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DOCKET NO. 40-8768

JUL 15 1981

Kerr-McGee Corporation  
 ATTN: Mr. W. J. Shelley  
 Vice President, Nuclear  
 Licensing & Regulation  
 Kerr-McGee Center  
 Oklahoma City, Oklahoma 73125

Gentlemen:

We received your letter of June 26, 1981, and check for \$150 for an amendment to License SUA-1387.

Your request has been classified by the Licensing staff as requiring a major amendment to the License. Therefore, a major safety and environmental amendment fee of \$4,200 is required, as specified in fee Category 2B of Section 170.31 of Part 170, copy enclosed. Payment of the additional \$4,050 should be made to the U.S. Nuclear Regulatory Commission and mailed to my attention. When submitting the fee, please refer to CONTROL NUMBER 10206.

Please note Footnotes 1(d) and 4 of Section 170.31, which provide that upon completion of the licensing review, the Commission will review its expenditures for professional manpower and appropriate support services; recompute the amendment fee, and, if necessary, make any refund.

Sincerely,

Original Signed By  
 J. D. Weiss

Douglas Weiss  
 License Fee Management Branch  
 Silver Spring Office  
 Office of Administration

Enclosure:  
 10 CFR 170

OFFICE	LFMB:ADM.						
SURNAME	DWeiss:rej						
DA	7/7/81						
REC FOR	8109020063 810626						
	PDR ADDCK 04008768						
	PDR						



# KERR-MCGEE NUCLEAR CORPORATION

KERR-MCGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

May 21, 1981

Mr. Bill Slifer  
Watersaver Company  
P.O. Box 16465  
Denver, CO 80216

Dear Mr. Slifer:

Subject: Hypalon Liners

Water saver is providing hypalon liners for a small two-cell evaporation pond (100'x100' cell) to be constructed near Kerr-McGee's Bill Smith mine in Converse County, Wyoming. The pond is for a uranium in-situ leach project, and the Nuclear Regulatory Commission (NRC) has requested that technical data on the liner material be submitted for NRC review. The composition of the waste water is expected to be generally as follows:

Sodium	- 15-20 grams per liter
Chloride	- 25-35 grams per liter
Bicarbonates	- 5- 8 grams per liter
Ammonia	- 3- 5 grams per liter
Uranium	- 5-10 milligrams per liter
Radium 226	- 50-100 picocuries per liter
Hydrocarbon	- None
pH	- 6- 9
Temperature	- Ambient temperature

Any information that you can provide in this area that would be suitable for submitting to the NRC would be greatly appreciated.

Sincerely,

M.D. Freeman  
Director, Chemical Mining

MDF:kb



# WATERSAVER COMPANY, INC.

P.O. BOX 16465 DENVER, COLORADO 80216 (303)623-4111

TWX 910-931-0433

May 26, 1981

Mr. M.D. Freeman  
Director, Chemical Mining  
Kerr-McGee Nuclear Corp.  
Kerr McGee Center  
Oklahoma City, OK 73125

Dear Mr. Freeman:

Thank you for your letter dated May 21, 1981.

Please find enclosed our Hypalon Information Manual on our Industrial Grade .036 mil Hypalon 10x10-1000d polyester. This is the material we are supplying to your Bill Smith Mine.

We have provided this material in the past to your Gore & Grants facilities. Attached is a partial list of over 17,000,000 sq.ft. of this material.

~~Based~~ on the anticipated waste stream in your letter, we find it in line ~~with~~ other projects.

Please let us know when we can be of additional help.

Very truly yours,

WATERSAVER COMPANY, INC.

Bill Slifer  
Vice-President

BS/lr

Encl.



Specialists fabricating membrane liners for liquid containment

PVC — CPE — EPDM — HYPALON® — NEOPRENE — BUTYL — URETHANE — OTHERS



**HYPALON INFORMATION  
MANUAL**

**WATERSAVER COMPANY, INC.**

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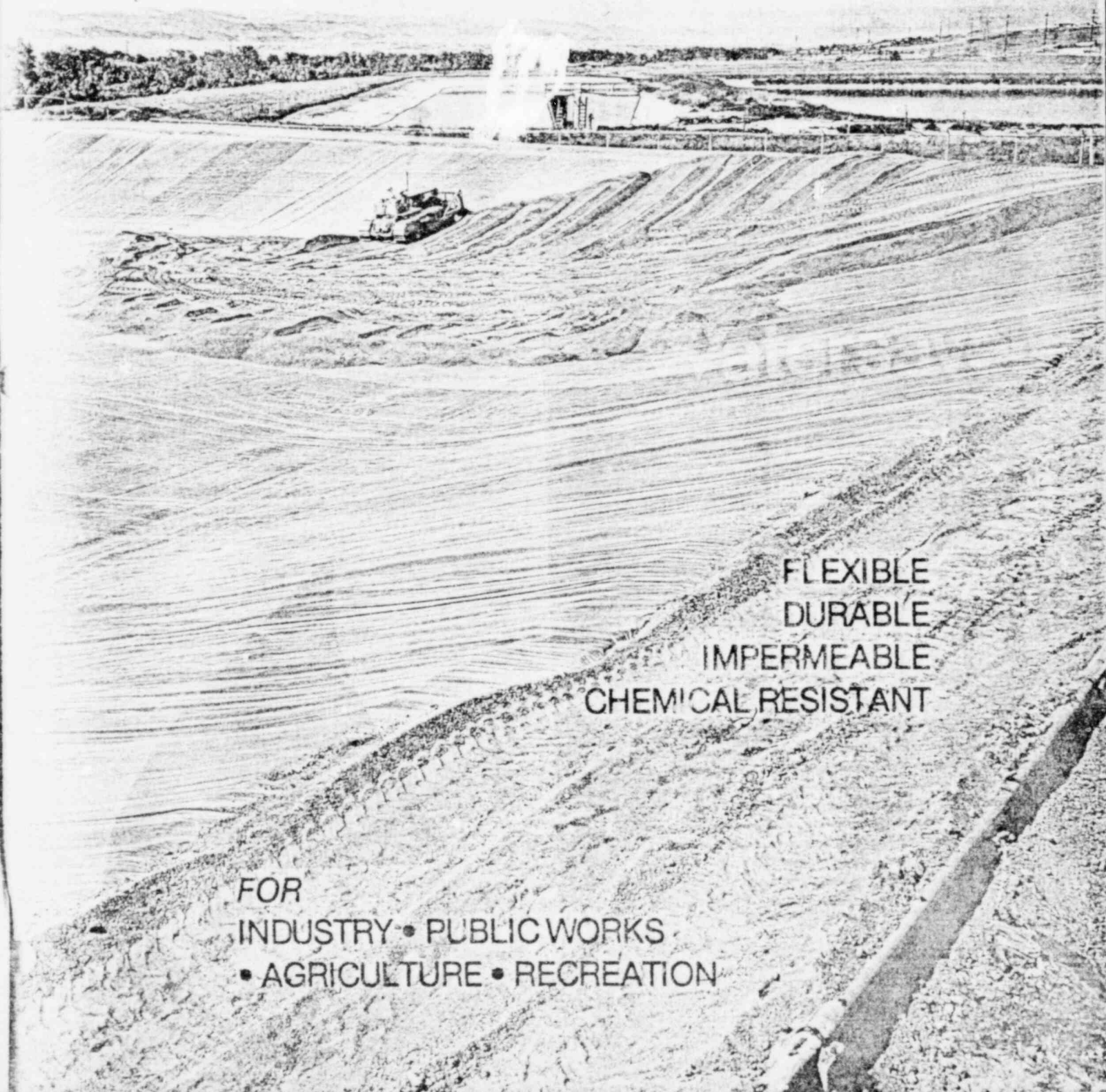
STEVENS WARRANTY

WATERSAVER WARRANTY



# Watersaver

MEMBRANE LININGS



FLEXIBLE  
DURABLE  
IMPERMEABLE  
CHEMICAL RESISTANT

FOR  
INDUSTRY • PUBLIC WORKS  
• AGRICULTURE • RECREATION



## WATERSAVER COMPANY, INC.

A company dedicated to service! For over twenty-five years we have been supplying membrane linings for installations throughout the world.

Watersaver Company growth and progress parallels the history of flexible membrane liners as used for liquid containment. We continue to develop lining systems and techniques for controlling fluids, water pollution and preventing seepage.

Our experienced personnel have provided engineers with the professional know-how to assist many companies in solving their particular containment problems.

Watersaver membrane lining systems are in wide use throughout the world in water reservoirs, industrial waste ponds, chemical and brine storage, sewage lagoons and canals.

Watersaver Company, inc. is the world's foremost fabricator of flexible membrane linings with two plants to serve you.

We have furnished liners for more installations than anyone in the world.

## WATERSAVER INTERNATIONAL, LTD.



## WATER POLLUTION CONTROL

Water quality awareness has developed a keen interest in pollution control in the world and particularly in the United States.

Congress has passed the Federal Water Pollution Control Act with the goal of eliminating discharge of pollutants by 1985. Under the Safe Drinking Water Act of 1974, States must now set their own standards for protecting ground water.

To meet this challenge, Watersaver Company adapted the use of its membrane lining systems to the problems of pollution control.

## SEEPAGE PREVENTION

Federal and State pollution control agencies are demanding the control of seepage that pollutes ground water endangering life.

Watersaver Company works with engineers, architects, technicians, farmers, ranchers, industrialists and governmental agencies throughout the world, demonstrating how seepage problems are solved quickly - economically - and permanently with the proper installation and use of a membrane lining system.

# Watersaver

## THE PROFESSIONALS

Saving water is our business...and that's exactly what we do! This informative brochure introduces you to our **Membrane Lining Systems**. If you have a liquid containment problem, for action **CONTACT THE PROFESSIONALS!**

## PRODUCT FEATURES

FLEXIBLE • DURABLE • IMPERMEABLE • CHEMICAL RESISTANT • WIDE PANELS • LATEST FABRICATION TECHNOLOGY • ECONOMICAL

## USES

INDUSTRIAL PONDS • BRINE PITS • IRRIGATION RESERVOIRS • FIRE WATER STORAGE • SOLAR EVAPORATION PONDS • CANAL LININGS • FLY ASH & SOLID WASTE LEACHATE CONTROL • LANDSCAPE LAKES • SEWAGE LAGOONS • COOLING PONDS • SLUDGE DRYING BEDS • OIL SPILL CONTAINMENT • POTABLE WATER RESERVOIR LININGS & COVERS • AND MANY OTHERS

## COVER PHOTO

Photo shows a protective earth cover being placed on a Watersaver Liner. This is the third industrial waste pond lined by Watersaver in five years at this location.



# Watersaver

## MEMBRANE LININGS

### PIONEERING MANUFACTURING TECHNIQUES

Plants and equipment are only as effective as the people who run them. At Watersaver Company we employ experienced personnel for efficient design, engineering and product construction concepts. All system planning, engineering, design and fabrication are worked out in advance through modern technology and machinery. Watersaver Company makes certain that quality is maintained by responsible factory trained employees. We provide assistance to Engineers and Contractors in the design and installation of lining materials.

#### HYPALON®

(Chlorosulfonated Polyethylene)

...provides excellent resistance to weathering and chemical attack. Hypalon is available only as a reinforced membrane and does not require a protective cover for most applications. Hypalon is approved for potable water containment.

#### PVC (Polyvinyl Chloride)

...membrane offers good chemical resistance, sealability, and serviceability in unexposed applications. It has performed satisfactorily as a liner for recreational lakes, canals, evaporation ponds, sewage lagoons, brine ponds, etc. It is recommended that an earthen cover be provided for PVC to maximize its service life as a fluid barrier.

#### OR CPE (Chlorinated Polyethylene)

...specifically formulated for resistance to oils. Membrane features excellent weatherability, sealability, chemical resistance and long term durability. CPE does not require a cover material for most applications.

#### OR CPER

(Reinforced Chlorinated Polyethylene)

...specifically formulated for resistance to oils. Offers all of the desirable characteristics of Watersaver CPE and in addition, provides greater strength and resistance to creep, sagging, and puncture where conditions of use are severe, such as steep slopes or other high stress applications.

#### EPDM

(Ethylene Propylene Diene Monomer)

...has been used for roofing and lining applications for many years. Superior weathering and elongation characteristics have made EPDM the most widely used single ply roofing membrane in the U.S.A.

#### EPDM R (Reinforced EPDM)

...has the superior weathering characteristics of the non-reinforced EPDM with additional strength and tear resistance required by some applications. Many potable water reservoirs are rehabilitated with EPDM R or Hypalon.

NOTE: Product information is of a general nature. Specific application may vary.



# GENERAL MEMBRANE LINER INFORMATION

## FACTORY FABRICATION

Just as you know there is no one liner that meets all containment problems - there is no one system of fabrication that best serves each liner to be fabricated.

