

# **DURISOL WALL FORM SYSTEM**

SYSTEM OVERVIEW

Updated:

August 2001

## WARRANTY

We warranty our products to be free of defects and manufactured to meet published physical properties when cured and tested according to ASTM, CSA and Durisol Standards.

Under this warranty, Durisol will replace any Durisol Wall Form proven to be defective when applied in accordance with written instructions and in applications recommended by Durisol for this product.

All claims must be made within 1 (one) year of shipment. Absence of such claim in writing during this period will constitute a waiver of all claims with respect of such products.

This warranty is in lieu of any and all other warranties expressed and implied.

## DISCLAIMER

The recommendations, suggestions, statements and technical data in this technical guide are based on Durisol's best knowledge. ***They are given for informational purposes only and are not to be construed as overriding any requirements of any applicable building code.***

Durisol Inc. has no control over installation, workmanship, inspection, building conditions or applications. There is no responsibility, expressed or implied warranty, either as to merchantability or fitness for the particular purpose, made as to the performance or results of an installation using Durisol Wall Forms.

Structures built with the Durisol Wall Forms should be designed and constructed in accordance with applicable building codes. ***Durisol material is not designed to carry any structural load other than temporary concrete pressures that occur during construction.*** The concrete core within the Wall Form is intended to be the primary load carrying material of the wall system. The design of the Durisol wall system should be conducted and reviewed by an engineer.

This document is not intended to override any applicable codes and practices that may be required in local jurisdictions. The user should refer to applicable building code requirements when exceeding the limitations of this document, when requirements conflict with the building code, or when an engineered design is specified. This specification is not intended to limit the appropriate use of concrete or construction not specifically prescribed. This document is also not intended to restrict the use of sound judgment or exact engineering analysis of specific applications that may result in designs with improved performance and economy.

## 1.0 SYSTEM OVERVIEW

The Durisol Wall System is a proven method of constructing modular insulated concrete walls with over 50 years of in-place experience. It is based on simple interlocking wall form units that are made from the unique Durisol material. Durisol is a proprietary material that is composed of only natural raw materials; specially graded wood chips (100% natural lumber) and Portland cement. We do not use polystyrene, foams, plastics or other potentially detrimental materials in the manufacture of our products.

The wood chips are mineralized and bonded under pressure with Portland cement. The resulting lightweight, open-textured product is highly durable, practically incombustible and completely resistant to insects and rot.

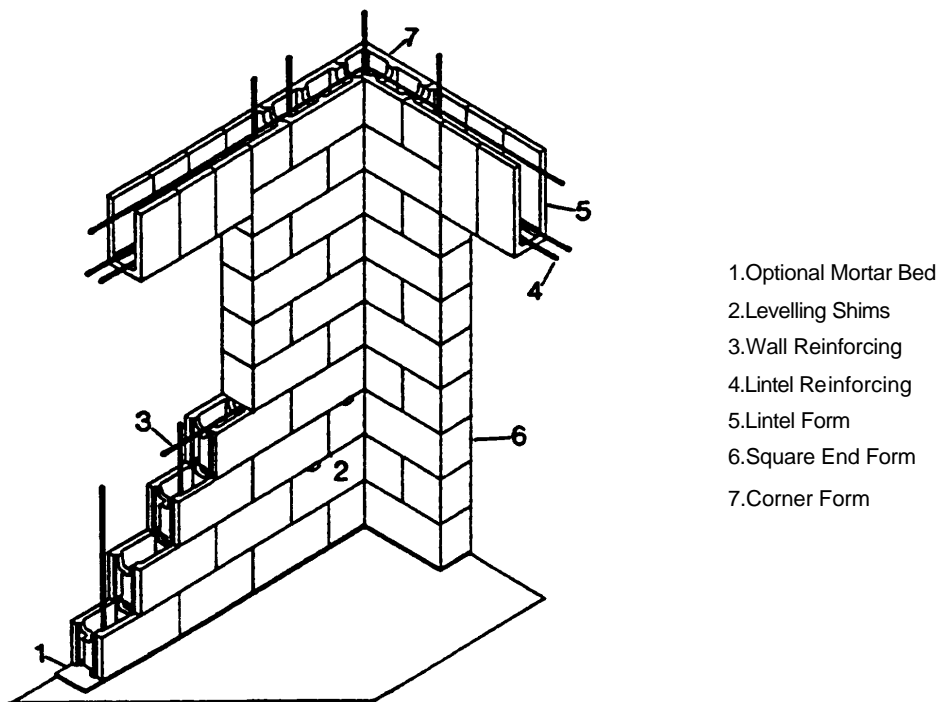


Figure 1.1 – Wall Form System Overview

### 1.1 Durisol Wall Forms

The Wall Form units are approximately 12" high x 36" long and come in various widths. The units are dry-stacked and filled with concrete and reinforcing steel. This efficient method of concrete construction results in a wall that has built-in thermal, fire and acoustic protection.

