



## INSTALLATION & OPERATING INSTRUCTIONS

MID DRIVE MOTOR



# EV

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### 1. INTRODUCTION

This manual provides a comprehensive guide for installation, inspection, and verification of Mid Drive Motor systems used in electric two-wheelers (e-bikes, e-scooters, and light electric motorcycles). It covers mechanical mounting, drive-train integration, electrical connections, diagnostic checks, and maintenance practices to ensure safe, efficient, and reliable operation.

#### **⚠ IEC / ISO Safety Notice**

This equipment shall be installed and serviced only by trained and qualified personnel in accordance with applicable international standards, including but not limited to:

IEC 60364 – Low-voltage electrical installations

IEC 60034 – Rotating electrical machines

IEC 60204-1 / ISO 13849 – Safety of machinery & electrical equipment

ISO 12100 – Risk assessment and risk reduction

Failure to follow these instructions may result in electric shock, mechanical injury, fire hazard, or equipment damage.

### 2. TOOLS & MATERIALS REQUIRED

#### **Tools**

Torque wrench

Allen key set

Socket wrench set

Screwdrivers (Phillips & Flat)

Chain tool / belt tension tool (as applicable)

Cable ties

Wire strippers

Crimping tool

Digital/Analog multimeter

Continuity tester (optional)

#### **Materials**

Motor mounting brackets / clamps (OEM supplied)

Fasteners and washers (OEM recommended grade)

Chain or belt (as per drivetrain design)

Insulation sleeves / heat shrink sleeve.

Cable sleeves / spiral wrap

### 3. PRE-INSTALLATION INSPECTION CHECKLIST

#### **Mechanical**

- Motor casing free from cracks, dents, or physical damage
- Mounting brackets undamaged and dimensionally correct
- Frame mounting points properly aligned and free from deformation
- For chain/belt drive:
  - Sprockets free from excessive wear
  - Chain or belt in good condition, without cracks or elongation
- For shaft drive:
  - Coupling, spline, and gear teeth free from wear or damage
  - Shaft seals intact with no signs of leakage
- Adequate clearance available for motor body, shaft, and cable routing

#### **Electrical**

- No cuts or damage on phase cables
- Hall / encoder sensor wires undamaged
- Connectors clean, dry, and locking tabs intact
- Battery voltage within motor-controller rating
- Controller current and power rating compatible with motor

### 4. WINDING CONTINUITY AND INSULATION RESISTANCE (IR) CHECK – SOP

#### **Purpose**

To verify that motor windings are healthy and insulated from the motor body before installation.

#### **Equipment Needed**

- Digital multi-meter with continuity mode

#### **Pin Reference**

Refer to GAD (General Assembly Drawing) for phase identification.

#### **SOP Steps**

##### **Step 1: Safety**

- Ensure motor is disconnected from battery and controller.
- Set multi-meter to continuity mode.

##### **Step 2: Phase-to-Phase Continuity Check**

Check continuity between:

- U ↔ V
- U ↔ W
- V ↔ W

Expected Result: Continuity must be present for all combinations.

**Step 3: Phase-to-Body Insulation Check**

- Place one probe on any phase (U/V/W).
  - Touch the other probe to motor metal casing.
- Expected Result: No continuity.  
Continuity to casing indicates winding-to-ground fault; motor must not be installed.

**Common Faults & Corrective Actions**

Symptom	Likely Cause	Solution
No phase continuity	Broken coil or wire	Repair or replace motor
Continuity to casing	Ground fault	Repair or replace motor

**5. MECHANICAL INSTALLATION**

**⚠ Mechanical Safety Warnings (IEC / ISO Aligned)**

- Mechanical Safety Warnings
- Ensure the vehicle is securely supported before installation to prevent accidental movement.
  - Use only OEM-recommended fasteners and torque values.
  - Keep hands, clothing, and tools clear of rotating drivetrain components.
  - Do not operate the motor without proper guards or covers.
  - Verify correct alignment to prevent abnormal vibration and premature failure.