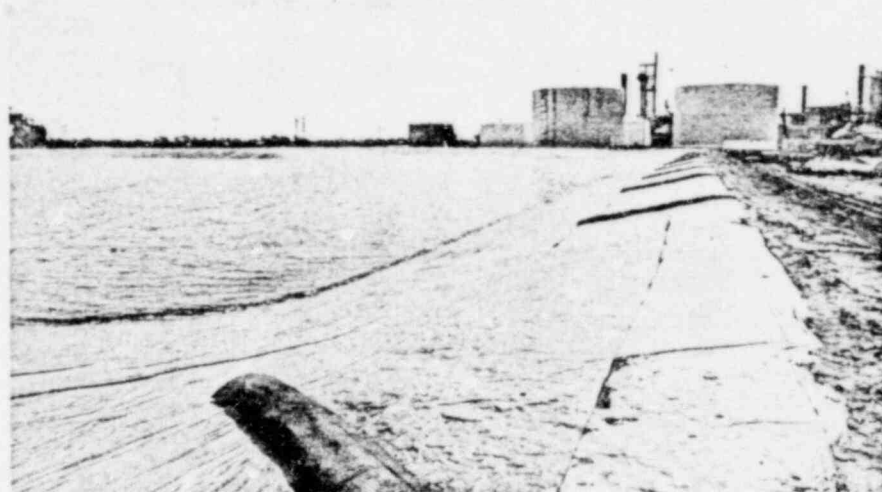
Watersaver has all fabrication systems and specifically uses the best sealing method for each membrane. Today's state of the art demands it - and Watersaver leads the way - Rigid Quality Control is your assurance of the World's finest membrane linings from Watersaver Company.

## FACTORY FABRICATED ACCESSORIES

Watersaver Company takes pride in its fabrication facility. Factory fabricated accessories such as pipe seals, corners, berm vents, ballast tubes, pressure relief vents and sump liners are available to complete the Watersaver Membrane Lining System.

## MEMBRANE CHARACTERISTICS

Watersaver Company membrane linings meet the most rigid specifications in the industry. Reinforced or non-reinforced lining materials may be selected in a variety of thicknesses ranging from .25 mm to 1.5 mm (10 to 60 mils). Material selection is based on specific project requirements.



## PANEL SIZES

Watersaver panels are custom fabricated to specific project requirements to minimize field splices and installation time. Panel widths to 45 meters (150 ft.) are available.

## INSTALLATION

Watersaver membrane lining systems are easily installed. A technical service representative is available from Watersaver Company to instruct the installa-

tion contractor in recommended procedures.

## ECONOMY

Watersaver membrane lining systems are economical and long lasting. We stock all lining materials and match the specific project requirements with the particular membrane lining system that most economically meets those requirements.

	OIL RESISTANT POLYVINYL CHLORIDE (ORPVC)							
	ISOBUTYLENE ISOPRENE (BUTYL) (IIR)							
	POLYCHLOROPRENE (NEOPRENE) (CR)							
	ETHYLENE PROPYLENE DIENE MONOMER (EPDM)							
	CHLOROSULFONATED POLYETHYLENE (HYPALON) (CSM)							
	CHLORINATED POLYETHYLENE (CPE)							
	POLYVINYL CHLORIDE (PVC)							
EXPOSED LINER	NR	R	RR	R	R	R	R	NR
EXPOSED SIDE SLOPE LINER	NR	RR	RR	RR	RR	RR	RR	NR
BURIED LINERS	R	R	RR	R	R	R	R	R
ACID RESISTANCE pH 2 to 7	R	R	RR	R	R	R	R	R
ALKALINE RESISTANCE pH above 8	NR	R	RR	R	R	R	R	NR
PETROLEUM PRODUCTS	NR	R	NR	NR	R	NR	R	R
POTABLE WATER	NR	R	RR	R	NR	R	NR	NR
DOMESTIC WASTE	R	R	RR	R	R	R	R	R
ROOFING MEMBRANE	NR	R	NR	R	R	NR	NR	NR

R - RECOMMENDED    RR - RECOMMENDED ONLY WITH REINFORCING    NR - NOT RECOMMENDED

THE ABOVE ARE GENERAL GUIDELINES ONLY. MATERIAL SELECTION SHOULD BE BASED ON SPECIFIC PROJECT REQUIREMENTS. CONTACT WATERSAVER FOR RECOMMENDATIONS.

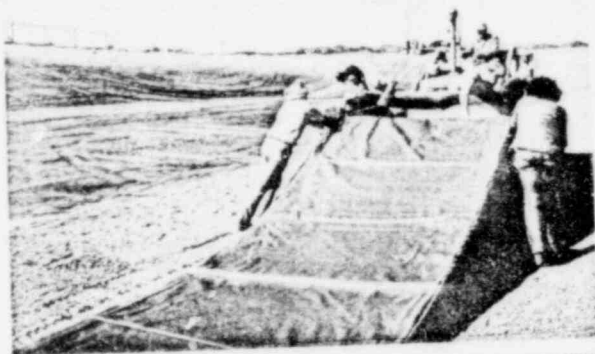
Have a question about liners? Call Toll Free 800-525-2424



#### SITE PREPARATION

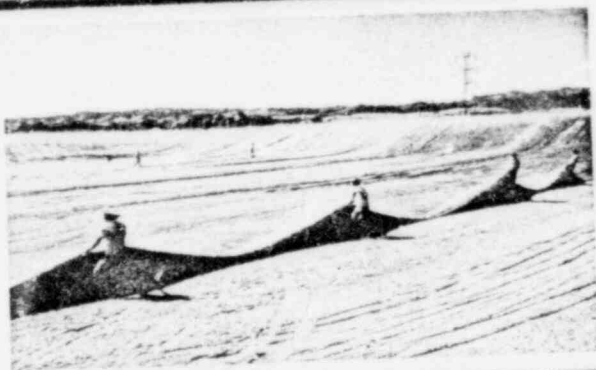
Excavation is completed by the earthmoving contractor. The base upon which the liner will be placed must be smooth, compacted and free of sharp rocks, roots and other foreign material, meeting the Engineer's specifications.

Structures including pipes, splash pads, inlets, outlets, and headwalls should be finished prior to placement of the liner.



#### POSITIONING THE PANEL

Liner panels may weigh as much as 2000 kg (4500 lbs.), therefore a large front end loader or forklift will assist in positioning the lining panels which are accordion folded in cartons on pallets.



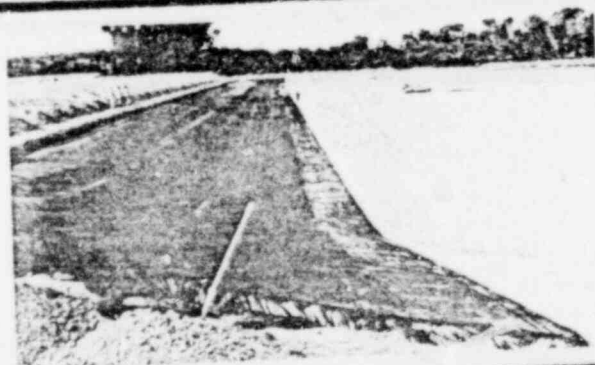
#### SPREADING THE PANEL

A crew of eight to ten men is needed to spread the panels to their full width. This crew installed 1 hectare (2.5 acres) in 8 hours.



#### FIELD SPLICING OF LARGE PANELS

Large factory fabricated panels are easily spliced together using specially formulated cements and adhesives developed by Watersaver Company.



#### ANCHORING TRENCH

Liner panels are anchored in a trench at the top of the slope. The flat sheet conforms to the substrate in the corner.



# WATERSAVER COMPANY, INC.

POST OFFICE BOX 16465 • DENVER, COLORADO 80216 • (303) 623-4111  
Plant and Office - 3560 Wynkoop Street

## PARTIAL LIST OF URANIUM COMPANIES Using Watersaver Liners

<u>COMPANY</u>	<u>MATERIAL</u>	<u>SIZE</u>	<u>LOCATION</u>
Anaconda	PVC/CPE	5,500,000 sq.ft.	Bluewater, N.Mexico
Anaconda	Hypalon	3,800,000 sq.ft.	Bluewater, N.Mexico
Cotter Corporation	Hypalon	8,000,000 sq.ft.	Canon City, Colo.
Cyprus Mines Corp.	Butyl	30,000 sq.ft.	Wilcox, Arizona
Exxon Nuclear	CPER	25,000 sq.ft.	Douglas, Wyoming
Exxon	Hypalon	800,000 sq.ft.	Washington State
Kerr McGee	Butyl	40,000 sq.ft.	Grants, N.Mexico
Kerr McGee	EPDM	120,000 sq.ft.	Crescent, Oklahoma
Kerr McGee	PVC/CPE	6,000,000 sq.ft.	Grants, N.Mexico
Kerr McGee	Hypalon	1,500,000 sq.ft.	Grants, N.Mexico
Minerals Exploration	Hypalon	2,500,000 sq.ft.	Rawlins, Wyoming
Mobil	CPE	55,000 sq.ft.	Crown Point, N.Mexico
Ortloff Minerals	Hypalon	180,000 sq.ft.	Naturita, Colo.
Ranchere Exploration	Hypalon	180,000 sq.ft.	Naturita, Colo.
Rocky Mtn. Energy	Hypalon	200,000 sq.ft.	Wright, Wyoming
Western Nuclear	PVC	180,000 sq.ft.	Jeffery City, WY
Wyoming Minerals	CPE	600,000 sq.ft.	Brine, Texas



# WATERSAVER COMPANY, INC.

P.O. BOX 16465    ☎ DENVER, COLORADO 80216    ☎ (303)623-4111

TWX 910-931-0433

Material: .036 Industrial Grade Hypalon  
Reinforced with 10x10, 1000  
Polyester Scrim

Manufactured by: Stevens Elastomeric  
and Plastic Product, Inc.  
a Subsidiary of J.P. Stevens Co.  
26 Payson  
Easthampton, MA 01027

Fabricated by: Watersaver Company, Inc.  
3560 Wynkoop  
P.O. Box 16465  
Denver, CO 80216

Similar Material: Fabricated by Watersaver Company  
in Excess of 50 Million Square Feet

Independent Testing Laboratory: Hauser Laboratory  
5680 Central Ave.  
Boulder, CO 80302  
Phone: (303) 443-4662

Delivery: To Jobsite

05-14-81



Specialists fabricating membrane liners for liquid containment  
PVC — CPE — EPDM — HYPALON\* — NEOPRENE — BUTYL — URETHANE — OTHERS

# ENGINEERING SPECIFICATION GUIDE

## 036 INDUSTRIAL GRADE HYPALON®

### SUPPORTED WITH 10x10 1000D SCRIM

#### 1. SCOPE

1.1 The scope covered by these specifications covers the furnishings and installation of a fabric-reinforced Hypalon lining. All work shall be done in strict accordance with the engineers drawings and specifications.

#### 2. CONTRACTOR'S EXPERIENCE

2.1 Any contractor proposing to perform the work hereunder shall have demonstrated his ability to do the work by having successfully installed at least two million square feet of reinforced membrane lining.

#### 3. LINING MATERIAL

3.1 The membrane used for lining material shall be fabric-reinforced Hypalon of new, first-quality products designed and manufactured specifically for the pur-

pose of this work, and shall have been satisfactorily demonstrated by prior use to be suitable and durable for such purposes. The manufacturer shall have produced, and have in service in similar applications for a period of not less than one (1) year, at least ten (10) million square feet of fabric-reinforced Hypalon material utilizing the same scrim specified for use under these specifications.

3.2 Hypalon utilized for encapsulation of the scrim shall be manufactured from a composition of high quality ingredients, suitably compounded, of which Hypalon 45 synthetic rubber resin is the sole elastomer. Zinc compounds of any kind, including zinc oxide, zinc stearate and zinc dusting agents, are prohibited. Dusting agents of any kind are prohibited on the finished product.

<u>Property</u>	<u>Test Method</u>	<u>Specification</u>
Tensile Strength	ASTM D-412	1500 psi min.
Elongation @ Break	ASTM D-412	300% min.
Water Absorption	ASTM D-471 (7 days @ 70°F)	2% (wt) max.
Cold Bend (36 mil specimen, reinforced)	ASTM D-2136 (1/8" mandrel)	-45°F, no cracks
Brittleness Temp. (30 mil specimen, unreinforced)	ASTM D-746 Procedure B	-45°F, no failures
Ozone Resistance	ASTM D-1149 (3 ppm @ 30% strain @ 104°F — 72 hours)	No effect
Heat Aging Tensile Strength Elongation @ Break	ASTM D-412 (14 days @ 212°F)	1500 psi min. 150% min.

