Information Sheet 3201

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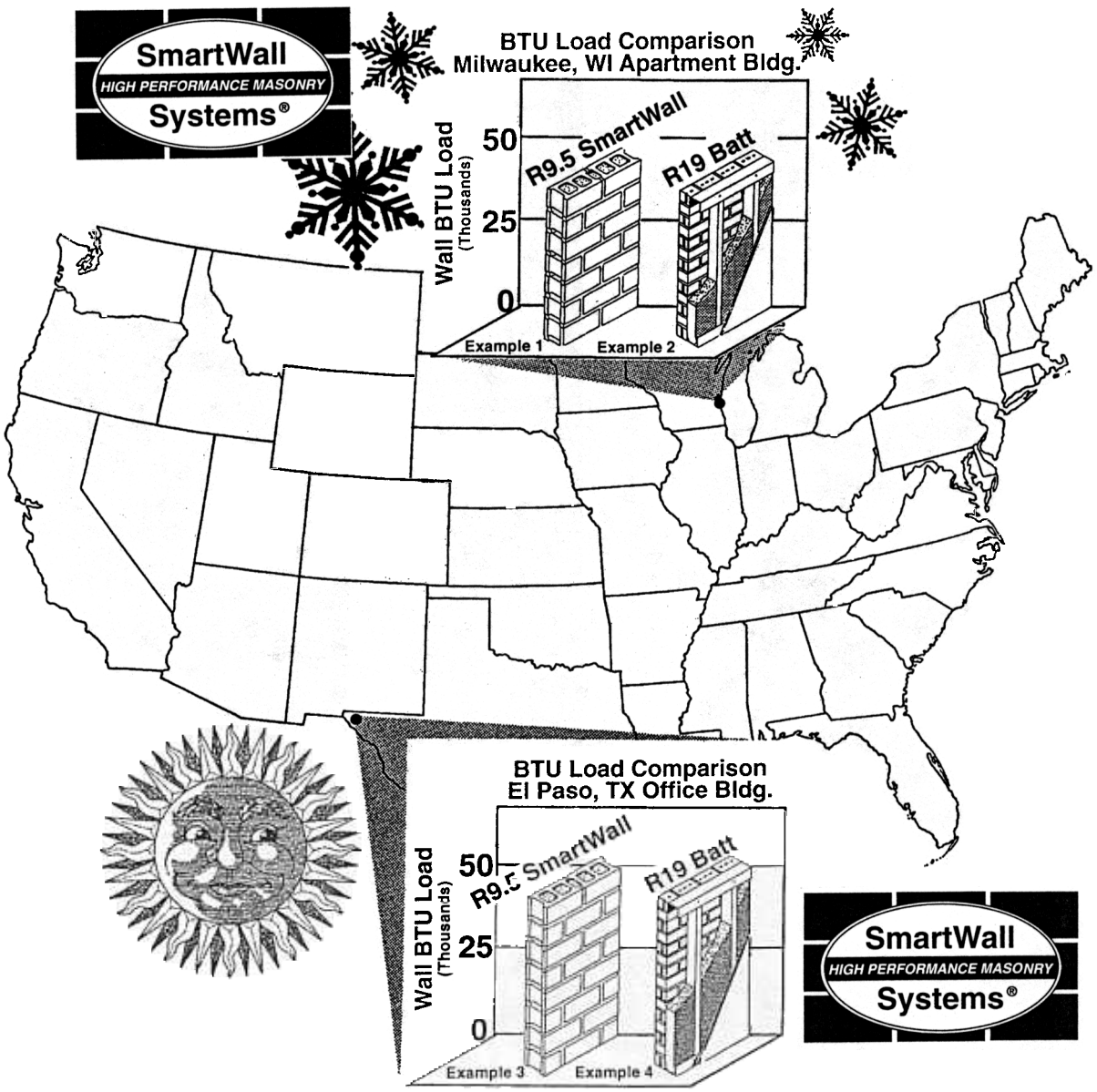
4th Edition – Aug 2004

Energy Efficient Buildings
with
SmartWall Systems®



Engineering guide for using ASHRAE/IES 90.1 ENVelope StandarD (ENVSTD) computer program.

