

COOLPRO PP78

Guide Specification

COOLPRO™ (PP78)

All Polypropylenes are not equal.

Developed with Montell Polyolefins, the reactor-process polypropylene resin, integrated with Cooley proprietary technology and fabric offers many benefits to engineers designing with geomembranes. Because the Cooley product does not contain 'fillers or extenders' it has excellent ultra-violet (UV) resistance for outstanding weatherability in exposed geomembrane applications. Cooley geomembranes are available with written weathering warranty up to 20 years.

Why use Cooley COOLPRO PP78?

Cooley Product Performance

The high performance of the Cooley polypropylene liners is a combination of a high strength polyester scrim, tough polypropylene polymer and a unique and proprietary manufacturing process. Cooley PP78 exhibits very high physical performance compared to products three times as thick. These characteristics are shown in the 'Physical Properties' data sheets for the respective thickness.

Cooley polypropylene has a high strength 9 x 9 count utilizing 1000 denier weft inserted scrim which provides enhanced physical performance that exceeds those of our competitors and other geomembranes. Cooley PP78 has:

- High Tensile Strength
- High Tear Strength
- High Puncture Resistance
- Excellent Dimensional Stability
- High Burst Strength
- Excellent Conformance and Lay Flat Characteristics (flexibility)
- Excellent Cold Crack Performance at Low Temperatures (exceeds -65°F)
- High Ultraviolet Resistance (up to 20 year weathering warranty)
- Excellent Seaming Characteristics (wide thermal window)
- High Peel and Shear Performance (seam welding)
- Excellent Chemical Resistance
- Can Be Installed in Relatively Low Ambient Temperatures
- Available in Large Panels to Reduce Field Seaming and Installation Time

Cooley polypropylene is available in five standard thicknesses from 20 mils (0.508 mm) to 60 mils (1.50 mm). Non-standard thicknesses can also be provided up to 120 mils (3 mm).

COOLPRO PP78™

Guide Specification

Panel Sizes

Cooley polypropylene provides the end-user with a liner product that can be supplied in panels up to half acre in size to expedite installation and minimize the amount of field seaming. These large panels can be supplied through our network of fabricators throughout the USA and abroad.

Field Installation

To expedite installation the Cooley polypropylene can be prefabricated and delivered to the site in large custom sized panels. This method enables the area to be lined with the minimum of material and field seaming. With the excellent seaming and related characteristics of the polypropylene, the usually expected problems with field seaming of other products are eliminated.

Typical Installations

The Cooley polypropylene geomembrane liners offer superior performance over other products for all aspects of lining lagoons, ponds or other impoundments, floating covers and similar containments. Cooley's high performance polyester scrim reinforced polypropylene provides the end-user with the optimum state-of-the-art liner material which is also user friendly. Even with the excellent chemical resistance, polypropylene has many other attributes such as potable water containment. Complying with the strict requirements of both the National Sanitation Foundation (NSF 61) in the United States and the WRc (BS 6290) in the United Kingdom, Cooley polypropylene is used in potable water applications. This means that the liner is ideal for aquaculture, aquatic and hydroponic farming applications. Cooley Polypropylene PP78™ is currently in service throughout the world.

**COOLRPO POLYPROPYLENE PP78™
 PHYSICAL PROPERTIES**

PROPERTY	TEST METHOD	VALUE				
Gauge, nominal (mils)		60	45	36	30	20
Plies, reinforcing 9 x 9 1000d polyester scrim		1	1	1	1	1
Breaking Strength - Fabric, minimum (lbs.)	ASTM D751 Method A	275 x 225	275 x 225	275 x 225	275 x 225	200 x 200
Low Temperature Flexibility 1/8 in Mandrel (°F)	ASTM D2136, 4 hrs.	.....40.....				
Puncture Resistance, minimum (lbs.)	TMS 101C	275	250	250	250	250
Tear Strength, minimum (lbs.)	ASTM D751 Tongue Tear	.....70.....				
Dimensional Stability (% change, maximum)	ASTM D1204 180°F/1 hour	.....1.0.....				
Hydrostatic Resistance minimum (psi)	ASTM D751 Method A, Procedure 1	350	350	350	350	300
Ply Adhesion, minimum (lbs./in.)	ASTM D413	20	20	20	20	20
Water Absorption (% wt. chge, max)	ASTM D471	.....<1%.....				
UV Resistance	ASTM G26 Xenon Arc	.....>12,000 hrs.....				
Resistance to Soil Burial (% Tensile Retention)	ASTM D3083 (Part 9.5)	.....90% min.				

