COMPARISON CHARTS: V-1, V-2, V-100 & V-100 DEEP POUR

To view chart on your screen:

in the Acrobat Menu bar, choose "View", then "Rotate Clockwise"

PHYSICAL PROPERTY	V-1 PREMIUM GROUT	V-2 GENERAL PURPOSE GROUT	V-100 STANDARD FORMULA EPOXY GROUT	V-100 DEEP POUR 3-PART FORMULA EPOXY GROUT
Compressive Strength (PSI)				
6 Hours	---	---	9,000	---
24 Hours	5,500	2,400	---	7,000
Ultimate/Cure Time	11,000 (28 Days)	8,000 (28 Days)	16,800 (7 Days)	13,500 (7 Days)
Tensile Strength	640	---	4,260	3,500
Flexural Strength (PSI)	1,430	---	6,800	5,000
Allowable Thickness (Min-Max)	3/4-8"	3/4-8"	1/16-1"	1-8"
Working Time (Min)	20-30	20-30	15	60
Can Add Pea Gravel	Yes	Yes	Yes	No
Yield/Unit	48# Bag = 690 cu.in. (2.5) 48# Bags = 1 cu.ft 100# Bag = 1434 cu.in. (1.2) 100# Bags = 1 cu.ft.	48# Bag = 743 cu.in. 2.3 Bags = 1 cu.ft. 100# Bag = 1512 cu.in. 1.14 Bags = 1 cu.ft.	105 lbs/cu.ft. 1¼# Kit = 20 cu.in. (86) 1¼# Kits = 1 cu.ft. 11# Kit = 180 cu.in. (10) 11# Kits = 1 cu.ft. 25# Kit = 412 cu.in. (4.4) 25# Kits = 1 cu.ft. 55# Kit = 900 cu.ft. (1.9) 55# Kits = 1 cu.ft.	1 cu.ft.

VOLUME OF GROUT REQUIRED PER HOLE DIAMETER

To view chart:
In Acrobat Menu Bar
choose "View"
then
"Rotate Clockwise"

UNISORB

VOLUME (IN CU. IN.) OF GROUT REQUIRED FOR ONE HOLE

Depth	Hole Diameter												
	1.5	2	2.5	3	3.5	4	5	6	7	8	9	10	12
4	7.1	12.6	19.6	28.3	38.5	50.3	78.5	113.1	153.9	201.1	254.5	314.2	452.4
5	8.8	15.7	24.5	35.3	48.1	62.8	98.2	141.4	192.4	251.3	318.1	392.7	565.5
6	10.6	18.8	29.5	42.4	57.7	75.4	117.8	169.6	230.9	301.6	381.7	471.2	678.6
7	12.4	22.0	34.4	49.5	67.3	88.0	137.4	197.9	269.4	351.9	445.3	549.8	791.7
8	14.1	25.1	39.3	56.5	77.0	100.5	157.1	226.2	307.9	402.1	508.9	628.3	904.8
9	15.9	28.3	44.2	63.6	86.6	113.1	176.7	254.5	346.4	452.4	572.6	706.9	1017.9
10	17.7	31.4	49.1	70.7	96.2	125.7	196.3	282.7	384.8	502.7	636.2	785.4	1131.0
12	21.2	37.7	58.9	84.8	115.5	150.8	235.6	339.3	461.8	603.2	763.4	942.5	1357.2
14	24.7	44.0	68.7	99.0	134.7	175.9	274.9	395.8	538.8	703.7	890.6	1099.6	1583.4
16	28.3	50.3	78.5	113.1	153.9	201.1	314.2	452.4	615.8	804.2	1017.9	1256.6	1809.6
18	31.8	56.5	88.4	127.2	173.2	226.2	353.4	508.9	692.7	904.8	1145.1	1413.7	2035.8
20	35.3	62.8	98.2	141.4	192.4	251.3	392.7	565.5	769.7	1005.3	1272.3	1570.8	2261.9

V-100 CHEMICAL RESISTANCE GUIDE

V-100 EPOXY GROUT CHEMICAL RESISTANCE GUIDE

SPECIALTY PRODUCTS

CHEMICAL	V-100 HI TEMP	V-100 DCR	V-100 CR	V-100 XTRA TEMP
Water	E	E	E	E
10% Acetic Acid	E	F	F	E
10% Sulfuric Acid	E	E	E	E
50% Sulfuric Acid	E	E	NR	E
10% Hydrochloric Acid	E	E	E	E
10% Nitric Acid	E	E	E	E
50% Ammonium Hydroxide	E	E	E	E
100% Ammonium Hydroxide	E	E	E	E
50% Sodium Hydroxide	E	E	E	E
Methanol	E	NR	NR	E
Xylene	E	E	E	E
Mineral Spirits	E	E	E	E
Acetone	NR	NR	NR	E
Trichloroethane	G	E	E	E
Motor Oil	E	E	E	E
Unleaded Gasoline	E	E	E	E
Leaded Gasoline	E	E	E	E
Diesel Fuel	E	E	E	E
Kerosene	E	E	E	E
15% Sodium Hypochlorite	E	E	E	E

E=Excellent G=Good F=Fair NR=Not Recommended

It should be noted that all products were immersed for 30 days at 72°F; cure cycle equaling 7 days at 72°F prior to immersion. V-100 Xtra Temp cured 24 hrs. at 72°F; 4 hrs. at 200°F; 4 hrs. at 350°F. All ratings are based on % weight gain or loss.

Please contact Unisorb Engineering to discuss the chemical resistance for chemicals not listed. Because each application varies by the exact combination of chemicals, exposure and temperature, Unisorb recommends product performance be verified by a test patch prior to the installation.

TYPICAL VISCOSITIES OF UNISORB PRODUCTS

FLUIDITY OF UNISORB EPOXY PRODUCTS

In discussion with customers, we frequently find ourselves asked about the fluidity of our epoxy products. The chart below, listing typical viscosities and the viscosities of various Unisorb epoxies, will help you in conveying the relative fluid properties of our epoxies when compared to typically used everyday products.

The unit used to express viscosity/fluidity is centipoise (cps). Centipoise is measured by placing a rotating shaft of specified dimensions into the fluid to be tested and measuring the resistance to turning. The base measurement for viscosity is water with a centipoise value of 1. Note that these viscosities are at room temperature and will vary with changes in temperature.

