BRAMMO

# EMPULSE / EMPULSE R

## 2013 – 2014

# Service Manual

# Table of Contents

## How To Use This Manual

### General

To assist in the use of this Manual, it is divided into numbered sections (shown on the previous page). Each section starts with a contents page listing the service procedures covered within that section. Each section is numbered from page 1, and the page number is shown at the bottom of each page.

References will be made from within a service procedure to other procedures that should be carried out as part of the main procedure.

The individual actions of the service procedures must be followed in the sequence in which they appear. Annotation numbers on the illustrations refer to the relevant numbered action after the illustration.

For reference purposes, an illustration number is shown in the bottom left hand corner of each illustration. **WARNINGS**, **CAUTIONS**, and NOTES have the following meanings:

**WARNING: Procedures which must be followed precisely to avoid the possibility of injury.**

*CAUTION: Calls attention to procedures which must be followed to avoid damage to components.*

*NOTE: Gives helpful information.*

### References

Operations covered in this Manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the vehicle is carried out. This is of particular importance where safety related items are concerned.

### Dimensions

The dimensions quoted are to design engineering specification. Service limits are included where applicable.

### Specifications

Brammo constantly strives to improve the specification, design, and production of their vehicles and alterations take place accordingly. While every effort has been made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular vehicle.

| **Abbreviations and Symbols** | |
|---|---|
| AC | Alternating current |
| Amp (A) | Ampere |
| AUX | Auxiliary |
| C | Celsius |
| cm | Centimeter |
| DC | Direct Current |
| dia. | Diameter |
| DOT | Department of Transportation |
| DTC | Diagnostic Trouble Code |
| EPA | Environmental Protection Agency |
| EV | Electric Vehicle |
| F | Fahrenheit |
| FRT | Flat Rate Time |
| HV | High Voltage |
| HW | Hardware |
| OAL | Overall Length |
| OBC | On-Board Charger |
| SoC | State of Charge |
| RF | Radio Frequency |
| RH | Right-Hand |
| V | Volt |
| W | Watt |

## General Fitting Instructions

### Component Removal

Whenever possible, clean components and surrounding area before removal.

- Block off openings exposed by component removal.
- Immediately seal all oil or hydraulic lines when apertures are exposed; use plastic caps or plugs to prevent loss fluid and ingress of dirt and other contaminants.
- Close the open ends of oil ways exposed by component removal with tapered hardwood plugs or conspicuous plastic plugs.
- Immediately after a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.
- Clean all workbenches and provide marking materials, labels, and containers before dismantling a component.

### Dismantling

Observe scrupulous cleanliness when dismantling components, particularly when brake parts are being worked on. A particle of dirt or a cloth fragment could cause a serious malfunction if trapped in these systems.

- Blow out all tapped holes, crevices, oil ways, and fluid passages with compressed air. Ensure that any O-rings used for sealing are correctly replaced or renewed, if disturbed during the process.
- Use marking ink to identify mating parts and ensure correct reassembly. Do not use a center punch or scribe to mark parts, they could initiate cracks or distortion in marked components.
- Wire mating parts together where necessary to prevent accidental interchange (e.g., roller bearing components).
- Attach labels to all parts which are to be renewed and to parts requiring further inspection before being passed for reassembly; place these parts in separate containers from those containing parts for rebuild.
- Do not discard a part due for renewal until after comparing it with a new part, to ensure that its correct replacement has been obtained.

### Cleaning Components

Always use the recommended cleaning agent or equivalent. Ensure that adequate ventilation is provided when volatile degreasing agents are being used. Do not use degreasing equipment for components containing items which could be damaged by the use of this process.

### General Inspection

All components should be inspected for wear or damage before being reassembled.

- Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight smear of grease can conceal the signs of an imminent failure.
- When a compound is to be checked dimensionally against recommended values, use the appropriate measuring equipment (surface plates, micrometers, dial gauges, etc.). Ensure the measuring equipment is calibrated and in good serviceable condition.
- Reject a component if its dimensions are outside the specified tolerances, or if it appears to be damaged.
- A part may be refitted if its critical dimension is exactly to its tolerance limit and it appears to be in satisfactory conditions.

### Oil Seals

#### *General*

Always renew oil seals which have been removed from their working location (whether as an individual component or as part of an assembly). NEVER use a seal which has been improperly stored or handled, such as hung on a hook or nail.

- Carefully examine every seal before fitting to ensure that it is clean and undamaged.

- Ensure the surface on which the new seal is to run is free of burrs or scratches. Renew the component if the original sealing surface cannot be completely restored.
- Protect the seal from any surface which it has to pass when being fitted. Use a protective sleeve or tape to cover the relevant surface.
- Lubricate the sealing lips with a recommended lubricant before use to prevent damage during initial use. On dual lipped seals, smear the area between the lips with grease.

## Locking Devices

### *General*

Always replace locking devices with ones of the same design.

### *Locking tabs and washers*

Always inspect locking tabs and washers. Do not reuse if damaged.

### *Pipe and hose unions*

To prevent rotational damage to components, use two spanners when loosening and tightening unions.

### *Nyloc and torque-nuts*

Discard and replace Nyloc and torque-nuts after removal.

### *Encapsulated and patch bolts*

Discard and replace encapsulated and patch bolts after removal.

*Note: Ensure all internal and external thread surfaces on new bolts, screws, and nuts are clean and dry before fitting, unless otherwise instructed.*

### *Thread locking liquids*

Always note presence of thread locking liquid on threads of fasteners upon removal. Reapply thread locking liquid upon installation.

## Flexible Pipes and Hoses

### *General*

When removing and installing flexible hydraulic pipes and hoses, ensure that the following practices are observed to ensure component serviceability.

- Absolute cleanliness must be observed with hydraulic components at all times.
- Obtain appropriate plugs or caps before detaching hose end fittings, so that the ports can be immediately covered to prevent ingress of dirt.
- Fit a cap to seal a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
- After any work on hydraulic systems, carefully inspect for leaks underneath the motorcycle while a second operator applies maximum brake pressure to the brakes.

# Specifications

## Final Drive/Motor

| | Empulse | Empulse R |
|---|---|---|
| Motor Type | Permanent Magnet AC (PMAC) - Water Cooled | Parker GVM IPM Motor - Water Cooled |
| Motor Controller | Sevcon Gen 4 | Sevcon Gen 4 |
| Peak Motor Power | 40kW, @6,000 rpm (54 hp) | 40kW, @4,500 rpm (54 hp) |
| Peak Continuous Current | 270 amps | 270 amps |
| Final Drive | Direct Chain Drive (14/48) 520 O-ring chain | Direct Chain Drive (14/48) 520 O-ring chain |
| Transmission | IET 6 speed gearbox with multi-plate, hydraulic activated wet clutch | IET 6 speed gearbox with multi-plate, hydraulic activated wet clutch |
| Emissions | None | None |
| Max Motor Torque | 63Nm (46.5 foot pounds) | 90Nm (66 foot pounds) |

## Battery Pack

| | |
|---|---|
| Battery Type | Brammo Power™ BPM15/90 Lithium-Ion (NCM Chemistry) |
| Battery Pack Capacity | 9.31 kWh (nominal), 10.2 kWh (max) |
| Battery Life | 1,500 cycles to 80% capacity (100% DOD) |
| Recharge Time | Level I maximum charging time: 8 hours (0-99% SoC, no cell imbalances)<br>Level II maximum charging time: 3.5 hours (0-99% SoC, no cell imbalances)<br>Every 10 minutes of Level II charging adds up to 5 miles of range |

## Dimensions

| | |
|---|---|
| Weight | 470lbs. / 213kg |
| Seat Height | 31.5” 80.0 cm |
| Width | 31.8” (bar end-to-bar end) 80.77 cm |
| Height | 42.6” (highest portion of dash) 108.2 cm |
| Length | 81.3” 206.5 cm |
| Ground Clearance | 7.3” 18.54 cm |
| Rake/Trail | 24/ 3.8” |
| Storage Capacity | Cargo Capacity 365 lbs. / 165.6 kg (805 lbs. / 365.1 kg total combined motorcycle, rider, passenger and cargo) |
| Wheelbase | 58.0” 147.32 cm |

## Introduction

### General

The Empulse is Brammo's performance electric motorcycle. Energy is stored in the Brammo's battery, which is a sealed unit containing Lithium-ion cells producing up to 9.31 kWh (nominal) of energy at up to 103.6 V. In a fully charged state, the Empulse has a range of approximately 121 miles (195 km) in the city and 56 miles (90 km) on the highway. Each of the seven battery modules contains four cell stacks for a total of 28 on-board cell stacks. Each cell has a nominal cell voltage of 3.7 volts for a total battery stack voltage of just under 103.6 volts. Under normal operating conditions, the Empulse's battery modules are rated for thousands of charge cycles. The battery modules used on the Empulse are maintenance free. Aside from normal charging, there is no other maintenance to perform on the battery modules.

The range also depends on driving and climatic conditions. The dash informs the rider of the state of charge and the expected remaining range.

Your Empulse is designed to take a charge from any J1772 electric vehicle charger (Level 1- 110V or Level 2 - 240V).

To maintain the battery in a charged state, the vehicle can be charged using either:

- Charging cable.
- Public EV charging station.

*Note: Position your Empulse as close as possible to an available AC wall outlet.*

*Note: In order to maximize the life of batteries, Brammo highly recommends a discharge/charge cycle (discharged to 30% SoC or less and then charged to 100% SoC) every three months.*

### Precautions

**WARNING: Take special care with high voltage wiring (identified by warning labels and/or orange outer sleeving), the connectors, and the components connected to the wiring.**

**WARNING: Never work on a vehicle while it is charging. The high voltage circuits will be live.**

**WARNING: Never touch, cut, or open a high voltage power cable or high voltage component unless the battery has first been shut off using the service disconnect.**

**WARNING: Never assume the motorcycle is shut off because it is silent.**

**WARNING: After disabling the motorcycle, power is maintained for 90 seconds in the charging system and 10 minutes in the high voltage electrical system. If the disabling procedure cannot be performed, proceed with caution as there is no assurance that the high voltage electrical system is disabled. Never touch, cut, or open any high voltage power cables (typically labeled as such and/or has orange outer sleeving) or high voltage component until after the battery has been disabled.**

**WARNING: Never cut into the sealed battery enclosure due to the high voltage and electrocution risks.**

# Special Tools

## Introduction

The following special tools have been developed to facilitate removal, dismantling and assembly of mechanical components in a cost effective and time efficient manner. The use of special tools also helps prevent the potential for damage to components.

Some operations in the manual cannot be carried out properly without the aid of the relevant special tools.

Special tools can be ordered from Brammo.

***???***

- Awaiting info from Brammo

## Identification Number Locations

### Introduction

The identification numbers of the motorcycle, motor, and transmission are located on each specific component on the Empulse. They may be required when ordering replacement parts.

### Vehicle Identification Number (VIN)

The 17-digit VIN is stamped onto the frame's steering head behind the headlight. Turn the handlebars fully left to view the number.

*Note: The VIN is also shown on the safety certification label.*

### Motor Serial Number

The motor serial number is located on a label on the underside of the motor.

### Transmission Serial Number

The transmission serial number is stamped on the lower left face of the transmission case - visible behind the kickstand.

## Lifting

### Lifting Instructions

**WARNING: Always disconnect the charge cable before lifting the Empulse. Never raise the Empulse when the charge cable is connected, even when charging is not in progress.**

The following instructions must be carried out before raising the Empulse off the ground.

- Use a solid level surface
- Ensure the power is off

To avoid damage occurring to the motorcycle components, do not position jacks or slings under the following components.

