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SEALS, CONCRETE ANCHORS, AND CONNECTIONS

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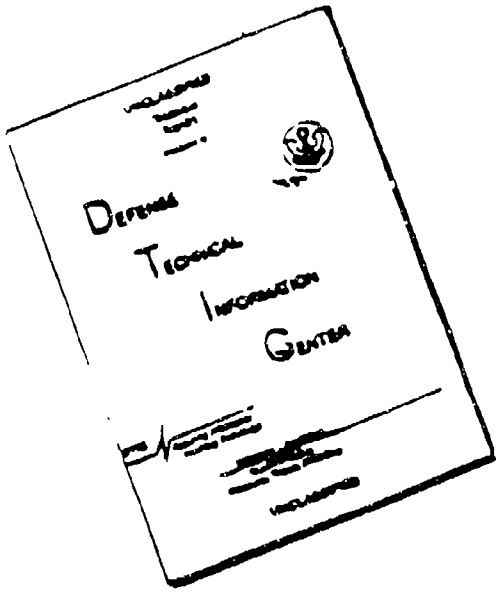

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The survivability of air base structures in a conflict continues to be a concern of the Air Force. Research to date has concentrated on structures, construction methods and new materials to provide improved protection against weapons effects. Because of this research, a considerable body of knowledge is now available to permit the overall design of these structures.

Important construction components remain to be thoroughly investigated, however. With the emphasis on modular, prefabricated and portable structures, joints and connections between structure sections have become a substantial problem. Other details, such as seals between joints and methods for anchoring much of the internal equipment, must be further studied.

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19. ABSTRACT (concluded)

The following report discusses briefly some of the design details which must be considered for air base structures. Three areas are addressed. They are, seals and sealant materials, concrete anchoring methods, and the analysis of a particular moment resistant concrete connection. Within the limited constraints of this study the results are discussed and conclusions expressed.

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1.0 BACKGROUND

A considerable amount of research has been performed to date on the overall structural response and survivability of airbase structures and structural elements subjected to weapons effects. Research has concentrated on structures, modular construction methods, and new materials to provide better protection in a conflict. Indeed, there is a fairly large body of knowledge now available from tests and analyses of prototypical structures to permit the proper overall design of these structures. Certain details of these designs, however, have not been adequately investigated. With the emphasis now being placed on prefabriated modular and portable structures, the dependability of joints and seals has become a matter of substantial concern. In addition, methods of reliably anchoring much of the interior mechanical and electrical equipment must also be studied further.

Design and analysis tools that address the response of such structural details to blast, shock, and fragment impact must be developed. This report discusses a few of these details, namely seals and sealing materials, a moment resistant connection, and anchoring devices that might be used in airbase structures.

2.0 SEALS

2.1 INTRODUCTION

Sealing protective structures against chemical agents is an issue of primary concern. Without chemical protection, the integrity of protective structures may not be complete. Although structural elements, such as concrete walls, blast doors, blast valves, and revetments, afford protection against shock, blast, and fragmentation, they cannot provide the required protection against chemical agents. Proper pressurization and sealing of the living area within a protective structure must be ensured.

This section addresses the different types of seals which may already exist, or which may possibly be used in future structures. It includes various information on these seals, including sealing materials, seal application, and current and previous seal designs. Each type of seal is examined individually. Guidelines, which can help in the design of seals for protective structures and minimize the risk of exposure to chemical agents, are provided.

A special thank you is in order to George Tompkins of Temet USA, Inc., for his cooperation in gathering information for this section of the report.

2.2 CHEMICAL AGENTS

A list of chemical warfare agents, which seals and sealants may be expected to withstand, is given in Table 1. This list was extracted from an actual project specification provided by Temet USA, Inc. The resistance of sealant materials to attack by such agents is of serious concern to the designer of airbase structures. Unfortunately little test data are available concerning this matter.

The Chemical Research Development and Engineering Center (CRDEC), Aberdeen Proving Grounds (ARMY), was reported to be conducting actual chemical warfare (CW) tests on seals and gaskets, but this was not confirmed.

TABLE 1. Known chemical agents.

Chemical Agent and Formula	Chemical Symbol	Molecular Weight	State at 20 °C	Vapor Density Air-1	Liquid Density g/cc
Phosgene COCl 2	CG	98.92	Colorless Gas	3.4	1.37 at 20° C
Diphosgene ClCOOCCl 3	DP	197.85	Colorless Liquid	6.8	1.65 at 20° C
Tabun (CH 2)2 NP(O)-(C 2H 5O)(CN)	GA	162.3	Colorless to Brown Liquid	5.63	1.073 at 25° C
Sarin (CH 3)2 CHO (CH 3)FPO	GB	140.10	Colorless Liquid	4.86	1.089 at 25° C
Soman (CH 2)3 CCH (CH 2)OPF(O)-CH 3	GD	182.18	Colorless Liquid	6.33	1.022 at 25° C
VX --	--	267.38	Colorless Liquid	9.2	1.008 at 25° C
Hydrogen Cyanide HCN	AC	27.02	Colorless Gas or Liquid	0.93	0.687 at 10° C
Cyanogen Chloride CNCl	CK	61.48	Colorless Gas	2.1	1.18 at 20° C
Arsine AsH 3	--	77.93	Colorless Gas	2.69	1.34 at 20° C
Distilled Mustard (ClCH 2 CH 2) 2S	HD	159.08	Colorless to Pale Yellow Liquid	5.4	1.268 at 25° C

TABLE 1. Known chemical agents (continued).

Chemical Agen and Formula	Chemical Symbol	Molecular Weight	State at 20 °C	Vapor Density Air-1	Liquid Density g/cc
Nitrogen Mustard (ClCH 2 CH 2)3 NC 2 H 5	HN-1	170.08	Dark Liquid	5.9	1.09 at 25° C
Nitrogen Mustard (ClCH 2 CH 2)2 NCH 3	HN-2	156.07	Dark Liquid	5.4	1.15 at 20° C
Nitrogen Mustard N(CH 2 CH 2 Cl) 3	HN-3	204.54	Dark Liquid	7.1	1.24 at 25° C
Phosgene Oxime Dichloroforoxime CCl 2 NO	CX	113.94	Colorless Solid or Liquid	---	------ at --° C
Lewisite (Cl CH 1 CH)2 AsCl	L	207.35	Dark Oily Liquid	7.1	1.89 at 20° C
Mustard-Lewisite Mixture --	HL	186.4	Dark Oily Liquid	6.5	1.66 at 20° C
Phenyldichloroarsine C 6 H 5 AsCl 2	PD	222.91	Colorless Liquid	7.7	1.65 at 20° C
Ethyldichloroarsine C 2 H 5 AsCl 2	ED	174.88	Colorless Liquid	6.0	1.66 at 20° C
Methyldichloroarsine CH 3 AsCl 2	MD	160.86	Colorless Liquid	5.5	1.836 at 20° C
Diphenylchloroarsine (C 6 H 5)2 AsCl	DA	264.56	White to Brown Solid	Forms little vapor	1.387 at 50° C

TABLE 1. Known chemical agents (concluded).

Chemical Agent and Formula	Chemical Symbol	Molecular Weight	State at 20 °C	Vapor Density Air-1	Liquid Density g/cc
Adamsite C 6 H 4 (AsCl)-(NH)C 6 H 4	DM	277.57	Yellow to Green Solid	Forms little vapor	1.65 at 20° C (Solid)
Diphenylcyanoarsine (C 6 H 5) 2 AsCN	DC	255.0	White to Pink Solid	Forms little vapor	1.334 at 35° C
Chloroacetophenone C 6 H 5 COCH 2 Cl	CN	154.59	Solid	5.3	1.318 at 20° C (Solid)
Chloroacetophenone in Chloroform CNC	CNC	128.17	Liquid basis of components	4.4	1.40 at 20° C
Chloroacetophenone and Chloropicrin in Chloroform	CNS	141.78	Liquid basis of components	Approx. 5.0	1.47 at 20° C
Chloroacetophenone in Benzene and Carbon Tetrachloride	CNB	119.7	Liquid basis of components	Approx. 4.0	1.14 at 20° C
Bromobenzylcyanide BrC 6 H 4 CH 2 CN	CA	196.0	Liquid	6.7	1.47 at 25° C
O-chlorobenzyl-malononitrile ClC 6 H 4 CHC-(CN) 2	CS	188.5	Colorless Solid	---	1.04 at 20° C (Solid)
BZ ---	--	337.4	---	11.6	Bulk 0.51 Solid

2.3 SEALING MATERIALS

The primary objective in sealing a protective structure is to minimize the leakage rate. Since most protective structures require the interior pressure to be greater than the exterior pressure, air leakage out of a structure will affect this interior pressure, and thereby increase the risk of chemical infiltration. If enough leaks are present, the interior and exterior pressures may become equal, thus allowing dangerous chemicals to enter the structure freely. Hermetically sealing a protective structure is not required when a positive interior pressure is present; however, minimization of the air leakage out of a structure is essential.

Sealing a structure to minimize air leakage can be done with several types of materials. These materials are categorized into caulking compounds, nonhardening extruded tapes, nonhardening mastics, strippable spray coatings, pressure sensitive tapes, gaskets, adhesives, fabrics, films, etc. Although all of these materials may provide a seal, care must be taken when selecting a sealing material as to its chemical and environmental susceptibility. Three primary concerns when choosing a sealing material are (1) impermeability to air, (2) resistiveness to chemical agents, and (3) ease of installation. These materials must be durable and should be capable of performing their required function for the design life of the structure (Ref. 1.).

Many types of sealing materials are available. The following paragraphs will address sealing materials that may be applied to protective structures. These materials, taken primarily from Ref. 1, are grouped into three categories: (1) gaskets, (2) sealants, and (3) fabrics. A brief description is given for each material, along with a listing of the primary advantages and disadvantages of such materials.

2.3.1 Gaskets

Gasketing materials play an important role in sealing protective structures. They can be used to seal doors, joints, separation walls, and various wall penetrations for piping, communication, and electrical wiring. The important factors to be considered when selecting a proper gasketing material are (1) impermeability to air; (2) the ability to flow into joint imperfections when compressed; (3) the ability to maintain a seal despite age and temperature variations; and (4) resistance to environmental deterioration and chemical

agents. The most common types of gasketing materials are cork, asbestos products, rubber, paper, and leather (Ref. 1).

Paper and leather products, although good for some sealing applications, are not appropriate for gasketing protective structures. Asbestos products, when used in a pure form, are very low in strength and high in porosity. When used as a filler in rubber and plastic compounds, however, they can provide strength and greater imperviousness. Environmental factors, which are beyond the scope of this study, may need to be considered when using such products (Ref. 1).

Cork, when used by itself, may not be durable enough for protective structures, but when combined with rubber products, it may contribute a quality of inertness and resistance to swell. It is also unaffected by age. Rubber products are used extensively to seal protective structures (Ref. 1).

There are numerous types of rubber elastomers available including neoprene, styrene rubber, polysulfide rubber, silicon rubber, urethane, etc. The most commonly used elastomer is neoprene. This sealing material, along with various others, is listed in Table 2 (Ref. 1).

Neoprene and silicon rubber gaskets appear to be the most widely used and recommended. Two Department of Defense sources make such a recommendation: TM 5-855-2, "Protection Against Chemical and Biological Agents and Radiological Fallout" (Ref. 2) and MIL-HDBK-144, "Engineering Design Handbook for Air Cleaning for Chemical Demilitarization" (Ref. 3).

The following are excerpts from two DOD sources recommending neoprene:

(1) TM 5-855-2, "Protection Against Chemical and Biological Agents and Radiological Fallout," Paragraph d, page 11. Note that no particular type or grade of neoprene is specified.

> d. Seals. Seals of neoprene rubber or other similar elastic material will be used in permanent-type structures. Such seals will be fitted in nonferrous metal strips fastened to the doorframe in such manner that adjustment may be readily made with doors closed. Seals of nonferrous metal weather stripping may be used on doors that are not susceptible to possible

infiltration of contamination in the event of pressure loss in a structure. In no event will seals be placed on blast-resistant doors.

(2) MIL-HDBK-144, "Engineering Design Handbook for Air Cleaning for Chemical Demilitarization," Paragraph 4.1.2.4 Gasketing, pages 4-39, 4-40. ASTM D1056 is specified. Note, subparagraph 3, also recommends silicone rubber.

> Gasketing. Gasketing is required to ensure leaktight sealing of components and the filter housings. The three major areas in which gaskets are used in such applications are:
> 1. Between filter/adsorber cells and the mounting frame. The gasket is bonded to the cell rather than to the mounting frame, permitting it to be replaced each time the filter or adsorber is changed. These are made of fairly soft, closed-cell, neoprene sponge, ASTM D1056, Grade SCE-43.9.
> 2. Between flanged connections on various sections of ductwork. These are a somewhat harder (less compressible) material, as indicated in the CAMDS ductwork specification (see Appendix E of reference 11).
> 3. In the filter-housing access doors, where the properties for this gasketing material are similar to those of the latter application.
>
> A neoprene gasketing material was used in the doors (application 3) of the first 12 CAMDS housings. Although the desired sealing was obtained, it was found that the gaskets took a severe compression-set over a period of time. As a result, the final CAMDS unit and DATS unit (section 8) now employ silicone rubber gaskets. Based on preliminary results, the latter gaskets have performed satisfactorily.
>
> Another factor to be considered in the selection of gasketing material is its compatibility with both the contaminants of interest (chemical agent in this case), and other constituents or potential constituents of the air stream, including SO_2, NO_x, and ozone. Since there is limited information available on this subject, it is suggested that CSL be consulted.

Although neoprene is one of the most widely used gasketing materials, little is known about its resistance to the chemical agents listed in Table 1. Several neoprene gasket suppliers and manufacturers of CW filters were contacted on the subject, and none of them knew of any tests performed on neoprene using any of the listed chemical agents. Currently most manufacturers use the ASTM-D1056-85 specification for flexible cellular materials-sponge or expanded rubber, which specifies the following: neoprene rubber (type S, class SCE, grade 41, temperature range F1, color black).

TABLE 2. Elastomers.

Common Name	Chemical Designation	General Properties
Natural	Natural Polyisoprene	Excellent physical properties; good resistance to cutting, gouging and abrasion; low heat, ozone, and oil resistance.
Synthetic Natural	Synthetic Polyisoprene	Same properties as natural rubber; requires less mastication than natural rubber.
Neoprene	Chloroprene	Excellent ozone, heat and weathering resistance; good oil resistance; excellent flame resistance.
GRS, Buna S	Styrene-Butadiene	Good physical properties; excellent abrasion resistance; not oil, ozone, or weather resistant.
Buna N, Nitrile	Acrylonitrile-Butadiene	Excellent resistance to vegetable, animal, and petroleum oils; poor low-temperature resistance.
Butyl	Isobutylene-Isoprene	Excellent weathering resistance; low permeability to gases; good resistance to ozone and aging; low tensile strength and resilience.
Chloro-Butyl	Chloro-Isobutylene-Isoprene	Same general properties as butyl.
Cis-4	Polybutadiene	Excellent abrasion resistance and high resilience; used principally as a blend in other rubbers.
Thiokol	Polysulfide	Outstanding solvent resistance; other properties poor.
EP2	Ethylene Propylene	Good aging, abrasion, and heat resistance; not oil resistant.
EPT	Ethyl Propylene Terpolymer	Good aging, abrasion, and heat resistance; not oil resistant.
Hypalon	Clorosulfonated Polyethylene	Excellent ozone, weathering, and acid resistance; fair oil resistance; poor low temperature resistance.

TABLE 2. Elastomers (concluded).

Common Name	Chemical Designation	General Properties
Silicone	Polysiloxane	Excellent high and low temperature resistance; low strength; good compression set resistance.
Urethane	Polyurethane Diisocyanate	Exceptional abrasion, cut, and tear resistance; high modulus and hardness; poor moist-heat resistance.
Viton	Fluorinated Hydrocarbon	Excellent high temperature resistance, particularly in air and oil.
Acrylics	Polyacrylate	Excellent heat, oil, and ozone resistance; poor water resistance.

2.3.2 Sealants

The function of sealants is similar to that of gaskets: minimization of air loss from protective structures and protection from chemical agents. Sealants are commonly applied in a non-solid form, while gaskets are usually preformed to fit between mating surfaces. Sealants, however, are used to fill cracks, seams, penetrations, etc. Sealants can be divided into three categories: (1) hardening (rigid and flexible), (2) nonhardening , and (3) tapes (Ref. 1).

Rigid type hardening sealants are characterized by their inability to flex; they will crack if flexed and are very difficult to remove. They are based on compounds of epoxies, polyesters, acrylics, polyamids, and polyvinyl acetates. Flexible type hardening sealants remain flexible after curing and are all elastomeric-based. The range of flexibility varies with hardness values from 10A - 85D Shore durometer (Ref. 1). Some common hardening sealants of the flexible type are those based on compounds of polysulfide, polyurethane, silicone, modified epoxy, viton, neoprene, acrylic, hypalon, butyl, and nitrile.

Nonhardening sealants are usually applied to seams with a trowel or brush and never dry completely. Some of these sealants remain permanently tacky, while others stay soft inside but form a protective skin. These sealants usually have bases comprised of butyl, acrylic, polybutene, aleo-resin, asphalt, or bitumen (Ref. 1).

Tapes, which can be used along seams, are available with a variety of backings and adhesives. The backings are usually pressure sensitive or solvent-activated. Other tapes are self-sticking. Some of the more common backing materials are paper, cloth, vinyl-coated cloth, polyethylene-coated cloth, glass cloth, aluminum foil, cellophane, cellulose acetate, polyester, and vinyl (Ref. 1).

The choice of a particular sealing material depends on the type of application. Resistance to heat, the ability to flex, and the ability to adhere to different surfaces are some of the factors that need to be considered. Table 3 lists some of the recommended sealants, which may meet particular sealing requirements.

TABLE 3. Recommended sealants.

Brand Name Sealant	Advantages	Disadvantages
"Lab Metal" (Alvin Products)	Satisfactory chemical resistance. Does not burn. Non-toxic. Easy to use (1 part system). Can be thinned and sprayed. Cures quickly (10-14 hrs.). Has good shelf life (2 yrs). Adheres to metal, wood, plastic, glass, paint, and plaster. Can be filed or sanded after cure to improve appearance. Good service temperature (-65 °F to +350 °F).	Does not come in cartridges. Not good for movable joints. Slight solvent odor (uncured).
"Silastic" 732 RTV (Dow Corning Corp.)	Non-toxic. Easy to use (1 part system). Comes in cartridges. Cures quickly (less than 24 hrs.). Good for movable joints. Adheres to metal, wood, glass, and masonry. Good service temperature (-100 °F to +500 °F).	Shelf life is at the minimum (1 yr.). Has a slight acetic acid odor (uncured). Will burn but not readily. Unsatisfactory chemical agent resistance.

TABLE 3. Recommended sealants (continued).

Brand Name Sealant	Advantages	Disadvantages
"7B4 Aluminum" Sealant (Benjamin Foster Company)	Nontoxic. Very little odor (uncured). Easy to use (1 part system). Comes in cartridges. Cures quickly (less than 24 hrs.). Good for movable joints. Adheres to metal, wood, glass, paint, and masonry. Good service temperature (-70 °F to +250 °F). Butyl base indicates good agent resistance.	Shelf life at minimum (1 yr.). Will burn.
"SMR-8257-E" (Intercoastal Corp.)	Nontoxic. Very little odor (uncured). Easy to use (1-part system). Comes in cartridges. Skins over quickly. Good for movable joints. Adheres to metal, wood, glass, paint, and masonry. Good service temperature (-65 °F to +200 °F). Butyl base indicates good agent resistance. Excellent shelf life (indefinite).	Does not cure inside. Will burn.

TABLE 3. Recommended sealants (continued).

Brand Name Sealant	Advantages	Disadvantages
"Incolastic Tapes" Nos. 7500, 7501, 7516, 7518, 7522 (Intercoastal Corp.)	Nontoxic. No odor (uncured). Easy to use (tape form). Adheres to metal, glass, wood, paint, and masonry. Good service temperature (-65 °F to +200 °F). Have choice of butyl content (higher numbers indicate higher butyl content). Butyl base indicates good chemical agent resistance. Indefinite shelf life (non-hardening).	Will burn. The size and configuration of leaks that can be sealed is limited.
"SC-1074B-1" (Sprayfat Corp.)	Nontoxic. Very little odor (uncured). Cures quickly (8-12 hrs.). This sealant is in the form of a strippable spray coating which allows large areas to be quickly sealed. Adheres to metal, glass, wood, paint, and masonry. Good service temperature. (FSN8030-079-0054).	Will burn. Some surfaces must be waxed in order that the sealant can be stripped off; e.g., stretched plexiglass, decals, stencils, neoprene, and wood. Chemical resistance unknown. Requires a compressor and spray gun to apply. The SC-1074B-1 base coat is black and non-reflective. However, there is a gray base coat available (SC-1074A-1).

TABLE 3. Recommended sealants (continued).

Brand Name Sealant	Advantages	Disadvantages
"Duribbon 1082" (Pittsburgh Plate Glass Company)	Nontoxic. No odor. Easy to use (tape form). Adheres to metal, glass, wood, paint, and masonry. Good service temperature (-65 °F to +200 °F). Butyl base indicated good agent resistance. Indefinite shelf life (non-hardening).	Will burn. Size and configuration of leaks that can be sealed is limited.
"No.24 Plastic" Sealer (Rector Engineering & Plastic Co.)	Nontoxic. No odor. Easy to use (pliable mastic). Adheres to metal, glass, wood, paint, and masonry. Good service temperature (-65 °F to +200 °F). Nonflammable. Indefinite shelf life (non-hardening). Reusable, can be thumbed into a hole and removed later.	Not to be used where there is traffic - it is non-hardening and can be removed. Asbestos base indicates unsatisfactory chemical agent resistance.

TABLE 3. Recommended sealants (concluded).

Brand Name Sealant	Advantages	Disadvantages
"No. 411 Aluminum" Foil Tape (Adhesive Tape Corp.)	Flame resistant (however, the adhesive will burn). Easy to use. Good service temperature (-65 °F to +200 °F). Satisfactory chemical agent resistance.	Storage life is 6 months.
"No. 91B" Polyethylene Coated Cloth Tape (Technical Tape Corp.)	Easy to use. Good service temperature (-65 °F to +200 °F). Shelf life 1 yr. Available in olive drab.	Will burn. Chemical agent resistance is unknown.

2.3.3 Fabrics

Fabrics, when used properly, may also provide adequate sealing. Material studies tests, performed under Edgewood Arsenal Contract DA-18-108-AMC-214(A) on the CB Pod System, showed that a laminate of Tedlar film and Dacron fabric, with a neoprene backing, met requirements of agent resistance, crease and abrasion resistance, high and low temperature exposure, and bulk (when folded). The study also showed that films low in permeability to chemical agents (Tedlar, polyester, and Capron) are superior to the best coatings (butyl), even though the coating is present in a much greater thickness (Ref. 1).

2.4 TYPICAL SHELTER SEALS

2.4.1 Module to Module

Protective structures are often constructed of modules that are joined together to obtain the necessary size and configuration. The points where these modules meet usually require seals to prevent the escape of interior air, thus ensuring chemical integrity of the structure.

A typical module-to-module joint is shown in Figure 1. This joint is similar to the one used on the MUST-V shelter (Ref. 4). The seal is constructed of a hollow core, neoprene rubber tube and runs along the entire length of the mating surface. Joints similar to those used in the MUST-V shelter should be designed to maintain a seal that will accommodate some relative movement between modules. The seal does not need to be 100 percent airtight. Leaks in the seals should, however, be minimized since too many leaks can affect the interior pressure of the structure.

Berming of a structure not only provides protection from blast and fragmentation, but it also aids in sealing. This was evident in the MUST-V shelter tests in which a module-to-module seal was broken, yet the amount of air that escaped did not greatly effect the interior pressure of the shelter. The soil surrounding the joint actually aided in sealing the shelter. This is not to say that module-to-module seals are not necessary. They are important, and care should be taken in designing such seals.

Since little information is known about module-to-module seals, only suggestions on future designs can be given. The use of a seal similar to the one in Figure 1 is a possibility. If designed properly, it could provide sealing and allow some relative movement between modules.

Another possibility is the design of a seal similar to the one shown in Figure 2. This seal, which is a conceptual design of the authors, has never been tested. It is intended to demonstrate the different possibilities that may be available for sealing module-to-module joints. A seal of this nature could facilitate sealing and provide for relatively large modular displacements.

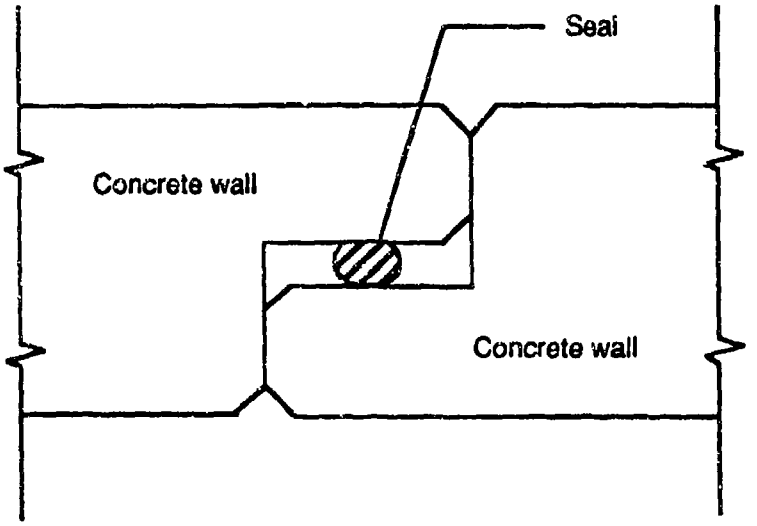


Figure 1. Typical module to module joint.

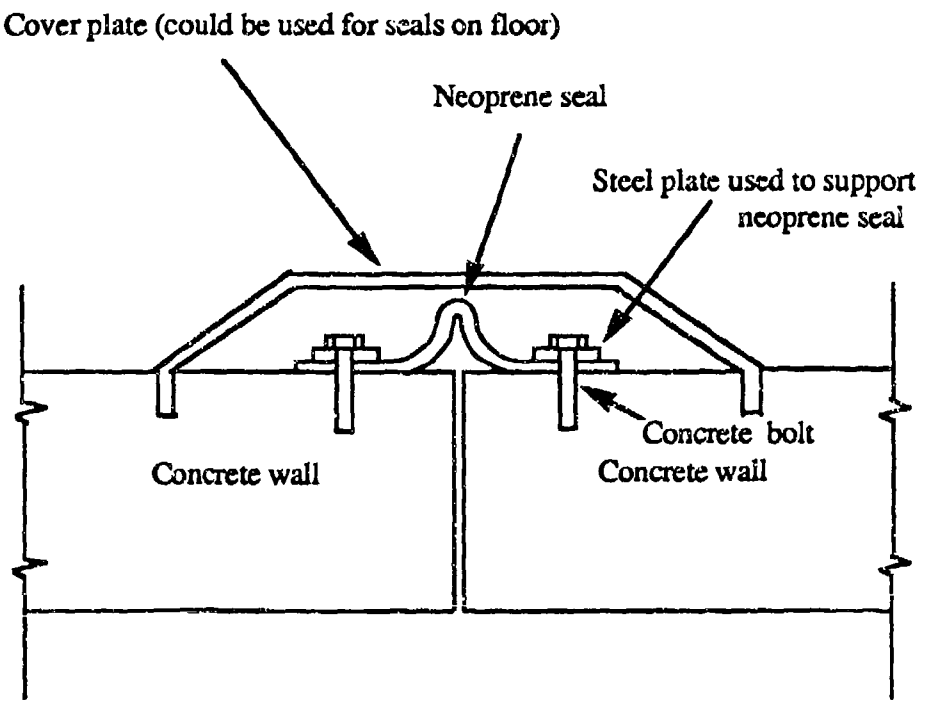


Figure 2. Conceptual seal design.

The importance of material type for module-to-module seals is not certain. These seals are not normally exposed to exterior air. If the seal is exposed to exterior air, or has the possibility of being exposed to exterior air, then the possibility of chemical attack upon the sealing material may need to be considered.

2.4.2 Exterior Walls

The sealing of exterior walls (bulkheads) is usually accomplished by the design of the gasket. If the exterior walls are bolted to the protective structure, the gasket can be placed between the wall and the structure. This gasket should be capable of conforming to the mating surfaces. If the mating surfaces are not flat, the gasket should be designed to accommodate imperfections such as warped or irregular surfaces.

Again, if the seal is exposed to exterior air, which may be contaminated, care should be taken in selecting a proper gasketing material.

2.4.3 Interior Walls

The sealing of interior walls that separate clean and contaminated regions within a protective structure is very important. Although a few minor leaks may not cause concern, the presence of many minor leaks could affect the interior pressure of the protective structure. Since little information is available on such seals, only suggestions can be given.

Using sealants to seal interior walls may be one option. This was the approach used in the MUST-V shelter, in which a type of caulking material was used to seal the interior walls. Although this caulking material provided a good initial seal, problems were encountered after the shelter was subjected to shock and blast loading. Several minor leaks developed along the seams where the sealant had been applied. Although the leaks did not affect the integrity of the shelter (i.e., decrease the interior pressure below an acceptable level), their presence did cause some concern.

When deciding which method is best for sealing interior walls, one must take into account possible relative movement between the interior wall and the structure itself. If a sealant is to be used, it would be best to choose a pliable material. Also, injecting the material into seams that separate interior walls from the structure may decrease the possibility of leakage

and provide better protection than simply running a bead of material (such as caulk) along a seam.

The importance of leakage along a seam should also be considered. Seams exposed to a vacuum on the exterior side may prove to be more critical if a leak does develop. For example, leaks that developed in the seam separating the living area from the generator room of the MUST-V shelter proved to be more significant than the leaks that developed in other walls. The leak was exacerbated by the vacuum in the generator room. The vacuum was created by the generator that drew cooling air from the generator room. The vacuum thus created actually helped pull air from the living area of the shelter once leaks developed. Although the leaks did not affect the chemical integrity of the shelter, they were present and noticeable.

Another option for sealing interior walls might be the use of gaskets. It is not known if this has been tried in the past. Although the performance of such a seal is uncertain, it is an option that could be considered.

2.4.4 Doors and Hatches

All doors and hatches that separate the living area of a protective structure from areas of possible contamination should be sealed. According to "Design Criteria for Semihardened Facilities with Nuclear, Biological and Chemical (NBC) Protection" (Ref. 5, p.26) :

> All doors in the airlock area, between the vapor and liquid areas, and between the dirty and clean mechanical rooms shall be metal with metal frames and gastight. The seal shall not deteriorate in the presence of the known threat chemicals and decontaminants.

Another source, "Protection Against Chemical and Biological Agents and Radiological Fallout," (Ref. 2, pp. 10-11) states:

> In the majority of cases the only doors that will have airtight characteristics are those opening to the outdoors or areas of contamination. Only in those cases where internal pressure may be required between different sections of a structure will airtight doors be used inside.

Furthermore:

> Seals of neoprene rubber or other similar elastic material will be used in permanent-type structures. Such seals will be fitted in nonferrous metal strips fastened to the doorframe in such a manner that adjustment may be readily made with doors closed. In no event will seals be placed on blast-resistant doors.

Since there are several manufacturers that specialize in the design and fabrication of gas and blast resistant doors and hatches, the actual design of seals for these items is not usually necessary. Normally, the specifications for a particular structure are set forth, and doors and hatches are purchased. Care must be taken, however, when making such specifications. According to the sources mentioned above, doors that separate the living area of a structure from a contaminated area shall be gastight or airtight. The exact definition of gastight and airtight is not clear. One manufacturer of such doors advised that their gas doors were designed for protective structures, but the doors are not 100 percent airtight. There is an acceptable level of leakage allowed.

If a protective structure has a design similar to the one of the MUST-V shelter, a 100 percent seal is not really necessary. The MUST-V shelter was pressurized and minimal leakage was permitted. If a protective structure is not designed to be completely sealed, then a requirement of completely airtight doors may not be beneficial.

However, if gas resistant doors (which allow some leakage) are used, the amount of leakage must be accounted for when designing the airflow system for the structure. Gastight doors (100 percent gastight) are available, but the cost of such doors is much greater than those that permit some leakage.

The use of seals on blast resistant doors is another issue of confusion. According to Reference 2, the use of seals on such doors is not acceptable: "In no event will seals be placed on blast-resistant doors" (Ref. 2, p. 11). Despite these requirements, seals are presently being used on blast doors by two of the leading manufacturers. The seals are not intended to provide protection from chemical agents, rather, they are used to prevent dust from entering the structure. These types of blast doors are not used between the toxic free area and the contaminated area. The authors of this report have obtained no evidence that the use of seals on blast doors will effect the function of the doors. If a blast door will be used as a gastight door as well, a "gastight" seal is required.

2.4.5 Feed-throughs

Many protective structures have electrical, communication, and plumbing requirements. For each of these requirements, feed-throughs must be constructed into one or several of the walls separating the living area of the structure from the contaminated area. These feed-throughs provide access for electrical wiring, communication wiring, and piping for water, sewer, or air conditioning. Different methods of sealing these feed-throughs are available.

Transits or wall sleeves are often used for carrying and sealing cables and pipes. Two examples of such sealing devices are shown in Appendix A. These devices are able to provide a tight seal. The possible exposure to blast pressure should be considered when using these devices. These devices may also have a limitation on the size of pipes or cables they can accommodate.

Another device used for sealing feed-throughs is a link-seal (Appendix A). This type of seal is usually employed for larger pipes or ductwork. This particular type of seal was used in the MUST-V shelter to seal a round duct that carried clean air into the shelter. The seal is comprised of links, which are attached to each other and placed around the duct. They fit snugly between the duct and a penetration in the wall. Bolts that pass through the seals are tightened to obtain the required sealing.

Other methods of sealing feed-throughs are also available. Two materials, also used in the MUST-V shelter, are expandable foam and fire-stop putty. The expandable foam is purchased in a liquid form and, when mixed, can be poured into feed-throughs and allowed to expand and harden. The ability of the foam to resist chemical agents is not known. The fire-stop putty is used to seal electrical conduit that lead into the shelter. The putty is packed around the conduit to provide an airtight seal. The manufacturer states that the putty prevents the passage of toxic gases (Appendix A), however, its resistivity to the known chemical agents listed in Table 1 is unknown.

2.5 CONCLUSIONS AND RECOMMENDATIONS

Sealing of protective structures is important to the chemical integrity of such structures. The loss of air can affect the interior pressure of a shelter and possibly make the structure

and its personnel vulnerable to chemical attack. This report has addressed some of the different types of seals and sealing materials that are available to prevent the entry of chemical agents. The information presented is limited and should be used only as a guide for selecting sealing materials. Furthermore, the ability of many of these materials to resist chemical attack is unknown. As research continues, different methods and materials for sealing should be developed. Appendix A lists several sources obtained in a literature search, all of which may be investigated to identify sealing materials and methods in addition to those mentioned in this report.

Methods used for sealing are varied. Sealing material exhibit significant differences in design philosophy as well. An attempt should be made to investigate thoroughly all methods of sealing and provide a suitable listing of standard sealing materials and methods. This investigation has generated a list of some available sealing materials and methods, but funding limitations did not allow a thorough investigation of each.

3.0 CONCRETE ANCHORING DEVICES

3.1 INTRODUCTION

In any airbase structure there are a great variety of components that must be firmly and reliably attached to the walls, floors, or ceilings of the structure. Motors, generators, fans, ductwork, cables, and filtering equipment are just a few of the different components that might be found in a typical structure. The reliable attachment of such equipment to the airbase structure presents a problem especially when reinforced concrete is the principal building material. Unlike most conventional concrete structures, those having a military mission must be capable of functioning before, during, and after the detonation of munitions nearby . Shock loads from such detonations place severe stress on anchoring devices; consequently, they must be given special consideration.

Probably the most secure anchoring method utilizes the steel reinforcing of the completed structure, that is, by welding or mechanically attaching devices directly to portions of exposed structural reinforcing bar (rebar). In addition to the necessity to mechanically uncover the rebar in the structure, this method would require that the attachment point locations be well identified prior to the pouring of concrete for the structure. Except for perhaps large pieces of equipment, the numbers and types of components that have to be attached would make this method impractical. For a similar reason attachment anchors that are inserted into the structure rebar cage prior to pouring the concrete would also be impractical except for special cases. Generally, the need for attachment points within a structure arises after the structure is built, and anchors designed for such situations must be used.

3.2 ANCHORING METHODS

Almost all of anchoring methods that can be applied to existing concrete or masonry require the drilling of holes into the masonry and the insertion of an anchor. Anchoring is usually accomplished by one or more of the following methods:

1. Friction between the fastener and the masonry material.
2. Clamping the item to be fastened to the masonry material, which generally requires that a hole be made completely through the masonry.

3. Expansion of the anchor against the wall of the drilled hole.
4. Adhesive bonding of the anchor in the hole with a chemical adhesive.

3.2.1 Friction

Friction anchors are generally light-duty fasteners that are driven into predrilled holes. Their pre-expanded shape applies pressure to the sides of the hole and generates pullout resisting friction loads (Fig. 3). Typical fasteners are the Rawl Spike and Topline Split-Drive Anchors . Pullout strengths are low, generally less than 6000 lbs for 1/2-in anchors placed in 3000 psi concrete.

Advantages:	Load can be applied immediately
	One piece anchor
	Exact hole depth not required
	Fast installation
	Inexpensive
Disadvantages:	Low pullout strength

3.2.2 Clamping

Clamping anchors require through holes in the masonry structure to permit a clamping action to occur between two surfaces (Fig. 4). Typical anchors are Rawl Toggles Bolts and U.S.E. Diamond Inc. Sup-R-Toggles . These are for light-duty applications and can sustain only small tensile loads in their typical installation (2550 lbs for 1/2-in bolts in hollow masonry). There does not appear, however, to be any fundamental reason why considerably stronger clamping anchors cannot be manufactured.

Advantages:	Can be used in any hollow base material application
	Load can be applied immediately
	Inexpensive
	Difficult to pull out (without masonry or clamping wing failure)
Disadvantages:	Low strength (in usual application)
	Clamping wing lost when screw removed
	Requires through hole

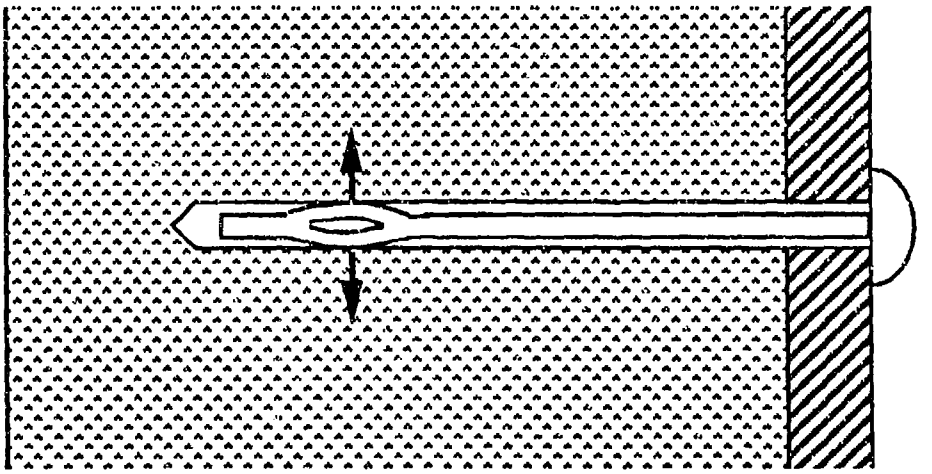


Figure 3. Friction anchor.

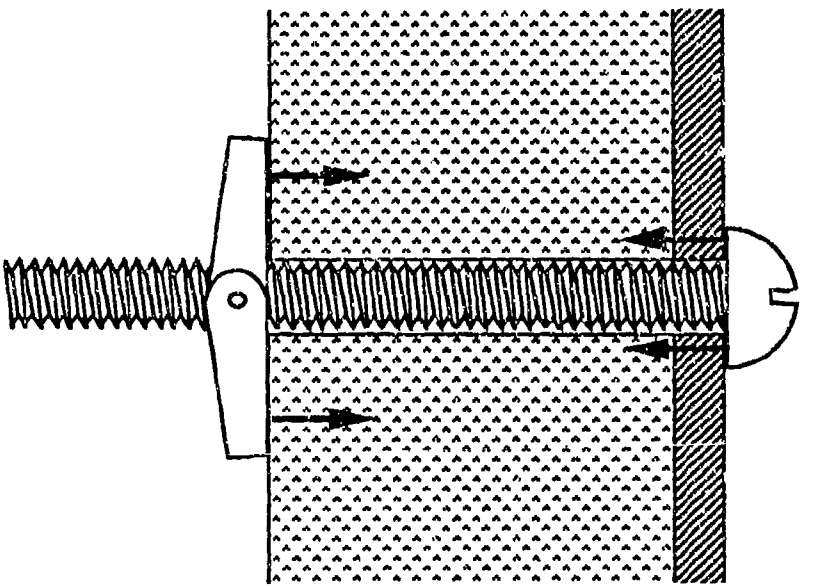


Figure 4. Clamping anchor.

3.2.3 Expansion

Expansion anchors operate on the principle of the expansion of the fastener in a predrilled hole and the creation of a large normal stress zone between the anchor and masonry. These come in a variety of styles and can be used in light-duty and heavy-duty applications. Typical light-duty anchors are Topline Plastic Anchors, Topline Nylon Nailins, and Topline Hammer Drive Anchors. Similar anchors are made by Rawl (Rawl Nylon Nailin, Rawl Zamac Nailin) . Pullout loads for these light-duty anchors are small (1300 lbs for a 1/4 x 2-in Rawl Zamac Nailin).

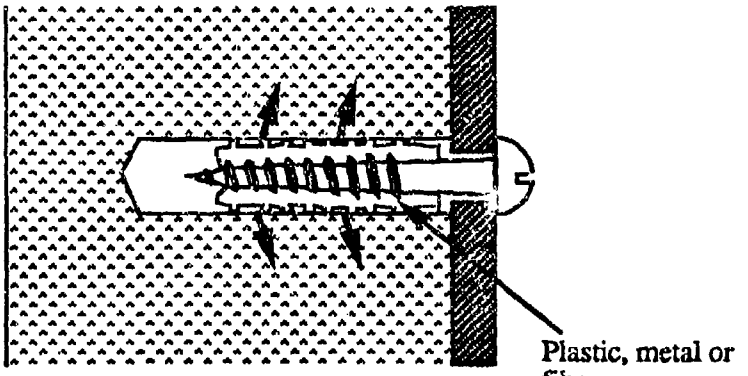
Most medium to heavy anchors require a predrilled hole. The Rawl Saber-Tooth drills its own hole as does the U.S.E. Sup-R-Drill. The latter two anchors and the Topline Wedge Anchor are set into the hole with hammer blows. The Rawl Steel Dropin and Topline Drop-in Anchor are placed using a hammer and a special setting tool. Topline Sleeve Anchors, Rawl Lok/Bolts, and Rawl-Bolts are set by tightening a nut or bolt. Typical light- to heavy-duty expansion anchors are shown in Figure 5.

The ultimate pullout strength for some medium to heavy-duty anchors is plotted vs anchor diameter in Figure 6.

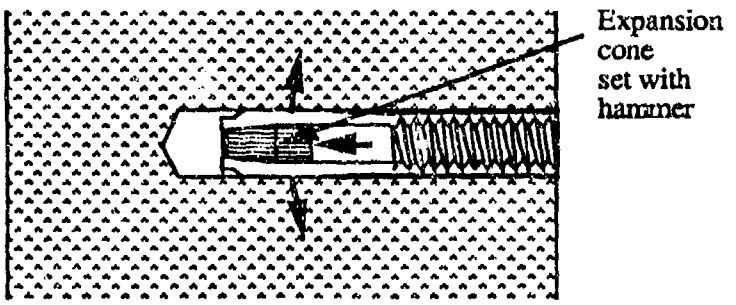
Advantages:	Load can be applied immediately
	Relatively strong
	Exact hole depth not required to set (for some anchors)
Disadvantages:	Prestresses hole
	Cannot be used close to the edge of the masonry

3.2.4 Adhesive Bonding

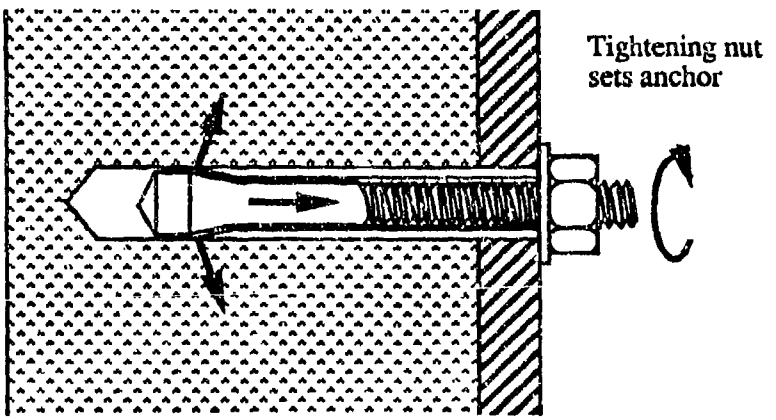
Adhesive bonded anchors are manufactured by several companies. Examples of these are the Rawl Chem-Stud, Topline AR Chemical Setter, and the U.S.E. Sup-R-Set Capsule Anchor. All of the anchors require a predrilled hole into which a thermosetting adhesive and a stud are placed. When cured, the stud, adhesive, and masonry form a strong stress-free bond. The polyester resin or epoxy acrylate adhesive and hardener are contained in a sealed capsule, which is placed in the masonry hole and mixed using the stud in a rotary



(a) Light-duty expansion anchor



(b) Medium- and heavy-duty expansion anchor



(c) Medium- and heavy-duty expansion anchor

Figure 5. Expansion Anchors

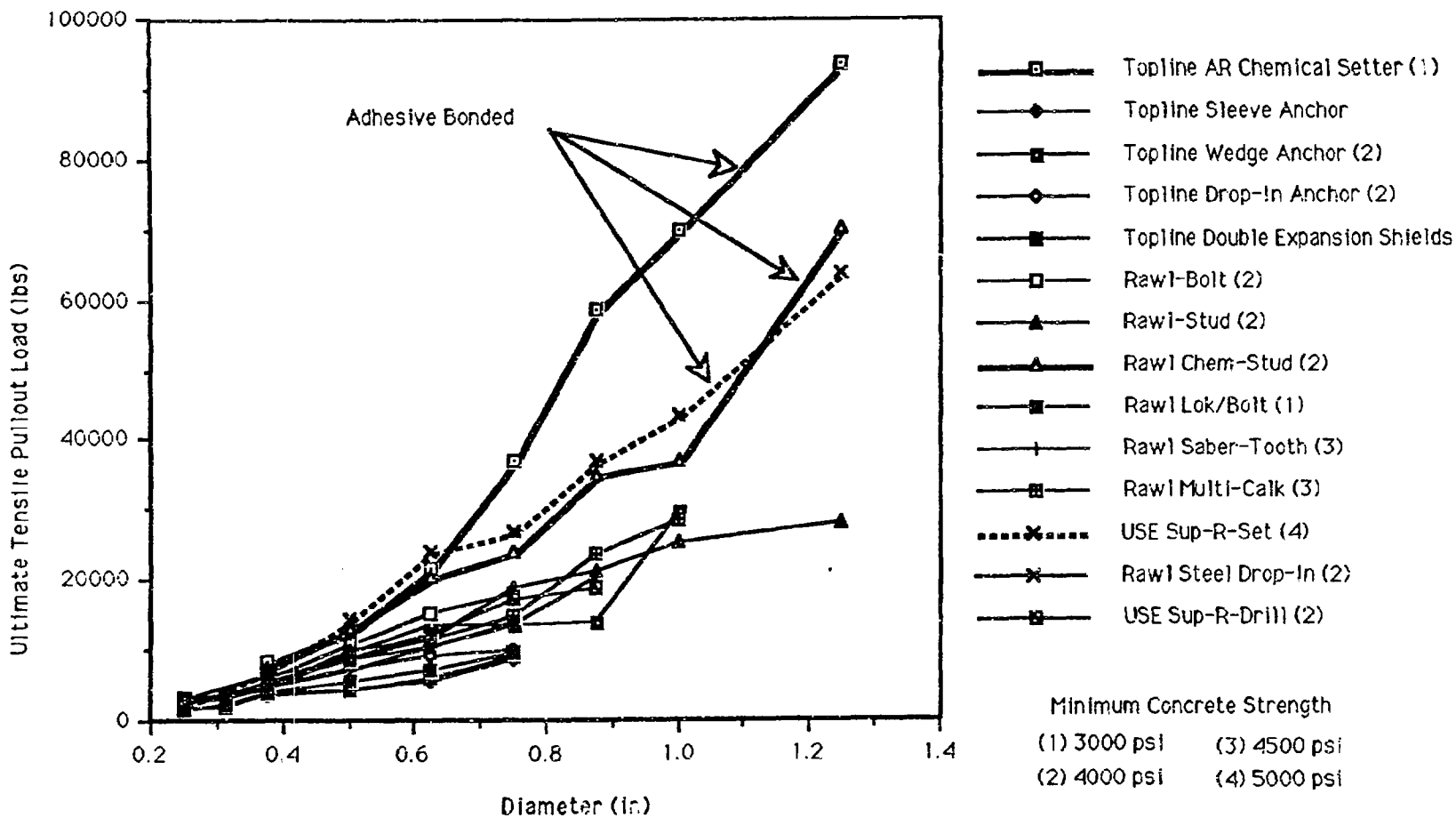


Figure 6. Pullout strength of masonry anchors.

hammer (Fig. 7). The anchor setting time is a function of the base material temperature and varies from less than 20 minutes at room temperature (68 °F.) to 5 hours at 32 °F. The ultimate pullout strength for these chemical anchors is plotted vs anchor diameter in Figure 6.

Advantages:	Self-contained unit
	Resistant to shock and vibration
	No expansion stress, can be used close to edge
	Very high load capacity
	Forms sealed weather tight anchor
	Hole fully bonded
Disadvantages:	Long curing time at low temperatures (load cannot be applied immediately)
	Relatively expensive

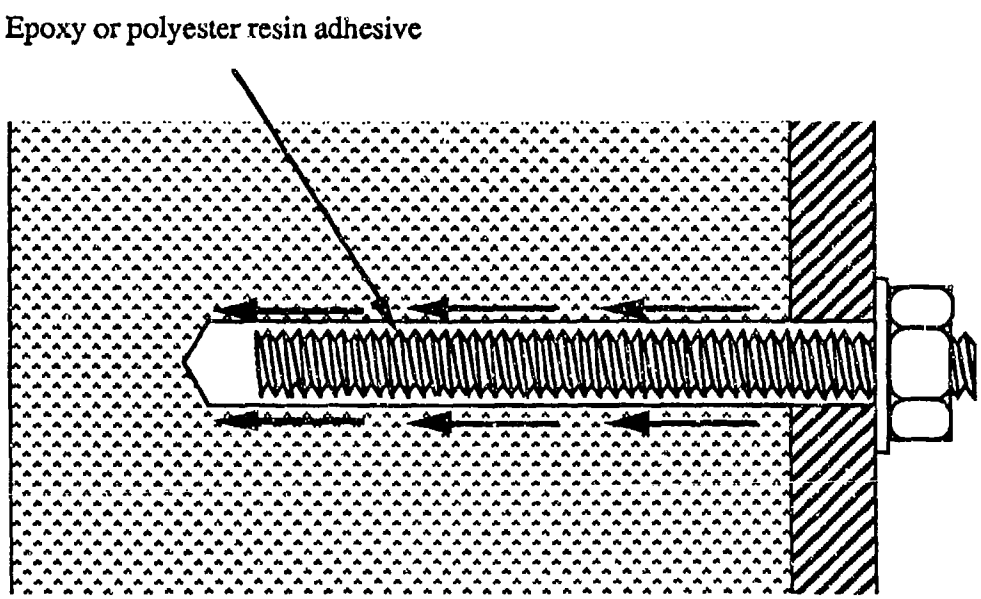


Figure 7. Adhesive bonded anchor.

3.3 DYNAMIC LOADS

Most concrete anchor manufacturers provide information on the static tensile pullout strengths of their products. Rarely is any quantitative information provided on the effectiveness of their products when loaded dynamically. Such information is sorely needed for the proper design of protective structures that must withstand severe and sometimes repeated shock loadings. Based on static pullout strength the most effective anchor is a chemically (adhesive) bonded one (Fig. 7). Under repeated shock loadings, however, the adhesive bonded anchor may not be the most effective. Tests of several of the types reported in Reference 6 indicate that for repeated shock loads in cracked concrete anchors that expand by the application of a tensile load (such as Topline Sleeve Anchors, Rawl Lok/Bolts and Rawl-Bolts) may be the most effective against such shock loads. The value of these anchor types became apparent after the anchor had already sustained slippage from an earlier shock load; subsequent loads continued to tighten the anchor and slippage was reduced. Chemical (adhesive) anchors, on the other hand, although more resistant to the initial shock, tended to pull out completely on second load if the bond had been damaged through slippage from an earlier shock.

3.4 CONCLUSIONS AND RECOMMENDATIONS

Aside from specially designed through anchors that completely penetrate the concrete wall and use a clamping action, it is clear from Figure 6 that adhesive bonded anchors are considerably more resistant to pullout loads than any of the other types of mechanical anchors considered. For all anchor diameters the adhesive bonded types are stronger by 20 to 80 percent. Unlike the mechanical devices that tend to stress the masonry over a small contact area, adhesive bonded anchors are set stress-free and have a contact area comparable to the full surface area of the anchor. Under these conditions, when loaded by either static or dynamic loads, much lower interaction stress levels are generated between the anchor and masonry; consequently, very large anchor loads can be applied before the interaction stresses reach failure intensities. There is a danger, however, in attempting to predict the effectiveness of anchors under shock loading by using only static pullout data. Once an anchor has slipped, its behavior on reload has been shown to vary considerably depending on the type of anchoring action used. After the initial slip, anchors that use a tensile wedging action may be more effective in a repeated shock environment. Dynamic

testing of anchors in such an environment is sorely needed to facilitate the reliable selection of the most effective anchor.

Literature from several anchor manufacturers is given in Appendix B.

4.0 MOMENT RESISTANT CONNECTIONS

4.1 INTRODUCTION

As part of the Air Force effort to upgrade the survivability of airbase structures, an effort was undertaken to look at the efficiency of the structural details used. Past efforts have concentrated on increasing the strength of structural elements used in airbase structures subjected to blast and groundshock loadings. Considerable success has been achieved in enhancing the resistance of these structural elements. However, since many of the newer airbase designs are modular in construction, the strength of the connections used between structural elements has achieved a new importance. These connections have become one of the areas of construction detailing that must be more fully analyzed.

4.2 BASE DAMAGE CONTROL CENTER

One of these critical connections is the corner joint between a wall and roof or wall and floor. The Base Damage Control Center (MUST V) (Ref. 7) is one of the types of air base structures that uses a specially designed connection that permits modular panel fabrication. The corner joint used in this structure (Fig. 8) is fabricated of wall and floor panels that contain reinforcing steel, plates, and studs welded together when the joint is completed. Upon completion, the welded end plates create a moment resistant connection between the panels.

The joint strength for this particular design has not been adequately determined. To address this question, a simple analysis was made to compare the moment capacity of the thinnest leg to that of the joint itself. The wall is constructed of rows of #8 rebar (A706 steel) spaced every 6 in on both faces as shown in Figure 9.

4.3 ANALYSIS

4.3.1 Moment Capacity of Wall Panel

Using the following definitions and assuming pure bending of the panel cross section

f_c = concrete stress

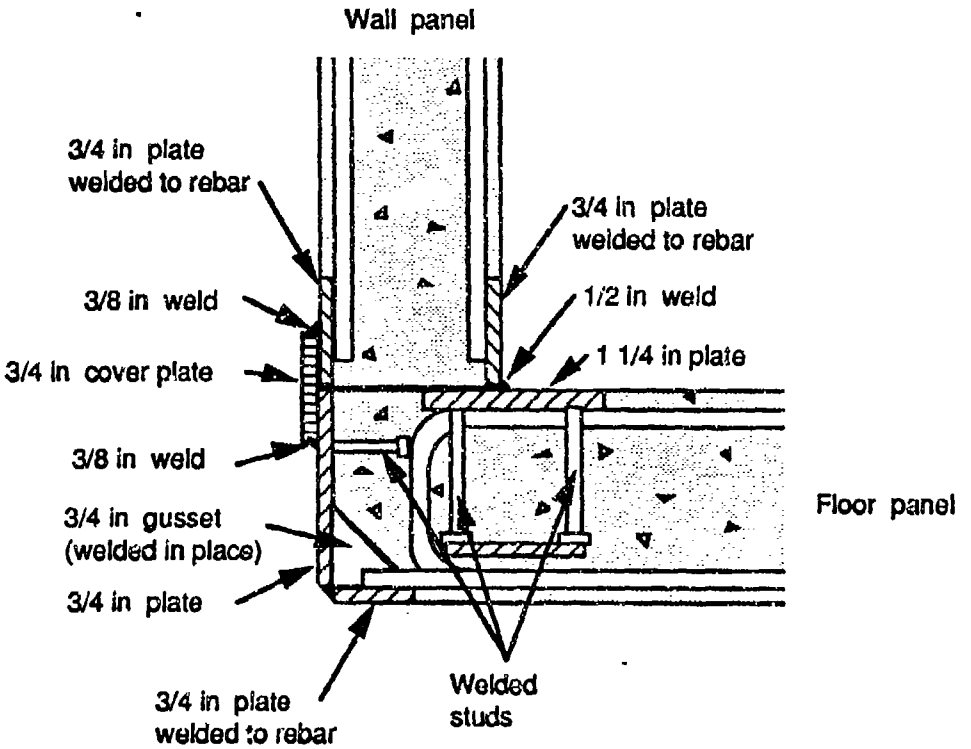


Figure 8. Typical panel-to-panel moment resistant connection.

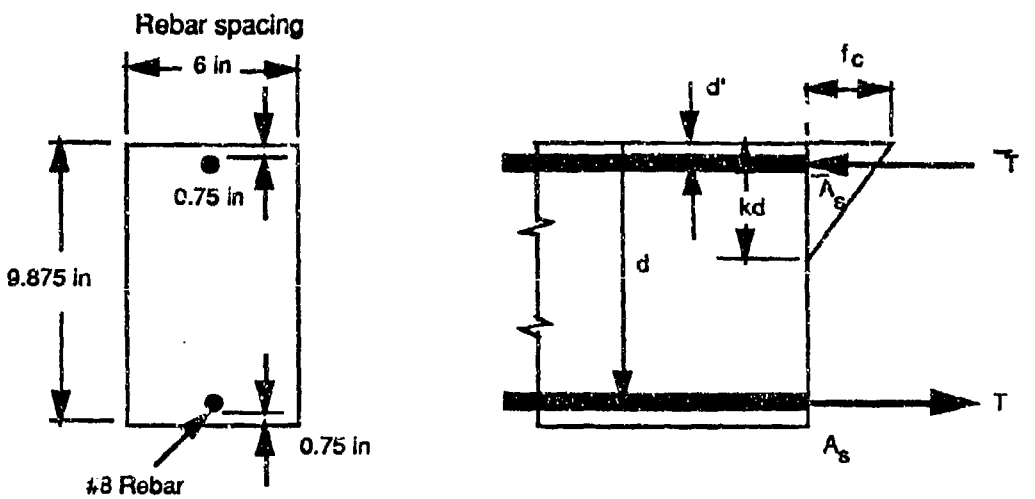


Figure 9. Rebar layout of wall panel.

$b =$ width

$\bar{A}_s =$ compression steel area

$A_s =$ tension steel area

$n =$ ratio of steel to concrete elastic moduli

$f_s =$ tensile steel stress

$\bar{f}_s =$ compressive steel stress

For horizontal equilibrium of the section

$$\frac{1}{2} f_c kdb = A_s f_s - \bar{A}_s \bar{f}_s \tag{1}$$

If plane sections are assumed to remain plane during bending then

$$\frac{f_s}{f_c} = \frac{d - kd}{kd} n \tag{2}$$

and

$$\frac{\bar{f}_s}{f_c} = 2 \frac{kd - d'}{kd} n \tag{3}$$

The factor of 2 in the preceding equation is a correction recommended by the ACI Code to account for concrete creep.

