

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\ESTACION DE
 SERVICIO - 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	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr	hr
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	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	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	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	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	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	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	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	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	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	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	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	9	0.320	Si	Si
Roof #1 Description: Flat roof, 2" heavy weight concrete 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	D
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	0.60	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 6pm.

Bldg Load Descriptions	Area Quan	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Roof	724	12,164	39.64	0	10,188	10,188	32.89
Wall	0	0	0.00	0	0	0	0.00
Glass	8	233	0.76	0	220	220	0.71
Floor Slab	0	0	0.00	0	0	0	0.00
Skin Loads		12,397	40.40	0	10,408	10,408	33.60
Lighting	80	0	0.00	0	287	287	0.93
Equipment	805	0	0.00	0	2,882	2,882	9.31
People	10	0	0.00	2,625	2,625	5,250	16.95
Partition	127	924	3.01	0	924	924	2.98
Cool. Pret.	0	0	0.00	0	0	0	0.00
Heat. Pret.	0	0	0.00	0	0	0	0.00
Cool. Vent.	280	0	0.00	4,334	4,936	9,270	29.93
Heat. Vent.	280	15,144	49.35	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	828	828	2.67
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	1,480	4.82	0	855	855	2.76
Return Duct	0	740	2.41	0	273	273	0.88
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		30,686	100.00	6,959	24,017	30,976	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	15,144	49.35	4,334	4,936	9,270	29.93
Infiltration	0	0.00	0	0	0	0.00
Pretreated Air	0	0.00	0	0	0	0.00
Zone Loads	13,321	43.41	2,625	17,126	19,751	63.76
Plenum Loads	0	0.00	0	0	0	0.00
Fan & Duct Loads	2,220	7.24	0	1,956	1,956	6.31
Building Totals	30,686	100.00	6,959	24,017	30,976	100.00

Check Figures

Total Building Supply Air (based on a 22° TD):	777 CFM
Total Building Vent. Air (36.09% of Supply):	280 CFM
Total Conditioned Air Space:	402 Sq.ft
Supply Air Per Unit Area:	1.9320 CFM/Sq.ft
Area Per Cooling Capacity:	155.8 Sq.ft/Ton
Cooling Capacity Per Area:	0.0064 Tons/Sq.ft
Heating Capacity Per Area:	76.28 Btuh/Sq.ft
Total Heating Required With Outside Air:	30,686 Btuh
Total Cooling Required With Outside Air:	2.58 Tons



Air Handler #1 - Estacion De Servicio - Summary Loads

Zn No	Description Zone Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
1	Estacion De Servicio 8pm August	402 10 3,620	13,321 685 1.70	17,126 777 1.93	2,625 0 0	20/P, 0.2/ft ² 280 280	20/P, 0.2/ft ² 280 280
Runout duct size: 6 in. dia, Diffusers: 6, CFM/runout: 130, Velocity: 659.7 ft/min, Pressure drop: 0.278 in.wg./100ft							
Zone Peak Totals:		402	13,321	17,126	2,625		
Total Zones: 1		10	685	777	0	280	280
Unique Zones: 1		3,620	1.70	1.93	0	280	280
Main trunk duct size: 14 in. h x 12in. w, Velocity: 727.0 ft/min, Pressure drop: 0.078 in.wg./100ft							



Air Handler #1 - Estacion De Servicio - Total Load Summary

Air Handler Description: Estacion De Servicio Constant Volume - Sum of Peaks
 Supply Air Fan: Draw-Thru with program estimated horsepower of 0.33 HP
 Fan Input: 75% motor and fan efficiency with 2 in. water across the fan
 Sensible Heat Ratio: 0.88 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 6pm in August.
 Outdoor Conditions: Clg: 91° DB, 72° WB, 84.75 grains, Htg: 25° DB
 Indoor Conditions: Clg: 75° DB, 50% RH, Htg: 75° DB

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in August at 8pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 17,126.

