ANCHOR BOLT TECHNICAL DATA

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WITH EITHER THE **JAKEBOLT** OR **VECTOR BOLT**, THE MEANS THROUGH WHICH CONCRETE FAILURE OCCURS INVOLVES THE SHEARING-OUT CONE SHAPED SECTION. SEE FIGURES 1 & 2.

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IN ORDER TO ASSURE THAT THE BOLT FAILS FIRST , IT IS NORMAL TO DESIGN THE ANCHOR IMBEDMENT DEPTH USING A FACTOR OF 2 ON THE ALLOWABLE SHEAR-STRESS APPLIED TO THE SURFACE OF THE CONE. KNOWING THE CROSS SECTIONAL AREA OF THE BOLT AND THE ULTIMATE TENSILE STRENGTH OF THE MATERIAL FROM WHICH IT IS MADE, IT IS POSSIBLE TO CALCULATE THE LOAD AT WHICH THE BOLT WILL FAIL HIGHER TENSILE VECTOR BOLTS REQUIRE DEEPER EMBEDMENTS TO DEVELOP FULL HOLDING POWER BEFORE CONCRETE FAILURE.

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FIGURE 1 : JAKEBOLT SHEAR CONE

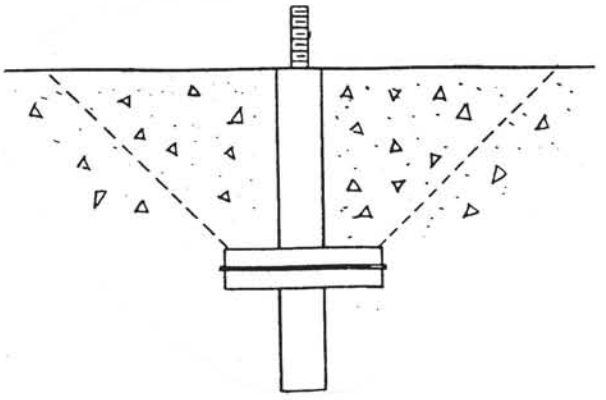
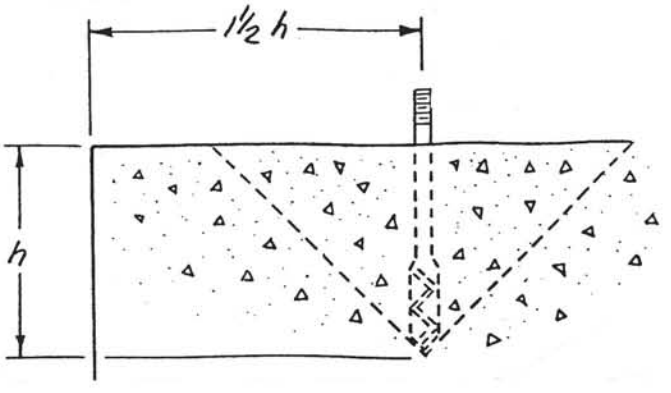


FIGURE 2 : VECTOR BOLT SHEAR CONE



ANCHOR BOLT TECHNICAL DATA

HEAVY DUTY JAKEBOLTS : MATERIAL 90,000 PSI

MINIMUM EMBEDMENT AND FAILURE LOAD FOR - JAKEBOLTS *

NOMINAL SIZE	FAILURE LOAD LBS.	CALCULATED MINIMUM DEPTH	RECOMMENDED MINIMUM DEPTH
1/2"	13,500	4.0 "	4.5 "
5/8"	22,000	4.0 "	5.0 "
3/4"	32,000	4.5 "	5.5 "
7/8"	44,600	5.5 "	6.5 "
1"	58,000	6.5 "	8.0 "
1-1/4"	90,800	8.0 "	9.5 "
1-1/2"	130,000	10.0 "	11.5 "

* = JAKEBOLTS - 90,000 PSI TENSILE

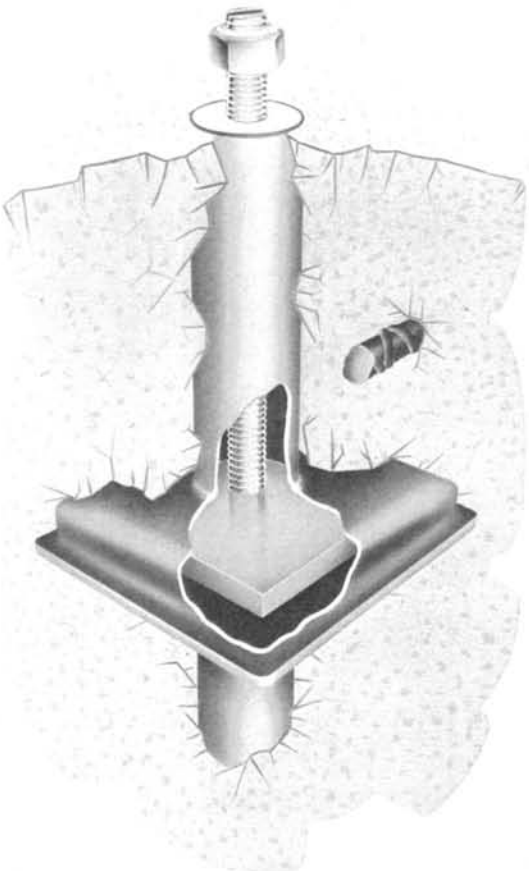
VECTOR BOLTS : MATERIAL 78,000 PSI

MINIMUM EMBEDMENT AND FAILURE LOAD FOR - VECTOR BOLTS **

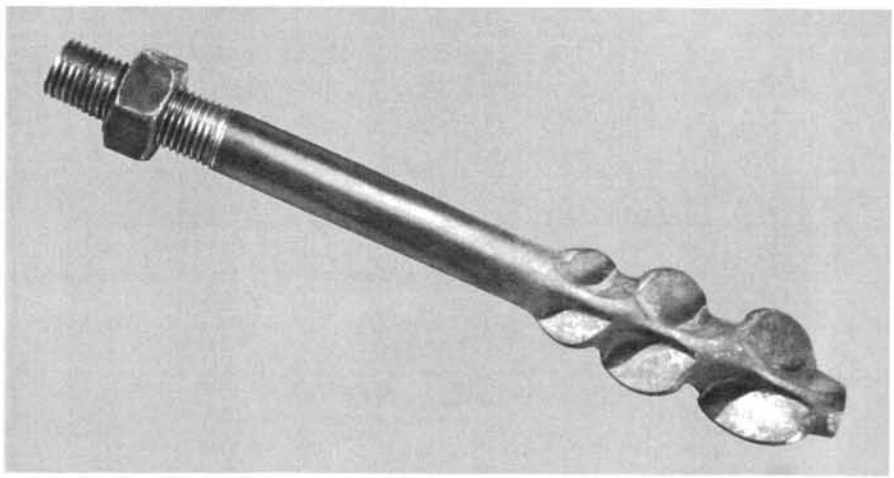
NOMINAL SIZE	FAILURE LOAD LBS.	CALCULATED MINIMUM DEPTH	RECOMMENDED MINIMUM DEPTH
12 MM	11,000	4.0 "	5.0 "
16 MM	20,200	5.0 "	6.0 "
20 MM	31,700	6.5 "	7.5 "
24 MM	45,600	8.0 "	9.0 "
30 MM	72,300	9.5 "	11.0 "
36 MM	105,000	11.5 "	13.5 "

** = VECTOR BOLTS - 78,000 PSI TENSILE

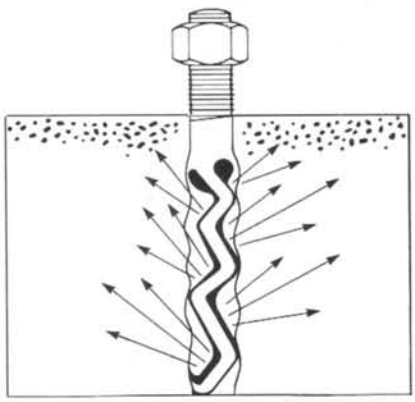
ANCHORS

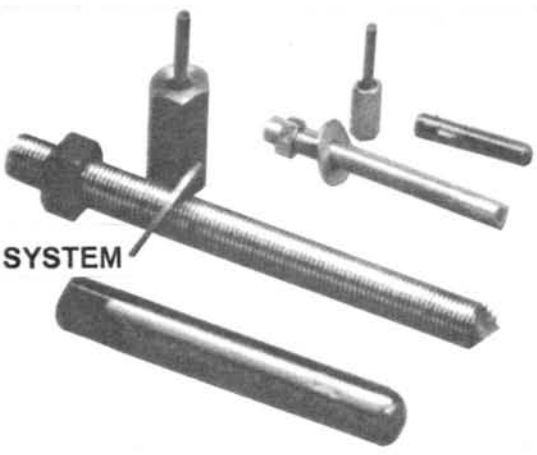


The Heavy Duty Jakebolt is designed to be cast in place during foundation construction.



Vector Anchor Bolts





UNISORB CAPSULE ANCHOR SYSTEM

PRODUCT CODES

VECTOR BOLTS

DESCRIPTION	PRODUCT CODE
EM12 1/2 X 6	450030
EM12 1/2 X 8	450050
EM16 5/8 X 6	450140
EM16 5/8 X 8	450120
EM16 5/8 X 10	450130
EM16 5/8 X 12	450160
EM16 5/8 X 14	450150
EM20 3/4 X 8	450210
EM20 3/4 X 10	450220
EM20 3/4 X 12	450230
EM20 3/4 X 14	450240
EM20 3/4 X 16	450250
EM20 3/4 X 18	450260
EM24 15/16 X 12	450410
EM24 15/16 X 14	450420
EM24 15/16 X 16	450440
EM24 15/16 X 18	450430
EM30 1-3/16 12	450510
EM30 1-3/16 14	450530
EM30 1-3/16 18	450520
EM30 1-3/16 24	450540
EM36 1-7/16 X 16	450670
EM36 1-7/16 X 24	450680

