The information contained in this publication is based on current information and product design at the time of publication and is subject to change without notification. Our ongoing commitment to product improvement may result in some variation. No representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications or results to be obtained therefrom. For verification of technical data or additional information not contained herein, please contact Spears® Technical Services Department [West Coast: (818) 364-1611 - East Coast: (678) 985-1263].

PURPOSE OF THIS MANUAL

This manual provides basic technical information, dimensions and installation guidelines for Spears® **OceanTUFF**™ CPVC Marine Drainage System that is designed for marine drainage applications. This unique product developed by Spears® has been awarded a U.S. Patent, No. 7,178,557 and is manufactured to ASTM F 2618 Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems. Spears® **OceanTUFF**™ CPVC Marine Drainage Systems carries a Limited Lifetime Warranty. Please contact Spears® Technical Services for additional information not covered.

Marine & Off-Shore Applications

CPVC plastic piping products are gaining acceptance for use in non-essential marine applications due to their lighter weight, corrosion resistance and low flame, smoke and toxicity properties. The **OceanTUFF™** system is assembled using a one-step cement to aid in a faster and cleaner installation process - using simple readily available joining tools instead of bulky expensive machinery.

Drainage Applications

Spears® **OceanTUFF**™ CPVC marine drainage products can be used in a variety of non-essential marine drainage applications. Among its many uses include black & gray water, vacuum flush sanitary piping, vents and drains. Please contact Spears® Technical Services to check your application suitability.

Independent Product Certifications Approvals

Spears® **OceanTUFF**™ CPVC Marine Drainage System is sold as a complete system of pipe, fittings and solvent cement. Conformance of Spears® **OceanTUFF™** CPVC marine pipe, fittings, and solvent cement approvals are independently (3rd party) tested, evaluated and certified by NSF International. All approvals are routinely monitored through an ongoing program of periodic inspection and testing by the certifying/approving agency.

Approvals

- **American Bureau of Shipping** (ABS) Type Approved for use in marine and off-shore applications in nominal pipe sizes 1-1/2" through 12". Meets IMO International Code for Application of Fire Test Procedures, Annex 1, Part 5 for surface flammability and Part 2 for low smoke and toxicity. Suitable for Marine & Offshore Applications for non-essential systems including black water, gray water, vacuum flush sanitary piping, vents and drains in services requiring no fire endurance testing or electrical conductivity testing. Piping to be used in non-hazardous areas only.

  Type Approval details and restrictions are specified in ABS Type Approval available on the ABS website at **www.eagle.org**.

- **U.S. Coast Guard** (USCG) approved for use in non-essential areas of USCG inspected marine vessels in nominal pipe sizes 1-1/2" through 12". Meets IMO International Code for Application of Fire Test Procedures, Annex 1, Part 5 for surface flammability and Part 2 for low smoke and toxicity and may be installed in concealed spaces in accommodation, service and control spaces without meeting the additional requirements of 46 CFR 56.60-25 (a) (2).

  Approval details and restrictions are specified in USCG file # 164.141/45/0 available on the USCG website at **www.cgmix.uscg.mil**.

- **NSF International** - Certified by NSF International in accordance with ASTM F 2618, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems* (NSF®-cw). See Spears® NSF® Official Listings at **www.nsf.org**.

- **NSF ORD 10222 For Use in Canada** - Certified for use in Canada by NSF International under the Standards Council of Canada as an Other Recognized Document (ORD) that defines the product specific requirements for Chlorinated Poly Vinyl Chloride (CPVC) Chemical Waste Systems, in accordance with ASTM F 2618 requirements.

Installation Training & Information

ASME B31.3 installer training courses are available from Spears® at no cost. If you would like to arrange for training or have any questions about the safe installation and use of this system, contact Spears® Manufacturing Company, 15853 Olden Street, Sylmar, CA 91342 USA, Telephone (818) 364-1611.

SAFETY INSTRUCTIONS

Read and understand this manual before proceeding with the installation and testing of the Spears® **OceanTUFF**™ CPVC Marine Drainage System. A complete understanding of the instructions provided are requirements for the installer of the Spears® **OceanTUFF**™ CPVC Marine Drainage System. These instructions contain important information.

