

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION**

POND SEALING OR LINING - FLEXIBLE MEMBRANE

Code 521A

INTRODUCTION

The materials covered by this specification are as referred to by NRCS conservation practice standard Pond Sealing or Lining - Flexible Membrane, Code 521A.

MATERIALS

The quality of any material shall meet the requirements indicated in tables 1, 2, 3, 4, 5, 6, 7, and 8, as appropriate.

Table 1 - Requirements for polyethylene and ethylene co-polymer plastic film

| Test description | | Requirements | | Test method |
|---|--------------------|---------------------|--------------------|---|
| | | Type I polyethylene | Type II co-polymer | |
| Tensile strength, each direction, minimum average | lb/in ² | 1,800 | 2,000 | ASTM-D-882, Method "A" |
| Ultimate elongation, each minimum average | pct | 500 | 500 | ASTM-D-882, Method "A" |
| Impact resistance, minimum average | g/mil | 45 | 65 | ASTM-D-1709, Method "B" |
| Water vapor permeability | perm-mil | 0.7 | 1.5 | ASTM-E-96 |
| Tear resistance, each direction, minimum | g/mil | 80 | 80 | ASTM-D-1922 |
| Soil burial Tensile strength change, each direction, maximum | pct | 5 | 5 | ASTM-D-3083 |
| Elongation loss, each direction, maximum | pct | 20 | 20 | |
| Luminous transmittance, maximum | pct | 1.0 | 1.0 | National Bureau of Standards Publication PS-17 |

Table 2 - Requirements for reinforced rubber sheeting

| Test description | | Requirements | | Test method |
|---|--------------------|---------------------|--------------------------|---|
| | | Up to 20 mill thick | 20 mil thick and greater | |
| Breaking strength, minimum | | | | ASTM-D-751 |
| Warp direction | lb/in | 75 | 100 | |
| Fill direction | lb/in | 75 | 100 | |
| Ultimate elongations, maximum | | | | ASTM-D-751 |
| Warp direction | pct | 30 | 30 | |
| Ozone resistance, procedure "B" 50 pphm, 100 °F | days | 7 | 7 | ASTM-D-1149 and ASTM-D-518 |
| Hydrostatic strength retained after ozone exposure, 7 days (Mullen) | pct | 100 | 100 | Federal Specification CCC 191 b Method 5512 ASTM-D-573 |
| Heat aging, 7 days at 212 °F | | | | ASTM-D-573 |
| Tensile strength retained | pct | 90 | 90 | |
| Elongation retained | pct | 90 | 90 | |
| Tear resistance, minimum, warp or fill direction | lb | 8 | 8 | ASTM-D-751 (tongue) |
| Hydrostatic burst (Mullen), minimum | lb/in ² | 100 | 175 | ASTM-D-751 |
| Dimensional stability, 7 days at 212°F | | | | (1) |
| Change in length or width | pct | +1.0 | +1.0 | |
| Low-temperature flexibility (optional) | | | | Federal Specification |
| No cracking or flaking | | -40 F | -40 F | CCC 191 b, Method 5874 |
| Commercial field splice strength | | | | Commercial field splice |
| Shear force, minimum tensile | pct | 75 | 75 | 1-in.-wide strip, pulled in shear at 10 in./min., after 7 days cure at room temperature |

(1) A 1-ft² sample, 10-inch bench marks in warp and fill direction, place on aluminum or stainless plate in changing air over.

Table 3 - Requirements for unreinforced rubber sheeting

| Test description | | Requirements | | Test method |
|---|--------------------|--------------|---------|--|
| | | Type A | Type B | |
| Tensile strength, minimum | lb/in ² | 1,200 | 1,200 | ASTM-D-412 |
| Modulus at 300% elongation, minimum | lb/in ² | 600 | 600 | ASTM-D-412 |
| Ultimate elongation, minimum | pct | 300 | 300 | ASTM-D-412 |
| Shore "A" hardness | | 60 ± 10 | 60 ± 10 | ASTM-D-2240 |
| Ozone resistance, procedure "A" | | | | ASTM-D-1149 |
| No cracks, 50 pphm at 100 °F, 20% elongation | days | 7 | -- | ASTM-D-518 |
| No cracks, 100 pphm at 100 °F, 50% elongation | days | -- | 7 | ASTM-D-518 |
| Heat aging, 7 days at 212 °F | | | | ASTM-D-573 |
| Tensile strength retained | pct | 75 | 75 | |
| Elongation retained | pct | 75 | 75 | |
| Water vapor permeability at 80 °F, maximum | perm mil | 0.002 | 0.05 | ASTM-E-96 (procedure BW) |
| Tear resistance, minimum | lb/in ² | 150 | 150 | ASTM-D-624 Die "B" |
| Dimensional stability, 7 days at 212 °F | | | | |
| Change in length or width | pct | ± 0.5 | ± 0.5 | |
| Commercial field splice strength 60 shear force minimum tensile | pct | 60 | 60 | Commercial field splice, in 1-inch wide strip pulled in shear at 10 in/min, after 7-day cure at room temperature |

