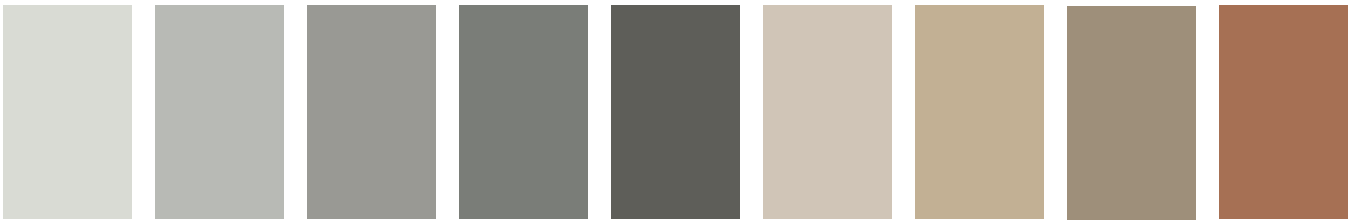
TAKTL® is an advanced Architectural Ultra High Performance Concrete (A|UHPC®) that is over four times as strong as traditional precast concrete and performs exceptionally well in demanding conditions. The key to TAKTL's strength is the carefully calibrated ratio of engineered ingredients and a mixing sequence that tightly packs molecules together and creates very strong bonds. This high packing density yields excellent flexural and compressive strength and virtually eliminates the capillary pores that cause freeze-thaw degradation in pre-cast concrete and GFRC panels.

TAKTL panels are reinforced with Alkali Resistant (AR) Glass Fiber and two layers of AR Glass Fiber Mesh. Panels are cast utilizing a proprietary, automated production process into molds that yield an intrinsic pattern and finish. Additionally, special surface effects can be created with aggregates and/or a variety of media-blasting techniques in an automated, enclosed blasting booth. TAKTL is the first company to fully integrate A|UHPC formulation, design, mold making, and automated manufacturing.

Standard Colors



White 87 | Platinum 75 | Titanium 63 | Grey 52 | Graphite 40 | Bone 78 | Sand 72 | Dune 60 | Terracotta 52

Colors TAKTL has developed nine standard colors for the building industry, with the ability to formulate custom colors as part of our standard program for quantities in excess of 7,000 ft^2 (650m^2). All standard and custom colors contain pigments that are UV-stable and specifically engineered for use in concrete. Pigments are added during the mixing process, and are therefore integral and consistent throughout the material matrix.

Color Variation + Weathering TAKTL is a natural, mineral-based product that generally exhibits subtle color variation between panels. We have a series of interrelated strategies for minimizing color variation within and between production lots, including:

- Tight specification and control of highest quality white cement, pigments, and micro-aggregates
- Stringent quality management procedures for incoming raw materials, including color monitoring and particle size distribution analyses
- Precise, automated material dosing and mixing sequences to achieve exact mix design and homogeneity
- Climate and humidity controlled curing chambers

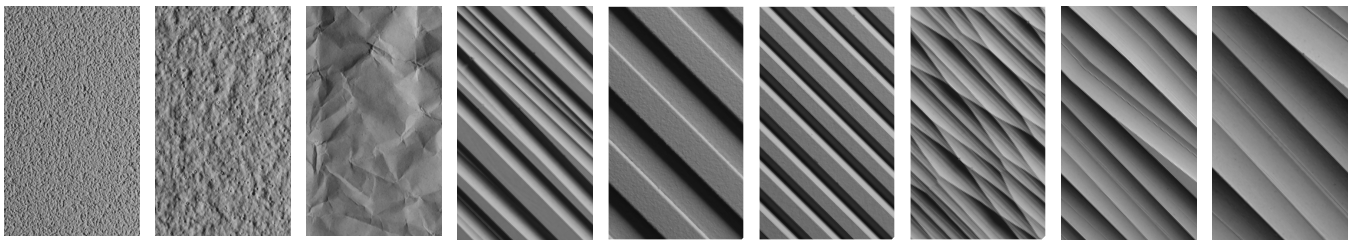
Darker colors have a greater potential for variation and, as a result, the tolerances for color variation are expanded.