TYPICAL VISCOSITIES (IN CENTIPOISE)

Water	1
#10 Motor Oil	500
Pancake Syrup	2500
Honey	10000
Chocolate Syrup	25000
Catsup	50000
Peanut Butter	250000
Caulking Compound	1000000

VISCOSITIES OF VARIOUS UNISORB EPOXIES (IN CENTIPOISE)

Standard V-100 Epoxy Grout	6000
Deep Pour V-100 Epoxy Grout, 3-Part	40000
DCR V-100 Grout	20000
Joint Filler V-100	2200

NEW V-100 EPOXY GROUTS

Attached are Unisorb Product Data sheets which introduce the ***new*** Low-Temp and CR Hi-Flow V-100 Epoxy Grouts.

The *new* Low-Temp epoxy product will cure in low-temperature applications where regular epoxies have their molecular activity literally turned off. This opens the door for epoxy usage where in the past epoxy grout could not be considered as a solution. Included on the data sheet is the compressive strength vs. cure time graph.

The *new* CR Hi-Flow has similar properties to the old CR at a lower cost and increased flowability.

As shown on the attached V-100 Comparison Chart, the properties of both *new* products are quite impressive when compared to our normal epoxy products.

As additional testing is performed, the Comparison Chart will be revised so that it is always up-to-date.

Also attached is a bulletin on cube vs. cylinder curing techniques.

LOW-TEMP V-100 EPOXY GROUT

Low-Temp V-100 Epoxy Grout is a 100% solid, solvent-free, 2-part epoxy system designed to be poured when air temperatures are between 25°F and 60°F. Optimum pouring temperature range is 45-55°F which allows for typical worklife and installation. Low-Temp V-100 **MUST BE STORED AT, OR WARMED TO**, 45-65°F. Do not use Low-Temp V-100 at temperatures **ABOVE** 65°F; the worklife is too short and cracking may result.

PHYSICAL PROPERTIES

Compressive Strength (ASTM D-695)	9,500 psi @ 40°F (4°C) 18,700 psi @ 72°F (22°C)
Heat Distortion Temperature (ASTM D-648)	153°F (67°C)
Service Temperature	200°F (93°C)
Mixed Viscosity (ASTM D-2393) (Brookfield Viscometer)	20,000 cps @ 40°F (4°C) 4,000 cps @ 72°F (22°C)
Worklife	7 min @ 72°F (22°C) 30 min @ 40°F (4°C)
Gel Time	2 hrs @ 40°F (4°C)
Hardness (ASTM D-2240) (ASTM D-2583)	95D @ 72°F (22°C) 50 Barcol 72°F (22°C)
Linear Shrinkage	0.00021 in./in. @ 40° F (4°C) 0.00100 in./in. @ 72°F (22°C)
Specific Gravity (ASTM D-792)	1.70
Water Absorption (30 Days @ 72°F)	0.12%
Depth of Pour	2 in. @ 50°F (10°C)

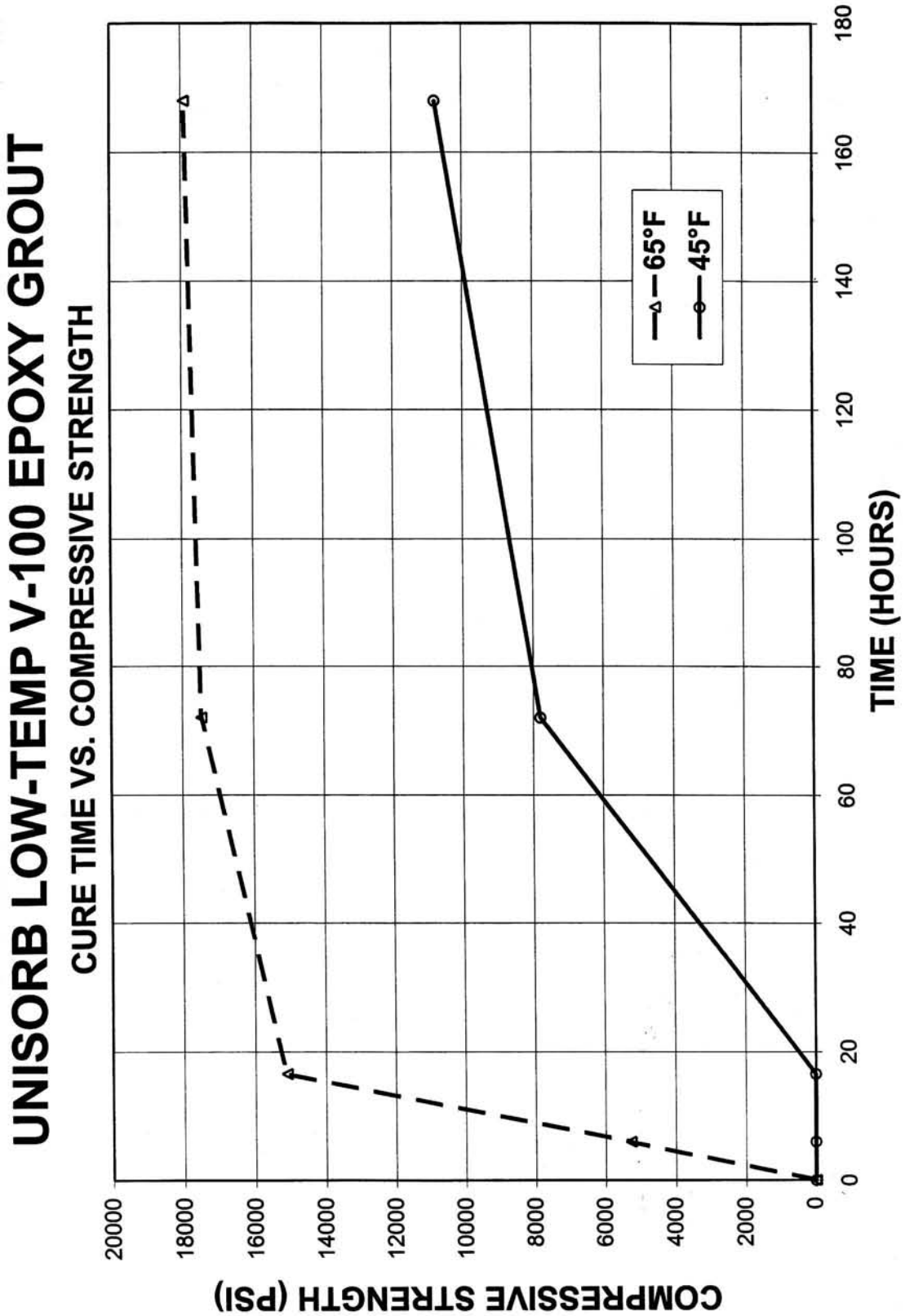
HANDLING PROCEDURE

Low-Temp V-100 Epoxy Grout must be stored between 45°F and 65°F prior to use. To use, pour the hardener into the resin and mix until a uniform color appears, usually 2-3 minutes. Pour this material immediately after mixing; working time is much shorter than standard epoxy.

