

**Project Report**

**General Project Information**

Project Title: Lennar - Whisper Village - 9152 Gladiola Way - Lot 37  
 Designed By: Andy O'Leary  
 Project Date: Wednesday, July 26, 2023  
 Client Name: Lennar  
 Company Name: Smith And Willis Heating And Air  
 Company Representative: Andy O'Leary  
 Company Address: 8450 Rosemary St  
 Company City: Commerce City, CO. 80022  
 Company Phone: (303)688-4487  
 Company E-Mail Address: aoleary@smithandwillis.com

**Design Data**

Reference City: Arvada, Colorado  
 Building Orientation: Front door faces East  
 Daily Temperature Range: High  
 Latitude: 39 Degrees  
 Elevation: 5453 ft.  
 Altitude Factor: 0.818

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	1	0.21	81%	30%	70	34.13
Summer:	91	59	15%	50%	75	-39

**Check Figures**

Total Building Supply CFM: 880 CFM Per Square ft.: 0.568  
 Square ft. of Room Area: 1,550 Square ft. Per Ton: 1,220  
 Volume (ft<sup>3</sup>) of Cond. Space: 13,117

**Building Loads**

Total Heating Required Including Ventilation Air: 22,210 Btuh 22.210 MBH  
 Total Sensible Gain: 16,704 Btuh 100 %  
 Total Latent Gain: -1,455 Btuh 0 %  
 Total Cooling Required Including Ventilation Air: 16,704 Btuh 1.39 Tons (Based On Sensible + Latent)

**Notes**

Rhvac is an ACCA approved Manual J and Manual D computer program.  
 Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.  
 All computed results are estimates as building use and weather may vary.  
 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

**THIS DESIGN IS FOR A  
 PRESCRIPTIVE COMPLIANCE  
 PATH WITH THE 2018 IECC**

AIR LEAKAGE REPORT IS MANDATORY AND REQUIRED  
 TO BE SUBMITTED BEFORE A CO CAN BE ISSUED. THE  
 BLOWER DOOR TEST MUST BE 3 ACH OR LESS.

HOLE HOUSE MECHANICAL VENTILATION SYSTEM REQUIRED

FOLLOW APPROVED R-VALUES AND U-FACTORS FOR ENERGY  
 COMPLIANCE PER THE APPROVED/ STAMPED AND SITE SPECIFIC  
 MANUAL JDS DOCUMENTS/ ENERGY DOCUMENTS.

**Miscellaneous Report**

System 1 Whole House System Input Data	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	1	0.21	81%	30%	70	34.13
Summer:	91	59	15%	50%	75	-39.05

**Duct Sizing Inputs**

	Main Trunk	Runouts
Calculate:	Yes	Yes
Use Schedule:	Yes	Yes
Roughness Factor:	0.00300	0.01000
Pressure Drop:	0.1000 in.wg./100 ft.	0.1000 in.wg./100 ft.
Minimum Velocity:	650 ft./min	450 ft./min
Maximum Velocity:	900 ft./min	750 ft./min
Minimum Height:	0 in.	0 in.
Maximum Height:	0 in.	0 in.

**Outside Air Data**

	Winter	Summer
Infiltration Specified:	0.300 AC/hr 58 CFM	0.300 AC/hr 58 CFM
Infiltration Actual:	0.493 AC/hr	0.493 AC/hr
Above Grade Volume:	X 11,513 Cu.ft. 5,673 Cu.ft./hr X 0.0167	X 11,513 Cu.ft. 5,673 Cu.ft./hr X 0.0167
Total Building Infiltration:	95 CFM	95 CFM
Total Building Ventilation:	0 CFM	0 CFM

---System 1---  
 Infiltration & Ventilation Sensible Gain Multiplier: 14.40 = (1.10 X 0.818 X 16.00 Summer Temp. Difference)  
 Infiltration & Ventilation Latent Gain Multiplier: -21.72 = (0.68 X 0.818 X -39.05 Grains Difference)  
 Infiltration & Ventilation Sensible Loss Multiplier: 62.09 = (1.10 X 0.818 X 69.00 Winter Temp. Difference)  
 Winter Infiltration Specified: 0.300 AC/hr (58 CFM)  
 Summer Infiltration Specified: 0.300 AC/hr (58 CFM)



**Load Preview Report**

Scope	Net Ton	ft. <sup>2</sup> /Ton	Area	Sen Gain	Lat Gain	Net Gain	Sen Loss	Sys Htg CFM	Sys Clg CFM	Sys Act CFM	Duct Size
Building	1.39	1,220	1,550	16,704	-1,455	16,704	22,210	355	880	880	
System 1	1.39	1,220	1,550	16,704	-1,455	16,704	22,210	355	880	880	17x20
Humidification							1,093				
Zone 1			1,550	16,704	-1,455	16,704	21,117	355	880	880	10x15
1-Crawl Space			400	639	-120	639	2,786	47	34	47	5
2-Kitchen/Great Room			400	6,911	-625	6,911	7,082	119	364	364	7,7,7
3-BR2 WIC			31	405	-101	405	880	15	21	21	4
4-Bath 2			54	195	-95	195	776	13	10	13	4
5-O Bath			62	226	-108	226	935	16	12	16	4
6-O WIC			43	136	-57	136	556	9	7	9	4
7-Owner Suite			239	3,870	-191	3,870	4,381	74	204	204	7,7
8-Mech			26	531	0	531	47	1	28	28	Not MDD: 1-4
9-Bedroom 2			146	2,945	-41	2,945	2,498	42	155	155	6,6
10-Laundry			21	526	0	526	38	1	28	28	Not MDD: 1-4
11-Hall			128	320	-117	320	1,138	19	17	19	5
Sum of room airflows may be greater than system airflow because system room airflow option uses the greater of heating or cooling.											

