

Filing Category: DESIGN—Concrete

DURISOL WALL FORMS FOR CONCRETE CONSTRUCTION

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CANADA

1.0 SUBJECT

Durisol Wall Forms for Concrete Construction.

2.0 DESCRIPTION

2.1 General:

The Durisol Wall Form system is a permanent formwork for reinforced concrete beams, lintels, walls, and foundation and retaining walls. The Wall Form units are limited to use in buildings that are of combustible construction. The exterior surface must be covered with an approved weather-resistant barrier and exterior wall covering. Two types of Durisol Wall Forms are recognized in this evaluation report: Standard Wall Forms and Thermal Wall Forms.

2.2 Materials:

2.2.1 Durisol Wall Forms: The Durisol Wall Form units are comprised of softwood fibers bonded together with portland cement. Each unit has cavities, extending vertically at 12 inches (305 mm) on center, in which reinforcement and concrete are placed as required by design. The units have nominal overall dimensions of 8, 10 or 12 inches (width) by 12 inches (height) by 24 or 36 inches (length). Five blocks are recognized: Standard 2-core, Standard 3-core, Split Half Form, Square End, and Corner. See Figures 1 and 2 for dimensions of the Standard Wall Forms and Thermal Wall Forms. The forms have a minimum average density of 27.2 lb./ft.³ (600 kg/m³), and have a maximum flame-spread rating of 25 and a maximum smoke-density rating of 450 when tested in accordance with UBC Standard 8-1.

When stacked in a running bond pattern, the blocks form vertical cores that have minimum dimensions of 9 inches by 4³/₄ inches (230 mm by 120 mm), spaced 11⁷/₈ inches (300 mm) on center; and form horizontal cores that have minimum dimensions of 4³/₄ inches by 4¹/₈ inches (120 mm by 105 mm), spaced 11⁷/₈ inches (300 mm) on center. Reinforcement and concrete are placed in the vertical and horizontal cores.

2.2.2 Wall Form Insulation Inserts: Insulated wall inserts are manufactured from mineral-fiber insulation. The insulation has a density of 7.5 lb./ft.³ (165 kg/m³).

2.2.3 Concrete: Normal-weight concrete having maximum ³/₄-inch (19 mm) aggregate conforming to ASTM C 33 must have a minimum compressive strength of 2,500 psi (17.2 MPa).

2.2.4 Reinforcement: Deformed steel reinforcement bars must have a minimum yield strength of 40 ksi (275 kPa) and must comply with Section 1903.5 of the 1997 *Uniform Building Code*™ (UBC), governing steel reinforcement.

2.2.5 Other: Wood members for plates or window and door framing must be approved for this use by the building official.

2.3 Design of Formwork:

Placement of the Durisol wall-form blocks used as formwork for concrete must result in a final structure that conforms to the shapes, lines and dimensions of concrete structural members as required by the design drawings and specifications. Additionally, the following UBC requirements must be met:

1. Durisol forms must be sufficiently tight to prevent leakage of concrete.
2. Durisol forms must be properly braced or tied together so as to maintain position and shape during placement of concrete.
3. Durisol forms and their supports must be designed so as not to damage previously placed structures.
4. Design of Durisol formwork must include consideration of the rate and method of concrete placement; and of the construction loads, including vertical, horizontal and impact loads.

2.4 Design of Concrete Structural Members:

The wall system must be designed in accordance with the following requirements:

1. Structures are limited to two stories and 10-foot (3048 mm) unsupported wall heights, in all seismic zones.
2. Maximum superimposed load applied vertically at the top of the wall is 4,000 plf (58 400 N/m) for concrete walls formed by Durisol model WF20, WF25-T1.5 or WF30-T3; 6,200 plf (90 520 N/m) for walls formed by model WF25 or WF30-T1.5; and 8,500 plf (124 000 N/m) for walls formed by model WF30.
3. Maximum basic wind speed is 100 miles per hour (161 km/h) in Exposure C locations as defined in the UBC.
4. Vertical and horizontal wall reinforcements must be spaced in accordance with Table 1, and rebar placement must comply with applicable sections of the UBC.
5. Wall openings must be vertically and horizontally reinforced in accordance with Table 1.
6. Roof and floors must be anchored and supported at the walls in accordance with applicable sections of the UBC.
7. Ledger bolts having the minimum diameter and spacing must be placed in accordance with approved design calculations and building plans.

