

***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\IDF - 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	402	6,758	46.10	0	5,660	5,660	37.63
Wall	0	0	0.00	0	0	0	0.00
Glass	8	233	1.59	0	220	220	1.46
Floor Slab	0	0	0.00	0	0	0	0.00
Skin Loads		6,991	47.69	0	5,880	5,880	39.09
Lighting	50	0	0.00	0	179	179	1.19
Equipment	805	0	0.00	0	2,882	2,882	19.16
People	1	0	0.00	263	263	525	3.49
Partition	127	924	6.30	0	924	924	6.14
Cool. Pret.	0	0	0.00	0	0	0	0.00
Heat. Pret.	0	0	0.00	0	0	0	0.00
Cool. Vent.	100	0	0.00	1,552	1,768	3,320	22.07
Heat. Vent.	100	5,424	37.01	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	544	544	3.61
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	879	6.00	0	562	562	3.73
Return Duct	0	440	3.00	0	226	226	1.50
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		14,659	100.00	1,815	13,227	15,042	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	5,424	37.01	1,552	1,768	3,320	22.07
Infiltration	0	0.00	0	0	0	0.00
Pretreated Air	0	0.00	0	0	0	0.00
Zone Loads	7,915	54.00	263	10,128	10,391	69.08
Plenum Loads	0	0.00	0	0	0	0.00
Fan & Duct Loads	1,319	9.00	0	1,331	1,331	8.85
Building Totals	14,659	100.00	1,815	13,227	15,042	100.00

Check Figures

Total Building Supply Air (based on a 20° TD):	511 CFM
Total Building Vent. Air (19.67% of Supply):	100 CFM
Total Conditioned Air Space:	402 Sq.ft
Supply Air Per Unit Area:	1.2693 CFM/Sq.ft
Area Per Cooling Capacity:	320.9 Sq.ft/Ton
Cooling Capacity Per Area:	0.0031 Tons/Sq.ft
Heating Capacity Per Area:	36.44 Btuh/Sq.ft
Total Heating Required With Outside Air:	14,659 Btuh
Total Cooling Required With Outside Air:	1.25 Tons



Air Handler #1 - Idf - 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
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1	Idf 8pm August	402 1 3,620	7,915 407 1.01	10,128 511 1.27	263 0 0	20/P, 0.2/ft ² 100 100	20/P, 0.2/ft ² 100 100
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Runout duct size: 6 in. dia, Diffusers: 4, CFM/runout: 128, Velocity: 650.1 ft/min, Pressure drop: 0.269 in.wg./100ft

Zone Peak Totals:		402	7,915	10,128	263		
Total Zones: 1		1	407	511	0	100	100
Unique Zones: 1		3,620	1.01	1.27	0	100	100

Main trunk duct size: 12 in. h x 10in. w, Velocity: 650.1 ft/min, Pressure drop: 0.076 in.wg./100ft



Air Handler #1 - Idf - Total Load Summary

Air Handler Description: Idf Constant Volume - Sum of Peaks
 Supply Air Fan: Draw-Thru with program estimated horsepower of 0.21 HP
 Fan Input: 75% motor and fan efficiency with 2 in. water across the fan
 Sensible Heat Ratio: 0.97 --- 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 10,128.

