



INSTALLATION, OPERATION & MAINTENANCE MANUAL

Low Voltage Electric Motors

HM Series (Cast Iron IE3) | SM3 Series (Aluminium IE3) | SPM Series (Single Phase)

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1. Introduction

This manual has been prepared by Electromote (Pty) Ltd to provide comprehensive guidance for the safe installation, commissioning, operation, and maintenance of the Electromote Low Voltage (LV) range of IEC electric motors.

Electromote specialises in the supply, modification, integration, and support of electric motors and drive solutions for industrial, mining, agricultural, and commercial applications across Southern Africa. All motors in this manual comply with IEC 60034 and are certified to a minimum IE3 Premium Efficiency classification per IEC 60034-30-1.

1.1 Motor Ranges Covered by this Manual

Electromote supplies the following LV motor ranges. All ranges meet a minimum IE3 efficiency classification. IE1 motors are no longer supplied as standard.

Range	Series	Frame	Power Range	Efficiency Class	Phase	Application
HM	HM3 / HM4	Cast Iron IEC 80–400	0.75 kW – 500 kW (std stock)	IE3 ex stock; IE4 & IE5 on request	3-Phase	Heavy industrial, mining, general purpose. Voltage: 400V, 550V, 690V, 1000V
SM	SM3	Aluminium IEC 63–160	0.09 kW – 15 kW	IE3 ex stock; IE4 & IE5 on request	3-Phase	Light industrial, food industry, HVAC, pumps. Voltage: 400V, 550V, 690V, 1000V
SPM	SPM	Aluminium IEC 63–100	0.25 kW – 3 kW	N/A – Single phase	1-Phase	Single phase – domestic, commercial, agriculture. 220V supply

* The HM4 series (IE4) and IE5 variants are available on special order. Ex-stock standard supply is IE3 for all three-phase ranges. IE efficiency classes do not apply to single-phase motors per IEC 60034-30-1.

1.2 Certification & Compliance

Electromote LV motors are designed and tested in accordance with the following standards and certification bodies:

- IEC 60034 series – International Standard for rotating electrical machines
- SANS 60034 series – South African adoption of IEC 60034
- IEC 60034-30-1 – IE3 Premium Efficiency classification (minimum standard for all three-phase motors)

- Explolabs Mark Scheme – South African independent testing and certification body. The HM3/4 and SM3 ranges carry the Explolabs Mark Scheme certification under SANS1804-1/2 and IEC 60034-2-1.

NOTE: The Explolabs Mark Scheme certification applies to both the HM3/4 and SM3 standard ranges, not only to Ex-rated/hazardous area variants. Contact Electromote for the Explolabs certificate numbers applicable to specific motor models.

1.3 How to Use This Manual

This manual follows the motor lifecycle from receipt through installation, commissioning, operation, maintenance, and decommissioning. Section 2 – Safety Information must be read and understood in full before any installation or maintenance activity commences.

2. Safety Information

⚠ WARNING: Electric motors contain hazardous voltages and rotating mechanical parts. Death or serious injury may result from incorrect installation, operation, or maintenance. Only trained and authorised personnel may work on this equipment.

2.1 General Safety Rules

- Only trained, competent, and authorised personnel may install, operate, or maintain electric motors.
- Isolate, lock out, and tag ALL electrical supplies before commencing any work on the motor or driven equipment (LOTO procedures must be followed at all times).
- Verify zero voltage using approved test equipment before touching any electrical components.
- Ensure all rotating parts have come to a complete stop before gaining access.
- Do not defeat, bypass, or remove any safety guards, covers, or interlocks.
- Wear appropriate Personal Protective Equipment (PPE) including arc-rated PPE where required by site standards.

2.2 Mechanical Safety

- Always use approved lifting equipment rated for the motor mass – refer to nameplate for motor weight.
- Use designated lifting lugs or eyebolts only. Never lift by the shaft, terminal box, fan cover, or conduit entries.
- Never work beneath a suspended load.
- Ensure all shaft guards and coupling covers are fitted before energising the motor.
- Confirm the driven equipment (pump, fan, gearbox) direction of rotation before coupling.

2.3 Electrical Safety

- Verify that supply voltage, frequency, and connection method match the motor nameplate before energising.
- Apply the correct connection (star or delta) based on motor power rating and supply voltage – refer to Section 7 for the revised connection rules.
- Ensure correct motor protection (overload relay, thermistor, circuit breaker) is installed and correctly set before operation.
- Earth the motor frame securely in accordance with SANS 10142-1 and applicable site regulations.
- Do not exceed the rated number of starts per hour – refer to Section 9.2.

⚠ WARNING: Failure to adhere to safety requirements may result in death, serious injury, equipment damage, fire, or voiding of warranty. Electromote accepts no liability for incidents arising from non-compliance with this manual.

3. Motor Range & Technical Specifications

All Electromote LV motors are squirrel-cage induction motors conforming to the IEC 60034 series of standards and meet IE3 Premium Efficiency classification per IEC 60034-30-1 as a minimum requirement.

3.1 HM3/4 Series – Cast Iron Motors

3.1.1 General Description

The HM3/4 series (HM3 = IE3, HM4 = IE4) are TEFC (Totally Enclosed Fan Cooled) heavy-duty cast iron frame induction motors covering IEC frame sizes 80 to 400, in the power range 0.75 kW to 500 kW as standard stock. Designed and built for the most demanding mining and industrial environments, including above and underground applications. IE3 is ex-stock standard; IE4 and IE5 are available on special request. Frame 400 and above, and outputs above 500 kW, are available on special order – contact Electromote.

