FABCEL® PADS FOR REDUCTION OF LOW FREQUENCY VIBRATION

FABREEKA®
A STABILUS COMPANY

VIBRATION ISOLATORS

The purpose of an isolator is to decrease the amplitudes of forced, random and steady state vibrations being transmitted into a machine or equipment support foundation. Isolators exist in many forms, including rubber, mat materials, metal coils, air bags and pneumatic isolators. The type of isolator performance used as the solution for an application depends on the type of machine to be isolated, static load, dynamic deflection and damping properties of the isolator.

All vibration isolators are essentially springs with an additional element of damping. In some cases, the "spring" and "damper" are separated, as in the case of a coil spring isolator used in conjunction with a viscous damper. The majority of isolator designs however, incorporate the spring and damper into one integral unit.

Important characteristics of any isolator are its load-deflection and load-natural frequency properties. The dynamic spring rate and damping of an isolator are mostly determined by the type of material used, while the stiffness (static and dynamic) is a function of the isolator design (material, shape). Static spring rate, dynamic spring rate, creep, natural frequency, damping and load deflection values vary widely from material to material and design to design. Therefore, materials or elements used for vibration isolation are chosen based on the significant differences in their performance when used to isolate specific frequencies and amplitudes.

Transmissibility

The ratio of the vibration transmitted after isolation to the disturbing vibration is described as transmissibility and is expressed in its basic form in Equation (1).

$$(1) \qquad T = \frac{1}{1-[Fd^2/Fn^2]}$$

Theoretical, undamped transmissibility

Where Fd is the disturbing frequency and Fn is the natural frequency of the isolator. When considering the property of damping, the equation is rewritten as Equation (2).

$$(2) \quad T = \sqrt{\frac{1 + (2\zeta Fd/Fn)^2}{(1-[Fd^2/Fn^2])^2 + (2\zeta[Fd/Fn])^2}}$$

Where ζ represents the damping ratio of the isolator.

Natural frequency and damping are the basic properties of an isolator that determine the transmissibility of a system designed to provide vibration and/or shock isolation. Additionally, other important factors must be considered in the selection of an isolator/isolation material.

Two such factors are:

- The source and type of the dynamic disturbance causing the vibration / shock.
- The response of the isolator to the dynamic disturbance.

With an understanding of its properties, the type of isolator is chosen primarily for the load it will support and the dynamic conditions under which it will operate.

Natural Frequency, Spring Rate

Not all isolators whose isolation characteristics are based on mechanical deflection have a linear relationship between load and deflection.

k is the dynamic stiffness or spring rate, which is also shown as k_d. k_s is the static stiffness determined from a load vs. deflection curve. k_s cannot be used in the dynamic equation if the isolator, such as Fabcel, has damping, as this makes it non-linear.

A common mistake is that the following equation Equation (3) can be used to calculate the natural frequency for all isolators if the spring rate (k) and weight (w) to support are known.

$$(3) \qquad Fn = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

$$\text{where mass } (m) = \frac{w}{g}$$

If the stiffness or spring rate (k) is not known, the equation can be rewritten Equation (4), so that the static natural frequency of the isolator is a function of its static deflection (δ_s). This results in a determination of the isolator's static natural frequency where (g) represents the gravitational constant. (9.81 m/s² or 32.2 ft/s²)

$$(4) \qquad Fn = \frac{1}{2\pi}\sqrt{\frac{g}{\delta_s}}$$

Theoretical, undamped static natural frequency

The curves are developed using the known properties of the isolator - dynamic natural frequency and damping Equation (2). Note that as damping is increased, the curve of transmissibility is flattened, so that in the region near to resonance, the curve is reduced, but in the region where isolation is required, the curve is increased. The curves show that if there is a significant amount of damping in an isolator, its natural frequency has to be reduced to retain a desired degree of isolation at the frequency ratio of concern.

However, using the static, linear principle in Equation (4), the following is true:

1) Large deflections are required for low frequency isolation.
2) Damping properties are neglected.
3) Only the static natural frequency is obtained.
4) The isolator is assumed to have a linear spring rate.

The static deflection principle can be used only when the isolator under consideration is both linear and elastic. For example, rubber, felt, fiberglass and composite pads tend to be non-linear and exhibit a dynamic spring rate, which differs from the static spring rate.

The natural frequency calculated using the static deflection (δ_s) determined from a static load - deflection test of an isolator invariably will give a value lower than that experienced during vibration (dynamically).

Any isolator with a calculated natural frequency based on static deflections may not behave in the predicted way because the dynamic spring rate differs from the static spring rate.

It is the dynamic natural frequency which has to be used in calculations rather than the static.

Damping

The property of damping is neglected in the static evaluation Equation (4), and this can have a significant effect on the isolation efficiency. Damping in an isolator has a beneficial effect because it helps to suppress vibration, but can also lead to a loss of isolation efficiency. To appreciate the effects of damping, refer to the transmissibility curves in Figure 1.

The ideal isolator would have as little damping as possible in the isolation region and as much as possible at the isolator's natural frequency to reduce amplification at resonance.

With an understanding of the basic properties and dynamic characteristics of an isolator, it is possible to design for and calculate the true transmissibility of the isolator as a function of frequency. However, dynamic stiffness (natural frequency vs load) or a transmissibility vs frequency curve with the actual damping coefficient of the material is required.

Figure 1 is a graphical representation of isolator transmissibility as a function of the frequency. Several percentages of critical damping are displayed to show the effect of damping in the isolation region and the amplification region, including the maximum amplification at resonance. (F_D / F_N = 1)

Note that as damping is increased, the curve of transmissibility is flattened, so that in the region near to resonance, the curve is reduced, but in the region where isolation is required, the curve is increased. The curves show that if there is a significant amount of damping in an isolator, its natural frequency has to be reduced to retain the desired degree of isolation at the frequency ratio of concern.

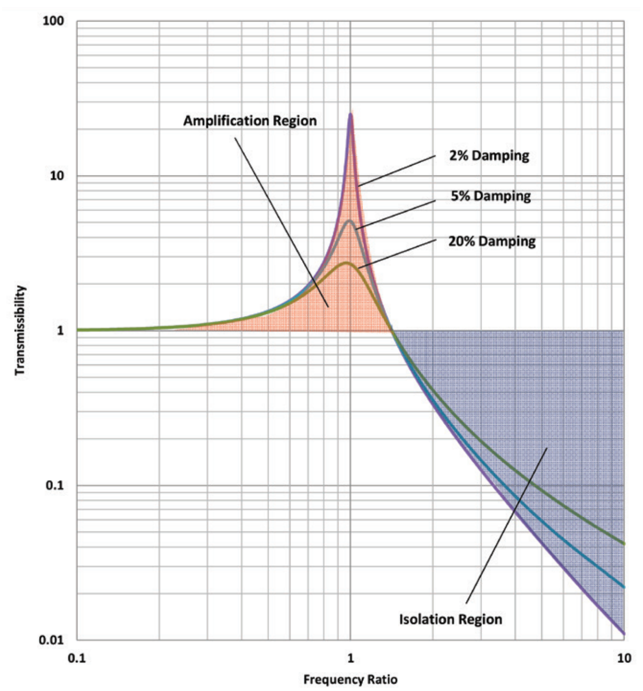


Figure 1

FABCEL® PAD

Fabcel® pad material is specifically designed to provide vibration isolation/reduction in industrial applications where structure-borne noise and vibration occur.