CURE TIME VS. COMPRESSIVE STRENGTH

TO VIEW CHART:

IN ACROBAT MENU, CHOOSE "VIEW", THEN "ROTATE CLOCKWISE"



CR HI-FLOW V-100 EPOXY GROUT

CR Hi-Flow V-100 Epoxy Grout is a maximum-performance, pumpable, two-component, solvent-free, zero VOC system, specifically designed when maximum strength is required and/or placement is in a harsh environmental condition. After curing, CR Hi-Flow V-100 Epoxy Grout is impervious to water and seawater and can be used in total submersion without affect on its operational functions.

PHYSICAL PROPERTIES

Compressive Strength (ASTM D-695)	18,000 psi 7 Day @ 72°F (22°C) 20,000 psi Ultimate
Heat Distortion Temperature (ASTM D-648)	200°F (93°C)
Service Temperature	275°F (Max. Continuous)
Mixed Viscosity (ASTM D-2393) (Brookfield Viscometer)	7,500 cps @ 77°F
Worklife	20-25 min @ 72°F (22°C)
Gel Time	30-40 min @ 72°F (22°C)
Cure Time	12 hrs @ 72°F (22°C)
Hardness (ASTM D-2240) (ASTM D-2583)	95D @ 72°F (22°C) 70D @ 300°F
Linear Shrinkage (ASTM D-2566)	0.0009 in./in. @ 72°F (22°C)
Specific Gravity (ASTM D-792)	1.70
Water Absorption (30 Days @ 72°F)	0.08%
Depth of Pour	2 in. max.
Tensile Strength (ASTM D-638)	5,500 psi
Flexural Strength (ASTM D-790)	8,100 psi
Creep Test (ASTM C-1181) (600 psi @ 150°F)	3.54×10^{-3} in./in.

V-100 EPOXY GROUT COMPARISON

	STANDARD V-100	CR V-100	CR HI-FLOW V-100	LOW-TEMP V-100*	DEEP POUR V-100	DCR V-100
Compressive Strength	16,800 psi 7-Day	18,500 psi 7-Day	18,000 psi 7-Day	9,500 psi @ 40°F	14,000 psi 7-Day	20,000 PSI 7-Day
			20,000 psi Ultimate	18,700 psi @ 72°F		
Heat Distortion Temp	132°F	150°F	200°F	153°F	136°F	227°F
Service Temp	150°F max.	250°F max.	275°F max.	200°F max.	250°F max.	325°F max.
Mixed Viscosity	6,000 cps	16,000 cps	7,500 cps	20,000 cps @ 40°F	37,000 cps	20,000 cps
				4,000 cps @ 72°F		
Work Life	10-15 min @ 72°F	45 min @ 77°F	20-25 min @ 72°F	30 min @ 40°F	60 min @ 70°F	40 min @ 72°F
				7 min @ 72°F		
Gel Time	30 min @ 72°F	60 min @ 77°F	30-35 min @ 72°F	2 hrs @ 40°F	90-120 min @ 77°F	60 min @ 72°F
Hardness	90 D	90 D	95 D	95 D @ 72°F		90 D
Creep Test 600 psi @ 150°F	1.95×10^{-2} in./in.	1.09×10^{-2} in./in.	3.54×10^{-3} in./in.	N/A (TBA)	7.09×10^{-3} in./in.	5.59×10^{-3} in./in.
Linear Shrinkage	0.00025 in./in. @ 77°F	0.0001 in./in.	0.0009 in./in. @ 72°F	0.00021 in./in. @ 40°F	0.0003 in./in.	0.0001 in./in. @ 72°F
				0.0010 in./in. @ 72°F		
Specific Gravity	1.7	1.8	1.7	1.7	2.22	2.07
H_2O Absorption	0.30% 30 day	0.03% 30 day	0.08% 30 day	0.12% 30 day	0.31% 30 day	0.12% 30 day
Depth of Pour	1" unconfined	2" max.	2" max.	2" max. @ 50°F	8" max.	8" max.
Tensile Strength	4,800 psi	4,900 psi	5,500 psi	N/A (TBA)	1,536 psi	3,000 psi
Flexural Strength	6,800 psi	8,500 psi	8,100 psi	N/A (TBA)	4,600 psi	6,000 psi
Package/Yield	11# kit = .10 cu ft	28# kit = .25 cu ft	28# kit = .27 cu ft	23# kit = .22 cu ft	3-part kit = 1 cu ft	63# kit = 0.5 cu ft
	22# kit = .21 cu ft	48# kit = .43 cu ft	56# kit = .50 cu ft	50# kit = .47 cu ft		125# kit = 1.0 cu ft
	55# kit = .53 cu ft	56# kit = .50 cu ft				
List Price	11# kit = $ 55.04	28# kit = $183.88	28# kit = $163.30	23# kit = $131.58	3-part kit = $182.37	63# kit = $196.67
	22# kit = $ 89.72	48# kit = $259.09	56# kit = $284.10	50# kit = $277.63		125# kit = $264.00
	55# kit = $216.38	56# kit = $309.47				

***NOTE** - For Low-Temp V-100 Epoxy Grout only

1. Store at 45°-65°F
2. Warm to 45°-65°F prior to use
3. DO NOT use above 65°F
4. Low-temp can be used when air temperatures are as low as 25°F

