

Minerals Council South Africa



EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA – INTERMEDIATE CERTIFICATE IN MINE ENVIRONMENTAL CONTROL	EXAMINER: NEO DIKGALE
PAPER 2	MODERATOR: NAVARRE KRUGER
SUBJECT CODE: COMIMEC2	TOTAL MARKS: [100]
EXAMINATION DATE: 13 MAY 2023	PASS MARK: (60%)
TIME: 14:30 – 17:30 (3 HOURS)	

NUMBER OF PAGES: 8 including the psychrometric charts & this cover page

SPECIAL REQUIREMENTS:

THIS IS **NOT** AN **OPEN BOOK EXAMINATION**.

FORMULA HANDOUTS ARE AVAILABLE TO CANDIDATES:

1. Answer all 5 questions **legibly** in English.
2. Write your **ID number** on the outside cover of each book used, and on any graph paper or other loose sheets handed in.

NB: Your name **must not** appear on any answer book or loose sheets.

3. Show all calculations and **check calculations on which your answers are based**.
4. Hand-held electronic calculators may be used for calculations.
5. Write **legibly**, in ink, on the **right-hand page** only – **left hand pages will not be marked**.
6. Illustrate your answers by means of sketches or diagrams wherever possible.
7. Answers must be given to an accuracy which is typical of practical conditions.

NB: Ensure that the correct unit of measurement (SI unit) is recorded, as marks will be deducted from answers if the incorrect unit is used (even if the calculated value is correct).

8. Please note that you are not allowed to contact the examiner or moderator regarding this examination.
9. Cell phones and any other electronic devices are **NOT** allowed in the examination room.
10. **The following charts are included: Psychrometric chart: 82,5kPa; 85kPa; 105kPa and 112,5kPa**

QUESTION 1

- 1.1 Answer the following questions based on sensible and latent heat:
- 1.1.1 What is the difference between sensible and latent heat? (2)
- 1.1.2 State the two kinds of latent heat (2)
- 1.1.3 How much latent heat is required to change 1kg of water into ice? (1)
- 1.1.4 How much latent heat is required to change 1kg of water into water vapour? (1)
- 1.2 What is the main source of heat in coal mines? (1)
- 1.3 List the three ways in which you will reduce the effects of the heat source mentioned in 1.2 above? (3)
- 1.4 The VRT in Gauteng/West Wits is lower ($9^{\circ}\text{C}/1000\text{m}$) than in the Free-State ($14.6^{\circ}\text{C}/1000\text{m}$). State the reason for this? (2)
- 1.5 Name and describe the three different ways in which heat can affect a worker. (6)
- 1.6 What is the main driving force of heat transfer? (1)
- 1.7 Define thermal capacity (1)

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QUESTION 2

- 2.1 Name two engineering and two administrative controls to reduce the effects of heat stress. (4)
- 2.2 Calculate the wet bulb temperature of air flowing at 2.0m/s if the wet kata is measured as $14.0\text{ mCal/cm}^2/\text{s}$. (3)
- 2.3 Calculate the amount of heat required to change 5kg of ice at -6°C to superheated water vapour at 110°C . If the process took 9 minutes, calculate the power involved? (10)
- 2.4 The estimated VRT for a mine in Klerksdorp is 49.1°C . Calculate the approximate depth in meters. (3)

