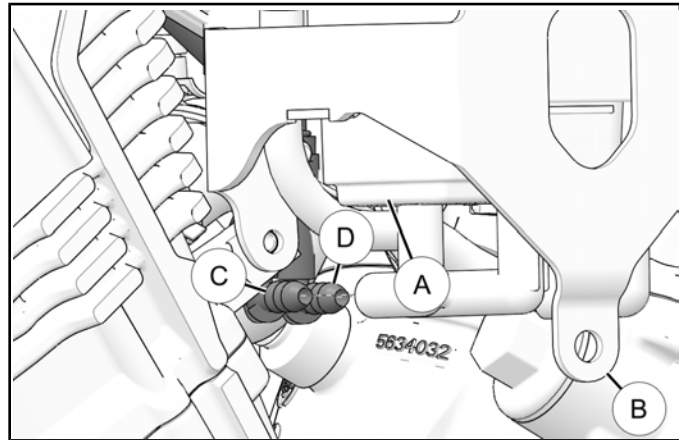


**REMOVE FUEL TANK**

1. Remove left side v-cover by removing its fasteners ⑧.



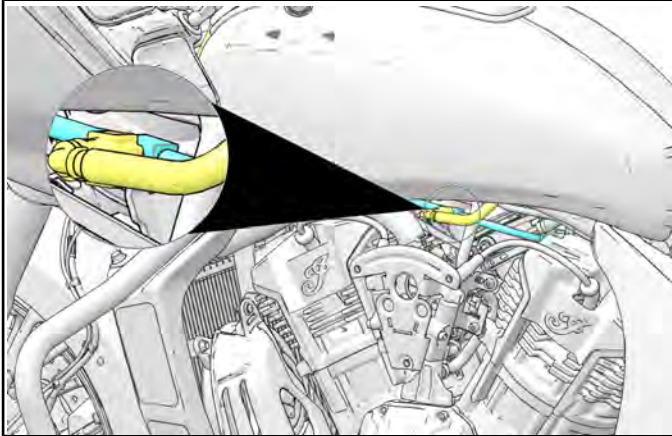
2. Support canister ① and cover bracket ②. Disconnect purge vent line ③ and tank vent line ④ from canister.



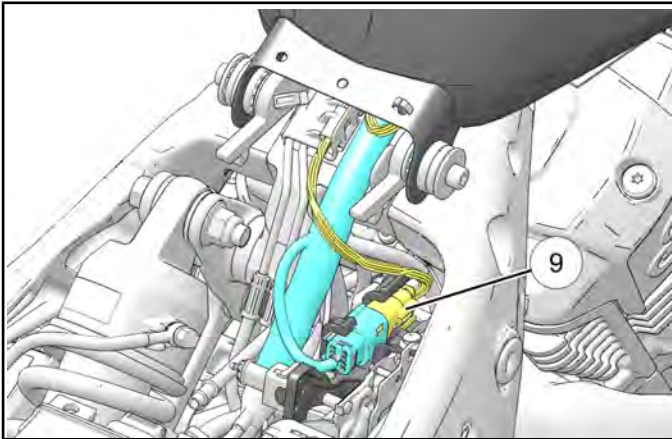
3. Disconnect the fuel feed line from the fuel rail.

**CAUTION**

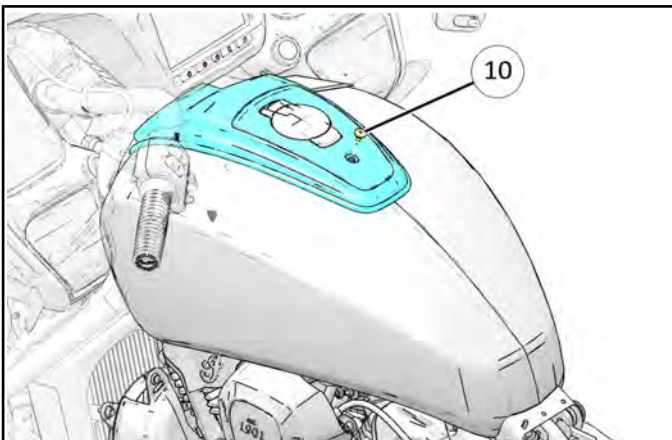
Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.



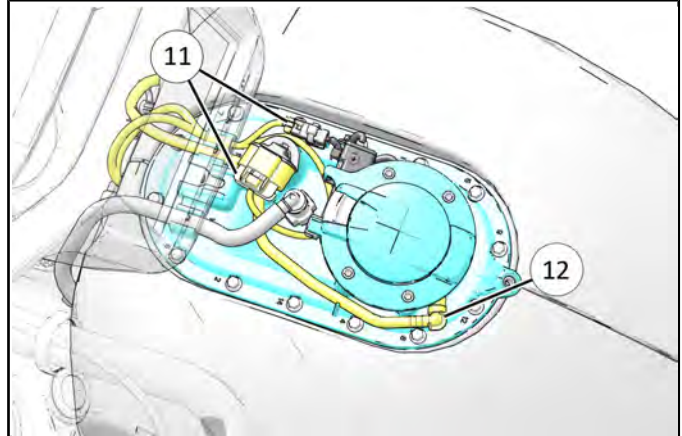
4. **2020 models only:** Disconnect the fuel pump electrical connector ⑨.



5. **2021 models only:** Remove fuel tank console by removing its fastener ⑩.

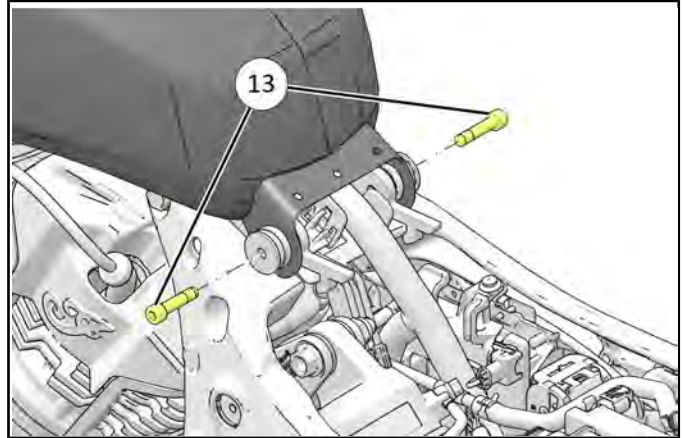


6. **2021 models only:** Disconnect fuel tank electrical connectors ⑪.



7. **If equipped,** Disconnect fuel vent line ⑫.

8. Remove fuel tank fasteners ⑬.

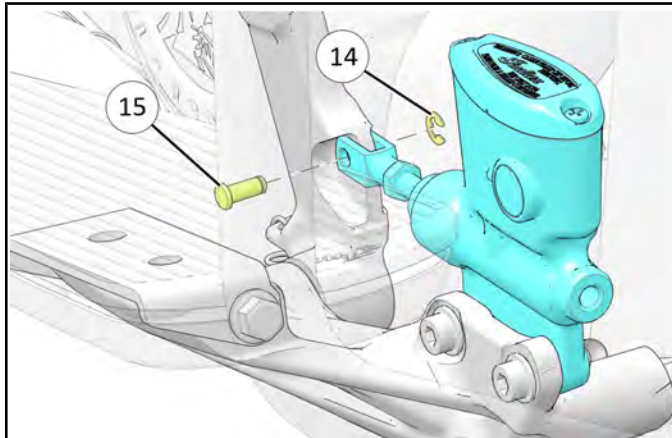


9. Lift rear of tank upward and pull rearward to remove.

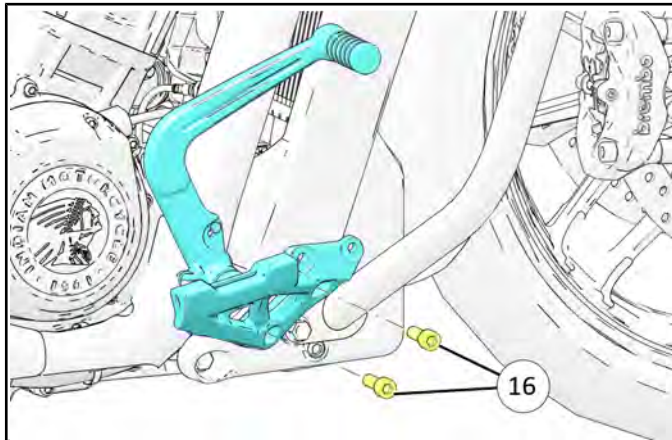
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**REMOVE RIGHT FLOORBOARD**

1. Remove rear master cylinder cotter pin ⑭ and pivot pin ⑮.

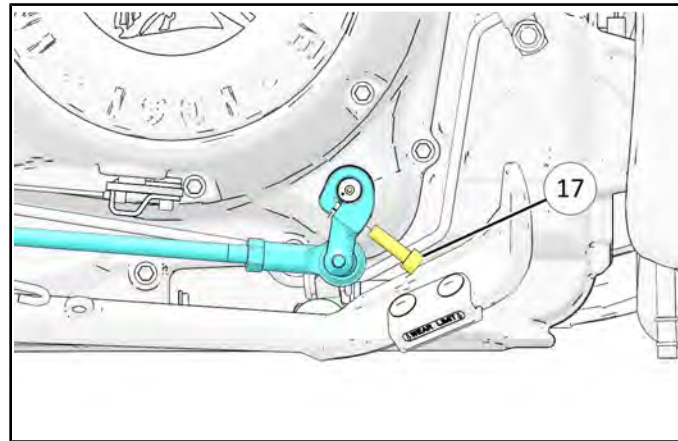


2. Remove the fasteners ⑯ securing the floorboard bracket.

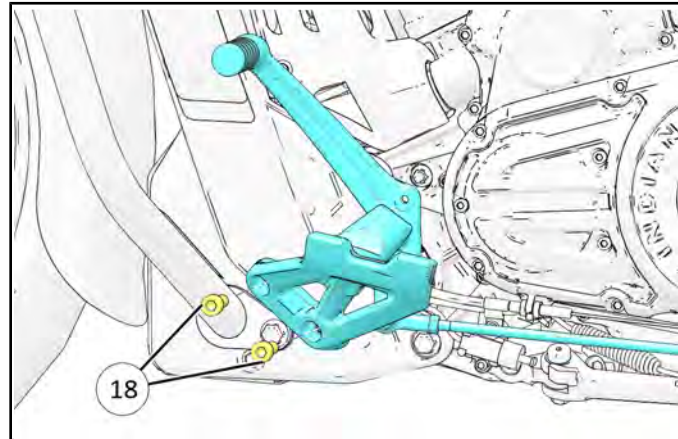


**REMOVE LEFT FLOORBOARD**

1. Remove fastener ⑰ securing shift lever.

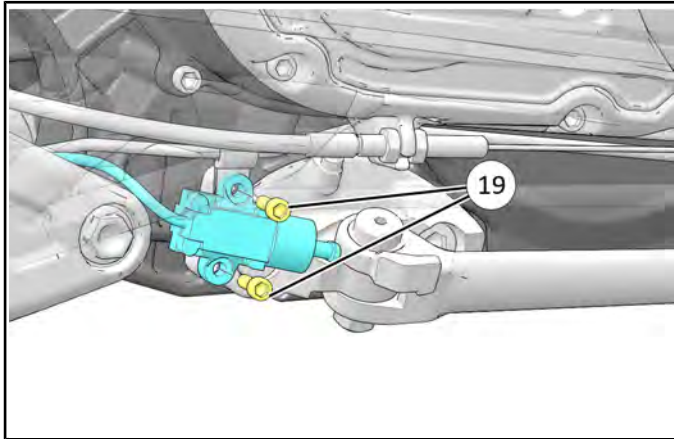


2. Remove the fasteners ⑱ securing the floorboard bracket.

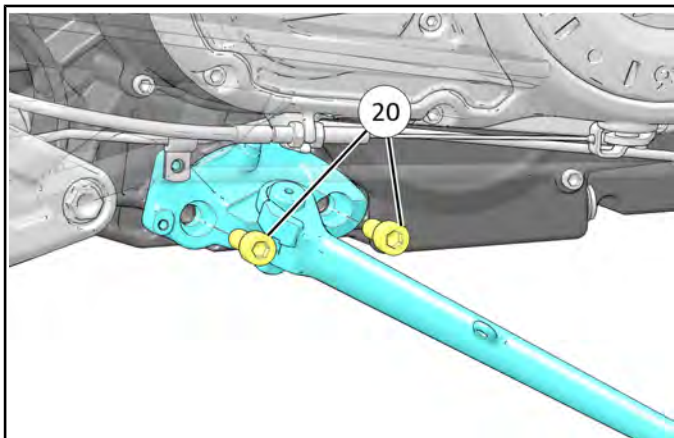


**REMOVE SIDE STAND AND SWITCH**

1. Carefully remove the sidestand spring.
2. Remove the two fasteners ⑲ securing the sidestand switch.

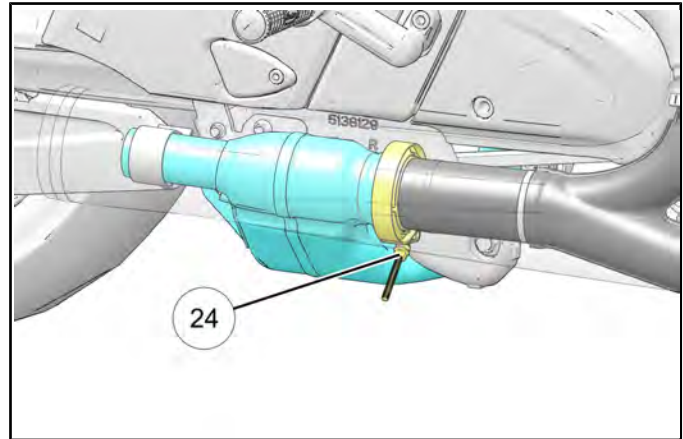


3. Place the sidestand in the down position and remove sidestand mount fasteners ⑳.

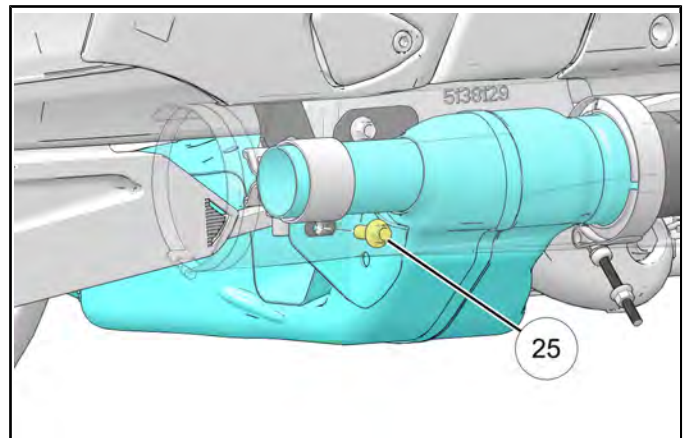


**REMOVE EXHAUST**

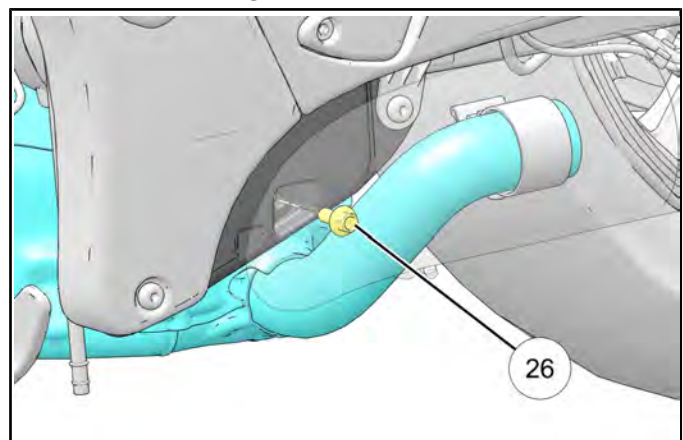
1. From underneath the right heatshield, loosen the exhaust clamp ㉔. Note orientation of clamp for reassembly.



2. From the right side, remove the resonator mount fastener ㉕.



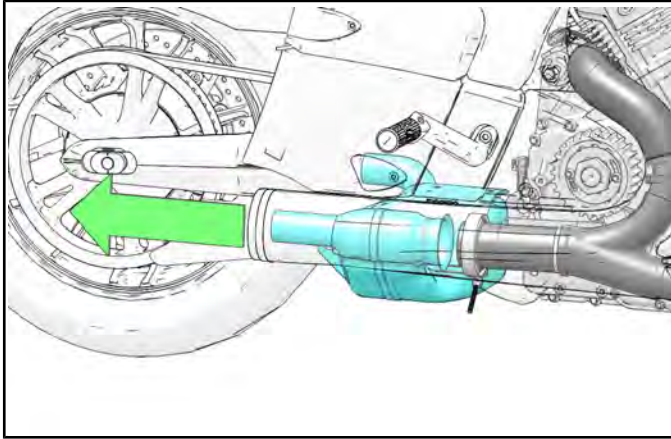
3. From the left side, remove the remaining resonator mount fastener ㉖.



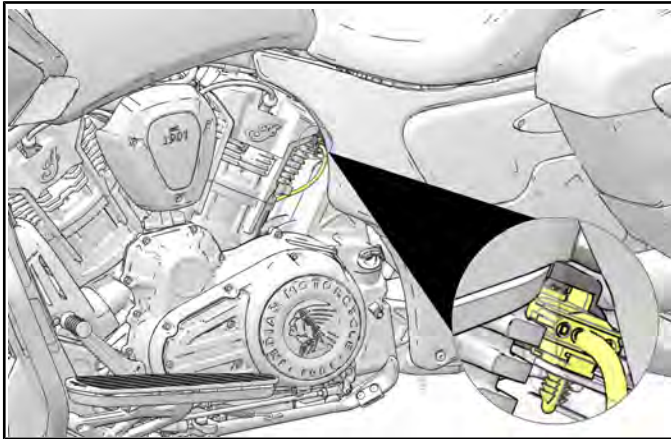
3



4. Move the resonator rearward and remove.

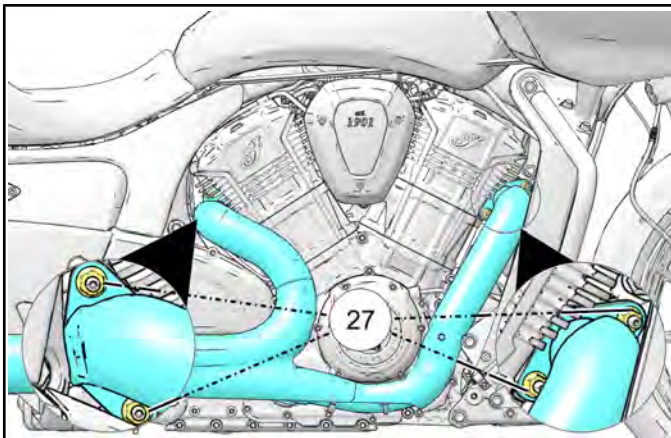


5. From the left side of the unit, disconnect the rear cylinder oxygen sensor electrical connector.



**NOTICE**  
The front cylinder oxygen sensor electrical connector can be disconnected while removing the headpipe.

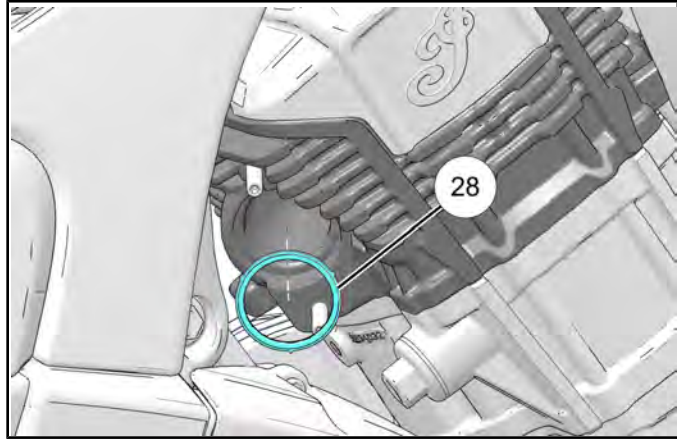
6. Remove headpipe nuts ⑳.



7. Carefully remove headpipe.

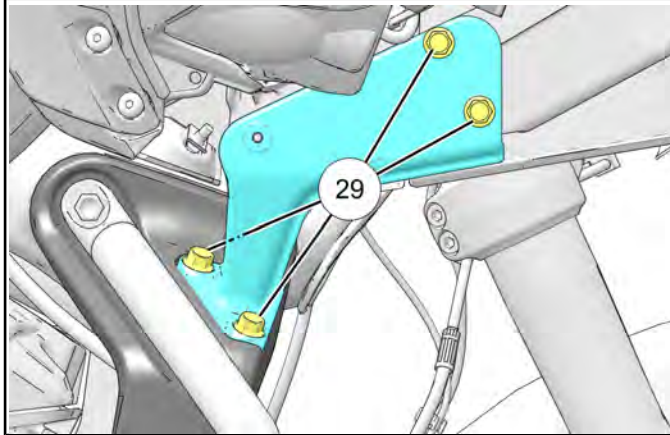
**IMPORTANT**  
Be sure to disconnect the remaining oxygen sensor electrical connector during removal.

8. Remove and inspect the headpipe gasket ㉑ for damage and replace if necessary.

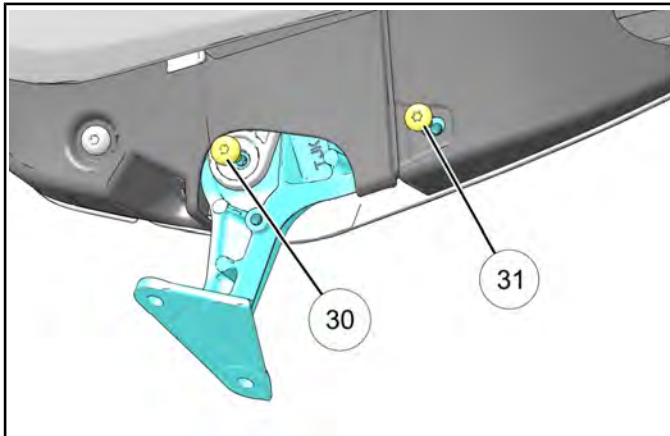


**REMOVE STAGE CAMSHAFT**

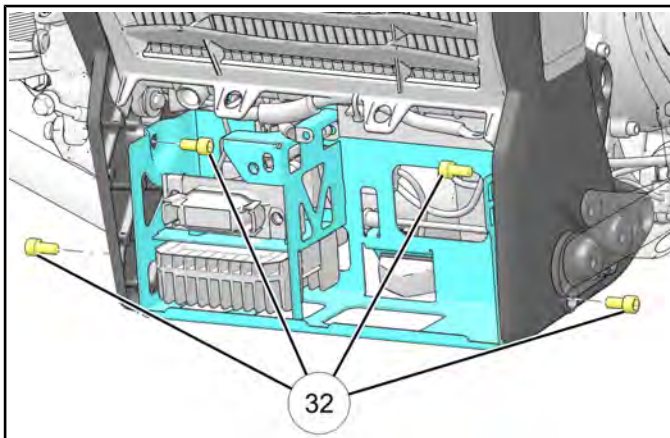
1. Loosen radiator and remove both down casts.
  - a. Remove lower fairing bracket fasteners ⑲. Repeat step for opposite side.



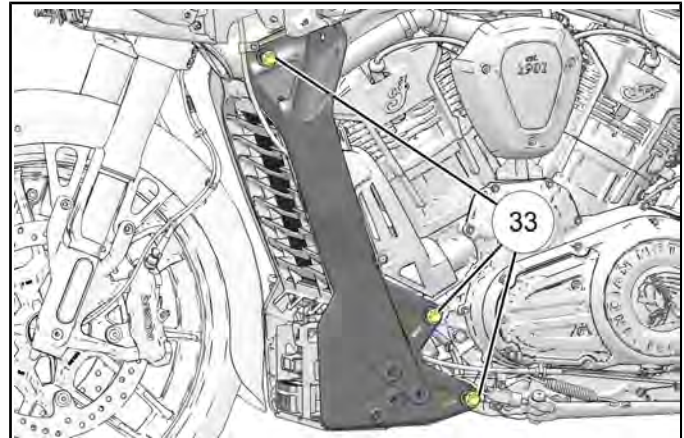
- b. On the inside of the fairing bracket, remove the speaker assembly fastener ⑳, and the dash closeout fastener ㉑. Remove the bracket.



- c. Remove battery box fasteners ㉒.



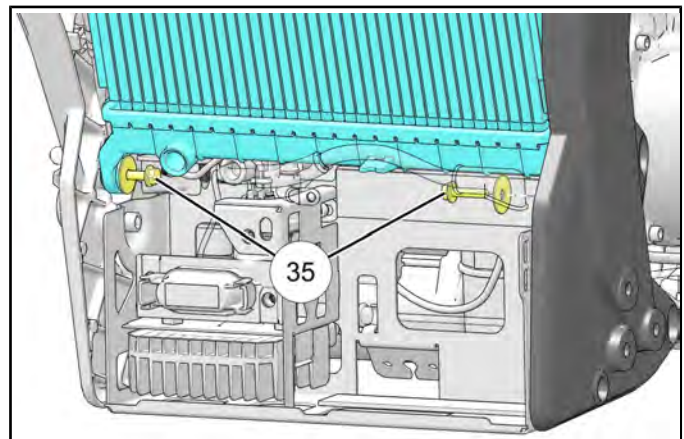
- d. Remove downcast fasteners ㉓.



- e. Remove fairing louver by removing its fasteners ㉔.



- f. Remove radiator fasteners ㉕.

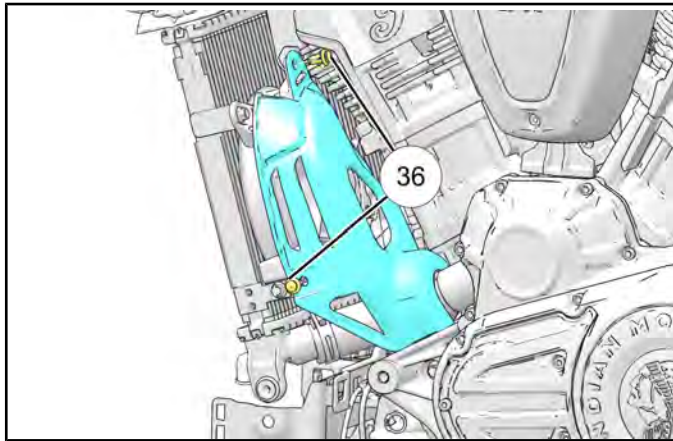


- g. Remove both frame downcasts.

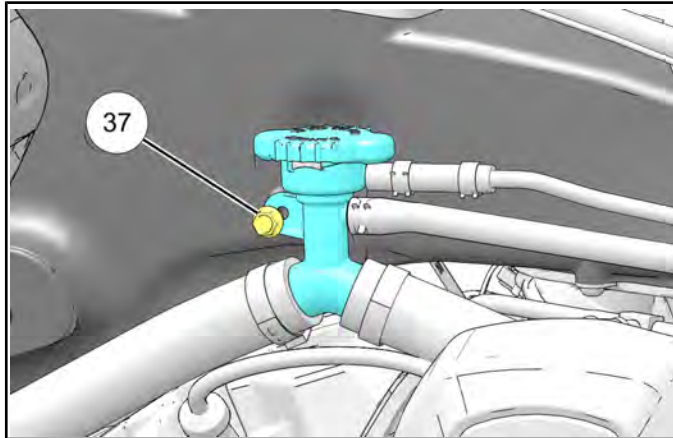


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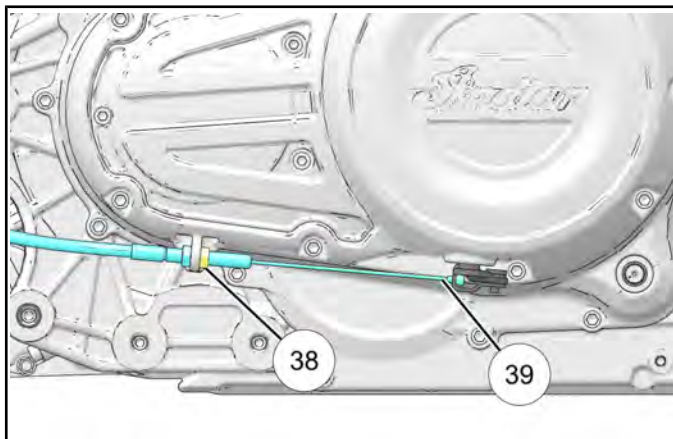
- h. Remove fan shroud by removing two push pins ③⑥.



- 2. Remove radiator filler neck from chassis by removing its fastener ③⑦.

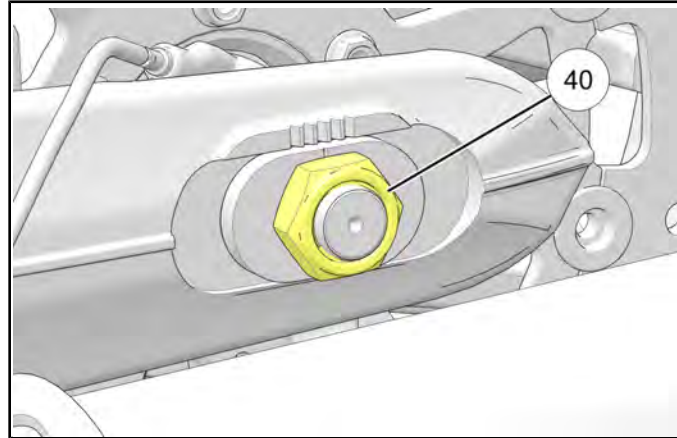


- 3. Disconnect clutch cable.
  - a. Loosen the clutch cable jam nut

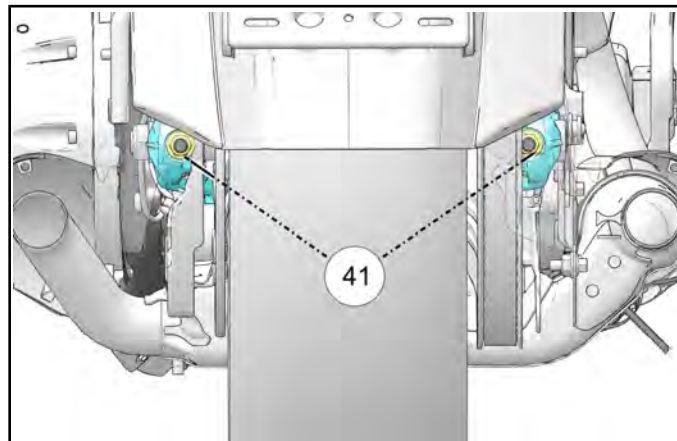


- b. Disconnect the clutch cable ③⑨ from the clutch pinion.
  - c. Remove clutch cable from primary cover.

- 4. Loosen axle nut and belt tensioner.
  - a. Make note of adjuster locations.
  - b. Loosen axle nut ④⑩ then tighten to **15 ft-lbs (20 Nm)**.

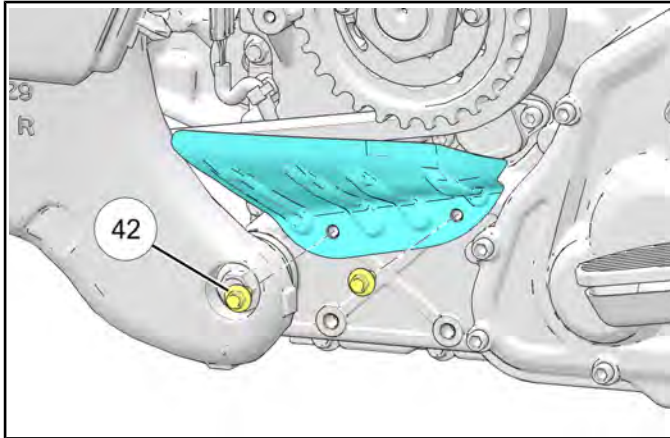


- c. Loosen right and left axle adjusters ④①.

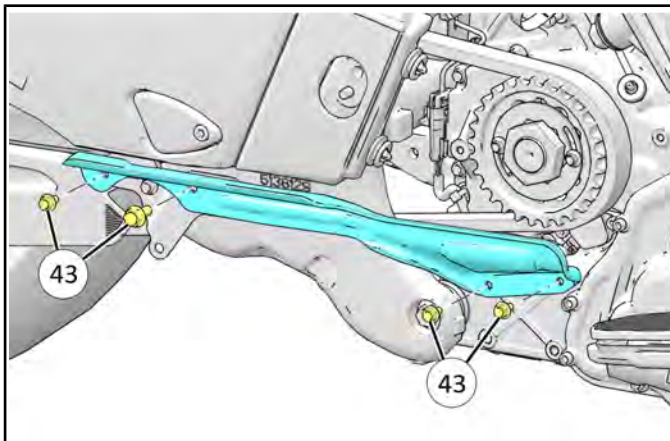


5. Remove drive belt cover and lower belt guard, then remove the belt from the sprocket.

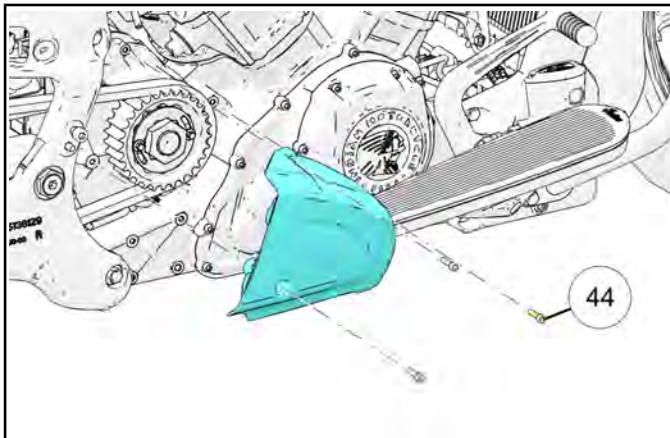
a. 2020 Models: Remove the belt shield by removing its fasteners ④②.



2021 Models: Remove the transmission shield by removing its fasteners ④③.

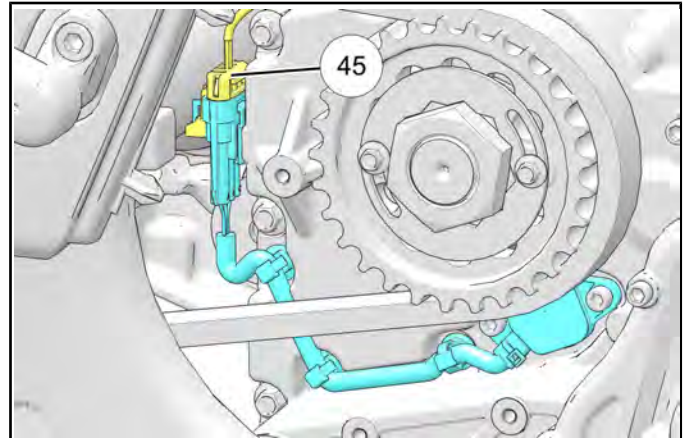


b. Remove fasteners ④④ securing the cover to the engine.



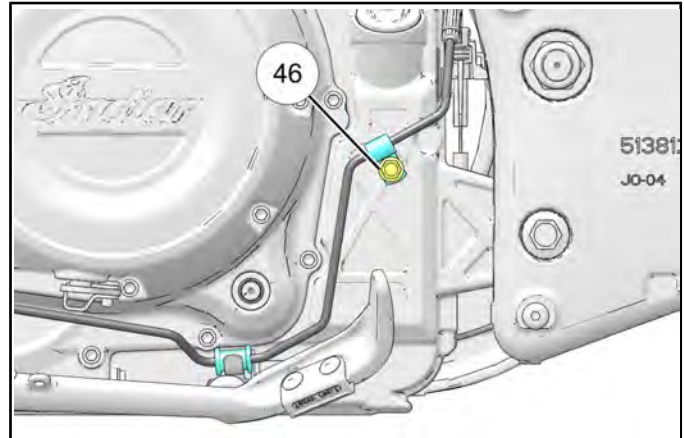
c. Remove belt from the drive sprocket. Belt does not need to be removed from the driven sprocket.

6. Disconnect gear position switch electrical connection ④⑤.

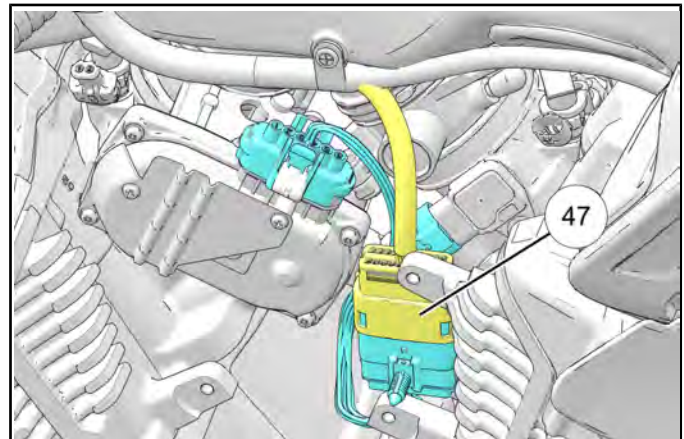


7. Slide Belt off of drive sprocket.

8. Remove brake line fastener ④⑥.

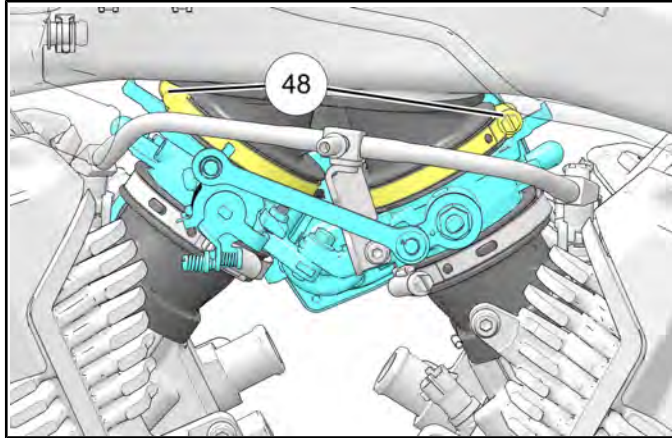


9. Disconnect chassis connector ④⑦.

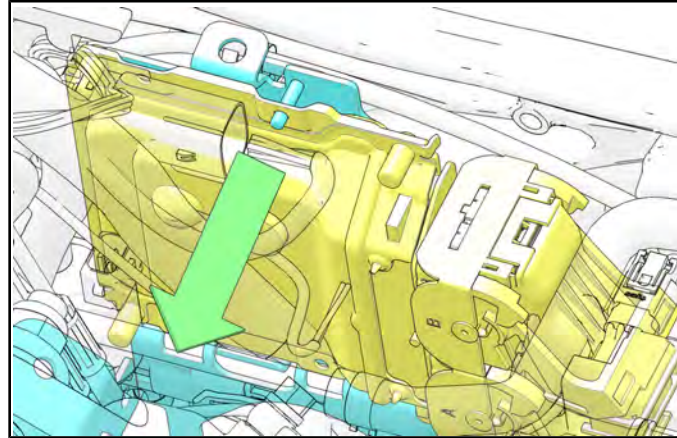


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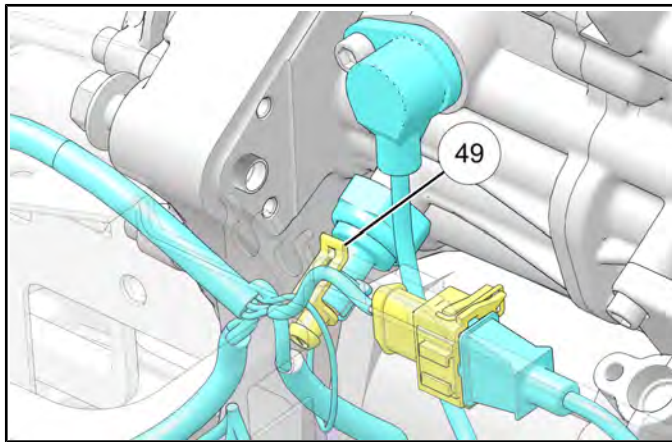
10. Loosen throttle body clamps (48).



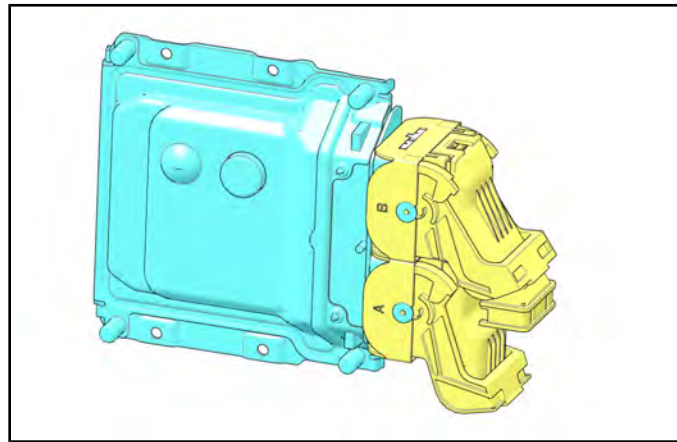
b. Slide the ECM off of its pin.



11. Near the battery box, disconnect the oil pressure switch (49).

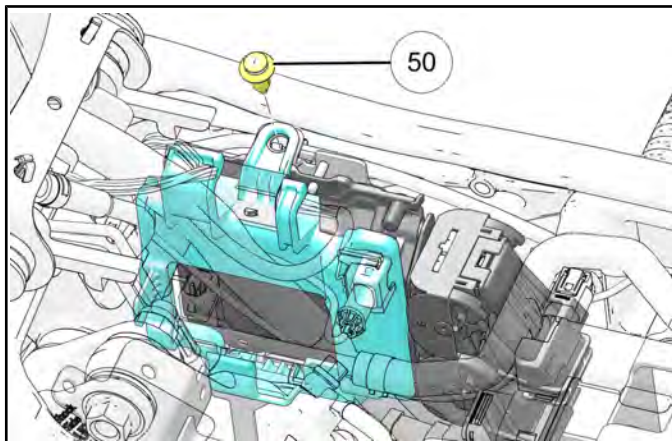


c. Lift the ECM up and disconnect its electrical connections.

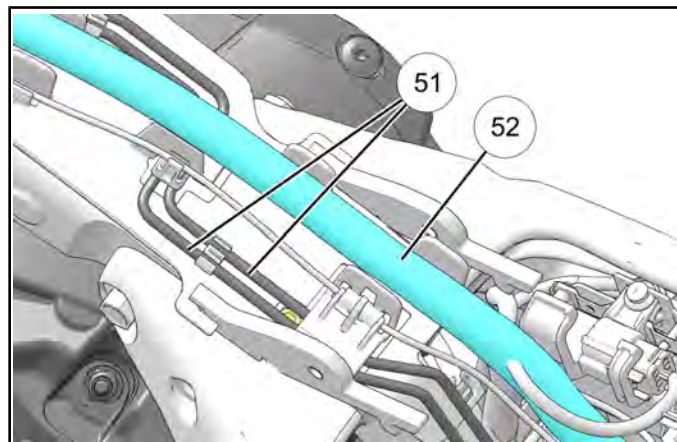


12. Remove the ECM.

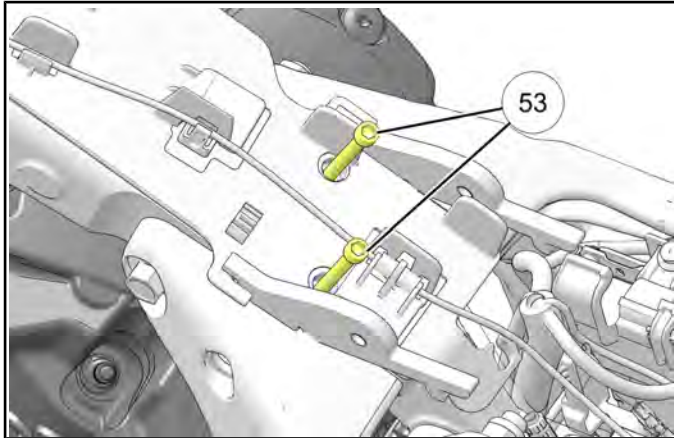
a. Remove pushdart (50) retaining under-seat retention bracket and remove.



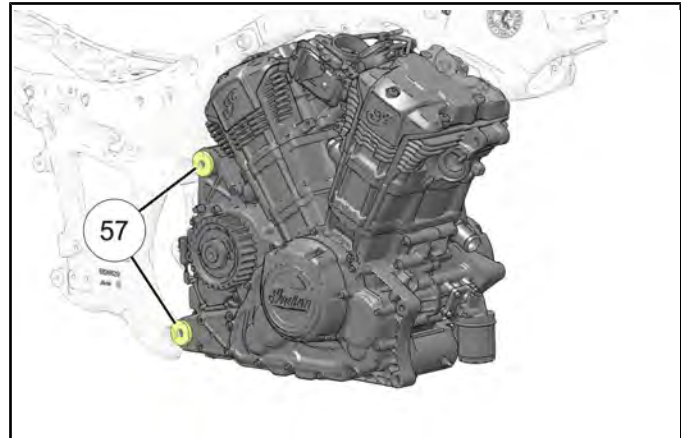
13. At the rear of the mainframe, move brake lines (51) and electrical harness (52) to expose fasteners beneath.



14. Remove fasteners ⑤③ securing mainframe to breather.

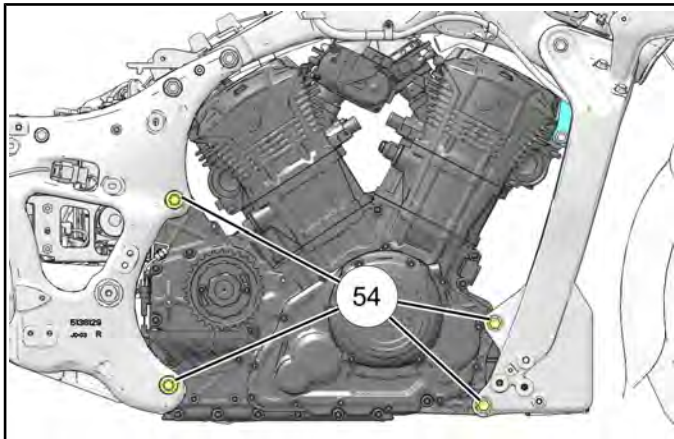


d. During removal, ensure to retrieve frame / engine spacers ⑤⑦.



15. Remove engine mounts.

a. Remove the right side engine fasteners ⑤④.

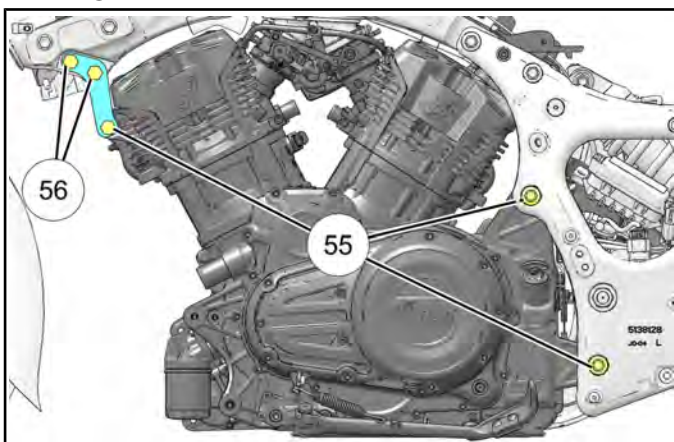


16. Lower the engine using the scissor jack and balance the engine on the jack. DO NOT completely separate the engine from the motorcycle.

**IMPORTANT**

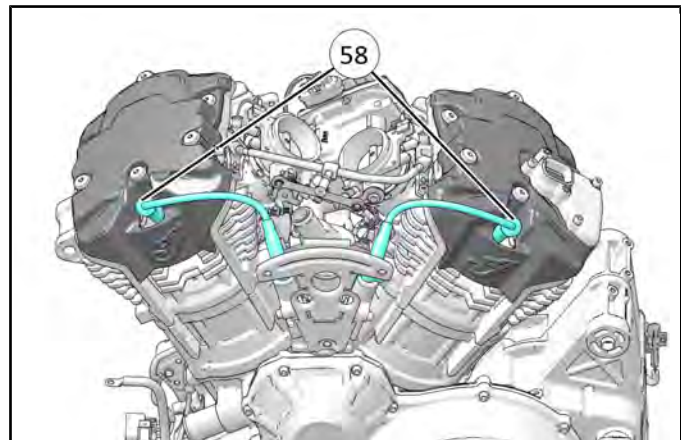
Radiator hoses and crankshaft sensor are still attached but there is enough slack to lower the engine to allow access to remove valve covers.

b. Remove the engine mount remaining fasteners ⑤⑤ on the left side.



17. Remove valve covers.

a. Unplug spark plug boots ⑤⑧ from spark plugs.

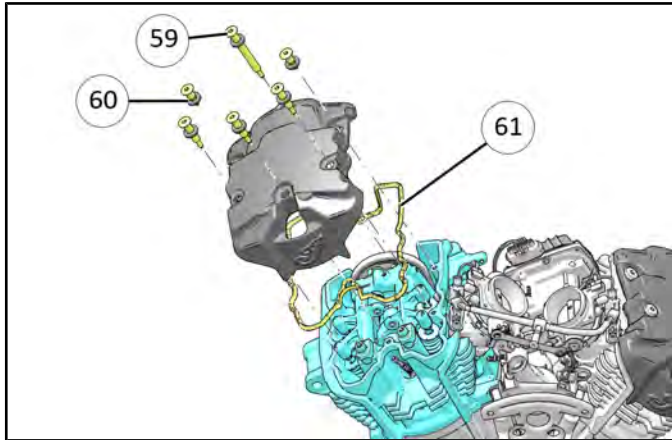


c. Remove upper cylinder head bracket by removing its fasteners ⑤⑥.

b. Remove valve cover fastener ⑤⑨ and isolators ⑥⑩.



c. Remove valve cover gasket ⑥1.



**NOTICE**

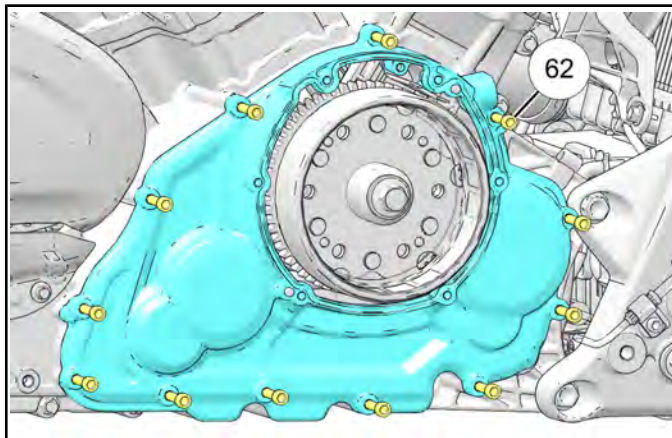
Inspect gasket for damage. Replace as needed.

18. Lock the crankshaft for service.

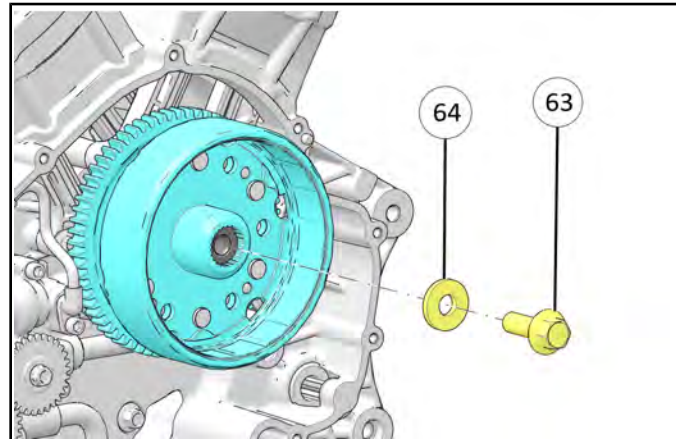
- a. Remove the spark plugs.
- b. Remove ACG cover by removing its fasteners ⑥2.

**NOTICE**

Inspect gasket for damage. Replace as needed.

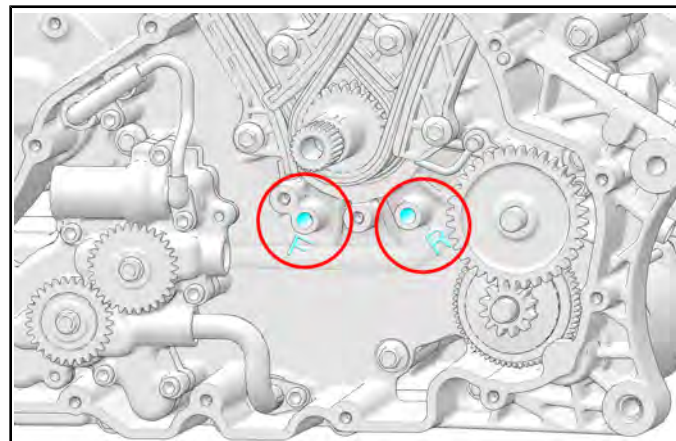


c. Remove Flywheel by removing the flywheel bolt ⑥3 and washer ⑥4.



d. Install flywheel bolt back into crankshaft.

e. Lock the crankshaft by inserting crankshaft locking pin **PF-52135** or a 5/16" pin punch (or equivalent) into the locking hole.



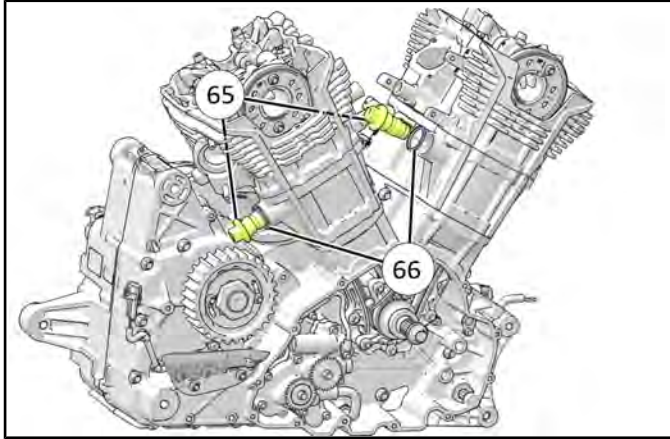
**NOTICE**

It may be necessary to rotate the crankshaft slight forward or back to properly align holes by turning the flywheel bolt.

19. Remove tensioners ⑥⑤ and sealing washers ⑥⑥.

**NOTICE**

Inspect sealing washer for damage. Replace as needed.

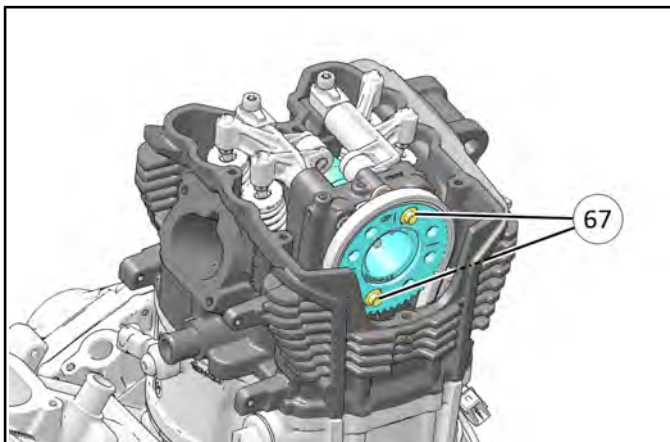


20. Remove the camshafts. To watch a video of this procedure, scan the QR code or click **HERE**.

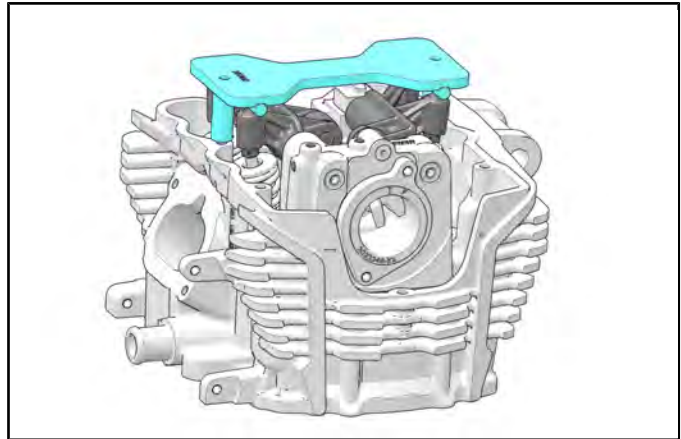


<https://vimeo.com/356900864/24d2b3c15a>

a. Remove camshaft sprocket fasteners ⑥⑦ and remove camshaft sprocket.

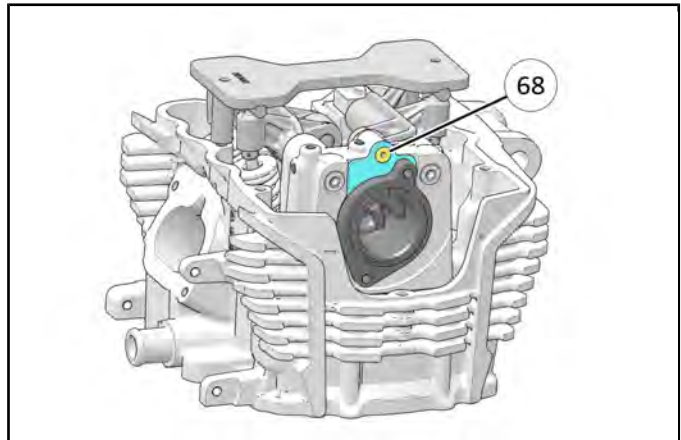


b. Install the special tool PF-52939 onto the cylinder head as shown.

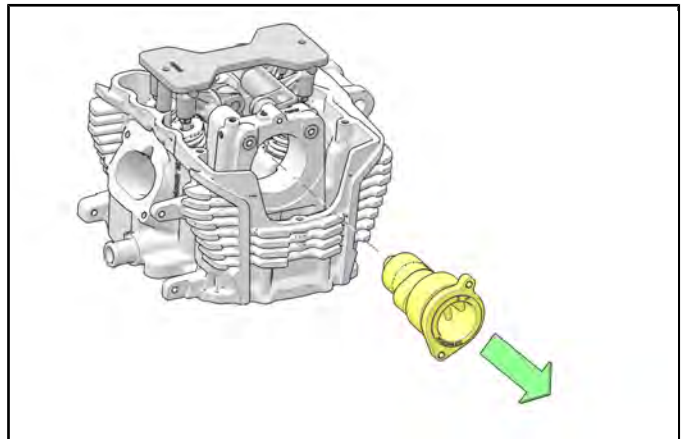


c. Tighten the fasteners to compress the rocker arm assemblies.

d. Remove the camshaft thrust plate by removing its fastener ⑥⑧.



e. Remove the camshaft.

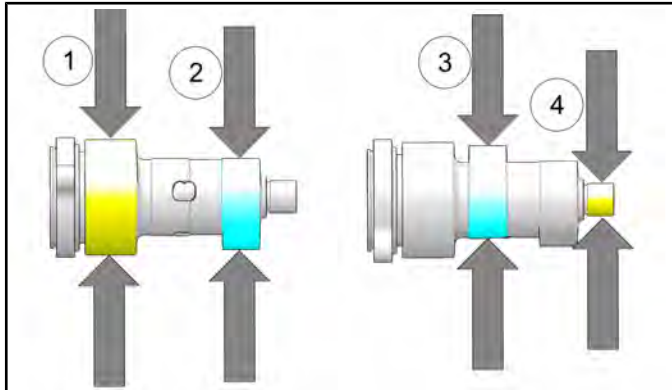


3



**CAMSHAFT INSPECTION**

For the following camshaft inspection procedure, refer to the camshaft service specifications section. See Service Specifications – Cylinder Head page 3.46.

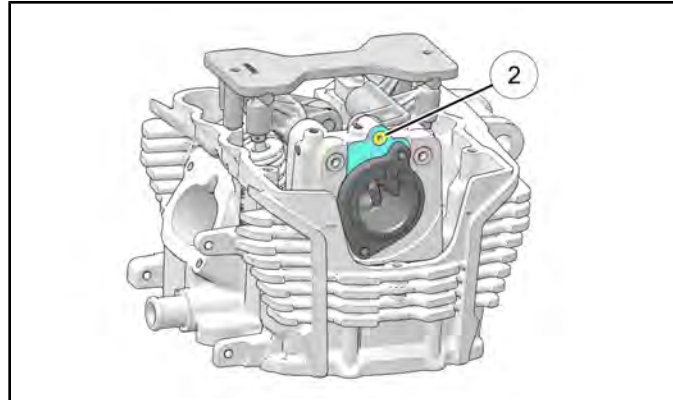


1. Visually inspect camshaft journal surfaces for scoring or signs of insufficient lubrication. Replace camshaft if heavy scoring or damage is noted.
2. Inspect height of each cam lobe. Exhaust cam lobe ③ and intake cam lobe ②.
3. Measure O.D. of each camshaft journal. Journals ① and ④.

REF	MEASUREMENT
①	2.24 in (57.0 mm)
②	1.799 in (45.706 mm)
③	1.811 in (46.001 mm)
④	0.6244 – 0.625 in (15.862 – 15.875 mm)

**CAMSHAFT INSTALLATION**

1. Install the special tool PF-52939 onto cylinder head.
2. Tighten the fasteners to compress the rocker arm assemblies.
3. Carefully install camshaft.
4. Install the camshaft thrust plate and secure with its fastener ②.



**IMPORTANT**  
Replace thrust plate screws with new screws during reassembly.

**TORQUE**  
Camshaft Thrust Plate Fastener:  
**62 in-lbs (7 N·m)**

5. Remove the special tool.

6. Reverse removal procedure for installation.

TORQUE
Camshaft Sprocket Fastener <b>159 in-lbs (18 N·m)</b>

TORQUE
Cam Chain Tensioner: <b>15 ft-lbs (20 N·m)</b>

TORQUE
Flywheel fastener: <b>112 ft-lbs (152 N·m)</b>

TORQUE
ACG Cover Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Valve Cover Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Engine Mount Fastener <b>45 ft-lbs (61 N·m)</b>

TORQUE
Cylinder Head Mount Fastener <b>75 ft-lbs (102 N·m)</b>

TORQUE
Breather Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Throttle Body Clamp: <b>26 in-lbs (3 N·m)</b>

TORQUE
Drive Sprocket Cover Fastener: <b>88 in-lbs (10 N·m)</b>

TORQUE
Belt Shield Fastener (2020): <b>88 in-lbs (10 N·m)</b>

TORQUE
Transmission Shield Fastener (2021): <b>84 in-lbs (10 N·m)</b>

TORQUE
Rear Axle Nut: <b>65 ft-lbs (84 N·m)</b>

TORQUE
Radiator Fill Nut Neck Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Radiator Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Fairing Louver Fastener: <b>36 in-lbs (4 N·m)</b>

TORQUE
Downcast Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
Battery Box Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Fairing Bracket Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Lower Fairing Bracket Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Dash Closeout Fastener: <b>36 in-lbs (4 N·m)</b>

3

TORQUE
Headpipe Nuts:
<ol style="list-style-type: none"> <li>1. Torque front header lower nut to 7 ft-lbs (9 N·m)</li> <li>2. Torque front header upper nut to 7 ft-lbs (9 N·m)</li> <li>3. Torque rear header bottom nut to 7 ft-lbs (9 N·m)</li> <li>4. Torque rear header top nut to 7 ft-lbs (9 N·m)</li> <li>5. Torque front header nuts (starting with lower) to 15 ft-lbs (20 N·m)</li> <li>6. Torque rear header nuts (starting with lower) to 15 ft-lbs (20 N·m)</li> </ol>

TORQUE
Resonator Mount to Frame / Transmission Shield Fastener (M8): <b>18 ft-lbs (24 N·m)</b>

TORQUE
Resonator Mount to Frame Fastener / Transmission Shield Fastener (M6) <b>84 in-lbs (10 N·m)</b>

TORQUE
Muffler Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Muffler Clamp: <b>40 ft-lbs (54 N·m)</b>

TORQUE
Heatshield Clamp: <b>31 in-lbs (3 N·m)</b>

TORQUE
Sidestand Mount Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
Sidestand Switch Fastener: <b>43 in-lbs (5 N·m)</b>

TORQUE
Floorboard Bracket Fastener: <b>35 ft-lbs (47 N·m)</b>

TORQUE
Shift Lever Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Fuel Tank Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Fuel Tank Console Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
V-Cover Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Front Fender Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Outer Fairing Fastener: <b>36 in-lbs (4 N·m)</b>

7. Connect negative (-) battery cable. Torque to specification.

TORQUE
Battery Terminal: <b>48 in-lbs (5 N·m)</b>

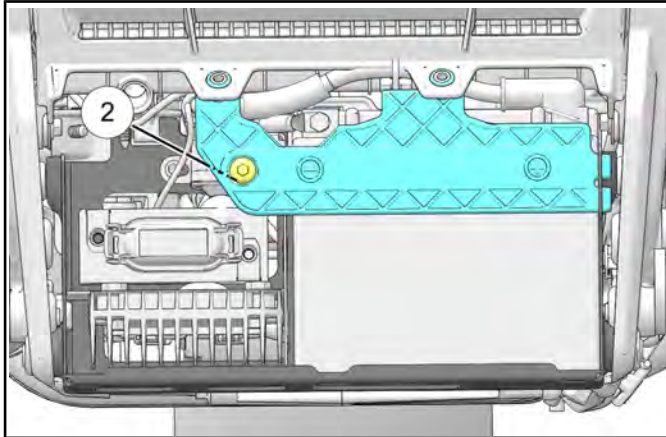
8. Install the fuel pump relay.

MAIN ENGINE RELAY 4016819	START RELAY 4016819	25A VCM1 401653  10A SPARE 2434016	FUEL PUMP RELAY 4016819	25A ABS 401653  25A AUDIO1 401653	SWITCHED POWER RELAY 4016819
15A EFI1 2410280	10A EFI2 2434016	10A TENDER 2434016	5A GAUGE 401652	25A SPARE 401653	10A SWITCHED1 2434016
7.5A IGN 401068 <small>7181485</small>	10A WCM 2434016	25A VCM2 401653	25A VCM3 401653	25A AUDIO2 401653	10A SWITCHED2 2434016

9. Install battery bracket and fastener ②. Torque to specification.

**TORQUE**

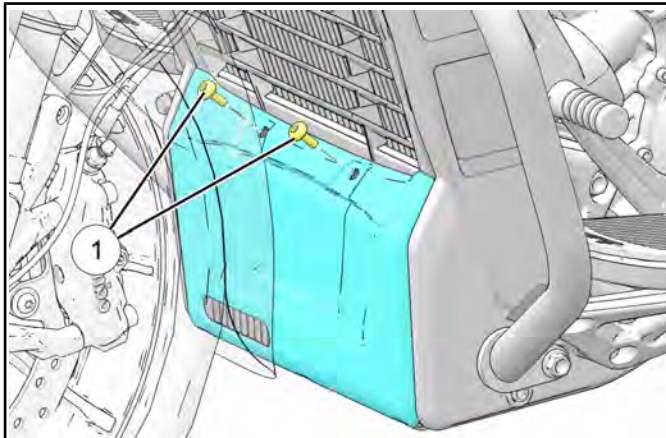
Battery Bracket Fastener:  
**84 in-lbs (10 N·m)**



10. Apply dielectric grease over terminal areas for corrosion protection.
11. Install chin fairing and fasteners ①. Torque to specification.

**TORQUE**

Chin Fairing Fastener:  
**36 in-lbs (4 N·m)**



12. Install side covers, saddlebags, and seat. Installation procedures can be found in service manual.

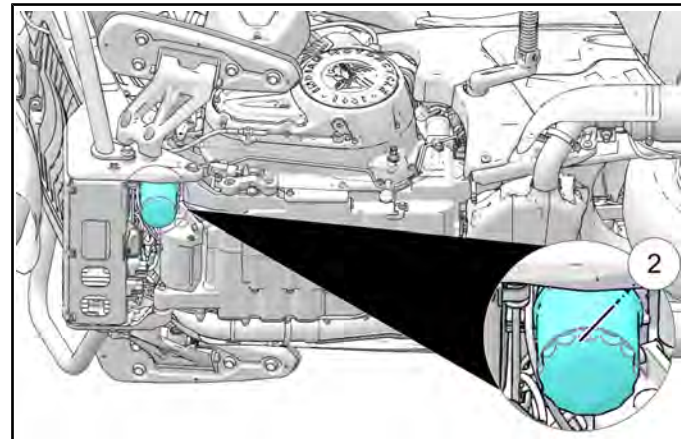
**OIL FILL AND LEVEL CHECK**

1. Install new sealing washer and o-ring on the drain plug. The sealing surfaces on drain plug and engine should be clean and free of burrs, nicks, or scratches.
2. Reinstall the drain plug.

**TORQUE**

Drain Plug:  
**15 ft-lbs (20 N·m)**

3. Place a drain pan beneath the oil filter ②. Use an oil filter wrench and remove the oil filter.



4. Use a clean dry cloth to clean the filter sealing surface on the engine.
5. Lubricate the o-ring on the new filter with a film of fresh engine oil. Check to make sure the o-ring is in good condition.
6. Install oil filter.

**TORQUE**

Oil Filter:  
**Approximately 3/4 turn after seal has contacted the filter adapter.**

7. Remove the dipstick. Add only 4 qts (3.8 L) of Indian Motorcycle 15-W60 oil. Do NOT overfill.
8. Reinstall the dipstick securely.
9. With the unit in an upright, centered position. Start the engine and idle for 30 seconds.

3

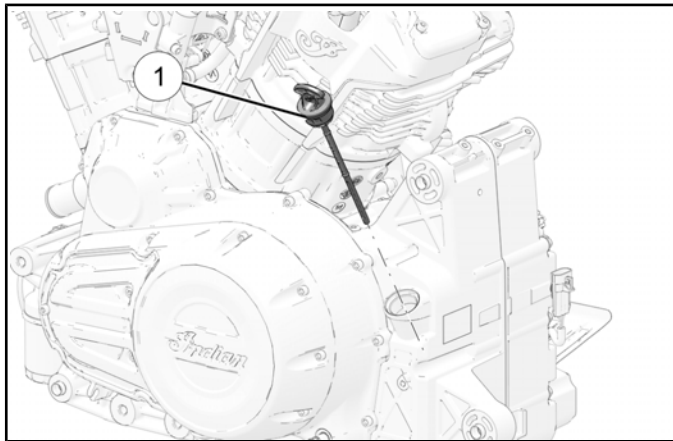
10. Stop the engine and add an additional 1 qts (0.95 L) of oil.

**CAUTION**  
Do NOT overfill. Overfilling can result in loss of engine performance and an oil saturated air filter. Use a suction device to remove excess oil if overfilled.

**CAUTION**  
After an oil change, the low oil pressure indicator may illuminate when the engine is started. If this occurs, do not increase RPM above idle speed until the indicator turns off. Operating above idle speed could result in damage to the engine.

11. Start the engine (from cold) and allow it to idle for 30 seconds. Stop the engine.

12. Remove the dipstick ① and wipe it clean.



13. Thread the dipstick until fully seated.

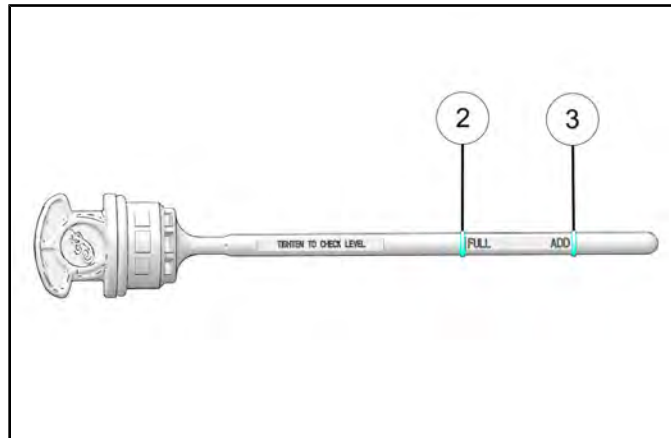
14. Remove the dipstick and view the oil level.

**CAUTION**  
Do not overfill. Overfilling can result in loss of engine performance and an oil-saturated air filter. Use a suction device to remove excess oil if overfilled.

15. Add the recommended oil as needed to bring the level between the ADD and FULL marks. Do not add oil if between the ADD and FULL marks.

**NOTICE**  
Oil should be added only if the proper oil check procedure is followed and the level is below the safe mark.

16. The approximate volume between the FULL ② and ADD ③ marks on the dipstick is 32 oz. (.94 L).



17. Reinstall the dipstick securely.

18. Dispose of used filter and oil properly.

19. Reset the oil change life in the instrument gauge.

20. Check for leaks around drain plug and oil filter.

**NOTICE**  
Recycle used oil and oil filter in accordance with local regulations.

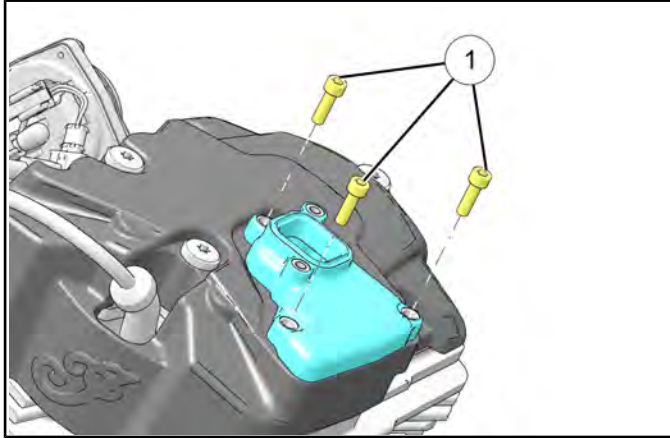
## CYLINDER HEAD SERVICE

### BREATHER ASSEMBLY REMOVAL / INSTALLATION

**IMPORTANT**  
The breather assembly can only be serviced with the engine out of the frame.

**REMOVAL**

1. Remove fasteners ① securing breather.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

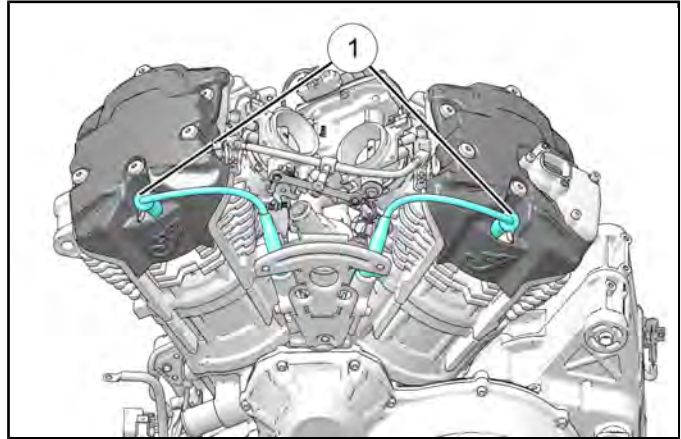
Breather Fastener:  
**84 in-lbs (10 N·m)**

**VALVE COVER REMOVAL**

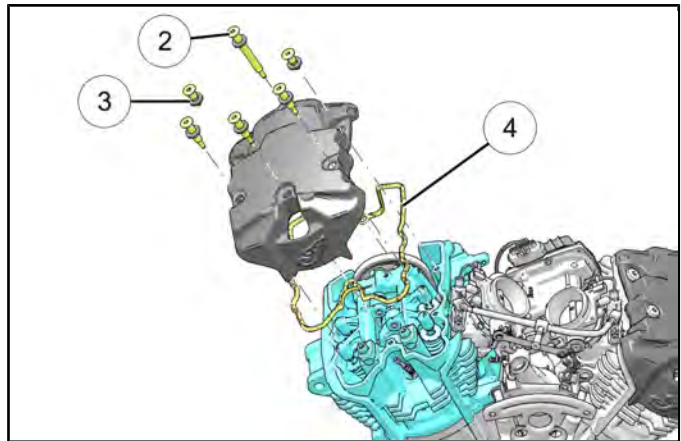
**IMPORTANT**

Due to the proximity of the valve cover in the frame, the engine must be lowered down for access. To lower the engine down, reference **Removing Engine From Frame page 3.15**.

1. Unplug spark plug boots ① from spark plugs.



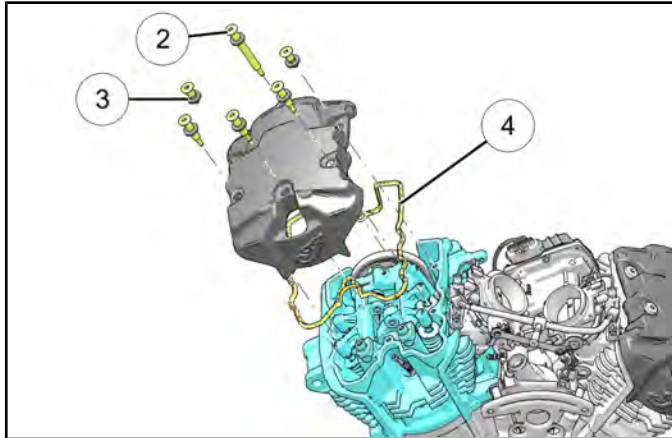
2. Remove valve cover fastener ② and isolators ③.
3. Remove valve cover gasket ④.



3

**VALVE COVER INSTALLATION**

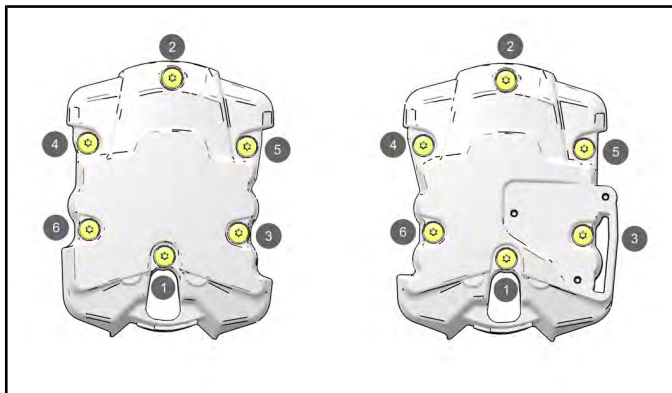
1. Using new gaskets, install the inner valve covers and thread fasteners ① in finger tight.



2. Reference the torque sequence at the beginning of this section and torque inner valve cover fasteners to specification.

**TORQUE**

Valve Cover Fastener:  
**84 in-lbs (10 N·m)**

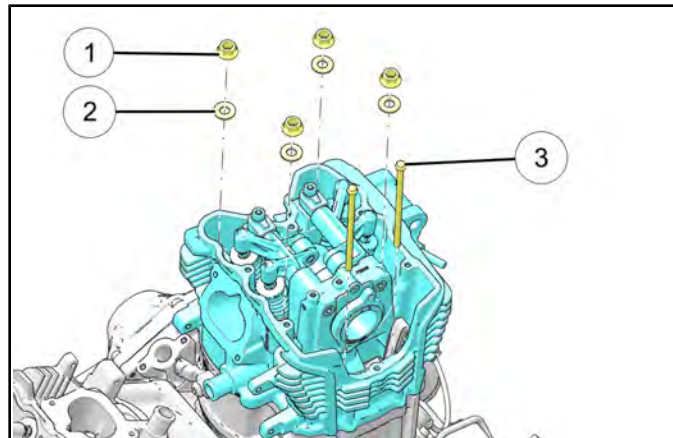


**CYLINDER HEAD REMOVAL**

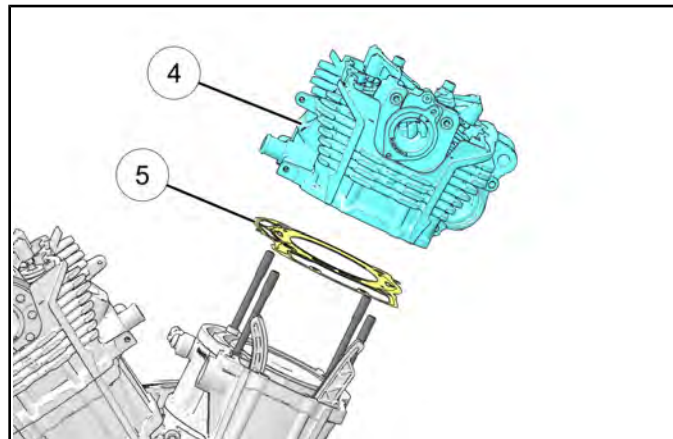
**⚠ CAUTION**

Cylinder and Cylinder Head heat sink edges are extremely sharp. Gloves should be worn whenever handling these components to prevent personal injury.

1. Remove Timing Chain. See **Cam Chain Removal / Installation** page 3.55.
2. Remove cylinder head nuts ①, washers ②, and head bolts ③.



3. Remove cylinder head ④ and head gasket ⑤.



**ROCKER ARM ASSEMBLY REMOVAL / INSTALLATION**

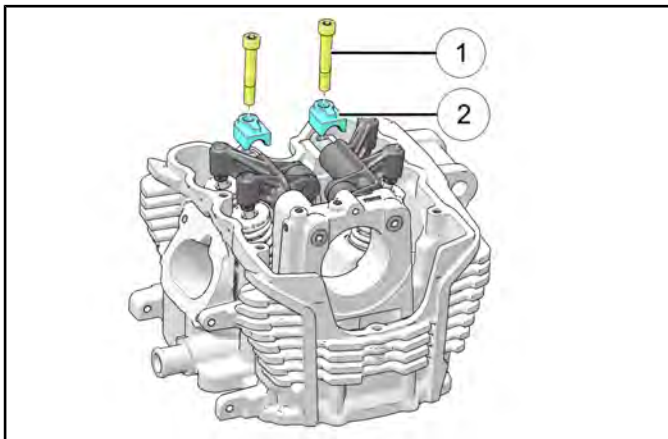
To watch a video of this procedure, scan the QR code or click **HERE**.



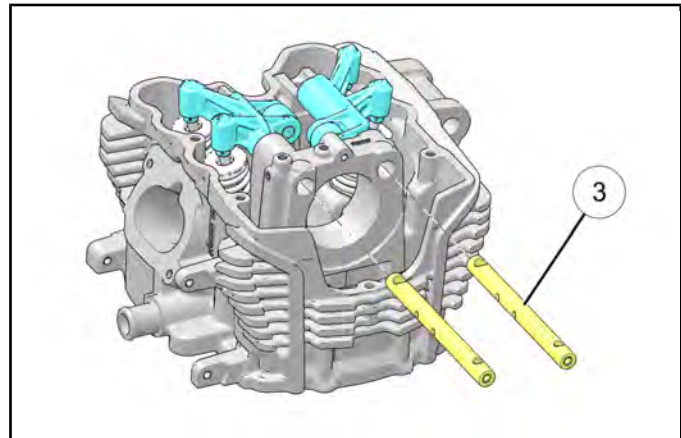
<https://vimeo.com/356919452/2858c08b70>

**REMOVAL**

1. Remove camshaft. See **Camshaft Removal page 3.62**.
2. Remove special tool from the cylinder head.
3. Remove rocker shaft cap fastener ① and cap ②.



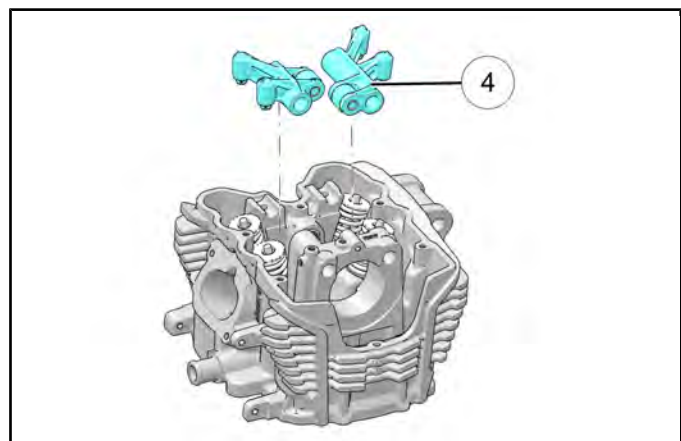
4. Remove rocker shaft ③.



**IMPORTANT**

Mark the rockers for reassembly. Each rocker can only be correctly installed one way.

5. Remove rocker shaft assembly ④.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**IMPORTANT**

Lubricate rocker shafts with white lithium grease (PN **1205854**) before reassembly.

**IMPORTANT**

If installing new rocker arms, submerge the new rocker arm(s) in clean engine oil prior to installation to ensure proper lubrication.

**TORQUE**

Rocker Shaft Cap Fastener:  
**27 ft-lbs (37 N·m)**



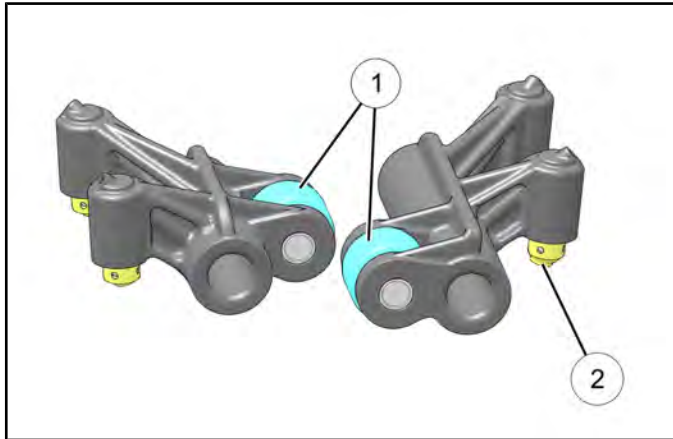


**ROCKER ARM ASSEMBLY INSPECTION**

**NOTICE**

Rocker arms are non-serviceable and must be replaced as an assembly.

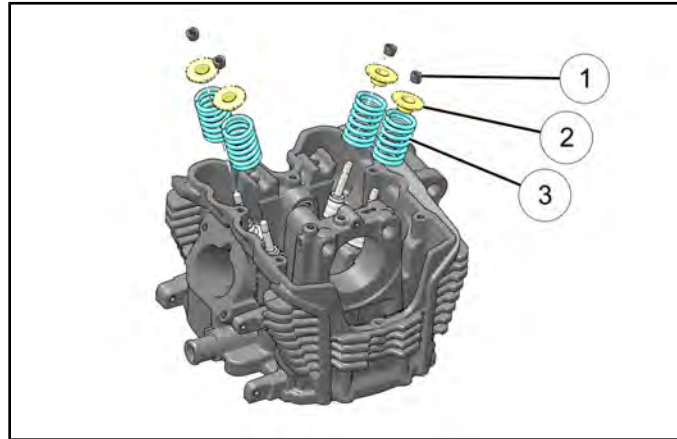
1. Inspect cam rollers ①. Ensure the rollers move freely and have no abnormal wear patterns or flat spots.



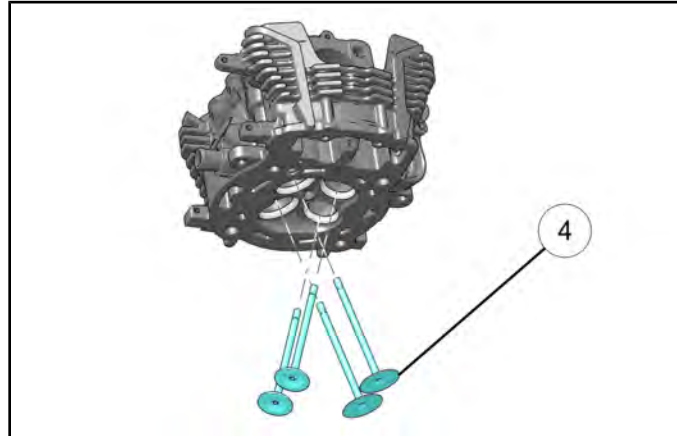
2. Inspect wear pad ②. Ensure it moves up and down freely. Check for abnormal wear.
3. Replace rocker arm assembly if abnormal wear is found.

**CYLINDER HEAD DISASSEMBLY**

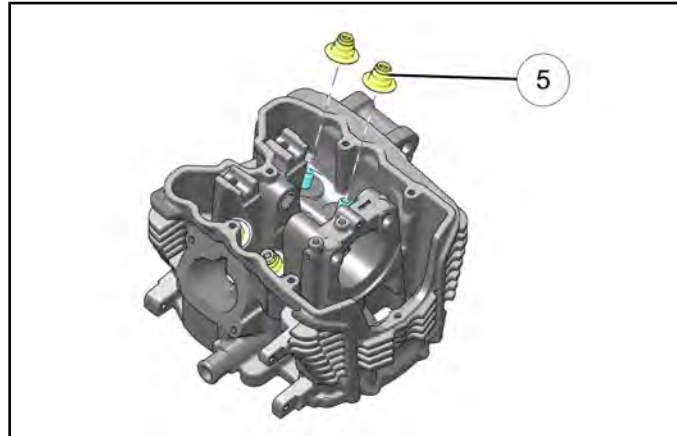
1. Remove the valve keepers ① using a valve spring compressor tool PV-1253. Use a small magnet to remove valve keepers.
2. Remove upper valve spring retainers ② and springs ③ .



3. Remove the valves ④ .



4. Remove and discard the spring seat / valve stem seal assemblies ⑤ .

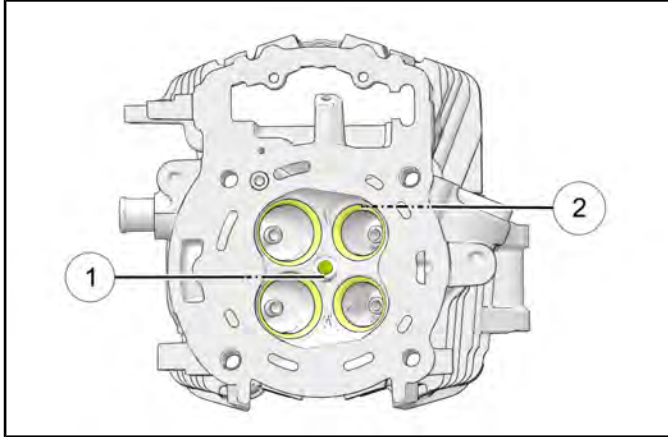


5. Clean carbon deposits from combustion chamber.

- Clean gasket surfaces.

**CYLINDER HEAD INSPECTION**

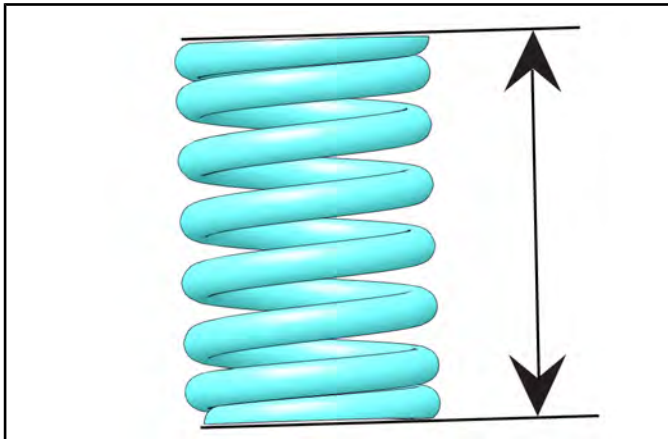
- Visually inspect cylinder head for cracks or damage. Pay close attention to the areas around spark plug ① and valve seats ②.



- Inspect cylinder head for distortion with a straight edge and feeler gauge. Check in different directions and locations on the cylinder head. For cylinder head service limits, see **Service Specifications – Cylinder Head page 3.46**.

**VALVE SPRING FREE LENGTH INSPECTION**

- Measure free length of valve springs. Replace springs that do not meet specification.



Valve Spring Free Length:  
2.1120" (53.70 mm)

**NOTICE**

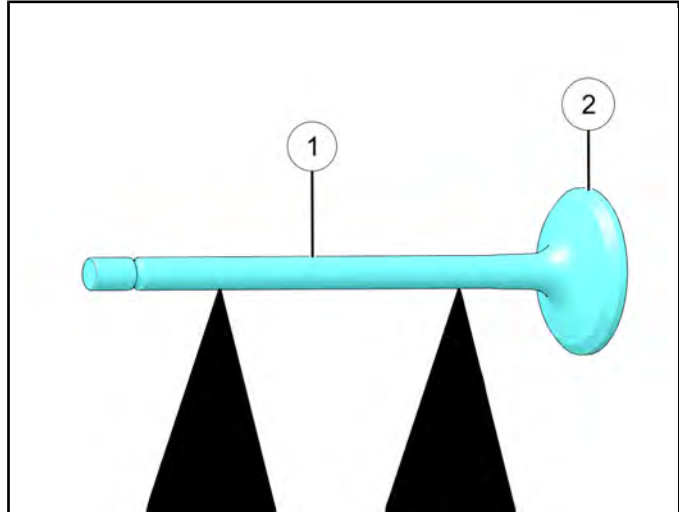
Intake and exhaust springs are identical.

**VALVE INSPECTION**

**NOTICE**

Valve service specifications can be found at the beginning of this chapter. See **Service Specifications – Cylinder Head page 3.46**.

- Place valves on V-blocks as shown and measure valve stem runout ① using a runout gauge or similar tool..



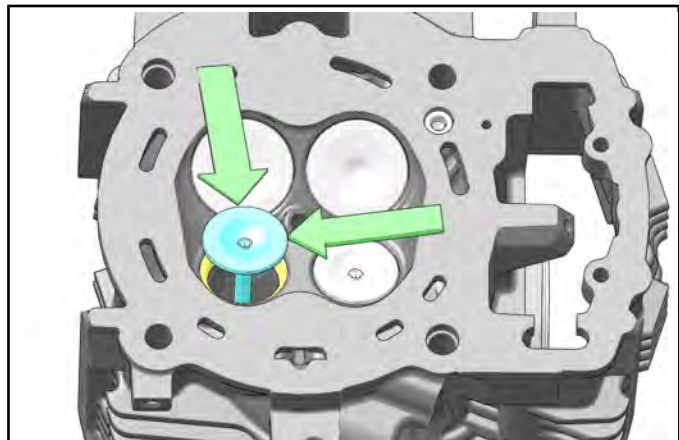
- Inspect the valve face for damage from burning, pitting or uneven contact.

- Place valves on V-block as shown and inspect valve head radial runout ②.

- Insert valves into their original locations in cylinder head.

- Inspect that each valve moves up and down smoothly without binding in guide.

- Measure valve stem deflection for each valve to determine if valve or valve guide requires replacement.







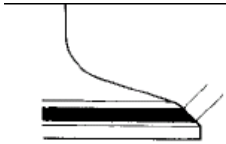


- Raise valve 10mm (0.400") off of seat.

3

- b. Position dial indicator as shown. Measure deflection in two directions perpendicular to each other (X & Y axis).
  - c. If valve deflection exceeds service limit measure valve stem diameter.
7. Replace valve and repeat step 6 if valve stem O.D. measures outside standard range. If valve stem deflection exceeds service limits with a new valve installed, valve guide must be replaced.
8. Installation of new valve guides and/or new valves requires valve seat reconditioning. This work should be performed by an experienced technician properly equipped to perform cylinder head reconditioning.

**VALVE INSPECTION**

CONDITION	ILLUSTRATION	POSSIBLE CAUSE	CORRECTIVE ACTION
Uneven seat width		Bent valve stem, worn valve guide	Replace valve and reface seat
Damaged valve face		Burnt, pitted, foreign material damage	Replace valve and reface seat
Contact area too high		Wear, settling of valve seat	Lower with 30° stone
Contact area too low		Wear, settling of valve seat	Raise with 60° stone
Contact area too wide		Wear, settling of valve seat	Narrow with both 30° stone and 60° stone
Contact area too narrow			Use 45° stone
Contact area free of pitting and damage, centered in seat, proper width.		Correct	None

3

**VALVE GUIDE REMOVAL / INSTALLATION**

**⚠ CAUTION**

Replacement of valve guides requires an oven, special equipment and experience to do the job correctly. If you are unsure of your ability to do the repair professionally it is best to sublet the labor to a competent machinist. Valve seat reconditioning is required when valve guides are replaced.

1. Support cylinder head and place valve guide remover into valve guide from the combustion chamber side.
2. Drive or press old valve guides out of cylinder head.

**⚠ CAUTION**

The cylinder head can be easily damaged if the procedure is done carelessly.

3. Apply 90 weight oil to outside of new valve guides.
4. Drive or press new guides from rocker arm side of head.
5. Measure valve guide height from spring seat:

Valve Guide Installed Height:  
**14.68–15.08 mm**

6. Ream new valve guides to size to obtain specified stem-to-guide clearance. Ream from combustion chamber side of head.
7. Clean cylinder head thoroughly with clean solvent.
8. Inspect and recondition valve seats.

**VALVE SEAT INSPECTION**

**NOTICE**

Valves cannot be ground. If valve face is burned or badly worn, replace the valve.

1. Remove carbon deposits from valves and seats.
2. Inspect valve face for burning, pitting or uneven contact.
3. Apply a light coating of machinist's layout fluid or paste to valve face.
4. Install valve into valve guide.
5. Tap valve several times to make a clear impression on the valve face. Do not rotate valve.
6. Remove valve and measure contact area (valve seat width). See **Service Specifications – Cylinder Head page 3.46.**



7. If valve seat is incorrect, recondition as needed.

**VALVE SEAT RECONDITIONING**

**NOTICE**

Valve seat reconditioning should be performed by a technician proficient in cylinder head reconditioning techniques using grinding stones. The use of carbide cutters is not recommended. Follow recommendations of the manufacturer of the valve seat reconditioning equipment being used. Do not grind seats more than necessary to provide proper seat width and contact point on valve face.

**CYLINDER HEAD ASSEMBLY****CAUTION**

Wear eye protection during assembly.

1. Lubricate valve stems with assembly lube.
2. Install valve in head *before* installing seal. Hold valve against seat wipe off the portion that extends above the guide.
3. Apply Indian Motorcycle engine oil to valve guide seal and install seal on valve, rotating the seal as you install it.
4. Press seal firmly in place on top of guide. Be careful not to dislodge spring from seal.
5. Install valve spring and upper retainer.

**CAUTION**

Do not compress valve springs more than necessary to install keepers.  
Support cylinder head so valves will not be damaged.

6. Compress valve springs using a valve spring compressor and adapter.
7. Apply a small amount of grease to both sides of a valve keeper.
8. Insert both valve keepers in place on valve.
9. Remove spring compressor.
10. Repeat previous steps for remaining valves.
11. Be sure all keepers are fully seated in groove.

**CYLINDER HEAD INSTALLATION****NOTICE**

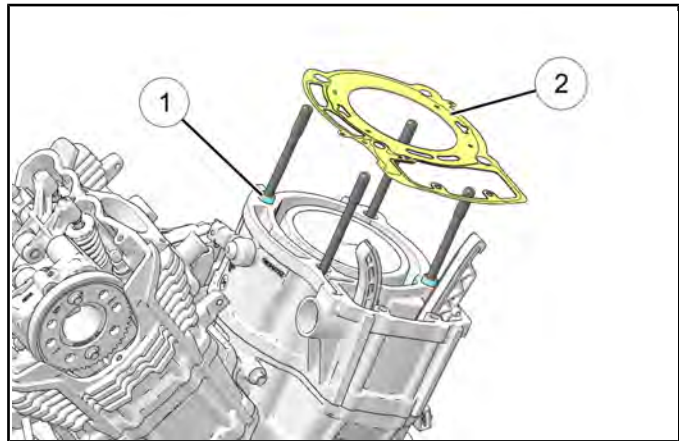
The base gasket seal is broken when the cylinder head is removed and must be replaced. See **Cylinder Installation page 3.105**.

1. Verify that locating dowels ① are in position on the cylinder deck.
2. Thoroughly clean cylinder and cylinder head mating surfaces.

**NOTICE**

Gaskets and gasket sealing surfaces must be free of oil and grease during assembly.

3. Install a new head gasket ②.



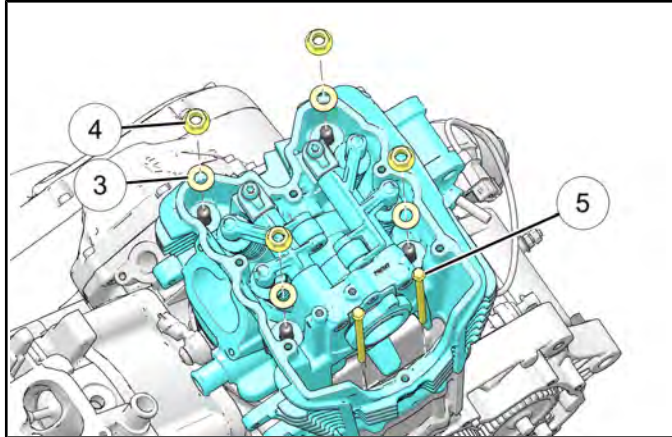
4. Set cylinder head in place on cylinder and press down until fully seated.

**3**

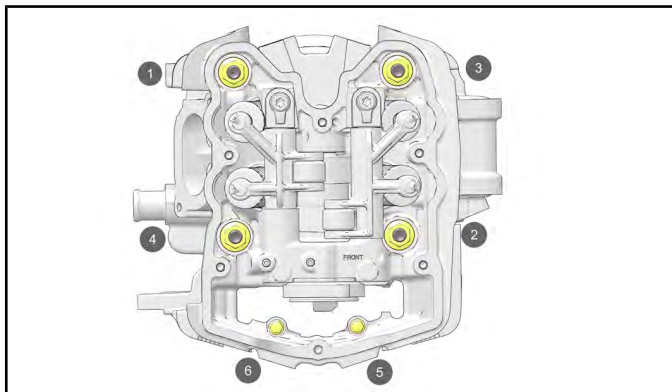
5. Install washers ③, nuts ④, and bolts ⑤. Tighten finger tight.

**IMPORTANT**

Add engine oil to the studs and bottom side of the cylinder head nuts.



6. Fully torque cylinder head following the procedure below to ensure accurate final torque:



**TORQUE**

Cylinder Head Nuts:

- 1. Torque fasteners to 15 ft-lbs (20 N·m) 2. Back off 90 ° 3. Torque all fasteners to 26 ft-lbs (35 N·m) 4. Torque angle all 360 °**

**TORQUE**

Cylinder Head Bolt:

**84 in-lbs (10 N·m)**

7. Install chain guides. See **Cam Chain Guide Installation page 3.61.**

**TROUBLESHOOTING, CYLINDER HEAD AND VALVE TRAIN****NOTICE**

Cylinder head, valve train and piston/cylinder problems are usually detected by an engine compression test. Other problems associated with this area of the engine are external fluid leaks, excessive oil consumption or abnormal noises.

The troubleshooting tables that follow list *possible* causes of engine mechanical problems. Always thoroughly investigate before disassembling an engine.

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
Hard Starting / Won't Start	Low Compression	Worn Valve Guide(s)	Replace Valve Guide(s)
		Poor Seating of Valve(s)	Repair or Replace
		Broken Valve Spring(s)	Replace
		Spark Plug Not Seated	Torque to Specification
		Incorrect Valve Timing	Repair / Retest
		Valve Stuck Open	Repair / Retest
		Cylinder Head Gasket Leak	Repair / Retest
		Slow Starter Motor	Refer to Electrical chapter
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust chapter
		Collapsed Hydraulic Lifter(s)	Bleed Air from Lifter(s) / Run at high idle for 10 minutes
		Ignition Problem	Refer to Electrical chapter
		Fuel Problem	Refer to Fuel Delivery / EFI chapter
Electric Starter Straining to Turn Engine Over	High Compression	Excessive carbon build-up in combustion chamber	De-carbon Combustion Chamber
		Compression Release Mechanism Failure	Inspect/Repair/Replace Compression Release Mechanism
	Excessive Starter Load	Internal Engine / Drive Components Seized or Binding	Determine Cause of Seizure or Binding
Poor idle Quality (Engine Related)	Low Compression	Collapsed Hydraulic Lifter(s)	Bleed Air from Lifter(s) / Run at high idle for 10 minutes
		Poor Seating of Valve(s)	Repair or Replace
	Excessive Oil in Combustion Chamber	Valve Guides	Replace
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust chapter
		Engine Oil Overfilled	Correct Engine Oil Level
Engine Noise	Valve Train Area	Collapsed Hydraulic Lifter(s)	Bleed Air from Lifter(s) / Run at high idle for 10 minutes
		Broken or Weak Valve Spring(s)	Replace



ENGINE / COOLING / EXHAUST

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
		Worn Camshaft or Rocker Arm	Replace
		Rocker Arm Bearing Damage	Replace
		Cam Bearings Worn or Damaged	Replace
	Piston / Cylinder Area	Worn Pistons and / or Cylinders	Replace
		Worn Wrist Pin, Wrist Pin Bore and / or Connecting Rod	Replace
		Worn Piston Rings or Piston Ring Lands	Replace
	General	Exhaust Leak	Reseal Exhaust
	Timing Chain Area	Chain / Sprocket Worn	Replace
		Chain Tensioner and / or Guide Worn	Replace
	Bottom End Area	Main Bearings	Refer to Transmission / Crankshaft chapter
		Rod Bearings	Refer to Transmission / Crankshaft chapter
		Loose Side Clearance	Refer to Transmission / Crankshaft chapter
	Transmission Area	Bearings	Refer to Transmission / Crankshaft chapter
Poor High-Speed Running	Air Intake Problem	-	Refer to Fuel Delivery / EFI chapter
	Fuel Injection Problem	-	Refer to Fuel Delivery / EFI chapter
	Ignition Problem	-	Refer to Electrical chapter
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Travel	Worn Camshaft / Rocker Arms	Replace
	Valves Opening and Closing at Wrong Time	Incorrect Valve Timing	Correct
Lack of Power in all RPM Ranges	Low Compression	Worn Piston, Rings, Cylinder, Poor Valve Seating	Repair / Replace
	Valve Timing Incorrect	Cam Chain and Sprockets	Correct
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Lift	Worn Camshaft / Rocker Arms	Replace
	Ignition / Fuel Injection System	—	Refer to Fuel Delivery / EFI or Electrical chapter
	Oiling Problem	Oil Overfilled	Correct Engine Oil Level

**CYLINDER / PISTON****GENERAL INFORMATION****SERVICE NOTES****NOTICE**

Clean the machine thoroughly before removing engine from frame.

- This section covers service of the cylinder, piston and rings. The engine must be removed from the frame to perform the procedures in this section. Refer to Engine / Cooling / Exhaust chapter for engine removal and installation.
- Mark and store all mated parts for assembly. Assemble engine by putting used parts that pass inspection back in the same location.
- Machined mating surfaces are very delicate. Handle and store all parts in such a way that the mating surfaces will not be damaged.
- Many parts require assembly lubrication. Follow the assembly lubrication procedures carefully.
- There are many precision measuring steps in this section. If you are not sure of your capabilities in these areas, have a competent machinist perform the precision part inspection operations.
- Cleanliness of parts is critical to engine life and proper parts inspection. Use clean solvent and hot, soapy water to clean parts. Dry with compressed air before inspection and engine assembly. Coat parts with fresh lubricant to prevent oxidation after cleaning.

**SPECIAL TOOLS – CYLINDER / PISTON**

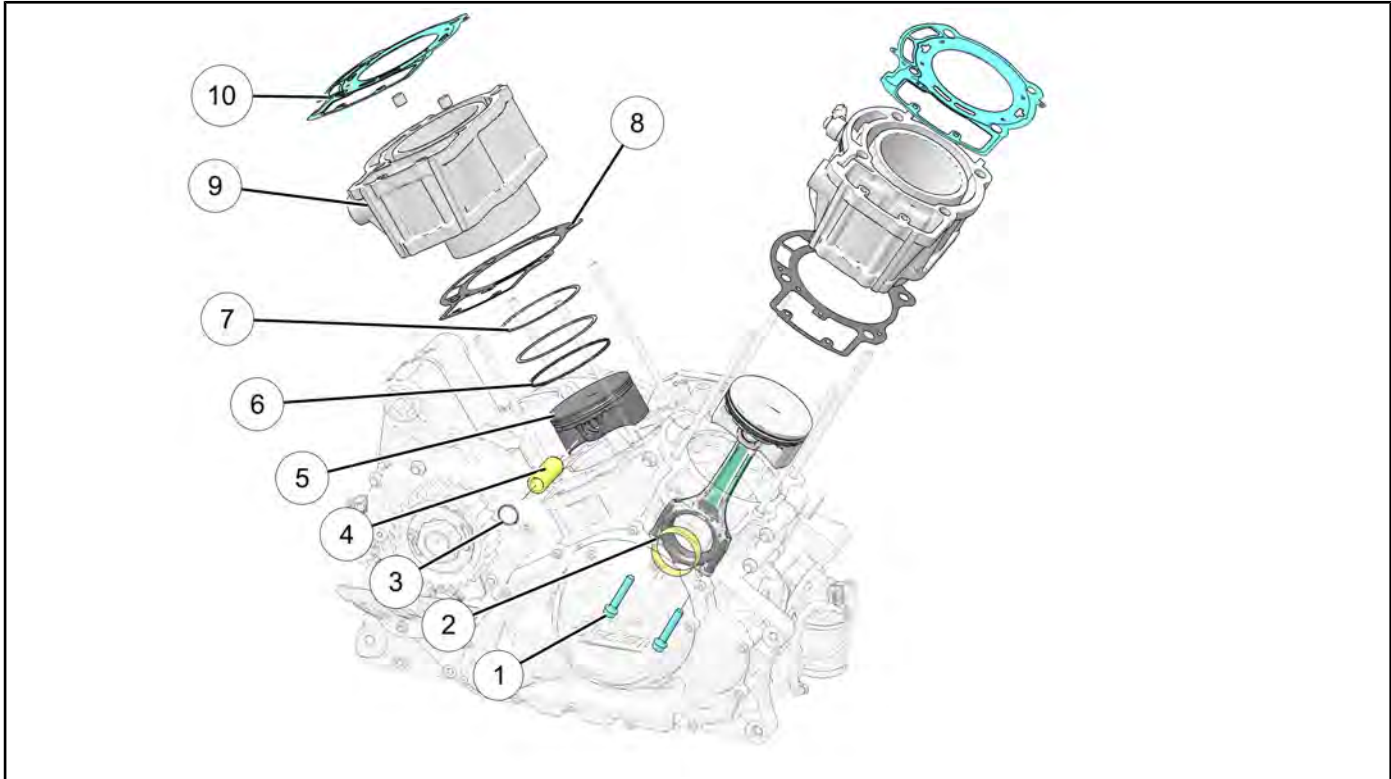
TOOL DESCRIPTION	PART NUMBER
Clutch Shaft Holding Tool	PF-51232
Crankshaft Rotation Tool	PF-51239
Crankshaft Locking Pin	PF-52135
Engine Case Splitting Tool	PF-51234-A
Straightedge, Feeler Gauge	Commercially Available
Protective Sleeves For Pistons / Studs	Commercially Available

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

**SERVICE SPECIFICATIONS - CYLINDER / PISTON**

ITEM		STANDARD	SERVICE LIMIT
Cylinder	I.D.	108.000 - 108.016 (4.25197" - 4.25295")	Check taper and out-of-round
	Out of Round	Measure 86 mm up from base gasket surface	0.05 mm (.002")
	Taper		0.05 mm (.002")
	Gasket Surface Warpage	-	.1mm max. (.0039")
Piston	Piston Mark Direction	Piston orientation is determined by arrow on piston crown. Position BOTH pistons so arrows point to front of engine.	
	Piston O.D. (Nominal) (Measured 11.5 mm up from bottom of skirt, 90 degrees to pin)	107.933 - 107.947mm (4.24933 - 4.24988")	Replace if piston-to-cylinder clearance is excessive with good cylinder
	Piston Pin Hole I.D.	23.004 - 23.01 mm (.9057 - .9059")	23.039 mm (.9070")
	Piston Pin O.D.	22.995 - 23.00 mm (.9053 - .9055")	22.96 mm (.9039")
	Piston to Cylinder	.053 - .083 mm (.0021 - .0033")	.17 mm (.0066")
	Piston to Piston Pin	.004 - .015 mm (.0001 - .0006")	.033 mm (.0013")
Piston Ring Clearances	Ring End Gap - Top (Installed) Ring End Gap - 2nd (Installed) Ring End Gap - 3rd (Oil Control Rails) (Installed)	.30 - .45 mm (.012 - .018") .50 - .75 mm (.020 - .029") .25 - .75 mm (.009 - .029")	.90 mm (.0354") 1.50 mm (.0591") 1.50 mm (.0591")
	Piston Ring Marks	-	"M TOP" mark must face UP on all rings.
Piston Ring to Ring Land	Top Ring (1.2mm ring thickness)	.055 - .060 mm (.0022 - .0024")	.11 mm (.0043")
	2nd Ring (1.2mm ring thickness)	.045 - .050 mm (.0018 - .0020")	.10 mm (.0039")
	Oil Control Ring	.220 - .360 mm (.0087 - .0142")	.45 mm (.0177")

**ASSEMBLY VIEWS**  
**CYLINDER / PISTON**



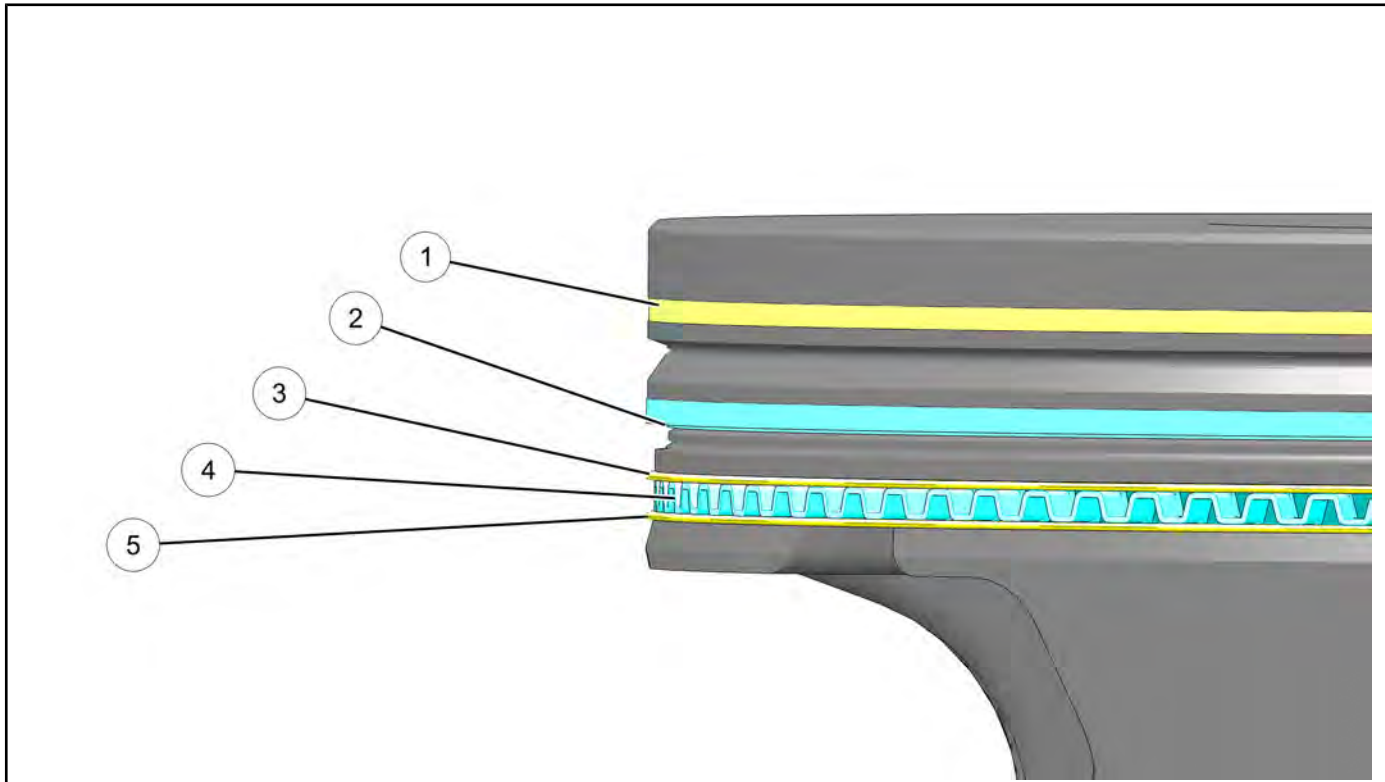
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REF	DESCRIPTION	TORQUE
①	Connecting Rod Fastener	<b>1. Torque to 19 ft-lbs (26 N·m)</b> <b>2. Torque angle to 105 °</b>
②	Connecting Rod Bearing	—
③	Circlip	—
④	Wristpin	—
⑤	Piston	—
⑥	Oil Control Ring	—
⑦	Compression Ring (Top Two Rings)	—
⑧	Cylinder Base Gasket	—
⑨	Cylinder Head	—
⑩	Headgasket	—

**CYLINDER / PISTON SERVICE**

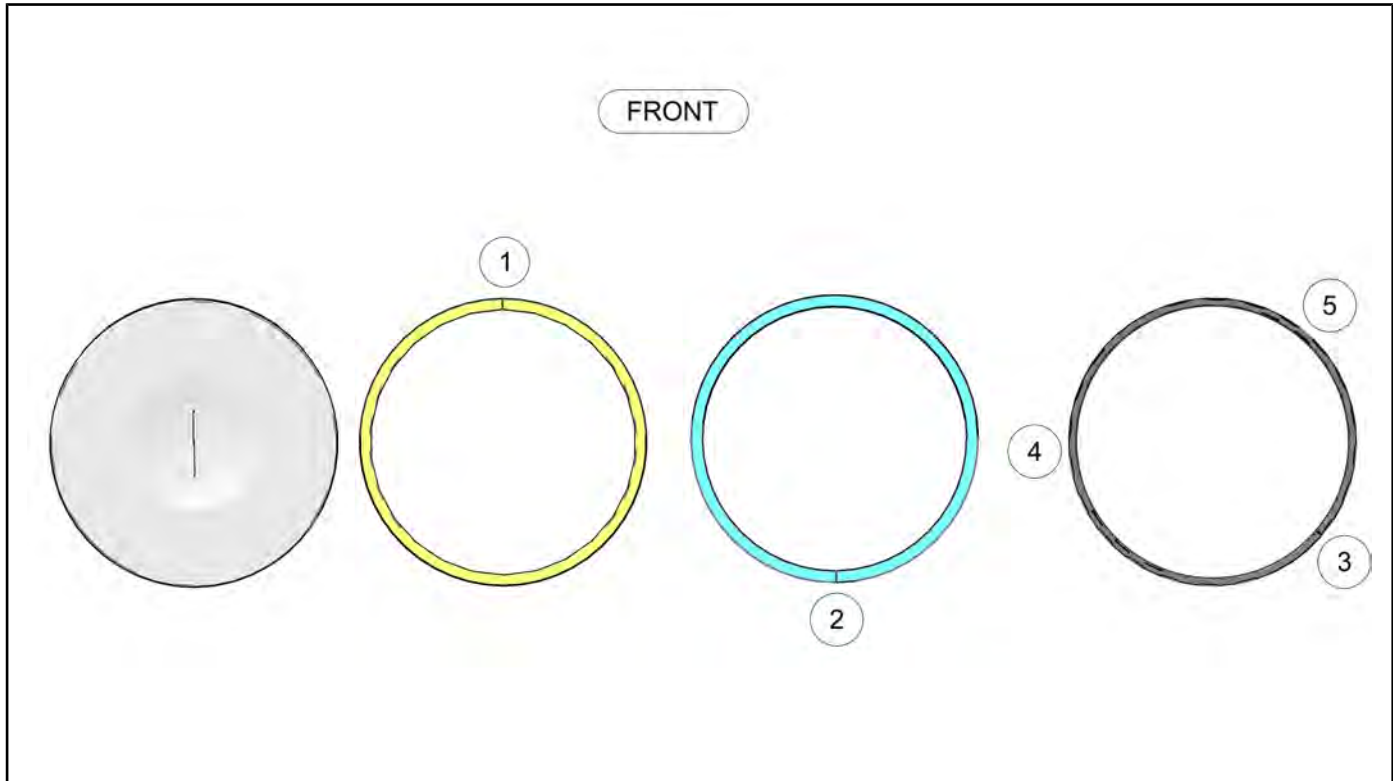
**PISTON RING PROFILE AND ORIENTATION**

**PISTON RINGS**



REF	DESCRIPTION
①	Top Compression Ring
②	Lower Compression Ring
③	Top Oil Ring
④	Oil Ring Expander
⑤	Lower Oil Ring

**PISTON RING END GAP ORIENTATION**

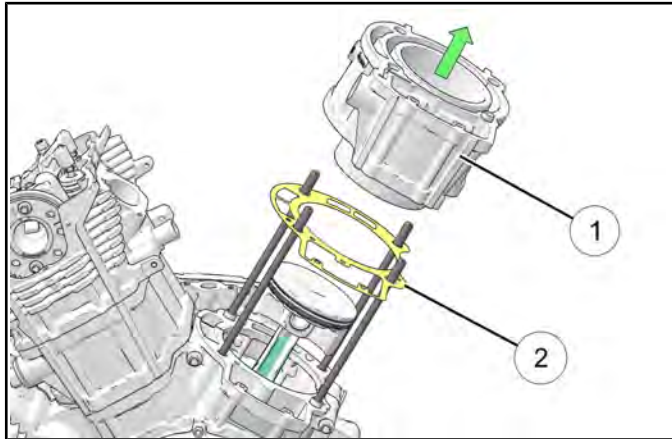


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REF	DESCRIPTION
①	Top Compression Ring
②	Lower Compression Ring
③	Top Oil Ring
④	Oil Ring Expander
⑤	Lower Oil Ring

**CYLINDER REMOVAL**

1. Remove cylinder head(s). See **Cylinder Head Removal page 3.84.**
2. Remove cylinder ①. Support pistons to prevent damage. Place a section of hose over the cylinder studs to prevent damage to the piston rings.



3. Remove cylinder base gasket ② .
4. Clean gasket surfaces of cylinders thoroughly.

**⚠ CAUTION**

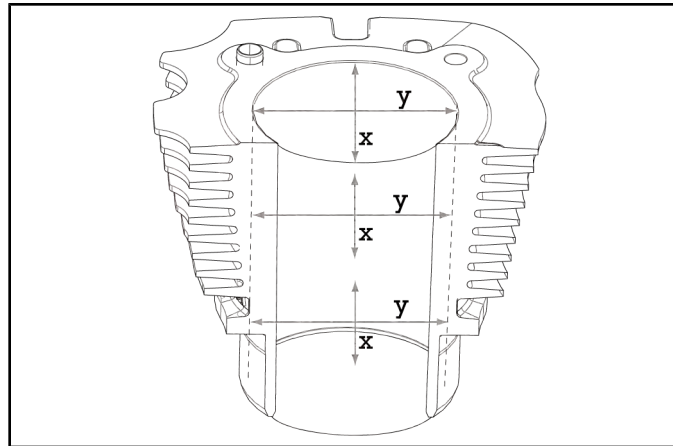
Careless handling of cylinder, pistons or rings may cause irreparable damage. Do not damage gasket surfaces during cleaning.

**CYLINDER INSPECTION**

1. Visually inspect cylinder bores for scratches and wear.
2. Inspect gasket surfaces for scratches or other damage that may cause an oil leak.

**CYLINDER BORE MEASUREMENT**

1. Measure each cylinder bore in 6 places to determine:



**NOTICE**

Bottom measurement should be taken 2.6 in (66 mm) up from base gasket surface.

- Cylinder Bore Inside Diameter
  - Cylinder Taper
  - Out of Round
2. Use maximum measurement to determine wear.
  3. Use the worksheet provided to record measurements and calculate the clearance.

**PISTON TO CYLINDER CLEARANCE WORKSHEET**

Front Cylinder	Recorded Measurement	Specification
Top "X"		Taper Service Limit: .05mm (.002")
Middle "X"		
Bottom "X"		
Top "Y"		
Middle "Y"		
Bottom "Y"		
Difference between largest "Y" measurement and smallest "Y" measurement	Taper for "Y" axis:	
Difference between largest "X" measurement and smallest "X" measurement	Taper for "X" axis:	
Largest difference between any "X" axis measurement and "Y" axis measurement	Cylinder Out-of-Round:	Out-of-Round Service Limit: .05mm (.002")
Piston Skirt Measurement		
Difference between largest "X" axis measurement and piston measurement	Piston-to-Cylinder Clearance*	Piston-to-Cylinder Clearance Service Limit: .15 mm (.006")

Rear Cylinder	Recorded Measurement	Specification
Top "X"		Taper Service Limit: .05mm (.002")
Middle "X"		
Bottom "X"		
Top "Y"		
Middle "Y"		
Bottom "Y"		
Difference between largest "Y" measurement and smallest "Y" measurement	Taper for "Y" axis:	
Difference between largest "X" measurement and smallest "X" measurement	Taper for "X" axis:	
Largest difference between any "X" axis measurement and "Y" axis measurement	Cylinder Out-of-Round:	Out-of-Round Service Limit: .05mm (.002")
Piston Skirt Measurement		
Difference between largest "X" axis measurement and piston measurement	Piston-to-Cylinder Clearance*	Piston-to-Cylinder Clearance Service Limit: .15 mm (.006")

Compare recorded measurement to specifications. If measured value exceeds service limit replace the appropriate part.

**NOTICE**

- The cylinders are Ni-SiC plated and cannot be reconditioned by boring or honing. If excessive surface damage, taper or out-of-round exists, the cylinder must be replaced.
- If the piston-to-cylinder clearance exceeds the service limit, *measure a new piston and re-calculate the clearance*. If the piston-to-cylinder clearance exceeds the service limits with a new piston, the cylinder must be replaced.

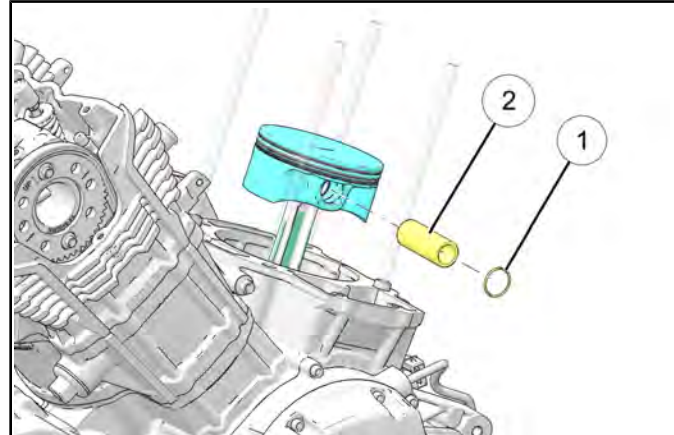


**CYLINDER WARPAGE MEASUREMENT**

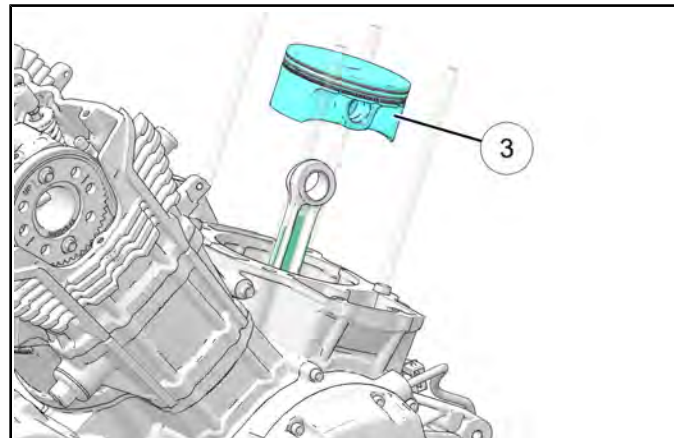
1. Inspect cylinder for warpage at cylinder head surface and base gasket surface.
2. Place a straight edge diagonally across cylinder mating surfaces in several positions. Attempt to slide a .05mm (.002") feeler gauge under the straight edge in each position.
3. Replace cylinder if warped beyond the service limit.

**PISTON & PISTON RING REMOVAL**

1. Cover crankcase with a clean shop towel to prevent piston circlip from falling into the crankcase.
2. Remove circlip ① .



3. Push piston pin ② and remove the piston ③ .



4. Rotate rings in piston grooves. Rings should rotate freely in grooves.
5. Clean carbon deposits from piston.
6. Spread rings only wide enough to remove them from piston. Spreading rings too wide will damage them.
7. Clean piston ring grooves. Break or cut a piston ring in half. File or grind one edge square and remove all burrs. Use this piston ring to carefully clean piston ring grooves.

**NOTICE**

A soft wire brush may be used to only clean the top of the piston. Do not use a wire brush to clean the sides of piston or the piston ring grooves.

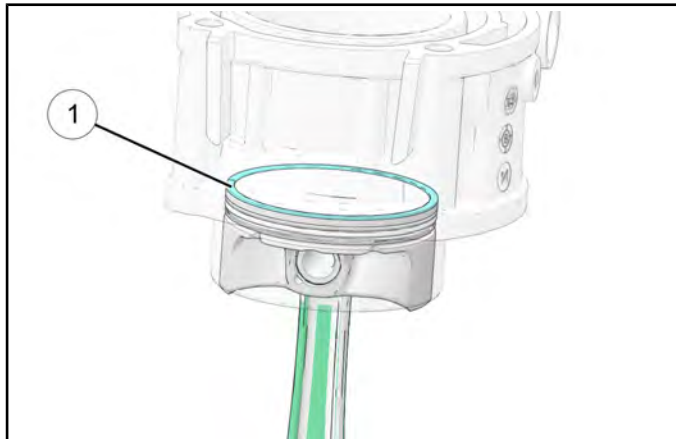
**PISTON & PISTON RING INSPECTION**

1. Replace parts that do not meet specification.

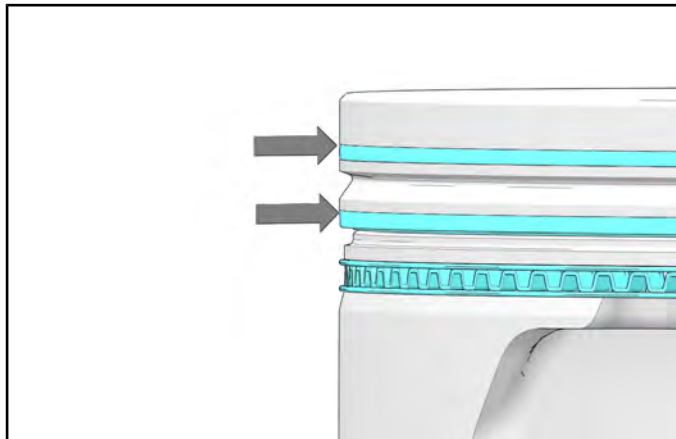
**NOTICE**

If piston-to-cylinder clearance exceeds service limit, *measure a new piston and re-calculate clearance*. If piston-to-cylinder clearance exceeds service limits with a new piston, cylinder must be replaced.

2. Use a piston to push the ring ① squarely into cylinder bore from bottom (push rings 25-50 mm into cylinder).



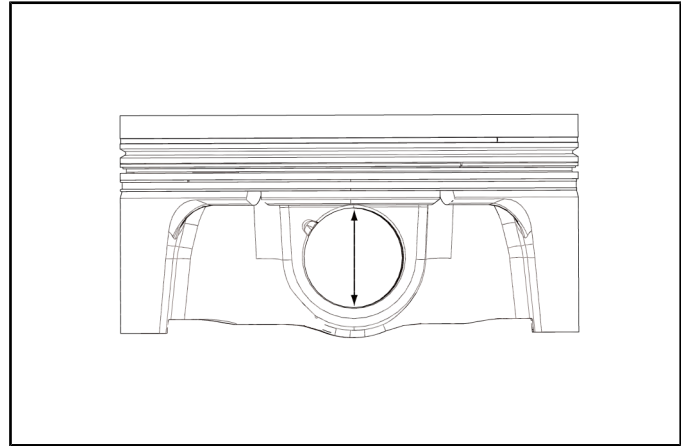
3. Measure installed ring end gap with a feeler gauge and compare to specifications. See **Service Specifications – Cylinder / Piston page 3.96**.
4. Install rings onto a clean piston. Push rings in until they are flush with piston. Using a feeler gauge, measure side clearances for the 1st & 2nd rings.



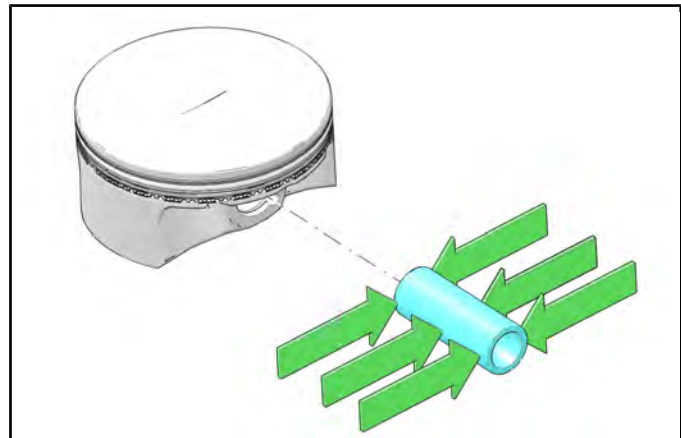
5. Replace parts that exceed service limit.

**PISTON PIN / PIN BORE INSPECTION**

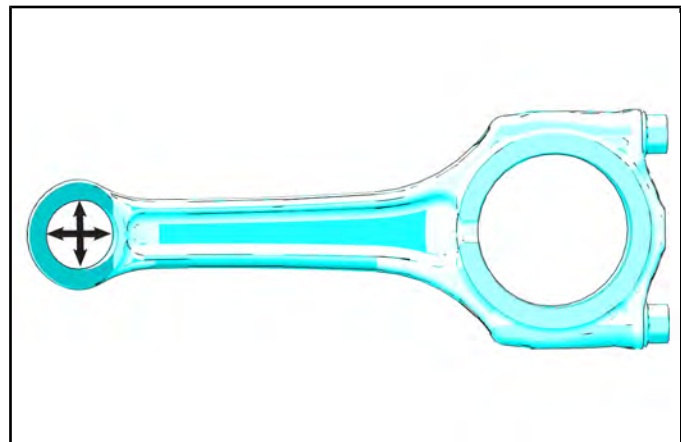
1. Measure piston pin hole I.D. top to bottom (as shown) and as close to the circlip groove as possible with a telescoping gauge. Record the smallest measurement.



2. Measure piston pin O.D. at three locations. Record largest measurement.



3. Calculate piston pin-to-piston clearance. Subtract pin O.D. from pin hole I.D.
4. Measure connecting rod small end I.D. at two locations.



3

5. Calculate connecting rod-to-piston pin clearance by subtracting pin O.D from rod hole I.D.
6. Compare measurements to specifications and replace any worn parts. See **Service Specifications – Cylinder / Piston page 3.96.**

### PISTON RING INSTALLATION

<b>⚠ CAUTION</b>
The rings may be damaged if they are over expanded during installation.

1. Lubricate all rings with engine oil.
2. Carefully install oil control ring expander with end gap located as shown. Reference **Piston Ring Profile And Orientation page 3.98.**
3. Install top and bottom rails with end gap located as shown.
4. Install top ring (marked “C”) and second ring (marked “CTOP”) with markings facing UP.
5. Compress each ring by hand and rotate to be sure they rotate freely in grooves.
6. Locate ring end gaps as shown below in relation to arrow on piston crown.

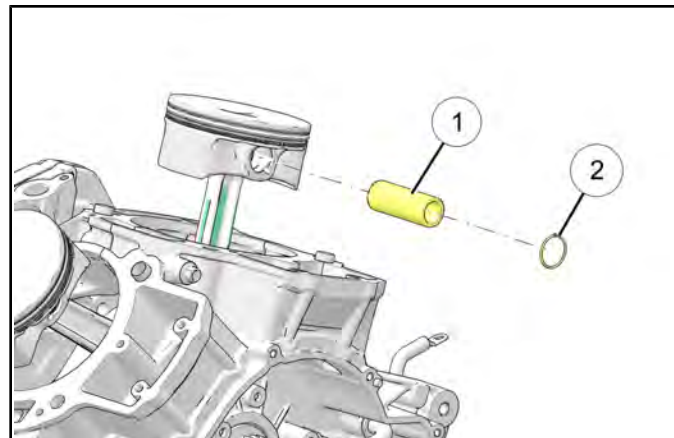
### PISTON INSTALLATION

The pistons are marked with an arrow on the crown. Install pistons on connecting rods with arrow facing the FRONT of the engine.

1. Place a clean shop towel over crankcase to prevent foreign material from entering crankcase.
2. Install a new circlip on one side of the piston with end gap facing UP (12:00 position).

<b>IMPORTANT</b>
<b>Never reuse piston pin circlips.</b>

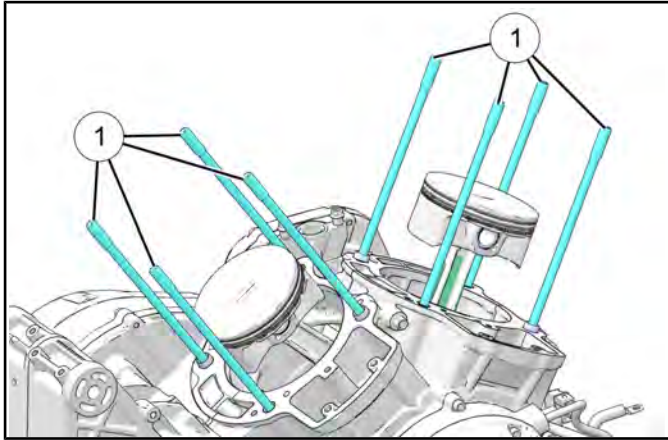
3. Lubricate piston pin and I.D. of connecting rod small end with engine oil or moly lube.
4. Install piston over connecting rod with arrow on piston crown facing FRONT of engine.
5. Push piston pin ① through rod and piston pin hole until it is stopped by circlip.
6. Install remaining circlip ② with end gap facing up (12:00 position.)



7. Make sure both piston circlips are seated properly in the groove.

**CYLINDER STUD REPLACEMENT**

1. Use a stud extractor to remove 10 mm studs ①.



2. Clean threads in cases thoroughly.
3. Apply engine oil to stud threads.
4. Install studs and torque them to specification.

**TORQUE**

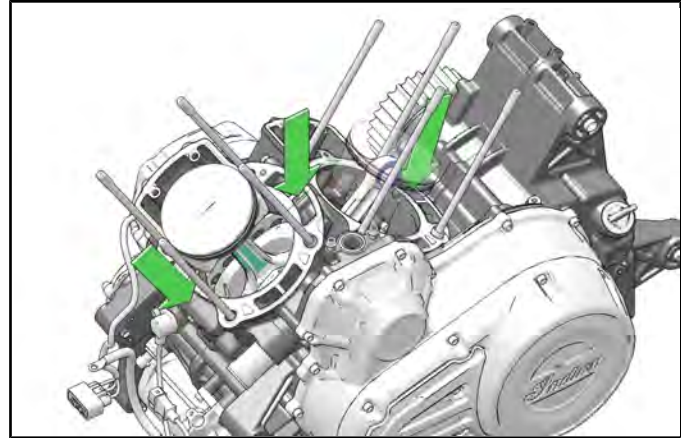
Cylinder Stud:  
25 ft-lbs (34 N·m)

**CYLINDER INSTALLATION****NOTICE**

Be sure all top end parts are ready for assembly. Sealant on crankcase parting line must not be allowed to dry before top end is assembled and torqued.

1. First wash cylinders with clean solvent, then with hot soapy water.
2. Rinse the cylinders with clear water and immediately dry with compressed air. Cylinder bore should be wiped with a clean white shop towel and engine oil.
3. Apply a light coat of engine oil to piston and rings.
4. Ensure cylinder alignment dowel pins are in place and gasket surfaces are clean and oil-free.

5. Apply a small amount of crankcase sealant to the crankcase parting lines on base gasket surface as shown.



6. Install new cylinder base gaskets onto crankcase.

**IMPORTANT**

Inspect all sealing surfaces carefully for scratches or imperfections. **DO NOT** allow oil or grease to contact gaskets or sealing surfaces during the assembly process.

7. Apply a small amount of engine oil to inside surfaces of a piston ring compressor band.
8. Install piston ring compressor over rings and compress rings into ring grooves.

**CAUTION**

Be sure compressor band end gap does not align with any ring end gap when compressing the rings.

**NOTICE**

Install cylinders in their original locations. **Cylinder with Knock Sensor is the front cylinder.**

9. Remove protective covering from crankcase.
10. Carefully install cylinder(s) over piston/ring assembly. Do not force cylinder over piston. Monitor rings carefully. If a piston ring becomes dislodged from the ring compressor; remove cylinder, inspect ring carefully for damage.
11. Remove piston ring compressor when rings are fully captive in cylinder.
12. Slide cylinder down over piston until seated to base gasket and crankcase surface.
13. Repeat for other cylinder.
14. Install cylinder head(s). See **Cylinder Head Installation page 3.91.**

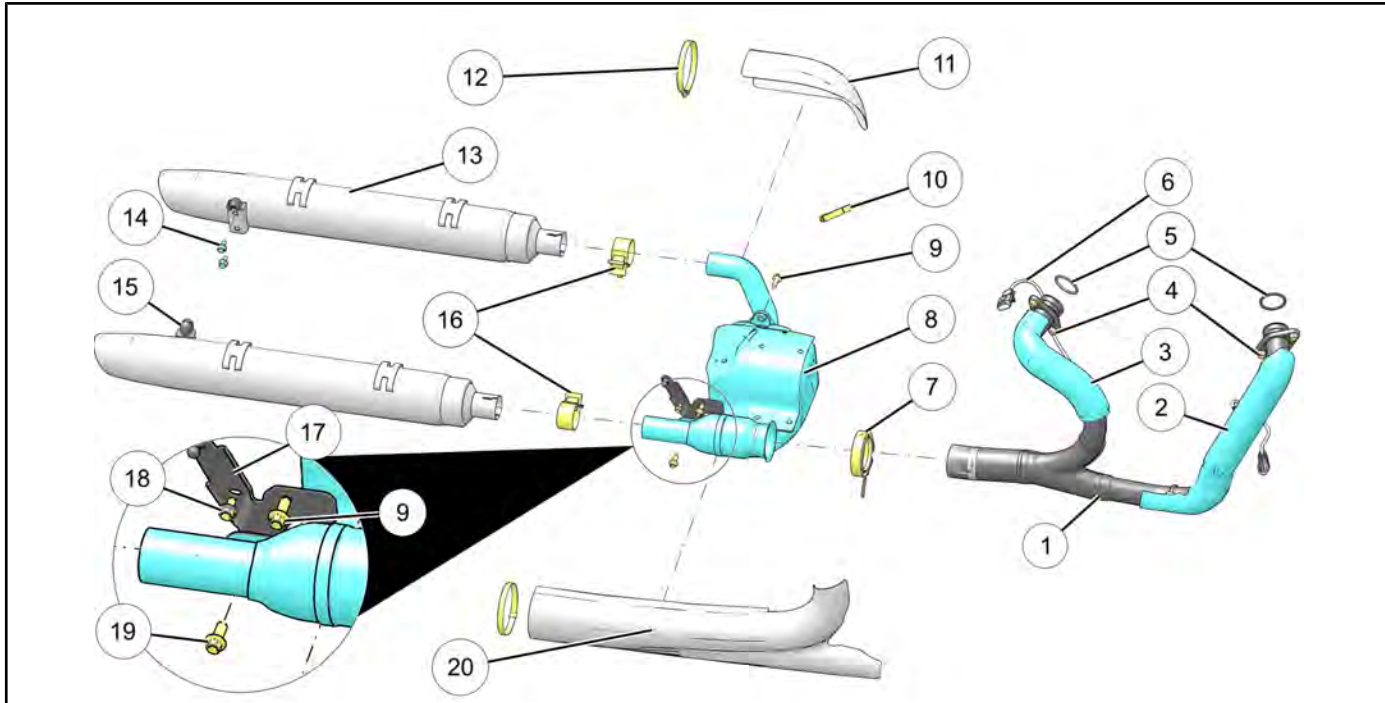
**TROUBLESHOOTING, CYLINDER / PISTON**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>PART(S) AFFECTED</b>	<b>REPAIR RECOMMENDED</b>
Hard Starting / Won't Start	Low Compression	Worn Valve Guide(s)	Replace Valve Guide(s)
		Poor Seating of Valve(s)	Repair or Replace
		Broken Valve Spring(s)	Replace
		Spark Plug Not Seated	Torque to Specification
		Incorrect Valve Timing	Repair / Retest
		Valve Stuck Open	Repair / Retest
		Cylinder Head Gasket Leak	Repair / Retest
		Slow Starter Motor	Refer to Electrical chapter
		Worn Rings, Piston, or Cylinder	Refer to Clutch / Primary / Shift chapter
		Collapsed Hydraulic Lifter (s)	Bleed Air from Lifter(s) / Run at high idle for 10 minutes
		Ignition Problem	Refer to Electrical chapter
		Fuel Problem	Refer to Engine / Cooling / Exhaust chapter
Electric Starter Straining to Turn Engine Over	High Compression	Excessive carbon build-up in combustion chamber	De-carbon Combustion Chamber
	Excessive Starter Load	Internal Engine / Drive Components Seized or Binding	Determine Cause of Seizure or Binding
Poor idle Quality (Engine Related)	Low Compression	Collapsed Hydraulic Lifter (s)	Bleed Air from Lifter(s) / Run at high idle for 10 minutes
		Poor Seating of Valve(s)	Repair or Replace
	Excessive Oil in Combustion Chamber	Valve Guides or worn valve stem seals	Replace
		Worn Rings, Piston, or Cylinder	Refer to Engine / Cooling / Exhaust chapter
		Engine Oil Overfilled	Correct Engine Oil Level
Engine Noise	Valve Train Area	Collapsed Hydraulic Lifter (s)	Bleed Air from Lifter(s) / Run at high idle for 10 minutes
		Broken or Weak Valve Spring(s)	Replace
		Worn Camshaft or Rocker Arm	Replace
		Rocker Arm Bearing Damage	Replace
		Cam Bearings Worn or Damaged	Replace

PROBLEM	POSSIBLE CAUSE	PART(S) AFFECTED	REPAIR RECOMMENDED
	Piston / Cylinder Area	Worn Pistons and / or Cylinders	Replace
		Worn Wrist Pin, Wrist Pin Bore and / or Connecting Rod	Replace
		Worn Piston Rings or Piston Ring Lands	Replace
	General	Exhaust Leak	Reseal Exhaust
	Timing Chain Area	Chain / Sprocket Worn	Replace
		Chain Tensioner and / or Guide Worn	Replace
	Bottom End Area	Main Bearings	Refer to Transmission / Crankshaft chapter
		Rod Bearings	Refer to Transmission / Crankshaft chapter
		Loose Side Clearance	Refer to Transmission / Crankshaft chapter
	Transmission Area	Bearings	Refer to Transmission / Crankshaft chapter
Poor High-Speed Running	Air Intake Problem	-	Refer to Fuel Delivery / EFI chapter
	Fuel Injection Problem	-	Refer to Fuel Delivery / EFI chapter
	Ignition Problem	-	Refer to Electrical chapter
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Travel	Worn Camshaft / Rocker Arms	Replace
	Valves Opening and Closing at Wrong Time	Incorrect Valve Timing	Correct
Lack of Power in all RPM Ranges	Low Compression	Worn Piston, Rings, Cylinder, Poor Valve Seating	Repair / Replace
	Valve Timing Incorrect	Cam Chain and Sprockets	Correct
		Damaged Cam Gears	Replace
	Valve Float	Weak Valve Springs	Replace
	Insufficient Valve Lift	Worn Camshaft / Rocker Arms	Replace
	Ignition / Fuel Injection System	—	Refer to Fuel Delivery / EFI or Electrical chapter
Oiling Problem	Oil Overfilled	Correct Engine Oil Level	

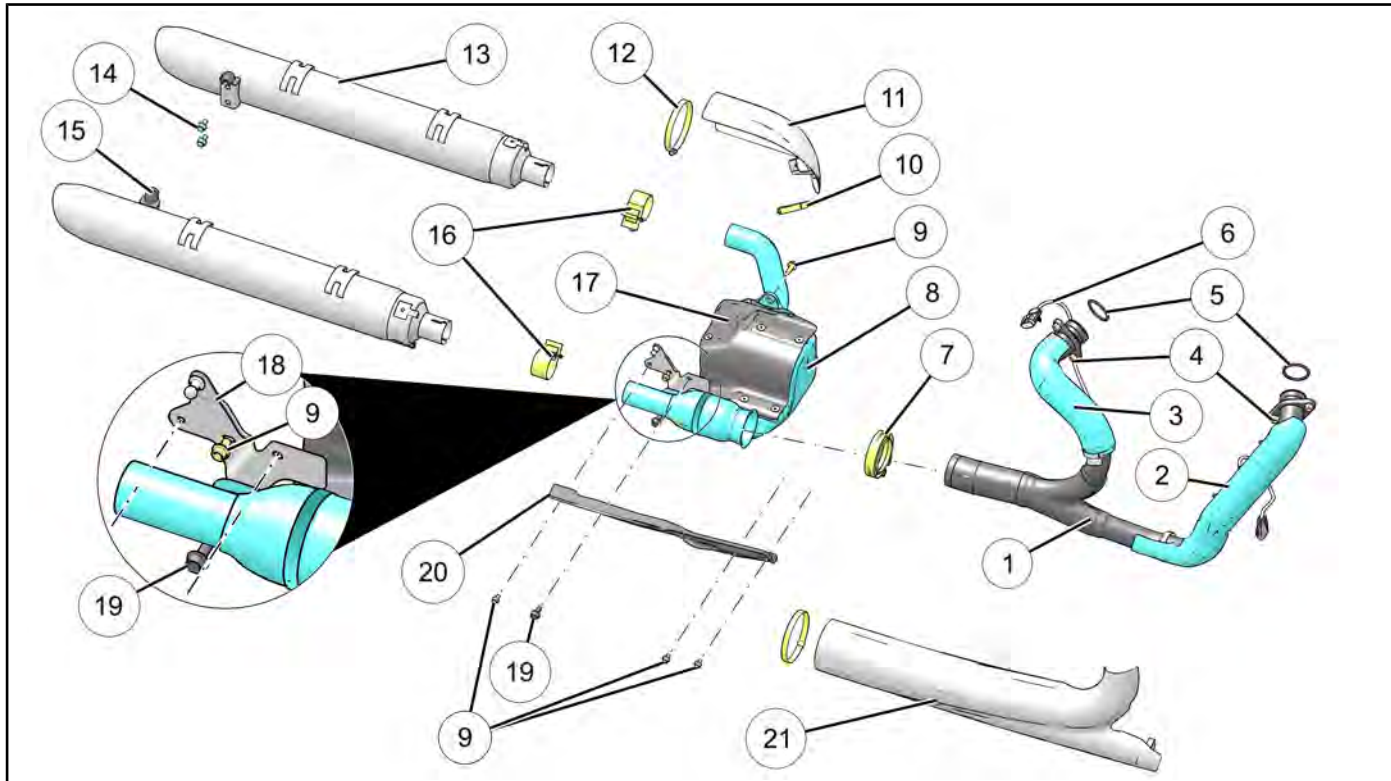
**EXHAUST**  
**EXHAUST SYSTEM**

**2020**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Headpipe	—	⑩	Exhaust Shield (Left)	—
②	Headpipe Heat Shield (Front)	—	⑫	Heat shield Clamp (Rear)	<b>31 in-lbs (3 N·m)</b>
③	Headpipe Heat Shield (Rear)	—	⑬	Muffler	—
④	Headpipe Nuts	Reference Headpipe Removal / Installation. See <b>Headpipe Removal / Installation page 3.112.</b>	⑭	Muffler Fastener	<b>18 ft-lbs (24 N·m)</b>
⑤	Headpipe Gasket	—	⑮	Frame Plug	
⑥	Oxygen Sensor	<b>14 ft-lbs (19 N·m)</b>	⑯	Muffler Clamp	<b>40 ft-lbs (54 N·m)</b>
⑦	Exhaust Clamp	<b>7 ft-lbs (9 N·m)</b>	⑰	Resonator Bracket	—
⑧	Resonator	—	⑱	Resonator Mount to Frame Fastener (M6)	<b>84 in-lbs (10 N·m)</b>
⑨	Resonator Mount to Frame Fastener (M8)	<b>18 ft-lbs (24 N·m)</b>	⑲	Resonator to Resonator Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>
⑩	Heat shield Clamp (Front)	<b>31 in-lbs (3 N·m)</b>	⑳	Exhaust Shield (Right)	—

2021-2022



3

REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Headpipe	—	⑫	Heat shield Clamp (Rear)	31 in-lbs (3 N·m)
②	Headpipe Heat Shield (Front)	—	⑬	Muffler	—
③	Headpipe Heat Shield (Rear)	—	⑭	Muffler Fastener	18 ft-lbs (24 N·m)
④	Headpipe Nuts	Reference Headpipe Removal / Installation. See <b>Headpipe Removal / Installation page 3.112.</b>	⑮	Frame Plug	—
⑤	Headpipe Gasket	—	⑯	Muffler Clamp	40 ft-lbs (54 N·m)
⑥	Oxygen Sensor	14 ft-lbs (19 N·m)	⑰	Resonator Heat Shield	—
⑦	Exhaust Clamp	7 ft-lbs (9 N·m)	⑱	Resonator Bracket	
⑧	Resonator	—	⑲	Resonator Mount to Frame / Transmission shield Fastener (M8)	18 ft-lbs (24 N·m)
⑨	Resonator Mount to Frame / Transmission shield Fastener (M6)	18 ft-lbs (24 N·m)	⑳	Transmission Shield	—
⑩	Heat shield Clamp (Front)	31 in-lbs (3 N·m)	㉑	Exhaust Shield (Right)	—
⑪	Exhaust Shield (Left)	—			



**EXHAUST SERVICE**

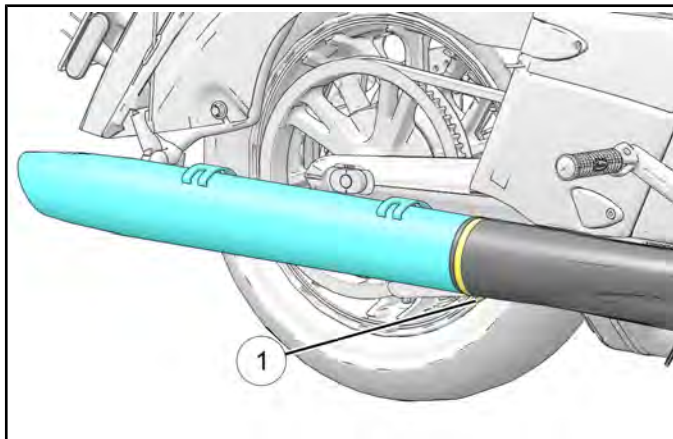
**MUFFLER REMOVAL / INSTALLATION**

**NOTICE**  
The procedure shows only one muffler being removed for simplicity. Perform the same steps for the opposite side.

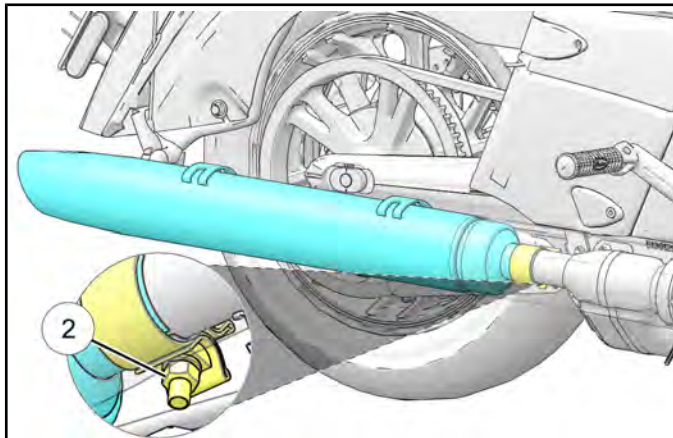
**WARNING**  
Engine and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wear insulated protective clothing or wait for components to cool sufficiently before working on the machine.

**REMOVAL**

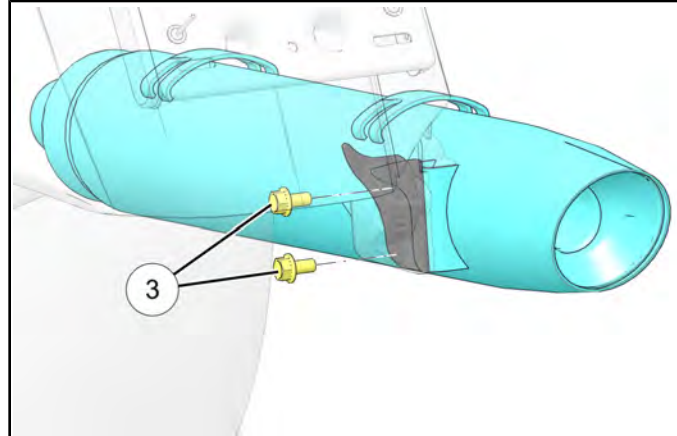
1. Remove saddlebags. See **Saddlebag Removal / Installation page**.
2. Loosen heatshield clamp ①.



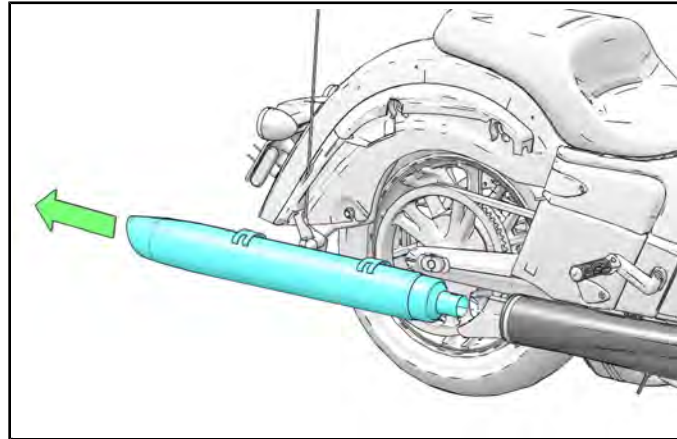
3. Loosen muffler clamp ②.



4. Remove muffler fasteners ③.



5. Remove muffler.



**INSTALLATION**

1. Installation is performed by reversing the removal procedure.

TORQUE
Muffler Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Muffler Clamp: <b>40 ft-lbs (54 N·m)</b>

TORQUE
Heatshield Clamp: <b>31 in-lbs (3 N·m)</b>

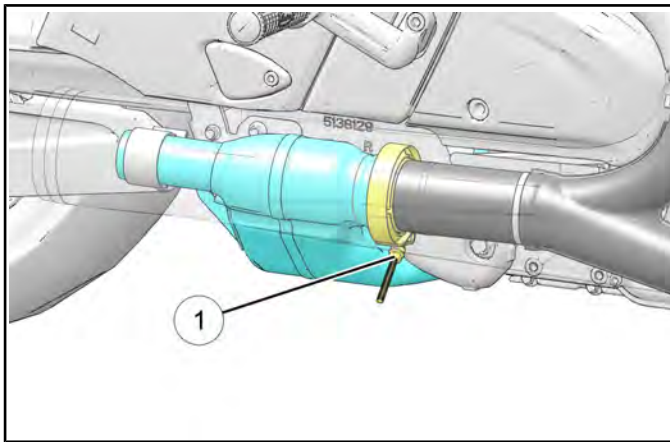
**RESONATOR REMOVAL / INSTALLATION**

**⚠ WARNING**

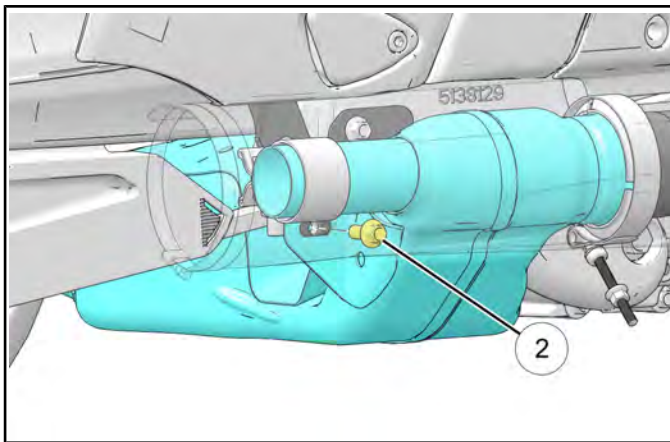
Engine and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wear insulated protective clothing or wait for components to cool sufficiently before working on the machine.

**REMOVAL**

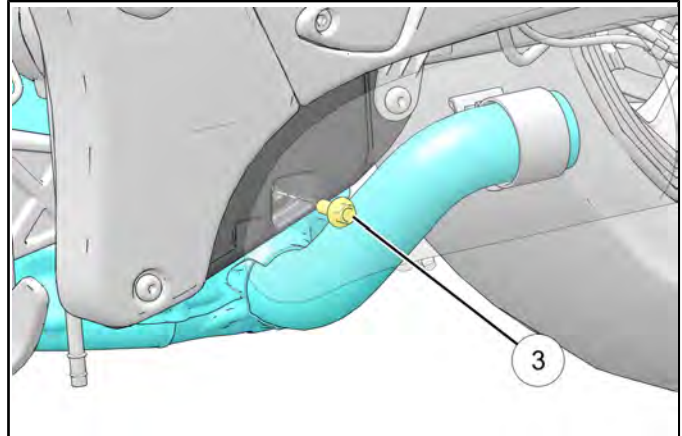
1. Remove mufflers. See **Muffler Removal / Installation page 3.110.**
2. From underneath the right heatshield, loosen the exhaust clamp ①. Note orientation of clamp for reassembly.



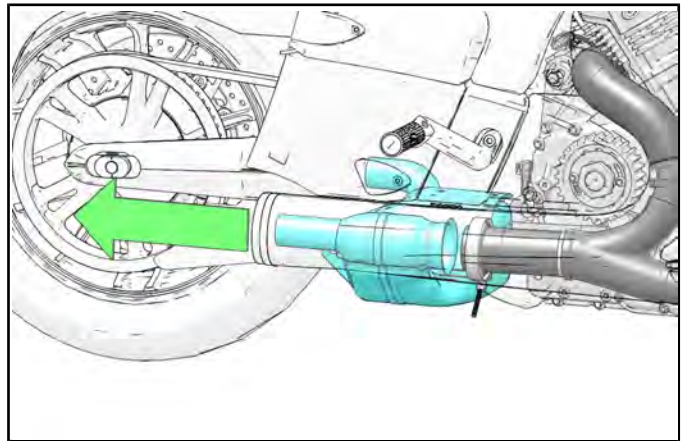
3. From the right side, remove the resonator mount fastener ②.



4. From the left side, remove the remaining resonator mount fastener ③.



5. Move the resonator rearward and remove.



**INSTALLATION**

1. **Installation is performed by reversing the removal procedure.**

TORQUE
Resonator Mount Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Exhaust Clamp <b>7 ft-lbs (9 N·m)</b>

2. Install Muffler. See **Muffler Removal / Installation page 3.110.**

3

### HEADPIPE REMOVAL / INSTALLATION

**⚠ WARNING**

Engine and exhaust components get hot and remain hot for a period of time after the engine is stopped. Wear insulated protective clothing or wait for components to cool sufficiently before working on the machine.

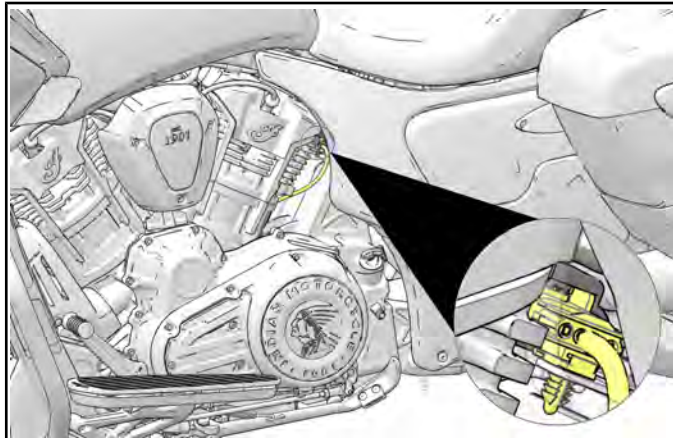
#### REMOVAL

1. Remove resonator. See **Resonator Removal / Installation page 3.111.**
2. Remove right floorboard. See **Floorboard Removal / Installation page 7.29.**

**⚠ CAUTION**

Do NOT allow the assembly to hang off of the brake line. Doing so may damage the brake line.

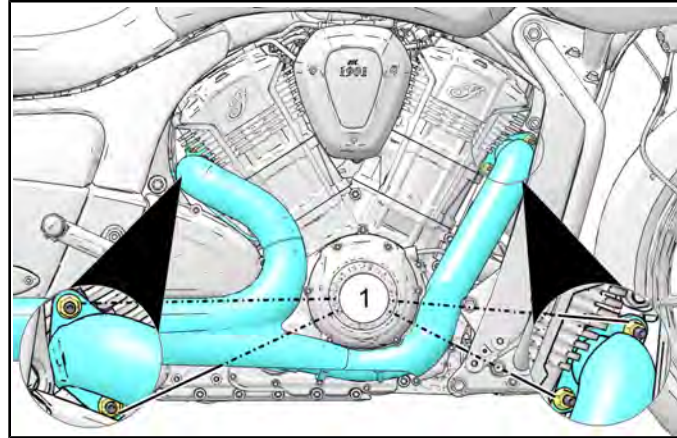
3. From the left side of the unit, disconnect the rear cylinder oxygen sensor electrical connector.



**NOTICE**

The front cylinder oxygen sensor electrical connect can be disconnected while removing the headpipe.

4. Remove headpipe nuts ①.

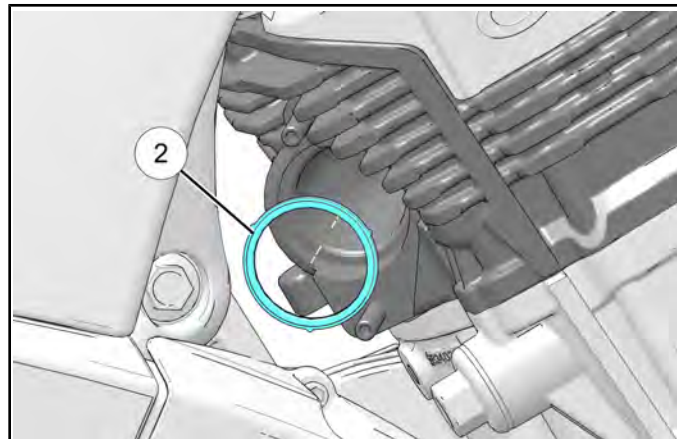


5. Carefully remove headpipe.

**IMPORTANT**

Be sure to disconnect the remaining oxygen sensor electrical connector during removal.

6. Remove and inspect the headpipe gasket ② for damage and replace if necessary.



**INSTALLATION**

- 1. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Headpipe Nuts:

- 1. Torque front header lower nut to 7 ft-lbs (9 N·m)**
- 2. Torque front header upper nut to 7 ft-lbs (9 N·m)**
- 3. Torque rear header bottom nut to 7 ft-lbs (9 N·m)**
- 4. Torque rear header top nut to 7 ft-lbs (9 N·m)**
- 5. Torque front header nuts (starting with lower) to 15 ft-lbs (20 N·m)**
- 6. Torque rear header nuts (starting with lower) to 15 ft-lbs (20 N·m)**

**TORQUE**Floorboard Bracket Fastener:  
**35 ft-lbs (47 N·m)****3**



# CHAPTER 4

## FUEL DELIVERY / EFI

4

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**GENERAL INFORMATION**  
**SERVICE NOTES**

Many hazards are present when working on or around the fuel injection system. Read and pay close attention to the following warnings and cautions when working on any component in this section.

**⚠ WARNING**

Gasoline is extremely flammable and is explosive under certain conditions. Work in a well ventilated area. Open flames, sparks and cigarettes must be kept away from gasoline.

**⚠ WARNING**

Careless handling of the control cables can result in twisting or bending of the cables. This can cause the cables to stick or bind, resulting in loss of vehicle control.

**⚠ WARNING**

The engine exhaust from this product contains chemicals known to cause cancer, birth defects or other reproductive harm.

**⚠ WARNING**

The engine and exhaust system become very hot during operation and remains hot for a period of time after the engine is shut off. Wear insulated protection for hands and arms or wait until the engine and exhaust system have cooled before performing service work.

**⚠ WARNING**

Always stop the engine and refuel outdoors or in a well ventilated area.

**⚠ WARNING**

If you get gasoline in your eyes or if you swallow gasoline, see your doctor immediately. Never try to syphon gasoline using mouth suction.

**⚠ WARNING**

Never start the engine or let it run in an enclosed area. Engine exhaust fumes are poisonous and can cause loss of consciousness and death in a short time.

**⚠ WARNING**

The battery should always be disconnected before working on the fuel system.

When replacing fuel lines, always use genuine Indian Motorcycle replacement parts. This will ensure top performance, function and durability.

Fuel lines remain under pressure at all times. Use caution when disconnecting lines for service.

Remove the fuel pump relay to disable fuel pump and crank engine to release pressure. Always depressurize the fuel system prior to service.

Cover the fuel hose connections with a clean, absorbent towel to minimize spillage while disconnecting.

**Don't overlook the basics while troubleshooting the fuel system:**

- Except where noted, views of connectors are from WIRE side of the connector.
- A battery in a low state of charge can cause problems. Be sure battery is in good condition and fully charged.
- Air leaks in intake tract / air box - check for air leaks and repair to avoid misdiagnosing the EFI system.
- Contaminated or improper fuel.
- Restricted fuel flow / filters (low fuel pressure).
- Fuel tank vent line pinched or obstructed.
- Faulty spark plug(s).
- Corroded, disconnected, or incorrectly connected wiring.
- Poor ground connections - be sure all grounds are clean and tight.
- Exhaust system restriction or improper exhaust.
- Engine mechanical condition.

4



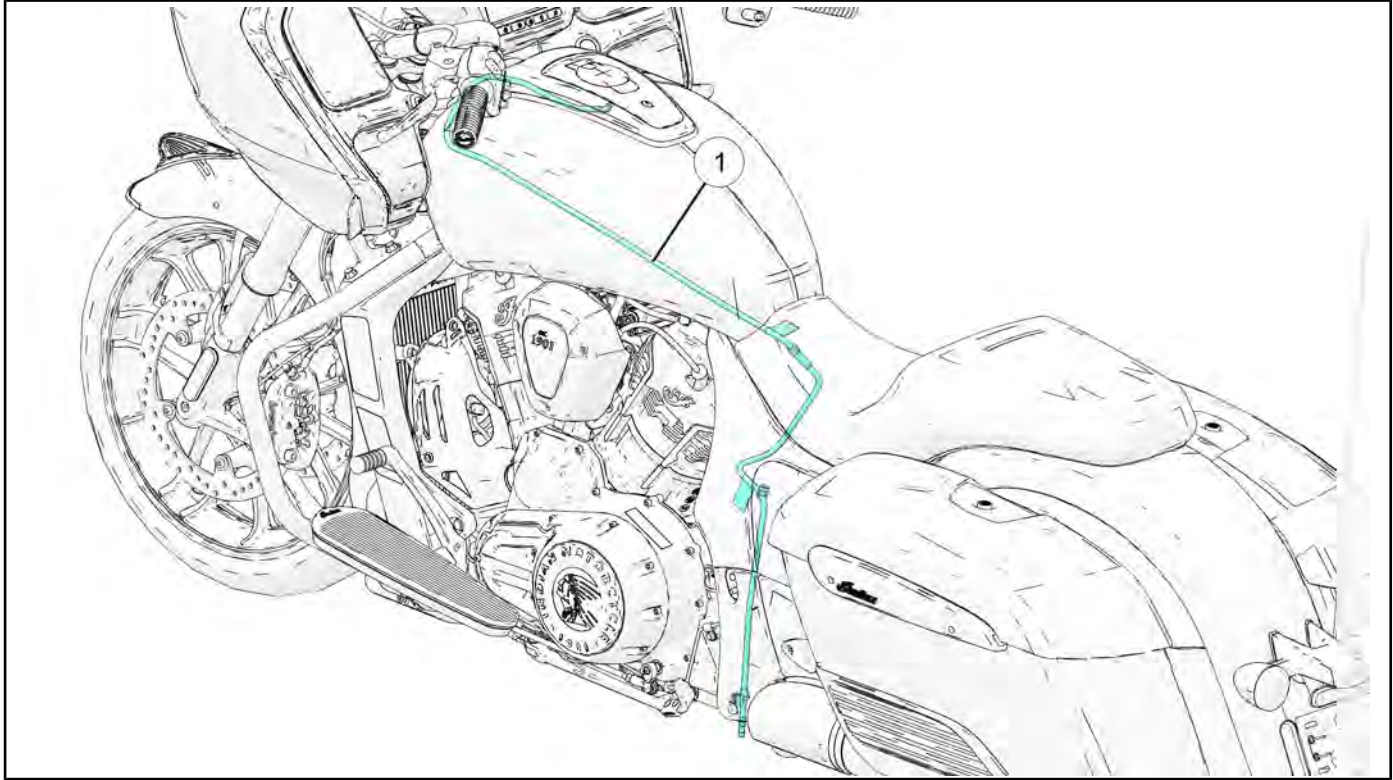
**SPECIAL TOOLS – FUEL DELIVERY / EFI**

TOOL DESCRIPTION	PART NUMBER
Electrical Tester Kit	PV-43526
Fuel Pressure Adapter	PV-48656
Fuel Pressure Gauge	PU-43506-A
Relay Bypass	PU-49466
Smartlink Module Kit	PU-47471
USB to Serial Adapter	PU-50621

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

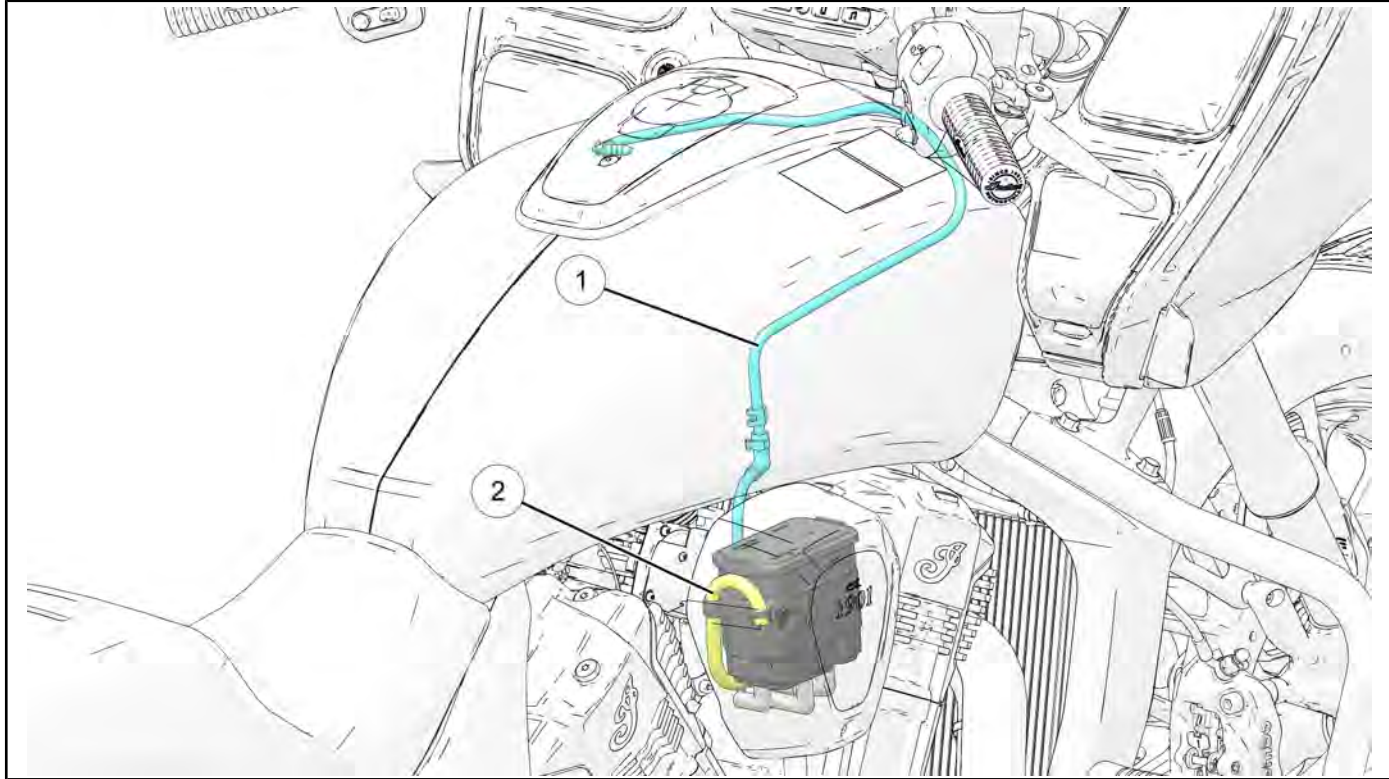
**SERVICE SPECIFICATIONS – FUEL DELIVERY / EFI**

ITEM	SPECIFICATIONS
Fuel Pump Pressure (Normal Operation)	4.00 BAR (400 kPa) (58 psi)
Idle Speed	850 rpm $\pm$ 50 rpm
Fuel Pump Amp Draw (Normal Operation)	3–5 Amps
Recommended Octane	91 Octane Minimum
Injector Resistance	11.4 - 12.6 Ohms

**FUEL DELIVERY / EFI MAINTENANCE****FUEL TANK VENT INSPECTION****49 STATE**

1. Inspect fuel tank vent line ① in accordance with periodic maintenance schedule and any time fuel tank has been removed and installed. Be sure the line is clear and not pinched or kinked, and that all connections are tight.

**50 STATE / INTL**

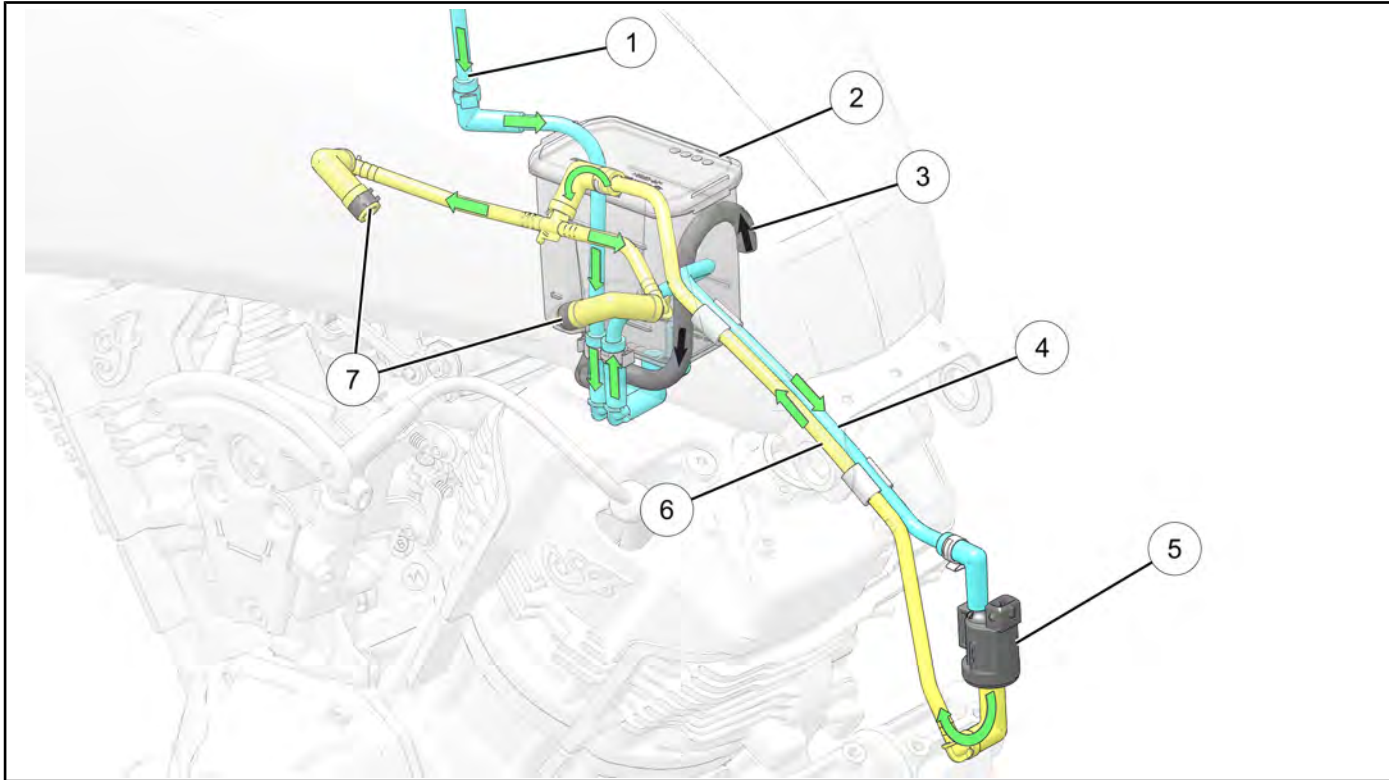


1. Inspect the Fuel vent to canister line ① in accordance with periodic maintenance schedule and any time fuel tank has been removed and installed. Be sure the line is clear and not pinched or kinked, and that all connections are tight. Inspect the carbon canister vent line ②. Ensure the line is clear and not pinched or kinked.

**EVAPORATIVE EMISSION CONTROL SYSTEM – 50 STATE / INTL**

**NOTICE**

The fuel tank vent line is routed to a carbon canister where the fuel vapor is stored until specific operating parameters are met and the ECM opens the purge valve. Fuel vapor is then routed out of the carbon canister, through the purge valve and into the throttle body for combustion. Inspect all EVAP lines for abrasion or wear. Check that all connections for both vent and canister purge systems are securely attached.

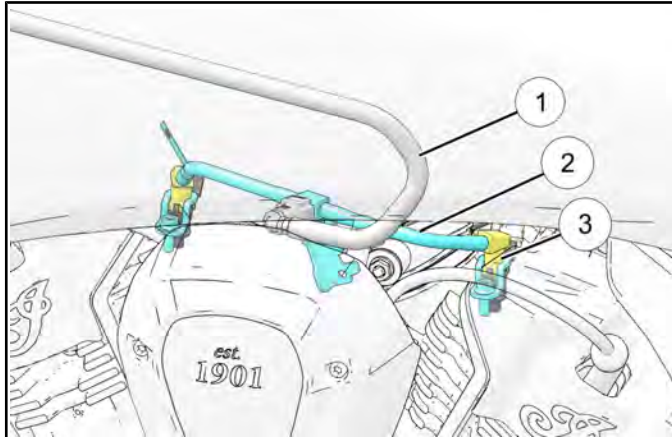


4

NUMBER	PART DESCRIPTION
①	Fuel Vent to Canister
②	Carbon Canister
③	Carbon Canister Vent Line
④	Carbon Canister to Purge Valve Line
⑤	Purge Valve
⑥	Purge Valve to Throttle Body Line
⑦	Purge Line to Throttle Body

## FUEL RAIL INSPECTION

1. The fuel hose (fuel rail) can be found behind the V-cover on the LH side of the motorcycle.
2. Inspect fuel line ① and fuel rail ② for deterioration, damage, leakage, or kinked areas. Inspect fuel line-to-fuel injector connection ③ for signs of leakage.



3. Replace any components that fail inspection with genuine Indian Motorcycle replacement parts.

**⚠ WARNING**

The fuel lines exiting fuel pump are subjected to high pressure. Replace with genuine Indian Motorcycle replacement parts to reduce the possibility of fuel line failure. Be sure fuel lines are routed properly and do not come in contact with sharp or hot objects, or anything that may cause wear or damage.

**SERVICE PRECAUTIONS**  
**EFI SYSTEM PRECAUTIONS**

*NOTICE*

While electronic fuel injection is durable and reliable, the components can be damaged or problems may occur if the following precautions are not taken.

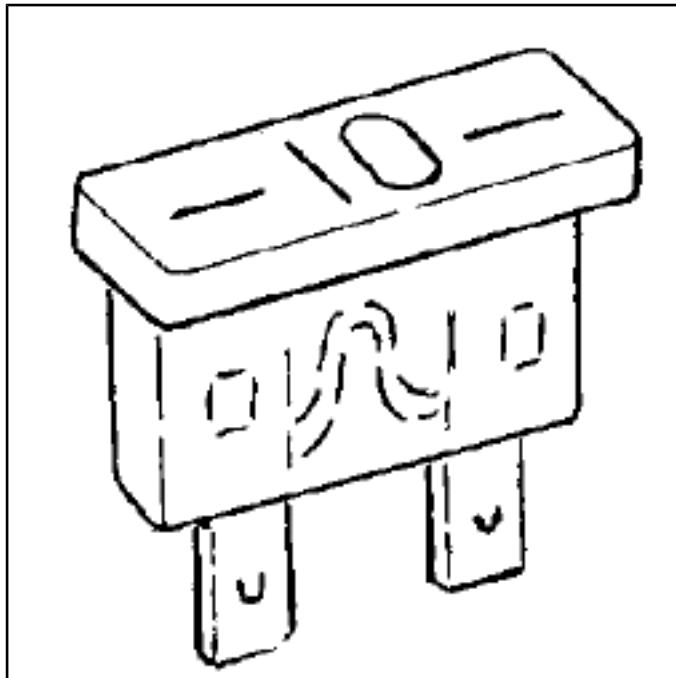
It is not advisable to “jump start” the machine with another battery. Although problems are unlikely to occur if everything is done carefully, the electrical component could be damaged.

Never disconnect the battery while the engine is running.

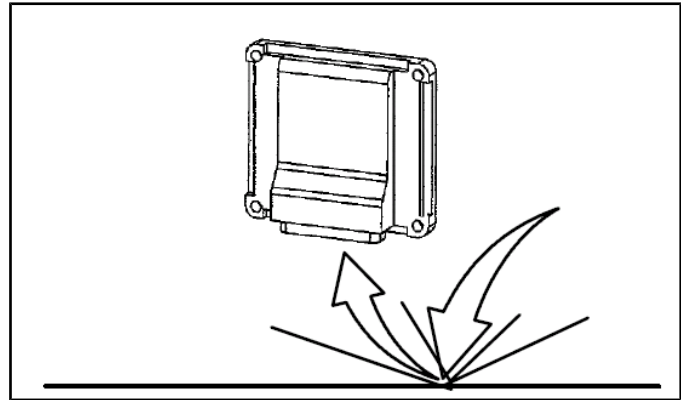
When connecting and disconnecting the battery cables refer to Electrical chapter for complete battery connection and charging information. See **Battery Installation page 10.6**.

Make sure that the ignition is powered down before connecting and disconnecting connections. Best practice is to disconnect the battery before connecting or disconnecting the electrical connections.

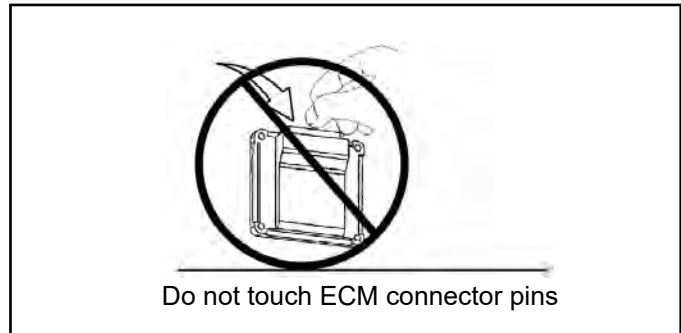
Fuses and circuit breakers protect critical electrical components and circuits. Never replace the fuse with a larger value fuse or “jumper” the fuse with wire, aluminum foil or any other means. Always investigate the cause of the problem and repair before replacing the fuse.



The ECM, VCM and sensors are sensitive pieces of electronic equipment. Dropping or hitting them may cause irreparable damage.



Static electricity can damage the electronic controllers beyond repair. The human body can easily store enough static electricity to damage sensitive electronic components. Before working with any components of the Fuel Injection system, ground yourself to dissipate any static charge. Also take care not to touch any of terminal pins on the ECM.



**Anti-static wrist strap PV-43541**

*NOTICE*

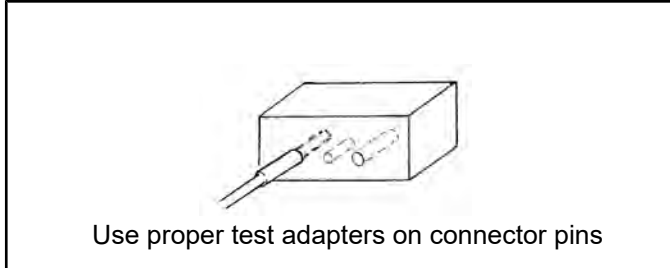
Some tests require probing of the ECM wiring harness connector. Do not touch or probe the exposed pins on the ECM. Static electricity from your body or the meter can easily damage the ECM.



## FUEL DELIVERY / EFI

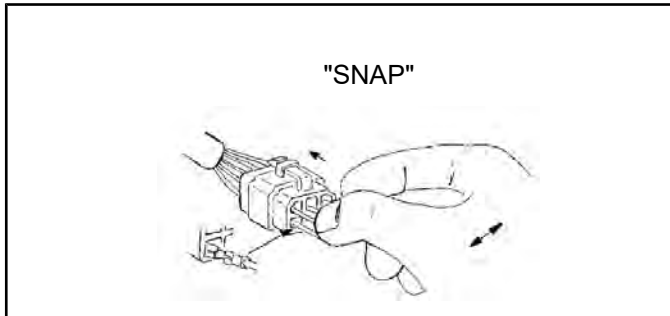
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Always use the proper adapter from the Connector Test Adapter Kit when probing the terminals. Most of the connectors are sealed and cannot be back probed. Be extremely careful not damage the connectors by forcing meter probes into the connectors.



### Connector test adapter kit PV-43526

Poor connections are the most common cause of Electronic Fuel Injection malfunctions. Inspect connector and wiring connections carefully during troubleshooting.



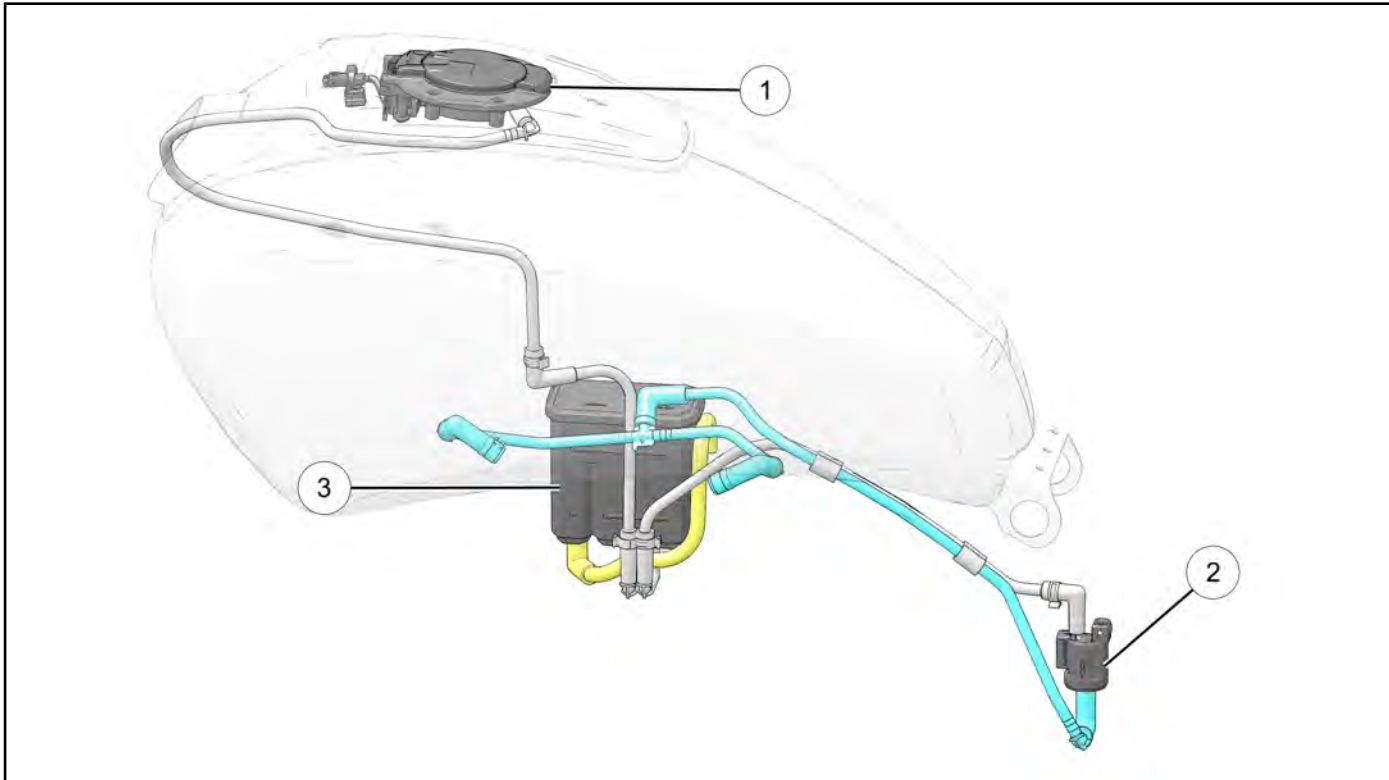
Carefully inspect the connections of the failed circuit before doing any other troubleshooting steps. Wire terminals should be corrosion free and fully seated into the connectors. Connector should snap together and lock.

**EVAP SYSTEM**  
**EVAP SYSTEM OVERVIEW**

**IMPORTANT**

Only 50 state and International models are equipped with an EVAP system.

An evaporative emission control system is a system that captures fuel tank vapors that would otherwise be vented to atmosphere. The EVAP system components consist of:



4

REF	DESCRIPTION
①	<b>Fuel Cap:</b> It is important to note that Indian Motorcycle does not use an enhanced EVAP control system. This means the system does not detect a gross leak, or restrictions in the EVAP system such as a missing or loose fuel cap. No check engine light will illuminate if the fuel cap is loose or missing. The unit will detect a fuel cap that is not closed when the engine is running or power is on.
②	<b>Purge Valve:</b> The purge valve is located near the ECU in the underseat compartment. There are two hose assemblies that connect to the throttle bodies. The purge valve must be installed with the arrow pointing the direction the vapor flows toward the hose assembly that terminates at the engine.
③	<b>Carbon Canister:</b> The carbon canister is mounted on the right side of the unit. Fuel vapors from the tank are routed to and absorbed by the canister's carbon granules. When the vehicle is running, vapors are drawn into the engine by intake vacuum. The purge valve controls the movement of the vapors from the canister to the throttle body.



### EVAP CONDITIONS AND SYMPTOMS

The following conditions and symptoms should be taken into consideration when working on a vehicle equipped with an EVAP system:

- Cracks in an EVAP hose or canister may cause
  - Fuel Odor
  - Trouble codes being set

**NOTICE**

A loose fuel cap will NOT trigger a trouble code, but may cause a fuel odor or notification on Ride Command screen.

Excessive hydrocarbon emission may be caused by any of the following:

- Ignition misfire
- Improper ignition timing
- Excessively lean or rich air/fuel mixture
- Low compression
- Worn valves or guides
- Worn cylinder or piston rings
- Vacuum leaks
- Dirty fuel injector
- Defective sensor or damaged sensor wiring

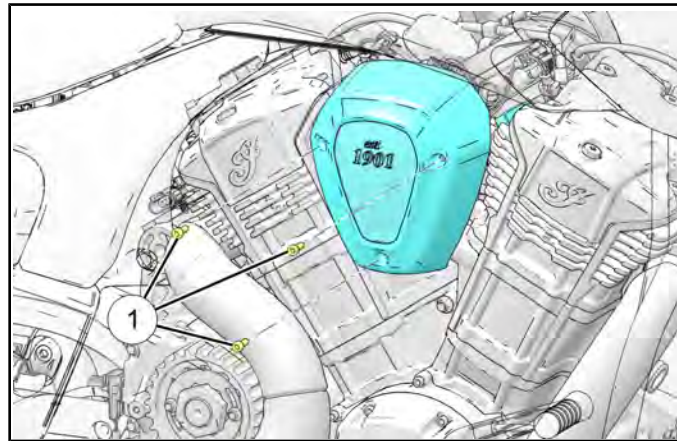
Excessive carbon monoxide emissions may be caused by any of the following:

- Rich air/fuel mixture
- Dirty air filter
- Leaking fuel injectors
- Fuel pressure too high / bad regulator
- Plugged or restricted carbon canister vent line

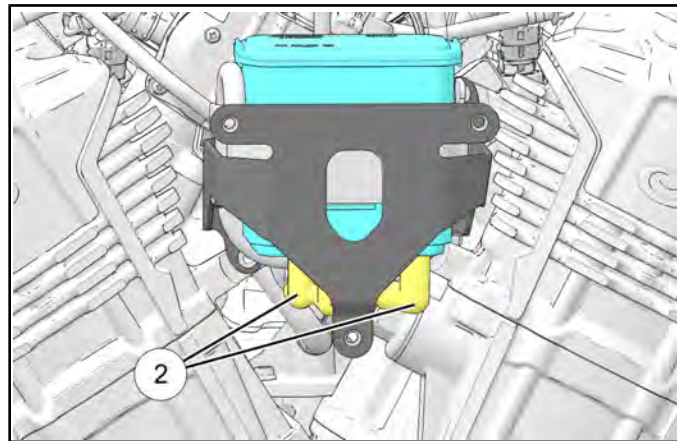
### CARBON CANISTER REMOVAL / INSTALLATION

#### REMOVAL

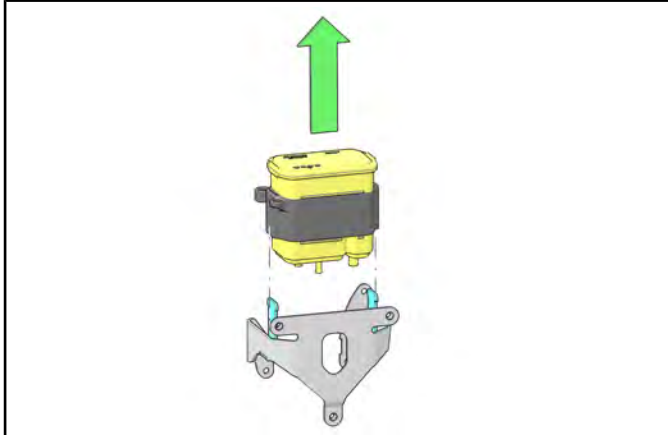
1. Remove fuel tank. See **Fuel Tank Removal (2020)** page 4.23.
2. Remove right side v-cover by removing its fasteners ①.



3. Disconnect vent lines ②.



- Remove the canister from v-cover bracket by sliding rubber mount off of bracket tabs. The rubber mount should remain attached to the canister.



**INSTALLATION**

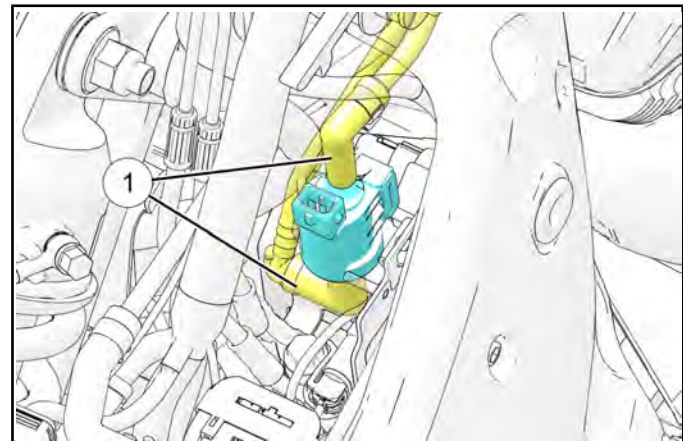
- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
V-Cover Fastener: <b>84 in-lbs (10 N·m)</b>

**PURGE VALVE TESTING / REPLACEMENT**

**REPLACEMENT**

- Remove right side upper side cover. See **Side Cover (Upper), Removal / Installation page 7.27.**
- Remove seat. See **Seat Removal / Installation page 7.32.**
- Remove ECM. See **ECM Removal / Installation page 4.53.**
- Unplug purge valve electrical connector.
- Disconnect the hoses connected to the purge valve ① and remove from bracket.

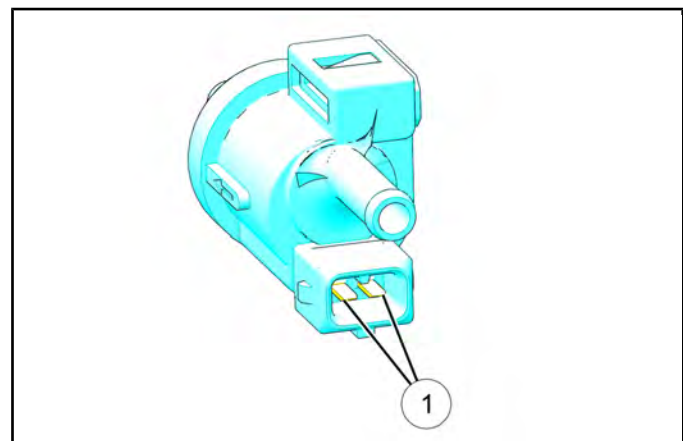


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- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TESTING**

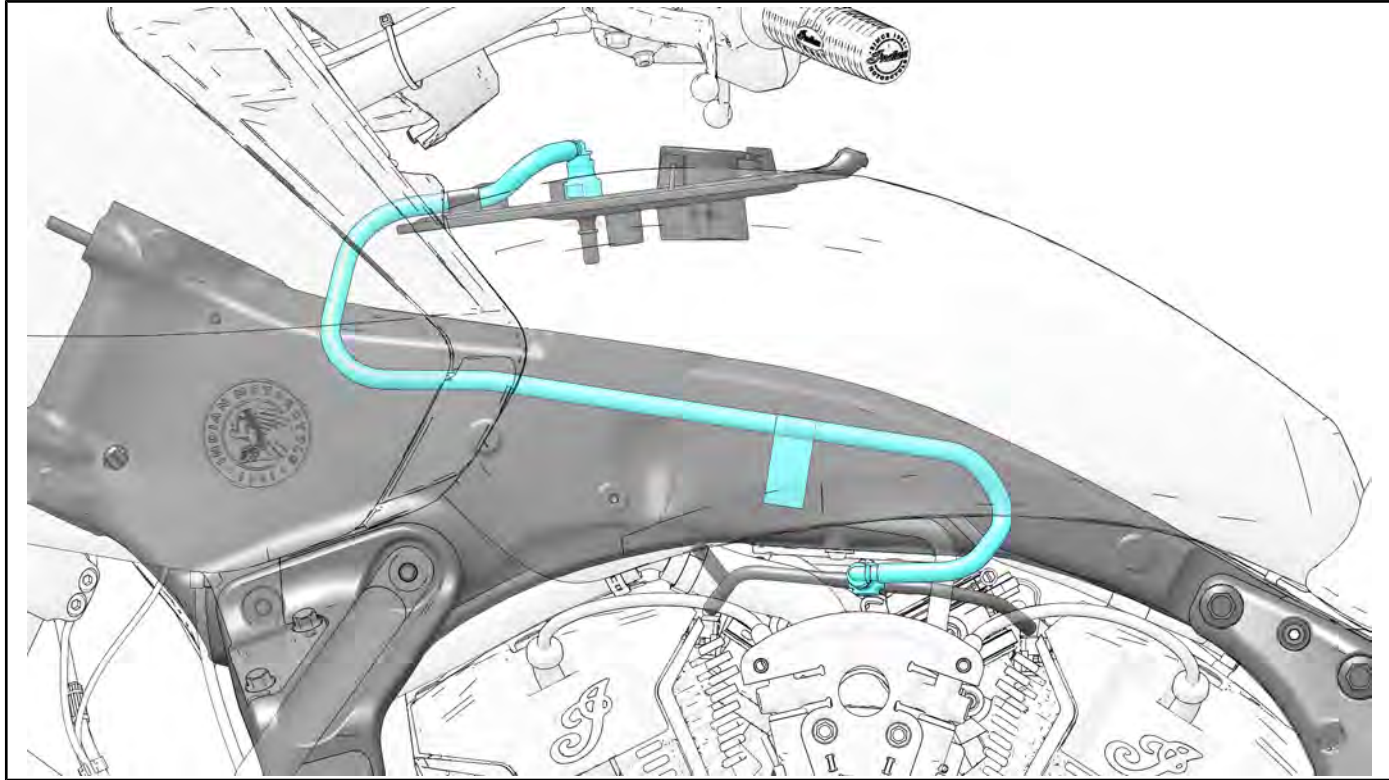
- Use a multi meter to test the resistance of the purge valve between the terminals ①.



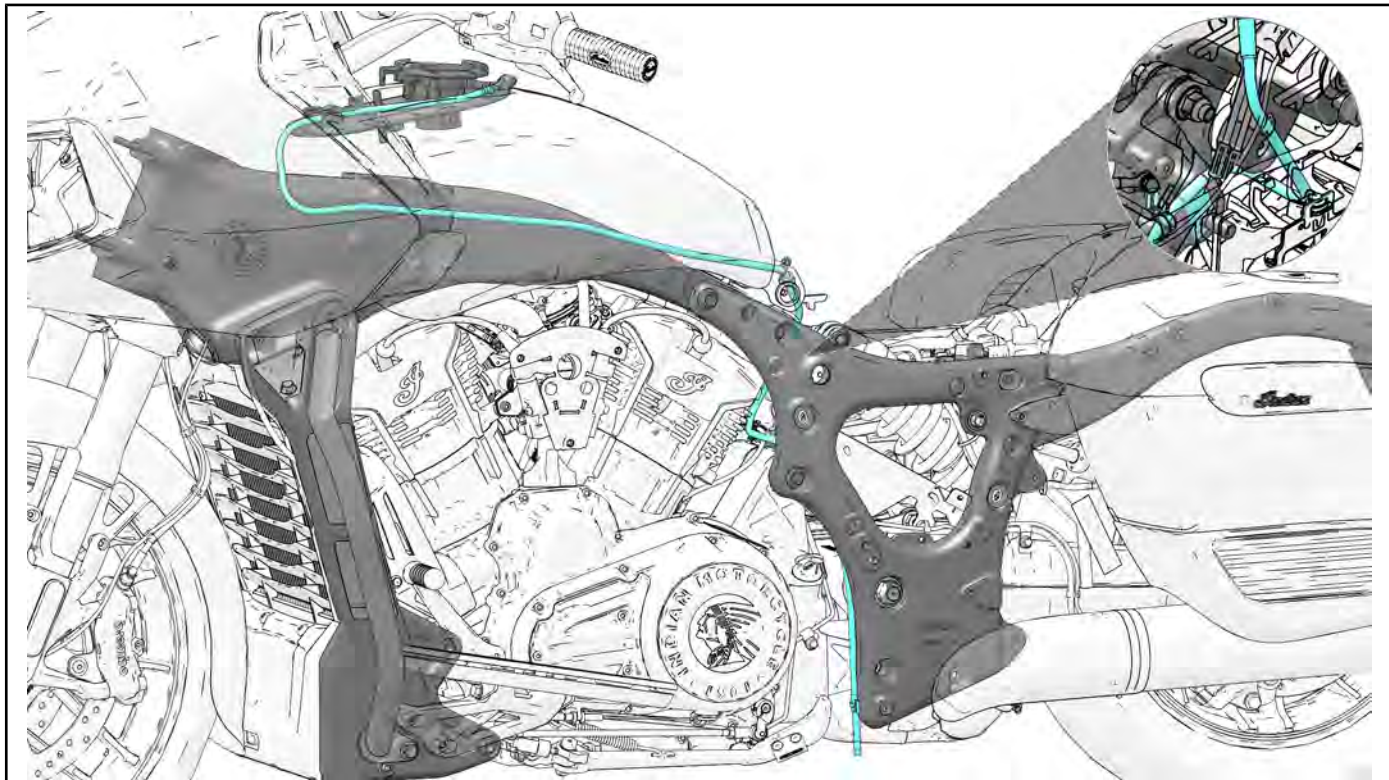
Purge Valve Resistance Specification: <b>17 +/- 2 OHMS</b>
---

**ASSEMBLY VIEWS**  
**FUEL LINE ROUTING - 49 STATE**

**FUEL LINE ROUTING**

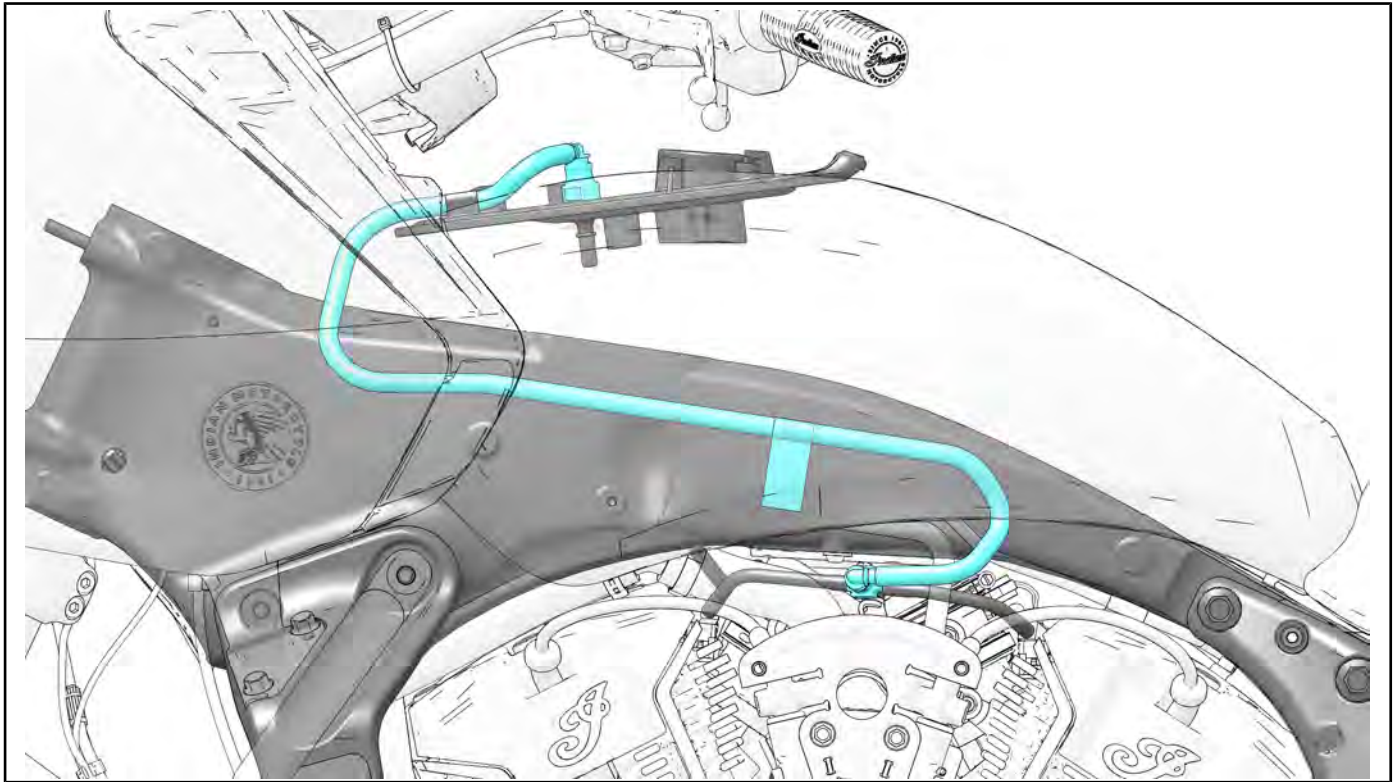


**FUEL VENT LINE ROUTING**



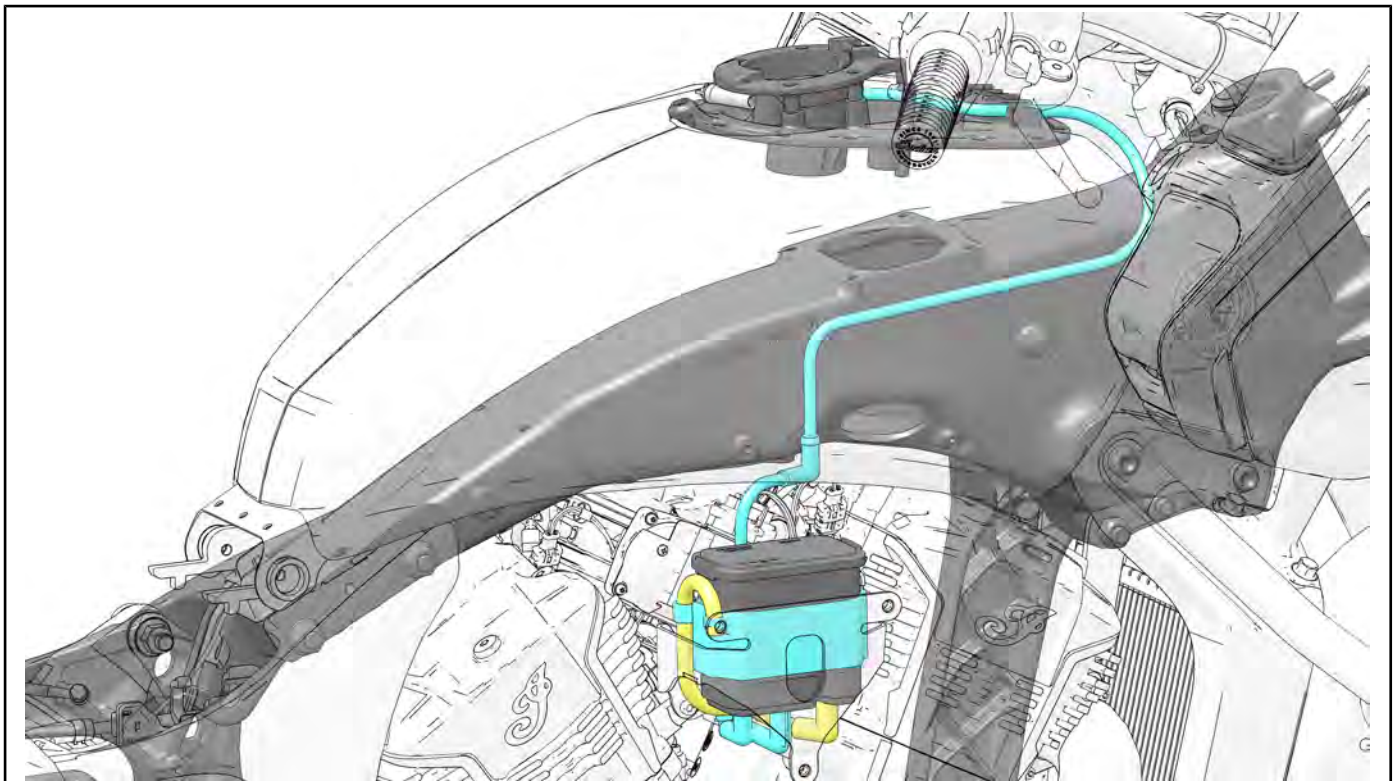
**FUEL LINE ROUTING - 50 STATE**

**FUEL LINE ROUTING**

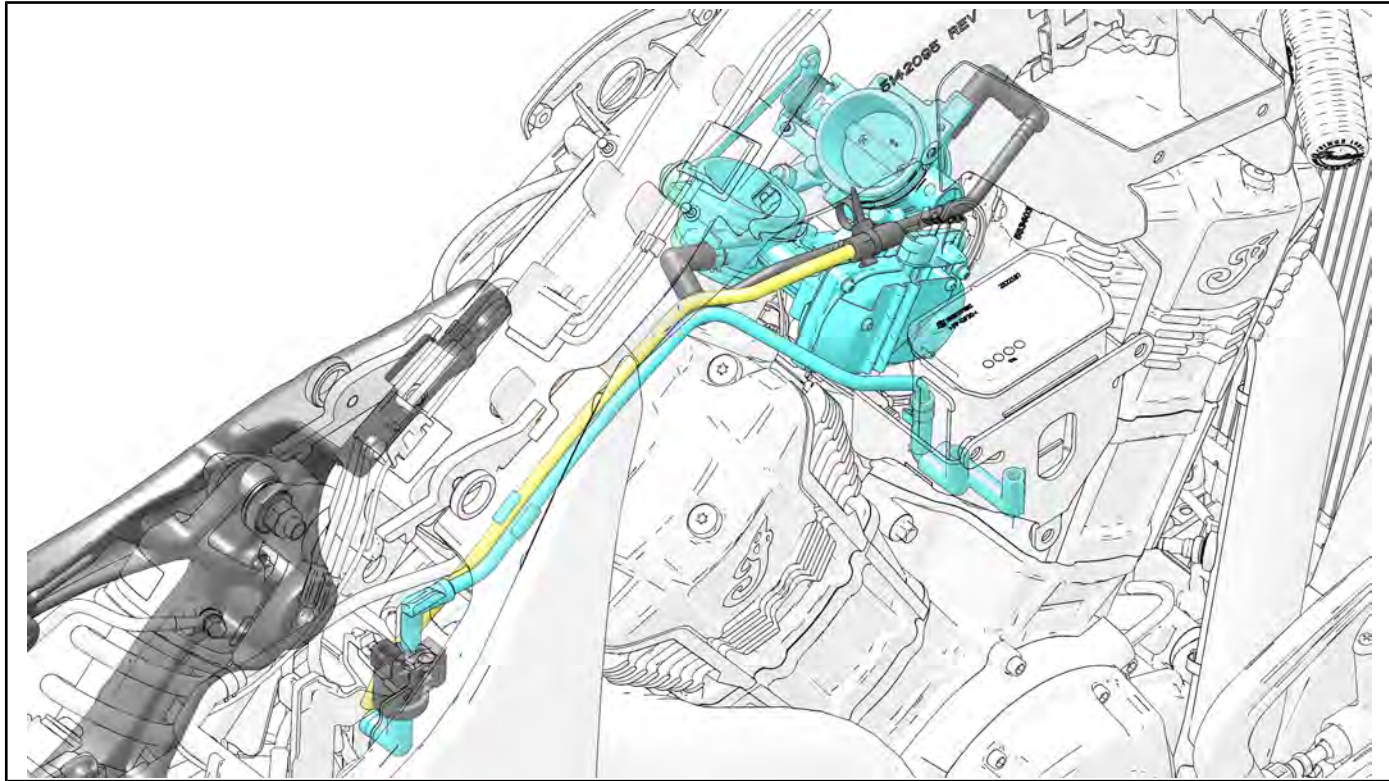


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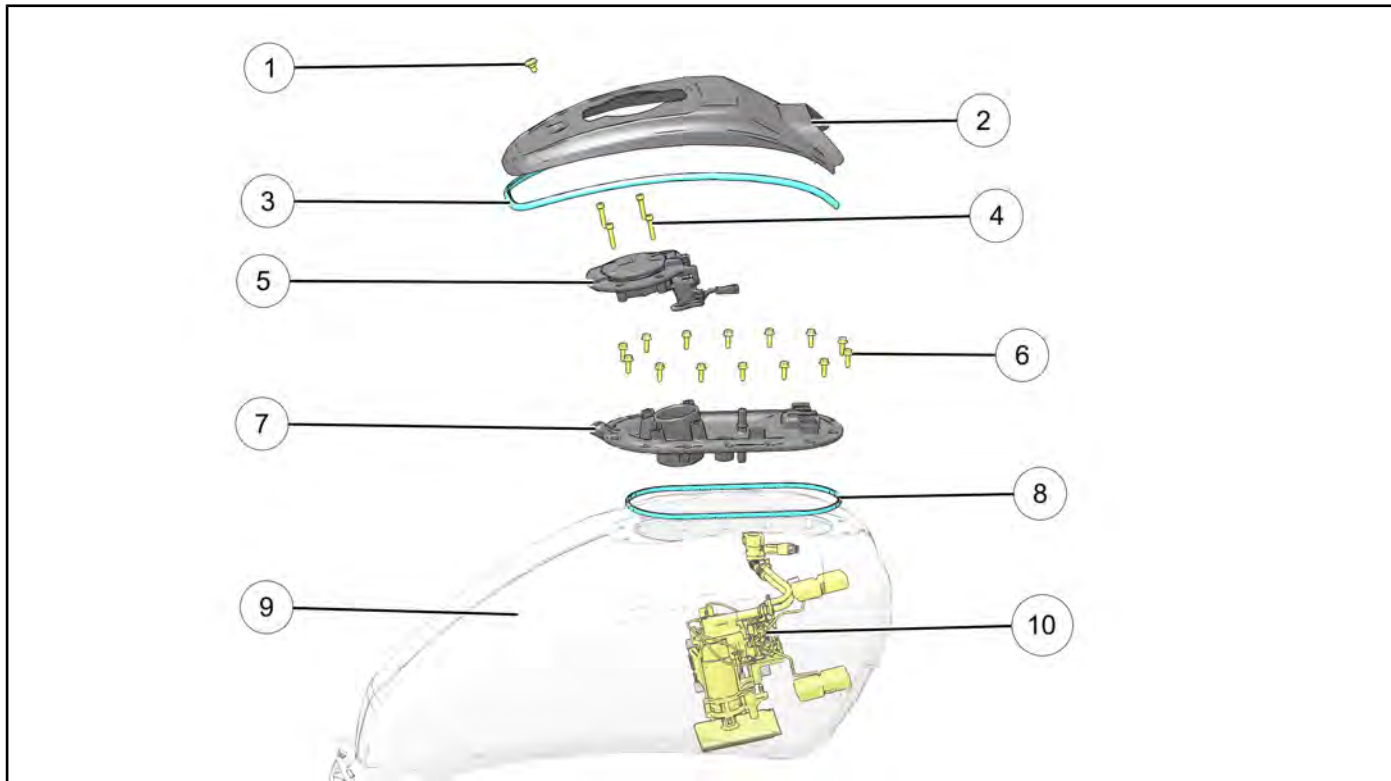
**FUEL VENT LINE ROUTING**



**FUEL PURGE LINE ROUTING**



**FUEL SYSTEM**  
**49 / 50 STATE**



4

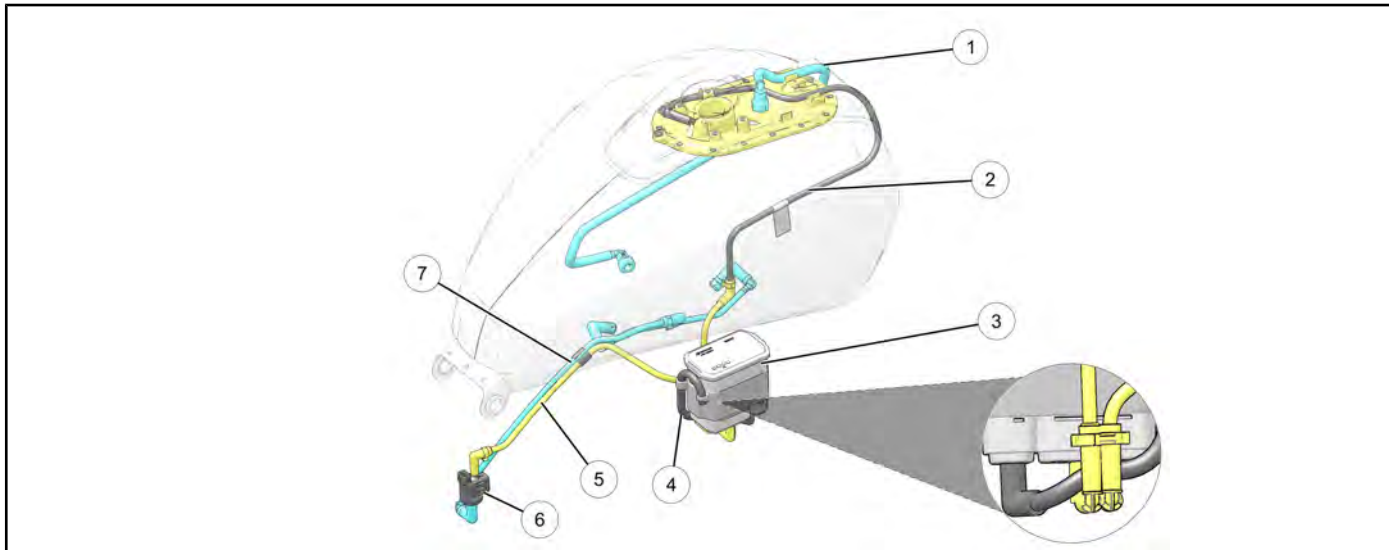
REF	DESCRIPTION	TORQUE
①	Fuel Tank Console Fastener	<b>84 in-lbs (10 N·m)</b>
②	Fuel Tank Console	—
③	Console Trim	—
④	Fuel Cap Fastener	<b>44 in-lbs (5 N·m)</b>
⑤	Fuel Cap	—
⑥	Fuel Access Plate Fastener	<b>44 in-lbs (5 N·m)</b>
⑦	Fuel Access Plate	—
⑧	Fuel Access Plate Seal	—
⑨	Fuel Tank	—
⑩	Fuel Pump Assembly	—

**49 STATE**



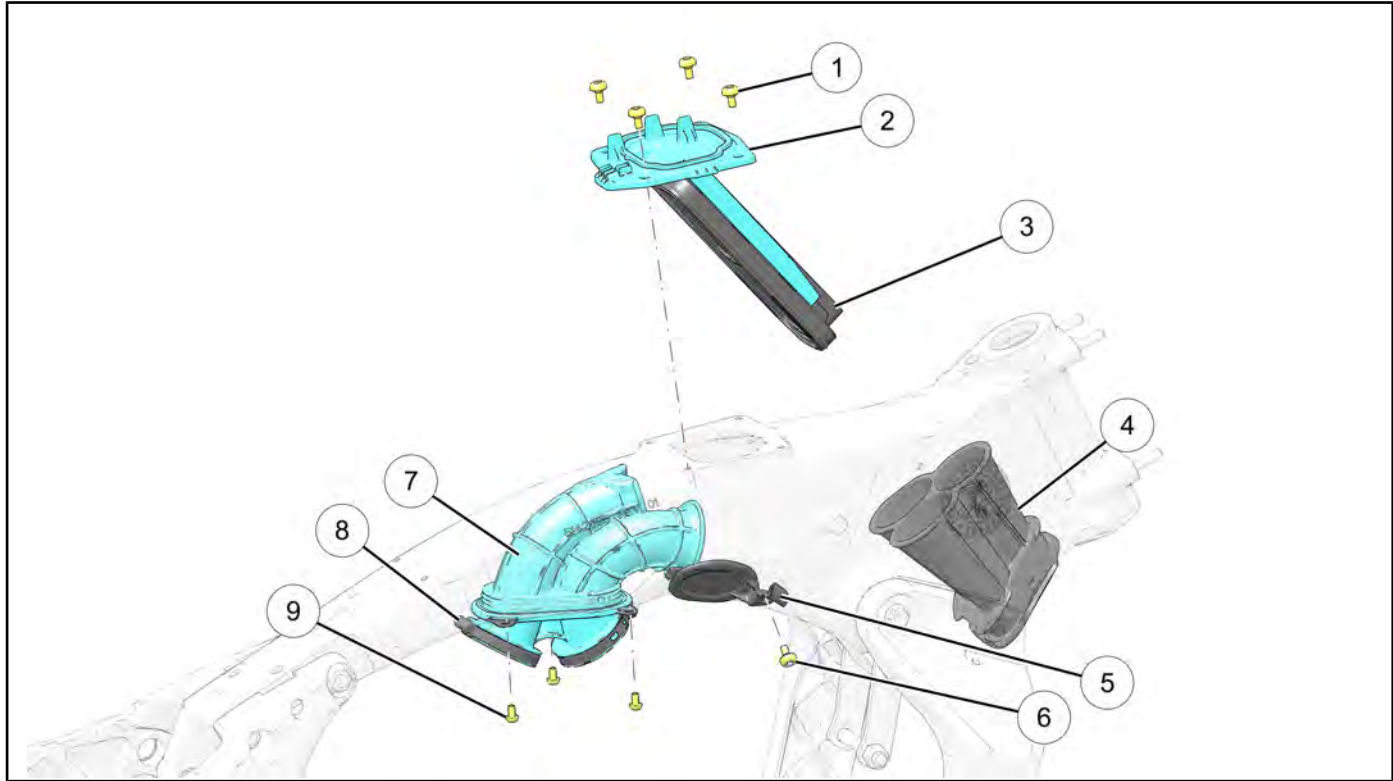
REF	DESCRIPTION
①	Fuel Line
②	Fuel Vent Line

**50 STATE**



REF	DESCRIPTION
①	Fuel Line
②	Fuel Vent to Canister
③	Carbon Canister
④	Carbon Canister Vent Line
⑤	Carbon Canister to Purge Valve Line
⑥	Purge Valve
⑦	Purge Valve to Throttle Body Line

**AIR BOX**

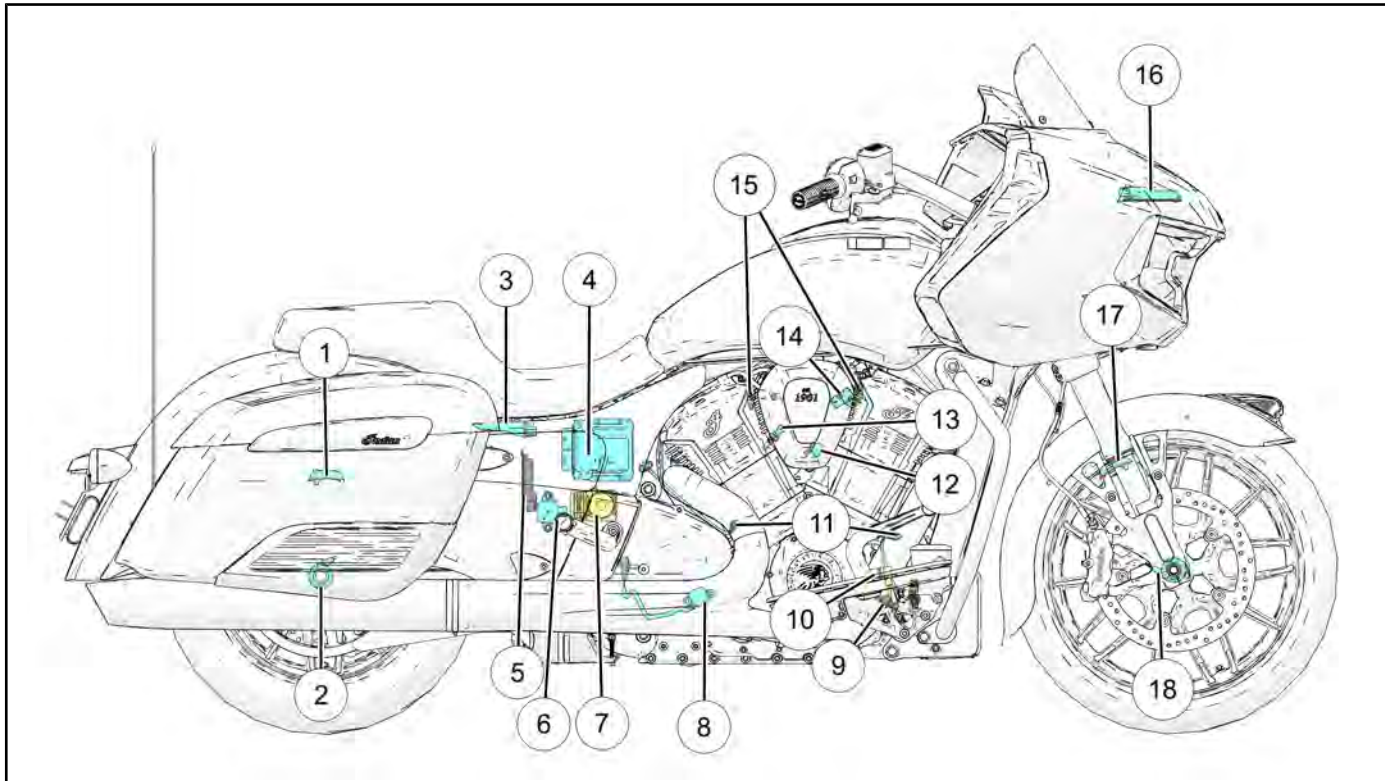


4

REF	DESCRIPTION	TORQUE
①	Airbox Filter Cover Fastener	<b>84 in-lbs (10 N·m)</b>
②	Airbox Filter Cover	—
③	Air Filter	—
④	Air Inlet Tube	—
⑤	Airbox Hatch Cover	—
⑥	Airbox Hatch Cover Fastener	<b>84 in-lbs (10 N·m)</b>
⑦	Throttle Body Inlet Adapter	—
⑧	Hose Clamp	<b>26 in-lbs (3 N·m)</b>
⑨	Throttle Body Inlet Adapter Fastener	<b>84 in-lbs (10 N·m)</b>



**SENSORS - POWERTRAIN MANAGEMENT**



REF	DESCRIPTION	REF	DESCRIPTION
①	TPMS (Tire Pressure Monitoring System) Sensor (Rear)	⑩	Crank Position Sensor
②	Wheel Speed Sensor (Rear)	⑪	Oxygen Sensor
③	WCM	⑫	Knock Sensor
④	ECU	⑬	Coolant Temperature Sensor
⑤	VCM 1	⑭	T-MAP
⑥	IMU	⑮	Fuel Injector
⑦	ABS Module	⑯	VCM 2
⑧	Gear Position Sensor	⑰	TPMS (Tire Pressure Monitoring System) Sensor (Front)
⑨	Oil Pressure Switch	⑱	Wheel Speed Sensor (Front)

## FUEL DELIVERY SERVICE INTAKE MANIFOLD, REMOVAL / INSTALLATION

### IMPORTANT

Due to the rigidity of the intake manifold and inlet adaptor material, it is easier to remove the throttle body and the intake manifold at the same time.