**Step 1: Motor Mounting**

- Position the mid drive motor on the designated frame mounting points.
- Install mounting brackets and fasteners.
- Tighten fasteners hand-tight initially.
- Align motor output with drivetrain input.
- Torque mounting bolts as per GAD.

**Step 2A: Drive train Integration – Chain/Belt Drive**

- Install chain or belt on motor sprocket/pulley and rear sprocket/pulley.
- Adjust chain/belt tension as per OEM specification.
- Ensure correct sprocket/pulley alignment.
- Check for smooth rotation without binding or abnormal noise.

**Step 2B: Drivetrain Integration – Shaft Drive**

- Install OEM-approved shaft coupling, spline, or gear interface.
- Ensure correct engagement length as specified in GAD.
- Verify axial and angular alignment.
- Tighten coupling fasteners to specified torque.

- Apply locking method if specified.
- Verify lubrication level (gear oil/grease).
- Rotate shaft manually to confirm smooth operation.

**6. ELECTRICAL INSTALLATION**

**⚠ Electrical Safety Warnings (IEC 60364 / IEC 60204-1)**

- Disconnect the battery and all power sources before making or altering any electrical connections.
- Never connect or disconnect phase or sensor connectors under load.
- Ensure proper earthing/grounding of metallic motor and controller housings where required.
- Use insulated tools and PPE rated for the system voltage.
- Do not operate the motor if insulation resistance or continuity tests fail.
- Power & Phase Connections
  - Connect motor phase cables (U/V/W) to controller as per color coding in GAD.
  - Ensure connectors are fully seated and locked.
- Low Voltage & Signal Connections
  - Connect Hall sensor / encoder connector as per pin-out in GAD.
- Cable Management
  - Route cables away from chain, sprockets, and rotating parts.
  - Avoid sharp bends and hot surfaces.
  - Secure cables using sleeves and zip ties.

**7. SENSOR & SIGNAL CONNECTIONS SOP**

**⚠ Functional Safety Warning (ISO 13849)**

- Incorrect sensor wiring may lead to uncontrolled motor operation, sudden torque output, or loss of braking assistance. Always verify correct sensor feedback before road operation.

**Purpose**

To ensure correct sensor feedback for smooth torque delivery, speed control, and motor protection.

**SOP Steps**

1. Switch OFF battery and controller power.
2. Inspect all sensor connectors for bent or loose pins.
3. Match connector keying and connect securely.
4. Power ON system and verify controller fault indicators.
5. Run motor at no-load and observe smooth rotation.

**Common Issues & Fixes**

Issue	Possible Cause	Solution
Motor jerks or vibrates	Sensor mismatch	Verify pin-out and wiring
No motor response	Sensor power missing	Check LV supply and ground
Overheating on rated load	Temperature sensor fault	Verify sensor continuity

**8. MAINTENANCE**

**Maintenance**

- Check mounting and coupling bolt torque every 1,000 km
- Inspect chain/belt for wear, alignment, and correct tension (if applicable)
- Inspect shaft drive for seal condition, lubrication level, and abnormal noise (if applicable)
- Verify condition of electrical connectors and cable insulation

**Cleaning**

- Clean motor exterior using dry cloth
- Do not spray high-pressure water directly on motor or connectors

**Storage**

- Store vehicle in dry environment
- Avoid prolonged exposure to moisture or extreme temperatures

**9. TECHNICAL SPECIFICATIONS**

As per GAD

**10. SINGLE LINE DIAGRAMS (SLD)**

The Single Line Diagram illustrates electrical interconnections between:

- Battery pack
- Motor controller
- Mid drive motor (phase connections)
- Sensors (Hall / encoder / temperature)
- Throttle, brake cut-off, display, and BMS

Refer to approved SLD drawings for exact wiring and connector details as per motor model.