SEE-Tech Solutions Pvt. Ltd.
Solution Providers for Energy Conservation & Plant Safety Improvement
"LetsConserve", 11/5, MIDC Infotech Park, Near VRCE Telephone Exchange,
South Ambazari Road, NAGPUR - 440 022, (INDIA)
Tel: +91-712-2222177, Fax: +91-712-2225293, E-mail: seemil_ngp@sancharnet.in
www.letsconserve.org

Area: Psychometry and Heat Exchanger

Topic: Double Effect Evaporative Cooling

Problem/ Issue: During summer when air is hot and humidity is low, generally most preferred solution for cooling is Evaporative Cooling as it is most efficient way compared to other options available like air conditioning through vapor absorption route. This option is feasible for small area where cooling is needed. But for larger volume or space like in official buildings we need to have large capacity cooler and some other advanced solution to have cooling equivalent to air conditioning.

Need: We need to design evaporative cooling with double effect to tackle the problem. Refer the scan copy of psychrometric chart provided with this problem.

Initially consider outside temperature of 41 deg in summer and you have to design the cooling system to cool it up to such a minimum level where cooling becomes equivalent to air conditioning by evaporative cooling only. In psychrometric chart, start from 41 deg and cool moist air adiabatically to saturation level i.e. at 100% RH where you get WBT of 25 deg. and corresponding DBT close to 26 deg. This is the maximum limit up to which you can cool the mixture as air gets saturated at 25 deg.

Still more cooling is achievable. We have to think other way. Go for double effect evaporative cooling which will cool air further below 25 deg. Now follow dotted line from point A to point C where we are giving sensible cooling to air from 41 to 28 deg (by using heat exchanger) and then we are cooling it adiabatically (by mixing moisture like evaporative cooling) to finally reach at lower DBT of 21 deg.

Expected Outcome from your work:

1. Your job is to design the system for such a double effect evaporative cooling.
2. Design heat exchanger for sensible cooling and post adiabatic cooling so that finally we can achieve cooling effect as close to Air conditioning.
3. Choose standard parameters and values available from books and consider the summer room temperature conditions.

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PSYCHROMETRIC CHART

Normal Temperature

SI Units

SEA LEVEL

BAROMETRIC PRESSURE: 101.325 kPa

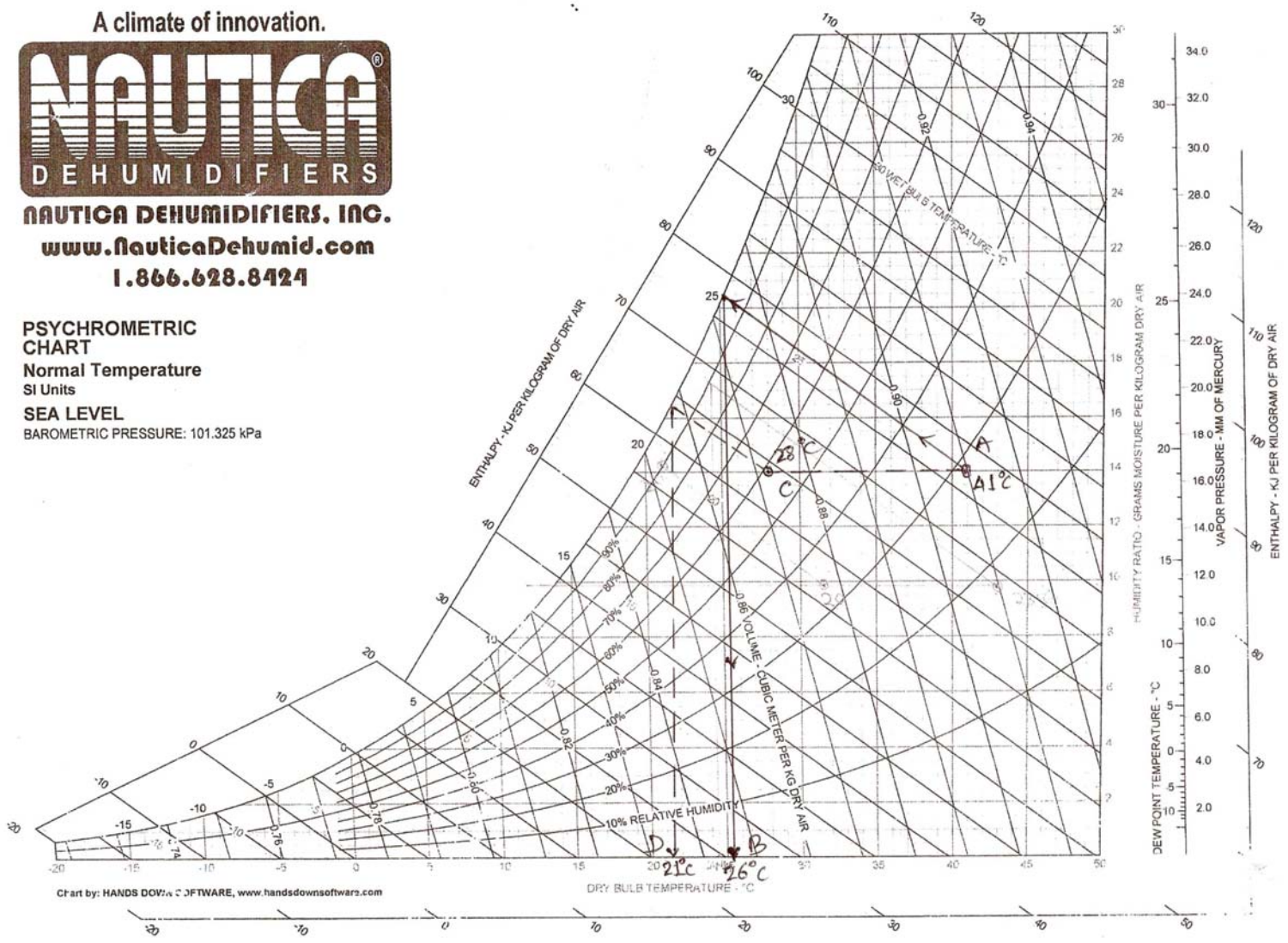

Chart by: HANDS DOWN SOFTWARE, www.handsdownsoftware.com