TYPICAL FACTORY

SEAM PROPERTIES:

PROPERTY	TEST METHOD	VALUE
Bonded Seam Strength (lbs./width)	ASTM D751	160 min
Peel Adhesion, minimum (lbs./inch)	ASTM D413	20 or FTB

COOLPRO Polypropylene PP78™
Geomembranes for Potable Water Applications



Cooley Environmental Liners

Cooley Engineered Membranes
50 Esten Avenue
Pawtucket, RI 02862 USA
Tel. 401/ 724-0490
Tel. 800/ 444-4023
Fax: 401-726-8731

NSF International (NSF) OFFICIAL LISTING

This is a Certification by NSF that these products conform to the requirements of
NSF Standard 61 - Drinking Water System Components - Health Effects
This is your Official Listing as we have it on record at this time

April 16, 1996

CC: 02

COOLEY ENGINEERED MEMBRANES
50 ESTEN AVENUE
PAWTUCKET, RI 02862

Plant At: PAWTUCKET, RI

PROTECTIVE (BARRIER) MATERIALS

Trade Designation	Water Contact Size Restriction	Water Contact Temp Material	Contact
Liners			
TPO	>10,000 gal.	CLD 23	PP
Accepted in thickness of 20-45 mils.			

**Cooley Engineered Membranes
COOLPRO Polypropylene PP78™
is approved for
Drinking Water Applications
by**



**WRc plc (UK)
Listed**



BS 6290

**COOLPRO Polypropylene PP78™
Guideline Specification
for
Polypropylene Geomembrane Installation**

COOLPRO POLYPROPYLENE PP78™

Guide Specification

1.0 GENERAL

1.1 SCOPE OF WORK

The work covered by these specifications consists of installing a 20-60 mil thick fabric reinforced polypropylene geomembrane, in the areas shown on the project drawings. All work shall be done in strict accordance with the project drawings; these specifications and the Fabricator's approved shop drawings.

Sufficient materials shall be furnished to cover all areas as shown on the drawings including seam areas, anchor trenches and accessories as required. The Fabricator/Installer of the liner shall allow for any anticipated or planned shrinkage or wrinkles in the field panels, installing the membrane free of stress or tension.

1.02 MANUFACTURER/FABRICATOR/INSTALLER INFORMATION

The following shall be the minimum information submitted at the time of the bid, relating to the polypropylene Manufacturer, proposed Fabricator and Installer: Name, Address, Phone, Fax, Qualifications of the individuals who will personally be assigned to the project.

1.03 PRODUCTS

The geomembrane material shall be a 20, 30, 36, 45 or 60 mil thick, fabric-reinforced, polypropylene as manufactured by Cooley Engineered Membranes of Pawtucket, RI. The geomembrane shall be manufactured by the extrusion/calendering process, consisting of first quality ingredients, suitably compounded of which polypropylene is the principal resin. The finished compound shall be uniform in color, thickness, size and surface texture.

The finished membrane shall consist of two (2) plies of polypropylene laminated over one (1) ply of reinforcing fabric. The reinforcing fabric shall be a 9 x 9 count utilizing 1000 denier weft inserted polyester fabric to create an open-type weave that permits strike-through of the polypropylene.

The polypropylene shall fully encapsulate the fabric and shall extend a minimum of 1/8" beyond the reinforcing scrim roll edges. Exposed fabric along the longitudinal edges of the roll stock shall not be permitted. The finished membrane shall meet or exceed the "physical properties" values as shown on the chart on the following page:

COOLPRO POLYPROPYLENE PP78™ Guide Specification

Polypropylene PP78™

Cooley's reinforced polypropylene liner developed in conjunction with Montell Polymers offers the most versatile flexible geomembrane liner available today. The unique combination of custom fabric reinforcement encapsulated by extruded high performance polypropylene proves a strong, highly chemical resistant liner. A chemically inert polymer is modified by a Catalloy® process technology.

