NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

POND SEALING OR LINING

FLEXIBLE MEMBRANE LINING

(number)
CODE 521A

DEFINITION

Installing a fixed lining of impervious material or treating the soil in a pond mechanically or chemically to impede or prevent excessive water loss.

PURPOSE

Reduce seepage losses in ponds to an acceptable level.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where water loss from a pond through leakage is or will be of such proportion as to prevent the pond from fulfilling its planned purposes or where leakage will damage land and crops and cause waste of water or environmental problems.

CRITERIA

Ponds to be lined shall be constructed to meet NRCS Conservation Practice Standards for IRRIGATION PITS (552A) OR REGULATING RESERVOIRS (552B), IRRIGATION STORAGE RESERVOIRS (436), POND (378), WASTE TREATMENT LAGOON (359), WASTE STORAGE PONDS (425), or WILDLIFE WATERING FACILITIES (648), as appropriate.

Flexible membrane linings shall be suitably constructed of high-quality materials and shall be certified by the manufacturer to be suitable for this use. Pigmented polyvinyl or polyethylene plastics, rubber, and similar materials that are highly resistant to bacteriological deterioration shall be acceptable base materials.

All plastic membranes shall have a cover of earth or earth and gravel not less than 5 inches thick. Rubber membranes need not be covered unless the areas will be traveled by livestock. In those areas, a minimum cover of 9 inches shall be used on all types of flexible membranes. The soil material in the bottom 3 inches of the cover shall not be coarser than silty sand.

The quality of all membranes shall meet or exceed the attached specifications for materials for polyethylene and rubber (tables 1, 2, and 3). Polyvinyl chloride membranes shall meet the requirements of ASTM Specification D3083. Minimum nominal thickness shall be:

Soil material not coarser than-	Plastic sheeting	Rubber sheeting - Reinforced	Rubber sheeting - Unreinforced
Gravel (GC, GM, GP, GW)	2	30	30
Sands (SM, SP, SW)	8	20	30

PLANS AND SPECIFICATIONS

Plans and specifications for sealing ponds with flexible membrane linings shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

A maintenance job sheet or maintenance plan shall be provided. It shall provide recommendations to maintain the pond seal.

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INSTALLATION

Subgrade preparation. The area to be lined shall be drained and allowed to dry until the surface is firm and can support the men and equipment that must travel over it during installation of the lining. All banks and fills in the area to be lined must be sloped no steeper than 1 to 1 for exposed linings and 2-1/2 horizontal to 1 vertical for buried linings.

The foundation area for flexible membrane linings shall be smooth and free of projections that can damage the lining. Stumps and roots shall be removed. Rocks, hard clods, and other such material shall be removed, rolled so as to provide a smooth surface, or covered with a cushion of fine soil. If needed, an effective sterilant shall be applied to the subgrade at the rate recommended by the manufacturer.

An anchor trench shall be excavated completely around the area to be lined at the planned elevation of the top of the lining. The trench shall be 8 to 10 inches deep and about 12 inches wide. All lining material shall be free of damage or defect. Each package delivered to the job site shall bear the name or symbol, the quantity therein, and the thickness or weight of the material.

Placement. Membranes shall be loosely spread over the subgrade. Polyethylene film requires about 5 percent slack for satisfactory results.

All field splices shall be made according to the manufacturer's recommended technique, using materials furnished for the purpose. The joints shall be watertight and capable of maintaining their integrity throughout the expected life of the lining.

Approximately 8 inches of the top of the lining shall be placed in the anchor trench and anchored with compacted backfill.

For covered membranes, the material to be used as a protective cover shall be free of large clods, sharp rocks, sticks, and other objects that can puncture the lining. The cover shall be placed to the specified depth without damage to the membrane.

MATERIALS

All materials are to meet the requirements indicated in tables 1, 2, and 3, as appropriate.

Table 1. --Requirements of polyethylene and ethylene co-polymer plastic film

Test description	Requirements: Type I polyethylene	Requirements: Type II co-polymer	Test method
Tensile strength, each direction, minimum average (pound per square inch)	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 (cf/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 ASTM-D-3083
Soil burial			
Tensile strength change, each direction, maximum (pct)	5	5	
Elongation loss, each direction, maximum (pct)	20	20	
Luminus transmittance, maximum (pct)	1.0	1.0	National Bureau of Standards Publication PS-17

Table 2. - Requirements of reinforced rubber sheeting

Test description	Requirements: Up to 20 mil thick	Requirements: 20 mil thick and greater	Test method
Breaking strength, minimum			ASTM-D-751
Warp direction (lb/in)	75	100	
Fill direction (lb/in)	75	100	
Ultimate elongation, maximum			ASTM-D-751
Warp direction (pct)	30	30	
Fill direction (pct)	30	30	
Ozone resistance, procedure B			ASTM-D-1149
50 pphm, 100°F (days)	7	7	ASTM-D-518
Hydrostatic strength retained after ozone exposure (7 days) (Mullen) (pct)	100	100	Federal Specifications CCC-T-191b. Method 5512 ASTM-D-518
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	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) No cracking or flaking	-40°F	-40°F	Federal Specification CC-T-191b., Method 5874
Commercial field splice strength Shear force, minimum Tensile (pct)	75	75	Commercial field splice 1-in.wide strip, pulled in shear at 10 in./min after 7 days cure at room temperature.

(1) 1-ft^2 sample, 10 in. bench marks in warp and fill direction, placed on aluminum or stainless plate in changing air over.

Table 3. - Requirements of unreinforced rubber sheeting

Test description	Requirements Type A	Type B	Test method	
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
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, 100°F--20% elongation (days)	7	--	ASTM-D-518	
No cracks, 100pphm, 100°F--50% elongation (days)		7	ASTM-D-518	
Heat aging, 7 days at 212°F			ASTM-D-518	
Tensile strength retained pct	75	75		
Elongation retained (pct)	75	75		
Water vapor permeability at 80°F maximum (perm/mil)	.002	.05	ASTM-E-96, (Procedure BW)	
Tear resistance, minimum (lb/in2)	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			Commercial field splice, 1-in.-wide strip pulled	
Tensile (pct)	60	60	in shear at 10 in./min, after 7 days 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.