



# MARSHIELD NUCLEAR

**T-FLEX®** Non Lead Shielding

www.marshield.com



# T-FLEX® SOLUTIONS



T-Flex<sup>®</sup> products are a great solution for all your shielding needs. Tungsten, Bismuth and Iron-based attenuating materials are available. T-Flex<sup>®</sup> can be molded into any shape, allowing the application of localized shielding directly at the source. Isolated hot spots can be shielded using T-Flex<sup>®</sup>, eliminating the need to shield larger areas surrounding the hot spot. T-Flex® can be engineered to meet weight, size, and radiation attenuation specifications. T-Flex® products have saved power plants time and money during maintenance shutdowns. All T-Flex<sup>®</sup> products are non-toxic and free of hazardous materials. T-Flex<sup>®</sup> shielding materials allow us the ability to create light weight, easy-to-use, customizable products. Customer feedback indicates that T-Flex<sup>®</sup> is a user friendly and effective means of reducing radiation fields. The weights and sizes available make T-Flex® easy to handle, with improved ergonomics, reducing the prospect of lifting and handling injuries. T-Flex<sup>®</sup> can provide attenuation properties similar to lead products, but at half the weight.

# T-FLEX® FLEXIBILITY



T-Flex<sup>®</sup> products maximize shielding effectiveness while keeping weight to a minimum. T-Flex<sup>®</sup> is ideal for applications that require custom mouldable shapes along with flexibility; such as small-bore pipes, elbows and valves. T-Flex<sup>®</sup> products are available as blankets, ribbon wrap, pipe shields, floor tiles, magnetic tiles, and molded shapes - flexible or rigid. Fasteners and securing methods are also available, including magnets, grommets and locking devices. T-Flex<sup>®</sup> Tungsten, Bismuth, and Iron products are rated for continuous use up to 350° F/176° C. T-Flex<sup>®</sup> Highlights:

- Efficient placement of shielding closest to source
- Install in seconds through "slip-over-the component" design, integral fasteners and/or magnets
- Keep radiation fields ALARA, achieving dose reduction goals by adding these highly effective shielding materials to your shielding tool box
- Lead alternative with no hazardous materials
- Mold to any shape
- Easily cut for in field adjustments

#### RIBBON WRAP

These highly flexible T-Flex<sup>®</sup> strips can spiral wrapped be around equipment and components for a quick spot shielding hot solution. Standard ribbon length is 8 feet (approximately 2.4 m) and material can be cut in the field easily using typical cutting tools.





### PIPE SHIELDS

Ideal for small bore pipe applications. Engineered to be within weight limitations w hile maximizing attenuation. Cinch straps are include for each section of pipe shielding.



Pipe Size	Material	Attenuation	T-Flex® OD	Lb/ft
1" (1.315")	T-Flex® Tungsten	50%	3.1"	19
1" (1.315")	T-Flex® Bismuth	50%	3.8"	20
1" (1.315")	T-Flex® Tungsten	75%	4.8"	50
1" (1.315")	T-Flex® Bismuth	75%	6.2"	58
2" (2.375")	T-Flex® Tungsten	50%	4.2"	28
2" (2.375")	T-Flex® Bismuth	50%	4.9"	29
2" (2.375")	T-Flex® Tungsten	75%	5.9"	69
2" (2.375")	T-Flex <sup>®</sup> Bismuth	75%	7.3"	75
3" (3.5")	T-Flex® Tungsten	50%	5.3"	37
3" (3.5")	T-Flex <sup>®</sup> Bismuth	50%	6.0"	38
3" (3.5")	T-Flex® Tungsten	75%	7.0"	87
3" (3.5")	T-Flex® Bismuth	75%	8.4″	92

# FLOOR SHIELDING



T-Flex<sup>®</sup> floor shielding designed is to provide economical and ergonomic solutions for shielding sources located below workers. Each tile combines the attenuation properties of T-Flex<sup>®</sup> with the durability of a work mat. Floor mats can be cut for in field adjustment as required. Floor shielding features a nonslip diamond tread surface. Sample applications include:

