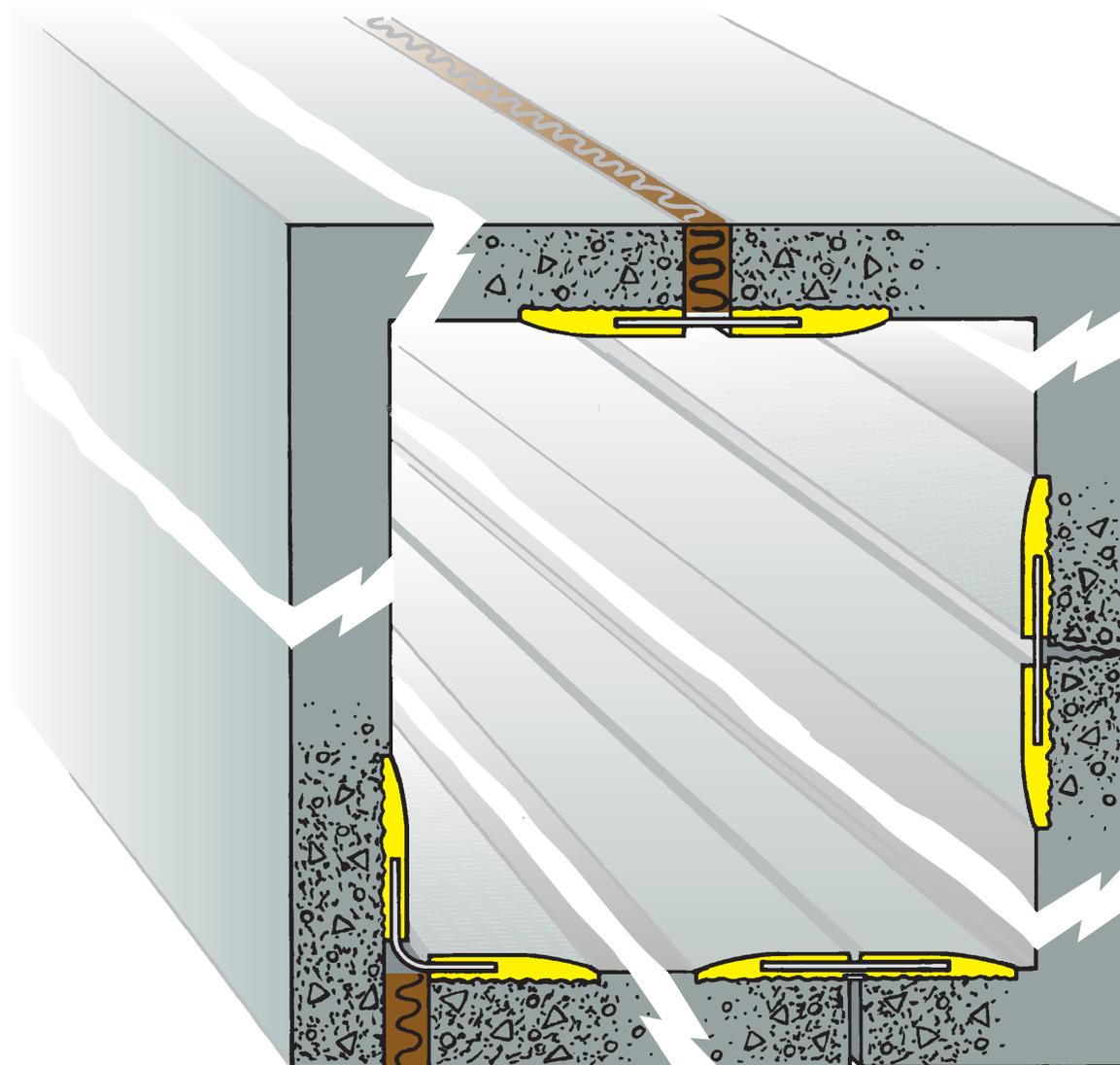


# Water and Secondary Containment Concrete Structures

Repair and Protection of Joints and Cracks



Sikadur®  
Combiflex®  
Systems



# TYPICAL JOINT OR CRACK SEALING PROBLEMS IN WATER STRUCTURES

## Water Structures

Civil Engineering structures in water or wet environments give rise to some particularly difficult joint sealing problems—to keep water in and to keep water out!

