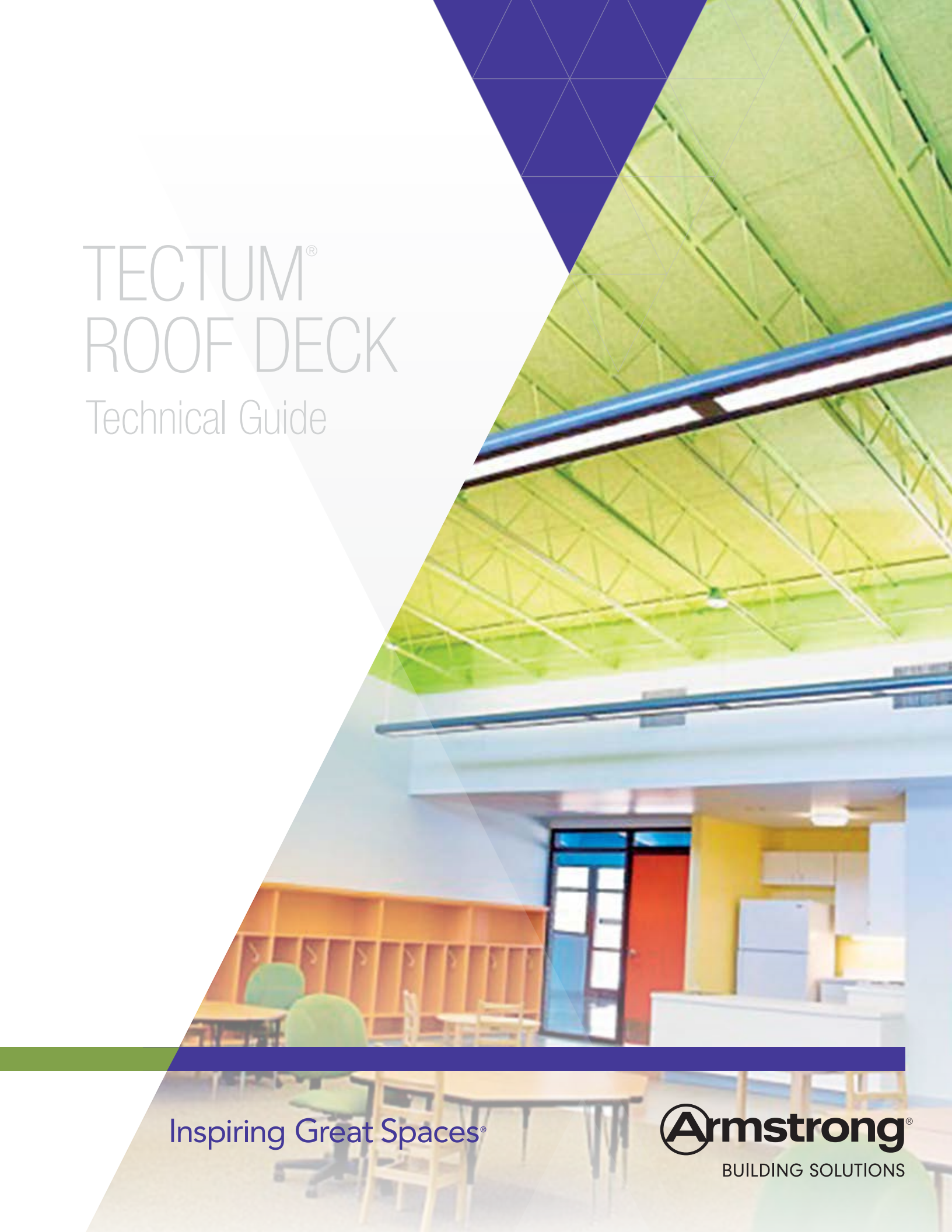
TECTUM® ROOF DECK

Technical Guide



Inspiring Great Spaces®

Armstrong® BUILDING SOLUTIONS

TABLE OF CONTENTS

3 **Acoustics**

– Comparison: Metal Roof Deck Types vs. Tectum® Roof Deck

– Tectum Roof Deck Acoustical Performance

4 **Fire Performance & Code Compliance for Tectum® Roof Deck**

4 **Wind Uplift**

5 **Insulation–Dew Point, Humidity, Ventilation**

7 **Painting**

ROOF DECKS AND ACOUSTICS

Types of Acoustical Metal Roof Deck Systems

Acoustical steel roof deck systems (perforated tin) are identified as either type B, B1A, BW or N, and 3NA or N1A (wide-ribbed roof decks).

