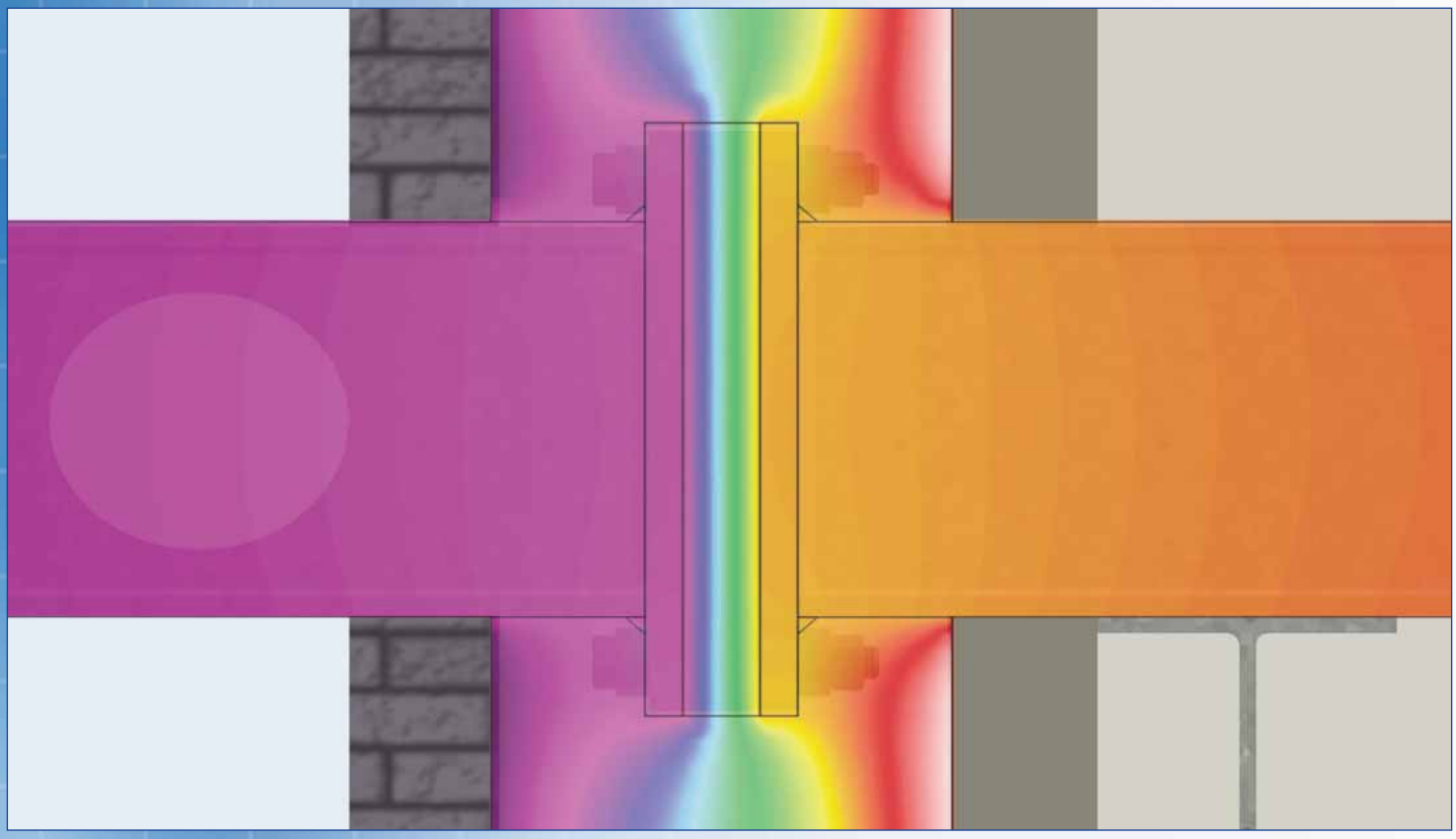
FABREEKA-TIM®



Product Catalog and Design Guide - Thermal Insulation Material

Fabreeka-TIM® Structural Thermal Break

FABREEKA-TIM®

What kinds of Thermal Break materials are you using?

Fabreeka-TIM® is trusted as the official thermal break solution specified by building professionals everywhere. It is considered a green product for its energy savings with regard to energy loss caused by thermal bridging. In addition it is proven to have high compressive strength combined with resistance to thermal conductivity. Made from a fiberglass-reinforced composite, Fabreeka International's Thermal Insulation Material (Fabreeka-TIM®) has a per-inch R-value of 0.56 (BTU/Hr/ft2/in/°F = 1.8) and is far superior to steel (R-0.003) or concrete (R-0.08), providing a structural thermal break between flanged steel framing members.

Why Choose Fabreeka-TIM®?

1. Made in the USA
2. ASTM Certified
3. Meets UL certification
4. ROHS II compliant
5. Used to achieve LEED certification
6. Enhances building envelope performance
7. Aids in meeting ASHRAE 90.1 and 189.1 energy standards
8. Reviewed on BuildingGreen.com/GreenSpec
9. Independently tested and certified to published specifications
10. Lot Control - repeatable, certified product every time
11. In-house Quality Control
12. Stock on hand in 1/4" (6.4mm), 1/2" (12.7mm), 1" (25.4mm) for quick turnaround times
    Also available in 3/4" (19.1mm) and 2" (50.8mm) thick
13. Precise, smooth cutting by water jet
14. Application engineers available for technical support
15. Best value added thermal break solution for shear connections to help lower energy costs
16. Exceptional customer service and follow up

LEED Description and Potential Credits

LEED, or Leadership in Energy & Environmental Design, is a green building certification program through the US Green Building Council that recognizes best-in-class building strategies and practices. To receive LEED certification, building projects satisfy prerequisites and earn points to achieve different levels of certification. Prerequisites and credits differ for each rating system, and teams choose the best fit for their project.

EAc1: Optimize Energy Performance
- NC-2009
- NC-v2.2
- CS-2009
- Schools-2009

EAp2: Minimum Energy Performance
- NC-2009
- NC-v2.2
- CI-2009
- CS-2009
- Schools-2009

Fabreeka-TIM® is a structural thermal break/ insulation material that is manufactured from a fiberglass-reinforced laminate composite. The properties of this material provide a thermally efficient, energy-saving product that prevents thermal bridging in structural connections. Fabreeka-TIM® is a load bearing "thermal break" used between flanged steel connections. The primary benefit is that it maintains structural integrity of a connection while reducing energy loss.

*Color may vary slightly.

The Building Envelope & Thermal Bridging

The need to evaluate thermal bridging in a building's design and performance, especially when seeking LEED accreditation, has become more prevalent because of the increasing requirements for more energy efficient buildings. In structural steel buildings, thermal bridging occurs when conductive materials provide a conduit for energy to transfer across a thermal barrier creating an energy loss and potential for condensation. In colder climates, internal heat will find the path of least resistance, and will always want to transfer to the colder side, resulting in more energy needed to maintain room temperature. The opposite can be said for warmer climates. Up to one-third of a building's energy could be lost through thermal bridges in structures *without* thermal breaks. By using Fabreeka-TIM® you can greatly reduce thermal energy transfer by introducing a thermal break into the structure with low thermal conductivity between higher conductive materials. When selecting a thermal break it is important to review the structural and thermal performance of the material and what test standards were used to evaluate the product.