Finishing Options To regulate the flow of moisture between the material surface and the environment, MicroSeal/T™, a hydrophobic, breathable finish, is applied to all panels before shipment. MicroSeal/T is invisible and does not affect the rich, natural appearance of the panel. For projects in which color variation is not desired, an alternative factory applied finish, ColorSeal/T™, is available. The ColorSeal/T process affords tighter control of the surface color characteristics, mitigating the subtle batch-to-batch color variation that results from using mineral raw materials.

Custom Colors + Finishes Custom colors are offered within our **TAKTL**STANDARD program. Custom textures and decorative aggregate finishes are available through our **TAKTL**STANDARD+ program. Please contact a member of our Technical Support Team to discuss unique project requirements.

Flat Textures

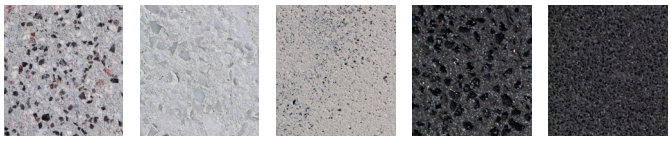
Raised Textures



Rough 1 | Rough 2 | Crinkle | Reeds | Itero | Shadows | Rio | Arbos 1 | Arbos 2

*NOTE: **Shadows** texture can only be specified in Mediablast finish or with ColorSeal/T.*

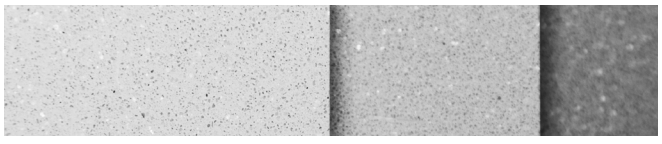
TAKTL KORSA™ Exposed Aggregate Finish



A01 | A02 | A03 | A04 | A05

TAKTL KORSA The TAKTL design and research teams perfected a technique for incorporating aggregates of varying color and size into the face layer of flat panels without compromising strength or long term performance. Five standard aggregate combinations are available in the **TAKTL KORSA** program: A01, A02, A03, A04, and A05. Strikingly beautiful with organic variation, all aggregate surfaces are fully tested and incorporated into our automated panel manufacturing process to ensure uncompromising quality and value. Custom aggregate finishes can be achieved for quantities in excess of 7,000 square feet.

Media Blasted Finish



Media Blasted Surface Texture Available as a standard finishing option with all colors and textures, mediablasting creates a subtly lighter and more visually varied surface of exposed aggregate. TAKTL's mediablaster was custom designed for A|UHPC finishing with automated articulating heads and a vertical panel orientation to create an even surface texture that is not achievable with fixed head blasting. Media is cleaned and re-circulated in a dust-free and resource-efficient cycle.

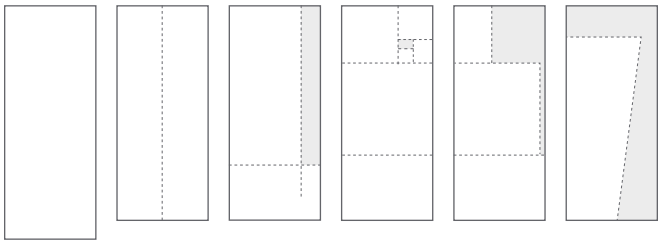
TAKTL Programs TAKTL offers a variety of programs to address the needs of projects spanning a wide range of design requirements, budgets and schedules. Please consult the table below for a quick comparison of the program choices and contact us for more details.

