

FILE

# **ILLBRUCK WILLSEAL BRIDGE JOINT SEAL**

**Preliminary Report  
July 1997**

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<b>16. ABSTRACT</b> <p>The Oklahoma Department of Transportation (ODOT) recently completed a field performance evaluation of Illbruck Willseal (hereafter referred to as Willseal) at one of two experimental evaluation locations.</p> <p>An expansion joint in the deck of an overpass bridge on U.S. 62 was sealed with Willseal precompressed foam sealant in October, 1993. The maximum opening of the joint is 89 mm (3 ½ in). Two sticks of Willseal, each sized to seal one half of the opening, were used. One stick was attached to each joint face with the adhesive backing which is part of the Willseal material. In addition to the Willseal backing, a Sika brand adhesive was applied to the joint face before the Willseal was attached to it. The two sticks were fastened to each other in the center of the joint with the Sika adhesive.</p> <p>The sealed joint has been monitored since application by ODOT's Office of Research. The Willseal performed adequately through September 27, 1996, when the last scheduled survey was done. At that time, no failures could be detected and the Willseal was still providing a watertight seal. On December 2, 1996, an unscheduled survey of the Willseal application was done to get a photograph of the sealed joint. At that time, it was noted that the sealant had failed where the two sticks of Willseal had been fastened together by the Sika Adhesive.</p> <p>Expansion joints in decks of two bridges on I-44 were sealed with Willseal in September, 1995. At this location, a single stick of Willseal was used in each joint. The adhesive backing, plus Sika adhesive, was used to attach the Willseal to one joint face. It was attached to the other face by Sika adhesive only. The sealant was performing well (no failures) at that location, as of December 2, 1996. This location is currently scheduled to be monitored until September, 1998.</p>					
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## EXECUTIVE SUMMARY

The Oklahoma Department of Transportation (ODOT) has recently completed a field performance evaluation of Illbruck Willseal (hereafter referred to as Willseal), at one of two experimental evaluation stations.

At the site where the evaluation has been completed, an expansion joint in the deck of an overpass bridge was sealed with Willseal. The bridge is located on U.S. 62, where it crosses over Choctaw Road, east of Oklahoma City.

In October, 1993, the expansion joint was sealed as a demonstration of Willseal in a bridge joint application. Installation was done by Owen Lea, a representative of Freeport, Inc., the local Willseal distributor. The maximum opening of the joint sealed is 89 mm (3 ½ in). Two sticks of Willseal, each sized to seal half of the opening, were used. One stick was attached to each joint face, with the adhesive backing which is part of the material. In addition to the adhesive backing, a Sika adhesive was applied to the joint face before the Willseal was attached to it. The two sticks were fastened to each other, where they met in the middle of the joint, with the same Sika adhesive.

The application on U.S. 62 has been monitored by ODOT's Office of Research since installation. The Willseal performed adequately (no leaks or other failures) through September 27, 1996, when the last scheduled survey was done. On December 2, 1996, an unscheduled survey was done to get a photograph of the sealed joint. At that time, it was noted that the sealant has failed where the two sticks of Willseal had been fastened together with Sika adhesive.

At the second evaluation site, two bridges on I-44, located where I-44 crosses the south end of Arcadia Lake, were sealed with Willseal. The installation was done in September, 1995. Maximum joint opening on the two I-44 bridges was 37 mm (1 ½ in). Each opening was sealed with a single stick of Willseal, sized for the maximum joint opening. One side of the Willseal stick was attached to the joint with the adhesive backing which is part of the material, plus Sika adhesive. The other side was attached with Sika adhesive only. The last survey of this location was done December 2, 1996. The sealant was performing well in both bridge joints at that time. No failures or other unusual conditions were observed. Monitoring of this location is expected to continue until September, 1998, when the three-year evaluation will be completed.

The contents of this report reflect the views of the author(s) who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the views of the Oklahoma Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation. While trade names may be used in this report, it is not intended as an endorsement of any machine, contractor, process, or product.