With the development of ASHRAE codes 90.1, 189.1 and energy efficient buildings it is useful to protect the building envelope from thermal bridging with the use of thermal break materials. Since many thermal break paths are created from canopy and balcony designs, adding a thermal break material in shear can become challenging. Architects and Structural Engineers must ensure materials are suited for the structural application. Fabreeka-TIM® material provides the needed strength combined with its R value properties to satisfy both requirements.

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Up until recent years there was little known about how to determine thermal bridging characteristics in buildings, but with the help of recent studies more information is becoming available. In March of 2012, a joint committee of AISC and SEI members published a supplement to Modern Steel Construction titled "Thermal Bridging Solutions: Minimizing Structural Steel's Impact on Building Envelope Energy Transfer"[1], which provides a definition of thermal bridging, calculations of thermal conductivity, and solutions for preventing, as it pertains to steel connections.

A study released in the fall of 2014 by the independent firm Morrison Hershfield, titled "Building Envelope Thermal Analysis (BETA) Guide Part 1", Section 1.2 "Methodology for Determining Thermal Performance of Building Envelope Assemblies"[2], explains the vital information designers can use for evaluating energy loss and determining thermal values for the building envelope and energy conservation.

As new and refurbished buildings strive for conformance to LEED and other "green" certifications, the importance of reducing thermal bridging in the building envelope becomes a priority, which was not the case in the past. A variety of applications within buildings and the building envelope are now calling for thermal breaks to help prevent thermal bridging. Because the best solutions depend on the application it is important to understand why and when to use certain types of thermal breaks over others. Fabreeka is here to provide proven products and services to engineers for vibration isolation and thermal break solutions.

Sample Specification

Thermal Insulation Material:

1. Fiberglass-Reinforced Laminate Composite, Fabreeka-TIM® , as manufactured by Fabreeka International, Inc.
2. Material shall maintain structural integrity of connections. Refer to Structural Drawings for specific Load requirements.
3. Ultimate Material Properties:

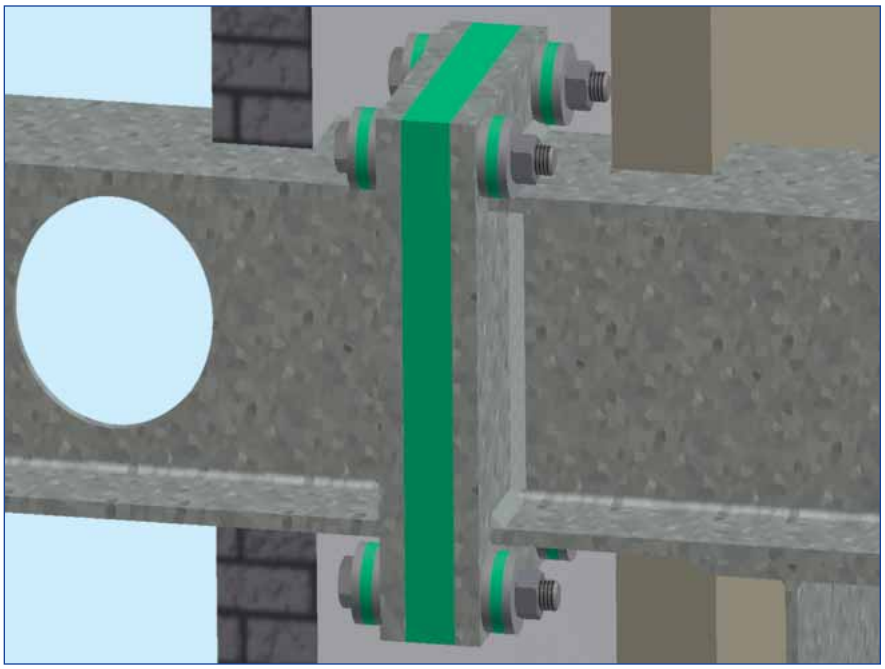
a. Tensile Strength	ASTM D638	11,000 psi (75.8 MPa)
b. Flexural Strength	ASTM D790	25,000 psi (172.4 MPa)
c. Compressive Strength	ASTM D695	38,900 psi (268.2 MPa)
d. Compressive Modulus	ASTM D695	
i. 1/2" thk (12.7mm)		291,194 psi (2,007.7 MPa)
ii. 1" thk (25.4mm)		519,531 psi (3,582.0 MPa)
e. Shear Strength	ASTM D732	15,000 psi (103.4 MPa)
f. Thickness		1" (25.4mm) or as indicated
g. Oxygen Index	ASTM D2863	21.8%
h. Coefficient of Thermal Expansion	ASTM D696	2.2
i. Thermal Conductivity	ASTM C177	1.8 BTU/Hr/ft^2/in/°F (0.259 W/m*°K)
j. Density		107.83 lb/ft^3 (1727Kg/M^3)

Fabreeka's sample specification is available in multiple file formats. Please contact us, or visit our website.

[1] "Thermal Steel Bridging", NASCC 2011, D'Aloisio/Miller-Johnson

[2] "Building Envelope Thermal Analysis (BETA) Guide Part 1", Section 1.2 "Methodology for Determining Thermal Performance of Building Envelope Assemblies", Morrison Hershfield, http://www.morrisonhershfield.com/newsroom/Pages/Highly-Anticipated-Building-Envelope-Thermal-Bridging-Guide-Now-Public.aspx

This document is intended to be a practical design guide to the structural engineer specifying Fabreeka-TIM® Thermal Insulation Material in lintel, canopy or end plate connections where moment forces occur. Final connection design should be made by a registered structural engineer. The examples shown in this design guide are for informational purposes only. The data shown may be used to assist the structural engineer in the final design.



Thermal Transmittance

To minimize energy loss due to heat flow through a building envelope via a structural connection, the heat transfer properties of the materials used within the envelope must be known. The ability of a material to resist heat flow is commonly known as the material's "R" value. Using Fabreeka-TIM® material as a "thermal break" or thermal insulator in a structural connection will reduce the rate at which heat flows by conduction, thereby changing the temperature gradient across the connection.

The R value for Fabreeka-TIM® material can be calculated by using the thermal conductivity value (K) and the material thickness (t) where:

$$R = t/K$$

Note: Thermal conductivity value (K) of a material is *independent* of thickness. However, the unit of inch is typically used as a standard for thermal insulation materials.

A material's "C" value or thermal conductance <u>does</u> depend on thickness where:

$$C = K/t$$

The C value of 1" (25.4mm) thick Fabreeka-TIM® material is half the value of 1/2" (12.7mm) thick Fabreeka-TIM® material. The thicker the material, the lower its C value.

The R value can also be calculated by using the C value of Fabreeka-TIM® material where:

$$R = 1/C$$

so

$$R = 1/C = t/K$$

Therefore, if the thickness of Fabreeka-TIM® material is 1" (25.4mm) and the K value is 1.8 (0.259), the C value is 1.8 (10.2), and the corresponding R value is 0.56 (0.098).

