

# Information Sheet

## HOW DO HOLMATRO EVO 3 BATTERY TOOLS WORK?

Battery tools are not new to Holmatro. Back in 2002 Holmatro introduced its first self-contained battery powered hydraulic cutter and combi tool. Since that time battery technology, motor technology and lightweight hydraulics have improved dramatically. As a result of this, a full range of battery powered cutters, spreaders and rams became feasible. Currently Holmatro's Greenline battery tools have evolved into their third generation, Greenline EVO 3.

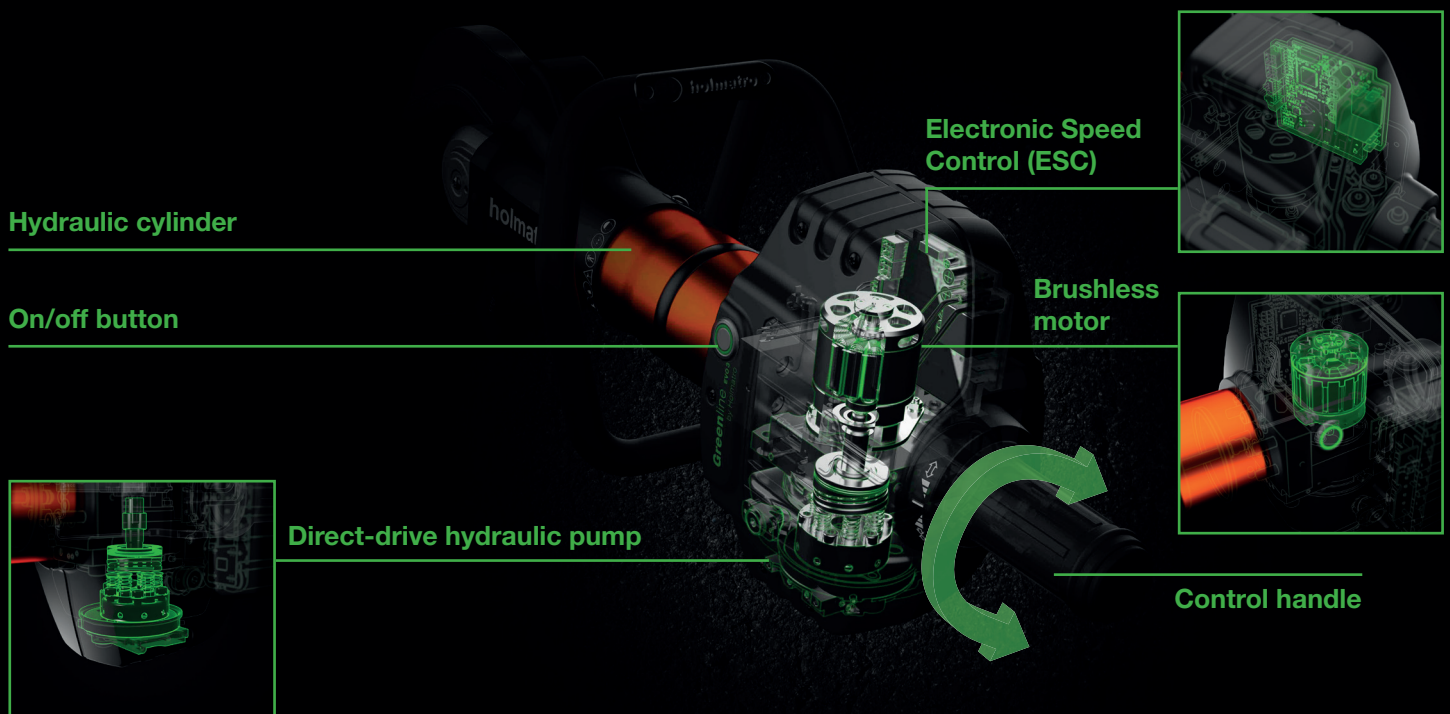
### How are EVO 3 tools powered?

"Battery" tools are hydraulic tools that are driven by an electric motor powered by energy from a rechargeable battery. Holmatro Greenline EVO 3 tools use lithium-ion batteries with high energy density, no memory effect and a low self-discharge rate. The batteries are charged on a battery charger which can either be powered from AC (mains) power or from a DC power supply on a fire truck. Battery tools offer the user ultimate freedom of movement and rapid deployment; simply switch on and start working. A battery tool can also be powered directly from AC power or a generator with the help of an AC/DC adaptor power cord for unlimited use. This is a reassuring back-up in extended extrications or in case a charged battery is not available, for whatever reason.

### What happens when they are switched on?

An EVO 3 tool is switched on by pressing the **on/off button**. The green light in the button will light up indicating that the tool is ready for operation. The electronics in the tool are activated and the electric motor is powered. EVO 3 is based on a very energy-efficient **brushless motor** powering the two-stage, **direct-drive hydraulic pump**. Thanks to the built-in **Electronic Speed Control (ESC)** the motor drives the pump directly; there's no need for a mechanical transmission between the motor and the pump. This eliminates mechanical energy loss, minimizes noise and reduces overall weight.

Once switched on, the motor runs in idle mode driving the integrated hydraulic pump at very low rpm. This cools the motor. As long as the control handle is in neutral position, an unpressurized oil flow circulates in the pump module. This requires virtually no battery power. The blades/arms/plunger of the tool are not yet moving, nor delivering any performance.



### What happens when operating the control handle?

By operating the control handle on the tool, the following things will happen:

1. The hydraulic oil flow from the integrated hydraulic pump will be directed to the **hydraulic cylinder** and the tool will start to perform. Depending on the direction in which the control handle is operated, the oil will flow to the bottom or the top side of the plunger. This will force the plunger in the hydraulic cylinder to move outwards or inwards consequently moving the blades/arms/plunger of the cutter/spreader/ram to deliver force.
2. The ESC circuit board controls the rpm of the brushless motor, and thus of the hydraulic pump. This is a big performance improvement in Greenline EVO 3 tools. ESC keeps the rpm of the motor at the optimum level, even when the tool is subjected to heavy loads or when the battery voltage drops (a fully charged Greenline battery starts at 28V and this voltage drops when the battery gets low). The ESC circuit board is fully sealed and therefore dust and moisture resistant.

Depending on the tool load, the two-stage pump will build up more or less pressure. At low pressures under no, or low load, the pump will produce high oil flow in its first stage, or SPEED mode, resulting in optimal tool speed. As the tool encounters more resistance (i.e. when the load is larger) the oil pressure will increase and the pump will change over to its second stage. In this stage, or POWER mode, maximum control and power can be generated. Within each stage, the ESC constantly keeps the tool speed at the highest possible level.

### What happens when releasing the control handle?

When the control handle is released the tool goes automatically back to neutral position and safety check valves in the hydraulic system immediately secure the position of the tool's blades/arms/plunger. The tool switches back to idle mode which keeps the motor and pump running at low rpm to cool the system. The hydraulic oil flow recirculates without pressure in the pump module. This requires virtually no battery power.

If the tool idles for two minutes the motor will stop and the green light of the on/off switch will flash indicating that the tool has turned itself off. After ten minutes the flashing will stop. The tool can be quickly reactivated again by pushing the on/off switch twice.



**EVO 3: a full range of battery-powered cutters, spreaders, combi tools and (telescopic) rams.**