HYBRID & ELECTRIC TECHNOLOGY
Transfluid's Hybrid

The industrial market has been focused on developing new technologies to reduce their ecological impact on land and sea. Global awareness of air, noise and water pollution attributed to internal combustion engines has caused vehicle manufacturers to invest large amounts of money and resources into developing hybrid systems used in automobiles and small commercial vehicles. However, because of the wide variety of drive line designs used in industrial and marine markets, a standardized, quality, heavy duty “hybrid product” has been impractical to develop.

Accepting the challenge to provide a hybrid product for this neglected market Transfluid is ready to introduce a solution for low to medium power marine and industrial applications. For decades Transfluid has been manufacturing a wide range of power transmission equipments and electric motors/generators. Profiting from their experience in thousands of industrial and marine applications and using their existing technology it resulted in the development of the technology of the future.

The System

The hybrid system works in three specific modes:
- **electric propulsion** to drive or sail at ZERO emissions and in absolute silence
- **engine propulsion** that uses the electric machine as generator to recharge the batteries
- “booster” function that allows the electric motor, during acceleration, to assist the engine in providing extra torque to the driveline

How It Works

The input side is a hydraulic or pneumatic controlled clutch. When disengaged, the engine is disconnected from the rest of the driveline allowing the vehicle or vessel to be operated by the electric motor instead of the engine. During engine operation, the clutch is engaged and the electric motor becomes a generator, recharging the batteries, if required. By operating the engine and electric motor at the same time, the “booster” operation is engaged, increasing the total available power to the driven machine. All operations are controlled via Transfluid’s proprietary electronic controller MPCB-R5, which communicates with all equipments through CAN BUS protocol, making the system a simple “plug and play” solution.
**HTV700**

- Split power drive drive with SAE B pto
- SAE standard dry clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Clutch actuation solenoid valve
- Three speed forward, one speed reverse Powershift Transmission
- Drop box for 2 or 4 wheel drive, available with wide variety of reduction ratios
- Electric machine that can operate as electric motor or electric generator
- Electric selector control unit with integrated soft shift ability
- Drop box installation with 6 different inclination angle positions

**HM560 with Hydrostatic Transmission**

- Split power drive drive with SAE B pto
- SAE standard dry clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Clutch actuation solenoid valve
- Single Pump drive
- Hydraulic Pump
- Electric machine that can operate as electric motor or electric generator

**Working scheme**

- Diesel engine
- Electric machine that can operate as electric motor or electric generator
- Electric selector control unit with integrated soft shift ability
- Clutch actuation solenoid valve
- SAE standard dry clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Drop box installation with 6 different inclination angle positions
- Spring loaded wet discs parking brake, operated by solenoid valve
- Electric machine that can operate as electric motor or electric generator
- Electric selector control unit with integrated soft shift ability
- Clutch actuation solenoid valve
- SAE standard dry clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Single Pump drive
- Hydraulic Pump
- Electric machine that can operate as electric motor or electric generator

**Legend**

- **Power Wire**
- **Can Wire**
- **Digital Wire**
Marine hybrid

HTM700

- Electric machine that can operate as electric motor or electric generator
- Split power drive with SAE B pto
- SAE standard dry Clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Clutch actuation solenoid valve
- Electric selector with integrated Soft-Shift ability
- Forward-Reverse Powershift marine gear

HM560 with Cardan Shaft

- Electric machine that can operate as electric motor or electric generator
- Split power drive with SAE B pto
- SAE standard dry Clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Clutch actuation solenoid valve
- Cardan shaft

Working scheme

- Electric machine that can operate as electric motor or electric generator
- SAE standard dry Clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Clutch actuation solenoid valve
- Electric selector with integrated Soft-Shift ability
- Forward-Reverse Powershift marine gear

LEGEND

POWER WIRE
CAN WIRE
The hybrid series

In close cooperation with leading battery and motorcontroller manufacturers the HM Module series (560-2000-3350-6300) was developed to provide a standard, simple, quality solution. Designed to “sandwich” between an engine with a SAE flywheel and housing and transmission with a SAE input, the HM module provides a seamless solution that is easier to apply and simpler to operate than any application specific solution. Additionally, the electric machine (the motor generator) can be mounted in multiple positions in order to provide the best fit for the engine compartment. To install, all that is required is a short distance between the engine and transmission, this make it an ideal solution for retrofits and new designs.