- Frame material: Heavy-duty cast iron
- Standard colour: RAL 7021 Dark Grey (other colours available on request)
- Enclosure: IP66 – dust tight and water jet resistant (IEC 60034-5 / SANS 60034-5)
- Efficiency class: IE3 ex stock; IE4 & IE5 available on request
- Insulation Class: H (180°C) with temperature rise limited to Class F (≤80 K under normal conditions)
- Cooling method: TEFC – IC411. Vibro Lube automatic lubrication system fitted from Frame 160 upward
- Mounting: IMB3 (foot mount) standard; IMB5 / IMB14 flange and combination mounts available
- Poles available: 2, 4, 6, 8, 10 pole
- Voltage options: 400 V, 550 V, 690 V, 1000 V (confirm voltage on nameplate before connection – see Section 7.2)
- Thermistors: Fitted as standard in frame 160 and above
- Bearings: Ball, roller, or sleeve depending on frame size and application. Frame 71–132: sealed for life ball bearings. Frame 160 and above: open regreasable bearings with Vibro Lube grease nipple system
- Compliance: IE3 SANS1804-1/2 & IEC 60034-2-1 with Explolabs Mark Scheme

- Warranty: 5 years from commissioning (6 years from delivery)

NOTE: Full technical data for all HM3T (IE3) configurations – rated current, speed, efficiency, power factor, and mass for 2-pole, 4-pole, 6-pole, 8-pole, and 10-pole variants – is provided in the Electromote HM Series Motor Catalogue. Data sheets can be downloaded at www.electromote.co.za or requested directly from Electromote.

3.2 SM3 Series – Aluminium Motors (IE3 Premium Efficiency)

3.2.1 General Description

The SM3 series motors are lightweight, TEFC raw aluminium frame induction motors covering IEC frame sizes 63 to 160 in the power range 0.09 kW to 15 kW. IE3 Premium Efficiency classification. The aluminium frame offers excellent heat dissipation and reduced weight, making these motors ideal for light industrial, commercial, HVAC, and pump applications. Voltage options: 400 V, 550 V, 690 V, 1000 V.

- Frame material: Raw Aluminium
- Standard colour: Natural anodised aluminium (other colours available on request)
- Enclosure: IP55 standard; IP66 available on request
- Efficiency class: IE3 Premium per IEC 60034-30-1; IE4 & IE5 available on request
- Insulation Class: F (155°C), temperature rise limited to Class B (≤80 K)
- Cooling method: IC411 – External surface cooling with fan
- Mounting: IMB3 foot mount standard; IMB5 flange and IMB35 combination (pad mount) available
- Poles available: 2, 4, 6, 8 pole
- Bearings: Frame 71–132: sealed for life ball bearings (no regrease). Frame 160: open regreasable bearings with Vibro Lube grease nipple system
- Compliance: IE3 SANS1804-1/2 & IEC 60034-2-1 with Explolabs Mark Scheme

NOTE: Full technical data for all SM3 IE3 configurations is provided in the Electromote SM3 product data sheet. Data sheets can be downloaded at www.electromote.co.za or requested directly from Electromote.

3.3 SPM Series – Single Phase Aluminium Motors

3.3.1 General Description

The SPM series comprises single-phase, capacitor-start / capacitor-run TEFC raw aluminium frame motors in IEC frame sizes 63 to 100, covering 0.25 kW to 3 kW. Designed for applications where only a single-phase 220–240 V supply is available.

- Frame material: Raw Aluminium
- Poles available: 2 pole and 4 pole
- Enclosure: IP55 as standard
- Insulation Class: F, temperature rise Class B
- Bearings: Sealed for life (no regrease points)
- Capacitor type: Capacitor-start / capacitor-run for high starting torque
- Thermal protector: Auto-reset PTC thermistor as standard

NOTE: Full technical data for all SPM single-phase motor configurations is provided in the Electromote SPM product data sheet. Data sheets can be downloaded at www.electromote.co.za or requested directly from Electromote.

4. Motor Identification

4.1 Nameplate Information

Every Electromote motor is fitted with a stainless steel nameplate. If the nameplate becomes damaged or illegible, contact Electromote for a replacement before operating the motor.

Nameplate Item	Description
Model / Type	Motor series and frame designation (e.g. HM3T-160M-4, SM3-100L-4, SPM-80-2)
Rated Output (kW)	Mechanical output power at motor shaft under rated conditions
Rated Voltage (V)	Supply voltage and connection (e.g. 380–420V Δ / 660–725V Y; 550V Δ / 950V Y [HM3T]; or 220–240V 1Ph [SPM])
Rated Current (A)	Full load current at rated voltage and output
Rated Frequency (Hz)	Supply frequency (50 Hz standard for South Africa)
Rated Speed (rpm)	Synchronous speed minus rated slip at full load
Connection	Star (Y) or Delta (Δ) at rated voltage – see Section 7 for rules
Insulation Class	Thermal class of winding insulation (F or H)
Duty / Service	Operating duty cycle (S1 = continuous as standard)
IP Rating	Ingress protection (IP55 or IP66)
Frame Size	IEC frame designation (e.g. 160M)
Efficiency Class	IE3 for 3-phase motors per IEC 60034-30-1
Mass (kg)	Motor weight for lifting and structural design purposes
Serial Number	Unique manufacturing ID for warranty and traceability

4.2 Motor Model Code

Example: HM3T - 160M - 4 - B3 - IE3

HM3T = Series | 160M = IEC Frame | 4 = Number of Poles | B3 = Mounting | IE3 = Efficiency Class

5. Storage & Handling

5.1 Receipt Inspection

Upon receipt, immediately inspect for transit damage. Verify that model, frame, voltage, power, and mounting match the order. Report damage or discrepancy to the carrier and Electromote within 48 hours. Do not install a damaged motor, contact Electromote immediately.

5.2 Storage Requirements

- Store in a clean, dry, ventilated, vibration-free environment.
- Maintain ambient storage temperature between 5°C and 40°C with relative humidity below 80% (non-condensing).
- Retain original packaging until ready for installation.
- Rotate shaft manually through at least 10 full revolutions every month to prevent bearing false brinelling.
- For storage exceeding 6 months, measure and record insulation resistance (IR) before commissioning.
- For storage exceeding 12 months: replace sealed-for-life bearings on frame 71–132 motors before commissioning [HM3T, SM3, SPM]. Regrease open bearings on frame 160+ motors with fresh grease [HM3T].
- Where fitted, energise space heaters during storage in high-humidity environments.