V-100 EPOXY GROUT COMPARISON

TO VIEW CHART:
IN ACROBAT MENU
CHOOSE "VIEW"
THEN
"ROTATE CLOCKWISE"

V-100 EPOXY GROUT COMPARISON

	CR V-100	CR HI-FLOW V-100	LOW-TEMP V-100*
Compressive Strength	18,500 psi 7-Day	18,000 psi 7-Day	9,500 psi @ 40°F
		20,000 psi Ultimate	18,700 psi @ 72°F
Heat Distortion Temp	150°F	200°F	153°F
Service Temp	250°F max.	275°F max.	200°F max.
Mixed Viscosity	16,000 cps	7,500 cps	20,000 cps @ 40°F
			4,000 cps @ 72°F
Work Life	45 min @ 77°F	20-25 min @ 72°F	30 min @ 40°F
			7 min @ 72°F
Gel Time	60 min @ 77°F	30-35 min @ 72°F	2 hrs @ 40°F
Hardness	90 D	95 D	95 D @ 72°F
Creep Test 600 psi @ 150°F	1.09×10^{-2} in./in.	3.54×10^{-3} in./in.	N/A (TBA)
Linear Shrinkage	0.0001 in./in.	0.0009 in./in. @ 72°F	0.00021 in./in. @ 40°F
			0.0010 in./in. @ 72°F
Specific Gravity	1.8	1.7	1.7
H_2O Absorption	0.03% 30 day	0.08% 30 day	0.12% 30 day
Depth of Pour	2" max.	2" max.	2" max. @ 50°F
Tensile Strength	4,900 psi	5,500 psi	N/A (TBA)
Flexural Strength	8,500 psi	8,100 psi	N/A (TBA)
Package/Yield	28# kit = .25 cu ft	28# kit = .27 cu ft	23# kit = .22 cu ft
	48# kit = .43 cu ft	56# kit = .50 cu ft	50# kit = .47 cu ft
	56# kit = .50 cu ft		

***NOTE** - For Low-Temp V-100 Epoxy Grout only

SHAPE FACTOR INFLUENCE ON COMPRESSIVE STRENGTH

Cube vs Cylinder:

Shape Factor Influence on Compressive Strength

A series of tests were performed on a batch of Unisorb V-1 Non Shrink Grout to show the relationship between the compressive strength reported when the test was performed per ASTM C-39 (Cylinders) and ASTM C-109 (Cubes). The results of these tests are summarized in the table below.

The grout mix included 50% by weight crushed limestone to accommodate the customers thickness requirements. Parallel tests were performed, with the samples being gathered, cured and tested at the same time and under the same conditions.

These results show that the difference may be considerably more than the 15% typically used to correct the height to diameter ratio.

This reinforces the importance of using the correct test procedure (ASTM C-109) when testing Unisorb grout.

	Cylinder	Cube	**% increase from cylinder to cube**
7 day	6585 psi	9165 psi	39%
28 day	8555 psi	11040 psi	29%

PHYSICAL PROPERTIES V-100

COMPARISON OF UNISORB V-100 CR FORMULA
vs.
COMPETITIVE GROUT PROVIDED BY NEWPORT NEWS

PHYSICAL PROPERTY	UNISORB V-100 CR FORMULA	COMPETITIVE EPOXY GROUT
COMPONENTS	2	3
MIXED VISCOSITY @ 25 C	16,000 CPS	40,000 CPS (UNISORB TESTED)
COMPRESSIVE STRENGTH	18,500 PSI	12,000 PSI (CLAIMED)
TENSILE STRENGTH	4,900 PSI (ASTM D-638)	2,000 PSI (CLAIMED) (ASTM C-307)
FLEXURAL STRENGTH	8,500 PSI (ASTM D-790)	4,000 PSI (CLAIMED) (ASTM C-580)
HDT (HEAT DISTORTION TEMP)	150F (ASTM D-648)	DATA NOT AVAILABLE
SERVICE TEMPERATURE	250F	140F
GEL TIME	60 MINUTES @ 25C	DATA NOT AVAILABLE
SHRINKAGE (7 DAY CURE @ 25C)	(LINEAR) 0.0001 IN/IN (VOLUME) OR 0.01% (ASTM D-2566)	DATA NOT AVAILABLE .01% (ASTM C-827) (LINEAR).0001 IN/IN (ASTM D-2566) (UNISORB TEST)
WATER ABSORPTION	0.03% (30 DAYS @ 25C)	0.19% (TIME/TEMP?)
COEFFICIENT OF THERMAL EXPANSION	5.0x10 -5 IN/IN/F (0.000050)	2.7x10-5 IN/IN/F (0.000027) (ASTM C-531)
FLEXURAL MODULUS	DATA NOT AVAILABLE	1.5x10-6 PSI (ASTM C-580)
BOND TO CONCRETE	STRONGER THAN CONCRETE	STRONGER THAN CONCRETE
IMPACT STRENGTH	BETTER THAN CONCRETE	BETTER THAN CONCRETE

UNISORB V-1
GROUT FIELD TESTING
(ASTM C-109)

1. MIX THE ENTIRE BAG
Some segregation of the mixture components may occur in shipping. Mixing a portion of a bag may give erroneous results. Make a record of the grout pour on the 'GROUT PLACEMENT RECORD.' This form records the environmental conditions at the time of the pour, and can be useful to explain differences between field tests and controlled environment lab tests.

2. TEST SPECIMENS
Make three samples for each test age. An extra set should be made to replace faulty specimens. Tests are performed at 3, 7, 14, and 28 days, unless otherwise specified in the contract. Use 2" machined metal cube molds for all tests on grout. Do not use plastic cube molds unless you will be capping the specimens with sulfur. Cylinder molds (3" dia. x 6" ht., or 4" dia. x 8" ht.) may be used when the grout is extended with aggregate. Consolidate grout in molds by rodding with a 3/8" diameter rod with a spherically rounded bottom. The compressive strength test results of cylindrical specimens will be between 78% and 83% lower than the 2" cube compressive strength test results due to the difference in the specimen geometry. Therefore, if cylinder specimens are used, the compressive strength test results should be multiplied by 1.25 to arrive at the corrected compressive strength compared to the 2" cube strength.