The standard Non-thermal Wall Form unit has an insulation value of R8. Additional insulation inserts made from various materials may also be incorporated directly within the Wall Form at the time of manufacturing. Currently the most common type of insert is made from mineral fibre insulation, which can provide for insulation values that range from R14 to R21+, depending on the specific application.

## 1.2 Applications

Durisol Wall Forms have been used worldwide in every possible building application both above and below-grade. In our 50-year history of Durisol Wall Forms, wall systems have been constructed for use in the following:

- Residential (Single and Multi-Unit)
- Industrial
- Agricultural
- Commercial
- Institutional
- High Rise (Over 26 story buildings in-place)

Durisol Wall Forms have been designed to accommodate all practical ranges of concrete thickness. The load carrying capacity of the wall system depends entirely upon the thickness of the concrete core and the steel reinforcing schedule.

The 4-hour Fire Resistance Rating of the WF20 (8") Wall Form makes the Durisol wall system ideal for use as a party wall or common wall between residential units. The high Sound Transmission Class Rating (STC) of over 52 provides for quiet living in apartments or next to highways, railroad tracks, airports and other loud environments.

## 1.3 Performance Advantages

The Durisol Wall System has a unique combination of desirable properties. In-service advantages are outlined as follows:

### 1.3.1 IMPACT RESISTANCE

Standard stuccos applied directly to the Durisol material result in a finish that is less expensive and more impact resistant than conventional EIFS systems (polystyrene, lath and stucco).

### 1.3.2 IMPROVED INDOOR AIR QUALITY

The cement content of the Durisol material itself creates an above average pH environment at the wall surface, which inhibits the growth of fungi and viruses. The Durisol material is completely inert with no VOCs or off-gasing. Furthermore, the hygroscopic nature of the material moderates RH levels and provides an inherent moisture regulator. This regulation of water vapour keeps humidity low and further serves to repress any type of fungal growth.

### 1.3.3 SOUND PROTECTION

Durisol wall systems provide considerable protection against unwanted noise. The sound absorptive properties of our material in combination with the mass of the wall system can provide an ideal combination of sound absorption and sound transmission properties. STC ratings for Durisol wall systems can range between 52 and 68, while the exposed surface of the Durisol Wall Form can provide Noise Reduction Coefficient (NRC) ratings as high as 1.0.

**Table 1.1 – STC Rating of Typical Durisol Wall Systems**

Wall System	STC Rating
WF20 (8") + plaster / EIFS	52
WF20 (8") + plaster/stucco	56
WF25 (10") + plaster/stucco	64
WF30 (12") + plaster/stucco	68

Notes:

1. Higher STC ratings are possible by altering wall configurations.
2. Test Reports are available upon request.

### 1.3.4 THERMAL MASS EFFECT

Materials like concrete, brick, and Durisol have a high heat capacity; that is, they can store a significant amount of heat energy. This benefit of thermal mass, as the ability to store heat is called, results in reduced heating costs as the energy/heat in the wall is transferred back into the cooler air. Similarly, when the surrounding air is warmer than the walls, heat will be transferred to the thermal mass and reduce cooling energy consumption. The benefits of thermal mass are increased through the use of Durisol Wall Forms since the majority of the insulation is located on the exterior face of the wall system. This is unlike foam concrete forms that have 50% of the insulation on the interior face and reduce the net benefit that is obtained through the effects of thermal mass.

The true benefit that is realized from thermal mass effects depends on a number of site-specific parameters such as climatic conditions and building orientation. Simple blanket statements such as "R-40 when including thermal mass" are inaccurate and misleading. Durisol Building Systems has a staff of engineers experienced in the field of Building Science who will provide customers with detailed evaluation of thermal mass effects upon request. Alternately, publications such as [ASHRAE Fundamentals](#) or [ASHRAE Standard 90.1](#) will provide guidance to evaluation of different wall systems and corresponding dynamic effects.