SmartWall Systems® is a registered trade mark of the Expanded Shale, Clay & Slate Institute

Thermal Mass - Heat Capacity

The effects of wall thermal mass are well known. High thermal inertia walls, such as stone, concrete masonry, SmartWall masonry, poured concrete or clay brick, have the ability (due to their high heat capacity) to delay and reduce the impact of outdoor temperature changes on conditioned indoor environments. This means less heat gain or loss, depending on the season, that must be supplied by energy consuming HVAC equipment. ASHRAE 90.1 quantifies thermal mass effects based on a wall's heat capacity. Heat capacity is defined as wall weight per square foot times specific heat. Table 2 lists heat capacity for concrete masonry units, and Table 3 lists heat capacity for other common building materials.

Thermal Bridging

In buildings, when insulating material is interrupted by a highly conductive material, thermal bridging takes place. Examples of thermal bridges include steel studs that interrupt the continuity of batt insulation and metal fasteners that go through heavily insulated exterior walls. Simply put, thermal bridges occur where differences in material thermal conductivities result in significant lateral heat flow; e.g., heat flowing along the surface of a wall and then flowing through the wall via a steel stud. ASHRAE 90.1 considers many thermal bridges. Table 4 (table 8C-2 in ASHRAE 90.1) lists the effect of thermal bridging in metal stud walls.

Example: The effects of thermal bridging in a typical metal stud wall with 2x4 studs 16" on center.

Uncorrected Insulation R-value	=	R 11
Correction Factor	=	.5
Effective Insulation R-value	=	R 5.5

Table 2 lists concrete masonry R-values calculated according to ASHRAE's series parallel method recommended by the National Concrete Masonry Association. This method accounts for thermal bridging within the CMU. **Because of its low thermal bridging characteristic, SmartWall Units with open cores (no insulation) have the same R-values as heavy CMU with core insulation as shown in Table 1.**

Thermal Performance

ASHRAE 90.1 provides two methods for determining how the thermal properties of walls impact building envelope energy-efficiency criteria. The first method is prescriptive and provides 38 Alternate Component Package (ACP) tables. The ACP tables list maximum wall U_o values, $U_o = 1/R$. The second method is the systems performance method and it employs a computer based program, Envelope Standard (ENVSTD). This approach requires input of many building parameters including wall heat capacity and wall U_o. ENVSTD uses these building-wide inputs to determine if the design meets the Standard's energy efficiency criteria. Because of this building-wide approach, SmartWall CMU wall systems, with an optimized combination of heat capacity and R-values, are found to be as energy efficient as "highly" insulated steel stud wall systems. For ease of comparison, four energy compliance examples are included on the following pages. The ENVSTD computer program was used to verify the excellent energy performance of SmartWall high performance concrete masonry walls. Each example uses the appropriate changes in the Wall U_o, Heat Capacity values and INsulation POSition with all other building parameters unchanged. Examples 1 & 2 compare an apartment building in Milwaukee, Wisconsin. Examples 3 & 4 compare an office building in El Paso, Texas. **CONCLUSION.....For the examples considered, ENVSTD proves that a 12" SmartWall System with perlite insulation uses less energy for heating and cooling than a metal stud frame wall with R-19 batt insulation.**

The Bottom Line

There are many ways to incorporate energy conservation into a building. One of the most cost effective and environmentally friendly ways is to consider the overall comfort of the users, as well as the total energy consumption over the life of the structure. This not only helps the person paying the heating and cooling bills, but also decreases the overall global demand for energy— benefitting both the user and the environment.

When it comes to energy performance SmartWall high performance concrete masonry systems outperform metal stud walls with batt insulation and provide lower heating and cooling cost. SmartWall Systems® is helping to decrease the overall global demand for energy

SmartWall Systems®

SmartWall is a high performance lightweight concrete masonry wall system that outperforms other masonry and non-masonry wall systems, especially in terms of energy efficiency, maintenance, appearance, fire resistance, durability and strength to weight ratio. SmartWall is a mason friendly, cost effective wall system that enhances speedy construction and has a very high degree of customer satisfaction.