### ▲ Raw Water Reservoirs

Bacterial oxidation of organic matter occurs. Suspended matter settles out and anaerobic decomposition can occur beneath the sediment.

### ▲ Channels and Culverts

High flow rate and abrasion problems are possible.

### ▲ Water Treatment Process and Potable Water Tanks

Tanks for chemical treatment, sedimentation, softening, filtration, dewatering and settling. Also storage reservoirs. Mechanical stirring and scraping, and abrasion from solid treatment chemicals, can occur. A pH from 2 to 11 is feasible for different stages of the process. Final water may be pH 6.5 to 9.2. Chemicals such as chlorine, ozone, sulfur dioxide, aluminum sulfate and caustic soda are used. Predominantly aerobic conditions are present. In potable water tanks the jointing system must not contaminate the water supply.

### ▲ Wastewater Treatment Process

Concrete structures include oxidation ponds or channels, inlet channels, overflow, sedimentation, settlement, conditioning, and digestion tanks.

Conventional anaerobic digestion is carried out as a two stage process. The first stage requires heat to the

temperature of 85° to 95°F and produces methane and carbon dioxide gasses; the second stage is settlement and solids separation.

The wastewater treatment environment is, therefore, one of the most severe for sealants.

### ▲ Secondary Containment Structures

Sealants must have temporary or long-term resistance to toxic or other chemicals which have to be contained. No error is possible in this function. Joints or cracks in repair situations must resist movement, temperatures and chemicals over a wide range.

## Typical Joint Problems in Water Structures

In practice, the typical problem joints and cracks can be summarized as follows:

### ▲ Failed Bituminous Joints

Existing joints leak and are filled with thermoplastic bitumen which is extremely difficult and expensive to remove. This will leave contaminated concrete joint edges, giving poor bond to sealants.

### ▲ Broken Joint Edges

In addition to removing existing sealants, the joint edges can be broken and damaged, needing extensive mechanical preparation and costly repair before resealing.

### ▲ Joints Moving In Two Directions

Construction movement joints and joint sealants are normally designed for movement in only one dimension. Movement in two or more dimensions



Failed Conventional Sealant

leads to excessive stress and failure.

### ▲ Joints Moving Vertically

Construction movement joints are normally designed to move laterally. Additional or alternative vertical movement leads to excessive stress and failure.

### ▲ Joints exposed to water pressure

on the face can have their lateral movement capabilities reduced, and, when exposed to back pressure, can balloon and fail.

### ▲ Gunned or poured joint sealants

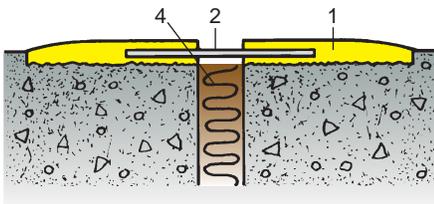
can have limited resistance when in contact with aggressive chemicals — particularly at increased concentrations.

Sikadur Combiflex is a unique system for waterproofing and sealing these problem joints or cracks.

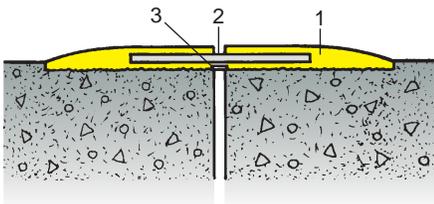
Sikadur Combiflex provides a complete step-by-step solution to these and many other joint sealing problems in both restoration and new construction projects.

# SIKADUR® COMBIFLEX® JOINT SEALING SYSTEM SOLUTIONS

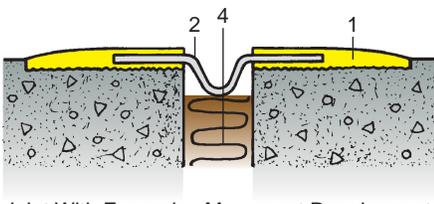
Sika's versatile joint sealing system effectively seals joints and cracks subject to normal or large movements in one or more dimensions.