5.3 Lifting & Handling

⚠ WARNING: Use only designated lifting lugs or eyebolts. Never lift by the shaft, terminal box, fan cover, or cable entries. Ensure lifting gear is rated for the motor mass shown on the nameplate.

- Inspect lifting lugs and eyebolts for damage before each use.
- HM series frame 315 and above: use a spreader bar to prevent angular loading on lifting lugs.
- Lower motors gently onto mounting surfaces.
- Protect shaft extensions with grease or VCI wrap during storage and transport.

6. Mechanical Installation

6.1 Foundation & Mounting Surface

A rigid, level, and vibration-free foundation is essential. Flexible or resonant structures cause premature bearing and coupling failure.

- Foundation must support at least three times the motor mass.
- Use precision-machined steel pads or shims to achieve correct height and levelling.
- Tighten mounting bolts to specified torque – refer to Appendix B.

- Correct all 'soft foot' before final tightening (all four feet must contact the base simultaneously).
- Motors mounted in a vertical shaft-down (IM V1) position must be fitted with a rain canopy over the cooling fan inlet.

6.2 Shaft Alignment

Misalignment is one of the leading causes of premature bearing, seal, and coupling failure.

- Use dial indicators or laser alignment equipment for all final alignments.
- Check and correct both angular and parallel (offset) misalignment.
- Re-check alignment after final tightening of all mounting bolts.
- Re-check alignment after the first 24–48 hours of loaded operation (thermal growth).

NOTE: For HM3T motors frame 315 and above, perform a hot alignment check after reaching steady-state operating temperature.

6.3 Coupling & Drive Arrangements

- Direct flexible coupling is preferred for most applications.
- Belt/pulley drives: set belt tension to manufacturer's specification – excess tension reduces bearing life.
- [SPM Series] – Single phase motors must not be coupled to driven equipment with high inertia loads without confirmation from Electromote.

6.4 Ventilation & Cooling Clearances

- Maintain minimum clearance of one fan cover diameter between motor fan inlet and adjacent structures.
- Ensure cooling air inlets and outlets are free from obstruction at all times.
- For IMV1 (vertical shaft-down) installations: fit the supplied rain cover.

Frame Size	Minimum Cooling Air Clearance
71 – 100	15 mm
112 – 132	30 mm
160 – 180	40 mm
200 – 280	50 mm
315 – 355	65 mm
400 and above	80 mm

7. Electrical Installation

7.1 Terminal Identification

Standard IEC three-phase motors are fitted with six terminals in the terminal box:

U1	V1	W1
U2	V2	W2

7.2 Connection Method – Three-Phase Motors (HM3T & SM3)

The table below covers all standard Electromote LV motor voltage configurations. Rows marked [HM3T only] apply exclusively to the cast iron HM3T range.

Motor Output	Supply Voltage	Connection	Winding Voltage	Motor Series	Application Note
3 kW and below	380 – 415 V (3-phase)	Star (Y)	220 V per phase	HM3T, SM3	Standard SA LV supply
3 kW and below	200 – 240 V (3-phase)	Delta (Δ)	200–240 V per phase	HM3T, SM3	Low-voltage 3-phase supply
4 kW and above	380 – 415 V (3-phase)	Delta (Δ)	380–415 V per phase	HM3T, SM3	Standard SA LV supply – full rated torque
4 kW and above	660 – 690 V (3-phase)	Star (Y)	380–400 V per phase	HM3T, SM3	HV-LV supply or star-delta starting
All HM3T ratings	550 V (3-phase)	Delta (Δ)	550 V per phase	HM3T only	Medium-voltage LV supply – check nameplate for 550VΔ/950Y marking
All HM3T ratings	950 V (3-phase)	Star (Y)	550 V per phase	HM3T only	950V supply or star-delta starting on 550VΔ/950Y rated motors
All ratings	950 V – 1 000 V (3-phase)	Star (Y)	548–577 V per phase	HM3T only	950V Y is the standard connection for HM3T 550VΔ/950Y motors. This same Star (Y) configuration is used for 1000V supplies. Confirm nameplate shows 550VΔ/950Y before connection.

⚠ WARNING: CRITICAL: Applying the wrong connection (star when delta is required, or vice versa) will result in either under-voltage (reduced torque and overheating) or over-voltage (immediate winding failure). Always verify the motor rated voltage on the nameplate AND the available site supply voltage before making connections. When in doubt, contact Electromote before energising.

7.2.1 Star (Y) Connection

Method: Link U2, V2, and W2 together (short-circuit the three second terminals). Connect L1 → U1, L2 → V1, L3 → W1.

- Used for: motors 3 kW and below on 380–415 V supply (HM3T, SM3).
- Used for: motors 4 kW and above on 660–690 V supply (HM3T, SM3).
- Used for: HM3T motors on 950 V supply (nameplate marked 550V Δ / 950V Y).

- Reduces winding voltage by factor of $1/\sqrt{3}$ relative to line voltage.
- Also used as the starting connection for star-delta (Y/Δ) reduced-voltage starting.

7.2.2 Delta (Δ) Connection

Method: Link U1–W2, V1–U2, W1–V2 (end-to-end). Connect L1 → U1, L2 → V1, L3 → W1.

- Used for: motors 4 kW and above on 380–415 V supply (HM3T, SM3) – standard operating connection.
- Used for: motors 3 kW and below on 200–240 V three-phase supply (HM3T, SM3).
- Used for: HM3T motors on 550 V supply (nameplate marked 550V Δ / 950V Y).
- Full line voltage is applied across each winding – provides full rated torque.

7.2.3 HM3T Dual Voltage Rating: 550V Δ / 950V Y

The HM3T series is available in a 550V Delta / 950V Star dual voltage configuration in addition to the standard 380V Δ / 660V Y rating. This variant is used where medium-voltage three-phase supplies of 550 V or 950 V are present, as commonly found in certain South African mining and industrial installations.

