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, de-watering 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 are normally designed to move laterally. Additional or alternative vertical movement leads to excessive stress and failure.

- **Joints exposed to water pressure**
  
  Construction movement joints are normally designed to move laterally. Additional or alternative vertical movement leads to excessive stress and failure.

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

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

**Simple Cracks**
1. Sikadur 31 adhesive
2. Sika Combiflex strip

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

**Correctly Dimensioned Joint**

**Joint Which Is Too Narrow for Sealants**

**Joint With Excessive Movement Requirements**

**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 Thickness: 40 mils.

Extremely High Bonding Properties

Fast Installation and Curing

Sika Hypalon Strip Offers Exceptional Durability

<table>
<thead>
<tr>
<th>TENSILE PROPERTIES (ASTM D-412)</th>
<th>TEAR RESISTANCE (ASTM D-624)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elongation at Break: 800%</td>
<td>250 lbs./in.</td>
</tr>
<tr>
<td>Tensile Strength: 1300 psi</td>
<td></td>
</tr>
</tbody>
</table>

Low Temperature Performance Maintained to -40°F (-40°C)

<table>
<thead>
<tr>
<th>ASTM C-882 HARDENED CONCRETE TO HARDENED CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Day (Dry Cure): 2800 psi min. (20 N/mm²)</td>
</tr>
<tr>
<td>14 Day (Moist Cure): 2000 psi min. (14 N/mm²)</td>
</tr>
</tbody>
</table>

Fast and cost effective

Sikadur Bond Strength

<table>
<thead>
<tr>
<th>COMPRESSION STRENGTH, PSI (ASTM D-695)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40°F (4°C)</td>
</tr>
<tr>
<td>8 HOUR</td>
</tr>
<tr>
<td>16 HOUR</td>
</tr>
<tr>
<td>1 DAY</td>
</tr>
<tr>
<td>3 DAY</td>
</tr>
<tr>
<td>7 DAY</td>
</tr>
<tr>
<td>14 DAY</td>
</tr>
<tr>
<td>28 DAY</td>
</tr>
</tbody>
</table>

Note Metric Conversion: 1,400 psi=10 N/mm²
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.

---

### RESULTS OF 12-MONTH STUDY

<table>
<thead>
<tr>
<th></th>
<th>IMMERSION IN POTABLE WATER, AEROBIC AND ANAEROBIC TREATMENT TANKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sikadur Combiflex</td>
<td>System unaffected, with no change in performance</td>
</tr>
<tr>
<td>Conventional Sealants</td>
<td>Softened with a significant decrease in physical properties</td>
</tr>
</tbody>
</table>

---

Potable Water Use

Sikadur Combiflex System is approved to ANSI/NSF Standard 61 for use in potable water.
**SIKADUR® COMBIFLEX® SYSTEM**

**CHEMICAL EXPOSURE DATA**

Water Disinfection Treatment Processes

**Chlorination Reactions**

<table>
<thead>
<tr>
<th>Chlorine + Organics</th>
<th>Trihalomethanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine + Pesticides</td>
<td>Limited Removal</td>
</tr>
</tbody>
</table>

**Ozone Reactions**

<table>
<thead>
<tr>
<th>Ozone + Natural Organics</th>
<th>Aldehydes + Ketones (Biodegradable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone + Pesticides, Phenols, Detergents, Hydrocarbons</td>
<td>Breakdown &amp; Removal</td>
</tr>
</tbody>
</table>

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

**RESULTS OF 3-MONTH STUDY**

<table>
<thead>
<tr>
<th></th>
<th>WATER</th>
<th>WATER/OZONE (3 PPM)</th>
<th>AIR/OZONE (2–300 PPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIKADUR COMBIFLEX</td>
<td>No effect on membrane or adhesive</td>
<td>No effect on membrane or adhesive</td>
<td>No effect on membrane or adhesive</td>
</tr>
<tr>
<td>CONVENTIONAL SEALANTS</td>
<td>Little to no effect</td>
<td>Loss of elongation, change in tensile properties, slight surface degradation</td>
<td>Loss of elongation, change in tensile properties, slight surface degradation</td>
</tr>
</tbody>
</table>

Conventional Sealant After 3 Month Ozone Exposure

Sikadur Combiflex System After 3 Month Ozone Exposure

Ozone Resistance

**Ozone Reactions**

- Breakdown & Removal of Natural Organics
- Biodegradable products
- Limited Removal by Chlorination

**Ozone Reactions**

- Aldehydes + Ketones
- Phenols, Detergents, Hydrocarbons
SIKADUR® COMBIFLEX® SYSTEM REFERENCES

IN ALL TYPES OF STRUCTURES

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

The information contained in this document(s), including but not limited to any recommendations regarding the use and application of Sika Corporation (“Sika”) product(s), is given in good faith based on Sika’s current experience and knowledge of its products when properly stored, handled and applied under normal conditions in accordance with Sika’s instructions. The information contained in this document(s) is valid only for the applications and uses of Sika product(s) described herein. Any deviation from any of the instructions, uses, applications and recommendations contained in this document(s) regarding the Sika product(s) will void any Sika warranty. The user of the Sika product(s) must test each product for suitability for the intended application and purpose. The user of Sika product(s) must always read and follow the warnings and instructions for each product on the current Technical Data Sheet, product label and Material Safety Data Sheets prior to product use. All sales of Sika product(s) are subject to its current terms and conditions of sale available at www.sikacorp.com or 201-933-8800. Technical Data Sheet(s) and Material Safety Data Sheet(s) are available at www.sikaconstruction.com. Nothing contained in any Sika materials relieves the user of the obligation to read and follow the warnings and instructions for each Sika product as set forth in the current Technical Data Sheet, product label and Material Safety Data Sheet. Sale of Sika product(s) are subject to the following Limited Material Warranty: Sika warrants this product for one year from date of installation to be free from manufacturing defects and to meet the technical properties on the current Technical Data Sheet if used as directed within shelf life. User determines suitability of product for intended use and assumes all risks. Buyer’s sole remedy shall be limited to the purchase price or replacement of product exclusive of labor or cost of labor. NO OTHER WARRANTIES EXPRESS OR IMPLIED SHALL APPLY INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Sika SHALL NOT BE LIABLE UNDER ANY LEGAL THEORY FOR SPECIAL OR CONSEQUENTIAL DAMAGES. Sika shall not be responsible for the use of this product in a manner to infringe on any patent or any other intellectual property rights held by others.