Fabcel pads have been used in industry since 1962 to reduce vibration and shock. They are manufactured from nitrile rubber in a range of types and thicknesses (layers) that allows for optimal loading/isolator performance. The featured cell geometry on the surface of the pads minimizes the shape factor usually associated with unreinforced, elastomeric (rubber) pad materials.

Fabcel Shape Factor

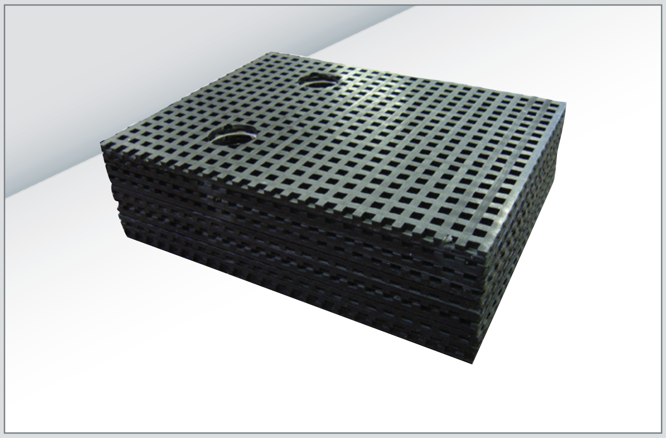
The stiffness of rubber in compression is dependent on three factors; the inherent stiffness or hardness of the rubber, the stiffness added by restraint in the perpendicular to the load (such as friction) and the "shape factors" of the rubber. As you can imagine, rubber is not compressible in the sense that when a compressive load is applied to a surface the volume of rubber does not change. Instead the shape of the rubber changes because the volume is displaced to areas that are not constrained.

"Shape factor" is the ratio of the loaded area divided by the area free to move or bulge. If this ratio is small then the rubber will be easier to deflect. If the ratio is high than the rubber sample will be stiffer. The waffle shape of our Fabcel pads is designed to minimize the effect of shape factor. *Note: Fabreeka places a shim every 1" of thickness to contribute to reducing the effects of shape factor. All of the data in this literature was testing using a 6"x6" sample where shims were used every 1" of thickness.* Pads with larger load areas will tend to be stiffer and pads with smaller load areas will be softer.

The data in this brochure can be used to get a very good estimate on the performance of any size pad, but if exact

Fabcel Pad Features

- Accommodates loads up to 300 psi.
- Vertical natural frequency as low as 5.0 Hz and a horizontal natural frequency as low as 3.0 Hz.
- High energy storage rate per unit volume which makes it ideal for most shock isolation applications.
- May be bonded together (layered) to achieve the desired isolation efficiency.
- Can be supplied as sheets, cut pads, washers and OEM parts.



performance is needed then testing of the exact shape may be necessary. All of our 5/16” thick pads will not vary much from the deflection and natural frequency curves; typical pad sizes may only vary by a few Hz. Fabcel 200 and 300 pads, which are 1/2” thick, may have more deviation in deflection and natural frequency because these pads have more shape factor influence due to the cells not being as defined. In a typical application where a designer needs to isolate a relatively high frequency such as a pump, fan or compressor, shape factor does not have much of an effect on vibration reduction because it only affects the frequency by a few Hz.

If you have an application where you need higher accuracy, please contact the Fabreeka Engineering department to assist in providing a more accurate performance estimate. Fabreeka Engineers can use our shape factor curves to offer more precise values. If an exact performance is necessary, then testing on the specific shape is necessary.

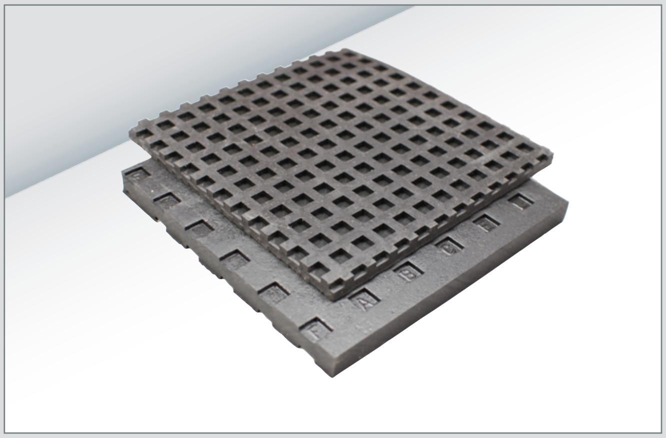
Fabcel pads are manufactured in sheets of 18” x 18”. However, they are commonly cut to size and bonded to achieve the proper thickness based on the application and isolation requirement.

Physical Properties

	Fabcel 25	Fabcel 50 l 200	Fabcel 100 l 300
Hardness Durometer	25±5	48±5	68±5
Tensile Strength	500 psi	2,000 psi	2,000 psi
Elongation	700%	350%	250%
Damping (C/Cc) (Nom)	7%	7%	7%
Thickness	5/16”	5/16” l 1/2”	5/16” l 1/2”
Maximum Load	25 psi	50 psi l 200 psi	100 psi l 300 psi

Fabcel pads are resistant to most oils, water, steam and chemicals.
Temperature limits for continuous exposure are -40°F to 200°F.

Fabcel pads are also available in different materials including Silicone and Fluororcarbon. Please contact Fabreeka’s Engineering Department to discuss your requirements.



Fabcel isolation washers and Fabreeka® bushings are used to eliminate metal-to-metal contact and break the vibration or shock transmission path.

FABCEL® PAD
SPRING RATE

The spring rate formula for all thicknesses of Fabcel pads is as follows:

K = SRF x Pad Area

Imperial	Metric
K = lbs/in	K = N/m

The following spring rate factor (SRF) formulas and example will allow you to determine Fabcel's spring rate for various loadings, pad size and thickness.

Note: Elastomers respond differently under dynamic conditions. The stiffness can increase more under dynamic conditions than under static conditions.

Static: The static spring rate factor is determined from the slope of the load deflection curve (shown in Figures 3, 6, 9, 12 and 15) or estimated from the dynamic spring rate factor. The average static spring rate is approximately 40% of the dynamic rate.

Dynamic: The dynamic spring rate factor is calculated using the frequency value shown in Figures 2, 5, 8, 11 and 14.