The SmartWall System is Energy Efficient

SmartWall provides superior energy conservation by optimizing the combination of R-values, thermal mass and low thermal bridging. Wall heating and cooling costs may be reduced by more than 50%! The concrete in SmartWall has more than 2.5 times the thermal resistance of the concrete in a typical heavy block. This significantly reduces thermal bridging, maximizes the effectiveness of core insulation, and results in the high R-value of SmartWall. As shown in Table 1, an un-insulated SmartWall performs as well as core-insulated heavy units! Also, SmartWall with perlite fill offers maximum thermal performance.

In addition to thermal resistance, SmartWall also benefits from thermal mass— the *flywheel* effect that minimizes peaks and valleys in heat load as a wall responds to daily changes in ambient temperature. Walls with optimized thermal mass reduce overall energy use, compared to non-masonry walls. SmartWall has an ideal balance of thermal mass and thermal resistance for optimum performance.

Calculating the overall effect of thermal mass and thermal resistance in a wall's dynamic response to the environment is a complicated task. To perform this task, the ASHRAE 90.1 energy code uses a computer program called ENVSTD, and the results can be dramatic. For example, using ENVSTD to compare the energy performance of a 12" SmartWall with perlite core insulation to an R-19 batt insulated metal stud wall shows that SmartWall outperforms the metal stud system! ENVSTD factors many variables besides opaque wall properties, including glass area, shading, overhangs, and building orientation. Using ENVSTD and SmartWall, energy efficient buildings can be designed that comply with energy codes without the need for added-on insulation. In many cases a single-wythe SmartWall does the job.

TABLE 1 R-VALUES FOR CONCRETE MASONRY WALLS [1] (Exposed Both Sides)

Nominal Thickness	Concrete Unit Weight lbs/ft^3	Cores Empty	With Core Inserts	Cores Filled With Perlite
8"	SmartWall [2]	2.5	4.2	6.6
	Heavy CMU's [3]	1.9	2.6	3.2
12"	SmartWall [2]	2.7	4.4	9.5
	Heavy CMU's [2]	2.0	2.7	4.4

(1) R-Values are mid-range per NCMA TEK 6.1A & 6.2A.
R in (h•ft^2 •°F)BTU and includes 0.85 air film coefficient.
(2) SmartWall at 90 lbs/ft^3
(3) Heavy CMU's at 135 lbs/ft^3

ASHRAE Energy Conservation Standard

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) building energy conservation standard clearly demonstrates that SmartWall Systems incorporating high performance lightweight concrete masonry units are indeed energy efficient.

The Standard, ASHRAE/IES 90.1-1989 provides state of the art guidance regarding the design of energy efficient buildings. Standard 90.1 recognizes the performance characteristics of the materials used to construct the building rather than concentrating on the R-values alone as earlier versions did. These characteristics include the effects of wall thermal mass, thermal bridging and insulation position.