- Carbon fiber body structure
- Hoses
- Battery
- Motor
- Transmission

### Lifting the Empulse

There are three recommended methods to lift the Empulse for servicing:

- A low profile motorcycle jack with a minimum lift range of 1500 lb capacity must be used
- Wheel lift motorcycle sling kit
- Motorcycle lifting table (1,500 lb capacity)

### Supporting the Empulse

**WARNING: Do not commence work on the Empulse until suitable safety supports have secured the motorcycle.**

## Approved Fluids and Capacities

| Fluid | Specification |
|---|---|
| Transmission Oil | Synthetic 10W-30 API GL-1 Motorcycle oil (wet clutch approved) |
| Brake Fluid | Use any proprietary brand fluid meeting DOT 4 specification |
| Clutch Fluid | Use any proprietary brand of brake fluid meeting DOT 4 specification |
| Coolant | Peak Global Lifetime 50/50. 50% aqueous Ethylene Glycol OAT |
| Chain Lubricant | Aerosol lubricant designed specifically for motorcycle O-ring chains. Apply as directed on can. |

## Service Disconnect - High Voltage

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove top body panel. Refer to *Body Panel - Top, page 80-11.*
2. Remove front body panel. Refer to *Body Panel - Front, page 80-10.*


3. Reach up behind the motorcycle frame and press the blue button on the high-voltage service disconnect and disconnect the high voltage connector.

### Installation

1. Installation is the reverse of the removal procedure.

## Battery #1

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove battery #2. Refer to *Battery #2, page 20-3.*


2. Remove bolts (x2) securing terminal cap to battery #1. Torque 1 Nm.
3. Remove terminal cap.


4. Remove bolt securing ground cables (x2) to battery and collect washers. Torque 18.4 Nm.

5. Disconnect logic cable connector from battery.

6. Remove bolts (x2) securing fan assembly bracket to battery and collect washers. Torque 4.7 Nm.

7. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers. Torque 18.4 Nm.
8. Remove battery #1.

**Installation**

1. Installation is the reverse of the removal procedure.

## Battery #2

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove battery #3. Refer to *Battery #3, page 20-4.*


2. Remove bolts (x4) from fuse cap from battery #1. Torque 1 Nm.
3. Remove fuse cap from battery #1.


4. Remove bolt securing busbar link connecting battery #2 to battery #1 and collect washer. Torque 18.4 Nm.


5. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers.Torque 18.4 Nm.
6. Maneuver battery #2 forward to gain access for removal of logic cables.


7. Disconnect logic cables (x2) and tie them aside.
8. Remove battery #2 with busbar link still attached.

### Installation

1. Installation is the reverse of the removal procedure.

## Battery #3

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove charging port. Refer to *Charging Port, page 20-15.*
2. Remove AIM module. Refer to *Auxiliary Input Module (AIM), page 90-10.*

   *Note: Fastener for connector requires 1/4 inch ASE tool for removal.*

3. Remove bolts (x2) securing the front of the tank bracket assembly and collect washers. Torque 3.6 Nm.

4. Remove bolts (x2) securing the rear of the tank bracket assembly and collect washers. Torque 8.1 Nm.

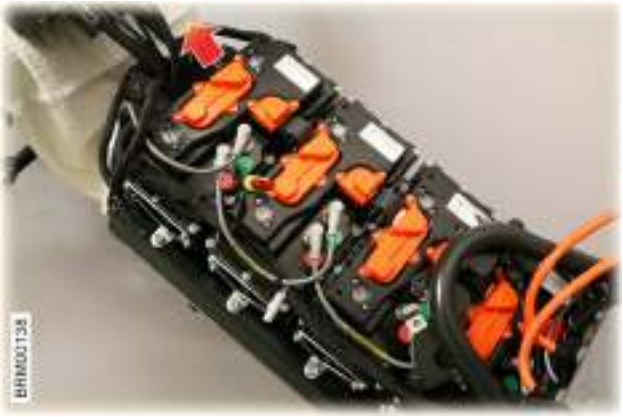
5. Disconnect white connector on harness above battery #3.

6. Cut cable tie tying the red/black OBC connector together under tank bracket assembly.
7. Disconnect the red/black OBC connector under tank bracket assembly.

8. Disconnect the black OBC connector under tank bracket assembly.

9. Cut cable tie attaching main harness to the top of battery #2.
10. Cut cable tie attaching main harness to the top of battery #4.

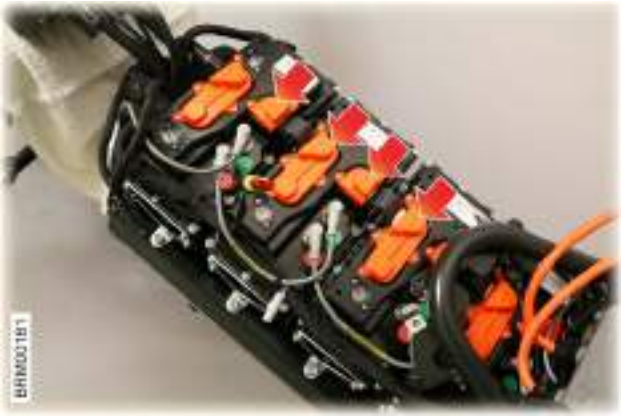

11. Disconnect the black logic cable from #1 battery to be able to flip tank bracket assembly up and over the handle bars.




12. Place protective cover over handle bars, then flip tank bracket assembly forward and place on top of protective cover to expose batteries.

    *Note: Place protective cover over handle bars and instrument cluster to prevent damage to components.*


13. Disconnect gray logic cables (x2) from battery #3.




14. Remove bolts (x2) securing terminal cap to battery #4. Torque 1 Nm.
15. Remove terminal cap.
16. Remove bolts (x2) securing terminal cap to battery #3. Torque 1 Nm.
17. Remove terminal cap.
18. Remove bolts (x4) securing fuse cap to battery #3. Torque 1 Nm.
19. Remove fuse cap.
20. Remove bolts (x4) securing fuse cap to battery #2. Torque 1 Nm.
21. Remove fuse cap.


22. Remove bolts (x2) securing busbar link to batteries #3 and #4 and collect washers. Torque 18.4 Nm.
23. Remove busbar link.


24. Remove bolts (x2) securing busbar link to batteries #2 and #3 and collect washers. Torque 18.4 Nm.
25. Remove busbar link.


26. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers. Torque 18.4 Nm.
27. Remove battery #3.

**Installation**

1. Installation is the reverse of the removal procedure.

## Battery #4

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove charging port. Refer to *Charging Port, page 20-15.*
2. Remove AIM module. Refer to *Auxiliary Input Module (AIM), page 90-10.*


3. Remove bolts (x2) securing the front of the tank bracket assembly and collect washers. Torque 3.6 Nm.


4. Remove bolts (x2) securing the rear of the tank bracket assembly and collect washers. Torque 8.1 Nm.

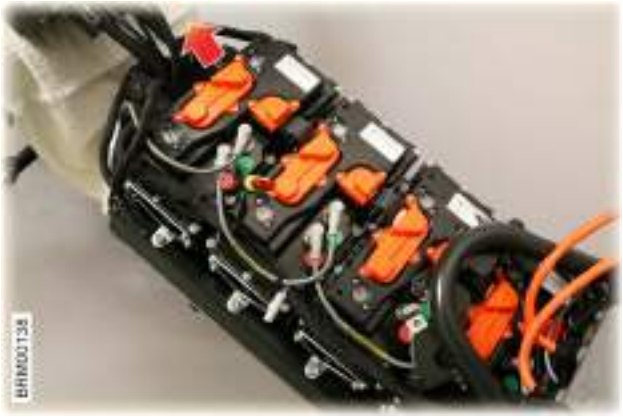

5. Disconnect white connector on harness above battery #3.


6. Cut cable tie tying the red/black OBC connector together under tank bracket assembly.
7. Disconnect the red/black OBC connector under tank bracket assembly.


8. Disconnect the black OBC connector under tank bracket assembly.

9. Cut cable tie attaching main harness to the top of battery #2.
10. Cut cable tie attaching main harness to the top of battery #4.


11. Disconnect the black logic cable from #1 battery to be able to flip tank bracket assembly up and over the handle bars.

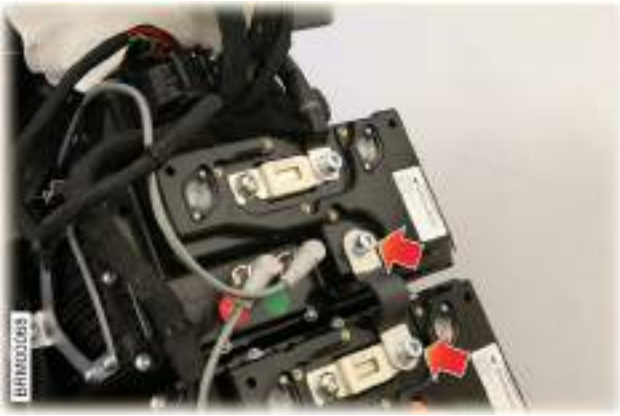



12. Place protective cover over handle bars, then flip tank bracket assembly forward and place on top of protective cover to expose batteries.

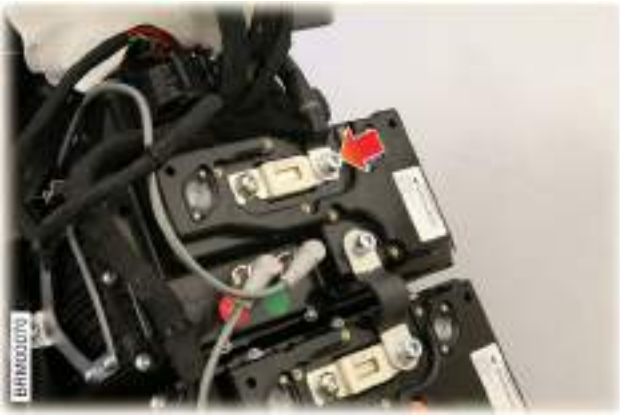
    *Note: Place protective cover over handle bars and instrument cluster to prevent damage to components.*


13. Disconnect gray logic cables (x2) from battery #3.


14. Remove bolts (x4) securing fuse cap to battery #4. Torque 1 Nm.
15. Remove fuse cap.
16. Remove bolts (x2) securing terminal cap to battery #4. Torque 1 Nm.
17. Remove terminal cap.
18. Remove bolts (x4) securing fuse cap to battery #3. Torque 1 Nm.
19. Remove fuse cap.




20. Remove bolts (x2) securing busbar link to batteries #3 and #4 and collect washers. Torque 18.4 Nm.
21. Remove busbar link.




22. Remove bolt securing high-voltage service disconnect cable to battery #4 and collect washers. Torque 18.4 Nm.
23. Remove high-voltage service disconnect cable.


24. Remove bolts (x2) securing VCU cross bracket to battery #4 and collect washers. Torque 4.7 Nm.
25. Release VCU cross bracket from battery #4.


26. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers. Torque 18.4 Nm.
27. Remove battery #4.

**Installation**

1. Installation is the reverse of the removal procedure.

## Battery #5

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove motor controller. Refer to *Motor Controller, page 90-3.*
2. Remove radiator. Refer to *Radiator, page 30-2.*


3. Remove bolts (x2) securing terminal cap to battery #5. Torque 1 Nm.
4. Remove terminal cap.
5. Remove bolts (x4) securing fuse cap to battery #5. Torque 1 Nm.
6. Remove fuse cap.
7. Remove bolts (x2) securing terminal cap to battery #5. Torque 1 Nm.
8. Remove terminal cap.

   *Note: Record installed position of terminal cap.*


9. Remove bolt securing high-voltage service disconnect cable to battery #5 and collect washers. Torque 18.4 Nm.
10. Remove high-voltage service disconnect.


11. Remove bolts (x2) securing busbar link to batteries #5 and #6 and collect washers. Torque 18.4 Nm.
12. Remove busbar link.


