Enex has developed an innovative method to improve the efficiency of R744 (CO\textsubscript{2}) refrigeration systems, based on overfeeding evaporators arranged in parallel. Several refrigeration systems of this type are already operating in different countries.

The \textit{Enjector\textsuperscript{®}} technology encompasses a series of design solutions for recovering of the energy contained in the high pressure fluid exiting the condenser/gas cooler. In one of the arrangements the energy recovered is used to obtain in a simple way the so-called “zero superheat” in evaporators, without the cost and the complexity associated with a liquid refrigerant pump.

**BENEFITS WITH ENJECTOR**

It is well known that today, with existing solutions, the limit for increasing suction pressure is the need to maintain at least 6 to 10K temperature difference between air to be cooled and evaporation temperature, so as to avoid risk of liquid at compressor suction, the most frequent cause of compressors breakdowns. Due to the above a significant part of heat transfer surface of evaporators is not used efficiently.

A better use of heat transfer surface allows an increase of evaporating temperature. For each degree increase of evaporation temperature the energy consumption reduces approx 3%, with an average increase of 5K the energy gain is about 15% all year round.

The liquid exiting the evaporators can be easily “pumped” into liquid receiver, from where it can feed again the evaporators.

When compared to dry-expansion evaporator systems, the proposed solution offers energy saving and smoother operating conditions, maintaining a simple plant lay-out and a low refrigerant charge, as well as a simple and trouble-free design.
**ENJECTOR FUNCTIONING**

The **ENJECTOR**® is used as an expansion device and at the same time it is able to pump liquid, if any, or vapor from low pressure side back into liquid receiver.

All the energy comes from recovery of energy from expansion process.

The energy contained in the high pressure fluid from condenser / gas cooler is transformed first into kinetic energy – very high velocity - in the nozzle. The pressure is reduced allowing sucking of liquid or vapor from auxiliary port. The kinetic energy of the fluid is then transformed into pressure by reducing the speed in the diffuser section of the ejector.

Basically the **ENJECTOR**® is a static compressor pumping both liquid and vapor, using “free” energy available from the high pressure fluid.

The **ENJECTOR**® concept matches perfectly with another well proven solution: “ECONOMIZER” further improving efficiency in the warmest climates: up to 25% compared with “State of the art” CO₂ systems today in use. The flash gas produced during the first stage of throttling process is compressed directly to high pressure, saving a significant amount of compressor work.

Moreover a significant amount of low pressure vapor can be compressed into intermediate receiver by the **ENJECTOR**®.

The **ENJECTOR**® is a static device, not subject to failure. The introduction of the new device doesn’t require any modification in the other components of the system and it is not critical: excluding it the system automatically operates according to usual dry expansion method. Together with the “ECONOMIZER” concept, the new system design outperforms, in terms of efficiency, any existing design concept for ambient temperatures up to 40°C and more.