*All test values are based on .030" specimens.*

3.3 Scrim used in the membrane shall be 10 x 10 1000D polyester of an open type weave that permits strike-through of the Hypalon through the fabric to facilitate adhesion between the plies of Hypalon. The fill yarn must have 2.5 turns per inch maximum and 2.0 turns per inch minimum. All selvage edges must be trimmed prior to applying the Hypalon coating.

3.4 The composite membrane material shall consist of a thoroughly bonded, fabric-reinforced Hypalon rubber sheeting. It shall be manufactured by the calendaring process and shall be uniform in color, thickness, size, and surface texture. The fabric shall be totally encapsulated between plies of Hypalon and shall not

extend closer than 1/8 inch to the edge of the Hypalon coating either side of the fabric. Exposed fabric along longitudinal edges of roll stock and indications of delamination will not be permitted. The composite material shall be a flexible, durable, watertight product free of pinholes, blisters, holes, and contaminants and shall not delaminate in a water environment.

The composite membrane material shall be fabric-reinforced Hypalon consisting of one ply of scrim and two plies of Hypalon as manufactured by Stevens Elastomeric And Plastic Products Inc., Easthampton, Massachusetts or approved equal.

© DuPont's trademark

**WATERSAVER COMPANY, INC.**

Property	Test Method	Specification
Thickness	ASTM D-751	.036 and not less than .033
Strength:		
Warp	ASTM D-751	200 Lbs.
Fill	Grab Method	200 Lbs.
Tear:		
Warp	ASTM D-751	80 Lbs.
Fill	Tongue Method	80 Lbs.
Puncture Resistance	FTM-101 <sup>B</sup> -2031	180 Lbs.

3.5 The fabricator shall be an experienced firm customarily engaged in factory-fabricating individual widths of fabric-reinforced Hypalon roll stock into large sheets. Factory seams shall have a minimum of 1-1/2" scrim to scrim overlap when made by the solvent seaming method, and 3/8 inch scrim to scrim overlap when made by the heat welded method.

Each factory-fabricated sheet shall be given prominent, unique indelible identifying markings indicating proper direction of unrolling and/or unfolding to facilitate layout and positioning in the field. Each factory-fabricated sheet shall be individually packaged in a heavy cardboard or wooden crate fully enclosed and protected to prevent damage to it during shipment, prominently identified in the same fashion as the sheet within and showing the date of shipment. Until installed, factory-fabricated sheets shall be stored in their original unopened crates; if outdoors, they shall be stored on pallet and shall be protected from the direct rays of the sun under a light-colored heat-reflective opaque cover in a manner that provides a free-flowing air space between the crate and cover.

#### 4. OTHER MATERIALS

4.1 Solvent for cleaning contact surfaces of field joints and for other required uses shall be as recommended by the manufacturer or approved fabricator of the fabric-reinforced Hypalon.

4.2 All seaming, sealing and high-solids adhesives shall be of a type or types recommended by the manufacturer or approved fabricator of the fabric-reinforced Hypalon and shall be delivered in original sealed containers each with an indelible label bearing the brand name and complete directions as to proper storage, use and application of the adhesive.

#### 5. INSTALLATION

5.1 Prior to ordering fabric-reinforced Hypalon material, the contractor shall submit, for the engineer's approval, shop drawings showing lining sheet layout with proposed size, number, position, of all factory-fabricated sheets and indicating the location of all field joints. Shop drawings shall also show complete details and/or methods for anchoring the lining at top of slope, making field joints, seals at structures, etc.

5.2 Lap joints shall be used to seal factory-fabricated sheets of fabric-reinforced Hypalon together in the field. All field joints between sheets of fabric-reinforced Hypalon shall be made on a supporting smooth surface and, unless the weather is sufficiently warm, heat guns shall be used to make the sealing temperature at least 90°F. The lap joints shall be formed by lapping the edges of sheets a minimum of 3" scrim-to-scrim. The contact surfaces of the sheets shall be wiped clean to remove all dirt, dust, moisture, or other foreign materials, then wiped with 111 Trichloroethane. Sufficient Hypalon-to-Hypalon bonding adhesive shall be applied to both contact surfaces in the joint area and the two surfaces pressed together while wet and immediately rolled. Any wrinkles shall be smoothed out and any cut edges of the fabric-reinforced Hypalon shall be sealed with high solids Hypalon adhesive to prevent wicking.

5.3 Any necessary repairs to the Hypalon membrane shall be patched with a piece of the membrane material itself and Hypalon-to-Hypalon adhesive. The adhesive shall be applied to the contact surfaces of both the patch and lining to be repaired, the two surfaces pressed together immediately and rolled, and any wrinkles smoothed out, all in accordance with Paragraph 5.2 hereof.

5.4 All joints, on completion of the work, shall be tightly bonded. Any membrane surface showing injury due to scuffing, penetration by foreign objects, or distress from other causes shall, as directed by the engineer, be replaced or repaired with an additional piece of fabric-reinforced Hypalon membrane of the proper size.

5.5 On completion of installation, the contractor shall dispose of all trash, waste, material and equipment used in connection with the work hereunder, and shall leave the premises in a neat and acceptable condition.

#### 6. SEAM STRENGTH

6.1 All factory and field seams (joints) shall, after 12 days, have a seam strength of 170 pounds when tested in accordance with ASTM D-751, Grab Method (using 4" wide specimens having a length of 10" plus the seam width). The distance between the jaws of the testing apparatus at the start of the test must be 8" plus the seam width and shall have sufficient strength in peel that they fail by delamination from the scrim rather than in the plane of the seam.

## WATERSAVER COMPANY, INC.

3560 WYNKOOP STREET • DENVER, COLORADO 80216 • (303) 623-4111

# Stevens Elastomeric And Plastic Products Inc.

A SUBSIDIARY OF J. P. STEVENS & CO., INC.

EASTHAMPTON, MASS 01027 (413) 527-0700

September 21, 1978

Mr. Jim Bryan  
Watersaver Company  
P. O. Box 16465  
Denver, Colorado 80216

History of Industrial Grade vs.  
Potable Water Grade Hypalons

Dear Jim;

Regarding the work we have been undertaking in developing our Industrial Grade Hypalon and the use of high strength scrim with the Hypalon materials, we offer the following comments.

The decision to develop a second generation of Hypalon lining materials was due in part by the demand of Government agencies and industrial users who have very tough waste containment problems.

The development of the "Industrial Grade" is based on work by Dupont during the early 1960's. Dupont originally had recommended the use of dibasic lead phthalate (not approved for potable water) for Hypalon 45. However, it was soon found to be quite difficult to process. The material would cure up very rapidly, sometimes right in the factory during calendaring.

It was during the late 1960's that Hypalon 45 was recommended to be used with magnesium oxide, which was approved for potable water. The magnesium proved to be quite stable and would remain a thermoplastic until well after it was installed in the field. It does not appear any further work was done to solve the processing problem of the dibasic lead phthalate.

We, like everyone else, have been using the magnesium oxide for potable water and industrial wastes based on Dupont's recommendation. However, we have had concerns and questions regarding the use of magnesium oxide as an all around general use product. Generally, it is not recommended that Hypalon compounds made with magnesium oxide, be used in continuous immersion with water. This is because water pick up is quite high over long term and appears to continue even after a full year of immersion.

The use of magnesium oxide with Hypalon 45 for potable water use appears to work despite the obvious water pick up problem. This is probably due to the crosslinking of the polymer and cool water temperatures. Physical changes do occur resulting in the elongation and tear property losses of 75 to 80% after 10 years in water, and 2 to 3 years weather exposure. It is for this reason we have been recommending the use of high strength scrim. The use of high strength scrim help to maintain

the original properties of the membrane and, of course, prevent the undesirable cured properties of the Hypalon from becoming a factor.

The use of lead salts or in this case dibasic lead phthalate with Hypalon is well documented. Dibasic lead phthalate, as part of a well designed Hypalon compound, is a heat, light, and chemical stabilizer that reacts with the sulfonyl chloride groups to chemically develop crosslinking through bonds formed from the sulfonyl chloride groups.

In order for us to process the Hypalon, we undertook a study to determine which ingredients react with the lead salts and eliminated them from the compound. The final product will process easily and remain a thermoplastic long enough to install in the field.

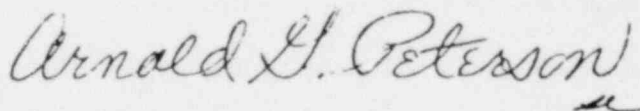
The primary benefit of the Industrial Grade is that it has very low water pick up and has improved chemical resistance in industrial effluents. The chemical resistance is easily seen by the lower volume swells and weight gains.

Our concern regarding these products, is not so much the short term life of a membrane, but really is the long term life. The combination of weather exposure, chemical immersion, the chemical reaction of the polymer and scrim fabric play an important part as whether or not a membrane will provide suitable long term life.

We believe that the Industrial Grade Hypalon is the best state of art available.

Sincerely,

STEVENS ELASTOMERIC & PLASTIC PRODUCTS INC.  
A Subsidiary of J. P. Stevens & Co., Inc.



Arnold G. Peterson  
Technical Director  
Liquid Containment Membranes

AGP/sl



# Stevens Elastomeric And Plastic Products Inc.

A SUBSIDIARY OF J. P. STEVENS & CO., INC.

EASTHAMPTON, MASS. 01027 (413) 527-0700

April 30, 1979

Mr. Jim Bryan  
Watersaver Company  
P. O. Box 16465  
Denver, Colorado 80216

Dear Jim;

The attached graphs show the difference between a standard potable water grade Hypalon and our Industrial Grade Hypalon.

The tests were standard weight gain tests per ASTM D471 at the time and temperature noted on the graphs.

The weight gain for the uranium mill tailing solution is very revealing as it supports the contention that the Industrial Grade Hypalon comes to equilibrium very quickly with a very low weight gain after 300 days at 70°C (158°F). As you know, there is concern about the effect of these uranium mill tailings on a Hypalon lining membrane, as no one has much data to show regarding long term effect. The data here is perhaps the best effort to date.

The data graphs will fit the data books your sales personnel have.

We appreciate your continued support to make Stevens Hypalon membrane the best product available.

Sincerely,

STEVENS ELASTOMERIC & PLASTIC PRODUCTS INC.  
A Subsidiary of J. P. Stevens & Co., Inc.