- Nameplate identification: The nameplate will show '550V Δ / 950V Y' or '550/950V'. Motors with standard 380/660V rating will NOT have this marking – do not interchange.
- On a 550 V supply: connect in Delta (Δ). Winding voltage = 550 V per phase.
- On a 950 V supply: connect in Star (Y). Winding voltage = 550 V per phase (line voltage / $\sqrt{3} \approx 548$ V).
- The winding insulation is designed for 550 V per phase in both configurations.
- Star-delta (Y/Δ) starting is applicable on 550V Δ / 950V Y motors connected to a 950 V supply, transferring from star (Y) to delta (Δ) at run speed.
- 1 000 V Star (Y) connection: HM3T motors can also be manufactured for direct connection to a 1 000 V (1 kV) three-phase supply. On a 1 000 V supply, the motor must be connected in Star (Y) configuration only – Delta connection is NOT permitted at this voltage. This is consistent with the HM series winding capability of 220 V to 1 100 V per the Electromote HM Series Catalogue. Motors wound for 1 000 V Star (Y) will be identified on the nameplate as '1000V Y'. Confirm voltage marking on nameplate before connection.

⚠ WARNING: Do NOT connect a 550V Δ/950V Y-rated motor to a standard 380–415V or 660–690V supply without confirmation from Electromote. Incorrect supply voltage will cause immediate winding damage. Always verify nameplate voltage markings before connection.

NOTE: Star-Delta starting summary: For 380–415V delta-connected motors (4 kW+) and for 950V star-connected motors (550/950V rating), star-delta starting reduces starting current to approximately 1/3 of DOL. Transfer from star to delta should occur at 70–80% of rated speed to minimise transfer current transients.

NOTE: Motors connected 690V Y through a VSD – require an additional first turn insulation.

7.3 Direction of Rotation

- Direction of rotation is determined by the phase sequence of the supply.

- To reverse rotation, interchange any two of the three supply phases (e.g. swap L1 and L2 at the motor terminals).
- Always perform a 'bump test' (momentary energisation uncoupled) to verify correct rotation before coupling to driven equipment.
- Electromote accepts no liability for damage to driven equipment caused by incorrect rotation direction.

7.4 Earthing Requirements

- The motor frame **MUST** be effectively earthed before energising.
- Connect earth conductor to the internal earth stud in the terminal box **AND** to the external earth lug on the motor frame.
- Earth conductor cross-section must comply with SANS 10142-1.
- Verify earth continuity with a calibrated earth tester before energising.

7.5 Terminal Box Sealing & IP Rating Maintenance

- HM3T: IP66 standard – use IP66-rated cable glands of correct size.
- Ensure cable gland is sealed after installation.
- SM3 / SPM: IP55 standard – use IP55-rated cable glands of correct size (IP66 available on request).
- Seal all unused cable entries with approved IP-rated blanking plugs of the correct thread size.
- Ensure terminal box gasket is clean, undamaged, and correctly seated before closing.
- Tighten terminal box cover bolts evenly to correct torque for uniform gasket compression.
- Where top cable entry is unavoidable, form a drip loop to prevent water tracking into the gland.

7.6 Terminal & Gland Tightening Torques

Terminal Stud Size	Tightening Torque (Nm)
M4	2.0–2.5
M5	3.5–4.5
M6	6.0–7.0
M8	15–18
M10	30–35
M12	40–50

Cable Gland Size	Tightening Torque (Nm)
M20	8–12
M25	15–20
M32	25–30
M40	35–45
M50	50–60

7.7 Variable Speed Drive (VSD) Application [HM3T & SM3]

Both the HM3T and SM3 ranges are suitable for VSD operation when the following guidelines are observed:

- Use a dV/dt or sine wave output filter on cable runs exceeding 100 m.
- For HM3T and SM3 frame 250 and above: insulated NDE bearings are recommended to prevent bearing current damage from VSD-induced shaft voltages. Earth rings or insulated NDE endshields are also advised on these frame sizes.
- Maximum frequency: 60 Hz (consult Electromote for higher speeds).
- Minimum frequency: 25 Hz for standard TEFC cooling. Below 25 Hz, forced external cooling must be provided.
- VSD carrier frequency: 2–6 kHz recommended.
- Use screened/armoured motor cable with screen bonded at both ends.

NOTE: SPM series single-phase motors must NOT be connected to a VSD. Capacitor-type single-phase motors are incompatible with VSD operation.

8. Pre-Commissioning Checks

8.1 Mechanical Pre-Commissioning Checklist

#	Check Item	Status
1	Motor foundation bolts tightened to specified torque	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
2	Soft foot corrected and re-checked	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
3	Shaft alignment within tolerance – angular and parallel	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
4	Coupling / belt drive correctly fitted and torqued	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
5	Shaft rotates freely by hand – no rubbing or binding	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
6	Shaft guard / coupling cover fitted	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
7	Cooling air clearances verified per Section 6.4	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
8	For IM V1 mounted motors – rain canopy fitted	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail

8.2 Electrical Pre-Commissioning Checklist

#	Check Item	Status
1	Supply voltage and frequency match nameplate	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
2	Correct connection (star or delta) applied per Section 7.2 table	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
3	All terminal connections tightened to specified torque	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
4	Cable glands tightened and sealed; unused entries blanked	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail

#	Check Item	Status
5	Terminal box gasket correctly seated; lid torqued down	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
6	Motor frame earthed – earth continuity verified	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
7	Insulation resistance measured and recorded (minimum 1 MΩ)	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
8	Overcurrent / overload protection installed and set correctly	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail
9	Thermistor circuit connected to protection relay [frame 160+ HM3T & SM3]	<input type="checkbox"/> Pass / <input type="checkbox"/> Fail

8.3 Insulation Resistance (IR) Testing

Motor Voltage	Test Voltage (DC)	Minimum Acceptable IR	Preferred IR (New Motor)
LV ≤ 1 kV (all ranges)	500 V DC	≥ 1 MΩ	> 10 MΩ

- Disconnect thermistors and embedded sensors before IR testing.
- Record IR reading, ambient temperature, and humidity. Correct values to 40°C if required.
- If IR is below 1 MΩ, investigate and dry out winding before energising.