1. Inspect the product. Make sure all parts are included with the shipment and that all necessary tools are available for proper installation.
2. Wear safety glasses, hard hat, and foot protection.
3. Avoid dangerous environments. If using electrically powered tools for installation, make sure the area is free from moisture or wetness that could create unsafe working conditions. Keep work areas well lit. Allow sufficient space for measuring and dry-fitting the system.
4. Prevent back injury. Always practice safe lifting and installation techniques.
5. Use only tools specifically designed for plastic pipe and fittings.
6. Work in a well-ventilated area. Ensure that there is proper ventilation when applying primers and cements and/or soldering materials.
7. Wear protective gloves. PVA-coated protective gloves are recommended when applying solvent cement. If hands contact solvent cement, use a waterless, abrasive soap to remove all residue.
8. When solvent cementing, avoid sources of heat or open flame. **DO NOT** smoke while handling solvent cement.
9. Keep work areas clean. Cluttered areas and slippery floors can create hazardous working conditions.
10. Wear hearing protection. Protect your hearing if you are exposed to long periods of very noisy job-site operations.
11. Keep visitors away. All visitors should be kept a safe distance away from the work area.
12. Follow all manufacturers' recommended precautions when cutting or sawing pipes, or when using any heat, flame, or power tools.

Typical Physical Properties of Spears® **OceanTUFF**™ CPVC Material

Property	Test Method	Typical Value
Mechanical Properties @ 73°F		
Specific Gravity		1.49
Tensile Strength, psi	ASTM D 792	9000
Tensile Modulus, psi	ASTM D 638	420,000
Flexural Strength	ASTM D 638	12,000
Izod Impact (notched @73°F)	ASTM D 790	
Fittings	ASTM D 256	3.0
Pipe		5.5
Thermal Properties		
Heat Deflection Temperature 264 psi	ASTM D 648	
Fitting		214°F
Pipe		230°F
Thermal Conductivity, BTU/hr/sq ft/°F/in	ASTM C 177	.95
Coefficient of Linear Expansion, in/in/°F	ASTM D 696	3.2×10^{-5}
Flammability		
Limiting Oxygen Index	ASTM D 2863	60
Flame Spread - Smoke Development - Toxicity	2010 FTP Code	Annex 1, Part 5 & Part 2
Electrical		
Dielectric Strength, volts/mil	ASTM D 149	1,250
Dielectric Constant, 60Hz, 30°F	ASTM D 150	3.70
Volume Resistivity, ohm/cm @ 95°C	ASTM D 150	34×10^{12}
Spears® CPVC Pipe is non-electrolytic		
Solvent Cement	ASTM F 2618/ASTM F 493	Heavy Body; Mustard Yellow Color

OceanTUFF™ CPVC fitting configurations are produced to applicable DWV patterns of ASTM D3311, *Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns*, plus various specialty patterns and manufactured specified configurations not included in ASTM D3311. All drainage fittings with 90° angles (sanitary tees, elbows, etc.) have socket pitch to maintain approximately 1/4" per foot drainage. **OceanTUFF**™ CPVC pipe is produced to dimensions specified in ASTM F 2618.

Expansion & Contraction

Spears® **OceanTUFF**™ CPVC products, like all piping materials, expand and contract with changes in temperature. **Example:** If the coefficient of linear expansion is 3.2 x 10^{-5} in./in. °F, a 25°F change in temperature will cause an expansion of 1 inch for a 100-foot straight length. For most operating and installation conditions, expansion and contraction can be accommodated at changes of direction, or simple expansion loops can be used. Thermal expansion change in length is calculated from Length of Run in feet, expected Change in Temperature and given Coefficient of Linear Thermal Expansion of 3.2 x 10^{-5} in./in. °F for CPVC:

ΔL = 12eL (ΔT)
Where:
e = 3.2 x 10-5 in./in. °F
L = Length of Run in feet
ΔT = Temperature Change in °F

Example:
How much will a 50 ft. run Spears® **OceanTUFF**™ pipe expand if the expected ambient temperature will range from 45°F to 85°F.
ΔL = 12eL (ΔT)
ΔL = 12 x .000032 x 50 x 40
ΔL = .768 inches

The following table provides quick reference in identifying expansion length change for different run lengths of pipe at various anticipated temperature changes.

