“Smart Seats”
A Guide to Marine Seat Construction for Optimum Life
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The following information was developed by Spradling International Marine, the world’s leading supplier of marine quality vinyls. With 50+ years of experience in the marine industry, SIM has compiled this informational guide for proper construction of exterior marine seating. The products and components in the “Smart” Seat have been selected for their special characteristics and performance qualities. Each item included is an intricate part in the production of a durable and UV-stable seat – one that will recover from the elements faster than ever. These products are enhanced with UV stabilizers and treated with biocide additives to prevent the antifungal growth of mold and mildew.
Dielectric logos are an excellent option vs. monogramming your name or logo on your marine upholstery. Dielectric logos are debossed into the vinyl instead of monogramming, which leaves tiny holes that penetrate the vinyl, creating an easy route for moisture to work itself into your seats. The unique process of debossing uses radio frequency heat sealing, and ultimately changes the surface grain but does not penetrate the topskin, retaining the original level of protection against contamination and/or marring.

To deboss an image, a template of your logo or artwork is used to prepare a metal die. Pressure and heat are used to press the die into the material, thus creating an impression of your design. Debossing is the action resulting in a lowering of the material under the die, making a flat impression, rather than raising the design area itself. The area is smooth because the heat and pressure act like an iron.
UV Stable Thread
Polyester Thread is recommended for marine use vs. nylon thread. This quality stands up to weather conditions better than thread made from natural fibers. Polyester thread is bonded and twisted to stop wicking action that may cause leaks. In addition to excellent sewability, polyester thread has the following advantages:
- High single-end seam strength
- Excellent elongation (partial recovery vs. Nylon)
- Great resistance to microorganisms (mold and mildew)
- Excellent resistance to chemicals, such as mineral acids, organic acids, strong alkali, and bleaching agents
- Good abrasion resistance
- High resistance to effects of sunlight (UV) and weathering

Thread Size: 92  Needle Size: 20

Antimicrobial Protected Polyester Thread creates a defense system in sewn products where they are vulnerable, making the products last longer and improve overall value. This Antimicrobial protection provides 24/7 cleanliness protection from microbes. This technology provides a product that inhibits the growth of odor and stain causing bacteria on the sewing thread, keeping the seam crevices cleaner and fresher for longer:
- Inhibits growth of microorganisms
- Fights mold and mildew
- Resists stain
- Helps prevent product deterioration
- Fights odor causing bacteria

Thread Size: 92  Needle Size: 22

PTFE Thread
Ordinary polyester thread fiber breaks down over time due to exposure to UV sunlight, cleaning agents, saltwater, and extreme weather. PTFE (polytetrafluoroethylene) fiber is not affected by these agents, making it the ultimate choice for outdoor sewing applications. It is available from several manufacturers and guaranteed to outlast the fabric in which it is used.

Thread Size: 92  Needle Size: 16

Regardless of the style of thread, some seams may require reinforcement based on the style of seam and/or seat design.
Marine Quality Vinyl
Marine quality vinyl is very similar to standard upholstery vinyl except for two important characteristics: UV stability and antifungal protection. Spradling’s marine quality vinyl is formulated to combat the elements, thus providing high ultraviolet resistance to fading and includes biocide inhibitors for protection from fungal growth. These products are also easily cleaned, durable, and puncture, tear, and scuff resistant.

The two most common constructions of marine quality vinyl are “expanded” and “non-woven”. Expanded vinyl was introduced to the market in response to the request for additional stretch as well as soft hand. It feels softer and generally has more stretch in the warp and fill directions than conventional vinyl, resulting in a quicker recovery. Recommended weight for expanded vinyl upholstery is 29 oz to 32 oz. Non-woven was introduced to help with workability. It features 360° stretch. The superiority of one construction over another is purely subjective and dependent on application and design. Recommended weight for non-woven vinyl upholstery is 12 to 14 mil with a 4-oz. knit backing. In addition to these two, Spradling offers many marine quality products that feature highly engineered attributes, special proprietary backings, and ultra-cleanable protective topcoats.