**Manual D Ductsize Data - Duct System 1 - Supply**

---Duct Name, etc.					
Type	Roughness	Diameter	Velocity	SPL.Duct	
Upstream	Temperature	Width	Loss/100	SPL.Fit	
Shape	Length	Height	Fit.Eq.Len	SPL.Tot	
Sizing	CFM	Area	SP.Avail	SPL.Cumul	
<b>---Duct Name: SR-100, Supplies: Bedroom 2, Effective Length: 7.7</b>					
Runout	0.0003	6	397	0.004	
Up: ST-190	55	4.7	0.047	0.000	
Rnd	7.7	6.6	0.0	0.004	
Presize	78	12	0.454	0.346	
<b>---Duct Name: SR-110, Supplies: BR2 WIC, Effective Length: 10.7</b>					
Runout	0.0003	4	241	0.003	
Up: ST-190	55	3.1	0.032	0.000	
Rnd	10.7	4.4	0.0	0.003	
Presize	21	11.2	0.454	0.346	
<b>---Duct Name: SR-120, Supplies: Bedroom 2, Effective Length: 4.2</b>					
Runout	0.0003	6	397	0.002	
Up: ST-190	55	4.7	0.047	0.000	
Rnd	4.2	6.6	0.0	0.002	
Presize	78	6.5	0.456	0.344	
<b>---Duct Name: SR-130, Supplies: Bath 2, Fitting: 2-I, Effective Length: 20.9</b>					
Runout	0.0003	4	149	0.001	
Up: ST-180	135	3.1	0.013	0.002	
Rnd	4.3	4.4	16.6	0.003	
Presize	13	4.5	0.456	0.344	
<b>---Duct Name: SR-140, Supplies: Owner Suite, Effective Length: 19.7</b>					
Runout	0.0003	7	382	0.007	
Up: ST-150	55	5.4	0.036	0.000	
Rnd	19.7	7.7	0.0	0.007	
Presize	102	36	0.451	0.349	
<b>---Duct Name: SR-150, Supplies: Owner Suite, Fitting: 2-I, Effective Length: 50.3</b>					
Runout	0.0003	7	382	0.006	
Up: ST-140	55	5.4	0.036	0.012	
Rnd	16.0	7.7	34.3	0.018	
Presize	102	29.3	0.440	0.360	
<b>---Duct Name: SR-160, Supplies: O WIC, Fitting: 2-I, Effective Length: 12.7</b>					
Runout	0.0003	4	103	0.000	
Up: ST-160	135	3.1	0.007	0.001	
Rnd	1.0	4.4	11.7	0.001	
Presize	9	1	0.457	0.343	
<b>---Duct Name: SR-170, Supplies: O Bath, Effective Length: 4.3</b>					
Runout	0.0003	4	183	0.001	
Up: ST-150	135	3.1	0.018	0.000	
Rnd	4.3	4.4	0.0	0.001	
Presize	16	4.5	0.457	0.343	
<b>---Duct Name: SR-220, Supplies: Hall, Effective Length: 10.2</b>					
Runout	0.0003	5	367	0.005	
Up: ST-150	55	3.9	0.051	0.000	
Rnd	10.2	5.5	0.0	0.005	
Presize	50	13.3	0.453	0.347	

**Manual D Ductsize Data - Duct System 1 - Supply (cont'd)**

---Duct Name, etc.				
Type	Roughness	Diameter	Velocity	SPL.Duct
Upstream	Temperature	Width	Loss/100	SPL.Fit
Shape	Length	Height	Fit.Eq.Len	SPL.Tot
Sizing	CFM	Area	SP.Avail	SPL.Cumul
<b>---Duct Name: ST-160, Effective Length: 1.8</b>				
Trunk	0.0003	12	218	0.000
Up: ST-140	55	9.3	0.007	0.000
Rnd	1.8	13.1	0.0	0.000
Presize	171	5.8	0.458	0.342
<b>---Duct Name: ST-150, Effective Length: 1.5</b>				
Trunk	0.0003	12	209	0.000
Up: ST-160	55	9.3	0.006	0.000
Rnd	1.5	13.1	0.0	0.000
Presize	164	4.7	0.458	0.342
<b>---Duct Name: ST-140, Effective Length: 3.7</b>				
Trunk	0.0003	12	348	0.001
Up: ST-130	55	9.3	0.015	0.000
Rnd	3.7	13.1	0.0	0.001
Presize	273	11.5	0.458	0.342
<b>---Duct Name: SR-180, Supplies: Kitchen/Great Room, Effective Length: 6.1</b>				
Runout	0.0003	7	453	0.003
Up: ST-190	55	5.4	0.048	0.000
Rnd	6.1	7.7	0.0	0.003
Presize	121	11.2	0.455	0.345
<b>---Duct Name: SR-190, Supplies: Kitchen/Great Room, Effective Length: 8.6</b>				
Runout	0.0003	7	453	0.004
Up: ST-190	55	5.4	0.048	0.000
Rnd	8.6	7.7	0.0	0.004
Presize	121	15.8	0.453	0.347
<b>---Duct Name: SR-200, Supplies: Kitchen/Great Room, Fitting: 2-I, Effective Length: 49.1</b>				
Runout	0.0003	7	453	0.004
Up: ST-110	55	5.4	0.048	0.020
Rnd	7.3	7.7	41.8	0.024
Presize	121	13.3	0.436	0.364
<b>---Duct Name: ST-200, Feeds Into: Crawl Space, Effective Length: 1.7</b>				
Trunk	0.0003	15.2	421	0.000
Up: SMT-100	55	20	0.019	0.000
Rect	1.7	10	0.0	0.000
Presize	584	8.3	0.460	0.340
<b>---Duct Name: ST-190, Feeds Into: Crawl Space, Effective Length: 3.8</b>				
Trunk	0.0003	13.7	377	0.001
Up: ST-170	55	16	0.017	0.000
Rect	3.8	10	0.0	0.001
Presize	419	16.6	0.458	0.342
<b>---Duct Name: ST-180, Feeds Into: Crawl Space, Effective Length: 2.5</b>				
Trunk	0.0003	13.7	417	0.001
Up: ST-110	55	16	0.021	0.000
Rect	2.5	10	0.0	0.001
Presize	463	10.8	0.459	0.341

**Manual D Ductsize Data - Duct System 1 - Supply (cont'd)**

---Duct Name, etc.					
Type	Roughness	Diameter	Velocity	SPL.Duct	
Upstream	Temperature	Width	Loss/100	SPL.Fit	
Shape	Length	Height	Fit.Eq.Len	SPL.Tot	
Sizing	CFM	Area	SP.Avail	SPL.Cumul	
<b>---Duct Name: ST-170, Feeds Into: Crawl Space, Effective Length: 3.2</b>					
Trunk	0.0003	13.7	408	0.001	
Up: ST-180	55	16	0.020	0.000	
Rect	3.2	10	0.0	0.001	
Presize	453	13.7	0.458	0.342	
<b>---Duct Name: SMT-100, Feeds Into: Crawl Space, Fitting: 1-F1, Effective Length: 160.1</b>					
Trunk	0.0003	20.1	363	0.000	
Up: Fan	55	17	0.010	0.016	
Rect	1.1	20	159.0	0.286	
Presize	857	6.6	0.460	0.340	
<b>---Duct Name: ST-110, Feeds Into: Crawl Space, Effective Length: 1.8</b>					
Trunk	0.0003	13.7	526	0.001	
Up: ST-200	55	16	0.031	0.000	
Rect	1.8	10	0.0	0.001	
Presize	584	7.9	0.459	0.341	
<b>---Duct Name: ST-120, Feeds Into: Crawl Space, Effective Length: 5.3</b>					
Trunk	0.0003	15.2	197	0.000	
Up: SMT-100	55	20	0.005	0.000	
Rect	5.3	10	0.0	0.000	
Presize	273	26.7	0.460	0.340	
<b>---Duct Name: ST-130, Effective Length: 10.7</b>					
Trunk	0.0003	12.9	281	0.001	
Up: ST-120	55	14	0.011	0.000	
Rect	10.7	10	0.0	0.001	
Presize	273	42.7	0.459	0.341	
<b>---Duct Name: SR-210, Supplies: Crawl Space, Fitting: 2-I, Effective Length: 29.6</b>					
Runout	0.0003	5	345	0.002	
Up: ST-170	135	3.9	0.041	0.010	
Rnd	5.2	5.5	24.5	0.012	
Presize	47	6.8	0.446	0.354	

Report Units: Pressure: in.wg, Duct lengths: feet, Duct sizes: inch, Airflow: CFM, Velocity: ft./min, Temperature: F

Notes: Static pressure available values for return ducts are at the entrance of the duct. For supply, they are at the exit. The cumulative static pressure loss value for a return trunk is with respect to the entry point of the return runout upstream with the highest static pressure available. Total and cumulative static pressure loss values for the supply main trunk include any device pressure losses entered, and the cumulative may also include the total static pressure loss of the return side.