Thermal Expansion Table

Length of Run (L) in feet	Length Change in Inches (ΔL) for Specified Change in Temperature (ΔT)								
	20°F	30°F	40°F	50°F	60°F	70°F	80°F	90°F	100°F
10	.08	.12	.15	.19	.23	.27	.31	.35	.38
20	.15	.23	.31	.38	.46	.54	.61	.69	.77
40	.31	.46	.61	.77	.92	1.08	1.23	1.38	1.54
50	.38	.58	.77	.96	1.15	1.34	1.54	1.73	1.92
70	.54	.81	1.08	1.34	1.61	1.88	2.15	2.42	2.69
90	.69	1.04	1.38	1.73	2.07	2.42	2.76	3.11	3.46
120	.92	1.38	1.84	2.30	2.76	3.23	3.69	4.15	4.61

Handling & Storage

Spears® **OceanTUFF**™ CPVC marine products resist attack from a large group of chemicals that are corrosive to metallic piping. However, care must be taken to avoid contact with chemicals that are harmful to CPVC. Specific chemicals, or chemical vapors that contact CPVC can weaken or damage the system. Consult with Spears® before using these CPVC products with any questionable materials.

Spears® recommends that CPVC products be stored indoors. If storing outdoors, these products must be covered with a non-transparent material to prevent extended sunlight exposure. Brief exposure to direct sunlight on the job site may result in color fade, but it will not affect the material's physical properties. Spears® **OceanTUFF™** CPVC fittings should be stored in their original containers to keep them free from dirt and to help reduce the possibility of damage. Spears® Solvent Cements should be stored indoors in closed containers between 40°F (5°) and 110°F (44°C).

Joining Methods

Spears® **OceanTUFF**™ CPVC pipe and fittings are easily joined using Spears® OT-5 One-Step Solvent Cement that has been specially formulated for marine drainage applications and manufactured in accordance with ASTM F 493, *Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings*, as specified in ASTM F 2618. When cured, this cement provides a fused joint that maintains the same physical and chemical resistance properties as the CPVC components in the system. Spears® OT-5 is a “one- step” cement and does not require the use of primer. Spears® **OceanTUFF**™ CPVC systems may be additionally joined using threaded (NPT) or flanged connections where removal or connection to supplementary equipment is required. Special transition couplings are available for joining to other piping systems.

Solvent Cement Joints - Store solvent cement cans below 90°F (33°C). Stir and use as is. If jelled, replace. Use within 2 years of date stamped on can. OT-5 cement is designed for use without a primer.

1. Cut pipe square, deburr and chamfer (bevel 10° to 15°). Clean and dry joining surfaces.
2. Check dry fit. For interference fit, pipe should push 1/3 - 2/3 way into fitting snugly.
3. Use a suitable applicator at least 1/2 size of pipe diameter; for larger sizes use brush or roller.
4. Apply a full even layer of cement on the pipe equal to the socket depth. Coat the fitting socket with a medium layer. Avoid excess cement and puddling. If necessary, apply a second full layer of cement on the pipe.
5. Assemble while cement is wet. If not wet, recoat all parts before assembly. Assure pipe bottoms into fitting socket using a 1/8 to 1/4 turns twist. To avoid push out and allow for initial set, hold joint for about 30 seconds. Wipe off excess cement. Handle newly assembled joints carefully.

An initial set time is recommended to provide good handling strength after which the joint will handle normal stresses of installation. Cure time is the recommended waiting period prior to placing the joint into service and before any pressure testing of the system. Set and cure times are relative to temperature at time of installation. Best results are obtained at temperatures between 40°F and 110°F. Due to the many field variables, these recommendations should be used as a general guide only.

Recommended Set & Cure Times

Temperature	Initial Set	Cure
60°F - 100°F	30 min.	1 hr.
40°F - 60°F	1 hr.	2 hrs.
0°F	2 hrs.	4 hrs.

In moist or humid conditions (relative humidity above 60%) allow 50% more cure time.

Average Number of Joints per Quart of OT-5 One-step Cement

Pipe Diameter	1-1/2	2	3	4	6	8	10	12	14	16
No. of Joints	90	60	40	30	10	5	2-3	1-2	3/4	1/2-3/4

Estimate based on laboratory tests. Due to many field variables, these figures should be used as a general guide only.

Threaded Joints - Spears® Manufacturing Company highly recommends the use of Spears® **BLUE 75**™ thread sealant, which has been tested for compatibility with Spears® products. Please follow the sealant Manufacturer's Application/Installation instructions. Choice of another appropriate thread sealant is at the discretion of the installer.