Hi-Loft™ backing is an exclusive knitted textile manufactured with 100% polyester yarns. It is aimed at creating a backing with bulk, strength, and unusual softness. When combined with a vinyl surface, an extremely soft hand is achieved without sacrificing product performance. Also improved are adhesion, tear strength, and stretch tear. Other benefits include improved tailorability and ease of use during sewing.

Matrix™ is an expanded vinyl showcasing a proprietary multi-stretch, 100% polyester backing, knitted in house. It is a hybrid of traditional vinyl constructions. This backing increases stretch strength and promotes quicker recovery. It is the future of marine grade vinyl.

Permaguard® is Spradling’s proprietary barrier coating, making maintenance easy. Most stains wipe off with a dry cloth or tissue, and stubborn stains may be eliminated with 91% isopropyl alcohol. So, stains disappear in seconds. But if that isn’t enough, Permaguard also provides unequaled resistance to scratches, scuffs, and abrasion.
Side Cushion Ventilation

Side Cushion Ventilation panels are designed to enhance the seat design while providing an additional avenue for water drainage. Using an exterior mesh (vinyl encapsulated woven polyester yarns) for this application is recommended. It must be dimensionally stable but flexible in all climates, and fade and mildew resistant. Ventilation mesh will maximize airflow that will result in quicker drying time for the whole seat. This type of product is available in several styles and colors. Similar panels are commonly used in outdoor furniture as cushion covers and sheet bags, allowing moisture to escape and assist with breathability.
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Ventilation Fabric
Undercover and Mesh are porous PVC (Polyvinyl Chloride) coated products that when applied to the bottom of boat seats help to increase air flow through the seating foam, thus increasing a quicker dry time. These materials are somewhat decorative and designed to cover the bottom of the seat, while providing a finished look. In order for these fabrics to perform, builders must strategically place several “drain holes” in the marine board or design them into rotocast seat bottoms.

“Undercover” is a 54” wide PVC coated polycotton scrim material, while “mesh” is a 60” PVC coated polyester. Both products are very economical and extremely crucial in the construction of marine seating.
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Marine Board or Rotocast Plastic
Specially formulated Marine Board is designed to withstand harsh outdoor marine environments. It is made of high-density polyethylene that is UV-stabilized to resist damage from direct sunlight and retains its beauty for years. Although wood and laminates have been used in the construction of marine seating for years, Marine Board is a better choice, as it does not splinter, rot, swell, or absorb water. You will experience no cracking or de-lamination, either. A crucial step in marine seating construction is the placement of several “drain holes”, allowing excess water to exit and the seat dry by increasing the airflow throughout the entire seat.

Rotocast molding is a manufacturing process used in creating custom hollow plastic parts, which are excellent for marine seating. Rotocast seating is very common in marine because of the durability of the product and the extensive design possibilities. This process, also called rotomolding or rotational molding, places powdered resin into a hollow mold, then while rotating the mold bi-axially, it is placed in an oven and melted until it evenly coats the inside of the mold. After cooling, the part is removed. With this process, it is possible to produce small to large parts for any style seating and parts can be designed to be resistant to UV, rot, mold, and mildew. Some seats feature drain holes in the seat bottom to retard a mildew growth opportunity by draining water away; some feature recessed water channels to divert water. The possibilities to design and build a seaworthy chair are endless.
3-D Ventilation Panel

3-D Ventilation Panel is a flexible three-dimensional mat originally developed for erosion protection and turf reinforcement. Its pyramid-like structure with vertically oriented individual heavy nylon monofilaments thermally fused at their intersections, combined with a “flat” two-dimensional layer on the bottom, ensures the mat retains its shape. This proven flexible three-dimensional open structure which, when examined closely, looks in shape similar to an egg carton with 95% of the volume of the mass being open to provide airflow. This product, when used in marine seat construction between the bottom foam and the seat base, vastly improves air-flow and drainage of water through the bottom of the seat. It will not degrade or rot.
Antimicrobial Biocide Reticulated Foam

Reticulated foam is technologically advanced; highly durable, mildew resistant, amine free, flexible polyurethane foam that provides both ultimate drainability as well as durability. It is a significantly higher quality cushioning material available in a wide variety of density and firmness qualities that provides consistent comfort. Always use Reticulated foam products that are infused with a safe antimicrobial additive that inhibits the growth of mold, mildew, and odors.