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Thermal Value Material Comparison K value[3] in BTU/Hr/ft^2/in/°F* (K value[3] in W/m*°K*)				
Thickness	**Material**	**Thermal Conductivity K Value**	**Thermal Conductance C Value**	**Heat Flow Resistance R Value**
1/4" (6.4mm)	**Fabreeka-TIM®**	**1.8 (0.259)**	**7.2 (40.5)**	**0.14 ($2.5x10^{-2}$)**
	Stainless Steel	**111 (16)**	**444 (2,500)**	**0.002 ($4x10^{-4}$)**
	Carbon Steel	**375 (54)**	**1,500 (8,438)**	**0.0007 ($1.18x10^{-4}$)**
1/2" (12.7mm)	**Fabreeka-TIM®**	**1.8 (0.259)**	**3.6 (20.4)**	**0.28 ($4.9x10^{-2}$)**
	Stainless Steel	**111 (16)**	**222 (1,260)**	**0.004 ($7.9x10^{-4}$)**
	Carbon Steel	**375 (54)**	**750 (4,252)**	**0.001 ($2.35x10^{-4}$)**
1" (25.4mm)	**Fabreeka-TIM®**	**1.8 (0.259)**	**1.8 (10.2)**	**0.56 ($9.8x10^{-2}$)**
	Stainless Steel	**111 (16)**	**111 (630)**	**0.009 ($1.59x10^{-3}$)**
	Carbon Steel	**375 (54)**	**375 (2,126)**	**0.003 ($4.7x10^{-4}$)**

Also available in thicknesses of 3/4" (19.1mm) and 2" (50.8mm).

The thermal transmittance, or U factor, of an entire assembly (system) is dependent on the C values and R values of the materials used in that system. Where:

$$U = 1/R_{TOTAL} \text{ (series) or } 1/R_{Eff} \text{ (parallel)}$$

The lower the U value, the lower the rate of heat flow for a given set of conditions.

Note: C value in BTU/Hr/ft^2/°F or (C - W/m^2*°K)
R value in Hr*ft^2*°F/BTU or (R - °K*m^2/W)

CAUTION

R values of materials within a building envelope can be added when the materials resist heat flow in series but cannot be added when there are parallel paths for heat flow. To accurately determine a system's overall effective R value requires a careful analysis. For accurate results, a 2D or 3D heat flow analysis program may be used.[4]

[3] Assumes steady state conditions and heat flow at a constant rate
* Temperature difference/gradient across connection (Δt)
[4] "Thermal Steel Bridging", NASCC 2011, D'Aloisio/Miller-Johnson

Ultimate Properties of Fabreeka-TIM®

Mechanical Properties (Nominal)			
Tensile Strength	PSI (MPa)	ASTM D638	11,000 (75.8)
Flexural Strength	PSI (MPa)	ASTM D790	25,000 (172.4)
Compressive Strength	PSI (MPa)	ASTM D695	38,900 (268.2)
Compressive Modulus - 1/2" (12.7mm) thk	PSI (MPa)	ASTM D695	291,194 (2,007.7)
Compressive Modulus - 1" (25.4mm) thk	PSI (MPa)	ASTM D695	519,531 (3,582.0)
Shear Strength	PSI (MPa)	ASTM D732	15,000 (103.4)
Operating Temperature Range *Loss in Ultimate Property Strength = 30% at 250°F	°F (°C)	-	-20 to +250* (-29 to +121*)
Thickness	in (mm)	-	1/4, 1/2, 3/4, 1, 2 (6.4, 12.7, 19.1, 25.4, 50.8)
Flame Resistance (Nominal)			
Oxygen Index	$\%O_2$	ASTM D2863	21.8
Thermal Properties (Nominal)			
Coefficient of Thermal Expansion	$in/in/°C x10^{-5}$	ASTM D696	2.2
Thermal Conductivity	$BTU/Hr/ft^2/in/°F$ W/m*°K	ASTM C177	1.8** 0.259**
Density	lb/ft^3 (Kg/M^3)		107.83 (1727)
***Reference:* Thermal Conductivity of Steel	$BTU/Hr/ft^2/in/°F$ W/m*°K		374.5 54.0

Coefficient of Friction Values (μs) [5]		
	5,000 psi (34.5 MPa)	**10,000 psi (69 MPa)**
Fabreeka-TIM® to Steel	**0.27**	**0.26**
Steel to Steel	**0.8**	**0.8**

[5] Surface roughness of steel 1.4 μin

Condensation Considerations

Condensation buildup can be addressed by designing the thermal break within the interior envelope of the structure as close to the outside wall as possible, applying a moisture barrier to the interior of the wall, and incorporate the appropriate insulation per the owner's scope of work.