1. To remove the intake manifold. Refer to **Throttle Body Removal / Installation page 4.63**.

## FUEL PUMP PRESSURE INSPECTION

### ⚠ WARNING

Gasoline is extremely flammable. Work in a well ventilated area. Open flames, sparks and cigarettes must be kept away from gasoline. **KEEP GASOLINE OUT OF THE REACH OF CHILDREN!**

### ⚠ CAUTION

Wear safety glasses or a face shield when working around the fuel system to protect your eyes.

1. Depressurize fuel system and disconnect fuel line at fuel rail. See **Fuel System Depressurization page 4.22**.
2. Install fuel pressure gauge **PU-43506-A** and fuel pressure gauge adapter **PV-48656**.
3. Start engine and record fuel pressure (or press the power switch ON and cycle the Engine Stop switch to read pressure when pump cycles for 2-3 seconds).

Minimum Fuel Pressure:  
**3.50 BAR (350 kPa) (51 psi)**

4. Turn ignition switch off. Disconnect gauge adapter and re-connect fuel line.

### FUEL PRESSURE TROUBLESHOOTING

FUEL PRESSURE TOO LOW: INSPECT	FUEL PRESSURE TOO HIGH: INSPECT
<ul style="list-style-type: none"> <li>* Low fuel level (add fuel)</li> <li>* Pump not running (Fuel pump or circuit malfunction)</li> <li>* Restricted fitting, fuel supply line, or gauge adapter hose</li> <li>* Fuel line kinked or restricted (from tank fitting to rail)</li> <li>* Fuel line leaking (leaking air in or fuel out)</li> <li>* Vent restriction</li> <li>* Plugged fuel pickup filter (located in fuel tank)</li> <li>* Pressure regulator malfunction (located on pump)</li> <li>* Fuel pump malfunction (Pump should run for about 2 seconds the instant that the power button or Engine Stop switch are turned ON.</li> </ul>	<ul style="list-style-type: none"> <li>* Plugged fuel return (in tank on pressure regulator)</li> <li>* Pressure regulator malfunction (located on pump).</li> </ul>

## FUEL SYSTEM DEPRESSURIZATION

**⚠ CAUTION**

Fuel lines remain under pressure at all times. Use caution when disconnecting lines for service. Always depressurize the fuel system prior to service.

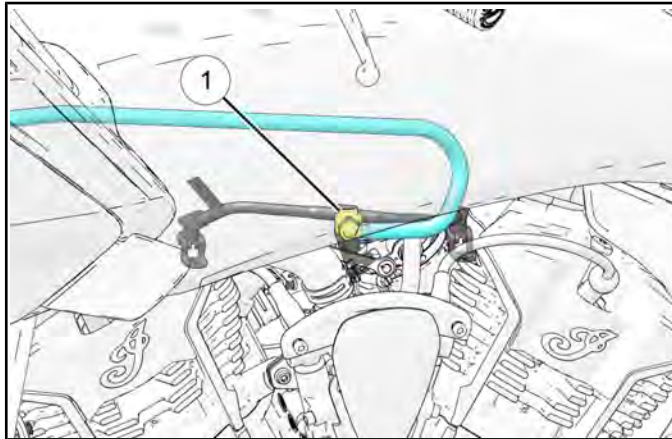
**⚠ WARNING**

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Wear eye protection.

1. Disconnect the fuel pump relay and crank engine for 5 seconds to release fuel pressure.
2. Wrap a clean shop towel around fuel line fitting ①.
3. Squeeze both release buttons (one on each side of fitting) and hold. Gently slide fitting straight off fuel rail.

**⚠ CAUTION**

Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.



4. Cover fuel fittings to keep debris out.

## FUEL TANK REMOVAL (2020)

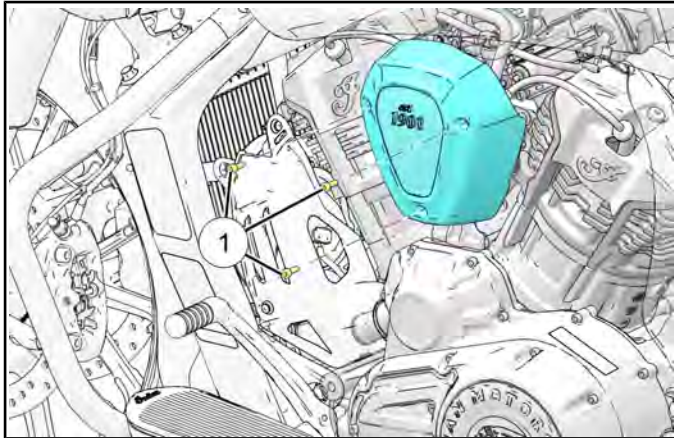
### 49 STATE

**⚠ WARNING**

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Protect fuel tank finish when removing, storing, and installing tank.

Be prepared to place the fuel tank in a secure location with a drain pan positioned to catch any fuel that may leak or drip from disconnected hoses or fittings.

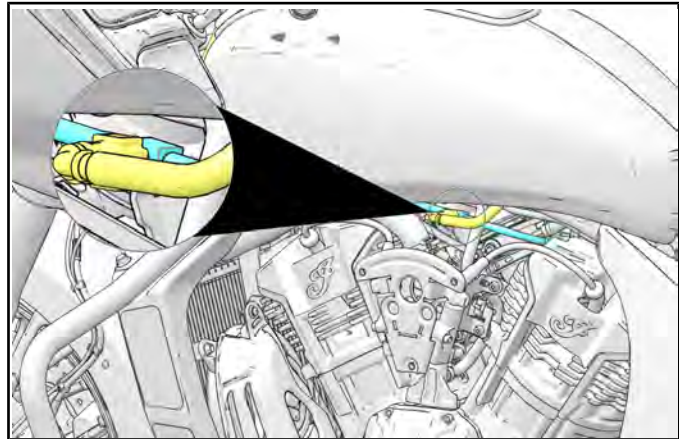
1. Depressurize fuel system. See **Fuel System Depressurization** page 4.22.
2. Remove seat. See **Seat Removal / Installation** page 7.32.
3. Remove left side v-cover by removing its fasteners ①.



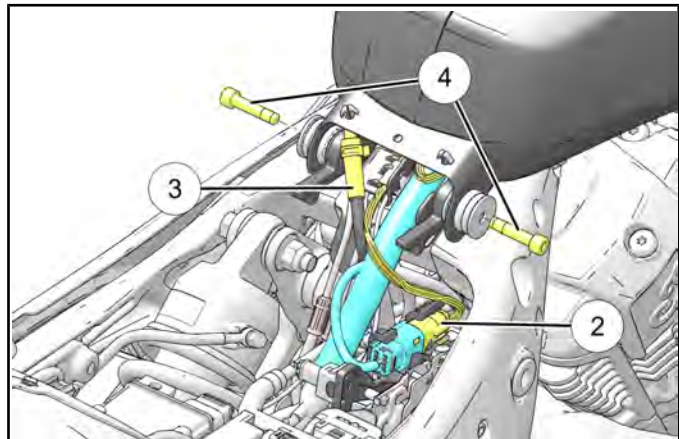
4. Disconnect the fuel line from the fuel rail by squeezing both release buttons and gently sliding off the fuel rail.

**⚠ CAUTION**

Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.



5. Disconnect the fuel pump electrical connector ②



6. Disconnect fuel vent line ③.
7. Remove the fuel tank fasteners ④.
8. Lift rear of tank upward and pull rearward to remove.

4

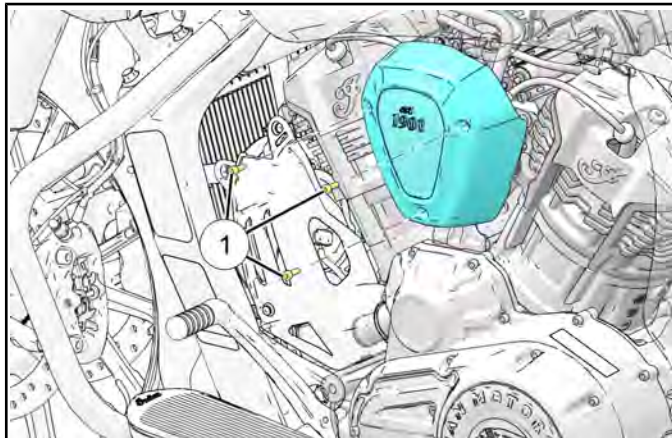
**50 STATE**

**⚠ WARNING**

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Protect fuel tank finish when removing, storing, and installing tank.

Be prepared to place the fuel tank in a secure location with a drain pan positioned to catch any fuel that may leak or drip from disconnected hoses or fittings.

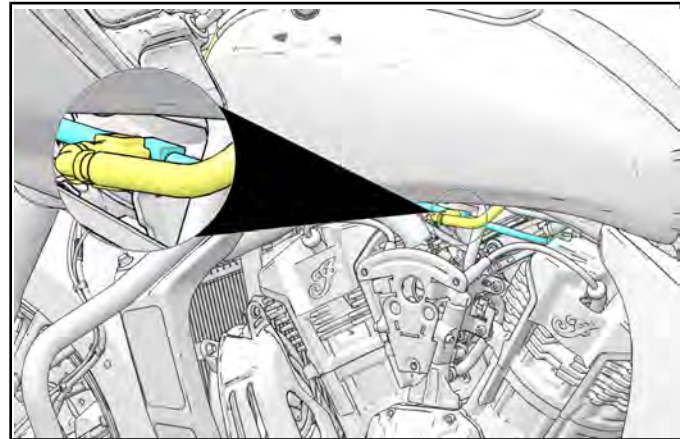
1. Depressurize fuel system. See **Fuel System Depressurization page 4.22.**
2. Remove seat. See **Seat Removal / Installation page 7.32.**
3. Disconnect vent line from carbon canister. Reference **Carbon Canister Removal / Installation page 4.12.**
4. Remove left side v-cover by removing its fasteners ①.



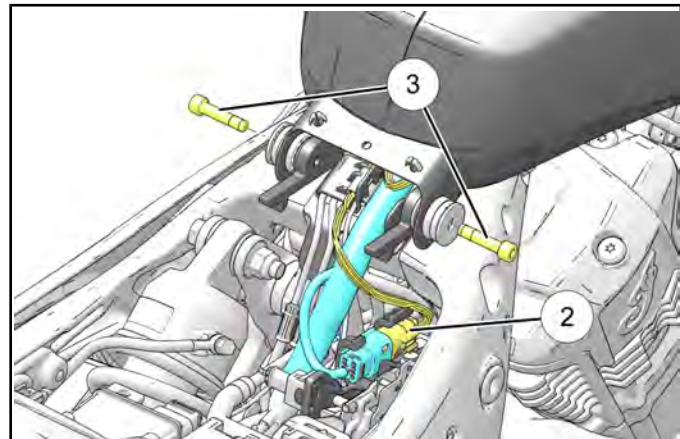
5. Disconnect the fuel line from the fuel rail by squeezing both release buttons and gently sliding off the fuel rail.

**⚠ CAUTION**

Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.



6. Disconnect the fuel pump electrical connector ②.



7. Remove the fuel tank fasteners ③.
8. Lift rear of tank upward and pull rearward to remove.

## FUEL TANK REMOVAL (2021)

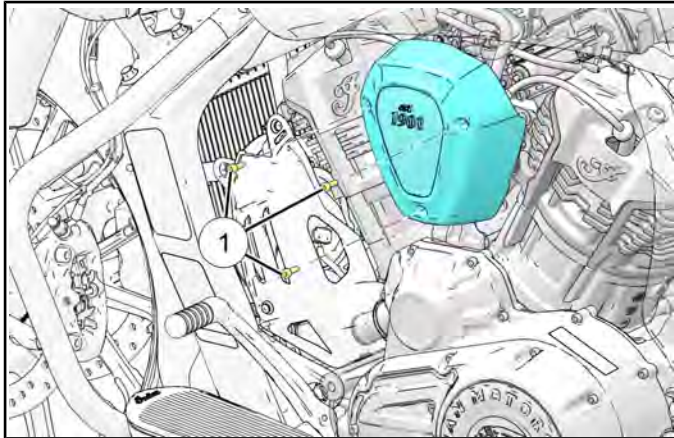
### 49 STATE

**⚠ WARNING**

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Protect fuel tank finish when removing, storing, and installing tank.

Be prepared to place the fuel tank in a secure location with a drain pan positioned to catch any fuel that may leak or drip from disconnected hoses or fittings.

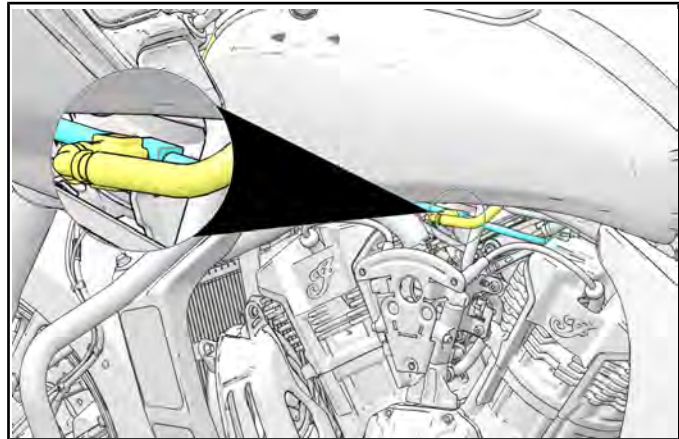
1. Depressurize fuel system. See **Fuel System Depressurization** page 4.22.
2. Remove seat. See **Seat Removal / Installation** page 7.32.
3. Remove left side v-cover by removing its fasteners ①.



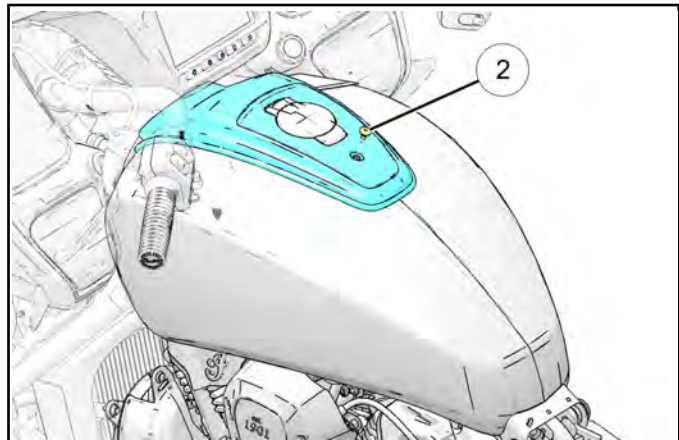
4. Disconnect the fuel line from the fuel rail by squeezing both release buttons and gently sliding off the fuel rail..

**⚠ CAUTION**

Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.



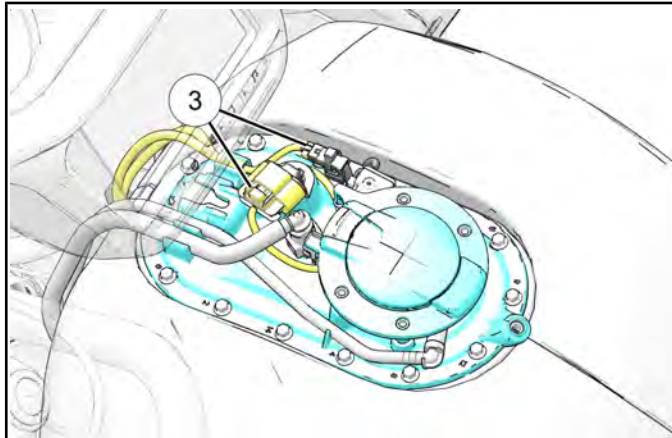
5. Remove fuel tank console fastener ②.



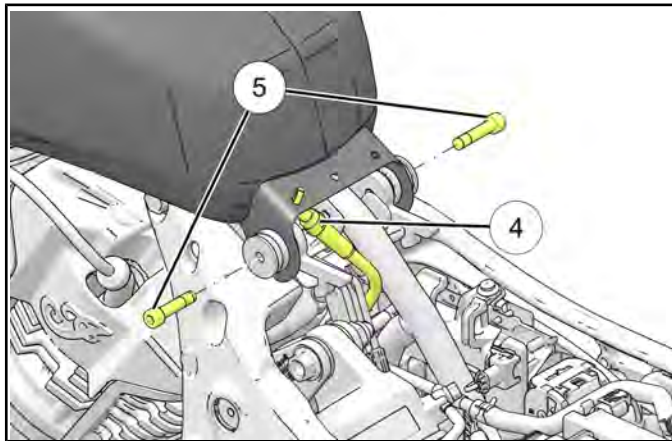
6. Lift rear of console and slide it forward to disengage the mount feature.

4

7. Disconnect electrical connectors ③.



8. Disconnect fuel vent line ④.



9. Remove fuel tank fasteners ⑤.

10. Lift rear of tank upward and pull rearward to remove.

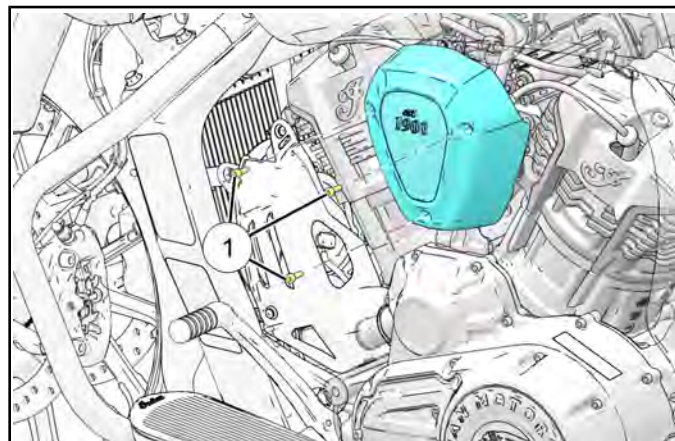
**50 STATE**

**⚠ WARNING**

Allow engine and exhaust to cool completely before disconnecting fuel line or removing tank. Protect fuel tank finish when removing, storing, and installing tank.

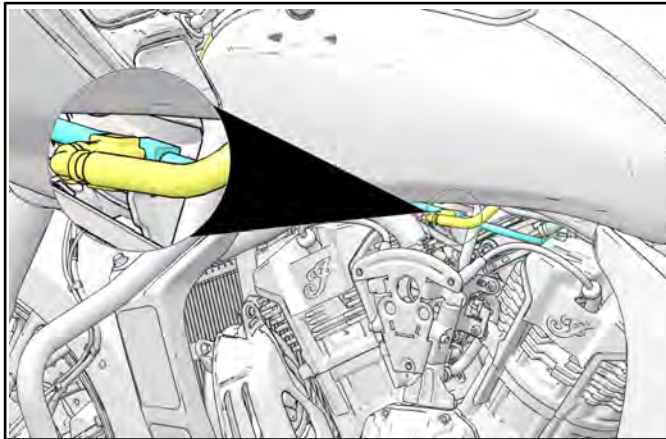
Be prepared to place the fuel tank in a secure location with a drain pan positioned to catch any fuel that may leak or drip from disconnected hoses or fittings.

1. Depressurize fuel system. See **Fuel System Depressurization page 4.22.**
2. Remove seat. See **Seat Removal / Installation page 7.32.**
3. Disconnect vent line from carbon canister. Reference **Carbon Canister Removal / Installation page 4.12.**
4. Remove left side v-cover by removing its fasteners ①.

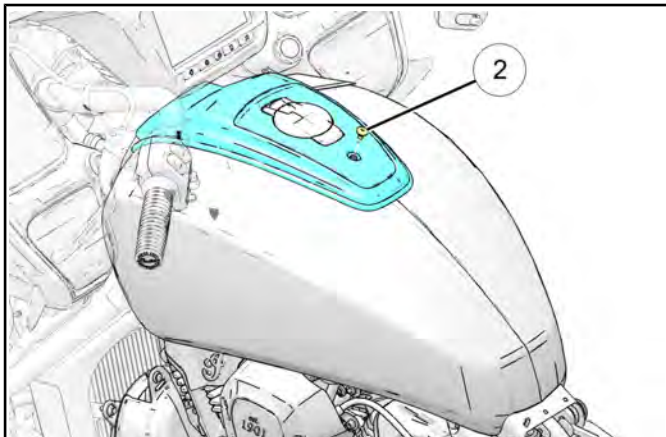


- Disconnect the fuel line from the fuel rail by squeezing both release buttons and gently sliding off the fuel rail.

**CAUTION**  
Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.

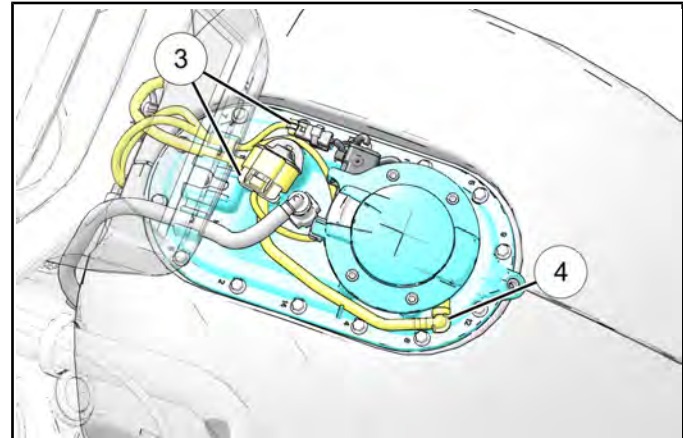


- Remove fuel tank console fastener ②.



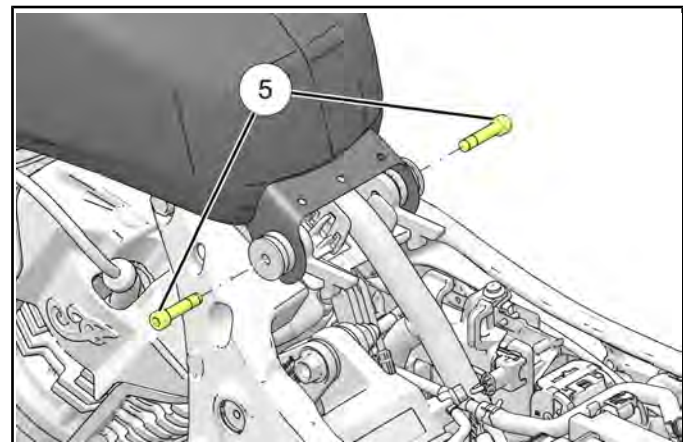
- Lift rear of console and slide it forward to disengage the mount feature.

- Disconnect fuel tank electrical connectors ③.



- Disconnect fuel vent line ④.

- Remove fuel tank fasteners ⑤.



- Lift rear of tank upward and pull rearward to remove.

4



### FUEL PUMP REMOVAL

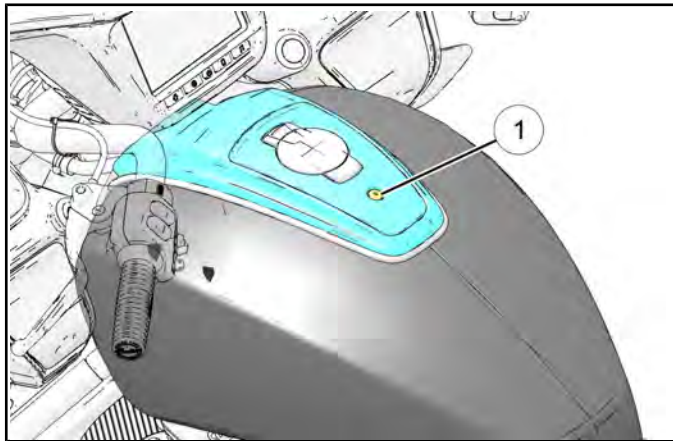
**CAUTION**

Be careful when performing this procedure to avoid damaging the fuel level float arm, fuel pump, electrical wiring, or hoses when removing the pump assembly. Always inspect wires and hoses closely for damage after removing the fuel pump.

**CAUTION**

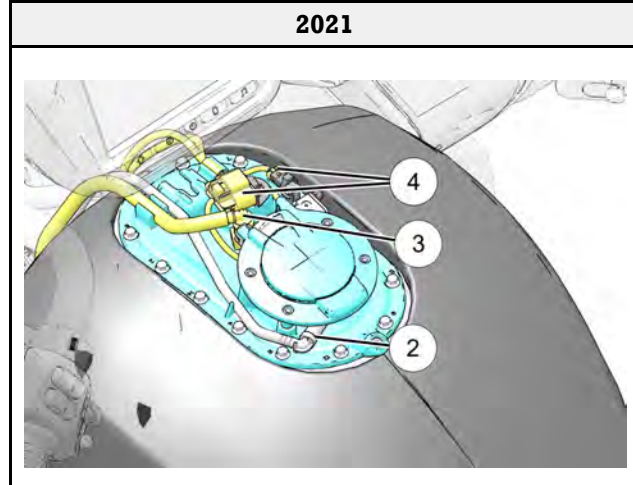
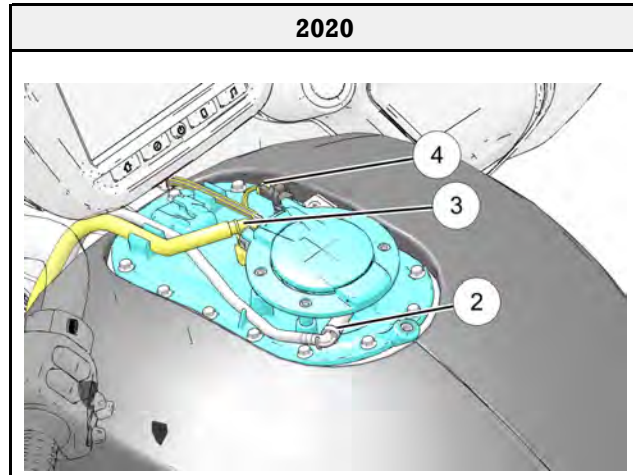
Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.

1. Remove fuel tank console by removing its fastener ①.

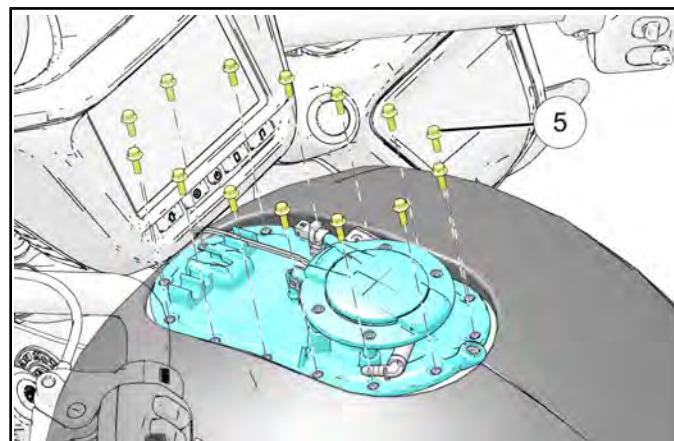


2. Slide console forward to release the console retainer and move rearward to remove from vehicle.

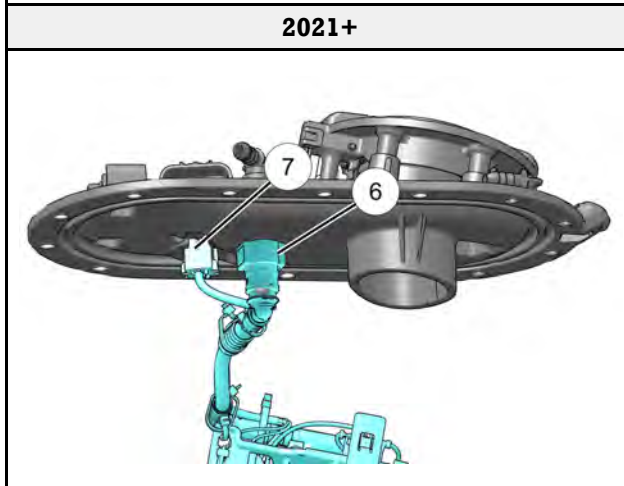
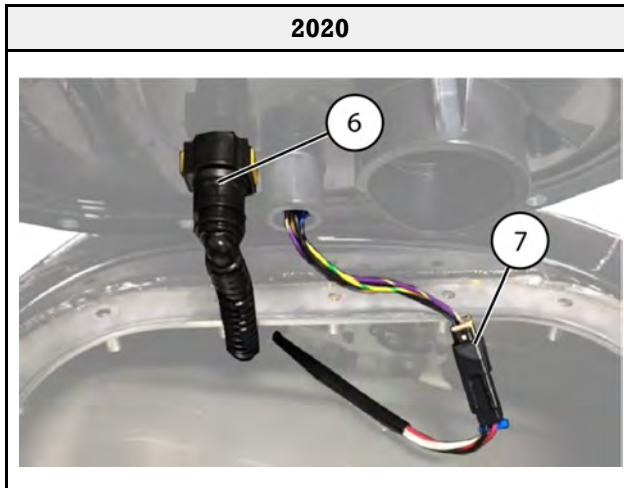
3. Disconnect fuel vent line ②.



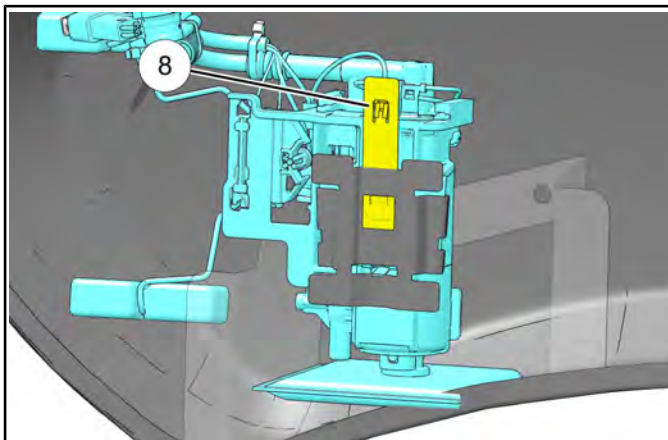
4. Disconnect fuel line ③. Squeeze both release buttons (one on each side of fitting) and hold to gently slide off fuel port.
5. Disconnect electrical connector ④.
6. Remove fuel access plate fasteners ⑤.



7. Lift up the fuel access plate and disconnect fuel pump fitting ⑥. Squeeze both release buttons (one on each side of fitting) and hold to gently slide off fuel port.



8. Disconnect fuel pump electrical connector ⑦.
9. Disconnect the fuel pump ⑧ from the fuel tank by pushing inward on lock tab.



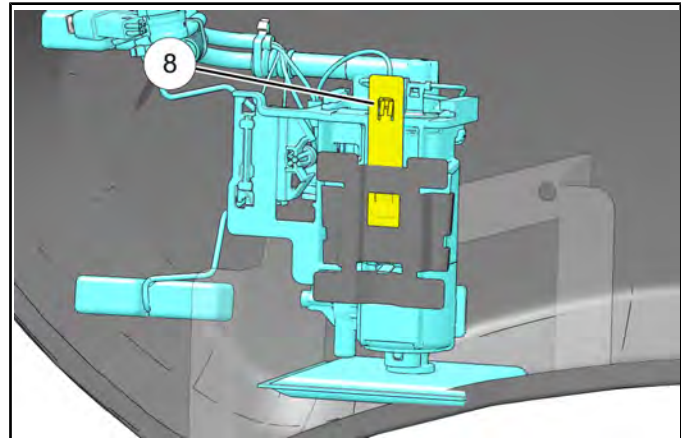
10. Lift the fuel pump assembly out of the retaining bracket and carefully lift out of the fuel tank.

### FUEL TANK VENT INSPECTION

1. Refer to Maintenance chapter for tank vent inspection and hose routing information. See **Fuel Tank Vent Inspection** page 4.5.

### FUEL PUMP INSTALLATION

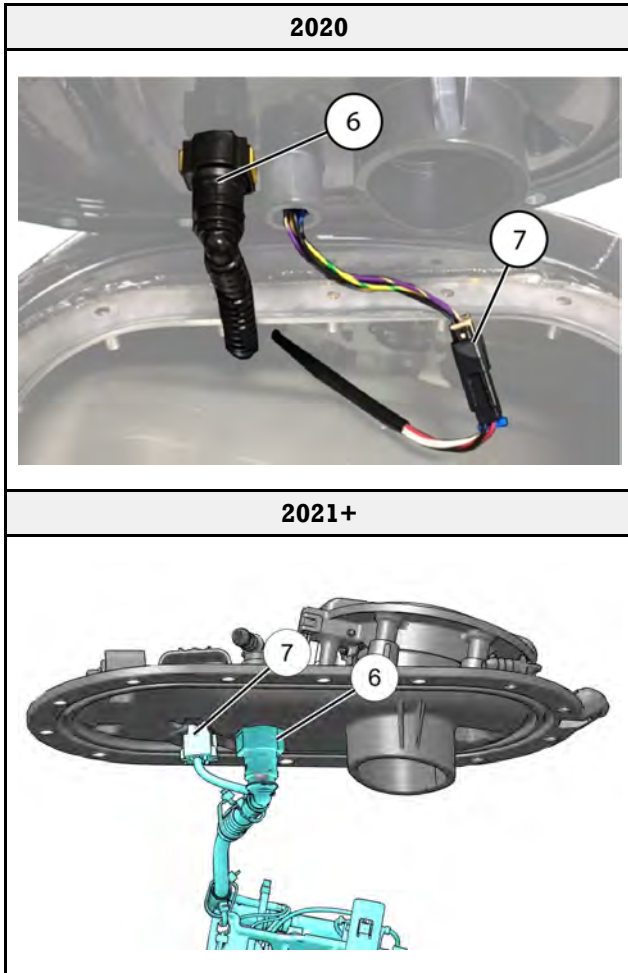
1. Lower the fuel pump assembly into the access hole with the level arm facing forward.
2. Once the pump body is inside the tank, line up the guide rails and retaining tab with the bracket.
3. Slide the fuel pump ⑧ into position until the retaining tab engages and you hear an audible "click". Gently pull straight up on the pump to ensure it is locked in place.



4. Verify that the float arm moves freely through its full range of motion.

4

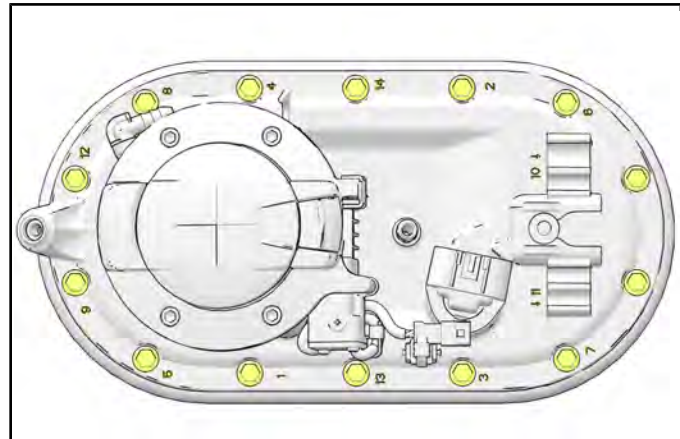
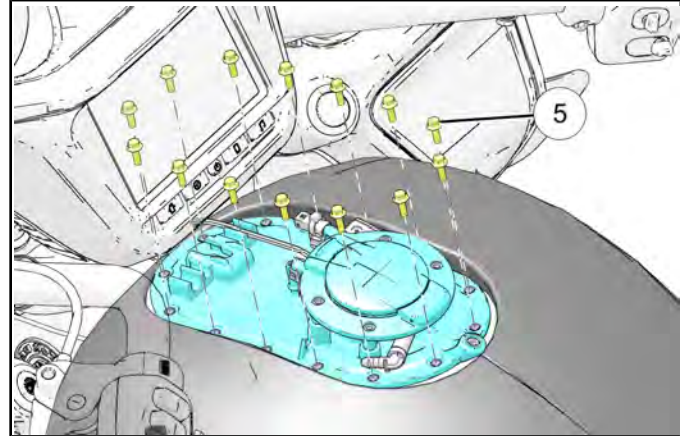
5. Connect the fuel pump electrical connector ⑦ and fuel pump fitting ⑥ to the access plate.



**IMPORTANT**  
 Verify fuel line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.

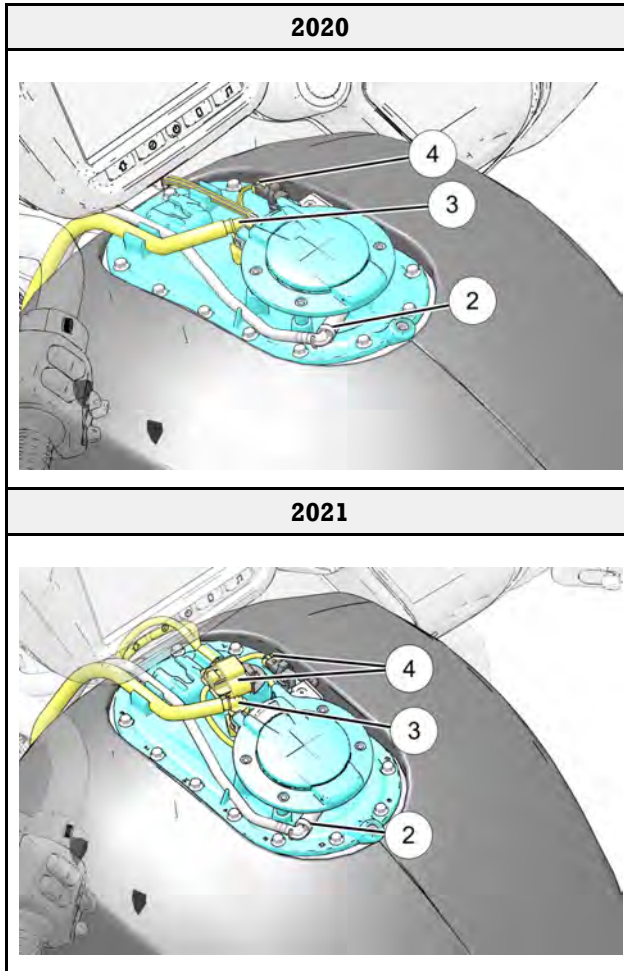
6. Replace the fuel access plate seal with a new one upon assembly.

7. Secure the fuel access plate with its fasteners ⑤ in order as shown.

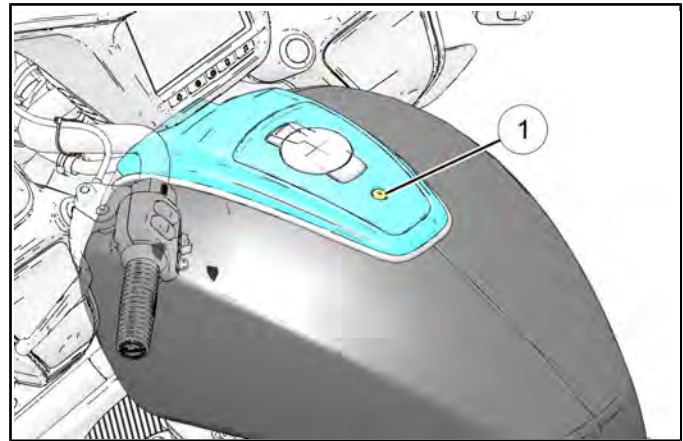


**TORQUE**  
 Fuel Access Plate Fastener:  
**44 in-lbs (5 N·m)**

8. Connect the electrical connector ④, fuel line ③, and fuel vent line ②.



10. Install fuel tank console by engaging the front post into its slot and slide it rearward. Secure with its fastener ①.



**TORQUE**  
 Fuel Tank Console Fastener:  
**84 in-lbs (10 N·m)**

**IMPORTANT**  
 Verify fuel line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.

9. Secure fuel line, fuel vent line and wire harness into access plate retaining features.

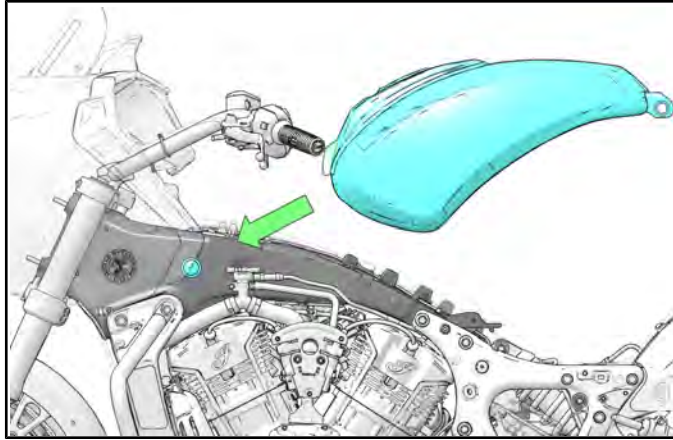


4

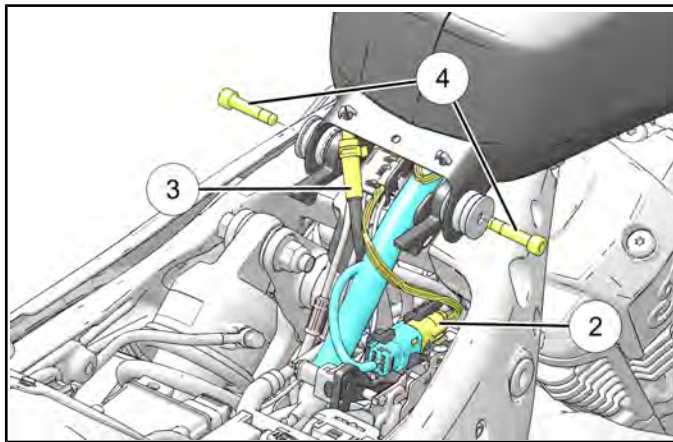
## FUEL TANK INSTALLATION (2020)

### 49 STATE

1. Place a protective cloth on the front of the tank when assembling tank to frame.
2. Verify that forward tank isolators are in position on the frame mounts and lower tank onto frame.



3. Slide tank forward until fully seated on forward isolators. Lower the rear of the tank into position over the rear mounting bracket.
4. Install fuel tank fasteners ④.



#### TORQUE

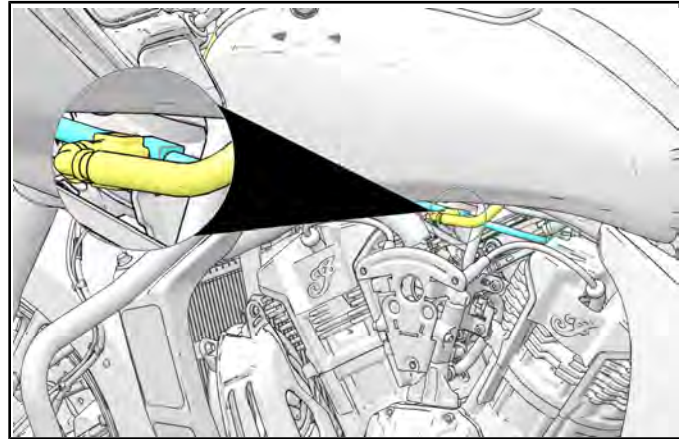
Fuel Tank Mounting Fasteners:  
**84 in-lbs (10 N·m)**

5. Connect fuel vent line ③.
6. Connect the fuel pump electrical connector ②.

7. Connect the fuel line to the fuel rail.

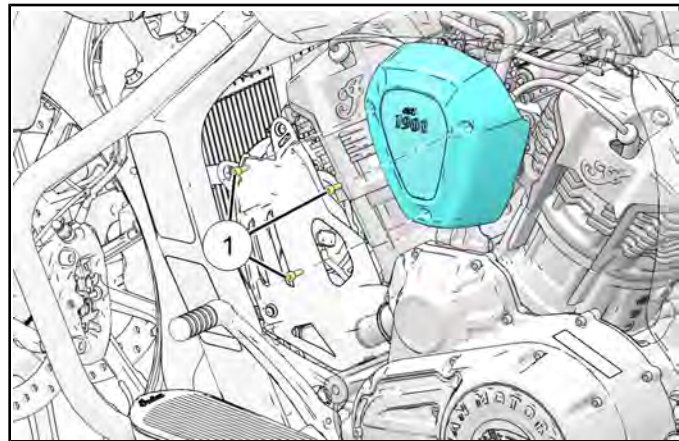
#### IMPORTANT

Verify fuel line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.



8. Prime the fuel system by turning the run/stop switch on and then off. Once the system is pressurized, carefully check all fuel connections, joints and lines for leaks.

9. Install left side v-cover and secure with its fasteners ①.



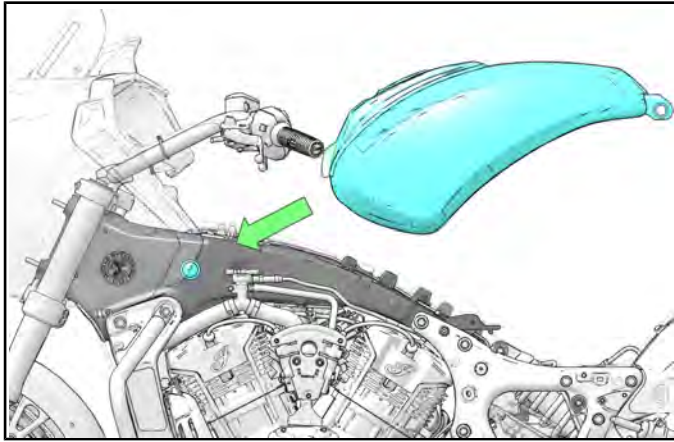
#### TORQUE

V-Cover Fastener:  
**84 in-lbs (10 N·m)**

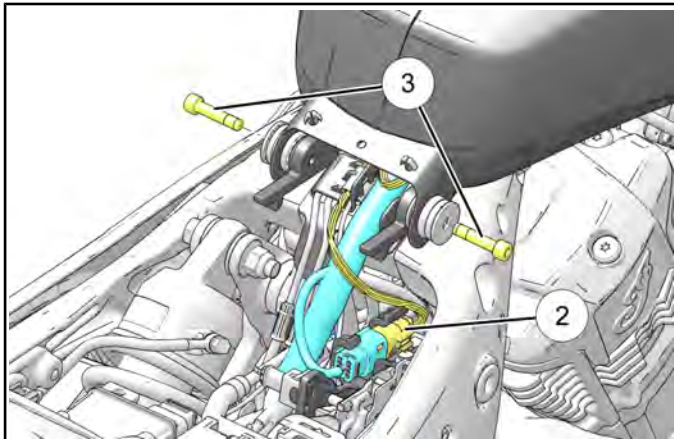
10. Install seat. See **Seat Removal / Installation** page 7.32

**50 STATE**

1. Place a protective cloth on the front of the tank when assembling tank to frame.
2. Verify that forward tank isolators are in position on the frame mounts and lower tank onto frame.



3. Slide tank forward until fully seated on forward isolators. Lower the rear of the tank into position over the rear mounting bracket.
4. Install fuel tank fasteners ③.



**TORQUE**

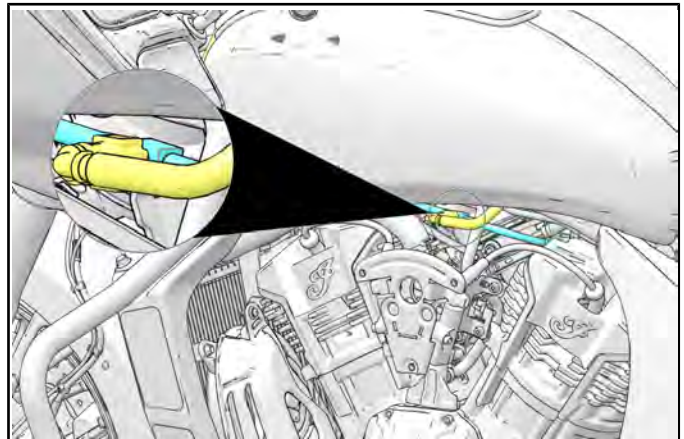
Fuel Tank Mounting Fasteners:  
**18 ft-lbs (24 N·m)**

5. Connect the fuel pump electrical connector ②.

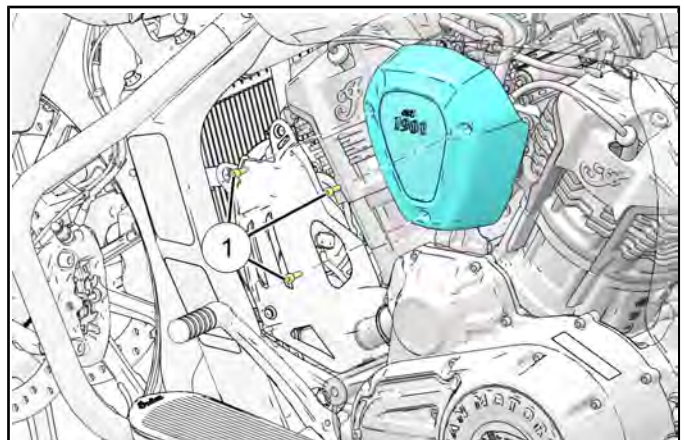
6. Connect the fuel line to the fuel rail.

**IMPORTANT**

Verify fuel line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.



7. Prime the fuel system by turning the run/stop switch on and then off. Once the system is pressurized, carefully check all fuel connections, joints and lines for leaks.
8. Install left side v-cover and secure with its fasteners ①.



**TORQUE**

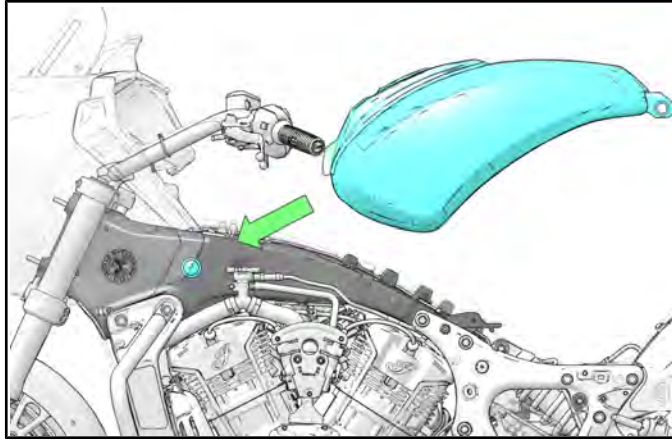
V-Cover Fastener:  
**84 in-lbs (10 N·m)**

9. Reconnect carbon canister vent lines. See **Carbon Canister Removal / Installation** page 4.12.
10. Install seat. See **Seat Removal / Installation** page 7.32

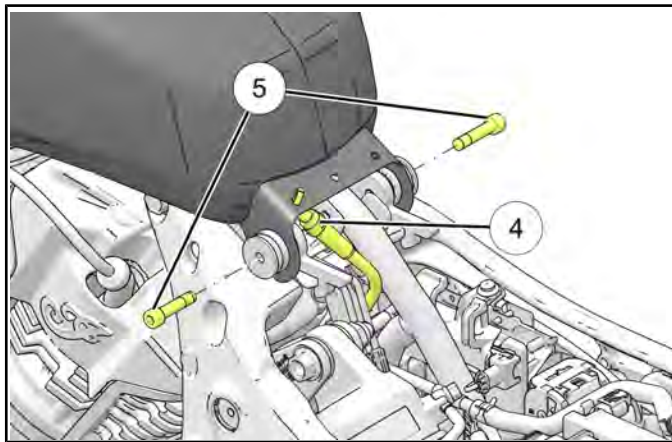
## FUEL TANK INSTALLATION (2021+)

### 49 STATE

1. Place a protective cloth on the front of the tank when assembling tank to frame.
2. Verify that forward tank isolators are in position on the frame mounts and lower tank onto frame.



3. Slide tank forward until fully seated on forward isolators. Lower the rear of the tank into position over the rear mounting bracket.
4. Install fuel tank fasteners ⑤.

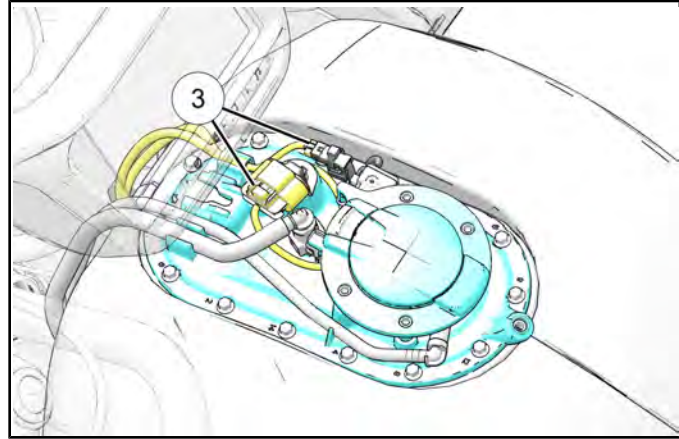


#### TORQUE

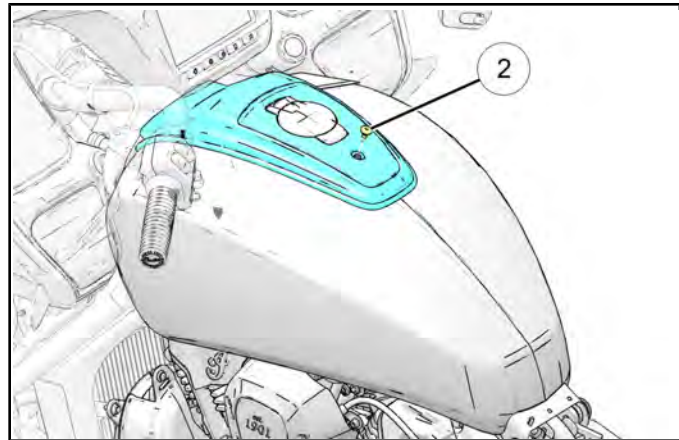
Fuel Tank Mounting Fasteners:  
**18 ft-lbs (24 N·m)**

5. Connect fuel vent line ④.

6. Connect the electrical connectors ③.



7. Reinstall fuel tank console by engaging the front post into its slot and slide rearward. Retain with its fastener ②.



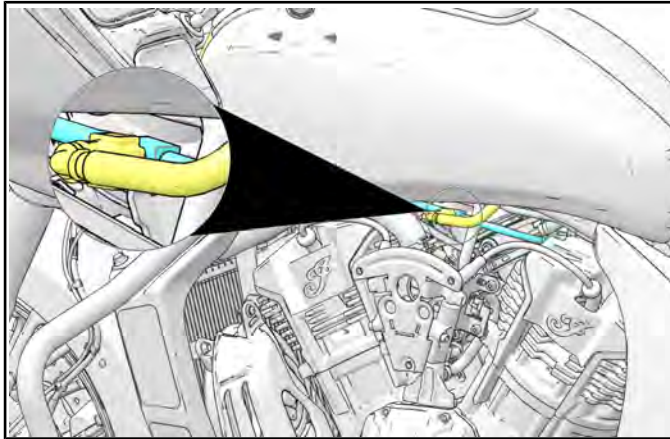
#### TORQUE

Fuel Tank Console Fastener:  
**84 in-lbs (10 N·m)**

8. Connect the fuel line to the fuel rail.

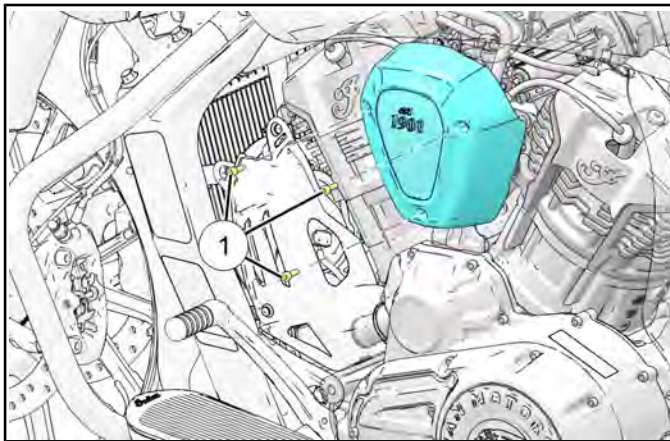
**IMPORTANT**

Verify fuel line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.



9. Prime the fuel system by turning the run/stop switch on and then off. Once the system is pressurized, carefully check all fuel connections, joints and lines for leaks.

10. Install left side v-cover and secure with its fasteners ①.



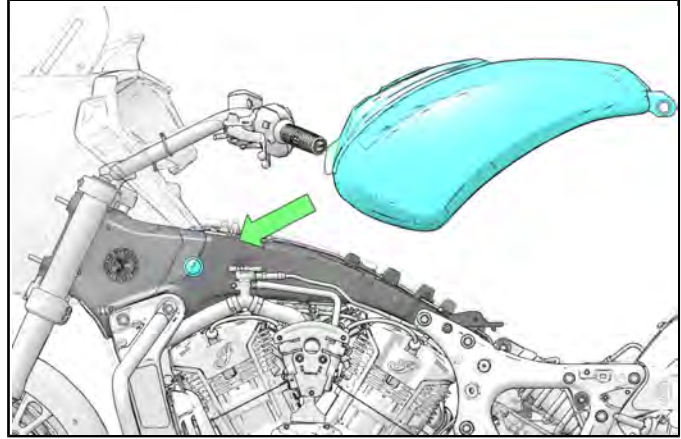
**TORQUE**

V-Cover Fastener:  
**84 in-lbs (10 N·m)**

11. Reinstall seat. See **Seat Removal / Installation page 7.32.**

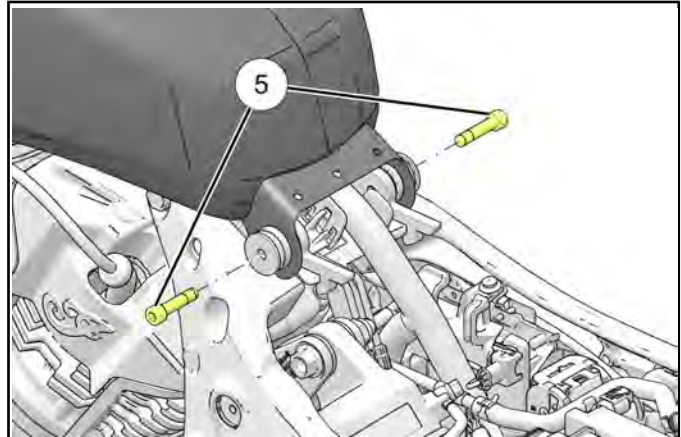
**50 STATE**

1. Place a protective cloth on the front of the tank when assembling tank to frame.
2. Verify that forward tank isolators are in position on the frame mounts and lower tank onto frame.



3. Slide tank forward until fully seated on forward isolators. Lower the rear of the tank into position over the rear mounting bracket.

4. Install fuel tank fasteners ⑤.

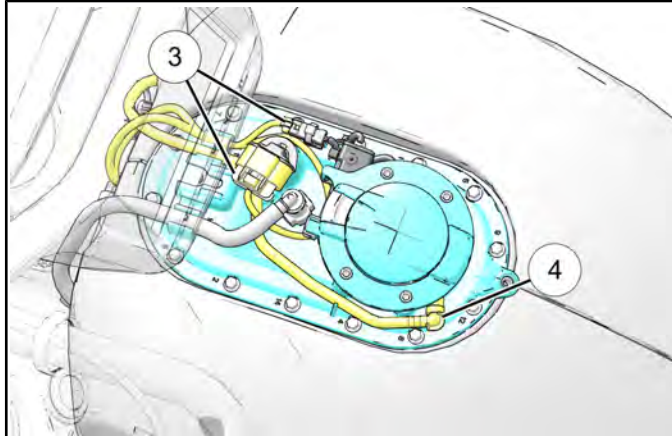


**TORQUE**

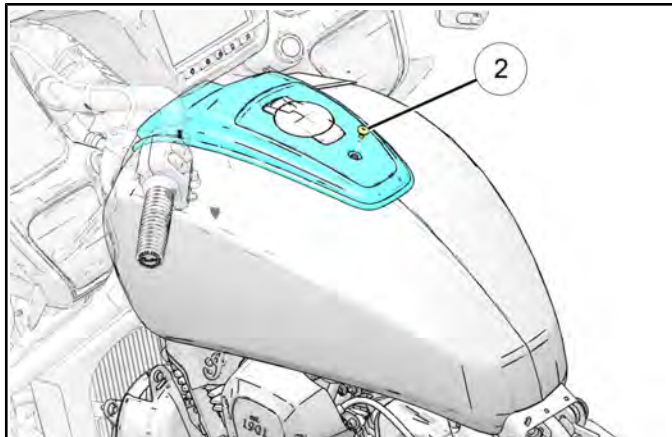
Fuel Tank Mounting Fasteners:  
**18 ft-lbs (24 N·m)**



5. Connect electrical connectors ③ and vent line ④.



6. Reinstall fuel tank console by engaging the front post into its slot and slide rearward. Retain with its fastener ②.

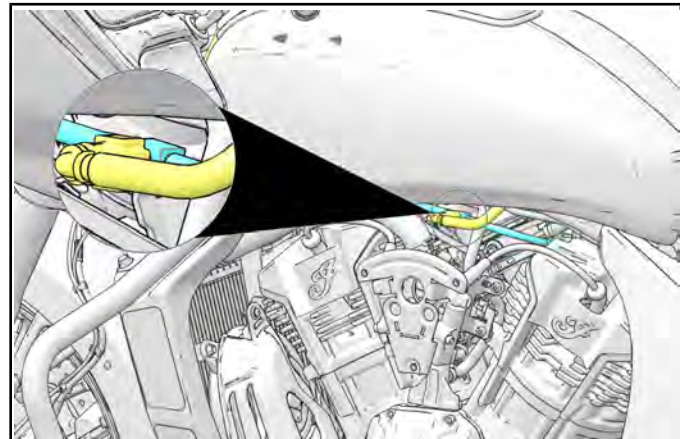


**TORQUE**  
 Fuel Tank Console Fastener:  
**84 in-lbs (10 N·m)**

7. Connect the fuel line to the fuel rail.

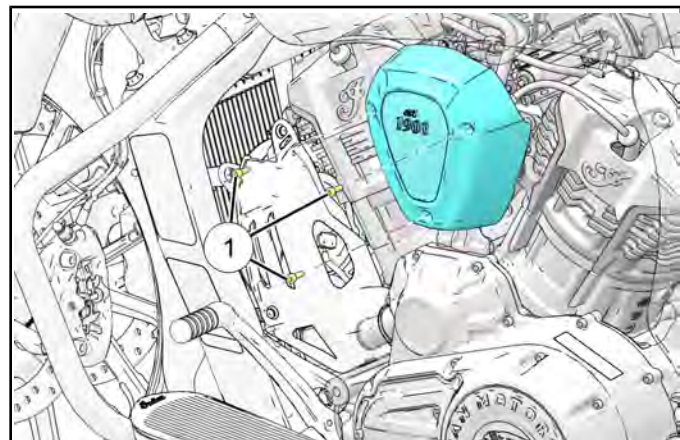
**IMPORTANT**

Verify fuel line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.



8. Prime the fuel system by turning the run/stop switch on and then off. Once the system is pressurized, carefully check all fuel connections, joints and lines for leaks.

9. Install left side v-cover and secure with its fasteners ①.



**TORQUE**  
 V-Cover Fastener:  
**84 in-lbs (10 N·m)**

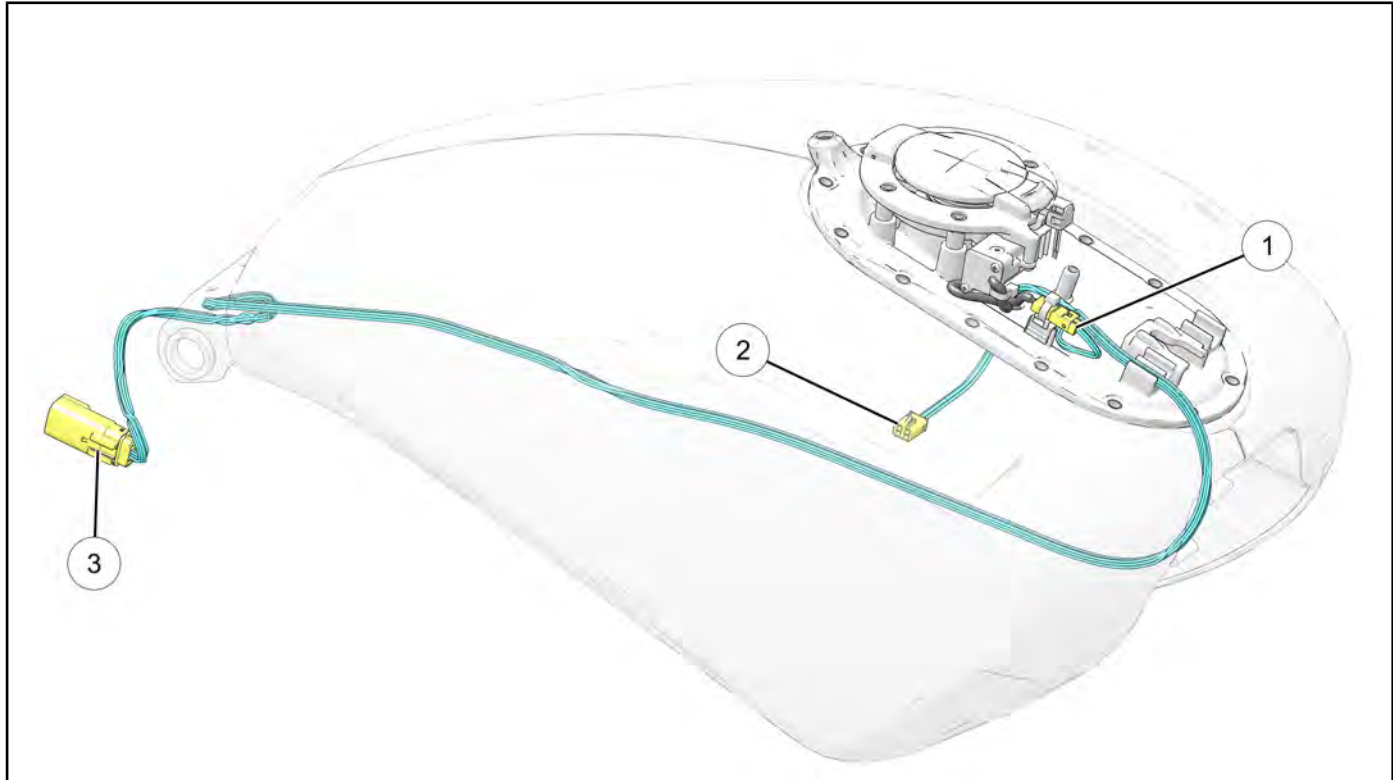
10. Reconnect carbon canister vent lines. See **Carbon Canister Removal / Installation** page 4.12.

11. Reinstall seat. See **Seat Removal / Installation** page 7.32.

**FUEL TANK HARNESS**

**NOTICE**

Model Year 2020 units only.



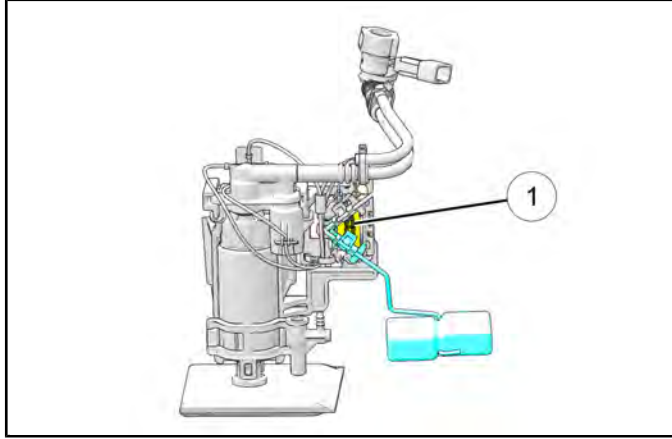
REF	DESCRIPTION
①	FTC
②	Fuel Pump
③	Chassis-Fuel

WIRE COLOR	FROM COMPONENT	TO COMPONENT	FUNCTION
VT/YE	Chassis-Fuel Port 4	Fuel Pump Port C	Fuel Pump Power
BK	FTC Port 4	Chassis-Fuel Port 7	FTC Switch Ground
YE/DG	Chassis-Fuel Port 2	Fuel Pump Port B	Fuel Sensor Output
BK	Chassis-Fuel Port 3	Fuel Pump Port D	Fuel Pump Ground
BK/BU	Chassis-Fuel Port 1	Fuel Pump Port A	Fuel Sensor Ground
OG/DG	Chassis-Fuel Port 5	FTC Port 1	FTC Lock + / Unlock -
DG/OG	FTC Port 2	Chassis-Fuel Port 6	FTC Lock - / Unlock +
DB/OG	FTC Port 3	Chassis-Fuel Port 8	FTC Switch Output

### FUEL LEVEL SENSOR RESISTANCE TEST

#### OVERVIEW OF OPERATION:

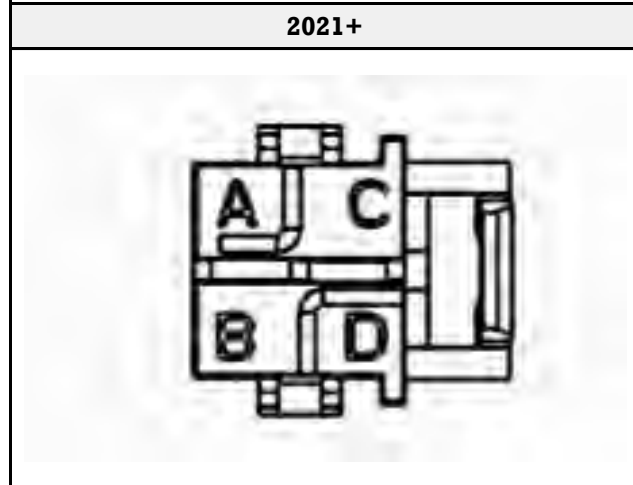
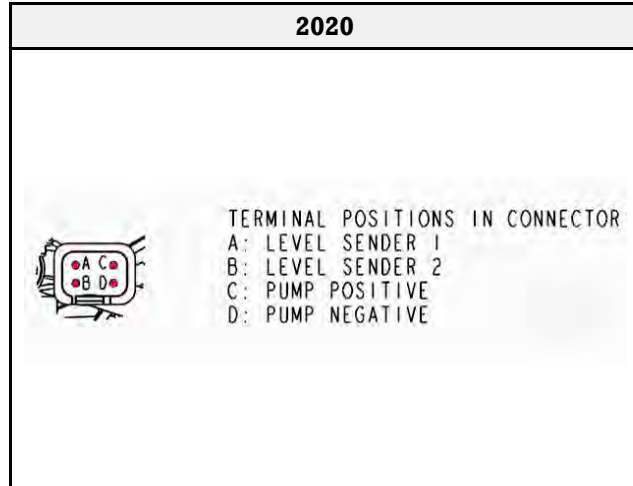
Fuel level readings are measured by a variable resistance fuel level sensor ①. The fuel level sensor is located inside the fuel tank on the fuel pump.



If fuel level readings are inaccurate when the motorcycle is powered up, or if the fuel gauge isn't indicating fuel level at all, perform the following test and refer to resistance values located at the end of this procedure.

1. Remove the fuel pump. See **Fuel Pump Removal page 4.28**.
2. Set multimeter to measure resistance. Attach suitable test probe adaptors to meter leads (**from kit PV-43526**).

3. On the *fuel pump* side of the connector, measure resistance across terminals A & B (2020) or terminals A & C (2021+) and compare to the table.



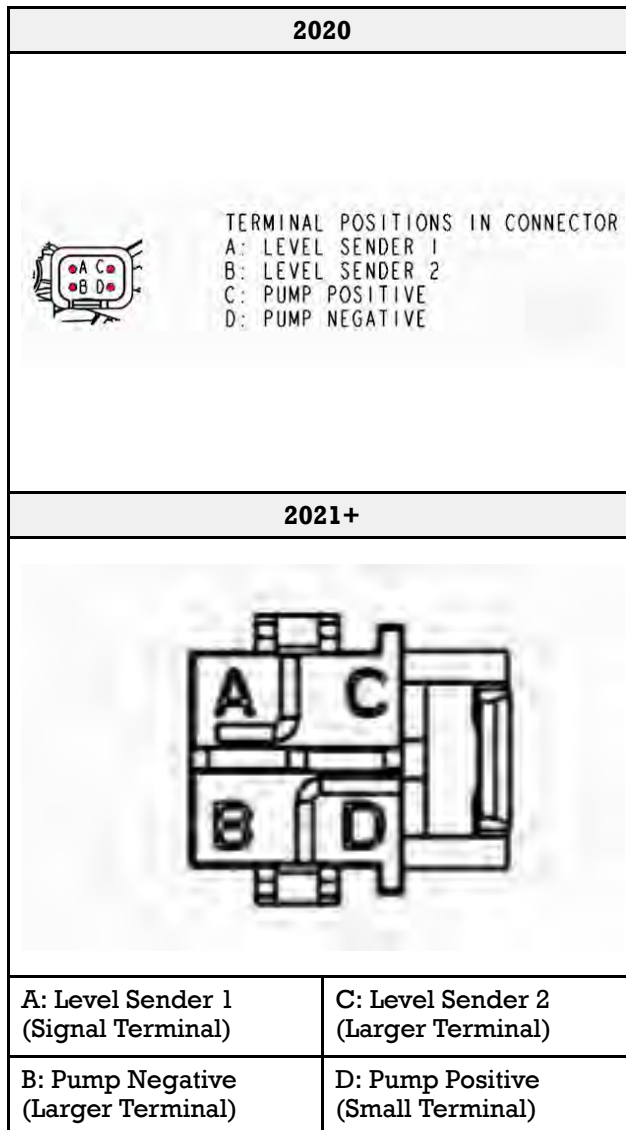
A: Level Sender 1 (Signal Terminal)	C: Level Sender 2 (Larger Terminal)
B: Pump Negative (Larger Terminal)	D: Pump Positive (Small Terminal)

LEVEL SENSOR ARM POSITION	APPROXIMATE RESISTANCE LIMITS
Full (Top of Range)	98–102 Ω
Empty (Bottom of Range)	445–455 Ω

### FUEL PUMP SUPPLY VOLTAGE TEST

Before performing this test, verify that battery is fully charged and in good operating condition.

1. Remove the console and access plate. Disconnect the fuel pump / level sensor electrical connector. Reference **Fuel Pump Removal page 4.28**.
2. Connect meter across terminals C & D (2020) or B & D (2021+) on the *wire harness* side of connector.



5. If low or no voltage is delivered to the fuel pump, verify ground wire (Pin D, Black) has good continuity to battery (-) post.
6. If ground is OK, check Gray wire from fuel pump relay to ECM pin #42 . The Gray wire receives a momentary ground from the ECM (for 2-3 seconds) and activates the fuel pump relay which supplies power to the pump on the VT/YE wire.
7. Trace both power and ground circuits to determine fault if battery voltage is not present for 2-3 seconds after power button and STOP / RUN switch are turned on.
8. When a CPS signal is received by the ECM (engine is cranking or running) the ECM maintains the ground on Pin 42 (Gray wire), keeping the pump powered.

4

3. Press the POWER ON button to power up the motorcycle electrical system.
4. Turn Engine Stop switch to RUN and read DC voltage on meter when switch is first turned on. Voltage reading should be close to battery voltage for 2-3 seconds after switching Engine Stop switch to RUN.

## FUEL PUMP CURRENT DRAW TEST

### NOTICE

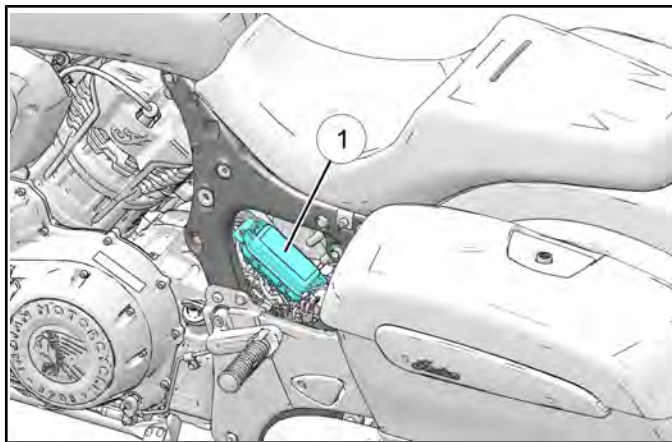
Fuel pump current draw is an indicator of pump condition. Perform draw test if fuel pump operation is suspect, or if fuel pump fuse is found open (blown).

### NOTICE

When meter leads are inserted the pump will run, and current draw will be displayed on the meter, even with key and stop switch off. Fuel tank must be completely installed and have enough fuel in it to cover the fuel pickup screens for an accurate test.

1. Remove left upper side cover. See **Side Cover (Upper), Removal / Installation page 7.27.**

1. Locate fuse box ①.



2. Remove fuel pump relay.
3. Set meter to DC Amps. Be sure red meter lead is in the 10A jack, and black meter lead is in common (-) jack.
4. Insert one meter lead in pin socket (20) and other meter lead in pin socket (24) of relay block. See **Fuse Application Chart page 10.69.**
5. Read fuel pump current draw on meter and compare to specification.
6. Inspect fuel pump circuit wiring or replace fuel pump if current draw exceeds specification.

**SPECIFICATION: Fuel Pump Current Draw  
Maximum: 6 DC Amps**

## PRIMING THE FUEL SYSTEM

Prime procedure should be performed:

- If a new fuel pump is installed or if tank is run completely dry.
  - Whenever fuel system is serviced (fuel line is disconnected).
  - Whenever battery disconnected.
1. Fill the fuel tank.
  2. Turn Engine Stop switch OFF.
  3. Press the power button to power up the motorcycle.
  4. Turn stop switch to RUN.
  5. Allow switch to remain in RUN position until pump stops running (about 2-3 seconds).
  6. Turn stop switch OFF.
  7. Press the power button to power down motorcycle.
  8. *WAIT* approximately 10 seconds.
  9. Repeat Steps 4-8 about 4 times to complete the priming procedure.

### NOTICE

Fuel level in tank must be high enough to submerge pickup screen on fuel pump.

## EFI SERVICE

### FUEL INJECTION SYSTEM - OVERVIEW OF OPERATION

The Electronic Fuel Injection (EFI) system functions to provide the engine with precisely metered fuel under varying loads and conditions.

The Engine Control Module or “ECM”, is located beneath the battery box. It is programmed to provide the correct fuel/air mixture and ignition timing based on several sensor input signals (engine load, temp, altitude, manifold pressure etc.). The ECM also provides grounds or voltage to other *EFI related* circuits of the electrical and fuel delivery systems.

An Electronic Throttle Control (ETC) system takes the place of a conventional, cable-operated throttle body. The ETC controls throttle blade angle and provides rate-of-change feedback to the ECM.

The ETC also serves as a plausibility check for the TMAP sensor. The MAP portion of the TMAP sensor is the primary air flow and load sensing device.

An electric fuel pump, mounted inside the fuel tank supplies fuel pressure to the injectors continuously when the engine is running or cranking. A pressure regulator incorporated on the pump keeps fuel pressure steady at approximately 4.0 Bar (400 kPa / 58 PSI). The fuel pump cycles “ON” for 2-3 seconds when the motorcycle is powered up and the Engine Stop switch is turned ON to pressurize the system for start-up.

The fuel injectors inject fuel when they are grounded by drivers inside the ECM. The duration of an injector pulse (length of time the injector circuit is grounded) is controlled by the ECM. Pulse duration determines the amount of fuel delivered to the engine (longer cycles = more fuel). The ECM selects the correct fuel injector pulse by calculating the airflow from the MAP sensor measurement and referencing a three dimensional “map” for the desired air-to-fuel ratio (AFR). The ECM calculates an injection time based on the measured airflow and desired AFR.

Although TMAP and engine RPM are the most influential inputs for selecting a map reference point, the ECM also evaluates feedback from minor sensors in the system, to obtain a more accurate “picture” of the fuel needs at any given moment.

The fuel control system is closed loop. When the engine is at a warm idle and typical cruising engine speeds and loads, the ECM will operate in “closed loop fuel control” mode. The oxygen sensors in each headpipe will provide feedback to the ECM and the injection time will be adjusted for each cylinder to achieve the target AFR.

### REAR CYLINDER DEACTIVATION

#### NOTICE

Model Year 2021+ models only.

Designed as an aid to reduce engine and exhaust heat to the rider, Rear Cylinder Deactivation turns off the rear cylinder when the engine gets hot.

The following condition must be met for Rear Cylinder Deactivation to be enabled.

- Engine must be up to operating temperature
- Ambient Temperature must exceed 15 C
- Engine speed must remain below 1000 rpm
- Throttle must be in the closed position (0% throttle)

**ECM CONNECTOR MAP**

PIN ECM 1	COLOR	FUNCTION	PIN ECM 2	COLOR	FUNCTION
101	—	—	201	GY/YE	Rear Heated Oxygen Sensor Control
102	BN/PK	TMAP 5V Feed	202	YE/BK	Transmission Gear Position Sensor Output
103	—	—	203	—	—
104	—	—	204	—	—
105	—	—	205	—	—
106	—	—	206	—	—
107	—	—	207	—	—
108	—	—	208	—	—
109	RD	Knock Sensor Feed	209	PK	Ignition 1
110	BK	Knock Sensor Return	210	BN/DB	TPS 5V Reference
111	PK/DB	Brake Light Feed	211	RD/BU	GSS 5V Reference
112	DG/YE	Tail Light Feed	212	PK/RD	ETC Motor Positive
113	—	—	213	WH	CPS Positive Signal
114	—	—	214	BK	CPS Negative Signal
115	—	—	215	OG/DG	IAT Sensor Output
116	—	—	216	OG/BN	MAP Sensor Output
117	—	—	217	—	—
118	—	—	218	—	—
119	DP/PK	Run/Stop Switch Output	219	—	—
120	BG/BK	Sidestand Switch Signal	220	GY	Fuel Pump Relay Control
121	—	—	221	OG/BN	Starter Relay Control
122	—	—	222	VT/RD	Pedal Position Sensor 1 5V Reference
123	DB	Front Left Turn Signal Lamp Output	223	WH/YE	Pedal Position Sensor 2 5V Reference
124	DB/RD	Front Right Turn Signal Lamp Output	224	YE	ETC Motor Negative
125	—	—	225	BG/WH	Rear Oxygen Sensor Return
126	OG/DB	Front Right Position Control Feed	226	BN/WH	TPS Return
127	—	—	227	GY/YE	Pedal Position Sensor 2 Return
128	—	—	228	GY/DB	Rear Heated Oxygen Sensor Output
129	—	—	229	YE	CANA High
130	—	—	230	DG	CANA Low
131	GY/RD	Front Oxygen Sensor Output	231	—	—
132	BG	Front Heated Oxygen Sensor Return	232	GY/RD	Pedal Position Sensor 2 Output
133	—	—	233	OG/DB	Cylinder Head Temp Sensor Output
134	—	—	234	GY/BK	Engine Relay Control

<b>PIN ECM 1</b>	<b>COLOR</b>	<b>FUNCTION</b>	<b>PIN ECM 2</b>	<b>COLOR</b>	<b>FUNCTION</b>
135	DB	Rear Left Turn Signal Lamp Output	235	VT/YE	Pedal Position Sensor 1 Output
136	DB/RD	Rear Right Turn Signal Lamp Output	236	BK/DG	Fuel Level Sensor Output
137	DG	CANB Low	237	BN/GN	Map Sensor Return
138	YE	CANB High	238	WH/RD	Pedal Position Sensor 1 Return
139	GN	Front Left Position Control Feed	239	YE/RD	Trunk Brake Lamp Feed
140	—	—	240	DB/BK	Canister purge Valve Feed
141	PK/BK	Starter Relay Coil Feed HSD	241	WH/DB	Front Fuel Injector Driver
142	—	—	242	WH/GY	Rear Fuel Injector Driver
143	OG/BN	CHT Return	243	YE/VT	Rear Brake Switch Output
144	BK/BU	Fuel Sender Ground	244	—	—
145	—	—	245	VT/RD	TPS 2 Signal
146	—	—	246	GY/DB	Rear Oxygen Sensor Output
147	—	—	247	OG/DB	Ambient Air Temperature Sensor Output
148	WH/OG	Trunk Tail Light Power	248	OG/YE	TPS 1 Output
149	—	—	249	VT/PK	Engine Relay Output
150	—	—	250	VT/PK	Engine Relay Output
151	—	—	251	BK/WH	ECM Ground
152	BK/GN	Gear Position Ground	252	BK/WH	ECM Ground
153	BKWH	Ambient Air Temperature Ground	253	GY	Rear Coil Signal
154	BK/WH	ECM Ground	254	WH	Front Coil Signal
155	GY/WH	Oxygen Sensor Control	255	—	—
156	—	—	256	—	—

4



**TROUBLE CODES**

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
84	2	Vehicle Speed Sensor	Speed signal from ABS Module is not valid	Check Wheel Speed Sensors in ABS Module	—
168	0	System Power	Data Valid But Above Normal Operational Range - Most Severe Level	Check Voltage Regulator and Battery	<b>P156A</b>
	1		Data Valid But Below Normal Operational Range - Most Severe Level	Check Voltage Regulator, Stator, Battery and Battery Connections, and Right Hand Control connection	<b>P156B</b>
	17		Data Valid But Below Normal Operating Range - Least Severe Level	Check Voltage Regulator, Stator, Battery and Battery Connections, and Left Hand Control connection	—
	18		Data Valid But Below Normal Operating Range - Moderately Severe Level	Check Voltage Regulator, Stator, Battery and Battery Connections, and WCM connection	<b>P1565</b>
190	2	Engine Speed	Data erratic, intermittent or incorrect	Check hand control connection check ECM connection, check CANbus for physical issues	<b>C184C</b>
	2		Data erratic, intermittent or incorrect		<b>C185C</b>
	19		Received Network Data In Error	Check ECM, check Crank Position Sensor, check CANbus for physical issues	—
630	14	Calibration	Special Instructions	Check WCM for proper software	<b>U2608</b>

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
1195	2	ATR Password Valid Indicator	Data Erratic, Intermittent Or Incorrect	Cycle Ignition. Then remove battery from WCM if IGN cycling doesn't work.	U2609
1196	9	ATR Component Status State	Abnormal Update Rate	Check ECM connection, check WCM connection, check CANbus for physical issues	U260A
	19		Received Network Data In Error	Cycle Ignition. Then remove battery from WCM if IGN cycling doesn't work.	U260B
1487	19	Illumination Brightness Percent	Received Network Data In Error	Check Tachometer connection, check VCM1 connection, check CANbus for physical issues	—
2348	5	High Beam Lamp	Current Below Normal Or Open Circuit	Check Headlight High Beam for proper lamp function. Check High Beam Wiring for open circuits	—
	6		Current Above Normal Or Grounded Circuit	Check Headlight High Beam for proper lamp function. Check High Beam Wiring for shorted circuits	—
2350	5	Low Beam Lamp	Current Below Normal Or Open Circuit	Check Headlight Low Beam for proper lamp function. Check Low Beam Wiring for open circuits	—
	6		Current Above Normal Or Grounded Circuit	Check Headlight Low Beam for proper lamp function. Check Low Beam Wiring for shorted circuits	—

4

FUEL DELIVERY / EFI

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
65559	11	CAN1 Bus Hardware	Root Cause Not Known	Check WCM connection, check CANbus for physical issues	<b>U260C</b>
	31		Condition Exists	Cycle Ignition. Replace ABS module if Ignition cycling does not fix	<b>C1130</b>
	31		Condition Exists	Check all controller connections, check CANbus for physical issues	—
	31		Condition Exists	Check all controller connections, check CANbus for physical issues	—
516097	23	p Module Control Message CRC	Checksum Error	Cycle Ignition, check CANbus wiring, check WCM and all VCM connections	<b>U260D</b>
	23		Checksum Error	Cycle Ignition, check CANbus wiring, check WCM and VCM1 connections	—
516115	12	Internal Inertial Measurement Unit	Bad Intelligent Device Or Component	Replace VCM1	—
516116	9	CAN Message PGN 65382	Abnormal Update Rate	Cycle Ignition, check CANbus wiring, check ABS and ECM connections	<b>U260E</b>
	9		Abnormal Update Rate		—
	9		Abnormal Update Rate		—
516118	9	CAN Message PGN 65314	Abnormal Rate		<b>U1109</b>
516120	9	CAN Message PGN 65265	Abnormal Update Rate	Cycle Ignition, check CANbus wiring, check VCM1 and ABS connections	<b>U1106</b>
	9		Abnormal Update Rate		<b>U260F</b>
	9		Abnormal Update Rate		—

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
516121	9	CAN Message PGN 61445	Abnormal Update Rate	Cycle Ignition, check CANbus for physical issues	<b>U1111</b>
516125	11	CAN 1	Root Cause Not Known	Cycle Ignition, check CANbus for physical issues	—
	11		Root Cause Not Known		—
516132	31	p Horn Switch	Condition Exists	Check connection at WCM and Left Hand Control, check CANbus for physical issues	—
516136	31	CAN Message Missing - PGN 61441	Condition Exists	Check ABS, Display, and ECM connections, check CANbus for physical issues	<b>U1112</b>
516185	9	PGN_65286	Abnormal Update Rate	Check VCM1 and LHC connection, check CANbus for physical issues	<b>U2612</b>
516186	9	PGN_65381	Abnormal Update Rate	Check VCM1 and LHC connection, check CANbus for physical issues	—
	9		Abnormal Update Rate	Check VCM2 and LHC connection, check CANbus for physical issues	—
516197	5	Fuel Lock Motor Driver	Current Below Normal Or Open Circuit	Check Fuel Door Lock actuator physical actuation. Check Fuel Door Lock wiring for short to ground	—
	6				
516198	31	Non-Configurable Address Claim Conflict	Condition Exists	Check to ensure VCM1 and VCM2 are in the correct locations. Check VCM1 and VCM2 for proper software. Check for proper VCM2 location pin connection	<b>C2314</b>
	31		Condition Exists		<b>C2311</b>

FUEL DELIVERY / EFI

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
516199	31	Configurable Address Claim Conflict	Condition Exists	Check to ensure only one VCM1 is connected. Check VCM1 and VCM2 for proper software. Check for proper VCM2 location pin connection	<b>C2300</b>
	31		Condition Exists		<b>C2301</b>
516200	31	Software Hardware Mismatch	Condition Exists	Check to ensure VCM's are installed in correct locations	<b>C2307</b>
	31		Condition Exists		<b>C2304</b>
516201	31	Can't Set Source Address	Condition Exists	Check VCM location pin for physical fault	<b>C230D</b>
516202	31	ECU Security Status	Condition Exists	Cycle Ignition, unlock vehicle through other method	—
	31		Condition Exists		—
516203	3	LF Antenna Driver	Voltage Above Normal, Or Shorted To High Source	Check Antenna wiring for shorts to ground. Replace Antenna	<b>C24C7</b>
	4		Voltage Below Normal, Or Shorted To Low Source		<b>C24C8</b>
	5		Current Below Normal Or Open Circuit		<b>C24C9</b>
516207	5	Puddle Light Driver	Current Below Normal Or Open Circuit	Check Puddle Light for proper lamp function. Check Puddle Light wiring for Open circuits	—
	6		Current Above Normal Or Grounded Circuit		—
516240	31	ECU	Condition Exists	Cycle Ignition. Replace WCM.	<b>C24CA</b>
520138	31	TC Manually Disabled	Condition Exists	Turn Traction Control back On. Cycle Ignition	<b>C2434</b>
520139	9	pTSCF1	Abnormal Update Rate	Check ABS and ECM connections. Check CANbus for physical issues	<b>U0136</b>
	22		Counter Error		<b>U0137</b>
	23		Checksum Error		<b>U0138</b>

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
520141	31	CAN1 Bus Wiring	Condition Exists	Check ABS connection, Check CANbus for physical issues	<b>C2438</b>
520293	5	Horn	Current below normal or open circuit	Check Horn functionality -Check Horn wiring for Open Circuit condition -Cycle Ignition	—
	6		Current normal or grounded circuit		—
520294	5	Windshield Motor driver	Current below normal or open circuit	Check Windshield Motor functionality. Check Windshield Motor wiring for Open Circuit condition. Cycle Ignition	—
	6				—
520295	2	Windshield Motor Switch	Data Erratic, Intermittent Or Incorrect	Check Windshield Up/ Dwn Switch for proper operation. Replace Hand Control if issue persists.	<b>C1749</b>
520297	31	System On Button	Condition Exists	Check Power Button for proper mechanical operation -Check Power Button for proper electrical operation. Check power button and wire harness for short circuits of the Power Button output	<b>C24CB</b>
520299	5	Power Lock Motor	Current Below Normal Or Open Circuit	Check Saddlebag Lock actuator connections. Check Saddlebag Lock wiring for Open Circuit or short to battery	—
	6		Current Above Normal Or Grounded Circuit	Check Saddlebag Lock actuator physical actuation. Check Fuel Door Lock wiring for short to ground	

4

FUEL DELIVERY / EFI

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
520304	12	Key Fob	Bad Intelligent Device Or Component	Replace Key Fob battery	<b>P1634</b>
520312	2	Power Lock Motor Swtich	Data Erratic, Intermittent Or Incorrect	Check Saddlebag lock switch for proper function -Check Saddlebag lock switch wiring for defects	—
520329	9	pOperator Switch Status (pOSS1)	Abnormal Update Rate	Check VCM1 and LHC connection, check CANbus for physical issues	—
520361	9	Requested Percent Fan Duty Cycle	Abnormal Update Rate	Cycle Ignition, Check VCM2 and ECM connection, check CANbus for physical issues	—
	19		Received Network Data In Error	Check VCM2 and ECM for proper software and calibrations	—
520504	5	Primary Fan Driver	Current Below Normal Or Open Circuit	Check for proper Fan operation. Check fan wiring for an Open Circuit	—
	6		Current Above Normal Or Grounded Circuit	Check for proper Fan operation. Check fan wiring for a Short Circuit. Check for debris in Fan	—
524000	19	pEngine Speed	Received Network Data In Error	Reduce Engine speed, check VCM1 and ECM for proper software calibrations	—
524040	2	Run/Stop Switch	Data Erratic, Intermittent Or Incorrect	Check Run/Stop Switch for proper operation. Replace Hand Control if issue persists	<b>C174B</b>

SPN	FMI	COMPONENT	CONDITION	ACTION	P-CODE
524042	19	pOperator Button - Chassis Unlock Button Status	Received Network Data In Error	Cycle Ignition, Check VCM1 and WCM software calibrations	—
524047	19	pOperator Button - Horn Switch Status	Received Network Data In Error	Cycle Ignition, Check VCM1 and LHC software calibrations	—
524056	19	High Beam Switch Status	Received Network Data In Error	Cycle Ignition, Check VCM2 and LHC software calibrations	—



## SENSOR DIAGNOSTICS

If a sensor fails or reads outside a “normal” range, a “pre-programmed” (default) value is substituted by the ECM until sensor reading returns to normal.

Sensor values can be viewed in Digital Wrench® on the “Sensor Data Grid Or Graphs” screen. Since the sensor reading may either be actual feedback from the sensor OR a default value set by the ECM in the event of a fault in the sensor or wiring, it is important to verify the condition of the sensor.

The Malfunction Indicator Light (MIL) may or may not illuminate to alert the rider of a possible problem, depending on which system fault has occurred. The first step following illumination of the MIL is to perform a visual inspection to see if a cause can be determined.

Connect Digital Wrench® to see what codes are present in memory, and focus your diagnostics on that sensor and the related wiring for that circuit. Refer to wiring diagrams and system break-out diagrams to narrow a problem search.

If multiple codes are set, refer to the wiring diagram and focus your efforts on wiring and connections common to each of the sensors, such as a power supply or common ground. Multiple sensor failure is extremely unlikely.

Many sensor tests described in this section are performed at the ECM wire connector. This method ensures that the data from a sensor is reaching the ECM. Sensor tests can be performed at the sensor if easily accessible, but the wiring between the sensor and the two 56-pin ECM connectors should always be closely examined and the path between the sensor and ECM verified if the sensor itself passes the test.

Poor or corroded connections are the most common cause of system faults. Always check the integrity of the male pins and female receptacles of the connectors in the affected circuit. These may include the sensor connector, the ECM connector, and any wiring between the two, such as jumper harnesses where applicable.

## ECM PINOUT TESTING

### NOTICE

Tests in this section may require reading resistance and voltages at ECM connector. Once ECM connector has been removed from the ECM:

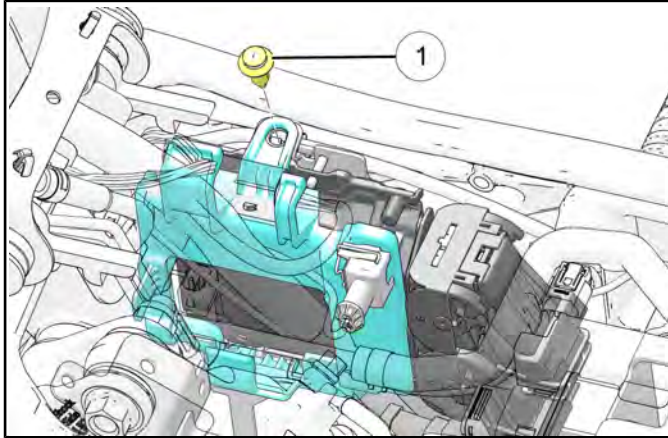
- Do not touch pins on ECM. Static electricity from your body can damage the ECM.
- Do not attempt to perform tests on the ECM unit.
- Always use the appropriate test connector from the Electrical Connector Test Adapter Kit (PV-43526) or an appropriate test probe that will not damage (expand) the connector pin socket.
- DO NOT attempt to use standard meter probes or other devices to probe connector pin sockets. this could expand a terminal socket or damage the connector, create a problem where none existed before, and complicate the diagnostic process.
- Sensor tests on the following pages can often be performed at the sensor connector itself or at the ECM connector based on accessibility of the connector or wiring.
- If a sensor tests within the specified range (OK), then test the circuit wiring. This usually originates at the ECM connectors, but may include other connections.

## ECM REMOVAL / INSTALLATION

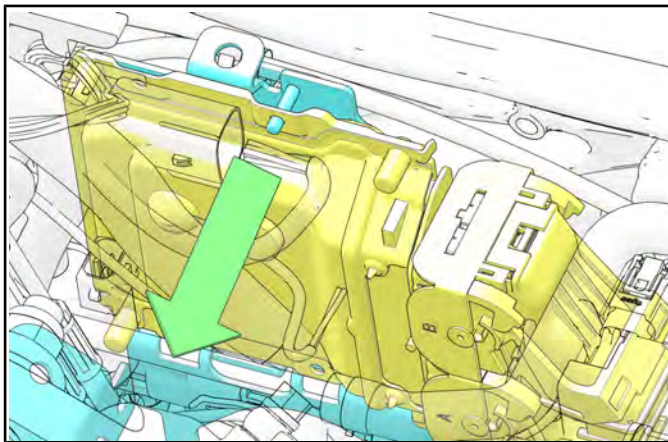
### IMPORTANT

Though the ECM appears identical to other heavy weight bike's ECM, they are not interchangeable.

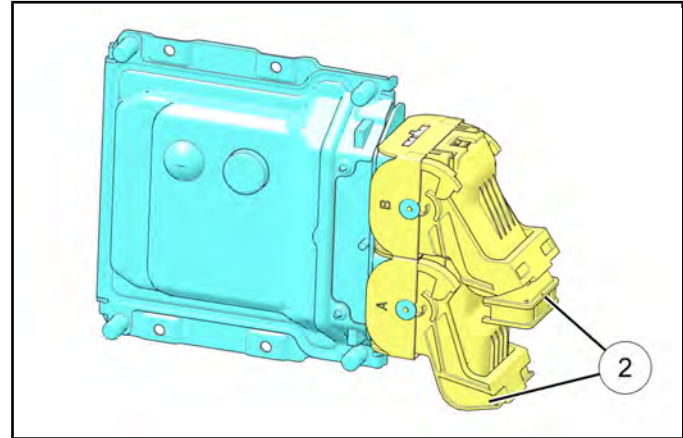
1. Remove seat. See **Seat Removal / Installation** page 7.32.
2. Remove pushdart ① retaining under-seat retention bracket and remove.



3. Slide the ECM off of its pin.



4. Lift the ECM up and disconnect its electrical connections ②.

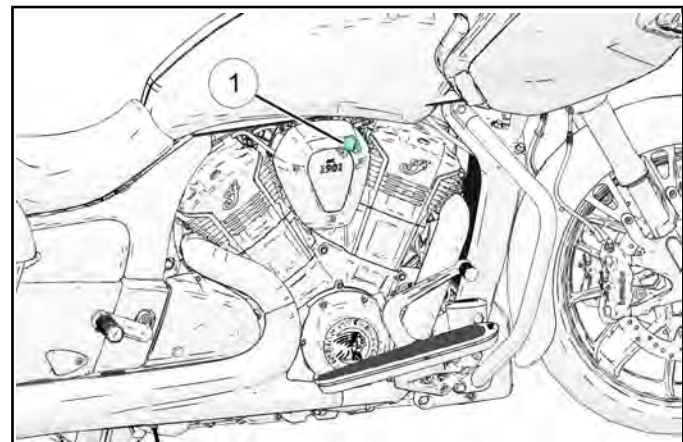


5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

## TEMPERATURE & MANIFOLD ABSOLUTE PRESSURE SENSOR (TMAP)

### OPERATION OVERVIEW

Mounted on the intake manifold, the TMAP sensor ① performs two functions in one unit.



Air passing through the intake is measured by the TMAP and relayed to the ECM. These signals, comprised of separate air temperature and manifold absolute pressure readings, are processed by the ECM and compared to its programming for determining the fuel and ignition requirements during operation. The TMAP sensor provides the ECM with engine load data.

### **TMAP SENSOR TEST**

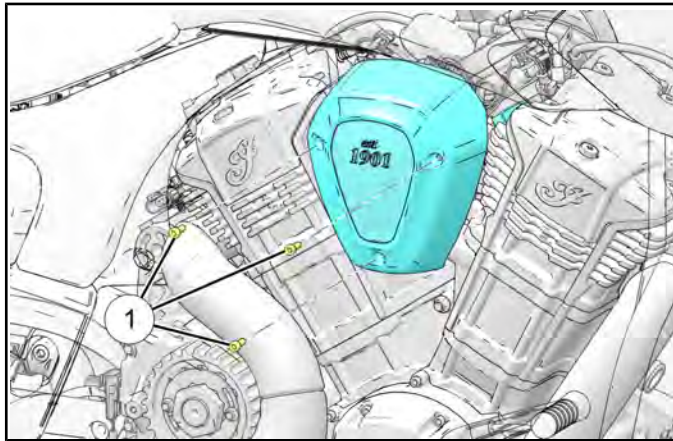
The TMAP sensor is a non-serviceable item. If it is faulty, it must be replaced

#### **IMPORTANT**

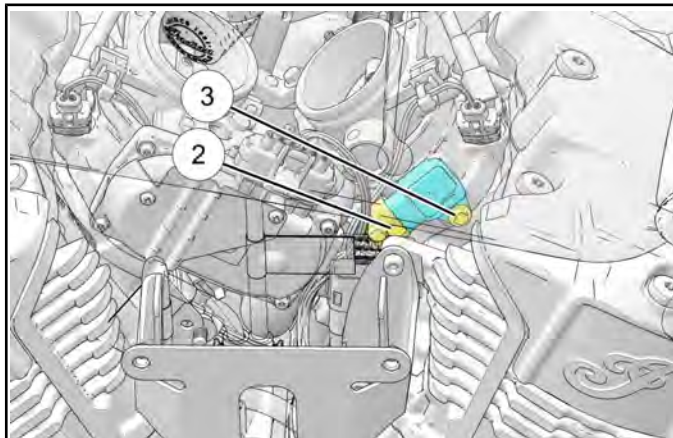
This sensor should only be tested using Digital Wrench Diagnostic Software.

### **TMAP SENSOR REPLACEMENT**

1. Remove right side v-cover by removing its fasteners ①.



2. Disconnect the TMAP electrical connector ②.



3. Remove the TMAP sensor fastener ③.
4. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### **TORQUE**

TMAP Sensor Fastener:  
**18 in-lbs (2 N·m)**

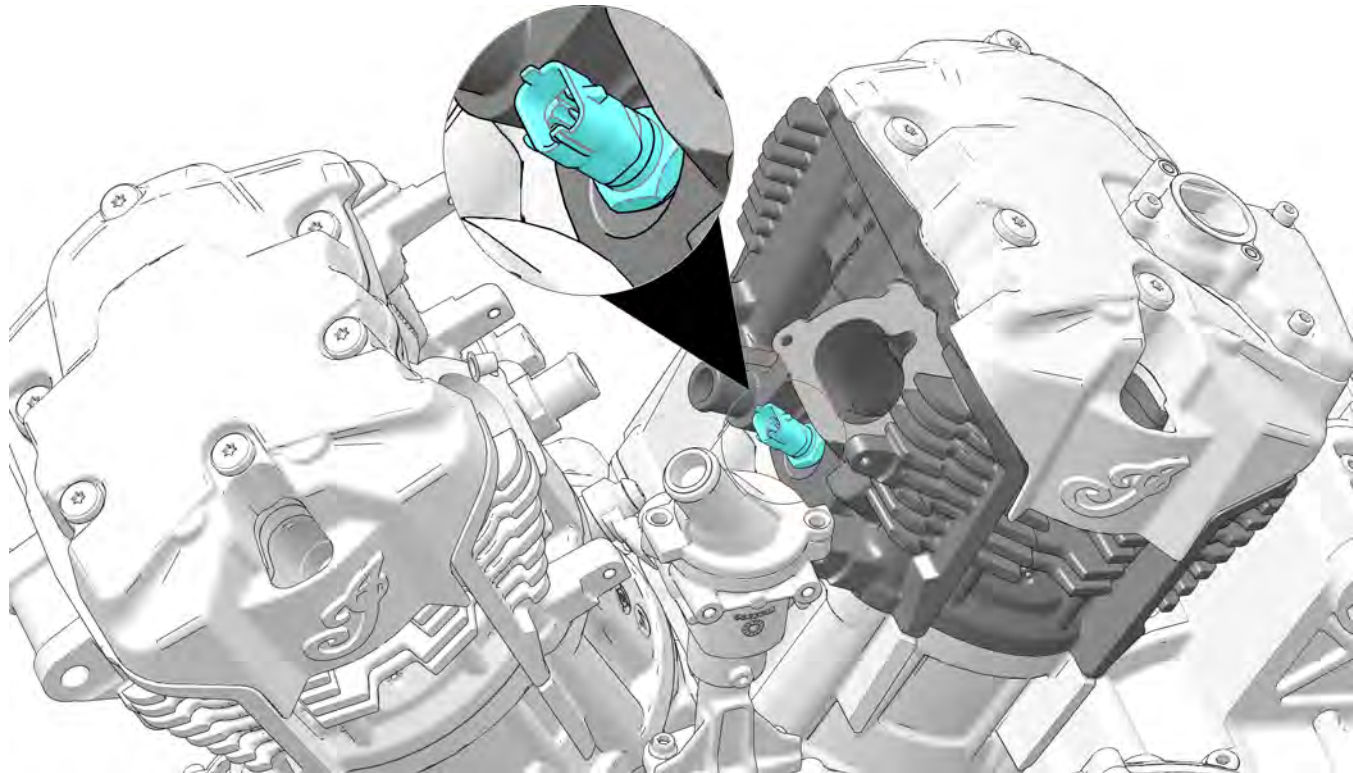
#### **TORQUE**

V-Cover Fastener:  
**84 in-lbs (10 N·m)**

## CYLINDER HEAD TEMPERATURE SENSOR, TEST / REPLACE

### OPERATION OVERVIEW

CHT TEST OVERVIEW		
INDICATES	INSPECT	LOCATION
Voltage received at ECM from CHT sensor is outside of parameters.	Resistance readings through sensor and wiring at ECM 2 connector (ECM disconnected). This will test will inspect the wiring, connectors, and CHT sensor resistance.	Under rear cylinder intake port.



4

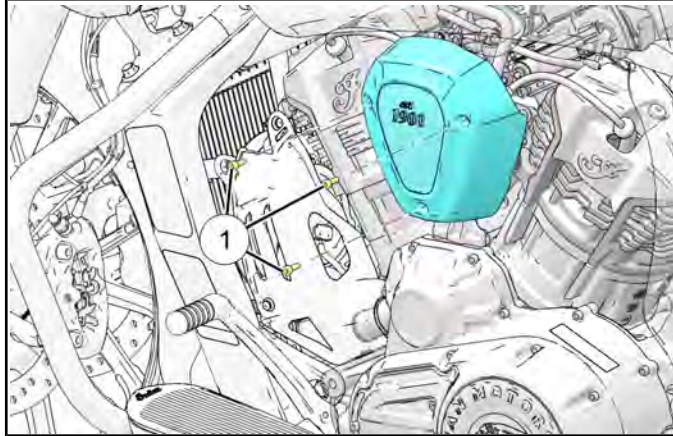
### CYLINDER HEAD TEMPERATURE SENSOR TEST

1. Disconnect ECM #2 connector. Reference **ECM Removal / Installation page 4.53**.
2. Attach test lead adapters to meter leads.
3. Set multimeter to measure resistance.
4. Measure resistance between pin 43 of the EMC#1 and pin 33 of the ECM #2 connector and compare to specification. See **ECM Connector Map page 4.42**.
5. If resistance is out of specified range, disconnect sensor and measure the resistance through each wire from ECM connector to the sensor connector. Resistance should be less than 1 Ohm (good continuity).
6. If Step 5 continuity is good, measure the resistance through the sensor and compare to specification.

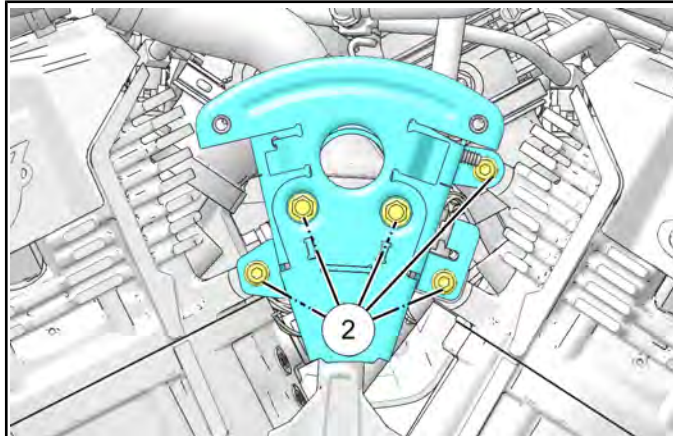
COMPONENT	METER SETTING	TEST CONNECTIONS	SPECIFICATIONS (±10%)
CYLINDER HEAD TEMPERATURE SENSOR	OHMS	Pin #43 to #33	30.5 K Ohms +/- 13% @ 25° C (77° F)

**CYLINDER HEAD TEMPERATURE SENSOR REPLACEMENT**

1. Remove left side v-cover by removing its fasteners ①.

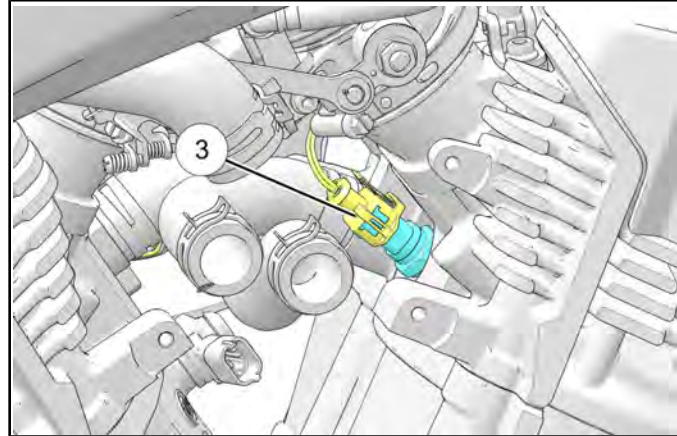


2. Remove ignition coils. See **Ignition Coil Removal / Installation page 10.52.**
3. Remove fasteners ② securing ignition coil bracket.



4. Disconnect the wiring harness and coolant return line hose from the ignition coil bracket.
5. Remove thermostat. See **Thermostat Removal / Installation page 3.43.**

6. Disconnect cylinder head temperature sensor electrical connector ③.



7. Remove cylinder head temperature sensor.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

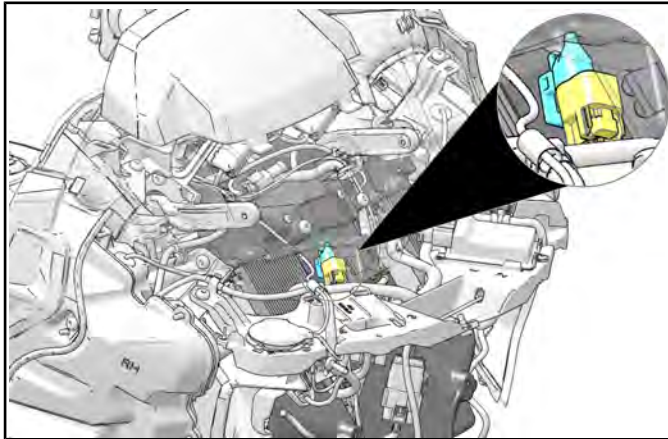
TORQUE
Cylinder Head Temperature Sensor: <b>15 ft-lbs (20 N·m)</b>

TORQUE
Ignition Coil Bracket: <b>84 in-lbs (10 N·m)</b>

TORQUE
V-Cover Fastener: <b>84 in-lbs (10 N·m)</b>

### AMBIENT AIR TEMPERATURE SENSOR

The ambient air temperature sensor is located inside the fairing as shown.



The ambient air temperature sensor can be tested by checking the resistance at different temperatures.

TEMPERATURE ( C )	RESISTANCE (k Ohms)
-40	195.652
-20	68.237
0	27.219
20	12.081
40	5.834
60	3.014
80	1.669
85	1.452

### FUEL RAIL REMOVAL / INSTALLATION

- To remove fuel rail, reference **Fuel Injector, Removal / Installation page 4.57.**

### FUEL INJECTOR, REMOVAL / INSTALLATION

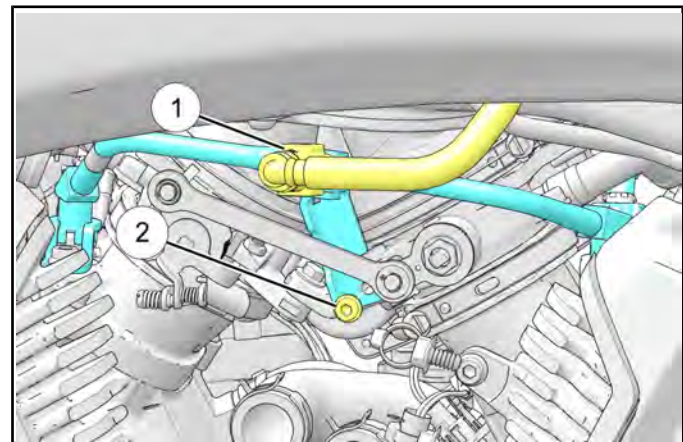
#### REMOVAL

- Depressurize fuel system. See **Fuel System Depressurization page 4.22.**
- Remove thermostat assembly. See **Thermostat Removal / Installation page 3.43.**
- Disconnect fuel line ① from fuel rail. Squeeze both release buttons (one on each side of fitting) and hold.

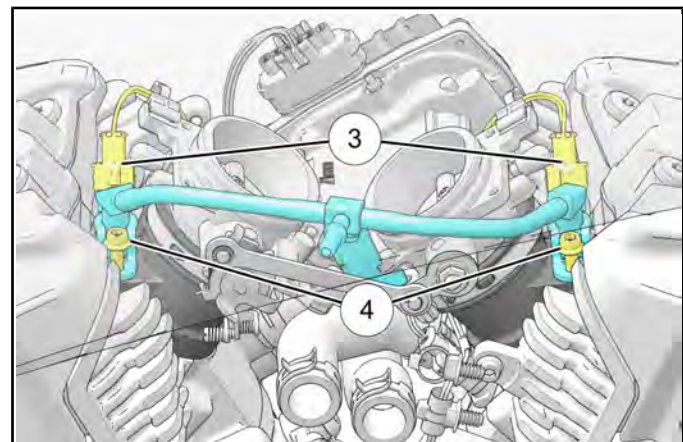
**⚠ CAUTION**

Do not use anything other than fingers to remove the quick connection. The use of tools can damage the connection.

4

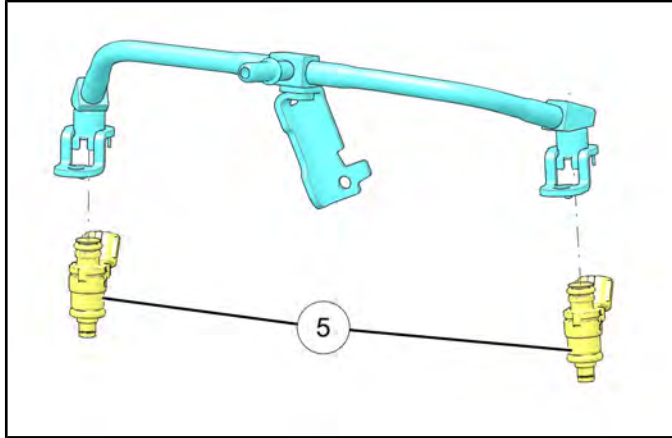


- Remove the fuel rail fastener ②.
- Disconnect fuel injector electrical connector ③.

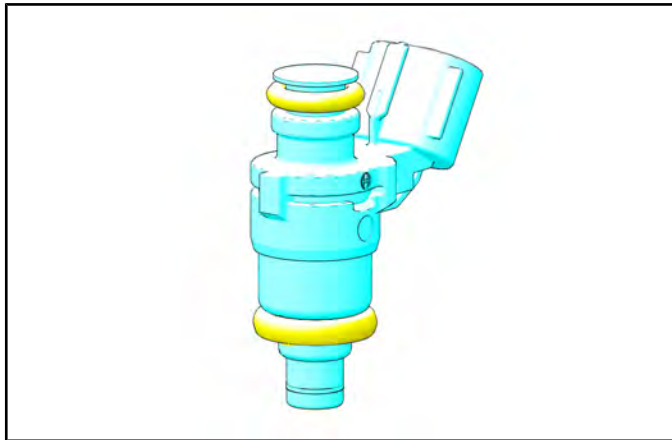


- Remove fuel injector fastener ④.
- Remove fuel injectors with the fuel rail.

8. Remove the fuel injectors ⑤ from the fuel rail.

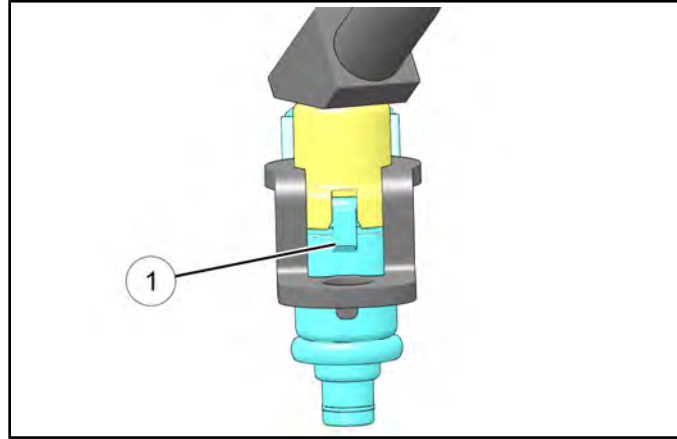


9. Inspect the fuel injector o-rings.



### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Ensure Injector is positioned so the clocking lug ① fits in the clocking tabs on the fuel rail.



3. Lubricate NEW injector o-rings with clean, silicone-free motor oil.

#### NOTICE

Apply oil sparingly and avoid contaminating the pintle valve / jet surface and upper inlet port.

#### IMPORTANT

Verify fuel supply line is properly seated and locked in place by listening for audible "click" when pressing into place. Pull gently on quick connector once seated to ensure a proper connection has been made.

#### TORQUE

Fuel Injector Fastener:  
**84 in-lbs (10 N·m)**

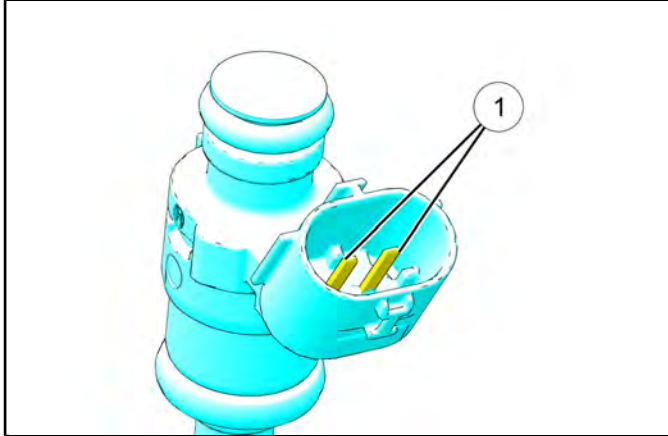
#### TORQUE

Fuel Rail Fastener:  
**62 in-lbs (7 N·m)**

**FUEL INJECTOR RESISTANCE TEST****IMPORTANT**

Take note of front and rear fuel injector harness connectors before disconnecting them.

The fuel injectors are non-serviceable. If diagnosis indicates a problem with either injector, test the resistance of the fuel injector(s) by measuring between the two pin terminals ①.



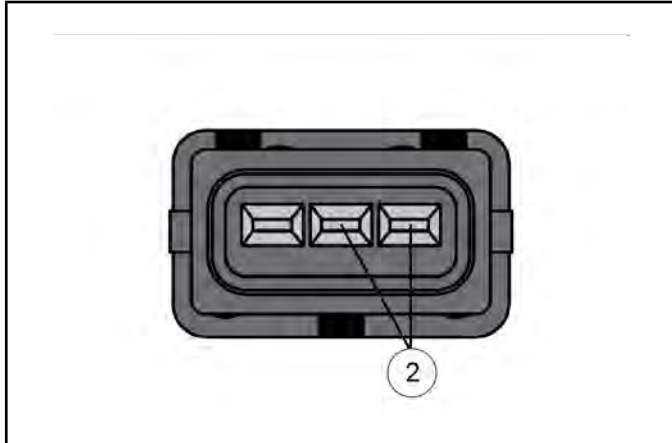
Fuel Injector Resistance Specification:  
**11.4  $\Omega$  — 12.6  $\Omega$**



## CRANKSHAFT POSITION SENSOR, TEST / REPLACE

### CPS TEST

1. To access the CPS connector, Reference the replacement procedure.
2. Connect an ohmmeter between the pin terminals ② and compare resistance readings to specification below.

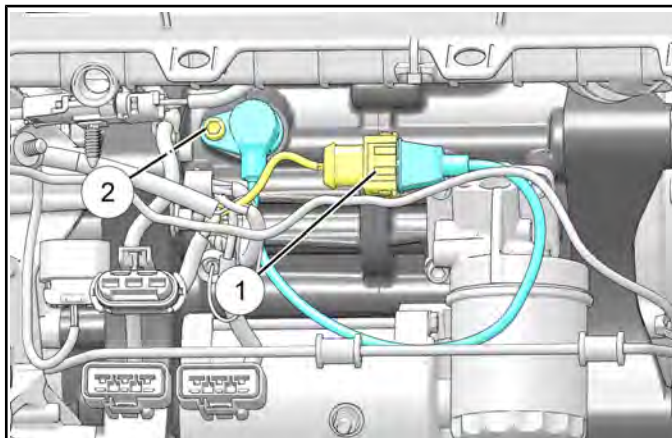


3. If resistance is correct, check to see that the sensor is mounted properly and that the tone wheel has not been damaged and is securely mounted to the crankshaft assembly.

Crankshaft Position Sensor: **860 Ohms @ 20°C (68°F)**

### REPLACEMENT

1. Remove battery box. See **Battery Box Removal / Installation page 10.16.**
2. Disconnect CPS electrical connector ①.



3. Remove CPS fastener ② and remove sensor.

#### IMPORTANT

Ensure o-ring is removed with CPS.

### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### NOTICE

Apply rubber lubricant to the CPS sensor o-ring to ease installation.

#### TORQUE

Crankshaft Position Sensor Fastener:  
**84 in-lbs (10 N·m)**

2. Install battery box. See **Battery Box Removal / Installation page 10.16.**

## KNOCK SENSOR TEST / REPLACE

### OVERVIEW

The Knock sensor is a piezoelectric sensor that advances or retards ignition based on load.

**⚠ CAUTION**

The knock sensor is torque sensitive and must be replaced if removed for any reason.

**IMPORTANT**

The knock sensor must be torqued to specification or it will not perform correctly. Sensors that have been over-tightened or under-tightened may set a diagnostic trouble code and cause the MIL to illuminate. Use a properly calibrated torque wrench during installation.

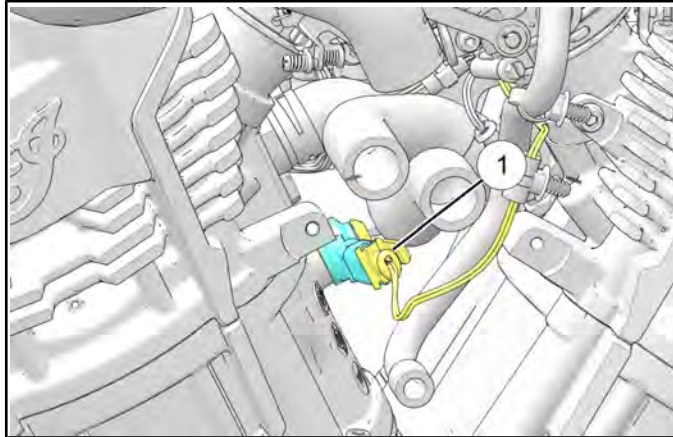
### KNOCK SENSOR DIAGNOSTIC INFORMATION

COMPONENT	LOCATION	P-CODE	SPN	FMI	DESCRIPTION
Knock Sensor	Rearward face of the front cylinder	P0327	731	4	Knock Sensor 1: Voltage too low
		P1327	520331	3	Positive Line: Voltage too high
		P1328		4	Positive Line: Voltage too low
		P132A	520332	3	Negative Line: Voltage too high
		P132B		4	Negative Line: Voltage too low

4

**TEST 1**

1. Disconnect the negative battery cable. See **Battery Removal page 10.6.**
2. Remove thermostat housing. See **Thermostat Removal / Installation page 3.43.**
3. Locate the Knock sensor on the front cylinder and disconnect its electrical connector ①.



4. Inspect the sensor-side of the connector for moisture and / or corrosion. Make sure the terminal pins are securely seated in the plug
5. Remove the ECM from the motorcycle to access ECM connector 1. See **ECM Removal / Installation page 4.53.**
6. Set multi meter to measure resistance.
7. Measure the resistance through each wire from ECM connector to the sensor connector. Resistance should be less than 1 Ohm (good continuity). See **ECM Connector Map page 4.42** for pin locations.

ECM1 Pin 109 to Knock Sensor Connector Pin 1 should be less than 1Ω.  
 ECM1 Pin 110 to Knock Sensor Connector Pin 2 should be less than 1Ω.

8. Measure the resistance across the Knock sensor pins 1 & 2.

Resistance across Knock Sensor Connector Pin 1 & Pin 2: Continuity  
 Resistance should be between 4.5–5.0 MΩ

9. If the resistance does not match the specified value, replace the sensor.

**TORQUE**

Knock Sensor Fastener:  
**15 ft-lbs (20 N·m)**

**TEST 2**

1. Using a multi meter with a low voltage AC frequency scale, connect the meter leads to the connector pins of the Knock sensor.
2. Allow the signal to stabilize to 0 Hz.
3. Lightly tap the front cylinder near the knock sensor with a rubber mallet or other non-metallic object.
4. Watch for frequency fluctuation.
5. If no frequency fluctuation is observed while tapping on the cylinder, replace the sensor.

**TORQUE**

Knock Sensor Fastener:  
**15 ft-lbs (20 N·m)**

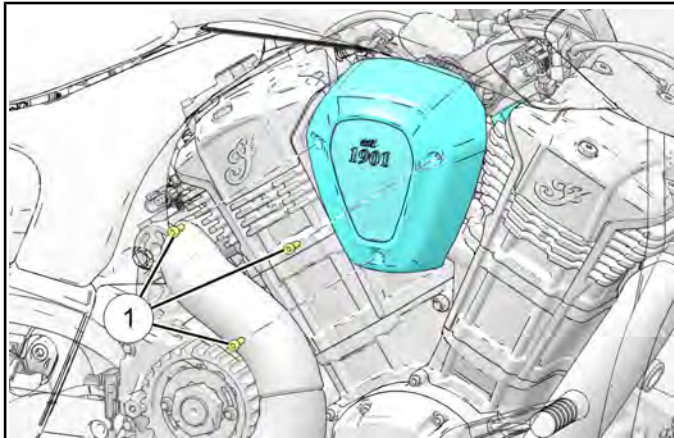
## THROTTLE BODY REMOVAL / INSTALLATION

### IMPORTANT

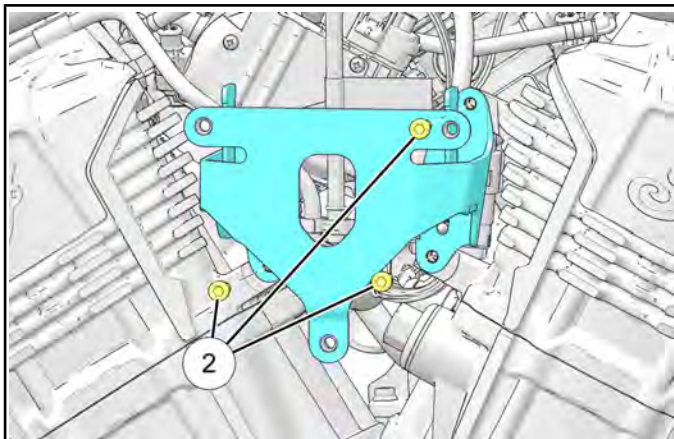
Due to the rigidity of the intake manifold and inlet adaptor material, it is easier to remove the throttle body and the intake manifold at the same time.

### REMOVAL

1. Remove ignition coil and bracket. See **Ignition Coil Removal / Installation page 10.52.**
2. Remove right side v-cover by removing its fasteners ①.

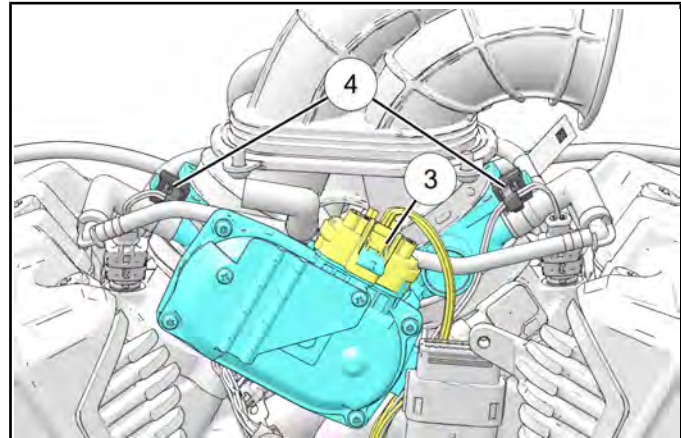


3. If equipped, remove carbon canister. See **Carbon Canister Removal / Installation page 4.12.**
4. Remove V-cover bracket by removing its fastener ②.

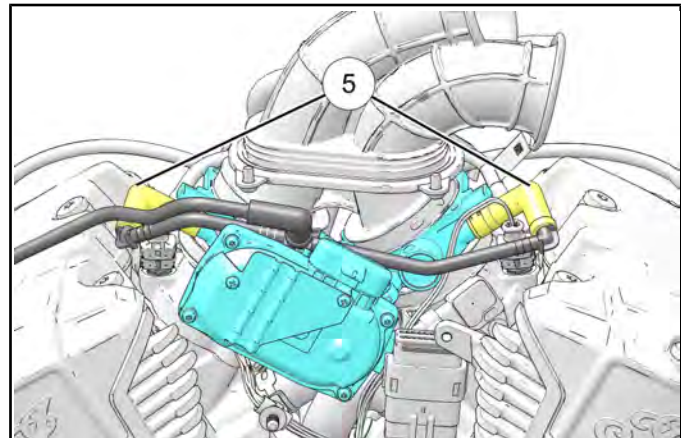


5. Disconnect the wiring harness from the v-cover bracket.

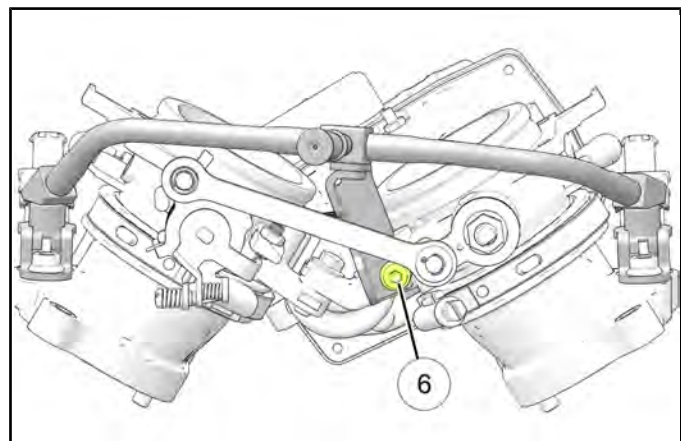
6. Disconnect throttle body electrical connector ③.



7. Disconnect fuel injector wire routing clips ④ from throttle body.
8. Disconnect fuel injector electrical connectors.
9. If equipped with EVAP, disconnect purge lines ⑤ from throttle body.

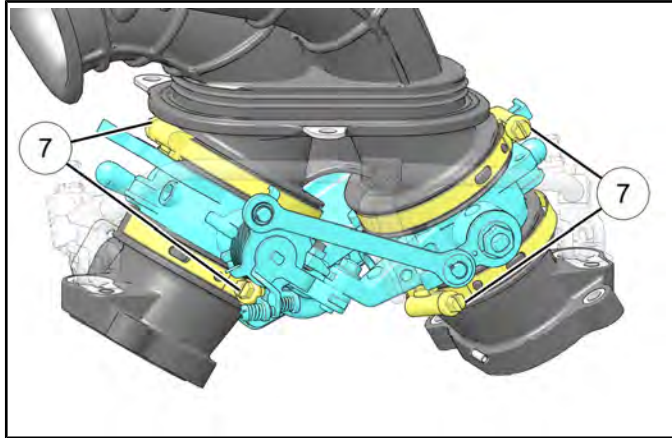


10. On the left side of the unit. Disconnect fasteners ⑥ securing fuel rail to throttle body.

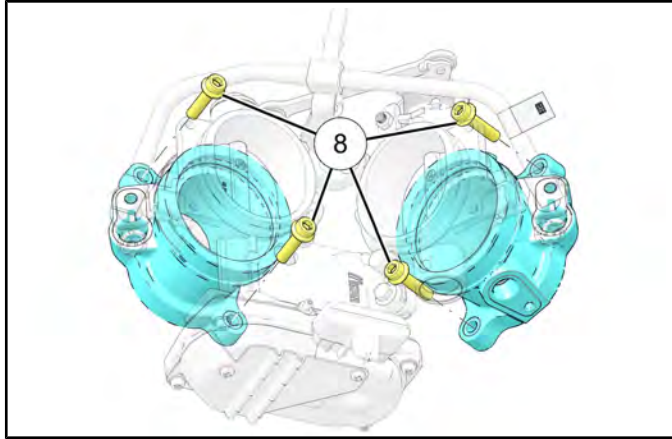


4

11. Loosen the clamps ⑦ securing the throttle body



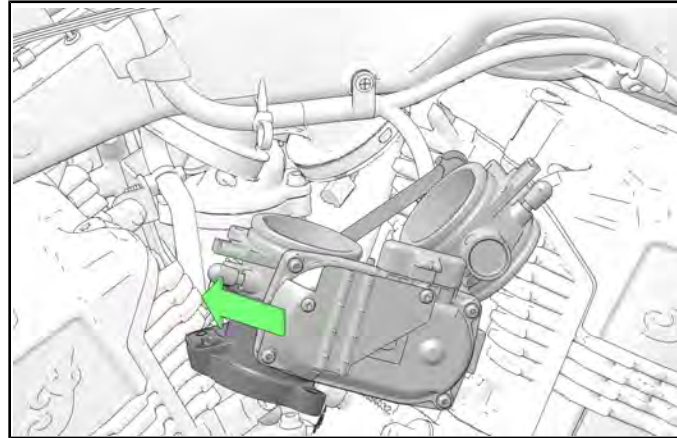
12. Remove the intake manifold fasteners ⑧.



13. Carefully remove the throttle body and intake manifold from the right side of the unit.

### INSTALLATION

1. Fit the rear lower runner to the new throttle body. Carefully slide the throttle body and rear intake manifold into position in the motorcycle.

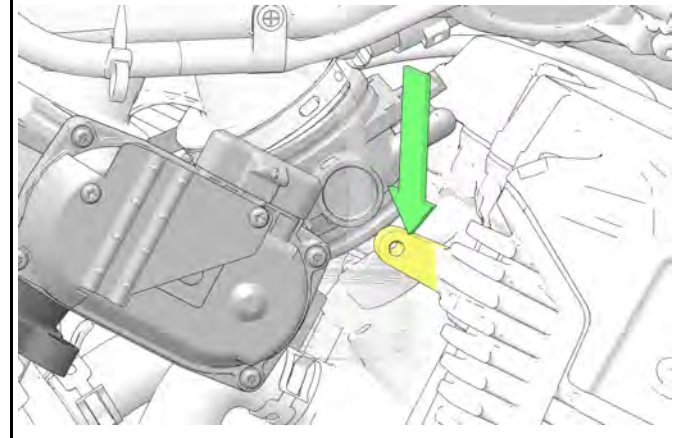


#### IMPORTANT

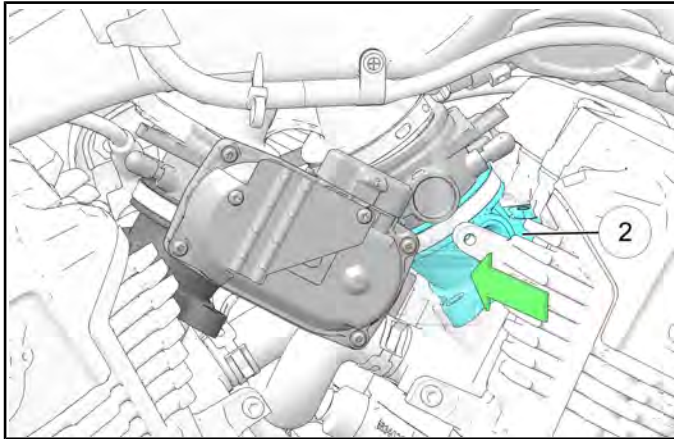
Do not use force when installing the throttle body. Damage to hoses, electrical wires or sensors may occur.

#### NOTICE

The front of the throttle body needs to clear the engine extrusion before the front intake manifold can be installed.



2. Install the front intake manifold ② to the throttle body and slide into position. Torque clamps to specification.

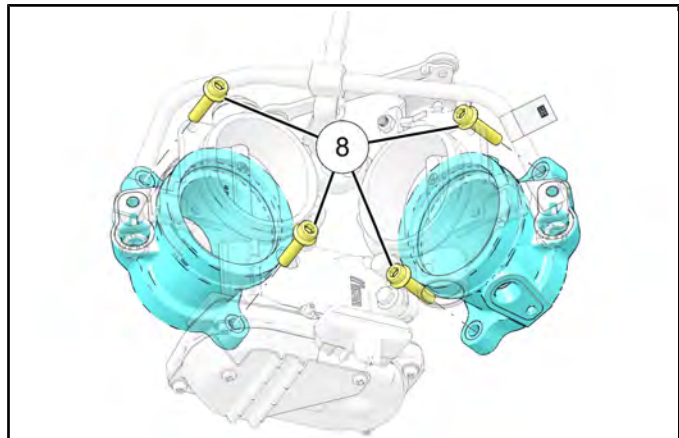
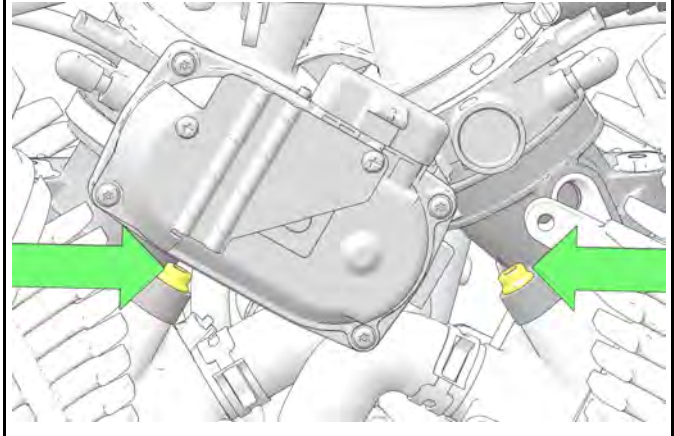


**TORQUE**  
Clamps:  
**26 in-lbs (3 N·m)**

3. Install the intake manifold fasteners ⑧.

*NOTICE*

The right hand intake manifold fasteners are difficult to access when torquing. Special Tool 5264374 is recommended when torquing these two fasteners.

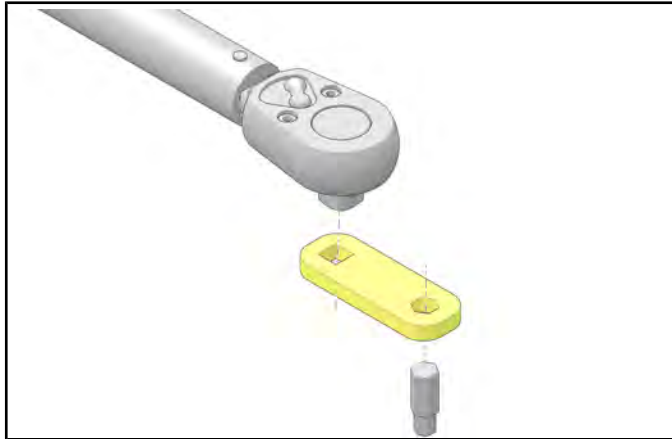


**TORQUE**  
Intake Manifold Fasteners (left-hand side):  
**84 in-lbs (10 N·m)**

4

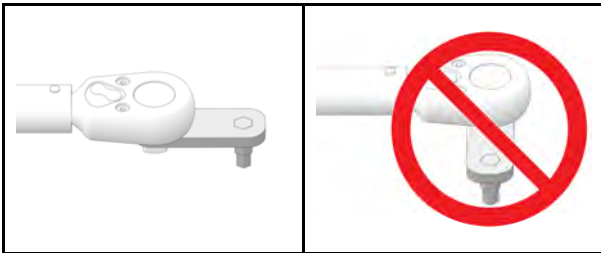
• **RIGHT-HAND SIDE FASTENERS:**

Install the FUEL RAIL TORQUE TOOL (5264374) onto a ¼ in drive torque wrench. Install a 5 mm allen bit to the hex end of the torque tool as shown.



**IMPORTANT**

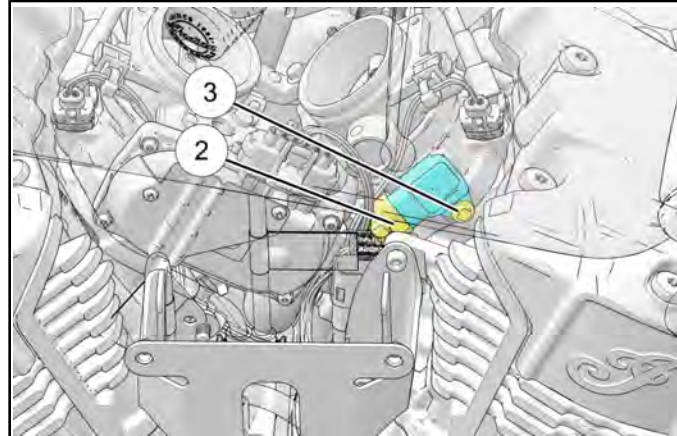
Alignment of the special tool is critical to achieve the correct torque. Make sure the TORQUE TOOL remains in-line with the torque wrench while torquing fasteners.



**TORQUE**

Intake Manifold Fasteners (right-hand side installed with special tool 5264374):  
**74 in-lbs (9 N·m)**

4. Connect the TMAP electrical connector ②.



5. Install the TMAP sensor fastener ③. Torque to specification

**TORQUE**

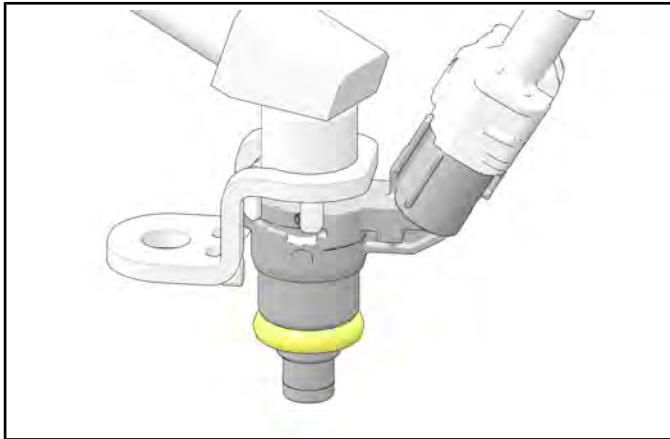
TMAP Sensor Fastener:  
**18 in-lbs (2 N·m)**

6. Lubricate NEW injector o-rings with clean, silicone-free motor oil.

**NOTICE**

Apply oil sparingly and avoid contaminating the pintle valve / jet surface and upper inlet port.

7. Install replacement o-rings onto the bottom of the injectors.



PART	POSITION
5416413	BOTTOM OF INJECTOR

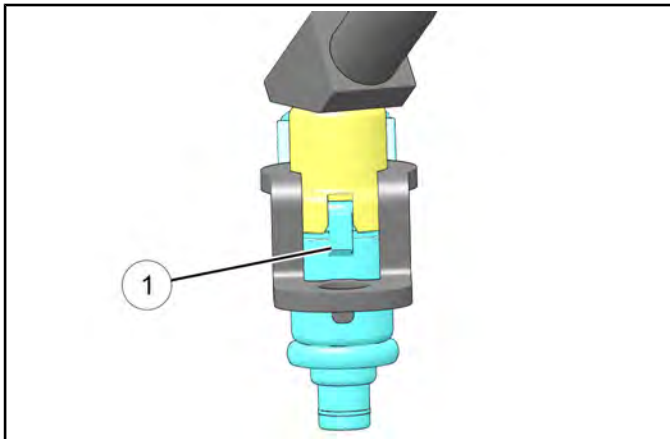
**IMPORTANT**

Verify that both of the new o-rings have been lubricated and installed correctly onto the injectors.

**IMPORTANT**

Use care not to fold or displace lower o-ring from seating surface.

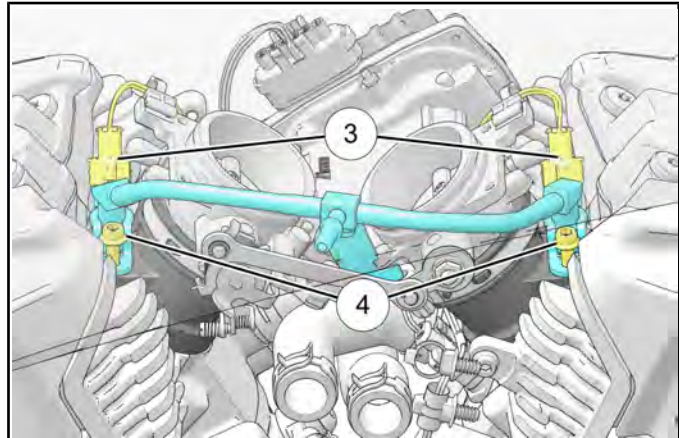
8. Ensure Injector is positioned so the clocking lug ① fits in the clocking tabs on the fuel rail.



**IMPORTANT**

Use care not to fold or displace lower o-ring from seating surface.

9. Connect fuel injector electrical connectors ③.



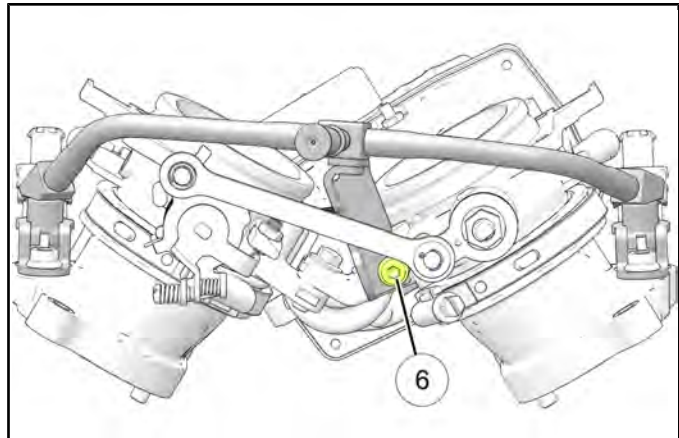
10. Install fuel injector fasteners ④ finger tight.

11. Install a commercially available 5 mm allen 1/4" drive socket onto a 1/4" drive torque wrench. Torque injector fasteners to specification.

**TORQUE**

Fuel Injector Fastener:  
**84 in-lbs (10 N·m)**

12. On the left side of the unit, fastener ⑥ securing fuel rail to throttle body. Torque fastener to specification.



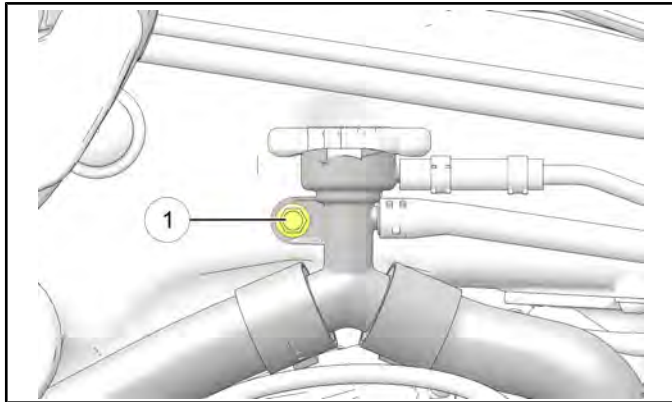
**TORQUE**

Fuel Rail Fastener:  
**62 in-lbs (7 N·m)**

4

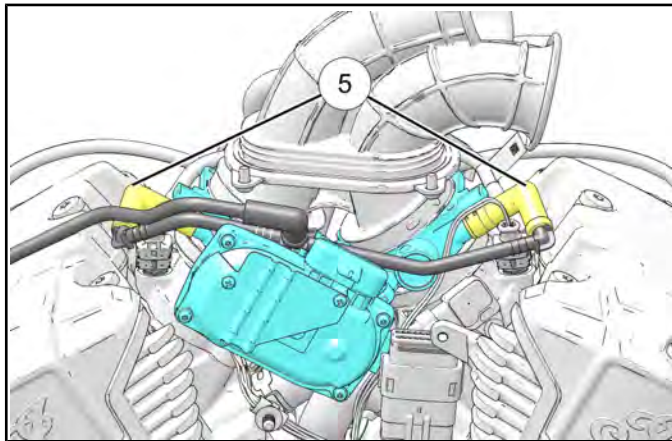


13. Install the coolant line fastener ①. Torque to specification.



**TORQUE**  
Coolant Line Fastener:  
**84 in-lbs (10 N·m)**

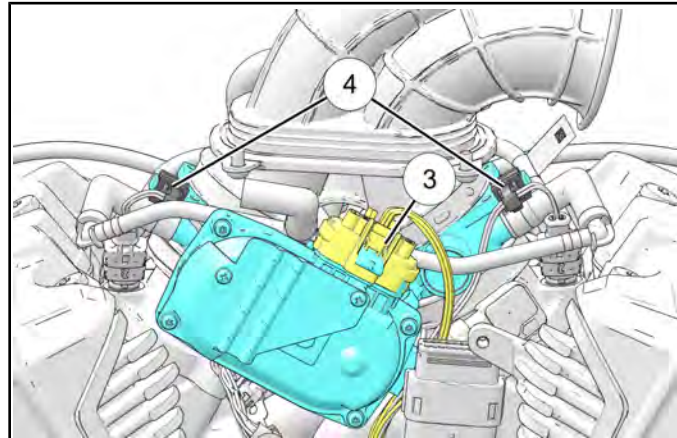
14. If equipped with EVAP, connect purge lines ⑤ to the throttle body.



15. Connect fuel injector electrical connectors.

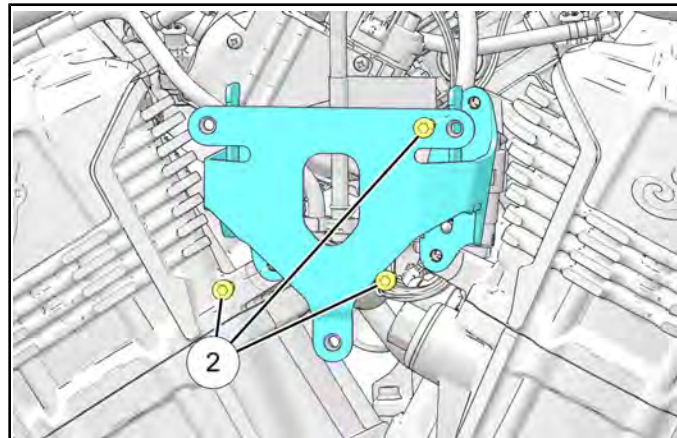
16. Connect fuel injector wire routing clips ④ to throttle body.

17. Connect throttle body electrical connector ③.



18. If equipped, Install carbon canister. See **Carbon Canister Removal / Installation page 4.12.**

19. Install V-cover bracket and secure with fasteners ②. Torque fasteners to specification



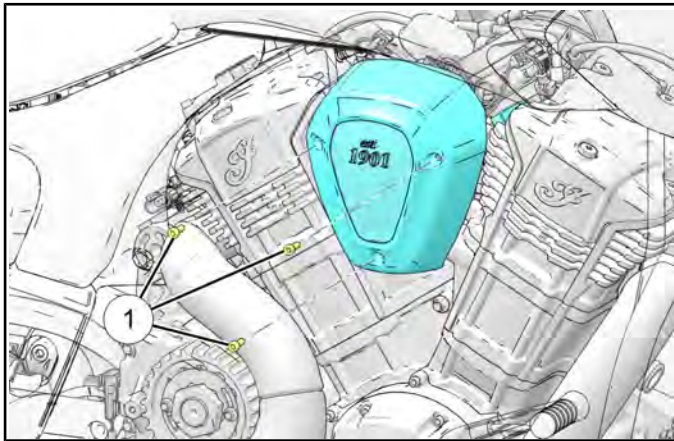
**TORQUE**  
V-cover Bracket Fastener:  
**84 in-lbs (10 N·m)**

20. Connect the wiring harness to the v-cover bracket.

21. Install ignition coil and bracket. See **Ignition Coil Removal / Installation page 10.52.**

22. Install right side v-cover and secure with fasteners

- ①. Torque fasteners to specification.



**TORQUE**

V-cover Fastener:  
**84 in-lbs (10 N·m)**

23. Perform the throttle body learn procedure. Refer to Throttle Learn Procedure page 4.78

24. Connect the motorcycle to Digital Wrench. Verify no fail codes and no MIL lights are present. Field Test the motorcycle to verify proper operation.

**CYLINDER MISFIRE DETECTION**

The ECU monitors crankshaft speed via the crankshaft position sensor. A misfire will cause a fluctuation in crankshaft speed. A code will set and flash the check engine light after an engine misfire threshold/rate is detected that is above a pre-determined limit. This threshold varies based on engine speed.

One or more of the following codes will be set if a misfire occurs:

- P0301 (SPN 65591/FMI 7) Misfire Detected, Cylinder 1 (Front)
- P0302 (SPN 65592/FMI 7) Misfire Detected, Cylinder 2 (Rear)
- P0314 (SPN 65590/FMI 7) Misfire Confirmed

If a misfire is detected, the following events will occur:

- The check engine indicator lamp will begin to flash and fuel will be cut to the affected cylinder(s). The check engine indicator lamp will continue to flash until the ignition switch has been moved to the off position. Restarting the engine will clear the flashing indicator and restore fuel to both cylinders.
- If a 2<sup>nd</sup> misfire occurs, the check engine indicator lamp will resume flashing and fuel will once again be cut to the affected cylinder(s).
- After the 3<sup>rd</sup> misfire, P0314 misfire fault is determined & set, the check engine light will remain on and fuel will be cut to the affected cylinder(s). If this occurs, follow the troubleshooting section below.

In cases where cylinder misfire is intermittent, or has been repaired in the field (e.g. loose spark plug wire has been reattached), Misfire Detection utilizes a self-healing feature to allow continued operation.

Following the 1st or 2nd misfire event, when the ignition is cycled OFF and ON again, the misfire code becomes historic and the MIL turns off. When P0314 is set, after the 3rd misfire event, the MIL will stay on for 3 fault free drive cycles before turning off.

If the MIL turned on solid due to P0314, it will stay on until the misfire condition has been removed and 3 fault free drive cycles have occurred.

<b>NOTICE</b>
<p><b>DRIVE CYCLE:</b> A drive cycle consists of cycling the ignition from OFF to ON, then start the engine and run at idle for a period of approximately 4 minutes. Finally, turn off the ignition for approximately 2 1/2 minutes.</p>

If it does not turn off, diagnose by verifying the following items:

<b>TROUBLESHOOTING</b>
<ul style="list-style-type: none"> <li>• Ignition Coil and connections are good</li> <li>• Spark plugs wires are secure</li> <li>• The correct spark plugs are installed and the plugs are not fouled</li> <li>• Crankshaft Position Sensor tests good</li> <li>• Wiring to the Crankshaft Position Sensor, ECU and Ignition Coil are not damaged. Chassis ground is clean and tight</li> <li>• Fuel pressure is within specification</li> <li>• Fresh/good quality fuel is in the fuel tank</li> <li>• Engine mechanical is good (leak down, timing)</li> </ul>

<b>IMPORTANT</b>
<p>Once the systems is repaired and functioning normally, connect to Digital Wrench to clear active and historic codes. Retest to verify the condition is no longer present.</p>

## CAN DIAGNOSTICS

### CAN (CONTROLLER AREA NETWORK) DIAGNOSTIC OVERVIEW

#### Overview

The speedometer and Engine Control Module (ECM) have integrated 120Ω termination resistors. With the speedometer unplugged, check resistance between the CAN terminals at the speedometer connector. The resistance should be 120Ω. With the speedometer connector plugged in, and the ECM connector unplugged the resistance will be 120Ω. With speedometer and ECM connectors plugged in, the resistance will be 60Ω

#### Baseline CAN Resistance Values

Checking resistance between Yellow CAN High wire and Green CAN Low wire at the specified module connectors below (while unplugged):

- VCM = 60Ω
- ECM = 120Ω
- Speedometer = 120Ω
- ABS Module = 60Ω
- Diagnostic Connector = 60Ω

#### Diagnostic Connector Resistance Test

If Pins G through H =60Ω: Main Data bus has connection and the ECU and Speedometer are connected.

If Pins G through H =120Ω: Main Data bus is experiencing issues with the terminating resistor in the ECU or speedometer. Check the connection at the ECU and speedometer for pin fit. With one of the modules removed check the resistance at the DG-YE wires leading into each module with the module disconnected. The reading should be 120Ω.

If the connection to the data bus via the harness checks ok, proceed with replacing the suspect damaged module.

These checks only confirm that the main data bus lines, ECU, and speedometer are connected to the data bus. If a CAN issue is suspected in any of the following modules the module should be removed and resistance checked at each of the An wires leading into the module DG-YE should read 60Ω with the module removed.

## DIGITAL WRENCH SPECIAL TOOLS

SPECIAL TOOL	PART NUMBER
Digital Wrench® Diagnostic Kit	PU-47063-D, which includes the following: <ul style="list-style-type: none"> <li>• Digital Wrench® Software: PU-48731-A</li> <li>• MultiLink XP Module Kit: PU-52792</li> </ul>
Wireless Vehicle Link (WVL)	PU-51435

### DIGITAL WRENCH® SOFTWARE OVERVIEW

The Polaris Digital Wrench® software allows a technician to perform the following tasks:

- Analyze real-time engine data
- Create customer service account records
- Generate / upload service reports
- Perform guided diagnostic procedures
- Perform output state control tests (most models)
- Reflash ECU calibration files
- View or clear trouble codes and freeze time data

See “Digital Wrench® Software Installation and Updates” for information on the latest software and updates.

For information on how to use the Digital Wrench® software, refer to the Digital Wrench® System Help. To access the Digital Wrench® System Help, do one of the following:

- Expand the Digital Wrench® Help drop-down on the left side of the main screen and click System Help.
- Select the ‘Display Diagnostic System Help’ menu icon (question mark) on the main screen.



### GUIDED DIAGNOSTICS

Guided diagnostics are available within Digital Wrench® for all supported Trouble Codes (that is, any fault that will turn on the ‘Check Engine’ indicator).

In addition, guided diagnostics are also available for many other electrical sub systems.

### DIAGNOSTIC SOFTWARE VERSION

Always use the most current version of the Digital Wrench software to ensure you have the latest updates or enhancements. New reprogramming files and guided diagnostic procedures are added to these updates as they become available. For information on how to determine if you have the latest update available, see Digital Wrench Version and Update ID page 4.74.

### ECM REPLACEMENT

Although the need for ECM replacement is unlikely, a specific replacement procedure is required to ensure that all essential data contained within the original ECU is transferred to the replacement ECU.

Refer to procedure and carefully follow all instructions provided in Digital Wrench.

### GUIDED DIAGNOSTIC AVAILABLE

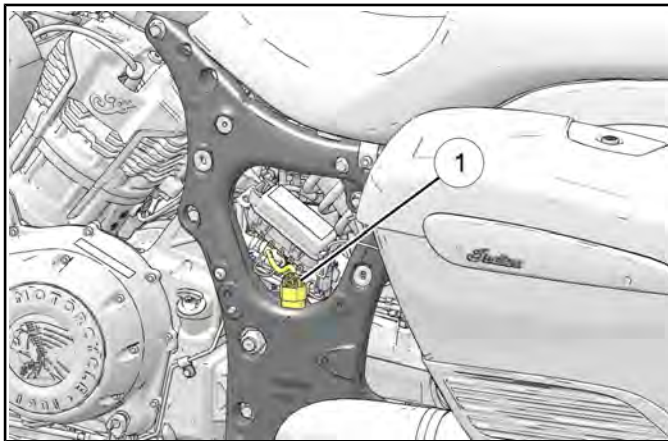
Guided diagnostics are available within Digital Wrench for most supported Diagnostic Trouble Codes (DTCs). That is, any fault that will turn on the 'Check Engine' indicator.

In addition, guided diagnostics are also available for many other electrical sub systems.

Diagnostic procedures are added to subsequent versions of Digital Wrench as they become available. Check your release version often and upgrade when available to be sure you are using the most current software available.

### DIGITAL WRENCH DIAGNOSTIC CONNECTOR

The diagnostic connector ① is located under the LH side cover, below the fuse box.

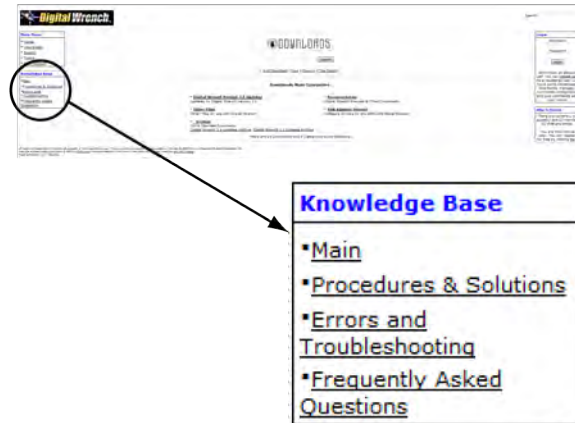


Follow these steps to connect the diagnostic interface cable to the vehicle:

1. Assemble the SmartLink Module and attach the PC Interface Cable to your laptop.
2. Unplug the Digital Wrench connector from its protective receptacle.
3. Connect the Vehicle Interface Cable to the Digital Wrench diagnostic connector.
4. Press the ON button to power up the motorcycle electrical system and switch the STOP / RUN switch to the RUN position.
5. Select the appropriate vehicle and wait for the status to display 'Connected' in the lower left corner of the screen.
6. Once connected, proceed with using Digital Wrench.

### DIGITAL WRENCH COMMUNICATION ERRORS

If you experience problems connecting to a vehicle or any other Digital Wrench related problem, visit the Digital Wrench Knowledge Base for the most current troubleshooting information, FAQs, downloads and software updates at: <http://polaris.diagsys.com/>.



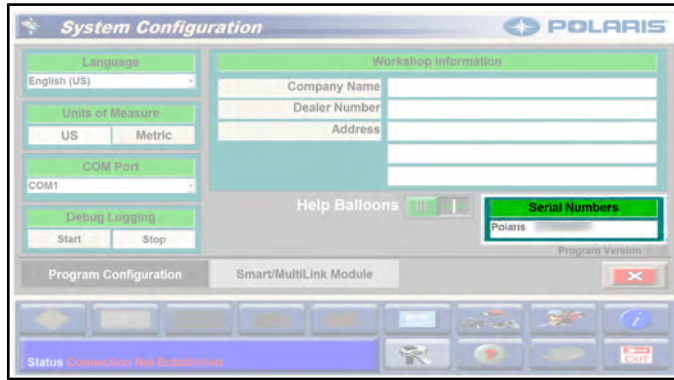
## DIGITAL WRENCH® SERIAL NUMBER LOCATION

To locate the Digital Wrench® serial number, do the following:

1. Launch the Digital Wrench® software.
2. On the Digital Wrench® main screen, select the 'Configure the Diagnostic System Software' menu icon.



3. Locate the serial number on the right side of the System Configuration screen.



## DIGITAL WRENCH VERSION AND UPDATE ID

Knowing what Digital Wrench version and update is installed will help determine which updates are required.

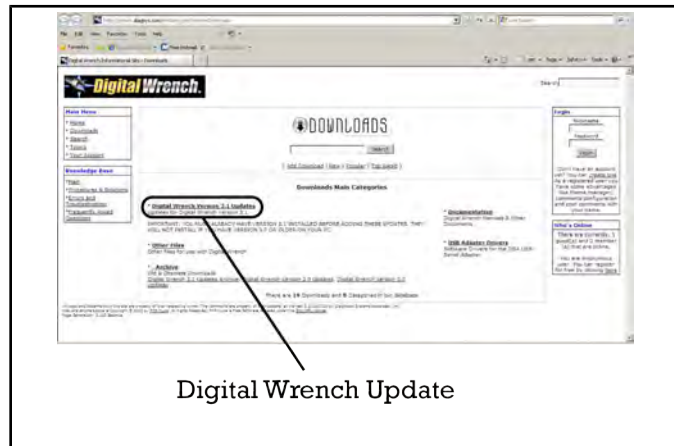
### NOTICE

Versions and updates are subject to change.

1. Open the Digital Wrench software. Locate the version ID shown on the lower right side of the Digital Wrench start-up screen.



2. Proceed to <http://polaris.diaqsys.com> to see if a newer update is available.



3. If a newer update is available, it should be downloaded before using Digital Wrench.

### NOTICE

Always operate with the latest update.

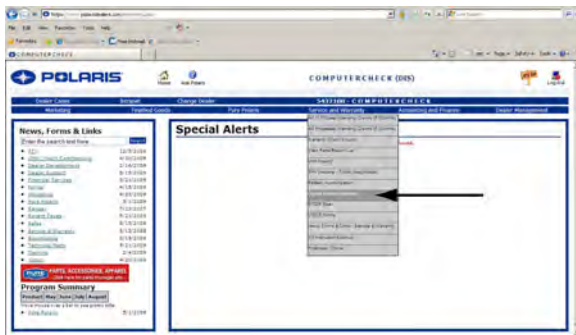
## DIGITAL WRENCH UPDATES

Updates are released for Digital Wrench via the Internet at: <http://polaris.diaagsys.com>. The Digital Wrench website can also be accessed through the dealer website at: [www.polarisdealers.com](http://www.polarisdealers.com).

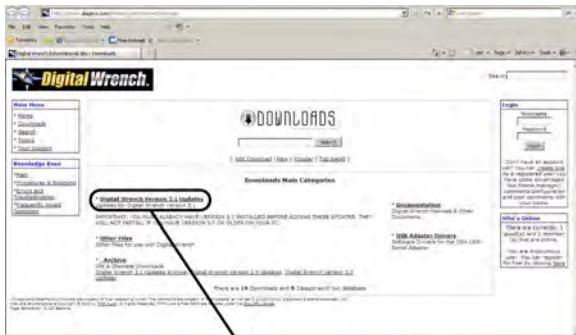
### NOTICE

Only authorized Indian Motorcycle dealers and distributors can access the dealer website.

1. Log on to [www.polarisdealers.com](http://www.polarisdealers.com).
2. Locate the **Service and Warranty** drop-down menu.
3. Click on **Digital Wrench Updates**.



4. The Digital Wrench portal website should appear in a new web browser.
5. Click on **Digital Wrench Version Updates**.



Digital Wrench Update

### NOTICE

You must already have the current version installed before adding an update. Updates will not install if you are using an older version loaded on your PC.

6. If the update file date listed is newer than your current version and update, download the file.



7. Click on the link shown above, save the file to your hard disk and then double-click the icon to start the update process.

### NOTICE

Do not "run" or "open" the file from where they are. Select "save" and download them to your PC before running the install.

8. When the update is complete, the version shown on the right side of the Digital Wrench start-up screen should match the update you just downloaded.



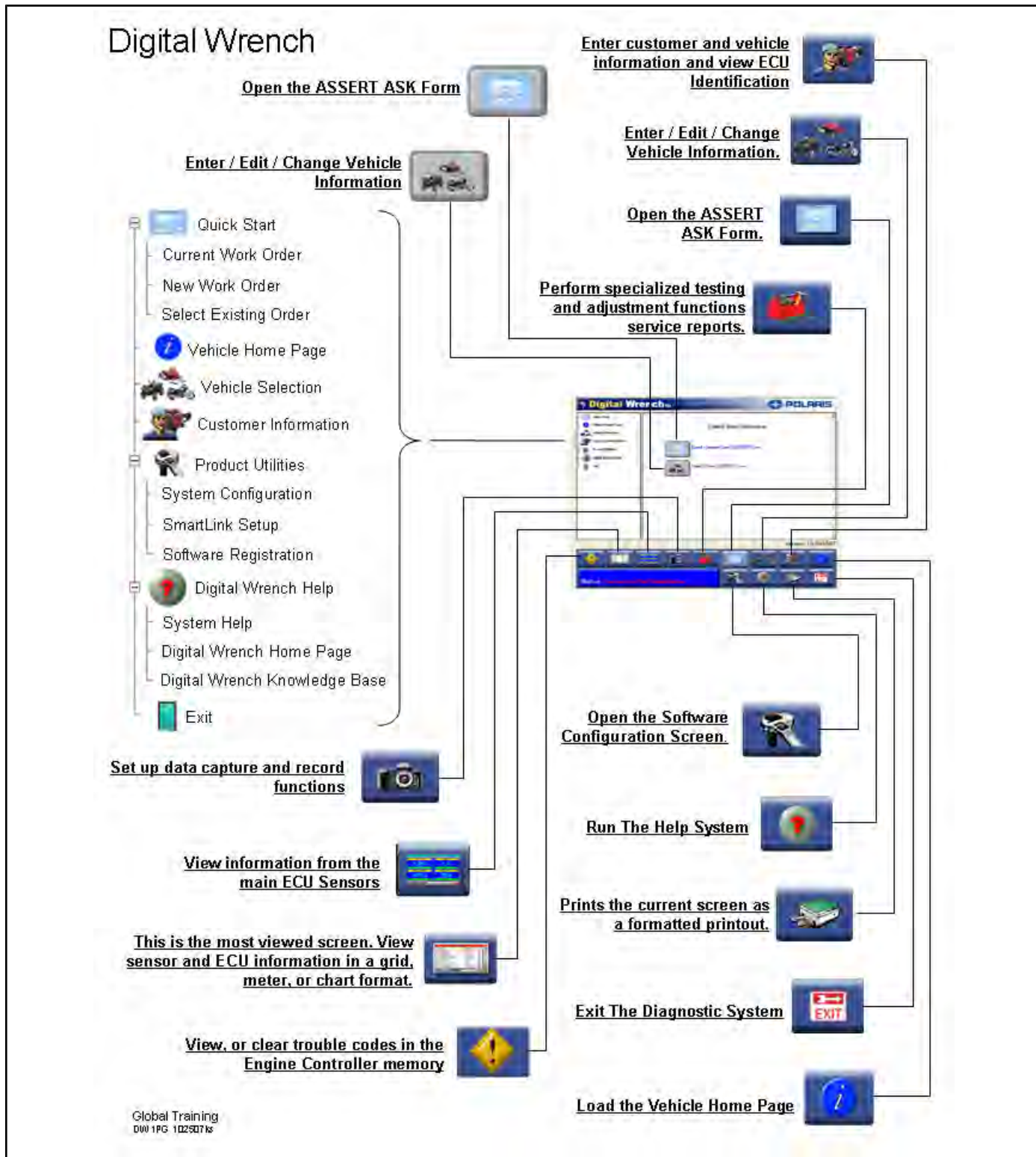
### NOTICE

Versions and updates are subject to change.

4



**DIGITAL WRENCH FEATURE MAP**



## ENGINE CONTROLLER REPROGRAMMING (REFLASH)

### Process Overview

The reprogramming feature is in the Special Tests menu on the Digital Wrench screen. Start Digital Wrench and click on the Special Tests menu icon (red tool box). A technician should be familiar with the process and with computer operation in general before attempting to reprogram an ECM.

The Digital Wrench Engine Controller Reprogramming (or “Reflash”) feature allows reprogramming of the ECM fuel and ignition map. To successfully reprogram the ECM, an Authorization Key must be obtained by entering a Request Code in the box provided on the Reflash Authorization site. The Request Code is automatically generated by Digital Wrench during the reprogramming process. The Reflash Authorization site is located under the **Service and Warranty** drop down menu on the dealer website at: [www.polarisdealers.com](http://www.polarisdealers.com).

#### NOTICE

Failure to follow the reprogramming instructions completely and correctly can result in an engine that does not run! Replacement ECMs are programmed as “no-start” and require a reflash for them to work.

### Reprogramming (Reflash) Tips:

- **BATTERY VOLTAGE:** The majority of problems with reprogramming can be attributed to a low battery. Be sure the battery voltage (no load) is at least 13 volts and at least 12.5 volts with the key ‘ON’. Connect a battery charger if necessary to bring voltage level above minimum. Fully charge the battery before you attempt to reprogram.
- **DEDICATED LAPTOP:** Best results are obtained using a laptop computer that is “dedicated to Digital Wrench”. A laptop that is used by a variety of people and in several applications around the dealership is more likely to cause a reprogramming problem than one dedicated to Digital Wrench diagnostics only.
- **OBTAINING THE LATEST UPDATE:** Reprogramming updates are provided periodically and contain the most recent calibrations.
- **CLOSE NON-ESSENTIAL PROGRAMS:** It is recommended that you DO NOT install non-essential programs on a Service Department laptop. Camera detection software, Virus Scanners, Tool Bars, etc. may clog up memory if running in the background and make it harder for the diagnostic software to operate.

- **KNOW THE PROCESS:** If you are not familiar with the entire reprogramming process, review the HELP section of the diagnostic software before you attempt reprogramming. Click on the ? on the tool bar or press F11. The information in the on-line help is the most current and complete information available. This should be your first step until you are familiar with the process.
- **COMMUNICATION PROBLEMS:** If you have had problems communicating with a vehicle while performing diagnostic functions, do not attempt reprogramming until the cause has been identified and fixed. Check all connections, and be sure battery voltage is as specified.
- Proceed to <http://polaris.diagsys.com> for specific information and FAQs on how to troubleshoot communication problems.
- **DON'T DISTURB THE PC:** While reprogramming is in progress, don't move the mouse and don't touch the keyboard. The process only takes a few minutes, and is best left alone until complete.

### Reprogramming (Reflash) Procedure:

If you are not familiar with the reprogramming process, review the “Reprogramming (Reflash) Tips” before you begin. Follow the on-screen instructions as you progress through the steps. If you encounter a problem, always check the On-Line help for current tips and information.

1. Verify the most current update has been downloaded and loaded into Digital Wrench.
2. Connect SmartLink Module cables to PC and vehicle.
3. Open the Digital Wrench program.
4. Select the model year, product line and vehicle description by selecting the “Change Vehicle Type” icon.
5. Select the “Special Tests” icon.
6. Select “Engine Controller Reprogramming”.
7. Select the file you want to load into the ECU then click the “Continue” icon to proceed to the Integrity Check and obtain a Request Code.
8. Copy (CTRL +C) the Request Code that will be required on the dealer website in the next step. DO NOT CLOSE Digital Wrench or the Request Code will be invalid. **NOTE: All characters are letters; there are no numbers in a request code.**

#### NOTICE

Request Codes and Authorization Keys must be entered EXACTLY as they appear on the screen.

9. Go to *www.polarisdealers.com* and click on “ReFlash Authorization” from the “Service and Warranty” drop-down menu.
10. Enter or paste (CTRL+V) the Request Code into the box.
11. Select the same file type from the list that you selected previously while in Digital Wrench. Enter the VIN/PIN along with the customer’s name and address. When completed, click the Authorize button *once* to proceed.
12. An “Authorization Key” will appear in the upper left corner of the screen. Copy (CTRL+C) this key exactly as it appears.
13. Enter or paste (CTRL+V) the Authorization Key in the box located on the Digital Wrench screen. Click the ‘Continue’ button and follow instructions provided on the screen to complete reprogramming procedure.
14. At this point the reflash process will begin. Do not touch the vehicle or PC during the process.
15. Once the ECU reprogramming procedure is complete, click the ‘Finish’ button on the screen. Verify the reflash was a success by starting the vehicle.

## THROTTLE LEARN PROCEDURE

### THROTTLE LEARN CONDITIONS

- Engine must be stopped
- Intake air temperature minimum = 5C and Max = 140C
- Engine coolant temperature min = 5C and Max = 100C
- Battery voltage min= 10V and Max = 16V
- Vehicle must be stopped

### THROTTLE LEARN PROCEDURE

1. Ensure vehicle is within the throttle learn conditions.
2. Leave ignition powered ON
3. Throttle learn will be initiated within 30 seconds.
4. Throttle learns within 5 seconds.
5. Power ignition off and leave off for 130 seconds.

## POLARIS MOBILE DIGITAL WRENCH® (PMDW)

Polaris Mobile Digital Wrench® (PMDW) is a diagnostic software application (app) designed specifically for Android™ devices. When paired with the Wireless Vehicle Link (WVL) (PU-51435), the PMDW app provides many of the same features and functions as the Digital Wrench® software.



You can download the PMDW app on your Android device from the Polaris dealer website. From the Service and Warranty drop-down, select Digital Wrench, and then click Mobile Digital Wrench App Download.

### **MINIMUM SPECIFICATIONS FOR ANDROID DEVICES**

- Minimum operating system: Android 3.1 “Honeycomb” or higher (Android 4.0 or higher preferred)

#### **NOTICE**

The PMDW app will not work on Microsoft Windows 8™ or Apple IOS™ products.

- Dual core processor / 2 GB internal memory / external micro SD (32 or 64 GB) slot / 500 MB RAM
- Rear facing camera with minimum 3.0 mega pixel resolution with auto / continuous focus
- Video, microphone, and voice-to-text capable
- Internet and Bluetooth wireless technology capable
- Device must be set to allow the installation of non-market applications

### **ADDITIONAL INFORMATION**

- An electronic user’s guide is provided within the PMDW app. To access the user’s guide, launch the app, and then click “Help” under the Settings / Preferences menu.
- Only CAN-based vehicles are compatible with the PMDW app and the WVLT. See the user’s guide for a complete list of compatible vehicles.

**TROUBLESHOOTING**  
**FUEL SYSTEM TROUBLESHOOTING, PART 1**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>AFFECTED PART(S)</b>	<b>REPAIR RECOMMENDED</b>
Engine turns over with electric starter, but won't start	Compression too low	See engine section	
	No spark at spark plugs	See ignition system	
	No fuel reaching intake tract	Out of fuel Blown Fuse Plugged fuel filters / lines Fuel pump not working Fuel pressure regulator Faulty fuel pump relay Open wiring / connector Faulty connection at ECM	Add Fuel Replace Clean/Replace Test / Replace Test / Replace Test / Replace Inspect / Repair Inspect / Repair
	Excessively rich or lean fuel mixture	Fuel pump Fuel pressure regulator Crank Position Sensor Low Battery TMAP sensor CHT sensor Fuel Injector	Test / Replace Test / Replace Test / Replace Test / Replace Test / Replace Test / Replace Test / Replace
	Spark at wrong time or no spark. Fuel delivery timing incorrect.	Timing Wheel or CPS installed incorrectly, damaged, or dirty; faulty CPS	Install correctly, inspect for proper air gap (gap is preset but cover, sensor, and timing wheel must be clean and in good condition).
Poor idle	Excessively rich or lean fuel mixture	Air Leaks Fuel Pump Fuel injector or fuel rail obstructed or leaking Air Filter Wrong Fuel / Old Fuel Crank Position Sensor	Inspect throttle body and stepper motors Inspect fuel pressure Replace Replace Inspect / Replace Inspect / Replace
Poor Running in Higher RPM Range	Air intake restriction Oil Overfilled Ignition problems Low Battery Voltage Loose, corroded, or wet connector(s) Valve train problems	Air filter Ignition Coil(s) / plug wires Battery ECM and wiring harness Valve springs, valve, head	Inspect Refer to ignition section. Charge or replace Unplug connections - inspect Inspect cylinder head & valves

**FUEL SYSTEM TROUBLESHOOTING, PART 2**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>AFFECTED PART(S)</b>	<b>REPAIR RECOMMENDED</b>
Engine Stalls	Fuel Pump Problem	Low battery voltage Faulty fuel pump No signal from ECM Wiring problem	Battery/Charging system Check fuel pressure Repair Wiring Repair/Chk Pump Relay
	Excessive rich or lean fuel/air mixture	TMAP Sensor Plugged fuel filter Fuel pump (pressure) Fuel pressure regulator Vacuum leak Wiring problem Air Filter Low battery voltage	Repair / Replace Test / Replace Pump Assembly Test / Replace Test / Replace Pump Assembly Repair / Replace hoses Repair Replace Ck battery & charging system
	Control Circuit/ Sensors not functioning correctly	Fuel pressure regulator TPS Engine speed sensor Fuel pump relay Rotor Fuse ECM Relay Low battery voltage ECM	Test Pressure / Replace Test / Replace Test / Replace Test / Replace Inspect / Install correctly Replace Replace Inspect Charging system
	Valve train problems or Compression low	Refer to Engine chapter	
Backfiring	Low Battery Voltage Ignition Problem Air leaks Restricted air intake or throttle body	Battery, spark plug fouled, poor wire connection for ignition or fuel injection, loose pin in multi-pin connector for ECM or wiring harness  Inlet and Exhaust Intake tract / Throttle body	Refer to battery section Replace plugs / diagnose Inspect wiring connections Disconnect and check pin connections Seal intake or exhaust leaks Clean air inlet tract and throttle body

4

**FUEL SYSTEM TROUBLESHOOTING, PART 3**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>AFFECTED PART(S)</b>	<b>REPAIR RECOMMENDED</b>
Poor Running in upper rpm ranges	Control Circuit/ Sensors not functioning correctly	CPS ETC Air temperature sensor Manifold Absolute Pressure sensor Intermittent wiring /connector problem ECM	Test / Replace Test / Replace Test / Replace Test / Replace Repair/Replace Test / Replace
	Fuel delivery incorrect	Plugged or kinked fuel and/or vent hoses Fuel pump Fuel regulator Fuel filter Battery/Charging System Fuel Injector plugged Contaminated fuel (water, additives, etc.) Inadequate octane Defective ETC Low battery voltage	Repair/Replace Test / Replace Test Pressure / Replace Test / Replace Pump Assembly Charge/Replace (if applicable) Clean/Replace Clean/Replace Use correct fuel Test / Replace Charging system
	Air intake restriction	Dirty Air Cleaner Intake restriction	Clean Repair
	Air Leak	ETC gasket surfaces Intake manifold ETC	Repair/Replace Repair/Replace Repair/Replace
Engine lacks power	Engine component problems Ignition problems Overfilled with oil	See Engine / Cooling / Exhaust chapter See Electrical chapter See Maintenance chapter	
	Improper fuel delivery	Plugged fuel injector Dirty air cleaner Vacuum leaks Fuel pump Fuel pressure regulator Air temperature sensor TMAP sensor Plugged vent hose Low battery voltage ECM	Repair / Replace Replace Repair Test / Replace Test / Replace Test / Replace Test / Replace Clear Test batt./Charging system

**FUEL SYSTEM TROUBLESHOOTING, PART 4**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>AFFECTED PART(S)</b>	<b>REPAIR RECOMMENDED</b>
Engine overheats	Internal Engine Parts Lubrication & Cooling system Low or incorrect oil Brakes dragging Drive belt too tight Ignition timing incorrect Spark plug(s) Low battery voltage	Cooling System Engine Oil Brake systems Drive Belt Ignition Coils Faulty ECM Charging System Faulty Battery Faulty Wiring	Refer to Engine / Cooling / Exhaust chapter Refer to Engine / Cooling / Exhaust chapter Refer to Brakes chapter Refer to Steering / Suspension chapter Refer to Electrical chapter Replace Test / Repair Replace Repair
	Lean Air/Fuel mixture	Fuel pressure regulator Air leak Fuel injector plugged CHT Vent hose plugged / kinked Air leak at throttle body to manifold seal	Repair / Replace Repair Clean / Replace Test / Replace Repair Test / Repair
Won't Accept New Calibration	Non-Current Calibration File Set Low Battery Voltage Attempting Re-Flash Without Proper VIN/PIN, Calibration I.D. number, or calibration authorization code		Go to Dealer website and download the most current Indian Motorcycle Calibration File Set  Attach Battery Charger During Re-Flash, and Re-Charge Battery When Re-Flash Is Completed  Enter Authorization Code Sent With Accessory Kit

4





# CHAPTER 5

## CLUTCH / PRIMARY / SHIFT

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**GENERAL INFORMATION****SERVICE NOTES – CLUTCH / PRIMARY / SHIFT**

- Clutch and external transmission shift linkage service can be accomplished with the engine in the frame.
- Internal transmission or internal shifting mechanism service requires engine removal and crankcase separation.
- Oil additives of any kind are not recommended by Indian Motorcycle. Using oil additives or oil of the wrong viscosity can have a detrimental affect on clutch performance, operation, and service life.
- Burnt clutch plates are not an indication of defective clutch plates. Burnt clutch plates indicate that a problem exists within the clutch system, the clutch has been used improperly, or plates were contaminated by improper oil or additives.
- Indian Motorcycle 15W/60 motorcycle oil is recommended for all operating temperatures. If Indian Motorcycle 15W/60 oil is not available, a high quality JASO MA compliant/rated, 15W/60 motorcycle oil suitable for use in wet clutch transmissions can be used.
- Lubricate parts during assembly as described in the procedures.
- Corroded or sticking shift linkage pivot points can cause abnormal shifting. Replace any linkage components that are damaged or do not move freely, and lubricate at regular intervals.

**SPECIAL TOOLS – CLUTCH / PRIMARY / SHIFT**

TOOL DESCRIPTION	PART NUMBER
Case Splitting / Assembly Tool	PF-51234-A
Clutch Shaft Holder	PF-51232
Crankshaft Locking Pin	PF-52135
Crankshaft Rotation Socket	PF-51239
Engine Stand Adapter	PF-51240
Moly Assembly Paste	2871460

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

**SERVICE SPECIFICATIONS - CLUTCH /  
PRIMARY / SHIFT**

ITEM		SPECIFICATIONS
<b>Clutch / Gear Shift / Linkage</b>	Clutch Type	Wet, Multi-Disk
	Clutch Operating Mechanism	Manual / Cable Operated
	Primary Reduction Ratio	1.56 : 1
	Transmission Shift Mechanism	Manually Operated, Spring Centered
	Gearshift Pattern	1-N-2-3-4-5-6
	Clutch Spring (Coil Type, QTY.3)	82.5 lbf @ Installed Height
	Clutch Lever Free Play (Cable)	.50-1.50 mm (.020-.060")

## CLUTCH / PRIMARY / SHIFT MAINTENANCE

### CLUTCH CABLE INSPECTION / LUBRICATION

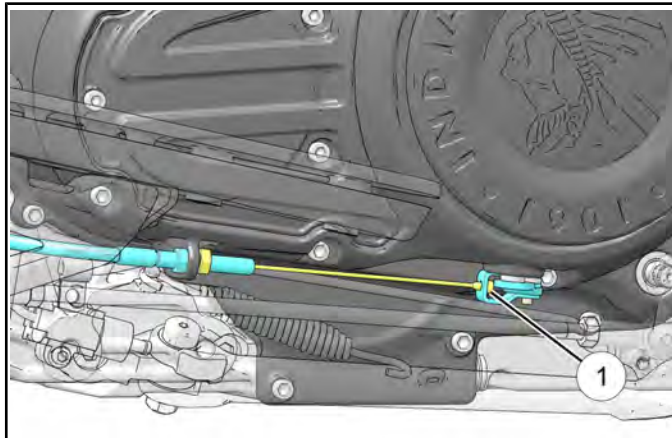
#### NOTICE

Control cable casings are lined with a low friction sleeve and are factory lubricated for reliable operation. Periodic lubrication of cables is not required and could be detrimental to cable performance. Only cable ends must be periodically inspected and lubricated in accordance with the Periodic Maintenance Schedule.

See **Maintenance Intervals page 2.4.**

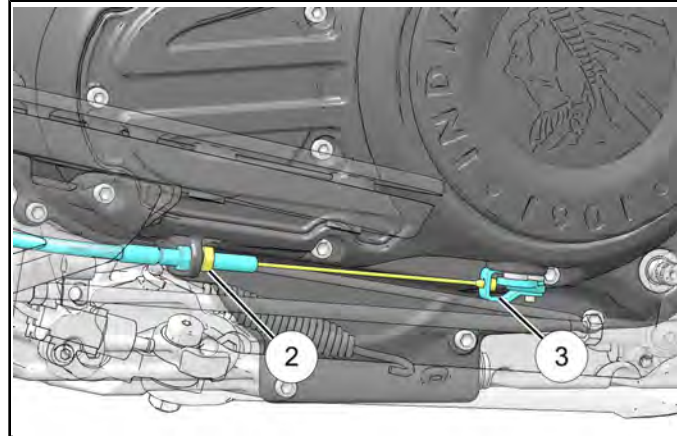
Inspect inner cable for fraying. Do not kink, bend or twist inner cable or cable casing during removal or installation.

1. Inspect the clutch cable for proper routing, smooth movement, and damage to the external casing.



2. Inspect the lower cable end ① for damage or frayed wires.

3. Loosen cable jam nut ② and Remove cable from clevis guide ③.



#### IMPORTANT

Protect finish of clutch shaft arm with a shop towel or tape.

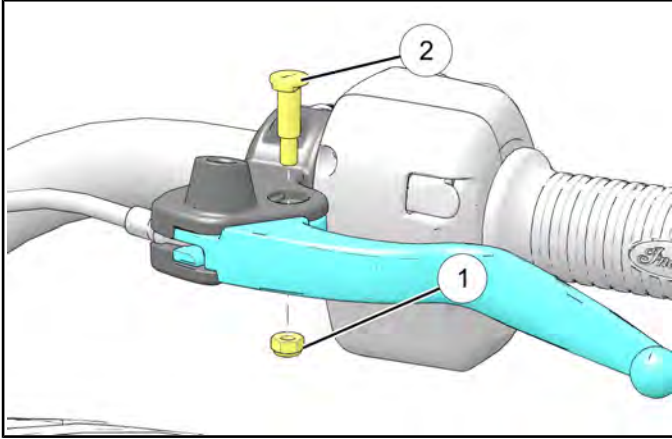
4. Apply a thin coating of all purpose grease to the clutch perch cable end and pivot point of pinion arm assembly.
5. Reverse steps 3 to reinstall clutch cable.
6. Adjust cable free play.
7. Tighten the lower cable guide fastener to specification.

#### TORQUE

Clutch Cable Jam Nut:  
**48 in-lbs (5 N·m)**

## CLUTCH LEVER LUBRICATION

1. Disconnect clutch cable at primary cover.  
See **Clutch Cable Inspection / Lubrication page 5.4.**
2. Pull cable housing out of lever perch and remove barrel from clutch lever. Do not kink cable.
3. Remove nut ① and push pivot pin ② upward to remove.



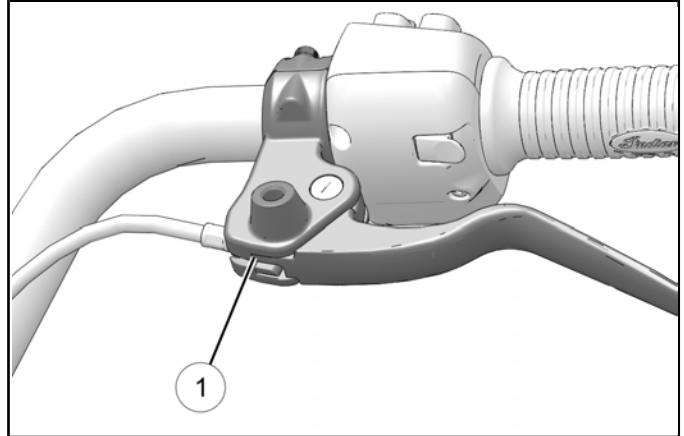
4. Inspect both ends of inner cable for frayed strands. Clean parts and apply moly paste to pivot fastener and lever cable end.
5. Assemble lever.
6. Install cable to lever. Rotate cable back through slot in perch, and push outer casing back into perch recess.
7. Attach lower end of cable to clutch arm on primary cover.
8. Adjust clutch lever free play  
See **Clutch Lever Free Play page 5.5.**

## CLUTCH LEVER FREE PLAY

### IMPORTANT

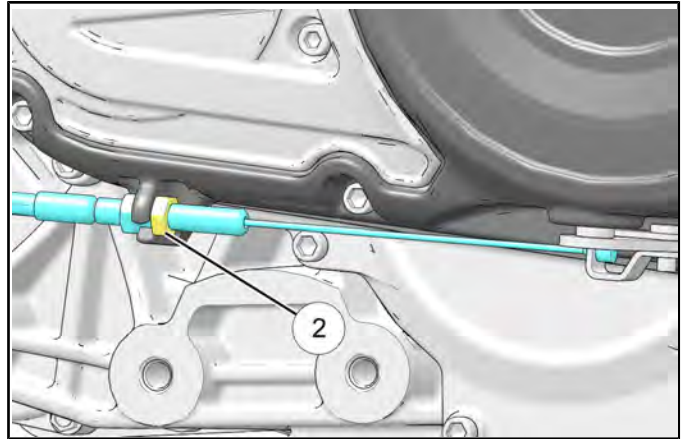
Periodically check the clutch cable free play. As the clutch wears, the cable will get tighter and will require adjustment. If the cable gets too tight, it can result in a slipping clutch situation.

1. With handlebars pointing straight ahead, measure the clutch lever free play at point shown ①



Clutch Lever Free Play:  
.019–.059" (0.5–1.5 mm)

2. Compare measurement to specification. If adjustment is required, proceed to Step 3.
3. Locate the clutch cable adjuster nut ②.



4. Hold cable and loosen the adjuster jam nut.
5. Turn adjuster nut in or out until clutch free play is correct.

6. Tighten adjuster jam nut to specification.

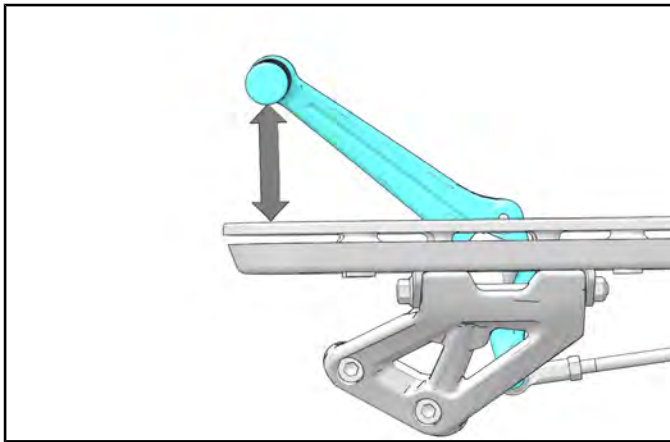
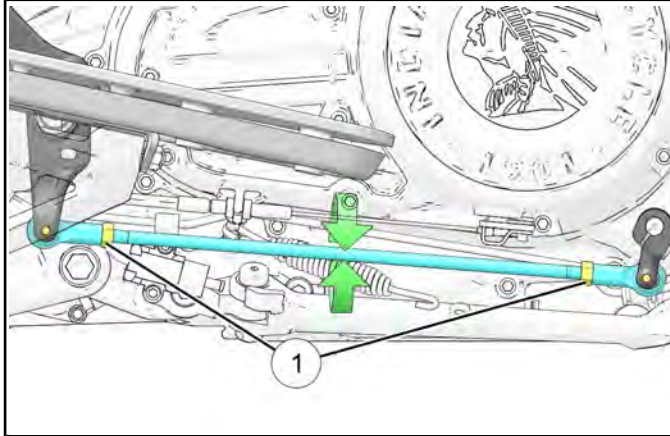
TORQUE
Clutch Cable Nut: 48 in-lbs (5 N·m)

### SHIFT PEDAL INSPECTION / LUBRICATION

1. Check all shift pedal and linkage fasteners to be sure they are tight. Torque fasteners to specification. See **Shift Pedal Adjustment page 5.7**.
2. Lubricate shift pedal pivot bushing and all pivots with all-purpose lubricant.

### SHIFT PEDAL ADJUSTMENT

1. Loosen jam nuts ①.
2. Rotate linkage rod until pedal angle is correct.



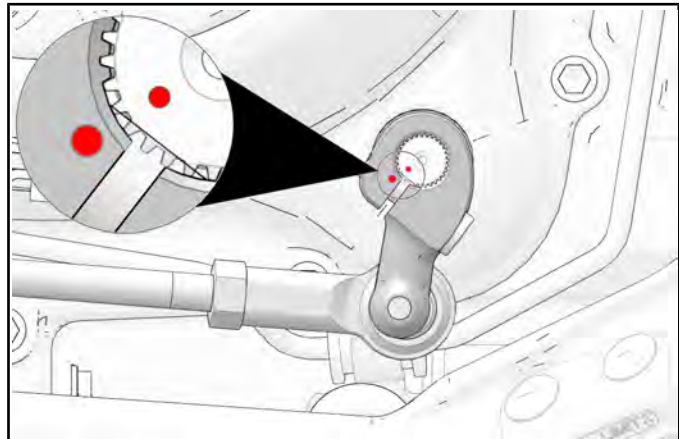
**Pedal Height Specification:**  
2.84 inches +/- .20 (72.18 mm +/- 5.00)

3. Tighten jam nuts ① to specification.

TORQUE
Shift Rod Jam Nuts: <b>84 in-lbs (10 N·m)</b>

**⚠ CAUTION**

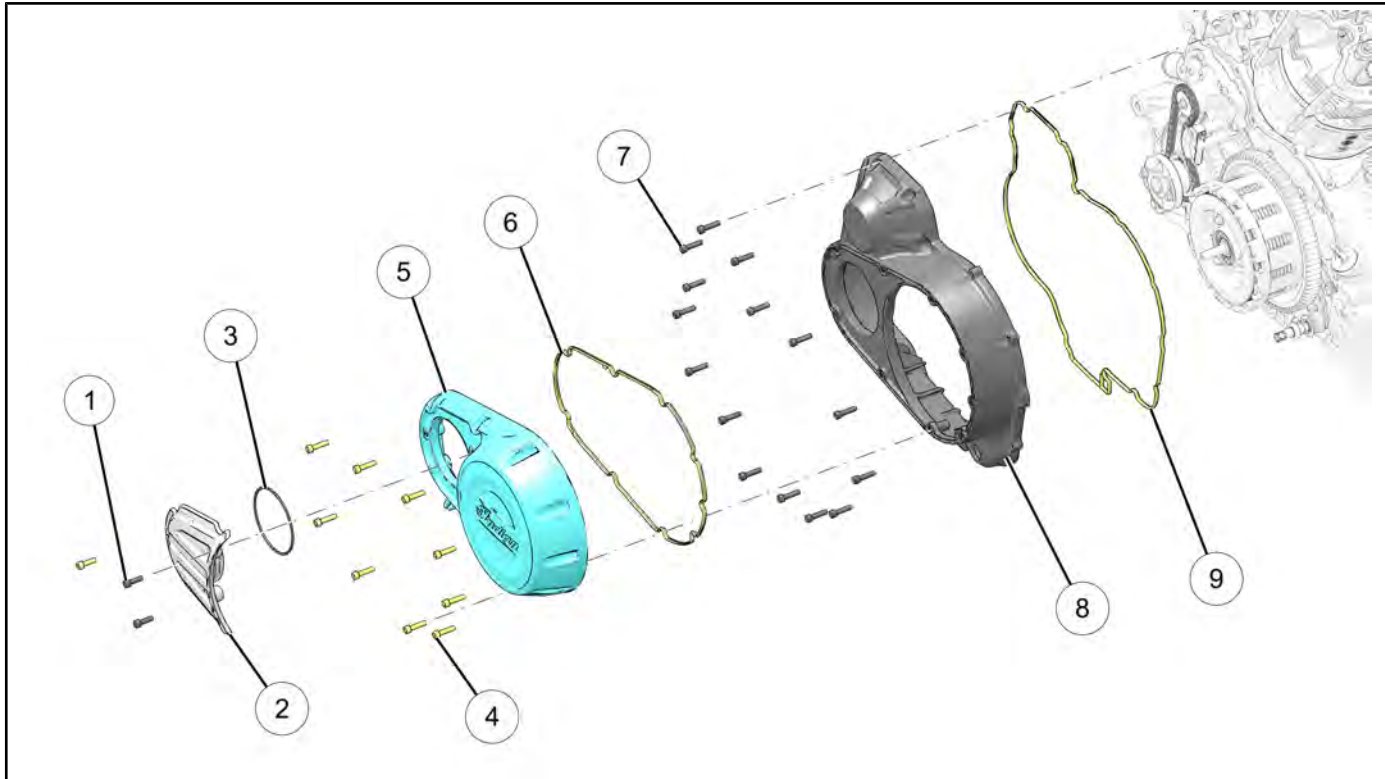
Do not remove and reposition the shift arm on the shift shaft to adjust gear shift pedal height. Dots on shift shaft and shift arm must be aligned for gears to shift correctly.



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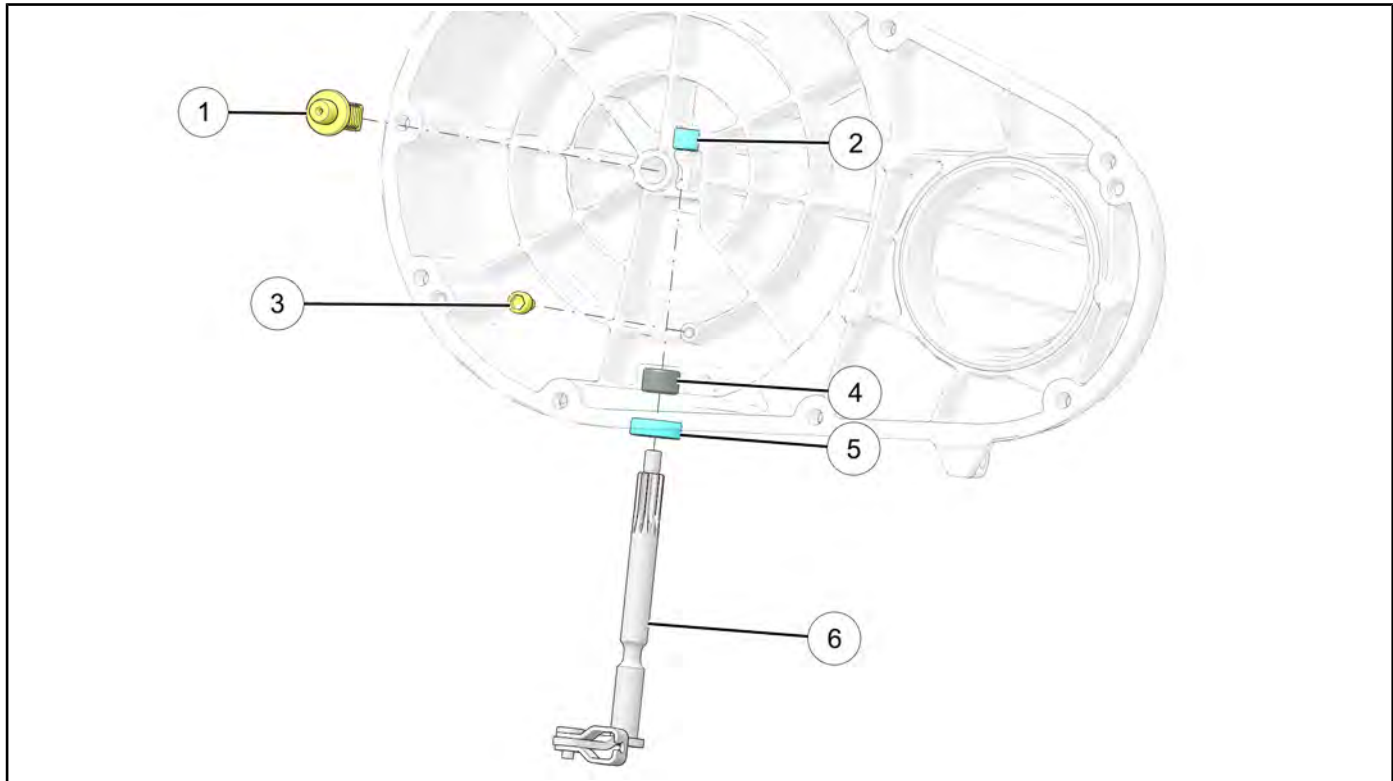


**ASSEMBLY VIEWS**  
**PRIMARY COVER**



REF	DESCRIPTION	TORQUE
①	Cold Start Cover Fastener	<b>84 in-lbs (10 N·m)</b>
②	Cold Start Cover	—
③	Cold Start Cover O-ring	—
④	Primary Cover Fastener (Outer)	<b>84 in-lbs (10 N·m)</b>
⑤	Outer Primary Cover	—
⑥	Outer Primary Cover Gasket	—
⑦	Primary Cover Fastener (Inner)	<b>84 in-lbs (10 N·m)</b>
⑧	Inner Primary Cover	—
⑨	Inner Primary Cover Gasket	—

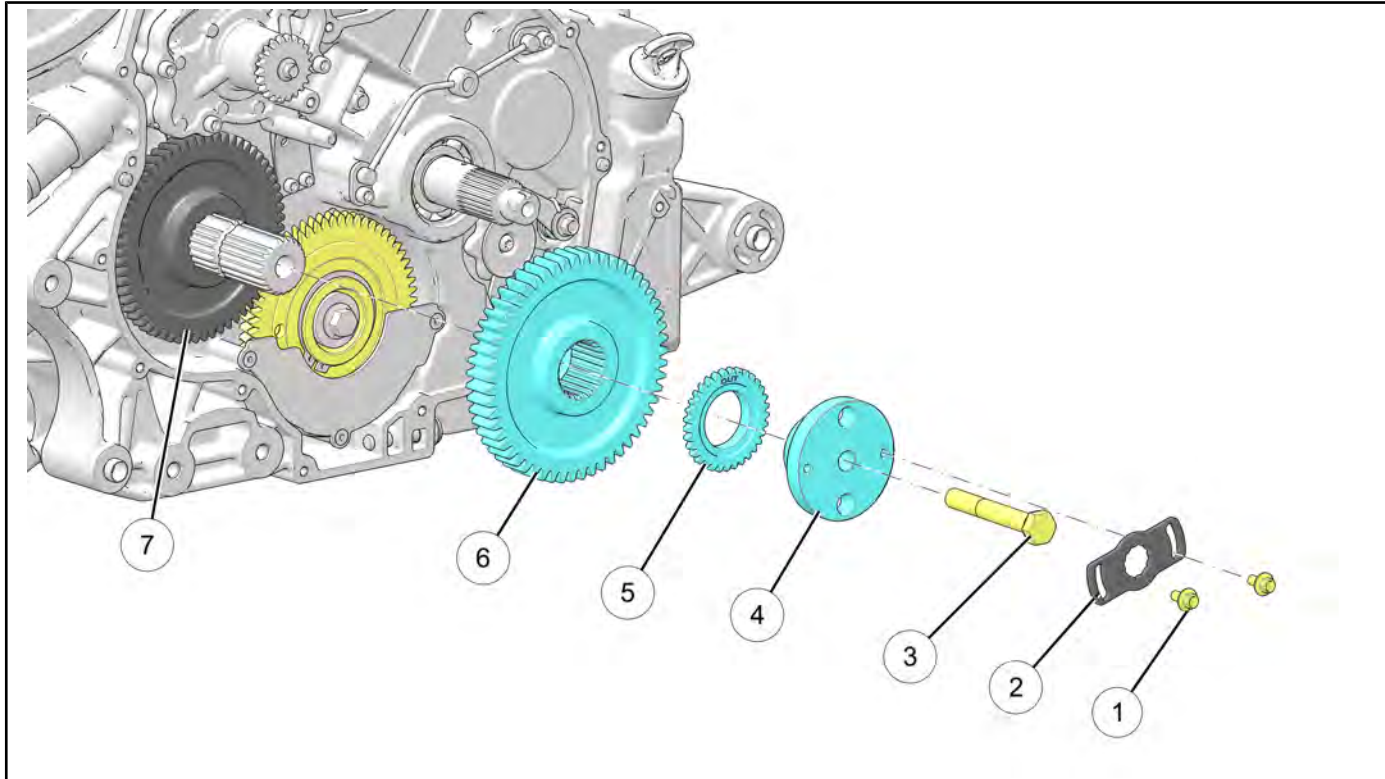
**CLUTCH PINION SHAFT**



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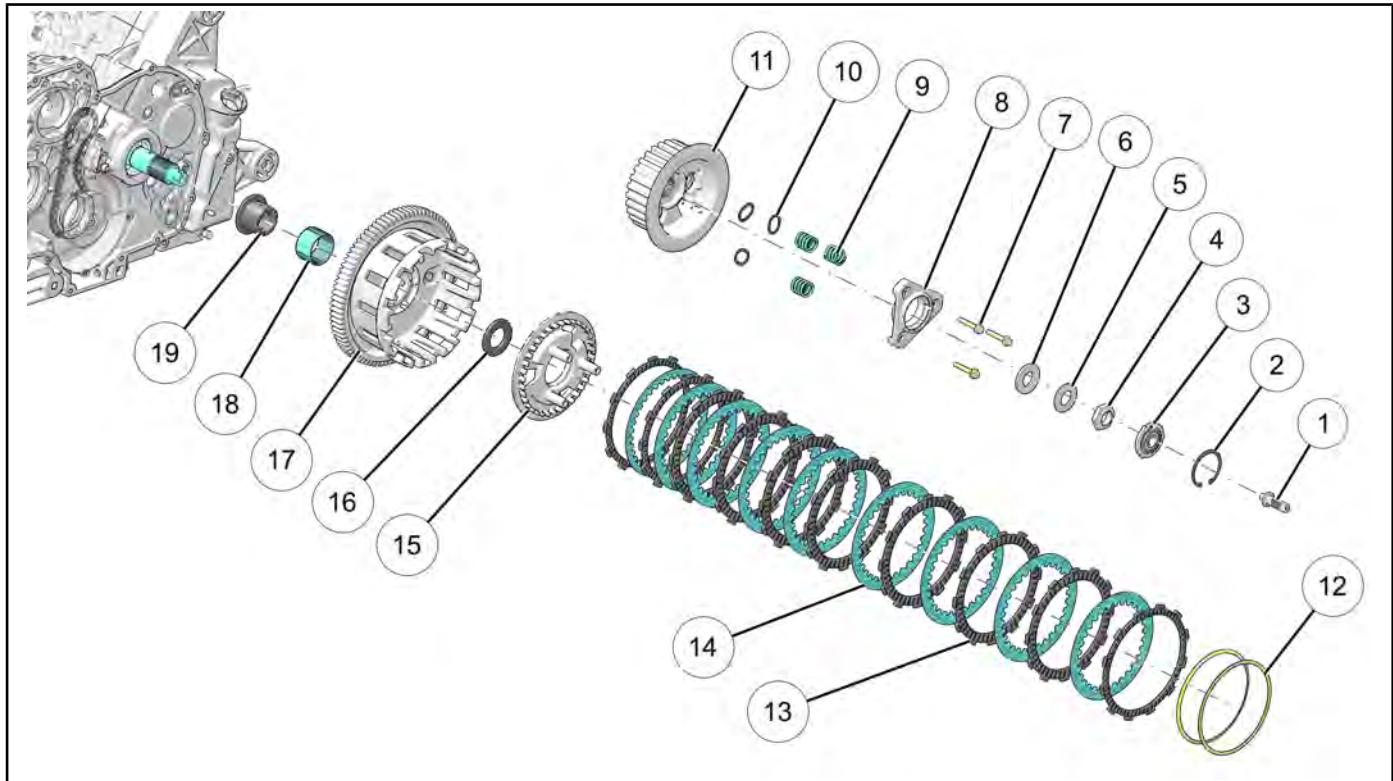
REF	DESCRIPTION	TORQUE
①	Lift Rack	—
②	Bearing M7	—
③	Pinion Shaft Retention Fastener	<b>62 in-lbs (7 N·m)</b>
④	Bearing M12	—
⑤	Shaft Seal	—
⑥	Pinion Shaft	—

**PRIMARY DRIVE GEAR**



REF	DESCRIPTION	TORQUE
①	Locking Plate Fastener	<b>84 in-lbs (10 N·m)</b>
②	Locking Plate	—
③	Primary Drive Gear Fastener	<b>83 ft-lbs (112 N·m)</b>
④	Cold test splined adapter	—
⑤	Water Pump Sprocket	—
⑥	Crankshaft Drive Gear	—
⑦	Crankshaft Balance Shaft Gear	—

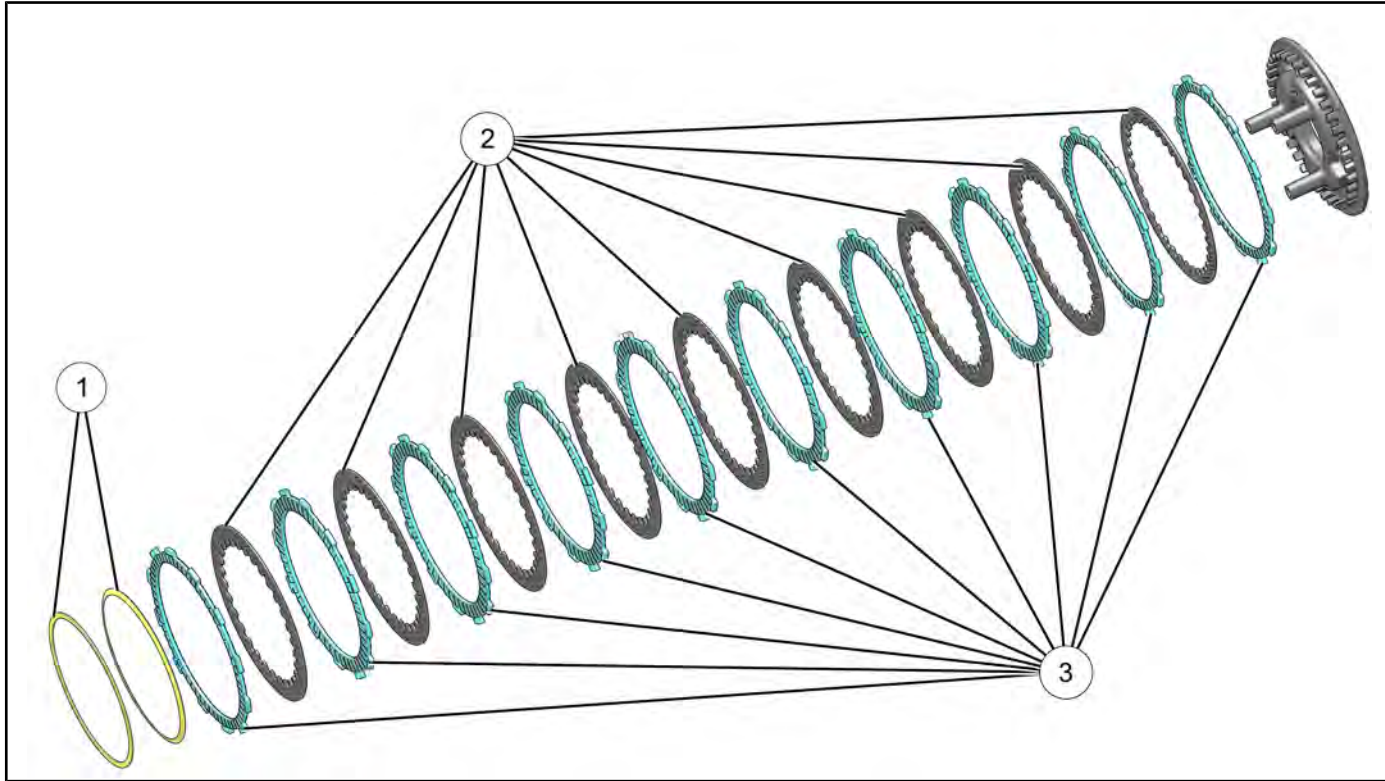
**CLUTCH**



5

REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Lift Rack	—	⑪	Pressure Plate	—
②	Internal Retaining Ring	—	⑫	Judder Spring	—
③	Clutch Lifter	—	⑬	Friction Plate	—
④	Clutch Stake Nut	<b>125 ft-lbs (170 N·m)</b>	⑭	Separator Plate	—
⑤	Spring Disc	—	⑮	Inner Clutch Hub	—
⑥	Washer	—	⑯	Washer	—
⑦	Stopper Plate Fastener	<b>84 in-lbs (10 N·m)</b>	⑰	Outer Basket Assembly	—
⑧	Stopper Plate	—	⑱	Needle Bearing	—
⑨	Clutch Spring	—	⑲	Clutch Adapter	—
⑩	Clutch Seat Spring	—			

**CLUTCH PLATE ASSEMBLY VIEW**

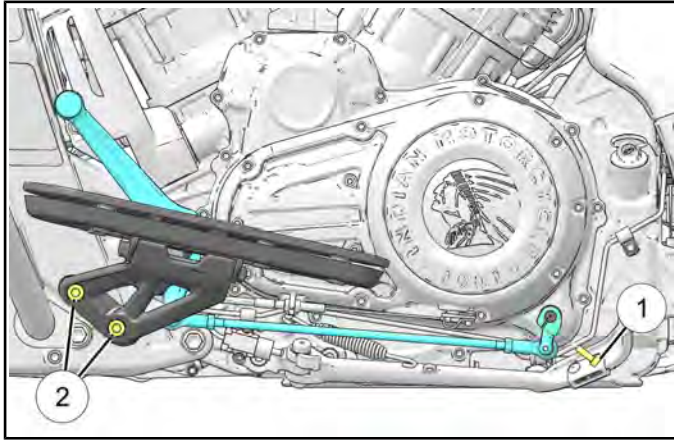


REF	DESCRIPTION
①	Judder Spring
②	Friction Disk
③	Clutch Separator Plate

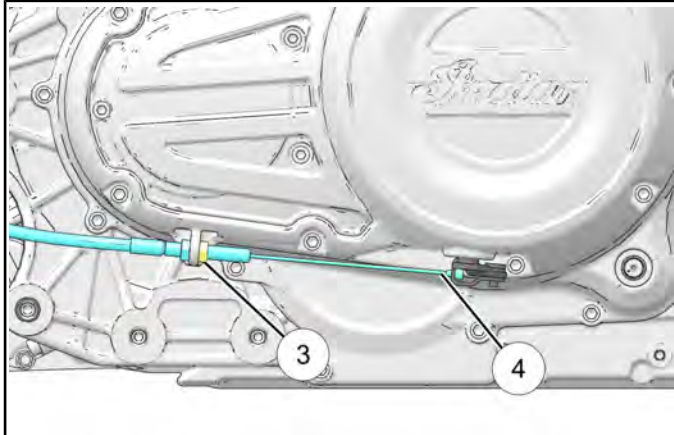
Judder spring must be installed with concave side facing UP (toward outside of clutch). The tallest edge of spring will be outermost.

**SERVICE PROCEDURES**  
**PRIMARY COVER REMOVAL**

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Drain oil from engine. See **Engine Oil & Filter Change** page 2.18.
3. Remove shift lever fastener ①.
4. Remove Left Hand floor board assembly by removing its fasteners ②. Remove assembly from unit.

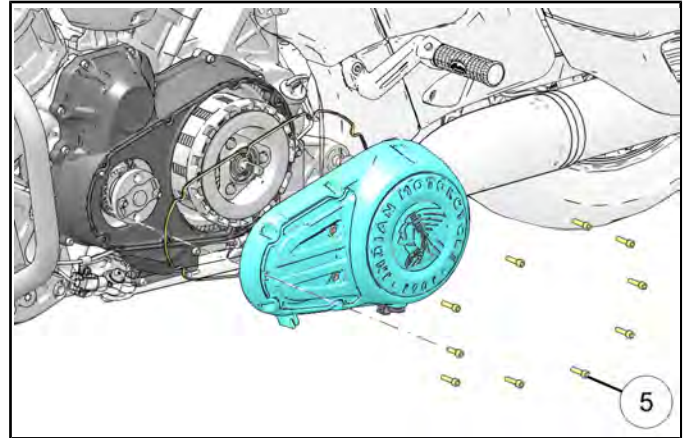


5. Loosen the clutch cable jam nut

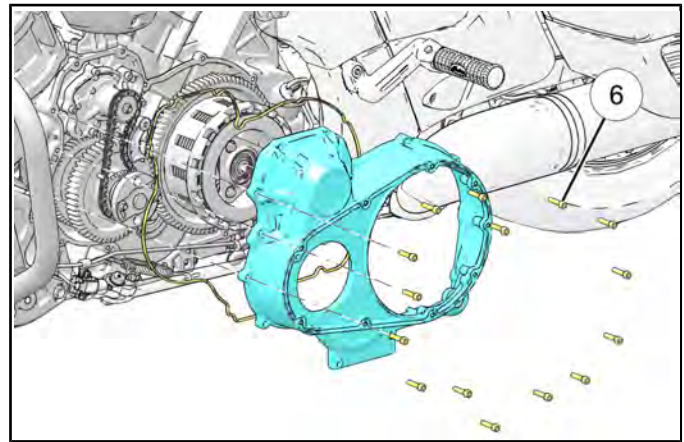


6. Disconnect the clutch cable ④ from the clutch pinion.
7. Remove clutch cable from primary cover.

8. Remove Outer primary cover fasteners ⑤.



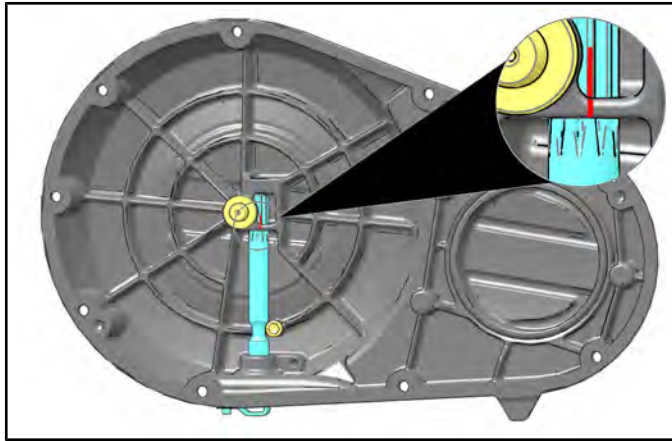
9. Remove Inner primary cover fasteners ⑥.



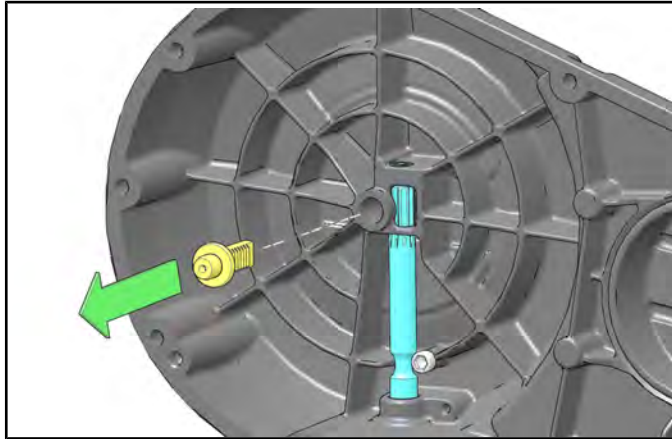
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### CLUTCH PINION SHAFT REMOVAL

1. Mark the pinion shaft as shown for reassembly.

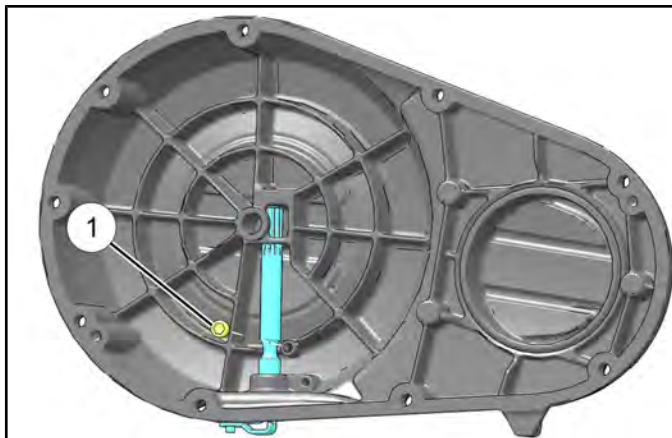


2. Remove the lift rack.

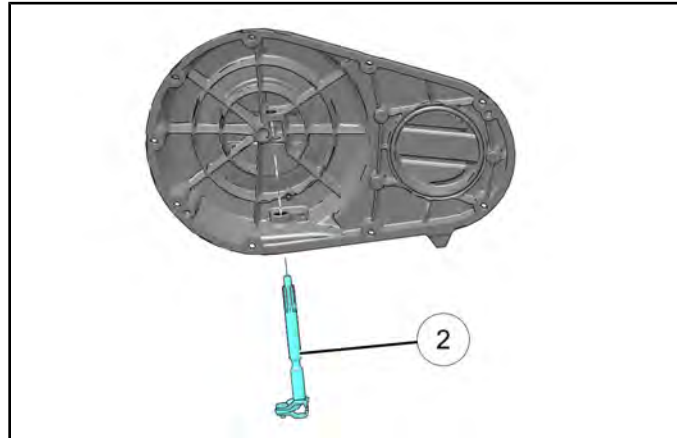


3. Remove the Primary Cover. See **Primary Cover Removal page 5.13**.

4. Remove pinion shaft retention fastener ①.



5. Remove pinion shaft ② from the primary cover.

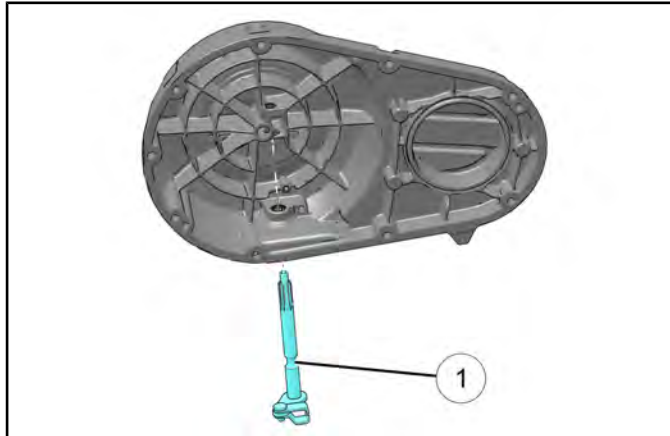


### CLUTCH PINION SHAFT BEARING INSPECTION

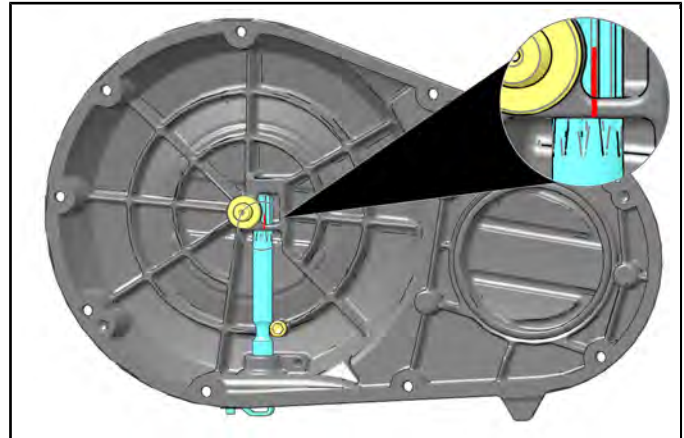
1. Apply engine oil to the bearings.
2. Temporarily install pinion shaft into primary cover.
3. Turn shaft by hand. Replace bearings that feel rough, notched, or loose.

### CLUTCH PINION SHAFT INSTALLATION

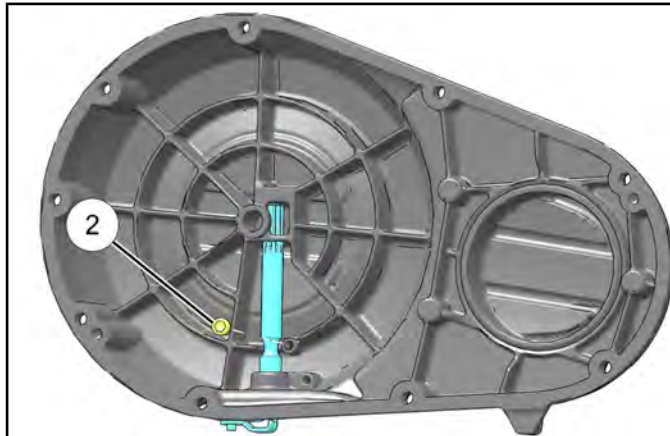
1. Lubricate and install clutch pinion shaft until fully seated in bearings.



