

# Data Sheets

The following PDF is a complete set of all the currently available Data Sheets for our various products. Each product's specifications were accurate at the time of preparation but are subject to change without notice.

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## Electrical Insulating Sleeving

Varflex Corporation, 512 West Court Street, Rome, NY • Phone (315) 336-4400 • Fax (315) 336-0005

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# Varglas A397 and 343 Acrylic Sleeving

## Description

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Varglas A397 and 343 Acrylic Sleeveings are produced by curing a modified acrylic resin on a continuous fiberglass braid, with A397 Acrylic best characterized by its flexibility. Both are resistant to most acids, organic solvents, oils and water and exhibit fair resistance to alkalis. They are compatible with modified polyester, acrylic, epoxy, phenolic and formvar wire enamels and are designed to perform for long periods in a 155°C range without loss of any electrical or physical properties.

## Specifications

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Both Varglas A397 and 343 Acrylic Sleeveings conform to, and are listed on the Qualified Products List (QPL) for, MIL-I-3190/3, latest revision (Grade A); NEMA TF-I, Type 6; and ASTM- D372.

Under the Component Program of Underwriters Laboratories, both Varglas A397 and 343 Acrylic Sleeveings in Grade A are recognized for 155°C, 600 volt service under UL File #E63450. CSA International certifies the use of both sleeveings in Grade A for 155°C, 600 volt service under CSA File #LR58486. They also are recognized in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL. Additionally, Grade C-3 Acrylic complies with UL's VW-I flammability requirements under UL File #E53690.

## Applications

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Varglas A397 and 343 Acrylic Sleeveings are used to insulate leads and crossovers in fractional and integral horsepower motors. They also are used in dry and oil-filled transformers, generators and other moisture-sensitive equipment, as well as in home appliances, lighting fixtures, instrument circuits and controls. Additional uses include switchgear, breaker panels, welding equipment and other commercial apparatus subjected to continuous operating temperatures of 155°C, particularly those requiring insulation system compatibility.

## Sizes

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AWG #24 through 2" I.D. Other sizes subject to inquiry

## Standard Color

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Natural. Other colors made to order.

## Standard Packaging

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Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



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# Varglas A397 and 343 Acrylic Sleeving

Property	Procedure	Performance
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## Physical

Tensile Strength, Coating	ASTM-D412	850 psi
Ultimate Elongation, Coating	ASTM-D412	150% @ 20°C
Tear Strength, Coating	ASTM-D624	60 psi
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)

## Chemical

Oil and Solvent Resistance	MIL-I-3190/3	Passes (Good)
Resistance to Acids and Alkalies	—	Good
Corrosion Resistance	—	Good. Contains no chlorine or other materials contributing to electrolyte formation.
Compatibility	UL 1446	Good. Compatible with modified polyester, acrylic, epoxy, phenolic and formvar wire enamels.

## Electrical

### Dielectric Strength after 48/23/50:

Grade A	NEMA TF - 1	7000v min. avg., 5000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
Grade C - 2	NEMA TF - 1	1500v min. avg., 800v min. indiv.
Grade C - 3	NEMA TF - 1	No voltage guarantee.

### Dielectric Strength after 96/23/96:

Grade A	NEMA TF - 1	50% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/3	1500 volts min. avg.

## Thermal

Thermal Endurance	MIL-I-3190/3 & UL 1441	Class 155°C (F)
Brittleness Temperature	ASTM-D350	- 25°C
Flame Resistance	ASTM-D350, Method B	Passes
	NEMA TF-1	Passes
	MIL-I-3190/3, Method B	Passes
	UL 1441	Passes (VW - 1), Grade C3 only.
Resistance to Potting Temperature	MIL-I-3190/3	No blisters, flow or cracks visible after 15 min. @ 225°C.

## Note:

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



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# Varglas ES-4400 Silicone Rubber Sleeving

## Description

Varglas ES-4400 Silicone Rubber Sleeving is produced by curing a specially compounded silicone gum with a select catalyst on a continuous length of fiberglass braid. Most silicone rubber is characterized, chiefly, by its capability of performing satisfactorily at elevated temperatures. Varglas ES-4400 Silicone Rubber, in addition to providing superior dielectric and thermal protection, at less weight, was developed to meet unusual fluid and flame resistance requirements. Its high temperature performance places it in a 220°C classification.

## Specifications

Varglas ES-4400 Silicone Rubber Sleeving conforms to, and is listed on the Qualified Products List (QPL) for, MIL-I-3190/8, latest revision (Grade A). It also exceeds the requirements of NEMA TF-1, Type 5; and ASTM-D372.

Under the Component Program of Underwriters Laboratories, Grade A Varglas ES-4400 Silicone Rubber is recognized for 200°C, 600 volt service and complies with VW-1 flammability requirements under UL File #E63450. (VW-1 compliance of Grades B through C-1 is covered under UL File #E53690.) CSA International certified the use of Grade A for 200°C, 600 volt service and flammability requirements under CSA File #LR58486 VW-1/FT1. Varglas ES-4400 is incorporated in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL.

## Applications

Varglas ES-4400 Silicone Rubber Sleeving's superior dielectric strength, high and low temperature performance, and excellent fluid and flame resistance make it ideally suited for use in industrial instrumentation for measurement, analysis and control; surgical, medical and optical instruments and apparatus; electrical and electronic machinery and equipment; and aircraft and other transportation equipment where its lighter weight provides an additional performance advantage.

## Sizes

AWG #24 through 1" I.D. Other sizes subject to inquiry.

## Standard Color

Blue-gray and tan. Other colors made to order.

## Standard Packaging

Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.



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# Varglas ES-4400 Typical Properties

Property	Procedure	Performance
<b>Physical</b>		
Tear Strength, Coating	ASTM-D624	180 psi (Die B)
Ultimate Elongation, Coating	ASTM-D882	570% @ 20°C
Hardness, Coating	ASTM-D2240	50 (Durometer, Shore A-2)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)
<b>Chemical</b>		
Chemical Resistance	UL 1441	Resistant to solvents and fluids including water vapor
Fungus Resistance	MIL- I- 631	Passes
Oil Resistance, 22 hour immersion @ 70°C	ASTM - D471	No measurable change in wall thickness when immersed in Skydrol LD. Varflex tests indicate good resistance to Freon 22 and refrigeration oil Suniso® 3-G.
Compatibility	UL 1446	Good. Compatible with select potting compounds and varnished wires with no deteriorating effects on end properties.
<b>Electrical</b>		
<b>Dielectric Strength after 48/23/50:</b>		
Grade A	NEMA TF - 1	8000v min. avg., 6000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
<b>Dielectric Strength after 96/23/96:</b>		
Grade A	NEMA TF - 1	80% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/8	5000 volts min. avg.
<b>Thermal</b>		
Thermal Endurance	MIL-I-3190/8	Class 220°C (R)
	MIL-I-3190/6 & UL 1441	Exceeds MIL-I-3190/6, latest revision, and UL 1441, Class 200°C
Brittleness Temperature	ASTM-D350	- 73°C
Flame Resistance	UL 1441	Passes (VW-1)
	ASTM-D350	Passes
	NEMA TF-1	Passes
	MIL-I-3190/8, Method A	Passes
Smoke Density (NBS Chamber)	ASTM-E662	Passes. Avg. non-flaming 3.7 OD.; Avg. flaming 19.7 OD.
Pushback after 168 hrs. @ 250°C	MIL-I-3190/8	No cracks or ruptures. 6000 volts min. avg. dielectric strength
<b>Note:</b>		

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# Vartube Extruded Tubing

## Description

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Vartube Extruded Tubings are made from polyvinyl chloride (PVC) and its copolymers which, because of the ease with which they combine with a large number of compounding elements, make it possible to produce tubings with a variety of performance characteristics.

There are three types of Vartube, all of which are resistant to oils, alcohol, aliphatic solvents, acids and alkalis as well as to fungus growth and corrosion.

