TAKTL® is an advanced Ultra High Performance Concrete (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 packs molecules together closely and creates very tight 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 comprised of TAKTL UHPC 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 sandblasting techniques in an automated, enclosed, blasting booth. TAKTL is the first company to fully integrate UHPC formulation, design, mold making, and automated manufacturing.

TAKTL Panels have achieved certification by Architectural Testing Inc (ATI) under ASTM C1186, Grade IV, which is the highest rated category for fiber-cement panels. ASTM C 1186 (Grade II minimum) is the International Building Code referenced standard for exterior fiber cement panels (1405.16).

QUALITY MANAGEMENT TAKTL adheres to a strict Quality Management System (QMS) that conforms to ICC-ES AC10 Quality Requirements and has achieved certification by Architectural Testing Inc (ATI) to consistently produce panels meeting the performance standards of ASTM C1186 Grade IV. TAKTL's QMS monitors parameters such as product dimensions, physical properties, flexural strength, anchor pull-out strength, color, curing conditions, and provides full traceability for each panel back to raw materials.

Under the independent quality certification program, ATI conducts unannounced audits of TAKTL operations at least four times annually, verifying procedures, reviewing QMS records, and selecting panels at random for laboratory testing and verification. TAKTL's Quality Team monitors procedures, testing, training, and reporting. Please refer to TAKTL's Quality Management Program Summary for a more detailed description of the Quality Management System governing TAKTL panel production.

STRENGTH TAKTL panels are significantly stronger than the leading competitive GFRC panels, making them much less susceptible to breakage during transit or installation. All certified test results exceed the minimum qualifying requirements in the highest performance category (Grade IV) for fiber-cement facade panels, as given under ASTM C 1186 Standard Specification for Flat Fiber-Cement Sheets. Test specimens were selected at random by ATI from TAKTL production runs.

Flexural Strength Samples from each production lot are selected and tested for flexural strength performance in accordance with ASTM C1186 requirements for Grade IV certified material. Certified flexural strength for TAKTL panels is 42.5 Mpa, exceeding published design values.

Anchor Pullout Anchor holes are inspected for depth and diameter, using a check fixture supplied by the manufacturer of the anchor and anchor drilling equipment. In addition, anchor pullout testing is conducted on samples from every lot of material.

Durability Unlike typical GFRC panels, TAKTL panels are not dependent upon a coating to maintain their full strength performance over time. Since TAKTL is extremely dense and is virtually without capillary pores, it will not absorb water or exhibit the typical expansion/contraction problems of cementitious panels. In extended freeze/thaw tests, conducted on uncoated panels in accordance with ASTM C 1186 requirements, TAKTL maintained 98-100% of its strength. As a reference, the highest performance category (Grade IV) requires only a score greater than 80% to pass.

Dimension + Anchor Location TAKTL panels have a nominal thickness of 5/8 inch (15.9mm) and nominal weight of 7.5 lbs/ft^2 (36.6 kg/m^2). In the case of panels with high relief surface patterns, the thickness is measured from the back surface to the lowest point in the surface pattern. Weight will vary slightly by pattern.

Panels are inspected at multiple points in the production process, including a final inspection immediately prior to packing and crating. The following tolerances are used for inspection criteria:

Length	± 0.062"	(± 1.6mm)
Width[1]	± 0.062"	(± 1.6mm)
Width	(< 12.5")	1± 0.5%
Thickness[2]	± 0.05"	(± 1.3mm)
Square-ness	± 0.062"	(± 1.6mm)
Edge Straightness	± 0.062"	(± 1.6mm)
Anchor Hole Location	± 0.062"	(± 1.6mm)

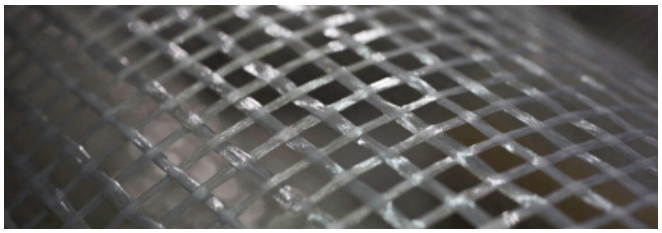
[1] Dimensional tolerance for panel width will not exceed ± 0.5% for all panels with a maximum tolerance of ± 0.062" (± 1.6mm) for panel widths greater than or equal to 12.5."

[2] In accordance with the ASTM C 1186 standard, thickness measurements are taken at the side midpoints of each panel to ensure the average of the side midpoints is within tolerance. Additionally, thickness measurements are taken near the corner anchor hole locations to confirm panel thickness meets or exceeds the concealed anchor manufacturer's minimum requirement (0.433"). Alternate thickness tolerances apply to TAKTL panels greater than 5/8" thick, in accordance with the ASTM C 1186 standard.

Back Surface Cast panels are immediately sealed with a plastic film to prevent water from escaping during the curing cycle and ensure higher strength development. Slight rippling of the surface and entrapment of small air bubbles are unavoidable and acceptable.