9. Commissioning

9.1 Initial Start-Up Procedure

1. Confirm all pre-commissioning checks (Section 8) complete and signed off.
2. Perform a bump test – momentarily energise motor uncoupled and verify correct rotation. Stop immediately.
3. If rotation is incorrect, isolate supply and swap any two supply phases at the motor terminals.
4. Run motor uncoupled for 5–10 minutes. Monitor for abnormal noise, vibration, or heat.
5. Record no-load current on all three phases (should be balanced within 5%).
6. Couple to driven equipment and perform loaded start.
7. Monitor full-load current, voltage, temperature, and vibration for the first hour of loaded operation.
8. Record baseline readings and compare against nameplate values.

9.2 Starting Methods & Maximum Permissible Starts

Starting Method	Starting Current	Starting Torque	Applicable Motor Size
Direct-On-Line (DOL)	600–800% FLC	100–200% rated	All sizes
Star-Delta (Y/Δ)	~200–267% FLC (star)	~33% rated (star)	4 kW+ delta-connected motors

Starting Method	Starting Current	Starting Torque	Applicable Motor Size
Soft-Starter	150–400% FLC (adj.)	Adjustable	All sizes
VSD (Frequency Inverter)	100–150% FLC	Full torque at low speed	HM3T & SM3 (not SPM)

Maximum consecutive cold starts (DOL): 2 starts in rapid succession, followed by minimum 30-minute cooling period. Consult Electromote for specific limits by frame size and motor rating.

9.3 Baseline Measurements to Record

- Supply voltage – all three phases, line-to-line
- Full-load current – all three phases
- Motor frame temperature at DE and NDE bearing housings
- Vibration velocity overall – measured at DE and NDE
- Insulation resistance (pre-start)
- Ambient temperature at commissioning
- Shaft alignment data (as-aligned values)

10. Operation Guidelines

10.1 Normal Operating Conditions

- Ambient temperature: -20°C to +40°C standard (motors for higher ambients available on request).
- Altitude: Up to 1 000 m without derating. Note: Johannesburg is approximately 1 750 m – derating may apply. Consult Electromote.
- Humidity: Up to 80% relative humidity non-condensing for IP55; IP66 motors tolerate condensing environments when correctly installed.
- Supply voltage: Within $\pm 10\%$ of rated voltage.
- Supply frequency: Within $\pm 5\%$ of rated frequency (50 Hz).
- Phase voltage imbalance: Must not exceed 1%.

10.2 Altitude Derating

Altitude (m above sea level)	Approximate Derating Factor
$\leq 1\ 000$ m	1.00 (no derating)
1 000 – 2 000 m	0.97
2 000 – 3 000 m	0.94
3 000 – 4 000 m	0.91

10.3 Operating Restrictions

- Do not operate continuously above rated current (full-load amps on nameplate).
- Do not exceed maximum permissible starts per hour.
- Shut down immediately if abnormal vibration, noise, or smell is detected – investigate before restarting.
- Do not operate without all guards and covers in place.
- [SPM Series] – If the motor fails to start within 3 seconds, isolate supply immediately to prevent winding damage from locked-rotor current.

11. Maintenance

11.1 Routine Maintenance Schedule

Interval	Activity	Applies To
Daily / Weekly	Visual inspection – abnormal noise, vibration, smoke, smell, leaks. Check cooling air inlets are clear.	All
Monthly	Clean external motor surfaces and cooling fins. Inspect cable glands and terminal box for damage.	All
3 – 6 Monthly	Measure and record insulation resistance. Compare to baseline trend. Re-torque electrical terminals if required.	All
6 – 12 Monthly	Check and re-verify shaft alignment. Inspect coupling for wear. Regrease bearings per schedule for frame 160+ HM3T motors. Check thermistor circuit (frame 160+).	HM3T frame 160+
Annually	Full inspection: terminal box, seals, gaskets. Bearing condition assessment. Review IR and vibration trends.	All
Per bearing life or 5-yearly	Replace sealed-for-life bearings on frame 71–132 motors at end of L10 bearing life or at major overhaul.	All frame 71–132

11.2 Bearings & Lubrication

11.2.1 Bearing Type by Frame Size

IEC Frame Range	Bearing Type	Regreasable?	Motor Series
71 – 132	Deep groove ball – sealed for life	NO – replace at overhaul	HM3T, SM3, SPM
160	Deep groove ball – open, with Vibro Lube grease nipples	YES – regrease per schedule	HM3T, SM3 (Frame 160 only)
180 and above	Deep groove ball – open, with Vibro Lube grease nipples	YES – regrease per schedule	HM3T only
315 and above	Roller bearing (NDE) – open, with grease nipples	YES – regrease per schedule	HM3T only

⚠ WARNING: Do NOT attempt to inject grease into sealed-for-life bearings (frames 71–132). These bearings have no grease relief port. Forcing grease will cause bearing damage and premature failure. Replace sealed bearings at the recommended overhaul interval.

11.2.2 Greasing Schedule – HM3T Frame 160 and Above

NOTE: The regreasing interval and grease quantity for each motor are printed on a label affixed to the fan cowl (refer to the fan cowl label on the specific motor in service – it takes precedence). The schedule below is reproduced from the standard HM Series fan cowl label.

Frame	Amount (g)	2 Pole (hrs)	4 Pole (hrs)	6 Pole (hrs)	8–10 Pole (hrs)	Bearing DE	Bearing NDE
160	20	2 000	5 400	6 900	7 800	6309C3	6309C3
180	20	2 000	5 400	6 900	7 800	6311C3	6311C3
200	25	1 500	5 000	6 500	7 000	6312C3	6312C3
225	25	1 500	5 000	6 500	7 000	6313C3	6313C3
250	35	1 000	4 500	6 300	6 800	6314C3	6314C3
280 (2P)	35	1 000	4 500	6 300	6 800	6314C3	6314C3
280 (4–10P)	35	1 000	4 500	6 300	6 800	6317C3	6317C3
315 (2P)	50	1 000	3 800	6 000	6 500	6317C3	6317C3
315 (4–10P)	50	1 000	3 800	6 000	6 500	Nu319	6319C3
355 (2P)	60	1 000	3 200	5 500	6 000	6319C3	6319C3
355 (4–10P)	60	1 000	3 200	5 500	6 000	Nu322	6322C3

- Recommended grease: Lithium-based, NLGI Grade 2, –20°C to +120°C (e.g. Shell Alvania R2, Mobil Polyrex EM, or equivalent).
- Do NOT mix grease types – flush old grease completely if changing grease specification.
- Purge old grease through the grease relief plug when regreasing.
- Do NOT over-grease – excess grease causes churning, overheating, and early bearing failure.

