

C/S Acrovyn® Doors

Performance Data

Acrovyn Door Systems has been tested in accordance with the codes and standards listed below.

Impact Tests

Variations of ASTM F476-76, Standard Test Methods for Security of Swinging Door Assemblies were conducted to compare the resistance to impact damage of C/S Acrovyn, high pressure laminate (HPL), thermally fused melamine, and wood veneer doors. The comparative testing was performed on the door face and edges. Sample failure was determined by visible damage to the surface of either the test face or the substrate.

Test purpose: To test the impact resistance of various door constructions using a 99.2 lb. steel ram.

Test procedure: The test specimens were evaluated in general accordance with ASTM F476-76. The steel ram was dropped from progressively higher drop heights to produce an impact on the surface of the test specimens (measured in ft-lb).

Test Specimens:

1. Typical wood veneer on face and edges of door samples with stain and varnish.
2. Thermally fused melamine on faces with .040" pvc banded edges bonded directly to core.
3. Typical HPL on both face and edges of door samples.
4. Acrovyn Door System: Wood grain Chameleon Acrovyn on face and wood grain Chameleon Acrovyn guards on the edges.

Test Results:

90 degree impact on stile: The C/S Acrovyn Door system withstood an impact of 136.4 ft lb (2.4 times the resistance of HPL). The thermally fused melamine sample failed at 24.8 ft-lb. The wood veneer and HPL failed at 41.33 and 57.87 ft-lb respectively. The Acrovyn Door failed per the test outline at 140.53 ft-lb.



Acrovyn face bulged
@ 17" (140.53 ft lb)



HPL fracture @
7" (57.87 ft lb)

Perpendicular impact on door face: The C/S Acrovyn Door and the HPL doors withstood an impact 165.33 ft-lb. Test was stopped after no damage was visible.



*HPL no damage @
20" (165.33 ft lb)*



*Acrovyn no damage @
20" (165.33 ft lb)*

45 degree gouge on door face: Wood veneer, thermally fused low pressure melamine laminate and HPL laminated samples all failed at 24.8 ft-lb. The Acrovyn door failed at 33.07 ft-lb.



*HPL gouge @ 3"
(24.8 ft lb)*



*Wood gouge @
3" (24.8 ft lb)*



*Acrovyn scuffed @
4" (33.07 ft lb)*



*HPL gouge @
20" (165.33 ft lb)*



*Wood gouge @
20" (165.33 ft lb)*



*Acrovyn scuffed @
20" (165.33 ft lb)*

60 degree gouge on door edge: The C/S Acrovyn Door system withstood an impact of 57.87 (2.67 and 2 times the resistance of Wood Veneer and HPL respectively). The wood veneer and thermally fused melamine samples both failed at 24.8 ft-lb. The HPL laminated samples failed 33.07 ft-lb. In comparison the Acrovyn Door failed at 66.13 ft-lb.



*Wood fracture @
3" (24.8 ft lb)*



*HPL fracture @
4" (33 ft lb)*



*Acrovyn dent @
8" (66.3 ft lb)*

Cycle Slam Tests

Test Purpose: Slam tests have been conducted on Acrovyn Doors to evaluate the Physical endurance of the Acrovyn Door assembly.

Test Procedure: WDMA TM-7 (1990) "Door physical endurance testing" was conducted by Intertek Testing Services NA, Inc. WDMA standard for "Extra Heavy Duty" is 1,000,000 cycles.

Test Results:

- 2,000,000* cycles for particle board Acrovyn Doors with replaceable stiles & edges.
- 1,000,000 cycles for mineral core Acrovyn Doors with replaceable stiles & edges.

* 100% more than the industry requirements for an Extra Heavy Duty door (Testing was stopped at 2 million cycles)



Acrovyn Door undergoing cycle slam testing as performed by ITS.



Acrovyn® Doors

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Surface Abrasion Tests

ASTM D4060-90 Taber Abrasion Testing has been conducted to compare C/S Acrovyn, high pressure laminate (HPL) and wood veneer resistance to abrasion.

Test Results: Acrovyn decorated with wood grain Chameleon ornamental patterns show improved performance over HPL & wood veneer door finishes. Testing was stopped when a distinctive wear pattern became evident.

- **Wood Veneer with Stain & Conversion Varnish** - failed at 1,000 cycles.
- **Thermally Fused Melamine** - failed at 1,000 cycles.
- **Wood Veneer with Stain & Catalyzed Polyurethane Coating** - failed at 5,000 cycles.
- **HPL** - began to show signs of wear at 6,000 cycles and considered failed at 10,000 cycles.
- **Acrovyn Chameleon** - wood grain Chameleon testing was terminated at 28,000 cycles when wear became evident.



Taber Abraser apparatus



Wood Veneer w/ Stain and varnish failed sample – 1,000 cycles.

Impact Resistance Test

Test Procedure: ASTM D-4226, Impact Resistance Testing has been conducted to compare the impact strength values of C/S Acrovyn, HPL and wood veneer.

Test Results: Acrovyn and Acrovyn Chameleon outperform HPL by a considerable margin as tested using a Gardner Impact Tester.

- **HPL** - Shatter & separation (brittle) failure at 4 in/lb
- **Solid Color Acrovyn** - Tear (ductile) failure at 56 in/lb
- **Acrovyn Chameleon** - Tear (ductile) failure at 80 in/lb



Gardner Impact Tester



High Pressure Laminate 4 in lb failure



Solid Color Acrovyn 56 in lb failure.



Chameleon Wood Grain Acrovyn 80 in lb failure.



