SENSIBLE EQUIPMENT COMPANY

TRICOIL®

The Sensible Solution

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PSYCHROMETRIC CHART

NORMAL TEMPERATURE
I-P Units
SEA LEVEL
BAROMETRIC PRESSURE : 29.921 INCHES OF MERCURY

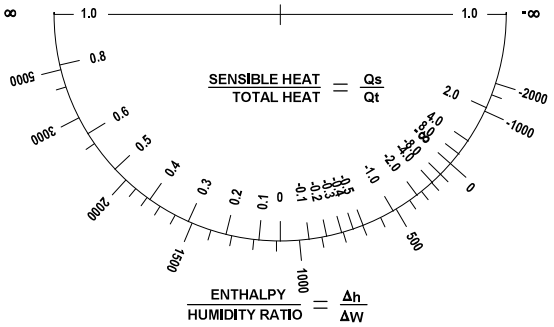

Chart by: HANDS DOWN SOFTWARE, www.handsdownsoftware.com

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PROCEDURE FOR USING THE PSYCHROMETRIC CHART TO MAKE TRICOIL® SELECTIONS

The application of a typical TRICOIL system is illustrated in the following example. The TRICOIL® Method is a proprietary system and is protected by United States of America patent laws, patent numbers 5,181,552;5,228,302; 5,337,577; and 5,493,871. Other USA and foreign patents are pending. Contact Sensible Equipment Company, P.O. Box 669, Goldenrod, Florida 32733. Phone Number (407) 296–8068 Fax Number (407) 217-1607.

EXAMPLE:

1. All projects start with a set of criteria which are used as a basis for calculating the room design cooling load. For this example the following criteria was used.

Design Criteria:		
	Room Conditions	76°Fdb/45%rh
	Outside Air Conditions	95°Fdb/80°Fwb
	Supply Air Relative Humidity	70% rh
	Outside Air Volume	2000 cfm

2. Calculate the room sensible heat gain (Q_{RSH}) and the room latent heat gain (Q_{RLH}). Also estimate the supply air (ΔT_d) and return air (ΔT_e) temperature rise due to fan, motor and duct heat gain. The following information was calculated using ASHRAE procedures:

Q_{RSH} = 176,000. btu/hr ΔT_d = 2°F
Q_{RLH} = 44,000. btu/hr ΔT_e = 1°F

3. Calculate the room sensible heat factor (RSHF) as follows:

Room Sensible Heat Factor, RSHF = $Q_{RSH} / (Q_{RSH} + Q_{RLH})$
= 176000 / (176000 + 44000) = 0.80

4. Draw the room sensible heat factor line on the protractor and transfer the line to the chart starting at the room conditions and terminating at the 70% relative humidity line. The point of intersection is the room supply air condition.

5. Calculate supply air volume as follows:

Supply Air Volume, $CFM_{SA} = Q_{RSH} / [1.1 \times (T_1 - T_2)]$
= 176000 / 1.1 x (76-60)
= 10,000 cfm

6. Calculate reheat required (ΔT_c) from TRICOIL Loop:

$\Delta T_c = T_2 - T_4 - \Delta T_d = 60 - 50 - 2 = 8°F$

7. Determine mixed return air / outside air condition: Neglecting the effects of air density, the solution can be determined as follows:

$T_7 = (T_1 + \Delta T_{RA}) \times (CFM_{RA} / CFM_{SA}) + T_6 \times (CFM_{OA} / CFM_{SA})$
= 77 x (8000/10000) + 95 x (2000/10000) = 80.6°F db

8. Determine precooled air condition:

Precooling (ΔT_a)= Reheat (ΔT_c) = 8°F ΔT
$T_8 = T_7 - \Delta T_a = 80.6 - 8 = 72.6$

9. Determine enthalpy (h) for calculating primary cooling:
Project state points T_4 and T_8 through enthalpy lines.
ΔH_b (differential enthalpy) = $h_8 - h_4$
ΔH_b = 29.1 - 20.2 = 8.9 btu/lb dry air

10. Calculate coil requirements.

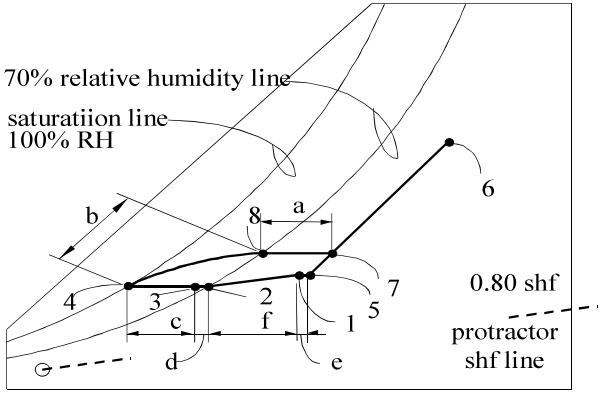
Precooling: Q_{PC} = $1.1 \times CFM_{SA} \times \Delta T_a$
= 1.1 x 10000 cfm x 8°F ΔT
= 88,000 btu/hr

Primary Cooling: Q_{PRSens} = $1.1 \times CFM_{SA} \times \Delta T_b$
= 1.1 x 10000 x (72.6 - 50)
= 248,600 btu/hr

$Q_{PRtotal}$ = $4.45 \times CFM_{SA} \times \Delta H_b$
= 4.45 x 10000 cfm x (29.1 - 20.2)
= 396,000 btu/hr = 32.6 tons

Reheat: Q_{RH} = $1.1 \times CFM_{SA} \times \Delta T_c$
= 1.1 x 10000 cfm x 8°F ΔT
= 88,000 btu/hr

PSYCHROMETRIC CHART The following chart indicates the process and state points of the TRICOIL® operation in the above example.



STATE POINT		PROCESS	
1. Room Air:	76°Fdb/45%rh	a. Precooling:	Q_{PC} = 88,000 btu/hr
2. Supply Air:	60°Fdb/54.2°Fwb	b. Primary Cooling:	Q_{PR} = 396,000 btu/hr
3. Leaving Reheat Coil:	58°Fdb/53.5°Fwb	c. Reheat:	Q_{RH} = 88,000 btu/hr
4. Leaving Primary Coil:	50°Fdb/49.8°Fwb	d. Supply Air Heat Gain: (Duct, Fan, and Motor)	ΔT_{SA} = 2°F
5. Return Air:	77°Fdb/62.4°Fwb	e. Return Air Heat Gain: Duct	ΔT_{RA} = 1°F
6. Outside Air:	95°Fdb/80.0°Fwb	f. Room Heat Gain: Sensible:	Q_{RSH} = 176,000 btu/hr
7. Mixed Air (R.A. and O.A.):	80.6°Fdb/66.4°Fwb	Latent:	Q_{RLH} = 44,000 btu/hr
8. Air Leaving Precooling Coil:	72.6°Fdb/63.8°Fwb		