*Arnold G. Peterson*

Arnold G. Peterson  
Technical Director  
Calendered Products

AGP/sI

cc: B. Slifer

R. Thorpe, H. Landry, L. Coco

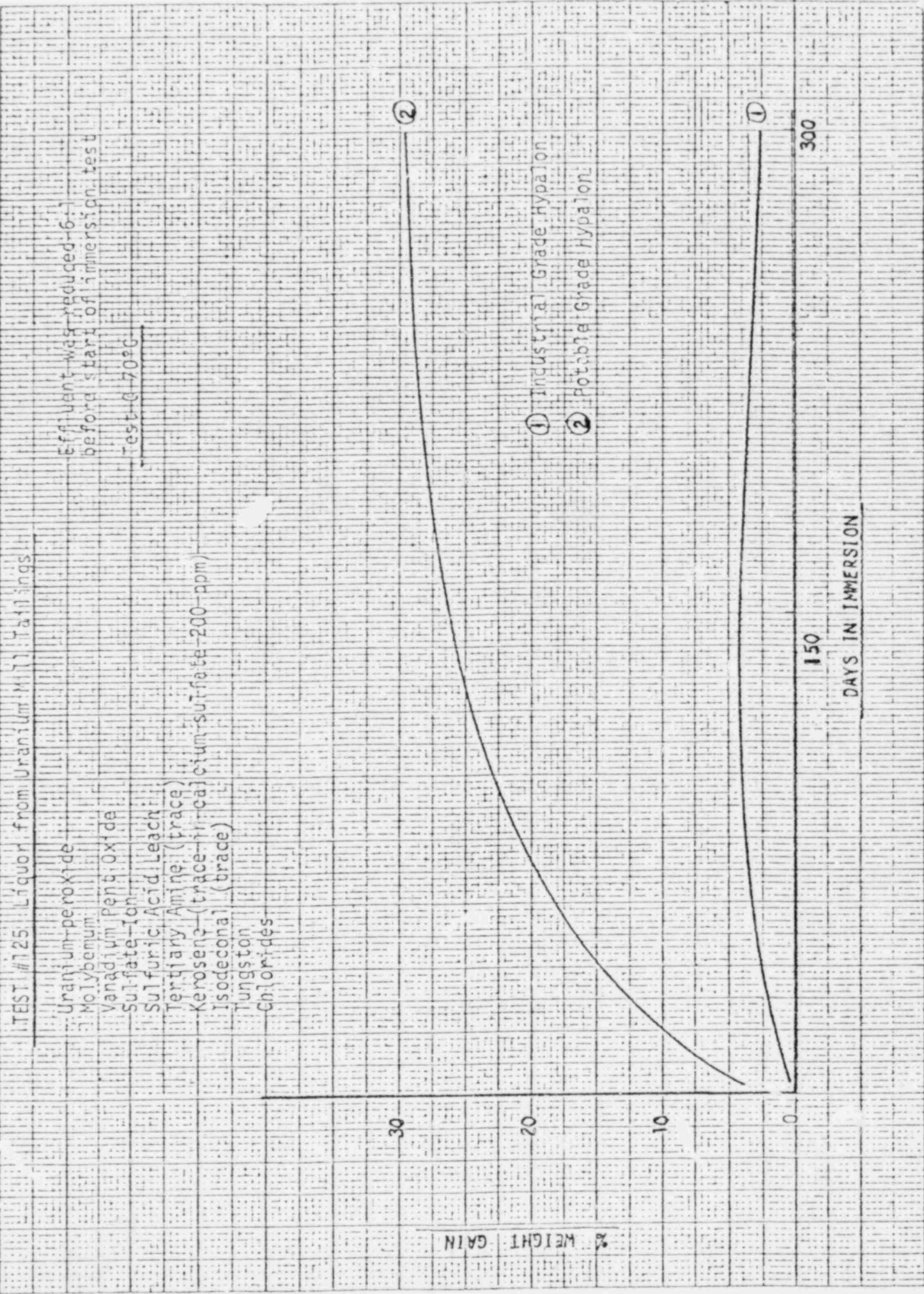
Enclosures

TEST #14: Water Immersion

NOTE: No dramatic difference between distilled water and cold tap water



7 14 21 28 35 42 56 95  
DAYS IN IMMERSION



# 447 DAY WATER IMMERSION TEST (TAP WATER)

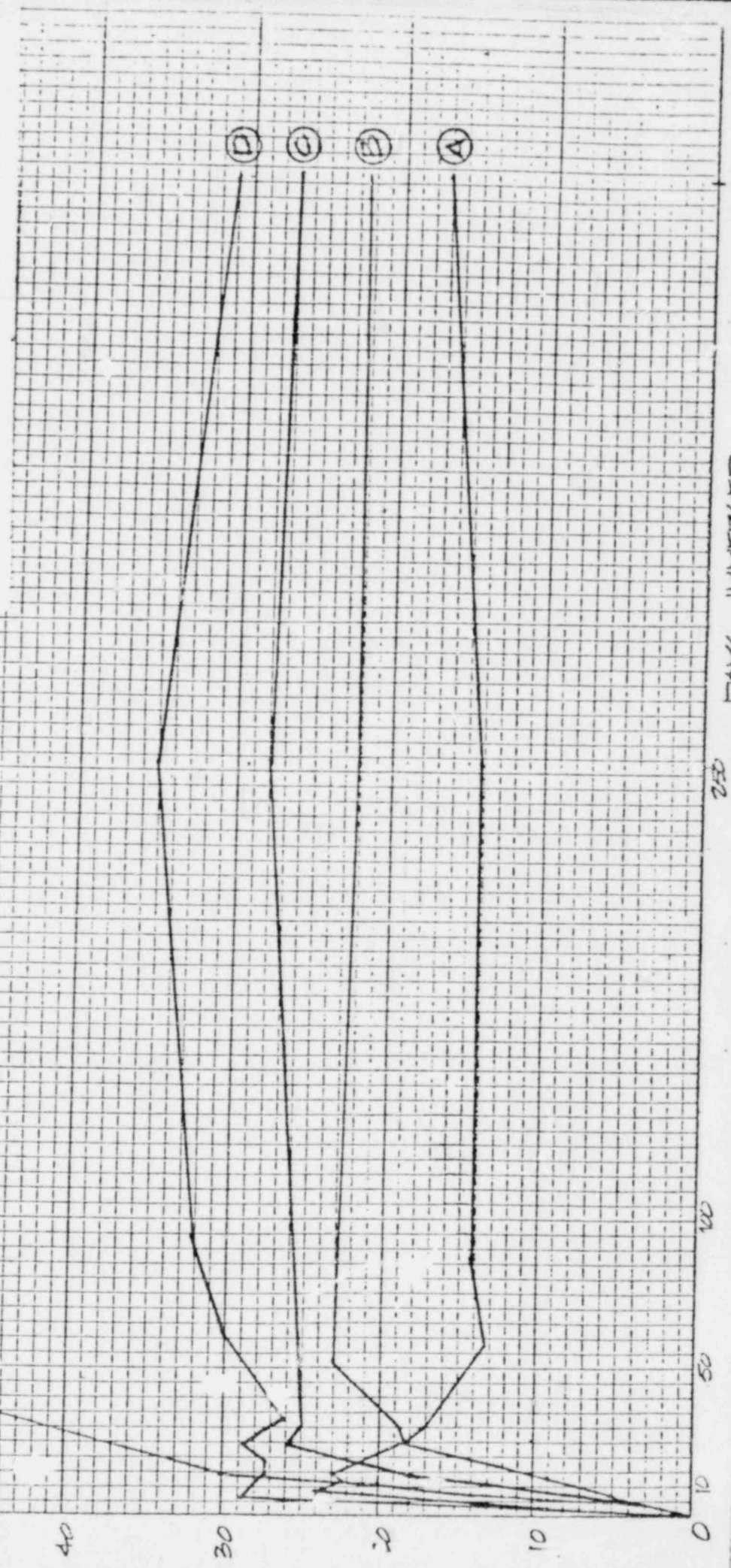
- A: CURED HYDRALON OVER-AGED (212°F, 72 HRS.) IN WATER 212°F.
- B: CURED HYDRALON OVER-AGED (212°F, 72 HRS.) IN WATER 158°F.
- C: UNCURED HYDRALON 2 WEEKS @ ROOM TEMP. IN WATER 158°F.
- D: UNCURED HYDRALON 2 WEEKS @ ROOM TEMP. IN WATER 212°F.

E: COMPETITOR'S "INDUSTRIAL GRADE" HYDRALON DISCONTINUED AFTER 50 DAYS @ 158°F

NOTE: A,B,C,D CONSIST OF GEMEX'S "INDUSTRIAL GRADE" HYDRALON.

23.9% @ 56 DAYS.

(E)





# WATERSAVER COMPANY, INC.

3567 WYNKOOP STREET • DENVER, COLORADO 80216 • (303) 623-4111

## INDUSTRIAL GRADE HYPALON

REAGENTS	% SOLUTION	PERCENT WEIGHT GAINS		
		70 HRS.	11 DAYS	81 DAYS
Acetic Acid	(5)	1.2	2.2	6.6
Acetone		7.2	7.0	7.7
Ammonium Hydroxide	(10)	2.0	4.5	14.0
Air line		23.2	21.0	21.6
Benzene		dissolved	0	0
Carbon Tetrachloride		dissolved	0	0
Citric acid	(1)	1.0	0.9	0.3
Cottonseed Oil		2.0	3.6	7.3
Detergent, Heavy Duty	(0.025)	0.7	1.0	1.0
Dimethylformamide		10.8	11.0	10.7
Ethyl alcohol	(50)	0.8	0.9	0.1
Ethyl acetate		16.0	16.5	13.7
Ethyl dichloride		152.8	148.6	237.6
Hexane		7.4	7.8	10.4
Hydrochloric Acid	(10)	0.2	0.9	0.08
Hydrogen Peroxide, 28%	(3)	0.2	0.9	0.3
Isooctane		5.0	5.2	7.0
Kerosene		30.7	26.7	42.5
Mineral Oil		1.0	1.4	2.8
Methyl Alcohol		0.6	0.6	0.2
Nitric Acid	(40)	1.3	2.7	13.0
Nitric Acid	(10)	0.4	0.5	3.0
Oleic Acid		5.5	7.8	8.6
Olive Oil		1.4	2.0	5.0
Phenol	(5)	5.6	6.0	6.0
Sodium Carbonate	(20)	1.0	0.8	0.9
Sodium Carbonate	(2)	0.9	0.8	0.3
Sodium Chloride	(10)	1.3	1.2	1.0
Sodium Hypochlorite		1.0	0.6	0.4
Sodium Hydroxide	(60)	0.3	1.0	0.5
Sodium Hydroxide	(10)	0.4	0.7	0.5
Sodium Hydroxide	(1)	0.3	0.7	0.2
Soap Solution	(1)	0.5	0.3	- 0.7
Sulfuric Acid	(30)	0.2	0.7	0.3
Sulfuric Acid	(3)	0.2	0.7	- 0.5
Toluene		dissolved	0	0
Transformer oil #55		17.2	25.7	45.0
Turpentine		125.8	123.0	dissolved
Water - distilled		0.7	0.8	0.7
Water - tap		0.8	0.9	1.2

Above tests are run under ASTM D 471, Immersion Method.  
 Weight gains are expressed in percent.  
 Tests were run at room temperature 75°F.

Courtesy of  
Watersaver Company, Inc.  
P. O. Box 16465  
Denver, Colorado 80216  
(800) 525-2424

January 1979

EFFECT OF SCRIMS AND  
PROPERTIES OF AGING  
ON FLEXIBLE LININGS MADE  
WITH CHLOROSULFONATED POLYETHYLENE

by  
A. G. PETERSON  
STEVENS ELASTOMERIC AND PLASTIC PRODUCTS INC.

## INTRODUCTION

The purpose of this paper is to discuss the various scrim fabrics and the effect of aging and resulting properties.

Because tear properties are one of the most important considerations, a great deal of time was spent on developing good comparative laboratory and field data.

Comparative data on all the scrim fabrics currently being offered in the market place are also shown.

## SCRIM FABRICS

(8 X 8 210 d visual)

16 X 8 100 d X 210 d Scrim - This scrim is the weakest of all scrims used for membrane linings. It is used mainly to provide stability during installation and contributes very little to physical strength and no resistance to tear propagation after aging.

5 X 5 1000 d Scrim - The most economical option to all of the other scrim fabrics being offered. Compares to the 6 X 6 1000 d Leno (visual) and the 6 X 6 spun polyester regarding tear propagation after aging.

(6 X 6 1000 d visual)

12 X 6 500 d X 1000 d Leno Weave Scrim - This is a new scrim that our competitors are showing to their customers. It is an attempt by them to improve on the 16 X 8 210 d regarding the tear propagation. While the tear properties are improved they are not any better than the 5 X 5 1000 d scrim.

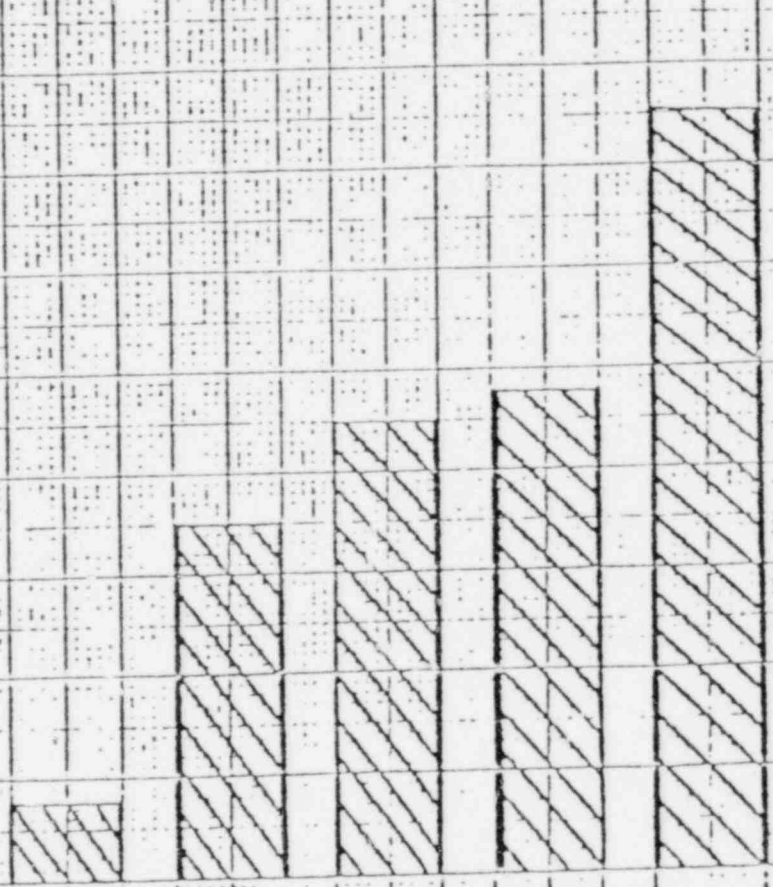
6 X 5 visual - 2.6 oz. per sq. yd. Leno Weave)  
12 X 6 Spun Polyester - A very low cost scrim, it has been sold by one competitor. Due to the large round yarn strand coverage it is very poor. It also has a very poor weight to strength ratio. Its weight is between a 6 X 6 1000 d and 10 X 10 1000 d, but the physicals are only slightly better than a 16 X 8 210 d leno scrim. We have reason to believe that this scrim will be replaced by the 6 X 6 1000 d polyester scrim. The spun polyester yarn is made up of short filament strands from 2 to 4 inches long and must have a tight twist in order for the yarn strand to hold together and this accounts for the large round cross section in the yarn strand.