3. FIELD SAMPLING
Select a smooth level surface for the specimen molds at the site. The area should be protected from direct sunlight, and extreme heat or cold. Take field samples of the fully mixed grout from the middle of the pour to avoid the possibility of excess water at the beginning of the pour. Fill specimen molds half way, rod to consolidate, then fill to the top and rod again. Top off to fill the mold completely, strike off and place an oiled cover glass on the top of the specimen, sliding it on to avoid trapping air bubbles. Do not disturb or transport the specimens for 24 hours.

4. CURING OF TEST SPECIMENS
After the 24 hour set time, remove the specimens from the molds, and immerse them in saturated lime water @ 72°F or a fog spray moist room, maintained at 72°F and 95% or greater relative humidity. The grout will attain full strength in 28 days when cured in this environment.

5. TESTING SPECIMENS
Three samples are tested at each time interval specified in the contract. The 2" cube specimens are tested without capping by setting them on the side so that two of the sides that were in contact with the machined surfaces of the mold are in contact with the bearing blocks. Cylindrical specimens require sulfur capping. Do not use neoprene pad caps because of the high strength of the grout. Multiply cylindrical specimen compressive strength results by 1.25 to obtain the equivalent 2" cube strength. Test samples are marked and retained until all parties have reviewed test results.

GROUT REPLACEMENT RECORD

GROUT PLACEMENT RECORD

DATE: _____

LOCATION

Company	Contractor
Street	Street
City/State	City/State
Contact	Contact
Phone Fax	Phone Fax

SITE	**A/E FIRM**
Building	Street
Project No.	City/State
Equipment	Contact
Model S/N	Phone Fax

GROUT DATA

Type: **Pre-Soak:** **Hrs.**

Water: **Qts. Per** **Lbs.**

Total Usage Cu. Ft.: **No. of Bags:**

Base Plate Size: **x** **x** **Deep** **Forms:** **x** **x** **Deep**

Hole Size: **Dia. x** **Deep** **Quantity:**

Anchors:

Pea Gravel Size: **% by Weight:**

Placement:
- ____ **Gravity Flow**
- ____ **Head Box**
- ____ **Pump**
- ____ **Hose & Funnel**
- ____ **Vibrator**
- ____ **Straps**
- ____ **Other** _____

Ambient Temperature: **°F** **Relative Humidity:**

Pour Location: **Inside** **Outside**

Cure:
- _____ **Wet rag**
- _____ **Water Mist**
- _____ **Tenting**
- _____ **Seal - Type**

Comments:

By: _____ **Date:** _____

TECHNICAL TEST DATA OF V-1 MACHINERY GROUT

The technical data shown below are based on numerous tests conducted by several national and international independent testing laboratories with different ratios of water to V-1 dry material. ASTM and DIN procedures were employed.

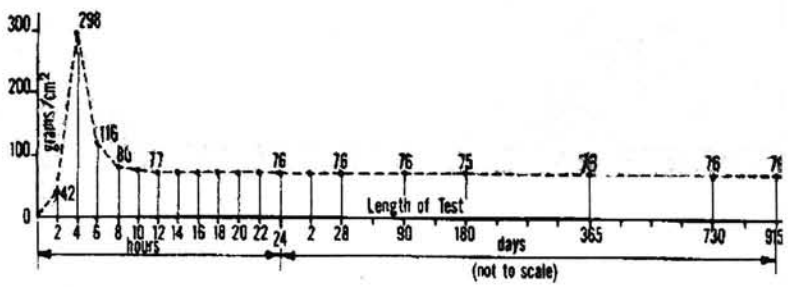
	24 HOURS	3 DAYS	7 DAYS	28 DAYS
COMPRESSIVE STRENGTH (MINIMUM PSI)	5,500	8,000	9,000	11,000
COMPRESSIVE STRENGTH WITH 50% GRAVEL ADDED (PSI) Up to 50% by weight of washed gravel, in sizes from 0.12 inch to 0.28 inch, can be added to the dry pre-mixed V-1 material.	5,100	6,800	8,000	9,700
TENSILE STRENGTH (PSI)	N.A.	N.A.	550	640
FLEXURAL STRENGTH (PSI)	N.A.	N.A.	1,150	1,430
HIGH TEMPERATURE EVALUATION COMPRESSIVE STRENGTH (PSI)	70°F control	800°F	900°F	1000°F
Average results of compressive strength tests after a standard 28 day cure, and three days at the given temperature.	11,000	11,000	9,700	8,400

TENSILE STRENGTH (PSI)	24 HOURS	3 DAYS	7 DAYS	28 DAYS
	N.A.	N.A.	550	640

INTERNAL PRESSURE DEVELOPMENT
(gram/cm²)

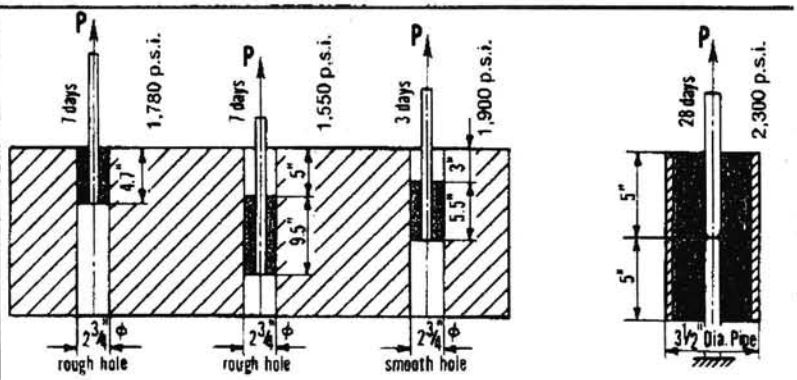
In its plastic state a grout should develop maximum internal void filling forces and during solidification a permanent compressive force should be reached and maintained. Only Unisorb V-1 Grout's exact programmed and controlled uniform step by step internal development guarantees non-shrinkage, a strong bond with the substrate and the prevention of harmfulinternal stresses. The 2½ year test presented here illustrates the permanent non-shrink bond strength of V-1 Grout.

The pressure of 1 psi (75 grams) remains constant, which is very important in insuring maximum density, coverage, and the transmission of dynamic forces into the foundation.



PULL-OUT ADHESIVE BOND
(1" Dia. Re-Bars)

These pull-out tests prove clearly the monolithic and adhesive bond formed as well as the non-shrink qualities of Unisorb V-1 Machinery Grout.