**1.3.4 NEGLIGIBLE THERMAL BRIDGING**

Durisol and framed wall systems are not simple one-dimensional assemblies. Real buildings are three-dimensional, with corners, window openings, etc. However, most wall R-value calculation methods, and almost all marketing brochures, do not factor in the effects of framing at windows, doors, corners, etc. Thus they tend to over-estimate the true thermal performance.

The construction details that increase heat flow through a framed wall system have little or no influence on the heat flow through the Durisol Insulated Wall Form System. Durisol Wall Forms are designed to ensure that the R-value through the core of the wall is almost the same as that through the web. This not only avoids thermal short-circuiting, it ensures uniform wall temperatures with no cold spots to encourage condensation, create discomfort, or cause dust marking.

Recent studies by Oakridge National Labs, ASHRAE 90.1 committee and other independent research agencies have shown how these factors influence the overall performance of wall systems (see following table).

**Table 1.2 – Thermal Bridging Effects of Durisol vs. Conventional Wall Construction**

Wall Type	Nominal R-value	Whole Wall R-value
2x6 (24" o/c) wood stud with R-19 batt insulation	R-20	R-13.7
2x4 (24" o/c) metal studs with R-11 batt insulation + 1" continuous EPS on exterior	R-17	R-10.2
Durisol WF30 T3	R-20	R-19.8

Notes:

1. The above Whole Wall insulation value considers thermal bridging effects only.
2. Mass effects will further increase the relative performance of Durisol and other mass wall systems.
3. Contact Durisol for detailed evaluation of dynamic thermal performance.

**1.3.5 FIRE RESISTANCE**

The fire resistant properties of Durisol itself and the Durisol wall system as a whole provide considerable protection from fires. Tests in Canada have been conducted for two and four-hour fire ratings while in Austria, six-hour fire ratings have been obtained.

The surface burning characteristics of Durisol far surpass all other types of stay-in-place formwork. Durisol has a flame spread and smoke spread rating of zero. Unlike foam, Durisol will not ignite, melt, sustain fire or release toxic fumes in the event of a fire.

- Over 4 hour Fire Resistance Rating
- Zero Flame Spread
- Zero Smoke Developed
- Zero Fuel Contributed

**1.3.6 MOISTURE PROTECTION**

Since no exterior finish will act as a perfect rain barrier, it is good practice to have a wall system that is capable of compensating for imperfections in the veneer. The nature of Durisol is such that it has considerable capacity to store moisture. In the event that moisture does become temporarily trapped within the wall, the Durisol is capable of accommodating this moisture without any damage to the wall. The permeable nature of Durisol serves to regulate the water vapour in the air and provides a smoothing effect to rapid swings in relative humidity. This results in a very flexible wall system that can compensate for punctured vapour barriers and other imperfections that may occur during construction. In fact, numerous in-service tests, in-place monitoring of structures and analysis through modeling programs have all proven that the Durisol Wall Form system can easily be designed without a vapour barrier.

**1.3.7 TERMITE RESISTANCE**

Unlike foam insulation, Durisol provides effective resistance to termite attack. A number of testing programs have been conducted where Durisol samples were placed in termite infested areas for as long as six years without any destruction of Durisol material occurring.

**Table 1.3 – Termite Resistance of Durisol**

Test Sample	Panel Damage Index (PDI)			
	3 years	4 years	5 years	6 years
Durisol placed on surface at termite test site	0.4	0.8	1.0	1.0
Durisol placed 2” below-grade at termite test site	0.4	0.6	1.0	1.0
Durisol set on wood base placed on surface of test site	0.6	0.6	1.0	1.0
Durisol placed 2” below-grade on wood base at test site	0.8	0.6	1.0	1.0
Durisol set 3” above grade on masonry base at test site	0.2	0.6	0.6	1.0
Durisol stored inside (no exposure to termites)	0	0	0	0
Control wood samples	5	4	4.5	5

\*Summary of test report FS-SRS-4502-4.204 conducted by US Forest Service at termite facilities in Mississippi and Arizona. Contact Durisol for detailed test information.