Substituting for the steel stresses in Equation 1 through the use of (2) and (3) obtains

$$\frac{1}{2} kdb = A_s \frac{d - kd}{kd} n - 2 \bar{A}_s \frac{kd - d'}{kd} n \tag{4}$$

Solving (4) for k

$$k = -3pn \pm \sqrt{9\,p^2n^2 + pn\left(2 + 4\frac{d'}{d}\right)} \tag{5}$$

where $p = \dfrac{A_s}{bd} = \dfrac{\overline{A_s}}{bd}$

For moment equilibrium of the section

$$M = \tfrac{1}{3} f_c k^2 d^2 b + \bar{A}_s \bar{f}_s (kd - d') + A_s f_s (d - kd) \tag{6}$$

or using (2) and 3)

$$M = \tfrac{1}{3} f_c (kd)^2 b + 2\overline{A_s}\frac{(kd - d')^2}{kd} n f_c + A_s \frac{(d - kd)^2}{kd} n f_c \tag{7}$$

For

$b =$ width $= 6$ in

$\bar{A}_s =$ compression steel area $= 0.785$ in^2

$A_s =$ tension steel area $= 0.785$ in^2

$n =$ ratio of steel to concrete elastic moduli $= 10$

$k = -3pn \pm \sqrt{9\,p^2n^2 + pn\left(2 + 4\frac{d'}{d}\right)}$ which for the above values is

$k = 0.3195$

For A706 steel (rebar), which has a yield strength of 60000 psi, the moment capacity of the section (Eq. 7) is 355000 in-lbs. In the foregoing elastic analysis, the moment capacity of the wall section is assumed to be reached when tensile yielding of the rebar occurs.

4.3.2 Stud Assembly Pullout

The moment capacity of the corner joint is driven primarily by the pullout strength of the stud assembly (Fig. 10). Assuming plate welds of adequate strength, pullout occurs when either the concrete shears along the shear planes as shown or the steel studs fail in tension.

One bound on the pullout load is governed by the magnitude of the shear load on the trapezoidal wedge at failure (Fig. 11). Neglecting the effect of the floor rebar, the pullout load is governed by the equation (Ref. 8):

$$P_{uc} = \phi C K A \sqrt{f'_c} \tag{8}$$

where

ϕ = shear capacity reduction factor = 0.85

f'_c = ultimate compressive strength of concrete (28 days) = 4300 psi

C = Constant for concrete type (per ACI 318-71, Section 11.3.2)
= 1.0 for normal weight concrete

K = 4.0

A = Failure area (sq in)

P_{uc} = Ultimate concrete tension capacity (lbs)

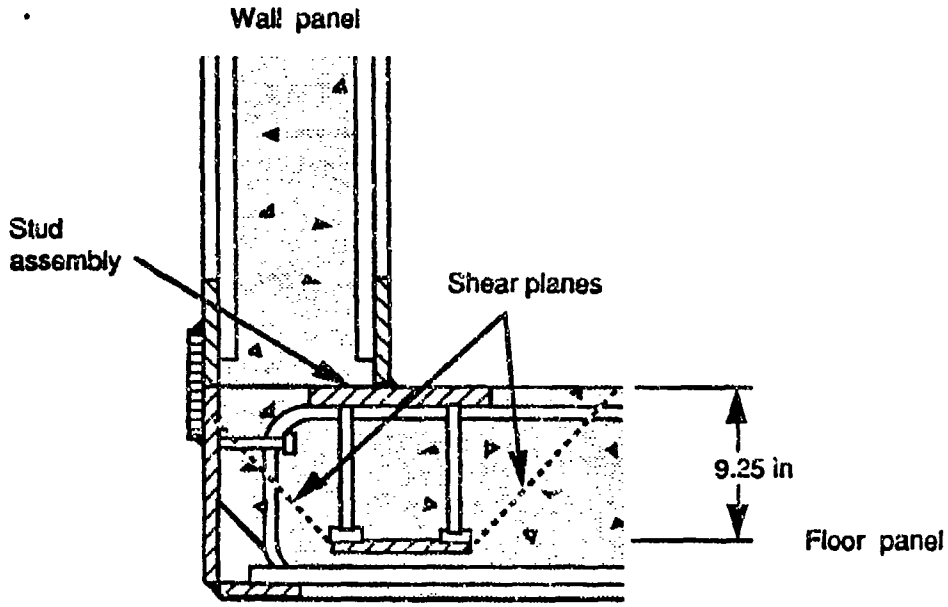


Figure 10. Shear plane of stud assembly.

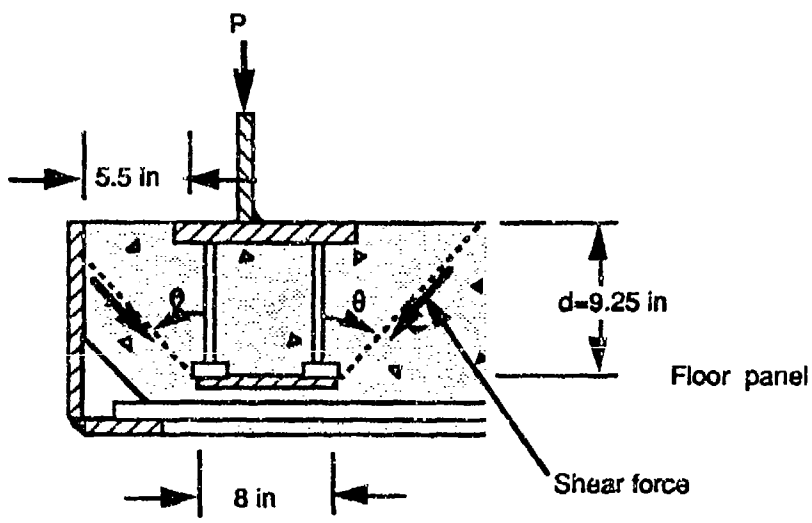


Figure 11. Loads on stud assembly.

For $\theta = 45$ degrees the area of the fractured surface (1 in depth) is

$$A = \frac{5.5}{0.707} + \frac{9.25}{0.707} + 8.0 = 28.9 \frac{in^2}{in}$$

Substituting for these quantities in Equation 8, the pullout load per unit length can be written

$$P_{uc} = (.85)(1.0)(4.0)(28.9)\sqrt{4300} = 6443 \frac{lbs}{in}$$

or for a 6-in depth (stud and rebar spacing) = 38660 lbs

The capacity of each stud (spaced every 6 in) is

$$P_{us} = 0.9 A_s f_s$$

where

A_s = area of stud = 0.6 in^2

f_s = ultimate strength of steel = 58000 psi

therefore

P_{us} = 31320 lbs/stud

Since there are two studs for every 6 in of depth the strength of the stud assembly is governed by $P = P_{uc}$ = 38660 lbs.

4.4 CONCLUSIONS AND RECOMMENDATIONS

For A706 steel (rebar), which has a yield strength of 60000 psi, the moment capacity of the wall section is 355000 in-lbs. The maximum tensile load in the steel rebar is 60000 psi x 0.785 in^2 = 47100 lbs, which gives an equivalent moment arm of 355000 in-lbs/47100 lbs = 7.5 in.

The pullout strength of the stud assembly is approximately 6443 lb/in or 38660 lb for the 6-in section. Since the stud assembly is welded to the tensile rebar (for joint opening) the moment arm of the joint is 7.5 + 0.5 + 0.375 = 8.37 in. The approximate moment capacity

of the joint is then 38660 lbs x 8.37 in = 323500 in-lbs. This value is 91 percent of the conservatively calculated moment capacity of the smallest leg.

The moment capacity of the joint is driven by the pullout load of the stud assembly. In the current design the stud assembly is simply positioned on the prefabricated floor panel rebar before the concrete is poured. Although perhaps not practical from a construction standpoint, a significant increase in joint moment capacity could be achieved by welding the lower stud assembly to the bottom rebars of the floor panel.

5.0 REFERENCES

1. Krisko, W. J., Study on Sealing and Leakage Reduction Measures for CB Protective Shelters, Department of Army, Edgewood Arsenal, 1970.

2. Protection Against Chemical and Biological Agents and Radiological Fallout, TM 5-855-2, Department of the Army, January 1961.

3. Engineering Design Handbook for Air Cleaning for Chemical Demilitarization, Military Handbook, MIL-HDBK-144, Department of Defense, December 1978.

4. Lifke, Joseph L. et al., Chemical Integrity Of The MUST-V Shelter Following Blast Testing, NMERI WA2-63 (2.11), Air Force Weapons Laboratory, KAFB, NM, June 1988.

5. Design Criteria for Semihard & Protected Facilities with Nuclear, Biological and Chemical (NBC) Protection, HQ USAFE EUROPE/DEX, June 1986.

6. Hunziker, P., Shock Tests of Concrete Anchor Bolts for Shock Resistant Applications in Protective Structures, Defence Technology Procurement Group, NC-Laboratory Spiez, Spiez, Switzerland 1984.

7. Stephens J. E., Base Damage Damage Control Center (MUST V), WA2-41, New Mexico Engineering Research Institute (NMERI), University of New Mexico, Albuquerque, NM, April 1987.

8. Embedment Properties of Headed Studs, Design Data 10, TRW Nelson Division, Lorain, OH, 1977.

APPENDIX A

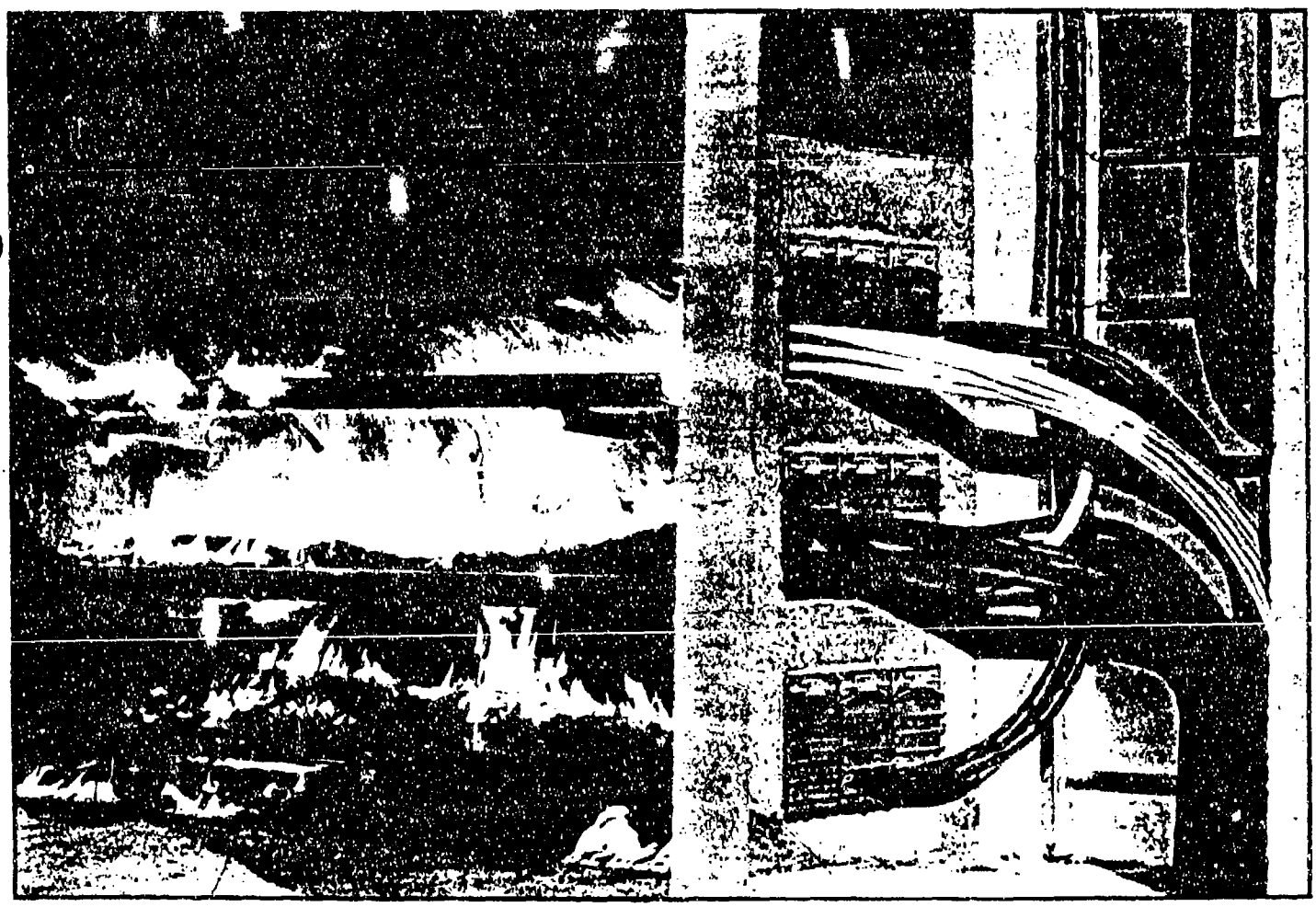
SEALANTS

The following is a selection of material available on sealants. The manufacturers represented are Nelson Electronic; Temet Oy; Temet USA, Inc.; Tremco; Dow Corning Corporation; and Hercules, Inc.

NELSON

MCT ENGINEERING MANUAL

MCT STOPS FIRE, GASES, WATER, FUMES, AND VOLTAGE

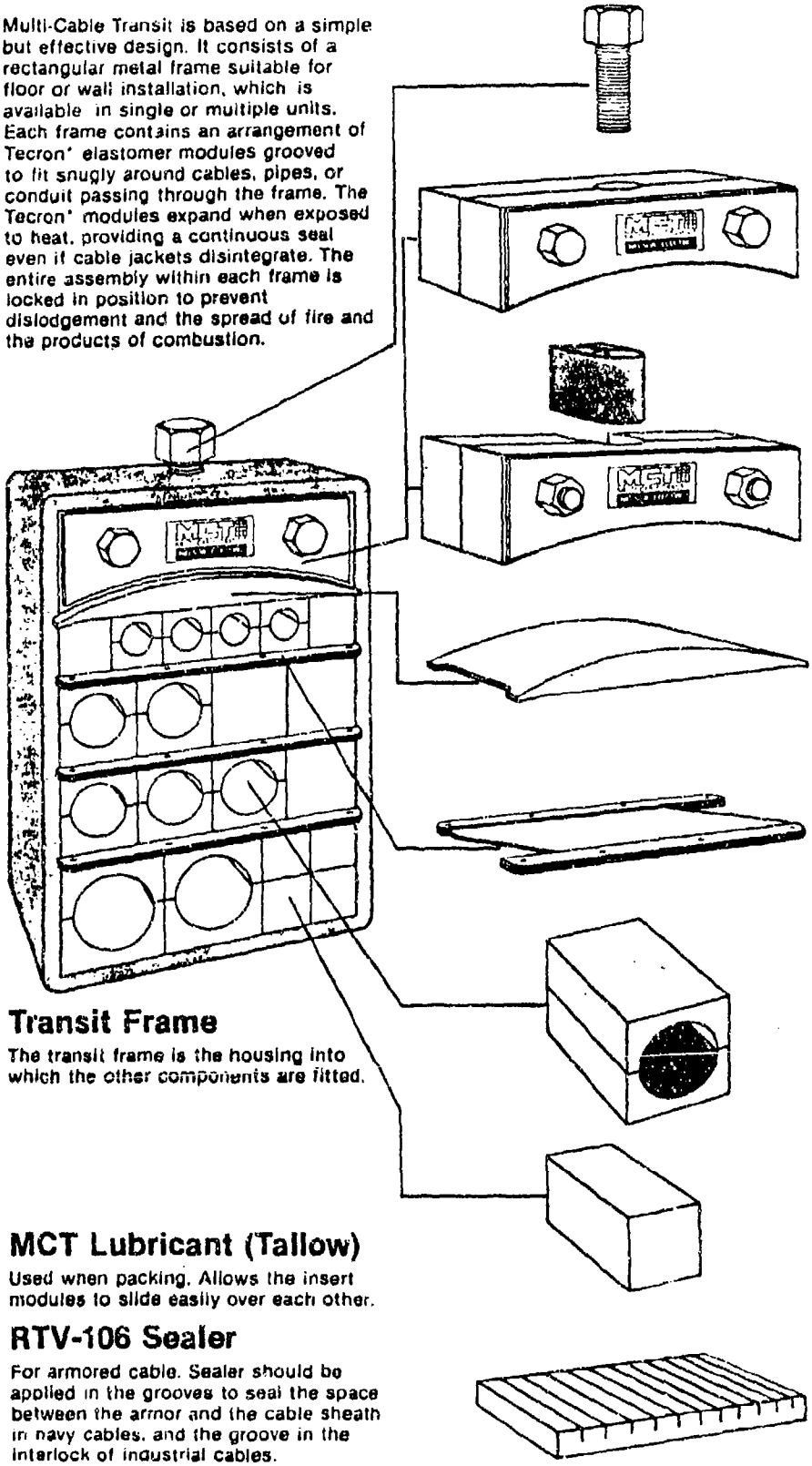


FIRE RATING 2 & 3 HRS.
Wall Opening Protective
Multiple-Cable Device
CLASSIFIED

Class 200 Fire Stop Products

Multi-Cable Transit

Multi-Cable Transit is based on a simple but effective design. It consists of a rectangular metal frame suitable for floor or wall installation, which is available in single or multiple units. Each frame contains an arrangement of Tecron* elastomer modules grooved to fit snugly around cables, pipes, or conduit passing through the frame. The Tecron* modules expand when exposed to heat, providing a continuous seal even if cable jackets disintegrate. The entire assembly within each frame is locked in position to prevent dislodgement and the spread of fire and the products of combustion.



Transit Frame

The transit frame is the housing into which the other components are fitted.

MCT Lubricant (Tallow)

Used when packing. Allows the insert modules to slide easily over each other.

RTV-106 Sealer

For armored cable. Sealer should be applied in the grooves to seal the space between the armor and the cable sheath in navy cables, and the groove in the interlock of industrial cables.

Compression Bolt

When tightened, the bolt applies pressure to the compression plate sealing the grooved insert modules around the cables.

End Packing — Standard

End packing assembly is bolted into place to provide a fire and watertight seal above the compression plate. The standard end packing assembly is used when both sides of the transit frame are accessible.

End Packing — Special

The special end packing assembly serves the same purpose as the standard and is used when the transit frame is accessible from only one side.

Compression Plate

The compression plate acts as a pressure plate above the internal assembly.

Stay Plates

Stay plates are inserted between every completed row to help distribute compression forces within the frame and to keep modules from dislodging under high pressure conditions.

Grooved Insert Modules

Grooved insert modules are available in seven module sizes to accommodate a range of cable/pipe from 5/32" to 3-3/4" O.D. They fit snugly around the cable or pipe to form an air-tight, water-tight seal when compression is applied in final assembly step.

Spare Insert Modules

Solid modules are used to fill voids or allow for future addition of cables. They are available in 3 module sizes.

Fill-In Insert Strips

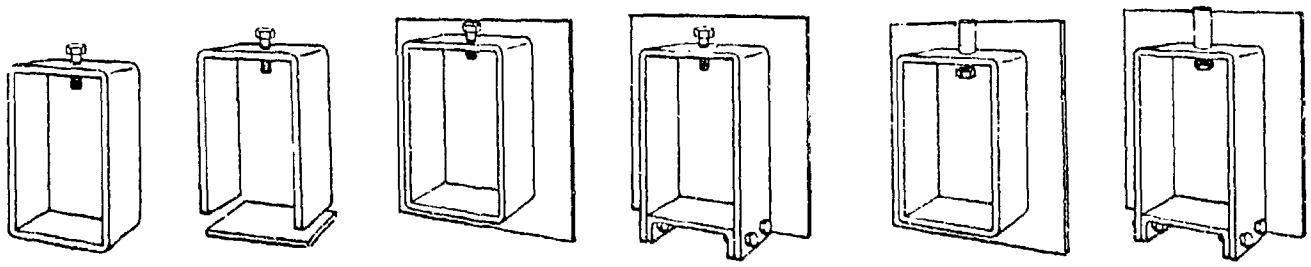
Used to fill space gaps. Available in two thicknesses: 5 and 10 mm. Strips are 120 mm long and are split to allow cutting at any desired length.

Class 200 Fire Stop Products

MCT Frames

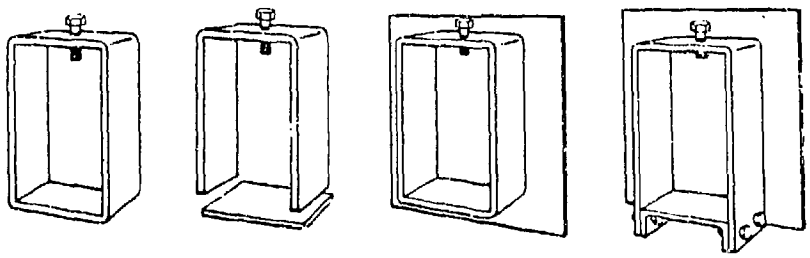
MCT Frames

Multi-Cable Transit Frames are available in four standard heights. (see sheets 5 and 6)



RGS RGS0 RGM RGM0 RGB RGB0

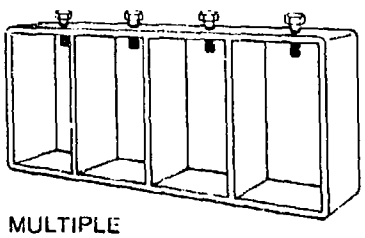
Aluminum Frames



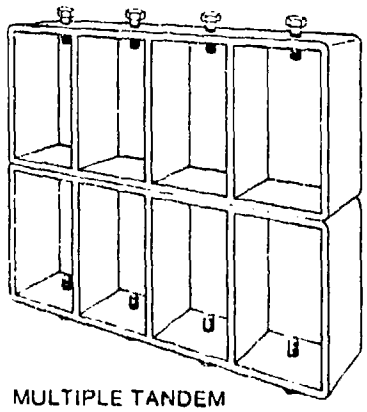
RGA RGAO RGAM RGAMO

STANDARD FINISHES
STEEL - GRAY PRIMER
ALUMINUM - NATURAL FINISH

* If Special Finishes Are Required, Consult Factory.



MULTIPLE
RGS-6X4 shown



MULTIPLE TANDEM
RGS-6X4T shown

EXAMPLE #1
Single Opening Frame

RGS-6
- Frame Type (See frame description & usage)
- Frame Size (see page 7 for explanation)

EXAMPLE #2
Multiple Openings

RGS-6 X 4
- Frame Type
- Frame Size
- Number of Frame Openings in a Row

EXAMPLE #3
Multiple Openings in Tandem

RGS-6 X 4 T
- Frame Type
- Frame Size
- Number of Frame Openings in a Row
- Tandem

FRAME DESCRIPTION AND USAGE

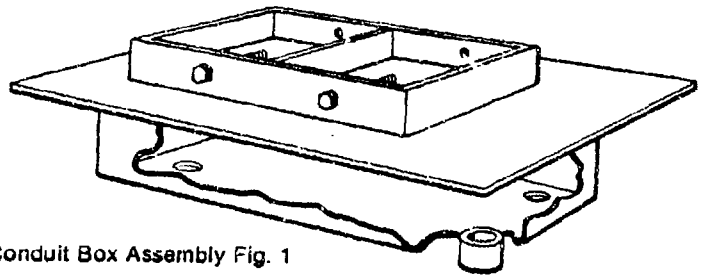
1. RGS - Steel frame for welding to steel plate.
2. RGS0 - Steel frame with knock out bottom for welding to steel plate. Use when cable is in place before frame is installed.
3. RGB - Steel frame with flange and bolt cylinder. Immerse in concrete or grout into block wall.
4. RGB0 - Steel frame with removable bottom, flange and bolt cylinder. Grout into concrete or block wall. Use when cable is in place before frame is installed.
5. RGM* - Steel frame with flange to be surface mounted. Can be welded or bolted in place.
6. RGM0* - Steel frame with flange and removable bottom, to be surface mounted. Can be welded or bolted in place. Use when cable is in place before frame is installed.
7. RGA - Aluminum frame for welding to aluminum plate.
8. RGA0 - Aluminum frame with knock out bottom for welding to alluminum plate. Use when cable is in place before frame is installed.
9. RGAM* - Aluminum frame with flange, to be surface mounted. Can be welded or bolted in place.
10. RGAM0* - Aluminum frame with flange and removable bottom, to be surface mounted. Can be welded or bolted in place. Use when cable is in place before frame is installed.

* Use Tecron Gasket in all cases where frames are to be bolted to surface

Class 200 Fire Stop Products

MCT Frames

Special Application Frames



Conduit Box Assembly Fig. 1

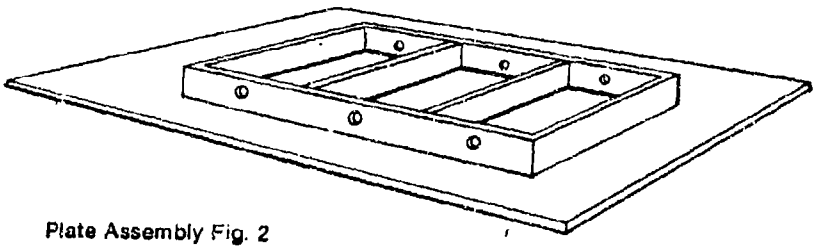
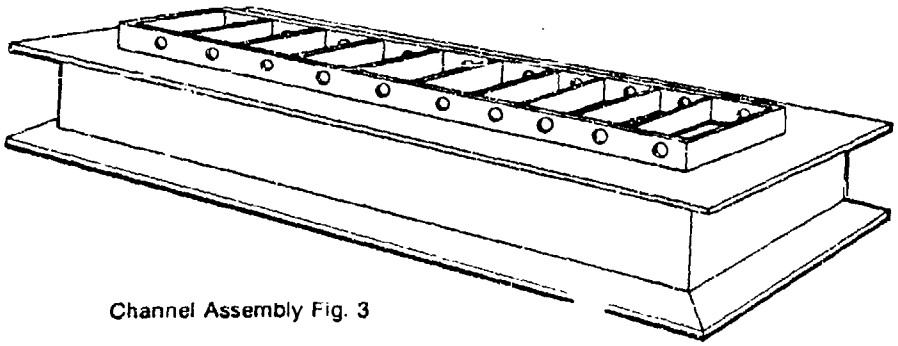


Plate Assembly Fig. 2



Channel Assembly Fig. 3

For assistance in designing and pricing special frame applications consult factory.

MCT Frame Dimensions

Class 200 Fire Stop Products

Steel Frames

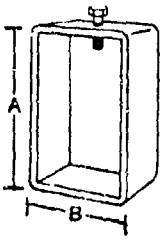


Fig. 1
RGS

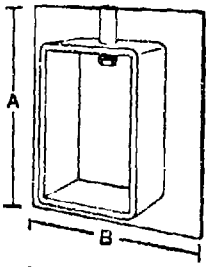


Fig. 2
RGB

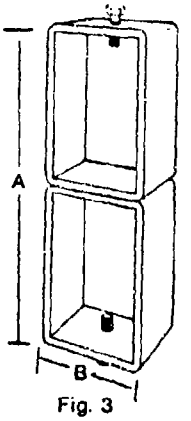


Fig. 3
RGS Tandem (T)

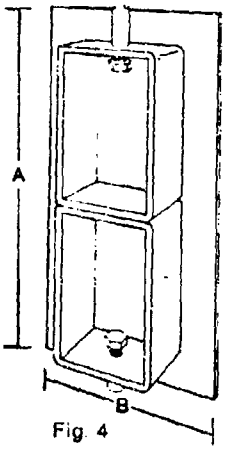


Fig. 4
RGB Tandem (T)

Catalog number		Height Dim. "A"	Width Dimension "B" Number of Frame Openings in Row 1	2	3	4	5	6	7	8	9	10	
RGS-2	(Fig. 1)	4.72	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS-4	Standard Assembly (See Note #1)	7.03	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS-6		9.34	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS-8		11.66	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS0		Same dimensions as RGS Standard Assembly											
RGB-2	(Fig. 2)	9.44	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGB-4	Standard Assembly Including Flange	11.78	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGB-6		14.09	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGB-8		16.44	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGM, RGM0, RGB0		Same dimensions as RGB Standard Assembly											
RGS-2T	(Fig. 3)	9.44	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	For Each Additional Frame Add 5 1/2"
RGS-4T	Tandem Assembly (See Note #1)	14.06	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS-6T		18.69	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS-8T		23.31	5.50	10.63	15.75	20.88	26.00	31.13	36.25	41.38	46.50	51.63	
RGS0 (Tandem)		Same dimensions as RGS Tandem Assembly											
RGB-2T	(Fig. 4)	14.16	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGB-4T	Tandem Assembly Including Flange	18.81	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGB-6T		23.44	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGB-8T		28.06	10.25	15.38	20.50	25.63	30.75	35.88	41.00	46.13	51.25	56.38	
RGM, RGM0, RGB0		(Tandem) Same dimensions as RGB Tandem Assembly											

NOTE: 1. Dimensions shown are actual frame dimensions. Allow 1/16" for cutouts to accept RGS type frames.
2. Frames are constructed of 3/8" x 2-3/8" steel.

MCT Frame Dimensions

Class 200 Fire Stop Products

Aluminum Frames

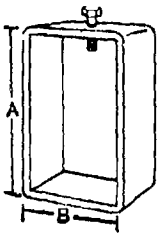


Fig. 1
RGA

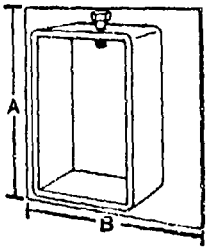


Fig. 2
RGAM

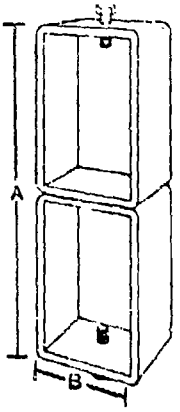


Fig. 3
RGA Tandem (T)

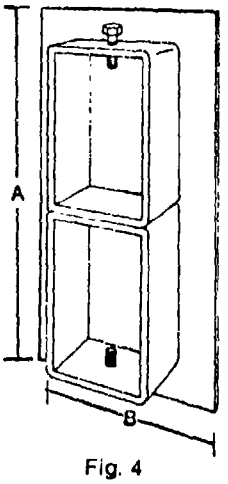


Fig. 4
RGAM Tandem (T)

Catalog number		Height Dim. "A"	Width Dimension "B" Number of Frame Openings in Row 1	2	3	4	5	6	7	8	9	10	
RGA-2	(Fig. 1)	4.97	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA-4	Standard Assembly (See Note #1)	7.28	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA-6		9.59	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA-8		11.91	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA0		Same as RGA Standard Assembly											
RGAM-2	(Fig. 2)	9.72	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM-4	Standard Assembly Including Flange	12.03	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM-6		14.34	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM-8		16.66	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	For Each Additional Frame Add 5.25"
RGAM0		Same as RGAM Standard Assembly											
RGA-2T	(Fig. 3)	9.94	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA-4T	Tandem Assembly (See Note #1)	14.56	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA-6T		19.19	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA-8T		23.81	5.75	11.00	16.25	21.50	26.75	32.00	37.25	42.50	47.75	53.00	
RGA0 (Tandem)		Same as RGA Tandem Assembly											
RGAM-2T	(Fig. 4)	14.69	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM-4T	Tandem Assembly Including Flange	19.31	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM-6T		23.94	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM-8T		28.56	10.50	15.75	21.00	26.25	31.50	36.75	42.00	47.25	52.50	57.75	
RGAM0 (Tandem)		Same as RGAM Tandem Assembly											

NOTE: 1. Dimensions shown are actual frame dimensions. Allow 1/16" for cutouts to accept RGA type frames.
2. Frames are constructed of 1/2" x 2-3/8" aluminum.

Estimating MCT Requirements

Class 200 Fire Stop Products

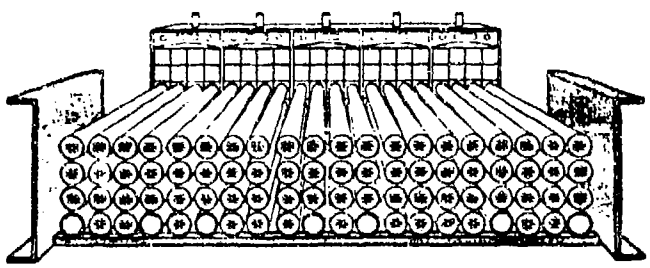
Cable Tray Method

NOTE: FOR THE MOST ACCURATE DESIGN THE GRID METHOD IS RECOMMENDED.

Smallest Frame Combination Recommended

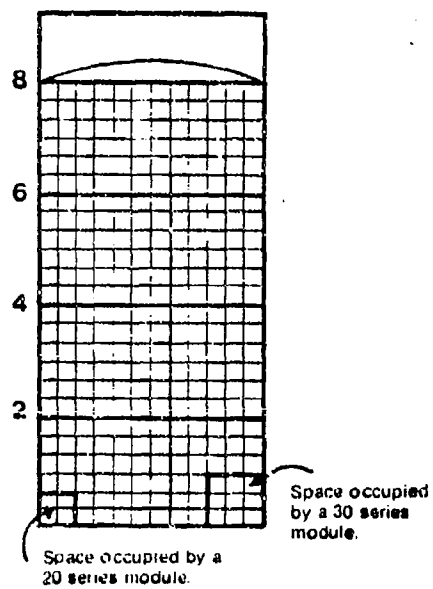
Type of Cable	Width of Cable Tray in Inches					
	6"	12"	18"	24"	30"	36"
Control Cable	RGS-6	RGS 6X2	RGS-6X4	RGS-6X5	RGS-6X6	RGS-6X7
Power Cable	RGS-4	RGS-4X2	RGS-4X4	RGS-4X5	RGS-4X6	RGS-4X7
Mixed	RGS-6	RGS-6X2	RGS-6X4	RGS-6X5	RGS-6X6	RGS-6X7

RGS type frames are shown merely as an example.
Any of the frame types can be used depending on application.
Frame sizes shown are based on 40% tray capacity.
If tray fill capacity exceeds 40%, add additional frame openings or change frame height accordingly. Calculations are based on using 6" deep trays.



Grid Method

The frame size can be easily determined by this method. Each square is 10 mm x 10 mm. One insert module 20 thus occupies 4 squares, etc. One insert module 30 occupies 9 squares. On the left hand side of the grid you will find the numbers 2, 4, 6 and 8. These numbers represent the packing areas for the various frames 2 thru 8. For example if you were filling a frame size 2 you would fill in the grid up to the heavy line marked 2. The same method applies to size 4, 6 and 8 frames. See page 8 and 9 for more explanation.



Frame Capacities

Module Series	15	20	30	40	60	90	120
Module Hole dia. in mm.	4-9	4-14	12-24	22-34	32-54	50-70	75-95
Frame Size	Number of Cables per Single Frame Opening						
2	32	18	8	3	2	0	0
4	64	36	16	9	4	1	1
6	96	54	24	12	6	2	1
8	128	72	32	18	8	2	2

The numbers given in the table are based on the same module series being used

If a mixture of module series are used, use grid method

Class 200 Fire Stop Products

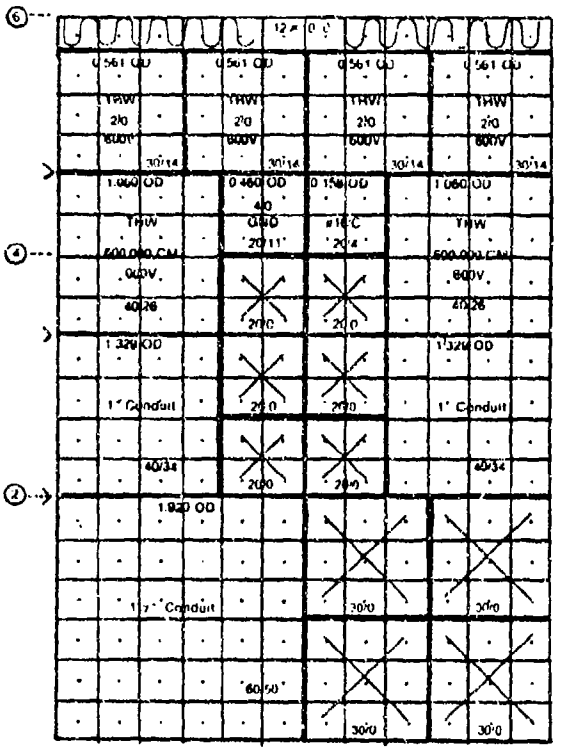
Selecting Multi-Cable Transit Components

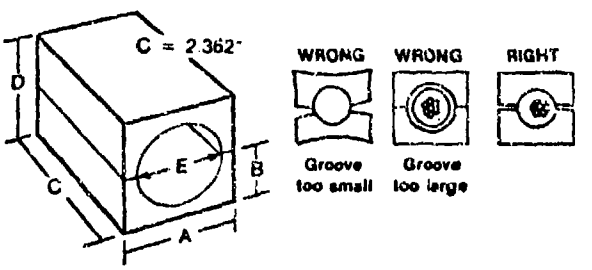
Grid Sheet Method

1. List all cables and/or conduits and their outside dimensions.
2. Select the proper size Tecron* module from the Module Selection Chart for each cable or conduit O.D. size.
   Cable: Select the module with an inside diameter one size smaller than the outside diameter of the cable (see "RIGHT" illustration).
   Conduit: Select the module with an inside diameter the same or slightly larger than the outside diameter of the pipe. (See Note 2)
3. The layout grid sheet, form #200-GS-001 shows the actual available space on the inside of a frame. The circled numbers at the left border indicate the frame sizes. Each box on the grid sheet represents a 10 millimeter square. All frame sizes are 120 millimeters wide.
4. Using the layout grid sheet, arrange each of the selected Tecron* modules on the grid by outlining its specific location. Note cable or conduit designation and module part number as shown on the sample. Indicate spare or blank Tecron* modules in the same manner marking an "X" through the square and noting module part number. Stay plates are shown as arrows between each completed row of modules.
5. Develop frame catalog number based on mounting application and number of frames required and desired arrangement.
6. Bill of material should include the required frame, and necessary Tecron* modules, and stay plates from the grid sheet. Include one end packing assembly and one compression plate for each frame opening.

NOTE:

1. Completed grid sheets are necessary for the installer to properly determine cable or conduit runs through individual frame openings.
2. For conduit applications, consult factory before conduit is installed.





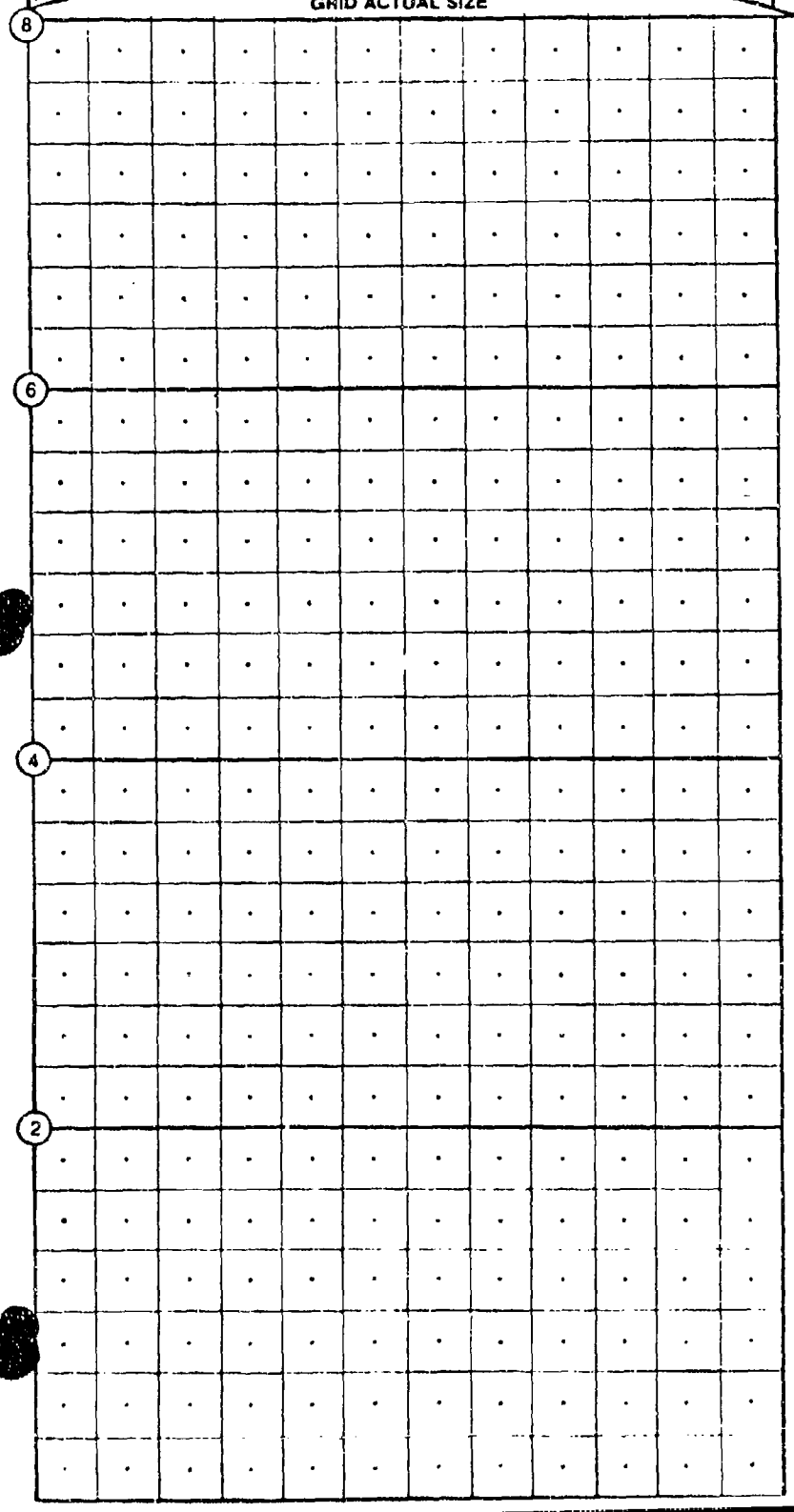
Module Selection Chart

Module 15		Module 20		Module 30		Module 40		Module 60		Module 90		Module 120		Spares	Fill-Ins
A = .591" B = .295" D = .591"		A = .787" B = .393" D = .787"		A = 1.181" B = .590" D = 1.181"		A = 1.574" B = .787" D = 1.574"		A = 2.362" B = 1.181" D = 2.362"		A = 3.543" D = 3.543"		A = 4.724" D = 4.724"		15/0 A = .591" D = .591"	24 x 5/0 A = 4.724" D = .196"
Part No. Size MM	"E" Inside Diam. Inch	Part No. Size MM	"E" Inside Diam. Inch	Part No. Size MM	"E" Inside Diam. Inch	Part No. Size MM	"E" Inside Diam. Inch	Part No. Size MM	"E" Inside Diam. Inch	Part No. Size MM	"E" Inside Diam. Inch	Part No. Size MM	"E" Inside Diam. Inch		
15/4	.157	20/4	.157	30/12	.472	40/22	.866	60/32	1.260	90/50	1.969	120/75	2.953	20/0	12 x 10/0
15/5	.197	20/5	.197	30/13	.512	40/24	.945	60/34	1.339	90/55	2.165	120/80	3.150		
15/6	.236	20/6	.236	30/14	.551	40/26	1.024	60/36	1.417	90/60	2.362	120/85	3.346	A = .787" D = .787"	A = 4.724" D = .393"
15/7	.276	20/7	.276	30/15	.591	40/28	1.102	60/38	1.496	90/65	2.559	120/90	3.543		
15/8	.315	20/8	.315	30/16	.630	40/30	1.181	60/40	1.575	90/70	2.756	120/95	3.740		
15/9	.354	20/9	.354	30/17	.669	40/32	1.260	60/42	1.654						
		20/10	.394	30/18	.709	40/34	1.339	60/44	1.732					30/0	
		20/11	.433	30/19	.748			60/46	1.811						
		20/12	.472	30/20	.787			60/48	1.890					A = 1.181" D = 1.181"	
		20/13	.512	30/21	.827			60/50	1.969						
		20/14	.551	30/22	.866			60/52	2.047						
				30/23	.906			60/54	2.126						
				30/24	.945										

FORM 200-GS-001 Multi-Cable Transit Layout Grid

MCT
MULTI-CABLE TRANSIT

GRID ACTUAL SIZE



PROJECT _____

GRID # _____

INSTALLED BY _____

INSPECTED BY _____

PART NO	QTY	PRICE	TOTAL	PART NO	QTY	PRICE	TOTAL
FRAME				30/21			
END PACKING				30/22			
COMPR PLATE				30/23			
STAY PLATES				30/24			
FILL-IN STRIPS				**SIZE 40 MODULES**			
24 x 5/0				40/22			
12 x 10/0				40/24			
BLANK MODULES				40/26			
15/0				40/28			
20/0				40/30			
30/0				40/32			
SIZE 15 MODULES				40/34			
15/4				**SIZE 60 MODULES**			
15/5				60/32			
15/6				60/34			
15/7				60/36			
15/8				60/38			
15/9				60/40			
SIZE 20 MODULES				60/42			
20/4				60/44			
20/5				60/46			
20/6				60/48			
20/7				60/50			
20/8				60/52			
20/9				60/54			
20/10				**SIZE 90 MODULES**			
20/11				90/50			
20/12				90/55			
20/13				90/60			
20/14				90/65			
SIZE 30 MODULES				90/70			
30/12				**SIZE 120 MODULES**			
30/13				120/75			
30/14				120 80			
30/15				120 85			
30 16				120/90			
30/17				120/95			
30 18				OPTIONAL BANDING			
30 19							
30 20				TOTAL LIST PRICE			

MCT Component Weights

Insert Blocks - Average Weight Per Pair

15/Series	1.0 oz.
20/Series	1.5 oz.
30/Series	2.5 oz.
40/Series	4.0 oz.
60/Series	8.5 oz.
90/Series	22.0 oz.
120/Series	40.0 oz.

Accessories

Compression plate - steel	21.0 oz.
Compression plate - alum.	9.0 oz.
Stay plate - steel	5.5 oz.
Stay plate - alum.	2.50 oz.
End packing - standard	27.0 oz.
End packing - special	26.0 oz.

Average Weight Each

Spare Inserts		Fill-in Inserts	
15/0	1.5 oz.	24 x 5/0	2.5 oz.
20/0	2.0 oz.	12 x 10/0	3.5 oz.
30/0	3.5 oz.		

Steel Frames

RGS-2 - 4.5 lbs. for single opening. Add 4 lbs. for each additional opening.
RGS-4 - 6 lbs. for single opening. Add 5 lbs. for each additional opening.
RGS-6 - 7.5 lbs. for single opening. Add 5.5 lbs. for each additional opening.
RGS-8 - 9 lbs. for single opening. Add 6 lbs. for each additional opening.

RGB-2 - 13 lbs. for single opening. Add 5.5 lbs. for each additional opening.
RGB-4 - 15.5 lbs. for single opening. Add 7.25 lbs. for each additional opening.
RGB-6 - 18.0 lbs. for single opening. Add 8.0 lbs. for each additional opening.
RGB-8 - 20.5 lbs. for single opening. Add 9.75 lbs. for each additional opening.

RGB0-2 - 14.75 lbs. for single opening. Add 6.75 lbs. for each additional opening.
RGB0-4 - 17.25 lbs. for single opening. Add 8.5 lbs. for each additional opening.
RGB0-6 - 19.75 lbs. for single opening. Add 9.25 lbs. for each additional opening.
RGB0-8 - 22.25 lbs. for single opening. Add 11.0 lbs. for each additional opening.

RGA-2 - 2.0 lbs. for single opening. Add 2 lbs. for each additional opening.
RGA-4 - 2.5 lbs. for single opening. Add 2.5 lbs. for each additional opening.
RGA-6 - 3.0 lbs. for single opening. Add 3 lbs. for each additional opening.
RGA-8 - 3.5 lbs. for single opening. Add 3.5 lbs. for each additional opening.

NOTE:
1. For RGM frames use RGB weights
2. For RGM0 frames use RGB0 weights
3. For RGS0 frames use RGS weights
4. For RGA0 frames use RGA weights

List of Tests Successfully Performed On MCT

Class 200 Fire Stop Products

(All tests were performed using steel frames. Aluminum frames used for other environmental conditions, such as a moisture barrier.)

By Nelson Electric

1. Capacitance comparison test on various types of coaxial cables
2. Watertight integrity test on Multi-Cable transit utilizing Nelson "Cast Enclosure"
3. Cable temperature rise in MCT (derating not required)
4. Preliminary cable holding tests on MCT for THW, 600V and 5000V cable (see "Cable Support")
5. Class I Group D, explosion test
6. Helium leak test of Multi-Cable Transit
7. Four hour fire test for a utility.
8. Four hour fire test bus duct
9. Three hour fire and hose test
10. MCT eddy current test
11. Class I, Group B explosion test for hazardous environment
12. Fire test with aluminum conduit
13. 25# and 50# air pressure test of MCT Uni-mount
14. Sound attenuation analysis of MCT, 125-4000 HZ
15. Two hour PVC pipe test

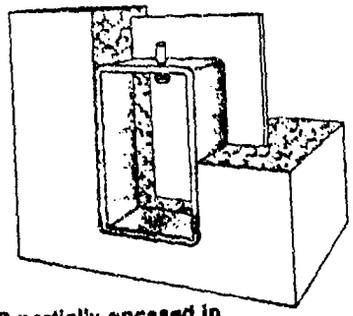
By Independent Laboratories

1. Lockheed Electronics 1578C-4454 one hour fire test (U.S. Navy and U.S. Coast Guard) for bulkheads. ASTM-E119 and Solas (Safety of Life at Sea) are basic testing documents.
2. Metallurgical Processing Laboratory - one hour fire test for ships deck. Same activities and regulations as above.
3. Lockheed Electronics 1578B-4454 MIL-S-901C shock test.
4. Lockheed Electronics 1578A-4454 MIL-STD-167 vibration test.
5. Westinghouse Canada CWAPD-15 $2x10^8$ effects of gamma radiation on MCT components.
6. Underwriters Laboratory R7269-2 two hour fire test "Wall Opening Protective Multiple-Cable Device For Use In Masonry Walls". This was a fire and hose stream test.
7. National Research Council of Canada two hour fire test on cable and conduit with **Positive Pressure.**
8. HCL (Hydrogen Chloride) emission test on modules by Bridgeport Testing Laboratory. Compares our emission to that of various cable jackets. (HCL emission from Tecron® is infinitesimal)
9. Underwriters Laboratory three hour fire and hose stream test on block and brick masonry walls.
10. Underwriters Laboratory three hour fire test on concrete floor slab.

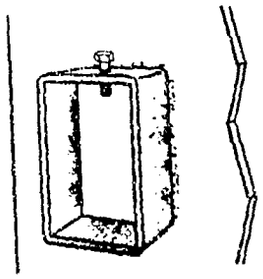
Class 200 Fire Stop Products

Installing Multi-Cable Transit

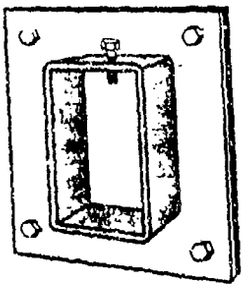
Typical Frame Installation Methods



RGB partially encased in concrete for flush mounting



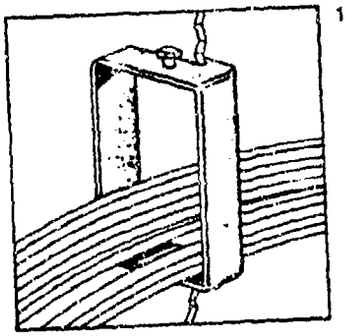
RGS welded on steel plate wall



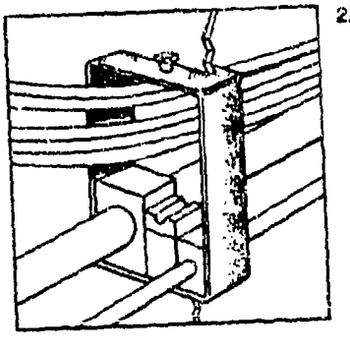
RGM surface mounted with bolts and Tecron® gasket

(UL) classified 3 hour wall and floor fire rating

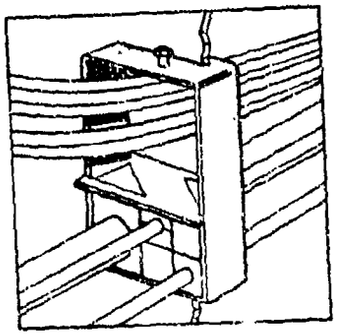
Installation of Multi-Cable Transit is quick, easy, and economical. The basic steps are described below:



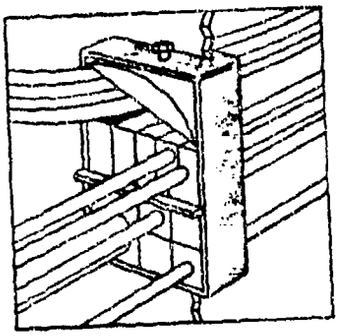
1. Empty frames are cast into or surface mounted to walls or floors by conventional construction methods. Cables, conduit, or pipe are run according to standard design criteria.



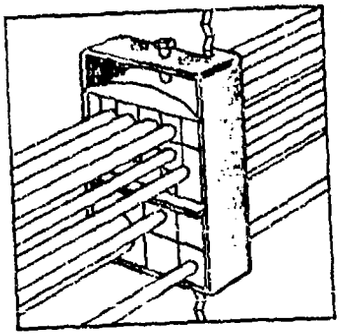
2. Preformed Tecron® elastomer modules are inserted around each cable, conduit, or pipe.



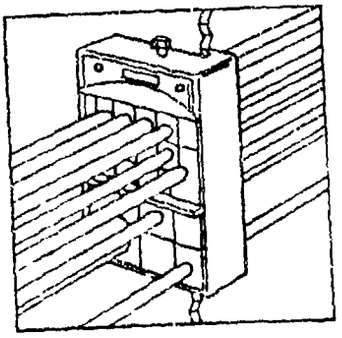
3. Stay plates are placed between rows of Tecron® modules.



4. Compression plate is inserted and pressed against top end of frame before packing last row of Tecron® modules.



5. When the last row has been packed the compression bolt is tightened until there is space enough to put in the end packing.



6. Insertion and tightening of end packing completes the job.

Printed in U.S.A.

A UNIT OF GENERAL SIGNAL
NELSON

HOLD YOUR FIRE
...SMOKE AND TOXIC GASES

Nelson Introduces Flameseal II—The Best Fire-Stop for Wall and Floor Penetrations Is Now Even Better.

NELSON
FLAMESEAL II™

READY TO USE FIRE-STOP PUTTY

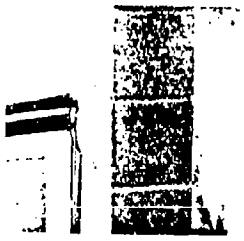
* UL — Fill, void or cavity materials classified by Underwriters Laboratories, Inc * for use in through-penetration firestop system nos. 83, 84, 85, 86, 87, 88, 89 and 107
35L4
See UL Classified Building Materials Directory

Hundreds of satisfied customers recognize Nelson's FLAMESEAL putty as the easiest to use and most cost effective fire-stop product available. Nelson is proud to announce that now the best is even better — Nelson FLAMESEAL II. Consider these features:

- The only fully inspectable non-mechanical fire-stop.
- An oxygen index of 53%.
- Halogen free
- Paintable
- Air and smoke tight
- Weather resistant
- Suitable for most industrial environments

Nelson FLAMESEAL II retains all of the features that made the original FLAMESEAL an industry leader.

- U.L. Classified* for 3-hour fire rating and 3-hour cold side temperature rating.
- Quickest and easiest installation without special tools.
- Lowest installed cost
- Easiest method for retrofitting.



- No mix. No mess. No waste.
- Longest shelf life of any fire-stop compound.
- No curing time—no drying time.
- Immediately and completely inspectable.
- Quick one-side application.
- Reusable.
- No toxic fumes.
- Not harmful to eyes or skin
- Asbestos free.

Outside Oklahoma call the FLAMESEAL Hotline

1-300-331-SEAL

NELSON

P.O. Box 726 • Tulsa, Oklahoma 74101
(918)627-5530 • telex 216459

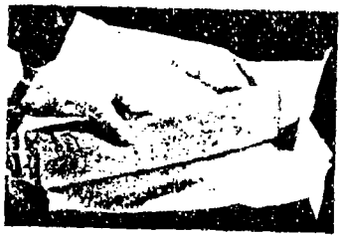
NELSON

FLAMESEAL II™

READY TO USE FIRE-STOP PUTTY

Nelson FLAMESEAL II is a premixed putty that completely seals openings in fire-rated walls, ceilings and floors. When exposed to fire, Nelson FLAMESEAL II swells to fill voids created by the burning away of cable jackets, preventing the passage of fire, smoke, water and toxic gases. U.L. Classified, Nelson FLAMESEAL II meets requirements of Section 300-21 of the National Electrical Code. No other product combines this package of fire-stop protection with such simplicity of use and economy of installation.

1. Inspect and clean opening. Unwrap bar and pull off appropriate amount.
2. Press Nelson FLAMESEAL II into opening, beginning at the bottom of the hole. Pack a layer to a minimum thickness of 3/4 inch.
3. Pack inexpensive loose ceramic fiber to 3/4 inch from top of opening.
4. Fill remainder of opening with Nelson FLAMESEAL II. Rewrap unused portion for future use.



Nelson FLAMESEAL II fire-stop putty is conveniently packed in 1" x 3" x 12" bars — 10 to a case.

For further information call the FLAMESEAL toll-free Hot Line:

1-800-331-SEAL 7325

In Oklahoma call (918) 627-5530 or Telex 216459

2# bars
$14.50 lb
$290.00

Cera
Blanket
roll
$38.50
½" x 3" x 25
Cathy

Lipland Corp.
265-8472

Smalley & Co.
345-8804

Nelson

Nelson Electric • P.O. Box 726 • Tulsa, Oklahoma 74101 • (918)627-5530 • Telex 216459

NELSON
FLAMESEAL II™

READY TO USE FIRE-STOP PUTTY

Technical Data

No other manufacturer can offer all of the benefits you get from Nelson's new fire-stop putty.

- Exceeds U.L. Classified* standards for 3-hour fire rating and 3-hour cold side temperature rating.
- Quickest and easiest installation—no special tools.
- Lowest installed cost.
- No mix, no waste, no mess.
- Longest shelf life of any fire-stop compound.
- No curing time—no drying time.
- Immediately inspectable.
- Easiest method for all retrofit.
- Quick one-side application.
- Reusable.
- No toxic fumes.
- Not harmful to eyes or skin.
- Asbestos free.
- Immediate fire-stop.
- No cable derating required.
- The only fully inspectable non-mechanical fire-stop.
- An oxygen index of 53%.
- Halogen free.
- Paintable.
- Air and smoke tight.
- Weather resistant.
- Suitable for most industrial environments .

1.0 PRODUCT DESCRIPTION

Nelson Flameseal II is a U.L. classified fire-stop product in putty form. Completely pre-mixed and ready to use, it can be hand pressed into place forming an immediate fire-seal. When exposed to fire the intumescent material will swell to seal off voids caused by deteriorating cable jackets, maintaining the seal and preventing the passage of fire or smoke to adjacent rooms.

Nelson Flameseal II has been tested and classified* by Underwriters Laboratories for a minimum three hour fire rating (F-Rating) and three hour cold side temperature rise (T-Rating).

*

Fill, void or cavity materials classified by Underwriters Laboratories Inc.® for use in through-penetration firestop system nos. 83, 84, 85, 86, 87, 88, 89 and 107.

35L4

See UL Building Materials Directory

1.1 MATERIALS

Materials to be used in the Flameseal are as follows:

1.1.1 Flameseal II Putty as manufactured by Nelson Electric of Tulsa, Oklahoma. It shall be soft and easily formed by hand.

1.1.2 Ceramic Fiber Insulation shall be a fiber material capable of exposure to temperatures in excess of 2000° F. It shall be flexible and easily worked.

1.1.3 Ceramic Fiber Board will be required to provide rigid support on large oversized openings. The board shall be rigid and able to withstand temperatures in excess of 2000°F.

1.1.4 Accessory Hardware will be required on oversized or blank openings. Anchor bolts shall be used to hold ceramic fiber board in place or support wire should be used to provide rigid backing.

1.2 TECHNICAL DATA

1.2.1 Flameseal II Putty
Color ..... Tan
Density ..... .049 lbs./in³
Consistency ..... 7.00 mm (Penetrometer)
Activation Temperature ..... 500°F.
Unit Size ..... 1"x3"x12"bar
Dielectric Strength/ Thickness .. 356 volts/mil
Thermal Conductivity ..... 0.4K cal/M.hr°C at 25°C
Volume Increase in Fire ..... 180% minimum

1.2.2 Ceramic Wool
Temperature Rated ..... 2300° F
Color ..... White
Density (as shipped) ..... 7 lbs./ft³ nominal
Density (as installed) ..... 12 lbs./ft³ nominal

1.2.3 Ceramic Fiber Board
Temperature Rated ..... 2000° F
Color ..... Off White

1.2.4 Accessories
Anchor Bolts—Plated steel, ¼-20 with expanding steel anchor.

Support Wire—Plated 12 gauge steel wire.