WARNING: Some pipe joint compounds or pastes may contain substances that could cause stress cracks in CPVC. For transitions to metal threaded systems, all cutting oils must be removed and the metal pipe thoroughly flushed and degreased prior to assembly with CPVC systems.

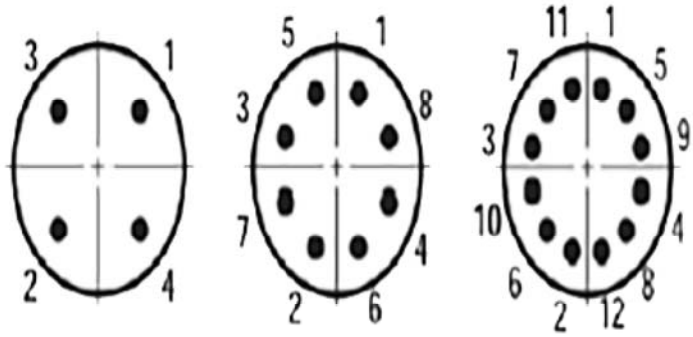
1. Apply joint sealant to the male pipe threads ONLY.
2. Thread joint hand tight for initial assembly.
3. Using commercial strap wrenches tighten 1 to 2 turns beyond hand tight; avoid overtightening. DO NOT use conventional pipe wrenches that can damage plastic fittings.

If a tape sealant is used:

1. Use PTFE tape no less than 3.5 mil thick.
2. Initial wrap must fully cover the thread end.
3. Wrap clockwise with standard pipe threads.
4. Use only 2-3 wraps of tape.

DO NOT use combination of paste and tape sealants.

Flanged Connections - Solvent cement flange hub to pipe according to preceding instructions. Use full faced, 1/8" thick gaskets of a material suitable for the intended application having a Shore "A" durometer of approximately 70. Use of well lubricated bolts and flat washers is required. Bolts must be tightened in a 180° opposing pattern to the recommended torque values.

Flange Size (in.)	Bolt Torque (ft.-lb.)	Torque Sequence
1-1/2	12	
2-4	25	
6-8	40	
10	64	
12	95	

OceanTUFF™ Transitions To Other Systems - Spears® **OceanTUFF**™ CPVC Marine Drainage System provides a complete line of transition fittings for use with other marine drainage piping materials for system additions and retrofits. Please contact Spears® for special construction of any system transition connection needs not specified.

CG-P092 GripLoc Transition Coupling - Hub x GripLoc™ Compression. Allows connection of **OceanTUFF**™ to Polypropylene, PVDF pipe and other IPS Systems and solvent cement socket connection to CPVC system.

CG-P093 Elastomer Transitions Couplings - IPS Clamp Joint X IPS Clamp Joint. Allows mechanical connections of Spears® **OceanTUFF**™ CPVC pipe to plain end pipe. Consists of high performance fluoroelastomer (FKM) sleeve, an outer stainless steel shear ring and two AISI 301 stainless steel clamping bands.

CG-P096 Grooved Coupling Adapter - Allows connection of the Spears® **OceanTUFF**™ to grooved metal piping systems. Requires use of a Metal Grooved Coupling with gasket. A flexible style grooved coupling must be used for plastic only. **Do not use rigid style couplings**.

CG-P099 Transition Coupling - Hub X Compression. Allows connection of the Spears® **OceanTUFF**™ to other piping systems and solvent cement socket connection to CPVC system. A safety groove must be cut into the Polypropylene or PVDF pipe to resist pull out. A grooved cutting tool is available from Spears® Manufacturing Company.

Flanges - Spears® provides a full range of flange connections including one-piece hub, Van Stone hub and Van Stone spigot and blind connections.

Support Spacing

Spears® **OceanTUFF**™ CPVC systems should be properly supported to avoid stress caused by sagging and system component loads. Support should be given to concentrated system loads, such a flanges and where changes in direction occur. Such support should be made as close to fittings as possible, yet allow for movement due to expansion and contraction.

Split ring pipe hangers and/or wrap around type brackets with adequate corrosion resistance can be used. However, hangers must **NOT** be used to pull the piping system into position or over tightened to either restrict necessary movement or cut into pipe. Hangers should be smooth, free of burrs and provide at least 1/2" load-bearing surface.

