The Enertronic Control System guarantees minimum energy consumption under all working conditions

This is achieved because the system continuously checks for the lowest possible condensing temperature against the falling ambient temperature.

Energy consumption can also be reduced because this advanced control can also operate at higher evaporating temperatures. If the control of the building installation is provided with a setpoint adjustment of the chilled water temperature – to aim continuously for the highest possible chilled water temperature – an annual energy saving up to 30% can be achieved with the Enertronic Control System when compared with conventional control systems.

To describe the effect of these controls to the energy consumption of a chiller, we use the COP (coefficient of performance) viz. cooling capacity / power consumption.

Fig. 1 shows the change in COP at a varying ambient temperature and a steady chilled water supply-temperature of 6 °C.

Whereas the cooling capacity increases and the power consumption decreases at lower ambient temperature, the COP of any chiller runs from 3,1 at 30 °C to 4,5 at 15 °C.

Fig. 2 shows the change in the COP at varying chilled water temperatures and a steady ambient temperature of 30 °C. With an increasing chilled water temperature both the cooling capacity as well as the power consumption increases. However, whereas the cooling capacity will increase faster the COP will only increase accordingly from 3,1 at 6 °C to 3,5 at 12 °C.

The COP considerably increases from 3,1 to 5 (see fig. 3) if we have the chilled water temperature equally being raised at falling ambient temperatures.

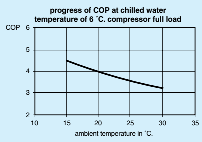

Fig. 1

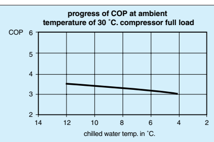

Fig. 2

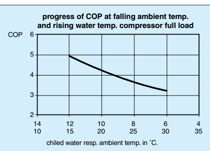

Fig. 3

The shown COP values are based on the full load operation of the chiller.
At part load the effect on the COP is even more favourable because of the oversized expansion valve which allows for even lower condensing values. Also the oversized evaporator and condensor at part load contributes to a more favourable COP.

By means of a load characteristic of a building and the annual progress of the ambient temperatures the total annual energy saving can be determined of a Lennox chiller fitted with the Enertronic Control System.
For comfort installations in a standard building energy savings of up to 30% are possible.

The Enertronic Control System: Applications

Application of the Lennox Enertronic Control System with the Ecologic Low-Noise or High Efficiency models, capacity range of 40 to 240 kW results in a perfect match of energy saving and respectively a low-noise operation or maximalisation of the COP under all operating conditions.

(Split)Seconscrew SC

The Enertronic Control System by Lennox is standard fitted with the Seconscrew compressor range in water, respectively split air cooled version from 150 to 450 kW.

(Split)Seconscrew SC

Subject to change without notice

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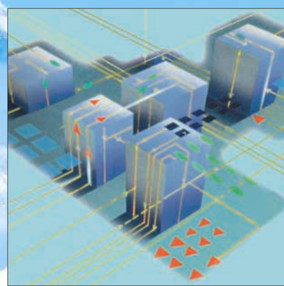
LENNOX

