

- 17 -

CLAIMS

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1. A modular heat pump assembly adapted to be attached to a conditioning chamber, the heat pump assembly comprising:

a two-stage evaporator system comprising high and low pressure evaporators

5 for conditioning of air;

a hot gas condenser for introducing sensible heat to the air;

a compressor;

an external evaporator for facilitating constant latent load maintenance;

10 at least one inlet port for receiving air from said conditioning chamber for conditioning by said heat pump assembly; and

an outlet port for discharging conditioned air from the heat pump assembly to the conditioning chamber.

2. An assembly according to claim 1, wherein said high and low pressure evaporators are arranged in a parallel or a series configuration.

15 3. An assembly according to claim 1, wherein said high and low pressure evaporators are provided by a single evaporator coil with variable pressure for latent and sensible air conditioning.

20 4. An assembly according to claim 1, wherein said high pressure evaporator operates as a partial dry/wet coil, and said low pressure evaporator operates as a dedicated wet coil.

5. An assembly according to claim 1, wherein a back pressure regulating valve is installed at a discharge line of said high pressure evaporator to ensure constant evaporating pressure.

25 6. An assembly according to claim 1, wherein said hot-gas condenser includes a sub-cooler arrangement comprising two sub-coolers.

7. An assembly according to claim 1, comprising control means for ensuring sufficient sensible heat is provided from the hot-gas condenser to the drying air to achieve a predetermined air temperature.

- 18 -

8. An assembly according to claim 7, wherein refrigerant flow to said condenser is regulated by means of a 3-way modulating valve.

9. An assembly according to claim 1, comprising a condenser for regulating temperature of said air by discharging excess heat from said air.

5 10. An assembly according to claim 9, wherein said condenser is an air-cooled condenser.

11. An assembly according to claim 9, wherein said condenser is one which can reject heat by heat transfer through cooling media besides air, such as a water-cooled condenser.

10 12. An assembly according to claim 1, comprising a bypass damper system for regulating the flow of bypass air through the assembly.

13. An assembly according to claim 12, comprising control means for modulating said bypass damper system to maintain a desired humidity of the air.

15 14. An assembly according to claim 1, comprising an auxiliary heater for facilitating the introduction of additional sensible heat to cater to higher temperature requirements of said air.

15. An assembly according to claim 14, comprising control means for activating said auxiliary heater as required.

20 16. An assembly according to claim 1, comprising an economiser installed before and after said evaporators for precooling said drying air before it enters said evaporators and preheating said drying air before it enters said condenser.

17. An assembly according to claim 16, wherein said economiser comprises two plate-fin coils charged with refrigerant.

25 18. An assembly according to claim 16, wherein said economiser comprises a compact heat exchanger or fin-tube heat exchanger.

19. An assembly according to claim 1, wherein said compressor is a scroll-type

- 19 -

compressor.

20. An assembly according to claim 1, wherein the compression of vapour refrigerant takes place with compressors operating with different compression methods such as centrifugal, reciprocating, rotary and screw compressors.

5 21. An assembly according to claim 1, wherein the compressor can be open, semi-hermetic or fully-hermetic.

22. An assembly according to claim 1, comprising a circulating fan, axial or centrifugal, for circulating air within the assembly and for discharging conditioned air to said conditioning chamber.

10 23. An assembly according to claim 1, comprising inlet means for facilitating the introduction of fresh air for mixing with the air within said assembly.

24. An assembly according to claim 23, wherein said inlet means includes an adjustable suction louver arrangement.

25. A heat pump assembly comprising:

15 a heat pump unit comprising (i) a two-stage evaporator system comprising high and low pressure evaporators for conditioning of air; (ii) a hot-gas condenser for introducing sensible heat to said air; (iii) a compressor; and (iv) an external evaporator for receiving said air from said hot-gas condenser and for facilitating constant latent load maintenance; and

20 a drying chamber adapted to receive conditioned air from said heat pump unit and recirculate air to the heat pump unit.

26. An assembly according to claim 25, wherein said heat pump unit and said drying chamber are partitioned from each other to facilitate scale-up of said drying chamber without altering said heat pump unit.