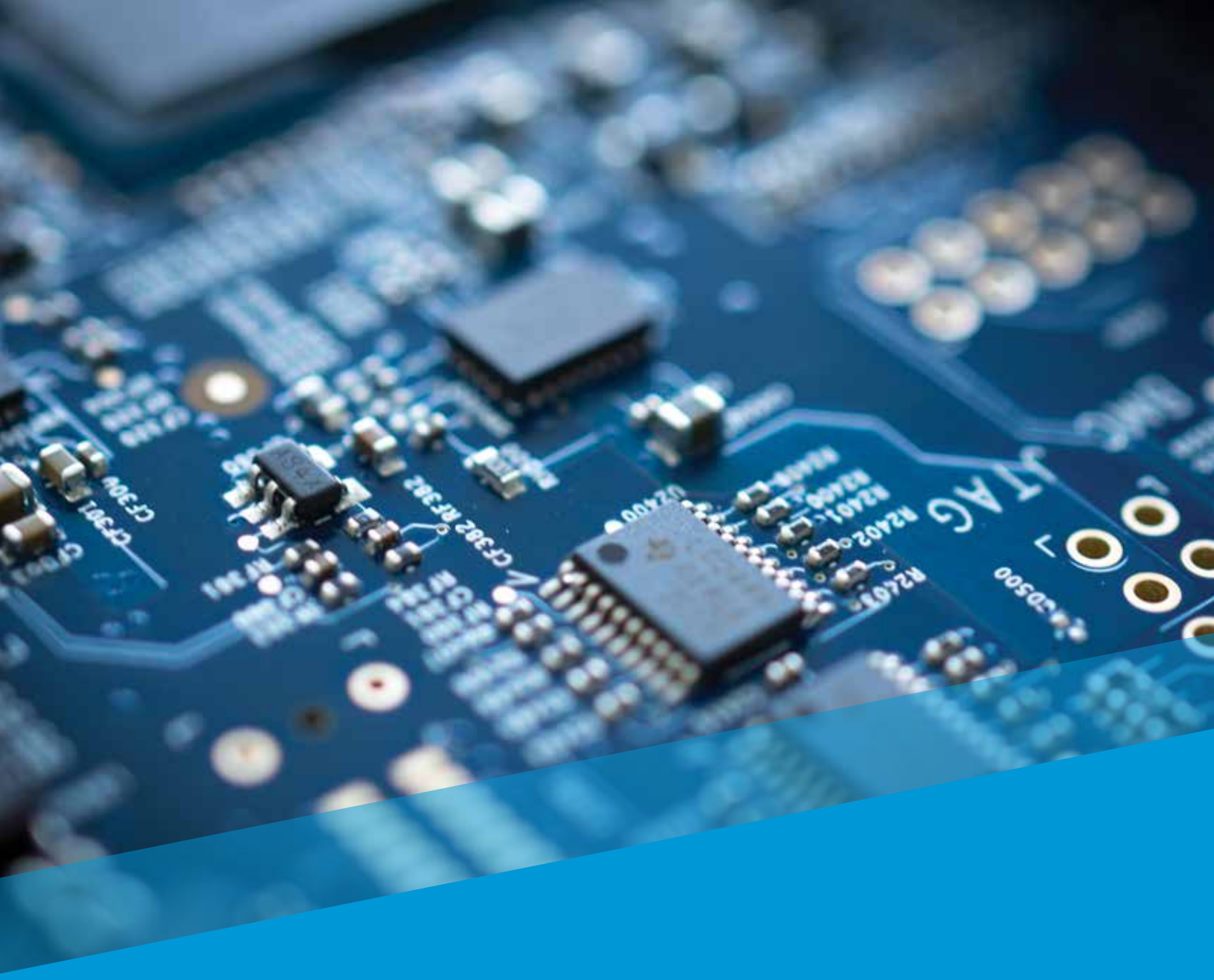

Tape Solutions for Flexible Heaters

SAINT-GOBAIN

Tape Solutions for Flexible Heaters

Saint-Gobain® Tape Solutions offers a complete range of products for flexible heater construction that serve the aerospace, defense, medical, industrial and semiconductor markets. From flex heater insulation to heat tracing and protection tapes, our **CHR**® Tapes, **Norbond**® Bonding Tapes and **Norseal**® Silicone Rubber product lines cover the full range of needs for flexible heater applications. Combining the unique properties of these product families, Tape Solutions can offer a complete optimized solution intended to deliver process efficiencies and application tailored performance.