ENERTRONIC CONTROL SYSTEM

The Integral Chiller Control



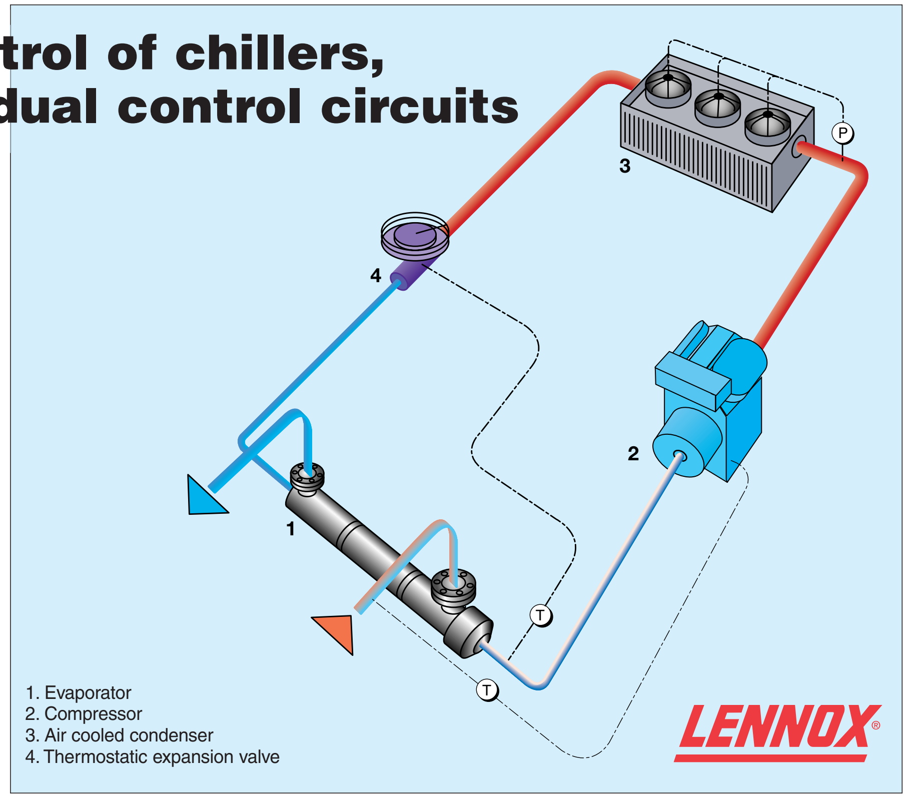
- **Maximalisation of Part Load COP**
- **Adaptive Control of LCWT**
- **BMS Communication Possibility**

Conventional control of chillers, featuring 3 individual control circuits

Market availability of a complete new generation of powerful, fast and free programmable micro-processors with high capacity memory, make it possible to have a new integral control of chillers, when combined with the software developed by Lennox.

This involves:
– A considerable reduction of the annual power consumption, with possible savings of 30% when compared with conventional units.
– An optimum operation of the chiller by the ability to 'tune' it to a specific building.
– Considerable improvement of control, operation and chiller-access, both for the user and the service engineers.
– Relatively simple application of future, environmentally friendly refrigerants.

In order to explain this new integral chiller control, it is worth reviewing the conventional control together with the pressure/enthalpy dia-gram.



– Chilled water inlet temperature - and compressor capacity control
– Condensing pressure control with respect to compressor capacity and condenser air inlet temperature
– Thermostatic expansion valve for superheat control

Conventional chiller control

This is characterised by three individual control circuits, which together evenly balance the cool-ing process. Adjusting the cooling capacity to the varying demand through these control circuits is, however, relatively slow.

Control circuit 1: evaporator-condensor
Variation in cooling demand of the unit is achieved by a modified inlet temperature of the cooling water at the evaporator. The multiple stage thermostat translates this modification into a command to the capacity control of the compressor, which results in an adapted sup-plied cooling capacity.
It is important to know that gen-erally, the following applies:

The more number of capacity stages involved, the smoother the operation of the chiller and the more favourable the annual power consumption. Moreover, a construction with two completely independent refrigerant circuits has an extra advantage to this effect.

Control circuit 2: compressor-condensor
Variation of compressor cooling capacity and ambient temperature result in a change of the condens-ing pressure. Within a certain band width, the condensing pres-sure is held on a constant level by the condensor pressure control which is required to ensure a cor-rect operation of the thermostatic expansion valve.

On aircooled chillers, this condens-or pressure control is obtained by on/off switches (pressostats) of the condensor fans or by applying a modulating fan speed control.
To this effect, a modulating fan speed control is far more prefer-able, when looking at the far smal-ler band width in which the con-densing pressure is maintained.

With pressostats this is, in practice, hard to achieve.

Control circuit 3: thermostatic expansion valve-evaporator
The thermostatic expansion valve primarily changes the state of the refrigerant from a liquid to a va-pour. The valve allows the correct amount of refrigerant through to hold the constant degree of 6K superheating at the evaporator. This is necessary to provide refrigerant gas at the compressor suction and avoid liquid slugging.