## SI (METRIC) CONVERSION FACTORS

<i>Approximate Conversions to SI Units</i>					<i>Approximate Conversions from SI Units</i>				
Symbol	When you know	Multiply by	To Find	Symbol	Symbol	When you know	Multiply by	To Find	Symbol
<b>LENGTH</b>					<b>LENGTH</b>				
in	inches	25.40	millimeters	mm	mm	millimeters	0.0394	inches	in
ft	feet	0.3048	meters	m	m	meters	3.281	feet	ft
yd	yards	0.9144	meters	m	m	meters	1.094	yards	yd
mi	miles	1.609	kilometers	km	km	kilometers	0.6214	miles	mi
<b>AREA</b>					<b>AREA</b>				
in <sup>2</sup>	square inches	645.2	square millimeters	mm <sup>2</sup>	mm <sup>2</sup>	square millimeters	0.00155	square inches	in <sup>2</sup>
ft <sup>2</sup>	square feet	0.0929	square meters	m <sup>2</sup>	m <sup>2</sup>	square meters	10.764	square feet	ft <sup>2</sup>
yd <sup>2</sup>	square yards	0.8361	square meters	m <sup>2</sup>	m <sup>2</sup>	square meters	1.196	square yards	yd <sup>2</sup>
ac	acres	0.4047	hectares	ha	ha	hectares	2.471	acres	ac
mi <sup>2</sup>	square miles	2.590	square kilometers	km <sup>2</sup>	km <sup>2</sup>	square kilometers	0.3861	square miles	mi <sup>2</sup>
<b>VOLUME</b>					<b>VOLUME</b>				
fl oz	fluid ounces	29.57	milliliters	mL	mL	milliliters	0.0338	fluid ounces	fl oz
gal	gallons	3.785	liters	L	L	liters	0.2642	gallons	gal
ft <sup>3</sup>	cubic feet	0.0283	cubic meters	m <sup>3</sup>	m <sup>3</sup>	cubic meters	35.315	cubic feet	ft <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.7645	cubic meters	m <sup>3</sup>	m <sup>3</sup>	cubic meters	1.308	cubic yards	yd <sup>3</sup>
<b>MASS</b>					<b>MASS</b>				
oz	ounces	28.35	grams	g	g	grams	0.0353	ounces	oz
lb	pounds	0.4536	kilograms	kg	kg	kilograms	2.205	pounds	lb
T	short tons (2000 lb)	0.907	megagrams	Mg	Mg	megagrams	1.1023	short tons (2000 lb)	T
<b>TEMPERATURE (exact)</b>					<b>TEMPERATURE (exact)</b>				
°F	degrees Fahrenheit	(°F-32)/1.8	degrees Celsius	°C	°C	degrees Celsius	9/5+32	degrees Fahrenheit	°F
<b>FORCE and PRESSURE or STRESS</b>					<b>FORCE and PRESSURE or STRESS</b>				
lbf	poundforce	4.448	Newtons	N	N	Newtons	0.2248	poundforce	lbf
lbf/in <sup>2</sup>	poundforce per square inch	6.895	kilopascals	kPa	kPa	kilopascals	0.1450	poundforce per square inch	lbf/in <sup>2</sup>

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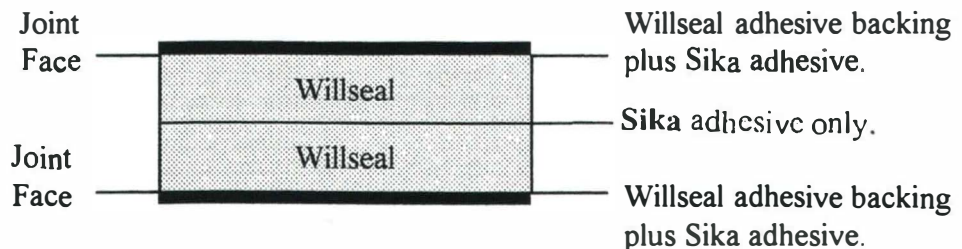
## INTRODUCTION

On October 14, 1993, an Illbruck Willseal (hereafter referred to as Willseal) expansion joint sealing device was installed on the overpass bridge where U.S. 62 crosses over Choctaw Road, east of Oklahoma City. U.S. 62 is a divided four lane highway in this area. The expansion joint sealed was located on the bridge carrying eastbound traffic. ADT at this location is roughly 14,000. The installation was done by Owen Lea, of Freeport, Inc., as a demonstration of Willseal used to seal expansion joints in bridge decks. Freeport, Inc. is the local distributor of Willseal.

