# *Infonavit*
# *HVAC Load Analysis*

for

Infonavit
Av. Juarez Manzana 44-a
Torreon Coahuila

Elite Software

CHVAC Commercial HVAC Loads

Prepared By:

Jamm
Alta Tecnologia

lunes, 19 de junio de 2017

# General Project Data Input

## General Project Information

| | |
|---|---|
| Project file name: | C:\Users\ALFRED\Desktop\ANTEPROYECTO A.A. INFONAVIT TORREON 160617\MEMORIA DE CALCULO\AREA DE ASESORES - 22.CHV |
| Project title: | Infonavit |
| Project address: | AV.JUAREZ MANZANA 44-A |
| Project city, state, ZIP: | TORREON COAHUILA |
| Designed by: | Jamm |
| Project date: | Mayo 2017 |
| Weather reference city: | TORREON, COAHUILA, MEXICO |
| Client name: | Infonavit |
| Client address: | Av. Juarez Manzana 44-a |
| Client city: | Torreon Coahuila |
| Company name: | Alta Tecnologia |
| Company representative: | Jamm |

| | | |
|---|---|---|
| Barometric pressure: | 29.921 | in.Hg. |
| Altitude: | 0 | feet |
| Latitude: | 25 | Degrees |
| Mean daily temperature range: | 18 | Degrees |
| Starting & ending time for HVAC load calculations: | 8am - 11pm | |
| Number of unique zones in this project: | 1 | |

## Building Default Values

| | | |
|---|---|---|
| Calculations performed: | Both heating and cooling loads | |
| Lighting requirements: | 2.00 | Watts per square foot |
| Equipment requirements: | 2.00 | Watts per square foot |
| People sensible load multiplier: | 250 | Btuh per person |
| People latent load multiplier: | 250 | Btuh per person |
| Zone sensible safety factor: | 5 | % |
| Zone latent safety factor: | 5 | % |
| Zone heating safety factor: | 5 | % |
| People diversity factor: | 100 | % |
| Lighting profile number: | 0 | |
| Equipment profile number: | 0 | |
| People profile number: | 0 | |
| Building default ceiling height: | 9.00 | feet |
| Building default wall height: | 9.00 | feet |

## Internal Operating Load Profiles (C = 100)

| | hr 1 | hr 2 | hr 3 | hr 4 | hr 5 | hr 6 | hr 7 | hr 8 | hr 9 | hr 10 | hr 11 | hr 12 | hr 13 | hr 14 | hr 15 | hr 16 | hr 17 | hr 18 | hr 19 | hr 20 | hr 21 | hr 22 | hr 23 | hr 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | C | C | C | C | C | C | C | C | C | C | 70 | 70 | 70 | C | C | C | C | C | C | C | C | C | C | C |
| 2 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 3 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 4 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 5 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 6 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 7 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 8 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 9 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |
| 10 | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C | C |

# General Project Data Input (cont'd)

## Building-Level Design Conditions

| Design Month | Outdoor Dry Bulb | Outdoor Wet Bulb | Indoor Rel.Hum | Indoor Dry Bulb | Grains Diff | In/Outdoor Correction |
|---|---|---|---|---|---|---|
| August | 95 | 73 | 50% | 75 | 19.11 | 4 |
| Winter | 25 | | | 75 | | |

## Master Roofs

| Roof No. | ASHRAE Roof# | Roof U-Fac | Dark Color | Susp. Ceil |
|---|---|---|---|---|
| 1 | 13 | 0.260 | No | No |

Roof #1 Description: Flat roof, 4", 6" hollowcore panels deck with no insulation, suspended ceiling below with no insulation

## Master Walls

| Wall No. | ASHRAE Group | Wall U-Fac | Wall Color |
|---|---|---|---|
| 1 | E | 0.046 | L |
| 2 | G | 0.062 | L |
| 3 | G | 0.032 | L |

## Master Partitions

| Partition No. | Partition U-Factor | Cool T-D | Heat T-D |
|---|---|---|---|
| 1 | 0.196 | 25 | 25 |