HEAVY DUTY JAKE BOLTS

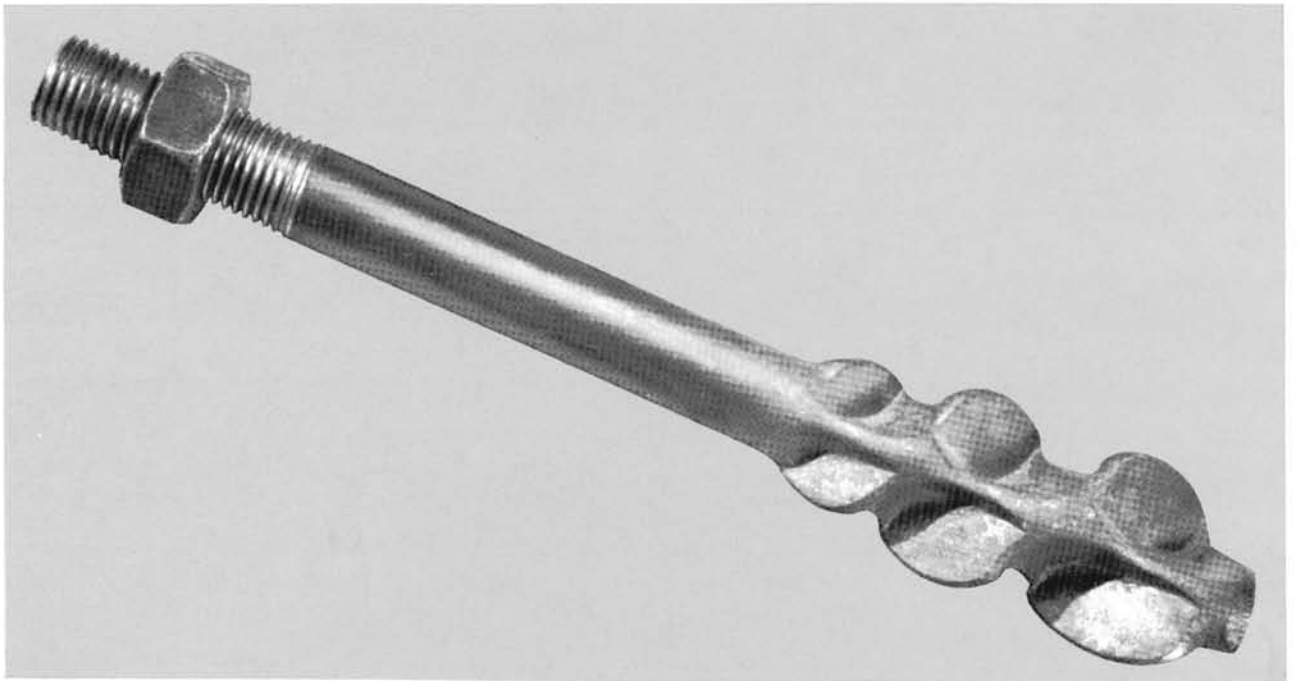
DESCRIPTION	PRODUCT CODE
1/2 X 6	420400
5/8 X 6	421400
5/8 X 12	421500
3/4 X 6	422400
3/4 X 12	422500
7/8 X 6	423400
7/8 X 12	423500
1 X 6	424400
1 X 12	424500
1-1/4 X 6	426400
1-1/4 X 12	426500
1-1/2 X 6	427400
1-1/2 X 12	427500
1-3/4 X 6	428400
1-3/4 X 12	428500
2 X 6	429400
2 X 12	429500

CAPSULE ANCHOR SYSTEM

DESCRIPTION	PRODUCT CODE
CAPSULES - (Sold in full pkgs only)	
C-38 10/PKG	521038
C-12 10/PKG	521012
C-58 10/PKG	521058
C-34 10/PKG	521034
C-78 10/PKG	521078
C-100 10/PKG	521100
C-114 5/PKG	521114
STUD ASSEMBLIES - (Longer studs available)	
S-38 X 5-1/8	523038
S-12 X 6-1/2	523012
S-58 X 7-5/8	523058
S-34 X 9-1/2	523034
S-78 X 10-1/4	523078
S-100 X 12	523100
S-114 X 15	523114
DRIVE UNITS - (Straight Shank Type)	
D-38	525038
D-12	525012
D-58	525058
D-34	525078
D-78	525100
D-100	525114
D-114	523114
INTERNALLY THREADED INSERTS	
3/8" I.d. x 3-1/2"	527038
1/2" I.d. x 4-1/4"	527012
5/8" I.D. x 5"	527058
3/4" I.D. x 6-5/8"	527034

(Use with complete system)

VECTOR ANCHOR BOLTS



VECTOR ANCHOR BOLTS

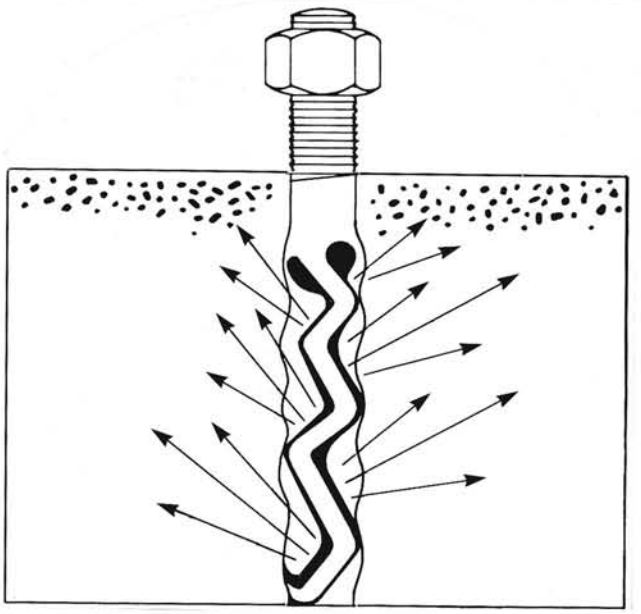
Vector Anchor Bolts are designed to generate - exceptional holding power. Made of high quality forged steel, vector bolts have a series of angular facets which resolve vertical stress forces into a cone shaped pressure pattern. This unique design greatly increases the contract area between the bolt and grout.The wedge shaped design on the bottom of the bolt transfers the tensile load of the stud into a lAteral compressional load in the foundation assuring maximum pull outstrength.

The tensile strength of the standard grade bolt is a minimum of 78,000 PSI. Higher strength bolts are available.

Vector Anchor Bolts are available in 10 diameter sizes with lengths from 3" to 40".

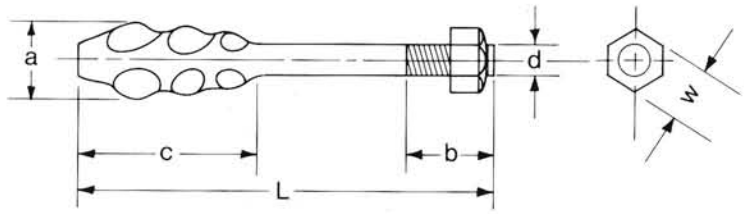
CORE DRILL SIZES FOR VECTOR BOLTS:

Vector bolt Size MM	Min. Dia. Hole For V-1 Grout	Min. Dia. Hole V-100 Epoxy Grout
EM--10	2"	1-1/2"
EM--12	3"	1-1/2"
EM--16	3"	1-1/2"
EM--20	3-1/2"	2"
EM--22	3-1/2"	2"
EM--24	4"	2"
EM--30	5"	2-1/2"
EM--36	6"	3"
EM--42	7"	3-1/2"
EM--48	8"	4"



EXCEPTIONAL HOLDING POWER

SPECIFICATIONS



MAXIMUM TENSILE STRENGTH

Commercial Grade — 78,000 psi.
Heavy Duty Grade — 100,000 psi.

TYPE	INCH MM	BASIC DIMENSIONS d	b	a	c	w	STANDARD LENGTH L"						
EM — 10	mm	10	25	20	55	17	150	200	250	300			
	inch (Ref.)	3/8"	1"	3/4"	2 1/8"	5/8"	6"	8"	10"	12"			
EM — 12	mm	12	30	24	70	19	75	100	125	150	180	200	230
	inch (Ref.)	1/2"	1 3/16"	1"	2 3/4"	3/4"	3"	4"	5"	6"*	7"	8"*	9"
EM — 16	mm	16	40	32	90	24	100	150	200	250	300	360	400
	inch (Ref.)	5/8"	1 5/8"	1 1/4"	3 1/2"	.94"	4"	6"*	8"*	10"*	12"	14"*	16"
EM — 20	mm	20	50	40	100	30	150	200	250	300	360	400	460
	inch (Ref.)	3/4"	2"	1 1/2"	4"	1.2"	6"	8"*	10"*	12"*	14"*	16"	18"*
EM — 22	mm	22	55	44	115	32	180	200	250	300	360	400	
	inch (Ref.)	7/8"	2 1/8"	1 3/4"	4 1/2"	1.3"	7"	8"	10"	12"	14"	16"	
EM — 24	mm	24	60	48	135	36	250	300	360	400	460	500	600
	inch (Ref.)	1 5/16"	2 3/8"	1 7/8"	5 3/8"	1.4"	10"	12"*	14"*	16"*	18"*	20"	24"
EM — 30	mm	30	75	60	150	46	320	400	460	500	600	720	800
	inch (Ref.)	1 3/16"	3"	2 3/8"	6"	1.8"	12 1/2"*	16"	18"*	20"	24"	28"	32"
EM — 36	mm	36	90	72	180	55	400	500	600	720	800	920	
	inch (Ref.)	1 7/16"	3 1/2"	2 7/8"	7"	2.2"	16"*	20"	24"*	28"	32"	36"	
EM — 42	mm	42	105	85	260	65	500	600	720	800	920	1000	
	inch (Ref.)	1 5/8"	4 1/8"	3 3/8"	10 1/4"	2.6"	20"	24"	28"	32"	36"	40"	
EM — 48	mm	48	120	98	260	75	720	800	920	1000			
	inch (Ref.)	1 7/8"	4 3/4"	3 7/8"	10 1/4"	2.9"	28"	32"	36"	40"			

* Standard Stock Sizes

VECTOR BOLT SELECTION & GROUT USE

VECTOR BOLT SELECTION & GROUT USE

DETAIL	EM-12 .47 in.	EM-16 .63 in.	EM-20 .79 in.	EM-24 .94 in.	EM-30 1.18 in.	EM-36 1.42 in.
Min. Hole Depth (Calculated in.)	4	5	6.5	8	9.5	11.5
Failure Load (lbs.)	11,000	20,200	31,700	45,600	72,300	105,000
V-1 MACHINERY GROUT						
Recommended Hole Diameter (in.)	3	3	3.5	4	5	6
Cubic Inches Per Inch of Depth	7.1	7.1	9.7	12.6	19.7	28.3
Grout Use For Recommended Hole in Cubic Inches	33	41	73	116	215	374
V-100 EPOXY GROUT STANDARD FORMULA						
Recommended Hole Diameter (in.)	1.5	1.75	2	2.5	3.5	4
Cubic Inches Per Inch of Depth	1.8	2.4	3.2	4.9	9.6	12.6
Grout Use For Recommended Hole in Cubic Inches	8	14	24	45	105	166

Calculation Notes

1. Determine diameter of Vector Bolt to be used.
2. Add the following: machine base thickness, mount height, hole depth and thread length.
3. Select correct standard length Vector Bolt.
4. Multiply the number of holes by grout use per hole (15% safety factor is included).
5. V-1 Grout supplied in 48 lb. bags (yield = 690 cu. in.).
6. V-100 Epoxy Grout supplied in kits: 1-1/4 lb., 11 lb., 25 lb., 55 lb. (yield = 16.5 cu. in./lb.).

VECTOR BOLT MATERIAL SPECIFICATIONS

MATERIAL SPECIFICATIONS FOR VECTOR ANCHOR BOLTS

Chemical Composition:	"C"	=	0.42 to 0.50%
	"Si"	=	0.15 to 0.35%
	"Mn"	=	0.50 to 0.80%
	"P"	=	0.045% max.
	"S"	=	0.045% max.
Physical Properties: (for 5/8" to 2" Dia.)	Tensile	=	93,000 to 109,000 psi
	Yield	=	58,000 to 67,000 psi
	Elong.	=	14% to 18% within 5 D min.