Summary			
Number of active trunks:	11		
Number of active runouts:	13		
Total runout outlet airflow:	879		
Main trunk airflow:	857		
Largest trunk diameter:	20.1	SMT-100	
Largest runout diameter:	7	SR-140	
Smallest trunk diameter:	12	ST-160	

**Rhvac - Residential & Light Commercial HVAC Loads**  
 Smith & Willis HVAC LLC  
 Littleton, CO 80125



**Elite Software Development, Inc.**  
 Lennar - Whisper Village - 9152 Gladiola Way - Lot 37  
 Page 7

**Manual D Ductsize Data - Duct System 1 - Supply (cont'd)**

**Summary**

Smallest runout diameter:	4	SR-110
Supply fan external static pressure:	0.800	
Supply fan device pressure losses:	0.270	
Supply fan static pressure available:	0.530	
Runout maximum cumulative static pressure loss:	0.364	SR-200
Return loss added to supply:	0.054	
Total effective length of return ( ft.):	207.3	Owner RA
Total effective length of supply ( ft.):	212.7	SR-200
Overall total effective length ( ft.):	420.0	Owner RA to SR-200
Design overall friction rate per 100 ft.:	0.126	(Available SP x 100 / TEL)
System duct surface area (No Scenario):	320.9	
Total system duct surface area:	320.9	

**Manual D Ductsize Data - Duct System 1 - Return**

---Duct Name, etc.				
Type	Roughness	Diameter	Velocity	SPL.Duct
Upstream	Temperature	Width	Loss/100	SPL.Fit
Shape	Length	Height	Fit.Eq.Len	SPL.Tot
Sizing	CFM	Area	SP.Avail	SPL.Cumul

**---Duct Name: Hall RA, Returns From: Hall, Fitting: 6-F, Effective Length: 25.6**

Runout	0.01	12	306	0.001
Up: RT-120	75	9.3	0.019	0.004
Rnd	5.5	13.1	20.2	0.005
Presize	240	17.2	-0.006	0.005

**---Duct Name: Owner RA, Returns From: Owner Suite, Fitting: 6-F, Effective Length: 23.3**

Runout	0.01	10	422	0.003
Up: RT-120	75	7.8	0.045	0.007
Rnd	7.3	10.9	16.0	0.011
Presize	230	19.1	0.000	0.011

**---Duct Name: RT-120, Feeds From: Kitchen/Great Room, Effective Length: 1.5**

Trunk	0.0003	12.9	483	0.000
Up: RT-130	75	14	0.028	0.000
Rect	1.5	10	0.0	0.000
Presize	470	6	-0.011	0.053

**---Duct Name: Low RA, Returns From: Kitchen/Great Room, Fitting: 6-F, Effective Length: 43.1**

Runout	0.0003	14	384	0.000
Up: RT-110	75	10.8	0.015	0.006
Rnd	2.3	15.3	40.8	0.006
Presize	410	8.6	-0.005	0.006

**---Duct Name: RT-130, Feeds From: Crawl Space, Effective Length: 3.5**

Trunk	0.0003	15.2	338	0.000
Up: RT-110	75	20	0.012	0.000
Rect	3.5	10	0.0	0.000
Presize	470	17.5	-0.011	0.053

**---Duct Name: RMT-100, Feeds From: Crawl Space, Fittings: 5-I1, 5-N, Effective Length: 177.7**

Trunk	0.0003	16.9	507	0.000
Up: Fan	75	25	0.024	0.042
Rect	0.7	10	176.9	0.042
Presize	880	4.3	-0.012	0.054

**---Duct Name: RT-110, Feeds From: Crawl Space, Effective Length: 1.3**

Trunk	0.0003	15.2	634	0.001
Up: RMT-100	75	20	0.039	0.000
Rect	1.3	10	0.0	0.001
Presize	880	6.7	-0.011	0.054

Report Units: Pressure: in.wg, Duct lengths: feet, Duct sizes: inch, Airflow: CFM, Velocity: ft./min, Temperature: F

Notes: Static pressure available values for return ducts are at the entrance of the duct. For supply, they are at the exit. The cumulative static pressure loss value for a return trunk is with respect to the entry point of the return runout upstream with the highest static pressure available. Total and cumulative static pressure loss values for the supply main trunk include any device pressure losses entered, and the cumulative may also include the total static pressure loss of the return side.

Summary	
Number of active trunks:	4
Number of active runouts:	3



**Manual D Ductsize Data - Duct System 1 - Return (cont'd)**

**Summary**

Total runout outlet airflow:	880		
Main trunk airflow:	880		
Largest trunk diameter:	16.9	RMT-100	
Largest runout diameter:	14	Low RA	
Smallest trunk diameter:	12.9	RT-120	
Smallest runout diameter:	10	Owner RA	
Runout maximum cumulative static pressure loss:	0.011	Owner RA	
Return loss added to supply:	0.054		
Total effective length of return ( ft.):	207.3	Owner RA	
System duct surface area (No Scenario):	43.1		
System duct surface area (Scenario 1):	36.3	Main	(Linked to duct load)
Total system duct surface area:	79.4		

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 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

**Total Building Summary Loads**

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
Lennar Window: Glazing-0.31/0.36, u-value 0.31, SHGC 0.36	111	2,375	0	4,329	4,329
Grage Door R2.8: Door-Garage Door R2.8	24	591	0	188	188
Entry R-6.2: Door-	24	265	0	84	84
R11 Draped-4: Wall-Basement, Custom, R11 Draped	445.5	1,700	0	60	60
R23: Wall-Frame, Custom, R23 Outside Wall	1788	7,648	0	1,252	1,252
16B-38: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Vented Attic, No Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane, R-38 insulation	756.5	1,358	0	905	905
21A-20-c: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, carpet covering, shortest side of floor slab is 20' wide	399.5	744	0	0	0
R50 Floor: Floor-Over open crawl space or garage, Custom, R-50 Floor	356.7	566	0	49	49
Subtotals for structure:		15,247	0	6,867	6,867
People:	3		600	690	1,290
Equipment:			0	7,785	7,785
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 95, Summer CFM: 95		5,870	-2,055	1,362	-693
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Humidification (Winter) 2.98 gal/day :		1,093	0	0	0
<b>Total Building Load Totals:</b>		<b>22,210</b>	<b>-1,455</b>	<b>16,704</b>	<b>15,249</b>

**Check Figures**

Total Building Supply CFM:	880	CFM Per Square ft.:	0.568
Square ft. of Room Area:	1,550	Square ft. Per Ton:	1,220
Volume (ft³) of Cond. Space:	13,117		

**Building Loads**

Total Heating Required Including Ventilation Air:	22,210 Btuh	22.210 MBH
Total Sensible Gain:	16,704 Btuh	100 %
Total Latent Gain:	-1,455 Btuh	0 %
Total Cooling Required Including Ventilation Air:	16,704 Btuh	1.39 Tons (Based On Sensible + Latent)

**Notes**  
 Rhvac is an ACCA approved Manual J and Manual D computer program.  
 Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.  
 All computed results are estimates as building use and weather may vary.  
 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.

