Hybrid & Electric Technology

TRANSFLUID
industrial transmissions
Founded in Milan, Italy in 1957, Transfluid has always been a point of reference in the world of industrial transmission equipment and the standard that its competitors measure themselves. Fluid couplings, variable speed drives, brakes, clutches, couplings and hydraulic transmissions constitute the core of the product line, while ultra-modern technology, careful selection of materials and meticulous assembly are the key ingredients in the recipe that has placed these products at the forefront of the market. Thousands of customers continue to choose Transfluid for the most diverse and demanding applications, knowing they can rely on Transfluid’s technical department, where design, engineering and planning experts are always on hand to quickly resolve client’s problems. Italian dynamic innovation, coupled with ongoing staff development and more than fifty years of hard-earned expertise, are the foundation of the company’s success. Transfluid’s unique approach has sparked small but important revolutions in the field of heavy-duty transmissions, for which recognition has come in the form of international awards.

Transfluid’s catalogue boasts a wide range of products, and each unit produced is tested for safety, quality and durability. Being a world leader in the design and manufacture of fluid couplings, Transfluid has earned a reputation for diligent service, which assures the competence of the applications through careful quality control and on-site technical assistance. In addition to the Italian Headquarters, Transfluid’s broad sales network consists of six branches located in Australia, China, France, Germany, Russia and United States, one representative office in Brazil and 32 distributors located throughout the world.

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.
**Industrial hybrid**

**HTV700**
- Split power drive drive with SAE B pto
- Electric machine that can operate as electric motor or electric generator
- Electric selector control unit with integrated soft shift ability
- Three speed forward, one speed reverse Powershift Transmission
- Drop box installation with 6 different inclination angle positions
- Spring loaded wet discs parking brake, operated by solenoid valve

**HM560 with Hydrostatic Transmission**
- Split power drive drive with SAE B pto
- 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
- Electric selector control unit with integrated soft shift ability
- Hydraulic Pump

**Working scheme**
- SAE standard dry clutch, operated by solenoid valve, to connect and disconnect internal combustion engine
- Electric machine that can operate as electric motor or electric generator
- Single Pump drive
Marine hybrid

HTM700

- 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
- Forward-Reverse Powershift marine gear
- Electric machine that can operate as electric motor or electric generator

HM560 with Cardan Shaft

- 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 machine that can operate as electric motor or electric generator
- Cardan shaft

Working scheme

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

Legend:
- OIL SUPPLY
- POWER SUPPLY
- CAN BOS COMMUNICATION
- MPCB-B5 INPUT
- MPCB-B5 OUTPUT
The hybrid series

In close cooperation with leading battery and motor controller 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, making 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, 4x4 drive box and brake. Designed to be exceptionally compact, it is ideal for non-high ground 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.

Technical specifications

<table>
<thead>
<tr>
<th>Module</th>
<th>SAE 4 to SAE 4 distance</th>
<th>Max No. of Electric Machine</th>
<th>Max Total Electric Input Power</th>
<th>Max RPM</th>
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<tbody>
<tr>
<td>HM560 Hybrid Module</td>
<td>305mm</td>
<td>1</td>
<td>20kW @ 3000rpm</td>
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<tr>
<td>HM2000 Hybrid Module</td>
<td>483mm</td>
<td>2</td>
<td>150kW @ 3000rpm</td>
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</tr>
<tr>
<td>HM3350 Hybrid Module</td>
<td>593mm</td>
<td>4</td>
<td>300kW @ 3000rpm</td>
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<tr>
<td>HM6300 Hybrid Module</td>
<td>791mm</td>
<td>4</td>
<td>300kW @ 3000rpm</td>
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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.

### Hybrid System

<table>
<thead>
<tr>
<th>Model</th>
<th>Control Pressure (bar)</th>
<th>Pressure Transducer (bar)</th>
<th>CAN Bus</th>
<th>SAE</th>
<th>MP12000-HM2000-HM3350-HM6300</th>
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<tbody>
<tr>
<td>HM700</td>
<td>620 (830)</td>
<td>221 (3)</td>
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<td>SAE3-11.5&quot;</td>
<td></td>
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<tr>
<td>HM300</td>
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<td>HM200</td>
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<td>221 (3)</td>
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### MPCB-R5 & Display Harness