**Type SHH:** A high heat-resistant, Class 105 tubing recognized by UL for continuous use in 105°C applications and VW-1 Flame test compliance under File #E69513. Also meets the requirements of, and is on the QPL for, MIL-I-631, Grade c, Classes I and II, Category 1.

**Type 120/210:** A high-quality, general purpose Class 90 tubing which exhibits an exceptionally wide temperature range from -55°C to 90°C maintaining a high dielectric strength and excellent flexibility over its full thermal span. Meets the requirements of, and is on the QPL for, MIL-I-631, Grades a and b, Classes I and II, Category 1.

**Type 302/203:** A Class 85 tubing able to withstand temperatures as low as -70°C. Its low-temperature characteristics exhibit unusual flexibility and high cut-through resistance with maintenance of dielectric strength. The upper thermal limit of 85°C is outstanding for this type of tubing. Meets the requirements of MIL-I-7444, Class 1, Types I and III.

## Applications

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**Type SHH:** Widely used on transformer, motor and coil lead wires. Also finds applications in electronic apparatus and in consumer goods such as toys, blenders, food machines, outboard motors, lawn care equipment, lighting equipment, motorcycles, etc. May also be used for vacuum or pressure hoses and transfer of compatible liquids.

**Type 120/210:** Used in appliances, electric motors, commercial and military aircraft, automotive components and a host of other installations. Its low temperature characteristics make it particularly useful in airborne equipment, electrical harnesses and snow machines.

**Type 302/203:** Recommended for cable and conduit installations and harnessing, especially where very low temperatures are to be encountered such as airborne devices, aircraft, missiles and snow machine wiring harness jackets.

## Sizes

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**Type SHH:** Std. wall #24 through 2-1/2" I.D.; 1/32" wall - #20 through 1/2" I.D.

**Type 120/210:** #24 through 1/2" I.D.

**Type 302/203:** #24 through 1" I.D.

## Standard Colors

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Transparent and black - #24 through #0

Black only - 5/16" I.D. and larger

Other colors made to order subject to minimum quantity ordering restrictions.

## Standard Packaging

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Spools. Cut lengths are available subject to cutting charges.



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# Vartube Typical Properties

	<b>Vartube SHH</b> MIL-I-631, Grade c		<b>Vartube 120/210</b> MIL-I-631, Grades a & b		<b>Vartube 302/203</b> MIL-I-7444, Class 1	
	Requirements	Performance	Requirements	Performance	Requirements	Performance
<b>Physical</b>						
Tensile Strength (Unaged)	Min. 1800psi	3480psi	Min. 1800psi	3000psi	Min. 1800psi	2150psi
Elongation (Unaged)	200 - 350%	315%	200 - 450%	350%	Min. 200%	350%
Flexibility	No cracks, 180° bend- 1/8" rod	No cracking	No cracks, 180° bend- 1/8" rod	No cracking	No cracks/splits when flexed	No cracks/splits
<b>Chemical</b>						
Oil Resistance	No cracks or oil penetration	Conforms	No cracks or oil penetration	Conforms	No tack or decomposition	Conforms
Corrosion Resistance	No corrosion	Conforms	No corrosion	Conforms	No corrosion of contact metals	Conforms
Fungus Resistance	No fungus growth	Conforms	No fungus growth	Conforms	No fungus growth	Conforms
<b>Electrical</b>						
Dielectric Strength						
— Dry	800v/mil	1180v/mil	750v/mil	1000v/mil	200v/mil	545v/mil
— Wet	85% of dry	94% of dry	85-90% of dry	95% of dry	200v/mil	493v/mil
<b>Thermal</b>						
Thermal Endurance (Continuous)	None	105°C	None	90°C	None	85°C
Cold Brittleness (Unaged)	- 10°C	- 25°C	- 46°C	- 57°C	- 67.8°C	- 74°C
Flame Resistance	15 sec. max.	Under 10 sec.	15 sec. max.	0 sec.	45 sec. max.	Under 10 sec.

**Note:**

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**Copolymer  
Coated  
Fiberglass  
Sleeving**

**Class 130**

(-25°C to +130°C)

(-13°F to +266°F)

Data Sheet

Suniso® is a registered trademark of Compton Corporation.

Icematic® is a registered trademark of Castrol, Inc.

ZEROL® is a registered trademark of Shrieve Chemical Products Company

25:3-06

# Varglas Hermetic Sleeving

## Description

Varglas Hermetic Sleeving is produced by coating braided fiberglass with a highly-crosslinked, modified acrylic copolymer that is extremely flexible yet very tough and abrasion resistant. It is highly resistant to refrigerants, at both high and low temperatures, and compatible with potting compounds and varnishes. Varglas Hermetic Sleeving offers good resistance to thermal shock and is unaffected by most common oils including xylol/paraffin oil (50/50 mixture by volume), refrigeration lubricants Suniso® 3-G (a mineral oil), Icematic® SW100 (a synthetic polyol-ester oil), and ZEROL® 150 (a synthetic alkylbenzene oil) and solvents including methylene chloride, toluene, xylene and 1,1,1 trichlorethane. Designed specifically for hermetic motors, its "low extraction" levels of soluble materials protect against contamination, as well as clogging, within the compressor system.

Varglas Hermetic Sleeving meets the requirements of NEMA TF-1, Type 2, and ASTM-D372.

## Applications

Varglas Hermetic Sleeving is ideally suited as insulation in hermetically-sealed refrigeration units. It is resistant to hydrochlorofluorocarbon (HCFC) refrigerants such as R-22 and R-123 as well as the new, environmentally-friendly hydroflouorocarbon (HFC) refrigerants such as R-134a. It also is compatible with mineral-oil lubricants such as Suniso® 3-G, synthetic polyol-ester refrigeration lubricants such as Icematic® SW100, and synthetic alkylbenzene refrigeration oils such as ZEROL® 150. In addition to being free of contaminating impurities, its tough coating resists thermal shock, rough assembly handling, and mechanical stress without loss of dielectric strength.

## Sizes

AWG #24 through 1" I.D. Other sizes subject to inquiry

## Standard Color

Natural.

## Standard Packaging

Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



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# Varglas Hermetic Typical Properties

Property	Procedure	Performance
<b>Physical</b>		
Flexibility and Toughness, Coating	UL 1441	Passes (Cold Bend and Penetration Tests).
Abrasion and cut- through resistance.	—	Excellent
<b>Chemical</b>		
Resistance to Refrigerants (Extractables) @ high psi and temperatures	GE Test Method #E5OFH15-51 "Freon® 22 Extractables"	Passes (Excellent). Extractables of less than 0.5% (actual 0.2%) in Refrigerants R-22, R-123 & R-134a.
Water Resistance (Water Extraction)	GE Test Method #E5OFH16-51 "Water Extraction"	Passes (Excellent). Extractables of less than 0.5% (actual 0.3%)
Resistance to Refrigerants and Oils (Blister Test)	GE Test Method #ESOKM16 "Resistance of Hermetic Insulation"	Passes (Excellent). No blisters when removed from 50/50 mixtures (volume) of HCFC or HFC refrigerants and mineral, polyol-ester or alkylbenzene oils.
Oil and Solvent Resistance	MIL-I-3190/3 & MIL-I-3190/6	Good. No cracks, softening or swelling when immersed in mineral or polyol-ester oil; methylene chloride; toluene; xylene and 1,1,1 trichlorethane.
Compatibility	UL 1446	Good. Compatible with most potting compounds and varnishes.
<b>Electrical</b>		
<b>Dielectric Strength after 48/23/50:</b>		
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
<b>Dielectric Strength after 96/23/96:</b>		
Grade B	NEMA TF - 1	45% of Original Value. (MIL-I-3190/3 requires 30% for Grade A)
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/3	2200 volts min. avg. (Spec. requires 1500 volts for Grade A).
<b>Thermal</b>		
Thermal Endurance	MIL-I-3190/2 & UL 1441	Class 130°C (B)
Brittleness Temperature	ASTM-D350	- 25°C
Flame Resistance	UL 1441, Horiz. Specimen	Passes
	ASTM-D350, Method B	Passes
	NEMA VS-1	Passes
	MIL-I-3190/2, Method B	Passes
Resistance to Potting Temperatures	MIL-I-3190	No blisters, flow or cracks visible after 15 min. @ 225°C.
<b>Note:</b>		
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# Varglas Non-Fray Sleeving

## Description

Varglas Non-Fray Sleeving is flexible, high-temperature secondary insulation made from closely braided, continuous filament fiberglass which has been heat-cleaned to remove impurities in the yarn and to retard fraying. There are four types available all of which are noncorrosive and nonflammable and not attacked by fungus.

