

***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\GERENCIA - 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
2	0.275	25	25

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

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	80	1,352	10.69	0	1,132	1,132	7.73
Wall	0	0	0.00	0	0	0	0.00
Glass	8	233	1.84	0	220	220	1.50
Floor Slab	0	0	0.00	0	0	0	0.00
Skin Loads		1,584	12.53	0	1,352	1,352	9.23
Lighting	50	0	0.00	0	179	179	1.22
Equipment	805	0	0.00	0	2,882	2,882	19.68
People	5	0	0.00	1,313	1,313	2,625	17.92
Partition	127	924	7.31	0	924	924	6.31
Cool. Pret.	0	0	0.00	0	0	0	0.00
Heat. Pret.	0	0	0.00	0	0	0	0.00
Cool. Vent.	180	0	0.00	2,789	3,176	5,964	40.72
Heat. Vent.	180	9,744	77.08	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	321	321	2.19
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	390	3.08	0	332	332	2.27
Return Duct	0	0	0.00	0	67	67	0.46
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		12,643	100.00	4,101	10,546	14,647	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	9,744	77.08	2,789	3,176	5,964	40.72
Infiltration	0	0.00	0	0	0	0.00
Pretreated Air	0	0.00	0	0	0	0.00
Zone Loads	2,509	19.84	1,313	6,650	7,963	54.36
Plenum Loads	0	0.00	0	0	0	0.00
Fan & Duct Loads	390	3.08	0	720	720	4.92
Building Totals	12,643	100.00	4,101	10,546	14,647	100.00

Check Figures

Total Building Supply Air (based on a 22° TD):	302 CFM
Total Building Vent. Air (59.80% of Supply):	180 CFM
Total Conditioned Air Space:	402 Sq.ft
Supply Air Per Unit Area:	0.7502 CFM/Sq.ft
Area Per Cooling Capacity:	329.6 Sq.ft/Ton
Cooling Capacity Per Area:	0.0030 Tons/Sq.ft
Heating Capacity Per Area:	31.43 Btuh/Sq.ft
Total Heating Required With Outside Air:	12,643 Btuh
Total Cooling Required With Outside Air:	1.22 Tons



Air Handler #1 - Gerencia - 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	Gerencia 8pm August	402 5 3,620	2,509 180 0.45	6,650 302 0.75	1,313 0 0	20/P, 0.2/ft ² 180 180	20/P, 0.2/ft ² 180 180
Runout duct size: 8 in. dia, Diffusers: 2, CFM/runout: 151, Velocity: 432.3 ft/min, Pressure drop: 0.081 in.wg./100ft							
Zone Peak Totals:		402	2,509	6,650	1,313		
Total Zones: 1		5	180	302	0	180	180
Unique Zones: 1		3,620	0.45	0.75	0	180	180
Main trunk duct size: 7 in. h x 8in. w, Velocity: 864.6 ft/min, Pressure drop: 0.224 in.wg./100ft							



Air Handler #1 - Gerencia - Total Load Summary

Air Handler Description: Gerencia Constant Volume - Sum of Peaks
 Supply Air Fan: Draw-Thru with program estimated horsepower of 0.13 HP
 Fan Input: 75% motor and fan efficiency with 2 in. water across the fan
 Sensible Heat Ratio: 0.85 --- 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 6,650.