TABLE 2 THERMAL PROPERTIES OF CONCRETE MASONRY WALLS

Concrete Masonry Unit and Insulation Type		SmartWall Systems® 90 lbs/ft³			"Heavy" Masonry 135 lbs/ft³		
		U	R	HC	U	R	HC
4"	Uninsulated	0.482	2.1	4.2	0.627	1.6	5.7
6"	Uninsulated	0.438	2.3	5.6	0.561	1.8	7.8
8"	Uninsulated	0.407	2.5	6.7	0.535	1.9	9.6
	Insert , core (fig A)	0.236	4.2	6.8	0.391	2.6	9.7
	ESCS @ 50 lbs/ft³ Loose Fill	0.318	3.1	10.2	0.362	2.8	13.1
	2" Insert, continuous (fig B)	0.187	5.4	6.6	0.326	3.1	9.4
	Vermiculite	0.161	6.2	7.3	0.314	3.2	10.2
	Perlite	0.152	6.6	7.2	0.308	3.2	10.1
	Foamed Cores	0.143	7.0	6.8	0.302	3.3	9.7
	4" Insert, continuous (fig B)	0.124	8.1	7.2	0.243	4.1	10.0
10"	Uninsulated	0.385	2.6	7.8	0.512	2.0	11.4
	Insert , core (fig A)	0.235	4.2	7.9	0.384	2.6	11.4
	ESCS @ 50 lbs/ft³ Loose Fill	0.183	5.5	12.4	0.313	3.2	16.0
	2" Insert, continuous (fig B)	0.189	5.3	7.6	0.326	3.1	11.0
	Vermiculite	0.134	7.5	8.5	0.274	3.7	12.1
	Perlite	0.127	7.9	8.4	0.268	3.7	11.9
	Foamed Cores	0.120	8.3	7.9	0.263	3.8	10.2
	4" Insert, continuous (fig B)	0.126	7.9	8.2	0.242	4.1	11.6
12"	Uninsulated	0.377	2.7	8.8	0.493	2.0	12.6
	Insert , core (fig A)	0.230	4.4	8.8	0.369	2.7	12.9
	ESCS @ 50 lbs/ft³ Loose Fill	0.153	6.5	14.6	0.266	3.8	18.7
	2" Insert, continuous (fig B)	0.185	5.4	8.6	0.315	3.2	12.5
	Vermiculite	0.111	9.0	9.6	0.231	4.3	13.7
	Perlite	0.105	9.5	9.5	0.226	4.4	13.6
	Foamed Cores	0.099	10.1	8.9	0.222	4.5	12.9
	4" Insert, continuous (fig B)	0.123	8.1	9.2	0.233	4.3	13.1

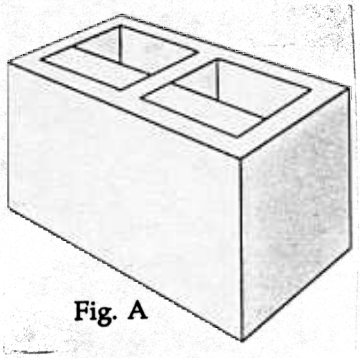


Fig. A

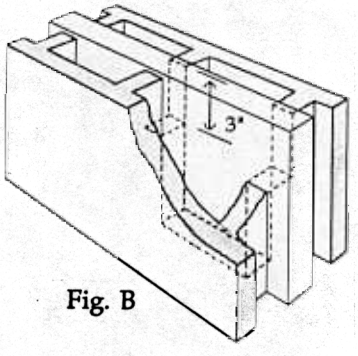


Fig. B

Notes:
1. All values are calculated using minimum dimensions for Load-Bearing Concrete Masonry per ASTM C-90.
2. The R-values are calculated using the NCMA R-value computer program (CMS 10911) using the series-parallel method.
3. Consult the manufacturer of cut web masonry units for structural compliance of their product.
4. ESCS - Expanded Shale, Clay and Slate aggregate.
5. The ESCS, vermiculite, and perlite thermal values are for loose fill poured into the erected block wall.
6. Film Coefficients of 0.85 are included in the R-values and the resultant U-value. R in (h • ft² • °F)/BTU U in BTU/(h • ft² • °F)
7. Wall HC (Heat Capacity) is based on ASTM minimum required block dimensions, 90 and 135 lbs/ft³ concrete unit weight and mortar. HC in BTU/(ft² • °F)

Thermal mass benefits are not new. Throughout the ages, high mass building materials were the product of choice for building strong, secure and comfortable structures and dwellings. It's only in the past few decades we have become misdirected with marketing emphasis only on the "R" value. Many have forgotten that the truly comfortable buildings of the past had the energy conservation built into the structural components. Now the ASHRAE 90.1 Standard provides the needed link between energy theory and the real world.

By designing buildings with the high performing SmartWall Systems, owners will get energy conservation built into the structure without complicated and expensive add-ons to insulate the building envelope. SmartWall masonry units are made with expanded shale, clay or slate (ESCS) aggregate. They are mason friendly and up to 40% lighter than obsolete heavy masonry units. Additionally, SmartWall offers superior fire resistance, sound absorption, reduced seismic loading and low shrinkage.

As a building owner or designer you can choose a system with a practical "R" number that when combined with thermal inertia, obtains proven energy performance with quiet comfort. The SmartWall system maximizes all the benefits of traditional masonry: design flexibility, economy, thermal mass and durability. In addition, the lighter weight SmartWall system benefits the mason because of fewer injuries, safer scaffolds, longer working career and the opportunity for female workers. Since increased productivity is a natural consequence of lighter units, overall construction time is often reduced. SmartWall meets the needs of today's market, and gives specifiers all the best reasons to choose concrete masonry. SmartWall is the Answer!