13. Disconnect gray logic cables (x2) from battery #5.

14. Support battery #5.


15. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers. Torque 18.4 Nm.
16. Remove battery #5.

### Installation

1. Installation is the reverse of the removal procedure.

## Battery #6

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove motor controller. Refer to *Motor Controller, page 90-3.*
2. Remove battery #7. Refer to *Battery #7, page 20-12.*


3. Remove bolts (x2) securing terminal cap to battery #6. Torque 1 Nm.
4. Remove terminal cap.


5. Remove bolt securing busbar link to battery #6 and collect washers. Torque 18.4 Nm.


6. Disconnect gray logic cables (x2) from battery #6.
7. Support battery #6.


8. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers. Torque 18.4 Nm.
9. Remove battery #6 by sliding it rearward from under the busbar and out of the motorcycle.

### Installation

1. Installation is the reverse of the removal procedure.

## Battery #7

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove motor controller. Refer to *Motor Controller, page 90-3.*


2. Remove bolts (x4) securing fuse cap to battery #7. Torque 1 Nm.
3. Remove fuse cap.
4. Remove bolts (x2) securing terminal cap to battery #7. Torque 1 Nm.
5. Remove terminal cap.

   *Note: Record installed position of terminal cap.*
6. Remove bolts (x4) securing fuse cap to battery #6. Torque 1 Nm.
7. Remove fuse cap.


8. Remove bolt securing motor controller ground cable from battery #7 and collect washers. Torque 18.4 Nm.
9. Disconnect gray logic cable.


10. Remove bolts (x2) securing busbar link to batteries #6 and #7 and collect washers. Torque 18.4 Nm.
11. Remove busbar link.
12. Support battery #7.


13. Remove bolts (x2) securing battery bracket to the motorcycle frame and collect washers. Torque 18.4 Nm.
14. Remove battery #7.

**Installation**

1. Installation is the reverse of the removal procedure.

## Charging Port

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Disconnect high-voltage connector. Refer to *Service Disconnect - High Voltage, page 20-1.*

2. Remove bolts (x4) securing charging port to the top tank bracket and collect washers. Torque 3.6 Nm.
3. Raise charging port to access harness retainer.

4. Release charging port harness retainer from charging port.

   *CAUTION: Extreme care must be taken during the removal of the charging port harness retainer or component damage may occur.*

   *Note: Record installed position of cables.*
5. Remove charging port.

### Installation

1. Installation is the reverse of the removal procedure.

## Onboard Charger

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove charging port. Refer to *Charging Port, page 20-15.*
2. Remove DC/DC converter and cooling fan assembly. Refer to *DC/DC Converter and Cooling Fan Assembly, page 20-18.*


3. Remove connectors (x2) from AIM module.

   *Note: Fastener for connector requires 1/4 inch ASE tool for removal.*


4. Remove bolts (x2) securing AIM module to top tank bracket and collect washers. Torque 3.6 Nm.
5. Remove AIM module.


6. Remove bolts (x2) securing the front of the tank bracket assembly and collect washers. Torque 3.6 Nm.


7. Remove bolts (x2) securing the rear of the tank bracket assembly and collect washers. Torque 8.1 Nm.


8. Cut cable tie tying the red/black OBC connector together under tank bracket assembly.

9. Disconnect the red/black OBC connector under tank bracket assembly.


10. Disconnect the black OBC connector under tank bracket assembly.


11. Cut cable ties (x2) retaining OBC cables to seat subframe.
12. Maneuver OBC cables (x3) through tank bracket assembly and set cables aside.


13. Remove bolts (x4) retaining the on-board charger assembly to seat subframe and collect washers. Torque 4.7 Nm.
14. Remove the on-board charger assembly.

**Installation**

1. Installation is the reverse of the removal procedure.

## DC/DC Converter and Cooling Fan Assembly

### Remove

1. Remove rear shock absorber assembly. Refer to *Shock Absorber Assembly, page 60-3.*
2. Remove tail cover body panel. Refer to *Body Panel - Tail Cover, page 80-7.*

3. Disconnect connector from DC/DC converter.

4. Disconnect connectors (x2) from cooling fan assembly.

5. Remove bolts (x2) securing the DC/DC converter and cooling fan assembly to on-board charger and collect washers. Torque 3.4 Nm.

6. Remove bolts (x2) securing the DC/DC converter and cooling fan assembly to battery bracket and collect washers. Torque 4.7 Nm.
7. Release the DC/DC converter and cooling fan assembly bracket from battery bracket.
8. Remove the DC/DC controller and cooling fan assembly.

### Installation

1. Installation is the reverse of the removal procedure.

## DC/DC Converter

### Remove

1. Remove the DC/DC converter and cooling fan assembly. Refer to *DC/DC Converter and Cooling Fan Assembly, page 20-18.*


2. Remove bolts (x4) securing the DC/DC converter to the assembly bracket and collect washers and spacers. Torque 2.2 Nm.
3. Remove the DC/DC converter.

### Installation

1. Installation is the reverse of the removal procedure.

## Cooling Fan

### Remove

1. Remove the DC/DC converter and cooling fan assembly. Refer to *DC/DC Converter and Cooling Fan Assembly, page 20-18.*


2. Squeeze the locking tabs (x2) together to release the fan connector from the bracket.


3. Remove the bolts (x2) securing the fan to bracket and collect washers and spacers. Torque 2.2 Nm.
4. Remove fan with connector still attached.

### Installation

1. Installation is the reverse of the removal procedure.

## Cooling system - Drain and Refill

**WARNING! To avoid serious injury, ensure the coolant returns to a safe temperature before commencing work.**

### Remove

1. Remove upper body panel. Refer to *Body Panel - Upper, page 80-9.*
2. Remove front body panel. Refer to *Body Panel - Front, page 80-10.*
3. Remove coolant expansion cap. Refer to *Expansion Cap, page 30-5.*


4. Remove hose clamp from coolant hose secured to coolant pump inlet.
5. Disconnect the coolant hose from the coolant pump inlet.

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*
6. Allow coolant to drain into container.

### Installation

1. Installation is the reverse of the removal procedure except for additional coolant refilling procedures.

2. After installation of hose and hose clamp, and with motorcycle upright, remove the cooling system vent bolt.
3. Slowly fill the cooling system with coolant from the radiator cap until you see coolant escaping from the vent hole.
4. Reinstall the vent hole cap. Torque 10Nm.

5. Remove the cover from the left side fuse block.

6. Remove the water pump relay.

7. Close the circuit with the male spade jumpers to manually operate the water pump.
8. Once the water pump has been cycled ON and OFF a few times, top off radiator.
9. Reinstall the water pump relay and install the fuse block cover.

## Radiator

### Remove

1. Drain cooling system. Refer to *Cooling system - Drain and Refill, page 30-1.*


2. Remove screws (x3) securing the left controller cover to the motorcycle and collect washers. Bolt A Torque 4.7 Nm, Bolts B Torque 3.4 Nm.
3. Remove left controller cover.
4. Remove screws (x3) securing the right controller cover to the motorcycle and collect washers.
5. Remove right controller cover.

6. Remove bolts (x4) securing the debris screen to radiator and collect washers. Torque 3.4 Nm.
7. Remove debris screen.

8. Release hose clamp retaining coolant hose to filler neck.
9. Release coolant hose from filler neck.

10. Cut cable ties (x2) securing upper radiator hose to clutch slave hose.

11. Remove hose clamp securing coolant hose to drive motor.
12. Release coolant hose from drive motor.

13. Cut cable ties (x2) securing lower radiator coolant hose wiring harness.
14. Support motor controller.

15. Remove bolts (x2) securing the motor controller to the controller brackets and collect washers. Torque 3.4 Nm.

16. Remove bolts (x4) securing the motor controller brackets to battery #5 and collect washers. Torque 4.7 Nm.


17. Remove the radiator and bracket assembly.

*CAUTION: Take care not to damage the radiator.*


18. Remove bolts (x2) securing the lower radiator closeout bracket to the motor controller brackets and collect washers. Torque 3.4 Nm.
19. Remove lower radiator closeout bracket.


20. Remove motor controller brackets from the radiator studs.


21. Remove hose clamps (x3) from coolant hoses secured to radiator.

*CAUTION: Take care not to damage component(s).*

**Installation**

1. Installation is the reverse of the removal procedure.

## Expansion Cap

**WARNING! To avoid serious injury, ensure the coolant returns to a safe temperature before commencing work.**

### Remove

1. Remove front body panel. Refer to *Body Panel - Front, page 80-10.*

2. Remove expansion cap.

### Installation

1. Installation is the reverse of the removal procedure.

## Coolant Pump

**WARNING! To avoid serious injury, ensure the coolant returns to a safe temperature before commencing work.**

### Remove

1. Perform a coolant drain. Refer to *Cooling system - Drain and Refill, page 30-1.*

2. Depress clip and disconnect connector from coolant pump.

3. Remove hose clamp from coolant hose secured to coolant pump outlet.
4. Disconnect the coolant hose from the coolant pump outlet.


5. Remove bolt retaining coolant pump P-clamp and collect washer. Torque 3.4 Nm.
6. Release coolant pump from P-clamp.
7. Remove coolant pump.

**Installation**

1. Installation is the reverse of the removal procedure.

## Motor and Transmission Assembly

*Note: Reference IET Service Manual for additional information.*

### Remove

1. Remove drive sprocket. Refer to *Drive Sprocket - Transmission, page 50-13.*
2. Remove coolant pump. Refer to *Coolant Pump, page 30-5.*

3. Remove bolts (x2) from rear master cylinder assembly and tie aside. Torque 18.4 Nm.

4. Depress clip and disconnect gear position sensor from harness.
5. Support motor/transmission assembly with proper support.

6. Remove front motor mounting bolt and collect washer and nut. Torque 36 Nm.
7. Support rear swing arm.

8. Remove rear swing arm bolt and collect spacers and washers. Torque 14 Nm.
9. Carefully lower motor/transmission just enough to access high voltage cable cover bolts.
10. Re-install rear swingarm bolt to support swingarm.


11. Remove bolts (x2) from high voltage cable cover. Torque 1 Nm.


12. Remove high voltage cable cover and label the cables to match the numbers on top of cover.


13. Remove bolts (x3) retaining high voltage cables to motor and collect washers. Torque 15 Nm.
14. Lower motor/transmission assembly out from bottom motorcycle.

**Installation**

1. Installation is the reverse of the removal procedure.

## Motor

*Note: Reference IET Service Manual for additional information.*

### Remove

1. Place motorcycle on a lift and use a rear wheel stand.
2. Disconnect high voltage connector. Refer to *Service Disconnect - High Voltage, page 20-1.*
3. Drain coolant. Refer to *Cooling system - Drain and Refill, page 30-1.*
4. Drain transmission fluid. Refer to  Refer to *Transmission Fluid - Drain and Refill, page 50-1.*

5. Remove bolt securing shift lever linkage to gear selector. Torque 7.7 Nm.
6. Release shift lever linkage from gear selector.

7. Remove electric motor cover.

*CAUTION: Do not damage electric motor cover seal is delicate.*

8. Release hose clamp securing coolant hose to motor.

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

*CAUTION: Do not allow coolant to contact encoder or harness connectors.*

9. Disconnect hose from motor.


10. Remove bolts (x8) securing motor to gearbox. Torque 4.5 Nm.


11. Disengage motor out slightly by using a small pry bar on machined pad on transmission case, while engaging tip of bar on motor flange.


12. With the motor slightly disengaged for access, remove bolts (x2) from high voltage cable cover. Torque 1 Nm.


13. Remove high voltage cable cover and label the cables to match the numbers on top of cover.


14. Remove bolts (x3) retaining high voltage cables to motor and collect washers. Torque 15 Nm.
15. Remove motor.

16. Remove and discard O-ring from motor.

**Installation**

1. Installation is the reverse of the removal procedure, except for the following:
2. Make sure to clean inside and outside of casing from any debris prior to installing.
3. You will need 5 mm (x8) screws with OAL of 54mm to install motor back onto transmission.