10 X 10 1000 d Polyester - This is the strongest of all the scrim listed here. It is made with 2.5 turns in the fill yarn to insure weaving uniformity and pattern. The opening between the yarn strand permits the Hypalon to Hypalon cover to completely bond to itself through the yarn interstices. Best resistance to tear propagation.

The following data applies to the scrim construction without calendered covering:

<u>SCRIM CONSTRUCTION</u>	<u>WEIGHT OZ/YD<sup>2</sup></u>	<u>YARN SIZE DENIER</u>	<u>YARN</u>	<u>TENSILE STRENGTH POUNDS</u>	<u>WEAVE</u>
16 X 8	.53	100 d X 210 d	Polyester	15 X 15	Leno
5 X 5	1.56	1000 d	Polyester	75 X 75	Non-woven
12 X 6	2.26	500 d X 1000 d	Polyester	90 X 90	Leno
12 X 6	2.60	Not Applicable	Spun Polyester	90 X 90	Leno
10 X 10	3.38	1000 d	Polyester	150 X 150	Plain



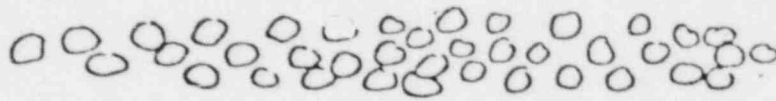


0 20 40 60 80 100 120 140 160

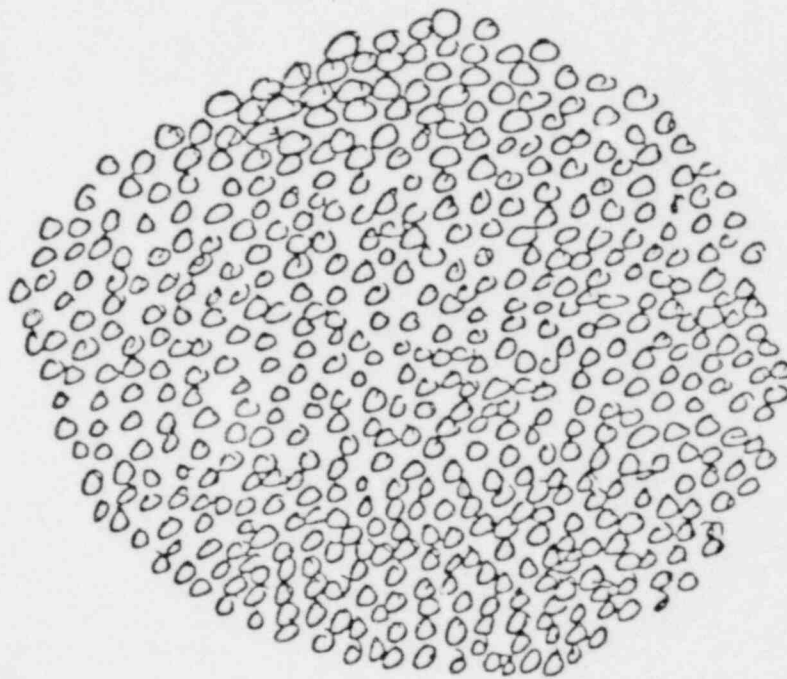
TENSILE STRENGTH OF SCRIM FABRICS

GRAB METHOD - POUNDS

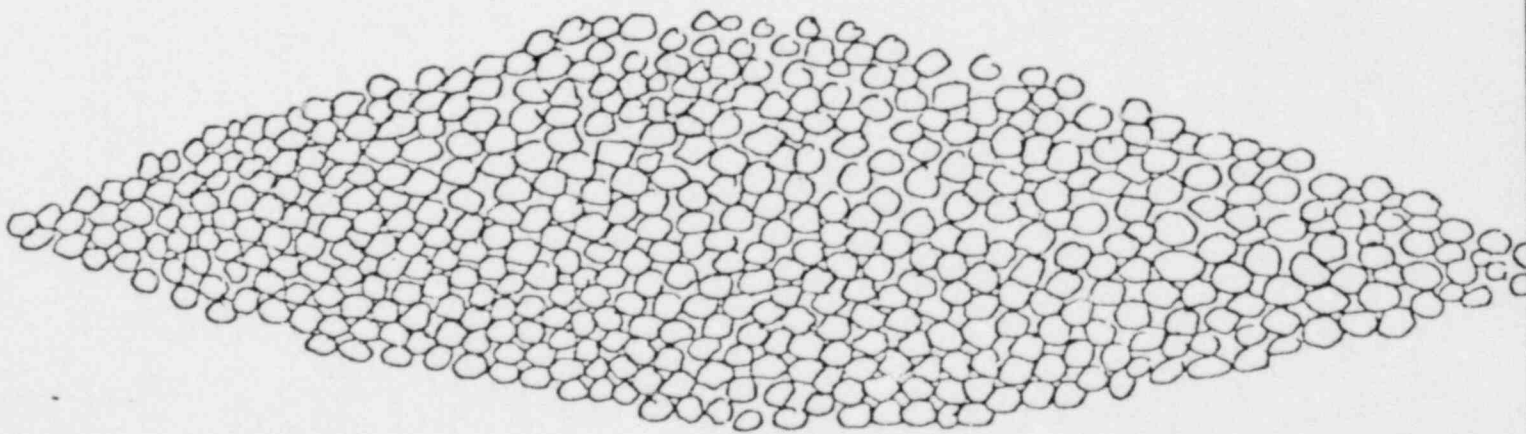
CROSS SECTION VIEW  
FULL SCALE X 60 SINGLE YARN STRAND



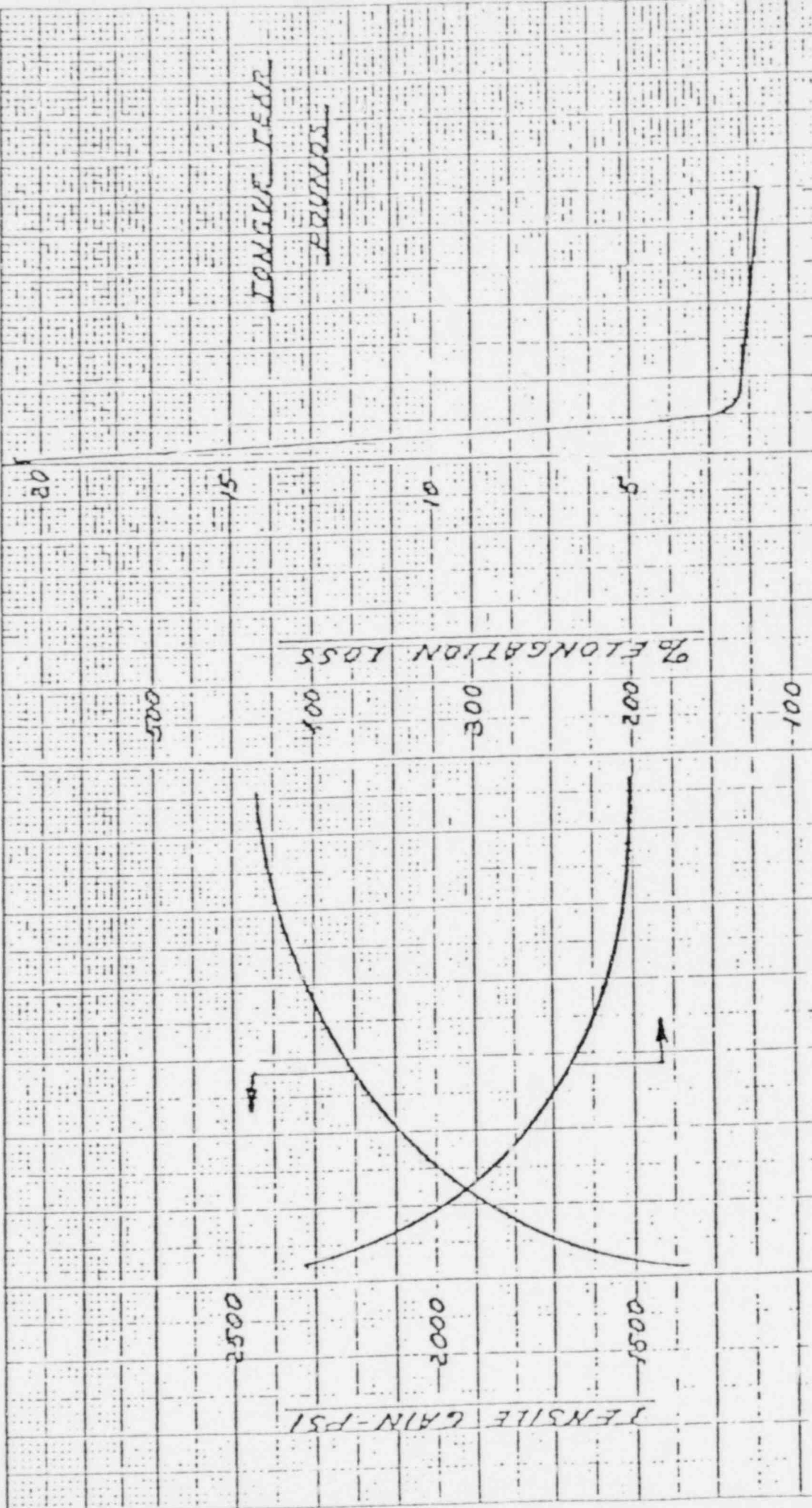
210 DENIER



SPUN POLYESTER



1000 DENIER



TENSILE GAIN-PSI

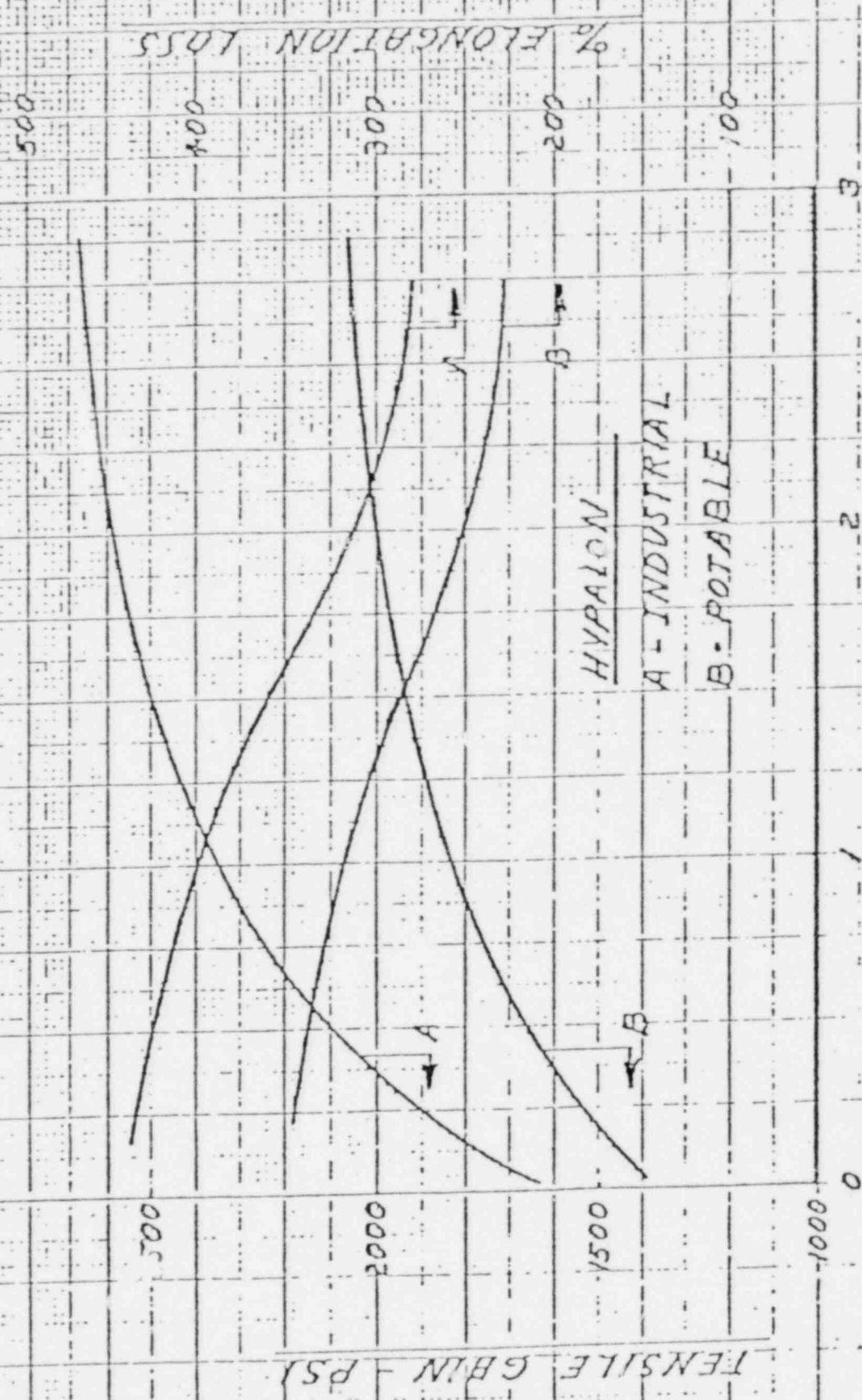
YEARS

% ELONGATION LOSS

YEARS

SEVEN YEAR FIELD EXPOSURE

30 MIL UNSUPPORTED  
BLACK HYPALON



OVEN AGING @ 158°F - 3 MONTHS

J. D. ... & Co., Inc.

ELASTOMERIC PRODUCTS DEPARTMENT  
EASTHAMPTON, MA 01027 (413) 527-0700

March 9, 1981

General guidelines and historical data for production values and quality control procedures used in the production of Stevens Industrial Grade Hypalon.