11.2.3 Bearing Operating Limits

- Normal bearing housing temperature: up to 70°C above ambient, not exceeding 90°C absolute.

- Vibration velocity RMS limits (IEC 60034-14 Class A): ≤ 2.8 mm/s for frame 56–132; ≤ 4.5 mm/s for frame 160 and above.
- Replace bearings immediately on detection of abnormal noise, excessive temperature, or vibration above limits.

11.3 Electrical Maintenance

- Inspect terminals for discoloration, corrosion, or looseness at every annual service. Re-torque as required.
- Trend insulation resistance (IR) readings over time. Declining trend indicates winding deterioration.
- Measure winding resistance phase-to-phase and compare – imbalance greater than 5% indicates a possible winding fault.
- Inspect terminal box gasket and cable glands for deterioration or loss of sealing integrity. Replace if defective.
- Verify thermistor circuit continuity and trip function annually on motors frame 160 and above [HM3T, SM3].

11.4 SPM Series Specific Maintenance

- Inspect run and start capacitors for swelling, leakage, or physical damage. Replace immediately if suspect.
- Test capacitor capacitance against nameplate value (tolerance typically ±5–10% for run capacitors).
- Auto-reset thermal protectors will cycle on over-temperature. Repeated cycling indicates a fault – investigate before restarting.

12. Troubleshooting

Symptom	Possible Cause(s)	Corrective Action
Motor fails to start	No supply; protection tripped; phase failure; VSD fault; mechanical lock	Check supply, fuses, contactors. Reset protection. Check for mechanical obstruction. Verify phase continuity.
Motor hums but does not rotate [SPM]	Faulty start capacitor; failed centrifugal switch; load too high	Test and replace start capacitor. Check centrifugal switch. Reduce load inertia.
Running current high on all phases	Motor overloaded; low supply voltage; excessive belt tension; bearing failure	Measure actual load vs. nameplate. Check supply voltage. Inspect coupling and bearings.
Current high on one phase only	Single-phasing; winding fault	Check all three supply phases. Measure winding resistance phase-to-phase. Contact Electromote if winding fault suspected.
Motor overheating	Overload; blocked cooling; excessive ambient; incorrect duty; phase imbalance	Reduce load to within nameplate. Clean cooling fins. Verify duty. Check phase balance.

Symptom	Possible Cause(s)	Corrective Action
Excessive vibration	Misalignment; unbalanced coupling; worn bearings; resonance; soft foot	Laser alignment. Balance coupling. Inspect/replace bearings. Check foundation.
Abnormal bearing noise [sealed bearing, frame 71–132]	End of bearing life; contamination during installation; overload	Replace bearing – do not attempt to regrease sealed bearing.
Abnormal bearing noise [regreasable, frame 160+]	Insufficient grease; contaminated grease; excessive load; alignment	Regrease per schedule. Check alignment. Inspect bearing. Replace if damaged.
Motor trips on thermal overload	Genuine overload; incorrect overload setting; high ambient; supply imbalance	Verify FLA vs. nameplate. Confirm overload setting. Check ambient and phase balance.
Water in terminal box	Damaged gland seal; cracked gasket; top cable entry without drip loop	Replace seals and gaskets. Re-seal terminal box. Form drip loop. Dry out winding and retest IR.
Motor runs slow / low torque on 380–415V supply, 4kW+	Motor left in star when delta connection is required	Isolate. Reconfigure to delta connection per Section 7.2 table.
Motor overheats / trips immediately on 550V supply [HM3T]	Motor connected in star instead of delta on 550V supply (over-voltage per winding); or standard 380/660V motor connected to 550V supply	Isolate immediately. Verify nameplate shows 550VΔ/950Y. Reconfigure to delta. If nameplate shows 380Δ/660Y, motor is wrong specification – contact Electromote.

13. Failure Analysis & Warranty Assessment

Failure Type	Typical Root Cause(s)	Warranty Position	IEC / SANS Ref.
Insulation breakdown	Moisture, contamination, thermal ageing, voltage spikes, single-phasing	Not covered if due to installation, environment, or supply	IEC 60034-1
Bearing failure – sealed [frame 71–132]	Contamination during installation; overload; end of bearing life; attempted regreasing of sealed bearing	Covered within warranty if no evidence of improper installation; NOT covered if regrease was attempted	IEC 60034-14
Bearing failure – regreasable [frame 160+]	Insufficient/excess lubrication; contamination; misalignment; VSD bearing currents	Not covered if maintenance intervals were not observed	IEC 60034-14
Water / dust ingress	Incorrect IP sealing; damaged glands or gaskets; incorrect cable entry	Not covered – customer installation responsibility	IEC 60034-5
Incorrect star/delta connection	Wiring error per old rules; incorrect assumption on voltage	Not covered	IEC 60034-1

Failure Type	Typical Root Cause(s)	Warranty Position	IEC / SANS Ref.
Single phasing / phase loss	Blown fuse; loose terminal; contactor fault	Not covered – supply and protection responsibility	IEC 60034-11
VSD-induced damage	Missing output filter; unscreened cable; no insulated NDE bearing on frame 160+	Covered if VSD installation per Section 7.7; otherwise not covered	IEC 60034-17
Overheating / overload	Motor operated beyond rated duty or current	Not covered – operational misuse	IEC 60034-1
Storage damage	Incorrect storage; no shaft rotation; humidity; bearing replacement not done after 12-month storage	Not covered	IEC 60034-1

NOTE: In all warranty claims, Electromote reserves the right to inspect the motor before acceptance of any claim. No motor may be dismantled without Electromote's prior written consent. Photographic evidence must be submitted with all claims.

