



Technical Reference Handbook

JPS
COMPOSITE MATERIALS
A Handy & Harman Company



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Company

JPS Composite Materials is the world's leading manufacturer of high strength fiberglass, Astroquartz[®], aramid, carbon, and specialty reinforcement fabrics.

Our materials are used extensively in composite reinforcing, insulating, and safety applications. JPS fabrics are used in consumer and industrial electronics, aerospace interior and exterior structures, advanced commercial and military radomes, in marine and surf applications, sporting goods, and other advanced composites, and as ballistic protection.

Our materials are readily adaptable to unlimited applications!

Direct customer access to customer service:

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Locations

Anderson, South Carolina

Corporate Headquarters

Aerospace Composite, Astroquartz[®], Aramid, and
Specialty Fabrics

Statesville, North Carolina

Electrical Laminate E-glass Fabrics,
Lightweight Advanced and
Aerospace Composite Fabrics,
Carbon Fabrics

Conditions of Sales

All sales of JPS products are subject to the terms and conditions of JPS' standard confirmation of order.

All statements herein are expressions of opinion which the Seller believes to be true and correct. Seller expressly disclaims liability for factual accuracy of such opinions and hereby advises Buyer to investigate each situation on an individual basis before taking action based on Seller's expression of opinion.

Statements concerning possible use of our products are not intended as recommendations for their use in the infringement of any patent. No patent warranty of any kind, expressed or implied, is made or intended.

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PLEASE NOTE: Because of the many variables associated with producing industrial reinforcement fabrics (yarn type, fabric construction, widths, finishes and other facts), the technical data and other information contained on these pages are intended as a general guide only. The data contained herein is subject to change at the Seller's discretion without notification unless specifically prohibited by specific purchase specifications.



Parameters for Fabric Selection

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In selecting a woven fabric for industrial applications a number of design parameters must be considered. These are broken down into five basic variables: Yarn Weight, Yarn Thickness, Yarn Count, Weave Pattern, and Fabric Finish.

Yarn weight and yarn count determine the majority of the physical properties of the fabric. Yarn count is defined as the number of warp yarn ends (lengthwise) and filling yarn picks (widthwise) used per inch.

The weave pattern determines the stiffness or drapability of the fabric. The pattern will also have an influence on overall thickness. For composite applications there are six basic patterns: Plain, Basket, Leno, Four Harness Satin (Crowfoot), Eight Harness Satin, and Twill.

The fabric finish is the surface chemistry applied to the fabric post weaving. Finishes are generally applied to promote adhesion between the fabric and any resin coatings. They may also serve to add stiffness, prevent moisture uptake, and wear damage caused by handling.

Glass Yarn

Yarn determines the majority of the end fabric properties, including the fabric weight, thickness, and strength.

The yarn properties are determined by the chemical composition, the number of input filaments per yarn strand, the number of yarn strands twisted or plied together, and the overall denier (weight) of the final input yarn.

Glass Formulations

Glass fibers are made from different formulations: “E” is the most common all-purpose glass. Other types include “S”, “T”, and “L”, among others. Astroquartz® products are the purest form of silica commercially available.

COMPOSITION OF TYPICAL GLASSES

(%) by weight

Ingredient	"E" Glass	"S", "T" Glass	"Astroquartz"® II & III
Silicon Dioxide	52-60	64-66	99.99
Calcium Oxide	16-25	-	-
Aluminum Oxide	12-16	24-26	-
Boron Oxide	8-13	-	-
Sodium and Potassium Oxide	0-1	-	-
Magnesium Oxide	0-6	9-11	-

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Filament/Yarn Nomenclature

An exact system for identifying fiberglass textile yarns is required because of the wide variety of available types. The nomenclature consists of two basic parts. The alphabetical portion describes the composition and construction. The numerical describes the weight and number of yarns twisted and plied together.

As an example:

Glass

Composition

E=Electrical

S=High Strength

E

C

Type of Yarn

C=Continuous
Filament

Filament Diameter

G

150

Strand Count

Yardage/Lb
(in Hundreds)

Number of Single Strands in Continuous Filament Yarns

1/2

Number of Strands Plied Together

The above describes the basic strand by composition, type and diameter. The numbers identify strand weight and construction. The above description would be for ECG 150 1/2 yarn, or more simply G-150 1/2, used in style 1581 fabric. The S-glass version for style 6581 fabric would be SCG 150 1/2, where "S" denotes S-glass. The non-twisted equivalent for 7781 would be ECDE 75 1/0.

The strand count is the first series of numbers following the letters. It indicates approximate yardage per pound, in hundreds. The number of yards in one pound of single yarn strand can be found by multiplying the strand count by 100.

The second series of numbers designates the number of plies in continuous filament yarns. The first digit in the second digit series indicates the number of single strands twisted together. Untwisted single strands are commonly referred to as “singles” yarn and are designated as 1/0.

The second digit in the second series, separated from the first digit by a diagonal line, designates the number of strands that are plied together. To find the total number of strands in a yarn, multiply the two numbers (0 multiplied as 1). A typical nomenclature for a continuous yarn:

ECG 150-1/2 Where:

E = E-glass

C = Continuous filament

G = Average filament diameter (see table, page 6)

150 = 15,000 Yd/Lb (Nominal) of basic “singles” strand

1/2 = One continuous filament yarn strand consisting of two strands plied together (1X2)

The approximate yards per pound of fabricated yarn can be found by dividing the strand count, multiplied by 100, by the number of strands.

Therefore, ECG 150 1/2 contains:

$$\frac{150 \times 100}{1 \times 2} = 7500 \text{ yds/lb for fabricated yarn}$$

The results of this computation must always be considered approximate, as yards per pound may be reduced slightly in the twisting and plying operations.

DESCRIPTION OF CONTINUOUS FILAMENT GLASS FIBERS

Filament Name	Filament Diameter		Strand Count (x100=yd/lb)	Tex	Number of Filaments
	mils	microns			
B	0.15	3.8	150	33	1224
C	0.15	3.8	150	33	816
D	0.23	5.0	1800	2.75	51
			900	5.5	102
			450	11	204
			225	22	408
			150	33	408
DE	0.25	6.0	75	66	816
			50	99	1224
			37	134	1632
E	0.29	7.0	225	22	204
G	0.36	9.0	150	33	204
			75	66	408
			37	134	816
H	0.43	10	25	198	816
K	0.51	13	75	66	204
			37	134	408
			25	198	608
			18	275	816

DESIGN CONSIDERATIONS FOR GLASS FABRIC SELECTION

There are five basic design variables to consider when choosing fabric for industrial use: thickness, aerial weight, yarn size, construction, finish.

Thickness

Glass fabrics are available in thicknesses ranging from ~0.001" to ~0.060".

Weight

Fabric weights are typically measured in ounces per square yard (osy) or grams per square meter (gsm). Glass fabrics are available from about 0.50 osy up to about 52 osy (17 gsm to 1773 gsm.)

Construction

Construction refers to the fabric pattern, which is both the number of warp yarns per inch (machine direction, ends) and fill yarns per inch (cross-machine direction, picks), and the pattern of interlacing used (plain, twill, satin, etc).

Yarn Size (denier or weight)

Fabric weight and thickness are determined by the input yarn size (denier or weight).

Finish

The finish is the chemical composition of the surface of final fabric. Organic coatings are applied (or removed) to make the fabric more suitable for future resin coating and end use performance requirements.

FABRIC CREATION

Yarn Preparation: Twisting/Plying

This process serves to control the yarn strength, diameter, weight, and flexibility.

Filaments are twisted and or plied based on the end fabric specification requirements.

Most glass fabrics are woven from singles yarns (1/0). Some notable exceptions including styles 108, 120, and 1581.

Warping

Warping is the laying of the machine direction fibers in parallel order. This creates the warp, or machine direction, of the fabric.

A specified number of yarns per inch are drawn from a

creel and wound on a warp beam. Several “section” beams are then combined to provide the designated number of yarns per inch required in the fabric specification.

Slashing/Combining

The section beams from warping are combined during the slashing process to create a warp beam (aka: loom beam). This entire system of parallel threads is wound onto one large beam to become the “warp”, or machine direction, of the fabric.

An additional yarn binder is applied to the warp yarns during the slashing process. The additional binder helps to improve fabric surface quality by providing extra protection to the warp yarns during the weaving process.

Entering

The entering operation draws the warp yarns into to the loom, setting up the weave pattern, yarn spacing and thread counts. The warp yarns are threaded through the harnesses and reed. The entire warp beam-harness-reed unit is then transferred to the loom to begin weaving.

Weaving

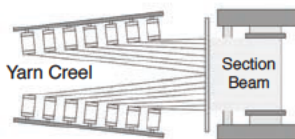
Weaving is the interlacing of filling (cross machine) yarns through warp (machine direction) yarns in a predetermined pattern, including yarn counts, yarn spacings, over/under sequences and predetermined intersecting angles.

Cleaning and Finishing

Dependent on the end fabric use, specialty chemical finishes may be applied to the fabric surface. The loom state (greige) fabric surface must first be cleaned. This is accomplished via either heat exposure or chemical washing. Most glass fabrics are ‘heat cleaned’, most polymer based and specialty fabrics are chemically scoured. The specialty finish is applied post cleaning.

Manufacturing Process Overview

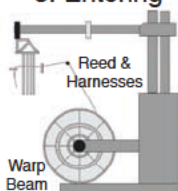
1. Yarn Prep and Warping



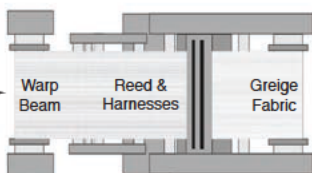
2. Slashing/Combining



3. Entering

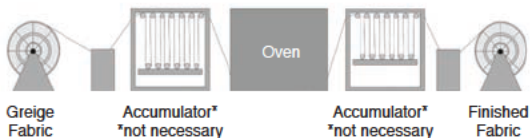


4. Weaving



5. Heat Cleaning/Chemical Scouring

6. Finishing



Finishes most commonly act as coupling agents to improve resin wet-out and bonding. Finishes may also be applied to improve water and wear resistance, high temperature performance..

JPS offers a wide range of existing finishes. We do develop specialty and exclusive finishes based on customer input. For more information please contact us.

Weave Patterns

The matching of yarn, weave pattern and finish for a particular application is an exacting science. Because glass, carbon, aramid and specialty fabrics are highly engineered, the right combination of fabric weight, thickness and construction is essential in selecting the proper fabric. Selecting the right reinforcement fabric for any requirement can be simplified by calling us. Our specialized experience can aid in selecting a reinforcement fabric suited to your requirements.

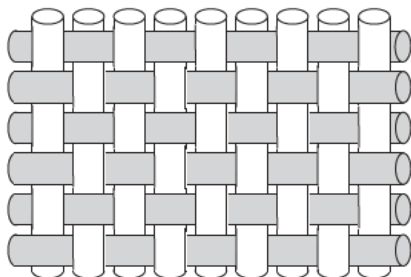
All standard of fabric weaves presented here can be produced with fiberglass, aramid, Astroquartz[®], polymer, specialty and carbon yarns.

The six most common fabric patterns are presented here. Other fabric patterns are available on request; as well as through development.

Plain Weave fabrics tend to be the most stable pattern, followed by Leno, Basket Weave, 4H Satin, 8H Satin fabrics.

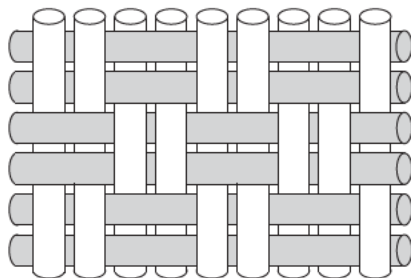
In terms of drape or conformability, 8H Satin is the most conformable, followed by the 4H Satin, Basket Weave, Plain Weave and Leno fabrics.

Plain Weave



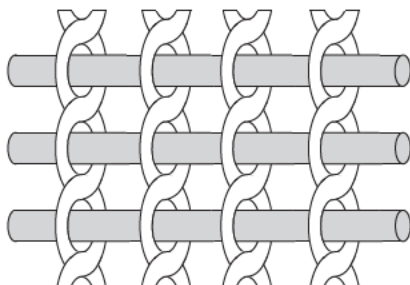
The plain weave consists of yarns interlaced in an alternating pattern, one over and one under every other yarn. The plain weave provides good fabric stability. It is the primary fabric used in the electronics and coating industries.

Basket Weave



The basket weave is similar to the plain weave, except that two or more filling yarns are alternately interlaced over and under one another. The basket weave is more pliable, flatter, and stronger than the plain weave, but is not as stable as a plain weave.