NOTE: Type "A" sheeting is recommended for general-purpose outdoor use. Type "B" material is recommended for use if an extreme outdoor environment requires a highly weatherable lining.

Table 4 - Requirements for polyvinyl chloride plastic sheeting

| Test description | | Requirements | Test method |
|--|--------------------|--------------|------------------------------------|
| Tensile strength, each direction, minimum average | lb/in ² | 2,000 | ASTM-D-882 |
| Elongation break, minimum | pct | 250 | ASTM-D-882, Method A |
| Volatile loss, maximum | pct | 0.7 | ASTM-D-1203, Method A |
| Tear resistance, each direction, minimum | g/mil | 160 | ASTM-D-1922 |
| Resistance to soil burial (percent change maximum in original value) | | | ASTM-D-3083 (120-day soil burial) |
| Breaking factor | pct | -5 | |
| Elongation at break | pct | -20 | |
| Modulus at 100% elongation | pct | + 10 | |
| Bonded seam strength, percent breaking factor | pct | 80 | ASTM-D-3083 Para. 9.3 (1-in width) |

Table 5 – Unreinforced chlorosulfonated polyethylene

| Test description | | Minimum Requirements | Test method |
|---|--------------------|----------------------|----------------------|
| Tensile strength, minimum pounds per square inch | lb/in ² | 2,000 | ASTM-D-412 |
| Ultimate elongation, minimum | pct | 250 | ASTM-D-412 |
| Ozone resistance, 50 pphm, 20% strain, 100 °F, 8,000 hr | pct | + 0 | ASTM-D-1149 |
| Heat aging, 14 days at 212 °F | | | ASTM-D-412 |
| Tensile strength, minimum pounds per square inch | pct | 1,000 | |
| Elongation at break | pct | 150 | |
| Tear resistance, minimum | lb/in | 250 | ASTM-D-624 Die B |
| Commercial field splice | | | ASTM-D-882, Method A |
| Strength, shear force, minimum tensile | pct | 60 | 7 days cure |
| Weight change after 7 days at 70 °C in water maximum | pct | 5 | ASTM-D-471 |

Table 6 – Reinforced chlorosulfated polyethylene

| Test description | Minimum Requirements 30 mils thick and greater | | Test method |
|---|---|------|---|
| | | | |
| Breaking strength, minimum | | | ASTM-D-751 |
| Rubber | lb/in | 100 | |
| Fabric | lb/in | 75 | |
| Ultimate elongation, maximum | | | ASTM-D-751 |
| Rubber | pct | 150 | |
| Fabric | pct | 20 | |
| Ozone resistance, 50 pphm, 20% strain at 100 °F, 8,000 hr | pct | +/-0 | ASTM-D-1149 |
| Hydrostatic strength after ozone exposure, 7 days (Mullen), percent retained | pct | 100 | Fed. Spec. CCC 191b Method 5512, ASTM -D-518 |
| Heat aging, 14 days at 212 °F of original | | | |
| Tensile strength | pct | 90 | |
| Elongation percent retained of original | pct | 90 | |
| Tear resistance, pounds minimum | | | ASTM-D-751 (Tongue) |
| Warp or fill direction | pct | 10 | |
| Puncture resistance, pounds minimum | pct | 120 | FTMS 101B, Method 2031 |
| Commercial field splice | | | |
| Strength - shear force, percent of minimum break | pct | 75 | ASTM-D-882, 7 days cure |