For additional information please contact ESCSI via Phone: (801) 272-7070, Fax: (801) 272-3377, e-mail: info@escsi.org or visit ESCSI's web site at www.escsi.org.

SmartWall Systems® Guide Specification

Guide Specification (Short Form): Sec 04810 - Unit Masonry Assemblies:

SmartWall Systems walls shall be constructed using high performance concrete masonry units manufactured by a SmartWall Systems producer certified by the Expanded Shale Clay and Slate Institute, Salt Lake City, Utah. The concrete masonry units shall meet the requirements of ASTM C 90 *Standard Specification for Load Bearing Concrete Masonry Units* and the following additional requirements:

- The concrete masonry unit shall have a minimum net compressive strength of 2500 psi (17 MPa) and a density not exceeding 93 lb/cu ft (1500 kg/m³), determined in accordance with ASTM C 140 *Sampling and Testing Concrete Masonry Units.*
- The lightweight aggregate used in the manufacture of the concrete masonry units shall be structural grade expanded shale, clay or slate manufactured by the rotary kiln process, and shall meet the requirements of ASTM C 331 *Standard Specification for Lightweight Aggregate for Concrete Masonry Units*".

TABLE 3 THERMAL PROPERTIES OF VARIOUS BUILDING MATERIALS
Thermal Resistance (R), and Heat Capacity (HC)

Building material R-values are from 1997 ASHRAE Handbook of Fundamentals, Chapter 24. HC-values are calculated from Density and Specific Heat from the same source, except as noted otherwise.

MATERIAL DESCRIPTION	PER THICKNESS LISTED			
	THICKNESS (in.)	R VALUE ($h \cdot ft^2 \cdot °F/Btu$)	HC VALUE ($Btu/ft^2 \cdot °F$)	WEIGHT (lb/ft^2)
BUILDING BOARD				
Gypsum Wallboard	0.5	0.45	0.54	2.1
Plywood (Douglas Fir)	0.5	0.62	0.41	1.4
Fiber board sheathing, regular density	0.5	1.32	0.23	0.8
Hardboard, medium density	0.5	0.69	0.65	2.1
Particle board, medium density	0.5	0.53	0.65	2.1
INSULATING MATERIALS				
Mineral Fiber With Metal Stud Framing [1]				
R-11, 2X4 @ 16" (R-11 X .50 correction factor)		5.50	0.30	1.7
R-11, 2X4 @ 24" (R-11 X .60 correction factor)		6.60	0.27	.4
R-19, 2X6 @ 16" (R-19 X .37 correction factor)		7.10	0.44	2.4
R-19, 2X6 @ 24" (R-19 X .45 correction factor)		8.55	0.39	1.9
Mineral Fiber With Wood Framing [2] (with lapped siding, 1/2" sheathing, and 1/2" gypsum board)				
R-11, 2X4 @ 16" on center		12.44	2.01	6.1
R-19, 2X6 @ 24" on center		19.11	2.13	6.5
Board, Slabs, and Loose Fill				
Cellular glass		3.03	0.13	0.7
Expanded polystyrene, extruded		5.00	0.08	0.3
Expanded polystyrene, molded beads [3]		3.85	0.03	0.1
Perlite [3]		3.13	0.11	0.4
Polyurethane		6.25	0.05	0.5
UF Foam [4]		4.35	0.02	0.1
Vermiculite [3]		2.44	0.13	0.4
Expanded Shale, Clay & Slate LWA [5]				
30 lbs/ft^3 Dry loose weight		1.21	0.53	2.5
40 lbs/ft^3 Dry loose weight		1.02	0.70	3.3
50 lbs/ft^3 Dry loose weight		0.88	0.88	4.2
Mortar[3], Plaster & Misc. Masonry				
Clay brick masonry	3.63	0.40	8.16	40.8
Stucco and cement plaster, sand aggregate	1	0.20	1.93	9.7
Gypsum plaster, perlite aggregate	1	0.67	1.20	3.8
Mortar	1	0.20	2.00	10.0
CONCRETE [3] (cast in place, precast)				
60 lbs/ft^3	1	0.52	1.05	5.0
70 lbs/ft^3	1	0.42	1.23	5.8
80 lbs/ft^3	1	0.33	1.40	6.7
90 lbs/ft^3	1	0.26	1.58	7.5
100 lbs/ft^3	1	0.21	1.75	8.3
110 lbs/ft^3	1	0.16	1.93	9.2
120 lbs/ft^3	1	0.13	2.10	10.0
135 lbs/ft^3	1	0.09	2.48	11.3
150 lbs/ft^3	1	0.07	2.75	12.5
WOODS				
Southern Pine	1	1.00-0.89	1.16-1.34	3.0-3.4
California Redwood	1	1.35-1.22	0.80-0.91	2.0-2.3