Correctly Dimensioned Joint



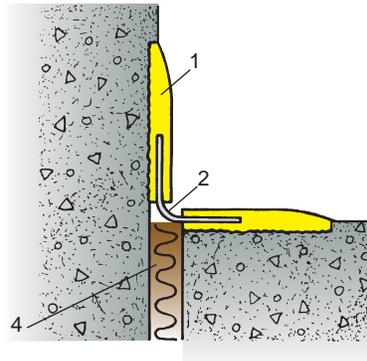
Joint Which Is Too Narrow for Sealants



Joint With Excessive Movement Requirements

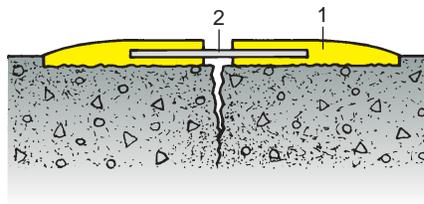
## ▲ Expansion Joints

1. Sikadur 31 adhesive
2. Sika Combiflex strip
3. Paper adhesive strip 20mm
4. Fiber filler board



## ▲ Construction Joints

1. Sikadur 31 adhesive
2. Sika Combiflex strip
4. Fiber filler board

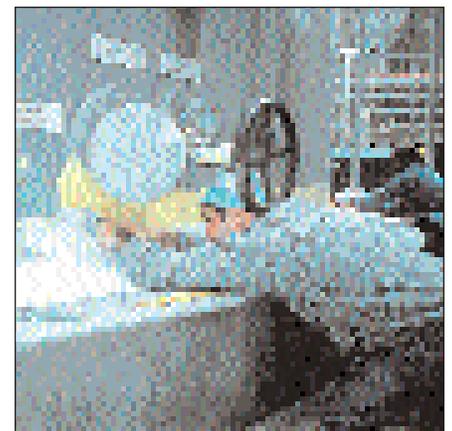


## ▲ Simple Cracks

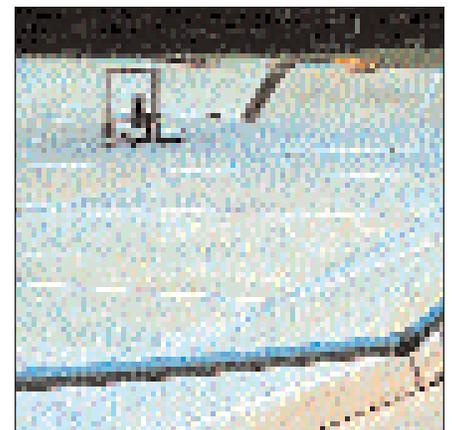
1. Sikadur 31 adhesive
2. Sika Combiflex strip



Sikadur Combiflex for Crack Sealing



Sikadur Combiflex for Edge Joints



Sikadur Combiflex for Movement Joints

# HOW TO INSTALL SIKADUR® COMBIFLEX® — FAST AND SECURE



**1** Thoroughly clean the bond surface mechanically. **Note: No need to remove existing failed joint sealant.**



**2** Apply *Sikadur 31* epoxy adhesive by brush or trowel on each side of the joint or crack. **Note: No need to repair all joint nosings.**



**3** Place activated *Sikadur Combiflex* strip in position.



**4** Roll *Sikadur Combiflex* strip to exclude air through the special perforations until adhesive comes through. **Note: Allow sheeting to drape in slot for high movement joints.**



**5** With brush or trowel, apply a top layer of *Sikadur 31* over entire width of sheeting. **Note: Do not deliberately waste adhesive over red center strip.**



**6** Remove red center strip before *Sikadur 31* fully hardens. **Note: This is best done within one hour at 73°F (22°C). Overlapping sections or details are permanently bonded on or off site using hot weld guns.**