4. Install the 5 mm screws to back of motor through the transmission case.
5. In a cross pattern tighten each screw until motor gear seats with transmission gear.

*CAUTION: Do not fully tighten the motor in the gearbox unless you are certain that the gear is properly engaged. You will be able to feel/hear the engagement of the gears by rotating the rear tire by hand.*

6. Once motor is aligned and correctly seated with transmission, remove the screws (x8).
7. Re-install bolts (x8) securing motor to casing. Apply Loctite 266, Torque 4.5 Nm.

*CAUTION: Do not fully tighten the motor in the gearbox unless you are certain that the gear is properly engaged. You will be able to feel/hear the engagement of the gears by rotating the rear tire by hand.*

8. Perform an encoder alignment once all is installed. Refer to *Motor Encoder - Program, page 40-5.*

## Motor Encoder - Program

### Align

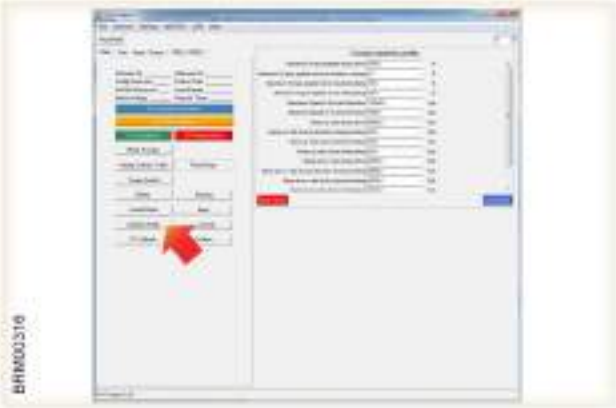
1. Place the motorcycle on a lift and the rear wheel suspended in a rear wheel stand,


2. Access the Sevcon motor controller service port located on the right side of the motorcycle.

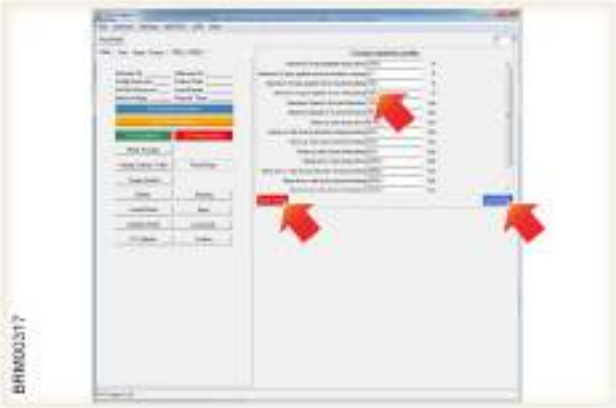

3. Ignition and motor controller need to be turned on first.

   *Note: Ensure that baud rate is set to 100 kHz (green button in center of window)*


4. Click on the 'H' helper window.




5. Click on 'Base line profile' button on the front helper panel.

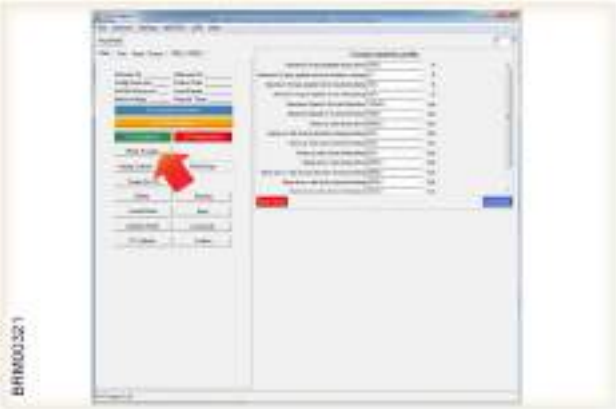



6. Turn off Regen by changing the line 'Maximum Torque applied when footbraking' to 0.0. Click on load values, and then click on read values to ensure the new 0.0 value was loaded.

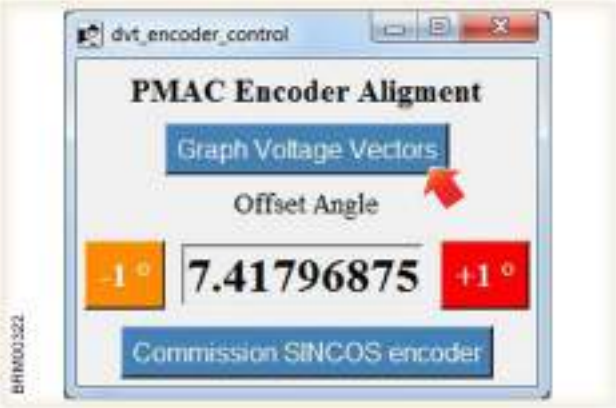

7. From the main DVT screen click on the Vehicle interface button that looks like a wheel.


8. At the bottom of the Vehicle interface panel, be sure the box for logging to a file is checked and then enter the FULL VIN for a file name.
9. With the motorcycle in 6th gear, slowly apply throttle.


10. Once 6,000 RPMs have been reached, let go of the throttle and quickly press the rewind button and then the play button while the rear wheel comes to a stop, then press pause.

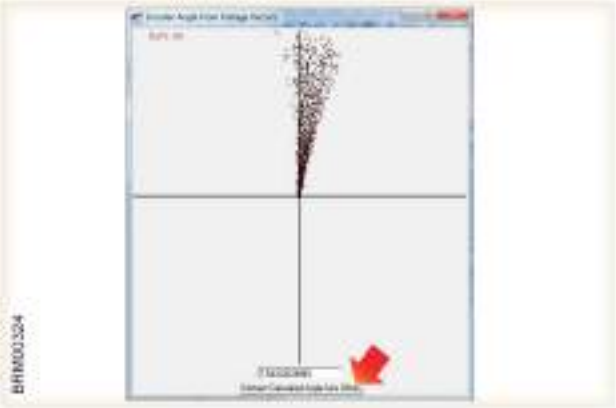



11. Go back to the 'H' helper screen and click on PMAC encoder.




12. Click on 'Graph Voltage Vectors'.

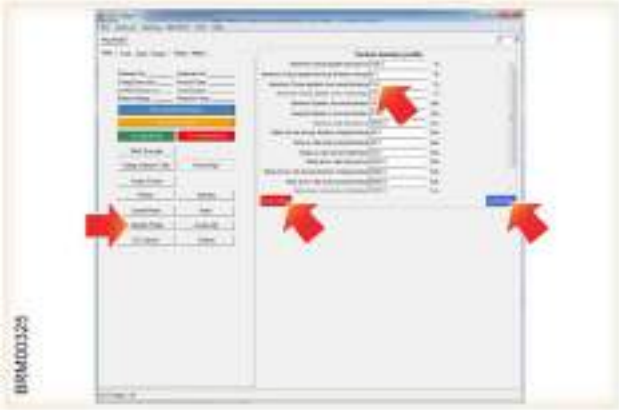

13. Open the file that was saved with the correct voltage vectors (this is the file you created with the FULL VIN). Once you find the VIN, select the VIN.




14. If the cone scatter plot is not perfectly aligned vertically, click in the middle of the scatter plot about 3/4 of the way from the base of the plot.
15. Then click on the 'Subtract Calculated Angle from Offset'.

⚠ *CAUTION: Only click the subtract button once.*

16. Then perform steps 7-13 again to check that the alignment setting are correctly set in the motor controller.
17. Open up the helper window again.




18. Click on ‘Baseline Profile button’ on front helper panel.
19. Re-enable Regen by setting the 'maximum Torque while footbraking' back to the original value (18.0 for 2013 Empulse R). Click on load values and click on read values to ensure 18.0 was loaded.
20. Click on 'Get controller information' on the main tab in the helper window.
21. Verify the configuration checksum (SC) matches the expected values on the software configuration worksheet (oxcooo)

*CAUTION: If the configuration checksum is not correct, you may have forgotten to re-enable regen, or your configuration may be out of date. To fix this problem, load the latest release of the configuration file.*

22. Close the DVT program and disconnect the connections.
23. Run the motorcycle on the rear wheel stand to ensure proper operation prior to riding the motorcycle.
24. If everything functions normally, double check all body panels and connection caps.

## Transmission Fluid - Drain and Refill

*Note: Reference IET Service Manual for additional information.*

**WARNING! To avoid serious injury, ensure the transmission oil returns to a safe temperature before commencing work.**

### Drain

1. Position a drain pan below the transmission.
2. Clean the area around the oil filler plug.


3. Remove oil filler plug and collect sealing washer.


4. Remove the oil drain plug and allow the oil to drain.
5. Clean the drain plug and inspect the sealing washer for damage. Replace the washer if necessary.
6. Install the oil drain plug. Torque 25 Nm.

### Refill

1. The transmission should be filled with the Empulse standing on level ground and supported on the kickstand.


2. Fill the transmission with 1.0L (1 quart) of synthetic 10W-30 JASO-MA/MA1/MA2 motorcycle oil (wet clutch approved).
3. Install the oil filler plug. Torque 15 Nm.
4. Clean the exterior of the transmission to remove any oil deposits.

## Clutch Fluid - Bleed

**WARNING! Only use new clutch fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Clutch fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Clutch fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

### Bleed

1. Remove bolts (x2) securing cover to kickstand assembly. Torque 7.7 Nm.
2. Remove cover.

3. Slide a bleed tube over bleed nipple on clutch slave cylinder.


4. Remove screws (x2) from clutch reservoir cap. Torque 1.15 Nm.
5. Remove cap.
6. Bleed clutch until a steady stream of fluid is flowing out of bleed nipple.
7. Keep checking fluid level and top off clutch reservoir as needed while bleeding clutch.
8. Install cap on clutch reservoir.
9. Check operation of clutch and repeat bleed procedure if necessary.
10. Re-install cover back onto kickstand assembly.

## Clutch Fluid - Drain and Refill

**WARNING! Only use new clutch fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Clutch fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Clutch fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

### Drain


1. Remove screws (x2) from top of clutch reservoir cover. Torque 1.15 Nm.
2. Remove clutch reservoir cap.

3. Remove bolts (x2) securing kickstand sensor and tie sensor aside. Torque 2.2 Nm.


4. Remove bolts (x5) securing kickstand assembly. Bolts A Torque 18.4 Nm, Bolt B Torque 41.8 Nm, Bolt C Torque 8.9 Nm, Bolt D Torque 7.7 Nm.
5. Remove kickstand assembly.

6. Remove banjo bolt from clutch slave cylinder and collect sealing washers. Torque 22.6 Nm.

7. Drain clutch fluid into drain pan.

**Refill**

1. Once fluid is fully drained, installation is the reverse of the removal procedure except for the following:
2. Re-install banjo bolt with new set of sealing washers. Torque 22.6 Nm.
3. Refill using Brammo approved clutch fluid up to the fill line inside the clutch reservoir.
4. Perform a clutch bleed. Refer to *Clutch Fluid - Bleed, page 50-2.*

## Clutch Master Cylinder

**WARNING! Only use new clutch fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Clutch fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Clutch fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the clutch lever while clutch system is disassembled.*

**Remove**

1. Remove left rear view mirror. Torque 7 Nm.
2. Remove clutch lever. Refer to *Clutch Lever, page 50-5.*

3. Remove clutch reservoir banjo bolt securing clutch line to reservoir and collect sealing washers. Torque 22.6 Nm.
4. Tie clutch hose aside.