Flex Heater Silicone Insulation Products

Products: Silicone Sponge, Solid and Reinforced Rubber

Functions: Used throughout the flex heater where long term insulation protection, extreme longer heater life and high dimensional stability are required

Features: High thermal stability over wide temperature range with UL flame retardant option, custom colors and thicknesses, fiberglass reinforcement option for prolonged high-pressure and temperature needs

Silicone Sponge Rubber: **Norseal** Silicone Sponge Rubber is used where long-term protection against moisture, chemical resistance, and excellent thermal stability are required. Its very low outgassing creates a cleaner operation, making this product line ideal in critical applications such as aircraft sensors. The silicone sponge rubber products can be relied on for the thermal stability over a wide temperature range and options available.

Norseal R10400 is a flame retardant closed cell sponge, recognized to UL 94-V0. It has superior mechanical strength properties, such as great tear strength, abrasion resistance and tensile strength over other silicone rubber systems that can be used in sharp applications in a variety of formed heat transfer shapes. **Norseal** R10404 offers thermal conductivity, electrical isolation and compression set resistance (vibration absorption). These properties combined make this product ideal for thin, flexible circuits/heaters for Military/Aerospace defense that will keep operating even under extreme conditions, as well as circuits for medical instrumentation where thin material and precision are critical. **Norseal** R10460 is a medium grade silicone sponge rubber that is rated UL 94 HB/ V-1 for thicknesses > 11.7 mm, flexible and compressible and designed to be used in a wide temperature range with excellent weatherability. This option is used in heaters to warm batteries in communications systems and aerospace applications where special flame retardant properties are required. **Norseal** R10470 can be used as a function of general insulation for flex heaters with an economical price point. This option allows for a wide temperature range (100–500°F) and is also available with acrylic or silicone adhesives for an easier and faster application.

Silicone Solid Rubber: **Norseal** Silicone Solid Rubber is used where extreme longer heater life is required. The options available include very thin gauges for small areas where traditional electric heating elements cannot fit. Featuring a smooth surface, longer service life, differing levels of durometer, pliability and the ability to assume the contour of irregular shapes. The combination of these properties makes this line the perfect choice to be used in a flex heater construction where unique shapes are required. The silicone solid rubber products reduce maintenance and provide a cost savings long term.

Norseal 9050/500 withstands temperatures from -100°F to +500°F. These solid silicones are manufactured in different formulations to provide a choice of physical properties and cost considerations. With a hardness of 50 to be used in flexible heaters, these products can be made to mount on a

variety of surfaces, including flat. 9050/500 is also available with a pressure sensitive adhesive option, allowing the heater to attach faster onto its mounting surface, resulting in reduced processing costs. Options include degrees of hardness from soft 30 to a relatively hard 70 durometer on the Shore A scale.

Silicone Reinforced Rubber: **Norseal** Silicone Reinforced Rubber gives the wire wound or the etched foil heater dimensional stability without sacrificing flexibility when used in flex heaters. Reinforced solid silicones are formulated with fiberglass to increase the product's ability to withstand high-pressure (up to 1000 psi) over a wide temperature range (up to 575°F) for prolonged periods.

Norseal 4444 is uniquely designed to give better reversion resistance with special crush-resistant fiberglass, making it the ideal solution for press pads application. **Norseal** 4480 is our most reversion-resistant silicone compound, designed for use in flexible heaters involving the tough combination of prolonged high-pressure confinement (up to 1000 psi) at temperatures up to 575°F. Suitable for substrate etched or wire wound heating elements that can be used for a wide range of industrial and commercial heating applications.