- PDI:** 0.0 - Sound; no feeding or surface investigation  
 1.0 - Surface investigation only  
 2.0 - Light Damage; penetration into panel  
 3.0 - Moderate Damage; penetration into panel  
 4.0 - Heavy Damage; extensive penetration and damage to panel  
 5.0 - Failure; complete or near complete destruction of panel

## 1.4 Construction Advantages

Durisol Wall Forms are lightweight and straightforward to use. With each Wall Form unit covering approximately 3 ft<sup>2</sup> (0.028m<sup>2</sup>) of wall area, construction is fast and efficient. This results in lower labour costs and shorter construction time.

The Durisol material can be easily cut, nailed and screwed with simple carpenter tools. This provides the builder with the flexibility to cut and fit shapes to suit site-specific situations. Wood bucks and bracing can be directly attached to the Durisol Wall Forms using nails and screws.

The insulating properties of Durisol Wall Forms allow winter construction without additional heating or insulation sources being required. Durisol wall systems have been constructed in temperatures as low as 22 °F (- 6°C) without any complication.

The unique free-draining Durisol material allows the use of high-slump concrete in the field that makes for easier and faster concrete pouring that ensures a solid wall without any compromise in strength. Ideally, concrete with a slump between 7" and 9" is recommended for use in conjunction with Durisol.

Interior and exterior finishes are applied directly to the Durisol material, eliminating subsequent steps in the construction process. Drywall can be attached *anywhere* on the Wall form surface, while the open-textured nature of hardened Durisol makes it an ideal substrate for plasters and stucco.

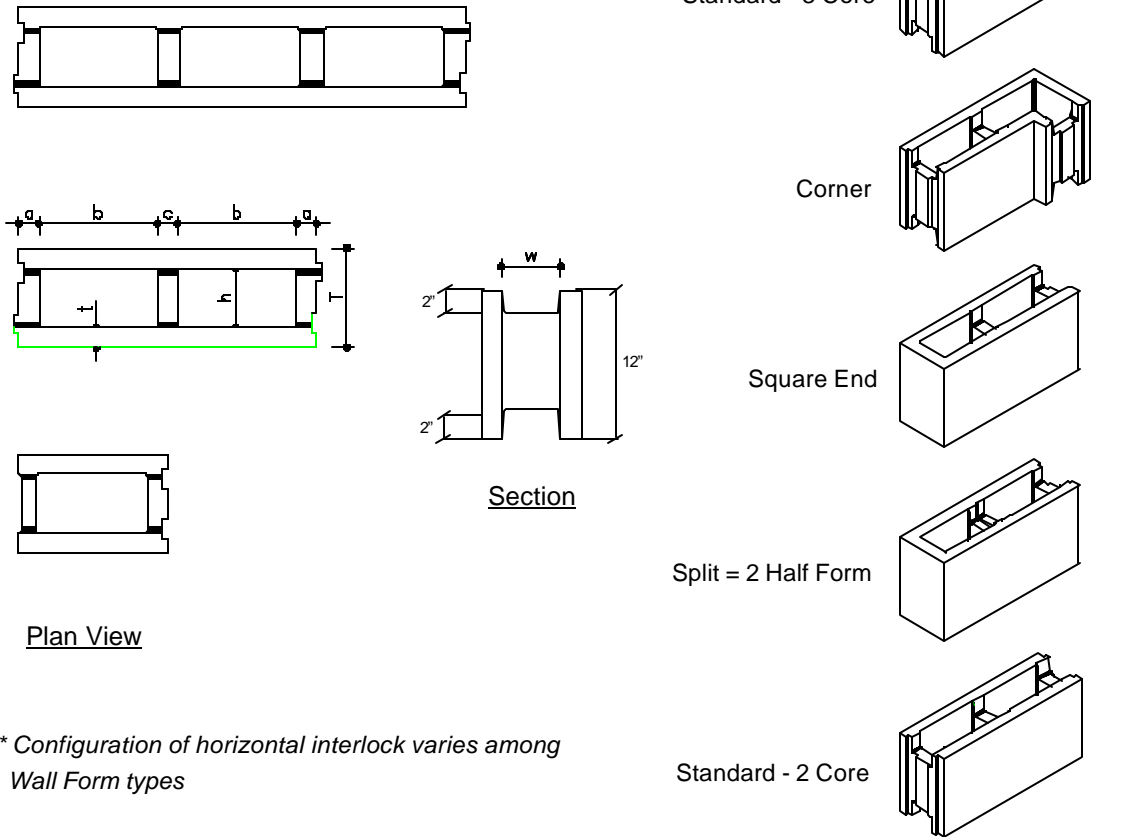
## 1.5 Design Flexibility

Durisol Wall Forms can be ordered with R-values ranging from R-8 to R-20. This allows for optimal wall design catered to the specific applications (i.e. above-grade, below-grade, residential, commercial, etc). Designs can be customized to suit the needs of the project and provide the most cost-effective solution without compromising performance of the building envelope.