Material Grade: C - 45 (German)

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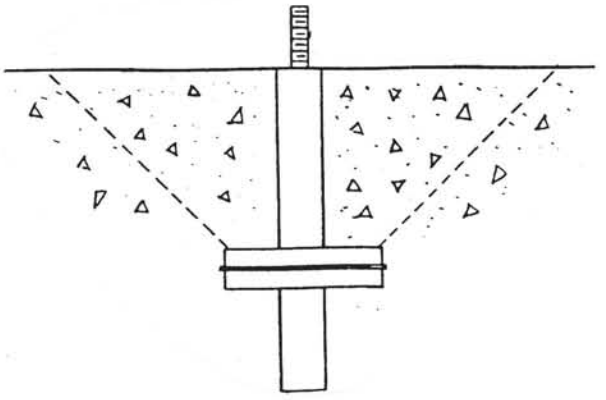
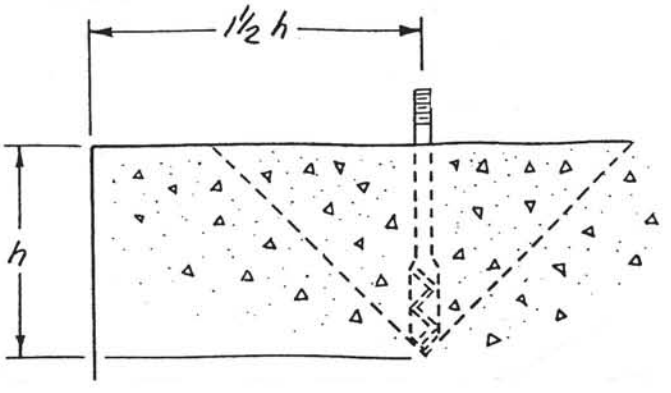


FIGURE 2 : VECTOR BOLT SHEAR CONE



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24 MM	45,600	8.0 "	9.0 "
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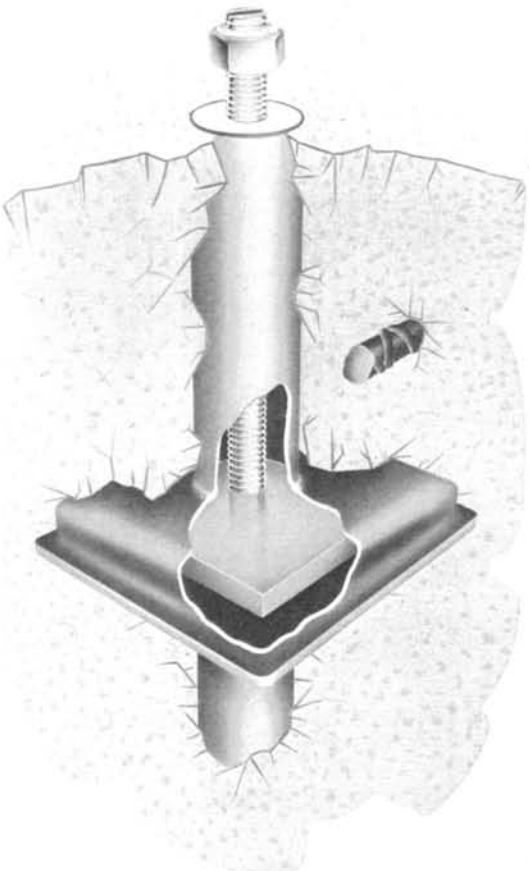
ANCHORS



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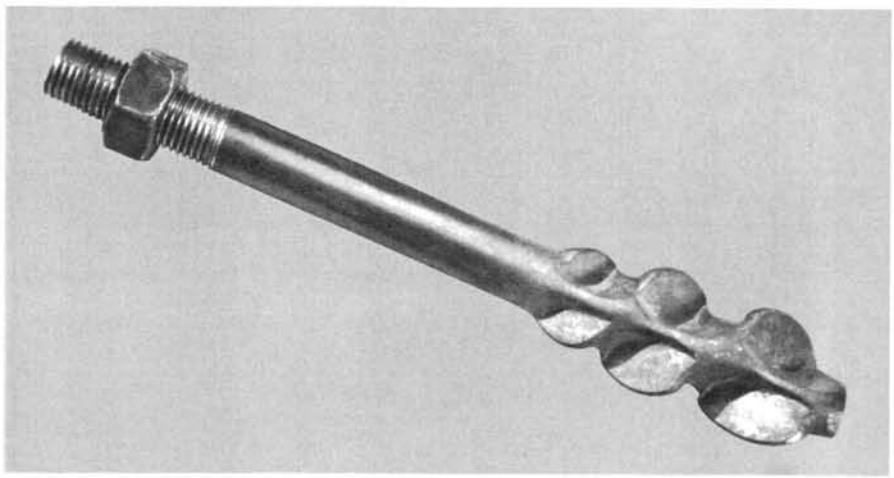
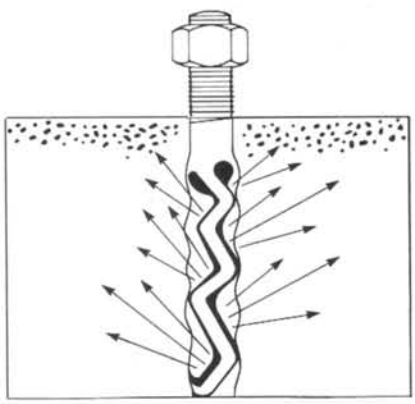
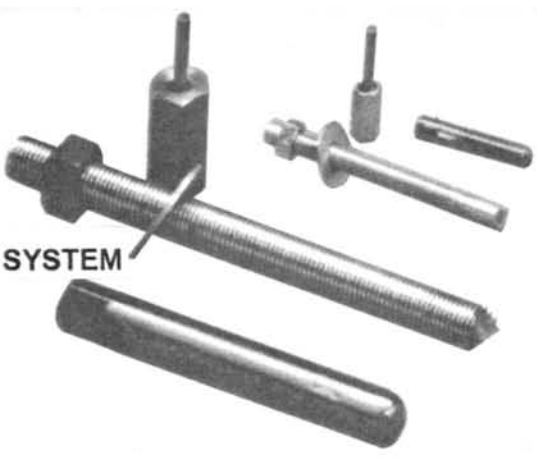


Vector Anchor Bolts





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EM16 5/8 X 14	450150
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EM20 3/4 X 10	450220
EM20 3/4 X 12	450230
EM20 3/4 X 14	450240
EM20 3/4 X 16	450250
EM20 3/4 X 18	450260
EM24 15/16 X 12	450410
EM24 15/16 X 14	450420
EM24 15/16 X 16	450440
EM24 15/16 X 18	450430
EM30 1-3/16 12	450510
EM30 1-3/16 14	450530
EM30 1-3/16 18	450520
EM30 1-3/16 24	450540
EM36 1-7/16 X 16	450670
EM36 1-7/16 X 24	450680

HEAVY DUTY JAKE BOLTS

DESCRIPTION	PRODUCT CODE
1/2 X 6	420400
5/8 X 6	421400
5/8 X 12	421500
3/4 X 6	422400
3/4 X 12	422500
7/8 X 6	423400
7/8 X 12	423500
1 X 6	424400
1 X 12	424500
1-1/4 X 6	426400
1-1/4 X 12	426500
1-1/2 X 6	427400
1-1/2 X 12	427500
1-3/4 X 6	428400
1-3/4 X 12	428500
2 X 6	429400
2 X 12	429500

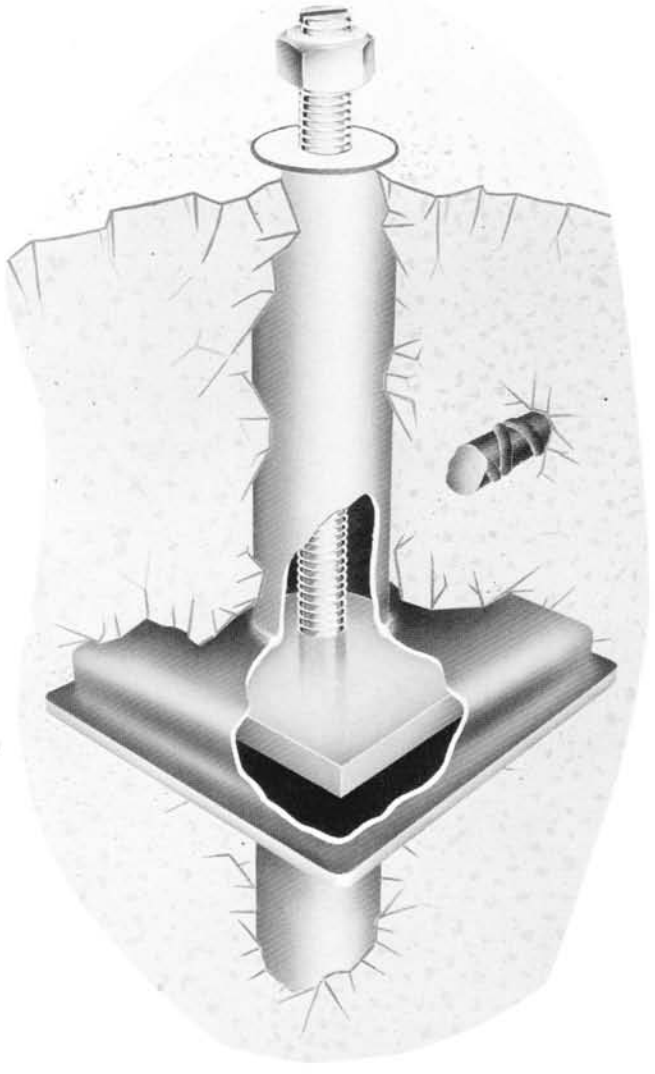
CAPSULE ANCHOR SYSTEM

DESCRIPTION	PRODUCT CODE
CAPSULES - (Sold in full pkgs only)	
C-38 10/PKG	521038
C-12 10/PKG	521012
C-58 10/PKG	521058
C-34 10/PKG	521034
C-78 10/PKG	521078
C-100 10/PKG	521100
C-114 5/PKG	521114
STUD ASSEMBLIES - (Longer studs available)	
S-38 X 5-1/8	523038
S-12 X 6-1/2	523012
S-58 X 7-5/8	523058
S-34 X 9-1/2	523034
S-78 X 10-1/4	523078
S-100 X 12	523100
S-114 X 15	523114
DRIVE UNITS - (Straight Shank Type)	
D-38	525038
D-12	525012
D-58	525058
D-34	525078
D-78	525100
D-100	525114
D-114	523114
INTERNALLY THREADED INSERTS	
3/8" I.d. x 3-1/2"	527038
1/2" I.d. x 4-1/4"	527012
5/8" I.D. x 5"	527058
3/4" I.D. x 6-5/8"	527034

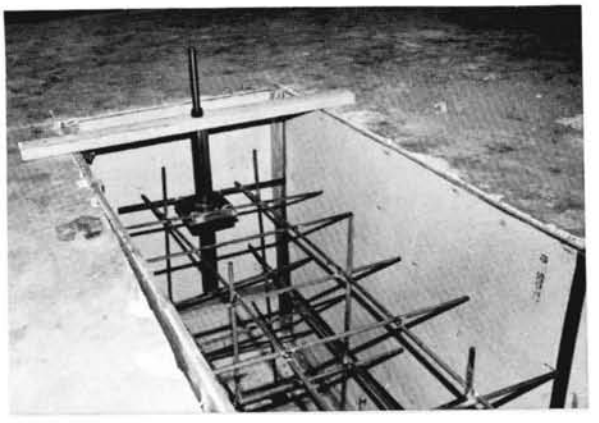
(Use with complete system)

HEAVY DUTY JAKEBOLTS™

Toughest, most durable, most advanced anchor bolts available for installation - at the time of foundation construction.