**System 1 Whole House System Summary Loads**

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
Lennar Window: Glazing-0.31/0.36, u-value 0.31, SHGC 0.36	111	2,375	0	4,329	4,329
Grage Door R2.8: Door-Garage Door R2.8	24	591	0	188	188
Entry R-6.2: Door-	24	265	0	84	84
R11 Draped-4: Wall-Basement, Custom, R11 Draped	445.5	1,700	0	60	60
R23: Wall-Frame, Custom, R23 Outside Wall	1788	7,648	0	1,252	1,252
16B-38: Roof/Ceiling-Under Attic with Insulation on Attic Floor (also use for Knee Walls and Partition Ceilings), Vented Attic, No Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane, R-38 insulation	756.5	1,358	0	905	905
21A-20-c: Floor-Basement, Concrete slab, any thickness, 2 or more feet below grade, no insulation below floor, carpet covering, shortest side of floor slab is 20' wide	399.5	744	0	0	0
R50 Floor: Floor-Over open crawl space or garage, Custom, R-50 Floor	356.7	566	0	49	49
Subtotals for structure:		15,247	0	6,867	6,867
People:	3		600	690	1,290
Equipment:			0	7,785	7,785
Lighting:	0			0	0
Ductwork:		0	0	0	0
Infiltration: Winter CFM: 95, Summer CFM: 95		5,870	-2,055	1,362	-693
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Humidification (Winter) 2.98 gal/day :		1,093	0	0	0
<b>System 1 Whole House System Load Totals:</b>		<b>22,210</b>	<b>-1,455</b>	<b>16,704</b>	<b>15,249</b>

Check Figures			
Supply CFM:	880	CFM Per Square ft.:	0.568
Square ft. of Room Area:	1,550	Square ft. Per Ton:	1,220
Volume (ft³) of Cond. Space:	13,117		

System Loads			
Total Heating Required Including Ventilation Air:	22,210 Btuh	22.210 MBH	
Total Sensible Gain:	16,704 Btuh	100 %	
Total Latent Gain:	-1,455 Btuh	0 %	
Total Cooling Required Including Ventilation Air:	16,704 Btuh	1.39 Tons (Based On Sensible + Latent)	

**Notes**  
 Rhvac is an ACCA approved Manual J and Manual D computer program.  
 Calculations are performed per ACCA Manual J 8th Edition, Version 2, and ACCA Manual D.  
 All computed results are estimates as building use and weather may vary.  
 Be sure to select a unit that meets both sensible and latent loads according to the manufacturer's performance data at your design conditions.



## *Equipment Data - System 1 - Whole House System*

### **Cooling**

System Type: Standard Air Conditioner  
Outdoor Model: ML14XC1S024-230A\*\*  
Indoor Model: CH35-30B+TDR+TXV  
Tradename: MERIT ML14XC1 SERIES  
Outdoor Manufacturer: LENNOX  
AHRI Reference No.: 9148127  
Nominal Capacity: 24000  
Efficiency: 14.5 SEER

### **Heating**

System Type: Natural Gas Furnace  
Model: ML193UH045XE36B-\*  
Tradename: MERIT 90  
Manufacturer: LENNOX INDUSTRIES, INC.  
Description: Natural Gas or Propane Furnace  
Capacity: 42000  
Efficiency: 93 AFUE

**System 1 Room Load Summary**

Room No	Room Name	Area SF	Htg Sens Btuh	Min Htg CFM	Run Duct Size	Run Duct Vel	Clg Sens Btuh	Clg Lat Btuh	Min Clg CFM	Act Sys CFM
---Zone 1---										
1	Crawl Space	400	2,786	50	5	-	639	-120	36	47
2	Kitchen/Great Room	400	7,082	127	7,7,7	-	6,911	-625	384	364
3	BR2 WIC	31	880	16	4	-	405	-101	23	21
4	Bath 2	54	776	14	4	-	195	-95	11	13
5	O Bath	62	935	17	4	-	226	-108	13	16
6	O WIC	43	556	10	4	-	136	-57	8	9
7	Owner Suite	239	4,381	79	7,7	-	3,870	-191	215	204
8	Mech	26	47	1	<sup>1</sup> 1-4	321	531	0	30	28
9	Bedroom 2	146	2,498	45	6,6	-	2,945	-41	164	155
10	Laundry	21	38	1	<sup>1</sup> 1-4	318	526	0	29	28
11	Hall	128	1,138	20	5	-	320	-117	18	19
Humidification			1,093							
System 1 total		1,550	22,210	380			16,704	-1,455	928	880

System 1 Main Trunk Size: 17x20 in.  
 Velocity: 363 ft./min  
 Loss per 100 ft.: 0.010 in.wg

Duct size results above are from Manual D Ductsize except where indicated otherwise.  
 Runout duct velocities are not printed with duct size results from Manual D Ductsize since they can vary within the room.  
 See the Manual D Ductsize report for duct velocities and other data.  
<sup>1</sup> Indicates duct sized with Rhvac's built-in duct sizing rather than with Manual D Ductsize.

**Cooling System Summary**

	Cooling Tons	Sensible/Latent Split	Sensible Btuh	Latent Btuh	Total Btuh
Net Required:	1.39	110% / -10%	16,704	-1,455	16,704
Actual:	2.00	100% / 0%	24,000	0	24,000

**Equipment Data**

	Heating System	Cooling System
Type:	Natural Gas Furnace	Standard Air Conditioner
Model:	ML193UH045XE36B-*	ML14XC1S024-230A**
Indoor Model:		CH35-30B+TDR+TXV
Brand:	MERIT 90	MERIT ML14XC1 SERIES
Description:	Natural Gas or Propane Furnace	
Efficiency:	93 AFUE	14.5 SEER
Sound:		
Capacity:	42000	24000
Sensible Capacity:	n/a	24,000 Btuh
Latent Capacity:	n/a	0 Btuh
AHRI Reference No.:	n/a	9148127

## Building Rotation Report

All rotation degree values in this report are clockwise with respect to the project's original orientation.  
 Building orientation as entered (zero degrees rotation): Front door faces East  
 At least one system with its System Air Type input set to Fixed was changed to Auto during the building rotation. If you want to change this behavior uncheck the option on the General tab of the Select Reports dialog called "Always use Auto for System Air Type for Building Rotation Report."