## 1.6 Research and Testing

Durisol is committed to research and development, with over 50 years of independent research, in-house testing and continuous improvement. Specific test reports on topics such as thermal resistance, fire performance, termite resistance, etc., may be available upon request.

### 1.7 Standard Wall Forms (Imperial)



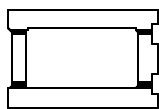
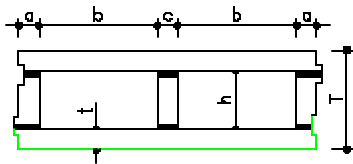
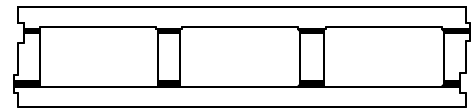
\* Configuration of horizontal interlock varies among Wall Form types

Figure 1.2 – Standard Wall Form Schematic

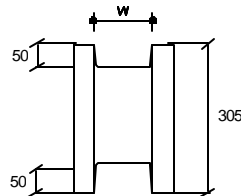
Table 1.4 – Standard Wall Form Dimensions (Imperial)

Wall Form Type	Wall Form Weight (lbs)	FORM DIMENSIONS							CONCRETE CORE DATA	
		T (in)	t (in)	a (in)	c (in)	w (in)	b (in)	h (in)	X-Sect Area (in <sup>2</sup> )	Fill Volume (yd <sup>3</sup> / ft <sup>2</sup> )
WF15	16	5 7/8	1 1/4	1 1/4	1 1/4	3 1/4	9 7/8	3 1/2	35.1	0.0098
WF20	33	7 7/8	1 5/8	1 3/4	1 1/2	4 3/8	9 3/8	4 3/4	43.4	0.0123
WF25	40	9 7/8	1 3/4	1 3/4	1 5/8	5 7/8	9 1/4	6 1/4	57.4	0.0162
WF30	31	11 7/8	2	1 7/8	1 5/8	7 1/2	9 1/8	7 7/8	71.3	0.0203

### 1.8 Standard Wall Forms (SI)

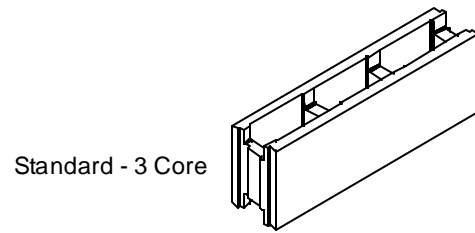


Plan View

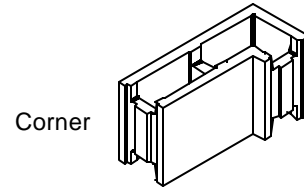


Section

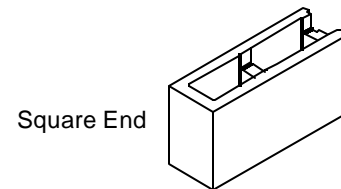
\* Configuration of horizontal interlock varies among Wall Form types