14. Warranty & Liability

14.1 Warranty

Electromote's full warranty terms, conditions, and goods return procedure are set out in the Electromote Warranty and Goods Return Policy, document number WAR01 (Revision 1, dated 13 January 2025). A copy of WAR01 is available on request from Electromote or may be supplied with each motor order.

NOTE: Refer to Electromote document WAR01 – Warranty and Goods Return Policy for all warranty periods, conditions, return procedures, and limitation of liability provisions. WAR01 governs all warranty and returns matters and takes precedence over any summary in this manual.

14.2 Warranty Conditions

Any warranty claim is strictly conditional upon:

- Installation, commissioning, operation, and maintenance carried out strictly in accordance with this manual and applicable statutory standards.
- Operation strictly within the motor nameplate ratings and stated duty.
- Correct electrical, thermal, and mechanical protection installed, set, and maintained.
- Full maintenance, operating, and protection records made available to Electromote upon request.
- For HM3T motors: bearing lubrication schedule (Section 11.2.2) followed and records retained for frames 160 and above.

14.3 Warranty Exclusions

The warranty expressly excludes failures arising from (including but not limited to):

- Water ingress, flooding, condensation, or environmental exposure inconsistent with IP rating.
- Corrosion, contamination, dust ingress, or chemical exposure.
- Improper storage, handling, or transportation.
- Incorrect installation, alignment, coupling, or foundation.
- Electrical supply abnormalities – voltage variation, phase imbalance, harmonics, incorrect starting, inadequate earthing.
- Overloading, stalling, excessive starting, or incorrect duty cycle.
- Blocked ventilation or operation outside ambient design limits.
- Fair wear and tear – bearings, seals, consumables.
- Any unauthorised repair, modification, or dismantling.
- Attempted regreasing of sealed-for-life bearings (frames 71–132).

14.4 Limitation of Liability

Electromote's liability is limited as set out in Electromote document WAR01 – Warranty and Goods Return Policy. In particular, WAR01 clause 4 (No Liability for Consequential Loss) provides that Electromote shall not be held liable for any loss of income or consequential loss suffered by the Customer resulting from any inoperable product during the period of inspection and/or repair. Please refer to WAR01 for the full and governing limitation of liability provisions.

15. Decommissioning & Disposal

- Isolate and lock out all electrical supplies before disconnecting the motor.
- Allow motor and driven equipment to cool completely before disconnecting.
- Follow site-specific decommissioning and permit-to-work procedures.
- Dispose of waste materials (grease, oil, capacitors, insulation) per South African environmental regulations (NEMA and applicable SANS standards).
- Recycle metals (cast iron, aluminium, copper windings) through approved recyclers.
- Contact Electromote for motor rewinding or refurbishment options as an alternative to disposal.

16. Records & Documentation

Electromote strongly recommends maintaining accurate, auditable records for every motor as a minimum:

- Motor nameplate data (model, serial number, ratings)
- Installation data and commissioning checklist (Section 8)
- Baseline measurements at commissioning (current, voltage, IR, vibration, alignment)
- All maintenance activities with dates, findings, and parts replaced
- IR test trending data
- Bearing lubrication history [HM3T frame 160+]
- Any fault, repair, or warranty claim events with root cause analysis

Records must be available on request to support any warranty claim.

Appendix A – Terminal Connection Diagrams

A.1 Star (Y) Connection

For: (a) 3 kW and below on 380–415 V; (b) 4 kW and above on 660–690 V; (c) HM3T rated 550V Δ /950Y on a 950 V supply – this Star (Y) connection also applies to site supplies up to 1 000 V [HM3T only].

Action	Terminals
Short-circuit (link) together	U2 – V2 – W2
Connect L1	→ U1
Connect L2	→ V1
Connect L3	→ W1
Earth	Earth stud in terminal box + external frame lug

A.2 Delta (Δ) Connection

For: (a) 4 kW and above on 380–415 V; (b) 3 kW and below on 200–240 V; (c) HM3T rated 550V Δ /950Y on a 550 V supply.

Action	Terminals to Link
Link 1	U1 — W2
Link 2	V1 — U2
Link 3	W1 — V2
Connect L1	→ U1
Connect L2	→ V1
Connect L3	→ W1
Earth	Earth stud in terminal box + external frame lug

A.3 HM3T 550V Δ / 950V Y Dual Voltage – Connection Summary

Applicable only to HM3T motors with nameplate marking '550V Δ / 950V Y'. Both connections use the same physical method as A.1 (Star) and A.2 (Delta) above.

Site Supply Voltage	Required Connection	Winding Voltage per Phase	Notes
550 V (3-phase)	Delta (Δ) – use method A.2	550 V	Normal full-voltage DOL starting at 550V
950 V (3-phase)	Star (Y) – use method A.1	~548 V ($950/\sqrt{3}$)	Star-delta starting available: start Y on 950V, transfer to Δ at ~80% speed

Site Supply Voltage	Required Connection	Winding Voltage per Phase	Notes
<p>NOTE: If the motor nameplate shows 380V Δ / 660V Y (standard rating), it must NOT be connected to a 550V or 950V supply. These are different winding specifications. Confirm nameplate voltage before any connection.</p>			

A.4 950 V / 1 000 V Connection [HM3T only]

Applicable only to HM3T motors with nameplate marking '550V Δ / 950V Y'. The Star (Y) connection used on a 950 V supply is the same connection applied for site supplies up to 1 000 V. Connection is Star (Y) only in both cases.