DSRF = 0.10 x (Dynamic Natural Frequency)^2 x stress

A typical spring rate example using Fabcel 50 is as follows:

Imperial		Metric
50 psi	Stress	0.35 MPa
10" x 10"	Area	0.254 m x 0.254 m
9 layers	Thickness	9 layers
7.5 Hz	Dynamic Nat Freq	7.5 Hz

Static Spring Rate Factor (SSRF)

SSRF = Slope of Load-Deflection Curve
Stress 50-40 psi = 10 psi
Deflection 0.56 - 0.47 in = 0.095 in
therefore: SSRF = 10/0.095 = 105 psi/in

Imperial		Metric
105 psi/in	SSRF	29 MPa/m
K_s = Static Spring Rate		
K_s = (SSRF) x Pad Area		
K_s = 105 lbs/in^2 x 100 in^2		$K_s = 29 \times 10^6 \frac{N/m^2}{m} \times 0.645\ m^2$
K_s = 10,500 lbs/in		**K_s = 1,871,000 N/m**

Dynamic Spring Rate Factor (DSRF)

DSRF = 0.10 x (Dynamic Natural Frequency)^2 x stress
DSRF = 0.10 x (7.5)2 x 50 psi
DSRF = 280 psi/in

Imperial		Metric
280 psi/in	DSRF	79 MPa/m
K_d = Dynamic Spring Rate		
K_d = (DSRF) x Pad Area		
K_d = 280 lbs/in^2 x 100 in^2		$K_d = 79 \times 10^6 \frac{N/m^2}{m} \times 0.645\ m^2$
K_d = 28,000 lbs/in		**K_d = 5,100,000 N/m**

Multiple Layers

When the disturbing or forcing frequency is very low and the isolation requirements are critical, multiple layers of Fabcel® pads are necessary to lower the natural frequency and provide an acceptable frequency ratio to meet the isolation requirements.

Multiple layer isolators are designed using shims to maintain proper shape factor under load. The layers are integrally bonded together.

Fabcel's cellular design permits a larger deflection under load than a solid rubber material of the same thickness. This results in a lower natural frequency and greater isolation.

Fabcel multiple layer isolators can be placed directly under a machine or its support. If a narrow structural steel member is used as a machine support or base, it may be necessary to increase the isolator area by including a steel load distributing plate at each isolator location or one large plate for all isolators.

Notes:
For stability, design of multiple layer isolators requires that the width/length should not be narrower than twice the thickness.

When layering and bonding Fabcel, a shim is required every 1" of material, i.e. every 3 layers of Fabcel 25/50/100 and every 2 layers of Fabcel 200/300.

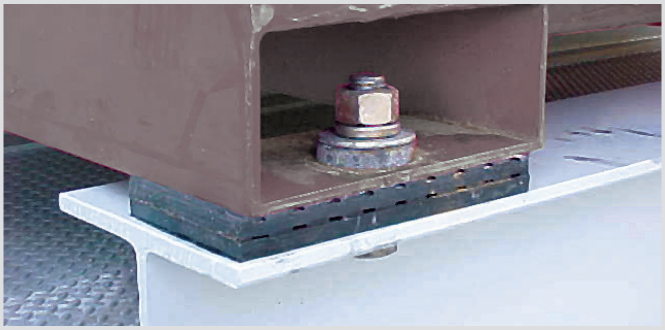
Fabcel Isolation Washers and Fabreeka Bushings

Fabcel isolation washers and Fabreeka bushings are typically used in conjunction with Fabreeka pads or Fabcel pads where the reduction of impact shock or isolation of transmitted vibration is required.

Bushings are manufactured with the same properties as Fabreeka pad, and therefore offer years of service under the most severe operating conditions.

Fabreeka bushings are made to specified dimensions (OD, ID, length). A minimum wall thickness of 3/32" is recommended.

Equipment isolated by Fabcel pads should not be bolted directly to structure, but should have isolation washers and bushings to prevent metal to metal contact. This effectively isolates the entire vibration transmission path.