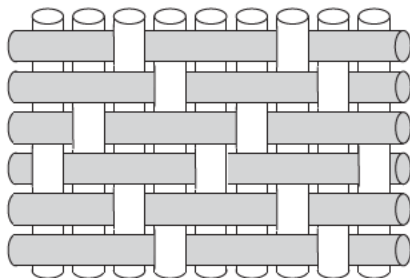
Leno



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The leno weave is used where relatively low aerial weights are desired but specific thicknesses must be maintained. The leno weave pattern locks the yarns in place by crossing two or more warp threads over each other and interlacing with one or more fill threads. Leno weave patterns are common in EIFS applications and to set bond line thicknesses for adhesives and tapes.

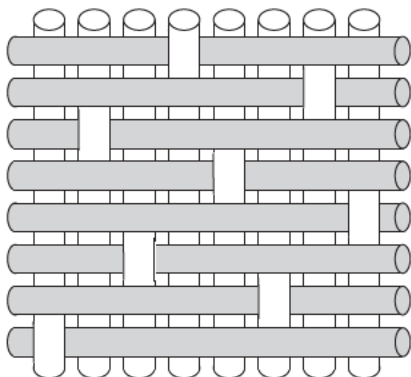
Four-Harness Satin (Crowfoot)



The four-harness satin relies on a three by one interlacing pattern. The fill yarn floats over three warp yarns and under one. The four-harness satin weave is more pliable than the plain weave and is easier to conform to curved surfaces typical in reinforced plastics.

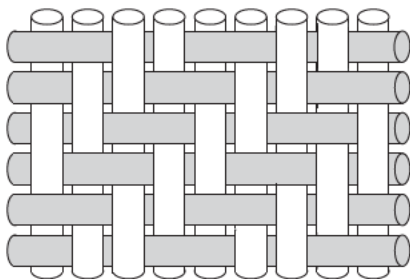
Eight-Harness Satin

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The eight-harness satin is similar to the four-harness satin except that one filling yarn floats over seven warp yarns and under one. This is a very pliable weave and is used for forming curved surfaces.

2x2 Twill



The twill is used where tightly woven fabric with high density is required. The twill weave is characterized by a diagonal rib or twill line. The warp yarn floats over two consecutive picks, permitting more yarns per unit area.

Specifications and Standards

JPS fabrics are designed to meet the requirements of a wide range of applications. Listed below is a partial offering of the standards and specifications we manufacture towards. For adherence to a specific standard or specification not listed please contact customer service or technical support.

AMS-3824 - Glass Cloth, Finished for Resin Laminates

AMS-3846 - Quartz Cloth, Finished for Resin Laminates

AMS-3902 - Para-Aramid Cloth for Structural Composites

AMS-C-9084 - Glass Cloth, Finished for Resin Laminates

ASTM-D-579 - Greige Woven Glass Fabrics

ASTM-D-1668 - Standard Specification for Glass Fabrics

ASTM-D-4029 - Standard Specification for Finished Glass Fabrics

BMS 9-3 - Boeing requirements for E-Glass Fabrics

BMS 9-8 - Boeing requirements for carbon Fabrics

BMS 9-17 - Boeing requirements for Intermediate Modulus Carbon Fabrics

IPC-4412 - Standard Specification for Glass Fabrics for Use in Printed Circuit Boards

MIL-DTL-62474 - Aramid-Reinforced-Plastic Composites

MIL-PRF-64154 - Glass-Reinforced-Phenolic Composites

MIL-R-7575 - Glass-Reinforced-Polyester Composites

MIL-R-9300 - Glass-Reinforced-Epoxy Composites

MIL-Y-1140 - Greige Woven Glass Fabrics

FIBERGLASS PRODUCTS

Physical Properties of E-glass Fiber

Approximate Chemistry*

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SiO ₂	52-56%
CaO.....	16-25%
Al ₂ O ₃	12-16%
B ₂ O ₃	5-10%
MgO.....	0-5%
NaO ₂	0-1%
KO ₂	0-1%
Other Elements.....	0-2%

Physical Properties*

Density.....	2.54-2.60 g/cc
Refractive Index.....	1.547 to 1.562
Mohs Hardness.....	6.5

Mechanical Properties*

UTS (room temp).....	3.4-3.5 GPa
Breaking Strain.....	4.5-5.0%
Young's Modulus.....	65-75 GPa
Shear Modulus.....	28-32 GPa
Poisson's Ratio.....	0.200

Thermal Properties*

CTE (-30°C to 250°C).....	5.4 $\mu\text{m/m}^\circ\text{C}$
Specific Heat Capacity.....	0.80-1.03 kJ/kg-K
Thermal Conductivity.....	1.0-1.3 W/m-K
Softening Point.....	$\leq 845^\circ\text{C}$

Electrical Properties*

Dk @ 1 MHz.....	6.6
Dk @ 10 GHz.....	6.1
Df @ 1 MHz.....	0.003
Df @ 10 GHz.....	0.004
Volume Resistivity.....	$4.02 \times 10^{15} \Omega\text{-cm}$
Surface Resistivity.....	$4.20 \times 10^{16} \Omega\text{-cm}$
Dielectric Strength.....	103kV/cm

*All values approximate. Actual values may vary, for further info contact JPS.

Physical Properties of S-Glass

Approximate Chemistry*

SiO ₂	64-66%
Al ₂ O ₃	24-26%
MgO.....	9-11%
Other Elements.....	0-1.2%

Physical Properties*

Density.....	2.46-2.49 g/cc
Refractive Index.....	1.520 to 1.525
Mohs Hardness.....	6.5

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Mechanical Properties*

UTS (room temp).....	4.6-4.8 GPa
Breaking Strain.....	5.4-5.8%
Young's Modulus.....	85-90 GPa
Shear Modulus.....	33-37 GPa
Poisson's Ratio.....	0.230

Thermal Properties*

CTE (-30°C to 250°C).....	2.9 $\mu\text{m/m-}^\circ\text{C}$
Specific Heat Capacity.....	0.74-0.82 kJ/kg-K
Thermal Conductivity.....	1.1-1.4 W/m-K
Softening Point.....	$\leq 1055^\circ\text{C}$

Electrical Properties*

Dk @ 1 MHz.....	5.3
Dk @ 10 GHz.....	5.2
Df @ 1 MHz.....	0.002
Df @ 10 GHz.....	0.007
Volume Resistivity.....	$0.905 \times 10^{13} \Omega\text{-cm}$
Surface Resistivity.....	$0.886 \times 10^{13} \Omega\text{-cm}$
Dielectric Strength.....	130kV/cm

*All values approximate. Actual values may vary, for further info contact JPS.

Fiberglass Fabric Applications

Fiberglass fabrics are used in a wide range of industrial applications, some of which are outlined below.

Aerospace Applications

Fiberglass is used for interior cabin structures including seats, luggage bins, bulkheads, lavatories, wall panels, and in honeycomb structures. Other applications include gasketing, as galvanic barriers between carbon and metal, for structural parts, and in support of radomes. JPS is BMS, AMS, SAE and MIL spec approved for your needs.

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Electrical Applications

Fiberglass fabrics can be found in printed circuit boards, antennas, high voltage generators, transformers, switches, cables and many other electrical applications.

Structural Applications

Fiberglass fabrics are used as reinforcements in highly engineered composite materials in many of the world's leading aircraft, automobiles, buildings, and roadways,

Recreational Applications

JPS fiberglass is found in many recreational composites, including in high performance racecars and motorcycles, bicycles, bats, racquets, hockey sticks, and in high end surf and snow boards.

Thermal Insulation

The U.S. Navy, commercial shipyards, the automotive, and aerospace industries all use fiberglass almost exclusively for pipe lagging, thermal pad cover, thermal protection, and insulation applications.

General Industrial Applications

Fiberglass fabrics can be found in window shades, vapor barriers, movie screens, packaging tapes, awnings, protective clothing, gaskets, conveyor belts, food cooking applications, and countless other products that improve our lives daily.

Fiberglass Fabric Finishes

Fiberglass fabrics are available with a variety of finishes and treatments. The most common finishes are listed here, for specific applications, or to develop a custom finish for your application please contact customer service or your technical support representative.

Finish Name	Functionality:		Notes
	Primary	Secondary	
Greige	Uncoated	Phenolic	Loom state fabric with yarn binders
Caramelized (210)	Uncoated	PTFE	Loom state fabric, partially volatilized
F3	Polyester	Epoxy	Volan, green tint
F12	Silicone		Neutral pH
F16	Polyester	Epoxy	Volan, green tint
112	Uncoated	Phenolic	Fully heat cleaned BMS 9-3 Listed
CS-309	Polyimide	Epoxy, BT	Silane Finish
CS-310	Epoxy		Silane Finish BMS 9-3 Listed
CS-550	PE, Epoxy	Phenolic	Volan, green tint
CS-616	Melamine		Silane finish, tan
CS-718	Epoxy		Silane Finish
CS-724	Epoxy		Silane Finish BMS 9-3 Listed
CS-745	Epoxy	BT, Cynate Ester, PI	Silane Finish
CS-767	Epoxy, Polyimide, Cynate Ester	BMI, Phenolic, SBR	Silane Finish BMS 9-3 Listed

Fiberglass Fabric Finishes (cont.)

Finish Name	Functionality:		Notes
	Primary	Secondary	
S-910	Polyester		High clarity for surf
S-912	Polyester	Epoxy	High clarity for surf
A-1100	Phenolic	Epoxy	Silane finish BMS 9-3 Listed
A-1100S	Phenolic	Epoxy	Recommend for hand layup, BMS 9-3 Listed
Z-6040	Epoxy	Phenolic	Common base silane
9464	Uncoated	Epoxy	Antimony-free Hull Board
9465	Uncoated	Epoxy	Higher flame retardant Hull Board
9466	Uncoated	Epoxy	Standard Hull Board
9827	Epoxy	Polyimide	Silane finish
9837	Vinyl Ester	Polyester	Vinyl silane finish
Great White	Polyester		Highest clarity for surf
Volan	Polyester	Epoxy	Volan finish, green tint, BMS 9-3 Listed

Fiberglass Fabrics

Style	Weave	Count		Warp Yarn	Fill Yarn	Weight (osy)	Weight (gsm)	Thickness (mils)	Strength (lbf/in)		
		Warp	Count						Warp	Fill	
101	Plain	75	75	ECD 1800 1/0	ECD 1800 1/0	0.48	16	1.0	0.02	40	40
104	X Plain	60	52	ECD 900 1/0	ECD 1800 1/0	0.55	19	1.1	0.03	60	50
106	X Plain	56	56	ECD 900 1/0	ECD 900 1/0	0.72	24	1.3	0.03	45	40
108	X Plain	60	47	ECD 900 1/2	ECD 900 1/2	1.40	48	2.4	0.06	70	40
112	Plain	40	39	ECD 450 1/2	ECD 450 1/2	2.08	71	3.6	0.09	100	90
113	Plain	60	64	ECD 450 1/2	ECD 900 1/2	2.39	81	3.4	0.09	120	70
116	X Plain	60	58	ECD 450 1/2	ECD 450 1/2	3.09	105	4.0	0.10	170	140
117	Plain	54	39	ECD 450 1/2	ECD 450 1/2	2.40	81	3.7	0.09	160	100
119	Plain	54	50	ECD 450 1/2	ECD 450 1/2	2.71	92	3.6	0.09	150	150
120	X 4H Satin	60	58	ECD 450 1/2	ECD 450 1/2	3.16	107	3.9	0.10	150	150
128	Plain	44	32	ECE 225 1/3	ECE 225 1/3	6.00	204	7.0	0.18	200	200
138	4H Satin	65	60	ECE 225 1/2	ECE 225 1/2	6.53	221	6.9	0.18	270	260
139	4H Satin	64	60	ECE 225 1/2	ECE 225 1/2	6.50	220	6.5	0.17	250	200
162	X Plain	28	16	ECE 225 2/5	ECE 225 2/5	12.01	407	13.8	0.35	650	420
220	X 4H Satin	60	58	ECE 225 1/0	ECE 225 1/0	3.14	106	3.7	0.09	150	150