Acoustical steel decks claim to absorb up to 90% of the sound in a space. How they achieve 90% sound absorption using a reflective metal surface is important to understand and the acoustical data must be carefully analyzed. To reach these high absorption values, glass fiber roof insulation must be installed in the flutes of the ribbed roof deck. This is the responsibility of the roofing contractor.

A second type of metal deck is the cellular deck. The cellular deck has a flat perforated surface. The typical thickness ranges from 1-1/2" to 3". The acoustical data for the cellular deck gives insight into the effectiveness of the B and N systems. The cellular type deck without insulation has an NRC of 0.15 to 0.30 as a result of the airspace. The addition of fiberglass insulation into the steel ribs raises the NRC to 0.65 with a maximum of 0.80.

Acoustical Performance Must Be Based On the System

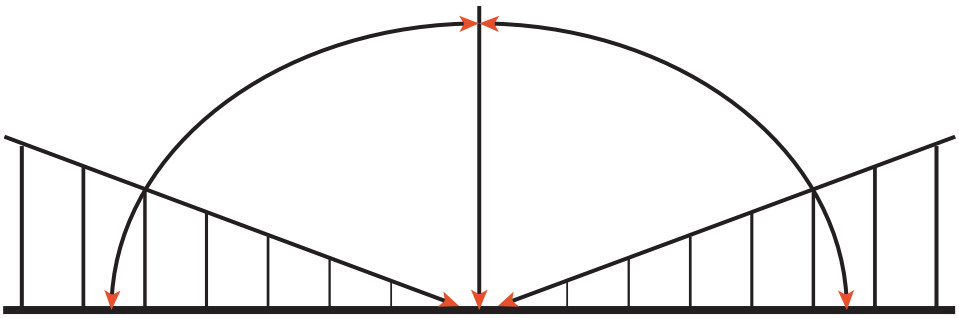
Why is there acoustical performance difference in the two systems? The difference is the 2" fiberglass roof insulation used in the test and the size of the test chamber. Seldom, if ever, is an acoustical steel roof deck (perforated tin) installed with a 2" rigid fiberglass roofing insulation—it is too expensive. In addition, codes may require a thermal barrier to protect the insulation/roofing materials and a 5/8" or thicker gypsum panel must be installed over the deck. Where humidity is a problem, a vapor retarder would also be required, which would further negate the effect of the 2" fiberglass rigid insulation.

Perforations On Vertical Surfaces Perform Less Efficiently

The type B or N surface perforations in the flutes perform less efficiently than perforations in the flat plate cellular metal deck. At certain angles of incident the sound waves do not enter the perforations. Therefore, these decks reflect more sound.

The Most Effective Acoustical Roof Deck System

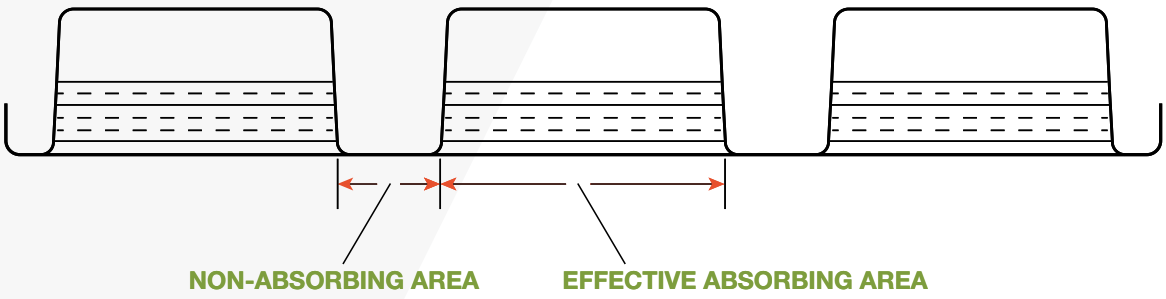
The flat surface of Tectum®, with its complex texture of interconnected openings, absorbs sound energy effectively and efficiently. For a flat absorptive surface, such as Tectum panels, all of the area is absorptive; whatever the angle of impingement; but it is particularly effective at normal or near normal impingement, as true of high ceilings or roof decks in gymnasiums, coliseums, civic centers, auditoriums, and multi-purpose arenas. Sound energy striking against (or impinging) the Tectum surface is absorbed. The following drawing illustrates, in a random field, all impinging energy lies within a 180° semi-circle.