5. Remove clutch master cylinder clamp bolts (x2). Torque 10 Nm.
6. Remove clutch master cylinder clamp.

7. Remove clutch master cylinder.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Replace sealing washers with a new set
3. Perform a clutch bleed once new clutch master cylinder is installed. Refer to *Clutch Fluid - Bleed, page 50-2.*

## Clutch Lever

### Remove

1. Remove lever pivot nut. Torque 2 Nm.
2. Release clutch switch from lever bolt and tie aside.

3. Remove lever bolt.
4. Remove clutch lever.

### Installation

1. Installation is the reverse of the removal procedure.

## Clutch Slave Cylinder

*Note: Reference IET Service Manual for additional information.*

**WARNING! Only use new clutch fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Clutch fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Clutch fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the clutch lever while clutch system is disassembled.*

### Remove

1. Remove bolts (x2) securing kickstand sensor and tie sensor aside. Torque 2.2 Nm.


2. Remove bolts (x5) securing kickstand assembly. Bolts A Torque 18.4 Nm, Bolt B Torque 41.8 Nm, Bolt C Torque 8.9 Nm, Bolt D Torque 7.7 Nm.
3. Remove kickstand assembly.

4. Remove banjo bolt securing hose to clutch slave cylinder. Torque 22.6 Nm.

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

*CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

5. Remove and discard sealing washers.
6. Tie clutch line aside.


7. Remove bolts (x2) securing clutch slave cylinder to transmission. Torque 8 Nm.
8. Remove clutch slave cylinder.

   *Note: If clutch slave cylinder housing becomes separated, correctly position internal spring and lubricate O-ring before reassembly.*

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Confirm clutch shaft rod is seated correctly, prior to installation of clutch slave cylinder.
3. Perform clutch bleeding procedure. Refer to *Clutch Fluid - Bleed, page 50-2.*

## Clutch Cover

### Remove

1. Remove motor/transmission assembly. Refer to *Motor and Transmission Assembly, page 40-1.*


2. With assembly on bench and clutch cover facing upward, remove cover bolts (x10). Torque 6 Nm.
3. Remove and discard paper gasket.
4. Remove clutch cover.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Clean excess sealant from clutch cover and transmission mating surfaces.
3. Apply thin layer of sealant to clutch and transmission case mating surfaces prior to installing gasket.
4. Replace paper gasket prior to installing clutch cover and carefully wipe some sealant around the edge of surface.


5. Confirm selector shaft alignment marks are aligned during installation process.

## Chain - Adjust Tension

### Adjust

1. Support motorcycle using a rear wheel stand (preferable) or the kickstand (alternative).

2. Check the slack in the drive chain by measuring at the midpoint of the lower chain length.

   *Note: New chain needs to be pre-stretched by suspending a mass from the lower length of the chain.*

   *Note: The recommended tool for measuring chain slack is a small precision metric ruler.*

3. Measured at the tight point of a chain revolution. This can be found by slowly rotating the rear wheel and observing the variation in chain slack at the midpoint of the lower length of chain.

   *Note: The chain should deflect a total of 17mm when approximately 1 kgf is applied to the chain upward and downward.*

4. Loosen rear axle nut.

5. Loosen the chain adjustment lock nuts and turn the adjusting bolts until 17 mm of total deflection is obtained.

6. Confirm both adjusting bolts are at the same mark on adjusters.

**Align**

1. Account for the thickness of both sprockets, as the intended alignment reference is the center plane of each sprocket.

   *Note: Pinion and wheel are to be on the same plane. The recommended alignment tools are a precision laser alignment tool and a small precision metric ruler.*

2. Position laser alignment tool on rear wheel sprocket and aim it at the drive sprocket.

3. Position the precision metric ruler against the rear wheel sprocket and mark the point at which the laser lands on the ruler.

4. Position the precision metric ruler against the drive sprocket. Adjust alignment by using the chain adjuster bolts until the laser dot lands in the same position as in step 3.

   *Note: The procedure and tools should be calibrated to achieve a reading of ±1 mm.*

   *Note: When chain adjustment and sprocket alignment are correct, ensure the assembly adjustment hardware and components are ready for drive mode.*

5. Once proper adjustment is achieved, tighten the lock nuts on the chain adjusters. Torque 14 Nm.


6. Tighten the rear axle nut. Torque 55 Nm.
7. Verify chain adjustment and sprocket alignment did not change during the torque sequence. Loosen the axle and axle adjusters and repeat process if required.

## Drive Sprocket - Transmission

*Note: Reference IET Service Manual for additional information.*

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Clutch fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Clutch fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

*CAUTION: Do not operate the clutch lever while clutch system is disassembled.*

### Remove

1. Raise and support rear of motorcycle with suitable stand or other adjustable support.


2. Cover rear swingarm in highlighted areas to protect against damage from chain and additional component removal during this procedure.
3. Remove rear wheel assembly. Refer to *Wheel - Rear, page 85-3.*
4. Remove clutch slave cylinder. Refer to *Clutch Slave Cylinder, page 50-6.*
5. Remove composite chain guard.


6. Remove bolt securing chain guide.
7. Remove chain guide.
8. Remove clutch actuator rod sleeve from chain guide.
9. Remove and discard O-ring from clutch rod sleeve.
10. Remove clutch actuator rod.


11. Remove clip retaining drive sprocket.
12. Remove drive sprocket and chain as an assembly.
13. Release chain from drive sprocket.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:

*CAUTION: Before installing axle shaft, confirm spacer between wheel bearings is properly aligned or component damage may occur.*

2. Perform clutch bleeding procedure. Refer to *Clutch Fluid - Bleed, page 50-2.*
3. Perform chain adjustment procedure. Refer to *Chain - Adjust Tension, page 50-9.*

## Sprocket - Rear Wheel

### Remove

1. Remove rear wheel. Refer to *Wheel - Rear, page 85-3.*


2. Remove bolts (x5) securing rear sprocket to wheel. Torque 41.8 Nm.


3. Remove rear drive sprocket.

### Installation

1. Installation is the reverse of the removal procedure.

## Front Damper - Left

*Note: Reference Marzocchi Service Manual for additional service information.*

### Remove

1. Remove front wheel. Refer to *Wheel - Front, page 85-3.*

2. Loosen upper bridge bolt securing left damper. Torque 18.4 Nm.

   *Note: Record installed height of damper in relation to upper and lower bridges and clocked position of damper adjustment nut to aid reassembly.*

3. Loosen lower bridge bolts (x2) securing left damper. Torque 18.4 Nm.
4. Remove left damper from bridges.

### Installation

1. Installation is the reverse of the removal procedure.

## Front Damper - Right

*Note: Reference Marzocchi Service Manual for additional service information.*

### Remove

1. Remove front wheel. Refer to *Wheel - Front, page 85-3.*

2. Loosen upper bridge bolt securing right damper. Torque 18.4 Nm.

   *Note: Record installed height of damper in relation to upper and lower bridges and clocked position of damper adjustment nut to aid reassembly.*

3. Loosen lower bridge bolts (x2) securing right damper. Torque 18.4 Nm.
4. Remove right damper from bridges.

### Installation

1. Installation is the reverse of the removal procedure.

## Shock Absorber Assembly

*Note: Reference Sachs Service Manual for additional service information.*

### Remove

1. Remove rear fender. Refer to *Fender - Rear, page 80-12.*
2. Raise and properly support motorcycle frame.

**WARNING! Do not support weight of the motorcycle by placing stand at rear of swingarm. Weight of the motorcycle must be supported by placing suitable stand or support under rear of frame or transmission assembly. Placing stand under transmission requires removal of lower body panel.**


3. Loosen clamps and release from the rear shock absorber reservoir bracket.


4. Remove shock absorber bolt securing assembly to the swingarm and collect nut and washers. Torque 16 Nm.


5. Remove shock absorber bolt securing assembly to the frame and collect nut and washer. Torque 16 Nm.


6. Remove rear shock absorber and reservoir assembly.

**Installation**

1. Installation is the reverse of the removal procedure.

## Master Cylinder - Front

**WARNING! Do not clamp brake hoses, as they will be damaged and require replacing.**

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove brake lever. Refer to *Front Brake Lever, page 70-3.*
2. Remove the rear view mirror. Torque 7 Nm.


3. Remove banjo bolt and discard sealing washers (x2). Torque 22.6 Nm.

   *CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

   *Note: Replace sealing washers upon installation.*


4. Remove brake master cylinder clamp bolts (x2). Torque 10 Nm.
5. Remove brake master cylinder clamp.
6. Remove brake master cylinder.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Perform a brake bleed. Refer to *Bleed Procedure - Front, page 70-15.*

## Master Cylinder - Rear

**WARNING! Do not clamp brake hoses, as they will be damaged and require replacing.**

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove seat. Refer to *Seat, page 80-7.*
2. Cut cable ties (x2) securing brake switch harness to motorcycle.

3. Disconnect brake switch harness connector located above battery #1.

4. Remove bolts (x2) securing rear brake master cylinder cover and collect washers. Torque 7.7 Nm.
5. Remove master cylinder cover.

6. Remove switch securing rear brake hose and discard sealing washers (x2). Torque 22.6 Nm.

   *CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

   *Note: Replace sealing washers upon installation.*
7. Disconnect hose from master cylinder.

8. Release clip from rear master cylinder clevis.
9. Remove clip.
10. Remove rear master cylinder.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Perform a rear brake bleed. Refer to *Bleed Procedure - Rear, page 70-16.*

## Front Brake Lever

### Remove

1. Remove lever pivot nut. Torque 2 Nm.
2. Release brake switch from lever bolt and tie aside.

3. Remove brake lever bolt.
4. Remove brake lever.

### Installation

1. Installation is the reverse of the removal procedure.

## Brake Rotor - LH Front

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove front wheel. Refer to *Wheel - Front, page 85-3.*

2. Remove bolts (x6) securing brake rotor to the wheel. Torque 18.4 Nm.
3. Remove brake rotor assembly and replace as needed.

### Installation

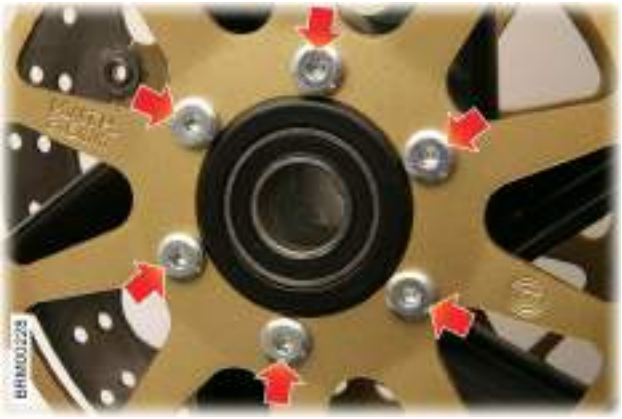
1. Installation is the reverse of the removal procedure.

## Brake Rotor - RH Front

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove front wheel. Refer to *Wheel - Front, page 85-3.*



2. Remove bolts (x6) securing brake rotor to the wheel hub. Torque 18.4 Nm.
3. Remove brake rotor assembly and replace as needed.

