COLLEGE OF ENGINEERING, PUNE

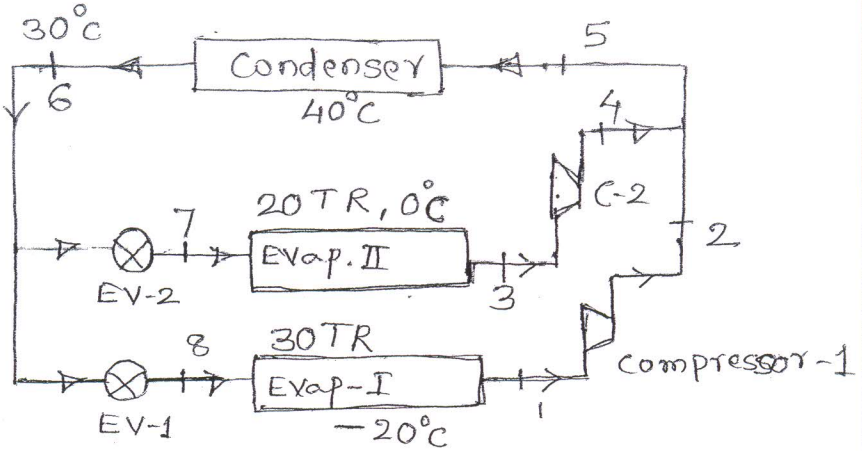
T.Y. B.TECH (MECH)

END SEMESTER EXAMINATION 2012-13

Sub: Refrigeration and Air Conditioning

Time: 3 hours **Max. Marks:** 50

INSTRUCTIONS: 1. All questions carry equal marks
2. Make suitable assumptions and state them clearly
3. Use of calculator is allowed
4. Use of refrigerant properties and charts allowed

1	a) A refrigeration system is shown in the figure given below. Represent the process on h-s diagram.  Determine: i) Mass of refrigerant circulated in each evaporator, ii) Power for each compressor and total power and ii) COP of the system. You can refer the refrigerant property table/chart.	5
	b) A multiple evaporator R-134a refrigeration system works between the temperature limits of -15°C and 30°C using a single compressor. It has two evaporators both working at -15°C having refrigeration load of 20 TR and 30 TR. You can assume the vapour entering the coprocessor is dry and saturated and there is no subcooling of refrigerant at the end of condenser. Using the properties of the refrigerant form charts/tables. Show the system on p-h diagram. Find: i) Refrigerating effect per kg of refrigerant. ii) The compressor power, iii) COP of he sytem	5
2	a) Define specific humidity and derive its equation in the form of partial pressure of water vapour and dry air	3
	b) Explain to estimate the heat load from occupants and ventilation air in estimation of a cooling load in air conditioning.	2
	c) The conditions inside a room are 25°C and 50% RH. The inside surface temperature of the window glass is 10°C. Will the moisture condense	2

	from the room air upon the window glass? d) The temperature of air entering the adiabatic saturator is 43°C and for the air leaving is 32°C. Determine specific humidity and relative humidity of the air entering if the atmospheric pressure is 101.325 kPa.	3
3	a) Explain the summer air conditioning system with the help of a block diagram and represent it on a psychrometric chart.	4
	b) An air conditioning plant is to be designed for comfort application for 25 persons with the following data: • Inside design conditions: 25°C DBT and 50% RH • Outside design conditions: 40°C DBT and 28°C WBT • Solar heat gain through glass: 5.5 kW • Solar heat gain through walls, roof : 5.8kW • Sensible heat gain per person: 60W, there are • Latent heat gain per person: 60 W • Internal lighting load: 25 lamps of 100 W • Sensible heat gain from other sources: 11.5 kW • In-filtrated air: 20 m^3/min • BPF: 0.2 • If 25% fresh air and 75% recirculated air is mixed and passed through the conditioner coil find: a. RSHF b. DPT of coil c. Amount of total air required d. Condition of supply air e. Capacity of the conditioner plant Draw the schematic diagram of the system and show the same on psychrometric chart	6
4	a) Give the classification of air conditioning systems. Explain with a neat sketch All-water air conditioning system.	5
	b) Name the methods to control the capacity of the compressor. Explain any one method with the help of a sketch. OR	5
	b) Give the classification of duct. The supply air quantity and the lengths of ducts are shown in figure shown below:. The velocity of air in main duct AB is limited to 400m/min. Find the sizes of the duct.	5