2.0 APPLICATIONS

Nelson Flameseal II is used to restore the integrity of fire rated walls and floors. The systems are used in conjunction with penetrating items such as electrical cables, cable trays, conduit and pipes (it may also be used to seal blank holes).

3.0 LIMITATIONS

Nelson Flameseal II has been tested to and is in compliance with UL 1479. No other representation or claims are made with regard to product use.

Although Nelson Flameseal II is compatible with most acid and chemical spills we do not recommend heavy exposure or direct contact with strong chemicals. If verification is required contact the factory.

4.0 STORAGE

All materials should be stored indoors. No special precautions are required. There is no limitation on shelf life. Partially used bars should be rewrapped in their packing before being stored.

5.0 INSTALLATION REQUIREMENTS

No special skills, tools, or precautions are necessary for the installation of the Nelson Flameseal II system.

All penetrating items shall be firmly anchored or secured prior to the installation of the fire seal system.

The opening should be clear and clean of all loose foreign materials.

6.0 INSTALLATION, GENERAL

Inspect and clean opening. Unwrap bar and pull off appropriate amount.

Press Nelson Flameseal II into opening, beginning at the bottom of the hole. Pack a layer to a minimum thickness of ¾ inch.

Pack inexpensive loose ceramic fiber to ¾ inch from top of opening.

Fill remainder of opening with Nelson Flameseal II. Rewrap unused portion for future use.

For more detailed information see Installation Instruction Sheet.

7.0 MAINTENANCE & RETROFIT

Nelson Flameseal II can be removed and reworked at any time.

When changing out cables, be sure to re-install both wool packing and putty in the same manner as the original installation. New putty may be mixed in with older installations as needed. Any unused putty should be rewrapped and stored in its original wrapper.

8.0 GUARANTEES

Nelson Electric warrants that each quantity of Flameseal II Putty shall meet the product specifications designated in this literature.

Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. No other warranty is expressed or implied.

Neither seller nor manufacturer shall be liable for replacement labor, any injury, loss or damage, direct or consequential arising from the use of or inability to use the product.

Only applications covered by published test data are recommended. User assumes all risks and liabilities when determining suitability for an application.

9.0 AVAILABILITY

The Nelson Flameseal II System—putty, wool and accessories are available through authorized distributors. Contact factory for address of your closest outlet.

10.0 ARCHITECTURAL DETAILS

The following assemblies have been tested in a 4½" thick lightweight concrete wall/floor (See U.L. Building Materials Directory for individual F and T ratings). As the thickness of the wall/floor increases, fire (F) and temperature (T) ratings will improve.

Electrical cables 300 MCM and smaller have been tested and are approved with PVC and/or XLPE jackets. The cables may be installed with or without steel cable tray. Metal pipe and conduit have also been tested and approved.

The information and data contained herein are based on information we believe reliable. You should thoroughly test any application, and independently conclude satisfactory performance before commercialization. Suggestions of uses should not be taken as inducements to infringe any particular patent.

Flameseal II is a registered trademark of Nelson Electric. All rights reserved.

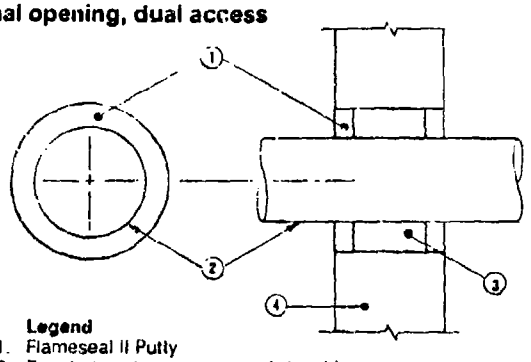
SUGGESTED SPECIFICATIONS

A fire-stop system shall be used to seal all penetrations of electrical cables, pipes and conduit through fire-rated walls and floors per U.L. 1479, NEC 300-21 and NEC 800-3(c).

The fire-stop system should consist of a heat activated putty and a high temperature fiber insulation. It shall provide an immediate fire seal, requiring no curing time, emit no hazardous or toxic fumes, and be inspectable.

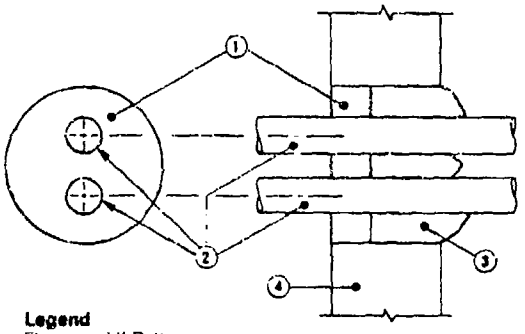
FLAMESEAL II INSTALLATION DETAIL FOR PIPE, CONDUIT OR CABLE

Normal opening, dual access



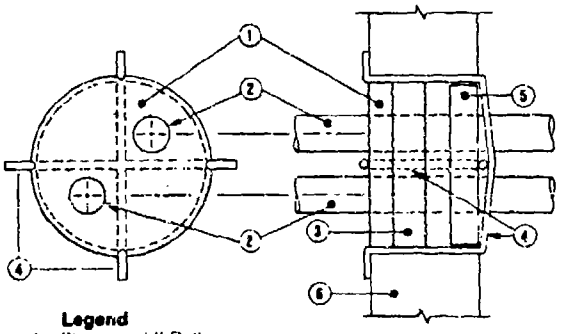
Legend
1. Flameseal II Putty
2. Penetrating item—pipe, conduit, cable
3. Stuffed ceramic fiber insulation
4. Wall or floor

Normal opening, single side access



Legend
1. Flameseal II Putty
2. Penetrating item—pipe, conduit, cable
3. Stuffed ceramic fiber insulation
4. Wall or floor

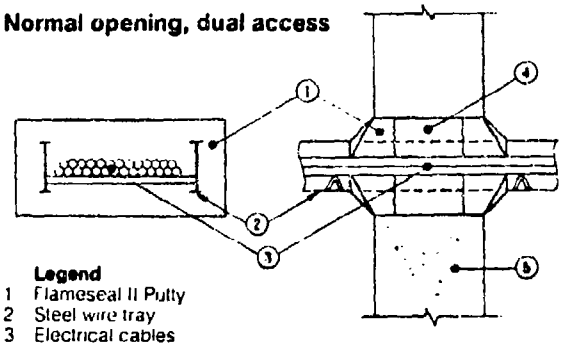
Oversized opening, single side access



Legend
1. Flameseal II Putty
2. Penetrating item—pipe, conduit, cable
3. Stuffed ceramic fiber insulation
4. Support wires
5. Rigid fiber board
6. Wall or floor

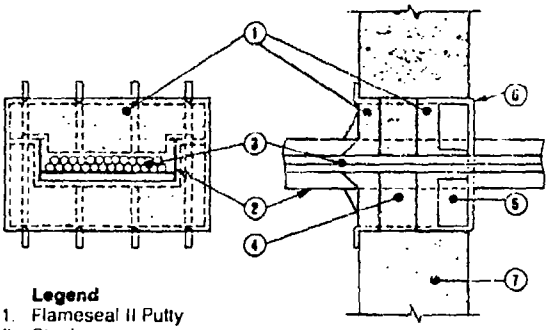
FLAMESEAL II INSTALLATION DETAIL FOR WIRE TRAY

Normal opening, dual access



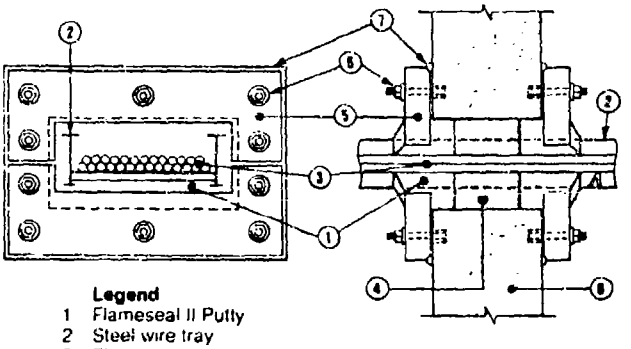
Legend
1. Flameseal II Putty
2. Steel wire tray
3. Electrical cables
4. Stuffed ceramic fiber insulation
5. Wall or floor

Oversized opening, single side access



Legend
1. Flameseal II Putty
2. Steel wire tray
3. Electrical cables
4. Stuffed ceramic fiber insulation
5. Rigid fiber board
6. Support wires
7. Wall or floor

Oversized opening, dual access



Legend
1. Flameseal II Putty
2. Steel wire tray
3. Electrical cables
4. Stuffed ceramic fiber insulation
5. Rigid fiber board
6. Steel anchor bolts
7. ¼ inch bead seal of Flameseal II Putty
8. Wall or floor

A UNIT OF GENERAL SIGNAL

NELSON

NELSON ELECTRIC, A UNIT OF GENERAL SIGNAL

P.O. BOX 726 • TULSA, OKLAHOMA 74101 • TOLL FREE 1-800-331-SEAL • (918) 627-5530 • TELEX 216459

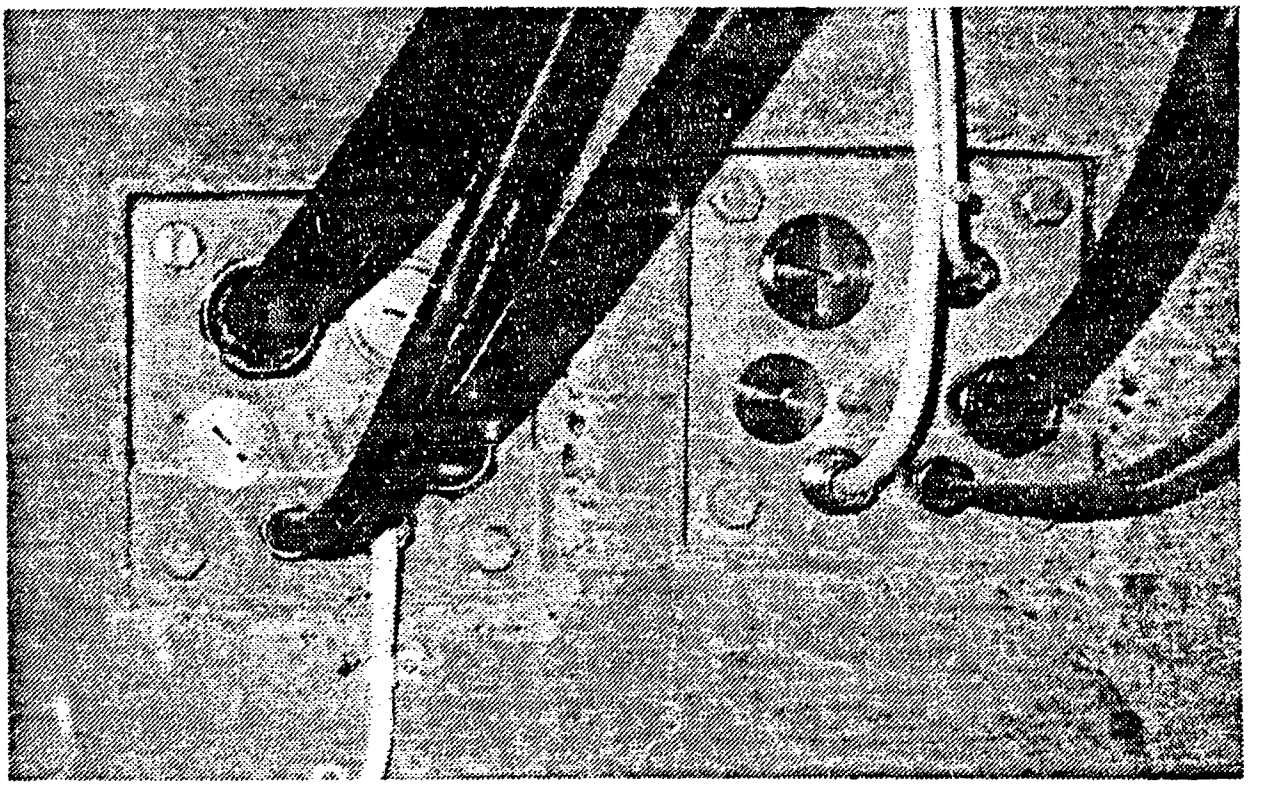
Blast resistant and gastight
wall sleeve system for electric cables

Type SJ-150

S 1 3 6

1.2.-84

Temet®



SJ-150 system is designed to enable conduction of electric cables through blast resistant or gastight walls.

The system is applicable for cable diameters of 8...54 mm. Due to the modular structure of the system the cable sizes can be changed even after concreting work is finished.

The structure is also suitable for modern concrete formwork technology.

ATCH 7

TECHNICAL SPECIFICATIONS

1. Blast Durability

   The wall sleeves shall withstand long duration blast waves with reflected peak overpressure up to 18 bar. Additionally the wall sleeves shall withstand a static overpressure of 18 bar positive and 0,2 bar negative acting from the outside.

2. Tightness

   The wall sleeves shall be absolutely gastight.

3. Mechanical Shock Durability

   The wall sleeves shall withstand a mechanical shock of the installation wall where the sudden change in velocity is 1,1 m/s in horizontal and 1,5 m/s in vertical direction.

4. Temperature Durability

   The wall sleeves shall remain fully operable within the ambient temperature range of —20...+80°C.

5. Surface Treatment

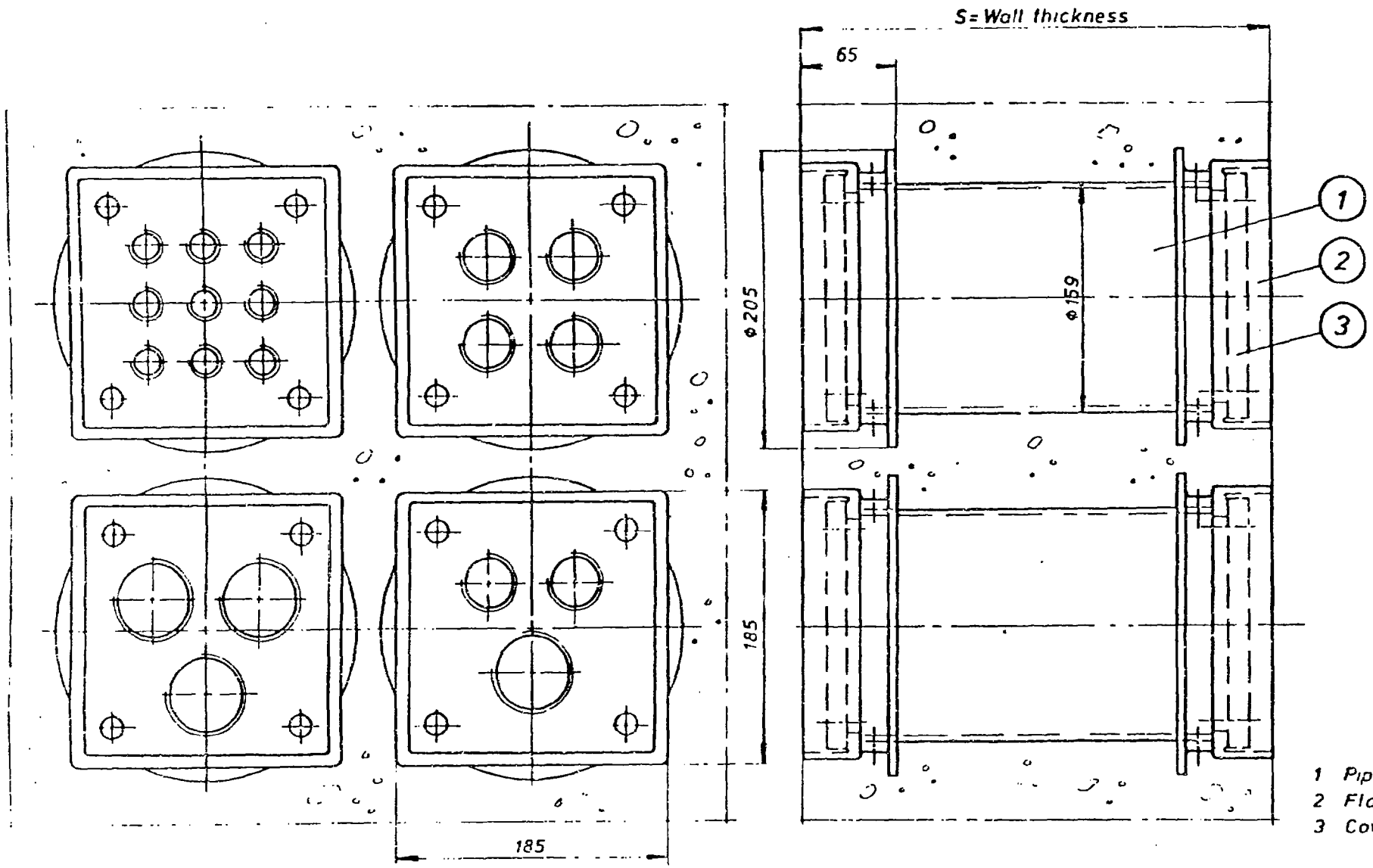
   Standard surface treatment of the sleeve main components shall be hot galvanizing.

6. Quality Control

   Due to the nature of the product the wall sleeve manufacturer shall have a functional quality control system supervised and approved by an acknowledged inspection institution.

DESIGN INFORMATION

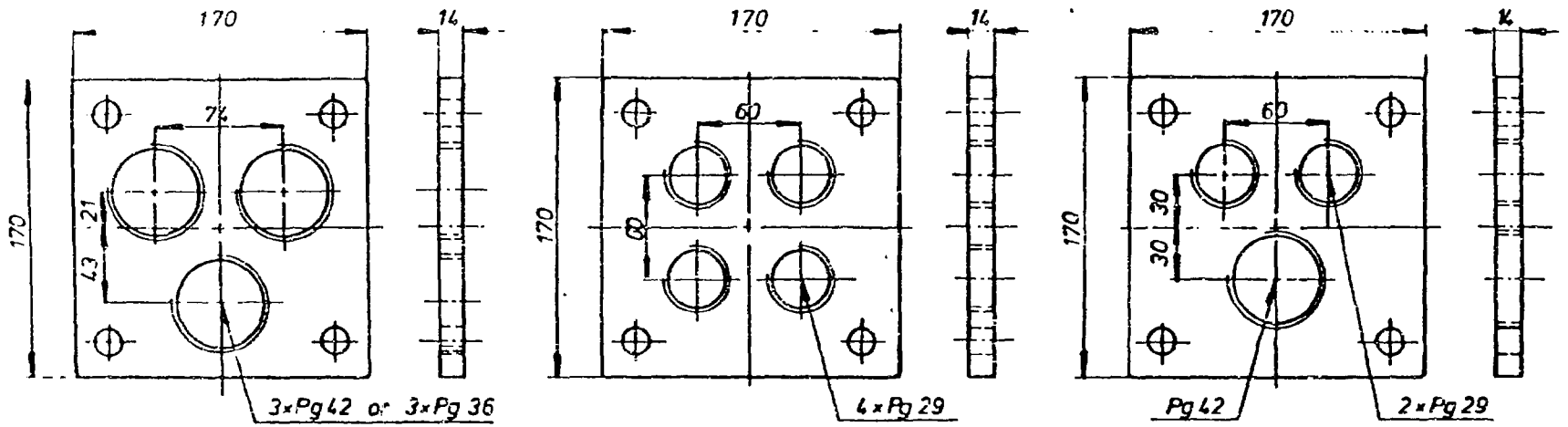
The construction, layout dimensions and cover types with cable alternatives are given in drawings nos 1, 2, 3 and in "Selection Table".



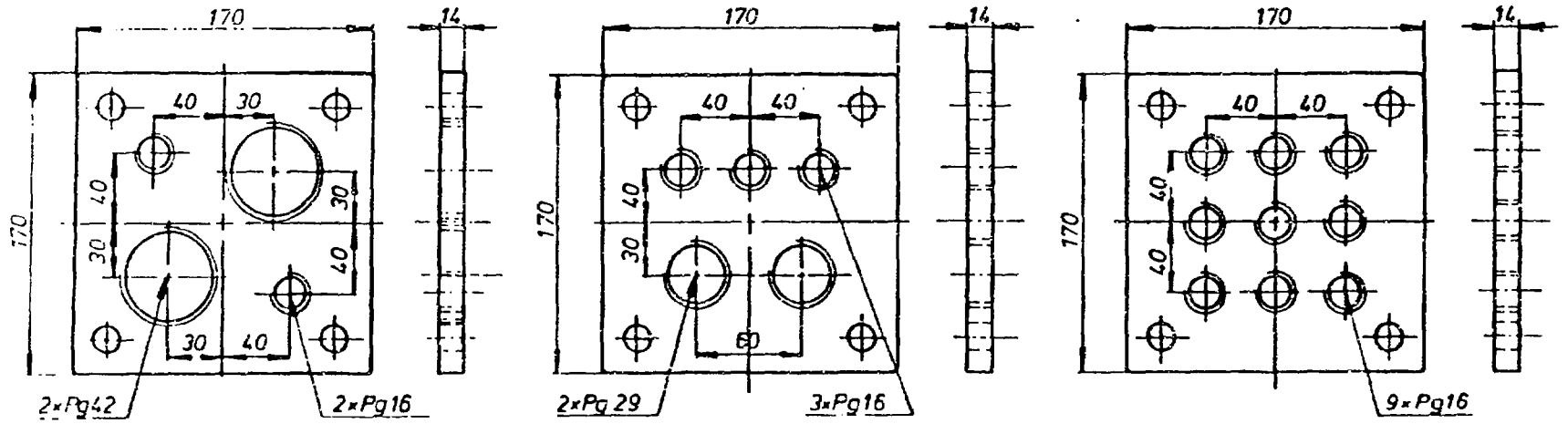
1 Pipe
2 Flange
3 Cover

Temet Oy	Drawing no. 1		Drawn / Checked / Approved

SJ-150 WALL SLEEVE SYSTEM FOR ELECTRIC CABLES

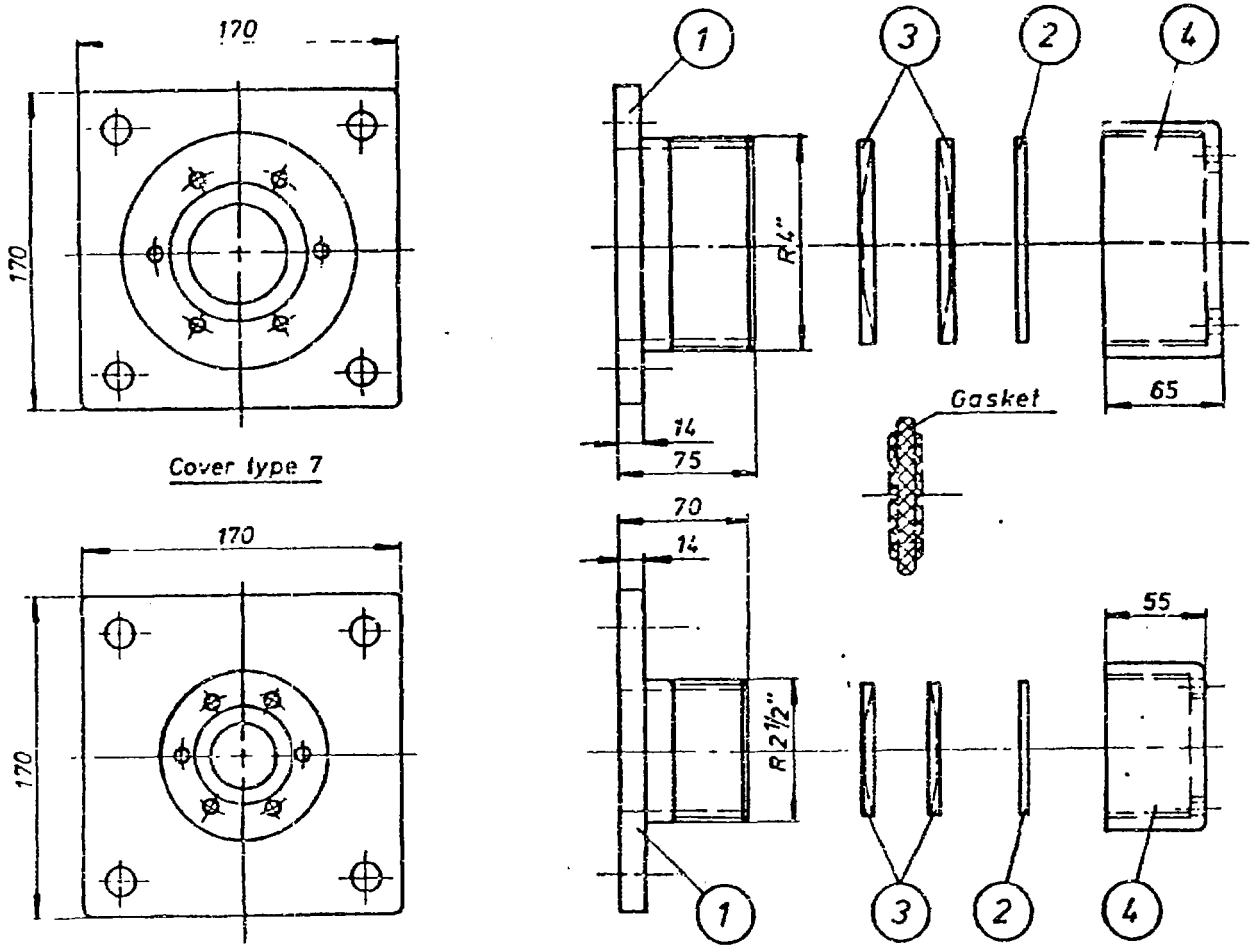


Cover type 1 Cover type 2 Cover type 3



Cover type 4 Cover type 5 Cover type 6

Temet Oy	Drawing no. 2		Drawn	
			Checked	
			Approved	
SJ-150 COVER TYPES				



1 Cover
2 Blind seal plate
3 Gasket plate
4 Socket

Temet Oy	Drawing no. 3		Drawn		
			Checked		
			Approved		
SJ-150 COVER TYPES					

SELECTION TABLE

COVER TYPE	CABLE		STUFFING BOX SFS 2193	
	Ø mm	pcs	Pg	pcs
1	37—41	3	42	3
2	21—26	4	29	4
3	21—26 37—41	2 1	29 42	2 1
4	12—14 37—41	2 2	16 42	2 2
5	12—14 21—26	3 2	16 29	3 2
6	12—14	9	16	9
COVER TYPE	POWER CABLE		SOCKET	
	Ø mm	pcs	NS	pcs
7	43—54	1	100	1
8	33—40	1	65	1

HOW TO ORDER

In your order please indicate the following details:

- Product type
- Cover type number
- Wall thickness

For examble: SJ-150- 4-S = 600

Manufacturer

Temet Oy

Asentajankatu 3 00810 Helsinki 81 Tel.int. + 358-0-780655 Telex 123225 Sheg sf

PASSAGEWAY

MODULAR COLLECTIVE PROTECTION

SK-1273 SERIES

Temet USA Inc.

SK-1273 Passageways are designed to maintain a weather tight seal around square or rectangular openings in adjacent structural elements where differential movement may occur due to blast effects or ground settlement.

The standard modules allow for up to a 3" displacement in the X, Y, or Z axis, individually or in combination. Gradual or abrupt displacements will not affect the seal.

Standard modules are also compatable with standard Temet blast and gas doors equipped with matching weather seal frames.

Examples of uses include coupling rigid mounted blast doors to shock isolated specialty doors (RFI, gas sealed, fire rated, etc.), providing portals between two rigid structural adjacent elements for personnel, piping, cabling, or ducting and many other applications where differential movement is a concern.

A full passageway application normally requires a male unit which includes an SS cover set, a gasket set, a threshold plate and clamp set, and a female unit which includes a clamp set only.

The cover set provides bolt on stainless steel covers for top and two sides. The gasket set provides a neoprene sheet gasket cut to proper length and glue to make the field joint in the neoprene sheet gasket.

SPECIAL OPTIONS

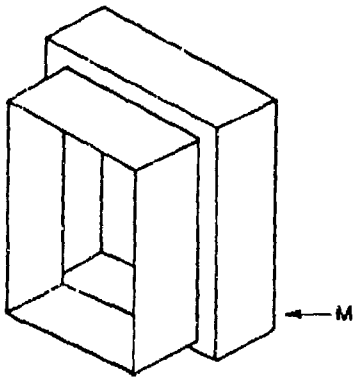
Units providing greater displacement may be obtained on a special order basis.

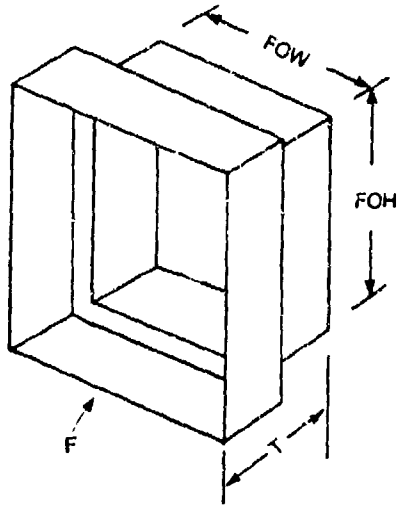
Units to accommodate special wall shape details may be obtained on a special order basis.

Std. surface treatment is factory primer. Other treatments are available on a special order basis.

ATCH 6

ORDERING INFORMATION





ORDERING NUMBER

Model No.	FOW × FOH ×	T	M or F
SK-1273	36 × 84 ×	12	M

Will provide male side of 3′ × 7′ passageway for mounting in a 12″ Cast or Block Wall

SK-1273	36 × 84 ×	12	F

Will provide fema') side of 3′ × 7′ passageway for mounting in the adjacent 12″ Cast or Block Wall

PRODUCT: SK-1273

SIZE: FOW = Free open width (inches, min. 12)

FOH = Free open height (inches, min. 12)

T = Thickness (inches, min. 8)

M = Male Set. Includes SS Cover Plate Set, Gasket Set, Threshold Plate and Clamp Set

F = Female Set. Includes Clamp Set only

Temet USA, Inc.

737 Walker Road, P.O. Box 439, Great Falls, VA 22066, (703) 759-6000, Telex: 90-1932
TELEFAX: (703) 759-6067

TREMCO

SPECIFICATION DATA

SPECTREM™ 2

A medium modulus, versatile, general purpose, high performance silicone construction sealant

FOR DEMANDING CAULKING AND GLAZING APPLICATIONS.

Composition: Spectrem 2 is a versatile, neutral cure, one-part, high performance medium modulus silicone, which reacts with atmospheric moisture to produce a flexible silicone rubber, ideal for a wide variety of general purpose caulking and glazing applications. Spectrem 2 provides high performance capability as well as exceptional cure stability and shelf-life properties.

Basic Uses: The medium modulus profile and outstanding physical properties of Spectrem 2 allow for sealing a wide variety of demanding applications. Spectrem 2 is suitable for both a wide variety of general purpose caulking applications and for glazing applications, including cap beads, toe beads and heel beads/air seals. It is particularly well suited as a weather seal in butt (2-sided) and stopless (4-sided) glazing systems and ideal for sealing joints within the curtain/window wall systems.

Capable of taking extension, compression, transverse and longitudinal movements, Spectrem 2 resists severe environmental conditions such as wind loading, wind driven rain, snow and sleet, and is impervious to acid rain, ozone, ultraviolet light and extreme temperature variations. Because of its excellent adhesive qualities, the tenacious adhesion of Spectrem 2 will not degrade, thus providing the long-term performance required for demanding weatherproofing applications. Spectrem 2 is recommended for use on both new construction and renovation projects.

Features:

- Excellent movement capabilities (+50% −50%).
- Excellent gunnability throughout a wide temperature range (−35°F to 160°F) (−37°C to 71°C).
- Long product life expectancy (30+ years).
- Unaffected by ultraviolet light, ozone, moisture and extreme temperature variations.
- Good tear resistance.
- Excellent unprimed adhesion to most common substrates.
- Rubberlike properties are maintained throughout product life.
- Service temperature range −65°F to 300°F (−54°C to 149°C).
- Dry tools easily to a smooth, attractive finish.
- Skins quickly.
- Stable curing system assures product reliability.
- No special cold storage requirements are necessary.

Limitations — Not for:

- Exterior below grade use.
- Continuous water immersion.
- Application over tars, asphalt or materials that bleed oils, plasticizers or solvents.
- Marble substrates
- Other natural stone substrates. (Tremco believes all silicone sealants have the potential to stain or discolor natural stone substrates. Because of this aesthetic issue, we highly recommend that DYmeric or DyMonic high performance sealants be used in these applications.)
- Application in airtight enclosures as the sealant requires atmospheric moisture to cure.
- Horizontal traffic joints.

Packaging: Spectrem 2 is available in 10.3 fl. oz. (305ml) cartridges, 30 cartridges/case. Bulk packaging (2 gallon and 5 gallon) is available by special request. Product shelf life is 12 months when stored below 80°F (27°C). No special cold temperature storage provisions are required.

Standard Colors:
White, Off-White, Dark Bronze, Gray, Black

Applicable Standards:
Spectrem 2 is supplied in a non-sag formulation which meets or exceeds the requirements of U.S. Federal Specifications for silicone building sealants, Class A one component building sealants, applicable ASTM tests, and Tremco standards.

TT-S-00230C (COM-NBS) Type II, Class A
TT-S-001543A (COM-NBS), Class A
ASTM C-920-79 Type S, Grade NS, Class 25, Use NT, M, G, A and O.

TREMCO 5 86 □ 7 P

Typical Glazing Details

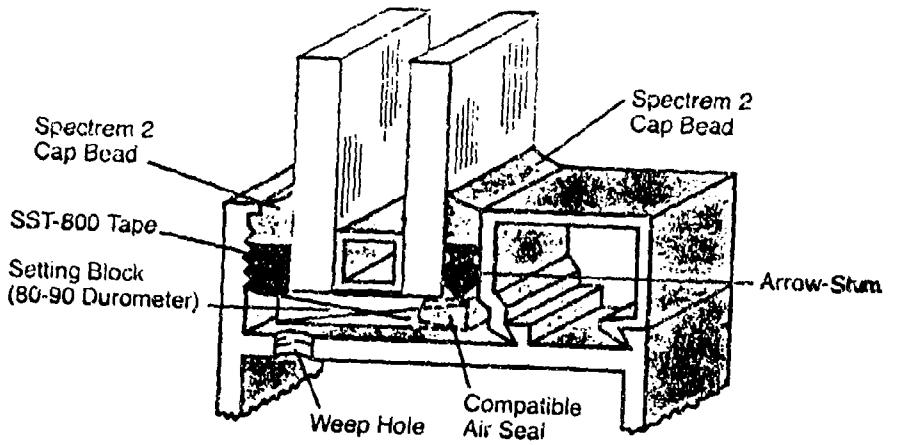
Joint Design:

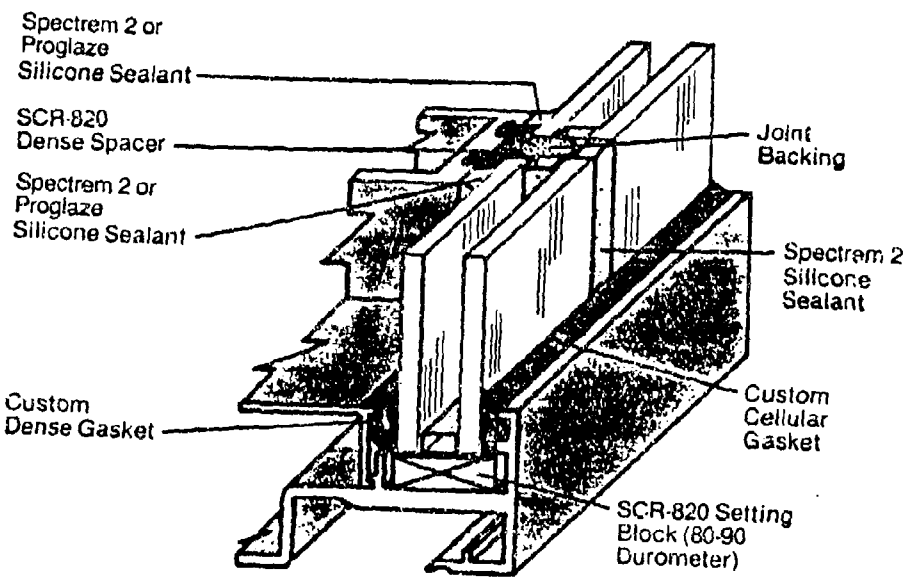
Spectrem 2 silicone sealant is a medium modulus high performance silicone sealant capable of accepting joint movement of +50% −50% in extension and compression.

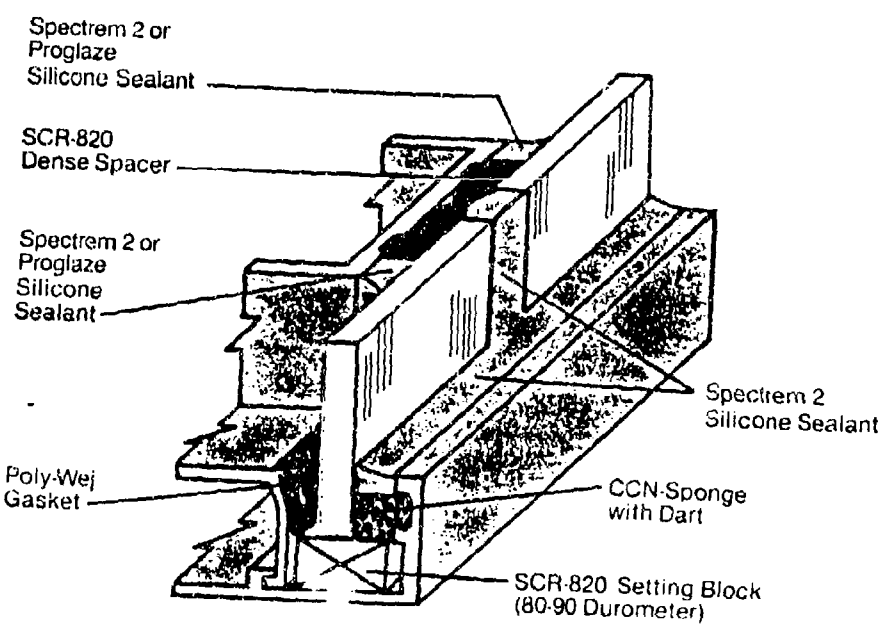
Good joint design in the construction industry dictates 4 times the anticipated movement of building components be used when calculating joint width. The theoretically derived 2:1 movement factor is based on thermal movement alone and doesn't allow for variances found at the job site and therefore should not be used.

The 4:1 design factor accommodates both thermal movement and wide variations in tolerances of construction materials, fabrication and erection often found in the field. This will also accommodate joints installed narrower than originally designed.

Tremco's many years of on-site construction experience indicates the 4:1 movement factor to be a prudent approach for use in joint design. Contact your Tremco representative for specific joint design recommendations.







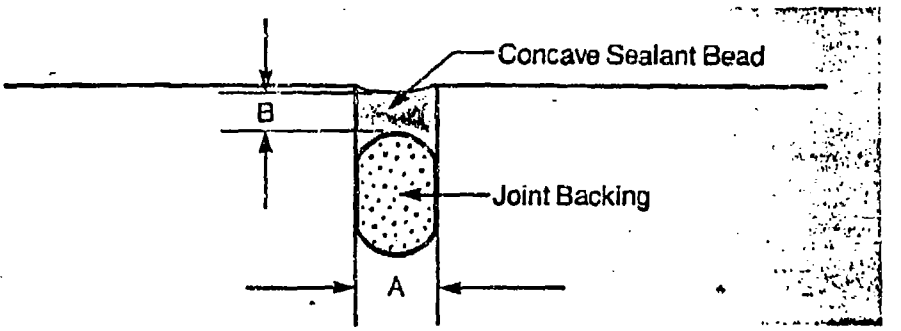
Bead Configuration for General Purpose Sealing:
Spectrem 2 silicone sealant should have a ratio of approximately 2:1 joint width to sealant depth. The sealant depth should be not less than 3/16" (4.8 mm, minimum) and not greater than 1/2" (12.7 mm, minimum). See the table at right.

Joint Width-to-Depth Recommendations for General Purpose Sealing

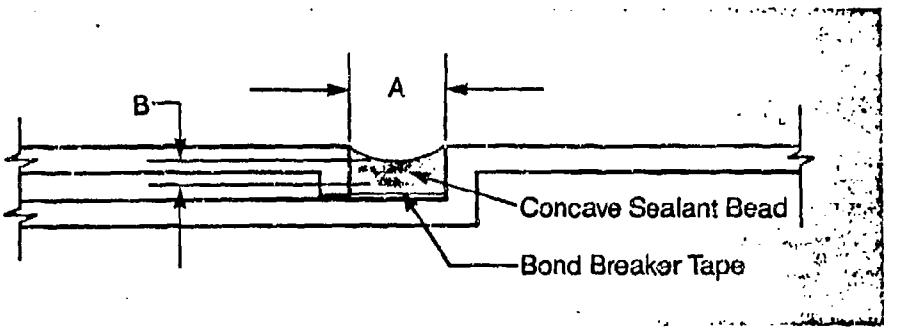
A. Width	1/4	3/8	1/2	5/8	3/4	7/8	1
B. Depth	3/16	3/16	1/4	3/8	3/8	3/8	1/2
C. Lineal ft./gal.	410	275	154	82	69	59	36

Recommended Joint Design with Joint Backing

A joint designed at four times the anticipated movement should have a width (A) to depth (B) ratio not less than 2 to 1. The sealant should be tooled concave to eliminate unsightly bulge when joint is in compression cycle. The concave hourglass bead profile reduces stress on the bond line.



Recommended Joint Design with Bond Breaker



Surface Preparation:
The joint interfaces should be clean, dry and free from any foreign matter.

Some substrates may require grinding, cutting or mechanical abrading to produce a sound, clean, dry surface for sealant application. Any surface dirt, dust and loose particles, should be removed from the joint prior to application of the sealant.

Metal, glass and other non-p ous surfaces should be wiped th a clean, solvent-saturated rag, lowed by a dry wipe with a clean t-free cloth before the solvent aporates. Preferred solvents are methyl ethyl ketone (MEK), toluol or xylol. A trial application of the solvent to an applied coating or finish is recommended to ensure there is no adverse reaction.

Priming: Spectrem 2 does not require a primer on most common construction substrates. However, some materials with special surface characteristics, finishes or coatings, may require a primer. A trial application of the sealant is recommended before commencement of the project.

Primers:
Primer #20
Primer #21
Primer #22

NOTE: See Primer Data Sheets for specific instructions.

Joint Backing — Bond Breaker:
Joint backing should be used to control the recommended joint depth and prevent 3-sided adhesion. Joint backing may be open cell polyurethane foam or closed cell polyethylene. Joint backing must be thoroughly dry. Where joint design or depth will prevent the use of joint backing, an approved adhesive backed polyethylene bond breaker tape must be installed to prevent three-sided adhesion. Do not install more joint backing or bond breaker tape than can be caulked in one day.

Application:
Spectrem 2 silicone can easily be applied with conventional hand or air-powered caulking equipment. The sealant should be applied in a continuous operation with adequate pressure to fill the joint to the proper width and depth. (Do not overfill the joint.)

Tooling: Dry tool the sealant with light pressure immediately after application to ensure positive and complete contact of the sealant to the joint interfaces.

Masking: Should masking be required, it is recommended the masking tape be removed immediately after tooling, before the sealant skins.

If necessary, the sealant can be installed below freezing provided the surfaces are clean, dry and frost-free. We recommend, however, for best conditions and performance, that the sealant be applied above 40°F (4°C).

Cure Rate:
Skin-over time — 20-60 minutes
Tack-free time (firm skin) — 1-2 hours
Through cure — 7-14 days

Cleaning: Cleaning of equipment and tools can be accomplished with solvents such as xylol, toluol or methyl ethyl ketone (MEK) while sealant is uncured.

Non-porous surfaces: Immediately remove all excess sealant adjacent to the joint with one of the above solvents.

Porous surfaces: Allow sealant to develop initial cure, then remove by abrasion or other mechanical means. Caution should be exercised to maintain original surface texture.

Storage Life: Product shelf life is 12 months under normal storage conditions of 80°F (27°C) or less. No special cold temperature storage provisions are required.

Availability: Immediately available from both Tremco distributors and distribution centers strategically located throughout the U.S.

Typical Performance Properties

As Supplied:		
ASTM C-679-77	Tack-free time, hours	1 - 2
	Curing time, days	7 - 14
	Full Adhesion, days	14 - 21
ASTM C-639-83	Flow sag or slump; inches	Nil
	working time; minutes	20 - 60
As Cured: After 14 days at 77°F (25°C) and 50% R.H.		
ASTM C-661-83	Hardness; Shore "A"	25
ASTM D-412-83	Tensile strength at maximum elongation; PSI	175
ASTM D-412-83	Tensile strength at 100% elongation; PSI	65
ASTM D-624-81	Tear strength, PLI	30
ASTM C-794-80	Peel strength, PLI Aluminum, Glass, Concrete	25
ASTM C-510-83 TT-S-001543A	Stain and color change	None
	Ozone resistance	Excellent
	Joint movement capability	
	Extension	+50
	Compression	−50
	UV resistance	Excellent

Cost: Cost information is available from your local Tremco representative, Tremco Distributor or by calling our Customer Service Department. For information call Tremco in Cleveland: U.S. 800/321-7906; in Ohio call 216/292-5154 collect.

Precautions: Caution! Uncured sealant may cause eye and skin irritation. Use only in well ventilated areas. Avoid skin and eye contact. Wash affected areas with hand cleaner followed by soap and water. If eye irritation or contact occurs, flush eyes with running water for 15 minutes and get medical attention. For further details, consult the Material Safety Data Sheet. Keep out of reach of children.

GUARANTEE:
We warrant our products to be free of defects and manufactured to meet published physical properties when cured and tested according to applicable specifications and Tremco standards. Under this warranty, we will provide, at no charge, product in containers to replace any product proved to be defective when applied in accordance with our written instructions, and in applications recommended by us as suitable for this product.

All claims concerning product defects must be made within six (6) months of shipment. Absence of such claims in writing, during this period, will constitute a waiver of all claims with respect to such product. This warranty is in lieu of any and all other warranties, expressed or implied.

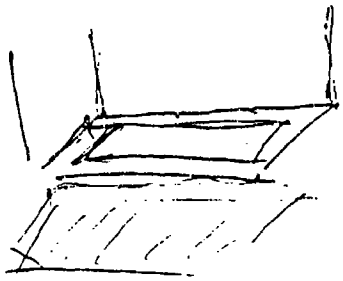
Maintenance:
Your Tremco representative can provide effective maintenance procedures to replace damaged sealant. Procedures will vary, depending upon the condition of the sealant and the joint.

Technical Services:
Your local Tremco representative, in conjunction with the Tremco Technical & Engineering Services Departments, offer unique problem-solving capability. This includes assistance through the design and specification stage and special applications, as well as providing on-site application instruction and inspection when requested. Their services are fully supported by the Tremco Research Center, which has earned a unique reputation in sealant technology. From concept through job completion, your Tremco Field Advisor is available for whatever assistance is necessary. For caulking inquiries, call Tremco in Cleveland: U.S. 800/321-7906; in Ohio call 216/292-5154 collect. For glazing inquiries, call 800/321-6357.

TREMCO
10701 Shaker Blvd /Cleveland, Ohio 44104
TWX: 810-427-2901

TREMCO

SPECIFICATION DATA



1/8 - 0

THC-900

Self-leveling expansion joint sealant

Designed to effectively resist moisture, abrasion and movement.

Composition: A hybrid, multi-component, chemically curing, self-leveling polyurethane joint sealant.

Basic Uses: Specifically developed for sealing concrete expansion and control joints in: parking garages, plaza and terrace decks, floor and sidewalk joints.

The THC-900 System exhibits tenacious adhesion which will not dissipate with time. This unique formulation which possesses a balanced adhesive strength, low modulus and high recovery, make it ideal to resist the adverse conditions common to horizontal joint installations: Moisture, Abrasion, Movement, Shear and Deflection at Expansion Joints.

LIMITATIONS:

- A three-part sealant requiring careful mixing prior to use.
- Must be used in conjunction with Tremco Primer #1 on concrete surfaces. For joint interfaces other than concrete, consult your local Tremco Representative.
- Should not be used in joints subject to constant water submersion, such as swimming pools, reservoirs, sewage treatment basins.
- Not designed for areas subject to constant spillage of harsh chemicals, such as acids, alkalies, and organic solvents.

Packaging: THC-900 is packaged in bulk: 1½ gallons (5.68 liters) of sealant when mixed in a 2 gallon container.

Colors: Supplied in separate easy-to-open containers. One Multi-System Color-Pak (pigmented concentrate) mixes with one THC-900 Base unit. Benefits include excellent color uniformity, greater availability of standard and special colors, a lower inventory requirement, a visual index of proper mixing and easy, safe, handling procedures.

Standard Colors: Precast White, Off-White, Limestone, Beige, Buff, Redwood/Tan, Bronze, Aluminum/Stone, Black.

APPLICABLE STANDARDS:

Supplied in a self-leveling formulation meeting the requirements of U. S. Federal Specification TT-S-00227E, ASTM C920-79, Type M, Grade P, Class 25, use T, M, O, and Tremco standards.

JOINT DESIGN

(a) Minimum size of joint should be four times the anticipated movement.

(b) Minimum joint width dimension is ⅜" (9 mm), to allow for adequate cleaning and priming; depth of joint should not exceed width of joint from ⅜" to ½" (9 mm to 13 mm). For joints larger than ½" x ½" (13 mm x 13 mm), the depth of the sealant should be no more than ½" to ⅝" (13 mm to 16 mm).

(c) THC-900 has been used to successfully seal horizontal joints in sidewalks, parking and plaza decks up to 12" (30.5 cm) in width. Depending upon the amount of traffic and the anticipated abuse versus joint width, a cover and/or a support plate may be necessary.

(d) Consult with your local Tremco Representative for specific design details.

TECHNICAL DATA

Surface Preparation:

New Construction — The joint interface must be clean, dry, and free from loose mortar, and laitance. Depending upon the substrate, a thorough wire brushing, grinding or sand blasting may be required. The presence of form release agents, waterproofings, damp-proofings, or other contaminants, will require grinding or sandblasting to expose virgin concrete.

Remedial Applications — All previous sealants, mastics, or joint fillers should be removed by routing or saw-cutting. Joint faces should then be sandblasted or ground to expose clean, sound, virgin concrete.

Primer: After proper substrate preparation, concrete surfaces to receive

Performance Characteristics

Cured Sealant Properties	Test Method	Typical Value
Shore A Hardness:		
Standard Conditions	TT-S-00227E	25-30
After heat aging	TT-S-00227E	30-35
Artificial Weathering	ASTM G 23-75 Type D	No elastomeric property change after 1000 hours.
Bond-Cohesion after water immersion	TT-S-00227E	No failure between masonry blocks after 25% extension
Tensile Strength	ASTM D 412-75	232 psi
Ultimate Elongation	ASTM D 412-75	575%
Recovery	TT-S-00227E Durability specimens blocked at 25% extension for 48 hours	96%
Weight Loss	TT-S-00227E	9.00%
Tear Resistance	ASTM D 624-73	56 lbs/inch
Staining	TT-S-00227E	passes
Service Temperature	N/A	−40 to 180° F (−40° to 82.5°C)

TREMCO 5/82 □ 7.11/Tr.

THC-900 must be primed with two successive coats of Tremco Primer No. 1. Allow 15 minutes between coats. Caulk as soon as primer is tack free.

For specific design criteria, consult your local Tremco Representative.

Mixing: The sealant must be thoroughly mixed in accordance with manufacturer's directions on container label, before application. Proper mixing is achieved with a slow speed, heavy-duty drill (maximum 425 rpm) for not less than 8 minutes, using a Dymeric two-part mixing paddle.

Pot Life: Approximately 1 to 2 hours at 75°F (24°C), depending on temperature. Higher temperatures will accelerate cure rate.

Initial Set: Approximately 10 hours at 75°F (24°C); 48 hours at 50°F (10°C).

JOINT BACKING - BONDBREAKER

Joints shall be backed with round closed-cell polyethylene, neoprene, or butyl rod under 30% compression. The sealant must not be applied against impregnated fiberboard, sand or other absorbing type backup materials that retain moisture. These materials must be cut back deep enough to allow for proper joint backing.

When joint design, or depth of joint will not permit the use of joint backing, a bondbreaker tape must be installed to prevent three-sided adhesion. An adhesive backed polyethylene tape should be used.

Application: THC-900 is supplied in a self-leveling consistency which will flow easily into joints with a caulking gun. Joints should be filled to within ¼" (6.6 mm) of the surface. Proper width-to-depth ratio must be maintained.

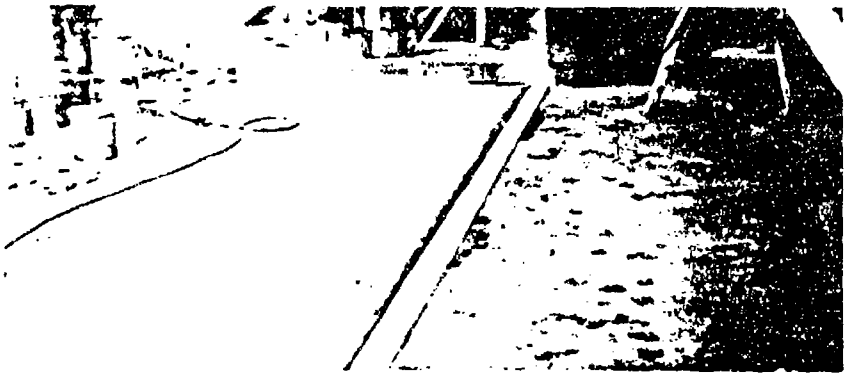
Tooling: Where necessary, light tooling can be performed immediately after application.

Cleaning: Immediately remove all excess sealant smears adjacent to the joint with Xylol or Toluol, as work progresses. Cured sealant can be removed easily from unprimed concrete.

Storage Life: One year

Precautions: Avoid inhalation of vapors and skin and eye contact. Contaminated clothing should be removed. May be harmful if swallowed; do not induce vomiting, call a physician immediately. Keep away from heat and open flame.

Typical THC-900 traffic joint with epoxy nosing.



Availability: Immediately available from Tremco Distribution Centers strategically located throughout the United States and Canada.

Cost: Data is available from your local Tremco Representative or by calling our Customer Service Department. For his name and telephone number call Tremco in Cleveland: 800-321-7906; In Ohio: 216-464-7994 Collect.

GUARANTEE:

We warrant our products to be free of defects and manufactured to meet published physical properties when cured and tested according to ASTM and Tremco standards. Under this warranty, we will provide, at no charge, product in containers to replace any product proved to be defective when applied in accordance with our written instructions, and in applications recommended by us as suitable for this product.

All claims concerning product defects must be made within twelve (12) months of shipment. Absence of such claims in writing, during this period, will constitute a waiver of all claims with respect to such product.

This warranty is in lieu of any and all other warranties expressed or implied.

Maintenance: Your Tremco Representative can provide effective maintenance procedures to replace damaged sealant. Procedures will vary depending on the condition of the sealant and the joint.

TECHNICAL SERVICES:

Your local Tremco Representative, in conjunction with the Tremco Technical Services Department, provides blueprint analysis, problem analysis, and assistance in design and development for special applications. On-site instruction can generally be provided at no charge, with full-time inspection available on a fee basis. Their services are complemented and extended by the Tremco Research Center, which has earned the unique reputation in glazing, sealant, and waterproofing technology.

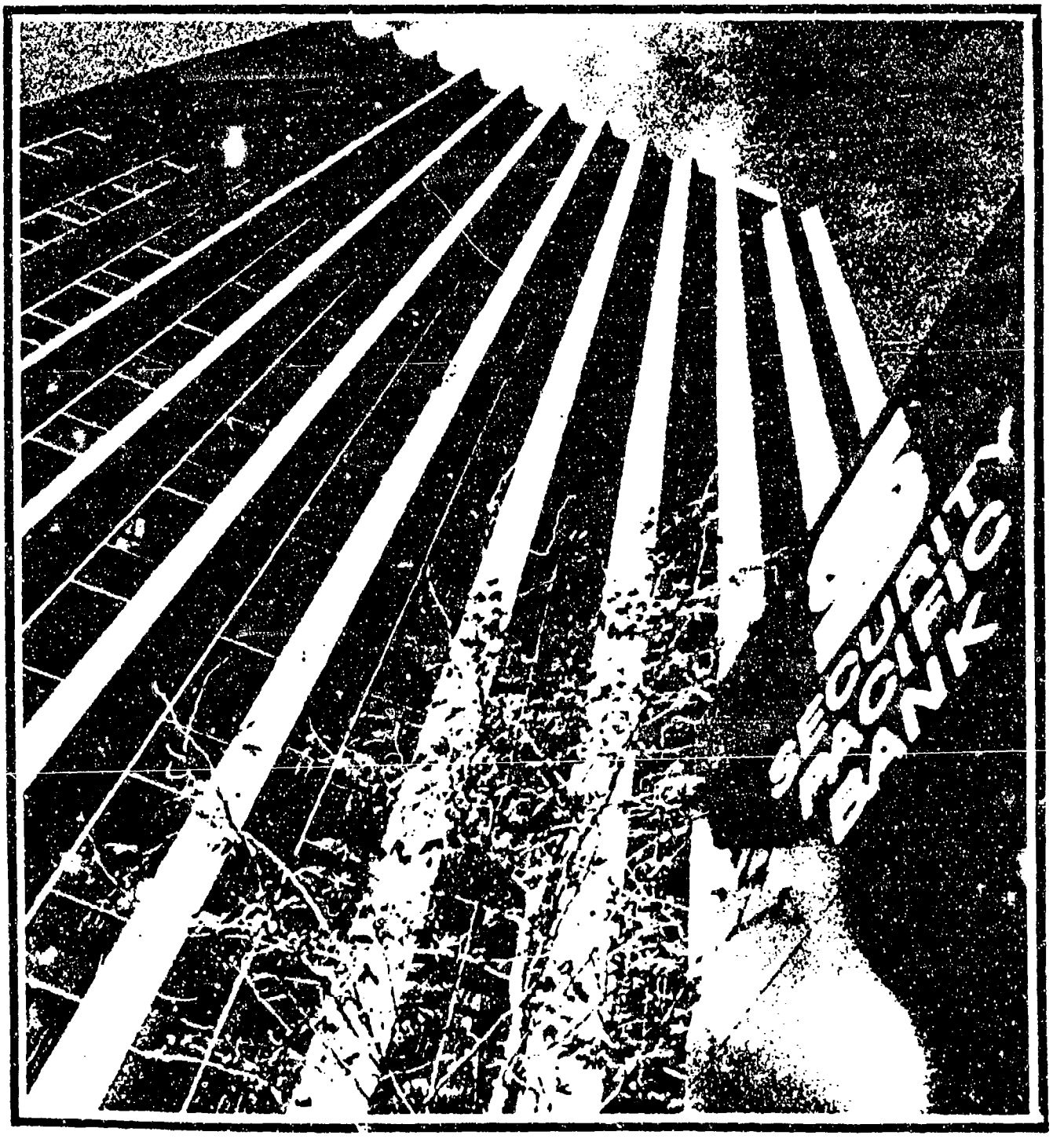
See Sweet's Architectural File, U. S.

TREMCO
10701 Shaker Blvd./Cleveland, Ohio 44104
TWX 810-427-2001

F-3116C Printed in U.S.A

Dow Corning® 790 silicone building sealant for expansion and control joints

DOW CORNING



Why Dow Corning® 790 sealant meets building teams' demands

More and more architects, engineers, contractors, sealant applicators, building owners and consultants are specifying Dow Corning 790 building sealant. Here's why:

Architects are specifying 790 because while most sealants are designed to accommodate joint movement of only ±12½% to ±25%, 790 can accommodate joint movements of ±50% without affecting adhesion or cohesion. The greater movement capability of Dow Corning 790 sealant allows more design flexibility and permits modern designs with fewer or narrower sight lines. Popular colors blend in further to make seemingly seamless walls. And, Dow Corning 790 sealant exceeds the requirements of Federal Specifications TT-S-001543 (COM) and TT-S-00230 for one-component sealant—so you know the product has been tested and exceeds industry standards.

Contractors know that delays in building schedules are costly. When Dow Corning 790 sealant is used in joints designed for ±25% expansion and contraction, its ±50% capabilities provide an extra margin of safety for wide variations in construction tolerances and for a wide variety of construction materials, thus eliminating costly redesign time and labor.