4. Ensure the marks previously made, line up.



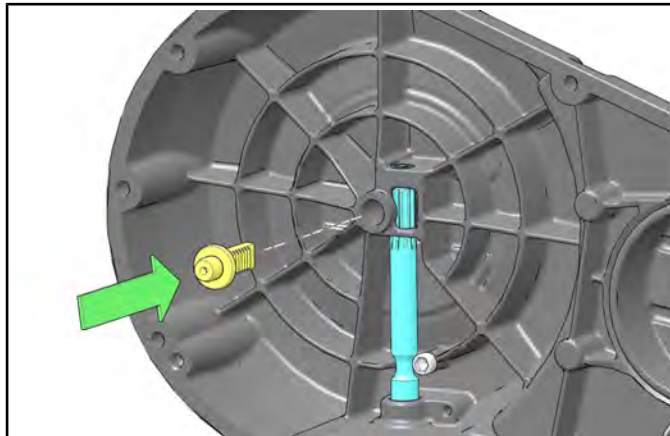
2. Secure pinion shaft with its fastener (2).



#### TORQUE

Pinion Shaft Retention Fastener:  
**62 in-lbs (7 N·m)**

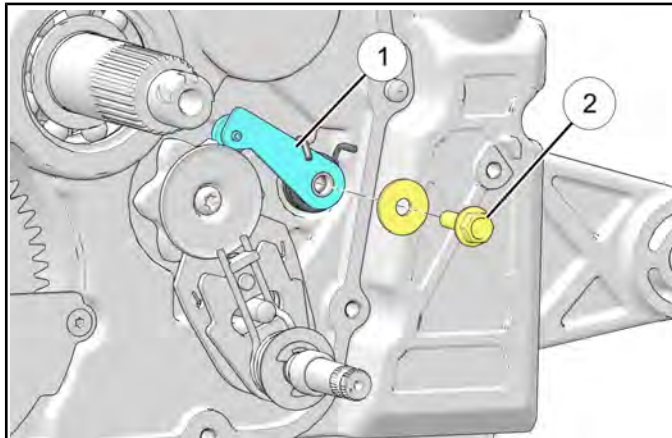
3. Install the lift rack.



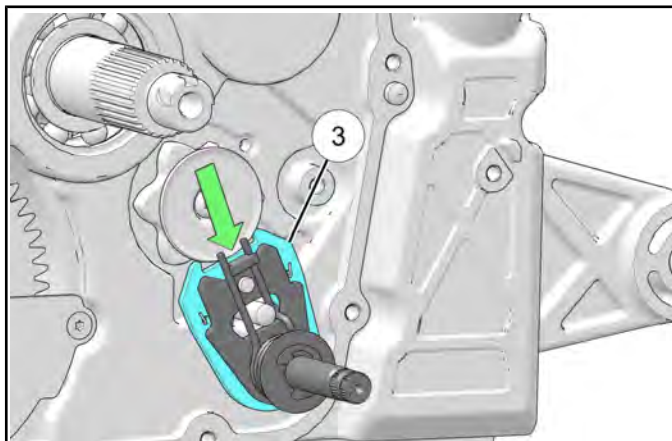


### SHIFT RATCHET REMOVAL & INSPECTION

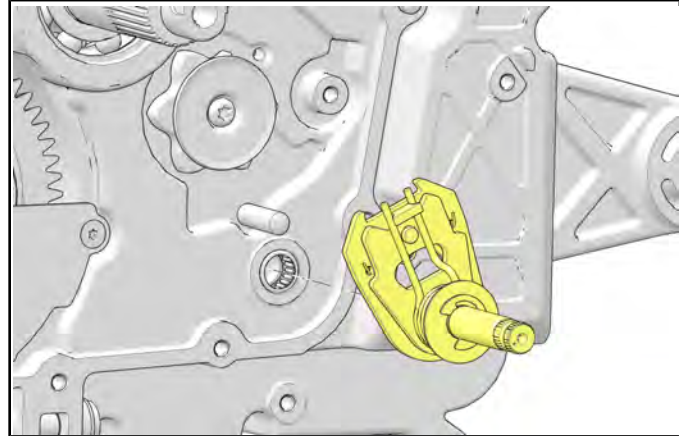
1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Shift transmission into neutral.
3. Remove primary cover. See **Primary Cover Removal** page 5.13.
4. Remove clutch assembly. See **Clutch Removal** page 5.21.
5. Rotate the detent lever ① so the spring is relaxed. Remove the fastener ② securing the detent lever to the engine case and remove lever.



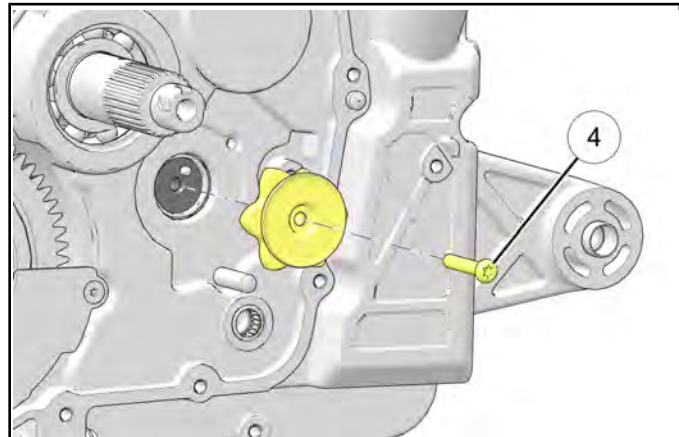
6. Push down on the ratchet plate ③ so it clears the shift star.



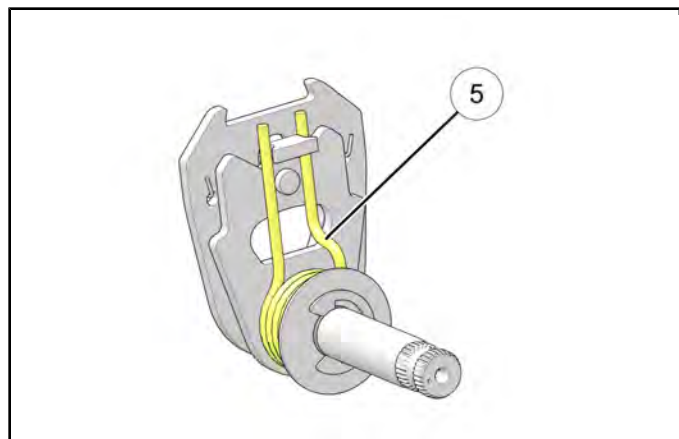
7. Pull the shift lever and spring assembly out of the bore.



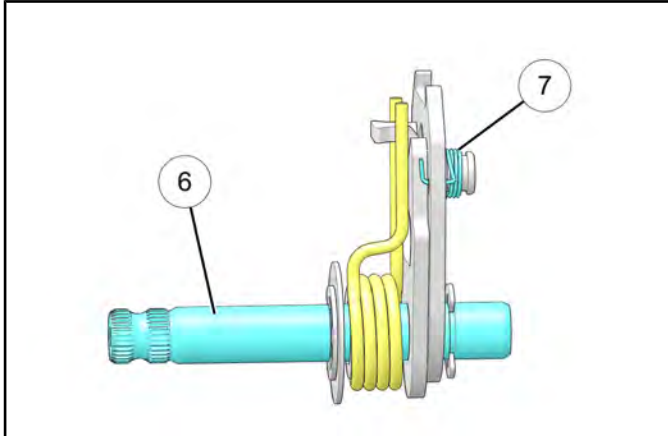
8. Remove the fastener ④ securing the shift star to the shift drum and remove shift star.



9. Inspect shift shaft return spring ⑤ for cracks or loss of tension. The spring should have enough tension to keep the shift shaft centered.

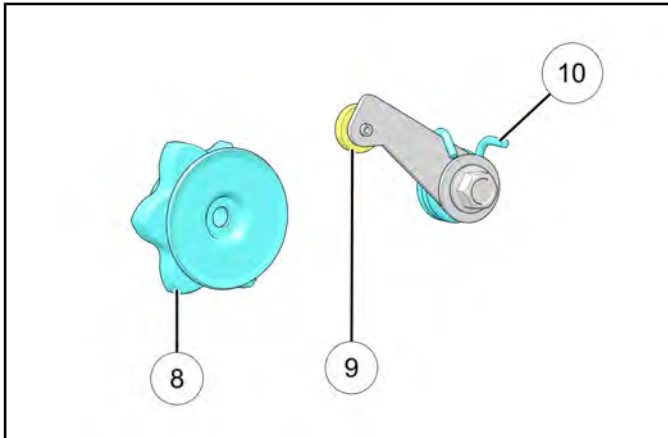


10. Inspect shift shaft ⑥ for wear or damage.



11. Inspect torsion spring ⑦ for tension. The spring should apply enough tension on the shift ratchet mechanism to keep it engaged with the shift star.

12. Inspect shift star ⑧.



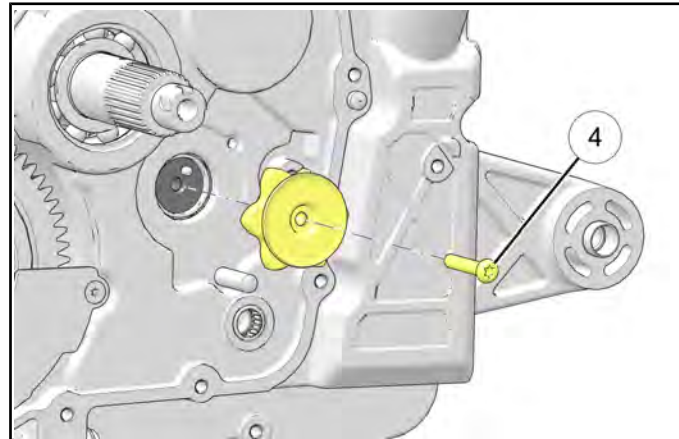
13. Inspect detent roller arm ⑨ for wear or damage.

14. Inspect spring ⑩ for cracks or fatigue.

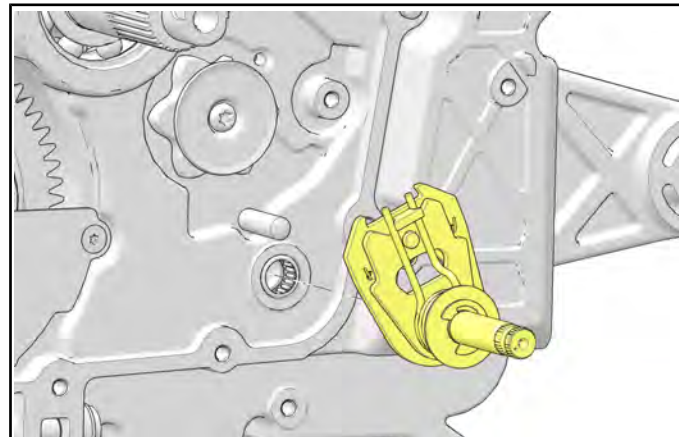
### SHIFT RATCHET INSTALLATION

1. Install the shift star to the shift drum and secure with its fastener ④.

TORQUE
Shift Star Fastener: <b>84 in-lbs (10 N·m)</b>

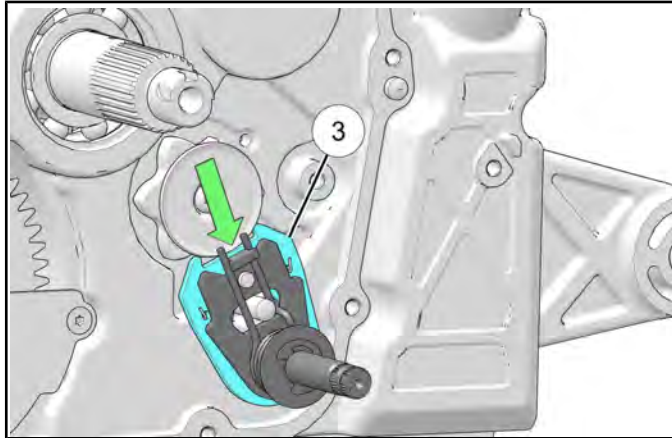


2. Install the shift lever and spring assembly into its bore.



5

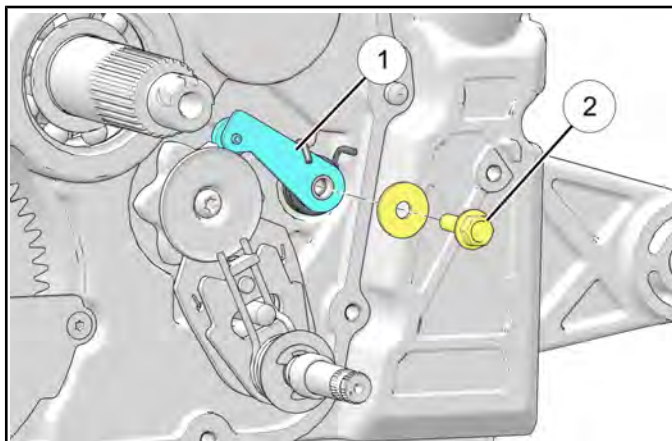
3. Push down on the ratchet plate ③ so it clears into shift star.



4. Install the detent lever ① and secure with fastener ②.

**TORQUE**

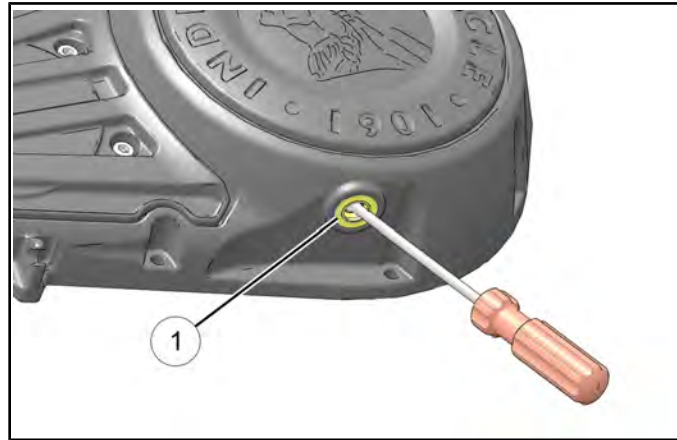
Detent Lever Fastener:  
**84 in-lbs (10 N·m)**



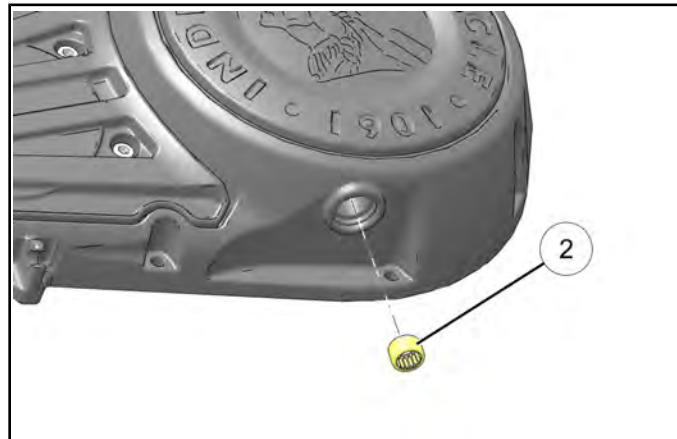
5. Install clutch. See **Clutch Installation page 5.25.**
6. Install primary cover. See **Primary Cover Installation page 5.19.**

**SHIFT SHAFT BEARING & SEAL REPLACEMENT**

1. Remove primary cover. See **Primary Cover Removal page 5.13.**
2. Carefully pry shift shaft seal ① from cover.



3. Using a suitable arbor and arbor press, press bearing ② from inside of cover to outside.

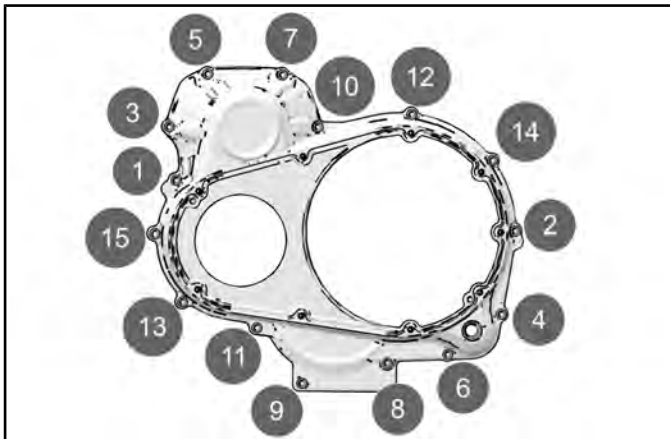
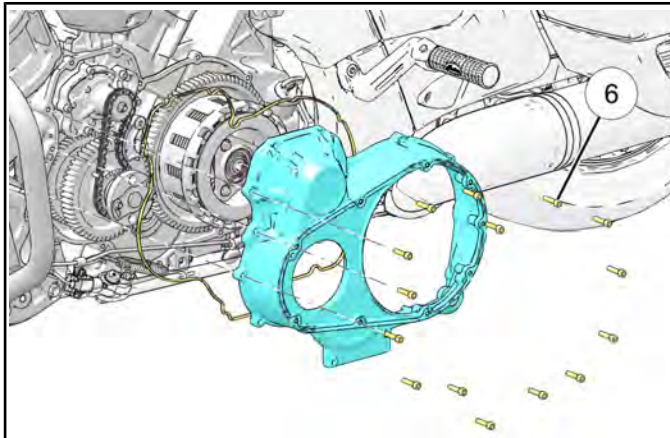


4. Apply white lithium grease to inner & outer surfaces of new bearing.
5. Press bearing into place with numbered side out until fully seated.
6. Apply a small amount of grease to lip of seal and apply engine oil to outside of seal.
7. Drive seal into place with a seal driver slightly smaller than the O.D. of seal.
8. Install primary cover. See **Primary Cover Installation page 5.19.**
9. After installing primary cover, be sure shift shaft returns freely to the centered position after rotating up or down.

**PRIMARY COVER INSTALLATION**

1. Clean gasket surfaces of crankcase and cover.
2. Install *new* inner primary cover gasket.
3. Install inner primary cover and secure with fasteners ⑥. Torque in sequence as shown.

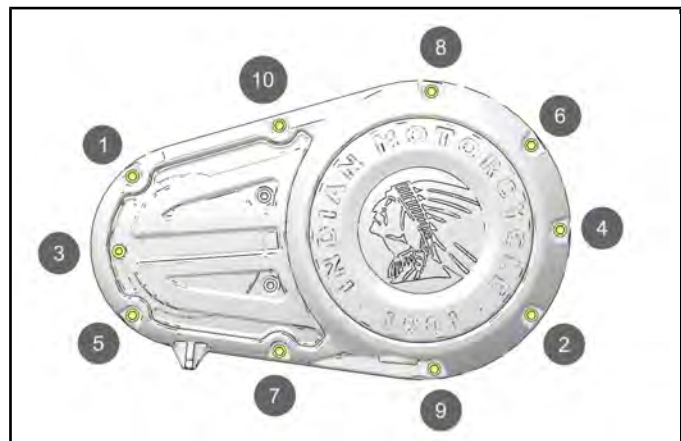
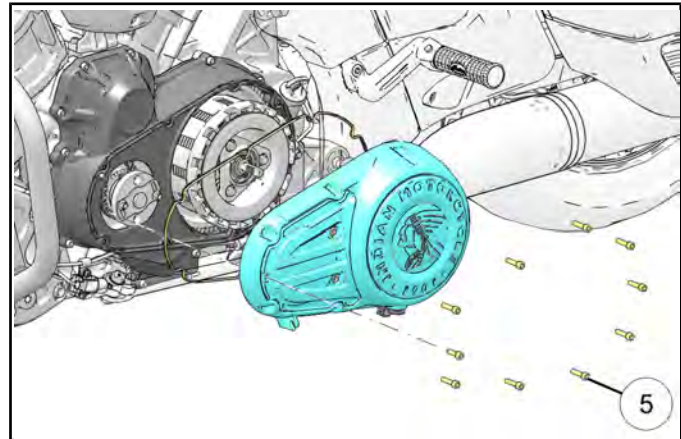
**TORQUE**  
 Primary Cover Fastener (Inner):  
**84 in-lbs (10 N·m)**



4. Install a *new* outer primary cover gasket.

5. Install outer primary cover and secure fasteners ⑤. Torque in sequence as shown.

**TORQUE**  
 Primary Cover Fastener (Outer)  
**84 in-lbs (10 N·m)**

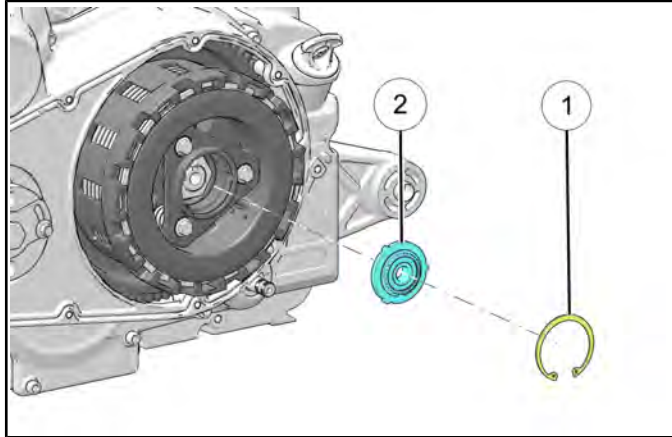


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## CLUTCH SERVICE CLUTCH RACK, REMOVAL / INSTALLATION

### REMOVAL

1. Remove primary cover. See **Primary Cover Removal page 5.13**.
2. Using an internal snap ring pliers, remove snap ring ① and clutch rack ②.



### INSTALLATION

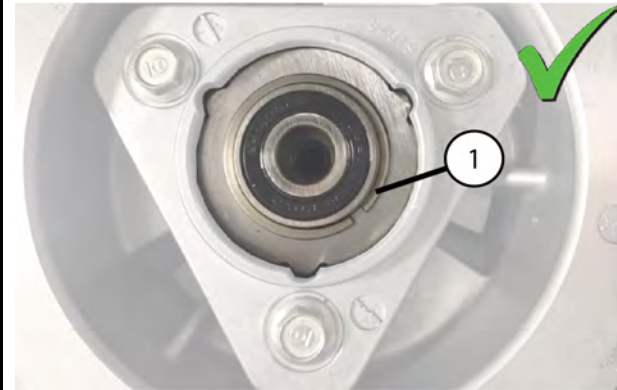
1. Install the clutch rack.

#### ⚠ CAUTION

The clutch rack is to be installed with the snap ring facing outward only. Failure to correctly install the clutch rack will cause improper operation.

#### CORRECT

Snap ring ① is facing outward.

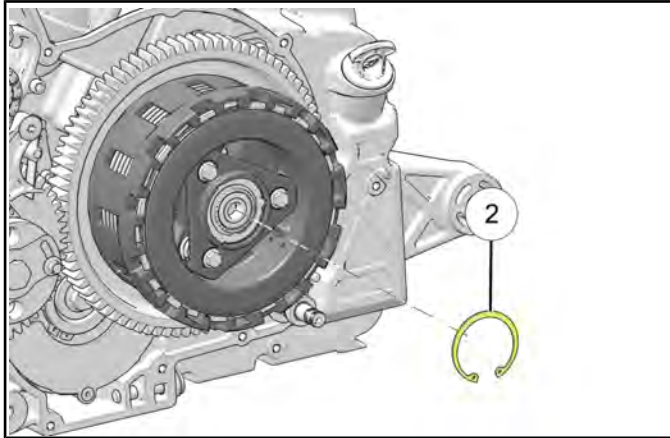


#### INCORRECT

Snap ring is facing inward.

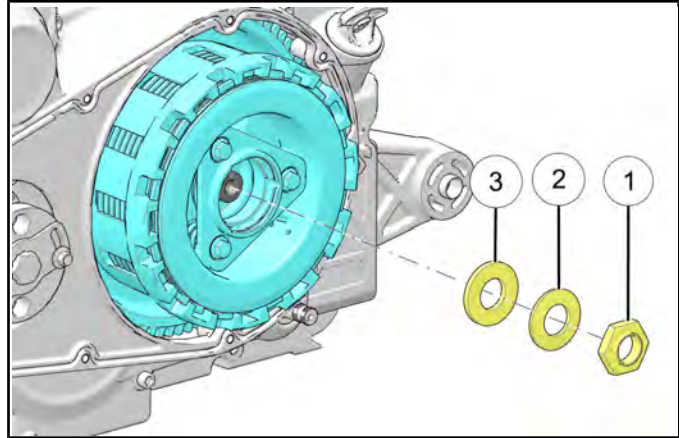


2. Install snap ring ② to retain clutch rack.



### CLUTCH REMOVAL

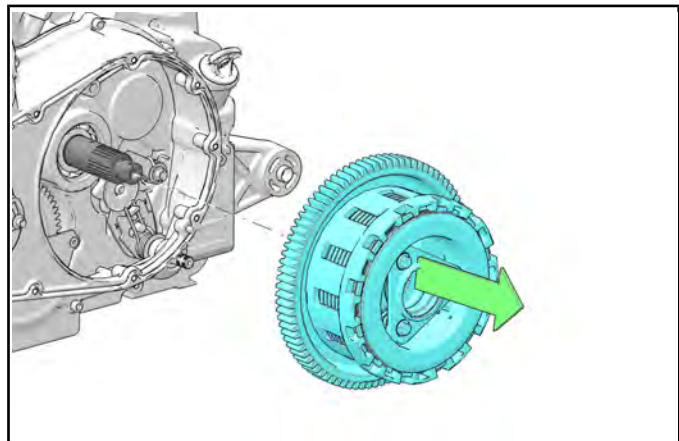
1. Remove primary cover. See **Primary Cover Removal** page 5.13.
2. Remove clutch rack. See **Clutch Rack, Removal / Installation** page 5.20.
3. Perform the crankshaft locking procedure. See **Locking the Crankshaft for Service** page 3.53.
4. Remove stake nut ①, Belleville washer ②, and flat washer ③. Discard the stake nut.



#### IMPORTANT

A new stake nut must be installed upon assembly.

5. Remove clutch assembly from clutch shaft.



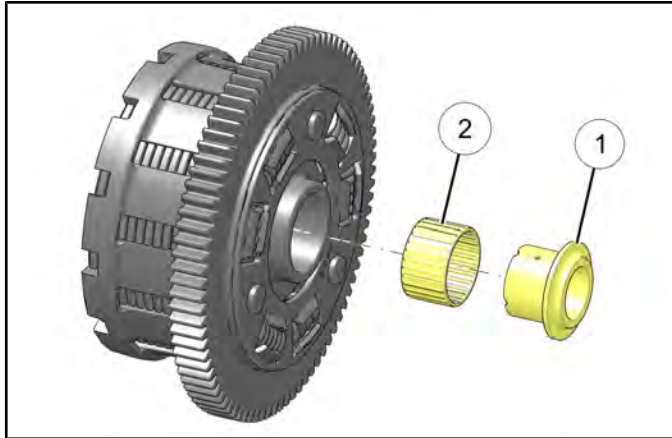
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## CLUTCH DISASSEMBLY

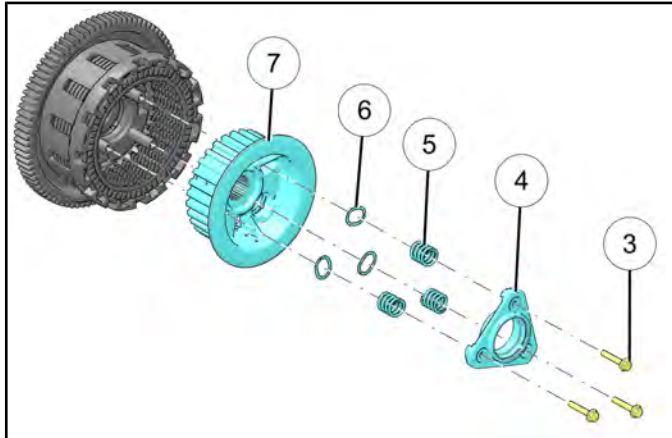
**CAUTION**

Clutch is under spring pressure. WEAR EYE PROTECTION.

1. Remove the clutch. See **Clutch Removal page 5.21**.
2. Remove the sleeve ① and needle bearing ② from the back side of the clutch assembly.

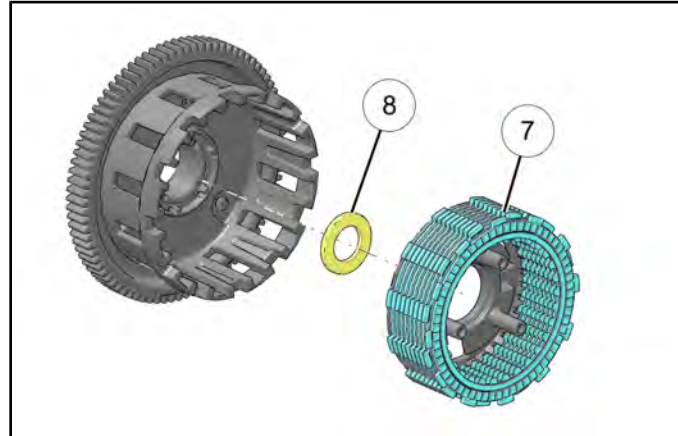


3. Alternately loosen the pressure plate fasteners ③ until spring tension has released.



4. Remove stopper plate ④.
5. Remove clutch springs ⑤ and retaining rings ⑥.

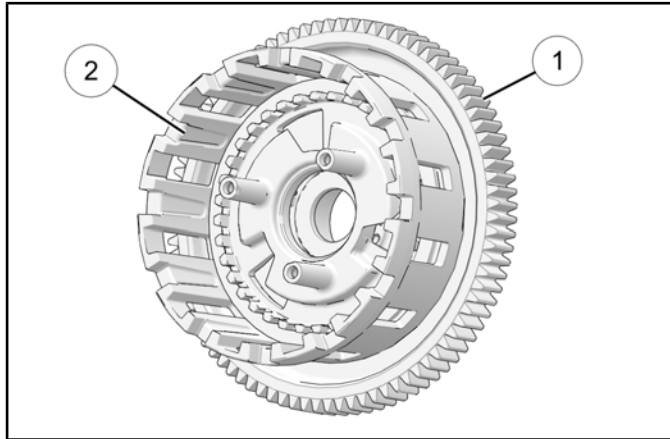
6. Lift the clutch assembly ⑦ out of the basket and set aside.



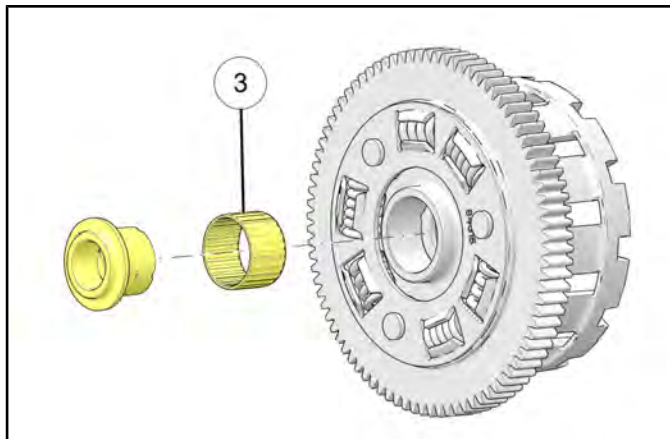
7. Remove thrust washer ⑧.
8. Remove the friction and separator plates. Reference **Clutch Plate Assembly View page 5.12**.

**CLUTCH INSPECTION**

1. Clean clutch plates, inner hub, and outer basket.
2. **Clutch Basket** Inspect clutch gear teeth ① for wear, cracks or damage.
3. Inspect inside surfaces ② of basket for cracks or wear (grooves) from clutch plates.

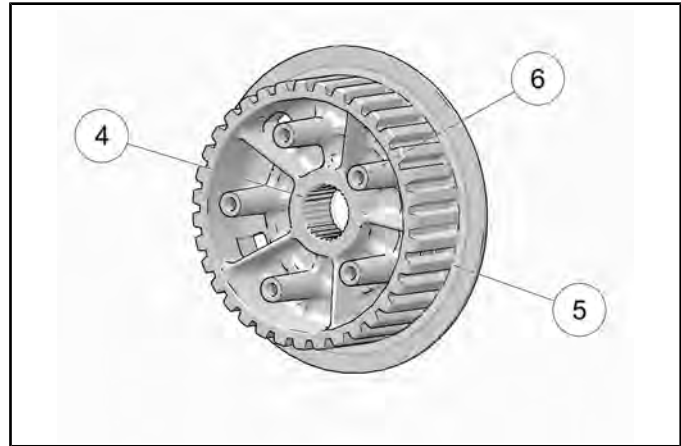


4. Replace parts that fail inspection
5. Rotate hub bearing. Check for smooth rotation. Inner race should have no detectable radial movement.
6. Lubricate bearing ③ with engine oil.



7. Inspect spline teeth ④ and standoffs ⑥ for wear, cracks or damage.

8. Inspect the surface of steel plate guides ⑤ on outer edge of hub for wear, grooves, or damage.



9. Visually inspect friction and steel plates for wear or damage on both surfaces. Replace plates as a set if any plate is worn or damaged.
10. Replace steel plates if grooved, distorted or discolored. Inspect plates for distortion by placing each plate on a precision flat surface. Insert a feeler gauge between plate and flat surface in several places.

**Clutch Steel Plate Warp Service Limit:  
.008 in (.20 mm)**

11. Measure thickness of friction plates in several places. Thickness should be the same at each place. Replace plates that fail inspection.

**Friction Plate Thickness (Minimum):  
.126 in (3.2 mm)**

12. Inspect pressure plate for cracks, scoring, or wear on friction surface. **Clutch Springs**

13. Inspect clutch springs for cracks or distortion.

**Clutch Release Rack and Bearing**

**NOTICE**  
Clutch rack is serviceable as an assembly only.

14. Inspect clutch rack for broken or damaged teeth.
15. Inspect lifter bearing visually for any signs or wear or discoloration. Rotate bearing inner race with your finger and check for smooth movement and no play.
16. Replace clutch rack assembly if necessary.

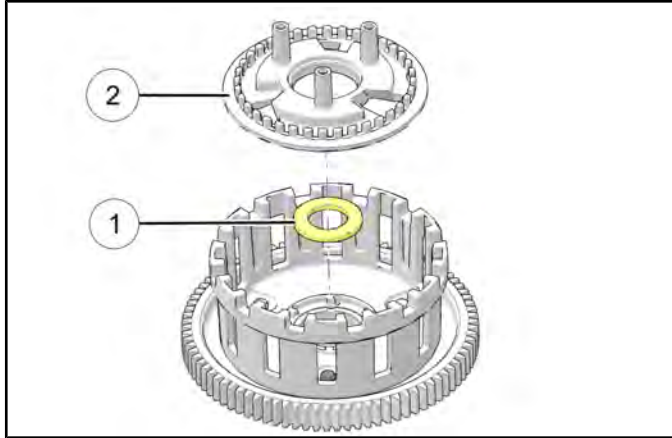


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**CLUTCH ASSEMBLY**

1. Install the thrust washer ① and the clutch hub ② into the clutch basket.

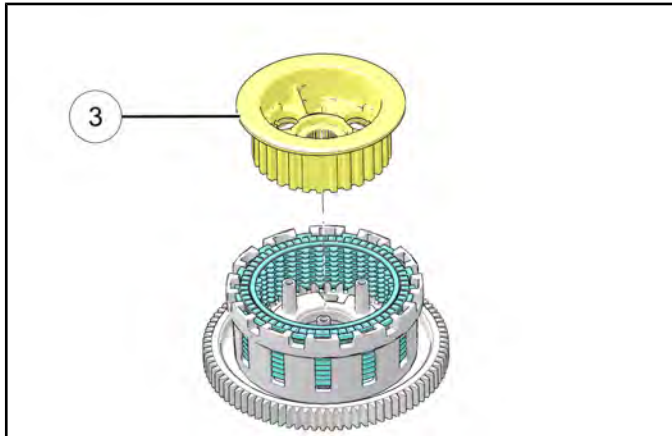


Refer to the Clutch Assembly View outlined in this chapter for clutch plate orientation. See Clutch Assembly page 5.24 and Clutch Plate Assembly View page 5.12.

**NOTICE**

If friction plates are new, soak them in clean engine oil for a few minutes before installing.

2. Install pressure plate ③.

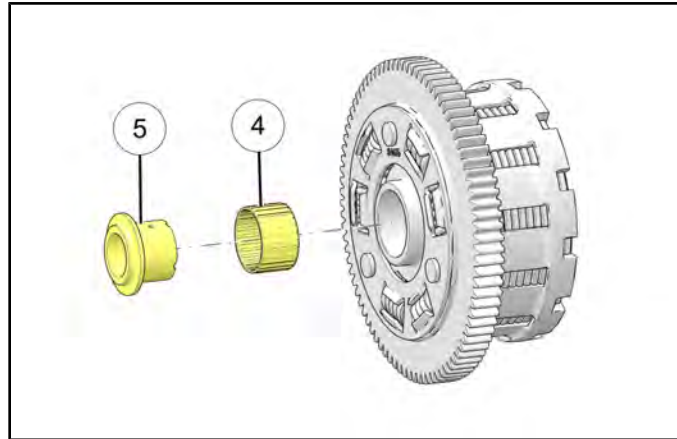


**NOTICE**

Use care while installing to prevent damage to friction plates and separator plates

3. Apply engine oil to hub bearing ④.

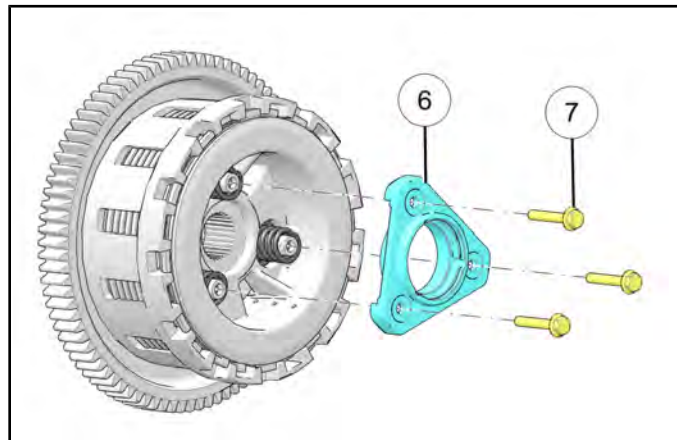
4. Install the hub bearing and sleeve ⑤ into the clutch assembly.



5. Install the stopper plate ⑥ and clutch springs and fasteners ⑦.

**IMPORTANT**

Alternately tighten the clutch spring fasteners in a star pattern until fully seated.



6. Torque clutch spring fasteners to specification.

**TORQUE**

Stopper Plate Fastener:  
**84 in-lbs (10 N·m)**

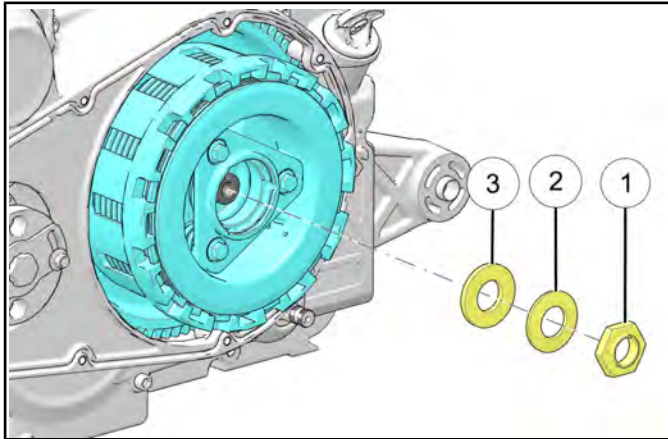
**CLUTCH INSTALLATION****IMPORTANT**

When installing clutch assembly on the input shaft, make sure that the thrust washer between the clutch basket and the clutch hub goes onto the shaft and does not fall between hub and basket.

1. Slide the clutch assembly onto the transmission input shaft until fully seated.
2. Install flat washer ③, belleville washer ②, and **NEW** stake nut ①.

**TORQUE**

Clutch Stake Nut  
**125 ft-lbs (170 N·m)**

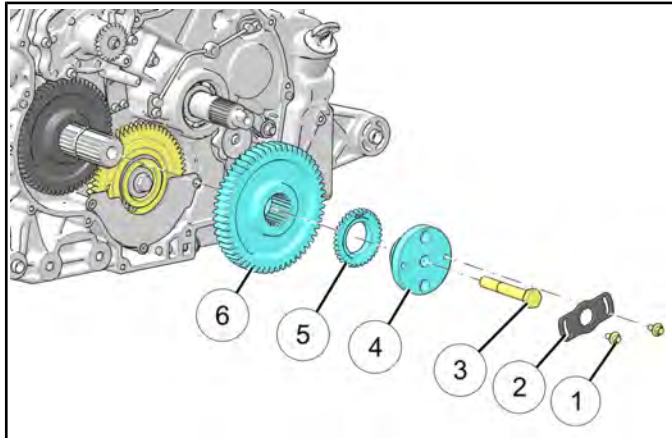


3. Stake the nut. See **Stake Nut Installation** page 6.42
4. Install clutch rack. See **Clutch Rack, Removal / Installation** page 5.20.
5. Install primary cover. See **Primary Cover Installation** page 5.19.

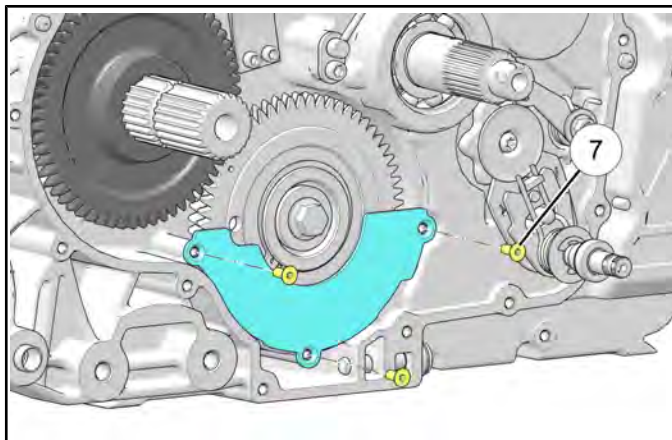
## PRIMARY DRIVE GEAR SERVICE

### PRIMARY DRIVE GEAR REMOVAL

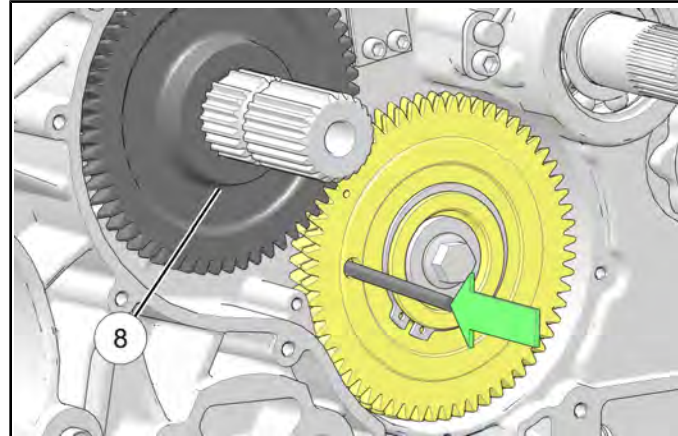
1. Remove primary cover. See **Primary Cover Removal** page 5.13.
2. Perform crankshaft locking procedure. See **Locking the Crankshaft for Service** page 3.53.
3. Remove water pump chain. Reference **Water Pump Removal / Installation** page 3.41.
4. Remove the locking plate (2) by removing its fasteners (1).



5. Remove the primary drive gear fastener (3).
6. Remove cold test splined adapter. (4).
7. Remove water pump sprocket (5).
8. Remove crank drive gear (6).
9. Remove the balance shaft shield by removing its fasteners (7).

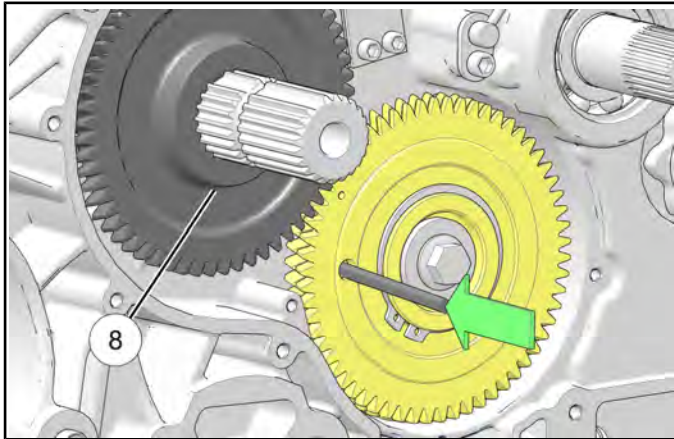


10. Install a punch or similar into the balance shaft split gear hole to relieve pressure off on the crank balance shaft gear (8) and remove.

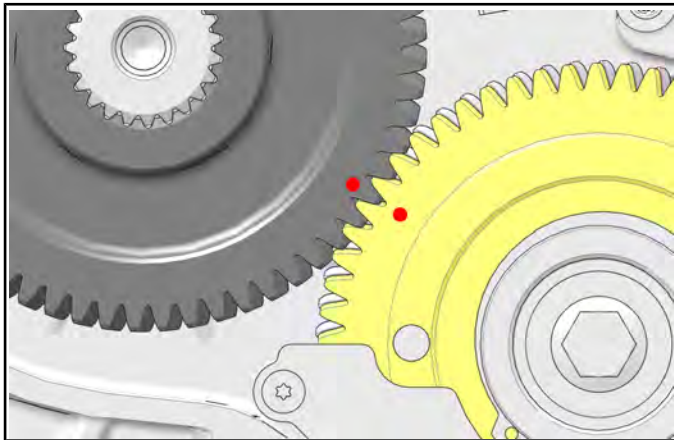


**PRIMARY DRIVE GEAR INSTALLATION**

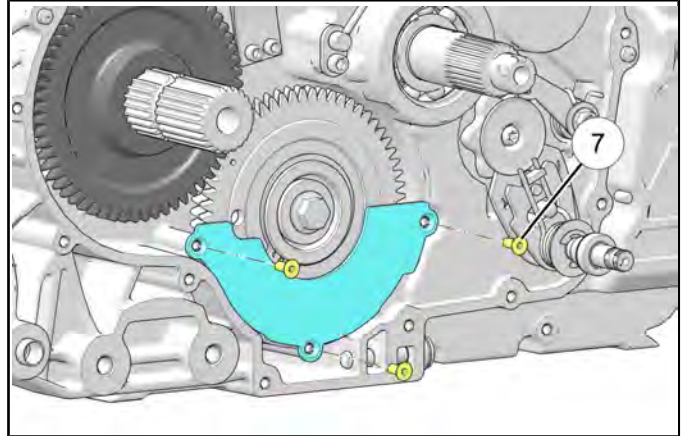
1. Install a punch or similar into the balance shaft split gear hole to align teeth and install crank balance shaft gear ⑧.



2. Ensure the timing marks are aligned.



3. Install the balance shaft shield and secure with its fasteners ⑦.

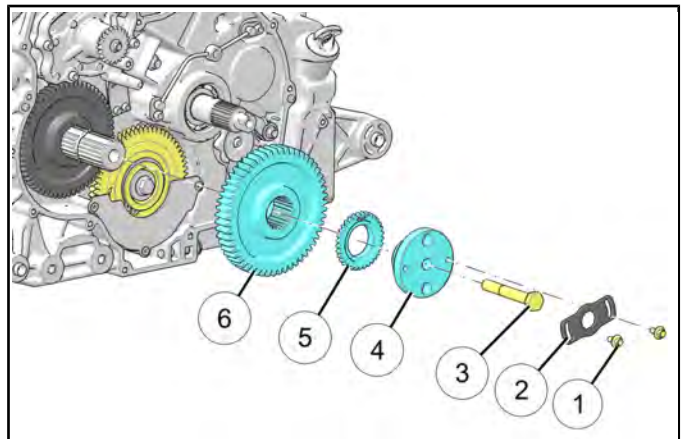


**TORQUE**

Balance Shaft Shield Fastener:  
**62 in-lbs (7 N·m)**

**5**

4. Install crank drive gear ⑥.



5. Install water pump sprocket ⑤.
6. Install cold test splined adapter. ④
7. Install the primary drive gear fastener ③.

**TORQUE**

Primary Drive Gear Fastener:  
**83 ft-lbs (112 N·m)**

8. Install the locking plate ② by secure with its fasteners ①.

**TORQUE**

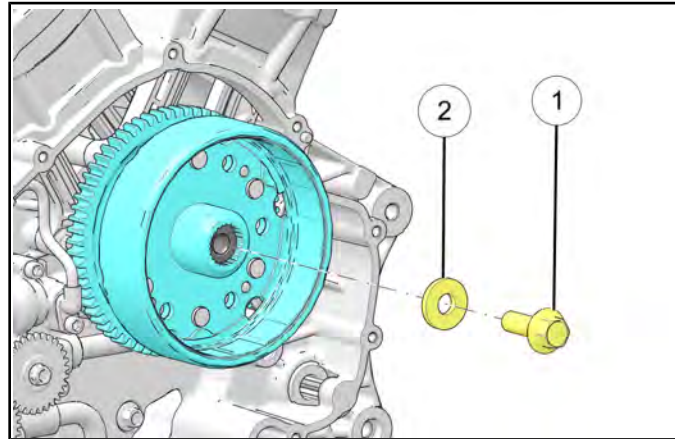
Locking Plate Fastener:  
**84 in-lbs (10 N·m)**

9. Install water pump chain. Reference **Water Pump Removal / Installation page 3.41.**
10. Install primary cover. See **Primary Cover Installation page 5.19.**

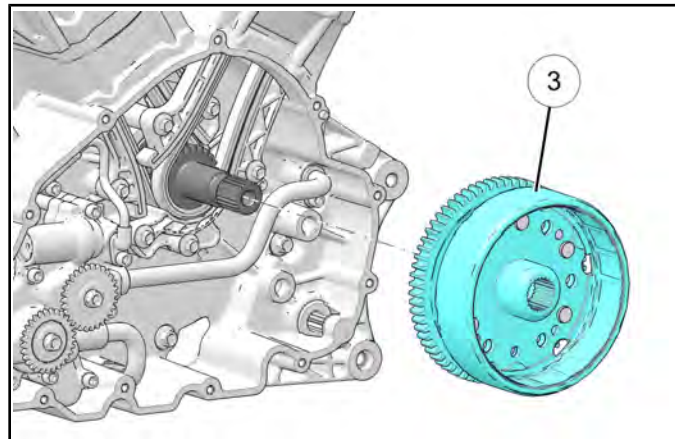
## FLYWHEEL REMOVAL / INSTALLATION

### REMOVAL

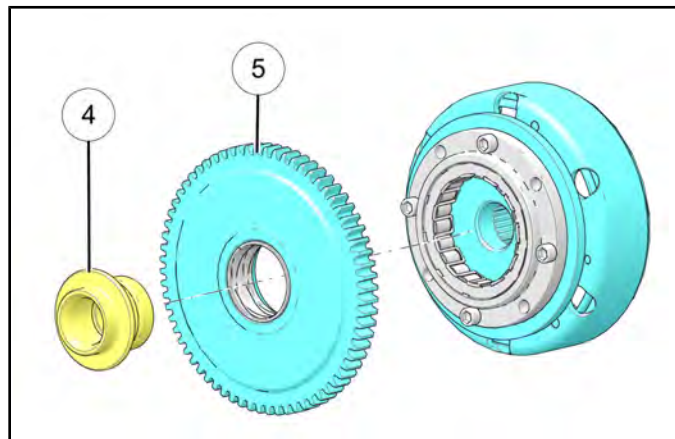
1. Remove stator. See **Stator Removal / Installation page 10.34.**
2. Remove ACG Cover. See **ACG Cover Removal / Installation page 10.34.**
3. Remove flywheel bolt ① and washer ②.



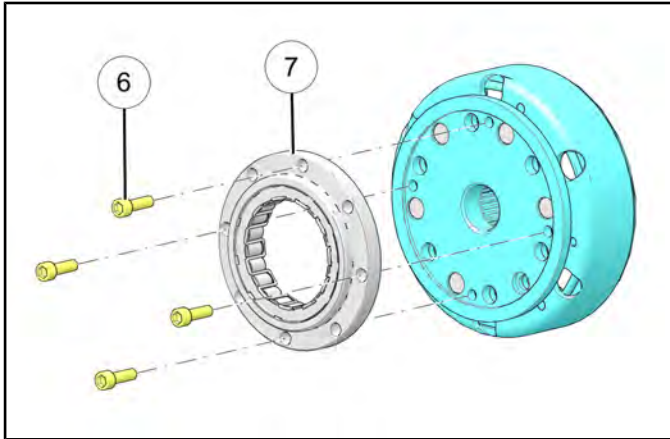
4. Remove flywheel assembly ③.



5. Remove starter/ACG spacer ④.



6. Remove starter clutch gear ⑤.
7. Remove sprag clutch hub ⑦ by removing its fasteners ⑥.



## INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Sprag Clutch Hub Fastener <b>84 in-lbs (10 N·m)</b>

TORQUE
Flywheel Fastener <b>112 ft-lbs (152 N·m)</b>

5

**TROUBLESHOOTING, CLUTCH / PRIMARY / SHIFT**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>PART(S) AFFECTED</b>	<b>REPAIR RECOMMENDED</b>
Clutch Lever Pulls Excessively Hard	Clutch lever pivot, bushings need lubrication	Clutch lever pivot points	Lubricate
	Drive plates catching on primary driven gear basket	Clutch primary driven gear / clutch plates	Replace necessary parts
	Clutch rack bearing damage	Clutch rack	Replace
	Clutch pinion shaft bearing binding	Pinion shaft bearings	Replace
	Clutch Cable Damaged	Clutch Cable	Replace
Clutch Slips	Clutch Cable too tight	Clutch Cable	Verify proper clutch cable tension
	Clutch springs weak	Clutch springs	Replace
	Pressure plate worn or distorted	Pressure plate	Replace
	Clutch plates worn, warped or distorted	Clutch Friction / Separator Plates	Replace plates as necessary
	Clutch rack mechanism sticking	Clutch rack mechanism	Replace
	Engine oil level low	Oil level	Correct oil level
	Oil additives present in oil or used previously	Oil quality	Replace oil & filter (clutch plates may need to be replaced)
Dragging clutch (doesn't disengage completely, creeping)	Clutch lever, pivot, cable, or lifter arm sticking	Lever, pivots, bushings, bearings, cable	Inspect
	Oil additives present in oil or used previously	Oil quality	Replace oil & filter (clutch plates may need to be replaced)
	Oil level too high	Oil level	Correct
	Oil viscosity too high	Oil quality	Replace oil & filter
	Pressure plate worn, warped or distorted	Pressure plate	Replace
	Clutch plate(s) worn, warped or distorted	Driven plates and / or drive plates	Replace
	Weak clutch springs	Clutch springs	Replace
	Damaged Clutch cable	Clutch Cable	Replace

# CHAPTER 6 TRANSMISSION / CRANKSHAFT

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  - SPECIAL TOOLS – TRANSMISSION / CRANKSHAFT ..... 6.2
  - SERVICE SPECIFICATIONS – TRANSMISSION / CRANKSHAFT ..... 6.3
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**GENERAL INFORMATION****SERVICE NOTES – TRANSMISSION / CRANKSHAFT**

- Remove engine from frame to service internal transmission and/or crankshaft components. See **Removing Engine From Frame page 3.15.**
- The crankcase must be separated to access internal transmission components and crankshaft.
- Label and store parts neatly to speed the assembly process and ensure that matched parts like connecting rods, camshafts and bearings and rocker arms can be installed in their original location
- Crankshaft main bearing replacement requires the case half to be replaced.
- All torque specifications are "dry" unless specified for oil or locking agent. Refer to exploded views
- When locking agents are required, use Loctite® Primer N to clean fastener before applying locking agent Primer N reduces cure time of thread locking agent in addition to preparing the surfaces

**SPECIAL TOOLS – TRANSMISSION / CRANKSHAFT**

<b>TOOL DESCRIPTION</b>	<b>PART NUMBER</b>
Case Splitting / Assembly Tool	PF-51234-A
Clutch Shaft Holding Tool	PF-51232
Crankshaft Locking Pin	PF-52135
Crankshaft Rotation Socket	PF-51239
Drive Sprocket Seal Installer	PF-51243
Engine Stand Adapter	PF-51240

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

## SERVICE SPECIFICATIONS - TRANSMISSION / CRANKSHAFT

### CONNECTING ROD / CRANKSHAFT SPECIFICATIONS

PART	PART SPECIFIC	STANDARD	SERVICE LIMIT
Connecting Rod	Connecting Rod to Crankshaft Side Clearance	.17 - .45 mm (.0067 - .01772")	.65 mm (.0256")
	Connecting Rod Bearing to Crankshaft Oil Clearance	.028 - .072 mm (.001 - .0028")	.12 mm (.0393")
	Connecting Rod Small End I.D.	23.015 - 23.025 mm (.9061 - .9065")	23.09 mm (.9091")
	Connecting Rod Width	21.05 - 21.15 mm (.8287 - .8326")	20.76 mm (.8173")
	Connecting Rod Big End I.D.	57.000 - 57.008 mm (2.2440 - 2.2444")	57.038 mm (2.2456")
Crankshaft Main Bearing / Rod Journals	Connecting Rod Journal Width	45.472 - 45.552 mm (1.7902 - 1.7934")	43.51 mm (1.712")
	Crankshaft Rod Journal O.D.	53.992 - 54.008 mm (2.1256 - 2.1263")	53.962 mm (2.1245")
	Main Bearing Oil Clearance	Left .020 mm (.00078") Right .050 mm (.00196")	.10 mm (.004")
	Main Bearing Journal O.D.	59.952 - 59.970 mm (2.3603 - 2.3610")	59.9323 mm (2.3595")
	Crankshaft End Play	.08 - .25 mm (.0031 - .0098")	-
Balance Shaft	Journal O.D., Left (Primary Side)	24.980 - 24.992 mm	-
	Journal O.D., Right (Cam Side)	24.969 - 24.979 mm	

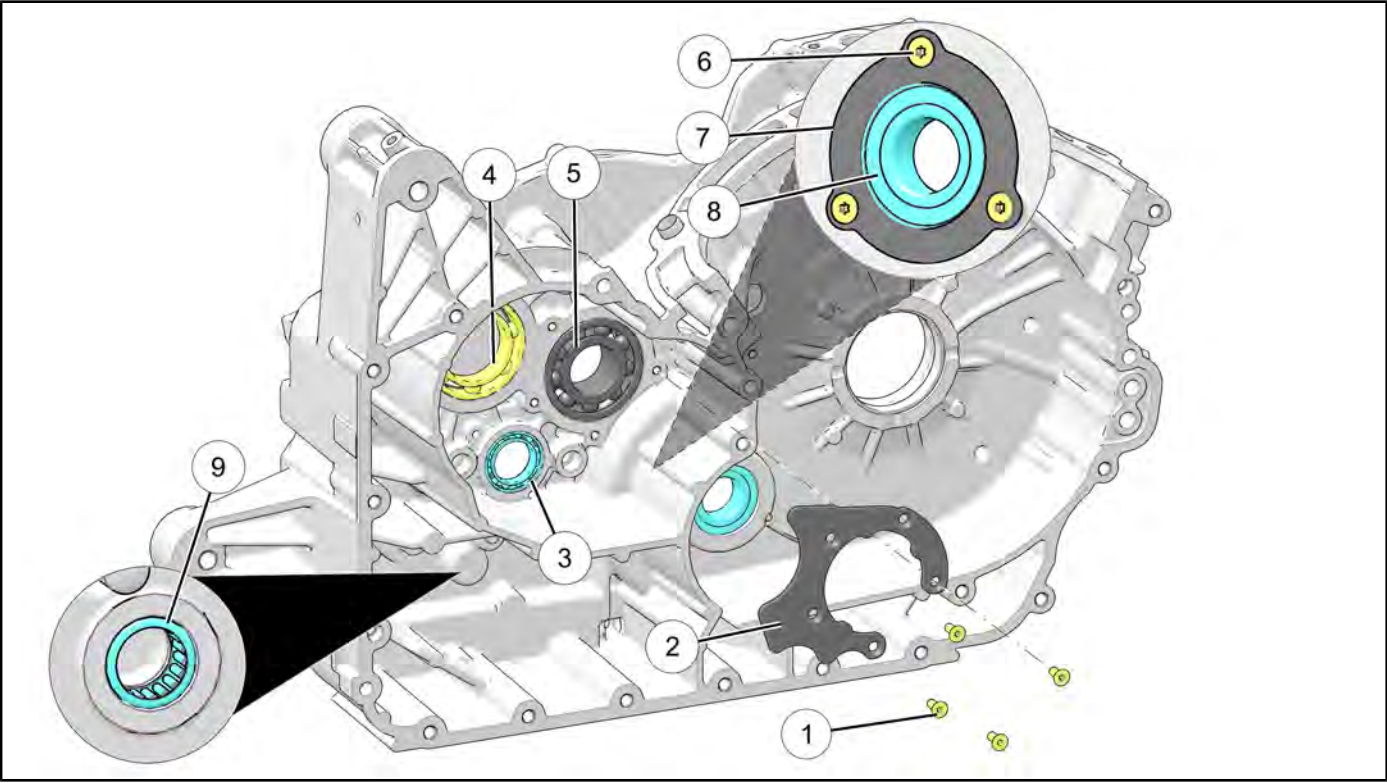
TRANSMISSION / CRANKSHAFT

**TRANSMISSION SPECIFICATIONS**

ITEM	PART SPECIFIC	STANDARD	SERVICE LIMIT
Shift Fork	Shift Fork I.D. (Rail)	12.00 - 12.026 mm (.4725 - .4732")	12.05 mm (.4744")
	Shift Fork Pin O.D.	6.036 - 6.136 mm (.2376 - .2416")	6.02 mm (.2370")
Shift Fork Rail	Shift Fork Rail O.D.	11.948 - 11.972 mm (.4704 - .4713")	11.92 mm (.4693")
	Shift Fork Rail Runout	-	.025 mm (.001")
Shift Drum	Shift Drum Groove	-	Replace drum if any wear is evident

ITEM		SPECIFICATIONS
Drive Train (General)	Transmission	6 Speed
	Primary Reduction Ratio	1.56: 1
	Final Reduction Ratio	2.38: 1
Drive Train (Gear Ratios)	Gear Ratio: 1st Gear	2.73: 1
	Gear Ratio: 2nd Gear	1.86: 1
	Gear Ratio: 3rd Gear	1.38: 1
	Gear Ratio: 4th Gear	1.10: 1
	Gear Ratio: 5th Gear	.94: 1
	Gear Ratio: 6th Gear (Overdrive)	0.81: 1

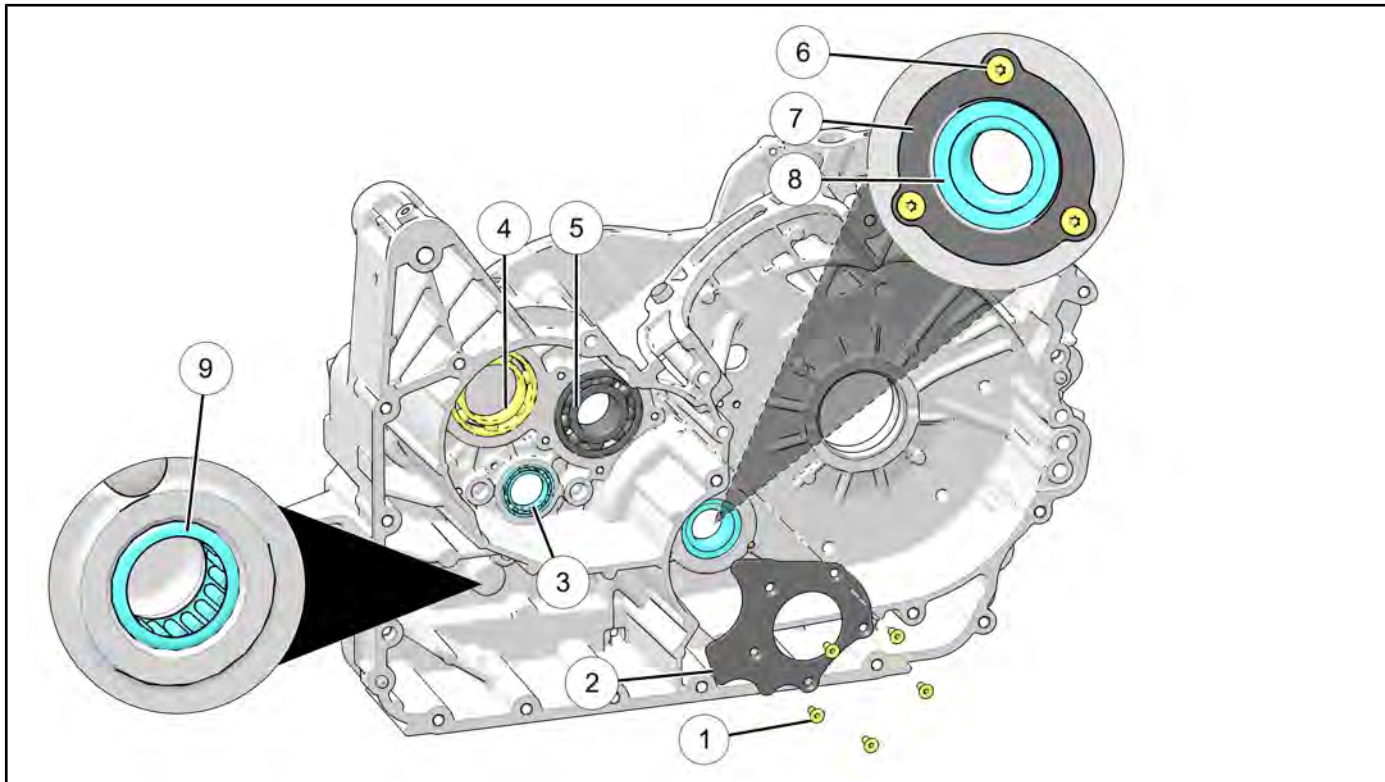
**ASSEMBLY VIEWS**  
**CRANKCASE**  
**LEFT (2020)**



6

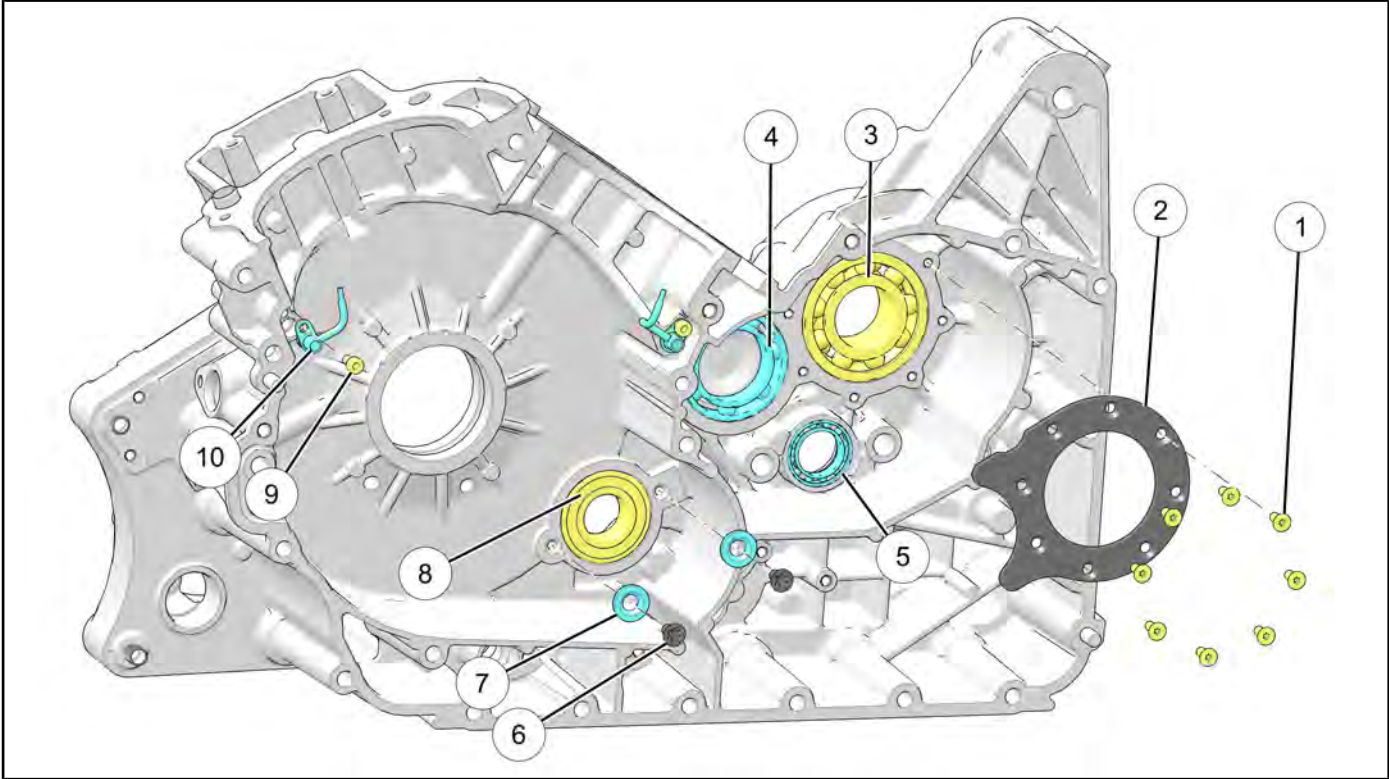
REF	DESCRIPTION	TORQUE
①	Bearing Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
②	Bearing Retainer Plate	—
③	Shift Drum Bearing	—
④	Output shaft bearing	—
⑤	Input shaft bearing	—
⑥	Balance Shaft Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
⑦	Balance Shaft Retainer Plate	—
⑧	Balance Shaft Bearing	—
⑨	Shift Shaft Bearing	—

**LEFT (2021+)**



REF	DESCRIPTION	TORQUE
①	Bearing Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
②	Bearing Retainer Plate	—
③	Shift Drum Bearing	—
④	Output shaft bearing	—
⑤	Input shaft bearing	—
⑥	Balance Shaft Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
⑦	Balance Shaft Retainer Plate	—
⑧	Balance Shaft Bearing	—
⑨	Shift Shaft Bearing	—

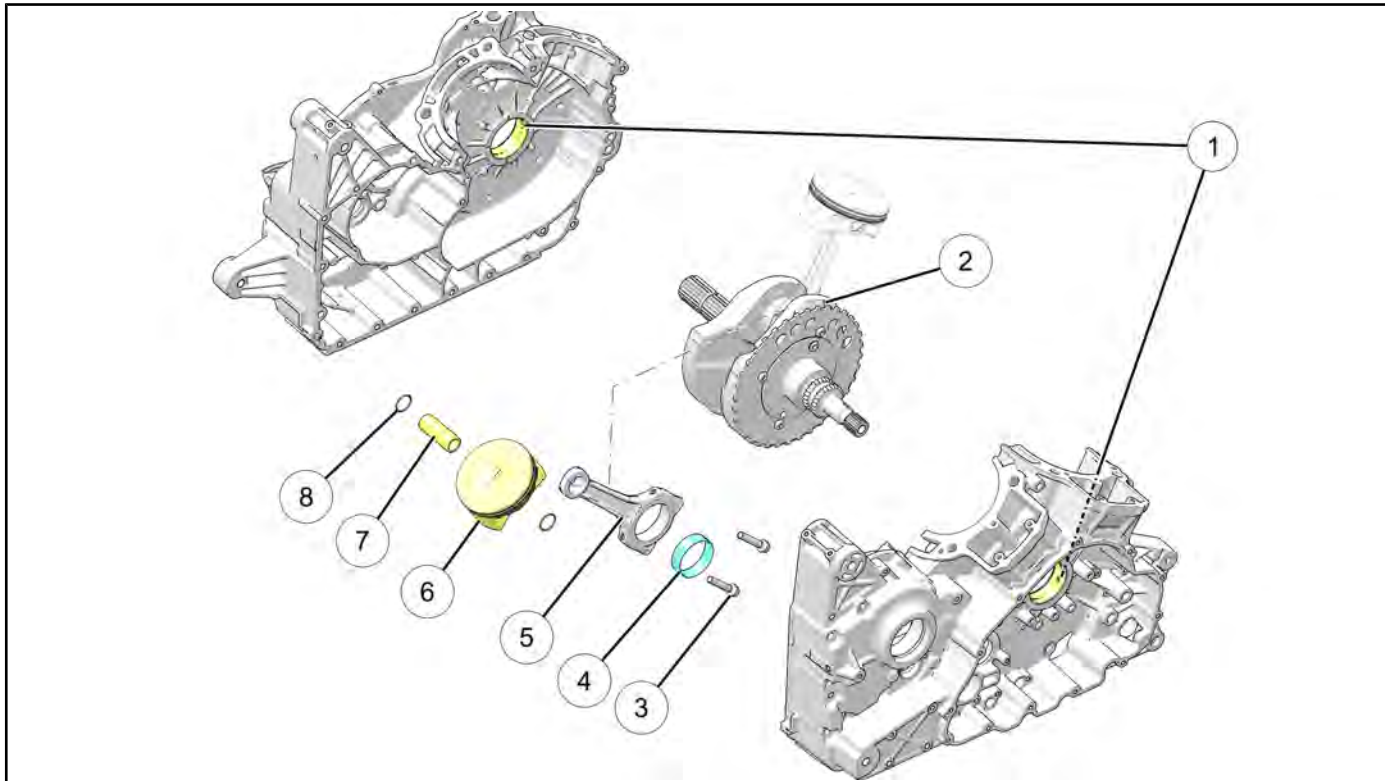
**RIGHT**



**6** XXXXXXXXXX

REF	DESCRIPTION	TORQUE
①	Bearing Retainer Plate Fastener	<b>62 in-lbs (7 N·m)</b>
②	Bearing Retainer Plate	—
③	Output Shaft Bearing	—
④	Input Shaft Bearing	—
⑤	Shift Drum Bearing	—
⑥	Balance Shaft Retainer Fastener	<b>84 in-lbs (10 N·m)</b>
⑦	Balance Shaft Retainer	—
⑧	Balance Shaft Bearing	—
⑨	Piston Cooling Jet Fastener	<b>62 in-lbs (7 N·m)</b>
⑩	Piston Cooling Jet	—

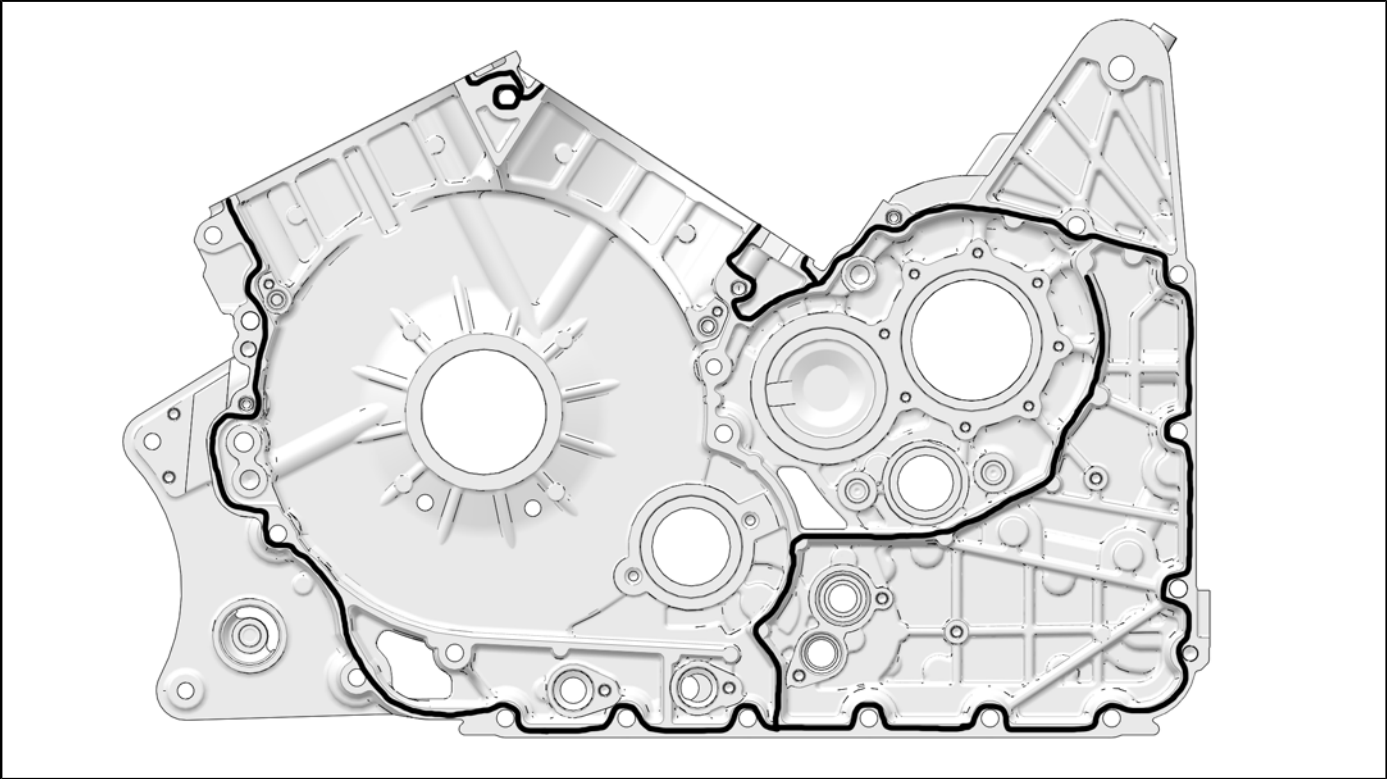
**CRANKSHAFT**



REF	DESCRIPTION	TORQUE
①	Crankshaft Bearing	—
②	Crankshaft Assembly	—
③	Connecting Rod Fastener	<b>1. Torque to 19 ft-lbs (26 N·m) 2. Torque angle to 105 °</b>
④	Connecting Rod Bearing	—
⑤	Connecting Rod	—
⑥	Piston	—
⑦	Wrist Pin	—
⑧	Circlip	—

**CRANKCASE TORQUE SEQUENCE**

**CRANKCASE SEALANT PATH**

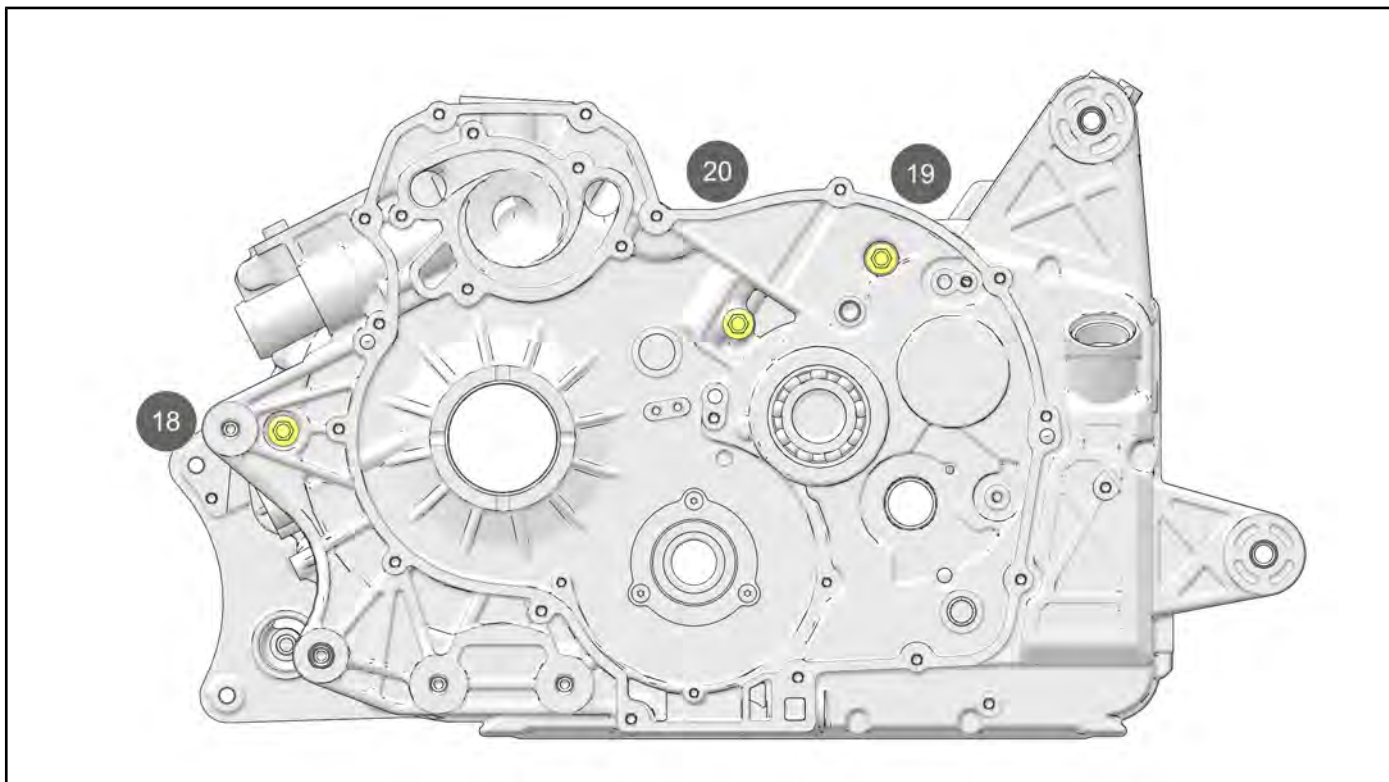
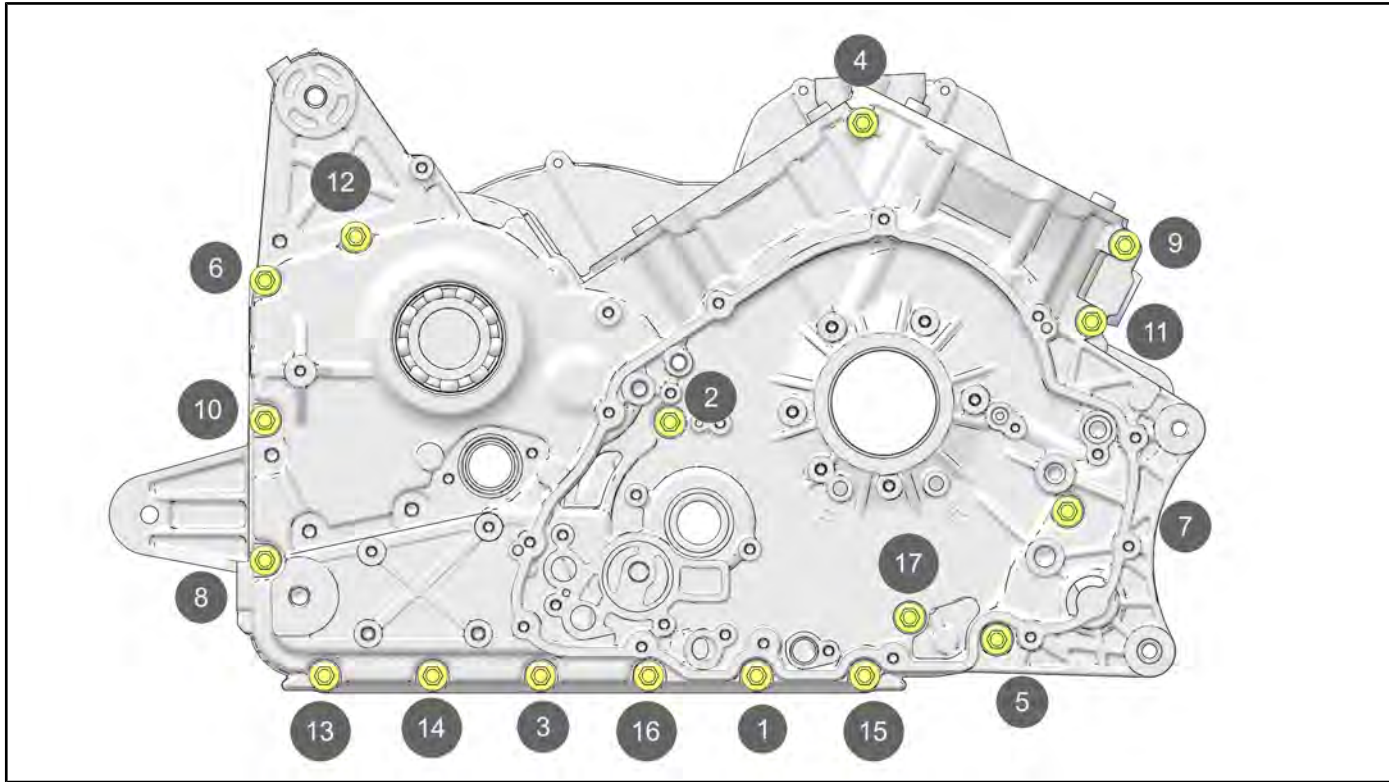


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Use sealant Loctite™ Ultra Black 598 and follow the path shown in the image prior to crankcase assembly.



**TORQUE SEQUENCE**

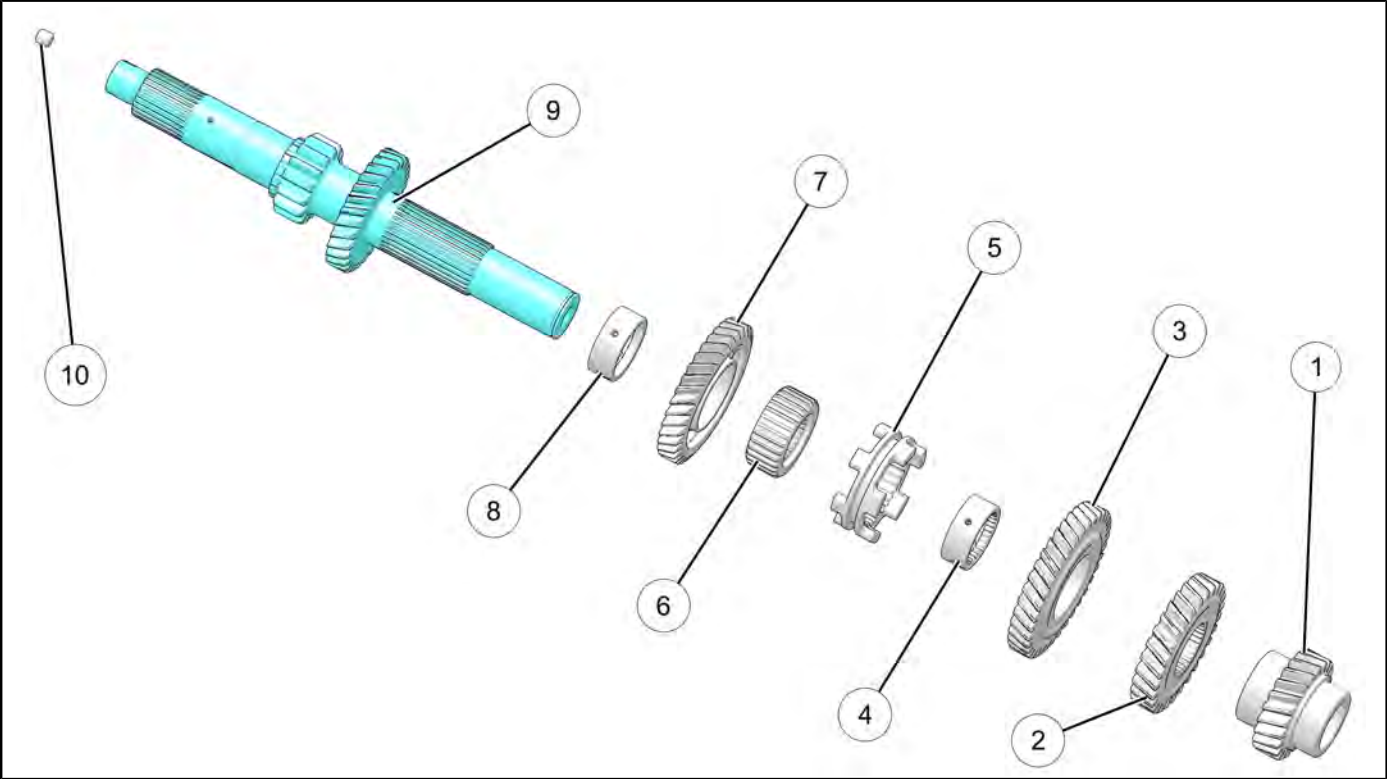


**TORQUE**

**Crankcase Fasteners:  
22 ft-lbs (30 N·m)**

**TRANSMISSION**

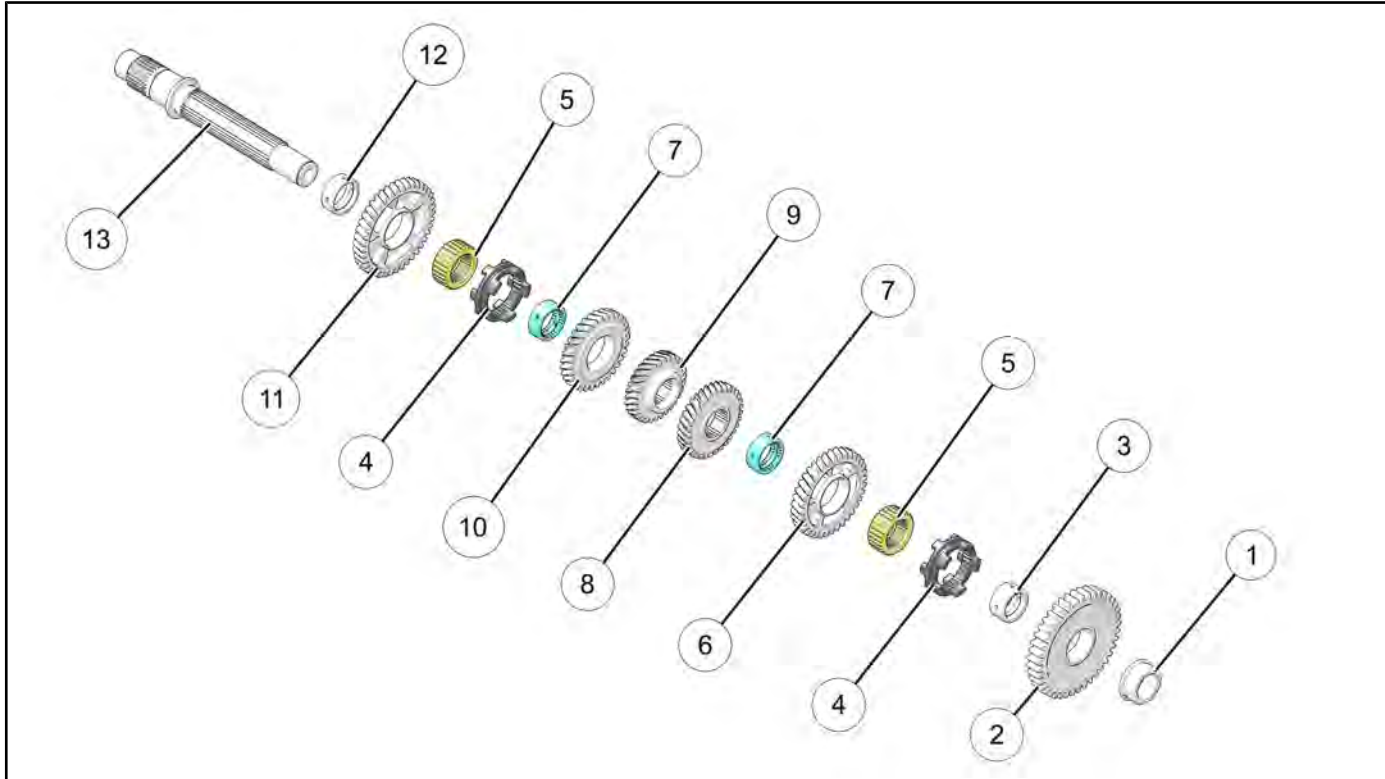
**INPUT SHAFT**



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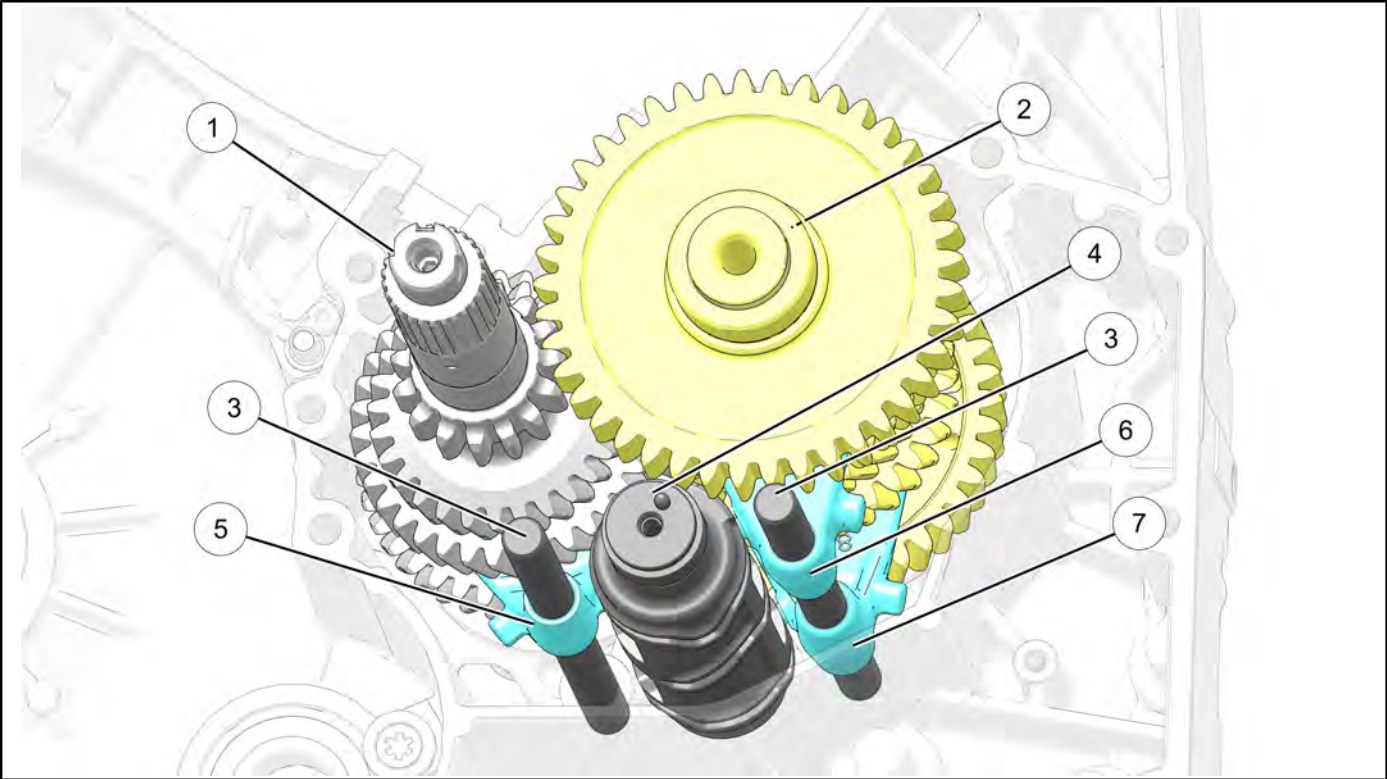
REF	DESCRIPTION	TORQUE
①	2nd Gear	—
②	4th Gear	—
③	6th Gear	—
④	Splined Bushing	—
⑤	Dog Ring	—
⑥	Splined Spacer	—
⑦	5th Gear	—
⑧	Plain Bushing	—
⑨	Input Shaft & 1st/3rd Gear	—
⑩	Oil Plug	<b>13 ft-lbs (18 N·m)</b>

**OUTPUT SHAFT**



REF	DESCRIPTION
①	Output Shaft Spacer
②	1st Gear
③	Plain Bushing
④	Dog Ring
⑤	Splined Spacer
⑥	3rd Gear
⑦	Splined Bushing
⑧	5th Gear
⑨	6th Gear
⑩	4th Gear
⑪	2nd Gear
⑫	Plain Bushing
⑬	Output Shaft

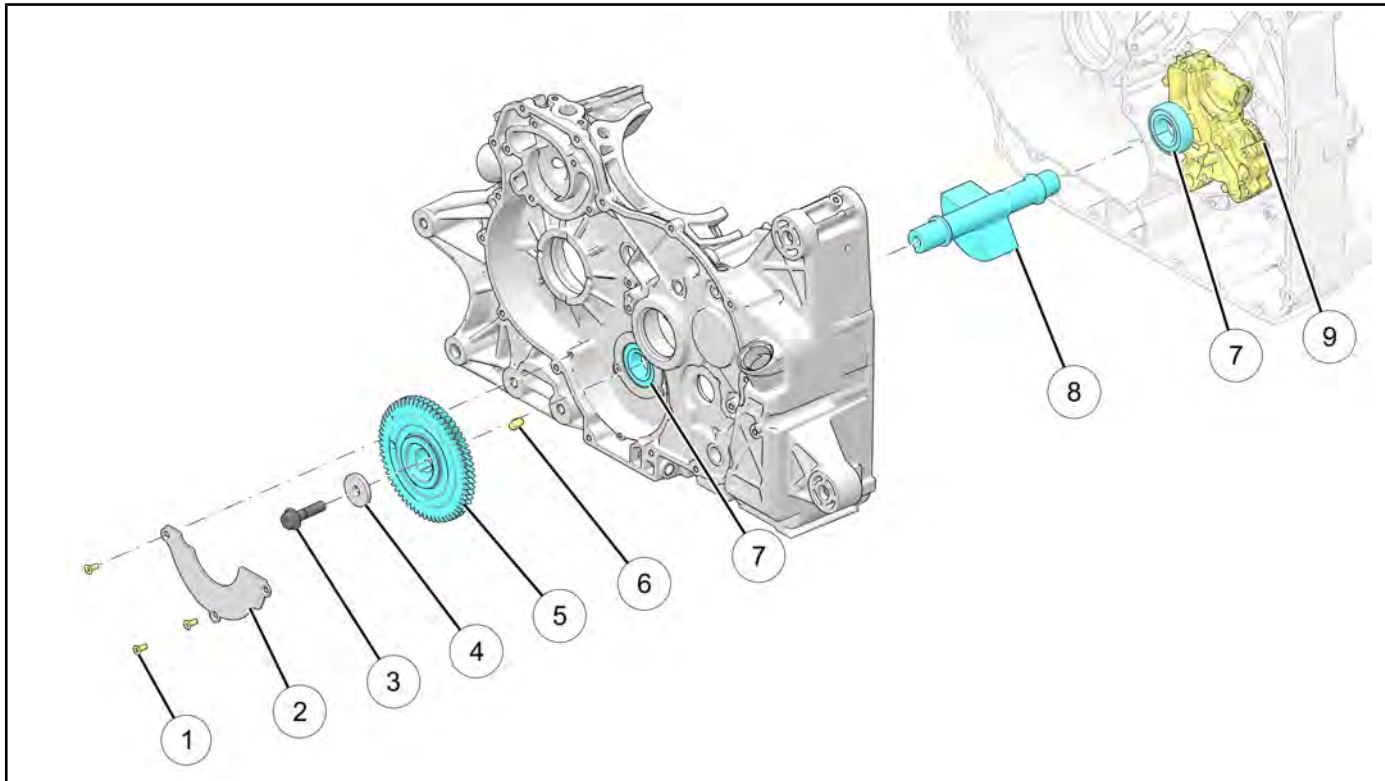
**SHIFT DRUM / SHIFT FORK**



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REF	DESCRIPTION	NOTES
①	Input Shaft	—
②	Output Shaft	—
③	Shift Rail	—
④	Shift Drum	—
⑤	Input Shaft Fork	Forge Number: 8 943
⑥	Output Shaft Fork	Forge Number: 8 942
⑦	Output Shaft Fork	Forge Number: 8 941

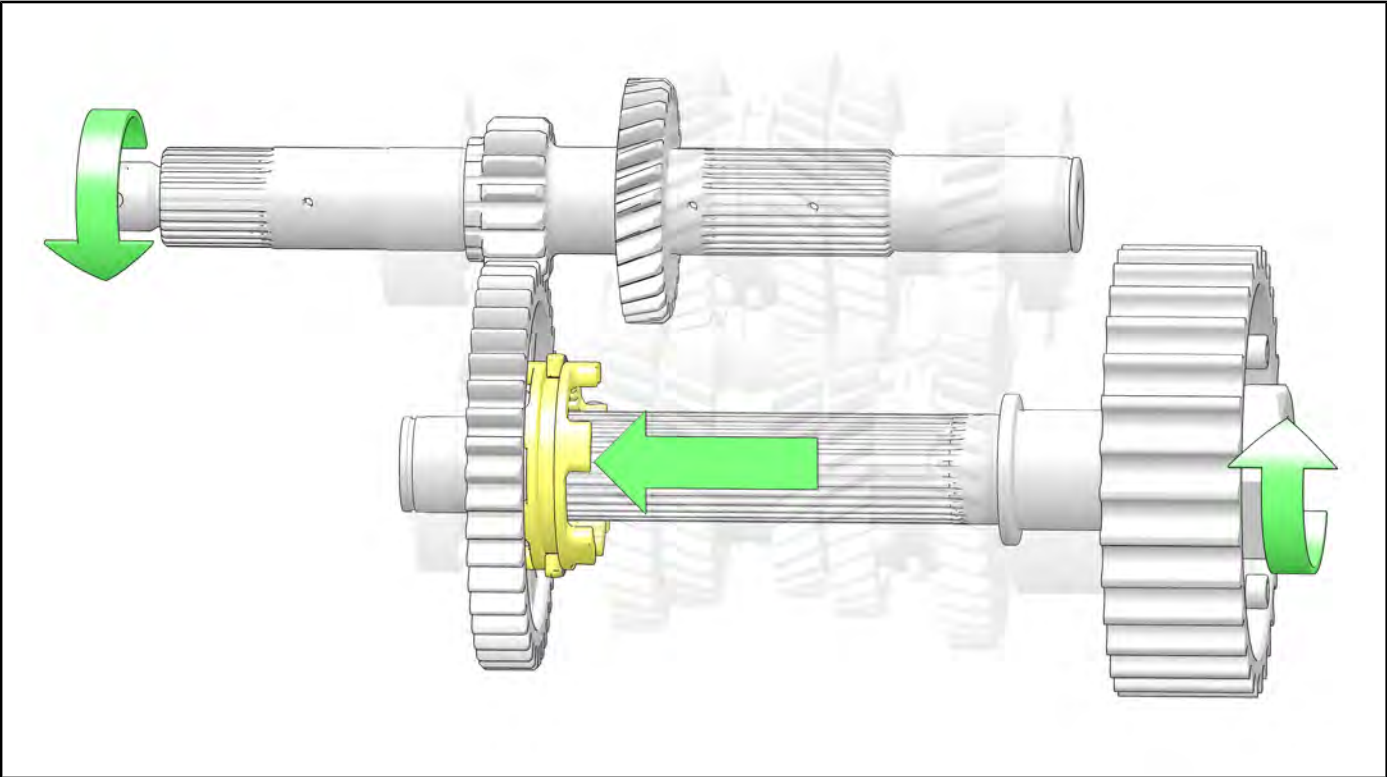
**BALANCE SHAFT**



REF	DESCRIPTION	TORQUE
①	Balance Shaft Shield Fastener	<b>62 in-lbs (7 N·m)</b>
②	Balance Shaft Shield	—
③	Balance Shaft Gear Fastener	<b>59 ft-lbs (80 N·m)</b>
④	Washer	—
⑤	Balance Shaft Gear	—
⑥	Balance Shaft Key	—
⑦	Balance Shaft Bearing	—
⑧	Balance Shaft	—
⑨	Oil Pump	—

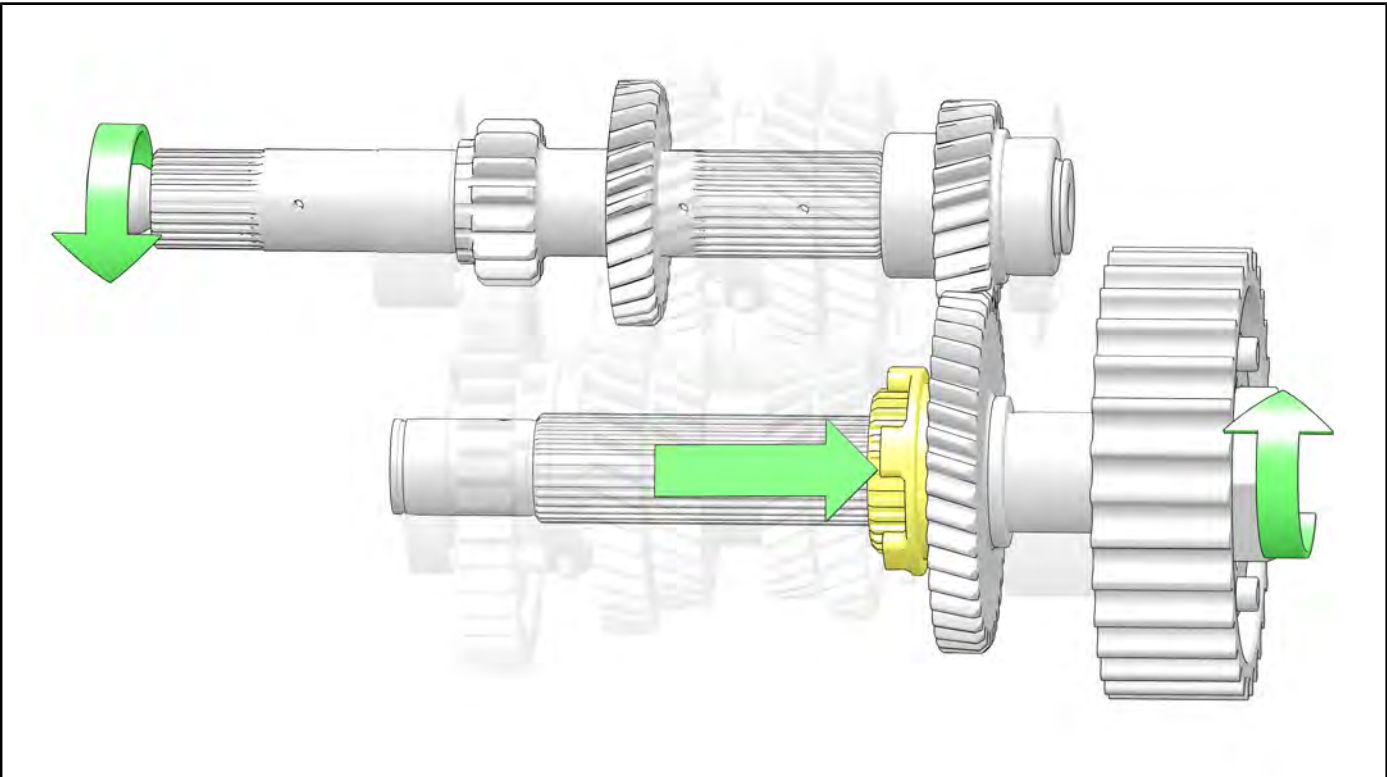
**GEAR TRAIN**

**1st Gear**

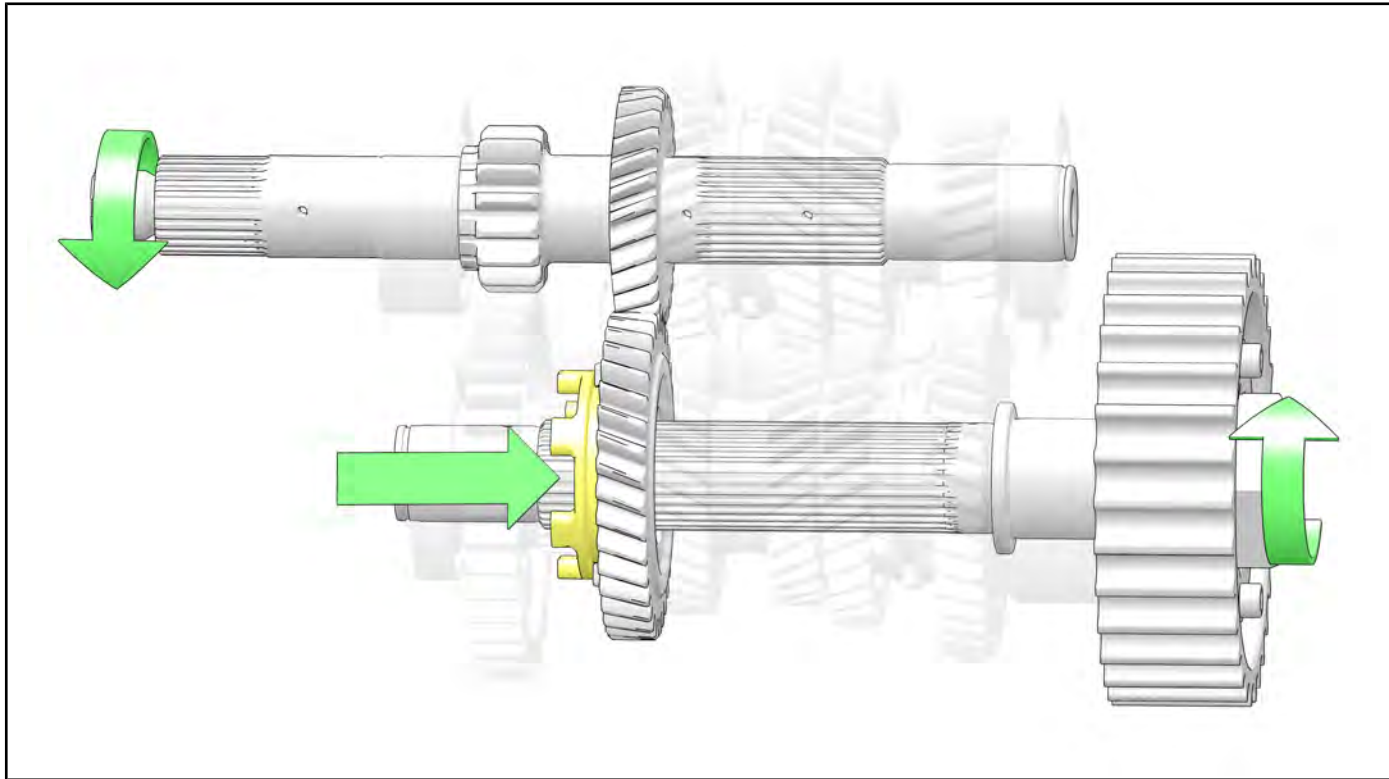


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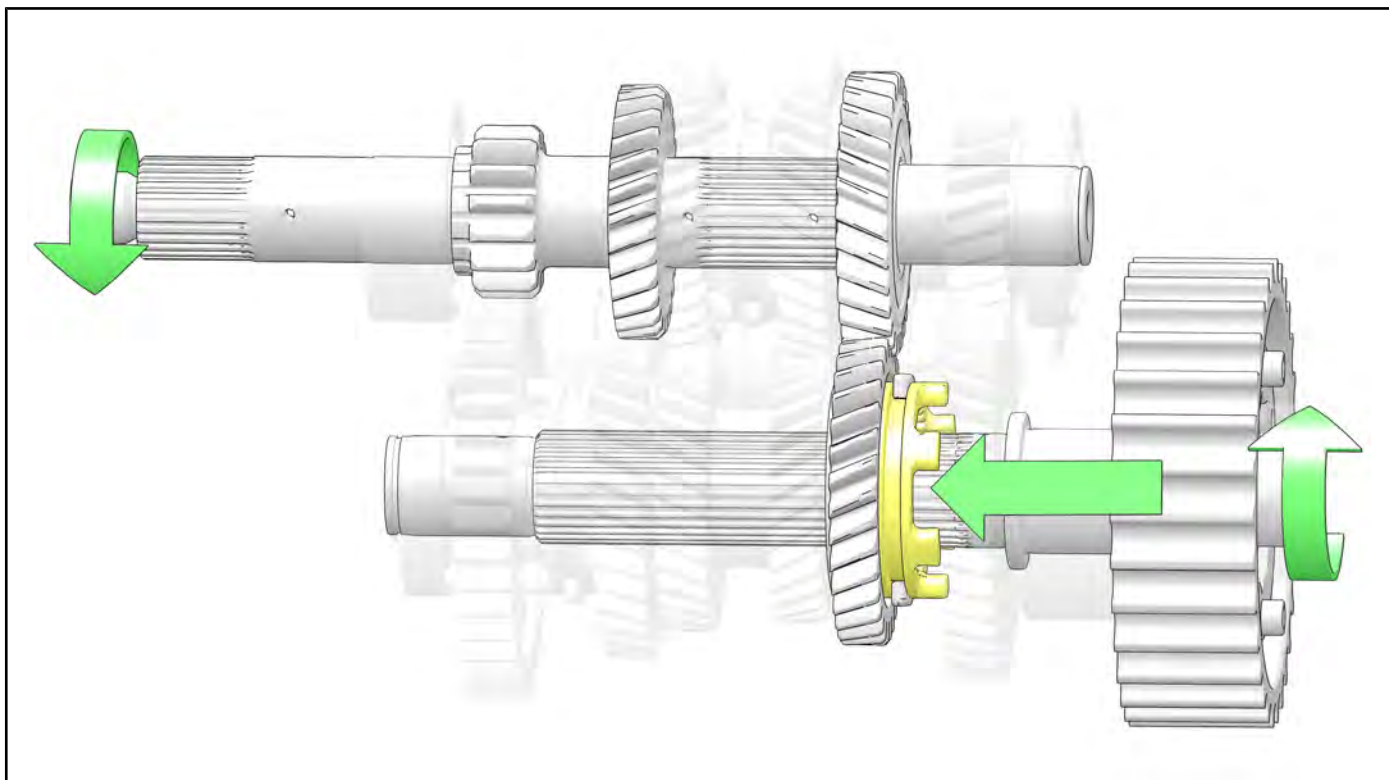
**2nd Gear**



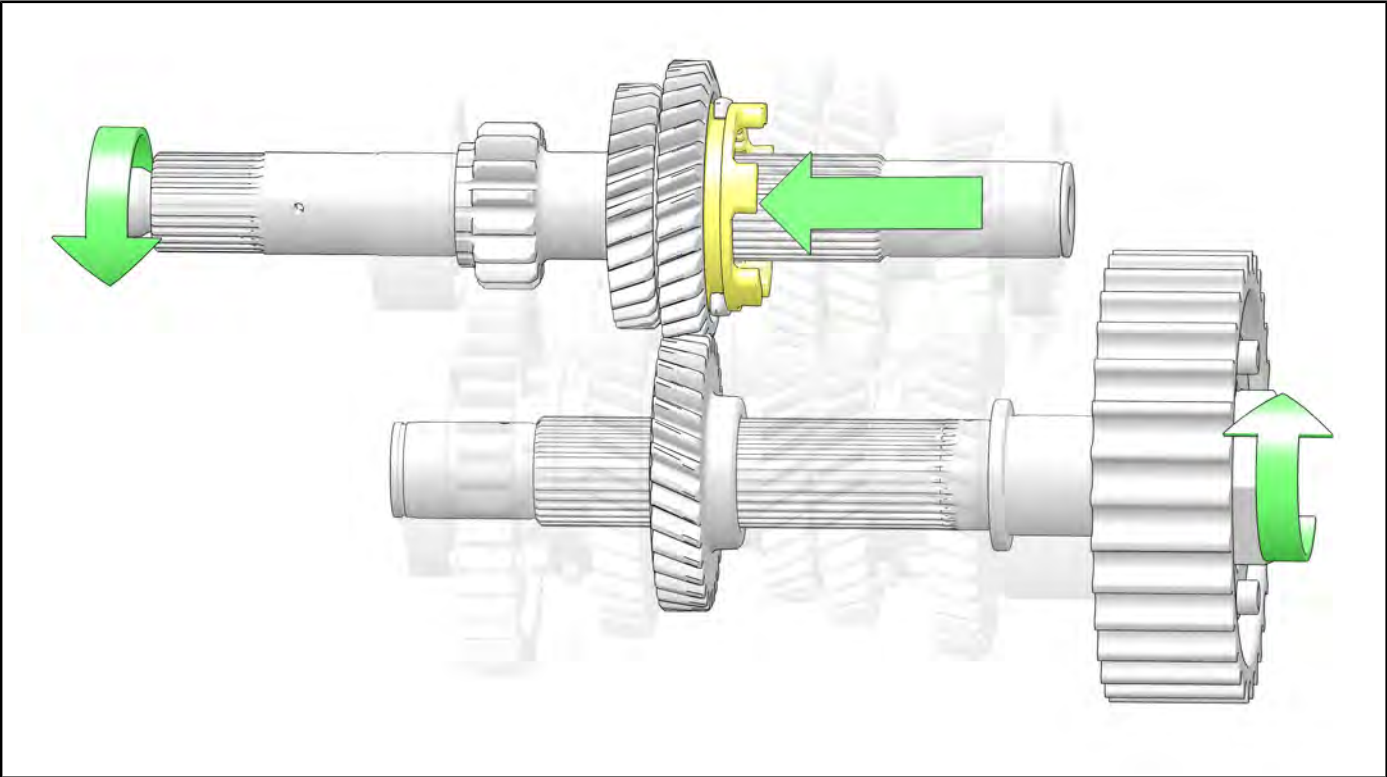
3rd Gear



4th Gear

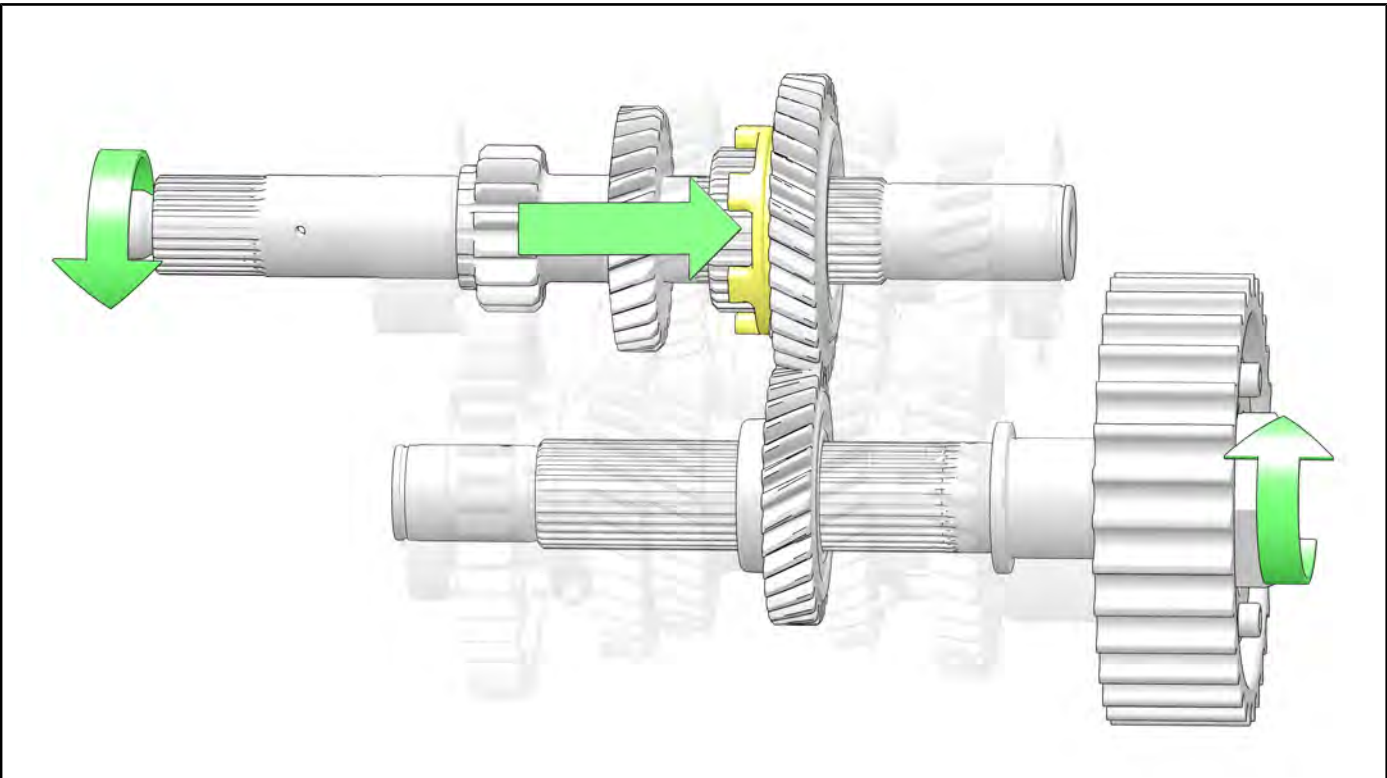


5th Gear



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6th Gear

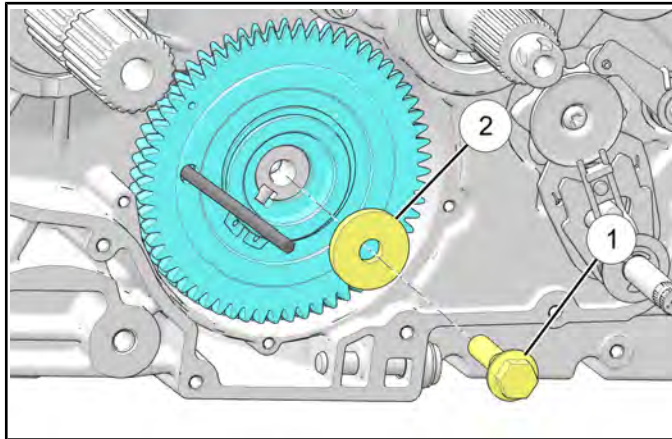




## BALANCE SHAFT SERVICE

### BALANCE SHAFT REMOVAL

1. Remove primary cover. See **Primary Cover Removal page 5.13.**
2. Remove clutch. See **Clutch Removal page 5.21.**
3. Remove primary drive gear. See **Primary Drive Gear Removal page 5.26.**
4. Remove balance shaft gear fastener ① and washer ② and remove balance shaft gear.



#### IMPORTANT

Be sure to collect the woodruff key from the end of the balance shaft once the gear has been removed.

5. Separate the engine cases. See **Crankcase Separation page 6.21.**
6. Rotate balance shaft until counterweights are clear of crankshaft. Grasp balance shaft and remove it from case.

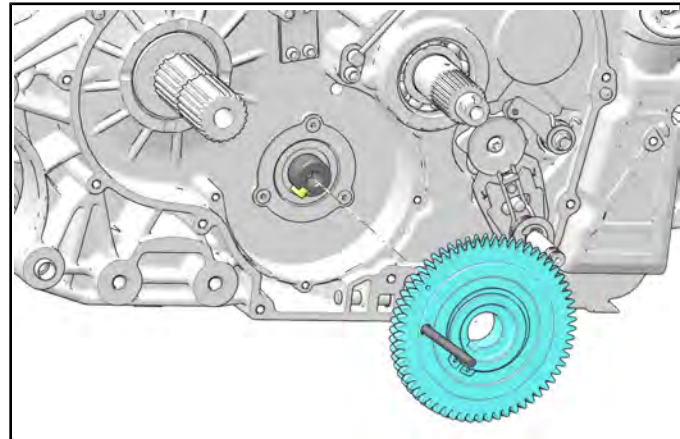


7. Check shaft for runout, or twisting.

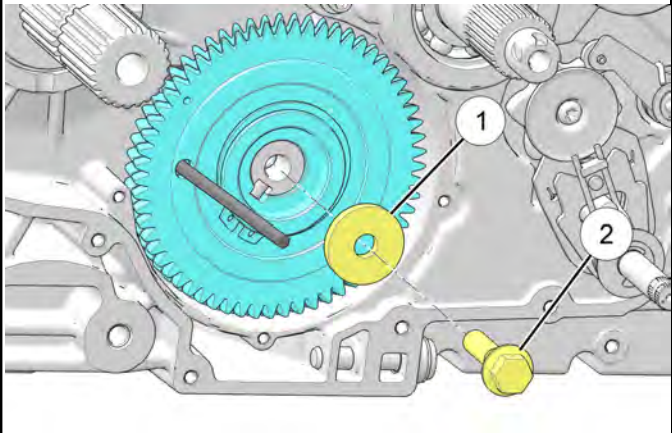
8. Rotate right and left balance shaft bearings by hand while observing bearing rotation. Bearings should run smooth and quiet and shaft should be a snug fit in bearing.
9. Visually inspect bearings for damage.

### BALANCE SHAFT INSTALLATION

1. Lubricate balance shaft bearings with engine oil.
2. Insert the balance shaft into the primary side bearing until fully seated. Woodruff key slot should be facing the cam side of the engine.
3. Assemble the engine cases. See **Crankcase Assembly page 6.40.**
4. Lock the crankshaft for service. See **Locking the Crankshaft for Service page 3.53.**
5. Place the woodruff key into the end of the balance shaft.
6. Place a pin punch, or other suitable tool, through hole and preload split gear teeth so they are aligned.



7. Secure balance shaft gear with washer ① and fastener ②.



TORQUE
Balance Shaft Gear Fastener: <b>59 ft-lbs (80 N·m)</b>

8. Install primary drive gear and align. See **Primary Drive Gear Installation** page 5.27.

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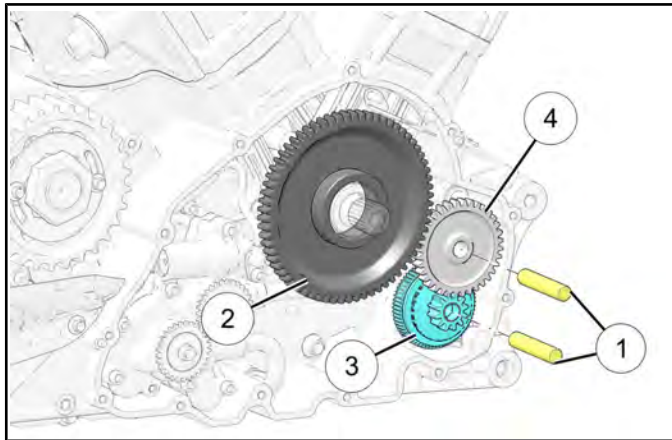
## STARTER DRIVE SERVICE

### STARTER DRIVE REMOVAL

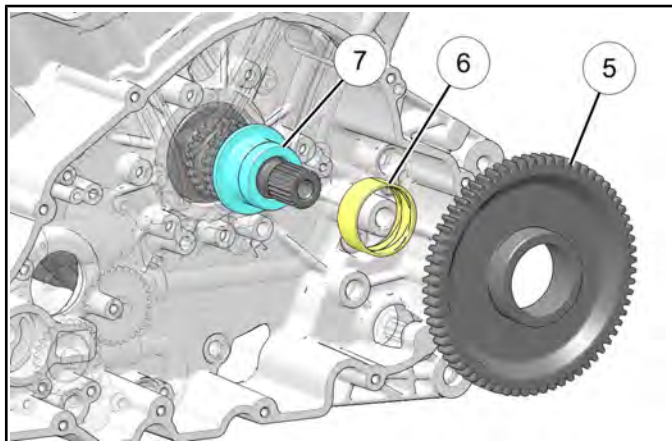
1. To remove starter drive, reference **ACG Cover Removal / Installation page 10.34**.

### STARTER DRIVE INSPECTION

1. Inspect gear teeth for chips, cracks or excessive wear.
2. Inspect shaft surfaces ① and bushing surfaces ② ③ ④ for excessive wear and scoring.



3. Measure the I.D. of the starter gear assembly ⑤ and the O.D. of the spacer ⑦. Inspect the flywheel bushing ⑥. Compare to specifications.



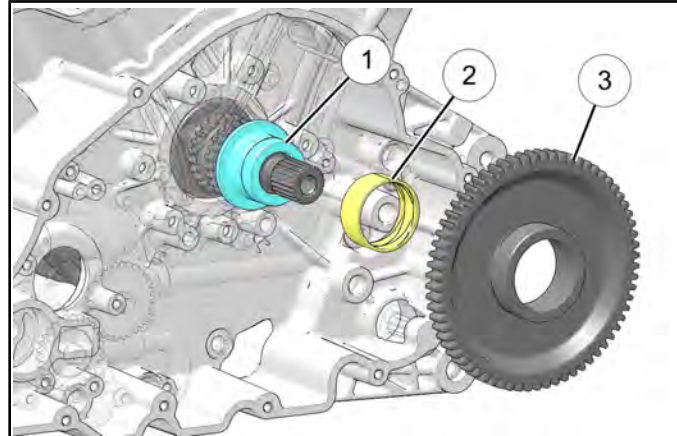
Spacer O.D:  
**39.985±.015 mm**

One-Way Clutch Hub I.D. (Flywheel):  
**40.025 ± 0.015**

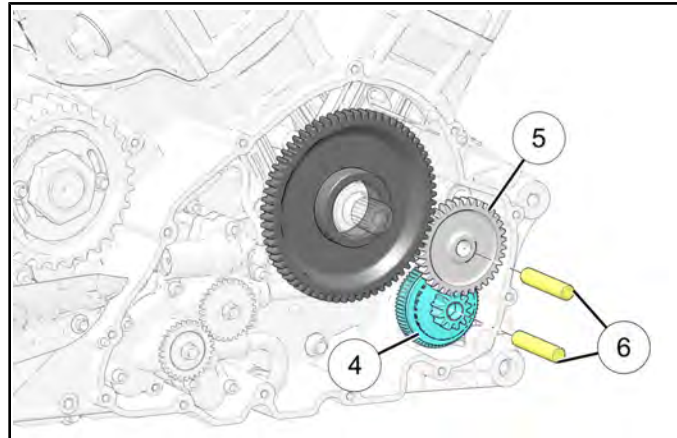
4. Replace if wear or damage is evident.

### STARTER DRIVE INSTALLATION

1. Install spacer ①, bushing ②, and flywheel ③.



2. Install starter drive gear ④, and starter idler gear ⑤.



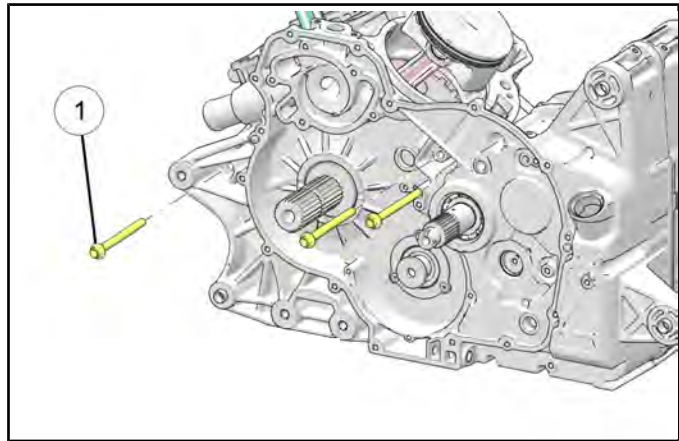
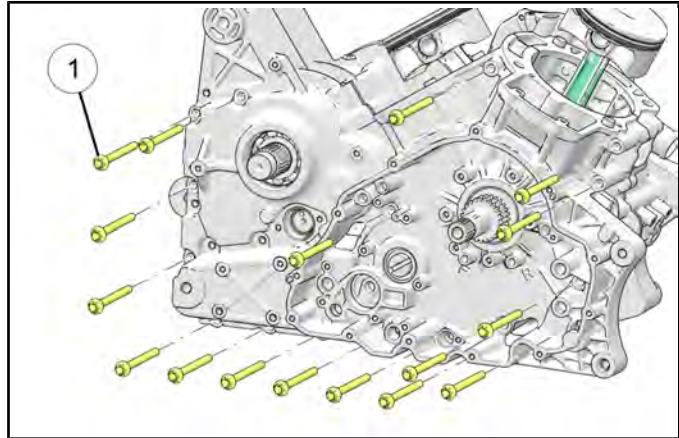
3. Secure with gear shafts ⑥.

## CRANKSHAFT SERVICE

### CRANKCASE SEPARATION

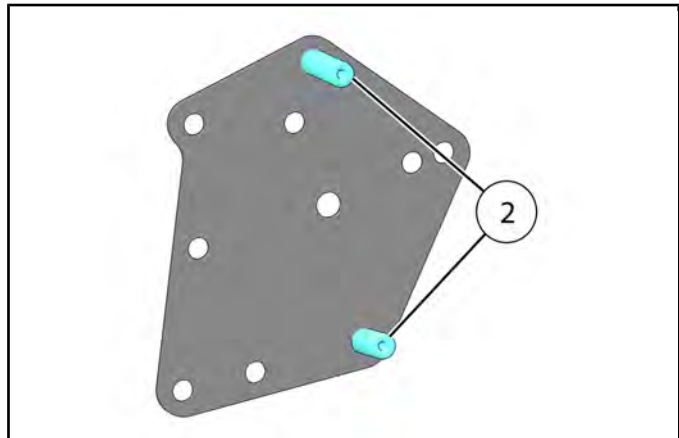
1. Drain engine oil. See **Engine Oil & Filter Change page 2.18.**
2. Remove engine from frame. See **Removing Engine From Frame page 3.15.**
3. Mount engine securely on an engine stand using engine stand adapter tool **PF-51240.**
4. Remove cylinder heads. See **Cylinder Head Removal page 3.84.**
5. Remove cylinders. See **Cylinder Removal page 3.100.**
6. Remove primary cover. See **Primary Cover Removal page 5.13.**
7. Remove water pump. See **Water Pump Removal / Installation page 3.41.**
8. Remove primary drive gear. See **Primary Drive Gear Removal page 5.26.**
9. Remove clutch assembly. See **Clutch Removal page 5.21.**
10. Remove the oil pump. See **Oil Pump Removal / Installation page 3.33.**
11. Remove drive sprocket. See **Drive Sprocket Removal page 8.62.**
12. Remove balance shaft gear. Reference **Balance Shaft Removal page 6.18.**

13. Remove engine case fasteners ①



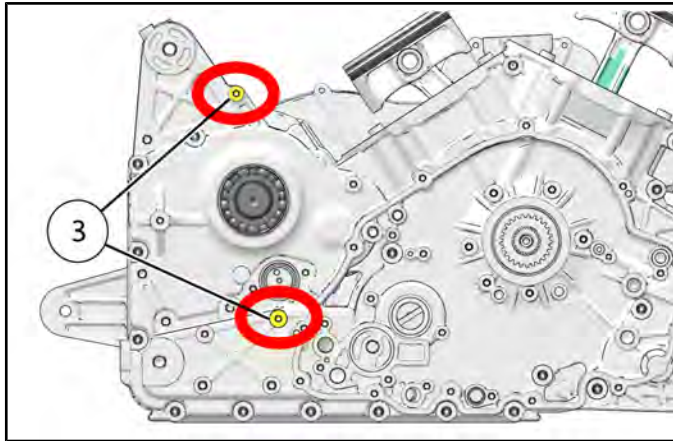
14. Place the Engine Case Splitting / Assembly tool **PF-51234-A** on a flat surface with the part number facing upward.

15. Assemble the threaded spacers ② into the holes marked with the letter "A" as shown.



6

16. The threaded holes ③ shown are used for crankcase separation.



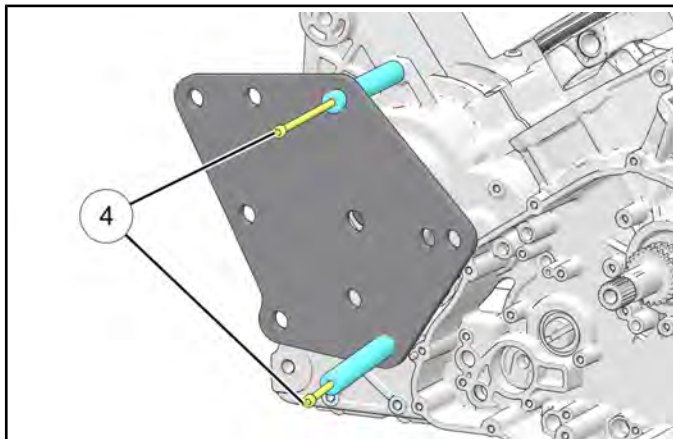
17. Install the adapter over the casehalf. Adjust the threaded spacers so they touch the case and the plate is level.

**IMPORTANT**

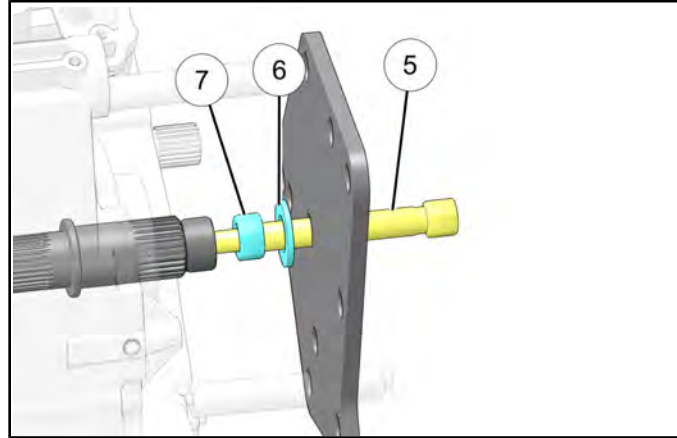
- Plate surface should be parallel to the surface of the engine crankcase.
- All threaded spacers must be in contact with engine case prior to fastening on the plate assembly.

18. Install the provided fasteners ④ through the threaded spaces and tighten into the casehalf.

19. The holes used to thread in the separator tool are on the right casehalf.



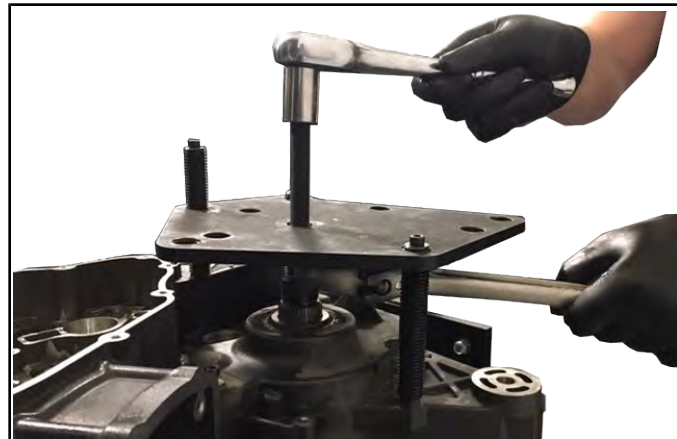
20. Install splitter adapter ⑤, washer ⑥, and nut ⑦.



21. Hold the nut and tighten the splitter.

**CAUTION**

While tightening, ensure the casehalf is separating evenly to avoid damage.



22. Alternately turn the case splitting tool in until resistance is felt, then work around the upper case with a soft-faced mallet until the cases are completely apart.

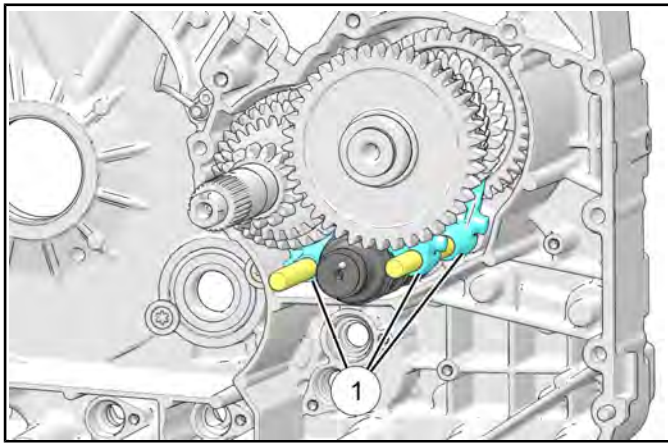
23. When fully separated, remove the right casehalf.

## TRANSMISSION REMOVAL

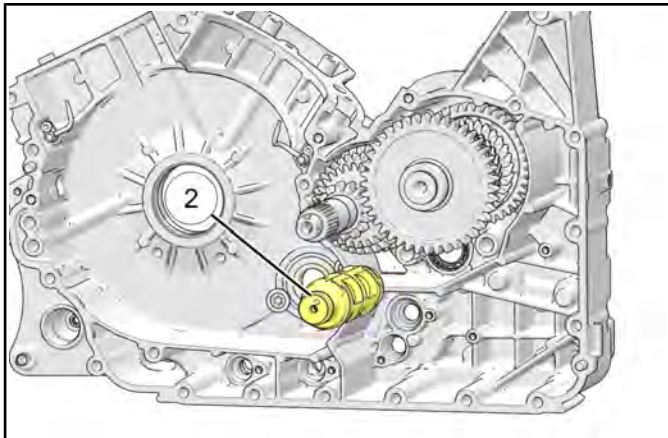
**CAUTION**

Gloves should be worn at all times while working on the transmission assembly to avoid personal injury.

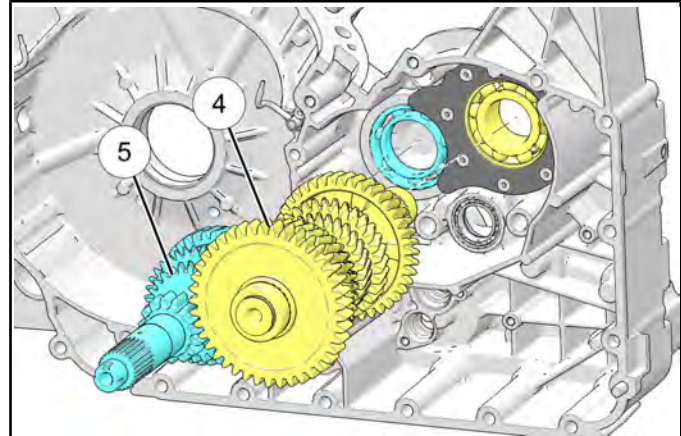
1. Remove the shift ratchet assembly. See **Shift Ratchet Removal & Inspection page 5.16.**
2. Remove the balance shaft. See **Balance Shaft Removal page 6.18.**
3. Separate crankcase. See **Crankcase Separation page 6.21.**
4. Remove shift fork rails (1).



5. Remove shift forks.
6. Lift the shift drum (2) out of the bearing.

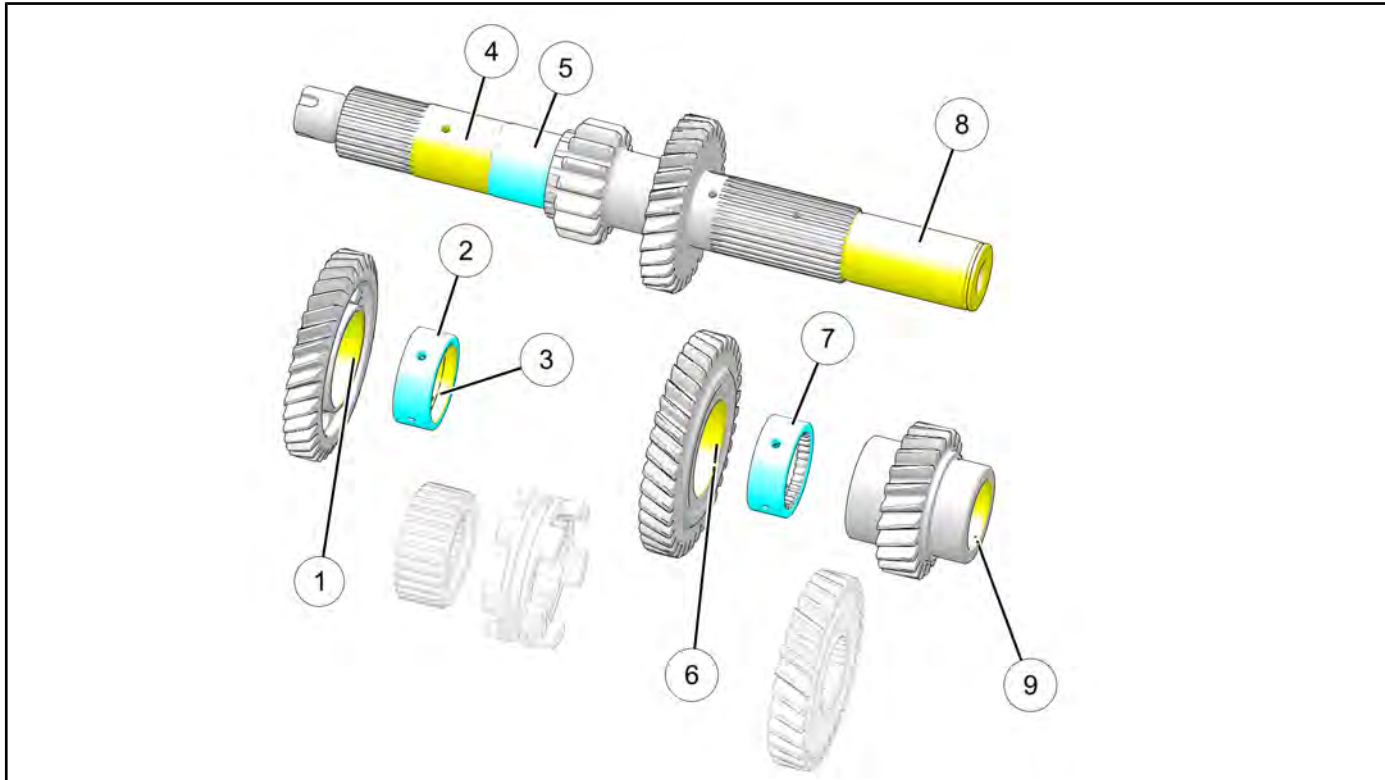


7. Remove input shaft (4) and output shaft (5).



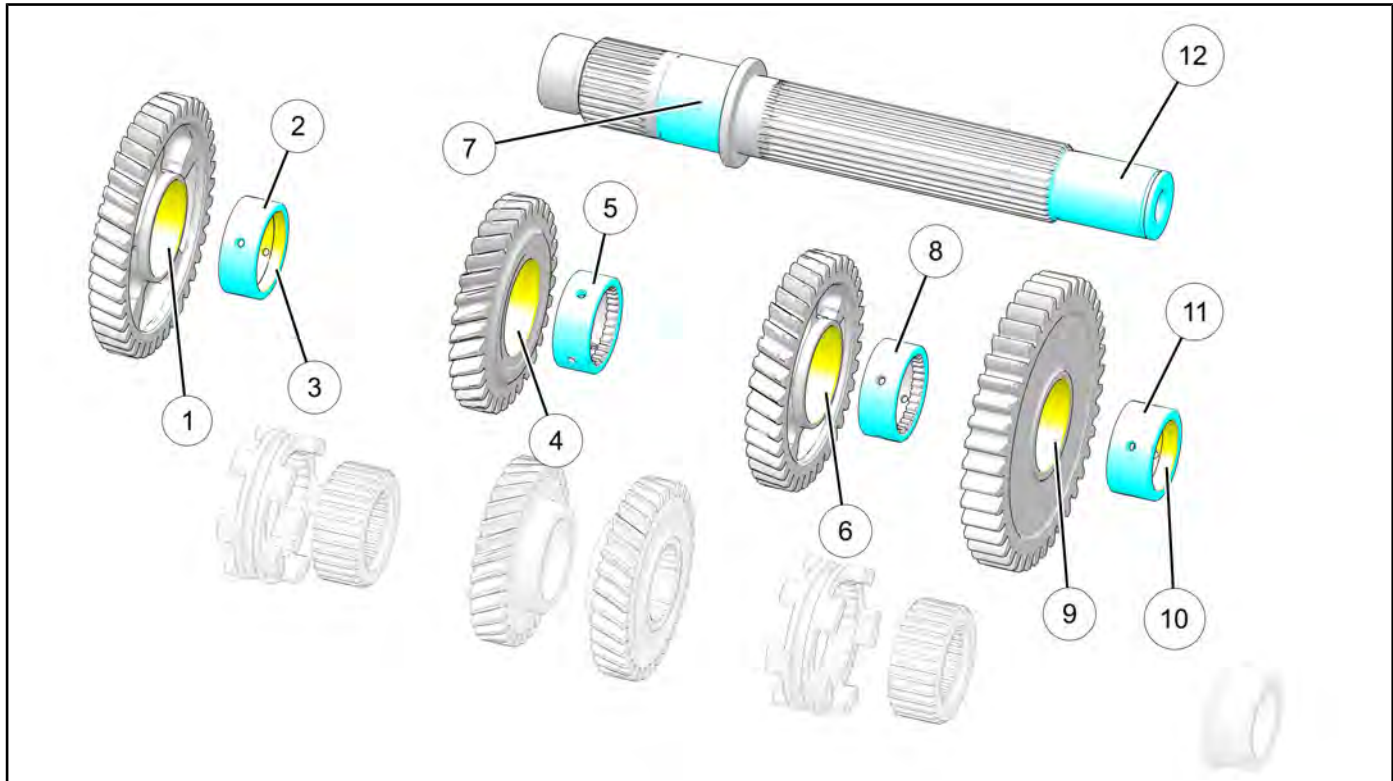
**TRANSMISSION INSPECTION**

**INPUT SHAFT**



NUMBER	MEASUREMENT LOCATION	DIAMETER SPECIFICATION
①	Gear, 5th — I.D.	39.010 — 39.026 mm
②	Bushing, 5th Gear — O.D.	38.955 — 38.980 mm
③	Bushing, 5th Gear — I.D.	32.010 — 32.035 mm
④	Input Shaft, Clutch Collar Journal	29.470 — 29.485 mm
⑤	Input Shaft, Bearing Journal (Primary Side)	29.976 — 29.990 mm
⑥	Gear, 6th — I.D.	39.010 — 39.026 mm
⑦	Bushing, 6th Gear — O.D.	38.955 — 38.980 mm
⑧	Input Shaft, 2nd Gear Journal (Press Fit)	27.987 — 28.0 mm
⑨	Gear, 2nd — I.D. (Press Fit)	27.884 — 27.909 mm

**OUTPUT SHAFT**



NUMBER	MEASUREMENT LOCATION	DIAMETER SPECIFICATION
①	Gear, 2nd — I.D.	39.010 — 39.026 mm
②	Bushing, 2nd Gear — O.D.	38.955 — 38.980 mm
③	Bushing, 2nd Gear — I.D.	32.010 — 32.035 mm
④	Gear, 4th — I.D.	39.010 — 39.026 mm
⑤	Bushing, 4th Gear — O.D.	38.955 — 38.980 mm
⑥	Gear, 3rd — I.D.	39.010 — 39.026 mm
⑦	Output Shaft, Bearing Journal (Drive Sprocket Side)	34.995 — 35.008 mm
⑧	Bushing, 3rd Gear — O.D.	38.955 — 38.980 mm
⑨	Gear, 1st— I.D.	37.010 — 37.026 mm
⑩	Bushing, 1st Gear — I.D.	28.015 — 28.040 mm
⑪	Bushing, 1st Gear — O.D.	36.965 — 36.990 mm
⑫	Output Shaft, 1st Gear Journal	27.987 — 28.0 mm



**NOTICE**

**Refer to the Assembly View section in this chapter for component locations and exploded diagrams. See Crankcase page 6.5.**

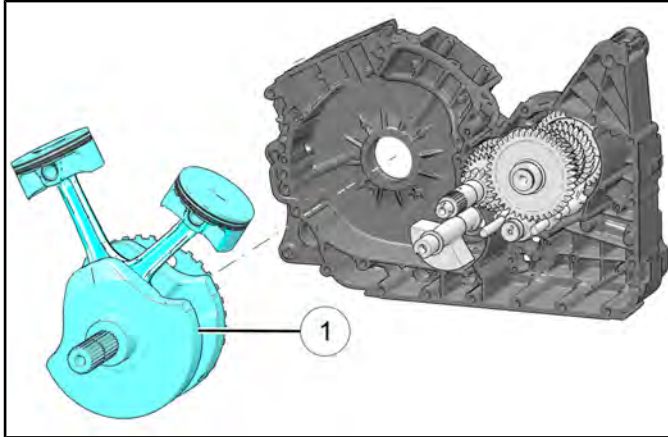
**Refer to the Service Specifications section in this chapter for complete transmission specifications. See Service Specifications – Transmission / Crankshaft page 6.3.**

**SHAFTS**

1. Measure outside diameter of shafts and bearing areas for wear and concentricity. Look closely at splines for wear. Inspect ends of shafts for signs of wear:
  - Dull finish
  - Discoloration
  - Rough or uneven surface
  - Measurement outside of specification
2. **Gears** Visually inspect:
  - Gear internal splines
  - Gear teeth
  - Gear dogs for rounding, cracks, chips
  - Gear dog slots for rounding
  - Bearing surfaces
  - Shift fork grooves
3. **Shift Forks, Shift Fork Rails**
4. Inspect all contact surfaces of each shift fork. Replace a shift fork if any part is discolored (overheated), unusually scored, warped, or worn beyond service limit.
5. Inspect each shift fork pin for wear or damage and compare to specifications.
6. Inspect shift fork rails for wear, scoring, or runout.
7. Measure shift fork rail O.D. for wear in 3 or 4 places along the length. The rail O.D. should be consistent over the entire length.
8. Slide rails into crankcase holes and check for a good snug fit.
9. Visually inspect the shift drum bearing in the left crankcase for wear or damage. The bearing must be fully seated in the case and held in position by the retaining plate. Replace the bearing if it is loose in the bore, or if any side play is detected.
10. Temporarily install shift drum into bearing and rotate, checking for smooth bearing operation.
11. **Shift Drum** Inspect shift drum grooves for wear. Pay close attention to corners of grooves where forks change direction.
12. Inspect surface of shift drum star for excessive wear or damage.
13. Inspect right side shift drum bearing.
14. Temporarily install shift drum in right hand case bearing and inspect fit. Spin drum to check for smooth bearing operation.

**CRANKSHAFT REMOVAL**

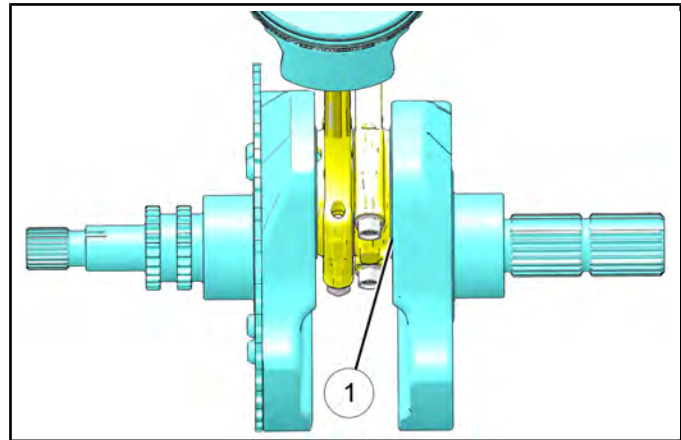
1. Separate RH crankcase from LH case. See **Crankcase Separation page 6.21.**
2. Rotate balance shaft until counterweight is clear of crankshaft.
3. Lift crankshaft assembly ① straight up until clear of case.

**NOTICE**

Connecting rod bearings and main bearings are easily damaged. Be careful not to cause damage to these parts when servicing items within the crankcase.

**CONNECTING ROD SIDE CLEARANCE INSPECTION**

1. Move connecting rods to one side of crankshaft. Insert a feeler gauge ① between one connecting rod and the crankshaft. Compare measurement to specification outlined in this chapter. See **Service Specifications – Transmission / Crankshaft page 6.3.**



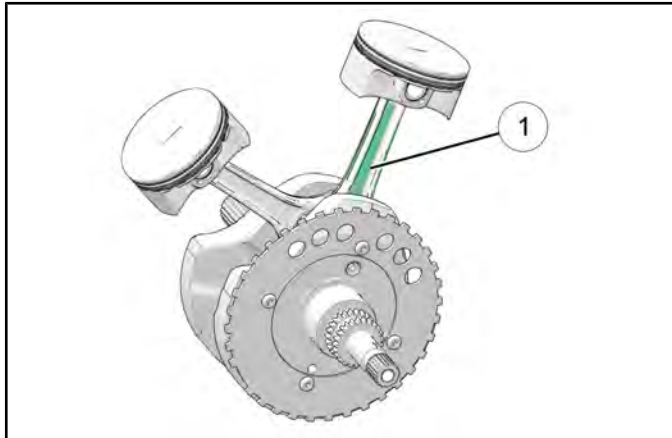
2. If clearance recorded exceeds service limit, the crankshaft, connecting rod or both must be inspected and worn parts replaced. See **Crankshaft Inspection page 6.30.**

## CONNECTING ROD REMOVAL / IDENTIFICATION

### IMPORTANT

Connecting rods and caps are serialized from the factory. Rod and cap numbers must match and be assembled on the same side of the rod assembly.

1. Use a permanent marker to mark orientation of connecting rods and rod bearing caps. **These parts MUST be installed in their original locations.** EXAMPLE: Right connecting rod must be assembled on the right side with the bearing cap that was removed from it. The bearing cap and connecting rod must be assembled in the same direction as it was removed using the **same fastener.**
2. Mark the outside of both connecting rods prior to removal so they can be assembled in the same direction in relation to the crankshaft.



3. Remove connecting rod fasteners and connecting rod bearing caps.

### NOTICE

It may be necessary to lightly tap the caps with a plastic mallet to loosen them.

The mating surface of connecting rod and cap is rough in appearance, which is a normal condition due to the manufacturing process. If rod caps are installed *incorrectly* and tightened, the precision mating surfaces will be damaged. Replace the connecting rod assembly if mating surfaces are damaged.

## CONNECTING ROD INSPECTION (BIG END)

### IMPORTANT

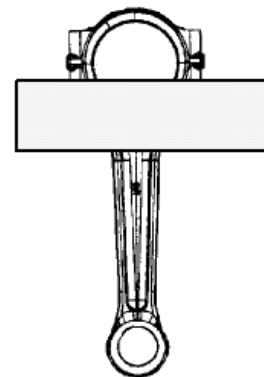
**Connecting rod fasteners can only be reused three times.** Failure to replace fasteners after completing three torque sequences may result in severe engine damage. Each time a fastener has been torqued to specification, it should be marked with a center punch.

#### EXAMPLE:

- 1st Torque: Manufacturer installation of connecting rod fasteners.
- 2nd Torque: Torque for inspection per this procedure.
- 3rd Torque: Reinstallation following inspection. **Discard fasteners the next time they are removed.**

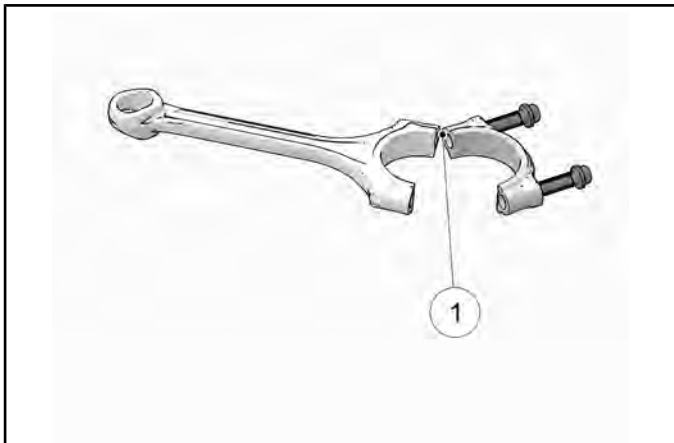
### CAUTION

Be sure to match connecting rod caps with their respective rod and orient the cap properly before installing the cap. Secure the big end of rods in a vise equipped with soft, protective jaws before torquing rod fasteners.



1. Remove bearings and install caps on connecting rods. Be sure mating surfaces ① of rod and cap are clean.

2. Apply engine oil to threads of rod fasteners. Torque fasteners to specification.



#### TORQUE

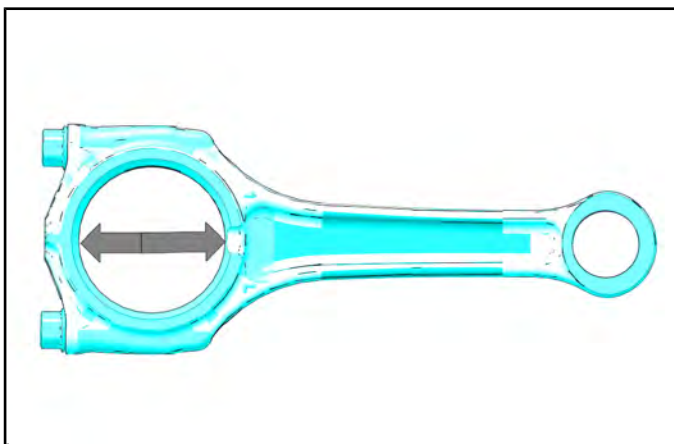
##### Connecting Rod Fasteners:

- a. Torque to 19 ft-lbs (26 N·m)
- b. Torque angle to 105 °

### CONNECTING ROD BEARING INSPECTION

Inspect bearing inserts for unusual wear, peeling, scoring, damage etc. Replace as a set if damage is noted. Inspect bearing clearance and refer to the Electronic Parts Catalog for the appropriate connecting rod bearing.

3. Measure I.D. of connecting rod big end for size and out of round and compare to specification. See **Service Specifications – Transmission / Crankshaft page 6.3.**

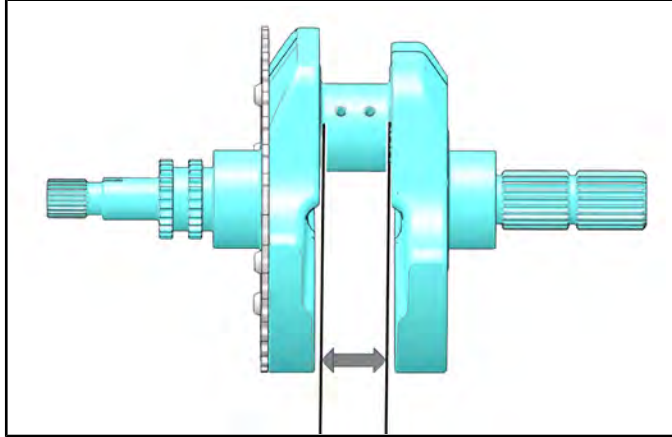


4. Visually inspect connecting rod upper and lower ends for scoring, damage, or excessive wear.

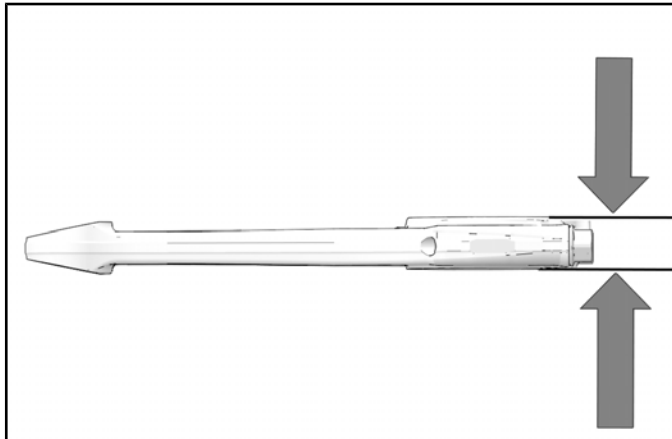
### CRANKSHAFT INSPECTION

Record all measurements and compare to specifications. Replace crankshaft if any measurement is worn beyond the service limit. See **Service Specifications – Transmission / Crankshaft page 6.3**.

1. Measure the width of the rod bearing journal.



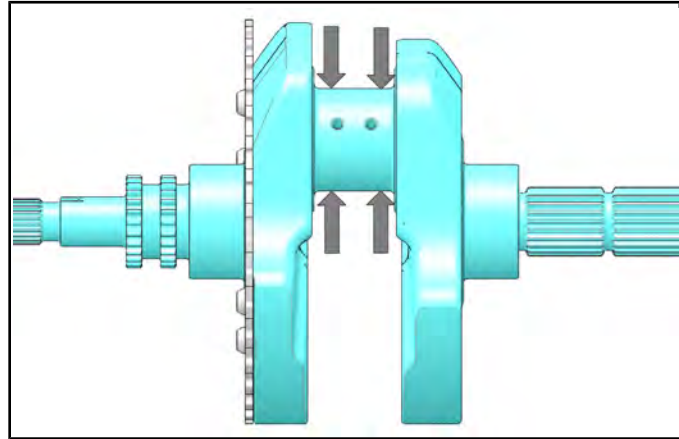
2. Measure width of connecting rods at big end.



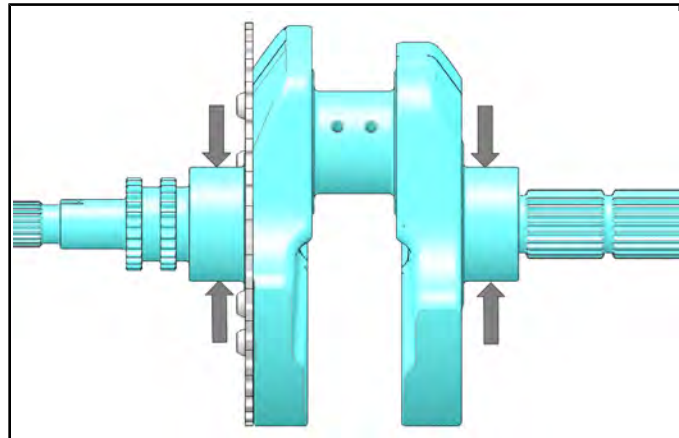
3. Visually inspect all bearing journals for scoring, damage or excessive wear.

4. Crankshaft and connecting rods are identified by color. Be sure to compare measurements to specifications for the proper color (or non-marked) connecting rod or crankshaft.

Measure O.D. of crankshaft rod journal in four places and compare to specifications.



5. Measure O.D. of main bearing journals.



## CONNECTING ROD INSTALLATION

1. Clean all oil off connecting rod, connecting rod cap and bearing inserts.
2. Install bearing inserts into connecting rods and caps. First, install bearing tab into groove, then press the rest of the bearing into place.

### NOTICE

Ensure the connecting rod and caps have matching numbers and are on the same side of the rod.

3. Apply white lithium grease to connecting rod bearings and crank pin.
4. Install rods and caps onto the crankshaft, observing the paint mark on the connecting rods. **The paint mark must face away from the center of the crankshaft.** Be sure the identifier marks made previously are aligned.

### ⚠ CAUTION

Due to the nature of the fracture rods, the cap will only fit onto the connecting rod correctly in ONE way. Failure to correctly fit the cap onto the rod will result in immediate engine damage.

5. Tighten rod cap fasteners:

### TORQUE

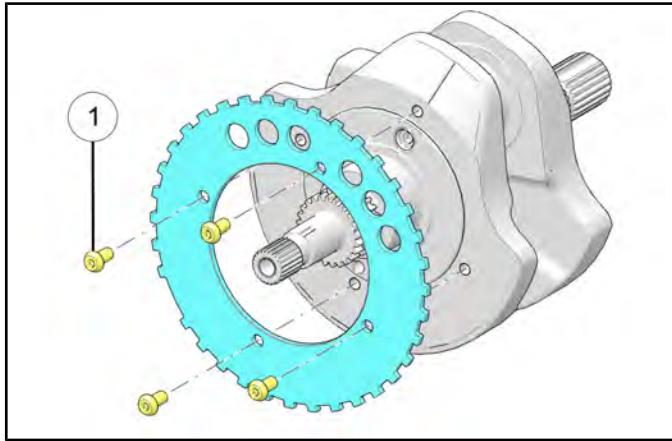
Connecting Rod Fasteners:

1. Torque to 19 ft-lbs (26 N·m) 2. Torque angle to 105 °

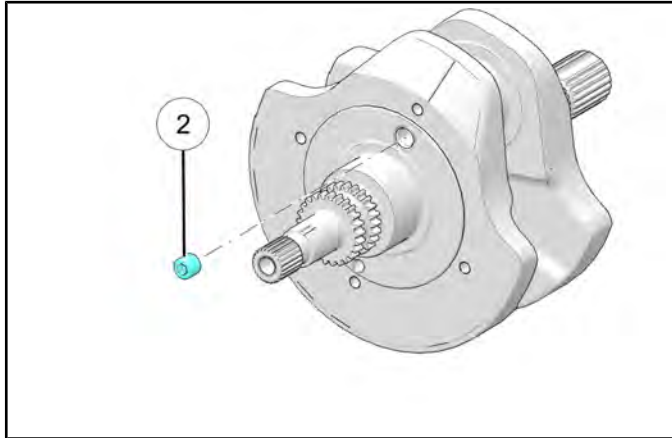
6. Check that the connecting rods rotate smoothly and freely on crankshaft journal.

**CRANKSHAFT CLEANING**

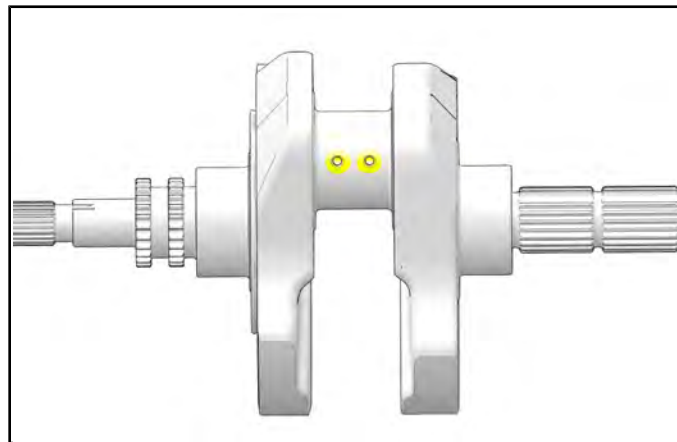
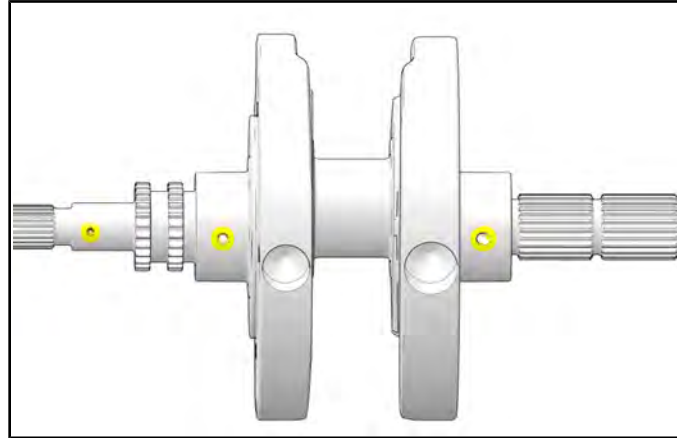
1. Remove tone ring by removing its fasteners ①.



2. Remove blind plug ② from crankshaft to ensure that passages are clear.



3. Ensure all passages are free of debris and dirt.



4. After cleaning passages, install blind plug and torque to specification. Plug should be flush with surface of crankshaft.

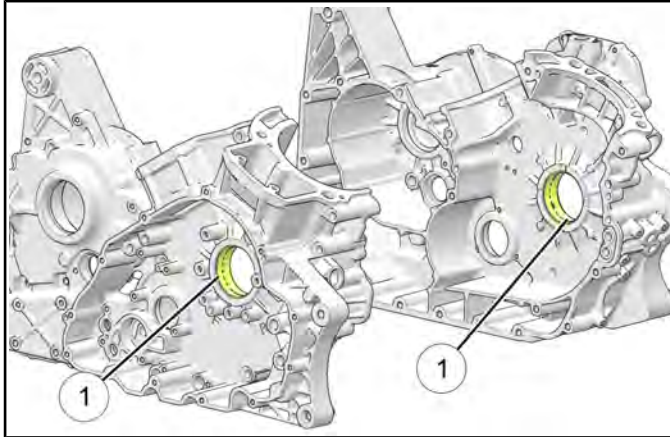
TORQUE
Blind Plug: <b>15 ft-lbs (20 N·m)</b>

TORQUE
Tone Ring Fastener: <b>18 ft-lbs (24 N·m)</b>

IMPORTANT
Add loc-tite to Tone ring fasteners.

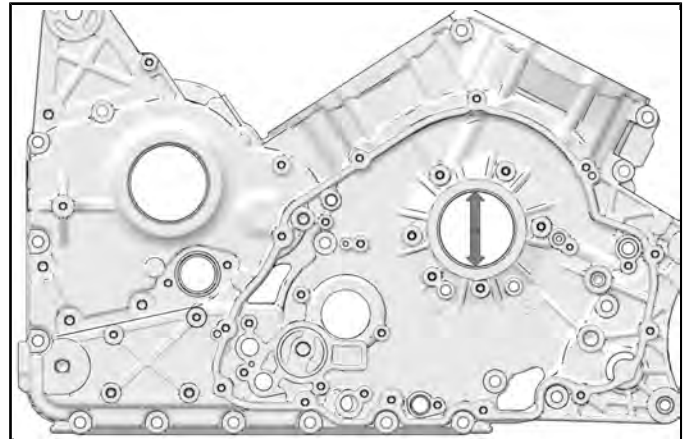
## MAIN BEARING INSPECTION

1. Inspect crankcase main bearing surfaces ① for wear, peeling, scoring, or damage.
2. Inspect alignment of bearing lubrication hole in left crankcase half and in right case half. Holes must be aligned with their respective oil passage in crankcase.



## MAIN BEARING OIL CLEARANCE INSPECTION

1. Measure main bearing I.D. and concentricity with a dial bore gauge for right and left side. Compare to specification. Subtract crankshaft main journal diameter from main bearing diameter to calculate oil clearance. See **Service Specifications – Transmission / Crankshaft** page 6.3.



2. If crankshaft dimensions are within tolerances and oil clearances are incorrect, the crankcase set must be replaced.

### NOTICE

Replace crankcase halves as a set.

6



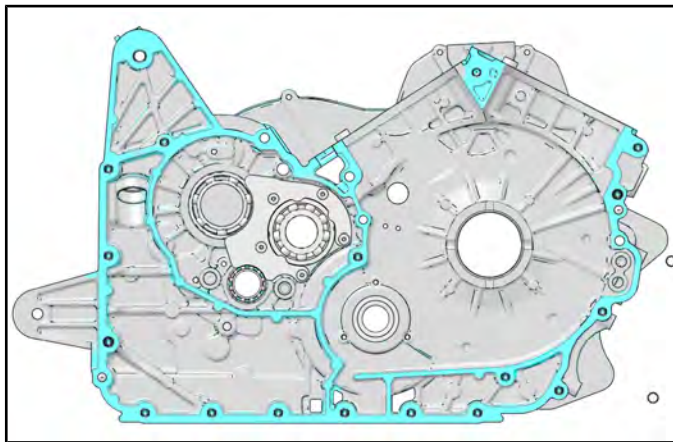
## LEFT CRANKCASE ASSEMBLY

### Prepare LEFT crankcase for assembly:

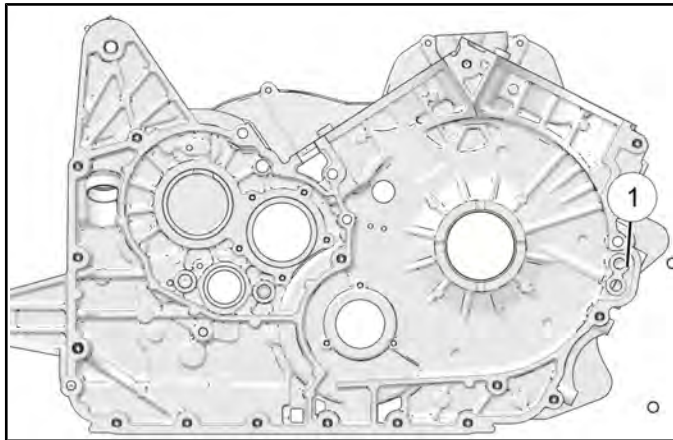
Refer to crankcase assembly view for locations and torque values. See **Crankcase page 6.5**.

- Apply a film of lithium grease to outer race of bearings to prevent galling upon installation.
- Press on outer race of bearings using an arbor press and a suitable arbor that is slightly smaller than bearing outside diameter.
- DO NOT press on inner race of ball bearings.

1. Thoroughly clean any remaining gasket from the sealing path line.



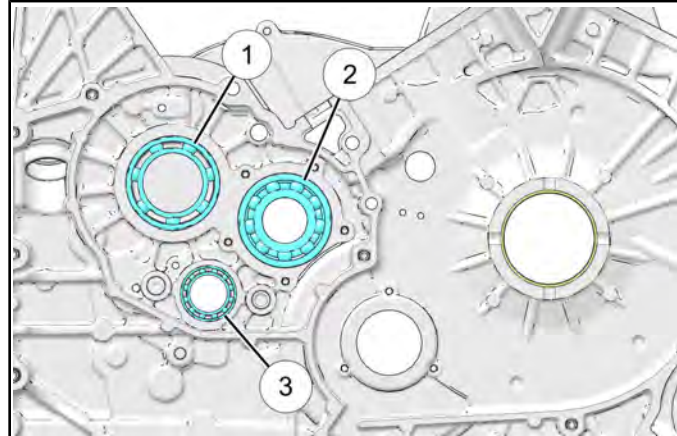
2. Clean crankcase and oil passage ① thoroughly. Rinse and dry with compressed air.



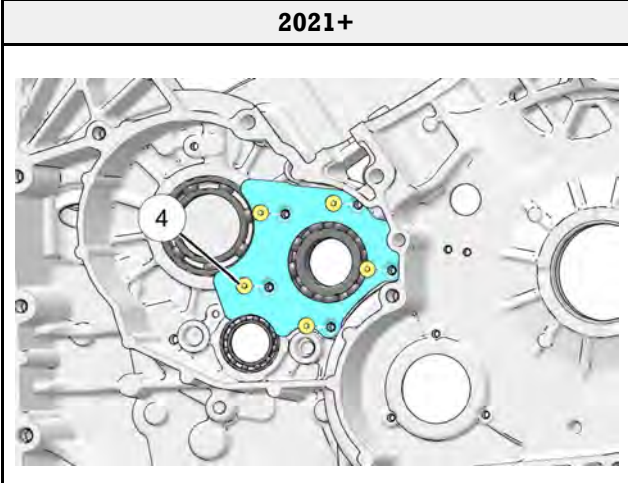
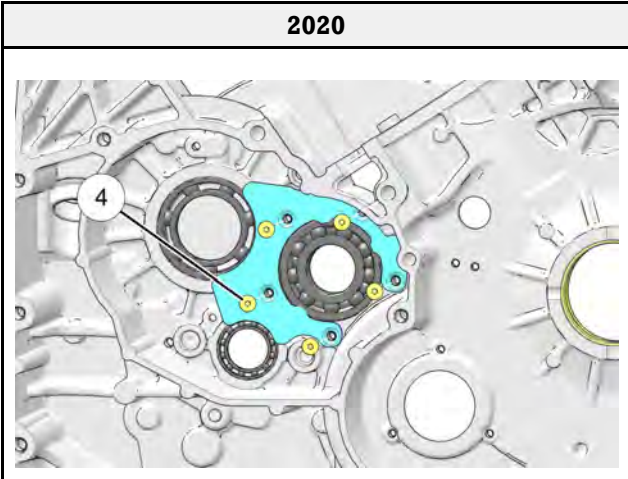
3. Install output shaft bearing ①, input shaft bearing ②, and shift drum bearing ③.

### IMPORTANT

Ensure output shaft bearing ① and shift drum bearing ③ are fully seated.  
Ensure input shaft bearing ② is projected past the retainer plate mounting surface 0.05–0.25" when fully seated.

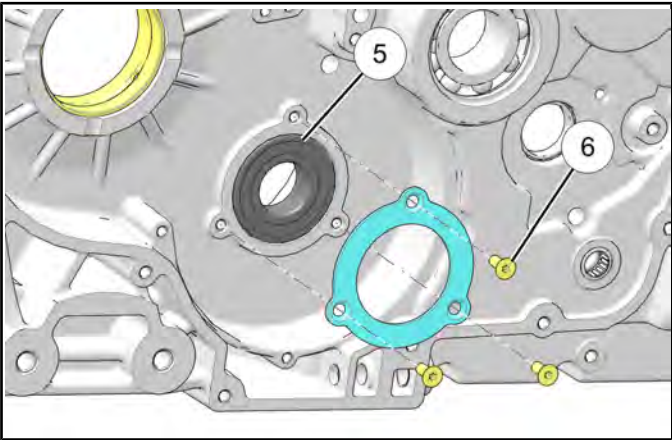


4. Install bearing retainer plate and secure with fasteners ④.



**TORQUE**  
Bearing Retainer Plate Fastener:  
**62 in-lbs (7 N·m)**

5. Install balance shaft bearing ⑤ and secure with retainer plate and fasteners ⑥.



**TORQUE**  
Balance Shaft Retainer Plate Fastener  
**62 in-lbs (7 N·m)**

6. Install new bearings in crankcase as required.

6

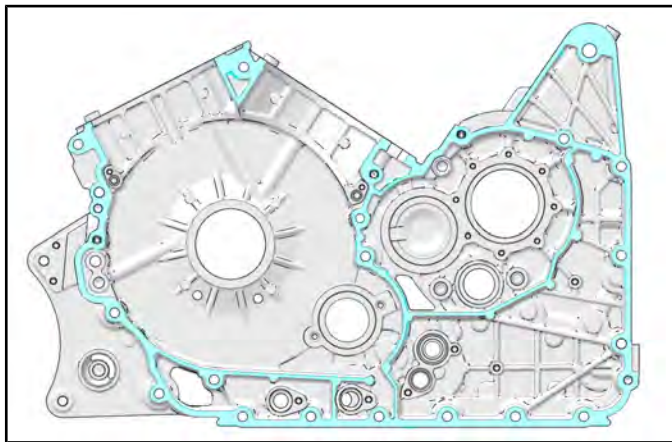
### RIGHT CRANKCASE ASSEMBLY

#### Prepare RIGHT crankcase for assembly:

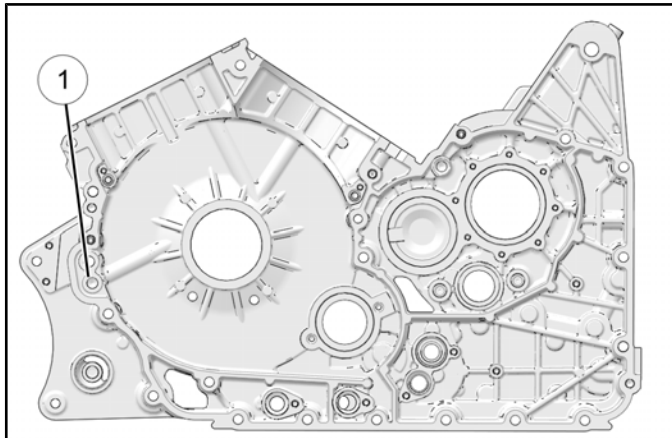
Refer to crankcase assembly view for locations and torque specification. See **Crankcase** page 6.5.

- Apply a film of lithium grease to outer race of bearings to prevent galling upon installation.
- Press on outer race of bearings using an arbor press and a suitable arbor that is slightly smaller than bearing outside diameter.
- DO NOT press on inner race of ball bearings.

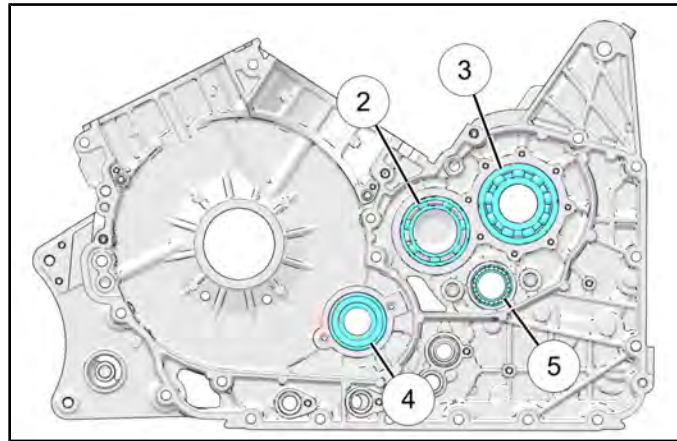
1. Thoroughly clean any remaining gasket material from the sealing path line.



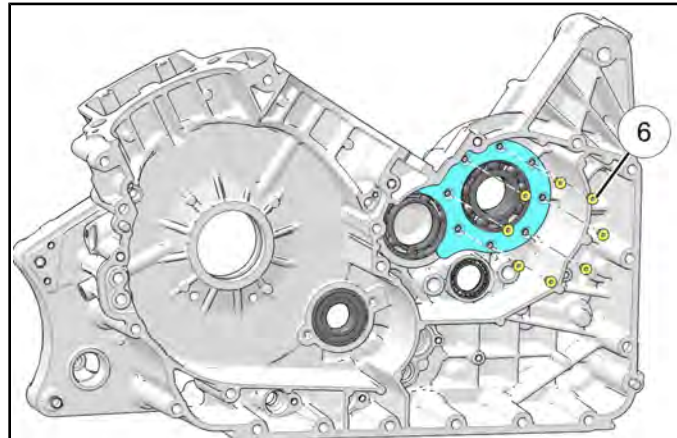
2. Clean crankcase oil passages ① thoroughly. Rinse and dry with compressed air.



3. Install Input Shaft Bearing ②, Output Shaft Bearing ③, Balance Shaft Bearing ④, and Shift Drum Bearing ⑤



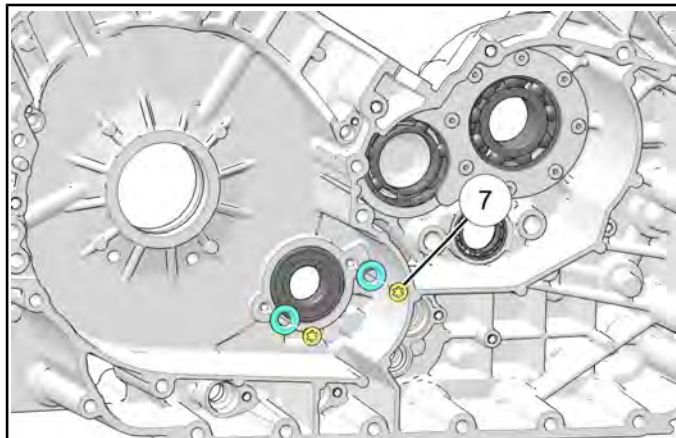
4. Install bearing retainer plate and fasteners ⑥.



#### TORQUE

Bearing Retainer Plate Fastener  
**62 in-lbs (7 N·m)**

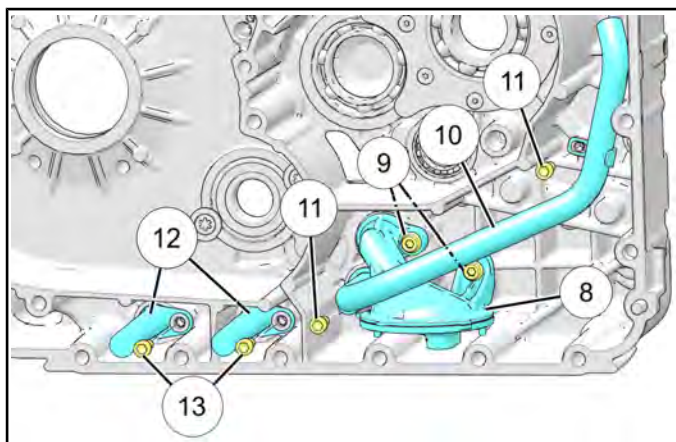
5. Install balance shaft bearing retainers and fasteners ⑦.



**TORQUE**  
Balance Shaft Bearing Retainer Fastener:  
**62 in-lbs (7 N·m)**

6. Install oil pickup ⑧ and fastener ⑨.

**IMPORTANT**  
Inspect and lubricate all o-rings prior to installation.



**TORQUE**  
Oil Pickup Fastener:  
**84 in-lbs (10 N·m)**

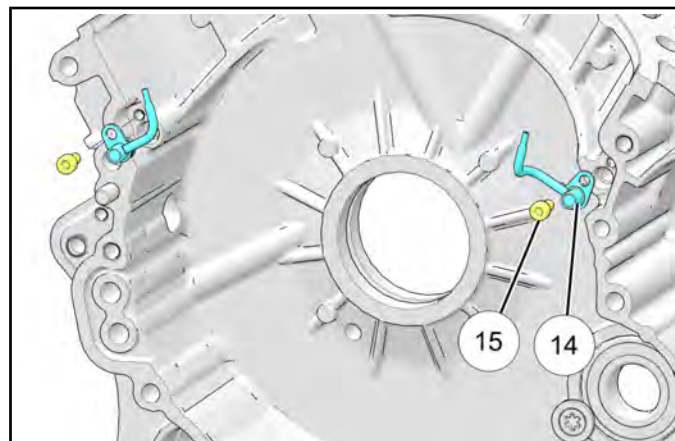
7. Install oil scavenge tube ⑩ and fasteners ⑪.

**TORQUE**  
Oil scavenge tube fastener:  
**84 in-lbs (10 N·m)**

8. Install oil screen ⑫ and fastener ⑬.

**TORQUE**  
Oil Screen Fastener:  
**84 in-lbs (10 N·m)**

9. Install piston cooling jets ⑭ and secure with fastener ⑮.



**TORQUE**  
Piston Cooling Jet Fastener:  
**62 in-lbs (7 N·m)**

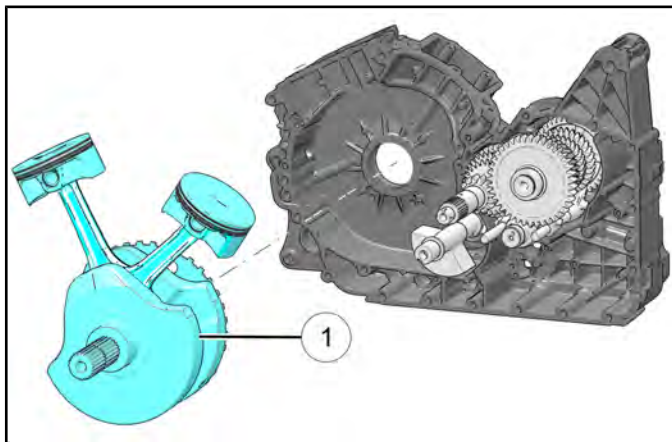
6

### CRANKSHAFT INSTALLATION

**NOTICE**

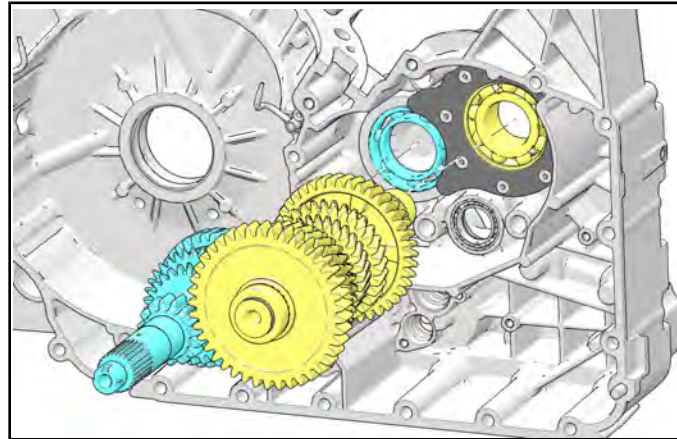
Install left engine case onto an engine stand.

1. If balance shaft is already in place, rotate the balance shaft counter weight out of the way prior to crankshaft installation.
2. Apply white lithium grease to main bearings.
3. Hold crankshaft over right crankcase and position rods so that left side rod is in cutout for rear cylinder and right side rod is in cutout for the front cylinder.
4. Place crankshaft ① into right crankcase half.

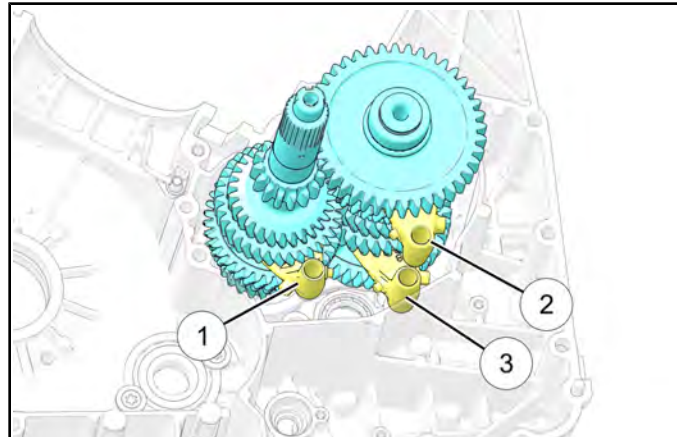


### TRANSMISSION INSTALLATION

1. If transmission shaft bearings were replaced, be sure all bearing retainer plate fasteners are installed and tightened to specification. See **Crankcase page 6.5**.
2. Assemble the input shaft and output shaft so the gears are properly meshed and insert them into the right case half. Verify both shafts are fully seated and rotate freely.



3. Install the shift forks.

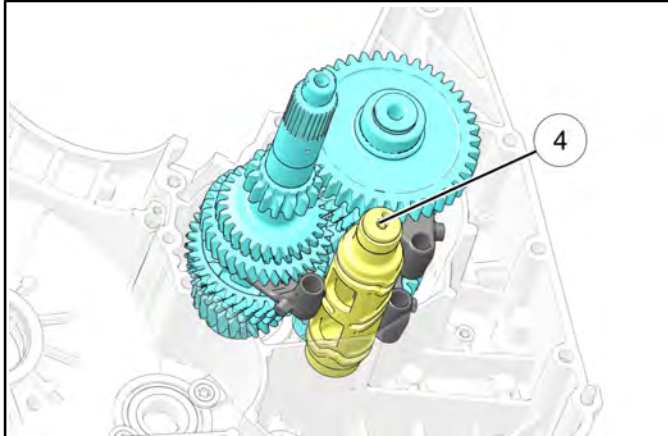


**IMPORTANT**

Each shift fork is different. Ensure shift forks are in the correct location upon assembly. There are numbers forged on the forks for identification.

REF	FORGE NUMBER
①	8 943
②	8 942
③	8 941

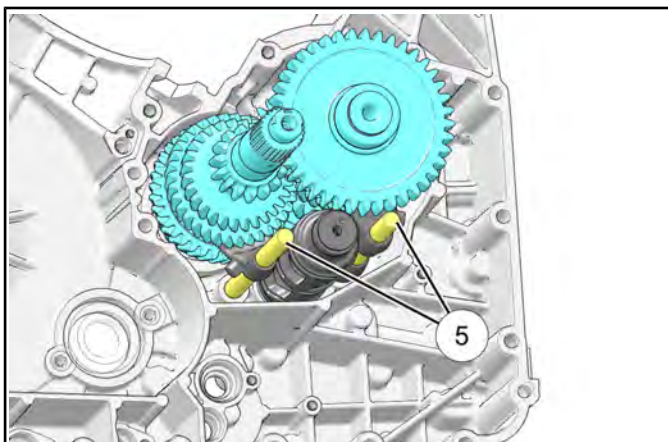
## 4. Install shift drum ④.

**IMPORTANT**

Ensure the shift drum is oriented as follows:  
The pin end **A** goes into the **LEFT** crankcase.  
The non-pin end **B** goes into the **RIGHT** crankcase.

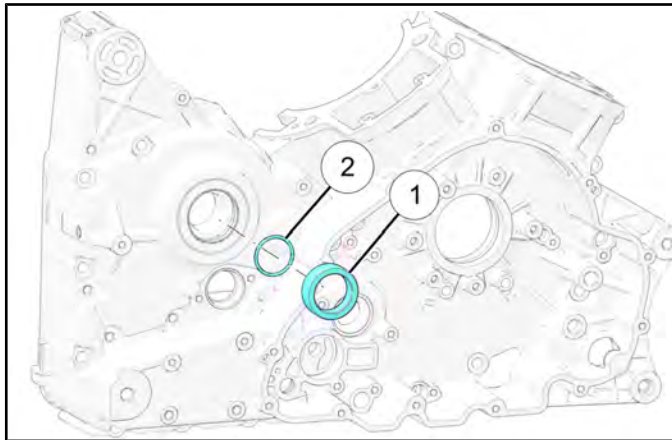


5. Rotate shift drum to align proper grooves with forks.
6. Move shift forks pins into drum grooves and seat rails.
7. Install shift rails ⑤.

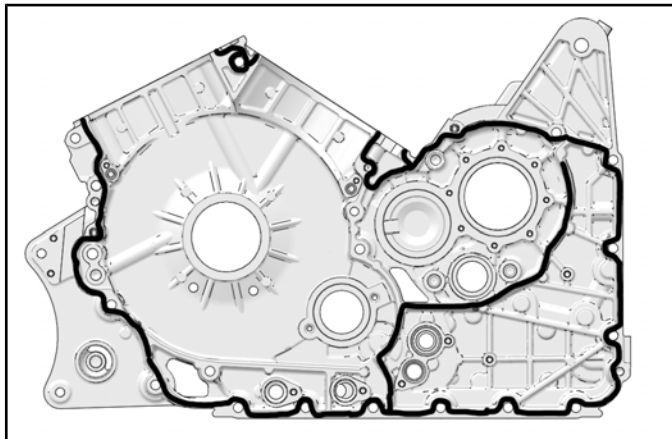


### CRANKCASE ASSEMBLY

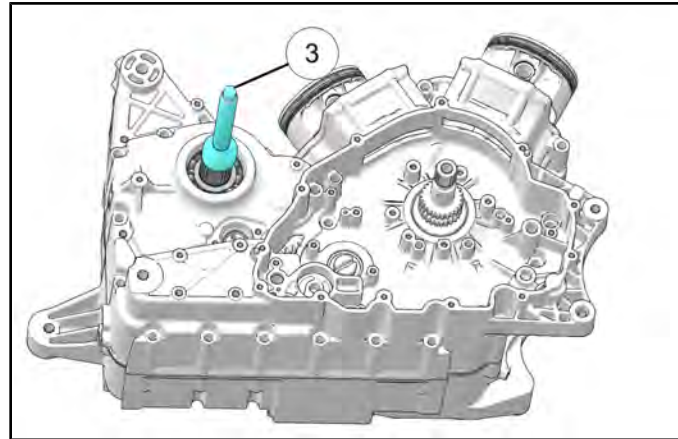
1. Clean crankcase mating surfaces to remove all grease, oil, and old sealant.
2. Check to be sure all shafts are seated properly (crankshaft, balance shaft, shift drum, shift forks, input shaft, output shaft).
3. Remove the drive sprocket spacer ① and o-ring ② from the right-hand crankcase prior to installation.



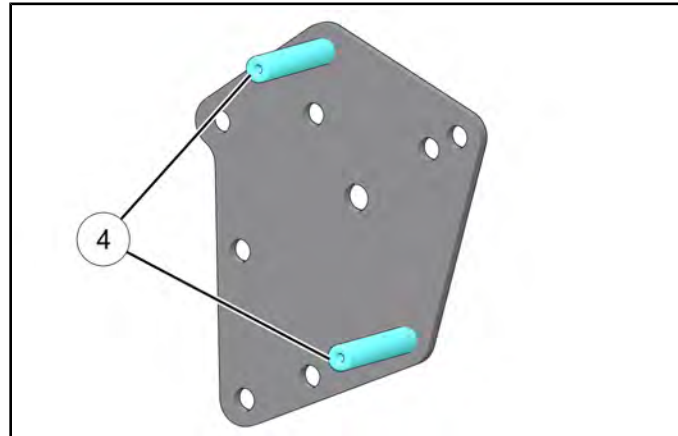
4. Apply a light even bead of Loctite™ Ultra Black 598 to casehalf sealing surface as shown.



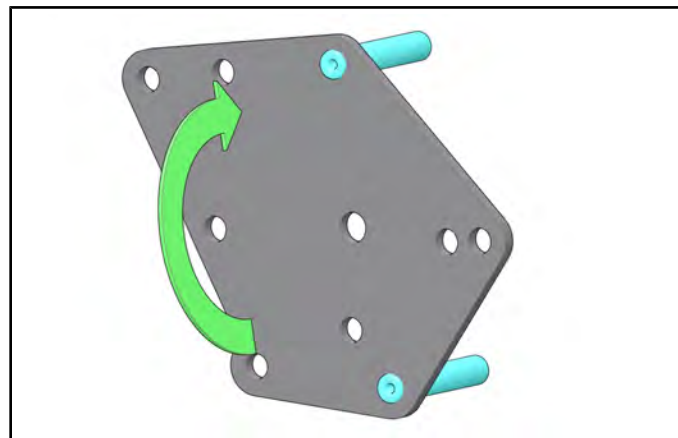
5. Thread the case assembly adapter ③ onto the output shaft.



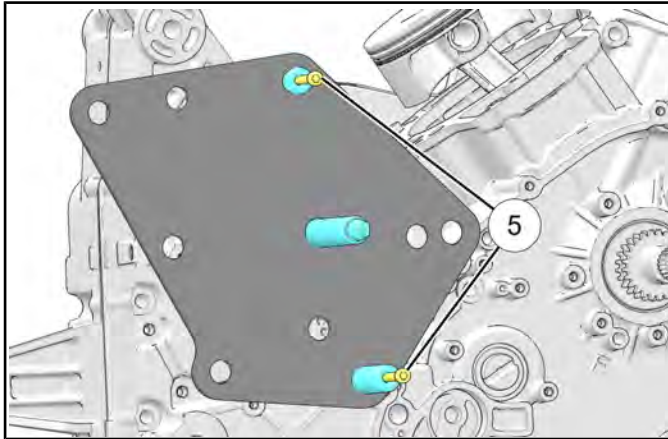
6. Place the Engine Case Splitting / Assembly tool **PF-51234-A** on a flat surface with the part number facing upward.
7. Assemble the threaded spacers ④ into the holes marked with the letter "A" as shown.



8. Flip the plate 180 degrees so the part number facing down.



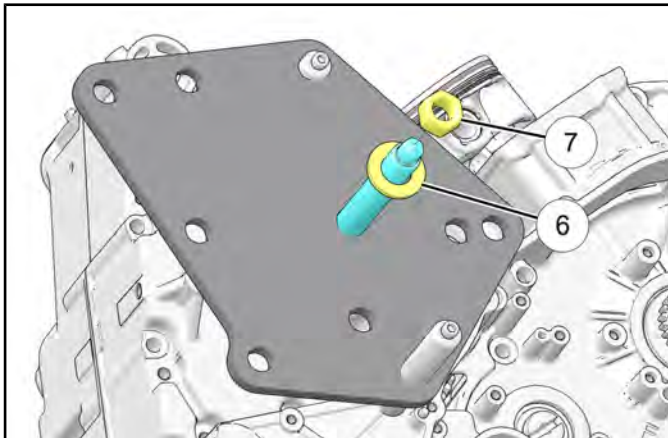
9. Install over the case assembly adapter as shown. Adjust the threaded spacers so they touch the case and the plate is level.



**IMPORTANT**

- Plate surface should be parallel to the surface of the engine crankcase.
- All threaded spacers must be in contact with engine case prior to fastening on the plate assembly.

10. Install the provided fasteners ⑤ through the threaded spaces and tighten into the case half.
11. Install washer ⑥ and nut ⑦.



12. Spread sealant into a thin even layer on entire case mating surface. Be sure all areas are covered.

**IMPORTANT**

DO NOT ALLOW SEALANT TO DRY. CONTINUE ASSEMBLY UNTIL CASES ARE SEALED AND ALL FASTENERS ARE TIGHT

13. Pull crankcase together by tightening nut and tapping on crankcase with a soft mallet.

**NOTICE**

The cases will mate before the output shaft is drawn fully into bearing. **IMPORTANT!** Continue to turn nut and tap case until sealant squeezes out along the entire perimeter and resistance is felt when turning nut.

14. Remove the tool.
15. Install crankcase fasteners and torque fasteners in sequence. See **Crankcase Torque Sequence page 6.9.**
16. Install a new output seal in right-hand crankcase using seal installer **PF-51243.**
17. Install the o-ring and drive sprocket spacer removed in STEP 3 with tapered edge toward the o-ring.
18. Install the gear position switch. See **Gear Position Switch Replacement page 10.165.**
19. Install the drive sprocket. See **Drive Sprocket Installation page 8.64.**
20. Install primary drive gear. See **Primary Drive Gear Installation page 5.27.**
21. Install water pump. See **Water Pump Removal / Installation page 3.41.**
22. Install transmission feed rail. See **Transmission Feed Rail Removal / Installation page 3.35.**
23. Install shift ratchet. See **Shift Ratchet Installation page 5.17.**
24. Install clutch assembly. See **Clutch Installation page 5.25.**
25. Install primary cover. See **Primary Cover Installation page 5.19.**
26. Install cylinders. See **Cylinder Installation page 3.105.**
27. Install cylinder heads. See **Cylinder Head Installation page 3.91.**
28. Install cam chains. See **Cam Chain Removal / Installation page 3.55.**
29. Remove the oil pump. See **Oil Pump Removal / Installation page 3.33.**
30. Install the starter drive. See **Starter Drive Installation page 6.20.**
31. Install flywheel. See **Flywheel Removal / Installation page 5.28.**
32. Install ACG cover. See **ACG Cover Removal / Installation page 10.34.**



33. Install stator. See **Stator Removal / Installation** page **10.34**.

34. Install engine in frame. See **Engine Installation** page **3.17**.

### STAKE NUT INSTALLATION

- The Stake nut is located on the clutch side of the transmission input shaft.
- It is important that they are torqued and staked correctly for proper function

#### IMPORTANT

Do not reuse or reinstall any previously used stake nut. A new stake nut needs to be installed every time the nut is removed or loosened.

Use the following procedure to install the stake nuts correctly:

1. Clean threads on shaft so there is no oil or contaminants.
2. Thread NEW stake nut onto shaft finger tight.
3. Torque stake nut to specification.
4. Stake the stake nut using round side of punch. Do not crack or tear staking lip. Do not use a sharp chisel to stake the nut.

**TROUBLESHOOTING**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>PART(S) AFFECTED</b>	<b>REPAIR RECOMMENDED</b>
Transmission Will Not Shift	Broken Shift Cam	Shift Cam	Replace shift cam
	Bent Shift Forks	Shift Fork	Replace shift fork(s)
	Worn Gearshift Pawl	Shift Cam	Replace shift cam
	Broken Gears	Transmission Gears	Replace necessary parts
	Damaged/Broken Bearings	Transmission, Shift Cam Bearings	Replace necessary parts
	Worn Gear Shift Ratchet Mechanism	Shifter Ratchet	Refer to Clutch / Primary / Shift chapter
	Broken or out-of-place spring on shift ratchet	Shift Ratchet Spring	Refer to Clutch / Primary / Shift chapter
	Shift Detent Ratchet Stuck	Shift Ratchet	Repair as necessary
	Seized Pivot Point, Bent External Shift Linkage	External Shift Linkage	Repair as necessary
	Bent or Distorted Shift Fork Rails	Shift Fork Rails	Replace Shift Fork Rails
	Debris From Broken Parts Locking Transmission	Transmission Components	Repair as necessary
Excessive Noise Related to Bottom End of Engine	Worn Main Bearings	Crankshaft and/or Crankshaft Bearings	Repair as necessary
	Worn Connecting Rod Bearings	Connecting Rod Bearings and/or Connecting Rod and/or Rod Bearings	Repair as necessary
	Worn Connecting Rod Small End Bushing	Connecting Rod, Connecting Rod Bushing, Piston Pin, Piston	Repair as necessary
	Worn, seized, chipped or broken gear teeth	Transmission Gears	Repair as necessary
	Worn, seized, chipped or broken Transmission Bearings	Transmission Bearings	Repair as necessary
	Originates from Primary Cover	Clutch, Torque Compensator, Flywheel, Oil Pump Drive	Repair as necessary
	Oil Pump	Oil Pump, Oil Pump Drive	Refer to Engine / Cooling / Exhaust chapter
	Cam Drive	Cam Chain, Cam Sprocket	Refer to Engine / Cooling / Exhaust chapter
<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>PART(S) AFFECTED</b>	<b>REPAIR RECOMMENDED</b>
Transmission Hard to Shift	Improper Clutch Operation	Clutch	Refer to Clutch / Primary / Shift chapter

**TRANSMISSION / CRANKSHAFT**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>PART(S) AFFECTED</b>	<b>REPAIR RECOMMENDED</b>
	Incorrect Oil Viscosity	Engine oil and filter	Refer to Engine / Cooling / Exhaust chapter
	Incorrect Clutch Adjustment	Clutch Adjustment	Refer to Clutch / Primary / Shift chapter
	Bent, Rubbing, Sticky, Broken Shift Shaft	Shifter Ratchet Assembly	Refer to Clutch / Primary / Shift chapter
	Sticking Pivot Point, Bent External Shift Linkage	External Shift Linkage	Repair or replace components as necessary
	Bent or Distorted Shift Forks	Shift Forks	Replace bent shift fork
	Damaged Shift Drum Grooves	Shift Drum	Replace damaged shift drum
	Shift Ratchet Bent / Stuck	Shift Ratchet	Repair as necessary
	Bent or Distorted Shift Fork Rails	Shift Fork Rails	Replace Shift Fork Rails
Transmission Jumps Out of Gear	Broken Shift Stop Pin	Shift Stop Pin	Replace stop pin
	Worn Shift Drum Pawls or Shifter Ratchet	Shift Drum or Shift Linkage	Replace damaged shift drum or shifter ratchet
	Broken Shift Ratchet Spring	Shift Ratchet Spring	Replace spring
	Damaged Shift Drum Grooves	Shift Drum	Replace shift drum
	Bent, Worn, Distorted Shift Forks	Shift Forks	Replace shift forks
	Bent or Distorted Shift Fork Rails	Shift Fork Rails	Replace shift fork rails
	Worn Engagement Dogs on Transmission Gears	Transmission Gears	Replace necessary parts

# CHAPTER 7

## FRAME / BODY

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## GENERAL INFORMATION

### SERVICE NOTES – FRAME / BODY

This section covers the removal and installation of frame and body components, assemblies and systems. Pay close attention to assembly procedures and torque specifications.

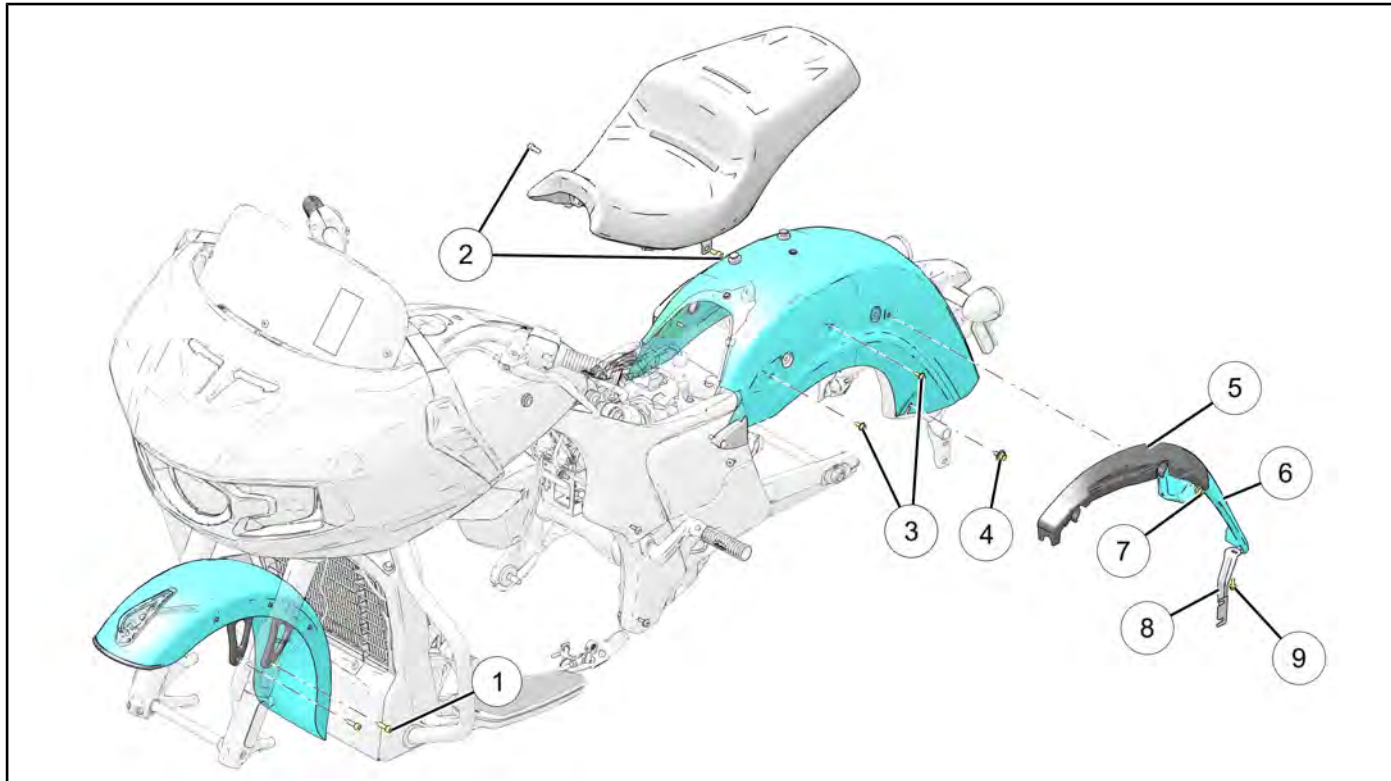
Cables, hoses and tie straps that have been removed during disassembly must be replaced per factory standards during assembly. Caution should be used when tightening body panels. Any deformation on the panel around the fastener is an indication that the fastener is too tight. Do not over tighten body components in order to avoid damage.