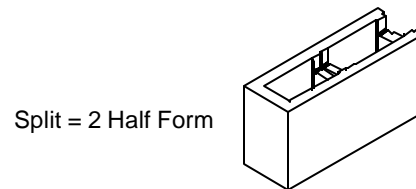
Standard - 3 Core



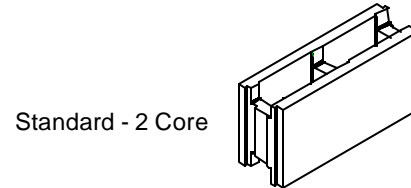
Corner



Square End



Split = 2 Half Form



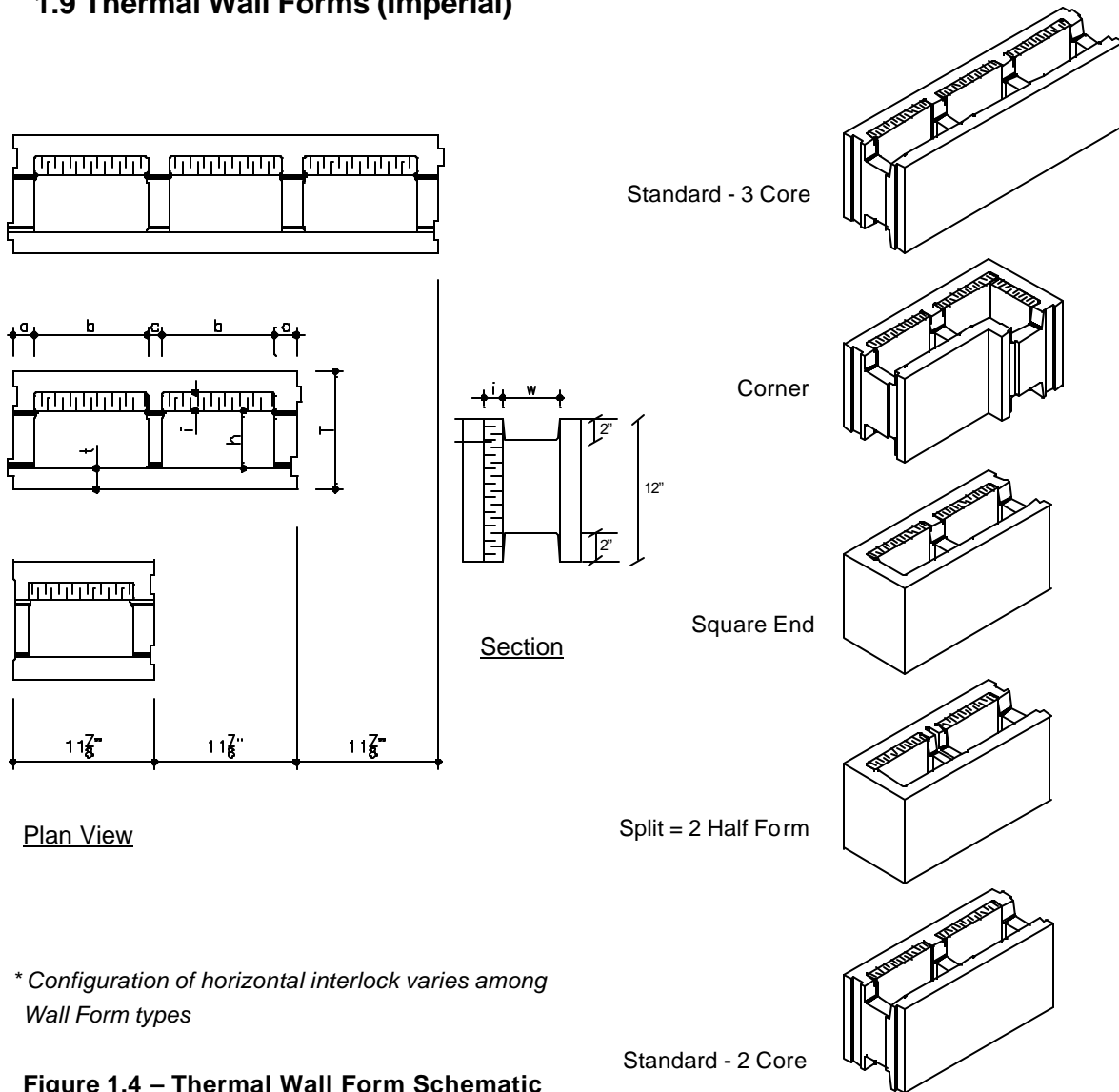
Standard - 2 Core

Figure 1.3 – Standard Wall Form Schematic (SI)

Table 1.5 – Standard Wall Form Dimensions (SI)

Wall Form Type	Wall Form Weight (kg)	FORM DIMENSIONS							CONCRETE CORE DATA	
		T (mm)	t (mm)	a (mm)	c (mm)	w (mm)	b (mm)	h (mm)	X-Sect Area (mm <sup>2</sup> )	Fill Volume (m <sup>3</sup> / m <sup>2</sup> )
WF15	8	150	30	30	30	85	252	90	22700	0.081
WF20	15	200	40	43	38	110	238	120	28000	0.101
WF25	18	250	45	45	40	150	235	160	37000	0.133
WF30	14	300	50	50	42	190	232	200	46000	0.167