Applicators are using 790 sealant because it virtually eliminates callbacks. "One part, ready to use" means you don't need an extra laborer to mix, heat or cool the material. Since no primer is required on many substrates, you save the time, money and extra labor needed to apply primer. Its gunnability from −20 F to 160 F means that it's easy for mechanics to handle and apply. No special dispensing equipment is required.

Consultants put their reputation on the line when recommending a sealant. And, because a sealant is usually the last material to be considered and yet the most noticeable (if it fails), his selection must be right ... the first time. Dow Corning 790 takes the guesswork out of the best material to recommend. Whatever the criteria, construction materials, construction methods, joint design, application methods, cost schedules, or performance, 790 sealant is the sealant of choice.

Building owners want a building that stays weatherproof, watertight and maintenance free. Dow Corning building sealant has a life expectancy of 20 years or more compared to two to five years for many conventional materials. No need to recaulk or replace sealant. Keeps water, dust and dirt out, cuts heating loss.

Look at the reasons why 790 was "spec'd" in the "case histories" shown here. Then contact your local Dow Corning building sealant distributor, or write directly to Dow Corning, Midland, Michigan 48640, and ask for details on this dependable silicone sealant with extra s-t-r-e-t-c-h-a-b-i-l-i-t-y.

Sealant accommodates windload movement of precast-concrete panels.

Type of job: exterior sealing, new work

Substrate: precast-concrete panels

Structure / location: Security Pacific Plaza Building, San Diego, Calif.

Conditions / requirements: 18-story, vertical triangle columns of precast bronze-colored concrete encasing steel framework. Building designed for windload variance of ⅞ inch per floor laterally. Architectural firm wanted "the most durable type of building sealant available"—sealant must remain rubbery and adhere well in spite of sunlight, moisture, windloading and temperature extremes. Sealant color to be bronze.

Joints: up to more than one inch wide, backed up with polyethylene rod, no primer used, 150 gallons of Dow Corning 790 sealant used for all 9,406 feet of precast-concrete panel joints. Air-powered guns were used to apply the sealant from bulk containers, beads tooled to concave.

Application date: 1972

Owner / builder: Security Pacific National Bank

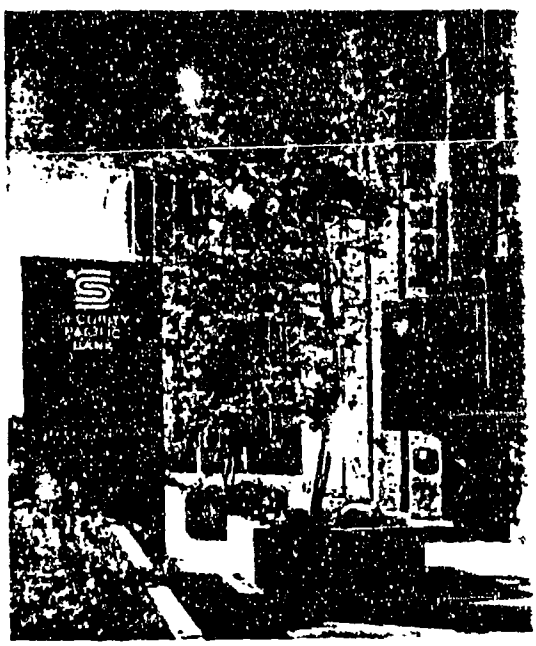
Engineer / architects: Tucker, Sadler and Bennett, San Diego

General contractor: M. H. Golden Construction Co., San Diego

Sealant consultant / supplier: Sunshine Supply Co., San Diego

Sealant applicator: Center Glass Co., La Mesa

Comments / benefits: Ed Waldman, sealant consultant, said, "We knew that 790 far exceeded the performance of anything previously devised in sealant material. We were impressed with its high elongation, compared to other silicone sealants, and we also liked its controlled recovery from both elongation and compression. Previous experience with silicone sealants showed the material to be durable and did not deteriorate under exposure."



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Massive skylight structure fully guaranteed by the builder— for 10 years.

Type of job: exterior sealing, new work

Substrates: acrylic panels and aluminum framing

Structure / location: nine baggage-pickup and train stations at Dallas-Fort Worth International Airport

Conditions / requirements: domed acrylic skylight panels are subjected to outside surface temperatures from 0 F to 200 F; a typical panel is 5' x 5', and in some cases there are 25 panels in a row. Each panel expands a half inch or more while going through this temperature range. "Skylights must be fully guaranteed for 10 years."

Joints: ⅝ inch deep, backed with bond-breaker rod, sealant bead tooled to concave surface. Joint surfaces were cleaned with solvent and primed for an added safety margin for adhesion; 6000 panels were set using about 90 gallons of 790 to seal approximately 120,000 feet of joint.

Application date: 1974

Builder / applicator: McKune Skylight Corporation, Dallas

Comments / benefits: Before specifying Dow Corning 790 sealant, McKune Skylight Corp. made a series of tests of several sealants.

Results: Polysulfide sealant tended to weather-check and crack in a relatively short time.

- Butyl tape was difficult to apply cleanly at the site, and therefore provided poor adhesion.
- Certain types of silicone are a little too hard and tended to pull away from either the acrylic or the aluminum under extreme movement.
- Dow Corning 790 sealant was specified because its low modulus (ease of stretching and compressing) allows it to take the extreme movement of the panels and recover to its original shape repeatedly.

Jim McKune, owner and manager of the firm, said that "because of the weather factor we knew that a silicone rubber would be a natural because it withstands weather extremes better than any other material." McKune also said, "The 790 sealant extruded so easily from hand-operated caulking guns that it was actually simpler to do it by hand" (than using air-pressure-operated applicators).

"If 790 hadn't been there for us to use, we just wouldn't have been able to build with precast-plaster panels."

Type of job: exterior sealing, new work

Substrate: precast-plaster panels

Structure / location: H ah's Hotel, Lake Tahoe

Conditions / requirements: 18-story, curtain wall of 8' x 10' panels of plaster precast on frames of metal studs and lath, bolted onto steelwork. (Design originally called for concrete curtain wall, but increased cost of concrete panels necessitated change to plaster.) Because of the unusually varied joints anticipated as a result of construction variations, the freezing temperatures during application (down to −17 F), the high altitude with little cloud cover (intense ultraviolet exposure), and the extreme daily temperature changes—a silicone building sealant with high elongation was needed.

Joints: up to more than one inch wide, no primer used, about 300

gallons of Dow Corning 790 sealant used

Application date: 1972-1973

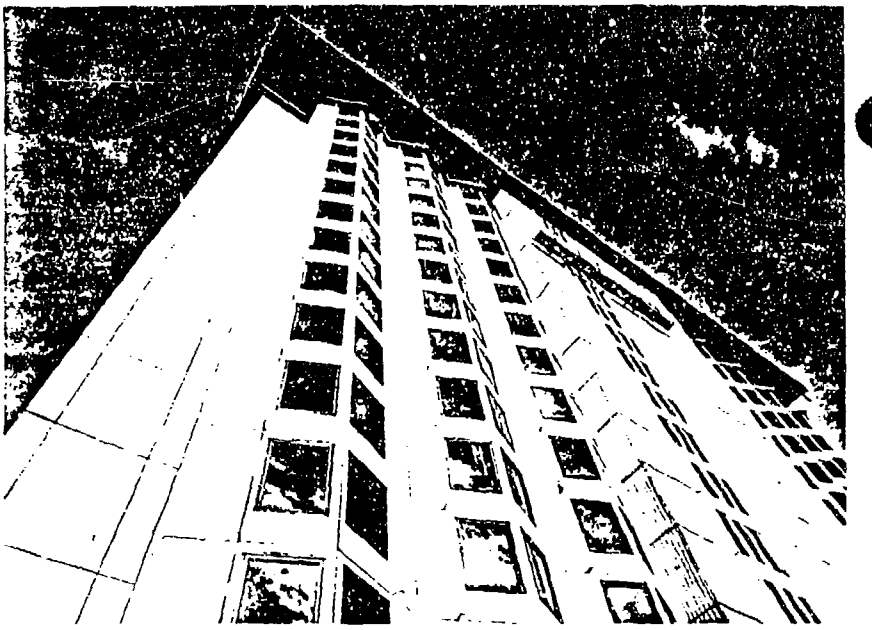
Owner: Harrah's Corporation

Architects: Martin Stern, Jr., AIA Architects and Assoc., Beverly Hills, Calif.

General contractor: Continental Heller of Sacramento

Sealant consultant: Harold A. Price & Co., Inc., Richmond, Calif.

Comments/benefits: Before a decision to use plaster panels could be made, the problem of joint treatment had to be resolved. The sealant consultant was retained as a member of the "building team" in the planning stage. Harold Price, the consultant, said that "only the new building sealant (Dow Corning 790) had the properties this unusual application demanded." Mike Scanlon, supervisor of construction for Harrah's Corporation, explained that "ordinary sealant just wouldn't do. Even supposing standard sealants could somehow have been applied in the below-zero weather, you'd still have to worry about continuous joint movement and the inevitable deterioration from ultraviolet light. And if 790 hadn't been there for us to use, we just wouldn't have been able to build with precast-plaster panels."



The information and data contained herein are based on information we believe reliable. You should thoroughly test any application and independently conclude satisfactory performance before commercialization. Suggestions of uses should not be taken as inducements to infringe any particular patent.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN 48640

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DOW CORNING

Information about Silicone Building Sealants

DOW CORNING

DOW CORNING® 799 SILICONE GLASS & METAL BUILDING SEALANT

Type	One-part silicone rubber
Cure	At room temperature upon exposure to moisture in the air
Special Properties	Clear; primerless to most construction materials; noncorrosive; no mixing; ready to use as supplied; easy gunning at all temperatures
Primary Uses	Conventional glazing (glass and plastic); sealing metal structures

DESCRIPTION

DOW CORNING® 799 silicone glass & metal building sealant is a strong, clear, one-part silicone adhesive/sealant that is noncorrosive and exhibits superior unprimed adhesion to most construction materials. Once cured, the sealant forms a durable, flexible, watertight bond with most building materials in any combination: glass, plastic, metal, concrete and masonry. In most cases, NO prime coat is required.

Important features include:

- Primerless – can be used with most building materials without the use of primer
- Noncorrosive – will not react with or corrode building components
- Color – clear
- Fast cure – 6 minutes tooling time; 25 minutes tack-free time
- Pleasant odor during the cure process
- All-temperature gunnability – consistency is relatively unchanged from -35 to 140 F (-37 to 60 C) permitting the sealant to be applied in any season
- Good weatherability – relatively unaffected by sunlight, rain, snow, ozone or temperature extremes
- Long-life reliability – cured sealant stays rubbery from -80 to 400 F (-62 to 205 C) without tearing, cracking, drying out or becoming brittle

USES

DOW CORNING 799 silicone glass & metal building sealant is primarily used for conventional and plastic glazing, and metal structure sealing.

It may be factory applied to glass, plastic and metal assemblies as the primary seal in finished products or as a secondary seal in components which are to be field erected before receiving the primary seal.

Limitations

DOW CORNING 799 silicone glass & metal building sealant is not recommended for use below-grade or in horizontal joints where physical abuse or abrasion is likely to be encountered. This includes:

- Totally confined spaces where sealant cannot cure because of a lack of atmospheric moisture
- Surfaces which will be painted. The paint film will not stretch with the extension of the sealant and may crack or peel

TYPICAL PROPERTIES

These values are not intended for use in preparing specifications.

As Supplied	
Color	Clear
Sag or Slump	Nil
Tack-Free Time, at 77 F (25 C), 50% RH, minutes	25
Tooling Time, minutes	4-8
As Cured – after 7 days at 77 F (25 C) and 50% RH	
Durometer Hardness, Shore A, points	30
Ultimate Tensile Strength, psi (MPa)	275 (1.9)
Tear Strength, ppi (N/m)	30 (52.5×10^2)
Peel Strength, ppi (N/m)	30 (52.5×10^2)
Movement Capability, percent	±25
Staining	None
Weatherability (2000 hrs in Quv. Weatherometer)	No change in hardness

Specification Writers: Please contact Dow Corning Corporation, Midland, Michigan, before writing specifications on this product.

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• Glass to glass butt joints sealed with clear glazing sealant may contain small amounts of air which are trapped during the packaging and or application of the sealant. Appearance standards should be established and agreed upon prior to sealant application

HOW TO USE

A thin bead of DOW CORNING 799 silicone glass & metal building sealant will accommodate more movement than a thick bead. Joints containing DOW CORNING 799 silicone glass & metal building sealant should be no deeper than 1/2-inch (12.7mm) and no thinner than 1/4-inch (6.4mm). For perimeter sealing or expansion joint design, the ratio of joint width to sealant depth should be about 2:1.

Polyurethane or polyethylene foam rod is the recommended back-up material for deep joints. For joints too shallow to allow foam rod, polyethylene tape is recommended. These materials permit the application of a thin bead and act as bond breakers which allow the sealant to stretch freely with the joint movement.

Cleaning The Surface

Clean all joints and glazing pockets, removing all foreign matter and contaminants such as grease, oil, dust, water, frost, surface dirt, old sealants or glazing compounds and protective coatings.

Metal, glass and plastic surfaces shall be cleaned by mechanical or solvent procedures. **Detergent or soap and water treatment are not acceptable.** In all cases where used, solvents should be wiped on with a clean lint- and oil-free absorbent cloth. ***Caution:*** *When using flammable solvents, keep away from heat, sparks and open flames. Use only with adequate ventilation. Avoid prolonged breathing of vapor and prolonged or repeated skin contact. Always follow solvent container label instructions.*

Priming

Nonreflective glass surfaces to which DOW CORNING 799 silicone glass & metal building sealant is to be applied do not require priming. Refer to the table entitled "DOW CORNING 799 Silicone Glass & Metal Building Sealant Surface Preparation And Primer Guide" for more specific recommendations. Consult Dow Corning for priming recommendations on various other substrates. *NOTE: A bead of sealant on the substrate material to test adhesion prior to general job use is always a recommended procedure.*

Masking

After cleaning and priming, areas adjacent to joints may be masked to assure neat sealant lines. Do not allow masking tape to touch clean surfaces to which the sealant is to adhere. Tooling should be completed in one continuous stroke immediately after sealant application and before a skin forms.

Masking should be removed immediately after tooling.

Method of Application

Install back-up material or joint filler, setting blocks, spacer shims and tapes as specified. Apply DOW CORNING 799 silicone glass & metal building sealant in a continuous operation using a positive pressure adequate to properly fill and seal the joint. Tool or strike the DOW CORNING 799 silicone glass & metal building sealant to spread the material against the back-up material and the joint surfaces. A tool with a concave profile is recommended to keep the sealant within the joint.

In glazing, tool the sealant applied at the sill so that precipitation and cleaning solutions will not pool. DOW CORNING 799 silicone glass & metal building sealant can be applied at outdoor temperatures as low as −35 F (−37 C) provided the surfaces are clean, dry and frost-free.

FIGURE 1: SEALING GLASS WITH DOW CORNING 799 SILICONE GLAZING & METAL BUILDING SEALANT

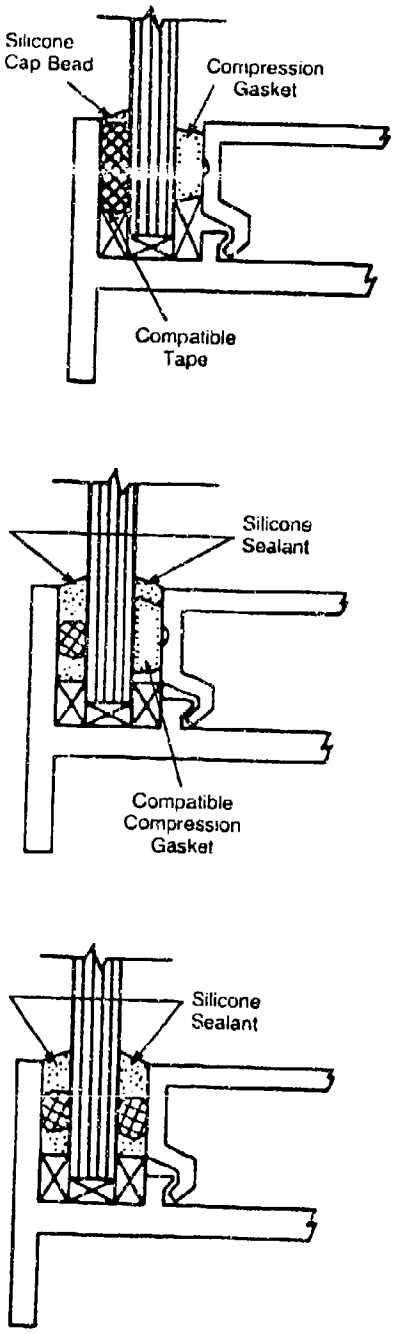


FIGURE 2: BUTT JOINT GLAZING

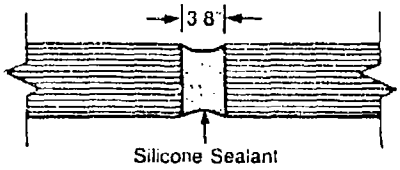


FIGURE 3: TYPICAL METAL SUBSTRATE APPLICATION

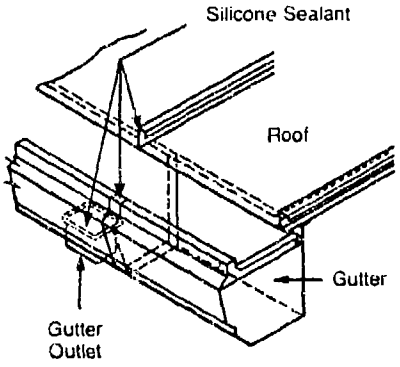
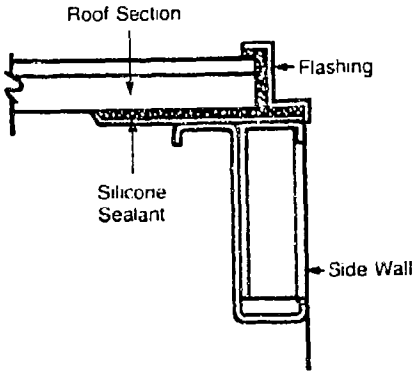


FIGURE 4: TYPICAL METAL BUILDING APPLICATION



DOW CORNING 799 SILICONE GLASS & METAL BUILDING SEALANT SURFACE PREPARATION AND PRIMER GUIDE*

Substrate	*Surface Preparation*	*Recommended Primer*
Glass, nonreflective, tile	Oil-free solvent wipe	None
Glass, reflective	Oil-free solvent wipe	Generally none, but will vary with manufacturer; pretest
Anodized and mill finish aluminum	Oil-free solvent wipe	None
Most steels: carbon, stainless, weathering, cold rolled, galvanized	Oil-free solvent wipe	None
Masonry	Abrade and oil-free solvent wipe	None
Most plastics, such as polycarbonate, PVC	Oil-free solvent wipe	None

*Surfaces should be sound, clean and dry, and free of dust, oils, laitance or other materials which could impair adhesion. Substrates should be tested for adhesion and compatibility. For a more complete surface preparation, please contact your local Dow Corning representative.

Excess sealant should be cleaned from glass, metal and plastic surfaces while still uncured using a commercial solvent such as xylol, toluol or methyl ethyl ketone. *Note: See earlier comment regarding use of cleaning solvents.* Should sealant accidentally contact adjacent porous surfaces, the excess sealant should be allowed to progress through the initial cure or set-up. It should then be removed by abrasion or other mechanical means.

CAUTION

On contact, uncured sealant may irritate eyes. Avoid eye contact. KEEP OUT OF REACH OF CHILDREN.

SHIPPING LIMITATIONS

None.

STORAGE AND SHELF LIFE

When stored in original, unopened containers at or below 90 F (32 C), DOW CORNING 799 silicone glass & metal building sealant has a shelf life of 12 months from date of shipment.

For best results, keep DOW CORNING 799 silicone glass & metal building sealant in tightly closed containers when not in use.

PACKAGING

DOW CORNING 799 silicone glass & metal building sealant is packaged in 10.3-fl-oz (305-ml) disposable cartridges which fit ordinary caulking guns and 4.5-gal (17-liter) bulk pails. It can be dispensed by many air-operated guns and most types of bulk dispensing equipment.

APPLICABLE STANDARDS:

DOW CORNING 799 silicone glass & metal building sealant meets or exceeds the test requirements of:

A. Federal Specification TT-S-001543A (COM-NBS) Class A

B. Federal Specification TT-S-00230C (COM-NBS) Class A

C. ASTM Specification: C-920 Type S, Grade NS, Class 25, Use T, NT, M, G, A; and GSA (C.I.D.) No. AA-1556 Type S, Grade NS, Class 25, Use T, NT, M, G, A.

USERS PLEASE READ

The information and data contained herein are believed to be accurate and reliable; however, it is the user's responsibility to determine suitability of use. Since Dow Corning cannot know all of the uses to which its products may be put or the conditions of use, it makes no warranties concerning the fitness or suitability of its products for a particular use or purpose.

You should thoroughly test any proposed use of our products and independently conclude satisfactory performance in your application. Likewise, if the manner in which our products are used requires governmental approval or clearance, you must obtain it.

Dow Corning warrants only that its products will meet its specifications. There is no warranty of merchantability or fitness for use, nor any other express or implied warranty. The user's exclusive remedy and Dow Corning's sole liability is limited to refund of the purchase price or replacement of any product shown to be otherwise than as warranted. Dow Corning will not be liable for incidental or consequential damages of any kind.

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MIDLAND, MICHIGAN 48640

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DOW CORNING

Guide Specifications

DOW CORNING

DOW CORNING® 888 SILICONE HIGHWAY JOINT SEALANT

GENERAL

A significant increase in the use of low-modulus silicone sealant in concrete highway joint applications has resulted from superior product performance in these and related applications. This success stems from the unique properties of silicone rubber, coupled with improved installation techniques. Because the properties of silicone materials differ from those of traditional sealing materials, many of the standard tests for specifying and testing used in the past by highway and other engineers do not apply to silicones. As a result, different tests and test procedures are required.

1.0 SCOPE

1.1 This specification provides a brief description of DOW CORNING® 888 silicone highway joint sealant, a list of general uses and an explanation of recommended test methods. A sample specification is also provided, as is an explanation of warranty.

2.0 PRODUCT DESCRIPTION

2.1 DOW CORNING 888 silicone highway joint sealant is a one-part silicone material that cures to a low-modulus silicone rubber upon exposure to atmospheric moisture. The cured silicone rubber remains flexible over a wide temperature range.

2.2 DOW CORNING 888 silicone highway joint sealant is used on transverse and longitudinal highway joints, bridge joints, runways, parking lots and decks, sidewalks, random cracks, curves and gutters.

3.0 MATERIAL

3.1 Material shall be manufactured and supplied by Dow Corning Corporation, Midland, Michigan 48640, its authorized distributor or other approved source.

4.0 DELIVERY AND STORAGE

4.1 Material shall be delivered in original, tightly sealed containers, clearly labeled with the manufacturer's name, product identification and lot numbers where applicable.

4.2 Material shall be stored out of the weather, in original, tightly sealed containers, as recommended by the manufacturer.

5.0 TEST METHODS AND PROCEDURES

5.1 There are two general types of tests: quality control and performance. Quality control tests require relatively short testing times. They measure the characteristics of the sealant as supplied and additional properties when cured. Performance tests are generally durability tests and require longer testing times. Their purpose is to determine if the sealant has the capability to perform in a specific application.

5.2 Quality control tests measure flow, specific gravity, extrusion rate and tack-free time of the sealant as supplied. Durometer, modulus, elongation and adhesion are measured after a test sample of the sealant has completely cured.

5.2.1 Flow is a measure of the ability of the sealant to flow or resist flow under vertical test conditions.

5.2.2 Tack-free time is a measure of the time required for the surface of the sealant to become dry to the touch. This initial cure provides an indication of when, following installation, the sealant will resist "tracking." Mil Spec 8802 is frequently used for this test.

5.2.3 Extrusion rate is a measure of the rate the sealant is extruded from a caulking tube through a 1/8-inch opening under 90 pounds per square inch (psi) of pressure.

5.2.4 Specific gravity is a measure of the weight of the sealant in comparison to that of water. ASTM D 792, Method A, is generally used for this test.

5.2.5 Durometer is a measure of the relative hardness of the sealant. Values are obtained on a cured rubber slab and can be used to provide an indication of flexibility. Generally, as the values increase, flexibility decreases. ASTM D 2240 is a frequently used test method.

5.2.6 Modulus is a measure of the force required to stretch a rubber test bar to a specific elongation. A key requirement of the sealant is its ability to withstand stretch in the form of cyclic movement. A superior sealant offers minimum resistance to such

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movement, and hence, a low modulus rating. ASTM D 412, Die C, is a procedure used to measure this force. Results are reported in psi at a specified elongation. Typically, 150 percent is used.

5.2.7 Elongation is a measure of the ultimate extention of a sealant. Generally, the higher the elongation property, the greater the ability of the sealant to withstand movement and the lower its modulus value. ASTM D 412, Die C, is also used for this method.

5.2.8 Adhesion is a measure of the adhesion of a sealant to a substrate. In the field, adhesion must be maintained even while the sealant material is being stretched. Consequently, testing includes a simulated situation using a 1/2-inch-wide × 1/2-inch-thick × 2-inch-long bead of sealant positioned between two 1-inch-wide × 2-inch-high × 3-inch-long concrete blocks in a manner similar to that shown of the end view of the standard joint design in Figure I. The sealant is on the 2-inch × 3-inch block faces. It is stretched to achieve the minimum desired value plus an insurance factor. For example, a 1/2-inch wide joint stretched 200 percent (1/2 inch – >1½ inch) demonstrates that the sealant has the ability to withstand 100 percent movement plus an insurance factor. It is unlikely that a joint would actually move that much in the field.

5.3 Performance testing assures that the sealant has the capability of performing as required. Laboratory testing does not automatically guarantee field performance, but it is a good indicator.

5.3.1 Cyclic movement measures the sealant's ability to withstand the thermal expansion/contraction movement associated with horizontal pavements. ASTM C 719 is one method that can be used to measure cyclic movement. This method incorporates a conditioning period followed by performance testing of specific movement capability requirements. Such testing allows the specifier to set up performance classes for different sealants or to distinguish between sealants within a certain generic class.

5.3.2 Accelerated weathering measures any degradation occurring when the sealant is exposed to simulated environmental conditions such as ultraviolet radiation or rain. The test method commonly used is ASTM C 793-75. With this method, a slab of cured sealant is placed in a weather-o-meter where it is subjected to alternating cycles of ultraviolet radiation and rain for a specified length of time such as 500, 1,000, or 5,000 hours. After the specified time, the sample is then placed in a freezer, bent around a mandrel and checked for cracks, blisters or other signs of degradation. ASTM C 793-75 uses carbon arc and generally requires approximately 1½ years to perform.

6.0 INSTALLATION CONSIDERATIONS

6.1 Proper joint design and proper joint preparation are both necessary to obtain the maximum performance that a sealant has to offer. Good joint design and inadequate joint preparation can lead to premature failure. Similarly, good joint preparation and poor design can lead to premature failure.

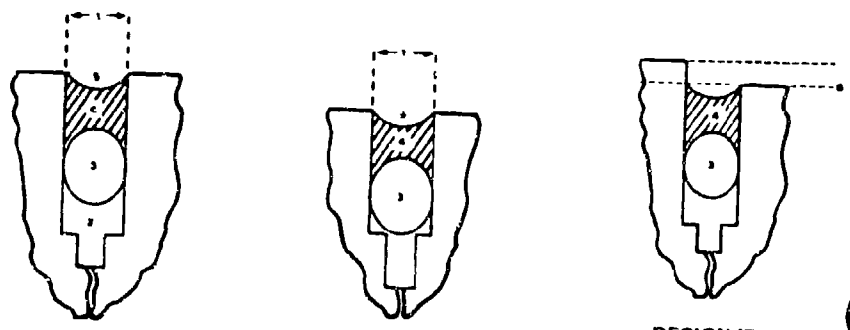
6.2 Proper joint design plays a significant part in the long-term success of the sealant. Proper design ensures that the sealant is used within its movement capability and includes a safety factor of 2 to 3 (sealant's capability is 2 to 3 times larger than anticipated movement). Slab length, joint width, temperature at installation, type of concrete, and location, such as in northern or southern climates, are factors that influence the amount of movement. Other factors include the type of project, whether it is new construction or rehabilitation, and if future work such as grinding is anticipated. Figure I shows different joint designs that may be used. All of these designs have certain common features that are essential to performance. Random cracks such as transverse cracks are generally assumed to be working cracks and are treated like working joints. Common joint design features include:

6.2.1 Joint width wide enough to accommodate movement.

6.2.2 Joint sawed deep enough to allow backer rod/sealant placement and space for pumping of old sealing compounds. *NOTE:* This applies to standard joints only; a void space beneath backer rod in new construction is not needed.

6.2.3 Proper backer rod placement, preventing three-sided adhesion.

FIGURE I: GOOD JOINT DESIGNS



STANDARD JOINT

SHALLOW CUT JOINT FOR NEW CONSTRUCTION

DESIGN IF GRINDING IS ANTICIPATED

TABLE I: ESTIMATING JOINT REQUIREMENTS

Joint Width, inches	*Minimum Joint Depth, inches*	*Backer Rod Diameter, inches*	*Backer Rod Placement Depth, inches*	*Sealant Bead Thickness, inches*
1/4	1	3/8	1/2	1/4
3/8	1¼	1/2	1/2	1/4
1/2	1¼	5/8	1/2	1/4
5/8	1½	3/4	9/16	5/16
3/4	1¾	1	7/8	3/8
7/8	1¾	1	11/16	7/16
1	2	1¼	3/4	1/2
>1	2+	1¼+	3/4	1/2

6.2.4 Sealant installed to proper depth and width.

6.2.5 Sealant tooled approximately 1/4 inch below the pavement surface.

6.2.6 Depth of lowest slab determines the amount of recess required if grinding is anticipated; once grinding is complete, the sealant will have proper recess below the pavement surface.

6.3 Joint preparation details must be observed to achieve a proper bond. The concrete surfaces to which the sealant is applied must be clean and dry at the time of sealant installation. There are several techniques that are used to accomplish this. The technique or combination of techniques selected depends on the specific application. The more commonly used procedures include diamond sawing, water washing, sandblasting and high pressure air blasting. Each step performs a specific function.

6.3.1 Saw cutting removes old sealant by slightly widening the joint. It also provides a joint wide and deep enough to accommodate the sealant and the bond breaker. Table I shows minimum joint saw depths for various joint widths.

6.3.2 After saw cutting is complete, the joints are washed with water to remove cement slurry from the joint. The effectiveness of this operation depends on the water pressure. As pressure increases, slurry removal will be more complete. Water pressure of 2,000 psi is generally effective for complete slurry removal. The disadvantage of this technique is the long drying time required, especially in the spring and fall.

6.3.3 Sand blasting is another technique that effectively removes cement slurry from joint walls. Because this technique is a "dry" step, less time is lost waiting for joints to dry.

6.3.4 High pressure air blast is employed to remove residual dust and dirt. The air must be oil- and water-free.

6.3.5 These techniques are not all-inclusive. Others can be used. The important requirement is that joints be clean and dry prior to sealant placement.

6.4 Other sealant installation considerations must be observed.

6.4.1 After the joints have been properly cleaned, expanded closed-cell polyethylene foam rod back-up material is installed in the joints. This material permits the application of a thin bead of sealant and acts as a bond breaker, allowing the sealant to stretch freely with joint movement. Table I shows proper backer rod size for various joint widths.

6.4.2 The sealant is applied in a continuous operation to properly fill and seal the joint width. Installation temperature should be above 4.4 C (40 F).

6.4.3 The joint is tooled with a blunt instrument so that it is slightly concave and approximately 1/4 inch below the road surface. Tooling should be done before a "skin" forms, usually within 10 minutes of application.

7.0 SAMPLE SPECIFICATION

7.1 A sample specification showing material properties and test procedures that could be used for DOW CORNING 888 silicone highway joint sealant is shown in Table II.

TABLE II: SAMPLE SPECIFICATION FOR DOW CORNING® 888 SILICONE HIGHWAY JOINT SEALANT

Test Method	*Test*	*Material Requirement*
As Supplied		
MIL-S-8802	Flow, maximum	0.2
ASTM D 792	Specific Gravity	1.4 to 1.515
MIL-S-8802	Extrusion Rate, grams per minute	90 to 250
MIL-S-8802	Tack-Free Time, minutes	35 to 75
Upon Complete Cure		
ASTM D 2240	Durometer[1]	15 to 25
ASTM D 412, Die C	Modulus, at 150% elongation[1], psi maximum	45
ASTM D 412, Die C	Elongation[1], % minimum	1200
CTM[2] 0950	Adhesion to Concrete[1], % minimum	500
Performance		
ASTM C 719-7	Movement, %	+100/-50
ASTM D 793-7	Accelerated Weathering, at 5,000 hours	No cracks, blisters or bond loss

[1]Sample cured 7 days at 25 ± 1 C (77 ± 2 F) and 50 ± 5% relative humidity. Proper joint design and proper joint preparation are necessary for maximum performance. See Section 6.0.

[2]In most cases, Corporate Test Methods (CTM's) correspond to ASTM standard tests. Copies of CTM procedures are available upon request.

Specification Writers: Please contact Dow Corning Corporation, Midland, Michigan, before writing specifications on this product.

7.2 Certification: Upon request, the sealant manufacturer will furnish certification showing that every lot of sealant will meet the requirements listed in Section 5 with the exception of cyclic movement and accelerated weathering. Once the initial performance has been demonstrated for movement and accelerated weathering, updated results can be provided on an as-needed basis.

7.3 Special testing: If this type of testing is deemed necessary for a specific project, the sealant should be present at least two weeks prior to project start-up. If the sealant is to be tested in nonstandard testing, the manufacturer should be contacted at least 30 days in advance.

7.4 Bond breakers: All materials used as bond breakers shall be compatible with the sealant. Only materials recommended by the sealant manufacturer should be used. Closed-cell polyethylene foam rod is the only material permitted with DOW CORNING 888 silicone highway joint sealant.

7.5 Joint preparation and sealant installation:

7.5.1 Existing sealing materials must be removed from the joint by saw cutting, plowing or any other method deemed appropriate.

7.5.2 Joints must be sawed to the proper width and depth. See Figure II. A 1/2-inch wide joint is shown as an example.

7.5.3 The joint must be thoroughly cleaned as soon as possible after cutting to remove all scale, dirt, dust, residue and any other foreign materials that might prevent bonding. Water blasting or sand blasting is recommended.

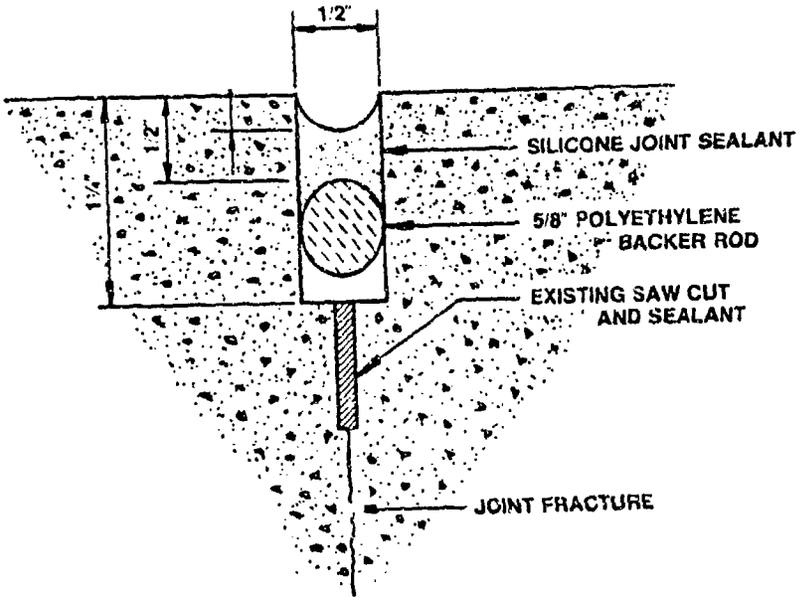
7.5.4 The joint must be inspected for cement residue on the joint face. If water blasting is used, the joint should be inspected after it has dried. Rubbing one's finger across the joint face is a way to check for residual dust.

7.5.5 Immediately before installation of the sealant, the joint must be cleaned and blown dry with water- and oil-free compressed air. The joint must be completely free of dirt, dust, moisture or other foreign materials.

7.5.6 The recommended bond breaker must be installed as shown in Figure II.

7.5.7 The sealant must be installed as described in "Installation Guide for DOW CORNING® 888 Silicone Highway Joint Sealant," (Form No. 61-507A-82). Immediately following sealant placement, it must be tooled below the pavement surface, as shown in Figure II.

FIGURE II: JOINT CONFIGURATIONS – RESEALED EXISITNG TRANSVERSE AND LONGITUDINAL JOINTS



The information and data contained herein are based on information we believe reliable. You should thoroughly test any application and independently conclude satisfactory performance before commercialization. Suggestions of uses should not be taken as inducements to infringe any particular patent.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN 48640

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Form No. 61-825-85

DOWCORNING

Information about Silicone Elastomers

DOW CORNING

DESCRIPTION

SILASTIC® 734 RTV self-leveling adhesive/sealant is a free-flowing, self-leveling, one-component material. Its low viscosity allows it to fill minute crevices and voids in potting and sealing applications. Supplied ready-to-use, this material cures at room temperature to a tough, rubbery solid. It adheres well to most common substrates including many metals, glass, most woods, ceramics, and various plastics.

SILASTIC® 734 RTV self-leveling adhesive/sealant resists weathering, moisture, vibration, ozone, and temperature extremes. In addition, it stays flexible from −85 to 450 F (−65 to 232 C).

USES

SILASTIC® 734 RTV self-leveling adhesive/sealant is primarily used in applications where a free-flowing, one-part sealant is needed. Applications include potting electrical terminals, coating mechanical devices, sealing ammunition fuses, and making formed-in-place gaskets.

HOW TO USE

SILASTIC® 734 RTV self-leveling adhesive/sealant is easy to use. It pours readily from its container for dip, brush or spray application and cures upon contact with moisture in the air to form a tough, flexible silicone rubber.

Cure Time

SILASTIC® 734 RTV self-leveling adhesive/sealant begins to cure upon exposure to moisture in the air. The cure progresses inward from the surface. At 75 F (24 C) and 50% relative humidity, the

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SILASTIC® 734 RTV SELF-LEVELING ADHESIVE/SEALANT

Type	One-component silicone rubber
Physical Form	Liquid
Cure	At room temperature upon exposure to moisture in the air
Special Properties	Free-flowing; self-leveling; low viscosity; good adhesion to most surfaces
Primary Uses	Various potting, coating and sealing applications

TYPICAL PROPERTIES

These values are not intended for use in preparing specifications.

As Supplied		
	Colors	White, clear
	Specific Gravity at 77 F (25 C)	1.04
	Consistency	Pourable
	Viscosity, poises	440
	Solid Content, percent	95
	Extrusion Rate (⅛" orifice, 90 psi air pressure), gms per min	450
As Cured*		
	Skin-Over Time, minutes	9
	Tack-Free Time, minutes	20
	Cure Time (⅛" thickness), hours	24
As Cured — Physical†		
ASTM D 2240	Durometer Hardness, Shore A	24
ASTM D 412	Tensile Strength, psi (MPa)	220
ASTM D 412	Elongation, percent	370
ASTM D 624	Tear Strength, die B, ppi (kN/m)	20 (3.5)
ASTM D 746	Brittle Point, degrees	-100 F (-73 C)
As Cured — Electrical		
	Volume Resistivity at 73.4 ± 3.6° F (23 ± 2° C), ohm/cm	1.7×10^{15}
	Dielectric Constant,	
	at 100 Hz	2.7
	at 100,000 Hz	2.7
	Dissipation Factor,	
	at 100 Hz	0.007
	at 100,000 Hz	0.0006
	Dielectric Strength at 77 F (25 C), 75 mil thickness, volts per mil	450

*Exposed to air at 77 F (25 C) and 50% relative humidity.
†Measured on 0.125-inch-thick slabs, exposed to air at 77 F (25 C) and 50% relative humidity for 72 hours.

Specification Writers: Please contact Dow Corning Corporation, Midland, Michigan, before writing specifications on this product.

sealant forms a tack-free skin within an hour.

Material beneath the tack-free skin continues to cure and, in about 24 hours at room temperature, sections ⅛-inch thick or less cure to a rubber with a Shore A durometer hardness of about 25.

Curing time is extended as the thickness of the rubber increases. A ½-inch cross-section, for example, may require 3 or 4 days for complete cure. However, the outer ⅛-inch will cure in about 24 hours.

In applications where SILASTIC® 734 RTV self-leveling adhesive/sealant may be partly or totally confined during cure, the time required for proper cure is lengthened by the degree of confinement. It is possible, with absolute confinement, that cure will not be completed. Metal-to-metal bonds should not overlap more than one inch. Every application involving confined cure should be thoroughly tested before commercialization.

Bonding

SILASTIC® 734 RTV self-leveling adhesive/sealant bonds to most materials but will *NOT* adhere to polyethylene and certain plastic and organic rubbers which exude fluids such as plasticizers. Bond strength varies accordingly to the substrate.

Stronger bonds are obtained by preparing surfaces with Dow Corning® 1200 prime coat. For best results:

1. Clean all surfaces, then wipe or rinse with acetone. Rubber surfaces should be roughened with sand-paper and wiped with acetone.

2. Apply a thin film of Dow Corning 1200 prime coat to all surfaces except silicone rubber. The primer should be allowed to dry 1 hour. A longer dry time may be required under conditions of low humidity.

Caution: *Dow Corning 1200 prime coat and acetone are flammable. Keep away from heat, sparks and open flame. Use only with adequate ventilation. In addition, when using flammable solvents, always follow all precautions given on solvent container label.*

Dow Corning 1200 prime coat has no FDA status.

3. If SILASTIC® 734 RTV self-leveling adhesive/sealant is being used as an adhesive, it should be applied to both surfaces and immediately put in place with enough pressure to assure uniform contact. (Best adhesion is obtained with a 10 to 30 mil glue line.)

4. Let the unit stand undisturbed for 24 hours.

FDA Status

When fully cured and washed, SILASTIC® 734 RTV self-leveling adhesive/sealant meets the requirements of FDA Regulation No. 21 CFR 177.2600 (formerly 121.2562) subject to end use compliance with any applicable total extractives limitations.

NSF Status

SILASTIC® 734 RTV self-leveling adhesive/sealant is listed by the National Sanitation Foundation under the criteria C2 for direct contact with food.

UL Status

SILASTIC® 734 RTV self-leveling

adhesive/sealant is recognized by Underwriters Laboratories, Inc. for service to 302 F (150 C) where elongation is not essential.

CAUTION

On direct contact, SILASTIC® 734 RTV self-leveling adhesive/sealant irritates eyes. In case of eye contact, flush eyes immediately with water and consult a physician.

Additionally, until fully cured, SILASTIC® 734 RTV self-leveling adhesive/sealant releases acetic acid. Avoid prolonged or repeated skin contact with uncured or partly cured material.
KEEP OUT OF REACH OF CHILDREN

SHIPPING LIMITATIONS

None.

STORAGE AND SHELF LIFE

When stored in original unopened containers at or below 90 F (32 C), SILASTIC® 734 RTV self-leveling adhesive/sealant has a shelf life of 12 months from date of shipment.

Refrigeration is unnecessary. Containers should always be kept sealed when not in use. Once a container of sealant has been opened, a plug of cured material may form in the nozzle or tube tip during storage. This is easily removed and does not affect the remaining contents.

PACKAGING

SILASTIC® 734 RTV self-leveling adhesive/sealant is supplied in 3-fl. oz. tubes, 10.7-fl. oz. cartridges and 4.5-gal. pails.

USERS PLEASE READ

The information and data contained herein are believed to be accurate and reliable; however, it is the user's responsibility to determine suitability of use. Since Dow Corning cannot know all of the uses to which its products may be put or the conditions of use, it makes no warranties concerning the fitness or suitability of its products for a particular use or purpose.

You should thoroughly test any proposed use of our products and independently conclude satisfactory performance in your application. Likewise, if the manner in which our products are used requires governmental approval or clearance, you must obtain it.

Dow Corning warrants only that its products will meet its specifications. There is no warranty of merchantability of fitness for use, nor any other express or implied warranties. The user's exclusive remedy and Dow Corning's sole liability is limited to refund of the purchase price or replacement of any product shown to be otherwise than as warranted. Dow Corning will not be liable for incidental or consequential damages of any kind.

Suggestions of uses should not be taken as inducements to infringe any patents.

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MIDLAND, MICHIGAN 48640

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Printed in U.S.A. Form No. 61-0561-80

DOW CORNING

Information About Silicone Elastomers

DOW CORNING

DESCRIPTION

DOW CORNING® 736 heat resistant sealant is a one-part, nonslumping paste that cures to a tough, rubbery solid at room temperature on exposure to water vapor in the air. This silicone product was formulated to perform at temperatures ranging from -65 to 260 C (-85 to 500 F) for continuous operation and to 316 C (600 F) for intermittent exposure. It can be used for numerous sealing and bonding applications.

USES

The high temperature properties of this sealant make it ideally suited for:

- Sealing and encapsulating heating elements in appliances
- Aerospace gasketing
- Moving oven belts
- Industrial ovens
- Bag filters on smoke stacks
- Other critical bonding, sealing, potting, encapsulating and protective coatings where parts must perform at high temperatures

HOW TO USE

Applying the Material: Tack-Free Time

DOW CORNING 736 heat resistant sealant is supplied ready to use.

Under pressure, it flows readily from its container. The pastelike consistency makes it easy to work: a spatula or wooden paddle can be used for tooling the surface.

The cure progresses inward from the surface. At conditions of at least 25 C (77 F) and 50 percent relative humidity the sealant forms a tack-free skin within 15 minutes. Tooling is not practical after the skin begins forming and should be completed within 5 to 10 minutes of application, even though this may require alternate periods of applying and tooling. Likewise, if masking tape has been used to mark off an area, it should be removed before the tack-free skin forms.

Cure Time

Cure time is affected by relative humidity, degree of confinement, and cross-sectional thickness of the sealant. Sections up to 1/8-inch thick become rubbery solids in about 24 hours at 25 C (77 F) at 50 percent relative humidity. Less moisture content reduces it slightly. In 24 hours, sections up to 1/8-inch thick cure to a rubber with a Shore A durometer hardness rating of about 25 points. After 3 days at room temperature, this durometer hardness levels off to about 32 points.

In applications where DOW CORNING 736 heat resistant sealant may be partly or totally confined during cure, the time

DOW CORNING® 736 HEAT RESISTANT SEALANT

Type	One-part, nonslumping silicone paste
Cure	Cures at room temperature by reaction with moisture in the air
Special Properties	Performs at temperatures ranging from -65 to 260 C (-85 to 500 F) for continuous operation and to 316 C (600 F) for intermittent exposure
Primary Uses	Bonding, sealing, potting, encapsulating and protective coating operations where parts must perform at high temperatures

TYPICAL PROPERTIES

These values are not intended for use in preparing specifications.

As Supplied	
Color	Red
Flow Slump	nil
Extrusion Rate (1/8-inch orifice, 90 psi), grams/minute	335
Cure Characteristics – exposed to air, 25 C (77 F) and 50% RH	
Skin-Over Time, minutes	6
Tack-Free Time, minutes	15
Cure Time (1/8-inch thickness), hours	24
As Cured – after 72 hours at 25 C (77 F) and 50% RH	
Durometer, Shore A, points	32
Tensile Strength, psi	350
Elongation, percent	500
Unprimed Adhesion (most substrates)	good

[illegible]

Specification Writers: Please contact Dow Corning Corporation, Midland, Michigan, before writing specifications on this product.

required for proper cure is generally lengthened by the degree of confinement. It is possible, with absolute confinement, that cure will not be completed. The result is the softening of the sealant at elevated temperatures. Metal-to-metal bonds should not overlap more than 1 inch. Every application involving confinement during cure should be thoroughly tested before commercialization.

Curing time increases with the thickness of the sealant. A 1/2-inch cross section, for example, may require 3 or 4 days for complete solidification. However, the cure will have penetrated the outer 1/8-inch in about 24 hours.

Adhered to glass, metal or most woods, DOW CORNING 736 heat resistant sealant has a typical peel strength of 20 pounds per inch after 72 hours at room temperature.

The odor given off during cure is due to the liberation of acetic acid. This odor disappears as the cure progresses and is not detectable after the cure is complete.

Bonding

1. Thoroughly clean and degrease metal and plastic surfaces, then rinse all surfaces, except plastic, with acetone. Rubber surfaces should be roughened with sandpaper, then wiped with acetone. Follow the precautions given on the solvent container label.

2. For stronger, more uniform bonds, apply a thin film of DOW CORNING® 1200 RTV prime coat to all surfaces except rubber and silicone rubber. Allow to air-dry for 30 to 45 minutes at room temperature. (Full instructions are provided with the prime coat.) *Caution:* DOW CORNING 1200 RTV prime coat is flammable and has no FDA status. Keep away from heat and open flames. Use only with adequate ventilation.

3. Apply DOW CORNING 736 heat resistant sealant to the prepared surface in a uniform thickness. Best adhesion is obtained with a 15- to 30-mil glue line. In those cases where the adhesive is used between two surfaces, put the second surface in place, using enough pressure to displace the air but not the adhesive.

4. Let the unit stand undisturbed at room temperature to cure.

Sealing

Using DOW CORNING 736 heat resistant sealant in sealing applications follows approximately the same step-by-step procedures as outlined for bonding applications. After preparing the surfaces and priming where required, the sealant is applied by forcing it into the joint or seam to obtain full contact between sealant and surfaces.

FDA STATUS

When fully cured and washed, DOW CORNING 736 heat resistant sealant meets the requirements of FDA Regulation No. 21 CFR 177.2600 subject to end use compliance with any applicable total extractives limitations.

NSF STATUS

DOW CORNING 736 heat resistant sealant is listed by the National Sanitation Foundation under the criteria C2 for direct contact with food.

USDA STATUS

DOW CORNING 736 heat resistant sealant is authorized by the United States Department of Agriculture for use in federally inspected meat and poultry plants.

UL STATUS

DOW CORNING 736 heat resistant sealant is recognized by Underwriters Laboratories for service to 150 C (302 F) where elongation is not essential.

SPECIFICATIONS

DOW CORNING 736 heat resistant sealant is designed to meet the requirements of MIL-A-46106A, Amendment 2, Type 1.

CAUTION

On contact, uncured sealant causes irritation. Avoid contact with eyes and skin. Contact lens wearers take appropriate precautions. In case of contact, flush eyes with water. Call a physician. Remove from skin with dry cloth or paper towel. Sealant releases acetic acid (vinegarlike odor) during cure. Keep out of reach of children.

SHIPPING LIMITATIONS

None.

STORAGE AND SHELF LIFE

When stored in its original unopened container at or below 32 C (90 F), DOW CORNING 736 heat resistant sealant has a shelf life of 12 months from the date of shipment.

PACKAGING

DOW CORNING 736 heat resistant sealant is supplied in 3-fl oz (90-mL) collapsible tubes, 10.3-fl oz (305-mL) plastic cartridges, 10.3-fl oz (305-mL) collapsible tubes, 4.5-gal (17-L) pails and 55-gal (208.2-L) drums.

The information and data contained herein are based on information we believe reliable. You should thoroughly test any application and independently confirm satisfactory performance before commercialization. Suggestions of uses should not be taken as inducements to infringe any particular patent.

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MIDLAND, MICHIGAN 48686-0994

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DOW CORNING

SPEC DATA®

This Spec-Data Sheet conforms to editorial style prescribed by The Construction Specifications Institute. The manufacturer is responsible for technical accuracy.

1. PRODUCT NAME

Dow Corning® 790 silicone building sealant· A one-part, low modulus elastomeric sealant.

2. MANUFACTURER

DOW CORNING CORPORATION
Midland, Michigan 48640
Phone: (517) 496-4000

3. PRODUCT DESCRIPTION

Dow Corning 790 silicone building sealant is a one-part silicone formulation that cures in the presence of atmospheric moisture to produce a durable, flexible, and very low-modulus silicone rubber building joint seal.

Because of its ultra-low modulus, high elongation, compression/extension recovery, and its ability to form strong, durable bonds with most building materials, this sealant provides excellent performance, even in building joints that experience extreme movement.

Basic Uses:

Dow Corning 790 silicone building sealant is particularly effective for sealing expansion and control joints. Typical uses include expansion control joints, precast concrete panel joints, curtainwall joints, mullion joints, and many other construction joints.

The sealant forms durable, flexible, watertight bonds with most building materials in any combination: stone, masonry, ceramics, marble, wood, steel, aluminum, and many plastics. In many cases, no prime coat is required.

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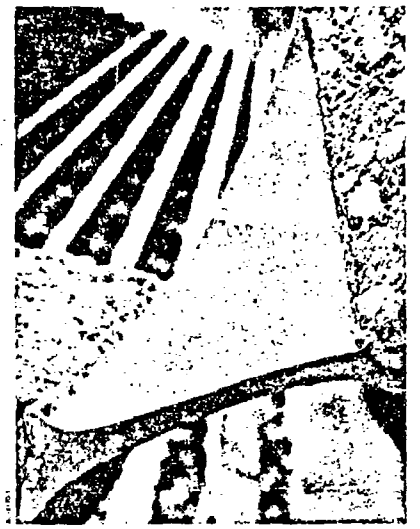
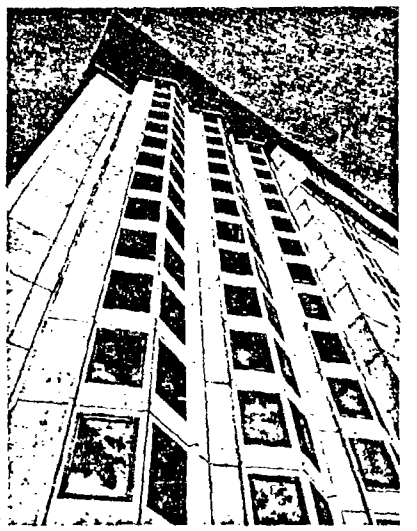




TYPICAL PROPERTIES

These values are not intended for use in preparing specifications.

As Supplied		
MIL-S-8802D	Tack-Free Time, hours	1
MIL-S-8802	Curing Time, days/77 F (25 C)	7-14
	Full Adhesion, days	14-21
MIL-S-8802D	Flow, sag or slump	Nil
	Working Time, minutes	10-20
As Cured — after days/77 F (25 C) and 50% RH		
ASTM D 2240	Durometer Hardness, Shore A, points	15
ASTM D 412	Ultimate Tensile Strength, maximum elongation, psi	100 (0.07 kgf/mm²)
ASTM D 412	Elongation, percent max	1600
MIL-S-8802D TT-S-00230	Peel Strength, lbs/in	25 (4.46 kg/cm)
ASTM C 510 TT-S-001543	Staining	None
	Ozone Resistance	Good
	Weathering, after 6,000 hours in Atlas Weatherometer	No change in hardness
	Joint Movement Capabilities, percent	
	Extension	+100
	Compression	-50

Specification Writers: Refer to Dow Corning Corporation, MANU-SPEC® Section 07900, SEALANTS.

August, 1983
(Supersedes September, 1981)
7p
JOINT SEALERS
Silicone Building Sealant

Limitations:

Dow Corning 790 silicone building sealant is not recommended for use below grade on concrete or on horizontal joints where abrasion and physical abuse are likely to be encountered.

It is not recommended for continuous immersion in water.

Dow Corning 790 silicone building sealant should not be applied:

A. To building materials that bleed oils, plasticizers, or solvents — materials such as impregnated wood, oil-based caulks, green or partially vulcanized rubber gaskets or tapes.

B. In totally confined spaces because the sealant requires atmospheric moisture for cure.

C. To surfaces which will be painted. The paint film will not stretch with the extension of the sealant and may crack and peel.

D. To surfaces in direct contact with food. This sealant has not been tested to determine its status under Federal Food and Drug Administration regulations. For food contact use, Dow Corning® silicone rubber sealant is recommended.

Composition and Materials:

Dow Corning 790 silicone building sealant is a low-modulus, one-part, ready-to-use material which has a consistency like that of toothpaste. This consistency remains uniform over a wide temperature range from -20 to 160 F (-29 to 71 C) allowing the sealant to be applied easily at most any temperature.

TABLE I: WEATHEROMETER TEST DATA

The following data was obtained from Weatherometer testing of Dow Corning 790 silicone building sealant. The test was run in an Atlas Weatherometer Model XW Sunshine, and conforms to the requirements of ASTM D 822 Type E.

Test	*Test Method*	*Initial*	*6000 Hours*
Durometer Hardness, Shore A, points.....	ASTM D 2240	15	15
Ultimate Tensile Strength, at maximum elongation, psi	ASTM D 412 Die C	105	80
Peel Strength, unprimed concrete	ASTM D 903	39 lb/100% cohesive failure	37 lb/100% cohesive failure
Peel Strength, unprimed aluminum ...	ASTM D 903	41 lb/100% cohesive failure	30 lb/100% cohesive failure

Prime coats are not required with concrete, glass, and many aluminum surfaces. Some treated aluminums may require use of a prime coat.

See Table II and consult Dow Corning for priming recommendations on other materials.

In all cases, it is recommended a sample be tested and/or a test placement be installed on the project.

Packaging:

Dow Corning 790 silicone building sealant is packaged in 10.3-fl oz (305-ml) disposable cartridges which fit ordinary caulking guns and in 2.0-gal (7.5-l) bulk pails. It can be dispensed by many air-operated guns and most types of bulk dispensing equipment.

Colors:

Dow Corning 790 silicone building sealant is available in five standard colors: black, white, gray, natural stone, and bronze.

Applicable Standards:

Dow Corning 790 silicone building sealant exceeds the durability requirements of Federal Specification TT-S-001543A for silicone building sealants, Federal Specification TT-S-00230C for one-component building sealants and Canadian Specification 19GP9A. These specifications require that sealants pass tests at joint movements of ±12½% and ±25%. Dow Corning 790 silicone building sealant passed both sets of tests at ±50% joint movement. Data from an independent lab test is available.

4. TECHNICAL DATA

Dow Corning 790 silicone building sealant is virtually unaffected by sunlight, rain, sleet, snow, ultraviolet radiation, ozone, or extremes of temperature (see Table I). Its unique weatherability enables it to retain original design properties even after years of exposure. Elongation, tensile strength, hardness, and adhesion do not change significantly with aging or exposure to weather.

Dow Corning 790 silicone building sealant is an ultra-low-modulus material; therefore, joint movement places only a low stress on the sealant/substrate bond line. The material also shows good recovery from extension and compression. It is this unique blend of properties

TABLE II: DOW CORNING 790 SILICONE BUILDING SEALANT SURFACE PREPARATION AND PRIMING RECOMMENDATIONS

Substrate	*Surface Preparation*	*Recommended Primer*
Masonry and stone surfaces, such as brick, concrete, granite and limestone	Air blast or wire brush	None
Glass, glazed surfaces, tile	Oil-free solvent wipe	None
Mill finish aluminum	Oil-free solvent wipe	None
Anodized aluminum	Oil-free solvent wipe	Dow Corning® 1200 prime coat
Steels: carbon, stainless, weathering	Oil-free solvent wipe	Dow Corning 1200 prime coat

that enables this sealant to perform well, even in joints that experience extremes of movement. When applied according to instructions, this material typically provides joints that can be stretched in excess of 100% or compressed up to 50% of original joint width without affecting the soundness of the seal or bond. However, joints should never be designed at the sealant's ultimate movement capability. It is recommended that joint movement should be 50% total movement (based upon initial joint width).

Cured sealant stays rubbery from -65 to 300 F (-55 to 149 C) without tearing, cracking, or becoming brittle under normal conditions. It is virtually unaffected by time or weather.

5. INSTALLATION

Joint Design:

A thin bead of silicone sealant will accommodate more movement than a thick bead (see illustration). Dow Corning 790 silicone building sealant should be no thicker than ½" (12.7mm) and no thinner than ¼" (6.4mm). Ideally, the ratio of joint width to sealant depth should be about 2:1

Polyurethane foam or expanded polyethylene foam rod are the recommended back-up materials for deep joints with porous substrates and polyethylene tape for joints too shallow to allow placement of foam rod. Open-cell polyurethane foam rod is required with non-porous substrates to allow curing from both sides of the sealant. These permit application of a thin bead and act as bond breakers which allows the silicone sealant to stretch freely with the joint.

Joint Dimensions:

The joint width should not be less than ¼" (6.4mm). The joint depths should allow a sealant depth of ⅛" (3.2mm) to a maximum of ½" (12.7mm). The silicone sealant bead depth should be less than the joint width. Ideally, the ratio of joint width to sealant depth should be about 2:1.