- Dry cask platforms
- Scorpion platforms
- Refuelling bridges



Material	lb/ft <sup>2</sup>	Thickness	Attenuation
T-Flex <sup>®</sup> Tungsten	10	0.375″	25%
T-Flex <sup>®</sup> Bismuth	10	0.515"	24%
T-Flex® Iron	10	0.765″	18%
T-Flex <sup>®</sup> Tungsten	15	0.505″	32%
T-Flex <sup>®</sup> Bismuth	15	0.725″	33%
T-Flex® Iron	15	1.125″	26%
T-Flex <sup>®</sup> Tungsten	20	0.645″	39%
T-Flex <sup>®</sup> Bismuth	20	0.945″	41%
T-Flex® Iron	20	1.475″	32%





Magnetic tiles cling to any carbon steel surface allowing for a variety of applications. Each tile installs quickly and is easily removed by pulling a D-ring. Tiles are available with magnets strong enough for use under equipment.





#### BLANKETS



blankets





Material	Size	lb/ft <sup>2</sup>	Attenuation	Weight	
T-Flex® Tungsten	1' x 3'	10	19%	30 lb	
T-Flex® Tungsten	1' x 3'	15	27%	45 lb	
T-Flex® Tungsten	1' x 4'	10	19%	40 lb	
T-Flex® Tungsten	1' x 4'	15	27%	60 lb	
T-Flex® Bismuth	1' x 3'	10	20%	30 lb	
T-Flex® Bismuth	1' x 3'	15	29%	45 lb	
T-Flex® Bismuth	1' x 4'	10	20%	40 lb	
T-Flex® Bismuth	1' x 4'	15	29%	60 lb	





Non-toxic T-Flex<sup>®</sup> beaker and vial shields provide a convenient method of reducing extremity dose when handling radioactive samples in laboratory environments. Shields are available for storage of beakers and vials individually or several together in a rolling case.







The silicone base T-Flex<sup>®</sup> for allows for manufacturing of complex and custom shapes. Custommoulded shapes allow the shielding to be installed as close to the source as possible, making it more effective at reducing dose rates, helping to keep doses ALARA.





# DRY CASK COMPOSITE



T-Flex<sup>®</sup> dry cask composite shielding is designed to tackle both neutron and gamma sources associated with dry cask operations. this composite In shielding material T-Flex<sup>®</sup>, an excellent gamma attenuator, is supplemented with an additional neutron such as attenuator borated polyethylene.





# GAMMA ATTENUATION IN BY TYPE OF MATERIAL

Attenuation for Various Materials and Thicknesses at Co-60 Energy (≈1250 keV)													
Material	Thickness (inch)												
	0.125	0.25	0.375	0.5	0.625	0.75	1	1.25	1.5	1.75	2	2.5	3
Lead Sheet	14%	28%	39%	48%	57%	63%	74%	82%	87%	91%	94%	97%	99%
T-Flex Tungsten	8%	17%	25%	32%	38%	44%	54%	62%	69%	75%	80%	86%	91%
T-Flex Bismuth	6%	12%	18%	24%	29%	34%	42%	50%	57%	62%	67%	76%	82%
T-Flex Iron	3%	6%	9%	12%	15%	18%	23%	28%	33%	37%	41%	48%	55%

Attenuation for Various Materials and Thicknesses at Co-60 Energy ( $\approx$ 1250 keV)



## GAMMA ATTENUATION BY TYPE OF MATERIAL



The physics of gamma radiation shielding and the attenuating impact of available shielding materials can be distilled down to "mass-in-the-path". For gamma energies approaching Cobalt-60 (1.25 MeV), achieving 50% attenuation or half-value-layer (hvl) will have very similar weights per unit area. What will vary is the thickness of the material necessary to achieve the desired attenuation.



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#### Mars Metal Company

4140 Morris Drive, Burlington, Ontario Canada L7L 5L6

Ph: 905.637.3862 Fax: 905.637.8841 Toll Free U.S. & Canada 1.800.381.5335

sales@marshield.com www.marshield.com