### SPECIAL TOOLS – FRAME / BODY

TOOL DESCRIPTION	PART NUMBER
PV-49955	Body Panel Tool Kit

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

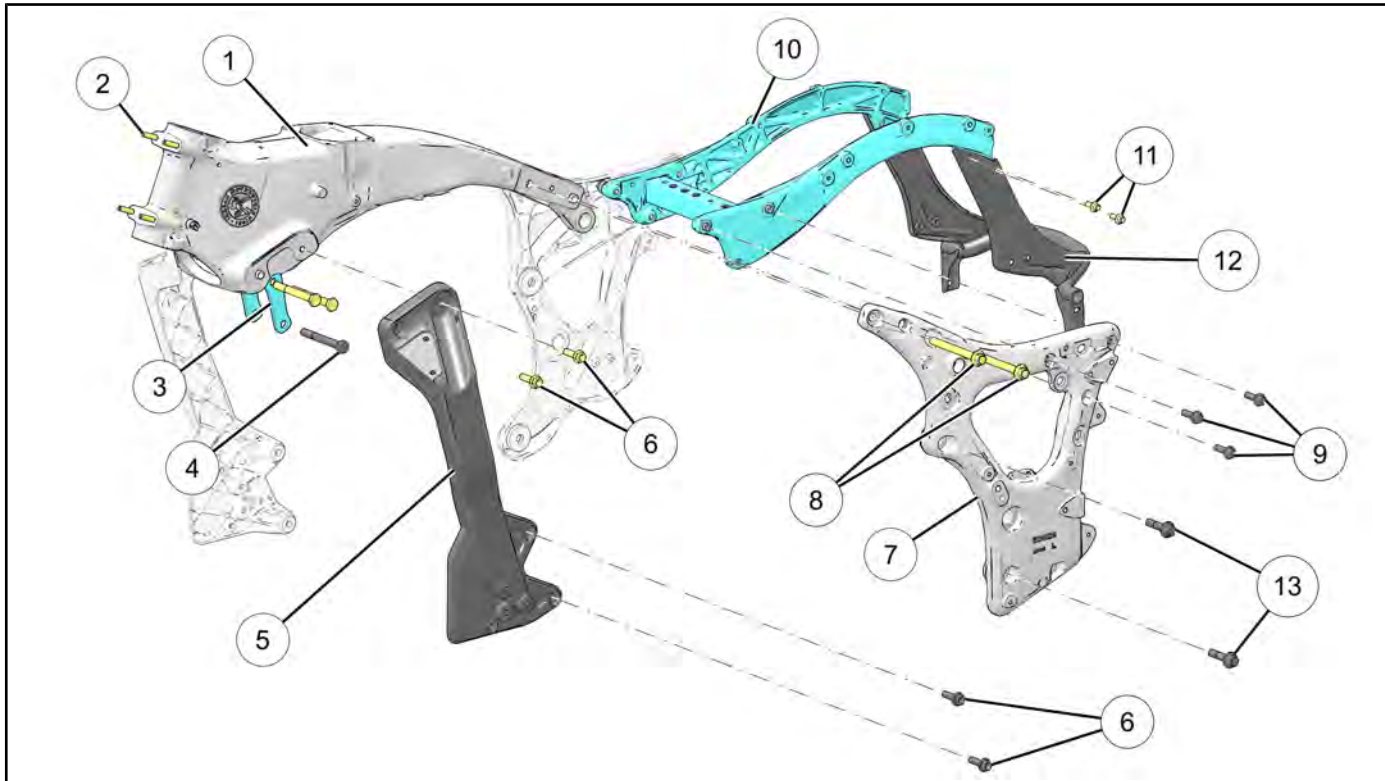
**ASSEMBLY VIEWS**  
**FENDERS / SEAT**



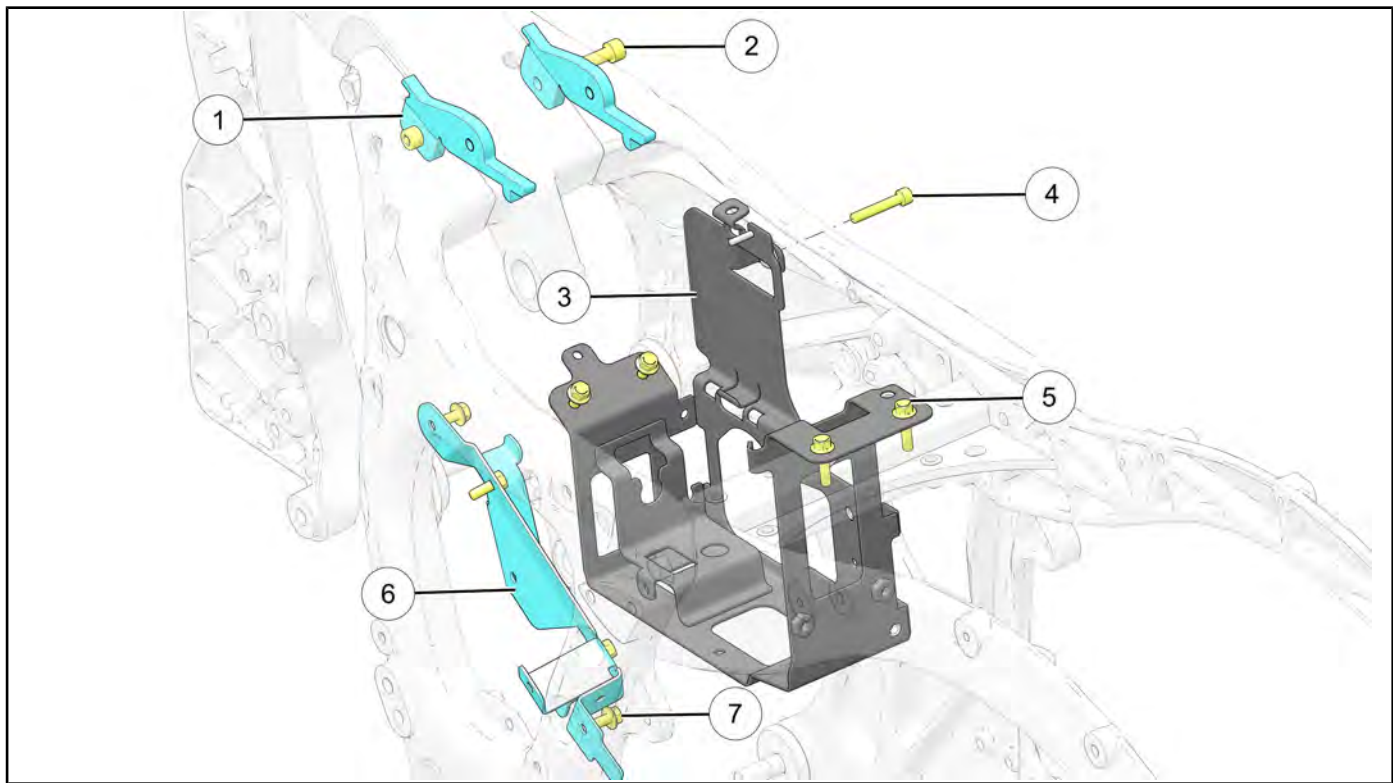
REF	DESCRIPTION	TORQUE
①	Fender Fastener (Front)	<b>18 ft-lbs (24 N·m)</b>
②	Seat Fastener	<b>18 ft-lbs (24 N·m)</b>
③	Fender Fastener (Rear) M6	<b>84 in-lbs (10 N·m)</b>
④	Fender Fastener (Rear) M8	<b>18 ft-lbs (24 N·m)</b>
⑤	Fender Closeout Upper (LH)	—
⑥	Fender Closeout Lower (LH)	—
⑦	Fender Closeout Lower Fastener	<b>84 in-lbs (10 N·m)</b>
⑧	Fender Closeout Bracket	—
⑨	Fender Closeout Bracket Fastener	<b>84 in-lbs (10 N·m)</b>

7

**FRAME**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Mainframe Front	—	⑧	Midcast M12 Fastener	<b>75 ft-lbs (102 N·m)</b>
②	Neck Stud	—	⑨	Midcast M10 Fastener	<b>35 ft-lbs (47 N·m)</b>
③	Cylinder Head Bracket	—	⑩	Rear Subframe	—
④	Cylinder Head Bracket Fastener	<b>75 ft-lbs (102 N·m)</b>	⑪	Rear Lower Subframe Fastener	<b>18 ft-lbs (24 N·m)</b>
⑤	Front Downcast	—	⑫	Rear Lower Subframe	—
⑥	Front Downcast Fastener	<b>45 ft-lbs (61 N·m)</b>	⑬	Midcast M12 Fastener	<b>75 ft-lbs (102 N·m)</b>
⑦	Midcast	—			



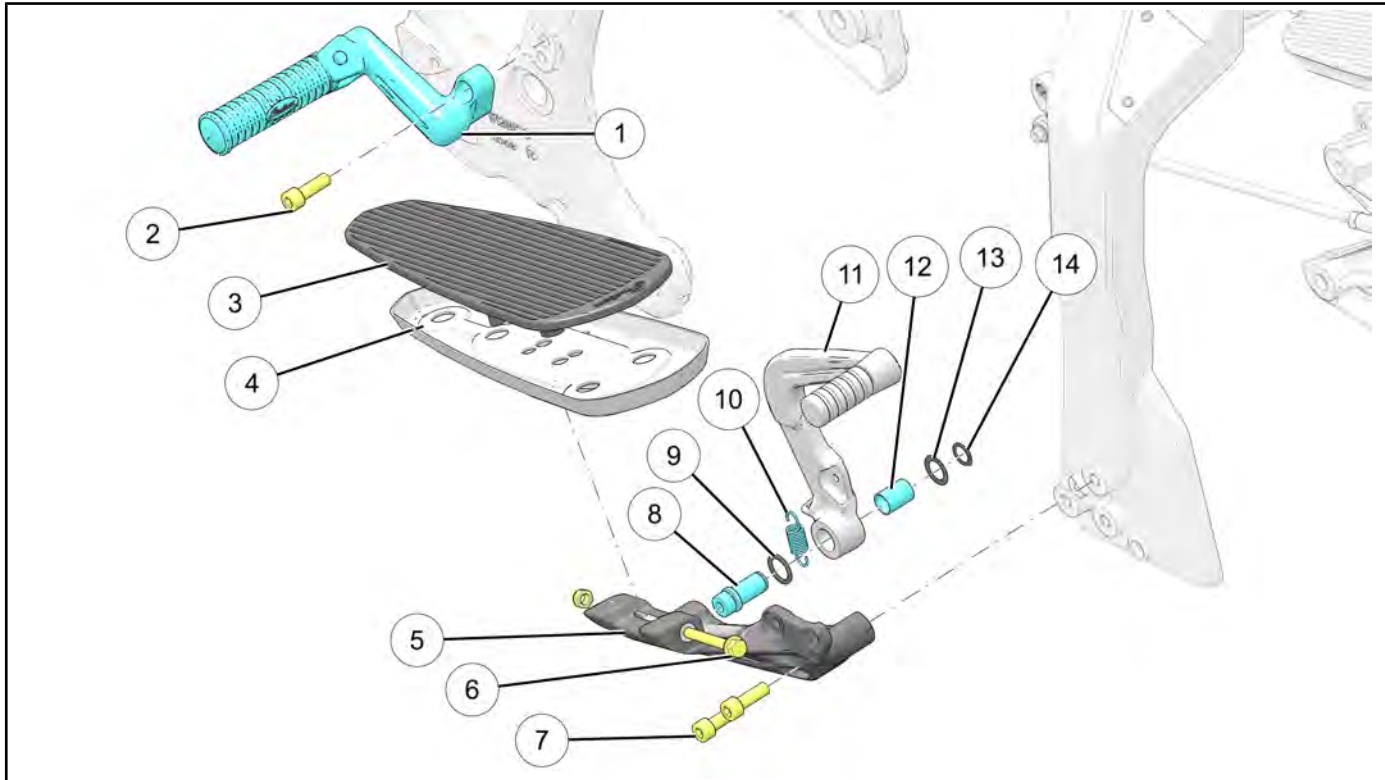
REF	DESCRIPTION	TORQUE
①	Fuel Tank Mount Bracket	—
②	Fuel Tank Mount Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>
③	ABS Mount Bracket	—
④	ABS Mount Bracket Fastener (Allen)	<b>84 in-lbs (10 N·m)</b>
⑤	ABS Mount Bracket Fastener (Hex)	<b>84 in-lbs (10 N·m)</b>
⑥	Fuse Block Mount Bracket	—
⑦	Fuse Block Mount Bracket Fastener	<b>84 in-lbs (10 N·m)</b>

**7** [REDACTED]

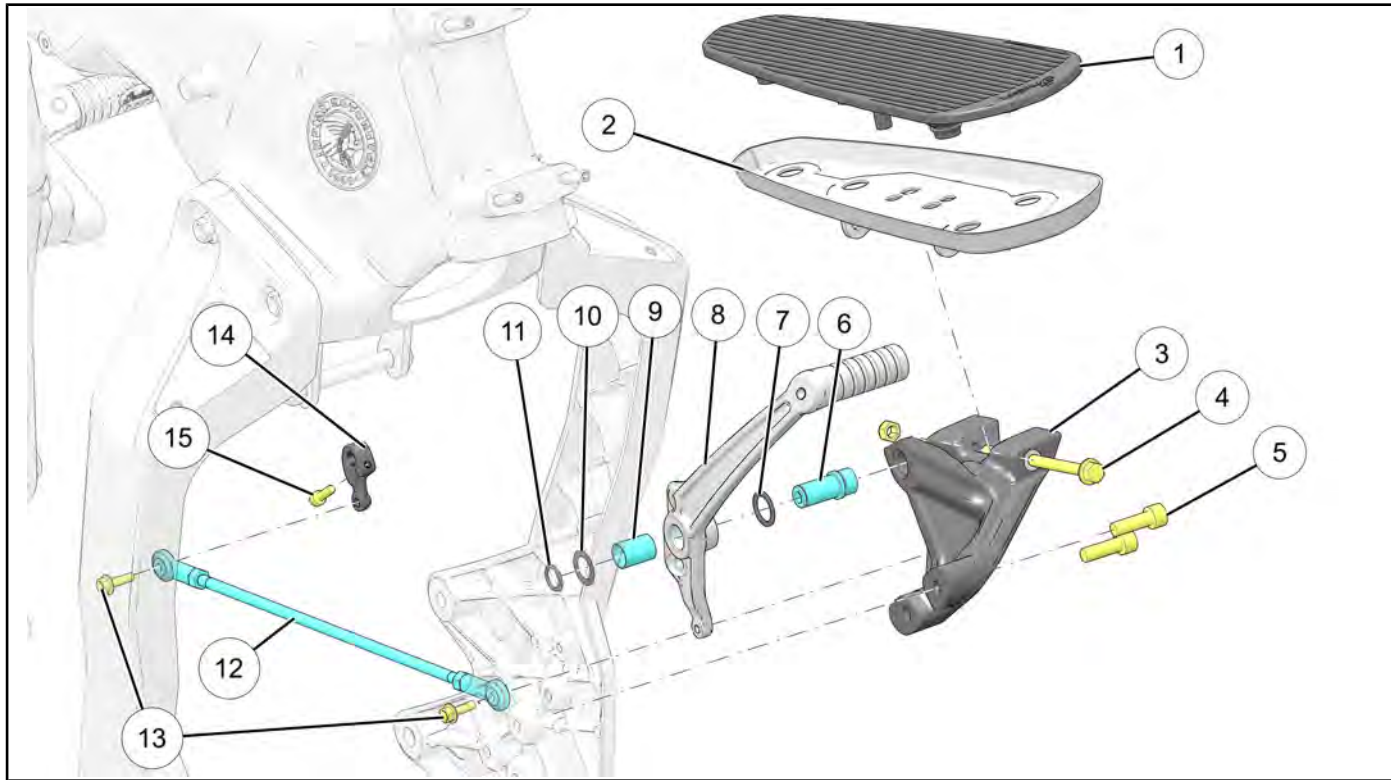


**FLOORBOARDS**

**BAGGER**



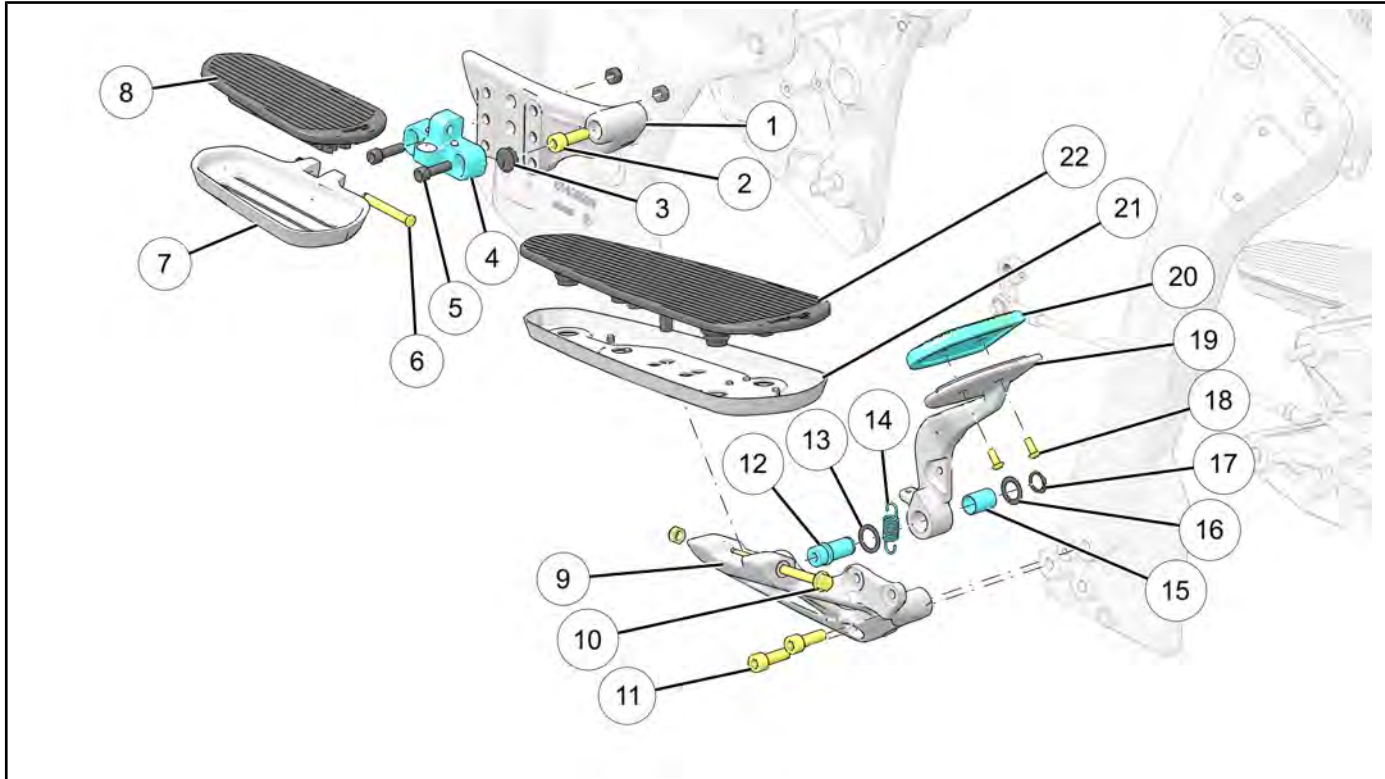
REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Footpeg Assembly	—	⑧	Pivot Shaft	<b>50 ft-lbs (68 N·m)</b>
②	Footpeg Fastener	<b>35 ft-lbs (47 N·m)</b>	⑨	Washer	—
③	Floorboard Pad	—	⑩	Brake Return Spring	—
④	Floorboard Base	—	⑪	Brake Pedal	—
⑤	Floorboard Bracket	—	⑫	Pivot Shaft Bushing	—
⑥	Floorboard Base Fastener	<b>18 ft-lbs (24 N·m)</b>	⑬	Washer	—
⑦	Floorboard Bracket Fastener	<b>35 ft-lbs (47 N·m)</b>	⑭	Snap Ring	—



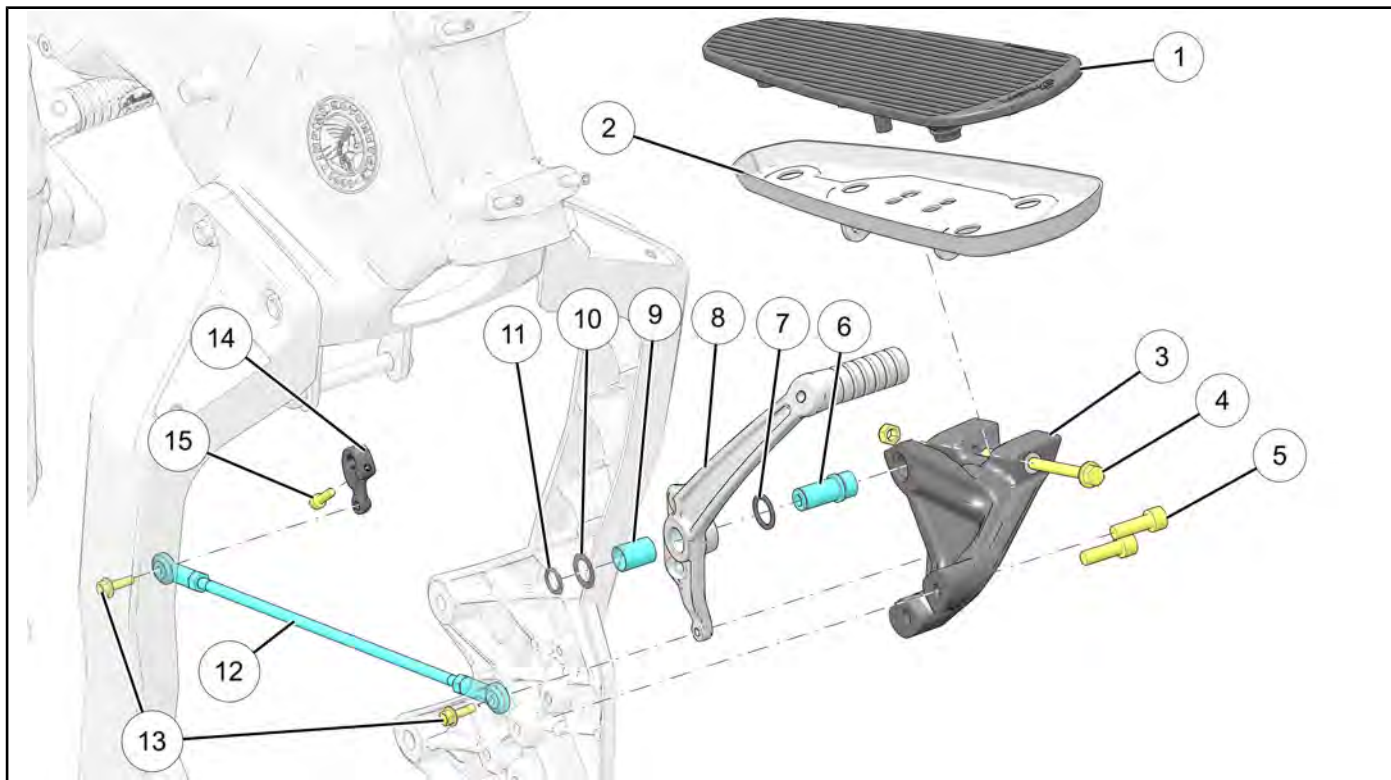
REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Floorboard Pad	—	⑨	Pivot Shaft Bushing	—
②	Floorboard Base	—	⑩	Washer	—
③	Floorboard Bracket	—	⑪	Snap Ring	—
④	Floorboard Base Fastener	<b>18 ft-lbs (24 N·m)</b>	⑫	Shift Linkage	—
⑤	Floorboard Bracket Fastener	<b>35 ft-lbs (47 N·m)</b>	⑬	Shift Linkage Fastener	<b>84 in-lbs (10 N·m)</b>
⑥	Pivot Shaft	<b>50 ft-lbs (68 N·m)</b>	⑭	Shift Lever	—
⑦	Washer	—	⑮	Shift Lever Fastener	<b>84 in-lbs (10 N·m)</b>
⑧	Shift Pedal	—			

7

**TOURING**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Passenger Floorboard Mount	—	⑫	Pivot Shaft	<b>50 ft-lbs (68 N·m)</b>
②	Passenger Floorboard Mount Fastener	<b>33 ft-lbs (45 N·m)</b>	⑬	Washer	—
③	Plug	—	⑭	Brake Return Spring	—
④	Floorboard Pivot	—	⑮	Pivot Shaft Bushing	—
⑤	Passenger Floorboard Pivot Fastener	<b>19 ft-lbs (25 N·m)</b>	⑯	Washer	—
⑥	Pivot Pin	—	⑰	Snap Ring	—
⑦	Passenger Floorboard Base	—	⑱	Brake Pedal Pad Fastener	<b>84 in-lbs (10 N·m)</b>
⑧	Passenger Floorboard Pad	—	⑲	Brake Pedal	—
⑨	Floorboard Bracket	—	⑳	Brake Pedal Pad	—
⑩	Floorboard Base Fastener	<b>18 ft-lbs (24 N·m)</b>	㉑	Floorboard Base	—
⑪	Floorboard Bracket Fastener	<b>35 ft-lbs (47 N·m)</b>	㉒	Floorboard Pad	—

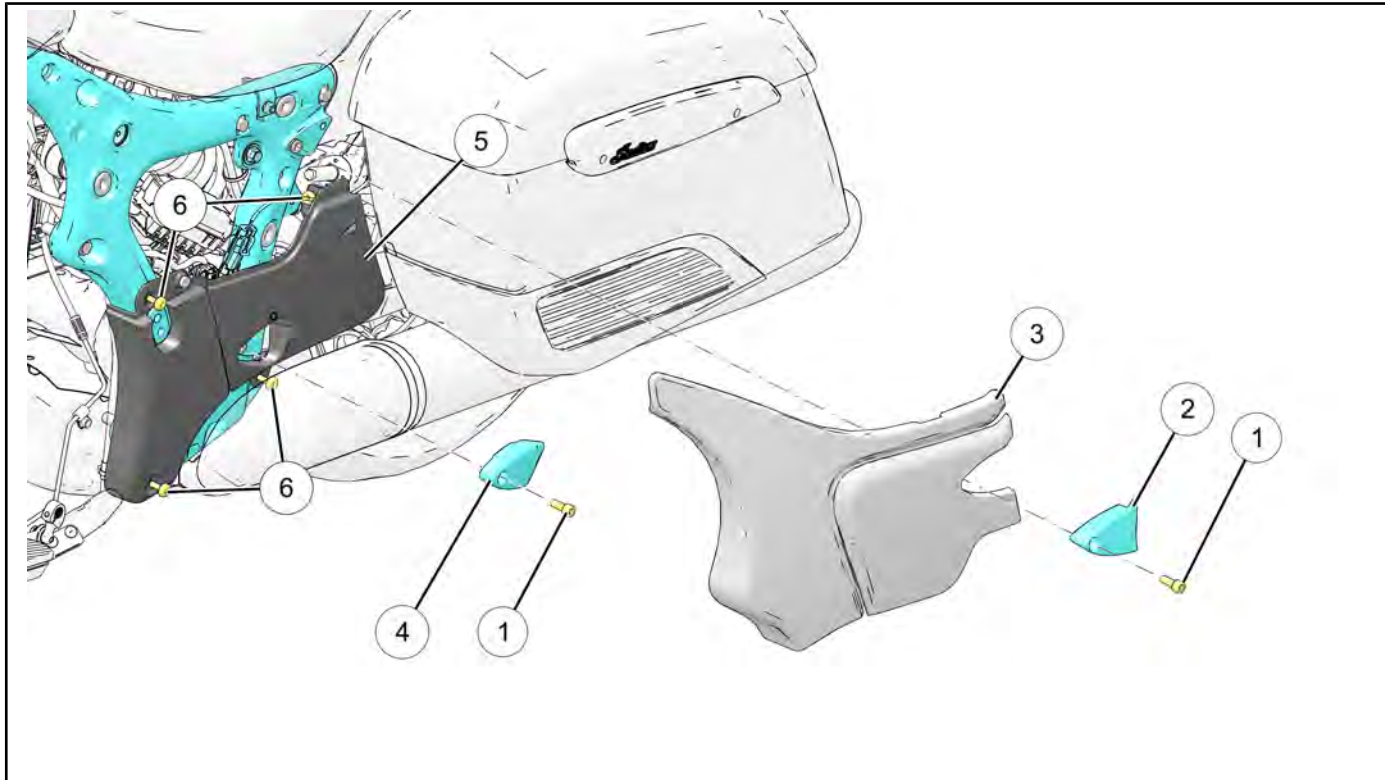


REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Floorboard Pad	—	⑨	Pivot Shaft Bushing	—
②	Floorboard Base	—	⑩	Washer	—
③	Floorboard Bracket	—	⑪	Snap Ring	—
④	Floorboard Base Fastener	<b>18 ft-lbs (24 N·m)</b>	⑫	Shift Linkage	—
⑤	Floorboard Bracket Fastener	<b>35 ft-lbs (47 N·m)</b>	⑬	Shift Linkage Fastener	<b>84 in-lbs (10 N·m)</b>
⑥	Pivot Shaft	<b>50 ft-lbs (68 N·m)</b>	⑭	Shift Lever	—
⑦	Washer	—	⑮	Shift Lever Fastener	<b>84 in-lbs (10 N·m)</b>
⑧	Shift Pedal	—			

7

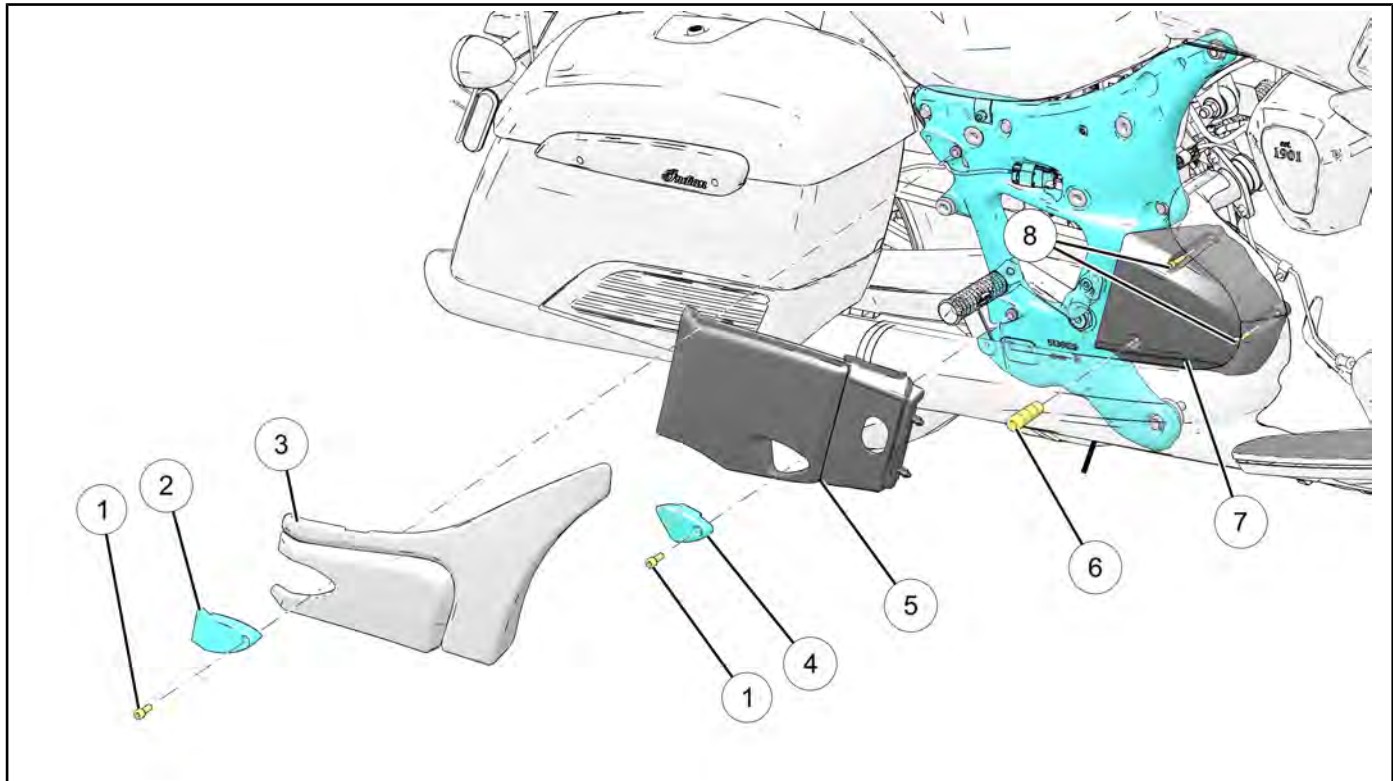
**SIDE PANELS**

**LEFT**



REF	DESCRIPTION	TORQUE
①	Tipover Cover Fastener	<b>18 ft-lbs (24 N·m)</b>
②	Tipover Cover, Upper (Left)	—
③	Side Cover, Upper (Left)	—
④	Tipover Cover, Lower (Left)	—
⑤	Side Cover, Lower (Left)	—
⑥	Lower Side Cover Accent Fastener	<b>84 in-lbs (10 N·m)</b>

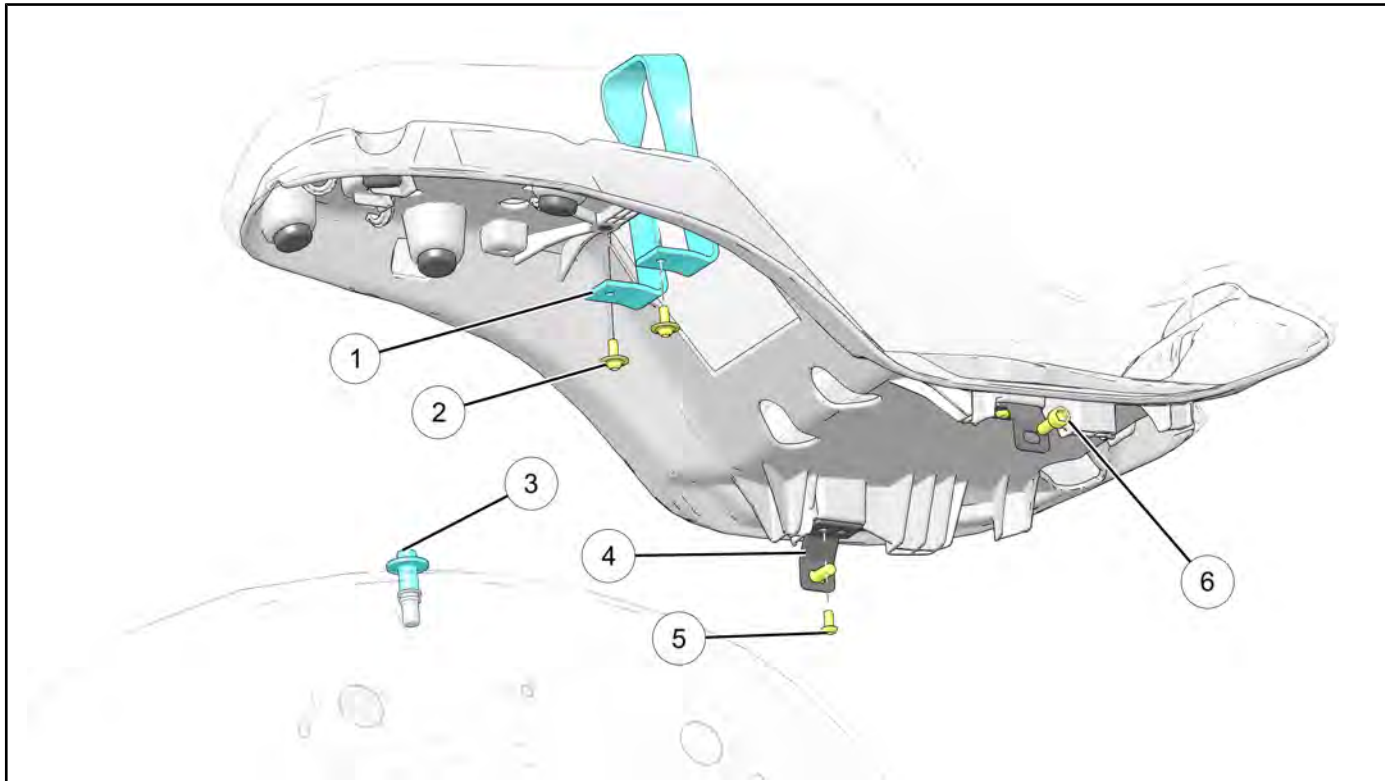
**RIGHT**



REF	DESCRIPTION	TORQUE
①	Tipover Cover Fastener	<b>18 ft-lbs (24 N·m)</b>
②	Tipover Cover, Upper (Right)	—
③	Side Cover, Upper (Right)	—
④	Tipover Cover, Lower (Right)	—
⑤	Side Cover, Lower (Right)	—
⑥	Sprocket Cover Plug	—
⑦	Sprocket Cover	—
⑧	Sprocket Cover Fastener	<b>84 in-lbs (10 N·m)</b>

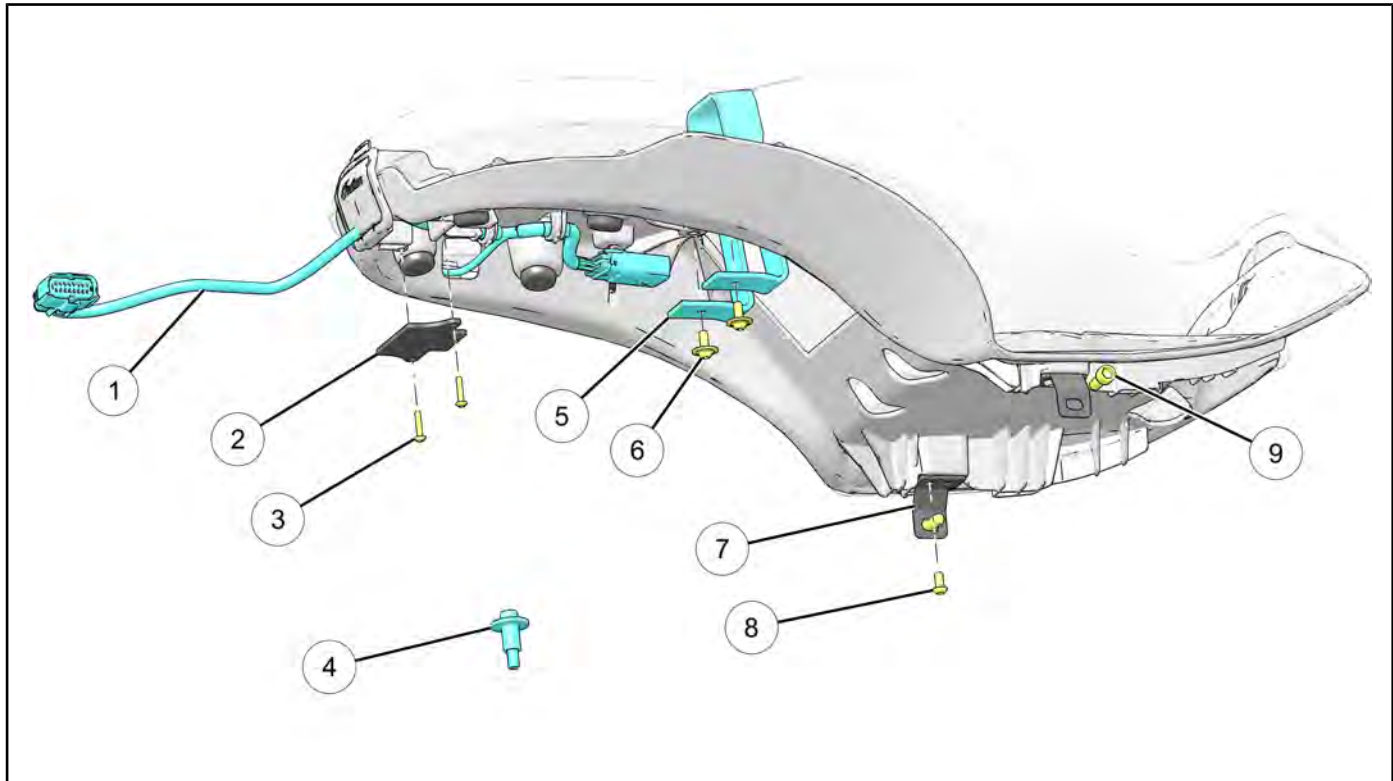
**7**

**SEAT**



REF	DESCRIPTION	TORQUE
①	Grabstrap	—
②	Grabstrap Fastener	<b>36 in-lbs (4 N·m)</b>
③	Seat Pan Fastener	<b>84 in-lbs (10 N·m)</b>
④	Seat Bracket	—
⑤	Seat Bracket Fastener	<b>52 in-lbs (6 N·m)</b>
⑥	Seat Fastener	<b>18 ft-lbs (24 N·m)</b>

**2022+ TOURING**

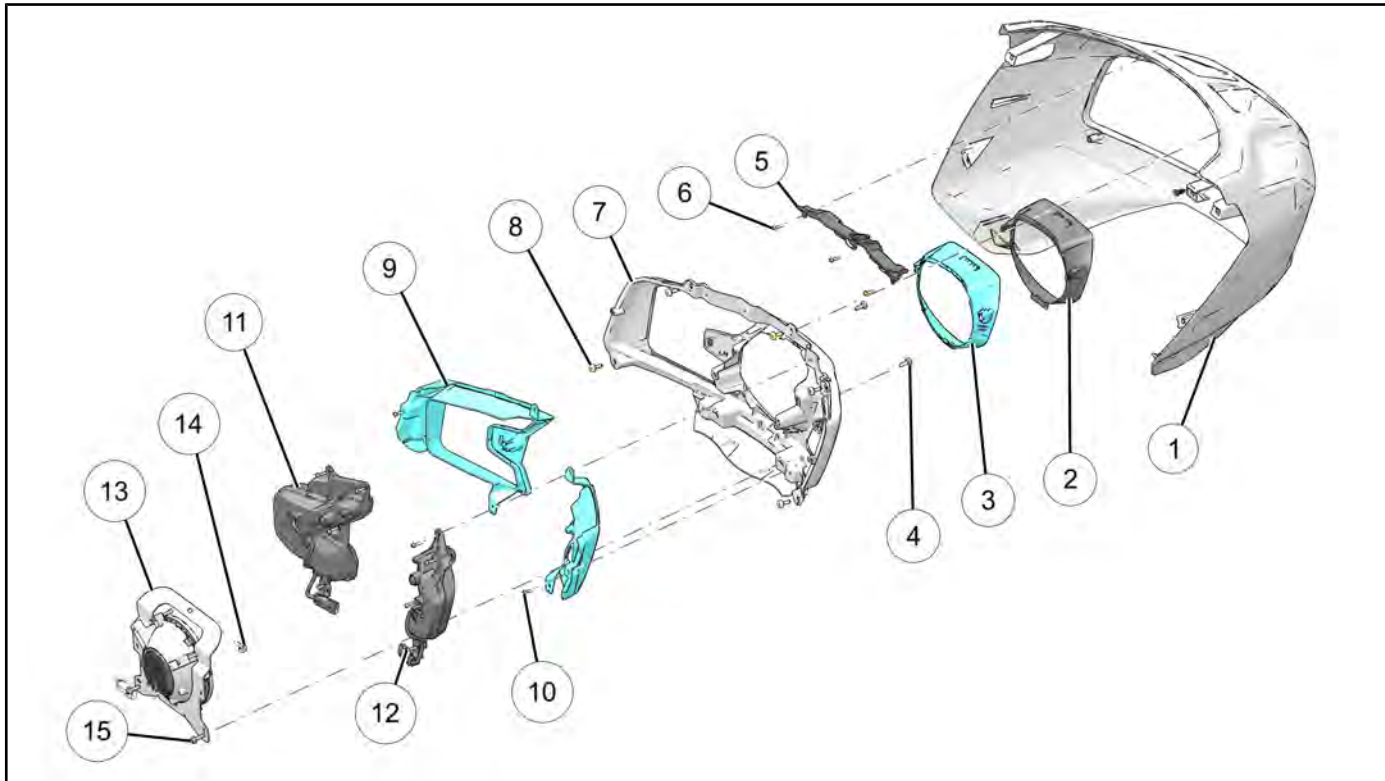


REF	DESCRIPTION	TORQUE
①	Seat / Trunk Harness	—
②	Seat / Trunk Harness Cover	—
③	Seat / Trunk Harness Cover Fastener	<b>36 in-lbs (4 N·m)</b>
④	Seat Pan Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	Grabstrap	—
⑥	Grabstrap Fastener	<b>36 in-lbs (4 N·m)</b>
⑦	Seat Bracket Fastener	<b>52 in-lbs (6 N·m)</b>
⑧	Seat Fastener	<b>18 ft-lbs (24 N·m)</b>
⑨	Seat Fastener	

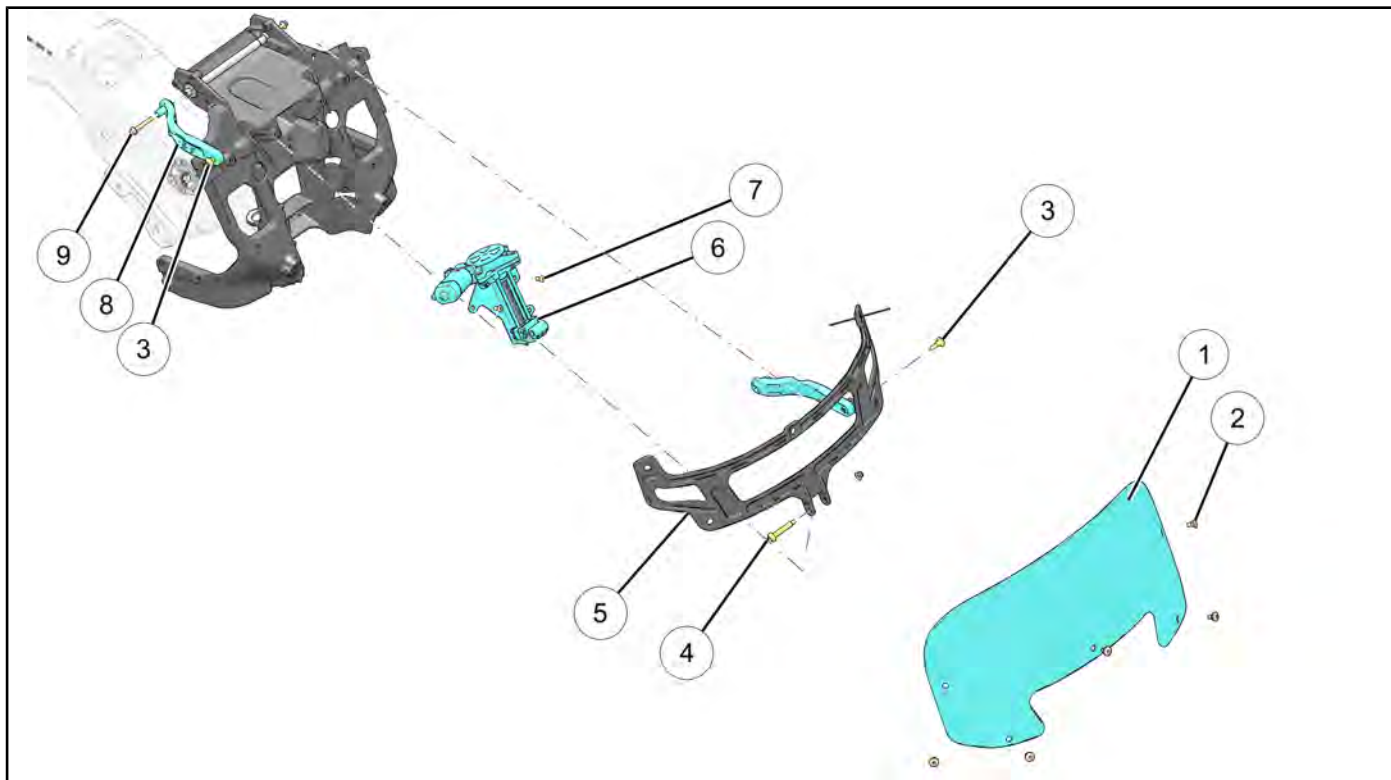
**7**



**FAIRING**



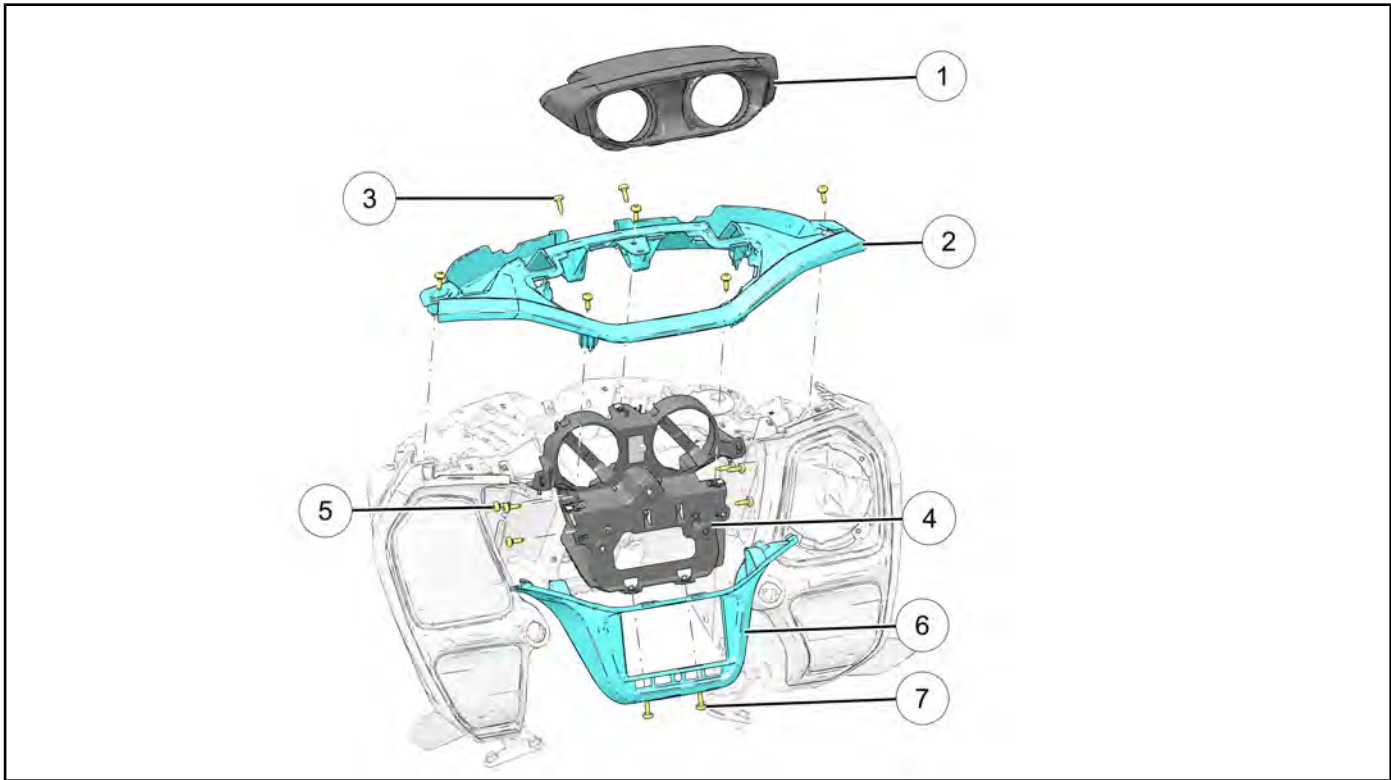
REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Outer Fairing	—	⑨	Turn Signal Bezel (Left)	—
②	Center Headlight Bezel	—	⑩	Turn Signal Bezel Fastener	<b>15 in-lbs (2 N·m)</b>
③	Headlight Grommet Bezel	—	⑪	Turn Signal (Left)	—
④	Headlight Bezel Assembly Fastener	<b>36 in-lbs (4 N·m)</b>	⑫	Turn Signal Fastener	<b>15 in-lbs (2 N·m)</b>
⑤	Upper Duct		⑬	Headlight Assembly	—
⑥	Upper Duct Fastener	<b>15 in-lbs (2 N·m)</b>	⑭	Headlight Fastener	<b>36 in-lbs (4 N·m)</b>
⑦	Headlight Bezel Assembly	—	⑮	Headlight Bracket Fastener	<b>36 in-lbs (4 N·m)</b>
⑧	Headlight Bezel Assembly Fastener	<b>36 in-lbs (4 N·m)</b>			



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Windshield	—	⑥	Windshield Motor	—
②	Windshield Fastener	<b>36 in-lbs (4 N·m)</b> Torque fasteners in sequence.	⑦	Windshield Motor Fastener	<b>84 in-lbs (10 N·m)</b>
③	Windshield Support to Link Fastener	<b>84 in-lbs (10 N·m)</b>	⑧	Windshield Link	—
④	Windshield Support to Motor Fastener	<b>84 in-lbs (10 N·m)</b>	⑨	Windshield Link to Pivot Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	Windshield Support	—			

7

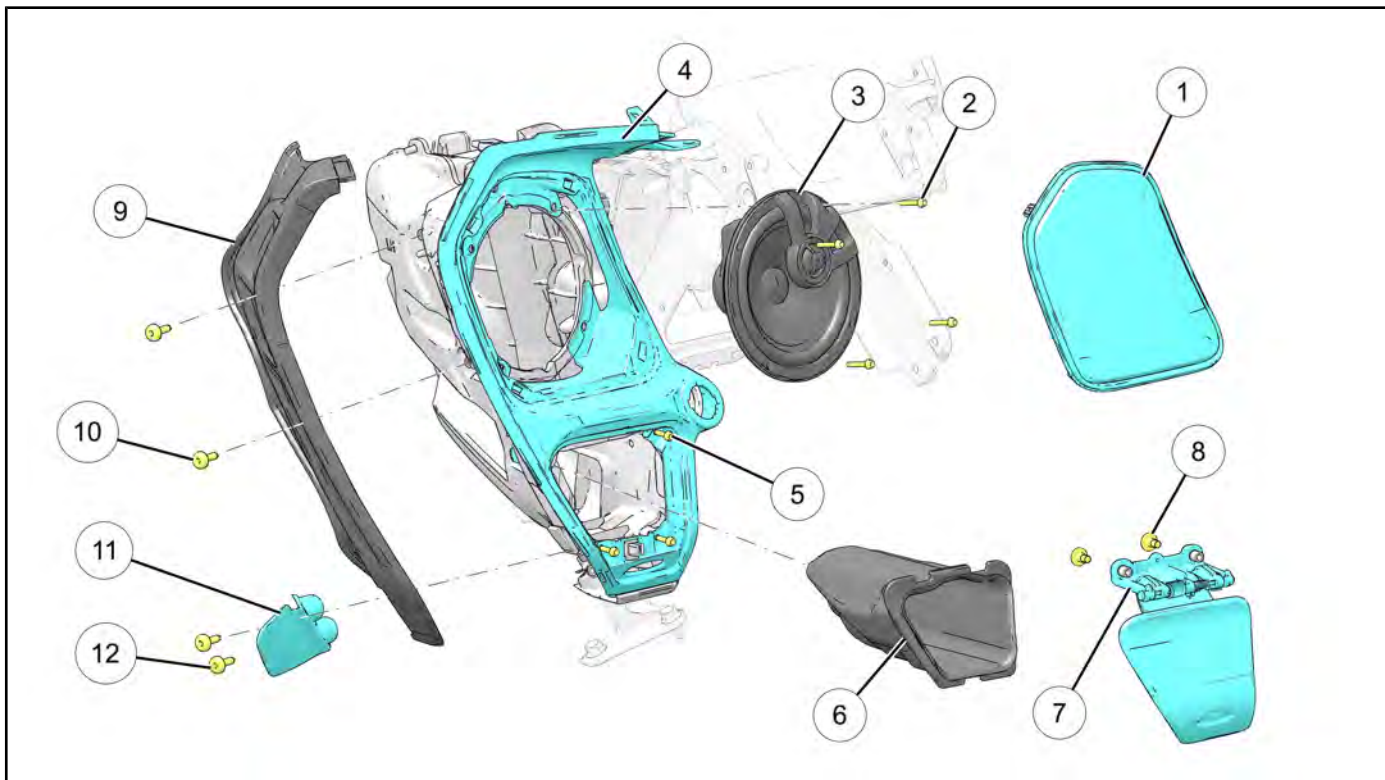




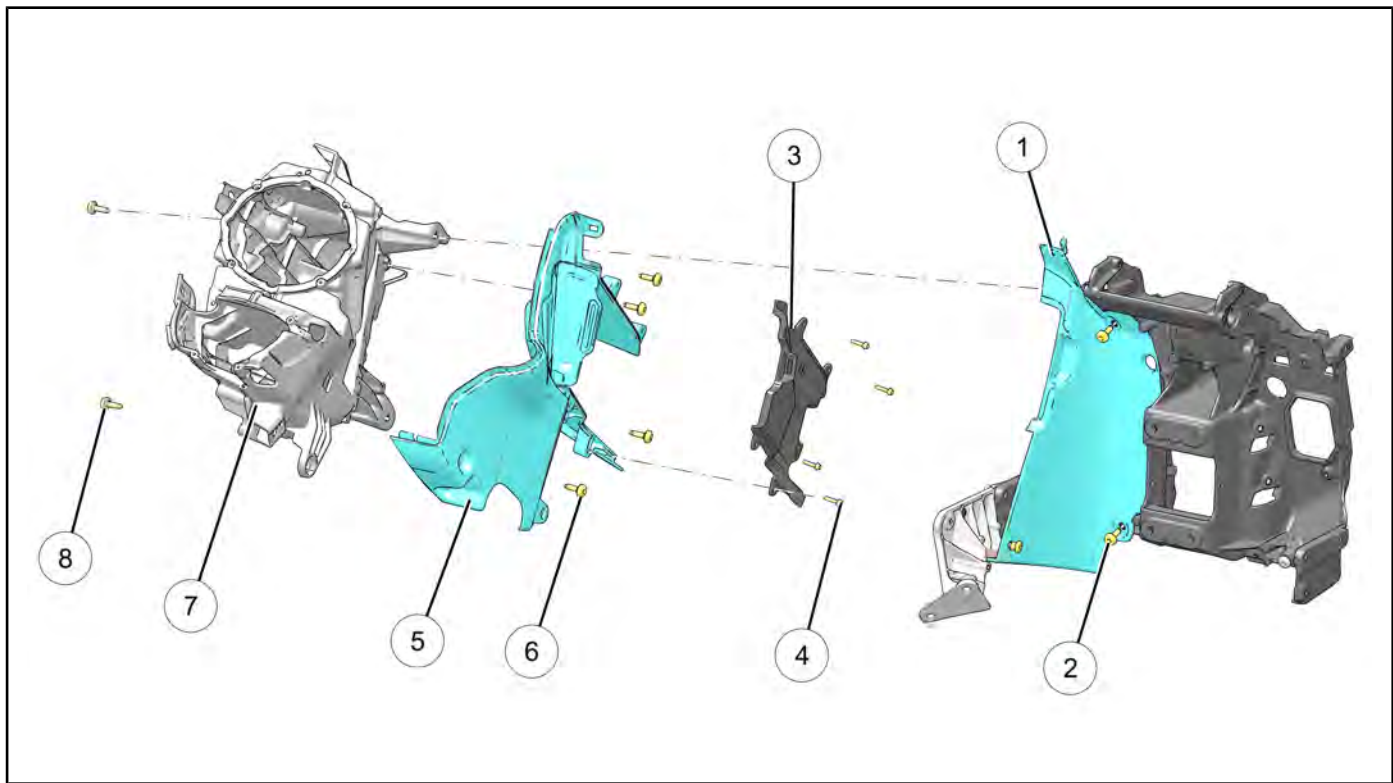
REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Hood Gauge	—	⑤	Dash Support Fastener	<b>36 in-lbs (4 N·m)</b>
②	Visor Top	—	⑥	Display Bezel	—
③	Visor Top Fastener	<b>36 in-lbs (4 N·m)</b>	⑦	Display Bezel Fastener	<b>36 in-lbs (4 N·m)</b>
④	Dash Support	—			

**7**

FRAME / BODY



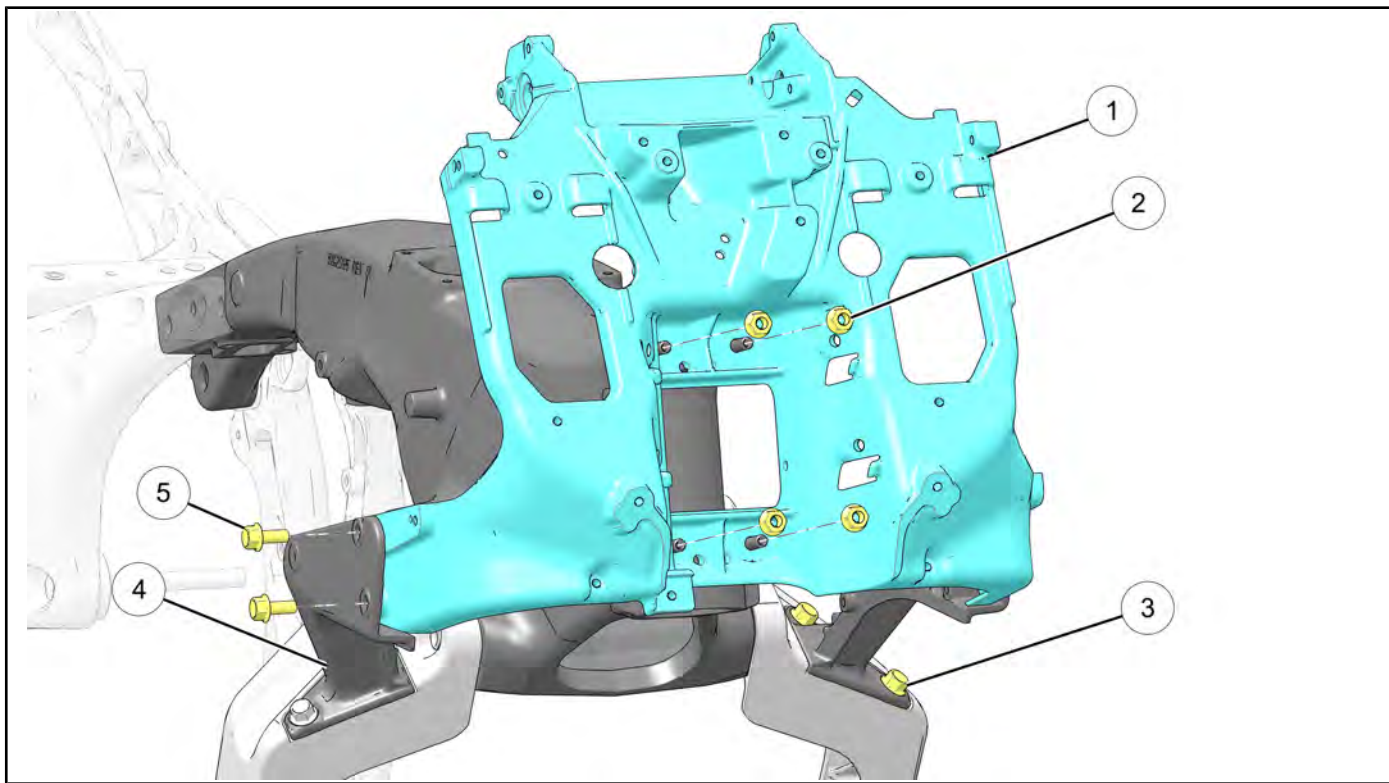
REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Speaker Grill	—	⑦	Storage Door Assembly	—
②	Speaker Fastener	<b>25 in-lbs (3 N·m)</b>	⑧	Storage Door Fastener	<b>36 in-lbs (4 N·m)</b>
③	Speaker	—	⑨	Dash Trim	—
④	Left Hand Dash	—	⑩	Dash Trim Fastener	<b>36 in-lbs (4 N·m)</b>
⑤	Left/Right Hand Dash Fastener	<b>25 in-lbs (3 N·m)</b>	⑪	Air Deflector	—
⑥	Storage Liner	—	⑫	Air Deflector Fastener	<b>36 in-lbs (4 N·m)</b>



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Dash Closeout	—	⑤	Outer Duct	—
②	Dash Closeout Fastener	<b>36 in-lbs (4 N·m)</b>	⑥	Outer Duct Fastener	<b>36 in-lbs (4 N·m)</b>
③	Inner Duct	—	⑦	Enclosure	—
④	Inner Duct Fastener	<b>15 in-lbs (2 N·m)</b>	⑧	Enclosure Fastener	<b>36 in-lbs (4 N·m)</b>

**7**

FRAME / BODY

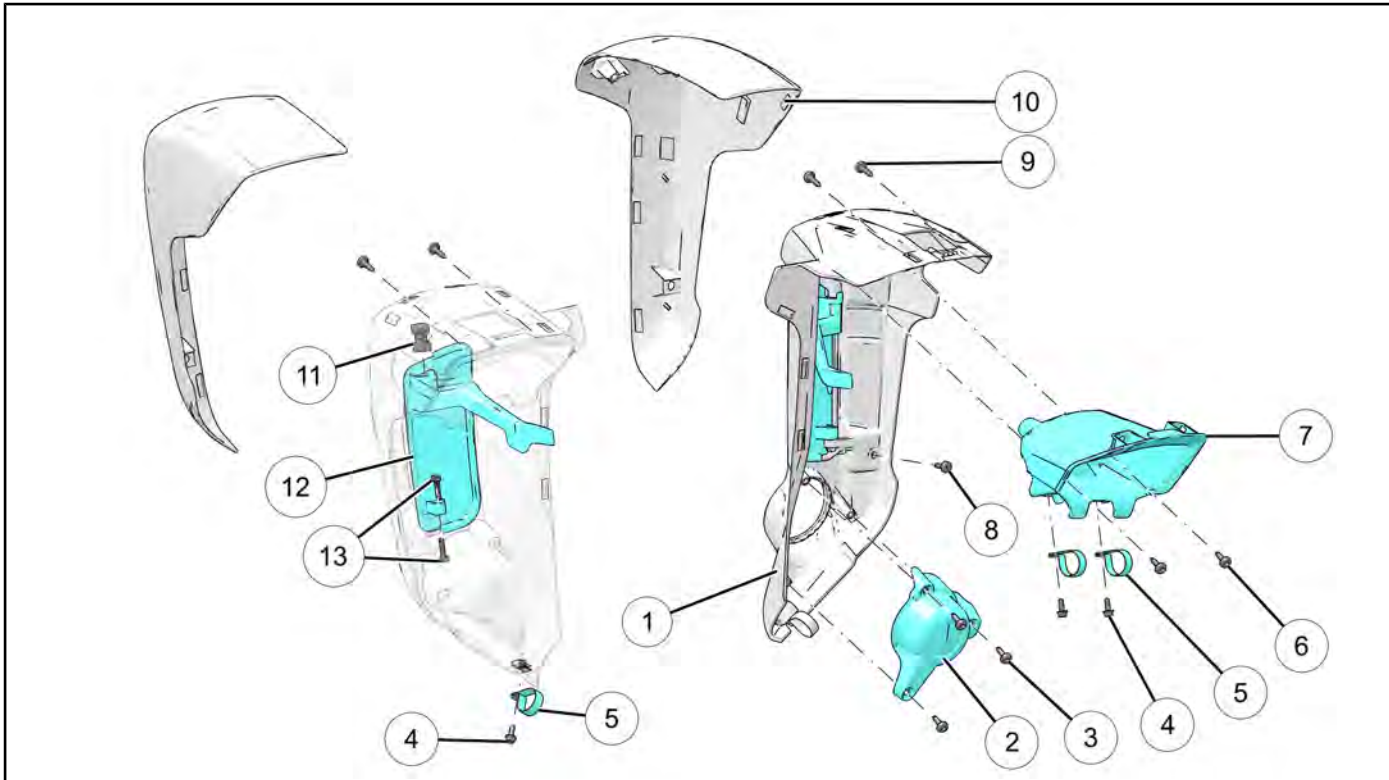


REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Fairing Bracket	—	④	Fairing Support	—
②	Fairing Bracket Nut	<b>18 ft-lbs (24 N·m)</b>	⑤	Fairing Support to Fairing Bracket Fastener	<b>18 ft-lbs (24 N·m)</b>
③	Fairing Support to Downcast Fastener	<b>18 ft-lbs (24 N·m)</b>			

**LOWER FAIRING**

**NOTICE**  
Touring Models.

**NON FOG LIGHT CONFIGURATION**

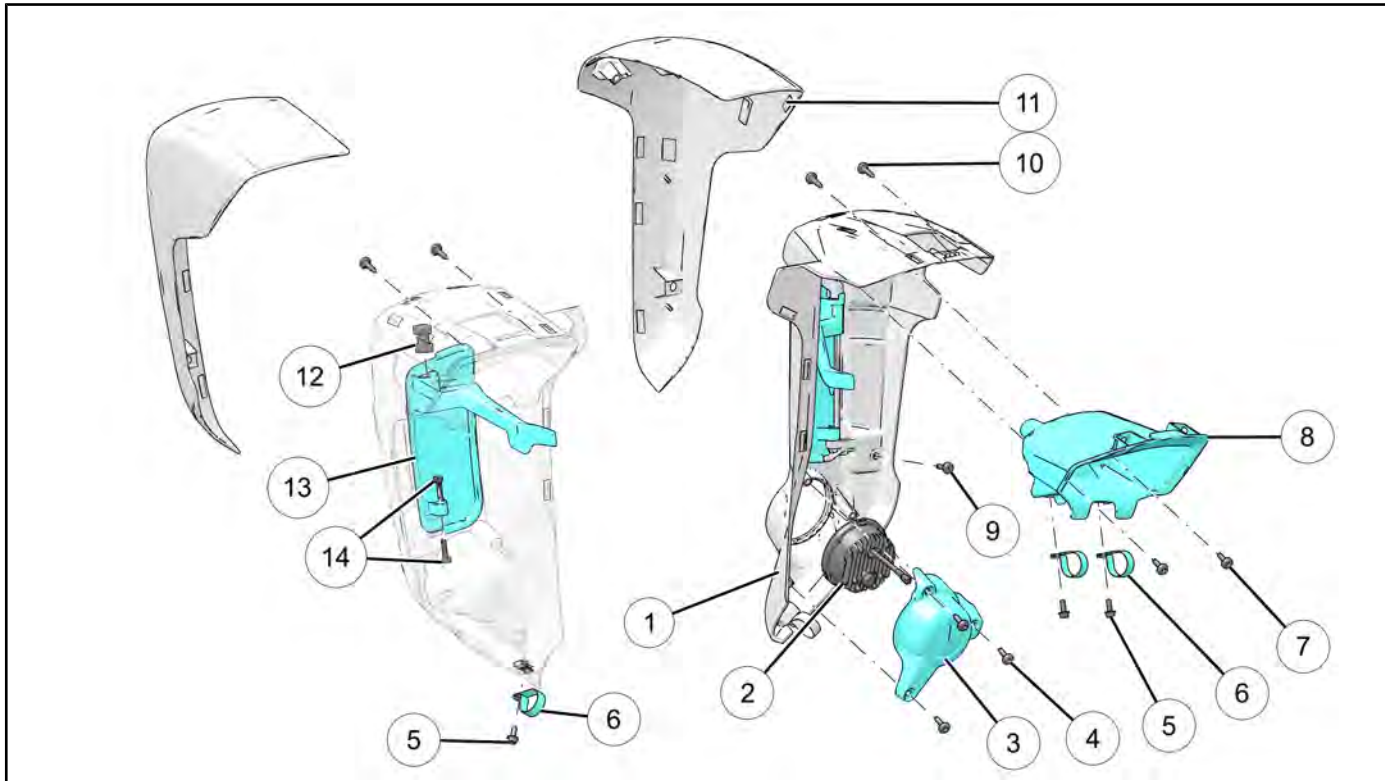


REF	DESCRIPTION	TORQUE
①	Inner Lower Fairing	–
②	Fog Light Bracket	–
③	Fog Light Bracket Fastener	<b>36 in-lbs (4 N·m)</b>
④	Highway Bar Clamp Fastener	<b>36 in-lbs (4 N·m)</b>
⑤	Highway Bar Clamp	–
⑥	Lower Fairing Cubby Fastener	<b>36 in-lbs (4 N·m)</b>
⑦	Lower Fairing Cubby	–
⑧	Lower Fairing Fastener	<b>36 in-lbs (4 N·m)</b>
⑨	Lower Fairing Cubby Fastener	<b>36 in-lbs (4 N·m)</b>
⑩	Outer Lower Fairing	–
⑪	Lower Fairing Vent Hinge	–
⑫	Lower Fairing Vent	–
⑬	Lower Fairing Vent Pin	–



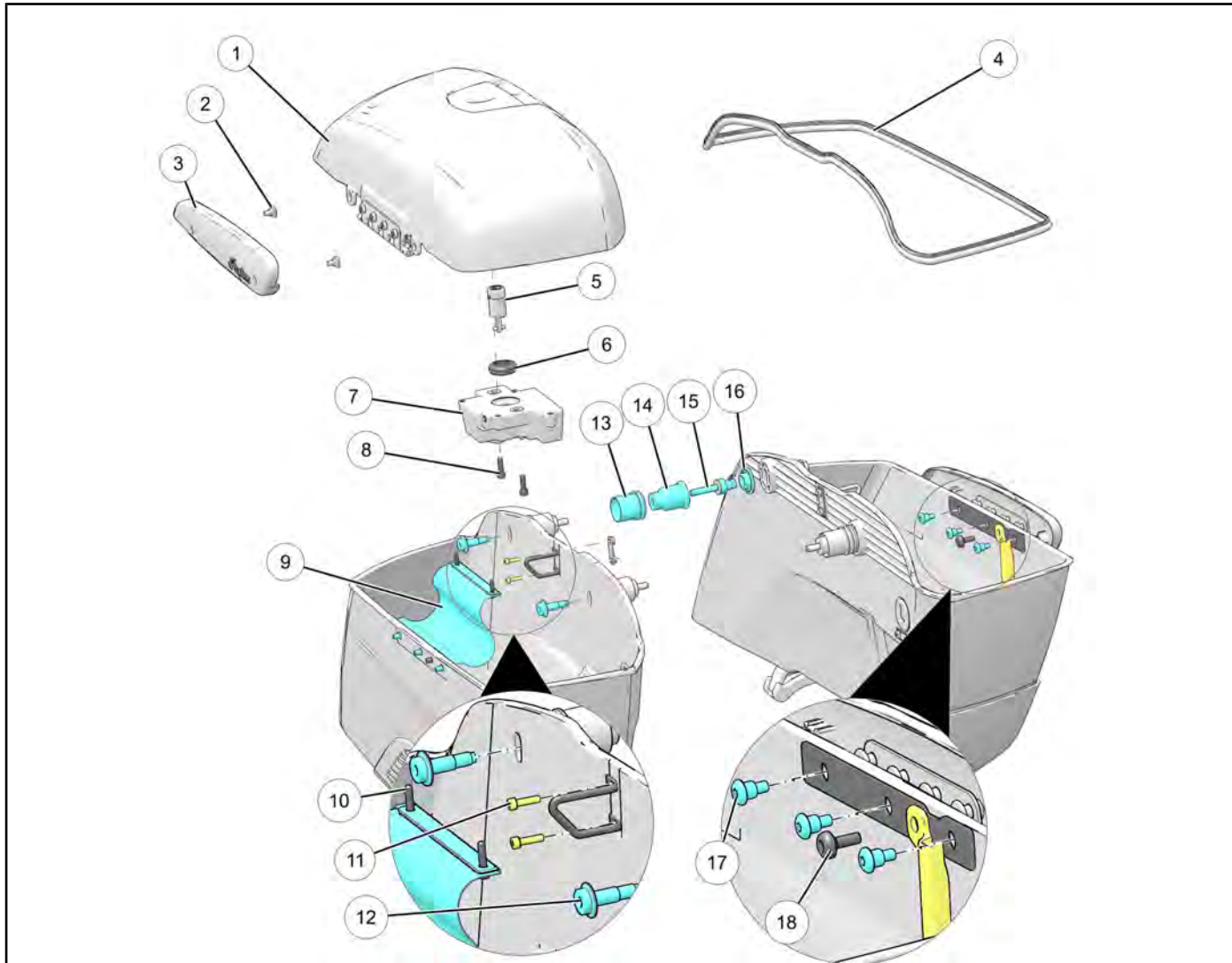


**FOG LIGHT CONFIGURATION**



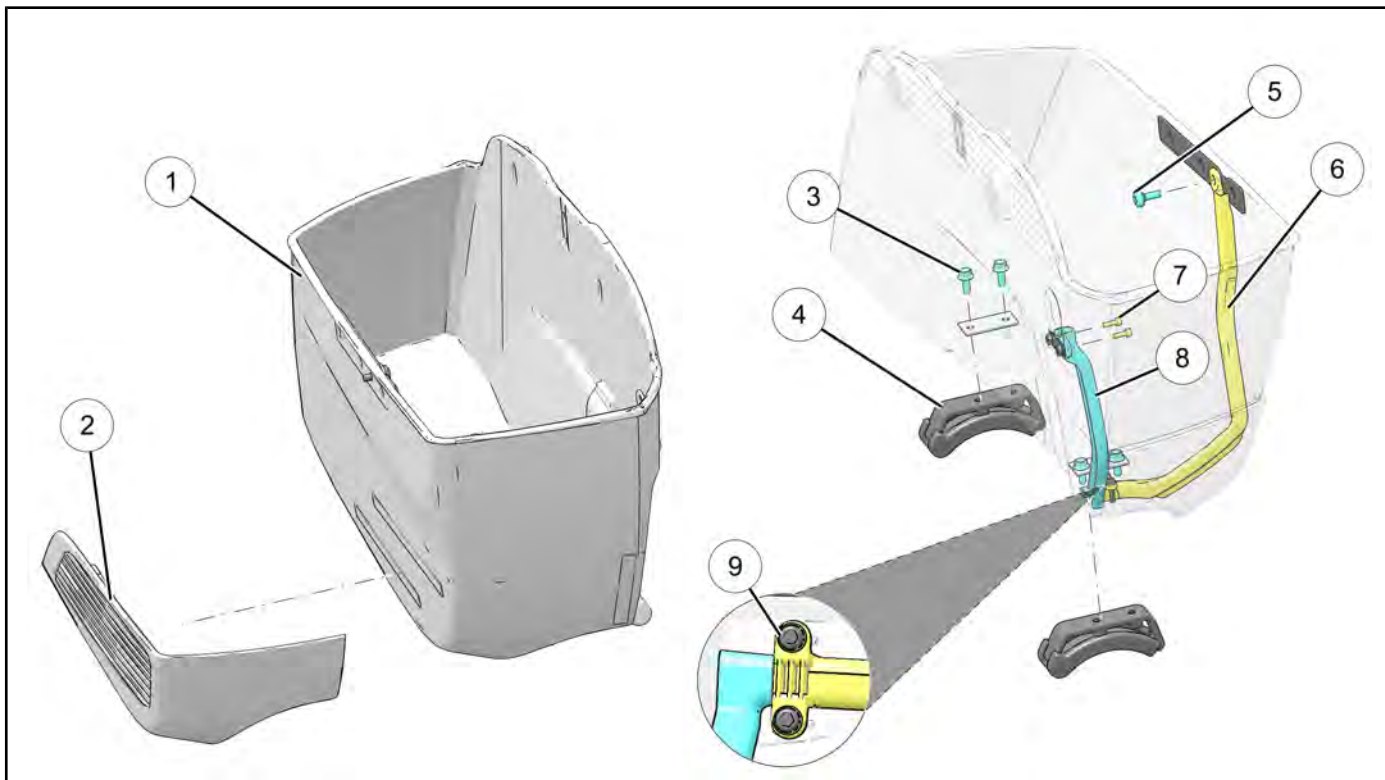
REF	DESCRIPTION	TORQUE
①	Inner Lower Fairing	-
②	Fog Light	-
③	Fog Light Bracket	-
④	Fog Light Bracket Fastener	<b>36 in-lbs (4 N·m)</b>
⑤	Highway Bar Clamp Fastener	<b>36 in-lbs (4 N·m)</b>
⑥	Highway Bar Clamp	-
⑦	Lower Fairing Cubby Fastener	<b>36 in-lbs (4 N·m)</b>
⑧	Lower Firing Cubby	-
⑨	Lower Fairing Fastener	<b>36 in-lbs (4 N·m)</b>
⑩	Lower Fairing Cubby Fastener	<b>36 in-lbs (4 N·m)</b>
⑪	Outer Lower Fairing	-
⑫	Lower Fairing Vent Hinge	-
⑬	Lower Fairing Vent	-
⑭	Lower Fairing Vent Pin	-

**SADDLEBAGS**



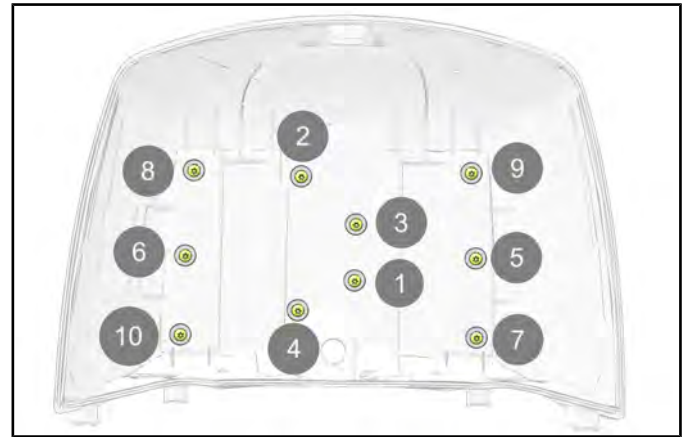
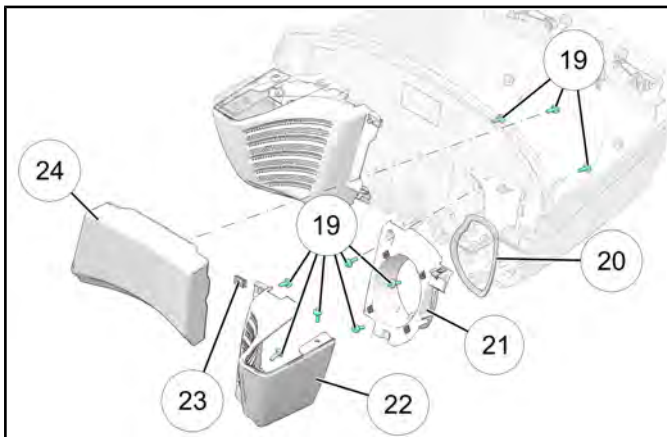
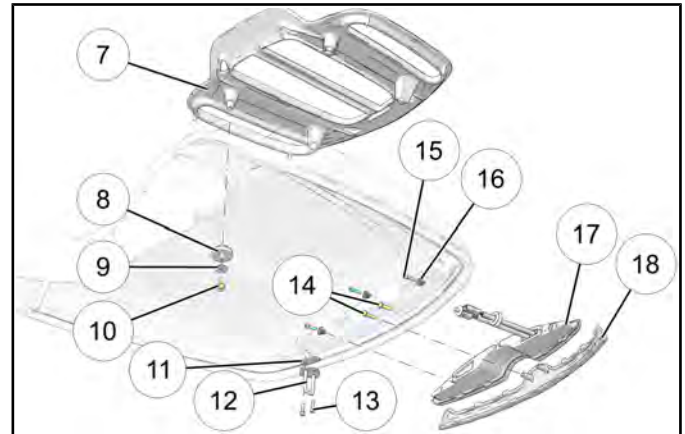
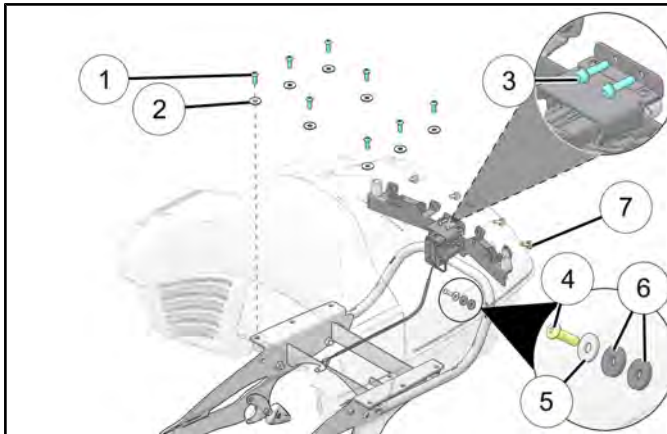
REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Saddlebag Lid	—	⑩	Limiter Fastener	15 in-lbs (2 N·m)
②	Hinge Cover Fastener	36 in-lbs (4 N·m)	⑪	Latch Hoop Fastener	36 in-lbs (4 N·m)
③	Hinge Cover	—	⑫	Saddlebag Fastener	18 ft-lbs (24 N·m)
④	Saddlebag Seal	—	⑬	Trunk Spool	—
⑤	Lock	—	⑭	Saddlebag Spool	—
⑥	Lock Seal	—	⑮	Saddlebag Spool Fastener	32 ft-lbs (43 N·m)
⑦	Electronic Saddlebag Lock	—	⑯	Bushing	—
⑧	Saddlebag Lock Fastener	62 in-lbs (7 N·m)	⑰	Leaf Hinge Fastener	36 in-lbs (4 N·m)
⑨	Limiter	—	⑱	Wire Guide Fastener (Upper)	84 in-lbs (10 N·m)

FRAME / BODY

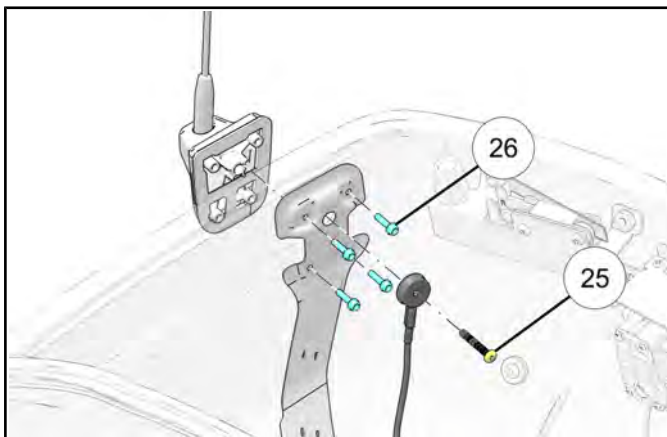


REF	DESCRIPTION	TORQUE
①	Saddlebag Bin	—
②	Saddlebag Bin Trim	—
③	Saddlebag Mount Fastener	<b>84 in-lbs (10 N·m)</b>
④	Saddlebag Mount	—
⑤	Wire Guide Fastener (Upper)	<b>84 in-lbs (10 N·m)</b>
⑥	Wire Guide	—
⑦	Wire Cover Fastener	<b>15 in-lbs (2 N·m)</b>
⑧	Wire Cover	—
⑨	Wire Guide Fastener (Lower)	<b>15 in-lbs (2 N·m)</b>

**TRUNK**



**TORQUE SEQUENCE**



**7**

FRAME / BODY

REF	PART DESCRIPTION	TORQUE
①	Trunk to Frame Arm Fastener	<b>12 in-lbs (1 N·m)</b>
②	Washer	–
③	Trunk Lock Fastener	<b>12 in-lbs (1 N·m)</b>
④	Trunk to Frame Arm Fastener	<b>12 in-lbs (1 N·m)</b>
⑤	Washer	–
⑥	Washer	–
⑦	Luggage Rack	–
⑧	Grommet	–
⑨	Washer	–
⑩	Luggage Rack Fastener	<b>84 in-lbs (10 N·m)</b>
⑪	Plate	–
⑫	Latch, Hoop	–
⑬	Latch, Hoop	<b>36 in-lbs (4 N·m)</b>
⑭	Fastener, Bezel	<b>12 in-lbs (1 N·m)</b>
⑮	Trunk Taillight Fastener	<b>12 in-lbs (1 N·m)</b>
⑯	Bushing	–
⑰	Taillight asm.	–
⑱	Bezel, Taillight	–
⑲	Speaker Cover / Backrest Fastener	<b>36 in-lbs (4 N·m)</b>
⑳	Seal	–
㉑	Speaker Housing	–
㉒	Speaker Cover	–
㉓	Clip	–
㉔	Backrest	–
㉕	Antenna Harness Fastener	<b>27 in-lbs (3 N·m)</b>
㉖	Antenna Mount Fastener	<b>27 in-lbs (3 N·m)</b>

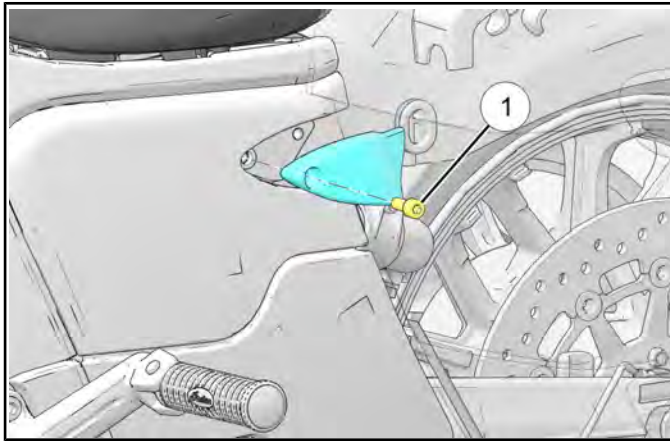
**BODY / FRAME SERVICE**

**SIDE COVER (UPPER), REMOVAL / INSTALLATION**

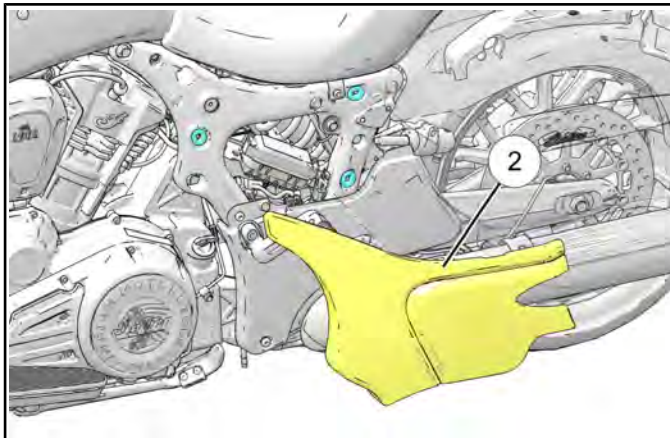
**CAUTION**  
 Use care not to scratch or damage painted surfaces during side cover removal and / or installation.

**LEFT SIDE REMOVAL / INSTALLATION**

1. Remove tipover cover by removing its fastener ①.



2. Remove upper side cover ②.

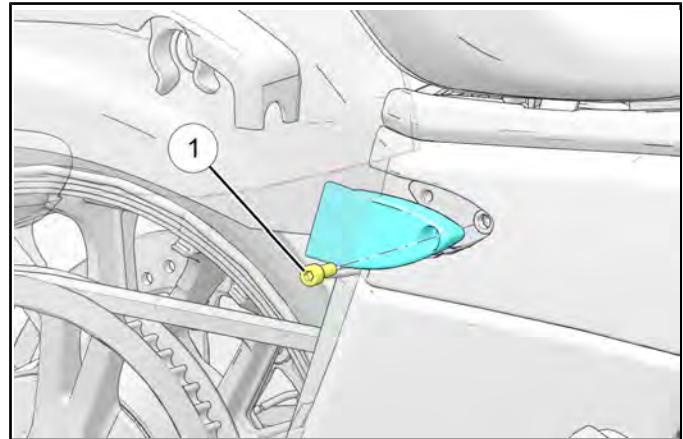


3. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

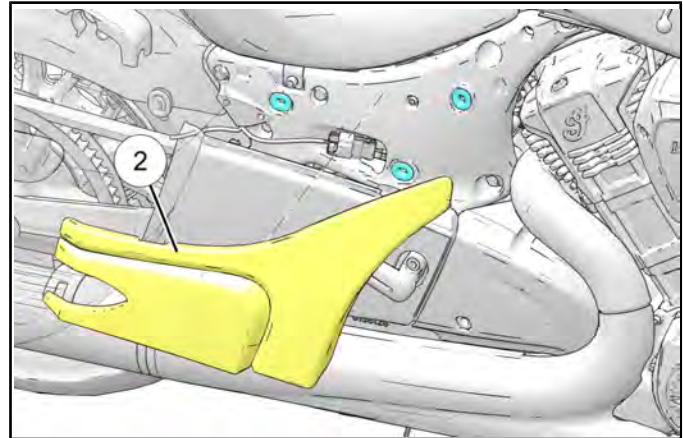
**TORQUE**  
 Tipover Cover Fastener:  
**18 ft-lbs (24 N·m)**

**RIGHT SIDE REMOVAL / INSTALLATION**

1. Remove tipover cover by removing its fastener ①



2. Remove upper side cover ②



3. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**  
 Tipover Cover Fastener:  
**18 ft-lbs (24 N·m)**



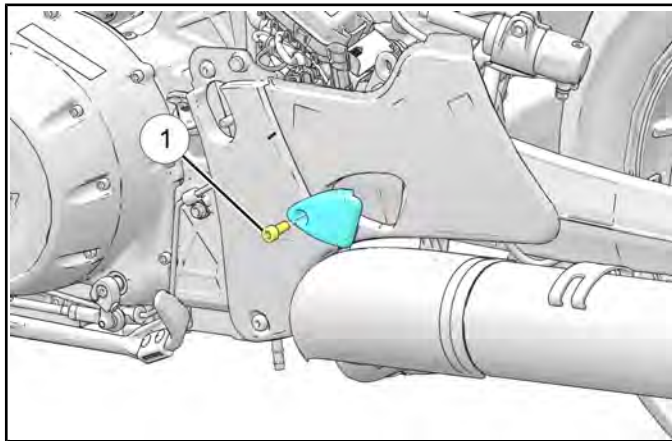
## SIDE COVER (LOWER), REMOVAL / INSTALLATION

**CAUTION**

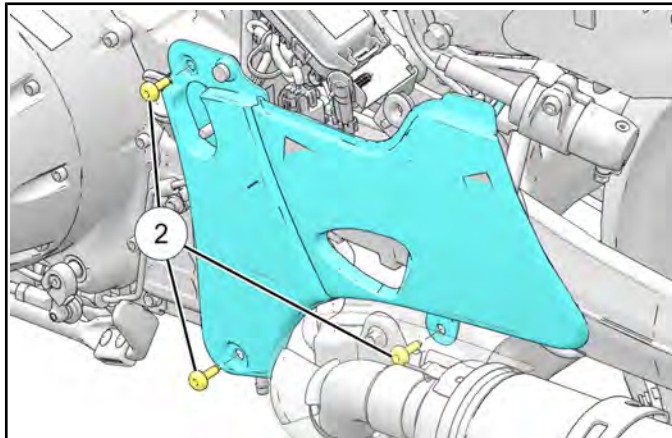
Use care not to scratch or damage painted surfaces during side cover removal / installation.

### LEFT SIDE COVER

1. Remove upper side cover. See **Side Cover (Upper), Removal / Installation** page 7.27.
2. Remove passenger foot pegs. See **Passenger Foot Pegs Removal / Installation** page 7.31.
3. Remove tipover cover by removing its fastener ①.



4. Remove lower side cover fasteners ②.



5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

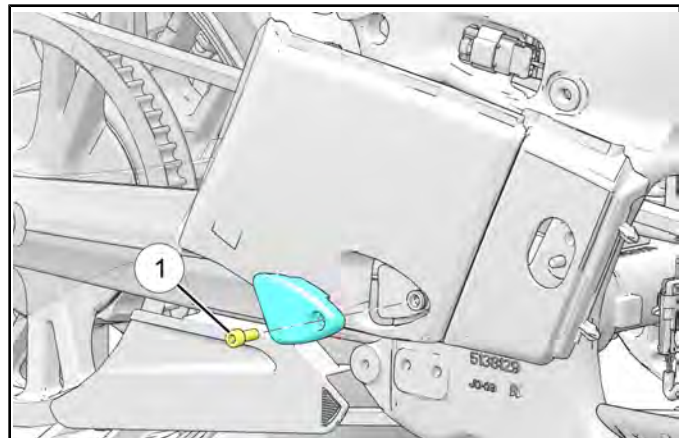
Tipover Cover Fastener  
18 ft-lbs (24 N·m)

**TORQUE**

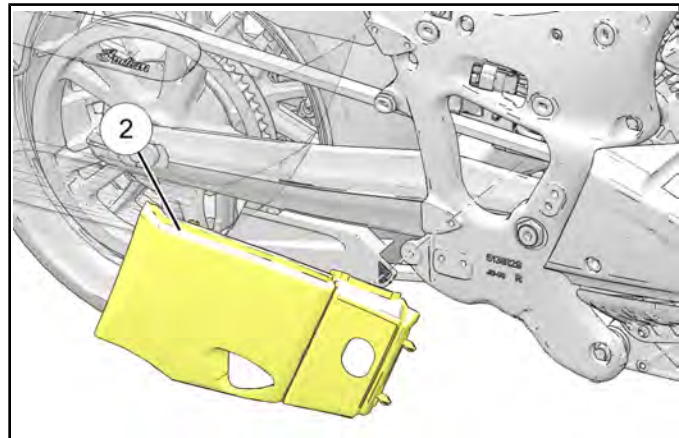
Lower Side Cover Accent Fastener  
84 in-lbs (10 N·m)

### RIGHT SIDE COVER

1. Remove upper side cover. See **Side Cover (Upper), Removal / Installation** page 7.27.
2. Remove passenger foot pegs. See **Passenger Foot Pegs Removal / Installation** page 7.31.
3. Remove drive sprocket cover. See **Drive Sprocket Cover, Removal / Installation** page 8.62.
4. Remove tipover cover by removing its fastener ①.



5. Remove lower side cover ②.



6. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Tipover Cover Fastener <b>18 ft-lbs (24 N·m)</b>

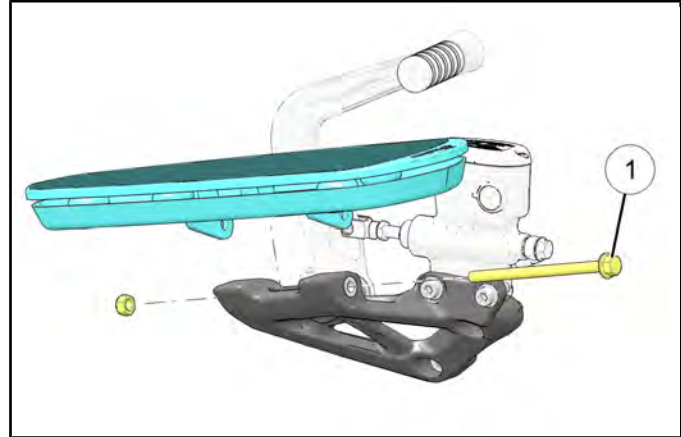
**FLOORBOARD REMOVAL / INSTALLATION**

Secure the motorcycle in an upright position.

For detailed floorboard assembly / disassembly information, reference **Floorboards page 7.6.**

**RIGHT**

1. Remove floorboard by removing its fastener ①.



2. Remove rear master cylinder. Reference **Rear Master Cylinder Service page 9.49.**

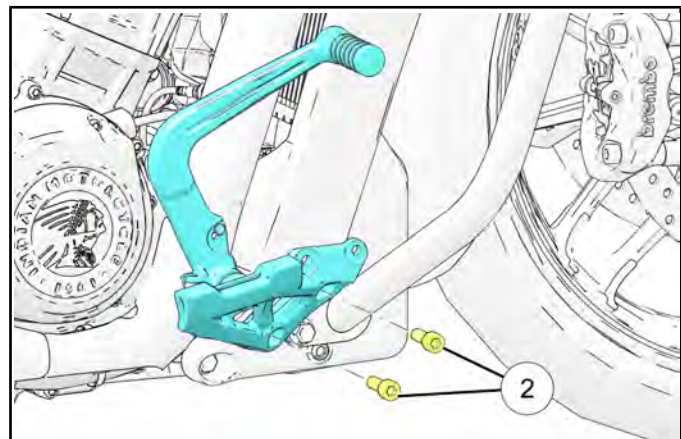
**IMPORTANT**

The brake line does NOT need to be disconnected.

**⚠ CAUTION**

Do not allow master cylinder to hang by the brake line.

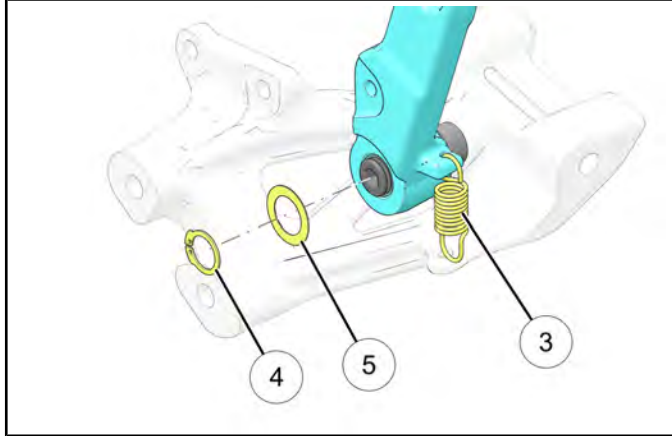
3. Remove the fasteners ② securing the floorboard bracket.



7



4. Remove return spring ③.



5. Remove snap ring ④ and washer ⑤.  
6. Remove brake pedal assembly off of pivot.

7. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Floorboard Bracket Fastener:  
**35 ft-lbs (47 N·m)**

**TORQUE**

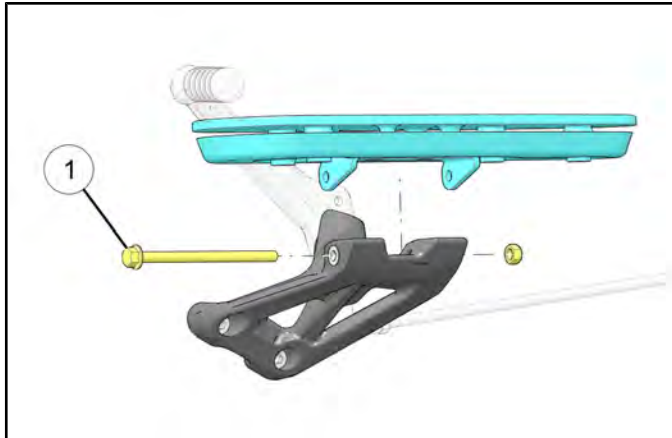
Master Cylinder Fastener (Rear):  
**18 ft-lbs (24 N·m)**

**TORQUE**

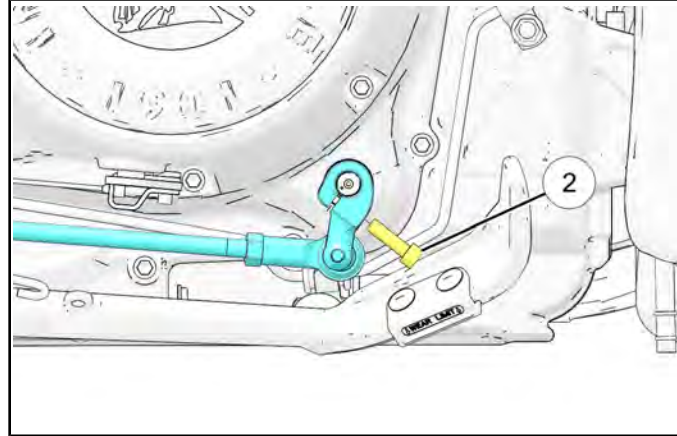
Floorboard Base Fastener:  
**18 ft-lbs (24 N·m)**

**LEFT**

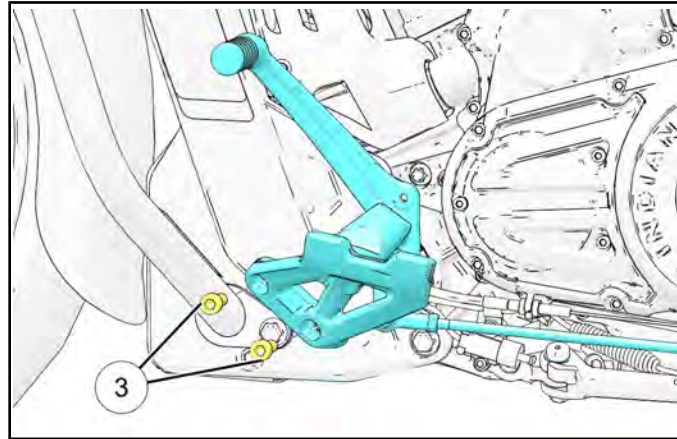
1. Remove floorboard by removing its fastener ①.



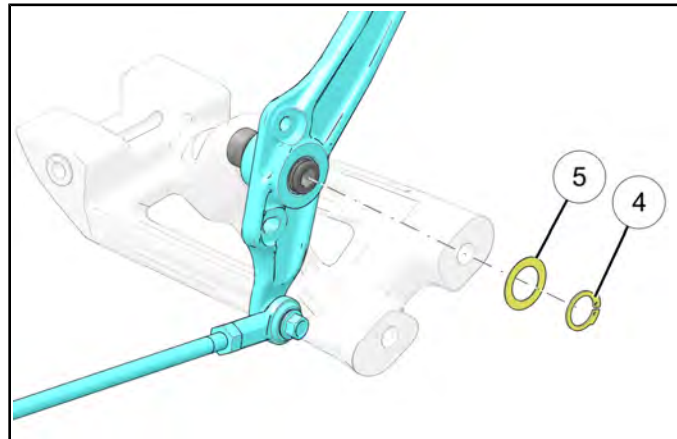
2. Remove fastener ② securing shift lever.



3. Remove the fasteners ③ securing the floorboard bracket.



4. Remove snap ring ④ and washer ⑤.



**5. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Floorboard Bracket Fastener: <b>35 ft-lbs (47 N·m)</b>

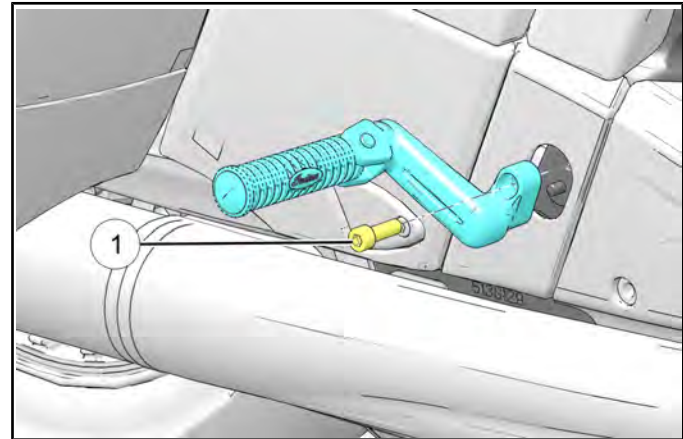
TORQUE
Shift Linkage Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Floorboard Base Fastener: <b>18 ft-lbs (24 N·m)</b>

**PASSENGER FOOT PEGS REMOVAL / INSTALLATION**

**REMOVAL**

1. Remove fastener ① securing foot peg bracket to frame.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

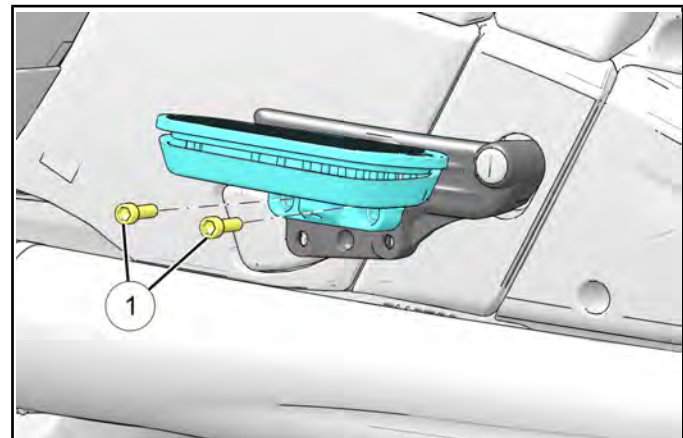
TORQUE
Passenger Foot Peg Fasteners: <b>35 ft-lbs (47 N·m)</b>

**7**

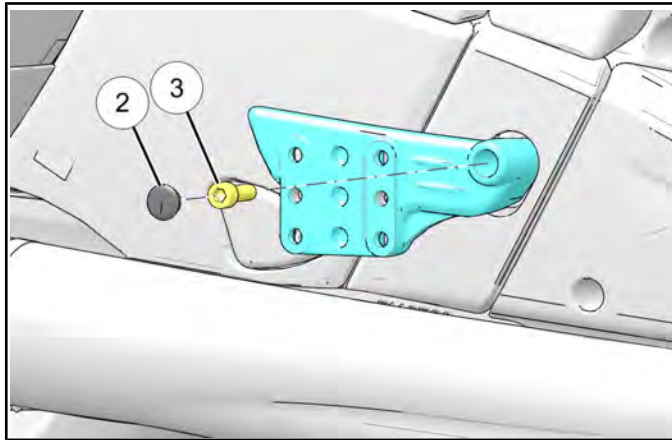
**PASSENGER FOOT PEGS REMOVAL / INSTALLATION (2022+)**

**REMOVAL**

1. Remove fastener ① securing floorboard pivot bracket to frame.



2. Remove Passenger Floorboard Mount by removing the plug ② and fastener ③.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

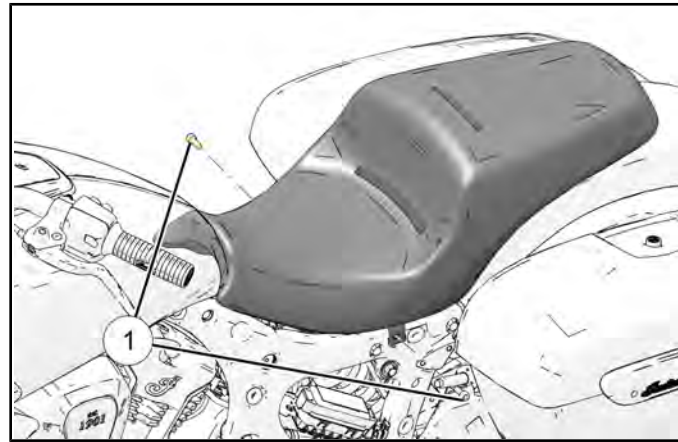
TORQUE
Passenger Floorboard Pivot Fastener: <b>19 ft-lbs (25 N·m)</b>

TORQUE
Passenger Floorboard Mount Fastener: <b>33 ft-lbs (45 N·m)</b>

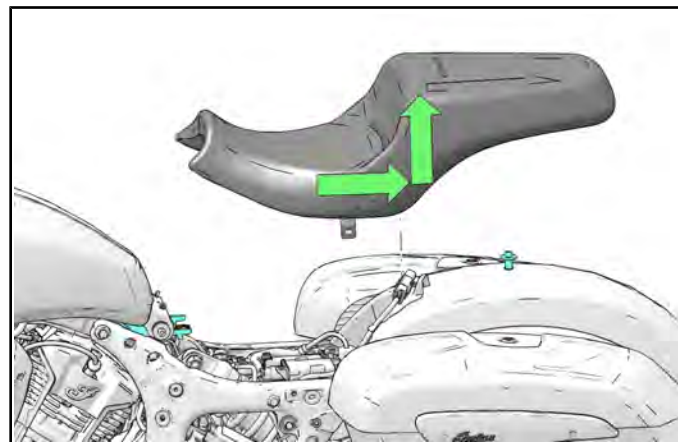
**SEAT REMOVAL / INSTALLATION**

**REMOVAL**

1. Remove side covers. See **Side Cover (Upper), Removal / Installation** page 7.27.
2. Remove seat fastener ①.



3. If equipped, disconnect seat electrical connector.
4. Remove the seat backward and up to remove.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

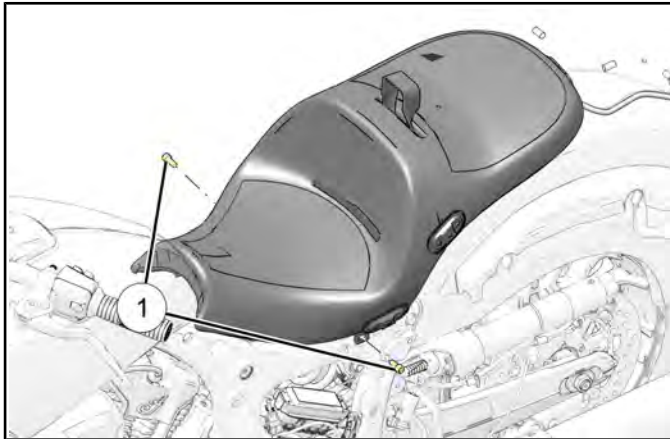
TORQUE
Seat Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Tipover Cover Fastener: <b>18 ft-lbs (24 N·m)</b>

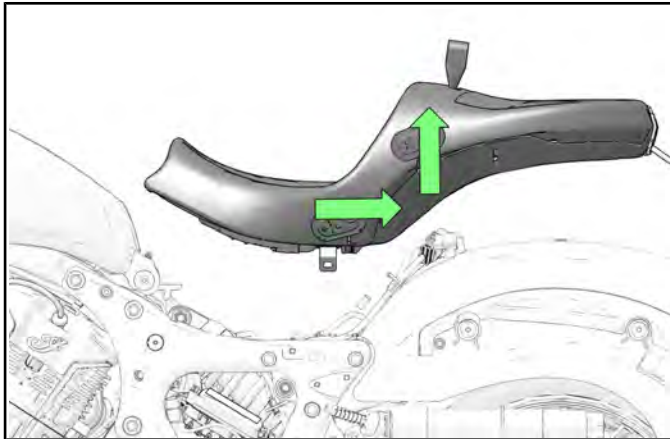
## SEAT REMOVAL / INSTALLATION (TOURING)

### REMOVAL

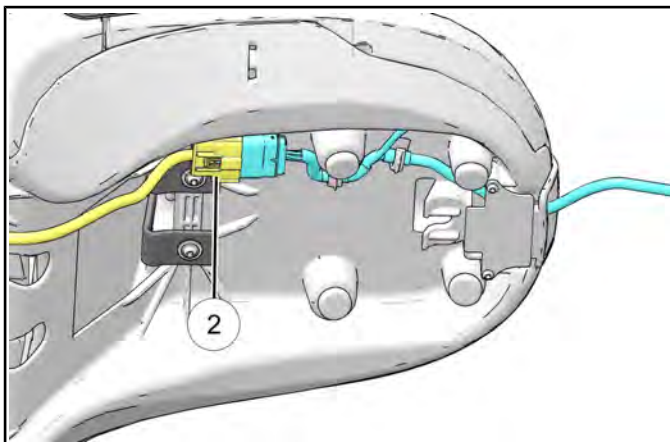
1. Remove Trunk. See **Trunk Removal / Installation page 7.33.**
2. Remove side covers. See **Side Cover (Upper), Removal / Installation page 7.27.**
3. Remove seat fastener ①.



4. Move the seat backward and up to disconnect from bike.



5. Disconnect seat electrical connector.



### INSTALLATION

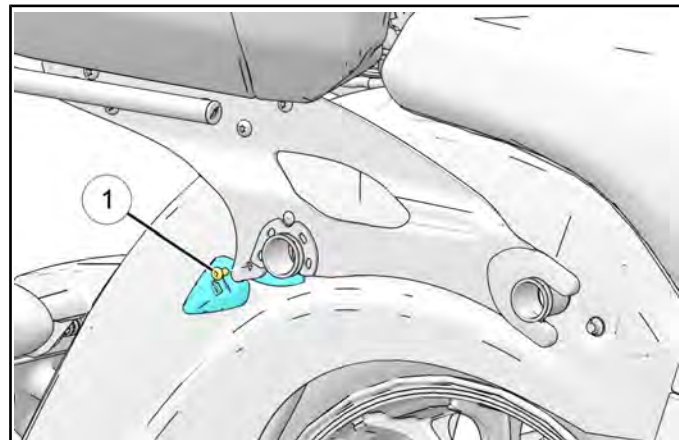
1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Seat Fastener: 18 ft-lbs (24 N·m)

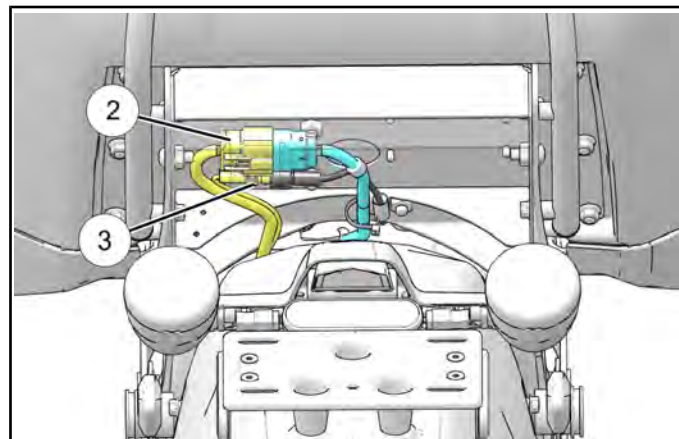
TORQUE
Tipover Cover Fastener: 18 ft-lbs (24 N·m)

### TRUNK REMOVAL / INSTALLATION

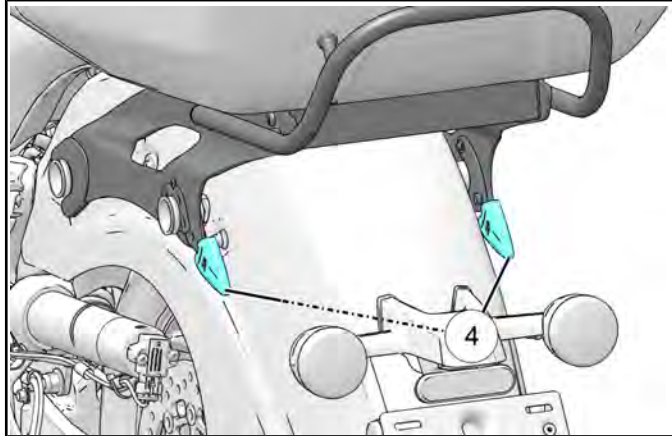
1. If applicable, remove the left and right saddlebags. See **Saddlebag Removal / Installation page** .
2. Remove the trunk lock fastener ① from each trunk latch.



3. Disconnect the trunk harness ② and the antenna connector ③.



- Lift the trunk latches ④ to unlock the trunk from the mount.



- Lift up on the rear of the trunk and slide rearward to release the trunk from the motorcycle.
- Installation is performed by reversing the removal procedure.**

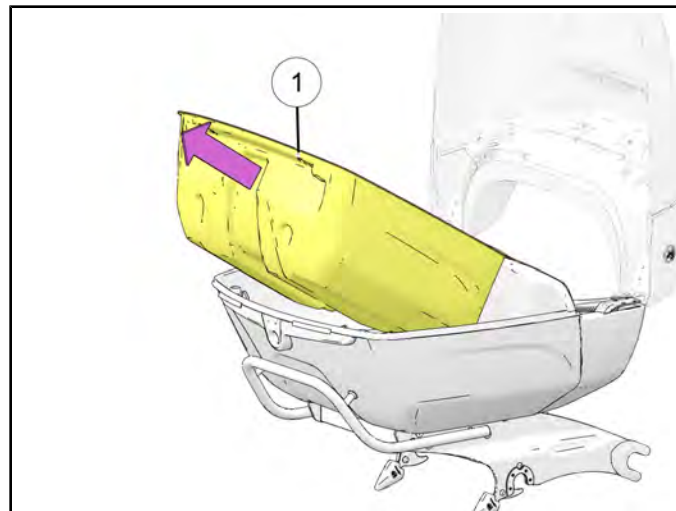
## TRUNK LOCK REPLACEMENT

### NOTICE

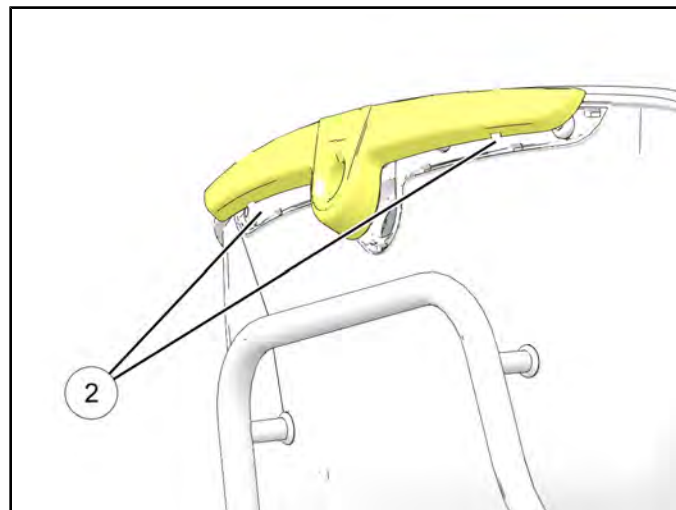
It is recommended that the trunk is removed from the motorcycle prior to disassembly. See TRUNK REMOVAL as outlined in this chapter.

### REMOVAL

- Remove the trunk from the motorcycle and place on flat work surface.
- Open the trunk lid completely.
- Lift the trunk liner ① up to remove from trunk base.



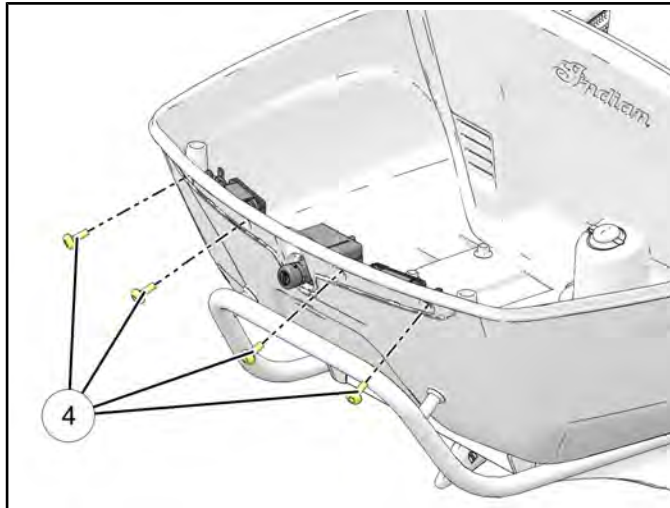
- Insert body panel tool (PV-49955) or similar into the relief holes ② cut into the bezel and gently pry bezel off of the trunk base.



### NOTICE

Bezel is held in place with pressure sensitive adhesive. It will be necessary to replace the adhesive with a suitable alternative (e.g. double sided tape) when the bezel is reinstalled.

5. Remove the four fasteners ④ securing the lock assembly to the trunk.



6. Remove the latch and lock actuator together as an assembly.
7. If replacing individual components, disconnect the lock actuator cable from the latch assembly to separate the components.

### INSTALLATION

1. Install the latch / lock actuator assembly and tighten fasteners finger-tight.
2. Torque latch fasteners to specification following the torque sequence.

TORQUE
Trunk Latch Fasteners: <b>18 ft-lbs (24 N·m)</b>



3. If installing a new latch bezel:
  - Peel protective layer off of pressure sensitive adhesive
  - Press bezel into place on the trunk bin with constant and even pressure and hold for 30 seconds.
4. Install trunk liner.
5. Operate lock and latch assembly to verify proper operation.

7

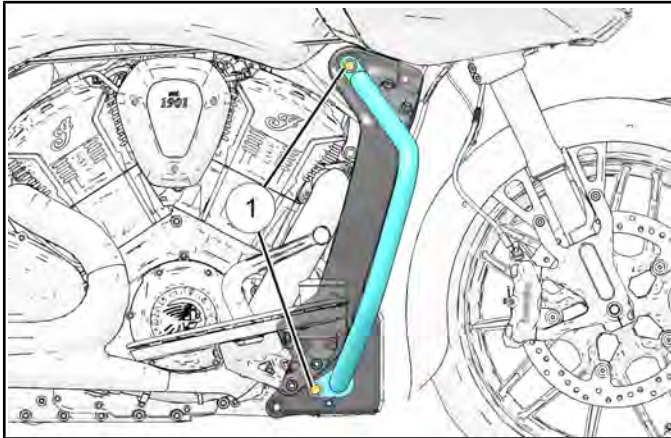
## HIGHWAY BAR REMOVAL / INSTALLATION

**⚠ CAUTION**

Protect chrome and painted surfaces prior to removal, particularly the front fender.

### REMOVAL

1. If equipped, remove lower fairing. See **Lower Fairing Removal / Installation page 7.53.**
2. Remove the fastener ① retaining highway bar assembly.



### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Highway Bar Fastener:  
**45 ft-lbs (61 N·m)**

## FRONT FENDER REMOVAL / INSTALLATION

### NOTICE

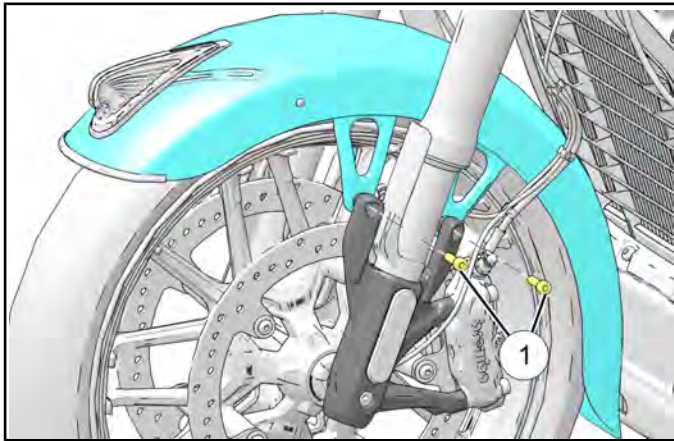
Motorcycle should be parked on a level surface resting on the side stand.

### CAUTION

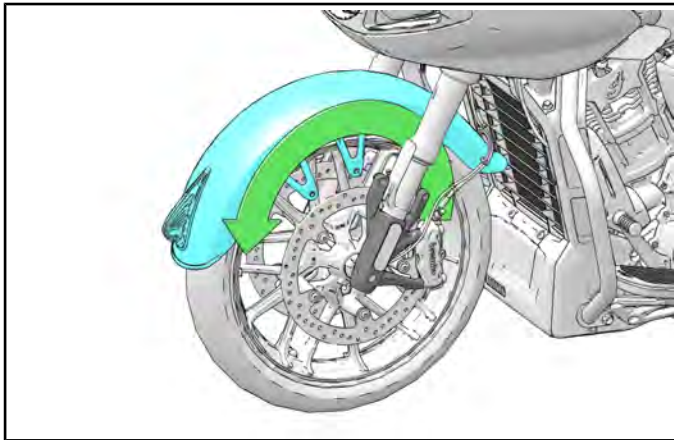
Use care not to scratch or damage painted surfaces during fender removal and / or installation.

### REMOVAL

1. Remove fasteners ① from each side of the motorcycle securing the fender.



2. Follow the fender light harness up into the fairing, locate the connector and disconnect.
3. Rotate the fender forward and remove.



## INSTALLATION

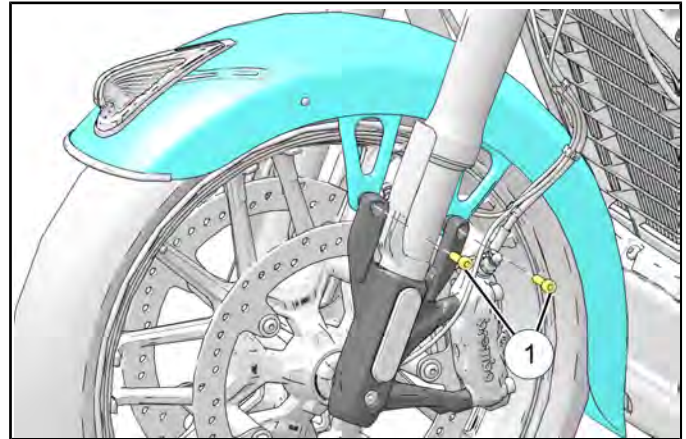
### NOTICE

Motorcycle should be parked on a level surface resting on the side stand.

### CAUTION

Use care not to scratch or damage painted surfaces during fender removal and / or installation.

1. Rotate the fender into position between the two front forks.
2. Connect the electrical connector to the fender light harness.
3. Install fasteners ① to each side of the motorcycle securing the fender. Torque fasteners to specification



### TORQUE

Fender Fastener (Front):  
18 ft-lbs (24 N·m)

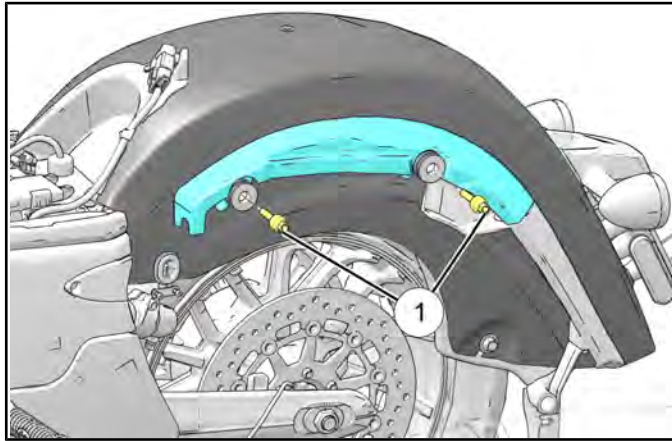
7



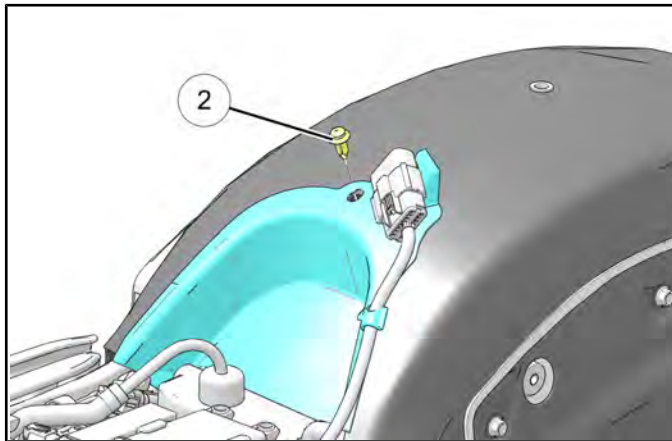
## REAR FENDER REMOVAL / INSTALLATION

### REMOVAL

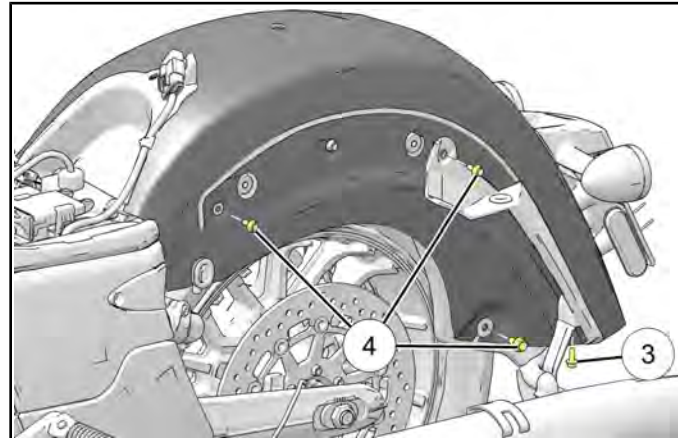
1. Disconnect the antenna cable from the mast.
2. Remove seat. See **Seat Removal / Installation page 7.32.**
3. Remove saddlebags. See **Saddlebag Removal / Installation page**
4. Remove upper fender closeout by removing fastener ①.



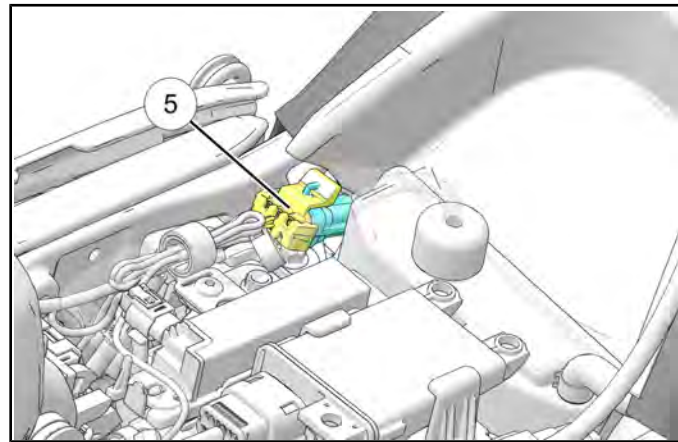
5. Remove push pin ②.



6. Remove closeout support fastener ③.



7. Remove fender fasteners ④.
8. Disconnect the electrical connector ⑤.



9. Remove fender.

**⚠ CAUTION**

Be careful not to damage painted surfaces.

**INSTALLATION****⚠ CAUTION**

Use care not to scratch or damage painted surfaces during fender removal and / or installation.

- 1. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Fender Closeout Lower Fastener:  
**84 in-lbs (10 N·m)**

**TORQUE**

Fender Fastener (Rear) M6:  
**84 in-lbs (10 N·m)**

**TORQUE**

Fender Fastener (Rear) M8:  
**18 ft-lbs (24 N·m)**

## FAIRING DISASSEMBLY

### NOTICE

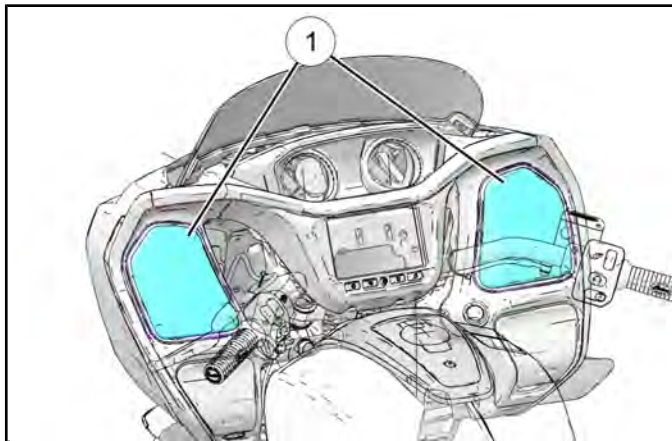
These sections are separated for ease of use. To fully disassemble the fairing, follow the procedures in order or to remove the fairing as an assembly, see **Fairing Removal / Installation page 7.50.**

### NOTICE

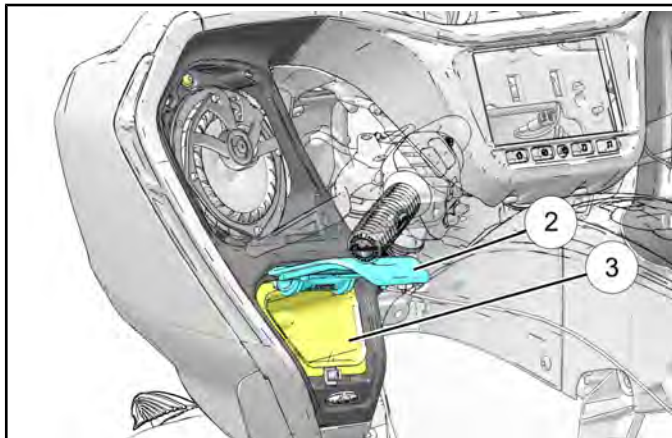
Place the power windshield in the FULL UP position prior to fairing removal.

## OUTER FAIRING

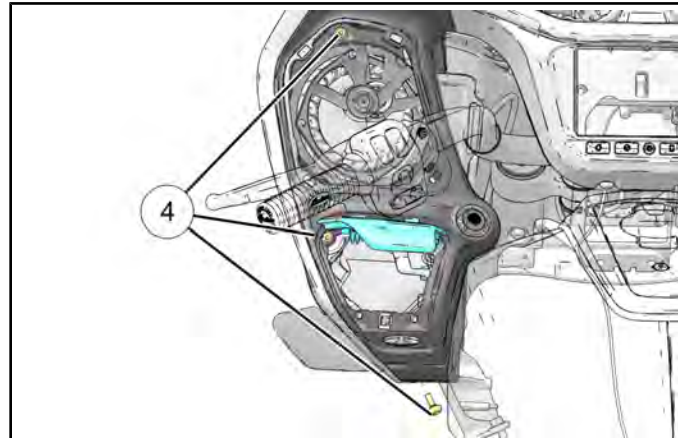
1. Carefully pry off speaker bezels ①.



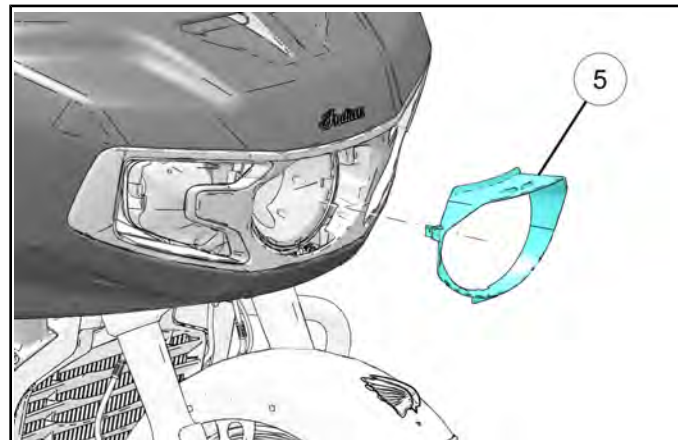
2. Open storage door ② and remove storage liner ③.



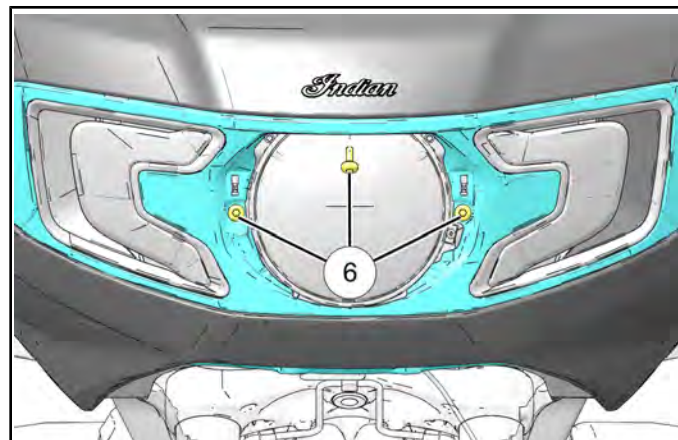
3. Remove outer fairing fasteners ④.



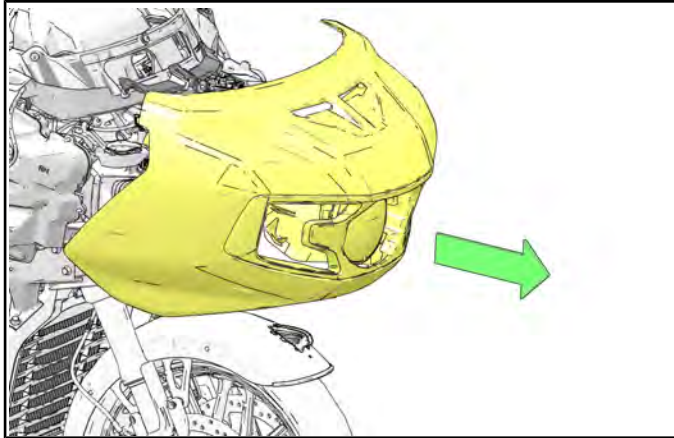
4. Repeat steps 2-3 for the remaining side.
5. Remove headlight bezel ⑤ by prying down at the top center to release the snap and then pull forward to release the side body clips.



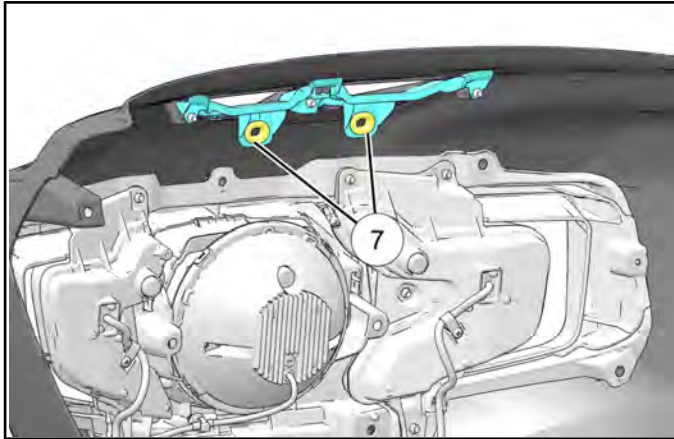
6. Remove outer fairing fasteners ⑥.



- Carefully move the outer fairing forward and unplug the headlight and turn signal electrical connection.



- Lubricate rubber grommets ⑦ in upper duct upon installation.



- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Outer Fairing Fastener ④:  
**36 in-lbs (4 N·m)**

**TORQUE**

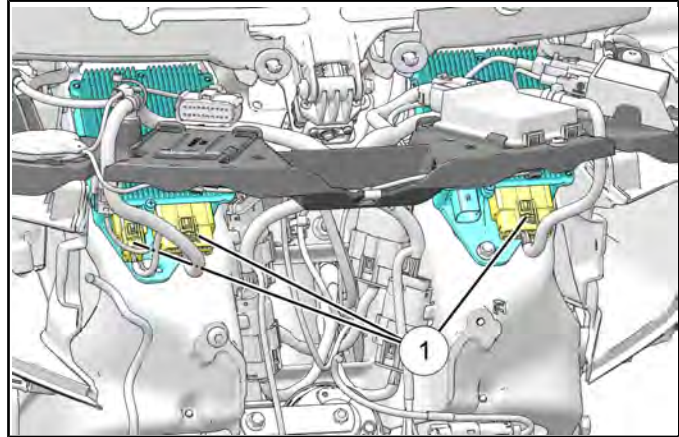
Headlight Bezel Assembly Fastener ⑥:  
**36 in-lbs (4 N·m)**

**FAIRING TRAY**

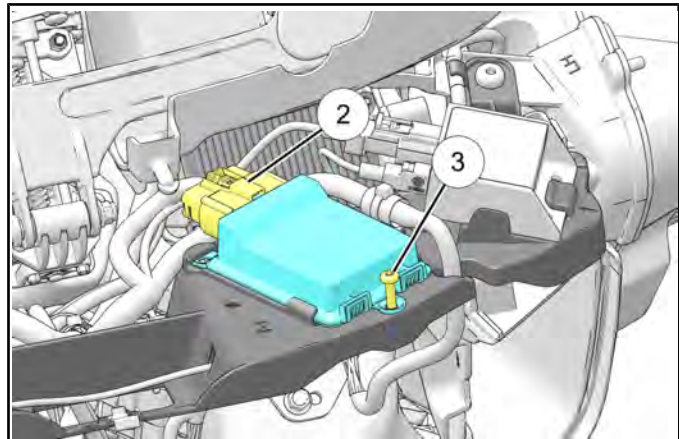
- Disconnect power supply module electrical connectors ①.

**NOTICE**

Not all models will have multiple power supply modules.



- Disconnect VCM2 electrical connector ②.

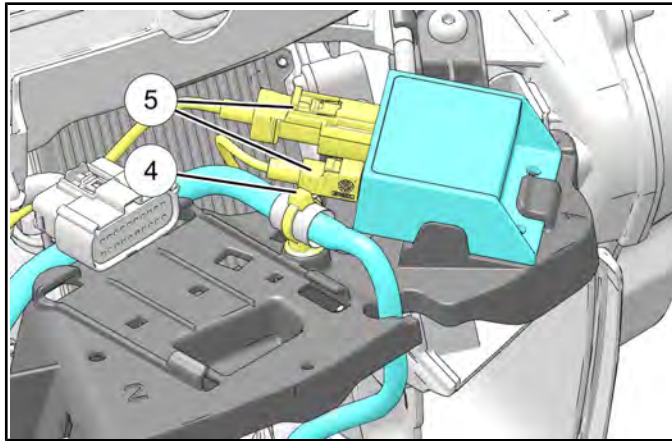


- Remove VCM2 by removing its fastener ③.
- If equipped, disconnect VMC3 electrical connector and remove fastener.

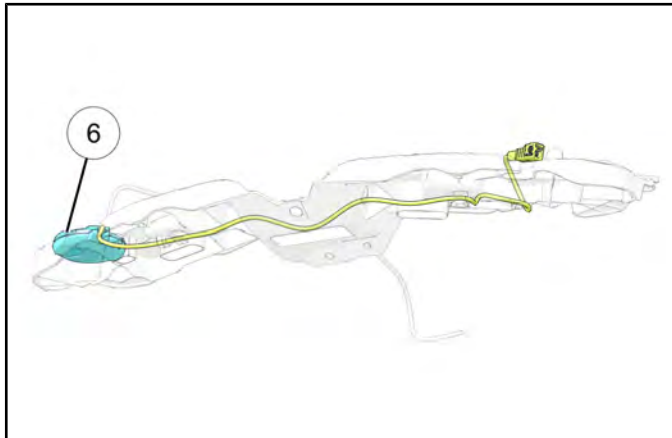
7

## FRAME / BODY

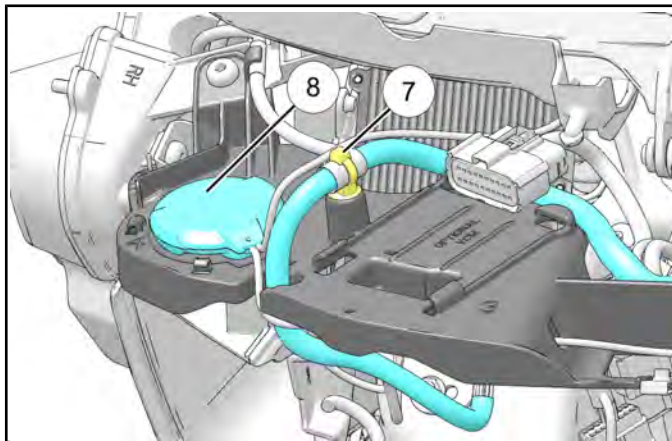
5. Disconnect Christmas tree clip ④ retaining wiring harness to fairing tray.



6. Disconnect Cell modem electrical connectors ⑤ and remove modem if applicable.
7. Route the smaller violet cell modem / GPS antenna electrical connector through the fairing tray to the antenna ⑥.

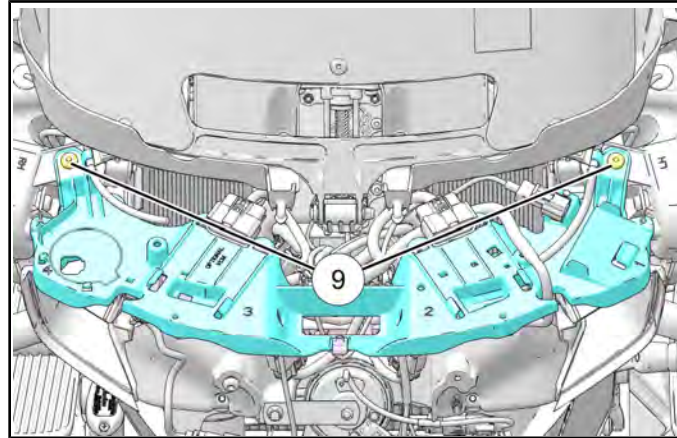


8. Disconnect Christmas tree clip ⑦ retaining wiring harness to fairing tray.



9. Remove antenna ⑧.

10. Remove fasteners ⑨ securing fairing tray.



11. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

### TORQUE

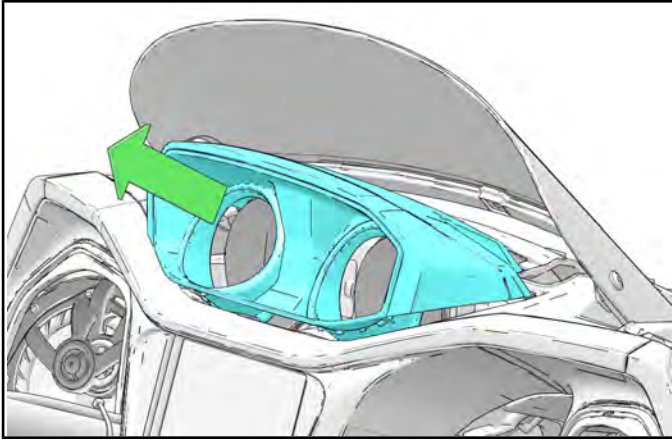
Fairing Tray Fastener ⑨:  
**36 in-lbs (4 N·m)**

### TORQUE

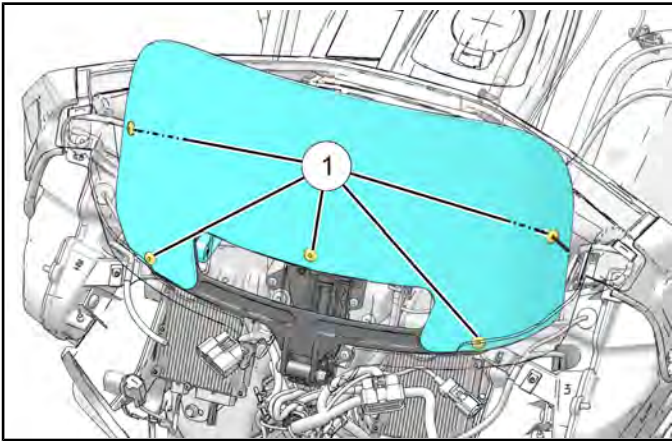
VCM2 Fastener ③:  
**15 in-lbs (2 N·m)**

**VISOR TOP**

1. Push up at the top rear of the gauge hood and remove.

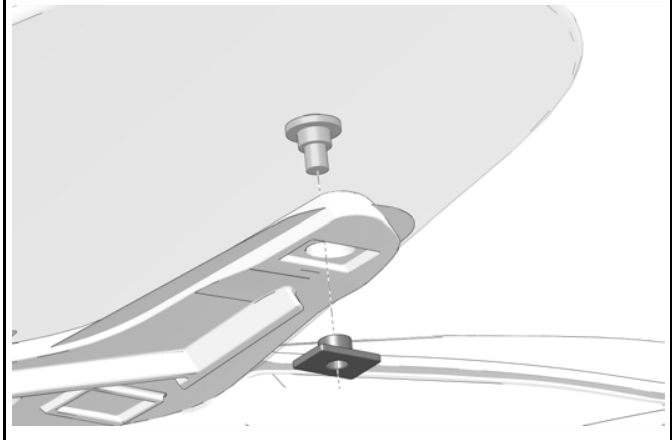


2. Remove windshield by removing its fasteners ①.

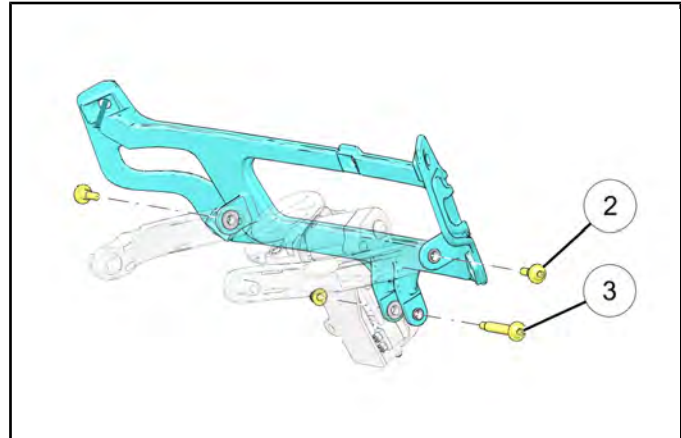


**NOTICE**

When removing the five windshield fasteners be sure to capture the T-nuts as they are not captive.

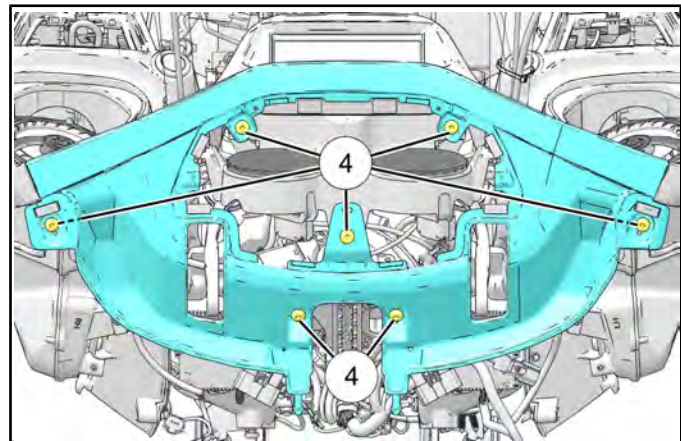


3. Remove windshield support by removing link fasteners ②.



4. Remove windshield support to windshield motor fastener ③.

5. Remove fasteners ④ securing visor top.



6. Disconnect the visor top from its four trim clips by gently prying the visor top off the unit and remove.

7

**7. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Visor Top Fastener ④: <b>36 in-lbs (4 N·m)</b>

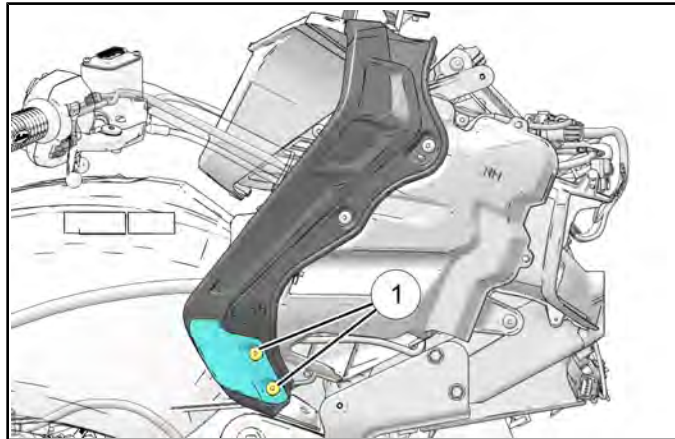
TORQUE
Windshield Support to Link Fastener ②: <b>84 in-lbs (10 N·m)</b>

TORQUE
Windshield Support to Motor Fastener ③: <b>84 in-lbs (10 N·m)</b>

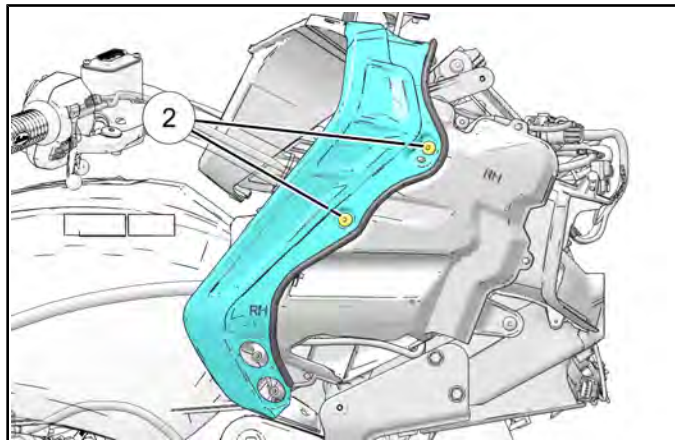
TORQUE
Windshield Fastener ①: <b>36 in-lbs (4 N·m)</b>

**DASH TRIM**

1. Remove fasteners ① securing air deflector.



2. Remove dash trim fasteners ②.



3. Pull on the dash trim to release it from the retention feature.

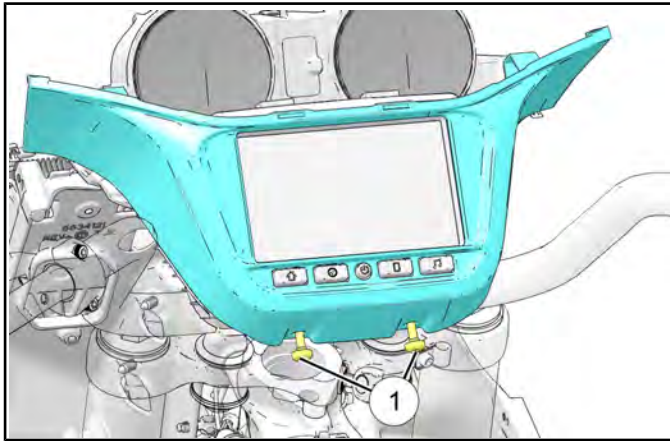
**4. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Dash Trim Fastener ②: <b>36 in-lbs (4 N·m)</b>

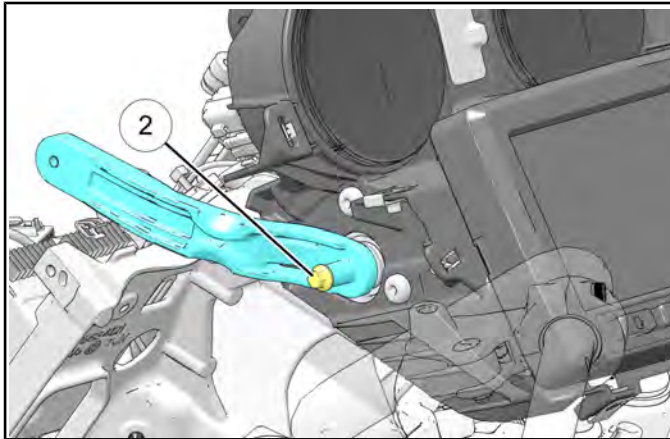
TORQUE
Air Deflector Fastener ①: <b>36 in-lbs (4 N·m)</b>

**DASH SUPPORT ASSEMBLY**

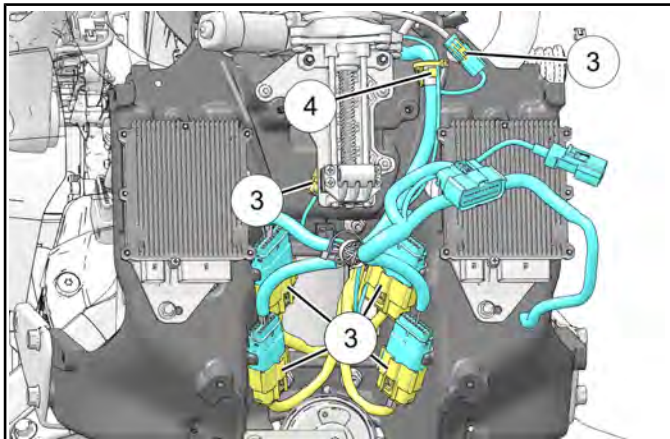
1. Remove display bezel by removing its fasteners ①.



2. Remove the windshield link by removing its fastener ②. Repeat step for remaining side.

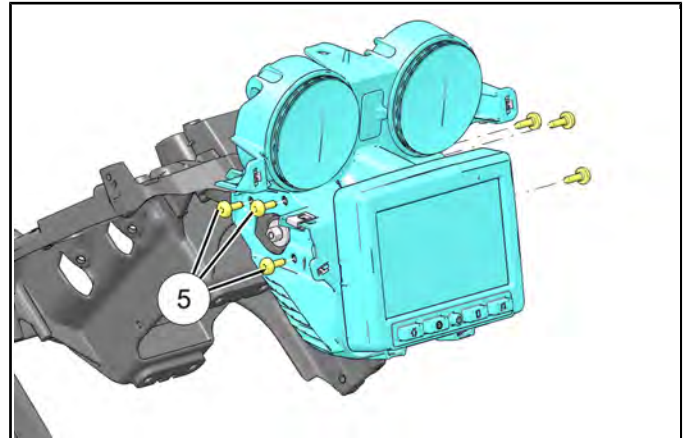


3. Disconnect the harness electrical connectors ③ and disconnect the routing clip ④.

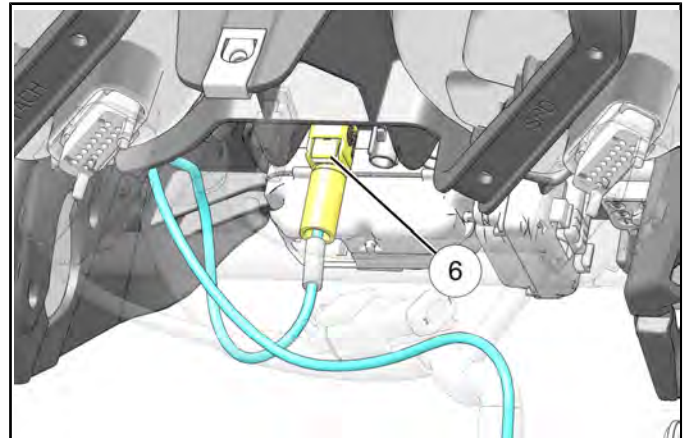


4. Disconnect harness retention clips from fairing bracket.

5. Remove the dash support assembly fasteners ⑤.



6. Remove the dash support assembly with the wiring harness. Upon removal, disconnect the antenna electrical connector ⑥ from the back of the display.



7. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Dash Support Assembly Fastener ⑤:  
**36 in-lbs (4 N·m)**

**TORQUE**

Windshield Link to Pivot Fastener ②:  
**84 in-lbs (10 N·m)**

**TORQUE**

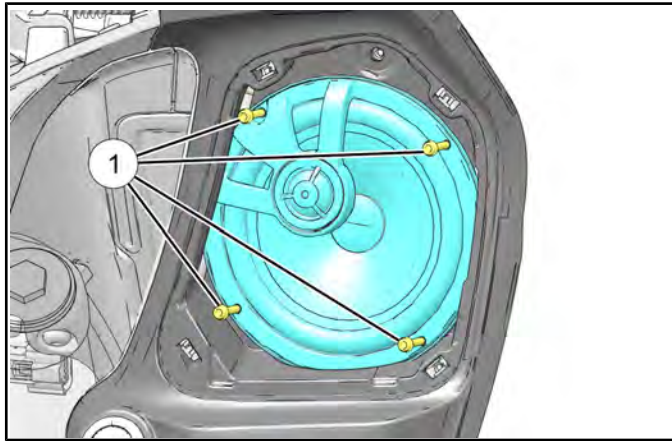
Display Bezel Fastener ①:  
**36 in-lbs (4 N·m)**

7

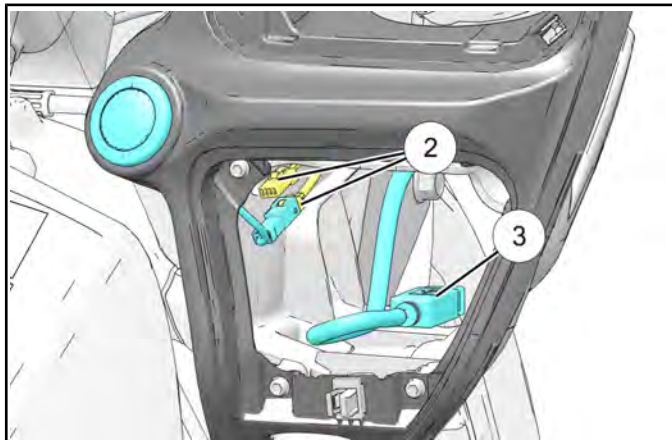


**RIGHT HAND DASH**

1. Remove fasteners ① securing speaker.



2. Disconnect speaker electrical connector upon removal.
3. Disconnect electrical connectors ②.

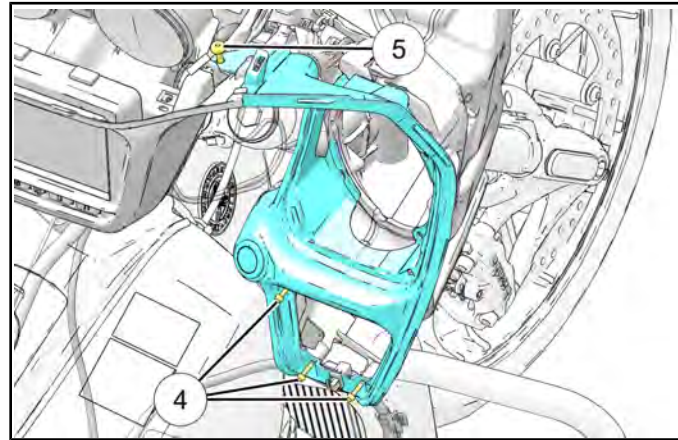


**IMPORTANT**

For model year 2021 units, the battery charge port must be replaced, Reference **Battery Charge Port Removal / Installation** page 10.22.

4. Route the USB charger ③ to its point of origin.

5. Remove the lower right hand dash fasteners ④ and upper dash fastener ⑤.



6. Remove the right hand dash.
7. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

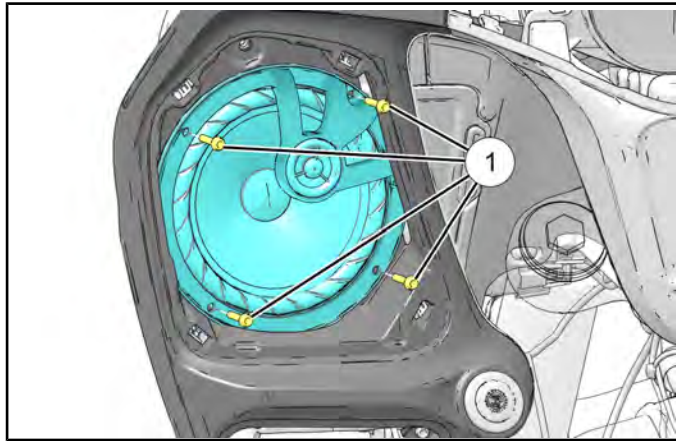
TORQUE
Right/Left Dash Fastener ④: <b>25 in-lbs (3 N·m)</b>

TORQUE
Upper Dash Fastener ⑤: <b>36 in-lbs (4 N·m)</b>

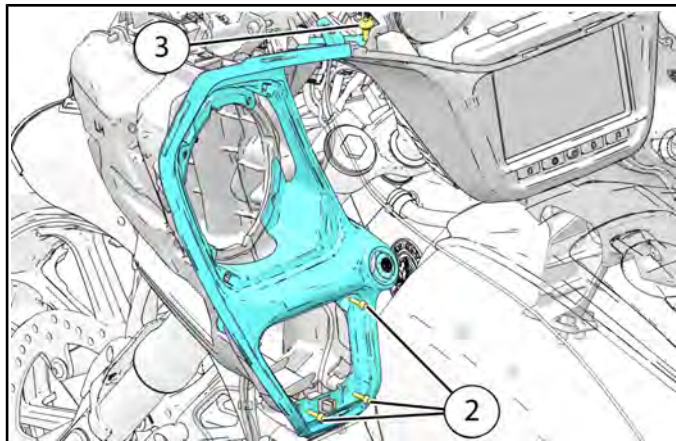
TORQUE
Speaker Fastener ①: <b>25 in-lbs (3 N·m)</b>

**LEFT HAND DASH**

1. Remove fasteners ① securing speaker.



2. Disconnect speaker electrical connector upon removal.
3. Remove the lower left hand dash fasteners ② and upper dash fastener ③.



4. Remove the left hand dash.
5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Right/Left Dash Fastener ②:  
25 in-lbs (3 N·m)

**TORQUE**

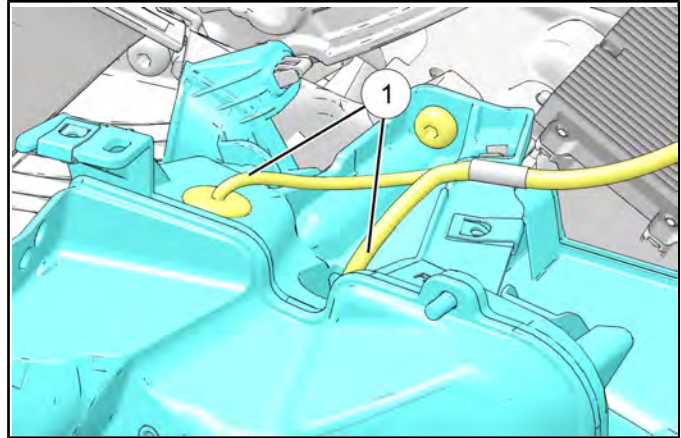
Upper Dash Fastener ③:  
36 in-lbs (4 N·m)

**TORQUE**

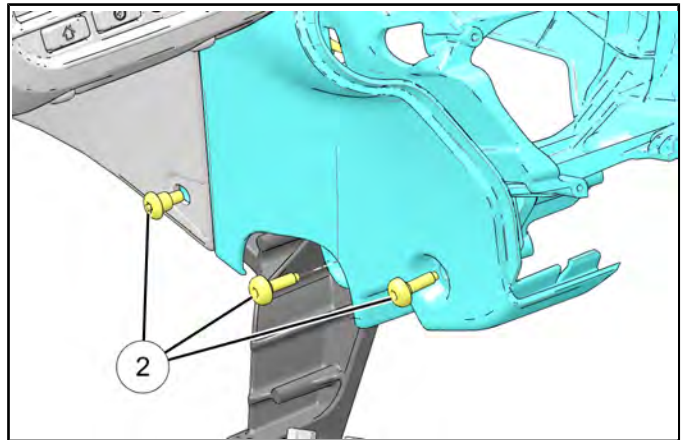
Speaker Fastener ①:  
25 in-lbs (3 N·m)

**ENCLOSURE DUCT ASSEMBLY**

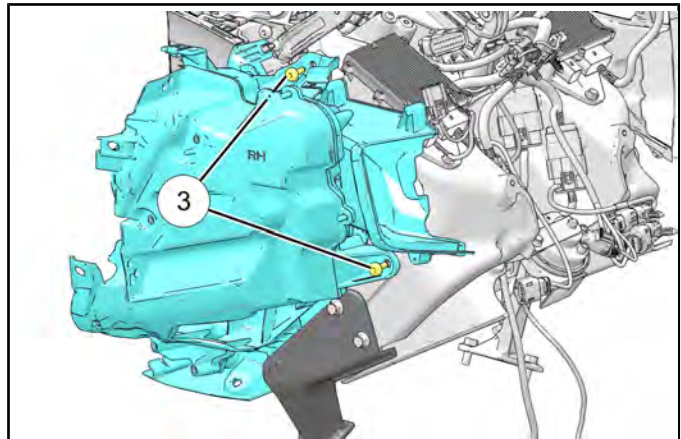
1. Remove the wiring harness ① from the enclosure duct.



2. Remove lower close off fasteners ② from fairing support.

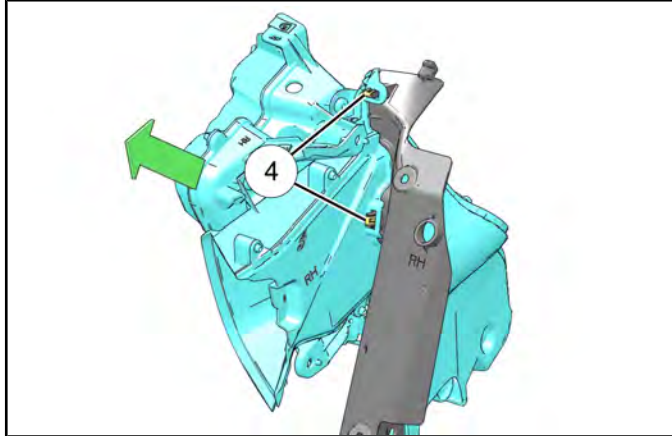


3. Remove enclosure duct fasteners ③.

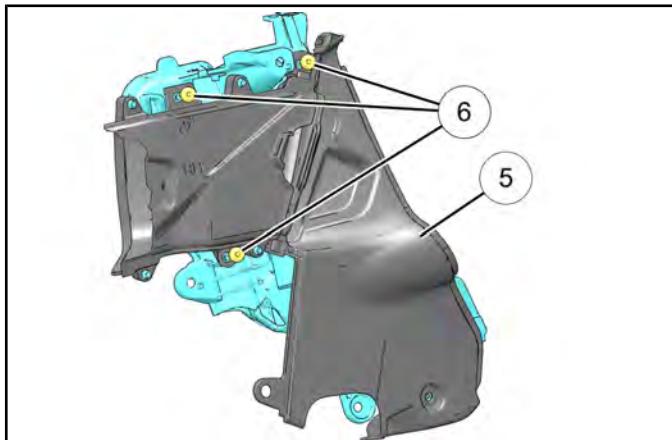


7

- Pull up on the enclosure duct assembly to remove it from its retention features ④.



- With the assembly removed, the outer duct ⑤ can be removed by removing its fasteners ⑥.



- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

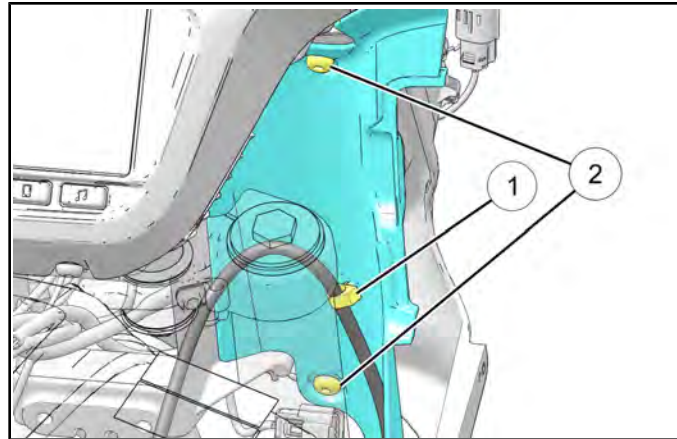
TORQUE
Outer Duct Fastener ⑥: <b>36 in-lbs (4 N·m)</b>

TORQUE
Enclosure Fastener ③: <b>36 in-lbs (4 N·m)</b>

TORQUE
Dash Closeout Fastener ②: <b>36 in-lbs (4 N·m)</b>

### **DASH CLOSEOUT**

- Remove brake line silencer clip ①.

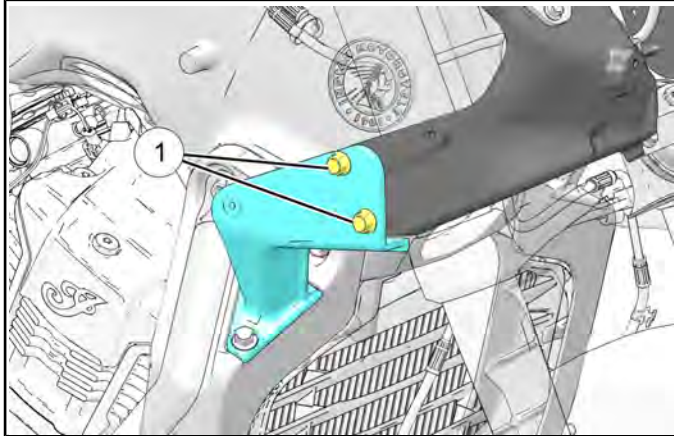


- Remove dash closeout fasteners ② and remove.
- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

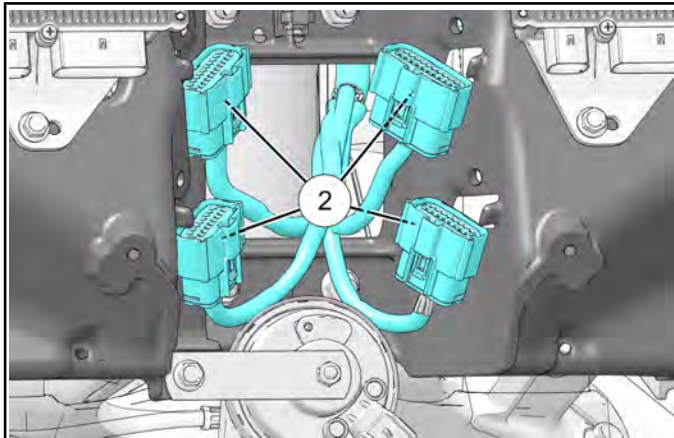
TORQUE
Dash Closeout Fastener ②: <b>36 in-lbs (4 N·m)</b>

**FAIRING BRACKET**

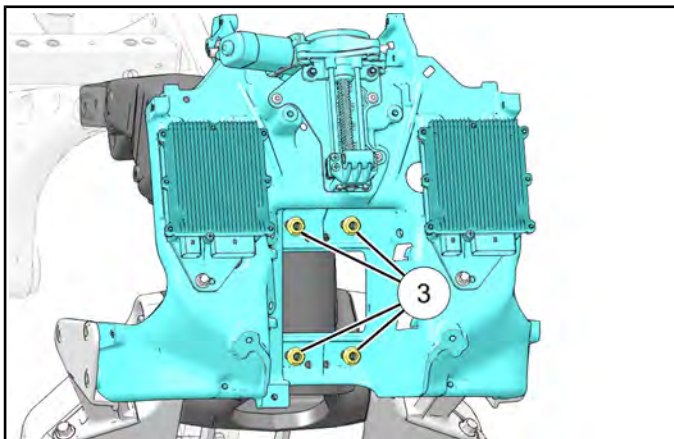
1. Remove fasteners ① securing fairing support to fairing bracket. Repeat step for remaining side.



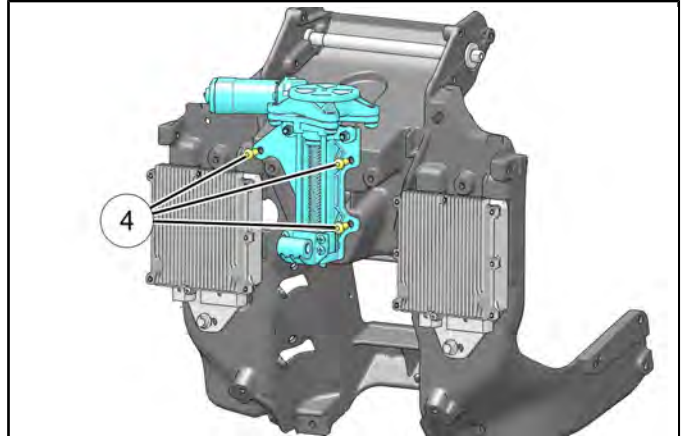
2. Route the harness electrical connectors ② through the opening in the fairing bracket.



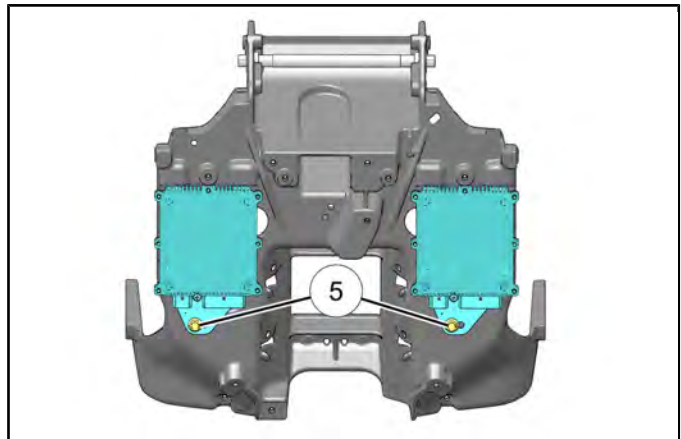
3. Remove nuts ③ securing fairing bracket to frame.



4. Remove windshield motor by removing its fasteners ④.



5. Remove power supply by removing its fastener ⑤.



6. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Power Supply Fastener ⑤:  
**84 in-lbs (10 N·m)**

**TORQUE**

Windshield Motor Fastener ④:  
**84 in-lbs (10 N·m)**

**TORQUE**

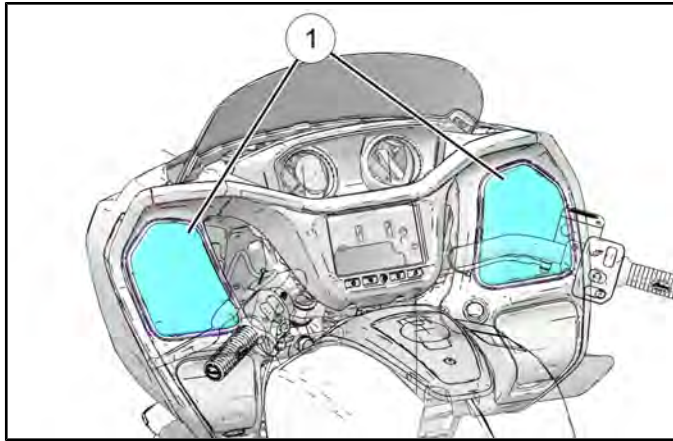
Fairing Bracket Nut ③:  
**18 ft-lbs (24 N·m)**

**TORQUE**

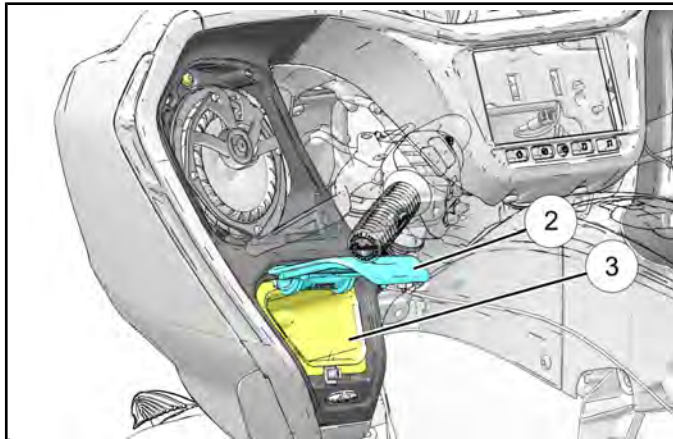
Fairing Support to Fairing Bracket Fastener ①:  
**18 ft-lbs (24 N·m)**

**FAIRING REMOVAL / INSTALLATION**

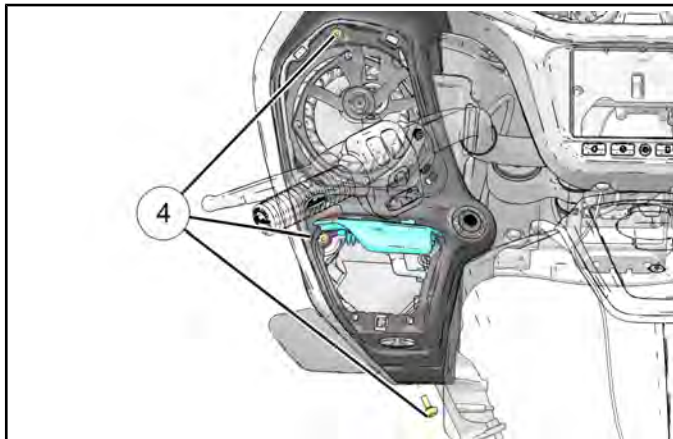
1. Carefully pry off speaker bezels ①.



2. Open storage door ② and remove storage liner ③.

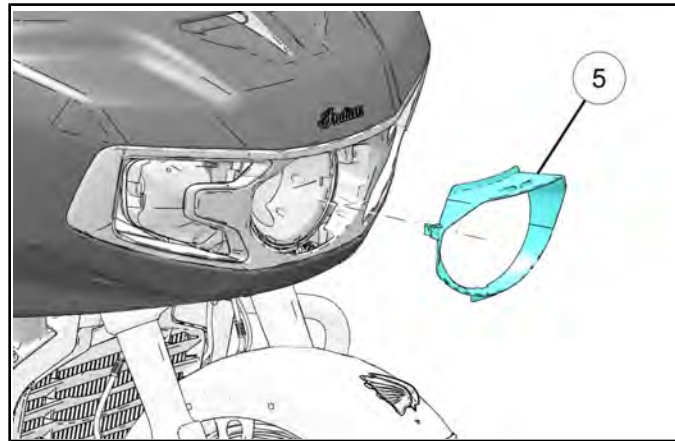


3. Remove outer fairing fasteners ④.

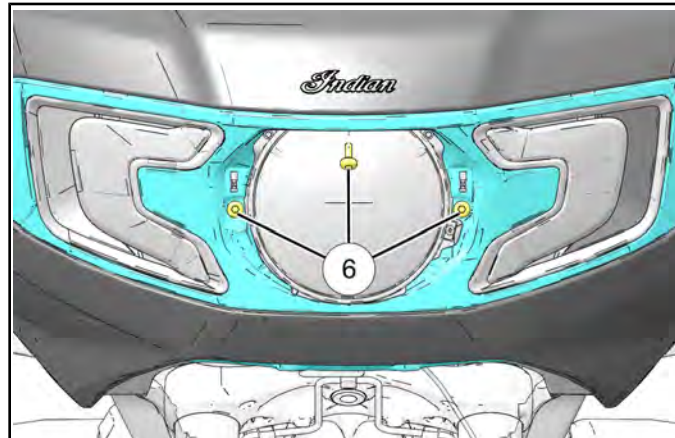


4. Repeat steps 2-3 for the remaining side.

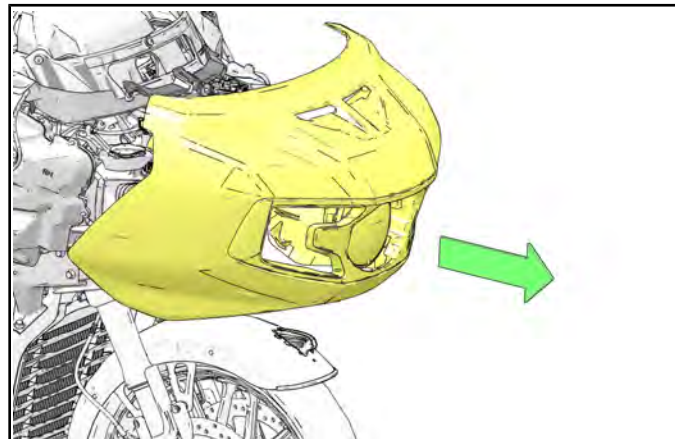
5. Remove headlight bezel ⑤ by prying down at the top center to release the snap and then pull forward to release the side body clips.



6. Remove outer fairing fasteners ⑥.

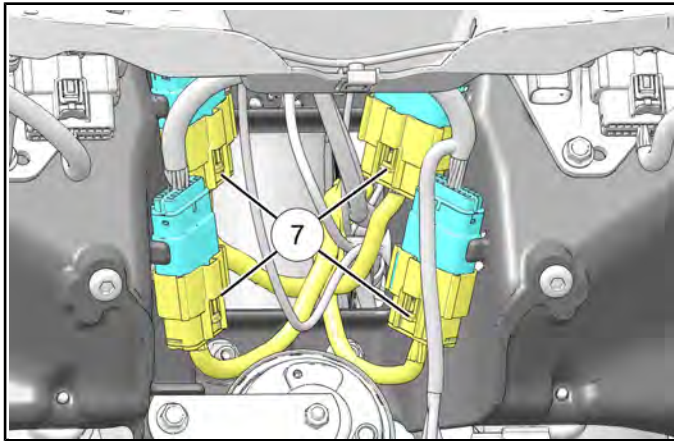


7. Carefully move the outer fairing forward and unplug the headlight and turn signal electrical connection.

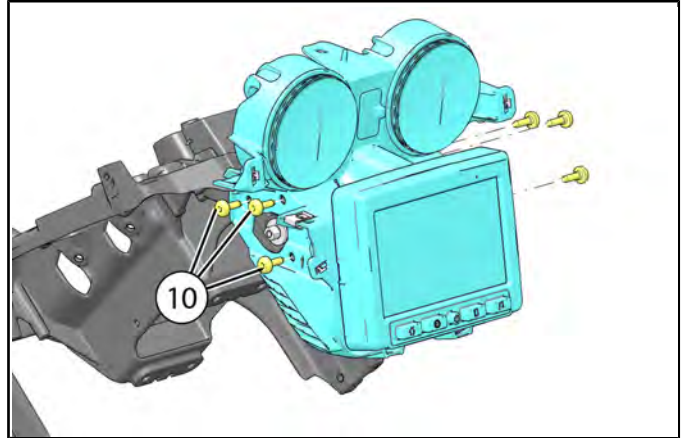


8. Remove Visor top. Reference **Fairing Disassembly** page 7.40.

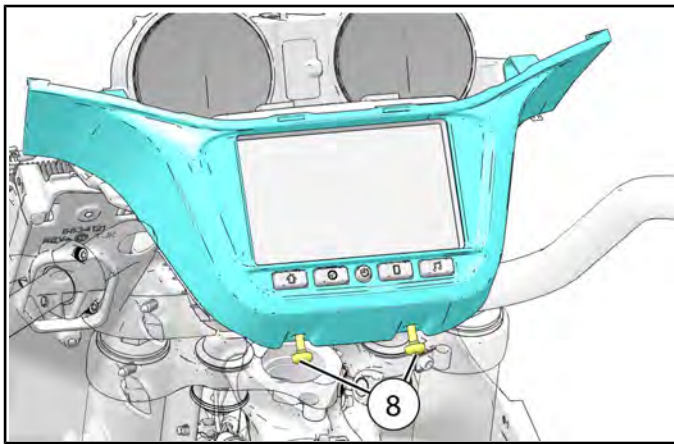
9. Disconnect the electrical connections ⑦ and push them through the opening of the fairing bracket.



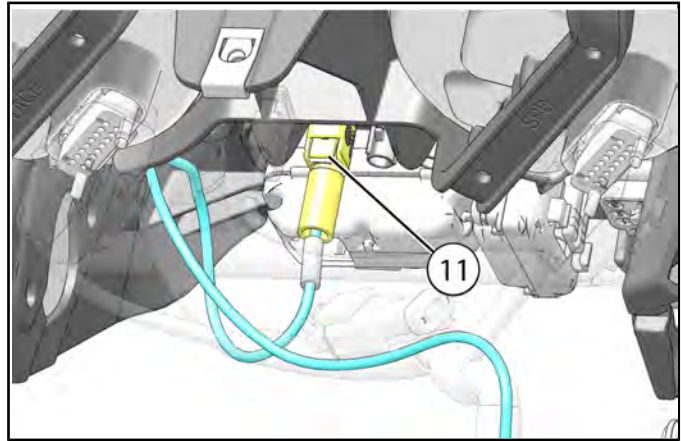
12. Remove the dash support assembly fasteners ⑩.



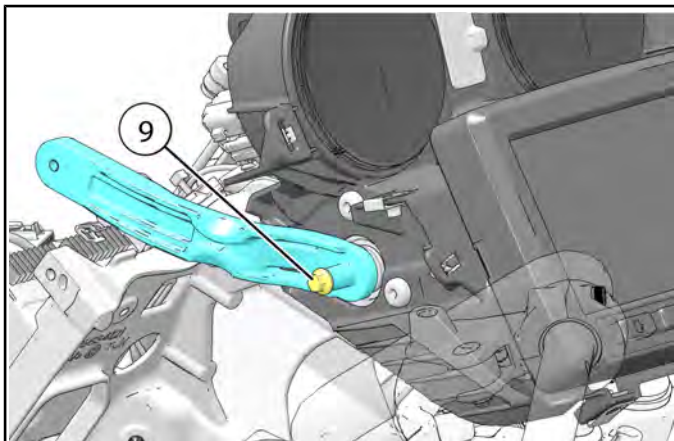
10. Remove display bezel by removing its fasteners ⑧.



13. Lift up the assembly to access the antenna electrical connector ⑪ and disconnect.

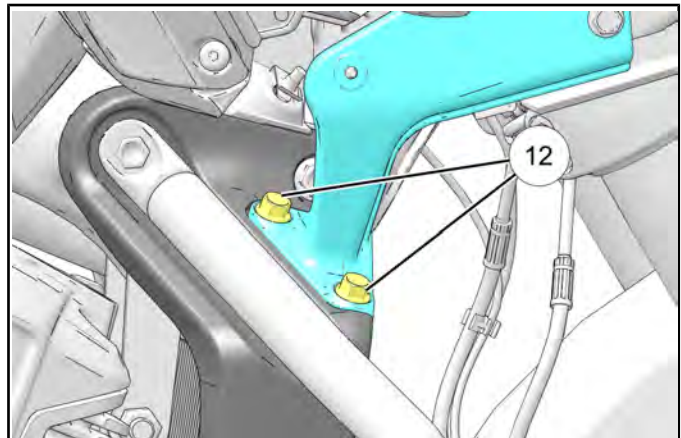


11. Remove the windshield link by removing its fastener ⑨. Repeat step for remaining side.



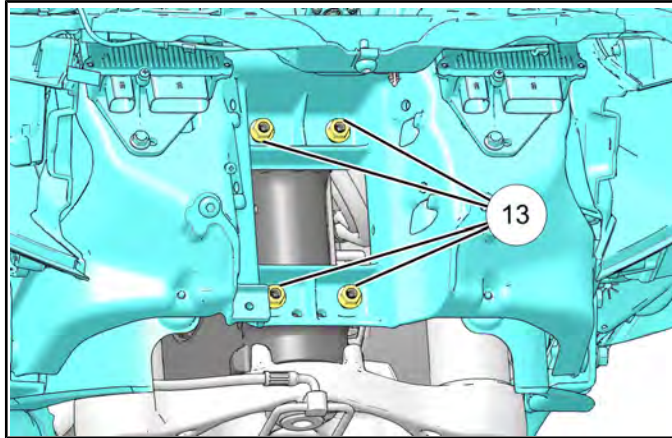
14. Route the antenna electrical connector through the fairing bracket opening.

15. Remove four fairing support fasteners ⑫. Repeat step for opposite side.

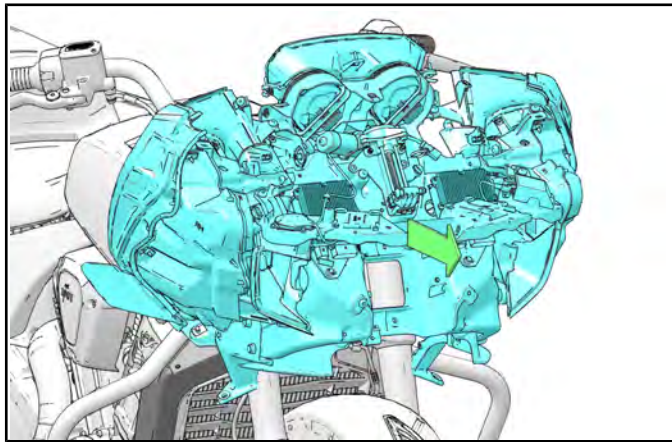


7

16. Remove fairing bracket fasteners ⑬.



17. Remove fairing assembly from the unit.



18. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.

**TORQUE**

Fairing Bracket Nut:  
**18 ft-lbs (24 N·m)**

**TORQUE**

Fairing Support To downcast Fastener:  
**18 ft-lbs (24 N·m)**

**TORQUE**

Dash Support Fasteners:  
**36 in-lbs (4 N·m)**

**TORQUE**

Windshield Support to Link Fastener :  
**84 in-lbs (10 N·m)**

**TORQUE**

Display Bezel Fastener:  
**36 in-lbs (4 N·m)**

**TORQUE**

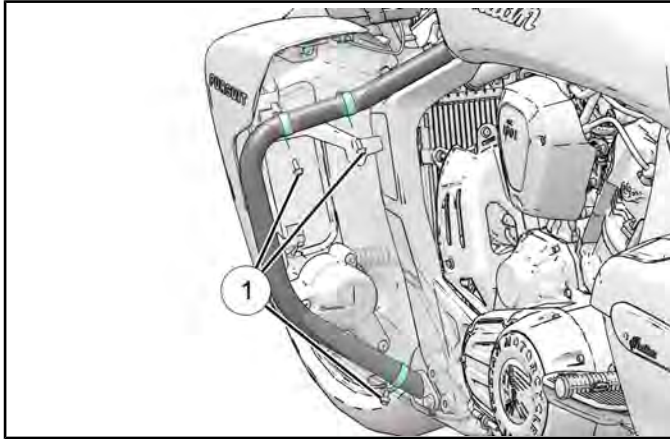
Outer Fairing Fastener:  
**36 in-lbs (4 N·m)**

**TORQUE**

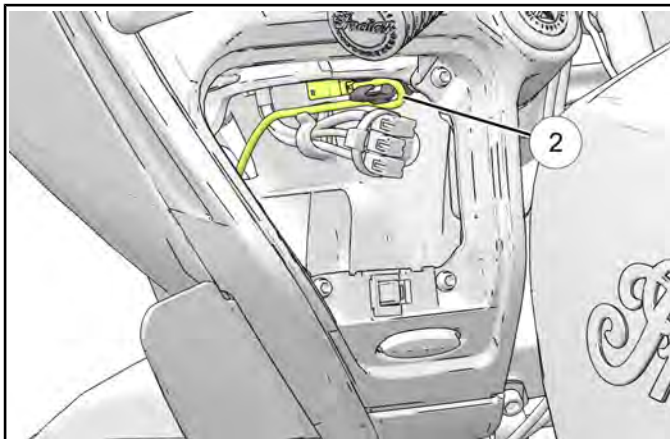
Headlight Bezel Assembly Fastener :  
**36 in-lbs (4 N·m)**

## LOWER FAIRING REMOVAL / INSTALLATION

1. If equipped, remove fog light. See **Fog Light Removal / Installation page 10.85.**
2. Remove lower fairing highway bar clamp fasteners ①.



3. Open storage door and remove storage liner.
4. Disconnect lower fairing harness connector.



5. Remove lower fairing harness for fairing.
6. Remove lower fairing assembly.
7. Repeat steps for remaining side.
8. **Installation is performed by reversing removal procedure.**

### TORQUE

Highway Bar Clamp Fastener:  
**36 in-lbs (4 N·m)**

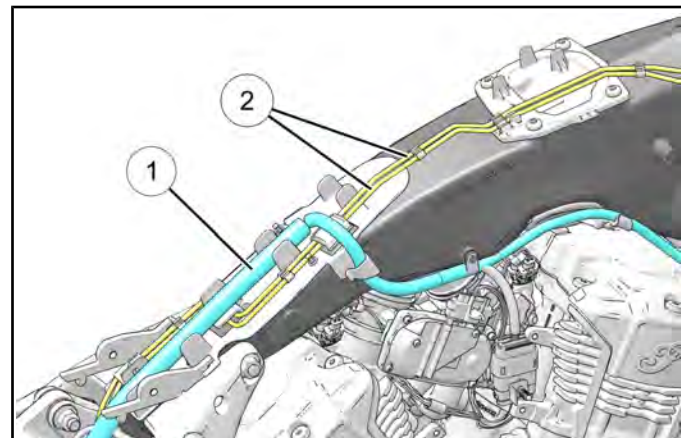
## FRONT CASTING REMOVAL / INSTALLATION

### ⚠ WARNING

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death could occur if the motorcycle tips or falls.

### REMOVAL

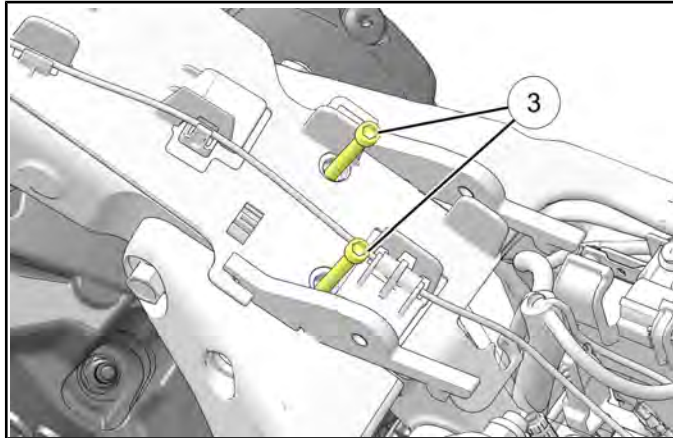
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove the fuel tank. See **Fuel Tank Removal (2020) page 4.23.**
3. Remove headpipe. See **Headpipe Removal / Installation page 3.112.**
4. Remove lower side cover. See **Side Cover (Lower), Removal / Installation page 7.28.**
5. Completely remove fairing. See **Fairing Disassembly page 7.40.**
6. Remove front fork. See **Front Fork Removal page 8.31.**
7. Remove triple clamp. See **Triple Clamp Removal page 8.45.**
8. Remove driver's floorboard. See **Floorboard Removal / Installation page 7.29.**
9. Remove highway bar. See **Highway Bar Removal / Installation page .**
10. Remove battery box. See **Battery Box Removal / Installation page 10.16.**
11. Perform steps 1–11 of throttle body removal. See **Throttle Body Removal / Installation page 4.63.**
12. Disconnect the electrical harness ① and brake lines ② from the mainframe.



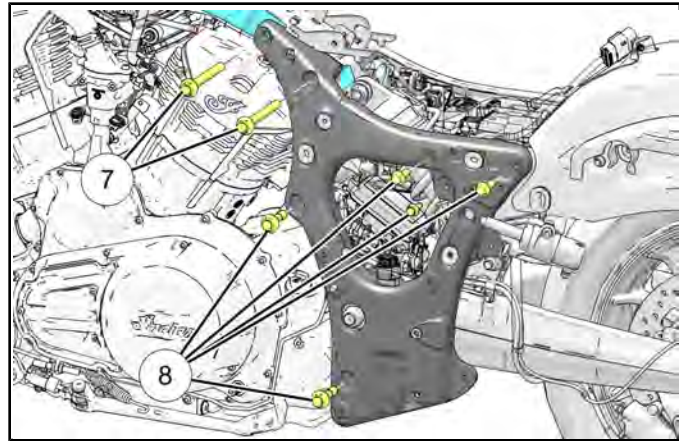


## FRAME / BODY

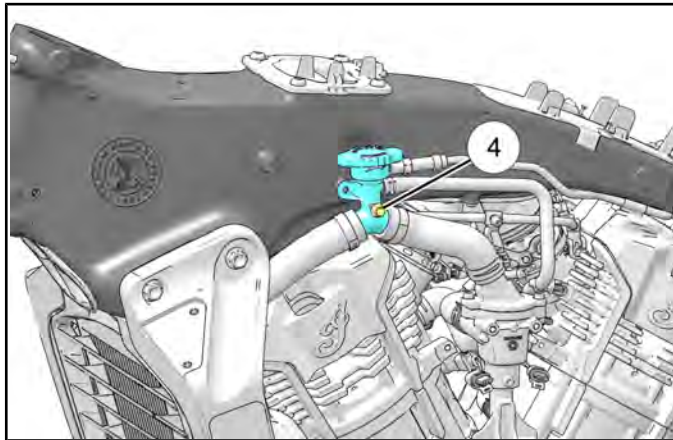
13. Remove fasteners ③ securing mainframe to breather.



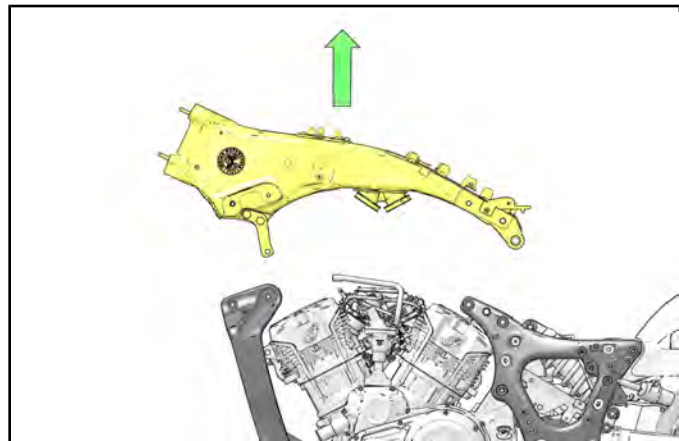
17. Remove midcast fastener ⑦ and ⑧. Repeat step for remaining side.



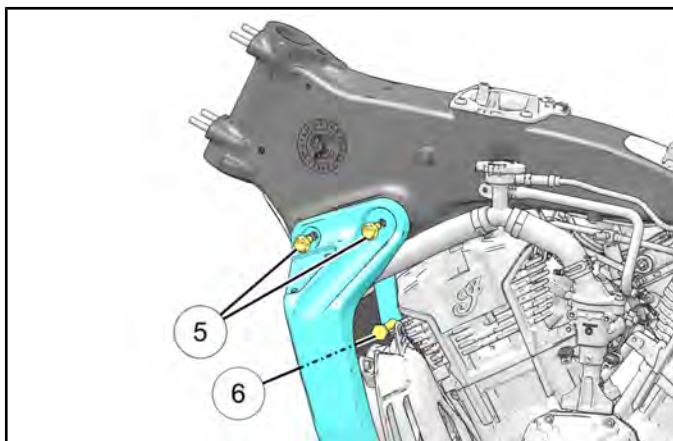
14. Remove fastener ④ securing remote fill to mainframe.



18. Remove main casting.



15. Remove downcast fasteners ⑤ and cylinder head fastener ⑥.



16. Remove downcast fasteners for remaining side.

**INSTALLATION**

- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Midcast M12 Fastener: <b>75 ft-lbs (102 N·m)</b>

TORQUE
Midcast M10 Fastener: <b>35 ft-lbs (47 N·m)</b>

TORQUE
Front Downcast Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
Cylinder Head Bracket Fastener: <b>75 ft-lbs (102 N·m)</b>

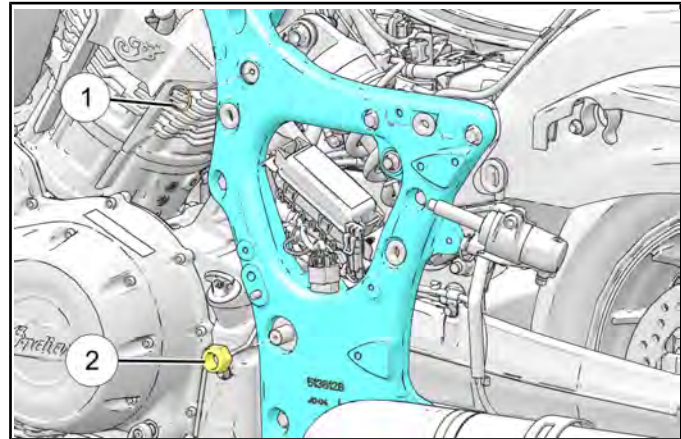
TORQUE
Engine Mount Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
Mainframe to Breather Fastener: <b>84 in-lbs (10 N·m)</b>

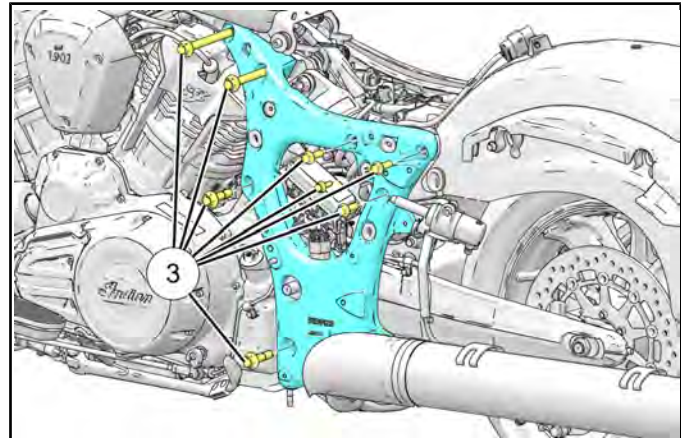
**MIDCAST REMOVAL / INSTALLATION**

**LEFT MIDCAST**

- Remove seat. See **Seat Removal / Installation page 7.32.**
- Remove Lower side cover. See **Side Cover (Lower), Removal / Installation page 7.28.**
- Remove shock pivot snap ring ①.



- Remove Swingarm nut ②.
- Support the engine with a scissor jack or similar.
- Remove fasteners securing midcast ③.



**7**

**7. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Seat Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Tipover Cover Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Midcast M12 Fastener: <b>75 ft-lbs (102 N·m)</b>

TORQUE
Midcast M10 Fastener: <b>35 ft-lbs (47 N·m)</b>

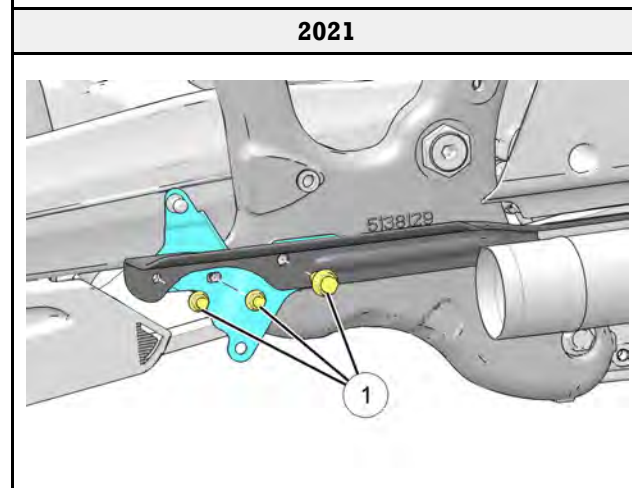
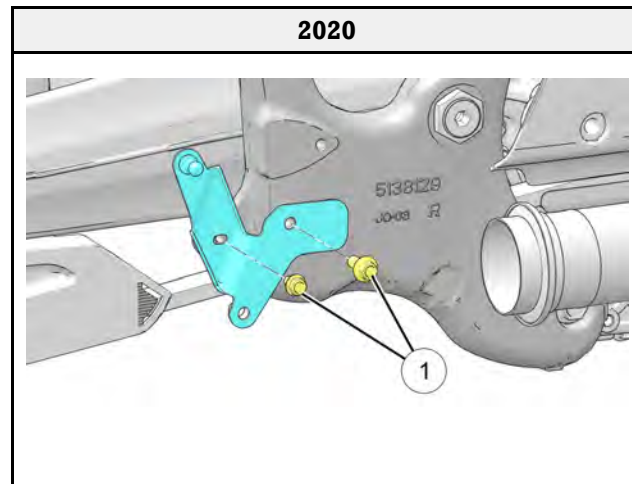
TORQUE
Engine Mount Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
Swing-Arm Pivot Jam Nut <b>75 ft-lbs (101 N·m)</b>

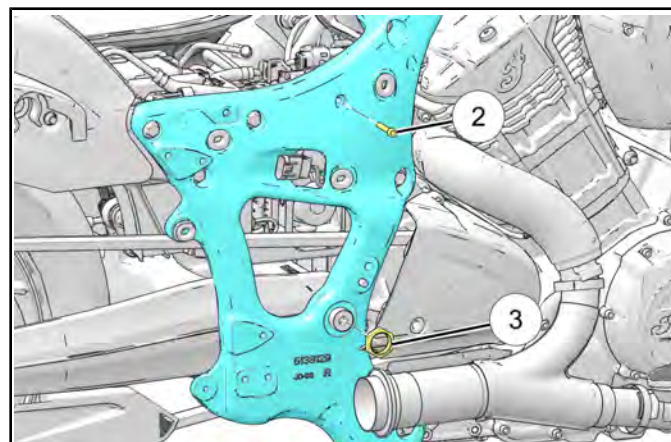
**RIGHT MIDCAST**

1. Remove seat. See **Seat Removal / Installation page 7.32.**
2. Remove Lower side cover. See **Side Cover (Lower), Removal / Installation page 7.28.**
3. Remove resonator. See

4. Remove resonator bracket by removing its fasteners ①.

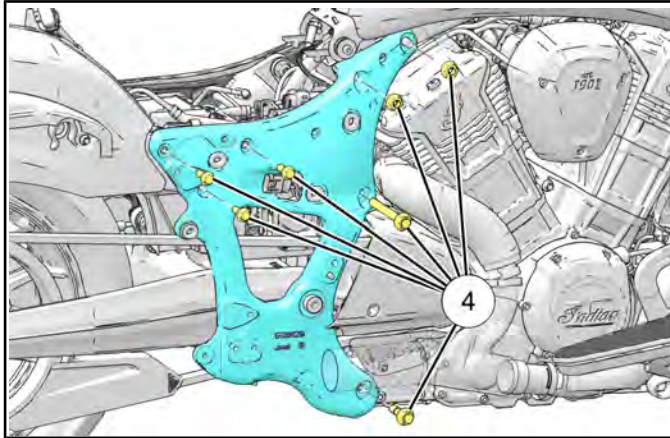


5. Remove ABS mount bracket fastener ②.



6. Remove Swingarm pivot nut ③.
7. Support the engine with a scissor jack or similar.

8. Remove fasteners securing casting ④.



9. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.

TORQUE
Seat Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Tipover Cover Fastener: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Midcast M12 Fastener: <b>75 ft-lbs (102 N·m)</b>

TORQUE
Midcast M10 Fastener: <b>35 ft-lbs (47 N·m)</b>

TORQUE
Engine Mount Fastener: <b>45 ft-lbs (61 N·m)</b>

TORQUE
ABS Mount Bracket Fastener (Allen) <b>84 in-lbs (10 N·m)</b>

TORQUE
Swing-Arm Pivot Jam Nut <b>75 ft-lbs (101 N·m)</b>

TORQUE
Resonator Mount to Frame Fastener (M8) <b>18 ft-lbs (24 N·m)</b>

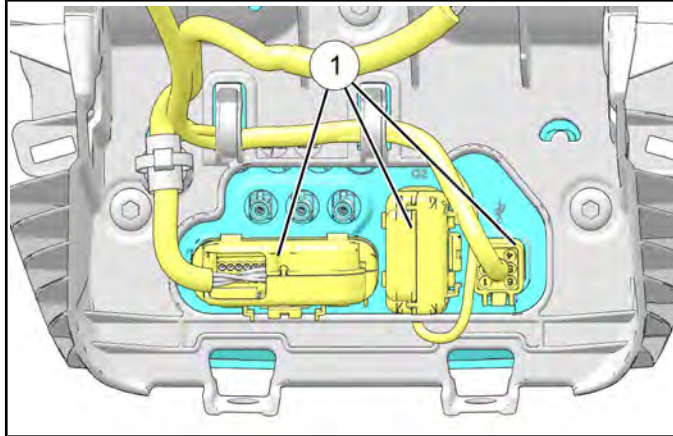
TORQUE
Resonator Mount to Frame Fastener (M6) <b>84 in-lbs (10 N·m)</b>

7

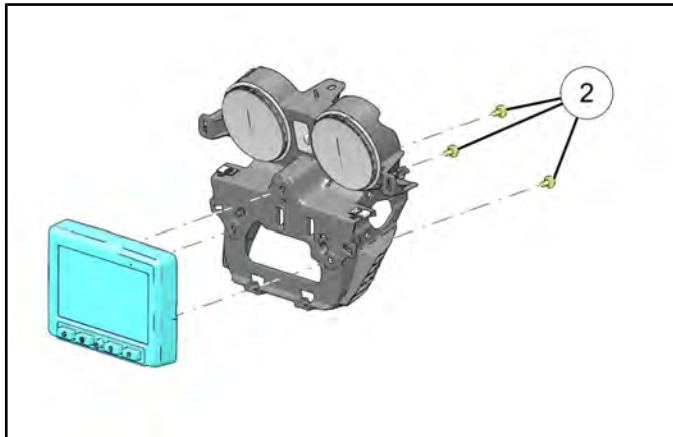
## RIDE COMMAND DISPLAY REMOVAL / INSTALLATION

### REMOVAL

1. Remove dash support assembly. Reference **Fairing Disassembly** page 7.40.
2. Disconnect electrical connectors ①.



3. Remove fasteners ② securing Ride Command Display to the dash support.



### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Ride Command Display Fastener:  
**36 in-lbs (4 N·m)**

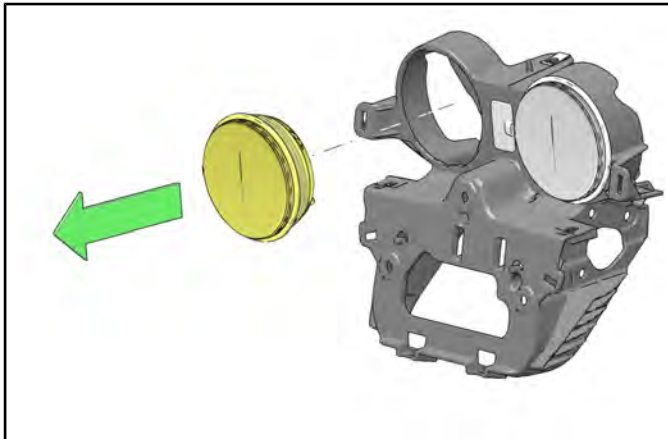
## SPEEDOMETER / TACHOMETER REMOVAL / INSTALLATION

### IMPORTANT

Speedometer replacement is being shown. Tachometer replacement can be done by following the same procedure.

### REMOVAL

1. Disconnect the speedometer electrical connection if not already done so.
2. Remove hood gauge. Reference **Fairing Disassembly page 7.40**.
3. Remove speedometer by gently prying it out of the dash support.



4. Remove the rubber grommet from the dash support.

### INSTALLATION

1. Install the rubber grommet into the dash support. Ensure the clocking feature is aligned with the dash support.



2. Using a small amount of soapy water, lubricate the rubber grommet.

## FRAME / BODY

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3. Insert the speedometer into the dash support.  
Ensure the clocking feature is aligned with the rubber grommet.



4. Ensure the speedometer is properly aligned and secure.

# CHAPTER 8

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## STEERING / SUSPENSION

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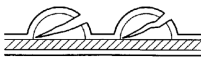
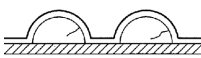



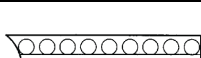


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## STEERING / SUSPENSION MAINTENANCE

### DRIVE BELT INSPECTION

**NOTICE**

Inspect drive belt in accordance with Periodic Maintenance Interval Chart and replace at specified intervals regardless of belt condition. See **Maintenance Intervals page 2.4.**

DRIVE BELT WEAR EXAMPLES	CONDITION	SERVICE RECOMMENDATION
	External Tooth Cracks	Replace Belt
	Internal Tooth Cracks	OK to run, but monitor condition
	Fuzzy Edge Cord	OK to run, but monitor condition
	Hook Wear	Replace Belt
	Missing Teeth	Replace Belt
	Bevel Wear (Outer Edge Only)	OK to run, but monitor condition
	Chipping (Not Serious)	OK to run, but monitor condition
	Stone Damage	Belt should be replaced if damage is on the edge of the belt

1. Periodically inspect drive belt for cuts, excessive wear, foreign substance (oil, grit), missing teeth, or any other damage.
2. If any damage is found, belt should be replaced.

**NOTICE**

Adjust drive belt tension at intervals in accordance with the Periodic Maintenance Interval Chart. See **Maintenance Intervals page 2.4.**

3. If belt or sprocket is being replaced due to damage, inspect the other drive system parts to make sure they are not damaged as well to prevent damage to replaced components.

### DRIVE BELT TENSION MEASUREMENT

Special Tool: **Belt Tension Gauge PV-43532**

**IMPORTANT**

Do not adjust the belt when wet, or immediately after riding. Belt must be *dry* and the drive system must be at ambient temperature (60-80° F). This is extremely important for accuracy.

**IMPORTANT**

Perform this procedure to achieve proper belt tension *and* alignment. Belt tension should be set before performing the alignment procedure.

**⚠ WARNING**

A drive belt that is not properly tensioned can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.

**⚠ WARNING**

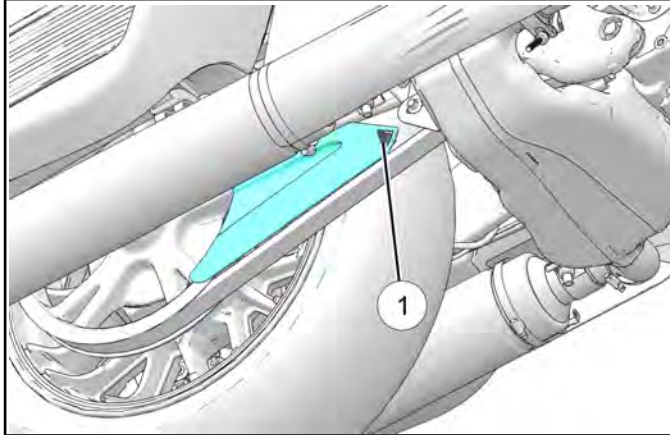
Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

1. Secure motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Shift transmission into NEUTRAL.
3. ELEVATE rear wheel off the ground when checking deflection or adjusting the belt.

*Find Tight Spot In Belt*

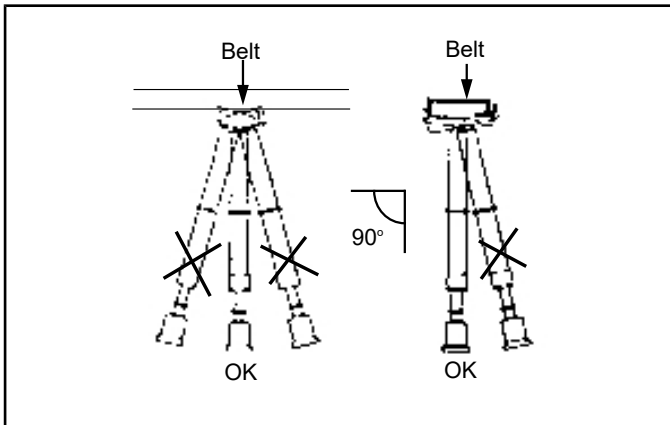
4. Use the tire valve stem as a reference and perform the following Steps:
  - Check / record belt deflection at 4 different points, 90 degrees apart. Rotate wheel in a CLOCKWISE rotation as viewed from belt side of motorcycle.
  - Place a mark on rear wheel at the tightest point (least deflection) to use as a reference.

- Continue to rotate the wheel in normal drive direction (CLOCKWISE) 1-2 revolutions until your reference mark (the tightest point) is lined up with the tension setting window in the lower belt guard ①.



- Adjust belt deflection with wheel in this position.

5. Place tape measure or ruler next to drive belt or use the graduations on lower belt guard for reference.
6. Slide O-ring on belt tension gauge to the 10 lb. mark.
  - Place belt tension gauge squarely against belt at center and keep it at a 90° angle to the belt surface.



7. Push up on gauge until O-ring just touches tool body. See **Drive Belt Tension - Specifications** page 8.5 for drive belt deflection specifications.

8. If belt deflects more than the specified distance with 10 lbs. of force, tighten the belt. If deflection is less than specified loosen the belt.

See **Drive Belt Adjustment** page 8.6.

NOTICE	
New drive systems (new vehicle or when belt and sprockets are replaced) should be set to the tight side of the specification and inspected after the first 500 miles (800 km).	

## DRIVE BELT TENSION - SPECIFICATIONS

### SPECIFICATIONS: DRIVE BELT

BELT DEFLECTION	
Model	Deflection @ 10 lbs force
Challenger	0.6" (15 mm) - New Belt 0.79" (20 mm) - Belt with 1000+ miles
SONIC TENSION DATA	
The following data is provided for use with the Gates 507C Sonic Tension Meter or an equivalent. Follow Steps 1-4 and the instructions included with your sonic tension meter.	
Required Data For Sonic Tension Meter	Specification
Span	710 mm
Belt Width	24 mm
Belt Mass Constant	8.4 g/mm
Tension	32 Hz (± 1 Hz) - New Belt 25 Hz (± 1 Hz) - Belt with 1000+ miles



## DRIVE BELT ADJUSTMENT

### IMPORTANT

Perform this procedure to achieve proper belt tension and alignment. Belt tension should be set before performing the alignment procedure.

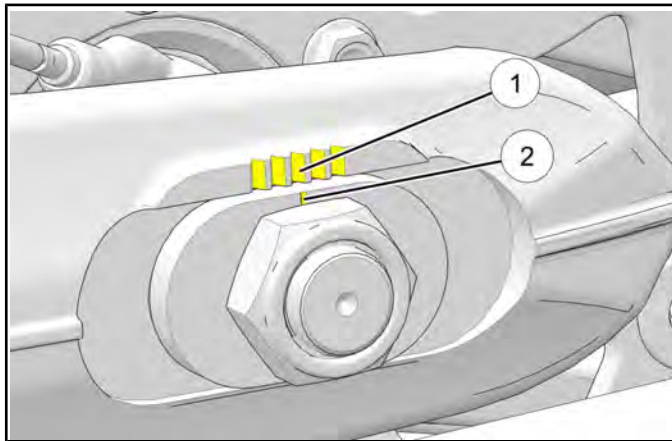
### BELT TENSION

#### ⚠ WARNING

A drive belt that is not properly tensioned can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.

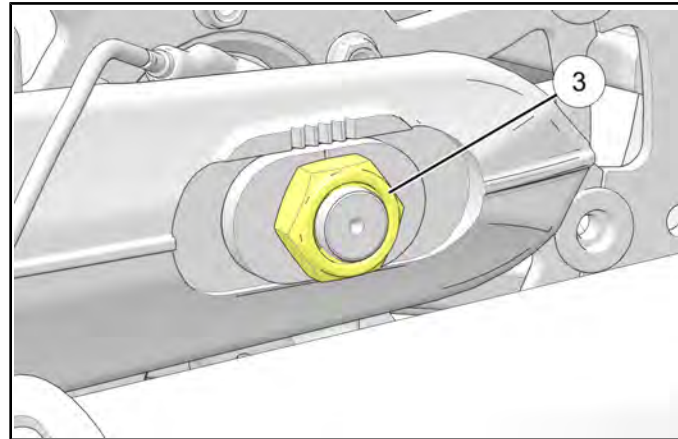
#### NOTICE

Marks ① and ② are used as a reference for initial wheel alignment. Marks should be in roughly the same position on both left and right sides of wheel.

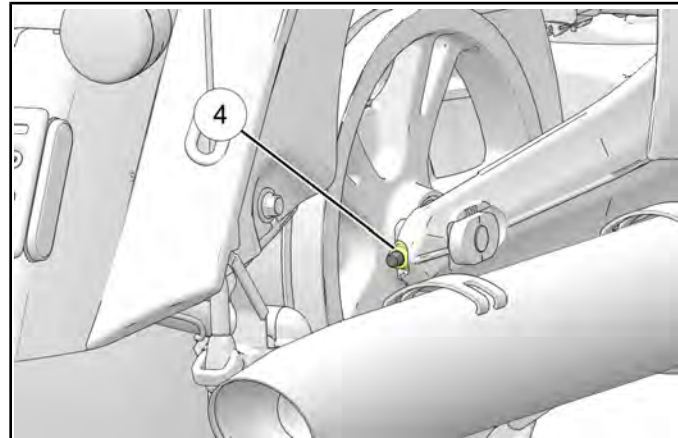


1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove saddlebags. See **Saddlebag Removal / Installation page**
3. Make note of adjuster locations ① and ②.
4. Raise the rear of the motorcycle so the rear tire can be freely rotated.

5. Loosen axle nut ③ then tighten to **15 ft-lbs (20 Nm)**.



6. Turn the RIGHT SIDE adjuster nut ④ to achieve proper belt tension. See **Drive Belt Tension Measurement page 8.4**.



**BELT ALIGNMENT**

1. When belt tension is correct, check and adjust final wheel alignment as follows:

**Belt Alignment**

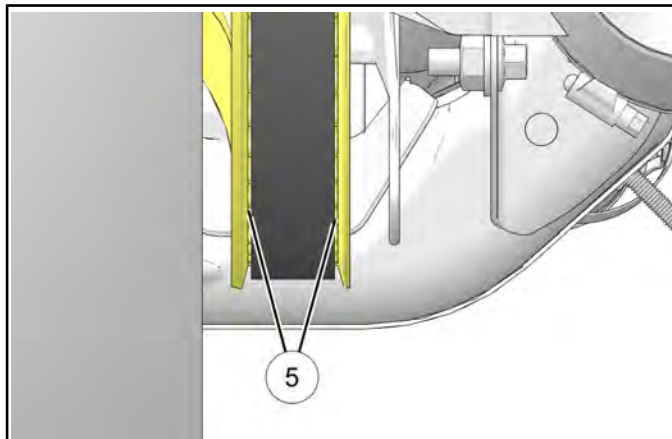
**⚠ WARNING**  
**A drive belt that is not properly aligned can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.**

**NOTICE**  
 To minimize change in belt tension, use LEFT SIDE adjuster only to make final adjustments to belt alignment.

2. Rotate the wheel BACKWARD. Tighten LEFT SIDE adjuster until belt comes off inside sprocket flange during backward wheel rotation.

**IMPORTANT**  
 The belt should track to the center of the sprocket tooth surface when properly aligned ⑤. Sprocket teeth should be visible on both sides of the drive belt.

3. Rotate the wheel in the FORWARD direction and verify that sprocket teeth are still visible on both sides of the drive belt ⑤.



4. If necessary, loosen the axle nut and LEFT SIDE adjuster until belt just moves off the right flange and begins to track down the center of the driven sprocket flange during forward wheel rotation.

**NOTICE**  
 It may be necessary to loosen the axle nut and tap the left end of the axle to ensure it moves forward when the adjuster is loosened. The axle nut must be retightened to the ADJUSTMENT SPECIFICATION before proceeding.

5. **Rear wheel alignment is satisfactory when the drive belt remains centered on driven sprocket during forward and backward wheel rotation. Sprocket teeth should be visible from both sides of the drive belt.**

6. Verify that drive belt tension is still within specification. See **Drive Belt Tension Measurement page 8.4.**

7. Tighten rear axle nut to specification.

**TORQUE**  
 Axle Nut (Rear):  
**65 ft-lbs (84 N·m)**

8. Pump rear brake pedal several times to reset brake pad distance.
9. Verify wheel rotates smoothly and freely without drag when brake pedal is released.

## SPROCKET INSPECTION

### NOTICE

Drive belt and sprocket service life are maximized and drive line noise minimized by proper cleaning. Cleaning interval is approximately every tire change, or more often if operated in dirty, dusty, or high debris environments.

### Inspection

1. Clean the drive belt and front and rear sprockets with a mild mixture of dish soap and warm water. Rinse and dry thoroughly.
2. Inspect front and rear sprocket teeth for wear or damage from foreign material.
3. Closely inspect drive belt condition.

## STEERING HEAD / FRONT WHEEL INSPECTION

### WARNING

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

### NOTICE

Be sure control cables, hoses and wiring are not interfering with handle bar rotation.

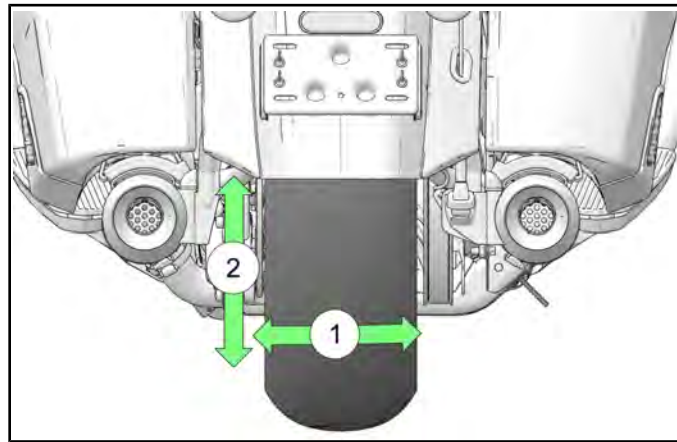
1. Secure motorcycle with front wheel off the floor.
2. Turn handlebars from full left to full right and inspect for smooth, free movement. Point front wheel straight ahead, grasp fork tubes and pull/push fork tubes back and forth. If steering binds, feels rough or uneven, or if movement is detected at steering stem, adjust or replace steering head bearings as necessary.
3. Rotate front wheel and inspect for smooth rotation of front wheel bearings. If roughness or unusual sounds are present, replace front wheel bearings. See Steering / Suspension chapter.
4. Turn handle bars full right or left and hold against the fork stop. Attempt to move front wheel side-to-side. If movement is observed, inspect front axle, wheel, and bearings. See Steering / Suspension chapter.

## SWING-ARM INSPECTION

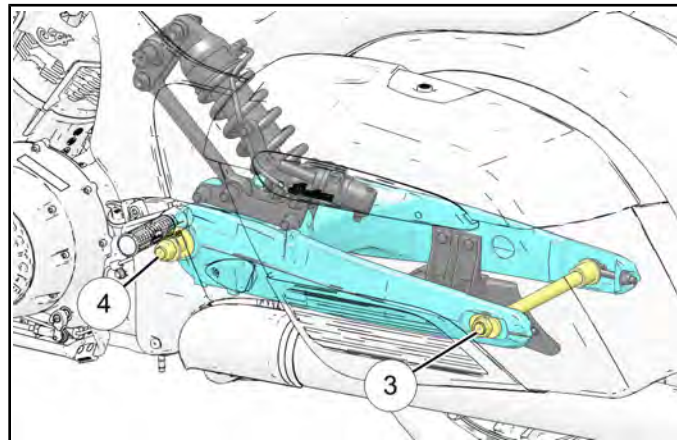
### WARNING

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

1. Sit astride the motorcycle. Compress the rear suspension several times and check for smooth and quiet operation ②.
2. Secure motorcycle with rear wheel elevated.
3. Inspect for worn Swing-Arm bearings by grasping the rear wheel and attempting to move wheel side-to-side ①.



4. If movement is detected, determine if movement is at axle area ③ or Swing-Arm pivot area ④. Refer to Steering / Suspension chapter for wheel bearing and Swing-Arm bearing replacement.



5. Rotate rear wheel and inspect for smooth rotation of rear wheel bearings. If roughness or unusual sounds are detected, inspect rear wheel bearings, belt tension and alignment, and brake pads.

6. Inspect rear shock for leakage and all rear suspension components for damage or loose fasteners.
7. Inspect suspension pivots and shock mounts for radial movement in all pivot joints. If a joint has radial movement, remove rear shock absorber and inspect suspension pivot linkage. See Steering / Suspension chapter.
8. Verify axle nut is tight.
9. Replace any worn or damaged parts.

### **REAR SHOCK PRELOAD INSPECTION**

Periodically inspect rear shock preload. For the most comfortable ride and proper ground clearance, adjust preload if ride height is out of specification. See **Rear Shock Preload Adjustment** page



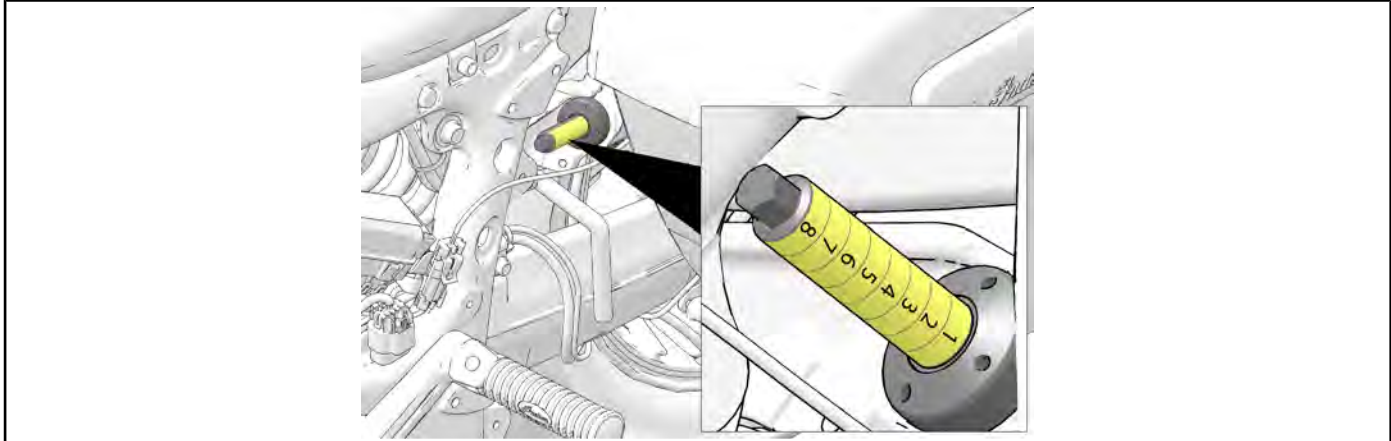
**REAR SHOCK PRELOAD ADJUSTMENT**

1. Remove upper left hand side panel.
2. Look up suspension setting for the specific loading according to chart (decals applied to the inside of the left-hand upper body panel).

<b>SHOCK: HYDRAULIC ADJUSTER SETTING (2018-2021)</b>		
<b>Total Cargo + Riders (lbs)</b>	<b>Adjustment Setting</b>	<b>CAUTION: DO NOT USE IMPACT TOOLS OR EXCEED 10 FT-LBS OF TORQUE WHEN ADJUSTING. DAMAGE TO COMPONENTS MAY OCCUR.</b>
0 – 175	1	
175 – 250	2	
250 – 325	3	
325 – 425	4	
425 – 500	5	

<b>SHOCK: HYDRAULIC ADJUSTER SETTING (2022+)</b>			
<b>Total Cargo + Riders (lbs)</b>	<b>Adjustment Setting (No Trunk)</b>	<b>Adjustment Setting (Trunk Equipped)</b>	<b>CAUTION: DO NOT USE IMPACT TOOLS OR EXCEED 10 FT-LBS OF TORQUE WHEN ADJUSTING. DAMAGE TO COMPONENTS MAY OCCUR.</b>
150	1	3	
175	1	3	
200	2	3	
225	2	4	
250	2	4	
275	3	5	
300	3	5	
325	3	6	
350	4	6	
375	4	7	
400	4	7	
425	4	8	
450	5	8	
475	5	N/A	
500	5	N/A	

- Use supplied tool or 10 mm socket to set adjuster to proper setting.



#### NOTICE

The numbers are biased towards the line which they represent.

### E-PRELOAD ADJUSTMENT

To adjust the electronic preload (EPL), do the following:

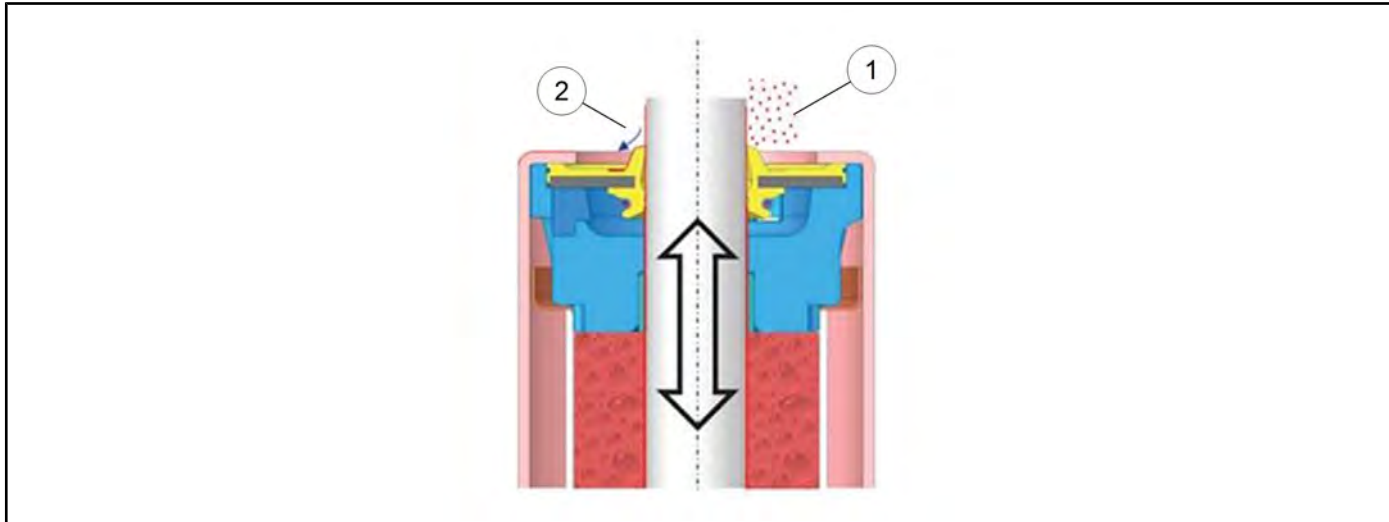


- Press the Menu/Control button to bring up the Control Panel.
- Tap on the riders button ① to adjust the weights of riders.
- Tap on the luggage ② to adjust the weight of the luggage setting.
- Fine weight adjustments can be made using the plus and minus buttons ③.





### SHOCK ANALYSIS

Shock “misting” ① or “weepage” ② is common and should be present during normal vehicle operation. All Shock Absorber Seals are designed to allow a thin film of oil to pass into and out of the shock. This thin film of oil lubricates the Seal to ensure low friction and reduces the corrosion rate of the Piston Rod.



Vehicle operating conditions have a high impact on how much shock oil might be present on the seal and shock body (i.e. road conditions and operating temperature). It is important to properly identify the difference between normal operation (weepage or misting) and a shock that has a leak. Below are some images to help determine what is normal and what could be identified as a bad shock.

MISTING OR WEEPAGE	LEAKAGE
	

### SIDESTAND INSPECTION

1. Support the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Inspect sidestand spring for damage or loss of tension. Be sure stand returns to fully retracted position.
3. Inspect side stand for smooth movement.

4. Inspect sidestand pivot fastener nut for proper torque.

TORQUE
Sidestand Pivot Fastener: <b>37 ft-lbs (50 N·m)</b>

5. Replace sidestand if it is bent. Do not attempt to straighten sidestand.

## SIDESTAND REMOVAL / INSTALLATION

### ⚠ WARNING

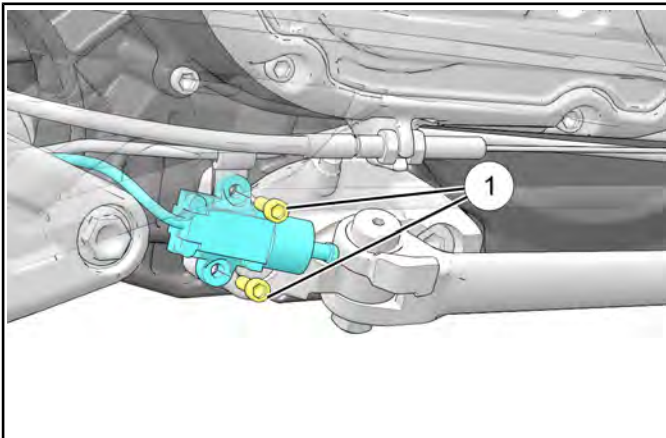
The sidestand spring is under tension. Wear eye and face protection when removing and installing the spring and sidestand. Be sure the vehicle is properly secured before you begin.

### IMPORTANT

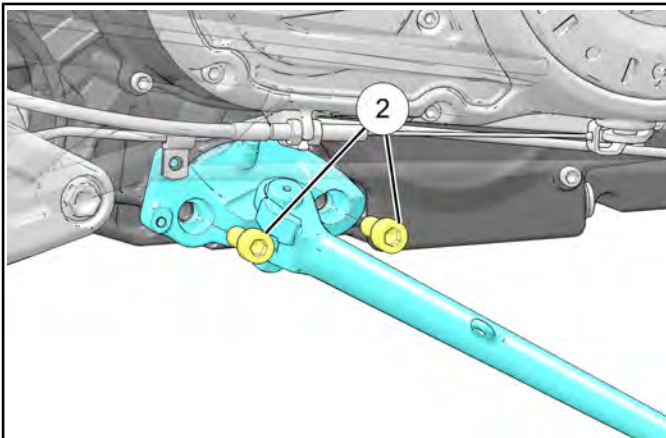
Sidestand fasteners must be replaced any time the sidestand is removed. The nut is a crushed lock and therefore it can not be reused.

### REMOVAL

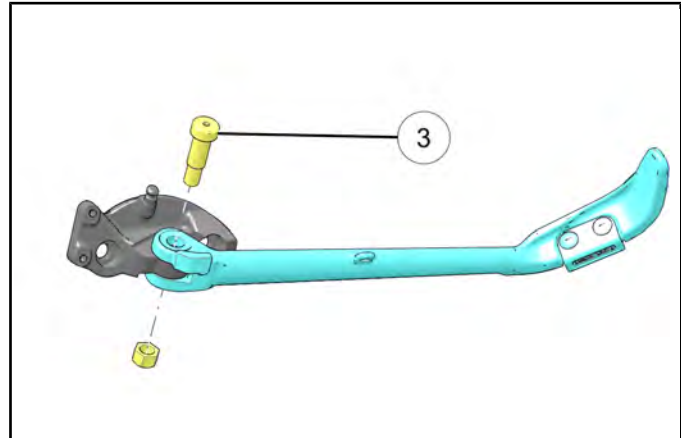
1. Secure motorcycle securely in an upright position. Clamp front tire securely in a wheel vise.
2. Place the sidestand in the upright position.
3. Carefully remove the sidestand spring.
4. Remove the two fasteners ① securing the sidestand switch.



5. Place the sidestand in the down position and remove sidestand mount fasteners ②.



6. Remove side stand pivot fastener ③.



### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Sidestand Pivot Fastener:  
37 ft-lbs (50 N·m)

#### TORQUE

Sidestand Mount Fastener:  
45 ft-lbs (61 N·m)

#### TORQUE

Sidestand Switch Fastener  
43 in-lbs (5 N·m)

**FRONT WHEEL / SUSPENSION**

**GENERAL INFORMATION**

**SERVICE NOTES – FRONT WHEEL / SUSPENSION**

**⚠ WARNING**

Indian Motorcycles are produced using the designated tires listed as original equipment. This includes field testing to ensure stability and superior handling. The use of tires other than original equipment may cause instability which could lead to a crash, resulting in serious injury or death. Use *only* the recommended tires inflated to the recommended tire pressures based on load conditions as listed on the tire information label.

Tubeless tires are used on certain Indian Motorcycle models. Operating the motorcycle with damaged rims creates a safety hazard including air pressure loss, steering imbalance and/or reduced steering control. Do not attempt to repair or straighten damaged rims.

**⚠ CAUTION**

Work performed to the front end of the motorcycle usually involves supporting the machine with the front end elevated. Take precautions so that the motorcycle is securely supported when the front tire is off the ground. This reduces the possibility of personal injury or damage to the motorcycle.

Leaking front fork seals are a safety hazard and should be replaced immediately if a leak is found. Fork oil could contaminate front brake components which could reduce stopping ability of the motorcycle. Contaminated brake discs or pads greatly reduce available stopping force & increase stopping distance. Brake discs can be cleaned using commercially available brake cleaner. NEVER attempt to clean contaminated brake pads. Replace pads as a set.

- Refer to **MAINTENANCE** chapter for front end components service.
- Refer to Steering / Suspension chapter for **TIRE REMOVAL, REPAIR, & BALANCING**
- Refer to Brakes chapter for **BRAKE SYSTEM** service and repairs.