	TAKTLCUSTOM	**TAKTL**STANDARD+	**TAKTL**STANDARD	**TAKTL**SELECT
OVERVIEW	Custom profiles, perforations, and complex shapes for a wide variety of architectural applications. Collaborative, integrated design services, in-house mold design and fabrication.	STANDARD program with the addition of custom textures and finishes. In-house mold design and fabrication.	The full palette of standard color, texture, finish and aggregate options, with the addition of custom colors. Panels cut/drilled per project drawings with a variety of corner and edge options	Includes the most popular colors, textures, and size modules, providing a wide range of design options that fully leverage efficiencies of automated manufacturing and the wider anchor spacing of TAKTL.
MINIMUM QTY	Varies upon application	10,000sf	7,000sf	5,000sf
PRICE	$$$	$$ - $$$	$$	$
COLORS	9 *plus custom colors*	9 *plus custom colors*	9 *plus custom colors*	4
TEXTURES	Custom *plus Mediablast, ColorSeal/T, and MicroSeal/T finishing options*	Custom *plus Mediablast, ColorSeal/T, and MicroSeal/T finishing options*	9 *plus Mediablast, ColorSeal/T and MicroSeal/T finishing options*	4 *plus Mediablast and MicroSeal/T finishing options*
SIZES	Panels Cut to Size per Shop Drawings *molds developed to optimize yield*	Panels Cut to Size per Shop Drawings *yield based on 4x10 and 4x12 panels*	Panels Cut to Size per Shop Drawings *yield based on 4x10 or 4x12 panels according to mold availability*	14 Standard *based on 4x10 and 4x12 panels*
CORNERS	Open and Fabricated Corners *with size and texture limitations*	Open and Fabricated Corners *with size and texture limitations*	Open and Fabricated Corners *with size and texture limitations*	Open Corners *with straight edges*
FASTENERS	Panels Pre-drilled *for face-fasteners or concealed anchors*	Panels Pre-drilled *for face-fasteners or concealed anchors*	Panels Pre-drilled *for face-fasteners or concealed anchors*	Panels Pre-drilled *for face-fasteners*
SUBFRAME	Optional	Optional	Optional	Optional
SHOP DRAWINGS	Provided	Provided	Provided	Optional
LEAD TIMES*	16+ Weeks	16 Weeks	10-14 Weeks	10-12 Weeks

**Lead times start upon receipt of approved submittal samples, shop drawings, and deposit.*

Standard Dimensions

Length | Maximum*	144 in (3,658mm)
Width | Maximum	48 in (1,120mm)
Thickness | Flat Textures	0.625 in (15.9mm)
Thickness | Raised Textures	0.625 in (15.9mm) *at thinnest point*
Weight | Flat Textures	7.2 lb/ft² (34.79kg/m²)
Weight | Raised Textures	7.5 lb/ft² – 10.6 lb/f² (51.75kg/m²)



Panel Blank	100% Usage	80% Usage	99% Usage	70% Usage	60% Usage
0 Saw Cuts	1 Saw Cut	2 Saw Cuts	6 Saw Cuts	4 Saw Cuts	2 Saw Cuts
1 Piece	2 Pieces	2 Pieces	6 Pieces	3 Pieces	1 Piece

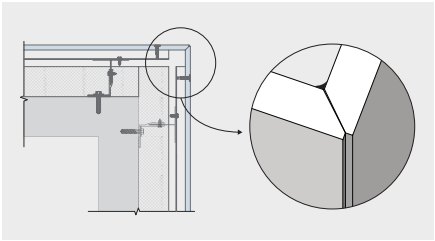
Panel Sizes TAKTL panels are cut to finished size in our factory per approved panel layout and manufacturing shop drawings. Panels are cast on a continuous production line into molds that yield standard sizes up to 4' in width and 12' in length*. The line is designed to operate at several different widths in order to minimize material waste. Panel size, orientation and layout directly influence installation costs by impacting number and placement of anchors, cost of substructure, weight of the panel and material handling challenges at the job site.

Material Optimization To minimize waste and also realize the lowest material cost, we recommend designing panel layouts that maximize material use. Our standard program efficiency target is 85% panel blank utilization. Please contact our Technical Support Team for assistance with panel sizes, material optimization, and related pricing parameters.

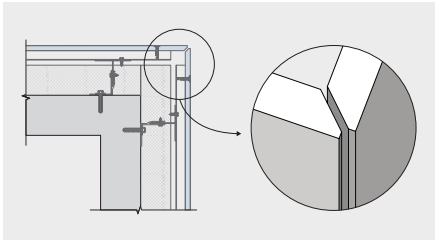
*TAKTLSTANDARD textures available up to 4'x10' and TAKTLSELECT textures available up to 4'x12' panel sizes. Please contact our Technical Support Team to discuss oversized TAKTLSTANDARD textures.