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

Zone Space sensible loss:	13,321 Btuh		
Infiltration sensible loss:	0 Btuh	0 CFM	
Outside Air sensible loss:	15,144 Btuh	280 CFM	
Supply Duct sensible loss:	1,480 Btuh		
Return Duct sensible loss:	740 Btuh		
Return Plenum sensible loss:	0 Btuh		
Total System sensible loss:			30,686 Btuh
Heating Supply Air: $14,801 / (1.000 \times 1.08 \times 20) =$		685 CFM	
Winter Vent Outside Air (40.9% of supply) =		280 CFM	
Zone space sensible gain:	17,126 Btuh		
Infiltration sensible gain:	0 Btuh		
Draw-thru fan sensible gain:	828 Btuh		
Supply duct sensible gain:	855 Btuh		
Reserve sensible gain:	0 Btuh		
Total sensible gain on supply side of coil:			18,808 Btuh
Cooling Supply Air: $18,808 / (1.000 \times 1.1 \times 22) =$		777 CFM	
Summer Vent Outside Air (36.1% of supply) =		280 CFM	
Return duct sensible gain:	273 Btuh		
Return plenum sensible gain:	0 Btuh		
Outside air sensible gain:	4,936 Btuh	280 CFM	
Blow-thru fan sensible gain:	0 Btuh		
Total sensible gain on return side of coil:			5,209 Btuh
Total sensible gain on air handling system:			24,017 Btuh
Zone space latent gain:	2,625 Btuh		
Infiltration latent gain:	0 Btuh		
Outside air latent gain:	4,334 Btuh		
Total latent gain on air handling system:			6,959 Btuh
Total system sensible and latent gain:			30,976 Btuh

Check Figures

Total Air Handler Supply Air (based on a 22° TD):		777 CFM	
Total Air Handler Vent. Air (36.09% of Supply):		280 CFM	
Total Conditioned Air Space:		402 Sq.ft	
Supply Air Per Unit Area:		1.9320 CFM/Sq.ft	
Area Per Cooling Capacity:		155.8 Sq.ft/Ton	
Cooling Capacity Per Area:		0.0064 Tons/Sq.ft	
Heating Capacity Per Area:		76.28 Btuh/Sq.ft	
Total Heating Required With Outside Air:		30,686 Btuh	
Total Cooling Required With Outside Air:		2.58 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-Estacion De Servicio peaks (sensible) in August at 8pm, Air Handler 1 (Estacion De Servicio), Group 0, 402.3 x 1.0, Construction Type: 1 (Light)								
Roof-1-9-Susp.C-D	724	1.00	41.9	0.320	9,703		16.000	11,585
Partition-1-2	127		25/25	0.275	880		6.930	880
Gls-P-1-1-Tran	8.0	1.000	12	1.040	210		27.720	222
0%S-0-NS-Solar	8.0	0.880	0	0.000	0			
Lights-Prof=0	80	1.000			273			
Equipment-Prof=0	805	1.000			2,745	0		
People-Prof=1	10.0	1.000			2,500	2,500		
Sub-total					16,310	2,500		12,687
Safety factors:					+5%	+5%		+5%
Total w/ safety factors:					17,126	2,625		13,321



Air System #1 (Estacion De Servicio) Psychrometric Analysis (G)

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		59.673		53.000	
Draw-Thru Fan			828	0.968	34
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			855	1.000	35
Zone Loads	2,625	4.967	17,126	20.033	708
Sensible Reserve			0	0.000	0
Zone Condition	2,625	64.640	18,808	75.000	777
Return Air Duct			273	0.500	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 280 CFM	4,334	6.173	4,936	5.593	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	6,959	70.814	24,017	81.093	777

General Psychrometric Equations Used In Analysis:

$PR = (\text{Barometric pressure of site} / \text{Standard ASHRAE pressure of } 29.921)$
 $TSH = PR \times 1.10 \times CFM \times (DB \text{ entering} - DB \text{ leaving})$
 $TLH = PR \times 0.68 \times CFM \times (\text{Grains entering} - \text{Grains leaving})$
 $GTH = PR \times 4.50 \times CFM \times (\text{Enthalpy entering} - \text{Enthalpy leaving})$

$TSH = 1.000 \times 1.10 \times 777 \times (81.093 - 53.000) = 24,016 \text{ Btuh}$
 $TLH = 1.000 \times 0.68 \times 777 \times (70.814 - 59.673) = 5,887 \text{ Btuh}$
 $SUM = 29,904 \text{ Btuh}$
 $GTH = 1.000 \times 4.50 \times 777 \times (30.562 - 21.967) = 30,058 \text{ Btuh}$
Total System Load = 30,976 Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM = $30,058 / (0.00 \times 500) = 0.0 \text{ GPM}$
 Heating GPM = $30,686 / (0.00 \times 500) = 0.0 \text{ GPM}$
 Steam Req. = $30,686 / 970 = 31.6 \text{ lb./hr}$

Entering Cooling Coil Conditions

Dry bulb temperature: 81.09
 Wet bulb temperature: 65.88
 Relative humidity: 44.75
 Enthalpy: 30.56 Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature: 53.95