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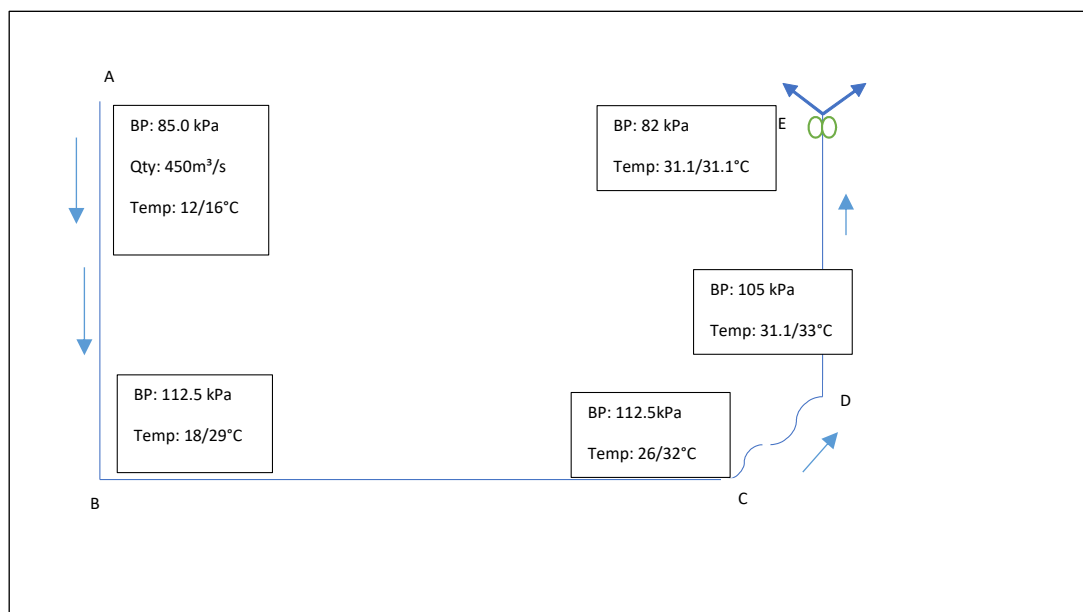
QUESTION 3

- 3.1 Describe how to test and remove hazardous and toxic gases from a confined space. (5)
- 3.2 Drinking water collected in your mine was found to contain traces of E-Coli. What would you recommend as the Occupational Hygiene officer on the mine? (1)
- 3.3. List 2 health hazards associated with contaminated process water? (2)
- 3.4 List 5 possible measures to protect workers against the effects of vibration (5)
- 3.5 Define the phenomenon “Stroboscopic effect” and how to control this effect. (2)
- 3.6 Section 11(5) of the MHSA requires an employer to conduct an investigation. Name the three types of investigations required under this section and all the stakeholders that should be involved in such investigations. (5)

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QUESTION 4

- 4.1 The air volume of $80\text{m}^3/\text{s}$ enters a bulk air cooler at $29.5/31.7^\circ\text{C}$ and the air quantity leaving the bulk air cooler is $78.8\text{m}^3/\text{s}$. Calculate the temperature of air leaving the bulk air cooler, assuming the pressure remains constant, and the air leaving is saturated. (3)
- 4.2 Utilize the sketch below to calculate the quantities at B,C, D and E assuming there are no air leakages. (10)



- 4.3 The intake air temperature to an underground hoist is 20.0/24.0°C and the barometric pressure is 110kPa. The hoist motor requires an electric input power of 2500kW and is 87% efficient. **Calculate:**
- 4.3.1. The amount of waste heat given off by the hoist motor (1)
- 4.3.2. The quantity of intake air which must be sent through the chamber to ensure that the wet bulb temperature does not exceed 23.0°C (4)
- 4.4. Air quantity of 60m³/s enters a 2850kW cooler at a temperature of 28.5/32.1°C. Calculate the temperature and the quantity of the air leaving the cooler. The barometric pressure is 105kPa. (4)