Standard Corner Options

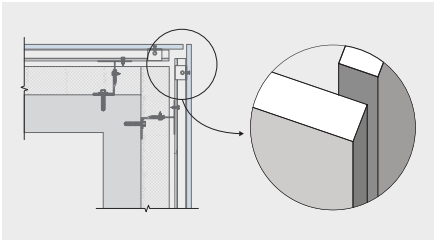
Closed Factory Adhered | Shown w/Visible Attachment



Open Quirk Miter | Shown w/Visible Attachment



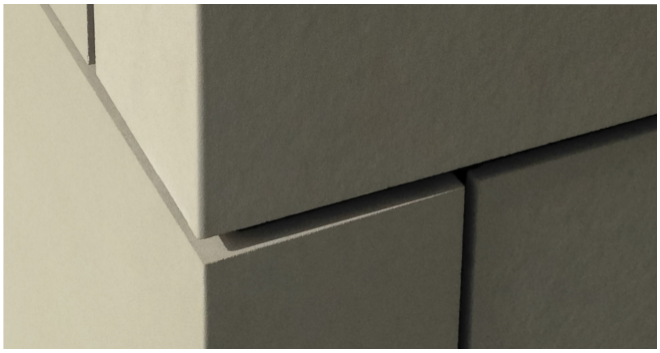
Open Square | Shown w/Concealed Attachment



Corners A variety of closed and open corner options are possible within the TAKTLSTANDARD program. TAKTL's CNC bridge saws precisely create straight and mitered edges as the finished panels are cut to size. Factory Adhered corners have been fully tested, with the strength of the joint matching (or exceeding) that of reinforced cast corners.

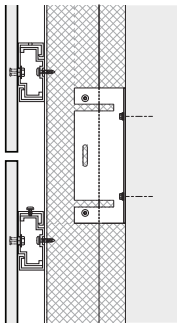
Joints Thermal movement is negligible in TAKTL panels and does not affect joint size. The coefficient of linear expansion for a 36"(914mm) TAKTL panel over a 68°F (38°C) temperature swing is 0.016"(0.4mm). Typical joint dimension is 3/8". The coefficient of linear expansion does not drive joint size. Joint size is determined by designer preference, building movement, and installation tolerances.

The structural engineer of the project should review criteria to determine minimum joint sizes based on building movement values.



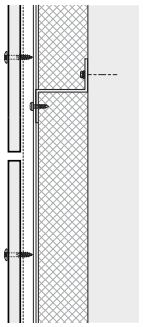
Application Examples

Rainscreen | Undercut Anchors



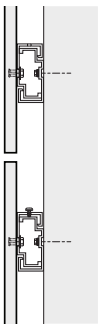
See Fig. 1.1

Rainscreen | Exposed Direct Fastener



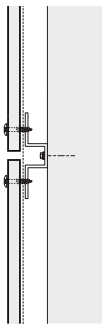
See Figure 1.2

Close Cladding | Undercut Anchors



See Fig. 1.1

Interior Cladding | Undercut Anchors



See Fig. 1.1

Applications TAKTL panels are compatible with a wide range of facade applications and cladding support systems, from rainscreens to interior lobby elevations. We've developed sample architectural details, available on our website, with some of the most common substructures and clips illustrated (*above*).

Anchoring TAKTL panels can be affixed with concealed undercut anchors or exposed fasteners through the face of the panel. Undercut anchors are compatible with textured surfaces and install with a fast, adhesive-free process. TAKTL panels can also be attached to substructure framing with screws or rivets. All panels are factory-drilled for ease of installation (*below*).

Anchor Spacing For a standard 5/8"(15.9mm) panel, the spacing between anchors should not exceed 39"(990mm) under typical design load conditions. The edge of the undercut anchor or the hole for face fastening shall be a minimum of 3"(76.2mm) from panel edge and not greater than 9"(228mm). For adequate support, panels must have a minimum of four anchors. The thickness of the panel, the depth of the anchor, and the engineer's stamped calculations incorporating windloads, seismic loads, and other project specific design criteria determine anchor spacing and quantity.