Yield per Bag: .4 Cubic Foot

ADHESION BETWEEN V-100 EPOXY GROUT & CONCRETE

ADHESION BETWEEN V-100 EPOXY GROUT AND CONCRETE

Attempts to measure the adhesion between V-100 epoxy grout products and concrete is often performed by loading the samples in tension. This type of test will show that concrete itself is the weaker member in tension. A test that is more indicative of the bond between epoxy and concrete is a slant shear test.

In this test concrete specimens are prepared using a mix of 30.1 lbs. of sand, 12.1 lbs. of portland cement and 4.8 lbs. of water. The samples are basically triangular in shape with a 2" square base. One side is 4¼" high and the diagonal goes from the top corner down to 3/4" from the base on the other side. The area of the resulting diagonal plane is 2" x 4". After a 28-day moist room cure the samples are dried and lightly sandblasted on the diagonal plane.

Epoxy is mixed in accordance with the instructions and applied to each diagonal surface. The diagonal surface of two concrete blocks are pressed together to form a rectangle approximately 2" x 2" x 5" high. The samples are blocked to keep the diagonal faces from slipping until the epoxy cures. After the desired cure time the samples are placed in a compression tester and loaded until failure.

Tests on standard V-100 epoxy grout show that all failures occur in the concrete. Values range from 4,000-4,400 psi with an average of 4,200 psi. The V-100 deep pour shows most failures in concrete with values ranging from 3,400-3,900 psi and an average of 3,700 psi.

The bond between V-100 epoxy grout and concrete is approximately the compressive strength of the concrete itself. Anchor bolts may be placed in concrete with V-100 epoxy products with every assurance that they will be as secure as those that have been cast in concrete.

V-1 BONDS TO CORE DRILLED HOLES

The ability of V-1 grout to adhere to the sidewall of a cored hole in concrete is critical in anchor bolt grouting. This property of V-1 grout is shown in the tests results below. In order to test the bond between the V-1 concrete, the anchor bolt embedment depths were held to less than or equal to the recommended minimum embedment depth (see chart). This assured that bolt failure did not occur before the grout and concrete was fully loaded.

The A-307 anchors were grouted into 2" diameter cored holes using V-1 grout. The method of failure was the anchor bolt material in the 1/2" anchors and concrete failure in the remainder. Concrete failures were a shear cone that developed in an approximate 45 degree pattern from the end of the bolt.

The fact that this shear cone development is through the grout and into the concrete shows that the bond of the grout to the concrete is stronger than the shear cone of the concrete.

Bolt Diameter	Calculated Full Embedment Strength	Failure Strength	Embedment Depth	Recommended Minimum Embedment Depth
1/2	8,230	10,840	4	4
5/8	13,108	12,850	4	5
3/4	19,372	23,200	5	6.5
1	35,148	29,466	7	8

PHYSICAL PROPERTIES OF DEEP POUR FORMULA

COMPARISON OF UNISORB DEEP POUR FORMULA
vs.
COMPETITIVE GROUT

PHYSICAL PROPERTY	UNISORB V-100 DEEP POUR FORMULA	COMPETITIVE EPOXY GROUT
COMPONENTS	3	3
MIXED VISCOSITY @ 25C	20,000 CPS	40,000 CPS (UNISORB TESTED)
COMPRESSIVE STRENGTH	13,500 PSI (ASTM D695)	12,000 PSI (CLAIMED)
TENSILE STRENGTH	3,500 PSI (ASTM D-638)	2,000 PSI (CLAIMED) (ASTM C-307)
FLEXURAL STRENGTH	5,000 PSI (ASTM D-790)	4,000 PSI (CLAIMED) (ASTM C-580)
HDT (HEAT DISTORTION TEMP)	125F (ASTM D-648)	DATA NOT AVAILABLE
SERVICE TEMPERATURE	250F	140F
GEL TIME	90-120 MINUTES @ 25C	DATA NOT AVAILABLE
SHRINKAGE (7 DAY CURE @ 25C)	(LINEAR) 0.00001 IN/IN (VOLUME) OR 0.001% (ASTM D-2566)	DATA NOT AVAILABLE .01% (ASTM C-827) (LINEAR).0001 IN/IN (ASTM D-2566) (UNISORB TEST)
WATER ABSORPTION	0.40% (30 DAYS @ 25C)	0.19% (TIME/TEMP?)
COEFFICIENT OF THERMAL EXPANSION	1.8x10 -5 IN/IN/F	2.7x10-5 IN/IN/F (0.000027) (ASTM C-531)
FLEXURAL MODULUS	DATA NOT AVAILABLE	1.5x10-6 PSI (ASTM C-580)
BOND TO CONCRETE	STRONGER THAN CONCRETE	STRONGER THAN CONCRETE
IMPACT STRENGTH	BETTER THAN CONCRETE	BETTER THAN CONCRETE

PHYSICAL PROPERTIES OF DEEP POUR FORMULA

PHYSICAL PROPERTY	UNISORB V-100 DEEP POUR FORMULA	COMPETITIVE EPOXY GROUT
DEPTH OF POUR	UP TO 8"	DATA NOT AVAILABLE
COMPRESSIVE STRENGTH AFTER 30 DAYS IMMERSION IN 25C WATER	18,500 PSI	DATA NOT AVAILABLE
COMPRESSIVE STRENGTH "EARLY STRENGTH" - 24 HRS @ 25C	7,000 PSI (ASTM D-695)	5,000 PSI (ASTM D-C579)
GENERAL CHEMICAL RESISTANCE	VERY GOOD	DATA NOT AVAILABLE

SUMMARY

A comparison of Unisorb V-100 Deep Pour Formula vs. the competitive epoxy grout was performed. The above data clearly shows the Unisorb product to be equal or superior.

Unisorb V-100 Deep Pour Formula's much lower viscosity would be very useful in gap filling areas where good flow is required. Unisorb V-100 Deep Pour Formula has higher physical strength in all categories: compressive strength, tensile and flexural. The heat resistance or service temperature of Unisorb V-100 Deep Pour Formula is far superior to the competitive material, 250F vs. 140F respectively.

