

Z-FORCE™
/// ZF
POWERTRAINS

THE Z-FORCE POWERTRAIN

The revolutionary Z-Force™ system is a high power, high efficiency powertrain designed and assembled by Zero Motorcycles in California. A modular design, the powertrain components can be used in a wide array of applications where an electric power pack, or complete powertrain, offers advantages. Using robust systems originally designed to endure on and off-road motorcycles applications, the Z-Force™ powertrain offers a cost effective and rapid path to deploying industry leading technology into a new concept, product or lineup.

Advantages of the Z-Force powertrain:

- » Robust, modular and refined
- » No gas, exhaust or fluids
- » Quiet and produces little heat
- » Minimal maintenance requirements
- » Extremely low operating costs
- » Incredibly high power-to-weight ratio
- » Easy to integrate and scalable
- » Batteries are fully UN 38.3 certified

Three main Z-Force™ powertrain kits:

1. Power pack
2. Motor
3. Complete powertrain

LEVERAGING ZERO MOTORCYCLES STATE OF THE ART POWERTRAINS

The Z-Force™ powertrain is the culmination of years of research and design in creating a powertrain where minimizing size and weight are essential. Over the last several years Zero Motorcycles has pushed the limits of technology to make the Z-Force™ powertrain one of the world's most compact, powerful and production ready systems. Below you will find images of the most current applications of the powertrain as used in Zero Motorcycles 2012 electric motorcycle lineup.



» ZF9 Power Pack – As seen on the 2012 Zero DS



» 29 Motor – As seen on the 2012 Zero S



» ZF3 Power Pack – As seen on the 2012 Zero XU



» DeltaQ Charger – As seen on the 2012 Zero XU

POWER PACK KIT

The Z-Force™ power pack uses state of the art Li-Ion cell technology and an advanced battery management system to achieve incredible longevity, reliability and a high power output. Capable of 3,000 full discharge cycles and of enduring a wide range physical requirements, the power pack is a straight forward solution to powering systems where consistency and quality are essential.

Features:

- » State of the art Li-Ion technology and battery management system
- » Elegant low resistance and highly robust cell interconnect technology
- » Rated to 3,000 full charge-discharge cycles before hitting 80% capacity (at which point it is still usable)
- » Three configurations and capacities available: ZF3, ZF6 and ZF9 (with 3,6,9 kWh respectively)
- » Chargeable using a standard household electrical outlet
- » Scalable quick-charge options available to cut recharge times by as much as 75%

Included: Power pack, charger, low-power pigtail, high-power pigtail, documentation



» ZF3 Power Pack



» DeltaQ charger

FACT SHEET

	ZF3	ZF6	ZF9
POWER PACK			
Type	Z-Force™ patented Li-Ion intelligent power pack	Z-Force™ patented Li-Ion intelligent power pack	Z-Force™ patented Li-Ion intelligent power pack
Chemistry	Lithium Nickel Manganese Cobalt Oxide	Lithium Nickel Manganese Cobalt Oxide	Lithium Nickel Manganese Cobalt Oxide
Estimated pack life to 80%	3,000 full charge-discharge cycles	3,000 full charge-discharge cycles	3,000 full charge-discharge cycles
Maximum voltage	74.7 V	74.7 V	74.7 V
Nominal voltage	65.7 V	65.7 V	65.7 V
Nominal electric charge	40 Amps h	80 Amps h	120 Amps h
Maximum capacity	3.0 kWh	6.0 kWh	9.0 kWh
Nominal capacity	2.6 kWh	5.3 kWh	7.9 kWh
Pack maximum continuous discharge "C" rating	5.0 1/h	5.0 1/h	5.0 1/h
Pack maximum burst discharge "C" rating	10.0 1/h	10.0 1/h	10.0 1/h
Pack maximum continuous charge "C" rating	0.5 1/h	0.5 1/h	0.5 1/h
Dimensions (LxWxH)	374.7 x 248.5 x 171.5 mm	347.0 x 248.0 x 449.5 mm	347.0 x 248.0 x 449.5 mm
Weight	24.5 kg	50.8 kg	69.4 kg
Volume	16.0 l	34.6 l	34.6 l
Gravimetric energy density	107 Wh/ kg	103 Wh/ kg	114 Wh/ kg
Volumetric energy density	165 Wh/l	152 Wh/l	228 Wh/l
CHARGER			
Type	Long cord DeltaQ charger	Long cord DeltaQ charger	Long cord DeltaQ charger
Power	1 kW	1 kW	1 kW
Charge time (from empty)	3.1 h (2.7 h to 95%)	6.0 h (5.3 h to 95%)	9.0 h (8 h to 95%)
Input	Standard 110V or 220V	Standard 110V or 220V	Standard 110V or 220V
Dimensions (LxWxH)	278 x 245.5 x 108.75 mm	278 x 245.5 x 108.75 mm	278 x 245.5 x 108.75 mm
Weight	4.3 kg	4.3 kg	4.3 kg