Heat Tracing Tapes

Products: Glass Cloth Tape and Aluminum Foil Tape

Function: Attachment method and protection for heating elements on pipes

Features: Conformable, flame retardant, abrasion resistant glass cloth. Designed for performance in wide range of temperatures and humidity. Aluminum tapes double as a moisture barrier

Glass Cloth Tape: **CHR** Glass Cloth Tapes come in a variety of adhesive formulations and offer excellent abrasion resistance, flame retardance, and electrical insulation for flexible heat cable attachment and protection in heat tracing applications. GL.94, with acrylic adhesive, has a high bond strength for moderate temperature ranges (-20 to 350°F); GL.95, with rubber adhesive, features a high tack thermosetting rubber adhesive; GL.99, with silicone adhesive, can be used for higher temperature applications up to 500°F; and G561, with thermosetting silicone adhesive, offers high adhesion up to 600°F. GL Series tapes are all UL 510 recognized on file E178430.

Aluminum Foil Tape: **CHR** AR.050 and AR.080 Soft Aluminum Tapes are highly conformable, ensuring good contact between the tape, the heat tracing cable and the heat sink. The aluminum backing provides even heat distribution across the heat sink. The aluminum tapes are flame retardant and create a moisture barrier to reduce condensation.

Flex Heater Insulation and Coverlay Tapes

Products: Single-Coated and Double-Coated Polyimide Tape

Functions: Used in flex heater construction, protects resistive circuit inside heater and serves as electrical insulation protection layer. Pressure sensitive adhesive (PSA) provides a placement method.

Features: Highly conformable, fast heat transfer polyimide offering resistance against chemicals and oils. Low outgassing options available. Performance for extreme high and low temperature conditions.

Polyimide Tape: **CHR** Polyimide Tapes offer a full range of options for use in flex heater construction. **CHR** 2345-1D and 2345-2D are premium grade tapes made with Dupont **Kapton**® Polyimide Film and silicone adhesive. **CHR** 2345-1, 2345-2, and 2345-5 cover a full thickness range to balance dielectric and heat transfer requirements. **CHR** K104 is a 0.5 mil polyimide tape, maximizing both conformability and heat transfer through the flex heater. **CHR** K250A and K350 can maintain strong adhesion for flex heaters used up to 500°F for extended periods of time. **CHR** K102 and K109 are acrylic adhesive options to maximize bond strength. K102 can be used in aerospace applications where outgassing considerations are critical. **CHR** 2345-1 and 2345-2 are UL 510 recognized on file E66639, while K250A and K350 are UL 510 recognized on file E51201.

Double-Coated Polyimide Tape: **CHR** K100 can be used in flex heater construction without the need for transfer tape for placement, as it already has adhesive coated on each side. It comes with a protective liner to ensure adhesion performance is preserved until use, and it is also thin and conformable for fast and efficient heat transfer.

Lamination, Placement and Protection Tapes

Products: Acrylic, Silicone, Electrically Conductive Acrylic Transfer and Polyester Protection Tapes

Functions: Bonding layer within flex heater construction. PSA mounting of silicone and polyimide flex heaters to heat sinks. Protection tape for flex circuit processing

Features: Electrically conductive option. Acrylic adhesive for high bond strength, can be thermoset. Silicone adhesive for broad temperature range and for low surface energy heat sink attachment. Dual acrylic/silicone tape option for bonding dissimilar surfaces. Thin polyester with rubber adhesive for high conformability and economical protection

Acrylic Transfer Tape: **Norbond** A7100 0.05mm and A7100 0.13mm are high bond strength transfer tape options for moderate temperature flex heater construction and placement. The 0.05mm option is optimal for flatter surfaces, while 0.13mm option is more suited for slightly curved surfaces or surfaces with profiles.