# TESTING AND APPROVALS: PERFORMANCE EVALUATION

## The Unique Sikadur Combiflex System:

- ▲ Can be used to seal old joints without removing the failed joint sealant
- ▲ Can be applied without reconstructing joint nosings
- ▲ Can be applied in cold and damp environments
- ▲ Is water and chemical resistant
- ▲ Resistant to UV light exposure
- ▲ Seals large and small irregular joints, even with high movement
- ▲ Seals between dissimilar planes
- ▲ Is rot resistant
- ▲ Is permanently elastic, even at low temperatures
- ▲ Is approved for potable water contact
- ▲ Resistant to ozone exposure (300 ppm)
- ▲ Accommodates vertical movement
- ▲ Fast and cost effective

## Exceptional Movement Capability

SIKA HYPALON STRIP OFFERS EXCEPTIONAL DURABILITY
TENSILE PROPERTIES (ASTM D-412) Elongation at Break: 800% Tensile Strength: 1300 psi
TEAR RESISTANCE (ASTM D-624) 250 lbs./in.
LOW TEMPERATURE PERFORMANCE MAINTAINED TO -40°F (-40°C)

Sika Hypalon Strip Thickness: 40 mils.

## Extremely High Bonding Properties

SIKADUR BOND STRENGTH
ASTM C-882 HARDENED CONCRETE TO HARDENED CONCRETE
2 Day (Dry Cure): 2800 psi min. (20 N/mm <sup>2</sup> ) 14 Day (Moist Cure): 2000 psi min. (14 N/mm <sup>2</sup> )

## Fast Installation and Curing

	COMPRESSIVE STRENGTH, PSI (ASTM D-695)		
	40°F (4°C)	73°F (22°C)	90°F (32°C)
8 HOUR		6,800	8,800
16 HOUR	400	9,600	10,100
1 DAY	3,900	9,800	11,700
3 DAY	6,700	11,300	11,900
7 DAY	9,100	12,000	13,000
14 DAY	10,400	12,000	13,000
28 DAY	11,200	12,000	13,000

Note Metric Conversion: 1,400 psi=10 N/mm<sup>2</sup>

Rapid curing Sikadur Epoxy Adhesive allows for quick turnaround time.

# SIKADUR® COMBIFLEX® SYSTEM CHEMICAL EXPOSURE DATA

## WATER AND SEWAGE EXPOSURE

### Twelve Month Study: Immersion in Potable Water, Aerobic and Anaerobic Treatment Tanks

The Sikadur Combiflex System was immersed in a water treatment environment.

Environments for Immersion:

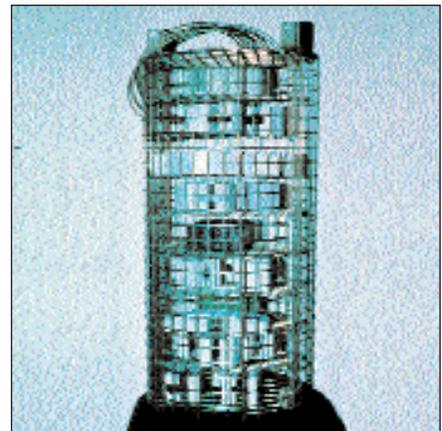
- ▲ **Potable Water:** 73°F ±2°F (22°C ±1°C)
- ▲ **Aerobic:** An aerobic sewage flow tank
- ▲ **Anaerobic:** A secondary overflow/settlement tank adjacent to the closed primary anaerobic digester. Full anaerobic conditions were presented at the depth at which samples were immersed.
- ▲ **Control:** Air dry stored 73°F ±2°F, (22°C ±1°C) 50% RH samples were prepared to act as controls.

*Results of Twelve Month Study:*  
Sikadur Combiflex showed excellent performance with no significant change in properties in all three environments.

*Note:* ALL conventional sealants were seriously degraded in the aerobic and anaerobic environments.