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

Zone Space sensible loss:	2,509 Btuh		
Infiltration sensible loss:	0 Btuh	0 CFM	
Outside Air sensible loss:	9,744 Btuh	180 CFM	
Supply Duct sensible loss:	390 Btuh		
Return Duct sensible loss:	0 Btuh		
Return Plenum sensible loss:	0 Btuh		
Total System sensible loss:			12,643 Btuh
Heating Supply Air: $2,898 / (1.000 \times 1.08 \times 15) =$		180 CFM	
Winter Vent Outside Air (100.0% of supply) =		180 CFM	
Zone space sensible gain:	6,650 Btuh		
Infiltration sensible gain:	0 Btuh		
Draw-thru fan sensible gain:	321 Btuh		
Supply duct sensible gain:	332 Btuh		
Reserve sensible gain:	0 Btuh		
Total sensible gain on supply side of coil:			7,304 Btuh
Cooling Supply Air: $7,304 / (1.000 \times 1.1 \times 22) =$		302 CFM	
Summer Vent Outside Air (59.8% of supply) =		180 CFM	
Return duct sensible gain:	67 Btuh		
Return plenum sensible gain:	0 Btuh		
Outside air sensible gain:	3,176 Btuh	180 CFM	
Blow-thru fan sensible gain:	0 Btuh		
Total sensible gain on return side of coil:			3,243 Btuh
Total sensible gain on air handling system:			10,546 Btuh
Zone space latent gain:	1,313 Btuh		
Infiltration latent gain:	0 Btuh		
Outside air latent gain:	2,789 Btuh		
Total latent gain on air handling system:			4,101 Btuh
Total system sensible and latent gain:			14,647 Btuh

Check Figures

Total Air Handler Supply Air (based on a 22° TD):		302 CFM	
Total Air Handler Vent. Air (59.80% of Supply):		180 CFM	
Total Conditioned Air Space:	402 Sq.ft		
Supply Air Per Unit Area:	0.7502 CFM/Sq.ft		
Area Per Cooling Capacity:	329.6 Sq.ft/Ton		
Cooling Capacity Per Area:	0.0030 Tons/Sq.ft		
Heating Capacity Per Area:	31.43 Btuh/Sq.ft		
Total Heating Required With Outside Air:	12,643 Btuh		
Total Cooling Required With Outside Air:	1.22 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-Gerencia peaks (sensible) in August at 8pm, Air Handler 1 (Gerencia), Group 0, 402.3 x 1.0, Construction Type: 1 (Light)								
Roof-1-9-Susp.C-D	80	1.00	41.9	0.320	1,078		16.000	1,287
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	50	1.000			171			
Equipment-Prof=0	805	1.000			2,745	0		
People-Prof=1	5.0	1.000			1,250	1,250		
Sub-total					6,334	1,250		2,389
Safety factors:					+5%	+5%		+5%
Total w/ safety factors:					6,650	1,313		2,509



Air System #1 (Gerencia) Psychrometric Analysis (G)

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		58.219		53.000	
Draw-Thru Fan			321	0.968	13
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			332	1.000	14
Zone Loads	1,313	6.396	6,650	20.033	275
Sensible Reserve			0	0.000	0
Zone Condition	1,313	64.615	7,304	75.000	302
Return Air Duct			67	0.500	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 180 CFM	2,789	10.244	3,176	9.268	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	4,101	74.859	10,546	84.768	302

General Psychrometric Equations Used In Analysis:

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

$TSH = 1.000 \times 1.10 \times 302 \times (84.768 - 53.000) = 10,546 \text{ Btuh}$
 $TLH = 1.000 \times 0.68 \times 302 \times (74.859 - 58.219) = 3,415 \text{ Btuh}$
 $SUM = 13,961 \text{ Btuh}$
 $GTH = 1.000 \times 4.50 \times 302 \times (32.096 - 21.742) = 14,061 \text{ Btuh}$
Total System Load = 14,647 Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM = $14,061 / (0.00 \times 500) = 0.0 \text{ GPM}$
 Heating GPM = $12,643 / (0.00 \times 500) = 0.0 \text{ GPM}$
 Steam Req. = $12,643 / 970 = 13.0 \text{ lb./hr}$

Entering Cooling Coil Conditions

Dry bulb temperature: 84.77
 Wet bulb temperature: 67.84
 Relative humidity: 41.97
 Enthalpy: 32.10 Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature: 25.00

Leaving Cooling Coil Conditions

Dry bulb temperature: 53.00
 Wet bulb temperature: 52.60
 Relative humidity: 97.45
 Enthalpy: 21.74 Btu/lbm

