RECOVAR®-E
Next-generation variable-speed drive for compressors and pumps
Variability is not just nice to have, it’s an economical must-have

Over the past twenty years, industry has developed solutions to make the speed of compressors and pumps variable. Before this, the only way to vary the output of these machines was the throttle. In many cases, more than half of the input power was lost.

With variable-speed drive solutions, this has changed.
• It started with hydraulic fluid couplings producing slippage with results not much better than the throttle.
• The design of hydraulic clutches then improved and included a torque converter and a superimposed epicyclic drive.
• Variable Frequency Drives (VFD) were developed and, at the same time, the cost of the shaft trains increased, and so did efficiency. The problem of THD (Total Harmonic grid Distortion) rose and kept VFD out of many applications.

RENK now presents the latest step in this development. RECOVAR®-E is a reengineered electric superimposition drive that helps the petrochemical industry to build the ideal variable-speed shaft train. A hybrid of a mechanical and an electrical solution offering the best of both worlds.
Why do you need RECOVAR®-E?

RECOVAR®-E – stands for R enk ECO nomic VAR iator.

RECOVAR®-E is a registered trademark of RENK. This drive solution offers speed variation at an economical initial and total cost.

While the original RECOVAR® used hydraulic superimposition the RECOVAR®-E has an electric superimposition drive. Taking advantage of the state of the art in electric motors and frequency converters, the driving system for the superimposition of the planet carrier is based on a Permanent Magnet Synchronous Superimposition (Si) motor and an Active Front-End Cycle Converter. So – E stands for Electric.

The cost efficient drive for Variable Speed Applications

RECOVAR®-E is a high-speed gear drive system incorporating components that allow the use of a low-cost constant-speed (electric) driver for a variable-speed application.

More than 50% of the compression and pumping systems above 3 MW require a variable-speed drive. Often medium-voltage motors fed by frequency converters and parallel shaft gears are selected. Others are using epicyclic gears with a hydrodynamic superimposition drive.

RECOVAR®-E is the drive solution for all these applications.

RECOVAR®-E for your application

A. Choose the power of your compressor/pump to be in the range of the lower chart – mark your dot A
B. Choose your lowest compressor/pump speed and power to be in the left hand lower chart – mark your dot B
C. Choose your highest compressor/pump speed and power to be in the right hand lower chart – mark your dot C

- If your three dots are within the charts we can build your variable speed drive
- If the connecting line between your dot A and B approaches vertical, this is a standard case
- If the connecting line between your dot B and C is nearly horizontal this is a standard case.
- In the standard case a first approach is that your driver can be selected for just 85–90% of the compressor/pump power
- The price of the RECOVAR®-E can be lowered if dot C is lower than dot B and also if dot B is left of dot A

Input speed can be freely selected
How is the system designed?

RECOVAR®-E is a torque-split drive. It uses a low-voltage Permanent Magnet Synchronous motor fed through an active Front-End Frequency Converter (FC) to rotate the planet carrier. When the speed is increased from a basic gear ratio, the SI motor works as an extra driver. Functioning as a generator, it allows the speed to be decreased.

The SI motor is rated according to the required torque and speed range of your application. The low power and high efficiency of the SI motor and FC boost the efficiency of RECOVAR®-E in excess of all other available solutions for variable-speed drives.

What is the driveline design?

The SI motor is directly coupled to the planet carrier. This design allows unparalleled simplicity with a total of 11 bearings compared to approximately double the mechanical complexity of any other superimposition drive. No working oil, no extra coolers, no extra oil tanks.

The SI motor is a state of the art Synchronous Motor. It offers ultimate efficiency of 96–98%, even at the lowest speed. The SI can provide zero speed until the brake is applied. Compared to an asynchronous induction motor the permanent magnet Synchronous Motor (Torque Motor), much more compact and lighter. This is due to the much higher magnetic field strength. Torque motors of the size employed in RECOVAR®-E have been used for more than a decade in thousands of direct drives.
**What are the major advantages of RECOVAR®-E?**

**Major features**

- Coaxial shaft arrangement
- **Lowest total weight** of all solutions
- **Lowest total space** requirement
- High input speed possible
- **API 614 compressor oil supply system** as for parallel shaft gear
- **20 % electric space** requirement compared to full-size medium-voltage converters
- Unrivalled **system availability** (even if the SI motor and FC is unavailable)
- Operation mode with passivated superimposition provides ultimate efficiency
- Most **API 613 requirements** can be complied with

---

**Negligible perturbation of grid**
(e.g. in offshore & FPSO applications)

**Unrivalled overall system efficiency**

![Graph showing system efficiency](image)

**Savings of RECOVAR®-E**
compared to existing solutions at approx. 10 MW

![Graph showing savings](image)
What about the Service Concept?

Most RECOVAR®-E components can be inspected/disassembled with the unit installed in the shaft train. For this purpose, RECOVAR®-E features a full horizontal split line.

The maintenance disadvantage of epicyclic gears (including existing superimposition gear concepts) has been overcome. By means of the SI motor and the brake, the controller will turn one planet after the other into the disassembly position. After the planets the central pinions can be removed. All parts are simple and easy to handle.

An efficient monitoring system for
- SI motor winding temperatures
- All bearing temperatures
- Output shaft vibrations
- SI – drive shaft vibration
makes sure, performance and condition are continuously monitored.

Who is responsible?

RENK is your system partner for RECOVAR®-E. We take care of all energy supply to the SI motor, system control and safety. RENK GEARcontrol (RGC) adapts itself to the local on-site PLC. Where possible, the RGC is maintainable online via an internet accessible router. RGC manages the start up, speed and safety control of RECOVAR®-E.

Have you got a reference?

RECOVAR® is a concept that has been successfully operating in power plants for 25 years. RENK has 20 years of experience in electric superimposition. Our SUPREX Extruder drives are working successfully in Polypropylene and Polyethylene plants. The feature powers between 5 and 22 MW. The RECOVAR®-E Design has been built up to a power of 97 MW at 8600 rpm.

The picture shows a RECOVAR® in service since 1989 and featuring hydraulic superimposition. A 97 MW RECOVAR®-E is operating in a test stand since 2016.
RENK AG

Augsburg Plant
Gögginger Str. 73
86159 Augsburg, Germany
Phone: +49 821 57 00-0
Fax: +49 821 57 00-460
Email: info.augsburg@renk.biz

www.renk.eu

A company of the MAN Group