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

Zone Space sensible loss:	7,915 Btuh		
Infiltration sensible loss:	0 Btuh	0 CFM	
Outside Air sensible loss:	5,424 Btuh	100 CFM	
Supply Duct sensible loss:	879 Btuh		
Return Duct sensible loss:	440 Btuh		
Return Plenum sensible loss:	0 Btuh		
Total System sensible loss:			14,659 Btuh
Heating Supply Air: $8,794 / (1.000 \times 1.08 \times 20) =$		407 CFM	
Winter Vent Outside Air (24.7% of supply) =		100 CFM	
Zone space sensible gain:	10,128 Btuh		
Infiltration sensible gain:	0 Btuh		
Draw-thru fan sensible gain:	544 Btuh		
Supply duct sensible gain:	562 Btuh		
Reserve sensible gain:	0 Btuh		
Total sensible gain on supply side of coil:			11,233 Btuh
Cooling Supply Air: $11,233 / (1.000 \times 1.1 \times 20) =$		511 CFM	
Summer Vent Outside Air (19.7% of supply) =		100 CFM	
Return duct sensible gain:	226 Btuh		
Return plenum sensible gain:	0 Btuh		
Outside air sensible gain:	1,768 Btuh	100 CFM	
Blow-thru fan sensible gain:	0 Btuh		
Total sensible gain on return side of coil:			1,994 Btuh
Total sensible gain on air handling system:			13,227 Btuh
Zone space latent gain:	263 Btuh		
Infiltration latent gain:	0 Btuh		
Outside air latent gain:	1,552 Btuh		
Total latent gain on air handling system:			1,815 Btuh
Total system sensible and latent gain:			15,042 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):		511 CFM	
Total Air Handler Vent. Air (19.67% of Supply):		100 CFM	
Total Conditioned Air Space:		402 Sq.ft	
Supply Air Per Unit Area:		1.2693 CFM/Sq.ft	
Area Per Cooling Capacity:		320.9 Sq.ft/Ton	
Cooling Capacity Per Area:		0.0031 Tons/Sq.ft	
Heating Capacity Per Area:		36.44 Btuh/Sq.ft	
Total Heating Required With Outside Air:		14,659 Btuh	
Total Cooling Required With Outside Air:		1.25 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-Idf peaks (sensible) in August at 8pm, Air Handler 1 (Idf), Group 0, 402.3 x 1.0, Construction Type: 1 (Light)								
Roof-1-9-Susp.C-D	402	1.00	41.9	0.320	5,390		16.000	6,436
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	1.0	1.000			250	250		
Sub-total					9,646	250		7,538
Safety factors:					+5%	+5%		+5%
Total w/ safety factors:					10,128	263		7,915



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

System Load Analysis	Latent	Grains	Sensible	Temp	CFM
Leaving Coil Condition		63.801		55.000	
Draw-Thru Fan			544	0.968	25
Misc Load on Supply Side			0	0.000	0
Supply Air Duct			562	1.000	26
Zone Loads	263	0.756	10,128	18.033	460
Sensible Reserve			0	0.000	0
Zone Condition	263	64.557	11,233	75.000	511
Return Air Duct			226	0.500	
Return Air Plenum			0	0.000	
Misc Load on Return Side			0	0.000	
Vent Air 100 CFM	1,552	3.382	1,768	3.050	
Blow-Thru Fan			0	0.000	
Entering Coil Condition	1,815	67.939	13,227	78.550	511

General Psychrometric Equations Used In Analysis:

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

$TSH = 1.000 \times 1.10 \times 511 \times (78.550 - 55.000) = 13,226 \text{ Btuh}$
 $TLH = 1.000 \times 0.68 \times 511 \times (67.939 - 63.801) = 1,437 \text{ Btuh}$
 $SUM = 14,663 \text{ Btuh}$
 $GTH = 1.000 \times 4.50 \times 511 \times (29.490 - 23.095) = 14,693 \text{ Btuh}$
Total System Load = 15,042 Btuh

Chilled and Hot Water Flow Rates and Steam Requirement

Cooling GPM = $14,693 / (0.00 \times 500) = 0.0 \text{ GPM}$
 Heating GPM = $14,659 / (0.00 \times 500) = 0.0 \text{ GPM}$
 Steam Req. = $14,659 / 970 = 15.1 \text{ lb./hr}$

Entering Cooling Coil Conditions

Dry bulb temperature: 78.55
 Wet bulb temperature: 64.46
 Relative humidity: 46.69
 Enthalpy: 29.49 Btu/lbm

Entering Heating Coil Conditions

Dry bulb temperature: 61.91

Leaving Cooling Coil Conditions

Dry bulb temperature: 55.00
 Wet bulb temperature: 54.86
 Relative humidity: 99.16
 Enthalpy: 23.09 Btu/lbm