With this process, the molecular structure of the polymer is modified to provide many specialized properties. These properties include excellent flexibility, low thermal coefficient of expansion and contraction, outstanding dimensional stability, wide temperature range for excellent seaming, good chemical resistance. All this performance without Environmental Stress

Cracking (ESC). Used for the containment of the most aggressive chemicals to potable water and aquaculture services highlights the broad uses of the product. Thermally seamed and highly flexible, the liner can be supplied in large panels for minimum field seaming and simple installation.

PROPERTY	TEST METHOD	VALUE				
Gauge, nominal (mils)		60	45	36	30	20
Plies, reinforcing 9 x 9 1000d polyester scrim		1	1	1	1	1
Breaking Strength - Fabric, minimum (lbs.)	ASTM D751 Method A	275 x 225	275 x 225	275 x 225	275 x 225	200 x 200
Low Temperature Flexibility 1/8 in Mandrel (°F)	ASTM D2136, 4 hrs.	.....-40.....				
Puncture Resistance, minimum (lbs.)	FTMS 101C	275	250	250	250	250
Tear Strength, minimum (lbs.)	ASTM D751 Tongue Tear	.....70.....				
Dimensional Stability (% change, maximum)	ASTM D1204 180°F/1 hour	.....1.0.....				
Hydrostatic Resistance minimum (psi)	ASTM D751 Method A, Procedure 1	350	350	350	350	300
Ply Adhesion, minimum (lbs./in.)	ASTM D413	20	20	20	20	20
Water Absorption (% wt. chge, max)	ASTM D471	.....<1%.....				
UV Resistance	ASTM G26 Xenon Arc	.....>12,000 hrs.....				
Resistance to Soil Burial (% Tensile Retention)	ASTM D3083 (Part 9.5)	.....90% min.				

TYPICAL FACTORY SEAM PROPERTIES:

PROPERTY	TEST METHOD	VALUE
Bonded Seam Strength (lbs./width)	ASTM D751	160 min
Peel Adhesion, minimum (lbs./inch)	ASTM D413	20 or FTB

COOLPRO POLYPROPYLENE PP78™

Guide Specification

1.04 SUBMITTALS

The polypropylene roll goods shall be factory fabricated into large panels. The fabricator shall furnish a proposed geomembrane panel layout to be approved in writing by the Engineer prior to material shipment. The drawings shall show: the direction of factory seams, the size of panels, and the location of field seams, consistent with the requirements of the project drawings. These details shall include the recommended termination details of the geomembrane. Except for the special requirements due to configuration and/or terminating the geomembrane, maximum use of large size panels shall be made to reduce field seaming to a minimum.

1.05 FACTORY FABRICATION

The fabricator shall be an experienced firm customarily engaged in factory-fabricating individual widths of scrim-reinforced geomembranes roll stock into large panels. The fabricator shall have experience in fabricating a minimum of 2,000,000 square feet of geomembranes by thermal fusion methods.

Prior to factory seaming, all roll goods shall be inspected. All factory seams shall be made by thermal fusion methods. All factory seams shall have a minimum scrim-to-scrim overlap of one and one-quarter inches (1 1/4") when fabricated. All seams shall be made so that the thermal fusion bond extends fully to the top edge of the sheet so that no loose edges are present on the top side of the panel.

1.06 INSPECTION AND TESTING OF FACTORY SEAMS

1.06.1 Inspection

All sheets and seams shall be 100% visually inspected during fabrication. No defective seams or exposed scrim will be allowed. All exposed scrim edges shall be sealed with an approved polypropylene edge caulk or capped with a strip of polypropylene. The geomembrane fabricator shall make all indicated repairs before the panels are packaged for shipment.

1.06.2 Testing

In addition to visual inspection, a 48-inch (1.2 M) sample shall be taken from each factory seam welding unit used in this work at the beginning of every work shift and every four hours of production thereafter. Samples shall be non-destructive, not requiring patching of fabricated panels. Test specimens shall be cut at quarter points from each 48-inch seam sample (a total of three places) and tested for seam strength and peel adhesion. The shear seam strength shall be tested in accordance with ASTM D751 as modified in Annex A of ANSI/NSF 54. The peel adhesion shall be tested in accordance with ASTM D413 as modified in Annex A of ANSI/NSF 54.