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QUESTION 5

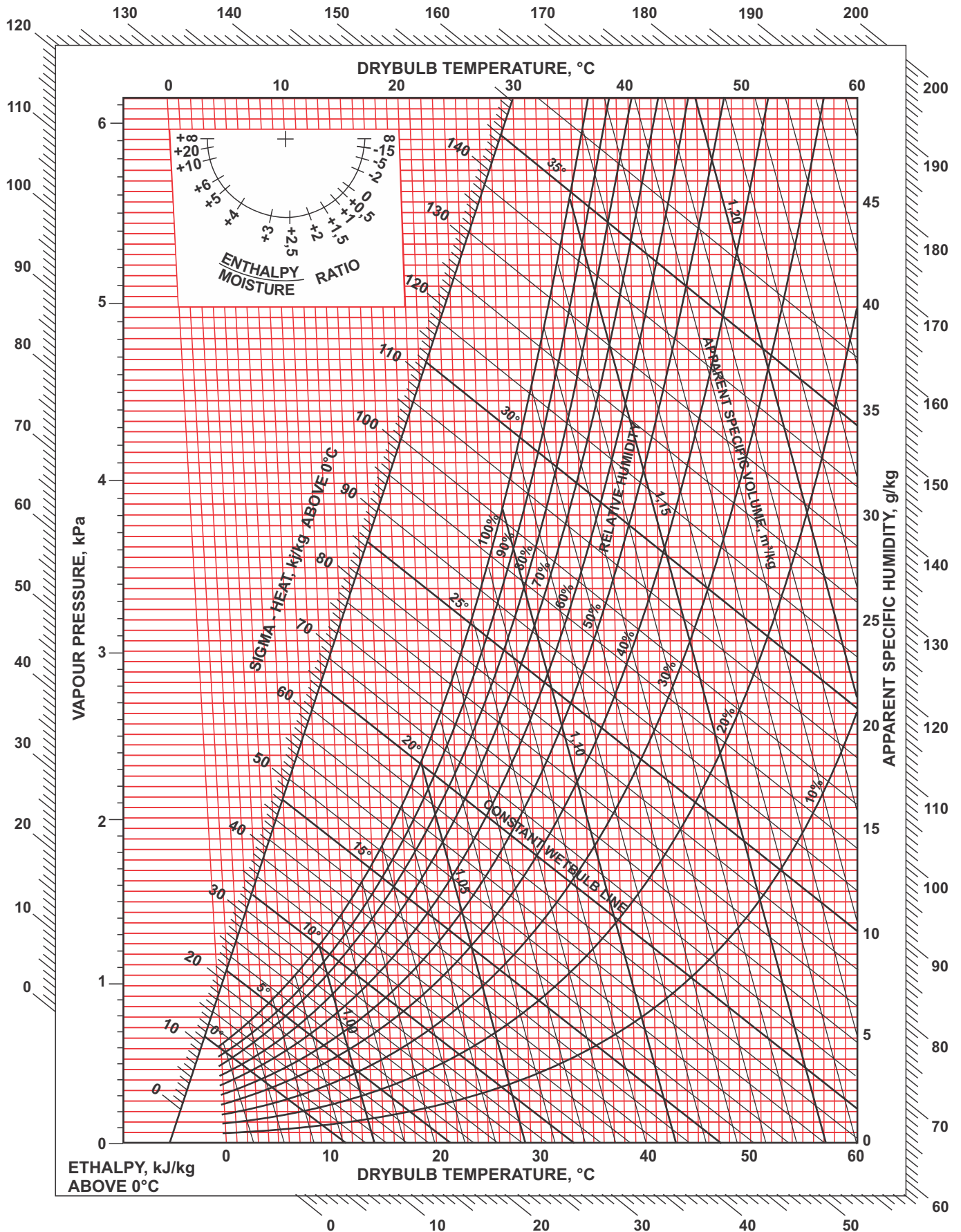
- 5.1 Name and discuss three health effects of airborne pollutants (6)
- 5.2 Discuss the principle of operation of Gravimetric samplers (3)
- 5.3. List the five requirements that an ideal dust sampling instrument should meet (5)
- 5.4 Name three points that should be considered when selecting a suitable filter (3)
- 5.4 Define Occupational Exposure limit- Ceiling Limit (OEL-C) (1)

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Total Marks [100]