**SPECIAL TOOLS – FRONT WHEEL / SUSPENSION**

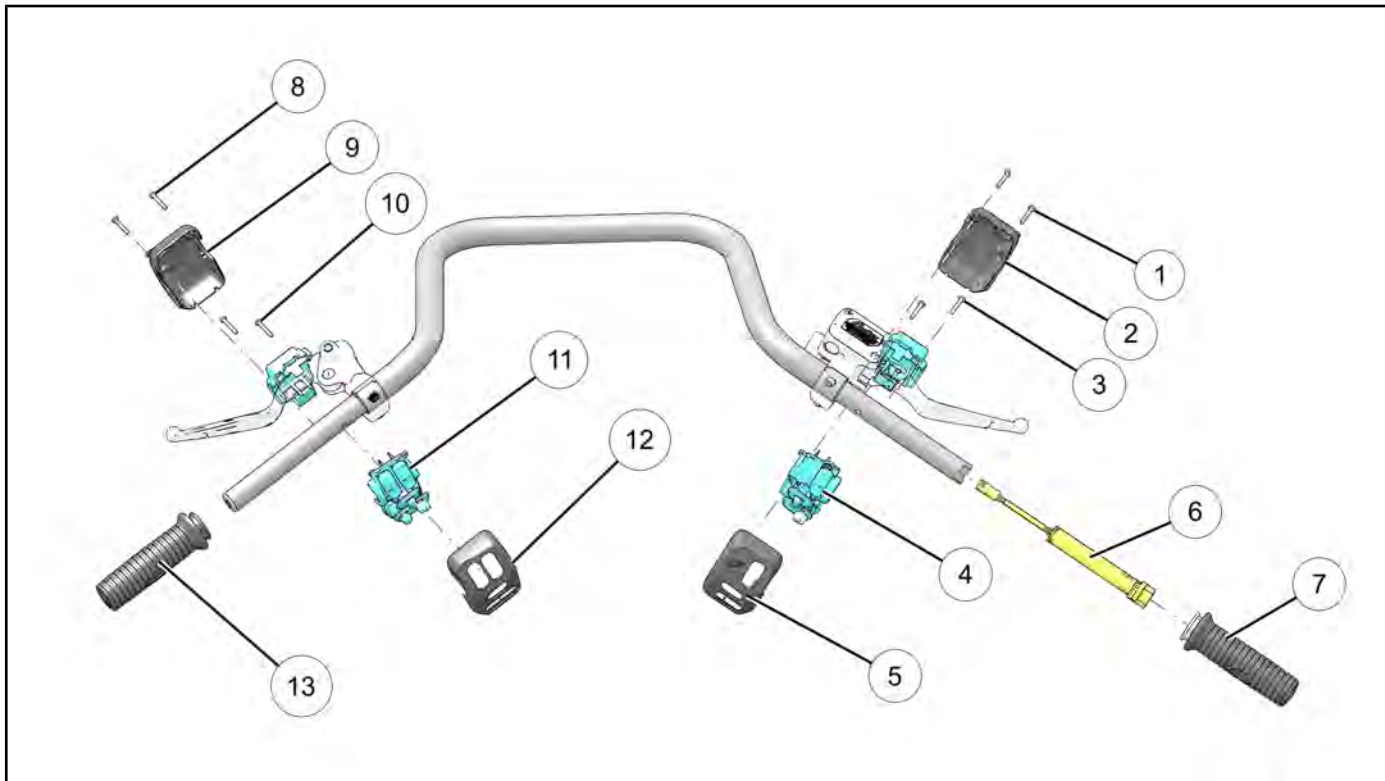
TOOL DESCRIPTION	PART NUMBER
Fork Spring Compressor	PV-49463
Fork Spring Compressor Adapter	PV-49464
Cartridge Shaft Tool	PV-49452
Damper Rod Holder	PV-49453
Fork Oil Level Tool	PV-59000-A
Fork Seal Driver	PV-49494
Wheel / Stem Bearing Removal / Installation Kit	PF-51324
Spanner Socket (Steering Stem)	PV-43508

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

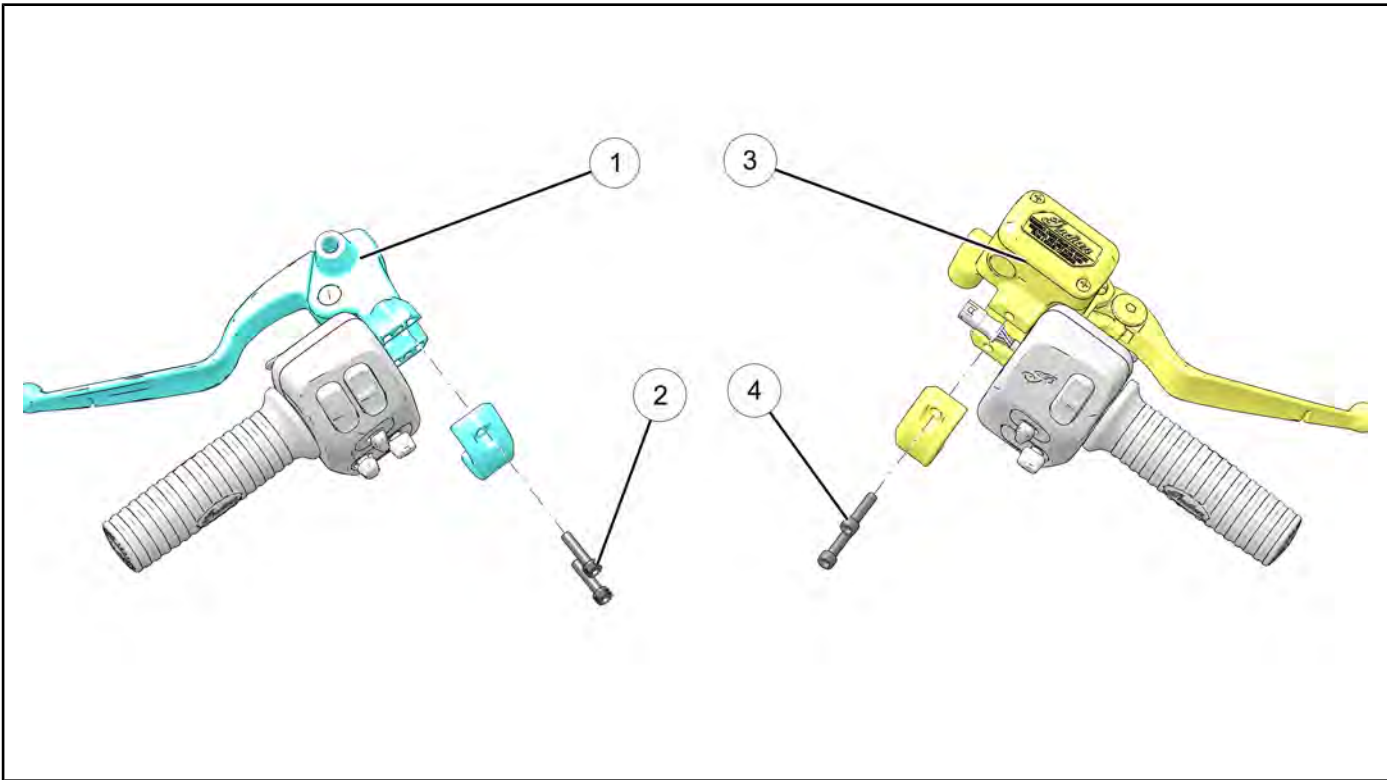
**SERVICE SPECIFICATIONS – FRONT WHEEL / SUSPENSION**

ITEM		STANDARD	SERVICE
Axle Runout		-	.20 mm (.008")
Front Wheel Runout Cast 3.5" x 19"	Axial	.50 mm (.020")	2.0 mm (.080")
	Radial	.50 mm (.020")	2.0 mm (.080")
Fork Tube Diameter		43 mm	Not Applicable
Fork Tube Runout		-	.20 mm (.008")
Fork Oil Type		Indian Motorcycle Fork Oil (PN: 2884244)	
Fork Oil Level (From Top of Tube)	Measured with spring removed, inner tube fully compressed.	103 mm (4.05")	+1 mm (.039")
Fork Oil Capacity (per leg, dry)	Oil level must be measured and adjusted to specification.	2020: 16.4 oz (485 cc) per leg 2021-2022: 18.1 oz (535 cc) per leg	Set Level

**ASSEMBLY VIEWS**  
**HANDLEBAR CONTROLS**



REF	DESCRIPTION	TORQUE
①	Switch Cube Cover Fastener	<b>12 in-lbs (1 N·m)</b>
②	Switch Cube Cover (Back Right)	—
③	Switch Cube Fastener	<b>12 in-lbs (1 N·m)</b>
④	Right Hand Switch Cube	—
⑤	Switch Cube Cover (Front Right)	—
⑥	Electronic Throttle Control	—
⑦	Throttle Grip	—
⑧	Switch Cube Cover Fastener	<b>12 in-lbs (1 N·m)</b>
⑨	Switch Cube Cover (Back Left)	—
⑩	Switch Cube Fastener	<b>12 in-lbs (1 N·m)</b>
⑪	Left Hand Switch Cube	—
⑫	Switch Cube Cover (Front Left)	—
⑬	Non-Throttle Grip	—

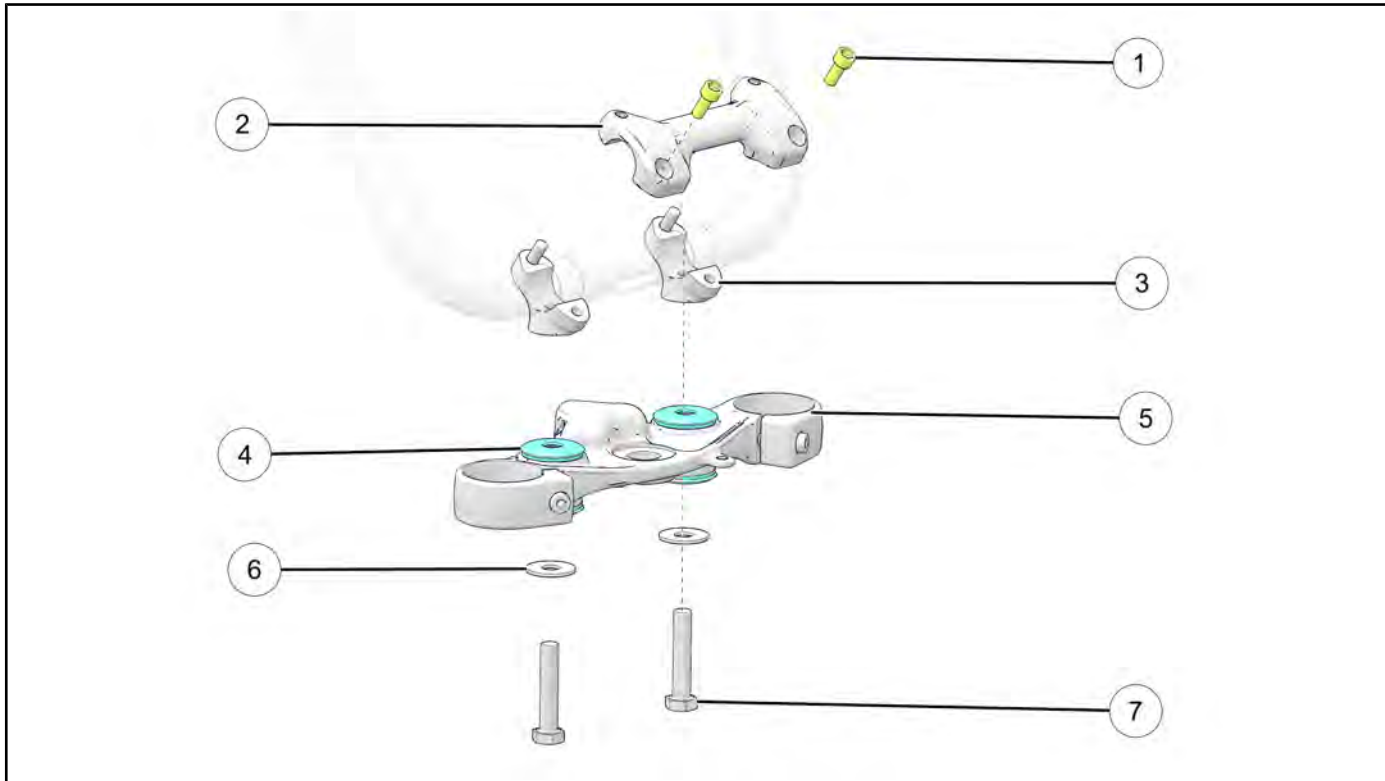


REF	DESCRIPTION	TORQUE
①	Clutch Lever Assembly	—
②	Clutch Perch Fastener	<p><b>96 in-lbs (11 N·m)</b></p> <p><b>IMPORTANT</b></p> <p>Torque the <b>Clutch Perch</b> upper fastener first and the bottom fastener second.</p>
③	Master Cylinder (Front)	—
④	Master Cylinder Clamp Fastener (Front)	<p><b>96 in-lbs (11 N·m)</b></p> <p><b>IMPORTANT</b></p> <p>Torque the <b>Master Cylinder Clamp</b> upper fastener first and the bottom fastener second.</p>

8



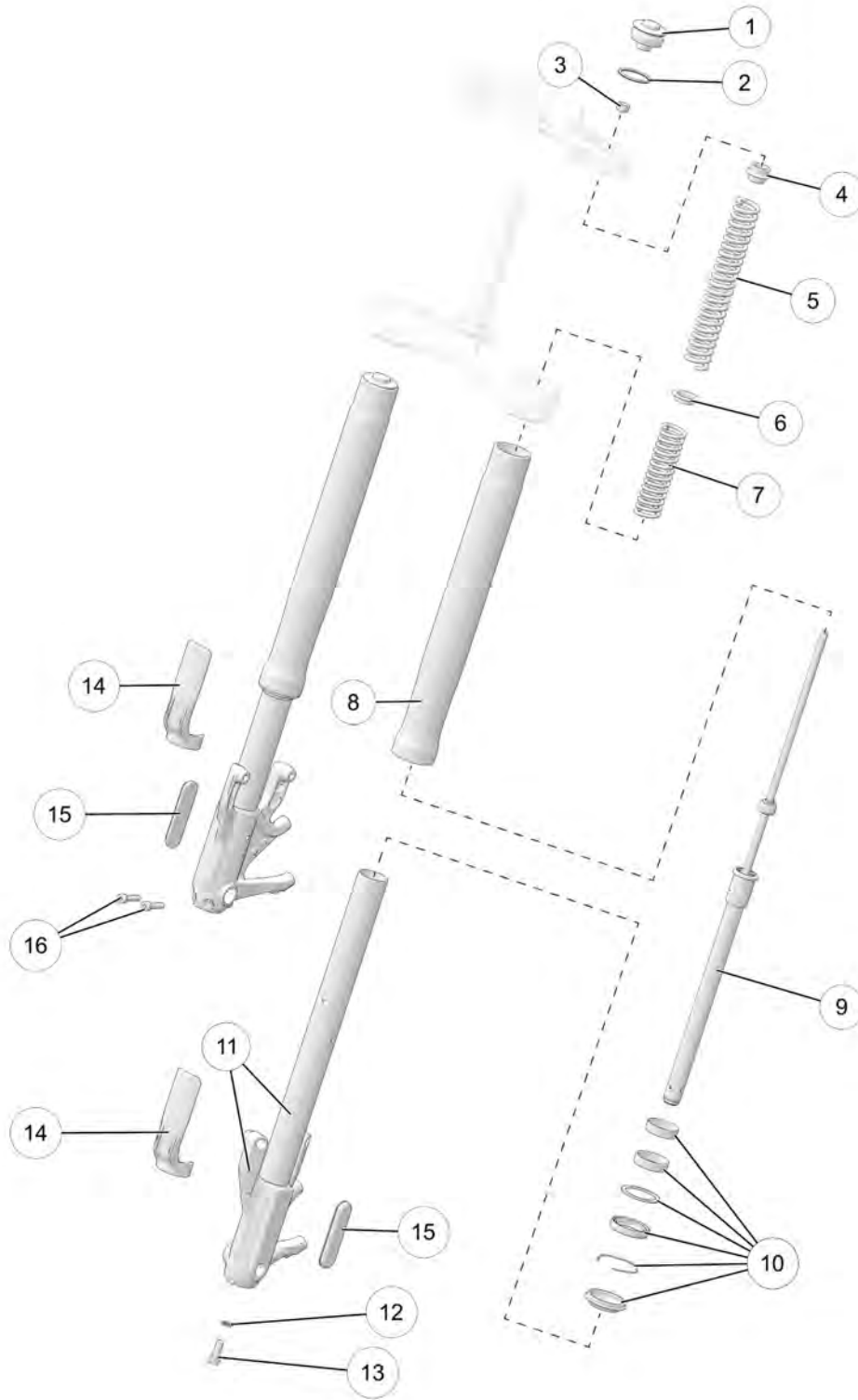
**HANDLEBAR**



REF	DESCRIPTION	TORQUE
①	Riser Cap Fastener	<b>18 ft-lbs (24 N·m)</b> Torque front fastener then rear.
②	Riser Cap	—
③	Handlebar Riser	—
④	Isolator	—
⑤	Triple Clamp	—
⑥	Washer	—
⑦	Handlebar Riser Fastener	<b>60 ft-lbs (81 N·m)</b>

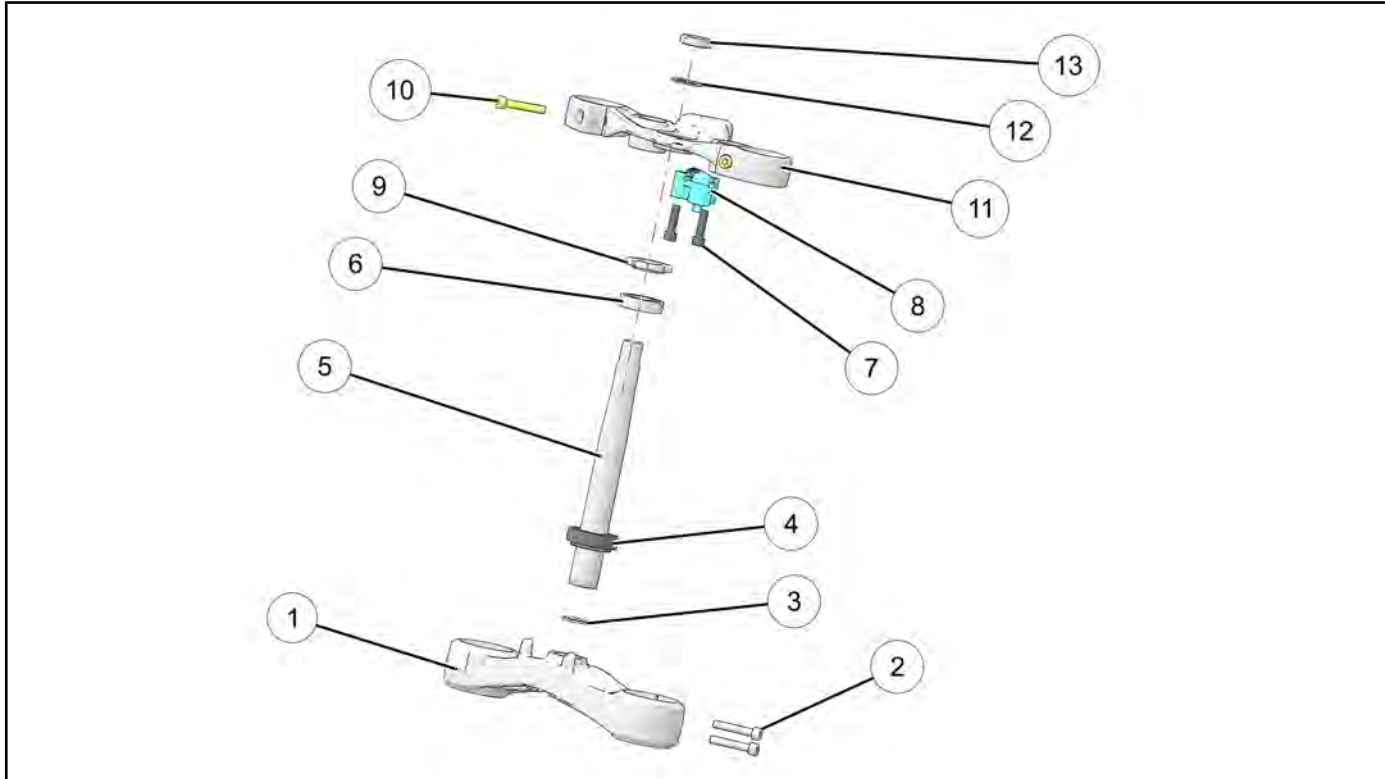


**FRONT FORK ASSEMBLY**



REF	DESCRIPTION	TORQUE
①	Fork Cap	<b>17 ft-lbs (23 N·m)</b>
②	O-Ring	—
③	Fork Cap Nut	<b>12 ft-lbs (16 N·m)</b>
④	Spring Guide, Upper	—
⑤	Spring, Upper	—
⑥	Spring Guide, Lower	—
⑦	Spring, Lower	—
⑧	Comp. Tube, Outer	—
⑨	Cylinder Comp.	—
⑩	Kit, Seals	—
⑪	Tube Comp. Inner	—
⑫	Sealing Washer	—
⑬	Cartridge Screw	<b>17 ft-lbs (23 N·m)</b>
⑭	Guard, Fork	—
⑮	Reflector	—
⑯	Front Axle Pinch Fastener	<b>19 ft-lbs (26 N·m)</b>

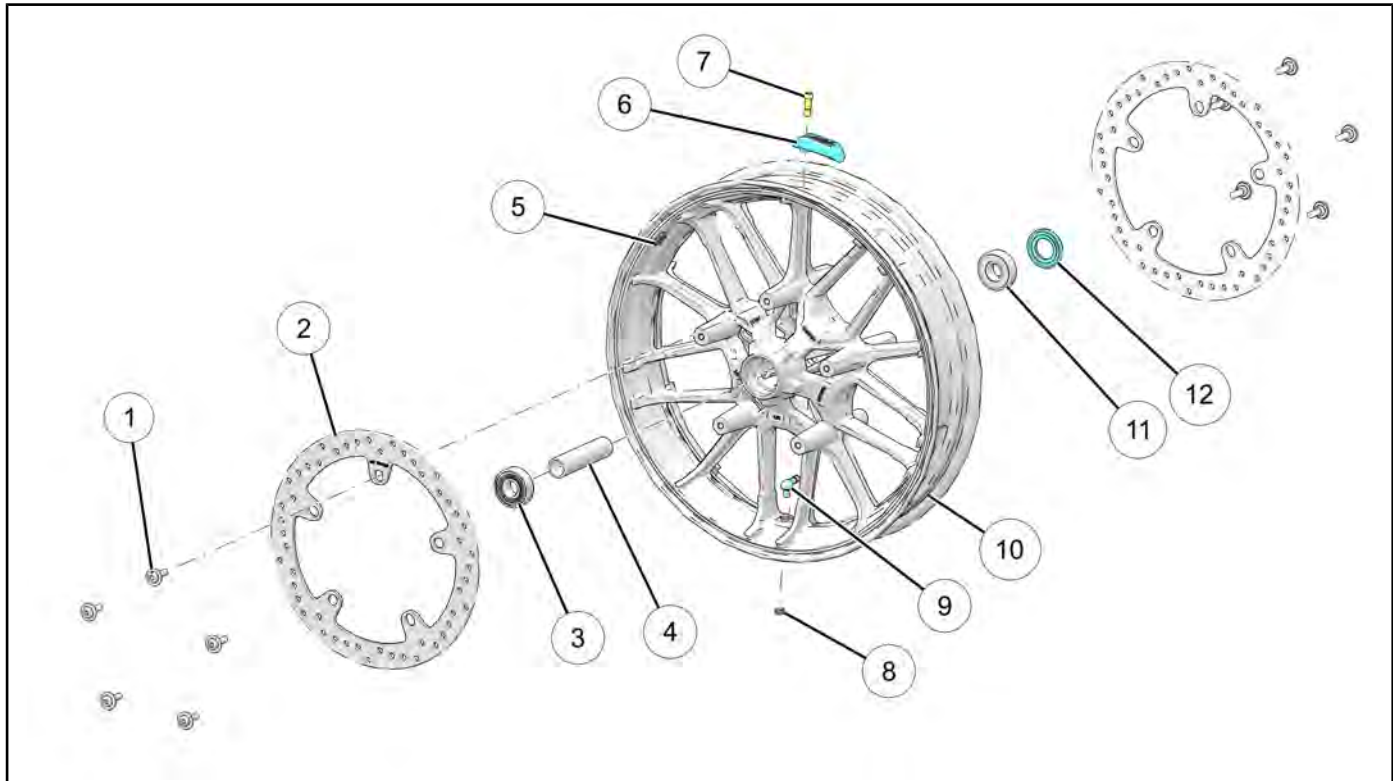
**TRIPLE CLAMP**



REF	DESCRIPTION	TORQUE
①	Lower Triple Clamp	—
②	Lower Fork Clamp Fastener	<b>18 ft-lbs (24 N·m)</b>
③	Steering Post Clip	—
④	Sealed Bearing	—
⑤	Steering Stem	—
⑥	Ball Bearing	—
⑦	Steering Lock Fastener	<b>18 ft-lbs (24 N·m)</b>
⑧	Steering Lock	—
⑨	Steering Head Nut	<b>1. Torque to 29 ft-lbs (39 N·m)</b> <b>2. Turn assembly lock to lock 5 times</b> <b>3. Loosen 60 °</b> <b>4. Install Triple clamp and tighten top nut</b> <b>72 ft-lbs (98 N·m)</b>
⑩	Upper Fork Clamp Fastener	<b>18 ft-lbs (24 N·m)</b>
⑪	Upper Triple Clamp	—
⑫	Washer	—
⑬	Top Triple Clamp Nut	<b>72 ft-lbs (98 N·m)</b>

**FRONT WHEEL**

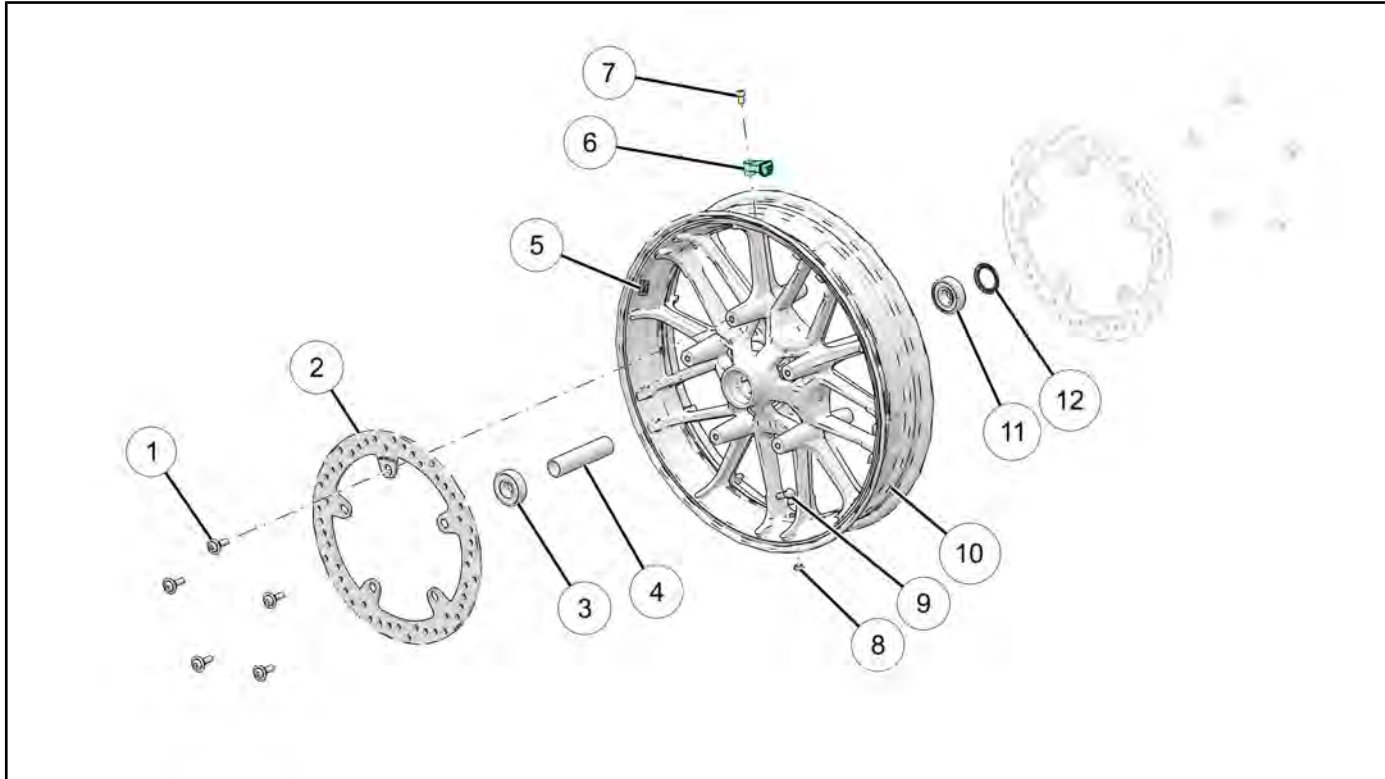
**2020**



REF	DESCRIPTION	TORQUE
①	Rotor Screw	<b>22 ft-lbs (30 N·m)</b>
②	Brake Rotor	—
③	Wheel Bearing	—
④	Bearing Spacer	—
⑤	Wheel Weight	—
⑥	Tire Pressure Sensor	—
⑦	Tire Pressure Sensor Fastener	<b>72 in-lbs (8 N·m)</b>
⑧	Valve Stem Nut	<b>53 in-lbs (6 N·m)</b>
⑨	Valve Stem	—
⑩	Front Wheel 19 x 3.5	—
⑪	Ball Bearing	—
⑫	Seal	—

## STEERING / SUSPENSION

2021-2022



REF	DESCRIPTION	TORQUE
①	Rotor Screw	<b>22 ft-lbs (30 N·m)</b>
②	Brake Rotor	—
③	Wheel Bearing	—
④	Bearing Spacer	—
⑤	Wheel Weight	—
⑥	Tire Pressure Sensor	—
⑦	Tire Pressure Sensor Fastener	<b>72 in-lbs (8 N·m)</b>
⑧	Valve Stem Nut	<b>53 in-lbs (6 N·m)</b>
⑨	Valve Stem	—
⑩	Front Wheel 19 x 3.5	—
⑪	Ball Bearing	—
⑫	Seal	—

**SERVICE PROCEDURES**

**HANDLEBAR REMOVAL / INSTALLATION**

**⚠ WARNING**

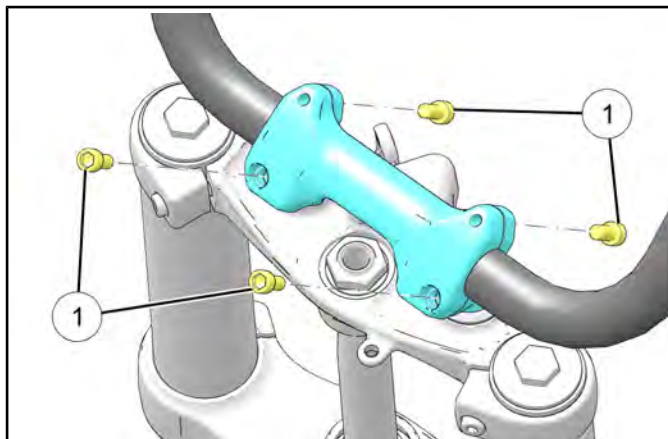
Clutch cable must be routed, installed, and adjusted correctly to function properly. Note how cable is routed and secured before removing the cable. Permanent cable damage may result if the inner cable is bent or twisted during installation. If the cable is incorrectly routed, installed, or adjusted, serious injury or death may occur.

**⚠ CAUTION**

Cover painted or chrome parts to prevent damage. Use care to protect fuel tank and front fender. Tank removal is recommended. Secure, set aside, or support parts as they are removed.

**REMOVAL**

1. Remove Fairing. See **Fairing Disassembly page 7.40.**
2. Remove throttle control. See **Throttle Control Removal / Installation page 8.26.**
3. Remove front master cylinder, reference **Front Master Cylinder Service page 9.45.**
4. Remove clutch lever assembly. See **Clutch Lever Assembly Removal / Installation page 8.25.**
5. Remove riser cap fasteners ①.



6. Remove rise cap and handlebar.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Riser Cap Fastener:  
**18 ft-lbs (24 N·m)**

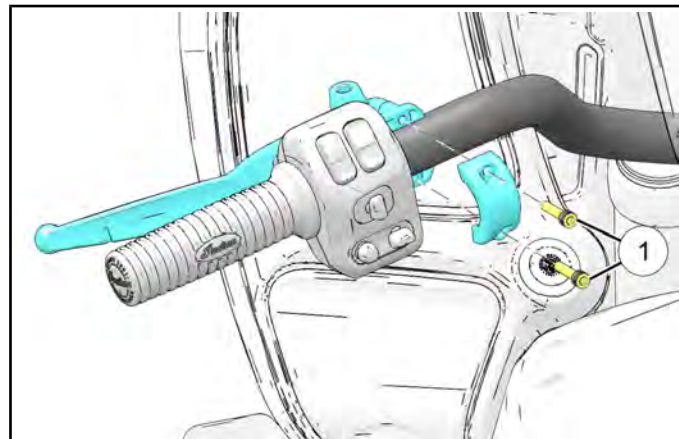
**NOTICE**

Torque front fastener then rear.

**CLUTCH LEVER ASSEMBLY REMOVAL / INSTALLATION**

**REMOVAL**

1. Remove clutch cable from lever assembly. See **Clutch Cable, Removal / Installation page 8.27.**
2. Remove clutch switch. See **Clutch Switch Removal / Installation page 10.30.**
3. Remove clutch perch fasteners ① and remove assembly.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**IMPORTANT**

Torque the **Clutch Perch** upper fastener first and the bottom fastener second.

**TORQUE**

Clutch Perch Fastener:  
**96 in-lbs (11 N·m)**



### **THROTTLE CONTROL REMOVAL / INSTALLATION**

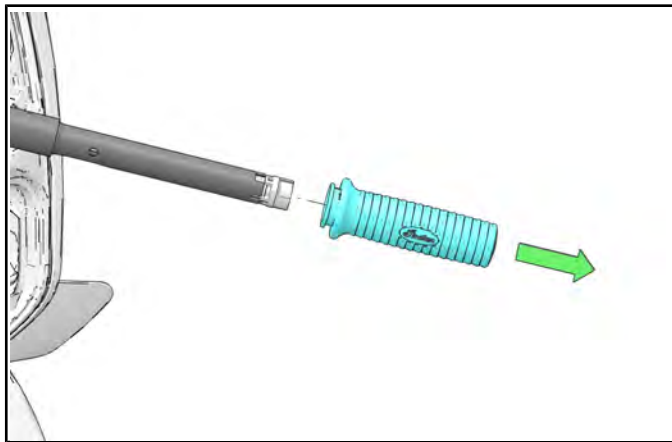
To watch a video of this procedure, scan the QR code or click **HERE**.



<https://vimeo.com/338076741/f1ec51a821>

#### **REMOVAL**

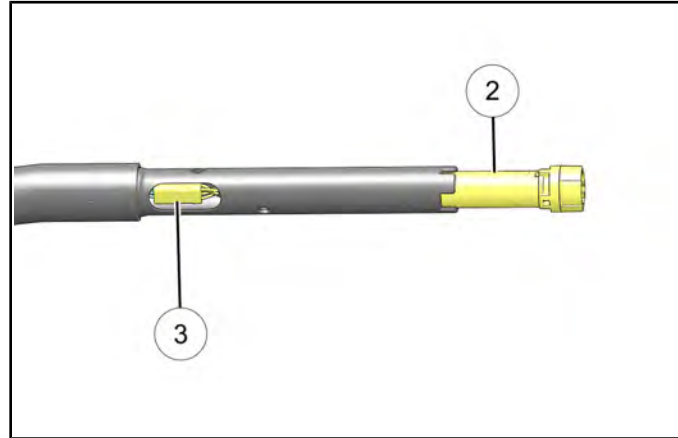
1. Remove outer fairing and dash support. See **Fairing Disassembly page 7.40.**
2. Remove switch cube. See **Switch Cube Replacement page 10.132.**
3. Remove grip.



4. Follow the wiring coming out of the handle bars and cut the cable tie ① retaining the slack.



5. Pull on the throttle control ② until the electrical connection ③ is visible and disconnect.



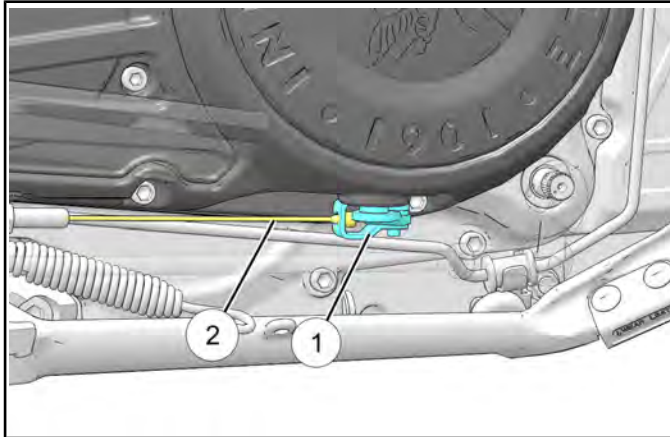
#### **INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

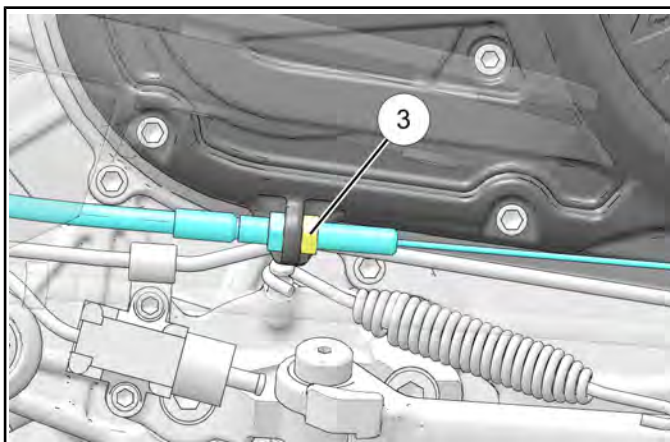
**CLUTCH CABLE, REMOVAL / INSTALLATION**

**REMOVAL**

1. Place motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Rotate pinion shaft ① and release clutch cable end ②.

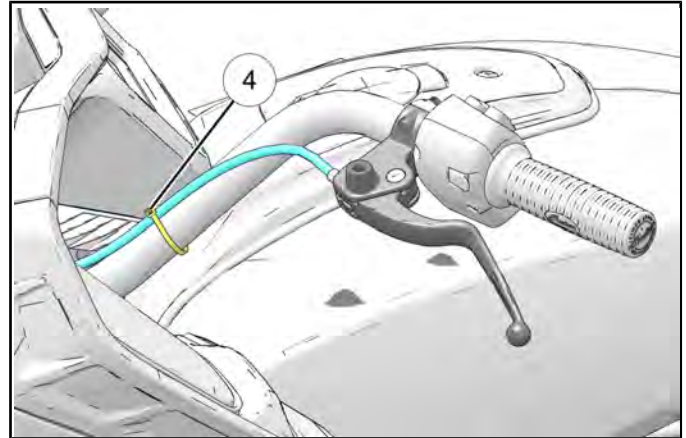


3. Remove clutch cable jam nut ③.

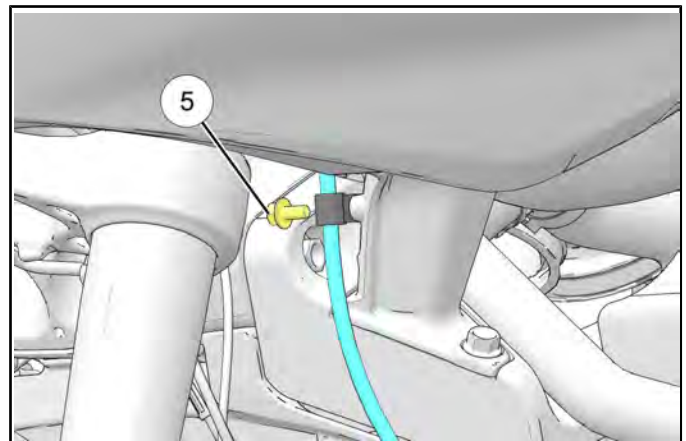


4. Remove the cable end from the cover.
5. Disconnect the clutch cable from the lever assembly.

6. Route the clutch cable through the rubber strap ④ on the handle bar.



7. On the left side fairing support, remove the clutch cable routing clip fastener ⑤.



8. Carefully remove the clutch cable.

**IMPORTANT**

Note the routing for reinstallation.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Clutch Cable Routing Clip Fastener:  
**84 in-lbs (10 N·m)**

**TORQUE**

Clutch Cable Jam Nut:  
**48 in-lbs (5 N·m)**

**FRONT WHEEL, REMOVAL / INSTALLATION**

**⚠ WARNING**

**This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.**

**⚠ CAUTION**

Do not twist the brake hose or brake line. Do not allow calipers to hang from the brake hose. Secure calipers in such a way to avoid hose damage.

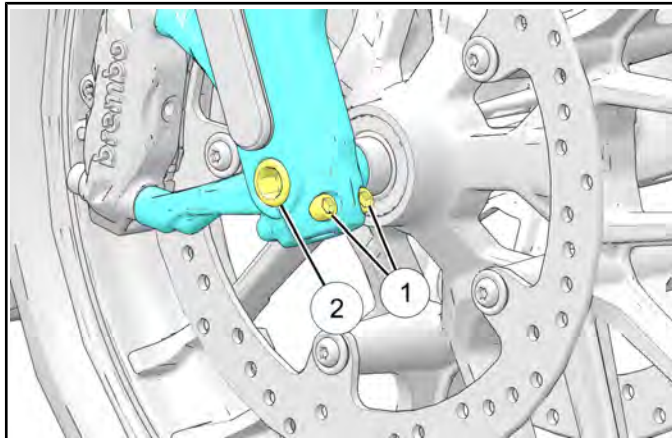
Secure the motorcycle in an upright position with tie-down straps and a platform jack positioned beneath the engine cases.

**NOTICE**

Do not operate the front brake lever with the calipers or wheel removed.

**REMOVAL**

1. Remove the front fender. See **Front Fender Removal / Installation page 7.37**.
2. Loosen axle pinch fasteners ① on lower right fork leg.



3. Support wheel and remove axle ②. Be prepared to catch spacer and wheel speed sensor.

**INSTALLATION**

1. Install front wheel and spacers into fork.
2. Make sure wheel speed sensor is properly installed in the hub before installing the axle nut.

3. Install the axle and torque to specification.

**TORQUE**

Front Axle:  
**52 ft-lbs (70 N·m)**

4. Install pinch fasteners. Torque to specification.

**TORQUE**

Front Axle Pinch Fastener:  
**19 ft-lbs (26 N·m)**

5. Install the front fender. See **Front Fender Removal / Installation page 7.37**.

**FRONT AXLE INSPECTION**

1. Place axle in V-blocks and inspect runout. Compare to specifications in this chapter. See **Service Specifications – Front Wheel / Suspension page .**



2. Replace axle if it fails inspection. Do not attempt to straighten a bent axle.

**FRONT WHEEL INSPECTION**

Refer to Service Specifications – Front Wheel / Suspension page when measuring the radial and axial runout.

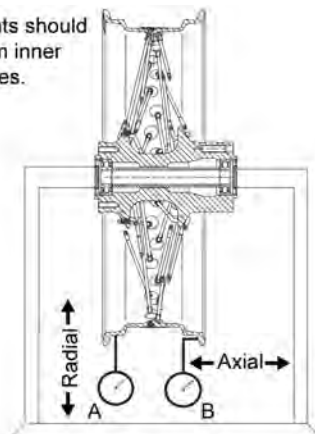
1. Install front wheel in truing stand.

**NOTICE**

Bearings must be in good condition to accurately measure runout.

2. Set up a dial indicator to measure radial runout (up and down) (A) and compare to specifications.
3. Position dial indicator to measure axial runout (side to side) (B) and compare to specifications.

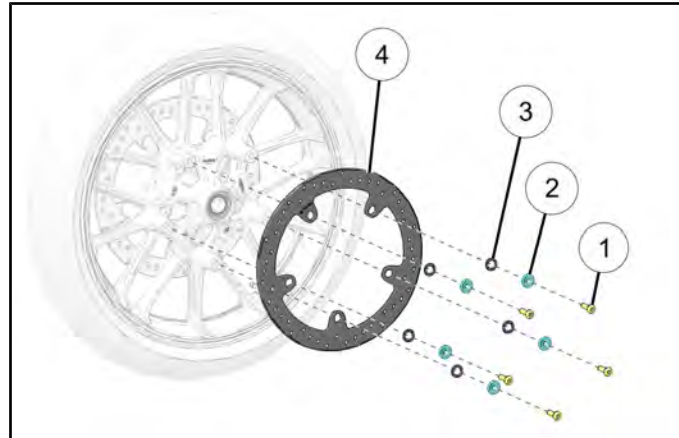
Measurements should be taken from inner wheel surfaces.



4. Visually inspect wheel for cracks.
5. Replace wheel if it fails visual or measured inspection. Do not attempt to straighten cast or wheels.

**BRAKE DISC REMOVAL / INSTALLATION****REMOVAL**

1. Remove front wheel. See **Front Wheel, Removal / Installation page 8.28.**
2. Remove and discard brake rotor screws ① and bushing ②.
3. Remove washer springs ③.
4. Remove brake disc ④ from wheel.



5. Flip wheel over and repeat procedure to remove opposite side brake disc.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

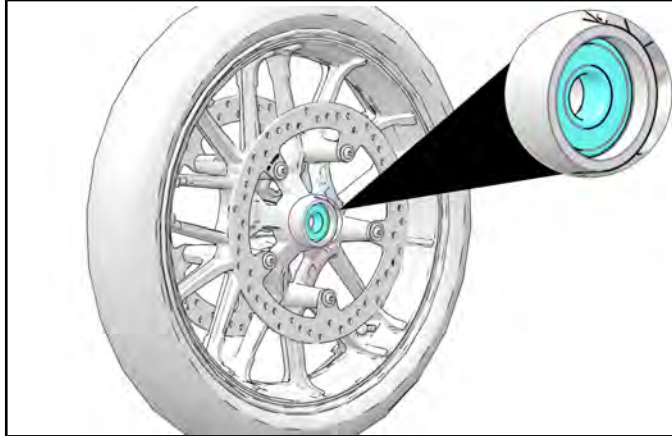
Brake Rotor Screw:  
22 ft-lbs (30 N·m)

**FRONT WHEEL BEARING INSPECTION**

**NOTICE**

Inspect bearings installed in the wheel. Do not remove to inspect. Bearings cannot be repacked. Replace both wheel bearings if one or both fail inspection, or if either bearing was removed.

1. Visually inspect bearing on each side for wear or damage.



2. Check bearings by turning inner race by hand.
  - Look for signs of discoloration, scoring, galling, or contamination from moisture or dirt. Replace bearings if any of the above are present.
  - Turn the inner race of the bearings. The bearings should turn smoothly and quietly. The inner race should be firm with minimal side to side movement and no detectable up and down movement.
3. Discard bearings that fail any of the above inspections.

**CAUTION**

Do not reuse bearings after removing them from the wheel. Removal damages the bearings internally.

4. Inspect bearing fit into wheel hub. The outer race of the bearing must fit tightly into the bore. You should not be able to move it (or remove it) by hand. Replace the wheel if outer race of a new bearing does not fit tightly in the bore.

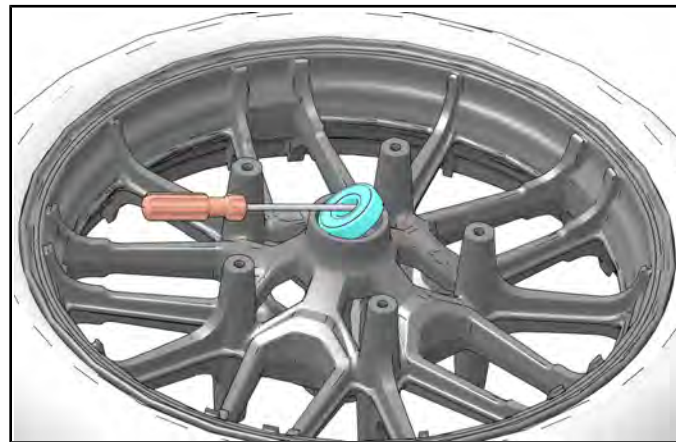
**FRONT WHEEL BEARING REPLACEMENT**

**CAUTION**

Do not reuse bearings that have been removed. This procedure requires the Wheel Bearing Removal / Installation Kit (PF-51324). Refer to special tool manufacturer instructions for proper use of tool.

**REMOVAL**

1. Remove front wheel. See **Front Wheel, Removal / Installation page 8.28.**
2. Remove brake discs. See **Brake Disc Removal / Installation page 8.29.**
3. Carefully remove both seals using a suitable seal removal tool and discard. Be careful not to scratch the seal bore.



4. Refer to special tool manufacturer instructions to remove bearing from LH side of hub.
5. Remove bearing.
6. Remove spacer.
7. Extract or drive bearing from RH side of hub.

**INSTALLATION**

**IMPORTANT**

The bearing containing the tone ring must be installed on the LH side of the wheel with the red seal facing outwards.

1. Use the Wheel Bearing Removal / Installation Kit (PF-51324) to install new wheel bearings. Refer to special tool manufacturer instructions for proper use of tool.
2. Install *new* wheel bearing into the LH side of hub followed by the inner bearing spacer.
3. Install *new* wheel bearing into the RH side of hub.

4. Install *new* seals and existing outer bearing spacers into each side of the wheel hub.
5. Install the brake discs. See **Brake Disc Removal / Installation** page 8.29.
6. Install the front wheel. See **Front Wheel, Removal / Installation** page 8.28.

### FRONT FORK REMOVAL

#### **⚠ WARNING**

**This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.**

#### **⚠ CAUTION**

Do not twist the brake hose or brake line. Do not allow calipers to hang from the brake hose. Secure calipers in such a way to avoid hose damage.

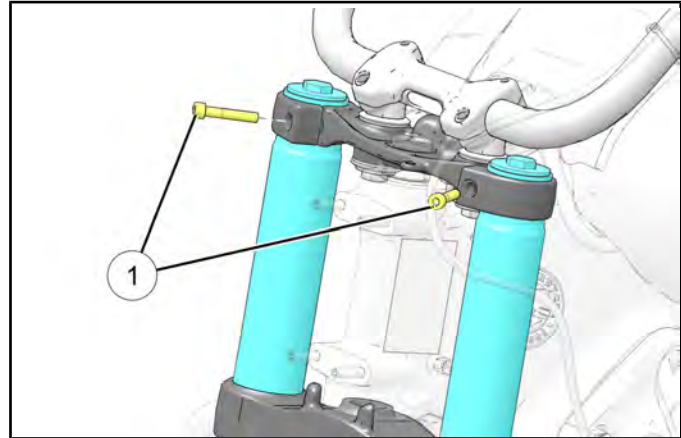
1. Remove front fender. See **Front Fender Removal / Installation** page 7.37.
2. Secure the motorcycle in an upright position with tie-down straps and a platform jack positioned beneath the engine cases.

#### **NOTICE**

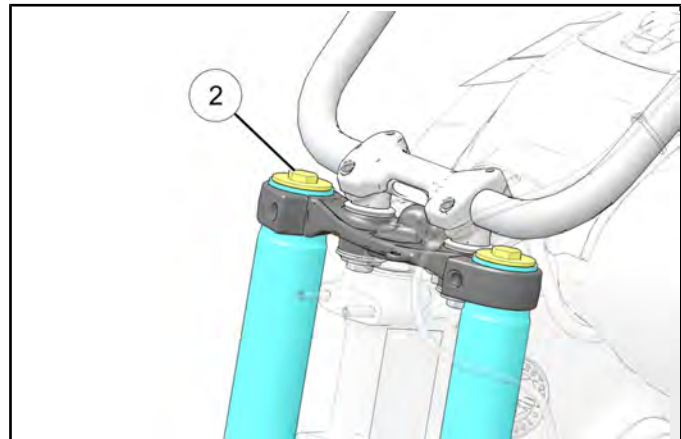
Do not operate the front brake lever with the calipers or wheel removed.

3. Remove front brake calipers and support them so they do not hang by brake hoses. See **Front Caliper Service** page 9.47.
4. Remove front wheel. See **Front Wheel, Removal / Installation** page 8.28.
5. Remove outer fairing. Reference **Fairing Disassembly** page 7.40.
6. If triple clamp will be removed, remove front brake line guides from the upper and lower triple clamps.

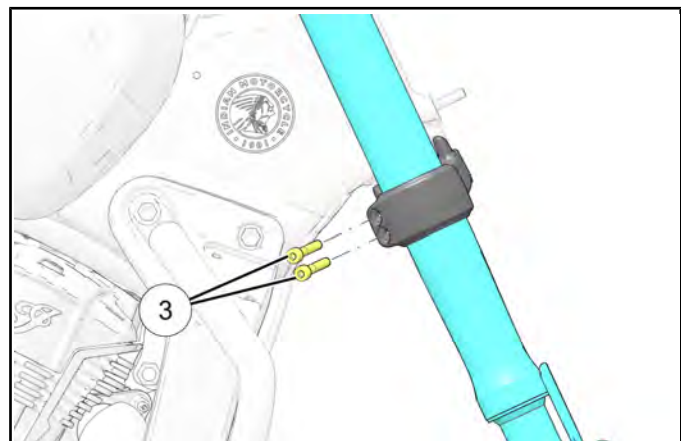
7. Loosen upper triple clamp pinch fastener ① for each fork tube.



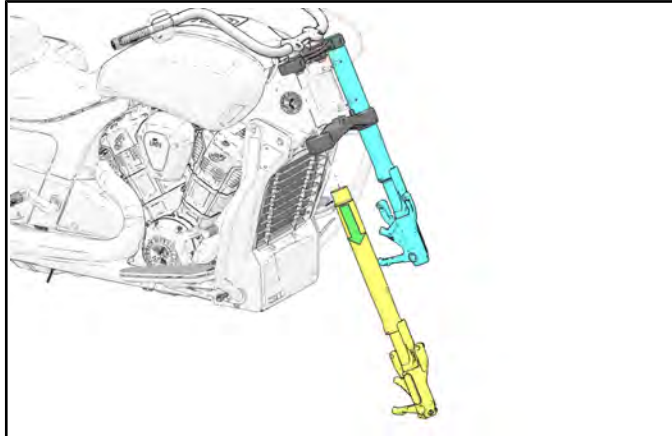
8. If disassembling the fork tube(s), loosen the fork cap(s) ② prior to loosening the lower triple clamp fasteners.



9. Loosen lower triple clamp pinch fasteners ③ for each fork tube.



10. Slide fork legs down and remove.



### FRONT FORK DISASSEMBLY

#### NOTICE

The following procedure requires the use of Fork Spring Compressor (PV-49463) and Fork Spring Compressor Adapter (PV-49464).

#### NOTICE

Refer to appropriate Front Fork Exploded View.

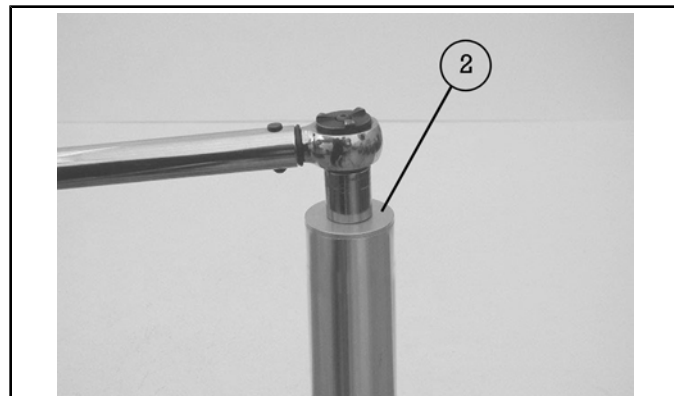
#### IMPORTANT

Clean fork tubes before disassembly.

1. Secure Fork Spring Compressor (PV-49463) vertically in a vise with drive bolt ① UP.



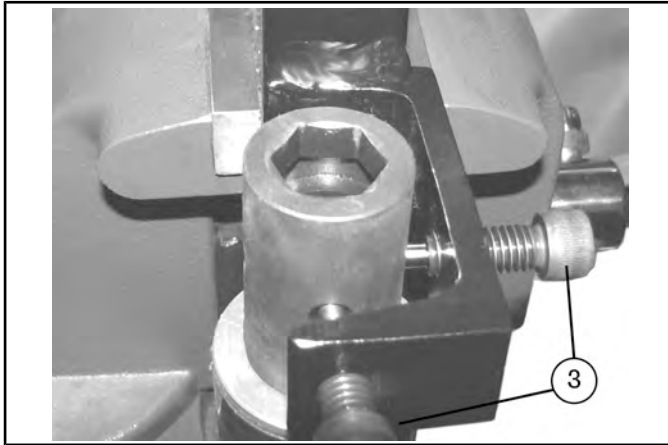
2. Loosen fork cap ② approximately 1 turn. Do not remove the cap.



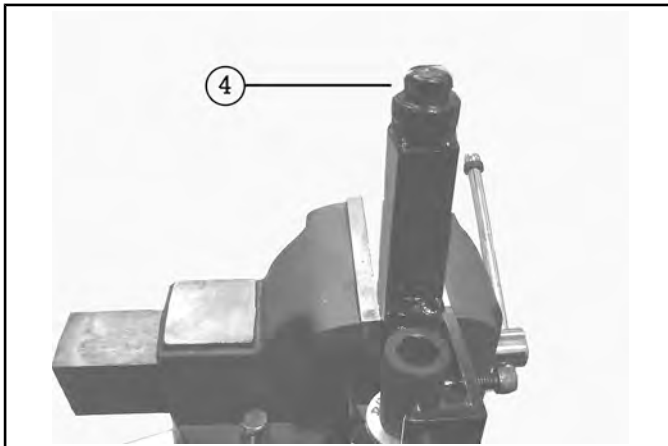
#### ⚠ WARNING

Wear eye / face protection. Be sure spring is engaged properly with pegs of tool as you compress the spring in the following steps.

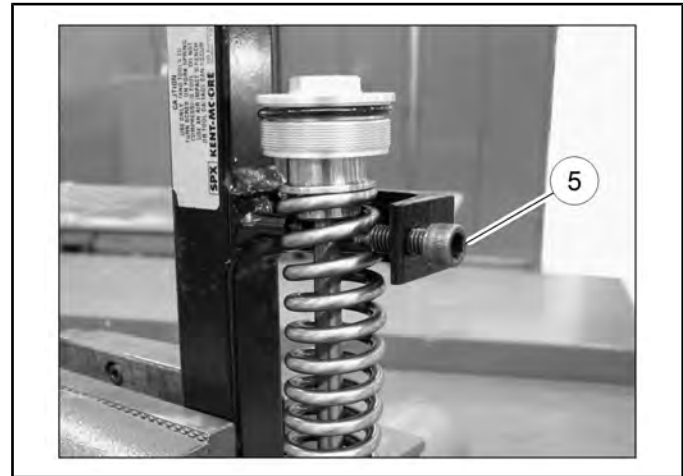
3. Mount special socket (**PV-49464**) in spring compressor. Center it in holding fixture with all thumb fasteners ③ .



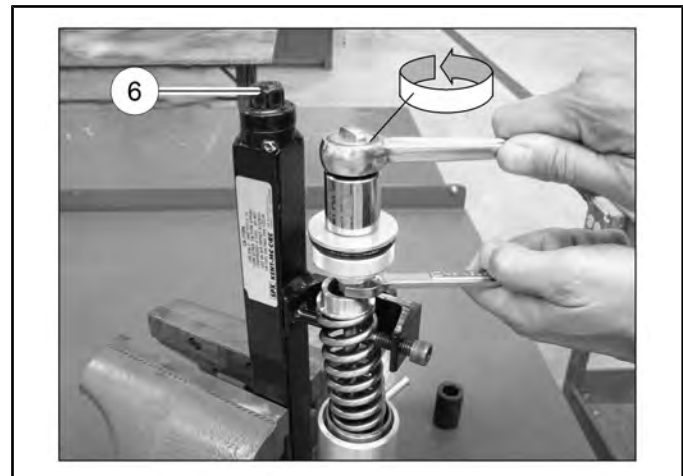
4. Place fork tube in spring compressor tool with hole in bottom of fork slider over peg on bottom of tool.
5. Adjust length of spring compressor by turning drive bolt ④ as required until fork cap is captive in socket.



6. Turn thumb screws ⑤ inward until retaining slot on end of screw aligns with spring. Push spring onto stationary peg, then onto adjustable pegs until spring coils are captive.



7. Turn drive bolt ⑥ of tool to compress spring just enough to hold fork in position and expose jam nut.
8. Hold jam nut with open end wrench and remove cap.





9. Remove nut from cartridge shaft.



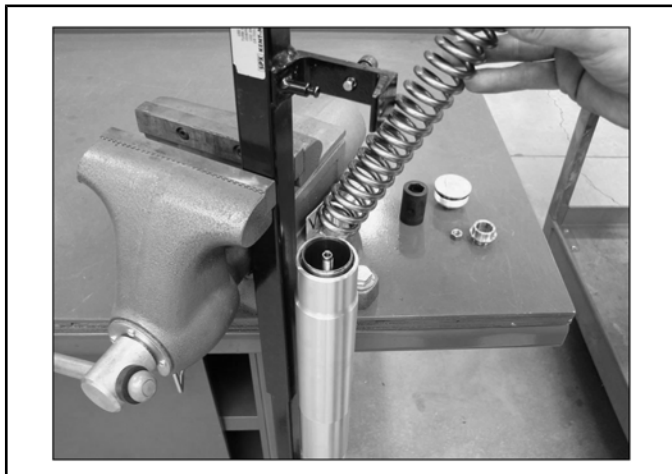
**NOTICE**

Nut can be removed later if it is not free on the shaft.

10. Slowly release all spring pressure and remove spacer.



11. Remove upper spring.

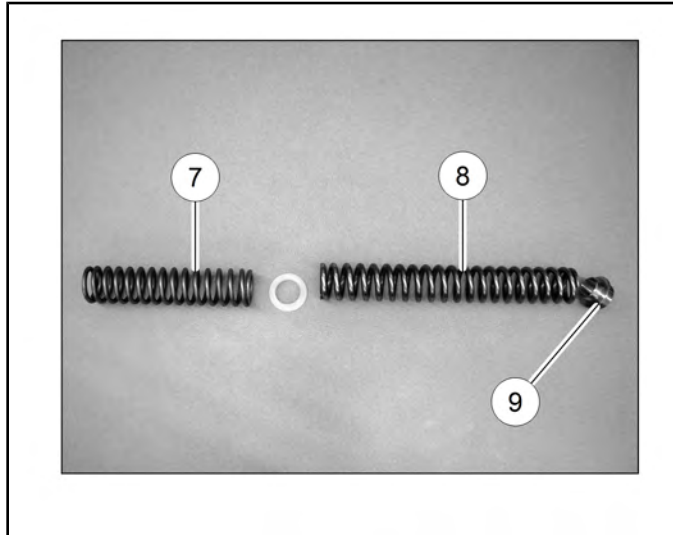


12. Remove fork leg from tool, lifting both inner and outer tubes together.

13. Pour fork oil out of tube and remove lower spring with lower spacer. Move cartridge shaft through complete stroke several times to drain cartridge until damping is gone.



14. Lower spring ⑦ has small diameter wire and the coils are closely spaced. The upper spring ⑧ has heavier wire and the coils spacing is wider. The metal spacer ⑨ is positioned on the top of the upper spring.



15. Proceed to Fork Seal Removal / Tube Disassembly. See **Fork Seal Removal / Tube Disassembly** page 8.35.

16. To change fork oil only, proceed to *Fork Oil Filling / Level Setting*. See **Fork Oil Filling / Level Setting** page 8.39.

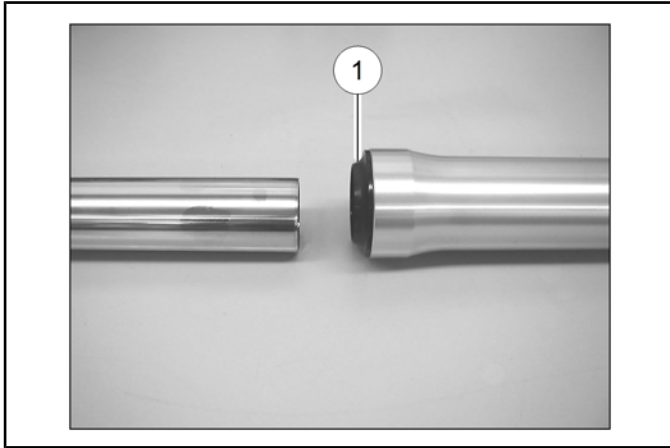
**FORK SEAL REMOVAL / TUBE DISASSEMBLY**

*NOTICE*

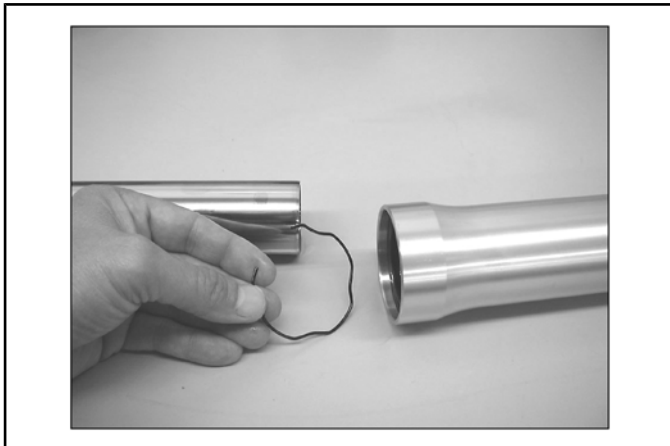
Replace dust seal and fork seal upon assembly

**SEAL REMOVAL**

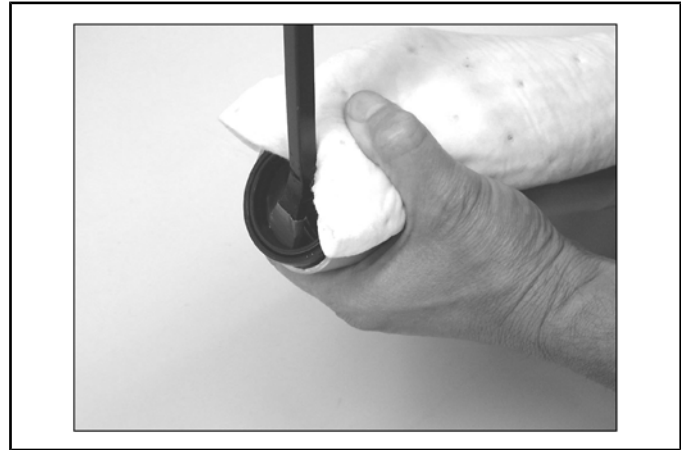
1. Separate tubes. Remove dust seal ① (by hand) or protect the tube and carefully pry to remove.



2. Remove seal retaining ring. Do not scratch tube.



3. Protect surface of outer tube. Carefully pry seal from outer tube. Do not scratch seal bore. Remove seal backing washer from outer tube.



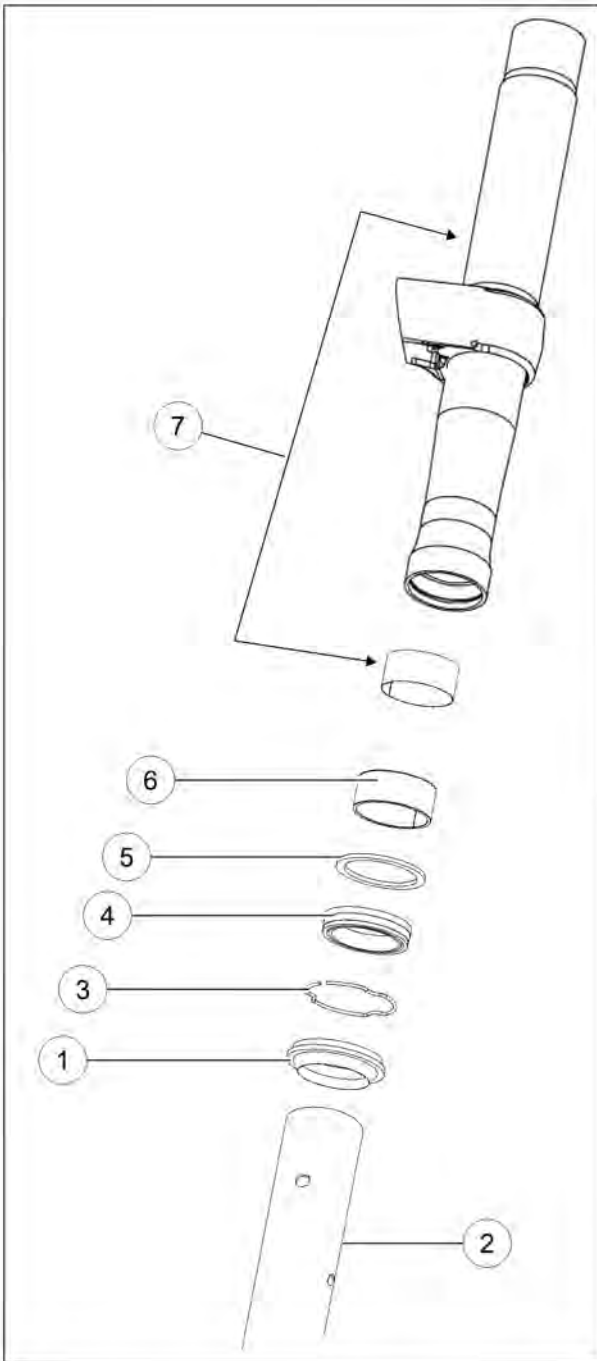
8

## STEERING / SUSPENSION

4. Inspect bearing surface of bushings. Replace bushing if bronze material appears on more than 1/4 (25%) of the entire anti-friction surface coating.

**NOTICE**

Use a light to visually inspect bushing inside the outer fork tube. Replace tube assembly if upper bushing is worn.



ITEM	DESCRIPTION
①	Dust Seal
②	Inner Tube
③	Retaining Ring
④	Seal
⑤	Backing Washer
⑥	Bushing, Lower (tap or pull evenly on opposite sides to remove)
⑦	Bushing, Upper (inside outer tube)

**CARTRIDGE REMOVAL****⚠ WARNING**

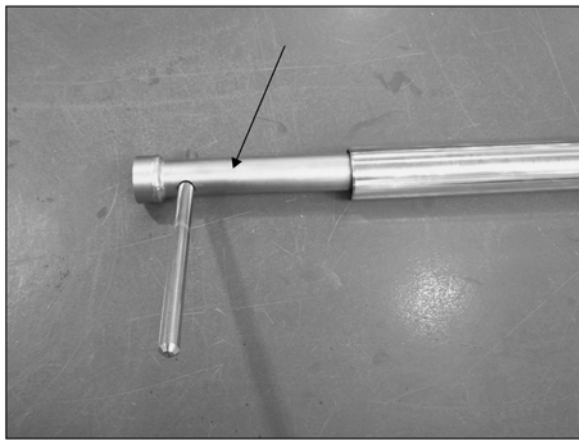
DO NOT disassemble the cartridge. If damaged or worn, it must be replaced as an assembly.

**NOTICE**

Cartridge removal is not required for fork oil change or for seal replacement. To clean cartridge, add clean fork oil to inner tube and pump damper rod to flush cartridge. Discard oil.

If cartridge removal is required proceed as follows:

1. Hold cartridge with holder PV-49452 using castellated end of tool (octagonal end out).



2. Remove cartridge screw and sealing washer using an extended 8 mm hex socket.



3. Remove cartridge from inner tube.

**FRONT FORK INSPECTION**

1. Inspect inner fork tube for scoring, heavy scratches, dents due to rocks or other road debris, or excessive wear. Replace tube if worn or damaged.
2. Place fork tube in V-blocks or truing stand and measure runout. Replace tube if runout exceeds service limit listed on **Service Specifications – Front Wheel / Suspension page**.

**⚠ WARNING**

Do not attempt to straighten bent fork tubes. Doing so will weaken the structural integrity of the forks and make the motorcycle unsafe to operate.

3. **DO NOT loosen or remove set screw**

**⚠ WARNING**

DO NOT disassemble the inner fork tube. If damaged or worn, the inner fork tube / lower casting must be replaced as an assembly.

4. Inspect outer tube for dents or other damage. Look for cracks in the tube, especially in the clamping zone. Assemble inner and outer fork tube and move inner tube through complete travel range. Check for resistance or binding in suspect area of outer tube. Replace outer tube if binding or resistance is evident, or if tube is cracked.
5. Inspect cartridge by moving shaft through travel range. If binding is evident, replace the assembly.

**FRONT FORK ASSEMBLY**

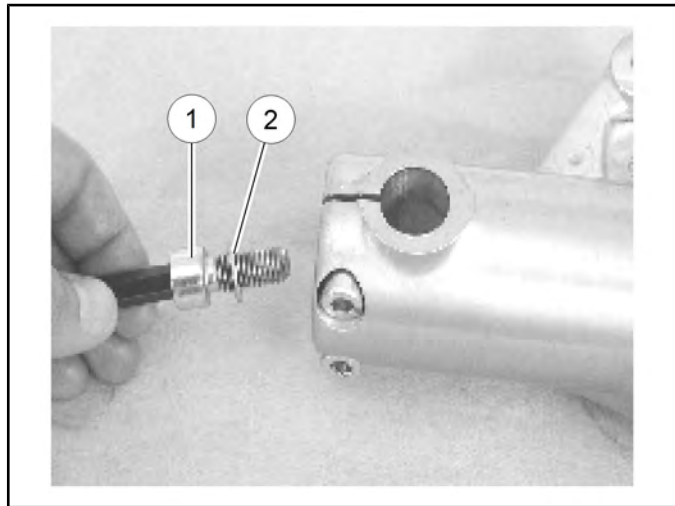
1. Place cartridge assembly into inner fork tube. Hold cartridge with PV-49452.



**IMPORTANT**

Be sure screw threads in bottom of cartridge are clean and not damaged.

2. Install a new cartridge screw ① and new sealing washer ②. Torque screw to specification.

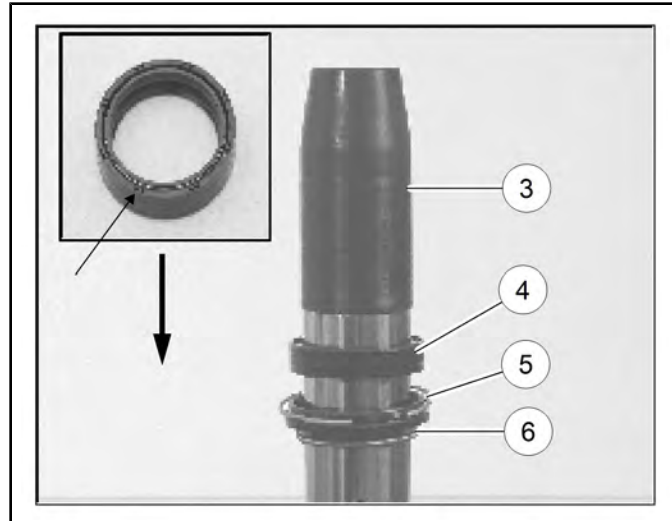


**TORQUE**

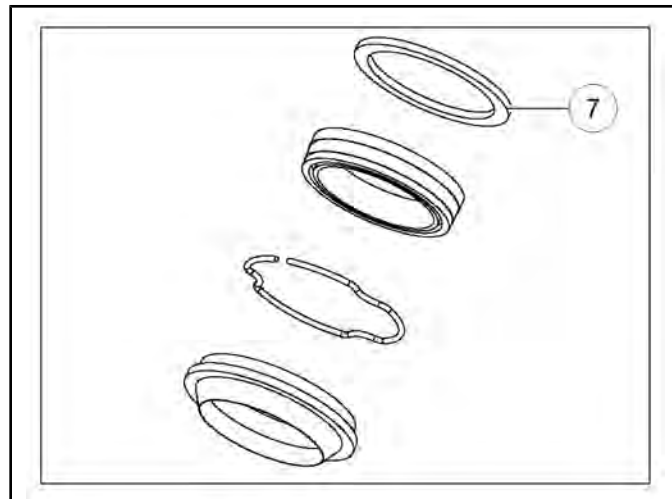
Cartridge Screw:  
**17 ft-lbs (23 N·m)**

3. To prevent seal damage, install seal guide ③ over end of fork tube as shown lubricate surface of guide.
4. Carefully install a new dust seal ④ (external spring faces down) and slide it over seal guide.
5. Set new retaining ring ⑤ on dust seal.

6. Lubricate and install a new fork seal ⑥ with marks facing dust seal and retaining ring.



7. Remove seal guide from inner tube and install seal backing washer ⑦ against seal. Machined face (flattest edge) should face UP (away from seal).



**NOTICE**

If lower tube bushing was removed from the outer tube for replacement, slide the new bushing onto the inner tube after backing washer is installed.

8. Lubricate lower bushing with fork oil. Assemble the outer tube to the inner tube.

**NOTICE**

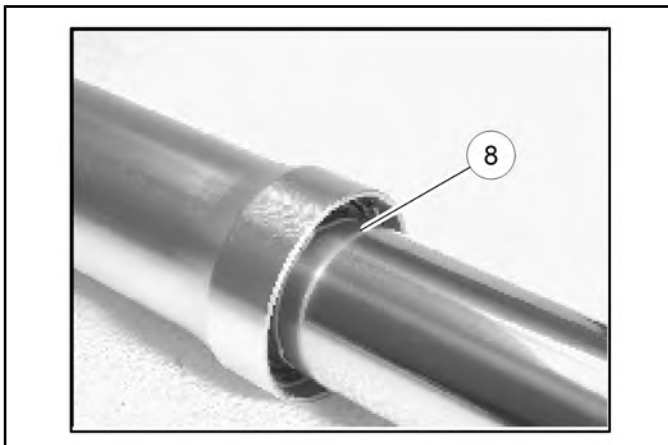
If lower bushing was not removed go to the next step.

9. Start the lower bushing into the outer fork tube and slide the backing washer against it. Use the seal driver to tap the bushing into the outer tube until fully seated.

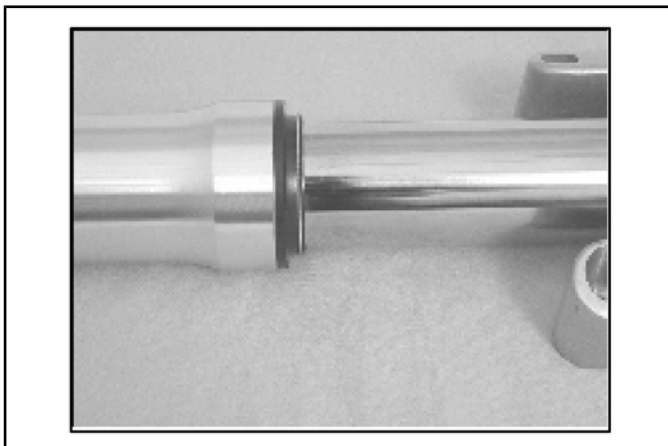
10. Lubricate outer surface of seal with fork oil.
11. Drive seal into outer tube with large side of seal driver until fully seated (below retaining ring groove).



12. Install retaining ring ⑧ into groove of fork tube. Be sure entire retaining ring is seated in groove.



13. Wipe any excess oil from seal cavity and press dust seal in (by hand) until fully seated in outer tube.



### FORK OIL FILLING / LEVEL SETTING

1. Slide tubes together lightly to bottom of travel range.



2. Tip fork leg at an angle to reduce bubbles when adding fork oil.

*ADD:* About 500 cc of P/N 2884244 fork oil.



3. Slowly add recommended fork oil until holes near the top of the outer tube are covered by oil. (The holes are located about 35mm (1 1/2 inches) below the top of the outer tube).

#### NOTICE

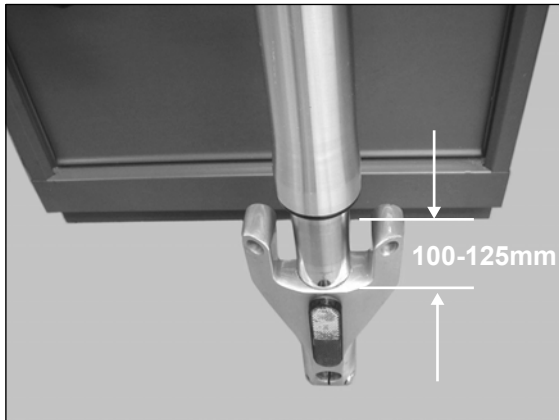
The oil quantity slightly exceeds fork capacity. Final fork oil level must be adjusted correctly as outlined later.

4. Set fork leg upright.

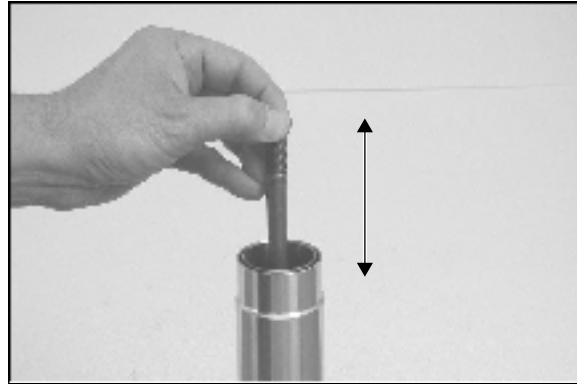
## STEERING / SUSPENSION

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5. Lift outer tube up about 100-125mm (4-5 inches) from fully compressed position.



7. Bleed cartridge by moving shaft up and down to purge air. Begin with small strokes, increasing stroke length until all air is removed and damping is smooth and consistent.

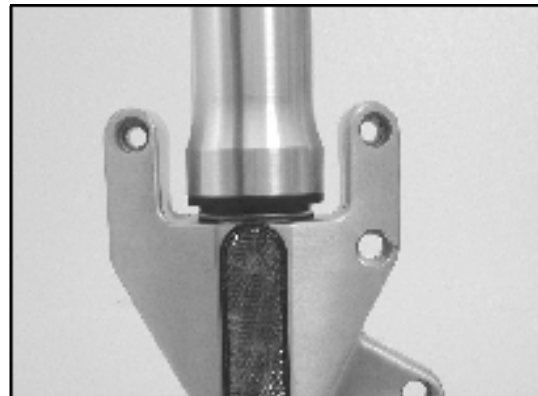


6. Seal top of tube firmly with your hand and push downward to build air pressure in tube. Hold for 10-15 seconds to force trapped air into the oil. Allow a few minutes for air to rise to the top of the oil in tube.



### OIL LEVEL ADJUSTMENT

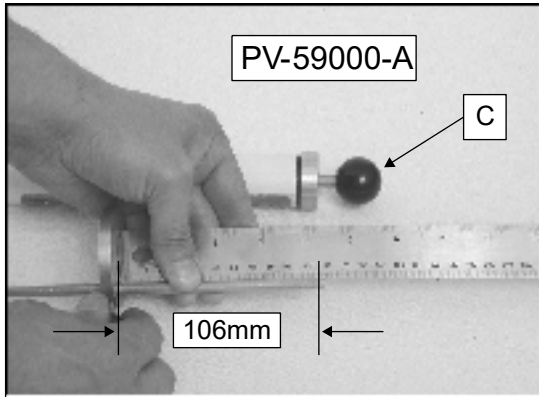
1. Slowly compress fork until it stops with dust seal against casting (at bottom of travel).



2. Adjust fork oil level tool (C) to specified level:
  - Springs and spacers removed
  - Tube upright and level
  - Cartridge rod at bottom of travel

**MEASUREMENT**

Fork Oil Level (From Top of Tube):  
**103 mm (4.05")**



3. Insert tool into fork with plate squarely seated on top of tube. Be sure fork is upright, fully compressed, and cartridge rod is at bottom of travel.
4. Draw excess oil out to set proper oil level.



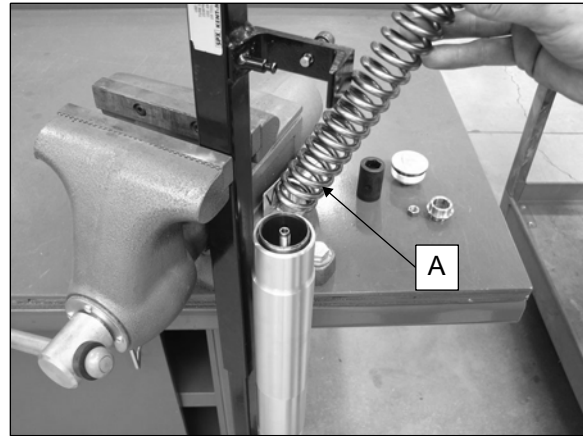
**FORK SPRING INSTALLATION / FINAL ASSEMBLY**

**⚠ WARNING**

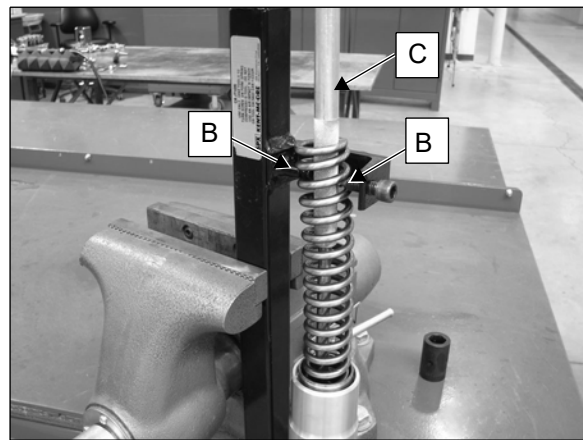
Springs are compressed during this procedure. Wear a face shield to reduce the chance of injury.

1. Set axle end of fork tube in spring compressor.
2. Install lower spring (spring is non-directional).
3. Install lower spacer.

4. Install upper spring (A) (spring is non-directional).



5. Engage all 3 pins (B) of compressor tool with coils of fork spring as done for disassembly.
6. Screw cartridge rod extension tool (C) onto cartridge rod and pull cartridge up to top of travel range.
7. Compress spring. Guide damper rod with extension tool while spring is being compressed.



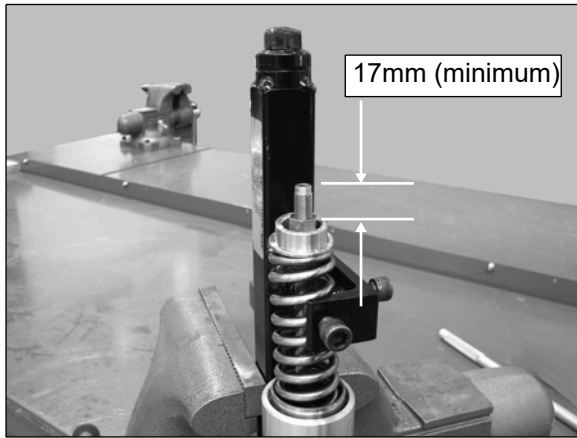
8. Hold damper rod up and remove cartridge shaft tool.
9. Install top spacer on spring.



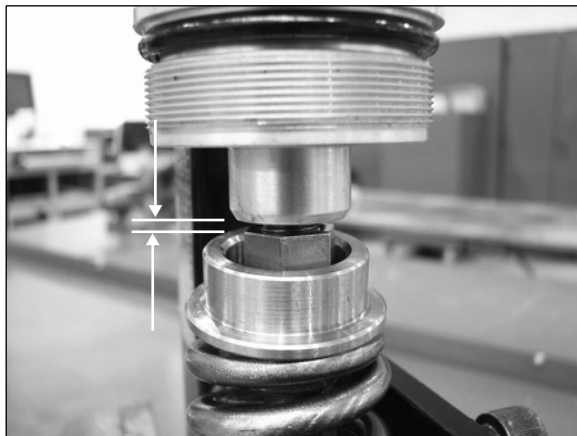
10. Install nut with flattest surface facing up.



11. Screw nut onto cartridge rod at least 17 mm to ensure cap threads will be fully engaged when installed.

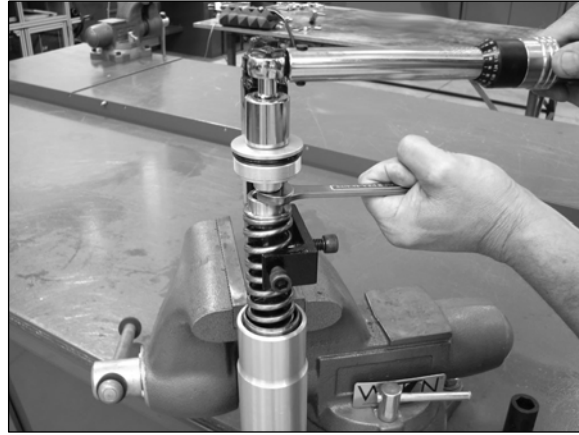


12. Install a new O-ring on fork cap and screw cap onto cartridge rod until bottomed. A gap should exist between cap and nut when cap is bottomed.



13. Screw nut upward until it contacts the cap.

14. *Tighten nut against cap.* Hold nut and torque cap to specification.



TORQUE
Fork Cap Nut: <b>12 ft-lbs (16 N·m)</b>

15. Screw cap into outer tube and torque to specification:

TORQUE
Fork Cap: <b>17 ft-lbs (23 N·m)</b>



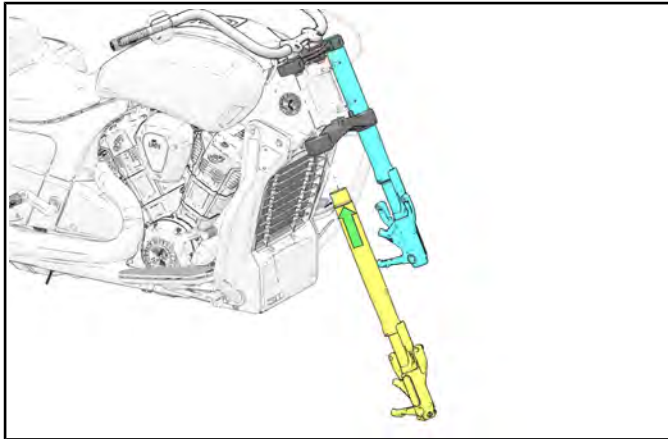
16. Wipe fork clean to remove all oil before installing in triple clamp.

**FRONT FORK INSTALLATION**

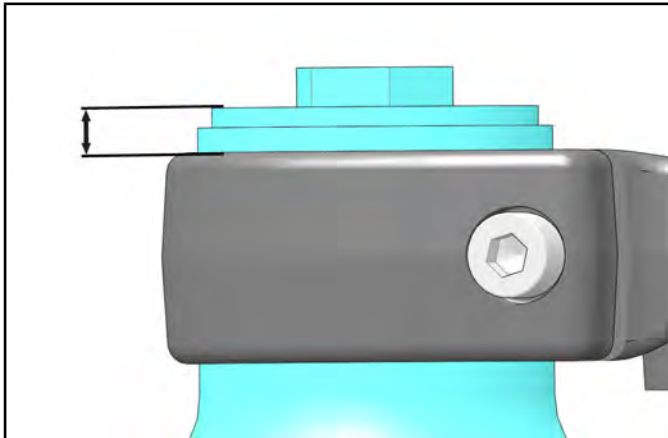
**NOTICE**

Clean the fork tubes and the clamping surfaces of the triple clamps to remove any oil or grease prior to installation.

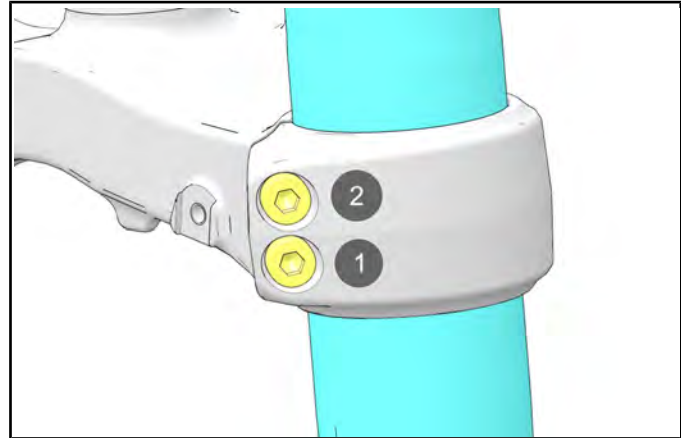
1. Install one fork tube assembly into lower triple clamp.



2. Continue to slide tube through lower triple clamp and into upper triple clamp. The top of the cap to the top of the triple clamp should be **0.26 in (6.60 mm)**.



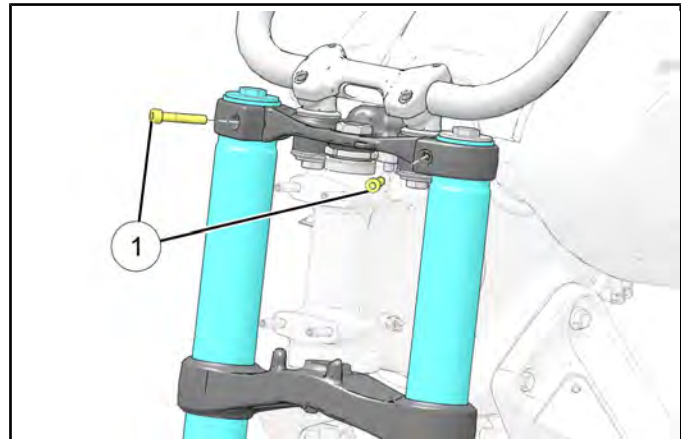
3. Torque the triple clamp fasteners in sequence as shown.



**TORQUE**

Lower Fork Clamp Fastener:  
**18 ft-lbs (24 N·m)**

4. Repeat steps 1–3 for the remaining fork tube.
5. Torque the upper triple clamp fastener ①.



**TORQUE**

Upper Fork Clamp Fastener:  
**18 ft-lbs (24 N·m)**

6. Install brake line guides (if removed).
7. Install front wheel. See **Front Wheel, Removal / Installation page 8.28**.
8. Install brake calipers. See **Front Caliper Service page 9.47**.
9. Install front fender. See **Front Fender Removal / Installation page 7.37**.
10. Install fairing. See **Fairing Disassembly page 7.40**.

## STEERING / SUSPENSION

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11. Inspect all fasteners for proper torque. Inspect hoses and wiring for proper routing.
12. Lower front end of motorcycle to the ground and test front suspension / fork operation.

**TRIPLE CLAMP REMOVAL**

**⚠ WARNING**

This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.

**⚠ CAUTION**

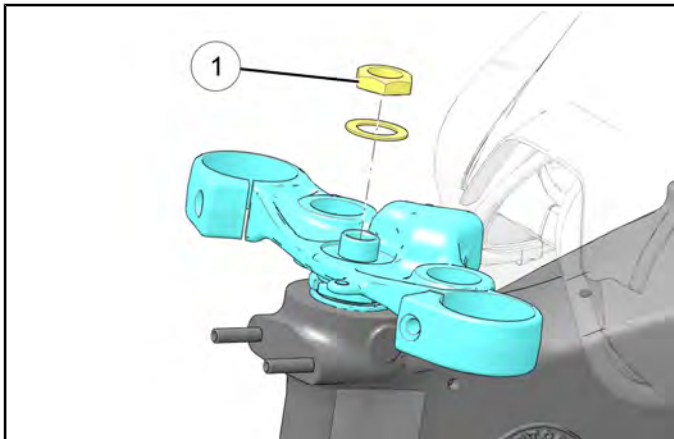
Do not twist the brake hose or brake line. Do not allow calipers to hang from the brake hose. Secure calipers in such a way to avoid hose damage.

1. Secure the motorcycle in an upright position with tie-down straps and a platform jack positioned beneath the engine cases.

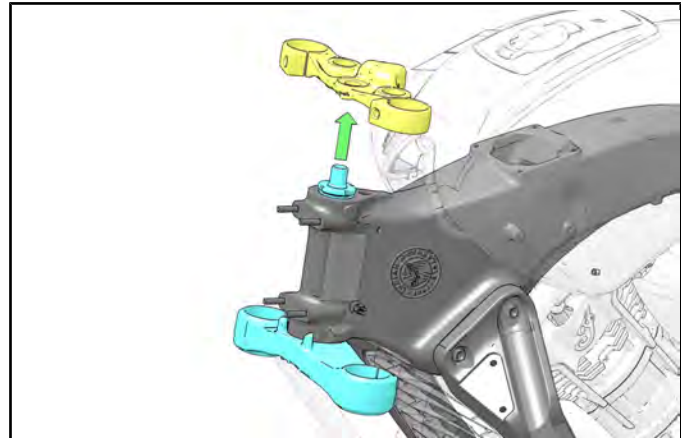
**NOTICE**

Do not operate the front brake lever with the calipers or wheel removed.

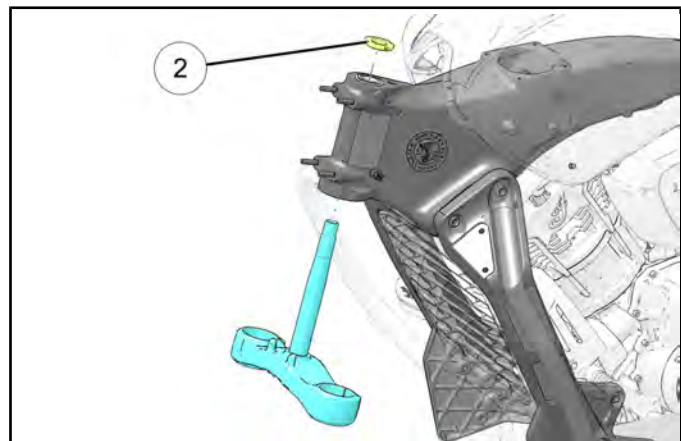
2. Remove front fender. See **Front Fender Removal / Installation page 7.37.**
3. Remove front brake calipers and support them so they do not hang by brake hoses. See **Front Caliper Service page 9.47.**
4. Remove front wheel. See **Front Wheel, Removal / Installation page 8.28.**
5. Remove Fairing. See **Fairing Disassembly page 7.40.**
6. Remove the handlebar / riser assembly. See **Handlebar Removal / Installation page 8.25.**
7. Remove fork tubes. See **Front Fork Removal page 8.31.**
8. Remove center nut ① and washer on upper triple clamp.



9. Slide upper triple clamp off steering stem.



10. Remove stem adjuster nut ② with a suitable spanner socket.



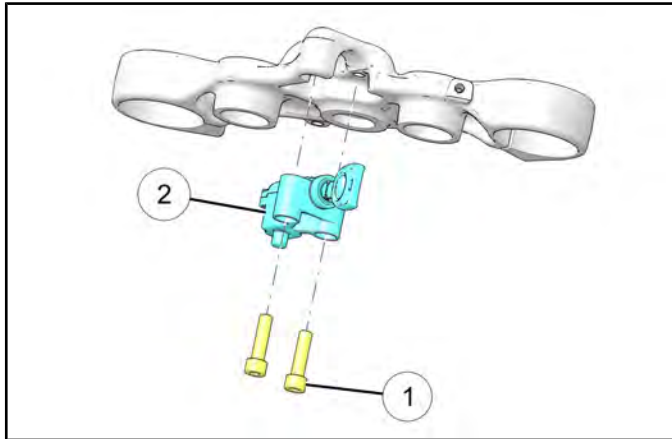
11. Remove lower triple clamp, with steering stem, and lower bearing (outer race will remain in head tube).
12. Inspect bearings and bearing races.

### **FRONT FORK LOCK REMOVAL / INSTALLATION**

#### **IMPORTANT**

Fork lock fasteners must be replaced when fork lock is removed. Do not reuse fork lock fasteners.

1. Perform steps 1–9 of triple clamp removal procedure. Reference **Triple Clamp Removal page 8.45**.
2. Remove two fork lock fasteners ① and remove fork lock ②.



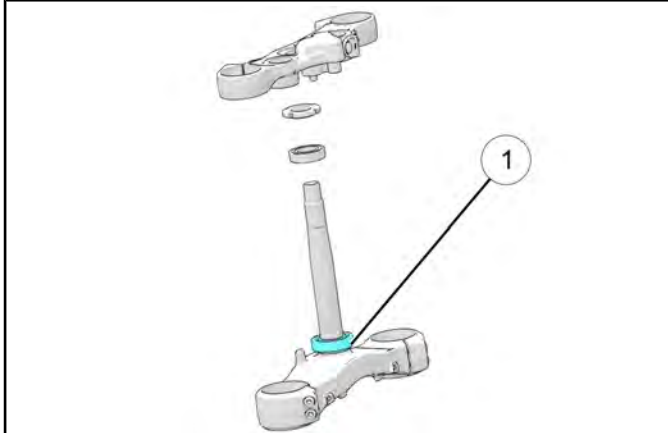
3. Install NEW fork lock ② and Install two NEW fasteners ①. Torque fasteners to specification.

#### **TORQUE**

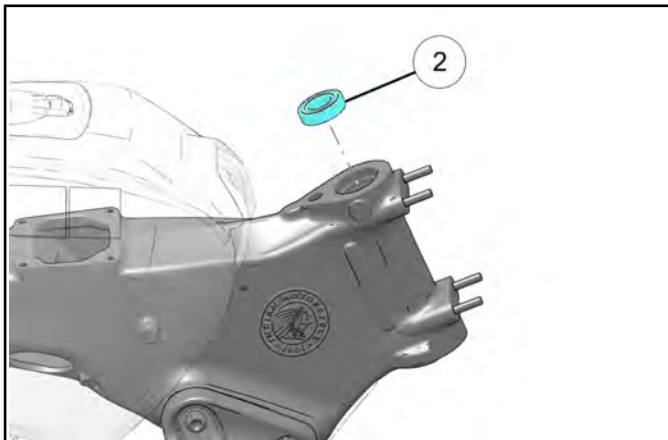
Steering Lock Fastener:  
**18 ft-lbs (24 N·m)**

**TRIPLE CLAMP INSTALLATION / STEERING HEAD BEARING ADJUSTMENT**

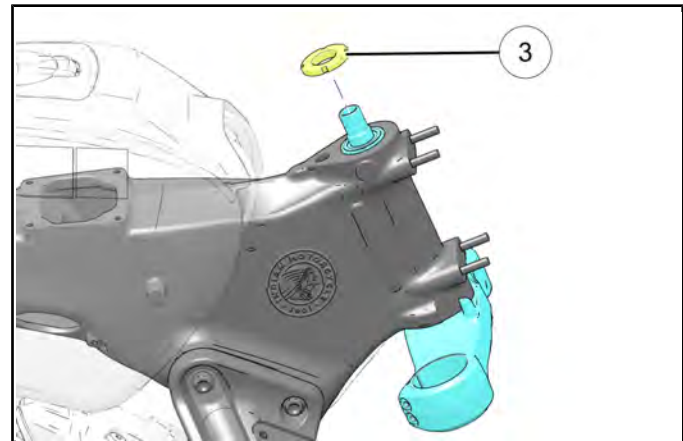
1. Inspect both top and bottom bearing races for pitting, dents, or worn surface. Replace bearings and races as a set if they are worn or damaged.
2. Be sure lower stem bearing ① is seated against step on lower triple clamp. Apply all purpose grease to bearing and install lower triple clamp / stem to frame.



3. Grease and install upper bearing ② onto stem and push it down until seated in upper bearing race.



4. Screw adjuster nut ③ (shoulder side down) onto the steering stem until it is finger tight.



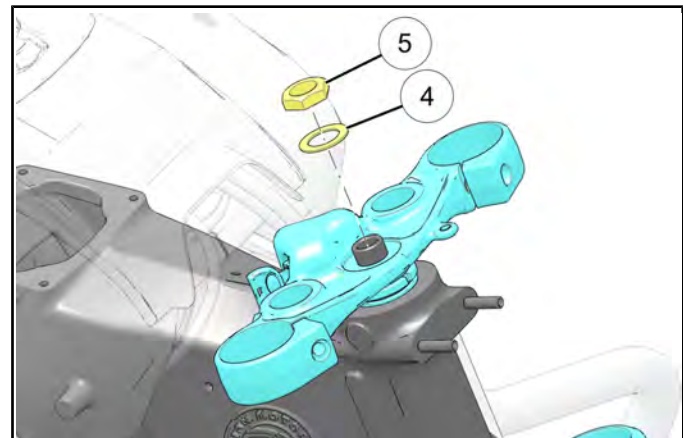
5. Turn triple clamp assembly fully to the right.
6. Torque adjuster nut to specification using suitable spanner wrench.

**TORQUE**

Steering Head Nut:

1. Torque to 29 ft-lbs (39 N·m)
2. Turn assembly lock to lock 5 times
3. Loosen 60 °
4. Install Triple clamp and tighten top nut 72 ft-lbs (98 N·m)

7. Set upper triple clamp in place on stem. Install washer ④ and nut ⑤ and tighten top nut until it is finger tight.

**NOTICE**

Nut will be torqued after fork tubes are installed.

8. Slide fork tubes through lower triple clamp and into upper triple clamp. Align top edge of fork cap with top edge of upper triple clamp and hold in position.

## STEERING / SUSPENSION

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9. Tighten top triple clamp pinch fastener enough to hold tubes in place. Leave lower triple clamp pinch fasteners *loose*.
10. Torque the top steering stem nut to specification.

TORQUE
Top Triple Clamp Nut: <b>72 ft-lbs (98 N·m)</b>

NOTICE
CHECK STEERING STEM BEARINGS at this time. Pull firmly on fork tubes with a front-to-rear motion. If movement can be felt in steering bearings, disassemble and go back to STEP 4. Tighten steering stem adjuster nut an additional 5 degrees, and reassemble following STEPS 4–10. Repeat this procedure until no play can be felt.

11. Install front forks. See **Front Fork Installation page 8.43**
12. Install handlebar, See **Handlebar Removal / Installation page 8.25**
13. Install fairing, See **Fairing Disassembly page 7.40**
14. Install front wheel, See **Front Wheel, Removal / Installation page 8.28**
15. Install front caliper, See **Front Caliper Service page 9.47**
16. Install front fender, See **Front Fender Removal / Installation page 7.37**
17. Verify all fasteners are installed and properly torqued.

**TROUBLESHOOTING**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REPAIR RECOMMENDED</b>
Heavy Steering	Steering Stem Nut Over Tightened	Torque to specification
	Damaged Steering Stem Bearings or Races	Replace
	Bent Steering Stem	Replace
	Front Tire Damaged or Worn	Replace
	Low Tire Pressure	Inflate to specification
Pulls to One Side or Wanders	Damaged Steering Stem Bearings or Races	Replace
	Steering Stem Nut Over Tightened or Under Tightened	Torque to specification
	Low Tire Pressure	Inflate to specification
	Rear Wheel Not Aligned Correctly	Align
	Bent Front Axle	Replace
	Damaged or Excessively Worn Front Tire / Incorrect Tire	Replace
	Damaged Wheel Bearings	Replace
	Damaged Swing Arm Bearings	Replace
	Loose Swing Arm Pivot Nut	Torque to specification
	Bent Frame or Swingarm	Replace
Handlebars Oscillate (Wobble)	Bent Front Axle	Replace
	Wheel Has Excessive Runout	True (Spoked) / Replace (Cast)
	Tire Mounted Incorrectly	Check Mounting and Balance
	Damaged Tire / Worn Tire	Replace
	Loose Steering Stem Nut	Torque to specification
	Incorrect Tire	Replace
	Incorrect Tire Pressure	Correct
Noise Coming From Front Suspension	Worn Fork Bushings	Rebuild Forks
	Low Fork Fluid	Determine Cause / Replace Fork Oil
	Loose Fasteners	Torque to specification
	Loose Steering Stem Bearings	Determine Cause / Correct
Front Wheel Oscillates (Wobbles)	Bent Front Rim	Replace
	Damaged Front Wheel Bearings	Replace
	Damaged or Incorrect Tire	Replace
Front Wheel Oscillates (Wobbles)	Loose Axle	Torque to specification



**STEERING / SUSPENSION**

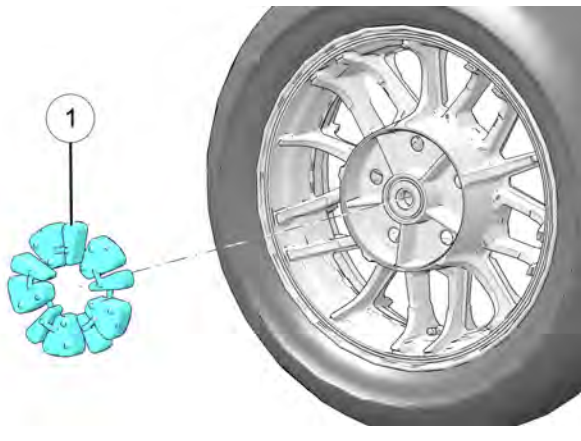
<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REPAIR RECOMMENDED</b>
	Fork Tube Height Unequal	Install Correctly
	Fork Oil Level Unequal	Set Correctly
	Fork Spring Free Length Different Between Right & Left	Replace
	Wheel Assembly Out-of-Balance	Balance
	Low Tire Pressure	Inflate to specification
Front Suspension Too Soft	Weak Fork Springs	Replace
	Low Fork Oil Level	Determine Cause/Replace Fork Oil
	Wrong Weight Fork Oil	Replace
	Contaminated and/or Deteriorated Fork Oil	Replace
	Low Tire Pressure	Set Correctly
Front Suspension Too Hard	Tire Pressure Too High	Set Correctly
	Bent Fork Tubes	Replace
	Wrong Weight Fork Oil	Replace
	Too Much Fork Oil	Set Correctly
	Plugged Oil Passages	Rebuild Front Forks
	Damaged Sliders	Replace
	Forks Binding	Correct
Wheel Turns Hard	Damaged Wheel Bearings	Replace
	Front Axle Bent	Replace
	Brake Dragging (Hydraulic or Mechanical Problem)	Repair as Necessary
	Brake Dragging (Bent Disc)	Replace
	Improper Assembly After Repairs	Correct as Necessary

**REAR WHEEL / SUSPENSION****GENERAL INFORMATION****SERVICE NOTES – REAR WHEEL / SUSPENSION****⚠ WARNING**

This motorcycle was produced with the designated tires as original equipment. The testing to ensure stability and superior handling was done using the OEM tires. Using non-OEM tires could result in poor motorcycle stability and handling, which can lead to a crash resulting in serious injury or death. Use only the recommended tires inflated to the recommended tire pressures.

**IMPORTANT**

Visual inspection of the cushion drive damper ① for cracks or deformation is required whenever the rear wheel is removed. Replace damper if damage is found.



Tubeless tires are used on certain Indian Motorcycle models. Operating the motorcycle with damaged rims creates a safety hazard including air pressure loss, steering imbalance and/or reduced steering control. Do not attempt to repair or straighten damaged cast or spoked rims. Always use genuine Indian Motorcycle parts or equivalent so that quality is not compromised. The use of tire valves and valve cores other than original equipment replacement Indian Motorcycle parts could cause tire deflation which may lead to loss of control, resulting in injury or death. Do not allow any motorcycle to leave your service area without tire valve caps securely installed.

- The rear shock absorber is serviceable.
- Refer to Maintenance chapter for maintenance of rear wheel & suspension components, and suspension ride height adjustment.

**SPECIAL TOOLS – REAR WHEEL / SUSPENSION**

SPECIAL TOOL	PART NUMBER
Swing-arm Bushing Tool	PF-51237
Bearing Removal / Installation Kit	PF-51324
Platform Jack	Commercially Available

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

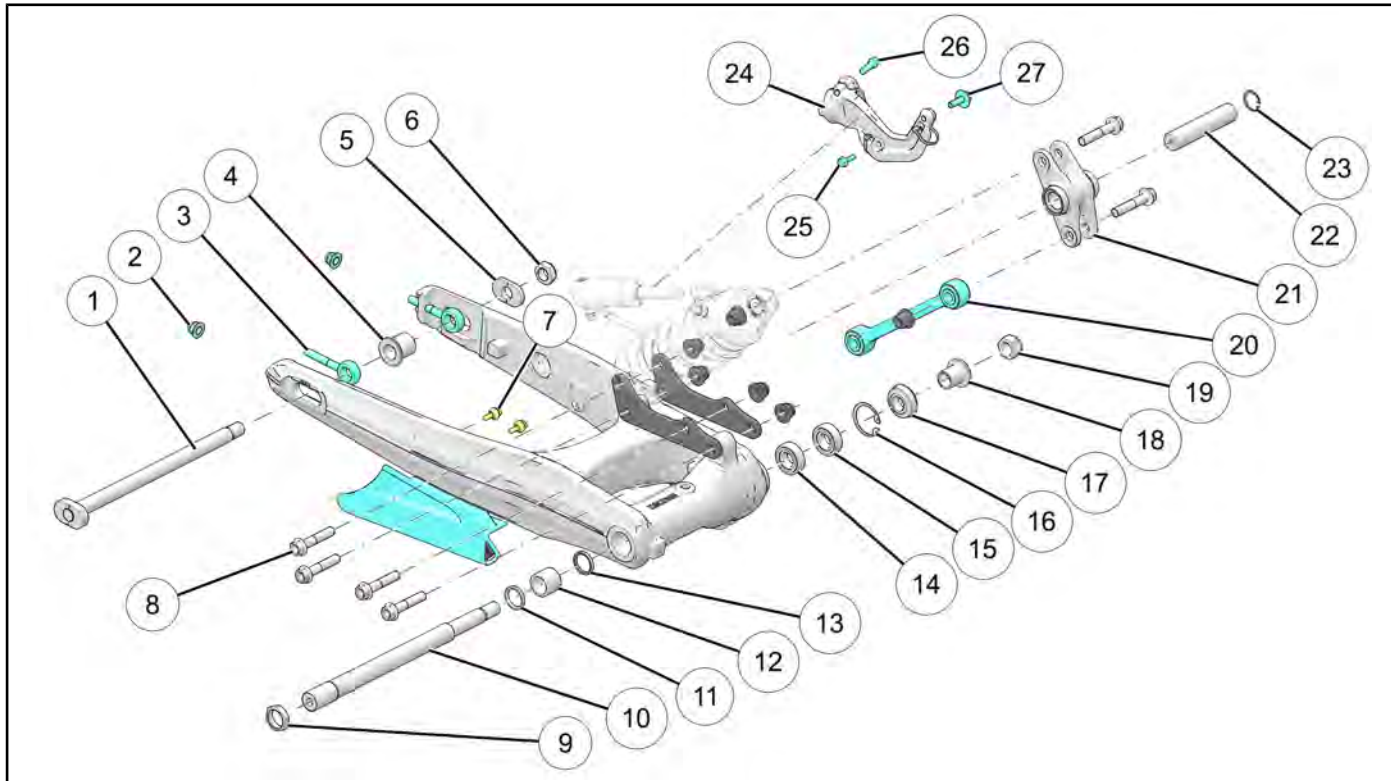
STEERING / SUSPENSION

**SERVICE SPECIFICATIONS – REAR WHEEL / SUSPENSION**

ITEM		STANDARD	SERVICE LIMIT
Axle Runout		-	.20 mm (.008")
Rear Wheel Runout	Axial	.80 mm (.030 inch)	2.0 mm (.080")
	Radial	.80 mm (.030 inch)	2.0 mm (.080")
Rear Wheel Size / Type		16" x 5" Cast	-
Rear Wheel Travel		4.5" (11.4 cm)	-
Shock Spring Free Length		8.84" (224.5 mm)	-
Shock Spring Installed Length (Standard)		Perform Ride Height Adjustment	-
Suspension Ride Height		Refer to Maintenance chapter for Ride Height Measurement procedure	-
Spring Rate		650 lbs/in	
Swing Arm Pivot Shaft Runout		Not Applicable	.20 mm (.008")
Swing Arm Pivot Shaft O.D.		LH Ball Bearing Journal: 19.965–19.99 mm / RH Needle Bearing Journal: 24.95–25.00 mm	-
Swing Arm Needle Bearing Bore O.D. (RH)		31.946–31.972 mm	-
Swing Arm Ball Bearing Bore O.D. (LH)		41.967–41.992 mm	-
Wheel bearing O.D. (approx)		51.987–52.00 mm	-
Wheel bearing I.D. (approx)		19.998–20.00 mm	-

**ASSEMBLY VIEWS**

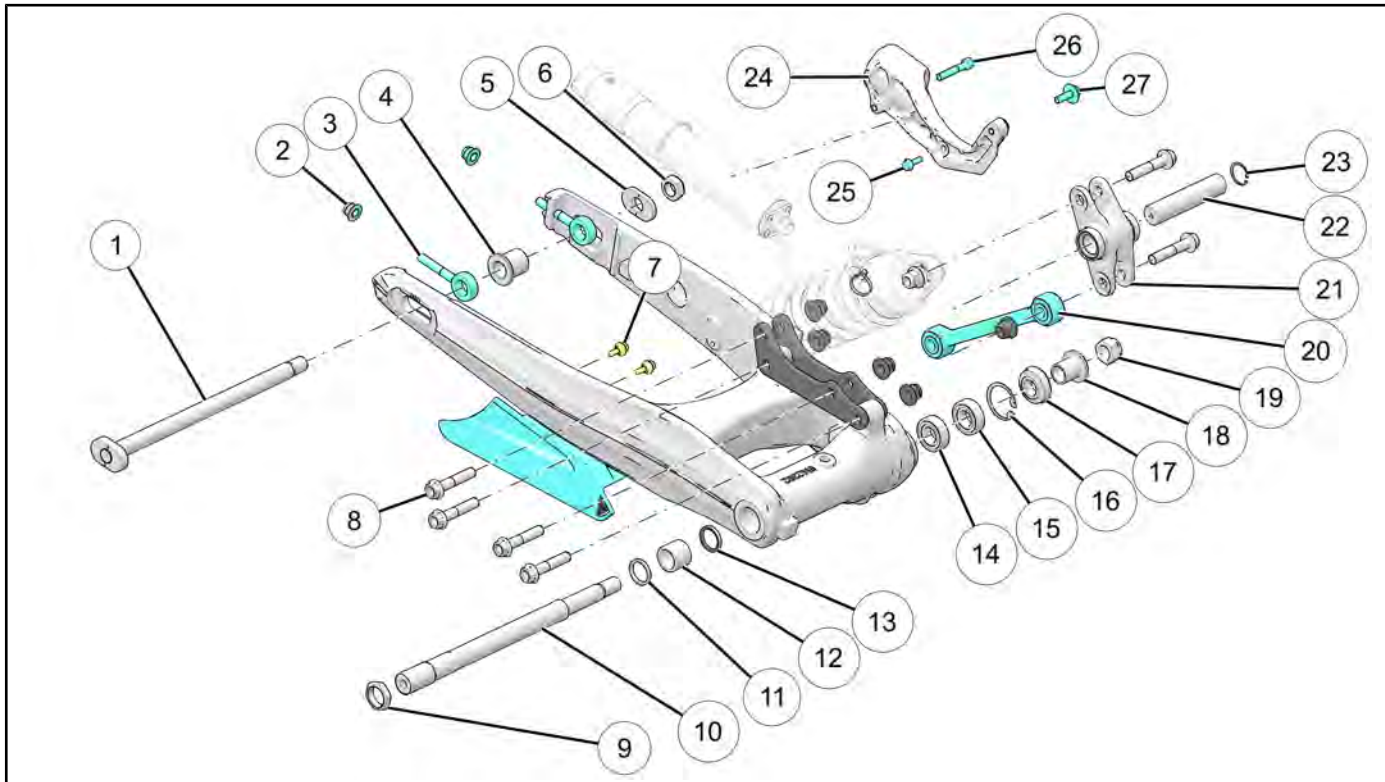
**REAR SUSPENSION (2020+)**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Rear Axle	—	⑮	Bearing	—
②	Adjuster Nut	—	⑯	Retaining Ring	—
③	Axle Adjuster	—	⑰	Pivot Spacer	—
④	Wheel Spacer	—	⑱	Outer Pivot Spacer	—
⑤	Axle Adjuster Plate	—	⑲	Swing-Arm Pivot Nut (Nylock)	<b>65 ft-lbs (88 N·m)</b>
⑥	Axle Nut	<b>65 ft-lbs (84 N·m)</b>	⑳	Shock Pushrod	—
⑦	Belt Guard Fastener	<b>96 in-lbs (11 N·m)</b>	㉑	Rocker Assembly	—
⑧	Gusset Plate Fastener	<b>96 ft-lbs (130 N·m)</b>	㉒	Rocker Pivot Shaft	—
⑨	Swing-Arm Pivot Jam Nut	<b>75 ft-lbs (101 N·m)</b>	㉓	Retaining Ring	—
⑩	Swing-Arm Pivot Shaft	<b>96 in-lbs (11 N·m)</b>	㉔	Adjuster Bracket	—
⑪	Seal	—	㉕	Shock Adjust Bracket Fastener M6	<b>96 in-lbs (11 N·m)</b>
⑫	Roller Bearing	—	㉖	Shock Adjuster Fastener	<b>18 ft-lbs (24 N·m)</b>
⑬	Seal	—	㉗	Shock Adjuster Bracket Fastener M8	<b>18 ft-lbs (24 N·m)</b>
⑭	Bearing	—			

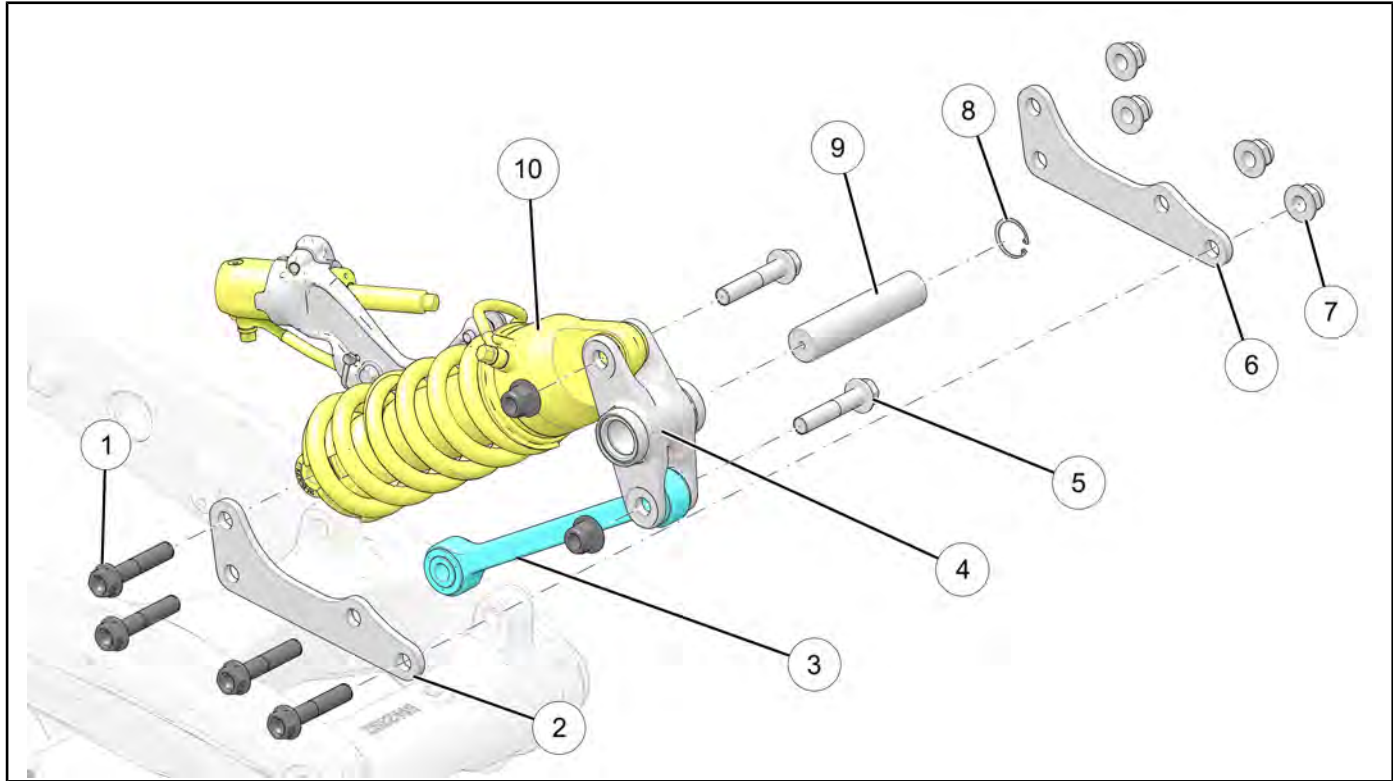
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**REAR SUSPENSION (2022+)**



REF	DESCRIPTION	TORQUE	REF	DESCRIPTION	TORQUE
①	Rear Axle	—	⑮	Bearing	—
②	Adjuster Nut	—	⑯	Retaining Ring	—
③	Axle Adjuster	—	⑰	Pivot Spacer	—
④	Wheel Spacer	—	⑱	Outer Pivot Spacer	—
⑤	Axle Adjuster Plate	—	⑲	Swing-Arm Pivot Nut (Nylock)	<b>65 ft-lbs (88 N·m)</b>
⑥	Axle Nut	<b>65 ft-lbs (84 N·m)</b>	⑳	Shock Pushrod	—
⑦	Belt Guard Fastener	<b>96 in-lbs (11 N·m)</b>	㉑	Rocker Assembly	—
⑧	Gusset Plate Fastener	<b>96 ft-lbs (130 N·m)</b>	㉒	Rocker Pivot Shaft	—
⑨	Swing-Arm Pivot Jam Nut	<b>75 ft-lbs (101 N·m)</b>	㉓	Retaining Ring	—
⑩	Swing-Arm Pivot Shaft	<b>96 in-lbs (11 N·m)</b>	㉔	E-Adjuster Bracket	—
⑪	Seal	—	㉕	Shock Adjust Bracket Fastener M6	<b>96 in-lbs (11 N·m)</b>
⑫	Roller Bearing	—	㉖	Shock Adjuster Fastener	<b>18 ft-lbs (24 N·m)</b>
⑬	Seal	—	㉗	Shock Adjuster Bracket Fastener M8	<b>18 ft-lbs (24 N·m)</b>
⑭	Bearing	—			

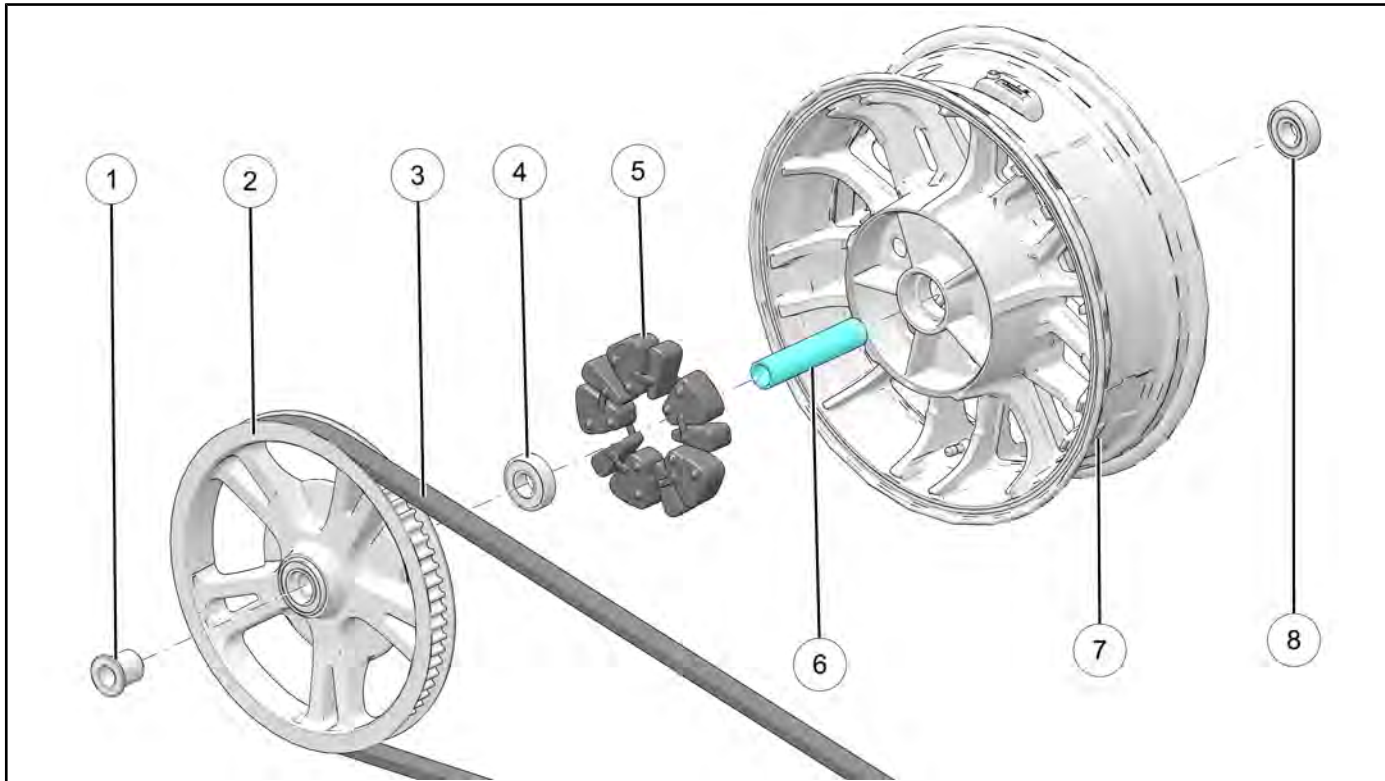
**REAR SHOCK / PUSHROD**



REF	DESCRIPTION	TORQUE
①	Gusset Plate Fastener	<b>96 ft-lbs (130 N·m)</b>
②	Gusset Plate	—
③	Shock Pushrod	—
④	Rocker Assembly	—
⑤	Rocker Fastener	<b>96 ft-lbs (130 N·m)</b>
⑥	Gusset Plate	—
⑦	Gusset Plate Nut	<b>96 ft-lbs (130 N·m)</b>
⑧	Retaining Ring	—
⑨	Rocker Pivot Shaft	—
⑩	Shock Assembly	—

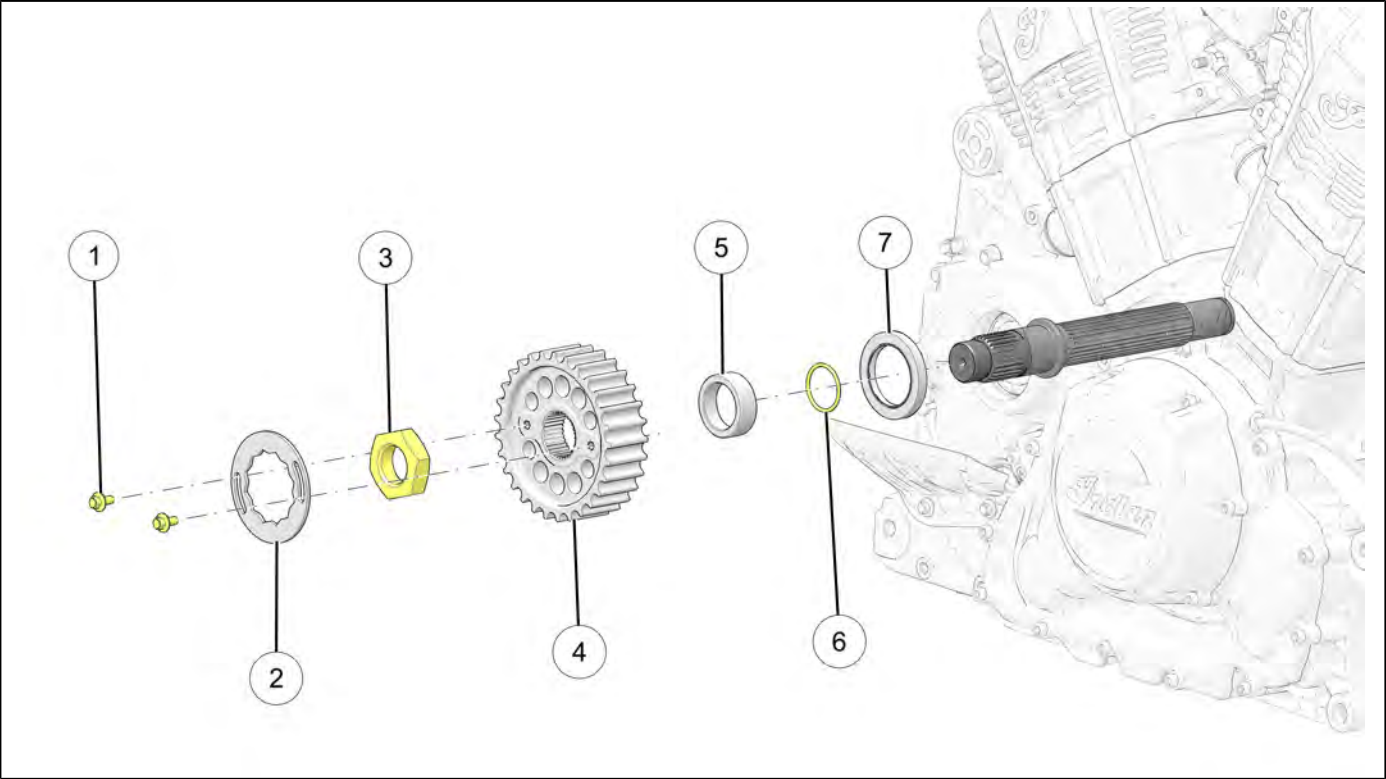
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**REAR WHEEL**



REF	DESCRIPTION
①	Wheel Spacer
②	Sprocket
③	Drive Belt
④	Wheel Bearing
⑤	Cush Drive Damper
⑥	Bearing Spacer
⑦	Rear Wheel
⑧	Wheel Bearing (Tone Ring Equipped)

**DRIVE SPROCKET**

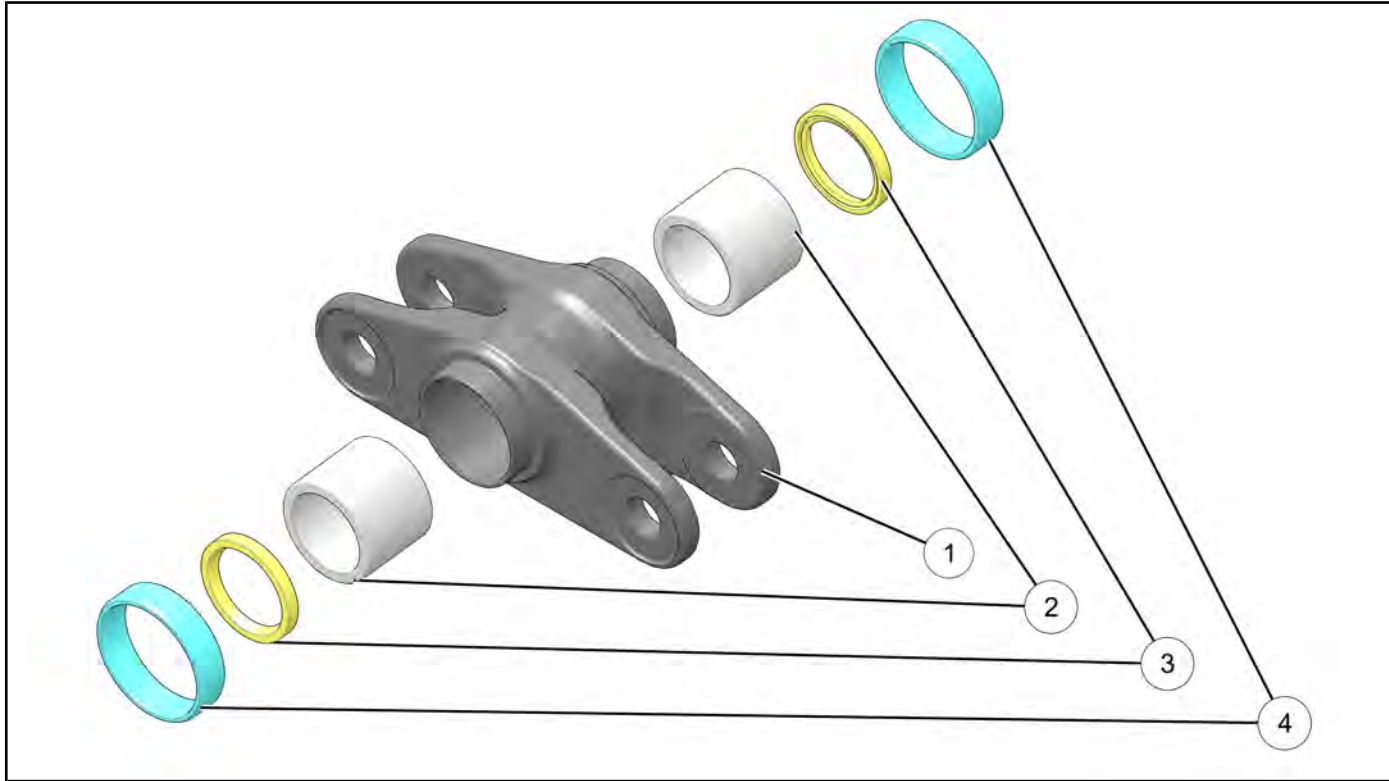


REF	DESCRIPTION	TORQUE
①	Lock Washer Fastener	<b>84 in-lbs (10 N·m)</b>
②	Lock Washer	—
③	Drive Sprocket Nut	<b>165 ft-lbs (224 N·m)</b>
④	Drive Sprocket	—
⑤	Drive Sprocket Spacer	—
⑥	O-Ring	—
⑦	Seal	—

**8**



**ROCKER ASSEMBLY**



REF	DESCRIPTION
①	Rocker
②	Needle Roller Bearing
③	Seal
④	Thrust Bearing

**DRIVE BELT SERVICE****DRIVE BELT INSPECTION**

1. Inspect belt tension and adjust if necessary. See Drive Belt Inspection page 8.4.
2. If belt or sprocket is being replaced due to damage, inspect the other drive system parts to make sure they are not damaged as well to prevent damage to replaced components.

**DRIVE BELT REMOVAL****NOTICE**

If belt is to be reinstalled, mark direction of rotation on the outer surface of belt. Reinstall belt in same direction as it was removed.

**WARNING**

A misaligned rear axle can cause drive line noise and damage the drive belt, which could cause belt failure and loss of control of the motorcycle.

**WARNING**

Care should be taken to be sure the motorcycle will not tip or fall while elevated. Severe personal injury or death may occur if the motorcycle tips or falls.

1. Remove rear wheel. See **Rear Wheel Removal / Installation page 8.67.**
2. Remove Swing-Arm assembly. See **Swing-Arm Removal page 8.74.**
3. Remove exhaust assembly. See **Muffler Removal / Installation page 3.110.**
4. Remove drive sprocket cover. See **Drive Sprocket Cover, Removal / Installation page 8.62.**
5. Remove belt from drive sprocket.

**DRIVE BELT INSTALLATION**

1. Inspect sprockets and verify sprocket fasteners are tight.
2. Install drive belt with the Indian Motorcycle script situated so that it reads correctly when viewed from the RH side of the motorcycle.
3. Install the drive sprocket cover. See **Drive Sprocket Cover, Removal / Installation page 8.62.**
4. Install the exhaust system. See **Muffler Removal / Installation page 3.110.**
5. Install the Swing-Arm assembly. See **Swing-Arm Installation page 8.78.**
6. Install the rear wheel. See **Rear Wheel Removal / Installation page 8.67.**
7. Set drive belt alignment and tension. See **Drive Belt Adjustment page 8.6.**

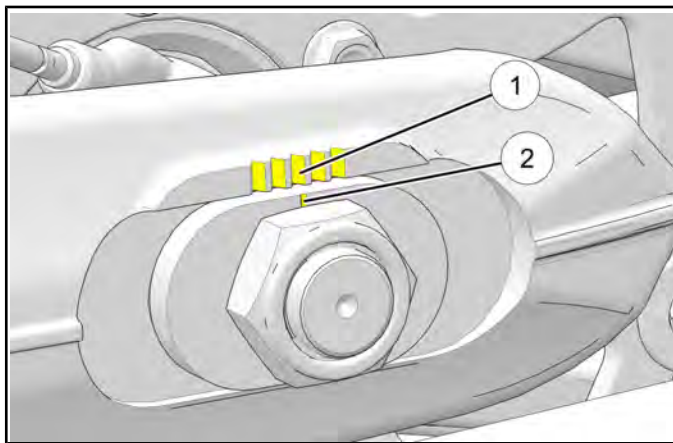
**DRIVE BELT ADJUSTMENT**

**IMPORTANT**  
 Perform this procedure to achieve proper belt tension and alignment. Belt tension should be set before performing the alignment procedure.

**BELT TENSION**

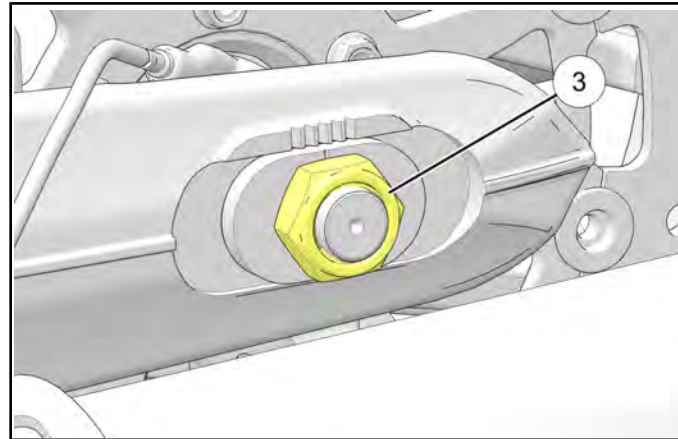
**WARNING**  
 A drive belt that is not properly tensioned can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.

**NOTICE**  
 Marks ① and ② are used as a reference for initial wheel alignment. Marks should be in roughly the same position on both left and right sides of wheel.

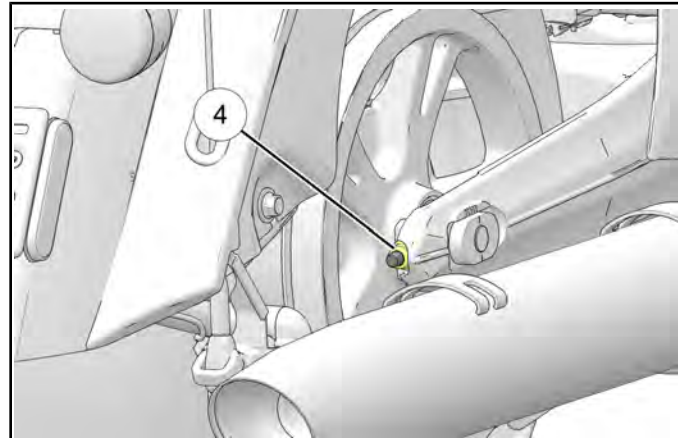


1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove saddlebags. See **Saddlebag Removal / Installation page**
3. Make note of adjuster locations ① and ②.
4. Raise the rear of the motorcycle so the rear tire can be freely rotated.

5. Loosen axle nut ③ then tighten to **15 ft-lbs (20 Nm)**.



6. Turn the **RIGHT SIDE** adjuster nut ④ to achieve proper belt tension. See **Drive Belt Tension Measurement page 8.4**.



**BELT ALIGNMENT**

1. When belt tension is correct, check and adjust final wheel alignment as follows:

**Belt Alignment**

**⚠ WARNING**

**A drive belt that is not properly aligned can cause drive line noise and damage the drive belt, causing possible belt failure and loss of control of the motorcycle.**

**NOTICE**

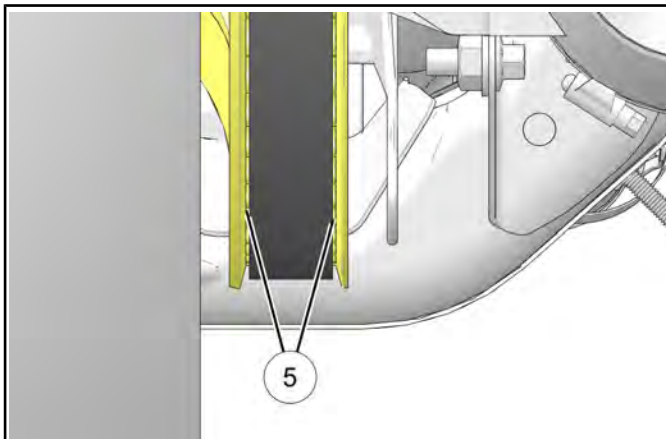
To minimize change in belt tension, use LEFT SIDE adjuster only to make final adjustments to belt alignment.

2. Rotate the wheel BACKWARD. Tighten LEFT SIDE adjuster until belt comes off inside sprocket flange during backward wheel rotation.

**IMPORTANT**

The belt should track to the center of the sprocket tooth surface when properly aligned ⑤. Sprocket teeth should be visible on both sides of the drive belt.

3. Rotate the wheel in the FORWARD direction and verify that sprocket teeth are still visible on both sides of the drive belt ⑤.



4. If necessary, loosen the axle nut and LEFT SIDE adjuster until belt just moves off the right flange and begins to track down the center of the driven sprocket flange during forward wheel rotation.

**NOTICE**

It may be necessary to loosen the axle nut and tap the left end of the axle to ensure it moves forward when the adjuster is loosened. The axle nut must be retightened to the ADJUSTMENT SPECIFICATION before proceeding.

5. **Rear wheel alignment is satisfactory when the drive belt remains centered on driven sprocket during forward and backward wheel rotation. Sprocket teeth should be visible from both sides of the drive belt.**

6. Verify that drive belt tension is still within specification. See **Drive Belt Tension Measurement page 8.4.**

7. Tighten rear axle nut to specification.

**TORQUE**

Axle Nut (Rear):  
**65 ft-lbs (84 N·m)**

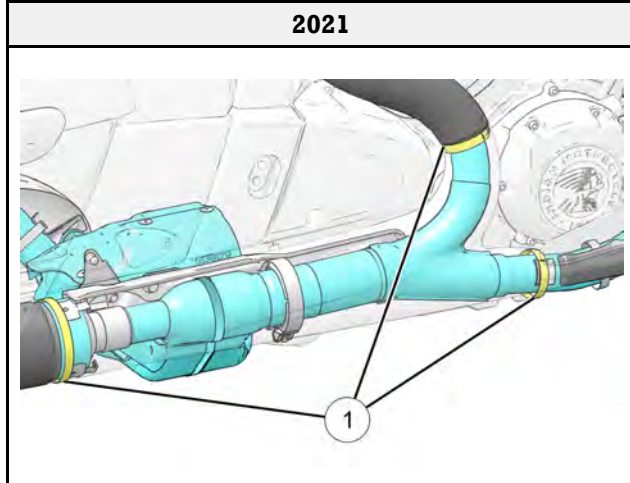
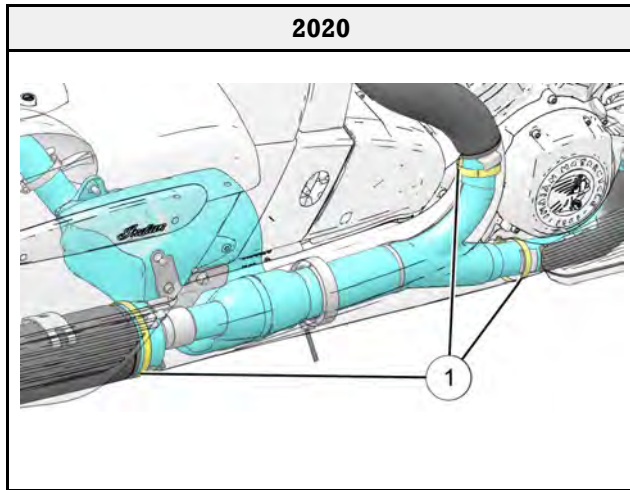
8. Pump rear brake pedal several times to reset brake pad distance.
9. Verify wheel rotates smoothly and freely without drag when brake pedal is released.

## DRIVE SPROCKET SERVICE

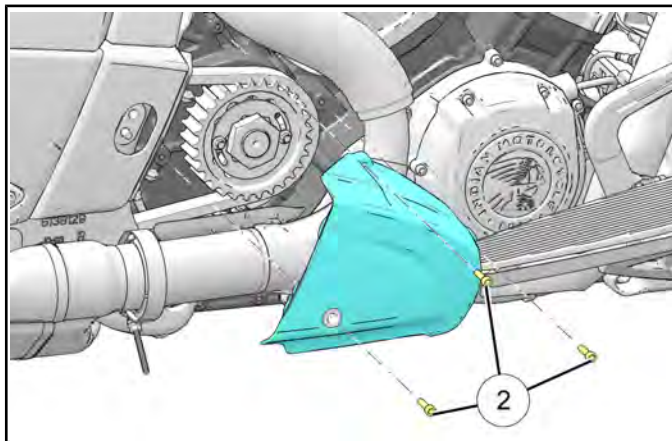
### DRIVE SPROCKET COVER, REMOVAL / INSTALLATION

#### REMOVAL

1. Remove the heat shield by completely loosening the heat shield clamps ①.



2. Remove fasteners ② securing the cover to the engine.



#### INSTALLATION

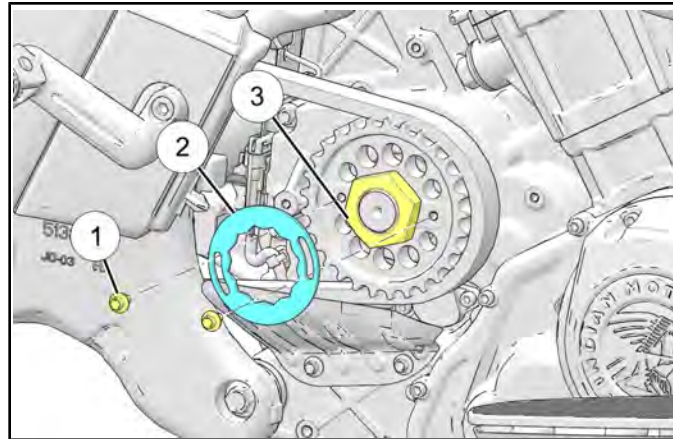
1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Torque drive sprocket cover fasteners to specification.

TORQUE
Drive Sprocket Cover Fastener: <b>88 in-lbs (10 N·m)</b>

TORQUE
Heat Shield Clamp: <b>31 in-lbs (3 N·m)</b>

#### DRIVE SPROCKET REMOVAL

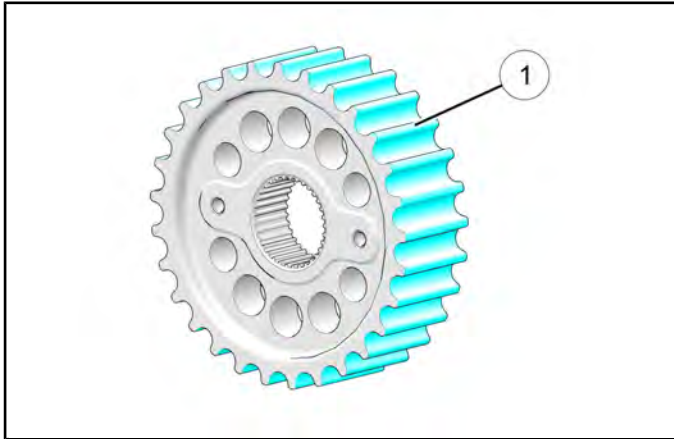
1. Secure the unit on a lift table with the front wheel in a wheel vice.
2. Remove drive sprocket cover. See **Drive Sprocket Cover, Removal / Installation page 8.62.**
3. Remove drive sprocket lock plate ② by removing its fasteners ①.



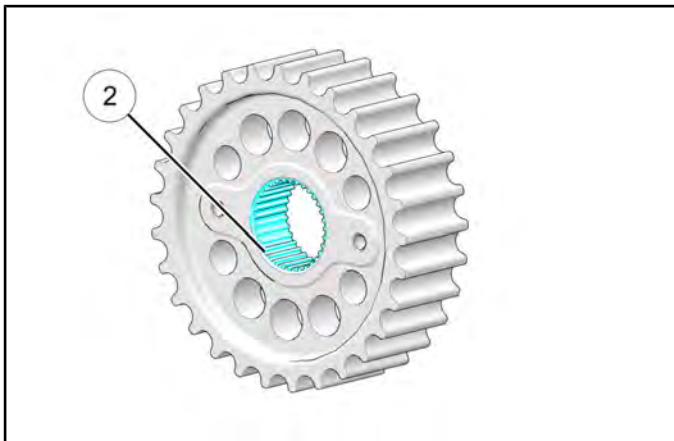
4. With the unit in gear or the rear brake applied, loosen the drive sprocket nut ③.
5. Remove drive belt. See **Drive Belt Removal page 8.59.**
6. Remove drive sprocket.

**DRIVE SPROCKET INSPECTION**

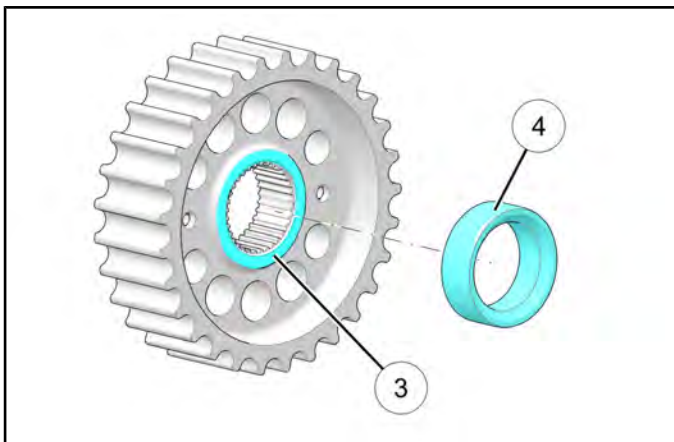
1. Visually inspect sprocket teeth ① for excessive wear and damage.



2. Inspect splines ② for a tight fit on output shaft splines.



3. Inspect the back surface of sprocket hub ③ where it contacts the seal sleeve. Replace if worn or if surface is rough.
4. Inspect the machined sealing surface of the spacer sleeve ④. Replace the spacer sleeve if it is grooved or otherwise damaged.



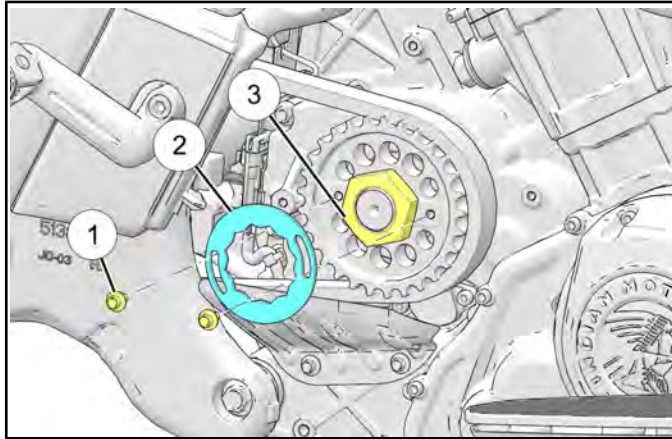
5. Sprockets and belt normally exhibit a polished appearance due to normal operation. Belt replacement is not required unless uncharacteristic damage is noted, or if the mileage service interval is reached. Belt or sprocket damage is usually due to debris trapped between belt and sprocket, or from improper maintenance and adjustment.

### DRIVE SPROCKET INSTALLATION

**NOTICE**

If replacing the output shaft seal, it will be necessary to use the Output Shaft Seal Tool (**PF-51243**) for proper installation.

1. Install drive sprocket.
2. Install drive belt. See **Drive Belt Installation page 8.59**
3. Tighten the drive sprocket nut ③.



**TORQUE**

Drive Sprocket Nut:  
**165 ft-lbs (224 N·m)**

4. Install the drive sprocket lock plate ② and secure with fasteners ①.

**TORQUE**

Lock Washer Fastener:  
**84 in-lbs (10 N·m)**

5. Install drive sprocket cover. See **Drive Sprocket Cover, Removal / Installation page 8.62**.

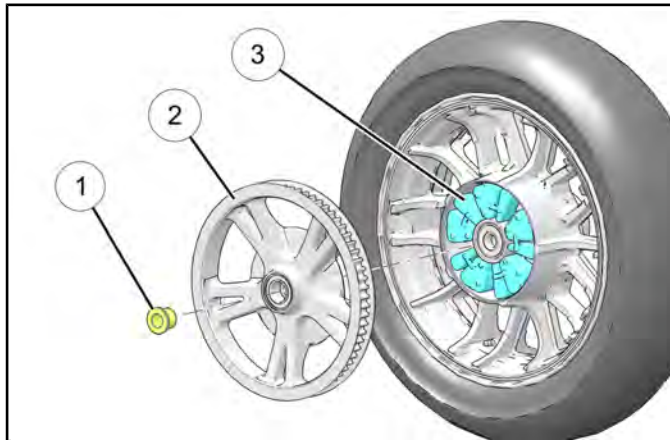
## DRIVEN SPROCKET SERVICE

### DRIVEN SPROCKET REMOVAL



Protect brake disc surface while working on wheel.

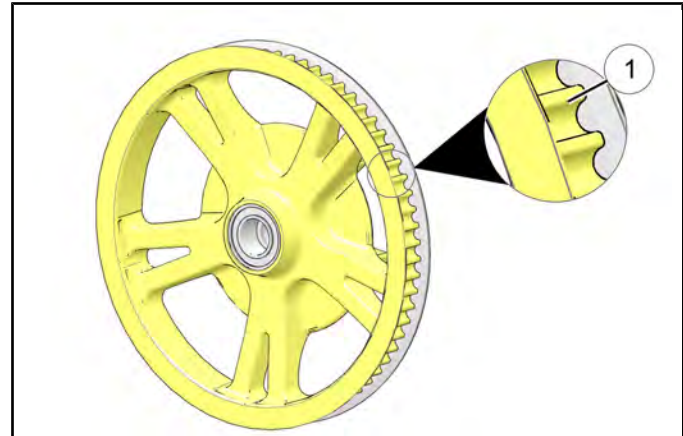
1. Remove rear wheel. See **Rear Wheel Removal / Installation** page 8.67.
2. Remove the RH wheel spacer ① from the driven sprocket roller bearing.



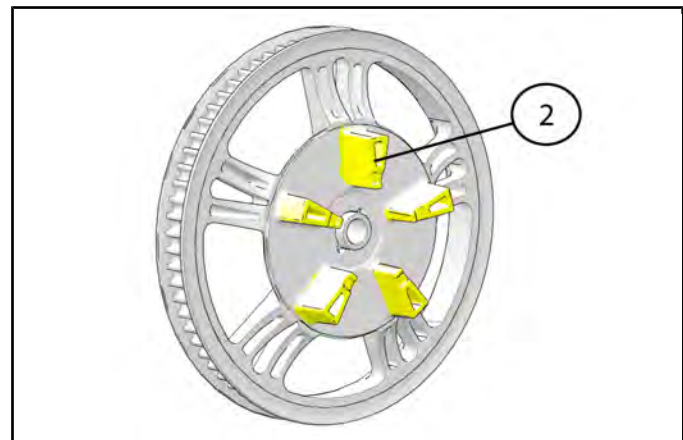
3. Lift the driven sprocket assembly ② off of the drive damper ③.

### DRIVEN SPROCKET INSPECTION

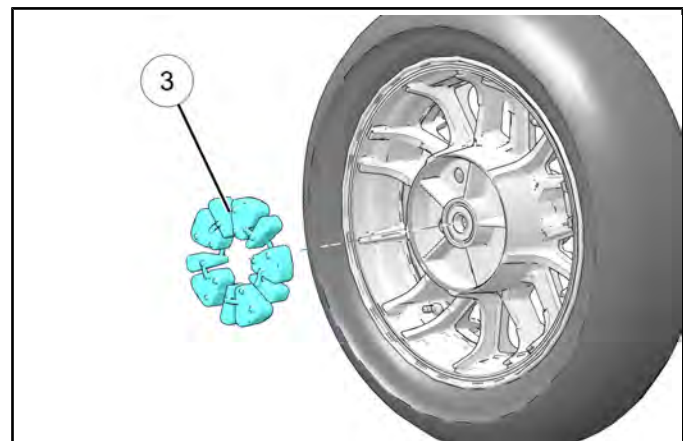
1. Visually inspect sprocket teeth ① for excessive wear and damage from foreign material or road debris.



2. Inspect the back side of the sprocket where it engages the damper ② for wear, galling or roughness. Surface must be smooth, with no burrs or surface irregularities.



3. Visually inspect the cushion drive damper ③ for cracks or deformation. Replace damper if damage is found.





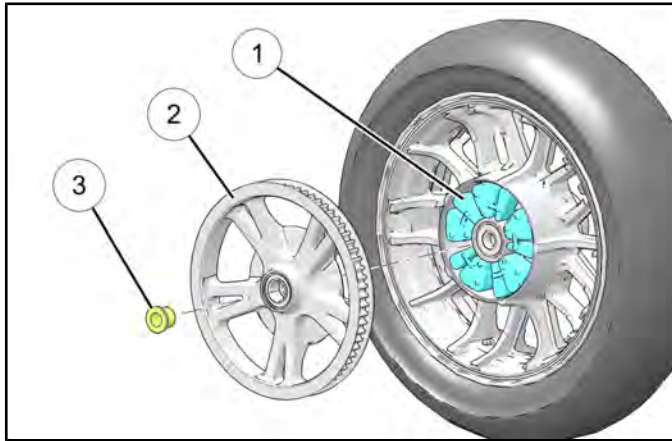
### **DRIVEN SPROCKET BEARING - REPLACEMENT**

The driven sprocket bearing is a non-serviceable item. If the bearing needs to be replaced, the entire driven sprocket assembly must be replaced.

1. Remove the driven sprocket. See **Driven Sprocket Removal** page 8.65.

### **DRIVEN SPROCKET INSTALLATION**

1. Install cushion damper ① into wheel hub.



2. Install sprocket assembly ② onto wheel hub making sure the cushion damper is properly engaged.
3. Install the RH wheel spacer ③ into the sprocket roller bearing.

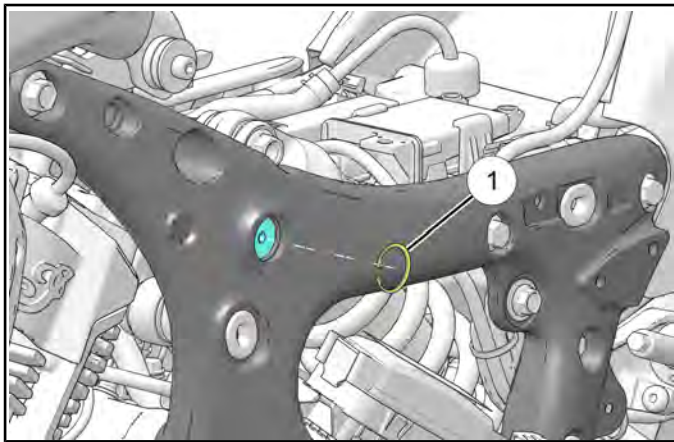
**REAR WHEEL SERVICE****REAR WHEEL REMOVAL / INSTALLATION****⚠ WARNING**

Rear wheel removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. Severe personal injury or death can occur if the motorcycle tips or falls.

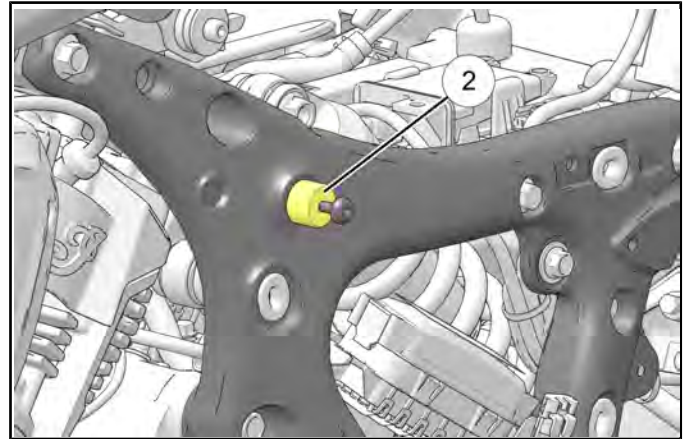
Make sure the exhaust system has cooled to room temperature before elevating the motorcycle. The drive belt may be damaged if it comes into contact with HOT exhaust components.

**REMOVAL**

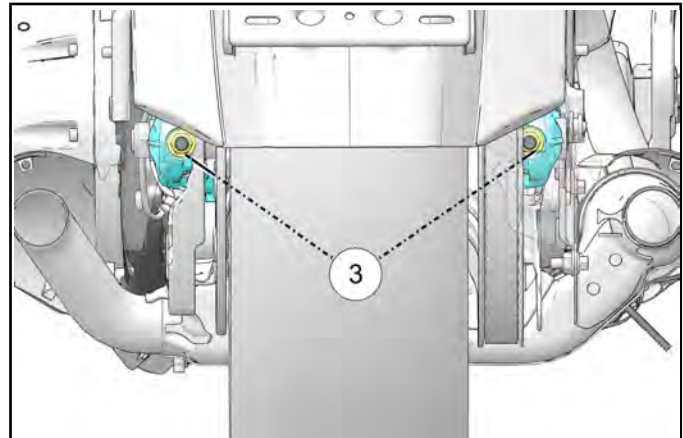
1. Place the motorcycle in an upright position on a lift table with the front wheel clamped in a wheel vise.
2. Remove saddlebags. See **Saddlebag Removal / Installation page** .
3. Remove upper left side panel. See **Side Cover (Upper), Removal / Installation page 7.27**.
4. Remove seat. See **Seat Removal / Installation page 7.32**.
5. Position a platform jack beneath the engine cases and raise until the rear tire is barely in contact with the ground.
6. Remove brake caliper. See **Rear Caliper Service page 9.50**.
7. Remove the upper shock pivot pin retaining ring ①.



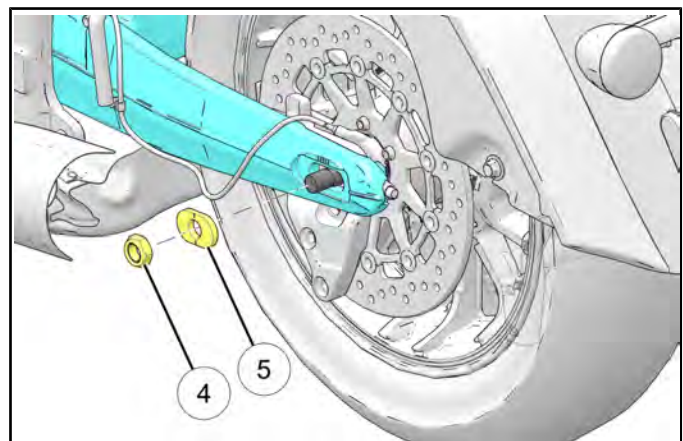
8. Thread a lower side panel fastener into the threaded opening on the pivot pin ② and pull on exposed fastener to withdraw pin from bore.



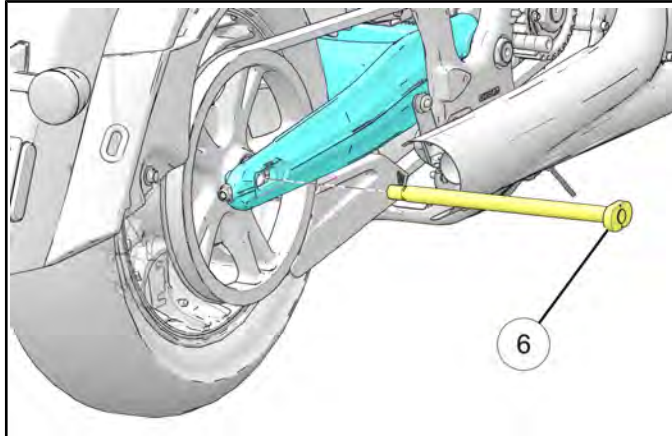
9. Loosen right and left axle adjusters ③ .



10. Remove rear axle nut ④ and washer ⑤ from left side of Swing-Arm.

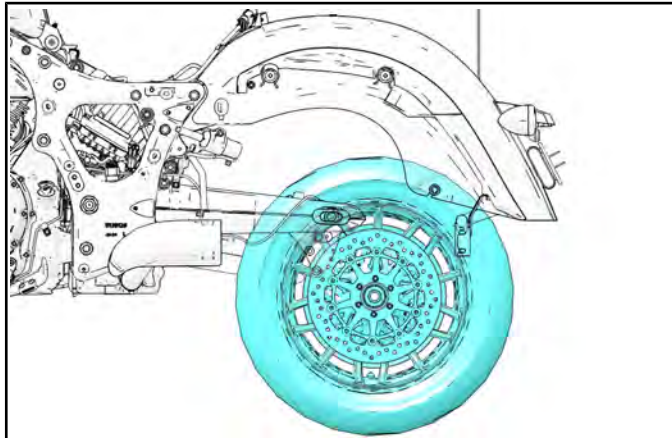


11. Remove axle ⑥ from right side of Swing-Arm.



12. Push wheel forward and slide drive belt to the right side off of the rear sprocket.

13. Remove rear wheel assembly by sliding it to the rear of the motorcycle.

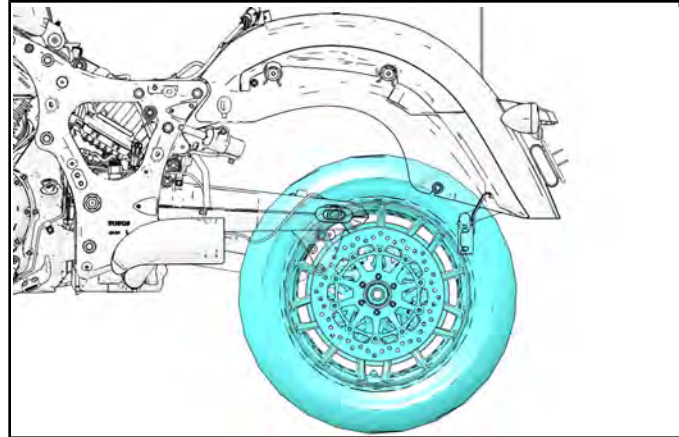


**INSTALLATION**

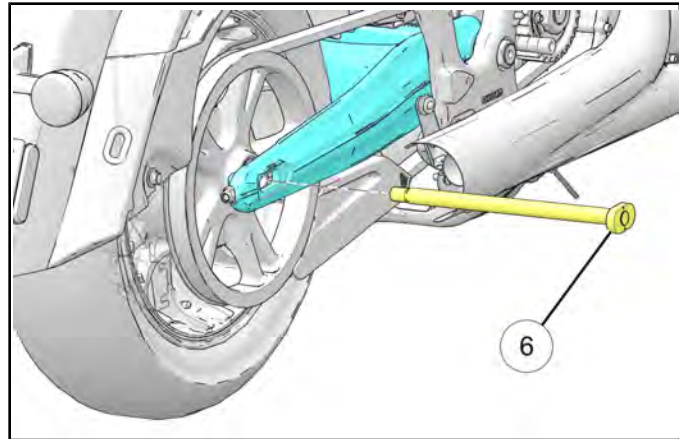
1. Place the motorcycle in an upright position on a lift table with the front wheel clamped in a wheel vise.

2. Position a platform jack beneath the engine cases and raise until the rear tire is barely in contact with the ground.

3. Install rear wheel assembly.

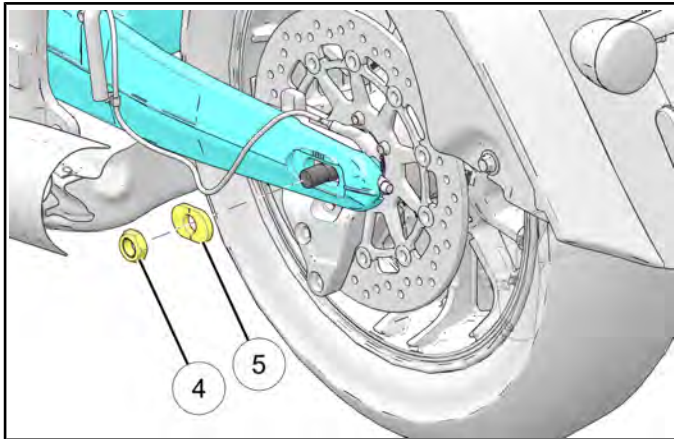


4. Install the axle ⑥ from right side of Swing-Arm.



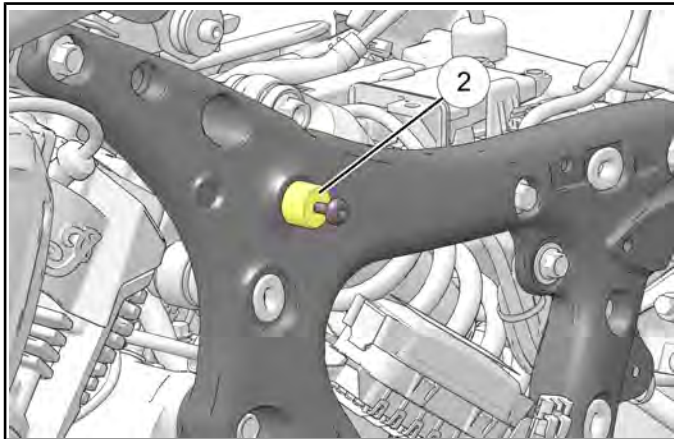
5. Install the drive belt over the rear sprocket.

6. Install washer ⑤ and rear axle nut ④ to the axle.  
Torque to specification.

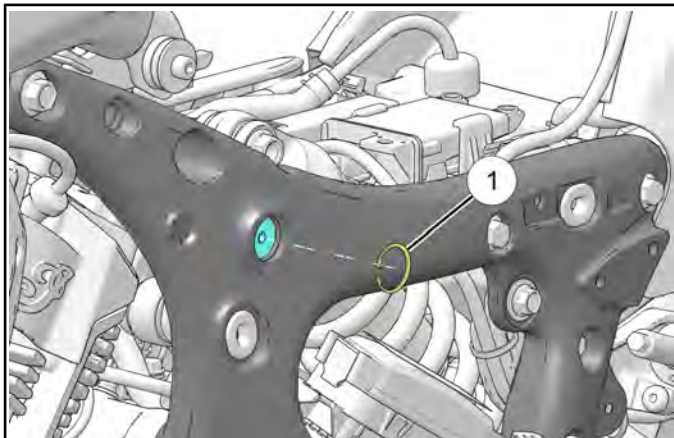


**TORQUE**  
Axle Nut:  
**65 ft-lbs (84 N·m)**

7. Install the pivot pin ② into position.



8. Install the upper shock pivot pin retaining ring ①.



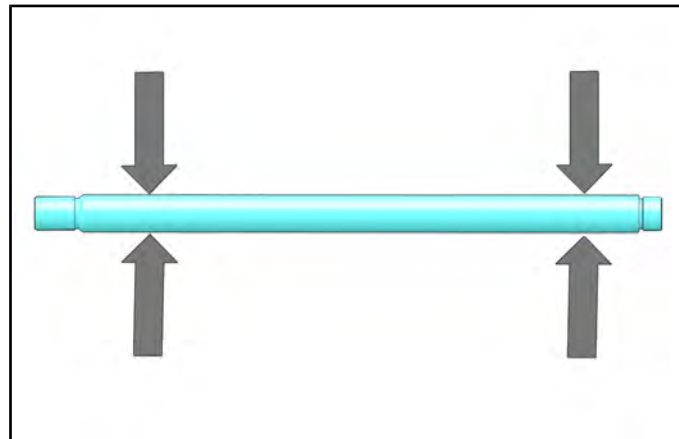
9. Install brake caliper. Torque fasteners to specification.

**TORQUE**  
Rear Caliper Mounting Fasteners:  
**31 ft-lbs (42 N·m)**

10. Install the seat. See **Seat Removal / Installation page 7.32**.  
11. Install upper left side panel. See **Side Cover (Upper), Removal / Installation page 7.27**.  
12. Install saddlebags. See **Saddlebag Removal / Installation page** .  
13. Perform Drive Belt Adjustment procedure. See **Drive Belt Adjustment page 8.60**.

**REAR AXLE INSPECTION**

1. Install rear axle in V-blocks and measure runout and compare to service limit.
2. Axle diameter should be measured on bearing surfaces.

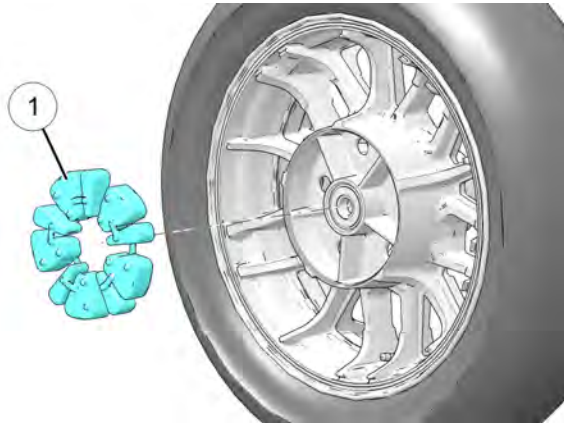


**Axle Diameter Measurement:**  
0.786 - 0.787 inches (19.965 - 19.990 mm)

**REAR WHEEL INSPECTION**

**IMPORTANT**

Visual inspection of the cushion drive damper ① for cracks or deformation is required whenever the rear wheel is removed. Replace damper if damage is found.



1. Set up a dial indicator to measure axial and radial runout of the wheel and compare to service limit. See Visual Inspection & Runout page 8.99.
2. Visually inspect wheel for cracks or other damage.
3. Replace wheel if it fails visual or measured inspection.

**REAR WHEEL BEARING INSPECTION**

**NOTICE**

If possible, also inspect wheel bearings before removing the wheel from the vehicle. Do not remove bearings from wheel to inspect. Bearings cannot be repacked. Replace both bearings if one or both fail inspection, or if either bearing was removed.

1. Visually inspect integral bearing seal for damage.
2. Inspect bearing fit in wheel hub. The outer race of the bearing must fit tightly into the bore. You should not be able to move outer race by hand.
3. Slide axle into wheel and check for smooth rotation and tight fit.

**NOTICE**

Due to extremely close tolerances, the bearings must be inspected visually, and by feel. Look for signs of discoloration, scoring, galling, or contamination from moisture or dirt. Replace bearings if any of the above are present. Turn the inner race of the bearings. The bearings should turn smoothly and quietly. The inner race should be firm with minimal side to side movement and no detectable up and down movement.

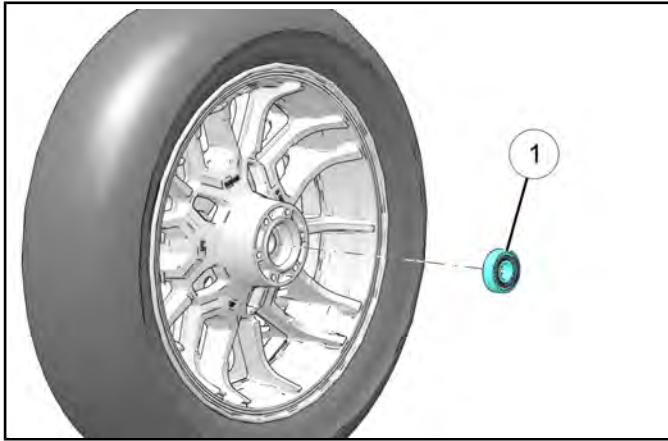
**WHEEL BEARING REPLACEMENT****REMOVAL****CAUTION**

Do not reuse bearings that have been removed.

**NOTICE**

This procedure requires the Wheel Bearing Removal / Installation Kit (PF-51324). Refer to special tool manufacturer instructions for proper use of tool.

1. Remove rear wheel. See **Rear Wheel Removal / Installation page 8.67.**
2. Remove driven sprocket. See **Driven Sprocket Removal page 8.65.**
3. Remove brake disc. See **Brake Disc Removal / Installation page 8.71.**
4. Carefully pry seal ① out of left-hand side of hub.



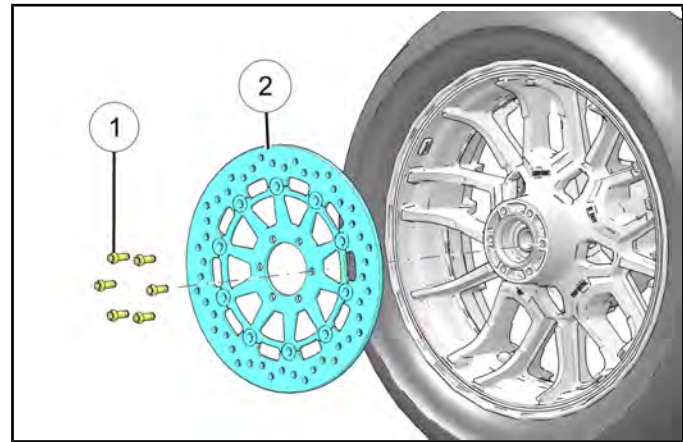
5. Refer to special tool manufacturer instructions to remove bearing from brake disc side of hub.
6. Remove bearing.
7. Remove spacer.
8. Extract or drive bearing from sprocket side.

**INSTALLATION**

1. Use the Wheel Bearing Removal / Installation Kit (PF-51324) to install new wheel bearings. Refer to special tool manufacturer instructions for proper use of tool.
2. Install new seal into the left-hand side of hub.
3. Install the brake disc. See **Brake Disc Removal / Installation page 8.71.**
4. Install driven sprocket. See **Driven Sprocket Installation page 8.66.**
5. Install the rear wheel. See **Rear Wheel Removal / Installation page 8.67.**

**BRAKE DISC REMOVAL / INSTALLATION****REMOVAL**

1. Remove the rear wheel. See **Rear Wheel Removal / Installation page 8.67.**
2. Remove brake disc fasteners ① .
3. Remove the brake disc ② .

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Torque brake disc fasteners to specification in a star pattern.

**TORQUE**

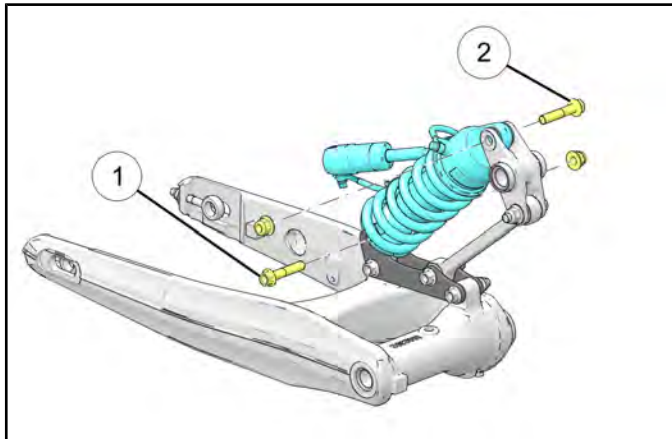
Brake Disc Fasteners:  
22 ft-lbs (30 N·m)

### SHOCK ABSORBER REMOVAL

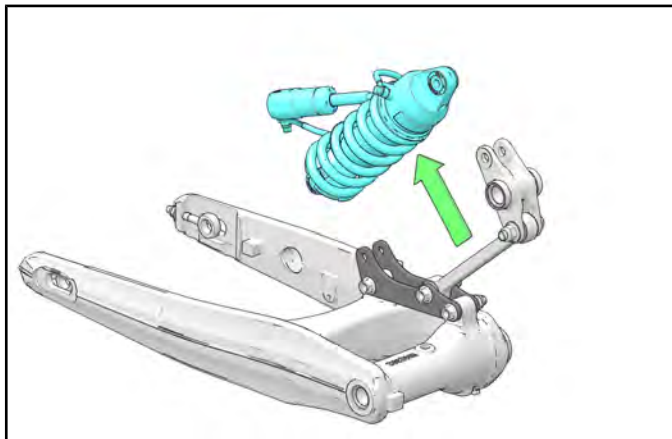
**⚠ WARNING**

Shock absorber removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. Severe personal injury or death can occur if the motorcycle tips or falls.

1. Remove the Swing-Arm / shock absorber assembly. See **Swing-Arm Removal page 8.74**.
2. With the Swing-Arm assembly resting on a sturdy work surface, remove the lower shock fastener ① and upper shock fastener ②.

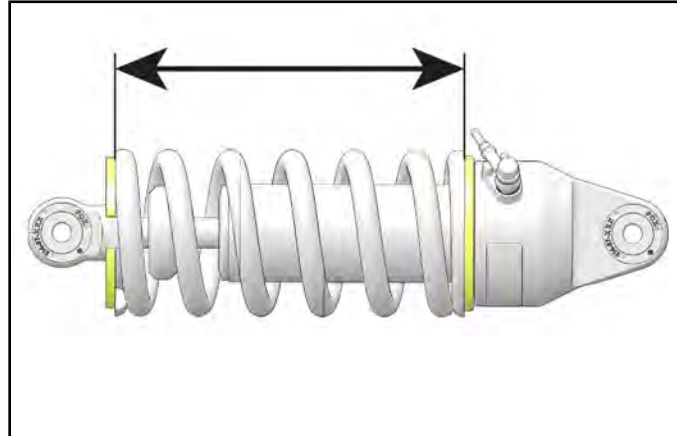


3. Remove shock absorber from Swing-Arm assembly.

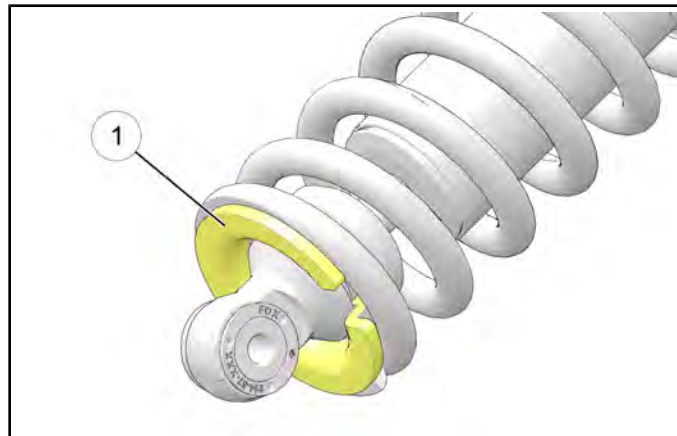


### SHOCK ABSORBER INSPECTION

1. Measure spring installed height and record so ride height adjustment can be returned to rider's preference.

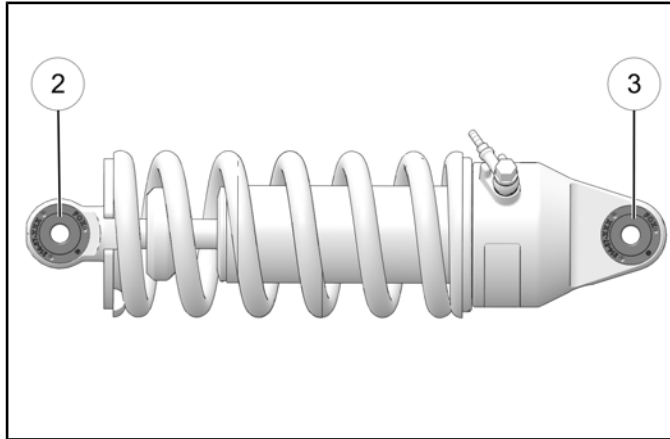


2. Using a commercially available spring compressor, compress shock enough to remove lower spring keeper ① and slide spring off of shock.



3. Thoroughly clean the shock spring.

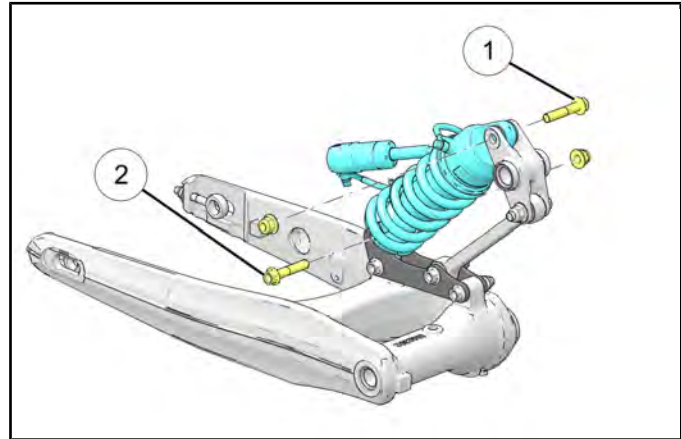
- Inspect eyelets ② and ③ for cracks, damage or loose fitting eyelet. Replace shock if either eyelet is cracked or damaged.



- With shock upright, move damper rod through entire travel range. Damper rod should move smoothly with consistent damping through the entire travel range, and return to the fully extended position when released.
- Inspect shock spring for cracks or distortion. Measure free length and compare to specification. See **Service Specifications – Rear Wheel / Suspension** page 8.52.
- Install spring onto shock body.

### SHOCK ABSORBER INSTALLATION

- Grease all pivot points.
- Lift shock into position and install top shock fastener ① from right to left, and install nut finger tight.



- Install the lower shock fastener ② from right to left, and install nut finger tight.
- Torque upper and lower shock fasteners to specification.

TORQUE
Shock Fasteners: <b>96 ft-lbs (130 N·m)</b>

- Install the Swing-Arm / shock absorber assembly. See **Swing-Arm Installation** page 8.78.



## SWING-ARM SERVICE

### SWING-ARM REMOVAL

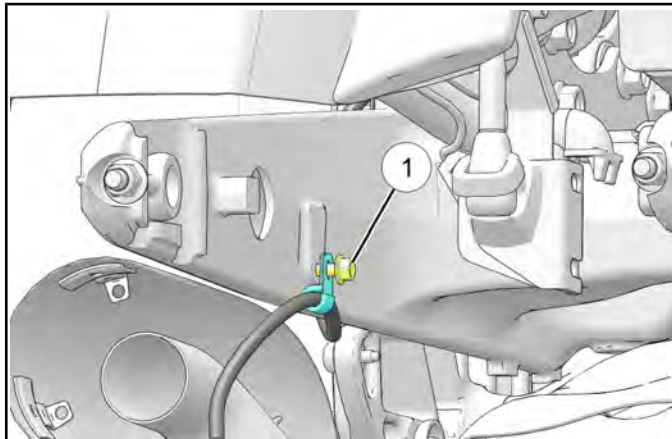
**⚠ WARNING**

Swing-Arm removal involves supporting the machine with the rear end elevated. Take precautions so that the motorcycle is securely supported when the rear tire is off the ground. Severe personal injury or death can occur if the motorcycle tips or falls.

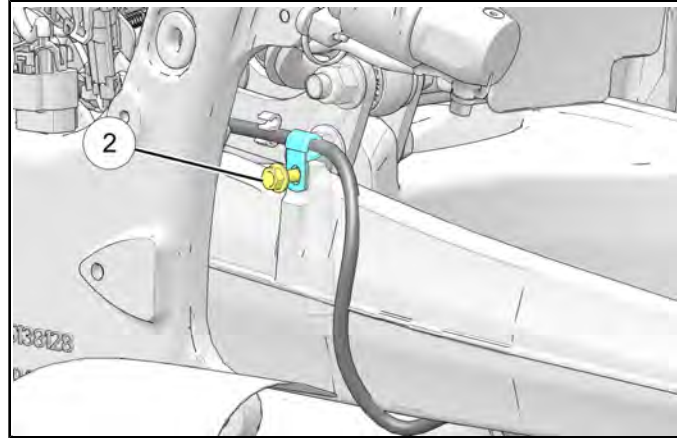
**⚠ WARNING**

Make sure the exhaust system has cooled to room temperature before elevating the motorcycle. The drive belt may be damaged if it comes into contact with HOT exhaust components.

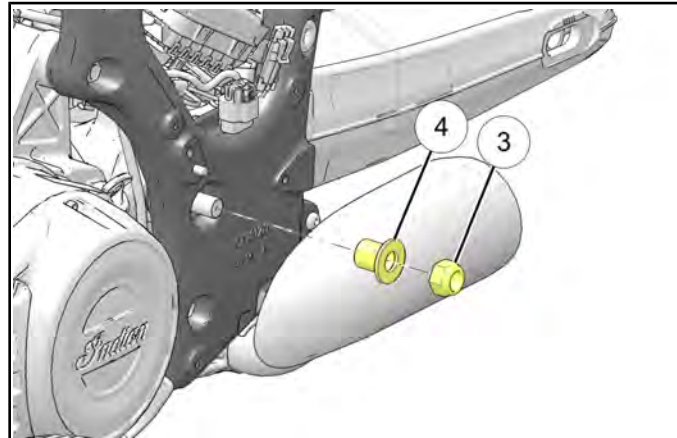
1. Place the motorcycle in an upright position on a lift table with the front wheel clamped in a wheel vise.
2. Position a platform jack beneath the engine cases and raise until it contacts the engine.
3. Remove rear wheel. See **Rear Wheel Removal / Installation** page 8.67.
4. Remove p-clamp ① fasteners located on the left inner surface of the Swing-Arm.



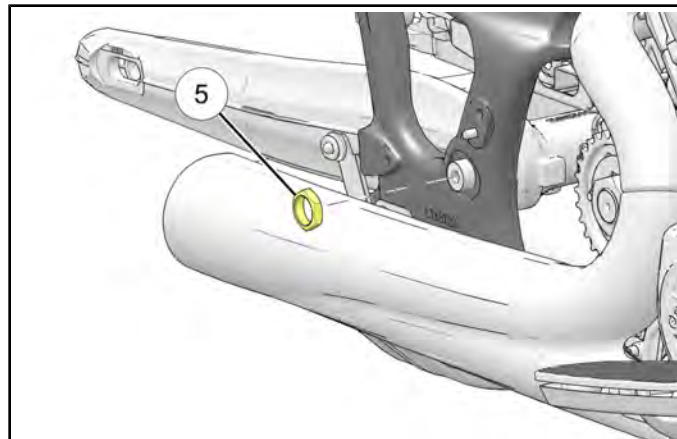
5. Follow the brake line forward and remove the remaining p-clamp ②.



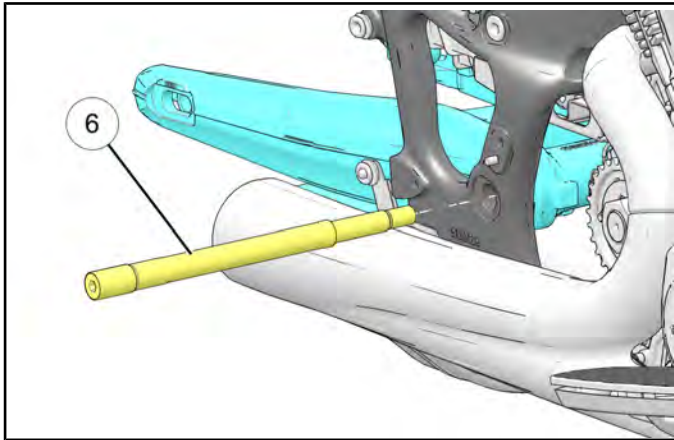
6. Remove Swing-Arm nut ③ and outer pivot spacer ④ from the left side of the Swing-Arm pivot shaft.



7. Remove the pivot jamb nut ⑤ located on the right side of the Swing-Arm pivot shaft.



8. Use an 8 mm hex wrench to thread the Swing-Arm shaft ⑥ out of the right side of the frame.



9. Disconnect the preload adjuster.
10. Remove shock rocker pivot shaft snap ring and shaft.
11. Support and remove the Swing-Arm assembly towards the rear of the motorcycle.

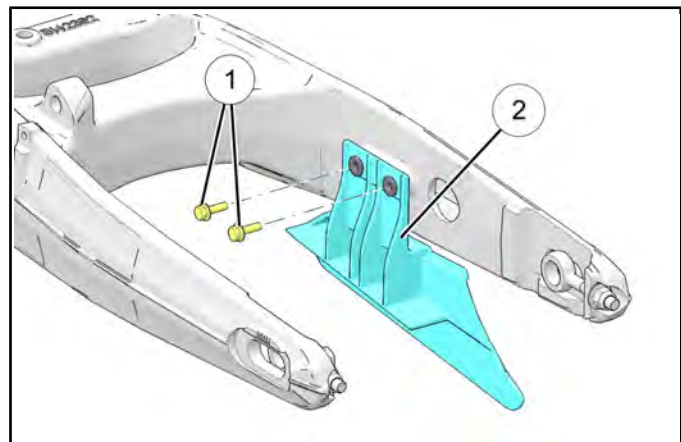
### SWING-ARM BUSHING / BEARING REPLACEMENT

#### NOTICE

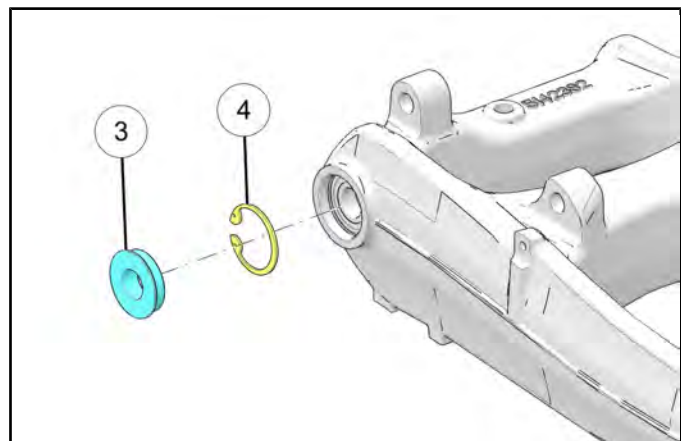
Disassembly and assembly of the Swing-Arm requires Swing-Arm Bushing Tool (PF-51237).

#### REMOVAL

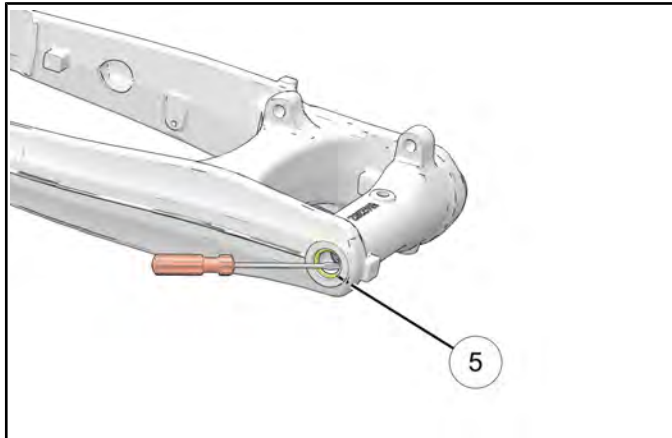
1. Remove Swing-Arm assembly from motorcycle. See **Swing-Arm Removal page 8.74**.
2. Remove shock absorber assembly from Swing-Arm. See **Shock Absorber Removal page 8.72**.
3. Remove the two fasteners ① and lower belt guard ②.



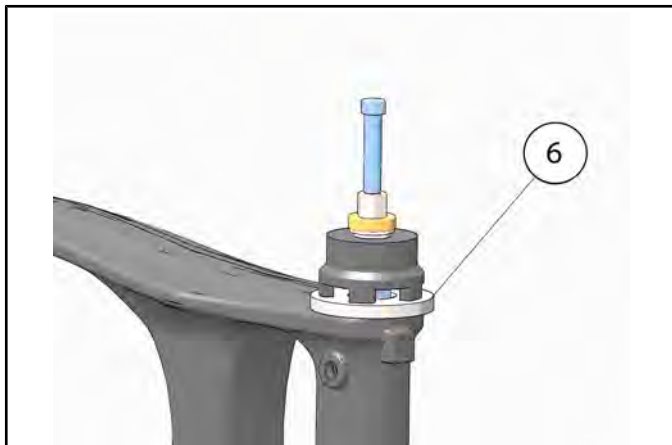
4. Remove the pivot spacer ③ from the left-hand side of the Swing-Arm followed by internal snap-ring ④.



5. Working from the right-hand side of the Swing-Arm, gently pry the seal ⑤ out of the bearing bore.

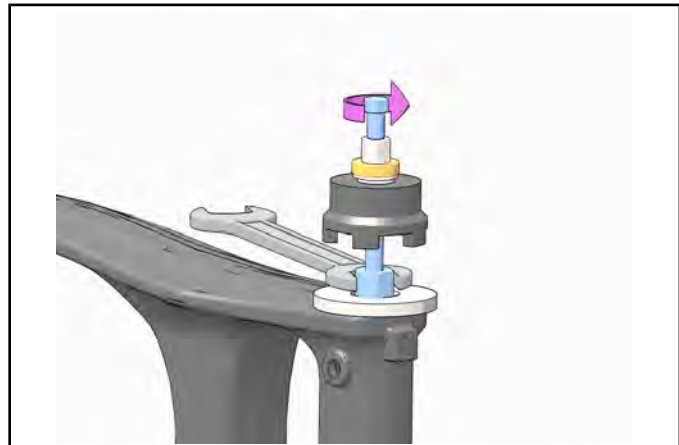


6. Assemble the Swing-Arm Bushing Tool (PF-51237):  
7. Lay the press plate ⑥ over the needle bearing and install the Swing-Arm Bushing Tool (PF-51237) through the needle bearing as shown.

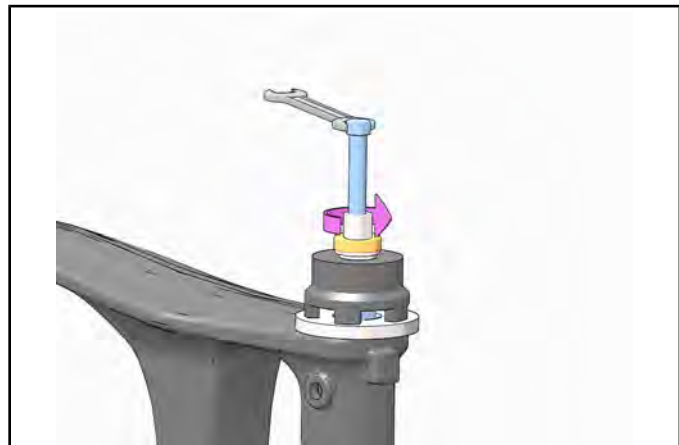


8. Raise the arbor up high enough to hold the adapter in place with an open ended wrench.

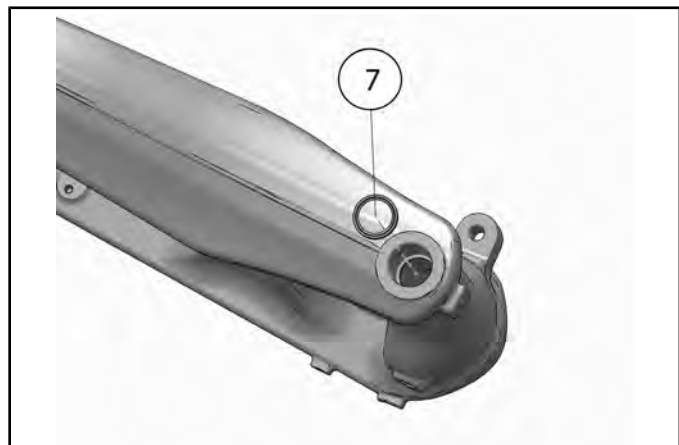
9. Turn the top of the threaded rod in until the adapter fingers are spread enough to grab the inner diameter of the needle bearing.



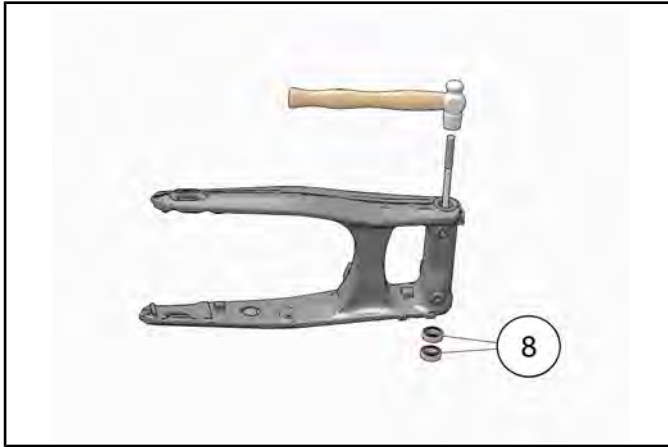
10. Lower the arbor until its seated on the press plate and thread the nut down onto the bearing.  
11. Hold the threaded rod in place and turn the nut in until the needle bearing is drawn from the bore.



12. With the needle bearing removed, gently pry the inner seal ⑦ out of the needle bearing bore.



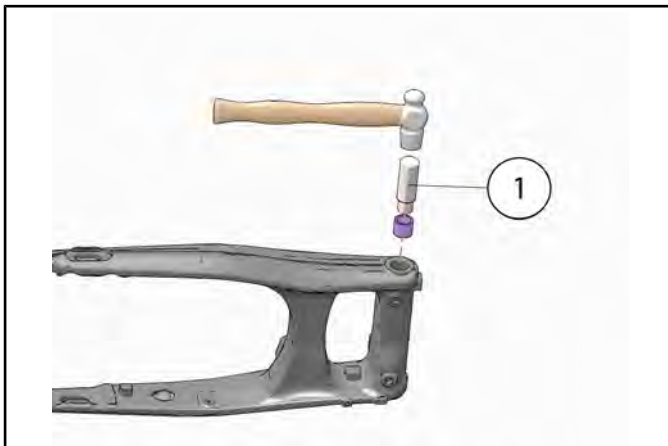
13. Insert a suitable bearing driver or drift through the right-hand side of the Swing-Arm and drive the two bearings ⑧ out through the left-hand side.



14. Inspect bearing bores for any galling or damage.

#### INSTALLATION

1. Working on the left-hand side of the Swing-Arm, press or drive *new* bearings into the bearing bore using a suitable bearing driver.
2. Install internal snap-ring and spacer removed in STEP 4 of this procedure.
3. Working on the right-hand side of the Swing-Arm, press a new *inner* seal into the bearing bore until seated on the shoulder.
4. Using the bearing driver ① provided in Swing-Arm Bushing Tool (PF-51237), drive a new needle bearing into the right-hand side of the Swing-Arm until fully seated.



5. Press a new *outer* seal into the bearing bore until seated.

6. Install lower belt guard and torque fasteners to specification.

#### TORQUE

Belt Guard Fasteners:  
96 in-lbs (11 N·m)

7. Install shock absorber assembly. See **Shock Absorber Installation** page 8.73.
8. Install Swing-Arm assembly. See **Swing-Arm Installation** page 8.78.

**SWING-ARM INSTALLATION**

**Drive belt must be installed on the drive sprocket prior to installing the Swing-Arm.**

**IMPORTANT**

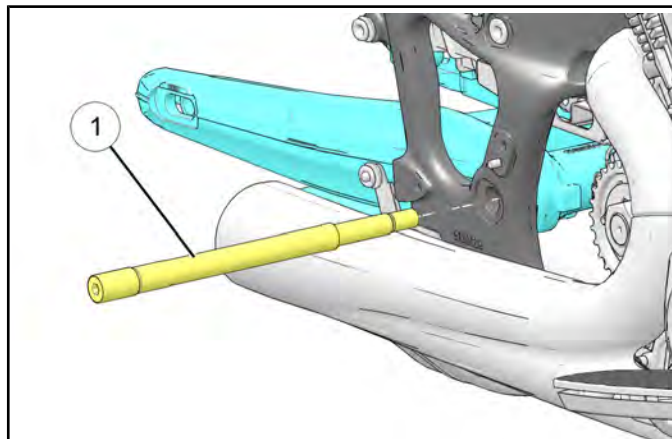
Drive belt must be installed on the drive sprocket prior to install the Swing-Arm.

1. Clean inside of the Swing-Arm shaft bores in both sides of the frame midcastings.
2. Grease Swing-Arm pivot shaft.
3. Apply a thin film of grease to the LH Swing-Arm spacer and press into position in the LH bearing bore.

**IMPORTANT**

Grease should be applied to the left side spacer so it stays in position when Swing-Arm is installed.

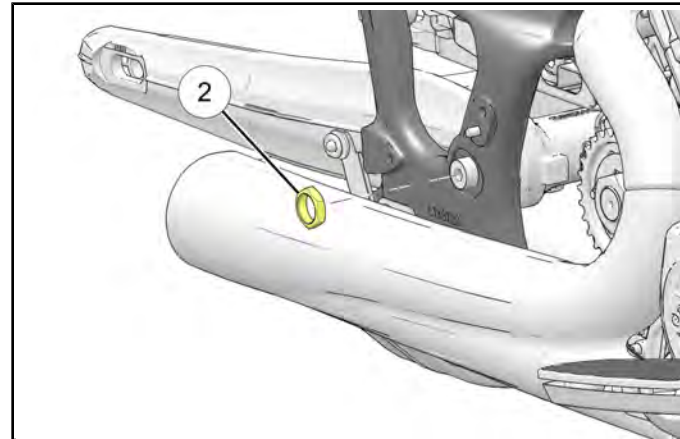
4. Lift the Swing-Arm / shock absorber assembly into position in the frame. Make sure the LH spacer stays in position.
5. Use an 8 mm hex wrench to thread the Swing-Arm shaft ① into the right side of the frame.



**TORQUE**

Swing-Arm Pivot Shaft:  
**96 in-lbs (11 N·m)**

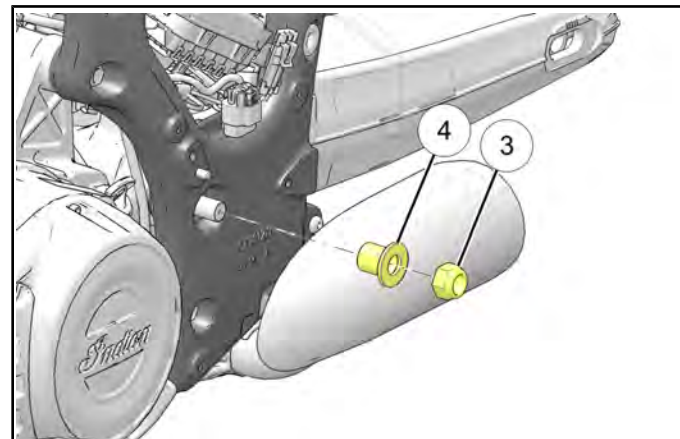
6. Install the Swing-Arm shaft jamb nut ② onto the end of the Swing-Arm shaft on the RH side.



**TORQUE**

Swing-Arm Pivot Jam Nut:  
**75 ft-lbs (101 N·m)**

7. Working on the LH side of the motorcycle, install the outer pivot spacer ④ and Swing-Arm nut ③.



**NOTICE**

**The Swing-Arm nut cannot be reused once removed from the Swing-Arm shaft. Apply AP grease to the shoulder of the new nut prior to installation.**

**TORQUE**

Swing-Arm Pivot Nut (Nylock):  
**65 ft-lbs (88 N·m)**

8. Route the rear brake line install the front and rear p-clamp.

TORQUE
P-Clamp Fasteners: <b>84 in-lbs (10 N·m)</b>

9. Install the rear wheel. See **Rear Wheel Removal / Installation page 8.67.**
10. Reference **Rear Brake System page 9.9** for line routing.
11. Make sure that the following applies:
- The rear wheel turns freely, without any interference between the belt guard, the tire, and the Swing-Arm.
  - Brake line is properly routed and secured.
  - The left and right axle adjusters are aligned properly (wheel is in alignment).
  - The rear brake functions properly.
  - All fasteners have been tightened correctly.
  - There is adequate clearance between Swing-Arm and exhaust mufflers and mounting.
  - The Swing-Arm is not loose, it doesn't wobble from side to side, and it doesn't move up and down more than 1/32 of an inch when pushed and pulled firmly.
12. Test ride motorcycle to be sure rear suspension operates smoothly without binding or abnormal noises.
13. Adjust ride height. See **Rear Shock Preload Inspection page 8.9.**

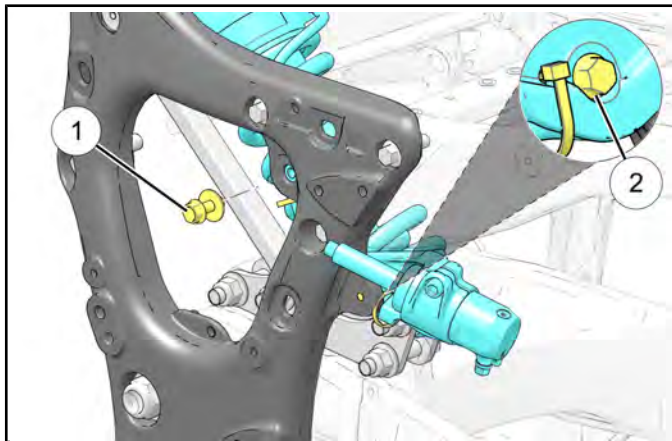
## REAR SHOCK SERVICE

2020-2021

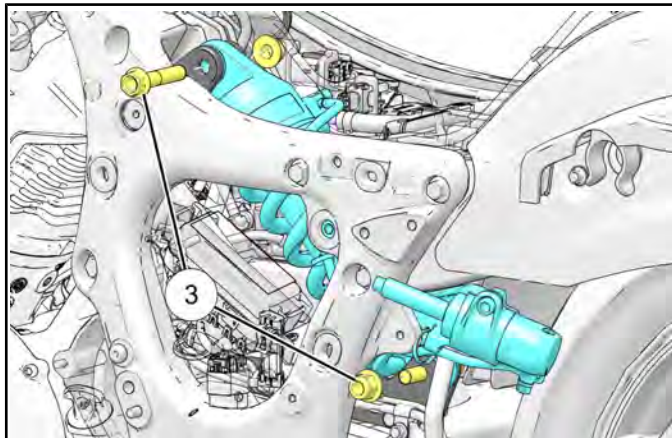
### REAR SHOCK REMOVAL / INSTALLATION

#### REMOVAL

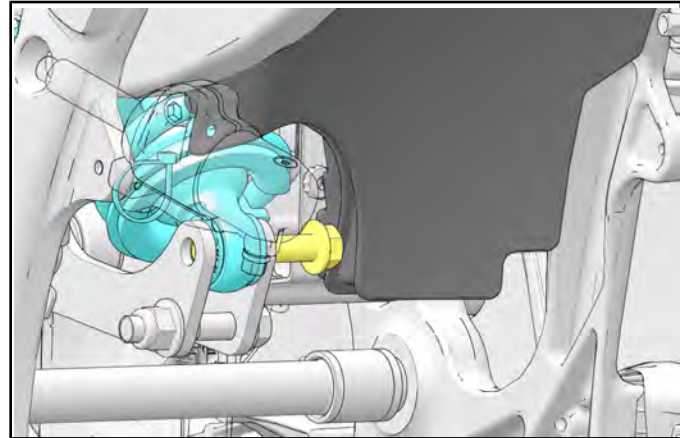
1. Position a platform jack beneath the engine cases and raise until it contacts the engine.
2. Remove saddlebags. See **Saddlebag Removal / Installation page** .
3. Remove seat. See **Seat Removal / Installation page 7.32**.
4. Remove adjuster bracket mount Adjuster M8 fastener ① and M6 fastener ②.



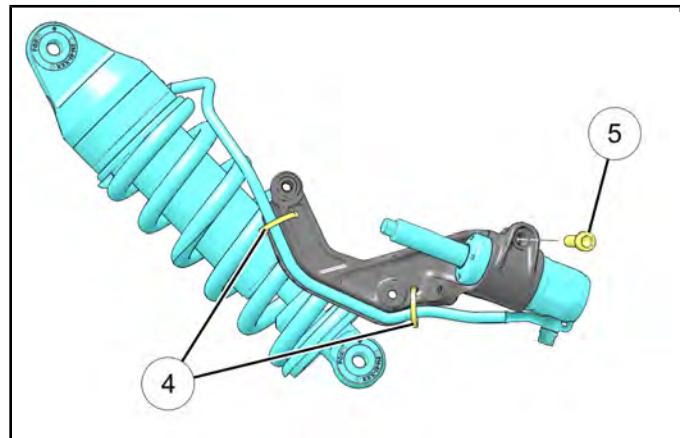
5. Remove the shock fasteners ③.



6. Due to the proximity of the recovery bottle, it may be necessary to loosen its fasteners to remove the lower shock bolt. Reference **Coolant Recovery Bottle Removal / Installation page 3.40**.



7. Carefully remove the shock assembly from the unit.
8. Cut cable ties ④ retaining adjuster line to the bracket.



9. Remove adjuster fastener ⑤.

**INSTALLATION**

- INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Shock Fastener: <b>96 ft-lbs (130 N·m)</b>

TORQUE
Shock Adjuster Bracket Fastener M8: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Shock Adjust Bracket Fastener M6: <b>96 in-lbs (11 N·m)</b>

TORQUE
Recovery Bottle Fastener (Lower): <b>84 in-lbs (10 N·m)</b>

TORQUE
Recovery Bottle Fastener (Upper): <b>36 in-lbs (4 N·m)</b>

**REAR SHOCK REBUILDING**

If the rear shock requires rebuilding, take the shock to a FOX approved dealer or distributor.

**REAR SHOCK BLEEDING PROCESS**

Use of Fox Oil: FOX R2 High Performance Suspension Fluid (PN: 025-06-004).

- Ensure adjuster is all the way out before working on the system.



- Remove spring from shock.



- Remove banjo fitting from hand adjuster.





STEERING / SUSPENSION

4. Slide spring perch piston out of bore.



7. Ensure that hand adjuster is all the way in.



5. Empty any oil from cap.



8. Remove bleed screw and o-ring from the adjuster.



6. Attach banjo hose to new hand adjuster using supplied new banjo bolt and washers. Ensure that anti-rotation feature is located in slot. Torque to 120 in-lbs



9. Fill body cap with oil.



10. Keep the hand adjuster elevated above shock.

**TORQUE**

Shock Banjo Bolt:  
**120 in-lbs (13 Nm)**

11. Press down on spring perch piston until it is fully bottomed.



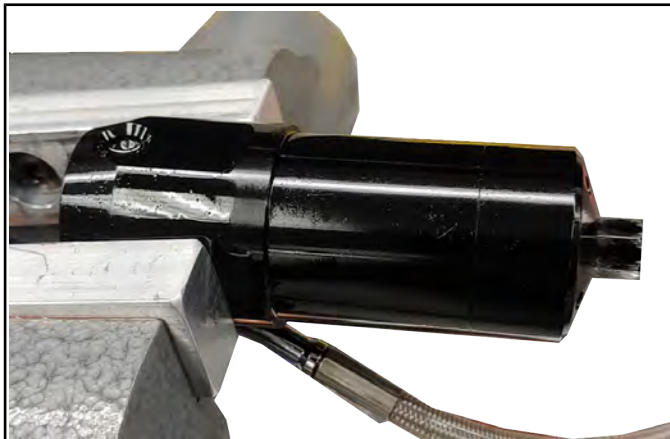
15. Fill squeeze bottle with about 8 oz. of FOX R2 High Performance suspension fluid.



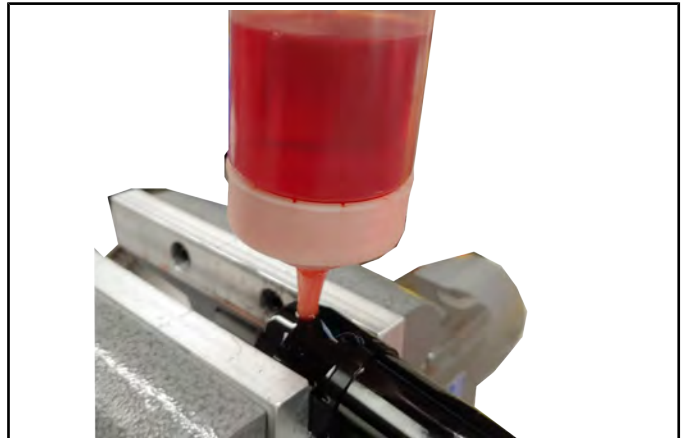
**NOTICE**

Oil will flow out of the bleed screw hole.

12. Fit bleed screw and o-ring back into hand adjuster.



16. upturn bottle into o-ring ensuring it has a good seal on adjuster. Hold bottle in position.

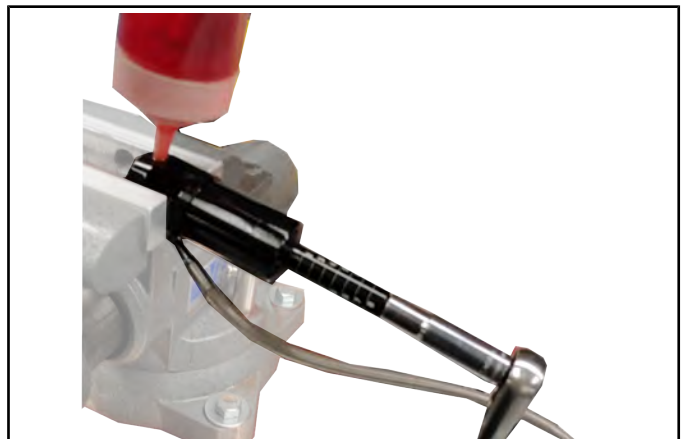


13. Clean shock and refit the spring.

14. Clamp hand adjuster in soft jaw vice at a slight downward angle with the bleed screw pointing up. Keep shock assembly below adjuster.



17. With fill bottle in place, screw out the adjuster fully.



18. Screw adjuster fully in and then back out once more.

## STEERING / SUSPENSION

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19. Adjuster should now be in the fully out position.  
Place bleed screw and o-ring in hand adjuster.  
Torque bleed screw to 25 in-lbs.



### TORQUE

Shock Bleed Screw:  
**25 in-lbs (3 Nm)**

20. Screw the adjuster all the way in. Measure the distance that the spring perch piston has moved. If this measurement is over 0.900", then the shock can be cleaned and fitting back onto unit. If the measurement is under 0.9000" then repeat steps 15–20 until measurement is over 0.900".



**2022+**

**E-PRELOAD OVERVIEW**

E-Preload allows the user to electronically adjust the rear shock setting. The user can enter the riders and cargo weight. The VCM will then use the input to adjust the pre-loading of the bike. Changes can be entered any time the bike is at a rest but will not adjust until the engine is running and the kickstand is up.

**E-PRELOAD ADJUSTMENT**

To adjust the electronic preload (EPL), do the following:



1. Press the Menu/Control button to bring up the Control Panel.
2. Tap on the riders button ① to adjust the weights of riders.
3. Tap on the luggage ② to adjust the weight of the luggage setting.
4. Fine weight adjustments can be made using the plus and minus buttons ③.



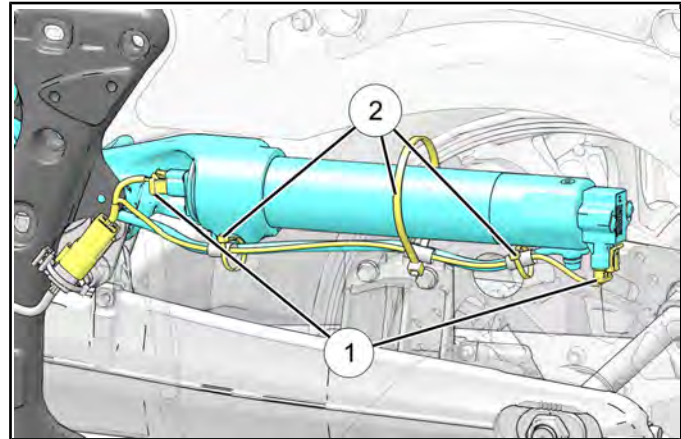
**REAR SHOCK REMOVAL / INSTALLATION (2022+)**

**IMPORTANT**

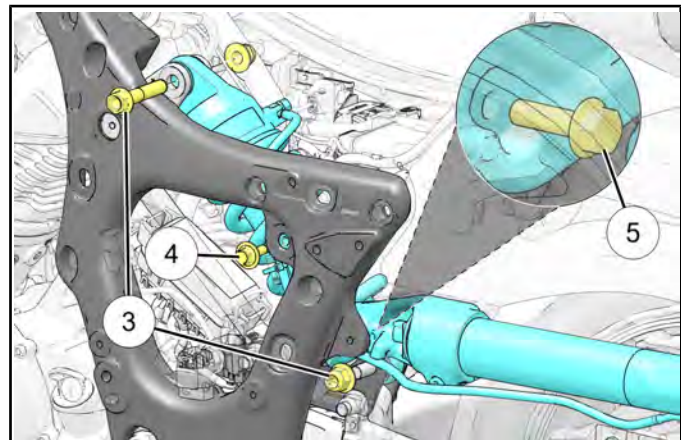
In the event that the shock is serviced, electronic preload will not function properly unless a sensor learn process has been executed. Use Digital Wrench II to execute this process.

**REMOVAL**

1. Position a platform jack beneath the engine cases and raise until it contacts the engine.
2. Remove saddlebags. See **Saddlebag Removal / Installation page** .
3. Remove seat. See **Seat Removal / Installation page 7.32**.
4. Disconnect shock electrical connectors ①.

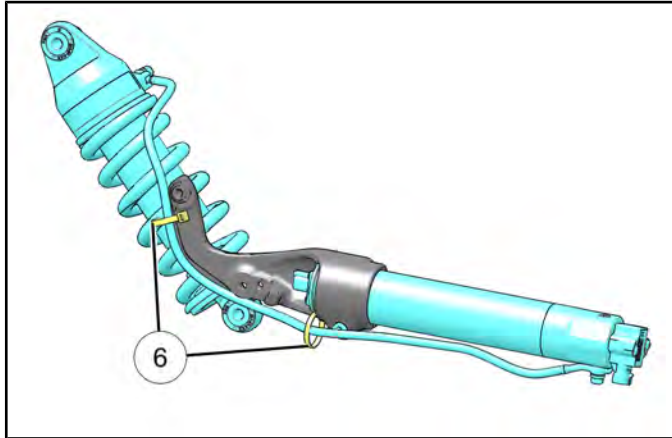


5. Remove harness retention points ②.
6. Remove the shock fasteners ③.

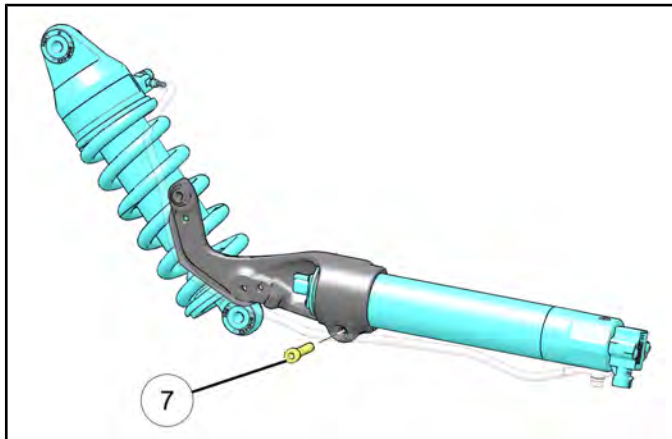


7. Due to the proximity of the recovery bottle, it may be necessary to loosen its fasteners to remove the lower shock bolt. Reference **Coolant Recovery Bottle Removal / Installation page 3.40**.
8. Remove shock adjuster bracket M8 fastener ④.
9. Remove shock adjust bracket M6 fastener ⑤.
10. Carefully remove the shock assembly from the unit.

11. Cut cable ties ⑥ retaining adjuster line to the bracket.



12. Remove adjuster fastener ⑦.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Shock Fastener: <b>96 ft-lbs (130 N·m)</b>

TORQUE
Shock Adjuster Bracket Fastener M8: <b>18 ft-lbs (24 N·m)</b>

TORQUE
Shock Adjust Bracket Fastener M6: <b>96 in-lbs (11 N·m)</b>

TORQUE
Recovery Bottle Fastener (Lower): <b>84 in-lbs (10 N·m)</b>

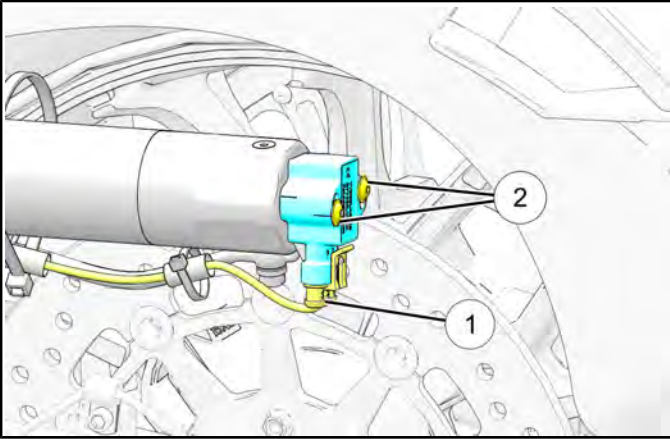
TORQUE
Recovery Bottle Fastener (Upper): <b>36 in-lbs (4 N·m)</b>

**REAR SHOCK ROTATION SENSOR REPLACEMENT (2022 +)**

IMPORTANT
In the event that the shock is serviced, electronic preload will not function properly unless a sensor learn process has been executed. Use Digital Wrench II to execute this process.

1. Position a platform jack beneath the engine cases and raise until it contacts the engine.
2. Remove saddlebags. See **Saddlebag Removal / Installation page** .
3. Remove seat. See **Seat Removal / Installation page 7.32**.

4. Disconnect rotation sensor electrical sensor ①.

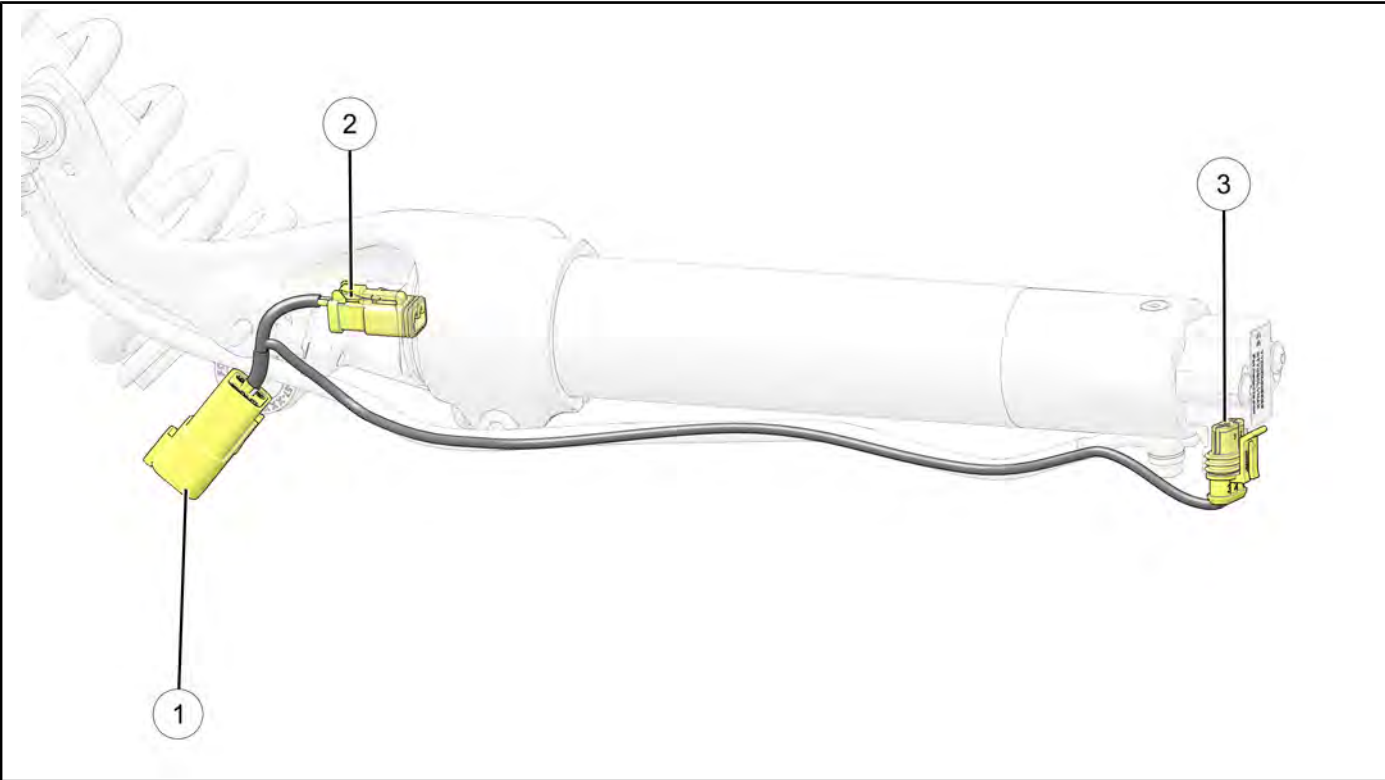


5. Remove rotation sensor by removing its fasteners ②.

6. **Installation is performed by reversing the removal procedure.**

TORQUE	
Rotation Sensor Fastener: <b>16 ft-lbs (22 N·m)</b>	

**REAR SHOCK PRELOAD HARNESS**



REF	DESCRIPTION
①	Chassis Connector
②	Preload Motor Connector
③	Rotation Sensor Connector

8

## STEERING / SUSPENSION

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### HARNES PINOUT

<b>COLOR</b>	<b>FROM</b>	<b>PORT</b>	<b>TO</b>	<b>PORT</b>	<b>FUNCTION</b>
PK / GN	Chassis	1	Rotational Sensor	1	Feedback Sensor Power (12V)
GN / WH	Rotational Sensor	3	Chassis	3	Feedback Sensor Signal
YE / DB	Motor	1	Chassis	5	E-Preload Motor (+)
GN / DB	Chassis	4	Motor	2	E-Preload Motor (-)
BK	Rotational Sensor	2	Chassis	2	Feedback Sensor Ground

### REAR SHOCK REBUILDING

#### **IMPORTANT**

In the event that the shock is serviced, electronic preload will not function properly unless a sensor learn process has been executed. Use Digital Wrench II to execute this process.

If the rear shock requires rebuilding, take the shock to a FOX approved dealer or distributor.

**TROUBLESHOOTING****TROUBLESHOOTING, REAR WHEEL / SUSPENSION**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REPAIR RECOMMENDED</b>
Rear Wheel Feels "Loose" or Wobbles	Loose fasteners	Torque to specification
	Distorted (bent) rear wheel	Replace wheel
	Worn or damaged wheel bearings	Replace wheel bearings
	Worn or damaged swing arm bushings.	Replace swing arm bushings
	Damaged or incorrect rear tire	Replace rear tire
	Unbalanced rear wheel assembly	Balance tire/wheel
	Low tire pressure	Inflate to specification
	Loose swing arm, axle or suspension fasteners	Torque to specification
	Pushrod or shock bearing failure	Replace pushrod or shock bearings
Rear Suspension Too Hard	Incorrect preload adjustment	Adjust to rider & load
	Damaged shock absorber	Replace / Rebuild shock
	Damaged or corroded suspension mount bushing	Correct as necessary
	Damaged or corroded swingarm bushings	Replace
	High tire pressure	Deflate to specification
	Drive belt adjustment too tight	Adjust drive belt tension
Rear Suspension Too Soft	Incorrect preload adjustment	Adjust to rider & load
	Damaged shock absorber	Rebuild or replace shock
	Weak shock spring	Replace shock spring
	Excessive load placed on motorcycle	Reduce load weight
	Low tire pressure	Inflate to specification
Rear Suspension Noisy	Loose fasteners	Torque to specification
	Worn wheel bearings	Replace
	Worn swing arm bushings	Replace
	Damaged shock absorber	Replace as necessary
	Worn pushrod or shock bearings	Replace pushrod or shock bearings
Wheel Drags (Turns Hard)	Incorrect drive belt adjustment	Adjust drive belt tension
	Brake problem	Diagnose and Service
	Loose fasteners	Torque to specification
	Bent rear axle	Replace
	Damaged wheel bearings	Replace
	Tire contact with object or chassis	Determine point of contact and correct



**TROUBLESHOOTING, FINAL DRIVE**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>POSSIBLE REPAIR NEEDED</b>
Belt Shows Excessive Wear On One Side	Out-of-Alignment	Align rear wheel
Belt Squeal	Out-of-Alignment	Align rear wheel
Belt Whine / Noise	Out-of-Alignment Belt Damage Incorrect Belt Tension	Align rear wheel Inspect Belt Adjust Tension
Broken Sprocket Teeth	Foreign material damage / Loose drive belt or sprocket	Replace parts or repair as necessary
Broken or Torn Cogs on Belt	Foreign material damage / Loose drive belt or sprocket	Replace parts as necessary
Belt Jumps Sprocket Teeth	Worn, damaged or out of adjustment belt or sprockets	Replace parts as necessary
	Belt Loose	Adjust Belt
Excessive Wear, Binding Suspension	Belt Tight	Adjust Belt
Broken Belt	Belt weakened by foreign material damage. Belt run excessively tight or loose.	Replace Belt, Replace Sprockets if damaged

## TIRES

### GENERAL INFORMATION

#### SERVICE NOTES – TIRES

**⚠ WARNING**

Indian Motorcycles are produced using the designated tires listed as original equipment. This includes field testing to ensure stability and superior handling. The use of tires other than original equipment may cause instability which can lead to a crash resulting in serious injury or death. Use *only* the recommended tires inflated to the recommended tire pressures. Operating the motorcycle with damaged rims creates a safety hazard including air pressure loss, steering imbalance and/or reduced steering control. Do not attempt to repair or straighten damaged rims.