A log shall be maintained showing the date, time, panel number and test results. Failure of the material and/or seams to meet all the requirements of these specifications may be cause for rejection of the polypropylene material and/or seams as appropriate. The Fabricator shall provide the test results to the owner or engineer upon request.

COOLPRO POLYPROPYLENE PP78™

Guide Specification

1.07 CERTIFICATION AND TEST REPORTS

Prior to installation of the polypropylene panels, the Fabricator/Installer shall provide the Engineer with the following certification and test reports:

1.07.1 Written certification that the material meets all of the requirements of section 1.03.

1.07.2 Written certification that the factory seams were inspected and tested in accordance with section 1.06.

1.08 Polypropylene PP78 PANEL PACKAGING AND STORAGE

Each factory-fabricated panel shall be rolled and/or accordion-folded and placed onto a sturdy wooden pallet designed to be moved by a forklift or similar equipment. Each panel shall be given prominent and unique identifying markings indicating the proper direction of unrolling and/or unfolding to facilitate layout and position in the field. The panels shall be suitably packaged, enclosed and protected to prevent damage during shipment and each package shall be prominently marked in the same fashion as the panels within. Until needed, packaged factory-fabricated panels shall be stored in their original unopened containers in a dry area, and protected from the direct heat of the sun, where possible. Pallets should not be stacked.

2.0 Polypropylene PP78 INSTALLATION AND SEAMING

2.01 SUBGRADE PREPARATION (New Excavation)

The surfaces on which the lining is to be placed shall be maintained in a firm, clean, dry and smooth condition during the lining installation. All surfaces shall be compacted and smooth graded with anchor trenches provided as required and detailed. All surfaces to be lined shall be free of rocks, roots, gravel, grade stakes or debris that may puncture the geomembrane. The subgrade shall be compacted to a minimum of 95% of the dry density (as determined by ASTM D398 Standard Proctor Method) on the engine specification. Geotextiles may be used as a cushioning agent. All vegetation, if present, shall be removed and if required by the Engineer, a soil sterilant applied. The soil sterilant shall be selected for the geographical area and native grasses and growth.

If groundwater is present within 12 inches below the surface to be lined, the General Contractor shall de-water the area prior to and during installation of the liner.

Immediately prior to the installation of the polypropylene geomembrane, a complete and detailed Inspection of the embankments shall be performed by the Field Engineer, Earthwork Contractor and the Geomembrane Installer to determine acceptance of the finished subgrade and elevations.

Any erosion or other damage to the base material, which has occurred since placement, shall be corrected by the earthwork contractor.

COOLPRO POLYPROPYLENE PP78™

Guide Specification

2.02 POLYPROPYLENE PP78 GEOMEMBRANE INSTALLATION

The surface of the existing excavation shall be prepared in accordance with the Engineer's requirements as specified in the drawings or specification documents. The surface must be acceptable to the installation contractor and the recommendations of the liner manufacturer.

The geomembrane shall be placed over the prepared surfaces in such a manner as to insure minimum handling and in accordance with the approved shop drawings. The lining shall be sealed to all concrete structures and other openings in accordance with details shown on the plans and shop drawings. The geomembrane lining shall be closely fitted and sealed around all inlets, outlets and other projections through the lining, using prefabricated fittings where possible as shown in the construction details. Liner sheets, damaged from any cause, shall be repaired or covered with additional sheeting.

Only those sheets of lining material which can be anchored and seamed together the same day shall be unpackaged and placed into position. In areas that high wind is prevalent, the lining installation should begin on the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags sufficient to hold it down during high winds. The leading edges of the liner material left exposed after the day's work shall be anchored to prevent damage or displacement due to wind.

Materials, equipment or other items shall not be dragged across the surface of the polypropylene liner or be allowed to slide down slopes on the lining. All parties walking or working on the polypropylene liner material shall wear soft-sole shoes.

2.03 FIELD SEAMS

Lap joints shall be used to seal factory-fabricated sheets together in the field. The lap joint shall be formed by lapping the edges of the sheets four (4) inches. The contact surfaces of the sheets shall be wiped clean of all dirt, dust, moisture and other foreign matter. A minimum one and one half inch (1½") bond shall apply to all field seams.