**Type H:** Heat cleaned only. Since it is not treated with sizing or pigments after heat cleaning, it is available only in the natural (silver) color.

**Type HO:** Heat cleaned and treated with an acrylic resin binder (natural or pigmented).

**Type HP:** Heat cleaned and treated with an acrylic resin binder (natural or pigmented) that is slightly more flexible than Type HO

**Type HM:** Heat cleaned and treated with an oleoresinous varnish binder (natural or pigmented).

Binders are applied to further retard fraying and to hold sleeving round for cutting. Types HO, HP and HM are available in a variety of colors which may be less vivid after exposure to 150°C. All four types are available in various wall thicknesses. All will serve as secondary insulation unaffected indefinitely through a temperature range from -60°C to 316°C and withstand up to 616°C for shorter periods. Since there is no impregnant that will provide dielectric protection at those extremes, these sleeveings require heavy or multiple-wall thicknesses if used as primary insulation.

## Specifications

Varglas Non-Fray Sleeveings conform to NEMA TF-2 and are made from glass fibers conforming to Military Specification MIL-Y-1140 (latest revision), Class C, Form 1 (continuous filament yarns).

Under the Component Program of Underwriters Laboratories, all Varglas Non-Fray Sleeveings comply with VW-1 flammability requirements under UL File #E53690. They are incorporated in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL.

## Applications

Varglas Non-Fray Sleeveings are used for thermal and mechanical protection in consumer, commercial and industrial applications where flexibility, abrasion resistance or additional secondary insulation is required and particularly when temperature extremes prohibit the use of other materials. These would include such applications as heating appliances, electric motors, resistors, lighting fixture transformers and ballasts, etc.

Non-Fray's greater flexibility and expandability find extensive use in wire harness assemblies where its ease of installation over irregular shapes and wire bundles provides definite assembly advantages.

In 1/32" Wall, Non-Fray is used as primary insulation in low-voltage applications such as coffeemakers, hand irons, toasters, hot plates, range units and other appliances.

## Sizes

AWG #24 through 2" I.D. Other sizes subject to inquiry.

## Standard Color

Natural - All 4 types. Other colors in Types HO, HP and HM made to order. Not available in white.

## Standard Packaging

Coils - All 4 types. Spools where specified. Cut pieces are available, subject to cutting charges, in Types HO, HP and HM only.



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# Varglas Non-Fray Typical Properties

Property	Performance
<b>Physical</b>	
Specific Gravity, g/cu. cm.	2.55 – 2.58
Elongation at Break, percent	4.5 – 4.9
Tensile Strength, psi @ 22°C	500,000 - 550,000
Water Absorbency @ 22°C, 65% R.H.	None
<b>Chemical</b>	
Resistance to Acids and Alkalies	Good resistance to most alkalies. Resistance to acids is fair.
Effect of Bleaches and Solvents	Unaffected
Resistance to Mildew, Aging and Sunlight	Excellent resistance to sunlight and aging. Not attacked by mildew.
<b>Electrical</b>	
Dielectric Strength	Provides only space factor electrical insulation of approximately 1100 volts for standard wall and 1500 volts for 1/32" wall.
Volume Resistivity @ 22°C and 500 volts dc, ohm-cm	$10^{15} - 10^{16}$
Dielectric Constant @ 22°C, 60 Hz	6.5 – 6.8
Dissipation Factor @ 22°C, 1 MHz	0.001 - 0.005
<b>Thermal</b>	
Thermal Endurance	Up to 316°C indefinitely; up to 616°C for shorter periods.
Cold Bend	- 10°C per UL 1441
Flame Resistance	Passes UL 1441 (VW-1). Will not burn.
<b>Notes:</b>	

Average properties of bulk E Glass, as reported in Owens-Corning Publication No. 5-TEX-18027. considered to be applicable to bare glass filaments.

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



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**Flexible  
Nylon  
Sleeving**

(-55°C to +105°C)  
(-67°F to +221°F)

Data sheet

# Nylon Untreated Sleeving

## Description

Varflex Nylon Untreated Sleeving is a flexible, protective sheathing that exhibits outstanding toughness and abrasion resistance. It is braided from high- tenacity nylon yarns that have been light and heat stabilized, have low dry-heat shrinkage (6%) and were designed specifically for industrial end uses. Of the 17 standard sizes of Nylon Untreated Sleeving offered by Varflex, ten of them are available both in standard wall (Type 94) and a heavier wall (Type 94H). Type 94H is identical to Type 94 except heavier nylon yarns are used, resulting in wall-thickness increases ranging from .003" to .010", depending upon inside diameter. The seven other standard sizes are supplied in single wall thicknesses and do not carry a type designation. (See Tables below.)

## Specifications

Varflex Untreated Nylon Sleeving conforms to Defense Supply Center Richmond's Commercial Item Description (CID) A-A-59301 (latest revision) covering "Sleeving, Textile, Braided, Synthetic Polymer", and is made from polyamide (nylon) yarns conforming to Military Specification MIL-C-572 (latest revision), Type P (polyamide), Form Y (yarn).

## Applications

Varflex Nylon Untreated Sleeving is intended for use as mechanical protection in consumer, commercial, and industrial applications where flexibility, abrasion resistance, and toughness are required. Although not intended as primary electrical insulation, its suppleness and expandability make it the ideal choice, and contribute to its extensive use, as secondary insulation in wire harness assemblies where its ease of installation over irregular shapes and wire bundles provides definite assembly advantages.

## Sizes

1/16" I.D. through 2" I.D. Other sizes subject to inquiry.

## Standard Color

Black

## Standard Packaging

Coils or spools at manufacturer's option, unless otherwise specified.

Size (I.D.)	Approximate Wall Thickness	
	Type 94	Type 94 H
3/16"	.026"	.029"
1/4"	.025"	.030"
5/16"	.025"	.030"
3/8"	.024"	.032"
7/16"	.024"	.032"
1/2"	.024"	.034"
5/8"	.033"	.038"
3/4"	.037"	.042"
7/8"	.036"	.042"
1"	.040"	.047"

Size (I.D.)	Approximate Wall Thickness
	No Type Designation
1/16"	.027"
1/8"	.027"
1-1/8"	.040"
1-1/4"	.048"
1-1/2"	.044"
1-3/4"	.045"
2"	.047"



## Electrical Insulating Sleeving

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# Nylon Untreated Typical Properties

Property	Performance
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## Physical

Specific Gravity, g/cu cm	1.14
Elongation at Break, percent	14.9
Breaking Tenacity, g/d	7.1
Moisture Regain, percent	4.5

## Chemical

Effects of Acids and Alkalies	Unaffected by most mineral acids, except hot mineral acids. Dissolves with partial decomposition in concentrated solutions of hydrochloric, sulfuric, and nitric acids. Soluble in formic acid. Substantially inert in alkalies.
Effects of Bleaches and Solvents	Can be bleached in most bleaching solutions. Generally insoluble in most organic solvents. Soluble in some phenolic compounds.
Resistance to Mildew, Aging and Sunlight	Excellent resistance to mildew and aging. Prolonged exposure to sunlight causes some deterioration.