Reference TAKTL Doc. SP28.1 for complete anchor and anchor spacing information.

Attachment Examples

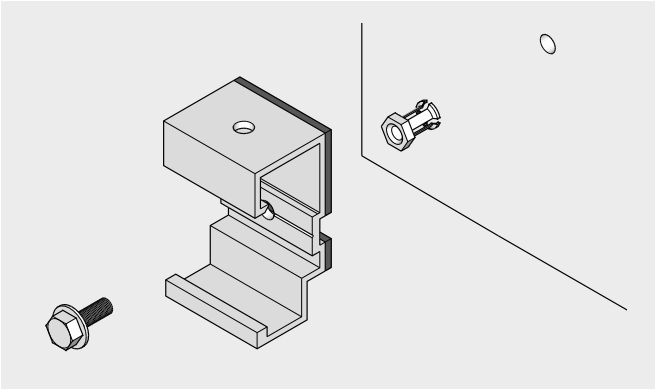


Fig. 1.1 | Concealed Fastener | Undercut Anchors | *Into Panel Back*

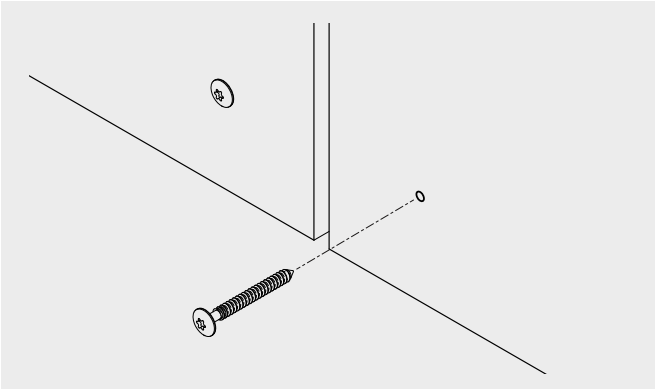


Fig. 1.2 | Exposed Direct Fastener | *Through Panel Face*

Technical Support + Project Management Every aspect of a project is coordinated by a Technical Support Specialist and Project Manager. Our Technical Support Specialists are able to provide expert assistance throughout the design, budgeting, sampling, specification writing, and quoting process. TAKTL Project Managers work closely with contractors and installers from the finalization of order details through project completion, overseeing drawings, approvals, scheduling, shipments, and problem resolution. Their expertise enables them to anticipate issues, collaborate with all team members, and support architects and contractors through a successful installation.

TAKTL does not offer engineering services. However, we work frequently with structural engineers and will be pleased to refer structural engineers who specialize in UHPC and/or facades.

Pricing Each project is unique, with a variety of factors influencing ultimate cost. These factors include: square footage requirement, number of color/texture combinations, project timeline, anchoring system, edge/corner style, panel size, and sheet utilization are among the most important. Custom colors, custom textures, and panel size can also impact both cost and delivery schedule. Please contact our Technical Support team to discuss budget pricing and how panel specifications impact manufacturing, shipping, and cost.

Specifications As an Ultra High Performance Concrete existing within the broader category of Glass-Fiber Reinforced Concrete, TAKTL panels are generally specified within Division 07 or 08. Please contact our Technical Support Team for our Guide Specification and assistance with specification placement and language.

Project Scheduling Lead Time Standard lead-times from receipt of deposit and approved submittals (drawings, color samples, documents) are listed below. We can often accommodate shorter lead-times, so please call us to discuss fast-moving projects.

TAKTLSELECT	10-12	Weeks
TAKTLSTANDARD	10-14	Weeks
TAKTLSTANDARD+	16	Weeks
TAKTLCUSTOM Project	16+	Weeks
Custom Samples	6-12	Weeks

Storage + Handling Panels are shipped in custom crates, designed to protect the panel faces and minimize damage in transit. We have created detailed instructions to make sure unloading, on-site storage, handling, field cutting/drilling and installation of our panels is as straightforward and efficient as possible. Panels must be protected from moisture (rain/snow and condensation) during storage to prevent uneven hydration that can cause surface discoloration. Careful handling of panels is required to maintain product quality. Handling instructions are similar to those for glass – handlers should hold panels on edge with the finish face and edges protected at all times.
Reference TAKTL Doc. H2.1 for complete handling and storage instructions.