The - All Steel Jakebolt - is designed to be - cast in place- during foundation construction.



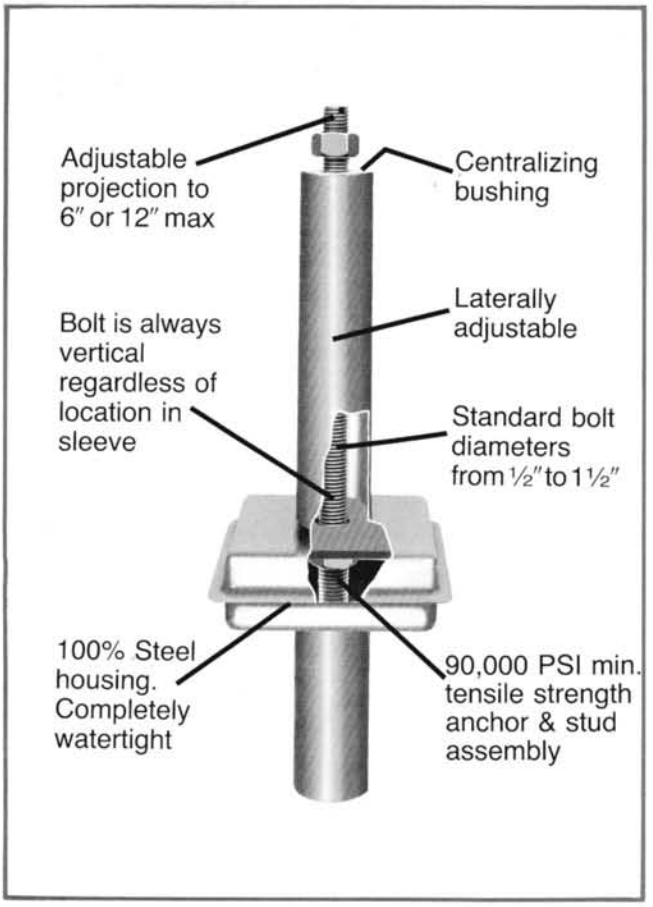
JAKEBOLT™ ANCHORS

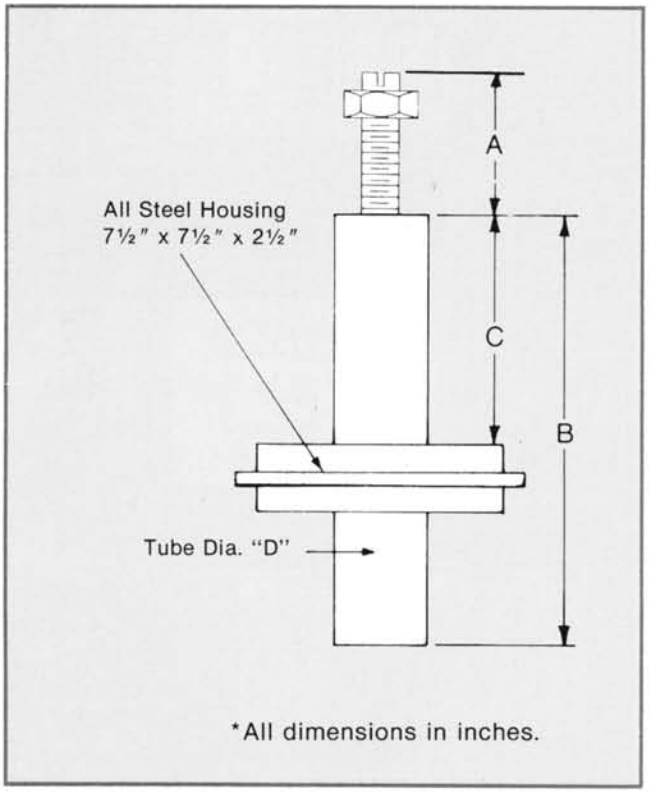
A large metalworking facility involved in the manufacturing of oil field equipment installed their machines on FIXATORS® and Heavy Duty JAKEBOLT® ANCHORS. JAKEBOLTS® are installed when the foundations are poured. This approach offered the following advantages over conventional methods:

- No expertise in grouting principles are required by the installation crew.
- The foundation does not require special preparation such as pre-cast holes and pre-wetting.
- There is no time delay to allow the grout to cure when setting machines.

Several machines have been installed successfully using this method and the company has been very satisfied with the results. Use of all-steel Heavy Duty JAKEBOLTS® with FIXATORS® has become the standard installation method for this company.

ALL STEEL JAKEBOLTS





Heavy Duty JAKEBOLTS® offer a truly cost effective way to provide strong, problem-free, high quality anchors for virtually any application. They are designed to be hung from a template or welded directly to reinforcing steel, then cast in place during new foundation construction.

Constructed entirely of steel, the Heavy Duty JAKEBOLTS® are tough, durable, MIG welded watertight to prevent contamination of internal components during installation. Each JAKEBOLT® comes supplied with a centralizing bushing which doubles as a seal and protects against contamination during grouting. JAKEBOLTS® are manufactured with retractable studs to allow a "Clear Floor" condition at any time. Anchor studs can be adjusted to project above the floor from 0 to 6″ or from 0 to 12″, depending on the bolt specified for the installation. The entire internal anchor assembly can be adjusted laterally as well as vertically to compensate for normal construction variances in both hole location and machine foot thickness.

The Heavy Duty JAKEBOLT® incorporates 90,000 psi tensile strength steel in the bolts. The all-steel anchor assembly is designed for service under the most severe conditions. Special versions of the Heavy Duty JAKEBOLT® are available

SPECIFICATIONS

Model Bolt Size	Projection Above Floor "A"	Over-All Length "B"	Top Tube Length "C"	Tube Dia. "D"	Bolt Centerline Movement
½ x 6	0-6	20	11½	2½	1¾
⅝ x 6	0-6	20	11½	2½	1½
¾ x 6	0-6	20	11½	2½	1½
⅞ x 6	0-6	20	11½	2½	1¼
1 x 6	0-6	20	11½	2½	1¼
1¼ x 6	0-6	20	11½	2½	1
1½ x 6	0-6	20	11½	2½	¾
1¾ x 6	0-6	26½	18	3½	1¾
2 x 6	0-6	26½	18	3½	1½
⅝ x 12	0-12	25¾	11½	2½	1½
¾ x 12	0-12	25¾	11½	2½	1½
⅞ x 12	0-12	25¾	11½	2½	1¼
1 x 12	0-12	25¾	11½	2½	1¼
1¼ x 12	0-12	25¾	11½	2½	1
1½ x 12	0-12	25¾	11½	2½	¾
1¾ x 12	0-12	32¼	18	3½	1¾
2 x 12	0-12	32¼	18	3½	1½

Foundation Connections. Once an adequate foundation has been established, the next task is to secure the machine to the foundation, making the machine structure and foundation integral. To achieve this, a connection of adequate rigidity must be provided. For most machine tools, a means of adjusting the relationship of the machine base to the foundation is also a prime requirement. The following approaches may be considered.

Anchor bolts and shims, *Figure* 2, offer a moderately rigid connection between machine and foundation. This approach, however, may not be adequate for high precision machinery because the large number of interfaces under load compromise the rigidity. Another drawback to this method is that precise alignments are often difficult to achieve.

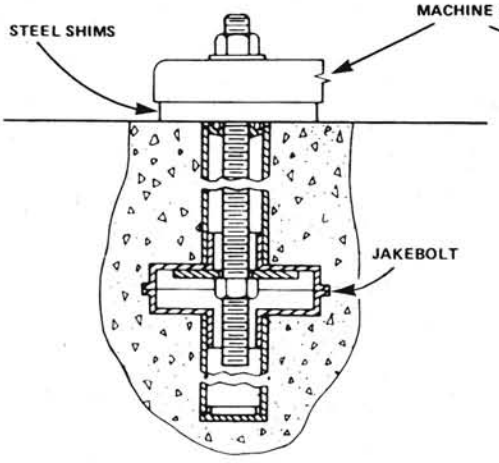
Leveling screws, *Figure* 3, permit faster adjustment than the shimming method. However, more frequent realignments are generally necessary. Also, precise alignments are difficult.

Anchor bolts in grout, *Figure* 4, provide a strong, continuous, and rigid support between a machine and its foundation. Grouting assures that the voids between the machine base and foundation surface are completely filled with a load-bearing material. A nonshrinking grout should be used to assure that critical alignments are maintained and maximum rigidity achieved.

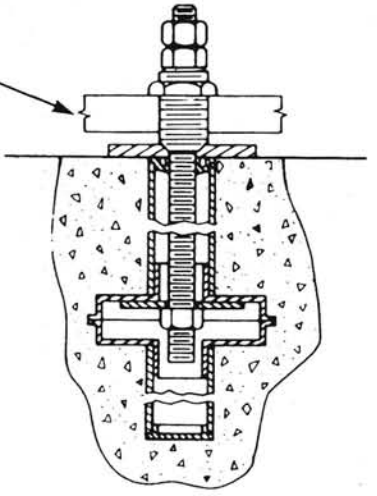
Leveling wedges, *Figure* 5, provide a firmer and stiffer support than either the shim pack or leveling screw. The most basic leveling wedge is a simple two-piece device which permits vertical adjustments by moving one wedge against the other with an adjusting screw. A more effective technique is to employ a three-piece wedge, with the third (upper) wedge member remaining stationary. With this design, horizontal motion is not transmitted to the machine as vertical adjustments are being made.

Mount systems are available which combine a three-piece wedge with a spherical seat arrangement in the upper wedge. This compensates for misalignment between the floor surface and the base of the machine. The system provides rigid support, easy adjustment, and a cost effective means of installing precision machinery.