Partition #1 Description: Block partition, 4" sand & gravel, hollow core, siding exterior, interior finish

| | | | |
|---|---|---|---|
| 2 | 0.275 | 25 | 25 |

Partition #2 Description: Brick partition, 8" thick, face & common, interior finish

## Master Glass

| Glass No. | Summer U-Factor | Winter U-Factor | Glass Shd.Coef. | Interior Shading | Interior Shd.Coef |
|---|---|---|---|---|---|
| 1 | 1.040 | 1.100 | 0.880 | 2 | 0.640 |

## Master Shading Devices

| Shade No. | Dist Horiz Overh Projects | Dist Beyond Right W.Edge | Dist Beyond Left W.Edge | Dist Overh Above Wind | Dist Right Fin Proj | Dist R-Fin Beyond W.Edge | Ht Of Right Fin | Dist Left Fin Proj | Dist L-Fin Beyond W.Edge | Ht Of Left Fin |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 2.00 | 1.00 | 1.00 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Building Summary Loads

Building peaks in August at 10pm.

| Bldg Load Descriptions | Area Quan | Sen Loss | %Tot Loss | Lat Gain | Sen Gain | Net Gain | %Net Gain |
|---|---|---|---|---|---|---|---|
| Roof | 22,170 | 302,621 | 62.34 | 0 | 153,958 | 153,958 | 43.96 |
| Wall | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Glass | 8 | 233 | 0.05 | 0 | 220 | 220 | 0.06 |
| Floor Slab | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Skin Loads | | 302,853 | 62.38 | 0 | 154,178 | 154,178 | 44.02 |
| Lighting | 500 | 0 | 0.00 | 0 | 1,791 | 1,791 | 0.51 |
| Equipment | 8,868 | 0 | 0.00 | 0 | 31,772 | 31,772 | 9.07 |
| People | 80 | 0 | 0.00 | 21,000 | 21,000 | 42,000 | 11.99 |
| Partition | 7,093 | 51,610 | 10.63 | 0 | 51,610 | 51,610 | 14.74 |
| Cool. Pret. | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Heat. Pret. | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Cool. Vent. | 1,332 | 0 | 0.00 | 22,233 | 11,722 | 33,955 | 9.70 |
| Heat. Vent. | 1,332 | 71,932 | 14.82 | 0 | 0 | 0 | 0.00 |
| Cool. Infil. | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Heat. Infil. | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Draw-Thru Fan | 0 | 0 | 0.00 | 0 | 13,976 | 13,976 | 3.99 |
| Blow-Thru Fan | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Reserve Cap. | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Reheat Cap. | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Supply Duct | 0 | 39,385 | 8.11 | 0 | 14,438 | 14,438 | 4.12 |
| Return Duct | 0 | 19,692 | 4.06 | 0 | 6,487 | 6,487 | 1.85 |
| Misc. Supply | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Misc. Return | 0 | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Building Totals | | 485,473 | 100.00 | 43,233 | 306,975 | 350,208 | 100.00 |

| Building Summary | Sen Loss | %Tot Loss | Lat Gain | Sen Gain | Net Gain | %Net Gain |
|---|---|---|---|---|---|---|
| Ventilation | 71,932 | 14.82 | 22,233 | 11,722 | 33,955 | 9.70 |
| Infiltration | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Pretreated Air | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Zone Loads | 354,464 | 73.01 | 21,000 | 260,352 | 281,352 | 80.34 |
| Plenum Loads | 0 | 0.00 | 0 | 0 | 0 | 0.00 |
| Fan & Duct Loads | 59,077 | 12.17 | 0 | 34,901 | 34,901 | 9.97 |
| Building Totals | 485,473 | 100.00 | 43,233 | 306,975 | 350,208 | 100.00 |