### Individual Rooms

Rm. No.	Room Name	0° Rot. CFM	45° Rot. CFM	90° Rot. CFM	135° Rot. CFM	180° Rot. CFM	225° Rot. CFM	270° Rot. CFM	315° Rot. CFM	High Duct Size
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**System 1:**

**Zone 1:**

1	Crawl Space	*50	50	50	50	50	50	50	50	5
2	Kitchen/Great Room	384	374	360	387	*393	365	344	366	7,7,7
3	BR2 WIC	23	21	16	21	*23	19	16	19	4
4	Bath 2	*14	14	14	14	14	14	14	14	4
5	O Bath	*17	17	17	17	17	17	17	17	4
6	O WIC	*10	10	10	10	10	10	10	10	4
7	Owner Suite	215	186	151	193	*220	200	168	201	7,7
8	Mech	30	30	30	*31	30	30	30	30	1--4
9	Bedroom 2	164	154	134	159	*167	144	120	145	6,6
10	Laundry	29	29	30	*30	30	29	30	29	1--4
11	Hall	*20	20	20	20	20	20	20	20	5

\* Indicates highest CFM of all rotations.

### Whole Building

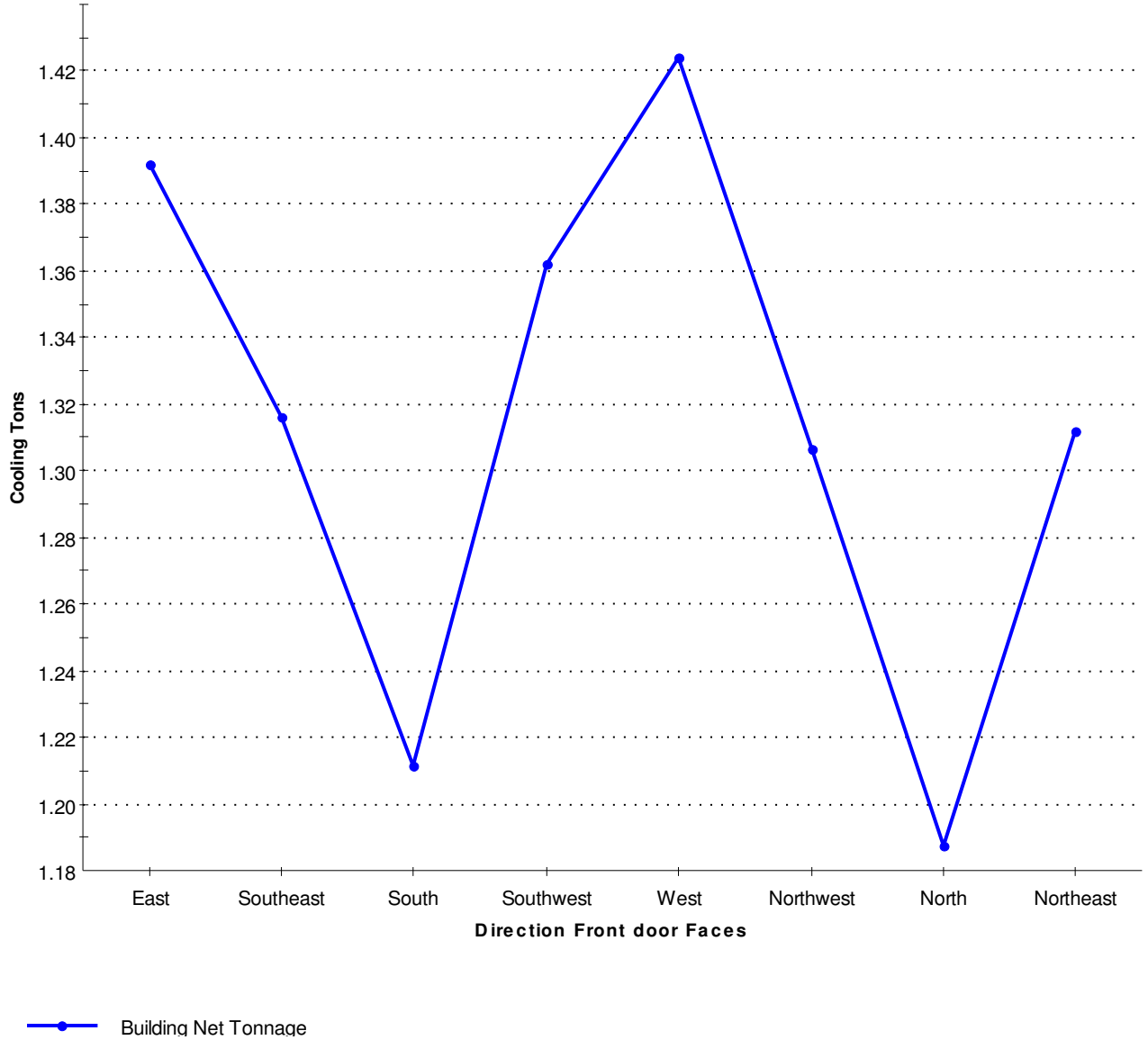
Rotation Degrees	Front door Faces	Supply CFM	Sensible Gain	Latent Gain	Net Tons
0°	East	928	16,704	*-1,455	1.39
45°	Southeast	878	15,793	-1,455	1.32
90°	South	808	14,537	-1,455	1.21
135°	Southwest	908	16,345	-1,455	1.36
180°	West	*950	*17,091	-1,455	*1.42
225°	Northwest	871	15,676	-1,455	1.31
270°	North	792	14,247	-1,455	1.19
315°	Northeast	875	15,745	-1,455	1.31

\* Indicates highest value of all rotations.