Table 7 - Requirements for high density polyethylene (HDPE)

| Test description | Requirements | | Test method |
|---|--------------|---------|--------------------------------------|
| | Type A | Type B | |
| Minimum tensile properties (each direction) | | | ASTM-D-638 |
| 1. Tensile strength yield (pounds/ inch width) | 120 | 150 | |
| 2. Tensile strength at break (pounds/ inch width) | 120 | 150 | |
| 3. Elongation at yield (percent) | 10 | 10 | |
| 4. Elongation at break (percent) | 500 | 500 | |
| 5. Modulus of elasticity (pounds/ sq in.) | 80,000 | 80,000 | |
| Tear resistance (pounds, minimum) | 40 | 50 | ASTM-D-1004 |
| Low temperature | - 40 °F | - 40 °F | ASTM-D-746 |
| Dimensional stability (each direction, percent change, maximum) | +/- 3 | +/- 3 | ASTM-D-1204 212 °F, 15 min |
| Resistance to soil burial (percent change maximum in original value) | | | ASTM-D-3083 (120-day soil burial) |
| 1. Tensile strength yield | +/- 10 | +/- 10 | |
| 2. Tensile strength at break | +/- 10 | +/- 10 | |
| 3. Elongation at yield | +/- 10 | +/- 10 | |
| 4. Elongation at break | +/- 10 | +/- 10 | |
| 5. Modulus of elasticity | +/- 10 | +/- 10 | |
| Bonded seam strength (factory seam, breaking factor, pounds/ inch width) | 108 | 135 | ASTM-D-3083 |
| Environmental stress crack (minimum, hours) | 500 | 500 | ASTM-D-1693 |

Table 8 - Requirements for supported extruded polyurethane

| Property | Test Method | Supported finished material ² | | | |
|--|---|--|---------------------------|--------------------|--------------------|
| | | Type 1 | Type 2 | Type 3 | Type 4 |
| Thickness | ASTM-D-751 | | | | |
| 1. Overall (mils, minimum) | | 25 | 45 | 30 | 70 |
| Minimum Tensile Properties | ASTM-D-751 | | | | |
| 1. Breaking Strength (pounds, minimum) | | | | | |
| fabric TD | | 50 | 70 | 110 | 100 |
| fabric MD | | 70 | 120 | 120 | 140 |
| composite MD | | 90 | 160 | 130 | 220 |
| composite TD | | 75 | 160 | 130 | 160 |
| Tear Strength (pounds minimum) composite | ASTM-D-751 Tongue Method 8x8-in sample | | | | |
| 1. Initial | | 2.5 | 4.5 | 35 | 4.5 |
| 2. After Heat Aging | 212 ⁰ F, 30 days | 2.5 | 4.5 | 35 | 4.5 |
| Low Temperature Composite | ASTM-D-2136 1/8 in mandrel 4 hr, Pass | -40 ⁰ F | -40 ⁰ F | -40 ⁰ F | -40 ⁰ F |
| Unsupported sheet, 100 mils | | | below - 60 ⁰ F | | |
| Dimensional Stability (each direction percentage change maximum) | ASTM-D-1204 212 ⁰ F, 30 days | -0.8 | -0.5 | -1.3 | -0.7 |
| Resistance to Soil Burial (percent change maximum in original values) | ASTM-D-3083 356-day soil burial 30-mil sheet (as modified in Appendix A) | | | | |
| a. Unsupported sheet | ASTM-D-882 | | | | |
| 1. Breaking Factor | | | | +15 | |
| 2. Elongation at Break | | | | -15 | |
| 3. Initial Modulus | | | | +30 | |
| b. Membrane Fabric Breaking Factor | ASTM-D-751 | TBD | TBD | TBD | TBD |
| Bonded Seam Strength (pounds, minimum) | ASTM-D-751 (As modified in Appendix A, 12 in/min) | | greater than single layer | | |
| Hydrostatic Resistance (pounds per square inch, minimum) | ASTM-D-751 Method A, Procedure I | 80 | 210 | 250 | 280 |
| Ozone Resistance | ASTM-D-1149 (As modified in 7 days, 100 pphm 104 ⁰ F, 1/8 in bent loop) | | | N/A | |
| Ply Adhesion (each direction, pounds/in. width minimum) | ASTM-D-413 Machine Method Type A | | | N/A | |
| Volatile Loss, percent (Unsupported) | ASTM-D-1203 Method A 30 mil sheet | | | 0.4 | |
| (Puncture Resistance, pounds) | FTMS 101B (Method 2065) | 25 | 50 | 45 | 70 |