## Thermal

<b>Shrinkage</b>	
- In Water at 100°C (212°F), percent	7.2
- In Dry Air at 177°C (350°F), percent	5.8
<b>Shrinkage Tension</b>	
- in Dry Air at 160°C (320°F), g/d	0.40
Thermal Conductivity, k, Btu • in/(h•ft <sup>2</sup> •°F)	1.7
Zero Strength Temperature*, °C (°F)	245 (476)
<b>Effects of Heat</b>	
- Softens, °C (°F)	180 (356)
- Sticks, °C (°F)	230 (446)
- Melts, °C (°F)	254 (489)

\* Temperature at which the yarn breaks under a load of 0.1 g/d

## Notes:

Typical properties of heavy-denier industrial yarns as reported in DuPont's Multifiber Bulletin X-273.

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



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## Flexible Fiberglass Sleeving

(-70°C to +482°C)  
(-94°F to +900°F)

Data sheet

S-2 Glass® is  
a registered  
trademark of AGY

Pyre-ML® is a  
registered  
trademark of the  
DuPont Company

71:3-06

# Varglas S1600 Sleeving

## Description

Varglas S1600 Sleeving is a high-strength, high-temperature sleeving produced from special S-2 Glass® fibers which, in addition to enhanced dielectric and mechanical properties, provide thermal protection beyond the limits of conventional sleeving made from E-glass fibers.

Although both S-2 Glass® and E-glass fibers have excellent resistance to all types of nuclear radiation, S-2 Glass®, unlike E-glass, is free of boron and, therefore, in the hostile atmosphere of a reactor, will not decompose to form gaseous products.

There are five types of S1600 Sleeving, all of which are noncorrosive, nonflammable and impervious to fungus attack.

**Untreated:** Not heat cleaned or treated, but containing its original sizing so it is available only in white.

**Type H:** Heat cleaned only. Since it is not treated with sizing or pigments after heat cleaning, it is available only in the natural (silver) color.

**Type HO:** Heat cleaned and treated with an acrylic resin binder (natural or pigmented)

**Type HM:** Heat cleaned and treated with an oleoresinous binder (natural or pigmented).

**Type ML:** Heat cleaned and treated with Pyre ML® binder (natural or pigmented).

Binders are applied to retard fraying and to hold sleeving round for cutting. Types HO, HM and ML are available in a variety of colors which may be less vivid after exposure to 150°C. All five types are available in various wall thicknesses as well as with multiple walls. All will serve as secondary insulation unaffected indefinitely through a temperature range from -70°C to 482°C and withstand up to 950°C for shorter periods. Since there is no impregnant that will provide dielectric properties at those extremes, these sleeveings require heavy or multiple-wall thicknesses if used as primary insulation.

## Specifications

Varglas S1600 Sleeveings conform to NEMA TF-2 and will not burn and are made from glass fibers conforming to Military Specification MIL- R-60346 (latest revision), Type IV, Class 1 (continuous filament yarns).

## Applications

Varglas S1600 Sleeveings are used for thermal and mechanical protection in applications requiring stability under extreme temperature and corrosive environments.

## Sizes

Types **H**, **HO**, **HM** and **Untreated** - AWG #26 through 2" I.D. Type **ML** - AWG #24 through 3/8" I.D.

## Standard Color

**Untreated** - White only, **Type H** - Natural (silver) only, **Types HO, HM and ML** - Natural. Other colors made to order.

## Standard Packaging

Coils - all 5 types. Spools where specified.

Cut pieces are available, subject to cuffing charges, in Types HO, HM and ML only.



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# Varglas S1600 Typical Properties

Property	Performance
<b>Physical</b>	
Specific Gravity, g/cu. cm.	2.48 – 2.49
Elongation at Break, percent	5.3 – 5.7
Tensile Strength, psi @ 22°C	650,000 - 700,000
Water Absorbency @ 22°C, 65% R.H.	None
<b>Chemical</b>	
Resistance to Acids and Alkalies	Good resistance to most acids and alkalies.
Effect of Bleaches and Solvents	Unaffected
Resistance to Mildew, Aging and Sunlight	Excellent resistance to sunlight and aging. Not attacked by mildew.
<b>Electrical</b>	
Dielectric Strength	Provides only space factor electrical insulation of approximately 1375 volts for standard wall. No dielectric guarantee.
Volume Resistivity @ 22°C and 500 volts dc, ohm-cm	10 <sup>16</sup>
Dielectric Constant @ 22°C, 60 Hz	5.0 – 5.4
Dissipation Factor @ 22°C, 1 MHz	0.0020
<b>Thermal</b>	
Thermal Endurance	Up to 482°C indefinitely; up to 950°C for shorter periods.
Cold Bend	- 70°C *
Flame Resistance	Passes NEMA TF-2, Section 6.3. Will not burn.

\* Actual performance should exceed this level since ultimate brittle point has not been determined

## Notes:

Average properties of bulk S Glass as reported in Owens Corning Publication No. 5-TEX-18027, considered to be applicable to bare glass filaments.

Information contained here is precise and reliable. However being unique, each end-use should be evaluated to satisfy its specific requirements.



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# Varglas Silicone Resin 500 Sleeving

## Description

---

Varglas Silicone Resin 500 Sleeving is a fiberglass braid with a silicone composite coating. This sleeving is best in areas where design requirements specify superior moisture, heat and radiation resistance. In addition to its Class 200°C rating, it also exhibits good low temperature properties. Varglas Silicone Resin Sleeving is available as Silicone Resin 500 in the four top grades and as standard Silicone Resin in Grade C-3 with Silicone Resin 500 being a more flexible product designed to conform to sharp bends.

## Specifications

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Varglas Silicone Resin 500 Sleeving conforms to, and is listed on the Qualified Products List (QPL) for, MIL-I-3190/5, latest revision (Grade A); NEMA TF-1, Type 4; and ASTM-D372.

Under the Component Program of Underwriters Laboratories, Grade A Varglas Silicone Resin 500 is recognized for 200°C, 600 volt service under UL File #E63450 with sizes 3/8" through and including 1" ID also complying with UL's VW-1 flammability requirements. It is incorporated in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL. CSA International certifies the use of Grade A Resin 500 for 200°C, 600 volt service under CSA File #LR58486. Additionally, standard Silicone Resin (Grade C-3) complies with UL's VW-1 flammability requirements under UL File #E53690.

## Applications

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Varglas Silicone Resin 500 Sleeving is used in nuclear motors, electric motors, equipment leads, relay leads and heating cable where flexibility, high dielectric protection and heat endurance are required and temperatures up to 200°C are encountered. Its good abrasion and radiation resistance also find wide use in aerospace and atomic energy applications.

## Sizes

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AWG #24 through 2" I.D. Other sizes subject to inquiry

## Standard Color

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Natural. Other colors made to order.

## Standard Packaging

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Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



## Electrical Insulating Sleeving

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# Varglas Silicone Resin 500 Typical Properties

Property	Procedure	Performance
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## Physical

Tensile Strength, Coating	ASTM-D412	200 psi
Ultimate Elongation, Coating	ASTM-D412	100% @ 20°C
Hardness, Coating	ASTM-D2240	60 (Durometer)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)

## Chemical

Oil and Solvent Resistance	MIL-I-3190/5	Good
Water Vapor Resistance	MIL-I-3190/5	Excellent
Resistance to Acids and Alkalies	—	Excellent in weak solutions. Fair in concentrated solutions.
Resistance to the Elements	—	Good sunlight and weathering properties.
Compatibility	UL 1446	Good. Compatible with most potting compounds and varnishes.

## Electrical

### Dielectric Strength after 48/23/50:

Grade A	NEMA TF - 1	8000v min. avg., 6000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
Grade C - 2	NEMA TF - 1	1500v min. avg., 800v min. indiv.
Grade C - 3	NEMA TF - 1	No voltage guarantee.