### Installation

1. Installation is the reverse of the removal procedure.

## Brake Caliper - LH Front

**WARNING! Do not clamp brake hoses, as they will be damaged and require replacing.**

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove LH caliper brake pads. Refer to *Brake Pads - LH Front, page 70-8.*

2. Remove banjo bolt and discard sealing washers (x2). Torque 22.6 Nm.

   *CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

   *Note: Replace sealing washers upon installation.*

3. Tie brake hose end aside.

4. Remove bolts (x2) securing the brake caliper to the caliper bracket. Torque 46 Nm.
5. Remove brake caliper as an assembly.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Perform a front brake bleed after installation. Refer to *Bleed Procedure - Front, page 70-15.*

## Brake Caliper - RH Front

**WARNING! Do not clamp brake hoses, as they will be damaged and require replacing.**

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove RH caliper brake pads. Refer to *Brake Pads - RH Front, page 70-9.*

2. Remove banjo bolt and collect sealing washers (x3). Torque 22.6 Nm.

   *CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

   *Note: Replace sealing washers upon installation.*

3. Tie brake hose ends aside.

4. Remove bolts (x2) securing the brake caliper to the caliper bracket. Torque 46 Nm.
5. Remove caliper as an assembly.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Perform a front brake bleed after installation. Refer to *Bleed Procedure - Front, page 70-15.*

## Brake Pads - LH Front

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove


1. Remove the two pin-retaining clips.


2. Remove the two pins and the anti-rattle spring plate.


3. Remove both brake pads.

### Installation

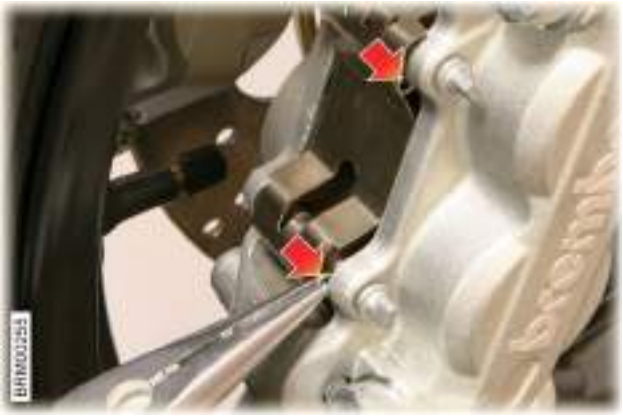

1. Measure the thickness of the remaining brake pad material. Minimum brake pad material thickness = 1 mm. Replace the pads if the thickness is less than 1 mm.
2. Install the brake pads into the caliper housing.
3. Fit the anti-rattle spring plate.

   *Note: Install anti-rattle spring plate with arrow pointing upwards*
4. Install the pins and secure with the retaining clips.

## Brake Pads - RH Front

⚠ *CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove




1. Remove the two pin-retaining clips.


2. Remove the two pins and the anti-rattle spring plate.


3. Remove both brake pads.

### Installation


1. Measure the thickness of the remaining brake pad material. Minimum brake pad material thickness = 1 mm. Replace the pads if the thickness is less than 1 mm.
2. Install the brake pads into the caliper housing.
3. Fit the anti-rattle spring plate.

   *Note: Install anti-rattle spring plate with arrow pointing upwards*
4. Install the pins and secure with the retaining clips.

## Brake Rotor - Rear

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove rear wheel. Refer to *Wheel - Rear, page 85-3.*

2. Remove bolts (x4) securing brake rotor to the rear wheel. Torque 18.4 Nm.

3. Remove rear brake rotor.

### Installation

1. Installation is the reverse of the removal procedure.

## Brake Caliper - Rear

**WARNING! Do not clamp brake hoses, as they will be damaged and require replacing.**

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove the pin retaining clip.

2. Partially drive out retaining pin.

3. Remove banjo bolt and discard sealing washers (x2). Torque 22.6 Nm.

   *CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

   *Note: Replace sealing washers upon installation.*

4. Tie brake hose end aside.

5. Remove the bolts (x2) securing the brake caliper to the swingarm and collect washers.
6. Release the brake caliper from the swingarm.

7. Remove pad retaining pin and spring tensioner.

8. Remove both brake pads from the caliper.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Clean caliper prior to installation.


3. Measure the thickness of the remaining brake pad material. Minimum brake pad material. thickness = 1 mm. Replace the pads if the thickness is less than 1 mm.


4. Install the pads into the brake caliper by retaining them with the retaining pin and spring tensioner.
5. Position the brake caliper on the swingarm and secure it with bolts. Torque 18.4 Nm.
6. Finish installing the retaining pin and pin-retaining clip.
7. Perform a rear brake bleed after installation. Refer to *Bleed Procedure - Rear, page 70-16.*

## Brake Pads - Rear

⚠ *CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove


1. Remove the pin retaining clip.


2. Partially drive out retaining pin.


3. Remove the bolts (x2) securing the brake caliper to the caliper bracket and collect washers. Torque 18.4 Nm.
4. Release the brake caliper from the caliper bracket.


5. Remove pad retaining pin and spring tensioner.


6. Remove both brake pads from the caliper.

**Installation**


1. Measure the thickness of the remaining brake pad material. Minimum brake pad material. thickness = 1 mm. Replace the pads if the thickness is less than 1 mm.


2. Install the pads into the brake caliper by retaining them with the retaining pin and spring tensioner.
3. Install the brake caliper on the caliper bracket with bolts (x2). Torque 18.4 Nm.
4. Finish installing the retaining pin and pin-retaining clip.

## Bleed Procedure - Front

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

**Bleed**

1. Support the motorcycle on a level surface to even out the fluid in reservoir.

2. Remove screws (x2) from the top of brake master cylinder. Torque 1.15 Nm.
3. Remove reservoir cover, set plate and diaphragm from inside of brake master cylinder.
4. Operate brake lever several times (8-10) to bleed air from the master cylinder.

5. Place an 8 mm wrench over the bleed fitting.
6. Remove rubber cap on top of the bleed fitting and connect the transparent bleeder tube to the bleed fitting and place the other end of the hose in a container.
7. Loosen the bleed fitting 1/4 turn and pump the brake lever until you see the brake fluid flowing out the bleed fitting. (pump about 5-10 times)
8. Pull brake lever all the way back and hold.
9. Loosen bleed fitting. (do not release brake lever while bleed fitting is open)
10. Close bleed fitting once your satisfied with fluid flow.

11. Release brake lever slowly and wait several seconds after it reaches its full travel.
12. Repeat steps 8-12 until bubbles cease to appear at the end of the bleeder tube and brake lever resistance is felt.
13. Tighten bleed fitting. Torque 18.5 Nm.
14. Fill the reservoir up to the max level using DOT 4 brake fluid from a sealed container.
15. Install diaphragm, set plate, followed by the reservoir cover.
16. tighten screws (x2) on top of the reservoir cover. Torque 1.15 Nm.

## Bleed Procedure - Rear

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

**Bleed**

1. Remove reservoir cap from rear braking system.
2. Fill the reservoir with the proper fluid and pump the brake pedal while filling the reservoir.
3. Place a 8 mm wrench over the bleed fitting and seat it against the fitting.
4. Connect the transparent tube up to the bleed fitting and place the outer opened end of tube into empty container.
5. Loosen bleed fitting 1/4 turn and pump brake pedal until you see brake fluid flowing out.
6. Push and hold brake pedal down and tighten up the bleed fitting.

7. Release brake pedal slowly and wait a minute after it has reached the end of its travel.
8. Repeat steps 5-7 until bubbles cease to appear in the fluid at the end of the bleed tube and pedal resistance is felt.
9. tighten bleed fitting to specified torque.
10. Fill the reservoir up to the max level using DOT 4 brake fluid from a sealed container.
11. Install cap back on reservoir.

## Handlebars

### Remove

1. Remove right and left mirrors. Torque 7 Nm.
2. Remove left grip. Refer to *Grip - Left, page 80-2.*
3. Remove turn signal switch assembly. Refer to *Switch Assembly (Headlight, Horn, Turn Signal), page 90-13.*
4. Remove mode switch assembly. Refer to *Switch Assembly (Start/Stop, Mode), page 90-14.*
5. Tie both switch assemblies aside.
6. Remove throttle assembly. Refer to *Throttle, page 90-14.*
7. Cut cable ties (x2) fastening clutch hose and wire harness.


8. Remove bolts (x2) from clutch master cylinder clamp. Torque 10 Nm.
9. Remove clutch master cylinder clamp.
10. Tie clutch master cylinder aside.
11. Cut cable ties (x2) securing brake lines to handlebars.


12. Remove bolts (x2) from brake master cylinder clamp. Torque 10 Nm.
13. Remove brake master cylinder clamp.
14. Tie brake master cylinder aside.


15. Remove bolts (x4) from handlebar clamps. Torque 18.4 Nm.
16. Remove clamps (x2) from handlebars.
17. Remove handlebars.

### Installation

1. Installation is the reverse of the removal procedure.

## Grip - Left

### Remove


1. Remove bolt retaining grip end to handlebars. Torque 2 Nm.
2. Slide grip off of handlebars.

### Installation

1. Installation is the reverse of the removal procedure.

## Grip - Right

### Remove


1. Remove bolt retaining grip end to handlebars. Torque 2 Nm.
2. Peel grip off the throttle assembly.

### Installation

1. Installation is the reverse of the removal procedure.

## Swingarm

### Remove

1. Raise and properly support motorcycle frame.

**WARNING! Do not support weight of the motorcycle by placing stand at rear of swingarm. Weight of the motorcycle must be supported by placing suitable stand or support under rear of frame or transmission assembly. Placing stand under transmission requires removal of lower body panel.**

2. Remove rear fender. Refer to *Fender - Rear, page 80-12.*


3. Cover rear swingarm in highlighted areas to protect against damage from chain and additional component removal during this procedure.
4. Remove rear wheel. Refer to *Wheel - Rear, page 85-3.*


5. Remove bolts (x2) securing P-clips to rear swingarm. Torque 4.7 Nm.
6. Route rear brake assembly through swingarm and tie aside.


7. Remove bolt securing shock absorber to swingarm, collect washers, and support shock arm. Torque 16 Nm.


8. Remove rear swingarm bolt and collect spacers and washers. Torque 14 Nm.


9. Remove chain by disconnecting serviceable link with special tool.
10. Remove bare swingarm.

**Installation**

1. Installation is the reverse of the removal procedure.

## Kickstand

### Remove


1. Unhook springs (x2) from the backside of kickstand.


2. Remove bolt securing kickstand sensor magnet. Torque 2.2 Nm.
3. Remove sensor magnet from kickstand.


4. Remove bolt securing the kickstand to the kickstand bracket and collect nut. Bolt A Torque 40.7 Nm, Nut B Torque 14 Nm.
5. Remove kickstand.

### Installation

1. Installation is the reverse of the removal procedure.

## Seat

**WARNING! Incorrect installation of the seat could cause the seat to move while the motorcycle is being ridden, resulting in an accident or serious injury.**

### Remove

1. Remove bolt securing seat assembly to motorcycle and collect washer. Torque 6.7 Nm.
2. Lift rear of seat then pull backwards to release front tab to remove seat.

### Installation

1. Installation is the reverse of removal procedure, except for the following:

2. Position the seat on the motorcycle and make sure the seat tongue is inserted into the mounting bracket.

## Body Panel - Tail Cover

### Remove

1. Remove seat. Refer to *Seat, page 80-7.*
2. Remove rear grab handles (x2). Refer to *Grab Handle - Rear, page 80-13.*

3. Disconnect rear harness connector.

4. Remove bolts (x4) securing rear tail lamp assembly to seat subframe and collect washers. Torque 9 Nm.
5. Remove tail lamp assembly while routing harness out the rear of motorcycle.


6. Remove bolts (x2) securing tail cover. Torque 1 Nm.


7. Remove lower bolt securing tail cover to rear body cover. Torque 1 Nm.


8. Remove bolt securing tail cover to seat subframe. Torque 1 Nm.
9. Remove tail cover.


10. Remove bolts (x2) securing rear body cover to DC/DC converter cooling fan cover and collect washers. Torque 1 Nm.
11. Remove rear body cover.

**Installation**

1. Installation is the reverse of the removal procedure.

## Headlamp Surround

### Remove

1. Remove bolts (x4) securing headlamp surround to headlamp. Torque 1 Nm.
2. Remove headlamp surround.

### Installation

1. Installation is the reverse of the removal procedure.

## Body Panel - Upper

### Remove

1. Remove seat. Refer to *Seat, page 80-7.*

2. Remove bolts (x2) securing upper body panel to seat subframe and collect washers. Torque 2 Nm. Torque 1 Nm.

3. Remove bolts (x2) securing upper body panel to motorcycle frame and collect washers. Torque 1Nm.
4. Lift and remove upper body panel.