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8. Allowable in-plane shear loads specified in Table 2 must be greater than or equal to design shear wall loads.
9. Anchorage to foundations must comply with applicable sections of the UBC.
10. The horizontal reinforcement at each roof and floor level must consist of, at a minimum, two No. 4 bars.
11. Allowable lintel spans are shown in Table 3.

2.5 Installation:

The Durisol wall-form system must be supported on concrete footings complying with Chapter 19 of the UBC. Vertical rebars, embedded in the footing, must extend a minimum of 24 inches (610 mm), or a length complying with the UBC, into the concrete wall system. As the Durisol blocks are stacked in a running-bond pattern, reinforcement bars must be placed in the vertical and horizontal cells as required by design. All horizontal and vertical reinforcement bars must have minimum concrete protection in accordance with the UBC.

Wood ledgers must be attached to the concrete wall by removing portions of the face shell of the form units, with the height of the removed portion equal to the depth of the wood ledger, such that the wood ledger members are attached directly to the concrete. The location and size of face shell removal for ledger bolt installation must be specified by the engineer of record. When concrete is poured into the wall system, the holes provided for the J-bolts form a solid concrete connection from the ledger board to the horizontal bond beam.

Wood plates must be anchored to the top of the wall. Anchor bolts used to connect the wood ledgers or plates to the concrete must be cast in place, with the bolts sized and spaced as required by design.

Refer to the Durisol, Inc., publication "Residential Design Information," dated February 2001, for typical installation details.

2.6 Interior Wall-finish Material:

Durisol wall forms are permitted to be exposed to the interior of the building without a wall covering. If regular gypsum wallboard is used as a finish material, it may be directly attached to the Durisol forms using No. 6 by 2-inch-long (52 mm) drywall screws spaced in accordance with Chapter 25 of the UBC.

2.7 Exterior Wall-finish Material:

2.7.1 Above Grade: Durisol wall forms must be covered on the exterior with a weather-resistive covering in accordance with either the UBC or an evaluation report. The wall covering must be attached, through the Durisol forms, directly into the concrete. Negative wind pressure capacity of the exterior finish material is recognized in the UBC, for generic materials, or in a current evaluation report, for proprietary materials.

2.7.2 Below Grade: Durisol wall-form surfaces must be dampproofed and, when required by the local building department, waterproofed in accordance with applicable sections of the code. Dampproofing and waterproofing materials must be approved by Durisol, Inc., and the local building official, and must be free of solvents that will adversely affect the wall forms.

2.8 Foundation Walls:

The wall system is permitted to be used for stem walls supported on concrete footings complying with the UBC.

2.9 Fire-resistive Construction:

A load-bearing wall constructed from the Durisol blocks has a four-hour fire-resistive rating when constructed in accordance with this evaluation report and the following requirements:

1. Normal-weight concrete with crushed limestone aggregate is used and the concrete has a minimum compressive strength at 28 days of 3,100 psi (21.4 MPa).
2. Each side of the wall is covered with a minimum two-coat portland-cement plaster. The base coat mix consists of 50 pounds (22.5 kg) of plaster mix, 69 pounds (31 kg) of plaster sand, and 2½ gallons (9.7 L) of potable water. The finish coat consists of equal portions of fast- and slow-set plaster, added to finishing lime. The finished thickness of the plaster must be 7/8 inch (22 mm).

2.10 Special Inspection:

Special inspection is required as noted in Section 1701 of the UBC for placement of reinforcing steel and concrete, and for concrete cylinder testing, except that special inspection is not required for foundation stem walls conforming to Table 18-I-D of the UBC. When approved by the building official, special inspection is not required when all of the following conditions are met:

1. Wall systems are a maximum of 8 feet (2438 mm) in height and are limited to use in single-story construction of Group R, Division 3, or Group U, Division 1, Occupancy.
2. Maximum height of a concrete pour is 48 inches (1219 mm).
3. Installation is by installers approved by Durisol, Inc.
4. Half the allowable design stresses permitted by the UBC are used for the design of the walls.

2.11 Identification:

The Durisol wall-form units are identified by the Durisol logo, stenciled on the pallets or the Wall Units, or both.

3.0 EVIDENCE SUBMITTED

Data in accordance with the ICBO ES Acceptance Criteria for Concrete and Concrete Masonry Walls (AC15), dated January 2001, along with reports of structural fastener tests, reports of surface-burning characteristic tests in accordance with UBC Standard 8-1, and an in-house quality control manual.