NOISE SOURCE

In the most common acoustical steel decks, the perforations are punched openings in the ribs. In a typical ribbed metal deck, even in a random field, only about one-half of the surface exposed to the sound is absorptive. In a high building, the field is not random, but more or less “normal” or at right angles to the flat surface. The impinging sound energy tends to balloon and glance off the ribbed-style acoustical deck. Thus, only one half or less of the roof deck area is absorptive. Giving the perforated area an NRC of 0.75, the effective NRC of the roof is only 0.38 – just about what field tests show.

The type H and NF flat plate acoustical steel deck is as effective as Tectum® roof deck. However, the price is considerably higher and as a result not used as often.



Tectum Roof Deck systems continue to outperform all structural acoustical roof decks including the acoustical steel deck (perforated tin). Note: Field tests have verified the consistent performance of Tectum roof deck systems. An NRC up to 1.00 on specific systems. Steel deck absorption values for greater that 1000 hertz consistently are lower (less absorption) than any Tectum roof deck system. A natural white surface is available and the Tectum roof decks can be painted up to six times without the loss of the acoustical performance. While even one coat of paint will negatively affect the noise absorption effectiveness of the acoustical steel deck.

The overall acoustical effect can be calculated by using the Armstrong® Reverberation Time Calculator located at armstrongceilings.com

FIRE PERFORMANCE AND ROOF DECK

There are a number of fire considerations when specifying Tectum roof decks. There are also a number of different fire tests and codes that must be met. These include ASTM E84 / UL 723, ASTM E2768 / UL 1256, and ASTM E198 / UL 790. Each of these tests deals with a different fire exposure and has a very different purpose.

ASTM E84 / UL 723 is the Steiner Tunnel test. This test measures flame spread index and smoke developed index on the surface of a material. This test is required for any material that forms an exposed interior surface within a building. Tectum materials have a flame spread index of 25 or less and a smoke developed index of 50 or less for all surfaces that could be exposed through cutting or drilling.

ASTM E2768 / UL 1256 / 30 Minute E84 are all variations of the standard E84 tunnel test which has been extended an additional 20 minutes. The requirement for these tests is to have a flame spread index of 25 or less and show no evidence of significant progressive combustion, when the test is continued for an additional 20-minute period. In addition, the flame front has not progressed more than 10 feet. By meeting these requirements, these products meet the IBC fire test requirements of fire retardant treated wood thus allowing them to be used in many applications requiring only noncombustible materials. These tests deal with the structural characteristics of the deck during a fire.

ASTM E108 / UL 790 are tests that measure fire exposure from exterior sources to roof covering assemblies. These are a measure of the assembly and not just the roof deck.

The International Building Code allows fire retardant treated wood to be used as an alternative for noncombustible materials in certain applications. Tectum® I, Tectum III and Tectum E panels can be substituted for non-combustible materials in the roofs of buildings requiring non-combustible construction where the design loads conform to the Tectum substrate. Exception: In buildings of Type I construction exceeding two stories in height, fire-retardant treated wood is not permitted in roof construction when the vertical distance from the upper floor to the roof is less than 20 feet. It also can be used unprotected in assembly, business, education, and residential occupancies when the roof decks can be exposed under these conditions. Tectum decks are permitted in non-combustible type construction where heavy timber building is permitted.

WIND UPLIFT RESISTANCE & ROOF DECK ASSEMBLIES

What is the UL 580 Standard for Tests for Uplift Resistance of Roof Assemblies?

This test is an evaluation of comparative resistances of roof assemblies to simulated load which correspond to wind velocities of 100–174 mph. This test evaluates the roof deck, its attachments to supports and roof covering materials only.

The test is conducted by applying various positive pressures to the underside of the deck and various negative pressures (vacuum) to the top of the deck. Three classifications are possible; Class 30, Class 60, and Class 90.

