MaxCell®

Technical Manual

Design Parameters

MaxCell® Design Parameters

Breaking Strength by Product Style, lbs

Product Style		Standard MaxCell	Fire Resistant MaxCell	Test Method
4”	3 Cell	➢ 2,750	➢ 2,200	ASTM D 2256 Bellcore 356 5.3.3
3”	3 Cell	➢ 2,530	➢ 1782	
2”	3 Cell	➢1815	➢ 1254	
	2 Cell	➢ 1243	➢ 836	
	1 Cell	➢ 682	➢ 418	
Micro	3 Cell	➢1232	➢836	
	2 Cell	➢ 858	➢ 550	
	1 Cell	➢ 484	➢ 275	

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MaxCell® Design Parameters

Physical Properties Summary Chart

Physical Properties	Standard Values	Test Method
<u>Dynamic Coefficient of Friction</u>		ASTM D4518
• HDPE Sheath vs. Std MaxCell w/ Lube	< 0.08	Bellcore 356 4.1.5
• Nylon Sheath vs. Std MaxCell w/o Lube	< 0.09	
• HDPE Sheath vs. Std MaxCell w/o lube	< 0.12	
• HDPE Sheath vs. FR MaxCell w/o Lube	< 0.12	
• LDPE Sheath vs. Std MaxCell w/o Lube	< 0.15	
• PVC Sheath vs. Std MaxCell w/o Lube	< 0.25	
Bending Test	PASS	Bellcore 356 4.2.5
Environmental Stress Cracking	PASS	ASTM D1693
Hydrocarbon Resistance	< 7.5% Tensile Loss	Bellcore 356 4.3.2
Print Durability	PASS	Bellcore 356 5.3.5
Melting Point	> 419 Degrees F	ASTM D3418
Fungi Resistance	PASS	ASTM G21
Halogen Content	Halogen Free, "0.00%"	MIL PRF 85045 F
Smoke Toxicity Index	PASS	NES 713
Optical Smoke Density	PASS	ASTM E662
Oxygen Index	22 to 24	ASTM D2863
Flammability, in Electrical Metallic Tubing	PASS	UL 797
<u>Coefficient of Thermal Expansion</u>		ASTM 4723
• MaxCell, mm / 100 M / 5 degrees C	8.4	
• HDPE Inner duct, mm / 100 M / 5 degrees C	60.9	

The above specifications are for Standard MaxCell Fabric, Please contact manufacturing for the physical properties of Fire Resistant MaxCell.

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MaxCell® Design Parameters

Chemical Resistance Summary Chart

Reagent Tested	Percent Tensile Loss		Test Method
	Standard MaxCell	Standard 1250PT Pull Tape	
Acetic Acid	< 0.5%	< 0.5%	ASTM D543
Hydrogen Peroxide, 3%	< 12.5%	< 12.5%	
Heavy Duty Detergent	< 0.5%	< 0.5%	
Kerosene	< 0.5%	< 0.5%	
Gasoline	< 10.0%	< 2.0%	
Diesel	< 5.0%	< 2.0%	
Hydraulic Fluid	< 0.5%	< 0.5%	
Synthetic Lubrication Oil	< 3.0%	< 2.0%	
Transmission Fluid	< 0.5%	< 3.0%	
Water, heat aging	< 10.0%	< 10.0%	
UV Exposure	< 25.0%	< 25.0%	
Ozone	< 15.0%	< 15.0%	

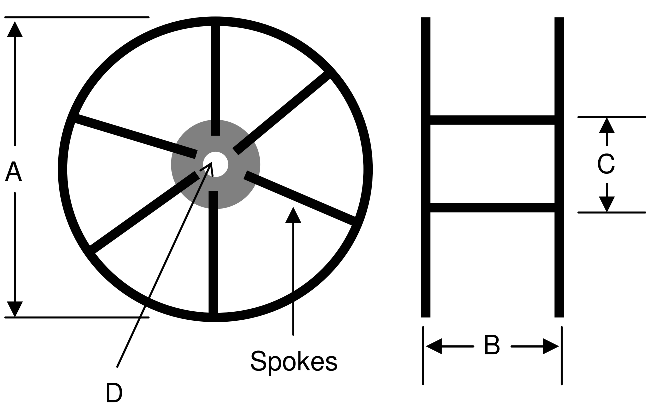
The above specifications are for Standard MaxCell. Please contact manufacturing for the physical properties of Fire Resistant MaxCell.

MaxCell® Design Parameters

Reels Dimension Chart

Reel Name	Material of Construction		Number of Spokes	Dimensions, in				Empty Reel Wt, lb
	Flange	Core		Height A	Width B	Core C	Arbor Dia., D	
250	Fiberboard	Fiberboard		20	15	3.9	3	6
315	Wood	Fiberboard		33	14.5	8	3	22
322	Wood	Fiberboard		33	22	8	3	24
415	Wood	PVC		48	14.5	8.6	3	50
422	Wood	PVC		48	22	8.6	3	55
515	Steel Tube	Steel Tube	6	60	14.5	10	3	55
522	Steel Tube	Steel Tube	6	60	22	10	3	57
615	Steel Tube	Steel Tube	6	72	14.5	15	3	79
622	Steel Tube	Steel Tube	6	72	22	15	3	81
645	Steel Tube	Steel Tube	7	72	44	15	3	86

All dimensions are approximate and are intended to be used as reference purposes only
Dimensions are subject to change



Prior to shipping all reels:

- Are wrapped with a UV protective film and
- Installation Instructions are attached

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Statement of Longevity and Chemical Resistance

1. Color will remain in the stitching for many years provided it is not exposed to direct sunlight for the duration. Prior to shipment all MaxCell reels are wrapped with a UV protective film. This film will provide up to six months of UV protection prior to in ground installation. The stitching is bonded and is resistant to water, oils, fuels, etc.

2. A. The general properties of polyester and nylon provide excellent tenacity, toughness, abrasion resistance and temperature resistance - the combination of these two polymers in MaxCell® produce a robust product. Both polymers have excellent resistance to fuels, including jet fuels, gasoline, diesel, and natural gas. Both fibers have superior mechanical properties and chemical resistance compared to polypropylene and polyethylene.

   B. Although MaxCell® is not UV resistant, UV degradation should not be an issue due to limited exposure. UV resistant wrapping is placed on the reels to provide up to 6 months of protection prior to in ground installation.

   C. Both polyester and nylon should not be degraded by biological attack in soil.

   Both nylon and polyester have been successfully used in geotextiles for decades in environments that are more severe than the environments intend for MaxCell®. Polyester accounts for approximately 32%, second to polypropylene, in percentage of fibers used in geotextiles, confirming polyester's acceptance for in-soil applications. The major concern for polyester will be hydrolysis. Under normal soil conditions (temperature = 68F and pH 3-9) this problem will be non-existent. <u>Models indicate that at 100% RH and 68F the polyester should survive 150 years with only 20% strength loss.</u> Other research indicates service life up to 100 years under these soil conditions. Some case studies: A polyester non-woven geotextile was recovered and tested after six years of service and only 10% of its strength was lost. Another study using woven polyester straps to support a vertical wall found only a 2% strength loss after 17 years of service. <u>A polyester fabric used underwater in Indonesia found only a 7% strength loss after 5 years of service.</u>

   Nylon generally has better hydrolysis resistance than polyester, especially at neutral and high pH. Currently, nylon is commercially used for oven baking bags and for autoclave bags where there is repeated long exposure to high temperature and humidity. The majority of literature reviewed indicated the effect of hydrolysis below the polymer's Tg is negligible; polyester (158-176F) and nylon (122-140), it is not anticipated to see these temperature ranges in below ground applications.

   D. MaxCell® was tested for heat aging for 1 week at 248F. Grab tensile results found 4.6% strength reduction in the warp and 39.6% strength reduction in the fill. Trap tear results found a 9% strength loss in the warp and a 52.6% strength loss in the fill. This would be approximately 30 years of service life. Since MaxCell® is deployed underground, there should not be an issue with strength or abrasion resistance loss over time.

MaxCell® Design Parameters

Statement of Longevity and Chemical Resistance

(Cont'd)

E. Precise prediction of service life is actually impossible to predict for MaxCell®, but based on scientific studies and past experience noted in textile literature, the nylon and polyester yarns are the materials of choice for this type of product in the underground environment.

3. MaxCell® will not react with the chemicals in fiber cladding, iron pipe or other elements within conduit.

4. MaxCell® lubricity tests results on recovered MaxCell®, after 4 months in an underground application, shows no loss of lubricant on the fabric. Technically, there should be no loss or degradation of the lubricant. There is the possibility that organic fuels can wash off the lubricant. This lubricate will not evaporate.

5. Water and mud should not affect the life expectancy of MaxCell®. (see 2C above)

6. MaxCell® is printed with ink jet technology. The print will not bleed if exposed or submerged in water. The print is <u>not</u> UV resistant and may fade over several months of exposure to direct sunlight. UV resistant wrapping is placed on the reels to protect the MaxCell® and the print prior to shipment. As a precautionary measure MaxCell® should not be stored uncovered in direct sunlight for a prolonged period of time.

Sources:

Nylon and Plastics Handbook
Edited by: Melvin I. Kohan
Hanser/Gardner Publications

Chemical Resistance Volume I – Thermoplastics Second Edition
Published by Plastic Design Library

Durability and Aging of Geosynthetics

Plastic Canada – Chemical Resistance Guide

MaxCell® Design Parameters

Chemical Resistance Summary Chart

Table of Chemical Resistance to Common Reagents

Reagent	Conc., %	Exposure Temp, degrees C	Exposure Time, days	% Retained Tensile Strength
Acetic Acid	glacial	23	31	100
Ammonium Hydroxide	2	23	31	100
	10	22	30	95
Antifreeze	50	23	21	90 - 95
Bleach	5	23	28	107
Brake Fluid		49	30	97
		66	28	80 - 90
Detergents	0.25	23	31	100
	0.25	75	1	100
Diesel Fluids		22	30	100
Ethylene Glycol		23	21	95 - 99
Freon F113		23	21	91 - 99
Gasoline		23	365	90 - 95
Gear Lube		23	21	90 - 96
Lithium Grease		23	21	95 - 100
Hydraulic Fluids		23	28	115
Hydraulic Oils		23	21	94 - 100
Hydrochloric Acid	10	23	21	96 - 98
Hydrofluoric Acid	48	23	31	80
Hydrogen Peroxide	28	23	31	100
Motor Oils		23	28	113
Nitric Acid	10	23	31	100
	40	23	31	75
Power Steering Fluid		23	21	97 - 100
Sodium Chloride	10	22	30	98
Sodium Hydroxide	2	23	31	100
	2	75	1	90
	10	23	21	0 -47
Steam		100	7	82
		100	14	55
Sulfuric Acid	3	23	31	100
	10	23	21	91 - 96
Water		23	365	92
		71	21	90 - 95

Source: Plastic Design Library, PO Box 443, Morris NY 13808, 607-263-2316

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