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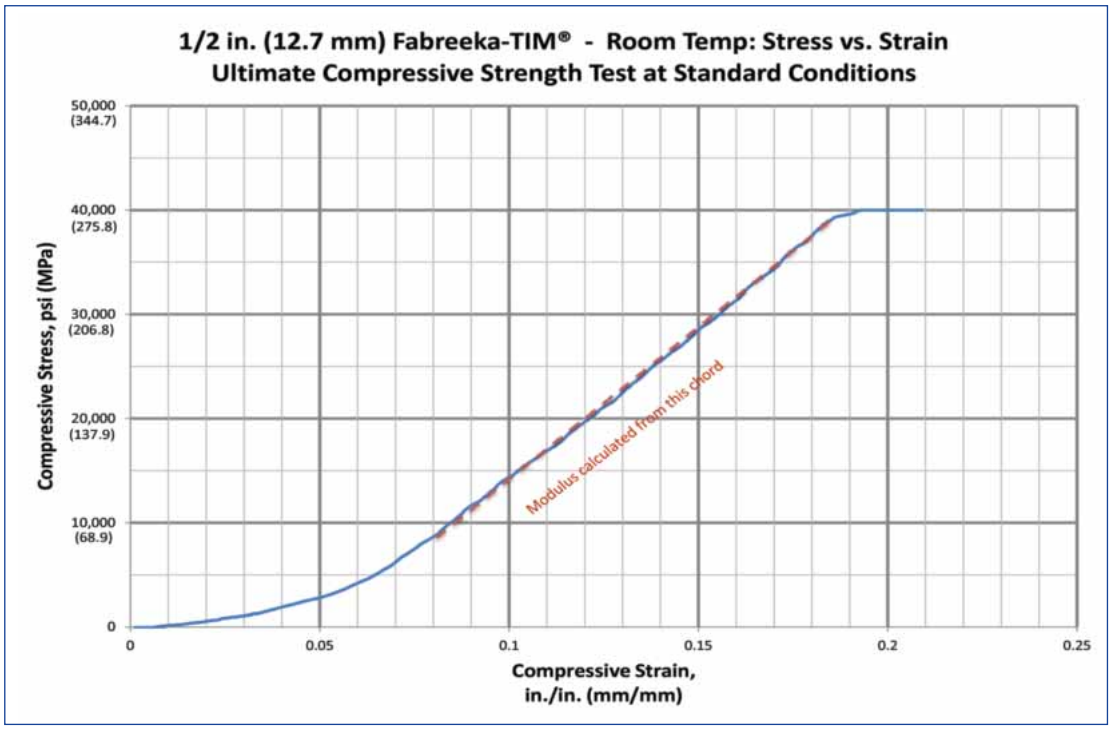
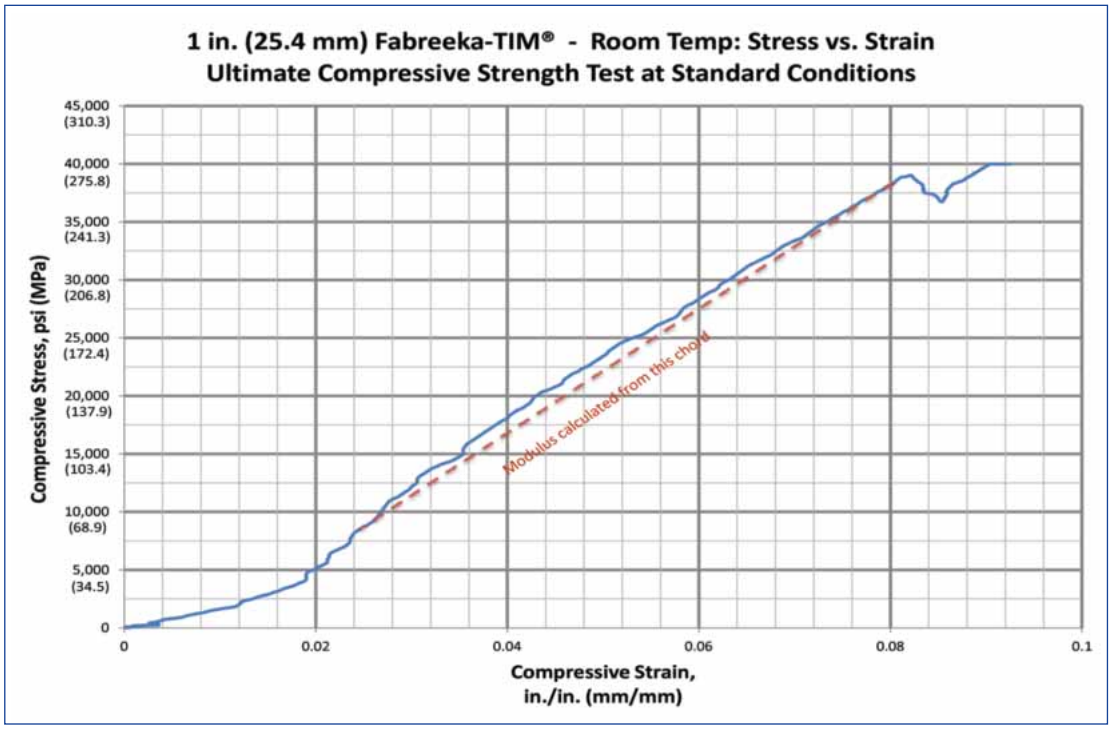
Compressive Modulus

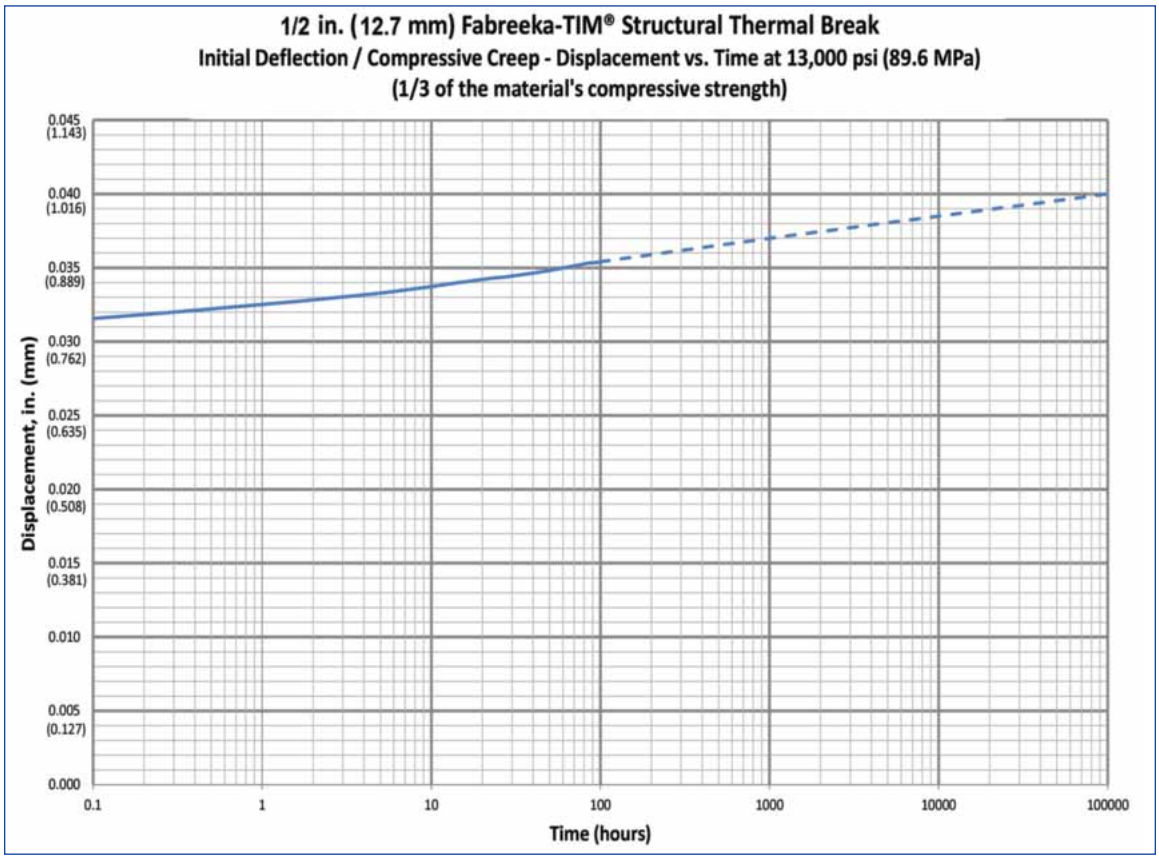
Room Temperature Modulus Calculation - Imperial (Metric) Determined as chord modulus from Stress-Strain curve between 10,000 and 38,900 psi (68.9 and 268.2 MPa)					
Sample Size in (mm)	Test Data Point 1		Test Data Point 2		Modulus psi (MPa)
	Stress psi (MPa)	Strain in/in (mm/mm)	Stress psi (MPa)	Strain in/in (mm/mm)	
0.5 x 2.34 x 2.34	10,153	0.0852	38,923	0.1840	291,194
1.0 x 2.34 x 2.34	9,997	0.0268	38,779	0.0822	519,531
(12.7 x 59.4 x 59.4)	(70.0)	(2.1640)	(268.6)	(4.6736)	(2007.7)
(25.4 x 59.4 x 59.4)	(68.9)	(0.6807)	(267.4)	(2.0879)	(3582.0)