FABCEL 25

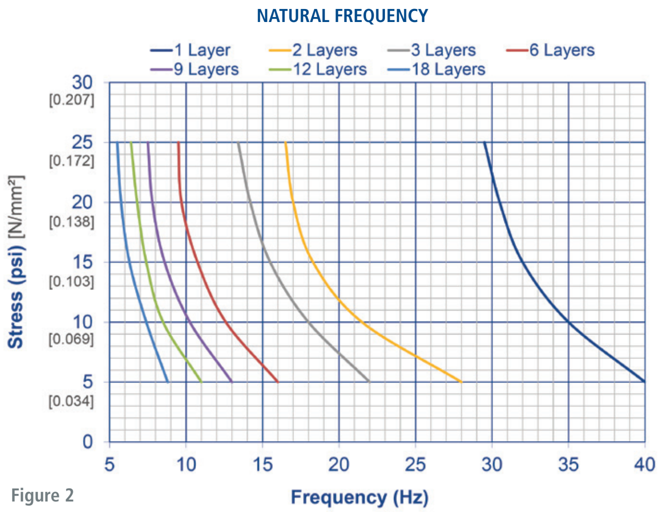


Figure 2

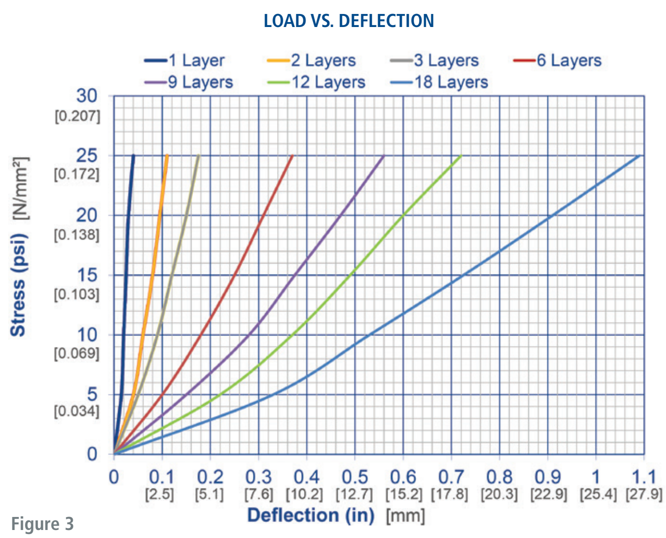


Figure 3

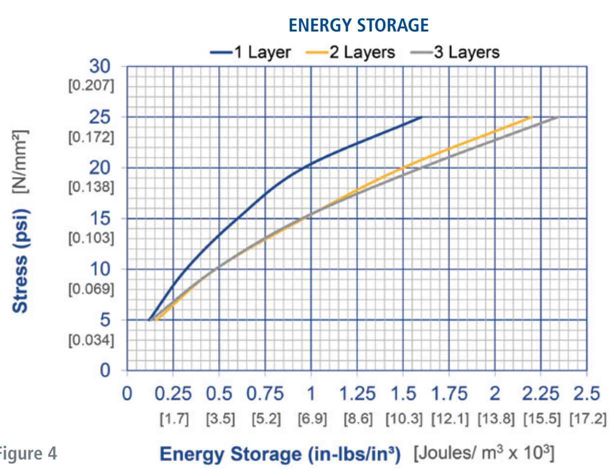


Figure 4

FABCEL 50

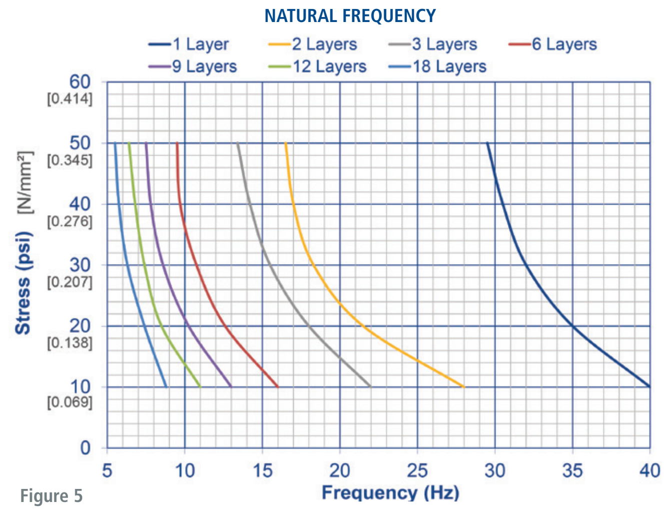


Figure 5

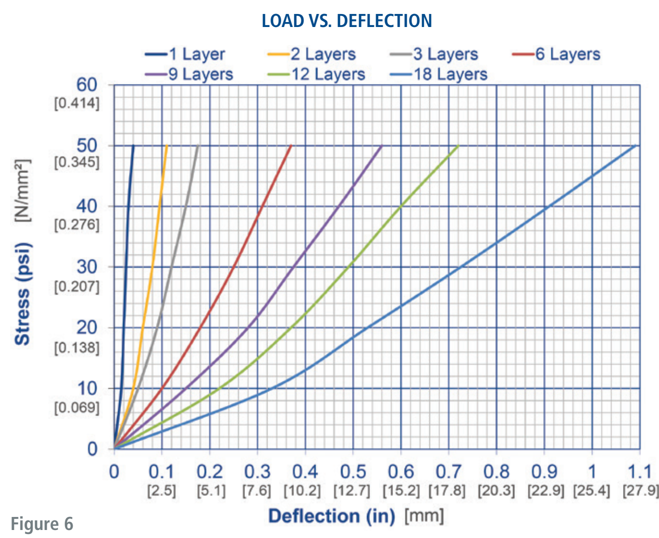


Figure 6

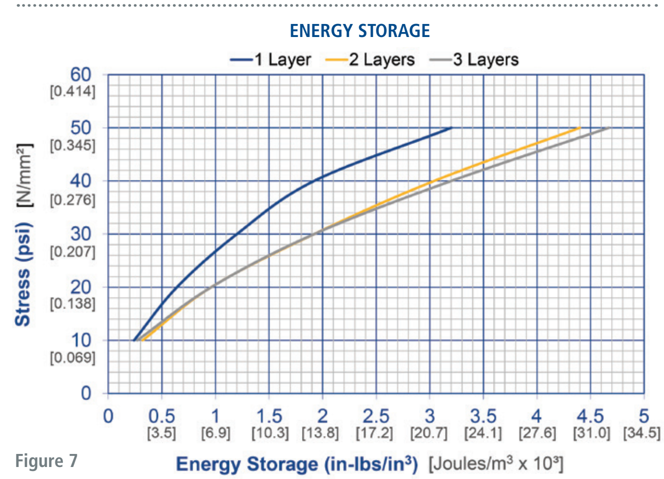


Figure 7

FABCEL 100

NATURAL FREQUENCY

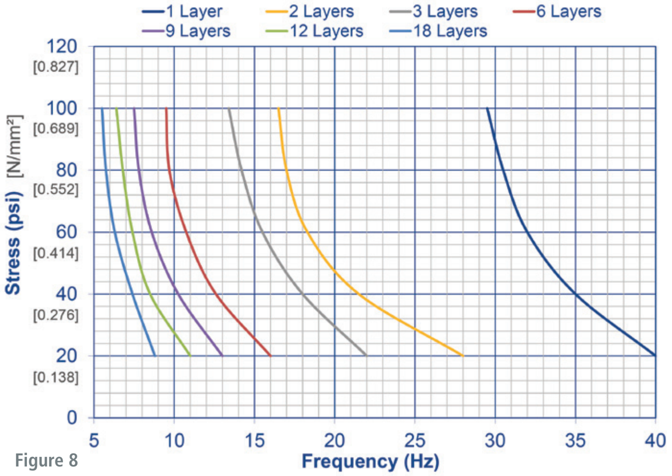


Figure 8

LOAD VS. DEFLECTION

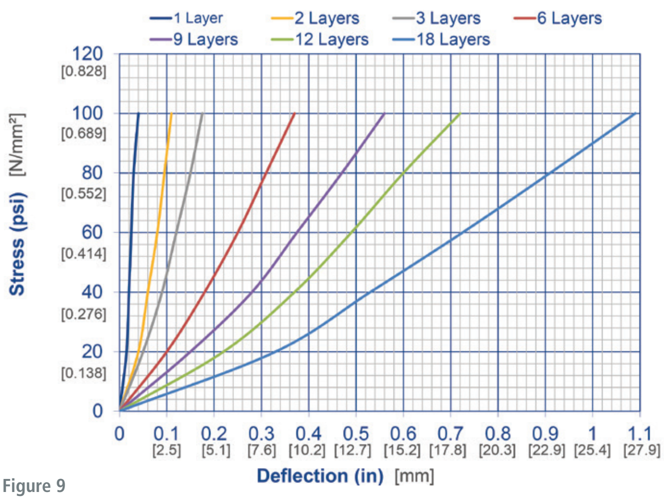


Figure 9

ENERGY STORAGE

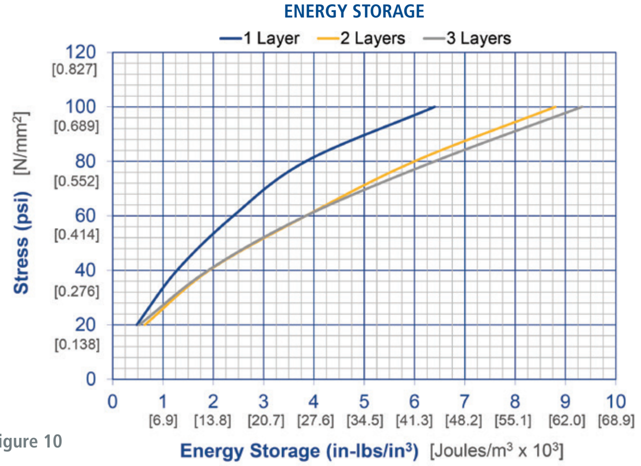


Figure 10

All Fabcel testing for this brochure was conducted using 6″ x 6″ samples. Actual results on different sizes may vary slightly due to shape factor. If you have questions on a particular product configuration, please contact Fabreeka's Engineering Department to discuss.