Silicone Transfer Tape: **CHR** TRS-050 is a unique high temperature transfer tape designed for laminations, bonding at high temperatures and bonding to low surface energy materials, such as silicone rubber.

Electrically Conductive Transfer Tapes: **CHR** 6810 is used for splicing and bonding flex circuits together, providing a simple, efficient method for circuit continuity.

Acrylic/Silicone Double-Sided Tape: **CHR** 8644 is a specialized, double-sided PET supported tape designed to optimize the bond between low energy materials, such as silicone rubber, to a wide variety of heat sink surfaces under moderate temperature conditions.

Polyester Protection Tape: **CHR** M734 is an orange 1 mil polyester tape with natural rubber adhesive designed to withstand high temperature processing and chemicals. Offers dependable protection of flex circuitry during manufacturing processes.

Flex Heater Silicone Insulation Material Selection Guide

Material Type	Product Code	Tensile Strength psi (kPa)	Elongation (%)	Temperature Range °F (°C)	Flammability Rating	Color	Product Features
Silicone Sponge Rubber	R10400	100 (690)	250	-100 to 500 (-73 to 260)	UL 94V-0	Gray	Closed cell sponge with excellent mechanical properties
	R10404	120 (828)	150	-80 to 400 (-62 to 205)		Light Green	Thermally conductive closed cell sponge that offers electrical isolation and temperature stability
	R10460	75 (518)	125	-100 to 500 (-73 to 260)	UL 94 HB/ V-1 for thicknesses > 11.7 mm	Dark Blue/ Gray	Closed cell sponge with low compression set and excellent mechanical properties
	R10470	90 (621)	150	-100 to 500 (-73 to 260)		Orange/ Tan (std); Black/Gray	Closed cell sponge available in medium and firm grades
Silicone Solid Rubber	9050/500	900 (6205)	400	-100 to 500 (-73 to 260)		Red (std); Black	Durometer 50 on the Shore A scale; manufactured in different formulations to provide a choice of physical properties and cost considerations
Silicone Reinforced Rubber	4444	300 ppi warp	<10	up to 400 (204)		Red (std)	Press pads that conform to the highest traces and multiwire; available in a range of thicknesses
	4480	300 ppi warp	<10	up to 575 (301)		Dark Gray (std)	

Heat Tracing Tapes Material Selection Guide

Substrate	Product Code	Adhesive	Backing Thickness in (mm)	Adhesive Thickness in (mm)	Dielectric Strength (kV)	Peel Adhesion oz/in (N/cm)	Temperature Range °F (°C)	Product Features
Glass Fabric	GL.94	Acrylic	0.0047 (0.120)	0.0018 (0.045)	2.5	37 (4.0)	-20 to 311 (-29 to 155)	Conformable, abrasion resistant for heat tracing; UL510 file E178430
	GL.95	Rubber	0.0047 (0.120)	0.002 (0.050)	2.5	32 (3.5)	0 to 266 (-18 to 130)	High tack thermosetting rubber UL510 file E178430
	GL.99	Silicone	0.0047 (0.120)	0.0018 (0.045)	2.5	20 (2.2)	-100 to 356 (-73 to 180)	High temperature heat tracing and hold down tape UL 510 file E178430
	G561	Silicone	0.0045 (0.114)	0.0025 (0.064)	4.5	35 (3.8)	-100 to 590 (-73 to 310)	Premium high temperature thermosetting adhesive
Aluminum	AR.050	Acrylic	0.002 (0.050)	0.0016 (0.040)	—	50 (5.5)	-58 to 302 (-50 to 150)	Conformable, good thermal distribution for heat tracing
	AR.080	Acrylic	0.0031 (0.080)	0.0016 (0.040)	—	55 (6.0)	-58 to 302 (-50 to 150)	Thicker version of AR.050 for added protection