(1) R-Value corrected per ASHRAE/IES 90.1-1989, Table 8C2; HC from vendors' data
(2) Calculated per ASHRAE 1997 FUNDAMENTALS, Chapter 24
(3) NCMA TEK 6-16 and NCMA "Concrete Masonry R-Value Program"
(4) NBS Tech Note 946.
(5) R-Values from Thermophysical Properties of Masonry and its Constituents, Part I, by Rudolph Valore, Jr.

TABLE 4 (ASHRAE 90.1 Table 8C-2)

Wall Sections with Metal Studs Parallel Path Correction Factors

Size of Members	Gauge of Stud	Spacing of Framing, in.	Cavity Insulation R - Value	Correction Factor	Effective Framing per Cavity R - Values
2 x 4	18 - 16	16 on Center	R - 11 R - 13 R - 15	0.50 0.46 0.43	R - 5.5 R - 6.0 R - 6.4
2 x 4	18 - 16	24 on Center	R - 11 R - 13 R - 15	0.60 0.55 0.52	R - 6.6 R - 7.2 R - 7.8
2 x 6	18 - 16	16 on Center	R - 19 R - 21	0.37 0.35	R - 7.1 R - 7.4
2 x 6	18 - 16	24 on Center	R - 19 R - 21	0.45 0.43	R - 8.6 R - 9.0
2 x 8	18 - 16	16 on Center	R - 25	0.31	R - 7.8
2 x 8	18 = 16	24 on Center	R - 25	0.38	R - 9.6

1. These factors can be applied to metal studs of this gauge or thinner.

EXAMPLE 1 - Apartment in Milwaukee, WI
12" SmartWall Systems® Wall

MATERIAL DESCRIPTION	HC	R	
90 PCF LW CMU, with film coefficients	8.30	9.50 (Tbl 1)	The insulationis"INTEGRAL"
All cells filled with Perlite loose fill		U=0.11	with the wall's thermalmass
			Use insulation position #2.

ASHRAE/IES STANDARD 90.1-1989
ENERGY EFFICIENT DESIGN OF NEW BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS

CITY: 139 Milwaukee, WI. BUILDING: Apartment
CODE <B,C,H>:Both Heated and Cooled WALLS: 12" CMU 90 pcf w/Perlite Fill

	WALL ORIENTATION						WEIGHTED	
	N	NE	E	SE	S	SW	W	NW	AVERAGE	CRITERIA
WL AREA	17158		59646		20896		58800		0.23	0.300
GL AREA	3410		14130		4720		13800		WWR	WWR
SCx	0.83		0.83		0.83		0.83		0.83	0.630
PF	0		0		0		0		0.00	0.0
VLT	0.79		0.79		0.79		0.79		0.79	N/A
Uof	0.520		0.520		0.520		0.520		0.52	0.480
WALL Uo	.105		.105		.105		.105		0.11	0.077
HC	8.3		8.3		8.3		8.3		8.30	1
INS POS	2		2		2		2		2	N/A
EQUIP	.38		.38		.38		.38		0.38	0.380
LIGHTS	.67		.67		.67		.67		0.67	0.670
DLCF	0		0		0		0		0.00	0.0
	L O A D S								TOTAL	
HEATING	3.139		8.451		2.256		8.579		22.424<	22.623
COOLING	1.688		9.302		3.193		9.582		23.766<	24.779
TOTAL	4.827		17.753		5.449		18.161		46.190<	47.402