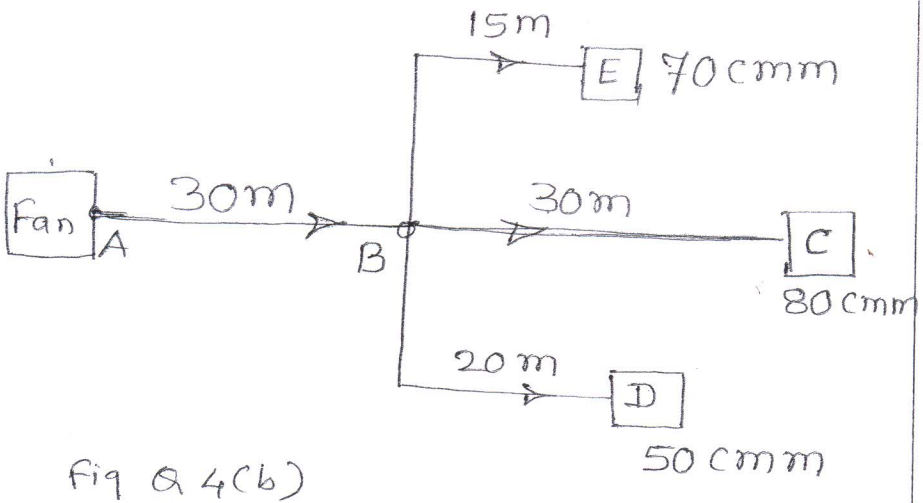


fig Q 4(b)

5	a) Explain the working of a Thermostatic expansion valve with a neat sketch. OR What do you mean by comfort? Explain the concept of thermodynamics of a human body for comfort conditions with suitable mathematical model.	**05**
	b) Explain with the help of a block diagram Lithium bromide absorption refrigeration system.	**05**
	OR Draw the block diagram of an air cooler. How do you evaluate the performance of an air cooler? Explain	**05**

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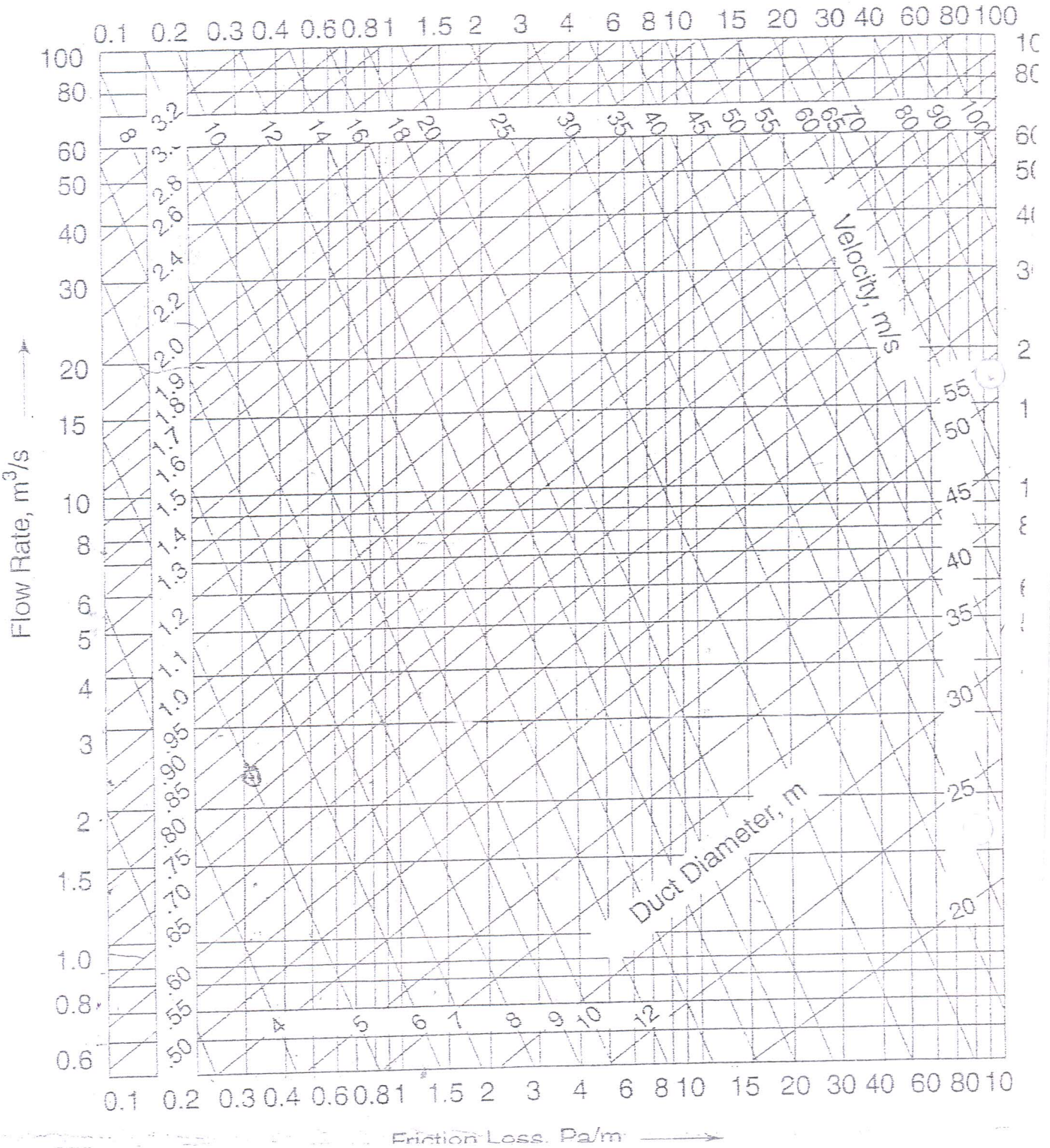