Reticulated foam is a very porous, low density solid foam. “Reticulated” means like a net. Reticulated foams are extremely open foams; there are few, if any, intact bubbles or cell windows. In contrast, the foam formed by soap bubbles is composed solely of intact (fully enclosed) bubbles. In reticulated foam only the linear boundaries where the bubbles meet remain.

Reticulated foam has long been known for its greater airflow due to its extremely open-cell structure. Outdoor furniture & boat manufacturers have used this for years because of its ability to pass water directly through the foam, which allows for faster drying of furniture cushioning. The properties that allow for direct water pass-through also create high levels of airflow.

Recommended Standards:
Standard Weight: 1.8 pounds per cubic feet (Density)
IFD (Indentation Force Deflection): 30 (Soft), 50 (Firm) & 70 (Extra Firm)
Antimicrobial Biocide Comfort Foam

Comfort Foam is an amine-free polyurethane foam which contains Biocide additives to protect against mold and mildew. It is sometimes molded to fit the seat design. Comfort Foam is usually a “softer” foam product and placed on top of the “support” foam, which is firmer and harder. The top foam gives the seat comfort, while the bottom foam offers support and prevents bottoming out. Support foam is usually a reticulated product.

Recommended Standards:
Standard Weight:
1.8 pounds per cubic feet (Density)
IFD (Indentation Force Deflection):
40 (Soft) - 70 (Hard)
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Clear Seat Film
Clear Seat Film or Silk Film is a very thin clear EMA (Ethylene Methyl Acrylate) film that usually is 0.4 or 1.0 mil in thickness. It is most commonly used to cover foam cushions so that the vinyl skins easily slide over the foam. If EMA films are not utilized, the backing on many marine quality vinyls may catch on the foam surface, making it harder and more time consuming during the upholstery process.
ECO Friendly Foam Lamination with Film

Eco-friendly foam lamination consists of specially constructed foam with physical properties equivalent to standard polyester foam products laminated with a “film” backing. This special eco-friendly foam performs as well as standard polyester foam, but with at least 10% renewable resources used in its construction. A blend of naturally organic materials allows for this process, which ultimately reduces the foam’s environmental footprint. Because it is specially made for marine applications, the foam also contains additives that retard microbial growth and degradation. It is also treated to prevent the staining of vinyl fabric and pink staining.

The laminated foam thicknesses most commonly used are 3/16” and 1/4”. Several lamination backings are available. “White” and “pink” films are more commonly used while Tricot and Remay are used for higher stress applications and usually involve PTFE thread. These “film” backings allow for more flexibility and ease in the sewing process.
Dielectric Channel Quilting

Dielectric Channel Quilting (radio frequency welding or heat sealing) or “pleated vinyl” is an economical and excellent choice for giving your marine upholstery that “quilted” look without actually stitching it, which creates many tiny holes that penetrate the vinyl of the upholstery. This is another way moisture can work itself into seating. Radio frequency heat sealing is an unique process that changes the surface grain, but doesn’t penetrate the topskin of the vinyl, thus retaining the original level of protection.

Dielectric channel quilting patterns are available in several styles widths and depths. The debossed area is called the “Channel”. It can either be debossed flat (plain valley) or debossed with a simulated stitch, thus giving more of an actual “hand-stitched” look. The area between these “Channels” is offered in various widths. The depth of the product is determined by the density and thickness of the “fill”, which is typically polyester batting. The “Channels” run the length of the roll, which is roughly 30-45 yards, depending on the material.
Foam Glossary

There are hundreds of types of foams lightweight—super soft, super firm—white, colored, polyether urethane, polyester urethane, polyethylene, and others—open cell-bonded—filled—prime. Any combination of these physical properties can make a type of foam offering numerous formulations that represent the most popular standard foams. The word “FOAM” is generic. In this text, we are referring to “FOAM” as a flexible cellular plastic polyurethane product. “FOAM” is referred to in reference to its physical properties and the type of test run on the foam.