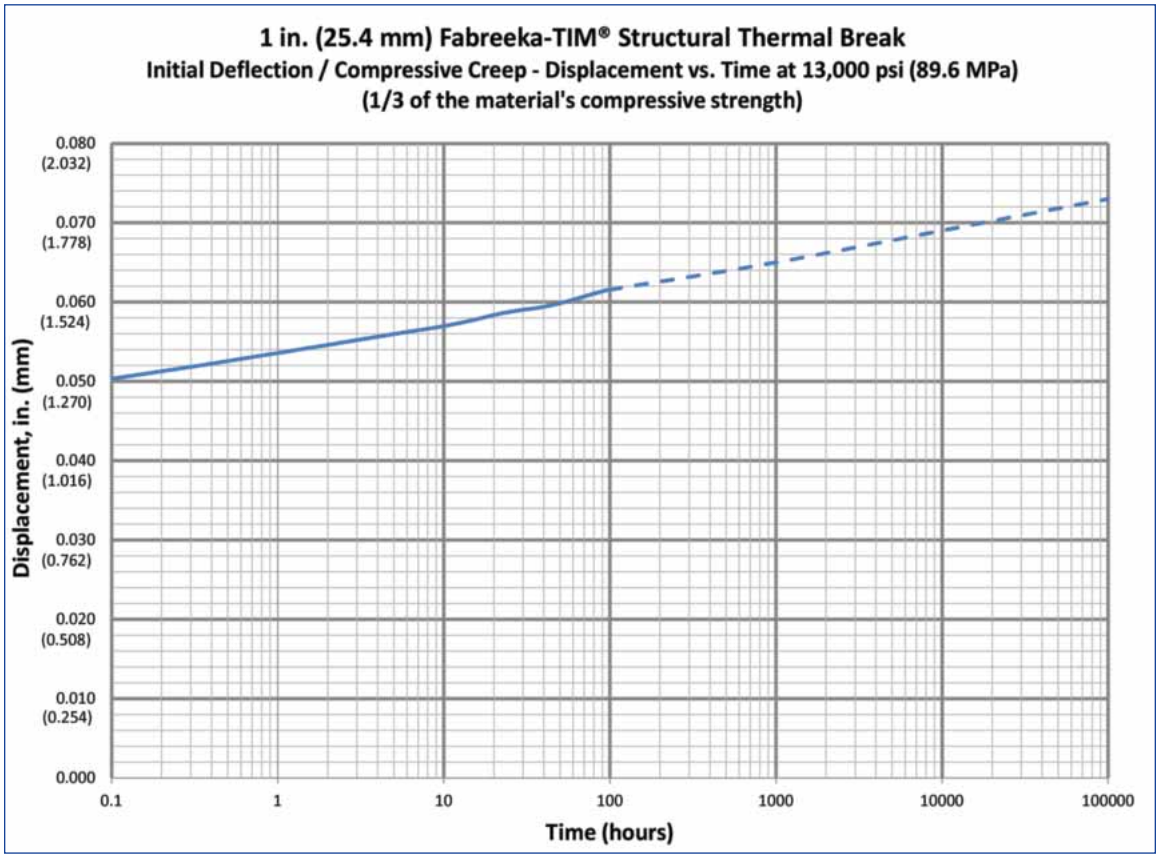


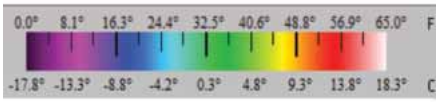


Initial Deflection / Creep

Per ASTM D2990



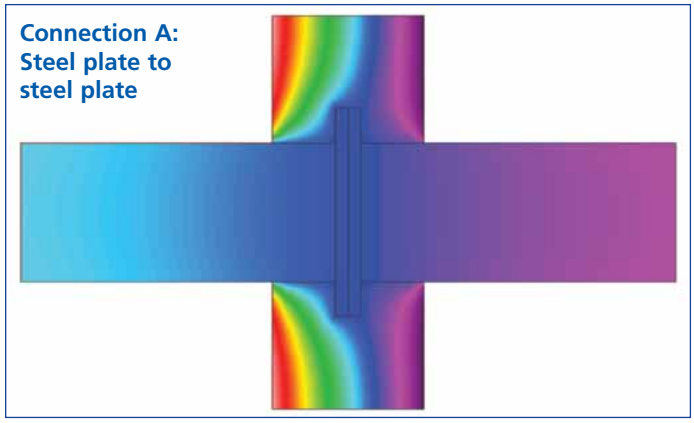


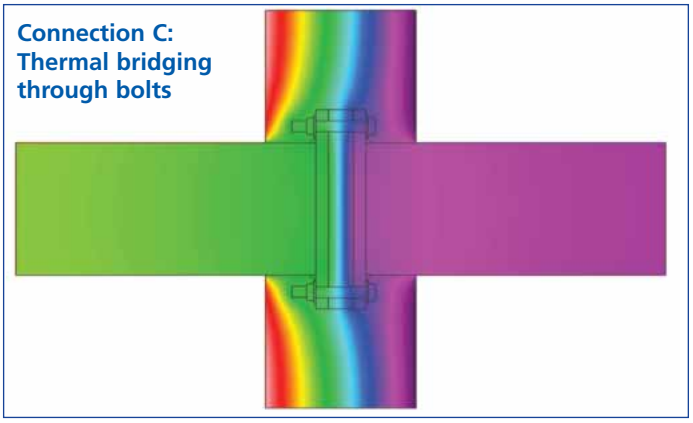


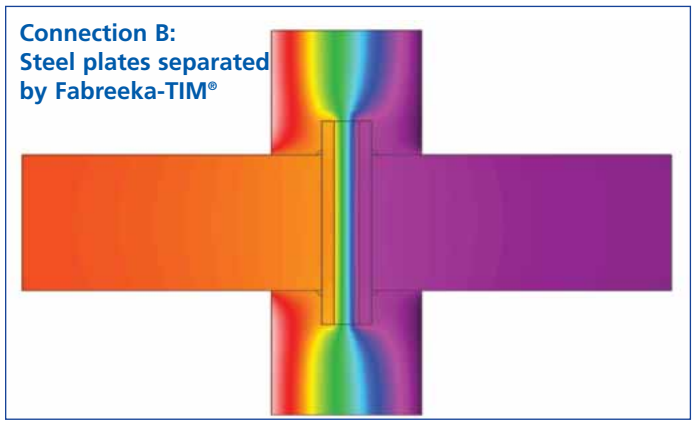
Boundary conditions for all thermal models on pages 10-11 *are 70°F (21°C) inside and 0°F (-18°C) outside, and assume a wall with an effective R-value of 6.2. The models show energy flow through an end plate connection with and without Fabreeka-TIM® material.*

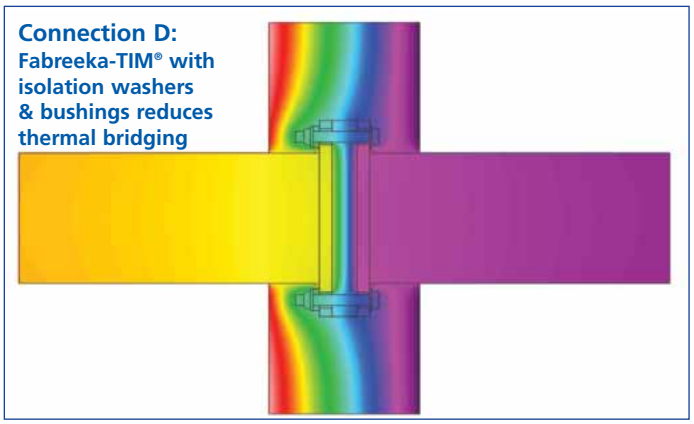
Connection A shows a typical beam-to-beam connection without a thermal break. Note the heat flow gradient through the connection. In Connection B, 1" (25.4mm) thick Fabreeka-TIM® material was added between the steel beams. Note the distinct thermal break of the heat flow on either side of the Fabreeka-TIM® material.