Transfluid also provides two packages that couple the HM technology with their power shift transmissions and marine products. The HTV700 is a complete vehicle transmission product utilizing a power shift transmission, 4wd differential box and brake. Designed to be exceptionally compact it is ideal for forground support equipment and small mining and construction machines. The HTM700 is a hybrid marine transmission. The electric function is becoming mandatory in many ports where they are trying to mitigate the air and water pollution caused by tendering and docking vessels. The HTV700 is applicable for engines up to 95 kW (127 hp) while the HTM700 is capable of 140 kW (187 hp). Both Packages are equipped with a come home feature.

Reference catalogs of the products we use in hybrid & electric technology

Technical specifications

HM560 Hybrid Module
- SAE 4 to SAE 4 distance = 305 mm
- Max No. of Electric Machine: 1
- Max Tot Elec. Input Power: 20kW @ 3000rpm

HM2000 Hybrid Module
- SAE 3 to SAE 3 distance = 458 mm
- Max No. of Electric Machine: 2
- Max Tot Elec. Input Power: 150kW @ 3000rpm

HM3350 Hybrid Module
- SAE 1 to SAE 1 distance = 690 mm
- Max No. of Electric Machine: 4
- Max Tot Elec. Input Power: 150kW @ 3000rpm

HM6300 Hybrid Module
- SAE 1 to SAE 0 distance = 830 mm
- SAE 0 to SAE 0 distance = 777 mm
- Max No. of Electric Machine: 4
- Max Tot Elec. Input Power: 150kW @ 3000rpm
Why Transfluid

By dedicating significant resources in the research and development of the Hybrid System range of products Transfluid is capable of providing complete hybrid solutions as well as the technical support required by manufacturers to implement these products. Transfluid’s Hybrid System easily integrates into traditional propulsion systems assuring an efficient solution to green power and fuel economy.

All modules fit between the engine and transmission, occupying limited space, as though they are an integrated and independent component in the propulsion driveline.

Not only the ecological sustainability is one of the advantages of Hybrid solutions but fuel savings and energy management are of the same importance. With the “booster” function, designers can consider a lower power engine yet still maintain the desired performances. Ship owners can retrofit their vessels thereby providing lower costs and profiting from immediate benefits.

Transfluid is not just a supplier, but also a partner. By providing innovative technology coupled with competitive pricing, even the most difficult hybrid problems can be quickly solved.

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<table>
<thead>
<tr>
<th>HYBRID DESIGN</th>
<th>INPUT &amp; OUTPUT</th>
<th>MAX OUTPUT</th>
<th>INPUT POWER</th>
<th>OUTPUT POWER</th>
<th>MAX TORQUE</th>
<th>WEIGHT</th>
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<tbody>
<tr>
<td>HM560</td>
<td>SAE4-10”</td>
<td>560 (414)</td>
<td>115 (55)</td>
<td>180 (240)</td>
<td>120 (265)</td>
<td>180</td>
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<td>HM2000</td>
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<td>2000 (1478)</td>
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<td>350 (772)</td>
<td>3000</td>
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<td>HM3350</td>
<td>SAE1-14”</td>
<td>3350 (2476)</td>
<td>500 (670)</td>
<td>620 (830)</td>
<td>660 (1236)</td>
<td>2300</td>
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<tr>
<td>HTV700</td>
<td>SAE4-10”</td>
<td>300 (222)</td>
<td>96 (125)</td>
<td>140 (187)</td>
<td>246 (540)</td>
<td>221</td>
</tr>
<tr>
<td>HTM700</td>
<td>SAE4-10”</td>
<td>560 (414)</td>
<td>140 (187)</td>
<td>220 (290)</td>
<td>500 (700)</td>
<td>288</td>
</tr>
</tbody>
</table>

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**EM180-8**
- Weight: 25 (55)
- Max Speed: 3000
- Battery: 96
- Size: SIZE 8