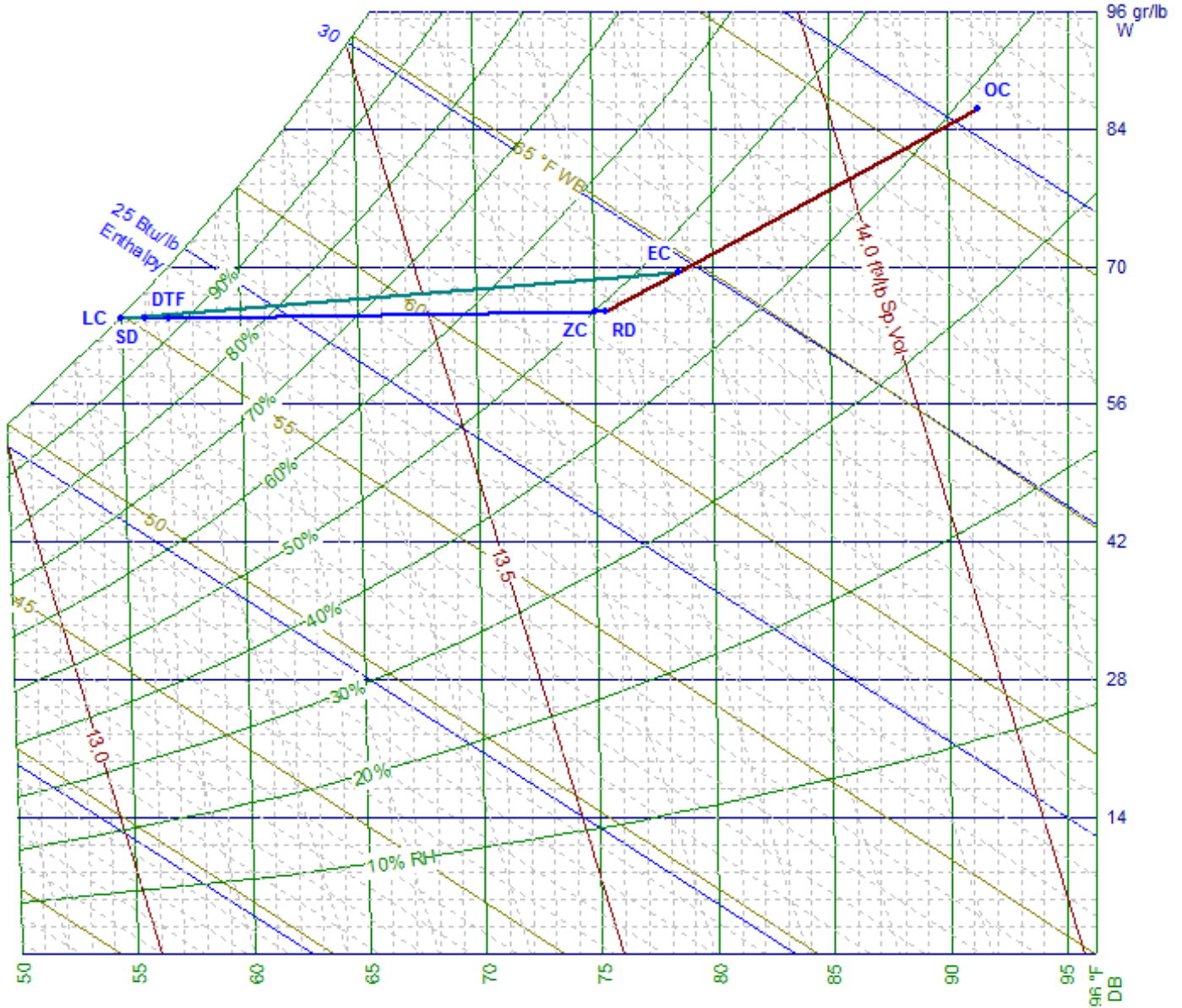
Leaving Heating Coil Conditions

Dry bulb temperature: 95.00



Air System #1 (Idf) 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 (Idf) 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