Fungi and Bacteria Resistance Testing

Acrovyn has been tested in accordance with ASTM G-21-96 "Determining Resistance of Synthetic Polymeric Materials to Fungi" and ASTM G-22-96 "Determining Resistance of Plastics to Bacteria" showing that Acrovyn does not support fungal or bacteria growth.

ASTM G-21-96 Fungi Growth Resistance

Procedure: Negative controls and positive control materials (Acrovyn, paper, cork, and cotton) were also inoculated. After inoculation, samples and controls were placed in a chamber and incubated at temperature of $30 \pm 1^\circ\text{C}$ and relative humidity greater than 90% for a minimum of 28 days.

Results:

<u>Sample</u>	<u>Day 0</u>	<u>Day 7</u>	<u>Day 14</u>	<u>Day 21</u>	<u>Day 28</u>
C/S Acrovyn	0	0	0	0	0
Positive controls (vinyl, paper, cork, cotton)	0	2, 4, 1, 4	2, 4, 2, 4	2, 4, 2, 4	2, 4, 2, 4
Negative Controls (glass slide)	0	0	0	0	0
Inoculum viability control	0	4	4	4	4

<u>ASTM Rating</u>	<u>Observed Growth on Specimens</u>
0	None
1	Traces of growth (less than 10%)
2	Light growth (10-30%)
3	Medium growth (30-60%)
4	Heavy growth (60%- to complete coverage)

Conclusion: Acrovyn samples showed no development of fungal growth.

ASTM G-22-96 Bacteria Growth Resistance

Procedure: Negative controls and positive control materials (Acrovyn, cotton) were also inoculated. After inoculation, samples and controls were placed in a chamber and incubated at temperature of $35 \pm 1^\circ\text{C}$ and relative humidity greater than 85% for a minimum of 21 days.

Results:

<u>Sample</u>	<u>Day 0</u>	<u>Day 7</u>	<u>Day 14</u>	<u>Day 21</u>
C/S Acrovyn	0	0	0	0
Positive controls (cotton)	0	1	2	
Negative Controls (glass slide)	0	0	0	0
Inoculum viability control	0	4		

(Positive and viability control observations were discontinued after confirmation of growth)

<u>ASTM Rating</u>	<u>Observed Growth on Specimens</u>
0	None
1	Traces of growth (less than 10%)
2	Light growth (10-30%)
3	Medium growth (30-60%)
4	Heavy growth (60%- to complete coverage)

Conclusion: Acrovyn samples did not develop bacterial growth when tested.

Adhesive Bond Durability

WDMA TM-6 1988 Adhesive Bond Method, Type II is the test to determine the resistance of glue line to separation and failure for interior doors. The Acrovyn Door System samples all passed.

Cleanability of Acrovyn

Acrovyn Stain Resistance/Cleanability tests were conducted in general accordance with procedures as outlined in ASTM D1308-93 Standard Test Method for Effect of Household Chemicals On Clear or Pigmented Organic Finishes.

Test Results: Common stains & marks are removed from Acrovyn with soap & water or a product like Fantastik®. For difficult marks use a mild solvent like isopropyl alcohol or a naphtha type product.

Staining Agent 7 Days @ 75F	Residual Stain After Cleaning with:	
	Soap & Water*	Mild Solvent**
Mustard	None	None
Ketchup	None	None
Chocolate Syrup	None	None
Merthiolate	None	None
Betadyne	None	None
Lipstick	None	None
Vegetable Oil	None	None
Coffee	None	None
Tea	None	None
Wine	None	None
Coca Cola	None	None
Bleach	Slight	Slight
Crayon	Slight	None
Rit Dye – Marine Blue 44	Slight	None
10% Sulfuric Acid	None	None
10% Sodium Hydroxide	Slight	Slight
Pencil	Slight	None
Ink Pens	None	None

Cleaning Agents:

*Formula 409®, Lestoil, Fantastik®, or equivalent

** Rubbing alcohol, naphtha type product, 50/50 mixture acetone/water

Fire Tests

Acrovyn doors are listed and labeled for 20, 45, 60 and 90-minute fire ratings. The Acrovyn Doors carry the ITS/Warnock Hersey label.

For certification of Construction Specialties, Inc. (formally known as C/S Group), 20 min fire rating and cross-listing under GP Gypsum Corp. 45, 60 & 90-minute fire ratings, go to Intertek ETL Semko website—<http://www.intertek.com/>.



Labeled Fire Door Testing

- UBC 7-2 (1997) Part 1 Testing Standards for Swinging Fire Doors
- UL 10C (1998) UL 10C (1998) Positive Pressure Fire Tests of Door Assemblies
- CAN 4S104 (1995)
- NFPA 252 (1999) Standard Methods of Fire Tests of Door Assemblies

Installation of fire rated doors shall be in accordance with NFPA 80 Standard for Fire Doors and Fire Windows. For smoke rating, a listed and labeled Category "H" smoke and draft control gasket shall be installed to the opening. Category "H" smoke and draft control gaskets shall be listed for compliance with test procedure UBC Standard 7-2 (97), Parts I & II. Pemko S88 or S44 on jambs and header and S77 at meeting edges of pairs are eligible for "S" label without use of any other smoke and draft control gaskets.



20-minute fire-rated Acrovyn Door being tested by ITS/WH.

U.S. Patents: 7,587,876; 7,621,102, 7,775,013 B2, 7,886,501 B2

U.S. Design Patents: D512 785S; D515 713S; D517 224S; D517 701S; D518 185S