**⚠ WARNING**

Do not attempt to repair tires that have:

- Punctures with a diameter of greater than 6mm (0.240").
- Cuts with a length of greater than 6mm (0.240").
- Any punctures or cuts on the sidewall of the tire.
- Tread depth of less than 1.6mm (.063") for the front tire.
- Tread depth of less than 1.6mm (.063") for the rear tire.
- Ply separation.
- Tread separation.
- Severe tread cupping.
- Cuts, gouges or scratches on the sealing surface of the bead.
- Flat spots on the tread.
- Bubbles, separation or any unusual damage to the inner liner of the tire.
- Chemical sealants or balance additives added to the tire.

**⚠ WARNING**

All repairs must be made from inside the tire.

**⚠ WARNING**

No form of temporary repair should ever be attempted. Secondary damage caused by a penetrating object may not be detected and tire or tube deflation may occur at a later date.

**⚠ WARNING**

**It is dangerous to ride with a worn tire. When a tire reaches the minimum tread depth listed below, replace the tire immediately.**

**⚠ CAUTION**

Two of the biggest factors contributing to premature tire wear are overloading and under-inflation. Do not deviate from the specifications for loading or inflation.

#### SPECIAL TOOLS – TIRES

TOOL DESCRIPTION	PART NUMBER
TPMS Activation Tool	PF-51288
Tire Changing Machine	Commercially Available

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

**SERVICE SPECIFICATIONS – TIRES**

Refer to Steering / Suspension chapter for front and rear wheel specifications.

**Tire Pressure Table (Cold)**

<i>NOTICE</i>	
Also refer to Manufacturing Information label.	

<b>TIRE TYPE / PRESSURE</b>	
130/60B19 66H / Metzeler Cruisetec	<b>Front: 36 psi (248 kPa)</b>
180/60R16 80H (I) / Metzeler Cruisetec	<b>Rear: 41 psi (283 kPa)</b>

<b>MINIMUM TREAD DEPTH</b>	
FRONT	.063 in (1.6 mm)
REAR	.063 in (1.6 mm)

**TIRE INSPECTION****TIRE WEAR PATTERNS****TIRE WEAR PATTERNS**

<b>SYMPTOM</b>	<b>CAUSE</b>
Wear on Left Side	Riding on Crowned Roads
Edges Worn	Underinflation or Excessive Loads
Excess Wear in the Middle of Tire	Over-inflation or Tire Abuse
Cracks in Tread Grooves	Underinflation, Excessive Loads, Suspension Bottoming
Tread Block Cupping (Usually Front Tire -See Below)	Normal Braking Wear

**OZONE CRACKING**

Ozone cracking usually shows up on the sidewalls of tires and is caused by sunlight, electric motor emissions, smog, or other environmental factors. Ozone cracking does not pose a problem unless the cracks reach the cords. If this occurs, moisture may penetrate the carcass of the tire causing cord separation. Tires showing signs of severe ozone cracking (cords visible at the bottom of the cracks) must be replaced.

**FRONT TIRE CUPPING**

Front of tread block worn more than rear of tread block:

- The cupping of front tires is somewhat normal.
- Rear tires are subjected to forces in both directions. The forces of braking and acceleration result in even tire wear.
- Front tires are subjected only to the forces of braking. When the brakes are applied, tire deflection is increased and wear occurs in only one direction.
- Incorrect tire pressure is the number one cause of excessive tire cupping. Too little tire pressure causes the tire to over-deflect which increases the amount of scrubbing and causes more tire cupping.
- Binding or improperly assembled front forks can also contribute to excessive tire cupping. If the front forks do not react as they should the tire acts as the sole suspension component and tread deflection increases.

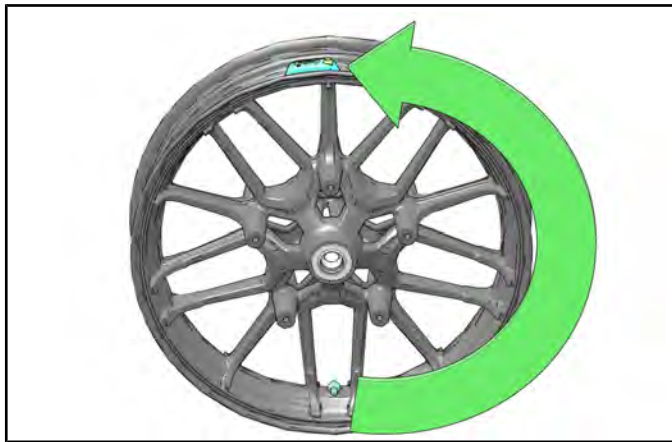
## TIRE PRESSURE MONITORING SYSTEM (TPMS)

### TPMS OVERVIEW

The Indian Challenger Motorcycles are equipped with an electronic tire pressure monitoring system (TPMS). The TPMS provides real-time tire pressure information to the operator of the vehicle and displays it via MFD and a low pressure warning light.

The TPMS sensors ① are located 180° from the valve stem ②. Use caution when servicing tires.

To avoid damaging a sensor, break the bead at the valve stem, then at 90° and 270° from the valve stem as required.



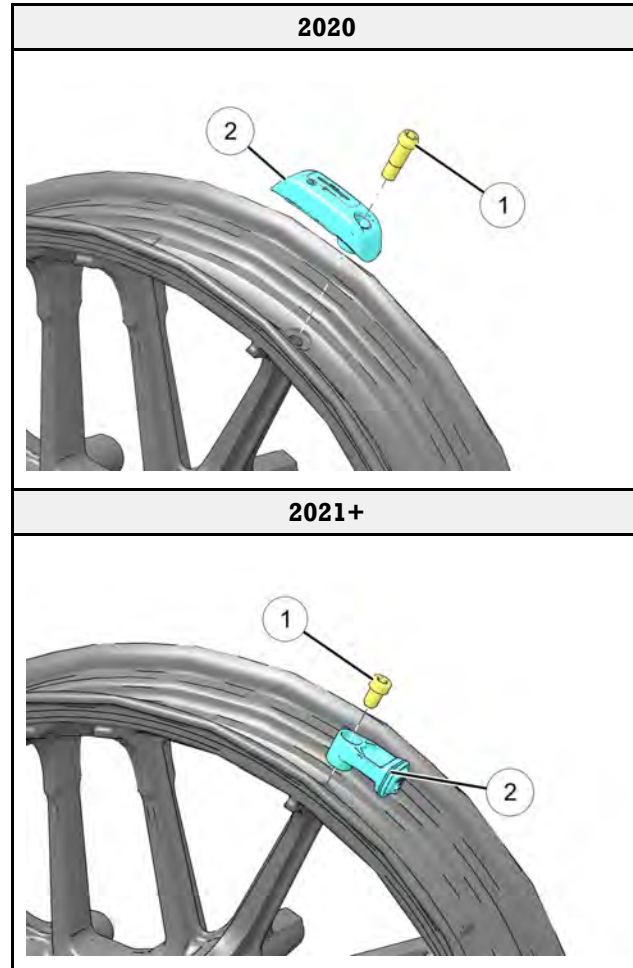
With TPMS, the pressure of each tire can be viewed in the MFD. If the display shows dashes (—) instead of a pressure value while traveling above 15 MPH (24 km/h), the system may not be functioning properly. See your dealer for service.

The TPMS warning indicator will illuminate if low tire pressure is detected. Always correct low tire pressure promptly. Always inspect tire pressure and condition before each ride.

The TPMS display may indicate an increase in tire pressure while riding, a normal occurrence as tires warm up. Riding into colder conditions may result in a drop in tire pressure as tires cool down. Regardless of conditions, low tire pressures should always be corrected promptly.

### TPMS SENSOR REPLACEMENT

1. Remove tire from rim. See **Tire Removal** page 8.97.
2. Remove fastener ① and sensor ②.



3. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Tire Pressure Sensor Fastener:  
72 in-lbs (8 N·m)

4. Install tire. See **Tire Installation** page 8.101.
5. Perform the **TPMS sensor activation** procedure.

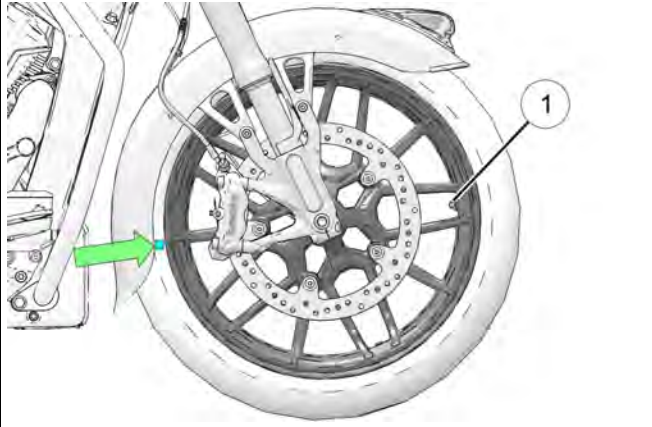
**TPMS ACTIVATION**

TPMS activation or “Wake Up” requires the use of the TPMS Activation tool (PF-51288).

**NOTICE**

The TPMS sensor is located 180° from the valve stem

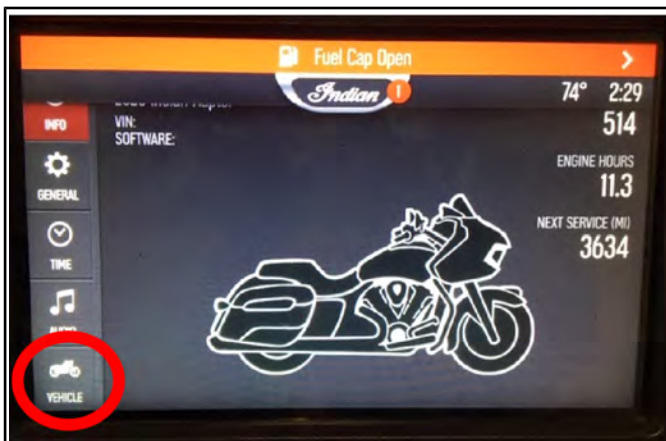
①. Locate the position of the front and rear valve stems and place a piece of tape on the tire on the opposite side (180°). Both pieces of tape (front and rear tires) should be visible so the TPMS Activation tool can be held within 3 in (7.6 cm) of the tire where the sensor is located.



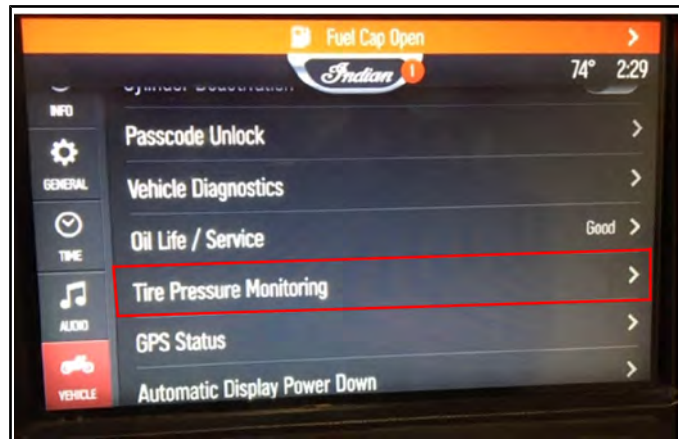
**NOTICE**

The TPMS Activation tool should be held close to the **sidewall of the tire** when activating the sensors. If the Activation tool is held over the aluminum rim, the sensor signal may not be received.

1. Press the power button to power up the motorcycle electrical system.
2. Navigate to the settings.
3. Select the vehicle icon.



4. Select tire pressure monitoring.



5. Select learn.



6. With the front wheel learning, Use the TPMS Activation tool (PF-51288) on the front wheel.



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## STEERING / SUSPENSION

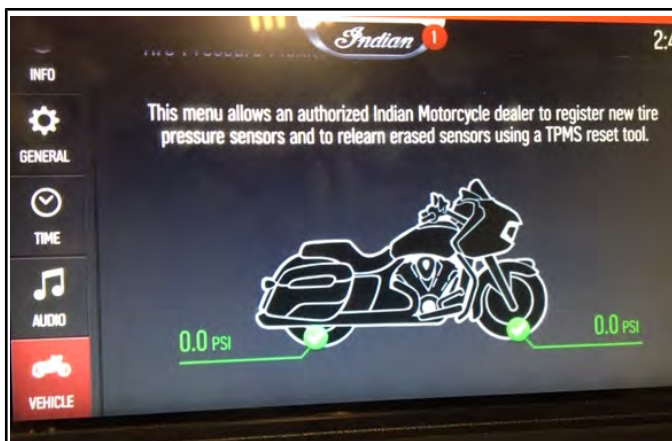
- When the sensor has learned, a success message will appear followed by the tire pressure reading.



- With the rear wheel learning, use the TPMS Activation tool (PF-51288) on the rear wheel.



- When the sensor has learned, a success message will appear followed by the tire pressure reading.



## TIRE REMOVAL

### TIRE CHANGING, GENERAL INFORMATION

There are three generally acceptable methods to dismount and mount a motorcycle tire to its rim. For each of the three methods, there are countless variations.

The three general methods are:

- Pneumatic or electrically operated tire machine
- Manually operated tire machine
- Manual manipulation of tire irons

Indian Motorcycle permits and recommends all three of the general methods, but realizes that careless or improper work habits can damage both the tire and rim no matter which method is used. With any of the methods, care must still be taken to avoid damaging the rim, tire, inner tube (if applicable), brake disk, or sprocket.

The pneumatic or electrically operated tire machine is preferred because it is the most efficient method to dismount and mount tires.

The manually operated tire machine is the next preferred method. It can be just as efficient as a power assisted tire machine but with some of the machines it may be necessary to remove the belt driven sprocket in order to gain sufficient clearance for tire removal.

Manual manipulation is the least preferred method since it will generally not deliver the same efficiency as the other methods and greater care needs to be taken when performed. Care must be taken when using tire irons to not damage or stress the tire bead. Also, the opposite bead needs to be in drop center of wheel during mounting and dismounting of the tire.

Be very careful not to damage the rim, tire, inner tube, brake disk, TPMS sensor or sprocket regardless of which method is used.

#### ⚠ CAUTION

On models equipped with a Tire Pressure Monitoring System (TPMS) break beads at the valve stem, then at 90° and 270° from the valve stem as required. If the bead is broken 180° from the valve stem (sensor location) the TPMS sensor may be damaged and require replacement. See **TPMS Overview page 8.94**.

## TIRE REMOVAL

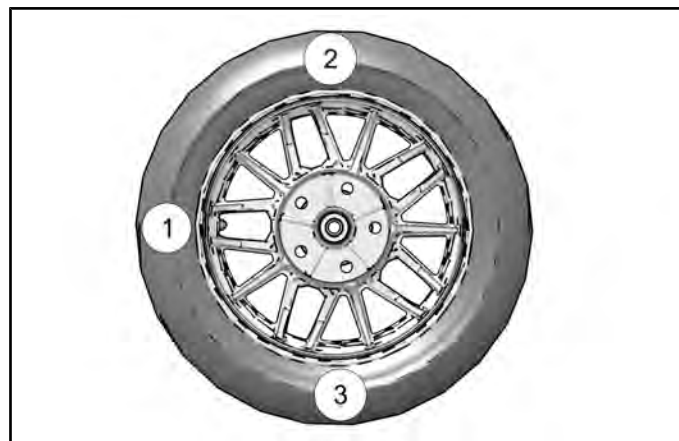
### NOTICE

**This procedure is written assuming that a pneumatic, electric, or manually operated rim-clamp type tire machine is being used.**

1. Remove wheel / tire assembly from motorcycle. See Steering / Suspension chapter for front and rear wheel removal procedures.
2. Remove valve core from valve stem and let all air escape.
3. Mount the wheel assembly onto a tire bead breaker and break the bead starting at the valve stem ①, then again at 90° ② and again at 270° ③ from the valve stem as necessary.

#### ⚠ CAUTION

The TPMS sensor is located 180° from the valve stem. If the bead is broken 180° from the valve stem the TPMS sensor may be damaged and require replacement.



4. Flip the wheel assembly over and repeat STEP 3 on the other side.

### IMPORTANT

Take great care not to bend or otherwise damage the brake disc and/or belt driven sprocket. If the bead breaker being used interferes with either the brake disc and/or belt driven sprocket, remove the disc or sprocket as required.

5. Push tire down and lubricate tire bead with tire lubricant on both sides of the tire.



## STEERING / SUSPENSION

6. Mount the tire and wheel assembly on the tire machine per the manufacturers instructions.

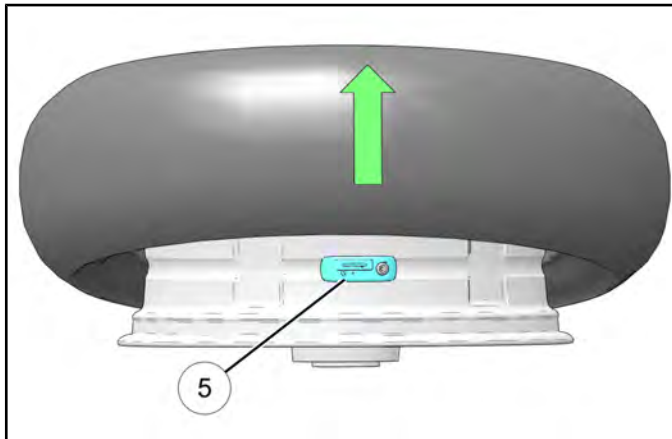
### NOTICE

**Refer to manufacturer's instructions for proper tire changer operation.**

7. Carefully work around the circumference of the upper bead ④ with the tire lever until it is completely off of the rim.



8. Paying attention to the location of the TPMS sensor ⑤, lift the lower tire bead up until the tire lever can be positioned and the tire completely removed.

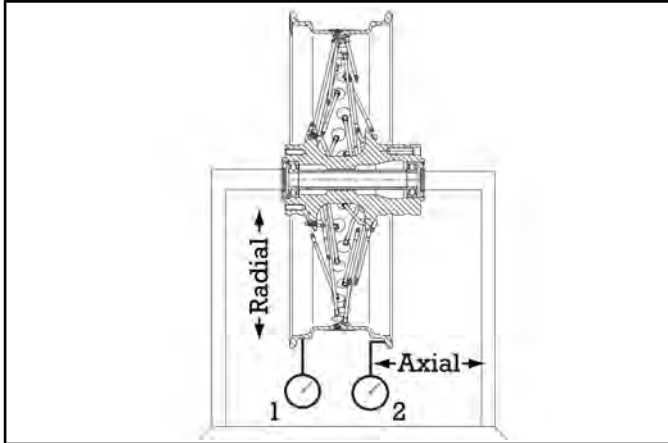


9. Work around the circumference of the rim until the tire can be lifted free of the rim.



**WHEEL INSPECTION****VISUAL INSPECTION & RUNOUT**

1. Clean the rim of all rubber particles and corrosion.
2. Inspect wheel for cracks and/or distortion.
3. Inspect bead seating area for scratches, distortion, or damage that could prevent proper sealing.
4. Measure wheel for radial runout (1).
5. Measure wheel for axial runout (2).

**NOTICE**

Measure runout on tire bead seating surface of wheel. Be sure surface is clean.

6. Compare measurements of axial and radial runout to specifications. See **Service Specifications – Front Wheel / Suspension page** . Replace wheel if any measurement exceeds Service Limit.
7. Clean the sealing surfaces of the rim thoroughly. Use a soft brush (nylon) soap and water if necessary.

**WARNING**

Do not scratch or damage sealing surfaces of rim. Loss of air pressure can cause a loss of control and an accident, resulting in serious injury or death.

**TIRE REPAIR PRECAUTIONS****WARNING**

Only permanent plug-patch repairs of small tread area punctures from **inside** the dismounted tire are recommended. Never perform an exterior repair and never use an inner tube as a substitute for a proper repair. Speed should not exceed 50 MPH for the first 24 hours after repair and the repaired tire should never be used over 80 MPH. Inspect inflation pressure after tire cools for at least three hours following initial operation.

## VALVE STEM

### VALVE STEM INSPECTION

1. Remove the valve stem cap and spray the valve stem down with a mild soap and water solution.
2. Observe the area around the base of the valve stem and valve core area. If any bubbles form over a 1–2 minute period, the valve stem or inner tube should be replaced.
3. Inspect valve stem for cracks or visible damage and replace if necessary.

#### NOTICE

**Tubeless:** Valve stem replacement is recommended when tire is being replaced.

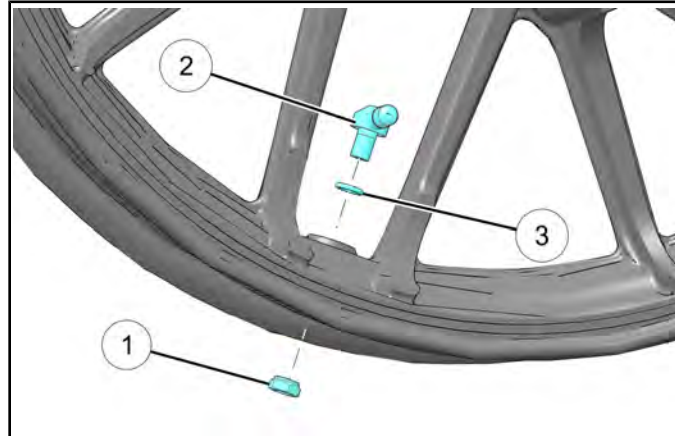
**Tube Type:** Inner tube replacement is recommended when tire is being replaced.

## VALVE STEM REPLACEMENT

### IMPORTANT

The Challenger uses directional tires and wheels. Both front and rear valve stem face the right side of the unit.

1. Remove tire from wheel as outlined in this chapter.
2. Remove valve stem nut ①, valve stem ② and o-ring ③.



3. Clean gasket or o-ring sealing surface of rim.
4. Place new valve stem (with seal washer or O-ring installed) through hole in rim and position it so the stem is perpendicular from wheel center and, valve opening facing the right side of the unit.
5. Hold stem and tighten nut to specification.

### TORQUE

Valve Stem Nut:  
**53 in-lbs (6 N·m)**

6. Install tire as outlined in this chapter.

**TIRE INSTALLATION****NOTICE**

**This procedure is written assuming that a pneumatic, electric, or manually operated rim-clamp type tire machine is being used.**

**NOTICE****Balance Dots**

Metzeler tires have a yellow dot on the sidewall which corresponds to the lightest part of the tire. This dot is meant to line-up with the tire valve which often is the heaviest part of the rim (although this is not always the case).

Indian Motorcycle does not recommend the use of liquid balancer/sealers. These are a form of temporary repair which may adversely affect ply material and mask secondary damage caused by the penetrating object. Reliance upon sealants can result in sudden tire failure and accident.

**Directional Arrows**

Tires and rims have directional arrows that must be observed when installing tires to rims. The wheel assemblies must be free of foreign debris that would affect balancing. Carefully inspect the wheel bearings, seals and axle for damage or corrosion.

1. Lubricate both tire beads with rubber lubricant.

**CAUTION**

Never apply grease, oil, gasoline, spray type lubricants or anything other than rubber lubricant or a neutral soap and water solution to the tire bead. Doing so can damage the tire.

2. Mount the tire and wheel assembly on the tire machine per the manufacturers instructions.

**NOTICE**

**Refer to manufacturer's instructions for proper tire changer operation.**

3. Orient tire correctly as to the balance dot and directional arrows.

4. Push tire on to rim until one bead is installed. It shouldn't be necessary to use tire irons to put one side of the tire onto the rim. Remember to keep bead(s) in the drop center of the wheel whenever possible.

**CAUTION**

Use care not to damage the TPMS sensor while installing the tire bead over the edge of the rim.

**NOTICE**

Confirm tire is positioned correctly by observing directional arrows.

5. Lubricate the tire bead.
6. With your hands, push as much of the remaining tire bead as possible into the rim, pinching both upper and lower beads into the drop center.
7. When no more of tire can be installed by hand, press down on portion of tire in front of you with your knee to keep the top bead in the drop center.
8. Install the tire lever and work around the remaining circumference of the wheel until the bead is fully installed onto the rim.


**NOTICE**

Be sure both beads are forced as far as possible into the drop center of the rim.


9. Install valve core if it was removed.
10. Line up balance dot.
11. Confirm that the directional arrows are pointing in the correct direction.
12. Bounce tire on the floor several times while rotating tire. This will expand tire bead outward slightly which will make tire inflation easier.
13. Inflate tire observing the precautions listed below.

**Tire Inflation & Precautions**

- Wear approved eye protection
  - Lubricate the tire beads with a tire mounting lubricant before inflation.
  - Lock assembly on mounting machine or place in safety cage before inflating to seat beads
  - Use extension gauge and hose with slip-on air chuck.
  - Stand back with no part of your body within the perimeter of the assembled tire and rim.
  - Inflate with core in valve stem
  - Never inflate above 42 psi to seat beads
  - If beads do not seat by 42 psi. Deflate and repeat procedures. Never use a volatile substance or rubber “donut” to aid bead seating.
14. Inspect the line molded onto the tire side walls. It must be the same distance from the rim all the way around the tire. If the distance varies it indicates that tire is not seated properly.
  15. If tire is not seated correctly, deflate and unseat the tire, lubricate the tire beads and repeat inflation procedure.
  16. Install wheel assembly onto balance stand and spin. Observe the wheel assembly while it is spinning to make sure the tire is seated properly.
  17. Adjust tire pressures to specifications.
  18. Balance tire / wheel assembly.

 <b>WARNING</b>
<p><b>FOR NEW TIRES:</b> Replacement of OEM tires or replacement with differently constructed tires will not immediately produce improved reactions the same as the original tires when new. When new tires are installed, they should not be subjected to maximum power or hard cornering until a reasonable “scrub” period of approximately 100 miles has been covered. This will permit the rider to become accustomed to “feel” of new tires or tire combination, and achieve optimum road grip. Inspect and adjust tire inflation pressure after tire cools down for at least three hours following “run-in”.</p>

**TIRE BALANCING**

 <b>WARNING</b>
<p>It is essential that the wheel assembly be balanced before use and rebalanced each time the tire is removed. Wheel balance affects stability, handling and overall safety of the motorcycle.</p>

All Metzeler street tires should be installed with the yellow balance dot at the tire valve.


The use of liquid balancer/sealer is not recommended.

This procedure will outline balancing wheel assembly in a gravity balance stand. If a pendulum or spin type balancer is being used, reference the manufacturer’s instructions that came with the equipment.

1. Mount wheel assembly in a commercially available balance stand.
2. Remove all balance weights. Clean tire and rim thoroughly.

<i>NOTICE</i>
<p>While it is possible to balance a wheel assembly with axle and grease-free wheel bearings as the pivot point, it is not recommended. Use an inspection stand that has knife edge bearings and its own axle.</p>

3. Spin the wheel assembly. Allow it to stop on its own and mark the highest (lightest) part of the wheel.
4. Repeat the spinning process to verify the heaviest part of the wheel.
5. Place balance weights at the lightest portion of wheel in small increments.
6. After each addition of weight, spin the wheel assembly and allow it to stop by itself.
7. When correct amount of weight has been added to wheel, it will no longer stop in the same location and the wheel assembly is balanced.

 <b>CAUTION</b>
<p>Do not add more than 85 grams (3.0 oz.) of weight to the front or rear wheel.</p>

If more than the recommended weight is necessary to balance the wheel, dismount the tire and rotate it 90° without regard to the yellow balance dot, and re-balance the wheel / tire.

**Adhesive Weight P/N 1520253**

8. Install wheel / tire assembly onto motorcycle. See Steering / Suspension chapter for front and rear wheel installation procedures.

**TROUBLESHOOTING**

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REPAIR RECOMMENDED</b>
Rear Wheel (Wobbles)	Bent rim	Replace
	Worn or damaged wheel bearings	Replace as a set
	Worn or damaged swing arm bushings.	Replace as a set
	Damaged or incorrect tire	Replace rear tire
	Wheel assembly out-of-balance	Balance wheel
	Low tire pressure	Inflate to specification
	Loose swing arm, axle or suspension fasteners.	Torque to specification
Handlebars Oscillate (Wobble)	Bent front axle	Replace
	Worn or damaged wheel bearings	Replace as a set
	Tire mounted incorrectly	Inspect and re-mount tire
	Damaged tire	Replace
	Loose steering stem nut	Adjust to specification
	Incorrect tire	Replace
	Incorrect tire pressure	Inflate to specification
Front Wheel Oscillates (Wobbles)	Bent rim	Replace
	Worn or damaged wheel bearings	Replace as a set
	Damaged or incorrect tire	Replace
	Loose axle or axle pinch fasteners	Torque to specification
	Right and left fork not installed at same height	Repair
	Fork oil level incorrect	Fill to specification
	Fork spring free length different between right & left	Replace spring that does not meet specification
	Wheel assembly out-of-balance	Balance wheel



# CHAPTER 9

## BRAKES

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## BRAKES

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## GENERAL INFORMATION

### SERVICE NOTES – BRAKES

Use only genuine Indian Motorcycle replacement parts when servicing the brake system. Clean all system components prior to disassembly, including the fluid reservoir cover(s) to reduce the chance of debris entering the system during repair or maintenance work. Start with a clean work area away from dust, water or other contamination. Cleanliness is very important for proper brake system maintenance and repair. Follow procedure outlined in this manual carefully, including fastener torques and the application of special lubricant in required areas. Special lubricants are included with service kits.

#### WARNING

Contaminated brake discs or pads greatly reduce the amount of stopping force available & increase stopping distance. Brake discs can be cleaned using a commercially available brake disc cleaner. Follow the manufacturer instructions printed on the container. NEVER attempt to clean contaminated brake pads. Always replace pads as a set.

#### WARNING

The brake system uses ethylene-glycol based fluid (DOT 4). Do not use or mix with different types of fluid such as silicone-based (DOT 5) or any petroleum-based fluid.

Do not let water or moisture enter the master cylinder when refilling. Water significantly lowers the boiling point of the fluid and can result in poor braking.

Do not use brake fluid taken from old, used or unsealed containers. Never reuse brake fluid. Keep brake fluid containers completely sealed and out of reach of children.

Brake hoses should be replaced whenever the exterior shows signs of deterioration or damage. Brake hoses should be replaced every four (4) years regardless of their exterior condition.

Bleed the brake system any time it is disassembled or when the brake action is spongy.

Always inspect the operation of the brakes before riding the motorcycle.

Replace sealing washers whenever brake lines are removed.

Always remove the master cylinder fluid reservoir cover and inspect the fluid level when brake pads are replaced.

#### NOTICE

Brake fluid and some types of brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level and clean before removing the cap.

### SPECIAL TOOLS – BRAKES

TOOL DESCRIPTION	PART NUMBER
ABS Tool (Lever Reserve)	PV-50104
Vacuum Brake Bleeder	Commercially Available

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

### SERVICE SPECIFICATIONS – BRAKES

ITEM	STANDARD	SERVICE LIMIT
Specified Brake Fluid	DOT 4	Replace every 24 months or 10,000 miles (16,000 km)
Brake Disc Thickness, Front	5 mm	4.5 mm (.177") (Min)
Brake Disc Thickness, Rear	7 mm	6.5 mm (.256") (Min)
Brake Disc Runout	-	.30 mm (.012") (Max)
Brake Pad Wear Limit (Front & Rear)	-	When wear limit groove is no longer visible
Brake Pedal Free Play (Pedal Clearance)	No Adjustment	-
Brake Lever Freeplay (Front)	No Adjustment	-

## BRAKE MAINTENANCE

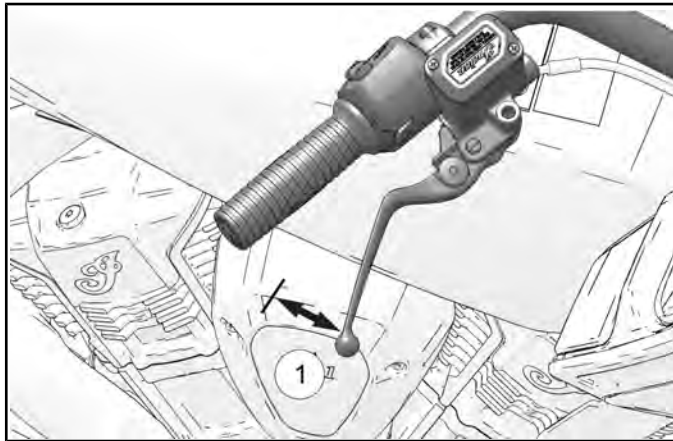
### FRONT BRAKE LEVER INSPECTION

1. Pull and release the front brake lever. It should move freely and smoothly and return to its rest position quickly when released. Lubricate brake lever if binding, or if it does not return quickly and completely when released.

See **Front Brake Lever Lubrication** page 9.4.

2. Measure brake lever free play ①. You should feel a firm resistance in the lever within the specified length of lever travel. If brake lever travels too far before beginning to apply the brake, inspect for brake fluid leaks and bleed air from the system.

See **Brake Fluid Replacement & Bleeding Precautions** page 9.37.

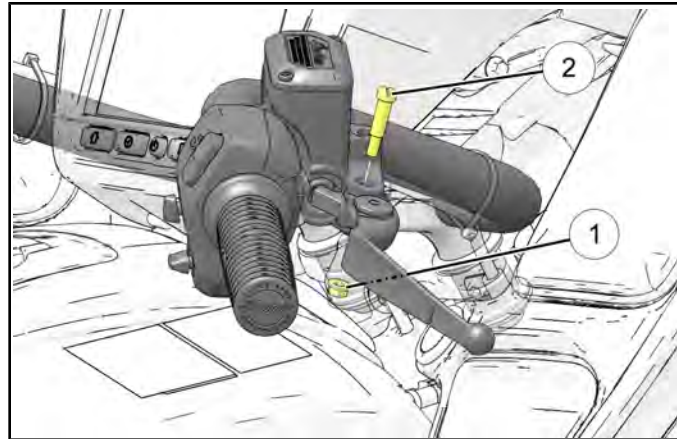


Brake Lever Free Play:  
 .75–1.0" ( 19.1–25.4 mm)

3. Safely elevate the front wheel. Verify wheel rotates freely without drag or binding when lever is released.

### FRONT BRAKE LEVER LUBRICATION

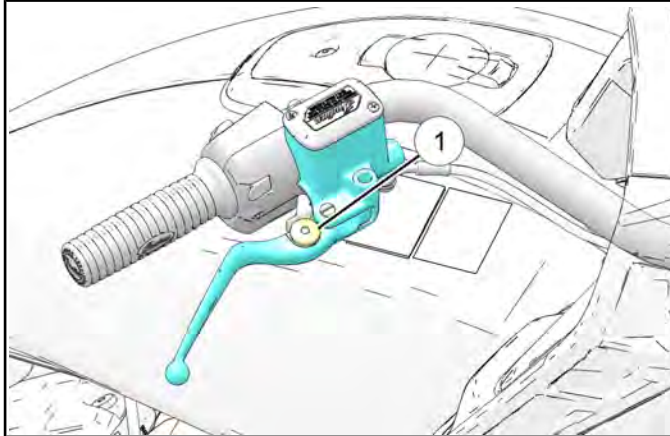
1. Remove nut ① and pivot pin ②.



2. Clean pivot pin, lever and lever perch.
3. Remove brake lever and apply grease to pivot pin ②, lever bushing, and contact surface of pushrod.
4. Assemble brake lever.

## FRONT BRAKE LEVER REACH

- Lever reach (distance to hand grip) is adjustable:
  - Pull lever forward (away from hand grip) and hold.
  - TO ADJUST reach distance, turn dial ① on the lever.



- The adjustment pin will seat at different depths in the dial at each setting. Stop once the proper brake lever reach is achieved.

### IMPORTANT

Make sure the adjustment pin is not resting between pockets on the dial. Once the reach is set, pull the brake lever 2–3 times to verify proper operation.

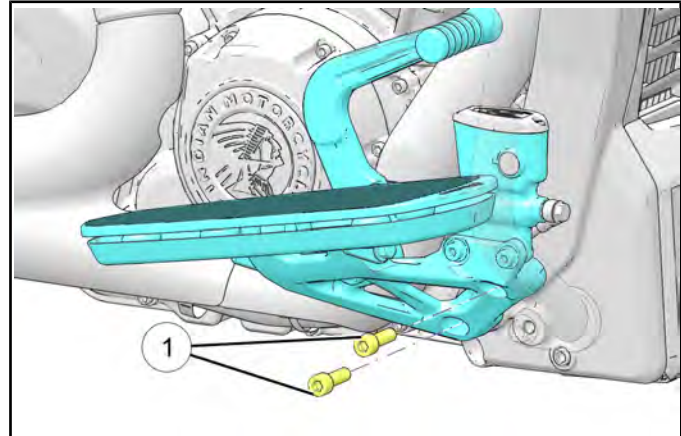
## BRAKE PEDAL INSPECTION

- Press and release brake pedal. It should move freely and smoothly and return to the rest position quickly when released.
- Press brake pedal and check for firm resistance. If pedal feels spongy or travels too far without resistance, inspect system for leaks and bleed brakes. See **Brake Fluid Replacement & Bleeding Precautions** page 9.37.

## BRAKE PEDAL LUBRICATION

Lubricate brake pedal at intervals listed on periodic maintenance table. See **Maintenance Intervals** page 2.4.

- Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
- Working on the RH side of the motorcycle, remove floorboard support fasteners ① and move floorboard / master cylinder assembly so the brake pedal pivot pin can be accessed.



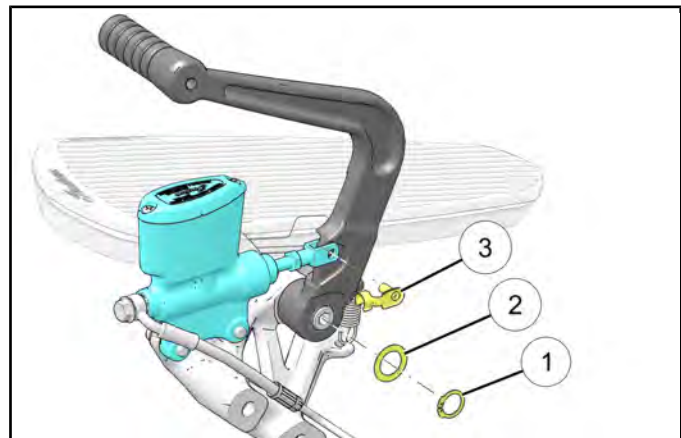
### NOTICE

It is not necessary to disconnect the brake line from the master cylinder to perform this procedure.

### IMPORTANT

Keep the floorboard / master cylinder assembly in an upright position at all times to ensure air does not enter the brake system.

- Remove pushrod pivot pin clip ③. Release the pushrod from the brake pedal.
- Remove snap ring ① and washer ②. Remove pedal and inner wave washer from post.



## BRAKES

5. Clean off old lubricant and dirt from all parts.
6. Apply all-purpose grease to post and pedal bushing.
7. Install wave washer, pedal, flat washer and snap ring. Be sure snap ring is fully seated in the groove.
8. Install pushrod pivot pin clip.
9. Assemble floorboard support to frame. Torque mounting fasteners to specification. See **Floorboard Removal / Installation page 7.29**.
10. Depress brake pedal to verify proper operation and pedal feel. Bleed brakes if necessary. See **Brake Fluid Replacement & Bleeding Precautions page 9.37**.

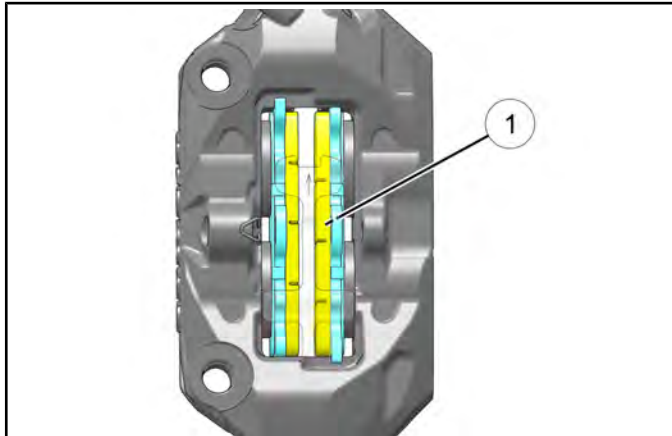
### FRONT BRAKE PAD INSPECTION

#### NOTICE

Wear indicator grooves are provided on each front brake pad to allow for a visual inspection without pad removal. Inspect pads by viewing from rear of caliper.

Replace pads if worn to bottom of grooves. See **Front Brake Pad Replacement page 9.42**.

1. Viewing the front brake pads from the rear of the calipers, locate the wear indicator grooves ①.



2. Wear indicator grooves should be visible on both inboard and outboard brake pads of both calipers.

#### CAUTION

Front brake pads should always be replaced as a complete set. If it is determined that an individual brake pad has worn past the wear indicator groove, both front calipers should receive new pad sets.

Failure to replace both sets of front brake pads together may cause reduced braking performance or brake failure, resulting in a vehicle crash.

### REAR BRAKE PAD INSPECTION

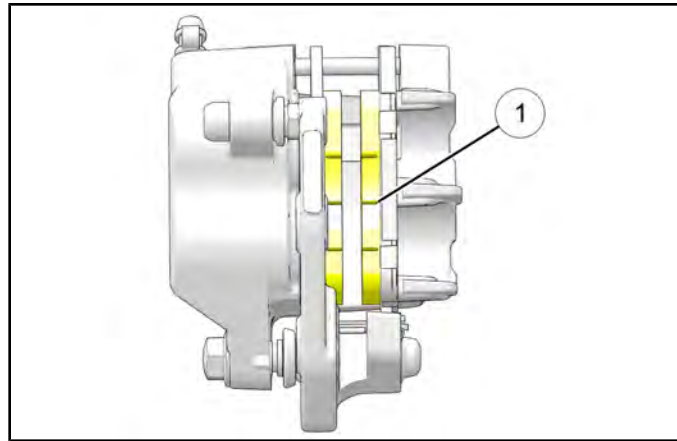
#### NOTICE

Wear indicator grooves are provided on each rear brake pad to allow for a visual inspection without pad removal. Inspect pads by viewing from the rear of the motorcycle, directly behind the LH tailpipe.

Replace pads if worn to bottom of grooves.

See **Rear Brake Pad Replacement page 9.43**.

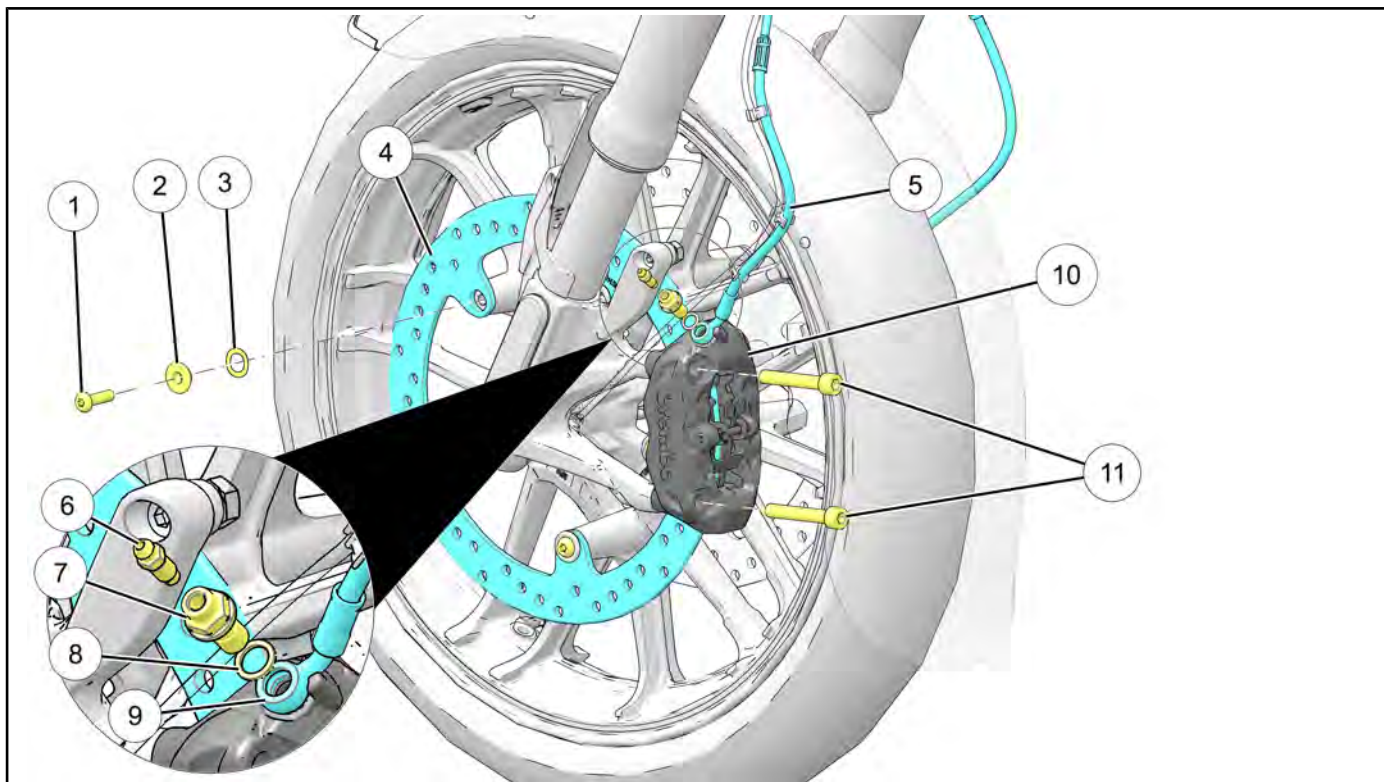
1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Viewing the rear brake pads from behind the motorcycle and below the lip of the rear fender, locate the wear indicator grooves ①.



3. Wear indicator grooves should be visible on both inboard and outboard brake pads.

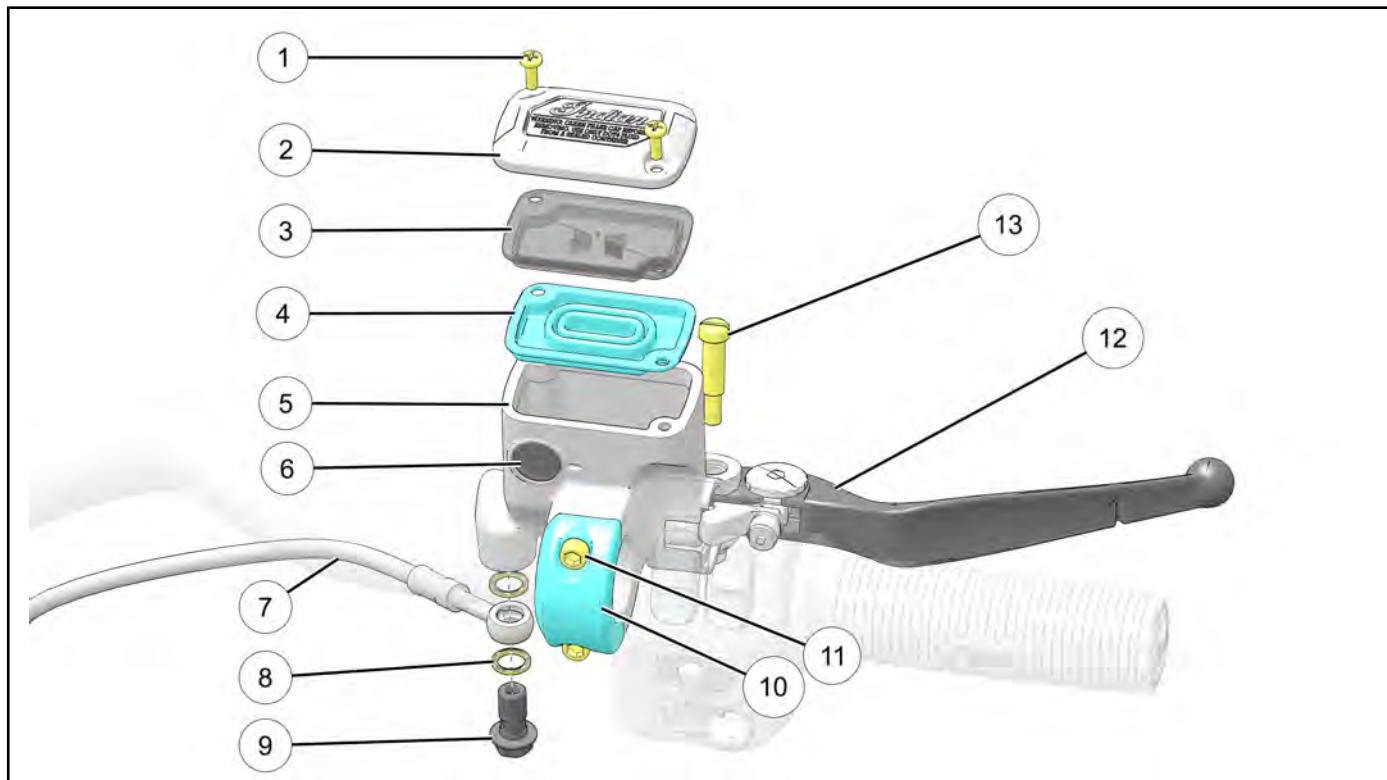
## ASSEMBLY VIEWS

### FRONT BRAKE SYSTEM

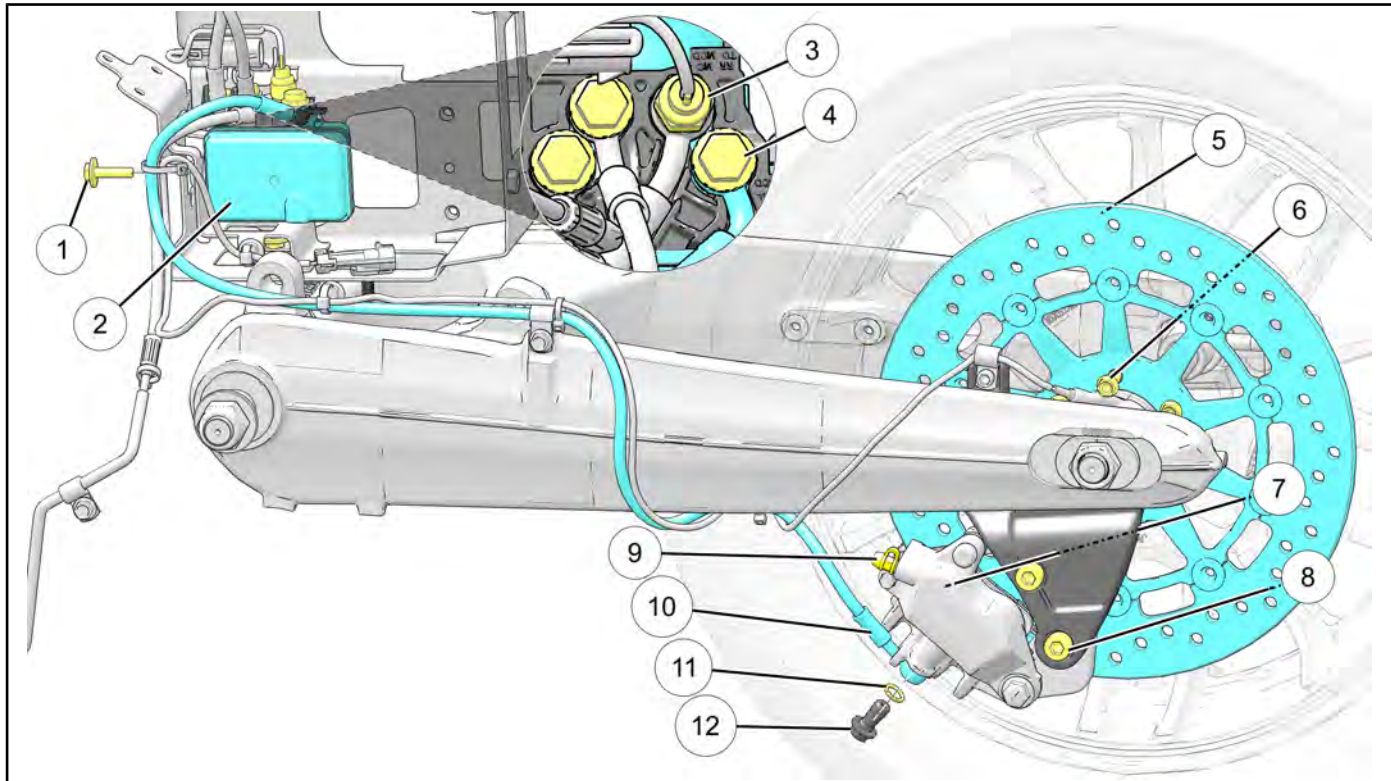


REF	DESCRIPTION	TORQUE
①	Rotor Screw	<b>22 ft-lbs (30 N·m)</b>
②	Rotor Bushing	—
③	Rotor Spring	—
④	Brake Rotor	—
⑤	Brake Line	—
⑥	Bleed Screw	<b>53 in-lbs (6 N·m)</b>
⑦	Banjo Bolt	<b>18 in-lbs (24 N·m)</b>
⑧	Copper Washer	—
⑨	Banjo Fitting	—
⑩	Brake Caliper	—
⑪	Brake Caliper Fastener (Front)	<b>35 ft-lbs (47 N·m)</b>

## BRAKES



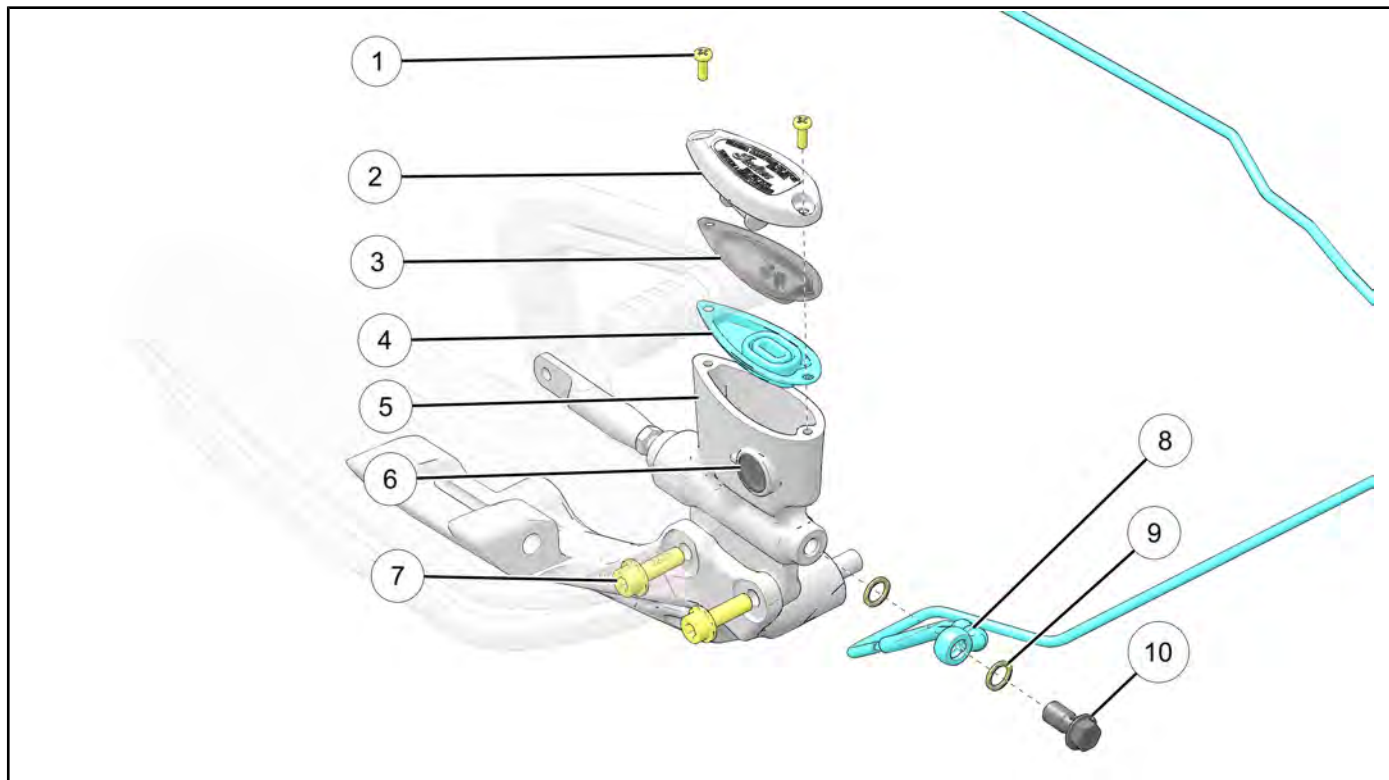
REF	DESCRIPTION	TORQUE
①	Master Cylinder Cover Fastener (Front)	<b>18 in-lbs (2 N·m)</b>
②	Front Master Cylinder Cover	—
③	Diaphragm Plate	—
④	Rubber Diaphragm	—
⑤	Master Cylinder	—
⑥	Sight Glass	—
⑦	Front Brake Line	—
⑧	Copper Washer	—
⑨	Master Cylinder Banjo Bolt	<b>18 ft-lbs (24 N·m)</b>
⑩	Master Cylinder Clamp	—
⑪	Master Cylinder Clamp Fastener (Front)	<b>96 in-lbs (11 N·m)</b> Torque Upper fastener, then lower.
⑫	Front Brake Lever	—
⑬	Brake Lever Pivot (Front)	<b>9 in-lbs (1 N·m)</b>
NA	Brake Lever Pivot Nut (Front)	<b>52 in-lbs (6 N·m)</b>

**REAR BRAKE SYSTEM**

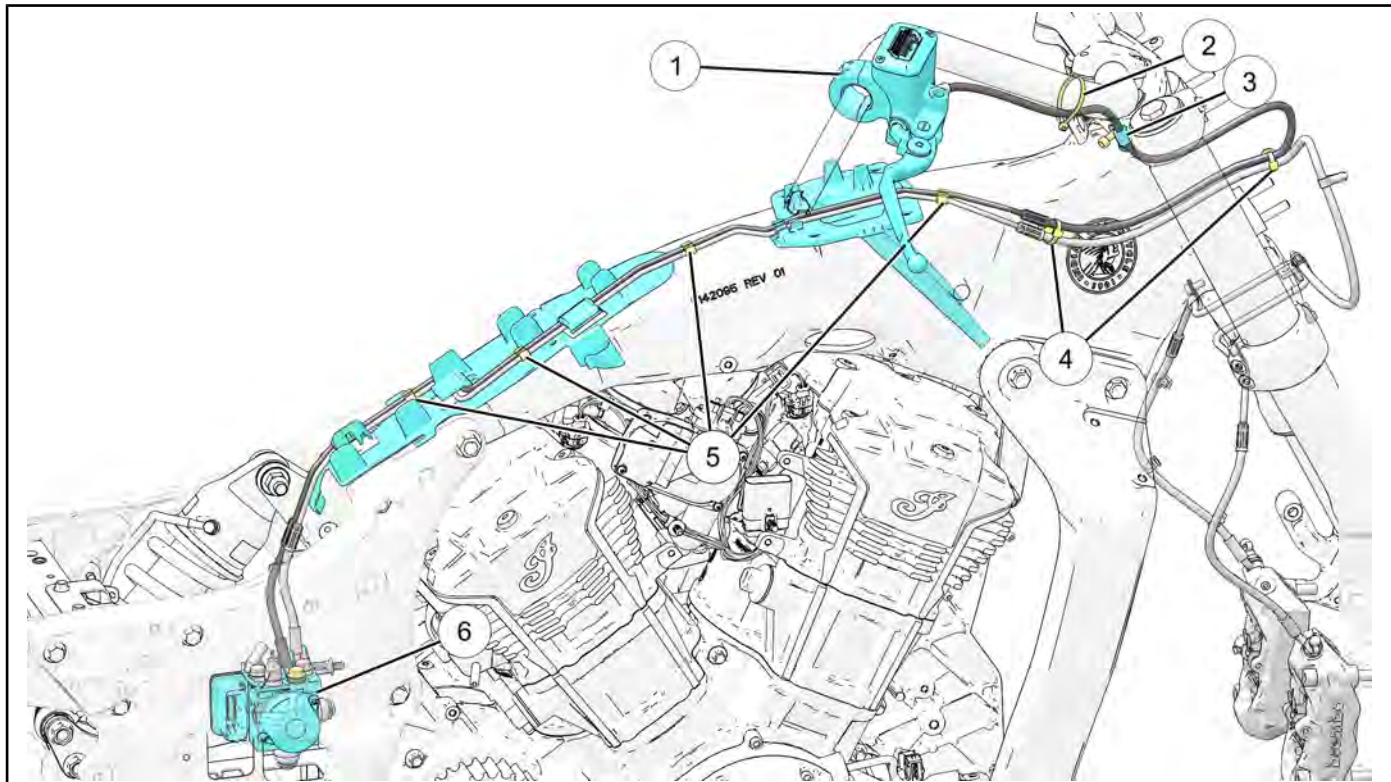
REF	DESCRIPTION	TORQUE
①	ABS Module Fastener	<b>84 in-lbs (10 N·m)</b>
②	ABS Module	—
③	Brake Pressure Sensor	<b>18 in-lbs (24 N·m)</b>
④	Banjo Bolt	<b>18 in-lbs (24 N·m)</b>
⑤	Brake Rotor	—
⑥	Brake Rotor Screw (Rear)	<b>22 ft-lbs (30 N·m)</b>
⑦	Rear Brake Caliper	—
⑧	Brake Caliper Fastener (Rear)	<b>31 ft-lbs (42 N·m)</b>
⑨	Bleed Screw	<b>53 in-lbs (6 N·m)</b>
⑩	Banjo Fitting	—
⑪	Copper Washer	—
⑫	Banjo Bolt	<b>18 in-lbs (24 N·m)</b>



## BRAKES



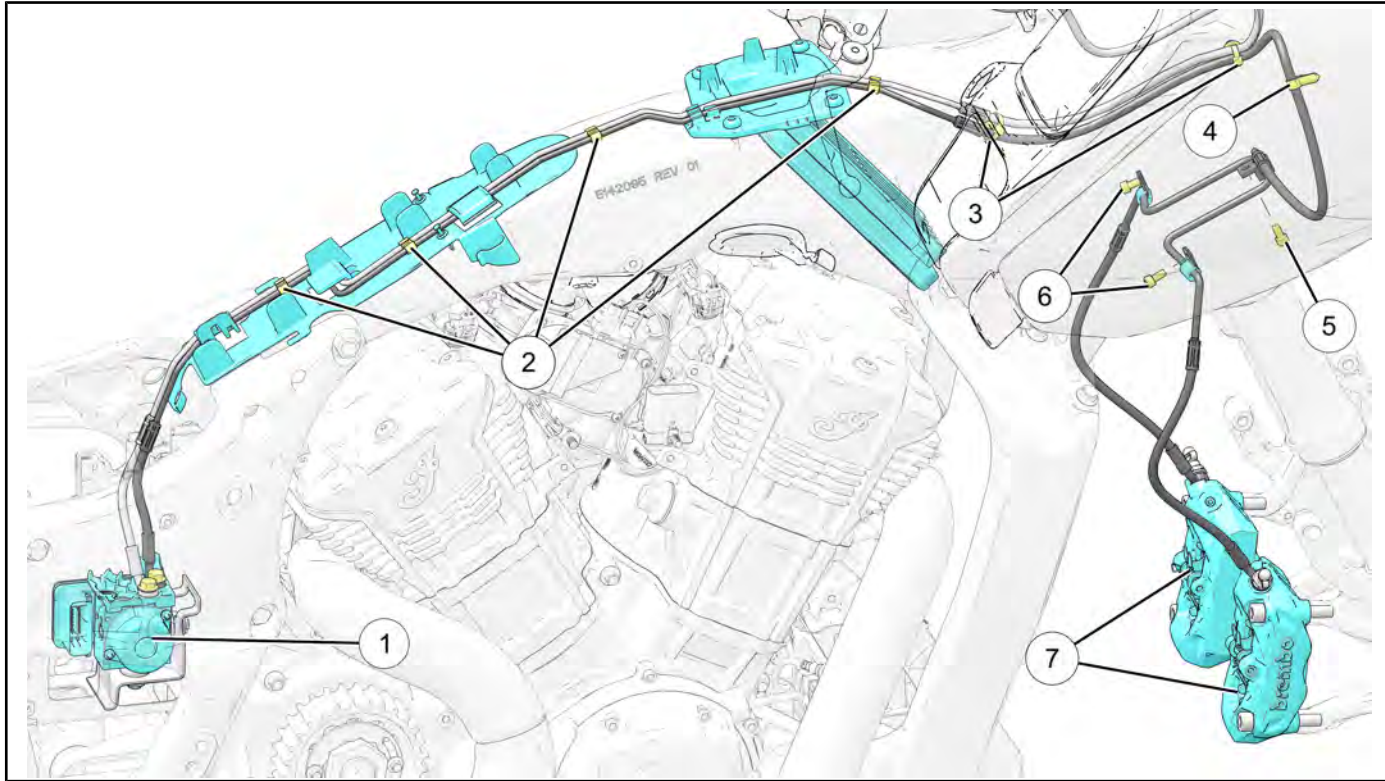
REF	DESCRIPTION	TORQUE
①	Master Cylinder Cover Fastener (Rear)	<b>18 in-lbs (2 N·m)</b>
②	Master Cylinder Cover (Rear)	—
③	Diaphragm Plate	—
④	Rubber Diaphragm	—
⑤	Master Cylinder	—
⑥	Sight Glass	—
⑦	Master Cylinder Fastener (Rear)	<b>18 ft-lbs (24 N·m)</b>
⑧	Brake Line	—
⑨	Copper Washer	—
⑩	Master Cylinder Banjo Bolt	<b>18 ft-lbs (24 N·m)</b>

**BRAKE LINE ROUTING****FRONT MASTER CYLINDER TO ABS MODULE**

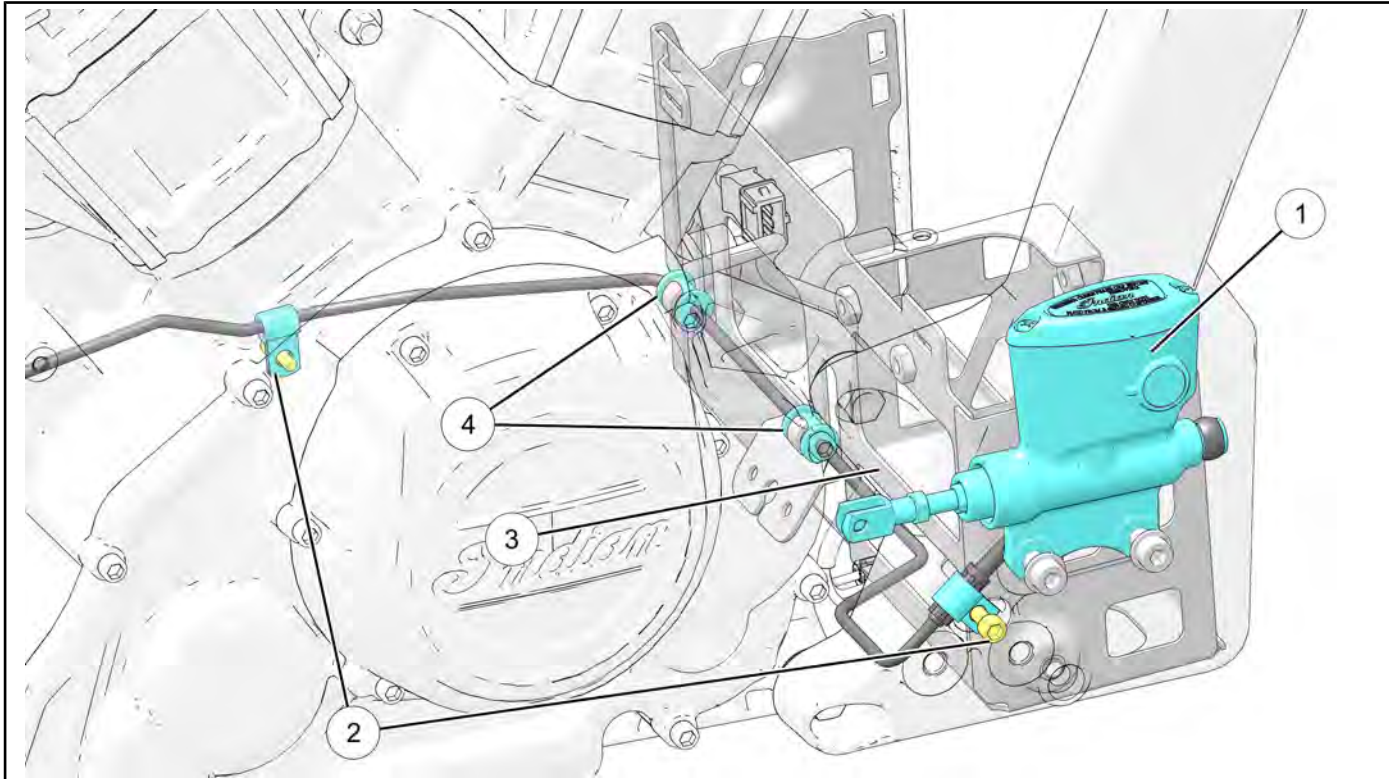
REF	DESCRIPTION	TORQUE
①	Front Master Cylinder	—
②	Cable Tie	—
③	P-Clamp Fastener	<b>84 in-lbs (10 N·m)</b>
④	Routing Clip	—
⑤	Retention Clip	—
⑥	ABS Module	—

## BRAKES

### ABS MODULE TO FRONT BRAKE CALIPER



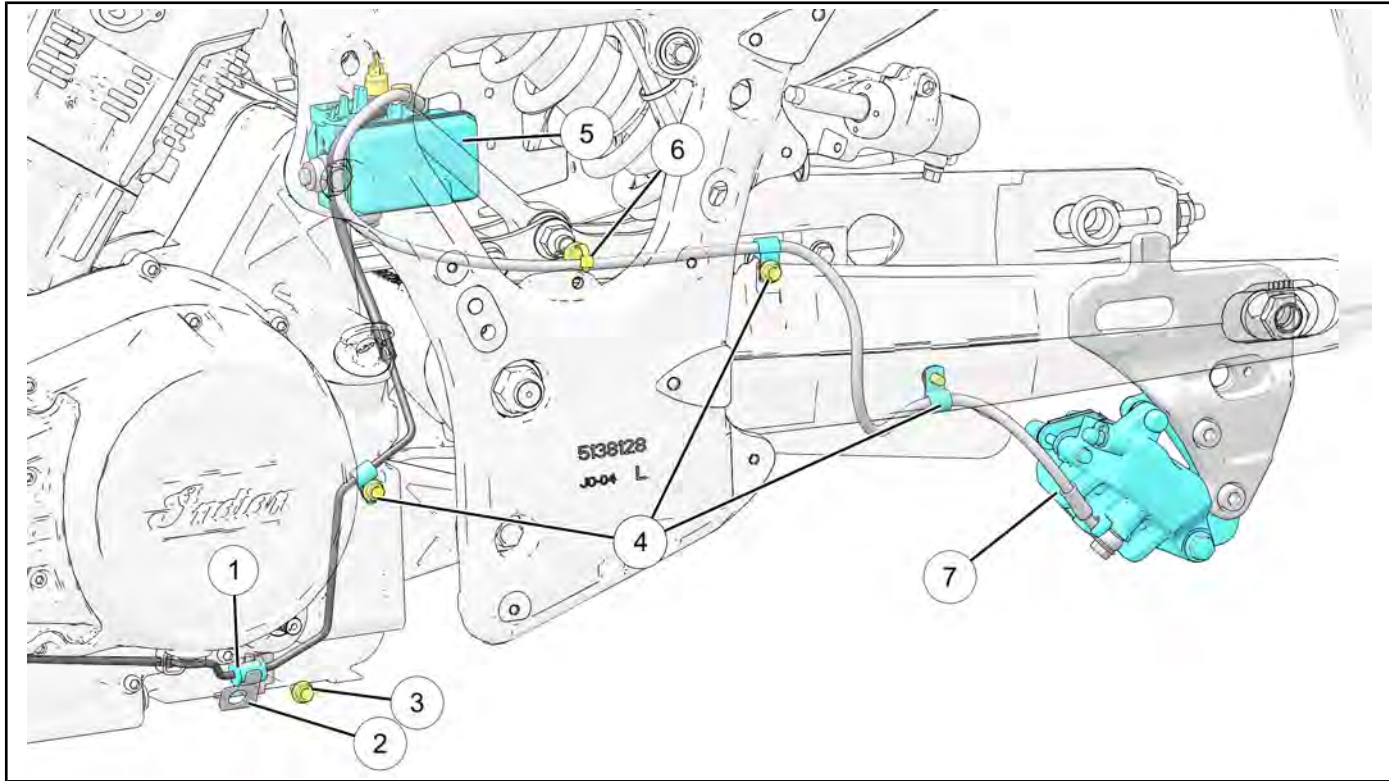
REF	DESCRIPTION	TORQUE
①	ABS Module	—
②	Retention Clip	—
③	Routing Clip	—
④	Silencer Clip	—
⑤	Junction Block Fastener	<b>84 in-lbs (10 N·m)</b>
⑥	P-clamp Fastener	<b>84 in-lbs (10 N·m)</b>
⑦	Front Brake Calipers	—

**REAR MASTER CYLINDER**

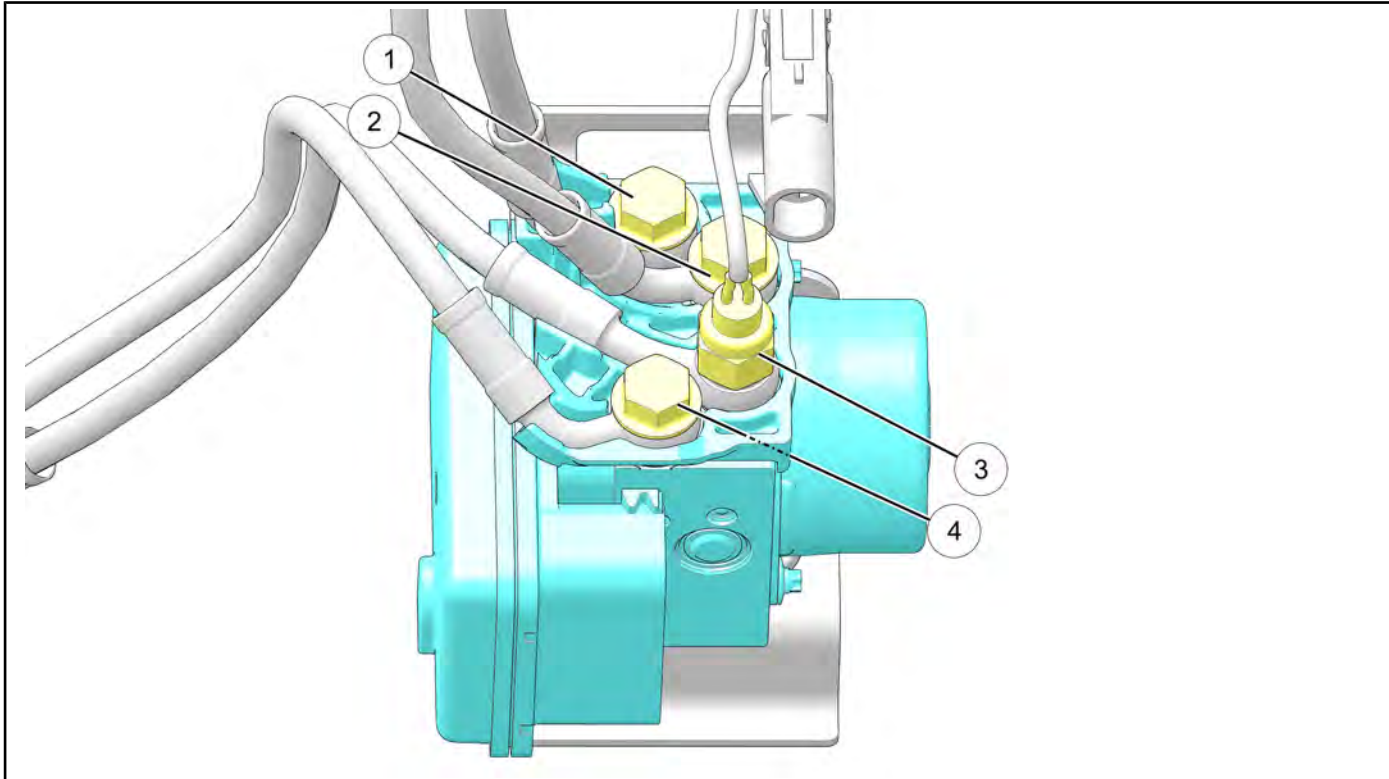
REF	DESCRIPTION	TORQUE
①	Master Cylinder	—
②	P-Clamp Fastener	<b>84 in-lbs (10 N·m)</b>
③	Battery Box	—
④	Isolator	—

## BRAKES

### REAR MASTER CYLINDER TO ABS MODULE / ABS MODULE TO REAR CALIPER

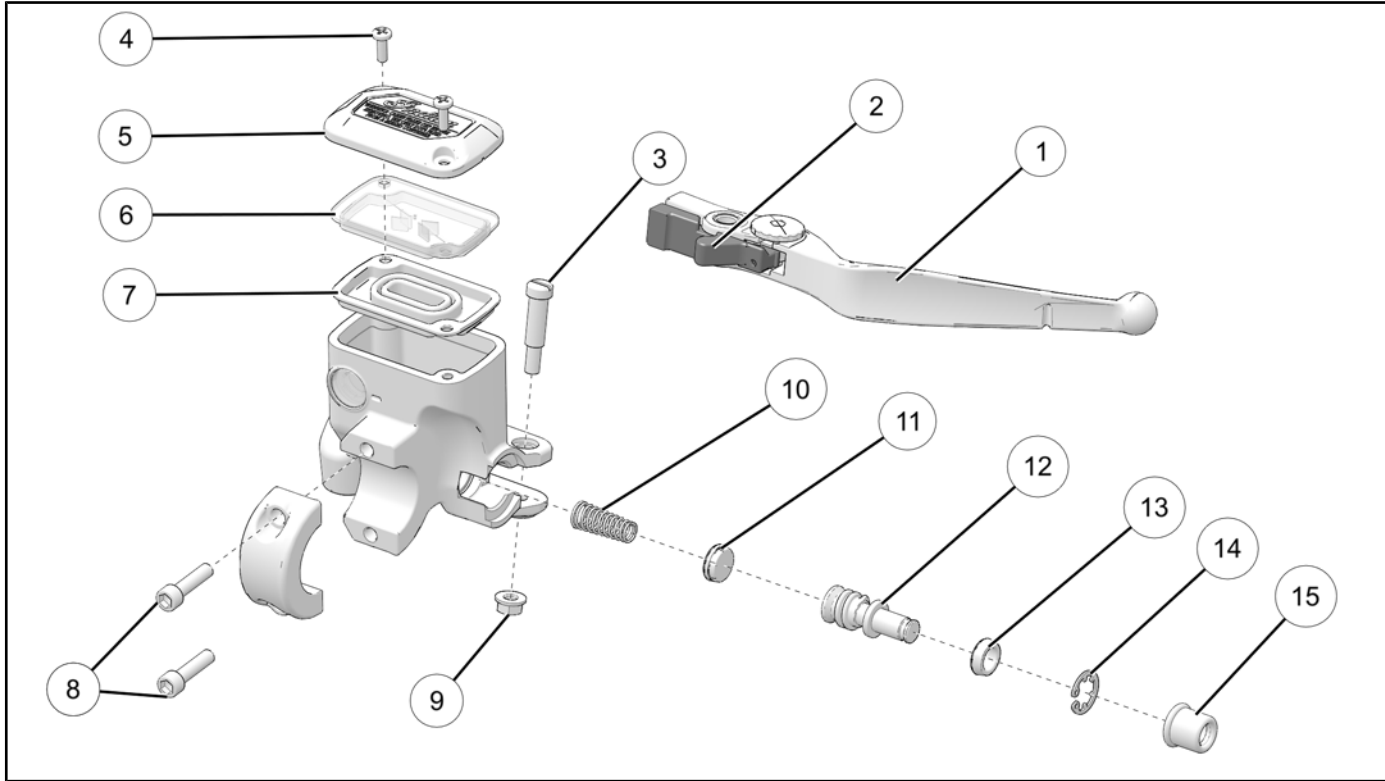


REF	DESCRIPTION	TORQUE
①	Isolator	—
②	Sidestand Stop Bracket	—
③	Sidestand Stop Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
④	P-Clamp Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	ABS Module	—
⑥	Routing Clip	—
⑦	Brake Caliper	—

**ABS MODULE BRAKE LINE ORIENTATION**

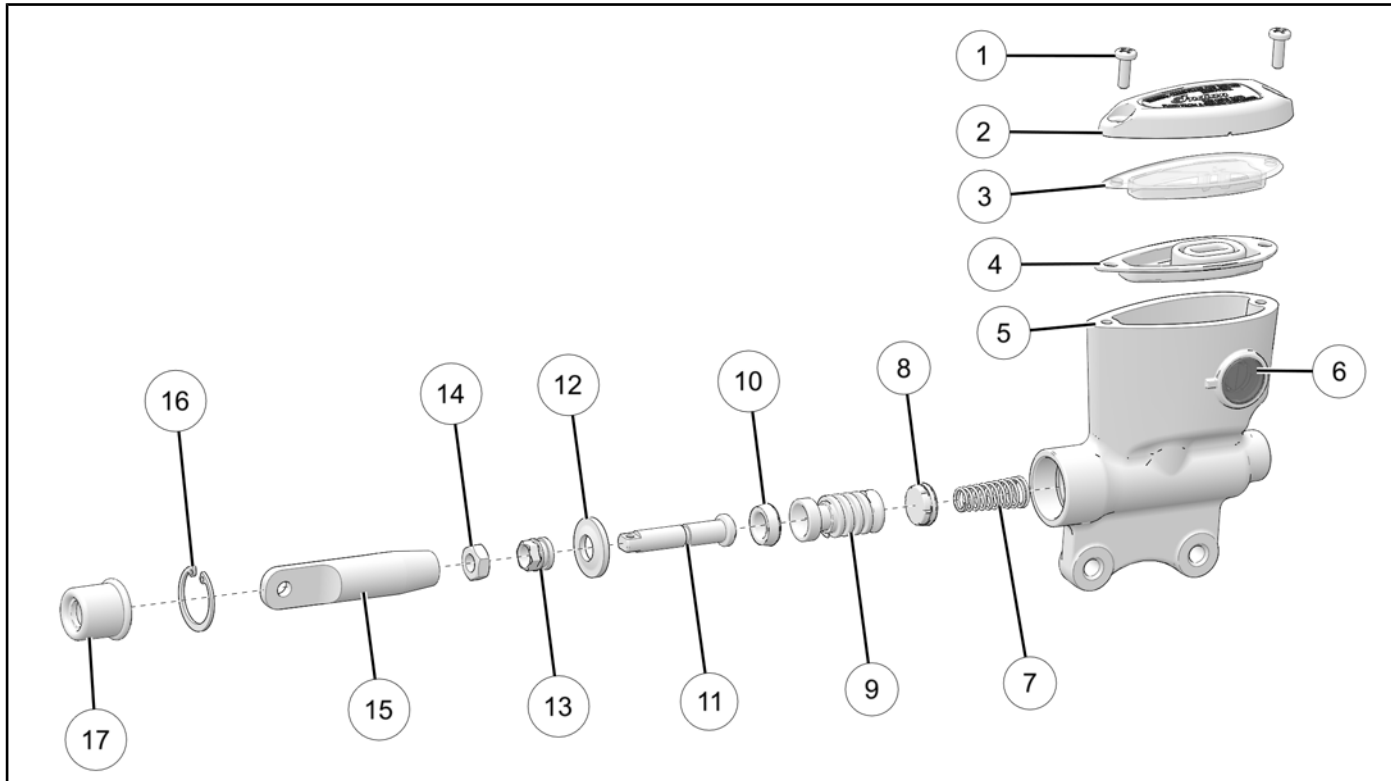
REF	DESCRIPTION
①	Front Brake Caliper Line
②	Front Master Cylinder Line
③	Rear Master Cylinder Line
④	Rear Brake Caliper Line

**FRONT MASTER CYLINDER**



REF	DESCRIPTION	TORQUE
①	Brake Lever	—
②	Brake Lever Adjuster	—
③	Brake Lever Pivot Pin (Front)	<b>9 in-lbs (1 N·m)</b>
④	Master Cylinder Cover Fastener (Front)	<b>18 in-lbs (2 N·m)</b>
⑤	Front Master Cylinder Cover	—
⑥	Diaphragm Plate	—
⑦	Rubber Diaphragm	—
⑧	Master Cylinder Clamp Fastener (Front)	<b>96 in-lbs (11 N·m)</b> (Torque Upper Fastener First)
⑨	Brake Lever Pivot Nut (Front)	<b>52 in-lbs (6 N·m)</b>
⑩	Piston Return Spring	—
⑪	Primary Cup	—
⑫	Piston	—
⑬	Secondary Cup	—
⑭	Circlip	—
⑮	Boot	—

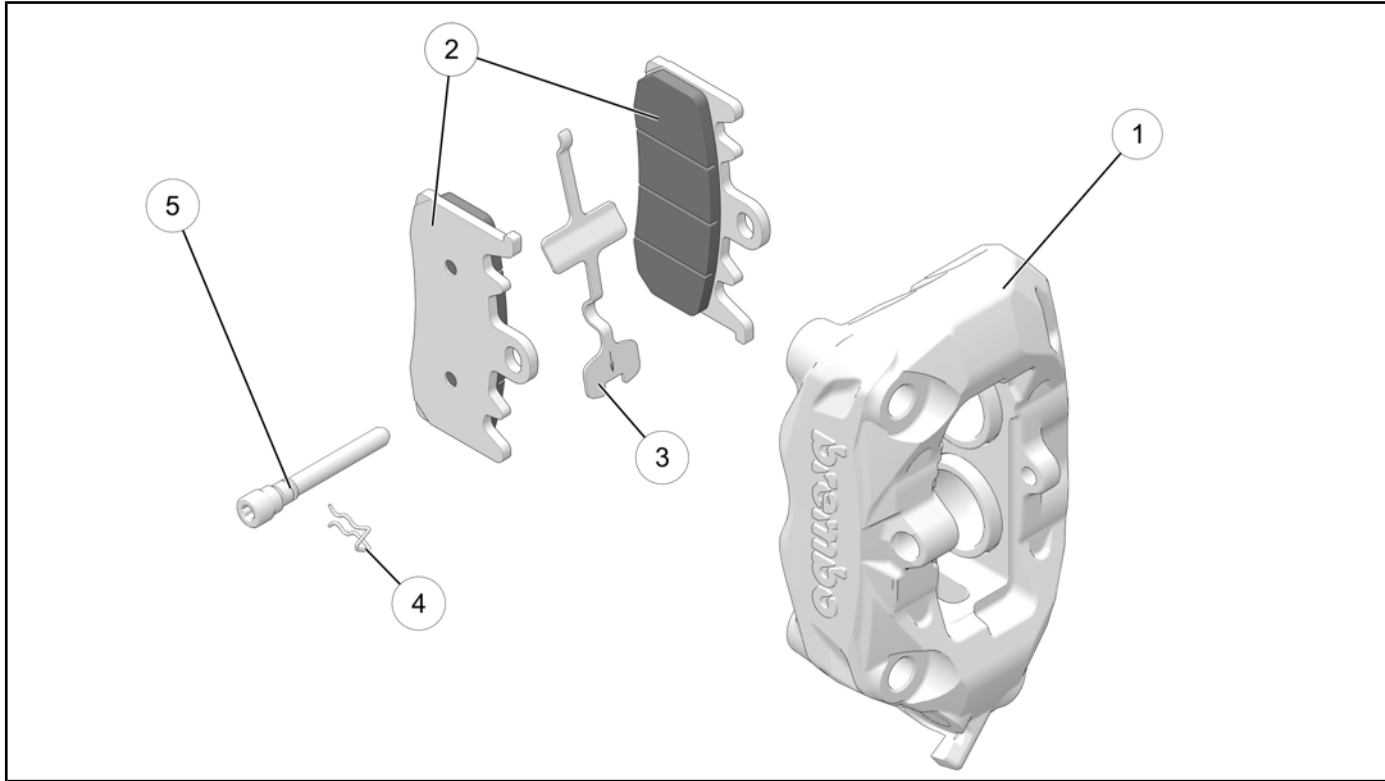
**REAR MASTER CYLINDER**



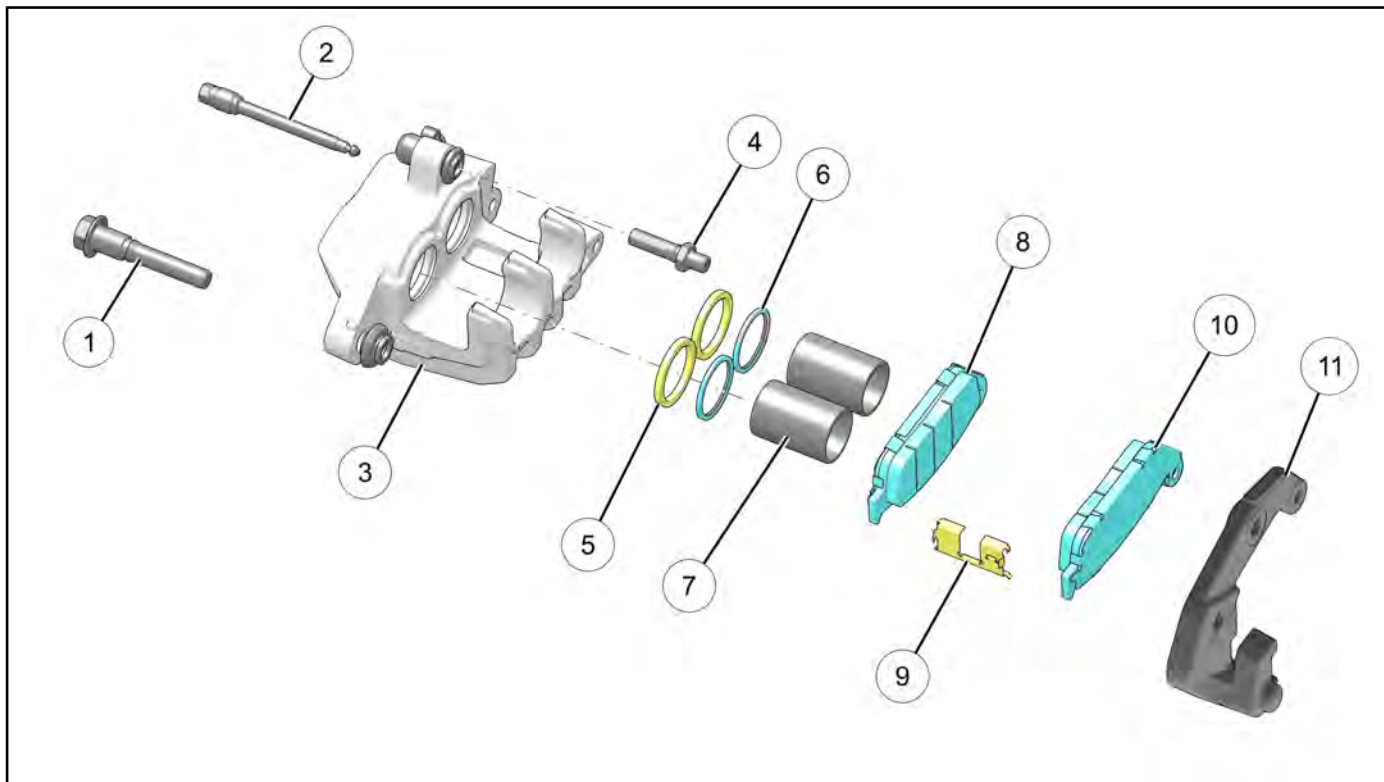
REF	DESCRIPTION	TORQUE
①	Master Cylinder Cover Fastener (Rear)	<b>18 in-lbs (2 N·m)</b>
②	Master Cylinder Cover (Rear)	—
③	Diaphragm Plate	—
④	Rubber Diaphragm	—
⑤	Master Cylinder	—
⑥	Sight Glass	—
⑦	Piston Return Spring	—
⑧	Primary Cup	—
⑨	Piston	—
⑩	Secondary Seal	—
⑪	Pushrod	—
⑫	Washer	—
⑬	Collar	—
⑭	Pushrod Nut	—
⑮	Clevis	—
⑯	Snap Ring	—
⑰	Boot	—



**FRONT BRAKE CALIPER**



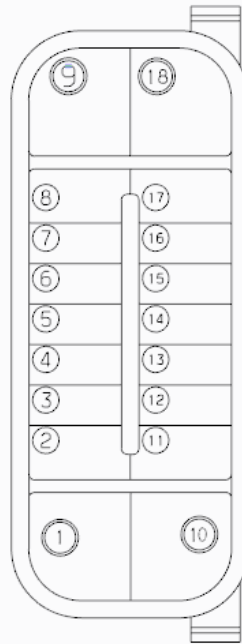
REF	DESCRIPTION	TORQUE
①	Caliper Body	—
②	Brake Pads	—
③	Pad Spring	—
④	Pin Clip	—
⑤	Brake Pad Retaining Pin	<b>53 in-lbs (6 N·m)</b>

**REAR BRAKE CALIPER**

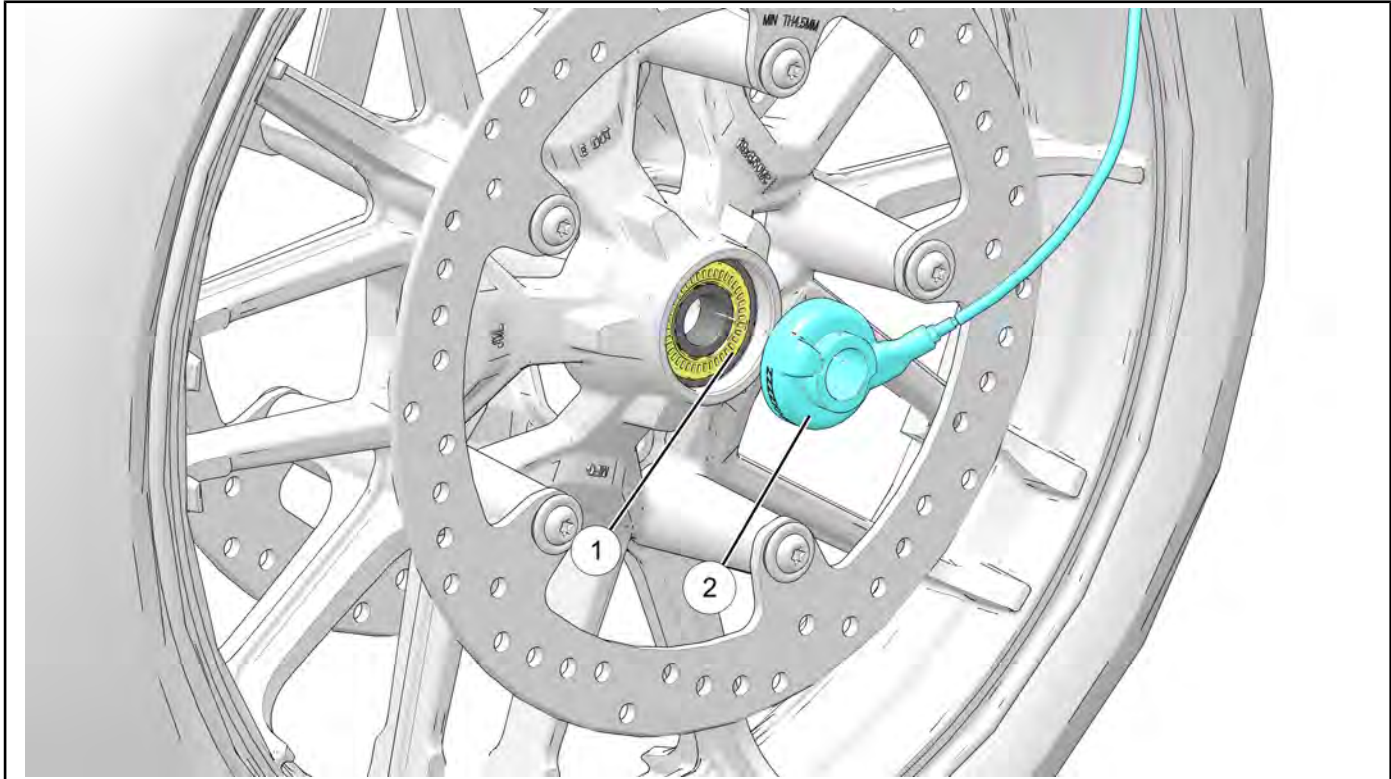
REF	DESCRIPTION	TORQUE
①	Caliper Retainer Fastener	<b>20 ft-lbs (27 N·m)</b>
②	Brake Pad Retaining Pin (Rear)	<b>53 in-lbs (6 N·m)</b>
③	Caliper Body	—
④	Guide Pin	<b>106 in-lbs (13 N·m)</b>
⑤	Piston Seal	—
⑥	Dust Seal	—
⑦	Piston	—
⑧	Brake Pad, Outboard	—
⑨	Pad Spring	—
⑩	Brake Pad, Inboard	—
⑪	Carrier, Caliper	—

## BRAKES

### ABS MODULE



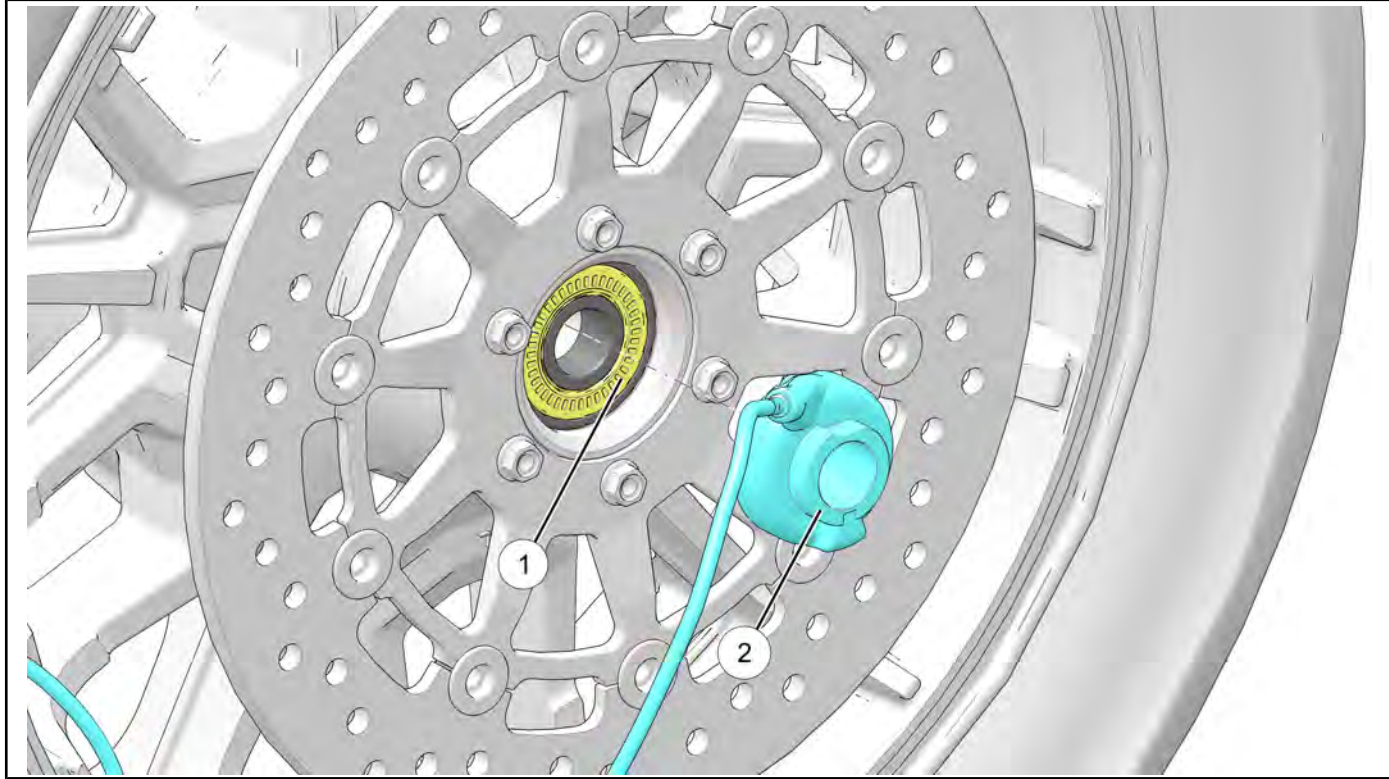
<b>PIN</b>	<b>DESCRIPTION</b>	<b>PIN</b>	<b>DESCRIPTION</b>
1	Ground for ECU	10	Ground for Motor
2	CAN High	11	CAN Low
3	Front Wheel Speed Sensor Signal	12	Front Wheel Speed Sensor Voltage
4	Ignition	13	Rear Wheel Speed Sensor Voltage
5	Diagnostic	14	Rear Wheel Speed Sensor Signal
6	Brake Light Switch	15	ABS Off Switch
7	Diagnostic	16	Rear Wheel Speed Sensor Output
8	Front Wheel Speed Sensor Output	17	ABS Warning Lamp
9	Voltage Supply ECU	18	Voltage Supply Motor

**WHEEL SPEED SENSOR, FRONT**

<b>REF</b>	<b>DESCRIPTION</b>
①	Wheel Bearing / Tone Ring Assembly
②	Wheel Speed Sensor

## BRAKES

### WHEEL SPEED SENSOR, REAR



REF	DESCRIPTION
①	Wheel Bearing / Tone Ring Assembly
②	Wheel Speed Sensor

## ANTI-LOCK BRAKES SYSTEM (ABS) SERVICE

### ABS SYSTEM SAFETY PRECAUTIONS

Before working on an Indian Motorcycle equipped with anti-lock brakes, review and understand all general brake system, brake fluid, and ABS specific precautions and system information. Do not attempt maintenance or repair of the anti-lock brake system without the proper tools.

#### WARNING

Proper brake system bleeding is extremely important to ensure adequate lever reserve in the system. Always perform the Brake Lever Reserve test described in this manual after bleeding the anti-lock brake system.

- Operating with non-recommended tires or improper tire pressure may reduce the effectiveness of the anti-lock brake system.
- Always install the recommended size and type of tires specified for the vehicle.
- Always maintain the recommended tire pressure.
- Indian Motorcycle DOT 4 Brake Fluid is required. Change every 10,000 miles (16,000 km) or 2 years, whichever comes first.
- The anti-lock brake system will not prevent wheel lock-up, loss of traction, or loss of control *under all conditions*. Always adhere to all safe motorcycle riding practices as recommended.
- It is not unusual to leave tire marks on the road surface during a hard braking event.
- The anti-lock braking system does not compensate for or reduce the risk associated with:
  - excessive speed
  - reduced traction on rough, uneven or loose surfaces
  - poor judgement
  - *improper operation*

### ABS GENERAL INFORMATION

The Anti-Lock Brake System is a safety feature designed to prevent wheel lock-up and improve control of the motorcycle during extreme braking events, including:

- Panic braking
- Slick surface braking (such as wet road surfaces)
- Surface transitions (from asphalt to oily asphalt or cobblestone, etc.)

Here are a few general points to note about ABS:

- The anti-lock brake system cannot be turned OFF.
- The ABS indicator lamp (located on the Instrument Cluster) always illuminates when the key is in the ON position and remains on until the anti-lock system activates, which occurs when vehicle speed exceeds 6 mph (10 kph).
- If the lamp is not illuminated when the key is ON, connect Digital Wrench and perform an ABS System inspection to determine the cause.
- When the ABS lamp is illuminated, the anti-lock brakes will not activate, but the conventional brake system will continue to operate normally.
- If the lamp continues to illuminate after the vehicle speed exceeds 6 mph (10 kph), the system is not functioning. Connect Digital Wrench and perform an ABS System inspection to determine the cause.
- When the anti-lock brakes engage during a braking event, the rider will feel pulsing at the brake lever or pedal. *Continue to apply steady pressure to the brakes for the best stopping performance.*
- The wheel speed sensor-to-pulse ring air gap is non-adjustable.
- The ABS system *can* be reprogrammed.
- The ABS light is controlled via CAN BUS.
- Wheel speed sensors provide feedback for both anti-lock brake operation and vehicle road speed.
- If fuse is open or removed, the ABS light will remain ON after 6 mph (10 kph). ABS will not be active. Normal (conventional) braking will be available provided the system components (master cylinder, lines, calipers, etc.) are in working order.

### ABS SYSTEM COMPONENTS

The following parts *function* in the same manner as the same component in a non-ABS system, although parts are not necessarily interchangeable. Always refer to the appropriate ABS parts information when replacing a component or component parts.

- Front Brake Calipers
- Rear Brake Caliper
- Front Master Cylinder
- Rear Master Cylinder
- Brake Light Switch
- Brake Lines

In addition to the brake system components listed above, the following are exclusive to ABS equipped vehicles:

- Wheel Speed Sensors ( between front and rear wheel axle bolted joints)
- Wheel Speed Sensor Pulse Rings (integrated into wheel bearings)
- ABS Module Assembly
- ABS Related Wiring
- ABS Indicator Lamp

### ABS OVERVIEW OF OPERATION

The ABS system is active and available when vehicle speed exceeds 6 mph (10 kph).

The system uses two independent Hall-Effect *Wheel Speed Sensors*. One sensor is contained within the front axle bolted joint and one sensor is contained within the rear axle bolted joint. Two *Pulse Rings* are also used, which are integrated into the front and rear wheel bearings. When the vehicle is in motion, the multiple reluctor segments on each pulse ring pass by the center pole of the respective wheel speed sensor, generating an electrical pulse signal in the sensor which is sent to the *ABS Module* which is located in front of the rear wheel.

The ABS Module interprets wheel speed signal pulses to determine speed, rate-of-change, and front / rear wheel speed differential to determine if wheel lock-up is about to occur. When wheel lock-up is imminent during a braking event, the ABS Module controls the operation of solenoids and a pressure pump (located inside the *ABS Module*) to regulate the amount of line pressure and cycles (length of time) applied to the caliper pistons and brake pads. This pressure / time modulation can often be felt at the brake lever or the brake pedal during an ABS braking event and is a normal condition. Note that the brake fluid is not diverted inside the module and does not “flow” in the system any more than occurs in a conventional (non-ABS) brake system.

If the surface coefficient changes (such as moving from wet pavement to dry pavement) the ABS system will recalculate (in a matter of milliseconds) and adjust pressure output to caliper(s) as required.

In the event of a system fault, the ECM turns on the ABS indicator lamp (via the CAN BUS) and leaves it on even after vehicle speed exceeds 6 mph (10 kph) activation speed.

If a system fault occurs, the light will remain on (and ABS will not be active) until the ignition key is turned to OFF position and back to ON.

The ABS Module Assembly is serviceable only as an assembly. The module itself is not rebuildable.

Disconnect negative (-) battery cable from battery before servicing ABS brake lines or system components.

## ABS TROUBLE CODES

Fault Name	SPN	FMI	C/U Code	TC Lamp on? (Yes / No)	Condition	Fault Setting	Service Action
ABS internal ECU Failure	520140	12	C2437	Yes	Bad Intelligent Device	ECU's Micro & Peripheral Integrated Circuits are determined to be failed	Replace Module
ABS Valve Relay	510131		C2420	Yes	Bad Intelligent Device	Valve Relay IC is determined to be Failed due to circuit level faults	Replace Module
ABS Solenoid (Front In)	520254	41	C1326	Yes	Condition Exists	Front Inlet Valve is determined to be Failed	Replace Module
ABS Solenoid (Front Out)	520255		C1327	Yes	Condition Exists	Front Outlet Valve is determined to be Failed	Replace Module
ABS Solenoid (Rear In)	520252		C1330	Yes	Condition Exists	Rear Inlet Valve is determined to be Failed	Replace Module
ABS Solenoid (Rear Out)	520253		C1332	Yes	Condition Exists	Rear Outlet Valve is determined to be Failed	Replace Module
ABS Controller Source Voltage	520262	0	C2422	Yes	Data Valid But Above Normal Operational Range – Most Severe Level	Battery Voltage of the ABS is greater than 16.5 v for more than 1 sec.	Check the Battery voltage
		1	C2421	Yes	Data Valid But Below Normal Operational Range – Most Severe Level	Battery Voltage of the ABS is less than 9.6V for more than 1 sec and the Vehicle Speed is greater than 6kph	Check the Battery voltage
		3	C1039	No	Voltage Above Normal (Moderate)	Battery Voltage of the ABS is greater than 16.5 v for more than 70ms.	Check for Battery voltage
		4	C1038	No	Voltage Below Normal (Moderate)	Battery Voltage of the ABS is less than 9.6V for more than 70ms and the Vehicle Speed is greater than 6kph	Check for Battery voltage
ABS Pressure Sensor Supply Out of Range	520132	31	C2423	Yes	Condition Exists	ABS Internal Pressure Sensor - Supply Voltage Faulty.	Replace the Module
ABS Internal Pressure Sensor	520133	12	C2424	Yes	Bad Intelligent Device	ABS Internal Pressure Sensor Failure	Replace the ABS Module
		2	C2439	Yes	Data Erratic, Intermittent, or Incorrect	Interference to the Pressure Sensor Signal, or pressure from the Pressure Sensor is outside of its calibrated range.	Key Cycle the vehicle 3 to 4 times and check to see if this fault is still active. If fault continues to appear, replace the module due to internal pressure sensor failure.
ABS Motor	520260	12	C101C	Yes	Bad Intelligent Device	Hardware Level Failures detected with ABS Pump Motor	Replace ABS Module
ABS Motor Supply Failure	520134	31	C2425	Yes	Condition Exists	Voltage is outside of Threshold Range - 40% of ABS Motor Pin	Check the Motor Supply Voltage, Verify no fuses have been blown.



## BRAKES

Fault Name	SPN	FMI	C/U Code	TC Lamp on? (Yes / No)	Condition	Fault Setting	Service Action
Front Wheel Speed Sensor	904	2	C1031	Yes	Data Erratic, Intermittent, or Incorrect	Failure is set if the Front Wheel Speed is detected to be in Standstill or detected to have Wheel Speed less than 5% compare to the Rear Wheel Speed Sensor for a period of 60sec	Check the Wss Sensor Tone Ring for any abnormalities (Damaged or Dirty or Worn Tone wheel), Check for the right mounting , Check for Bad Airgap and wheel vibrations
		3	C2426	Yes	Voltage Above Normal	Voltage on the Front Wheel Sensor Signal Line is above threshold	Check for the Front Wheel Speed Sensor Signal Line Voltage
		4	C2427	Yes	Voltage Below Normal	Voltage on the Front Wheel Sensor Supply /Signal Line is below threshold	Check for the Front Wheel Speed Sensor Supply/Signal Line Voltage
Rear Wheel Speed Sensor	907	2	C103D	Yes	Data Erratic, Intermittent, or Incorrect	Failure is set if the Rear Wheel Speed is detected to be in Standstill or detected to have Wheel Speed less than 5% compare to the Front Wheel Speed Sensor for a period of 60 sec	Check the Wss Sensor Tone Ring for any abnormalities (Damaged or Dirty or Worn Tone wheel), Check for the right mounting , Check for Bad Airgap and wheel vibrations
		3	C113D	Yes	Voltage Above Normal	Voltage on the Rear Wheel Sensor Signal Line is above threshold	Check for the Rear Wheel Speed Sensor Signal Line Voltage
		4	C123D	Yes	Voltage Below Normal	Voltage on the Rear Wheel Sensor Supply/ Signal Line is below threshold	Check for the Rear Wheel Speed Sensor Supply/Signal Line Voltage
Undetermined Wheel Speed Sensor Error	520135	31	C2430	Yes	Condition Exists	Occurs when not able to determine the specific wheel speed sensor failure, Very Rare Failure.	Check the Wss Sensor and Tone Wheel Alignment /Airgap.
CAN1 Bus Hardware	65559	31	C1130	Yes	Condition Exists	CAN Controller Failure, Micro determines that the CAN Transceiver is Bad	Replace the ABS Module if multiple key cycles does not recover module.
CAN1 Bus Wiring	520141	31	C2438	Yes	Condition Exists	CAN HI and CAN LO are shorted together somewhere along the way as an input to the ABS	Check the CAN wiring going into the module

Fault Name	SPN	FMI	C/U Code	TC Lamp on? (Yes / No)	Condition	Fault Setting	Service Action
Inertial Measurement Unit	520136	7	C2431	No	Mechanical System Failure or Out of Adjustment	Wrong orientation of the sensor box per what was specified	Verify IMU Installation and Connections for abnormalities.
		2	C2432	No	Data Erratic or Incorrect or Intermittent	Signal Data for each of the 6 data items from the IMU module is not within there specific cal params.	Verify IMU Installation and Connections for abnormalities.
		9	U0132	No	Abnormal Update Rate	CAN Frames sent from IMU are not being sent at correct timing (Failure is confirmed/ set if the Messages are not received consistency for 10 cycles - 100ms.The debounce level is increased once if the message is timedout and decreased if the message is received again.The Failure is confirmed if the Debounce Level reaches 10). Could also signify a problem with IMU wiring as it wouldn't be able to transmit at that point.	Verify IMU Installation and Connections for abnormalities.
		22	U0133	No	Counter Fault	Rolling Count is not as expected for a certain number of counts. (Failure is confirmed/ set if the Alive Counter is missed consistently for 10cycles -100ms. The debounce level is increased once if the message Counter is incorrect and decreased if the message Counter is received again.The Failure is confirmed if the Debounce Level reaches 10)	Verify IMU Installation and Connections for abnormalities.
		23	U0134	No	Checksum Fault	Incorrect Checksum Calculation.(Failure is confirmed/set if the calculated checksum is wrong consistently for 10cycles -100ms.The debounce level is increased once if the AliveCounter is incorrect and decreased if the Alive Counter is received correct again.The Failure is confirmed if the Debounce Level reaches 10)	Verify IMU Installation and Connections for abnormalities.



## BRAKES

Fault Name	SPN	FMI	C/U Code	TC Lamp on? (Yes / No)	Condition	Fault Setting	Service Action
TC Manually Disabled	520138	31	C2434	No	Condition Exists	ABS Controller successfully enters TC Off Mode State.	No Service Action required
ABS Module (Un-Filled Component)	520265	7	C1042	Yes Flashing	Mechanical System Failure or Out of Adjustment	This fault will be active If the ABS module has not undergone a successful Evac/Fill procedure.	This will not be present on service modules, this procedure will be done by Bosch MFG since service modules are already filled.
pDrive Mode Commanded (PGN:65389)	524077	2	C2435	No	Data Invalid or Intermittent or Incorrect	Data received from the ECM is something other than 1/2/3/4 ASCII for Apollo Specifically	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked
		9	U0135	No	Abnormal Update Rate	PGN 65389 is not being received in correct time intervals. (Failure is confirmed/ set if the Messages are not received consistently for 10 cycles - 1000ms, The debounce level is increased once if the message is timedout and decreased if the message is received again. The Failure is confirmed if the Debounce Level reaches 10).	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked

<b>Fault Name</b>	<b>SPN</b>	<b>FMI</b>	<b>C/U Code</b>	<b>TC Lamp on? (Yes / No)</b>	<b>Condition</b>	<b>Fault Setting</b>	<b>Service Action</b>
pTSCF1 (PGN:65313)	520139	9	U1036	No	Abnormal Update Rate	PGN 65313 is not received by the ABS for a certain period of time.(Failure is confirmed/set if the Messages are not received consistently for 10 cycles - 100ms. The debounce level is increased once if the message is timedout and decreased if the message is received again.The Failure is confirmed if the Debounce Level reaches 10).	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked
		22	U0137	No	Counter Fault	Rolling Count is not as expected for a certain number of counts. (Failure is confirmed /set if the received Alive Counter is incorrect consistently for 10 cycles - 100ms. The debounce level is increased once if the message Counter is incorrect and decreased if the message Counter is received again.The Failure is confirmed if the Debounce Level reaches 10)	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked
		23	U0138	No	Checksum Fault	Incorrect Checksum Calculation for certain number of counts. (Failure is confirmed /set if the received Checksum is incorrect consistently for 10 cycles - 100ms.The debounce level is increased once if the AliveCounter is incorrect and decreased if the Alive Counter is received correct again.The Failure is confirmed if the Debounce Level reaches 10)	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked

## BRAKES

Fault Name	SPN	FMI	C/U Code	TC Lamp on? (Yes / No)	Condition	Fault Setting	Service Action
PGN 65314 Timing	516118	9	U1109	No	Abnormal Update Rate	Message is not received 10 times in a row. (Failure is confirmed/set if the Messages are not received continuously for 10 cycles - 100ms. The debounce level is increased once if the message is timedout and decreased if the message is received again. The Failure is confirmed if the Debounce Level reaches 10).	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked
PGN 61445 Timing Gear Position	516121	9	U1111	No	Abnormal Update Rate	Discrete Gear Postion PGN is not being received 10 times in a row. (Failure is confirmed/set if the Messages are not received continuously for 10 cycles - 1000ms. The debounce level is increased once if the message is timedout and decreased if the message is received again. The Failure is confirmed if the Debounce Level reaches 10).	Communication Error has occurred wiring and connections for both ECM and ABS need to be checked
PGN 61441 Missing EBC1-Lamp Info	516136	31	U1112	No	Condition Exists	PGN 61441 is not received 10 times in a row. (Failure is confirmed/set if the Messages are not received continuously for 10 cycles - 1000ms. The debounce level is increased once if the message is timedout and decreased if the message is received again. The Failure is confirmed if the Debounce Level reaches 10).	Communication Error has occurred wiring and connections for both Gauge and ABS need to be checked
PGN 65265 Missing CCVS - Clutch Status	516120	9	U1106	No	Abnormal Update Rate	Timeout, Unexpected Timing of CCVS PGN, (Not received 10 times in a row) - (Failure is confirmed/set if the Messages are not received continuously for 10 cycles - 1000ms. The debounce level is increased once if the message is timedout and decreased if the message is received again. The Failure is confirmed if the Debounce Level reaches 10).	Communication Error has occurred wiring and connections for both Hand Controls and ABS need to be checked
Variant Invalid	520319	31	C1082	Yes	Condition Exists	Variant 0 Installed on Bike prior to Mfg or Servcie. OR variant other than 0 1 2 was installed.	Follow Variant Write Procedure within DW. Verify the ABS has the correct variant installed.
		14	C2436	Yes	Special Instructions	Data not read properly in EEPROM	Verify the ABS Variant Procedure was successful

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## **ABS AND LOW BATTERY VOLTAGE**

When attempting to start an engine on a bike with a weak battery (less than 12.5 volts KOEO) it is possible that the 'Check Engine' light will illuminate and trouble code P106B will be stored in the ECM.

The P106B code indicates the engine is not getting a speed signal from the ABS module. This code DOES NOT indicate the presence of a single faulty wheel speed sensor.

### **Possible Causes:**

- Low battery voltage - particularly while engine is cranking
- CAN bus communication error between the ABS module and the ECM
- Both front and rear wheel speed sensors are faulty
- Faulty connection at ABS module
- ABS module not programmed (partial ECUID present in Digital Wrench)

When diagnosing this code, make sure the battery is fully charged and passes a load test prior to clearing and retesting.

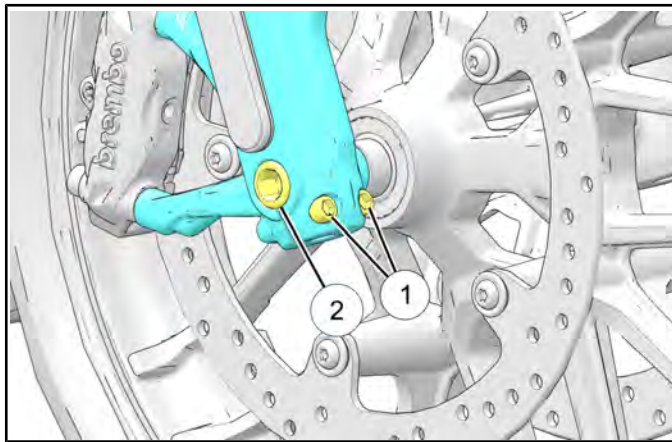
## WHEEL SPEED SENSOR REPLACEMENT

### REMOVAL – FRONT

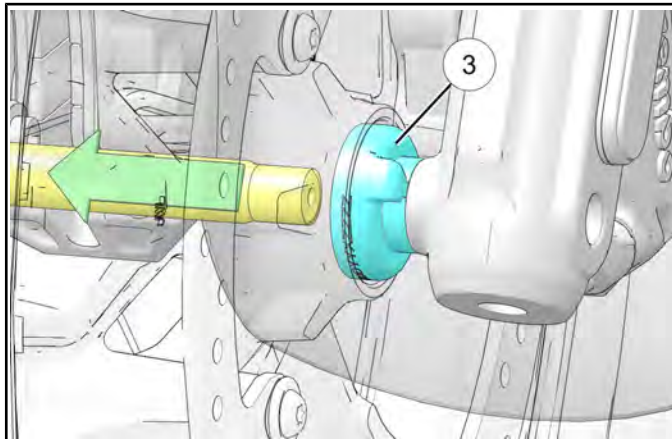
**⚠ WARNING**

This procedure requires raising and supporting the motorcycle so that the front wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.

1. Lift the unit so the front wheel is off the ground.
2. Loosen the front axle pinch bolts ①.



3. Loosen the axle ② enough that the wheel speed sensor ③ is able to be removed.



4. Disconnect wheel speed electrical connector.

### INSTALLATION – FRONT

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Front Axle  
**52 ft-lbs (70 N·m)**

**TORQUE**

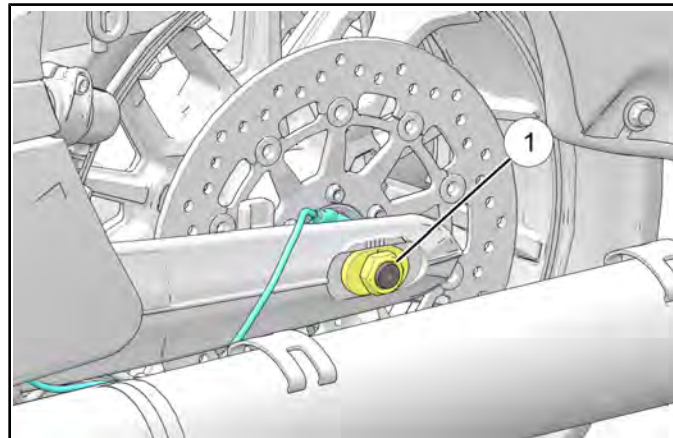
Front Axle Pinch Bolts  
**19 ft-lbs (26 N·m)**

### REMOVAL – REAR

**⚠ WARNING**

This procedure requires raising and supporting the motorcycle so that the rear wheel is off the ground. Precautions should be taken to ensure the motorcycle is properly stabilized at all times. Failure to properly support motorcycle may result in personal injury or damage to the motorcycle.

1. Secure motorcycle on lift and lift rear wheel off the ground.
2. Remove left hand saddlebag. Reference **Saddlebag Removal / Installation page**.
3. Remove rear axle nut ①.



4. Move axle back far enough to remove wheel speed sensor.
5. Disconnect wheel speed sensor electrical connector.

### INSTALLATION – REAR

**INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
--------

Axle Nut (Rear): <b>65 ft-lbs (84 N·m)</b>
---



**ABS MODULE REPLACEMENT**

**CAUTION**

Brake fluid and brake cleaners could damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Be sure master cylinder reservoir is level before removing cover.

**NOTICE**

Do not disassemble the ABS module. The ABS module is serviceable only as a sealed (pre-bled) assembly. If ABS module has failed internally, replace complete assembly.

**WARNING**

The hydraulic brake system **MUST** be completely bled following removal or replacement of the ABS module. Follow the brake bleeding procedure outlined in this chapter after ABS module service.

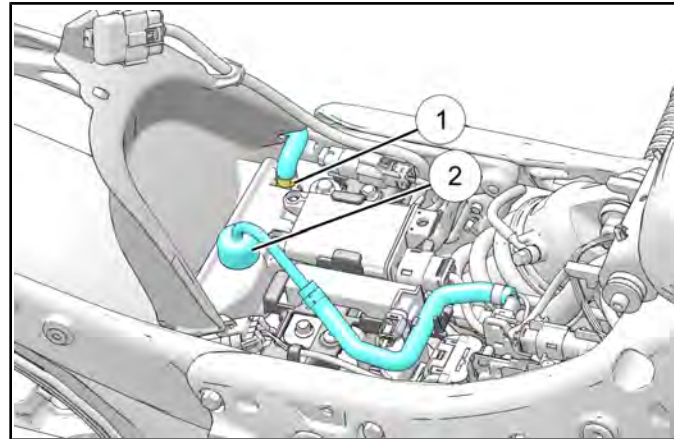
**IMPORTANT**

Due to the proximity of the ABS module fasteners, it is easier to remove by removing the module with the under-seat bracket.

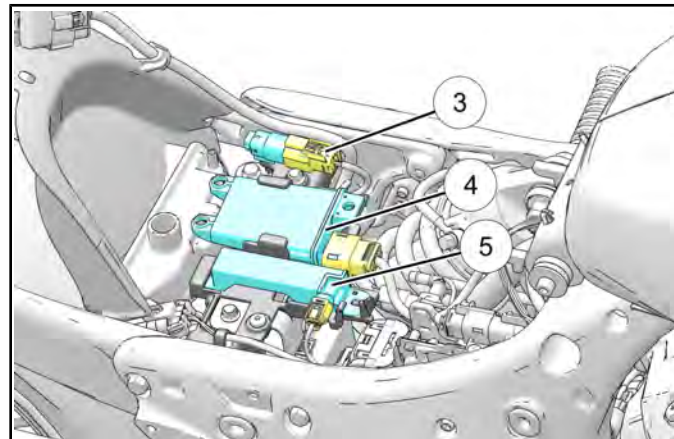
**REMOVAL**

1. Remove seat. See **Seat Removal / Installation page 7.32**.
2. Disconnect the negative battery cable.
3. Position motorcycle in an upright position with the front wheel clamped in a wheel vise.
4. Remove ECM. See **ECM Removal / Installation page 4.53**.

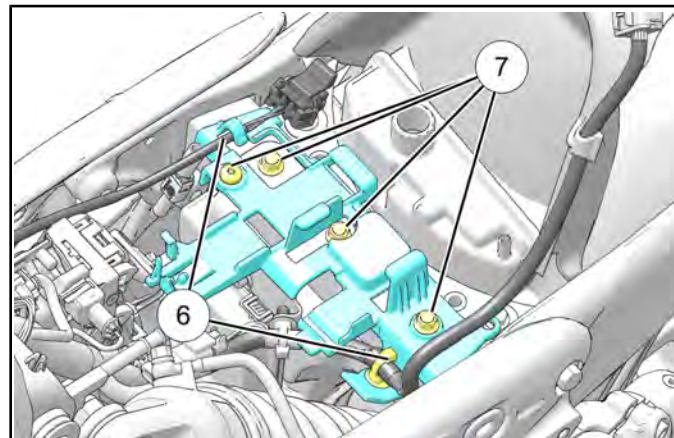
5. Remove coolant overflow line ① and coolant pickup line ② from recovery bottle..



6. Disconnect electrical connection ③.

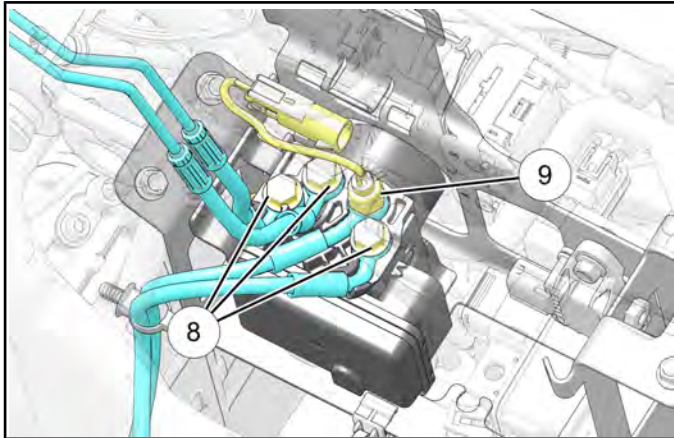


7. Disconnect WCM ④ electrical connector and remove.
8. Disconnect antenna module ⑤ electrical connector and remove.
9. Disconnecting the wiring retained ⑥ to under-seat wire bracket.



10. Remove under-seat wire bracket by removing its fasteners ⑦.

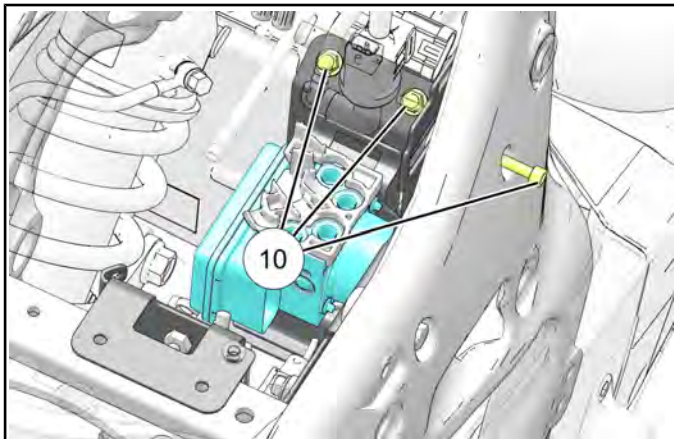
11. Remove the ABS module banjo fittings ⑧ and pressure sensor ⑨.



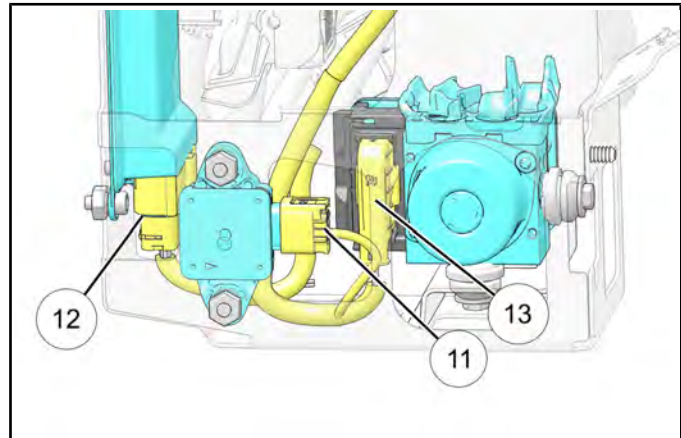
**⚠ CAUTION**

Failure to place brake lines in correct location on ABS module will result in adverse braking performance during an ABS event.

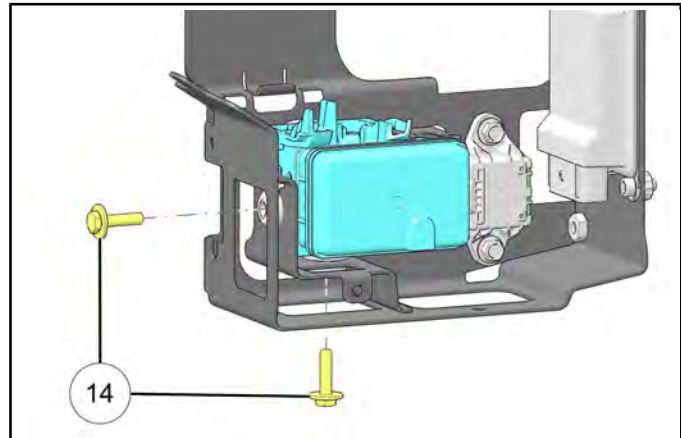
12. Remove fasteners ⑩ securing under-seat bracket.



13. While removing the under-seat bracket, disconnect the inertia sensor ⑪ and the VCM ⑫ and ABS module connector ⑬.



14. Remove the ABS module by removing its fasteners ⑭.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
ABS Mount Bracket Fastener (Allen): <b>84 in-lbs (10 N·m)</b>

TORQUE
ABS Mount Bracket Fastener (Hex): <b>84 in-lbs (10 N·m)</b>

TORQUE
ABS Module Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Under-Seat Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Banjo Bolt: <b>18 in-lbs (24 N·m)</b>

TORQUE
Under-Seat Wire Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

## ABS BRAKE SYSTEM BLEEDING BRAKE FLUID REPLACEMENT & BLEEDING PRECAUTIONS

### ⚠ WARNING

Contaminated brake discs or brake pads greatly reduce braking performance and increase stopping distance. Do not attempt to clean contaminated pads. Replace them. Clean the brake disc with brake cleaner.

### ⚠ WARNING

This brake system requires ethylene-glycol based fluid (DOT 4). Do not use or mix different types of fluid such as silicone-based or petroleum-based.

### ⚠ WARNING

Do not use brake fluid taken from old, used or unsealed containers. Never reuse brake fluid. Brake fluid can accumulate moisture, reducing its performance.

### ⚠ WARNING

Brake fluid is poisonous. Keep brake fluid tightly sealed and out of reach of children.

### ⚠ WARNING

A soft, spongy feeling in the brake lever and/or brake pedal could indicate a hazardous condition in the brake system. Do not operate the motorcycle until the failure in the brake system is corrected.

### ⚠ WARNING

An unsafe condition exists when air is trapped in the hydraulic brake system. Air in the brake hydraulic system acts like a soft spring and absorbs a large percentage of the pressure developed by the master cylinder. Without this pressure, the braking system cannot develop full braking force to allow for safe, controlled stops. It is extremely important to bleed the brakes properly after any brake system work has been performed or when inspection reveals spongy brakes.

**Keep these points in mind when bleeding hydraulic brakes:**

- The master cylinder reservoirs have limited capacities. It is easy to empty them during the bleeding procedure. This introduces air into the system which you are trying to purge. Watch the reservoir closely and add fluid when necessary to keep the level above the LOW mark and prevent air from re-entering the system.
- Apply only light to moderate pressure to the lever or pedal when bleeding the brake system. Extreme pressure or rapid movement will cause a surge of fluid through the small orifices of the brake system when the bleeder screw is opened and could introduce air into the system by means of cavitation.
- Small amounts of air can become trapped in the banjo fastener fittings at the master cylinder(s) and junction points of brake lines. These fittings can be purged of air by following a standard bleeding procedure at these fittings (instead of the bleed screw on caliper) if necessary to speed the bleeding process. This is usually only needed if system was completely drained of fluid. Bleed each line connection, starting with the fitting closest to the master cylinder, working toward the caliper, and ending with the bleed screw.
- Always torque banjo fasteners and other brake system fasteners and components to specified torque.
- Always install NEW genuine Indian Motorcycle replacement parts and rubber parts upon assembly. Apply special lubricant where indicated (included in service kits).

## ABS BRAKE VACUUM BLEEDER

A vacuum bleeder is recommended for ABS system bleeding and can also be used to bleed conventional (non-ABS) brake systems. One style of bleeder is shown below.



### ABS FLUID CHANGE

Review Brake Fluid Replacement and Bleeding Precautions before working with brake fluid.

**NOTICE**

When bleeding or flushing the system, monitor fluid level in master cylinder reservoir constantly. **DO NOT** allow fluid level to fall below the LOW level.

Use only DOT 4 brake fluid from a sealed container.

**NOTICE**

**EMPTY LINES** - If system is dry or very low on fluid due to parts replacement or disassembly, fill reservoir and pump lever or pedal slowly through stroke range until air bubbles no longer rise through the fluid into the reservoir.

**FLUSHING THE SYSTEM** - Brake systems should be flushed every 2 years or more often if the fluid is discolored. To flush the system, follow normal brake bleeding process, and pump fluid through the system until fluid moving through the bleeder hose is clear. Do not allow reservoir level to fall below the LOW level or complete system bleeding will be required.

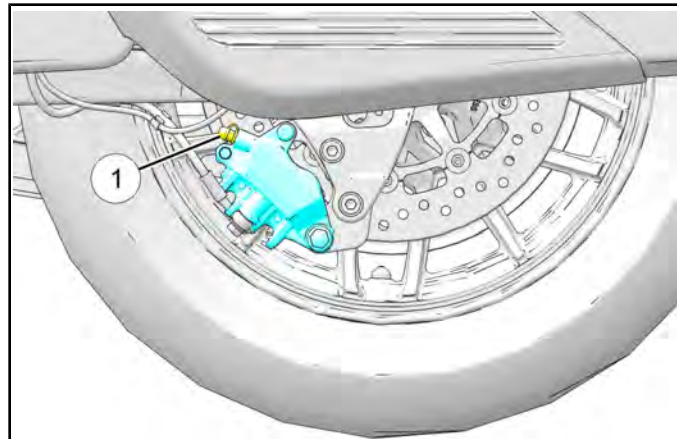
### ABS REAR BRAKE BLEEDING

**NOTICE**

The use of a vacuum bleeder is recommended. **DO NOT** allow fluid level in reservoir to drop below the LOW mark at any time during the bleeding procedure.

Repeat entire bleed procedure at least once.

1. Remove rubber cap from rear caliper bleed screw ① and place a box end wrench on the screw.
2. Attach a tight-fitting clear hose from the vacuum bleeder to the bleed screw and apply vacuum.



3. Fill rear brake fluid reservoir and leave cover off so fluid can be added as it is drawn through the system.
4. Open bleed screw about 1/4 turn.
5. Pump brake pedal repeatedly with smooth full strokes while adding brake fluid to the reservoir as required. For best results pump the pedal at a fairly rapid rate but avoid pumping too fast or fluid may become aerated. After about 2 cups of fluid have been run through the system, the bleeder hose should have clear, bubble-free fluid running through it.
6. Close bleeder screw and fill the brake fluid reservoir.
7. Repeat the entire bleeding process to be sure all air is purged from the system.
8. Torque all bleed screws to specification and install the rubber caps.

**TORQUE**

Caliper Bleeder Screws:  
**53 in-lbs (6 N·m)**

9. After completing the bleeding procedure a second time, inspect brake fluid level and add if necessary.

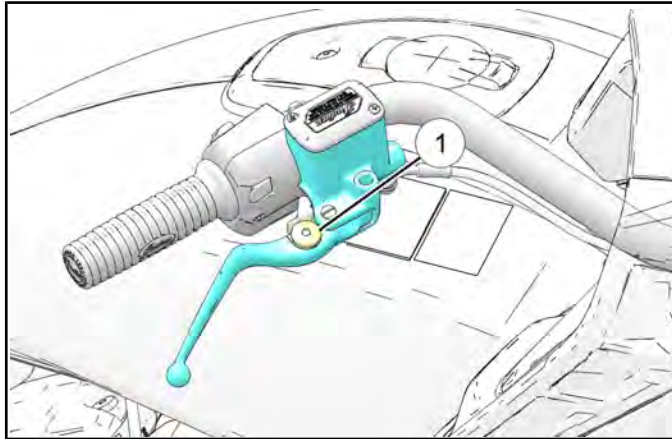
10. Clean the reservoir cover, diaphragm plate, diaphragm, and reservoir sealing surface. If diaphragm is extended, return it to normal (flat) position. Install diaphragm, diaphragm plate, and cover.
11. If pedal is not firm, repeat bleeding procedure and inspect brake system.

## ABS FRONT BRAKE BLEEDING

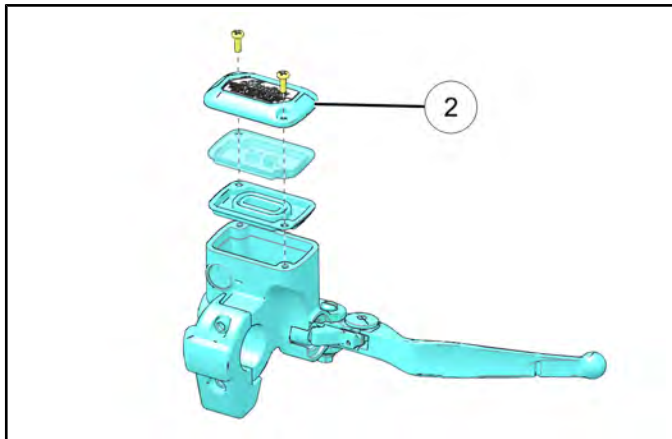
**NOTICE**

Bleed left front caliper first then right caliper. Repeat the bleeding procedure at least once.

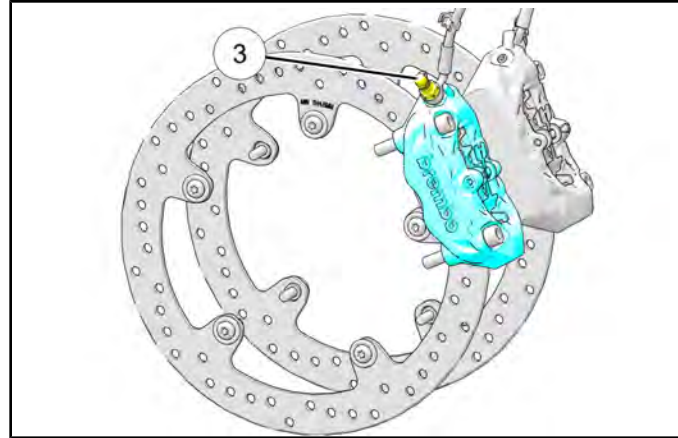
1. Pull brake lever forward and rotate reach adjustment dial ① to the longest reach setting to maximize lever stroke for bleeding.



2. Remove front brake fluid reservoir cover ② and leave it off so fluid can be added as it is drawn through the system.



3. Remove rubber cap from bleeder screw ③ on front left caliper and place a box end wrench on the screw.



4. Attach tight fitting clear hose from vacuum bleeder to bleed screw and apply vacuum.
5. Hold lever to handlebar or hold firm pressure on lever, then open bleed screw about 1/4 turn.
6. Pump brake lever repeatedly with smooth full strokes while adding brake fluid to the reservoir as required. For best results pump the lever at a fairly rapid rate but avoid pumping too fast or fluid may become aerated. After about 2 cups of fluid have been run through the system, the bleeder hose should have clear, bubble-free fluid running through it.
7. Close bleeder screw and fill the brake fluid reservoir.
8. Proceed to Step 9 to bleed the right front brake caliper.
9. Remove rubber cap from bleeder screw on front right caliper and place a box end wrench on the screw.
10. Connect vacuum bleeder hose to the bleed screw and start vacuum.
11. Hold lever to handlebar or hold firm pressure on lever, then open bleed screw about 1/4 turn.
12. Pump brake lever repeatedly with smooth full strokes while adding brake fluid to the reservoir as required. For best results pump the lever at a fairly rapid rate but avoid pumping too fast or fluid may become aerated. After about 2 cups of fluid have been run through the system, the bleeder hose should have clear, bubble-free fluid running through it.
13. Close bleed screw.
14. Once both front calipers have been bled, repeat procedure again on left caliper, then right to ensure all air has been purged.

15. Fill fluid reservoir and install diaphragm and cover.  
Torque cover fasteners to specification.

**TORQUE**

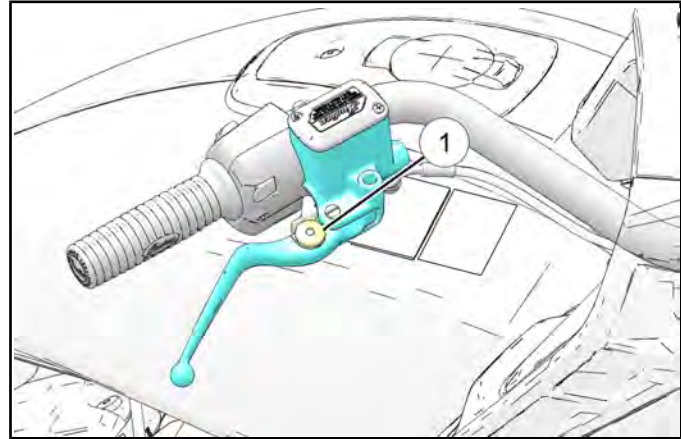
Front Master Cylinder Cover:  
**18 in-lbs (2 N·m)**

16. Perform Brake Lever Reserve Inspection. See **Brake Lever Reserve Inspection page 9.41.**

**BRAKE LEVER RESERVE INSPECTION**

This procedure requires use of the Brake Lever Reserve Tool (**PV-50104**).

1. Turn handlebars fully RIGHT.
2. Set front brake lever reach adjustment ① so it is closest to handlebar.



3. Place grommet of Brake Lever Reserve Inspection Tool **PV-50104** on ball end of front brake lever.
4. Connect a scale (commercially available) with a minimum of 25 kg / 50 lb capacity to end of tool.
5. Keep tool centered so it does not touch hand grip. Pull on scale to specified force.

**Brake Lever Reserve Force: 37 lbs (16.8 kg)**

6. Have an assistant verify brake lever *does not* contact hand grip. Clearance must exist at specified pull force as shown.
7. If lever makes contact with hand grip or bar end, bleed the front brake system.
8. See troubleshooting if bleeding problems persist.



## BRAKE SYSTEM SERVICE FRONT BRAKE PAD REPLACEMENT

### IMPORTANT

Always replace brake pads as a set and always replace pads in both front calipers at the same time.

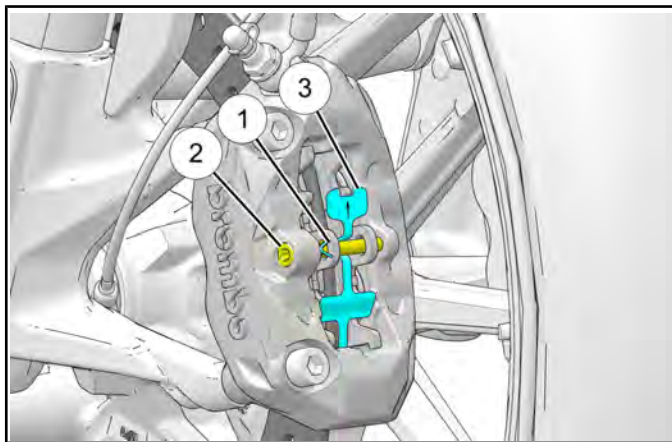
To watch a video of this procedure, scan the QR code or click **HERE**.



<https://vimeo.com/354240031/843e9a9251>

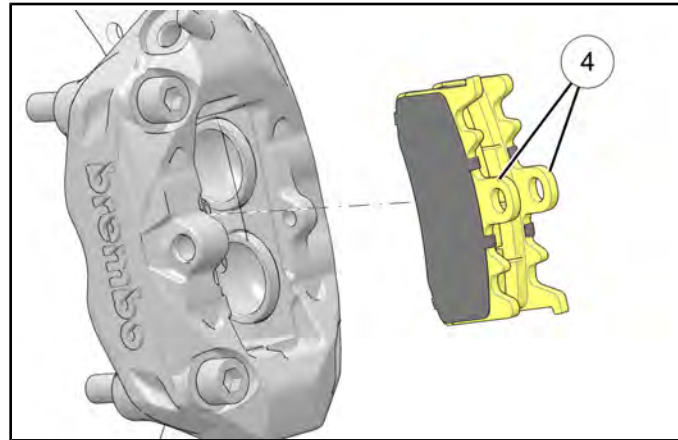
### REMOVAL

1. Remove pin clip ①.



2. Remove pad retaining pin ②.
3. Remove pad spring ③.

4. Remove brake pads ④.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Wipe brake disc clean with a shop towel sprayed with brake cleaner (commercially available).
3. Inspect caliper piston seals for any sign of fluid leakage.
4. Install isolator on new brake pads. Be sure isolator plate does not protrude from the brake backing plate.
5. Install new brake pads with friction material toward disc. Apply silicone grease to O-ring on pad retaining pin.

**TORQUE**

Brake Pad Retaining Pin (Front):  
**53 in-lbs (6 N·m)**

6. Inspect brake fluid in reservoir and set to proper level.
7. Slowly pump lever to set brake pads against disc. Lever should be firm, not spongy. If lever is spongy, inspect pad installation, bleed brake lines and inspect brake disc.
8. Operate brake lever several times until lever is firm and pressure can be felt.

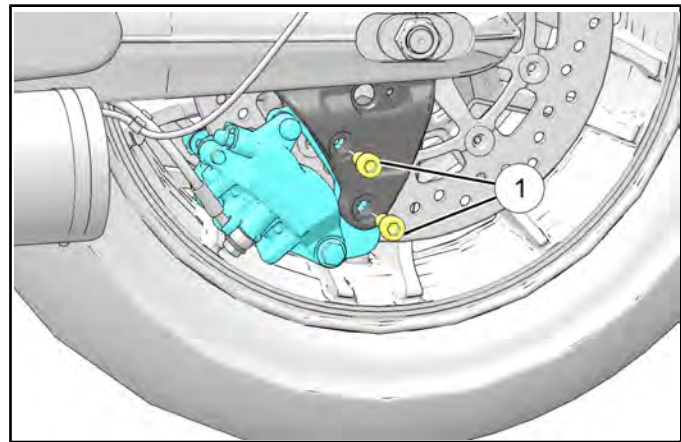
**⚠ WARNING**

After pad installation or any brake system repair, safely elevate wheel, apply and release brake pedal or lever 2-3 times and release. Verify wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect vehicle to determine cause and then repair as necessary.

**REAR BRAKE PAD REPLACEMENT****IMPORTANT**

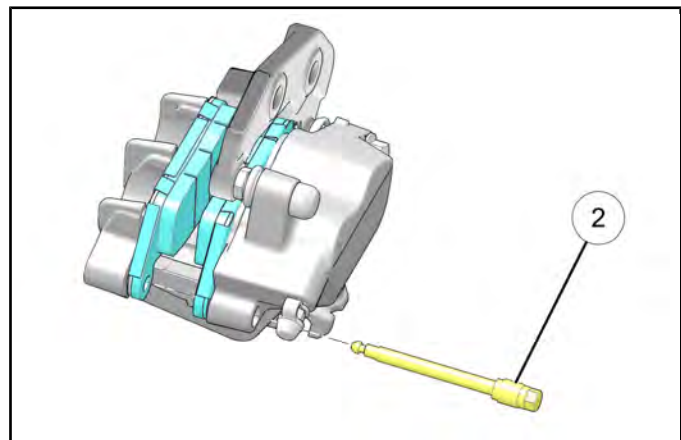
Always replace brake pads as a set.

1. Remove left saddlebag. Reference **Saddlebag Removal / Installation page 3.110**.
2. Remove muffler. See **Muffler Removal / Installation page 3.110**.
3. Push caliper toward wheel to push pad and pistons back and provide clearance for new pad installation.
4. Remove two fasteners retaining brake caliper and remove.

**IMPORTANT**

Do not twist the brake line or allow the brake caliper to hang on the brake line.

5. Remove pad retaining pin ②.



6. Slide inner pad out front edge of rear caliper. Install new pad. Be sure backing plate is properly installed on new pad with insulator between brake pad and plate. Slide pad into place and engage tab in the back of the caliper.

## BRAKES

7. Install new outer brake pad. Be sure tab is engaged with caliper as it is for the inner pad.

### IMPORTANT

Make sure the backing plate is properly installed on the new pad with the insulator between the brake pad and plate.

8. Apply silicone grease to O-ring on pad retaining pin.
9. Install pad retaining pin.

### TORQUE

Brake Pad Retaining Pin:  
**150 in-lbs (17 N·m)**

10. Install brake caliper and retain with fasteners.

### TORQUE

Brake Caliper Fastener:  
**31 ft-lbs (42 N·m)**

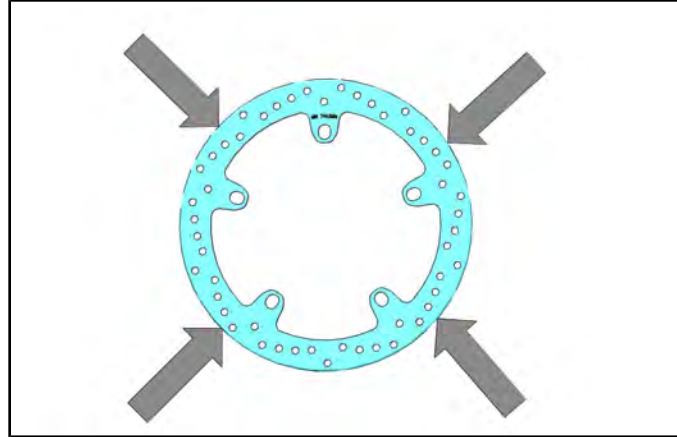
11. Inspect fluid level in the reservoir and adjust as necessary.
12. Pump brake pedal slowly several times to set new pads against disc, until lever is firm and pressure can be felt.
13. Bleed brake system if necessary.

### ⚠ WARNING

After pad installation or any brake system repair, safely elevate wheel, apply and release brake pedal or lever 2-3 times and release. Verify wheel turns freely without drag. If rear brake drag is evident, inspect pedal clearance. Do not operate the motorcycle if drag is still evident after clearance adjustment. Inspect vehicle to determine cause and repair as necessary.

## BRAKE DISC INSPECTION

1. Visually inspect disc for cracks or damage.
2. Measure brake disc thickness in several locations around disc with a micrometer, and along wear surface and compare to specifications. See **Service Specifications – Brakes page 9.3**.



### NOTICE

Replace the brake disc if any measurement is worn beyond the service limit.

3. With disc mounted to wheel, inspect for brake disc runout / warpage with a dial indicator and compare to specifications. See **Service Specifications – Brakes page 9.3**.

### NOTICE

Runout should be measured 2-4mm in from outside edge of disc.

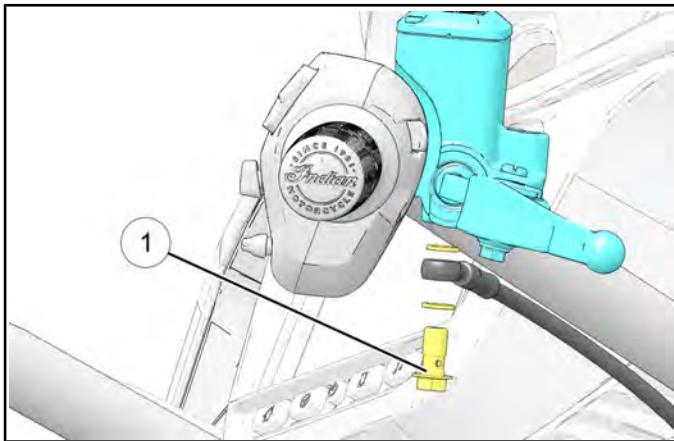
4. Replace brake disc if dial indicator reading displays excessive brake disc runout and other possible causes have been eliminated.

## FRONT MASTER CYLINDER SERVICE

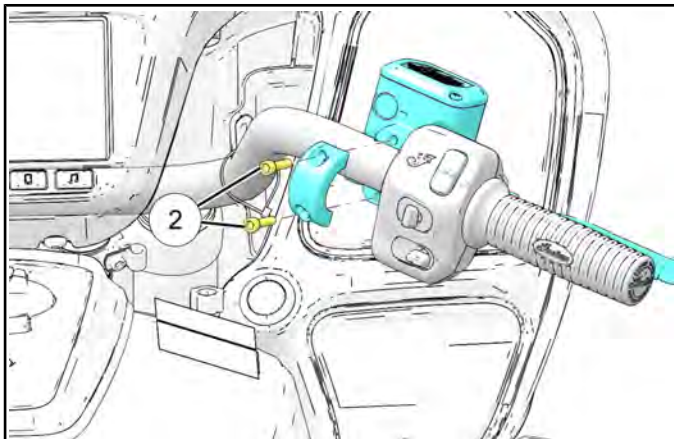
**CAUTION**

Brake fluid and brake cleaners could damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Be sure master cylinder reservoir is level before removing cover.

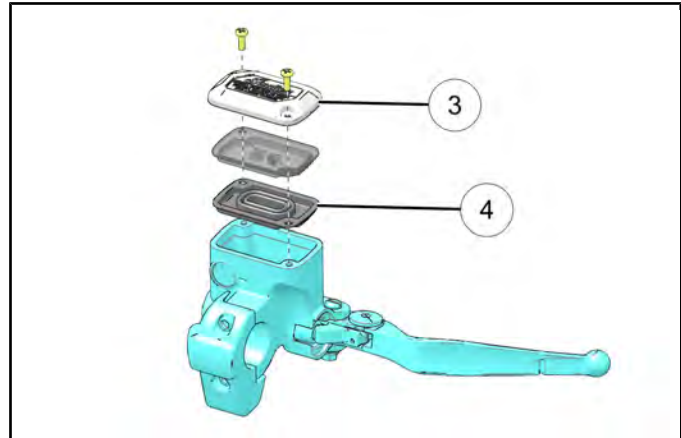
1. Clean the master cylinder. Attach a drain hose to caliper bleed screw and place the end in a suitable container. Drain brake fluid from the front brake system by slowly pumping brake lever.
2. Remove the right-hand side mirror from the lever perch.
3. Remove banjo fastener ① and brake line from master cylinder.



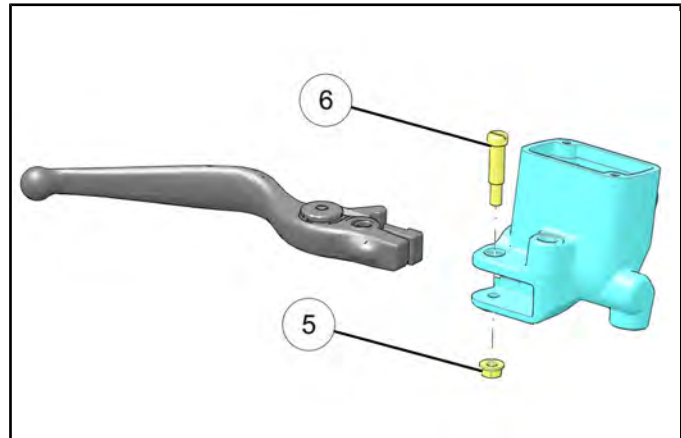
4. Remove fasteners ②, clamp, and master cylinder.



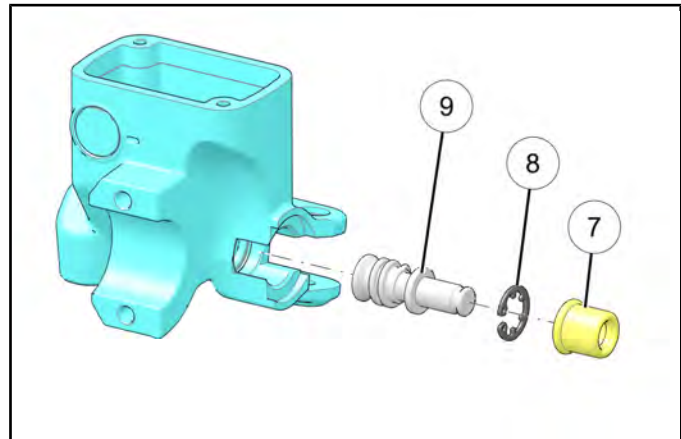
5. Remove reservoir cover ③, diaphragm plate, and diaphragm ④.



6. Remove the pivot pin nut ⑤ and fastener ⑥. Pull lever assembly out of master cylinder.

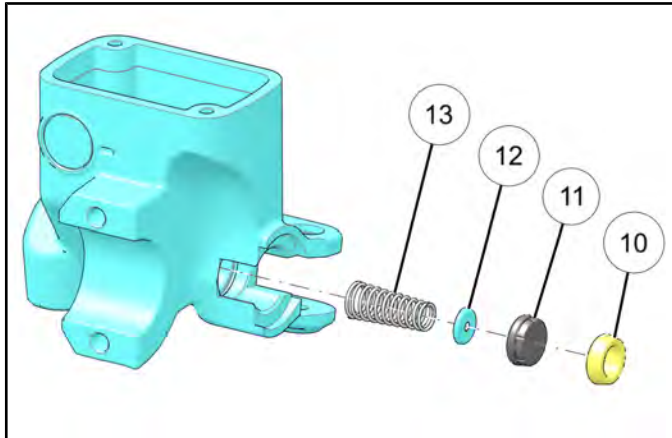


7. Remove dust boot ⑦, snap ring ⑧, and piston ⑨.



## BRAKES

- Remove secondary seal ⑩, primary seal ⑪, spring retainer ⑫, and spring ⑬.



- Clean master cylinder with isopropyl alcohol and dry with compressed air. DO NOT soak in alcohol for more than 30 seconds. DO NOT aim pressurized air directly at the level sight glass.
- Inspect cylinder bore and chamfer of bore for corrosion, scratches, scoring, or pitting. Replace master cylinder if any of these conditions are evident.
- Measure the diameter of the bore. Replace master cylinder if worn beyond the service limit.

Master Cylinder Bore Diameter Service Limit:  
**.6248 in (15.87 mm)**

- Measure the diameter of the master cylinder piston. Replace piston if worn beyond the Service Limit.

Master Cylinder Piston Diameter Service Limit:  
**.6248 in (15.87 mm)**

- Clean the compensating port and supply port with compressed air to be sure they are clean and unobstructed.
- Apply a light film of special lubricant from piston kit to each piston seal cup.
- Assemble the piston / spring assembly as shown. Large diameter of beveled edge on piston cups face toward spring. Install a new retaining ring on end of piston with machined edge (sharpest of the two edges).
- Carefully install spring / piston assembly into master cylinder bore. Work the front piston seal carefully past the chamfer and into bore. Use care not to damage or fold the seal when working it past the chamfer.

- Continue to install the piston until the rear seal is past the chamfer. Push and hold the piston in far enough to allow the retaining ring to be installed.
- Be sure retaining ring is fully seated in the groove.
- Clean the bore from the retaining ring outward, so the outer edge of the new dust boot adheres properly and will not dislodge from the bore.
- Install new boot, seating the outer edge fully in the bore and engage outer lip of boot in piston groove.
- Apply special lubricant from kit to brake lever contact surface.
- Install master cylinder on handlebar. Torque clamp fasteners to specification.

### IMPORTANT

Torque the **Master Cylinder Clamp** upper fastener first and the bottom fastener second.

### TORQUE

Master Cylinder Clamp Fasteners:  
**96 in-lbs (11 N·m)**

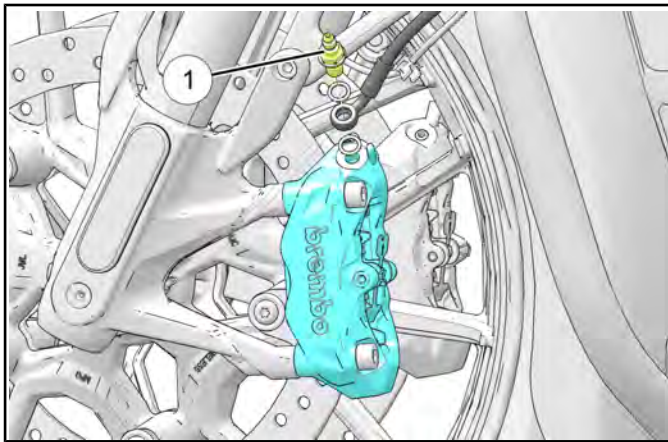
## FRONT CALIPER SERVICE

**CAUTION**

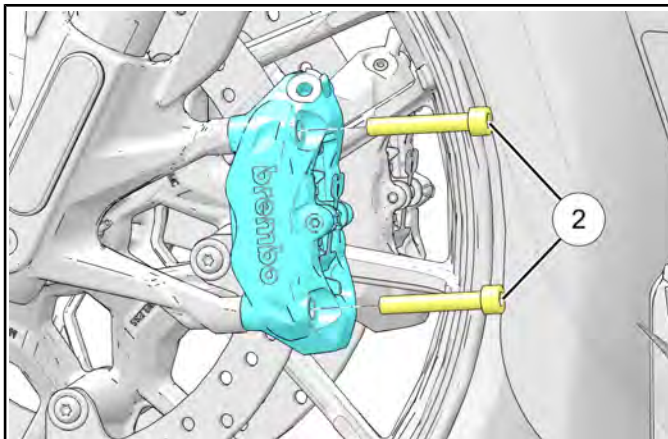
Brake fluid and brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level before removing the cap.

Replace all rubber parts upon assembly. Keep parts in order for assembly.

1. Remove banjo fastener ①, sealing washers, and brake hose from caliper assembly and allow it to drain into a container.

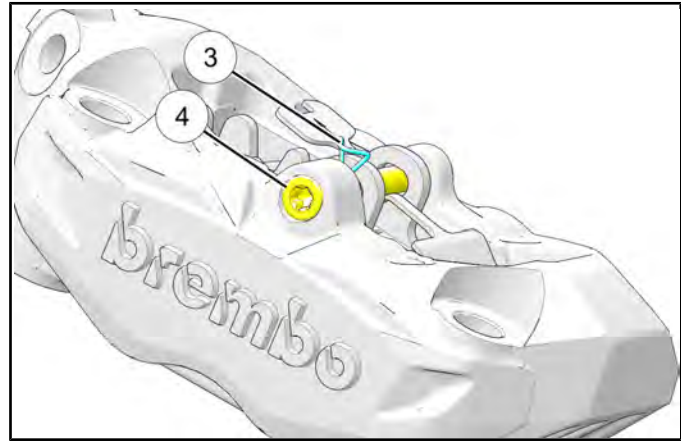


2. Remove front caliper mounting studs ② and remove the caliper.

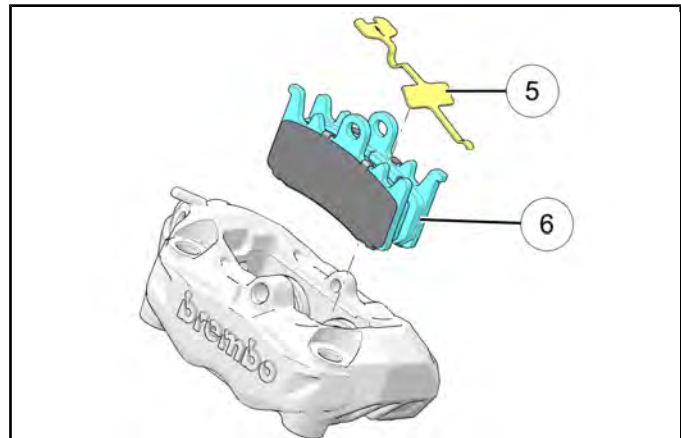


3. Cover the end of brake line(s) to prevent debris from entering.

4. Cover the brake hose connection on the caliper and clean the outer surfaces of caliper assembly with brake cleaner (commercially available) or isopropyl alcohol. Dry with compressed air.
5. Remove the pin clip ③ and pad retaining pin ④.



6. Remove brake pad spring ⑤ and brake pads ⑥.

**NOTICE**

**Pads contaminated with oil or grease must be replaced as a set.**

7. The brake caliper itself is a non-serviceable item. If wear or damage is found on the brake caliper, replace it.

**8. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Brake Pad Retaining Pin: <b>53 in-lbs (6 N·m)</b>

TORQUE
Brake Caliper Fastener (Front): <b>35 ft-lbs (47 N·m)</b>

TORQUE
Banjo Bolt: <b>18 in-lbs (24 N·m)</b>

**FRONT CALIPER INSTALLATION**

1. Clean mounting surfaces of caliper and fork leg.
2. Apply brake cleaner or isopropyl alcohol to a clean shop towel and wipe brake discs clean.
3. Separate brake pads and install caliper assembly over brake disc.
4. Install caliper mounting studs and torque to specification.

TORQUE
Brake Caliper Fastener (Front): <b>35 ft-lbs (47 N·m)</b>

5. Connect brake hose to caliper with banjo fastener and new sealing washers. Torque to specification.

TORQUE
Banjo Bolt: <b>18 in-lbs (24 N·m)</b>

6. Fill and bleed the front brake hydraulic system. See **ABS Front Brake Bleeding page 9.40.**

⚠ WARNING
After pad installation or any brake system repair, safely elevate the wheel, apply and release the brake pedal or lever 2-3 times and release. Verify the wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect the vehicle to determine the cause and then repair as necessary.

**REAR MASTER CYLINDER SERVICE**

**⚠ CAUTION**

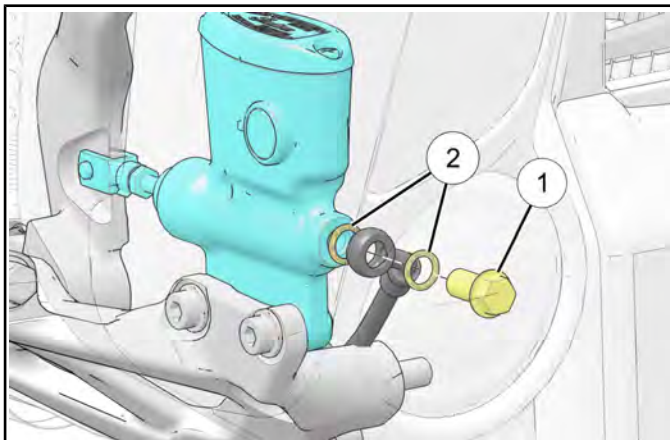
Brake fluid and brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level before removing the cap. Replace all rubber parts upon assembly.

**NOTICE**

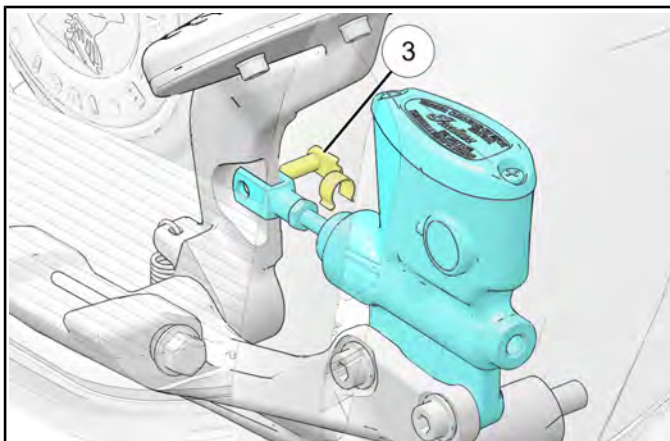
Replace all rubber parts upon assembly.

**REMOVAL / DISASSEMBLY**

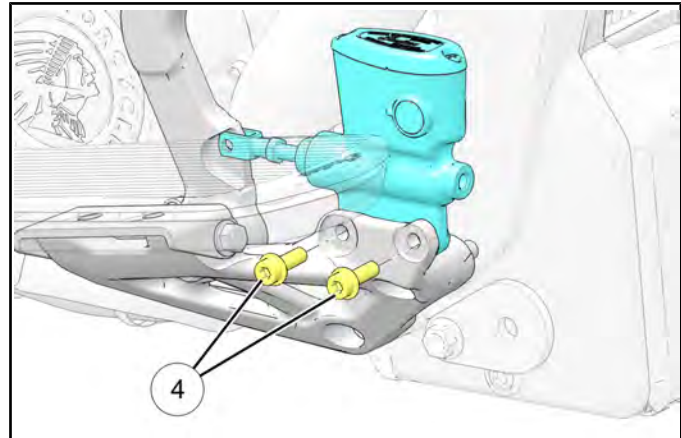
1. Remove brake line banjo fastener ①, sealing washers ②, and brake line. Allow fluid to drain into a container.



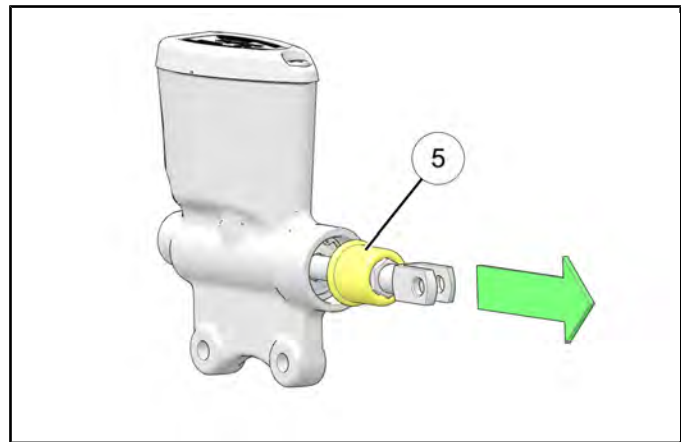
2. Remove clevis pin ③ securing brake pedal to master cylinder.



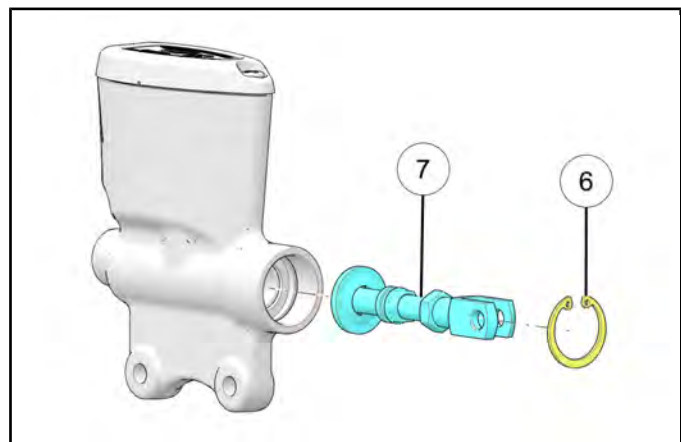
3. Remove fasteners ④ retaining rear master cylinder.



4. Move dust boot ⑤ from master cylinder.



5. Remove snap ring ⑥ and pushrod ⑦.

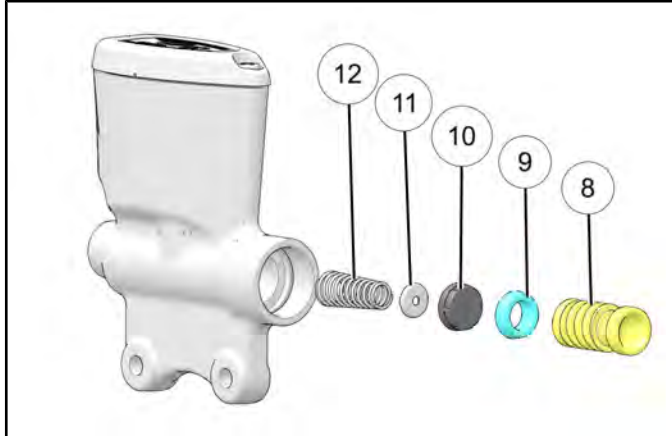


9



## BRAKES

6. Remove piston ⑧.



7. Remove secondary seal ⑨.
8. Remove primary seal ⑩.
9. Remove spring retainer ⑪ and spring ⑫.
10. Inspect cylinder bore and chamfer on the front of the bore for corrosion, scratches, scoring, or pitting. Replace master cylinder if any of these conditions are evident.
11. Measure the bore diameter. Replace if worn beyond the service limit. See **Service Specifications – Brakes page 9.3**.
12. Clean compensating port and supply port with compressed air to be sure they are clean and unobstructed.

### INSTALLATION / REASSEMBLY

1. Clean all parts with clean Indian Motorcycle DOT 4 brake fluid or isopropyl alcohol.
2. Replace ALL RUBBER PARTS with new.
3. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Brake Line Banjo Fastener:  
**18 in-lbs (24 N·m)**

#### TORQUE

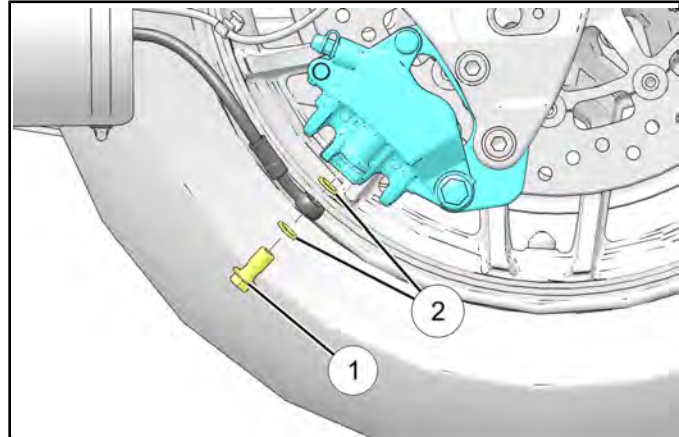
Master Cylinder Fastener (Rear):  
**18 ft-lbs (24 N·m)**

#### TORQUE

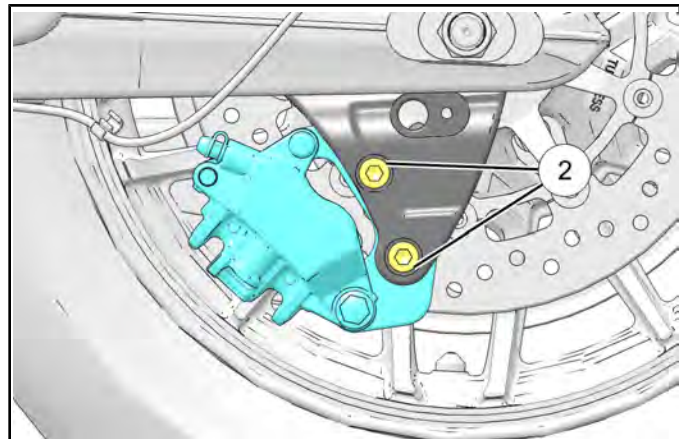
Master Cylinder Cover Fastener (Rear):  
**18 in-lbs (2 N·m)**

## REAR CALIPER SERVICE

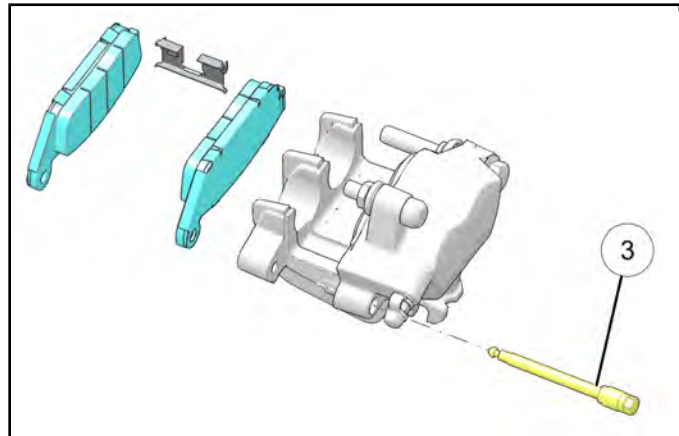
1. Remove left saddlebag. Reference **Saddlebag Removal / Installation page**
2. Remove muffler. See **Muffler Removal / Installation page 3.110**.
3. Remove banjo bolt ① and sealing washers ② and allow fluid to drain into a container.



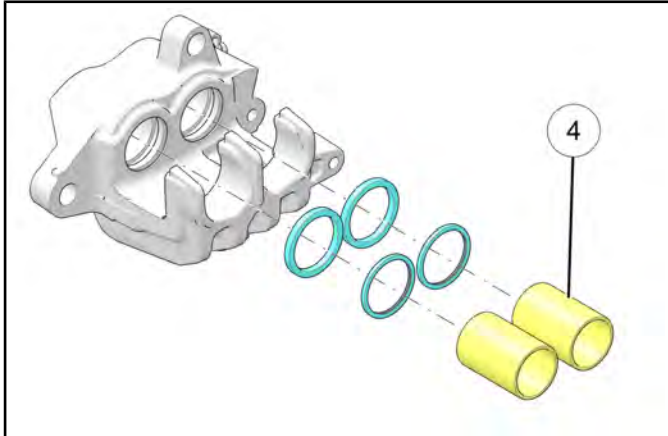
4. Remove caliper fasteners ② and lower caliper off of mounting bracket.



5. Remove brake pad retaining pin ③.



6. Slide caliper bracket off pins and remove spring plate.
7. Remove caliper pistons ④. Keep pistons in order for installation in their respective bores.



8. Remove dust seals and piston seals. Use care not to damage the seal bores.
9. Clean caliper thoroughly with isopropyl alcohol. Dry with compressed air. Clean seal grooves thoroughly. Any residue left behind in the grooves could cause caliper pistons to stick and result in brake drag.
10. Inspect each bore and surface of each piston for corrosion, scratches, scoring, or pitting. Replace caliper assembly if any of these conditions are evident.
11. Measure diameter of each bore and piston. Replace caliper assembly or parts if worn beyond service limit.

<p>Caliper Piston Bore Diameter Service Limit: <b>27.05 mm (1.0649 in)</b></p>
--

<p>Caliper Piston Diameter Service Limit: <b>26.35 mm (1.0604 in)</b></p>
---

12. Install all new rubber parts during assembly. Do not reuse old seals or boots. Apply special lubricant from service kit to new piston seals and dust seals.
13. Apply special assembly oil to outer surface of all pistons.
14. Install piston seals and dust seals in caliper body.
15. Install pistons in their respective bore.
16. Replace caliper pin boot on bracket and on caliper. Apply special lubricant from service kit to boots and both pins.

17. Assemble bracket to caliper. Remove excess lubricant.
18. Install spring plate and outer brake pad with insulator and backing plate. Start pad pin through outer pad.
19. Install inner pad with insulator and backing plate.
20. Torque brake pad retaining pin to specification.

TORQUE
--------

<p>Brake Pad Retaining Pin: <b>150 in-lbs (17 N·m)</b></p>
--

21. Be sure end tabs of pads are both fully engaged in the heel plate on bracket.
22. Install caliper to bracket and torque caliper fasteners to specification.

TORQUE
--------

<p>Caliper Fasteners: <b>31 ft-lbs (42 N·m)</b></p>
---

23. Install brake line with new sealing washers and torque banjo fastener to specification.

TORQUE
--------

<p>Banjo Bolt: <b>18 in-lbs (24 N·m)</b></p>
--

24. Bleed brake system. See **ABS Rear Brake Bleeding page 9.38.**

## REAR CALIPER INSTALLATION


1. Install caliper to rear mounting bracket and torque to specification.

TORQUE
Caliper Fasteners: <b>31 ft-lbs (42 N·m)</b>

2. Install brake hose, and banjo fastener with new sealing washers.

TORQUE
Banjo bolt: <b>18 in-lbs (24 N·m)</b>

3. Fill and bleed the rear hydraulic brake system. See **ABS Rear Brake Bleeding page 9.38.**

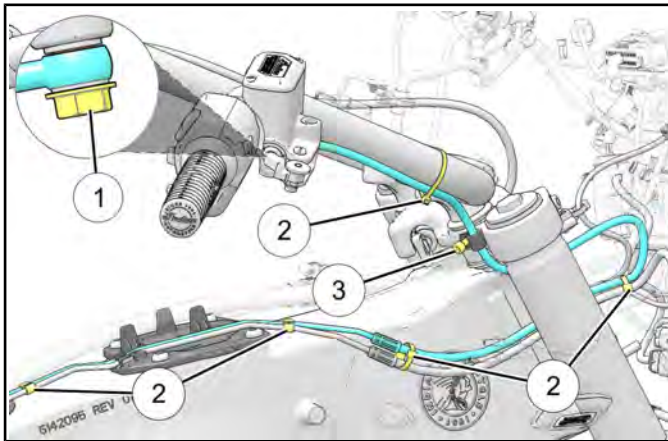
 WARNING
After pad installation or any brake system repair, safely elevate the wheel, apply and release the brake pedal or lever 2-3 times and release. Verify the wheel turns freely without drag. If brake drag is evident, do not operate the motorcycle. Inspect the vehicle to determine the cause and then repair as necessary.

**BRAKE LINE REPLACEMENT****CAUTION**

Brake fluid and brake cleaners will damage paint, plastics and some rubber compounds. Cover or remove plastic and painted parts before working on the brake system. If brake fluid is spilled on cosmetic surfaces, immediately rinse the area with a mild solution of soap and water until all traces of brake fluid are removed. Make sure the master cylinder reservoir being worked on is level before removing the cap.

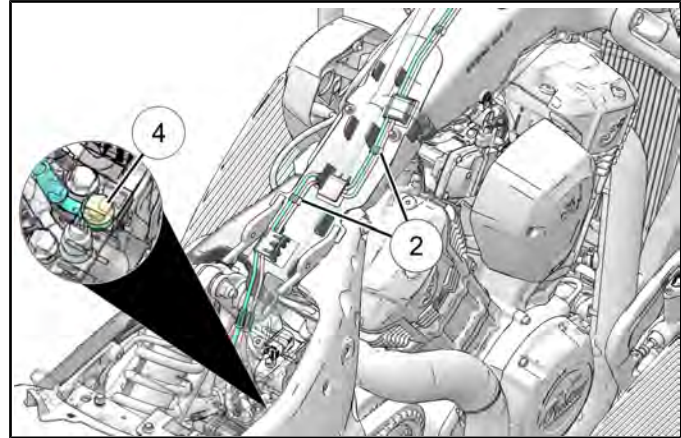
**FRONT (MASTER CYLINDER TO ABS MODULE)**

1. Perform steps 1-9 of **ABS Module Replacement** page 9.34.
2. Remove Fuel Tank. See **Fuel Tank Removal (2020)** page 4.23.
3. Remove Fairing. See **Fairing Removal / Installation** page 7.50.
4. Remove master cylinder banjo bolt ①. Have a drain pan ready to catch any brake fluid.



5. Disconnect brake line from its retention features ②.
6. Remove p-clamp fastener ③.

7. Remove remaining retention features ②.



8. Remove banjo bolt from ABS module ④.
9. Remove the brake line from the unit.
10. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

ABS Module Banjo Bolt:  
**18 in-lbs (24 N·m)**

**TORQUE**

P-Clamp Fastener:  
**84 in-lbs (10 N·m)**

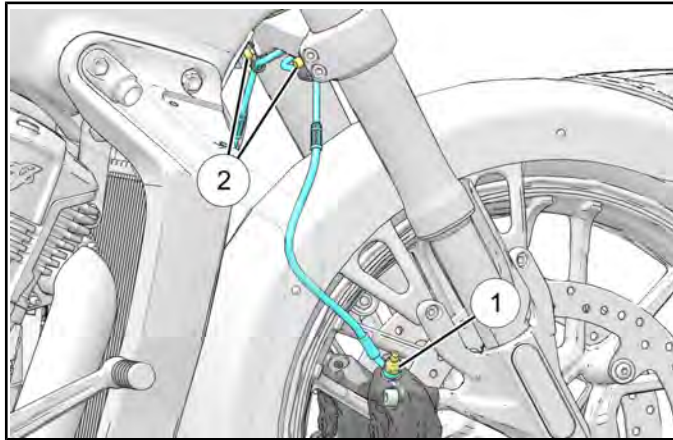
**TORQUE**

Master Cylinder Banjo Bolt:  
**18 in-lbs (24 N·m)**

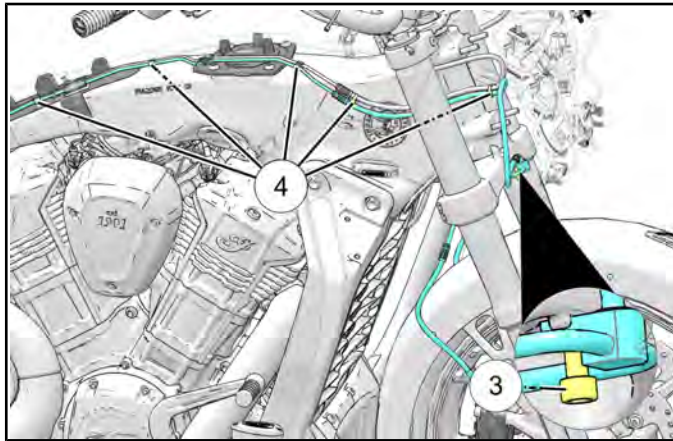
11. Reference **Brake Line Routing** page 9.11 for the proper routing.

**FRONT (ABS MODULE TO FRONT BRAKE CALIPER)**

1. Perform steps 1-9 of **ABS Module Replacement** page 9.34.
2. Remove Fuel Tank. See **Fuel Tank Removal (2020)** page 4.23.
3. Remove Fairing. See **Fairing Removal / Installation** page 7.50.
4. Remove brake caliper banjo bolt ①. Have a drain pan ready to catch any brake fluid.

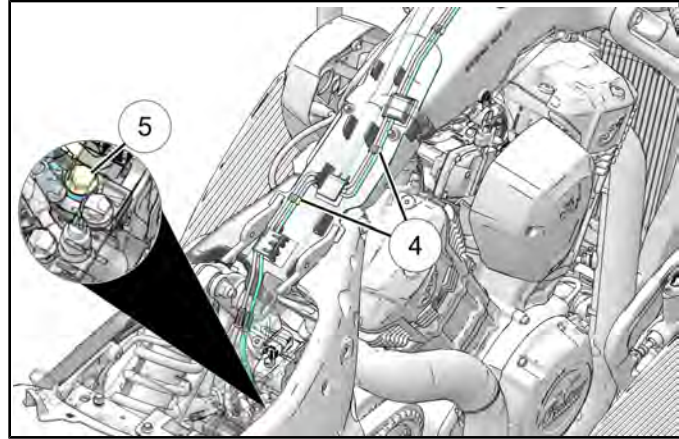


5. Remove p-clamp fasteners ②.
6. Remove junction block fastener ③.



7. Remove brake line from retention features ④.

8. Remove brake line from remaining retention features ④.



9. Remove banjo bolt from ABS module ⑤.
10. Remove the brake line from the unit.
11. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

ABS Module Banjo Bolt:  
**18 in-lbs (24 N·m)**

**TORQUE**

P-Clamp Fastener:  
**84 in-lbs (10 N·m)**

**TORQUE**

Front Brake Caliper Banjo Bolt:  
**18 in-lbs (24 N·m)**

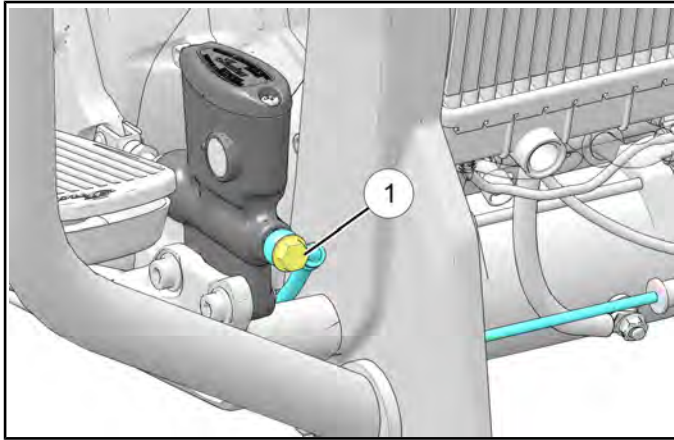
**TORQUE**

Front Junction Block Fastener:  
**84 in-lbs (10 N·m)**

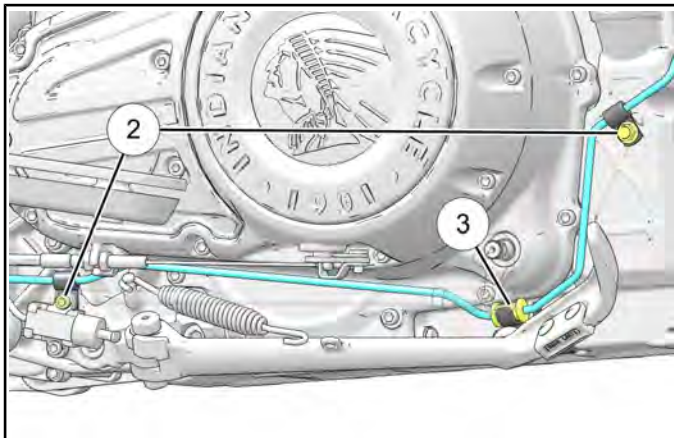
12. Reference **Brake Line Routing** page 9.11 for the proper routing.

**REAR (MASTER CYLINDER TO ABS MODULE)**

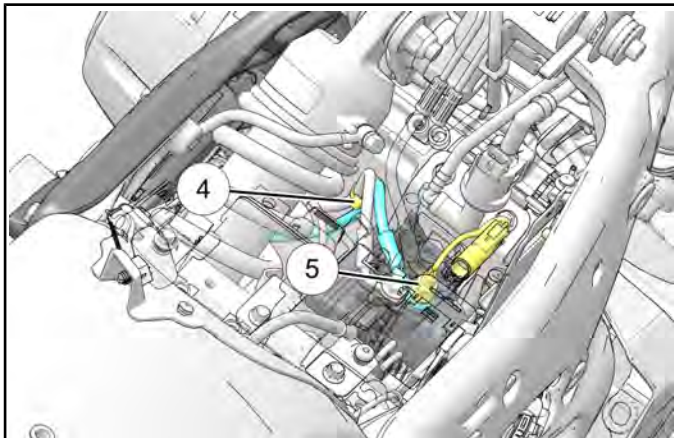
1. Remove battery box. See **Battery Box Removal / Installation** page 10.16.
2. Remove master cylinder banjo bolt ①. Have a drain pan ready to catch any brake fluid.



3. Remove p-clamp fasteners ②.



4. Disconnect brake line isolator ③.
5. Disconnect routing clip ④.



6. Disconnect brake pressure sensor electrical connector.

7. Remove brake pressure sensor ⑤.

8. Remove brake line from the unit.

9. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Brake Pressure Sensor:  
**18 in-lbs (24 N·m)**

**TORQUE**

P-Clamp Fastener:  
**84 in-lbs (10 N·m)**

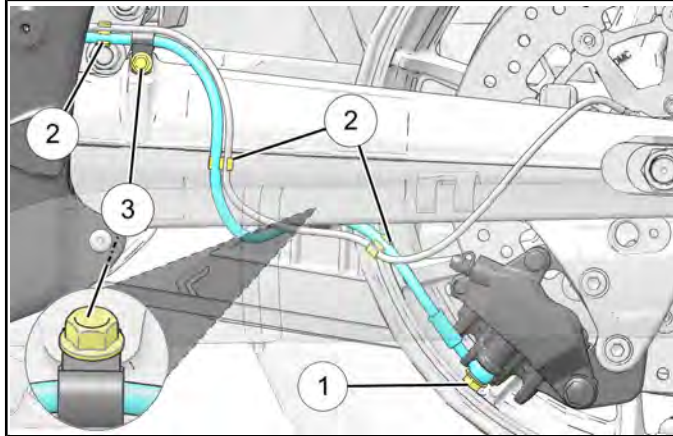
**TORQUE**

Master Cylinder Banjo Bolt:  
**18 in-lbs (24 N·m)**

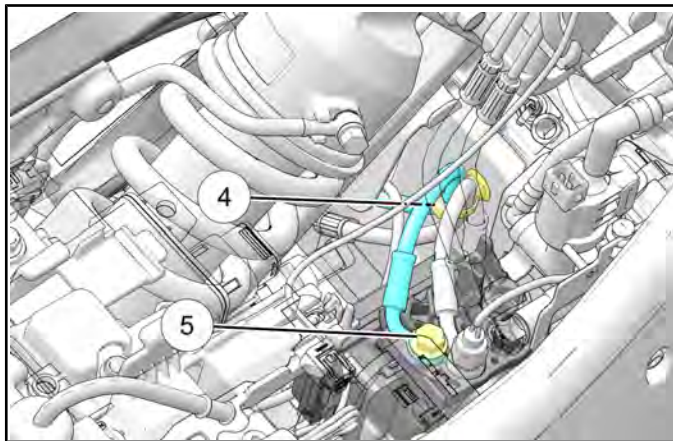
10. Reference **Brake Line Routing** page 9.11 for the proper routing.

**REAR (ABS MODULE TO REAR CALIPER)**

1. Remove seat. See **Seat Removal / Installation page 7.32**.
2. Remove ECM. See **ECM Removal / Installation page 4.53**.
3. Remove saddlebags. See **Saddlebag Removal / Installation page** .
4. Remove rear caliper banjo bolt ①. Have a drain pan ready to catch any brake fluid.



5. Disconnect brake line from retention clips ②.
6. Remove brake line p-clamp fasteners ③.
7. Disconnect routing clip ④.



8. Remove ABS module banjo bolt ⑤.
9. Remove brake line from unit.

10. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
ABS Module Banjo Bolt: <b>18 in-lbs (24 N·m)</b>

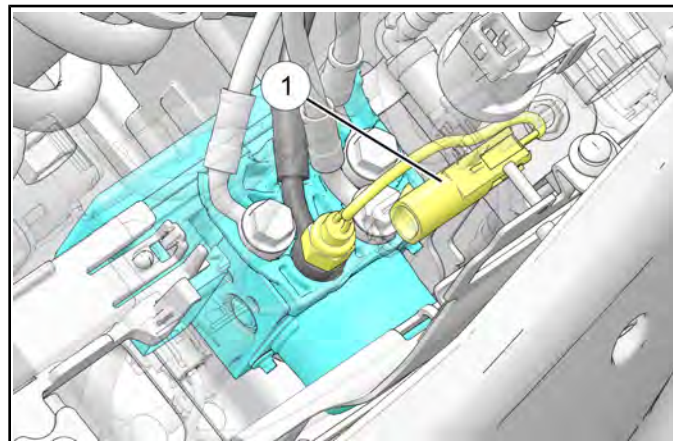
TORQUE
P-Clamp Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Rear Brake Caliper Banjo Bolt: <b>18 in-lbs (24 N·m)</b>

11. Reference **Brake Line Routing page 9.11** for the proper routing.

**BRAKE PRESSURE SENSOR REMOVAL / INSTALLATION**

1. Remove seat. See **Seat Removal / Installation page 7.32**.
2. Remove ECM. See **ECM Removal / Installation page 4.53**.
3. Unplug the brake pressure sensor electrical connector ①.

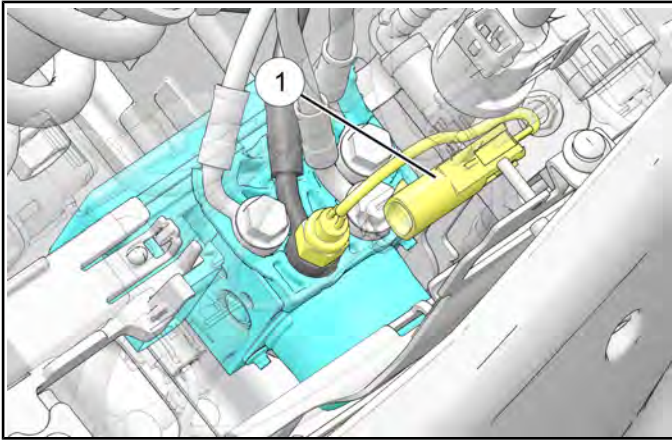


4. Remove the sensor.
5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Brake Pressure Sensor <b>18 in-lbs (24 N·m)</b>

**BRAKE PRESSURE SENSOR TEST**

1. Remove seat. See **Seat Removal / Installation** page 7.32.
2. Remove ECM. See **ECM Removal / Installation** page 4.53.
3. Unplug the brake pressure sensor electrical connector ①.



4. Set the multi meter to read resistance and insert meter leads into the appropriate jacks.
5. Check the resistance of the sensor with the rear brake UN-Applied.

Un-applied Brake Pedal Resistance:  
2000  $\Omega$

6. When the rear brake is applied, the resistance should read OL.



## BRAKES

### TROUBLESHOOTING – BRAKES

PROBLEM	POSSIBLE CAUSE	POSSIBLE REPAIR NEEDED
Weak Brakes or Erratic Braking Action	Fluid Leakage (External) Fluid Leakage (Internal of Master Cylinder) Worn Pads Oil Contamination of Brake Pads and/or Brake Disc Air In System Low Brake Fluid Level In Reservoir Excessive Brake Disc Runout Worn or Damaged Wheel Bearings Loose Front Axle Nut or Clamps or Loose Rear Axle Caliper Mount Surface Uneven Or Misaligned; Missing or Damaged Fasteners Clogged or Restricted Hydraulic Line Caliper Bracket Misaligned, Bent or Distorted Loose Brake Disc Brake Pads Glazed	Repair or Replace Leaking Component Replace Master Cylinder Replace Brake Pads Pads Must Be Replaced. Disc May Be Cleaned. Bleed Air From System Fill Reservoir, Bleed Brakes, Top Off Fluid Level. Replace Brake Disc. Replace Wheel Bearings. Torque Correctly Inspect / Repair Replace Line(s) Replace Bracket Install New Fasteners. Torque to Specification Replace Pads. Avoid Needless Heavy Braking for 100-200 miles (Burnish New Brake Pads).
Poor Brakes or No Brakes When First Applied. Brake Lever Pressure Present If Lever Is “Pumped”.	Air In System Low Brake Fluid Level In Reservoir Brake Disc is Bent or Warped Caliper Misalignment External Leak Internal Leak (master cylinder) Faulty Brake Hose	Bleed Air From System Fill Reservoir, Bleed Brakes, Top Off Fluid Level. Replace Brake Disc Determine Cause and Correct Repair or Replace Damaged Component Repair or Replace Master Cylinder Inspect for Bulges / Replace
Brake Pedal or Brake Lever Pulsates	Brake Disc Bent or Warped Mounting Surface of Brake Disc Uneven / Disc Loose Caliper Mount Surface Uneven Or Misaligned; Missing or Damaged Fasteners	Replace Brake Disc Repair or Replace as Necessary Repair or Replace as Necessary
Excessive Lever or Pedal Travel / Spongy Brake Feel.	Air in System Loose Mounting Hardware Low Brake Fluid Level In Reservoir Incorrect Brake Fluid Used See “Weak / Erratic Brakes” and Poor Brakes” possible causes above.	Bleed Air From System Repair as Necessary Fill Reservoir, Bleed Brakes, Top Off Fluid Level. Flush System and Replace With Correct Fluid
Fluid Leakage	Loose Banjo Fittings Damaged Banjo Fitting Sealing Washers Cracked / Damaged Hose Worn Master Cylinder Piston, Caliper Piston(s) or Seals Diaphragm (master Cylinder reservoir) Leaking Fluid level too high (new brake pads installed without removing added fluid)	Tighten to Specified Torque Replace Replace Repair / Replace Master Cylinder or Wheel Caliper. Inspect / Replace Cover, Cap, Diaphragm or Reservoir as Required Correct fluid level

PROBLEM	POSSIBLE CAUSE	POSSIBLE REPAIR NEEDED
Brakes Drag Excessively or Self-Apply (Brakes Overheat)	Reservoir Over Filled Brake Pedal Or Lever Not Returning Completely To Rest Position Inadequate Freeplay Compensating Port Plugged Internal Corrosion of Components (Master Cylinder / Caliper) Rear Caliper: Corrosion of Sliding Parts, Bent or Damaged Parts Contaminated Brake Fluid Caliper Pistons Sticking Rider Error (Operator Riding Brakes)	Adjust Level As Necessary Inspect Linkage, Pivots and Mechanism For Cause Of Binding Or Restricted Movement; Measure Pedal Clearance / Adjust Repair or Replace Master Cylinder Replace Damaged Component Repair or Replace As Necessary Flush System, Install Correct Fluid Repair / Replace Caliper (Corrosion / Buildup of Residue In Caliper Piston Seal Grooves) Educate Operator
Brake Squeal/ Squeak	If noise is minor and inconsistent, some brake squeak / squeal is characteristic of disc brakes and usually caused by dust / dirt on pads and / or brake disc. Pad Not Secure in Caliper Aftermarket (not genuine Indian Motorcycle) Parts Worn or Damaged Wheel Bearing(s) Worn Pads / Disc	Apply non oil-based solvent to a clean shop towel and wipe dust / dirt from brake disc. Repair as Necessary. Inspect Pad Installation Install Genuine Indian Motorcycle Parts Replace Replace



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## ELECTRICAL MAINTENANCE

### BATTERY

This motorcycle is equipped with a maintenance free battery which is located under the seat. DO NOT remove cell caps or add distilled water to the battery. If the battery discharges, refer to Electrical chapter for diagnostic information.

#### WARNING

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

**External:** Flush with water.

**Internal:** Drink large quantities of water or milk.

Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.

**Eyes:** Flush with water for 15 minutes and get prompt medical attention.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries. **KEEP CHILDREN AWAY FROM BATTERY.**

#### CAUTION

Whenever removing the battery, disconnect the negative (black) cable first. When reinstalling the battery, connect the negative (black) cable last.

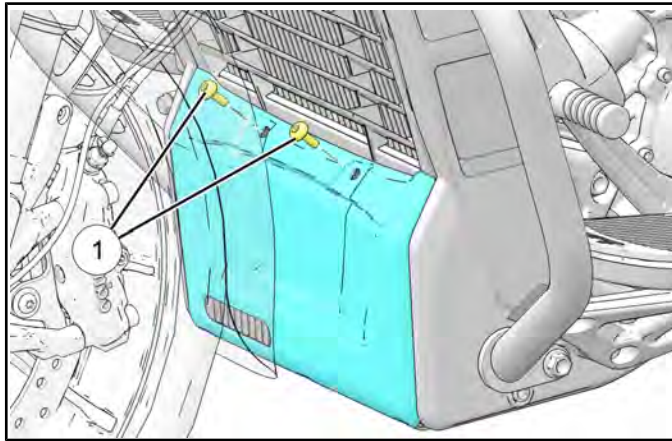
Do not remove the battery cables while the engine is running. Doing so may damage the Electronic Control Module (ECM).

Take great care NOT to reverse the battery leads when installing the battery.

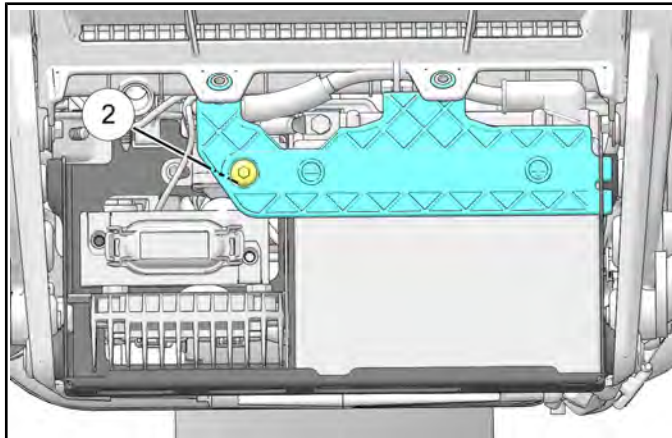


## BATTERY REMOVAL

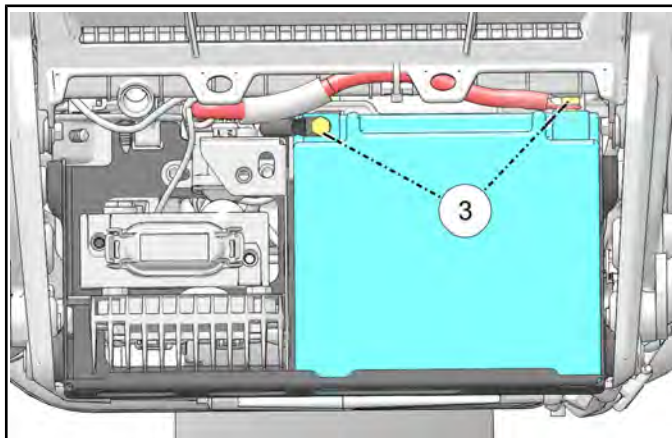
1. Remove chin fairing by removing its fasteners ①.



2. Remove battery bracket by removing its fastener ② and sliding the bracket out of its retention feature.



3. Remove negative (-) and battery positive (+) terminals bolts ③ and remove battery.



## BATTERY INSTALLATION

### NOTICE

Be sure cable ends and battery terminals are clean. Apply a light film of di-electric grease to terminal fastener threads.

1. Carefully install battery.
2. Connect positive (+) then negative (-) battery cables.

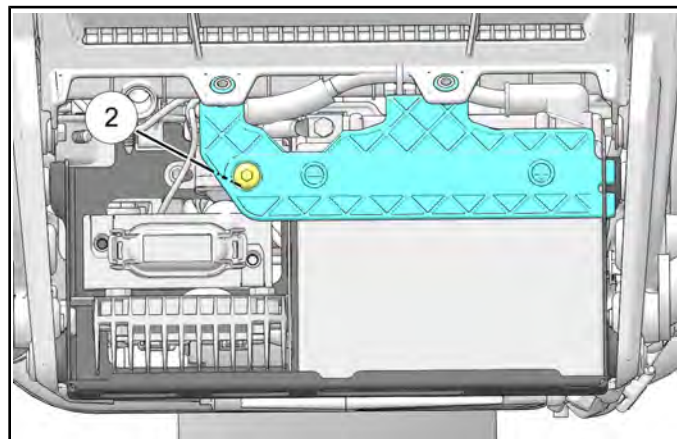
### TORQUE

Battery Terminal:  
**48 in-lbs (5 N·m)**

3. Install battery bracket and fastener ②.

### TORQUE

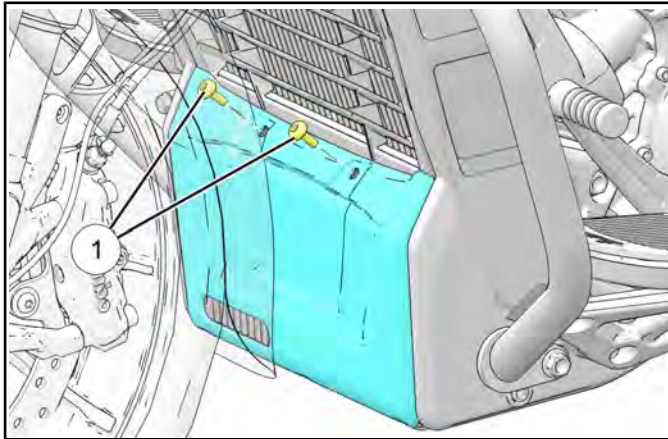
Battery Bracket Fastener:  
**84 in-lbs (10 N·m)**



4. Apply dielectric grease over terminal areas for corrosion protection.

5. Install chin fairing and fasteners ①.

TORQUE
Chin Fairing Fastener: <b>36 in-lbs (4 N·m)</b>



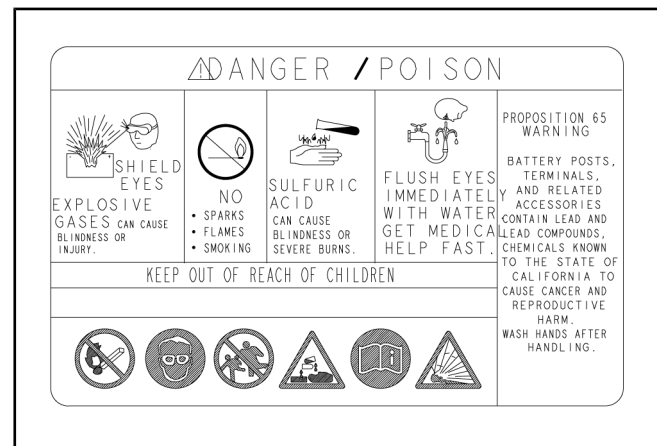
**STARTING / CHARGING**  
**GENERAL INFORMATION**

**SERVICE NOTES – STARTING / CHARGING**

All electrical system and component service can be performed with the engine in the frame.

IMPORTANT
<p><b>CAUTIONS TO OBSERVE DURING ELECTRICAL SYSTEM SERVICE</b></p> <ul style="list-style-type: none"> <li>• Always turn off ignition switch before disconnecting any electrical component.</li> <li>• Always verify that bullet-type connectors are free of corrosion, contamination or breaks when troubleshooting electrical problems.</li> <li>• Verify that bullet-type connectors are firmly seated. Listen and/or feel for a click when connecting them.</li> <li>• Ensure to release the lock on lock-type couplers before disconnecting them to avoid damaging the connector.</li> <li>• Pulling on the wires when disconnecting couplers can introduce problems. Hold the connectors themselves when disconnecting them, not their associated wires.</li> <li>• Inspect each male and female terminal of multi-pin connectors for corrosion, contamination, loose or bent pins.</li> </ul>

**Battery Label**



**⚠ WARNING**

Battery electrolyte is poisonous. It contains sulfuric acid. Serious burns can result from contact with skin, eyes or clothing. Antidote:

- **External:** Flush with water.
- **Internal:** Drink large quantities of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Call physician immediately.
- **Eyes:** Flush with water for 15 minutes. Call physician immediately.

Batteries produce explosive gases. Keep sparks, flame, cigarettes, etc. away. Ventilate when charging or using in an enclosed space. Always shield eyes when working near batteries.

**KEEP BATTERIES AND BATTERY ACID OUT OF REACH OF CHILDREN**

The charging system used on the motorcycle is calibrated for the maintenance free battery that is installed as original equipment. Do not replace with a conventional lead-acid battery. Before troubleshooting the charging system, inspect the battery thoroughly. A discharged, poorly charged or faulty battery will make the readings obtained during charging system troubleshooting erroneous or difficult to interpret.

A battery will self-discharge when the motorcycle is not in use. Make sure to properly store the battery as outlined later in this section.

Maximum voltage and service life is only achieved when the battery is properly serviced initially. Make sure to follow instructions outlined later in this section.

Overcharging can be caused by a faulty battery (shorted cell). Test system with a known good battery when diagnosing an overcharge condition.

New batteries must be properly maintained as outlined in this section to ensure proper service life.

**⚠ CAUTION**

Even with a good battery, battery voltage can recover after charging, but under excessive loads the battery voltage will drop quickly and eventually “die”. Often the charging system is suspect when it is not the cause of the problem. Always inspect for excessive loads if the battery continues to lose its charge. Items such as incorrect wattage bulbs, sticking brake light switch(s), continuous low rpm operation or leaving the lights on without the engine running for long periods of time can drain a battery even if the charging system is operating correctly.

**⚠ CAUTION**

**WIRE ROUTING**

Make sure that all wires are routed correctly away from moving parts, hot exhaust, or sharp edges.

**⚠ CAUTION**

**FUSES**

Fuses are in place to protect circuit wiring and components. Always determine the cause of an open fuse before installing a new fuse.

Do not increase the value of the fuse to correct the problem.

Do not use wire, tin foil or other substitutes for fuses.

**⚠ CAUTION**

**ELECTRONIC COMPONENTS**

Semiconductor parts used in electronic components will not withstand careless handling.

Do not drop or strike parts that contain semiconductors such as the ECM or rectifier/regulator. Dropping electronic components can cause damage to the component.

Follow instructions supplied in this chapter, including Fuel Delivery / EFI chapter and Electrical chapter, very carefully when working on electronic components. Failure to follow instructions may cause irreparable damage to the part being inspected.

**SPECIAL TOOLS – STARTING / CHARGING**

<b>TOOL DESCRIPTION</b>	<b>PART NUMBER</b>
Battery Tester	PU-50296
Electrical Tester Kit	PV-43526
Relay Bypass	PU-49466
USB to Serial Adapter	PU-50621

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

## ELECTRICAL

### SERVICE SPECIFICATIONS - STARTING / CHARGING

#### ELECTRICAL SPECIFICATIONS

ITEM		SPECIFICATIONS
Electrical (General)	Ignition System	Distributor-less Transistorized Dual Coil Type Ignition
	Starting System	Electric
	Charging System	Permanent Magnet / 3 Phase / Full Wave Rectification
	Regulator/Rectifier	Solid State Three Phase Voltage Regulator/Rectifier
	Lighting System	12 V DC

#### CHARGING SPECIFICATIONS

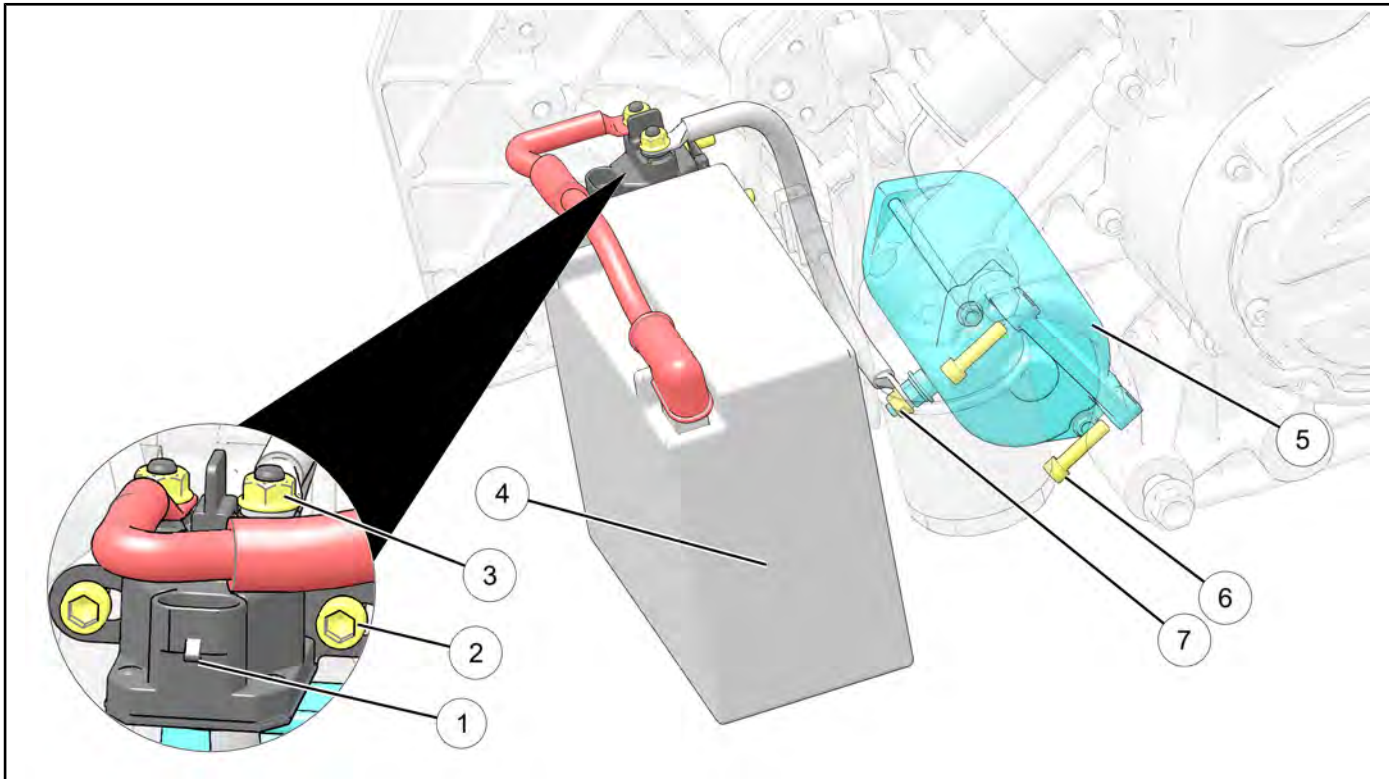
ITEM		SPECIFICATIONS
No Load AC Output @ 800-1000 RPM (Engine cool)		17-26.5 VAC @ Idle
No Load AC Output @ 2000 RPM (Engine cool)		40-45 VAC at 2000 RPM
Stator Coil Resistance (@ 21°C / 70°F) (Black to each other black) (Disconnect regulator - see test.)		90.7 mΩ ± 20%
Stator Coil Resistance To Ground (Each black wire)		Infinity (no continuity)
Regulated Voltage		14.3 - 14.7 V DC
Output (Amps / Watts)		56 A / 710 W @ 2000 RPM
Battery	Type	Yuasa: YTX20HL
	Voltage	12 Volts DC
	Nominal Capacity @ 10 Hr Rate	18 AH
	Recommended Battery Charging Current	STD: 1.85 A for 5 to 10 hrs
	CCA Rating	310

#### STARTING SYSTEM SPECIFICATIONS

ITEM	SPECIFICATION
Battery Voltage, No Load	Above 12.5 V DC
Resistance: Between Any Two Commutator Bars	Continuity (0 Ohms)
Resistance: Commutator to Armature Shaft	Infinity (OL on Fluke™ 73)
Resistance: Battery Input Terminal to Insulated Brush	Continuity (0 Ohms)
Resistance: Bat. Input Terminal to Starter Motor Case	Infinity (OL on Fluke™ 73)
Starter Motor Operating Amp Draw	140-160 Amps
Starter Motor No Load Amp Draw (Bench Test)	30-37 Amps after initial surge
Starter Torque Limit Clutch Break-Away Torque	50 - 60 ft-lbs (70 - 80 Nm) when new

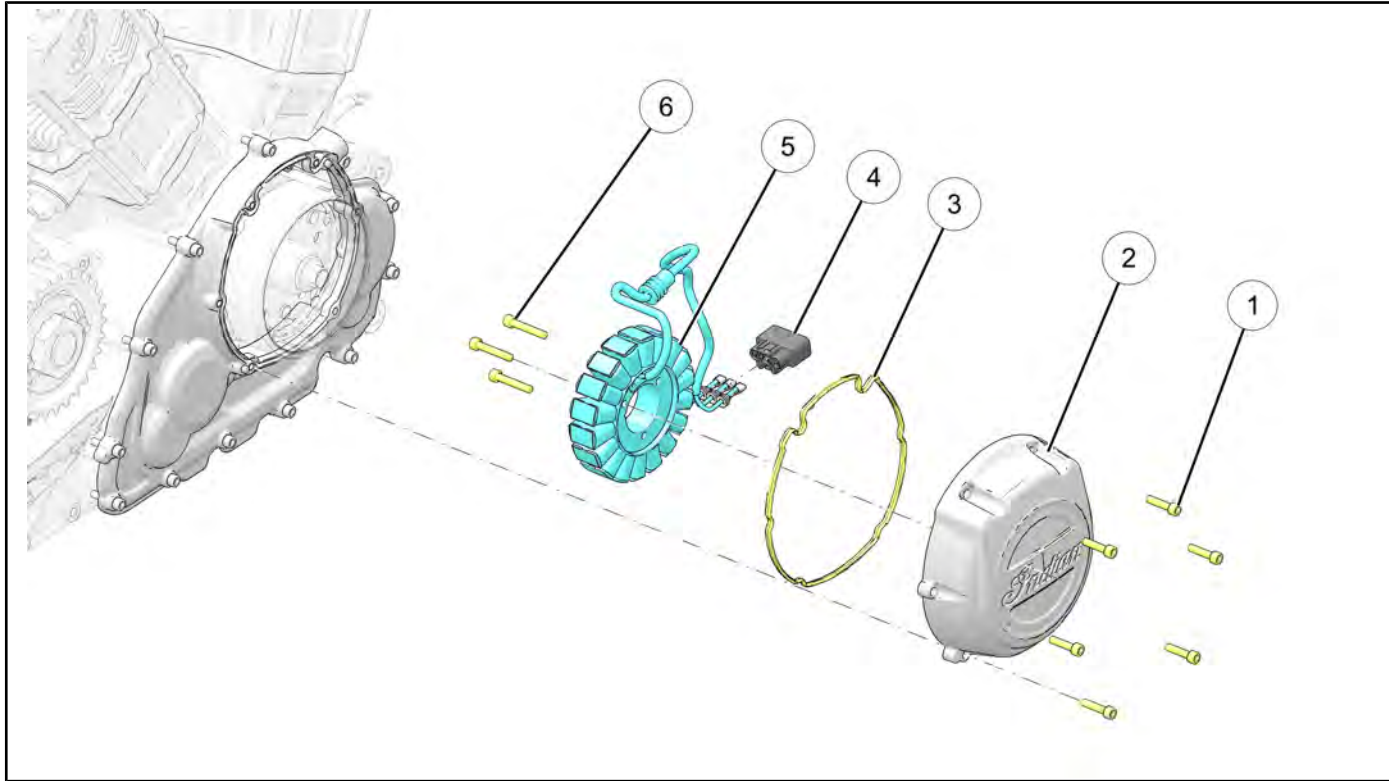
## ASSEMBLY VIEWS

### STARTER MOTOR / SOLENOID

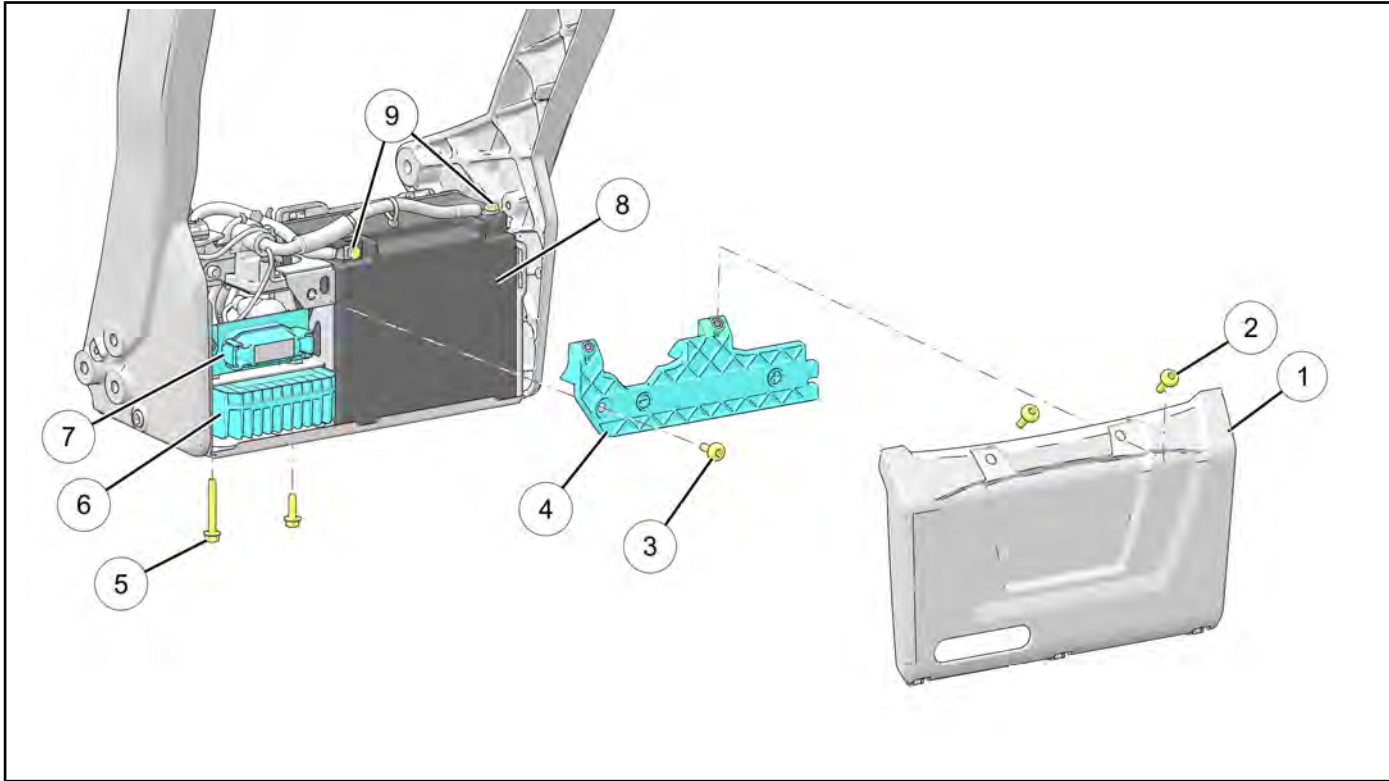


REF	DESCRIPTION	TORQUE
①	Starter Relay	—
②	Starter Relay Fastener	<b>84 in-lbs (10 N·m)</b>
③	Starter Relay Terminal Fastener	<b>44 in-lbs (5 N·m)</b>
④	Battery	—
⑤	Starter	—
⑥	Starter Mount Fastener	<b>84 in-lbs (10 N·m)</b>
⑦	Starter Terminal Fastener	<b>84 in-lbs (10 N·m)</b>

**STATOR**



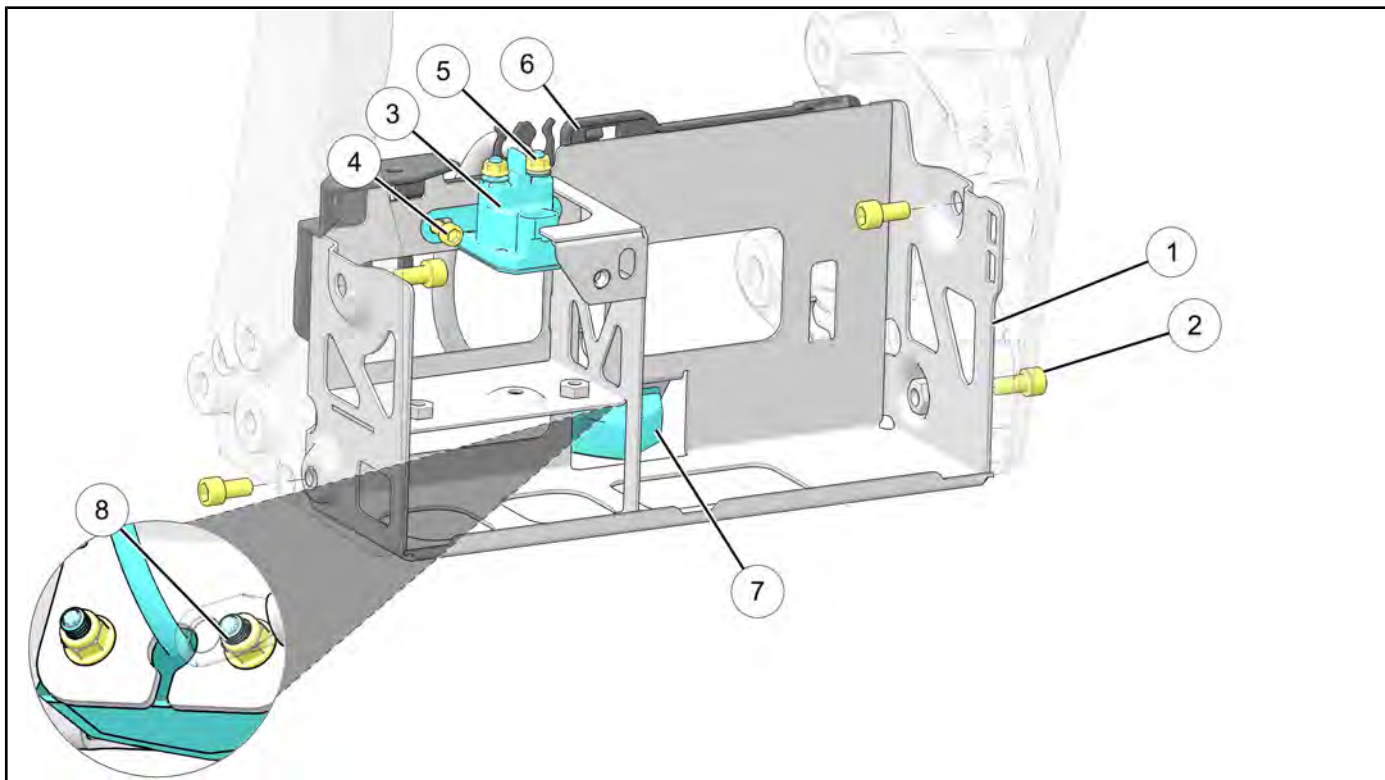
REF	DESCRIPTION	TORQUE
①	Stator Cover Fastener	<b>84 in-lbs (10 N·m)</b>
②	Stator Cover	—
③	Stator Cover Gasket	—
④	Stator Connector	—
⑤	Stator Assembly	—
⑥	Stator Fastener	<b>84 in-lbs (10 N·m)</b>

**BATTERY BOX**

REF	DESCRIPTION	TORQUE
①	Chin Fairing	—
②	Chin Fairing Fastener	<b>36 in-lbs (4 N·m)</b>
③	Battery Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
④	Battery Bracket	—
⑤	J-Case / Voltage Regulator Fastener	<b>84 in-lbs (10 N·m)</b>
⑥	Voltage Regulator	—
⑦	J-Case	—
⑧	Battery	—
⑨	Battery Terminal	<b>48 in-lbs (5 N·m)</b>



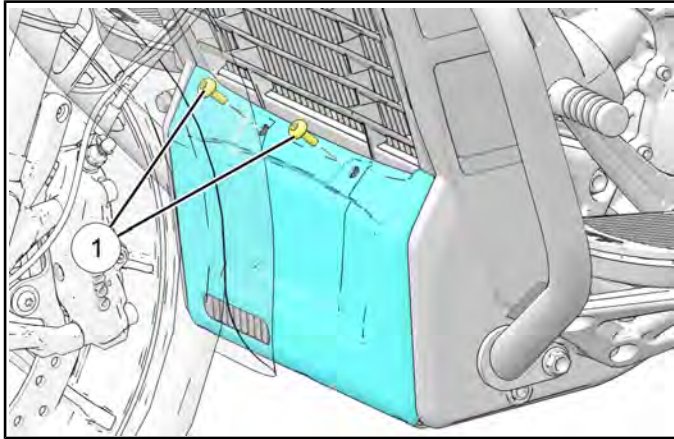
## ELECTRICAL



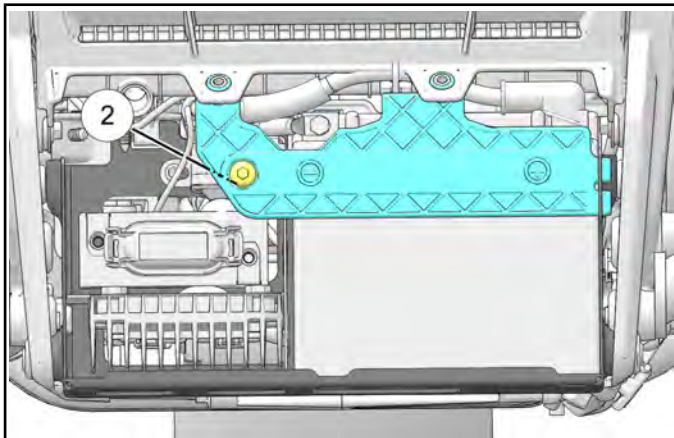
REF	DESCRIPTION	TORQUE
①	Battery Box	—
②	Battery Box Fastener	<b>18 ft-lbs (24 N·m)</b>
③	Starter Solenoid	—
④	Starter Solenoid Fastener	<b>84 in-lbs (10 N·m)</b>
⑤	Starter Solenoid Terminal Nut	<b>44 in-lbs (5 N·m)</b>
⑥	Tray Harness	—
⑦	Puddle Light	—
⑧	Puddle Light Fastener	<b>84 in-lbs (10 N·m)</b>

**BATTERY SERVICE****BATTERY REMOVAL**

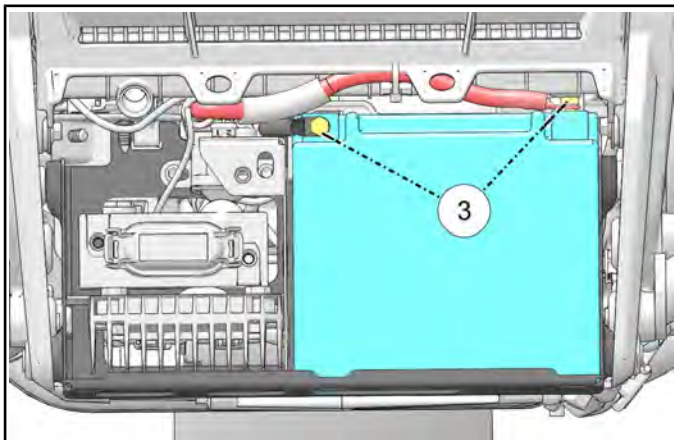
1. Remove chin fairing by removing its fasteners ①.