Uplift Resistance Classification

Roof Deck Constructions Classified for Uplift Resistance have been investigated for damageability from both external and internal pressures on the deck associated with high velocity winds. Uplift classifications are derived from tests conducted in accordance with the Standard for Tests for Uplift Resistance of Roof Assemblies, ANSI/UL 580. The ANSI/UL 580 test method subjects a 10 ft. X 10 ft. test sample to various static and oscillating air pressures to index performance under uplift loads imposed on roof decks.

The magnitude of the wind velocity across a roof deck and the resulting uplift pressures on a roof deck are dependent upon many factors such as wind gusts, the shape of the roof deck, edge configuration and the landscape surrounding the roof deck installation. A method to calculate the uplift pressures on roof decks is contained in the American Society of Civil Engineers (ASCE) Standard 7, Minimum Design Loads for Buildings and Other Structures.

The nominal static uplift pressure, the oscillating uplift pressures and the maximum static uplift pressure for each Class are:

CLASS	NOM STATIC UPLIFT PRESSURE PSF	RANGE OF OSCILLATING PRESSURE PSF	MAX STATIC UPLIFT PRESSURE PSF
15	15	11 to 21	23
30	30	22 to 42	45
60	60	44 to 83	75
90	90	66 to 90	105

The static pressures are maintained for a 5-minute period and the oscillating pressures are applied at a 10 ±2 frequency and are maintained for a 60-minute period for each Class. An assembly rated Class 60 has successfully withstood pressures imposed during Class 30 and Class 60 tests. An assembly rated Class 90 has successfully withstood pressures imposed during Class 30, Class 60, and Class 90 tests.

The test method provides a comparative measure of uplift resistance of roof deck constructions. The test evaluates the roof deck or roof deck assembly and its attachment to supports as well as the attachment of the roof covering, if used.

In addition to UL 580 Classification, Tectum® IIIW roof decks also have Miami-Dade County NOA (Notice of Acceptance, approval #18-0619.03. The NOA covers the High Velocity Wind Zone areas of Broward (Fort Lauderdale) and counties with design wind speeds of 140 mph and 146 mph respectively. The NOA is the highest standard designed to protect structures from any wind-borne debris that would result from hurricane force winds.

TECTUM® ROOF DECK: DEW POINT, RELATIVE HUMIDITY, AND VENTILATION

Relative humidity is a measure of the amount of water vapor in the air as compared to how much water vapor the air can hold at a given temperature. The amount of water vapor air can hold is dependent upon temperature. Colder air cannot hold as much water vapor as warmer air. When the amount of water vapor in the air reaches the saturation point some of the water vapor will start to condense. This point is called the dew point temperature. This condensation will always start on anything with a lower temperature than the air.

A major area of concern in buildings or construction results when the condensation from high inside humidity levels and low outside temperatures causes a dew point within building products. If the dew point occurs within a material this condensation will occur with the material. The main ways to prevent this from occurring are to either raise the internal temperature (mainly through adding insulation) or to add a vapor retarder. Proper installation is critical for vapor retarders to perform properly. This includes proper sealing and taping.

When properly designed, Tectum® panels have been used for many years, without problems, in very high humidity areas such as swimming pools and natatoriums.

Tectum III panels have a built-in vapor retarder with Styrofoam™ brand insulation. A dew point that results from inside/outside temperature differences, with moisture, can create problems with any roof deck including Tectum roof deck unless a vapor retarder is present with additional insulation above the vapor retarder. The objective is to add a vapor retarder and additional insulation to Tectum panels so that the condensation does not occur within the Tectum panels and moisture does not penetrate the insulation and condense.

The amount of insulation required, depends on the location's average low temperatures and humidity, relative to the indoor conditions where it is installed. A vapor retarder and insulation may be necessary; this is evaluated on a case by case basis.

Every building has a certain amount of humidity. However, it becomes a problem only when the inside humidity and the outside temperature combine to cause condensation in the deck or insulation.

Proper design prevents this from occurring within the roof deck system by designing for the average mean January temperature in the area, the likely normal humidity percentage inside and the probable inside temperature.