### 1.9 Thermal Wall Forms (Imperial)



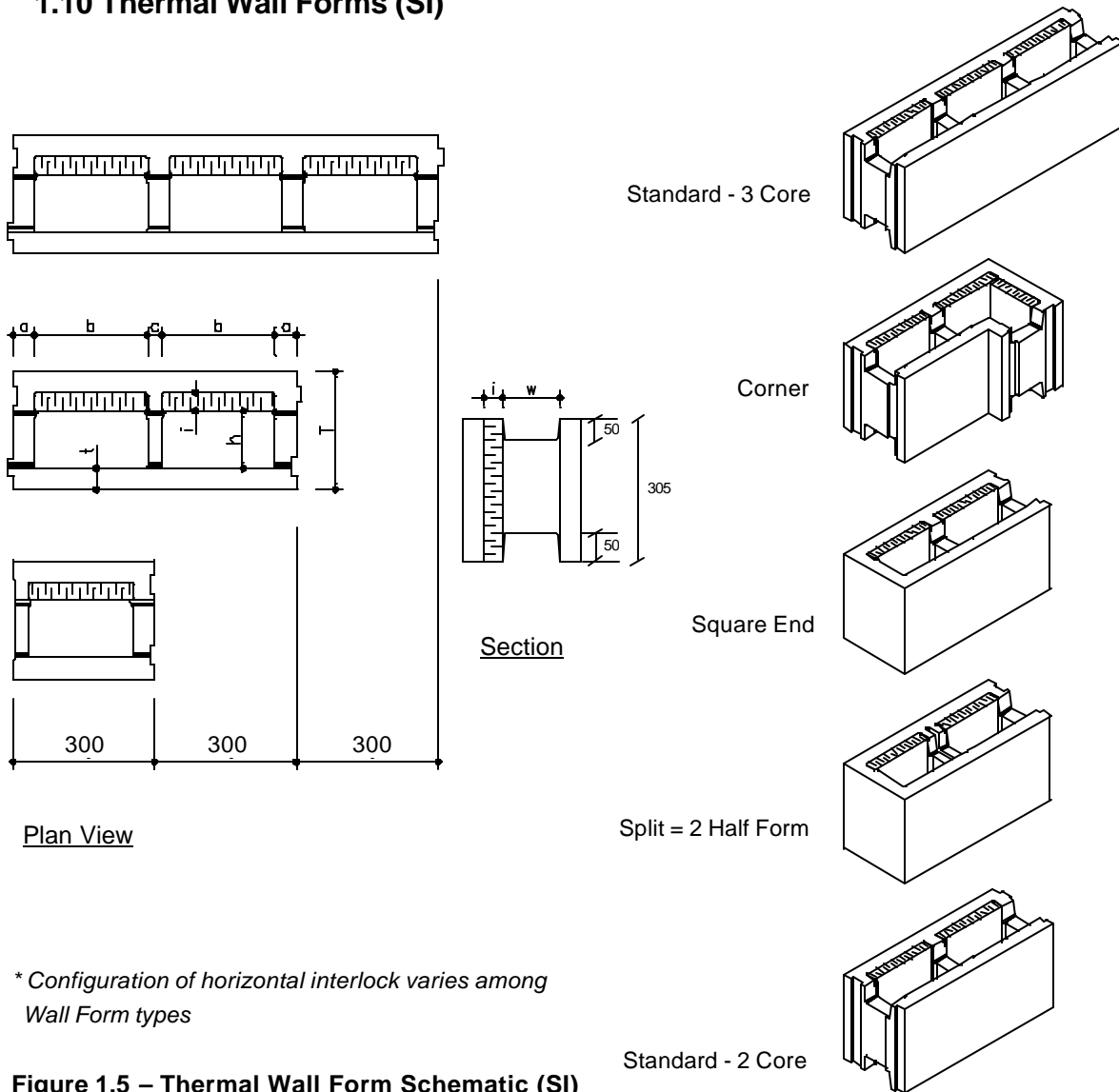
\* Configuration of horizontal interlock varies among Wall Form types