FABCEL 200

NATURAL FREQUENCY

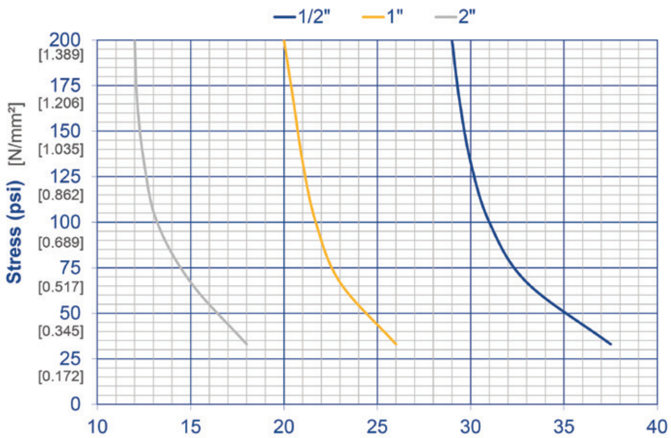


Figure 11

LOAD VS. DEFLECTION

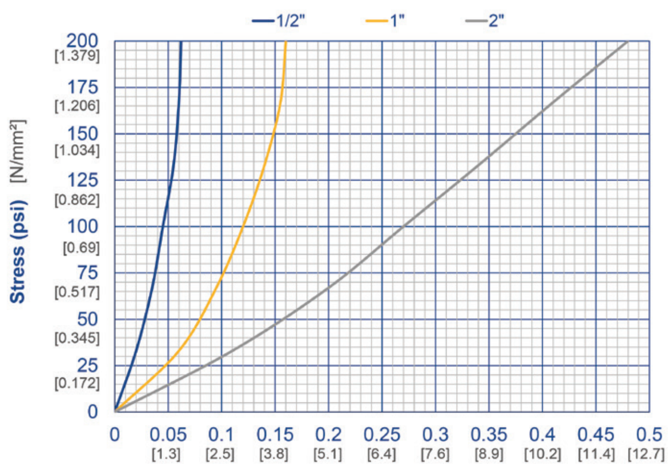


Figure 12

ENERGY STORAGE

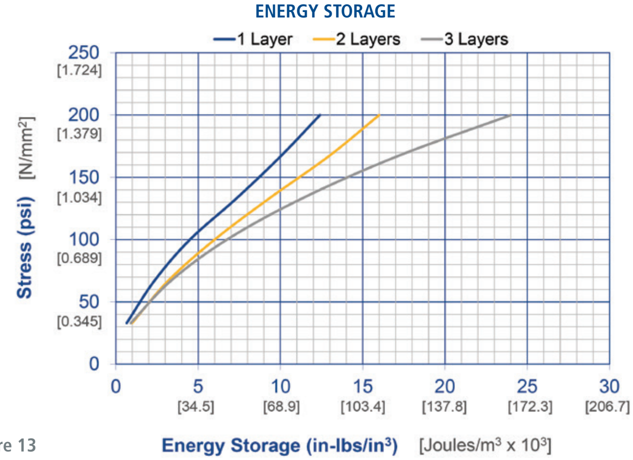


Figure 13

FABCEL 300

NATURAL FREQUENCY

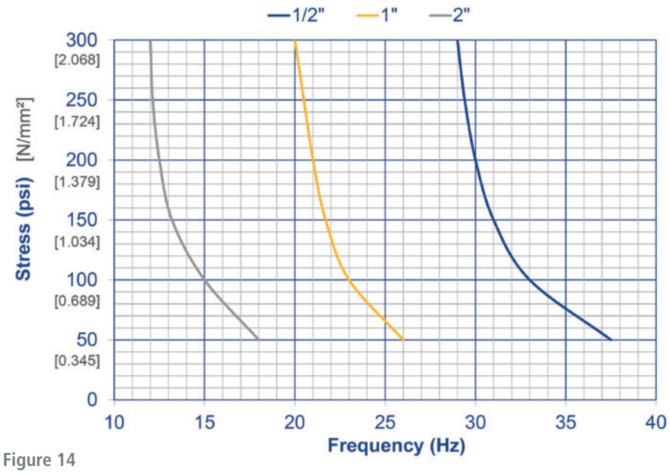


Figure 14

LOAD VS. DEFLECTION

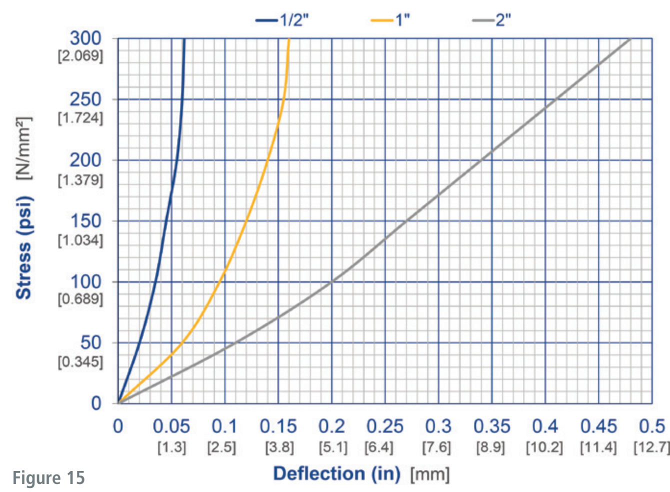


Figure 15

ENERGY STORAGE

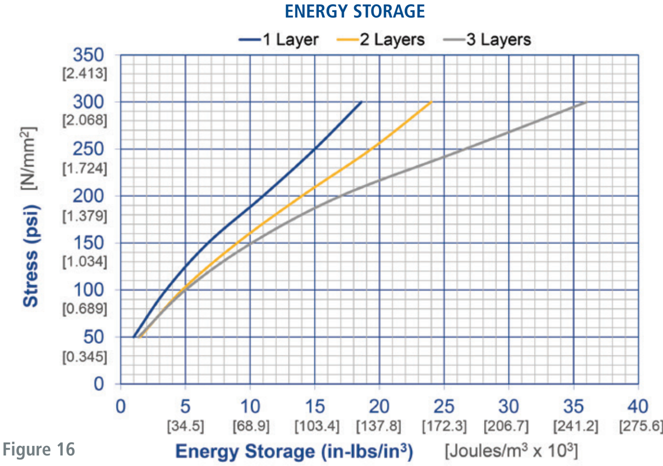


Figure 16

PERCENT REDUCTION IN TRANSMITTED VIBRATION FOR FABCEL PADS

Percent Reduction in Transmitted Vibration for Fabcel 25, 50 and 100

Forcing Frequency CPS (Hz)	Fabcel	1 Layer 5/16" (8mm) thk Load - psi					2 Layers 5/8" (16mm) thk Load - psi					3 Layers 1" (24mm) thk Load - psi					6 Layers 2" (50mm) thk Load - psi				
	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
	100	20	40	60	80	100	20	40	60	80	100	20	40	60	80	100	20	40	60	80	100
20		--	--	--	--	--	--	--	--	--	--	--	--	--	--	15	--	35	55	65	69
30		--	--	--	--	--	--	12	37	47	55	--	47	62	68	73	59	77	83	86	87
40		--	--	--	--	--	3	63	71	75	78	55	75	81	83	86	79	88	90	92	93
50		--	--	13	30	43	53	78	83	85	86	74	85	88	89	91	87	92	94	94	95
60		20	40	50	60	66	71	85	88	89	90	83	89	91	92	93	91	94	95	96	96
70		50	61	68	72	76	79	89	91	92	93	88	92	93	94	95	93	95	96	97	97
80		65	72	76	79	82	85	92	93	94	94	90	94	95	95	96	94	96	97	97	97
90		74	79	82	84	86	88	93	94	95	95	92	95	96	96	96	95	97	97	98	98
100		79	83	85	87	89	90	94	95	96	96	94	96	96	97	97	96	97	98	98	98
120		86	88	90	91	92	93	96	96	97	97	95	97	97	97	98	97	98	98	98	98