The competitive manufacturer's data claims that their grout does not shrink according to ASTM C-827 volume shrinkage test method; however, this test does not have the sensitively needed to accurately measure shrinkage in a polymer based system. ASTM D-2566 linear shrinkage test procedure was used in testing Unisorb V-100 Deep Pour Formula. Using this test procedure V-100 Deep Pour Formula showed 0.00001 in./in. shrinkage. In testing the competitive epoxy grout using this test method a result of 0.0001 in./in was produced. This result proves that the material does shrink and illustrates the inadequacy of the C-827 test in that the test method is not sensitive enough to accurately measure shrinkage of a polymer based system.

Unisorb V-100 Deep Pour Formula also maintains its physical properties while submerged in water (compressive strength after 30 days showed no change); water absorption after 30 days at 25C was 0.40%, compared with the competitor's 0.19% with no time specified.

Contrary to statements made by others, polymers in general do not get stronger as silica type aggregates are added. The compressive strength is actually reduced. Test data for Unisorb's Deep Pour Formula illustrates this fact nicely. When no aggregate is added the compressive strength is 18,000 psi. When 90# of aggregate is added, the compressive strength is 14,000 psi and is further reduced to 13,000 psi with 120# of aggregate.

UNISORB STRUCTURAL REPAIR FORMULA

A Wall and Ceiling Patching Compound

Unisorb Structural Repair Formula is a cement based, self-bonding and quick setting, wall and ceiling patching compound. When used for patching spalls or holes between 1/2" to 3" thick, it provides a non-shrink, high strength repair. This product does not require concrete primers, bonding agents, etc.

PHYSICAL CHARACTERISTICS

Compressive Strengths:	300 psi (1 hour)
	2,400 psi (3 hours)
	3,000 psi (24 hours)
	4,100 psi (7 days)
	5,100 psi (28 days)
Flexural Strength:	1,100 psi
Shear Bond To Concrete:	800 psi (1 day)
	1,300 psi (7 days)
Set Time @ 72F:	13 mins. (initial)
	15 mins. (final)
Yield:	50 lbs. = .40 cu. ft.
	20 lbs. = .16 cu. ft.

APPLICATION TECHNIQUES

Mix dry powder with clean water at the job site to form a trowelable mixture. Use exact ratio of 4 qts. of water to 50 lbs. of grout. Mix only the amount that can be readily placed. Place in area to be repaired and trowel to desired finish. Allow to cure. **NOTE:** Thick sections of repair may need to be accomplished in separate lifts.

BASE PREPARATION

All contact surfaces must be cleaned of all oil, grease, scale, etc. Unsound concrete should be chipped out. The area to be repaired should be chipped out to a minimum depth of 1/2". Rough concrete surfaces provide the best bonding conditions. **NOTE:** Do not use as a concrete "capping" material.

TEMPERATURE CONSIDERATIONS

Use standard high temperature concreting techniques for conditions over 90F, and low temperature techniques for conditions below 50F.

V-1 MACHINERY GROUT REFERENCE LIST

PROJECT: Chesapeake Paper
West Point, VA

Contractor: Tidewater Construction
Contact: Bob Parris, Project Mgr.
804-843-5665

V-1 has been used for installation of new paper machine and also has been used to replace metallic grout which failed in the dryer section of another paper machine. Grout is subjected to water, steam and temperatures in excess of 200F.

PROJECT: Georgetown Steel
Georgetown, SC
Contact: Steve Rishel, Plant Engineer
803-546-2525

V-1 was used under the rolling mills and various other locations in the plant. V-1 is the only grout which has been able to withstand high temperatures and constant contact with water.

PROJECT: Teledyne Allvac
Monroe, NC
Contact: Tim Stegall, Project Engineeer
704-289-4511

Consulting Engineers: L. B. Smith & Associates
Contact: Larry Smith
794-289-5168

V-1 was used on the installation of a GFM Rotary Forge. Grout is subjected to high impact and heavy weight. Installation was completed in 1983 with no problems to date.

V-1 MACHINERY GROUT REFERENCE LIST

PROJECT: Carpenter Steel Company
Reading, PA
Contact: Mike Stefovik, Project Engineer
215-371-2607

V-1 was used on the installation of a GFM Rotary Forge. Grout is subjected to high impact and heavy weight. Installation was completed in 1983 with no problems to date.

PROJECT: Westvaco Paper
Covington, VA
Contact: Steve Gaylor
703-969-5000

V-1 was used for installation of new paper machine in 1985. V-1 was selected for its ease of placement, high early strength and ability to withstand the papermill environment. No problems to date.

PROJECT: I/N TEC and I/N KOTE

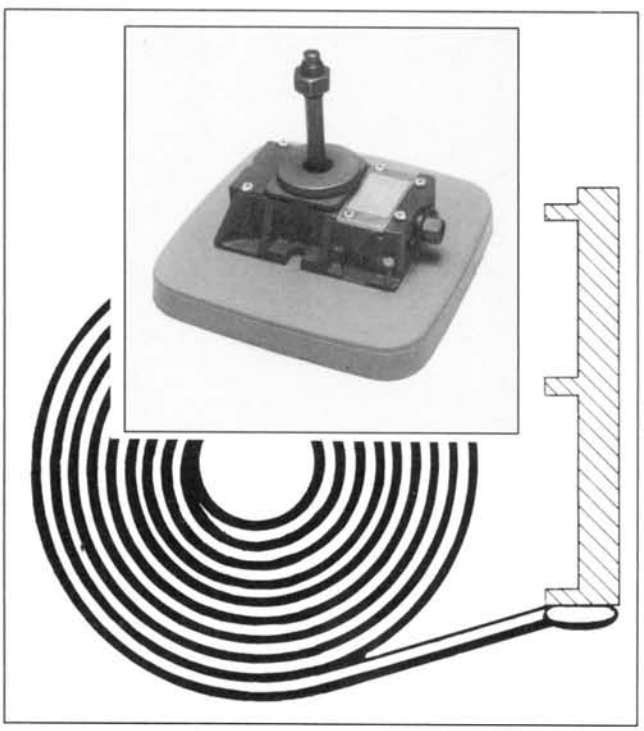
Contractor: Calumet Construction
Hammond, IN
Contact: Mr. Bill Meeker
219-844-9420

Steel process equipment for sheet material, cold mill, squaring shears, edgers, cooling lines, etc.