Vapor retarder is defined as: A material having a perm rating of 1.0 or less such as foil, plastic sheathing or insulation facing, installed to retard passage of water moisture through the exterior envelope. ASHRAE Fundamentals Handbook states that, "The accepted perm rating of a vapor barrier for use in domestic construction is 1.0 perm."

The Styrofoam brand insulation used in Tectum III roof deck qualifies as a vapor retarder under both definitions. Styrofoam brand insulation thicknesses have the following perm ratings. These perm ratings were determined by the ASTM E96 test procedure.

Thickness	Permeance (Maximum)
1.5"	1.0
2.0"	0.8
3.0"	0.6

Neither polyisocyanurate (ISO) nor extruder polystyrene (EPS) board roof insulations meet the definitions of a vapor retarder.

Ventilation Requirements for Roof Decks

Tectum® Roof Decks may be used in conjunction with a suspended ceiling. Ventilation to the outside of the building must be provided in the ratio of 0.48 in.^{2} of vent for every ft.^{2} of plenum area. Vents should be provided at the exterior and on all sides of the building, wherever practical. Ridge vents are recommended on sloped roofs. Local building codes should be consulted to verify all ventilation requirements of the code are being met.

DO NOT vent shower rooms, cavity walls, exhaust fans, and similar areas into the plenum. Ventilation requirements should not be neglected in order to reduce construction costs. Armstrong Building Solutions recommends the architect consult a mechanical engineer for ventilation requirements where humidity and temperatures higher than normal are anticipated.

PAINTING SPECIFICATIONS AND RECOMMENDATIONS

Field Painting

Field Painting Specification Recommendation: Sherwin-Williams® Product: Waterborne Acrylic Dry Fall (B42W1) 50 GAL. Drums MPI# 118 (or substitute Alkali-based, flat latex paints with similar properties) Tests have shown six coats of spray-applied paint have no negative impact on the acoustical and fire properties of the Tectum® panels.

- **Recommended Spread Rate per Coat:** Wet Mils: 3.5–5.0; Dry Mils: 1.5–2.0
- **Coverage:** 336–450 sq. ft./gallon approximate (based on flat surface). If necessary, cross spray at a right angle.
- **Surface Preparation:** Surface must be clean, dry, and in sound condition. Remove all oil, dirt, grease, and other foreign material to ensure adequate adhesion.

Application Condition

- **Temperature:** 50° F minimum, 110° F maximum (air, surface, and material); At least 5° F above dew point.
- **Relative Humidity:** 75% maximum
- **Dry Time:** 20 minutes
- **Recoat:** 1 hour*; During the early stages of drying, the coating is sensitive to rain, dew, high humidity, and moisture condensation.
- Plan painting schedules to avoid these influences during the first 16–24 hours of curing. Dry fall characteristics will be adversely affected at temperatures below 77° F or above 50% relative humidity.

* Tectum panels should be fastened in place prior to field painting.

Application Equipment

The following is a guide. Changes in pressure and tip sizes may be needed for proper spray characteristics.

- **Airless Spray:** Pressure: 2800 Hose: 1/4"; ID Tip: 0.013"; Reduction: As needed up to 10% by volume.
- **Conventional Spray:** Gun: Binks 95; Fluid Nozzle: 63C; Air Nozzle: 63PB
- **Atomization Pressure:** 60 psi
- **Fluid Pressure:** 50 psi
- **Reduction:** As needed up to 20% by volume
- **Brush and Roller:** Not recommended

Field Touch Up and Color Match

- **Standard White Color Match:** Sherwin-Williams® #SW7005
- **Standard Natural Color Match:** Sherwin-Williams #SW6126

TAKE THE NEXT STEP

1 877 ARMSTRONG (276-7876)

Customer Service Representatives
7:45 a.m. to 5:00 p.m. EST Monday through Friday

TechLine – Technical information, detail drawings, CAD design assistance, installation information, other technical services – 8:00 a.m. to 5:30 p.m. EST, Monday through Friday. FAX 1 800 572 8324 or email: techline@armstrongceilings.com

armstrongbuildingsolutions.com/tectum

Latest product news

Standard and custom product information

Online catalog

CAD, Revit®, SketchUp® files

Product literature and samples – express service or regular delivery

armstrongbuildingsolutions.com/tectum

Inspiring Great Spaces®

Armstrong® BUILDING SOLUTIONS

BPCS-1038-519