2. Remove battery bracket by removing its fastener ② and sliding the bracket out of its retention feature.



3. Remove negative (-) and battery positive (+) terminals bolts ③ and remove battery.

**BATTERY INSTALLATION****NOTICE**

Be sure cable ends and battery terminals are clean. Apply a light film of di-electric grease to terminal fastener threads.

1. Carefully install battery.
2. Connect positive (+) then negative (-) battery cables.

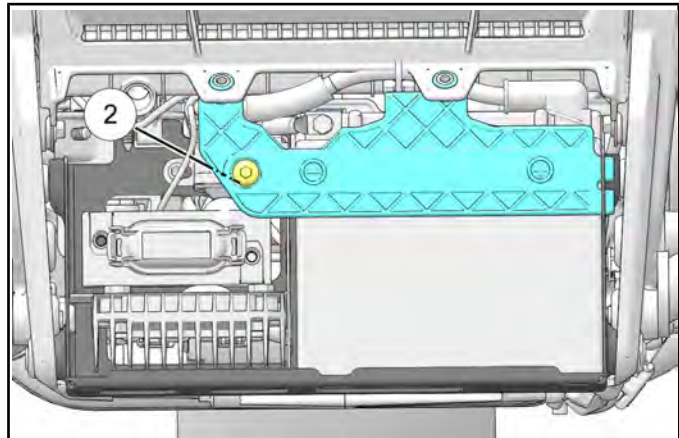
**TORQUE**

Battery Terminal:  
**48 in-lbs (5 N·m)**

3. Install battery bracket and fastener ②.

**TORQUE**

Battery Bracket Fastener:  
**84 in-lbs (10 N·m)**



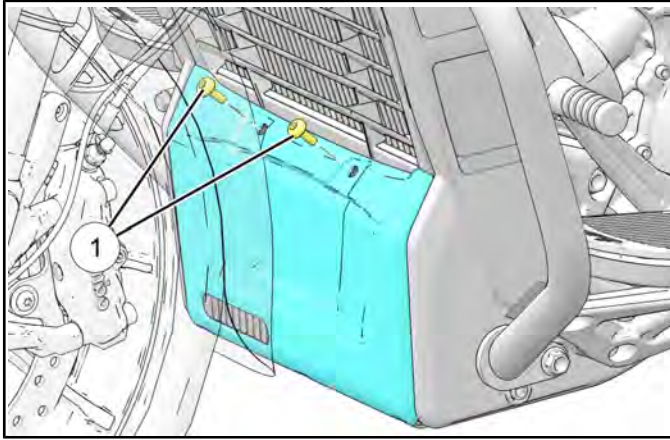
4. Apply dielectric grease over terminal areas for corrosion protection.

## ELECTRICAL

5. Install chin fairing and fasteners ①.

### TORQUE

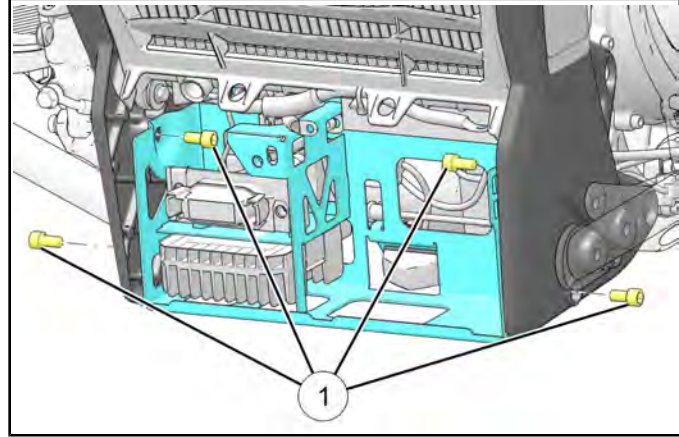
Chin Fairing Fastener:  
36 in-lbs (4 N·m)



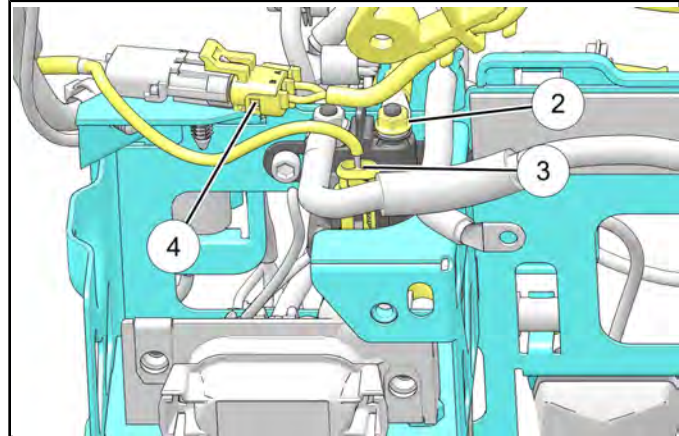
## BATTERY BOX REMOVAL / INSTALLATION

### REMOVAL

1. Remove battery. See **Battery Removal page 10.15.**
2. Remove battery box fasteners ①.

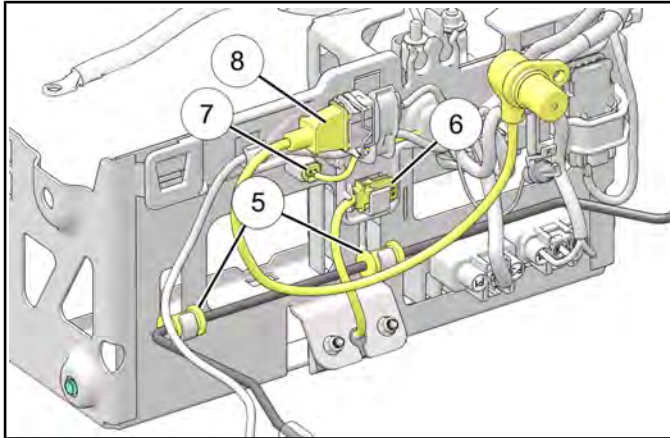


3. Disconnect the brake line grommets from the battery box.
4. Remove starter solenoid nut ② and remove cable going to starter.

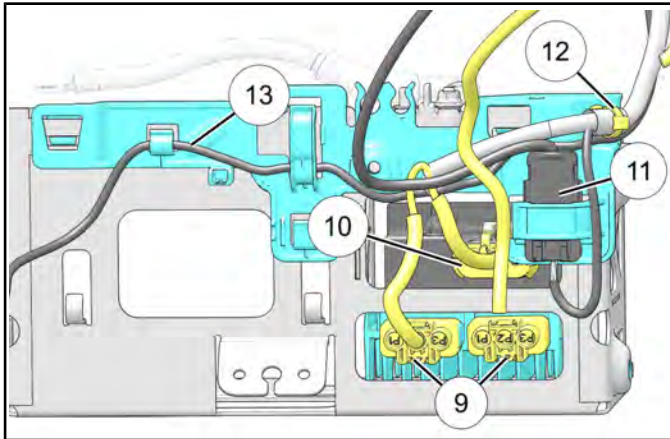


5. Disconnect Starter Solenoid electrical connector ③ and fan electrical connector ④.

6. Disconnect brake line isolators ⑤ from battery box.



7. Disconnect puddle light electrical connector ⑥ and harness termination connector ⑦.
8. Disconnect crankshaft position sensor connector ⑧ un-clip remaining end from battery box.
9. Disconnect stator/regulator electrical connectors ⑨.



10. Disconnect J-case electrical connector ⑩.
11. Remove clip ⑪ from battery box.
12. Disconnect electrical harness retention clip ⑫ from battery box.
13. Remove kickstand switch wiring ⑬ from the battery box.

### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Starter Solenoid Terminal Nut:  
**44 in-lbs (5 N·m)**

#### TORQUE

Battery Box Fastener  
**18 ft-lbs (24 N·m)**

2. Install battery. See **Battery Installation page 10.15.**

## **BATTERY CHARGING AND MAINTENANCE**

### **AGM BATTERY CHARGER RECOMMENDATIONS**

Indian Motorcycle recommends using the BatteryMINDER® 2012 AGM - 2 AMP battery charger (PN 2830438) to charge and maintain AGM batteries. The charger can be found on the Polaris PG&A website and ordered in DEX – Item Availability.

Batteries that fall below 12.5V run the risk of sulfation, a condition whereby sulfate crystals form inside the battery and significantly reduce performance. AGM chargers are designed specifically for charging AGM type batteries and use high frequency pulses to partially reverse sulfation.

#### **IMPORTANT**

The use of non-AGM battery chargers or non-AGM battery tenders may result in a misleading “battery not found” or “open cell” fault message. Please ensure you are using the recommended AGM charger when charging AGM type batteries.

### **INDIAN MOTORCYCLE RECOMMENDED AGM BATTERY TESTING PROCEDURE:**

1. Test battery using the battery tester PU-50296.
2. If the tester indicates a test result other than “Good Battery,” follow the steps below before replacing the battery:
  - a. Connect battery to the recommended battery charger. If charging sequence begins as normal, fully charge battery and proceed to step 3.  
  
The time listed on the PU-50296 battery tester printout is an estimate. The recommended automatic charger will indicate when the battery is fully charged on its display.
  - b. If charging sequence does not initialize, refer to **AGM Battery Charging Recommendations – Deeply Discharged (below 3 volts)** to attempt to restore the deeply discharged battery. If charging sequence will not finish as intended, the battery needs to be replaced.
3. Re-test battery. If the test results show that battery failed, proceed with battery replacement.

**AGM BATTERY CHARGING RECOMMENDATIONS – LOW CHARGE**

The nominal voltage for an Indian Motorcycle battery is 12.8 Volts when fully charged. The battery will self-discharge when disconnected from a vehicle, and will discharge at a faster rate when connected. If the battery voltage falls below 12.5V, it should be charged immediately using the recommended battery charger. Listed below are the recommended battery inspection schedules.


- Batteries which are not connected to a vehicle should be inspected every 60 days. The battery must be charged if found to be below 12.5 volts.
- Batteries which are connected to motorcycles should be inspected when they arrive at your dealership and at least once every month thereafter. The battery must be charged if found to be below 12.5 volts.
- Showroom bikes used to demonstrate radio, display and infotainment features should be charged daily. If possible, these bikes should be connected to the recommended battery charger continuously.

Always use the recommended automatic battery charger, and wait for the charger to complete the charge cycle before disconnecting it.

**AGM BATTERY CHARGING RECOMMENDATIONS – DEEPLY DISCHARGED (BELOW 3 VOLTS)**

AGM batteries discharged to a voltage of 3 volts or less may not be recognized by the recommended automatic battery charger. (The minimum voltage threshold recognized by other battery chargers may be as high as 10.5 volts). Often times deeply discharged batteries can be restored by attaching another, fully-charged, battery to “jump start” the low battery. Follow the steps below to restore a deeply discharged battery.

1. Carefully connect the two batteries’ positive terminals, then the negative terminals using jumper cables.
2. Connect the recommended battery charger to the low battery and initiate the charging sequence.

 <b>WARNING</b>
Always check to ensure the positive cables are connected to the positive terminals before powering the charger on. Reversing polarity when charging can damage electrical components and risk personal injury. Be careful not to let battery cable clamps touch each other.

3. After the charging sequence has initiated, disconnect the fully-charged battery. Always disconnect the fully-charged battery positive first, followed by low battery positive, low battery negative, and finally fully-charged battery negative
4. Proceed with charging both batteries to full capacity. Listed in the table below are the approximate charging times for deeply discharged batteries. Always use the recommended automatic battery charger, and wait for the charger to complete the charge cycle before disconnecting it. The recommended automatic charger will indicate when the battery is fully charged on its display.

BATTERY PN	CHARGING TIME	BATTERY CAPACITY	CHARGING RATE
4011496	11 hours	18 AH	2 amps
4014770	8 hours	12 AH	2 amps

**AGM BATTERY MAINTENANCE TIPS**

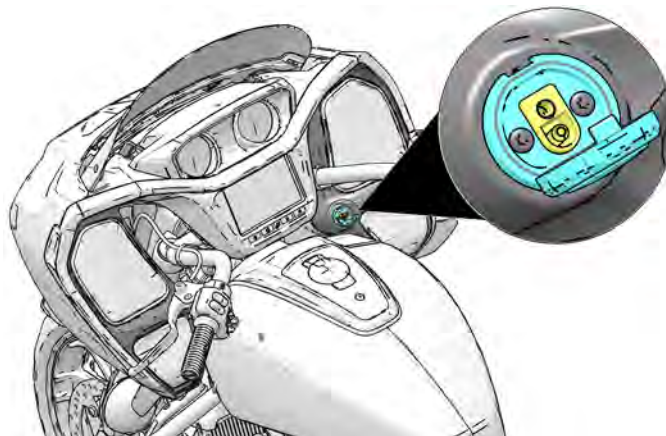
1. If the motorcycle will not be driven for more than 2 weeks, maintaining the battery with the BatteryMINDER® 2012 AGM - 2 AMP charger (PN 2830438) is recommended.
2. To help prolong battery life, it is recommended to remove the battery from vehicles stored ONE month or longer. To maximize the life of stored batteries, they should be kept in a cool / dry location. Batteries will self discharge more rapidly when stored in extreme temperatures. Batteries should be maintained using the recommended battery charger while in storage.
3. Batteries will self-discharge more quickly when dirty. Periodic cleaning of the battery terminals using a terminal brush will help maximize battery life. Wash terminals with a solution of one tablespoon baking soda and one cup water. Rinse well with tap water and dry off with clean shop towels. Coat the terminals with dielectric grease or petroleum jelly.
4. Battery connections should be tightened to the correct torque during installation. This will reduce voltage drop and ensure a reliable connection between the regulator/rectifier and battery.
5. Models are conveniently equipped with a SAE bullet style connector for quick access to charging the battery. The recommended BatteryMINDER® 2012 charger comes with the mating connector for easy plug and play maintenance.

**2020**

The connector is on the left side of the unit near the fuse box.

**2021+**

The connector is located on the right hand fairing dash.

**10**



## ELECTRICAL

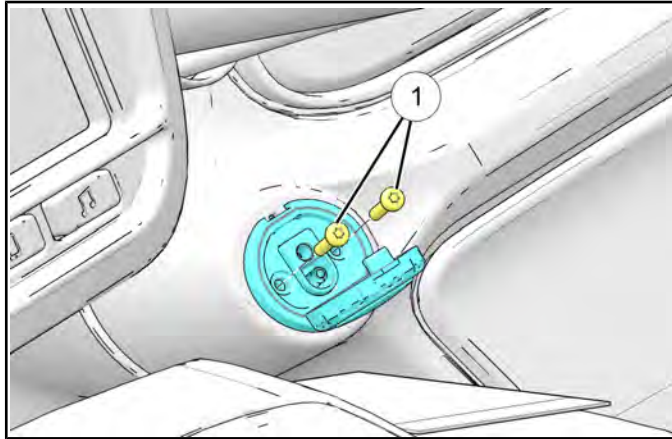
### BATTERY CHARGE PORT REMOVAL / INSTALLATION

#### NOTICE

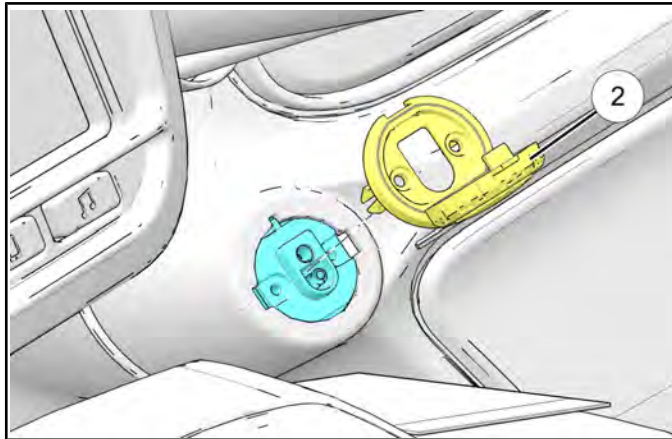
2021+ Models Only

#### REMOVAL

1. Remove the two charge port fasteners ①.

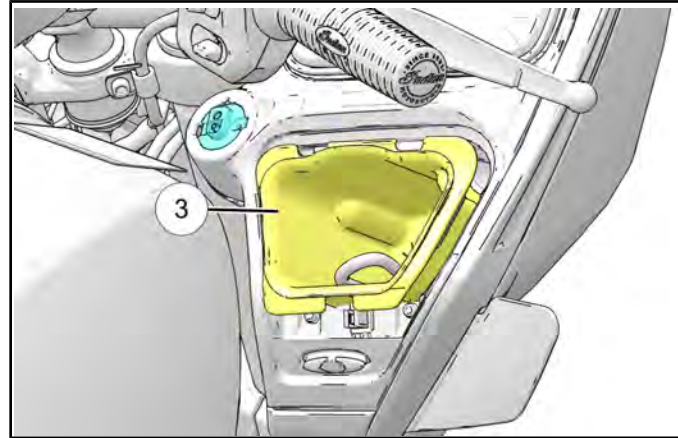


2. Remove the charge port cover.

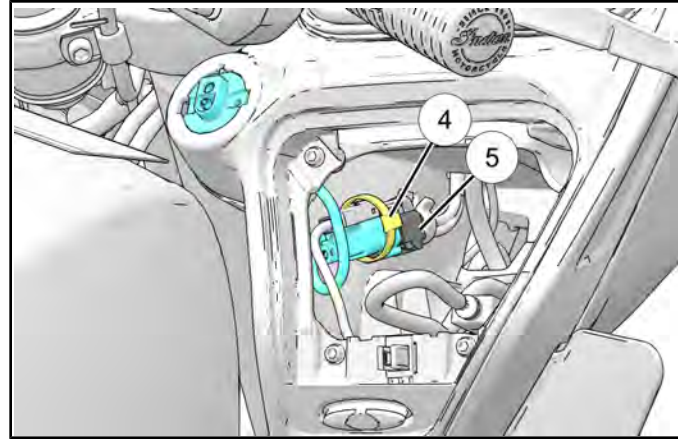


3. Open the right hand storage door.

4. Remove the storage liner ③.



5. Disconnect the retention cable ④.



6. Disconnect the charge port electrical connector ⑤.

7. Remove the charge port.

8. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**BATTERY INSPECTION**

1. Remove battery. See **Battery Removal page 10.15**.
2. Inspect battery tray and hold-down cover for damage. Be sure all foam strips are in place on battery box.
3. Inspect for cracked or broken battery case.

**⚠ CAUTION**

Do not remove the battery cap assembly in an attempt to inspect fluid level, specific gravity or attempt to add fluid to battery. After initial servicing, battery should remain sealed.

4. Inspect terminals for corrosion. If corrosion is found, remove battery and clean terminals with a solution of baking soda and water. Finish process by cleaning terminals (both battery and battery cables) with a wire brush.
5. Install battery. See **Battery Installation page 10.15**.
6. Once connections are secured, apply a thin film of di-electric grease to terminals.

## STARTER MOTOR SERVICE

### SAFETY INFORMATION

**⚠ WARNING**

Always disconnect the battery (negative terminal first) before servicing the starter motor.

- Inspect the condition of the battery before troubleshooting the starter system. Also inspect main engine ground and battery cable connections.

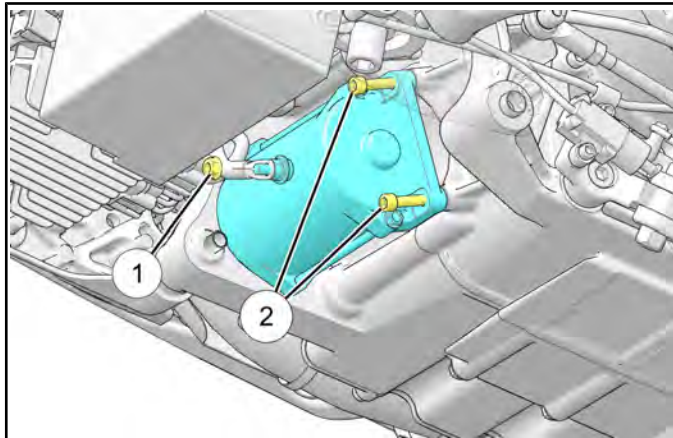
### STARTER MOTOR, REMOVAL / INSTALLATION

#### REMOVAL

**⚠ WARNING**

Ensure that the ignition switch is turned off. Remove the negative cable at the battery before removing the starter motor.

1. Disconnect battery cables. Reference **Battery Removal page 10.15**.
2. The oil filter must be removed to access the top starter fastener. Reference **Engine Oil & Filter Change page 2.18**
3. Disconnect the positive terminal ① from the starter motor.
4. Remove the two fasteners ② from the rear of the starter motor and slide assembly to the LH side of the motorcycle to release from engine case.



5. Remove starter motor.

#### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Starter Mounting Fasteners:  
**84 in-lbs (10 N·m)**

**TORQUE**

Oil Filter:  
**Approximately 3/4 turn after seal has contacted the filter adapter.**

**TORQUE**

Starter Motor Positive Terminal Nut:  
**84 in-lbs (10 N·m)**

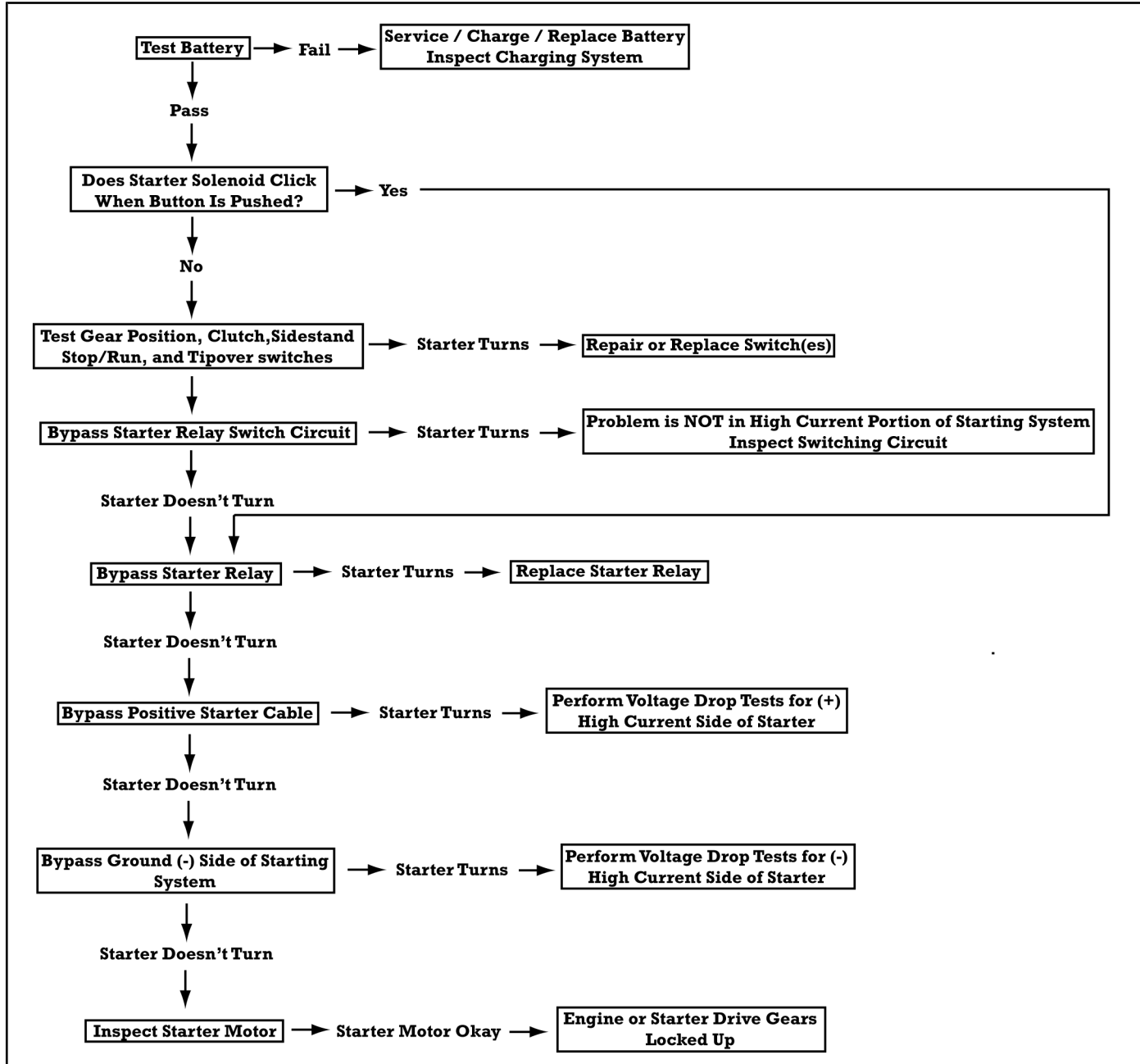
2. Inspect oil level. Reference **Engine Oil Level page 2.20**.

**STARTING SYSTEM DIAGNOSTIC TABLE**

<b>SYMPTOM</b>	<b>POSSIBLE CAUSE</b>	<b>RECOMMENDATION</b>
Starter motor does not turn with transmission in neutral. Turns with clutch pulled in.	Gear Position Switch or circuit malfunction.	Test Gear Position Switch.
Starter motor does not turn with transmission in gear and clutch lever pulled in. Turns with transmission in neutral.	Clutch Switch or Side Stand switch circuit malfunction.	Test Switches.
Starter motor will not turn.	Low battery voltage. Poor cable connections. Main ground loose.	See Troubleshooting Flow Chart 1
Starter motor turns slowly. Engine may or may not start.	Low battery. Faulty starter motor or drive mechanism. Engine mechanical problem.	See Troubleshooting Flow Chart 2
Starter motor turns, but engine does not turn.	Starter torque limit clutch slipping.	See Troubleshooting Flow Chart 3
Starter motor turns at normal speed, but engine does not start.	Ignition Problem Engine Problem Fuel Delivery Problem	Electrical chapter Engine / Cooling / Exhaust chapter Fuel Delivery / EFI chapter

**TROUBLESHOOTING FLOW CHART 1**

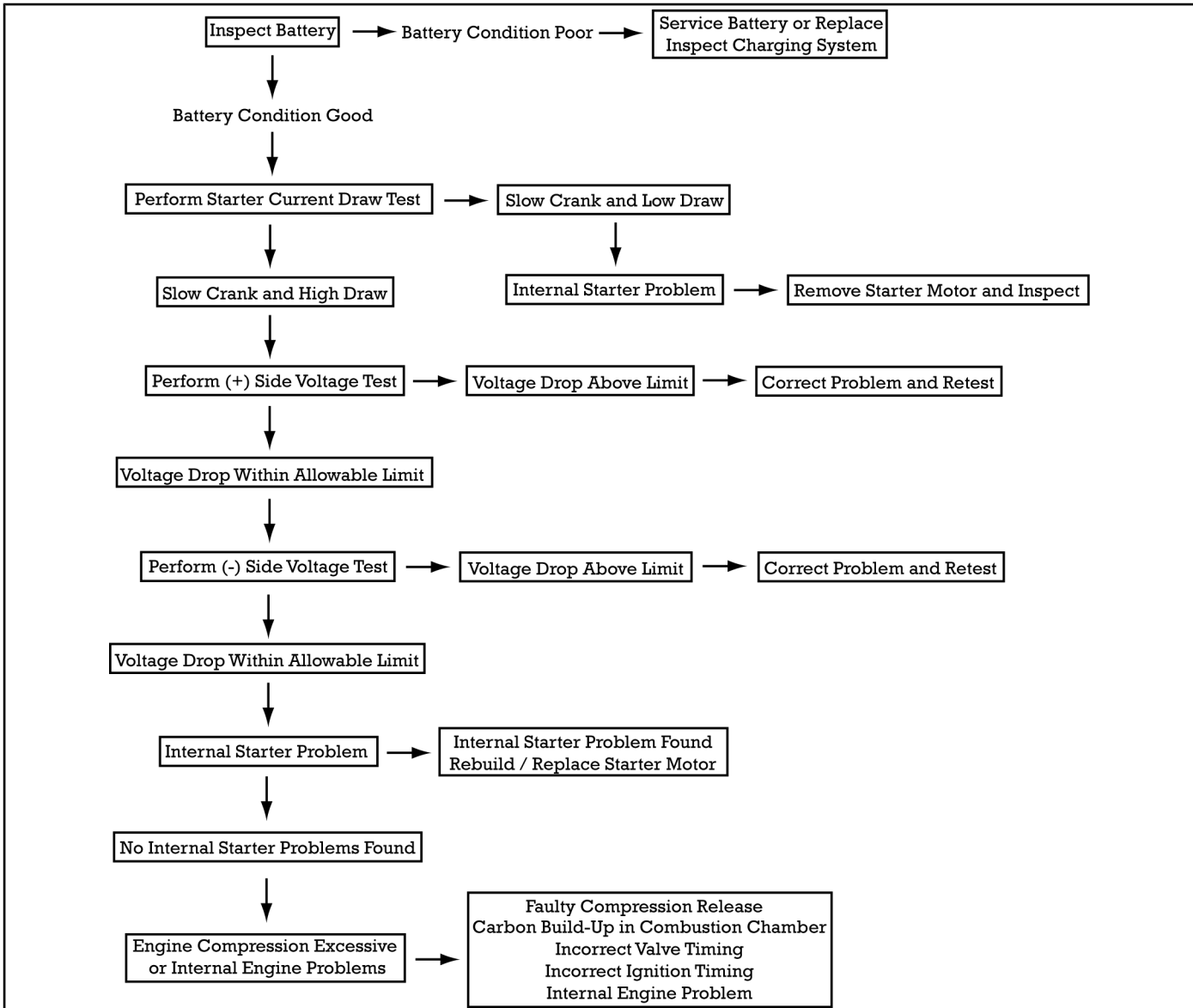
**NOTICE**  
Make sure the Key Fob authorization has occurred before performing troubleshooting.



**TROUBLESHOOTING FLOW CHART 2**

**NOTICE**

These procedures require a Digital Multi Meter (DMM) and high a high current shunt, or an inductive ammeter clamp and a DMM.



10

**TROUBLESHOOTING FLOW CHART 3**

SYMPTOM	POSSIBLE CAUSE
Starter motor turns, but engine does not turn. The starter motor can be heard spinning.	Starter clutch malfunction.
	Starter torque limit clutch slipping.
	Starter gears damage.

## STARTING SYSTEM TESTS

### BATTERY LOAD TEST

1. Load test battery using a commercially available battery load tester. Follow the battery load tester manufacturer instructions.

**NOTICE**

Although not as conclusive, the following test can be used to direct troubleshooting efforts if a battery load tester is not readily available.

2. Charge battery until open circuit voltage is above 12.5 Volts.
3. Install battery and connect battery cables.
4. Connect digital multimeter to battery and keep it connected for duration of test.
5. Press power button to power up electrical system and move head light high beam switch to High Beam for 1 minute (without the engine running).
6. Measure battery voltage.
7. If battery voltage has dropped below 10.5 V DC, re-charge and re-test battery or replace it.

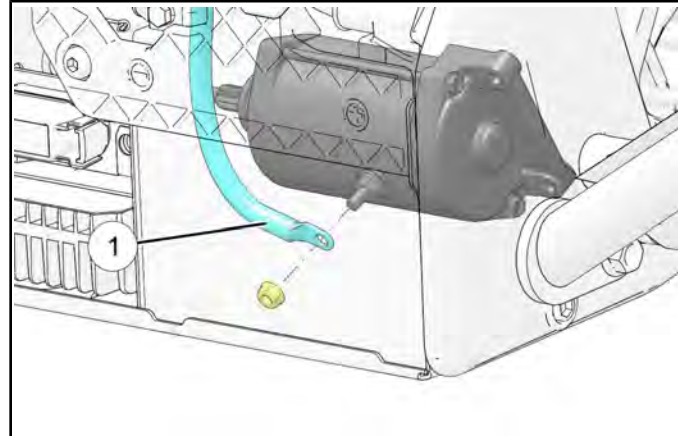
### STARTER SOLENOID POSITIVE CIRCUIT TEST

**⚠ WARNING**

**Secure motorcycle on the side stand and place transmission in neutral for the following test.**

1. Place the transmission in neutral.

2. Remove the positive cable ① from starter motor.

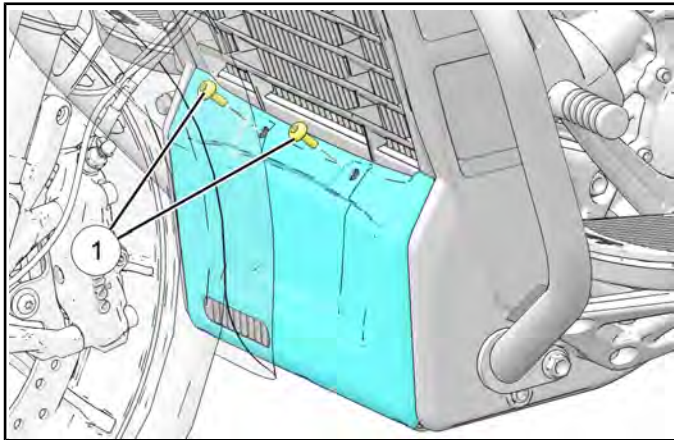


3. Set multi meter to **DC Volts** and insert meter leads in the appropriate jacks.
4. Connect the red meter lead (+) to the positive starter cable eyelet and the black (-) meter lead to chassis ground.
5. Press the power button to power up the electrical system and place the STOP/RUN switch in the RUN position.
6. Press starter button. The meter should display battery voltage. If voltage is more than .2 volts below battery voltage, inspect the power supply circuit.

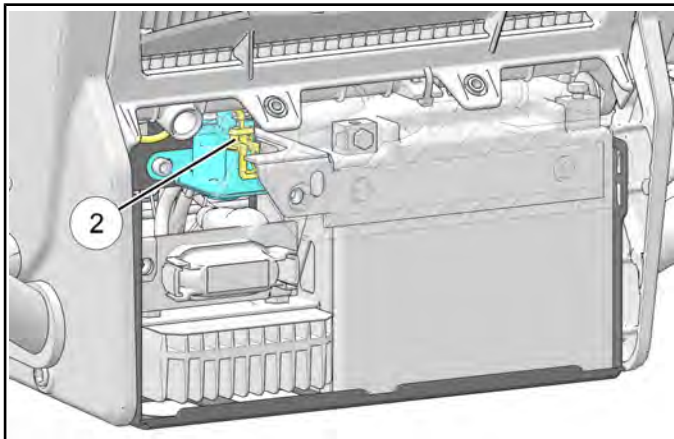
**STARTER SOLENOID GROUND CIRCUIT TEST**

**⚠ WARNING**  
**Ensure that the motorcycle is secure and that the transmission is in neutral for the following test.**

1. Shift transmission to Neutral.
2. Remove chin fairing by removing its fasteners ①.

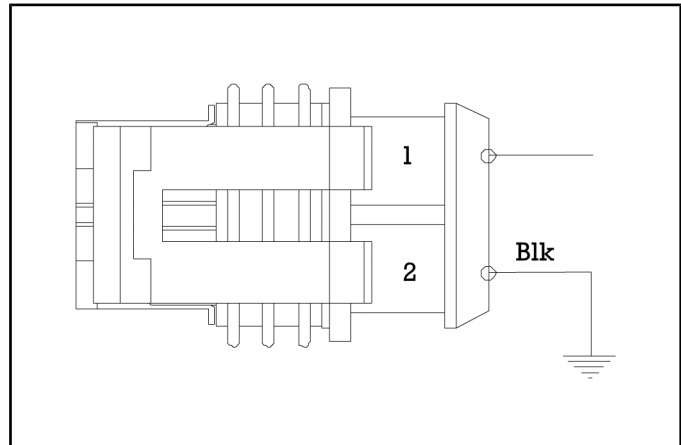


3. Disconnect the start solenoid connector ②.



4. Set the multi meter to read resistance and insert meter leads into the appropriate jacks.

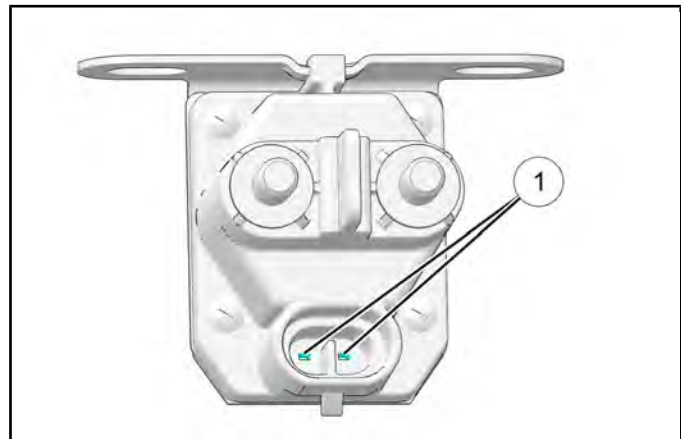
5. Working on the vehicle side of the harness, test continuity between terminal 2 (black wire) and chassis ground.



Resistance should be  $\leq 0.5 \Omega$

**STARTER SOLENOID RESISTANCE TEST**

1. Using a multi-meter check the resistance of start solenoid pins ①.



Start Solenoid Resistance:  
 2.5  $\Omega$



**CLUTCH SWITCH CIRCUIT TEST**

The symptom of a faulty clutch switch circuit is:

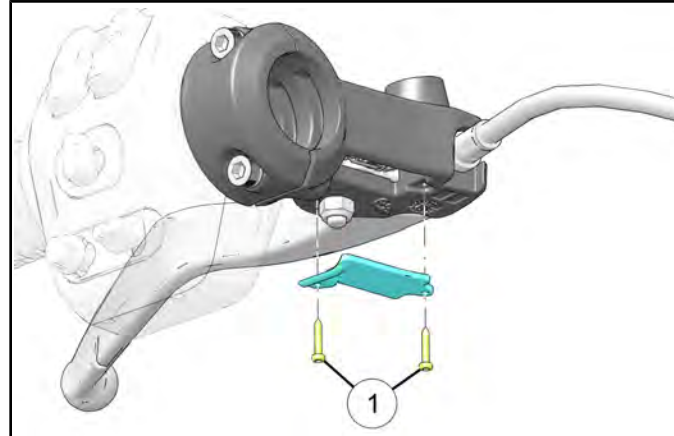
- Starter motor will not operate with transmission in gear and clutch lever pulled in. Starter *operates* with transmission in neutral. Use an ohmmeter to determine if continuity is present when the switch is closed (lever pulled in).

1. Transmission can be in neutral or in any gear.
2. Disconnect ECM connector 1. Reference **ECM Removal / Installation page 4.53**.
3. Set multi meter to measure resistance and insert meter leads into appropriate jacks.
4. Connect red (+) lead of multi meter to PIN 19 in ECM connector 1 (harness side). See **ECM Connector Map page 4.42**.
5. Connect black meter lead to chassis ground.
6. Operate clutch lever while observing meter display.
7. Pull clutch lever to the handlebar. Meter should display continuity or very low resistance (less than 1 ohm) when the clutch switch closes.
8. Release clutch lever, meter should display OL (open line).
9. If clutch switch does not test as described inspect clutch switch, clutch switch wiring or mounting of switch to clutch lever for fault.
10. If switch is mounted correctly and physically operates but does not open and close electrically, replace switch.

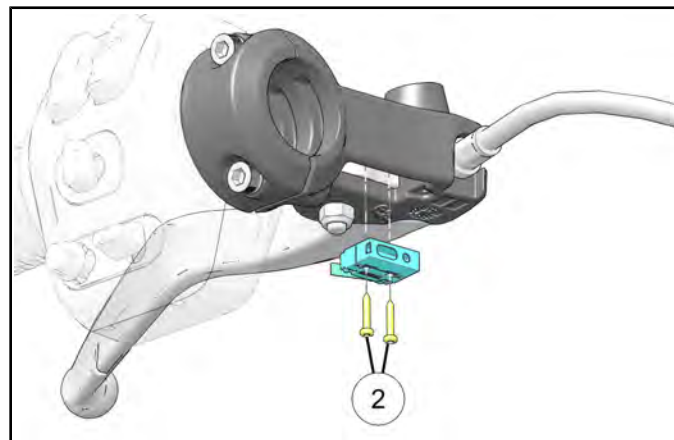
**CLUTCH SWITCH REMOVAL / INSTALLATION**

**REMOVAL**

1. Remove clutch switch cover fasteners ① and clutch switch cover .



2. Remove clutch switch retaining fastener ②.



3. Gently pull the clutch switch out of the lever perch until the locating pins are free and the switch can be disconnected.

**⚠ CAUTION**

The clutch switch has two locating pins on the top side which slide into the clutch lever perch. Use caution when removing the clutch switch so the locating pins do not break off.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

2. Torque clutch switch and cover fasteners to specification.

**TORQUE**

Clutch Switch Fastener:  
**6 in-lbs (1 N·m)**

**TORQUE**

Clutch Switch Cover Fasteners:  
**6 in-lbs (1 N·m)**

**STARTER CURRENT DRAW TEST****NOTICE**

This procedure requires the use of an inductive ammeter to read current draw and a volt meter to monitor battery voltage during the test.

**⚠ WARNING**

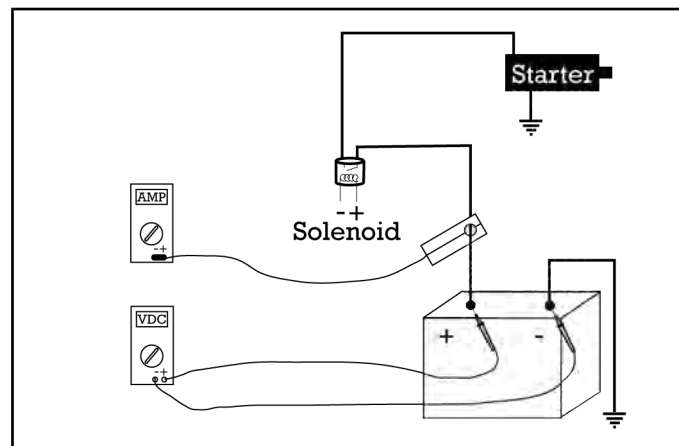
**Do not allow any part of the jumper cable clamp to touch the chassis or any other ground.**

**⚠ CAUTION**

Disable the ignition system so that the engine will not start during this test.

- Remove spark plug caps.
- Install test spark plugs into plug caps.
- Ground spark plugs against engine.

1. Inspect the battery. Charge or replace battery as necessary before proceeding.
2. Place transmission in neutral.
3. Position an inductive ammeter clamp on battery positive cable.
4. Set the multi meter to **Volts DC** scale and connect red lead of meter to positive post of battery.
5. Connect black lead of meter to negative post of battery.



6. Press the power button to power up the electrical system and observe ammeter. It should register negative amps. If it does not, turn the ammeter probe around.
7. Place the engine STOP/RUN switch in the RUN position, transmission is in neutral, clutch lever pulled in and that the ignition system is disabled.

## ELECTRICAL

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8. Press starter switch and crank starter for about 5 seconds and observe both meters and the tachometer.
9. The battery voltage should remain above 9.6 volts.
10. The amperage draw of the starter should not exceed 160 amps.

Starter current draw @ 77°F (25°C): ≤160 Amps

### **STARTER CLUTCH REMOVAL**

1. Reference **ACG Cover Removal / Installation page 10.34**.

### **GEAR POSITION SWITCH TEST**

Symptoms of a faulty gear position switch may include:

- Starter motor does not operate when transmission is in neutral,

#### **BUT**

- Starter motor does operator when the clutch is pulled in.

1. Access the gear position switch electrical connector. Reference **Gear Position Switch Replacement page 10.165**
2. Place the ignition switch in the RUN position to power up the electrical system.
3. Place engine stop switch in the RUN position.
4. Shift transmission into Neutral.
5. Observe Neutral indicator light.
6. If indicator is not lit with transmission in neutral:
  - Place the RUN/STOP switch in the STOP position and turn motorcycle power off.
  - Roll the motorcycle forward and back enough to verify that it is in neutral.
7. Backprobe the connector and view voltage with a multi-meter.

LETTER	WIRE COLOR	FUNCTION
A	RED	VCC
B	BLUE	GROUND
C	BLACK	GEAR

8. Compare the voltage of each gear with the table below.

GEAR	VOLTAGE RANGE
1	0.40–0.72 V
N	0.91–1.09 V
2	1.29–1.52 V
3	1.93–2.13 V
4	2.68–3.05 V
5	3.40–3.77 V
6	4.12–4.52 V

**IMPORTANT**

Voltage can also be read in digital wrench.

9. If any of the readings are not within the specified parameters, replace or repair wiring as necessary.

**CHARGING SYSTEM SERVICE**

**ACG COVER REMOVAL / INSTALLATION**

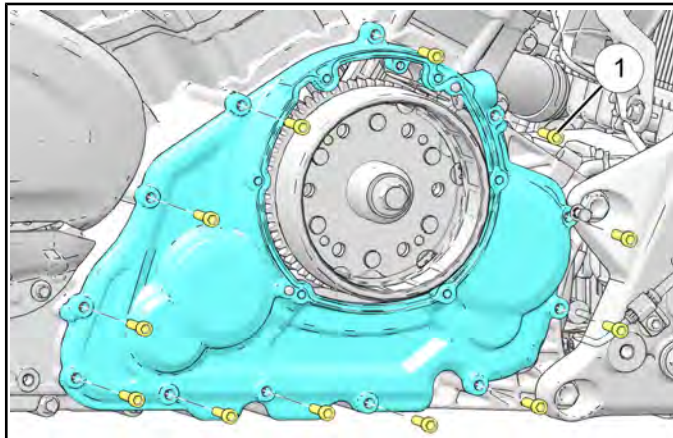
**REMOVAL**

1. Remove the RH floorboard / master cylinder assembly and move out of the way. See **Floorboard Removal / Installation page 7.29**.

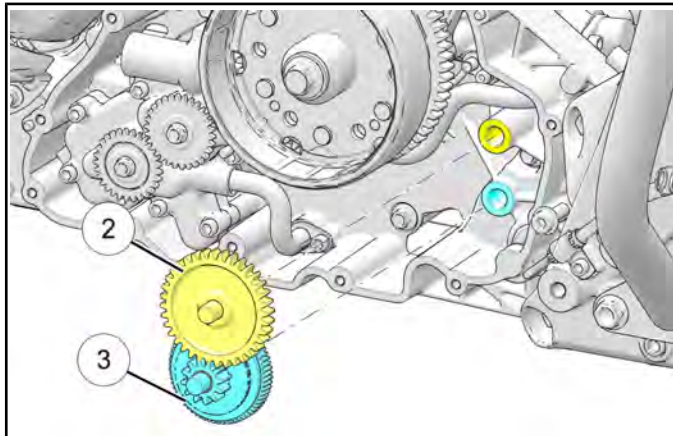
**NOTICE**

The RH floorboard and rear brake master cylinder can be removed as an assembly. It is not necessary to disconnect the brake line from the master cylinder while performing this procedure.

2. Remove exhaust headpipe. See **Headpipe Removal / Installation page 3.112**
3. Remove stator. See **Stator Removal / Installation page 10.34**
4. Remove ACG cover by removing its fasteners ①.



5. Remove starter idler gear ② and starter drive gear ③.



**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Clean gasket mating surfaces and install cam chain cover using a new gasket.
3. Torque cam chain cover fasteners following the specified torque sequence.

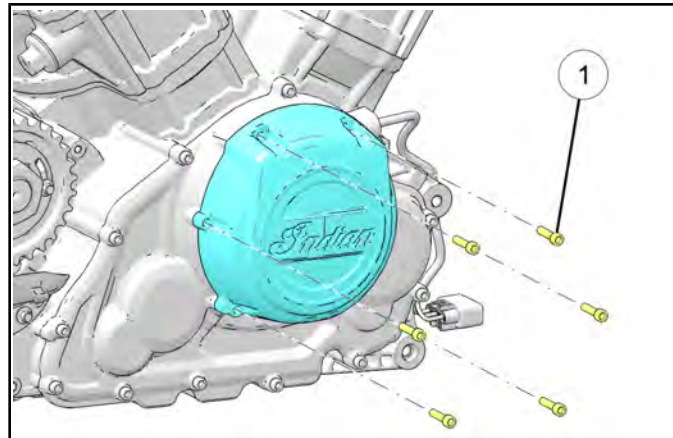
**TORQUE**

ACG Cover Fasteners:  
**84 in-lbs (10 N·m)**

**STATOR REMOVAL / INSTALLATION**

**REMOVAL**

1. Remove stator cover by removing its fasteners ①.

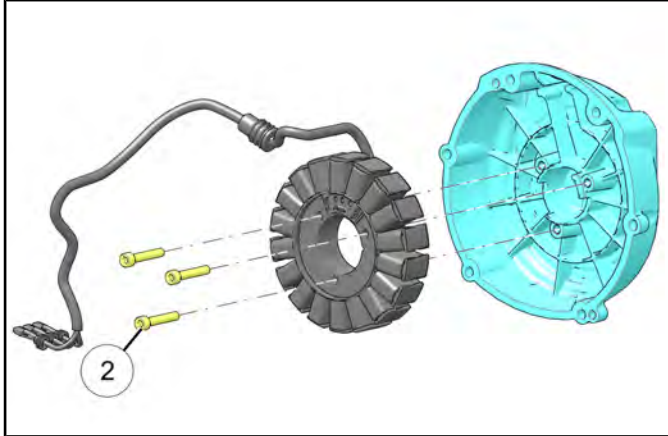


2. Using a flat head screwdriver or similar tool, remove the terminal retainer from the back of the stator connector.
3. Remove the stator assembly with the cover.

**IMPORTANT**

Route the stator wiring through the inner ACG case during removal.

4. Remove stator fasteners ② and remove stator from the cover.



### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Stator Fastener:  
**84 in-lbs (10 N·m)**

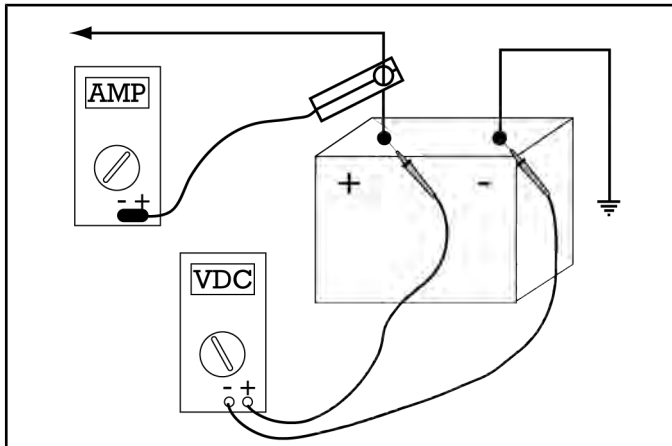
#### TORQUE

Stator Cover Fastener:  
**84 in-lbs (10 N·m)**

**REGULATED VOLTAGE / AMPERAGE OUTPUT INSPECTION (ALL MODELS)****NOTICE**

This procedure requires the use of an inductive ammeter to read current draw and a volt meter to monitor battery voltage during the test.

1. Place the inductive ammeter over the positive (+) battery cable. Reference **Battery Removal page 10.15**.
2. Set multi meter to V DC scale.
3. Connect voltmeter red (+) lead to battery red (+) lead and black (-) voltmeter lead to battery black (-) lead.



4. Start engine and warm to operating temperature.
5. At 1000 RPM or slightly above; the ammeter should reach the "break-even" point (no amperage leaving the battery) and the voltmeter should be rising toward 14 VDC.

Specification: Break-even point for charging System:  
1500 RPM  $\pm$  25%

6. Increase engine RPM to 2500. The ammeter should rise a slight amount, then stabilize. Volt meter should read above 14 V DC.

7. Use results obtained from preceding tests and the following descriptions to determine if charging system is functioning properly.

**CHARGING SYSTEM OPERATING**

**CORRECTLY:** Ammeter goes up a small amount, then stabilizes slightly above +0 amps. Volt meter rises toward 14.8  $\pm$  V DC, drops off a little and starts to stabilize.

**LOW BATTERY:** Amperage continues to rise, voltage levels off as battery is absorbing voltage. Charging system may be okay. Need to charge battery fully or use a good battery and repeat test. Meters will indicate similar reading to the overcharging chart.

**CHARGING SYSTEM UNDERCHARGING:** Ammeter drops to 0 or remains below 0 (negative reading) at all rpm, volt meter remains the same or goes down. Go to voltage drop inspection.

**CHARGING SYSTEM OVERCHARGING:** Ammeter rises well above 0 and remains there or continues to rise. Volt meter goes well above 14.8 V DC and may continue to rise.

**EXCESSIVE LOAD:** Current levels off or starts to drop, voltage continues to rise. Load may be excessive (accessories or shorted components). Determine if excessive loads are present. Disconnect accessories and re-test.

8. Turn ignition key off.
9. Remove inductive ammeter clamp.

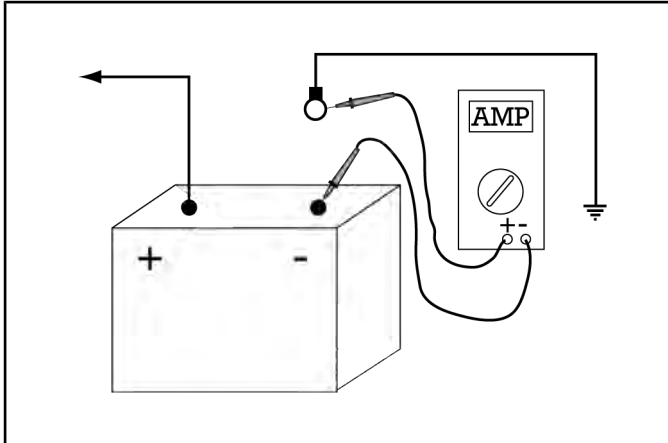
**CURRENT DRAIN INSPECTION****IMPORTANT**

Current drain should only be measured after all systems have timed out and gone to sleep. Leave power OFF and do not disturb for approximately **12 MINUTES** for an accurate reading.

Current drain is suspect if battery discharges when motorcycle is not in operation (short periods of storage).

1. Disconnect ground cable (-) from battery. Reference **Battery Removal page 10.15**.

- Set multi meter to read milliamps (mA) and insert meter leads into appropriate jacks. Connect red meter lead to ground cable eyelet and connect black meter lead to battery negative (-) terminal.

**NOTICE**

Do not operate electric starter or meter fuse will be damaged.

- With ignition switch off, **and after 12 minutes have passed**, read current drain.
- If current drain exceeds specifications inspect wiring and components for short to ground.

Parasitic Draw Specification (after 12 minutes with power OFF): 2.0 mA

- Locate the faulty component or wiring by disconnecting accessories, wiring connections, and fuses one-at-a-time while observing current drain. When current drain falls within specifications, focus efforts on the last circuit or component that was disconnected.



**STATOR AC VOLTAGE OUTPUT TEST**

**NOTICE**  
Set multi meter to VAC (alternating current). Engine cold. Regulator / Rectifier disconnected (2-pin and 3-pin connector). Engine must be running. Be sure to heed the following Warnings and Cautions.

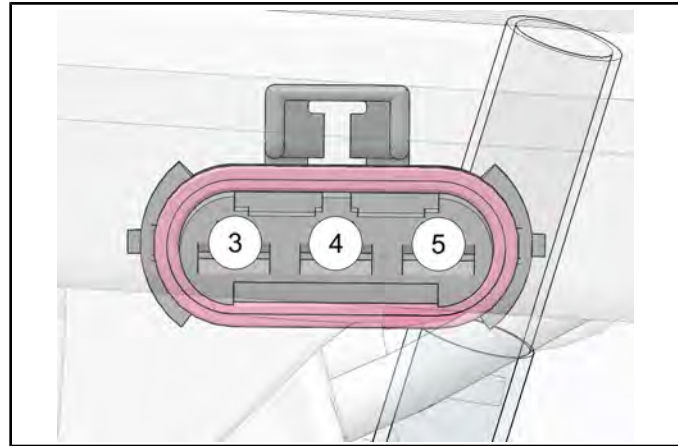
**WARNING**  
**HOT COMPONENTS:**  
The engine and exhaust system become very hot during operation and remain hot for a period of time after the engine is shut off. Wear insulated protection for hands and arms or wait until the engine and exhaust system have cooled sufficiently before working on the machine.

**WARNING**  
**CARBON MONOXIDE:**  
Never run an engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas that can cause loss of consciousness and may lead to death. If you must run the engine to do some repairs, do so in an open area or with an exhaust evacuation system operating.

**CAUTION**  
**VOLTAGE / ARCING:**  
Use caution not to touch any of the connections or allow the exposed terminals to come close to any other part of the vehicle or other objects, as an arc may occur.

1. Disconnect the 3-pin stator connector.
2. Set multi meter to measure AC Volts.

3. Connect one lead of the multi meter to pin A ③ and one lead to pin B ④ on the 3-pin stator connector.



**CAUTION**  
**VOLTAGE / ARCING**  
Use caution not to touch any of the connections or allow the exposed terminals to come close to any other part of the vehicle or other objects, as an arc may occur.

4. Start the engine and let it run at idle. Observe the multi meter reading.
5. The meter should indicate the following readings:

No load AC Volts @ 800 RPM:  
All Models: **22 VAC ±25%**

6. Repeat test for pins A ③ & C ⑤.
7. Repeat test for pins B ④ & C ⑤.

**NOTICE**  
The test results in Steps 6, 7, and 8 can read more than the specified voltage, but it is **important that the reading for each pair of wires is approximately equal.**

8. Increase RPM to 2000. Repeat Steps 4-7.
9. At 2000 RPM the meter should indicate the following readings:

No Load AC Volts @ 2000 RPM:All Models: **40 VAC ± 25%**

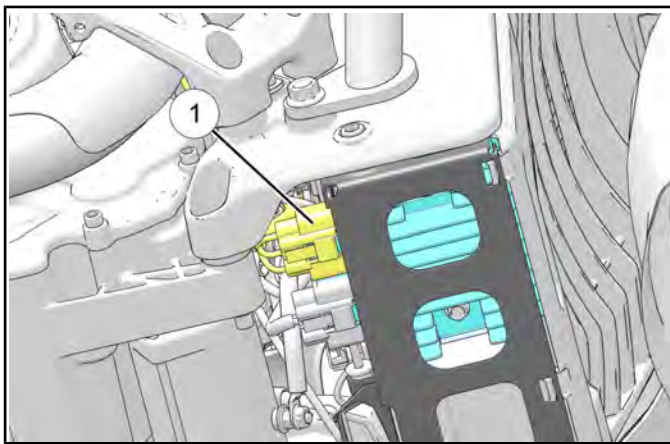
**NOTICE**  
The test results obtained in step 10 can read more than the specified voltage, but it is important that they are all approximately equal.

**STATOR RESISTANCE TEST**

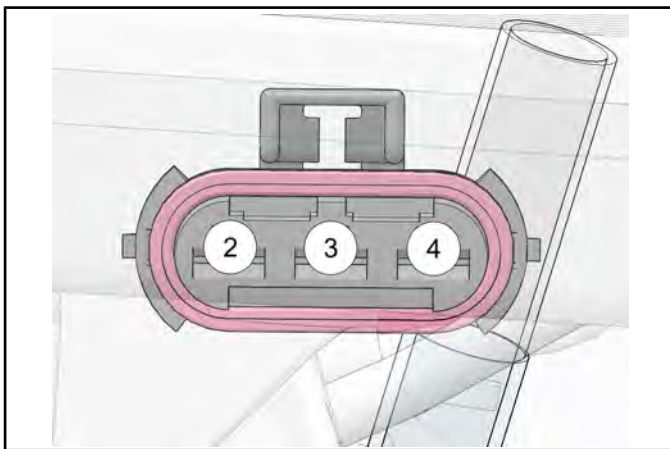
**CAUTION**  
The engine must not be running while performing the following resistance test.

**NOTICE**  
Set multi meter to measure resistance. Engine OFF and cold. Regulator Rectifier 3-pin connector unplugged.

1. Disconnect the stator 3 pin connector ① from the regulator / rectifier.



2. Set the multi meter to measure resistance ( $\Omega$ ) and insert the meter leads in to the appropriate jacks.
3. Connect one meter lead into pin A ② and the other lead into pin B ③ on the stator connector and read resistance value.



Stator Resistance: Less than 1 Ohm

4. Repeat test for pins A ② & C ④.
5. Repeat test for pins B ③ & C ④.

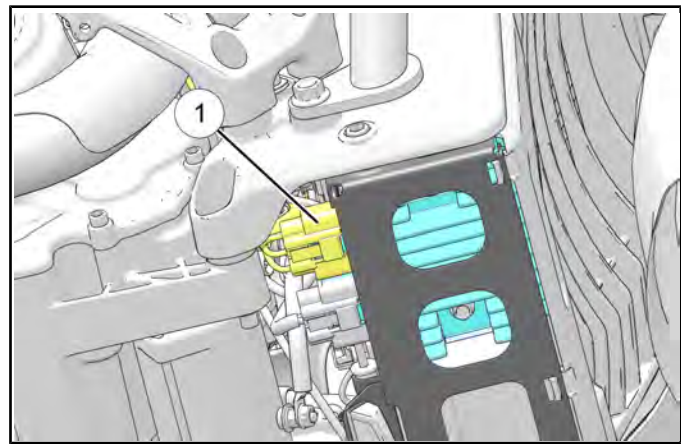
6. If resistance values do not match specification, inspect stator and replace as necessary.

**STATOR WINDINGS TO GROUND INSPECTION**

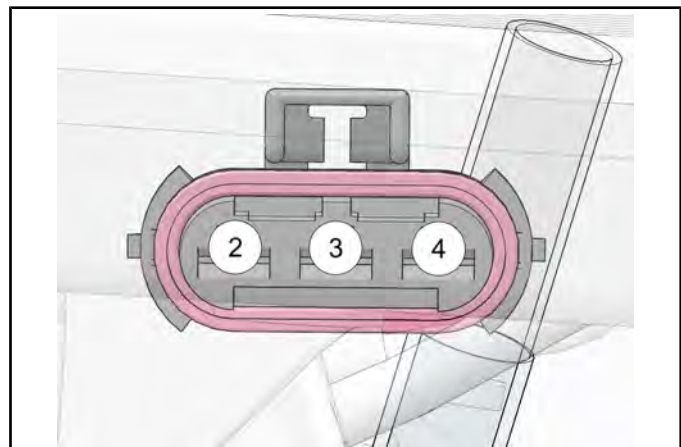
**CAUTION**  
The engine must not be running while performing the following resistance test.

**NOTICE**  
Set multi meter to measure resistance. Engine OFF and cold. Regulator Rectifier 3-pin connector unplugged.

1. Disconnect the stator 3 pin connector ① from regulator / rectifier.



2. Connect one multi meter lead to pin A ② and place the other lead of the multi meter in contact with a good engine ground, observe resistance to ground reading.



Stator to Ground (-) Continuity Specifications: Open Circuit (OL)

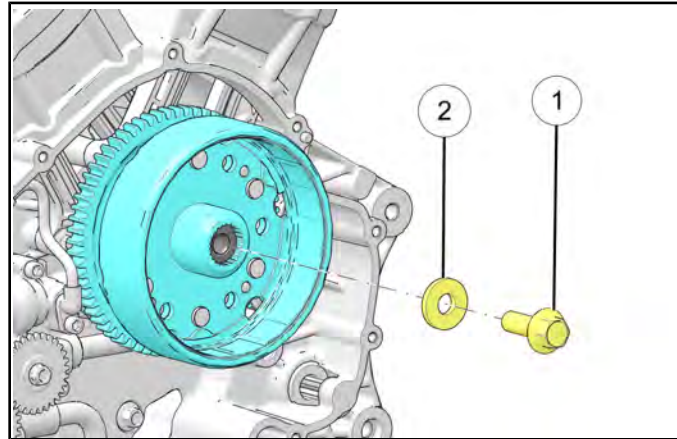
10

3. Repeat test for other two stator leads ③ & ④ to ground.
4. There should be no connection from stator windings to ground.

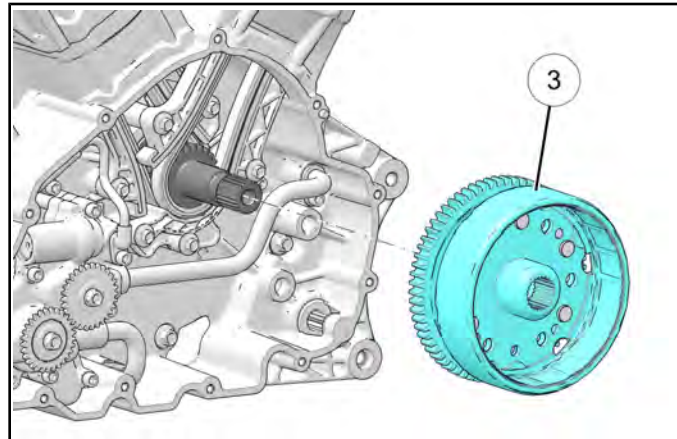
### **FLYWHEEL REMOVAL / INSTALLATION**

#### **REMOVAL**

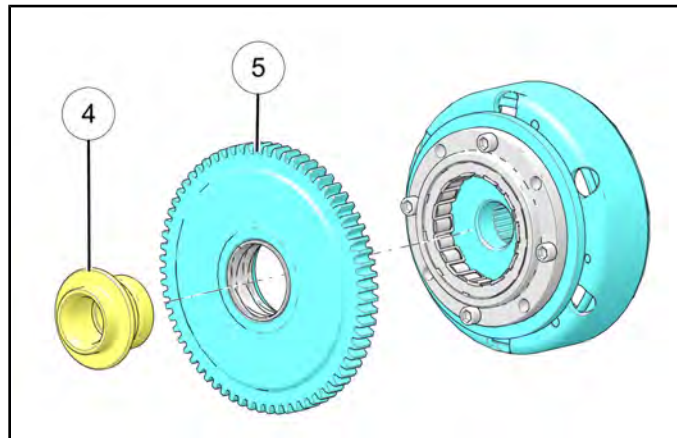
1. Remove stator. See **Stator Removal / Installation page 10.34.**
2. Remove ACG Cover. See **ACG Cover Removal / Installation page 10.34.**
3. Remove flywheel bolt ① and washer ②.



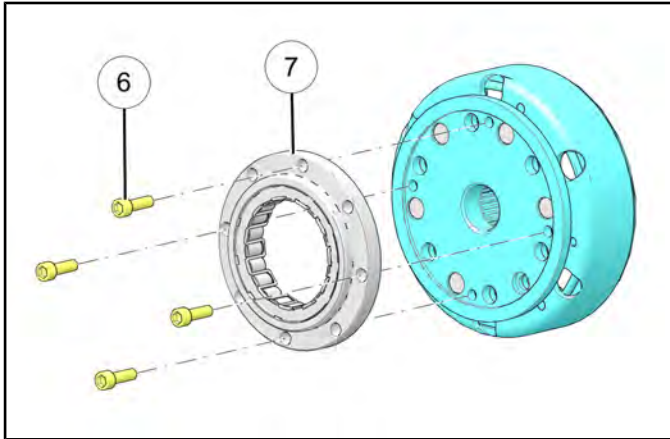
4. Remove flywheel assembly ③.



5. Remove starter/ACG spacer ④.



6. Remove starter clutch gear ⑤.
7. Remove sprag clutch hub ⑦ by removing its fasteners ⑥.



**INSTALLATION**

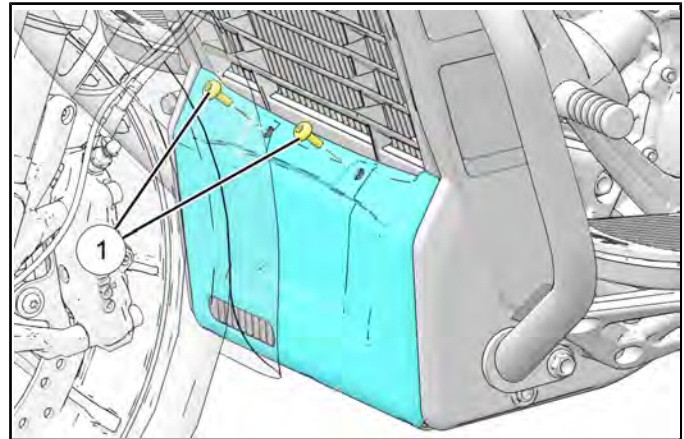
1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Sprag Clutch Hub Fastener <b>84 in-lbs (10 N·m)</b>

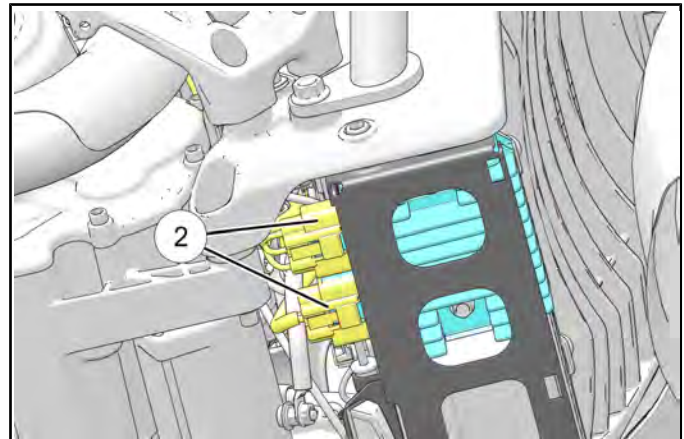
TORQUE
Flywheel Fastener <b>112 ft-lbs (152 N·m)</b>

**REGULATOR / RECTIFIER REPLACEMENT**

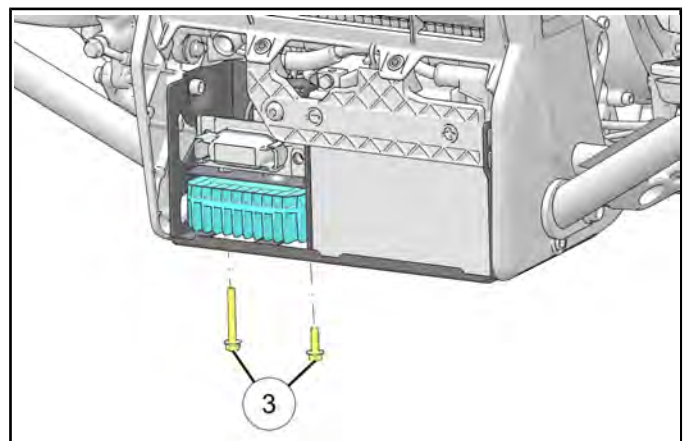
1. Remove chin fairing by removing its fasteners ①.



2. Disconnect the regulator / rectifier electrical connectors ②.



3. Remove the regulator / rectifier fasteners ③



4. Remove the regulator / rectifier from the battery box.

10

## ELECTRICAL

### 5. INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.

#### TORQUE

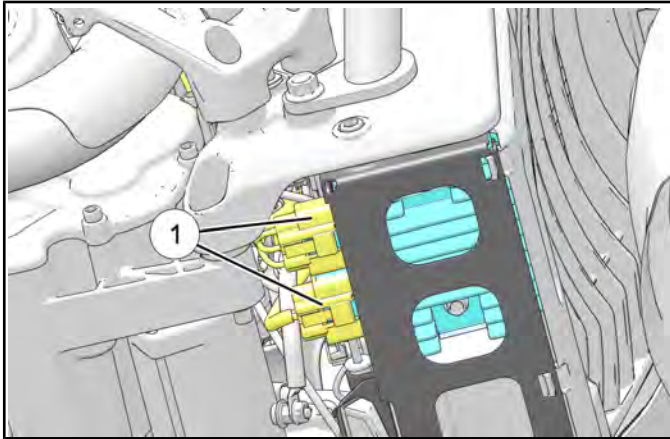
Regulator/Rectifier Fastener:  
**84 in-lbs (10 N·m)**

#### TORQUE

Chin Fairing Fastener  
**36 in-lbs (4 N·m)**

### RECTIFIER / REGULATOR CONNECTOR INSPECTION

1. Disconnect both connectors ①.



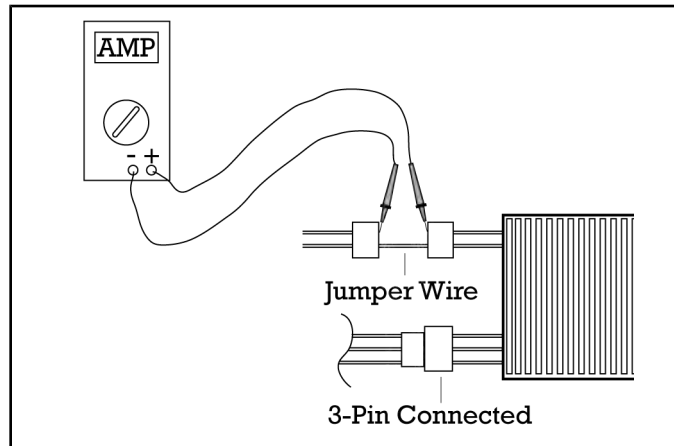
2. Inspect male and female pins in the 3-pin connector and the 2-pin connector carefully. Check for corrosion, loose pins, poor connections, or evidence of overheating or other damage.
3. If the wiring and connectors are undamaged and appear to be clean and tight, inspect the battery, stator, and related wiring. Test the regulator / rectifier for diode leakage.

### DIODE LEAKAGE TEST

#### IMPORTANT

Engine must be OFF. Perform this test at the regulator / rectifier 2-Pin connector. Testing at any other point (between battery and battery cable for example) could include leakage not attributable to the Regulator / Rectifier unit.

1. Disconnect the 2-pin connector at voltage regulator / rectifier unit.
2. Install a jumper across the connectors as shown for the Bk wire to provide a complete ground path.
3. Connect meter as shown, with red (+) meter lead to the RD / BK wire on harness side, and the black meter lead to the RD / BK wire on the regulator / rectifier side.



4. Compare leakage to specification below.

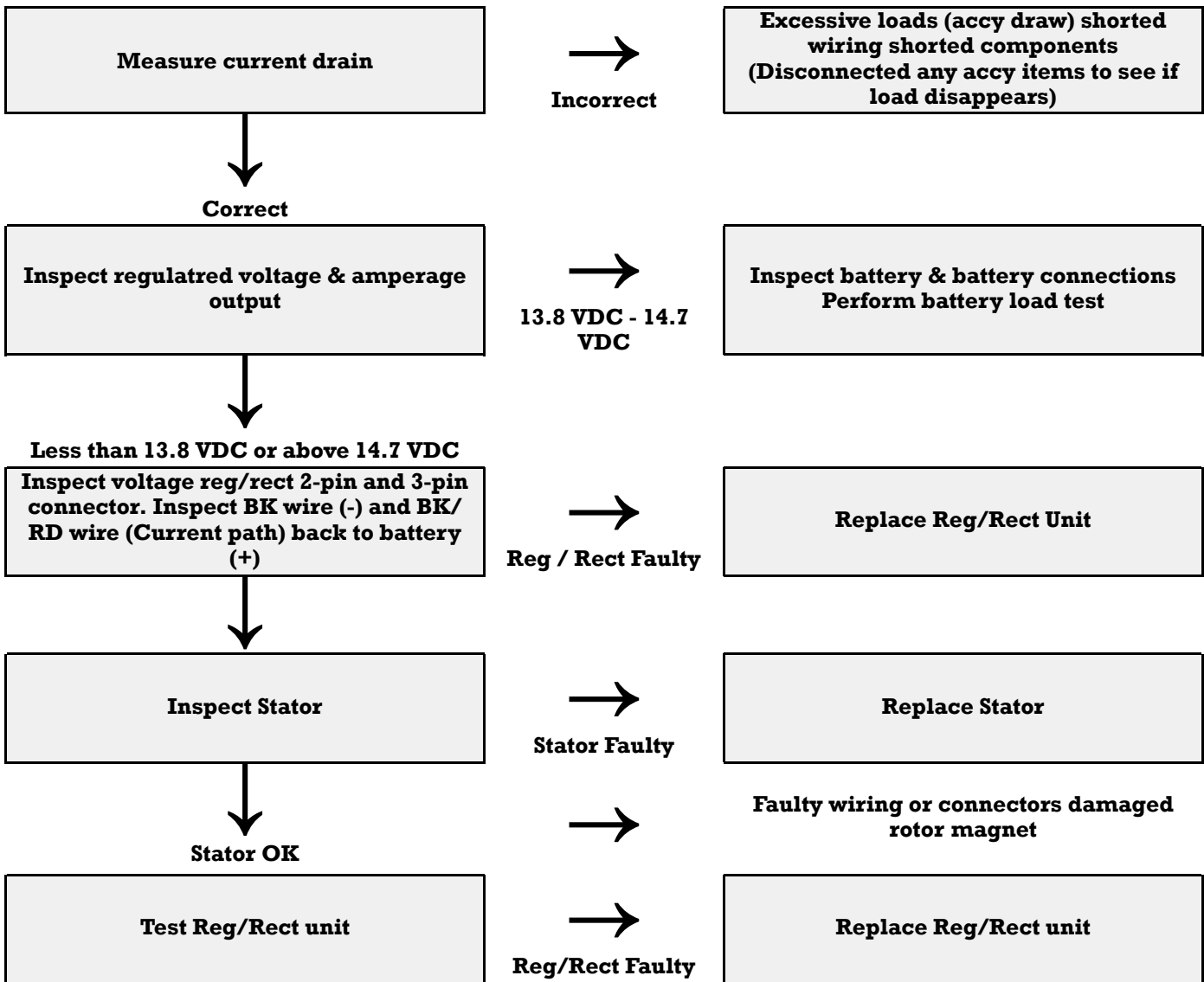
#### Specification

**Leakage: Less than 1.0 mA**

**TROUBLESHOOTING, CHARGING SYSTEM**

**NOTICE**

The battery must be fully charged and in good condition to obtain accurate readings. Battery charging current is automatically reduced by the regulator / rectifier if the regulator / rectifier unit reaches a critical temperature (overheated). The system should be cool when testing DC charging output or when testing the regulator / rectifier to ensure accurate readings. Refer to test procedure for individual charging system components for more information.

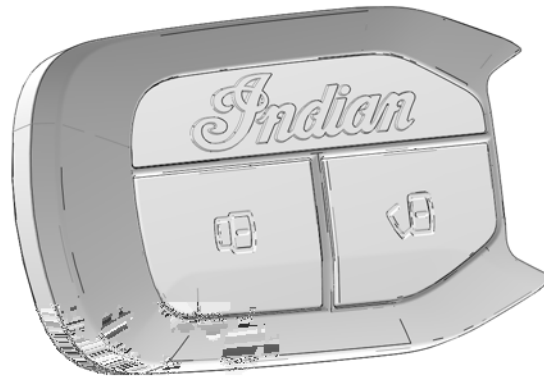


## KEY FOB

### KEY FOB OVERVIEW

Indian Challenger motorcycles utilize a keyless ignition system (Key Fob) for vehicle startup and operation. The Key Fob acts as a two-way transmitter which provides an authentication signal to the Wireless Control Module (WCM) located on the motorcycle. When the Key Fob is detected, the ignition system is enabled and the motorcycle becomes operational.

**Challenger** models equipped with electronically lockable storage utilize a multi-function Key Fob which, in addition to authentication, allows the user to remotely lock and unlock the saddlebags and/or trunk. Models have an integrated Alarm / Immobilizer feature which is armed and disarmed using the Multi-Function Key Fob.



## KEY FOB OPERATION AND PROGRAMMING

### Key Fob Operation:

- When the electrical system is activated using the power or starter switch, the key fob must be within range.
- If the key fob is not detected:
  - The security light and/or power switch will stay on solid for 70 seconds then flash for 10 seconds before shutting down.
  - The PIN can be entered using the display to unlock the security system.
  - The electrical system will automatically shut down. The starter motor will not engage during this time.

### Entering a Security System PIN

To change your PIN, you must have either the key fob or your existing valid PIN available to gain access to the security system. If the key fob is not detected or is not available and you cannot remember your PIN, please see your INDIAN MOTORCYCLE dealer.

Please read the entire procedure before beginning.

1. Turn the power switch on. Do NOT start the engine. The security light and/or power switch will turn on briefly until the key fob is detected or until the valid, current PIN is entered.
2. Push or hold the turn signal CANCEL switch for 10 seconds until the security light and/or power switch turn on.

#### NOTICE

On models with Infotainment Display, a pop-up window will appear during this procedure stating that the key fob is out of range.

3. Enter either the master PIN or your current 4-digit rider PIN within 20 seconds. If the PIN is successfully entered, the security light and/or power switch will remain on and the horn will sound briefly.

#### IMPORTANT

If the valid PIN is not entered within 20 seconds, the security light and/or power switch will flash for 10 seconds, then the system will shut down. Return to step 1 to try again.

4. Enter a new 4-digit security PIN of your own choosing. If the PIN is successfully entered, the security light and/or power switch will remain on and the horn will sound briefly. Proceed to step 5.

#### IMPORTANT

If the 4-digit PIN is NOT successfully entered within 20 seconds, the security light and/or power switch will flash for 10 seconds, then the system exits the procedure. Return to step 1 to try again.

5. Re-enter the new 4-digit PIN. If this entry matches the first entry, the security light and/or power switch will turn off and the horn will sound briefly. The new rider PIN has been saved. *Record your new rider PIN.*

#### IMPORTANT

If the second entry is not entered within 20 seconds or does not match the first entry, the security light and/or power switch will flash for 10 seconds, then the system exits the procedure. The new PIN was NOT saved. Continue to use your former valid PIN. Return to step 1 to try again.

### Driving Key Fob Operation:

- After starting the engine, the Wireless Control Module (WCM) will verify that the key fob is within range again when shifting from neutral into gear. The security light will flash once during this check.
- The WCM will not search for the key fob again as long as the engine continues running. If the key fob is lost during riding, the operator will need to enter their PIN to restart the vehicle.
- If the key fob is not detected when shifting into gear:
  - The engine will turn off. The security light and/or power switch will flash.
  - The electrical system will then automatically shut down.

### Saddlebag Key Fob Operation:

- If equipped with electric saddlebag locks, the locks can be controlled by either the key fob or the lock switch on the console.
- When using the console lock switch, the key fob must be within range.
- If the key fob is not detected:
  - The power switch will flash.
  - The system will not perform the lock or unlock procedure.

### Programming the Key Fob:



## ELECTRICAL

Programming the key fob can only be done by the dealer and must be done using Digital Wrench®. A single key fob can be programmed to multiple motorcycles. One motorcycle can have up to 4 key fobs programmed to the WCM.

Programming Procedure:

1. Connect Digital Wrench® and turn power switch to "ON" position. Do NOT start the engine.
2. In Digital Wrench®, select "Special Tests" (Red Toolbox) , next select "#4: Key fob Maintenance".



3. Select "Continue." Digital Wrench® will then read the WCM information for key fob.



4. The Key fob Settings menu will then display the original and current key fob(s) programmed to the WCM.



5. To change or add a new key fob number, type in the 10 digit number under "New Value" and then select "Write New".

### NOTICE

When adding additional key fobs, all current and additional key fobs must be present.

6. If a key fob number is to be cleared out, type "0" into "New Value" cell of desired key fob and select "Write New".

### NOTICE

At least one key fob must be programmed to the motorcycle at all times

**KEY FOB AUTHENTICATION**

Four things must occur for the WCM to authenticate the Key Fob and enable the motorcycle for operation:

1. Motorcycle battery is sufficiently charged for normal vehicle operation.
2. Key Fob must be within range of WCM receiver (within **6 feet** of motorcycle)
3. Key Fob battery must have sufficient voltage.
4. Key Fob PIN is properly paired with motorcycle WCM (Digital Wrench)

Authentication Tell Tales

**SUCCESSFUL:**

- Security Light turns OFF
- Motorcycle Starts / Runs

**UNSUCCESSFUL:**

- Electrical system shuts down after 70 seconds
- Security Light / Power Button flashes 2x's per second for 10 seconds
- Horn honks every 5 seconds after startup
- Motorcycle DOES NOT Start / Run

Reference **Key Fob Troubleshooting page 10.47**.

**KEY FOB TROUBLESHOOTING**

1. Test Key Fob Battery (preliminary test).
  - a. **Two-Button Fob** – Press LOCK / UNLOCK button and verify that red LED illuminates.
  - b. Measure fob battery voltage with DVOM. If voltage measures less than 3.0VDC, replace battery. Does LED illuminate?  
 YES — Proceed to STEP 2  
 NO — Replace Key Fob

**NOTICE**

If battery is low and the bike is powered on, the LED on the key fob will flash multiple times. If the battery is at a acceptable level, it will flash once.

2. Test Key Fob Range (indicates Key Fob battery condition).
  - a. Hold the Key Fob 8-12 inches from the motorcycle seat; press the POWER button to energize the electrical system.
  - b. Verify that Key Fob LED flashes within 1 second. Does it flash?  
 YES — Proceed to STEP 2c  
 NO — Replace Key Fob battery and retest. If LED still does not flash, proceed to STEP 3
  - c. Move the Key Fob away from the seat in 1 foot increments and verify that the LED flashes when the motorcycle is energized up to 2-3 feet. Does the range test pass?  
 YES — Perform STEPS 3a-3b. No further action required.  
 NO — Verify motorcycle battery voltage is at least 11.5VDC. If voltage is LOW, charge the battery. If voltage is acceptable, proceed to STEP 4.

**NOTICE**

If key fob is suspect for decreased range, learn in new key fob and repeat STEP 2.

Normal Range: Up to 2-3 feet.  
Cannot be closer than 8 inches

3. Verify Key Fob and VCM are paired.
  - a. Connect motorcycle to Digital Wrench.
  - b. Verify VCM software is up-to-date.
  - c. Select the 'Special Tests' menu.
  - d. Select 'Key Fob Maintenance'.

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- e. Verify correct Key Fob ID is present.
- f. Click 'Write'.
- g. Repeat STEPS 2a-2b. Does Key Fob authenticate?

**YES** — No further action required.

**NO** — Verify motorcycle battery voltage is at least 11.5VDC. If voltage is **LOW**, charge the battery. If voltage is acceptable, learn in a second known good key fob and repeat STEPS 2a-2b.

4. Test WCM Receiver Antenna.

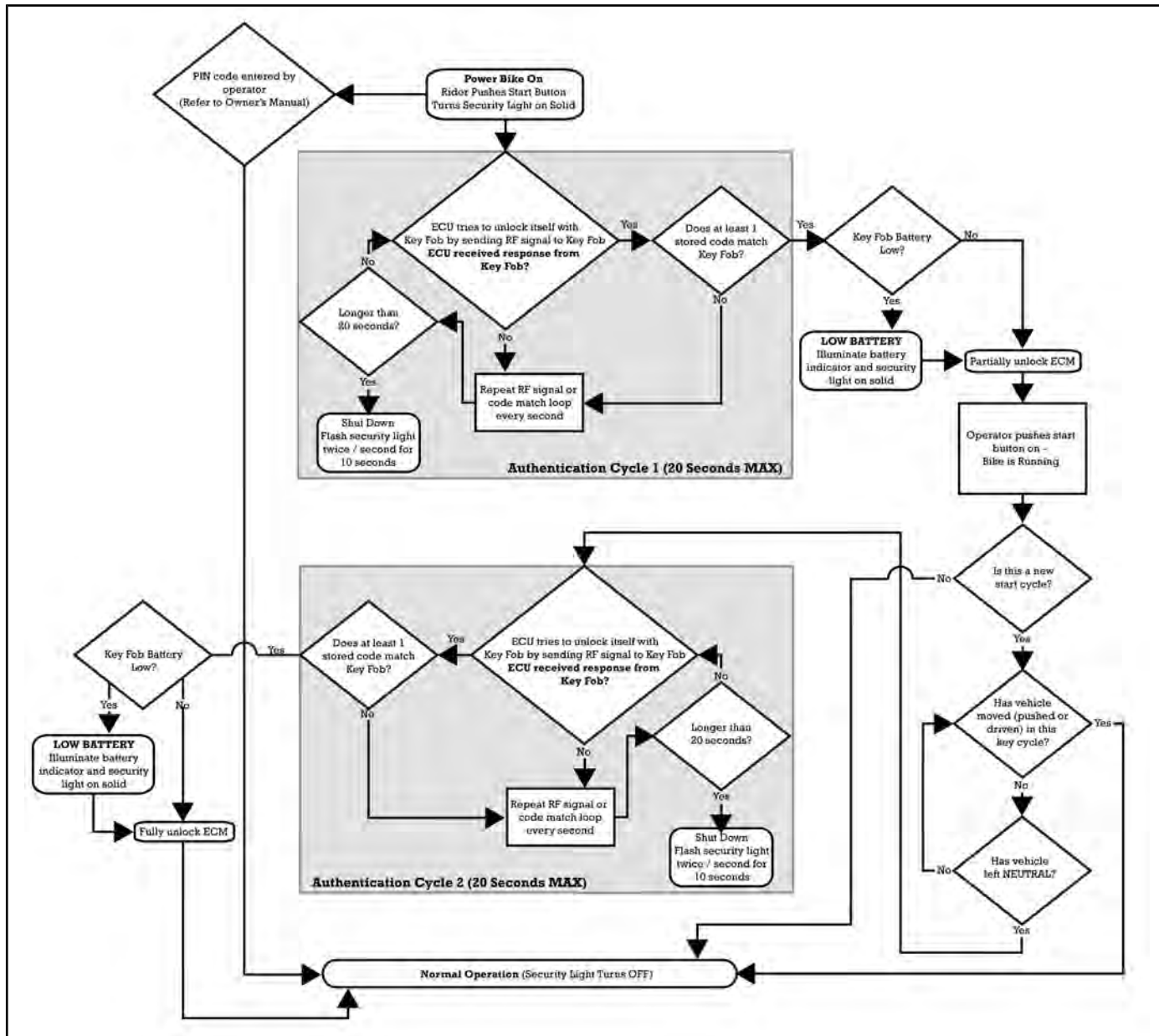
- a. Inspect the 21 kHz 2-wire antenna (on top of WCM) using a DVOM. Pin 10 is Antenna OUT B; Pin 11 is Antenna OUT A.

<b>SPECIFICATION</b> 320 mΩ
--------------------------------

- b. Does antenna test within specification?

**YES** — Replace WCM

**NO** — Contact Indian Motorcycle Technical Service.



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**ALARM SYSTEM OVERVIEW**

2020 Indian Challenger models have incorporated an Alarm / Immobilizer feature which can be activated using the multi-function (two button) key fob. This feature can be used if the multi-function key fob (PN:4017761) is purchased and paired with the WCM.

**Alarm System Operation**

To Activate the Alarm:

- Press the LOCK button on the Key Fob 2 times.
- The horn will sound briefly to confirm that the alarm is activated.

**To Deactivate the Alarm (Key Fob must be within range):**

- Press the UNLOCK button on the Key Fob. **OR**
- Press the power button on the console panel. **OR**
- Press the starter button. **OR**
- Press the LOCK / UNLOCK switch on the right side of the fairing. **OR**
- Move the motorcycle to the fully upright position from leaning on the sidestand. (The horn will sound repeatedly if the Key Fob is not detected within 5 seconds.)

**IGNITION SYSTEM**  
**GENERAL INFORMATION**

**SERVICE NOTES – IGNITION SYSTEM**

There are many hazards present when working on or around the ignition system. Read and pay close attention to the following warnings and cautions when working on any component in this section.

**⚠ WARNING**

Never run an engine in an enclosed area. Exhaust contains poisonous carbon monoxide gas that can cause loss of consciousness and may lead to death. If you must run the engine to do some repairs, do so in an open area or with an exhaust evacuation system operating.

**⚠ WARNING**

The engine and exhaust system become very hot during operation and remain hot for a period of time after the engine is shut off. Wear insulated protection for hands and arms or wait until the engine and exhaust system have cooled before working on the machine.

**⚠ CAUTION**

Some procedures call for the engine to be run in order to warm the engine to operating temperature. If this is done the exhaust pipes can “blue” if a cooling air stream is not provided by means of a shop fan directed the exhaust system.

**⚠ CAUTION**

Parts containing semi-conductors can be easily damaged if handled carelessly. Do not drop or subject the electronic components to shock loads.

**⚠ CAUTION**

Follow the instructions closely when troubleshooting items in this section. Some electrical components can be damaged if they are connected or disconnected while the ignition is powered ON and current is present.

**⚠ CAUTION**

Using incorrect heat range spark plugs can damage the engine. Always follow the manufacturer’s recommendations for spark plug heat range.

**GENERAL PRECAUTIONS**

- This ignition system is controlled electronically and no provisions are available to inspect or change ignition timing. A timing light is still valuable as a diagnostic tool.
- Poor connections are the most common cause of ignition problems. Inspect all connections and replace the spark plugs before doing extensive ignition system troubleshooting.
- Make sure the battery is fully charged and that the charging system is operating correctly.
- A signal from the Crankshaft Position Sensor must be present at the ECM for spark to occur.

**SPECIAL TOOLS – IGNITION SYSTEM**

SPECIAL TOOL	PART NUMBER
Electrical Tester Kit	PV-43526
Digital Multimeter	Commercially Available
Inductive Timing Light	Commercially Available

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

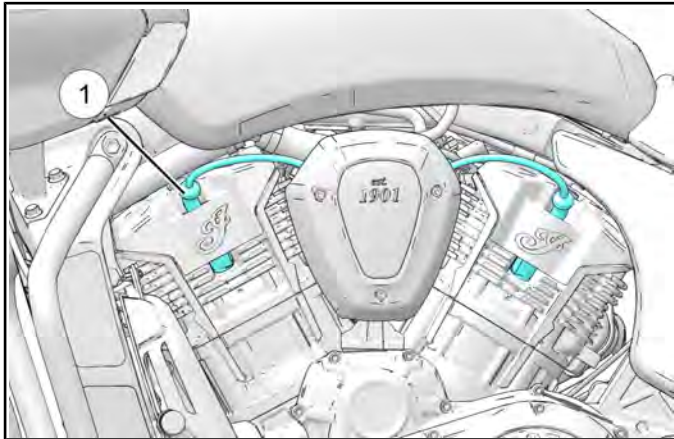
**SERVICE SPECIFICATIONS – IGNITION SYSTEM**

ITEM	SPECIFICATIONS	
Spark Plug	NGK LZMAR8AI-1	
Spark Plug Gap	0.039 in (1.0 mm)	
Ignition Coil / Cables Resistance Values	Primary	0.58 Ohms ± 10%
	Secondary	See coil test
	Plug Wire (with cap and boot*)	8360 Ohms ± 20%
Crank Position Sensor Resistance	1050 Ohms ± 10% @ 68°F (20°C)	
* Spark plug end caps are not removable		

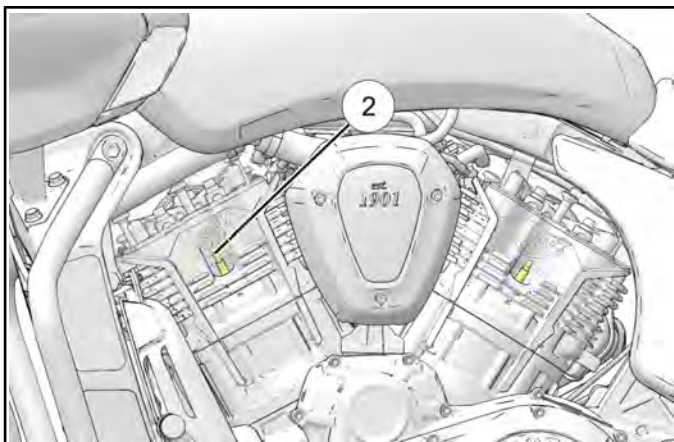
**SERVICE****SPARK PLUG REMOVAL****⚠ CAUTION****HOT COMPONENTS**

Wear insulated gloves and/or allow engine and exhaust to cool before handling these parts.

1. With the engine at room temperature, grasp the spark plug boot ① and rotate back and forth slightly to release from the spark plug. DO NOT pull on the wire or spark plug wire may be damaged.



2. Grabbing only the base of the spark plug boot, pull straight out of spark plug well.
3. Clean out spark plug wells with compressed air to remove any loose dirt or debris.
4. Using a 3" extension and a 5/8" spark plug socket, remove spark plugs ②.

**SPARK PLUG INSPECTION / GAP****⚠ CAUTION**

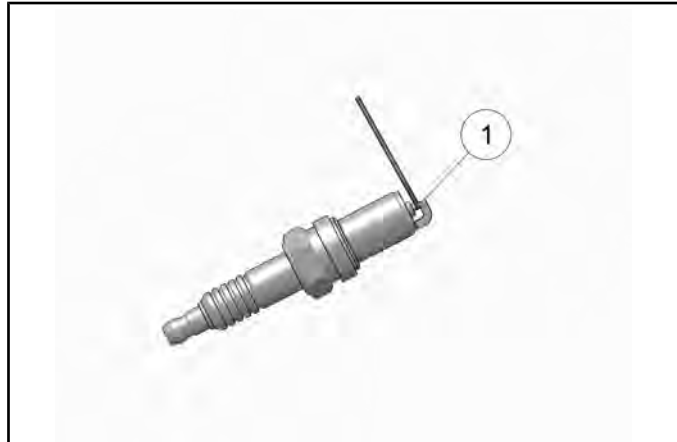
A hot engine can cause serious burns. Allow engine to cool or wear protective gloves when removing the spark plugs.

1. Remove spark plugs. See **Spark Plug Removal page 10.51**.
2. Inspect electrodes for wear and carbon buildup. Look for a sharp outer edge with no rounding or erosion of the electrodes.
3. Clean with electrical contact cleaner or a glass bead spark plug cleaner only.

**⚠ CAUTION**

A wire brush or coated abrasive (sandpaper) should not be used to clean electrodes.

4. Measure electrode gap with a wire gauge ①. Adjust gap if necessary by carefully bending the grounding electrode until the specified gap is achieved.



**Spark Plug Type:**  
NGK LZMAR8AI-1

**Spark Plug Gap:**  
0.039 in (1.0 mm)

**10**

### SPARK PLUG INSTALLATION

1. Inspect spark plug gap with a wire gauge. If gap adjustment is necessary, bend ground electrode carefully using a spark plug gap tool.

**Spark Plug Type:**  
NGK LZMAR8AI-1

**Spark Plug Gap:**  
0.039 in (1.0 mm)

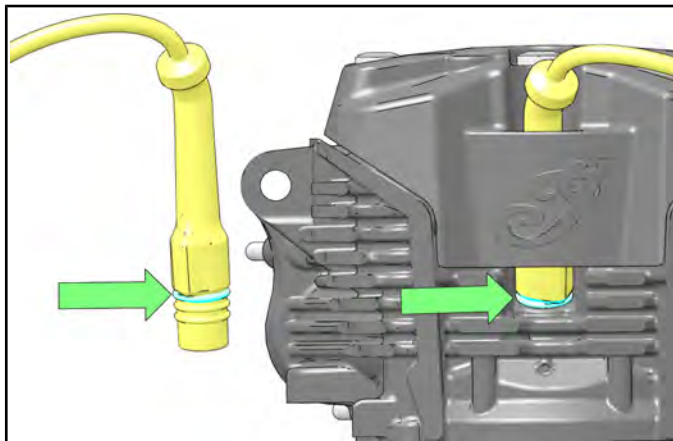
2. Apply anti-seize compound sparingly to spark plug threads, avoiding the bottom 2 - 3 threads.
3. Torque spark plugs to specification.

**TORQUE**  
Spark Plug:  
**84 in-lbs (10 N·m)**

**⚠ CAUTION**  
Do not over tighten spark plugs. Damage to the cylinder head or spark plug may result.

4. Install spark plug wire boots securely over the plugs.

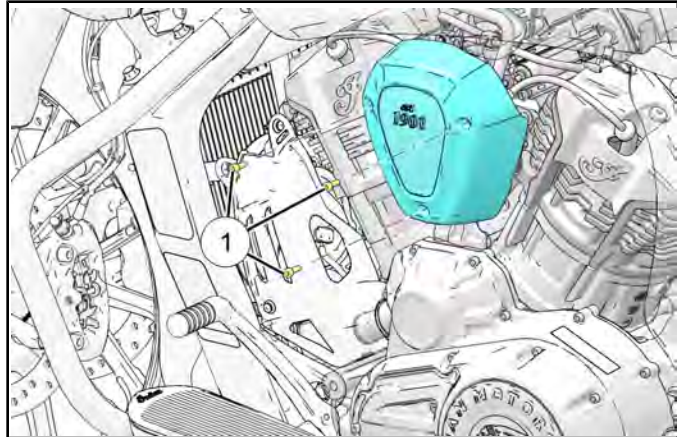
**IMPORTANT**  
The spark plug boot is fully seated when the third rib on the boot is level with the spark plug hole as shown.



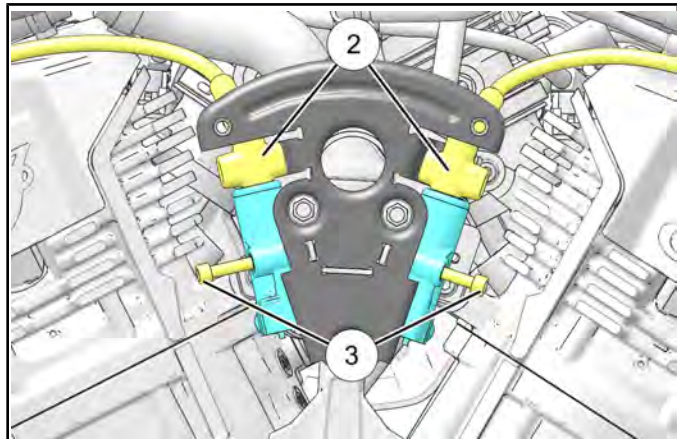
### IGNITION COIL REMOVAL / INSTALLATION

#### REMOVAL

1. Verify that motorcycle is not powered up and the STOP / RUN switch is in the OFF position.
2. Remove left side v-cover by removing its fasteners ①.

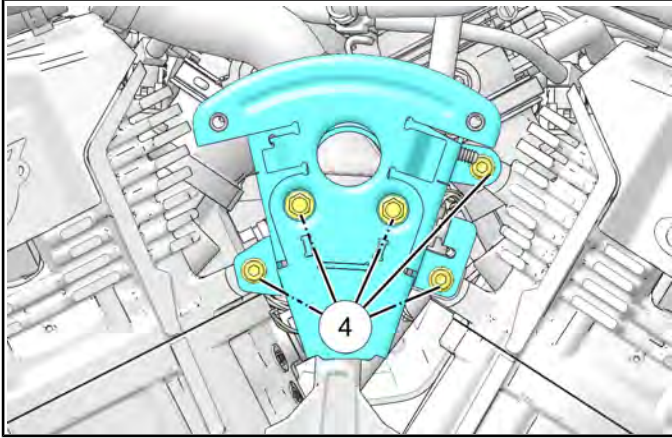


3. On the back side of the ignition coils, disconnect the electrical connector.
4. Disconnect spark plug wires ②.



5. Remove fasteners securing ignition coils ③.

6. Remove ignition coil bracket fasteners ④.



### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Ignition Coil Bracket:  
**84 in-lbs (10 N·m)**

#### TORQUE

Ignition Coil Fastener:  
**84 in-lbs (10 N·m)**

#### TORQUE

V-Cover Fastener:  
**84 in-lbs (10 N·m)**



## TROUBLESHOOTING

### BASICS

Before troubleshooting the ignition system, ensure that the engine STOP/RUN switch is in the RUN position, the battery is fully charged, and system related fuses are not open (blown). Check visually for corroded, loose, or broken connections in critical areas (e.g. sensor connector). Check for loose wire pins in the individual sensor connectors and at the ECM (beneath the battery box).

#### Don't forget the spark plugs!

The Ignition System Troubleshooting flow chart (and the accompanying text) is designed to help you troubleshoot ignition system problems. It will not lead you to faulty or fouled spark plugs. Always inspect spark plug condition *first* (and replace if necessary) when troubleshooting ignition system problems.

Be sure that the spark plugs are the correct heat range and are the correct size specification.

 **WARNING**

Extremely high voltage is present in the ignition system. Do not touch the ignition coil, wires or spark plugs during test procedures.

### TEST LEAD ADAPTER KIT

1. Tests in this section may include the testing of voltage and / or resistance at the connectors for various sensor and system components. Use the appropriate test adapter lead when performing these tests at connector pin(s).
2. Forcing an incorrect or oversized probe into a connector may cause inaccurate test results (due to lack of a solid mechanical connection to the terminal). It can also damage the connector being probed or the connector housing, creating another problem which greatly complicates the diagnostic process. Extreme care must be taken not to introduce problems while probing a connector.

**Electrical Tester Kit: PV-43526**

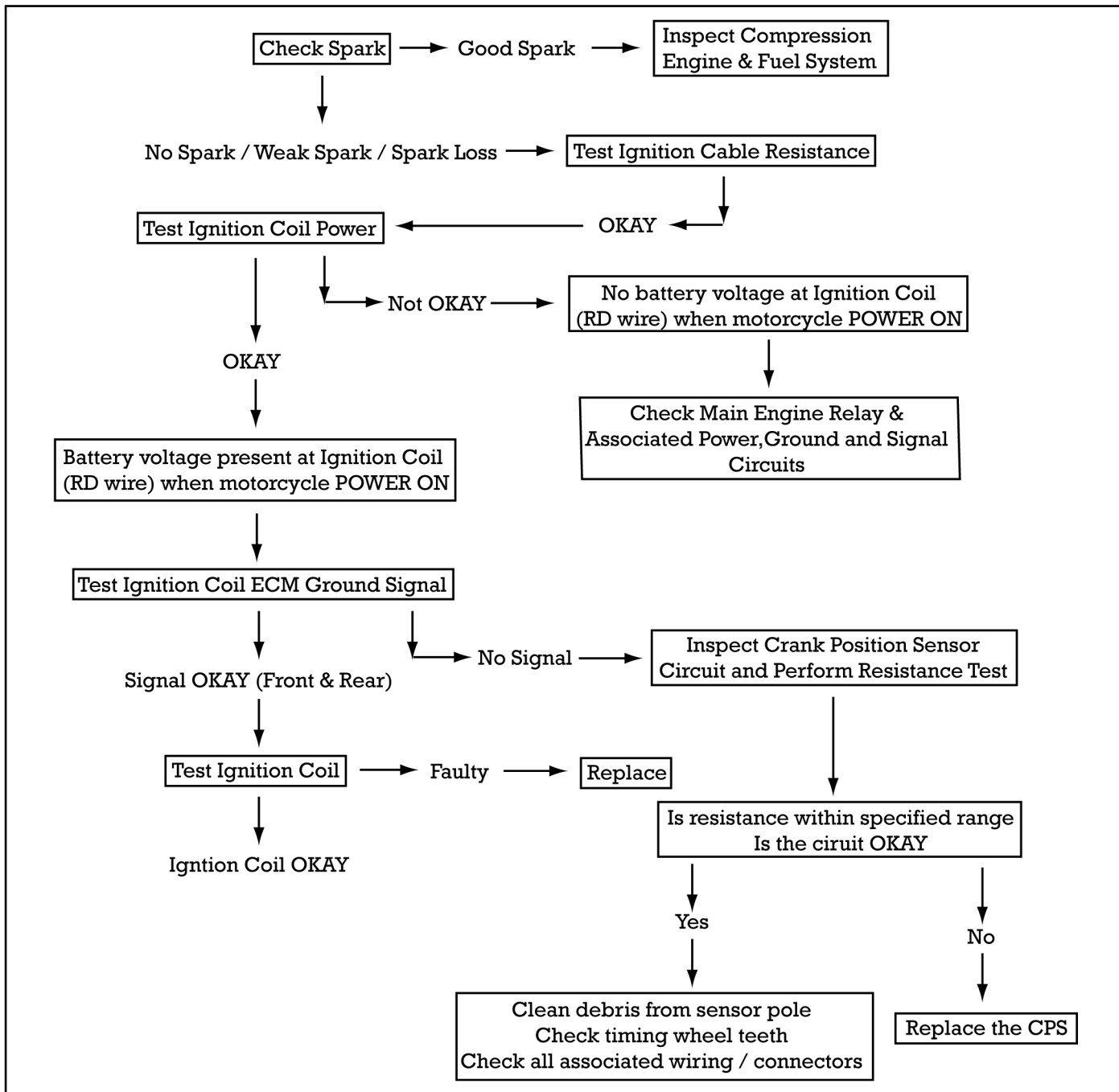
 **CAUTION**

Once the ECM connector has been disconnected, do not touch the pins on the ECM. Static electricity from your body can damage the ECM. Do not attempt to perform tests on the ECM.

### ECM CONNECTOR MAP

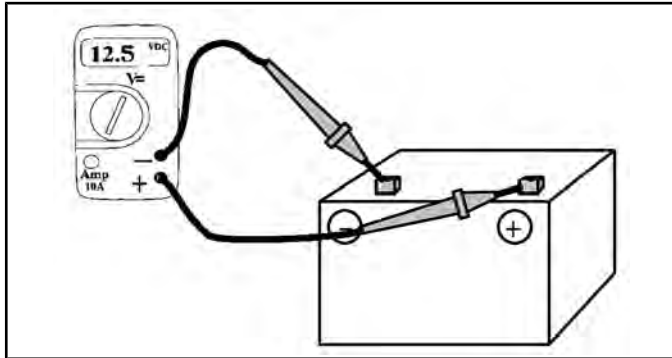
See **ECM Connector Map** page 4.42.

**IGNITION SYSTEM TEST FLOWCHART**



**BATTERY VOLTAGE INSPECTION: TEST 1**

1. Access the battery. See **Battery Removal page 10.15**.
2. Set multi meter to measure DC Volts.
3. Inspect battery voltage.



4. If the battery voltage is below 12.5 V DC charge or replace the battery with a fully charged battery.

**NOTICE**

When operating the starter with a low battery, the voltage available for the ignition coils can drop below the minimum required to produce spark.

**SPARK INSPECTION: TEST 2**

1. Connect an inductive timing light to one spark plug wire.
2. Press ON to power up the motorcycle and place the STOP/RUN switch in the RUN position.
3. Shift transmission into neutral and pull in clutch lever.
4. Depress starter button and observe timing light.
5. Determine if timing light flashes without interruption for both cylinders.

6. Consistent flashes indicate that some secondary voltage is present. The likelihood of an ignition related problem is reduced but not eliminated. Keep the following points in mind:

- There is a threshold voltage and amperage requirement for timing lights below which they will not trigger and therefore, not flash.
- Fouled spark plugs may drop secondary voltage so low that a timing light will not trigger and therefore, not flash.
- With no current flowing (open secondary side of the ignition coil) the timing light will not flash.
- A faulty high tension lead (plug wire) or poor connection is one example of an open secondary.

7. Replace spark plugs, connect plug wires and re-test.
8. If timing light does not flash consistently for one or both cylinders, test high tension leads (Test 3).

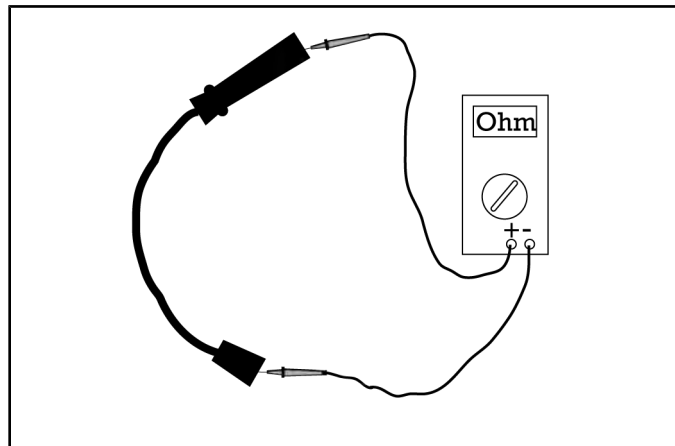
**IGNITION CABLE RESISTANCE: TEST 3**

1. Remove high tension leads by pulling firmly on the boots at the coil and spark plug. **DO NOT** pull on the wire or it may become permanently damaged.

**NOTICE**

The plug caps or coil ends are **NOT** removable. Wire must be replaced as an assembly.

2. Test each high tension lead with an ohmmeter and compare to specification. Move wire to detect internal breaks or poor connections at terminal ends.



High Tension Lead Resistance:  $1860\Omega \pm 20\%$

**IGNITION COIL POWER & GROUND SIGNAL TEST 4****POWER TO IGNITION COIL**

Battery voltage must be present at the ignition coil (Pin B) when the power button is switched on and the electrical system powered up.

1. Disconnect the electrical connector from the ignition coil. See **Ignition Coil Removal / Installation page 10.52**.
2. Set the multi meter to measure VDC and insert the meter leads into the appropriate jacks.
3. Connect the black lead to ground (on the engine).
4. Connect a small thin test adapter lead to the center terminal of the ignition coil primary connector and the red meter lead to the test adapter.
5. Press the power button to power up the motorcycle electrical system and place the STOP/RUN switch in the RUN position.
6. Battery voltage should appear on the center terminal of the coil connector (RD wire).
7. With transmission in Neutral, crank the engine. Battery voltage should again be present on center wire.

**IGNITION COIL GROUND SIGNAL**

The following steps will test the ECM (Ground) Signal To Ignition Coil

ECM ground signal must be present at each of the outer terminals of the ignition coil primary harness connector. The signal will appear as a pulse on the meter between Ground (-) and Open (OL).

1. Set the multi meter to measure resistance ( $\Omega$ ).
2. Place a small thin test adapter into one of the outer terminals of the ignition coil connector (either the WH or BK wire) and connect one meter lead to the test adapter..
3. Ground the other lead to the engine.
4. Place transmission in Neutral.
5. Press the power button to power up the motorcycle electrical system and place the STOP/RUN switch in the RUN position.
6. Crank the engine with the electric starter and watch the display on the multi meter. The meter display should pulse evenly while engine is cranking, indicating a ground signal is present.
7. Repeat the test on the other outside wire in the connector.
  - If no pulse is present, test the Crankshaft Position Sensor.
  - If the signal is present on one wire and not the other, test related wiring and connections.
  - If both signals are present and there was battery voltage on the RD wire (center terminal) but still no spark, test the ignition coil windings. (Test 5).

**IGNITION COIL RESISTANCE: TEST 5**

**Ignition Coil Primary Winding**

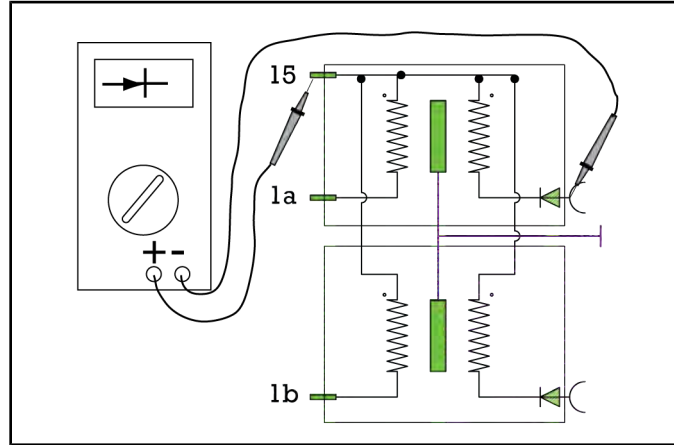
1. Remove ignition coil. See **Ignition Coil Removal / Installation page 10.52.**
2. Set the multi meter to measure resistance ( $\Omega$ ) and insert the meter leads into the appropriate jacks.
3. Measure resistance between terminal 1 and terminal 2 on the coil. Compare to specification.

Primary Coil Resistance:  $0.58\Omega$

**Ignition Coil Secondary Windings**

4. Remove ignition coil. See **Ignition Coil Removal / Installation page 10.52.**
5. Select DIODE CHECK function on the multi meter.
6. Place red meter lead on terminal 2 (center) of coil primary and black lead on secondary terminal and record.
7. Move black DMM lead to the other secondary terminal and record. (Reading should be the same for both secondary windings).

8. Repeat measurements on each secondary coil with meter leads reversed.



**NOTICE**

Diode inside the secondary coil requires the Diode Check function of multi meter.

Secondary Coil Resistance:  $9.6\text{ k}\Omega$   
or  
Open Line (OL) with leads reversed

9. Compare readings to specification. Resistance should be low with leads one way and OL with leads reversed.

**CRANKSHAFT POSITION SENSOR (CPS) RESISTANCE INSPECTION:**

See **Crankshaft Position Sensor, Test / Replace page 4.60.**

## CHASSIS ELECTRICAL GENERAL INFORMATION

### SERVICE NOTES – CHASSIS ELECTRICAL

Keep the following notes in mind when diagnosing an electrical problem:

- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a resistance value under 10 Ohms, remember to subtract meter lead resistance from the reading. Connect the leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's Manual included with your meter for more information.
- Pay attention to the prefix on the multimeter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate the component to be tested. Disconnect it from the wiring harness or power supply.

### SPECIAL TOOLS – CHASSIS ELECTRICAL

TOOL DESCRIPTION	PART NUMBER
Battery Tester	PV-50296
Electrical Tester Kit	PV-43526
TPMS Activation Tool	PF-51288
USB to Serial Adapter	PU-50621

**Bosch Automotive Service Solutions:** 1-800-328-6657 or <https://polaris.service-solutions.com/>

**ASSEMBLY VIEWS**

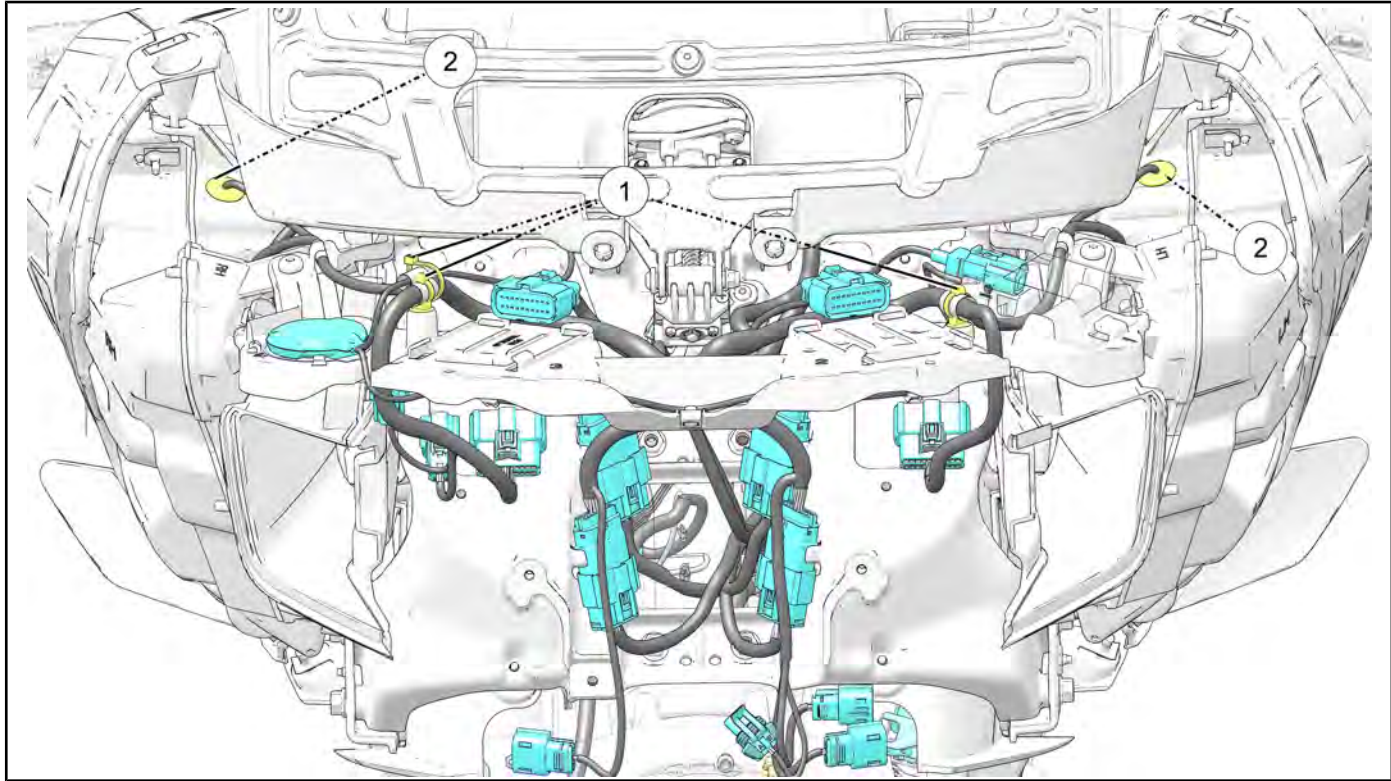
**WIRING HARNESS ROUTING / RETENTION**

*NOTICE*

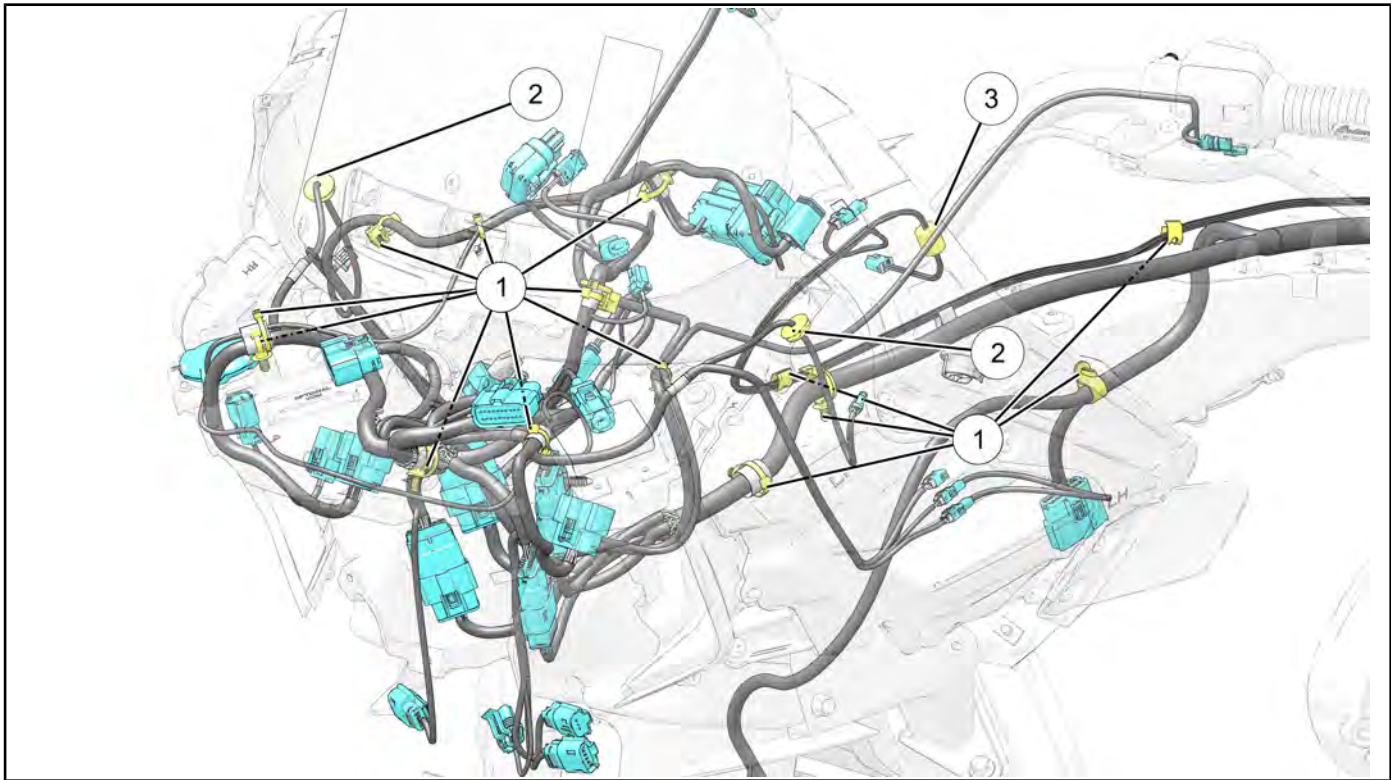
If replacing the harness, Noting routing during removal will aid in proper installation.

**IMPORTANT**

The white tape on the harness signifies a retention point.



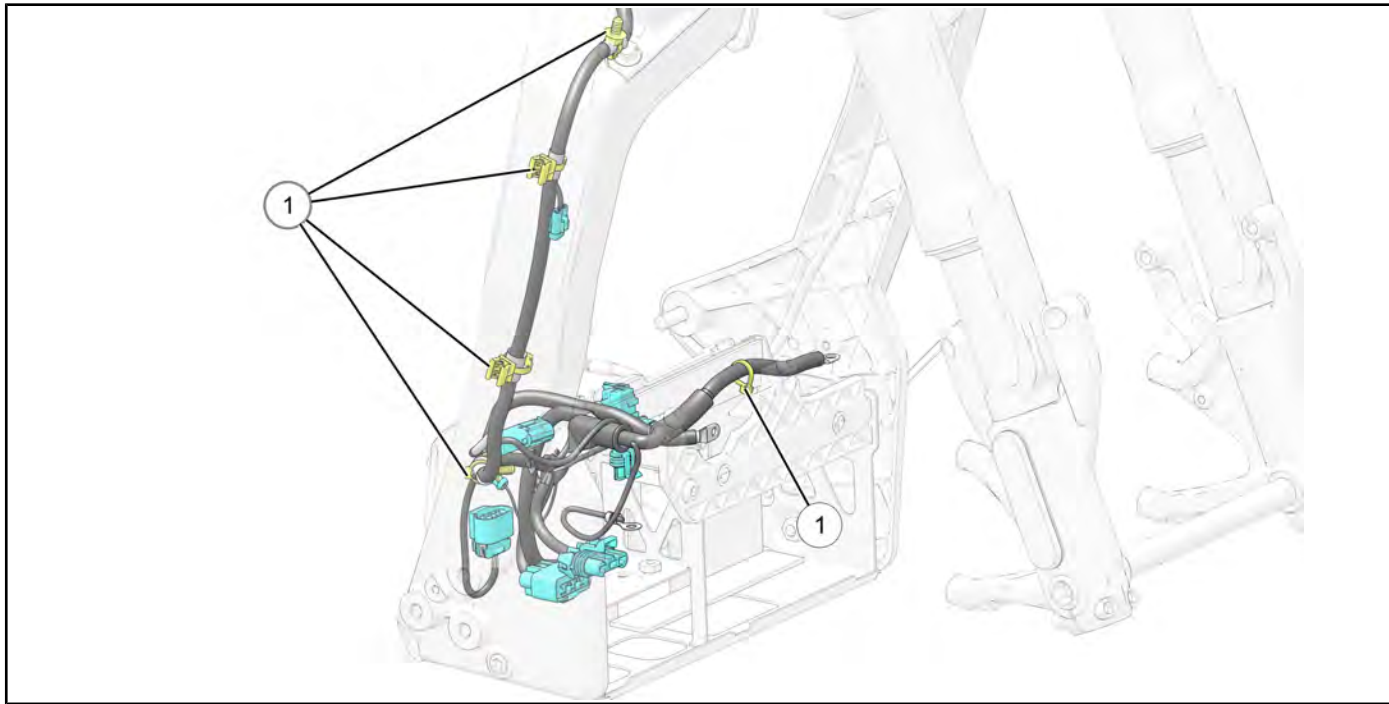
REF	DESCRIPTION
①	Retention Point
②	Harness Grommet



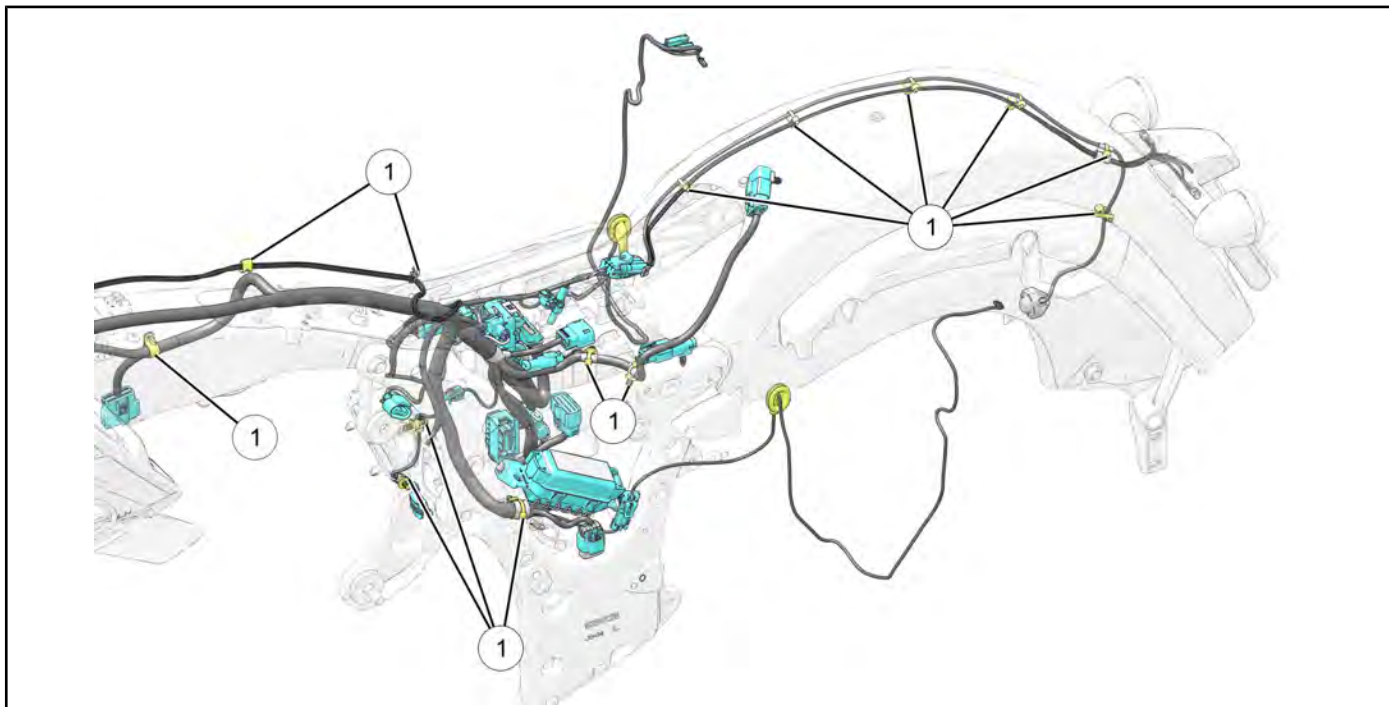
REF	DESCRIPTION
①	Retention Point
②	Harness Grommet
③	Fuel Tank Harness Grommet



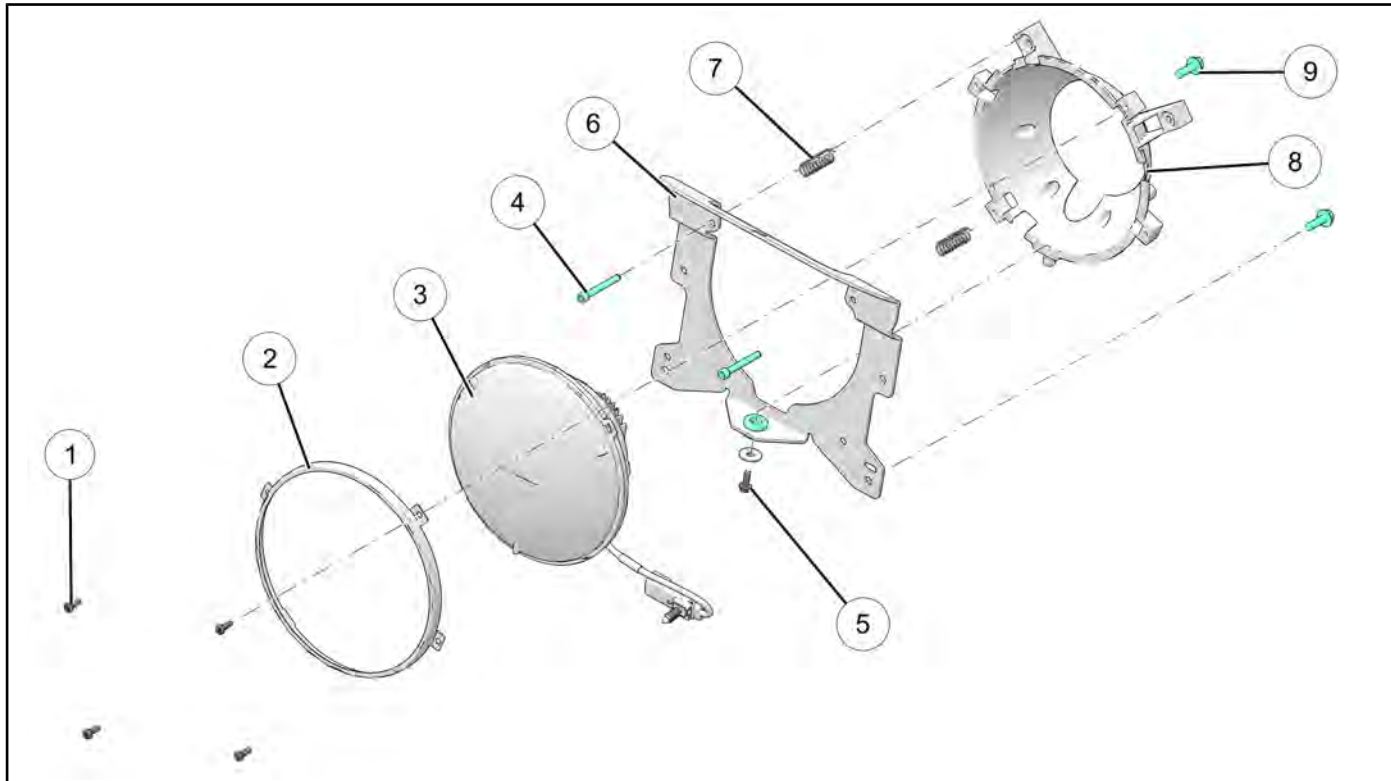
**ELECTRICAL**



REF	DESCRIPTION
①	Retention Point



REF	DESCRIPTION
①	Retention Point

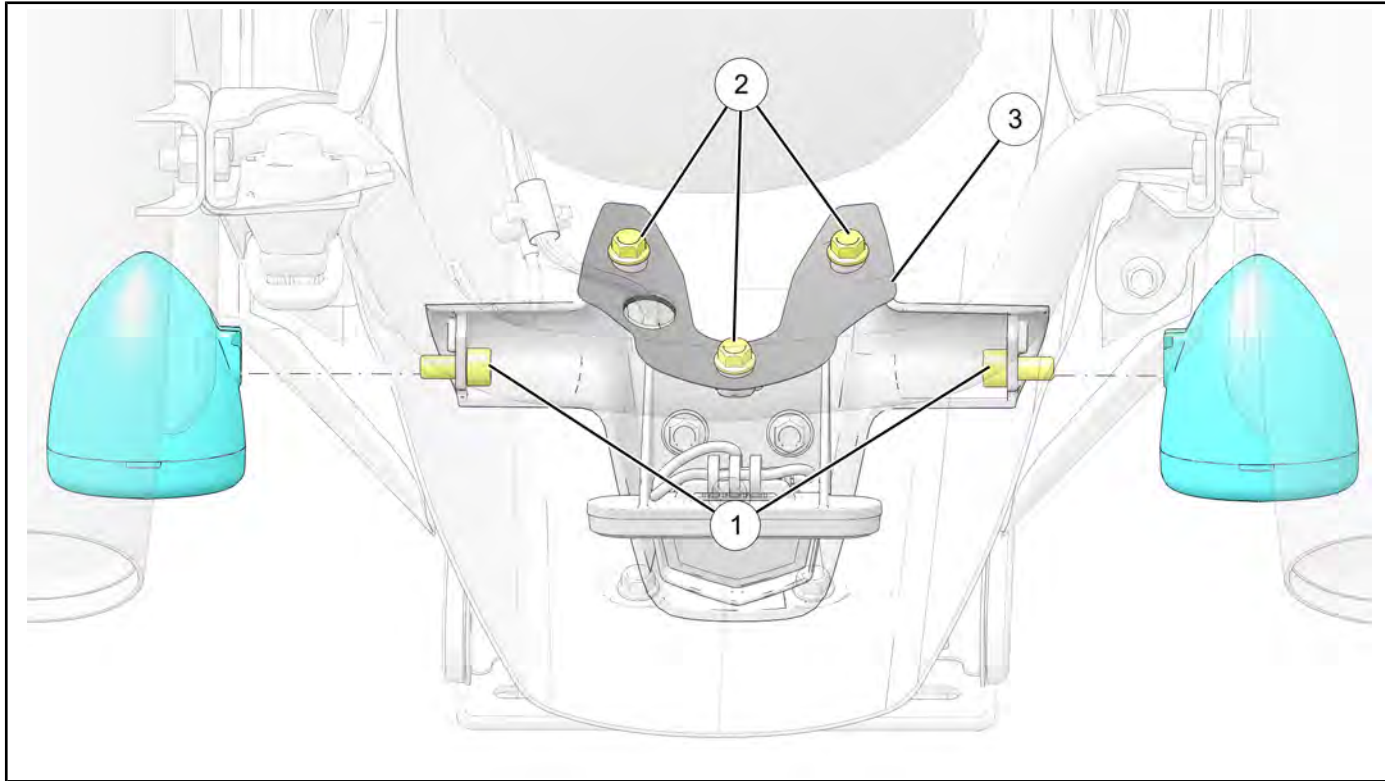
**HEADLIGHT ASSEMBLY VIEW**

REF	DESCRIPTION	TORQUE
①	Headlight Retention Ring Fastener	<b>12 in-lbs (1 N·m)</b>
②	Headlight Retention Ring	—
③	Headlight	—
④	Headlight Adjustment Fastener	—
⑤	Headlight Carrier Fastener	<b>12 in-lbs (1 N·m)</b>
⑥	Headlight Bracket	—
⑦	Spring	—
⑧	Headlight Carrier	—
⑨	Headlight Bracket Fastener	<b>36 in-lbs (4 N·m)</b>

**10**

## ELECTRICAL

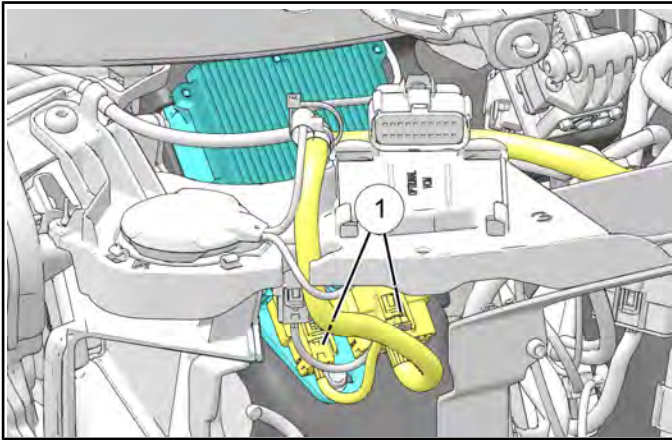
### TAIL LIGHT / LICENSE PLATE LIGHT



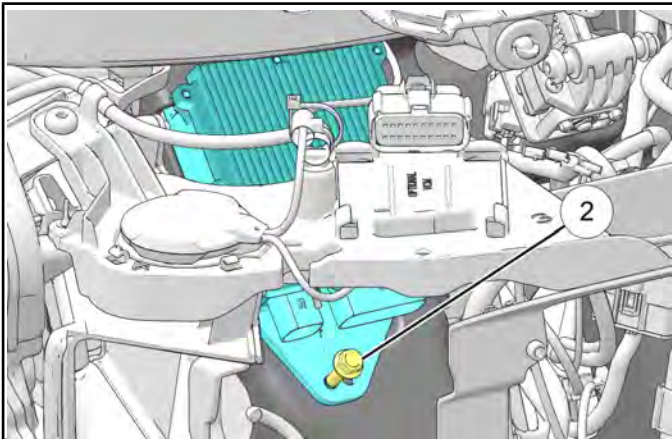
NUMBER	PART DESCRIPTION	TORQUE
①	Turn Signal Fastener	<b>15 in-lbs (2 N·m)</b>
②	Tail Light Mount Bracket Fastener	<b>84 in-lbs (10 N·m)</b>
③	Tail Light Mount Bracket	—

**POWER SUPPLY****POWER SUPPLY REMOVAL / INSTALLATION****REMOVAL**

1. Remove outer fairing. Reference **Fairing Disassembly** page 7.40.
2. Disconnect power supply electrical connector ①.



3. Remove power supply fastener ②.



4. Remove the power supply from the unit.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

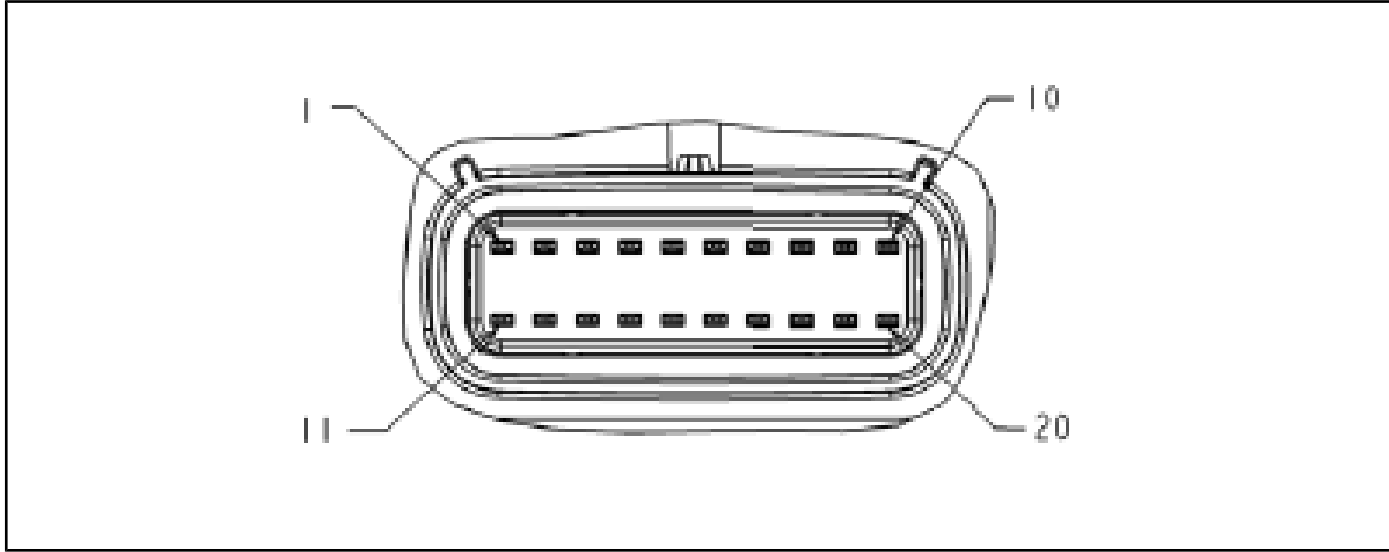
**TORQUE**

Power Supply Fastener:  
**84 in-lbs (10 N·m)**

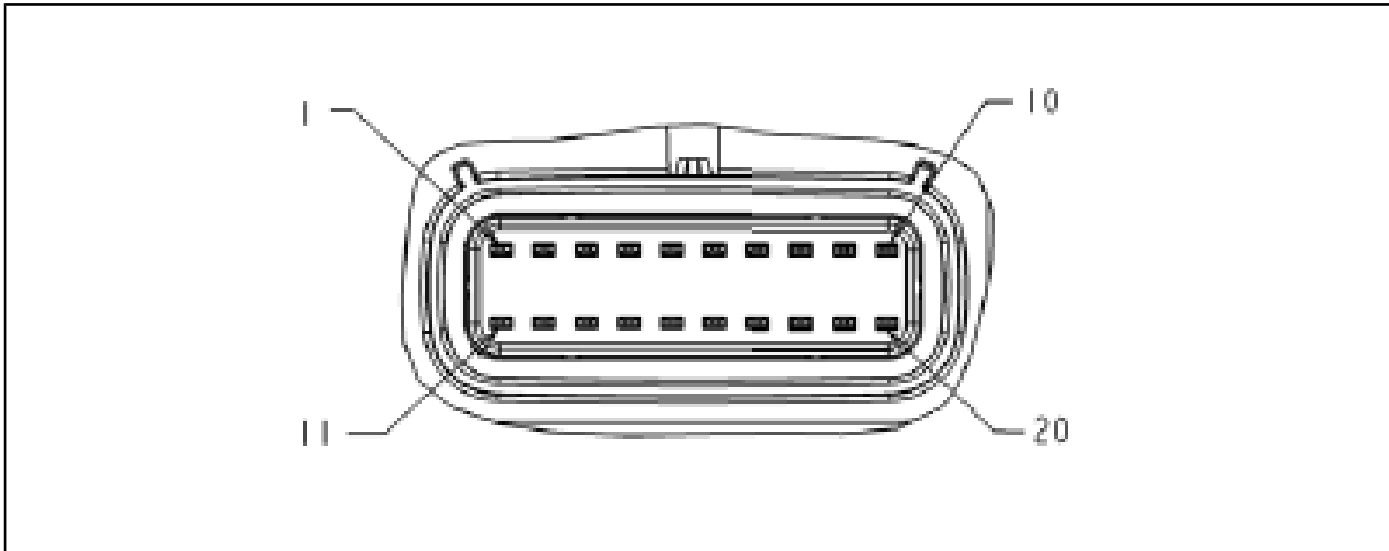
ELECTRICAL

**POWER SUPPLY CONNECTOR MAP**

**POWER SUPPLY (LEFT)**



PIN	WIRE COLOR	FUNCTION
①	YE	CAN HI
②	WH/BK	Front Left Speaker Negative (-)
③	WH	Front Left Speaker Positive (+)
④	GY/BK	Front Right Speaker Negative (-)
⑤	GY	Front Right Speaker Positive (+)
⑥	—	—
⑦	PK/GN	VCM Accessory Power Out
⑧	BK/GN	Main Audi Rear Speaker Power Ground
⑨	BK	Power Supply A Ground
⑩	BK	Power Supply A Ground
⑪	DG	CAN LO
⑫	GY/YE	Pre-Amp Front Right Speaker Negative (-)
⑬	GY/RD	Pre-Amp Front Right Speaker Positive (+)
⑭	WH/YE	Pre-Amp Front Left Speaker Negative (-)
⑮	WH/RD	Pre-Amp Front Left Speaker Positive (+)
⑯	—	—
⑰	—	—
⑱	OG/YE	Main Audio Rear Speaker Power Feed
⑲	BG	Main Audio Power Feed
⑳	BG	Main Audio Power Feed

**POWER SUPPLY POSITION (RIGHT)**

PIN	WIRE COLOR	FUNCTION
①	YE	CANC High
②	GN/DB	Left Saddlebag Speaker Negative (-)
③	DG/OG	Left Saddlebag Speaker Positive (+)
④	VT/DB	Right Saddlebag Speaker Negative (-)
⑤	VT/PK	Right Saddlebag Speaker Positive (+)
⑥	—	—
⑦	PK/GN	VCM Accessory Power Out
⑧	BK/OG	Saddlebag Speaker Ground
⑨	BK	Power Supply B Ground
⑩	BK	Power Supply B Ground
⑪	DG	CANC Low
⑫	DG/YE	Pre-Amp Rear Right Speaker Negative (-)
⑬	DG/RD	Pre-Amp Rear Right Speaker Positive (+)
⑭	VT/YE	Pre-Amp Rear Left Speaker Negative (-)
⑮	VT/RD	Pre-Amp Rear Left Speaker Positive (+)
⑯	BK	Power Supply B Ground
⑰	BK	Power Supply B Ground
⑱	OG/DB	Secondary Audio Speaker Power Feed
⑲	BG/WH	Secondary Audio Power Feed
⑳	BG/WH	Secondary Audio Power Feed

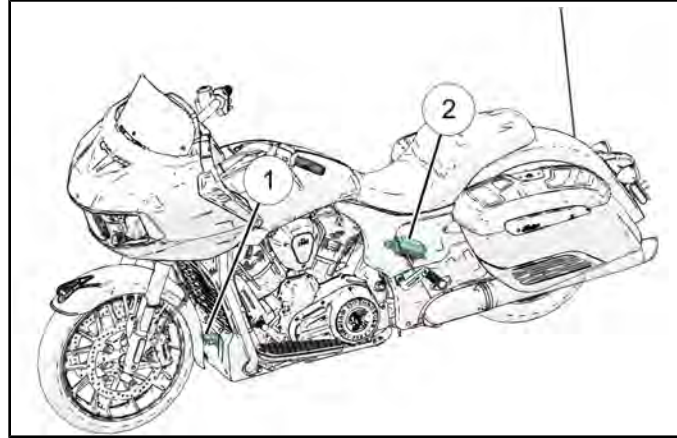
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## FUSE BOX

### FUSE BOX LOCATION

There are two fuse boxes utilized on the full size Indian Motorcycle platform.

- The J-Case fuse box ① is located in the front of the unit in the battery box area.



- The main fuse box ② which is located beneath the LH upper side cover.

**FUSE APPLICATION CHART**

**MAIN FUSEBOX**

MAIN ENGINE RELAY 4016819	START RELAY 4016819	25A VCM1 401653 10A SPARE 2434016	FUEL PUMP RELAY 4016819	25A ABS 401653 25A AUDIO1 401653	SWITCHED POWER RELAY 4016819
15A EFI1 2410280	10A EFI2 2434016	10A TENDER 2434016	5A GAUGE 401652	25A SPARE 401653	10A SWITCHED1 2434016
7.5A IGN 4011068 7191485	10A WCM 2434016	25A VCM2 401653	25A VCM3 401653	25A AUDIO2 401653	10A SWITCHED2 2434016



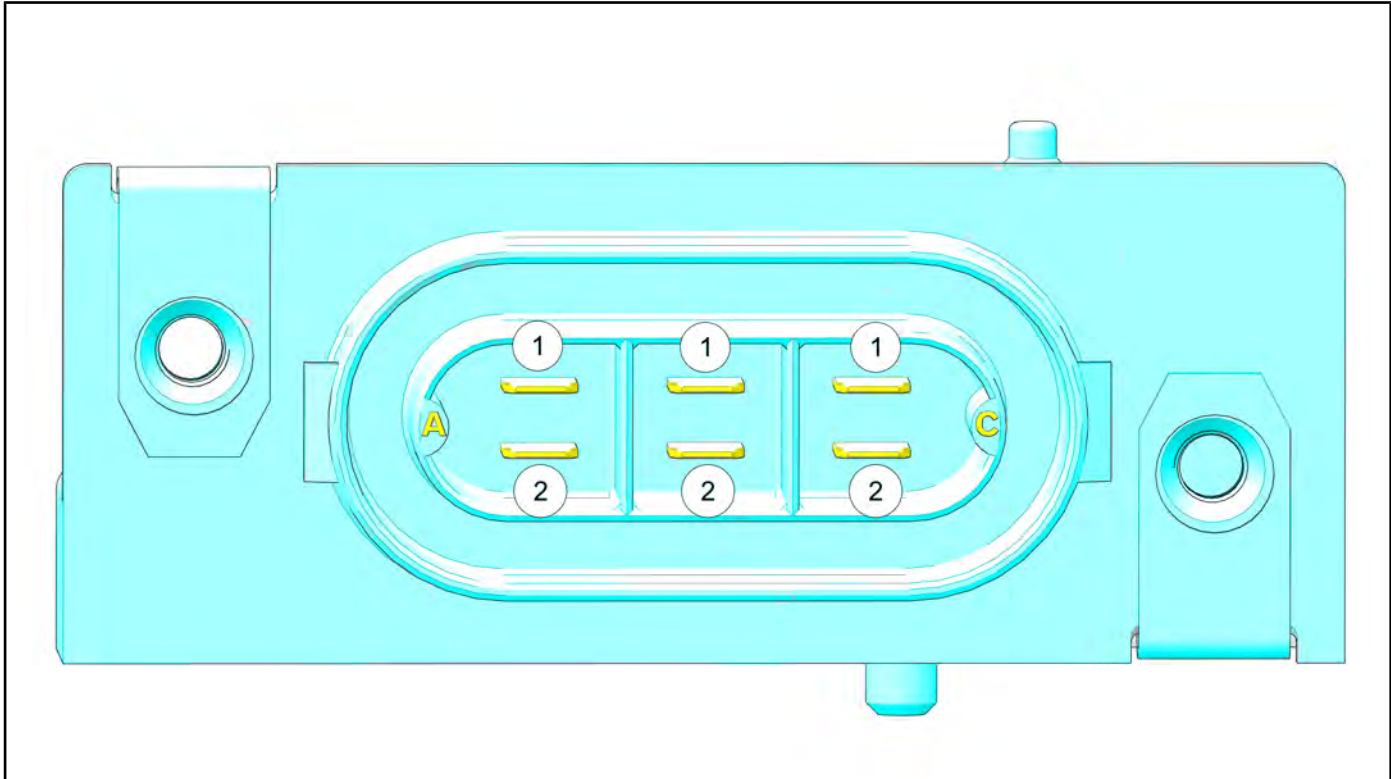
CIRCUIT	PIN	WIRE COLOR	FUNCTION
Main Engine Relay	48	RD/YE	VCM Control Feed
	47	RD/DG	Main Engine Relay Load
	44	RD	Main Fuse Output
	43	GY/BK	Engine Relay Control
EFI 1 Fuse 15A	46	RD/DG	Main Engine Relay Load
	42	VT/PK	Engine Relay Output
IGN Fuse 7.5A	45	RD/DG	Main Engine Relay Load
	41	PK/RD	Ignition Coil Feed
Start Relay	40	PK/BK	Starter Relay Coil Feed
	39	DG/WH	Starter Solenoid Feed

10



## ELECTRICAL

	36	VT/PK	Engine Relay Output
	35	OG/BN	Starter Relay Control
<b>EFI 2 Fuse 10A</b>	38	RD/DG	Main Engine Relay Load
	34	DB/PK	AUX Engine Relay Output
<b>WCM Fuse 10A</b>	37	RD	Main Fuse Output
	33	RD/YE	WCM Control Feed
<b>VCM 1 Fuse 25A</b>	32	RD	Main Fuse Output
	28	RD/WH	VCM Feed
<b>Spare 10A</b>	31	—	—
	27	—	—
<b>Tender Fuse 10A</b>	30	RD	Main Fuse Output
	26	GY/RD	Accessory Constant Fuse Output
<b>VCM 2 Fuse 25A</b>	29	RD	Main Fuse Output
	25	RD/BK	VCM2 Power Feed
<b>Fuel Pump Relay</b>	24	VT/PK	Engine Relay Output
	20	VT/PK	Engine Relay Output
	23	VT/YE	Fuel Pump Feed
	19	GY	Fuel Pump Relay Control
<b>Gauge Fuse 5A</b>	22	RD	Main Fuse Output
	18	OG	Instrumentation Fuse Output
<b>VCM 3 Fuse 25A</b>	21	RD	Main Fuse Output
	17	RD/DG	VCM 3 Power Feed
<b>ABS Fuse 25A</b>	16	RD	Main Fuse Output
	12	RD/BK	ABS Secondary Power Feed
<b>Audio 1 Fuse 25A</b>	15	RD	Main Fuse Output
	11	BG	Main Audio Power Feed
<b>Spare Fuse 25A</b>	14	—	—
	10	—	—
<b>Audio 2 Fuse 25A</b>	13	RD	Main Fuse Output
	9	BG	Secondary Audio Power Feed
<b>Switched Power Relay</b>	8	OG/YE	Switched Power Relay Feed – Coil
	4	RD	Main Fuse Output
	7	RD/BU	Switched Power Relay Load
	3	BK	Ground
<b>Switched 1 Fuse 10A</b>	6	RD/BU	Switched Power Relay Load
	2	PK/GN	Accessory Power Output
<b>Switched 2 Fuse 10A</b>	5	RD/BU	Switched Power Relay Load
	1	GY/WH	Accessory Switched Output

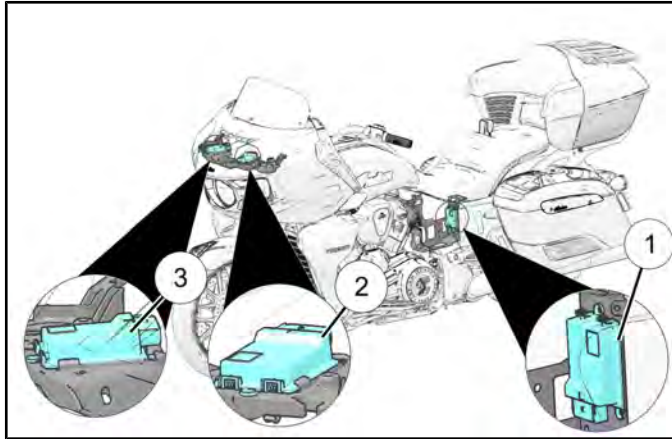
**J-CASE**

CIRCUIT	PIN	WIRE COLOR	FUNCTION
ABS 40A Fuse	A1	Red	ABS Fuse Input
	A2		ABS Fuse Output
Infotain Main 50A Fuse	B1	Red	Infotain Input
	B2		Infotain Output
Engine Main 50A Fuse	C1	Red	Engine Main Fuse Input
	C2		Engine Main Fuse Output

## VEHICLE CONTROL MODULE (VCM)

### VEHICLE CONTROL MODULE (VCM) OVERVIEW

VCM 1 and VCM 2 are standard on 2020-2021 models. Some 2022+ models come equipped with VCM 3. See image for locations of VCM 1 ①, VCM 2 ②, and VCM ③.



#### IMPORTANT

VCM 1, VCM 2, and VCM 3 have separate functions and are not interchangeable.

#### IMPORTANT

**Replacement of the Vehicle Control Module (VCM) should only be performed by a qualified dealer. Vehicle Control Module (VCM) setup and initialization requires the use of Digital Wrench.**

VCM 1	VCM 2	VCM 3
Fuel Door	Heated Grip Switch	Fog Lights
Heated Grips	Heated Grip Indicator Light	
Saddle Bag Locks	Windshield Motor	
Puddle Light	Cooling Fan	
Horn	Garage Door	
	Headlights (low and high)	

## VEHICLE CONTROL MODULE (VCM), REMOVAL / INSTALLATION

#### CAUTION

The negative battery cable **MUST** be disconnected before the VCM can be removed.

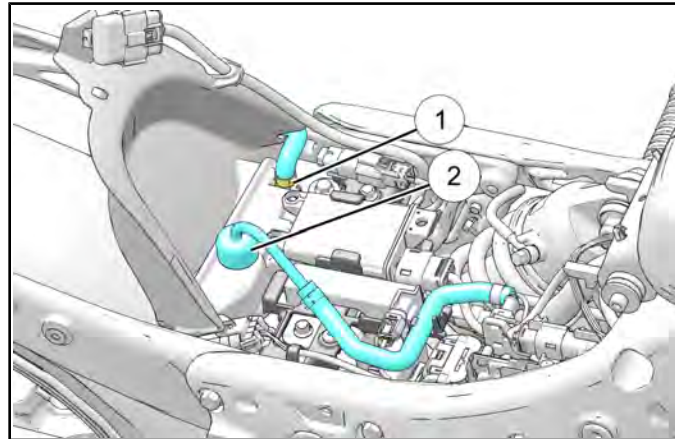
Electrical tape can be used to cover the negative battery terminal and cable end to prevent a short from occurring across the VCM during removal.

#### IMPORTANT

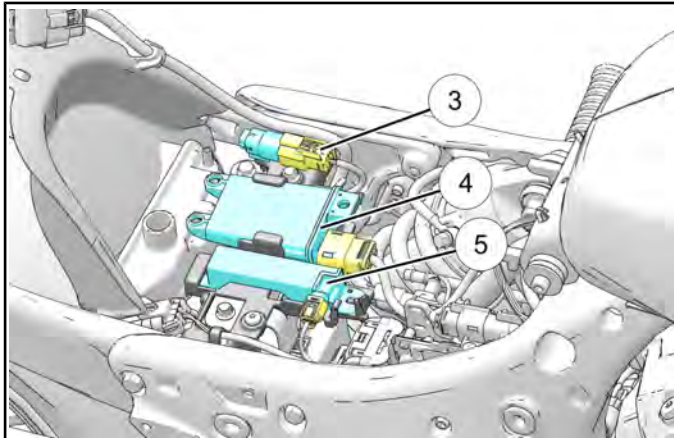
VCM 1 and VCM 2 have separate functions and are not interchangeable.

### VCM 1

1. Remove seat. See **Seat Removal / Installation page 7.32.**
2. Disconnect the negative battery cable.
3. Position motorcycle in an upright position with the front wheel clamped in a wheel vise.
4. Remove ECM. See **ECM Removal / Installation page 4.53.**
5. Remove coolant overflow line ① and coolant pickup line ② from recovery bottle..



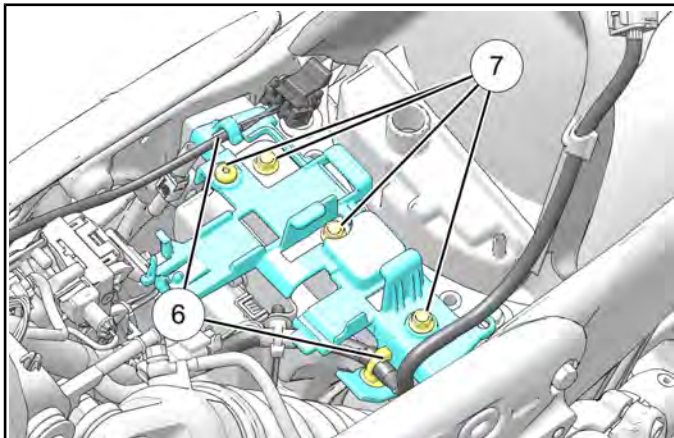
6. Disconnect electrical connection ③.



7. Disconnect WCM ④ electrical connector and remove.

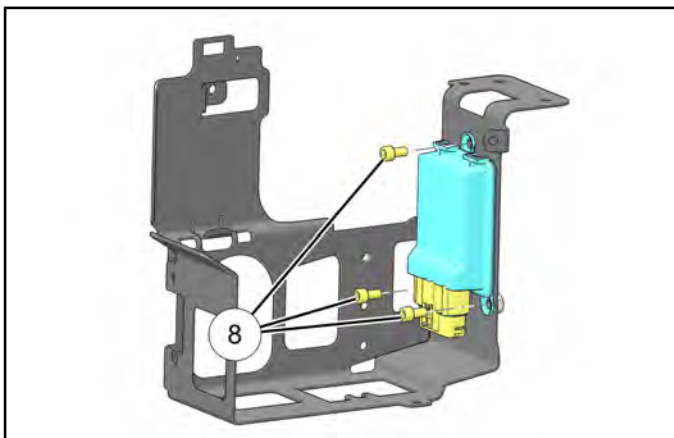
8. Disconnect antenna module ⑤ electrical connector and remove.

9. Disconnecting the wiring retained ⑥ to under-seat wire bracket.



10. Remove under-seat wire bracket by removing its fasteners ⑦.

11. Remove VCM fasteners ⑧.



12. Disconnect VCM electrical connector.

13. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
VCM 1 Fastener: <b>84 in-lbs (10 N·m)</b>

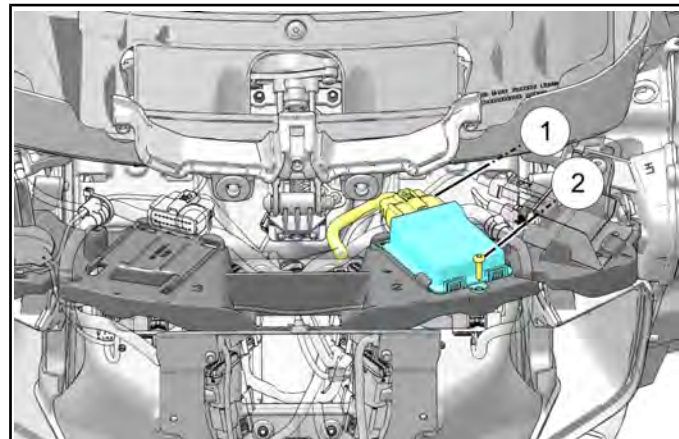
TORQUE
Under-Seat Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Under-Seat Wire Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

**VCM 2**

1. Remove outer fairing. See **Fairing Disassembly page 7.40.**

2. Disconnect electrical connector ①.

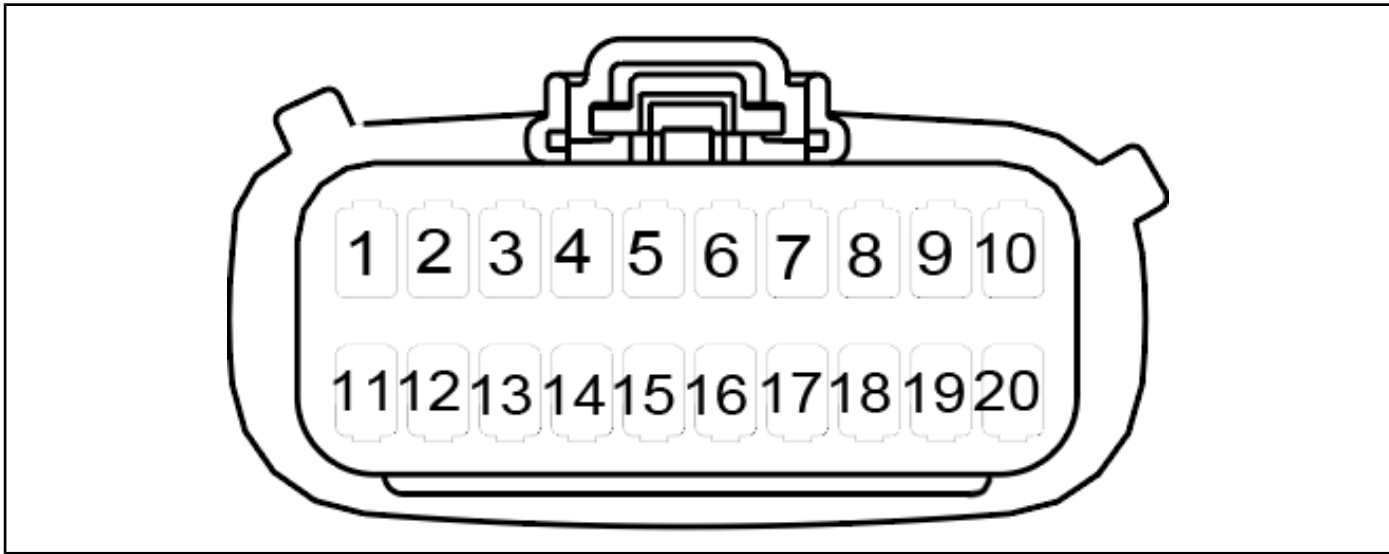


3. Remove fastener ② securing VCM and remove.

4. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
VCM 2 Fastener: <b>15 in-lbs (2 N·m)</b>



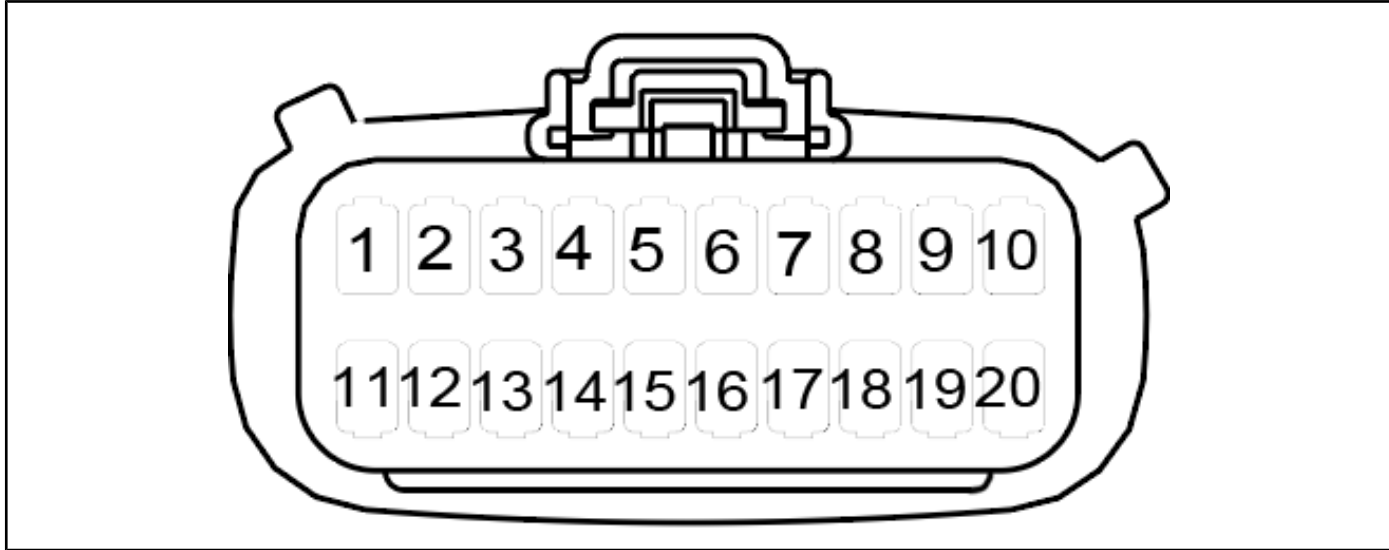
**VCM CONNECTOR PINOUT****VCM 1 UNDER SEAT**

PIN	WIRE COLOR	FUNCTION
1	RD	VCM Feed
2	YE	CANA High
3	DG/OG	Fuel Door Solenoid Negative
4	—	—
5	PK	Heated Grips Output
6	—	—
7	WH	Horn
8	DB/OG	Fuel Door Switch Output
9	RD/WH	Lock Motor Feed
10	PK/GN	Accessory Power Output
11	DG	CANA Low
12	OG/DG	Fuel Door Solenoid Positive
13	BU	Puddle Light Feed
14	BK	Ground
15	—	—
16	—	—
17	—	—
18	OG/WH	Unlock Motor Feed
19	—	—
20	RD	VCM Feed

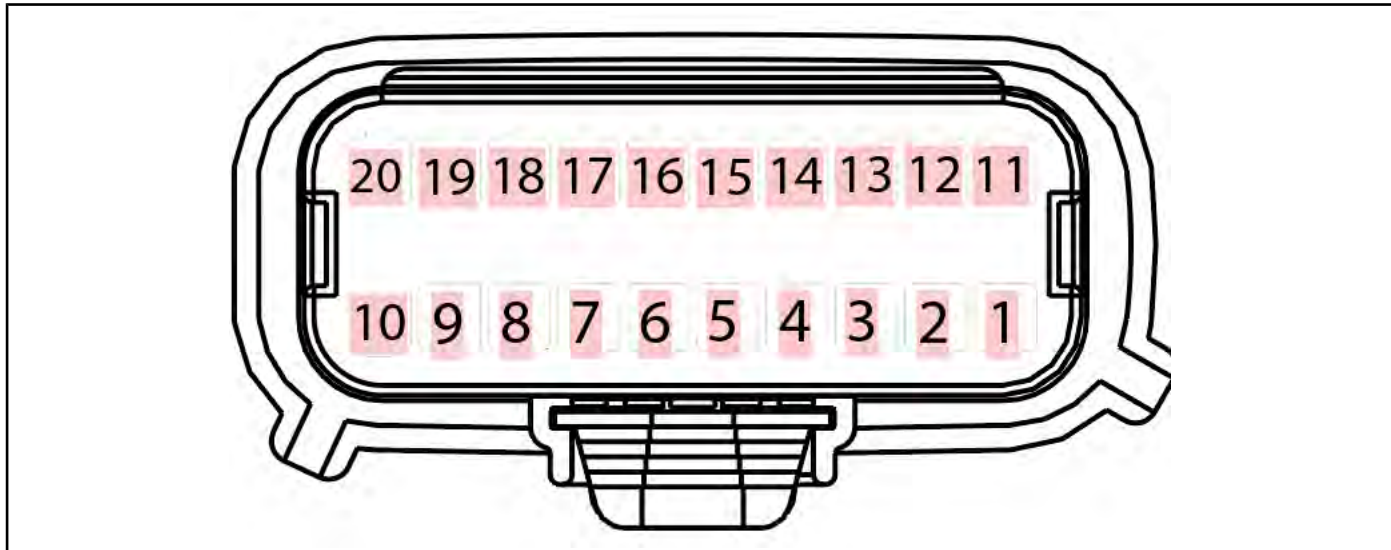
10

ELECTRICAL

VCM 1 UNDER SEAT (2022)



PIN	WIRE COLOR	FUNCTION
1	RD	VCM Feed
2	YE	CANA High
3	DG/OG	Fuel Door Solenoid Negative
4	—	—
5	PK	Heated Grips Output
6	GN/WH	E-Preload Sensor Input
7	WH	Horn
8	DB/OG	Fuel Door Switch Output
9	RD/WH	Lock Motor Feed
10	PK/GN	Accessory Power Output
11	DG	CANA Low
12	OG/DG	Fuel Door Solenoid Positive
13	BU	Puddle Light Feed
14	BK	Ground
15	—	—
16	—	—
17	—	—
18	OG/WH	Unlock Motor Feed
19	—	—
20	RD	VCM Feed

**VCM 2 FAIRING**

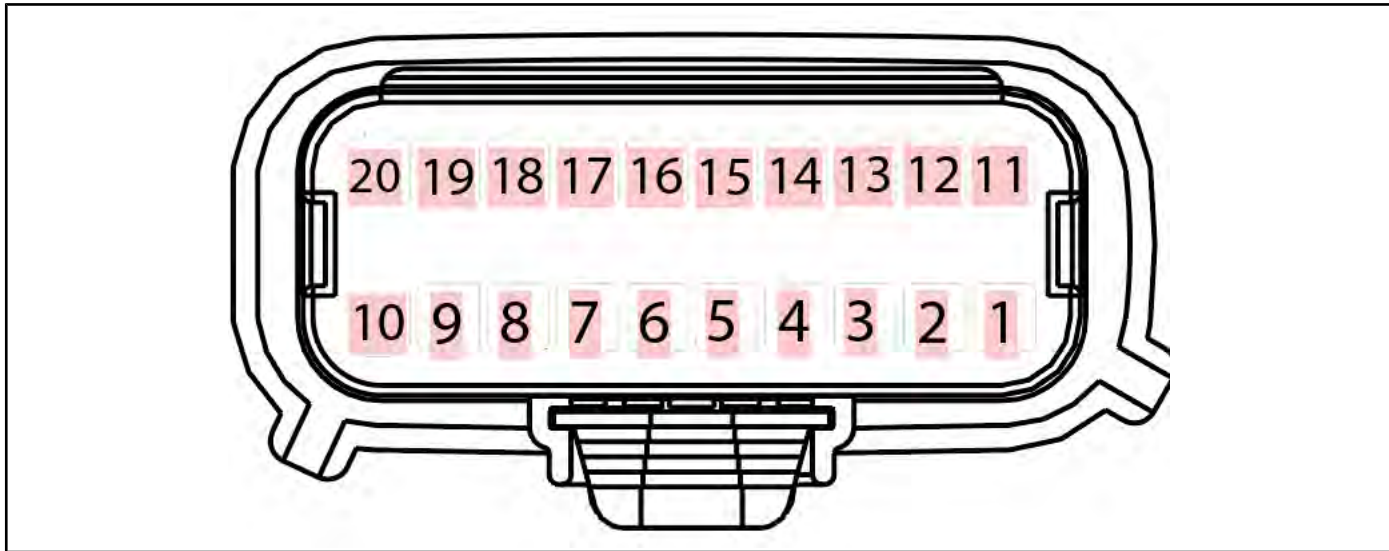
PIN	WIRE COLOR	FUNCTION
1	RD/BK	Power Feed
2	YE	CANA High
3	—	—
4	BU/RD	Heated Grips LED
5	DG	Low Beam Output
6	BU/YE	Heated Grips INC
7	OG/RD	Fan Control
8	BU/BK	Heated Grip Dec
9	GY/DB	Windshield Motor Up
10	PK/GN	VCM Accessory Power Out
11	DG	CANA Low
12	—	—
13	YE/BN	Garage Door 1 Feed
14	BK	Ground
15	GN	Garage Door 2 Feed
16	YE	High Beam Output
17	—	—
18	GY/DG	Windshield Motor Down
19	BK	Ground
20	RD/BK	Power Feed

10



ELECTRICAL

VCM 2 FAIRING (2022+)

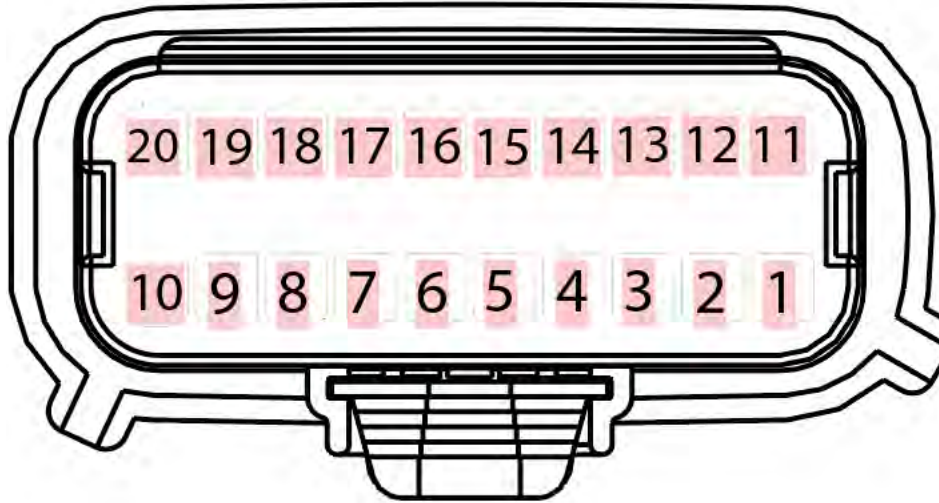


PIN	WIRE COLOR	FUNCTION
1	RD/BK	Power Feed
2	YE	CANA High
3	RD/GN	E-Preload Motor (-)
4	BU/RD	Heated Grips LED
5	DG	Low Beam Output
6	BU/YE	Heated Grips INC
7	OG/RD	Fan Control
8	BU/BK	Heated Grip Dec
9	GY/DB	Windshield Motor Up
10	PK/GN	VCM Accessory Power Out
11	DG	CANA Low
12	RD/BU	E-Preload Motor (+)
13	YE/BN	Garage Door 1 Feed
14	BK	Ground
15	GN	Garage Door 2 Feed
16	YE	High Beam Output
17	—	—
18	GY/DG	Windshield Motor Down
19	BK	Ground
20	RD/BK	Power Feed

## VCM 3 FAIRING

**NOTICE**

MY22+ Units



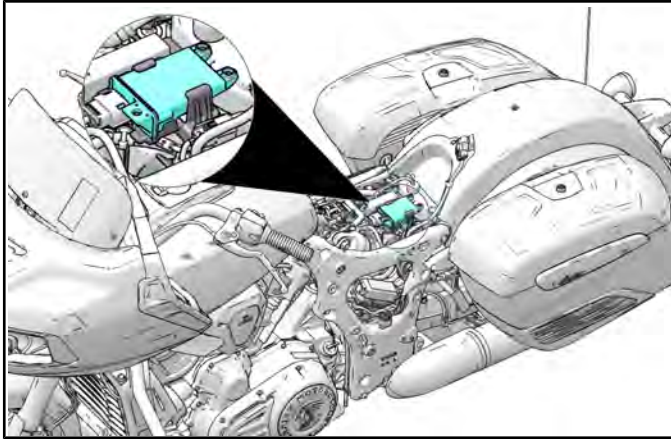
PIN	WIRE COLOR	FUNCTION
1	RD/DG	VCM 3 Power Feed
2	YE	CANC High
3	—	—
4	—	—
5	—	—
6	DG/BK	AUX Light Switch Output
7	—	—
8	—	—
9	—	—
10	PK/GN	VCM Accessory Power Out
11	DG	CANC High
12	—	—
13	DG/RD	Left AUX Light Feed
14	BLK	Ground
15	DG/BN	Right AUX Light Feed
16	—	—
17	—	—
18	—	—
19	PK/DB	VCM Accessory Power Out
20	RD/DG	VCM 3 Power Feed

10

## WIRELESS CONTROL MODULE (WCM)

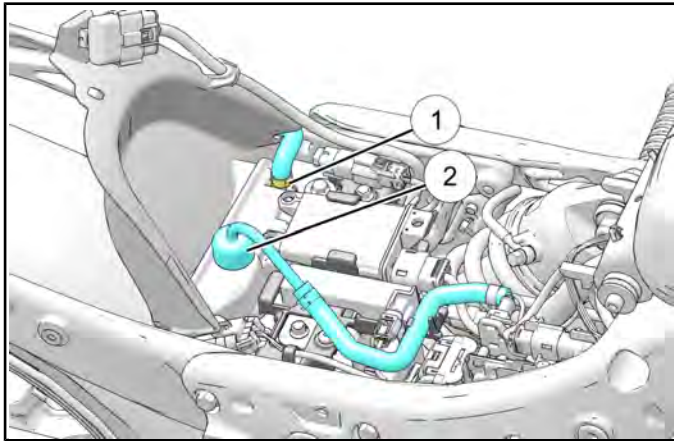
### **WCM OVERVIEW**

The Wireless Control Module (WCM) controls main power module, lock switch, key fob authentication, and the TPMS receiver. The WCM is located under the seat as shown.

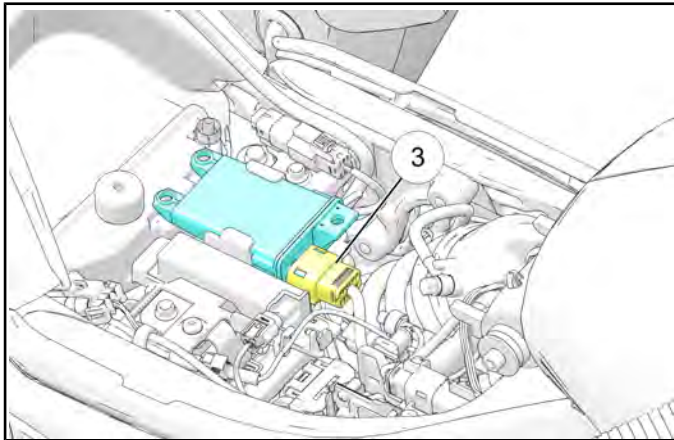


**WCM, REMOVAL / INSTALLATION****WCM REMOVAL**

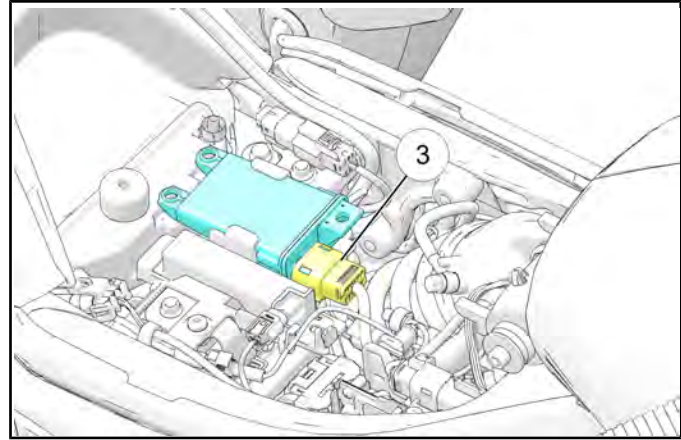
1. Remove seat. See **Seat Removal / Installation page 7.32.**
2. Disconnect the negative battery cable.
3. Position motorcycle in an upright position with the front wheel clamped in a wheel vise.
4. Remove ECM. See **ECM Removal / Installation page 4.53.**
5. Remove coolant overflow line ① and coolant pickup line ② from recovery bottle..



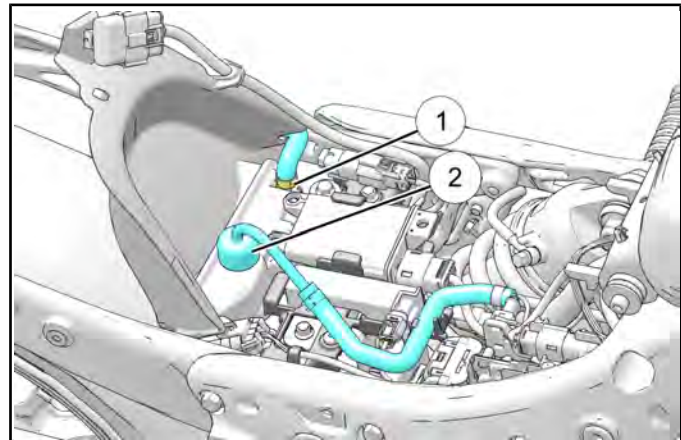
6. Disconnect WCM ③ electrical connector and remove.

**WCM INSTALLATION**

1. Install WCM into position and connect WCM electrical connector ③.

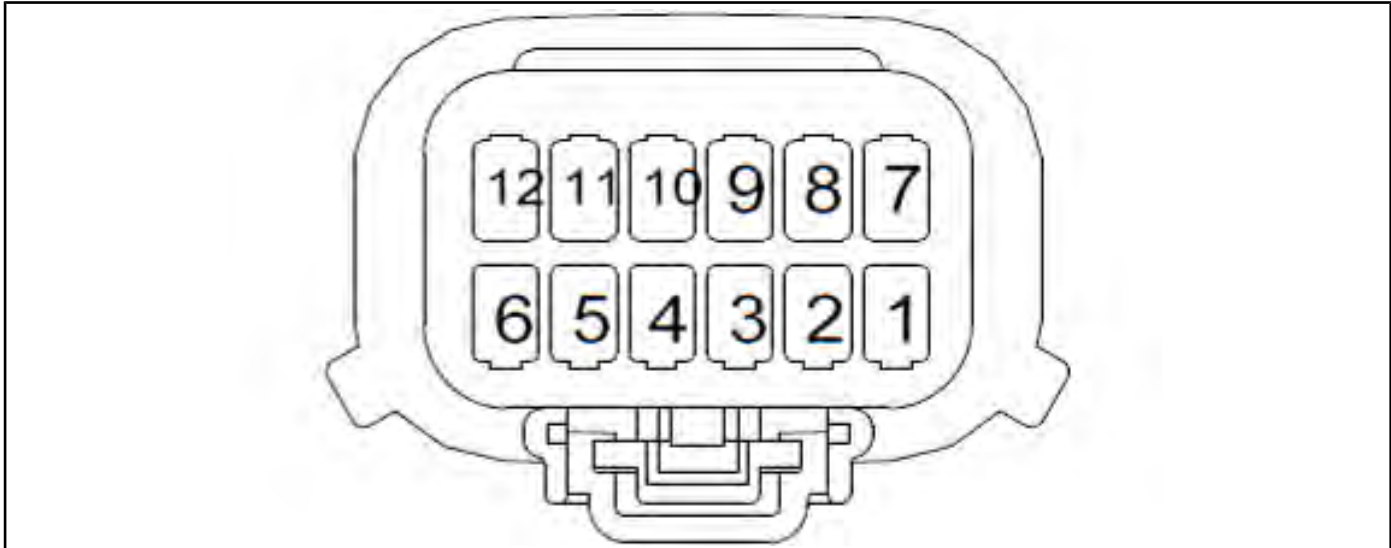


2. Install coolant overflow line ① and coolant pickup line ② to the recovery bottle..



3. Install the ECM. See **ECM Removal / Installation page 4.53.**
4. Connect the negative battery cable.
5. Install the seat. See **Seat Removal / Installation page 7.32.**



**WCM PINOUT**

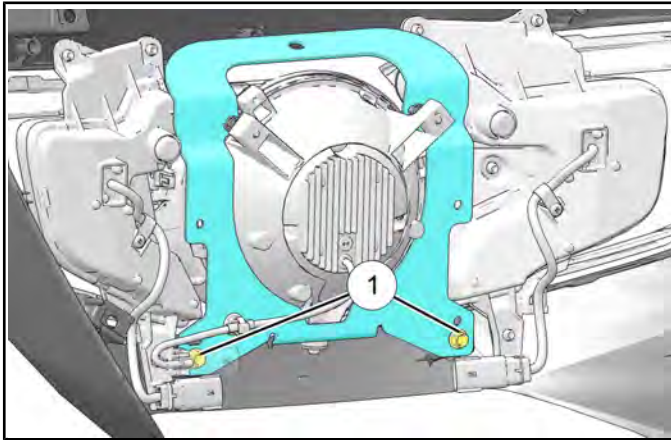
PIN	WIRE COLOR	FUNCTION
1	RD/YE	Battery Voltage Input
2	YE	CAN High Signal
3	BD/BK	Digital Input - Lock Function
4	DG	CAN Low Signal
5	DB/WH	Digital Input - Unlock Function
6	VT/YE	Digital Input - Power Button
7	PK	Digital Output - K15 SIGNAL
8	OG/YE	Digital Output - Accessory Power
9	BN/WH	Digital Output - Security Light
10	BK	LF Antenna Connection 1
11	VT/YE	LF Antenna Connection 2
12	BK	Ground

## HEADLIGHT SERVICE

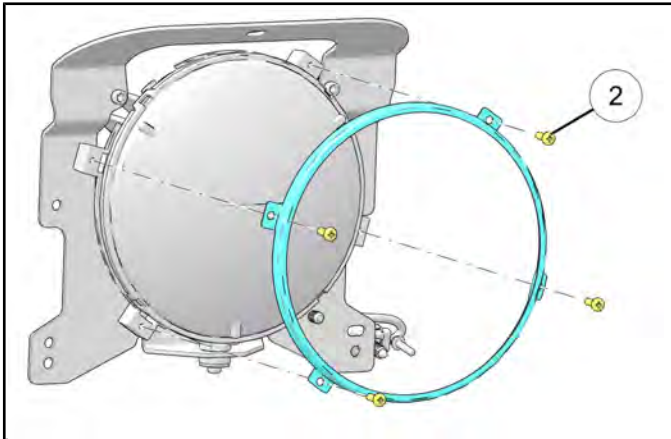
### HEADLIGHT REPLACEMENT

#### REMOVAL

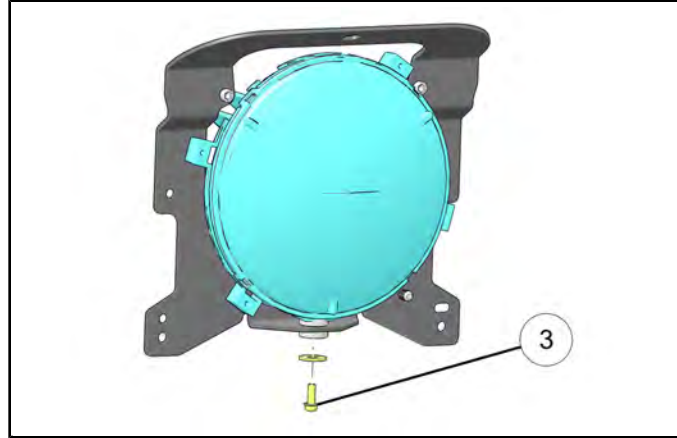
1. Remove outer fairing. Reference **Fairing Disassembly** page 7.40.
2. Remove headlight bracket fasteners ①.



3. Remove headlight retaining ring by removing its fasteners ②.



4. Remove headlight carrier fastener ③ and remove headlight.



#### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

##### TORQUE

Headlight Retaining Ring Fasteners:  
**12 in-lbs (1 N·m)**

##### TORQUE

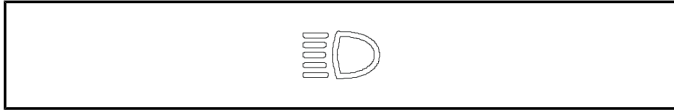
Headlight Carrier Fastener:  
**12 in-lbs (1 N·m)**

2. Perform headlight adjustment. See **Headlight Aim Inspection** page 2.27.

### HEADLIGHT WARNING INDICATORS

Indian motorcycles are equipped with “tell tales” indicating when a fault occurs with the low or high beam headlight.

If a fault occurs with the headlight bulb (low or high beam) the high beam indicator light will flash on the instrument cluster. Once the bulb has been replaced and the issue corrected, the high beam indicator will return to normal operation.



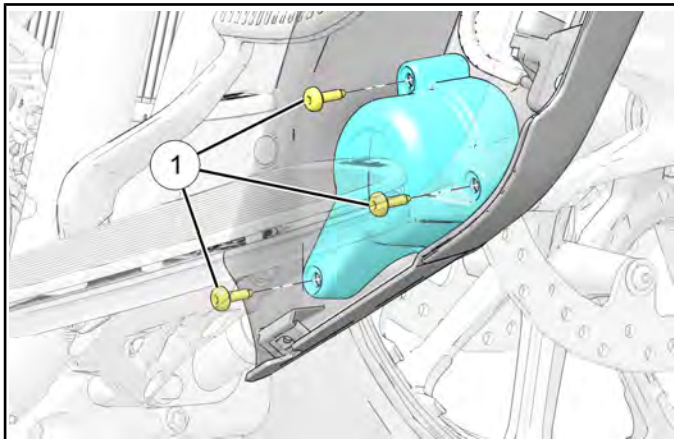
### FOG LIGHT SERVICE

#### FOG LIGHT REMOVAL / INSTALLATION

**NOTICE**

Touring Models

1. Remove fog light bracket by removing its fasteners ①.



2. Disconnect fog light electrical connector.
3. Remove fog light.
4. **Installation is performed by reversing the removal procedure.**

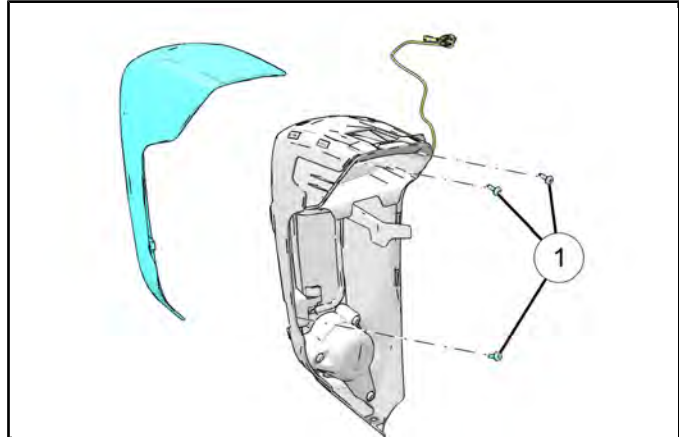
**TORQUE**

Fog Light Bracket Fastener:  
**35 ft-lbs (47 N·m)**

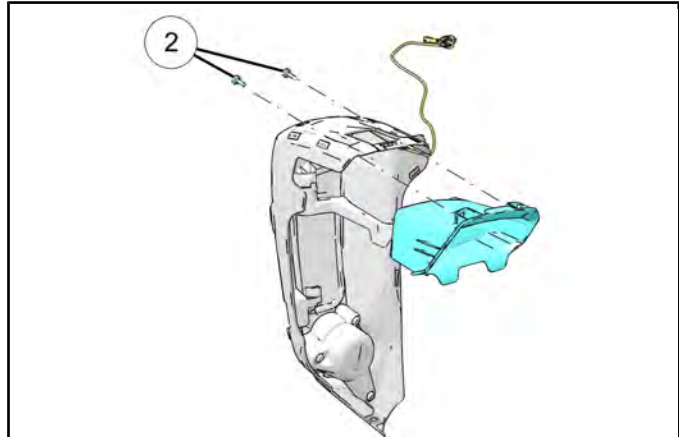
### LOWER FAIRING SERVICE

#### LOWER FAIRING HARNESS REMOVAL / INSTALLATION

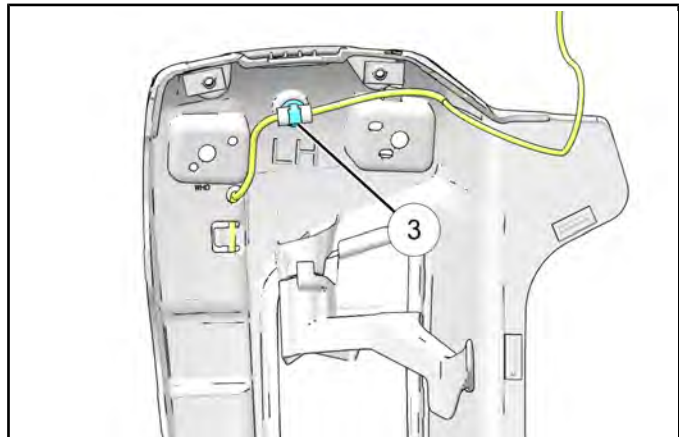
1. Remove lower fairing. See **Lower Fairing Removal / Installation page 7.53.**
2. Remove outer fairing cover by removing its fasteners ①.



3. Remove lower fairing cubby by removing its fasteners ②.



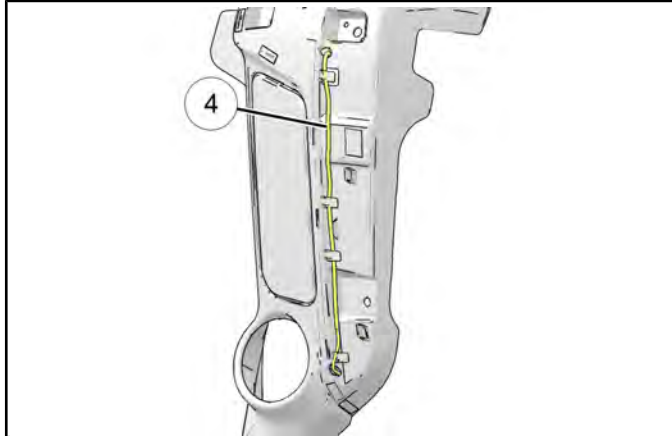
4. Disconnect harness routing clip ③.





## ELECTRICAL

5. Disconnect harness from retention features.



6. Installation is performed by reversing the removal procedure.

### TORQUE

Lower Fairing Cubby Fastener:  
**36 in-lbs (4 N·m)**

### TORQUE

Lower Fairing Fastener  
**36 in-lbs (4 N·m)**

## HEADRESS SERVICE

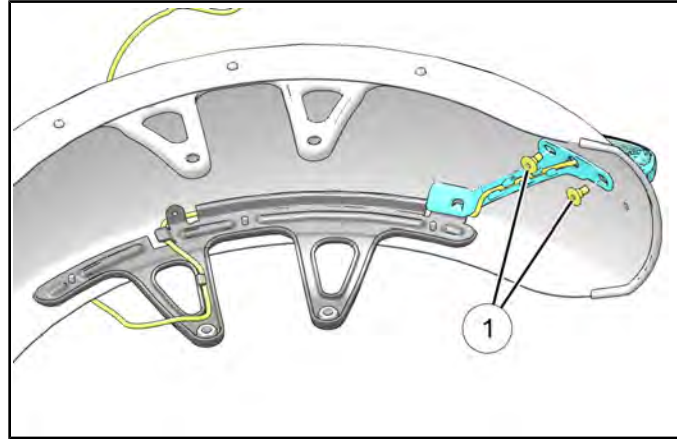
### HEADRESS REMOVAL / INSTALLATION

The front headress is located on the front fender of the unit. Base and International models are **NOT** illuminated.

## REMOVAL

Models equipped with an illuminated headress will require the electrical connection to be disconnected. Remove outer fairing, see **Fairing Disassembly page 7.40**. Follow headress electrical wire and disconnect.

1. Remove front fender. See **Front Fender Removal / Installation page 7.37**.
2. Remove two fasteners ① securing headress.



3. Disconnect the electrical wire from the routing features.

## INSTALLATION

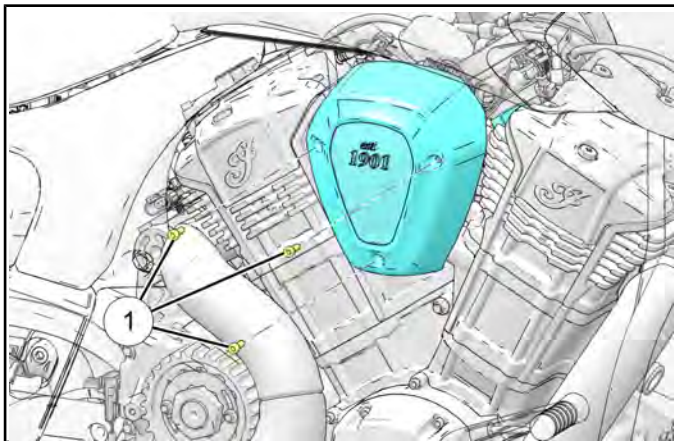
1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

### TORQUE

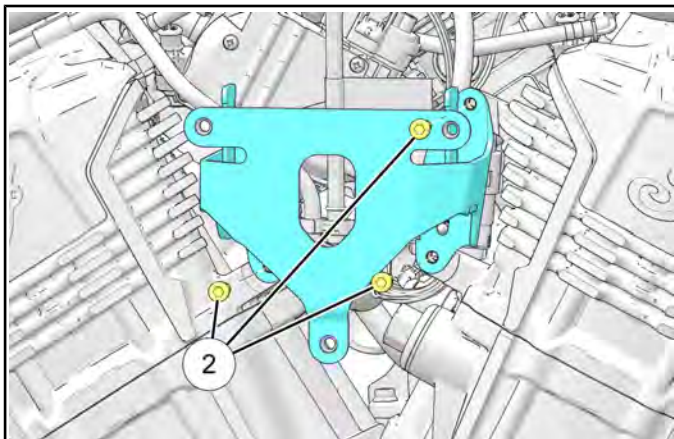
Headress Fastener:  
**36 in-lbs (4 N·m)**

**WIRING HARNESS****WIRING HARNESS REPLACEMENT****MAIN HARNESS**

1. Remove battery box. See **Battery Box Removal / Installation page 10.16.**
2. Remove fairing and disconnect fairing harness from the main harness. Reference **Fairing Disassembly page 7.40.**
3. Remove fuel tank. See **Fuel Tank Removal (2020) page 4.23.**
4. Remove right side v-cover by removing its fasteners ①.

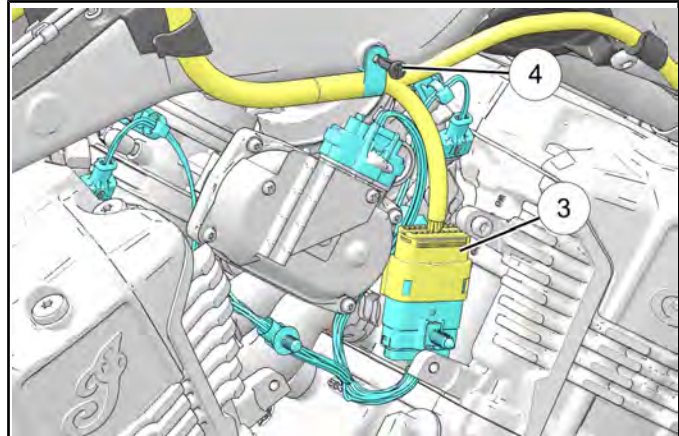


5. If equipped, remove carbon canister. See **Carbon Canister Removal / Installation page 4.12.**
6. Remove V-cover bracket by removing its fastener ②.



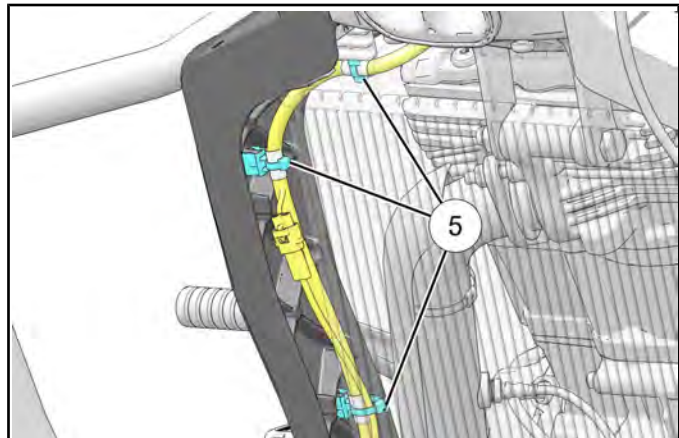
7. Disconnect the wiring harness from the v-cover bracket.

8. Disconnect the engine harness ③.

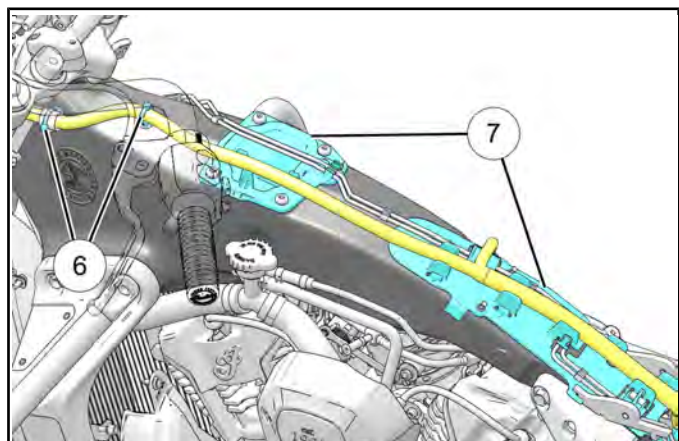


9. Remove routing clip pin ④.

10. Disconnect the harness routing clips ⑤ from the right hand downcast.



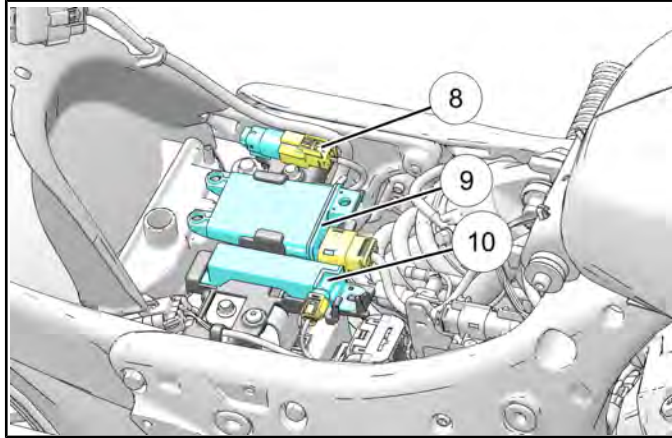
11. On the mainframe, disconnect the two routing clips ⑥.
12. Move the harness up toward the rear of the unit and disconnect from the routing features ⑦.

**10**

## ELECTRICAL

13. Disconnect ECM. See **ECM Removal / Installation** page 4.53.

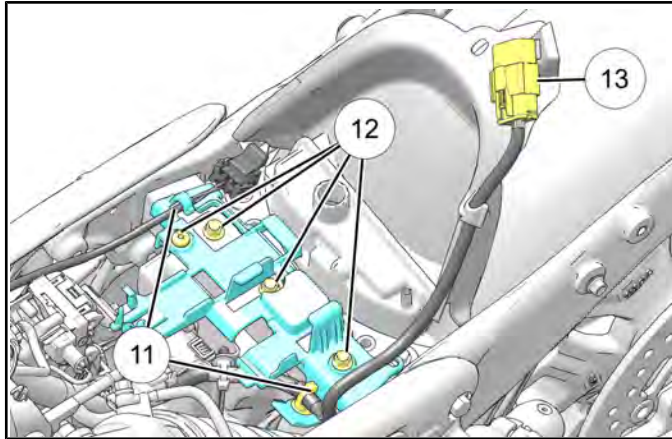
14. Disconnect harness termination fitting ⑧.



15. Disconnect WCM ⑨ electrical connector and remove.

16. Disconnect antenna module ⑩ electrical connector and remove.

17. Disconnecting the wiring retained ⑪ to under-seat wire bracket.

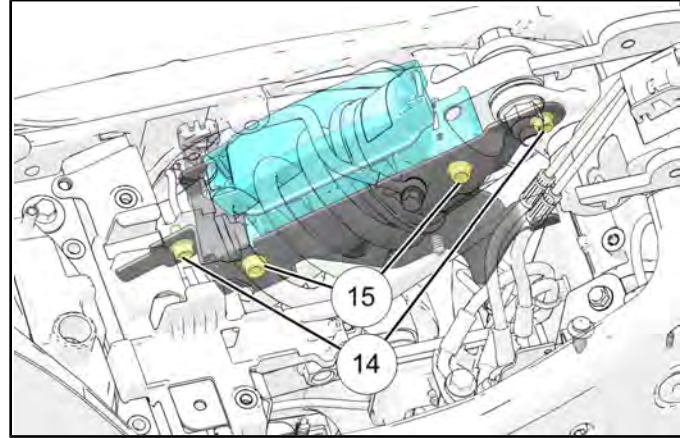


18. Remove under-seat wire bracket by removing its fasteners ⑫.

19. Disconnect the trunk connector ⑬.

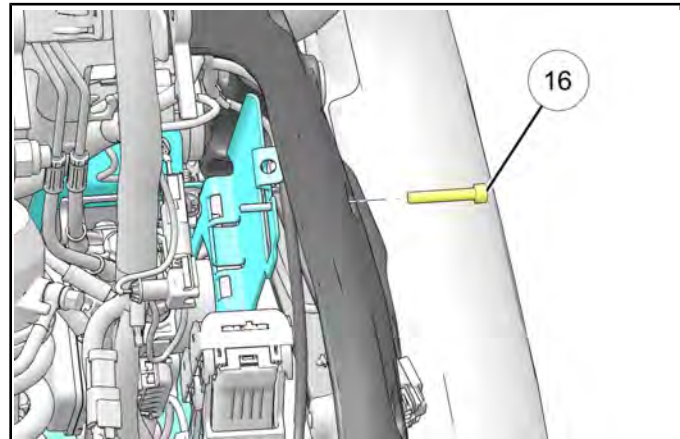
20. Disconnect gear position sensor electrical connector. Reference **Gear Position Switch Replacement** page 10.165.

21. Remove the two fasteners ⑭ securing the fuse box bracket.

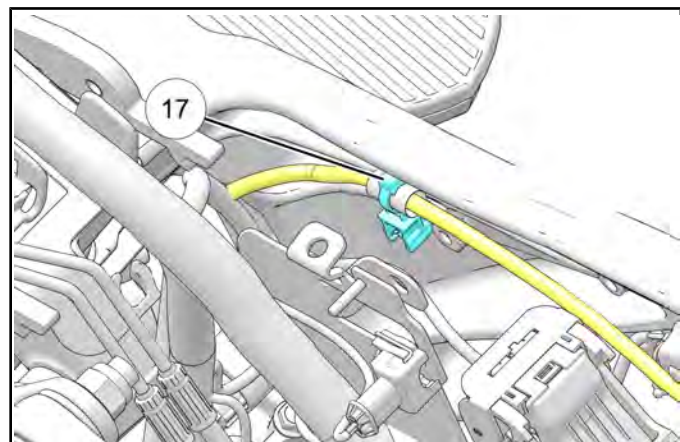


22. Remove the two fasteners ⑮ securing the fuse box.

23. Remove the battery box fastener ⑯



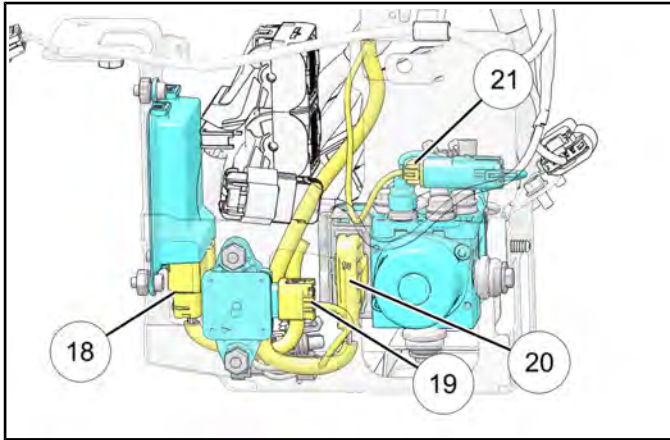
24. Move the battery box toward the center of the unit to disconnect a harness clip ⑰.



25. Disconnect electrical connection for:

- VCM ⑱.
- Inertia sensor ⑲.

- ABS Module ⑳.
- Brake Pressure Switch ㉑.



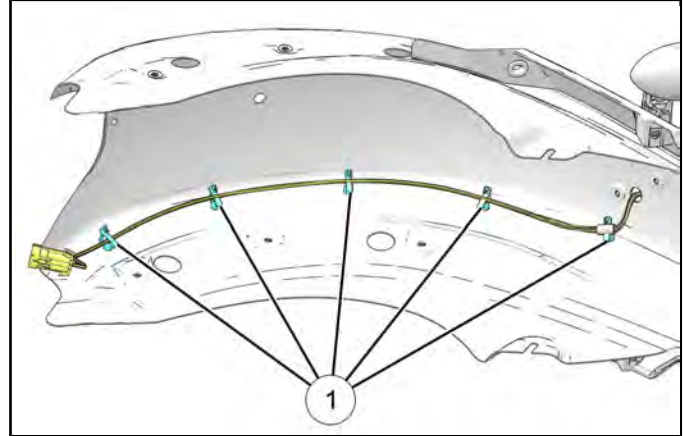
26. Carefully remove the harness from the unit.