Pressure/enthalpy diagram Starting point for integral chiller control

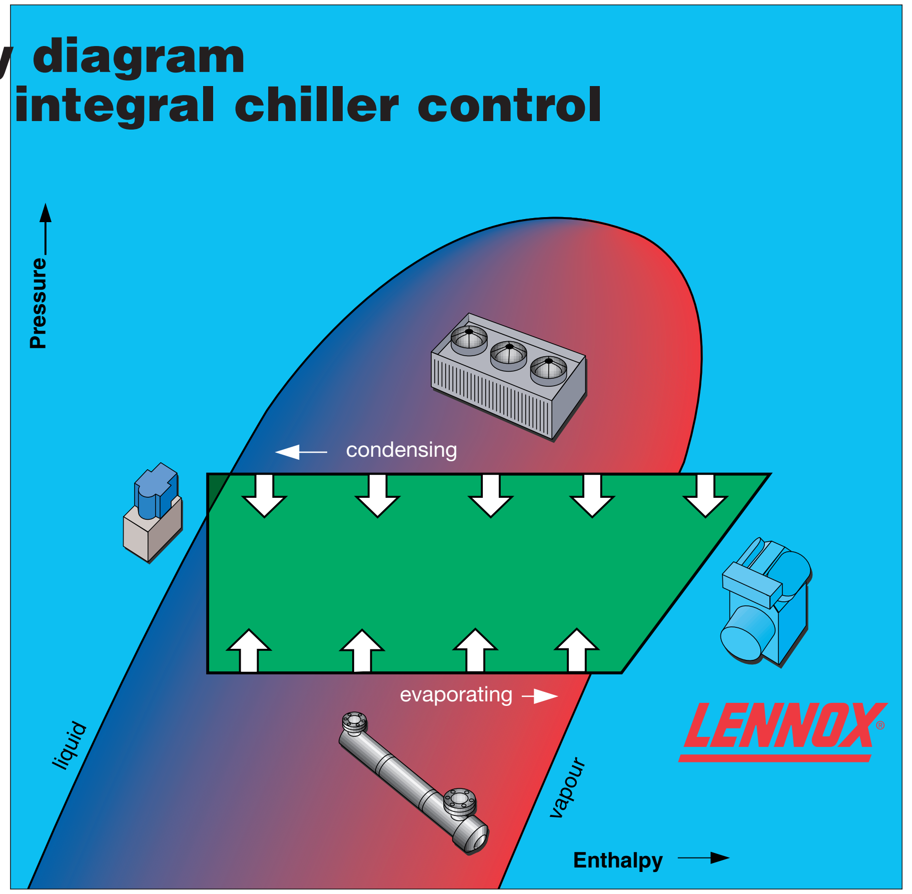
The pressure/enthalpy diagram is the starting point for the new integral chiller control.
The important value here is the distance between the evaporating and condensing lines, a standard for the power consumption i.e.: the smaller the difference between the evaporating and condensing pres-sure/ temperature, the lower the power consumption of the com-pressor.

Every chiller control is meant to close up the evaporating and condensing pressure within acceptable limits for a safe operation.
However, here the thermostatic expansion valve is the limitation, where it requires a minimum condensing temperature of 35 °C. for correct operation.

When applying an electronically controlled expansion valve, an operational safe run is guaranteed, even at considerably lower condensing temperatures up to 15 °C.

Moreover, the new integral chiller control makes it possible to achieve an operational safe run minimizing superheating.

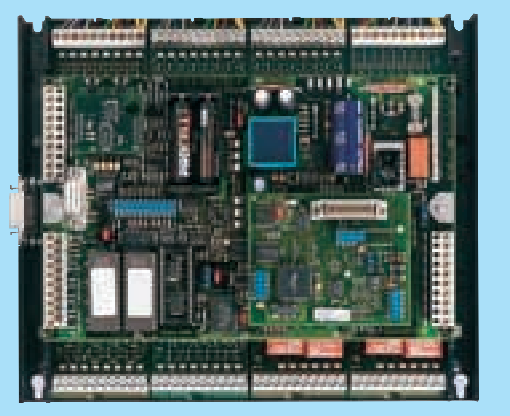
Showing respect for our environment



Under all operating conditions, a continuous control of:
– The lowest possible condensing temperature
– The highest possible evaporating temperature
– Chilled water outlet temperature adjusted to the actual demand

Consequently, one can work with a higher evaporating tempera-ture, which results in an improved energy efficiency.