AIR FLOW (BREATABILITY): The Air Flow test measures the ease with which air passes through a foam. It is also an excellent measure of the overall efficiency with which the foam was produced.

BOARDY: An undesirable stiff surface feel found in some foams with high 25% IFD values. (See Hand)

BOTTOM OUT: Lack of support under full weight load. This characteristic is often found in low-density foam. The problem can be reduced by increasing density to achieve an adequate Support Factor.

COMPRESSION SET: Foam with poor Compression Set may quickly exhibit an undesirable appearance often described as “taking a set.” In a cushion, mattress core, or with innerspring mattress padding, the result is noticeable as a permanent surface depression which may eventually affect upholstery cover fit. Foam cushioning is tested for Compression Set in the lab by compressing a foam sample down to 90% of its thickness and holding it in that compressed position at above average temperature for 22 hours.

DENSITY: The weight of a cubic foot of foam. Density is independent from firmness. Although foam production conditions can adversely affect the grade of flexible polyurethane, Density is considered to be the most important indicator of overall foam quality. Higher density virgin foam cores can be designed to provide plush surface softness without sacrificing deep-down support. Example: a 12”x12”x12” block of 1.25 foam should weigh 1 ¼ lbs.

FATIGUE (FLEX FATIGUE): A softening or loss of firmness. A condition which often causes complaints with upholstered furniture, and with some foam mattresses. Fatigue can be measured in the laboratory by repeatedly compressing a foam sample and measuring the change in IFD.

HAND: The feel of the foam as the hand is rubbed lightly over the surface. If the foam has a stiff or hard feel to the touch, it is described as having poor hand. Foam with good Hand has a springy, velvet feel which is appealing to customers.

HYSTERESIS: The ability of foam to maintain original support characteristics after flexing. Hysteresis is the percent of 25% IFD loss measured as a compression tester returns to normal (25% IFD) position after measuring 65% compression.

IFD: Indentation Force Deflection is a measure of load bearing capacity or firmness. IFD is measured on the surface as 25% IFD, and under full load bearing conditions as 65% IFD. For example, to determine 25% IFD, a four-inch thick foam sample is compressed to three-inch thickness. The number of pounds required to achieve compression is the 25% IFD value. The 65% IFD reading is obtained in the same way at deeper compression (65% of the sample thickness). The higher the 25% IFD, the firmer the surface feel. Foams with higher 65% IFD values resist bottoming-out and provide a firm ride in cushioning. Ideal IFD specification will depend upon the application.

For Example: Take 30 lbs. Pressure to indent 25% (or from a 4” piece to a 3” piece)

**Super Soft=9#  Soft=14-21#  Medium=7-34#  Firm=36-40#
Extra Firm=44#  Super Firm=55#  Super Extra Firm=80#+ ** All approximate values

ILD: Indentation Load Deflection (see IFD)

LAMINATION: A fabrication process which bonds one foam variety to another using durable adhesives or heat. Lamination can be used to combine foam slabs with differing firmness and densities to obtain desired combination of comfort and support.

MOLDED: Foam chemicals are poured into a mold to form a cushion or mattress core with unique surface contours. The molding process does not greatly affect the performance of the foam, but can help to visually enhance a product line.

RESILIENCE: Surface liveliness and spring-back ability. Measured in the lab with a Ball Rebound test, a steel ball is dropped onto the foam from a fixed height. Resilience is expressed as a percentage of ball rebound against the original height of the ball drop. A boardy foam will have low resilience. Foam cushioning Resilience values range from 40 to 75%.

SUPPORT FACTOR: The ratio of 65% IFD divided by 25% IFD. The higher the number, the greater the difference between the surface firmness and the deep-down support. Support Factor is the best means of measuring the comfort for comparison purposes. Higher Support Factors allow desirable surface softness and firm inner support.
Vinyl Glossary

ABRASION RESISTANCE - Wearability of a vinyl coated fabric (or any product) to resist surface damage from rubbing or chafing.