Material: Stevens Industrial Grade Hypalon 45  
Model Code: HTS-954EV  
Specific Gravity: 1.45  
Scrim: 10x10 1000 denier Polyester yarn  
Weight: 3.38 oz./yd.<sup>2</sup>  
Weave: Plain  
Tensile Strength: 150 x 150 lbs.

Test values obtained on the unsupported Hypalon which is checked before being released to production. Sample lots are milled and laboratory calendered into 15 mil sheets from which the physicals are taken.

The following values are typical historical production values of the Industrial Grade Hypalon.

UNSUPPORTED INDUSTRIAL GRADE HYPALON

PRODUCTION TEST RESULTS

<u>PROPERTY</u>	<u>METHOD</u>	<u>RESULTS</u>
Tensile Strength	ASTM D412	1700 psi
Elongation at Break	ASTM D412	320%

<u>PROPERTY</u>	<u>METHOD</u>	<u>RESULTS</u>
<u>OVEN AGING .14 DAYS @ 212°F</u>		
Tensile Strength	ASTM D412	2300 psi
Elongation at Break	ASTM D412	200%

NOTE: Because of the 14 day time frame, oven aging is not normally used as a test to qualify pre-production lots of Hypalon compound.

Water Absorption	ASTM D471	
	7 Days @ 70°F	2% (wt)
	14 Days @ 120°F	9% (wt)
Cold Bend	ASTM D2136	-55
Brittleness Point	ASTM D-746	-55
Ozone Resistance	ASTM D1149	
	3 ppm @ 30% Strain	
	104°F 2800 hours	No Effect

FINISHED HYPALON SHEET WITH 10 x 10 1000 d SCRIM

PRODUCTION TEST RESULTS

<u>Tensile Strength</u>	ASTM D751	
	36 mil - 210 pounds	
	45 mil - 245 pounds	
<u>Tear Strength</u>	ASTM D751	
	36 mil - 96 pounds	
	45 mil - 115 pounds	
<u>Puncture Resistance</u>	FTM 101 <sup>B</sup> -2031	
	36 mil - 190 pounds	
	45 mil - 210 pounds	
<u>Dimensional Stability</u>	2 HRS. @ 212°F	
	36 mil - .5 - 2%	
	45 mil - .5 - 2%	

QUALITY CONTROL PROCESS/PROCEDURES

Material: Hypalon 45 Chlorosulfonated Polyethylene

Description: The Hypalon 45 resin is made by the Dupont Company, Wilmington, Delaware, in a production process that yields the following properties.

Specific Gravity: 1.07 ± .03 at 25/4°C

Mooney Viscosity: 31 - 43  
ML 1 + 4: 100°C

Chlorine: % 22.0 - 25.0

Sulfur: % .85 - 1.15

Stevens compounds the Hypalon 45 resin with other ingredients through a mixing process which produces a synthetic rubber suitable for the calendaring process. The synthetic rubber composition yields the following properties.

Description: Stevens Industrial Grade Hypalon 45

Model Code: HTS-954 EV

Specific Gravity: 1.45

Mooney Viscosity: 50 - 57  
ML 1 + 4: 250°F

Brabender - Plastograph Torque: 1500 - 1800 grams

Tensile Strength: 1700 psi

Elongation At Break: 320%

Inspection Frequency: Brabender check every 5,000 pounds. Other tests are made when deemed necessary or upon specific customer/project request.

CALENDER PROCESS QUALITY CONTROL

Temperature and pressure process controls are in keeping with the latest state of art and excellent manufacturing standards.

All key process controls relating to quality of finished goods are cross-checked by visual dial, Time vs. Temperature charts and manual checks.

A process quality control - manufacturing manual specifies all manufacturing processes in order to obtain first rate standards of quality.

Inspection Frequency

Time vs. Temperature charts provide a continuous permanent record of all key temperatures throughout the production run. Manual checks are made every two (2) hours and noted on a daily reporting schedule.

Final Inspection

Retain samples are taken with each new roll of scrim, or 10 to 12 samples per shift.

The following information is noted:

1. Date
2. Scrim case number
3. Roll Number
4. Run Number
5. Order Number
6. Customer

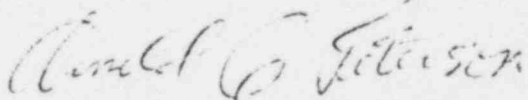
Physical Testing

The following tests are made on a normal production basis. Other tests may be made upon specific customer/project requirements.

Tensile Strength:	ASTM D751
Tongue Tear:	ASTM D751
Puncture Resistance:	FTM 101 <sup>B</sup> 2031
Ply Adhesion Peel Strength:	Lbs. per inch of width tested on an Instron at 2" per minute.

All retain samples are packed and put into storage with all necessary identification.

STEVENS ELASTOMERIC & PLASTIC PRODUCTS, INC.  
A Subsidiary of J.P. Stevens & Co., Inc.



Arnold G. Peterson  
Technical Director  
Calendered Products



Fabrication Details  
of  
10 x 10 - 1000 Polyester Reinforced  
Industrial-Grade Hypalon

Fabrication Technique:

Factory splices - dielectric.

Prior to Start of Fabrication:

Each machine is tuned and adjusted to specification requirements of specific type and thickness of material to be fabricated. Sample seams are made on each machine.

Machine Functions Constantly Monitored:

- A. Grid and plate voltages for proper balance.
- B. Dwell time and R.F. output balance.
- C. Dwell and cool time balance.
- D. Adjust and fine tune R.F. sealing bar.
- E. Consistent proper press pressure.

The above functions guarantee a high-quality factory-fabricated seam. This equipment and our employees have fabricated over 150 million square feet of quality membrane linings.

The Fabrication Equipment:

Watersaver Company, Inc. modified and designed for specific fabrication of membrane lining materials using up-to-date tested and proven techniques.

Factory Fabricated Accessories:

Available to complete Watersaver lining system.

Example:

- Factory Fabricated Pipe Seals.
- Factory Fabricated Berm Vents.
- Factory Fabricated Ballast Tubes.
- Special Accessories, as required.

The above accessories are manufactured from the same material being used as membrane liner and assure proper sealing of pipe and/or other penetrations, wind protection, etc.

Fabrication Quality Assurance:

- a) Roll goods visually inspected prior to fabrication to assure no defects.
- b) Each factory fabricated seam visually checked as it leaves the press sealing surface.
- c) Each factory fabricated seam checked for proper width and seal.
- d) Before packaging, each seam is air-lance tested and visually inspected again.
- e) Any fabricated panel found to have a defect is rejected or minor defects corrected.
- f) Watersaver Company, Inc. has full-time production people, most of whom have been with the Company for many years. No temporary and/or part-time help is employed.
- g) Fabrication is done under strict supervision and inspection.
- h) Seam Samples of each fabricated panel are taken and retained if required.
- i) Random factory seams are tested for quality assurance.

Packaging:

Fabricated panels are accordion folded and packed in a 500-pound test double-wall, water-resistant cardboard container with tube-type reinforced edge protectors. The carton is steel banded on a heavy-duty wooden pallet.

Fabricated panels will be delivered to jobsite via commercial flatbed trucks which are loaded at Watersaver Company, Inc. facility and unloaded at jobsite. Minimizing damage due to mishandling by freight carrier. The cartons are placed on the truck in such a manner they can be unloaded with a forklift in a very short time, and delivered to jobsite in factory-fresh condition.

All cartons will be clearly marked and indentified as required.



# WATERSAVER COMPANY, INC.

POST OFFICE BOX 16465 ♦ DENVER, COLORADO 80215 ♦ (303) 623-4111

Plant and Office — 3560 Wynkoop Street

## POND AND RESERVOIR MEMBRANE LINERS

### GENERAL INSTRUCTIONS FOR JOBSITE PREPARATION

1. The earth upon which the liner will be placed must be smooth and free from sharp rocks, roots, vegetation, and other foreign material. A compacted substrate is advisable to prevent settling. Compaction around pipes and structures is especially important.
2. Check measurements and grades prior to start of liner installation. Surveyor control stakes should be left in place to assist in placing the lining panels.
3. Dig the anchor trench as shown on the shop drawing or the engineering drawings. A typical cross section is found on TLD-74, where a minimum 12" setback is shown. ALWAYS THROW EARTH FROM TRENCH AWAY FROM SIDE SLOPE.
4. Crew size will depend on the project size. A minimum of 6 men is required, most projects need at least 10 men to spread panels.
5. Old tires or sand bags will be needed to keep the material in position during windy conditions. Normally 10 tires per panel up to 50 tires are required.
6. Tools and equipment not supplied by Watersaver include; wiping rags, paint brushes for adhesive, rakes and shovels. Liner panels may weigh as much as 4000#. A large front end loader or forklift will be required to assist in the spreading of the lining material. Palleted cartons are about 84" x 36" x 36".
7. Cements and adhesives shall be kept from extreme heat and cold.
8. A Technical Services Representative is available from the Watersaver Co. for a small fee when made part of the purchase agreement.
9. All PVC (Vinyl) liners must be covered with earth if an extended life is expected. A minimum of 12" of earth should be placed on the bottom and slopes. Side slopes of 3:1 or less are normally required to hold the earth cover. Windy conditions may require special rip rap considerations.
10. Driving on the liner is permitted only when the liner is first covered with 12" of earth. If an area is to have sustained traffic 24" of cover is advised. Damage to the liner must be repaired as it is discovered!
11. Structures including, pipes, splash pads, inlets, outlets, and headwalls should be finished prior to placement of the liner. Prefabricated corners and pipe seals are available for flashing the liner to structures.

This sheet is furnished to aid in planning liner installations. Watersaver Co., Inc. as a supplier of materials only, does not assume responsibility for errors in design, engineering, quantities, or dimensions.

HYPALON INSTALLATION MANUAL

WATERSAVER COMPANY, INC.

P. O. BOX 16465

DENVER, COLORADO 80216

303 - 623-4111

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Mandatory Provisions, Field Seaming Procedure . . . . .	12
Tool List for Field Seaming Crew(s) . . . . .	13

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## STORAGE AND HANDLING

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1. The material will be delivered to the jobsite in a palletized cardboard container for customer unloading and storage.
2. In unloading and on the jobsite the palletized containers should be handled in a manner that does not cause damage to the container or the panels.
3. For unloading and jobsite handling a front-end loader with forks or a forklift capable of operating under jobsite conditions is recommended.
4. The cartons should be stored upright in a dry area. When possible the boxed panels should be stored indoors or in a shed on the jobsite.
5. If such storage is not available on the jobsite, the contained panels should be stored together and covered with a waterproof membrane, such as opaque polyethylene. The waterproof membrane should be securely fastened to provide coverage and protection for both the top and sides of the cartons.
6. We do not recommend stapeling of this membrane to the boxes because of the potential damage to the panels inside. Please make sure to allow an 8-inch free-air space between cartons and tops.

## INSTALLATION PLAN

### General Sequence of Events

1. Make ready all materials required for installation prior to commencement of lining operations. See attached "Check-off List of Materials".
2. Unfold only those panels which are to be anchored or seamed together in one day. See attached "Procedure for Unfolding Techniques".
3. After the panels are initially placed, it is desirable to remove as many wrinkles as possible. The purpose of this is to make the edges which are to be bonded as smooth and free of wrinkles as possible.
4. As soon as the panels are in position, commence field-seaming operations. See attached "Procedure on Field Seaming Techniques".
5. At the end of each day all unseamed edges shall be anchored by sandbags. If winds are expected, the use of boards along the edges of the panels, with sandbags on top, should be used to anchor liner.
6. After field seaming is complete in a given area, liner edges in anchor trench should be buried.