**Building Rotation Report (cont'd)**

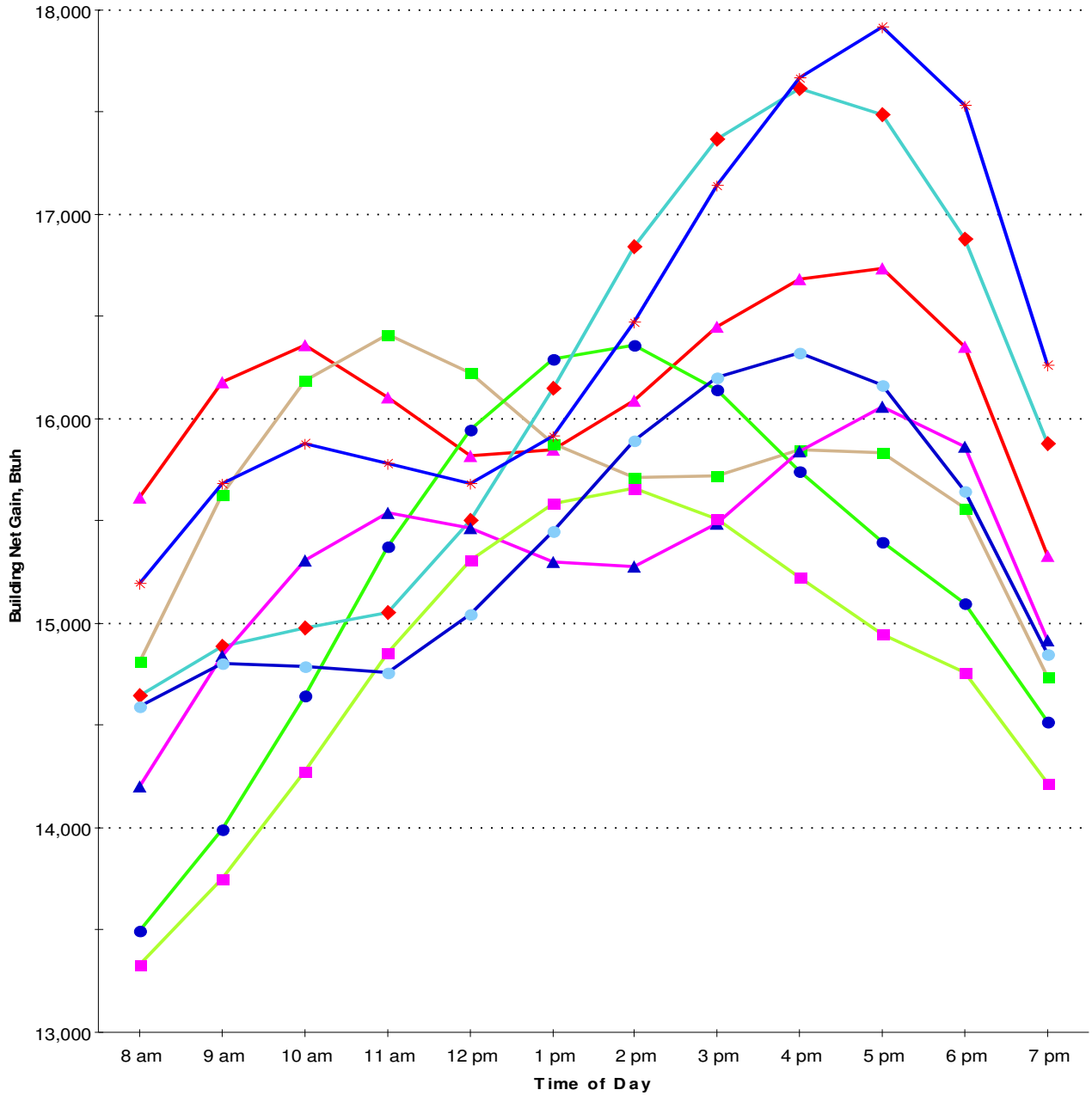
**Building Rotation Tonnage**





**Building Rotation Report (cont'd)**

**Building Rotation Hourly Net Gain**



- ▲ Front door faces East
- Front door faces Southeast
- Front door faces South
- ◆ Front door faces Southwest
- ✱ Front door faces West
- ▲ Front door faces Northwest
- Front door faces North
- Front door faces Northeast



# Manual S

## Lennar

### Whisper Village

### Plan 301

**Equipment:**

- Furnace = Lennox Model ML193UH045XE36B (44,000 BTU)**
- Air Conditioner = Lennox Model ML14XC1S024 (2 Ton)**
- Evaporator Coil = Lennox Model CHX35-30B (2.5 Ton)**

**Duct Summary**

Report Units: Pressure: in.wg, Duct lengths: feet, Duct sizes: inch, Airflow: CFM, Velocity: ft./min, Temperature: F

Notes: Static pressure available values for return ducts are at the entrance of the duct. For supply, they are at the exit. The cumulative static pressure loss value for a return trunk is with respect to the entry point of the return runout upstream with the highest static pressure available. Total and cumulative static pressure loss values for the supply main trunk include any device pressure losses entered, and the cumulative may also include the total static pressure loss of the return side.

**Summary**

Number of active trunks:	11	
Number of active runouts:	13	
Total runout outlet airflow:	879	
Main trunk airflow:	857	
Largest trunk diameter:	20.1	SMT-100
Largest runout diameter:	7	SR-140
Smallest trunk diameter:	12	ST-160
Smallest runout diameter:	4	SR-110
Supply fan external static pressure:	0.800	
Supply fan device pressure losses:	0.270	
Supply fan static pressure available:	0.530	
Runout maximum cumulative static pressure loss:	0.364	SR-200
Return loss added to supply:	0.054	
Total effective length of return ( ft.):	207.3	Owner RA
Total effective length of supply ( ft.):	212.7	SR-200
Overall total effective length ( ft.):	420.0	Owner RA to SR-200
Design overall friction rate per 100 ft.:	0.126	(Available SP x 100 / TEL)

System duct surface area (No Scenario):	320.9
Total system duct surface area:	320.9

## Furnace Heat Rise—Used 58 Degrees on Program

SPECIFICATIONS					
Gas Heating Performance	Model No.	ML193UH030XE36B	ML193UH045XE36B	ML193UH070XE36B	ML193UH090XE36C
	AHRI Reference No.	20256877	20256878	20256879	20256880
	<sup>1</sup> AFUE	93%	93%	93%	93%
	Input - Btuh	30,000	44,000	66,000	88,000
	Output - Btuh	29,000	42,000	63,000	84,000
	Temperature rise range - °F	25 - 55	30 - 60	40 - 70	50 - 80
	Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10	3.5 / 10.0	3.5 / 10.0	3.5 / 10
	High static - in. w.g.	0.5	0.5	0.5	0.5

## Furnace Blower Data

ML193UH045XE36B PERFORMANCE (Less Filter)

External Static Pressure in. w.g.	Air Volume / Watts at Various Blower Speeds									
	High		Medium-High		Medium		Medium-Low		Low	
	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts	cfm	Watts
0.00	1420	343	1305	264	1170	191	930	102	780	66
0.10	1390	348	1270	271	1135	199	885	109	735	71
0.20	1355	349	1230	280	1100	207	850	119	680	81
0.30	1330	368	1205	291	1060	220	795	126	625	84
0.40	1295	378	1180	298	1025	226	755	134	570	91
0.50	1265	386	1140	310	995	233	720	140	515	95
0.60	1240	402	1100	316	955	242	670	148	475	104
0.70	1210	411	1065	331	920	253	615	157	425	107
0.80	1160	420	1030	340	880	262	580	160	355	114

## Evaporator Coil static Pressure

AIR RESISTANCE														
Air Volume cfm	Total Air Resistance - in. w.g.													
	CHX35-18A-6F		CHX35-24A-6F		CHX35-24B-6F		CHX35-30A-6F		CHX35-30B-6F		CHX35-36A-6F		CHX35-36B-6F	
	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil	Dry Coil	Wet Coil
200	0.02	0.02	---	---	---	---	---	---	---	---	---	---	---	---
400	0.05	0.06	0.04	0.05	0.03	0.04	0.04	0.05	0.02	0.02	---	---	---	---
600	0.09	0.11	0.09	0.11	0.05	0.07	0.09	0.10	0.05	0.06	---	---	---	---
800	0.15	0.17	0.15	0.19	0.09	0.11	0.15	0.17	0.09	0.11	0.15	0.18	0.08	0.10
1000	0.22	0.25	0.23	0.29	0.15	0.17	0.24	0.27	0.14	0.16	0.22	0.27	0.11	0.16
1200	---	---	0.32	0.40	0.21	0.23	0.34	0.38	0.19	0.23	0.30	0.39	0.16	0.21
1400	---	---	0.43	0.50	0.28	0.30	0.45	0.51	0.26	0.30	0.41	0.48	0.21	0.27
1600	---	---	---	---	---	---	---	---	---	---	0.53	0.63	0.27	0.35