Systems should be supported in accordance with manufacturers recommendations and standard marine design pratice. The following chart shows recommended horizontal support spacing for un-insulated continuous spans with no concentrated loads. This information is provided as a general guideline. Engineering specifications and system installation conditions may require significant variations.

Recommended Hanger Spacing (feet)

Pipe Diameter	1-1/2	2	3	4	6	8	10	12
Hanger Spacing	6	6	7	7-1/2	8-1/2	9	10	12

System Pressure Testing

Spears® **OceanTUFF**™ CPVC systems should be tested with water as follows, or according to class society rules and regulations. Test only after sufficient joint cure (see “Recommended Set & Cure Time”). The system may be tested in its entirety or isolated in sections for testing. Close all openings tight except the highest opening and fill the system to the point of overflow. Fill the system slowly, being sure to allow all air to escape. A pressure test of ten (10) foot (3048 mm) head of water should be conducted for entire system or section tested. Allow the system/section under test to set 15 minutes before inspection for leaks. Drain each section after inspection. Any leaking solvent cement joints should be cut from the system, replaced and retested after proper joint cure. Check any leaking mechanical joints for proper installation, applicable tightening and presence of any debris in the joint. Reassemble and retest.

System Integrity

Spears® **OceanTUFF**™ products have been developed and designed to be used as a total system consisting of pipe, fittings, accessories, solvent cement and thread sealant. All Spears® **OceanTUFF**™ components should be used in order to ensure a sound piping system. Substitution of other products for Spears® **OceanTUFF**™ pipe, fittings, or solvent cement may be detrimental to system integrity and is not recommended. The Spears® Limited Lifetime Warranty does not cover problems occurring within the piping system as the direct result of non-use of Spears® **OceanTUFF**™ system products.

Sample Engineering Specification

Spears® **OceanTUFF**™ Marine Drainage System shall be manufactured from CPVC Type IV, minimum ASTM Cell Classification 23447 per ASTM D1784 and available in sizes 1-1/2" - 12". System pipe and fittings shall be manufactured in accordance with ASTM F2618 and certified by NSF International for use in corrosive waste systems. System shall be approved by the United Stated Coast Guard and meet flame spread and smoke and toxicity requirements of the 2010 FTP code Annex 1, Parts 5 and 2. All fittings shall be CPVC drainage patterns meeting the applicable requirements of ASTM D3311 or the manufacturers specifications. Joining method for pipe and fittings shall be solvent cement welding. Solvent cement shall be a “one-step” primerless type CPVC cement specially formulated and manufactured in accordance with ASTM F2618 and F493. Spears® **OceanTUFF**™ Marine Drainage System shall be approved by the American Bureau of Shipping (ABS) and meet IMO FTP Code Annex 1, Part 5 for surface flammability and Part 2 for low smoke and toxicity. All pipe, fittings, and cement shall be supplied together as a complete system with a Limited Lifetime Warranty, as Spears® **OceanTUFF**™ CPVC Marine Drainage System manufactured by Spears® Manufacturing Company.

Deck & Bulkhead Penetrations

Spears® marine products can be installed in deck and bulkhead penetrations according to their respective approval requirements. Be sure to check fire stop system and CPVC material compatibility with the fire stop manufacturer. For more information please contact our Technical Support Department at (818) 364-1611.

Where it is intended to pass plastic pipes through bulkheads or decks, the original integrity of watertight bulkheads and decks is to be maintained at the location. If the bulkhead or deck is also a fire division and destruction by fire of plastic pipes may cause inflow of liquid from a tank, then a metallic shutoff valve operable from above the bulkhead deck is to be fitted at the bulkhead or deck.

Note: Spears® marine approved products have not been tested for “A”, “B” or “F” class divisions in accordance with IMO Resolution A.754(18), Recommendation on Fire Resistance Tests for “A”, “B” and “F” Class Divisions.

Penetrating Structural Members

Wood Beams-Spears® **OceanTUFF**™ CPVC marine piping can be passed through beams without use of sleeves or insulators. Drill hole 1/4" larger than pipe diameter to allow for expansion and contraction. Floating pipe through beams is advisable.

Steel Beams-When Spears® **OceanTUFF**™ CPVC marine piping passes through steel beams, use compatible plastic insulators, rubber grommets, pipe insulation or similar devices to prevent abrasion and noise. Floating pipe through beams is advisable.

Important: Do not penetrate beams, columns or structural members before consulting design engineer.