*CAUTION: Take care not to damage component(s).*

### Installation

1. Installation is the reverse of the removal procedure.

## Body Panel - Lower

### Remove


1. Remove bolts (x2) securing panel to controller bracket and collect washers. (connects to front body panel). Torque 1 Nm.
2. Remove bolts (x2) securing panel to radiator bracket and collect washers. Torque 1 Nm.
3. Remove lower body panel.

*CAUTION: Take care not to damage component(s).*

### Installation

1. Installation is the reverse of the removal procedure.

## Body Panel - Front

### Remove

1. Remove lower body panel. Refer to *Body Panel - Lower, page 80-10.*


2. Remove bolts (x2) securing front body panel to motorcycle frame and collect washers. Torque 1 Nm.
3. Remove front body panel.

### Installation

1. Installation is the reverse of the removal procedure.

## Body Panel - Top

### Remove

1. Remove upper body panel. Refer to *Body Panel - Upper, page 80-9.*


2. Remove bolts (x2) securing panel to motorcycle frame and collect washers. Torque 1 Nm.


3. Remove bolt securing panel to charge port bracket and collect washer. Torque 1 Nm.


4. Raise top body panel to access and disconnect speaker connector.
5. Remove top body panel.

### Installation

1. Installation is the reverse of the removal procedure.

## Fender - Front

### Remove

1. Remove bolts (x4) retaining front fender. Torque 2 Nm.

2. Remove bolt securing brake line P-clamp to fender, collect nut, and washer. Torque 5.2 Nm.
3. Remove front fender.

*CAUTION: Take care not to damage component(s).*

### Installation

1. Installation is the reverse of the removal procedure.

## Fender - Rear

### Remove

1. Remove bolts (x3) securing rear fender and collect washers. Torque 2 Nm.
2. Remove rear fender.

*CAUTION: Take care not to damage component(s).*

### Installation

1. Installation is the reverse of the removal procedure.

## Chain Guard

*Note: Reference IET Service Manual for additional information.*

### Remove

1. Remove clutch slave cylinder. Refer to *Clutch Slave Cylinder, page 50-6.*


2. Remove chain guard.

### Installation

1. Installation is the reverse of the removal procedure.

## Grab Handle - Rear

### Remove


1. Remove bolts (x2) securing grab handle to seat subframe and collect washers. Torque 21.4 Nm.
2. Remove grab handle.

### Installation

1. Installation is the reverse of the removal procedure.

## Footrest - Front

### Remove


1. Remove bolt securing footrest to bracket and collect nut and washers. Torque 5 Nm.
2. Remove guided sleeve from bolt hole to release footrest.
3. Remove spring from footrest.
4. Remove footrest.

### Installation

1. Installation is the reverse of the removal procedure.

## Footrest - Rear

### Remove


1. Remove bolt securing footrest and collect nut and washers (x2). Torque 5 Nm.


2. Remove guided sleeve from bolt hole.
3. Remove foot peg and collect locking ball bearing and small locking plate from bracket.

### Installation

1. Installation is the reverse of the removal procedure.

## Axle - Front

### Remove

1. Raise and support front of motorcycle with suitable stand or other adjustable support.


2. Remove axle nut. Torque 14 Nm.


3. Loosen axle pinch bolts (x4) on both front shock absorbers. Torque 5.2 Nm.


4. Remove axle shaft and collect left collar.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:

*CAUTION: Before installing axle shaft, confirm spacer between wheel bearings is properly aligned or component damage may occur.*

## Axle - Rear

### Remove

1. Raise and support rear of motorcycle with suitable stand or other adjustable support.

2. Remove rear axle nut and washer. Torque 55 Nm.

3. Remove rear axle shaft.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:

*CAUTION: Before installing axle shaft, confirm spacer between wheel bearings is properly aligned or component damage may occur.*

2. Perform chain adjustment procedure. Refer to *Chain - Adjust Tension, page 50-9.*

## Wheel - Front

### Remove

1. Raise motorcycle and place on a motorcycle stand or other adjustable support.
2. Remove left front brake caliper. Refer to *Brake Caliper - LH Front, page 70-6.*
3. Remove right front brake caliper. Refer to *Brake Caliper - RH Front, page 70-7.*
4. Remove front axle. Refer to *Axle - Front, page 85-1.*
5. Remove wheel assembly from the front shock absorbers.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:

*CAUTION: Before installing axle shaft, confirm spacer between wheel bearings is properly aligned or component damage may occur.*

## Wheel - Rear

### Remove

1. Raise and support rear of motorcycle with suitable stand or other adjustable support.


2. Cover rear swingarm in highlighted areas to protect against damage from chain and additional component removal during this procedure.
3. Remove rear axle shaft. Refer to *Axle - Rear, page 85-2.*
4. Move rear wheel forward for clearance to derail chain from the rear wheel sprocket.
5. Derail chain from rear wheel sprocket.
6. Tie rear brake caliper and bracket assembly aside.

*CAUTION: Support the brake caliper(s) with suitable fixture. Do not allow caliper(s) to hang by the brake hose. Do not twist the brake hose.*

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

7. Slide rear wheel assembly out of frame and collect chain adjusters.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:

*CAUTION: Before installing axle shaft, confirm spacer between wheel bearings is properly aligned or component damage may occur.*

2. Prior to installing rear axle shaft, confirm brake caliper bracket engages with slot in right chain adjuster and frame.
3. Perform chain adjustment procedure. Refer to *Chain - Adjust Tension, page 50-9.*

## Fusebox - LH (Low Voltage)

### Remove

1. Remove upper body panel. Refer to *Body Panel - Upper, page 80-9.*

2. Remove fuse box cover.

3. Pull intended fuse or relay.

*CAUTION: Use provided fuse puller to remove fuses or component damage may occur.*

### Installation

1. Installation is the reverse of the removal procedure.

## Fusebox - RH (High Voltage)

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

1. Remove upper body panel. Refer to *Body Panel - Upper, page 80-9.*
2. Disconnect high voltage connector. Refer to *Service Disconnect - High Voltage, page 20-1.*


3. Remove fusebox cover.

4. Pull intended fuse or relay.

*CAUTION: Use provided fuse puller to remove fuses or component damage may occur.*

**Installation**

1. Installation is the reverse of the removal procedure.

## Motor Controller

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

**WARNING! To avoid serious injury, ensure the coolant returns to a safe temperature before commencing work.**

### Remove

1. Remove motor controller main contactor. Refer to *Motor Controller - Main Contactor, page 90-4.*

2. Remove bolt and nut from fusible link and collect washers. Torque 10 Nm.
3. Remove fusible link from motor controller.
4. Remove fusible link to main contactor busbar.
5. Remove cover from motor controller.

6. Remove bolt securing controller to contactor busbar and collect washers. Torque 11 Nm.
7. Remove busbar.

8. Remove bolts (x4) securing cables to motor controller and collect washers. Torque 11 Nm.
9. Remove cables.

### Installation

1. Installation is the reverse of the removal procedure.

## Motor Controller - Main Contactor

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

**WARNING! To avoid serious injury, ensure the coolant returns to a safe temperature before commencing work.**

### Remove

1. Disconnect high voltage connector. Refer to *Service Disconnect - High Voltage, page 20-1.*
2. Remove coolant pump. Refer to *Coolant Pump, page 30-5.*

3. Cut cable tie securing coolant pump harness to ground cable.

4. Remove upper bolts (x2) securing motor controller rear bracket to motorcycle frame and collect washers. Torque 7.7 Nm.

*CAUTION: Before removing motor controller bracket bolts, support the motor controller assembly with suitable fixture.*

5. Remove lower bolts (x2) securing motor controller to motor controller front brackets and collect washers. Torque 3.4 Nm.

*CAUTION: Before removing motor controller bracket bolts, support the motor controller assembly with suitable fixture.*

6. Remove lower bolts (x2) securing motor controller rear bracket to motor controller and collect washers. Torque 3.4 Nm.

7. Lower motor controller assembly.

⚠ *CAUTION: Ensure electrical harness is not strained during this process.*

⚠ *CAUTION: Ensure pipes and hoses are not strained during this process.*

8. Tie motor controller rear bracket towards rear, away from motor controller.

9. Remove bolts (x2) securing access cover to motor controller assembly and collect washers. Torque 1 Nm.

10. Remove access cover.

11. Remove nut securing ground cable to motor controller and collect washers. Torque 13.5 Nm.

12. Disconnect both connectors located at the front of the motor controller.

13. Remove bolt securing red cable to fuse and collect washers. Torque 5.2 Nm.
14. Slide motor controller out to the right side of motorcycle to gain access to main contactor.

*CAUTION: Ensure electrical harness is not strained during this process.*

15. Remove bolts (x2) securing main contactor to motor controller assembly and collect washers. Torque 2.5 Nm.

16. Remove nuts (x2) securing main contactor to busbars and collect washers. Torque 10 Nm.
17. Remove main contactor.

**Installation**

1. Installation is the reverse of the removal procedure.

## Motor Controller - Fusible Link

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

**WARNING! To avoid serious injury, ensure the coolant returns to a safe temperature before commencing work.**

### Remove

1. Disconnect high voltage connector. Refer to *Service Disconnect - High Voltage, page 20-1.*
2. Remove coolant pump. Refer to *Coolant Pump, page 30-5.*

3. Cut cable tie securing coolant pump harness to ground cable.

4. Remove upper bolts (x2) securing motor controller rear bracket to motorcycle frame and collect washers. Torque 7.7 Nm.

*CAUTION: Before removing motor controller bracket bolts, support the motor controller assembly with suitable fixture.*

5. Remove lower bolts (x2) securing motor controller to motor controller front brackets and collect washers. Torque 3.4 Nm.

*CAUTION: Before removing motor controller bracket bolts, support the motor controller assembly with suitable fixture.*

6. Remove lower bolts (x2) securing motor controller rear bracket to motor controller and collect washers. Torque 3.4 Nm.

7. Lower motor controller assembly.

⚠ *CAUTION: Ensure electrical harness is not strained during this process.*

⚠ *CAUTION: Ensure pipes and hoses are not strained during this process.*

8. Tie motor controller rear bracket towards rear, away from motor controller.

9. Remove bolts (x2) securing access cover to motor controller assembly and collect washers. Torque 1 Nm.

10. Remove access cover.

11. Remove bolt and nut from fusible link and collect washers. Torque 10 Nm.
12. Remove fusible link from motor controller.

### Installation

1. Installation is the reverse of the removal procedure.

## Vehicle Control Unit (VCU)

**WARNING! The Empulse has high-voltage DC electrical systems which can be dangerous and may cause severe injury. Before working on any high-voltage components confirm the high-voltage service disconnect is disconnected.**

### Remove

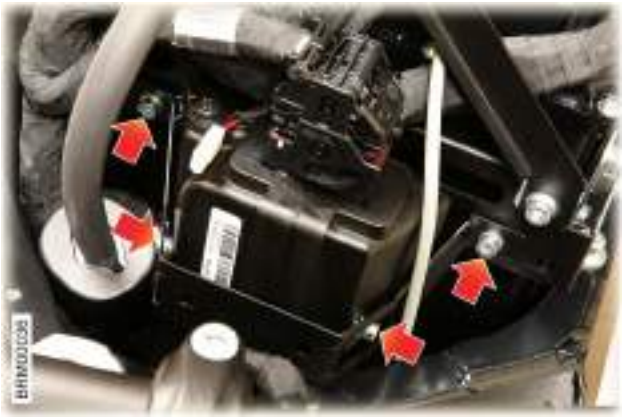
1. Disconnect high voltage connector. Refer to *Service Disconnect - High Voltage, page 20-1.*

   *CAUTION: Confirm high-voltage connector is disconnected prior to removing VCU connectors or component damage may occur.*

2. Disconnect upper VCU connector.

3. Disconnect lower VCU connector.

4. Remove bolt securing VCU to lower bracket. Torque 3.6 Nm.



5. Remove bolts (x4) securing upper VCU bracket and collect washers. Torque 3.6 Nm.
6. Remove upper VCU bracket.
7. Lower VCU to remove from frame.