Note: Do not bury the liner edge in the anchor trench within 30 feet of an "incomplete" field seam. This is to allow the seam area to be re-tensioned to remove wrinkles along the seam area.

7. In selecting the sequence to be used in field seaming, always start in the middle and work toward an open end. This will minimize large wrinkles from becoming trapped - which requires cutting and patching. Also, always work from the toe of the slope up, when seaming on the side slopes. This will keep any wrinkles which may occur due to having people working on the side slope behind the area you are seaming.

CUSTOMER-FURNISHED MATERIALS FOR INSTALLATION

Customer should supply the listed materials for installation of prefabricated panels of WATERSAVER HYPALON LINERS

---

1. All field installation labor and official supervision, i.e., crew chief or foreman.
2. Means to move packaged, folded panels of liner to specified locations at pit site, such as front-end loader with forks or a fork lift capable of operating under jobsite conditions. Packages 4' x 6' x 6' will weigh from 2500 to 4000-plus pounds.
3. Stakes and string or chalk lines (not lime) to define panel location and initial unfold guidelines as indicated on the marked blueprint provided.
4. Tape measure, 100-foot.
5. Roll of twine or heavy string.
6. Canvas, burlap or polyethylene bags filled with sand or soft dirt to hold the unseamed edges in place. Quantity depends on wind present during installation; figure on one bag per five-to-ten feet of unanchored panel perimeter.
7. Old boards, such as 1 x 4; 2 x 4; 1 x 6 for holding unseamed edges in place while awaiting seaming. (To be used in conjunction with sandbags.)
8. Minimum of five (5) shovels.
9. Minimum of five hand rakes, or large paving rakes.
10. One or more small compacting rollers for smoothing out or compacting rough or badly gouged earth at the pit site. (Such as a lawn roller.)
11. Portable hot air gun. (See Seaming Tool List.)
12. Large box or barrel of clean cotton rags.



13. All proper safety equipment and supplies. Responsibility for all safety aspects of the installation is the customers.
14. All persons at the site to have smooth, protrusion-free shoe soles (no heels). Tennis shoes or smooth, rubber soled work shoes.
15. Wooden dowels, 3/4" to 1-1/2" diameter, approximately 12" long. Ends to be rounded smooth. The dowels are to be rolled into the edge of the panel to allow greater hold/purchase of the liner by the crew while they are spreading and positioning the panel.
16. If field seaming will be performed, all required equipment per the attached "Tool List for Field Seaming Crew" should be provided.

### CUSTOMER MAKE-READY LIST

Things to be accomplished the afternoon or evening before commencement of the lining operations.

---

1. All pond dimensions should be checked to verify that actual pond dimensions are not greater than those dimensions shown on the drawing.
2. Pond surface raked smooth, rolled if necessary. Free of all large, sharp rocks, or other sharp objects, and free of all vegetation and/or stubble.
3. The anchor trench should be completed around the entire area being lined. Excavated anchor trench dirt should be spread by raking it back flat away from the anchor trench or levelling it with a blade. This is to allow efficient and safe handling of the containerized panel by the fork lift during pulling and spreading of the panel on top of the berm.
4. All penetrations, (pipes, etc.) covered or wrapped to protect liner from being cut, abraded or punctured during installation.
5. Where bonding of liner to concrete is required, the surface should have a smooth trowel finish and be clean, dry, and ready for adhesive applications. All corners on concrete structures should be bevelled or rounded.
6. All pipes, drains, fittings, etc., which are to be installed beneath the liner, should be in place and ready to be covered with the liner.
7. Stakes (when necessary) and/or lines indicating panel locations as shown on the layout drawing, to be installed. (Not necessary on smaller applications.)
8. Distribute sandbags (about one every five-feet) along the perimeters of the area to be lined the next day. Do not put them in the area where the panels will be unfolded.
9. All equipment, tools, and supplies to be at the site in a storage area.

10. The panels which will be pulled and spread in the first day should be located along the berm or in the general area of expected coverage as indicated by the panel layout drawing. Leave the panels in their cardboard containers. Do not remove the steel packaging bands.

## UNFOLDING PREFABRICATED PANELS

General instructions for unfolding prefabricated panels  
of WATERSAVER HYPALON LINERS

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1. The carton is marked on the outside clearly indicating the panel identification letter or number and the panel size. The panel size will also be marked on the top fold of the panel inside the carton. Directions for unfolding the panel are clearly marked on the lid of the container by arrows indicating the direction to "pull" and "spread".
  - A. "Pull" - indicates the direction in which the length of the panel is unfolded.
  - B. "Spread" indicates the direction in which the width of the panel is unfolded.

When locating the packaged panels, observe these markings so panels can be unfolded in the proper direction.

2. Leave packaging on the panel until ready to unfold. If the panel will be sitting in direct sunlight for over 1/2 hour before unfolding, it should be completely shaded with any opaque sheeting. It is necessary to leave a free-flowing air space between the opaque sheeting and the packaged panel.
3. When ready to "pull" and "spread" the panels, remove the packaging carefully. At this point the steel bands on the container should be cut and removed from the general. First remove the cardboard top of the container and then the sides by either lifting it or opening the cardboard siding along the stapled edge. **DO NOT USE A KNIFE TO CUT AWAY CARDBOARD SIDING BECAUSE DAMAGE TO THE LINER MAY OCCUR.** Before pulling out the panel make sure the staples on the bottom lip of the carton have been removed, and carefully inspect the pallet for, and remove, any protrusions which may cause damage to the panel.
4. Positioning the panel and unfolding it from the pallet is best handled with a large front-end loader or fork lift. The panel is double accordion folded and may weight as much as 4000 pounds.

5. To pull out the panel, lay the leading edge on the ground by removing several folds by hand from the top of the panel. Position two or three workers on top of the leading edge, pick up the palletized panel with the fork lift and slowly back up until the full length of the panel is unfolded. It is helpful to have two men positioned on either side of the palletized panel to walk along and help the folds off the top of the panel as the fork lift backs up.
6. After the panel is extended to its full length, it is then straightened out to the guidelines as indicated by the panel layout or the Technical Service Representative.
7. The panel is then spread into position. To achieve this, position men at the edge of the panel as indicated by the Technical Representative or Crew Chief. Generally, the men are positioned approximately 15 feet apart, depending on the size of the panel and the terrain to be covered. If required, men are positioned at the uphill end of the panel to keep it from sliding down the slope as it is unfolded. If the edge to be gripped is subsequently to be bonded, then the panel edge is folded back about two or three feet, and the fold is gripped for pulling rather than the edge. This is to avoid stretching the edge where it is to be bonded. Gripping of the panel can be facilitated by use of a short length of dowel, 3/4" to 1-1/2" in diameter, and 12" to 18" long. The liner is first wrapped around the dowel, and then gripped. The edges of the dowels should be carefully rounded off to prevent sharp edges from digging into the liner as it is pulled.
3. As the panel is pulled out it is necessary to maintain air under the liner. This air can be obtained and maintained by several means. One way to maintain air under the liner is to simply hold the edge up and advance at a rate fast enough to capture air under the liner as it is unfolded. Another way would be the same as above, except the edge is constantly raised and lowered as it is being spread out to "fan" air under the liner.

When there is a prevailing wind from the direction to which the liner is being pulled, then air can be introduced by lifting the edge just enough to allow the prescribed amount of air to blow in under the liner. Care must be exercised in this case to only raise the edge of the liner enough to let the "desired" amount of air under the liner and lowered to cut off the air as soon as enough air is captured; otherwise, it is possible to have the liner blow away.

When the panel has been partially spread and it is necessary to stop (as is often the case) the edge should be lowered to try to trap as much air as possible and keep it from escaping. In spite of this, some air will escape and it is necessary to introduce more air under the liner; this is accomplished by "fanning" the edge of the sheet up and down, and sending waves of air far in under the panel. Fanning is much easier and more effective when the crew engages in this action in unison. A common mistake is, when attempting to do this, the crew does not get enough vertical height on the fanning action; the edge of the liner should be raised from over-the-head level down to knee level as the cyclic fanning action is performed. This fanning action should be continued as directed by the Technical Representative or Crew Chief before spreading of the liner is attempted.

9. A slight lateral tension on the leading edge of the panel being spread should be maintained. This lateral tension facilitates the spreading operations.

10. Notes:

- A. Generally, a 2:1 slope is the steepest slope which men can walk on to spread the liner. Where the liner must be installed on a slope steeper than 2:1, special detailed plans must be worked out ahead of time by the people responsible for planning the job.
- B. During the pulling-spreading operations it is necessary that the crew wear work gloves, as these operations can be quite chafing to the knuckles.

- C. During pulling-spreading operations it is necessary that the crew work as a team, instructed by the Technical Representative or the Crew Chief.
- D. If a gust of wind attempts to pull the liner away from the crew and they are about to lose their footing, the following points are applicable:
  - 1. Putting lateral tension in the leading edge and lower it to the ground.
  - 2. Attempt to restrain it further by putting one knee on the leading edge.

If these efforts fail to restrain it, LET IT GO. DO NOT HOLD ONTO THE LINER AND BE PULLED ALONG WITH THE WIND.

- E. It is advisable that all persons at the pond-site wear soft rubber-soled shoes to prevent damage to the membrane from foot traffic.
- F. When possible all foot traffic in and out of the site should take place in an unlined area, to limit unnecessary foot traffic on the Hypalon. If the site is completely lined then a given area, preferably a corner for ponds, should be designated as the the only area by which people enter or leave the site. As the final inspection this area should be thoroughly checked for any damaging abrasion to the Hypalon surface, and repaired as necessary. After this no additional foot traffic should be allowed in the lined area.
- G. Extreme caution should be exercised when walking on the Hypalon liner material when it is wet. The sheeting becomes very slippery. It is generally necessary to use a rope as an aid in going in or out of the pond.

## RECOMMENDED GUIDELINES

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1. Under ideal soil and weather conditions, removal of surface cure should not be completed more than ten minutes ahead of seaming. Under adverse conditions, such as high heat, winds, muddy substrate, or other conditions which increase the possibility of foreign material being deposited on the washed surfaces, the amount of time between washing and seaming should be reduced at the discretion of the Technical Advisor or Crew Chief.
2. Before adhesive is applied, surfaces to be seamed must have surface cure thoroughly removed and be essentially free of dirt and foreign materials. The presence of a few particles of sand or dirt is permissible in situations where such presence is unavoidable. The acceptable limit for such presence is where the few particles are totally encapsulated in the adhesive/seam and they do not connect to form a path for a leak.
3. On hot days, better results in removal of surface cure may be achieved by the use of perchloroethylene.
4. "Fishmouths" can be folded over and bonded closed or slit, bonded down, and patched per instructions given by the Technical Advisor. Patches over "fishmouths" or other seam flaws should extend at least 2" past the flaw in question. The rule on patches should be; "if there is any question as to whether to patch or not, then patch it"!



MANDATORY PROVISIONS

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1. Panel Position: Minimum overlap - 6-inches.
2. Field Seam: Bonded seam area - 3 to 4-inches.
3. Factory Seams: Minimum seam width - 7/8-inch. (Dielectric Method)
4. Preparation:
  - A. Remove all foreign matter, loose dirt, oil, etc., from edges to be bonded together.
  - B. Surfaces to be seamed must be washed with rags (usage rate is approximately 10-per-hour) or natural bristle scrub brushes soaked with trichlorethylene or perchlorethylene to remove surface cure. (Surface cure is removed when Hypalon turns shiny and slick when wet and a dull black when dry.)
5. Application of Adhesive: Apply a liberal amount of Hypalon adhesive to one of the surfaces and lap together immediately without delay between the time the adhesive is applied and the material is overlapped. Adhesive must be thoroughly wet at the time surfaces are joined, with no evidence of surface "skinning" or drying of the adhesive.
6. Seaming Method: Seam is "stitched" by rolling with a hand roller in a direction perpendicular to the seam, applying firm pressure. A small amount of adhesive, forced out of the seam edge, is desirable and indicates sufficient adhesive has been applied.

NOTE: The temperature of the sheet and adhesive when bonding must be above 60°F. minimum. If ambient conditions create temperatures lower than this, then the sheet and adhesive must be warmed by artificial means; i.e., hot air guns, radiant heaters, heat lamps, spare heaters, etc.