### **REAR HARNESS**

1. Remove fender. See **Rear Fender Removal / Installation page 7.38.**

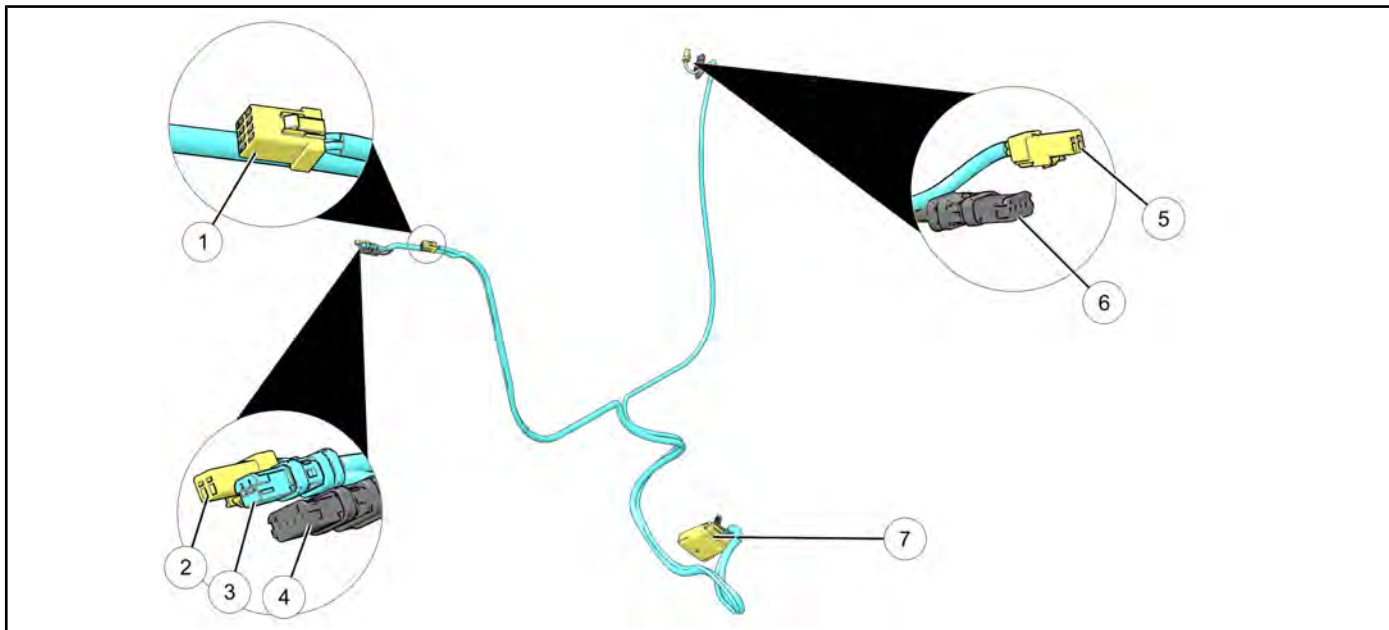
2. Disconnect tail light and license plate light. Reference **Tail / Brake / License Plate Light, Removal / Installation page 10.128.**

3. Disconnect rear harness routing clips ①.



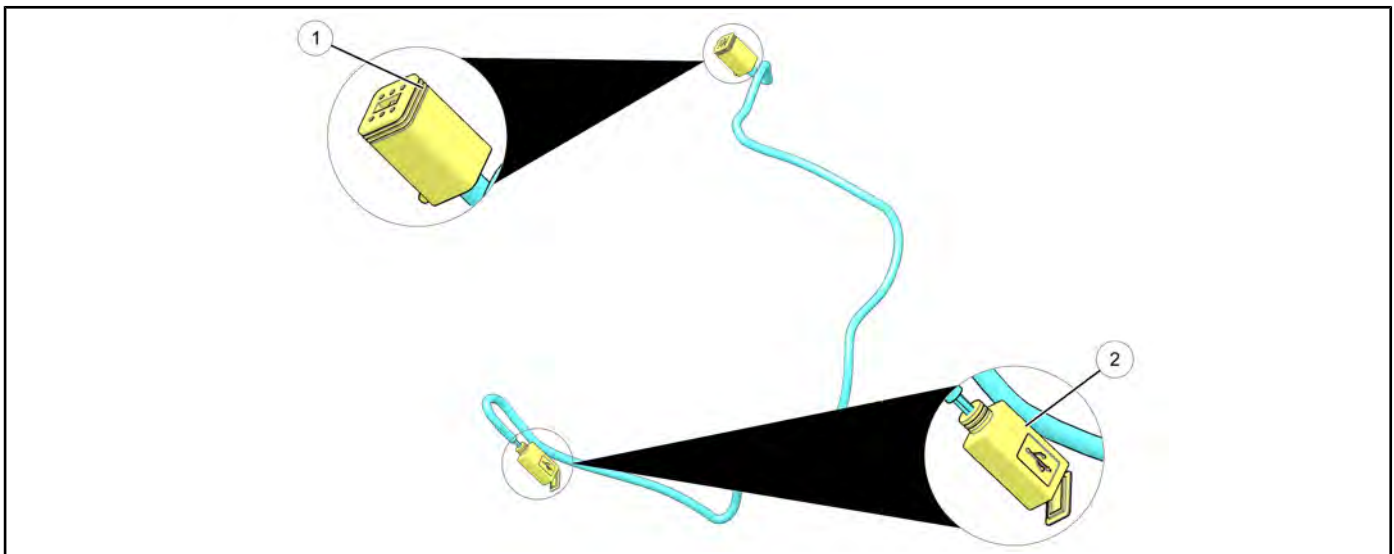
**WIRE HARNESS CONNECTOR IDENTIFICATION**

**HANDLEBAR HARNESS**



REF	DESCRIPTION	REF	DESCRIPTION
①	Twist Grip Sensor	⑤	Heated Grip
②	Heated Grip	⑥	Left Switch Cube
③	Right Switch Cube	⑦	Handlebar to Chassis
④	Right Switch Cube		

**USB HARNESS**

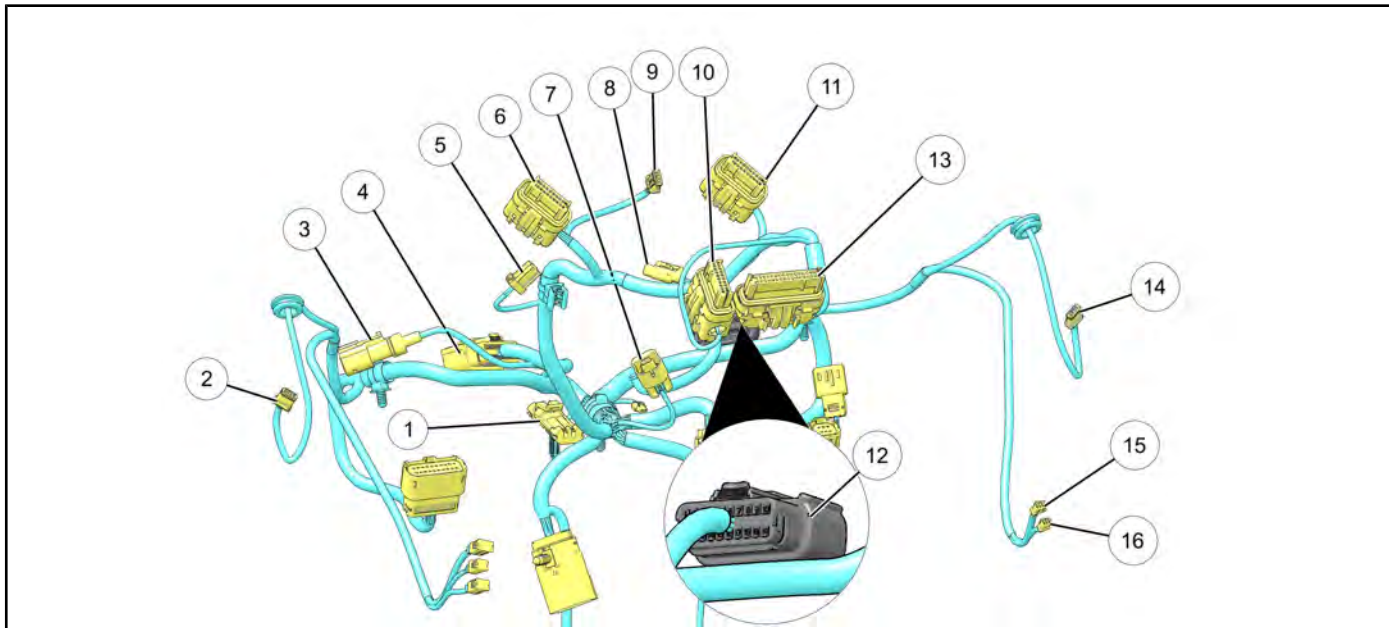


REF	DESCRIPTION
①	Display
②	USB

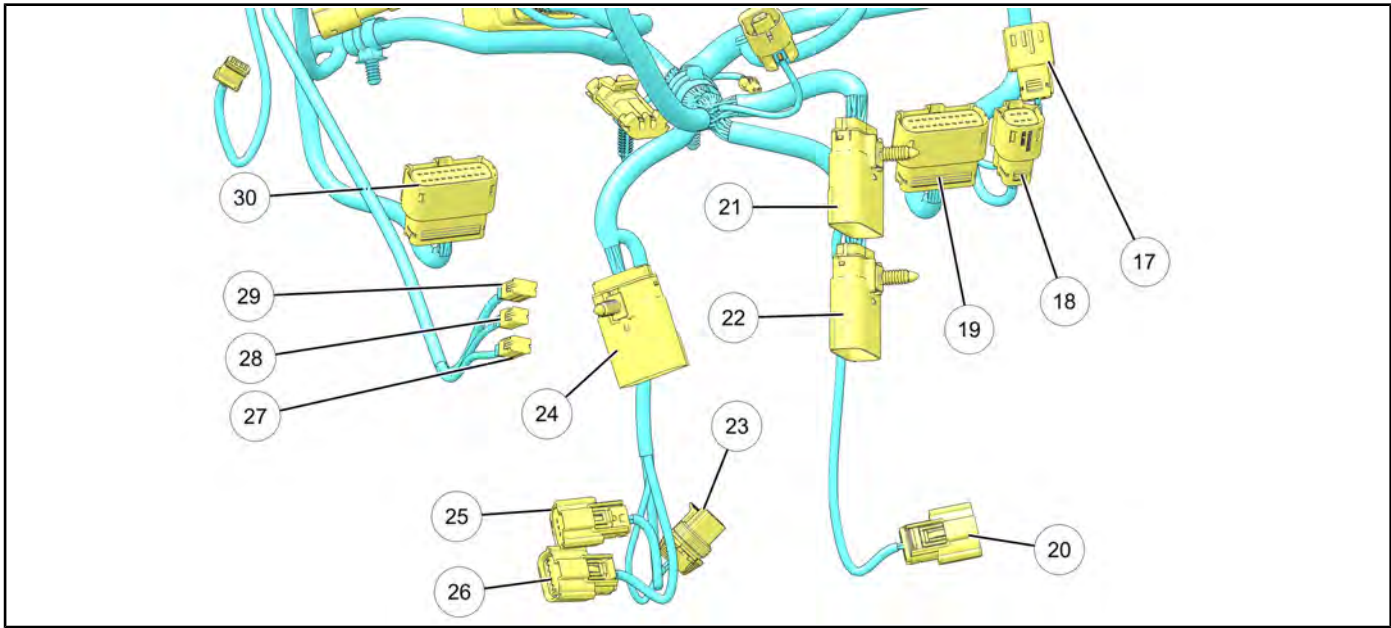
10

# ELECTRICAL

## FAIRING HARNESS



REF	DESCRIPTION	REF	DESCRIPTION
①	ABS Front Wheel Speed Sensor	⑨	Homelink
②	Left Speaker	⑩	7 Inch Display CAN
③	Cell Modem	⑪	Tach
④	VCM 2	⑫	VCM 3
⑤	Windshield Motor	⑬	7 in Display
⑥	Speedometer	⑭	Right Speaker
⑦	Ambient Air	⑮	Lock Switch
⑧	CAN Info	⑯	Ignition Switch

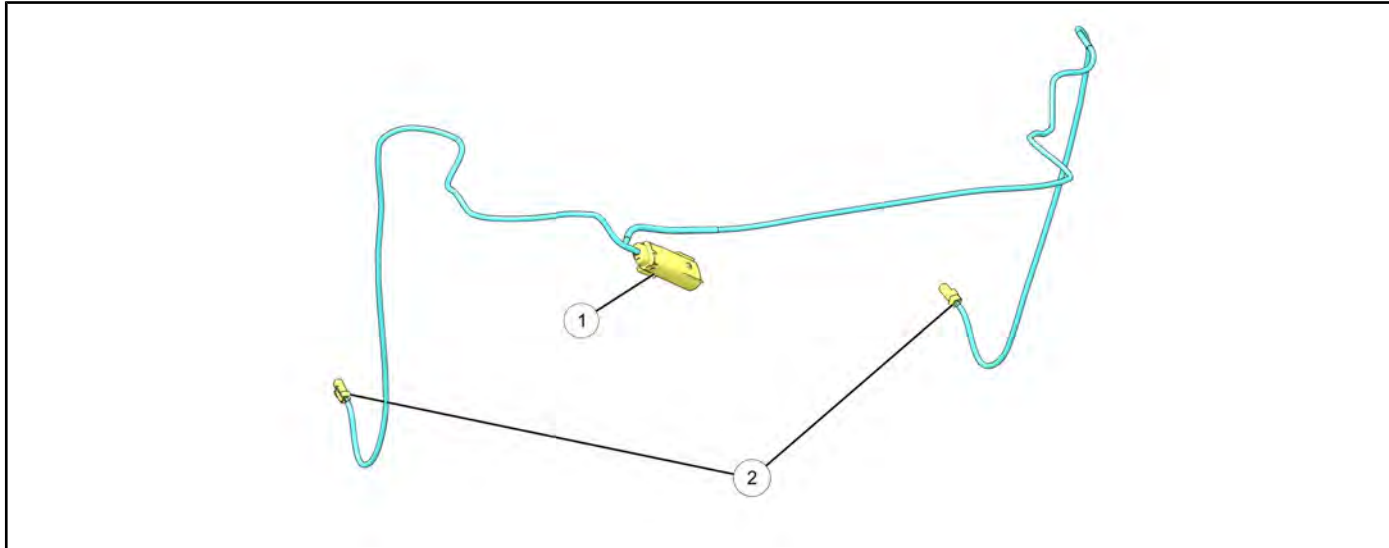


REF	DESCRIPTION	REF	DESCRIPTION
17	Fog Lamps	24	Chassis Audio
18	Power Supply B	25	Headlight
19	Power Supply A	26	Left Turn Signal
20	Right Turn Signal	27	Heated Switch 3
21	Chassis-Fairing	28	Heated Switch 2
22	Chassis Speedometer	29	Fog Lamp Switch
23	Horn	30	Power Supply



# ELECTRICAL

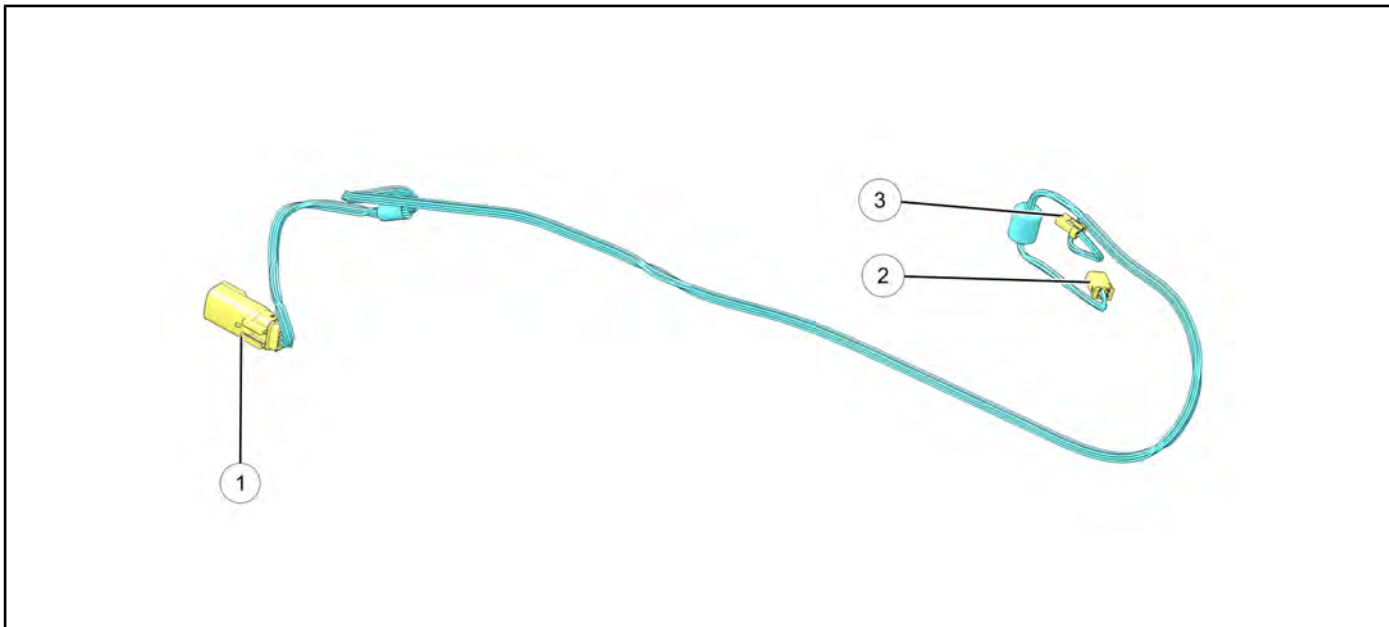
## DRIVING LIGHT HARNESS



REF	DESCRIPTION
①	Fog Lamp Connector
②	AUX Light Connector

**FUEL TANK HARNESS**

**NOTICE**  
Model Year 2020 units only.

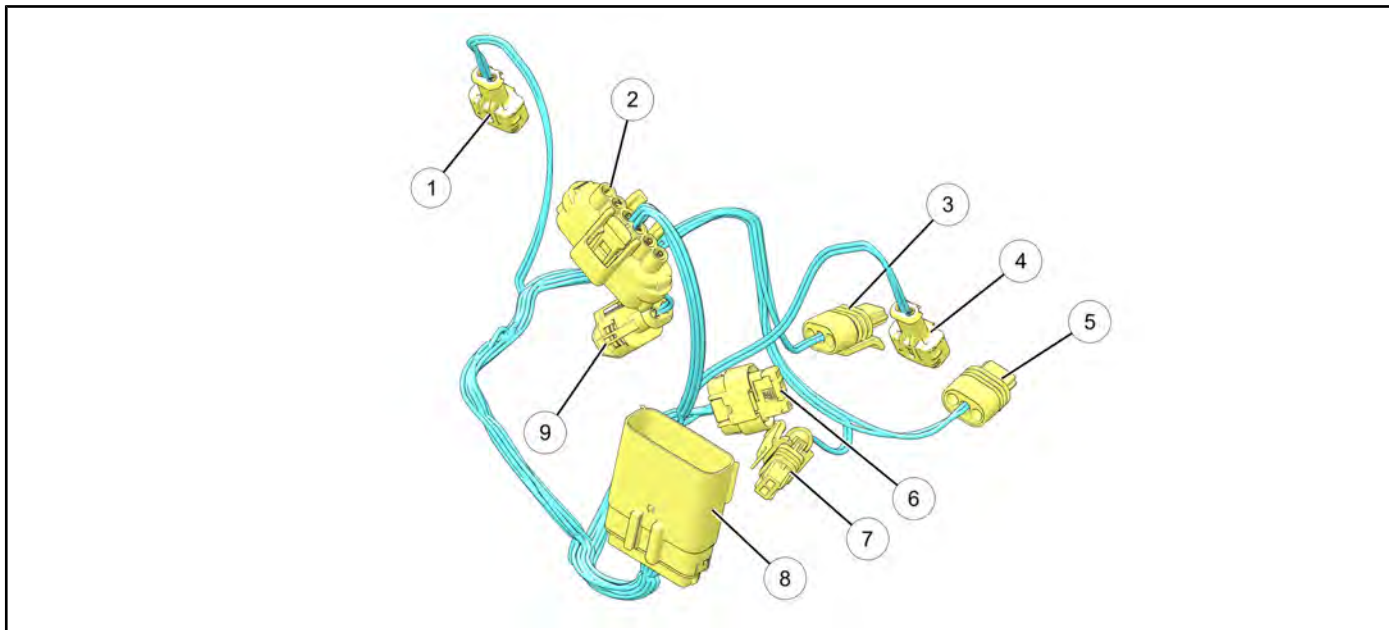


REF	DESCRIPTION
①	Chassis-Fuel
②	Fuel Pump
③	Gas Cap Lock

10

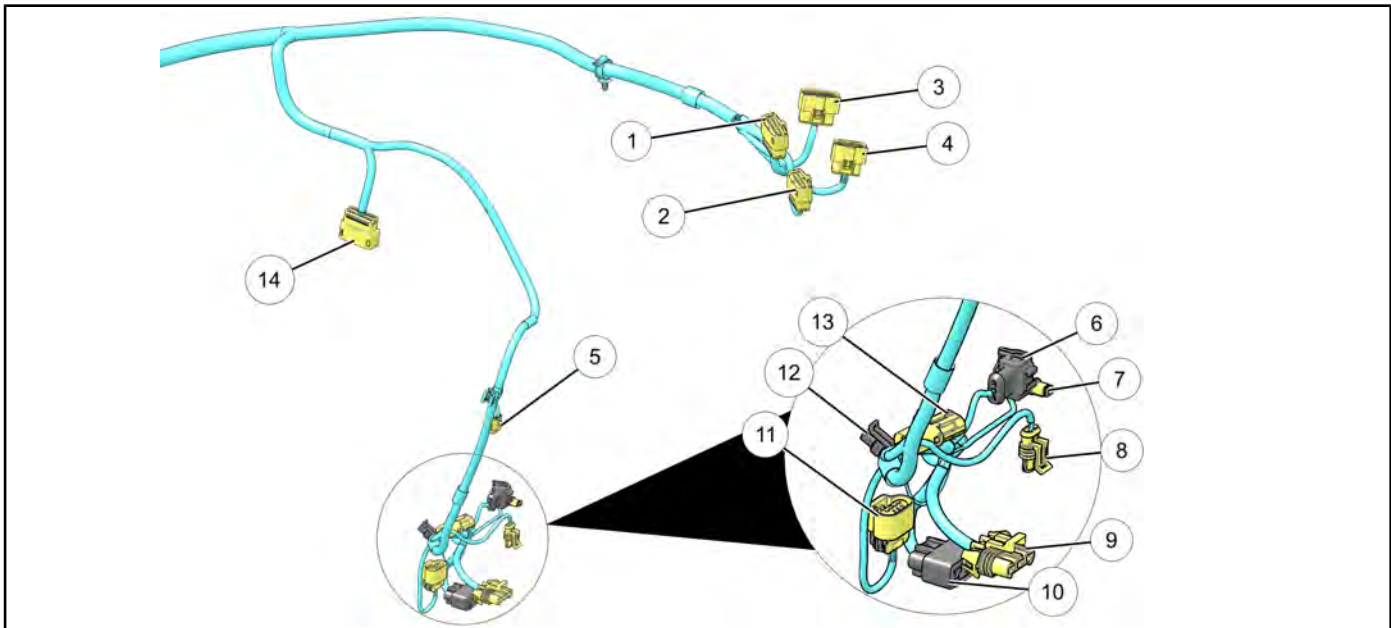
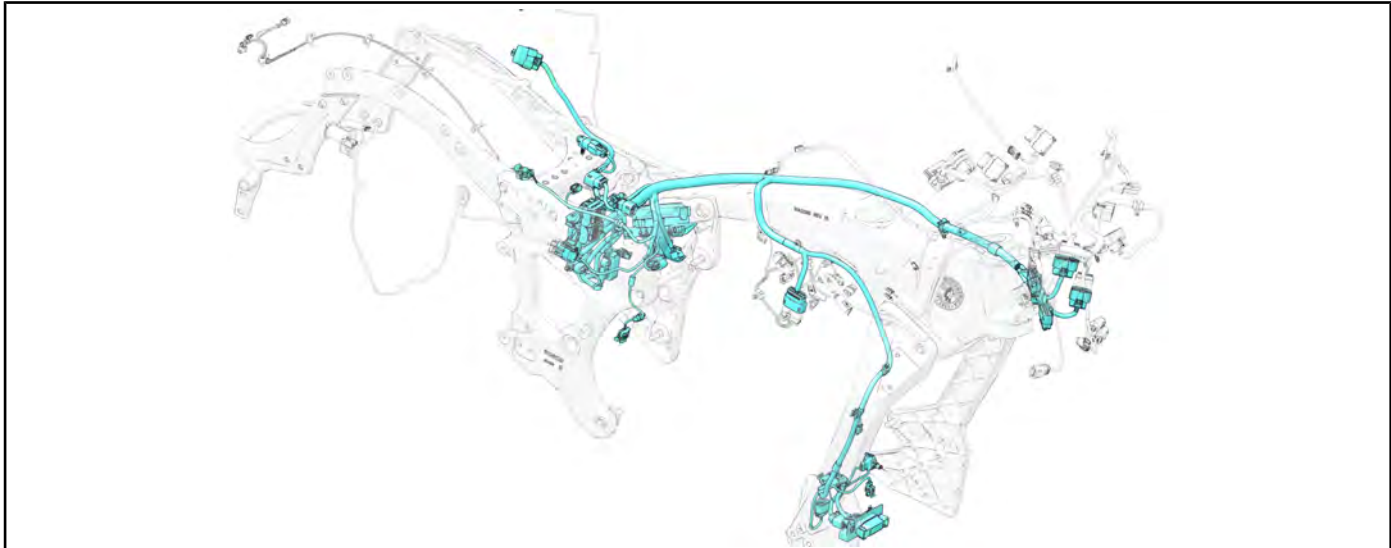
# ELECTRICAL

## ENGINE HARNESS



REF	DESCRIPTION	REF	DESCRIPTION
①	Rear Fuel Injector	⑥	TMAP
②	ETC Motor	⑦	Knock Sensor
③	Rear Ignition Coil	⑧	Engine-Chassis
④	Front Fuel Injector	⑨	Cylinder Head Temperature Sensor
⑤	Front Ignition Coil		

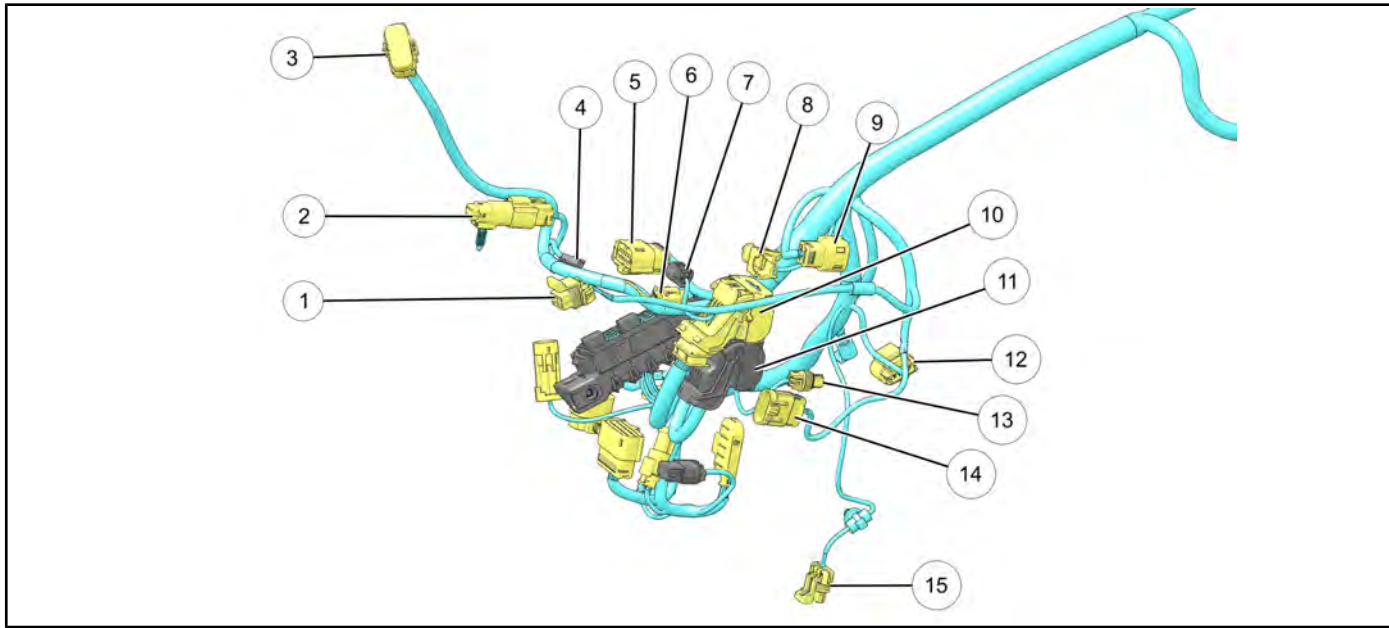
**CHASSIS HARNESS**



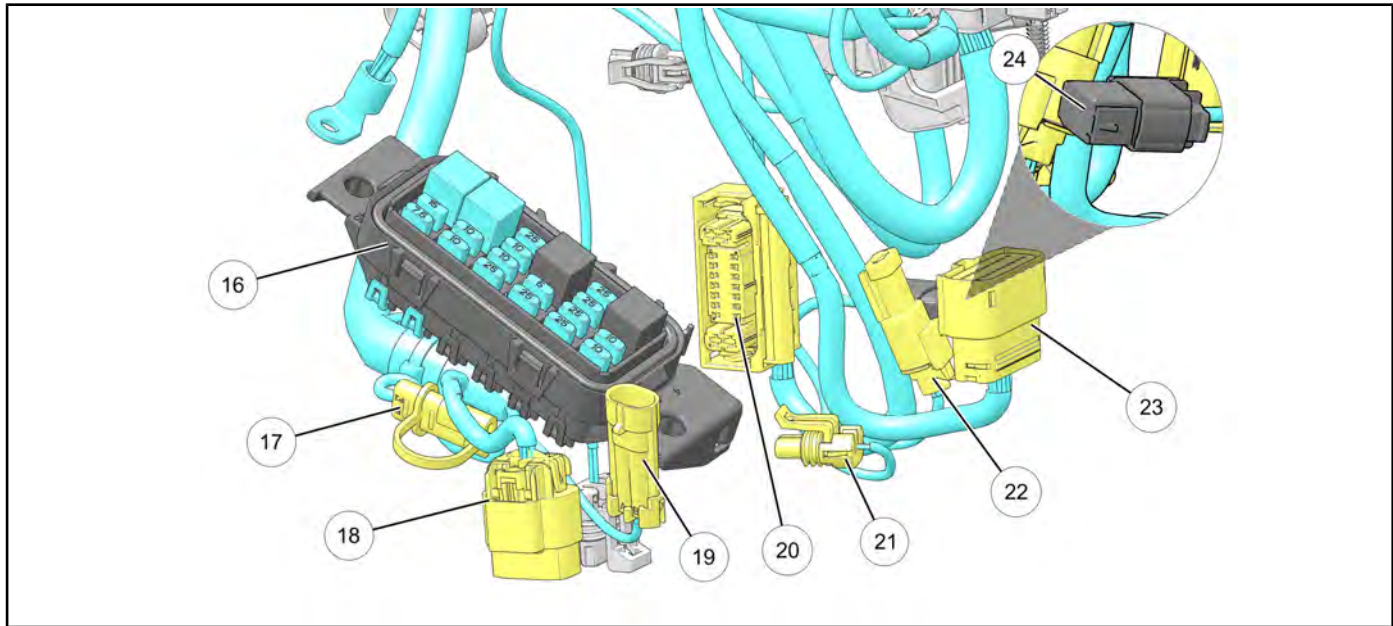
REF	DESCRIPTION	REF	DESCRIPTION
①	Chassis-Fairing	⑧	Start Solenoid
②	Chassis Speedometer	⑨	J-Case
③	Handlebars	⑩	Voltage Regulator
④	Fairing Audio	⑪	Oxygen Sensor
⑤	SS SW	⑫	Oil Pressure Sensor
⑥	CPS	⑬	Cooling Fan
⑦	Puddle Light	⑭	Chassis-Engine

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# ELECTRICAL



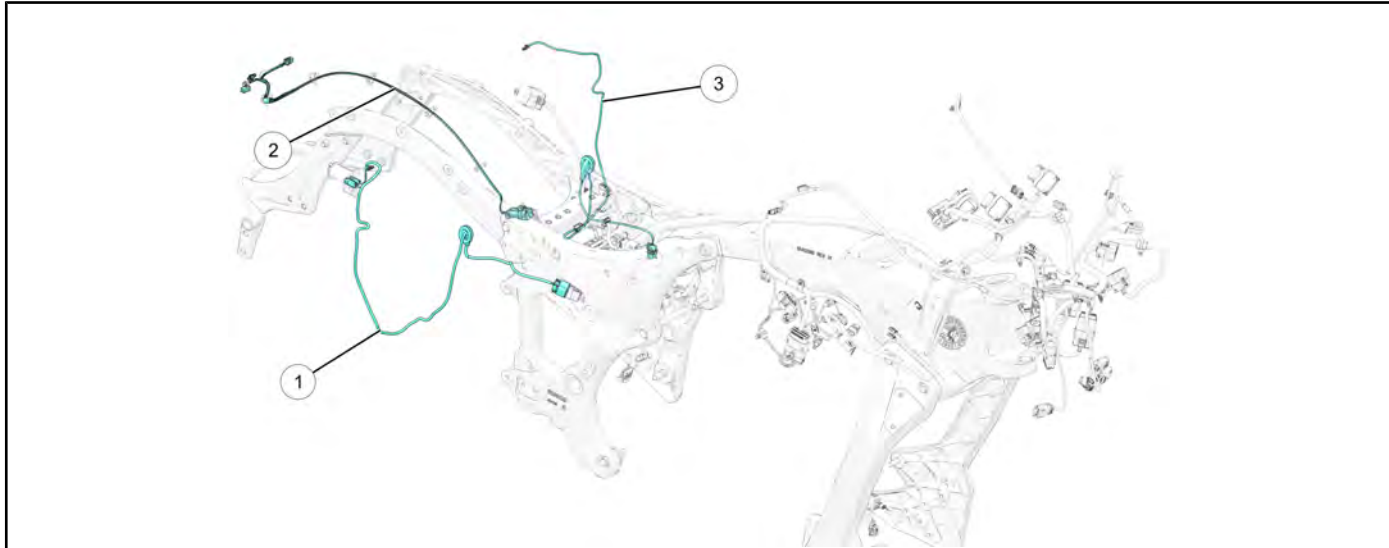
REF	DESCRIPTION	REF	DESCRIPTION
①	Rear Lighting Harness	⑨	Console
②	Saddlebag Audio	⑩	ECM 1
③	Trunk	⑪	ECM 2
④	Rear 12V SW	⑫	Rear Oxygen Sensor
⑤	WCM	⑬	Rear Brake Switch
⑥	ABS CAN	⑭	Right Saddlebag
⑦	LF Antenna	⑮	GSS
⑧	Purge		



REF	DESCRIPTION	REF	DESCRIPTION
⑩⑥	Fusebox	⑩①	Rear Wheel Speed Sensor
⑩⑦	Battery Tender	⑩②	Info CAN
⑩⑧	Diagnostic port	⑩③	VCM 1
⑩⑨	Left Saddle Bag Electric Lock	⑩④	IMU
⑩⑩	ABS		

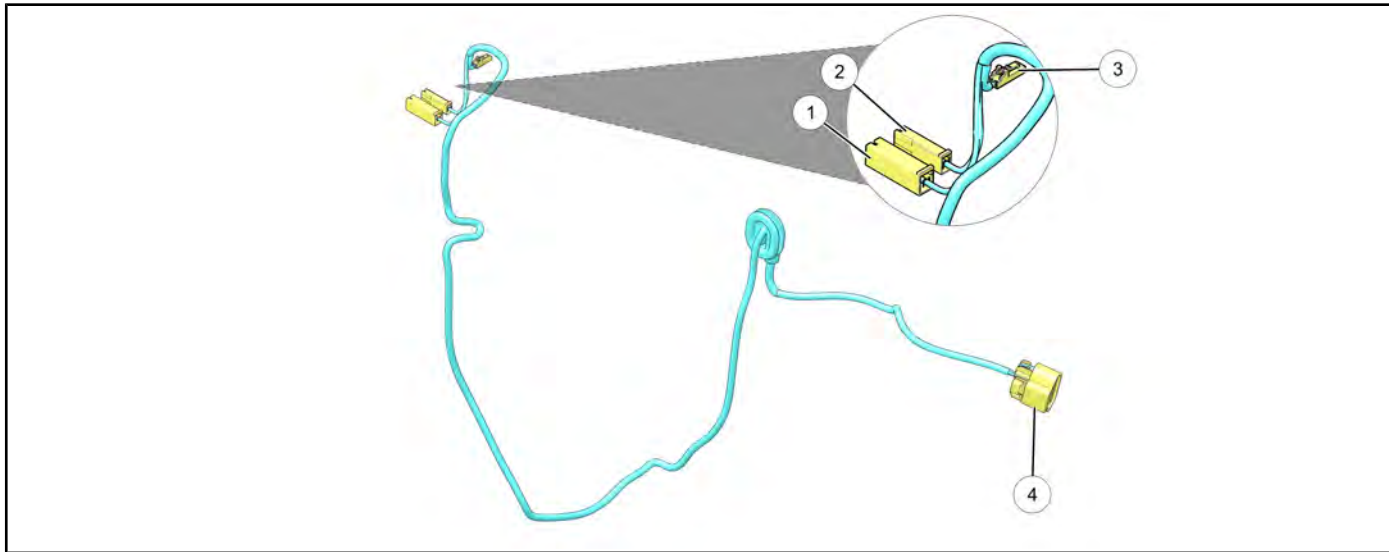
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**REAR SUB-HARNESSES**



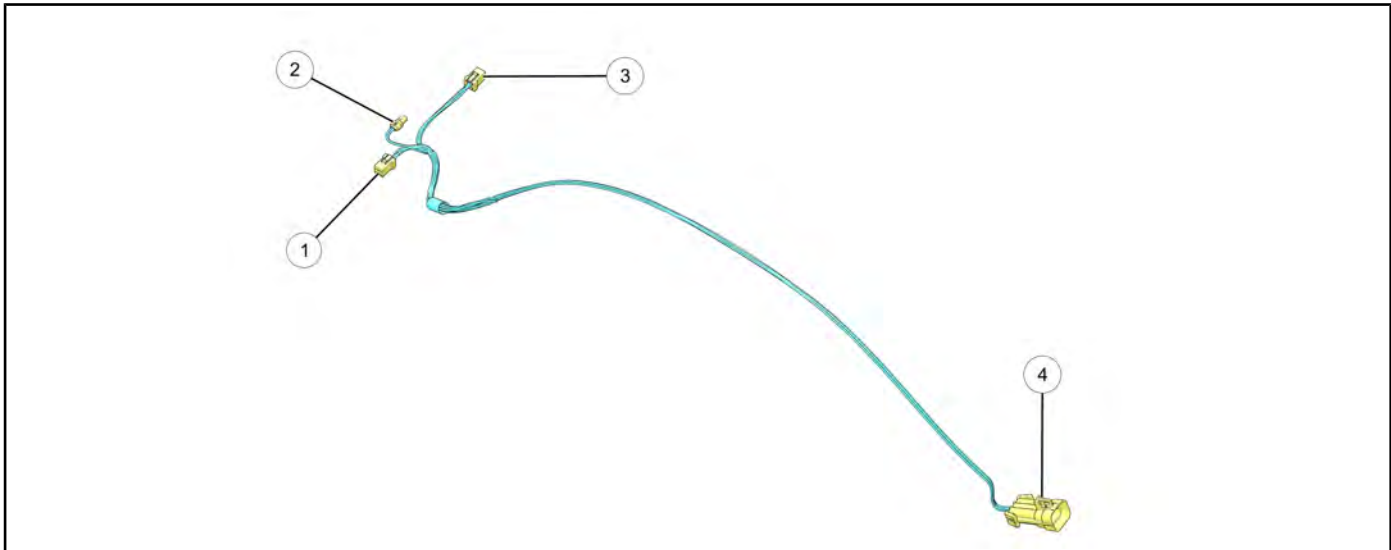
REF	DESCRIPTION
①	Right Saddlebag Harness
②	Tail light Harness
③	Left Saddlebag

**RIGHT SADDLEBAG HARNESS**



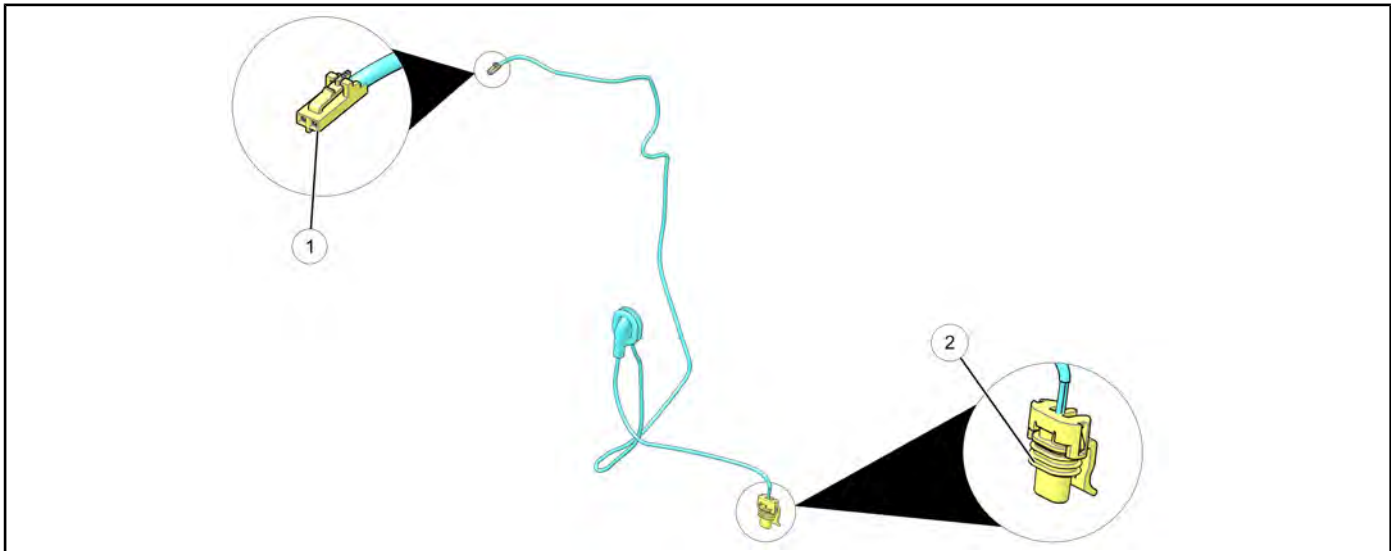
REF	DESCRIPTION
①	12V (-)
②	12V (+)
③	Saddlebag Lock
④	Chassis-Harness

**TAIL LIGHT HARNESS**



REF	DESCRIPTION
①	Right Turn/Stop
②	License Plate
③	Left Turn/Stop
④	Chassis-Harness

**LEFT SADDLEBAG HARNESS**



REF	DESCRIPTION
①	Saddlebag Lock
②	Chassis-Harness

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### HARNESS PINOUTS

#### FAIRING

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
BU/WH	Lock switch	4	Chassis Fairing	13	Bag unlock switch output
BN/GN	Lock switch	2	Chassis Fairing	11	Bag Lock Switch Output
VT/YE	Ignition Switch	2	Chassis Speedo	13	Power Button SW
DG/BK	Fog Switch	2	VCM3	6	Aux Light Switch Output
YE/BK	Chassis Fairing	12	Tach	10	Oil Pressure Switch Output
GN	VCM 2	15	Homelink	3	Garage Door 2 Feed
OG/YE	Chassis Speedo	10	Splice 0011	2	SW Power CONTL
OG/YE	7 Inch Display	31	Splice 0011	1	SW Power CONTL
OG/YE	Speedometer	3	Splice 0011	1	SW Power CONTL
GY/RD	Fog Switch	4	VCM3	4	Aux Light Switch Indicator Light
BU/RD	VCM2	4	Heated SW2	1	Heated Grip LED
BU/BK	VCM2	8	Heated SW2	2	Heated Grip DEC
BK	Chassis Fairing	3	Horn	B	Ground
YE/BN	VCM 2	13	Homelink	2	Garage Door 1 Feed
BK/WH	Ambient Air	B	Chassis Audio	11	Ambient Air Temperature Ground
OG	Splice 0026	2	Chassis Speedo	5	Instrumentation Fuse Output
OG	Tach	4	Splice 0026	2	Instrumentation Fuse Output
OG	Splice 0026	2	7 inch display	32	Instrumentation Fuse Output
OG	Splice 0026	1	Speedometer	4	Instrumentation Fuse Output
DG/RD	7 Inch Display	2	Power Supply Pos 2	13	Preamp Rear Right Speaker Positive
OG/DB	Ambient Air	A	Chassis Speedo	9	Ambient Air Temp Sensor Output
GY/RD	Power Supply Pos 1A	13	7 Inch Display	17	Preamp front right speaker positive
WH/RD	7 inch Display	21	Power Supply POS 1A	15	Preamp front left speaker positive
WH/YE	Power Supply Pos 1A	14	7 Inch Display	20	Preamp Front Left Speaker Negative
GY/BK	Power Supply Pos 1A	4	Right Speaker	3	Front Right Speaker Negative
GY	Power Supply Pos 1A	5	Right Speaker	2	Front Right Speaker Positive
WH	Power Supply Pos 1A	3	Left Speaker	2	Front Left Speaker Positive
WH/BK	Power Supply Pos 1A	2	Left Speaker	3	Front Left Speaker Negative
BG	Power Supply Pos 1A	20	Chassis Fairing	14	Main Audio Power Feed
BG	Power Supply Pos 1A	19	Chassis Fairing	10	Main Audio Power Feed
BK	Headlight	2	Chassis Fairing	17	Ground
BK	Chassis Fairing	20	Splice 0069	2	Main Audio Ground
BK	Splice 0069	1	Power Supply Pos 1A	9	Power Supply A Ground
BK	Splice 0069	1	Power Supply Pos 1A	10	Power Supply A Ground
BK	Splice 0069	2	Power Supply Pos 1A	16	Main Audio Ground

PD/GN	Chassis Speedo	7	Splice 0071	2	VCM Accessory Power Out
PD/GN	Splice 0071	1	Homelink	1	VCM Accessory Power Out
PD/GN	Lock Switch	3	Splice 0071	2	VCM Accessory Power Out
PD/GN	Splice 0071	2	Tach	3	VCM Accessory Power Out
PD/GN	Splice 0071	2	Fog Switch	3	VCM Accessory Power Out
PD/GN	Splice 0071	1	Power Supply Pos 2	7	VCM Accessory Power Out
PD/GN	Splice 0071	1	Power Supply Pos 1A	7	VCM Accessory Power Out
PD/DB	VCM3	19	Splice 0071	2	VCM Accessory Power Out
PD/GN	VCM3	10	Splice 0071	2	VCM Accessory Power Out
PD/GN	Heated SW3	3	Splice 0071	1	VCM Accessory Power Out
PD/GN	Splice 0071	1	Position Lamp	1	VCM Accessory Power Out
PD/GN	VCM2	10	Splice 0071	1	VCM Accessory Power Out
GY/YE	Power Supply Pos 1A	12	7 Inch Display	18	Preamp Front Right Speaker Negative
BK	Splice 0080	2	Chassis Speedo	6	Ground
BK	Splice 0080	1	Speedometer	5	Ground
BK	Homelink	4	Splice 0080	2	Ground
BK	Ignition SW	1	Splice 0080	2	Ground
BK	Splice 0080	2	Tach	5	Ground
BK	Splice 0080	2	7 Inch Display	16	Ground
DB/RD	Chassis Fairing	15	Right Turn	1	Front Right Turn Signal Lamp Output
DG	Power Supply Pos 1B	2	Chassis Audio	1	Rear Left Speaker +
DG/BK	Power Supply Pos 1B	1	Chassis Audio	9	Rear Left Speaker -
VT	Power Supply Pos 1B	5	Chassis Audio	2	Rear Right Speaker +
VT/BK	Power Supply Pos 1B	4	Chassis Audio	10	Rear Right Speaker
YE	Headlight	3	VCM2	16	High Beam Output
DG	Headlight	1	VCM2	5	Low Beam Output
GY/DB	VCM2	9	Windshield Motor	1	Windshield Motor Up
GY/DG	VCM2	18	Windshield Motor	2	Windshield Motor Down
DG/RD	Fog Lamps	1	VCM3	13	LH Aux Light Feed
DG/BN	Fog Lamps	3	VCM3	15	RH Aux Light Feed
BN/WH	Chassis Speedo	14	Ignition SW	3	Security LED
YE	Splice 0132A	1	Speedometer	1	CANA HIGH
YE	Splice 0132A	2	7 Inch Display	29	CANA HIGH
YE	Splice 0132B	2	Splice 132A	2	CANA HIGH
YE	Splice 0132B	2	Tach	1	CANA HIGH
YE	Splice 0132C	1	Splice 0132B	1	CANA HIGH
YE	Splice 0132C	1	VCM2	2	CANA HIGH
YE	Chassis Speedo	1	Splice 0132C	2	CANA HIGH

## ELECTRICAL

BG/WH	Chassis Audio	13	Power Supply Pos 2	19	Secondary Audio Power Feed
BG/WH	Chassis Audio	5	Power Supply Pos 2	20	Secondary Audio Power Feed
DG	Speedometer	2	Splice 0144A	1	CANA LOW
DG	Splice 0144A	2	7 Inch Display	30	CANA LOW
DG	Splice 0144B	2	Splice 0144A	2	CANA LOW
DG	Splice 0144B	2	Tach	2	CANA LOW
DG	Splice 0144C	1	Splice 0144B	1	CANA LOW
DG	Splice 0144C	1	VCM2	11	CANA LOW
DG	Chassis Speedo	2	Splice 0144C	2	CANA LOW
WH	Horn	A	Chassis Speedo	4	Horn Feed
BU/YE	VCM2	6	Heated SW3	2	Heated Grips INC
GY/BK	Chassis Fairing	4	ABS FWSS	B	Front Wheel Speed Signal Negative
DG/YE	7 inch Display	1	Power Supply Pos 2	12	Preamp Rear Right Speaker Negative
GY/RD	Chassis Fairing	5	ABS FWSS	A	Front Wheel Speed Signal Positive
DB/PK	Chassis Speedo	8	Splice 0194	2	AUX Engine Relay Output
DB/PK	Right Turn	3	Splice 0194	1	Aux Engine Relay Output
DB/PK	Left Turn	3	Splice 0194	1	Aux Engine Relay Output
VT/RD	7 Inch Display	5	Power Supply Pos 2	15	Preamp Rear Left Speaker Positive
VT/YE	7 Inch Display	4	Power Supply Pos 2	14	Preamp Rear Left Speaker Negative
DB	Chassis Fairing	1	Left Turn	1	Front Left Turn Signal Lamp Output
OG/RD	Chassis Speedo	15	VCM2	7	Fan Control
YE	7 Inch Display	2	Splice 0242A	1	CANC HIGH
YE	VCM3	2	Splice 0242A	2	CANC HIGH
YE	Splice 0242A	1	CAN Info	1	CANC HIGH
YE	Splice 0242A	2	Splice 242B	2	CANC HIGH
YE	Splice 0242B	1	Power Supply Pos 2	1	CANC HIGH
YE	Splice 0242C	2	Splice 0243B	1	CANC HIGH
YE	Power Supply Pos 1A	1	Splice 0243C	1	CANC HIGH
YE	Chassis Fairing	18	Splice 0243C	1	CANC HIGH
DG	7 Inch Display CAN	1	Splice 0243A	1	CANC LOW
DG	VCM3	11	Splice 0243A	2	CANC LOW
DG	Splice 0243A	1	CAN Info	2	CANC LOW
DG	Splice 0243A	2	Splice 0243B	2	CANC LOW
DG	Splice 0243B	1	Power Supply Pos 2	11	CANC LOW
DG	Splice 0243B	2	Splice 0243C	2	CANC LOW
DG	Splice 0243C	1	Power Supply Pos 1A	11	CANC LOW
DG	Chassis Fairing	8	Splice 0243C	1	CANC LOW
RD/BK	Chassis Fairing	2	VCM2	20	VCM2 Power Feed

RD/BK	Chassis Fairing	19	VCM2	1	VCM2 Power Feed
RD/DG	Chassis Speedo	11	VCM3	1	VCM2 Power Feed
RD/DG	Chassis Speedo	16	VCM3	20	VCM2 Power Feed
BK	Chassis Speedo	3	Splice 0250	2	Ground
BK	Lock Switch	1	Splice 0250	2	Ground
BK	Fog Switch	1	Splice 0250	2	Ground
BK	Fog Lamps	2	Splice 0250	2	Ground
BK	Heated SW3	1	Splice 0250	1	Ground
BK	VCM2	19	Splice 0250	1	Ground
BK	Right Turn	2	Splice 0250	1	Ground
BK	Position Lamp	2	Splice 0250	1	Ground
BK	Chassis Audio	3	Splice 0250	1	Ground
BK	Left Turn	2	Splice 0250	1	Ground
BK	Chassis Speedo	12	VCM2	14	Ground
BK	Chassis Fairing	7	Splice 0252	2	Ground
BK	Splice 0252	1	Power Supply POS 2	9	Power Supply B Ground
BK	Splice 0252	1	Power Supply POS 2	10	Power Supply B Ground
BK	Splice 0252	2	Power Supply Pos 2	17	Power Supply B Ground

## ELECTRICAL

### CUBE FAIRING

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
YE/BK	Chassis Handlebar	19	Twistgrip Sensor	4	Pedal Position Sensor 2 Return
YE/GN	Chassis Handlebar	18	Twistgrip Sensor	8	Pedal Position Sensor 2 Output
WH/GN	Chassis Handlebar	8	Twistgrip Sensor	5	Pedal Position Sensor 1 Output
BD/PK	Chassis Handlebar	14	Right Switchcube 2	1	Run / Stop Switch Output
YE/RD	Chassis Handlebar	17	Twistgrip Sensor	3	Pedal Position Sensor 2 +5v Reference
YE	Chassis Handlebar	1	Left Switchcube 1	3	250K CAN HIGH
YE	Chassis Handlebar	10	Right Switchcube 1	3	250K CAN HIGH
DG	Chassis Handlebar	11	Left Switchcube 1	4	250K CAN HIGH
DG	Chassis Handlebar	20	Right Switchcube 1	4	250K CAN HIGH
WH/RD	Chassis Handlebar	7	Twistgrip Sensor	2	Pedal Position Sensor 1 +5V Reference
GY/RD	Chassis Handlebar	2	Left Switchcube 1	1	Right Switchcube Feed
VT/YE	Chassis Handlebar	3	Right Switchcube 2	2	Ignition Switch Signal
WH/BK	Chassis Handlebar	9	Twistgrip sensor	1	Pedal Position Sensor 1 Return
PK	Chassis Handlebar	5	Splice 64	1	Heated Grips Output
PK	Left Heat	1	Splice 64	2	Heated Grips Output
PK	Right Heat	1	Splice 64	2	Heated Grips Output
PK	Chassis Handlebar	16	Splice 64	1	Ground
PK	Left Heat	2	Splice 64	2	Ground
PK	Left Switchcube 1	2	Splice 64	2	Ground
PK	Right Heat	2	Splice 64	2	Ground
PK	Right Switchcube 1	2	Splice 64	2	Ground
RD/YE	Chassis Handlebar	6	Right Switchcube 1	1	VCM Control Feed

### REAR LIGHTING

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
BK	Chassis Harness	E	Splice 0044	2	Chassis Ground
BK	Rear Right Turn Signal	2	Splice 0044	1	Chassis Ground
BK	License Plate Lamp	2	Splice 0044	1	Chassis Ground
BK	Rear Left Turn Signal	2	Splice 0044	1	Chassis Ground
DG/YE	Chassis Harness	A	License Plate Lamp	1	Tail Light Feed
DB	Rear Left Turn Signal	1	Chassis Harness	D	Rear Left Turn Signal Lamp Output
DB/RD	Rear Right Turn Signal	1	Chassis Harness	C	Rear Right Turn Signal Lamp Output

**CHASSIS**

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
DB/WH	Chassis Fairing	13	WCM	5	Bag Unlock Switch Output
DB/BK	Chassis Fairing	11	WCM	3	Bag Lock Switch Output
VT/BK	WCM	6	Chassis Speedo	13	Ignition Switch Signal
YE/BK	Oil Pressure Switch	1	Chassis Fairing	12	Oil Pressure Switched Output
OG/YE	WCM	8	Splice 0011	2	Switched Relay Feed – Coil
OG/YE	Fusebox	8	Splice 0011	1	Switched Relay Feed – Coil
OG/YE	Chassis Speedo	10	Splice 0011	2	Switched Relay Feed – Coil
BK	Chassis Fairing	3	Ground	1	Fairing Ground
RD	ECM 1	109	Chassis Engine	9	Knock Sensor Feed
BK/WH	ECM 1	153	Fairing Audio	11	Ambient Air Temperature Ground
BN	ABS	14	ABS Rear Wheel Speed Sensor	B	Rear Wheel Speed Signal –
BN/RD	ABS	13	ABS Rear Wheel Speed Sensor	A	Rear Wheel Speed Signal +
DG/WH	Fusebox	39	Start Solenoid	1	Starter Solenoid Feed
OG	Fusebox	18	Chassis Speedo	5	Instrumentation Fuse Output
VT/YE	Fusebox	23	Console	4	Fuel Pump Feed
OG/DB	ECM 2	247	Chassis Speedo	9	Ambient Air Temperature Sensor
RD/WH	VCM 1	9	Splice 0033	2	Lock Motor Feed
RD/WH	Right Saddlebag Electric Lock	A	Splice 0033	1	Lock Motor Feed
RD/WH	Left Saddlebag Electric Lock	A	Splice 0033	1	Lock Motor Feed
RD/WH	Trunk	1	Splice 0033	2	Lock Motor Feed
OG/WH	VCM1	18	Splice 0034	2	Unlock Motor Feed
OG/WH	Left Saddlebag Electric Lock	B	Splice 0034	1	Unlock Motor Feed
OG/WH	Right Saddlebag Electric Lock	B	Splice 0034	1	Unlock Motor Feed
OG/WH	Trunk	2	Splice 0034	2	Unlock Motor Feed
PK/RD	ECM 2	212	Chassis-Engine	6	ETC Motor Positive
YE	ECM 2	224	Chassis-Engine	5	ETC Motor Negative
GY/WH	Fusebox	01	Splice 0043	1	Accessory Switched Output
GY/WH	Trunk	5	Splice 0043	1	Accessory Switched Output
GY/WH	Splice 0043	2	Rear 12v Switch	A	Accessory Switched Output
BK	Ground	1	Splice 0044	2	Ground
BK	Console	7	Splice 0044	2	Ground
BK	Rear Lighting	E	Splice 0044	1	Ground
BK	Rear Brake Switch	B	Splice 0044	1	Ground

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BG	Fusebox	11	Splice 0044	2	Main Audio Power Feed
BG	Chassis Fairing	14	Splice 0044	1	Main Audio Power Feed
BG	Chassis Fairing	10	Splice 0044	1	Main Audio Power Feed
RD	J-Case	A	ABS	18	ABS Main Fuse Output
WH/RD	Handlebars	9	ECM 2	238	Pedal Position Sensor
WH/GY	ECM 2	242	Chassis-Engine	8	Rear Fuel Injector Driver
WH/DB	ECM 2	241	Chassis-Engine	15	Front Fuel Injector Driver
BK	Ground	1	Chassis-Fairing	17	Low Beam Ground
SHLD	CPS	3	Splice 0179	1	Crank Position Sensor Shield
PKL	VCM1	5	Handlebars	5	Heated Grips Output
OG/BN	ECM 2	216	Chassis-Engine	14	Manifold Absolute Pressure Sensor Output
BK	Splice 0067	1	Ground	1	ABS Ground
BK	ABS	10	Splice 0067	2	ABS Ground
BK	ABS	1	Splice 0067	2	ABS Ground
BK	Chassis Fairing	20	Ground	1	Main Audio Ground
RD	J-Case	C	Splice 0070A	2	Main Fuse Output
RD	Splice 0070B	2	J-Case	B	Main Fuse Output
RD	Splice 0070B	1	Fusebox	15	Main Fuse Output
RD	Splice 0070A	1	Fusebox	29	Main Fuse Output
RD	Fusebox	44	Splice 0070A	1	Main Fuse Output
RD	Fusebox	2	Fusebox	04	Main Fuse Output
RD	Fusebox	22	Splice 0070A	2	Main Fuse Output
RD	Fusebox	37	Splice 0070A	1	Main Fuse Output
RD	Fusebox	30	Splice 0070A	2	Main Fuse Output
RD	Fusebox	32	Splice 0070A	1	Main Fuse Output
RD	Fusebox	13	Splice 0070A	1	Main Fuse Output
RD	Fusebox	21	Splice 0070A	1	Main Fuse Output
RD	Fusebox	16	Splice 0070A	2	Main Fuse Output
PK/GN	Fusebox	02	Splice 71	2	Accessory Power Output
PK/GN	Handlebars	2	Splice 71	1	Accessory Power Output
PK/GN	Chassis Speedo	7	Splice 71	1	Accessory Power Output
PK/GN	Diag	B	Splice 71	2	Accessory Power Output
PK/GN	ABS	4	Splice 71	2	Accessory Power Output
PK/GN	VCM 1	10	Splice 71	2	Accessory Power Output
PK/GN	IMU	4	Splice 71	1	Accessory Power Output
VT/RD	ECM 2	245	Chassis-Engine	1	TPS 2 Signal
BK	Ground	1	Splice 0080	2	Ground
BK	Handlebars	16	Splice 0080	1	Ground

BK	Rear 12V Switch	B	Splice 0080	2	Ground
BK	Diag	D	Splice 0080	2	Ground
BK	Splice 0080	2	Fusebox	3	Ground
BK	Chassis Speedo	6	Splice 0080	1	Ground
YE/BK	ECM 2	202	GSS	C	Transmission Gear Position Sensor Output
RD/YE	Fusebox	33	Splice 0083	1	VCM Control Feed
RD/YE	WCM	1	Splice 0083	2	VCM Control Feed
RD/YE	Handlebars	6	Splice 0083	2	VCM Control Feed
RD/YE	Fusebox	48	Splice 0083	1	VCM Control Feed
VT/PK	Fusebox	42	Splice 0083	2	Engine Relay Output
VT/PK	Splice 0085	2	Fisebpx	24	Engine Relay Output
VT/PK	ECM 2	250	Splice 0085	1	Engine Relay Output
VT/PK	Splice 0085	1	Chassis-Engine	7	Engine Relay Output
VT/PK	Fusebox	36	Splice 0085	2	Engine Relay Output
VT/PK	Fusebox	20	Splice 0085	2	Engine Relay Output
VT/PK	ECM 2	249	Splice 0085	1	Engine Relay Output
GY/WH	ECM 1	155	Front Oxygen sensor	B	Front Heated Oxygen Sensor Control
DB/RD	ECM 1	124	Chassis-Fairing	15	Front Right Turn Signal Lamp Output
RD	Fairing Audio	1	Trunk	8	Rear Left Speaker Positive
DG	Fairing Audio	9	Trunk	10	Rear Left Speaker Negative
WH	Fairing Audio	2	Trunk	11	Rear Right Speaker Positive
BK	Fairing Audio	10	Trunk	9	Rear Right Speaker Negative
GY/YE	Handlebars	19	ECM 2	227	Pedal Position Sensor 2 Return
BN/GN	ECM 2	237	Chassis-Engine	11	MAP Sensor Return
BN/WH	ECM 2	226	Chassis-Engine	4	TPS Return
GY/RD	Handlebars	18	ECM 2	232	Pedal Position Sensor 2 Output
YE/DG	ECM 2	236	Console	2	Fuel Level Sensor Output
WH/OG	ECM 1	148	Trunk	4	Trunk Tail Light Power
BN/WH	WCM	9	Chassis-Speedo	14	Security LED Feed
GY/BK	ECM 2	234	Fusebox	43	Engine Relay Control
PK	ECM 2	209	WCM	7	Ignition 1
BK	VCM 1	14	Ground	1	VCM Ground
BK	WCM	12	Ground	1	VCM Ground
BK	Trunk	16	Ground	1	Heated Seat Ground
VT/YE	Handlebars	8	ECM 2	235	Pedal Position Sensor 1 Output
DB/PK	ECM 1	119	Chassis-Engine	14	Run/Stop Switch Output
WH/YE	Handlebars	17	ECM 2	223	Pedal Position Sensor 2 +5v Reference
BK	ECM 1	110	Chassis-Engine	10	Knock Sensor Return



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GY/YE	ECM 2	201	Rear Oxygen Sensor	B	Rear Heated Oxygen Sensor Control
YE	ECM 2	229	Splice 0132A	1	CANA HIGH
YE	VCM 1	2	Splice 0132A	2	CANA HIGH
YE	Splice 0132A	1	Splice 0132B	1	CANA HIGH
YE	WCM	2	Splice 0132B	1	CANA HIGH
YE	Splice 0132B	2	Splice 0132C	1	CANA HIGH
YE	Diag	H	Splice 0132C	1	CANA HIGH
YE	Splice 0132C	2	Splice 0132D	1	CANA HIGH
YE	Handlebars	1	Splice 0132D	2	CANA HIGH
YE	Splice 0132E	1	Splice 0132D	1	CANA HIGH
YE	Chassis-Speedo	1	Splice 0132E	2	CANA HIGH
YE	Handlebars	10	Splice 0132E	2	CANA HIGH
YE	Splice 0133A	1	ECM 1	138	CANB HIGH
YE	ABS	2	Splice 0133A	2	CANB HIGH
YE	Splice 0133A	2	Splice 0133B	2	CANB HIGH
YE	IMU	3	Splice 0133B	1	CANB HIGH
YE	ABS-CAN	1	Splice 0133B	1	CANB HIGH
BN/DB	ECM 2	210	Chassis-Engine	2	TPS +5V Reference
OG/BN	ECM 2	221	Fusebox	35	Starter Relay Control
GY	ECM 2	220	Fusebox	19	Fuel Pump Relay Control
BG	Fusebox	09	Splice 0143	1	Secondary Audio Power Feed
BG	Fairing Audio	13	Splice 0143	2	Secondary Audio Power Feed
BG	Fairing Audio	5	Splice 0143	2	Secondary Audio Power Feed
DG	ECM 2	230	Splice 0144A	1	CANA Low
DG	VCM 1	11	Splice 0144A	2	CANA Low
DG	Splice 0144B	1	Splice 0144A	2	CANA Low
DG	WCM	4	Splice 0144B	2	CANA Low
DG	Splice 0144B	2	Splice 0144C	1	CANA Low
DG	Splice 0144C	2	Diag	G	CANA Low
DG	Splice 0144C	2	Splice 0144D	1	CANA Low
DG	Handlebars	11	Splice 0144D	2	CANA Low
DG	Splice 0144D	1	Splice 0144E	1	CANA Low
DG	Chassis Speedo	2	Splice 0144E	2	CANA Low
DG	Handlebars	20	Splice 0144E	1	CANA Low
DG	Splice 0145A	1	ECM 1	137	CANB Low
DG	ABS	11	Splice 0145A	2	CANB Low
DG	Splice 0145A	2	Splice 0145B	2	CANB Low
DG	IMU	2	Splice 0145B	1	CANB Low

DG	ABS CAN	2	Splice 0145B	1	CANB Low
BG/BK	ECM 1	120	Sidestand Switch	1	Sidestand Switch Signal
YE/RD	ECM 2	239	Trunk	7	Trunk Brake Lamp Feed
PK/DB	Rear Lighting	B	ECM 1	111	Brake Light Feed
DG/YE	Rear Lighting	A	ECM 1	112	Tail Light Feed
GY/RD	Fusebox	26	Splice 0153	1	Accessory Constant Fuse Output
GY/RD	Splice 0153	1	Battery Tender	1	Accessory Constant Fuse Output
DG	Right Electric Bag Lock	C	Splice 0153	2	Accessory Constant Fuse Output
GY/RD	Diag	A	Splice 0153	2	Accessory Constant Fuse Output
GY/RD	Splice 0153	2	Trunk	4	Accessory Constant Fuse Output
VT/RD	Handlebars	7	ECM 2	222	Pedal Position Sensor 1 +5V Reference
BN/PK	ECM 1	102	Chassis-Engine	13	TMAP 5V Feed
BK	Ground	1	Splice 0158	1	Rear AMP Ground
BK	Trunk	15	Splice 0158	1	Rear AMP Ground
BK	Right Bag Electric Lock	D	Splice 0158	2	Rear AMP Ground
WH	Chassis Speedo	4	VCM 1	7	Horn
GY/RD	ECM 1	131	Front 02	C	Front Heated Oxygen Sensor Output
GY/BK	ABS	3	Chassis Fairing	4	Front Wheel Speed Signal
VT/YE	Left Antenna	1	WCM	11	Left Antenna Feed
BK	Left Antenna	2	WCM	10	Left Antenna Return
DB/BK	ECM 2	240	Purge	1	Canister Purge Valve Feed
DB	ECM 1	135	Rear Lighting	D	Rear Left Turn Signal Lamp Output
BK	Console	3	Ground	1	Fuel Pump Ground
BK	Splice 173	1	Fairing Audio	3	Audio Shield Ground
SHLD	Splice 173	2	Trunk Connector	-	Main Audio Rear Shield
SHLD	Splice 173	2	Saddlebag Audio	-	Secondary Audio Shield
RD/WH	Fusebox	28	Splice 0174	1	VCM Feed
RD	VCM 1	1	Splice 0174	2	VCM Feed
RD	VCM 1	20	Splice 0174	2	VCM Feed
WH	ECM 2	254	Chassis-Engine	18	Front Coil Signal
BK/WH	Ground	1	Splice 0179	1	ECM Ground
BK/WH	ECM 2	251	Splice 0179	2	ECM Ground
BK/WH	ECM 1	154	Splice 0179	2	ECM Ground
BK/WH	ECM 2	252	Splice 0179	2	ECM Ground
GY/RD	ABS	12	Chassis-Fairing	5	Front Wheel Speed Signal
OG/DG	ECM 2	215	Chassis-Engine	12	Intake Air Temperature Sensor Output
RD	Voltage Regulator	3	Regulator POS	1	Voltage Regulator Output

## ELECTRICAL

BK	Voltage Regulator	1	Ground	1	Voltage Regulator Ground
GY	ECM 2	253	Chassis-Engine	20	Rear Coil Signal
DB/PK	Fusebox	34	Splice 0194	1	Aux Engine Relay Output
DB/PK	Splice 0194	1	Front Oxygen Sensor	A	Aux Engine Relay Output
DB/PK	Splice 0194	1	Rear Oxygen Sensor	A	Aux Engine Relay Output
DB/PK	Splice 0194	1	Purge	2	Purge Valve Aux Engine Relay Output
DB/PK	Rear Lighting	F	Splice 0194	2	Aux Engine Relay Output
DB/PK	Chassis Speedo	8	Splice 0194	2	Aux Engine Relay Output
DB/RD	ECM 1	136	Rear Lighting	C	Rear Right Turn Signal Lamp Output
BK	ECM 2	214	CPS	2	CPS Negative Signal
GY/DB	ECM 2	228	Rear Oxygen Sensor	C	Rear Heated Oxygen Sensor output
OG/YE	ECM 2	248	Console	3	Throttle Position Sensor 1 Output
BG/WH	ECM 2	225	Front Oxygen Sensor	D	Front Heated Oxygen Sensor Output
BK/BU	ECM 1	144	Console	1	Fuel Sender Ground
BG	ECM 1	132	Front Oxygen Sensor	D	Front Heated Oxygen Sensor Return
OG/BN	ECM 1	143	Chassis-Engine	16	Cylinder Head Temperature Sensor Return
DB	ECM 1	123	Chassis-Fairing	1	Front Left Turn Signal Lamp Output
WH	ECM 2	213	CPS	1	CPS Positive Signal
OG/DB	ECM 2	233	Chassis-Engine	17	Cylinder Head Temperature Sensor Output
YE/VT	ECM 2	243	Rear Brake Switch	A	Rear Brake Switch Output
OG/RD	Chassis Speedo	15	Cooling Fan	B	Cooling Fan Feed
BK	Cooling Fan	A	Ground	1	Cooling Fan Ground
BK	Side Stand Switch	2	Ground	1	Sidestand Switch Ground
BK	Start Solenoid	2	Ground	1	Start Solenoid Coil Ground
PK/RD	Chassis-Engine	19	Fusebox	41	Ignition Coil Feed
BU	Puddle Light	1	VCM 1	13	Puddle Light Feed
BK	Puddle Light	2	Ground	1	Puddle Light Ground
BK/GN	ECM 1	152	GSS	B	Gear Position Ground
RD/BU	ECM 2	211	GSS	A	GSS 5v Reference
YE	Info CAN	1	Splice 0242A	1	CANC HIGH
YE	Trunk	3	Splice 0242A	1	CANC HIGH
YE	Splice 0242A	2	Splice 0242B	2	CANC HIGH
YE	Diag	E	Splice 0242B	1	CANC HIGH
YE	Chassis-Fairing	18	Splice 0242B	1	CANC HIGH
DG	Info CAN	2	Splice 0243A	1	CANC LOW
DG	Trunk	6	Splice 0243A	1	CANC LOW
DG	Splice 0243A	2	Splice 0243B	2	CANC LOW
DG	Diag	F	Splice 0243B	2	CANC LOW

DG	Chassis-Fairing	8	Splice 0243B	1	CANC LOW
OG/DG	VCM 1	12	Console	5	Fuel Door Solenoid Positive
DG/OG	VCM 1	3	Console	6	Fuel Door Solenoid Negative
RD/BK	Fusebox	25	Splice 246	1	VCM 2 Power Feed
RD/BK	Chassis-Fairing	19	Splice 246	2	VCM 2 Power Feed
RD/BK	Chassis-Fairing	2	Splice 246	2	VCM 2 Power Feed
RD/DG	Fusebox	17	Splice 0247	1	VCM 3 Power Feed
RD/DG	Chassis-Speedo	16	Splice 0247	2	VCM 3 Power Feed
RD/DG	Chassis-Speedo	11	Splice 0247	2	VCM 3 Power Feed
DB/OG	VCM 1	8	Console	8	Fuel Door Switch Output
BK	IMU	1	Ground	1	IMU Ground
BK	Chassis-Speedo	3	Ground	1	Ground
BK	Chassis-Speedo	12	Ground	1	Ground
BK	Chassis-Fairing	7	Ground	1	Ground
BK	Chassis-Fairing	9	Ground	1	Ground
RD/BK	Fusebox	12	ABS	9	ABS Secondary Power Feed
PK/BK	ECM 1	141	Fusebox	40	Starter Relay Coil Feed
OG/DB	ECM 1	126	Chassis-Fairing	6	Front Right Position Control Feed
RD/DG	ECM 1	139	Chassis-Fairing	16	Front Left Position Control Feed
RD/DG	Saddlebag Audio	3	Fairing Audio	14	Secondary Audio Speaker Power Ground
RD/DG	Saddlebag Audio	6	Fairing Audio	6	Secondary Audio Speaker Power Ground
RD/DG	Fusebox	47	Splice 0260	2	Main Engine Relay Load
RD/DG	Fusebox	38	Splice 0260	2	Main Engine Relay Load
RD/DG	Fusebox	46	Splice 0260	1	Main Engine Relay Load
RD/DG	Fusebox	45	Splice 0260	1	Main Engine Relay Load
RD/BU	Fusebox	07	Splice 0260	1	Switched Power Relay Load
RD/BU	Fusebox	06	Splice 0260	2	Switched Power Relay Load
RD/BU	Fusebox	05	Splice 0260	2	Switched Power Relay Load
OG/WH	Trunk	12	Fairing Audio	4	Main Audio Speaker Power Feed
BK/YE	Trunk	13	Fairing Audio	12	Main Audio Speaker Power Ground
DG	Fairing Audio	7	Saddlebag Audio	5	Right Saddlebag Speaker +
WH	Fairing Audio	15	Saddlebag Audio	4	Right Saddlebag Speaker -
RD	Fairing Audio	8	Saddlebag Audio	2	Left Saddlebag Speaker +
BK	Fairing Audio	16	Saddlebag Audio	1	Left Saddlebag Speaker -
BK	Battery Tender	2	Ground	1	Battery Tender Ground

## ELECTRICAL

### HARNESS PINOUTS (2022)

#### FAIRING

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
BU/WH	Lock switch	4	Chassis Fairing	13	Bag unlock switch output
BN/GN	Lock switch	2	Chassis Fairing	11	Bag Lock Switch Output
VT/YE	Ignition Switch	2	Chassis Speedo	13	Power Button SW
DG/BK	Fog Switch	2	VCM3	6	Aux Light Switch Output
YE/BK	Chassis Fairing	12	Tach	10	Oil Pressure Switch Output
GN	VCM 2	15	Homelink	3	Garage Door 2 Feed
OG/YE	Chassis Speedo	10	Splice 0011	2	SW Power CONTL
OG/YE	7 Inch Display	31	Splice 0011	1	SW Power CONTL
OG/YE	Speedometer	3	Splice 0011	1	SW Power CONTL
GY/RD	Fog Switch	4	VCM3	4	Aux Light Switch Indicator Light
BU/RD	VCM2	4	Heated SW2	1	Heated Grip LED
BU/BK	VCM2	8	Heated SW2	2	Heated Grip DEC
BK	Chassis Fairing	3	Horn	B	Ground
YE/BN	VCM 2	13	Homelink	2	Garage Door 1 Feed
BK/WH	Ambient Air	B	Chassis Audio	11	Ambient Air Temperature Ground
OG	Splice 0026	2	Chassis Speedo	5	Instrumentation Fuse Output
OG	Tach	4	Splice 0026	2	Instrumentation Fuse Output
OG	Splice 0026	2	7 inch display	32	Instrumentation Fuse Output
OG	Splice 0026	1	Speedometer	4	Instrumentation Fuse Output
DG/RD	7 Inch Display	2	Power Supply Pos 2	13	Preamp Rear Right Speaker Positive
OG/DB	Ambient Air	A	Chassis Speedo	9	Ambient Air Temp Sensor Output
GY/RD	Power Supply Pos 1A	13	7 Inch Display	17	Preamp front right speaker positive
WH/RD	7 inch Display	21	Power Supply POS 1A	15	Preamp front left speaker positive
WH/YE	Power Supply Pos 1A	14	7 Inch Display	20	Preamp Front Left Speaker Negative
GY/BK	Power Supply Pos 1A	4	Right Speaker	3	Front Right Speaker Negative
GY	Power Supply Pos 1A	5	Right Speaker	2	Front Right Speaker Positive
WH	Power Supply Pos 1A	3	Left Speaker	2	Front Left Speaker Positive
WH/BK	Power Supply Pos 1A	2	Left Speaker	3	Front Left Speaker Negative
BG	Power Supply Pos 1A	20	Chassis Fairing	14	Main Audio Power Feed
BG	Power Supply Pos 1A	19	Chassis Fairing	10	Main Audio Power Feed
BK	Headlight	2	Chassis Fairing	17	Ground
BK	Chassis Fairing	20	Splice 0069	2	Main Audio Ground
BK	Splice 0069	1	Power Supply Pos 1A	9	Power Supply A Ground
BK	Splice 0069	1	Power Supply Pos 1A	10	Power Supply A Ground
BK	Splice 0069	2	Power Supply Pos 1A	16	Main Audio Ground

PD/GN	Chassis Speedo	7	Splice 0071	2	VCM Accessory Power Out
PD/GN	Splice 0071	1	Homelink	1	VCM Accessory Power Out
PD/GN	Lock Switch	3	Splice 0071	2	VCM Accessory Power Out
PD/GN	Splice 0071	2	Tach	3	VCM Accessory Power Out
PD/GN	Splice 0071	2	Fog Switch	3	VCM Accessory Power Out
PD/GN	Splice 0071	1	Power Supply Pos 2	7	VCM Accessory Power Out
PD/GN	Splice 0071	1	Power Supply Pos 1A	7	VCM Accessory Power Out
PD/DB	VCM3	19	Splice 0071	2	VCM Accessory Power Out
PD/GN	VCM3	10	Splice 0071	2	VCM Accessory Power Out
PD/GN	Heated SW3	3	Splice 0071	1	VCM Accessory Power Out
PD/GN	Splice 0071	1	Position Lamp	1	VCM Accessory Power Out
PD/GN	VCM2	10	Splice 0071	1	VCM Accessory Power Out
GY/YE	Power Supply Pos 1A	12	7 Inch Display	18	Preamp Front Right Speaker Negative
BK	Splice 0080	2	Chassis Speedo	6	Ground
BK	Splice 0080	1	Speedometer	5	Ground
BK	Homelink	4	Splice 0080	2	Ground
BK	Ignition SW	1	Splice 0080	2	Ground
BK	Splice 0080	2	Tach	5	Ground
BK	Splice 0080	2	7 Inch Display	16	Ground
DB/RD	Chassis Fairing	15	Right Turn	1	Front Right Turn Signal Lamp Output
DG	Power Supply Pos 1B	2	Chassis Audio	1	Rear Left Speaker +
DG/BK	Power Supply Pos 1B	1	Chassis Audio	9	Rear Left Speaker -
VT	Power Supply Pos 1B	5	Chassis Audio	2	Rear Right Speaker +
VT/BK	Power Supply Pos 1B	4	Chassis Audio	10	Rear Right Speaker
YE	Headlight	3	VCM2	16	High Beam Output
DG	Headlight	1	VCM2	5	Low Beam Output
GY/DB	VCM2	9	Windshield Motor	1	Windshield Motor Up
GY/DG	VCM2	18	Windshield Motor	2	Windshield Motor Down
DG/RD	Fog Lamps	1	VCM3	13	LH Aux Light Feed
DG/BN	Fog Lamps	3	VCM3	15	RH Aux Light Feed
BN/WH	Chassis Speedo	14	Ignition SW	3	Security LED
YE	Splice 0132A	1	Speedometer	1	CANA HIGH
YE	Splice 0132A	2	7 Inch Display	29	CANA HIGH
YE	Splice 0132B	2	Splice 132A	2	CANA HIGH
YE	Splice 0132B	2	Tach	1	CANA HIGH
YE	Splice 0132C	1	Splice 0132B	1	CANA HIGH
YE	Splice 0132C	1	VCM2	2	CANA HIGH
YE	Chassis Speedo	1	Splice 0132C	2	CANA HIGH

## ELECTRICAL

BG/WH	Chassis Audio	13	Power Supply Pos 2	19	Secondary Audio Power Feed
BG/WH	Chassis Audio	5	Power Supply Pos 2	20	Secondary Audio Power Feed
DG	Speedometer	2	Splice 0144A	1	CANA LOW
DG	Splice 0144A	2	7 Inch Display	30	CANA LOW
DG	Splice 0144B	2	Splice 0144A	2	CANA LOW
DG	Splice 0144B	2	Tach	2	CANA LOW
DG	Splice 0144C	1	Splice 0144B	1	CANA LOW
DG	Splice 0144C	1	VCM2	11	CANA LOW
DG	Chassis Speedo	2	Splice 0144C	2	CANA LOW
WH	Horn	A	Chassis Speedo	4	Horn Feed
BU/YE	VCM2	6	Heated SW3	2	Heated Grips INC
GY/BK	Chassis Fairing	4	ABS FWSS	B	Front Wheel Speed Signal Negative
DG/YE	7 inch Display	1	Power Supply Pos 2	12	Preamp Rear Right Speaker Negative
GY/RD	Chassis Fairing	5	ABS FWSS	A	Front Wheel Speed Signal Positive
DB/PK	Chassis Speedo	8	Splice 0194	2	AUX Engine Relay Output
DB/PK	Right Turn	3	Splice 0194	1	Aux Engine Relay Output
DB/PK	Left Turn	3	Splice 0194	1	Aux Engine Relay Output
VT/RD	7 Inch Display	5	Power Supply Pos 2	15	Preamp Rear Left Speaker Positive
VT/YE	7 Inch Display	4	Power Supply Pos 2	14	Preamp Rear Left Speaker Negative
DB	Chassis Fairing	1	Left Turn	1	Front Left Turn Signal Lamp Output
OG/RD	Chassis Speedo	15	VCM2	7	Fan Control
YE	7 Inch Display	2	Splice 0242A	1	CANC HIGH
YE	VCM3	2	Splice 0242A	2	CANC HIGH
YE	Splice 0242A	1	CAN Info	1	CANC HIGH
YE	Splice 0242A	2	Splice 242B	2	CANC HIGH
YE	Splice 0242B	1	Power Supply Pos 2	1	CANC HIGH
YE	Splice 0242C	2	Splice 0243B	1	CANC HIGH
YE	Power Supply Pos 1A	1	Splice 0243C	1	CANC HIGH
YE	Chassis Fairing	18	Splice 0243C	1	CANC HIGH
DG	7 Inch Display CAN	1	Splice 0243A	1	CANC LOW
DG	VCM3	11	Splice 0243A	2	CANC LOW
DG	Splice 0243A	1	CAN Info	2	CANC LOW
DG	Splice 0243A	2	Splice 0243B	2	CANC LOW
DG	Splice 0243B	1	Power Supply Pos 2	11	CANC LOW
DG	Splice 0243B	2	Splice 0243C	2	CANC LOW
DG	Splice 0243C	1	Power Supply Pos 1A	11	CANC LOW
DG	Chassis Fairing	8	Splice 0243C	1	CANC LOW
RD/BK	Chassis Fairing	2	VCM2	20	VCM2 Power Feed

RD/BK	Chassis Fairing	19	VCM2	1	VCM2 Power Feed
RD/DG	Chassis Speedo	11	VCM3	1	VCM2 Power Feed
RD/DG	Chassis Speedo	16	VCM3	20	VCM2 Power Feed
BK	Chassis Speedo	3	Splice 0250	2	Ground
BK	Lock Switch	1	Splice 0250	2	Ground
BK	Fog Switch	1	Splice 0250	2	Ground
BK	Fog Lamps	2	Splice 0250	2	Ground
BK	Heated SW3	1	Splice 0250	1	Ground
BK	VCM2	19	Splice 0250	1	Ground
BK	Right Turn	2	Splice 0250	1	Ground
BK	Position Lamp	2	Splice 0250	1	Ground
BK	Chassis Audio	3	Splice 0250	1	Ground
BK	Left Turn	2	Splice 0250	1	Ground
BK	Chassis Speedo	12	VCM2	14	Ground
BK	Chassis Fairing	7	Splice 0252	2	Ground
BK	Splice 0252	1	Power Supply POS 2	9	Power Supply B Ground
BK	Splice 0252	1	Power Supply POS 2	10	Power Supply B Ground
BK	Splice 0252	2	Power Supply Pos 2	17	Power Supply B Ground
RD/BU	VCM2	12	Chassis Speedo	17	E-Preload Motor (+)
RD/GN	Chassis Speedo	18	VCM2	3	E-Preload Motor (-)



## ELECTRICAL

### CUBE FAIRING

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
YE/BK	Chassis Handlebar	19	Twistgrip Sensor	4	Pedal Position Sensor 2 Return
YE/GN	Chassis Handlebar	18	Twistgrip Sensor	8	Pedal Position Sensor 2 Output
WH/GN	Chassis Handlebar	8	Twistgrip Sensor	5	Pedal Position Sensor 1 Output
BD/PK	Chassis Handlebar	14	Right Switchcube 2	1	Run / Stop Switch Output
YE/RD	Chassis Handlebar	17	Twistgrip Sensor	3	Pedal Position Sensor 2 +5v Reference
YE	Chassis Handlebar	1	Left Switchcube 1	3	250K CAN HIGH
YE	Chassis Handlebar	10	Right Switchcube 1	3	250K CAN HIGH
DG	Chassis Handlebar	11	Left Switchcube 1	4	250K CAN HIGH
DG	Chassis Handlebar	20	Right Switchcube 1	4	250K CAN HIGH
WH/RD	Chassis Handlebar	7	Twistgrip Sensor	2	Pedal Position Sensor 1 +5V Reference
GY/RD	Chassis Handlebar	2	Left Switchcube 1	1	Right Switchcube Feed
VT/YE	Chassis Handlebar	3	Right Switchcube 2	2	Ignition Switch Signal
WH/BK	Chassis Handlebar	9	Twistgrip sensor	1	Pedal Position Sensor 1 Return
PK	Chassis Handlebar	5	Splice 64	1	Heated Grips Output
PK	Left Heat	1	Splice 64	2	Heated Grips Output
PK	Right Heat	1	Splice 64	2	Heated Grips Output
PK	Chassis Handlebar	16	Splice 64	1	Ground
PK	Left Heat	2	Splice 64	2	Ground
PK	Left Switchcube 1	2	Splice 64	2	Ground
PK	Right Heat	2	Splice 64	2	Ground
PK	Right Switchcube 1	2	Splice 64	2	Ground
RD/YE	Chassis Handlebar	6	Right Switchcube 1	1	VCM Control Feed

### REAR LIGHTING

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
BK	Chassis Harness	E	Splice 0044	2	Chassis Ground
BK	Rear Right Turn Signal	2	Splice 0044	1	Chassis Ground
BK	License Plate Lamp	2	Splice 0044	1	Chassis Ground
BK	Rear Left Turn Signal	2	Splice 0044	1	Chassis Ground
DG/YE	Chassis Harness	A	License Plate Lamp	1	Tail Light Feed
DB	Rear Left Turn Signal	1	Chassis Harness	D	Rear Left Turn Signal Lamp Output
DB/RD	Rear Right Turn Signal	1	Chassis Harness	C	Rear Right Turn Signal Lamp Output

**CHASSIS**

WIRE COLOR	FROM	PORT	TO	PORT	FUNCTION
DB/WH	Chassis Fairing	13	WCM	5	Bag Unlock Switch Output
DB/BK	Chassis Fairing	11	WCM	3	Bag Lock Switch Output
VT/BK	WCM	6	Chassis Speedo	13	Ignition Switch Signal
YE/BK	Oil Pressure Switch	1	Chassis Fairing	12	Oil Pressure Switched Output
OG/YE	WCM	8	Splice 0011	2	Switched Relay Feed – Coil
OG/YE	Fusebox	8	Splice 0011	1	Switched Relay Feed – Coil
OG/YE	Chassis Speedo	10	Splice 0011	2	Switched Relay Feed – Coil
BK	Chassis Fairing	3	Ground	1	Fairing Ground
RD	ECM 1	109	Chassis Engine	9	Knock Sensor Feed
BK/WH	ECM 1	153	Fairing Audio	11	Ambient Air Temperature Ground
BN	ABS	14	ABS Rear Wheel Speed Sensor	B	Rear Wheel Speed Signal –
BN/RD	ABS	13	ABS Rear Wheel Speed Sensor	A	Rear Wheel Speed Signal +
DG/WH	Fusebox	39	Start Solenoid	1	Starter Solenoid Feed
OG	Fusebox	18	Chassis Speedo	5	Instrumentation Fuse Output
VT/YE	Fusebox	23	Console	4	Fuel Pump Feed
OG/DB	ECM 2	247	Chassis Speedo	9	Ambient Air Temperature Sensor
RD/WH	VCM 1	9	Splice 0033	2	Lock Motor Feed
RD/WH	Right Saddlebag Electric Lock	A	Splice 0033	1	Lock Motor Feed
RD/WH	Left Saddlebag Electric Lock	A	Splice 0033	1	Lock Motor Feed
RD/WH	Trunk	1	Splice 0033	2	Lock Motor Feed
OG/WH	VCM1	18	Splice 0034	2	Unlock Motor Feed
OG/WH	Left Saddlebag Electric Lock	B	Splice 0034	1	Unlock Motor Feed
OG/WH	Right Saddlebag Electric Lock	B	Splice 0034	1	Unlock Motor Feed
OG/WH	Trunk	2	Splice 0034	2	Unlock Motor Feed
PK/RD	ECM 2	212	Chassis-Engine	6	ETC Motor Positive
YE	ECM 2	224	Chassis-Engine	5	ETC Motor Negative
GY/WH	Fusebox	01	Splice 0043	1	Accessory Switched Output
GY/WH	Trunk	5	Splice 0043	1	Accessory Switched Output
GY/WH	Splice 0043	2	Rear 12v Switch	A	Accessory Switched Output
BK	Ground	1	Splice 0044	2	Ground
BK	Console	7	Splice 0044	2	Ground
BK	Rear Lighting	E	Splice 0044	1	Ground
BK	Rear Brake Switch	B	Splice 0044	1	Ground

## ELECTRICAL

BG	Fusebox	11	Splice 0044	2	Main Audio Power Feed
BG	Chassis Fairing	14	Splice 0044	1	Main Audio Power Feed
BG	Chassis Fairing	10	Splice 0044	1	Main Audio Power Feed
RD	J-Case	A	ABS	18	ABS Main Fuse Output
WH/RD	Handlebars	9	ECM 2	238	Pedal Position Sensor
WH/GY	ECM 2	242	Chassis-Engine	8	Rear Fuel Injector Driver
WH/DB	ECM 2	241	Chassis-Engine	15	Front Fuel Injector Driver
BK	Ground	1	Chassis-Fairing	17	Low Beam Ground
SHLD	CPS	3	Splice 0179	1	Crank Position Sensor Shield
PKL	VCM1	5	Handlebars	5	Heated Grips Output
OG/BN	ECM 2	216	Chassis-Engine	14	Manifold Absolute Pressure Sensor Output
BK	Splice 0067	1	Ground	1	ABS Ground
BK	ABS	10	Splice 0067	2	ABS Ground
BK	ABS	1	Splice 0067	2	ABS Ground
BK	Chassis Fairing	20	Ground	1	Main Audio Ground
RD	J-Case	C	Splice 0070A	2	Main Fuse Output
RD	Splice 0070B	2	J-Case	B	Main Fuse Output
RD	Splice 0070B	1	Fusebox	15	Main Fuse Output
RD	Splice 0070A	1	Fusebox	29	Main Fuse Output
RD	Fusebox	44	Splice 0070A	1	Main Fuse Output
RD	Fusebox	2	Fusebox	04	Main Fuse Output
RD	Fusebox	22	Splice 0070A	2	Main Fuse Output
RD	Fusebox	37	Splice 0070A	1	Main Fuse Output
RD	Fusebox	30	Splice 0070A	2	Main Fuse Output
RD	Fusebox	32	Splice 0070A	1	Main Fuse Output
RD	Fusebox	13	Splice 0070A	1	Main Fuse Output
RD	Fusebox	21	Splice 0070A	1	Main Fuse Output
RD	Fusebox	16	Splice 0070A	2	Main Fuse Output
PK/GN	Fusebox	02	Splice 71	2	Accessory Power Output
PK/GN	Handlebars	2	Splice 71	1	Accessory Power Output
PK/GN	Chassis Speedo	7	Splice 71	1	Accessory Power Output
PK/GN	Diag	B	Splice 71	2	Accessory Power Output
PK/GN	ABS	4	Splice 71	2	Accessory Power Output
PK/GN	VCM 1	10	Splice 71	2	Accessory Power Output
PK/GN	IMU	4	Splice 71	1	Accessory Power Output
VT/RD	ECM 2	245	Chassis-Engine	1	TPS 2 Signal
BK	Ground	1	Splice 0080	2	Ground
BK	Handlebars	16	Splice 0080	1	Ground

BK	Rear 12V Switch	B	Splice 0080	2	Ground
BK	Diag	D	Splice 0080	2	Ground
BK	Splice 0080	2	Fusebox	3	Ground
BK	Chassis Speedo	6	Splice 0080	1	Ground
YE/BK	ECM 2	202	GSS	C	Transmission Gear Position Sensor Output
RD/YE	Fusebox	33	Splice 0083	1	VCM Control Feed
RD/YE	WCM	1	Splice 0083	2	VCM Control Feed
RD/YE	Handlebars	6	Splice 0083	2	VCM Control Feed
RD/YE	Fusebox	48	Splice 0083	1	VCM Control Feed
VT/PK	Fusebox	42	Splice 0083	2	Engine Relay Output
VT/PK	Splice 0085	2	Fisebpx	24	Engine Relay Output
VT/PK	ECM 2	250	Splice 0085	1	Engine Relay Output
VT/PK	Splice 0085	1	Chassis-Engine	7	Engine Relay Output
VT/PK	Fusebox	36	Splice 0085	2	Engine Relay Output
VT/PK	Fusebox	20	Splice 0085	2	Engine Relay Output
VT/PK	ECM 2	249	Splice 0085	1	Engine Relay Output
GY/WH	ECM 1	155	Front Oxygen sensor	B	Front Heated Oxygen Sensor Control
DB/RD	ECM 1	124	Chassis-Fairing	15	Front Right Turn Signal Lamp Output
RD	Fairing Audio	1	Trunk	8	Rear Left Speaker Positive
DG	Fairing Audio	9	Trunk	10	Rear Left Speaker Negative
WH	Fairing Audio	2	Trunk	11	Rear Right Speaker Positive
BK	Fairing Audio	10	Trunk	9	Rear Right Speaker Negative
GY/YE	Handlebars	19	ECM 2	227	Pedal Position Sensor 2 Return
BN/GN	ECM 2	237	Chassis-Engine	11	MAP Sensor Return
BN/WH	ECM 2	226	Chassis-Engine	4	TPS Return
GY/RD	Handlebars	18	ECM 2	232	Pedal Position Sensor 2 Output
YE/DG	ECM 2	236	Console	2	Fuel Level Sensor Output
WH/OG	ECM 1	148	Trunk	4	Trunk Tail Light Power
BN/WH	WCM	9	Chassis-Speedo	14	Security LED Feed
GY/BK	ECM 2	234	Fusebox	43	Engine Relay Control
PK	ECM 2	209	WCM	7	Ignition 1
BK	VCM 1	14	Ground	1	VCM Ground
BK	WCM	12	Ground	1	VCM Ground
BK	Trunk	16	Ground	1	Heated Seat Ground
VT/YE	Handlebars	8	ECM 2	235	Pedal Position Sensor 1 Output
DB/PK	ECM 1	119	Chassis-Engine	14	Run/Stop Switch Output
WH/YE	Handlebars	17	ECM 2	223	Pedal Position Sensor 2 +5v Reference
BK	ECM 1	110	Chassis-Engine	10	Knock Sensor Return

## ELECTRICAL

GY/YE	ECM 2	201	Rear Oxygen Sensor	B	Rear Heated Oxygen Sensor Control
YE	ECM 2	229	Splice 0132A	1	CANA HIGH
YE	VCM 1	2	Splice 0132A	2	CANA HIGH
YE	Splice 0132A	1	Splice 0132B	1	CANA HIGH
YE	WCM	2	Splice 0132B	1	CANA HIGH
YE	Splice 0132B	2	Splice 0132C	1	CANA HIGH
YE	Diag	H	Splice 0132C	1	CANA HIGH
YE	Splice 0132C	2	Splice 0132D	1	CANA HIGH
YE	Handlebars	1	Splice 0132D	2	CANA HIGH
YE	Splice 0132E	1	Splice 0132D	1	CANA HIGH
YE	Chassis-Speedo	1	Splice 0132E	2	CANA HIGH
YE	Handlebars	10	Splice 0132E	2	CANA HIGH
YE	Splice 0133A	1	ECM 1	138	CANB HIGH
YE	ABS	2	Splice 0133A	2	CANB HIGH
YE	Splice 0133A	2	Splice 0133B	2	CANB HIGH
YE	IMU	3	Splice 0133B	1	CANB HIGH
YE	ABS-CAN	1	Splice 0133B	1	CANB HIGH
BN/DB	ECM 2	210	Chassis-Engine	2	TPS +5V Reference
OG/BN	ECM 2	221	Fusebox	35	Starter Relay Control
GY	ECM 2	220	Fusebox	19	Fuel Pump Relay Control
BG	Fusebox	09	Splice 0143	1	Secondary Audio Power Feed
BG	Fairing Audio	13	Splice 0143	2	Secondary Audio Power Feed
BG	Fairing Audio	5	Splice 0143	2	Secondary Audio Power Feed
DG	ECM 2	230	Splice 0144A	1	CANA Low
DG	VCM 1	11	Splice 0144A	2	CANA Low
DG	Splice 0144B	1	Splice 0144A	2	CANA Low
DG	WCM	4	Splice 0144B	2	CANA Low
DG	Splice 0144B	2	Splice 0144C	1	CANA Low
DG	Splice 0144C	2	Diag	G	CANA Low
DG	Splice 0144C	2	Splice 0144D	1	CANA Low
DG	Handlebars	11	Splice 0144D	2	CANA Low
DG	Splice 0144D	1	Splice 0144E	1	CANA Low
DG	Chassis Speedo	2	Splice 0144E	2	CANA Low
DG	Handlebars	20	Splice 0144E	1	CANA Low
DG	Splice 0145A	1	ECM 1	137	CANB Low
DG	ABS	11	Splice 0145A	2	CANB Low
DG	Splice 0145A	2	Splice 0145B	2	CANB Low
DG	IMU	2	Splice 0145B	1	CANB Low

DG	ABS CAN	2	Splice 0145B	1	CANB Low
BG/BK	ECM 1	120	Sidestand Switch	1	Sidestand Switch Signal
YE/RD	ECM 2	239	Trunk	7	Trunk Brake Lamp Feed
PK/DB	Rear Lighting	B	ECM 1	111	Brake Light Feed
DG/YE	Rear Lighting	A	ECM 1	112	Tail Light Feed
GY/RD	Fusebox	26	Splice 0153	1	Accessory Constant Fuse Output
GY/RD	Splice 0153	1	Battery Tender	1	Accessory Constant Fuse Output
DG	Right Electric Bag Lock	C	Splice 0153	2	Accessory Constant Fuse Output
GY/RD	Diag	A	Splice 0153	2	Accessory Constant Fuse Output
GY/RD	Splice 0153	2	Trunk	4	Accessory Constant Fuse Output
VT/RD	Handlebars	7	ECM 2	222	Pedal Position Sensor 1 +5V Reference
BN/PK	ECM 1	102	Chassis-Engine	13	TMAP 5V Feed
BK	Ground	1	Splice 0158	1	Rear AMP Ground
BK	Trunk	15	Splice 0158	1	Rear AMP Ground
BK	Right Bag Electric Lock	D	Splice 0158	2	Rear AMP Ground
WH	Chassis Speedo	4	VCM 1	7	Horn
GY/RD	ECM 1	131	Front 02	C	Front Heated Oxygen Sensor Output
GY/BK	ABS	3	Chassis Fairing	4	Front Wheel Speed Signal
VT/YE	Left Antenna	1	WCM	11	Left Antenna Feed
BK	Left Antenna	2	WCM	10	Left Antenna Return
DB/BK	ECM 2	240	Purge	1	Canister Purge Valve Feed
DB	ECM 1	135	Rear Lighting	D	Rear Left Turn Signal Lamp Output
BK	Console	3	Ground	1	Fuel Pump Ground
BK	Splice 173	1	Fairing Audio	3	Audio Shield Ground
SHLD	Splice 173	2	Trunk Connector	-	Main Audio Rear Shield
SHLD	Splice 173	2	Saddlebag Audio	-	Secondary Audio Shield
RD/WH	Fusebox	28	Splice 0174	1	VCM Feed
RD	VCM 1	1	Splice 0174	2	VCM Feed
RD	VCM 1	20	Splice 0174	2	VCM Feed
WH	ECM 2	254	Chassis-Engine	18	Front Coil Signal
BK/WH	Ground	1	Splice 0179	1	ECM Ground
BK/WH	ECM 2	251	Splice 0179	2	ECM Ground
BK/WH	ECM 1	154	Splice 0179	2	ECM Ground
BK/WH	ECM 2	252	Splice 0179	2	ECM Ground
GY/RD	ABS	12	Chassis-Fairing	5	Front Wheel Speed Signal
OG/DG	ECM 2	215	Chassis-Engine	12	Intake Air Temperature Sensor Output
RD	Voltage Regulator	3	Regulator POS	1	Voltage Regulator Output

## ELECTRICAL

BK	Voltage Regulator	1	Ground	1	Voltage Regulator Ground
GY	ECM 2	253	Chassis-Engine	20	Rear Coil Signal
DB/PK	Fusebox	34	Splice 0194	1	Aux Engine Relay Output
DB/PK	Splice 0194	1	Front Oxygen Sensor	A	Aux Engine Relay Output
DB/PK	Splice 0194	1	Rear Oxygen Sensor	A	Aux Engine Relay Output
DB/PK	Splice 0194	1	Purge	2	Purge Valve Aux Engine Relay Output
DB/PK	Rear Lighting	F	Splice 0194	2	Aux Engine Relay Output
DB/PK	Chassis Speedo	8	Splice 0194	2	Aux Engine Relay Output
DB/RD	ECM 1	136	Rear Lighting	C	Rear Right Turn Signal Lamp Output
BK	ECM 2	214	CPS	2	CPS Negative Signal
GY/DB	ECM 2	228	Rear Oxygen Sensor	C	Rear Heated Oxygen Sensor output
OG/YE	ECM 2	248	Console	3	Throttle Position Sensor 1 Output
BG/WH	ECM 2	225	Front Oxygen Sensor	D	Front Heated Oxygen Sensor Output
BK/BU	ECM 1	144	Console	1	Fuel Sender Ground
BG	ECM 1	132	Front Oxygen Sensor	D	Front Heated Oxygen Sensor Return
OG/BN	ECM 1	143	Chassis-Engine	16	Cylinder Head Temperature Sensor Return
DB	ECM 1	123	Chassis-Fairing	1	Front Left Turn Signal Lamp Output
WH	ECM 2	213	CPS	1	CPS Positive Signal
OG/DB	ECM 2	233	Chassis-Engine	17	Cylinder Head Temperature Sensor Output
YE/VT	ECM 2	243	Rear Brake Switch	A	Rear Brake Switch Output
OG/RD	Chassis Speedo	15	Cooling Fan	B	Cooling Fan Feed
BK	Cooling Fan	A	Ground	1	Cooling Fan Ground
BK	Side Stand Switch	2	Ground	1	Sidestand Switch Ground
BK	Start Solenoid	2	Ground	1	Start Solenoid Coil Ground
PK/RD	Chassis-Engine	19	Fusebox	41	Ignition Coil Feed
BU	Puddle Light	1	VCM 1	13	Puddle Light Feed
BK	Puddle Light	2	Ground	1	Puddle Light Ground
BK/GN	ECM 1	152	GSS	B	Gear Position Ground
RD/BU	ECM 2	211	GSS	A	GSS 5v Reference
YE	Info CAN	1	Splice 0242A	1	CANC HIGH
YE	Trunk	3	Splice 0242A	1	CANC HIGH
YE	Splice 0242A	2	Splice 0242B	2	CANC HIGH
YE	Diag	E	Splice 0242B	1	CANC HIGH
YE	Chassis-Fairing	18	Splice 0242B	1	CANC HIGH
DG	Info CAN	2	Splice 0243A	1	CANC LOW
DG	Trunk	6	Splice 0243A	1	CANC LOW
DG	Splice 0243A	2	Splice 0243B	2	CANC LOW
DG	Diag	F	Splice 0243B	2	CANC LOW

DG	Chassis-Fairing	8	Splice 0243B	1	CANC LOW
OG/DG	VCM 1	12	Console	5	Fuel Door Solenoid Positive
DG/OG	VCM 1	3	Console	6	Fuel Door Solenoid Negative
RD/BK	Fusebox	25	Splice 246	1	VCM 2 Power Feed
RD/BK	Chassis-Fairing	19	Splice 246	2	VCM 2 Power Feed
RD/BK	Chassis-Fairing	2	Splice 246	2	VCM 2 Power Feed
RD/DG	Fusebox	17	Splice 0247	1	VCM 3 Power Feed
RD/DG	Chassis-Speedo	16	Splice 0247	2	VCM 3 Power Feed
RD/DG	Chassis-Speedo	11	Splice 0247	2	VCM 3 Power Feed
DB/OG	VCM 1	8	Console	8	Fuel Door Switch Output
BK	IMU	1	Ground	1	IMU Ground
BK	Chassis-Speedo	3	Ground	1	Ground
BK	Chassis-Speedo	12	Ground	1	Ground
BK	Chassis-Fairing	7	Ground	1	Ground
BK	Chassis-Fairing	9	Ground	1	Ground
RD/BK	Fusebox	12	ABS	9	ABS Secondary Power Feed
PK/BK	ECM 1	141	Fusebox	40	Starter Relay Coil Feed
OG/DB	ECM 1	126	Chassis-Fairing	6	Front Right Position Control Feed
RD/DG	ECM 1	139	Chassis-Fairing	16	Front Left Position Control Feed
RD/DG	Saddlebag Audio	3	Fairing Audio	14	Secondary Audio Speaker Power Ground
RD/DG	Saddlebag Audio	6	Fairing Audio	6	Secondary Audio Speaker Power Ground
RD/DG	Fusebox	47	Splice 0260	2	Main Engine Relay Load
RD/DG	Fusebox	38	Splice 0260	2	Main Engine Relay Load
RD/DG	Fusebox	46	Splice 0260	1	Main Engine Relay Load
RD/DG	Fusebox	45	Splice 0260	1	Main Engine Relay Load
RD/BU	Fusebox	07	Splice 0260	1	Switched Power Relay Load
RD/BU	Fusebox	06	Splice 0260	2	Switched Power Relay Load
RD/BU	Fusebox	05	Splice 0260	2	Switched Power Relay Load
OG/WH	Trunk	12	Fairing Audio	4	Main Audio Speaker Power Feed
BK/YE	Trunk	13	Fairing Audio	12	Main Audio Speaker Power Ground
DG	Fairing Audio	7	Saddlebag Audio	5	Right Saddlebag Speaker +
WH	Fairing Audio	15	Saddlebag Audio	4	Right Saddlebag Speaker -
RD	Fairing Audio	8	Saddlebag Audio	2	Left Saddlebag Speaker +
BK	Fairing Audio	16	Saddlebag Audio	1	Left Saddlebag Speaker -
BK	Battery Tender	2	Ground	1	Battery Tender Ground
GN/WH	E-Preload	3	VCM1	6	E-Preload Sensor Signal
YE/DB	E-Preload	5	Chassis Speedo	17	E-Preload Motor (+)
GN/DB	E-Preload	4	Chassis Speedo	18	E-Preload Motor (-)



## ELECTRICAL

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BK	E-Preload	2	Ground R	1	E-Preload Sensor GND
PK/GN	E-Preload	1	Splice 71	1	E-Preload Sensor Feed

## HORN SERVICE

### GENERAL OVERVIEW

The horn uses a load-sensing circuit for diagnostic purposes. The VCM sends a 12V pull-up voltage to the horn through the WH wire.

- With the horn disconnected, you should see 12V at the horn connector when checked with a DVOM.
- When the horn is connected, the 12V pull-up goes away.
- The horn button circuit is a node on the CAN bus. depressing it sends a signal to the VCM. The VCM responds by sending 12V to the horn, making it sound.

### LOAD SIDE TESTING

12 VDC is supplied to the WH wire.

- Engage the horn connector to the horn, and back probe the WH wire at the hornconnector with one DVOM probe. Connect the other probe to chassis ground. Key on, voltage reading should be nearly battery voltage when the horn button is depressed.
- With the horn connected, back probe the BK and WH wires at the horn. key on, Depress the horn button. Voltage reading should be near battery voltage.
- With the horn connected, back probe the BK wire at the horn, and place the other probe at battery negative. Your reading should be close to 0 volts.

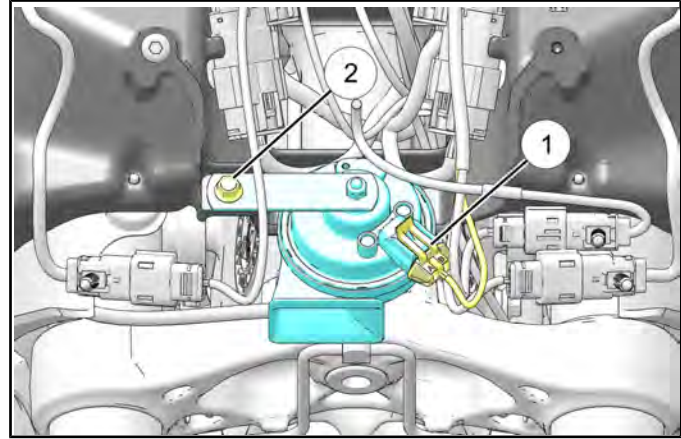
### SWITCH SIDE TESTING

- The horn button/switch is on the CAN bus. Disconnect the switch/button, and turn the ignition off.
- Ensure all modules have gone to sleep. The time will vary from model to model, but this may take a few minutes.
- Set your DVOM to ohms, and place one probe on the DARK GREEN, and one on the YELLOW wire. You should read near 60 ohms.
- For more information regarding the CAN Network, refer to: **CAN (Controller Area Network) Diagnostic Overview page 4.71**

## HORN REMOVAL / INSTALLATION

### REMOVAL

1. Remove outer fairing. Reference **Fairing Disassembly page 7.40**.
2. Disconnect horn electrical connector ①.



3. Remove horn fastener ② and remove.

### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

#### TORQUE

Horn to Bracket:  
**84 in-lbs (10 N·m)**

## TAIL LIGHT SERVICE

### LED TAIL / BRAKE LIGHT OPERATION

The multiple LED tail / brake lamp functions much like a conventional incandescent tail / brake lamp. LED lights require a regulated current supply to prevent damage, so a current regulation circuit is incorporated inside the tail lamp unit. Direct 12 volt battery power can be applied directly to the brake or tail lamp wire for testing purposes, but polarity **MUST** be observed or the LEDs will be permanently damaged.

#### Tail / Brake Light Power Supply:

When the motorcycle is powered ON, battery voltage is delivered to the TAIL / BRAKE LEDs on the DARK BLUE / PINK wire from the Secondary Engine Relay. Current through each TAIL LED (WHITE wire) is limited (inside tail lamp unit) to approximately 250 mA.

#### Tail / Brake Light Ground Signal:

The front and rear brake light switches provide a path to ground to the ECM via WHITE / RED wire (front brake switch) and YELLOW / VIOLET wire (rear brake switch). When the ECM receives a grounding signal from either of the brake switches, ground is provided to the tail / brake light LED, thus illuminating the light.

When the motorcycle is powered ON, the ECM provides a ground path to the tail light LED, thus illuminating the light.

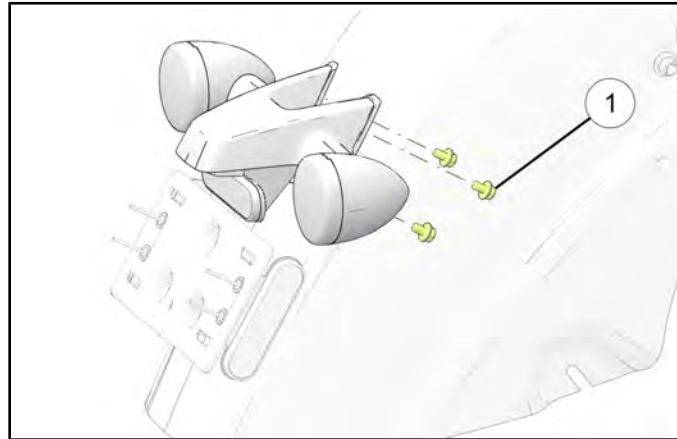
## TAIL / BRAKE / LICENSE PLATE LIGHT, REMOVAL / INSTALLATION

### NOTICE

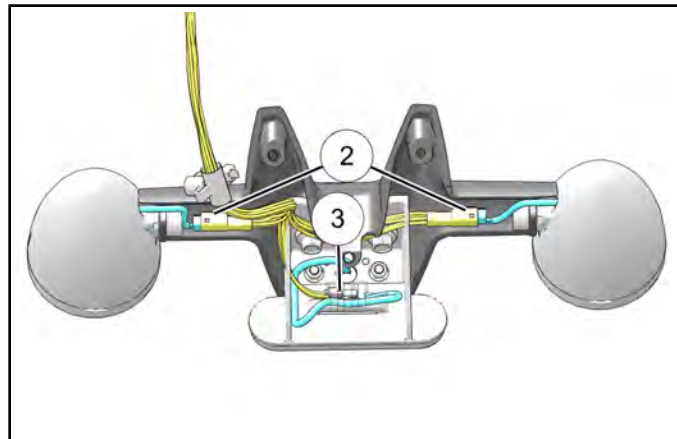
The tail and brake lights are LEDs and cannot be replaced individually. If the lights fail to function when activated, and all circuit tests indicate correct power and ground distribution, the tail /brake light must be replaced as an assembly. The license plate light can be replaced individually.

### TAIL LIGHT / BRAKE LIGHT REMOVAL

1. Place the motorcycle in an upright position with the front wheel clamped in a wheel vise.
2. Remove fastener ① securing turn signal / brake light assembly.

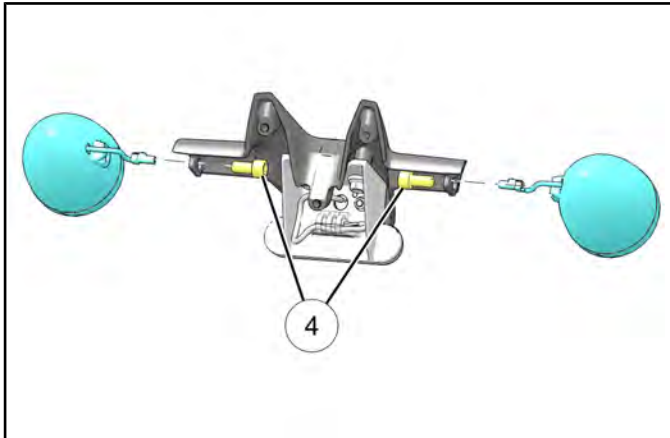


3. Disconnect turn signal electrical connector ②.

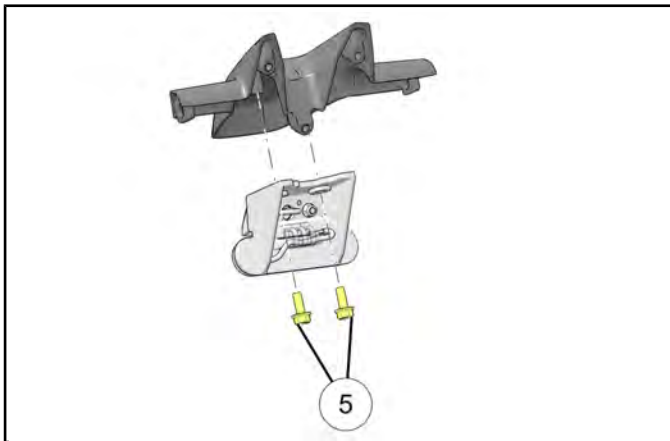


4. Disconnect license plate light connector ③.

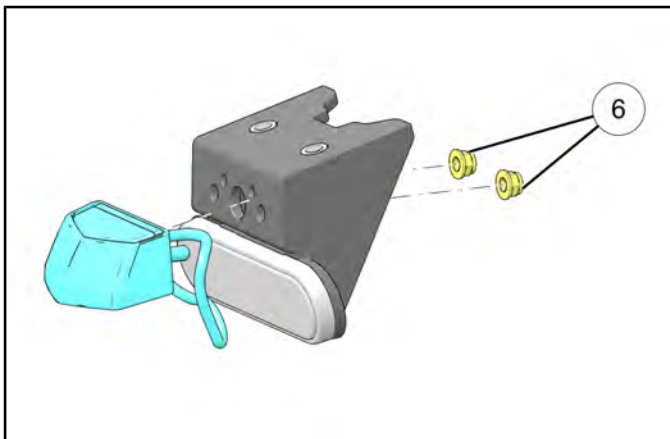
5. Remove fasteners ④ securing turn signal.



6. Remove fasteners ⑤ securing license plate assembly.



7. Remove fasteners ⑥ securing license plate light to assembly.



**TAIL LIGHT / BRAKE LIGHT INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
License Plate Light Fastener: <b>16 in-lbs (2 N·m)</b>

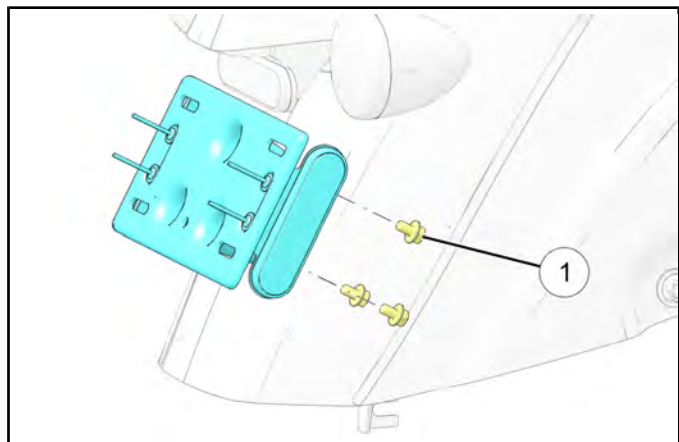
TORQUE
License Plate Light Assembly Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Turn Signal Fastener: <b>84 in-lbs (10 N·m)</b>

TORQUE
Tail Light Mount Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

**LICENSE PLATE ASSEMBLY REMOVAL**

1. Remove fasteners ① securing license plate assembly.



**LICENSE PLATE BRACKET / LIGHT INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
License Plate Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

## TURN SIGNAL / HAZARD SYSTEM SERVICE

### TURN SIGNAL OPERATION

The turn signal / hazard light system does not utilize a conventional “flasher module”, but instead receives a grounding signal from the ECM. Power to the LED turn signals is provided via the SEC ENGINE RELAY located in the main fuse box. Turn Signal INPUTS & OUTPUTS can be located in the ECM Connector Map and Fuse Application Chart.

See **ECM Connector Map** page 4.42.

See **Fuse Application Chart** page 10.69.

#### NOTICE

The turn signals use LED lights and must be replaced as an assembly. Bulbs cannot be replaced individually.

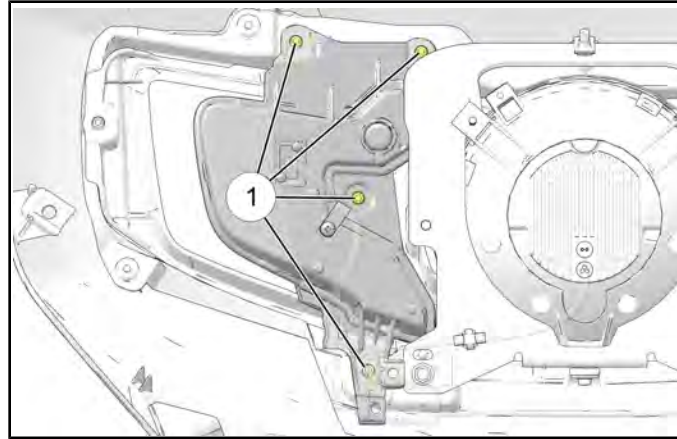
## FRONT TURN SIGNAL, REPLACEMENT

#### NOTICE

The turn signals are LED and must be replaced as an assembly. Bulbs cannot be replaced individually.

### REMOVAL

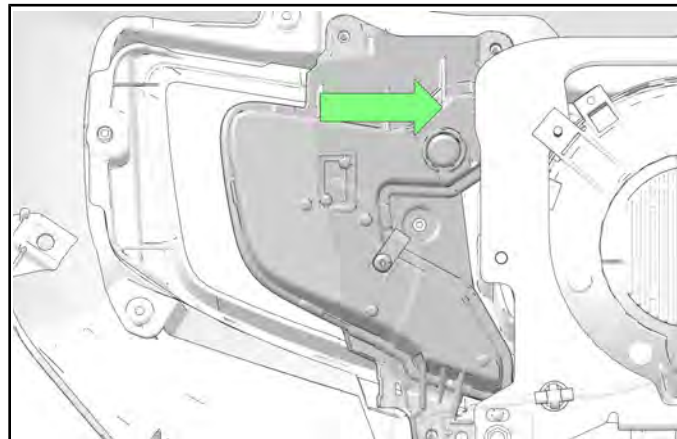
1. Remove Outer Fairing. See **Fairing Disassembly** page 7.40.
2. Disconnect the turn signal electrical connector.
3. From the back side of the outer fairing, remove four turn signal fasteners ①.



4. Slide the turn signal assembly out to the side away from the headlight and remove.

### INSTALLATION

1. Slide the new turn signal assembly into position. Insert the top side of the light first, and then the bottom.



2. Install the four turn signal fasteners ①. Torque fasteners to specification.

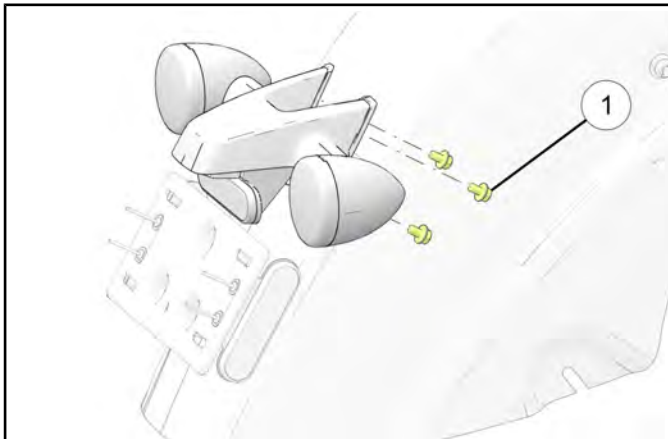
TORQUE
Turn Signal Fastener (Front): <b>15 in-lbs (2 N·m)</b>

3. Connect electrical connector to the harness.

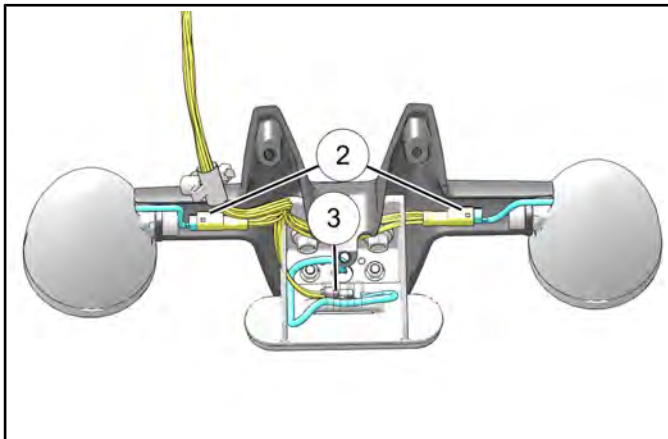
### **REAR TURN SIGNAL, REPLACEMENT**

#### **REMOVAL**

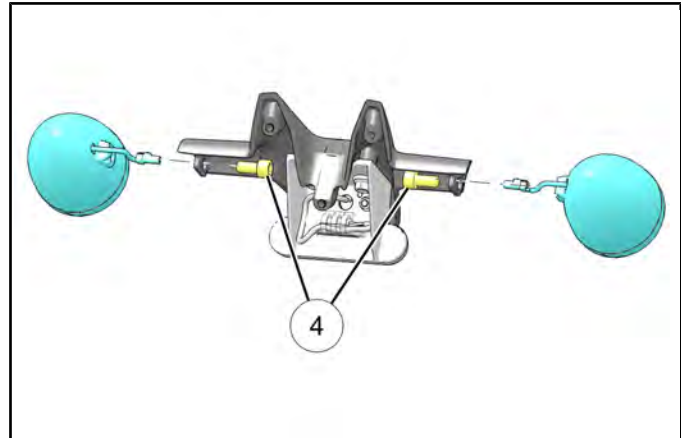
1. Remove fastener ① securing turn signal / brake light assembly.



2. Disconnect turn signal electrical connector ②.



3. Disconnect license plate light connector ③.
4. Remove turn signal fastener ④.



#### **INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
Turn Signal Fastener: <b>84 in-lbs (10 N·m)</b>

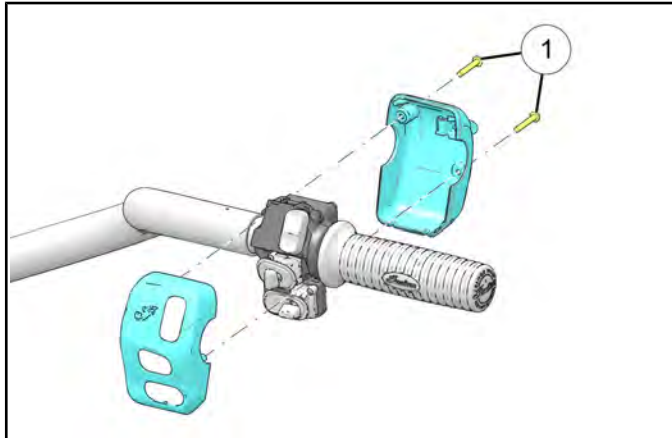
TORQUE
Tail Light Mount Bracket Fastener: <b>84 in-lbs (10 N·m)</b>

**SWITCH CUBE**

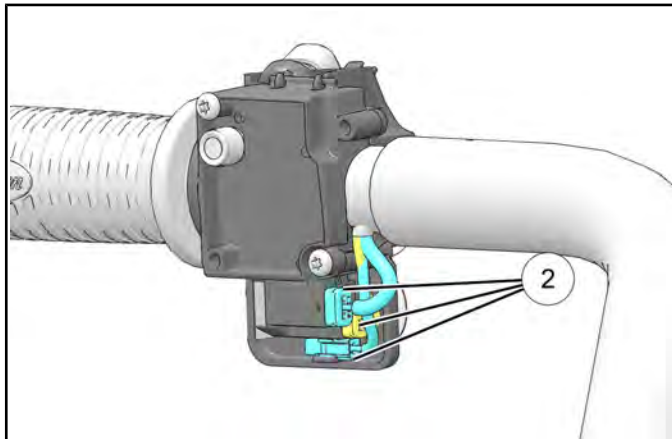
**SWITCH CUBE REPLACEMENT**

**REMOVAL**

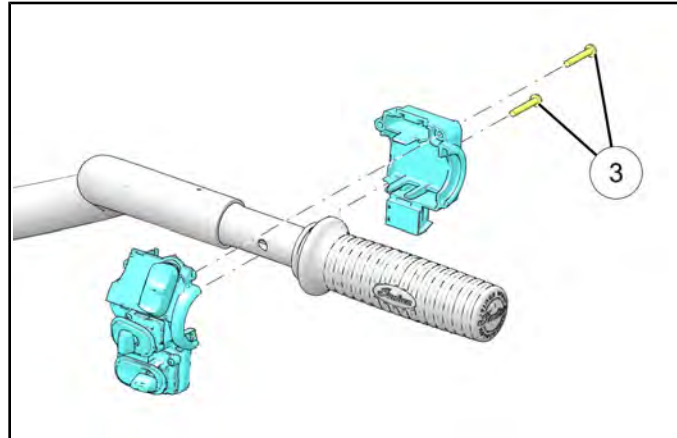
1. Remove clutch switch. See **Clutch Switch Removal / Installation page 10.30**.
2. Remove front master cylinder, reference **Front Master Cylinder Service page 9.45**.
3. Remove switch cube cover by removing its fasteners ①.



4. Disconnect switch cube electrical connectors ②.



5. Remove inner switch cube fasteners ③.

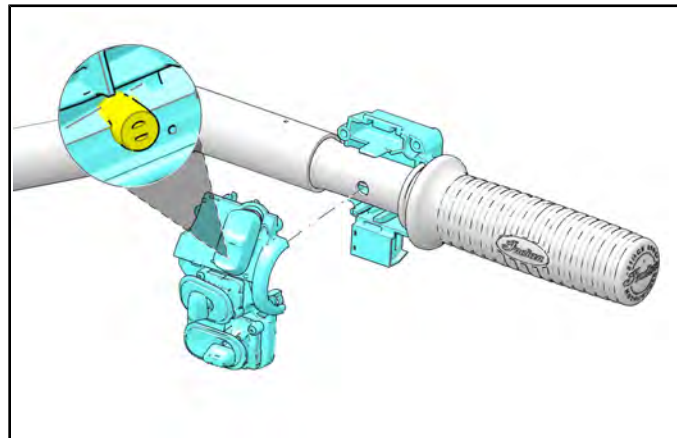


**INSTALLATION**

**NOTICE**

Before assembling cube halves, ensure the wire harness is completely pulled through and no wires are pinched. Confirm there is no wire slack in handlebars.

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Upon installation, ensure inner switch cube retention feature is secured in locating hole in handlebar.



3. Torque fasteners to specification.

**TORQUE**

Switch Cube Fastener:  
**12 in-lbs (1 N·m)**

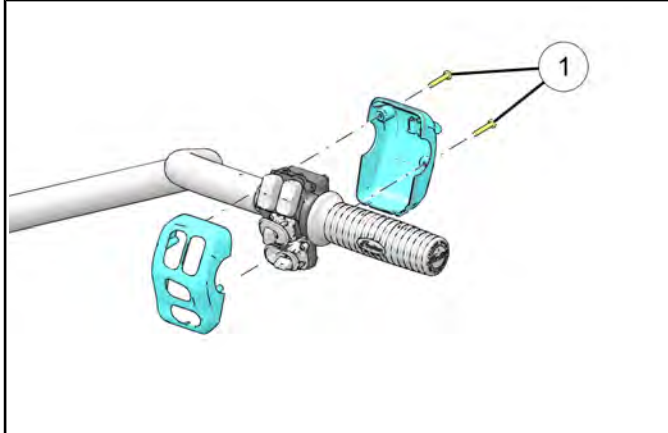
**TORQUE**

Switch Cube Cover Fastener:  
**12 in-lbs (1 N·m)**

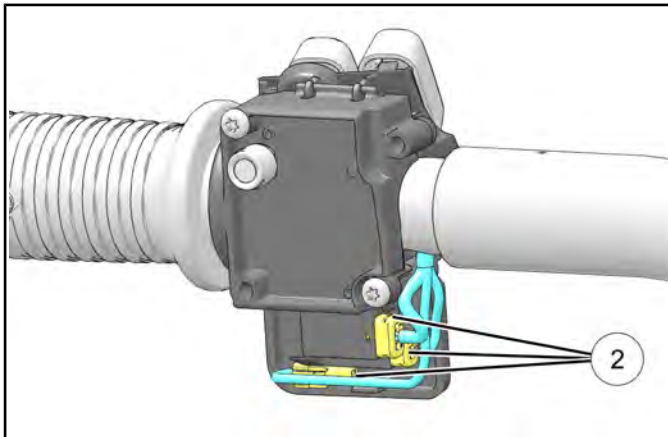
**SWITCH CUBE REPLACEMENT - 2021+**

**REMOVAL**

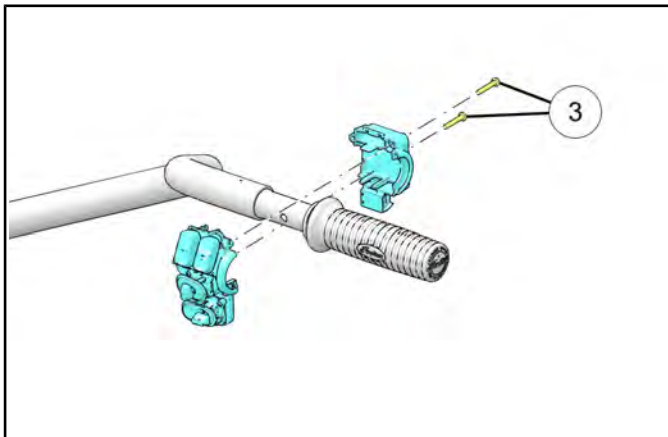
1. Remove clutch switch. See **Clutch Switch Removal / Installation page 10.30**.
2. Remove front master cylinder, reference **Front Master Cylinder Service page 9.45**.
3. Remove switch cube cover by removing its fasteners ①.



4. Disconnect switch cube electrical connectors ②.



5. Remove inner switch cube fasteners ③.

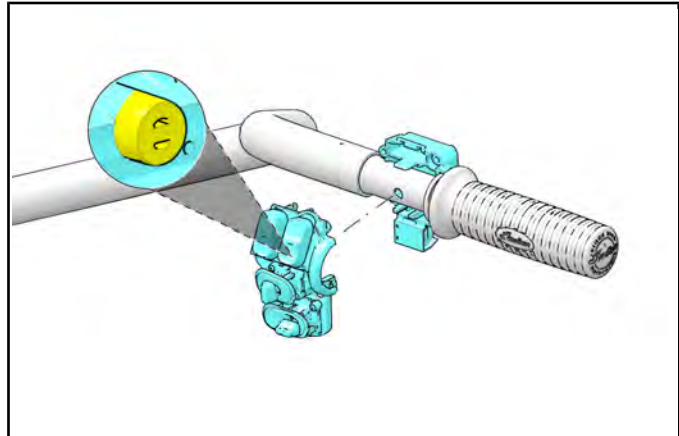


**INSTALLATION**

**NOTICE**

Before assembling cube halves, ensure the wire harness is completely pulled through and no wires are pinched. Confirm there is no wire slack in handlebars.

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**
2. Upon installation, ensure inner switch cube retention feature is secured in locating hole in handlebar.



3. Torque fasteners to specification.

**TORQUE**

Switch Cube Fastener:  
**12 in-lbs (1 N·m)**

**TORQUE**

Switch Cube Cover Fastener:  
**12 in-lbs (1 N·m)**

**SWITCH CUBE PINOUT**

**LEFT SWITCH CUBE**

PIN	FUNCTION
1	Switch Cube Feed
2	Ground
3	250K CAN HIGH
4	250K CAN LOW



## ELECTRICAL

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### LEFT HEAT

PIN	FUNCTION
1	Heated Grips Output
2	Ground

### RIGHT SWITCH CUBE 2

PIN	FUNCTION
1	Run / Stop Switch Output
2	Ignition Switch Signal

### RIGHT SWITCH CUBE 1

PIN	FUNCTION
1	VCM Control Feed
2	Ground
3	250K CAN HIGH
4	250K CAN LOW

### RIGHT HEAT

PIN	FUNCTION
1	Heated Grips Output
2	Ground

## THROTTLE CONTROL

### THROTTLE CONTROL REMOVAL / INSTALLATION

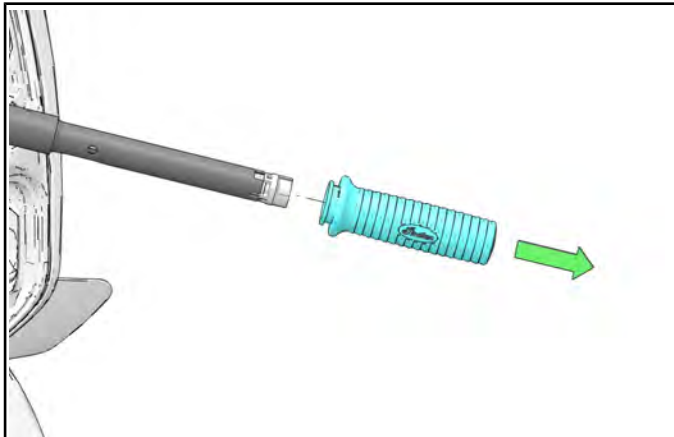
To watch a video of this procedure, scan the QR code or click [HERE](#).



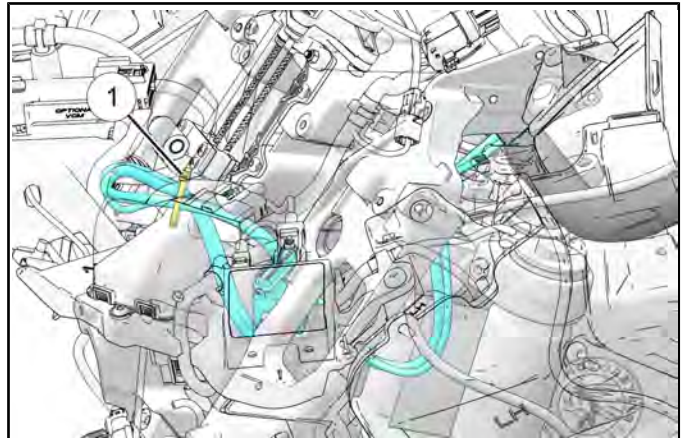
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#### REMOVAL

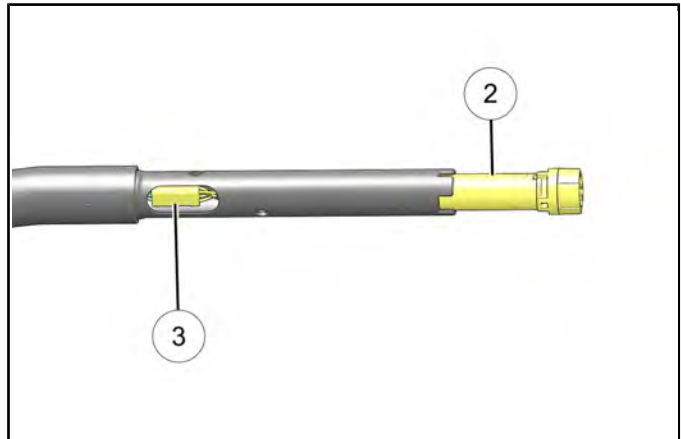
1. Remove outer fairing and dash support. See **Fairing Disassembly** page 7.40.
2. Remove switch cube. See **Switch Cube Replacement** page 10.132.
3. Remove grip.



4. Follow the wiring coming out of the handle bars and cut the cable tie ① retaining the slack.



5. Pull on the throttle control ② until the electrical connection ③ is visible and disconnect.

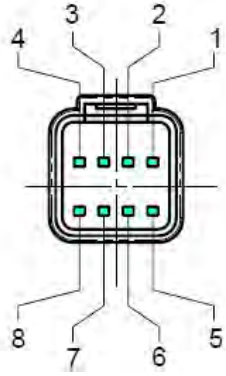


#### INSTALLATION

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

ELECTRICAL

**THROTTLE CONTROL PINOUT**

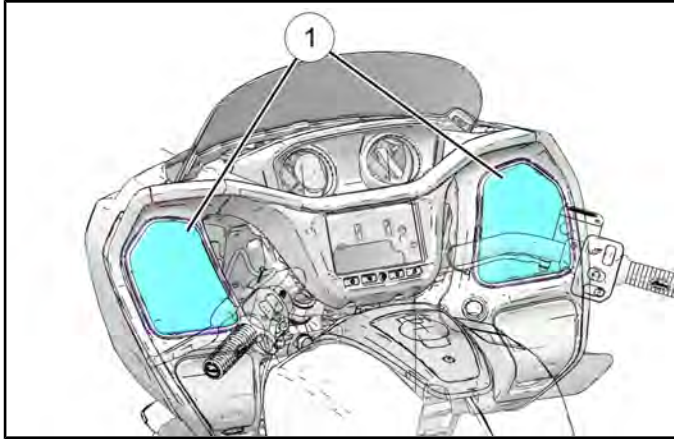


PIN	FUNCTION
1	Throttle Position Sensor 1 Return

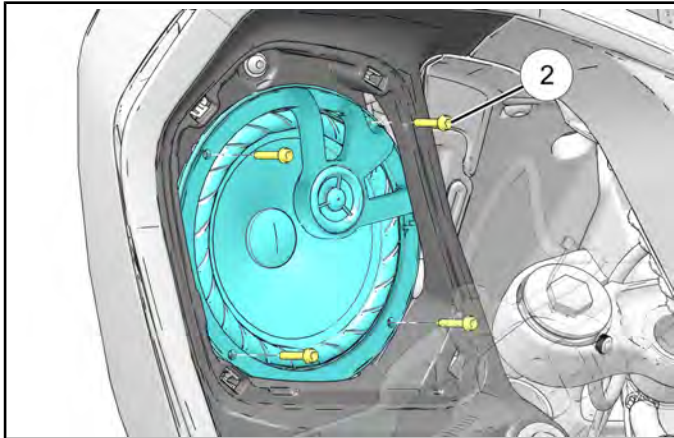
2	Throttle Position Sensor 1 +5V Reference
3	Throttle Position Sensor 2 +5V Reference
4	Throttle Position Sensor 2 Return
5	Throttle Position Sensor 1 Output
6	-
7	-
8	Throttle Position Sensor 2 output

**INFOTAINMENT SYSTEM****SPEAKER REMOVAL / INSTALLATION**

1. Carefully pry off speaker bezel ①.



2. Remove fasteners ② securing speaker.



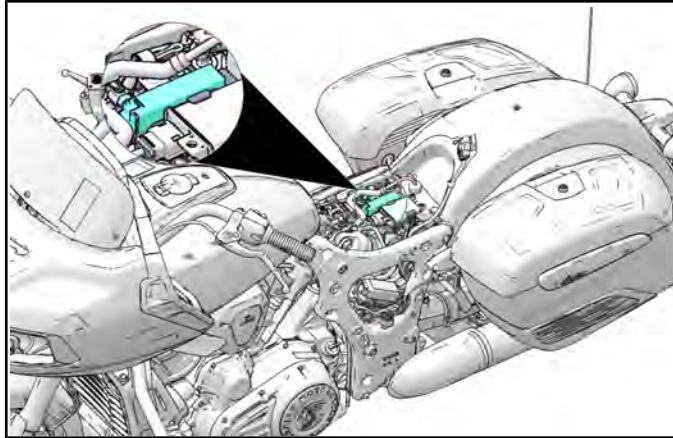
3. Disconnect speaker electrical connector upon removal.
4. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Speaker Fastener ①:  
**25 in-lbs (3 N·m)**

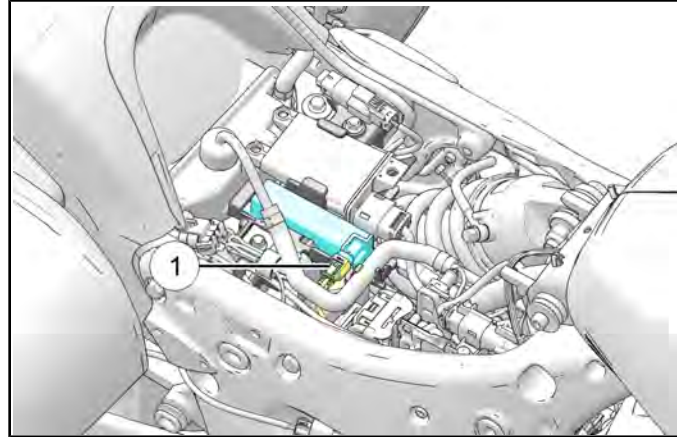
### **ANTENNA MODULE OVERVIEW**

The antenna module is located under the seat as shown.



### **ANTENNA MODULE REMOVAL / INSTALLATION**

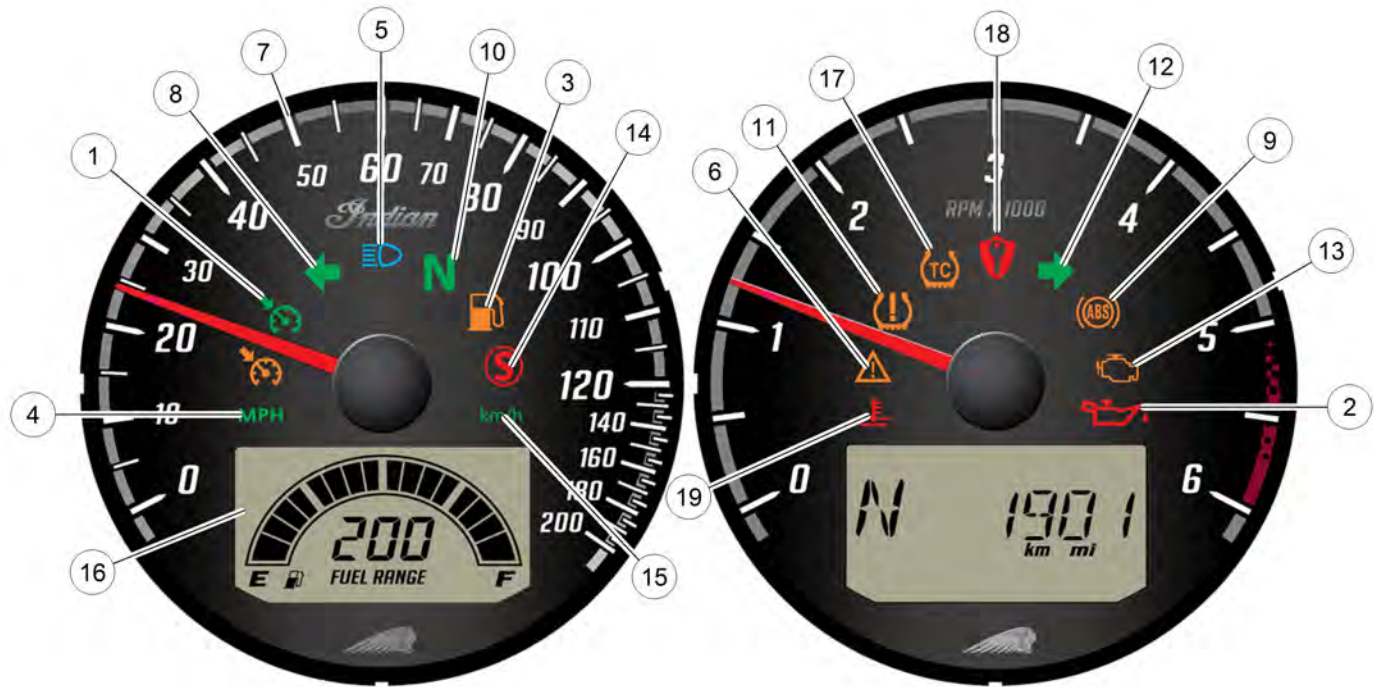
1. Remove seat. See **Seat Removal / Installation page 7.32.**
2. Position motorcycle in an upright position with the front wheel clamped in a wheel vise.
3. Unplug antenna module Electrical connector ①.



4. Remove antenna module from the under-seat wire bracket
5. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**INSTRUMENTATION**

**INSTRUMENT CLUSTER**













For detailed information regarding MODE selection and Multi-Function Display operation refer to the Indian Motorcycle Owner’s Manual.



The instrument cluster includes the speedometer, indicator lamps, Multi-Function Display (MFD) and fuel gauge (where applicable).

NUMBER	LIGHT	INDICATES	CONDITION
①		Cruise Control Status	<i>Amber Lamp:</i> Cruise control is enabled, but not set. When flashing, a cruise control related fault exists. <i>Green Lamp:</i> Cruise control is set to the desired speed. <i>Read the safety and operation procedures before using cruise control.</i>
②		Low Oil Pressure	This lamp illuminates when oil pressure drops below a safe operating pressure while the engine is running. If this lamp illuminates while the engine is running above idle speed, turn the engine off as soon as safely possible and check the oil level. <i>If the oil level is correct and the lamp remains on after the engine is restarted, turn the engine off immediately. See your dealer.</i>
③		Low Fuel	This lamp illuminates when approximately one gallon (3.8 liters) of fuel remains in the fuel tank. The LCD Display will switch into a Low Fuel Mileage Counter Mode to provide the rider with mileage tracking from the time the indicator was activated.
④	<b>MPH</b>	Vehicle speed	When standard mode is selected, speed displays in miles per hour.

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## ELECTRICAL

NUMBER	LIGHT	INDICATES	CONDITION
⑤		High Beam	The headlight switch is set to high beam. This indicator will flash if there is a problem with the low or high beam light.
⑥		Chassis Fault	The alert symbol illuminates if a chassis fault occurs.
⑦	—	Vehicle Speed	Analog display of vehicle road speed in MPH or km/h.
⑧		Left Turn Signal	The turn signal indicator flashes when the left turn signal (hazard) is active. <i>If there is a problem in the signal system, the lamps will flash at twice the normal rate.</i>
⑨		Anti-Lock Brake System Status	The indicator remains on until the anti-lock system activates, which occurs when vehicle speed exceeds 6 MPH (10 km/h). When the lamp is illuminated, the anti-lock brakes will not activate, but the conventional brake system will continue to operate normally.
⑩		Neutral	The transmission is in neutral.
⑪		Tire Pressure Monitoring System (TPMS)	(If equipped) The TPMS indicator illuminates if low tire pressure is detected. It will also illuminate along with the Low Battery Voltage indicator when TPMS battery power is low, requiring service.
⑫		Right Turn Signal	The turn signal indicator flashes when the right turn signal (hazard) is active. <i>If there is a problem in the signal system, the lamps will flash at twice the normal rate.</i>
⑬		Check Engine	<i>If this lamp illuminates while the engine is running, see your dealer promptly.</i> The light will remain on if the tilt sensor shuts down the engine. If abnormal sensor or engine operation is detected the light will remain on as long as the fault condition exists. Retrieve the error codes for diagnosis.
⑭		Sidestand Indicator	Illuminates when the sidestand is in the down position.
⑮	km/h	Vehicle Speed	When metric mode is selected, speed displays in kilometers per hour.
⑯	—	Multi-Function Display (MFD)	—
⑰		Traction Control	This lamp illuminates when traction control is engaged.

NUMBER	LIGHT	INDICATES	CONDITION
⑱		Security System Status	This indicator lamp illuminates while the security system is searching for the key fob signal and when the security system is locked. The lamp flashes if the key fob is not detected within range or if the fob is not programmed properly. It also illuminates with the low battery voltage indicator when the key fob battery is low.
⑲		Engine Hot	This lamp illuminates to indicate an overheated engine. If the indicator flashes, a severe overheating condition exists.



## ELECTRICAL

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### **Odometer**

The odometer displays total distance traveled.

### **Trip Odometers**

The trip odometers (Trip 1 and Trip 2) display total distance traveled since being reset. To reset a trip odometer, toggle to the trip odometer, then press and hold the LEFT-TOGGLE switch until the trip odometer resets to zero.

### **Engine Speed**

Engine Speed displays in revolution per minute (RPM).

### **DC Voltage**

The volt meter displays battery voltage. If the engine is not running, approximate *battery* voltage displays. If the engine is running, approximate *charging* voltage displays.

### **Gear Position**

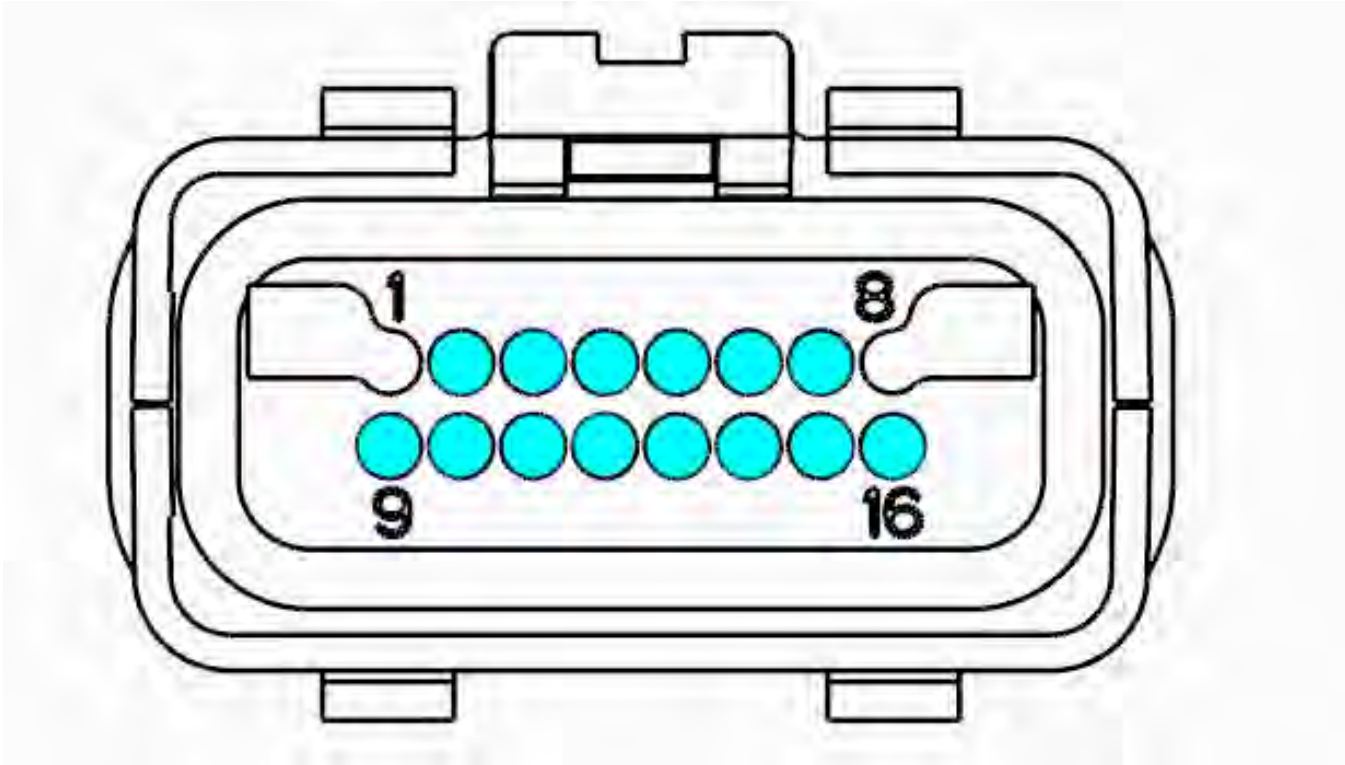
Gear position displays at all times while the engine is running, unless a fault occurs with the gear position sensor.

### **Temperature**

The temperature area displays ambient air temperature.

### **Fuel Range**

The fuel range displays the distance the motorcycle can travel on the remaining fuel in the fuel tank.

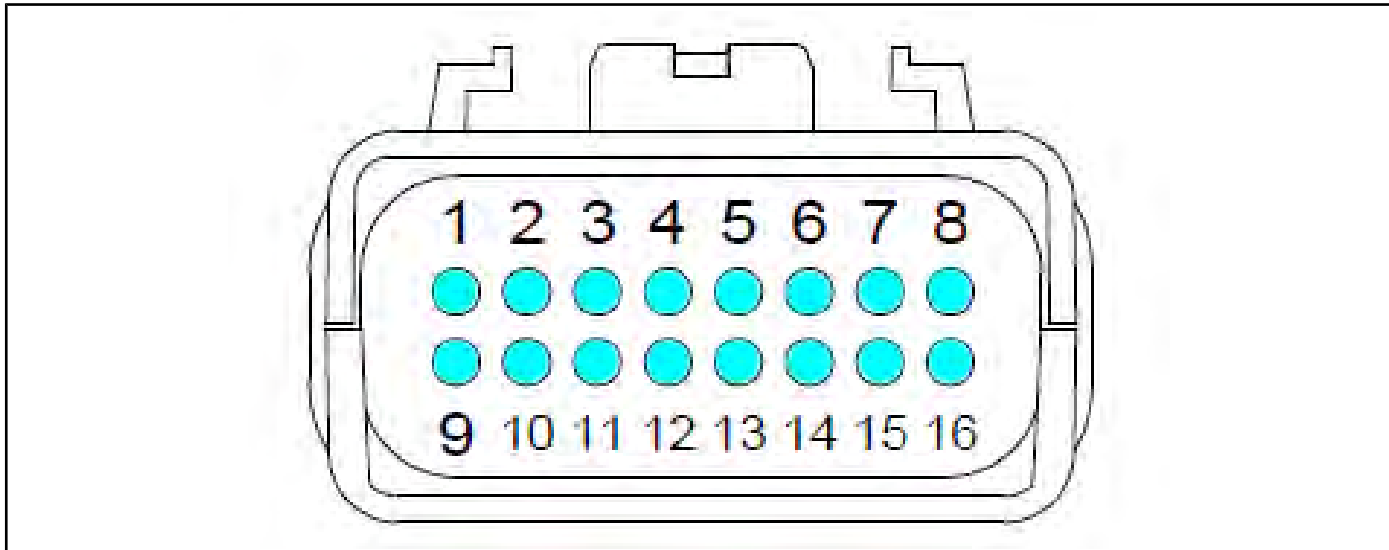
**INSTRUMENT CLUSTER PINOUT****SPEEDOMETER**

PIN	Wire Color	FUNCTION
1	YE	CAN High
2	DG	CAN Low
3	OG/YE	Switched Power +
4	OG	Constant Power +
5	BK	Power Ground
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-

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ELECTRICAL

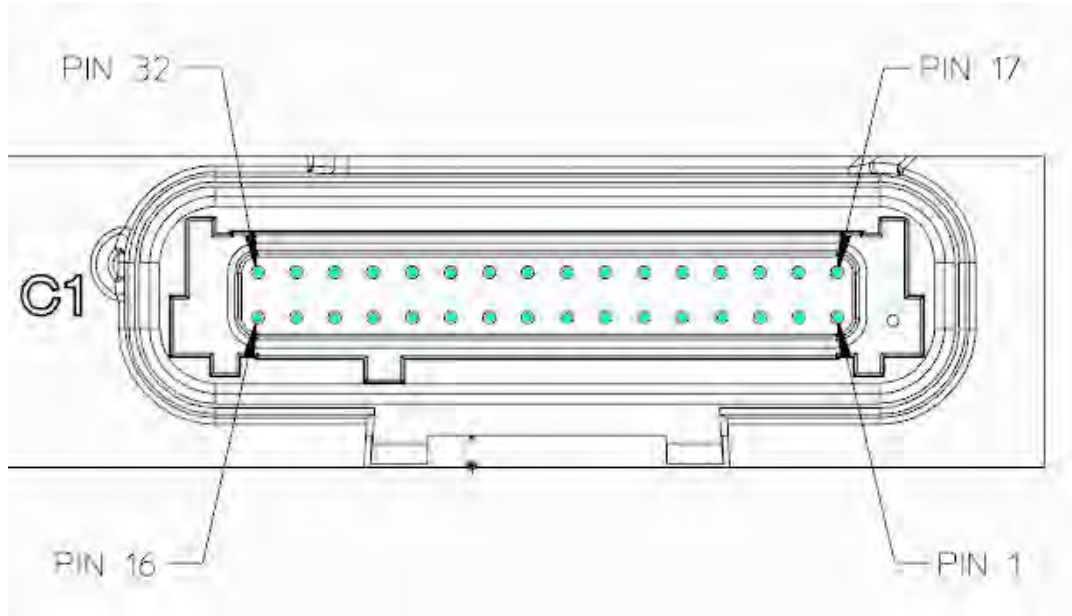
TACHOMETER



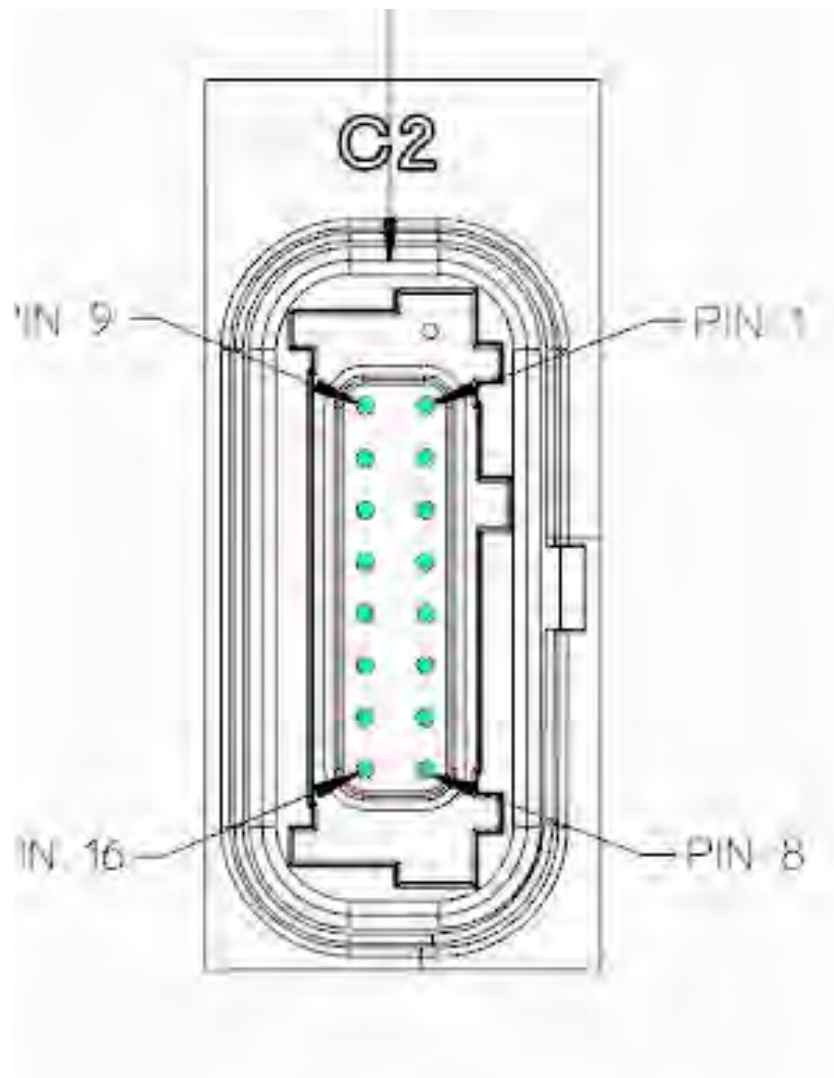
PIN	Wire Color	FUNCTION
1	YE	CANA High
2	DG	CANA Low
3	PK/GN	VCM Accessory Power Out
4	OG	Instrumentation Fuse Output
5	BK	Ground
6	—	—
7	—	—
8	—	—
9	—	—
10	YE/BK	Oil Pressure Switch Output
11	—	—
12	—	—
13	—	—
14	—	—
15	—	—
16	—	—



**RIDE COMMAND DISPLAY  
DISPLAY CONNECTOR PINOUT**



PIN	FUNCTION	PIN	FUNCTION
1	Lineout 2 Rear Right -	17	Lineout 1 Front Right +
2	Lineout 2 Rear Right +	18	Lineout 2 Front Right -
3	Lineout 2 Shield	19	Lineout 1 Shield
4	Lineout Rear Left -	20	Lineout 1 Front -
5	Lineout Rear Left +	21	Lineout 1 Front Left +
6	Analog In 3	22	Video 1 In -
7	Analog In 2	23	Video 1 In +
8	Analog In 1 Ambient Temperature Sensor	24	Video 1 Shield
9	—	25	—
10	—	26	Remove 1
11	USB 1 Shield	27	USB1 -
12	USB 1 Ground	28	USB1 +
13	USB 1 VBUS	29	CAN1 High
14	Mode In	30	CAN1 Low
15	AMP Turn On	31	Ignition
16	Ground	32	Battery

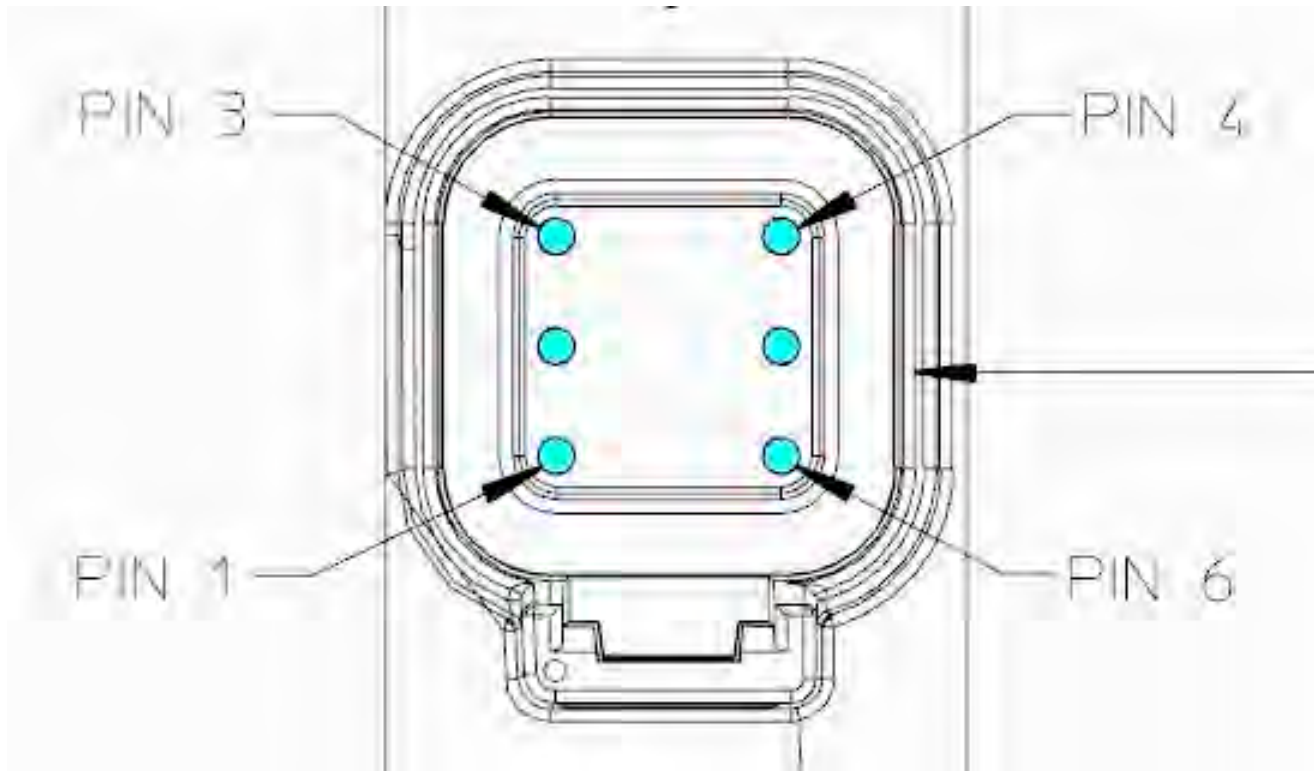


PIN	FUNCTION	PIN	FUNCTION
1	CAN2 LOW	9	Video 3 In -
2	CAN2 HIGH	10	Video 3 In +
3	Lineout 3 +	11	Video 2 In -
4	Lineout 3 -	12	Video 2 In +
5	Lineout 3 Shield	13	Line In Left Return
6	Lineout 3	14	Line In Left
7	Lineout 3	15	Line In Right
8	Amp Turn on Front/Rear Switched Camera Power	16	Line In Right Return

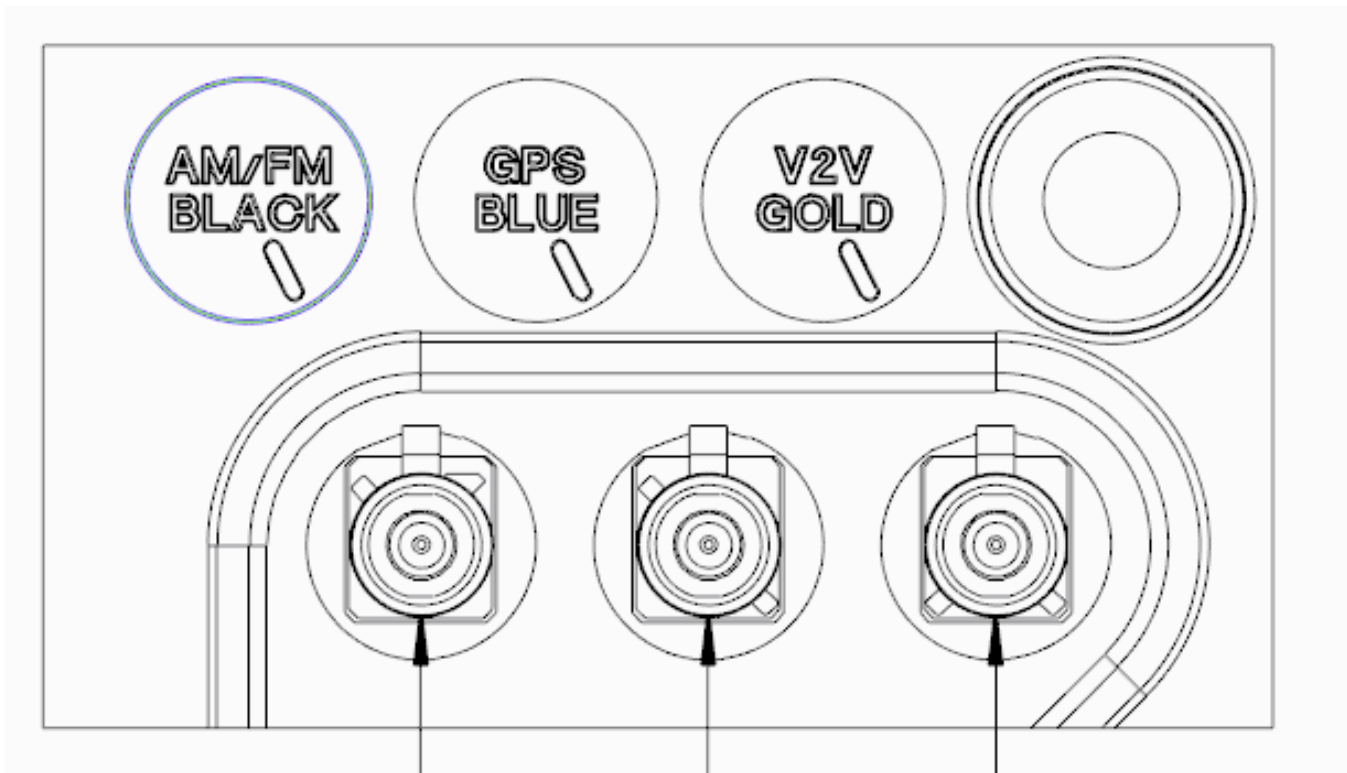
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## ELECTRICAL

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<b>PIN</b>	<b>FUNCTION</b>
1	Ground
2	+5V BUS
3	D+
4	D-
5	Ground – Shield
6	VBUS Remote Sense





ELECTRICAL

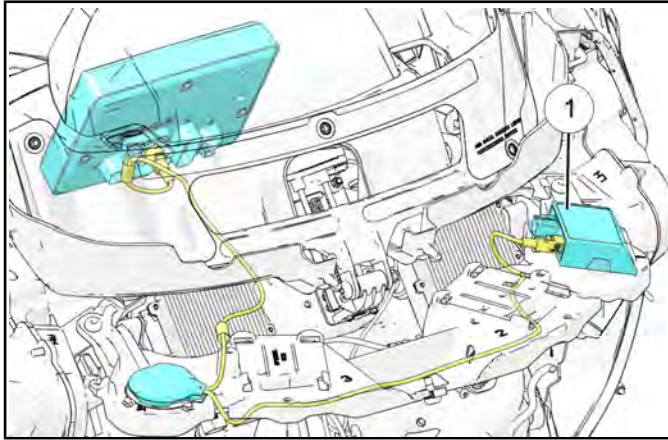
**RIDE COMMAND DIAGNOSTICS / TROUBLESHOOTING**

**Problem: Black Screen / Will Not Power On**

STEP	ACTION	YES	NO
1	Power cycle the bike by switching ignition on and off with main power switch in fairing. <b>Did you find and repair the condition?</b>	Go to Step 8	Go to Step 2
2	Check the 5 amp fuse labeled <i>Gauge</i> in the main fuse box under the left side upper panel. Refer to Fuse Box Location page 10.68 <b>Is the fuse blown?</b>	Go to Step 9	Go to Step 3
3	Reinstall <i>Gauge</i> fuse and test screen for proper operation. <b>Did you find and repair the condition?</b>	Go to Step 8	Go to Step 4
4	1. Turn ignition on. 2. Disconnect the display from the harness. 3. Using pin 16 (Ground) as ground reference, check for battery voltage on pins 31 (Switched Power) and 32 (Battery Power) of the display connector. <b>Is there Battery Voltage at pins 31 and 32 with the ignition on?</b>	Go to Step 8	Go to Step 5
5	Refer to the Fairing & Chassis wiring schematic in appendix and check circuits without voltage for continuity and proper operation. <b>Did you find any problems in the circuit?</b>	Go to Step 7	Go to Step 1 and repeat diagnosis
6	Replace display with known good display. <b>Did you find and repair the condition?</b>	Go to Step 8	Go to Step 1 and repeat diagnosis
7	Repair, replace, and check all affected power/ground circuits. Check for battery voltage at pins 31 and 32. <b>Is there battery voltage at pins 31 and 32 with the ignition on?</b>	Go to Step 8	Go to Step 1 and repeat diagnosis
8	Update display with newest software available. Refer to the Owner's Manual for instructions on how to update/ reflash software. <b>Is display working properly?</b>	Confirm display operation and continue use.	Go to Step 6
9	1. Test circuit for continuity and/or shorts in wiring. 2. Fix any shorts in the wiring and reinstall new fuse. <b>Did you find and repair the condition?</b>	Go to Step 8	Go to Step 4

**GPS / CELL ANTENNA TROUBLESHOOTING**

1. Remove Outer Fairing. Reference **Fairing Disassembly** page 7.40.
2. Unplug the GSP and Cell connectors from the cell modem ① and display.



3. Plug the GPS / Cell Antenna back into the cell modem and display, making sure connectors are securely seated, and check for functionality.

**NOTICE**

Must be in an area with GPS and Verizon 4G cell signal available.

4. If GPS and or cell data is still not present, replace GPS / Cell antenna with new unit.
5. If after replacing the GPS / Cell antenna, there is still no cell data present, move on to cell modem troubleshooting (If applicable).

**CELL MODEM TROUBLESHOOTING (IF APPLICABLE)**

Ensure the following BEFORE beginning:

- Reliable internet connection.
- Latest version of Digital Wrench is installed on computer. Log into Polaris Dealer Website, select "**Service and Warranty**" menu, then "**Digital Wrench Updates**".

1. Connect Digital Wrench to diagnostic port on motorcycle and power on motorcycle.
2. Enter vehicle information as required.
3. Select "Engineering Tests" menu.
4. Select "Modem Procedures" menu.
5. Select "Cell Modem Diagnostics".
6. After selecting option from step 5, follow Digital Wrench screen prompts until Digital Wrench provides a result.
7. Verify the functionality of the cell modem.
8. If the cell modem is still not functional, call Indian Motorcycle for Ride Command Support.

**CELL MODEM TROUBLESHOOTING (IF APPLICABLE)**

Ensure the following BEFORE beginning:

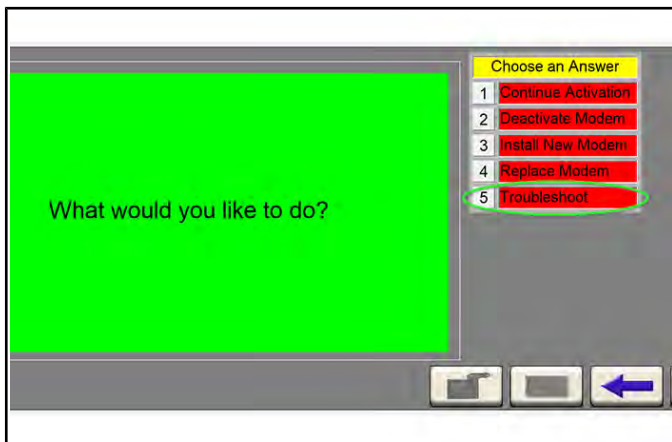
- Reliable internet connection and good Verizon cell signal.
- Connect the battery to a battery tender.
- Disable the automatic power down function, **Settings > Vehicle > Automatic Power Down**.
- Latest version of Digital Wrench is installed on computer. Log into Polaris Dealers Website, select "**Service and Warranty**" menu, then "**Digital Wrench Updates**".

1. Connect Digital Wrench® cable to diagnostic port on motorcycle and power on motorcycle.
2. Enter vehicle information as required.
3. Select **Special Tests** menu item.

4. Select "**Modem Service Procedures**" menu item.



5. Select "**Troubleshoot**" option.



6. After selecting the option from **step 5**, follow Digital Wrench screen prompts until Digital Wrench provides a result.
7. Verify the functionality of the cell modem.
8. If the cell modem is still not functional call Indian Motorcycle for Ride Command support.

### **HEADSET TROUBLESHOOTING**

If headset is not functioning properly with display:

1. Check volume level on Headset.
2. Ensure Headset has latest software. Visit Headset Manufacturer Website to verify and install most up to date software.
3. Clear all pairings from Headset and re-pair with display
4. Pair Headset with another Bluetooth enabled device and check for proper functionality

### **ANDROID "OK GOOGLE" ISSUES**

\*Not currently available for model year 2020

1. Ensure Headset and Android phone are paired to the motorcycle.
2. Turn phone screen ON and unlock phone.
3. Press and hold the center button (Mute, Play/ Pause) on the handlebar control.
4. Display should initiate a Voice Command session with phone.
5. Ensure Google App is selected as the default app and that your phone always remembers this selection

### **UNCLEAR HEADSET SOUND**

1. Unpair and repair headset from Ride Command in bluetooth menu.
2. If this does not resolve the issue, clear all previously paired headsets from Ride Command, and repair the headset.
3. If there is still unclear sound, pair different headset and see if sound quality improves.
4. If sound quality improves, previous headset was malfunctioning.

## CRUISE CONTROL

### **CRUISE CONTROL OVERVIEW**

The Indian Motorcycle cruise control system operates in conjunction with the Electronic Throttle Control (ETC) eliminating the need for a conventional actuator / cable assembly. The Engine Control Module (ECM) uses several inputs to determine the position of the ETC in order to maintain the desired vehicle speed. Momentary signals are sent to the Vehicle Control Module (VCM) from the right hand switch cube based on operator input. The VCM converts these operator inputs to CAN and relays the message to the Engine Control Module (ECM).

Cruise control only operates in gears 4 — 6.

#### **Cruise Related Control Modules:**

- Electronic Throttle Control (ETC)
- Engine Control Module (ECM)
- Anti-Lock Brake Control Module

#### **Cruise Related Inputs / Outputs (RH Switch Cube):**

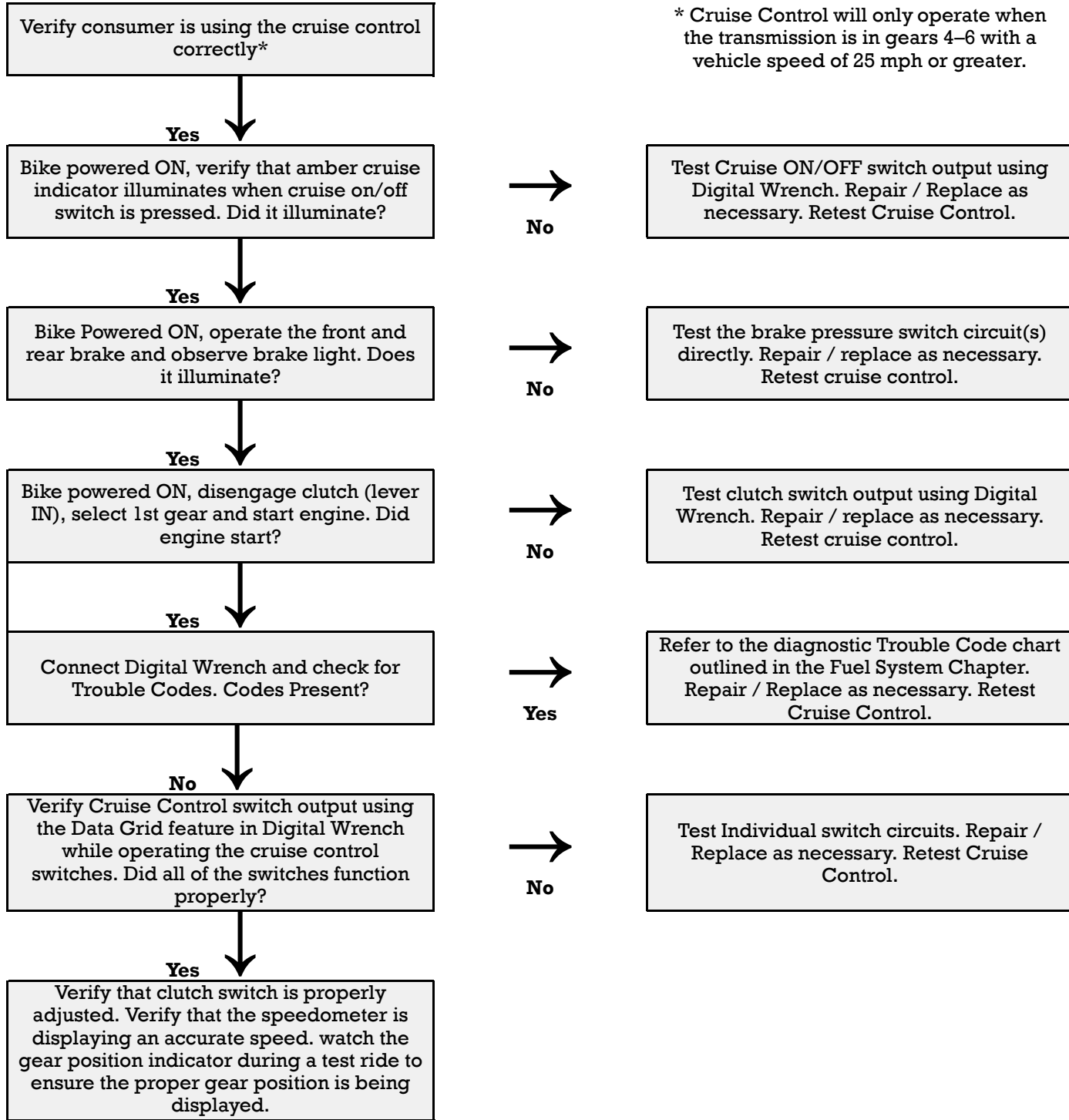
- CRUISE ON / OFF — Right hand switch cube module to ECM via CAN
- CRUISE RES / ACC — Discrete input to the VCM then CAN message to ECM
- CRUISE SET / DEC — Discrete input to the VCM then CAN message to ECM

#### **Cruise Related Inputs / Outputs (other controls):**

- Brake Pressure Switch (Front & Rear) — Discrete input to ECM
- Clutch Switch — Clutch switch is wired to left hand switchcube input to the CAN and ECM
- Vehicle Speed (Wheel Speed Sensors) — Discrete inputs to ABS module and then CAN message to ECM

**CRUISE CONTROL DIAGNOSTICS**

\* Cruise Control will only operate when the transmission is in gears 4–6 with a vehicle speed of 25 mph or greater.



## SECURITY ALARM

### Overview

A 2-button key fob is required for use of the security alarm.

To activate the security alarm, double push the lock button on the key fob. The horn will sound briefly to confirm that the alarm is activated.

With the key fob within range, the following actions will deactivate the alarm.

#### NOTICE

**The security light and / or power switch will turn on briefly until the key fob is detected. If the key fob is not detected within 20 seconds, the horn (alarm) will sound repeatedly for 60 seconds.**

- Press the unlock button on the key fob.
- Press the power switch on the center console.
- Press the starter button.
- Press the lock / unlock switch on the center console.
- Move the motorcycle to the fully upright position from leaning on sidestand. (The horn will sound repeatedly if the key fob is not detected within 5 seconds)

#### NOTICE

**Each time the alarm has been deactivated, a double press of the key fob lock button will reactivate.**

## GUIDED DIAGNOSTICS

### NOTICE

Things to consider prior to performing the following diagnostic tests:

- When was the last time the battery was disconnected?
- How many hours are on the vehicle (Fairing bikes only)?
- Has any servicing been done to the bike recently?
- Any other notable events occur before or during the start of this issue?

### Bike Does Not Authenticate with Key Fob

**A:** Does the LED on the key fob blink when the bike is turned on?

**B:** Does the LED on the key fob blink when a key fob button is pressed?

**C:** Does the bike lock or unlock when the key fob button is pushed (Fairing bikes only)?

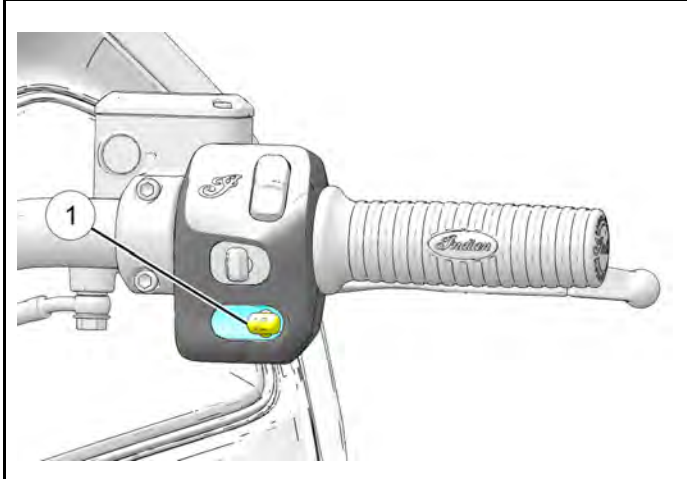
**D:** Does the Tire Pressure Monitoring System work when the PIN code is used?

## ELECTRICAL

A	B	C	D	
No	No	No	No	Look at WCM (1,2)
No	Yes	NA	NA	Antenna or serial number in key fob (2,3)
No	No	NA	NA	Bad key fob battery or key fob (1)
No	Yes	Yes	Yes	Look at 125 kHz antenna (3)
Yes	Yes	NA	NA	Connect to bike with Digital Wrench (2)
Yes				This means the 125 kHz antenna is working properly This means the correct serial number is stored in the WCM
		Yes		This means the correct serial number is stored in the WCM This means the key fob counter is working properly This means the 433 MHz receiver is working properly
			Yes	This means the 433 MHz receiver is working properly
		No	Yes	Look at key fob battery and serial number in Digital Wrench (2)
Yes	Yes	No	Yes	Connect to bike with Digital Wrench (2)

### Troubleshooting

- Remove the key fob battery and test voltage.
  - Is the battery voltage OK?
  - YES:** Install battery and retest authentication.
  - NO:** Proceed to next step.
- Replace key fob battery with new cell.
  - Did this fix the issue?
  - YES:** No further action required.
  - NO:** Connect to Digital Wrench and write a new key fob serial number in Slot 2.
- Connect to Digital Wrench and verify the correct WCM software is installed.
- Verify that serial numbers match the key fob being used.
- Inspect the 125 kHz antenna for broken wires.

**POWER WINDSHIELD****POWER WINDSHIELD OPERATION**

The windshield switch provides CAN data to the VCM 2. The VCM interprets, commands, and moves the windshield accordingly. The windshield command stops when high current at the end of travel is detected. Commands in the same direction will be prevented for a few seconds once end of travel is detected. If double pressed in one direction, it will automatically move the windshield to end of travel in that direction. An additional press in either direction will cancel auto windshield motion.

A breakout diagram of the windshield circuit can be found in the circuit diagrams section. See **Circuit Diagrams page** .

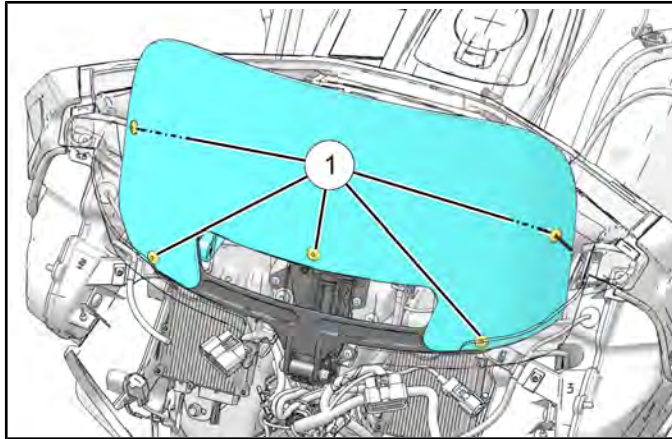


**POWER WINDSHIELD MOTOR, REMOVAL**

**IMPORTANT**

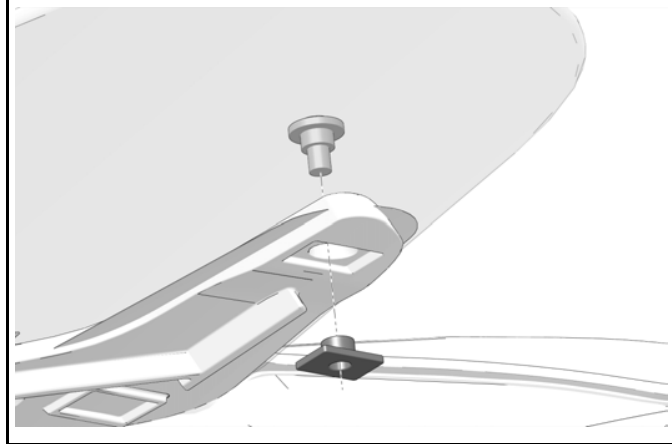
Ensure the windshield is in the full upright position.

1. Remove the outer fairing and windshield. See **Fairing Disassembly page 7.40**
2. Remove windshield by removing its fasteners ①.

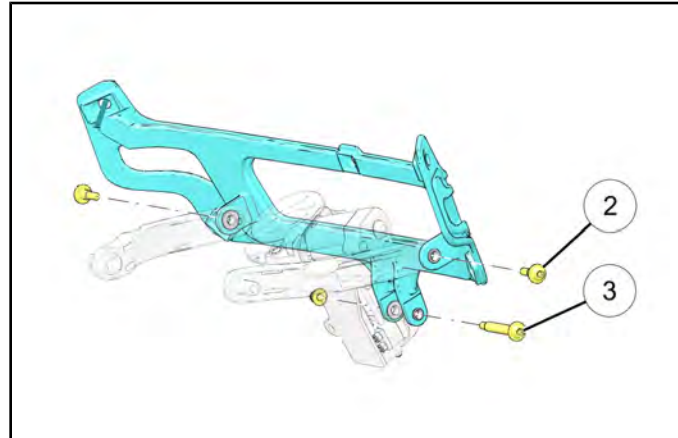


**NOTICE**

When removing the five windshield fasteners be sure to capture the T-nuts as they are not captive.

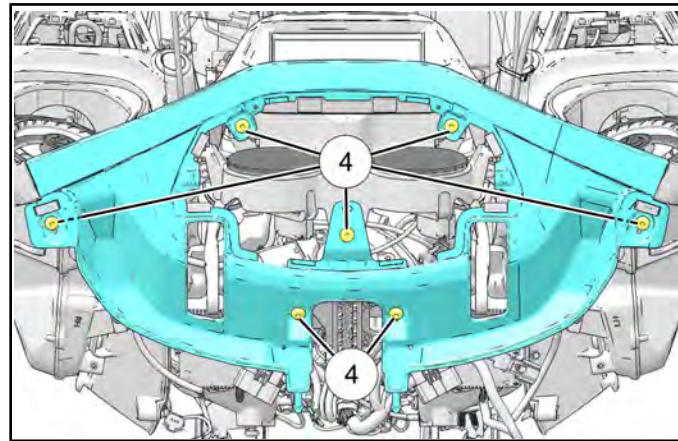


3. Remove windshield support by removing link fasteners ②.

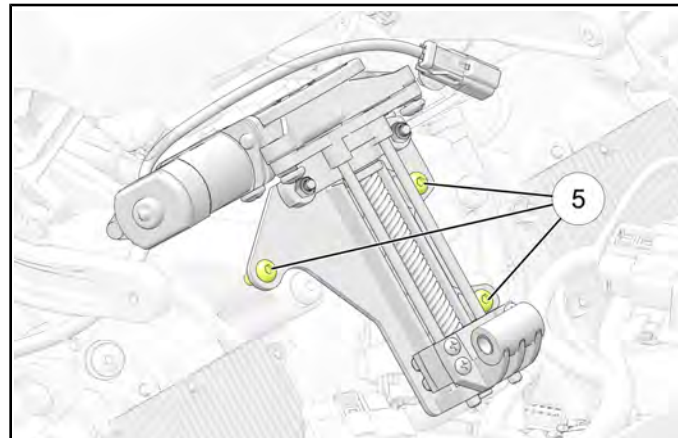


4. Remove windshield support to windshield motor fastener ③.

5. Remove fasteners ④ securing visor top and remove.



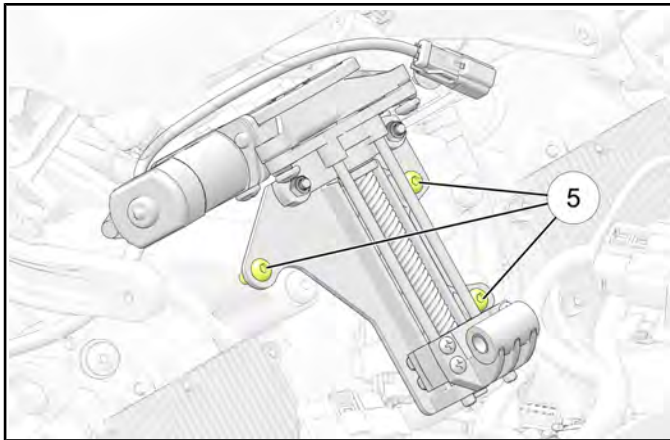
6. Remove the three fasteners ⑤ securing the windshield lift motor to the mounting bracket.



7. Disconnect the electrical connector and remove motor assembly.

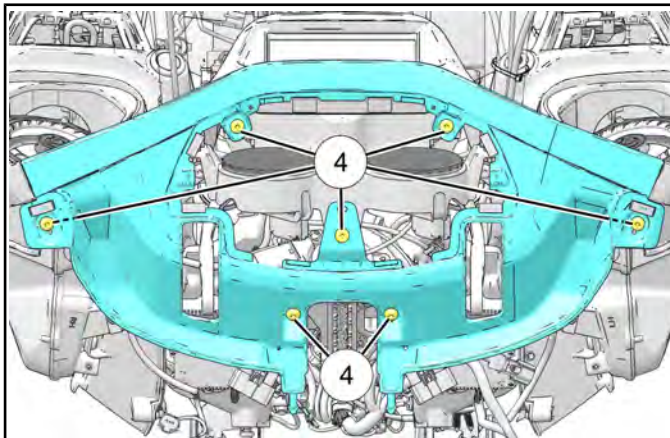
**POWER WINDSHIELD MOTOR, INSTALLATION**

1. If the limiter switch is being replaced, attach the switch to the motor assembly at this time.
2. Plug the electrical connector into the windshield lift motor assembly and lower into position.
3. Install motor fasteners ⑤ and torque to specification.



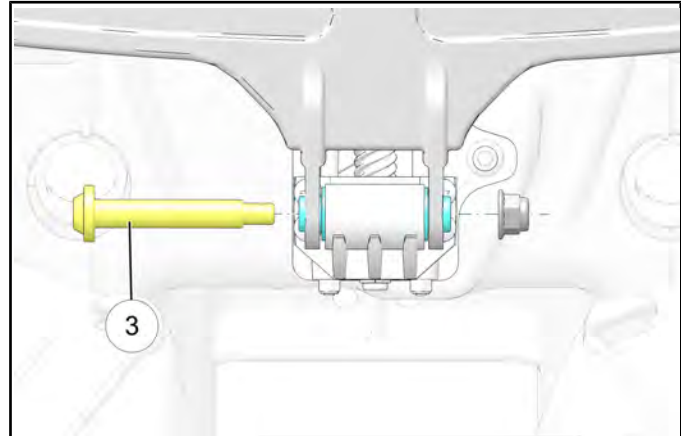
**TORQUE**  
 Windshield Motor Fasteners:  
**84 in-lbs (10 N·m)**

4. Install windshield support and seven fasteners ④. Torque fasteners to specification.



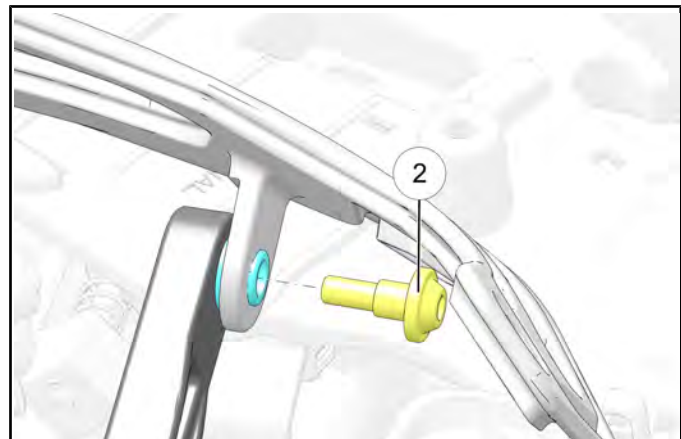
**TORQUE**  
 Windshield Support to Motor Fasteners:  
**84 in-lbs (10 N·m)**

5. Loosely install windshield support to windshield motor fastener ③.



**NOTICE**  
 Make sure the spacers are retained in place between the bracket and windshield motor during installation.

6. Loosely install windshield support to link fasteners ②.



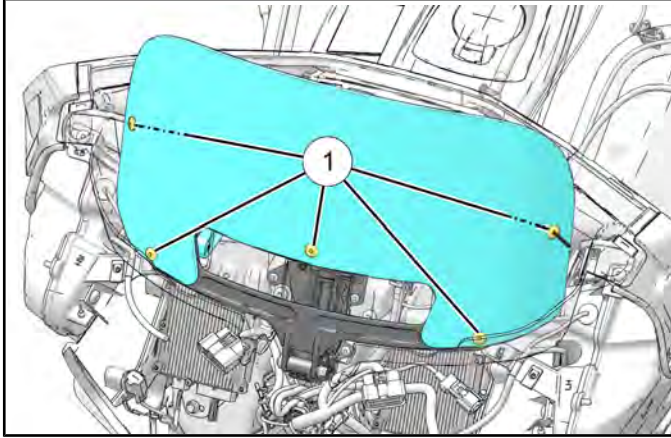
**NOTICE**  
 Make sure the spacer is retained in place between the bracket and support link during installation.

7. Torque fasteners windshield support to link fasteners .

**TORQUE**  
 Windshield Support to Link Fasteners ②:  
**84 in-lbs (10 N·m)**  
 Windshield Support to Motor Fastener ③:  
**84 in-lbs (10 N·m)**

## ELECTRICAL

8. Install the windshield, T-nuts and its fasteners ①.



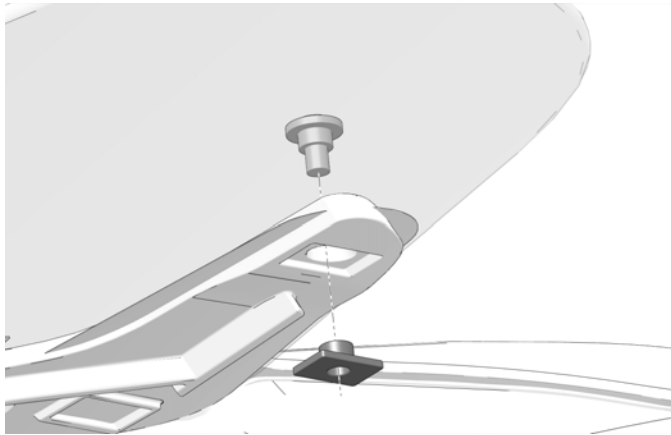
### TORQUE

Windshield Fastener:  
**36 in-lbs (4 N·m)**

9. Install the outer fairing and windshield. See **Fairing Disassembly page 7.40.**

10. Verify the windshield moves up and down through the travel range.

## SEAT / TRUNK



### HEATED / COOLED SEAT

#### NOTICE

MY21 Models only.

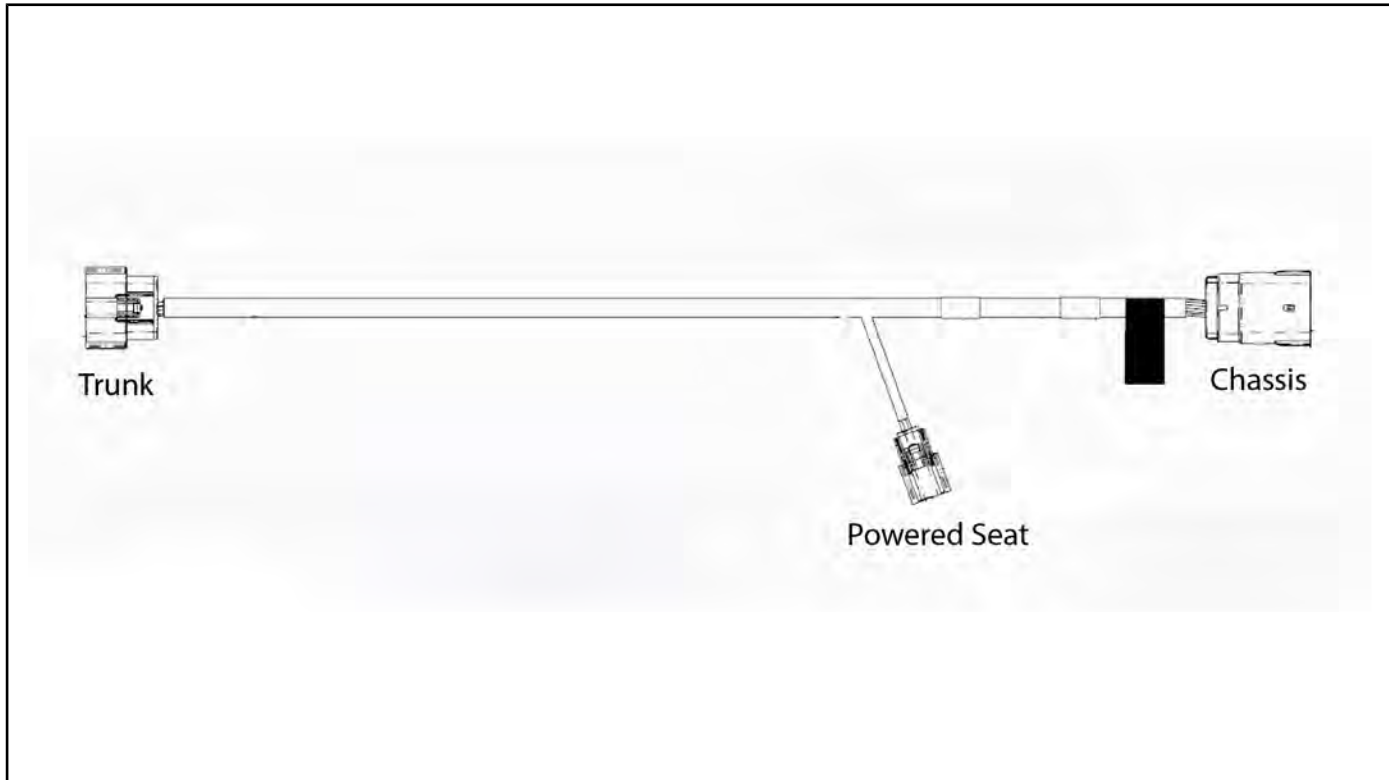


WIRE COLOR	FROM COMPONENT	PORT NUMBER	TO COMPONENT	PORT NUMBER	FUNCTION
GY/WH	Chassis	5	Powered Seat	1	Accessory Switched Output
BK	Powered Seat	2	Chassis	16	Rear Amp Ground

YE	Chassis	3	Powered Seat	3	CAN High
DG	Chassis	6	Powered Seat	4	CAN Low

**SEAT / TRUNK HARNESS**

Touring Models



WIRE COLOR	FROM COMPONENT	PORT NUMBER	TO COMPONENT	PORT NUMBER	FUNCTION
RD/WH	Chassis	1	Trunk	1	Lock Motor Feed
OG/WH	Chassis	2	Trunk	2	Unlock Motor Feed
OG/WH	Chassis	12	Trunk	12	Trunk Speaker Power
BK/WH	Chassis	13	Trunk	13	Trunk Speaker Ground
GY/WH	Chassis	5	Powered Seat	1	Accessory Switched Output
BK	Trunk	15	Chassis	15	Trunk Ground
DG	Chassis	8	Trunk	8	Rear left Speaker Positive
DG/BK	Chassis	9	Trunk	9	Rear left Speaker Negative

## ELECTRICAL

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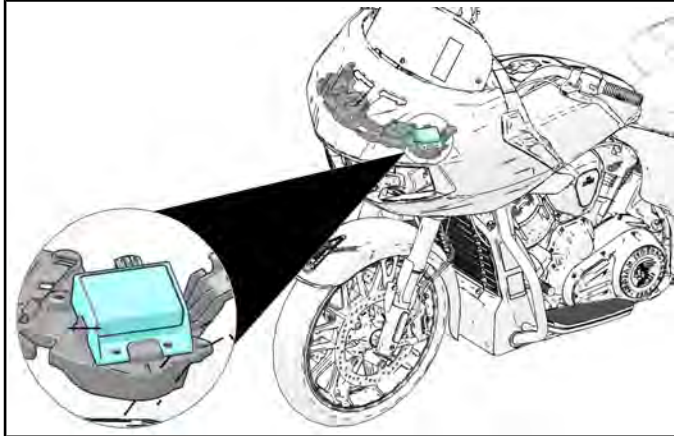
VT	Chassis	10	Trunk	10	Rear Right Speaker Positive
VT/BK	Chassis	11	Trunk	11	Rear Right Speaker Negative
WH/OG	Chassis	4	Trunk	4	Trunk Tail Light Power
BK	Powered Seat	2	Chassis	16	Rear Amp Ground
YE	Chassis	3	Powered Seat	3	CAN HI
DG	Chassis	6	Powered Seat	4	CAN LO
YE/RD	Chassis	7	Trunk	7	Trunk Brake Lamp Feed
GY/RD	Trunk	14	Chassis	14	Accessory Constant Fuse Output

**CELL MODEM****CELL MODEM OVERVIEW****OPERATION OVERVIEW**

The cell modem controls the Ride Command and phone functions on the display.

**LOCATION**

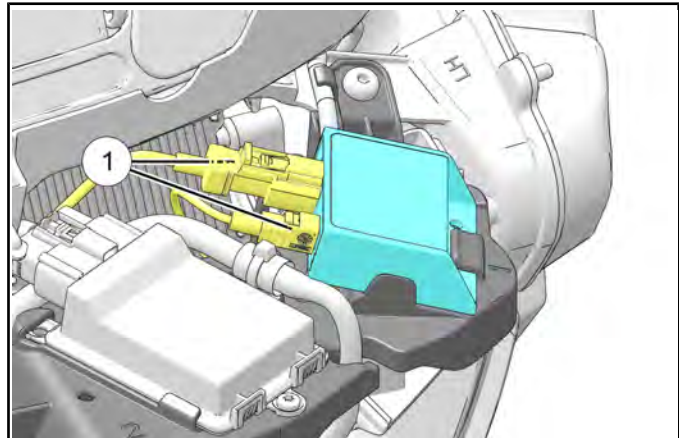
The cell modem is located inside the fairing on the fairing tray.

**PINOUT**

PIN	FUNCTION
1	—
2	Data +
3	Data -
4	+5V DC
5	USB Drain
6	Ground

**CELL MODEM REPLACEMENT****REMOVAL**

1. Remove Outer Fairing. Reference **Fairing Disassembly** page 7.40.
2. Disconnect Cell modem electrical connectors ① and remove modem if applicable.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

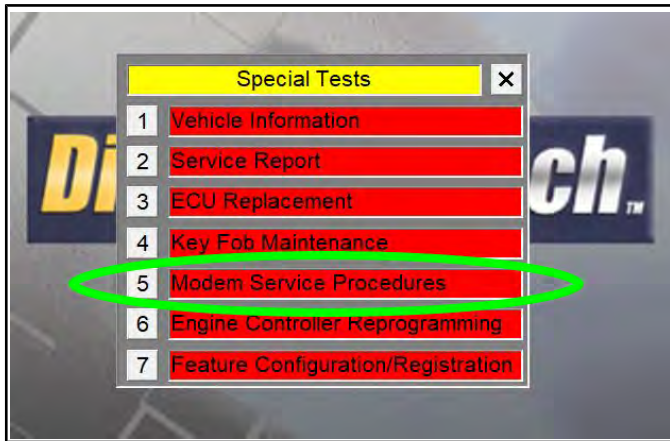
## ELECTRICAL

### **PERFORM DIGITAL WRENCH CELL MODEM ACTIVATION (USA AND CANADA ONLY)**

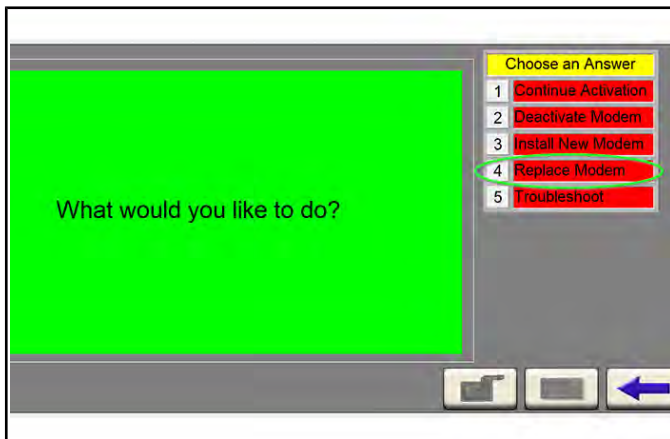
Ensure the following BEFORE beginning:

- Reliable internet connection and good Verizon cell signal.
- Connect the battery to a battery tender.
- Disable the automatic power down function, **Settings > Vehicle > Automatic Power Down**.
- Latest version of Digital Wrench is installed on computer. Log into Polaris Dealers Website, select "**Service and Warranty**" menu, then "**Digital Wrench Updates**".

1. Connect Digital Wrench® cable to diagnostic port on motorcycle and power on motorcycle.
2. Enter vehicle information as required.
3. Select **Special Tests** menu item.
4. Select **Modem Service Procedures** menu item.



5. Select **Replace Modem** option.



6. Follow Digital Wrench® screen prompts until **Modem Activation Completed Successful** is displayed.



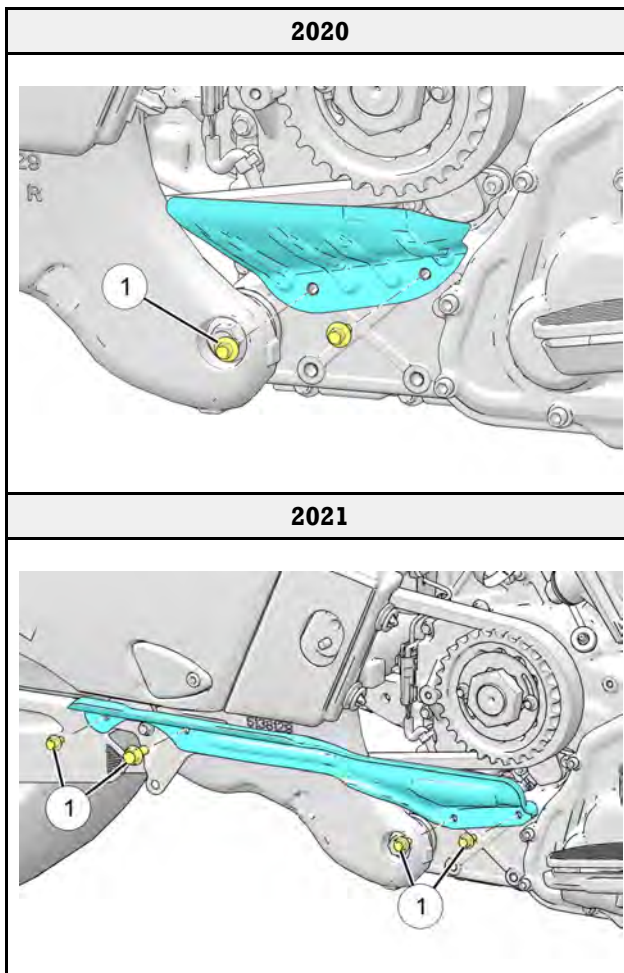
### **CELL MODEM TROUBLESHOOTING**

For Cell Modem Troubleshooting see **GPS / CELL ANTENNA TROUBLESHOOTING** page 10.151.

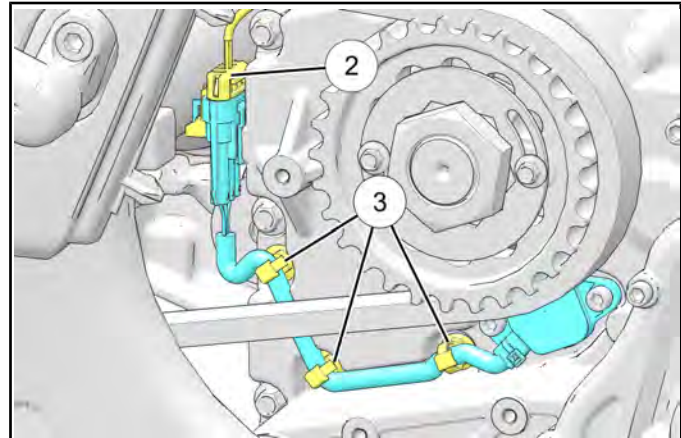
**GEAR POSITION SWITCH****GEAR POSITION SWITCH REPLACEMENT****REMOVAL**

1. Remove drive sprocket shield. See **Drive Sprocket Cover, Removal / Installation page 8.62.**
2. 2020 Models: Remove the belt shield by removing its fasteners ①.

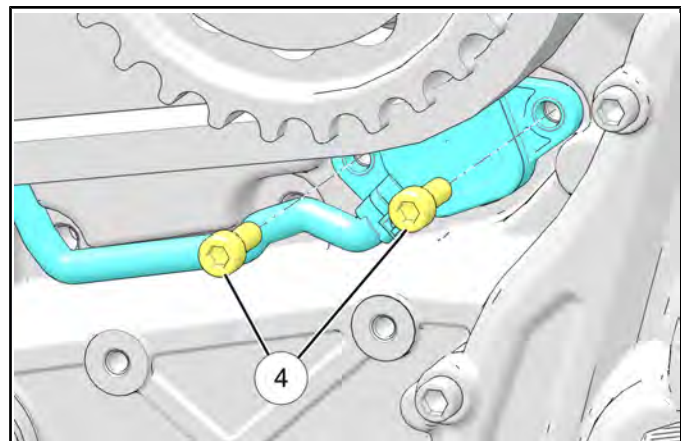
2021 Models: Remove the transmission shield by removing its fasteners ①.



3. Disconnect gear position switch electrical connection ②.



4. Disconnect routing clips ③.
5. Remove fasteners ④ securing gear position switch.



6. Remove the gear position switch o-ring.

**INSTALLATION**

1. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

**TORQUE**

Gear Position Sensor Fastener:  
**44 in-lbs (5 N·m)**

**TORQUE**

Drive Sprocket Shield Fastener:  
**88 in-lbs (10 N·m)**

**10**



## ELECTRICAL

### GEAR POSITION SWITCH TEST

Symptoms of a faulty gear position switch may include:

- Starter motor does not operate when transmission is in neutral,

#### **BUT**

- Starter motor does operator when the clutch is pulled in.
1. Access the gear position switch electrical connector. Reference **Gear Position Switch Replacement page 10.165**
  2. Place the ignition switch in the RUN position to power up the electrical system.
  3. Place engine stop switch in the RUN position.
  4. Shift transmission into Neutral.
  5. Observe Neutral indicator light.
  6. If indicator is not lit with transmission in neutral:
    - Place the RUN/STOP switch in the STOP position and turn motorcycle power off.
    - Roll the motorcycle forward and back enough to verify that it is in neutral.
  7. Backprobe the connector and view voltage with a multi-meter.

LETTER	WIRE COLOR	FUNCTION
A	RED	VCC
B	BLUE	GROUND
C	BLACK	GEAR

8. Compare the voltage of each gear with the table below.

GEAR	VOLTAGE RANGE
1	0.40–0.72 V
N	0.91–1.09 V
2	1.29–1.52 V
3	1.93–2.13 V
4	2.68–3.05 V
5	3.40–3.77 V
6	4.12–4.52 V

#### **IMPORTANT**

Voltage can also be read in digital wrench.

9. If any of the readings are not within the specified parameters, replace or repair wiring as necessary.

## INERTIAL MEASUREMENT UNIT (IMU)

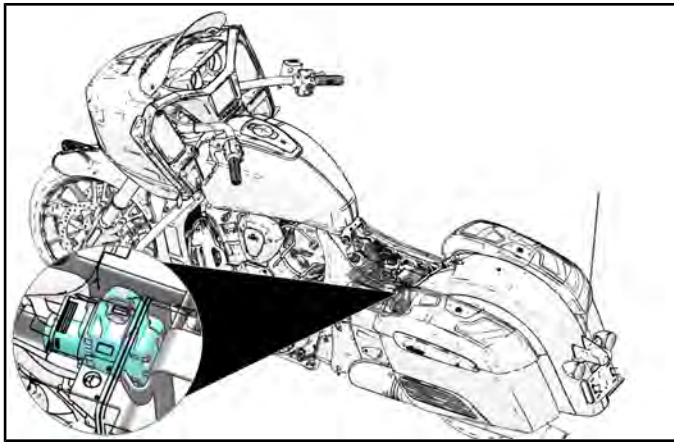
### IMU OVERVIEW

#### OPERATION OVERVIEW

The Inertial Measurement Unit (IMU) uses a six-axis accelerometer/gyro which sends out acceleration data in three linear and three rotational directions. The ABS module uses this information to determine optimal braking and traction control based on lean angle, cornering, and other factors of what the bike is doing. The IMU has some self-diagnostic features which can relay to the ABS module, the ABS module interprets these signals and can log an error code if there is an issue.

#### LOCATION

The IMU is located near the ABS module on the under-seat bracket.

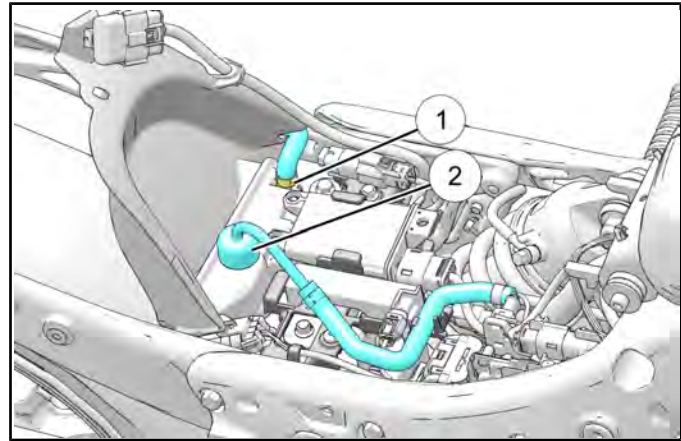


#### PINOUT

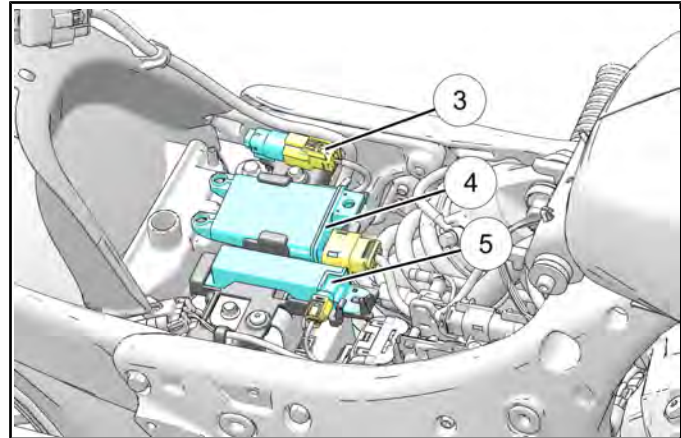
PIN	WIRE COLOR	FUNCTION
1	BK	GROUND
2	DG	CAN LOW
3	YE	CAN HIGH
4	PK/GN	UBAT

### IMU REPLACEMENT

1. Remove seat. See **Seat Removal / Installation** page 7.32.
2. Disconnect the negative battery cable.
3. Position motorcycle in an upright position with the front wheel clamped in a wheel vise.
4. Remove ECM. See **ECM Removal / Installation** page 4.53.
5. Remove coolant overflow line ① and coolant pickup line ② from recovery bottle..



6. Disconnect electrical connection ③.

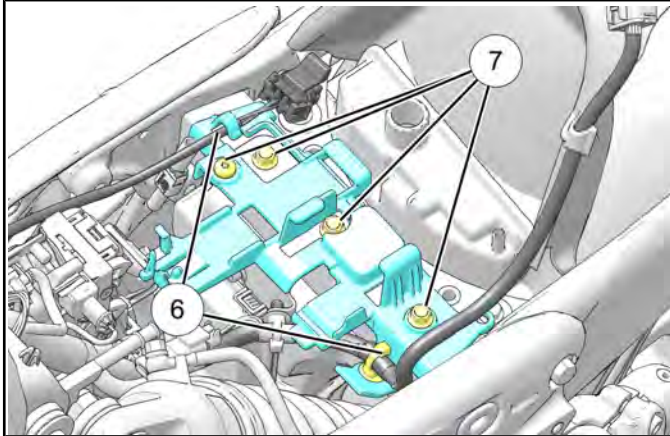


7. Disconnect WCM ④ electrical connector and remove.
8. Disconnect antenna module ⑤ electrical connector and remove.

## ELECTRICAL

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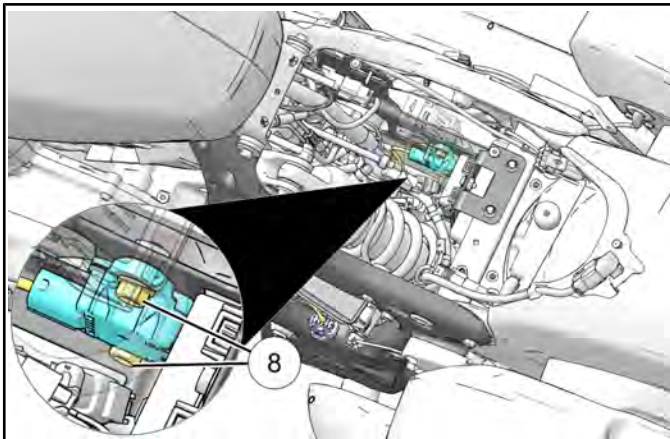
9. Disconnecting the wiring retained ⑥ to under-seat wire bracket.



10. Remove under-seat wire bracket by removing its fasteners ⑦.

11. Disconnect IMU electrical connector.

12. Remove IMU fasteners ⑧.

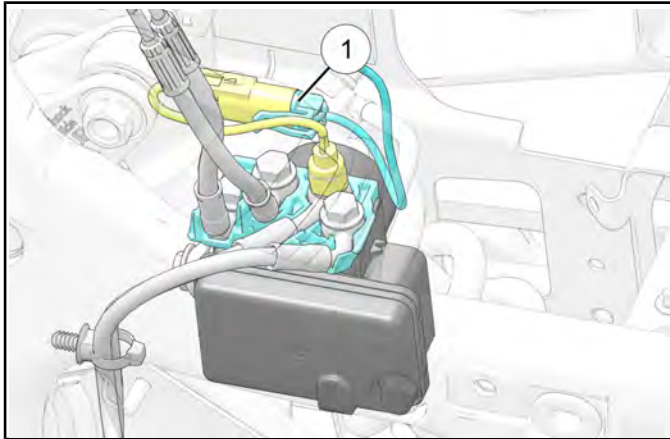


13. **INSTALLATION IS PERFORMED BY REVERSING THE REMOVAL PROCEDURE.**

TORQUE
IMU Fastener: <b>84 in-lbs (10 N·m)</b>

**SWITCH TESTING****BRAKE LIGHT SWITCH TEST**

1. Access the ABS module by performing steps 1-10 of ABS module replacement. Reference **ABS Module Replacement** page 9.34.
2. Locate the brake light switch connectors ① on the ABS module and disconnect.



3. Set multi meter to measure resistance.
4. Connect meter leads to each terminal of the front brake switch.
5. Apply the front brake.

Resistance Specification:  
**Continuity with pedal / lever depressed**

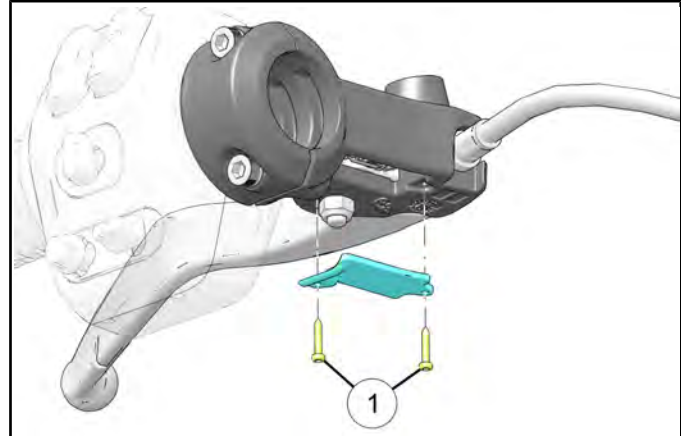
6. Connect meter leads to each terminal of the rear brake switch ③ .

7. Apply the rear brake.

Resistance Specification:  
**Continuity with pedal / lever depressed**

**CLUTCH SWITCH TEST**

1. Remove the clutch switch cover fasteners ① and clutch switch cover.



2. Disconnect clutch switch 2 pin connector. Measure the resistance of the switch with lever pulled to handlebar (less than 1 Ohm resistance) and with lever released (OL).

**SIDE STAND SWITCH TESTING**

1. Inspect side stand. Be sure that when the side stand is fully retracted (UP) that the switch plunger is extended and that when the side stand is extended (down) the plunger is depressed.
2. Remove the voltage regulator bracket to access the side stand switch connector and disconnect. See **Regulator / Rectifier Replacement page 10.41.**
3. Set multi meter to measure resistance and insert meter leads into appropriate jacks.
4. Place one meter lead onto each of the side stand switch connector pins.

5. Read resistance with the side stand switch plunger depressed and extended.

Switch Depressed (Stand DOWN):

**No Continuity (OL)**

Switch Extended (Stand UP):

**Continuity (Less than 1Ω)**

## ELECTRICAL DIAGNOSTICS

### ELECTRICAL SERVICE NOTES

Keep the following notes in mind when diagnosing an electrical problem.

- Refer to wiring diagram for stator and electrical component resistance specifications.
- When measuring resistance of a component that has a low resistance value (under 10 Ohms), remember to subtract meter lead resistance from the reading. Connect leads together and record the resistance. The resistance of the component is equal to tested value minus the lead resistance.
- Become familiar with the operation of your meter. Be sure leads are in the proper jack for the test being performed (i.e. 10A jack for current readings). Refer to the Owner's Manual included with your meter.
- Voltage, amperage, and resistance values included in this manual are obtained with a Fluke™ 77 Digital Multimeter (PV-43568). This meter is acceptable for use when diagnosing electrical problems. Readings obtained with other meters may differ.
- Pay attention to the prefix on the meter reading (K, M, etc.) and the position of the decimal point.
- For resistance readings, isolate component to be tested. Disconnect wire harness or power supply.

### DIGITAL MULTI-METER (DMM) NOTES

Polaris advises to only use a high quality DMM that meets the same standards as the Fluke™ 77 (PV-43568) for electrical testing.

Unless you are very familiar with Ohm's Law, and have complete information about the circuit you are trying to diagnose, test lights are likely to provide results that would be misleading. This is especially true if any solid state component is involved, where you will almost certainly not have complete circuit information.

Polaris also specifically advises against the use of other circuit testing devices, including but not limited to:

- Short finders
- Simplified circuit testers
- Fuse piggy-back devices

Testers beside a DMM will only work in one scenario, and slight variables can provide you with misleading results. The testing practices described in this chapter are more certain and rely only on the DMM and your knowledge.

### STATIC AND DYNAMIC TESTING

There are many methods for testing a DC circuit. These methods fall into one of two categories, either static or dynamic.

#### STATIC TESTING

The two most common forms of static testing are:

- Resistance testing (the Ohms setting on your DMM)
- Measuring voltage with the circuit open, such as when the harness connector is off a sensor you are testing. This is commonly referred to as measuring "Available Voltage".

These two tests will help you find the majority of electrical issues. If they do not, we must remember that static circuit testing does not take into account how current actually flows in that circuit. That is only accomplished with dynamic testing.

Before attempting dynamic testing (as it is intrusive on sealed connectors and damage could be done if not careful), verify the following:

- Static voltage testing advised for that circuit has been completed, and is in spec.
- All associated circuits have under 1 ohm of resistance from end to end. Testing Continuity / Resistance page 10.173
- All associated circuits have no shorts to ground. Testing For A Short To Ground page 10.174
- All associated circuits have no shorts to voltage. Testing For A Short To Voltage page 10.175

#### DYNAMIC TESTING

There are two types of dynamic testing we will advise to use when diagnosing electrical concerns:

- Current flow testing (Amperage) Testing Current Flow (Amperage) page 10.176. Measuring Amperage is not a common practice, as you will not typically have a spec to compare your reading to. Also, many components on this machine flow over 10 Amps, which will blow the majority of DMM fuses. The exception to this is a parasitic draw test refer to Current Draw - Key Off page 10.176.
- Measuring voltage drop. Performing this test correctly will give you understanding of how electrical pressure (voltage) varies in a circuit as current is flowing. Testing Voltage Drop page 10.178

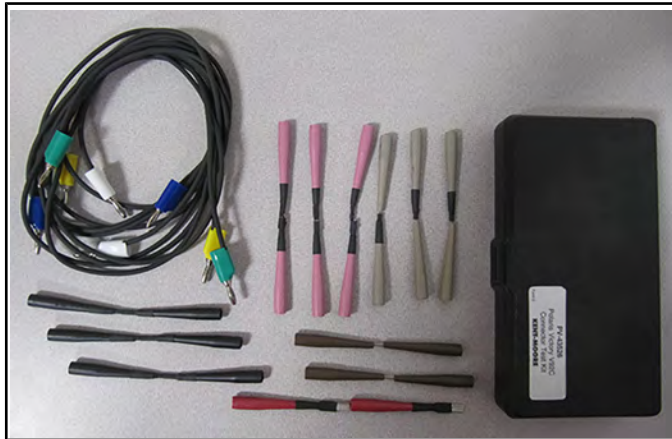
## CONNECTOR PROBING GUIDELINES

### FRONT PROBING

Front probing is accomplished by pulling the harness connector from the component, and then taking a measurement from the terminal face. This is the measurement taken in most situations.

The terminals in electrical connectors are small and fragile. Do not probe directly with your meter leads, as the meter leads are larger than almost all terminals. Probing with a meter lead will likely damage the terminal by spreading it beyond its design limits, causing no tension. If there is no tension, you will have either no connection or a poor connection.

To avoid causing damage, use of the appropriate adapters is required. Most terminals used on Polaris machines can be tested using terminal test kit PV-43526. It includes male and female adapters that can be plugged into banana connectors to adapt to your meter.



PV-43526 adapters are also used as known good terminal drag testers. Insert the male tester terminal into the female connector on the harness. There should be a noticeable amount of force to install and remove the tester, and you should be able to tip the harness connector with the tester hanging from the connector, and not have the tester fall out.

If very little or no resistance is felt, or if the tester falls out when the connector is held upside down, this is an indication that the female connector in the harness has insufficient tension and will cause connection issues. You can either replace that harness, or service it by replacing the terminal or attempting to adjust/tighten the tang in the female terminal.

For a video demonstration, scan the QR code below, or right click it and select “open in new tab”.



### BACK PROBING

Back probing is typically not advisable on sealed connectors, as it can easily cause damage to the wire, terminal, connector body, or body to wire seal.

#### NOTICE

There are commercially available back probe kits. Fine, narrow needles with no coating to block current flow also work well for back probing.

If back probing must be done to see voltage drop while current is flowing in the circuit (dynamic testing), ensure it is done only on connectors that are large enough to accommodate the probe. Ensure back probing is done gently and carefully. Ensure no damage has been done after probing.

For a video demonstration, scan the QR code below, or right click it and select “open in new tab”.



### BREAK OUT

This is a method of front probing to achieve the goal of back probing, which is to measure the circuit while it is functioning.

You can use test probe kit PV-43526, test leads, and electrical tape to create a bridge with exposed testing areas to have everything exposed but still working.

#### IMPORTANT

Use electrical tape to cover the exposed conductive parts of the circuit, mainly the clamps of your test leads. If they contact each other, circuit or component damage could occur from a short.

## TESTING CONTINUITY / RESISTANCE

Testing using the Ohmmeter function of your DMM is one of the first things you will do when troubleshooting an electrical issue. It is especially convenient when the wiring diagram provides a resistance spec for the component in the circuit you are diagnosing. It can quickly give you a good idea if you simply need to replace a part, or if there might be another circuit issue.

Using the following points in conjunction with your DMM owner's manual will ensure your resistance testing is always accurate:

- Only measure resistance on an isolated part of the circuit. This means if you are testing internal resistance of a component, it cannot be connected to the harness. If you are measuring a wire (typically from the ECU to a sensor) both the sensor and ECU would need to be unplugged. Most Ohmmeters provides a precise amount of current to determine resistance. Any other sources will make your reading inaccurate.
- Ensure you are making good contact by using the proper terminal adapters. Connector Probing Guidelines page 10.172
- If you are not using a self ranging meter, double check your range setting.
- If your continuity is under 1 ohm, leave the harness disconnected and move on to Testing For A Short To Ground page 10.174 and Testing For A Short To Voltage page 10.175.

For a video demonstration, scan the QR code below, or right click it and select "open in new tab."





### TESTING FOR A SHORT TO GROUND

Shorts to ground happen when the current flowing in a given circuit bypasses the load. The current flowing from B+ finds an easier way to return to ground (B-), so much more of it can flow than the circuit is designed for. This causes the circuit's protection device (either a fuse or circuit breaker) to open, protecting the circuit from damage.

There are many possible causes of a short to ground, here are some:

- The harness rubbing against a component that is grounded, such as the frame, chassis component, or engine.
- A component's internal circuitry contacting its case.
- Wire-to-wire chaffing causing contact with the conductor of a ground side circuit.
- Corrosion/moisture in a component providing a ground path.
- Moisture in a connector body providing a ground path.

#### NOTICE

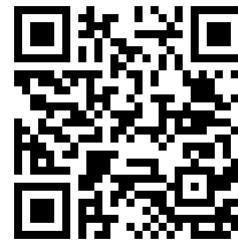
This test is typically done right after checking continuity from sensor to ECU when diagnosing an EFI DTC. It can also be used to help diagnose concerns about blowing fuses. Ensure you are able to duplicate the concern before testing so that your results point you in the right direction. Testing for Intermittent Conditions page 10.175

### TESTING PROCEDURE

1. Consult the wiring diagram. Determine which circuit you will be testing.

2. Ensure that any static voltage checks advised in relation to the DTC or concern you are diagnosing have been performed and are in spec.
3. Ensure you have checked continuity of the circuit. Testing Continuity / Resistance page 10.173
4. Ensure that neither end of the circuit is connected.
5. Set your DMM to Ohms.
6. Connect one meter lead securely to the battery negative post.
7. Connect the other lead to either end of the disconnected circuit. Ensure you are using the correct adapter. Connector Probing Guidelines page 10.172
8. If there is continuity, the harness is damaged and should be repaired or replaced.
9. If the DMM reads OL, there is no short to ground. Leave the harness disconnected on both sides, and proceed to check for a short to voltage. Testing For A Short To Voltage page 10.175

For a video demonstration, scan the QR code below, or right click it and select "open in new tab".



## TESTING FOR A SHORT TO VOLTAGE

There are three possible short to voltage causes:

1. Internal electronic component short.
2. Harness chaffing leading to contact of the circuit being diagnosed to one with B+ or a different reference voltage.
3. Moisture in a connector or component.

### TESTING PROCEDURE

1. Consult the wiring diagram. Determine which circuit you will be testing.
2. Ensure that any static voltage checks advised in relation to the DTC or concern you are diagnosing have been performed and are in spec.
3. Ensure you have checked continuity of the circuit. Testing Continuity / Resistance page 10.173
4. Ensure you have checked for a short to ground. Testing For A Short To Ground page 10.174
5. Ensure that neither end of the circuit is connected.
6. Set your DMM to DC volts.
7. Connect one meter lead securely to the battery negative post.
8. Connect the other lead to either end of the disconnected circuit. Ensure you are using the correct adapter. Connector Probing Guidelines page 10.172
9. If there is voltage present, the harness is damaged and should be repaired or replaced. You may need to remove the protective tape and tubing to inspect.
10. If the DMM reads 0 volts, the concern may be in a component related to the circuit. If so, checking internal continuity of non-electronic components may reveal the concern, but diagnosis at this point may require using known good parts.

For a video demonstration, scan the QR code below, or right click it and select "open in new tab".



## TESTING FOR INTERMITTENT CONDITIONS

Intermittent conditions are very difficult to diagnose, as when you are testing the circuit, you may not have the circuit failing to indicate where the issue is. Intermittent electrical failures are almost always related to a poor connection that only goes open in specific situations, such as going over a certain kind of bump, at a certain temperature, or when the machine is torque loaded in one way.

Here is a list of possible failures that can be associated with an intermittent electrical failure:

- Loose female terminal in an electrical connector.

### NOTICE

If the terminals in question are the correct size/series, always use PV-43526 to test the drag when inserting and removing the test terminal adapters. Compare the effort to the drag against the known good tester terminal for reference.

- Poor terminal to wire crimp.
- Terminal crimp that occurred at least partially on insulation instead of the conductor wire strands.
- Terminal fretting corrosion
- Contamination/moisture corrosion
- A full or partial break of the conductor wires in the insulation, with or without visible insulation damage.
- Improper routing, especially when it leads to chaffing or heat damage, especially near exhaust.

You may need to use different techniques to duplicate these concerns. These include but are not limited to:

- Moving the harness by wiggling it or flexing certain areas.
- Pulling at or near the suspected connector.
- Pushing in different directions to flex the connector body and try to isolate poor connections.
- Changing the temperature. This can be accomplished with either heat guns or cold air guns.

### WARNING

Always exercise caution when using these tools, and use them for short periods of time when changing the temperature of an area. Failure to do so can lead to serious injury and/or damage to the machine.

### TESTING CURRENT FLOW (AMPERAGE)

Performing a current flow test requires the meter leads be inserted into the correct cavities in the meter, and be placed in series in the circuit to be tested. Refer to your Digital Multi Meter's owner's manual for potential model specific instructions. Ensure you are using acceptable adapters to avoid damaging the connector terminals. See Connector Probing Guidelines page 10.172.

**NOTICE**

Amperage specs are generally not provided for circuits/components. Please only perform this test when advised in the manual.

**IMPORTANT**

Many circuits on this machine will exceed the 10 Amp fuse in most Digital Multi Meters in normal operation.

### TESTING PARASITIC DRAW

Parasitic draw is when there is excessive current flow with the key off.

While the most common causes of draws are improperly installed accessories (tapping into unswitched B+ instead of switched) there can be electronic component failures that can cause this as well.

#### TESTING PROCEDURE

1. Remove the negative cable from the battery.
2. Connect a jumper from the negative battery cable terminal to the negative battery post.
3. Ensure your meter leads and selector dial are set to measure amperage.
4. Connect your red lead to the battery negative cable terminal.
5. Connect your black lead to the battery negative post.
6. Momentarily key the ignition switch on, then off.

**IMPORTANT**

Ensure all electrical components are switched off, or damage to your jumper and/or meter will occur.

**NOTICE**

Wait ten minutes with the key off for the ECU to power down to avoid a faulty readout while testing amperage draw.

7. Wait 10 minutes before checking the value. Vehicles will vary, but electronic components will take time to fully go to sleep after switched power is removed.
8. Maximum allowable is 10 milliamps. If your meter is ranged to the 10 Amp scale, this will appear as 0.010 Amps.
9. If over 10 milliamps, go to the fuse block and start systematically removing one fuse at a time until the value drops, indicating the circuit that requires attention.

### CURRENT DRAW - KEY OFF

Parasitic draw is when there is excessive current flow with the key off.

While the most common causes of draws are improperly installed accessories (tapping into unswitched B+ instead of switched) there can be electronic component failures that can cause this as well.

**IMPORTANT**

Do not connect or disconnect the battery cable, or ammeter with the engine running. Damage will occur to electrical components.

**IMPORTANT**

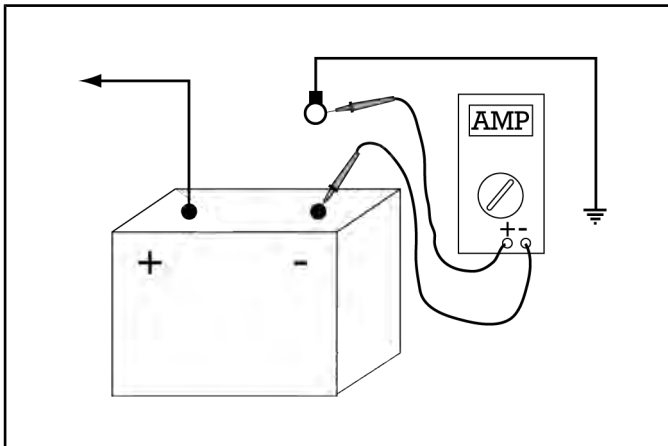
Charging system damage will occur if incompatible components are installed. Always reference the Polaris Electronic Parts Catalog for the proper part numbers.

**NOTICE**

Wait ten minutes with the key off for the ECU to power down. This will avoid a faulty readout while testing amperage draw.

**TESTING PROCEDURE**

1. Remove the negative cable from the battery.
2. Connect a jumper from the negative battery cable terminal to the negative battery post.
3. Ensure your meter leads and selector dial are set to measure amperage.
4. Connect your red lead to the battery negative cable terminal.



5. Connect your black lead to the battery negative post.
6. Momentarily key the ignition switch on, then off.

**IMPORTANT**

Ensure all electrical components are switched off, or damage to your jumper and/or meter will occur.

7. Wait 10 minutes before checking the value. Vehicles will vary, but electronic components will take time to fully go to sleep after switched power is removed.
8. Maximum allowable is 10 milliamps. If your meter is ranged to the 10 Amp scale, this will appear as 0.010 Amps.

Current Draw - Key Off:  
Maximum of .01 DCA (10 mA)

9. If over 10 milliamps, go to the fuse block and start systematically removing one fuse at a time until the value drops, indicating the circuit that requires attention.

## TESTING VOLTAGE DROP

*NOTICE*

If you disconnect the connector at the load, and measure voltage with one lead on the power supply wire, and one to ground, you will be measuring available voltage. This is a static test and not dynamic voltage drop testing. Refer to Static and Dynamic Testing page 10.171.

The measurement of voltage is the **DIFFERENCE** in electrical pressure between the two points your DMM leads are touching.

Most circuits will have one load. The load is the component in the circuit that uses the current flow to do work, such as move a solenoid or light a bulb.

Voltage coming into the load should be near battery voltage with current flowing. There will be some loss from moving through electrical contacts in connectors and relays, but it will be minimal.

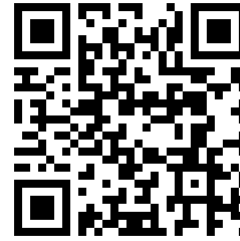
*NOTICE*

You will need to backprobe to perform this test. For information about doing this safely, refer to Connector Probing Guidelines page 10.172.

Voltage should be near fully depleted by the load. This means that when measuring on the ground side of the circuit, immediately after the load, back to battery negative, you should have near zero pressure difference (voltage).

If you do have a difference in pressure, this means there is something adding resistance to the circuit such as corrosion.

For a video demonstration, scan the QR code below, or right click it and select "open in new tab".





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