- **Back Surface Air Voids** Air voids will not affect the performance of the panel with regard to structural integrity, resistance to freeze-thaw or long-term durability. Air voids deeper than 1/8-inch (3.2mm) at a concealed anchor point shall result in relocation of the anchor, evaluation for filling, or rejection.

- **Back Surface Unevenness** Panels with ripples or uneven back surfaces are acceptable if the thicknesses measured at the anchor points are within tolerance of the nominal panel thickness, and variations in the back surface do not interfere with proper mounting of the anchoring system or result in panel installation out of tolerance with regard to alignment to adjacent surfaces. If necessary, the back surface may be ground down to facilitate proper drilling and installation.



Mesh Placement TAKTL Facade + Wall Panels have two layers of continuous alkali-resistant fiberglass mesh embedded inside them as reinforcement. Any panel with exposed white fiber mesh on the front surface should be rejected. Ghosting or telegraphing of the back layer of mesh, where the texture of the mesh is visible but it is completely covered in concrete, is considered passing so long as the panel meets the standard thickness tolerances.

Edge Conditions TAKTL Panels are typically cut to size in production, with edges either straight cut or mitered. Unless otherwise specified, the cut panel edges are unsealed. Visible exposed edges, including quirk miters, can vary in thickness according to the contours of the panel thickness. Irregular edge conditions and minor chips that re not more than 5/16 inch (8 mm) in width, not more than 2 inches (51 mm) in length, and not more than 1/8 inch (3 mm) in depth can be present and are considered acceptable if not visible in good, typical daylight illumination at normal viewing angles (no acute angle extremes) with an unaided naked eye at not less than 20 feet (6 meters) viewing distance. Chipped edges will not impact the panel performance over time with regard to its weather resistance or structural integrity.

Note: Although pigments are integral to the material matrix and consistent throughout, the color of edges and chipped surfaces may be a slightly lighter than the face color by virtue of the finish created at the surface by the mold. Minor chips can usually be camouflaged and edges finished with ColorSeal/T™ that has been matched to the panel face.

Flatness Bowing out of plane is not uncommon for thin panels. If the bowing of the panel prevents proper installation or cannot be controlled by mounting, the panel should be rejected and replaced if visible in good, typical daylight illumination at normal viewing angles (not acute angle extremes) with an unaided naked eye at not less than 20 feet (6 meters) viewing distance.

Anchor Holes (Unused) Occasionally, concealed anchor holes are drilled that do not meet required tolerances. In that case, alternative anchor holes are drilled. Strength testing has confirmed that anchor pull-out tests performed on anchors with an abandoned hole one inch (25mm) away still meet the TAKTL pull-out strength quality standard and design values. Abandoned holes do not increase moisture absorption or affect flexural strength or extended freeze-thaw performance.

Note: For field cutting and drilling, TAKTL recommends maintaining 3 inches (76mm) minimum clearance from anchors because field operations are not expected to be executed with the same quality control procedures, tools, or trained technicians as those in the TAKTL factory.

Texture and Surface Appearance The panel face is inspected for visual consistency and finish upon de-mold, before cutting, and again prior to packing. Minor blemishes and imperfections are deemed acceptable if not visible in good, typical daylight illumination at normal viewing angles (not acute angle extremes) with an unaided naked eye at not less than 20 feet (6 meters) viewing distance. Some examples of such variations and imperfections include:

- **Micro Air Bubbles** Visible pores or micro air bubbles characteristic of some textures or custom patterns. These do not represent any reduction in the strength or durability of the panels.
- **Deviation of Texture** Deviation from a flat surface less than 1/16-inch (1.6mm) in depth.
- **Mesh Shadowing** The mesh layer closest to the panel visibly "telegraphing" or "ghosting" on the surface.
- **Blemishes** Minor dents, stains, or other deviations from approved pattern/texture created either by the mold or through panel processing.

Natural Color Variation TAKTL is a mineral-based product with raw materials that can vary from delivery to delivery and cause color variation in the cast TAKTL panels. This variation is minimized by TAKTL's careful control of raw material specifications, project batch coordination, and production conditions. Darker colors and certain textures have greater potential for color variance.

Weathering TAKTL gains most of its strength during the first month after it is cast, but it will continue to cure for several years. This curing reaction is hydration in the material – water molecules creating bonds with cement – and the panel will therefore interact with water in the environment and lighten slightly over time. Weathering is currently measured according to ASTM G155 with $\Delta E < 2$ at 500 hours. TAKTL utilizes two in-house Xenon-arc weathering chambers for testing custom colors. Laboratory certified testing of custom colors may be arranged for an additional charge.

Beyond conducting industry accepted tests to predict weathering performance, the design and environmental factors beyond TAKTL's control (such as overhangs, sills, orientation to wind and rain), make it impossible to guarantee weathering performance. Differences are to be expected from one facade to another and within a facade at the corners, around windows, and from the top to bottom of the facade.