PROJECT: Various
United Engineers & Constructors
Philadelphia, PA
Contact: Tom Stranix, Civil/Structural Department
215-422-3040

All types of steel mill equipment.

GROUT FORMS General Information & Proper Grouting Procedures



UNISORB® Grout Forms in pre-formed square shapes are available to satisfy grouting requirements in machinery installations. The plastic Grout Forms provide for uniformity in poured machinery bases and eliminate construction of Grout Forms on the job site.

Nine inch square grout forms are available in heights up to 8 inches, and 11 inch square grout forms are available in heights up to 10 inches. Twelve by fifteen inch grout forms are available in heights up to 8 inches. UNISORB® Grout Forms give excellent results when used with UNISORB® V-1® cementitious grout and V-100® epoxy grout formulas.

UNISORB® BUTYL RUBBER SEALANT

High-tack butyl rubber sealant is supplied with the UNISORB® Grout Forms for application to the bottom flange of the form. The sealant adheres instantly to the Grout Forms and to clean, dry foundation surfaces. It gives a tight seal between the Grout Form and foundation surface preventing grout from leaking out during pouring. Sealant requires no cure time, unlike conventional caulking products, and allows for immediate pouring of grout as soon as forms are in position. The butyl sealant comes in easy to use rolls.

INSTALLATION INSTRUCTIONS

1. ***Apply butyl sealant to the bottom flange of the form (molded edge is the bottom). Apply sealant around the entire base of the form. Cut the sealant and butt the ends together or overlap and pinch together to make a complete seal. Application temperature range of the sealant is 20° F to 120° F.***
2. ***Leave the release paper on the sealant until the Grout Form is ready to be pressed into position. The Grout Form with sealant and release paper may be set in place while equipment is being installed.***
3. ***When ready to pour remove the release paper from the sealant. Press the form in place with medium pressure for five seconds so it is completely sealed to the foundation. The form is instantly sealed with no cure time required.***
4. ***Place grout following instructions provided with the grout.***
5. ***When the grout is set the forms may be removed if desired by cutting from top to bottom and unpeeling from the grout pad.***
6. ***Excess butyl sealant can be removed if desired with mineral spirits.***

GROUT FORMS General Information & Proper Grouting Procedures

CEMENT-BASED GROUT

1. **PREPARATION**—All grout contact surfaces should be cleaned of all oil, grease, scale and other foreign matter. Chip away any unsound concrete leaving the surface level but rough. Grout placement and vent holes should be provided if necessary. After contaminants are removed, the foundation must be saturated with water for 24 hours prior to grouting. Before placing the grout all excess water should be removed, leaving the surfaces moist.

2. **FORMING**—The method of forming must provide for rapid, continuous and complete grout placement. The forms selected should not leak or buckle under the pressure of a flowable grout consistency. On the pouring side, the form must be slanted so the grout can be poured without entrapping air. On the opposite side, provide for at least a 2" horizontal distance between the form and FIXATOR® and at least 1/2" head above the underside of the plate. Do not place form tight to FIXATOR® as air may be entrapped. Plates or equipment should be placed to provide 1 1/2" minimum grout thickness.

3. **TEMPERATURE**—Manufacturer's instructions should be followed when using grout under low or high temperature conditions.

4. **PLACEMENT**—It is always a good practice to prevent entrapped air pockets from forming in the material while in the plastic state. This can be accomplished by pouring the grout from one side of the depression so that a full surface of grout is squeezed out of the other side, or by placing a slightly excess amount of grout on the surface so that the bearing weight of the grouted object can displace the grout in such a manner that full bearing is effected. Where grout must be flowed some distance, make the initial batch more flowable so as to act as a lubricant for the material to follow. Continuous and rapid mixing and placement will reduce the amount of working time required. Do not rework grout that has already been placed and that has thickened.

5. **CURING**—To prevent sagging of the material, causing loss of bearing area, forms should not be removed until the grout has hardened sufficiently. At this point the grout has enough body to make final finishing easy.

6. **MISCELLANEOUS**—Where there are larger unconfined areas, vibrating can be done with no risk of segregation.* In very small confined areas where grout tends to take the path of least resistance and the placement is visually good, the "funnel and hose" placement method can be used as another assurance against entrapped air or water.* In this method a funnel or hopper with a rubber or plastic hose (1" opening or larger) attached to the funnel discharge opening does an excellent job. Simply place the end of the hose in the center of the anchor hole, withdrawing the hose slowly as the necessary quantity of grout is placed. By starting in the center the air is forced to the outside.

   In larger, deeper applications, the grout may be poured in stages of 24-hour intervals.

   *Applicable only if UNISORB® V-1® cementitious grout is used.

V-100® STANDARD EPOXY GROUT

1. **PREPARATION**—All grout contact surfaces should be cleaned of all oil, grease, scale and other foreign matter. Chip away any unsound concrete leaving the surface level but rough. Light sandblasting or acid etching may be sufficient but must be completely neutralized before grouting. Grout placement and vent holes should be provided if necessary. After contaminants are removed, the foundation must be dry and have no water in the anchor holes.

2. **FORMING**—The method of forming must provide for rapid, continuous and complete grout placement. The forms selected should not leak or buckle under the pressure of a flowable grout consistency. On the pouring side, the form must be slanted so the grout can be poured without entrapping air, and should be high enough to allow the grout to build at least a 2" head. On the opposite side, provide for at least a 2" horizontal distance between the form and FIXATOR® and at least 1/2" head above the underside of the plate. Do not place form tight to FIXATOR® as air may be entrapped. Plates or equipment should be placed to provide 1/2" to 3/4" grout thickness.

3. **TEMPERATURE**—Manufacturer's instructions should be followed when using grout under low or high temperature conditions.

4. **PLACEMENT**—It is always a good practice to prevent entrapped air pockets from forming in the material while in the plastic state. This can be accomplished by pouring the grout from one side of the depression so that a full surface of grout is squeezed out of the other side, or by placing a slightly excess amount of grout on the surface so that the bearing weight of the grouted object can displace the grout in such a manner that full bearing is effected.

5. **CURING**—To prevent sagging of the material, causing loss of bearing area, forms should not be removed until the grout has hardened sufficiently. At this point the grout has enough body to make final finishing easy.