**Figure 1.4 – Thermal Wall Form Schematic**

**Table 1.6 – Thermal Wall Form Dimensions (Imperial)**

Wall Form Type	Wall Form Weight (lbs)	FORM DIMENSIONS								CONCRETE CORE DATA	
		T (in)	t (in)	a (in)	c (in)	w (in)	i (in)	b (in)	h (in)	X-Sect Area (in <sup>2</sup> )	Fill Volume (yd <sup>3</sup> / ft <sup>2</sup> )
WF25 T1.5	43	9 7/8	1 3/4	1 3/4	1 5/8	4 3/8	1 1/2	9 1/4	4 3/4	43.4	0.0123
WF30 T1.5	35	11 7/8	2	1 7/8	1 5/8	5 7/8	1 1/2	9 1/8	6 1/4	57.4	0.0162
WF30 T3.0	39	11 7/8	2	1 7/8	1 5/8	4 3/8	3	9 3/8	4 3/4	43.4	0.0123

### 1.10 Thermal Wall Forms (SI)



\* Configuration of horizontal interlock varies among Wall Form types

**Figure 1.5 – Thermal Wall Form Schematic (SI)**

**Table 1.7 – Thermal Wall Form Dimensions (SI)**

Wall Form Type	Wall Form Weight (kg)	FORM DIMENSIONS								CONCRETE CORE DATA	
		T (mm)	t (mm)	a (mm)	c (mm)	w (mm)	i (mm)	b (mm)	h (mm)	X-Sect Area (in <sup>2</sup> )	Fill Vol (m <sup>3</sup> / m <sup>2</sup> )
WF25 T1.5	20	250	45	45	40	110	38.1	235	120	28000	0.101
WF30 T1.5	16	300	50	47	42	150	38.1	232	160	37000	0.133
WF30 T3.0	18	300	50	47	42	110	76.2	232	120	28000	0.101

### 1.11 Wall System Summary

The following Tables summarize the Wall Forms and overall wall systems that are possible using the standard Durisol Wall Forms.

**Table 1.8 – Wall Form Types and Availability**

Wall Form Shape	Size (height x length)	AVAILABILITY			
		WF15	WF20	WF25	WF30
Standard 3 Core	(12" x 35 1/2")	x	✓	✓	x
Corner	(12" x 35 1/2")	✓	✓	✓	✓
Square End	(12" x 23 5/8")	x	✓	✓	✓
Split	(12" x 23 5/8")	x	✓	✓	✓
Standard 2 Core	(12" x 23 5/8")	✓	✓	✓	✓

\* WF15 Wall Forms are manufactured in special configurations. Please contact Durisol for information.

**Table 1.9 – Wall System Summary**

Parameter	Unit				WF25	WF30	WF30
		WF20	WF25	WF30	T1.5	T1.5	T3.0
Total wall thickness	in	7 7/8	9 7/8	11 7/8	9 7/8	11 7/8	11 7/8
Insulation insert thickness	in	0	0	0	1 1/2	1 1/2	3
Concrete wall thickness	in	4 3/4	6 1/4	7 7/8	4 3/4	6 1/4	4 3/4
Form height	in	12	12	12	12	12	12
Form modular length	in	11 7/8	11 7/8	11 7/8	11 7/8	11 7/8	11 7/8
Weight of form	lb/ft <sup>2</sup>	12	15	22	15	22	22
Weight of concrete wall	lb/ft <sup>2</sup>	50	65	82	50	65	50
Total weight of wall	lb/ft <sup>2</sup>	62	80	104	65	87	72
Concrete Core Data							
- Thickness	in	4 3/4	6 1/4	7 7/8	4 3/4	6 1/4	4 3/4
- X-sectional area	in <sup>2</sup>	43.4	57.4	71.3	43.4	57.4	43.4
- Moment of inertia	in <sup>4</sup>	79	186	361	79	186	79
- Fill volume	yd <sup>3</sup> / ft <sup>2</sup>	0.0123	0.0162	0.0203	0.0123	0.0162	0.0123
R-value of unfinished wall	ft <sup>2</sup> •h•°F/ BTU	8	8	8	14	14	19

\* WF15 is not typically intended for use as a load-bearing wall and is not included in the above table. Please contact Durisol for specific information on the WF-15 wall type.

### **1.12 Durisol Manufacturing**

Durisol Wall Forms are produced through a manufacturing process involving machine-molding of Durisol material into the desired shapes. Various Wall Form configurations are available to accommodate corner, window, door, pilaster and lintel details. Custom molding is available for larger-scale projects.

### **1.13 Technical Support**

Durisol Building Systems offers a full range of technical support for our products. Structural design, annual energy analysis, heat-air-moisture simulations, healthy house, and passive solar design assistance are among the typical services provided for customers of Durisol Building Systems.