

Type FR

FLAME RESISTANT

Product Description

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) products are comprised of a blend of Modacrylic, Aramid and Polyester fibers. This insulation is designed as a mid-loft product intended for garments that could be exposed to unplanned or accidental flames, heat or electric arc. 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) has very nice drape characteristics to aid in garment styling for end user comfort.

Intended Uses

- For use in apparel designed for only momentary, unplanned or accidental exposure to flames, heat or electric arc.
- Not for use in protective apparel for proximity firefighting, wildland firefighting, structural firefighting, fire entry, technical rescue or other firefighting operations.
- 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) is strictly a component rather than an end article. Garment manufacturers need to conduct their own testing on full finished garments to determine whether the garments meet any particular standard. It is only intended for use in apparel when in conjunction with applicable fire-resistant shell and liner materials. Refer to the construction guidelines and care instructions section for proper construction requirements.

Fiber Composition

U.S. Convention:

Insulation:
55% Modacrylic
30% Aramid
15% Polyester

ISO Convention:

Insulation:
55% modacrylic (MAC)
30% aramid (AR)
15% polyester (PES)

Available Widths

60" (1.52 m) roll width (nominal) with a 2" (5.1 cm) inside diameter core.

Properties

Typical Values*	3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) 55% Modacrylic, 30% Aramid, 15% Polyester						
	Basis Weight		Thickness ASTM D 5736 @ 0.002 psi		Thermal Resistance (R _{ct})** ASTM F 1868		
	g/m ²	oz/yd ²	cm	inch	clo	R-value	m ² °K/W
FR 120	120	3.5	1.0	0.40	2.0	1.8	0.31
FR 150	150	4.4	1.2	0.48	2.4	2.1	0.37
FR 200	200	5.9	1.55	0.61	3.0	2.6	0.46

* Values represent the averages of the population of lots at date of publication

** Warmth is for insulation alone

$$\text{Clo (R}_{ct}) = \frac{(0.18 \text{ °C} \times \text{m}^2 \times \text{hr})}{\text{K cal}} \quad \text{R-value} = \frac{(\text{hr} \times \text{ft}^2 \times \text{°F})}{\text{BTU}}$$

Flammability Properties¹

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) 55% Modacrylic, 30% Aramid, 15% Polyester				
Vertical Burn ASTM D6413/D6413M-136 (Initial non-laundered) ^{***}		Product Designation		
		FR 100	FR 150	FR 200
Char Length	inches	<6	<5	<4
	mm	<152	<125	<100
Afterflame	sec	<2	<2	<2
Afterglow	sec	<2	<2	<2
Melting Drip	sec	0	<2	<2
CAN/CGSB-4.2 No. 27.10-2000 (Initial non-laundered) ^{****}				
Damage Length	mm	<100	<100	<100
AfterFlame	sec	<2	<2	<2
Surface Ignition EN ISO 15025:2002 (Initial non-laundered) [†]				
Further flaming to top or sides		no	no	no
Hole formation		yes	yes	yes
Flaming, melting debris		no	no	no
Afterflame	sec	<2	<2	<2
Afterglow	sec	<2	<2	<2

¹ This data was generated by outside, independent laboratories

^{***}ASTM D 6413/D6413M-136 Standard Test Method for Flame Resistance of Textiles (Vertical Test)

^{****}CAN/CGSB-4.2 No. 27.10-2000 Textile Test Methods. Flame Resistance - Vertically Oriented Textile Fabric or Fabric Assembly Test

[†]EN ISO 15025:2002 Protective clothing - Protection against heat and flame - Method of test for limited flame spread

Construction Guidelines

GENERAL MANUFACTURING GUIDELINES

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) products need to be properly used in order to produce their intended benefits in apparel and related articles. For this reason, specifiers, garment manufacturers and converters need to abide by the construction guidelines and care instructions in this Technical Data Sheet. It is primarily the garment manufacturer's/designer's responsibility to assure their end customers' satisfaction by:

1. Selecting appropriate shell and lining fabrics, including findings and recommended scrims for the intended application.
2. Following the construction guidelines supplied by 3M for the design and manufacture of each garment.
3. Determination of the proper care instructions (taking into account 3M recommended care instructions) and creation of the appropriate label to be sewn into each garment.

GENERAL FABRIC RECOMMENDATIONS

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) is not intended for use between non-FR fabrics. Always use the applicable fire-resistant shell and liner materials when constructing apparel. (Manufacturers have responsibility for garment design and for specifying the appropriate FR fabrics for the intended applications.)