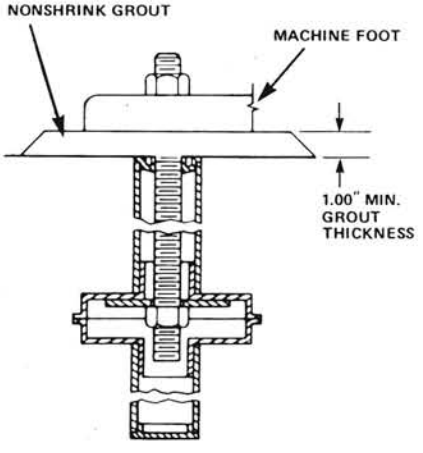
FOUNDATION CONNECTIONS



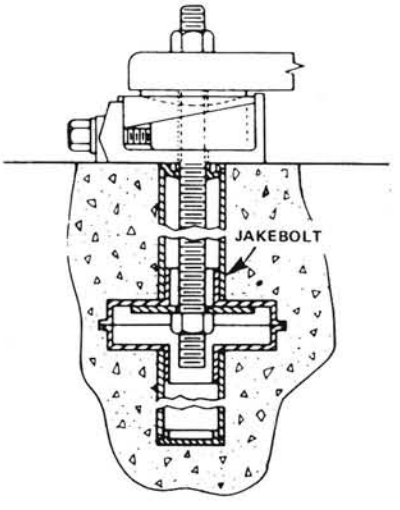
2. ANCHOR BOLTS and shims offer a moderately rigid connection between machine and foundation, but may not be adequate for precision machines.



3. LEVELING SCREWS permit faster adjustment than shimming method (Figure 2), but may require more frequent realignment.



4. BOLTS IN GROUT provide a strong, continuous, and rigid support between machine tools and their foundations.



5. LEVELING WEDGES, with adjusting screw, provide a firmer and stiffer support than shim packs (Figure 2) or leveling screws (Figure 3).

ANCHOR BOLT TECHNICAL DATA

THE ANCHOR BOLT PLAYS AN IMPORTANT PART AS PRIMARY ELEMENT IN THE MACHINE - TO - FOUNDATION CONNECTION. THE FUNCTION OF THE BOLT IS TO TRANSFER LOAD FROM THE MACHINE TOOL BASE TO THE FOUNDATION. TO DO THIS ,THE ANCHOR BOLT MUST BE FIRMLY ANCHORED INTO THE CONCRETE FOUNDATION AND CAPABLE OF SUSTAINING SIGNIFICANT TENSION LOADINGS IN THE UPWARD DIRECTION.

SINCE CONCRETE IS NOT CAPABLE OF WITHSTANDING TENSILE LOADINGS, THE ANCHOR BOLT MUST RESOLVE THE TENSILE LOAD APPLIED TO IT INTO COMPRESSION LOADING IN THE FOUNDATION.

THE **JAKEBOLT** TRANSFERS THE TENSILE LOAD IN THE UPWARD DIRECTION ON THE FOUNDATION THROUGH THE BEARING PLATE.

IN THE **VECTOR BOLT** , THE WEDGE SHAPE DESIGN ON THE BOTTOM OF THE BOLT ACCOMPLISHES THE SAME FUNCTION

WITH EITHER THE **JAKEBOLT** OR **VECTOR BOLT**, THE MEANS THROUGH WHICH CONCRETE FAILURE OCCURS INVOLVES THE SHEARING-OUT CONE SHAPED SECTION. SEE FIGURES 1 & 2.

IT CAN BE PROVEN MATHEMATICALLY THAT THE MOST IMPORTANT FACTOR IN CALCULATING LOAD ON AN ANCHOR BOLT IS THE DEPTH OF THE EMBEDMENT ONCE. THE DEPTH OF INBEDMENT IS KNOWN , IT IS POSSIBLE TO CALCULATE THE MAXIMUM LOAD WHICH MAY BE APPLIED TO AN ANCHOR BOLT.

IN PRACTICE,IT IS MORE DESIRABLE **TO HAVE THE ANCHOR BOLT FAIL BEFORE THE CONICAL SECTION IS PULLED FROM THE CONCRETE.** IN THE CASE OF THE **JAKEBOLT**,THIS FACILITATES THE REPLACEMENT OF THE STUD WITH A MINIMUM OF PROBLEMS. WITH THE **VECTOR BOLT**,THE FOUNDATION DAMAGE WILL BE LIMITED SO THAT THE BOLT CAN SIMPLY BE CORED OUT AND A NEW ONE GROUTED IN ITS PLACE.

IN ORDER TO ASSURE THAT THE BOLT FAILS FIRST , IT IS NORMAL TO DESIGN THE ANCHOR IMBEDMENT DEPTH USING A FACTOR OF 2 ON THE ALLOWABLE SHEAR-STRESS APPLIED TO THE SURFACE OF THE CONE. KNOWING THE CROSS SECTIONAL AREA OF THE BOLT AND THE ULTIMATE TENSILE STRENGTH OF THE MATERIAL FROM WHICH IT IS MADE, IT IS POSSIBLE TO CALCULATE THE LOAD AT WHICH THE BOLT WILL FAIL HIGHER TENSILE VECTOR BOLTS REQUIRE DEEPER EMBEDMENTS TO DEVELOP FULL HOLDING POWER BEFORE CONCRETE FAILURE.

THE USE OF REINFORCING STEEL IN ANY FOUNDATION , INCREASES THE FACTOR OF SAFETY AGAINST THE SHEAR CONE TYPE FAILURE AND IS HIGHLY RECOMMENDED.

ALSO,THE PLACEMENT OF THE ANCHOR BOLT SHOULD BE FAR ENOUGH AWAY FROM ANY WALLS TO PERMIT A FULL SHEAR CONE TO DEVELOP .**FAILURE TO DO THIS CAN RESULT IN SERIOUS REDUCTION OF THE ANCHOR BOLTS' HOLDING POWER. A GOOD GUIDE IS TO HAVE THE ANCHOR BOLT NO CLOSER TO THE EDGE THAN 1-1/2 TIMES THE EMBEDMENT DEPTH.**

IN THE CASE OF THE VECTOR BOLT ,THE USE OF GROUT TENDS TO INCREASE THE FACTOR OF SAFETY., SINCE GROUT IS A VERY HIGH STRENGTH MATERIAL COMPARED TO CONCRETE.THE GROUT SERVES THE FUNCTION OF SPREADING THE HIGH UNIT LOADS SEEN NEAR THE ANCHOR BOLT FLUTES OVER A MUCH LARGER AREA.

FIGURE 1 : JAKEBOLT SHEAR CONE

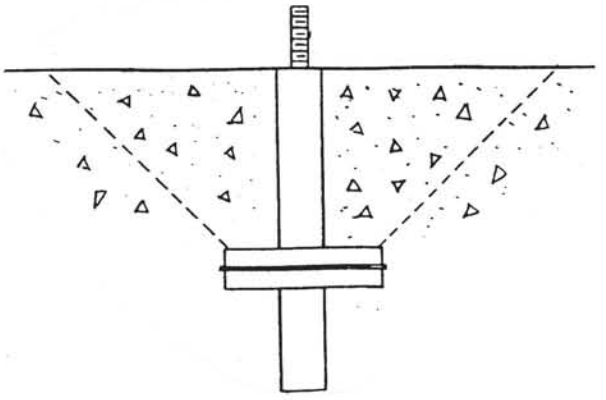
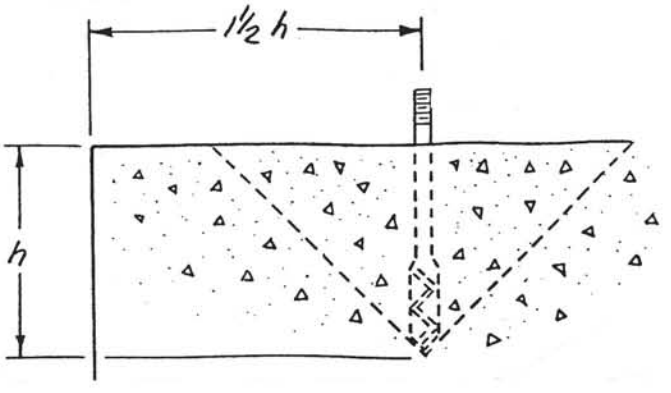


FIGURE 2 : VECTOR BOLT SHEAR CONE



ANCHOR BOLT TECHNICAL DATA

HEAVY DUTY JAKEBOLTS : MATERIAL 90,000 PSI

MINIMUM EMBEDMENT AND FAILURE LOAD FOR - JAKEBOLTS *

NOMINAL SIZE	FAILURE LOAD LBS.	CALCULATED MINIMUM DEPTH	RECOMMENDED MINIMUM DEPTH
1/2"	13,500	4.0 "	4.5 "
5/8"	22,000	4.0 "	5.0 "
3/4"	32,000	4.5 "	5.5 "
7/8"	44,600	5.5 "	6.5 "
1"	58,000	6.5 "	8.0 "
1-1/4"	90,800	8.0 "	9.5 "
1-1/2"	130,000	10.0 "	11.5 "

* = JAKEBOLTS - 90,000 PSI TENSILE

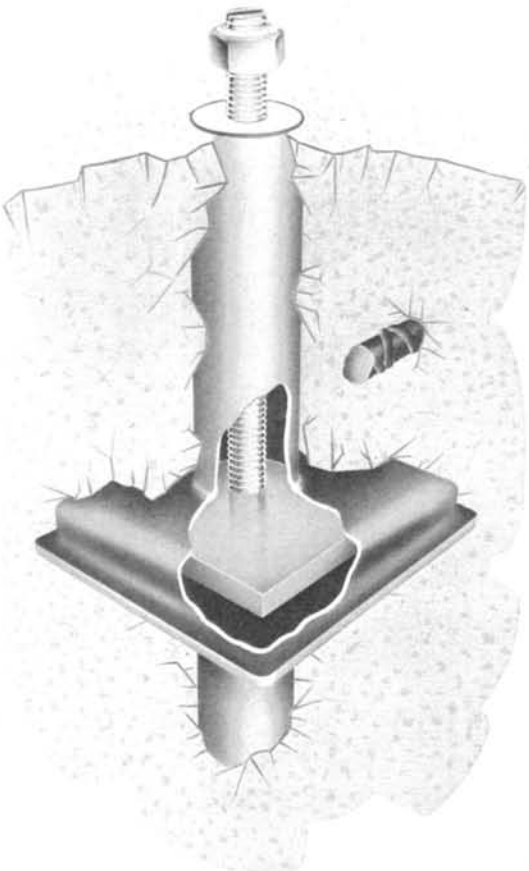
VECTOR BOLTS : MATERIAL 78,000 PSI

MINIMUM EMBEDMENT AND FAILURE LOAD FOR - VECTOR BOLTS **

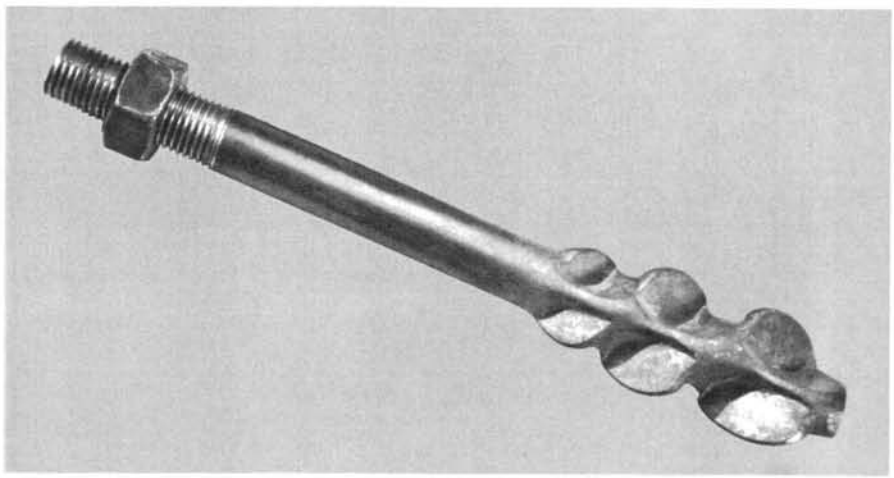
NOMINAL SIZE	FAILURE LOAD LBS.	CALCULATED MINIMUM DEPTH	RECOMMENDED MINIMUM DEPTH
12 MM	11,000	4.0 "	5.0 "
16 MM	20,200	5.0 "	6.0 "
20 MM	31,700	6.5 "	7.5 "
24 MM	45,600	8.0 "	9.0 "
30 MM	72,300	9.5 "	11.0 "
36 MM	105,000	11.5 "	13.5 "