<table>
<thead>
<tr>
<th>Model</th>
<th>Connectivity</th>
<th>Input Power</th>
<th>Output Power</th>
<th>Input &amp; Output</th>
<th>Weight</th>
<th>Max Speed</th>
<th>Battery &amp; Generator</th>
<th>Motor Mode</th>
<th>Motor Model</th>
<th>Motor Controller</th>
<th>Gear Selector</th>
<th>Display</th>
<th>Controls</th>
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</thead>
<tbody>
<tr>
<td>EM180-8</td>
<td>SAE4-10&quot;</td>
<td>110 (150)</td>
<td>140 (200)</td>
<td>SAE6-15&quot;</td>
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<td>3000 rpm</td>
<td>6200 rpm</td>
<td>160 (185)</td>
<td>560-700</td>
<td>560-700</td>
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<tr>
<td>EM180-12</td>
<td>SAE4-10&quot;</td>
<td>140 (200)</td>
<td>170 (240)</td>
<td>SAE6-15&quot;</td>
<td>60 (97)</td>
<td>3000 rpm</td>
<td>5600 rpm</td>
<td>160 (185)</td>
<td>560-700</td>
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<tr>
<td>EM220-15</td>
<td>SAE6-15&quot;</td>
<td>170 (240)</td>
<td>200 (280)</td>
<td>SAE6-15&quot;</td>
<td>60 (97)</td>
<td>3000 rpm</td>
<td>5600 rpm</td>
<td>160 (185)</td>
<td>560-700</td>
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<td>EM220-20</td>
<td>SAE6-15&quot;</td>
<td>200 (280)</td>
<td>230 (330)</td>
<td>SAE6-15&quot;</td>
<td>60 (97)</td>
<td>3000 rpm</td>
<td>5600 rpm</td>
<td>160 (185)</td>
<td>560-700</td>
<td>560-700</td>
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<tr>
<td>EM220-35</td>
<td>SAE6-15&quot;</td>
<td>230 (330)</td>
<td>260 (370)</td>
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<td>60 (97)</td>
<td>3000 rpm</td>
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<tr>
<td>EM290-50</td>
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<td>3000 rpm</td>
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<td>EM290-75</td>
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<tr>
<td>EM350-100</td>
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<td>330 (470)</td>
<td>360 (500)</td>
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<td>3000 rpm</td>
<td>5600 rpm</td>
<td>160 (185)</td>
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<td>EM400-150</td>
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<td>360 (500)</td>
<td>390 (560)</td>
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<td>3000 rpm</td>
<td>5600 rpm</td>
<td>160 (185)</td>
<td>560-700</td>
<td>560-700</td>
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</table>
The innovative concept 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.

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.
Marine electric propulsion system integrated with single speed marine gear REVERMATIC 11-700RBD or two speed marine gear RANGERMATIC 21-700 RBD.

EPS-M35 including:
- E-machine EM290-35
- Frequency drive TYPE 75 powered at 300 V dc
- MPCB-5R Management system w/display and software
- Electronic control system for single engine
- Marine gear REVERMATIC or RANGERMATIC

EPS-M50 including:
- E-machine EM290-50
- Frequency drive TYPE 75 powered at 300 V dc
- MPCB-5R Management system w/display and software
- Electronic control system for single engine
- Marine gear REVERMATIC or RANGERMATIC

EPS-M75 including:
- E-machine EM290-75
- Frequency drive TYPE 75L powered at 300 V dc
- MPCB-5R Management system w/display and software
- Electronic control system for single engine
- Marine gear REVERMATIC or RANGERMATIC

Ratio available for powershift REVERMATIC or RANGERMATIC:
- Single speed model 11-700 ratio: 1.45 or 1.88 or 2.25 + reverse gear
- Double speed model 31-700 ratio 1.88 and 2.75 + 1.88 reverse gear

Electric traction system integrated with REVERMATIC 11-700 or RANGERMATIC 31-700 or 21-700 or 22-700

EPS-I35 including:
- E-machine EM290-35
- Frequency drive TYPE 75 powered at 300 V dc
- MPCB-5R Management system w/display and software
- Electronic control system for single engine
- Powershift transmission REVERMATIC and RANGERMATIC

EPS-I50 including:
- E-machine EM290-50
- Frequency drive TYPE 75 powered at 300 V dc
- MPCB-5R Management system w/display and software
- Electronic control system for single engine
- Powershift transmission REVERMATIC and RANGERMATIC

EPS-I75 including:
- E-machine EM290-75
- Frequency drive TYPE 75L powered at 300 V dc
- MPCB-5R Management system w/display and software
- Electronic control system for single engine
- Powershift transmission REVERMATIC and RANGERMATIC

Ratio available for powershift REVERMATIC or RANGERMATIC:
- Single speed model 11-700 ratio: 0.86 or 1.04 or 1.45 or 1.88 or 2.25 and reverse gear
- Three speed 31-700 ratio 0.865 - 1.882 - 2.75 and 1,882 reverse gear

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