Field Cutting + Drilling TAKTL panels are typically cut and drilled per approved drawings prior to shipment. However, situations may arise in which field cutting is required, and we have created detailed instructions to make field cutting, drilling, and installation of our panels as easy and efficient as possible. TAKTL panels can be cut with standard equipment in the field - we recommend a wet saw with a continuous rim blade, keeping the panel surface uniformly wet during cutting, rinsing it thoroughly, and drying with compressed air. For field drilling, we recommend wet drilling with glass or diamond bits, keeping the panel surface uniformly wet during drilling, rinsing it thoroughly, and drying with compressed air.
Reference TAKTL Doc.: P2.1, P4.1, P6.1 for complete field processing instructions.

Installation Depending upon the type of project, panel size, and substructure, our panels can be successfully installed by a variety of specialized façade contractors and trades, including carpenters, ironworkers and glazers. Working with the installing contractor and the production team, the TAKTL Project Manager creates a detailed shipment schedule and panel packing sequence that balances installation strategy with drawing release dates and production efficiencies.

REFERENCE DOCUMENTS	
H2.1	TAKTL Un-Crating, Storage + Handling Instructions
P2.1	TAKTL Field Processing | Field Cutting Instructions
P4.1	TAKTL Field Processing | Field Drilling Instruction
P6.1	TAKTL Field Processing | Field Grinding Instructions
Q2.1	TAKTL Quality Management | Tolerances + Acceptance Criteria

FIRE TESTING / SURFACE BURN CHARACTERISTICS		RESULTS	CERTIFICATION REQUIREMENT DETAILS
NFPA 285	Fire Propagation	PASS	No flame propagation (vertical or lateral) Temperatures at key distances from source within limits
ASTM E84-17	Flame Spread Index	Class A (0)	Class A: Flame spread 0-25 / ASTM C1186: Flame spread 0
	Smoke Development Index	Class A (0)	Class A: Development 0-450 / ASTM C1186: Development 0
ASTM E136-16	Combustibility	Non Combustible (4% loss,< 0°C)	Max loss of mass during the test ≤ 50%; Surface and interior temp rise ≤ 30°C above furnace temp; No flaming after first 30 seconds
CAN/ULC S114-05	Combustibility	Non Combustible (6.6% loss,< 0°C)	Max loss of mass during the test ≤ 20%; Temp rise of specimens ≤ 36°C. No flaming of any of the specimens during the last 14.5 minutes

ASTM C1186 CERTIFICATION - GRADE IV		RESULTS	RECOMMENDED DESIGN VALUES	CERTIFICATION REQUIREMENT DETAILS
ASTM C1185-08	Tolerance - Length	0.00 in	0.25 in	1/4 inch maximum variation from nominal dimension
ASTM C1185-08	Tolerance - Width	0.00 in	0.25 in	1/4 inch maximum variation from nominal dimension
ASTM C1185-08	Tolerance - Thickness within Sheets	3.65 %	≤ 15 %	≤ 15% variation between extreme measure of max measured value
ASTM C1185-08	Tolerance - Thickness between Sheets	0.022 in	≤ 0.05 in	≤ 0.05 inch variation between sheets
ASTM C1185-08	Tolerance - Squareness (Diagonal)	0.00 in	≤ 0.03 in/ft	Length variation ≤ 1/32/in/ft of sheet length
ASTM C1185-08	Tolerance - Squareness (Width Edge)	0.00 in	≤ 0.03 in/ft	Variation between opposite edges of sheet ≤ 1/32/in/ft
ASTM C1185-08	Tolerance - Squareness (Length Edge)	0.00 in	≤ 0.03 in/ft	Variation between opposite edges of sheet ≤ 1/32/in/ft
ASTM C1185-08	Tolerance - Straightness (Length)	0.00 in	0.03 in/ft	Edge dimensions within 1/32/in/ft of length
ASTM C1185-08	Toloerance - Straightness (Width)	0.00 in	0.03 in/ft	Edge dimensions within 1/32/in/ft of width
ASTM C1185-08	Density	137.1 lb/ft^3		Reporting Requirement Only
ASTM C1185-08	Modulus of Elasticity - Equilibrium	3,685,222 psi		Reporting Requirement Only
ASTM C1185-08	Modulus of Rupture - Equilibrium	(avg) 4,786 psi	≥ 3,916 psi	Flexural strength must be ≥ 3190 psi
ASTM C1185-08	Modulus of Rupture - Wet	(avg) 4,306 psi	> 3,480 psi	Flexural Strength >2,610 psi and >50% of Equilibrium Flexural Strength
ASTM C1185-08	Freeze/Thaw - Flexural Strength Retention	97.3 %	≥ 90 %	No visible cracks and ≥ 80% strength retention
ASTM C1185-08	Heat/Rain Exposure - Rainscreen Assy	No Defects	No Defects	No visible cracks/structural alteration of the sheets and frame assembly
ASTM C1185-08	Moisture Content	0.9 %		Reporting Requirement Only
ASTM C1185-08	Moisture Movement	0.00 %		Reporting Requirement Only
ASTM C1185-08	Water Absorption	3.9 %		Reporting Requirement Only
ASTMC 1185-08	Penetration & Water Droplet Formation	0/0		Moisture penetration permitted, but no droplet formation

