

## FAQ: Choosing a 96V mid-drive motor for an electric motorcycle (12–30 kW) – integration method



**Reference :** FAQ-001-96V-MIDDRIVE-MOTO

**Brand :** EVEA

**Options :**

No variants

**3D Model :** Not available

**EAN-13 :**

You're looking for a **96V mid-drive motor** for a hobby/performance-oriented electric motorcycle (light road, enduro, dirt) with a realistic target of **12 kW continuous** and **~30 kW peak**. At this power level, the right selection is not about chasing the highest number on a marketing sheet: it's about choosing a motor that **can sustain the heat load, integrates mechanically** without risky compromises, and fits within a coherent **ecosystem** (FOC controller, sensors, drivetrain, DC power chain).

### Summary

**96V** is a sweet spot for a 12–30 kW electric motorcycle: lower current, more manageable harnessing, reduced I<sup>2</sup>R losses, and an accessible ecosystem (BMS, contactors, controllers). Choosing a mid-drive motor typically comes down to five axes: 96V architecture, machine technology (**PMSM / IPM PMSM**), rigorous spec reading (**continuous vs peak kW, continuous vs peak RMS current**), thermal strategy (**ventilation + derating, sealed vs ventilated**), and system integration (shaft **spline vs keyed**, cabling, IP rating, sensors). A comparison illustrates typical choices: **SiAECOSYS SIA155-64** (96V, 12 kW / 29 kW, IP67, encoder) vs **ME1114** (96V, ventilated open-frame, 7/8" keyed shaft).

### Why 96V for hobby/performance

**96V** is a common balance point because it reduces the current required for a given power level versus 48–72V (less Joule loss in cables, connectors, and the DC bus), while staying within a broadly available ecosystem (BMS, contactors, controllers). On a motorcycle, this translates into a harness and connectors that are easier to manage, lower I<sup>2</sup>R losses (therefore less "parasitic" heat), and more headroom for peak power without systematic oversizing—provided the DC chain is designed correctly (fuse, contactor, precharge). Watch-outs: **loaded voltage (battery sag)** and **DC bus safety/reliability** (precharge, protections) are non-negotiable reliability prerequisites.

## IPM PMSM vs “classic” PMSM

At comparable power, the key differences are in **control (FOC)**, loop stability, and the ability to hold torque in certain regions. **PMSM**: permanent magnet synchronous motor, very common in traction. With a properly sized and tuned FOC controller, torque control is stable, efficiency is high, and behavior is predictable. **IPM PMSM** (interior magnets): same family, often chosen for a torque/efficiency compromise and an interesting margin depending on the control strategy—especially for extended speed range if field weakening is correctly managed by the inverter.

- **FOC** is required to properly exploit a PMSM (and IPM) in traction.
- **Sensors**: sin/cos or encoder depending on the motor, and a **temperature sensor** is the baseline for controlled derating in performance use.
- Choosing IPM makes sense when torque stability, efficiency, and usable range (control) matter more than marketing figures.

## Continuous vs peak kW, continuous vs peak current

This distinction is decisive. **Continuous (nominal)**: the power the motor can sustain without overheating, representative of prolonged riding. **Peak**: power available for a short duration (acceleration bursts), limited by thermal constraints, the battery, and the controller. The same logic applies to current: **continuous RMS current** drives thermal sizing for the motor and the whole chain (cables, connectors, controller); **peak RMS current** is burst capability—useful, but highly dissipative.

Key point: **you size the wiring for continuous, not peak**. As an order of magnitude, phase conductors around **~13 mm<sup>2</sup>** are consistent with **~125 A RMS** under conservative assumptions. That does not imply the system can tolerate **300–420 A** continuously without penalties: heating, increased resistance, voltage drop, reduced real torque/power, degraded overall efficiency, and connectors potentially becoming the limiting factor.

### Mini comparison (96V): SIA155-64 vs ME1114

Selection criterion	SIA155-64	ME1114 (96V reference)
Continuous / peak	12 kW / 29 kW	~12 kW / ~30 kW
Continuous RMS current	125 Arms	125 Arms
Peak RMS current	~302 Arms	~420 Arms (≈ 1 min)
Max torque (order of magnitude)	~85 N·m	~65 N·m (order of magnitude based on $K_t$ ~0.13 × 420A)
Ingress protection	IP67	IP20 ventilated open frame
Sensors	encoder + KTY84/130	sin/cos + KTY84/130
Shaft	spline	7/8" keyed
Typical use	Enduro/off-road wet use if integration is done properly	“Dry” performance, easy ventilation, DIY-friendly

Quick read: enduro/mud/rain/washing: **IP67** is a major argument, but thermal integration must be handled rigorously (a sealed motor makes airflow more critical). Ventilated open frame: dissipation can be excellent if air is truly available, but environmental protection becomes more demanding.

## Cooling: sealed vs ventilated

Long-duration performance is primarily a **thermal** problem. A ventilated (open-frame) motor dissipates efficiently if air actually flows and often tolerates repeated bursts better, but it forces you to engineer environmental protection (water/mud/dust). A sealed **IP67** motor fits wet off-road use, but its dissipation depends heavily on integration (fairing, hot-air pockets, proximity to heat sources, lack of airflow). In all cases, a **derating** strategy using a temperature sensor and controller is essential to preserve reliability and avoid abrupt cutoffs.

- Design a **real airflow path** (inlet/outlet) and avoid thermally confined zones.
- Use the **temperature sensor** for progressive derating rather than a hard cut.
- Treat environmental protection as a system function (covers, placement, splash management), especially with open-frame motors.

## Integration checklist

This is where the difference is made between a motor that looks great on paper and a reliable motorcycle. The critical points are drivetrain integration, wiring sized for continuous operation, control/sensor compatibility, and "IP" understood at the **system** level.

### 1) Drivetrain: spline vs keyed/smooth shaft

Shaft choice affects **time-to-build** as much as power. **Spline**: excellent mechanical strength for traction, an industrial standard; downside: sprockets/couplers are less "off-the-shelf" and often require adaptation/machining. **Keyed shaft (e.g., 7/8")**: very broad ecosystem (pulleys, sprockets), faster prototyping; downside: loads, alignment, and vibration durability must be secured.

### 2) Power wiring: size for continuous

Size the harness for **continuous** operation (stable temperature), then validate peak events for duration/frequency. Pay attention to connectors, crimps, and strain relief (vibration). Account for resistance increase when hot (losses, voltage drop, performance reduction).

### 3) Control / sensors

Verify controller compatibility with **sin/cos** or an **encoder** depending on the motor. Address EMC: power/signal separation, shielding, routing. Provide a degraded/safe mode in case of sensor loss.

### 4) IP: motor vs system

Even with an IP67 motor, connectors, cable entries, enclosures, and the controller are often the weak points. Think in terms of **system IP**, not just component IP.

## Final block: which motor for which project

**Wet enduro/off-road project**: a sealed IP67 solution is generally the most rational, provided thermal integration is addressed (airflow + derating). **"Dry" performance project**: a ventilated open-frame motor can be very effective and easy to cool, at the cost of designing an environmental protection strategy.

## Key takeaways

- At 12–30 kW, 96V reduces current and stabilizes real-world performance (harness, losses, thermal behavior).
  - Motor choice is as much about the ecosystem (FOC, sensors, drivetrain, DC chain) as about advertised kW.
  - Continuous = sizing; peak = transient performance, to be governed by thermal management + derating strategy.
  - Spline vs keyed: mechanics can dictate time-to-build as much as power.
  - IP67 suits wet use; open-frame dissipates well but requires environmental protection design.
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