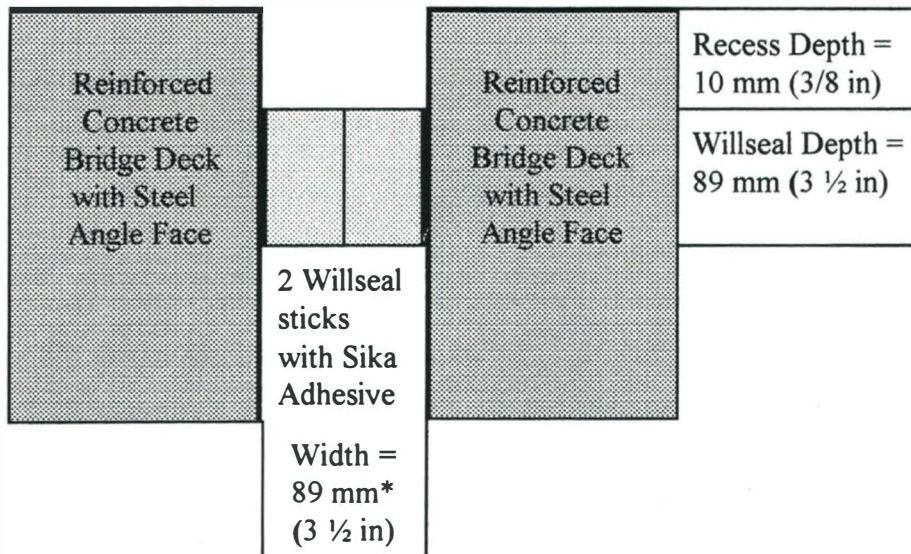
## INSTALLATION

The Office of Research of The Oklahoma Department of Transportation (ODOT) was notified of the installation after it had been completed. Therefore, the installation procedure was not observed by ODOT Research. Information describing installation was received by telephone from Freeport, Inc.

Before installation, the faces of the joint were cleaned by sandblasting. Joint faces consisted of "Armor-Joint"-type steel angles. When the faces had been sandblasted, they were cleaned by compressed air. A Sika brand adhesive was then applied to the joint faces. Two sticks of Willseal, each sized to seal one-half of the 89 mm (3 ½ in) expansion joint opening were then applied as described in the Illbruck Installation Instructions (Appendix A). The Willseal was fastened to the joint face on each side with the Sika adhesive, in addition to the adhesive backing on the Willseal. The two faces of the Willseal which met in the center of the joint opening were fastened to each other by the same Sika adhesive. Adhesives used are diagrammed in Figure 1.



**Figure 1. Diagram of Willseal Bridge Joint Seal Showing Adhesives Used.**



\*Maximum Joint Width

**Figure 2. Cross Sectional Diagram Showing Dimensions, Willseal Device on U.S. 62, Choctaw Road Overpass.**

## EVALUATION

The Willseal installation has been monitored since shortly after it was completed. The first inspection was done October 18, 1993, when ODOT Research received notice that it was in place. Since that time, it has been surveyed twice a year, on (approximate) six month intervals. Observations from each survey are listed in Table 1.

<b>Table 1. Surveys of Willseal Device Located on U.S. 62 Overpass Bridge crossing Choctaw Road.</b>	
<b>Date (Month, Year)</b>	<b>Observations</b>
October, 1993	Device is in good condition. No unusual observations.
April, 1994	Device is in good condition. Approximately one inch of sand is on top of the device (from sanding due to ice formation).
November, 1994	Device is in good condition. Bridge has apparently been swept. Approx. 1/4 inch of sand remains on the seal.
April, 1995	Device is in good condition. There is approx. One inch of sand on top of the Willseal device from sanding during winter maintenance.
October, 1995	No apparent change since last survey. Sand on top of the seal has not been swept off as it has in the past.
April, 1996	Device is still in good condition. Swept by hand during the survey so it could be inspected.
September, 1996	The Willseal device again has sand and dirt accumulated on top of it from an unknown source, but still appears to be functioning as a water-tight seal.
December, 1996*	Two adhesion failures (approx. 6 in. And 18 in. long) are located where the two sticks of Willseal were fastened together with Sika adhesive.

\*Unscheduled Survey.