Friction Loss, Pa/m →

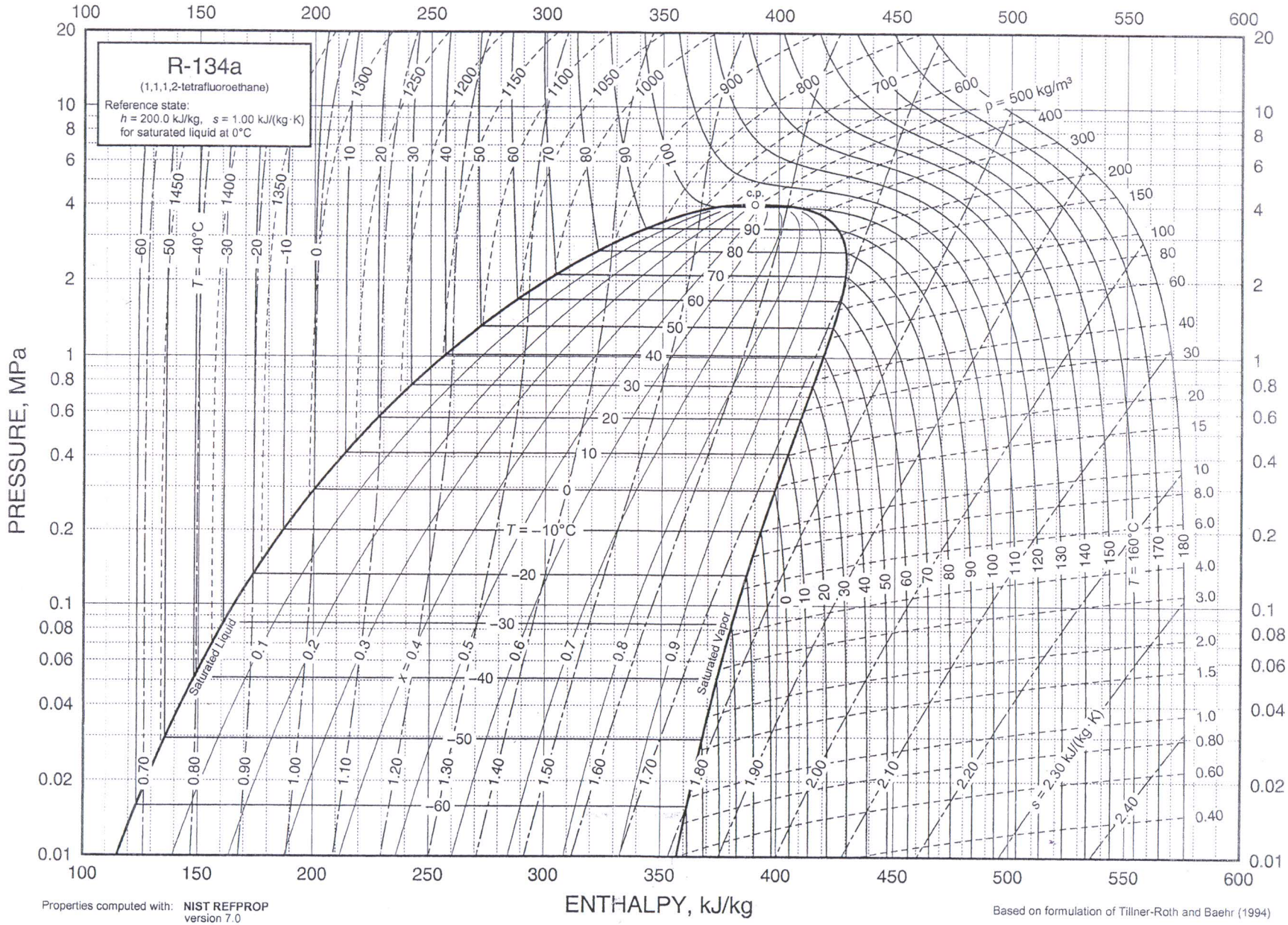

Fig. 8 Pressure-Enthalpy Diagram for