ADHESION – Bonding strength between the backing and the vinyl surface.

BACKING – Any product used as a carrier to support a vinyl surface adding overall product strength, including fabric, non-woven, paper, etc.

CALENDER – Dry compound manufacturing method used to apply a controlled coating of vinyl gum so as to produce a film. Compound is heated and drawn through a series of high temperature polished rolls to combine all chemicals into the necessary film thickness. It can then be laminated to any backing or remain as a film, if desired.

CAST COATING – Liquid (plastisol) manufacturing process for expanded or non-expanded vinyls using casting release paper to carry product during production process. Cast coating manufacturing method allows for greater accuracy in total product quality vs. calendaring vinyl production procedure.

EXPANDED VINYL – Vinyl coated fabric construction consisting of three major parts – BACKING, FOAM (center section) and vinyl SKIN SURFACE. During production, heat is utilized to “cook” the vinyl making the middle foam layer “expand,” thus creating the term “expanded” vinyl.

FILLER – Additive (calcium carbonate) generally used to increase the weight of a vinyl product in lieu of adding other raw materials. (Fillers are also referred to as LOADING AGENTS.)

FILM – Solid or flexible vinyl (of any thickness) without a backing.

FLAT VINYL – Another name for non-expanded vinyl.

FOGGING – Phenomenon created when a vinyl-coated fabric or film is subjected to high temperatures in confined areas. Result is plasticizer exudation (common to automobile interiors.)

GAUGE – Total thickness of a vinyl product.

GRAIN (EMBOSSING) – Mechanically textured surface of vinyl.

LAMINATED – Bonding of film and fabric usually with heat and adhesive.

MILDEW PROOF – Treatments given to vinyl compound and/or a backing to retard the growth of a variety of fungi that may result in mildew growth.

NON-EXPANDED VINYL – Vinyl coated product manufactured without a foam layer between the skin surface and backing.

PIGMENT – Compound used to provide color.

PLASTICIZER – Additive used to make basic raw material, polyvinyl chloride (PVC), soft and flexible.

PRINT – Application of tinted inks used to change the surface appearance of a solid color. Prints are used to give vinyl fabrics a variety of surface looks including floral, leathers, etc.

PVC – Common name for polyvinyl chloride resin, the basic raw material in all vinyls.

SLIP FINISH – Same as top coat.

SKIN THICKNESS – Overall thickness of the wear layer surface (solid vinyl).

STRIKE-THROUGH – Manufacturing defect that allows texture from backing to show on surface area.

SUBSTRATE – Another name for backing.

TEAR STRENGTH – Ability of vinyl fabric to resist tearing. Measured horizontally and vertically on surface area.

TOPCOAT – Thin layer of clear or tinted vinyl used on wear surface to protect total product from abrasion. Topcoat also provides desired degree of gloss.

TOP SKIN – The thin vinyl layer in an expanded product.

UNSUPPORTED VINYL – Any vinyl film or expanded produced without a backing.

UV STABILIZED PIGMENTS – Special pigments formulated to resist fading or color change resulting from long-term exposure to the sun (ultra-violet rays).

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Spradling International Marine, the world’s leading vinyl supplier to boat builders and marine seat manufactures, has developed this informational guide, “SMART” SEATS, for marine seat construction and care for optimum life of your vinyl. Drawing from Spradling’s 50+ years of marine vinyl experience in collaboration with several leading marine industry professionals, this guide has everything you need to know about the proper components needed to knowledgeably produce exceptional seating for the marine industry. Each page features detailed information on each “SMART” SEAT component with product-to-product breakdowns, and explanations of why these products should be used and their benefits to the longevity of your marine seating. Several components feature extended information that can be accessed online with your smart phone via the QR codes on each specific page. The “SMART” Seat is also accessible online at www.spradlingvinyl.com/sim.

Intellectuals solve problems, geniuses prevent them.

Albert Einstein