## DISCUSSION

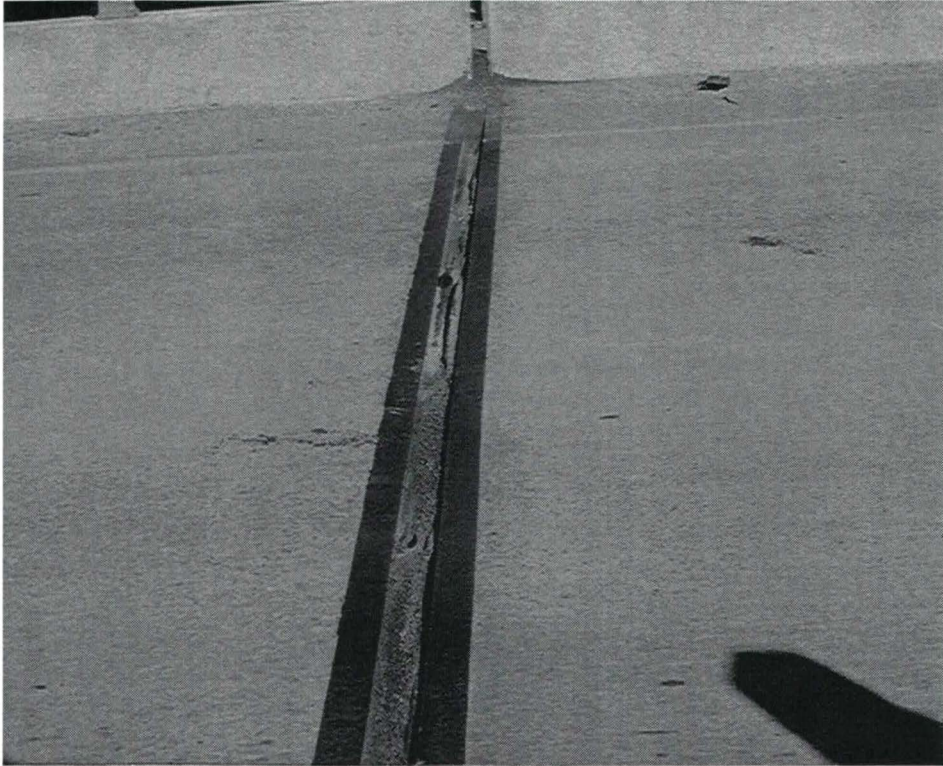
When the last scheduled survey was done (September 27, 1996), The Willseal device was still in place, and functioning as a water-tight joint seal. At that time, the device had an accumulation of sand, 19 mm (3/4 in) to 25 mm (1 in) in depth, on top of it. An unscheduled survey was made on December 2, 1996, to get a photograph of the device. It was noted at that time that two failures had occurred, both were located in the middle of the joint (Figure 2). Each winter, the bridge deck has to be sanded, salted, or both, due to ice forming on its surface. Sand, salt, and debris from other sources, then collect in sealed joints. As vehicles pass over the joints, they push the accumulated matter down against the joint seal. The accumulated matter also absorbs water from precipitation, staying wet or damp long after the deck has dried. Whether or not the accumulated debris in the joint directly caused or contributed to the failure is not clear. However, this condition is typical of sealed joints on ODOT bridges. This is not likely to change, as current personnel cuts make it unlikely that manpower will be available for cleaning bridges.

The failures noted consisted of a separation where the two sticks of Willseal were fastened together with adhesive. There were no failures where the edges of the Willseal were fastened to the sides of the joint by the adhesive backing plus the Sika adhesive. It may be possible to get a better performance from this type of joint seal if it is used where it is known in advance that the bridge will be swept regularly, and sand and other debris will not accumulate on top of it.

On September 13, 1995, expansion joints of two bridges located on I-44 over portions of Arcadia Lake were sealed with Willseal by Oklahoma Turnpike Authority maintenance forces. An ODOT Research representative observed the installation and has monitored performance of the joint seals since then. The representative indicated that Willseal is among the quickest and easiest to install of bridge joint seals currently available. It can also be installed at any temperature or in any weather condition.

Maximum joint openings on both bridges at the I-44 location were approximately 37 mm (1 1/2 in). Joints of these bridges were sealed with a single stick of Willseal, fastened to the joint face on one side with the Willseal adhesive backing plus Sika adhesive. The other side of the seal was fastened to the joint face with Sika adhesive. As of December 2, 1996. All of the seals were in good condition. These seals were applied so that their tops were near (within 6 mm (1/4 in) of) the roadway surface. There was no buildup of sand or other debris in the cracks.





**Figure 3. Failures in Willseal Device on U.S. 62 Overpass Bridge, December 2, 1996.**

### **CONCLUSIONS**

1. The Willseal device performed adequately for the entire three-year evaluation but failed approximately six weeks after the period ended.
2. The failure referred to above was an adhesion failure where the two Willseal sticks were fastened together with Sika adhesive. There were no failures where the Willseal material was fastened to the joint faces by the same adhesive plus the adhesive backing which is part of the Willseal sticks.