ASTM E330 | Test Method for Structural Performance of Exterior Windows, Curtain Walls & Doors by Uniform Static Air Pressure Difference

Full-scale transverse loading tests have been performed on typical panels and wall assemblies, providing results that correlate to anchor and fastener testing for the purposes of engineering evaluation and calculation. TAKTL also performs project specific testing as required by our engineers or per project specifications. The attachment system connections used to connect the TAKTL panel attachment to the underlying wall or substrate must be designed by a professional engineer and the details submitted for review and approval.

CONCEALED UNDERCUT ANCHORS - ASTM E488-10E/488M-10

ANCHOR EMBED	SHEAR	RECOMMENDED DESIGN VALUE	TENSILE	RECOMMENDED DESIGN VALUE
10.0mm (Standard)	1,187 lbf	890 lbf	692 lbf	520 lbf
11.5mm	1,493.5 lbf	1,120 lbf	760.9 lbf	550 lbf
13.0mm	1,434 lbf	1,075 lbf	903 lbf	675 lbf

VISIBLE FASTENERS - AISA 905-08

METAL	SHEAR	RECOMMENDED DESIGN VALUE	TENSILE	RECOMMENDED DESIGN VALUE
18 GA / 50KGI Steel	2106 lbf	1895 lbf	630 lbf	567 lbf
16 GA / 50KGI Steel	1906 lbf	1620 lbf	820 lbf	738 lbf
2.2mm / 6061 Alum.	1772 lbf	1506 lbf	618 lbf	556 lbf

FREEZE/THAW STRENGTH RETENTION ASTM E488 - C666M-03

SHEAR 117%	TENSILE 111%

IMPACT TESTING		RESULTS	CERTIFICATION REQUIREMENT/DETAILS
ASTM C1629	Hard Body	Level 3 (150 lb-ft)	Level 3: No Failure, spider-web cracking appeared on reverse side; no penetration into the stud cavity;
	Hard Body - *Load Extension*	(247 lb-ft)	Level 3(+): Panel break point, panel rupture, panel remains integral;
ASTM C1629	Soft Body	Level 3 (525 lb-ft)	Level 3: No failure/visible fracture on exterior face, spider-web cracking appeared on reverse side, no penetration into the stud cavity;
	Soft Body - *Load Extension*	(1,500 lb-ft)	Level 3+: No failure/visible fracture on exterior face, back up wall failed;

ACCELERATED WEATHER TESTING/COLOR CHANGE		RESULTS	
ASTM G155-05a/D2244-09a	ColorSeal/T (2000 hrs)	1.69 ΔE	
ASTM G155-05a/D2244-09a	MicroSeal/T (500 hrs/1,000 hrs)	0.37-3.2 ΔE	Pigment specific

Third party testing performed by Architectural Testing Inc, Intertek, and QAU Laboratories
Please contact our Technical Support Team for project-specific consultation on Certified Test Results and Recommended Values