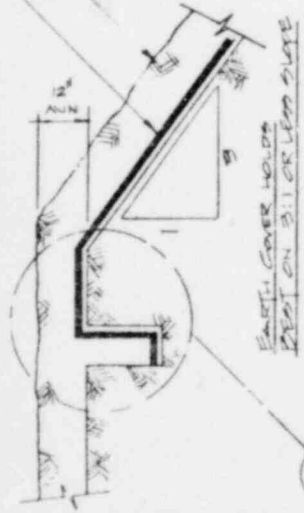
## TOOL LIST

For field seaming crews

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1. Each man on the seaming crew to wear Polyvinyl Alcohol (PVA) coated gloves. Edmont-Wilson Glove No. 37-165, or equal, Coshocton, Ohio 43812.
2. Three sets, Size 10, cloth gloves.
3. Two sets knee pads. (If desired)
4. Roll of tape to hold on knee pads.
5. Gallon can with handle.
6. Ten cotton rags per hour.
7. Gallon can with handle, with adhesive.
8. A 2-inch diameter x 2-inch long, flat-face, steel roller with handle (stitcher). (Hoggson brand, from H. M. Royal, Inc., 11911 Woodruff Avenue, Downey, California, Phone 213-773-3774)
9. A stiff, natural bristle scrub brush.
10. A whisk broom (or fox tail brush).
11. A 1 x 10" x 10' long Douglas fir clear board, rounded off on both ends and rounded off on all edges with a rope tied to one end.
12. A Stanley knife.
13. One red or yellow crayon for marking liner surface.
14. A pair of scissors with rounded-off points.
15. Safety glasses for each man on seaming crew. (For protection from solvent splash.)
16. Hot Air guns if required during cool weather.

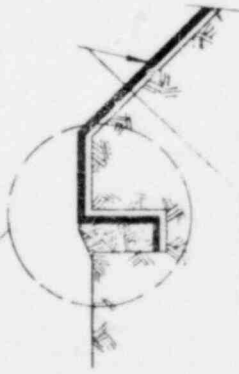
PVC AND OIL RESISTANT  
PVC ANV. B COVERED  
EARTH COVER ANV. 12"



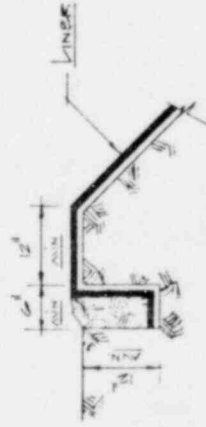
COVERED LINER  
NO SCALE

REINFORCED LINING MATERIALS  
SHOULD BE USED IF THE SLOPE IS  
2:1 OR STEEPER

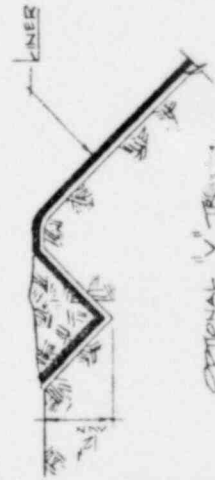
EXPOSED LINERS ARE AVAILABLE IN  
C/C  
HYDRO-ON  
EPDM  
NEOPRENE  
URETHANE



EXPOSED LINER  
NO SCALE



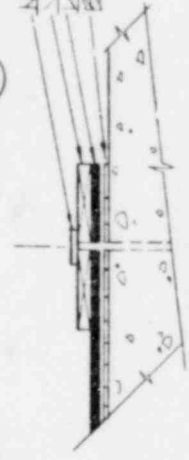
TYPICAL BURIAL TRENCH  
NO SCALE



OPTIONAL V TRENCH  
NO SCALE

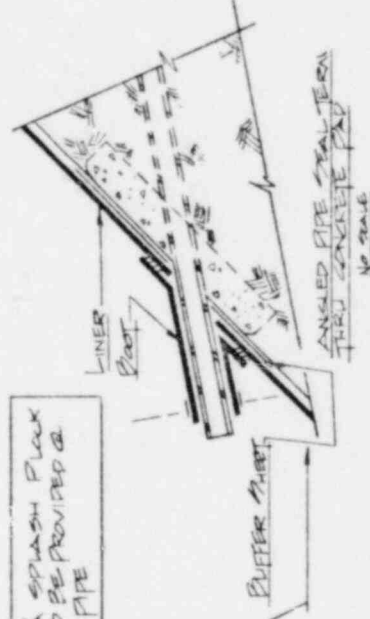


HALF INCH OR FASTER  
WOOD OR METAL STRIP  
LINING MATERIAL  
DO NOT USE ADHESIVE

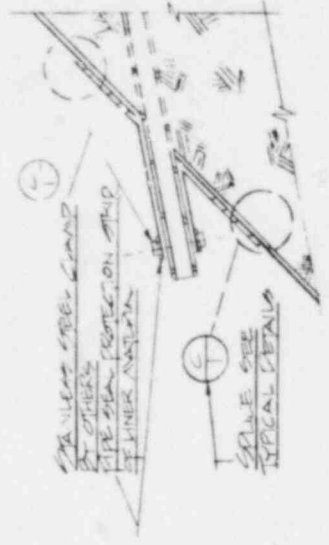


IRREGULAR VERTICAL & HORIZONTAL  
MECHANICAL TERMINATION  
NO STONE

NOTE: A SPLASH PLANK  
SHOULD BE PROVIDED @  
INLET PIPE



ANGLED PIPE SEAL TERN  
NO SCALE



ANGLED PIPE SEAL TERN  
NO SCALE



IRREGULAR FIELD SPICE  
NO SCALE

NOTE: FOR FIELD SPICING EPDM, NEOPRENE AND URETHANE  
CONTACT WATERSEVER CO FOR ANV AND CONNECTIONS

WATERSEVER CO INC  
BOX 1066 TOWER, GOLD BOOGE  
PHONE 903-623-4111  
OFFICES IN NEW JERSEY, TEXAS,  
CALIFORNIA, OKLAHOMA  
TYPICAL LINING DETAILS  
FUNCTION 4  
DRAWN BY SALE VFR  
T. NUMBER 2.01 NONE  
T.D. - 77

# J. P. Stevens & Co., Inc.

ELASTOMERIC PRODUCTS DEPARTMENT  
EASTHAMPTON, MA 01027 (413) 527-0700

## CERTIFICATION OF INSTALLATION

This Certification must be completed and signed by the Installation Contractor and Purchaser and returned to J.P. Stevens & Co., Inc.

Warranties will not be issued until Certification of Installation is completed.

MATERIAL PRODUCT CODE \_\_\_\_\_ GAUGE \_\_\_\_\_

NUMBER OF SQUARE FEET \_\_\_\_\_

**TYPE OF INSTALLATION:**

COVER                       WALLS                       BOTTOM                       OTHER (Describe)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**LOCATION OF INSTALLATION:**

NAME OF PURCHASER \_\_\_\_\_

STREET \_\_\_\_\_ TOWN \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

SPECIAL INSTRUCTIONS TO LOCATE INSTALLATION \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

NAME OF INSTALLATION CONTRACTOR \_\_\_\_\_

STREET \_\_\_\_\_ TOWN \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

COMPLETION OF INSTALLATION DATE \_\_\_\_\_

Purchaser hereby acknowledges receipt of material and completion of the above installation.

SIGNED \_\_\_\_\_

TITLE \_\_\_\_\_

Installation Contractor hereby acknowledges that all specifications, engineering drawings, and on site recommendations have been complied with.

SIGNED \_\_\_\_\_

TITLE \_\_\_\_\_

\_\_\_\_\_

**FOR STEVENS OFFICE USE ONLY**

WARRANTY ISSUE NUMBER \_\_\_\_\_

DATE \_\_\_\_\_ APPROVED BY \_\_\_\_\_

J.P. Stevens & Co., Inc.  
ELASTOMERIC PRODUCTS DEPARTMENT  
EASTHAMPTON, MA 01027 (413) 527-0700

WARRANTY NO. \_\_\_\_\_

DATE \_\_\_\_\_

J.P. STEVENS & CO., INC.  
LIMITED 20 YEAR WARRANTY FOR POND/PIT LINERS AND COVERS

J.P. Stevens & Co., Inc., as manufacturer, warrants each J.P. Stevens & Co., Inc. liner which is manufactured, sold as first quality and installed under Watersaver Co., Inc supervision and/or control (1) to be free of any defects in materials and/or workmanship at the time of sale and (2) to have a useful life from the date of sale for a period of Twenty years under the normal uses and service for which it is designed and manufactured in any customary weather which may be encountered and which is not customarily considered to be in the nature of an act of God, casualty or catastrophe such as (but not limited to) earthquake, flood, piercing hail, tornado, etc. Normal use and service excludes, among other things, the exposure of the liner to harmful chemicals, mechanical abuse by machinery, equipment or people or excessive pressures or stresses from any source.

Should defects or premature loss of use within the scope of the above warranty occur, J.P. Stevens & Co., Inc. will supply repair or replacement materials on a pro rata basis at the then current price in such manner as to charge the customer only for that portion of the warranted Twenty year life which has elapsed since he purchased the material. To enable J.P. Stevens & Co., Inc.'s technical staff to properly determine the cause of any alleged defect and to take appropriate steps to effect timely corrective measures if such defect is within the warranty, any claim for alleged breach of warranty must be made and presented to J.P. Stevens & Co., Inc. within thirty (30) days after the alleged defect was first noticed or the defect and all warranties will be deemed to have been waived by the purchaser.

J.P. Stevens & Co., Inc.'s liability under this warranty shall in no event exceed the amount of the sale price of the material sold to the purchaser for the particular installation in which it failed, and under no circumstances shall J.P. Stevens & Co., Inc. have any liability for any special, direct, indirect or consequential damages arising from loss of production or any other losses owing to failure of the material or installation, and no allowance will be made for repairs, replacements or alterations made by the purchaser unless with J.P. Stevens & Co., Inc.'s consent in writing. J.P. Stevens & Co., Inc. neither assumes nor authorizes any person other than an officer of the Company to assume for it any other or additional liability in connection with the J.P. Stevens & Co., Inc.'s liner. All damages to parties other than the purchaser-user are specifically disclaimed.

If J.P. Stevens & Co., Inc.'s liner is installed by other than Watersaver Co., Inc. or a contractor under supervision and/or control, neither this warranty nor any other warranty shall be in effect or enforceable.

Any materials sold, other than as first quality, are sold as is and without warranty of any kind or nature

Included in this warranty are reservoir cover products provided by J.P. Stevens & Co., Inc. provided these cover products are specifically made and installed for cover applications.

All warranties are given for individual installations and to become effective J.P. Stevens & Co., Inc. have a certificate of installation stating, date installed, supervisor of installation, location, and identification code of \_\_\_\_\_ & Co., Inc.'s product.

The warranties herein are given in lieu of all other possible warranties, express, implied, statutory or otherwise, and by accepting delivery of the materials, the purchaser expressly waives all other such possible warranties except those specifically given herein and purchaser acknowledges thereby that the warranties given herein are accepted in preference to any all such other possible warranties.

This warranty is limited to installations for commercial and/or industrial uses only and does not apply to consumer uses as defined by the Magnuson-Moss Warranty Act or any similar State consumer warranty statute. The parties expressly agree that the sale hereunder is for commercial or industrial use only.

\_\_\_\_\_  
J.P. Stevens & Co., Inc.

\_\_\_\_\_  
Title



Established 1948

# WATERSAVER COMPANY, INC.

P.O. BOX 16465

DENVER, COLORADO 80216

(303) 623-4111

Plant and Office — 3560 Wynkoop Street

## WARRANTY AND AGREEMENTS

All goods sold by the Watersaver Company, Inc., are covered by the following warranties and agreements:

1. Roll goods are warranted by the manufacturer. Said manufacturer's warranty given to the purchaser is the only warranty applicable to such roll goods and is expressly in lieu of any warranty by the Watersaver Company, Inc., expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose.

2. Fabrication of the roll goods into panels by the Watersaver Company, Inc., is warranted to be free from defects in workmanship under normal use and service. Liability under this warranty shall be limited to repair or replacement at the option of the Watersaver Company, Inc., of the goods which prove to be defective; provided, however, that any claim under this warranty be made in writing to the Watersaver Company, Inc., within thirty (30) days after the alleged defect is first noticed or should have been noticed by the purchaser.

This warranty is expressly in lieu of all other warranties, express or implied, including the warranties of merchantability and fitness for a particular purpose and of all other obligations or liabilities on the part of the Watersaver Company, Inc., and Watersaver Company, Inc., neither assumes, nor authorizes any other person for it, any other liability in connection with this sale of goods. This warranty shall not apply to any goods that have been subject to accident, negligence, alteration, abuse or misuse. The Watersaver Company, Inc., shall in no event be liable for any breach of warranty in an amount exceeding the purchase price of the goods and shall not be responsible for any special, direct, indirect, consequential or incidental damages in excess of said purchase price.

\_\_\_\_\_ (owner)

\_\_\_\_\_ (project location)

\_\_\_\_\_ (date)

WATERSAVER COMPANY, INC.

by \_\_\_\_\_

(name)

(title)