Sikadur Combiflex in Wastewater Treatment



Sikadur Combiflex Test Specimens

## Water and Sewage Exposure

RESULTS OF 12-MONTH STUDY	
IMMERSION IN POTABLE WATER, AEROBIC AND ANAEROBIC TREATMENT TANKS	
SIKADUR COMBIFLEX	System unaffected, with no change in performance
CONVENTIONAL SEALANTS	Softened with a significant decrease in physical properties

## Potable Water Use

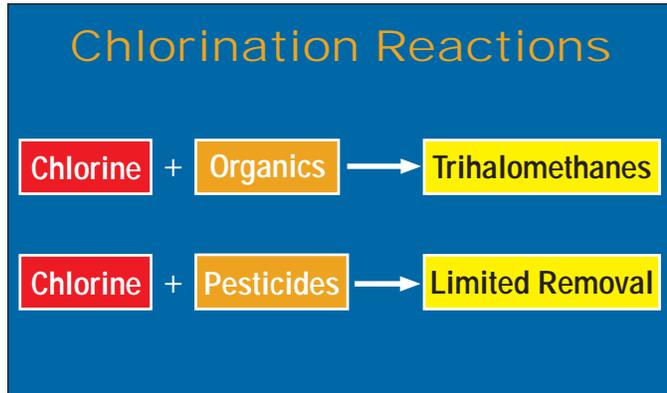
Sikadur Combiflex System is approved to ANSI/NSF Standard 61 for use in potable water.



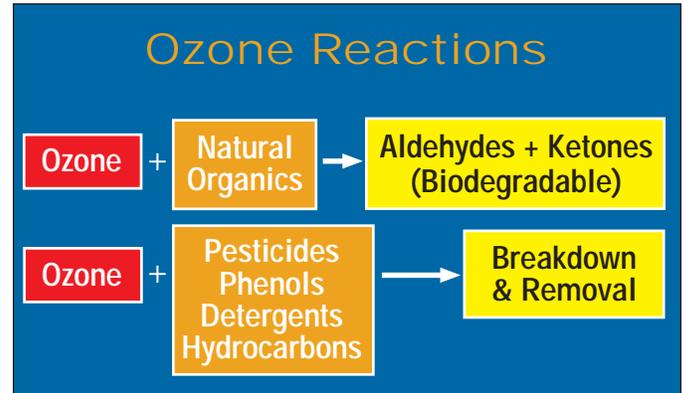
Sikadur Combiflex After 12 Month Immersion in Raw Sewage and Potable Water

# SIKADUR® COMBIFLEX® SYSTEM CHEMICAL EXPOSURE DATA

## Water Disinfection Treatment Processes



Traditional Use of Chlorine in Water Treatment



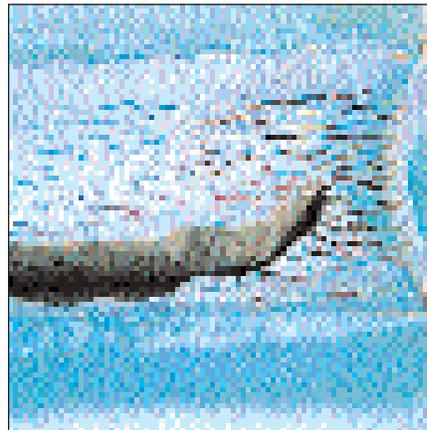
Increasing Use of Ozone in Water Treatment

## OZONE RESISTANCE

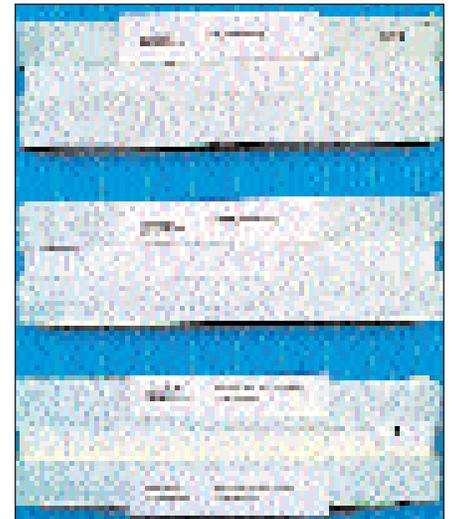
Three Month Study:  
Water/Ozone (3 ppm)  
Air/Ozone (2–300 ppm)