### **RECOMMENDATIONS**

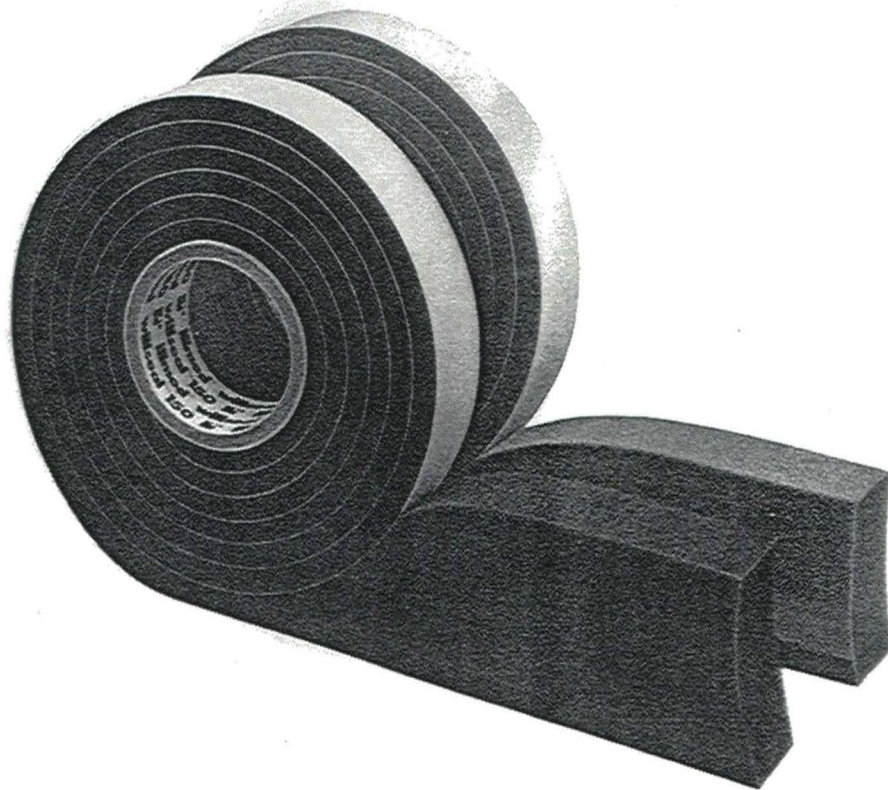
1. Willseal should not be approved as an ODOT bridge joint sealing option based on the U.S. 62 Choctaw Road Overpass installation.
2. Monitoring of the joints sealed with Willseal on the I-44 Arcadia Lake bridges should continue until the evaluation on that installation is completed.

## **APPENDIX A, ILLBRUCK WILLSEAL INSTALLATION INSTRUCTIONS**



**illbruck**

## **Installation Instructions**



**willseal™**

**The precompressed foam sealant  
that expands to fill your needs.**





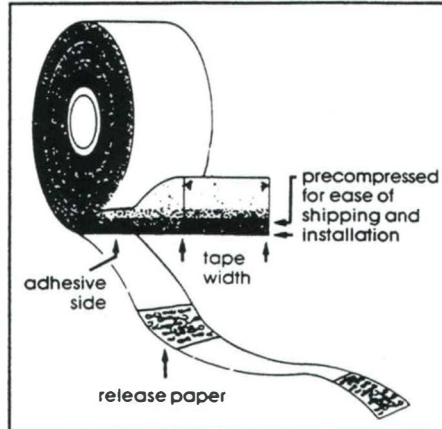
# willseal™ is easy to install

## Tools needed:

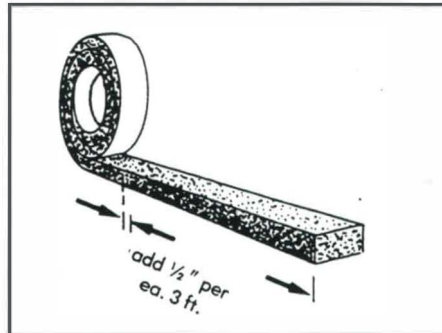
- sharp knife
- putty knife
- measuring tape