**EM180-12**
- Weight: 35 (76)
- Max Speed: 3000
- Battery: 96
- Size: SIZE 20

**EM220-15**
- Weight: 45 (98)
- Max Speed: 3000
- Battery: 96
- Size: SIZE 20

**EM220-20**
- Weight: 55 (120)
- Max Speed: 3000
- Battery: 96
- Size: SIZE 20

**EM220-35**
- Weight: 80 (175)
- Max Speed: 3000
- Battery: 288
- Size: SIZE 75

**EM300-50**
- Weight: 135 (295)
- Max Speed: 3000
- Battery: 288
- Size: SIZE 75

**EM300-75**
- Weight: 185 (404)
- Max Speed: 3000
- Battery: 288
- Size: SIZE 75L

**EM300-100**
- Weight: 215 (425)
- Max Speed: 3000
- Battery: 384
- Size: SIZE 75L

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The EPS (ELECTRIC PROPULSION SYSTEM) provides innovative electric propulsion through the combination of standard Transfluid products. Integrating standard components and adhering to SAE standards produces a new product which easily interfaces with any user and application. When used with commercial vehicles, the EPS system includes an automatic "Powershift" RANGERMATIC or REVERMATIC transmission. For marine propulsion the REVERMATIC marine gear uses the reliable RBD coupling. Both transmissions can be installed with Transfluid’s permanent magnets electric motor. This improves the operations of the vehicle or boat by using the efficiency and performance of the electrical machine.

The innovation of EPS consists of an automatic RANGERMATIC "Powershift" transmission coupled to a permanent magnet electric motor. This optimizes the driving experience of the vehicle and enhances the performance of the motor. The RANGERMATIC reduction ratios allow the user to select the optimal ratio according to the operating conditions. The addition of the DROP BOX DP280 on the output of the EPS system provides additional gear ratios to enhance the electric motor performances. Additionally, the drop box is available with two outputs for four-wheel drive applications. This provides identical use and driving of the EPS system to those of a combustion engine. The use of batteries, indispensable for the supply of the electric machines, allows the recovery of kinetic energy during deceleration and braking (Kinetic Energy Recovery System) storing energy that would otherwise be lost, increasing the autonomy of the vehicle.

### EPS industrial system

<table>
<thead>
<tr>
<th>TYPE</th>
<th>POWER at 3000 rpm kW (hp)</th>
<th>NOMINAL TORQUE Nm (lbs-ft)</th>
<th>BATTERY VOLTAGE Vdc</th>
<th>NOMINAL CURRENT A</th>
<th>WEIGHT kg (lbs)</th>
<th>TRANSMISSION</th>
<th>COUPLING</th>
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<td>25 (18)</td>
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<td>85</td>
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<td>125</td>
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<td>1.45 - 1.88</td>
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<tr>
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<td>48 (35)</td>
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<td>45 (98)</td>
<td>RANGERMATIC</td>
<td>1.88 - 2.25</td>
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<tr>
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<td>20 (27)</td>
<td>64 (47)</td>
<td>96</td>
<td>170</td>
<td>55 (120)</td>
<td>RANGERMATIC</td>
<td>1.88 reverse gear</td>
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<tr>
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<td>EPS50</td>
<td>50 (67)</td>
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<td>EPS75</td>
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<td>289</td>
<td>185 (404)</td>
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<tr>
<td>EPS100</td>
<td>100 (134)</td>
<td>318 (235)</td>
<td>384</td>
<td>370</td>
<td>195 (425)</td>
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<td></td>
</tr>
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</table>

Technical features, dimensions and any other data are not binding. Transfluid S.p.A. reserves the right to change them without notice.
**EPS marine system**

The innovative concept of the marine EPS REVERMATIC11-700 RBD marine gear coupled to the electric motor allows you to maximize the maneuverability of the boat and to increase the performance of the electric motor. The reduction ratio of the marine gear allows the user to size the propeller of the boat to demand the maximum power delivered by the electric motor, fully exploiting the motor power and speed. The reverse function is performed by the REVERMATIC11-700 RBD marine gear. This protects the electrical components from transient current peaks.

In addition, the EPS Marine system can be used as an extra drive system on large power engines by connecting the output of the EPS system to the PTO (commonly called PTI in marine transmission).

To optimize the performance of the motor a DROP BOX DP280 can be mounted on the output of the EPS system, before to PTI, to provide additional gear ratios optimizing the motor torque output.

An example:

By using a compact EPS system weighting only 220 kg, powered at 300 V dc, it is possible to obtain on the PTI a torque of 2750 Nm, a very interesting value for the propulsion of large boats.
Remote monitoring - Fast service  
Safe - Reliable - Timely

Annual subscription for remote monitoring and service of Hybrid or Electric System through web portal with password access

- Gift box with emergency spares kit
- Delivery of spares parts to the nearest service center within 72 hours
- Advance notice for maintenance
- Online monitoring

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