### Test Conditions:

- ▲ Control in Air at 70°F (21°C) and 50% RH
- ▲ Water Vapor at 70°F (21°C) and 100% RH
- ▲ Water Immersion in Potable Water at 70°F (21°C)
- ▲ Ozone/Air at 70°F (21°C), 250–300 ppm Ozone, 100% RH
- ▲ Ozone/Water at 70°F (21°C), 3 ppm Ozone in Potable Water



Conventional Sealant After 3 Month Ozone Exposure

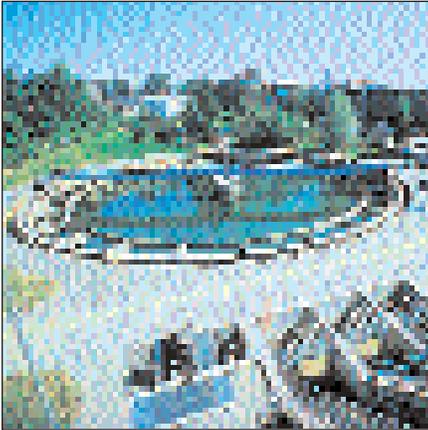


Sikadur Combiflex System After 3 Month Ozone Exposure

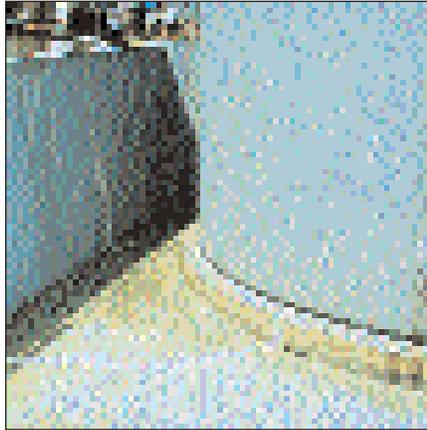
## Ozone Resistance

RESULTS OF 3-MONTH STUDY			
	WATER	WATER/OZONE (3 PPM)	AIR/OZONE (2–300 PPM)
SIKADUR COMBIFLEX	No effect on membrane or adhesive	No effect on membrane or adhesive	No effect on membrane or adhesive
CONVENTIONAL SEALANTS	Little to no effect	Loss of elongation, change in tensile properties, slight surface degradation	Loss of elongation, change in tensile properties, slight surface degradation

# SIKADUR® COMBIFLEX® SYSTEM REFERENCES IN ALL TYPES OF STRUCTURES



Sikadur Combiflex in Wastewater Treatment



Sikadur Combiflex in a Secondary Containment Tank



Sikadur Combiflex Installation in a Culvert



Sikadur Combiflex is an integral part of Sika's Concrete Restoration Systems (CRS)—a comprehensive approach to concrete repair and protection.

Technical and computer-generated specification components are available immediately via fax. Call your local Sika Tech Center at 1-800-933-SIKA

**Spec Component: SC-073-0000**  
Supersedes: SC-073-0001

**Part 1 - Section Product and Application**  
This specification covers the sealing of joints and cracks subject to normal to very large movement with an epoxy resin adhesive sealing system.

**3.01 Acceptable Manufacturers**  
A. Manufacturer: as manufactured by Sika Construction, Luthern, New Jersey, in accordance with the requirements of the specification and has performed satisfactorily for joint sealing for a minimum of 100 joints.  
B. Substitution: The use of other than the specified system will be considered providing the proposer is able to verify to the Engineer. This request shall be accompanied by a written confirmation from an approved independent testing laboratory that the proposed substitute will meet or exceed the specified performance criteria, tested in accordance with the specified test and (C) that the proposed substitute has the proposed substitute system has an approved record of 200 joints and crack sealing, confirmed by actual test data and full accounts/inspections that it can meet this.