(Computer screen information, ENVSTD version 2.4)********** PASSES **********

EXAMPLE 2 - Apartment in Milwaukee, WI
TYPICAL FACE BRICK STEEL STUD WALL

MATERIAL DESCRIPTION	HC	R	
Face Brick, 4"	8.16	0.40	The insulation is "INTERIOR"
Fiber board sheathing 1/2" reg. density	0.23	1.32	to the wall's thermal mass.
Insulation R-19in 2/6 metal stud @ 16 o.c.	0.44	7.10	Use insulation position #3.
Gypsum Board, 1/2"	0.54	0.45	
Film coefficients,(sum of inside & outside)	0.0	0.85	
TOTALS	9.37	10.12	(U=.0988) Note: If uncorrected R22

ASHRAE/IES STANDARD 90.1-1989
ENERGY EFFICIENT DESIGN OF NEW BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS

CITY: 139 Milwaukee, WI. BUILDING: Apartment
CODE <B,C,H>:Both Heated and Cooled WALLS: Brick on R-19 Steel Stud @16oc

	WALL ORIENTATION						WEIGHTED	
	N	NE	E	SE	S	SW	W	NW	AVERAGE	CRITERIA
WL AREA	17158		59646		20896		58800		0.23	0.300
GL AREA	3410		14130		4720		13800		WWR	WWR
SCx	0.83		0.83		0.83		0.83		0.83	0.630
PF	0		0		0		0		0.00	0.0
VLT	0.79		0.79		0.79		0.79		0.79	N/A
Uof	0.520		0.520		0.520		0.520		0.52	0.480
WALL Uo	.0988		.0988		.0988		.0988		0.10	0.077
HC	9.37		9.37		9.37		9.37		9.37	1
INS POS	3		3		3		3		3	N/A
EQUIP	.38		.38		.38		.38		0.38	0.380
LIGHTS	.67		.67		.67		.67		0.67	0.670
DLCF	0		0		0		0		0.00	0.0
	L O A D S								TOTAL	
HEATING	3.121		8.393		2.283		8.537		22.333<	22.623
COOLING	1.751		9.629		3.353		9.986		24.720<	24.779
TOTAL	4.872		18.022		5.636		18.523		47.053<	47.402

(Computer screen information, ENVSTD version 2.4)********** PASSES **********

EXAMPLE 3 - Office Building in El Paso, TX
12" SmartWall Systems® Wall

MATERIAL DESCRIPTION	HC	R	
90 PCF LW CMU, with film coefficients	8.30	9.50 (Tbl 1)	The insulation is "INTEGRAL"
All cells filled with Perlite loose fill		U=0.11	with the wall's thermal mass
			Use insulation position #2.

ASHRAE/IES STANDARD 90.1-1989
ENERGY EFFICIENT DESIGN OF NEW BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS
CITY: 70 El Paso, TX. BUILDING: Medium Office Building
CODE <B,C,H>:Both Heated and Cooled WALLS: 12" CMU 90 pcf w/Perlite Fill

	WALL ORIENTATION							WEIGHTED	
	N	NE	E	SE	S	SW	W	NW	AVERAGE	CRITERIA
WL AREA	4113		7137		4299		6023		0.284	0.281
GL AREA	1096		1950		1170		1914		WWR	WWR
SCx	0.482		0.482		0.482		0.482		0.482	0.500
PF	0.20		0.18		0.18		0.20		0.190	0.000
VLT	0.36		0.36		0.36		0.36		0.360	N/A
Uof	1.042		1.042		1.042		1.042		1.042	1.150
WALL Uo	.11		.11		.11		.11		0.110	0.158
HC	8.3		8.3		8.3		8.3		8.300	1
INS POS	2		2		2		2		N/A	N/A
EQUIP	0.50		0.50		0.50		0.50		0.500	0.500
LIGHTS	1.73		1.73		1.73		1.73		1.730	1.730
DLCF	0		0		0		0		0.000	0.000
	L O A D S								-TOTAL-	
HEATING	1.442		1.850		0.842		1.757		5.891<	6.992
COOLING	7.404		16.562		9.281		15.112		48.360<	59.447
TOTAL	8.846		18.412		10.123		16.869		54.251<	66.439