## To install willseal:

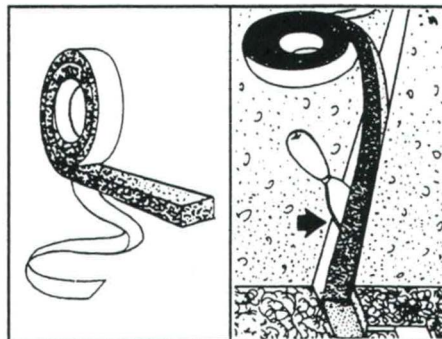
1. Clean joints of dirt and debris.
2. Unwind willseal along the length of the joint.
3. Measure exact length of joint, then add  $\frac{1}{2}$ " to each 3' of joint length to determine proper length of willseal.
4. Cut willseal to the proper length with sharp knife.
5. Remove the release paper from the adhesive backing on willseal (consider working in short sections).
6. Place willseal into the joint and lightly press adhesive against side of joint with hand or putty knife.
7. Using hands, or putty knife, continue pressing willseal to one side of the joint until firmly positioned.
8. Continue along joint, working in short sections, until complete. Remember to gradually use the extra  $\frac{1}{2}$ " per 3' of willseal as you fill the joint.



A look at willseal.



Add an additional  $\frac{1}{2}$ " of willseal for every 3' of joint.

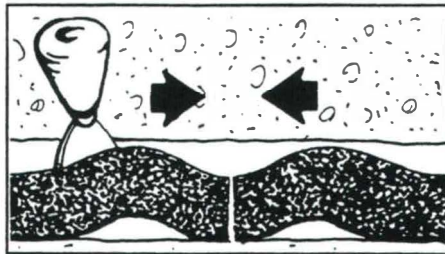


Remove release paper in short sections. Place willseal in joint with putty knife or fingers.

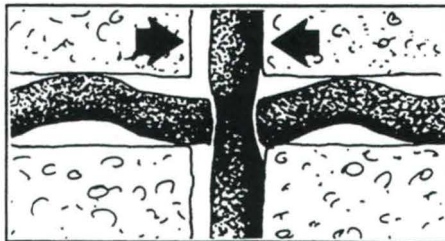
## Helpful Hints:



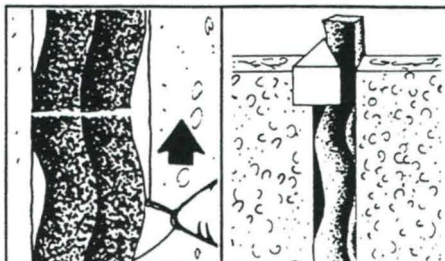
Do not pull willseal around corners.  
Cut and butt willseal at corners.



Always add extra willseal at seams & splices to ensure a positive seal.



Seal cross joints using one continuous piece and two firmly butted pieces.



Two pieces of willseal can be applied side-by-side. In wet joints, use shims to keep pressure on willseal.

### Remember...

3' + 1/2" of willseal for every 3' of joint.

### When sealing pre-cast panels...

attach willseal to the units already in place, then add new panel.

### When sealing window and/or door frames...

never pull willseal around a corner. Install willseal in two separate lines, butted firmly in corner.

### When sealing long joints...

use one of these techniques:

- Cut ends straight and butt together.
- Taper-cut and overlap.
- Pinch ends and overlap.

### When sealing cross-joints...

install willseal in one joint, then install willseal in the cross-joint, butting the new pieces tightly to the first piece.

### When working with fresh concrete...

willseal can be applied in usual manner.

### When sealing wide-joint sections...

use two layers of willseal pressed together. This method is only recommended for small applications. For larger applications, use a more suitable size of willseal.

### When installing willseal in wet joints...

willseal may not adhere to a wet surface immediately. To keep willseal in place until expanded, place wood shims against the non-adhesive side of willseal until the adhesive forms a permanent bond with the side of the joint.

## **Temperature effect on willseal expansion rate**

<b>When joint temp is:</b>	<b>willseal expands in:</b>
<b>80°F (30°C)</b>	<b>32 minutes</b>
<b>70°F (20°C)</b>	<b>2 hours</b>
<b>64°F (15°C)</b>	<b>6 hours</b>
<b>50°F (10°C)</b>	<b>12 hours</b>
<b>40°F (5°C)</b>	<b>24 hours</b>
<b>32°F (0°C)</b>	<b>48 hours</b>
<b>(Times shown are approximate for willseal stored at 68°F)</b>	

**Note:** to speed up expansion at colder temperatures, apply heat with a heat gun.



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