**C. Qualification from the manufacturer demonstrating compliance with the ISO 9000 quality system development, manufacture, and sale of the product.**

**3.02 Performance Criteria**  
A. Properties of the mixed epoxy resin adhesive:  
1. Pot Life: 20-40 minutes  
2. Traffic Time To Traffic: 2-3 hours  
3. Consistency (1/2 in. PAS) 100mpa  
4. Crack Size:  
5. Crack Depth:  
B. Properties of the cured epoxy resin adhesive:  
1. Compressive Strength (ASTM D-695) at 28 days  
a. Compressive Strength: 10,000 psi min.  
b. Modulus of Elasticity: 7.5 x 10<sup>6</sup> psi min.  
2. Tensile Properties (ASTM D-695) at 28 days  
a. Tensile Strength: 2000 psi min.  
b. Elongation at Break: 2.0% min.  
c. Modulus of Elasticity: 8.3 x 10<sup>6</sup> psi min.  
3. Flexural Properties (ASTM D-790) at 28 days  
a. Flexural Modulus at Loading: 3000 psi min.  
b. Flexural Modulus at Loading: 8.0 x 10<sup>6</sup> psi min.  
4. Shear Strength (ASTM D-790) at 14 days: 2000 psi min.  
5. Total Water Absorption (ASTM D-593) (24 hours @ 1.0% max)  
6. Bond Strength (ASTM C-408) (Reinforced Concrete to Reinforced Concrete)  
a. 1.00 psi (70 kPa) 2000 psi min.  
b. 1.00 (70 kPa) 2000 psi min.  
7. Deflection Temperature (ASTM D-695) at 14 days: 100°F min. (Other shear loading-60°F)

**SC-073 Sikadur® Combiflex Sealing System**

- Wipe Hypalon sheeting with Combiflex Activator a minimum of 1 hour as a maximum of 8 hours before installation.
- Apply the mixed Sikadur 31, Hi-Mod Gel epoxy resin adhesive on each side of the crack to a thickness of approximately 1/8". The epoxy resin adhesive should extend 1/4" - 3/4" beyond the edge of the sheeting. Work into the substrate for positive adhesion. Bond area should be a minimum of 1 1/2" both sides of crack.
- Set the sheeting into the epoxy resin adhesive. Using a hard roller, force the sheeting down into the epoxy.
- Apply an additional 1/2" layer of epoxy as a top coat to the Hypalon sheet. Sikadur 31, Hi-Mod Gel should not be applied greater than 1/2" thick.
- Remove the red expansion strip from the sheeting before the epoxy resin adhesive has set.

Client Name: \_\_\_\_\_  
Job Name: \_\_\_\_\_  
Date: \_\_\_\_\_

**SC-073 Sikadur® Combiflex Expansion Joint - Special Conditions**

- Wipe Hypalon sheeting with Combiflex Activator a minimum of 1 hour and a maximum of 8 hours before installation.
- Apply the mixed Sikadur 31, Hi-Mod Gel epoxy resin adhesive on each side of the crack to a thickness of approximately 1/8". The epoxy resin adhesive should extend 1/4" - 3/4" beyond the edge of the sheeting. Work into the substrate for positive adhesion. Bond area should be a minimum of 1 1/2" on both sides of crack.
- Set the sheeting into the epoxy resin adhesive. Using a hard roller, force the sheeting down into the epoxy.
- Apply an additional 1/2" layer of epoxy as a top coat to the Hypalon sheeting. Sikadur 31, Hi-Mod Gel should not be applied greater than 1/2" thick.
- Remove the red expansion strip from the sheeting before the epoxy resin adhesive has set.

Note: When applied over a traffic-bearing joint Sikadur Combiflex should be protected from damage by installing a cover plate which is bolted at one side and above for proper expansion and contraction of the joint.

Client Name: \_\_\_\_\_  
Job Name: \_\_\_\_\_  
Date: \_\_\_\_\_

**1-800-933-SIKA NATIONWIDE**

**Regional Headquarters and Sales Centers**

For the location of your nearest Sika sales office, contact your regional center.

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