### Dielectric Strength after 96/23/96:

Grade A	NEMA TF - 1	80% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/5	5000 volts min. avg.

## Thermal

Thermal Endurance	MIL-I-3190/5 & UL 1441	Class 200°C (H)
Brittleness Temperature	ASTM-D350	- 56°C
Flame Resistance	ASTM-D350, Method B	Passes
	NEMA TF-1	Passes
	MIL-I-3190/5, Method B	Passes
	UL 1441	Passes (VW-1), Grade A in sizes 3/8" through and including 1" ID and Grade C3 only.

## Note:

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



## Electrical Insulating Sleeving

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# Varglas Silicone Rubber Sleeving

## Description

Varglas Silicone Rubber Sleeving is produced by coating braided fiberglass with a high-performance silicone rubber that is extremely flexible and exhibits unusual toughness and abrasion resistance. In addition to having a Class 200°C rating, its brittle point of -73°C also suggests its use in a wide range of applications requiring resistance to temperature extremes.

## Specifications

Varglas Silicone Rubber Sleeving conforms to, and is listed on the Qualified Products List (QPL) for, MIL-I-3190/6, latest revision (Grade A); NEMA TF-1, Type 5; and ASTM-D372.

Under the Component Program of Underwriters Laboratories, Grade A Varglas Silicone Rubber is recognized for 200°C, 600 volt service and complies with VW-1 flammability requirements under UL File #E63450. (VW-1 compliance of Grades B through C-3 is covered under UL File #E53690.) CSA International certifies the use of Grade A for 200°C, 600 volt service and flammability requirements under CSA File #LR58486 VW-1/FT1. Varglas Silicone Rubber is incorporated in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL.

## Applications

Varglas Silicone Rubber Sleeving is used in appliances, motors and generators as well as in automotive, marine and aircraft electrical and electronic components such as transformers, coils, relays, etc. where a 200°C thermal rating is required. In addition to being well-suited as heavy duty insulation where subjected to high heat, such as in die-casting and plastic molding, Varglas Silicone Rubber Sleeving is also suitable for use in extremely low-temperature environments such as high altitude and aerospace applications.

## Sizes

AWG #24 through 2" I.D. Other sizes subject to inquiry

## Standard Color

Natural and white. Other colors made to order.

## Standard Packaging

Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



## Electrical Insulating Sleeving

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# Varglas Silicone Rubber Typical Properties

Property	Procedure	Performance
<b>Physical</b>		
Tensile Strength, Coating	ASTM-D412	1500 psi
Ultimate Elongation, Coating	ASTM-D412	800% @ 20°C
Hardness, Coating	ASTM-D2240	50 (Durometer)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)
<b>Chemical</b>		
Oil and Solvent Resistance	MIL-I-3190/6	Passes (Excellent)
Water Vapor Resistance	MIL-I-3190/6	Passes (Good)
Resistance to Acids and Alkalies	—	Excellent
Resistance to the Elements	—	Unaffected by sunlight and weather.
Compatibility	UL 1446	Good. Compatible with most potting compounds and varnishes.
<b>Electrical</b>		
<b>Dielectric Strength after 48/23/50:</b>		
Grade A	NEMA TF - 1	8000v min. avg., 6000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
Grade C - 2	NEMA TF - 1	1500v min. avg., 800v min. indiv.
Grade C - 3	NEMA TF - 1	No voltage guarantee.
<b>Dielectric Strength after 96/23/96:</b>		
Grade A	NEMA TF - 1	80% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/6	5000 volts min. avg.
<b>Thermal</b>		
Thermal Endurance	MIL-I-3190/6 & UL 1441	Class 200°C (H)
Brittleness Temperature	ASTM-D350	- 73°C
Flame Resistance	UL 1441	Passes (VW-1)
	ASTM-D350, Method B	Passes
	NEMA TF-1	Passes
	MIL-I-3190/6, Method B	Passes
Pushback	MIL-I-3190/6	No cracks or ruptures. 6000 volts mm. avg. breakdown strength.
<b>Note:</b>		
Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.		



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**Class 240**

(-80°C to +240°C)

(-112°F to +464°F)

# Varglas 240 Silicone Rubber Sleeving

## Description

Varglas 240 Silicone Rubber Sleeving is produced by coating braided fiberglass with a specially formulated, proprietary silicone rubber that exhibits exceptional high-temperature properties. In addition to its flexibility, toughness and abrasion resistance, Varglas 240 Silicone Rubber provides superior thermal protection and flame resistance with a higher dielectric capability at less weight than previously available. Its ability to meet a Class 240°C rating, combined with a brittleness temperature of -80°C, makes it an ideal choice for applications that require outstanding physical and electrical insulation properties throughout a wide operating temperature range.

## Specifications

Varglas 240 Silicone Rubber Sleeving conforms to, and is listed on the qualified Products List (QPL) for, MIL-I-3190/9, latest revision (Grade A); and exceeds the requirements of UL 1441, Table 19.8; NEMA TF-1, Type 5; and ASTM-D372.

Under the Component Program of Underwriters Laboratories, Grade A Varglas 240 Silicone Rubber is recognized for 240°C, 600 volt service and complies with VW-1 flammability requirements under UL File #E63450. CSA International certifies the use of Grade A for 240°C, 600 volt service and flammability requirements under CSA File #LR58486 VW-1/FT1.

## Applications

Varglas 240 Silicone Rubber Sleeving is suitable for industrial applications such as motors, generators, transformers and engines where superior dielectric protection at elevated temperatures of 240°C is critical. In addition to automotive engines, Varglas 240 Silicone Rubber's flame resistance and wide-operating temperature range make it particularly well suited for aircraft engines and other aerospace applications where it satisfies electrical and thermal barrier requirements while providing the added benefit of lighter weight.

## Sizes

AWG #24 through 2" I.D. Other sizes subject to inquiry.

## Standard Color

Red oxide and black only.

## Standard Packaging

Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



## Electrical Insulating Sleeving

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# Varglas 240 Silicone Rubber Typical Properties

Property	Procedure	Performance
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## Physical

Tensile Strength, Coating	ASTM-D412	1600 psi
Ultimate Elongation, Coating	ASTM-D412	800% @ 20°C
Hardness, Coating	ASTM-D2240	54 (Durometer, Shore A)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)

## Chemical

Oil and Solvent Resistance	MIL-I-3190/9	Passes
Water Vapor Resistance	MIL-I-3190/9	Passes
Resistance to Acids and Alkalies	—	Excellent
Resistance to the Elements	—	Unaffected by sunlight and weather.
Compatibility	UL 1446	Good. Compatible with most potting compounds and varnishes.

## Electrical

### Dielectric Strength after 48/23/50:

Grade A	NEMA TF - 1	8000v min. avg., 6000v min. indiv.
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### Dielectric Strength after 96/23/96:

Grade A	NEMA TF - 1	80% of Original Value.
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Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/9	Passes. 7000v min. avg. with no disintegration, reversion or cracks. (Spec. requires 5000v.)
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## Thermal

Thermal Endurance	MIL-I-3190/9 & UL 1441	Class 240°C (S)
Brittleness Temperature	ASTM-D350	- 80°C
Flame Resistance	UL 1441	Passes (VW-1)
	ASTM-D350, Method A	Passes
	NEMA TF-1	Passes
	MIL-I-3190/9, Method A	Passes
Pushback	MIL-I-3190/9	No cracks or ruptures. 6000 volts min. avg. breakdown strength.

## Note:

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



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# Varflo Sleeving

## Description

---

Varflo Sleeving is braided fiberglass coated with a modified polyvinyl chloride resin. Superior plasticizers, along with the best flame retardants and fungicides, make Varflo an outstanding Class 130°C sleeving. It has good flexibility and resistance to oils, solvents and moisture. Varflo has good shelf life and will not lose dielectric strength when subjected to severe twisting.