Action	Terminals
Short-circuit (link) together	U2 – V2 – W2
Connect L1	→ U1
Connect L2	→ V1
Connect L3	→ W1
Earth	Earth stud in terminal box + external frame lug
<p>NOTE: HM3T motors rated 550V Δ / 950V Y must ONLY be connected Star (Y) when the site supply is 950 V or 1 000 V. Confirm nameplate voltage marking before connection.</p>	

A.5 Single Phase Connection [SPM Series]

Terminal	Connection
L	Live supply (Phase)
N	Neutral
E	Earth (frame)
C	Run capacitor (factory fitted – do not remove)
CS	Start capacitor (factory fitted – do not remove)

Appendix B – Mechanical Fastener Torque Values

B.1 Foundation / Mounting Bolts (Grade 8.8)

Bolt Size	Tightening Torque (Nm)
M10	45–55
M12	70–85
M16	170–200
M20	330–380
M24	560–650

B.2 Electrical Terminal Studs

Stud Size	Tightening Torque (Nm)
M4	2.0–2.5
M5	3.5–4.5
M6	6.0–7.0
M8	15–18
M10	30–35

Appendix C – Bearing & Lubrication Reference

C.1 Bearing Regreasing Schedule – HM3T Frame 160 and Above

The following schedule is reproduced from the standard HM Series fan cowl label. Always confirm against the fan cowl label on the specific motor in service – it takes precedence for the unit in service.

Frame	Grease (g)	2P (hrs)	4P (hrs)	6P (hrs)	8–10P (hrs)	Bearing DE	Bearing NDE
160	20	2 000	5 400	6 900	7 800	6309C3	6309C3
180	20	2 000	5 400	6 900	7 800	6311C3	6311C3
200	25	1 500	5 000	6 500	7 000	6312C3	6312C3
225	25	1 500	5 000	6 500	7 000	6313C3	6313C3
250	35	1 000	4 500	6 300	6 800	6314C3	6314C3
280 (2P)	35	1 000	4 500	6 300	6 800	6314C3	6314C3

Frame	Grease (g)	2P (hrs)	4P (hrs)	6P (hrs)	8–10P (hrs)	Bearing DE	Bearing NDE
280 (4–10P)	35	1 000	4 500	6 300	6 800	6317C3	6317C3
315 (2P)	50	1 000	3 800	6 000	6 500	6317C3	6317C3
315 (4–10P)	50	1 000	3 800	6 000	6 500	Nu319	6319C3
355 (2P)	60	1 000	3 200	5 500	6 000	6319C3	6319C3
355 (4–10P)	60	1 000	3 200	5 500	6 000	Nu322	6322C3

For IEC frame 63–132 (all series): Sealed-for-life ball bearings – do NOT regrease. Replace at end of L10 bearing life or at major overhaul.

C.2 Recommended Grease [HM3T Frame 160+]

Property	Specification
Base oil type	Mineral or semi-synthetic
Thickener	Lithium or lithium-complex
NLGI Grade	2
Temperature range	–20°C to +120°C
Approved brands	Shell Alvania R2, Mobil Polyrex EM, Castrol Spheerol EPL2, or approved equivalent

Appendix D – Insulation Resistance Reference

Motor Voltage	Test Voltage (DC)	Minimum IR	Preferred IR (New)
LV ≤ 1 kV	500 V DC	≥ 1 MΩ	> 10 MΩ

IR values are temperature-dependent. Correct to 40°C. Declining trend over multiple measurements indicates winding deterioration requiring investigation.

Appendix E – Cable Entry Gland Details (HM Series)

All HM Series motors are supplied with two (2) cable entry points as standard. The table below lists the metric parallel thread size for each frame, verified against the Electromote HM Series Motor

Catalogue. All unused cable entries MUST be sealed with IP66-rated blanking plugs of the correct thread size to maintain the IP66 ingress protection rating.

Motor Frame	Cable Entry Thread	Number of Entries
71	M20×1.5	2
80	M20×1.5	2
90S	M20×1.5	2
90L	M20×1.5	2
100L	M20×1.5	2
112M	M25×1.5	2
132S	M25×1.5	2
132M	M25×1.5	2
160M	M25×1.5	2
160L	M25×1.5	2
180M	M32×1.5	2
180L	M32×1.5	2
200L	M32×1.5	2
225	M40×1.5	2
250	M40×1.5	2
280	M50×1.5	2
315	M63×1.5	2
355	M63×1.5	2

NOTE: Thread designation is metric parallel (M) with 1.5 mm pitch. Use IP66-rated cable glands matching the thread size shown. For frame sizes 400 and above, contact Electromote for cable entry thread specifications. The HM Series Catalogue (page 5) confirms all standard frames are supplied with two (2) cable entries.

Appendix F – Applicable Standards & Certification

Standard / Body	Subject
IEC 60034-1 / SANS 60034-1	Rotating electrical machines – Rating and performance
IEC 60034-2-1	Standard methods for determining losses and efficiency
IEC 60034-5 / SANS 60034-5	Degrees of protection provided by integral design (IP code)
IEC 60034-11 / SANS 60034-11	Thermal protection
IEC 60034-14 / SANS 60034-14	Mechanical vibration – measurement, evaluation and limits
IEC 60034-17 / SANS 60034-17	Cage induction motors when fed from converters (VSD)

Standard / Body	Subject
IEC 60034-30-1	Efficiency classes of line operated AC motors (IE code) – IE3 minimum
IEC 60072-1	Dimensions and output series – Frame numbers 56 to 400
SANS 10142-1	The wiring of premises – Low-voltage installations (South Africa)
IEC 60529	Degrees of protection provided by enclosures (IP Code)
SANS 1804-1 / SANS 1804-2	South African National Standard for rotating electrical machines – Part 1: General requirements; Part 2: Efficiency classes. Basis for Explolabs Mark Scheme certification of HM3/4 and SM3 ranges
Explolabs (Pty) Ltd – Type Assessment Report XPL/25515/26.0017	South African Government-approved independent test laboratory (Reg No: 1999/027771/07). Electromote HM3T induction motors type-tested to SANS 60529:2013 Ed 1.2 / IEC 60529:2013 Ed 2.2 for IPX9* (high-pressure water jet) ingress protection. Report issued 6 January 2026. Contact: +27 (11) 316 4601 admin-mgr@explolabs.co.za

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