** = VECTOR BOLTS - 78,000 PSI TENSILE

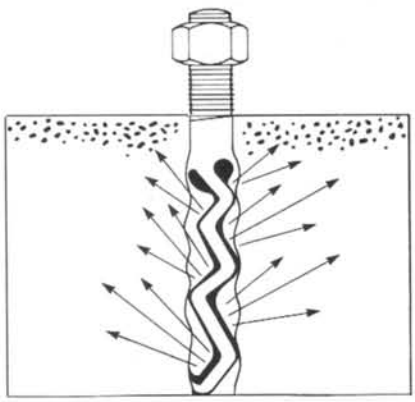
ANCHORS

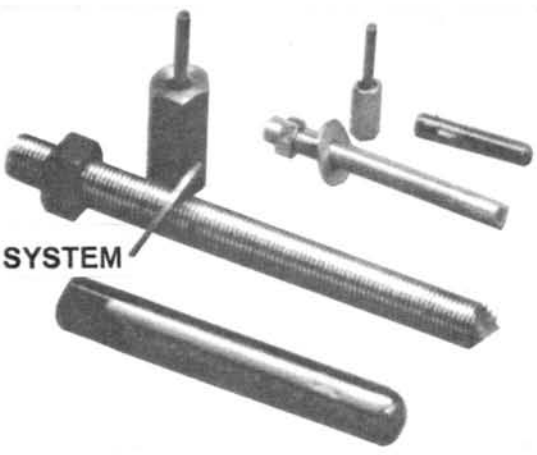


The Heavy Duty Jakebolt is designed to be cast in place during foundation construction.



Vector Anchor Bolts





UNISORB CAPSULE ANCHOR SYSTEM

PRODUCT CODES

VECTOR BOLTS

DESCRIPTION	PRODUCT CODE
EM12 1/2 X 6	450030
EM12 1/2 X 8	450050
EM16 5/8 X 6	450140
EM16 5/8 X 8	450120
EM16 5/8 X 10	450130
EM16 5/8 X 12	450160
EM16 5/8 X 14	450150
EM20 3/4 X 8	450210
EM20 3/4 X 10	450220
EM20 3/4 X 12	450230
EM20 3/4 X 14	450240
EM20 3/4 X 16	450250
EM20 3/4 X 18	450260
EM24 15/16 X 12	450410
EM24 15/16 X 14	450420
EM24 15/16 X 16	450440
EM24 15/16 X 18	450430
EM30 1-3/16 12	450510
EM30 1-3/16 14	450530
EM30 1-3/16 18	450520
EM30 1-3/16 24	450540
EM36 1-7/16 X 16	450670
EM36 1-7/16 X 24	450680

HEAVY DUTY JAKE BOLTS

DESCRIPTION	PRODUCT CODE
1/2 X 6	420400
5/8 X 6	421400
5/8 X 12	421500
3/4 X 6	422400
3/4 X 12	422500
7/8 X 6	423400
7/8 X 12	423500
1 X 6	424400
1 X 12	424500
1-1/4 X 6	426400
1-1/4 X 12	426500
1-1/2 X 6	427400
1-1/2 X 12	427500
1-3/4 X 6	428400
1-3/4 X 12	428500
2 X 6	429400
2 X 12	429500

CAPSULE ANCHOR SYSTEM

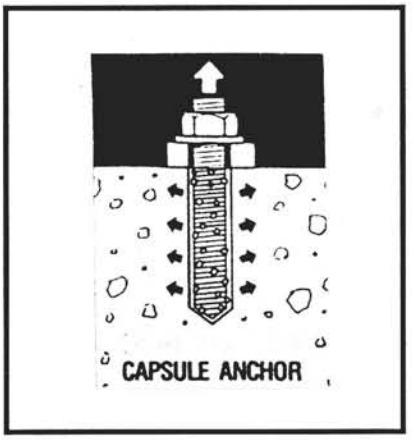
DESCRIPTION	PRODUCT CODE
CAPSULES - (Sold in full pkgs only)	
C-38 10/PKG	521038
C-12 10/PKG	521012
C-58 10/PKG	521058
C-34 10/PKG	521034
C-78 10/PKG	521078
C-100 10/PKG	521100
C-114 5/PKG	521114
STUD ASSEMBLIES - (Longer studs available)	
S-38 X 5-1/8	523038
S-12 X 6-1/2	523012
S-58 X 7-5/8	523058
S-34 X 9-1/2	523034
S-78 X 10-1/4	523078
S-100 X 12	523100
S-114 X 15	523114
DRIVE UNITS - (Straight Shank Type)	
D-38	525038
D-12	525012
D-58	525058
D-34	525078
D-78	525100
D-100	525114
D-114	523114
INTERNALLY THREADED INSERTS	
3/8" I.d. x 3-1/2"	527038
1/2" I.d. x 4-1/4"	527012
5/8" I.D. x 5"	527058
3/4" I.D. x 6-5/8"	527034

(Use with complete system)

CAPSULE ANCHOR SYSTEM

THE CAPSULE ANCHOR is a non-expanding chemical anchor that achieves greater load bearing capabilities and allows more versatility than conventional mechanical anchors.

CONVENTIONAL EXPANSION ANCHOR

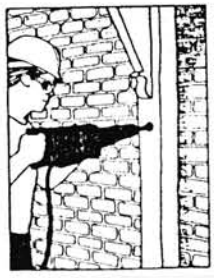


CAPSULE ANCHOR

CAPSULE ANCHOR SYSTEM

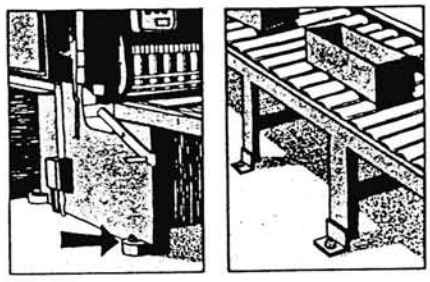
CAPSULE ANCHORS OFFER THESE UNIQUE ADVANTAGES :

NO EXPANSION STRESS PLACED ON CONSTRUCTION MATERIALS



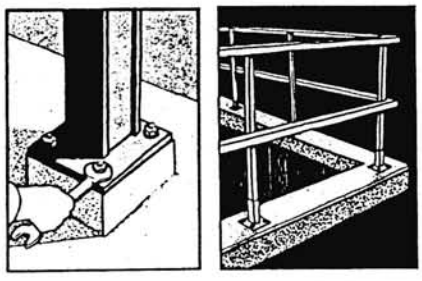
Driving the stud breaks the capsule, and the resultant chemical interaction between the resin,agregate,crushed glass,and the hardener forms a thick synthetic mortar which bonds the stud to the material - even lightweight block.

CAN BE USED FOR DYNAMIC LOADS



Chemical bonding,unlike expansion fastening , will not "work loose" under shock or vibration conditions.

MINIMAL CENTER-TO-CENTER TO-EDGE DISTANCE



Because no expansion stress is placed on the concrete,the capsule anchor can be set much closer to the edges than mechanical anchors.

CAN BE SET IN MOST WEATHER CONDITIONS

The polyester resin is practically unaffected by water or corrosives and actually seals the stud from the elements.

Stainless steel studding is available for corrosive environment and under water applications.

EXTREMELY HIGH PULL-OUT LOADS

The components are thoroughly mixed during installation to form a complete bond between the stud and hole - along the entire length of the hole.

CORRECT DOSAGE OF COMPONENTS ASSURED

Unlike grouts or epoxies,the capsule anchor's aggregate,resin and hardener are pre-measured and then sealed.

This prevents jobsite mixing errors and thus provide greater dependability.

CAPSULE ANCHOR SYSTEM

APPLICATIONS OF CAPSULE ANCHOR SYSTEM

- Air Conditioners
- Conveyors
- Grinders
- Jib Cranes
- Motors
- Printing Presses
- Refrigeration Equipment
- Compressors
- Crane Rails
- Hand Rails
- Machine Tools
- Presses
- Pumps
- Robots

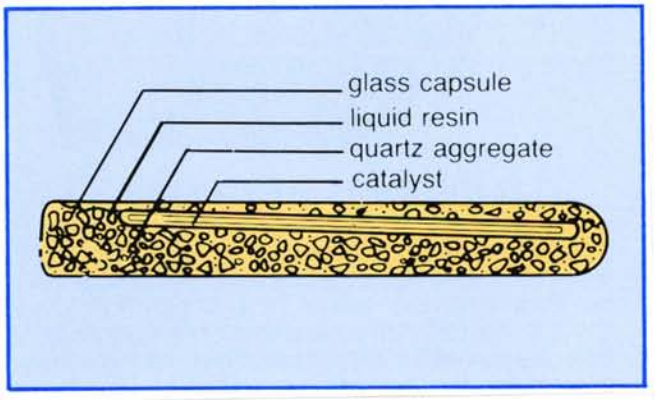
The CAPSULE ANCHOR SYSTEM is a new method of heavy duty anchoring using a high strength urethane adhesive to retain a threaded rod and other materials such as re-bar, in concrete or other masonry material. The system consists of a glass capsule containing the proper proportion of base resin, hardener and aggregate for the anchor. An appropriate length stud with washer and nut and an adapter/driver to allow the stud to be inserted into a standard hammer drill, are also included.

To install the anchor a clearance hole is prepared and a capsule is inserted. The stud is driven into the hole with a standard rotary hammer drill using the driver adapter included in the capsule kit. This action breaks the glass capsule and mixes the pre-measured components. At room temperature the anchor nuts may be torqued down within approximately 30 minutes.

Extensive testing and field trials have proven the UNISORB® CAPSULE ANCHOR SYSTEM to be one of the most dependable anchor systems available, far superior to expansion type anchoring systems. The CAPSULES may be used in wet or damp locations including under water and can be used horizontally or overhead without special measures to retain the capsule contents.