Preparatory Work:

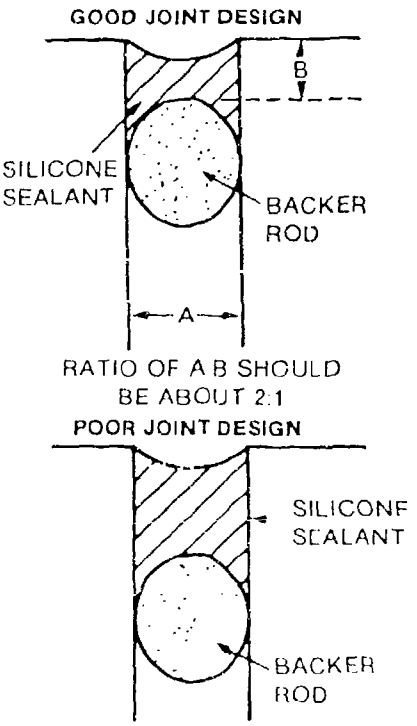
Clean all concrete, masonry and stone joints of all contaminants and impurities. Concrete form release agents, water repellents, laitance, surface dirt and rust, all old sealants and other surface treatments and protective coatings are examples of materials which must be removed from the joint surfaces to obtain proper sealant adhesion. Porous substrates should be cleaned where necessary by grinding, saw cutting, blast cleaning (sand or water), mechanical abrading or a combination of these methods as required to provide a sound, clean, dry surface for sealant application. Dust, loose particles, etc. should be blown out of joints with oil-free compressed air or vacuum cleaned.

Metal and glass surfaces adjacent to masonry should be cleaned by wiping with an oil-free absorbent cloth saturated with solvent such as xylol, toluol, or methyl ethyl ketone. Do not use alcohols.

Priming:

Refer to Table II for priming recommendations. A bead of

FIGURE 1: RECOMMENDED JOINT DESIGN



silicone sealant on the substrate material to test adhesion prior to general job use is always recommended

Masking:

Areas adjacent to joints may be masked to assure neat sealant lines. Do not allow masking tape to touch clean surfaces to which the silicone sealant is to adhere. Tooling should be completed in one continuous stroke immediately after sealant application and before a skin forms. Masking should be removed immediately after tooling.

Method of Application:

Dow Corning 790 silicone building sealant should be applied in a continuous operation. A positive pressure adequate to properly fill and seal the joint width should be employed. Tool or strike the Dow Corning 790 silicone building sealant with light pressure to spread the material against the back-up material and the joint surfaces. Do not use soaps, oil and alcohols as tooling aids. For maximum performance on non-porous surfaces, sealants should be applied above 40 F (4 C).

A tool with a concave profile is recommended to keep the Dow Corning 790 silicone building sealant within the joint. The sealant can be applied at outdoor temperatures as low as -35 F (-37 C) provided that surfaces are clean, dry and frost-free.

Excess sealant should be cleaned from nonporous surfaces before curing, using a commercial solvent such as xylol. On porous surfaces, excess sealant should be allowed to cure and then be removed by abrasion or other mechanical means. The sealed joint should not be disturbed for at least 48 hours.

Precautions:

Uncured sealant may cause skin irritation. Avoid prolonged or repeated skin contact.

Dow Corning® 1200 Prime Coat is flammable. Keep away from heat and open flames. Use only with adequate ventilation. Use same precautions when handling any flammable or combustible solvent.

Storage and Shelf Life:

When stored at or below 90 F (32 C), Dow Corning 790 silicone building sealant has a shelf life of 6 months from date of shipment.

6. AVAILABILITY AND COSTS

Availability:

Dow Corning 790 silicone building sealant is marketed throughout the United States, Canada, Europe, Latin America, Australia and Japan through distributors and building supply outlets.

Cost:

Prices per gallon depend on volume of purchases.

7. WARRANTY

Ten-year Warranty.

A. Warranty (what Dow Corning guarantees)

Dow Corning Corporation warrants that Dow Corning 790 silicone building sealant is of merchantable quality, and that for a period of ten (10) years from the date of purchase, the sealants:

1. Will not become brittle or crack due to weathering or to normal expansion and contraction of adjacent surfaces.
2. Will not harden beyond a Shore A durometer of 50, nor soften below a minimum of 10 points.
3. Will not change color significantly when used with compatible back-up materials.

B. Limitation of warranty (what Dow Corning does not guarantee)

The warranty listed is in lieu of all implied warranties. Dow Corning makes no warranty, express or implied, with respect to the properties of adherence, appearance, (except as otherwise noted in item 3), or any other property of Dow Corning building sealants which is in any way dependent on the techniques, methods, or precautions employed in application. The warranty and Dow Corning's liability shall expire 10 years after date of purchase.

C. Exclusive remedy (what Dow Corning will do if the sealant is not as warranted or does not perform as warranted)

Dow Corning shall refund the purchase price of any sealant which does not meet or does not perform according to warranty.

D. Limitation of liability (what Dow Corning will not be liable for)

The remedy stated above constitutes the exclusive remedy and Dow Corning's sole liability in connection with claims arising out of the purchase or use of the sealant. Dow Corning shall

TABLE III: ESTIMATING REQUIREMENTS

	Linear Feet Per Gallon of Dow Corning Sealant for Various Joint Sizes					
	WIDTH, inches					
DEPTH, inches	1/4	3/8	1/2	5/8	3/4	1
1/8	616	411	307	246	205	154
3/16	411	275	205	164	137	103
1/4	307	205	154	123	103	77
3/8	—	137	103	82	68	51
1/2	—	—	77	62	51	39

not be liable for any sum exceeding the purchase price of sealant shown to be otherwise than as warranted. In no event shall Dow Corning be liable for incidental or consequential damages, such as, for illustrative purposes only, labor costs in removing or replacing the sealant, repair or replacement of other building materials, and the like.

E. Notification of claim (what must be done to obtain a refund)

Notification of any claim must be sent by certified mail to Dow Corning Corporation, Midland, Michigan 48640, Attention: Building Sealants. The notice must contain a statement as to how the sealant failed to meet the warranty and indicate the date of purchase, purchase price, and the amount of refund claimed. Dow Corning reserves the right to inspect the sealant in question and to require proof of purchase.

8. MAINTENANCE

No maintenance is needed. If sealant becomes damaged, replace damaged portion. Dow Corning 790 silicone building sealant will adhere to cured sealant with only a preparatory solvent wipe to remove accumulated dirt.

9. TECHNICAL SERVICES

Complete technical information and literature are available from authorized Dow Corning distributors. Laboratory facilities, technical service, and a list of distributors are available from Dow Corning.

10. FILING SYSTEMS

SPEC-DATA® II.

Sweet's Catalogs Section 7.11:

- General building
- Industrial construction & renovation
- Mechanical engineering
- Civil engineering
- Engineering comprehensive

Architectural specifications and complete technical literature are available upon request. Contact Dow Corning for specific bulletins.

The information and data contained herein are based on information we believe reliable. You should thoroughly test any application, and independently conclude satisfactory performance before commercialization. Suggestions of uses should not be taken as inducements to infringe any particular patent.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN 48640

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DOW CORNING

SPEC DATA®

This Spec-Data Sheet conforms to editorial style prescribed by The Construction Specifications Institute. The manufacturer is responsible for technical accuracy.

1. PRODUCT NAME

HBR® Backer Rod

2. MANUFACTURER

Hercules Incorporated
Plastic Products Group
Middletown Industrial Park
P.O. Box 257
Middletown, Delaware 19709
Phone: (302) 834-5000
Telex: 83-5335

3. PRODUCT DESCRIPTION

Basic Use: HBR backer rod is a backing for elastomeric and other cold-applied sealants. It also helps control the amount of sealant applied for a proper seal, helps produce the ideal joint shape, and also acts as a bond-breaking strip. Typical uses are in glazing and expansion-joint applications for windows, curtain walls, expansion wall joints, partitions, doors, settling cracks, pavements, precast units, and copings. See Figure 1.

Limitations: HBR should not be used with hot-melt adhesives and sealants where their temperature is over 160°F (70°C).

Composition and Materials: HBR is round, flexible, continuous lengths of extruded, closed-cell polyethylene foam. Gray in color, HBR rod is available in a variety of diameters (see Table I).

Applicable Standards:

CEGS-07951-9 Back-Stop Material

TT-S-00227E (COM-NBS) 6.1.8

Packaging: Continuously wound on reels, and packaged in octagonal cartons for shipping, except for the 1½- and 2-in. sizes. HBR backer rods of 1½- and 2-in. diameters are packed in 9-ft. straight lengths. Octagonal cartons can be shipped via UPS. See Table I for quantities and weights.

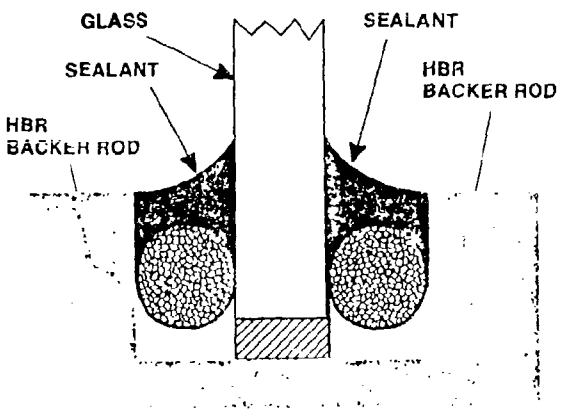
TABLE I
Sizes and Packaging Data

HBR Backer Rod Diameter, in.	Feet per Carton	Weight (gross), lbs per Carton
¼	8,000	15
⅜	4,200	15
½	2,500	15
⅝	1,700	15
¾	1,250	15
1	650	15
1¼	400	15
1½	990	45
2	729	50

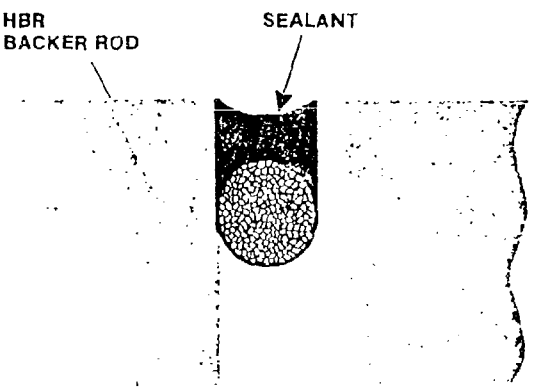
4. TECHNICAL DATA

HBR backer rod is chemically inert, and resistant to oils, gasoline, and solvents. It does not stain or adhere to sealant materials, and, therefore, acts as a bond-breaker strip. HBR has a resilient closed-cell structure and is nonexuding. See Table II, page 2, for typical physical properties.

Figure 1. Typical Uses of HBR Backer Rod



HBR backer rod for glazing



HBR backer rod in expansion joints and similar applications

SEALANTS
backer rod
7p
Hercules Incorporated
November 1979
(Supersedes November 1978)

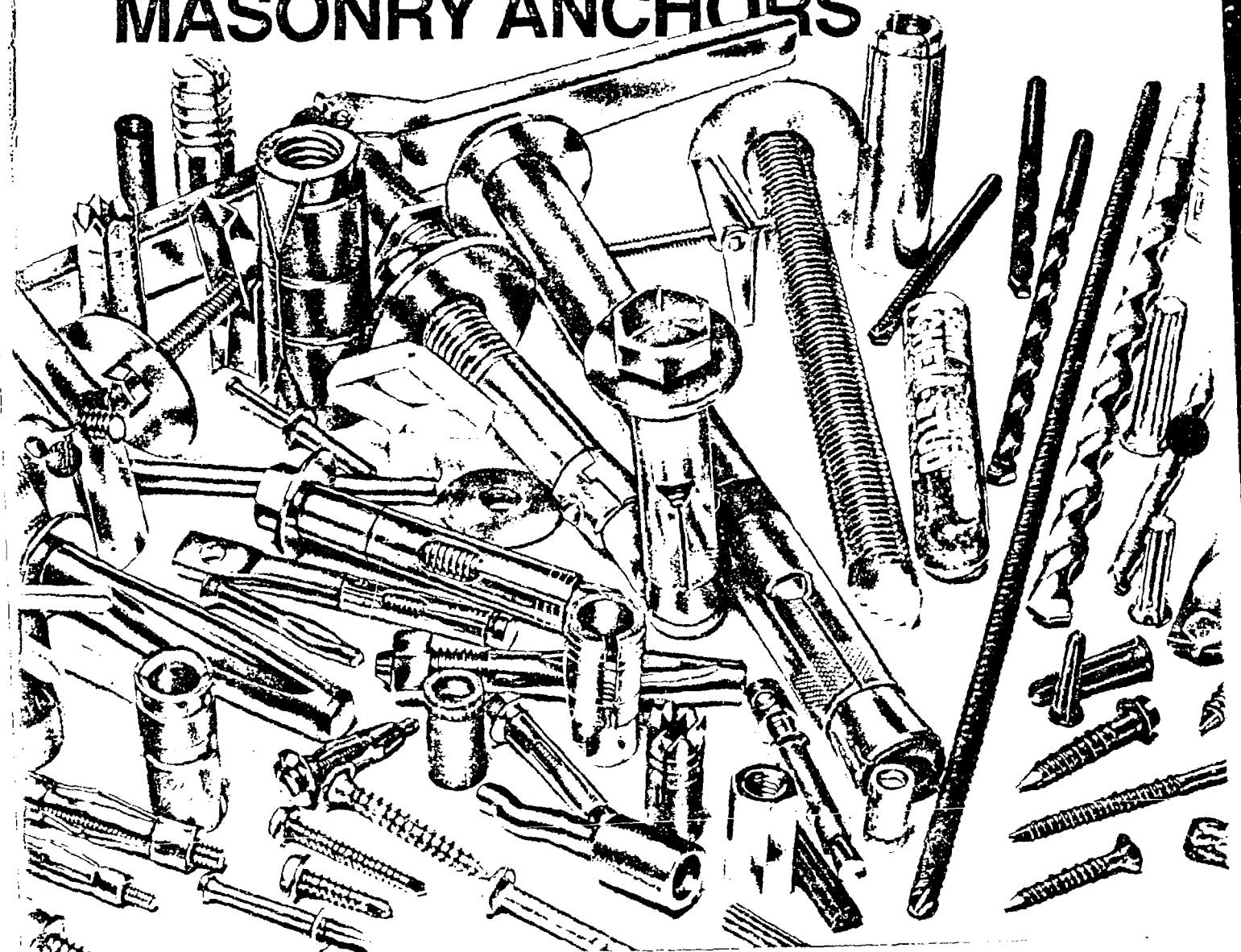
APPENDIX B

CONCRETE ANCHORS

The following is a selection of material available on concrete anchors. The manufacturers represented are the Rawlplug Company, Inc; U.S.E. Diamond, Inc.; and Topline Construction Products.

Rawl 420 M

MASONRY ANCHORS



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Rawl-Drive 2
Rawl-Stud 9
Rawlplug 14
Rawly 12
Saber-Tooth 15
Safety Factors 3
Sleeve 5
Spacing 10
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]

[illegible] centuries, a "masonry anchor" was a [illegible] of lead carved to size and wedged [illegible] a nail or screw was driven. These early [illegible] were then followed by lead and fiber anchors with hol- [illegible] (the first Rawlplug was developed in 1919) which [illegible] produced in a variety of sizes to "match" hole sizes [illegible]

A multitude of anchor types have been developed in subsequent years leading to today's proliferation of choices. But while this variety of "choices" does provide a better match up of anchors to specific needs, it also makes the selection process that much more difficult.

For that reason, before selecting the type, size and number of anchors to be used for any given application, all of the following factors should be taken into consideration:

1. The "holding power" required. This calculation should include not only the load factor (weight) but also the way the load is transmitted to the anchor—shear, tension or combined, plus any "leverage" factors.

2. The conditions of use. Will the installed anchors be used to support a static load, or will they be subjected to vibration and/or intermittent shock loads?

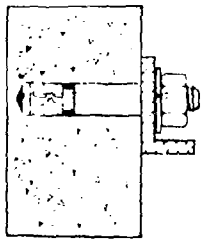
3. The number and size of anchors to be used. This "condition" of installation is often determined by the manufacturer of the fixture or equipment to be fastened (the equipment or fixture often containing a specific number of mounting holes of a given screw or bolt size).

4. The strength of the masonry material. Maximum anchor performance requires that the material in which the anchor is installed can also sustain the load to which the anchor will be subjected. Anchors installed in stone and dense concrete can withstand far greater "pullout loads" than the same anchor installed in lightweight concrete, block or brick. Medium to heavy loads cannot be safely fastened to soft masonry materials (stucco, grout, plaster or plasterboard) since such materials will not withstand the load.

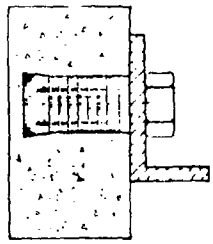
A factor far less tangible than those mentioned above is the total "installed cost" which includes the cost of the anchor and the cost of the labor involved in the installation. Some anchors take longer to install than others; some require greater skills; some require deeper holes to obtain the same holding power, some require layout or hole spotting and some do not. There are anchors that require very precise hole dimensions (diameter and depth), and others that can be installed in a "sloppy" hole and still function as required. Ultimately the "holding power" requirements and the conditions of installation and use need to take precedence over the "installed cost" to assure maximum performance of the products selected.

Note: The varying conditions of field installations require that a minimum 4:1 safety factor (25% of the ultimate requirement or "design load") be applied for static loads, and critical application (vibratory loads, overhead installation, etc.) may require a safety factor of as much as 10:1 or more.

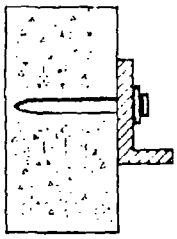
For additional information on special applications, write to the Engineering Department, The Rawlplug Company, Inc., New Rochelle, New York 10802



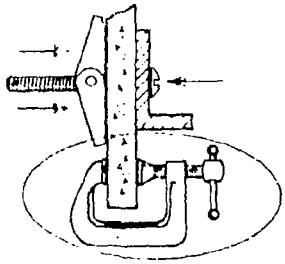
EXPANSION against the wall of the drilled hole.



UNDERCUTTING the masonry material at the base of the drilled hole.

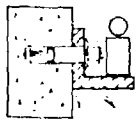


FRICTION between the fastener and the masonry material.

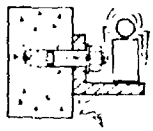


CLAMPING the item to be fastened to the masonry material.

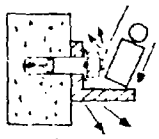
"Loading" Conditions



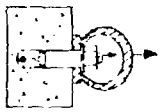
STATIC or Dead Load...constant and unchanging.



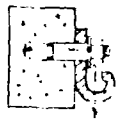
DYNAMIC or Vibration Load...intermittent and of varying intensity.



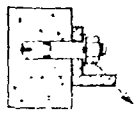
IMPACT or Shock Load...periodic load of substantial intensity.



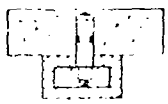
TENSION Load...direct axial load applied to installed anchor.



SHEAR Load...a load applied at a right angle to the installed anchor.

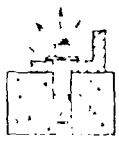


COMBINED Load... a load applied to the anchor at any angle between 0° and 90°



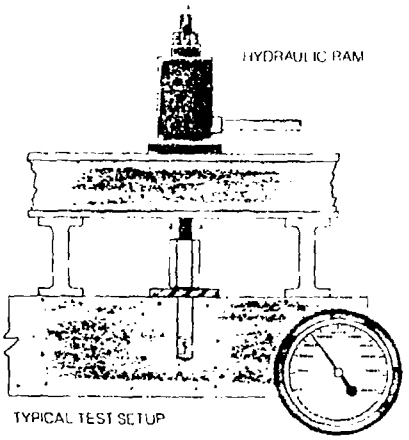
CEILING usually a direct axial (tension) load

WALL usually either combined or shear load



FLOOR may be tension, shear or combined load

Pullout Load Tests



To assist in the selection and specification of masonry anchors, Rawl provides pullout load test data for those products most frequently used in structural fastening and other critical applications. Such data is derived from tests performed in accordance with ANSI/ASTM standard E488. Illustrated above is a typical test setup for direct axial loading of an embedded anchor as governed by the ANSI standard.

Safety Factors

Because of varying conditions of field installations, a 4:1 safety factor (25% of the ultimate value) is the minimum accepted industry standard for static loads. Critical applications (vibratory loads, overhead installations, etc.) may require a safety factor of as much as 10:1, or more.

Spacing Recommendations

The load on a masonry anchor is transmitted to the material in which it is installed. Loading of anchors in closely spaced clusters of two or more can result in interaction of forces on the masonry material and lead to a reduction in anchor performance. The expansion anchor industry has established a minimum standard of 10 anchor diameters for spacing and 5 anchor diameters for edge distance to provide 100% anchor efficiency. These distances may be reduced by as much as 50% with a proportionate reduction in efficiency

Masonry Listings and GSA Specifications for Rawl Products

Calk-In GSA Specification FF-S-325, Group I, Type 1, Class 1.
Tested in the New York Testing Laboratories.

Chem-Stud ICBO.

Double GSA Specification FF-S-325, Group II, Type 2, Class 2, Style 2.

Hammer Drive Pin GSA Specification FF-P-395B.

H/S Drop-In GSA Specification FF-S-325, Group II, Type 3, Class 1.
FM Approved and UL Listed.
Tested by Columbia University, Department of Civil Engineering Research Laboratories.

Lag-Shield GSA Specification FF-S-325, Group II, Type 1, Classes 1 & 2.

Lok/Bolt GSA Specification FF-S-325, Group II, Type 3, Class 3.
FM Approved and UL Listed.
Tested by the Pittsburgh Testing Laboratory.

Multi-Calk GSA Specification FF-S-325, Group I, Type 1, Class 2.
Tested in the New York Testing Laboratories.

Nylon Nailin GSA Specification FF-S-325, Group V, Type 2, Class 4.

Rawl-Bolt ICBO, FM Approved, UL Listed.

Rawl-Drive GSA Specification FF-S-325, Group VI.
ICBO, FM Approved, UL Listed.
Tested in the New York Testing Laboratories.

Rawl-Stud GSA Specification FF-S-325, Group II, Type 4, Class 1.
ICBO, FM Approved, UL Listed.
Tested by the Pittsburgh Testing Laboratory.

Rawlplug GSA Specification FF-S-325, Group IV, Type 2.
Tested in the New York Testing Laboratories.

Rawly GSA Specification FF-B-588C, Type III.

Saber-Tooth GSA Specification FF-S-325, Group III, Type 1.
ICBO, FM Approved, UL Listed.
Tested in the New York Testing Laboratories.

Scru-Lead GSA Specification FF-S-325, Group IV, Type 1.

Set-Bolt GSA Specification FF-S-325, Group VIII, Type 2.
FM Approved.

Single GSA Specification FF-S-325, Group II, Type 2, Class 2, Style 1.

Spike FM Approved.

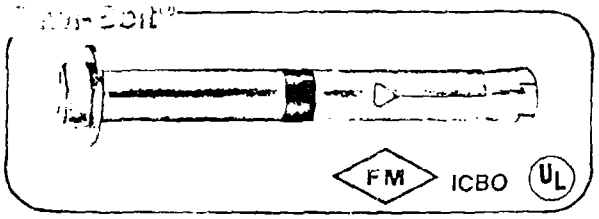
Steel Drop-In GSA Specification FF-S-325, Group VIII, Type 1.
ICBO, FM Approved, UL Listed.
Tested by the Pittsburgh Testing Laboratory.

Toggle Bolt GSA Specification FF-B-588C, Type 1, Class A, Style 1.

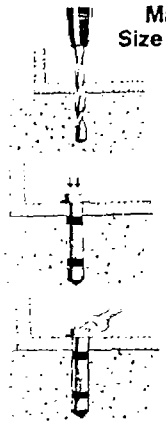
Zamac Nailin GSA Specification FF-S-325, Group V, Type 2, Class 3.
Tested by the Pittsburgh Testing Laboratory.

†General Services Administration Federal Specification FF-S-325 classifies anchoring devices by groups, types, classes and styles. Rawl masonry anchors comply with GSA Specifications and Standards as indicated under each anchor listing

	ANCHOR TYPE	USE IN	USE WITH	MADE OF	SIZE RANGE	GENERAL INFORMATION
ONE STEP ANCHORS						
	Rawl-Bolt*	Concrete, block, brick, stone	No other fastener needed	Steel	3/8" × 2¼" to 3/4" × 8¼"	Finished hex head, removable, vibration-resistant
	Rawl-Stud	Concrete, brick, stone	No other fastener needed	Steel, 303 & 316 S.S., galvanized	¼" × 1¾" to 1¼" × 12"	Heavy duty one-piece expansion bolt. Custom lengths on special order
	Lok/Bolt	Concrete, block, brick, stone	No other fastener needed	Steel	¼" × 1⅛" to ¾" × 5¾	Pre-assembled, all-purpose anchor 7 head styles, 6 diameters, 20 lengths
	Rawl-Drive	Concrete, dense brick, stone	No other fastener needed	Steel	3/16" × 1" to ½" × 6"	One-piece expansion bolt. Heat-treated for maximum shear strength, 4 head styles.
	Spike™	Concrete, dense brick, stone	No other fastener needed	Steel	3/16" × 1" to ¼" × 10"	Easy "Drill 'n Drive" installation. Vibration-resistant. Galvanized or Perma-Seal®.
	Tapcon®	Concrete, block, brick	No other fastener needed	Steel	3/16" × 1¼" to ¼" × 6"	Fast, easy to install. No hole spotting, removable, 2 head styles. 30 sizes.
	Zamac Nailin	Concrete, block, brick, stone	No other fastener needed	Zinc alloy and steel	3/16" × ⅞" to ¼" × 2"	Fast, easy to install. Mushroom or flat head styles. Available with S/S nails.
	Nylon Nailin	Concrete, block, brick, wallboard	No other fastener needed	Nylon and steel	3/16" × 1" to ¼" × 6"	Fast, light duty anchor. 3 head styles. Available with S/S nails.
BOLT ANCHORS						
	Chem-Stud™	All solid masonry	Rawl couplers and drivers.	Polyester resin capsule, steel	⅜" to 1¼"	Self-contained unit, shock resistant. Rapid curing.
	Calk-In	Concrete, brick, stone	Machine screw or bolt	Zinc alloy and lead	6-32 to ¾"-10	Single unit calking anchor, can be set shallow (flush) or deep in hole.
	Multi-Calk	Concrete, brick, stone	Machine screw or bolt	Zinc alloy and lead	½" to 1"	Heavy duty multi-unit calking anchor. Use with bolt head down for stud applications.
	Single	Concrete, brick, stone	Machine screw or bolt	Rustproof zinc alloy	¼" to ¾"	Non-calking bolt anchor, easy to install. Tightening bolt sets anchor.
	Double	Concrete, brick, stone	Machine screw or bolt	Rustproof zinc alloy	¼" to 1"	Heavy duty non-calking bolt anchor. ⅞" and 1" sizes in malleable iron.
	Saber-Tooth	Concrete, dense brick, stone	Machine screw or bolt	Steel	¼" to ⅞"	Self-drilling anchor, installed by power or manually
	Steel Drop-In	Concrete, brick, stone	Machine screw or bolt	Steel, Stainless Steel	¼" to ¾"	Heavy duty use in solid masonry. Internal plug cannot be lost.
SCREW ANCHORS						
	Rawlplug	All masonry material	Sheet metal, wood, lag screws	Jute fiber w/ lead liner	#6 × ¾" to ⅜" × 3"	All-purpose screw anchor. 26 sizes. No hole spotting. Vibration-resistant.
	Lag Shield	Mortar joint, concrete	Lag bolt	Rustproof zinc alloy	¼" to ¾"	Available in short and long styles. Long style recommended for weaker masonry.
	Scru-Lead	Concrete, block, brick	Sheet metal, wood, lag screws	Lead alloy	#6-8 × ¾" to #16-18 × 1½"	Light duty, multi-size anchor. Use with dead loads
	Bantam Plug	Concrete, block, tile, brick	Sheet metal, wood, lag screws	Corrosion-resistant plastic	#6-8 × ¼" to #14-16 × 1½"	Light duty, multi-size anchor. Has collar for hollow materials.
HOLLOW WALL ANCHORS						
	Toggle Bolt	Block, wallboard, plaster, tile	No other fastener needed	Steel, Stainless Steel	[illegible] × 2" to [illegible] × 6"	Fully threaded machine screw. Seven head styles
	Rawly	Wallboard, plaster, paneling	No other fastener needed	Steel	[illegible] extra short to [illegible] extra long	Also slotted hex head or drive type. Remove screw as often as needed
	Rawl Poly-Toggle*	Wallboard or solid masonry	Sheet metal screws	Polypropylene	[illegible] to [illegible]	Fast, easy, economical. Medium duty application for hollow walls
SPECIAL FASTENERS						
	Cad-Screw™	Steel (18, 20, 22 gauge) and wood	Big Fella or little guy	Steel	12-11 × 1⅛" to 12-11 × 4	Fast, gimlet point. High thread. Phillips head. Cadmium plated
	Hammer Drive Pin	Concrete, block, brick	No other fastener needed	Steel	[illegible] × [illegible] to [illegible] × 3	Lightweight anchor requiring no drilling. Use 2 lb. hammer with Drive Tool
	Rawl Twin-Fast® Screws	Metal	No other fastener needed	Steel	6-20 × [illegible] to [illegible]-14 × 1	Drills and tips own hole. 4 head styles. Removable



Use in: Concrete, brick, stone
Use with: No other fastener needed
Made of: Steel (grade 5 bolt)
Size range: ⅜" x 2¼" to ¾" x 8¼"



- No layout or hole-spotting required
- "Finished head" design
- Vibration-resistant expansion cone
- Heavy loading capacity
- Dual-level anchor loading and undercut
- One-piece assembly
- FM approved, UL listed, ICBO Report No. 2041
- 4 diameters, 18 lengths

Remove inspection tag. Do not expand before installation. Position fixture, drill hole. Insert Rawl-Bolt and tap flush with fixture. Tighten to recommended torque.

The Rawl-Bolt is a single-unit, vibration-resistant, removable anchor bolt assembly with a finished hex head design. Since the anchor size is hole size, the Rawl-Bolt eliminates layout or hole-spotting.

As the anchor is driven into the hole, the slotted, oversized annular ring on the bottom of the cone is compressed until it mates perfectly with the hole. This action prevents the anchor from spinning while it is being tightened.

Expansion occurs at two levels within the drilled hole. First, the cone is pulled into the large triple-tined expansion sleeve, developing a mid-level load-bearing capacity over a large surface area. Further turning of the bolt causes the threaded bolt to advance into the threads at the compressed end of the cone, forcing the four sections of the cone outward, driving them into the masonry. This action develops a lower level undercut load-bearing capacity deep in the hole over a full 360° area, greatly increasing the holding power of the anchor and reducing the tendency of the concrete to spall under heavy loading.

In addition, as the bolt enters the compressed threaded area of the cone, tremendous lateral forces are created between the concrete and the mating male and female threads, which keeps them locked together preventing loosening under even the most severe vibratory conditions.

The Rawl-Bolt is designed to draw the work tighter to the surface because of its unique, flexible, compression ring. As the anchor is being tightened, the nylon compression ring will, if necessary, compress so that the material being fastened is tightly secured against the face of the masonry.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6910	⅜" x 2¼"	50	300	⅜"	2"	35	8
6913	⅜" x 3"	50	300	⅜"	2"	35	11
6914	⅜" x 3½"	50	300	⅜"	2"	35	12
6916	⅜" x 4"	50	300	⅜"	2"	35	14
6930	½" x 2¼"	50	200	½"	2½"	60	16
6932	½" x 3¼"	25	150	½"	2½"	60	21
6934	½" x 4¼"	25	150	½"	2½"	60	26
6936	½" x 5¼"	25	150	½"	2½"	60	32
6940	⅝" x 3"	20	120	⅝"	2¾"	100	28
6942	⅝" x 4"	20	120	⅝"	2¾"	100	40
6944	⅝" x 5"	15	90	⅝"	2¾"	100	47
6945	⅝" x 6"	15	90	⅝"	2¾"	100	57
6947	⅝" x 8½"	15	60	⅝"	2¾"	100	77
6950	¾" x 3¼"	15	90	¾"	3"	120	47
6952	¾" x 4¼"	10	60	¾"	3"	120	58
6954	¾" x 5¼"	10	60	¾"	3"	120	70
6956	¾" x 7¼"	10	40	¾"	3"	120	105
6957	¾" x 8¼"	10	40	¾"	3"	120	110

PULLOUT LOAD TESTS*

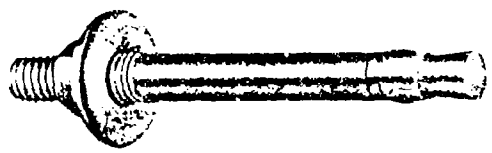
TENSION LOAD (LBS.)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
⅜"	2"	35	4,015	4,840	5,310
⅜"	2½"	35	5,200	5,590	6,[illegible]
⅜"	3½"	35	5,585	6,150	7,550
½"	2½"	60	5,935	7,415	7,485
½"	3"	60	7,325	9,780	10,545
½"	5"	60	8,060	10,855	11,460
⅝"	2¾"	100	8,070	8,440	9,253
⅝"	3"	100	8,615	9,905	11,135
⅝"	4"	100	10,450	12,685	15,660
⅝"	6"	100	11,255	15,070	18,045
¾"	3"	120	10,460	10,475	11,175
¾"	4"	120	11,545	12,345	14,005
¾"	5"	120	12,610	15,700	18,050
¾"	7"	120	14,170	18,210	24,070

SHEAR LOAD (LBS.)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
⅜"	2"	35	6,525	7,875	7,875
⅜"	2½"	35	7,270	8,155	8,265
⅜"	3½"	35	8,770	8,525	9,055
½"	2½"	60	9,455	9,675	11,400
½"	3"	60	10,150	10,690	12,005
½"	5"	60	12,930	14,740	14,435
⅝"	2¾"	100	15,005	15,005	15,005
⅝"	3"	100	19,825	19,995	21,290
⅝"	4"	100	20,065	20,290	21,540
⅝"	6"	100	20,545	20,895	22,055
¾"	3"	120	20,140	20,140	21,440
¾"	4"	120	22,935	26,525	29,795
¾"	5"	120	25,175	28,705	30,905
¾"	7"	120	29,725	33,125	33,155

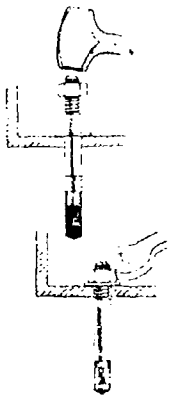
***NOTE:** Test data above represent average ultimate loads sustained in concrete having minimum compressive strength as indicated.



ICBO UL FM

GSA Specification
FF-S-325, Group II, Type 4, Class 1

Use in: Concrete, brick, stone
Use with: No other fastener needed
Made of: Steel (12L14)
Size range: ¼" x 1¾" to 1¼" x 12"



- No layout or hole-spotting required
- Patented inter-locking wedges
- FM approved, UL listed, ICBO Report No. 2041
- 36 diameters and lengths, other sizes on special order
- Also stocked in mechanically galvanized carbon steel, types 303 and 316 stainless steel

Position fixture, drill hole. Drive Rawl-Stud into hole until nut and washer are flush with fixture, and tighten.

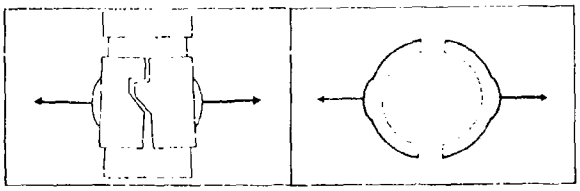
CARBON STEEL RAWL-STUD

7400	¼" x 1¾"	1⅛"	¾"	100	500	3¼
7402	¼" x 2¼"	1⅛"	⅞"	100	500	3¾
7404	¼" x 3"	1⅛"	⅞"	100	500	5¼
7410	⅜" x 2¼"	1¾"	1⅛"	50	250	8¾
7412	⅜" x 2¾"	1¾"	1⅛"	50	250	10½
7413	⅜" x 3"	1¾"	1⅛"	50	250	11
7414	⅜" x 3½"	1¾"	1⅛"	50	250	12½
7415	⅜" x 3¾"	1¾"	1⅛"	50	250	13
7416	⅜" x 5"	1¾"	1⅛"	50	250	17¼
7420	½" x 2¾"	2¼"	1¼"	50	200	18
7422	½" x 3¾"	2¼"	1¼"	50	200	24
7423	½" x 4½"	2¼"	1¼"	50	200	30
7424	½" x 5½"	2¼"	1¼"	50	150	34
7426	½" x 7"	2¼"	1¼"	25	100	44
7430	⅝" x 3½"	2⅞"	1⅝"	25	100	40
7432	⅝" x 4½"	2⅞"	1⅝"	25	100	54
7433	⅝" x 5"	2⅞"	1⅝"	25	100	57
7434	⅝" x 6"	2⅞"	1⅝"	25	25	64
7436	⅝" x 7"	2⅞"	1⅝"	25	25	72
7438	⅝" x 8½"	2⅞"	1⅝"	25	25	84
7440	¾" x 4¼"	3⅛"	1¾"	20	20	70
7441	¾" x 4¾"	3⅛"	1¾"	20	20	76
7442	¾" x 5½"	3⅛"	1¾"	20	20	85
7444	¾" x 6¼"	3⅛"	1¾"	20	20	95
7446	¾" x 7"	3⅛"	1¾"	20	20	105
7448	¾" x 8½"	3⅛"	1¾"	10	10	120
7449	¾" x 10"	3⅛"	1¾"	10	10	135
7451	¾" x 12"	3⅛"	1¾"	10	10	155
7450	[illegible] x 6"	4"	2"	10	10	120
7452	[illegible] x 8"	4"	2"	10	10	160
7454	[illegible] x 10"	4"	2"	10	10	200
7461	1" x 6"	4"	2½"	10	10	170
7463	1" x 9"	4"	2½"	10	10	240
7465	1" x 12"	4"	2½"	10	10	300
7473	1¼" x 9"	5½"	3¼"	5	5	360
7475	1¼" x 12"	5½"	3¼"	5	5	480

RAWL-STUD

The Rawl-Stud is a one-piece anchor bolt available in either standard low carbon steel or in stainless steel for installations in highly corrosive environments.

The patented dual-pressure expansion collar distributes the load equally in the lateral planes of the concrete, thus preventing bolt cocking or premature rupture of the concrete due to distortion or uneven distribution of the load.



PULLOUT LOAD TESTS*

TENSION LOAD (LBS.)

¼"	1⅛"	8	1,670	2,380	2,195
¼"	1½"	8	2,120	2,585	2,560
¼"	2"	8	2,725	2,925	3,050
⅜"	1⅝"	28	3,565	4,125	4,150
⅜"	2"	28	3,900	4,310	4,400
⅜"	3"	28	4,800	4,800	5,070
½"	2¼"	60	6,525	6,625	6,625
½"	3"	60	7,135	8,050	8,050
½"	4"	60	7,945	9,945	9,945
⅝"	2¾"	90	7,330	8,365	8,390
⅝"	4"	90	9,375	10,140	11,565
⅝"	5"	90	11,010	11,555	14,100
¾"	3⅜"	175	10,745	10,745	15,525
¾"	5"	175	14,855	15,695	19,380
¾"	6"	175	17,385	18,745	21,755
⅞"	3⅞"	250	12,330	15,820	13,275
⅞"	4½"	250	14,300	17,620	20,995
⅞"	5¾"	250	18,245	21,225	24,440
1"	4½"	300	13,880	19,990	27,370
1"	5½"	300	18,625	22,720	29,890
1"	6½"	300	23,370	25,455	32,415
1¼"	5⅝"	450	20,240	27,320	34,995
1¼"	7"	450	20,240	28,000	36,200

SHEAR LOAD (LBS.)

¼"	1⅛"	8	1,450	2,070	2,080
¼"	1½"	8	1,655	2,075	2,080
¼"	2"	8	1,925	2,080	2,080
⅜"	1⅝"	28	3,840	5,185	5,810
⅜"	2"	28	4,265	5,420	5,925
⅜"	3"	28	5,390	6,040	6,230
½"	2¼"	60	6,405	6,930	6,985
½"	3"	60	6,620	7,190	7,295
½"	4"	60	6,905	7,535	7,710
⅝"	2¾"	90	8,850	8,850	10,095
⅝"	4"	90	9,215	9,680	10,385
⅝"	5"	90	9,505	10,345	10,620
¾"	3⅜"	175	14,660	14,660	15,265
¾"	5"	175	15,770	17,110	18,045
¾"	6"	175	16,450	18,620	19,755

*NOTE: Test data represent average ultimate loads sustained in concrete having minimum compressive strengths as indicated.

STAINLESS STEEL RAWL-STUD

Stainless Steel Rawl-Stud anchors are used for a variety of fastening applications in chemical and food processing plants, sewage and water treatment facilities, and in other installations where the fastening will be exposed to corrosive environments.

TYPE 303 STAINLESS STEEL RAWL-STUD

7300	¼" x 1¾"	1⅛"	¾"	100	500	3¼
7302	¼" x 2½"	1⅛"	⅞"	100	500	3¾
7304	¼" x 3"	1⅛"	⅞"	100	500	5¼
7310	⅜" x 2¼"	1¾"	1⅛"	50	250	8¼
7312	⅜" x 2¾"	1¾"	1⅛"	50	250	10½
7313	⅜" x 3"	1¾"	1⅛"	50	250	11
7314	⅜" x 3½"	1¾"	1⅛"	50	250	12½
7315	⅜" x 3¾"	1¾"	1⅛"	50	250	13
7316	⅜" x 5"	1¾"	1⅛"	50	250	17¼
7320	½" x 2¾"	2¼"	1¼"	50	200	18
7322	½" x 3¾"	2¼"	1¼"	50	200	24
7323	½" x 4"	2¼"	1¼"	50	200	30
7324	½" x 5½"	2¼"	1¼"	50	150	34
7326	½" x 7"	2¼"	1¼"	25	100	44
7330	⅝" x 3½"	2⅞"	1⅝"	25	100	40
7332	⅝" x 4½"	2⅞"	1⅝"	25	100	54
7334	⅝" x 6"	2⅞"	1⅝"	25	25	64
7336	⅝" x 7"	2⅞"	1⅝"	25	25	72
7338	⅝" x 8½"	2⅞"	1⅝"	25	25	84
7340	¾" x 4¼"	3⅜"	1¾"	20	20	70
7341	¾" x 4¾"	3⅜"	1¾"	20	20	76
7342	¾" x 5½"	3⅜"	1¾"	20	20	85
7344	¾" x 6¼"	3⅜"	1¾"	20	20	95
7346	¾" x 7"	3⅜"	1¾"	20	20	105
7348	¾" x 8½"	3⅜"	1¾"	10	10	120
7349	¾" x 10"	3⅜"	1¾"	10	10	135
7361	1" x 6"	4½"	2⅜"	10	10	170
7363	1" x 9"	4½"	2⅜"	10	10	240
7365	1" x 12"	4½"	2⅜"	10	10	300

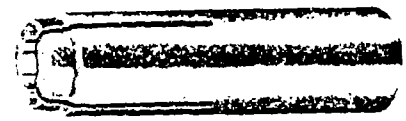
TYPE 316 STAINLESS STEEL RAWL-STUD

7612	⅜" x 2¾"	1¾"	1⅛"	50	250	10½
7614	⅜" x 3½"	1¾"	1⅛"	50	250	12½
7616	⅜" x 5"	1¾"	1⅛"	50	250	17¼
7620	½" x 2¾"	2¼"	1¼"	50	200	18
7622	½" x 3¾"	2¼"	1¼"	50	200	24
7624	½" x 5½"	2¼"	1¼"	50	150	34
7626	½" x 7"	2¼"	1¼"	50	100	44
7630	⅝" x 3½"	2⅞"	1⅝"	25	100	40
7632	⅝" x 4½"	2⅞"	1⅝"	25	100	54
7634	⅝" x 6"	2⅞"	1⅝"	25	25	64
7638	⅝" x 8½"	2⅞"	1⅝"	25	25	84
7640	¾" x 4¼"	3⅜"	1¾"	20	20	70
7642	¾" x 5½"	3⅜"	1¾"	20	20	85
7646	¾" x 7"	3⅜"	1¾"	20	20	105
7648	¾" x 8½"	3⅜"	1¾"	10	10	120

MECHANICALLY GALVANIZED RAWL-STUD

7723	½" x 4½"	2¼"	1¼"	50	200	30
7724	½" x 5½"	2¼"	1¼"	50	150	34
7734	⅝" x 6"	2⅞"	1⅝"	25	25	64
7742	¾" x 5½"	3⅜"	1¾"	20	20	85
7748	¾" x 8½"	3⅜"	1¾"	10	10	120
7750	1" x 6"	4	2	10	10	170
7752	1" x 8"	4	2	10	10	190
7763	1" x 9"	4	2	10	10	240

Rawl Steel Drop-In

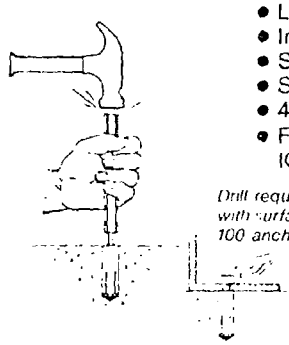


UL FM ICBO

GSA Specification
FF-S-325, Group VIII, Type 1

Use in: Concrete, brick, stone
Use with: Machine screw or bolt
Made of: Steel (12L14)
Size range: ¼" through ¾"

- Layout or hole-spotting required
- Internal plug, pre-assembled
- Smooth anchor body
- Small diameter hole
- 4 sizes stainless steel (Type 303)
- FM approved, UL listed, ICBO Report



Drill required hole. Drop in anchor and tap flush with surface. Using setting tool (provided free with 100 anchors), set the Drop-In with several sharp hammer blows. Position the fixture, insert screw or bolt and tighten.

The Rawl Steel Drop-In is an all-steel, fire-resistant machine bolt anchor with a pre-assembled internal expander plug that is glued in the body so that it cannot be lost or fall out, even when being installed overhead. This special anchor design offers fast and easy installation and provides maximum holding power. It can be installed flush with masonry surface or sub-set. Stainless Steel Drop-In anchors available from stock (sizes ¼" through ⅝").

STEEL DROP-IN (INTERNAL PLUG)

6304	¼"	⅜"	1¼"	5/16"	100	1000	2
6306	⅜"	½"	1⅞"	⅝"	50	500	6
6308	½"	⅝"	2⅜"	13/16"	50	250	12
6320	⅝"	¾"	3"	1 3/16"	25	125	32
6312	¾"	1"	3½"	1¼"	10	50	48

STAINLESS STEEL DROP-IN (INTERNAL PLUG)

6204	¼"	⅜"	1¼"	5/16"	100	1000	2
6206	⅜"	½"	1⅞"	⅝"	50	500	6
6208	½"	⅝"	2⅜"	13/16"	50	250	12
6210	⅝"	¾"	3"	1 3/16"	25	125	32

One setting tool included with 100 anchors

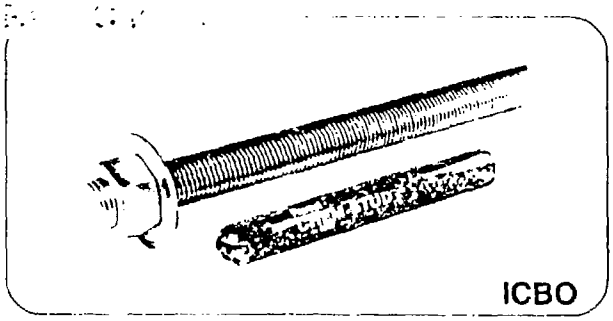
SETTING TOOLS

Size	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PULLOUT LOAD TESTS*

Tension Load (lbs.)	3,400	6,400	9,000	10,460	[illegible]
Shear Load (lbs.)	1,800	4,220	[illegible]	1,200	[illegible]

*NOTE: The load data above represent average ultimate load sustained in concrete having minimum compressive strength of 4,000 psi.



Use in: Concrete and other solid masonry
Use with: Threaded rod, reinforcing rod
Made of: Capsule—
Polyester resin adhesive
Anchor rods—
Carbon and stainless steel
Size range: 3/8" to 1 1/4"

- Self-contained unit
- Unaffected by shock or vibratory loads
- Resistant to freeze-thaw action
- Rapid curing
- High load capacities
- No expansion stress, can be used close to edge
- Eliminates need for cast-in-place or grout-in-place anchors
- ICBO Report

Drill hole to proper depth, clean hole. Insert Chem-Stud capsule. Thread anchor rod into coupler. Install driver in roto hammer, engage coupler and driver unit. Spin anchor rod through capsule to bottom of hole. Remove driver. Wait for specified setting time and remove coupler from anchor rod.

Base Material Temperature	Setting Time
68°F and above	10 minutes
50°F-68°F	20 minutes
32°F-50°F	1 hour
23°F-32°F	5 hours

The design of the Chem-Stud anchor combines the positive performance characteristics of cast-in-place anchors and the installation benefits of drilled-in anchors, resulting in an easy-to-install, vibration-resistant anchor able to sustain high load capacities.

The anchor system consists of a polyester adhesive capsule, a threaded anchor rod, nut and washer. As the chisel-pointed rod is spun into the two-part capsule, the polyester resin and hardening catalyst are combined. The resin completely surrounds the anchor rod and penetrates the surrounding masonry. As the resin cures, the resulting bond enables the anchor to achieve high tension and shear loads without stressing the base material. In addition, the anchor hole is completely sealed making it totally resistant to freeze-thaw action.

RAWL CHEM-STUD CAPSULES

6502	3/8	10	50	7/16	3 1/2"	4
6503	1/2"	10	50	9/16	4 1/4"	5
6504	5/8"	10	40	11/16"	5"	9
6505	3/4"	10	40	7/8"	6 5/8"	11
6505	7/8"	10	40	1"	7	11
6507	1"	10	40	1 1/8"	8 1/4"	50
6508	1 1/4"	5	20	1 1/2"	10 1/4"	64

CHEM-STUD ANCHOR RODS

A307 STANDARD CARBON STEEL

6512	3/8" x 5 1/8"	10	50	7/16"	3 1/2"	12
6513	1/2" x 6 1/2"	10	50	9/16"	4 1/4"	28
6514	5/8" x 7 1/2"	10	40	11/16"	5"	51
6515	3/4" x 9 5/8"	10	40	7/8"	6 5/8"	96
6516*	7/8" x 10 1/4"	—	10	1"	7"	140
6517	1" x 12"	—	10	1 1/8"	8 1/4"	213
6518	1 1/4" x 15"	—	5	1 1/2"	10 1/4"	433

*Galvanized

A325 HIGH-STRENGTH CARBON STEEL

6522	3/8" x 5 1/8"	10	50	7/16"	3 1/2"	12
6523	1/2" x 6 1/2"	10	50	9/16"	4 1/4"	28
6524	5/8" x 7 1/2"	10	40	11/16"	5"	51
6525	3/4" x 9 5/8"	10	40	7/8"	6 5/8"	96
6527	1" x 12"	—	10	1 1/8"	8 1/4"	213
6528	1 1/4" x 15"	—	5	1 1/2"	10 1/4"	433

303 STAINLESS STEEL

6542	3/8" x 5 1/8"	10	50	7/16"	3 1/2"	12
6543	1/2" x 6 1/2"	10	50	9/16"	4 1/4"	28
6544	5/8" x 7 1/2"	10	40	11/16"	5"	51
6545	3/4" x 9 5/8"	10	40	7/8"	6 5/8"	96
6547	1" x 12"	--	10	1 1/8"	8 1/4"	213
6548	1 1/4" x 15"	--	5	1 1/2"	10 1/4"	433

COUPLERS

6562	3/8"	10	50
6563	1/2"	10	50
6564	5/8"	10	50
6565	3/4"	5	25
6566	7/8"	5	25
6567	1"	5	25
6568	1 1/4"	5	25

DRIVERS

Hex	SDS	A&B	Spline		
6570	6574	6584	—	3/8" to 5/8"	10
6572	6576	6536	—	3/4" to 1 1/4"	10
-	—	—	6580	3/8" to 5/8"	5
--	-	—	6582	3/4" to 1 1/4"	5

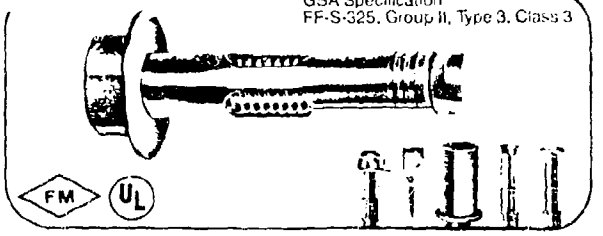
PULLOUT LOAD TESTS*

3/8"	3 1/2"	20	7,820	1,010
1/2"	4 1/4"	40	13,435	6,440
5/8"	5"	90	20,585	11,240
3/4"	6 5/8"	160	24,220	18,120
7/8"	7"	200	35,090	22,400
1"	8 1/4"	300	37,145	24,700
1 1/4"	10 1/4"	600	70,100	49,300

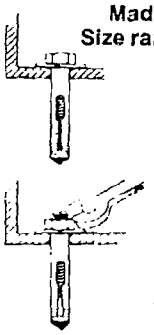
*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 4,000 psi. Higher shear loads can be achieved by using ASTM A325 or 4140 anchor rods.

Rawl Lok/Bolt

GSA Specification
FF-S-325, Group II, Type 3, Class 3



Use in: Concrete, block, brick, stone
Use with: No other fastener needed
Made of: Steel
Size range: ¼" x ⅝" to ¾" x 7½"



- No layout or hole-spotting required
- 7 head styles, 6 diameters, 21 lengths
- Extenders for extra length
- FM approved, UL listed
- One-piece assembly
- Thread diameter is less than anchor diameter

Position fixture, drill hole. Insert Lok/Bolt, tap flush with fixture and tighten.

The Rawl Lok/Bolt is an all-steel, multi-purpose anchor bolt intended for use in a wide range of masonry materials

Installation is fast and easy. Drill hole of same diameter as Lok/Bolt with fixture in place. Insert Lok/Bolt, tap into hole until flush with fixture and tighten with wrench or screwdriver until hand-tight.

Under load, the specially tapered bolt is drawn further into the expansion sleeve to develop greater locking action against the walls of the hole.

The all-steel construction meets fire and general building code requirements. The Rawl Lok/Bolt comes in seven head styles, six diameters and twenty-one lengths.

Rod hangers are approved for pipe support to 4" diameters on ⅜" size, 8" pipe for ½" anchor, and to 12" for ⅝" size.

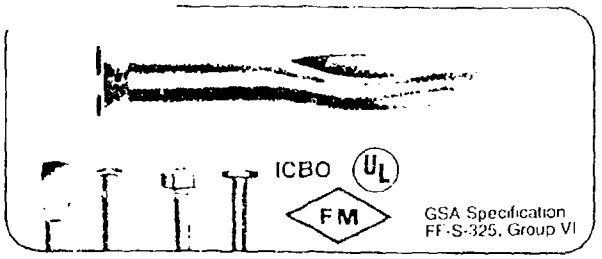
The large variety of head styles, diameters and lengths provides maximum versatility for just about any masonry anchoring requirement.

PULLOUT LOAD TESTS*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
¼"	1⅛"	3-4	1,650	1,550
5/16"	1½"	6-8	2,400	2,300
⅜"	1⅝"	12-16	4,100	3,020
½"	2¼"	22-28	5,700	4,400
⅝"	2¾"	45-60	7,200	6,200
¾"	3½"	65-90	9,600	9,920

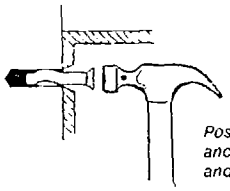
*NOTE: Test data above represent average ultimate load sustained in concrete having compressive strength of 3,000 psi

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HEX NUT					
5005	5/16" x 1½"	100	1000	6-8	4¼
5010	5/16" x 2½"	100	500	6-8	5¾
5015	⅜" x 1⅞"	50	500	12-16	7
5020	⅜" x 3"	50	500	12-16	10
5025	½" x 2¼"	25	250	22-28	14
5030	½" x 3"	25	250	22-28	17¼
5034	½" x 4"	25	125	22-28	22
5033	½" x 5¼"	25	125	22-28	27
5035	⅝" x 2¼"	25	125	45-60	25½
5038	⅝" x 3"	25	125	45-60	34
5040	⅝" x 4¼"	10	100	45-60	41
5045	⅝" x 6"	10	100	45-60	49
5050	¾" x 2½"	10	100	65-90	46
5055	¾" x 4"	10	10	65-90	70
5060	¾" x 5¼"	10	10	65-90	90
5065	¾" x 7½"	10	10	65-90	110
ACORN NUT					
5125	¼" x ⅝"	100	1000	3-4	2
5150	¼" x 1⅜"	100	1000	3-4	2¾
5175	¼" x 2¼"	100	1000	3-4	3¼
ROUND HEAD					
5205	¼" x 1⅛"	100	1000	3-4	2
5210	¼" x 2"	100	1000	3-4	2¾
5215	¼" x 2¾"	100	1000	3-4	3¾
5220	¼" x 3¾"	100	1000	3-4	4¼
5225	5/16" x 2⅜"	100	1000	6-8	4¼
5230	5/16" x 3⅜"	100	500	6-8	6½
5235	⅜" x 2½"	50	500	12-16	8
5240	⅜" x 3¾"	50	250	12-16	10¾
FLAT HEAD					
5305	¼" x 1⅛"	100	1000	3-4	2
5310	¼" x 2"	100	1000	3-4	2¼
5315	¼" x 3"	100	1000	3-4	3¾
5320	¼" x 4"	100	500	3-4	4½
5325	¼" x 5¼"	100	500	3-4	6½
5330	5/16" x 2½"	100	1000	6-8	4½
5335	5/16" x 3½"	100	500	6-6	6¼
5340	⅜" x 2¾"	50	500	12-16	7½
5345	⅜" x 4"	50	250	12-16	10¾
5350	⅜" x 5"	50	250	12-16	14
5360	⅜" x 6"	50	250	12-16	16
THRESHOLD FLAT HEAD					
5500	¼" x 2"	100	1000	3-4	2½
TIE-WIRE					
5700	5/16" x 1½"	100	1000	6-8	5¼
MULTIPLE USE KIT					
5660	½"	25	250	--	10
LOK/BOLT EXTENDERS for added length. Will fit all head styles.					
5682	5/16" x 1"	100	1000	—	1¾
5684	⅜" x 1"	100	1000	--	3
5686	½" x 1"	100	1000	--	5¼
LOK/BOLT ROD HANGERS					
5815	⅜" x 1⅛"	50	250	12-16	9
5825	½" x 2¼"	25	125	22-28	21
5840	⅝" x 4¼"	10	50	45-60	59



Use in: Concrete, dense brick, stone
Use with: No other fastener needed
Made of: Steel
Size range: 3/16" x 1" to ½" x 6"

- No layout or hole-spotting required
- 5 head styles- round, flat, stud, wafer head and tie-wire
- One-piece, pre-expanded anchor
- FM approved, UL listed, ICBO Report No. 2041
- Heavy duty permanent installation



Position fixture, drill hole same nominal diameter as anchor. Insert Rawl-Drive (leave nut on stud type) and hammer flush with fixture.

The Rawl-Drive one-piece anchor is designed for maximum performance in hard masonry, primarily concrete and stone.

Made of tough, high grade steel "with a memory", the Rawl-Drive exhibits great tensile strength and hardness achieved through two heat treatments. It is sheared and pre-expanded by an exclusive Rawl process. When driven into the hole, the two halves of the Rawl-Drive are compressed by the wall of the hole and will continuously try to regain their original bulged shape, exerting a tremendous force against the inside walls of the hole.

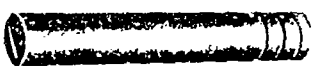
The hardness of the steel used in its manufacture prevents damage to the threads when setting the stud type Rawl-Drive. Hole depth should be ¼" greater than the overall anchor length. Then, if the fixture is removed, the Rawl-Drive can be hammered flush with the surface of the concrete.

Tie-wire Rawl-Drive anchors are used for suspended ceiling applications. The flat head (counter-sunk) and wafer head styles are particularly suited for wood-to-concrete anchoring. The round head style is for all other applications requiring fast, permanent installations.