Extreme care should be taken throughout the work to avoid fishmouths, wrinkles, folds or pleats in the seam area. If fishmouths do occur, they should be slit out far enough from the seam to dissipate them, lapped, seamed together in the lapped area and patched. Any necessary repairs to the polypropylene geomembrane shall be done using an additional piece of the specified polypropylene sheeting applied as stated in Section 2.04.2 of this specification. All patching material shall have rounded edges.

COOLPRO POLYPROPYLENE PP78™

Guide Specification

Cleanup within the lining compound shall be an ongoing responsibility of the Lining Contractor. Particular care should be taken to ensure that no stones, scrap material, trash, tools or other unwanted items are trapped beneath the geomembrane liner.

All field seams shall be made utilizing hot air or hot wedge welding techniques as outlined in Sections 7 and 8 of the EPA Technical Guidance Document: "Inspection Techniques for the Fabrication of Geomembrane Field Seams".

2.04 INSPECTION AND TESTING OF POLYPROPYLENE PP78 FIELD SEAMS

2.04.1 Inspection

Upon completion of the liner installation, all seams shall be visually inspected for compliance with these specifications. In addition to the visual inspection, all field seams shall be checked using an air lance nozzle directed on the upper edge and surface to detect any loose edges or ripples indicating unbonded areas within the seam (per ASTM D4437).

All field seams, on completion of the work shall be tightly bonded. Any geomembrane surface showing injury due to scuffing, penetration by foreign object, or distress from other causes shall be replaced or repaired. All exposed scrim edges shall be sealed with an approved polypropylene edge sealant or capped with a strip of polypropylene.

2.04.2 Repairs

Any repairs made to the liner shall be made with polypropylene lining material. Patches shall be cut with rounded corners and shall extend a minimum of four (4) inches in each direction from the damaged area. The entire surface of the patch shall be bonded to the PP lining material. If reinforced patches are used, the cut edges of the patch should be coated with an approved polypropylene edge sealant.

2.04.3 Testing of Field Seams

Destructive test seams are to be made by each seaming crew, at the beginning of the seaming process and every four (4) hours thereafter, or every time equipment is changed. These seams are to be made of like material provided for the purpose of testing and not cut from the seamed panels. Each seaming crew and the materials they are using must be traceable and identifiable to their test seams. The samples shall be numbered, dated and identified as to the personnel making the seam, and location made by appropriate notes on a print of the panel layout for the project. The completed field seam sample shall measure not less than 14 inches in width and 24 inches in length.

COOLPRO POLYPROPYLENE PP78™

Guide Specification

The field test seams are to be tested for seam strength and peel adhesion. Seam shear strength shall be tested in accordance with ASTM D751 as modified in Annex A of ANSI/NSF 54. The peel adhesion shall be tested in accordance with ASTM D 413 as modified in Annex A of ANSI/NSF 54.

If a test seam fails to meet the field seam design specification, additional test seam samples will have to be made by the same seaming crew, using the same tools, equipment and seaming materials and retested.

3.0 WARRANTY

The Geomembrane Manufacturer shall confirm in writing, that the material to be furnished will be free of defects in materials and workmanship at the time of sale, and against deterioration due to the effects of ozone, ultraviolet or other normal weathering on a pro-rated basis for up to 20 years from the date of completed installation. The polypropylene Geomembrane Manufacturer shall furnish a sample warranty for review and approval prior to shipment.

End of Specification

These guideline specifications are for general informational purposes only. Each application will have its own particularities that must be evaluated and specified by qualified engineers. Cooley does not practice engineering and these guidelines are not presented as a substitute for and should not be utilized in lieu of appropriate engineering analysis of each particular environment and use the lining is intended for. Purchasers of Cooley Engineered Membranes Environmental Liners are urged to consult with their engineers for the appropriate specifications for the installation of Cooley Engineered Membranes Environmental Liners. There is no warranty of fitness for a particular purpose or merchantability issued by Cooley Engineered Membranes Environmental Liners. Similarly there is no express or implied warranty which is issued in connection with Cooley Engineered Membranes Environmental Liners other than that warranty which appears within the confines of the terms and conditions of Cooley's limited warranty, which are set forth in the limited warranty's document.