(Computer screen information, ENVSTD version 2.4)********** PASSES **********

EXAMPLE 4 - Office Building in El Paso, TX
TYPICAL FACE BRICK STEEL STUD WALL

MATERIAL DESCRIPTION	HC	R	
Face Brick, 4"	8.16	0.40	The insulation is "INTERIOR"
Fiber board sheathing 1/2" reg. density	0.23	1.32	to the wall's thermal mass.
Insulation R-19 in 2/6 metal stud @ 16 o.c.	0.44	7.10	Use insulation position #3.
Gypsum Board, 1/2"	0.54	0.45	
Film coefficients, (sum of inside & outside)	0.0	0.85	
TOTALS	9.37	10.12	(U=.0988)Note:If uncorrected R=22

ASHRAE/IES STANDARD 90.1-1989
ENERGY EFFICIENT DESIGN OF NEW BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS
CITY: 70 El Paso, TX. BUILDING: Medium Office Building
CODE <B,C,H>:Both Heated and Cooled WALLS: Brick on R-19 Steel Stud @16oc

	WALL ORIENTATION							WEIGHTED	
	N	NE	E	SE	S	SW	W	NW	AVERAGE	CRITERIA
WL AREA	4113		7137		4299		6023		0.284	0.281
GL AREA	1096		1950		1170		1914		WWR	WWR
SCx	0.482		0.482		0.482		0.482		0.482	0.500
PF	0.20		0.18		0.18		0.20		0.190	0.000
VLT	0.36		0.36		0.36		0.36		0.360	N/A
Uof	1.042		1.042		1.042		1.042		1.042	1.150
WALL Uo	.0988		.0988		.0988		.0988		0.099	0.158
HC	9.37		9.37		9.37		9.37		9.370	1
INS POS	3		3		3		3		N/A	N/A
EQUIP	0.50		0.50		0.50		0.50		0.500	0.500
LIGHTS	1.73		1.73		1.73		1.73		1.730	1.730
DLCF	0		0		0		0		0.000	0.000
	L O A D S								-TOTAL-	
HEATING	1.449		1.861		0.917		1.792		6.021<	6.992
COOLING	7.541		16.898		9.537		15.437		49.413<	59.447
TOTAL	8.990		18.759		10.455		17.230		55.434<	66.439

(Computer screen information, ENVSTD version 2.4)********** PASSES **********

What Are SmartWall Unit Details?

General Information on SmartWall high performance concrete masonry units:
The information below is for general use only. For exact shapes and physical properties, contact your supplier:

Unit Size (inches)	Maximum Jobsite Weight lbs[1]	Minimum Weight Savings Percent[2]	Concrete Unit Weight Oven Dry lbs/ft³ (93 Max)	Wall R-Value[3]		Wall [4] HC Value
				No Insulation	UF Foam Insulation	
12x8x16	36	37	80-93	2.7	10.1	8.7
10x8x16	33	28	80-93	2.6	8.3	7.8
8x8x16	26	27	80-93	2.5	7.0	6.7
6x8x16	23	23	80-93	2.4	NA	5.6
4x8x16	18	31	80-93	2.1	NA	4.3
8x8x24	38	38	80-93	2.5	7.0	6.4

(1) Oven dry weights will be less than jobsite weights and will depend on unit shape and the concrete unit weight used. The maximum jobsite weights are given just for field control to help insure SmartWall units are being used. For maximum oven dry weights of SmartWall units, contact your supplier.

(2) When compared to heavy concrete masonry at 135 lbs/ft³

(3) R-Values are based on ASTM minimum required block dimensions and 90 lbs/ft³ concrete unit weight using series parallel method (air film included). R in (h • ft² • °F)/BTU.)

(4) Wall HC (Heat Capacity) is based on ASTM minimum required block dimensions, 90 lbs/ft³ concrete unit weight and mortar. HC in BTU/(ft² • °F)