MOTOR KIT

Zero Motorcycles' compact and efficient brushless motor is capable of producing significant torque and power. Completely air cooled, it is designed to provide years of performance and utility minus the need for any regular maintenance. When decelerating, the motor is capable of working with the optional controller to recapture energy. If coupled with the Z-Force™ power pack, the regen can be used to partially recharge the battery.

Features:

- » Permanent magnet electric motor capable of delivering instant torque from zero RPM
- » Requires no routine maintenance
- » Integrated Z-Force™ Air Induction System allows the production of more horsepower from a lighter and more compact motor
- » Optional controller allows regenerative deceleration capable of incrementally recharging a Z-Force™ power pack

Included: Motor, signal pigtail, documentation

Optional: Controller, controller pigtail, high-power leads (only needed for the 29 motor)



» High-efficiency, double-stator, axial flux, permanent magnet, brushless motor

» Sevcon Gen4, Size 2, 3-Phase controller



FACT SHEET

	14	29
MOTOR		
Type	High efficiency, axial flux, permanent magnet, brushless	High efficiency, double-stator, axial flux, permanent magnet, brushless
Cooling	Integrated forced air cooling	Integrated forced air cooling
Peak power	14 hp @ 3500 rpm	29 hp @ 4000 rpm
Peak torque	22 ft-lb @ 3200 rpm	42 ft-lb @ 3800 rpm
Dimensions (diameter x L)	201.0 x 146.5 mm	201.0 x 163.0 mm
Shaft diameter and length	25.4 x 32.4 mm	25.4 x 23.2 mm
Weight	10.0 kg	13.2 kg
CONTROLLER (OPTIONAL)		
Type	Sevcon Gen4, Size 2, 3-Phase	Sevcon Gen4, Size 4, 3-Phase
Maximum output	250 A	420 A
Input	Standard 45V or 115V	Standard 45V or 115V
Dimensions (LxWxH)	187 x 151 x 69 mm	227 x 168 x 79 mm
Weight	1.3 kg	2.7 kg



» ZF6 / ZF9 Power Pack (shown without included cover)



» DeltaQ charger



» Sevcon Gen4, Size 4,
3-Phase controller



» High-efficiency, axial flux,
permanent magnet, brushless motor

COMPLETE POWERTRAIN KIT

Zero Motorcycles offers the complete Z-Force powertrain kit as a turnkey solution that can be easily integrated into wide range of applications. Optimized to work as a system that is highly efficient and powerful, the complete powertrain contains everything needed for charging and producing instant torque.

Features - Power Pack:

- » State of the art Li-Ion technology and battery management system
- » Elegant low resistance and highly robust cell interconnect technology
- » Rated to 3,000 full charge-discharge cycles before hitting 80% capacity (at which point it is still usable)
- » Three configurations and capacities available: ZF3, ZF6 and ZF9
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Features - Motor:

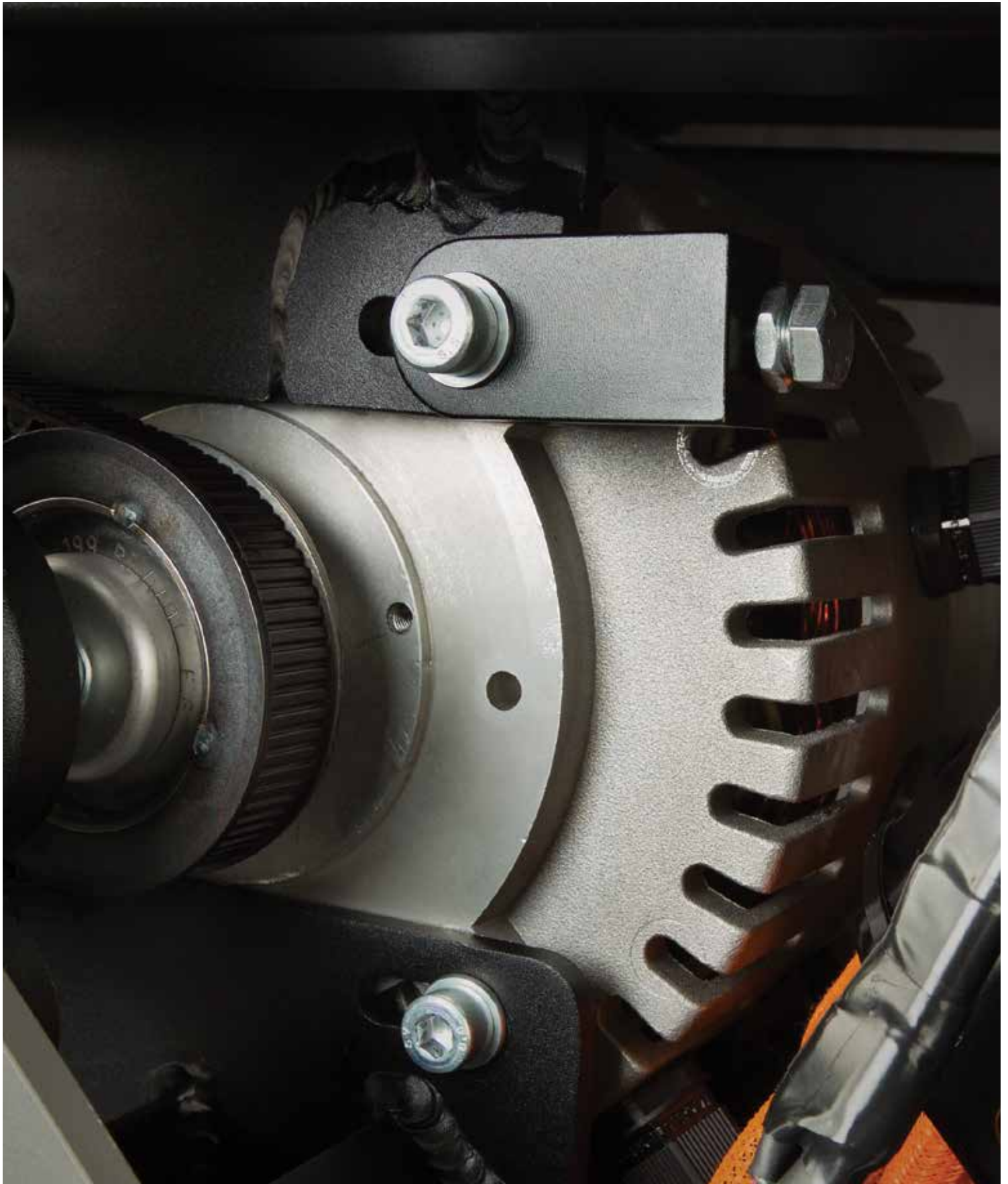
- » Permanent magnet electric motor capable of delivering maximum torque from zero RPM
- » Requires no routine maintenance
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- » Optional controller allows regenerative deceleration capable of incrementally recharging a Z-Force™ power pack

Included: Power pack, charger, controller, motor, main bike board, contactor, low-current harness, high-current harness, basic dash, low-current harness pigtail kit, controller pigtail, high-power leads, documentation

Optional: Mode switch, throttle, DC-DC converter, key switch, kickstand switch, brake switches, lighting harness, full dash, LH switch unit, kill switch, dealer service kit

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Weight	10 kg	13.2 kg	13.2 kg



ZERO MOTORCYCLES

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