4.0 FINDINGS

That the Durisol Wall Forms for Concrete Construction described in this evaluation report comply with the 1997 Uniform Building Code™, subject to the following conditions:

- 4.1 The wall form blocks are manufactured and identified in accordance with this report, and installed in accordance with this report and the manufacturer's installation instructions.
- 4.2 The form blocks are used in buildings of combustible construction.
- 4.3 Plans and calculations showing compliance with this report are submitted to the building official for approval.
- 4.4 Special inspection is required in accordance with Section 2.10 of this evaluation report.

This report is subject to re-examination in two years.

TABLE 1—REINFORCING SCHEDULE^{1,2,3,4,5}

WALL TYPE (S)	SEISMIC ZONES	REINFORCING	
		Horizontal	Vertical
Crawl space wall and above-grade wall	0, 1, 2 and 2B	#3 ea. cell	#3 ea. cell
	3 and 4	#4 ea. cell	#4 ea. cell
Basement wall with height of backfill "H" ≤ 5' - 0"	All	#4 ea. cell	#4 ea. cell
Basement wall with height of backfill "H" > 5' - 0"	All	#4 ea. cell	#5 ea. cell

For **SI**: 1 inch = 25.4 mm, 1 psf = 0.048 kN/m², 1 plf = 14.6 N/m, 1 mph = 1.61 km/h, 1 pcf = 16 kg/m³, 1 psi = 0.0069 MPa, 1 ksi = 6.72 MPa.

¹Maximum total superimposed load on the top of the wall complies with Section 2.4 of this report.

²Maximum allowable wind pressure based on 100 mph, Exposure C.

³Equivalent fluid pressure of soil = 62.5 pcf.

⁴Concrete: f'_c = 2,500 psi, minimum. All voids must be filled.

⁵Reinforcing steel: F_y = 40 ksi. All reinforcing must be lapped as follows: #4 - 18 inches, #5 - 24 inches. Corner bars must be provided with 24-inch legs at every course at all corners and intersections.

TABLE 2—ALLOWABLE IN-PLANE SHEAR CAPACITY OF SHEAR WALLS ¹

WALL LENGTH ("L") (feet)	ALLOWABLE IN-PLANE SHEAR CAPACITY (plf)		
	WF20, WF25-T1.5, and WF30-T3	WF25 and WF30-T1.5	WF30
$L < 4' - 0''$	0	0	0
$4' - 0'' \leq L < 6' - 0''$	2,650	3,520	4,400
$6' - 0'' \leq L < 8' - 0''$	2,650	3,520	4,400
$L \geq 8' - 0''$	2,650	3,520	4,400

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.6 N/m.

¹Walls must be reinforced with horizontal and vertical rebar in accordance with Table 1.

TABLE 3—LINTEL CAPACITIES

LINTEL CLEAR SPAN (feet)	ALLOWABLE CAPACITY (plf)					
	WF20, WF25-T1.5, WF30-T3		WF25, WF30-T1.5		WF30	
	One Course	Two Course	One Course	Two Course	One Course	Two Course
4.0	1,052	2,104	1,403	2,805	1,753	3,507
5.0	842	1,683	1,122	2,244	1,403	2,805
6.0	701	1,403	935	1,870	1,169	2,338
7.0	601	1,202	802	1,603	1,002	2,004
8.0	526	1,052	701	1,403	877	1,753

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.6 N/m, 1 psi = 0.0069 MPa.

Note:

1) f'_c = 2,500 psi, minimum.

2) Allowable lintel capacities based on shear capacity of lintel.

3) Extend all reinforcing 600 mm beyond opening.

4) Minimum reinforcing: WF20, WF25-T1.5, WF30-T3 - #4 @ Bottom
WF25, WF30-T1.5 - #4 @ Bottom
WF30 - 2 #3 @ Bottom

5) Wall form units may be custom-cut to create a concrete lintel beam in accordance with design and recommendations of a professional engineer.