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Fiberglass Fabrics

Style	Common	Weave	Count		Warp		Fill		Weight		Thickness		Strength (lb/ft/in)	
			Warp	Fill	Yarn	Yarn	Yarn	Yarn	(osy)	(gsm)	(mils)	(mm)	Warp	Fill
332	X	4H Satin	48	32	ECG 37 1/0	ECG 37 1/0	ECG 37 1/0	ECG 37 1/0	13.00	441	14.2	0.36	610	500
333		4H Satin	48	32	ECDE 37 1/0	ECDE 37 1/0	ECDE 37 1/0	ECDE 37 1/0	13.00	441	14.0	0.36	600	420
403		4H Satin	54	50	ECG 75 1/0	ECG 75 1/0	ECG 150 1/2	ECG 150 1/2	8.40	285	8.9	0.23	440	350
520		Plain	18	17	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	8.70	295	9.1	0.23	440	350
880	X	8H Satin	73	72	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	5.70	193	6.0	0.15	300	230
993		Plain	38	67	ECD 900 1/0	ECD 900 1/0	ECD 900 1/0	ECD 900 1/0	0.71	24	1.2	0.03	30	20
1014	X	Knit	18	20	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	6.60	223	10.5	0.26	20	10
1025		Knit	18	20	ECDE 225 1/0	ECDE 225 1/0	ECDE 225 1/0	ECDE 225 1/0	4.90	167	8.4	0.21	20	10
1035		Plain	66	68	ECD 900 1/0	ECD 900 1/0	ECD 900 1/0	ECD 900 1/0	0.88	30	1.1	0.03	40	40
1037		Plain	70	73	ECC 1200 1/0	ECC 1200 1/0	ECC 1200 1/0	ECC 1200 1/0	0.73	25	1.3	0.03	40	40
1044		Plain	44	44	ECDE 100 1/0	ECDE 100 1/0	ECDE 100 1/0	ECDE 100 1/0	5.10	171	5.6	0.14	150	150
1047		Plain	47	47	ECDE 100 1/0	ECDE 100 1/0	ECDE 100 1/0	ECDE 100 1/0	5.44	184	5.6	0.14	200	200
1064		Plain	18	21	ECG 75 1/2	ECG 75 1/2	ECG 150 1/2	ECG 150 1/2	4.60	156	5.8	0.15	220	150
1065		Plain	56	56	ECD 450 1/0	ECD 450 1/0	ECD 900 1/0	ECD 900 1/0	1.08	37	2.1	0.05	120	40
1067		Plain	70	70	ECD 900 1/0	ECD 900 1/0	ECD 900 1/0	ECD 900 1/0	0.91	31	1.4	0.04	50	50

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Fiberglass Fabrics

Style	Common	Weave		Count		Warp		Fill		Weight (osy)	Thickness (mills)	Strength (lbf/in)			
				Warp	Fill	Warp	Fill	Warp	Fill						
1070	X	Plain		60	35	ECD 450 1/0		ECD 900 1/0		1.02	35	1.9	0.05	126	33
1071		Plain		60	30	ECD 900 1/0		ECD 900 1/0		0.60	20	1.2	0.03	60	30
1076		Plain		60	25	ECD 450 1/0		ECD 900 1/0		0.96	33	1.8	0.05	120	20
1078		Plain		54	54	ECD 450 1/0		ECD 450 1/0		1.41	48	1.7	0.04	100	100
1080	X	Plain		60	47	ECD 450 1/0		ECD 450 1/0		1.41	48	2.2	0.06	120	90
1081		Plain		70	60	ECD 450 1/0		ECD 450 1/0		1.72	59	2.4	0.06	80	20
1086		Plain		60	60	ECD 450 1/0		ECD 450 1/0		1.65	56	2.2	0.06	120	120
1125		Plain		40	39	ECD 450 1/2		ECG 150 1/0		2.60	88	3.5	0.09	100	150
1131	X	Plain		120	52	ECD 450 1/0		ECG 150 1/0		3.65	124	4.8	0.12	190	260
1141		Plain		32	21	ECDE 75 1/0		ECDE 75 1/0		4.20	142	7.0	0.18	250	120
1142	X	Plain		31	21	ECG 37 1/0		ECG 37 1/0		8.39	284	10.3	0.26	400	310
1161	X	Plain		100	42	ECD 450 1/0		ECDE 100 1/0		3.86	131	5.0	0.13	150	340
1162	X	Plain		100	36	ECD 450 1/0		ECG 75 1/0		4.33	137	5.6	0.14	100	180
1165	X	Plain		60	52	ECD 450 1/2		ECG 150 1/0		3.66	124	4.1	0.10	150	260
1167	X	Plain		60	55	ECD 450 1/2		ECG 150 1/0		3.79	129	4.2	0.11	160	260

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Fiberglass Fabrics

Style	Weave	Count		Warp	Yarn	Fill	Yarn	Weight (osy)	Weight (gsm)	Thickness		Strength (lbf/in)	
		Warp	Fill							(mils)	(mm)	Warp	Fill
1188	X 4H Satin	47	30	ECH 25 1/0	ECG 150 1/0	ECG 150 1/0	ECG 150 1/0	12.02	408	11.8	0.30	750	130
1280	X Plain	60	60	ECD 450 1/0	ECD 450 1/0	ECD 450 1/0	ECD 450 1/0	1.65	56	2.2	0.06	120	120
1297	X Plain	50	20	ECD 450 1/0	ECD 450 1/0	ECD 900 1/0	ECD 900 1/0	0.79	27	2.0	0.05	110	30
1299	X Plain	50	20	ECD 450 1/0	ECD 450 1/0	ECD 450 1/0	ECD 450 1/0	0.92	31	2.0	0.05	100	40
1521	X Plain	30	16	ECG 150 1/2	ECG 150 1/2	ECG 75 1/0	ECG 75 1/0	3.60	122	5.5	0.14	150	150
1522	X Plain	24	22	ECG 150 1/2	ECG 150 1/2	ECG 150 1/2	ECG 150 1/2	3.63	123	4.7	0.12	170	140
1523	X Plain	28	20	ECG 150 3/2	ECG 150 3/2	ECG 150 3/2	ECG 150 3/2	11.55	392	13.2	0.34	510	390
1526	Plain	35	32	ECG 150 1/2	ECG 150 1/2	ECG 150 1/2	ECG 150 1/2	5.30	180	6.2	0.16	250	240
1527	Plain	17	17	ECG 150 3/3	ECG 150 3/3	ECG 150 3/3	ECG 150 3/3	11.98	406	14.0	0.36	480	480
1528	X Plain	42	32	ECG 150 1/2	ECG 150 1/2	ECG 150 1/2	ECG 150 1/2	6.03	204	7.0	0.18	280	200
1530	Plain	20	18	ECG 150 3/3	ECG 150 3/3	ECG 150 3/3	ECG 150 3/3	13.20	448	15.0	0.38	500	470
1543	4H Satin	49	30	ECG 75 1/2	ECE 225 1/0	ECE 225 1/0	ECE 225 1/0	8.52	289	8.2	0.21	680	70
1557	4H Satin	57	30	ECG 150 1/2	ECE 225 1/0	ECE 225 1/0	ECE 225 1/0	5.25	178	5.3	0.13	370	110
1562	X Leno	30	16	ECG 150 1/0	ECG 150 1/0	ECG 150 1/0	ECG 150 1/0	1.88	64	4.9	0.12	100	70
1564	X Plain	20	18	ECG 37 1/2	ECG 37 1/2	ECG 37 1/2	ECG 37 1/2	12.42	421	15.1	0.38	520	500

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Fiberglass Fabrics

Style Common	Weave	Count		Warp Yarn	Fill Yarn	Weight		Thickness (mils)	Strength (lb/in)	
		Warp	Fill			(osy)	(gsm)		Warp	Fill
1568	Leno	16	8	ECH 25 1/0	ECG 37 1/3	7.97	270	16.5	0.42	237 374
1581	X 8H Satin	57	54	ECG 150 1/2	ECG 150 1/2	8.78	298	8.2	0.21	440 370
1582	8H Satin	60	56	ECG 150 1/3	ECG 150 1/3	13.52	462	12.6	0.32	600 570
1583	8H Satin	54	48	ECG 75 1/2	ECG 75 1/2	16.55	561	16.1	0.41	1000 850
1584	X 8H Satin	44	35	ECG 150 4/2	ECG 150 4/2	26.34	893	22.9	0.58	1000 900
1597	Plain	30	30	ECG 37 1/4	ECG 37 1/4	38.46	1308	38.3	0.97	800 90
1608	Plain	30	26	ECG 150 1/0	ECG 150 1/0	2.22	75	3.5	0.09	160 130
1609	X Plain	32	10	ECG 150 1/0	ECD 450 1/0	1.48	50	2.8	0.07	160 20
1610	X Plain	32	28	ECG 150 1/0	ECG 150 1/0	2.36	80	4.0	0.10	150 130
1611	Plain	32	28	ECG 150 1/0	ECDE 150 1/0	2.42	82	4.0	0.10	160 150
1614	X Leno	30	14	ECG 150 1/0	ECG 75 1/0	2.35	80	5.7	0.14	100 130
1617	Plain	30	14	ECG 150 1/0	ECG 75 1/0	2.31	78	6.8	0.17	100 50
1620	X Plain	20	20	ECG 150 1/0	ECG 150 1/0	1.60	50	3.2	0.08	220 160
1628	X Plain	40	28	ECDE 150 1/0	ECDE 150 1/0	2.71	92	4.3	0.11	220 330
1632	Plain	30	32	ECG 150 1/0	ECG 150 1/0	3.75	127	4.9	0.12	160 110

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Fiberglass Fabrics

Style	Weave Common	Count		Warp Yarn	Fill Yarn	Weight		Thickness		Strength (lbf/in)	
		Warp	Fill			(osy)	(gsm)	(mils)	(mm)	Warp	Fill
1633	Plain	40	20	ECG 150 1/0	ECG 75 1/0	3.20	108	4.1	0.11	120	120
1634	Plain	41	24	ECDE 150 1/0	ECDE 150 1/2	3.11	105	3.7	0.10	120	120
1636	Plain	40	24	ECDE 150 1/0	ECDE 150 1/0	2.59	88	4.4	0.11	210	130
1647	Plain	51	30	ECG 150 1/0	ECE 110 1/0	3.55	121	4.1	0.11	120	120
1649	Plain	51	38	ECG 150 1/0	ECE 110 1/0	4.01	136	4.7	0.12	120	200
1651	Plain	51	27	ECG 150 1/0	ECG 37 1/0	4.31	146	5.3	0.14	120	130
1652 X	Plain	52	52	ECG 150 1/0	ECG 150 1/0	4.13	140	4.4	0.11	230	100
1657	Plain	51	32	ECDE 150 1/0	ECDE 150 1/0	2.82	96	3.8	0.10	150	100
1658 X	Plain	20	10	ECG 150 1/0	ECG 75 1/0	1.62	55	3.7	0.09	100	20
1659 X	Leno	20	10	ECG 150 1/0	ECG 75 1/0	1.66	56	4.5	0.11	80	160
1669	Plain	60	12	ECG 150 1/0	ECD 450 1/0	2.50	85	3.2	0.08	310	160
1674 X	Plain	40	32	ECG 150 1/0	ECG 150 1/0	2.87	97	4.2	0.11	210	200
1675 X	Plain	40	32	ECDE 150 1/0	ECDE 150 1/0	2.89	98	4.4	0.11	220	160
1676 X	Plain	56	48	ECDE 150 1/0	ECDE 150 1/0	4.00	136	4.8	0.12	70	60
1677 X	Plain	41	40	ECDE 150 1/0	ECDE 150 1/0	3.15	105	3.7	0.09	180	160

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Fiberglass Fabrics

Style Common	Weave	Count		Warp		Fill		Weight (osy)	Thickness (mils)	Strength (lbf/in)	
		Warp	Fill	Yarn	Yarn	Yarn	Yarn			Warp	Fill
1678	Plain	40	40	ECG 150 1/0	ECG 150 1/0	ECG 150 1/0	ECG 150 1/0	3.20	4.3	0.11	200
1680	8H Satin	72	70	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	5.73	5.6	0.14	390
1681	Plain	56	36	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	ECDE 150 1/0	3.65	4.7	0.12	220
1688	X Plain	32	20	ECG 150 1/0	ECG 150 1/0	ECG 75 1/0	ECG 75 1/0	2.90	4.7	0.12	150
1692	Plain	40	22	ECG 150 1/0	ECG 150 1/0	ECG 75 1/0	ECG 75 1/0	3.19	5.2	0.13	200
1694	Plain	40	24	ECG 150 1/0	ECG 150 1/0	ECG 75 1/0	ECG 75 1/0	3.54	5.2	0.13	200
1695	X Plain	40	24	ECDE 150 1/0	ECDE 150 1/0	ECDE 75 1/0	ECDE 75 1/0	3.59	5.4	0.14	190
1800	Plain	16	14	ECK 18 1/0	ECK 18 1/0	ECK 18 1/0	ECK 18 1/0	9.39	11.2	0.28	460
1884	8H Satin	44	35	ECK 18 1/0	ECK 18 1/0	ECK 18 1/0	ECK 18 1/0	25.40	26.0	0.66	950
1908	Mod Twill	32	15	ETDE 11.6 Tex	ETDE 11.6 Tex	ETDE 11.6 Tex	ETDE 11.6 Tex	24.0	40.0	1.02	600
1938	8H Satin	45	36	ECK 18 1/0	ECK 18 1/0	ECG 37 1/2	ECG 37 1/2	26.8	26.6	0.68	1000
2025	X Plain	20	14	ETDE 11.6 Tex	ETDE 11.6 Tex	ETDE 11.6 Tex	ETDE 11.6 Tex	17.05	26.2	0.67	340
2112	X Plain	40	39	ECE 225 1/0	ECE 225 1/0	ECE 225 1/0	ECE 225 1/0	2.10	3.0	0.08	120
2113	X Plain	60	56	ECE 225 1/0	ECE 225 1/0	ECD 450 1/0	ECD 450 1/0	2.35	2.8	0.07	220
2114	Plain	56	48	ECE 225 1/0	ECE 225 1/0	ECE 225 1/0	ECE 225 1/0	2.69	3.3	0.08	190

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Fiberglass Fabrics

Style Common	Weave	Count		Warp Yarn	Fill Yarn	Weight (osy)	Weight (gsm)	Thickness		Strength (lb/in)	
		Warp	Fill					(mils)	(mm)	Warp	Fill
2116	X Plain	60	58	ECE 225 1/0	ECE 225 1/0	3.12	106	3.4	0.09	200	180
2117	Plain	66	55	ECE 225 1/0	ECE 225 1/0	3.18	108	3.7	0.09	200	150
2119	Plain	54	50	ECE 225 1/0	ECE 225 1/0	2.66	90	3.4	0.09	140	110
2125	Plain	41	38	ECE 225 1/0	ECE 225 1/0	2.60	88	3.5	0.09	120	120
2313	Plain	60	64	ECE 225 1/0	ECD 450 1/0	4.32	146	5.9	0.15	180	280
2316	Plain	61	61	ECE 225 1/0	ECE 225 1/0	3.13	106	3.8	0.10	230	230
2319	Plain	60	49	ECE 225 1/0	ECE 225 1/0	2.72	92	3.4	0.09	200	180
3070	Plain	70	70	ECDE 300 1/0	ECDE 300 1/0	2.83	96	3.0	0.08	190	160
3313	Plain	61	62	ECDE 300 1/0	ECDE 300 1/0	2.45	83	3.0	0.08	190	160
3582	8H Satin	60	56	ECG 50 1/0	ECG 50 1/0	13.76	467	13.8	0.35	700	600
3733	Plain	18	18	ECG 37 1/0	ECG 37 1/0	5.59	190	7.1	0.18	370	320
3784	X 8H Satin	45	36	ECG 37 1/2	ECG 37 1/2	25.79	874	24.2	0.61	1180	930
3788	X 12H Satin	42	36	ECG 37 1/4	ECG 37 1/4	52.30	1773	48.7	1.24	1900	1600
3884	8H Satin	46	36	ECDE 37 1/2	ECDE 37 1/2	26.50	899	26.7	0.68	1000	930
4180	X 4H Satin	80	100	SCD 450 1/0	SCD 450 1/0	2.52	85	2.7	0.07	180	200

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Fiberglass Fabrics

Style	Weave	Count		Warp		Fill		Weight (osy)	Weight (gsm)	Thickness		Strength (lbf/in)	
		Common		Warp	Fill	Warp	Yarn			Yarn	(mils)	(mm)	Warp
4522	Plain	24	22	SCG 150 1/2	SCG 150 1/2	SCG 150 1/2	SCG 150 1/2	3.66	124	5.1	0.13	190	150
4526	Basket 2x2	36	34	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	5.60	190	6.0	0.15	350	350
4527	Plain	24	22	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	3.58	121	5.6	0.14	340	310
4533	Plain	18	18	SCG 75 1/2	SCG 75 1/2	SCG 75 1/2	SCG 75 1/2	5.59	190	8.1	0.21	340	310
4579	Plain	30	16	SCG 150 1/2	SCG 150 1/2	SCG 75 1/0	SCG 75 1/0	3.59	122	5.4	0.14	300	300
4985	Plain	18	22	SCG 75 1/2	SCG 150 1/2	SCG 150 1/2	SCG 150 1/2	4.70	159	6.2	0.16	300	110
6080	Plain	60	47	SCD 450 1/0	SCD 450 1/0	SCD 450 1/0	SCD 450 1/0	1.44	49	2.0	0.05	150	110
6220	4H Satin	60	58	SCE 225 1/0	SCE 225 1/0	SCE 225 1/0	SCE 225 1/0	3.08	104	4.0	0.10	250	200
6580	X 8H Satin	72	72	SCG 150 1/0	SCG 150 1/0	SCG 150 1/0	SCG 150 1/0	5.60	190	5.6	0.14	350	300
6581	8H Satin	56	54	SCG 150 1/2	SCG 150 1/2	SCG 150 1/2	SCG 150 1/2	8.75	297	10.4	0.26	250	250
6771	8H Satin	46	45	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	7.06	239	8.0	0.20	500	500
6781	X 8H Satin	57	54	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	8.94	303	9.6	0.24	560	450
16781	X 8H Satin	58	55	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	9.00	305	9.6	0.24	550	500
16791	Conform	58	55	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	9.00	305	9.6	0.24	550	500
26781	X 8H Satin	56	53	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	SCG 75 1/0	8.50	288	9.0	0.23	450	400

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Fiberglass Fabrics

Style Common	Weave	Count		Warp	Yarn	Fill	Yarn	Weight		Thickness (mils)	Thickness (mm)	Strength (lb/ft ²)	
		Warp	Fill					(oz/yd)	(gsm)			Warp	Fill
7500	X Plain	16	14	ECG 37 1/2	ECG 37 1/2	ECG 37 1/2	ECG 37 1/2	9.41	319	11.9	0.30	420	400
7510	X Plain	18	21	ECG 75 1/2	ECG 75 1/2	ECG 150 1/2	ECG 150 1/2	4.50	152	7.0	0.18	120	70
7520	Plain	18	18	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	8.39	284	10.1	0.26	330	310
7523	Plain	28	20	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	11.55	392	13.2	0.34	680	500
7531	X Plain	23	14	ECG 75 1/2	ECG 75 1/2	ECG 75 1/2	ECG 75 1/2	5.50	186	9.0	0.23	160	110
7532	X Plain	16	14	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	ECG 75 1/3	7.20	244	9.4	0.24	340	300
7533	X Plain	18	18	ECG 75 1/2	ECG 75 1/2	ECG 75 1/2	ECG 75 1/2	5.61	191	7.3	0.19	250	230
7544	X 2 End Plain	28	14	ECG 37 1/2	ECG 37 1/2	ECG 37 1/4	ECG 37 1/4	18.00	612	19.1	0.49	700	700
7581	X 8H Satin	57	54	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	9.00	305	8.9	0.23	570	500
7587	X Mock Leno	40	21	ECG 37 1/2	ECG 37 1/2	ECG 37 1/2	ECG 37 1/2	20.50	695	30.0	0.76	750	450
7597	Double Satin	30	30	ECG 37 1/4	ECG 37 1/4	ECG 37 1/4	ECG 37 1/4	37.90	1289	40.3	1.02	1000	1100
7618	Plain	43	18	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	4.95	168	6.5	0.17	330	120
7624	Plain	44	24	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	5.53	187	7.0	0.18	350	250
7627	Plain	44	24	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	5.58	189	6.2	0.16	320	170
7628	X Plain	44	31	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	ECG 75 1/0	6.10	207	7.1	0.18	350	270

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Fiberglass Fabrics

Style	Common	Weave	Count		Warp Yarn	Fill Yarn	Weight (osy)	Thickness		Strength (lbf/in)		
			Warp	Fill				(mils)	(mm)	Warp	Fill	
76281		4H Satin	44	32	ECG 75 1/0	ECG 75 1/0	6.10	207	7.0	0.18	350	270
7629		Plain	44	34	ECG 75 1/0	ECG 75 1/0	6.26	212	7.1	0.18	350	270
7637	X	Plain	44	23	ECG 75 1/0	ECG 37 1/0	7.09	240	9.5	0.24	320	420
7642		Plain	44	20	ECG 75 1/0	ETG 37 1/0 Tex	6.86	233	10.9	0.28	350	180
7645	X	8H Satin	46	42	ECG 75 1/2	ECG 75 1/2	14.31	485	13.4	0.34	600	500
17645	X	8H Satin	46	42	SCG 75 1/2	SCG 75 1/2	13.90	471	13.0	0.33	700	600
7781	X	8H Satin	57	54	ECDE 75 1/0	ECDE 75 1/0	8.87	301	8.6	0.22	500	400
17781	X	8H Satin	58	55	ECDE 75 1/0	ECDE 75 1/0	9.00	305	8.7	0.23	580	500
7791	X	Conform	58	58	ECDE 75 1/0	ECDE 75 1/0	8.95	303	8.7	0.23	500	440
16550	X	Plain	24	22	SCG 150 1/2	SCG 150 1/2	3.66	124	5.6	0.14	250	230
21522	X	Plain	24	22	ECG 150 1/2	ECG 150 1/2	3.65	124	5.5	0.14	300	280
27533	X	Plain	18	17	ECG 75 1/2	ECG 75 1/2	5.55	188	8.2	0.21	300	280
85392	X	Plain	44	30	SCG 75 1/0	T-5043	6.00	203	8.5	0.22	300	75

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Fiberglass Fabric Weight Index

Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)
21522	3.65 124	4985	4.70 159	880	5.70 193	7532	7.20 244	16791	9.00 306		
1165	3.66 124	1025	4.90 167	1680	5.73 194	1142	8.39 284	17781	9.00 306		
4522	3.66 124	7618	4.95 168	128	6.00 203	7520	8.39 284	1800	9.39 318		
16550	3.66 124	1044	5.10 173	85392	6.00 203	403	8.40 285	7500	9.41 319		
1632	3.75 127	1557	5.25 178	1528	6.03 204	7537	8.50 288	1523	11.55 392		
1167	3.79 129	1526	5.30 180	7628	6.10 207	1543	8.52 289	7523	11.55 392		
2316	3.86 131	1047	5.44 184	76281	6.10 207	520	8.70 295	1527	11.98 406		
1161	3.86 131	7531	5.50 186	7629	6.26 212	6581	8.75 297	162	12.00 407		
1649	4.01 136	7624	5.53 187	7667	6.27 213	1581	8.78 298	3764	12.02 408		
1676	4.12 140	7627	5.58 189	139	6.50 220	7781	8.87 301	1188	12.02 408		
1652	4.13 140	3733	5.59 190	138	6.53 221	6781	8.94 303	1564	12.42 421		
1141	4.20 142	4533	5.59 190	1014	6.60 223	7698	8.95 303	332	13.00 441		
1651	4.31 145	4526	5.60 190	7642	6.86 233	7791	8.95 303	333	13.00 441		
7510	4.50 152	6580	5.60 190	6771	7.06 239	7581	8.99 305	1530	13.20 448		
1064	4.60 156	7533	5.61 191	7637	7.09 240	16781	9.00 306	1582	13.52 462		

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Fiberglass Fabric Weight Index

Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)
3582	13.76 467	3788	52.30 1773						
17645	13.90 470								
7645	14.31 485								
3783	16.15 546								
2025	17.05 578								
7544	17.99 612								
7587	20.50 695								
1908	24.00 811								
1884	25.40 861								
3784	25.79 874								
1584	26.34 893								
3884	26.50 899								
1938	26.80 909								
7597	37.90 1289								
1597	38.46 1308								

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Fiberglass Fabric Thickness Index

Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)
101	0.78 0.02	108	2.2 0.06	1669	3.2 0.08	1677	3.7 0.09	1678	4.3 0.11
104	1.0 0.03	1080	2.2 0.06	2114	3.3 0.08	2117	3.7 0.09	1636	4.4 0.11
1035	1.1 0.03	1086	2.2 0.06	113	3.4 0.09	1657	3.8 0.10	1652	4.4 0.11
993	1.1 0.03	1280	2.2 0.06	2116	3.4 0.09	2316	3.8 0.10	1675	4.4 0.11
1071	1.2 0.03	3080	2.3 0.06	2119	3.4 0.09	116	3.9 0.10	1659	4.5 0.11
106	1.3 0.03	1081	2.4 0.06	112	3.5 0.09	120	3.9 0.10	2875	4.5 0.11
1037	1.3 0.03	4180	2.7 0.07	1125	3.5 0.09	1610	4.0 0.10	1522	4.7 0.12
1067	1.4 0.04	1609	2.8 0.07	1608	3.5 0.09	1611	4.0 0.10	1649	4.7 0.12
1078	1.7 0.04	2113	2.8 0.07	2125	3.5 0.09	6220	4.0 0.10	1681	4.7 0.12
1076	1.8 0.05	2313	2.8 0.07	119	3.6 0.09	1165	4.1 0.10	1688	4.7 0.12
1070	1.9 0.05	3132	2.8 0.07	3116	3.6 0.09	1633	4.1 0.10	1131	4.8 0.12
1297	2.0 0.05	3313	2.9 0.07	117	3.7 0.09	1647	4.1 0.10	1562	4.9 0.12
1299	2.0 0.05	2112	3.0 0.08	220	3.7 0.09	1167	4.2 0.11	1629	4.9 0.12
6080	2.0 0.05	3070	3.0 0.08	1634	3.7 0.09	1674	4.2 0.11	1632	4.9 0.12
1065	2.1 0.06	1620	3.2 0.08	1658	3.7 0.09	1628	4.3 0.11	1676	4.9 0.12

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Fiberglass Fabric Thickness Index

Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)
1530	15.0 0.38	3788	48.7 1.24						
1564	15.1 0.38								
3783	15.7 0.40								
1583	16.1 0.41								
7544	19.1 0.49								
1584	22.9 0.58								
3784	24.2 0.61								
1884	26.0 0.66								
2025	26.2 0.67								
1938	26.6 0.68								
3884	26.7 0.68								
7587	30.0 0.76								
1597	38.3 0.97								
1908	40.0 1.01								
7597	40.3 1.02								

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

ASTROQUARTZ® PRODUCTS

Astroquartz® is a registered trademark of JPS Industries

JPS has been weaving the 99.99% pure silica fabric since 1964. Astroquartz® is used in many of the world's most advanced composite applications. This includes usage in the manned and unmanned space programs, as stealth supporting materials, as radomes for superior signal integrity, and internet connectivity on commercial airliners.

Astroquartz® is the leader when it comes to low dielectric, high strength, and high thermal reliability composite reinforcements.

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Astroquartz II® & Astroquartz III® Properties

Astroquartz®, Astroquartz II® and Astroquartz III® are composed of identical raw materials. Astroquartz® has been discontinued in favor of Astroquartz II® and Astroquartz III®. Improved manufacturing and handling technologies have allowed Astroquartz II® and Astroquartz III® to become more robust and cost effective. All represent unparalleled quality, purity, and performance. JPS and Astroquartz® innovation gives new flexibility to your design opportunities.

Properties of Astroquartz® Fibers

Tensile Strength -

Virgin Single Filament.....6.0 GPa (870 ksi)

Tensile Strength - Impregnated Strand on 20 End Roving
(ASTM D-2343).....3.6 GPa (530 ksi)

Young's Modulus.....72 GPa (10 msi)

Poisson's Ratio.....0.16

Density.....2.2 g/cm³

Silica Content (exclusive of yarn binder).....99.99%

Fiber Diameter - Astroquartz II®.....9μm

Fiber Diameter - Astroquartz III®.....14μm

Physical Properties of Fused Quartz

Mechanical Properties

Density.....	2.2 g/cm ³ or 0.79 lb/m ³
Hardness (Mohs Scale).....	7

Electrical Properties

Dielectric Constant (Dk) - 1 MHz.....	3.70
Dielectric Constant (Dk) - 10 GHz.....	3.74
Dissipation Factor (Df) - 1 MHz.....	0.0001
Dissipation Factor (Df) - 10 GHz.....	0.0002

Thermal Properties

Linear Expansion Coefficient.....	0.54×10^{-6}
Specific Heat @ 20°C (J/gK).....	7.5×10^2
Thermal Conductivity (W/mK).....	1.38
Strain Point (Log ₁₀ n = 14.6).....	1070°C (1958°F)
Annealing Point (Log ₁₀ n = 13).....	1220°C (2084°F)
Softening Point (Log ₁₀ n = 7.6).....	1700°C (3092°F)

Note: n = Viscosity in Poise

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Optical Properties

Refractive Index @ 15°C.....	1.4585
Dispersion.....	67
Field of Transparency (μm).....	0.2 to 4.0

Astroquartz® Applications and Design Considerations

Astroquartz® fabrics offer better solutions when high strength, low dielectric loss and high heat resistance is required.

The aerospace industry relies on Astroquartz® fiber products made from pure fused silica (99.99% SiO₂) to produce an outstanding, reproducible reinforcement material.

There are five basic design variables to consider when choosing Astroquartz® fabrics:

Astroquartz® Applications and Design Considerations (cont.)

Thickness

Quartz and composite fabrics are available in thicknesses ranging from 0.003" to 0.027" (0.13-0.69 mm).

Weight

The weight for Astroquartz® fabrics range from 2.0 to 19.5 ounces per square inch (128 to 660 gsm).

Construction

Construction is the number of warp and fill yarns per inch (machine and cross-machine direction) and the fabric pattern. This helps determine the thickness, weight, drapability, and overall performance of the fabric.

Yarn Size

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Yarn size is a major factor in determining the weight and thickness of the fabric. The yarn size, twist and ply counts will also play a large role in determining the overall strength of the woven fabric. For specific applications, one yarn may be selected over another to the advantage of the performance characteristics.

Finish

The Astroquartz® fabrics can be coated with a coupling agent, called the finish, to assist resin wet out and to improve the strength of the fiber to resin interface. This has the effect of improving the mechanical, thermal and electrical performance characteristics of the final part. Please contact JPS technical or customer service for assistance in choosing the correct fabric finish for your application.

Astroquartz ® II & III Fabric Finishes

A partial list of the available finishes is presented, for additional finishes or to develop an application specific finish, please contact JPS.

Finish Name	Functionality:		Notes
	Primary	Secondary	
S-928	Epoxy		Epoxy functional silane
1059 HT/ 2059 HT/ 3059 HT	Polyimide	Thermo-plastic matrices	Formulated for high temperature and moisture resistance
9779	Epoxy	Bismaleimide Cynate Ester	Amino-silane
9827/ 2827/ 3827	Epoxy	Polyimide, Bismaleimide	Recommended for electronic and aerospace applications
9836/ 2836/ 3836	Epoxy	Bismaleimide	Scoured fabric to to remove most organic binder components
9837/ 2837/ 3837	Polyester	Vinyl Ester Epoxy, Cynate Ester	Recommended for resins cured by vinyl addition

Astroquartz II ® Chopped Fiber

Astroquartz II ® chopped fiber is made by cutting continuous filaments of high purity, extremely fine quartz to a predetermined length. Fiber composition is 99.99% SiO₂(silica) exclusive of binder.

Astroquartz II ® chopped fibers are widely used in reinforced plastics, molding compounds and ceramic composites. The chopped fibers add thermal resistance and improved ablation to the final part.

Type 556 Chopped Fiber

Fiber Lengths*
from 1/8" to 1"

Astroquartz II ® chopped fiber with an aminosilane binder. Compatible with epoxy, phenolic and some polyimide resins.

* Due to the nature of the cutting process, cut lengths may vary slightly.

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Standard Packaging

1 lb packages packed loosely in clear polyethylene bags.

Order Requirements and Lead Times

Please contact JPS to confirm availability and lead time.

Dependent on available inventory the minimum order requirement is approximately 60 lbs. Please allow 8-12 weeks for processing.

Astroquartz® II & III Fabrics

Style	Weave	Count		Warp	Yarn	Fill	Yarn	Weight (osy)	Weight (gsm)	Thickness		Strength (lbf/in)	
		Warp	Fill							(mils)	(mm)	Warp	Fill
503	X	50	40	QCG 300 1/2	QCG 300 1/2	QCG 300 1/2	QCG 300 1/2	3.58	128	5.0	0.13	155	140
507	Plain	27	25	QCG 300 1/2	QCG 300 1/2	QCG 300 1/2	QCG 300 1/2	2.10	71	4.0	0.10	80	60
525	Plain	50	50	QCG 300 1/0	QCG 300 1/0	QCG 300 1/0	QCG 300 1/0	2.00	68	3.0	0.08	65	65
527	Plain	42	32	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	6.10	206	8.0	0.20	270	250
531	8H Satin	68	65	QCG 300 1/2	QCG 300 1/2	QCG 300 1/2	QCG 300 1/2	5.20	176	7.0	0.18	225	200
533	2x2 Basket	36	36	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	5.30	179	7.0	0.18	250	250
557	Crowfoot	57	31	QCG 300 2/2	QCG 300 2/2	QCG 300 1/0	QCG 300 1/0	5.00	169	6.0	0.15	410	55
570	5H Satin	38	24	QCG 300 2/8	QCG 300 2/8	QCG 300 2/8	QCG 300 2/8	19.5	659	27.0	0.69	825	650
572	Plain	17	16	QCG 300 2/8	QCG 300 2/8	QCG 300 2/8	QCG 300 2/8	9.90	335	17.0	0.43	590	480
581	X	57	54	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	8.60	291	10.0	0.25	400	375
591	Conform	57	54	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	8.45	286	12.0	0.30	420	350
593	5H Satin	49	46	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	7.50	254	9.0	0.23	270	270
594	Leno	20	10	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	QCG 300 2/2	2.40	81	8.0	0.20	90	55
4503	X	40	31	QCK 125 1/0	QCK 125 1/0	QCK 125 1/0	QCK 125 1/0	3.38	114	5.0	0.13	115	100
4581	X	47	44	QCK 125 2/0	QCK 125 2/0	QCK 125 2/0	QCK 125 2/0	8.45	286	10.0	0.25	370	330

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506. Note: AQ II fabrics are woven with 9779 resin compatible binder. AQ III are available only as finished fabrics.

Astroquartz® Mat Style No. 550

Specifications

Length.....	1000 mm (39.37 in)
Width.....	500 mm (19.69 in)
Area.....	0.5 m ² per sheet (5.38 ft ²)
Thickness.....	5 mm (0.2 in)
Weight.....	78 g/m ³ (2.3 oz/yd ³)
Density.....	0.016 g/cm (1 lb/ft - approx.)

Handling

Astroquartz® s/550 mat is impregnated with a polyvinyl alcohol binder in the manufacturing operation. This provides a stable mat which can be handled, cut, or fabricated to exact dimensions and can be installed with ease. The binder can be removed by heating to 900°F for 1 hour, or at 500°F for 24 hours. Binder content on the Astroquartz mat is between 4% and 5% by weight. Cut sheets of approximately 500 mm x 500 mm (20 in x 20 in) are also available with an area of approximately 2.8 ft² per sheet.

43 Astroquartz® II Roving

Astroquartz II® roving is made from continuous filaments of pure fused silica nine microns in diameter. Fiber composition is 99.99% SiO₂ (silica) exclusive of binder. Standard 20 end roving equivalent to 20 ends of 150 1/0 contains 4800 nine micron diameter filaments. The fiber density is 2.2 g/cm³. Astroquartz II® roving has a fiber tensile strength of 0.5 MSI*

Property Data**

Type	End Count•	Binder••	Yds/Lb†	Strength††
552	20	9779/9989	750	65 lbs
552	12	9779/9989	1250	40 lbs
552	8	9779/9989	1875	25 lbs
552	6	9779/9989	2500	20 lbs

* Test Method - ASTM D-234

** Test Method - ASTM D-578

• +0-1

••0.3%-0.6% LOI

† ±10%

†† Tensile, min. avg., uncoated roving

Astroquartz ® Roving (cont.)

Astroquartz II ® roving is available with an end count less than 20, please consult JPS for details. Other finishes are also available.

Standard Packaging

Inside Diameter.....	3 in
Length.....	11 in
Traverse.....	10 in
Waywind.....	3 in
Wind Direction.....	Forward
Type Build.....	Straight
Maximum OD.....	7 OD

Approximate Net Weight

9779 Binder.....	2.2 lbs
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Astroquartz II ® Sewing Thread

Astroquartz II ® sewing thread is made from high purity, extremely fine, continuous filaments of pure fused silica; capable of extended exposure to 2000°F. Fiber composition is 99.99% SiO₂ (silica) exclusive of binder. Astroquartz II ® sewing threads are supplied coated with PTFE.

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With 9855 Teflon Coating (20±4%)

Type	Approx. Diameter	Breaking Strength*		Approx. Yield**	
	(in)	Typical (lb)	Minimal	Uncoated	Coated
Q-12	0.014	15	12	3660	2925
Q-18	0.017	24	19	2440	1950
Q-24	0.022	30	25	1830	1460
Q-27	0.024	30	25	-	900

* Test Method - ASTM D-578

** ±10%

Standard Packaging

Astroquartz II ® sewing thread are typically available in 0.5 kg spools. Please contact JPS for price and delivery lead times.

Astroquartz® Yarn

Astroquartz® yarn is made from extremely fine continuous filaments of 99.99% pure fused silica, exclusive of binder, capable of extended heat exposure to 2000°F.

Astroquartz® yarn has more than five times the yarn yield of high silica leached yarn. This results in higher tensile strength and abrasion resistance. With Astroquartz® high production efficiencies are possible in the production of high temperature flexible insulation.

Astroquartz® yarn is widely used in the form of braided insulation for thermocouple wire, coaxial cables, space separators, hoop wire, and heating elements

Property Data

	Approx.	Approx.	Approx.
Type	Diameter (in)	Breaking ϵ (lb)*	Yield (yd/lb)
300 2/0	0.008	3	15000
300 2/2	0.012	6	7500
300 2/4	0.018	10	3750
300 2/8	0.020	24	1875

*Test Method - ASTM D-578

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Astroquartz® yarns are available with an amino-silane binder system, compatible with phenolic, epoxy, and some polyimide resins. Heavier or lighter count yarns can also be manufactured. Please consult JPS for price and delivery.

Standard Packaging

Yarns are available on standard milk bottle packages for plied yarns and double flanged packages for twisted single yarn. Net yarn weights range from a minimum of 1 lb/pkg to a maximum of 2.5 lb/pkg.

Fiber Characteristics

Astroquartz II®*

Number of Filaments

300 1/0 - 120 filaments

300 2/0 - 240 filaments

300 2/2 - 480 filaments

Astroquartz III®**

125 1/0 - 120 filaments

125 2/0 - 240 filaments

* Astroquartz II® filaments are 9 μ m in diameter, similar to an ECG filament

* Each filament is 9 μ m in diameter, equivalent to an ECK filament.

Physical Properties of Para-Aramids

Para-Aramids - Kevlar ®*, Twaron ®**

Physical Properties

Density.....	1.44 g/cc
Equilibrium Moisture Level, Kevlar 29.....	4.5%
Equilibrium Moisture Level, Kevlar 49.....	3.5%

Mechanical Properties

UTS (room temp).....	2.9-3.0 GPa
Elongation at Break.....	2.4-3.6%
Young's Modulus.....	71-112 GPa
Shear Modulus.....	26-41 GPa
Poisson's Ratio.....	0.36

Thermal Properties

Shrinkage in Water at 212°F (100°C).....	<0.1%
Shrinkage in Dry Air at 351°F (177°C).....	<0.1%
Specific Heat Capacity at 77°F (25°C).....	1.420 kJ/kg-K
Specific Heat Capacity at 212°F (100°C).....	2.01 kJ/kg-K
Specific Heat Capacity at 356°F (180°C).....	2.52 kJ/kg-K
Thermal Conductivity.....	0.04 W/m-K
Decomposition Temperature in Air.....	800-900°C
Recommended Max Temperature Range for Long Term Use in air.....	149-177°C
Heat of Combustion.....	35x10 ⁶ J/kg

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* Kevlar ® is a registered trademark of the E.I. DuPont du Nemours

** Twaron ® is a registered trademark of Teijin Twaron USA, Inc.

All values approximate. Actual values may vary, for further info contact JPS

Physical Properties of UHMWPE

Ultra High Molecular Weight Polyethylene -
Dyneema®*, Spectra®**

Physical Properties

Density.....0.97 g/cc

Mechanical Properties

UTS (Spectra 900).....25-30 GPa
UTS (Spectra 1000).....35-43 GPa
Elongation at Break (Spectra 900).....3.6-3.9%
Elongation at Break (Spectra 1000).....2.9-3.5%
Young's Modulus (Spectra 900).....850-920 GPa
Young's Modulus (Spectra 1000)..... 1170-1580 GPa

Thermal Properties

Melting Range.....144-152°C
Decomposition Temperature in Air..... >300°C
Advised Lowest Temperature..... No Limit
Advised Long Duration Temperature Limit..... 70°C
Advised Short Duration Temperature Limit
 Non-Constrained Fiber.....130°C
 Constrained Fiber.....145°C
Tensile Strength Relative to 23°C
 at -60°C.....110%
 at 23°C.....100%
 at 60°C.....80%
 at 100°C.....55%

* Dynnema® is a registered trademark of Royal DSM N.V.

** Spectra® is a registered trademark of Honeywell International Corp.

All values approximate. Actual values may vary, for further info contact JPS

Advanced Materials Applications

Ballistics and Protection Products

JPS manufactures high performance fabrics for use in ballistic resistant applications. High performance fabrics are used extensively in bullet, fragment, and stab resistant body armor for militaries, federal agencies, police, and correctional departments. They are also used in the manufacture of helmets for both military and civilian agencies.

Aerospace and Recreational Composites

JPS high performance fabrics are used in a variety of composite applications. Aramids and other high performance fabrics are designed to maximize strength, weight savings, durability, and cost. Applications include aerospace, kayaks, recreational sporting goods, and safety equipment, among others.

Advanced Fabrics Nomenclature

High performance fibers are typically designated by denier, tex, or decitex (dtex). Each is described below.

Denier

The denier system is used internationally to measure the size of textile filaments and yarns. Denier number indicates the weight in grams of 9,000 meters of filament or filament yarn. For example, if 9,000 meters weighs 100 grams, it is a 100-denier yarn. The smaller the denier number, the finer the yarn.

$$\text{Denier} = \text{dtex} \times 0.9$$

Tex and Decitex

The tex system is also applicable to the measurement of filament yarns. It is based on the weight in grams of one kilometer (3,300 feet) of yarn. Decitex (dtex) is defined as ten times tex.

$$\text{Tex} = \text{dtex}/10$$

Finishes for Advanced Materials

A partial list of the available finishes is presented, for additional finishes or to develop an application specific finish, please contact JPS.

Finish Name	Description
CS-811	Loom state fabric
CS-800	Scoured aramid fabrics
CS-802	Scoured UHMWPE fabrics
CS-892	Water repellent finish for Spectra and Dyneema fabrics
CS-898	Traditional water repellent finish for Kevlar fabrics
CS-899	Traditional water repellent finish for Twaron fabrics
CS-6000	Engineered aramid water repellent treatment for improved performance
LCS	Laminated Composite Substrate
ML	Micro-Laminate
WRT	Water Repellent Treated

Aramid Fabrics

Style #	Weave		Count		Warp		Fill		Weight		Thickness		Strength (lb/in)	
	JPS	AMS	Common		Warp	Fill	Warp	Yarn	(osy)	(gsm)	(mils)	(mm)	Warp	Fill
290					Leno	9.6	5	Kevlar 29 1500d	Kevlar 29 1500d	4.0	136	12.8	0.33	70 900
296					Leno	12	12	Kevlar 29 3000d	Kevlar 29 3000d	9.8	333	28.0	0.71	900 1420
297					Leno	14	14	Kevlar 29 6000d	Kevlar 29 6000d	12.4	420	33.5	0.85	890 600
312					Plain	36	36	Kevlar KM2+ 400d	Kevlar KM2+ 400d	3.5	122	7.0	0.18	650 600
313					Rip Stop	36	36	Kevlar KM2+ 400d	Kevlar KM2+ 400d	3.1	105	6.0	0.15	650 600
314					Plain	31	31	Kevlar KM2+ 400d	Kevlar KM2+ 400d	3.1	105	6.0	0.15	570 570
323	335				4H Satin	17	17	Kevlar 49 1420d	Kevlar 49 1420d	6.2	210	12.0	0.30	900 900
324					2x2 Twill	24	24	Kevlar 49 1140d	Kevlar 49 1140d	7.3	248	13.4	0.34	750 800
5324					2x2 Twill	24	24	Twaron 2200 1270dt	Twaron 2200 1270dt	7.2	244	13.3	0.34	750 800
328	328				Plain	17	17	Kevlar 49 1420d	Kevlar 49 1420d	6.5	220	12.8	0.33	900 900
5328	328				Plain	17	17	Twaron 2200 1580dt	Twaron 2200 1580dt	6.4	215	12.0	0.30	900 900
343	143				4H Satin	100	20	Kevlar 49 380d	Kevlar 49 195d	5.5	187	11.0	0.28	1000 100
345	124				4H Satin	34	34	Kevlar 49 195d	Kevlar 49 195d	1.7	58	3.0	0.08	200 200
348	181				8H Satin	50	50	Kevlar 49 380d	Kevlar 49 380d	5.1	173	8.7	0.22	650 650
5348	181				8H Satin	50	50	Twaron 1055 405dt	Twaron 1055 405dt	4.9	166	8.0	0.20	650 650

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Aramid Fabrics

Style #		Weave		Count		Warp		Fill		Weight		Thickness		Strength	
JPS	AMS	Common		Warp	Count	Warp	Yarn	Fill	Yarn	(osy)	(gsm)	(mils)	(mm)	Warp	Fill
349			4H Satin	41	40	Kevlar 49 195d	Kevlar 49 195d	Kevlar 49 195d	Kevlar 49 195d	2.0	68	4.0	0.10	230	230
350	120	X	Plain	34	34	Kevlar 49 195d	Kevlar 49 195d	Kevlar 49 195d	Kevlar 49 195d	1.8	61	3.9	0.10	200	200
351	220	X	Plain	22	22	Kevlar 49 380d	Kevlar 49 380d	Kevlar 49 380d	Kevlar 49 380d	2.2	75	4.8	0.12	300	300
5351	220		Plain	22	22	Twaron 1055 405dt	Twaron 1055 405dt	Twaron 1055 405dt	Twaron 1055 405dt	2.2	75	4.6	0.12	300	300
352	281	X	Plain	17	17	Kevlar 49 1140d	Kevlar 49 1140d	Kevlar 49 1140d	Kevlar 49 1140d	5.2	176	9.8	0.25	750	700
5352	281		Plain	17	17	Twaron 2200 1270dt	Twaron 2200 1270dt	Twaron 2200 1270dt	Twaron 2200 1270dt	5.2	176	10.7	0.27	800	800
353	285	X	4H Satin	17	17	Kevlar 49 1140d	Kevlar 49 1140d	Kevlar 49 1140d	Kevlar 49 1140d	5.2	176	9.3	0.24	660	650
5353	285	X	4H Satin	17	17	Twaron 2200 1270dt	Twaron 2200 1270dt	Twaron 2200 1270dt	Twaron 2200 1270dt	5.2	176	9.7	0.25	750	750
354	500		Plain	13	13	Kevlar 49 1420d	Kevlar 49 1420d	Kevlar 49 1420d	Kevlar 49 1420d	4.9	166	9.8	0.25	650	650
5354	500		Plain	13	13	Twaron 2200 1580dt	Twaron 2200 1580dt	Twaron 2200 1580dt	Twaron 2200 1580dt	4.9	166	10.0	0.25	550	550
357	540		Plain	11	17	Kevlar 49 1420d	Kevlar 49 1420d	Kevlar 49 1420d	Kevlar 49 1420d	5.2	176	10.0	0.25	410	700
372			4x4 Twill	72	72	Kevlar 49 195d	Kevlar 49 195d	Kevlar 49 195d	Kevlar 49 195d	3.8	129	7.0	0.18	520	550
383	900		5H Satin	16	16	Kevlar 49 2160d	Kevlar 49 2160d	Kevlar 49 2160d	Kevlar 49 2160d	9.1	309	13.0	0.33	920	970
5383	900		5H Satin	16	16	Twaron 2200 2420dt	Twaron 2200 2420dt	Twaron 2200 2420dt	Twaron 2200 2420dt	9.1	309	13.0	0.33	920	970
384	1050		Basket 4x4	28	28	Kevlar 49 1420d	Kevlar 49 1420d	Kevlar 49 1420d	Kevlar 49 1420d	10.7	363	19.0	0.48	1360	1300

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Aramid Fabrics

Style #	Weave		Count		Warp		Fill		Weight		Thickness		Strength (lbf/in)	
	JPS	AMS	Common	Warp	Fill	Yarn	Yarn	Yarn	(osy)	(gsm)	(mils)	(mm)	Warp	Fill
5384	1050		1050	28	28	Twaron 2200 1580dt	Twaron 2200 1580dt		10.7	363	19.0	0.48	1360	1360
386	1350		1350	27	22	Kevlar 49 2160d	Kevlar 49 2160d		13.9	471	26.4	0.67	1800	1500
5386	1350		1350	27	22	Twaron 2200 2420dt	Twaron 2200 2420dt		13.9	471	26.4	0.67	1820	1500
388	1033		1033	40	40	Kevlar 49 1420d	Kevlar 49 1420d		15.5	526	27.6	0.70	1900	1700
5388	1033		Basket 8x8	40	40	Twaron 2200 1580dt	Twaron 2200 1580dt		15.5	526	26.9	0.68	1830	1790
710			Plain	24	24	Kevlar 29 1500d	Kevlar 29 1500d		9.7	324	19.4	0.49	1100	1200
712			Plain	12	12	Kevlar 29 3000d	Kevlar 29 3000d		9.1	309	16.5	0.42	1200	1200
5712			Plain	12	12	Twaron 1000 3360dt	Twaron 1000 3360dt		9.1	309	16.5	0.42	1200	1200
713			Plain	31	31	Kevlar 29 1000d	Kevlar 29 1000d		8.2	278	16.8	0.43	780	1000
5713			Plain	31	31	Twaron 2040 1100dt	Twaron 2040 1100dt		8.2	278	16.3	0.41	900	900
715			Plain	28	28	Kevlar KM2+ 400d	Kevlar KM2+ 400d		2.9	99	5.3	0.13	510	530
716			Plain	31	31	Kevlar KM2+ 400d	Kevlar KM2+ 400d		3.2	109	5.7	0.14	560	550
717			Plain	34	34	Kevlar KM2+ 400d	Kevlar KM2+ 400d		3.6	122	6.3	0.16	580	630
718			2x2 Twill	34	34	Kevlar KM2+ 400d	Kevlar KM2+ 400d		3.6	122	5.6	0.14	620	600
719			2x2 Twill	38	38	Kevlar KM2+ 400d	Kevlar KM2+ 400d		4.0	136	6.2	0.16	710	710

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Aramid Fabrics

Style #	Weave	Count	Warp	Fill	Warp	Fill	Weight	Thickness	Strength
JPS	AMS	Common	Warp	Fill	Warp	Fill	(osy)	(mils)	(lb/in)
5719	X	Plain	19.5	19.5	Twaron 2040 930dt	Twaron 2040 930dt	4.3	146	7.5
720	X	Plain	20	20	Kevlar 129 1420d	Kevlar 129 1420d	7.6	259	13.8
722	X	Plain	22	22	Kevlar 129 1420d	Kevlar 129 1420d	8.5	289	15.8
724		Plain	24	24	Kevlar KM2+ 1000d	Kevlar KM2+ 1000d	6.2	210	11.4
5724		Plain	24	24	Twaron 2040 1100dt	Twaron 2040 1100dt	6.2	210	11.0
725		Plain	27	27	Kevlar KM2+ 500d	Kevlar KM2+ 500d	3.5	119	6.3
5726		Plain	26	26	Twaron 2040 930dt	Twaron 2040 930dt	5.8	200	10.1
728		Plain	17	17	Kevlar K29 1500d	Kevlar K29 1500d	6.6	224	12.7
727		Plain	26	26	Kevlar 129 1000d	Kevlar 129 1000d	6.7	227	12.3
5728		Plain	17	17	Twaron 2040 1680dt	Twaron 2040 1680dt	6.9	234	12.1
729		Plain	17	17	Kevlar 129 1420d	Kevlar 129 1420d	6.6	224	12.8
730		Plain	22	22	Kevlar 29 1000d	Kevlar 29 1000d	5.6	190	11.6
5731		Plain	31	31	Twaron 2040 1100dt	Twaron 2040 1100dt	8.1	275	16.1
735		Basket 2x2	35	35	Kevlar 29 1500d	Kevlar 29 1500d	14.1	478	25.4
736		Basket 2x2	36	36	Kevlar 129 1420d	Kevlar 129 1420d	14.1	478	26.3

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Aramid Fabrics

Style #	Weave	Count		Warp	Fill	Weight (osy)	Thickness (mils)	Thickness (mm)	Strength (lbf/in)			
		Warp	Fill						Warp	Fill		
JPS	AMS	Common		Yarn	Yarn							
739		Plain	39	36	Kevlar 29 1500d	Kevlar 29 1500d	15.2	517	25.3	0.64	2000	1800
740		Plain	40	40	Kevlar 29 200d	Kevlar 29 200d	2.1	71	5.2	0.13	340	330
741		Plain	11	11	Kevlar 29 3000d	Kevlar 29 3000d	8.5	288	16.1	0.41	1100	1150
5741		Plain	11	11	Twaron 1000 3360dt	Twaron 1000 3360dt	8.5	288	15.0	0.38	1100	1150
742		Plain	31	31	Kevlar KM2+ 600d	Kevlar KM2+ 600d	4.9	167	8.0	0.20	810	830
743		Twill 4x4	40	40	Kevlar 29 3000d	Kevlar 29 3000d	16.5	559	29.0	0.74	3200	3200
744		2x2 Twill	31	31	Kevlar KM2+ 600d	Kevlar KM2+ 600d	4.9	167	8.5	0.21	690	710
745	X	Plain	17	17	Kevlar 29 3000d	Kevlar 29 3000d	13.3	451	25.3	0.64	1200	700
5745		Plain	17	17	Twaron 1000 3000dt	Twaron 1000 3000dt	13.4	454	24.2	0.61	1700	1800
746		4H Satin	31	31	Kevlar KM2+ 600d	Kevlar KM2+ 600d	4.8	163	8.5	0.22	690	710
747		Plain	10	10	Kevlar 29 3000d	Kevlar 29 3000d	6.5	220	12.0	0.30	900	1000
748		Basket 8x8	48	48	Kevlar 29 1500d	Kevlar 29 1500d	18.8	637	32.1	0.82	2200	2300
749		Plain	24	24	Kevlar KM2+ 600d	Kevlar KM2+ 600d	3.8	129	6.8	0.18	650	720
750		2x2 Twill	24	24	Kevlar KM2+ 600d	Kevlar KM2+ 600d	3.8	129	6.9	0.18	720	680
754	X	Basket 2x2	21	21	Kevlar 29 3000d	Kevlar 29 3000d	16.5	559	29.0	0.74	2000	2000

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Aramid Fabrics

Style #	Weave	Count	Warp	Fill	Weight	Thickness	Strength
JPS	AMS	Common	Warp	Fill	(osy)	(mils)	(lb/f/in)
			Yarn	Yarn	(gsm)	(mm)	Warp Fill
5754		Basket 2x2	21	21	Twaron 1000 3360dt	Twaron 1000 3360dt	16.2 549 30.0 0.76 2000 2000
755	X	Basket 4x4	21	21	Kevlar 29 3000d	Kevlar 29 3000d	16.3 554 27.9 0.71 2000 2000
5755		Basket 4x4	21	21	Twaron 1000 3360dt	Twaron 1000 3360dt	16.2 549 30.0 0.76 2000 2000
759		Basket 4x4	24	24	Kevlar 29 3000d	Kevlar 29 3000d	18.0 610 30.0 0.76 2300 2000
760		Basket 2x2	30	30	Kevlar 29 1420d	Kevlar 29 1420d	11.8 400 21.1 0.54 850 600
764		Plain	31	31	Kevlar KM2+ 850d	Kevlar KM2+ 850d	6.8 231 13.9 0.35 850 1100
5704		Plain	31	31	Twaron 2040 930dt	Twaron 2040 930dt	6.8 231 13.8 0.35 900 950
766		Plain	34	34	Kevlar KM2+ 600d	Kevlar KM2+ 600d	5.4 184 9.8 0.25 800 800
767	X	Plain	28	28	Kevlar KM2+ 600d	Kevlar KM2+ 600d	4.4 150 7.8 0.20 550 570
768	X	Plain	28	28	Kevlar KM2+ 500d	Kevlar KM2+ 500d	3.6 122 6.5 0.17 500 550
5768	X	Plain	28	28	Twaron 2040 550dt	Twaron 2040 550dt	3.6 122 6.5 0.17 500 500
770		Plain	31	31	Kevlar KM2+ 600d	Kevlar KM2+ 600d	4.8 163 8.6 0.22 700 800
772		Plain	24	24	Kevlar KM2 1000d	Kevlar KM2 1000d	6.2 210 11.0 0.28 760 780
5772		Plain	28	28	Twaron 2040 550dt	Twaron 2040 550dt	3.6 122 6.6 0.17 500 550
5761		Plain	26	26	Twaron 2040 1100dt	Twaron 2040 1100dt	6.7 227 11.0 0.28 760 780

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Aramid Fabrics

Style #		Weave		Count		Warp		Fill		Weight		Thickness		Strength	
JPS	AMS	Common		Warp	Fill	Warp	Yarn	Warp	Yarn	(osy)	(gsm)	(mils)	(mm)	Warp	Fill
5774		Plain		27	27	Twaron 2040 500d	Twaron 2040 500d	3.6	122	6.5	0.17	580	610		
775		Plain		31	31	Kevlar KM2+ 850d	Kevlar KM2+ 850d	6.8	231	11.8	0.30	880	950		
777		X		32	32	Kevlar KM2+ 400d	Kevlar KM2+ 400d	3.2	108	6.2	0.16	450	450		
779		Plain		70	70	Kevlar 159 200d	Kevlar 159 200d	3.7	122	7.6	0.19	350	350		
785		Plain		20	20	Kevlar KM2+ 850d	Kevlar KM2+ 850d	4.4	150	7.6	0.19	700	700		
787		X		23	23	Kevlar KM2+ 850d	Kevlar KM2+ 850d	5.1	173	8.7	0.22	800	800		
790		X		22	22	Kevlar KM2+ 850d	Kevlar KM2+ 850d	4.3	146	7.5	0.19	600	600		
794		X	Twill 2x2	26	26	Kevlar KM2+ 840d	Kevlar KM2+ 840d	5.7	194	9.6	0.24	850	950		
796		Plain		26	26	Kevlar KM2+ 850d	Kevlar KM2+ 850d	5.8	200	10.2	0.26	850	950		
797		X	Basket 2x2	34	34	Kevlar KM2+ 600d	Kevlar KM2+ 600d	5.3	180	8.9	0.23	750	850		
798		X	Plain	28	28	Kevlar KM2+ 400d	Kevlar KM2+ 400d	2.9	98	5.6	0.14	800	600		
4033		X	Plain	23	23	Kevlar KM2+ 600d	Kevlar KM2+ 600d	3.5	119	6.9	0.18	600	600		
4039		X	Plain	29	29	Kevlar KM2+ 600d	Kevlar KM2+ 600d	4.5	153	8.4	0.21	700	700		
5930		X	Plain	27	27	Twaron 2040 930dt	Twaron 2040 930dt	5.8	197	10.5	0.27	850	950		
5931		Plain		31	31	Twaron 2040 930dt	Twaron 2040 930dt	7.0	237	12.0	0.31	900	950		

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Aramid Fabric Weight Index

Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)
345	1.7 58	717	3.6 122	767	4.4 150	5352	5.2 177	5724	6.5 221
350	1.8 61	718	3.6 122	785	4.4 150	5353	5.2 177	728	6.6 224
349	2.0 68	768	3.6 122	4039	4.5 153	797	5.3 180	729	6.6 224
740	2.1 71	5768	3.6 122	746	4.8 163	766	5.4 184	5761	6.6 224
351	2.2 75	5772	3.6 122	770	4.8 163	343	5.5 187	764	6.8 228
5351	2.2 75	5774	3.6 122	354	4.9 167	730	5.6 190	775	6.8 231
715	2.9 99	372	3.7 126	5348	4.9 167	791	5.7 194	5704	6.8 231
798	2.9 99	779	3.7 126	5354	4.9 167	726	5.8 197	5728	6.9 235
314	3.1 105	749	3.8 129	742	4.9 167	5726	5.8 197	5931	7.0 238
716	3.2 109	750	3.8 129	744	4.9 167	5930	5.9 200	5324	7.2 244
777	3.2 109	290	4.0 136	348	5.1 173	323	6.2 211	324	7.3 248
725	3.5 119	719	4.0 136	787	5.1 173	724	6.2 211	731	7.9 269
4033	3.5 119	790	4.3 146	352	5.2 177	5328	6.4 218	5731	8.1 275
312	3.6 122	5719	4.3 146	353	5.2 177	328	6.5 221	713	8.2 279
313	3.6 122	795	4.4 150	357	5.2 177	747	6.5 221	5713	8.2 279

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Aramid Fabric Weight Index

Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)	Style	Weight (oz/yd ²) (g/m ²)
741	8.5 289	5745	13.4 456						
722	8.5 289	5386	13.6 462						
5741	8.5 289	386	13.9 473						
383	9.1 309	735	14.1 479						
5383	9.1 309	736	14.1 479						
712	9.1 309	739	15.2 517						
5712	9.1 309	5388	15.3 520						
5383	9.4 320	388	15.5 527						
710	9.7 330	5755	16.2 551						
296	9.8 333	755	16.3 554						
384	10.7 364	743	16.5 561						
5384	10.7 364	754	16.5 561						
760	11.8 401	5754	16.5 561						
297	12.4 422	759	18.0 612						
745	13.3 452	748	18.8 639						

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Aramid Fabric Thickness Index

Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)
345	3.0 0.08	768	6.5 0.17	795	7.9 0.20	357	10.0 0.25	5931	12.0 0.31		
350	3.9 0.10	5768	6.5 0.17	5348	8.0 0.20	5354	10.0 0.25	5728	12.1 0.31		
349	4.0 0.10	5774	6.5 0.17	742	8.4 0.21	796	10.2 0.26	727	12.3 0.31		
5351	4.6 0.12	5772	6.6 0.17	4039	8.4 0.21	5726	10.2 0.26	728	12.7 0.32		
351	4.8 0.12	749	6.8 0.18	746	8.5 0.21	5930	10.2 0.26	290	12.8 0.33		
740	5.2 0.13	750	6.8 0.18	348	8.7 0.22	5352	10.7 0.27	328	12.8 0.33		
715	5.3 0.13	4033	6.9 0.18	787	8.7 0.22	343	11.0 0.28	729	12.8 0.33		
798	5.6 0.14	312	7.0 0.18	797	8.9 0.23	5724	11.0 0.28	5704	12.9 0.33		
716	5.7 0.14	3113	7.0 0.18	353	9.3 0.24	5761	11.0 0.28	383	13.0 0.33		
717	5.7 0.14	372	7.2 0.18	770	9.4 0.24	796	11.4 0.29	5383	13.0 0.33		
314	6.0 0.15	790	7.5 0.19	794	9.6 0.24	730	11.6 0.29	5354	13.3 0.34		
719	6.2 0.16	5719	7.5 0.19	5353	9.7 0.25	775	11.8 0.30	354	13.4 0.34		
777	6.2 0.16	785	7.6 0.19	352	9.8 0.25	323	12.0 0.31	720	13.8 0.35		
713	6.3 0.16	779	7.6 0.19	354	9.8 0.25	747	12.0 0.31	764	13.9 0.35		
725	6.3 0.16	767	7.8 0.20	766	9.8 0.25	5328	12.0 0.31	383	14.8 0.38		

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Aramid Fabric Thickness Index

Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)	Style	Thickness (mils) (mm)
5741	15.0 0.38	745	25.3 0.65						
722	15.8 0.40	735	25.4 0.65						
741	16.1 0.41	736	26.3 0.67						
5731	16.1 0.41	386	26.4 0.67						
5713	16.3 0.41	5388	26.9 0.68						
712	16.5 0.42	388	27.6 0.70						
5712	16.5 0.42	755	27.9 0.71						
713	16.8 0.43	296	28.0 0.71						
384	19.0 0.48	743	29.0 0.74						
5384	19.0 0.48	754	29.0 0.74						
710	19.4 0.49	5754	29.0 0.74						
760	21.1 0.54	759	30.0 0.76						
5745	24.2 0.61	5755	30.0 0.76						
5386	25.0 0.64	748	32.1 0.82						
739	25.3 0.65	297	33.5 0.85						

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Engineered Aramid Fabrics

These unique fabrics are engineered using the synergy from a combination of specialty yarns and weave types to produce a structure with advanced ballistic performance.

Style	Weave	Count		Warp Yarn	Fill Yarn	Weight		Thickness		Strength	
		Warp	Fill			(osy)	(gsm)	(mils)	(mm)	Warp	Fill
420	Proprietary	28	28	Proprietary	Proprietary	4.0	136	7.6	0.19	700	620
421	Proprietary	28	28	Proprietary	Proprietary	4.0	136	7.4	0.19	770	620
422	Proprietary	28	28	Proprietary	Proprietary	4.0	136	7.4	0.19	770	630
423	Proprietary	28	28	Proprietary	Proprietary	4.0	136	7.7	0.19	750	640

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Dyneema Fabrics

[illegible]

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. JPSCM strongly recommends designers and users perform testing for application and package specific conditions. For additional information, please contact a Technical Service Representative, (864) 224-3506

*Kevlar Tracer

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. JPSCM strongly recommends designers and users perform testing for application and package specific conditions. For additional information, please contact a Technical Service Representative, (864) 224-3506

Carbon Fabrics

JPS Composite Materials now offers a full line of carbon fabrics, available with a wide variety of yarn types and weights. We have invested in the production of carbon fabrics using the latest new weaving technologies. With the addition of our new carbon fabrics division JPS offers the most complete lineup of composite reinforcement fabrics in the industry.

We offer a variety of PAN based carbon fabrics utilizing 3k, 4k, 6k, and 12k carbon fibers. Our carbon fabrics are manufactured in a dedicated, FOD controlled, state-of-the-art facility located on our Statesville, NC campus.

JPS carbon fabric can be used for a wide variety of applications, including and primary and secondary aerospace structures, for high performance and recreational composites, as well as in ducting, tooling, and cosmetic applications.

We invite you to consider using carbon fabrics from JPS for your application. See first hand why we are considered the leader when it comes to high performance, precision engineered composite reinforcement materials.

For more information about our carbon fabrics, or to tailor a fabric to suit your application, please contact us at:

1-800-431-1110

1-800-288-0577

(864) 260-6581 Fax

For further information, write to
JPS Composite Materials
PO Box 2627, Anderson, SC, 29622
dhudgens@jpscm.com

Carbon Fabrics

Style	Weave	Tow Size	Warp	Count	Warp Yarn	Fill Yarn	Weight (osy)	Weight (gsm)
604	8H Satin	3k	24	23	3k Carbon	3k Carbon	11.05	374
605	5H Satin	3k	18	18	3k Carbon	3k Carbon	8.46	286
608	8H Satin	3k	24	24	3k Carbon	3k Carbon	11.29	382
611	Plain	3k	12.5	12.5	3k Carbon	3k Carbon	5.88	199
612	Plain	3k	12	12	3k Carbon	3k Carbon	5.64	191
620	2x2 Twill	3k	12	12	3k Carbon	3k Carbon	5.64	191
622	2x2 Twill *	3k	12	12	Hexcel AS4C	Hexcel AS4C	5.70	193
623	2x2 Twill	3k	18	18	3k Carbon	3k Carbon	8.46	286
632	2x2 Twill	3k	12	12.5	Hexcel AS4C	Hexcel AS4C	5.82	197
635	2x2 Twill	12k	10.5	10.5	Hyosong 12k	Hyosong 12k	19.95	675
636	2x2 Twill	12k	11	11	12k Carbon	12k Carbon	20.69	700
660	2x2 Twill	6k	12	12	6k Carbon	6k Carbon	11.29	382
* Contains Tracer Yarn								

The physical properties listed are for greige (untreated) fabrics. Actual values may vary. For additional information, please contact a Technical Service Representative, (864) 224-3506.

Technical References - English

Fiber	Density (lb/in ³)	Tensile Strength (ksi)	Tensile Modulus (msi)	Strain to Failure (%)	Specific Tensile Strength (10 ⁶ in)	Specific Tensile Modulus (10 ⁸ in)	Coefficient of Thermal Expansion (10 ⁻⁶ /°F)	Decomposition Temperature (°F)
E-glass	0.095	500	10.5	4.0	5.28	1.11	3.00	1346
S-2 Glass	0.090	665	12.5	5.5	7.42	1.40	0.90	1562
Astroquartz ®	0.080	870	10.0	-	-	-	0.54	3092
Kevlar ® 49, 1420d	0.052	424	15.8	2.5	8.15	3.04	-1.50	842
Kevlar ® 29 1500d	0.052	424	10.9	3.4	8.15	2.10	-1.22	842
Kevlar ® KM2+ 400d	0.052	520	13.6	3.8	10.00	2.61	-1.22	842
Kevlar ® KM2+ 500d	0.052	525	10.8	3.8	10.10	2.08	-1.22	842
Kevlar ® KM2+ 600d	0.052	525	13.6	3.8	10.10	2.61	-1.22	842
Kevlar ® KM2+ 850d	0.052	512	11.8	3.8	9.85	2.27	-1.22	842
Spectra ® 900 650d	0.035	348	11.4	3.6	9.93	3.25	-	302
Spectra ® 1000 375d	0.035	410	14.9	3.1	11.70	4.25	-	302
Spectra ® 2000 195d	0.035	465	16.4	2.9	13.27	4.68	-	302
Twaron ® 1000	0.052	507	9.4	3.7	9.74	1.81	-1.22	842
Twaron ® 2000	0.052	479	12.9	3.3	9.21	2.50	-1.22	842
Twaron ® HM	0.052	507	14.7	2.1	9.69	2.85	-1.33	842

Technical References - Metric

Fiber	Density (g/cm ³)	Tensile Strength (GPa)	Tensile Modulus (GPa)	Strain to Failure (%)	Specific Tensile Strength (10 ⁶ cm)	Specific Tensile Modulus (10 ⁸ cm)	Coefficient of Thermal Expansion (10 ⁻⁶ /°C)	Decomposition Temperature (°C)
E-glass	2.50	2.6	72	4.0	13.42	2.82	1.60	730
S-2 ® Glass	2.48	4.8	85	5.5	18.86	3.55	0.48	850
Astroquartz ®	2.20	6.0	72	-	-	-	0.54	1700
Kevlar ® 49, 1420d	1.44	2.9	109	2.5	20.71	7.72	-2.70	450
Kevlar ® 29 1500d	1.44	2.9	75	3.3	29.71	5.32	-2.20	450
Kevlar ® KM2+ 400d	1.44	3.3	94	3.8	23.39	6.64	-2.20	450
Kevlar ® KM2+ 500d	1.44	3.4	75	3.8	24.27	5.27	-2.20	450
Kevlar ® KM2+ 600d	1.44	3.4	94	3.8	24.60	7.52	-2.20	450
Kevlar ® KM2+ 850d	1.44	3.4	81	3.8	24.27	5.76	-2.20	450
Spectra ® 900 650d	0.97	2.4	79	3.6	25.23	8.26	-	150
Spectra ® 1000 375d	0.97	2.8	103	3.1	29.72	10.80	-	150
Spectra ® 2000 195d	0.97	3.2	113	2.9	33.71	11.89	-	150
Twaron ® 1000	1.44	3.5	65	3.7	24.76	4.59	-2.20	450
Twaron ® 2000	1.44	3.3	90	3.3	23.39	6.35	-2.20	450
Twaron ® 2200	1.45	3.5	103	2.1	24.59	7.23	-2.40	450

Selected Conversions and Formulae

US to SI

$$1 \text{ oz/yd}^2 = 33.91 \text{ g/m}^2$$

$$1 \text{ oz} = 28.35 \text{ g}$$

$$1 \text{ lb} = 16 \text{ oz}$$

$$1 \text{ lb} = 0.454 \text{ kg}$$

$$1 \text{ N} = 0.102 \text{ kgf}$$

$$1 \text{ lbf} = 4.45 \text{ N}$$

$$1 \text{ psi} = 6894.76 \text{ Pa}$$

$$1 \text{ denier} = 0.111 \text{ Tex}$$

$$^{\circ}\text{F} = (^{\circ}\text{C}) \times (9/5) + 32$$

$$1 \text{ in} = 25.4 \text{ mm} = 2.54 \text{ cm}$$

$$1 \text{ lb/ft}^2 = 4.88 \text{ kg/m}^2$$

$$1 \text{ lb/ft}^3 = 16.02 \text{ kg/m}^3$$

$$1 \text{ yd} = 0.91 \text{ m}$$

$$1 \text{ ft} = 0.3048 \text{ m}$$

$$1 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1} = 0.86 \text{ kcal} \cdot \text{m}^{-1} \cdot \text{h}^{-1} \cdot \text{K}^{-1} = 6.9 \text{ btu} \cdot \text{in}/(\text{ft} \cdot \text{hr} \cdot ^{\circ}\text{F})$$

SI to US

$$1 \text{ g/m}^2 = 0.0295 \text{ oz/yd}^2$$

$$1 \text{ g} = 0.035 \text{ oz}$$

$$1 \text{ kg} = 2.205 \text{ lb}$$

$$1 \text{ kgf} = 9.81 \text{ N}$$

$$1 \text{ ksi} = 6.89 \text{ MPa}$$

$$1 \text{ MPa} = 1 \text{ N/mm}^2$$

$$1 \text{ GPa} = 1000 \text{ MPa}$$

$$1 \text{ Tex} = 9 \text{ denier}$$

$$1 \text{ Tex} = 496,052 \text{ yds/lbs}$$

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times (5/9)$$

$$1 \text{ cm} = 0.39 \text{ in}$$

$$1 \text{ kg/m}^2 = 0.205 \text{ lb/ft}^2$$

$$1 \text{ kg/m}^3 = 0.062 \text{ lb/ft}^3$$

$$1 \text{ m} = 1.09 \text{ yd}$$

$$1 \text{ m} = 3.281 \text{ ft}$$

Metric Conversion Chart

Fabric	US	Factor	Metric
Length	yd	x 0.914	= m
Width	in	x 2.540	= cm
Weight	oz/yd ²	x 33.906	= g/m ²
Breaking Strength	lb/in	x 1.7513	= N/cm
Thickness	in	x 25.400	= mm
Mullen Burst	lb/in ²	x 0.007	= MPa
Air Permeability	cfm	x 0.508	= cm/cm ²
Area	yd ²	x 0.8361	= m ²

Notes

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Anderson, SC, 29622

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