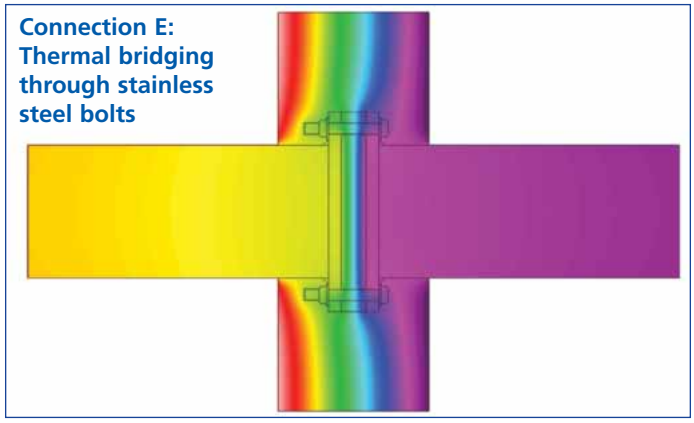
In Connection C, the heat flow profile shows how bolts act as a "thermal bridge" compromising the performance of the thermal break material. In Connection D, Fabreeka-TIM® washers and Fabreeka® bushings were added to the bolted connection to break the heat flow through the bolts. Using Fabreeka-TIM® washers and Fabreeka® bushings significantly reduces heat flow in the connection.

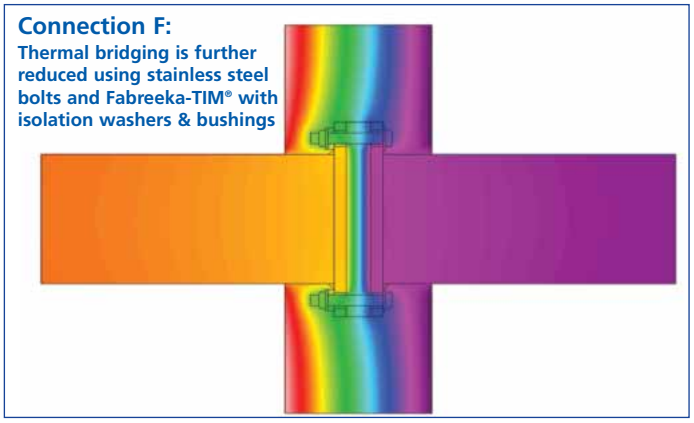












In Connections E & F, stainless steel bolts were used, which further reduce heat flow when compared to steel bolts (Connections C & D). Connection F shows optimal performance. Stainless steel bolts are used in conjunction with Fabreeka-TIM®, Fabreeka-TIM® washers and Fabreeka® bushings, significantly reducing heat flow through the connection.

Fabreeka-TIM® Washer and Fabreeka® Bushing Sizes for Structural Connections

Fabreeka-TIM® material is supplied in sheets or cut to size per customer drawings and/or specifications and is available in thicknesses of 1/4" (6.4mm), 1/2" (12.7mm), 3/4" (19.1mm), 1" (25.4mm) and 2" (50.8mm). Precision water jet cutting is available for holes and special joints.

Fabreeka-TIM® material is also supplied as thermal break washers for the bolted connections between external and internal steelwork. For optimal thermal break, the area around the fastener hardware should be taken into consideration. In addition to the Fabreeka-TIM® plate, Fabreeka recommends Fabreeka-TIM® thermal break washers and bushings made from Fabreeka® material. See page 12 for a connection example.

Recommended Washer and Bushing Sizes

Bolt Dia - in (mm)	Washer OD - in (mm)	Washer ID - in (mm)	Bushing OD - in (mm)	Bushing ID - in (mm)
3/16 (M5)	9/16 (14.29)	1/4 (6.40)	1/2 (12.70)	1/4 (6.40)
1/4 (M6)	3/4 (19.05)	5/16 (7.94)	9/16 (14.29)	5/16 (7.94)
5/16 (M8)	7/8 (22.23)	3/8 (9.53)	5/8 (15.88)	3/8 (9.53)
3/8 (M10)	1 (25.40)	7/16 (11.11)	11/16 (17.46)	7/16 (11.11)
7/16 (M12)	1 1/4 (31.75)	1/2 (12.70)	3/4 (19.05)	1/2 (12.70)
1/2 (M12)	1 3/8 (34.93)	9/16 (14.29)	13/16 (20.64)	9/16 (14.29)
9/16 (M14)	1 1/2 (38.10)	5/8 (15.88)	7/8 (22.23)	5/8 (15.88)
5/8 (M16)	1 3/4 (44.45)	11/16 (17.46)	15/16 (23.81)	11/16 (17.46)
3/4 (M20)	2 (50.80)	13/16 (20.64)	1 1/16 (26.99)	13/16 (20.64)
7/8 (M22)	2 1/4 (57.15)	15/16 (23.81)	1 3/16 (30.16)	15/16 (23.81)
1 (M25)	2 1/2 (63.50)	1 1/16 (26.99)	1 5/16 (33.34)	1 1/16 (26.99)

Notes: Fabreeka-TIM® washers are 1/4" (6.4mm) thick.
Thickness of steel end plate determines length of Fabreeka® bushing.
Additional sizes available - Please contact Fabreeka to discuss.

ATTENTION

Steel Washer must be USS Grade 8 and cover entire top and bottom surface of Fabreeka-TIM® washer, or failure of the Fabreeka-TIM® washer may result. Please refer to the top right illustration on page 13.