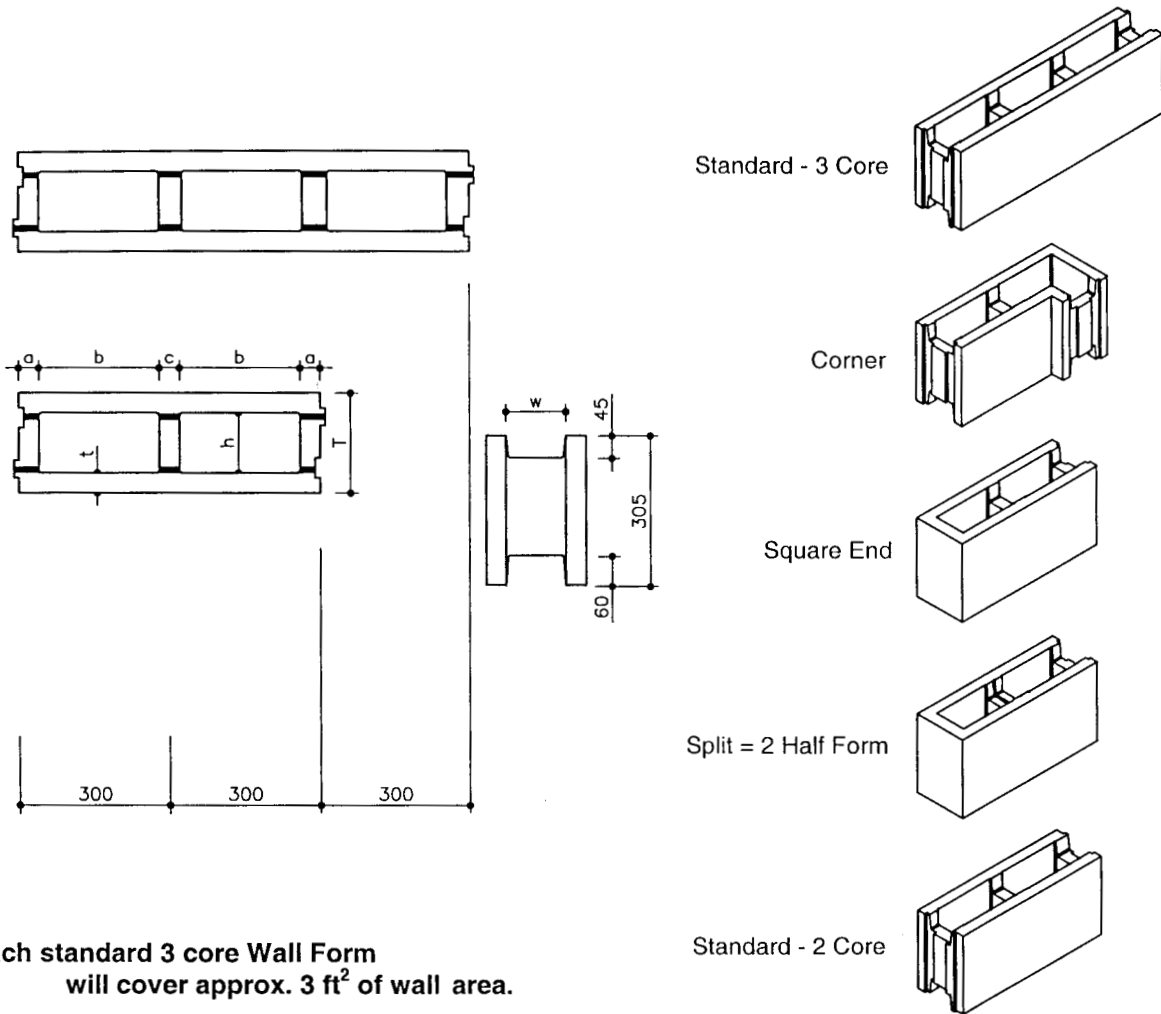
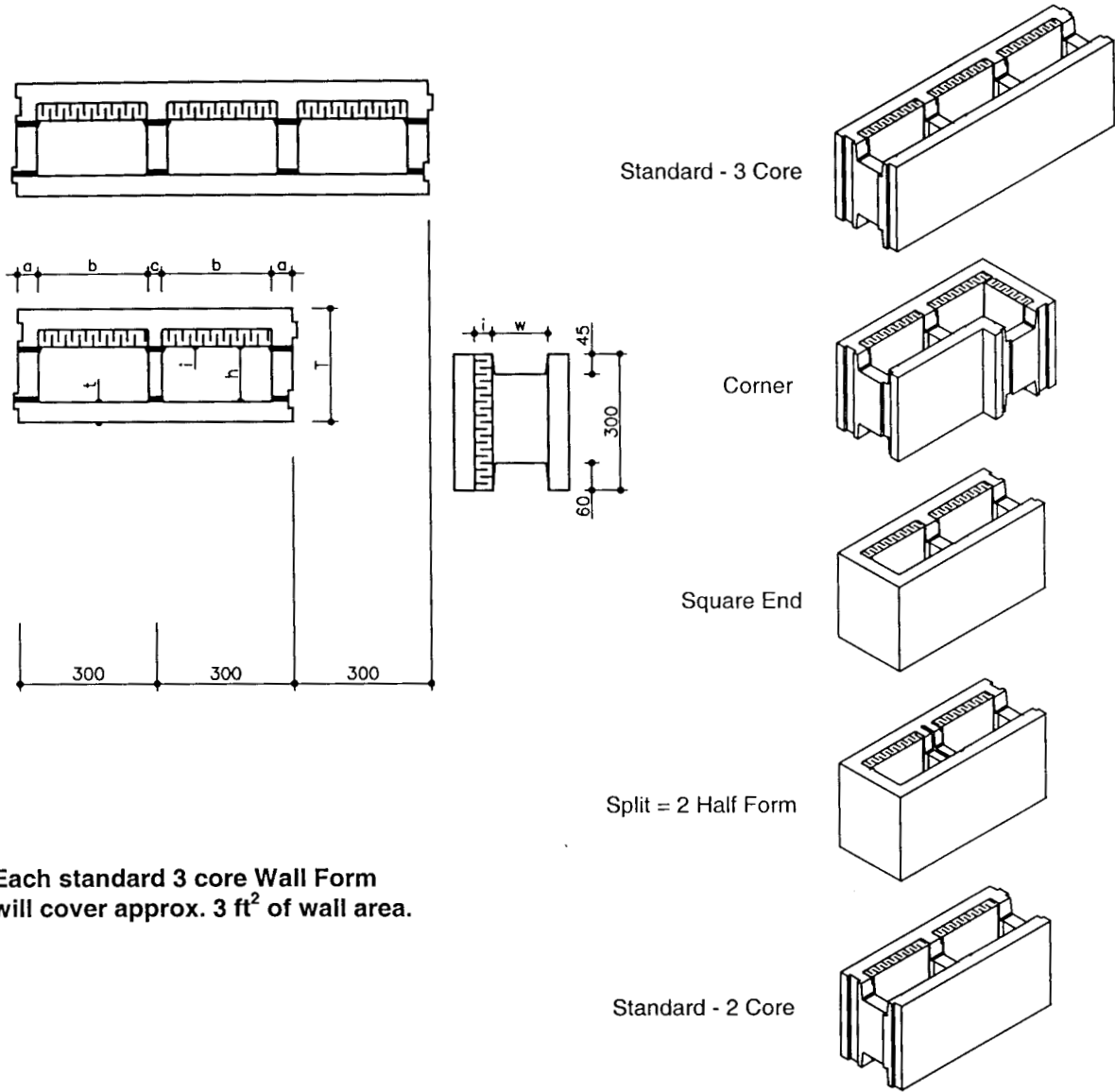


Table 1.1 - Standard Wall Form Dimensions

		FORM DIMENSIONS					CONCRETE CORE DATA			
Wall Form Type	Wall Form Weight (kg)	T (mm)	t (mm)	a (mm)	c (mm)	w (mm)	b (mm)	h (mm)	X-Sect Area (mm ²)	Fill Volume (m ³ / m ²)
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	47	42	190	232	200	46000	0.167

FIGURE 1— DURISOL STANDARD WALL FORMS



Each standard 3 core Wall Form will cover approx. 3 ft² of wall area.

		FORM DIMENSIONS						CONCRETE CORE DATA			
Wall Form Type	Wall Form Weight (kg)	T (mm)	t (mm)	a (mm)	c (mm)	w (mm)	i (mm)	b (mm)	h (mm)	X-Sect Area (mm ²)	Fill Volume (m ³ / m ²)
WF25 T1.5	18	250	45	45	40	110	38.1	235	120	28000	0.101
WF30 T1.5	14	300	50	47	42	150	38.1	232	160	37000	0.133
WF30 T3.0	14	300	50	47	42	110	76.2	232	120	28000	0.101

FIGURE 2—DURISOL THERMAL WALL FORMS