## Check Figures

| | | |
|---|---|---|
| Total Building Supply Air (based on a 20° TD): | 13,126 | CFM |
| Total Building Vent. Air (10.15% of Supply): | 1,332 | CFM |
| Total Conditioned Air Space: | 4,434 | Sq.ft |
| Supply Air Per Unit Area: | 2.9602 | CFM/Sq.ft |
| Area Per Cooling Capacity: | 151.9 | Sq.ft/Ton |
| Cooling Capacity Per Area: | 0.0066 | Tons/Sq.ft |
| Heating Capacity Per Area: | 109.49 | Btuh/Sq.ft |
| Total Heating Required With Outside Air: | 485,473 | Btuh |
| Total Cooling Required With Outside Air: | 29.18 | Tons |

# *Air Handler #1 - Area De Asesores - Summary Loads*

| Zn No | Description<br>Zone Peak Time | Area<br>People<br>Volume | Htg.Loss<br>Htg.CFM<br>CFM/Sqft | Sen.Gain<br>Clg.CFM<br>CFM/Sqft | Lat.Gain<br>S.Exh<br>W.Exh | Htg.O.A.<br>Req.CFM<br>Act.CFM | Clg.O.A.<br>Req.CFM<br>Act.CFM |
|---|---|---|---|---|---|---|---|
| 1 | Area De Asesores | 4,434 | 354,464 | 260,352 | 21,000 | 10/P, 0.12/ft² | 10/P, 0.12/ft² |
| | 10pm August | 80 | 18,234 | 13,126 | 0 | 1,332 | 1,332 |
| | | 39,906 | 4.11 | 2.96 | 0 | 1,332 | 1,332 |
| Runout duct size: 6 in. dia, Diffusers: 146, CFM/runout: 125, Velocity: 636.1 ft/min, Pressure drop: 0.240 in.wg./100ft | | | | | | | |
| | Zone Peak Totals: | 4,434 | 354,464 | 260,352 | 21,000 | | |
| | Total Zones: 1 | 80 | 18,234 | 13,126 | 0 | 1,332 | 1,332 |
| | Unique Zones: 1 | 39,906 | 4.11 | 2.96 | 0 | 1,332 | 1,332 |
| Main trunk duct size: 56 in. h x 58in. w, Velocity: 869.7 ft/min, Pressure drop: 0.016 in.wg./100ft | | | | | | | |

# *Air Handler #1 - Area De Asesores - Total Load Summary*

| | |
|---|---|
| Air Handler Description: | Area De Asesores Constant Volume - Sum of Peaks |
| Supply Air Fan: | Draw-Thru with program estimated horsepower of 5.50 HP |
| Fan Input: | 75% motor and fan efficiency with 2 in. water across the fan |
| Sensible Heat Ratio: | 0.93 --- This system occurs 1 time(s) in the building. --- |

| | |
|---|---|
| Air System Peak Time: | 10pm in August. |
| Outdoor Conditions: | Clg: 83° DB, 70° WB, 87.51 grains, Htg: 25° DB |
| Indoor Conditions: | Clg: 75° DB, 50% RH, Htg: 75° DB |

Summer: Ventilation controls outside air, ----- Winter: Ventilation controls outside air.

| | | | | |
|---|---|---|---|---|
| Zone Space sensible loss: | 354,464 | Btuh | | |
| Infiltration sensible loss: | 0 | Btuh | 0 | CFM |
| Outside Air sensible loss: | 71,932 | Btuh | 1,332 | CFM |
| Supply Duct sensible loss: | 39,385 | Btuh | | |
| Return Duct sensible loss: | 19,692 | Btuh | | |
| Return Plenum sensible loss: | 0 | Btuh | | |
| Total System sensible loss: | | | | 485,473 Btuh |
| Heating Supply Air: 393,848 / (1.000 X 1.08 X 20) = | | | 18,234 | CFM |
| Winter Vent Outside Air (7.3% of supply) = | | | 1,332 | CFM |
| Zone space sensible gain: | 260,352 | Btuh | | |
| Infiltration sensible gain: | 0 | Btuh | | |
| Draw-thru fan sensible gain: | 13,976 | Btuh | | |
| Supply duct sensible gain: | 14,438 | Btuh | | |
| Reserve sensible gain: | 0 | Btuh | | |
| Total sensible gain on supply side of coil: | | | | 288,766 Btuh |
| Cooling Supply Air: 288,766 / (1.000 X 1.1 X 20) = | | | 13,126 | CFM |
| Summer Vent Outside Air (10.1% of supply) = | | | 1,332 | CFM |
| Return duct sensible gain: | 6,487 | Btuh | | |
| Return plenum sensible gain: | 0 | Btuh | | |
| Outside air sensible gain: | 11,722 | Btuh | 1,332 | CFM |
| Blow-thru fan sensible gain: | 0 | Btuh | | |
| Total sensible gain on return side of coil: | | | | 18,209 Btuh |
| Total sensible gain on air handling system: | | | | 306,975 Btuh |
| Zone space latent gain: | 21,000 | Btuh | | |
| Infiltration latent gain: | 0 | Btuh | | |
| Outside air latent gain: | 22,233 | Btuh | | |
| Total latent gain on air handling system: | | | | 43,233 Btuh |
| Total system sensible and latent gain: | | | | 350,208 Btuh |