Fabreeka-TIM® plates and washers

Fabreeka® bushings

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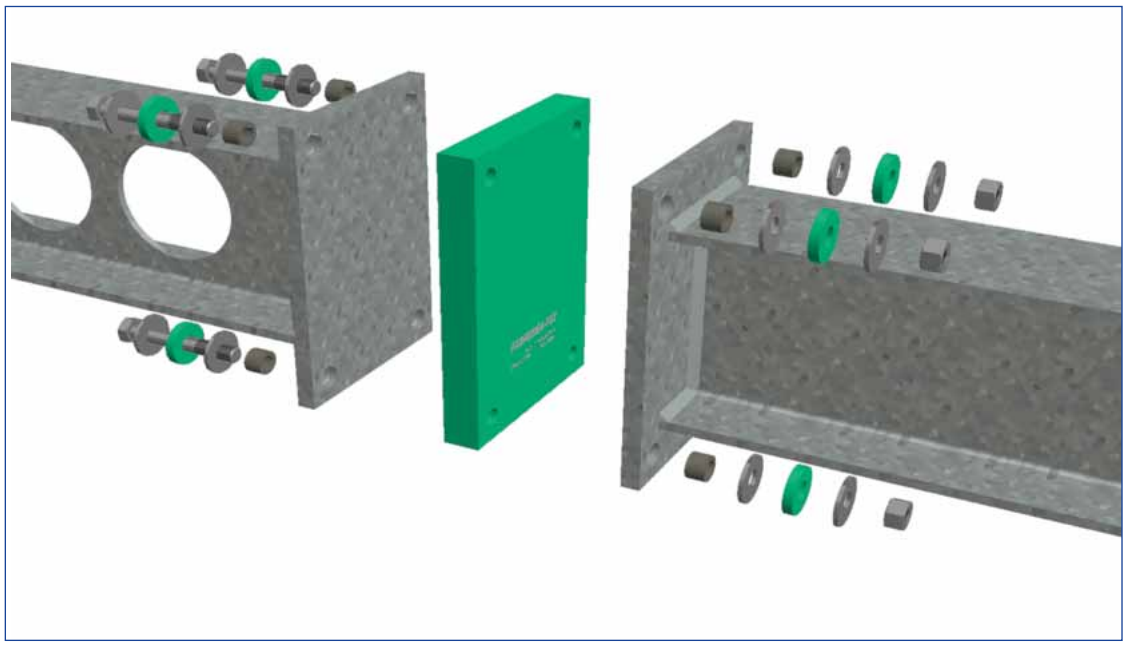
Thermal Break Connection Design Examples

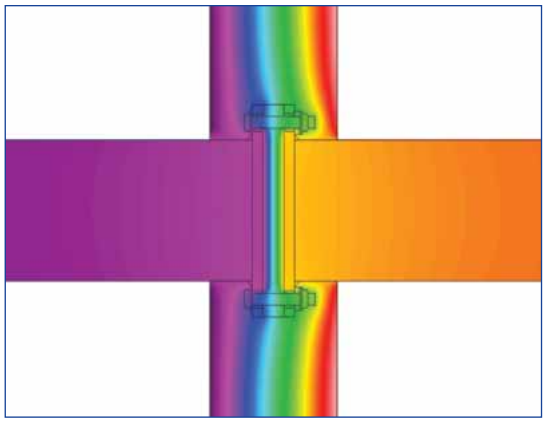
Fabreeka-TIM® can be used as a thermal break solution in both point and linear structural connections. The use of Fabreeka-TIM® material to minimize energy flow in a structural connection requires knowledge of its thermal and material properties as well. To effectively design a bolted connection using Fabreeka-TIM® components, one needs to consider the tensile and shear forces acting upon the bolts and to also consider any deflection and creep in the material itself.

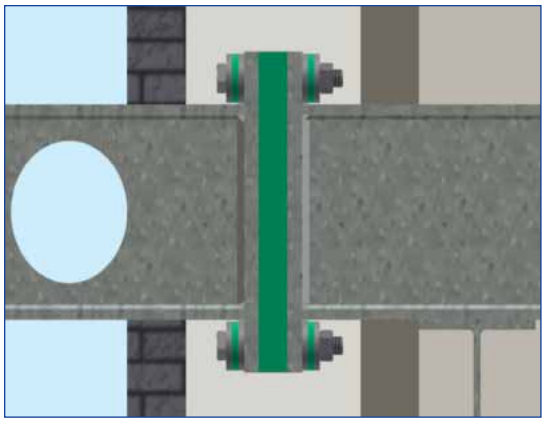
In cantilever, lintel or end beam connections, bolt preload (pretension) due to torque applies a clamp force and corresponding deflection on the material. Additional load is applied as a result of moment forces acting on the connection. A moment will create additional deflection on the compression side of the moment.

The coefficient of friction value of the Fabreeka-TIM® material can be used in conjunction with the applied compressive stress on the material to help resist shear load transfer through the connection.

To accurately provide a quote, please supply us with the design connection showing dimensions of Fabreeka-TIM® plate, hole size and location(s), connection plate thickness and fastener size, and also if you require washers and bushings to complete the thermal break connection.