Refrigerant 134a

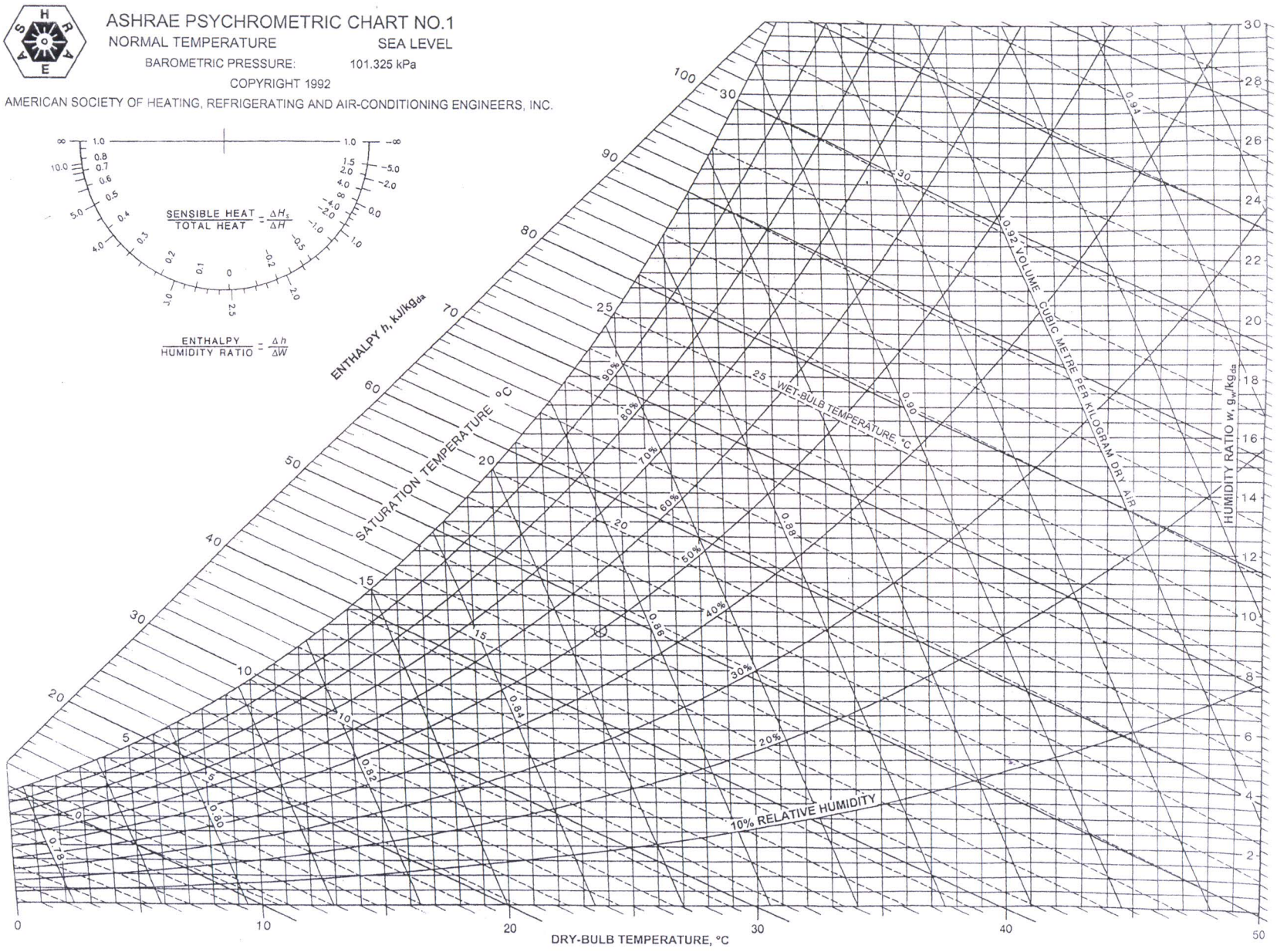

Fig. 1 ASHRAE Psychrometric Chart No. 1