## Check Figures

| | | |
|---|---|---|
| Total Air Handler Supply Air (based on a 20° TD): | 13,126 | CFM |
| Total Air Handler Vent. Air (10.15% of Supply): | 1,332 | CFM |
| Total Conditioned Air Space: | 4,434 | Sq.ft |
| Supply Air Per Unit Area: | 2.9602 | CFM/Sq.ft |
| Area Per Cooling Capacity: | 151.9 | Sq.ft/Ton |
| Cooling Capacity Per Area: | 0.0066 | Tons/Sq.ft |
| Heating Capacity Per Area: | 109.49 | Btuh/Sq.ft |
| Total Heating Required With Outside Air: | 485,473 | Btuh |
| Total Cooling Required With Outside Air: | 29.18 | Tons |

## *Zone Detailed Loads (At Zone Peak Times)*

| Load Description | Unit Quan | -SC- CFAC | CLTD SHGF | U.Fac -CLF- | Sen. Gain | Lat. Gain | Htg. Mult. | Htg. Loss |
|---|---|---|---|---|---|---|---|---|
| Zone 1-Area De Asesores peaks (sensible) in August at 10pm, Air Handler 1 (Area De Asesores), Group 0, 4,434.0 x 1.0, Construction Type: 1 (Light) | | | | | | | | |
| Roof-1-13-No.Clg-L | 22,170 | 0.50 | 25.4 | 0.260 | 146,627 | | 13.000 | 288,210 |
| Partition-1-2 | 7092.729 | | 25/25 | 0.275 | 49,153 | | 6.930 | 49,153 |
| Gls-P-1-1-Tran | 8.0 | 1.000 | 8 | 1.040 | 210 | | 27.720 | 222 |
| 0%S-0-NS-Solar | 8.0 | 0.880 | 0 | 0.000 | 0 | | | |
| Lights-Prof=0 | 500 | 1.000 | | | 1,706 | | | |
| Equipment-Prof=0 | 8,868 | 1.000 | | | 30,259 | 0 | | |
| People-Prof=1 | 80.0 | 1.000 | | | 20,000 | 20,000 | | |
| Sub-total | | | | | 247,954 | 20,000 | | 337,584 |
| Safety factors: | | | | | +5% | +5% | | +5% |
| | | | | | --- | --- | | --- |
| Total w/ safety factors: | | | | | 260,352 | 21,000 | | 354,464 |

# Air System #1 (Area De Asesores) Psychrometric Analysis (G)

| System Load Analysis | Latent | Grains | Sensible | Temp | CFM |
|---|---|---|---|---|---|
| Leaving Coil Condition | | 62.275 | | 55.000 | |
| Draw-Thru Fan | | | 13,976 | 0.968 | 635 |
| Misc Load on Supply Side | | | 0 | 0.000 | 0 |
| Supply Air Duct | | | 14,438 | 1.000 | 656 |
| Zone Loads | 21,000 | 2.353 | 260,352 | 18.032 | 11,834 |
| Sensible Reserve | | | 0 | 0.000 | 0 |
| Zone Condition | 21,000 | 64.627 | 288,766 | 75.000 | 13,126 |
| Return Air Duct | | | 6,487 | 0.500 | |
| Return Air Plenum | | | 0 | 0.000 | |
| Misc Load on Return Side | | | 0 | 0.000 | |
| Vent Air 1,332 CFM | 22,233 | 1.945 | 11,722 | 0.761 | |
| Blow-Thru Fan | | | 0 | 0.000 | |
| Entering Coil Condition | 43,233 | 66.573 | 306,975 | 76.261 | 13,126 |