Enertronic Control System (PLC)



The Enertronic Control System The integral chiller control

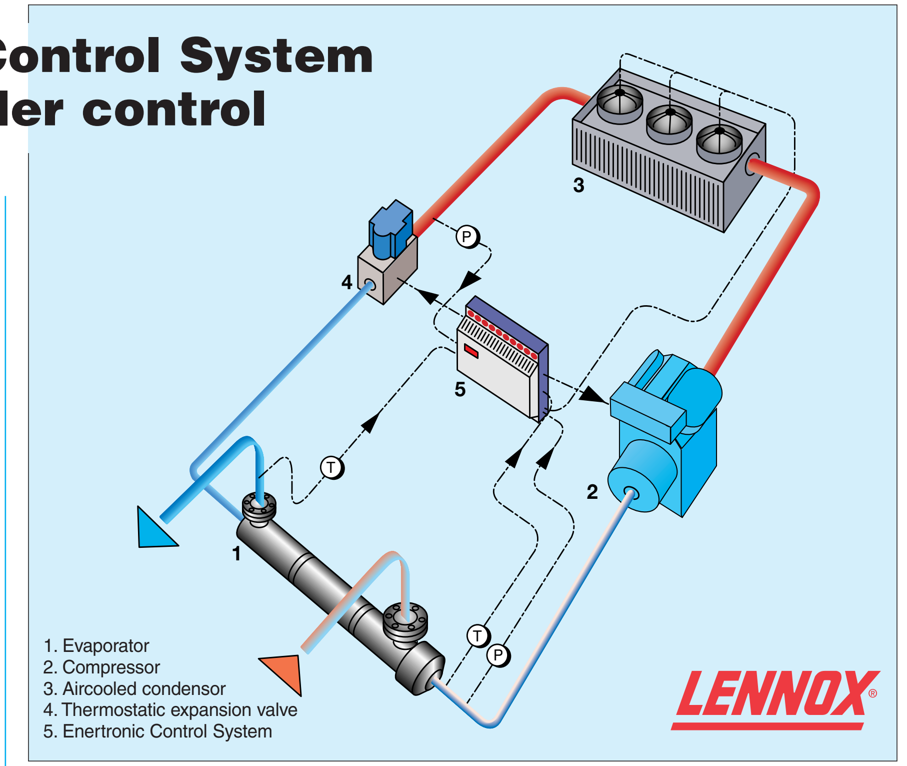
With the new integral chiller control from Lennox, the Enertronic Control System, a minimum power consumption can be guaranteed under all operating conditions. Energy savings up to 30% on an annual basis can be achieved when compared with conventional-ly controlled chillers.

The Enertronic Control System comprises:

– The application of a new ex-tremely powerful and fast free-programmable microprocessor, which absorbs all actual relevant data of the chilling process, and turns it into control signals.
– The in-house software developed by Lennox which, with the help of the recorded data, continuous-ly strives for a lowest possible condensing temperature, a high-est possible evaporating temper-ature and a chilled water outlet temperature adjusted to the actual demand.
– The application of a new modulating speed control for the condenser fan motors: the pulse band control.
– The application of electronic expansion valves.
– The self-parametric control of both the chilled water outlet temperature, as well as the condensing pressure control.
– The display (monitor).

The Enertronic Control System makes it possible to hook up to building control systems by adding standard modules. This enables to aim continuously for a set-point rise of the outlet temperature of the chilled water; consequently a setpoint rise of 6 °C to 12 °C chilled water outlet temperature will result in an improved COP of 20%.
Optimum adjustment of the chiller and building behaviour can be obtained because of this new electronic control, which is appar-ent from:

– A more accurate control of the chilled water outlet temperature.



The Enertronic Control System comprises:
– Powerful microprocessor
– In-house developed software
– Adaptieve control of chilled water outlet temperature
– Elektronic expansion valve

– The band width regulation of the chilled water outlet temperature based on the water flow.
– Adjustment of the band width based on the ambient temper-ature.

Remote control through a modem socket is a standard option, while specific customers' demands can also be implemented, with the modular software set-up of Lennox.

With an intelligent control input from the building control system, one can utilize the intelligence of the Enertronic Control System to its best performance.

With the set-up of the software, the physical characteristics of environment friendly refrigerants R134a and R407c have also been taken into account, together with the standard R22 refrigerant.

In conclusion, the new integral control technology of Lennox offers its users and their installation an extremely efficient energy saving and optimally designed chiller.

Up to 30% annual energy savings compared to conventional control