Forcing Frequency CPS (Hz)	Fabcel	9 Layers 3-1/16" (78mm) thk Load - psi					12 Layers 4-1/8" (105mm) thk Load - psi					15 Layers 5-3/16" (132mm) thk Load - psi					18 Layers 6-1/4" (160mm) thk Load - psi				
	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25	5	10	15	20	25
	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
	100	20	40	60	80	100	20	40	60	80	100	20	40	60	80	100	20	40	60	80	100
10		--	--	--	--	--	--	--	--	3	26	--	--	4	26	42	--	3	26	42	55
20		26	65	76	79	82	55	76	82	85	87	66	80	85	87	89	73	85	87	89	90
30		75	86	90	91	92	83	90	92	93	94	87	91	93	94	95	89	93	94	94	95
40		87	92	94	94	95	90	94	95	96	96	92	95	96	96	97	93	96	96	96	97
50		91	94	96	96	96	94	96	96	97	97	95	96	97	97	98	95	97	97	97	98
60		94	96	97	97	97	95	97	97	97	98	96	97	98	98	98	96	97	98	98	98
70		95	97	97	97	98	96	97	98	98	98	97	98	98	98	98	97	98	98	98	98
80		96	97	98	98	98	97	98	98	98	98	98	98	98	98	98	98	98	98	98	98
90		98	97	98	98	98	97	98	98	98	98	98	98	98	98	99	98	98	98	99	99
100		97	98	98	98	98	98	98	98	98	99	98	98	99	99	99	98	98	99	99	99
120		98	98	98	99	99	98	98	99	99	99	98	99	99	99	99	98	99	99	99	99

Percent Reduction in Transmitted Vibration for Fabcel 200 and 300

Forcing Frequency CPS (Hz)	Fabcel	1 Layer 1/2" (13mm) thk Load - psi				2 Layers 1" (25mm) thk Load - psi				4 Layers 2" (50mm) thk Load - psi			
	200	50	100	200	--	50	100	200	--	50	100	200	--
	300	50	100	200	300	50	100	200	300	50	100	200	300
20		--	--	--	--	--	--	--	--	--	--	26	43
30		--	--	--	--	--	--	4	19	32	59	76	80
40		--	--	--	--	16	43	61	66	70	80	87	89
50		--	13	42	48	58	69	78	80	82	88	92	93
60		32	51	65	68	74	80	85	86	88	91	94	95
70		57	68	76	78	81	85	89	90	91	94	96	96
80		70	76	82	84	86	89	91	92	93	95	96	97
90		77	82	86	87	89	91	93	94	94	96	97	97
100		82	85	89	90	91	93	94	95	95	96	97	98
110		85	88	91	92	93	94	95	96	96	97	98	98
120		87	90	92	93	94	95	96	96	97	97	98	98

Transmissibility can be calculated by using the following formula:

$$\text{Percent Reduction} = 100 \times \left[1 - \frac{1}{\left(\frac{\text{Forcing Frequency}}{\text{Resonant Frequency}} \right)^2 - 1} \right]$$

Fabcel B30

Fabcel B30 is a unique Fabcel product specifically designed to provide higher damping than the standard Fabcel pads, to minimize rebound and to reduce vibration near resonance. The best way to reduce vibration is to isolate it, but in order to accomplish this, the isolator's natural frequency must be well below the disturbing frequency (problem frequency). Please refer to the transmissibility curve on page 4. This is easy to accomplish when the disturbing frequency is known and there are isolators, such as our other Fabcel products, with a low enough natural frequency to suit the application.

In some cases the vibration frequency can't be isolated because it is too low, it is random vibration which has many frequencies, or is simply unknown. Considering that most vibration problems are due to two frequencies being in resonance, the next best approach is to minimize vibration amplification at resonance. This is where the Fabcel B30 can be very effective. The additional damping in the Fabcel B30 minimizes amplification at resonance to lower the vibration levels.

Fabcel B30 may be a great solution for many types of application such as washing machines (changing RPMs), grinders (random vibration) and other industrial equipment where vibration needs to be decoupled from the supporting floor or other structure.

Physical Properties

	Fabcel B30
Hardness Durometer	30±5
Tensile Strength	2,150 psi
Elongation	890%
Damping (C/Cc) (Nom)	15%
Density	1.03 g/cm³
Thickness	5/16"
Maximum Load	30 psi