Leaving Cooling Coil Conditions

Dry bulb temperature: 53.00
 Wet bulb temperature: 52.97
 Relative humidity: 99.84
 Enthalpy: 21.97 Btu/lbm

Leaving Heating Coil Conditions

Dry bulb temperature: 95.00

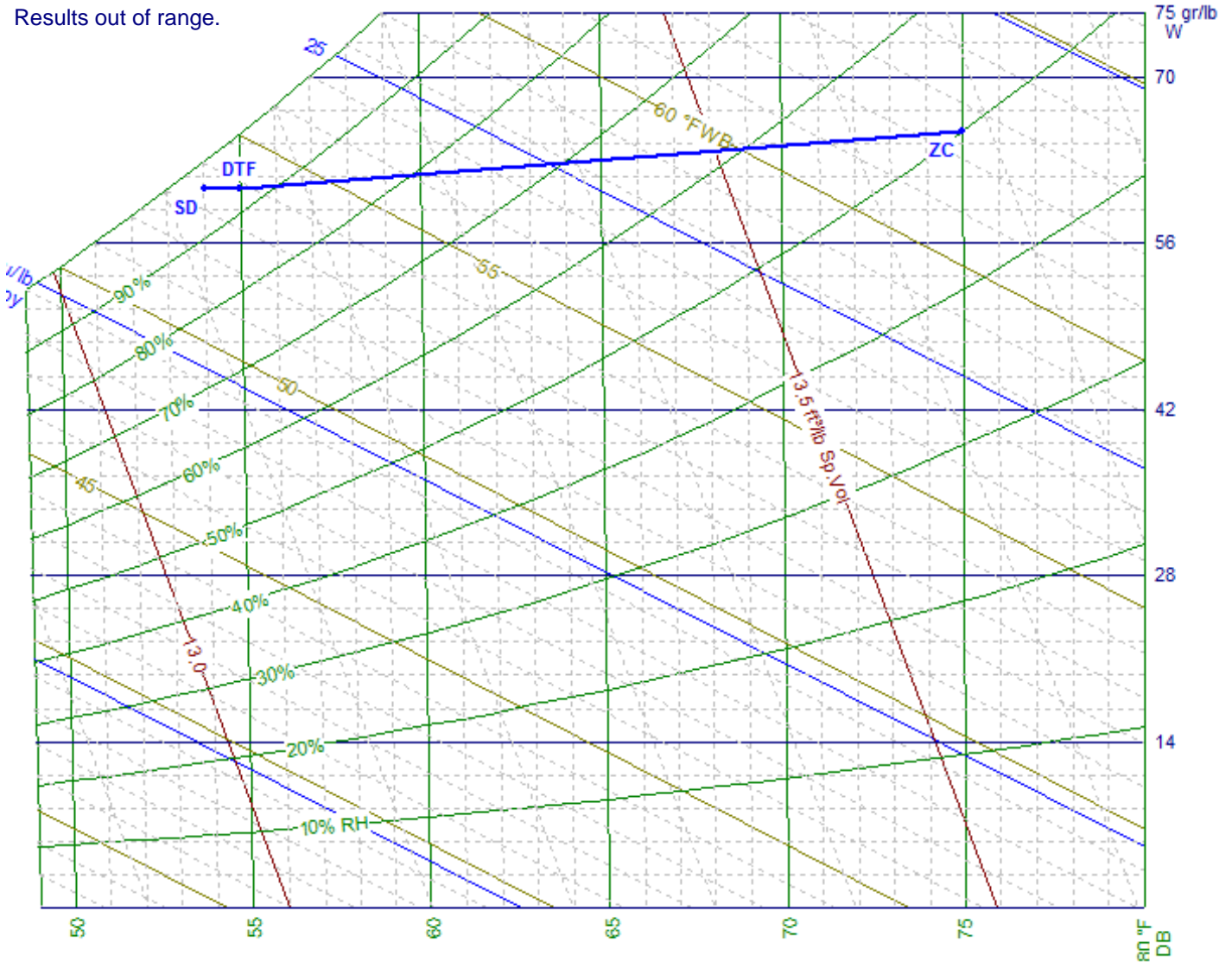


Air System #1 (Estacion De Servicio) Psychrometric Chart

- | | | | |
|-----|-----------------------------------------|-----|------------------------------------|
| 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 |

One or more points or processes failed to be added to the chart:
 Supply-side duct temperature gain Zone process could not be added.

Results out of range.





Air System #1 (Estacion De Servicio) 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
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PRE	Pretreated Air Condition	HRV	Heat Recovery Ventilator Condition

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