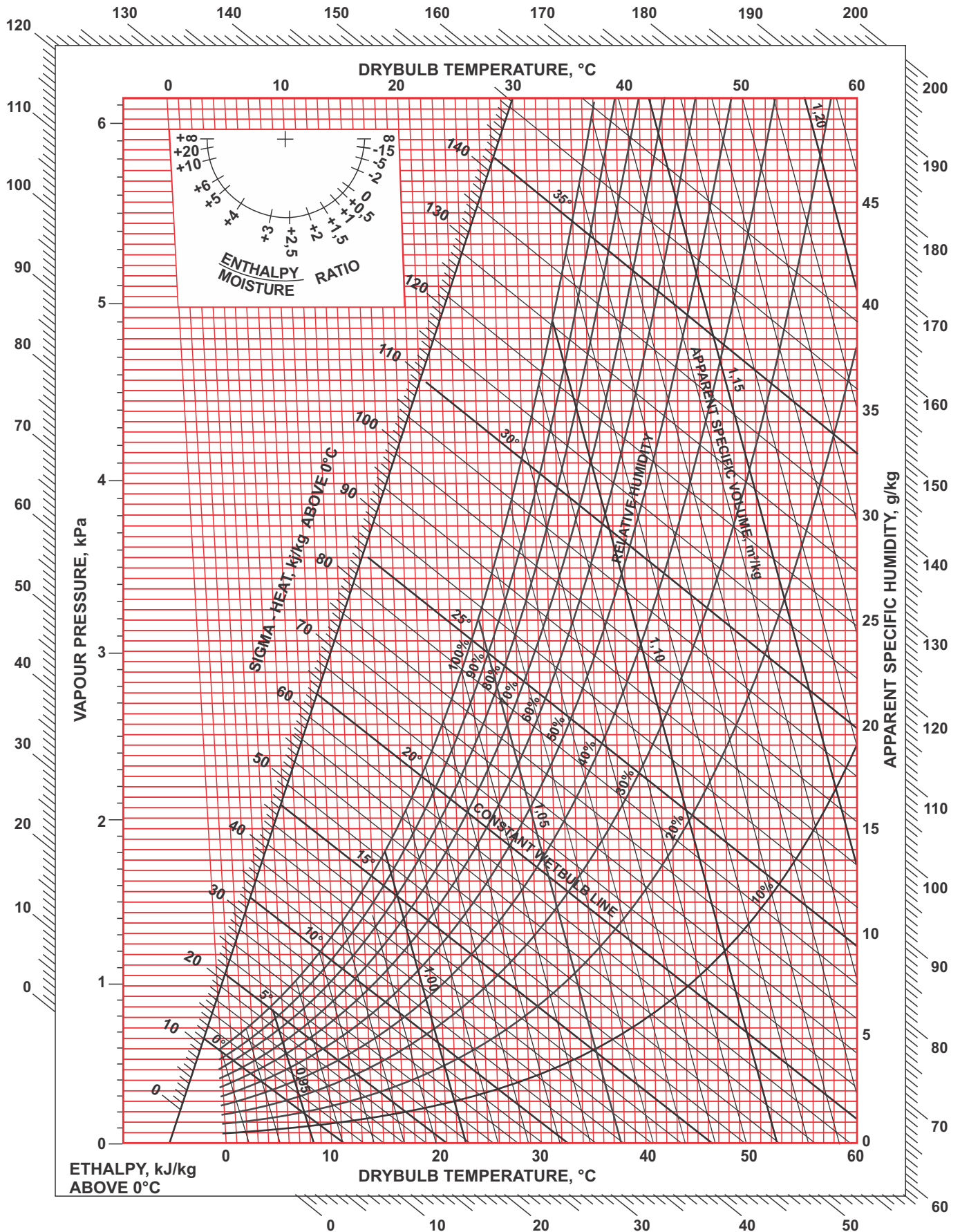
PSYCHROMETRIC CHART

82,5 kPa



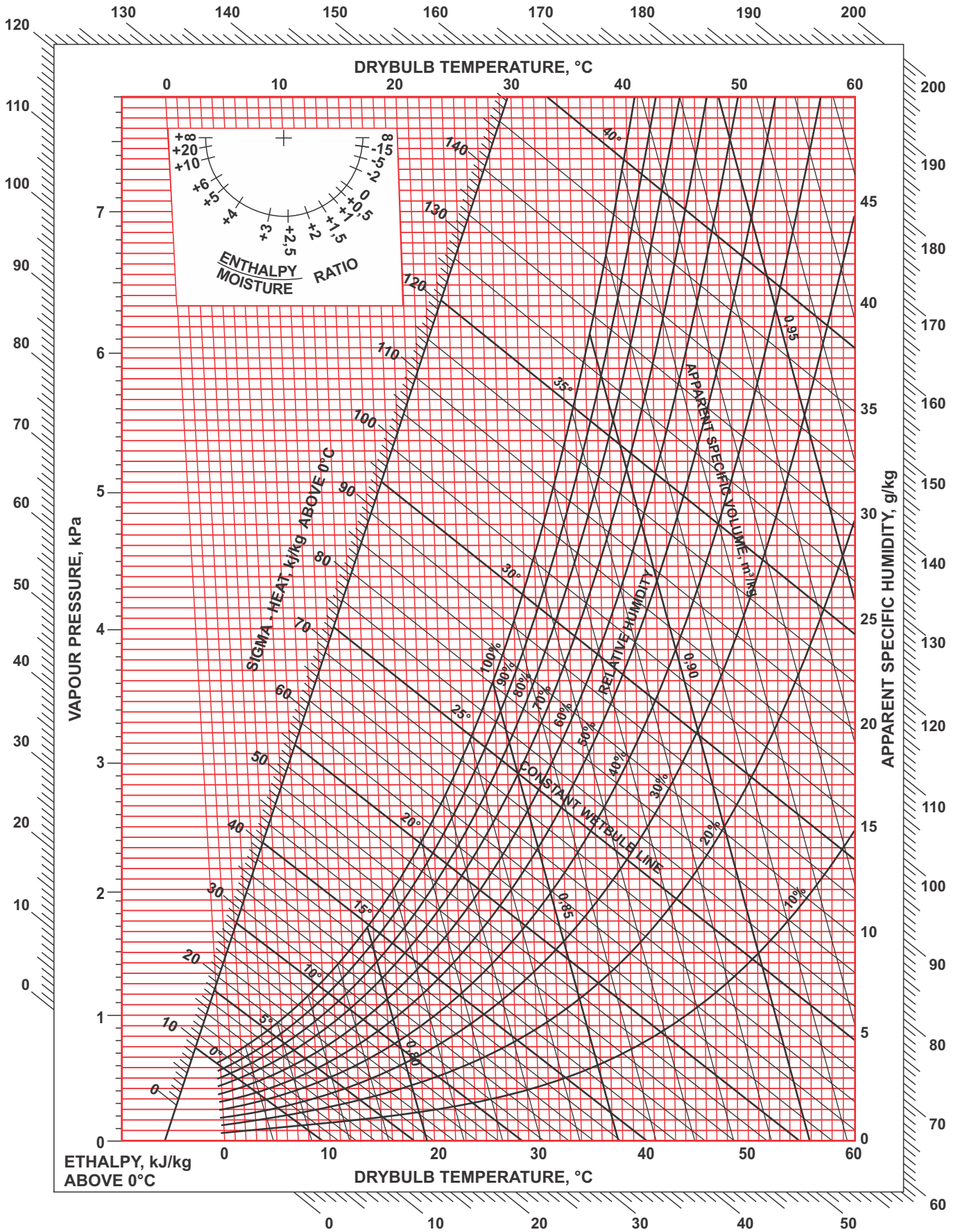
PSYCHROMETRIC CHART

85,0 kPa



PSYCHROMETRIC CHART

105,0 kPa



PSYCHROMETRIC CHART

112,5 kPa