Note: In order to accommodate projects in which the natural qualities of TAKTL's color variation and weathering are not desired, a standard, factory-applied option, ColorSeal/T™, is available. This method produces an even color within and between panels and exhibits minimal weathering over extended periods. Please note that the ColorSeal/T process eliminates the subtle batch-to-batch color variation that results from raw materials that are natural minerals.

INSPECTIONS AND ACCEPTANCE CRITERIA

Final Factory Inspection Immediately prior to crating, a final inspection is conducted to ensure dimensions, edges, face, and backs are within dimensional and color tolerance and visual acceptance range. Also prior to shipping, lot strength testing and anchor pullout testing records are collected and verified. A manifest accompanies each crate, listing its contents with cross reference to the project panel list and panel layout designations.

Panels are shipped F.O.B. TAKTL's Pittsburgh facility in crates designed to minimize shipping damage. However, damage can occur in transit, so it is imperative that the receiving party carefully inspect crates upon receipt and immediately take action if crates are damaged or show evidence of rough handling.

Delivery/Uncrating Inspection The receiving party is responsible for inspecting panels as they are uncrated for the first time and immediately reporting the condition of the TAKTL panels. Because panels must be handled and stored carefully to avoid edge chipping, cracking, and face staining, TAKTL cannot control nor accept responsibility for damage sustained in storage, handling, or installation. Please refer to Procedure for Reporting Damage and/or Non-Conforming Parts below.

Installation Inspection Some damage or defects will not be apparent during installation, as indicated in the Acceptance Criteria - Summary Chart (Appendix A). These include the installation contractor should communicate problems immediately to the TAKTL Project Manager using the Procedure for Reporting Damage and/or Non-Conforming Parts below.

SHIPPING, INSTALLATION AND MAINTENANCE

Shipping Panels undergo final inspection as part of the packing and shipping procedures. To the extent possible, production and shipping is planned to support the installation sequence; however, this will depend in large part upon how early in the production planning process complete and approved drawings are available. Crates are shipped with a manifest that lists each panel and its reference to the project panel list and panel layout designations.

Uncrating, Handling, and Storing Crates are shipped F.O.B. TAKTL's Pittsburgh plant. The receiving party must carefully read TAKTL Un-Crating, Storage and Handling (Document: H2-1) prior to unloading, storing, or opening crates and indicate his/her understanding of the procedures and authority to accept responsibility for their use.

Cutting, Drilling, and Installation Panels can easily be cut and drilled in the field by an experienced installer who has carefully read TAKTL Field Cutting, Drilling, and Grinding Instructions (Documents: P2-1, P4-1, P6-1) and follows procedures recommended by TAKTL.

Field Repairs Blemishes, chips, staining, or cracks sustained during storing, handling, or installation of panels should be discussed with a TAKTL Project Manager to determine feasibility and method of field repair or replacement.

Care and Maintenance Refer to TAKTL ColorSeal (Doc. SP22-1) or MicroSeal (Doc. SP26-1) Technical Data Documents.

Procedure for Reporting Damage and/or Non-Conforming Parts To report damage or a quality problem, please notify the TAKTL Project Manager via email or phone call as soon as the issue arises, and document the problem with photographs, written description, and as much pertinent information as possible to assist in diagnosing root cause and ensuring satisfactory resolution.

Tolerances + Acceptance Criteria	
Thickness (5/8" [15.9 mm] thick panels)	± 0.050" (± 1.3 mm)
Thickness (3/4" [19 mm] thick panels)	± 0.060" (± 1.5 mm)
Length	± 0.062" (± 1.6 mm)
Width	± 0.062" (± 1.6 mm)
Width (< 12.5")	± 0.5%
Squareness	± 0.062" (± 1.6 mm)
Edge Straightness	± 0.062" (± 1.6 mm)
Hole Location	± 0.062" (± 1.6 mm)
Anchor Tensile Strength	400 lbf (8.5 mm anchors)
Back surface voids	Air voids deeper than 1/8 inch (3.2mm) at a concealed anchor point shall result in relocation of the anchor, evaluation for filling, or rejection
Back surface unevenness	Thickness measured at the anchor points within tolerance of the nominal panel thickness; variations do not interfere with proper mounting or result in non- alignment to adjacent surfaces
Mesh Placement	Mesh completely encased at the back (ghosting on back of panels acceptable
Cut edge conditions	Edge chip or edge surface blemish that is not more than 5/16 inch (8mm) in width, not more than 2 inches (51 mm) in length, and not more than 1/8 inch (3mm) in depth
Deviation from flat	Bowing should not prevent proper installation and be corrected by mounting
Anchor holes (Unused)	Must be at least 1 inch (25 mm) from active anchor hole
Deviation of Texture	Deviation from a flat surface less than 1/16-inch (1.6mm) in depth, 1/8-inch (3.2 mm) width, and 2 inches (51 mm) in length with a gradual change in topography
Micro-air bubbles	Acceptable if not visible in typical daylight illumination at normal viewing angles (not acute angle extremes) with an unaided naked eye at not less than 20 feet (6 meters) viewing distance
Mesh Shadowing	
Blemishes, Dents, Stains	