PULLOUT LOAD TESTS*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Embedment	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tension Load (lbs.)	1,285	2,010	3,500	5,010	6,015
Shear Load (lbs.)	1,520	2,230	4,850	7,813	11,340

*NOTE: Test data represent average ultimate load sustained in concrete having a minimum compression strength of 3,000 psi



TIE-WIRE SETTING TOOL
Cat. No. 3250

ROUND HEAD

3031	[illegible] x 1"	100	1000	[illegible]	[illegible]	1
3091	[illegible] x 1½"	100	1000	[illegible]	[illegible]	1¼
3211	¼" x 1¼"	100	1000	¼"	1⅛"	1¾
3241	¼" x 1½"	100	1000	¼"	1⅛"	2½
3271	¼" x 2"	100	1000	¼"	1⅛"	3
3301	¼" x 2½"	100	1000	¼"	1⅛"	3¾
3451	[illegible] x 1½"	50	500	[illegible]	1⅜"	4
3601	⅜" x 2"	25	250	⅜"	1⅞"	7½
3631	⅜" x 2½"	25	250	⅜"	1⅞"	8½
3691	⅜" x 3½"	25	250	⅜"	1⅞"	11¾
3781	½" x 3"	25	125	½"	2⅝"	25

FLAT HEAD

3032	3/16" x 1"	100	1000	3/16"	⅞"	1
3092	3/16" x 1½"	100	1000	3/16"	⅞"	1¼
3122	3/16" x 2"	100	1000	3/16"	⅞"	1¾
3152	3/16" x 2½"	100	1000	3/16"	⅞"	2
3162	3/16" x 3"	100	1000	3/16"	⅞"	2½
3172	3/16" x 3½"	100	1000	3/16"	⅞"	3
3182	3/16" x 4"	100	500	3/16"	⅞"	3½
3192	3/16" x 5"	100	500	3/16"	⅞"	4½
3202	3/16" x 6"	100	500	3/16"	⅞"	5½
3242	¼" x 1½"	100	1000	¼"	1⅛"	2½
3272	¼" x 2"	100	1000	¼"	1⅛"	3
3302	¼" x 2½"	100	1000	¼"	1⅛"	3¾
3332	¼" x 3"	100	1000	¼"	1⅛"	4½
3362	¼" x 3½"	100	1000	¼"	1⅛"	5
3392	¼" x 4"	100	500	¼"	1⅛"	5¾
3452	¼" x 5"	100	500	¼"	1⅛"	7
3462	¼" x 6"	100	500	¼"	1⅛"	8½
3472	¼" x 7"	100	100	¼"	1⅛"	10
3482	¼" x 8"	100	100	¼"	1⅛"	11½
3492	¼" x 9"	100	100	¼"	1⅛"	13
3502	¼" x 10"	100	100	¼"	1⅛"	14½
3511	¼" x 11"	100	100	¼"	1⅛"	16
3512	¼" x 12"	100	100	¼"	1⅛"	17½
3514	¼" x 14"	100	100	¼"	1⅛"	20½

STUD

3243	¼" x 1½"	100	1000	¼"	1⅛"	2½
3273	¼" x 2"	100	1000	¼"	1⅛"	3
3633	⅜" x 2½"	25	250	⅜"	1⅞"	8½
3663	⅜" x 3"	25	250	⅜"	1⅞"	9¼
3693	⅜" x 3½"	25	250	⅜"	1⅞"	11¾
3813	½" x 3½"	25	125	½"	2⅝"	28
3843	½" x 4"	25	125	½"	2⅝"	30
3873	½" x 6"	25	25	½"	2⅝"	35

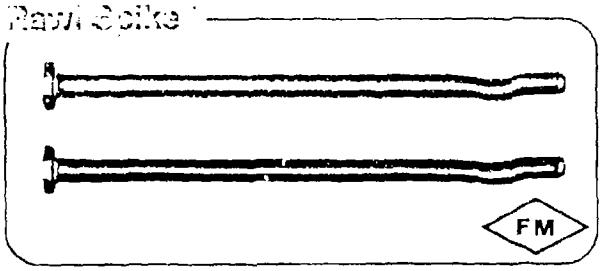
TIE-WIRE

3244	¼" x 1¾"	500	500	¼"	1⅛"	2½
3245	¼" x 1¾"	100	500	¼"	1⅛"	2½

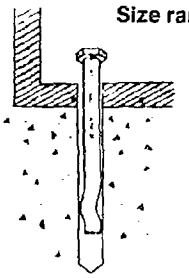
WAFER HEAD

3277	¼" x 2"	100	1000	¼"	1⅛"	3
3337	¼" x 3"	100	1000	¼"	1⅛"	4½
3397	¼" x 4"	100	500	¼"	1⅛"	5¾
3457	¼" x 5"	100	500	¼"	1⅛"	7
3467	¼" x 6"	100	500	¼"	1⅛"	8½
3477	¼" x 7"	100	100	¼"	1⅛"	10
3487	¼" x 8"	100	100	¼"	1⅛"	11½
3497	¼" x 9"	100	100	¼"	1⅛"	13
3507	¼" x 10"	100	100	¼"	1⅛"	14½
3517	¼" x 12"	100	100	¼"	1⅛"	17½

Rawl Spike



Use in: Concrete, dense brick, stone
Use with: No other fastener needed
Made of: Carbon steel
Size range: 3/16" x 1" to 1/4" x 10"



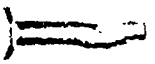
- No layout or hole-spotting required
- One-piece fastener
- Mechanically galvanized (G-90) or Perma-Seal® coated
- Fast "Drill 'n Drive" installation
- Vibration-resistant

Drill hole same diameter as anchor. Insert Rawl Spike and hammer flush.

The Rawl Spike is used to fasten equipment and fixtures to solid concrete. The one-piece fastener is made of high-grade tempered steel and has a shear strength greater than Grade 8 steel. It is vibration-resistant and quick and easy to install. Drilled hole depth is not critical (minimum embedment 1¼"). Unique design prevents loss of holding power even under conditions of extreme vibration.

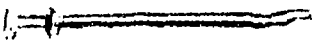
ASK FOR INFORMATION ABOUT:

RAWL SHORT SPIKE



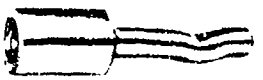
The new Short Spike is designed for fastening thin gauge metals such as flashing, duct strap, track and signs to various masonry materials.

RAWL FORMING SPIKE



The Forming Spike is a double-headed version for use in temporary fastenings associated with concrete form work.

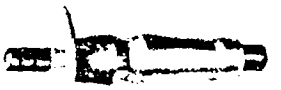
RAWL PIPE SPIKE



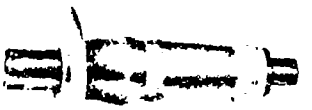
The Pipe Spike is designed for suspending various materials overhead. The cost savings are substantial when compared with PAT or drop-in type anchors.

RAWL SPIKE

3700	—	3/16" x 1"	100	1000	3/16	7/8"	1¼
3701	—	3/16" x 1¼"	100	1000	3/16"	7/8"	1½
3702	3703	3/16" x 1½"	100	1000	3/16"	1¼"	1½
3704	3705	3/16" x 2"	100	1000	3/16"	1¼"	2
3706	3707	3/16" x 2½"	100	1000	3/16"	1¼"	2½
3708	3709	3/16" x 3"	100	1000	3/16"	1¼"	2¾
3710	3711	3/16" x 3½"	100	1000	3/16"	1¼"	3¼
3712	3713	3/16" x 4"	100	500	3/16"	1¼"	3½
3714	3715	3/16" x 4½"	100	500	3/16"	1¼"	4
3716	3717	3/16" x 5"	100	500	3/16"	1¼"	4½
3718	3719	3/16" x 5½"	100	500	3/16"	1¼"	5
3720	3721	3/16" x 6"	100	500	3/16"	1¼"	5½
3762	3723	¼" x 1½"	100	1000	¼"	1¼"	2½
3764	3725	¼" x 2"	100	1000	¼"	1¼"	3
3766	3727	¼" x 2½"	100	1000	¼"	1¼"	4
3768	3729	¼" x 3"	100	1000	¼"	1¼"	4½
3770	3731	¼" x 3½"	100	1000	¼"	1¼"	5
3772	3733	¼" x 4"	100	500	¼"	1¼"	6
3774	3735	¼" x 4½"	100	500	¼"	1¼"	6½
3776	3737	¼" x 5"	100	500	¼"	1¼"	7
3778	3739	¼" x 5½"	100	500	¼"	1¼"	7½
3780	3741	¼" x 6"	100	500	¼"	1¼"	8
3782	3743	¼" x 6½"	100	100	¼"	1¼"	8½
3784	3745	¼" x 7"	100	100	¼"	1¼"	9½
3786	3747	¼" x 7½"	100	100	¼"	1¼"	10½
3788	3749	¼" x 8"	100	100	¼"	1¼"	11
3792	3753	¼" x 9"	100	100	¼"	1¼"	12
3798	3757	¼" x 10"	100	100	¼"	1¼"	13



RAWL SPIKE SETTING TOOL
Cat. No. 3750



RAWL SPIKE HEAVY DUTY SETTING TOOL
Cat. No. 3751

FORMING SPIKE

3795	3/16" x 1¼"	100	1000	3/16"	1¼"	2½
3796	3/16" x 2	100	1000	3/16"	1¼"	3
3797	3/16" x 2¾"	100	1000	3/16"	1¼"	4

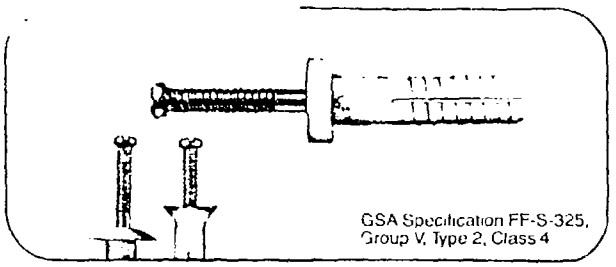
PIPE SPIKE

3758	½"	50	500	¼"	1¼"	6

PULLOUT LOAD TESTS*

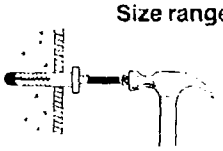
Tension Load (lbs.)	Rawl Spike	[illegible]	1¼"	975	1,180	1,450	[illegible]
Shear Load (lbs.)				2,250	2,425	2,600	[illegible]
Tension Load (lbs.)	Short Spike	[illegible]		975	1,180	1,450	[illegible]
Shear Load (lbs.)				1,750	1,850	[illegible]	[illegible]
Tension Load (lbs.)	Form Spike			[illegible]	[illegible]	[illegible]	[illegible]
Shear Load (lbs.)				[illegible]	[illegible]	[illegible]	[illegible]
Tension Load (lbs.)	Pipe Spike			1,040	[illegible]	[illegible]	

*NOTE [illegible]

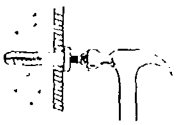


GSA Specification FF-S-325, Group V, Type 2, Class 4

Use in: Concrete, block, brick, wallboard
Use with: No other fastener needed
Made of: Nylon with steel or stainless steel nail
Size range: 3/8" x 1" to 1/4" x 6"



- No layout or hole-spotting required
- One-piece assembly
- 3 head styles - round, flat and mushroom
- Light duty
- Also available in bulk



Position fixture, drill hole same nominal diameter as anchor. Insert Nailin anchor and tap gently until head of anchor body is set tightly against item to be fastened. Hammer nail flush to expand the body.

ROUND HEAD					
2431	—	3/16" x 1"	100	1000	1/2
2451	—	3/16" x 1 1/2"	100	1000	3/4
2521	2626	1/4" x 1"	100	1000	3/4
2541	2546	1/4" x 1 1/2"	100	1000	1
2561	2566	1/4" x 2"	100	1000	1
FLAT HEAD					
2432	—	3/16" x 1"	100	1000	1/2
2452	—	3/16" x 1 1/2"	100	1000	3/4
2522	2527	1/4" x 1"	100	1000	3/4
2542	2547	1/4" x 1 1/2"	100	1000	1
2562	2567	1/4" x 2"	100	1000	1
MUSHROOM HEAD					
2433	—	3/16" x 1"	100	1000	1/2
2513	—	1/4" x 3/4"	100	1000	1/2
2523	2528	1/4" x 1"	100	1000	3/4
2543	2548	1/4" x 1 1/2"	100	1000	1
2563	2568	1/4" x 2"	100	1000	1
2573	—	1/4" x 3"	100	1000	2 1/4
2583	—	1/4" x 4"	100	1000	2 1/4
2593	—	1/4" x 6"	100	400	4

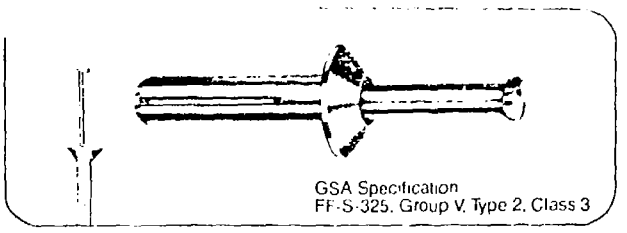
BULK (MASTER PACK) - ROUND HEAD

2434	3/16" x 1"	Steel	1000	5
2454	3/16" x 1 1/2"	Steel	1000	7
2524	1/4" x 1"	Steel	1000	5 3/4
2544	1/4" x 1 1/2"	Steel	1000	7 3/4
2564	1/4" x 2"	Steel	1000	9 3/4

PULLOUT LOAD TESTS*

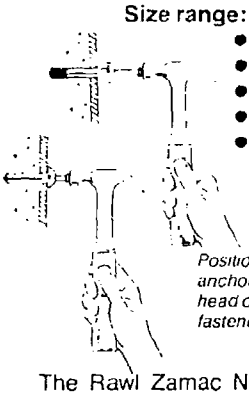
Tension Load (lbs.)	180	200	235	265	270

*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 3,000 psi



GSA Specification FF-S-325, Group V, Type 2, Class 3

Use in: Concrete, block, brick, stone
Use with: No other fastener needed
Made of: Zinc with plated steel or stainless steel nail
Size range: 3/16" x 7/8" to 1/4" x 2"



- No layout or hole-spotting required
- One-piece assembly
- Mushroom and flat head styles
- Tamper-proof
- Also available in bulk

Position fixture, drill hole same nominal diameter as anchor. Insert Nailin anchor and tap gently until head of anchor body is set tightly against item to be fastened. Hammer nail flush to expand the body.

The Rawl Zamac Nailin has a body of Zamac #7, a special zinc alloy developed for its resistance to corrosion. The expansion device is a nail which can be supplied in either plated steel or stainless steel depending on the degree of corrosion resistance required. These fasteners are manufactured in both round head and flat head configurations.

MUSHROOM HEAD

2802	3/16" x 7/8"	0-1/8"	100	500	1
2806	1/4" x 3/4"	0-1/8"	100	500	1 1/2
2808	1/4" x 1"	1/8"-1/4"	100	500	1 3/4
2814	1/4" x 1 1/4"	1/4"-1/2"	100	500	2 1/4
2820	1/4" x 1 1/2"	1/2"-3/4"	100	500	2 1/2
2826	1/4" x 2"	3/4"-1 1/4"	100	500	3

FLAT HEAD

2836	1/4" x 1 1/2"	0-3/4"	100	500	2 1/2
2838	1/4" x 2"	3/4"-1 1/4"	100	500	3

STAINLESS STEEL NAIL—MUSHROOM HEAD

2858	1/4" x 1"	1/8"-1/4"	100	500	1 3/4
2864	1/4" x 1 1/4"	1/4"-1/2"	100	500	2 1/4
2870	1/4" x 1 1/2"	1/2"-3/4"	100	500	2 1/2
2876	1/4" x 2	3/4"-1 1/4"	100	500	3

BULK (MASTER PACK)—MUSHROOM HEAD

2803	3/16" x 7/8"	Steel	0-1/8"	1000	9 3/4
2807	1/4" x 3/4"	Steel	0-1/8"	1000	16 3/4
2809	1/4" x 1"	Steel	1/8"-1/4"	1000	19
2815	1/4" x 1 1/4"	Steel	1/4"-1/2"	1000	22 3/4
2821	1/4" x 1 1/2"	Steel	1/2"-3/4"	1000	24 3/4
2827	1/4" x 2"	Steel	3/4"-1 1/4"	1000	29 1/2

PULLOUT LOAD TESTS*

Tension Load (lbs.)	500	600	820	960	1,150	1,300
Embedment Depth	3/4"	7/8"	1"	1 1/8"	1 3/8"	1 1/2"

*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 4,100 psi

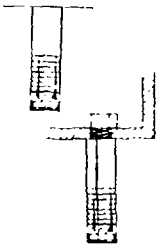
Rawl Saber-Tooth

UL FM ICBO

GSA Specification FF-S-325, Group III, Type 1

Use in: Concrete, brick, stone
Use with: Machine screw or bolt
Made of: Steel (12L14 ASTM A307 Grade A)
Size range: ¼" to ⅞"

- Layout or hole-spotting required
- 4 styles—snap-off, hand flush, tie-wire and non-drill
- Heavy duty
- Undercuts hole
- FM approved, UL listed, ICBO Report No. 2041
- Core-drills hole with flat bottom for maximum plug penetration



Insert anchor in appropriate chuck, drill until chuck meets masonry surface. Remove anchor, clean hole and anchor, and insert plug. Put assembly in hole and hammer (without rotation) until chuck again meets surface. Snap off taper, position fixture, insert screw or bolt and tighten.

The Rawl Saber-Tooth is a heavy duty masonry anchor that drills its own hole. Each anchor is its own drill.

This system for fastening to masonry is made possible chiefly by the exclusive DURATHERM heat-treating process which makes the "teeth" hard enough to drill the toughest masonry materials—even granite.

Drilling time and labor are reduced. Each anchor is like a new, sharp drill and the "core drill" design means that a much smaller area of masonry surface is being attacked for a given hole size than with the usual masonry drill.

When the Saber-Tooth is driven home over its expander plug, the four expander slots permit even expansion against the wall of the hole, while the DURATHERM hardened teeth "undercut" the drilled hole. Tapered ridges provide additional resistance to withdrawal from the hole. The heavy holding power developed is deep in the masonry, where masonry itself is strongest.

SNAP-OFF FLUSH

6004	¼"	7/16"	1⅛"	⅛"	100	1000	4¼
6005	5/16"	15/32"	1 9/32"	⅛"	100	500	6
6006	⅜"	9/16"	1 11/32"	9/16"	50	250	10
6008	½"	11/16"	2 1/32"	¾"	50	200	17½
6010	⅝"	27/32"	2 15/32"	⅞"	25	125	36
6012	¾"	1"	3¼"	1 3/16"	10	50	50
6014	⅞"	1⅛"	3 11/16"	1⅛"	10	50	76

TIE-WIRE

6732	7/32"	15/32"	1 1/16"	—	100	500	5¼

HAND FLUSH

6104	¼"	7/16"	1¼"	⅜"	100	1000	4¼
6105	5/16"	15/32"	1 7/32"	⅜"	100	1000	4½
6106	⅜"	9/16"	1 7/16"	7/16"	50	500	7½
6108	½"	11/16"	1 15/16"	¾"	50	250	14½
6110	⅝"	27/32"	2⅜"	⅞"	25	125	30
6112	¾"	1"	3"	1⅛"	10	50	44

HAND HOLDERS for manual installation

Size	¼"	5/16"	⅜"	½"	⅝"	¾"

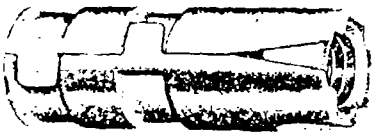
NON-DRILL EXTERNAL PLUG

6460	¼"	7/16"	1¼"	100	1000	4½
6462	⅛"	9/16"	1 7/16"	50	500	8
6465	½"	11/16"	2"	50	250	14
6467	⅝"	⅞"	2⅜"	25	125	28
6468	¾"	1"	3"	10	50	49

PULLOUT LOAD TESTS*

Tension Load (lbs.)	2,710	3,225	4,775	7,160	10,600	13,600	20,565

*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 4,500 psi



GSA Specification
FF-S-325, Group II, Type 2, Class 2, Style 1

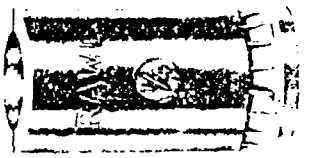
Use in: Concrete, brick, stone
Use with: Machine screw or bolt
Made of: Zinc alloy
Size range: ¼" to ¾"

- Layout or hole-spotting required
- Rustproof
- Non-calking, expands as bolt is tightened

PULLOUT LOAD TEST*

[illegible]						
Tension Load (lbs.)	1,700	2,100	2,900	5,600	9,000	12,000

*NOTE: Test data above represent ultimate load sustained in concrete having minimum compressive strength of 3,300 psi.



GSA Specification
FF-S-325, Group I, Type 1, Class 1

Use in: Concrete, brick, stone
Use with: Machine screw or bolt
Made of: Lead and zinc
Size range: 6-32 to ¾-10

- Layout or hole-spotting required
- Single unit calking anchor
- Rustproof
- Setting tool provided
- Screw engagement minimum of ⅔ of anchor threads

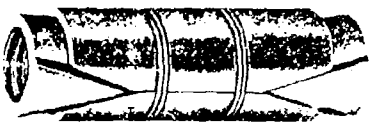
PULLOUT LOAD TESTS*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tension Load (lbs.)	770	945	1,340	2,340	3,020

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tension Load (lbs.)	4,810	5,930	7,800	11,250

*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 4,500 psi.

Hevi Dowl



GSA Specification
FF-S-325, Group II, Type 2, Class 2, Style 2

Use in: Concrete, brick, stone
Use with: Machine screw or bolt
Made of: Zinc (⅞" and 1" are malleable iron)
Size range: ¼" to 1"

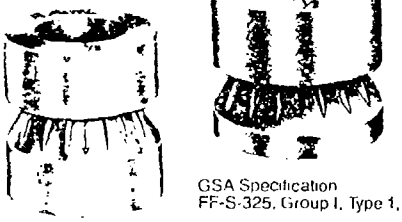
- Layout or hole-spotting required
- Heavy duty
- Non-calking, expands as bolt is tightened
- Dual expansion develops greater contact with walls of hole

PULLOUT LOAD TESTS*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tension Load (lbs.)	2,050	2,800	4,250	9,000	13,000	16,000	20,300	25,540

*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 3,300 psi.

Hevi Mini-Dowl



GSA Specification
FF-S-325, Group I, Type 1, Class 2

Use in: Concrete, brick, stone
Use with: Machine screw or bolt
Made of: Lead and zinc
Size range: ½" to 1"

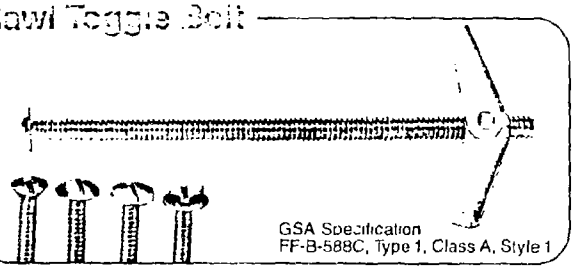
- Layout or hole-spotting required
- Heavy duty
- Threaded and plain style
- 2 unit minimum installation

PULLOUT LOAD TESTS*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tension Load (lbs.)	8,680	11,465	14,800	23,500	28,600

*NOTE: Test data above represent average ultimate load sustained in concrete having minimum compressive strength of 4,500 psi.

Rawl Toggle Bolt



GSA Specification
FF-B-588C, Type 1, Class A, Style 1

Use in: Block, wallboard, plaster, hollow tile
Use with: No other fastener needed
Made of: Steel
Size range: ⅛" x 2" to ½" x 6"

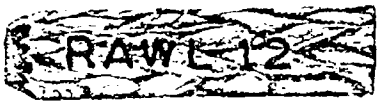
- Five head styles—round, flat, mushroom, button and slotted hex head
- Comes with fully threaded machine screws
- Wings only also available
- Wing is lost when screw is removed

PULLOUT LOAD TESTS*

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hole size	⅞"	⅞"	⅞"	⅞"	⅞"	1¼"
Tension Load (lbs.)	310	535	835	1,070	1,385	2,550

*NOTE: Test data above represent average ultimate loads sustained in hollow concrete block.

Rawlplug



GSA Specification
FF-S-325, Group IV, Type 2

Use in: All masonry material
Use with: Sheet metal, wood or lag screws
Made of: Braided jute with lead liner
Size range: 6 x ¾" to ⅜" x 3"

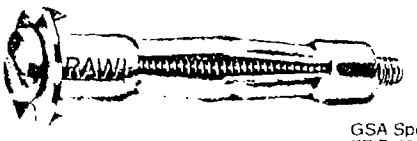
- No layout or hole-spotting required
- Screw may be removed
- High holding power
- 26 sizes
- Also available in bulk or contractor kits

PULLOUT LOAD TESTS*

SHEET METAL AND WOOD SCREWS	[illegible]	[illegible]	[illegible]	[illegible]	LAG SCREWS
Tension Load (lbs.)	1,190	1,300	2,000	2,983	3,225

*NOTE: Test data above represents average ultimate load sustained in concrete having minimum compressive strength of 3,000 psi

Rawly



GSA Specification
FF-B-588C, Type III

Use in: Wallboard, plaster, paneling
Use with: No other fastener needed
Made of: Steel
Size range: ⅛" extra short to ¼" extra long

- Slotted hex head screws available
- Remove screw as often as needed
- Also available in drive type (no drilling required)

Drill hole completely through hollow wall and insert Rawly flap head with back of screwdriver until gripper prongs are embedded in wall. Maintain pressure with screwdriver (to prevent anchor from rotating in hole) while turning in screw until a definite resistance is felt. Remove screw, line up mounting hole of item to be fastened, reinsert screw and tighten.

WALL THICKNESS

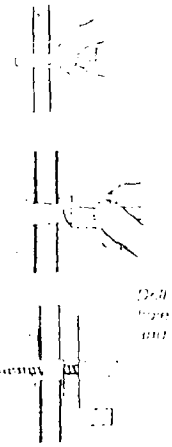
Style	Extra Short	Short	Long	Extra Long

Rawl Poly-Toggle Screw Anchor

U.S. Pat. No. 4,197,781
Poly-Toggle is a trademark of The Rawlplug Co., Inc.

Use in: Wallboard or solid masonry
Use with: Sheet metal screw
Made of: Polypropylene
Size range: Short for ⅜" to ½" wallboard
Medium for ½" to ⅝" wallboard
Long for ⅝" to ¾" wallboard

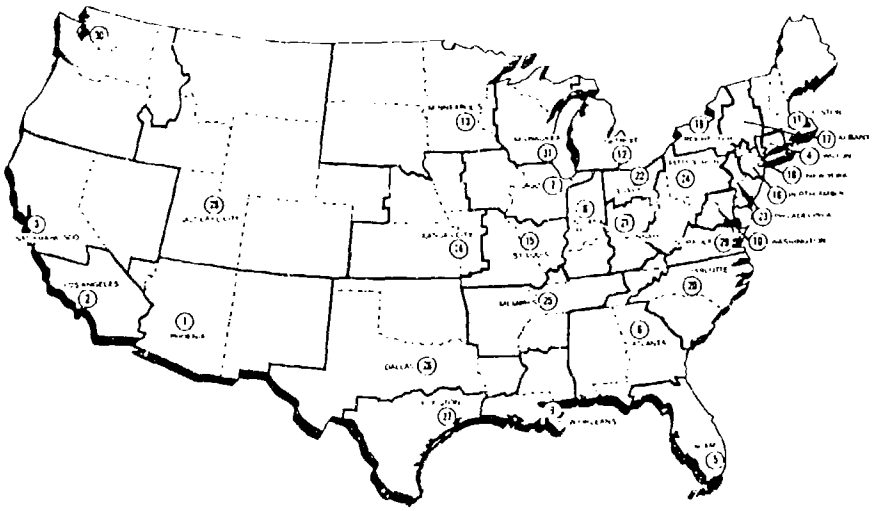
- Screw-activated
- Exact fit assures solid holding power
- Accepts #8-#12 screws
- If screw is removed, anchor stays in place
- For use in solid masonry, twist off outer wings



Drill hole. Squeeze Poly-Toggle flat and push into hole. Tap with hammer. Pull tabs in place, insert screw and tighten until hole secure.

TYPICAL ANCHOR SPECIFICATION

Expansion anchors shall be Rawl (anchor description and size) as manufactured by The Rawlplug Company, Inc., Two F. B. Powers Square, New Rochelle, New York, 10802. (Note: For steel anchors, add to above, "Anchors shall be zinc plated in accordance with ASTM Specification B633.) Expansion anchors shall be installed in holes drilled with carbide tipped drills conforming to ANSI Specification B94.12-1977. Installation shall be in accordance with instructions as provided by the manufacturer.



FOR ADDITIONAL INFORMATION, CONTACT THE RAWL BRANCH OFFICE NEAREST YOU.

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(602) 944-5277 FAX (602)870-1182
3. CALIFORNIA, Irwindale 91706, 16147 Montoya St.
(818) 334-0814 FAX (818)334-7218 In CA: 1-800-468-9513
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(415) 285-2606 FAX (415)285-6090
5. CONNECTICUT, Wilton 06897, 388 Danbury Rd. (Rt. 7)
(203) 762-0064 FAX (203)762-2550
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(305) 888-6909 FAX (305)883-1037 In FL: 1-800-843-5398
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In Baltimore: (301) 792-4228
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14. MINNESOTA, Minneapolis 55435, 5250 "D" W. 73rd St.
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(201) 775-5515 FAX (201)775-3898
In NY: 1-800-634-0909 In NJ: 1-800-426-0909
18. NEW YORK, Albany 12202, Port of Albany Bldg. S4
(518)434-4640
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(212) 675-4849
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26. TENNESSEE, Memphis 38112, 2644 Yale Ave.
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27. TEXAS, Dallas 75207, 1833 Levee St.
(214) 748-8151 FAX (214)745-1197
In TX: 1-800-442-7079
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(801) 466-3406 FAX (801)484-0731
29. VIRGINIA, Virginia Beach 23462, 352 Cleveland Pl. #101
(804) 473-3811 FAX (804)473-1977
30. WASHINGTON, Seattle 98108, 111 S. Findlay St.
(206) 762-8832 FAX (206)762-8492 In WA: 1-800-562-5375
In OR: (503) 248-0737
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For the name of your nearest distributor call toll-free **1-800-243-8160**

THE RAWLPLUG COMPANY, INC. • NEW ROCHELLE, NEW YORK 10802 • (914) 235-6300
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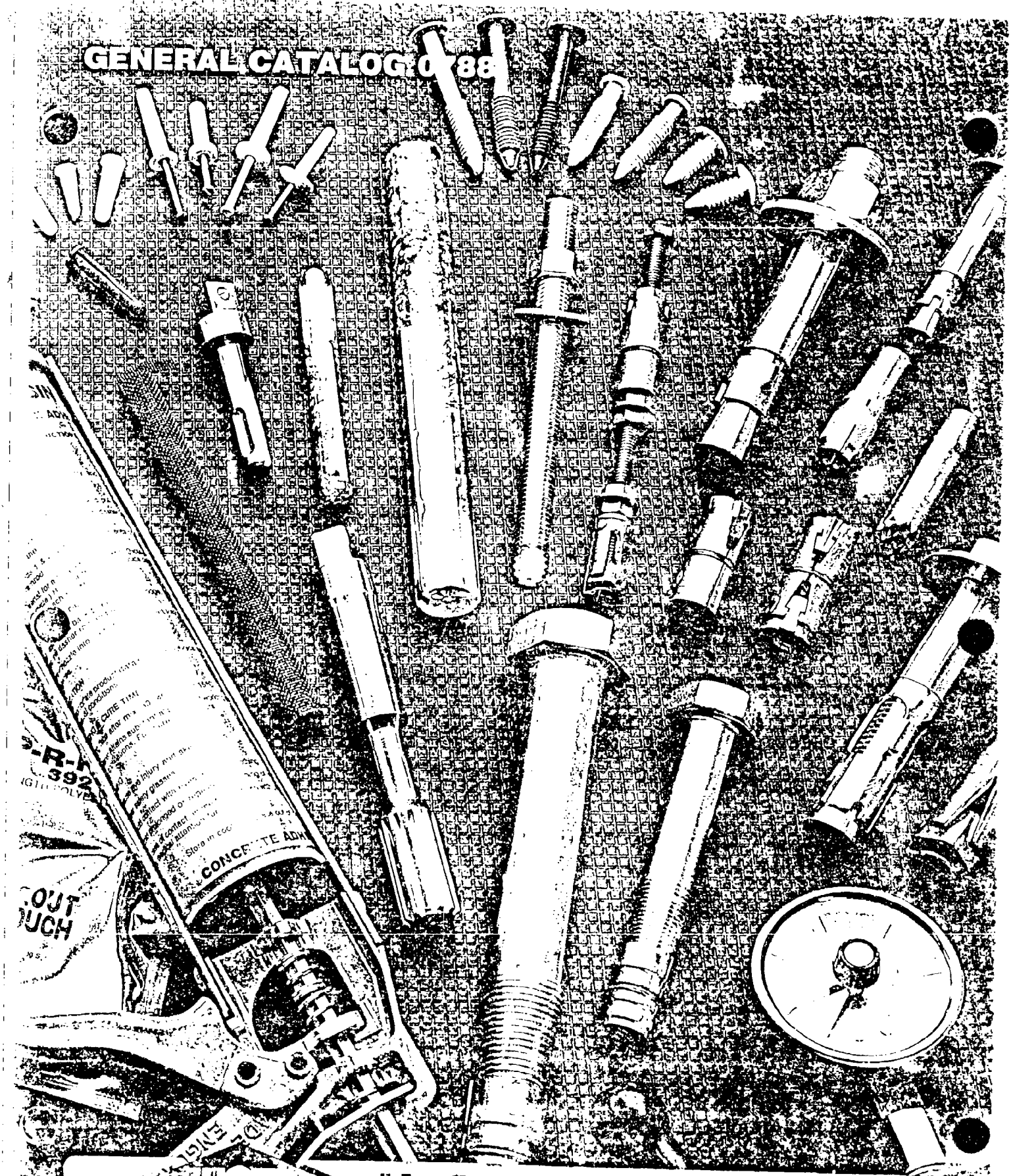
GENERAL CATALOG 0788



U.S.E. DIAMOND, INC.

P.O. Box 1580 · Sharon, PA 16146 · (412) 220-3147

Because too little attention is given to specification or proper selection of fasteners, there is frequent misapplication, often leading to costly failures. In the selection of fasteners, reliability and ability to meet requirements should be the determining factors. Economy should be secondary.

The following requirements must be considered:

1. LOAD REQUIREMENTS: Weight of item to be fastened.
2. LOAD CONDITION: Forces to which fasteners will be submitted after installation.
3. BASE MATERIAL: Concrete, masonry, stone, steel, wood, etc.
4. ATMOSPHERIC CONDITION: Is installation outdoors or indoors? Will fasteners be subjected to humidity, chemicals, salt water or variable temperatures?
5. IN-PLACE COST: Anchor price and installation time plus cost of tools.

LOAD REQUIREMENT:

Total weight of material to be fastened divided by minimum number of fasteners required determines load requirement per fastener. A safe working load is 1/4th the rated holding power of the anchor.

LOAD CONDITION:

There are four classifications, namely: dead, variable, vibratory or shock.

a. DEAD LOADS are those in which no outside force will be applied, such as: mirrors, electrical outlet boxes, flush mounted signs, etc.
b. VARIABLE LOADS are those in which irregular loading is experienced, as found in suspended signs, hand rails, etc.
c. VIBRATORY LOADS involve high-frequency impact (usually of low intensity), such as encountered in motor or fan installations, etc.
d. SHOCK LOADS are most critical and involve intense or sharply applied impacts as encountered in door bumpers, guard rails, etc.

BASE MATERIALS:

These will vary over a wide range in solid and hollow types. The vast majority of fasteners are designed for use only in solid or only in hollow materials. Very few can be used in both. In each classification, variations in hardness, age and/or brittleness, must be considered

a. Solid concrete presents relatively few problems for anchor selection. Holding power will be in direct ratio to compressive strength of concrete.
b. Aged or brittle concrete presents a problem because of greater chipping. This condition causes deviations from the prescribed hole dimensions, resulting in decreased holding power. Fasteners that can adapt to irregularities should be used in such materials.
c. Hollow concrete, such as pre-cast hollow core slabs, creates other problems. Terrazzo and soft sub base concretes are included in this category.
d. Stone presents some problems. Hardness must be considered to estimate drilling time and to select the right anchor for the type of stone.
e. Blocks (concrete, cinder, way-lite, etc.) generally have low compressive strength. Such materials require anchors with high expansion characteristics, able to conform to irregularities.
f. Brick and mortar present a variety of problems since the materials encountered may vary from hard (brittle) to quite soft. In the case of hard brick, low-torque and/or low-impact anchors are generally recommended. Draw-up (mechanical) or caulking anchors are usually preferred in soft brick. Mortar, particularly in the vertical joints, requires a fastener that will not only fit between courses but will engage both courses of brick.
g. Plaster and wallboard drastically limit the selection of fasteners. These materials are generally very thin and have low compressive strength. Only fasteners for hollow materials, such as toggles, should be used.
h. Wood, plywood and veneers require fasteners suitable for the particular material and thickness. The same conditions exist as in plaster, and comparable fasteners should be used.

ATMOSPHERIC CONDITION:

Fasteners manufactured from materials having good corrosion-resistant characteristics are necessary to withstand atmospheric conditions. Plating of steel fasteners is not a positive answer, as much protective plating is lost in installation. Lead and zinc anchors offer greater longevity though stainless steel may be necessary for high corrosion or chemical environment applications.

IN-PLACE COST:

In-place cost, the final consideration, is determined by:

a. Price of fasteners.
b. Setting time and cost.
c. Loss rates.
d. Tools required.

While the old method of star drilling contributed to the popularity of powder-actuated and self-drilling anchors, the new self-rotating electric impact hammers have reduced installation time of conventional anchors to a point where their in-place costs are now at or below the levels of powder or self-drill systems. Conventional anchors have always enjoyed a higher degree of reliability and versatility in being able to meet the varied requirements of load, load conditions, base materials and atmospheric conditions.

If more than one type of fastener can meet the first four requirements (load requirement, load condition, base material, atmospheric condition) then the fastener offering the lowest in-place cost should be the one selected.

ANCHOR AND FASTENER DESIGNS:

Holding power of a fastener is determined by its length, diameter, penetration of base material and method of engagement. Expansion characteristics are vital.

There are eight general classifications of fastener design. Each has desirable features that must be considered in the light of its ability to meet the requirements for the particular application. Most are specialized for limited ranges of applications; very few can be adapted to overall construction conditions or standardization programs.

ANCHOR PERFORMANCE:

The performance data shown in various tables was obtained using the ASTM E488 test-standard. All concrete was unreinforced and all holes were drilled with drill bits conforming to A.N.S.I. B94-12-1977. The figures shown are the average of several tests and are to be regarded as maximums. Unless otherwise noted, all shear tests were conducted with S.A.E. Grade 2 bolts in a minimum of 3,000 P.S.I. concrete.

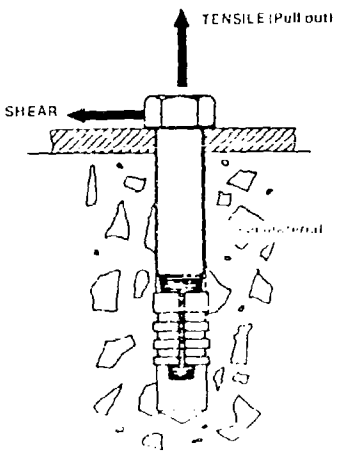
To compensate for variations in base materials, drills and setting practices, a **minimum** factor of safety of 4:1 should be applied to all performance data. Specific applications will determine the correct factor of safety to be applied to your fastening. The designer is responsible for determining the correct safety factor.

DRILLS:

The holding power of any anchor is directly related to the diameter of the hole and is, therefore, as important as the material strength and the strength of the anchor itself. As noted above, all performance data was obtained with drill bits conforming to A.N.S.I. B94-12-1977 carbide-tipped drill standard.

NOMINAL DRILL DIAMETER	TOLERANCE BAND	NOMINAL DRILL DIAMETER	TOLERANCE BAND
3/16	.206-.198	5/8	.660- .650
1/4	.268-.260	11/16	.723- .713
5/16	.335-.327	3/4	.787- .775
3/8	.398-.390	7/8	.917- .905
7/16	.468-.458	1	1.042-1.030
1/2	.530-.520	1-1/8	1.175-1.160
9/16	.592-.582	1-1/4	1.300-1.285

Application data, installation instructions, edge and distance performance data and material specifications are available on all products.



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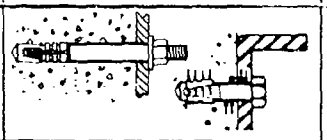
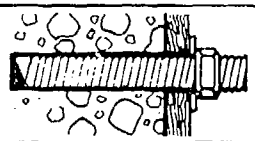
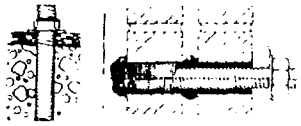
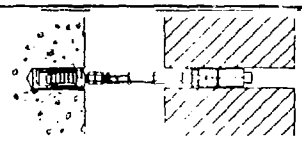
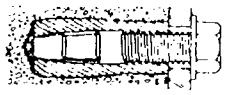
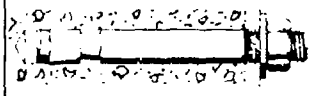
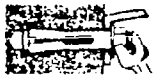
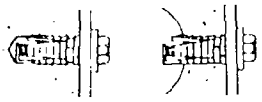
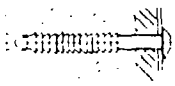
SUPER-CHOICE APPLICATION

Key ● Very Suitable ○ May Be Suitable Per Application

Anchors		Fastening Base Material							Application Criteria				
	Types of Anchors	Concrete	Hard natural stone	Soft natural stone	Solid brick	Hollow brick	Hollow concrete block	Wood Metal Gypsum Plastic Foam ins	In-place (through) fastening	Immediate loading	Flush surface removing	Dynamic loading	Temp. resistant
HEAVY & SPECIAL DUTY	Taper-Bolt[1,2]	●	○						●	●	●	●	●
	Adhesive Sup-R-Set[1,2] Capsules	●	●	○	○				○			●	○
	Adhesive Grout Pouch™ 392 (Pourable)	●	●	●	○	○	○					●	○
	HDS-392-T Grout Pump™ (Side Wall)	●	●	●	●	●	●	●	●			●	○
	Sup-R-Tie™ (Repair Anchor)	●	●	●	●	●	●	○		●			●
MEDIUM DUTY	Sup-R-Drop™ (Drop-in Anchors)	●	○						○	●	●	○	●
	Sup-R-Stud[2] (Wedge Anchor)	●	○		●				○	●		○	●
	Sup-R-Sleeve[2] (Sleeve Anchor)	●	○	○	●	○	●		●	●			●
	Forway[1]	○	○	○	●	●	●		○	●	●		●
LIGHT DUTY	Tap-It[2]	●	●	●	●	○	○	●	●	●			
	Uni-Tap[2]				○	○		●	○	●		○	○

Note (1) Base materials vary widely. When in doubt consult the USE A & E Manual and/or your local representative.
(2) Taper Bolt is designed for repeated removeability.

	Anchors	PROGRAM											
Removable and resettable	Types of Anchors (as installed)	Size Range - Diameter 3/16	1/4	5/16	3/8	1/2	5/8	3/4	1	1 1/4	Base Materials	Versions	Characteristics
● See note (2)			●	●	●	●	●	●	●		- Grade 5 or 8 steel Zinc Plated Mechanically Galv. - Stainless Steel - High Strength non-ferrous	- Hex Head Bolt - Eye Bolt - Machine Threaded Stud - Proof-Set Machine Threaded Stud	Metal Expansion/ Caulking Anchor with large expander sleeve
					●	●	●	●	●	●	2 Part Resin and/or - Carbon Steel/Stainless Steel Threaded Rod - Rebar - High Strength Non-ferrous Rod	Rod can take any form or configuration that can be placed in position using a power tool.	Anchor rod chemically adheres to resin which has adhesive bond to concrete. No setting stress
○ ○		●	●	●	●	●	●	●	●	●	2 Part Resin and/or any material with enhanced surface	Material can take any form or configuration. Inverted bolt heads provide excellent additional holding power.	Anchor rod chemically adheres to resin which has adhesive bond to concrete. No setting stress
			●		●						- Zinc Plated Carbon Steel - Stainless Steel	Recessed Flush Mount	Mechanical with expansion/caulking in each wall and tie rod. No lateral tension
			●		●	●	●	●			- Zinc Plated Carbon Steel - Stainless Steel	Standard female machine screw thread.	Expansion of anchor wall by internal tapered plug.
			●		●	●	●	●	●	●	- Carbon Steel Zinc Plated Mechanically Galv. - Stainless Steel	Standard male machine screw thread.	Expansion of stainless steel collar by tapered stud body.
			●	●	●	●	●	●			Zinc Plated Carbon Steel	- Acorn Head - Hex Head - Round Head - Flat Head	Expansion of steel sleeve by tapered body.
			●	●	●	●	●	●			Zinc Alloy Casting	Standard female machine screw thread	Four way expansion of anchor wall by internal nut
		●	●								Nylon and/or - carbon steel zinc plated nail - aluminum nail - nylon nail	- Mushroom Head Round Head Flat Head	Expansion of body by impact on nail head
			●								Nylon	White Standard Other colors available	Holds by reverse tension of flutes

A [illegible]

Taper-Bolt offers proven superiority in structural anchoring of all types of equipment. Typical applications: tunnel liner panels, air conditioning and heating units, electrical and plumbing systems, concrete forms, seating, hand and guide rails, expansion joints, storage shelving units, tool racks, ornamental iron, dock bumpers, highway dividers, architectural panels, tilt-up construction, industrial fencing and countless other uses.

- All bolts S.A.E. Grade 5.
- Specials available in stainless steel and with mechanical galvanized finish.
- 7/8" and 1-1/8" diameter available on request.
- I.C.B.O., N.Y. CITY, SAN FRANCISCO APPROVED.
- EXCEEDS GSA SPEC. FF-S-325 2.4.1.
- Taper Studs, Proof-Setting Taper Studs, and Eye Taper Bolts all available on request.

ORDER CODE	SIZE	MIN. EMBED-MENT	3,000 P.S.I. TENSILE	3,000 P.S.I. SHEAR	5,000 P.S.I. TENSILE	5,000 P.S.I. SHEAR	QTY. BOX
3411	1/4 x 1-3/4	1-1/4	1666	2425	2066	3502	100
3412	1/4 x 2-1/4						100
3413	1/4 x 3-1/4						100
3420	3/8 x 2-1/4	1-7/8	4030	7177	4987	8567	50
3421	3/8 x 2-5/8						[illegible]
3422	3/8 x 3						50
3423	3/8 x 4						50
3430	1/2 x 2-7/8	2-3/8	8165	12177	9346	15217	25
3431	1/2 x 4						25
3432	1/2 x 5						25
3440	5/8 x 3-1/2	2-5/8	9990	17030	10470	17257	25
3441	5/8 x 4-1/2						25
3442	5/8 x 6						25
3443	5/8 x 7						25
3450	3/4 x 4-1/8	3-3/8	11906	27916	17073	28110	10
3451	3/4 x 5-1/2						10
3452	3/4 x 7						10
3453	3/4 x 8						10
3460	1 x 5-5/8	4-5/8	28263	36257	30817	38487	5
3461	1 x 6-3/4						5
3462	1 x 7-1/4						5
3463	1 x 9						5

EXTRA TAPER-BOLT NUTS

ORDER CODE	SIZE	QTY. BOX
3410-2	1/4	100
3420-2	3/8	50
3430-2	1/2	50
3440-2	5/8	25
3450-2	3/4	25
3455-2	7/8	10
3460-2	1	10
3465-2	1-1/8	10
3471-2	1-1/4	10

B [illegible]

Sup-R-Stud is a heavy-duty, all steel, expansion wedge anchor designed to work under dead and variable loads in solid concrete. Each Sup-R-Stud is a complete fastening system; anchor, nut and washer are inserted as a single unit and all at the same time.

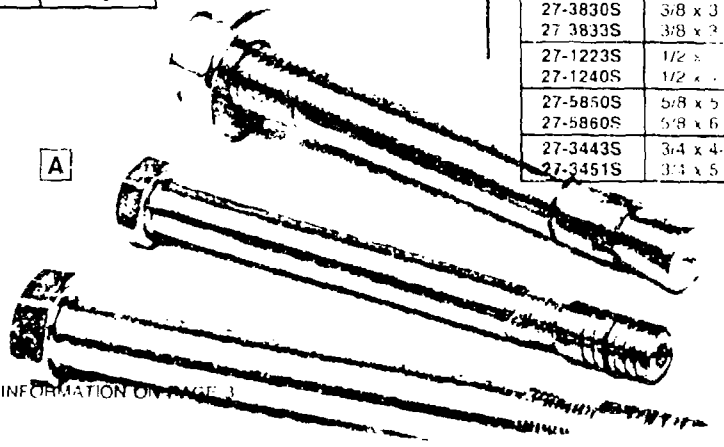
Installation is fast, easy and economical since Sup-R-Stud is installed with the fixture in place. Bolt size and hole size share the same diameter so Sup-R-Stud anchors securely even when the hole is deeper than its length.

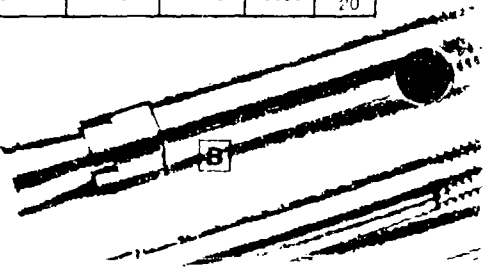
ALL WEDGE CLIPS ARE STAINLESS STEEL
GSA SPEC FF-S-325 2.4.1
I.C.B.O. & N.Y. CITY APPROVED. SAN FRANCISCO APPROVED
UL LISTED EXCEPT ¼".
[illegible] manufacture — call us for your special sizes or materials

ORDER CODE STD.	ORDER CODE 303 STAINLESS	SIZE	MIN. EMBED-MENT	THREAD LENGTH	4500 P.S.I. CONCRETE TENSILE	4500 P.S.I. CONCRETE SHEAR	QTY. BOX
26-14134	27-14134	1/4 x 1-3/4	1-1/8	3/4	2520	1500	100
26-14214	27-14214	1/4 x 2-1/4					100
26-14314	27-14314	1/4 x 3-1/4					100
26-38214	27-38214	3/8 x 2-1/4	1-1/2	1-1/8	4700	3750	50
26-38300	27-38300	3/8 x 3					50
26-38334	27-38334	3/8 x 3-3/4					50
26-38500	27-38500	3/8 x 5					50
26-12234	27-12234	1/2 x 2-3/4	2-1/4	1-1/4	7330	6800	50
26-12400	27-12400	1/2 x 4					50
26-12514	27-12514	1/2 x 5-1/4					25
26-12700	27-12700	1/2 x 7					25
26-58312	27-58312	5/8 x 3-1/2	2-3/4	1-1/2	10340	10600	25
26-58500	27-58500	5/8 x 5					20
26-58600	27-58600	5/8 x 6					20
26-58700	27-58700	5/8 x 7					20
26-58812	27-58812	5/8 x 8-1/2					20
26-34414	27-34414	3/4 x 4-1/4	3-1/4	1-1/2	13700	15330	20
26-34434	27-34434	3/4 x 4-3/4					20
26-34512	27-34512	3/4 x 5-1/2					20
26-34700	27-34700	3/4 x 7					10
26-34812	27-34812	3/4 x 8-1/2					10
26-34100	27-34100	3/4 x 10					10
26-78600	27-78600	7/8 x 6	3-7/8	2-1/4	17360	20800	5
26-78800	27-78800	7/8 x 8					5
26-78100	27-78100	7/8 x 10					5
26-16000	27-16000	1 x 6	4-1/2	2-1/4	21330	27100	5
26-19000	27-19000	1 x 9					5
26-11200	27-11200	1 x 12					5
26-11490	27-11490	1-1/4 x 9	5-1/2	3-1/4	26250	42100	5
26-11412	27-11412	1-1/4 x 12					5

316 STAINLESS

ORDER CODE	SIZE	MIN. EMBED-MENT	THREAD LENGTH	4500 P.S.I. CONCRETE TENSILE	4500 P.S.I. CONCRETE SHEAR	QTY. BOX
27-1413S	1/4 x 1-3/4	1-1/8	3/4	2520	1500	100
27-1421S	1/4 x 2-1/4					100
27-3830S	3/8 x 3	1-1/2	1-1/8	4700	3750	50
27-3833S	3/8 x [illegible]					50
27-1223S	1/2 x [illegible]	2-1/4	1-1/4	7330	6800	[illegible]
27-1240S	1/2 x [illegible]					50
27-5850S	5/8 x 5	2-3/4	1-1/2	10340	10600	20
27-5860S	5/8 x 6					20
27-3443S	3/4 x 4-3/4	3-1/4	1-1/2	13700	15330	20
27-3451S	3/4 x 5-1/2					20





SEE SAFETY FACTOR INFORMATION ON PAGE 3

C [illegible]

Sup-R-Sleeve is an all-steel, multi-purpose, bolt size/hole size anchor effective under dead and variable loads in a wide range of materials. Its unusual versatility arises from the unique slipping sleeve design and the fact it's available in four head styles as well as many lengths and sizes.
UL LISTED EXCEPT ¼". G.S A. SPEC FF-S-325 2.3.3

ORDER CODE	SIZE	MINIMUM EMBEDMENT	3500 PSI CONCRETE TENSILE	3500 PSI CONCRETE SHEAR	QTY. BOX
	ACORN NUT				
1705	1/4 x 1-3/8	1	1400	920	100
1706	1/4 x 2-1/4	1	1400	920	100
	HEX NUT				
1710	5/16 x 1-1/2	1	1900	1600	100
1711	5/16 x 2-1/2	1	1900	1600	100
1712	3/8 x 1-7/8	1-1/4	2960	2520	50
1713	3/8 x 3	1-1/4	2960	2520	50
1714	1/2 x 2-1/4	1-1/2	4860	4880	25
1715	1/2 x 2-3/4	1-1/2	4860	4880	25
1716	1/2 x 4	1-1/2	4860	4880	25
1717	1/2 x 6	1-1/2	4860	4880	25
1718	5/8 x 2-1/4	2	6780	7880	25
1719	5/8 x 4-1/4	2	6780	7880	10
1721	3/4 x 2-1/2	2	8780	11620	10
1722	3/4 x 4-1/4	2	8780	11620	5
1723	3/4 x 6-1/4	2	8780	11620	5
	FLAT HEAD				
1766	1/4 x 3	1	1400	920	100
1772	3/8 x 2-3/4	1-1/4	2960	2520	50
1773	3/8 x 4	1-1/4	2960	2520	50
1774	3/8 x 5	1-1/4	2960	2520	50
1775	3/8 x 6	1-1/4	2960	2520	50
	ROUND HEAD				
1788	1/4 x 1-1/4	1	1400	920	100
1789	1/4 x 2	1	1400	920	100
1795	3/8 x 2-1/2	1	2960	2570	50

D [illegible]

Sup-R-Drop is a fully assembled, highly versatile, internally expanded steel anchor for medium and heavy loads in solid concrete.

It's easily installed using standard carbide drills and supplied setting tool. Once set, the bolt, stud or threaded rod can be removed or replaced without affecting the Drop-In's holding power.
UL LISTED EXCEPT ¼"

ORDER CODE	BOLT SIZE	DRILL SIZE	THREAD DEPTH	ANCHOR LENGTH	TENSILE STRENGTH	SHEAR STRENGTH	QTY. BOX
1314	1/4	3/8	7/16	1	2400	2177	100
1338	3/8	1/2	5/8	1-9/16	4200	3950	50
1312	1/2	5/8	11/16	1-13/16	6990	6422	50
1358	5/8	7/8	7/8	2-9/16	9750	12500	25
1334	3/4	1	1-3/8	3-3/16	11500	16590	25

E SUP-R-DRILL™

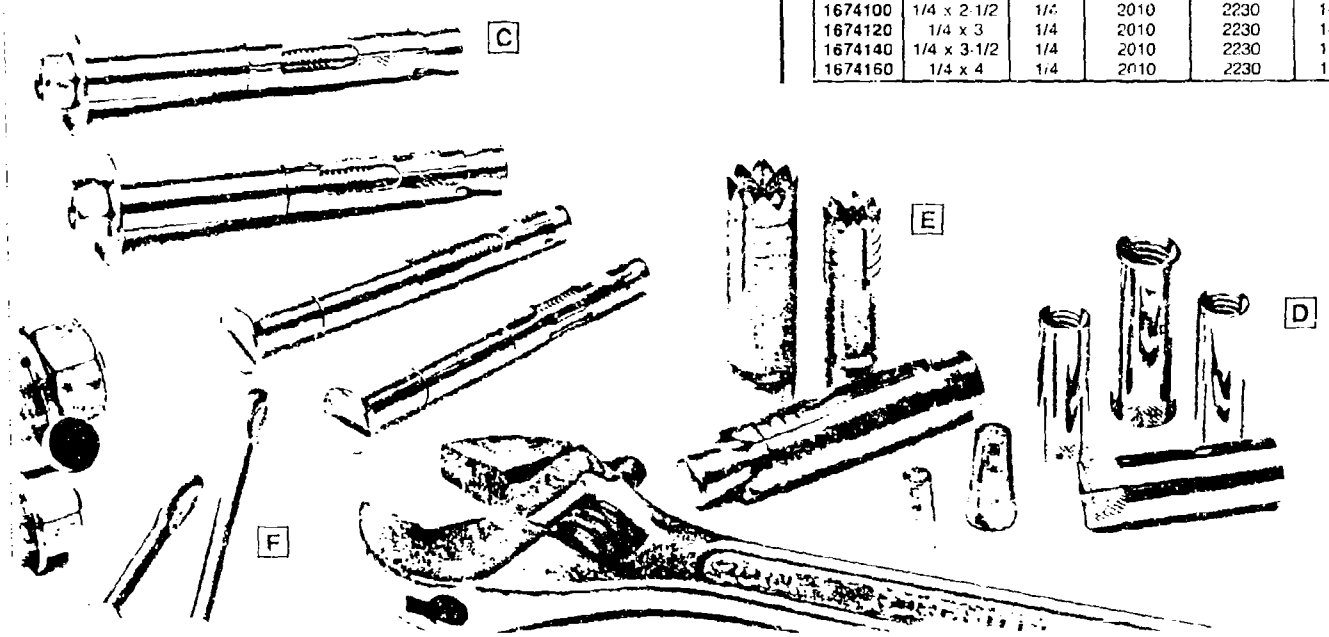
Sup-R-Drill serves a dual function as both masonry drill and anchor. It's designed to fasten medium to heavy-duty dead and variable loads in solid concrete only. Since it drills its own hole, no masonry drill bit is needed nor are irregular or oversize holes a problem.
G.S.A. SPEC FF-S-325 3.2.3

ORDER CODE	BOLT SIZE	ANCHOR O.D.	ANCHOR LENGTH	THREAD DEPTH	TENSILE STRENGTH	SHEAR STRENGTH	QTY. BOX
904-1	1/4	7/16	1-3/32	7/16	3310	2530	50
905-1	5/16	16/32	1-15/16	17/32	3750	3800	50
906-1	3/8	9/16	1-17/32	5/8	5470	4680	25
908-1	1/2	11/16	2-1/32	7/8	8800	9500	25
910-1	5/8	27/32	2-15/32	1	12500	13300	25
912-1	3/4	1	3-17/64	1-9/32	17100	16100	25
914-1	7/8	1-1/8	3-11/16	1-15/32	18800	17900	25

F SUP-R-DRIVE™

A special one-piece, flat head drive anchor that gives exceptional service in solid concrete. Steel is heat treated to produce special properties.

ORDER CODE	ANCHOR DIAMETER AND LENGTH	DRILL SIZE	TENSILE STRENGTH	SHEAR STRENGTH	MIN. EMBED-MENT	QTY. BOX
1674060	1/4 x 1-1/2	1/4	2010	2230	1-1/8	100
1674080	1/4 x 2	1/4	2010	2230	1-1/8	100
1674100	1/4 x 2-1/2	1/4	2010	2230	1-1/8	100
1674120	1/4 x 3	1/4	2010	2230	1-1/8	100
1674140	1/4 x 3-1/2	1/4	2010	2230	1-1/8	100
1674160	1/4 x 4	1/4	2010	2230	1-1/8	100



A SUP-R-SET CAPSULE ANCHOR

Polyester resin and aggregate in an easy to handle glass capsule insert in pre-drilled hole and drill rod or rebar into place. Does not stress concrete and has excellent vibration resistance. Epoxy resin capsules providing higher strengths and long-term water resistance are available to order. I.C.B.O. approved.