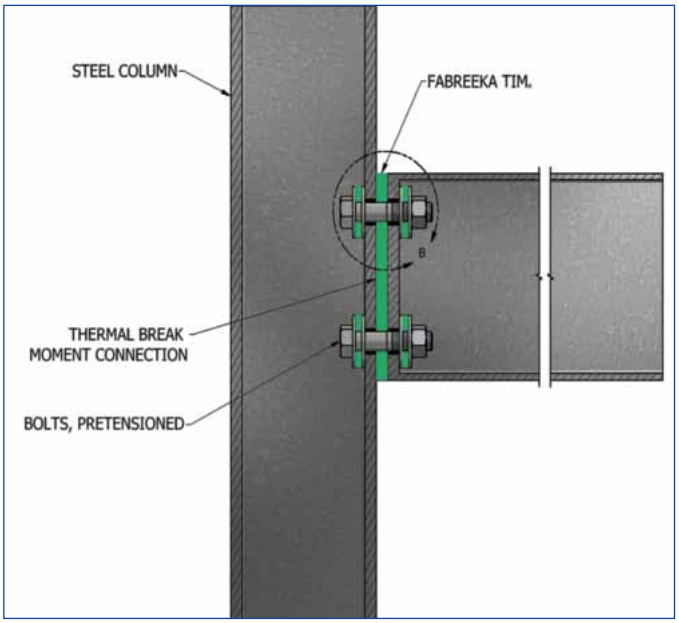


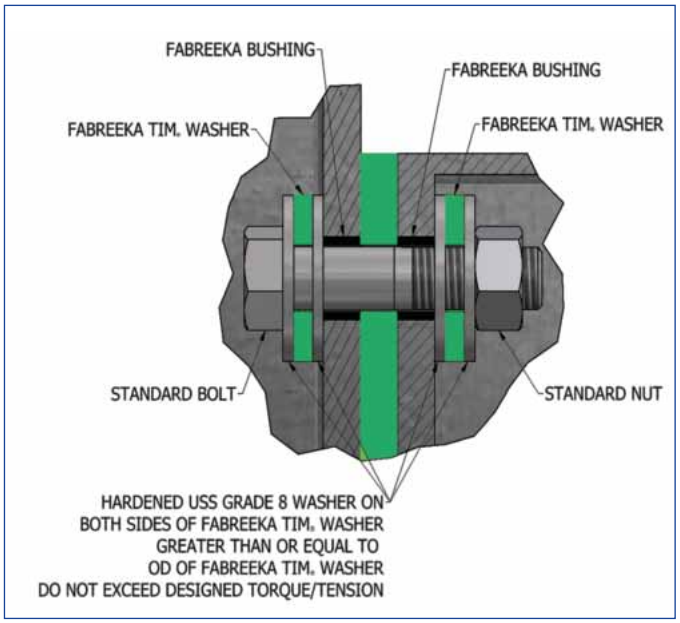


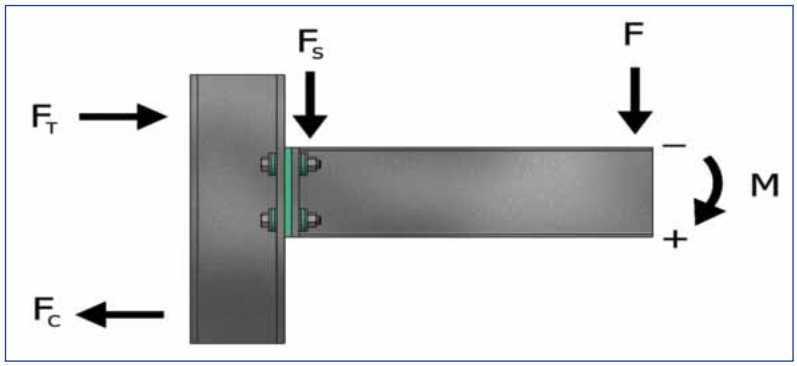


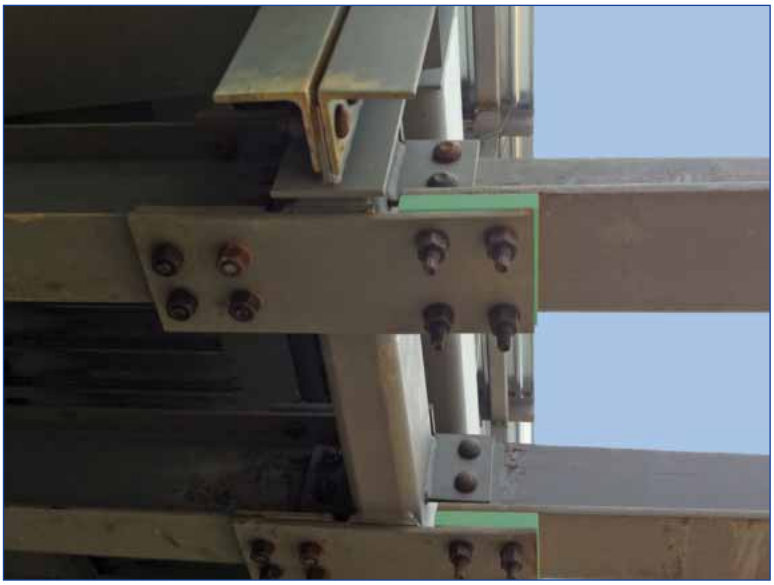
Thermal Break Connection Design Examples

End Plate Connection





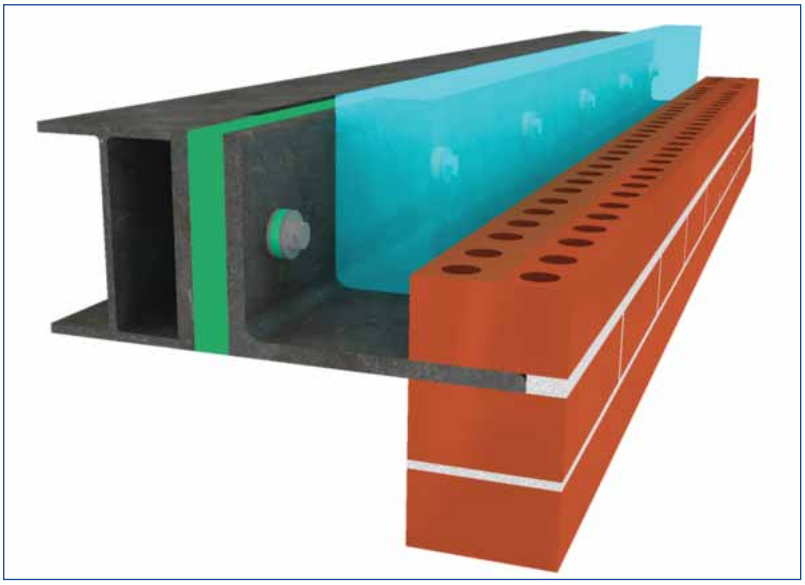




FABREEKA-TIM®

Thermal Break Connection Design Examples

Lintel Connection



Rooftop Dunnage Post Connection to Column

Fabreeka-TIM® is currently used in:

- **Balcony connections**
- **End beam connections**
- **Canopy connections**
- **Lintel or curtain wall connections, including brick, glass, etc.**
- **Rooftop dunnage post connections**
- **Cold storage applications**
- **And more**

Other Thermal Break Products

For buildings designed to have a high performing envelope, another area of concern is for lighter load applications where Fabreeka-TIM structural thermal break may be excessive. Thermal bridging or energy flow paths through highly conductive building components are considered in the envelope design of many different building types. Ultimately there is a need for a lighter load thermal breaks to prevent thermal bridging and improve energy efficiency when incorporating sustainable elements into your building envelope.

Applications range from facade support brackets and clips to metal building framing to certain concrete and precast connections. For these types of lighter load applications, the Fabreeka-TIM LT Series thermal breaks have been developed to provide the most energy savings and the best return on investment.

Thermal Break LT Series - Fabreeka-TIM® LT15 & LT5

Fabreeka-TIM LT15 material is designed for 1,500 psi loading, and Fabreeka-TIM LT5 material is designed for 500 psi loading. Both provide better thermal insulation than vinyl and plastics, reduce corrosion between dissimilar metal elements, and both are made from recycled materials, which help to achieve LEED credits.

*Optional adhesive backing for easier installation is available upon request.

Properties of Fabreeka-TIM® LT Series

		LT15	LT5
Thermal Conductivity	BTU/Hr/ft²/in/°F	0.792	0.792
Max Compressive Operating Load	PSI	1,500	500
Operating Temperature Range	°F	-40 to +158	-40 to +158
Thickness (nominal)	in	1/8, 1/4	1/8
Note: Fabreeka-TIM LT15 and LT5 are only to be used in *non moment* connections, not for structural connections.			

Applications for Fabreeka-TIM® LT series include:

- **Parapets, Soffits, Roof to Wall transitions**
- **Steel Stud Exterior Walls**
- **Masonry Ties**
- **Concrete and Precast joints and accessories**
- **Metal Building Framing**
- **Below Grade to Above Grade transitions**
- **Cladding attachment support clips for Z-girts, C-channels, Hat channels used in:**
  - Curtain Walls, Rain screens, Metal Wall Panels, Veneer Walls, Louvres

Fabreeka's Learn at Lunch Program

Are you an Architect or Design Firm who would like to know more about Fabreeka's products for building and construction?

Fabreeka offers a Learn at Lunch program just for you. Fabreeka's presentation can assist with PDH credits and has been approved by several organizations. Please contact Fabreeka to find out more.

1-800-322-7352, info@fabreeka.com or www.fabreeka.com

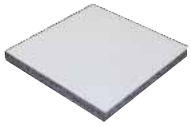
Additional Fabreeka® Products for Building & Construction

Expansion Bearings

SA-47 Bearing Pads

Fabreeka Bearing Pads

Isolation Washers & Bushings



PTFE Bearing Pads

Sources of information on Thermal Bridging

Several good sources of data on thermal bridging are as follows:

- ASHRAE 1365 RP Thermal Performance of Building Envelope Details for Mid- and High-Rise Buildings
- ISO 14683:2007 - Thermal Bridges in Building Construction - Linear Thermal Transmittance - Simplified Methods and Default Values
- "Thermal Steel Bridging", NASCC 2011, D'Aloisio/Miller-Johnson
- Morrison Hershfield Ltd, "Building Envelope Thermal Bridge Guide"

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