The 3M™ Thinsulate™ Insulation family of products does not require downproof fabrics in most instances. However, when using 3M™ Thinsulate™ Insulation with fabrics that are not downproof, the potential for fiber migration should be determined.

- Fiber migration due to wash durability can be detected by sewing a pillow of the garment components — following the construction guidelines — and washing it five times as recommended. Observe the fabric surface for protruding fiber ends.
- Fiber migration caused by other mechanisms can be assessed by submitting fabric samples to the 3M laboratory through 3M sales representatives.

All constructions, regardless of pick count, should be evaluated for fiber migration following the previously stated instructions.

The use of fiberproof scrims to separate the insulation from textured shell or lining fabrics, coated, micro-coated, or waterproof breathable fabrics is required when needed to prevent fiber migration. This can be accomplished by adding scrim(s) during the garment construction process when necessary.

Some scrims, such as polyolefin, may adversely affect flame resistance properties and should not be used. Scrims, if needed, should be assessed by the manufacturer to assure that final garment flame resistance requirements are met.

When using coated, micro-coated, or waterproof breathable fabrics, the durability of the insulation is decreased because of surface friction and because water cannot be flushed through the garment and an intervening layer of scrim should be used against such fabrics. Durability may also be enhanced by providing a means via openings or vents at the bottom of a garment through which water can be easily expelled to minimize stress on the insulation during agitation and water extraction.

CONSTRUCTION GUIDELINES FOR 3M™ THINSULATE™ FLAME-RESISTANT INSULATION (TYPE FR) COMPONENTS FOR USE IN GARMENTS AND PRECURSOR PACKAGES

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) may be quilted using conventional quilting equipment. It must be quilted in a diamond pattern or equivalent not to exceed 6" by 6" (as measured on the diagonals). Quilt spacing of less than 4" by 4" is discouraged in order to achieve desired warmth.

Thorough garment testing by the manufacturer is necessary for quilt dimensions outside of the recommended range to make sure that product efficacy is maintained. This testing will need to include, but is not restricted to: Thermal Resistance (i.e., "Clo value"), laundry durability, and pertinent flame resistance characteristics. Consult with your 3M sales or technical service representative for further information.

ROLL HANDLING INSTRUCTIONS

Lay flat, do not stand on end.

Allow 24 hours for recovery after vacuum pack is removed.

Care Instructions

Care instructions from the garment manufacturer need to be followed to ensure integrity of the overall garment.

INDUSTRIAL WASH:

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) should be quilted in a 4" to 6" diamond pattern as measured on the diagonals. Industrial wash up to 75 °C (167 °F). Use only mild detergent and short washing process. Use only non-chlorine bleach when needed. Tumble dry up to 66 °C (150 °F); do not tunnel finish. Do not steam press. Steam only or use cool iron. Industrial laundering may reduce loft.

Note: These conclusions were determined through 3M internal test procedures for heavy industrial wash as defined above. Using harsher cleaning conditions can significantly reduce product life, in which case additional wash testing is recommended.

WASH OR DRY-CLEAN:

- + 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) should be quilted in a 4" to 6" diamond pattern as measured on the diagonals. Machine washable hot up to 60 °C (140 °F). Use only non-chlorine bleach when needed. Tumble dry high heat up to 66 °C (150 °F). Do not steam press. Steam only or use cool iron or professionally dry-clean. Dry-cleaning and hot washing may reduce loft.

WASH ONLY:

- + 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) should be quilted in a 4" to 6" diamond pattern as measured on the diagonals. Machine wash hot up to 60 °C (140 °F). Use only non-chlorine bleach when needed. Tumble dry high heat up to 66 °C (150 °F). Do not steam press. Steam only or use cool iron. Hot washing may reduce loft.

DRY-CLEAN ONLY:

- + Professionally dry-clean only. Tumble dry, low heat. Do not steam press. Steam only or use cool iron. Dry-cleaning may reduce loft.

Illustrative Examples

Arc ratings for ensembles of various shell & lining fabrics in combination with 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR):

Tested in accordance with ASTM F1959-2004 Standard Test Method for Determining the Arc Rating of Materials for clothing and based on a single test for each product listed below. ATPV data is for illustrative purposes only and does not mean that the final results will be the same with these or other fabric materials or that any specific standards will be met by the final garment. Manufacturers need to conduct their own testing on full finished garments to determine suitability for its application and whether the garments meet any particular standard.