## Detailed Cooling Capacities

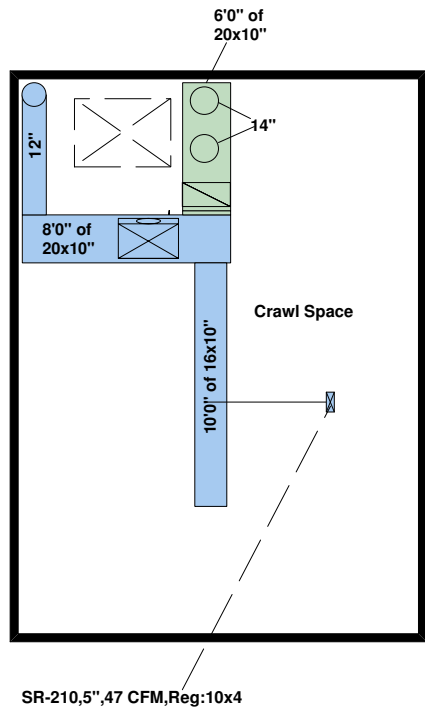
Entering Wet Bulb Temperature	Total Air Volume	Outdoor Air Temperature Entering Outdoor Coil																			
		85°F					95°F					105°F					115°F				
		Total Cool Cap.	Comp Motor Input	Sensible to Total Ratio (S/T)			Total Cool Cap.	Comp Motor Input	Sensible to Total Ratio (S/T)			Total Cool Cap.	Comp Motor Input	Sensible to Total Ratio (S/T)			Total Cool Cap.	Comp Motor Input	Sensible to Total Ratio (S/T)		
				Dry Bulb					Dry Bulb					Dry Bulb					Dry Bulb		
cfm	kBtuh	kW	75°F	80°F	85°F	kBtuh	kW	75°F	80°F	85°F	kBtuh	kW	75°F	80°F	85°F	kBtuh	kW	75°F	80°F	85°F	
63°F	720	23.4	1.4	0.76	0.9	1	22.4	1.6	0.78	0.93	1	21	1.82	0.8	0.96	1	19.7	2.08	0.83	0.99	1
	815	24	1.41	0.79	0.94	1	22.8	1.6	0.81	0.97	1	21.6	1.83	0.83	0.99	1	20.4	2.09	0.87	1	1
	905	24.4	1.41	0.81	0.97	1	23.2	1.61	0.84	0.99	1	22.2	1.83	0.87	1	1	20.8	2.09	0.9	1	1
67°F	720	24.6	1.41	0.61	0.74	0.87	23.4	1.61	0.62	0.76	0.89	22.2	1.84	0.63	0.78	0.92	20.8	2.09	0.65	0.81	0.96
	815	25.4	1.41	0.63	0.77	0.91	24	1.61	0.64	0.79	0.93	22.6	1.84	0.65	0.81	0.97	21.2	2.1	0.67	0.84	1
	905	25.8	1.42	0.64	0.79	0.94	24.4	1.62	0.66	0.82	0.97	23	1.84	0.67	0.84	1	21.6	2.1	0.69	0.88	1
71°F	720	25.8	1.41	0.46	0.6	0.72	24.4	1.62	0.47	0.61	0.74	23.2	1.84	0.47	0.62	0.76	21.6	2.1	0.48	0.64	0.78
	815	26.4	1.42	0.47	0.62	0.75	25.2	1.62	0.48	0.63	0.77	23.8	1.85	0.48	0.64	0.79	22.2	2.11	0.49	0.66	0.82
	905	27	1.42	0.48	0.63	0.77	25.6	1.63	0.49	0.65	0.79	24.2	1.85	0.5	0.66	0.82	22.6	2.11	0.51	0.68	0.86

AC Sensible Capacity= 22,800 \* 0.81 = 18,468 BTU's

Sensible Gain from Manual J = 16,704 BTU's

16,704/18,468 = .90 or 10% over

NOTE: The 1.5 ton AC only delivers 15,980 BTU's



- ALL DUCTS, REGISTERS, AND GRILLES MAY VARY IN THE ROOM LOCATION DUE TO CONSTRUCTION CONSTRAINTS BUT MUST BE THE NOTED DUCT SIZE
- ALL OPEN TO BELOW ROOM CFM TO BE INCLUDED IN THE ROOM BELOW CFM UNLESS SUPPLIED BY A 2<sup>ND</sup> FLOOR SYSTEM
- ALL OPEN AREAS MAY SHARE CFM LOADS FOR TOTAL CFM IN COMMON AREA
- TG DENOTES TRANSFER GRILLE
- TRANSFER GRILLES MAY BE REPLACED BY JUMPER DUCTS, AND BOTH SHALL BE SIZED FOR ONE CFM PER SQ. INCH
- ROOMS OTHER THAN FULL OR ¾ BATHS WITH NEGLIGIBLE CFM MAY OR MAY NOT HAVE A SUPPLY
- IF APPLICABLE, BASEMENT RETURN CFM MAY BE LOWER THAN SUPPLY CFM BUT WILL BE INCLUDED IN FIRST (OR FIRST AND SECOND) FLOOR CFM
- IF APPLICABLE, FINISHED BASEMENT OPTION MAY BE SHOWN, BUT MAY ONLY NEED 2 OR 3 SUPPLIES TO ACCOMMODATE THE CFM LOAD IN THE UNFINISHED CONDITION AND CAN BE PLACED IN LOCATIONS DICTATED BY THE INSTALLER
- LOW ENERGY CONSUMPTION CRITERIA, BUILDING DESIGN EQUIPMENT LOCATIONS, AND BUILDING CODE REQUIREMENTS, MAY HINDER CUSTOMER COMFORT PREFERENCES. CONTINUOUS BLOWER OPERATION MAY BE REQUIRED TO EQUALIZE TEMPERATURE DIFFERENCES
- CALCULATIONS INDICATE THAT THE PROVIDED RETURN AIR VENTS ARE SUFFICIENT; HOWEVER, ADDITIONAL RETURN AIR MAY BE PROVIDED AS DICTATED BY PERFORMANCE REQUIREMENTS

**NOTE:** Install transfer grille to crawl space

**NOTE:** All pipes are sized for flex. If ran in hard pipe pipes can be downsized 1" except when going up walls.

**NOTE:** Some heat runs are oversized to help with potential temporary load; seasonal balancing is required for proper system operation