## General Psychrometric Equations Used In Analysis:

PR = (Barometric pressure of site / Standard ASHRAE pressure of 29.921)
TSH = PR x 1.10 x CFM x (DB entering - DB leaving)
TLH = PR x 0.68 x CFM x (Grains entering - Grains leaving)
GTH = PR x 4.50 x CFM x (Enthalpy entering - Enthalpy leaving)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TSH | = | 1.000 | x | 1.10 | x | 13,126 | x ( | 76.261 | - | 55.000 | ) = | 306,975 | Btuh |
| TLH | = | 1.000 | x | 0.68 | x | 13,126 | x ( | 66.573 | - | 62.275 | ) = | 38,363 | Btuh |
| | | | | | | | | | | | | --- | |
| SUM | = | | | | | | | | | | | 345,338 | Btuh |
| GTH | = | 1.000 | x | 4.50 | x | 13,126 | x ( | 28.717 | - | 22.858 | ) = | 346,069 | Btuh |
| Total System Load | | | | | | | | | | | = | 350,208 | Btuh |

## Chilled and Hot Water Flow Rates and Steam Requirement

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cooling GPM | = | 346,069 | / ( | 0.00 | x | 500 | ) | = | 0.0 GPM |
| Heating GPM | = | 485,473 | / ( | 0.00 | x | 500 | ) | = | 0.0 GPM |
| Steam Req. | = | 485,473 | / | 970 | | | | = | 500.5 lb./hr |

## Entering Cooling Coil Conditions

| | | |
|---|---|---|
| Dry bulb temperature: | 76.26 | |
| Wet bulb temperature: | 63.40 | |
| Relative humidity: | 49.36 | |
| Enthalpy: | 28.72 | Btu/lbm |