In addition to general purpose construction applications and installation of machinery, the anchor system is also commonly used in tough-to-hold applications, such as installation of dock bumpers and doweling of concrete.

UNISORB® CAPSULE ANCHOR SYSTEMS offer tremendous holding power which is stronger than the concrete itself. A graded blend of quartz aggregate transfers the pullout forces into the concrete. Since there are no expansive forces from the anchor systems, they can be placed near the foundation edges, chip troughs, coolant trenches or wireways. High anchor-to-concrete strengths are developed which allow smaller anchor holes and smaller studs to be used than is possible with conventional expanding anchor type systems.



CAPSULE ANCHOR SYSTEM

ANCHOR SIZE	CAPSULE NUMBER	DRILL DIAMETER	HOLE* DEPTH	ANCHOR NO. AND LENGTH	ULTIMATE TENSILE LOAD†	ULTIMATE SHEAR LOAD†
3/8	C-38	7/16	3½	S-38 x 5⅛	6,580 lbs.	4,063 lbs.
½	C-12	9/16	4¼	S-12 x 6½	12,015 lbs.	6,815 lbs.
5/8	C-58	¾	5	S-58 x 7⅝	18,117 lbs.	11,988 lbs.
¾	C-34	⅞	6⅝	S-34 x 10¼	26,425 lbs.	17,000 lbs.
⅞	C-78	1	6⅝	S-78 x 10¼	33,200 lbs.	25,400 lbs.
1	C-100	1¼	8¼	S-100 x 12	40,213 lbs.	29,900 lbs.
1¼	C-114	1½	10¼	S-114 x 15	70,467 lbs.	49,133 lbs.

All dimensions in inches.

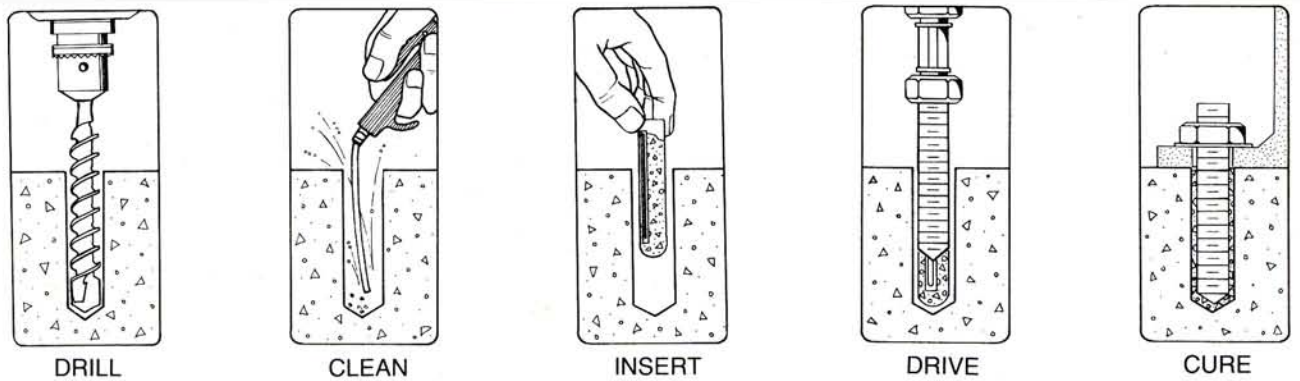
†ULTIMATE TENSILE LOAD TEST DATA

Test results using 4,000 PSI concrete are given as a guide only. It is recommended that tests to simulate actual conditions be carried out to determine the suitability of Capsule Anchors for particular applications.

MINIMUM CURE TIME

CONCRETE TEMPERATURE	CURE TIME
Over 68°F (20°C)	10 Min.
50° to 68°F (10° to 20°C)	20 Min.
32° to 50°F (0° to 10°C)	1 Hour
23° to 32°F (−5° to 0°C)	5 Hours

INSTALLATION



1. Drill a clearance hole for the stud using a rotary hammer drill. The chart below shows the proper diameter and depth for each anchor size. If using high tensile strength studs, it will be necessary to drill deeper to develop the necessary holding strength. Also, deeper holes should be drilled when they are located near the foundation edge, chip troughs or have extremely close spacing.
2. Thoroughly clean the holes. For best results blow out the concrete dust using compressed air. Excessive dust will reduce the adhesive qualities of the anchor.
3. Insert the capsule anchor. Two or more may be used when deeper holes are encountered.
4. Assemble the drive unit into the hammer drill and stud. Drive the pointed end of the stud into the adhesive capsule anchor. This action will break the glass tube and completely mix all components. Turn the drill off immediately when the stud is completely inserted.
5. Remove the driver with a wrench, being careful not to disturb the anchor during the initial set. Allow the anchor to set undisturbed during the minimum cure time. The anchor is now ready for use.

SEE HAMMER DRILL SECTION FOR DRILLS AND BIT SELECTION

CAPSULE ANCHOR SYSTEM

UNISORB CAPSULE ANCHOR SYSTEM

PULL-OUT STRENGTH AND TORQUE VALUES

The Unisorb Capsule Anchor System provides quick, easy and high strength anchoring for equipment, machine tool and construction applications at a low cost and with short down time. Attached are tables with important capsule anchor data.

Allowable Torque Calculations

$T_{allowed} = K F_{ult} d$

Where $T_{allowed}$ = Allowable torque in ft-lbs

F_{ult} = Pull out strength in lbs.

d = Anchor bolt diameter in ft.

K = Torque coefficient

A generally accepted value of K for lubricated threaded fasteners is 0.20.

For these calculations a safety factor of 2 will be used, therefore, we have:

$$T_{allowed} = \frac{0.20\ F_{ult}\ d}{2}$$

Sample Calculation

For 1/2" fasteners using pull-out strength from attached table:

$$T_{allowed} = \frac{0.20\ (12{,}015\ \text{lbs.})(1/2")\ \frac{1\ \text{ft.}}{12\ \text{ft.}}}{2}$$

$$T_{allowed} = 50.1\ \text{ft.-lbs.}$$

SPECIFICATIONS

UNISORB CAPSULE ANCHOR SYSTEM

DIAMETER INCHES	MODEL NO	HOLE DEPTH INCHES	• MAXIMUM ALLOWED TORQUE ON NUT FT-LB	RECOMMENDED TORQUE ON NUT FT-LB
3/8	C-38	3-1/2	22	15
1/2	C-12	4-1/4	42	30
5/8	C-58	5	91	65
3/4	C-34	6-5/8	157	110
7/8	C-78	7	280	185
1	C-100	8-1/4	441	300
1-1/4	C-114	10-1/4	617	425

• BASED ON SAFETY FACTOR OF TWO USING LUBRICATED THREADED FASTENERS. FOR NON-LUBRICATED FASTENERS, ALLOWABLE TORQUE INCREASES SUBSTANTIALLY.

STUD	ULTIMATE LOAD TENSILE LBS	ULTIMATE LOAD SHEAR LBS	RECOMMENDED SAFE WORKING LOAD TENSILE LBS
3/8	6,580	4,063	1,120 TO 1,460
1/2	12,015	6,815	1,890 TO 2,480
5/8	18,117	11,988	3,105 TO 4,070
3/4	26,425	17,000	5,010 TO 6,550
7/8	33,200	25,400	5,750 TO 7,540
1	40,213	29,900	7,490 TO 9,810
1-1/4	70,467	49,133	11,310 TO 14,810

CAPSULE ANCHOR SYSTEM

SPECIFICATIONS * / STUD ASSEMBLIES

CAPSULE #	C-38	C-12	C-58	C-34	C-78	C-100	C-114
STUD DIAMETER	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
THREAD SIZE	3/8 - 16	1/2 - 13	5/8 - 11	3/4 - 10	7/8 - 9	1 - 8	1-1/4 - 7
ROD LENGTH	5"	6-1/4"	7-1/2"	10-1/4"	10-1/4"	11-3/4"	14-1/8"
DRILL SIZE	7/16"	9/16"	11/16"	7/8"	1"	1-1/4"	1-1/2"
HOLE DEPTH	3-1/2"	4-1/4"	5"	6-5/8"	7"	8-1/4"	10-1/4"
MORTAR VOLUME REQUIRED PER INCH EMBEDMENT	.085	.110	.230	.285	.335	.650	.820
TIGHTENING TORQUE FT - LBS	10	25	45	80	120	165	365
MAXIMUM TORQUE FT - LBS	20	50	90	160	200	300	600

* SPECIFICATIONS OF SAE J429 - GRADE 2 ALL THREADED STUDS IN 4000 PSI CONCRETE

SPECIFICATIONS / CAPSULES

CAPSULE #	C-38	C-12	C-58	C-34	C-78	C-100	C-114
CAPSULE DIAMETER	.430"	.500"	.665"	.850"	.850"	1.000"	1.310"
CAPSULE LENGTH	3 - 3/8"	3 - 3/4"	3 - 3/4"	4 - 5/8"	6 - 1/4"	8 - 1/4"	9 - 3/4"
MORTAR VOLUME CUBIC INCHES	0.37	0.55	0.90	2.07	3.20	6.53	12.20

SPECIFICATIONS / REINFORCING BAR *

REBAR SIZE	DRILL SIZE	HOLE DEPTH	CAPSULE	MORTAR VOLUME REQUIRED PER INCH EMBEDMENT
#3 (3/8)	1/2'	3-1/2"	C-38	.106 CUBIC INCHES
#4 (1/2)	5/8"	4-1/2"	C-12	.137 CUBIC INCHES
#5 (5/8)	3/4'	5"	C-58	.169 CUBIC INCHES
#6 (3/4)	7/8"	6"	C-34	.212 CUBIC INCHES
#7 (7/8)	1"	7"	C-34	.243 CUBIC INCHES
#8 (1)	1-1/8"	8"	C-78	.280 CUBIC INCHES
#9 (1-1/8)	1-3/8"	9"	C-100	.578 CUBIC INCHES
#10 (1-1/4)	1-1/2"	10"	C-100	.599 CUBIC INCHES
#11 (1-3/8)	1-3/4"	11"	C-114	.956 CUBIC INCHES

* MINIMUM YIELD STRENGTH OF GRADE #60 REBAR
IN 4000 PSI NORMAL WEIGH COMPRESSIVE STRENGTH CONCRETE

SPECIFICATIONS / SMOOTH ROUND BAR *

BAR DIAMETER	DRILL SIZE	HOLE DEPTH	CAPSULE	MORTAR VOLUME REQUIRED PER INCH EMBEDMENT
3/8"	7/16'	4"	C-38	.060 CUBIC INCHES
1/2"	9/16"	5"	C-12	.074 CUBIC INCHES
5/8"	11/16"	6"	C-58	.173 CUBIC INCHES
3/4"	7/8"	7"	C-34	.208 CUBIC INCHES
7/8"	1"	8"	C-34	.239 CUBIC INCHES
1"	1-1/8"	9"	C-78	.285 CUBIC INCHES
1-1/4"	1-1/2"	10-1/2"	C-100	.643 CUBIC INCHES
1-1/2"	1-3/4"	12-1/2"	C-114	.756 CUBIC INCHES