FABCEL B30

NATURAL FREQUENCY

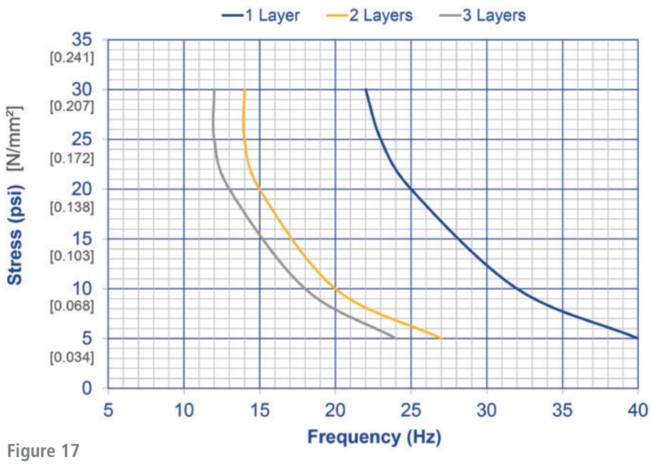


Figure 17

LOAD VS. DEFLECTION

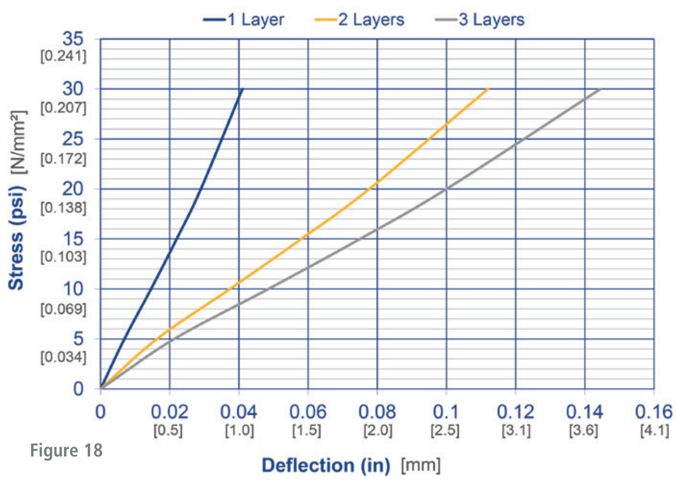


Figure 18

DAMPING

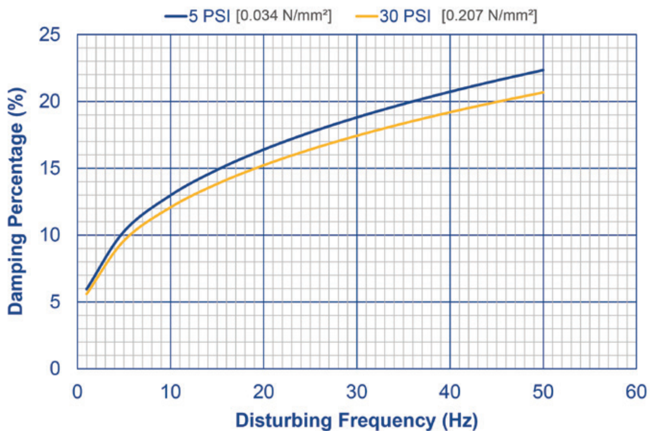


Figure 19

ENERGY STORAGE

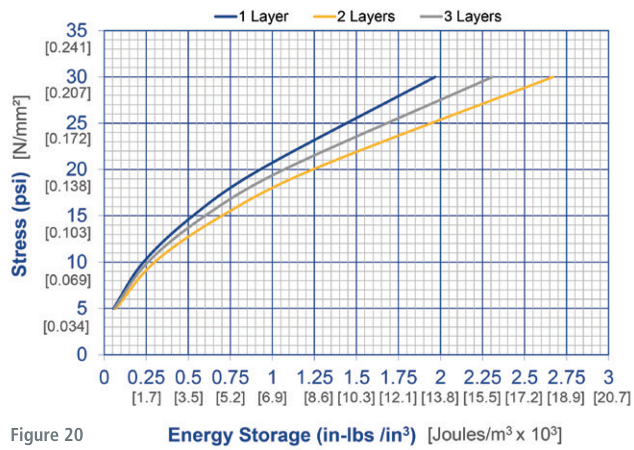


Figure 20

FABCEL FOR
VIBRATION ISOLATION

Fabcel pads are commonly used to reduce low frequency vibration and structure-borne noise. To determine the proper type and thickness of Fabcel for an application, the stress on the material must be calculated and the desired level of vibration isolation known.

When calculating the stress, the maximum load conditions should be considered for each support location (unbalanced dynamic forces, non-uniform machine/equipment weight, etc.)

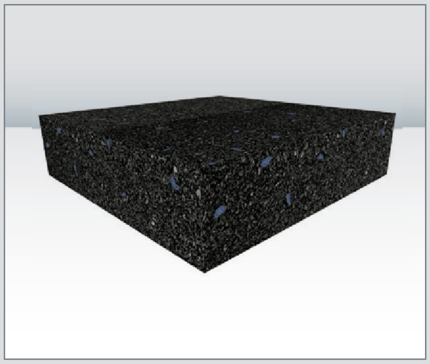
A compressor weighs 11,520 lbs. It is supported on four feet, which are 6" x 6". Assuming even load distribution, the stress on each foot is 11,520/4 = 2,880 lbs, 2,880 lbs/36 in^2 = 80 psi. 80 psi exceeds the stress limit for Fabcel 50 (See page 10), so Fabcel 100 should be used.

The compressor operates at a frequency of 1,800 rpm or 30 Hz. A transmissibility at this frequency of 40% (60% reduction) or better is required. Refer to the "percent reduction" chart on page 13 to determine the proper thickness of Fabcel 100 under a stress of 80 psi to achieve the desired transmissibility.

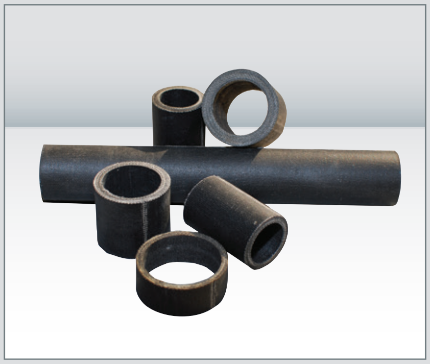
Using the forcing frequency of 30 Hz, Fabcel 100 at 80 psi, 1" thick (3 layers) will provide a 68% reduction in vibration, which is equivalent to a transmissibility of 32%.

Note: Reducing the area of Fabcel material under a given load will increase the stress, but will also lower the spring rate, resulting in a lower natural frequency and greater vibration reduction. Adding layers to the thickness will also produce the same result.

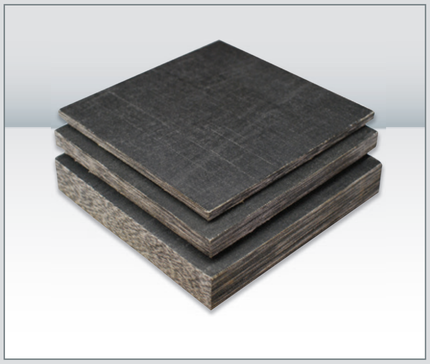
Additional Products



FAB-EFP



Fabreeka Bushings



Fabreeka Pads

FABCEL FOR
SHOCK ISOLATION

Fabcel pads can also be used to reduce impact shock and limit transmitted force. The effectiveness of a shock isolator is measured not by transmissibility (as with vibration) but by the isolator deflection and energy storage.

Due to the storage and release of energy, the output force is much less than the input force, resulting in limited force transmission.

To determine the proper type and thickness of Fabcel, the following information is required:

Static stress on Fabcel (from equipment weight) Dynamic stress on Fabcel (from dynamic load applied) Kinetic energy applied to Fabcel from shock input

KE = FxD (force x distance of dynamic input) or KE = 1/2 MV^2 (mass and velocity of dynamic input)

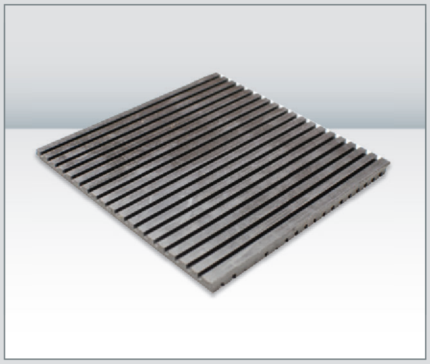
The static and dynamic stress are used to determine the static and dynamic deflection on the Fabcel. The total stress should not exceed the maximum allowable stress of the pad type. The maximum amount of kinetic energy the Fabcel pad can absorb without failure can be calculated by using the dynamic deflection and choosing a pad thickness.

Strain = dynamic deflection / thickness
$KE_{\text{to absorb}}$ = vol of Fabcel (1/2 x total stress x strain)

Using the energy storage charts on pages 10 through 12, the kinetic energy to be absorbed must be compared to the kinetic energy storable at the dynamic stress of the Fabcel.

The energy storage capacity must be greater than the kinetic energy applied.