We manufacture — call us if you need special lengths.

ORDER CODE	CAP-SULE SIZE	DRILL DIA.	MIN. EMBED-MENT	ULT. STRENGTH TENSILE 3000 PSI CONC.	ULT. STRENGTH TENSILE 5000 PSI CONC.	SHEAR	QTY. BOX
3204	1/4	3/8	3-1/2	1,786	2,527	1,128	10
3206	3/8	7/16	3-1/2	5,420	7,127	3,983	10
3208	1/2	9/16	4-1/2	8,691	14,492	7,323	10
3210	5/8	3/4	5-1/2	14,358	23,946	11,757	10
3212	3/4	7/8	6-1/2	21,684	27,075	17,257	10
3214	7/8	1	7-1/2	24,387	37,062	24,338	5
3216	1	1-1/8	8-1/2	26,118	43,545	29,128	5
3220	1-1/4	1-3/8	7-1/2	38,304	63,750	47,911	5

B STUD ASSEMBLIES (chamfer cut)

ORDER CODE	SIZE	QTY. BOX
3204018	1/4 — 20 x 4-1/2	10
3206020	3/8 — 16 x 5	10
3208025	1/2 — 13 x 6-1/4	10
3210030	5/8 — 11 x 7-1/2	10
3212041	3/4 — 10 x 10-1/4	10
3214047	7/8 — 9 x 11-3/4	5
3216047	1 — 8 x 11-3/4	5
3220056	1-1/4 — 7 x 14-1/8	5

C SUP-R-SETTER™*

SPLINE	3200010
SDS	3200020
H-60	3200030

*Sockets not included

D REBAR ATTACHMENTS

ORDER CODE	DESC.
3200140	#4
3200150	#5
3200160	#6
3200170	#7
3200180	#8
3200190	#9
3200191	#10
3200100	Set of 4 (#4, #5, #6, #7)

E SUP-R-RESIN GROUT POUCH 392 (FOURABLE)

Polyester resin and mineral filler in an easy to mix pouch. User never has to touch the material. After mixing, just cut the bag and pour into hole until ⅓ full. Place rod or rebar by hand, turning as you insert. I.C.B.O. approved.

Important: Material pre-proportioned by factory. No on site mixing problems.

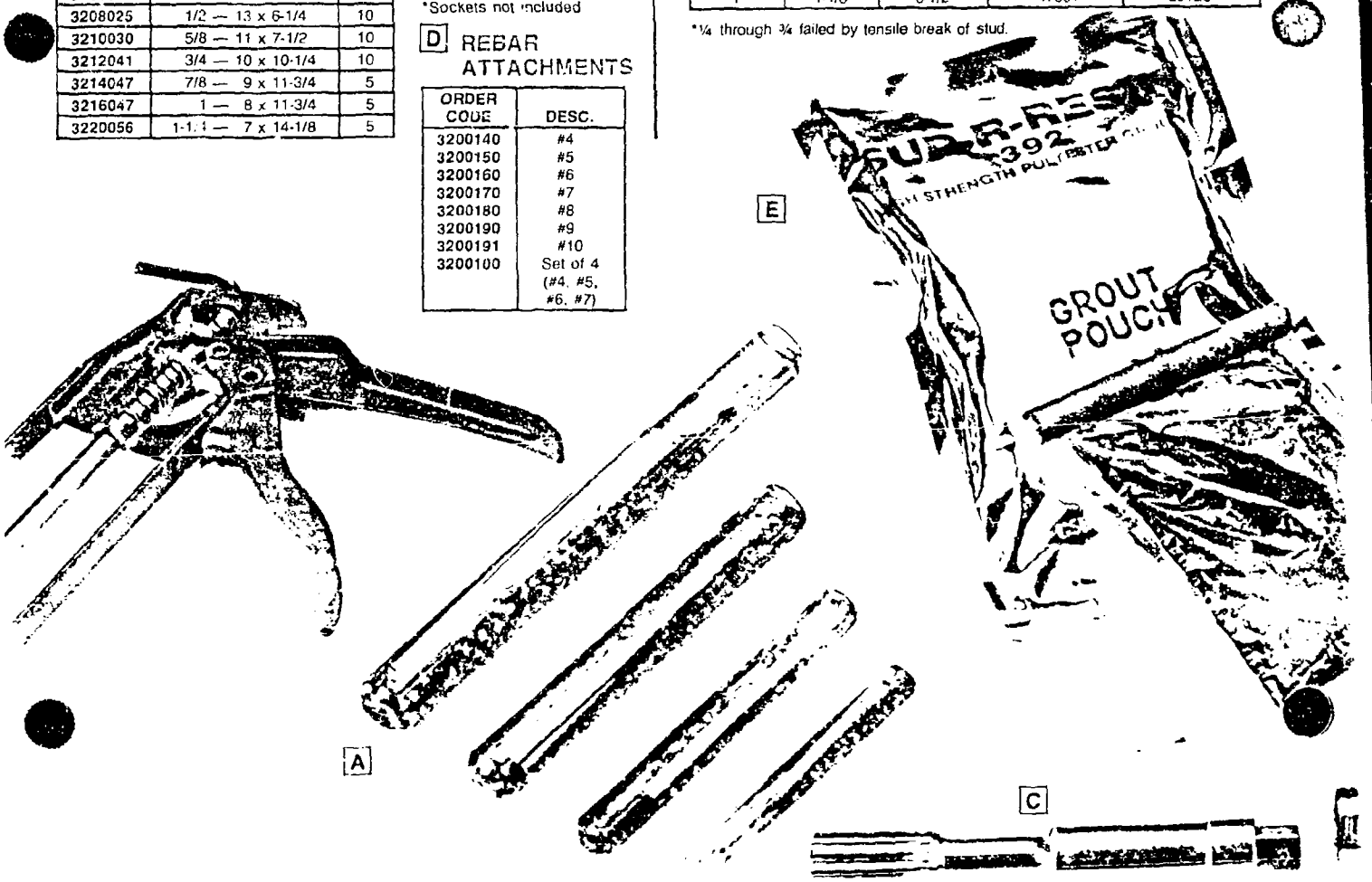
Epoxy pouch can be made available. Call us for special formulations for high strength or temperature applications.

ORDER CODE	DESC.	GROUT WT.	QTY./BOX
7511008	Grout Pouch 392	10 oz.	5
751100S	Grout Pouch 392	1 oz.	25

USER DATA - USING ASTM A307 STEEL STUDS

STUD SIZE	HOLE SIZE	HOLE DEPTH	ULTIMATE STRENGTH 5000 P.S.I. CONCRETE TENSILE	SHEAR
1/4	3/8	3-1/2	*3054	1128
3/8	7/16	3-1/2	*7356	3983
1/2	9/16	4-1/2	*15146	7323
5/8	3/4	5-1/2	*24104	11757
3/4	7/8	6-1/2	*27090	17257
7/8	1	7-1/2	39710	24338
1	1-1/8	8-1/2	47861	29128

*¼ through ¾ failed by tensile break of stud.



E SUP-R-RESIN [illegible]

Specially formulated putty-like polyester resin and mineral filler in an easy-to-mix pump or pouch. The material is designed to hold in horizontal or overhead applications.

A complete set of accessories is available to allow the resin to be used in brick, block, and concrete, both solid and hollow

Epoxy formulation can be made available. Also special system is available for seismic areas. Call us for details.

ORDER CODE	PRODUCT DESCRIPTION	DRILL SIZE (A.N.S.I. STAND)	NUMBER PER BOX
7521015	392T (16 OZ.) GROUT PUMP	N/A	5
7706924	3/8 Dia. x 6 Long	1/2	25
7706940	3/8 Dia. x 10 Long	1/2	25
7708924	STEEL 1/2 Dia. x 6 Long	5/8	15
7708940	WIRE 1/2 Dia. x 10 Long	5/8	15
7710924	MESH 5/8 Dia. x 6 Long	3/4	10
7710940	5/8 Dia. x 10 Long	3/4	10
7712924	3/4 Dia. x 6 Long	1	10
7712940	3/4 Dia. x 10 Long	1	10
	Other Sizes Can Be Special Ordered		
7500100	MANUAL DISPENSING GUN	N/A	1
7521012	THIXOTROPIC (PUTTY LIKE) GROUT POUCH (12 oz.)	N/A	5
7500200	DISPENSING CARTRIDGE WITH 8" NOZZLE	N/A	2
7500201	NOZZLE 8"	N/A	5/BAG
7529060	HORIZONTAL DELIVERY SYSTEM KIT 5 Pouches/2 Dispensing Cartridges with Nozzle	N/A	1 KIT

[illegible]

3104018	1/4 Dia x 4-1/2 Long	3/8	10
3106020	3/8 Dia. x 5 Long	1/2	10
3106032	3/8 Dia. x 8 Long	1/2	10
3106048	3/8 Dia x 12 Long	1/2	10
3108025	1/2 Dia. x 6-1/4 Long	5/8	10
3108032	1/2 Dia. x 8 Long	5/8	10
3108048	1/2 Dia. x 12 Long	5/8	10
3110030	5/8 Dia. x 7-1/2 Long	3/4	10
3110032	5/8 Dia. x 8 Long	3/4	10
3110048	5/8 Dia. x 12 Long	3/4	10
3112041	3/4 Dia. x 10-1/4 Long	7/8	10
3114047	7/8 Dia. x 11-3/4 Long	1	5
3116047	1 Dia. x 11-3/4 Long	1-1/8	5
3120056	1-1/4 Dia. x 14-1/8 Long	1-3/8	5

USE SAME USER DATA CHART AS SUP-R-RESIN® GROUT POUCH 392 ON PRECEDING PAGE.

F SUP-R-TIE (MECHANICAL REPAIR ANCHOR)

Mechanical rod tie anchor used where masonry walls must be tied or retro-tied. Only anchor that can be tested in one wall before tieing in the adjoining wall. All steel components are stainless.

ORDER CODE	SIZE	QTY. BOX
0804112	1/4 x 3	50

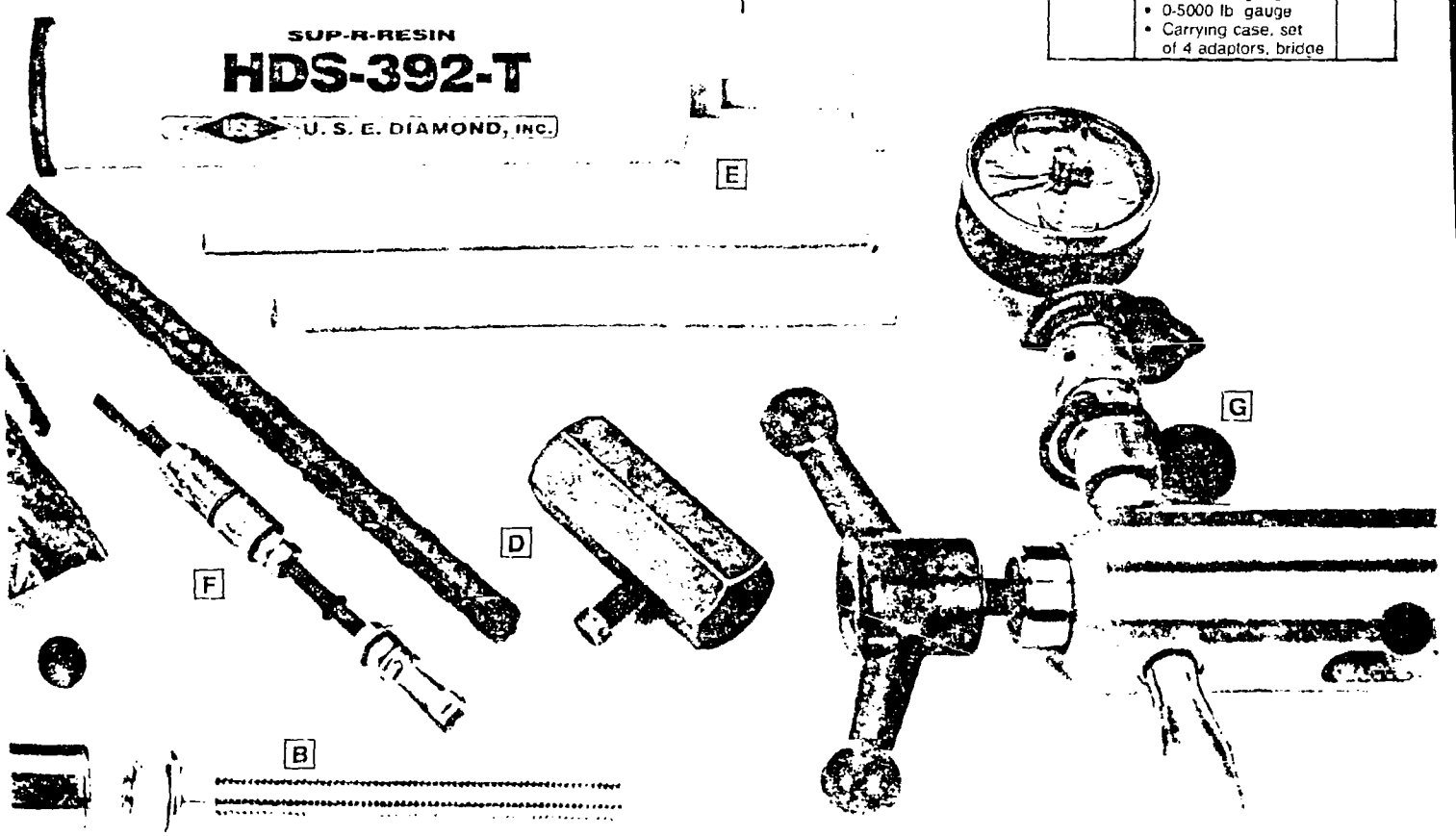
Will withstand wind and temperature variations.

Other sizes available on request

G SUP-R-GAGE (TENSION TESTER)

Hand held portable tester which allows on site pull tests to 5,000 lbs.

ORDER CODE	DESCRIPTION	QTY. B[illegible]
0875	• 0-5000 lb. gauge • carrying case, set of 3 adaptors	
08751	• Kit • 0-1500 lb. gauge • 0-5000 lb gauge • Carrying case, set of 4 adaptors, bridge	1



A

Forway is designed for positive anchoring of medium and heavy loads in an almost unlimited variety of solid and hollow-base materials. Its evenly distributed four-way expansion insures holding power in concrete, brick, stone and cinder block, among many more.

Under pressure the nut retaining leg bends outward to permit full tightening in hollow materials or holes deeper than Forway itself.

G.S.A. SPEC FF-S-325 3.2.2.2.1.3

ORDER CODE	BOLT SIZE	DRILL SIZE	SHIELD LENGTH	TENSILE STRENGTH	SHEAR STRENGTH	TENSILE BLOCK	QTY. BOX
1104	1/4	1/2	1-1/4	2320	2100	1925	100
1105	5/16	9/16	1-1/2	2600	3300	2100	100
1106	3/8	11/16	1-3/4	3640	3850	2440	50
1108	1/2	7/8	2-1/4	5100	8100	3050	50
1110	5/8	1-1/8	2-5/8	5820	14170	N.A.	25
1112	3/4	1-1/4	3-3/4	9850	15300	N.A.	25

KEYSTONE™ DOUBLE / SINGLE

Keystones are designed for medium to heavy variable, dead and vibratory loads in all types of masonry, holding especially well in soft materials. Keystone Doubles offer true parallel expansion; it's recommended for shear loads since the top expander cone acts as additional support for the bolt.

B DOUBLES

ORDER CODE	BOLT DIAMETER	DRILL SIZE	SHIELD LENGTH	TENSILE STRENGTH	SHEAR STRENGTH	QTY. BOX
1204	1/4	1/2	1-1/2	3500	2800	100
1205	5/16	5/8	1-7/8	3700	3700	100
1206	3/8	3/4	2	7500	4500	50
1208	1/2	7/8	2-1/2	11500	9200	50
1210	5/8	1	3	15000	13200	25
1212	3/4	1-1/4	3-1/2	18000	16100	25

G.S.A. SPEC FF-325 3.2.2.2.2.2

C SINGLES

ORDER CODE	BOLT DIAMETER	DRILL SIZE	SHIELD LENGTH	TENSILE STRENGTH	SHEAR STRENGTH	QTY. BOX
1004	1/4	1/2	1-3/8	3000	2180	100
1005	5/16	5/8	1-3/8	3300	3300	50
1006	3/8	3/4	1-7/8	6000	4000	50
1008	1/2	7/8	2-1/4	9500	8100	50
1010	5/8	1	2-5/8	13500	13000	25
1012	3/4	1-1/4	3	15000	15300	25

G.S.A. SPEC FF-325 3.2.2.2.2.1

D ZAP-IT™ DRIVE ANCHOR

Zap-It is a die cast zinc shell with steel nail drive anchor designed for light loads in solid masonry.

ORDER CODE	ANCHOR DIAMETER LENGTHS	HOLE DIA.	TENSILE STRENGTH	SHEAR STRENGTH	EMBED-MENT	QTY. BOX
3916	1/4 x 1	1/4	750	1516	3/4	100
3920	1/4 x 1-1/4	1/4	1000	1516	1	100
3924	1/4 x 1-1/2	1/4	1100	1516	1-1/4	100
3928	1/4 x 2	1/4	1400	1516	1-3/4	100

E

Sup-R-Lag is designed to anchor light to medium loads in all types of masonry from concrete to brick. Lag Shields use lag screws or bolts to expand the anchors for a wide variety of applications from hand rails to heavy equipment.

ORD. CODE	BOLT DIAMETER	DRILL SIZE	SHIELD LGTH.	TENSILE STRENGTH	SHEAR STRENGTH	QTY. BOX
3304	Short 1/4	1/2	1	1450	1860	100
3305	Short 5/16	1/2	1-1/4	1510	2500	100
3306	Short 3/8	5/8	1-3/4	1600	5600	50
3308	Short 1/2	3/4	2	2000	8200	50
3314	Long 1/4	1/2	1-1/2	1620	1860	100
3315	Long 5/16	1/2	1-3/4	1700	2500	100
3316	Long 3/8	5/8	2-1/2	1850	5600	50
3318	Long 1/2	3/4	3	2800	8200	50

5/8 & 3/4 Available on request
G.S.A. SPEC FF-S-325 3.2.2.1

F SUP-R-CAULK™

Sup-R-Caulk is ideal for shallow-hole anchoring of light and medium loads in solid masonry and concrete. As it expands, lead flows into any irregularities in the hole, making an incorrect setting of the anchor very difficult.

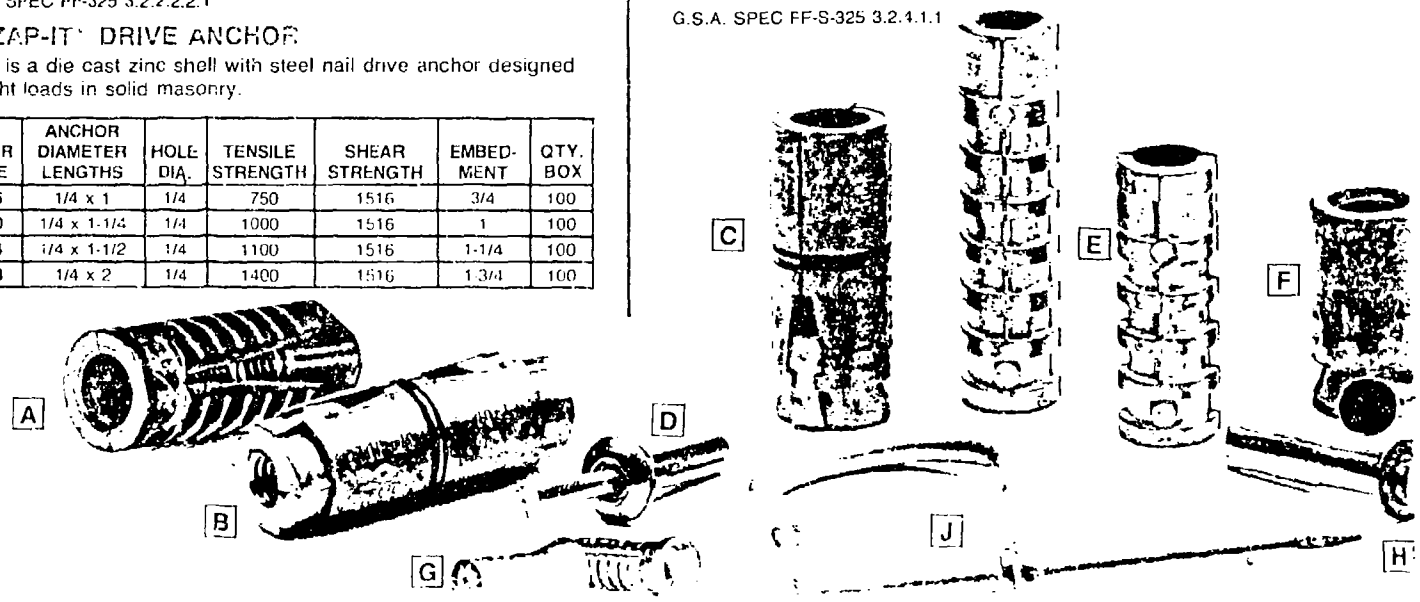
ORDER CODE	SCREW SIZE	ANCHOR LENGTH	DRILL SIZE	TENSILE STRENGTH	SHEAR STRENGTH	QTY. BOX
1405	10-24	5/8	3/8	950	12[illegible]	100
1407	1/4-20	7/8	1/2	2120	2070	100
1408	5/16-18	1	5/8	2900	2400	50
1409	3/8-16	1-1/4	3/4	5250	4180	50
1411	1/2-13	1-1/2	7/8	6080	5000	50
1412	5/8-11	1-3/4	1-1/8	7200	14100	50
1413	3/4-10	2-1/4	1-3/8	10100	15200	50

G.S.A. SPEC FF-325 3.2.1.1.1

G SUP-R-LEAD (WOOD SCREW ANCHOR)

ORDER CODE	SCREW SIZE x ANCHOR LENGTH	DRILL SIZE	STRENGTH TENSILE	STRENGTH SHEAR	QTY. BOX
3531	6-8 x 3/4	1/4	183	N.A.	100
3532	6-8 x 1	1/4	183	N.A.	100
3533	6-8 x 1-1/2	1/4	183	N.A.	100
3535	10-14 x 3/4	5/16	281	N.A.	100
3536	10-14 x 1	5/16	310	N.A.	100
3537	10-14 x 1-1/2	5/16	310	N.A.	100
3541	16-18 x 1	3/8	415	N.A.	100
3542	16-18 x 1-1/2	3/8	415	N.A.	50

G.S.A. SPEC FF-S-325 3.2.4.1.1



H

DHD Hammer Drive is an aluminum body/steel nail anchor which expands when hit with a hammer. This fast, inexpensive light to medium-duty anchor is used to fasten thin material (clips, clamps or straps) to masonry and concrete.

ORDER CODE	ANCHOR SIZE	HOLE DIAMETER	TENSILE STRENGTH	QTY. BOX
09-04314	3/16 x 7/8	3/16	770	100
09-04320	3/16 x 1-1/4		880	100
09-04416	1/4 x 1	1/4	1100	100
09-04420	1/4 x 1-1/4		1320	100
09-04424	1/4 x 1-1/2		1430	100
09-04520	5/16 x 1-1/4	5/16	1540	100
09-04528	5/16 x 1-3/4		1650	100
09-04536	5/16 x 2-1/4		1760	100
09-04544	5/16 x 2-3/4		1870	100
09-04632	3/8 x 2	3/8	2300	100
09 04652	3/8 x 3-1/4		2500	100
09-04836	1/2 x 2-1/4	1/2	2700	25
09-04856	1/2 x 3-1/2		2950	25

G.S.A. SPEC FF-S-325 5.1.

I SUP-R-CLAMPS (ONE HOLE)

ORDER CODE	SIZE	HOLE SIZE	QTY. BOX
24-80004	1/4	7/32	500
24-80006	3/8	7/32	500
24-80008	1/2	7/32	500
24-80010	5/8	7/32	500
24-80012	3/4	9/32	500
24-80016	1	9/32	250

J SUP-R-RINGS™ (DRIVE)

The drive ring is made of galvanized, hard drawn steel wire used in wood or, with the proper anchor, in concrete or masonry for permanent or temporary support of drop wires.

ORDER CODE	EYE SIZE	X	LENGTH	QTY. BOX
3000801	1/2		2-1/16	50
3000804	5/8		2-1/4	25
3000805	7/8		2-9/16	25
3000807	1-1/4		2	25

K SUP-R-RINGS™ (BRIDLE)

The bridle ring is designed to secure utility drop wires, jacketed cables and electrical wiring to masonry surfaces.

MACHINE SCREW

ORDER CODE	SIZE	QTY. BOX
3100821	K 3/4 10-24	100
3100823	M 1-1/4 10-24	100
3100825	O 1-1/4 1/4-20	100
3100827	R 1-5/8 1/4-20	100

L

ORDER CODE	SIZE	QTY. BOX
1510041	3/4	100
1510042	1	100
1510043	1-1/4	100
1510044	1-1/2	100
1511111	HAMMER DRIVE TOOL	

M SUP-R-TOGGLE™

Sup-R-Toggle is a two-piece, spring-wing blind fastener of zinc-plated steel. It's designed for anchoring in hollow construction, providing the mechanical properties of a nut and bolt but with increased bearing surface.

ORDER CODE	SCREW SIZE	AVAIL. HEAD TYPES	DRILL SIZE	TENSILE STRENGTH ULTIMATE	TENSILE STRENGTH 1/2 DRY WALL	QTY. BOX
8303	1/8 x 2	RMH	3/8			50
8305	1/8 x 3	FRMH	3/8			50
8310	1/8 x 4	FRMH	3/8	305	120	50
8313	3/16 x 2	R	1/2			50
8315	3/16 x 3	FRMH	1/2			50
8320	3/16 x 4	FRMH	1/2	467	165	50
8325	3/16 x 5	FR	1/2			50
8330	3/16 x 6	R	1/2			50
8335	1/4 x 3	FRMH	5/8			50
8340	1/4 x 4	FRMH	5/8			50
8345	1/4 x 5	FR	5/8	1090	175	50
8350	1/4 x 6	FR	5/8			50
8355	5/16 x 3	R	7/8			50
8360	5/16 x 4	R	7/8			50
8362	5/16 x 5	R	7/8	1140	160	50
8365	5/16 x 6	R	7/8			50
8370	3/8 x 3	R	7/8			50
8375	3/8 x 4	R	7/8			50
8378	3/8 x 5	R	7/8	1200	155	50
8380	3/8 x 6	R	7/8			50
8385	1/2 x 4	R	1-1/4			25
8390	1/2 x 6	R	1-1/4	1258	185	25

R = ROUND
F = FLAT
M = MUSHROOM
H = WASHER FACED HEX HEAD

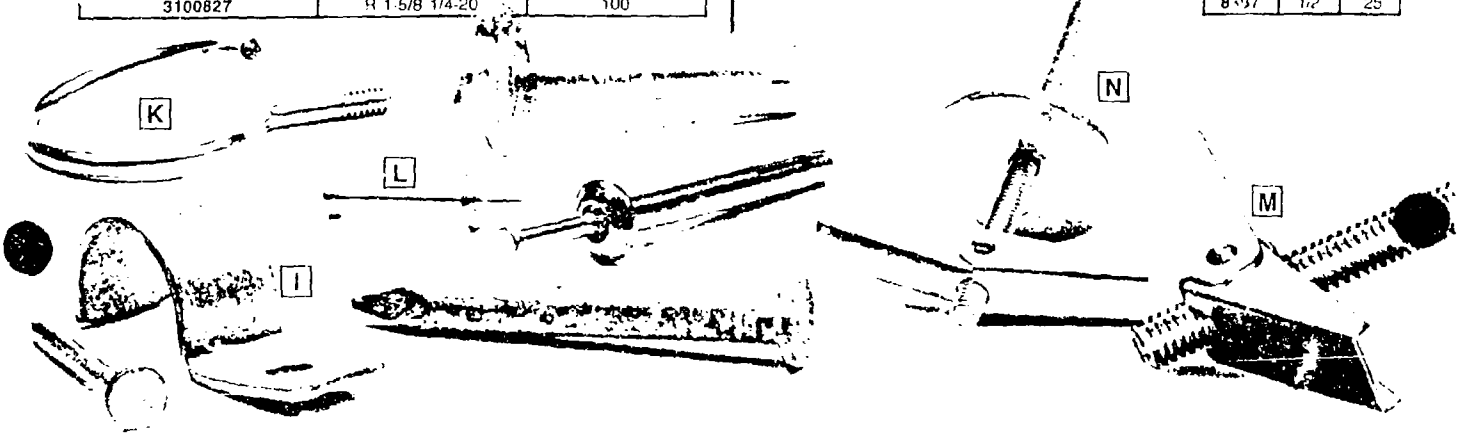
G.S.A. SPEC FF-B-588C 3.3

N SUP-R-TOGGLE™ (Hanger Type)

ORDER CODE	SCREW SIZE	DRILL SIZE	QTY. BOX
8320-5	3/16 x 4	1/2	100
8325-5	3/16 x 5	1/2	100
8340-5	1/4 x 4	5/8	100
8345-5	1/4 x 5	5/8	100

SUP-R-TOGGLE™ (Heads)

ORDER CODE	SIZE	QTY. BOX
8307	1/8	100
8317	3/16	100
8337	1/4	100
8357	5/16	100
8377	3/8	100
8397	1/2	25



A TAP-IT

Tap-It functions as a one piece anchor, toggle, blind fastener or rivet and works equally effectively in solid or hollow construction for light to medium loads in all types of material. It's installed with a hammer and grips in materials as thin as 1/16". Tap-It is without question the simplest and most versatile fastener available, the closest approach yet to a universal anchor. It handles some 60% of all fastening applications with five different head styles, two diameters and lengths from 5/16" to 6".

ORDER CODE	ANCHOR DIAMETER AND LENGTH	HEAD STYLE AND DIAMETER	QTY. BOX
4420	3/16 x 3/4	Flush (5/16)	100
4620	3/16 x 1	Flush (5/16)	100
4650	3/16 x 1	Flat (3/8)	100
*4750	3/16 x 1-1/2	Flat (3/8)	100
5450	1/4 x 3/4	Flat (7/16)	100
5650	1/4 x 1	Flat (7/16)	100
5750	1/4 x 1-1/2	Flat (7/16)	100
5850	1/4 x 2	Flat (7/16)	100
4630	3/16 x 1	Round (3/8)	100
4640	3/16 x 1	Round (b) (5/16)	100
*4730	3/16 x 1-1/2	Round (3/8)	100
5630	1/4 x 1	Round (7/16)	100
5730	1/4 x 1-1/2	Round (7/16)	100
5830	1/4 x 2	Round (7/16)	100
4960	3/16 x 5/16	Mushroom (7/16)	100
4460	3/16 x 3/4	Mushroom (9/16)	100
4660	3/16 x 1	Mushroom (1/2)	100
*5360	1/4 x 1/2	Mushroom (9/16)	100
5460	1/4 x 3/4	Mushroom (9/16)	100
5660	1/4 x 1	Mushroom (9/16)	100
5760	1/4 x 1-1/2	Mushroom (9/16)	100
5860	1/4 x 2	Mushroom (9/16)	100
*5160	1/4 x 3	Mushroom	100
*5260	1/4 x 4	Mushroom	100
*5960	1/4 x 6	Mushroom	100

TAP-IT — ALL NYLON

5468	1/4 x 3/4	Mushroom	100
5668	1/4 x 1	Mushroom	100
5768	1/4 x 1-1/2	Mushroom	100
5868	1/4 x 2	Mushroom	100
*5168	1/4 x 3	Mushroom	100
*5268	1/4 x 4	Mushroom	100

(b) round recessed
*unassembled

B TAP-IT NYLON WASHER

Disks of solid nylon 1/16" thick, in two diameters, are designed to supply added bearing surface in Tap-It applications.

ORDER CODE	THICK-NESS	OUTSIDE DIAMETER	HOLE DIAMETER	QTY. BOX
5901	1/16	1-1/2	1/4	100
5902	1/16	2	1/4	100

C UNI-TAP ALL-NYLON FASTENER

Uni-Tap is a new concept fastener whose non-conducting nylon is perfect for insulating and refrigeration applications. It's easy to drive, lightweight, exceptionally strong and much less expensive than a metal fastener. Five lengths between 1" and 3-1/8" allow the most economical choice for each material and the ridged shank assures secure, long-holding fastening in hollow or solid materials.

CAN BE COLORED TO SUIT YOUR APPLICATION

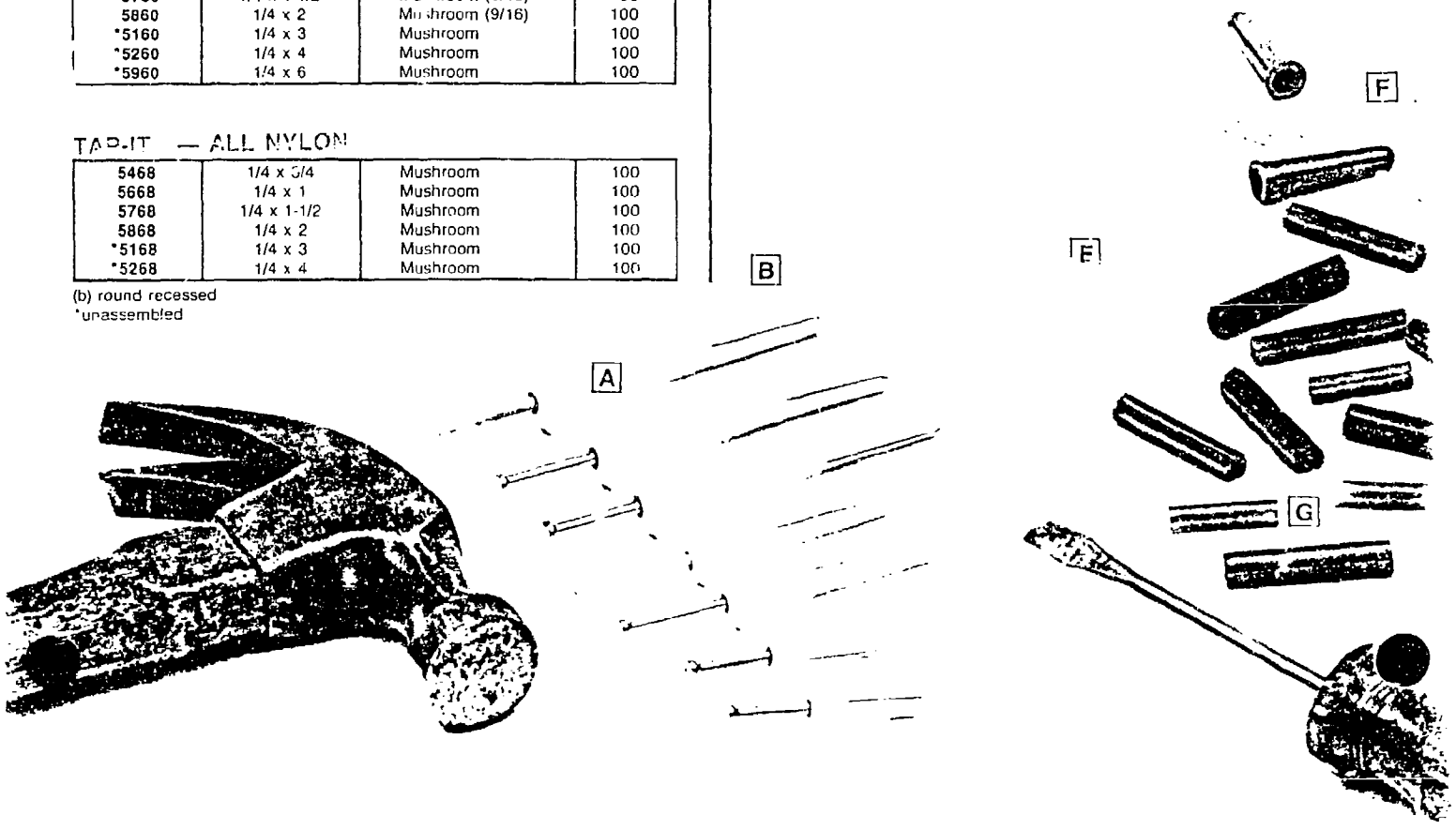
ORDER CODE	SIZE*	HOLLOW MATL. TENSILE	SOLID MATL. TENSILE	SHR.	QTY. BOX
6460	1/4 x 1	100	130	290	100
6660	1/4 x 1-5/8	100	130	290	100
6760	1/4 x 2-1/8	100	130	290	100
6860	1/4 x 2-5/8	100	130	290	100
6960	1/4 x 3-1/8	100	130	290	100

*.281" DIA. HOLE REQ.

D SUP-R-BIT™ IMPACT HAMMER DRILL BITS

FOR USE WITH UNITAP

ORDER CODE	DIA. X LENGTH X SHANK		
95041	9/32	4	1/4
95048	9/32	6	1/4



E [illegible]

Versa-Toggle is a strong, one-piece, light-duty plastic anchor. It is easy to use; it's installed in a 5/16" hole and needs no special tools.

ORDER CODE	SIZE	HOLE SIZE	WALL THICK.	SCREW SIZE	QTY. BOX
8538	Ex Short	5/16	3/8	8-12	100
8512	Short	5/16	1/2	8-12	100
8558	Long	5/16	5/8	8-12	100

F PLASTIC SCREW ANCHORS

Designed for light-duty fastening in concrete, brick, masonry or drywall.

ORDER CODE	ANCHOR LENGTH & DIA.	SCREW SIZE	QTY. BOX
8450	3/16 x 7/8	4-6-8	100
8451	3/16 x 7/8	4-6-8	1000
8460	1/4 x 1	10-12	100
8461	1/4 x 1	10-12	1000
8430	5/16 x 1-3/8	14-18	100
KITS WITH DRILL AND SCREWS			
8450-1	3/16 x 7/8	8	100 Anchors and Screws + Carbide Drill Bit
8460-1	1/4 x 1	10	

G UNI-PLUG SCREW ANCHOR

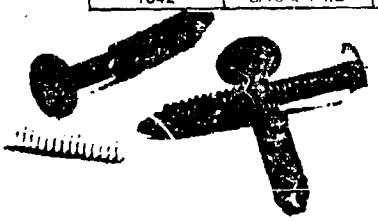
Uni-Plug is an extruded vinyl anchor of the plug type which can be set at various depths.

ORDER CODE	DIA. x ANCHOR LENGTH	SCREW SIZE	COLOR	QTY. BOX
1822	1/4 x 1	7-9	Red	100
1823	1/4 x 1-1/2	7-9	Red	100
1831	1/4 x 1	10-12	Green	100
1832	1/4 x 1-1/4	10-12	Green	100
1833	1/4 x 1-1/2	10-12	Green	100
1841	5/16 x 1	14	Blue	100
1842	5/16 x 1-1/2	14	Blue	100

H [illegible]

Carbi-Twist masonry bits are for use in rotary-only drills. Their unique fluting carries material out of the hole with speed and efficiency. The carbide tip is specifically designed to be effective in rotary-only drilling of masonry material. Carbi-Twist bits are available in twenty diameters from 1/8" to 1-1/2" and in five lengths from 3" to 12".

ORDER CODE	DIA.	X	LENGTH	X	SHANK
9402	1/8		3		1/8
94021	5/32		3		5/32
94023	11/64		3		11/64
9403	3/16		3		3/16
9404	1/4		4		1/4
94046	1/4		6		1/4
94041	9/32		4		1/4
9405	5/16		4		1/4
9406	3/8		4		1/4
9407	7/16		6		1/4
9408	1/2		6		1/4
94081	1/2		6		3/8
9409	9/16		6		1/2
9410	5/8		6		1/2
9411	11/16		6		1/2
9412	3/4		6		1/2
9414	7/8		6		1/2
9416	1		6		1/2
9418	1-1/8		10		1/2
9420	1-1/4		10		1/2
9422	1-3/8		10		1/2
9424	1-1/2		10		1/2
94042	1/4		12		1/4
94052	5/16		12		5/16
94062	3/8		12		3/8
94082	1/2		12		1/2
94102	5/8		12		1/2
94122	3/4		12		1/2
94142	7/8		12		1/2
94162	1		12		1/2



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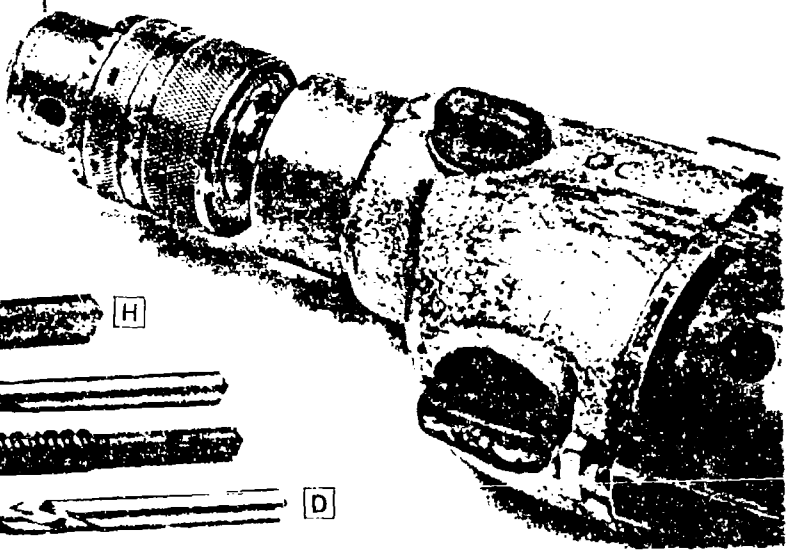
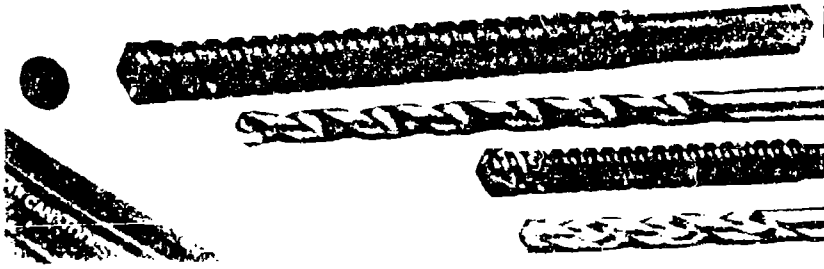




H

D

A

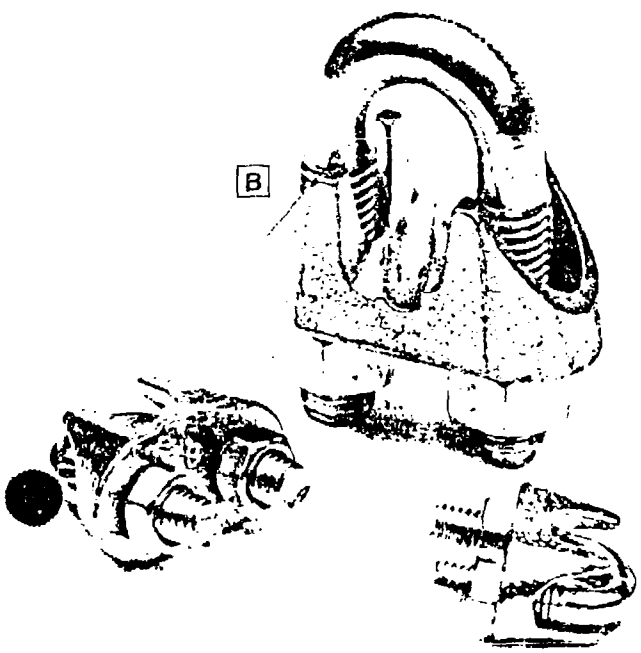
Holly is an economical, one-piece, light-duty, all-metal anchor designed for quick, easy use in hollow wall construction. Holly has a bright, rust-resistant zinc plated finish, can be set close to studs and offers a wider grip for maximum strength. Holly can be removed, leaving only a ¼" hole to fill.

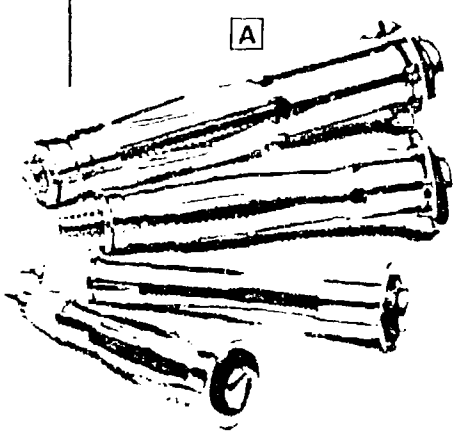
ORDER CODE	SIZE	HOLE SIZE	SCREW HEAD	GRIP RANGE	QTY. BOX
120	1/8 XS	5/16	RD	0 to 3/16	100
121	1/8 SR	1/4	RD	1/8 to 1/2	100
122	1/8 LR	1/4	RD	5/8 to 1-1/4	100
123	1/8 XLR	1/4	RD	1-1/4 to 1-3/4	100
130	3/16 SR	3/8	RD	1/8 to 5/8	50
131	3/16 LR	3/8	RD	5/8 to 1-1/4	50
132	3/16 XLR	3/8	RD	1-1/4 to 1-3/4	50
140	1/4 SR	7/16	RD	1/8 to 5/8	50
141	1/4 LR	7/16	RD	5/8 to 1-1/4	50
142	1/4 XLR	7/16	RD	1-1/4 to 1-3/4	50
DRIVE HOLLY					
150	1/8 MSD	DRIVE	PAN	3/16 to 3/8	100
151	1/8 SD	DRIVE	PAN	1/8 to 1/2	100
152	1/8 SLD	DRIVE	PAN	1/8 to 3/4	100

B WIRE ROPE CLIPS

U.S.E. malleable iron clips, properly used, provide a positive method of fastening wire rope.

ORDER CODE	ROPE CABLE SIZE	MIN. NO. OF CLIPS	MIN. IN. OF ROPE TO TURN BACK	QTY. BOX
7101	1/16	2	3	25
7102	1/8	2	3-1/4	25
7103	3/16	2	3-3/4	25
7104	1/4	2	4-3/4	25
7105	5/16	2	5-1/4	25
7106	3/8	2	6-1/2	25
7107	7/16	3	7	25
7108	1/2	3	11-1/2	25
7110	5/8	3	12	25
7112	3/4	4	18	25
7114	7/8	4	19	25
7116	1	4	26	25
7118	1-1/8	5	34	Bulk





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CALL

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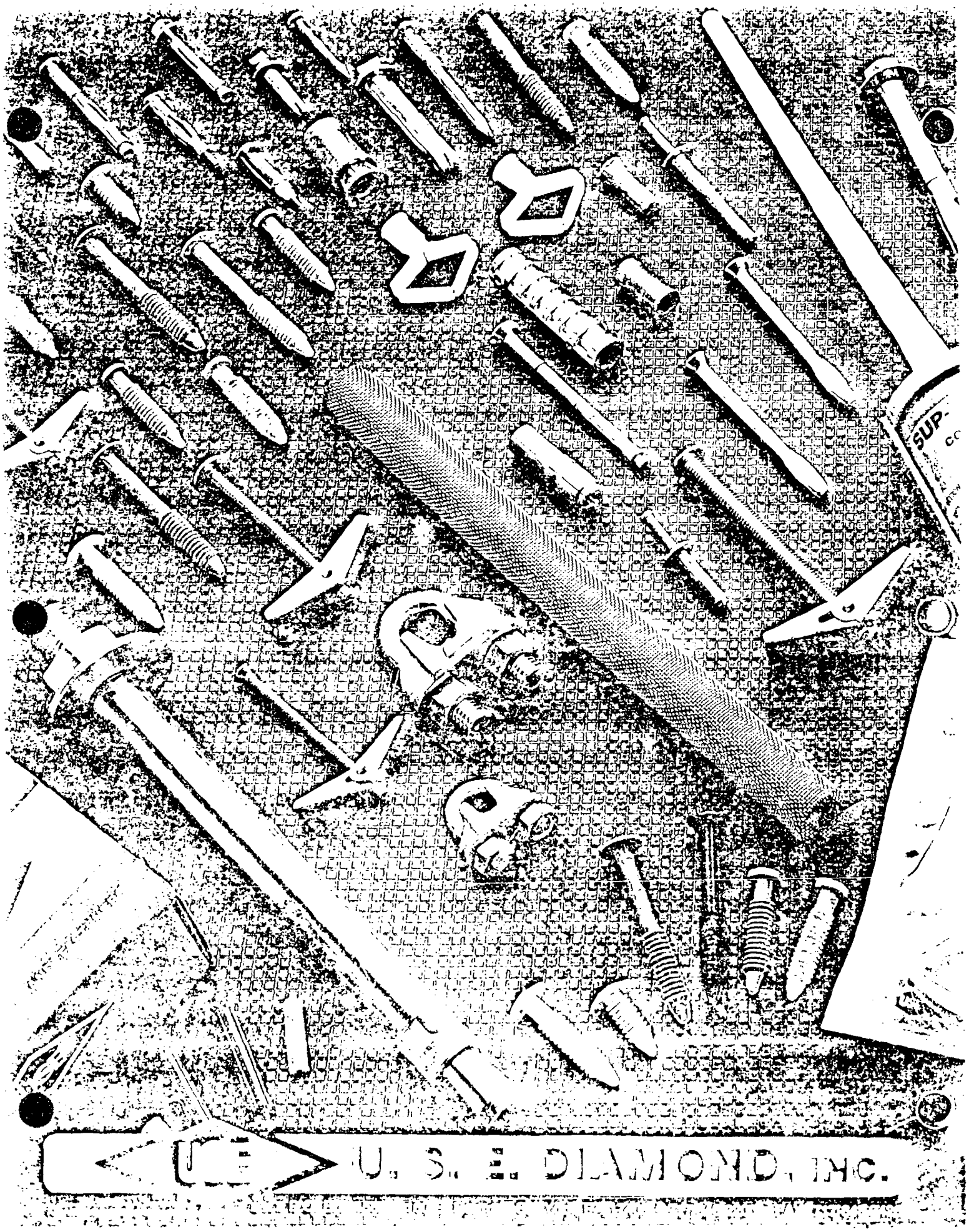
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TOPLINE CONSTRUCTION PRODUCTS™

MASONRY ANCHOR Price Catalog

#0688

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DESIGN/INSTALLATION DATA

MAXIMUM WORKING LOAD The maximum safe working load should not exceed 1/4 of the average ultimate value of a specific anchor size. A higher safety factor may be required for applications with cyclic, fatigue, or shock loads and should be selected by the designer on that basis.

MINIMUM EMBEDMENT For each type of anchor a minimum depth of embedment is specified. This is minimum depth for an anchor to be installed and still meet minimum pullout values. Anchors installed less than minimum depth will stress the base material above its limits and may cause failure during installation or expansion of the anchor. Embedment depth is a critical factor in determining the load capacity of an anchor, and it represents the point at which the anchors expansion forces are acting on the concrete. The required anchor embedment is the distance from the concrete surface to the bottom of the anchor.

MINIMUM ANCHOR SPACING For each type of anchor a spacing distance between anchors is specified. The load bearing capacity of an anchor is influenced by an adjacent anchor. Anchor spacing is the minimum distance between two anchor center lines without an influence on the tensile or shear failure load of either anchor. The following guidelines are recommended for determining spacing distances.

EMBEDMENT DEPTH	MIN. SPACING BETWEEN ANCHORS
0 to 6.3 INCHES	3.5 X EMBEDMENT DEPTH
6.3 INCHES & GREATER	2.0 X EMBEDMENT DEPTH

For wedge and sleeve anchors the spacing distance may be reduced by 50% provided the shear and tension values are reduced by 40%. For drop-in anchors the spacing distance may be reduced by 50% provided the shear and tension values are reduced by 50%. Linear interpolation may be used for intermediate spacings. Spacing reduction factors are cumulative for groups of three or more anchors.

MINIMUM EDGE DISTANCE For each type of anchor a minimum edge distance is specified. Due to reduced material volume a minimum edge distance must be maintained to prevent the edge from breaking away prematurely when the anchor is installed. Also, a safe edge distance must be maintained in order to achieve the full load bearing capacity of the anchor. The following guidelines are recommended for determining edge distance.

EMBEDMENT DEPTH	MIN. EDGE DISTANCE ANCHORS
0 to 6.3 INCHES	1.75 X EMBEDMENT DEPTH
6.3 INCHES & GREATER	1.0 X EMBEDMENT DEPTH

Drop-in anchors should have a minimum edge distance of eight (8) diameters. For wedge and sleeve anchors the edge distance may be reduced by 50% provided the shear and tension values are reduced by 40%. For drop-in anchors the edge distance may be reduced by 50% provided the shear and tension values are reduced by 50%.

COMBINED LOADING Anchors loaded in tension and shear simultaneously will generally have ultimate capacities lower than an anchor loaded in tension or shear separately. Combined loads should be calculated on a straight line interaction diagram of pure shear (S) and pure tension (T).

$$\frac{\text{S APPLIED}}{\text{S ALLOWED}} + \frac{\text{T APPLIED}}{\text{T ALLOWED}} \text{ less than or equal to } 1$$

TOPLINE CONSTRUCTION PRODUCTS' anchors are tested in accordance with ASTM E488-84 and ICBO Standard for Testing Expansion Anchors in Concrete.

TOPLINE ANCHOR SELECTION GUIDE

	TYPE OF ANCHOR	FASTENING BASE MATERIAL							APPLICATION CRITERIA				
		SOLID CONCRETE	HOLLOW CONCRETE	SOLID BRICK, BLOCK & STONE	HOLLOW BRICK, BLOCK	TILE	WALLBOARD, PANEL, PLASTIC & WOOD	METAL	IN PLACE (THRU) FASTENING	IMMEDIATE LOADING	FLUSH SURFACE REMOVING	DYNAMIC LOADING	TEMP-ERATURE RESISTANT
HEAVY DUTY	Wedge Anchors	●		▲					●	●		▲	●
	Chemical Setters	●		▲									▲
	Sleeve Anchors	●	●	●	●				●	●			●
	Drop-In Anchors	●		▲					▲	●	●	▲	●
MEDIUM DUTY	Split Drive Anchors	●	▲	●					●	●			●
	Single Exp Shields	●	●	●	●					●	●		●
	Double Exp Shields	●	●	●	●					●	●		●
	Concrete Screws	●	▲	●	▲					●	●		●
	Lag Shields	●	●	●	●	▲				●	●		●
	Lead Screw Anchors	●	●	●	●					●	●		▲
LIGHT DUTY	Toggle Bolts & Wings		●		●	●	●	▲	▲	●			●
	Hollow Wall Anchors					●	●			●	●		
	Plastic Anch & Kits	●	●	●	●	●	●	▲		●	●		
	Machine Screw Anch	●		●					▲	●	●		
	Hammer Drive Anch	●	▲	●	▲				●	●			▲
	Nylon Nail - Ins	●	●	●	●	▲	▲	▲	●	●			
	Plastic Toggles					▲	●			●	▲		

KEY ● Very Suitable ▲ May Be Suitable, Depending On Application

TOPLINE™

WEDGE ANCHORS

FOR USE IN HEAVY DUTY APPLICATIONS.

Zinc Plated Steel
Hot Dipped Galvanized
304 Stainless Steel

ADVANTAGES/FEATURES

- For use in medium duty fastening to concrete applications.
- Required hole size equals anchor diameter.
- Very suitable for setting through in-place fixtures.
- Load can be applied immediately.
- Controlled expansion.
- Projections on the collar offer optimum contact and grip with the concrete.
- Exact hole depth not required to set anchor.
- Hot dipped galvanized wedge anchors are supplied with a 304 stainless steel wedge collar.

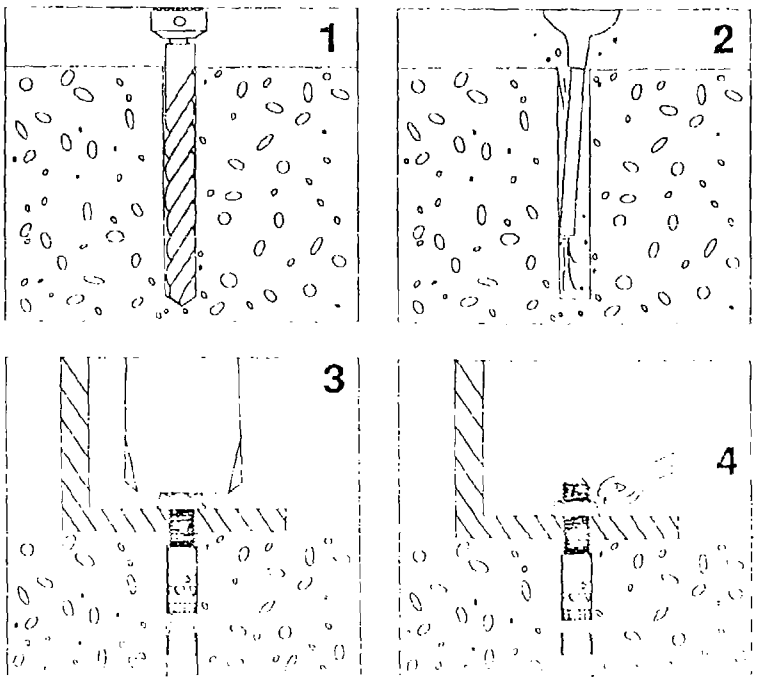
INSTALLATION INSTRUCTIONS

1. Determine hole depth by adding approximately 1" to required anchor embedment. Choose a carbide-tipped drill bit with same nominal diameter as anchor body. Drill bit must conform to tip diameter tolerances of ANSI Specification B94.12-1977.

2. Drill hole perpendicular to work surface. Hold drill securely and straight during drilling or wobble may cause irregularly shaped holes. Do not use pneumatic or other drilling systems. Clean out dust and debris fom hole with a blow out bulb or compressed air.

3. Place washer and nut on the anchor. Set nut flush with top of anchor and drive anchor through material to be anchored and into work surface until nut and washer are snug with material to be attached. (Anchor must be driven into hole at an initial embedment equal to required embedment plus thickness of nut.)

4. Drive anchor into hole so that at least 6 threads are below work surface. Tighten nut until finger tight, then turn 3 to 5 full turns to set expansion wedge. Should anchor spin in hole, pry up using screwdriver or other tool to lock wedge in place. Anchor must be embedded at depth equal to or greater than 4-1/2" anchor diameters.



