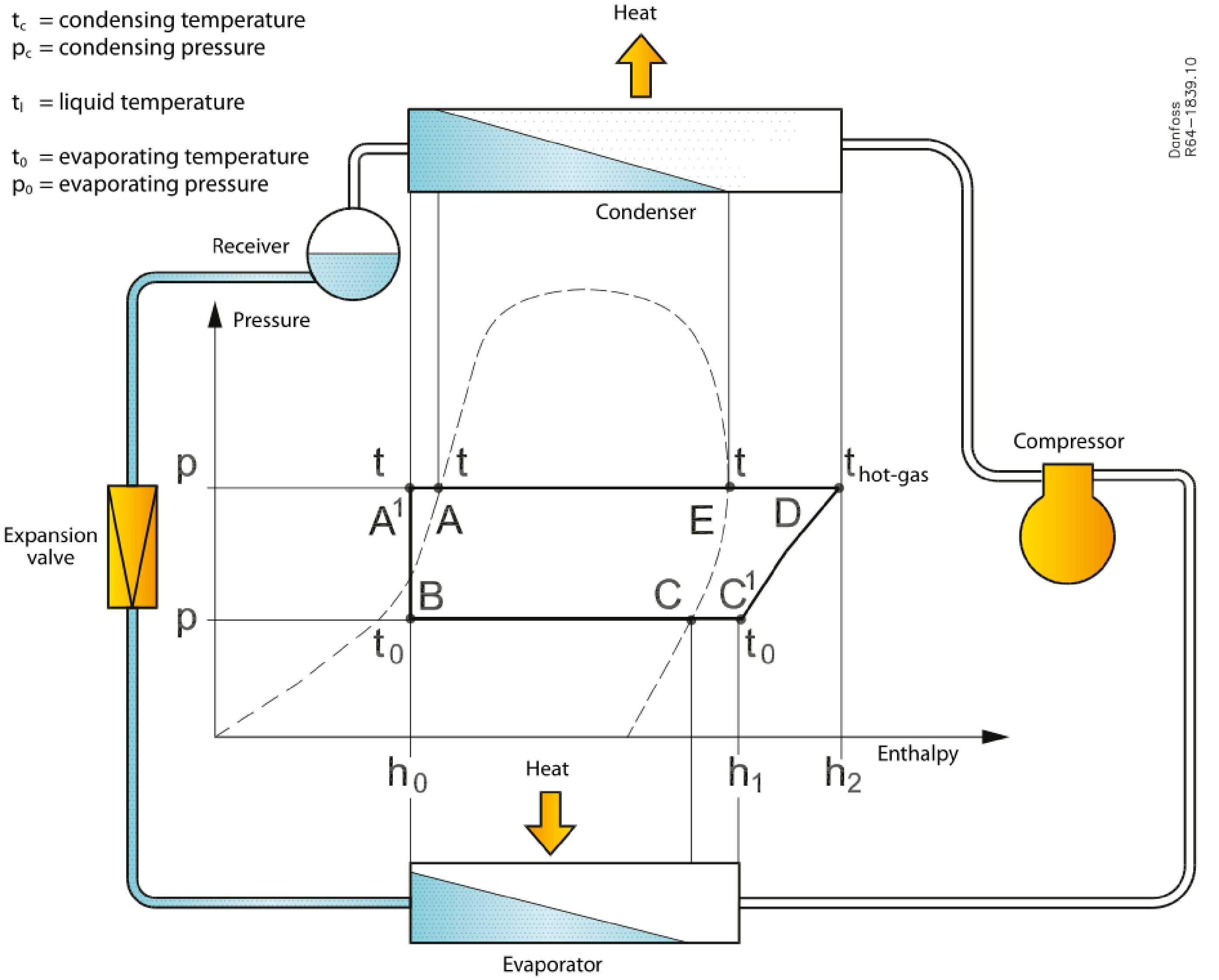

The condensed refrigerant in the condenser is in condition A which lies on the line for the boiling point of the liquid. The liquid has thus a temperature t c , a pressure p c also called saturated temperature and pressure.
The condensed liquid in the condenser is further cooled down in the condenser to a lower temperature A' and now has a temperature t l and an enthalpy h 0 . The liquid is now sub-cooled which means that it is cooled to a lower temperature than the saturated temperature.
The condensed liquid in the receiver is in condition A' which is sub-cooled liquid. This liquid temperature can change if the receiver and liquid is either heated or cooled by the ambient temperature. If the liquid is cooled the sub-cooling will increase and visa versa.
When the liquid passes through the expansion valve its condition will change from A' to B. This conditional change is brought about by the boiling liquid because of the drop in pressure to p0 .
At the same time a lower boiling point is produced, t0 , because of the drop in pressure.
In the expansion valve the enthalpy is constant h 0 , as heat is neither applied nor removed.
At the evaporator inlet, point B, there is a mixture of liquid and vapour while in the evaporator at C there is saturated vapour. At the evaporator outlet 4. Refrigeration process, pressure/enthalpy diagram point C' there is super-heated vapour which means that the suction gas is heated to a higher temperature than the saturated temperature.
Pressure and temperature are the same at point B and at outlet point C' where the gas is super-heat- ed the evaporator has absorbed heat from the surroundings and the enthalpy has changed to h1 .
When the refrigerant passes through the compressor its condition changes from C' to D.

Pressure rises to condensing pressure p c . The temperature rises to t hot-gas which is higher than the condensing temperature t c because the vapour has been strongly superheated. More energy (from the electrical motor) in the form of heathas also been introduced and the enthalpy there fore changes to h2 .
At the condenser inlet, point D, the condition is thus one of superheated vapour at pressure p c .
Heat is given off from the condenser to the surroundings so that the enthalpy again changes to main point A' . First in the condenser there occurs a conditional change from strongly superheated vapour to saturated vapour (point E), then a condensation of the saturated vapour. From point E to point A the temperature (condensing tempera ture) remains the same, in that condensation and evaporation occurs at constant temperature.
From point A to point A' in the condenser the condensed liquid is further cooled down, but the pressure remains the same and the liquid is now sub-cooled.

Figure B gives details of momentary temperatures in a refrigeration plant. At the compressor outlet the pressure is 7.6 bar and the temperature is 60 °C because of the presence of superheated gas. The temperature in the upper part of the condenser will quickly fall to saturation temperature, which at the pressure concerned will be 34 °C, because superheat is removed and condensation begins.

Pressure at the receiver outlet will remain more or less the same, while subcooling of the liquid begins because the temperature has fallen by 2 °C to 32 °C.

In the evaporator a pressure of 1 bar and an evaporating temperature of –10 °C are indicated. In the last part of the evaporator the vapour becomes superheated so the temperature at the thermostatic expansion valve bulb becomes +2 °C, corresponding to the superheat set on the valve.

As illustrated below, air temperature will vary, in that the air will take up heat on its way round the store from products, walls, ceiling, etc. The temperature of the air blown across the condenser will also vary with the time of year.

A refrigeration plant must then be dimensioned according to the largest load it will be subjected to. To be able to accommodate smaller loads, facilities must exist in the plant for altering yield. The process of making such alterations is called regulation and it is precisely regulation that Danfoss' automatic controls are made for. But that is a subject, which is outside the scope of this publication.