### Installation

1. Installation is the reverse of the removal procedure.

## Auxiliary Input Module (AIM)

### Remove

1. Remove upper body panel. Refer to *Body Panel - Upper, page 80-9.*

2. Remove connectors (x2) from AIM module.

   *Note: Fastener for connector requires 1/4 inch ASE tool for removal.*

3. Remove bolts (x2) securing AIM module to top tank bracket and collect washers. Torque 3.6 Nm.
4. Remove AIM module.

### Installation

1. Installation is the reverse of the removal procedure.

## Instrument Panel

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*


2. Twist harness collar and disconnect instrument panel harness.


3. Remove bolts (x4) securing instrument panel to bracket. Torque 0.8 Nm.
4. Remove instrument panel.

### Installation

1. Installation is the reverse of the removal procedure.

## Horn

### Remove


1. Disconnect connectors (x2) and horn diode jumper connected to horn.


2. Remove bolt securing horn to lower bridge and collect washer. Torque 7.7 Nm.
3. Remove horn.

**Installation**

1. Installation is the reverse of the removal procedure.

   *Note: Connect horn connector with red wire (or red mark) to the side of the horn diode with a red stripe of heatshrink.*

## Ignition Switch

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*


2. Disconnect ignition switch harness connector.


3. Remove bolts (x2) securing ignition switch to top bridge. Torque 18.4 Nm.
4. Remove ignition switch.

### Installation

1. Installation is the reverse of the removal procedure except for the following:
2. Before fully tightening ignition switch bolts, make sure steering lock engages properly.

## Switch Assembly (Headlight, Horn, Turn Signal)

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*


2. Disconnect headlamp switch connector from harness.
3. Cut cable ties (x2) from switch assembly.


4. Remove screws (x2) from top and bottom part of switch assembly. Torque 1.4 Nm.
5. Separate top and bottom half of switch assembly.
6. Collect small plastic trim piece and bushing.
7. Remove switch assembly from handlebars.

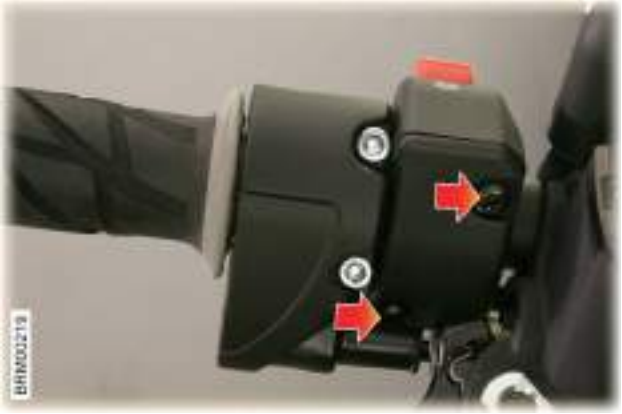
### Installation

1. Installation is the reverse of the removal procedure.

## Switch Assembly (Start/Stop, Mode)

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*
2. Cut cable ties (x2) securing start/stop switch assembly harness to handlebars.
3. Disconnect start/stop switch assembly harness connector.



4. Remove screws (x2) from rear of switch assembly. Torque 1.4 Nm.
5. Remove lower switch bezel.
6. Remove switch assembly from handlebars.

### Installation

1. Installation is the reverse of the removal procedure.

## Throttle

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*
2. Cut cable ties (x2) securing throttle harness to handle bars.
3. Disconnect throttle harness connector.

4. Remove bolt on end of handle bars. Torque 2 Nm.

5. Remove bolts (x2) securing throttle assembly. Torque 4 Nm.


6. Remove throttle clamp.
7. Remove throttle assembly.

**Installation**

1. Installation is the reverse of the removal procedure, except for the following:


2. Align tab of handle grip section with slot in switch while captured in upper throttle housing.

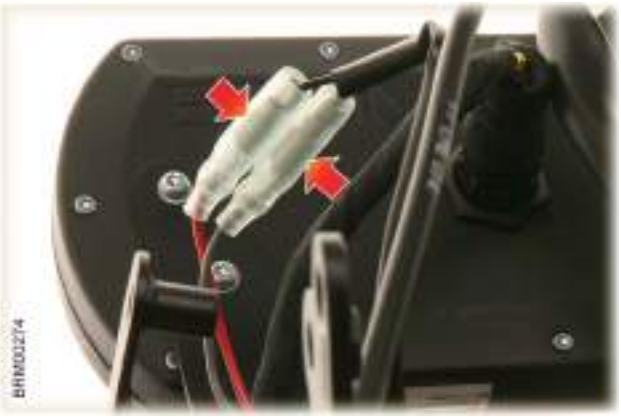

3. Engage throttle spring in upper throttle housing.


4. Throttle spring shown engaged.
5. Slide throttle assembly over handlebars.
6. While installing throttle assembly clamp, align pin on handlebar with hole in clamp.

## Brake Lever Switch

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*
2. Remove brake lever. Refer to *Front Brake Lever, page 70-3.*
3. Cut cable ties (x2) securing brake lever switch harness to handlebars.



4. Disconnect brake lever switch connectors located below instrument cluster.
5. Remove brake lever switch assembly.

### Installation

1. Installation is the reverse of the removal procedure.

## Brake Pedal Switch

**WARNING! Do not clamp brake hoses, as they will be damaged and require replacing.**

**WARNING! Only use new brake fluid from an airtight container. Fluid from open containers or previously bled from the system will have absorbed moisture, which will adversely affect performance and must not be used.**

**WARNING! Brake fluid is highly toxic; keep containers sealed and out of the reach of children. If accidental consumption of fluid is suspected, seek medical attention immediately. If the fluid comes into contact with the skin or eyes, rinse immediately with plenty of water. Brake fluid can damage plastic and painted surfaces. Handle with care, and wipe up spills immediately.**

*CAUTION: Do not operate the brake lever while brake caliper(s) is/are removed or while brake system is disassembled.*

### Remove

1. Remove seat. Refer to *Seat, page 80-7.*
2. Cut cable ties (x2) securing brake switch harness to motorcycle.

3. Disconnect brake switch harness connector located above battery #1.

4. Remove bolts (x2) securing cover to rear brake master cylinder and collect washers. Torque 7.7 Nm.
5. Remove master cylinder cover.

6. Remove switch securing rear brake hose and discard sealing washers (x2). Torque 22.6 Nm.

   *CAUTION: Plug all open connections to prevent ingress of moisture and dirt.*

   *Note: Position a suitable container to contain fluid spillage.*

   *Note: Position absorbent material around affected area to absorb possible fluid spillage.*

   *Note: Replace sealing washers upon installation.*

**Installation**

1. Installation is the reverse of the removal procedure, except for the following:

   *Note: Clean component mating faces prior to installation.*

2. Perform a rear brake bleed after installation. Refer to *Bleed Procedure - Rear, page 70-16.*

## Kickstand Sensor

### Remove

1. Remove tail cover body panel. Refer to *Body Panel - Tail Cover, page 80-7.*

2. Remove bolts (x2) securing kickstand sensor. Torque 2.2 Nm.

3. Disconnect kickstand sensor harness connector.
4. Remove kickstand sensor by routing it out through the top, near cooling fan assembly.

### Installation

1. Installation is the reverse of the removal procedure.

## Gear Selector Sensor

### Remove

1. Raise motorcycle and place on a motorcycle stand or other adjustable support.
2. Drain transmission fluid. Refer to *Transmission Fluid - Drain and Refill, page 50-1.*
3. Remove tail cover body panel. Refer to *Body Panel - Tail Cover, page 80-7.*


4. Remove bolts (x5) securing kickstand assembly. Bolts A Torque 18.4 Nm, Bolt B Torque 41.8 Nm, Bolt C Torque 8.9 Nm, Bolt D Torque 7.7 Nm.
5. Remove kickstand assembly.

6. Disconnect gear selector sensor from harness.


7. Remove bolt securing gear selector sensor to transmission. Torque 8 Nm.
8. Remove gear selector sensor and route it through to the bottom of motorcycle.

### Installation

1. Installation is the reverse of the removal procedure.

## Speed Sensor

### Remove

1. Remove seat assembly. Refer to *Seat, page 80-7.*
2. Cut cable ties (x7) securing the speed sensor harness to the rear brake line and clutch sensor harness.


3. Disconnect speed sensor connector located over battery #1.


4. Remove bolt securing speed sensor to rear brake caliper bracket and collect washer. Torque 7.7 Nm.
5. Remove speed sensor and harness.

### Installation

1. Installation is the reverse of the removal procedure.

## Headlamp Assembly

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*


2. Remove bolts (x2) securing headlamp to mounting brackets and collect washers. Torque 8.1 Nm.


3. Support headlamp and release from mounting brackets.


4. Disconnect harness connector from headlamp assembly.


5. Pull parking lamp bulb holder from headlamp assembly.

⚠ *CAUTION: Do not pull on wiring harness or damage will occur. Pull bulb retainer straight out of housing.*

6. Remove headlamp assembly.

### Installation

1. Installation is the reverse of the removal procedure, except for the following:
2. Check alignment of headlamp beam.

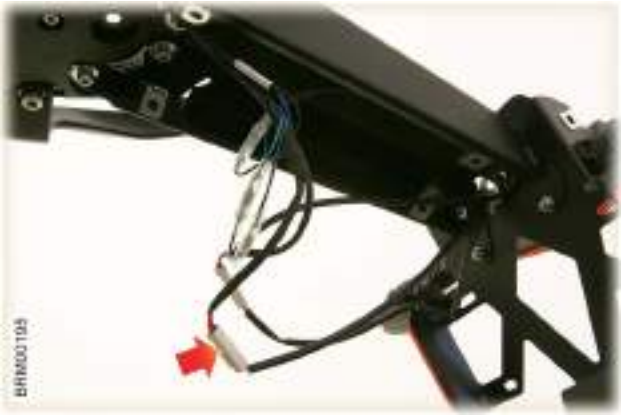
## Tail Lamp Assembly

### Remove


1. Remove bolts (x4) securing the closing panel of the tail lamp assembly and collect washers. Torque 3.4 Nm.

   *Note: Record fitted position of components before removal.*

2. Remove closing panel.




3. Disconnect tail lamp harness connectors (x2).


4. Remove bolts (x2) securing tail lamp cover. Torque 2 Nm.
5. Remove closing panel.


6. Remove bolts (x2) securing tail lamp and collect washers and spacers. Torque 2 Nm.

   *Note: Record fitted position of components before removal.*

7. Remove tail lamp and harness.

### Installation

1. Installation is the reverse of the removal procedure.

## Turn Signal - Front

### Remove

1. Remove headlamp surround. Refer to *Headlamp Surround, page 80-9.*
2. Disconnect connectors (x2) for the turn signal harness.


3. Remove nut securing turn signal to turn signal bracket and slide off end of electrical harness and collect washers. Torque 3 Nm.
4. Remove turn signal and harness from bracket.

### Installation

1. Installation is the reverse of the removal procedure.

## Turn Signal - Rear

### Remove


1. Remove bolts (x4) securing the closing panel of the tail lamp assembly and collect washers. Torque 3.4 Nm.

   *Note: Record fitted position of components before removal.*
2. Remove tail light cover.


3. Disconnect connectors (x2) for the turn signal harness.


4. Remove nut securing turn signal to rear taillight bracket and slide off end of harness and collect washers. Torque 3 Nm.
5. Remove turn signal and harness from rear taillight bracket.

**Installation**

1. Installation is the reverse of the removal procedure.