## Specifications

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Varflo Sleeving conforms to, and is listed on the Qualified Products List (QPL) for, MIL-I-3190/2, latest revision (Grade A); NEMA TF-1, Type 3; and ASTM-D372.

Under the Component Program of Underwriters Laboratories, Grade A Varflo Sleeving is recognized for 105°C, 600 volt service and complies with VW-1 flammability requirements under UL File #E63450. (VW-1 compliance of Grades B through C-1 is covered under UL File #E53690.) CSA International certifies the use of Grade A for 105°C, 600 volt service and flammability requirements under CSA File #LR58486 VW-1/FT1. Varflo is incorporated in systems work, per UL Standard 1446, to facilitate product acceptance by UL.

## Applications

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Varflo Sleeving is used to insulate leads in motors, transformers, generators and similar apparatus. Because of its excellent flexibility, good electrical properties and resistance to soldering temperatures, Varflo is also used in radio and TV as well as other electronic circuitry in measuring instruments, computers, etc. Varflo is used on both original equipment and aftermarket automotive industry applications such as regulators, starters, alternators, etc. primarily because of its toughness, flexibility and dielectric strength.

## Sizes

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AWG #24 through 2" I.D. Other sizes subject to inquiry

## Standard Colors

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Yellow and black. Other colors made to order.

## Standard Packaging

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Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



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# Varflo Sleeving Typical Properties

Property	Procedure	Performance
<b>Physical</b>		
Tensile Strength, Coating	ASTM-D412	1500 psi
Ultimate Elongation, Coating	ASTM-D412	250% @ 20°C
Tear Strength, Coating	ASTM-D2240	80 (Durometer, Shore A)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)
Abrasion and Cut-Through Resistance	—	Excellent
<b>Chemical</b>		
Oil and Solvent Resistance	MIL-I-3190/2	Good. Does not blister, peel or crack.
Moisture Vapor Resistance	MIL-I-3190/2	Good
Fungus Resistance	MIL-I-631	Passes.
Compatibility	UL 1446	Good. Compatible with suitable potting compounds.
<b>Electrical</b>		
<b>Dielectric Strength after 48/23/50:</b>		
Grade A	NEMA TF - 1	8000v min. avg., 6000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
<b>Dielectric Strength after 96/23/96:</b>		
Grade A	NEMA TF - 1	60% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/2	5000 volts min. avg.
<b>Thermal</b>		
Thermal Endurance	MIL-I-3190/2	Class 130°C (B) for 15,000+ hrs.
Brittleness Temperature	ASTM-D350	- 34°C
Flame Resistance	UL 1441	Passes (VW - 1)
	ASTM-D876	Passes
	NEMA TF-1	Passes
	MIL-I-3190/2, Method A	Passes
Resistance to Potting Temperatures	MIL-I-3190/2	No blisters, flow or cracks visible after 15 min. @ 225°C.
Pushback	—	No cracking or peeling results after "pushback" and heating to 177°C.
<b>Note:</b>		
Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.		



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**Expandable  
Polyester  
Monofilament  
Sleeving**

(-70° to +125°C)

**Expandable  
Halar®  
Monofilament  
Sleeving**

(-70°C to +150°C)

Data Sheet

# Varspan Sleeving

## Description

Varspan expandable monofilament sleeveings are designed to provide mechanical protection to wires, cables, harnesses, hydraulic lines, tubes, hoses, etc., as well as to components of both regular and irregular shapes. Their ability to expand to two or three times their original ID allows for ease of application and their "open-weave" braid construction, which will not trap heat or moisture, results in a cost-effective bulk/weight ratio.

Varspan is available as an expandable polyester monofilament sleeveing, in three types, or as an expandable Halar® E-CTFE (ethylene chlorotrifluoro ethylene) monofilament sleeveing.

Varspan Sleeveing made with expandable polyester-monofilaments is offered in both general purpose (Varspan GP) and flame-retardant (Varspan FR) yarns. The general purpose version of Varspan is also available in heavy duty (Varspan HD) which is braided with a thicker .015" polyester-monofilament strand for applications where additional abrasion and cut-through protection are required. All exhibit good mechanical, chemical, and thermal stability in a temperature range of -70°C to +125°C.

Varspan Sleeveing made with expandable Halar® monofilaments is offered as Varspan HT. In addition to being flame retardant, Varspan HT (Halar®) offers superior resistance to most solvents, acids and bases and can be used in higher operating temperatures (-70°C to +150°C) than Varspan GP, FR and HD sleeveings.

Cut with a hot-blade device for frayless ends or turn ends inward.

## Applications

All **Varspan Sleeveings** are suitable for military, industrial, marine, aeronautical, transportation, electronic and manufacturing applications where mechanical protection and resistance to chemicals, jet fuel, diesel fuel, gasoline, lubricating oils, solvents, hydraulic fluids, water and salt water are prerequisites and flexibility through a wide- operating temperature range is desired.

**Varspan FR** offers a higher degree of flame retardation required for special applications.

**Varspan HT** (Halar®), in addition to flame retardation and its suitability for use at higher operating temperatures than the other Varspan sleeveings, is recommended for use where the sleeveing may be exposed to harsher chemicals and more severe environments.

## Sizes

**Varspan GP** and **Varspan FR** - 1/8" through 2-1/2" I.D.

**Varspan HD** - 3/8" through 3" I.D.

**Varspan HT** (Halar®) - 1/8" through 2-5/8" I.D.

## Standard Colors

**Varspan GP** - Black, clear, red, orange, yellow, green and gray.

**Varspan FR** - Black or natural (white) with the flame retardation identified by a criss-cross (diamond) pattern of two contrasting tracer strands.

**Varspan HD** - Black or natural (white).

**Varspan HT** - (Halar®) - Black or natural (white) with the flame retardation identified by one contrasting tracer strand

## Standard Packaging

Spools. See reverse side for details



## Electrical Insulating Sleeveing

Varflex Corporation, 512 West Court Street, Rome, NY • Phone (315) 336-4400 • Fax (315) 336-0005

Toll Free 1-800-648-4014 • www.varflex.com • e-mail: sales@varflex.com



# Sizes, Dimensions & Standard Packaging

Nominal Size	Fits-Min/Max	Weight	Approx. Spool Length
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## Varspan GP and Varspan FR

Nominal Size (in.)	Fits-Min/Max (in.)	Weight (lb./100ft.)*	Approx. Spool Length (ft.)
1/8	3/32 – 1/4	0.18	1,000
1/4	1/8 – 3/8	0.27	1,000
3/8	3/16 – 5/8	0.57	500
1/2	1/4 – 3/4	0.74	500
3/4	1/2 – 1-1/4	1.25	250
1-1/4	3/4 – 1-1/2	1.59	250
1-1/2	1- 2-1/2	1.96	250
1-3/4	1-1/4 – 2-3/4	2.63	200
2	1-1/2 – 3	3.43	100
2-1/2	1-3/4 – 3-1/2	3.75	100

\*Applicable to standard wall thickness of approximately .025"

## Varspan HD

Nominal Size (in.)	Fits-Min/Max (in.)	Weight (lb./100ft.)**	Approx. Spool Length (ft.)
3/8	3/16 – 3/4	0.83	500
5/8	5/16 – 15/16	1.14	500
1	1/2 – 1-3/8	1.74	250
1-1/2	7/8 – 2	2.57	250
2	1-1/2 – 3	3.48	100
3	2-1/2 – 4-1/2	4.35	50

\*\*Applicable to Varspan HD braided with thicker .015" strands

## Varspan HT (Halar®)

Nominal Size (in.)	Fits-Min/Max (in.)	Weight (lb./100ft.)***	Approx. Spool Length (ft.)
1/8	3/32 - 1/8	0.25	500
1/4	1/8 - 3/8	0.40	500
1/2	1/4 - 7/8	1.20	500
3/4	1/2 - 1-1/4	1.70	250
1	1/2 - 1-3/8	2.30	250
1-1/4	3/4 - 1-1/2	2.80	250
1-7/8	1-1/4 - 2-1/2	4.00	75
2-5/8	1-3/4 - 3-1/2	6.00	50

\*\*\*Applicable to standard wall thickness of approximately .025"

### Note:

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



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**Fluoroelastomer  
Coated  
Fiberglass  
Sleeving**

**Class 220**

(-70°C to +220°C)

(-94°F to +428°F)

Data sheet

# Varglas Viton® 231 Sleeving

## Description

Varglas Viton® 231 Sleeving is a braided fiberglass/modified Viton® composite with exceptional physical and electrical properties. It has excellent abrasion and cut-through resistance and offers improved flexibility throughout a wide operating temperature range. Its resistance to solvents, both aromatic and aliphatic; fuels, including JP-5; and oils, including Skydrol; place this fluoroelastomer above other available polymer-coated fiberglass braids.