3M™ Thinsulate™ Flame-Resistant Insulation (Type FR)			
Product Designation	Shell Fabric	Liner Fabric	Arc Rating cal/cm ²
FR 120	6 oz/yd ² NOMEX® IIIA	3.3 oz/yd ² NOMEX®	36
FR 150	6 oz/yd ² NOMEX® IIIA	3.3 oz/yd ² NOMEX®	41
FR 200	6 oz/yd ² NOMEX® IIIA	3.3 oz/yd ² NOMEX®	44
FR 120	11 oz/yd ² INDURA® ULTRA SOFT® 961	5.5 oz/yd ² INDURA® ULTRA SOFT® 341	47
FR 150	11 oz/yd ² INDURA® ULTRA SOFT® 961	5.5 oz/yd ² INDURA® ULTRA SOFT® 341	48
FR 200	11 oz/yd ² INDURA® ULTRA SOFT® 961	5.5 oz/yd ² INDURA® ULTRA SOFT® 341	49

Measured properties of 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) products in quilted applications:

Results are based on 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) products quilted in a 6" diamond pattern (measured diagonally). Quilting data is based on a single quilting run for each product and is for illustrative purposes only and does not mean that the final results will be the same with these or other fabric materials. Quilting conditions and variables may influence results. The 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) products below were quilted between 11 oz/yd² INDURA® Ultra Soft® 961 and 5.5 oz/yd² INDURA® Ultra Soft® 341; along with a 0.4 oz/yd² (13.5 g/m²) scrim.

Physical Properties	3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) 55% Modacrylic, 30% Aramid, 15% Polyester			
	Additional Features			
Product Designation	Thickness		Thermal Resistance (R _{cl}) [*] ASTM F1868	
	cm	inch	clo	R-value
FR 120	0.80	0.32	1.5	1.3
FR 150	1.0	0.39	1.7	1.5
FR 200	1.1	0.45	2.0	1.8

* Properties are for quilted packages

$$\text{Clo (R}_{cl}) = \frac{(0.18 \text{ } ^\circ\text{C} \times \text{m}^2 \times \text{hr})}{\text{K cal}} \quad \text{R-value} = \frac{(\text{hr} \times \text{ft}^2 \times \text{ } ^\circ\text{F})}{\text{BTU}}$$



WARNING

- Always use the applicable fire-resistant shell and liner materials when constructing apparel.
- Do not use in protective apparel for structural firefighting, proximity firefighting, wildland firefighting, fire entry, technical rescue or other firefighting operations.
- Do not use in apparel designed for more than momentary, unplanned or accidental exposure to flames, heat or electric arc.
- Always add Proper Care/Laundrying Instructions to apparel.
- Always ensure that 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) is the only type of 3M™ Thinsulate™ Insulation used in constructing apparel requiring flame resistance.
- Use of 3M™ Thinsulate™ Flame-Resistant Insulation (Type FR) in inappropriate applications could increase the severity of injury to the end user.



CAUTION

- Always use NIOSH or CE-approved Personal Protective Equipment when the handling, cutting or processing of rolls is expected to produce fibers or airborne dust.
- Do not use in apparel designed for more than momentary, unplanned or accidental exposure to chemicals or flammable contaminants.

IMPORTANT NOTICE

WARRANTY: In the event any 3M™ Thinsulate™ Insulation product is found to be defective in material, workmanship or not in conformance with any express warranty for a specific purpose, 3M's only obligation and your exclusive remedy shall be to repair, replace or refund the purchase price of such parts or products upon timely notification thereof and substantiation that the product has been stored, maintained and used in accordance with 3M's written instructions.

EXCLUSIONS TO WARRANTY: THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHER WARRANTY OR CONDITION OF QUALITY, EXCEPT OF TITLE AND AGAINST PATENT INFRINGEMENT.

LIMITATION OF LIABILITY: Except as provided above, 3M shall not be liable or responsible for any loss or damage, whether direct, indirect, incidental, special or consequential, arising out of the sale, use or misuse of 3M™ Thinsulate™ Insulation products or the user's inability to use such products. **THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.**

3M's general terms and conditions also apply to the sale of this product.

3M may change the product, specifications and availability of the product as improvements are made: therefore, user should contact 3M for latest information before specifying the product.

All 3M™ Thinsulate™ Insulation rolls and 3M™ Thinsulate™ Featherless Insulation bags are produced within strict dimensional and weight tolerance specifications. However, changes in environment and other factors may cause the final dimensions and/or bag weights to shift, shrink, or otherwise change up to a maximum of ±4% during handling or shipment.

Please allow products to recover 24 hours after vacuum pack is removed.

**Home Care Division**

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