Please consult Fabreeka's Engineering Department regarding frequency of dynamic input and corresponding stress limitations.



DIMFAB

Fabcel Mounts

A Variety of Products

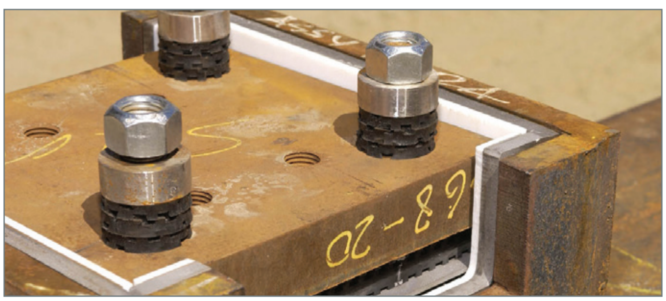
In addition to Fabcel pads, Fabreeka offers many products to support your vibration and shock control requirements. Our Engineering department can help you determine which product will provide the best solution.

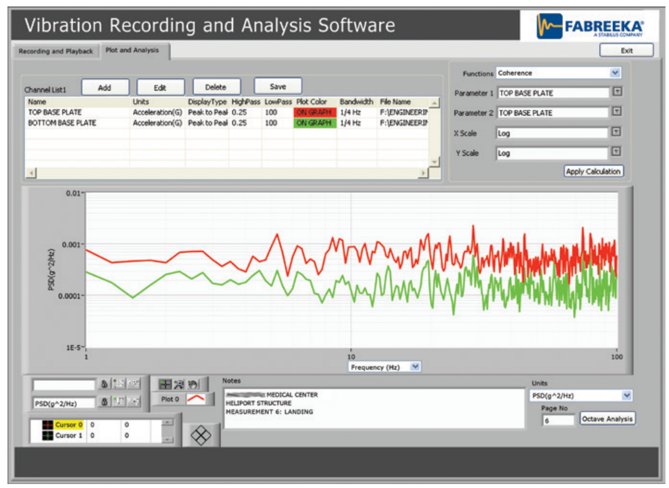
EXAMPLES OF FABCEL APPLICATIONS

BUILDING & CONSTRUCTION – HELIPORT

Fabcel is commonly used to provide vibration isolation and reduce structure-borne noise in buildings. Applications include footings, columns and support structures.

For example, Fabcel isolation washers are used in combination with layers of Fabcel material to provide complete isolation of the vibration transmission path at each structural connection in a heliport design.





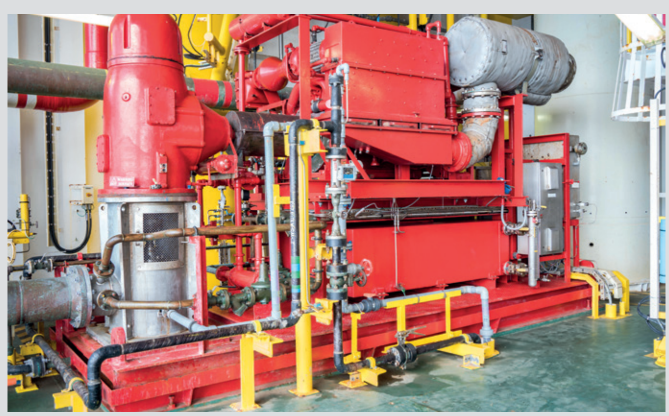
The plot represents energy absorption versus frequency. Helicopter impact forces are indicated by the red line, and the green line shows an 84% reduction in transferred energy with the isolators installed.

POWER GENERATION – TRANSFORMER

Fabcel pads and transformer mounts control structure-borne vibration and noise in single- and three-phase transformer installations.

OIL & GAS – COMPRESSOR

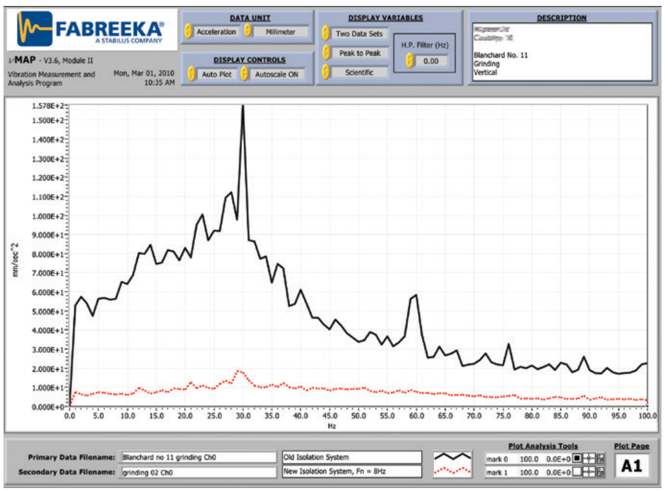
Fabcel pads, along with washers and bushings, are one of the options to avoid unwanted vibration on compressor skids.



OEM PARTS

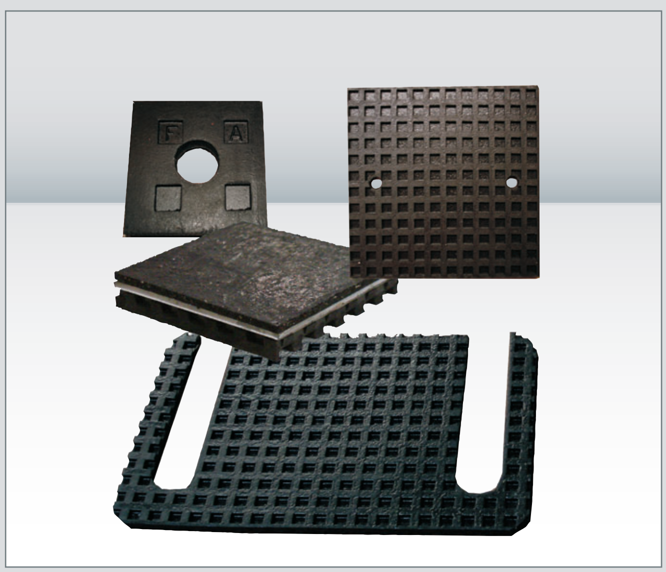
INDUSTRIAL MACHINERY – GRINDER

Fabreeka performed a vibration study to compare the frequency floor response with the current set up versus the new isolation system for a Blanchard grinder. The new isolators consisted of Fabcel Lev-L mounts with 9 layers of Fabcel 100. The new isolation system reduced the transmitted vibration levels by 92%.



Fabcel can be supplied in the form of sheets, cut pads, washers and assemblies for OEM applications. The dimensions and thickness are specifically designed for the reduction of impact shock, vibration isolation and structure-borne noise reduction. Fabcel can also be manufactured with a PTFE (Teflon®) surface or a thermal insulation material to provide either a low coefficient of friction or thermal protection when required.

Isolation Washers



Want to learn more about us, or have a specific isolation issue?

Ask us about it – we'll get together to find a solution.

If you have any questions regarding how Fabreeka's products comply with various regulations, please refer to our website at www.fabreeka.com/product-compliance

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