* MINIMUM TENSILE STRENGTH OF LOW CARBON STEEL BAR (ASTM A307)
IN 4000 PSI NORMAL WEIGH COMPRESSIVE STRENGTH CONCRETE

SPECIFICATIONS / COIL ROD *

COIL ROD SIZE	DRILL SIZE	HOLE DEPTH	CAPSULE	MORTAR VOLUME REQUIRED PER INCH EMBEDMENT
1/2"	9/16"	4-1/4"	C-12	.132 CUBIC INCH
3/4"	7/8"	6-1/2"	C-34	.344 CUBIC INCH
1"	1-1/8"	10"	C-100	.530 CUBIC INCH
1-1/4"	1-3/8"	12"	C-114	.663 CUBIC INCH

* COIL ROD / CONTINUOUS THREADED LAG STUD/FORMING ROD -MIN YIELD 90 KSI TENSILE
IN 4000 PSI NORMAL WEIGH COMPRESSIVE STRENGTH CONCRETE

CAPSULE ANCHOR SYSTEM

ENGINEERING - LOADING DATA SHEET

CAPSULE #	C-38	C-12	C-58	C-34	C-78	C-100	C-114
STUD DIAMETER	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1-1/4"
HOLE DIAMETER	7/16"	9/16"	11/16"	7/8"	1"	1-1/4"	1-1-/2"
HOLE DEPTH = MINIMUM EMBEDMENT	3-1/2"	4-1/4"	5"	6-5/8"	7"	8-1/4"	10-1/4"
BMT MIN BASE MATERIAL THICKNESS	5-1/2"	6-1/4"	7-1/8"	8-1/2"	9"	10-1/2"	12-1/2"
ANCHOR LENGTH	5"	6-1/4"	7-1/2"	10-1/4"	10-1/4"	11-3/4"	14-1/8"
MAXIMUM FASTENED THICKNESS	1"	1-1/2"	1-3/4"	2-3/4"	2-1/4"	2-1/2"	2-1/2"
MIN. - MAX TORQUE FOOT POUNDS	10-20	25-50	45-90	80-160	120-200	165-300	365-600
ULTIMATE TENSION CARRYING LOAD IN POUNDS (NOTE #4)	5,735	10,500	16,724	24,716	27,720	36,360	58,140
ULTIMATE SHEAR CARRYING LOAD IN POUNDS (NOTE #5)	3,441	6,300	10,034	14,829	16,632	21,816	34,884
C=SPACING REQUIRED TO OBTAIN MAX WORKING LOAD (TENSION OR SHEAR)	3"	4"	5"	6"	7"	8"	10"
C MIN = MINIMUM ALLOWABLE SPACING BETWEEN ANCHORS (#1)	1-1/2'	2"	2-1/2"	3"	3-1/2"	4"	5"
E=EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD (TENSION OR SHEAR)	4-1/2"	6"	7-1/2"	9"	10"	12"	15"
E MIN = MIN ALLOWABLE EGDE DISTANCE (#2 &#3) (TENSION OR SHEAR)	1-1/2'	2"	2-1/2"	3"	3-1/2"	4"	5"

#1 WHEN USING C MINIMUM, REDUCE THE WORKING LOAD 30%

#2 WHEN USING E MINIMUM AND THE LOAD IS DIRECTED TOWARD THE EDGE, REDUCE THE WORKING LOAD 50%

#3 WHEN USING E MIMIMUM AND THE LOAD IS NOT DIRECTED TOWARDS THE EDGE, REDUCE WORKING LOAD 40%

#4 LOAD VALUES BASED ON MIN TENSILE STRENGTH OF SAE J429 GRADE 2 THREAD STEEL BARS.

#5 LOAD VALUES BASED ON MIN SHEAR STRENGTHS OF SAE J429 GRADE 2 THREADED STEEL BARS (60% OF TENSILE VALUES)

(CALCULATIONS BASED ON THREAD TENSILE STRESS AREA)

CAPSULE ANCHOR SYSTEM
INSTALLATION INSTRUCTIONS FOR SHALLOW EMBEDMENT

When encountering capsule anchor applications with less than standard embedment, please refer to the following in addition to the standard instructions:

1. Shallow embedment is allowable only in floor applications. It is not to be used in wall or ceiling applications.
2. Evaluate the strength of the top surface of the concrete. This is the most likely element to fail.
3. Use only the capsule indicated for anchor size. The contents of the capsule must be contained in the hole prior to mixing.
4. Place mark on the stud indicating the minimum embedment. This will be a visual indicator to assure that the stud is fully driven into the hole.
5. Ultimate loads of SAE Grade 2 studs in 4000 PSI concrete are shown below for information only. In all cases, tests should be performed, simulating the exact conditions of the installation.

FOR FURTHER INFORMATION: CONTACT ACORN TOLL-FREE AT 1-800-523-5474

ANCHOR SIZE	CAPSULE NUMBER	DRILL DIAMETER	MINIMUM EMBEDMENT	ULTIMATE* TENSILE	ULTIMATE* SHEAR
3/8	C-38	7/16	2"	2,860 lbs.	3,020 lbs.
1/2	C-12	9/16	2-1/4"	5,250 lbs.	5,540 lbs.
5/8	C-58	3/4	2-1/2"	8,360 lbs.	8,820 lbs.
3/4	C-34	7/8	3-1/2"	12,400 lbs.	13,000 lbs.
7/8	C-78	1	3-3/4"	13,900 lbs.	14,600 lbs.
1	C-100	1-1/4	4-1/4"	18,200 lbs.	19,200 lbs.
1-1/4	C-125	1-1/2	5-1/4"	29,100 lbs.	30,700 lbs.

*Use safety factor to obtain working load (4:1 or 5:1 is typical)

CAPSULE ANCHOR SYSTEM

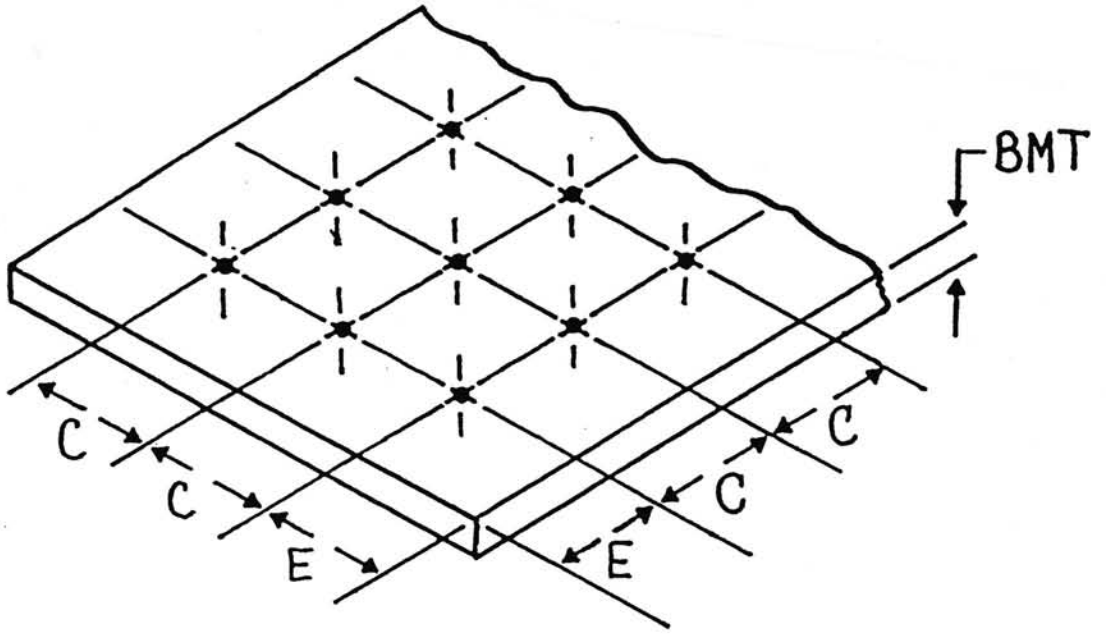
GENERAL DESIGN NOTES:

All factoring of Engineering data to be completed before applying factors of safety for safe working load.

Load factors are cumulative.

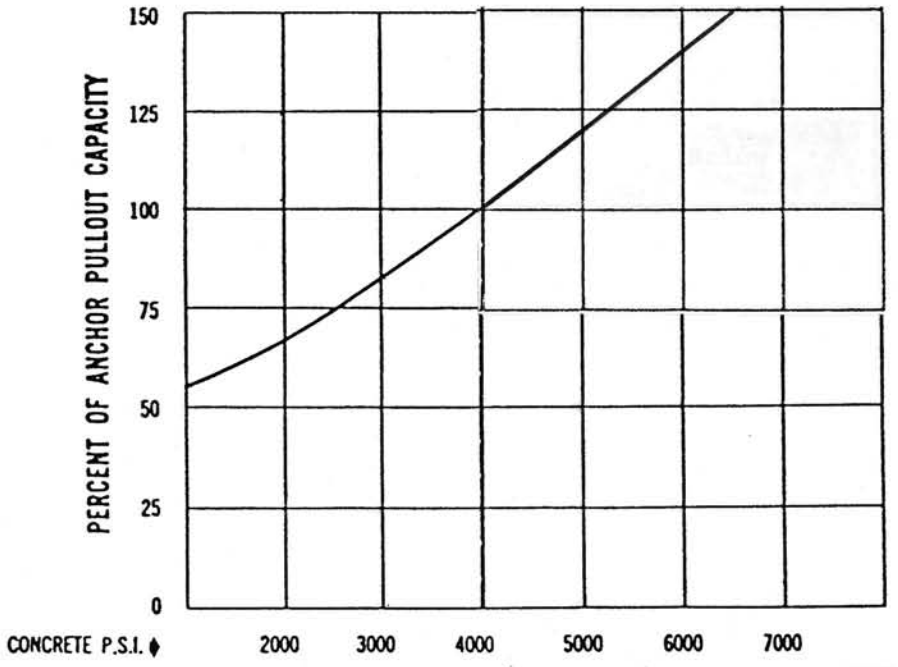
Linear interpolation between minimum/maximum values may be performed.

General industry practice for static loads is to use a safety factor of 4:1 to obtain working loads.



DISTANCE BETWEEN ANCHOR (C) AND DISTANCE FROM EDGE (E)

PULLOUT STRENGTH VS. CONCRETE P.S.I.



NOTE: This graph is only applicable for stone aggregate.

EXAMPLE: 1/2" diameter Anchor in 3,000 P.S.I. concrete at minimum embedment:

Pullout value	10,500 lbs.
% from graph	x 82%
Pullout strength in 3,000 P.S.I. concrete	8,610 lbs.

In stronger concrete (greater P.S.I.), anchor pullout strength may be increased if anchor rod material strengths are increased, as long as the weaker of the two elements is used for factoring a safe working load.