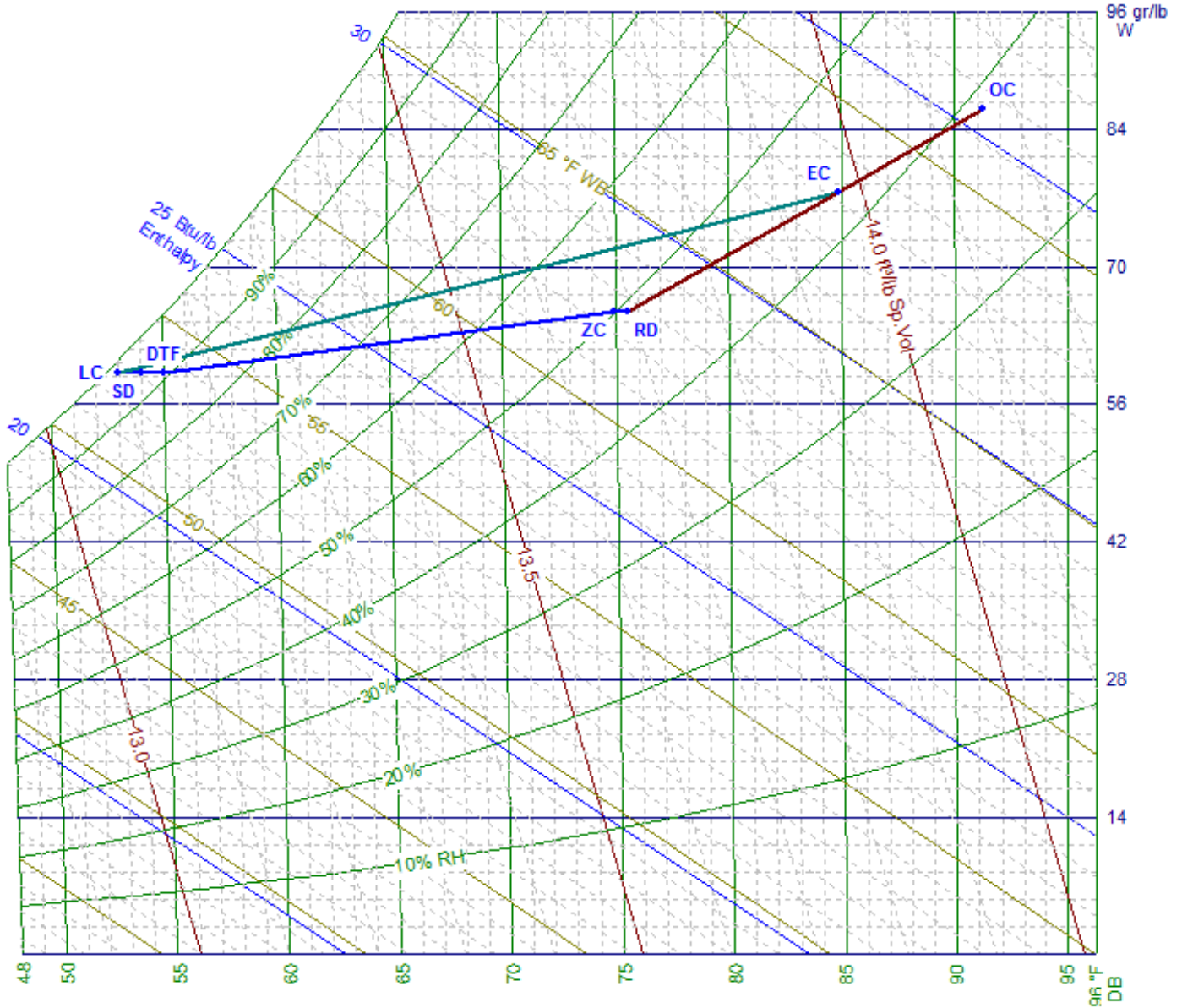
Leaving Heating Coil Conditions

Dry bulb temperature: 89.87



Air System #1 (Gerencia) 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 (Gerencia) 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