## Specifications

Varglas Viton® 231 Sleeving conforms to, and is listed on the Qualified Products List (QPL) for, MIL-I-3190/7, latest revision (Grade A), and exceeds the requirements of NEMA TF-1 and ASTM-D372.

Under the component program of Underwriters Laboratories, Varglas Viton® 231 Sleeving complies with VW-1 flammability requirements under UL File #E53690. It is incorporated in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL.

## Applications

Varglas Viton® 231 Sleeving is used in DC generators and motors to reduce arcing problems and elsewhere when the need to maintain a silicone-free environment is important. Its flame resistance and excellent resistance to abrasion make it ideally suited for the insulation of leads and connections of critical electrical components as well as for wire harnesses in areas where continuous operating temperatures run as high as 220°C. Varglas Viton®231 is also used in transformers where resistance to high impingement velocity oils is required and, generally, where better solvent and oil resistance is needed.

## Sizes

AWG #24 through 3" I.D. Other sizes subject to inquiry.

## Standard Color

Black, white and natural.

## Standard Packaging

Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.

Viton® is a registered trademark of the DuPont Company.

51:3-06



## Electrical Insulating Sleeving

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# Varglas Viton® 231 Typical Properties

Property	Procedure	Performance
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## Physical

Tensile Strength, Coating	ASTM-D412	2000 psi @ 24°C; 600 psi @ 149°C
Ultimate Elongation, Coating	ASTM-D412	150% @ 24°C; 75% @ 149°C
Hardness, Coating	ASTM-D2240	80 (Durometer, Shore A)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)

## Chemical

Resistance to Atmospheric Oxidation, Sun and Water	—	Excellent
Resistance to Ozone Concentrations	—	Unaffected at levels as high as 100 ppm
Fungus Resistance	MIL-E-5272	Passes
Solvent*, Chemical and Oil Resistance	MIL-I-3190/7	Passes (Excellent)

\* Do not use Ketone type solvents as a cleaning liquid for Varglas Viton® 231. We recommend using V.M. & P. Naphtha.

## Electrical

### Dielectric Strength after 48/23/50:

Grade A	NEMA TF - 1	7000v min. avg., 5000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C - 1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.

### Dielectric Strength after 96/23/96:

Grade A	NEMA TF - 1	80% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/7	6000 volts min. avg.

## Thermal

Thermal Endurance	MIL-I-3190/7	Class 220°C (R)
Brittleness Temperature	ASTM-D350	- 70°C
Flame Resistance	UL 1441	Passes (VW-1)
	ASTM-D350	Passes
	NEMA TF-1	Passes
	MIL-I-3190/7, Method A	Passes
Oxygen Index	—	85%
Radiation Resistance	DuPont Bulletin E-37758	Up to 10 <sup>6</sup> rads with little or no effect on physical properties
Smoke Density	Rohm & Haas SD Test XP-2	Passes; test requires a minimum SDR <sub>4</sub> of 15%.

## Note.

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



## Electrical Insulating Sleeving

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# Varfil Sleeving

## Description

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Varfil Sleeving is braided fiberglass coated with a polyester-modified polyvinyl chloride resin. The composite coating on this Class 130°C sleeving has improved properties over standard polyvinyl plastisol coatings with regard to chemical compatibility and solvent resistance (resists swelling in oil, xylol and trichloroethane). Some users prefer the slight degree of firmness found in Varfil when compared to Varflo (vinyl-coated fiberglass).

## Specifications

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Varfil Sleeving conforms to military specification MIL-I-3190/2, latest revision (Grade A); NEMA TF-1, Type 2; and ASTM-D876.

Under the Component Program of Underwriters Laboratories, all grades of Varfil Sleeving comply with VW-1 flammability requirements under UL File #E53690.

## Applications

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Varfil Sleeving finds wide acceptance by motor manufacturers as well as by motor repair shops. It is used to insulate leads in motors, transformers, generators and similar apparatus. Because of its toughness, dielectric strength, good electrical properties and resistance to soldering temperatures, Varfil also is used in electronic circuitry in measuring instruments, computers, etc. and for both original equipment and aftermarket automotive industry applications such as regulators, starters, alternators, etc.

## Sizes

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AWG #24 through 2" I.D. Other sizes subject to inquiry

## Standard Color

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Yellow and black. Other colors made to order.

## Standard Packaging

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Coils, spools or 36" lengths at manufacturer's option, unless otherwise specified. There is no cutting charge for 36" lengths, but lengths other than 36" are subject to cutting charges.

Sizes over 1" I.D. are generally supplied in 36" lengths.



## Electrical Insulating Sleeving

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# Varfil Typical Properties

Property	Procedure	Performance
<b>Physical</b>		
Tensile Strength, Coating	ASTM-D412	1800 psi
Ultimate Elongation, Coating	ASTM-D412	200% @ 20°C
Tear Strength, Coating	ASTM-D2240	85 (Durometer, Shore A)
Flexibility and Toughness, Coating	UL 1441	Passes (Penetration Test)
Abrasion and Cut-Through Resistance	—	Excellent
<b>Chemical</b>		
Oil and Solvent Resistance	MIL-I-3190/2	Good. Does not blister, peel or crack.
Moisture Vapor Resistance	MIL-I-3190/2	Good
Fungus Resistance	MIL-I-631	Passes
Compatibility	UL 1446	Good. Compatible with suitable potting compounds.
<b>Electrical</b>		
<b>Dielectric Strength after 48/23/50:</b>		
Grade A	NEMA TF - 1	7000v min. avg., 5000v min. indiv.
Grade B	NEMA TF - 1	4000v min. avg., 2500v min. indiv.
Grade C-1	NEMA TF - 1	2500v min. avg., 1500v min. indiv.
<b>Dielectric Strength after 96/23/96:</b>		
Grade A	NEMA TF - 1	60% of Original Value.
Hydrolytic Stability after 336 hrs. @ 70°C over Constant Water Reflux	MIL-I-3190/9	5000v min. avg.
<b>Thermal</b>		
Thermal Endurance	MIL-I-3190/2	Class 130°C (B) for 15,000 + hrs.
Brittleness Temperature	ASTM-D350	- 34°C
Flame Resistance	UL 1441	Passes (VW-1)
	ASTM-D876	Passes
	NEMA TF-1	Passes
	MIL-I-3190/2, Method A	Passes
Resistance to Potting Temperatures	MIL-I-3190/2	No blisters, flow or cracks visible after 15 min. at 225°C.
Pushback		No cracking or peeling results after pushback and heating to 117°C.
<b>Note:</b>		
Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.		



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## Flexible Fiberglass Sleeving

(-56°C to +200°C)  
(-69°F to +392°F)

Data sheet

# Silflex Sleeving

## Description

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Silflex Sleeving is flexible, secondary insulation made from closely braided, continuous filament fiberglass which, after heat cleaning to remove impurities such as starch, oils and binders, is impregnated with a high-temperature silicone resin.