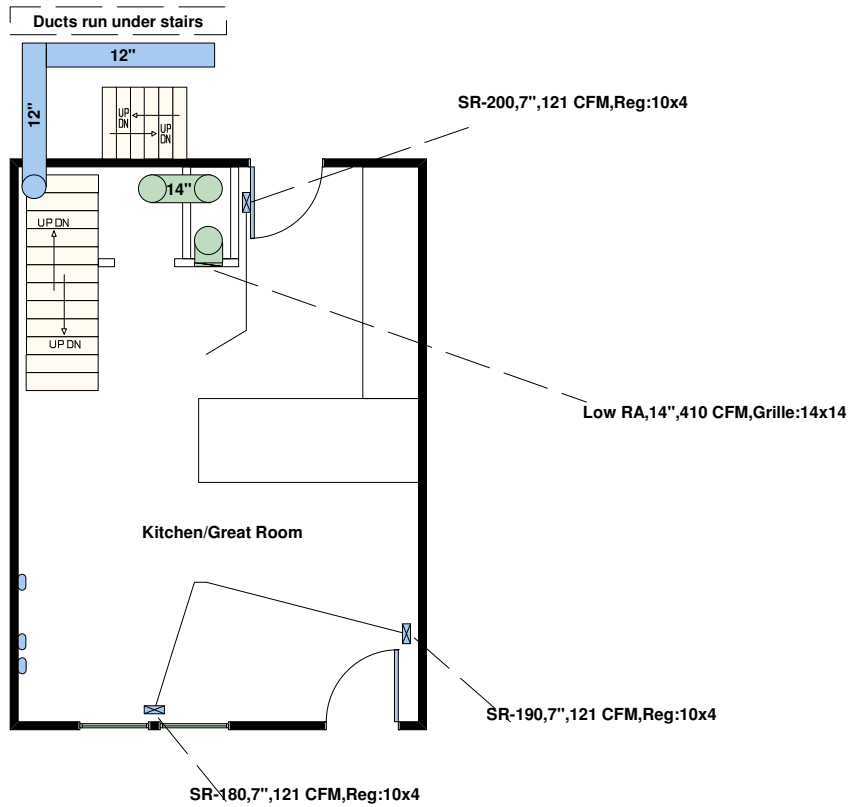
**Lennar  
Whisper Village  
Plan 301**

**Crawl Space**

North

**Scale: 1/8"=1'0"**  
**Page Size: 8.5x11"**

Drawn:  
 Approved:  
 Date:  
 Job Number:



**NOTE: Install transfer grille to crawl space**

**NOTE: All pipes are sized for flex. If ran in hard pipe pipes can be downsized 1" except when going up walls.**

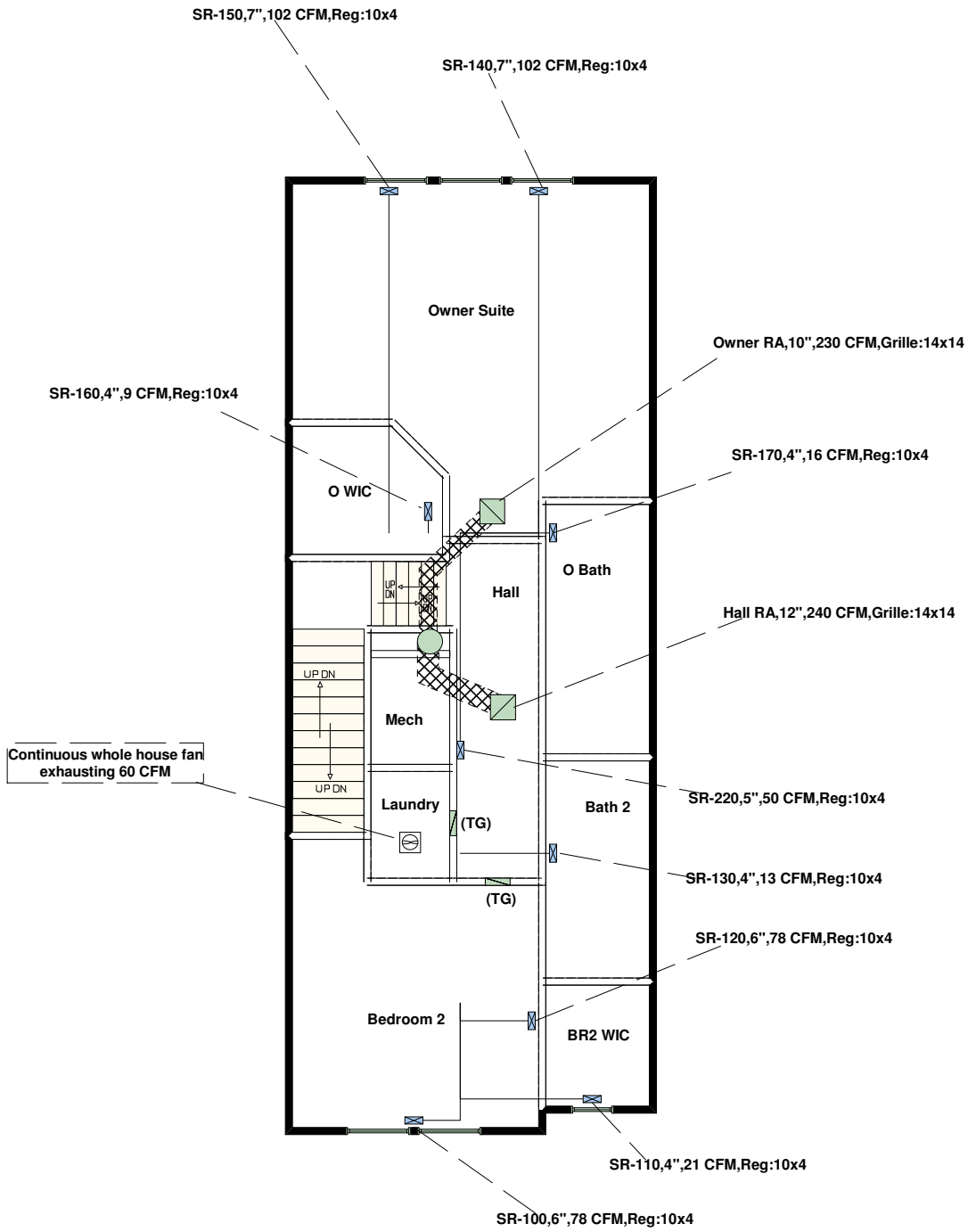
**NOTE: Some heat runs are oversized to help with potential temporary load; seasonal balancing is required for proper system operation**

**Main Floor**

**Lennar  
 Whisper Village  
 Plan 301**

**Scale: 1/8" = 1'0"**  
**Page Size: 8.5x11"**

Drawn:  
 Approved:  
 Date:  
 Job Number:



**NOTE:** Some heat runs are oversized to help with potential temporary load; seasonal balancing is required for proper system operation

**NOTE:** Install transfer grille to crawl space

**NOTE:** All pipes are sized for flex. If ran in hard pipe pipes can be downsized 1" except when going up walls.

**2nd Floor**

**Lennar  
Whisper Village  
Plan 301**

**Scale: 1/8"=1'0"**  
**Page Size: 8.5x11"**  
 Drawn:  
 Approved:  
 Date:  
 Job Number: