

# Sailcloth and Sail Cleaning

The earliest sailcloth was constructed of woven flax. In the 1800s, the switch was made to American cotton and later to Egyptian cotton. Currently, most woven sailcloth is constructed out of Dacron polyester, although other fibers such as Kevlar, Spectra and Pentex see specialty use, chiefly in yacht racing sails.

## **Polyester** (DuPont Dacron® and other brands)

A manufactured fiber introduced in the early 1950s, polyester is the most common fiber used in sailcloth. It is most commonly referred to by its DuPont trade name Dacron®, the name given to the Type 52 high modulus fiber made specifically for sailcloth. Polyester's desirable properties include excellent resiliency, high abrasion resistance, high UV resistance, high flex strength and low cost. Low absorbency allows the fiber to dry quickly. Although polyester has been replaced by higher modulus fibers for most racing applications, its proven durability makes it the most common all-around sailcloth fiber.



Magnified view of tightly woven Dacron® Polyester.

Advancements by Allied Signal - Polymers Engineering Group produced a fiber called 1W70 polyester that has a 27% higher tenacity than Type 52. Other polyester trade names include Terylene®, Tetoron®, Trevira® and Diolen®.

## **Nylon** (no longer used for regular sails – now used primarily for spinnakers)

First produced in 1938, nylon is the first completely synthetic fiber developed. In the sailcloth industry, it is used in full radial and asymmetrical spinnakers because of its light weight, high strength, superior abrasion resistance and flexibility. It does not, however, have good resistance to stretch, which is not a big factor in downwind sails, but makes it unsuitable for mains and headsails. **Nylon is more susceptible to UV and chemical degradation than polyester and should never be washed with chlorine bleach.** Also, its physical properties can change by as much as 100% due to moisture absorption.

## **There are four primary factors found in polyester sailcloth:**

( For definitions of the terms used, see glossary at end of article )

### **YARN QUALITY**

Yarn quality varies in terms of tenacity (breaking strength), modulus (resistance to stretch), creep (long term stretch) and "weaving quality". A high tenacity, high modulus yarn produced specifically for weaving is the most desirable.

### **YARN CONTENT (WEFT & WARP)**

Yarn content relates to the aspect ratio of the particular sail. Lower aspect sails (lateen and cat rigs) require a more balanced weave, with fibers of similar denier and count in the warp and fill. Higher aspect ratio sails (Bermuda sloop style) require more, heavier fibers along the load lines and fewer across the sail.

### **TIGHTNESS OF THE WEAVE**

The tightness of the weave can vary between sailcloth types in the following ways:

- The size of the yarns employed. The smaller the yarn denier, the tighter the weave.
- The shrinkage of the yarns employed. Higher shrink yarns will produce a tighter weave than lower shrink yarns.

### **FINISH**

Finish, or resin, as it's sometimes called, is a special coating applied to sailcloth to lock the weave. The finish on sailcloth greatly affects the "hand", or feel, of the material, giving it an almost craft paper like crispness when new. This feel is not the sole intent, but rather a side effect of the extra measure taken to stabilize the weave. The finish helps a sail made from treated sailcloth take on the desired, smooth airfoil shape. Protecting the finish from premature breakdown and wear is an important part of sail care to maximize a sail's working life.

### **Basic Sail Cleaning –**

Inorganic and organic particles act in aggregate to chafe the fibers of your sail. They also help retain moisture in the crevasses of the weave which in turn gives mildew a foundation to grow on. Airborne pollutants can also advance breakdown of the cloth's finish. In addition to basic cleaning, here are several methods for getting rid of or at least reducing stains.

Lay your sail out on a soft surface. A wood deck or a tarp on a lawn work well. Avoid concrete or asphalt, but if that's all the open space that's available, sweep and wash the area first, then lay down a clean tarp to work on. If stain removing, remember many of the products will kill a lawn.

Use a soft brush and a mild detergent or Ivory soap. Avoid direct application of un-dissolved hard powder detergents and stiff brushes as they may damage the sail's finish and stitching. Detergents with a neutral ph factor will not tend to set certain types of soil rather than remove them. Always scrub in line with seams. After scrubbing, rinse sail with plenty of warm water to remove all soap. Lay flat or hang loosely in a shaded place to dry.

**Never place sails in a washing machine or dryer** ... the creasing and folding necessary to get a sail into a washing machine, the abrasion during the washing and rinse cycles, not to mention the harsh creasing of the spin cycle will significantly reduce the working life of your sail. Heat from a hot wash and/or the dryer will delaminate and break down the coating as well as shrink bolt ropes and sail cloth.



### **STAINS**

#### **Dirt or caked-on salt –**

Remove with mild detergent or soap and a soft bristle brush. Rinse the sail with plenty of fresh water.



#### **Tree Sap -**

Gently wipe off with rubbing alcohol on a dry cloth. Wash with mild soap and rinse liberally with fresh cool water.

#### **Oil, grease, tar and wax –**

Start by trying grease dissolving liquid detergents applied undiluted, straight to the stain – Dawn dish soap, Liquid Tide, Simple Green, or citrus-based degreasing soap, for example.

For a little tougher stains, a mix of 1% household bleach and soap can be used on Dacron polyester - ***Do not use bleach on Nylon sails.*** Most bleach (sodium hypochlorite) solutions off the shelf, like Clorox, are a 5.25 percent solution and will need to be diluted. Rinse well with fresh water.

Acetone rubbed on the spot with a clean cloth can remove isolated oily types of stains. Be sure to properly rinse out all of the acetone from the sailcloth, polyester is acetone resistant, but too much or for a long period can be damaging.

Heavy staining might be removed by brushing on a liquid detergent mixed with two pints of mineral spirits (paint thinner) or a stronger degreaser, TCE (trichloroethylene), or naphtha. This should be brushed in the sail and left for 20 minutes and then washed out with warm water.

Exercise caution with solvents - some will loosen, remove, dissolve or smear, sail numbers and emblems.

Be sure the area is well ventilated and precautions taken if the solvents are flammable. Finish by washing the entire sail with mild soap and rinse liberally with fresh cool water.

#### **Paint and varnish –**

Acetone or M.E.K. (methyl ethyl ketone) should remove most common paint and varnish stains; old style shellac varnish can be easily removed by Alcohol. **Important:** Solvents can break down the adhesives and finish of sails if used in excess. Finish by washing with mild soap and rinse liberally with fresh cool water.

### Blood stains -

Soak stained portion in a solution of 10 parts water to one part bleach – *Do not use bleach on Nylon sails.* Soak the stained area only for from 30 minutes up to 2 hours, lightly scrubbing the spot occasionally. If, after treating, the stains are still present, dampen the sail with a 1% solution of ammonia in water, allow to stand for about 20 minutes and then thoroughly rinse stained area.

DO NOT mix ammonia and bleach – phosgene, a deadly gas, will result. Finish by washing with mild soap and rinse liberally with fresh cool water.



### Rust and metallic stains –

These types of stains can be frustrating and difficult to remove. First scrub with soap and water and apply acetone, M.E.K. or alcohol. If the stain lingers, try a diluted mixture (5%) of oxalic acid and soak 15-20 minutes. You can get oxalic acid powder at a drug store or at the hardware store under the tag of “wood bleach”. As a last resort, you can try (with caution) Hydrochloric acid (2 parts to 100) in warm water. Finish by washing with mild soap and rinse liberally with fresh cool water

### Mildew –

Prevention is the best course, but if mildew has attacked the sail, treat it immediately and prevent the area from coming in contact with the rest of the sail. In other words, don't fold or roll mildew growth into the rest of the sail, act promptly so it will not get worse.



Mildew Stained Sail - SAIL Magazine

Lysol is an example of a topical fungicide that when sprayed on the sail will kill existing spores and temporarily inhibit any additional growth. After the organism is killed, most of the stain can be removed by soaking (not scrubbing) in a fungicide.

Begin a full cleaning by clearing away mildew's surface residue with a dry brush.

Most bleach (sodium hypochlorite) solutions off the shelf, like Clorox, are a 5.25 percent solution and will need to be diluted. Some commercial brands of mildew cleaners like Telex have three percent or less solution of bleach and can be used with less dilution.

Place the effected area in a solution of 1% bleach and cold water for about two hours.

For particularly stubborn, deep set stains, simple surface treatments and short soaks may not work completely. It might then be necessary to immerse the stain in a fungicide for 12 hours or more, to allow it to get in to where the stain is.

It is *not* necessary to use a greater concentration of disinfectant, only to get the fungicide where the stain is. No amount of vigorous surface scrubbing will do what a good soak will do.

Dettol<sup>®</sup>, a commonly available household disinfectant, is the most powerful and effective over-the-counter fungicide and inhibitor you can use to treat very heavily mildewed fabric.

Wash and rinse the sail thoroughly to ensure there is no chemical residue remaining.

After your sails are clean and dry inspect the entire sail including all stitch work and look for small tears or holes. If you discover either broken stitches or holes, repair these areas with sail tape, a proper patch or bring the sail to your local sail maker to have the repairs made.

## Commercial Products –

### Sail Cleaners -

Davis's Foaming Sail Cleaner  
Starbrite Sail and Canvas Cleaner  
Sail Wash (hydrogen peroxide and detergent)  
Boat Life Mildew Remover

### Waterproofing -

303 waterproofing and UV inhibitor  
Sailkote

### Rust Remover -

Whink Rust Stain Remover - in the brown bottle (pre-mixed Oxalic Acid)

## Fabric Glossary –

**ASPECT RATIO:** The luff length of the sail divided by the foot length.

**BIAS:** The direction diagonally across a piece of fabric at 45 degrees to the warp and fill.

**COUNT:** The number of fibers per inch in the warp or fill.

**CREEP:** Permanent, continuous elongation of a fiber under a sustained load

**CRIMP:** The "waviness" of the fiber or yarn when it is laid over and under fibers or yarns in a fabric. Crimp can contribute to the elongation of a fabric under load as it is "pulled out" of the loaded direction and "pushed into" the less heavily loaded direction.

**CROSS-CUT:** A sail panel layout in which the seams run roughly parallel to one another, typically perpendicular to the leech

**DENIER:** A measure of the weight of a continuous fiber filament. It is the weight in grams of 9,000 meters of a given fiber. The lower the number, the finer the fiber. Higher denier, heavier fibers are generally more rugged and durable.

**DENIER PER INCH (DPI):** A measure of the fabric's relative weight and strength, expressed as the number of fibers per inch, generally in the primary yarn direction.

**ELONGATION:** The difference between the initial length of a fabric sample and its length after stretching, expressed in 1/100ths of an inch.

**FIBER:** The basic entity that is twisted into yarns and then used in the production of a fabric.

**FILAMENT:** A single fibril of natural or synthetic textile fiber. Filaments are twisted or bunched to form fibers.

**FILL (WEFT):** The yarns or fibers that run across the width of the roll of fabric, perpendicular to the warp direction.

**FILM:** An extruded sheet of plastic, most often Mylar® polyester film. Film's desirable properties include low stretch, good bias stability, low porosity and good adhesion. Less desirable properties include low tear strength and relatively high physical shrinkage (due to creases and folds in the film).

**FLEX STRENGTH:** The ability of a fiber to retain its strength after being folded back and forth, commonly expressed as percent loss in breaking strength after flutter or fold testing.

**GSM:** Weight expressed in grams per square meter.

**HAND:** A subjective term for the way the fabric feels when touched. Terms like softness, crispness, dryness and silkiness all describe the hand of the fabric.

**INITIAL MODULUS/MODULUS:** A measure of a material's ability to resist stretch. Initial modulus is usually expressed as grams of load per unit stretch for a certain fiber denier. The higher the initial modulus, the less the fiber will stretch.

**INSERT:** A yarn or fiber laid directly into a fabric without first being woven or put into a scrim.

**LAMINATE:** Fabric constructed from layers of film, scrim and/or taffeta glued together under high pressure and/or heat to form a composite sail material.

**PRIMARY YARN DIRECTION:** The direction that is most resistant to stretch, typically due to a higher yarn count or a higher modulus fiber.

**RADIAL:** A panel layout where the seams and panels radiate from the corners of the sail in the direction of the highest load.

**SAILMAKERS WEIGHT (SM-oz):** Weight in ounces of a piece of fabric measuring 28.5" x 36".

**SCRIM:** A base fabric component created by laying out fibers in a grid pattern with the fibers joined at their intersection. A scrim can be constructed by passing fill and warp yarns over and under one another; by knitting, in which the fibers are "tied" at each intersection; or by laying the fibers straight across one another and connecting them at the intersections with glue.

**TAFFETA:** An unfinished fabric employed as a covering, usually in laminate sailcloth, often enhancing durability and chafe resistance

**TENACITY:** The tensile stress at rupture of a fiber expressed in grams of force per denier. Tenacity relates to the breaking strength of fibers and should not be confused with modulus, which relates more directly with a fiber's ability to resist stretch.

**TENSILE STRENGTH:** A measure of the ability of a fiber, yarn or fabric to withstand pulling stresses.

**THREADLINE:** The direction of the fibers or yarns in the warp, fill or bias.

**UV RESISTANCE:** A measure of the effect of sunlight on cloth. UV resistance is usually expressed as the time it would take for a material exposed to sunlight to lose half of its breaking strength.

**WARP:** The yarns or fibers in a fabric that run the length of a roll of cloth and, in a woven fabric, are interlaced with the fill (weft) yarns.

**WEFT** (see **FILL**)

**WOVEN:** Material made by interlacing fibers over and under each other in a regular pattern. Types of weaves include plain, leno and basket, among others.

**YARN:** A continuous strand of fibers created when a cluster of individual fibers are twisted together. Yarns are used to create fabrics.

Compiled from suggestions made by: NORTH Sails, UK Sails, Neil Pryde Sails, Ullman Sails, and Doyle Sails, SailNET