Flex Heater Insulation and Coverlay Tapes Material Selection Guide

Substrate	Product Code	Adhesive	Backing Thickness in (mm)	Adhesive Thickness in (mm)	Dielectric Strength (kV)	Peel Adhesion oz/in (N/cm)	Temperature Range °F (°C)	Product Features
Polyimide	2345-1D	Silicone	0.001 (0.025)	0.0015 (0.038)	6.5	21 (2.3)	-100 to 500 (-73 to 260)	Premium **Kapton**® grade
	2345-2D		0.002 (0.051)	0.0015 (0.038)	10	23 (2.5)	-100 to 500 (-73 to 260)	Premium **Kapton** grade, thicker version of 2345-1D
	2345-1		0.001 (0.025)	0.0015 (0.038)	6.5	25 (2.7)	-100 to 500 (-73 to 260)	Standard grade polyimide tape
	2345-2		0.002 (0.051)	0.0015 (0.038)	10	25 (2.7)	-100 to 500 (-73 to 260)	Thicker version of 2345-1
	2345-5		0.005 (0.127)	0.0015 (0.038)	17	25 (2.7)	-100 to 500 (-73 to 260)	Thickest polyimide tape offering
	K104		0.0005 (0.013)	0.001 (0.025)	4	15 (1.6)	-100 to 500 (-73 to 260)	Thinnest polyimide tape offering
	K250A		0.001 (0.025)	0.0015 (0.038)	6.5	30 (3.3)	-100 to 500 (-73 to 260)	High temperature adhesive; UL 510 file E51201
	K350		0.002 (0.051)	0.0015 (0.038)	10	30 (3.3)	-100 to 500 (-73 to 260)	Thicker version of K250A; UL 510 file E51201
	K102	Acrylic	0.001 (0.025)	0.0015 (0.038)	7	30 (3.3)	-20 to 350 (-29 to 177)	Low outgassing
	K109		0.002 (0.051)	0.0015 (0.038)	10	30 (3.3)	-20 to 350 (-29 to 177)	Thicker version of K102
Double Coated Polyimide	K100	Silicone/ Silicone	0.001 (0.025)	0.0018/0.0018 (0.045/0.045)	7.5	20 (2.2)	-100 to 500 (-73 to 260)	Double-sided polyimide tape

Lamination, Placement and Protection Tapes Material Selection Guide

Substrate	Product Code	Adhesive	Backing Thickness in (mm)	Adhesive Thickness in (mm)	Peel Adhesion oz/in (N/cm)	Temperature Range °F (°C)	Product Features
Transfer Tape	A7100 0.05 mm	Acrylic	—	0.002 (0.050)	112 (13.0)	-40 to 302 (-40 to 150)	Thin ultra-high bond acrylic
	A7100 0.13 mm		—	0.005 (0.130)	112 (13.0)	-40 to 302 (-40 to 150)	Thicker version of 0.05mm A7100 for more contoured parts
	TRS-050	Silicone	—	0.002 (0.050)	45 (4.9)	-100 to 500 (-73 to 260)	High temperature transfer adhesive
	6810	Electrically Conductive Acrylic	—	0.002 (0.050)	46 (5.0)	-20 to 311 (-29 to 155)	Electrically conductive for bonding circuits
Double Coated Polyester	8644	Acrylic/Silicone	0.0009 (0.023)	0.0017/0.0019 (0.042/0.048)	23/46 (2.5/5.0)	-40 to 320 (-40 to 160)	Used to bond dissimilar surfaces, adheres well to silicone rubber on silicone adhesive side
Polyester	M734	Rubber	0.001 (0.025)	0.0006 (0.015)	6 (0.7)	-0 to 325 (-18 to 163)	Residue free masking/protection tape, chemical and temperature resistant

Your Partner in Custom Tape Solutions

A custom tape solution can pay for itself many times over thanks to the process and product improvements it can provide. Tape development engineers will work with partners to design an economical but highly effective tape product.

Even with endless permutations of industrial tapes available there is only one company that can deliver a custom-made tape with optimal adhesive, the perfect backing materials, seamless process integration and superb performance.

To learn more about how **Saint-Gobain** can help solve tape and materials engineering challenges, call us or visit us online.

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