## Specifications

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Silflex Sleeving conforms to NEMA TF-2 and is made from glass fibers conforming to Military Specification MIL-Y-11140 (latest revision), Class C, Form 1 (continuous filament yarns).

Under the Component Program of Underwriters Laboratories, Silflex Sleeving complies with VW-1 flammability requirements under UL File #E53690.

## Applications

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Silflex Sleeving is used in areas where flexibility as well as resistance to radiation, moisture, high temperature, and flame are essential. It offers space factor electrical insulation of approximately 650 volts with minimum outgassing, particularly after a pre-bake, and readily accepts potting compounds thereby enhancing electrical properties in systems work.

## Sizes

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AWG #24 through 2" I.D. Other sizes subject to inquiry.

## Standard Color

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Natural. Other colors made to order.

## Standard Packaging

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Coils or spools at manufacturer's option unless otherwise specified.



## Electrical Insulating Sleeving

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# Silflex Typical Properties

Property	Performance
<b>Physical</b>	
Specific Gravity, g/cu. cm.	2.55 – 2.58
Elongation at Break, percent	4.5 – 4.9
Tensile Strength, psi @ 22°C	500,000 - 550,000
Water Absorbency @ 22°C, 65% R.H.	None
<b>Chemical</b>	
Resistance to Acids and Alkalies	Excellent in weak solutions. Fair in concentrated solutions..
Resistance to Solvents	Fair
Resistance to the Elements	Good Sunlight and weathering properties.
Compatibility	Improved compatibility with most potting compounds and varnishes.
Moisture Vapor Resistance	Excellent
<b>Electrical</b>	
Dielectric Strength	Provides only space factor electrical insulation of approximately 650 volts.
Volume Resistivity @ 22°C and 500 volts dc, ohm-cm	$10^{15} - 10^{16}$
Dielectric Constant @ 22°C, 60 Hz	6.5 – 6.8
Dissipation Factor @ 22°C, 1 MHz	0.001 – 0.005
<b>Thermal</b>	
Thermal Endurance	Up to 200°C indefinitely.
Brittleness Temperature	- 56°C per ASTM D746
Flame Resistance	Passes UL 1441 (VW-1). Will not burn.
<b>Notes:</b>	

Average properties of bulk S Glass as reported in Owens Corning Publication No. 5-TEX-18027, considered to be applicable to bare glass filaments.

Information contained here is precise and reliable. However being unique, each end-use should be evaluated to satisfy its specific requirements.



## Electrical Insulating Sleeving

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**Double Wall  
Acrylic  
Coated  
Fiberglass  
Sleeving**

**Class 155**

(-25°C to +155°C)

(-13°F to +311°F)

Data Sheet

# Varglas Double Wall Acrylic Sleeving

## Description

Varglas Double Wall Acrylic Sleeving is a Grade A, acrylic coated fiberglass sleeving that has been overbraided with a secondary fiberglass braid which, in addition to providing increased physical protection, affords motor manufacturers, as well as rewinders, employing vacuum pressure impregnation with both interior and exterior surfaces that are highly suitable for the absorption and retention of the low-viscosity, solvent-type and solventless resins utilized during the impregnation and drain cycles.

Because of its acrylic lineage, Varglas Double Wall Acrylic Sleeving is resistant to most acids, organic solvents, oils and water and exhibits fair resistance to alkalies. It is compatible with modified polyester, acrylic, epoxy, phenolic and formvar wire enamels and is designed to perform for long periods in a 155°C range without loss of any electrical or physical properties. And, since it is Grade A, it provides a minimum average short-time dielectric strength of 7000 volts before vacuum impregnation.

## Specifications

The mainstay in this composite is our standard Grade A Varglas A397 Acrylic Sleeving which conforms to MIL-I-3190/3, latest revision; NEMA TF-1, Type 6; and ASTM-D372.

Under the Component Program of Underwriters Laboratories, this acrylic coated sleeving is recognized for 155°C, 600 volt service under UL File #E63450. CSA International certifies its use for 155°C, 600 volt service under CSA File #LR-58486. It also is recognized in systems work, per UL Safety Standard 1446, to facilitate product acceptance by UL.

## Applications

Varglas Double Wall Acrylic Sleeving is used primarily to insulate the coil and phase leads in random-wound and formed-coil motors which are to be resin-impregnated, after assembly, utilizing vacuum pressure impregnation processes. However, because of the increased physical protection provided by the fiberglass overbraid, Varglas Double Wall Acrylic Sleeving can also be used whenever additional abrasion resistance and insulation system compatibility are required in applications subjected to continuous operating temperatures of 155°C.

## Sizes

AWG #8 through 1/2" I.D. Other sizes subject to inquiry

## Standard Color

Natural.

## Standard Packaging

Spools

## Note:

Information contained here is precise and reliable. However, being unique, each end-use should be evaluated to satisfy its specific requirements.



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## Other Varflex Products

### **Varglas Volan®**

A fiberglass braid treated with DuPont's Volan® which acts as a tie-coat or coupling agent between the fiberglass and any thermosetting resins subsequently applied to it by the customer. This coupling agent makes possible good physical adhesion through wetting and excellent chemical adhesion through chemical bonds. This improved wetting and bondage between resin and fiberglass through Volan® enhances resulting composite properties such as flexural strength and heat distortion temperature.

Volan® is applied to fiberglass braid that previously has been heat treated to remove starch and resin binders. Modified through PH adjustment and the necessary additives, Volan® with heat is readily bonded to sizing-free fiberglass leaving reactive groups oriented outward to chemically combine with reactive groups of the applied resins.

Polyester phenolic and epoxy resins find application with Volan®. Volan® treated fiberglass can be processed further through operations such as saturation, lamination, coating and potting.

### **Special Release Coat**

When motors and other electrical apparatus are subject to encapsulation, their insulated lead wires can fuse together as a result of contact with the potting material.

After curing, it then becomes necessary to separate the leads to facilitate their connection to their respective terminals. Pulling them apart in such situations can result in damage to their electrical- insulating acrylic coatings.

To overcome this problem, Varflex has developed its Special Release Coat. This optional treatment is applied as a topcoat and is available on all types, grades and colors of Varglas Acrylic Sleeveings. Our Special Release Coat contains no waxes, silicones, stearates or halogens and separates cleanly from tested potting compounds.

### **Twisted & Plied Yarns**

Twisted and plied yarns from Varflex start with with single-strand yarns composed of continuous, multi-filament fibers that are turned in the "Z" (reverse) twist direction.

Our ply frames ply two or more strands by twisting the strands in an opposite "S" (forward) twist direction into a balanced, multi-end yarn product having the desired diameter as well as increased tensile strength.

Varflex twisted and plied yarns are furnished in various-sized "milk bottle" packages (plastic tube with base) or on a double-flanged plastic bobbin. Twisted and plied fiberglass is supplied with the starch-oil based sizing (binder) that was applied during the yarn manufacturing process to improve subsequent handling and fabrication operations.

### **Braider Packages**

Braider packages from the Varflex are produced in our Winding Department where twisted and plied yarns produced to your specifications are transferred to "braider packages" suitable for use on New England Butt-type and Wardwell braiding machines. During the winding process, we can combine different yarn constructions giving you the ability to braid a variety of sleeving sizes.

### **Uncoated Fiberglass Braid**

Varflex has braiders with a wide range of carriers which enable us to supply uncoated fiberglass braid in a variety of types and sizes.

***And, for those applications not satisfied through the use of its standard products, Varflex stands ready to supply special coatings and treatments as well as special braiding and overbraiding. Don't forget... with our knowledge, experience, dedication and enthusiasm, we will help you find a solution.***

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Volan® and Nomex® are registered trademarks of the DuPont® Company.

05-06



### **Electrical Insulating Sleeving**

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