## Entering Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 70.42 |

## Leaving Cooling Coil Conditions

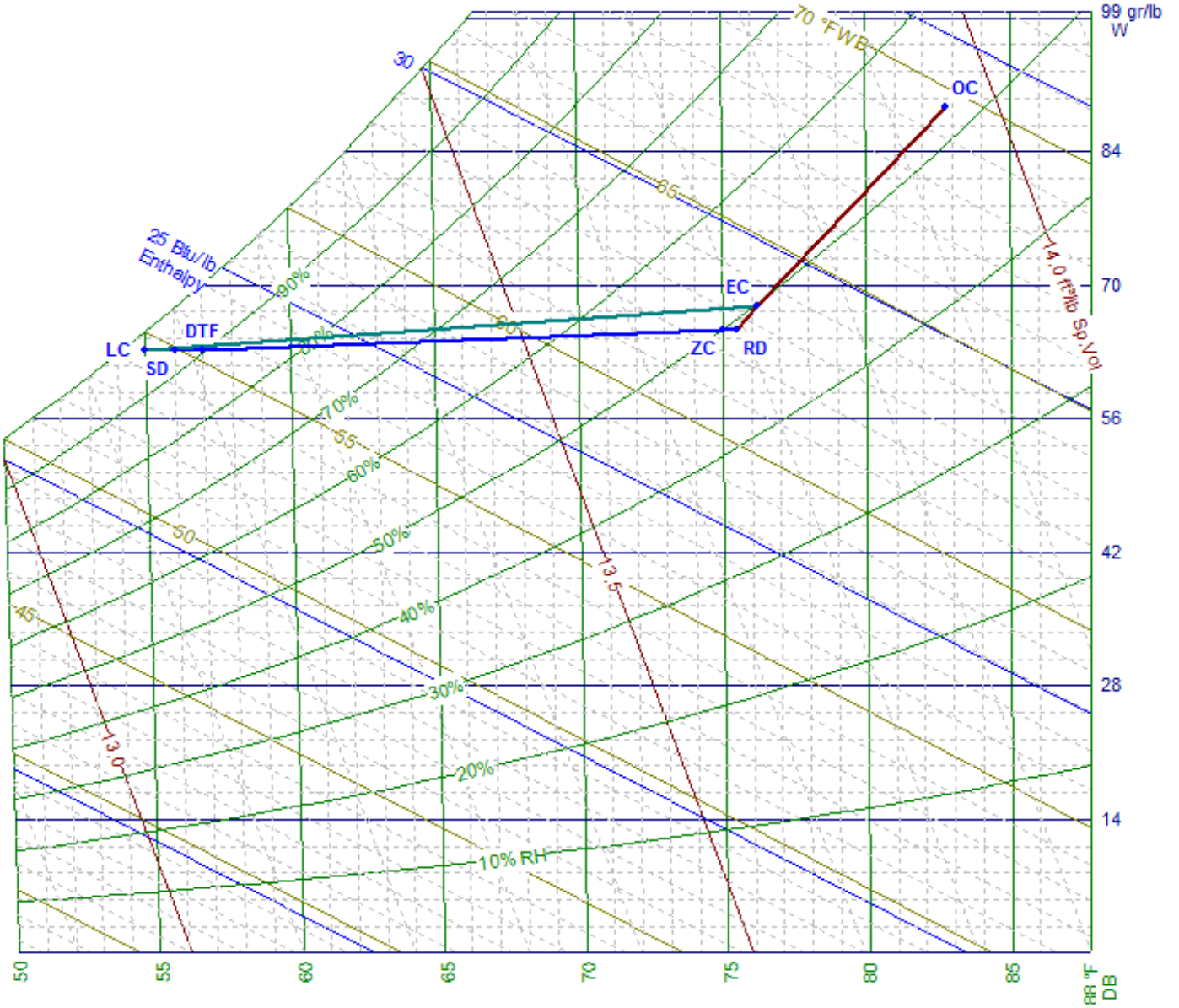
| | | |
|---|---|---|
| Dry bulb temperature: | 55.00 | |
| Wet bulb temperature: | 54.47 | |
| Relative humidity: | 96.80 | |
| Enthalpy: | 22.86 | Btu/lbm |

## Leaving Heating Coil Conditions

| | |
|---|---|
| Dry bulb temperature: | 95.00 |

# *Air System #1 (Area De Asesores) Psychrometric Chart*

| | | | |
|---|---|---|---|
| ZC | Zone Condition | OC | Outdoor Condition |
| LC | Leaving Coil Condition | EC | Entering Coil Condition |
| SD | Supply Duct Temperature Rise | RD | Return Duct Temperature Rise |
| DTF | Draw Through Fan Sensible Gain | BTF | Blow Through Fan Sensible Gain |
| RE | Reserve or Reheat Sensible Gain | PL | Return Air Plenum Sensible Gain |
| SM | Supply Side Miscellaneous Sensible Gain | RM | Return Side Miscellaneous Gain |
| PRE | Pretreated Air Condition | HRV | Heat Recovery Ventilator Condition |



# *Air System #1 (Area De Asesores) Psychrometric Chart (G)*

| | | | |
|---|---|---|---|
| ZC | Zone Condition | OC | Outdoor Condition |
| LC | Leaving Coil Condition | EC | Entering Coil Condition |
| SD | Supply Duct Temperature Rise | RD | Return Duct Temperature Rise |
| DTF | Draw Through Fan Sensible Gain | BTF | Blow Through Fan Sensible Gain |
| RE | Reserve or Reheat Sensible Gain | PL | Return Air Plenum Sensible Gain |
| SM | Supply Side Miscellaneous Sensible Gain | RM | Return Side Miscellaneous Gain |
| PRE | Pretreated Air Condition | HRV | Heat Recovery Ventilator Condition |