PRICING

Carbon Steel Wedge Anchors Zinc

PART #	SIZE	STD BOX	STD CTN	TL LIST
AWGE04-028	1/4 X 1 3/4	100	900	$39.00
AWGE04-040	1/4 X 2 1/2	100	900	$46.00
AWGE04-052	1/4 X 3 1/4	100	900	$59.40
AWGE06-038	3/8 X 2 1/4	100	600	$57.00
AWGE06-044	3/8 X 2 3/4	100	600	$65.20
AWGE06-048	3/8 X 3	100	600	$65.60
AWGE06-060	3/8 X 3 3/4	100	600	$83.00
AWGE06-080	3/8 X 5	50	300	$98.50
AWGE08-044	1/2 X 2 3/4	50	300	$100.10
AWGE08-060	1/2 X 3 3/4	50	300	$112.40
AWGE08-068	1/2 X 4 1/4	25	150	$126.10
AWGE08-088	1/2 X 5 1/2	25	150	$151.10
AWGE08-112	1/2 X 7	25	100	$185.50
AWGE10-056	5/8 X 3 1/2	25	150	$188.50
AWGE10-072	5/8 X 4 1/2	25	150	$207.50
AWGE10-080	5/8 X 5	25	150	$214.10
AWGE10-096	5/8 X 6	25	100	$241.00
AWGE10-112	5/8 X 7	25	100	$282.80
AWGE10-136	5/8 X 8 1/2	25	75	$299.40
AWGE12-068	3/4 X 4 1/4	20	80	$262.60
AWGE12-076	3/4 X 4 3/4	20	80	$286.40
AWGE12-088	3/4 X 5 1/2	10	80	$320.90
AWGE12-112	3/4 X 7	10	40	$389.50
AWGE12-136	3/4 X 8 1/2	10	30	$443.50
AWGE12-160	3/4 X 10	10	30	$533.00
AWGE14-096	7/8 X 6	5	30	$690.00
AWGE14-128	7/8 X 8	5	15	$830.00
AWGE14-160	7/8 X 10	5	15	$956.00
AWGE16-096	1 X 6	5	30	$810.00
AWGE16-144	1 X 9	5	15	$875.00
AWGE16-192	1 X 12	5	15	$1,177.00

Stainless Steel Wedge Anchor Type 303

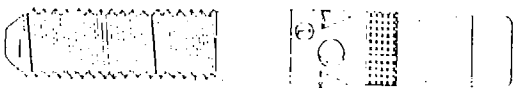
PART #	SIZE	STD BOX	STD CTN	TL LIST
AWGE04-028SS	1/4 X 1 3/4	100	900	$121.00
AWGE04-040SS	1/4 X 2 1/2	100	900	$132.88
AWGE04-052SS	1/4 X 3 1/4	100	900	$154.00
AWGE06-038SS	3/8 X 2 1/4	100	600	$212.00
AWGE06-044SS	3/8 X 2 3/4	100	600	$244.00
AWGE06-048SS	3/8 X 3	100	600	$266.20
AWGE06-060SS	3/8 X 3 3/4	100	600	$300.00
AWGE06-080SS	3/8 X 5	50	300	$363.44
AWGE08-044SS	1/2 X 2 3/4	50	300	$418.88
AWGE08-060SS	1/2 X 3 3/4	50	300	$476.00
AWGE08-068SS	1/2 X 4 1/4	25	150	$528.88
AWGE08-088SS	1/2 X 5 1/2	25	150	$620.00
AWGE08-112SS	1/2 X 7	25	100	$728.00
AWGE10-056SS	5/8 X 3 1/2	25	150	$750.00
AWGE10-072SS	5/8 X 4 1/2	25	150	$880.00
AWGE10-080SS	5/8 X 5	25	150	$908.60
AWGE10-096SS	5/8 X 6	25	100	$1,000.00
AWGE10-112SS	5/8 X 7	25	100	$1,174.80
AWGE10-136SS	5/8 X 8 1/2	25	75	$1,320.00
AWGE12-068SS	3/4 X 4 1/4	20	80	$1,232.00
AWGE12-076SS	3/4 X 4 3/4	20	80	$1,360.00
AWGE12-088SS	3/4 X 5 1/2	10	80	$1,452.00
AWGE12-112SS	3/4 X 7	10	40	$1,740.00
AWGE12-136SS	3/4 X 8 1/2	10	30	$1,860.00
AWGE12-160SS	3/4 X 10	10	30	$2,240.00
AWGE14-096SS	7/8 X 6	5	30	$2,688.00
AWGE14-128SS	7/8 X 8	5	15	$3,352.00
AWGE14-160SS	7/8 X 10	5	15	$3,512.00
AWGE16-096SS	1 X 6	5	30	$3,212.00
AWGE16-144SS	1 X 9	5	15	$4,400.00
AWGE16-192SS	1 X 12	5	15	$4,900.00

Wedge Anchors Galvanized

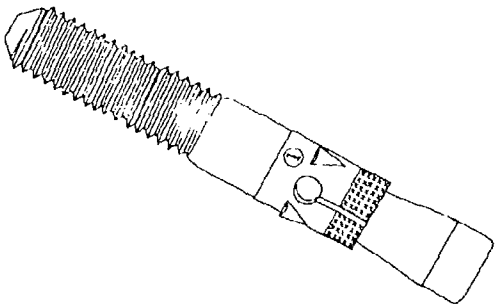
PART #	SIZE	STD BOX	STD CTN	TL LIST
AWGE08-068GV	1/2 X 4 1/4	25	150	$225.00
AWGE08-088GV	1/2 X 5 1/2	25	150	$338.00
AWGE08-112GV	1/2 X 7	25	100	$398.00
AWGE10-056GV	5/8 X 3 1/2	25	150	$400.16
AWGE10-072GV	5/8 X 4 1/2	25	150	$422.00
AWGE10-080GV	5/8 X 5	25	150	$431.20
AWGE10-096GV	5/8 X 6	25	100	$450.00
AWGE10-112GV	5/8 X 7	25	100	$609.44
AWGE10-136GV	5/8 X 8 1/2	25	75	$714.08
AWGE12-068GV	3/4 X 4 1/4	25	80	$484.00
AWGE12-076GV	3/4 X 4 3/4	25	80	$519.20
AWGE12-088GV	3/4 X 5 1/2	20	80	$540.00
AWGE12-112GV	3/4 X 7	10	40	$760.00
AWGE12-136GV	3/4 X 8 1/2	10	30	$800.00
AWGE12-160GV	3/4 X 10	10	30	$954.20
AWGE14-096GV	7/8 X 6	5	30	$1,162.00
AWGE14-128GV	7/8 X 8	5	15	$1,540.00
AWGE16-096GV	1 X 6	5	30	$1,569.00
AWGE16-144GV	1 X 9	5	15	$1,580.00

Rod Hanger Wedge Anchors

PART #	SIZE	STD BOX	STD CTN	TL LIST
AWRC06-036	3/8 X 2 1/4	50	250	$96.00
AWRC08-044	1/2 X 2 3/4	50	250	$190.00
AERC10-056	5/8 X 3 1/2	25	125	$335.00
AWRC12-068	3/4 X 4 1/4	10	50	$625.00



TECHNICAL DATA

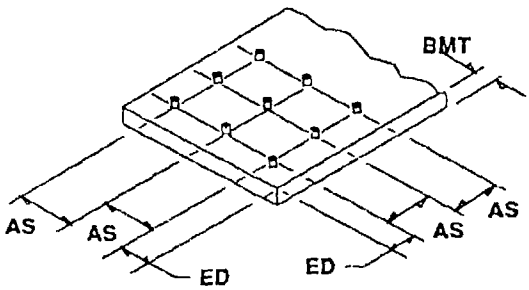


SETTING DETAILS	ANCHOR SIZE						
	1/4	3/8	1/2	5/8	3/4	7/8	1
BD=D	1/4	3/8	1/2	5/8	3/4	7/8	1
E	1-1/8	1-5/8	2-1/4	2-3/4	3-1/4	4-1/2	4-1/2
L	1-3/4 to 3	2-1/8 to 5	2-3/4 to 7	3-1/2 to 8-1/2	4-1/4 to 10	6 to 10	6 to 12
TL	3/4	7/8 to 1-1/8	1 1/8 to 1-1/4	1 1/2 to 3	1 1/2 to 3	2-1/4	2-1/4
M	3-7	20-30	40-65	50-90	75-100	-	-
	3" or 1.3 times embedment whichever is greater						
AS	4	5-1/4	7-7/8	9-5/8	11-7/8	15-3/4	15-3/4
ED	2	3	4	5	6	7-7/8	7-7/8

SETTING DETAILS
- KEY -

BD = D (Drill bit size = Anchor diameter)
E (Minimum depth embedment)
L (Anchor length - Maximum/Minimum)
TL (Thread length)
*M (Install torque - ft. lbs.)
BMT (Base material thickness)
AS (Min. anchor spacing for max. work load)
ED (Min. edge distance for max. work load)

* Torque values are for wedge anchors that are dry and clean, not lubricated or dirty.



Type C1020 Steel Studs with C1075 Collars

Meets &/or exceeds G.S.A. Specification FF-S-325, Group VII, Type 1. Tests were performed by an independent laboratory company and were conducted in accordance with Standard Test Methods of Anchors in Concrete & Masonry Elements. 4000 PSI concrete, tested in accordance with ASTM E-488, was utilized. Holes were drilled using ANSI B94 Masonry Bits. Results were averaged and tabulated above. The above tension values are the ultimate pull out loads. As such they should be considered for reference purposes only. Most working conditions require a safety factor of 4:1. Critical applications (vibratory loads, overhead installations, etc.) may require a safety factor of as much as 10:1.

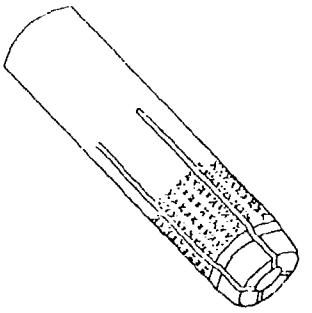
TEST REPORTS AVAILABLE UPON REQUEST

PART NUMBER	SIZE	EMBEDMENT	TENSION	SHEAR
AWGE04-028	1/4" X 1 3/4"	1 1/8"	2800 lbs.	2705 lbs.
AWGE04-052	1/4" X 3 1/4"	2 7/8"	3240 lbs.	2705 lbs.
AWGE06-038	3/8" X 2 1/4"	1 1/4"	3160 lbs.	4960 lbs.
AWGE06-044	3/8" X 2 3/4"	1 3/4"	4350 lbs.	4960 lbs.
AWGE06-048	3/8" X 3"	2 1/8"	4980 lbs.	4960 lbs.
AWGE08-060	1/2" X 3 3/4"	2 3/4"	6810 lbs.	6950 lbs.
AWGE08-068	1/2" X 4 1/4"	3 1/4"	9650 lbs.	6950 lbs.
AWGE10-072	5/8" X 4 1/2"	2 3/4"	7850 lbs.	11490 lbs.
AWGE10-096	5/8" X 6"	4 3/4"	13750 lbs.	11490 lbs.
AWGE12-068	3/4" X 4 1/4"	2 5/8"	7450 lbs.	13495 lbs.
AWGE12-088	3/4" X 5 1/2"	4"	13570 lbs.	13495 lbs.
AWGE14-096	7/8" X 6"	4"	14110 lbs.	15050 lbs.
AWGE16-096	1" X 6"	4"	12950 lbs.	30050 lbs.
AWGE16-144	1" X 9"	6 3/4"	29850 lbs.	30050 lbs.

TOPLINE™ DROP-IN ANCHORS

Zinc Plated Steel

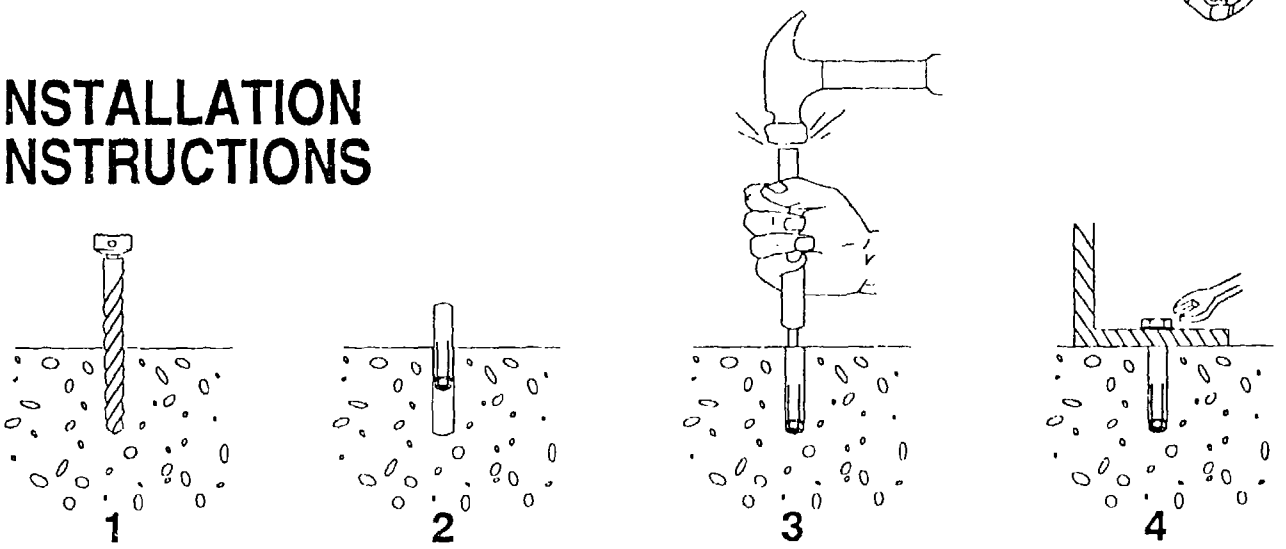
FOR USE IN STRUCTURAL FASTENING TO CONCRETE.



ADVANTAGES/FEATURES

- Shallow embedment depth with high performance.
- Anchor is installed flush with base material.
- Internal coarse threads.

INSTALLATION INSTRUCTIONS



1 Select a carbide-tipped drill bit with same nominal diameter as anchor body. Drill bit must conform to tip diameter tolerances of ANSI Specification B94.12-1977. Attach depth gauge to rotary hammer drill. (Add enough length to depth gauge to allow space for conical tip of drill bit.) Drill hole perpindicular to work surface. Hold drill securely and straight during drilling or wobble may cause irregularly shaped holes.

2 Drop in anchor and tap it, so that it becomes flush with surface.

3 To set drop-in anchor - Expand anchor by inserting setting tool into anchor body and hammering on tool until shoulder of tool contacts top of drop in anchor.

4 Position fixture, insert bolt and tighten.

PRICING

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ADRI04	1/4"	100	1000	$35.39
ADRI06	3/8"	50	500	$54.95
ADRI08	1/2"	50	500	$90.40
ADRI10	5/8"	25	250	$146.20
ADRI12	3/4"	25	100	$257.50

TECHNICAL DATA

PART NUMBER	SIZE	EMBEDMENT	TENSION
ADRI04	1/4"	1 1/8	2230
ADRI06	3/8"	1 3/4	4825
ADRI08	1/2"	2	7598
ADRI10	5/8"	2 1/2	9275
ADRI12	3/4"	3 3/8	10139

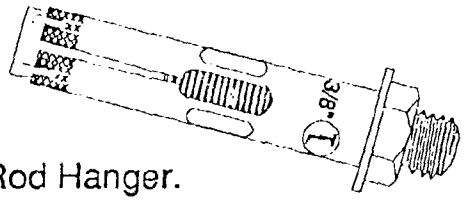
Meets &/or exceeds G.S.A. Specification FF-S 325, Group VII, Type 1. Tests were performed by an independent laboratory company and were conducted in accordance with Standard Test Methods of Anchors in Concrete & Masonry Elements. 4000 PSI concrete, tested in accordance with ASTM E 488, was utilized. Holes were drilled using ANSI B94 Masonry Bits. Results were averaged and tabulated above. The above tension values are the ultimate pull out loads. As such they should be considered for reference purposes only. Most working conditions require a safety factor of 4:1. Critical applications (vibratory loads, overhead installations, etc.) may require a safety factor of as much as 10:1.

TOPLINE™ SLEEVE ANCHORS

Zinc Plated Steel

FOR USE IN ALL MASONRY MATERIALS.

ADVANTAGES/FEATURES



- Exact hole depth not required to set anchor.
- Required hole size equals sleeve diameter.
- Available in a variety of styles: Acorn, Hex, Flat and Rod Hanger.
- Anti-rotation ribs and sleeve slots provide for spin-free anchor installation.

INSTALLATION INSTRUCTIONS

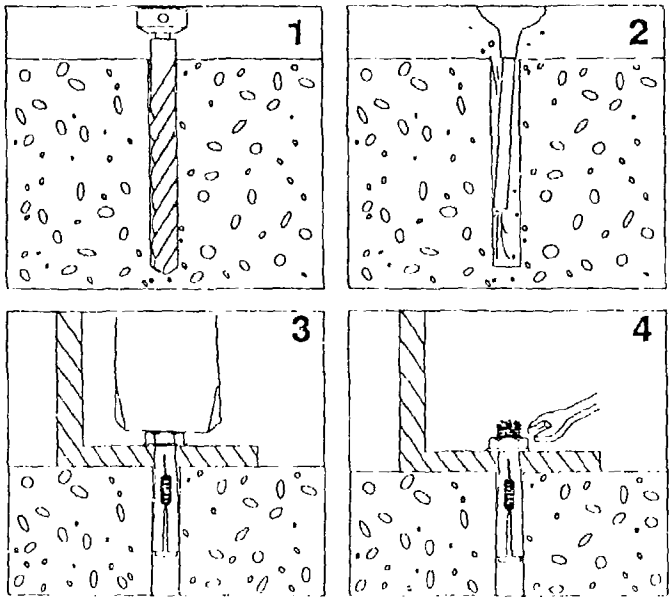
Determine hole depth by adding approximately 1" to required anchor embedment. Choose a carbide-tipped drill bit with same nominal diameter as anchor body. Drill bit must conform to tip diameter tolerances of ANSI Specification B94.12-1977.

1. Drill hole perpendicular to work surface. Hold drill securely and straight during drilling or wobble may cause irregularly shaped holes, which can result in reduced holding power.

2. Clean out dust and debris from hole with a blow-out bulb or compressed air.

3. Set nut flush with the top of anchor and drive anchor through material to be anchored into the work surface until nut and washer are snug with material to be attached.

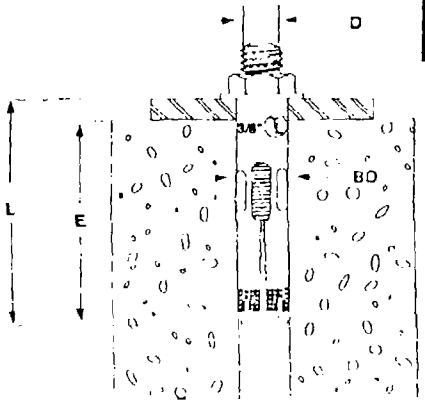
4. Tighten nut until finger tight, then turn 3 to 4 full turns to set the expansion sleeve.

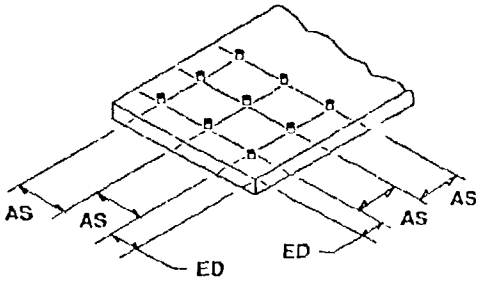


TECHNICAL DATA

SETTING DETAILS
- KEY -

BD - Drill Bit Diameter and Anchor Diameter
D - Bolt Diameter
E - Minimum Depth Embedment
L - Effective Anchor Length
AS - Min. Anchor Spacing For Max. Work Load
ED - Min. Edge Distance/Max. Work Load





	ANCHOR SIZE					
BD	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
D	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"
E	1 1/8"	1 1/4"	1 1/2"	2"	2 1/4"	2 1/2"
L	1 3/8" to 4"	1 1/2" to	1 7/8" to 6"	2 1/4" to 4"	2 1/4" to 4 1/4"	2 1/2" to 4 1/4"
AS	4"	4	5 1/4"	7"	7 7/8"	9"
ED	2"	2 1/2"	3"	4"	5"	6"

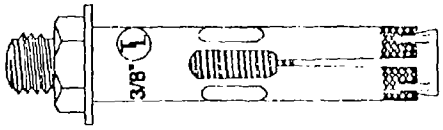
TECHNICAL DATA (Continued)

ANCHOR SIZE	BOLT DIAMETER	MINIMUM EMBEDMENT	AVERAGE ULTIMATE STRENGTH	RECOMMENDED DESIGN LOADS
3/8"	5/16"	1 3/4"	3744 lbs.	936 lbs.
1/2"	3/8"	2"	4576 lbs.	1144 lbs.
5/8"	1/2"	2 1/4"	5483 lbs.	1370 lbs.
3/4"	5/8"	2 5/8"	8741 lbs.	2185 lbs.

The recommended design loads were obtained by applying a safety factor of 4:1, to the average ultimate test load. A higher safety factor may be required for applications with cyclic, fatigue, or shock loads.

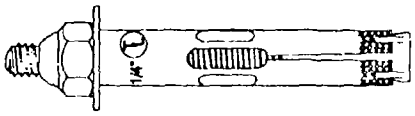
PRICING

Hex Nut



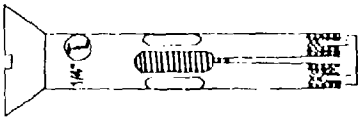
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ASLH05-024	5/16" X 1 1/2"	100	1,000	$30.36
ASLH05-040	5/16" X 2 1/2"	100	1,000	$39.96
ASLH06-030	3/8" X 1 7/8"	50	500	$40.52
ASLH06-048	3/8" X 3"	50	500	$58.28
ASLH08-036	1/2" X 2 1/4"	25	250	$65.68
ASLH08-048	1/2" X 3"	25	250	$87.16
ASLH08-064	1/2" X 4"	25	250	$133.60
ASLH08-096	1/2" X 6"	25	125	$187.48
ASLH10-026	5/8" X 2 1/4"	25	250	$109.40
ASLH10-048	5/8" X 3"	25	250	$133.52
ASLH10-068	5/8" X 4 1/4"	10	100	$153.20
ASLH10-096	5/8" X 6"	10	100	$179.00
ASLH12-040	3/4" X 2 1/2"	10	100	$210.00
ASLH12-068	3/4" X 4 1/4"	5	50	$258.48
ASLH12-100	3/4" X 6 1/4"	5	50	$386.80

Acorn Nut



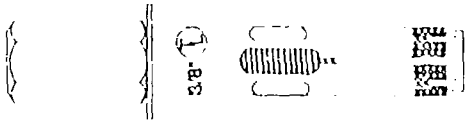
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ASLA04-010	1/4" X 5/8"	100	1,000	$25.25
ASLA04-022	1/4" X 1 3/8"	100	1,000	$25.50
ASLA04-036	1/4" X 2 1/4"	100	1,000	$34.50

Flat Head



PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ASLF04-032	1/4" X 2"	100	1,000	$37.20
ASLF04-048	1/4" X 3"	100	1,000	$45.36
ASLF04-064	1/4" X 4"	100	1,000	$63.60
ASLF06-048	3/8" X 3"	50	500	$66.32
ASLF06-064	3/8" X 4"	50	500	$80.80
ASLF06-080	3/8" X 5"	50	300	$123.80
ASLF06-096	3/8" X 6"	50	300	$147.96

Rod Hanger

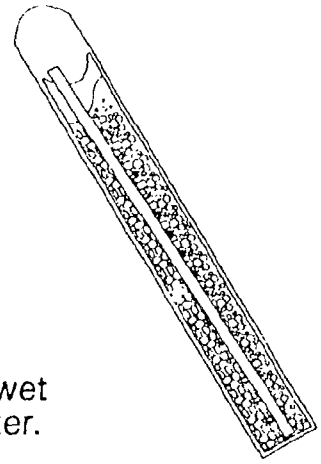


PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ASLC06-030	3/8" X 1 7/8"	50	500	$84.80
ASLC06-030	3/8" X 3"	50	250	$134.00
ASLC06-036	1/2" X 2 1/4"	25	250	$151.60

TOPLINE™ AR CHEMICAL SETTER
SUPER LL AP

FOR USE IN HEAVY DUTY APPLICATIONS.

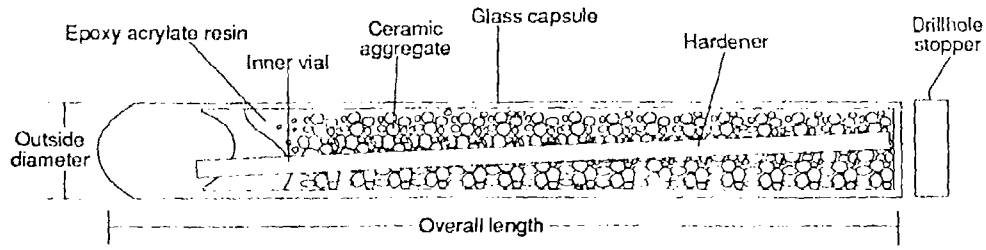
ADVANTAGES/FEATURES



- Full retention of holding power.
- Oustanding alkali resistance.
- High tenacity and initial rigidity.
- Extended shelf life, with fusion-sealed capsules.
- Excellent vibration resistance.
- Improved mechanical properties and heat resistance.
- Superior curability in low temperature installations.
- Amenability to practically any work condition, including with wet surfaces, in rocks or concrete, and in either fresh or salt water.

BASIC CONFIGURATION

The AR Chemical Setter is a hermetically sealed capsule containing an epoxy acrylate resin with high bonding power and superior alkali resistance for freedom from long term degradation, together with a resin hardening agent and a highly uniform ceramic aggregate.



RECOMMENDED CURING TIMES

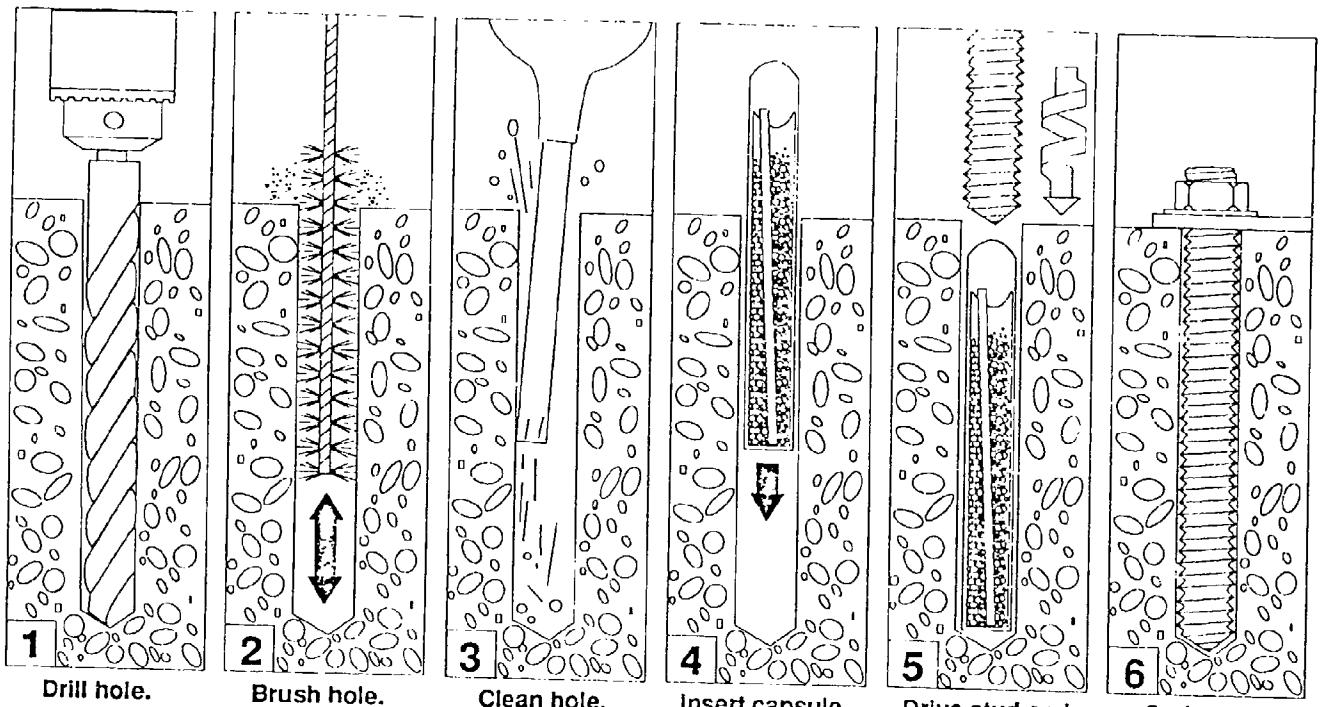
The table below may be taken as an approximate guide to appropriate curing times, which vary with the ambient temperature. The embedded stud must not be disturbed during the curing period.

For upward installation, the stud should always be secured by wedging or other means until the end of the curing period to prevent its descent or dropout.

Temperature (°F)	23	33	41	50	59	68	77	86
Curing Time (min.)	480	80	50	30	20	18	15	10

INSTALLATION INSTRUCTIONS

The capsule is placed in a clean drill hole, then broken and thoroughly mixed by driving in a 45° bevel bolt or deformed bar with a rotary hammer.



1 Drill hole. 2 Brush hole. 3 Clean hole. 4 Insert capsule. 5 Drive stud and agitate with rotary hammer. 6 Curing.

Unparalleled Quality and Performance, with Epoxy Acrylate Resin of Ultra-High Corrosion Resistance.

PRICING

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ARCA06	3/8"	20	100	205.00
ARCA08	1/2"	20	100	230.00
ARCA10	5/8"	20	100	285.50
ARCA12	3/4"	10	50	425.75
ARCA14	7/8"	5	20	530.00
ARCA16	1"	5	10	745.00
ARCA20	1 1/4"		5	1270.00

TECHNICAL DATA

* Pullout Loads shown are values obtained by Japan Testing Center for Construction Materials.

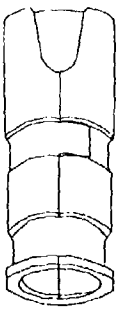
PART NUMBER	SIZE	LENGTH	DRILL DIA.	HOLE DEPTH	PULLOUT
ARCA06	3/8"	3 1/2"	7/16"	3 1/2"	8,620 lbs.
ARCA08	1/2"	3 3/4"	9/16"	4 1/4"	12,880 lbs.
ARCA10	5/8"	4 3/4"	3/4"	5"	21,630 lbs.
ARCA12	3/4"	7 1/2"	7/8"	8"	36,930 lbs.
ARCA14	7/8"	9"	1 1/8"	10"	58,730 lbs.
ARCA16	1"	11"	1 1/4"	12"	70,040 lbs.
ARCA20	1 1/4"	12"	1 1/2"	14"	93,700 lbs.

Tests were conducted using SAE Grade 2 studs in 3,000 PSI concrete. Ultimate values shown. Actual results may vary and are dependent on proper installation. General industry practices for static loads is to use a safety factor of 4:1 to obtain working loads.

TOPLINE™ SINGLE EXPANSION SHIELDS

FOR USE IN MEDIUM DUTY APPLICATIONS.

ADVANTAGES/FEATURES

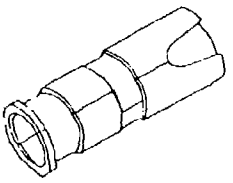


- Can be used for fastening into rock, concrete, brick, etc.
- If bolt is removed and replaced, holding power is unaffected.
- One piece design, made of zinc alloy - is entirely rust-proof.
- Shock and vibration proof, won't creep or shake loose.

INSTALLATION INSTRUCTIONS

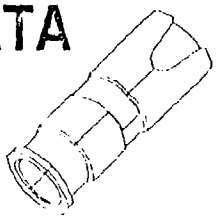
1. Drill hole of recommended diameter. Install shield flush with surface of hole.
2. Place fixture. Insert machine bolt through fixture into shield and tighten.
3. To determine length of bolt: thickness of fixture plus length of shield, equals length of bolt.

PRICING



PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ASES04	1/4" SINGLE	100	1,000	$54.21
ASES05	5/16" SINGLE	50	500	$75.20
ASES06	3/8" SINGLE	50	500	$93.20
ASES08	1/2" SINGLE	50	250	$144.40
ASES10	5/8" SINGLE	25	125	$215.01
ASES12	3/4" SINGLE	25	125	$314.50

TECHNICAL DATA

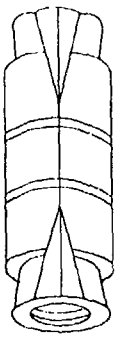


BOLT DIAMETER	DRILL SIZE	SHIELD LENGTH	TENSILE STRENGTH	SHEAR STRENGTH
1/4"	1/2"	1 5/16"	1800 lbs.	2100 lbs.
5/16"	5/8"	1 1/2"	2000 lbs.	3250 lbs.
3/8"	3/4"	1 1/2"	2200 lbs.	3950 lbs.
1/2"	7/8"	2"	3500 lbs.	8200 lbs.
5/8"	1"	2 5/8"	5050 lbs.	13050 lbs.
3/4"	1 1/4"	2 3/4"	8800 lbs.	15400 lbs.

TOPLINE™ DOUBLE EXPANSION SHIELDS

FOR USE IN MEDIUM DUTY APPLICATIONS.

ADVANTAGES/FEATURES

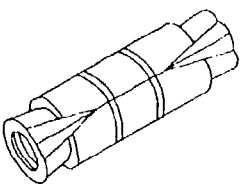


- Can be used for fastening into rock, concrete, brick, etc.
- Eliminates high stress points detrimental in fastening into materials of medium hardness, expands fully and has high gripping power.
- Ideal for sheer loads or where bolt is subject to side pressure or vibration.
- Does not fracture, and permits fastenings at any depth.

INSTALLATION INSTRUCTIONS

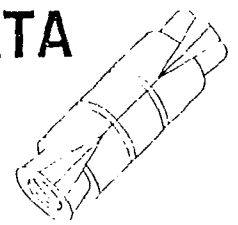
1. Drill hole of recommended diameter (slightly deeper than length of shield). Insert the shield into hole.
2. Shield should be flush or slightly below surface of masonry. Place fixture. Insert machine bolt and tighten.
3. A deep setting increases holding power of masonry. If desired, place a pipe sleeve between shield and fixture being attached.

PRICING



PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ADES04	1/4" DOUBLE	100	1,000	$64.60
ADES05	5/16" DOUBLE	50	500	$90.27
ADES06	3/8" DOUBLE	50	500	$121.50
ADES08	1/2" DOUBLE	50	250	$159.90
ADFS10	5/8" DOUBLE	25	125	$223.40
ADES12	3/4" DOUBLE	10	100	$416.15

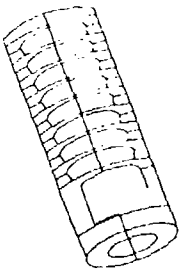
TECHNICAL DATA



BOLT DIAMETER	DRILL SIZE	SHIELD LENGTH	TENSILE STRENGTH	SHEAR STRENGTH
1/4"	1/2"	1 3/8"	1850 lbs.	2780 lbs.
5/16"	5/8"	1 5/8"	2000 lbs.	3600 lbs.
3/8"	3/4"	2"	3900 lbs.	4485 lbs.
1/2"	7/8"	2 1/2"	4600 lbs.	9300 lbs.
5/8"	1"	2 3/4"	5950 lbs.	13250 lbs.
3/4"	1 1/4"	4"	9350 lbs.	16200 lbs

TOPLINE™ LAG SHIELDS

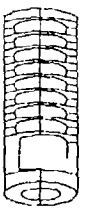
FOR USE IN MEDIUM DUTY APPLICATIONS.



ADVANTAGES/FEATURES

- Can be used in all types of masonry from concrete to brick.
- Can be used with lag screws or bolts.
- Unique four way expansion assures a tight grip even in out-of-round holes.

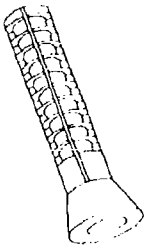
PRICING



PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ALGS04	1/4" SHORT	100	2,000	$25.52
ALGS05	5/16" SHORT	100	2,000	$34.20
ALGS06	3/8" SHORT	50	1,000	$50.00
ALGS08	1/2" SHORT	25	500	$74.00
ALGL04	1/4" LONG	100	2,000	$33.20
ALGL05	5/16" LONG	100	2,000	$39.20
ALGL06	3/8" LONG	50	500	$59.40
ALGL08	1/2" LONG	25	500	$92.20

TOPLINE™ LEAD SCREW ANCHORS

FOR USE IN MEDIUM DUTY APPLICATIONS.



ADVANTAGES/FEATURES

- Can be used in solid masonry and concrete.
- Ideal for shallow hole anchoring - as it expands lead flows into any irregularities in hole, making incorrect setting difficult.

PRICING

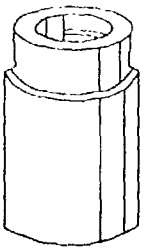
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
AWSL08-12	6-8 X 3/4"	100	4,000	$11.00
AWSL08-16	6-8 X 1"	100	3,000	$11.40
AWSL08-24	6-8 X 1 1/2"	100	2,000	$12.20
AWSL10-12	10-14 X 3/4"	100	4,000	$12.20
AWSL10-16	10-14 X 1"	100	3,000	$12.20
AWSL10-24	10-14 X 1 1/2"	100	2,000	$15.60
AWSL16-16	16-18 X 1"	100	2,000	$18.80
AWSL16-24	16-18 X 1 1/2"	100	1,000	$23.00

TOPLINE™

MACHINE SCREW ANCHORS

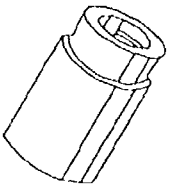
FOR USE IN MEDIUM DUTY APPLICATIONS.

ADVANTAGES/FEATURES



- Can be used in concrete, block, brick or stone.
- Lead sleeve conforms to irregularities of hole.
- Can be used with machine screws or bolts.
- Setting tools provided in each box of anchors.
- Sleeve manufactured from lead or lead alloy; to ASTM B633, SC1, Type III.

PRICING
Machine Screw Anchors



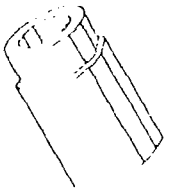
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
AMSL06	6-32	100	8,000	$24.72
AMSL08	8-32	100	8,000	$28.68
AMSL10	10-24	100	4,000	$27.49
AMSL14	1/4"	100	1,000	$31.08
AMSL16	5/16"	100	1,000	$56.40
AMSL18	3/8"	50	500	$76.30
AMSL20	1/2"	50	250	$108.50

Sizing Information

SIZE	ANCH. LENGTH & HOLE DEPTH	HOLE SIZE
6-32	17/32"	5/16"
8-32	17/32"	5/16"
10-24	11/16"	3/8"
1/4-20	7/8"	1/2"
5/16-18	1-1/16"	5/8"
3/8-16	1-5/16"	3/4"
1/2-13	1-9/16"	7/8"

PRICING
Setting Tools

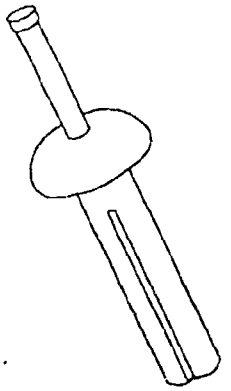
PART NUMBER	SIZE	QTY/BOX	LIST PRICE
AMST06	#6	10	$2.25
AMST08	#8	10	$2.25
AMST10	#10	10	$2.35
AMST14	1/4"	10	$3.00
AMST16	5/16"	10	$3.35
AMST18	3/8"	10	$4.00
AMST20	1/2"	10	$5.75



TOPLINE™

HAMMER DRIVE ANCHORS

FOR USE IN MEDIUM DUTY APPLICATIONS.



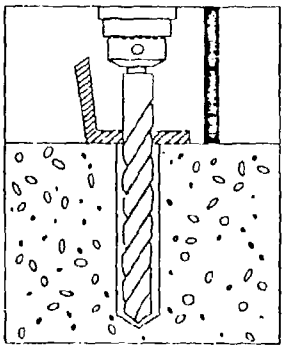
ADVANTAGES/FEATURES

- Can be used in concrete, block, brick or stone.
- Quickly hammered into place, ease of installation.
- Nail acts as an expansion and locking pin.
- Integral unit made of zinc alloy with hardened steel nail, nail zinc plated per ASTM B633, SC1, Type III.

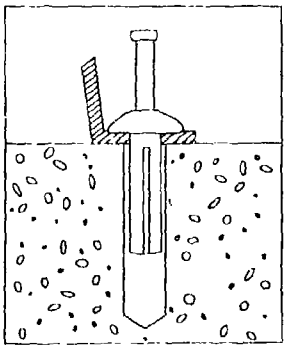
Conforms to the description in Federal Specification FF-S-325, Group V, Type 2, Class I, Style 1.

INSTALLATION INSTRUCTIONS

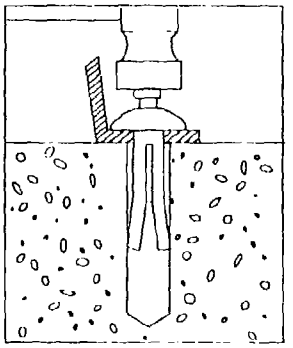
1. Drill hole in base material same diameter as anchor. Minimum depth of hole should be overall length of anchor minus thickness of material to be fastened.



2. Insert anchor through the object to be fastened and into hole in base material.



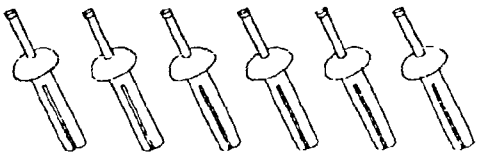
3. Tap nail until it is flush with hammer drive anchor head.



SIZING INFORMATION

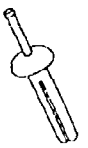
SIZE DIA. X LENGTH	HOLE SIZE
3/16 X 7/8	3/16
1/4 X 3/4	1/4
1/4 X 1	1/4
1/4 X 1-1/4	1/4
1/4 X 1-1/2	1/4
1/4 X 2	1/4

PRICING



PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
AHDM10-014MC	3/16 X 7/8	100	1,000	$14.60
AHDM10-014B	3/16 X 7/8	-	6,500	$12.41
AHDM14-016MC	1/4 X 1	100	1,000	$18.90
AHDM14-016B	1/4 X 1	-	5,000	$16.05
AHDM14-020MC	1/4 X 1 1/4	100	1,000	$21.60
AHDM14-020B	1/4 X 1 1/4	-	4,000	$18.30
AHDM14-024MC	1/4 X 1 1/2	100	1,000	$23.60
AHDM14-024B	1/4 X 1 1/2	-	2,500	$20.00
AHDM14-032MC	1/4 X 2	100	1,000	$35.60
AHDM14-032B	1/4 X 2	-	2,000	$30.25

Performance in 2000 PSI Concrete.

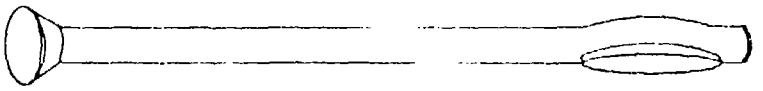


TECHNICAL DATA

SIZE	EMBEDMENT	PULLOUT LOAD
3/16 X 7/8	3/4"	1124 LBS.
1/4 X 1	7/8"	944 LBS.
1/4 X 1 1/4	1 1/8"	1146 LBS.
1/4 X 1 1/2	1 3/8"	854 LBS.
1/4 X 2	1 7/8"	1169 LBS.

Tests performed by Independent Testing Laboratory. Test report copies available upon request.

TOPLINE™ SPLIT-DRIVE ANCHORS



Grade 8.2 Carbon Steel
Heat Treated & Tempered
Bright Zinc Plated - Flat Head

FOR USE IN MEDIUM DUTY FASTENING TO CONCRETE APPLICATIONS.

ADVANTAGES/FEATURES

- Load can be applied immediately.
- High grade steel with a memory.
- One-piece, pre-expanded anchor.
- Exact hole depth not required to set anchor.
- Fast, Permanent installation.

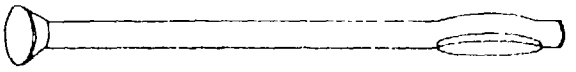
TECHNICAL DATA

ANCHOR DIAMETER (IN.)	1/4
ULTIMATE TENSILE LOAD (LBS.) AVG.	1,975
ULTIMATE SHEAR LOAD (LBS.) AVG.	2,175

Performance In 4000 PSI Concrete at 2 1/2" Embedment

- Test Data represents the average of values in tests conducted in accordance with ASTM/ANSI E488 test procedures.
- All holes were drilled with bits conforming to ANSI B94.12-1977.
- To calculate design loads, a minimum safety factor of 4:1 should be applied to ultimate values. Use higher safety factor for critical applications.

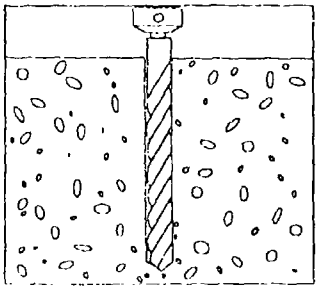
PRICING



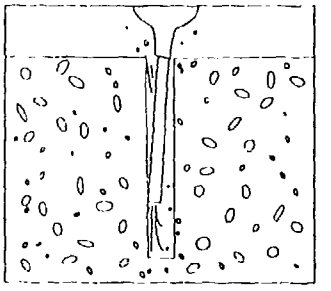
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ASDF14-024	1/4" X 1 1/2"	100	1000	$35.00
ASDF14-032	1/4" X 2"	100	1000	$40.00
ASDF14-040	1/4" X 2 1/2"	100	1000	$46.00
ASDF14-048	1/4 X 3"	100	1000	$52.00
ASDF14-056	1/4 X 3 1/2"	100	1000	$59.00
ASDF14-064	1/4 X 4"	100	1000	$68.50

INSTALLATION INSTRUCTIONS

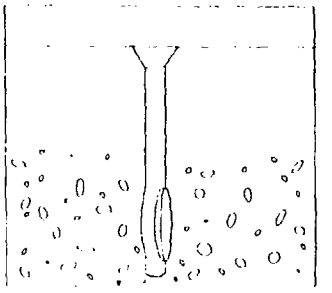
1. Determine hole depth by adding approximately 1" to required anchor embedment. Choose a carbide-tipped drill bit with same nominal diameter as anchor body. Drill bit must conform to tip diameter tolerances of ANSI Specification B94.12-1977.



2. Clean out dust and debris from hole with blow-out bulb or compressed air.

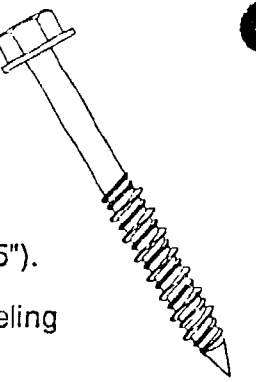


3. Insert the split-drive anchor into the hole and hammer it flush to the surface. When the entire sheared section of the split-drive is fully inserted into the masonry, the anchor is set.



TOPLINE™ CONCRETE SCREWS

FOR USE IN MEDIUM DUTY APPLICATIONS.



ADVANTAGES/FEATURES

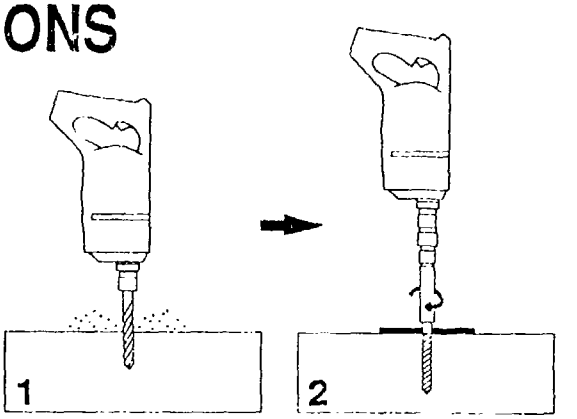
- Can be used in C.I.P., concrete, hollow core block, solid block, brick, or any other masonry material.
- Available in two diameters - (3/16" and 1/4") and multiple lengths (1 1/4" up to 5").
- Comes in two head styles - Phillips flat head and slotted hex washer head.
- Cuts threads into concrete, can later be removed for adjustment, shimming, leveling and then re-driven into the same hole.

INSTALLATION INSTRUCTIONS

1. Use setting tool with bit in drilling position to drill hole in base material.

2. Retract bit, insert TOPLINE Concrete screw into socket head of tool and drive into hole.

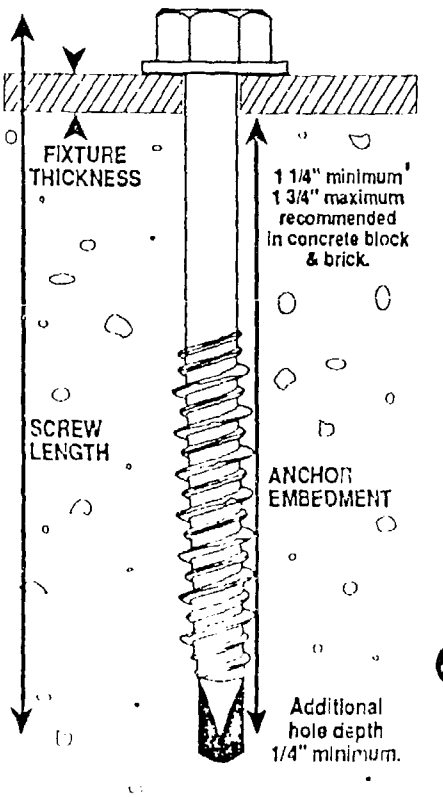
INSTALLATION IS COMPLETE, by simply drilling the hole and driving the screw.



CONCRETE SCREW SELECTION

SCREW SELECTOR GUIDE

Fixture Thickness	Recommended Screw Length	Screw Diameter	Bit Length
0 - 1/4"	1 1/4"	3/16 or 1/4"	3 1/2"
1/4 - 3/4"	1 3/4"	3/16 or 1/4"	3 1/2"
3/4 - 1 1/4"	2 1/4"	3/16 or 1/4"	4 1/2"
1 1/4 - 1 3/4"	2 3/4"	3/16 or 1/4"	4 1/2"
1 3/4 - 2 1/4"	3 1/4"	3/16 or 1/4"	5 1/2"
2 1/4 - 2 3/4"	3 3/4"	3/16 or 1/4"	5 1/2"
2 1/2 - 3"	4"	3/16 or 1/4"	5 1/2"



SCREW LENGTH
The fixture thickness and the desired embedment are added to determine the screw length.

HOLE DEPTH
The desired screw embedment plus an additional 1/4" depth for displaced material determine the total hole depth in the masonry material.

HOLE DIAMETER
The correct hole diameter is very important. That's why a specially sized drill bit is included with every box of screws. Each TOPLINE drill bit is made to close tolerances and is designed to assure maximum pull-out strength.

PRICING

Hex Head

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
DCOH10-020	3/16" X 1 1/4"	100	1000	$17.40
DCOH10-028	3/16" X 1 3/4"	100	1000	$18.60
DCOH10-036	3/16" X 2 1/4"	100	2000	$20.40
DCOH10-044	3/16" X 2 3/4"	100	2000	$24.75
DCOH10-052	3/16" X 3 1/4"	100	2000	$31.20
DCOH10-060	3/16" X 3 3/4"	100	2000	$33.60
DCOH10-064	3/16" X 4"	100	2000	$36.00
DCOH14-020	1/4" X 1 1/4"	100	1000	$22.80
DCOH14-028	1/4" X 1 3/4"	100	2000	$25.80
DCOH14-036	1/4" X 2 1/4"	100	2000	$28.80
DCOH14-044	1/4" X 2 3/4"	100	2000	$32.70
DCOH14-052	1/4" X 3 1/4"	100	2000	$40.65
DCOH14-060	1/4" X 3 3/4"	100	2000	$47.40
DCOH14-064	1/4" X 4"	100	2000	$50.10
DCOH14-080	1/4" X 5"	100	2000	$94.80

Flat Head

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
DCOF10-020	3/16" X 1 1/4"	100	1000	$17.40
DCOF10-028	3/16" X 1 3/4"	100	1000	$18.60
DCOF10-036	3/16" X 2 1/4"	100	2000	$20.40
DCOF10-044	3/16" X 2 3/4"	100	2000	$24.75
DCOF10-052	3/16" X 3 1/4"	100	2000	$31.20
DCOF10-060	3/16" X 3 3/4"	100	2000	$33.60
DCOF10-064	3/16" X 4"	100	2000	$36.00
DCOF14-020	1/4" X 1 1/4"	100	1000	$22.80
DCOF14-028	1/4" X 1 3/4"	100	2000	$25.80
DCOF14-036	1/4" X 2 1/4"	100	2000	$28.80
DCOF14-044	1/4" X 2 3/4"	100	2000	$32.70
DCOF14-052	1/4" X 3 1/4"	100	2000	$40.65
DCOF14-060	1/4" X 3 3/4"	100	2000	$47.40
DCOF14-064	1/4" X 4"	100	2000	$50.10
DCOF14-080	1/4" X 5"	100	2000	$94.80

Accessories - Drill Bits

PART NUMBER	SIZE	MIN. QTY	LIST EACH
TCOB10-056	5/32" X 3 1/2"	10	$5.40
TCOB10-072	5/32" X 4 1/2"	10	$6.00
TCOB10-096	5/32" X 5 1/2"	10	$6.75
TCOB14-056	3/16" X 3 1/2"	10	$6.00
TCOB14-072	3/16" X 4 1/2"	10	$6.75
TCOB14-096	3/16" X 5 1/2"	10	$7.50
TCOB14-112	3/16" X 7"	10	$13.50

Drill Bits and Tools

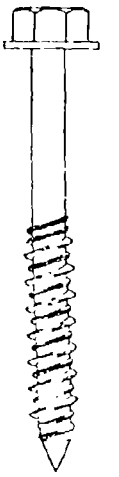
PART NUMBER	MIN. QTY	LIST EACH
Complete Drive Tool Kit TDT Hx Hd and Phil Hd	1	$57.50
Magnetic Driver Hx Hd TMDH14 1/4"	1	$8.50
Magnetic Driver Hx Hd TMDH56 5/16"	1	$3.50
Magnetic Driver Phil Bit TMDH23 #2 & #3	1	$11.30
Phil Bit TP2 #2	1	$1.00
Phil Bit TP3 #3	1	$1.00
Masonry Drill Holder TDH	1	$15.50
Allen Hx Key TSA	1	$2.20
Sleeve Assembly TSA	1	$16.30
Long Sleeve Assembly TSAL #5 & #6	1	$41.30

TECHNICAL DATA

PERFORMANCE

* Pullout/Shear may differ depending on the condition of material. The results below are to be utilized for reference purposes only.

SIZE \ MATERIAL		3000 PSI, SOLID CONCRETE BLOCK		HOLLOW CONCRETE BLOCK		BRICK
Diameter	Length	Pullout	Shear	Pullout	Shear	Pullout
3/16"	1"	485 lbs.	750 lbs.	440 lbs.	727 lbs.	462 lbs.
	1 1/4"	485 lbs.	750 lbs.	440 lbs.	727 lbs.	462 lbs.
1/4"	1"	750 lbs.	1785 lbs.	660 lbs.	925 lbs.	660 lbs.
	1 1/2"	990 lbs.	1875 lbs.	705 lbs.	1450 lbs.	770 lbs.
	2"	1435 lbs.	2027 lbs.	815 lbs.	1940 lbs.	904 lbs.



TOPLINE™

HOLLOW WALLS

FOR USE IN LIGHT DUTY APPLICATIONS.

HOLLOW WALL ANCHORS

HOLLOW WALL DRIVES

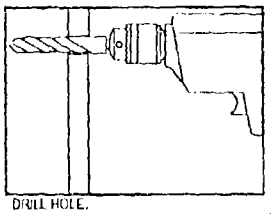
ADVANTAGES/FEATURES

- Integral unit made of steel, zinc plated to ASTM B633, SC1, Type III.
- For use in drywall, plaster, sheetrock, paneling, cinder block, etc.
- Screws can be removed without disturbing the anchor.
- Not affected by vibration - won't back out.
- Will not crack walls or crumble plaster.

- Screws are combination Phillips and Slotted pan head.

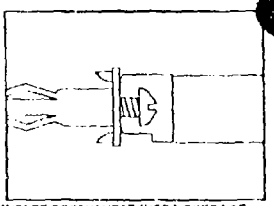
INSTALLATION INSTRUCTIONS

1



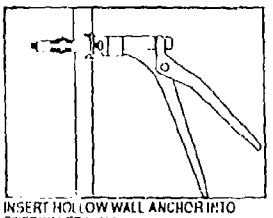
DRILL HOLE.

2



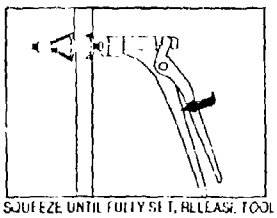
INSERT SCREW HEAD INTO NOSEPIECE

3



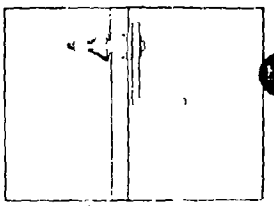
INSERT HOLLOW WALL ANCHOR INTO PREDRILLED HOLE.

4



SQUEEZE UNTIL FULLY SET, RELEASE TOOL

5



INSTALL FIXTURE

PRICING and SPECIFICATIONS

Hollow Wall Anchors

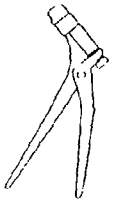
PART NO.	SIZE	HOLE SIZE	GRIP RANGE	STD BOX	STD CTN	PRICE/C
AHWL02-XS	1/8" EXTRA SHORT	5/16"	1/16" to 1/4"	100	2,000	$21.44
AHWL02-S	1/8" SHORT	1/4"	1/8" to 1/2"	100	2,000	$24.74
AHWL02-L	1/8" LONG	1/4"	5/8" to 7/8"	100	2,000	$28.05
AHWL02-XL	1/8" EXTRA LONG	1/4"	1 1/4" to 1 3/4"	100	2,000	$29.09
AHWL03-S	3/16" SHORT	3/8"	1/8" to 5/8"	50	1,000	$35.08
AHWL03-L	3/16" LONG	3/8"	5/8" to 1 3/16"	50	1,000	$39.29
AHWL03-XL	3/16" EXTRA LONG	3/8"	1 1/4" to 1 3/4"	50	1,000	$45.76
AHWL04-S	1/4" SHORT	1/2"	1/8" to 5/8"	50	1,000	$43.49
AHWL04-L	1/4" LONG	1/2"	5/8" to 1 3/16"	50	1,000	$54.86
AHWL04-XL	1/4" EXTRA LONG	1/2"	1 1/4" to 1 3/4"	50	1,000	$63.27

Hollow Wall Drives

PART NO.	SIZE	HOLE SIZE	GRIP RANGE	STD BOX	STD CTN	PRICE/C
AHWD02-XS	1/8" EXTRA SHORT	11/32"	3/16" to 3/8"	100	2,000	$27.02
AHWD02-S	1/8" SHORT	1/4"	1/8" to 1/2"	100	2,000	$30.0[illegible]
AHWD02-L	1/8" LONG	1/4"	1/8" to 13/16"	100	2,000	$32.46

Hollow Wall Installation Tool

PART NO.	DESCRIPTION	EACH	CARTON	PRICE EA
THWR	SETTING TOOL	1	10	$19.80

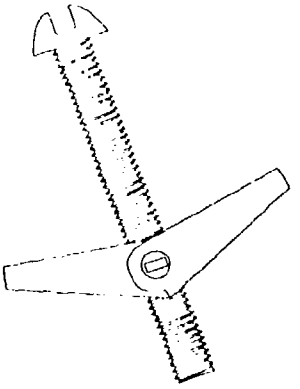


TOPLINE™

TOGGLE BOLTS and TOGGLE WINGS

FOR USE IN LIGHT DUTY APPLICATIONS.

ADVANTAGES/FEATURES



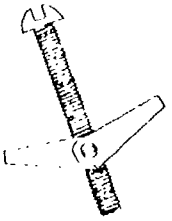
- Can be used in any hollow base material application.
- Comes with fully threaded machine screws with standard coarse threads.
- Wing nut springs open automatically.
- Screw and wing are zinc plated to ASTM B633, SC1, Type III.
- Toggle wings available separately.

SIZING INFORMATION

SIZE	1/8"	3/16"	1/4"	5/16"	3/8"	1/2"
HOLE SIZE	3/8"	1/2"	5/8"	7/8"	1"	1 1/4"

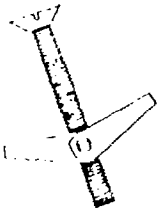
PRICING

Round Head Toggle Bolts



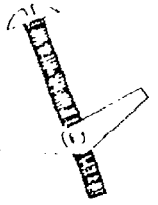
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ATBR02-032	1/8" X 2"	100	3,000	$11.80
ATBR02-048	1/8" X 3"	100	3,000	$13.74
ATBR02-064	1/8" X 4"	100	2,000	$15.12
ATBR03-032	3/16" X 2"	50	1,500	$14.47
ATBR03-048	3/16" X 3"	50	1,000	$15.82
ATBR03-064	3/16" X 4"	50	1,000	$18.24
ATBR03-080	3/16" X 5"	50	1,000	$19.97
ATBR03-096	3/16" X 6"	50	500	$21.67
ATBR04-048	1/4" X 3"	50	1,000	$22.00
ATBR04-064	1/4" X 4"	50	500	$24.84
ATBR04-080	1/4" X 5"	50	500	$27.47
ATBR04-096	1/4 X 6"	50	500	$29.95
ATBR05-048	5/16" X 3"	25	250	$47.37
ATBR05-064	5/16" X 4"	25	250	$51.75
ATBR05-080	5/16" X 5"	25	250	$55.68
ATBR05-096	5/16" X 6"	25	250	$60.01
ATBR06-048	3/8" X 3"	25	250	$61.55
ATBR06-064	3/8" X 4"	25	250	$68.39
ATBR06-080	3/8" X 5"	25	250	$74.13
ATBR06-096	3/8" X 6"	25	250	$79.93
ATBR08-064	1/2" X 4"	10	100	$128.35
ATBR08-080	1/2" X 5"	10	100	$140.50
ATBR08-096	1/2" X 6"	10	100	$149.44

Flat Head Toggle Bolts



PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ATBF02-048	1/8" X 3"	100	3,000	$14.17
ATBF02-064	1/8" X 4"	100	2,000	$15.61
ATBF03-048	3/16" X 3"	50	1,000	$15.67
ATBF03-064	3/16" X 4"	50	1,000	$17.99
ATBF04-048	1/4" X 3"	50	1,000	$21.73
ATBF04-064	1/4" X 4"	50	500	$24.47

Mushroom Head Toggle Bolts

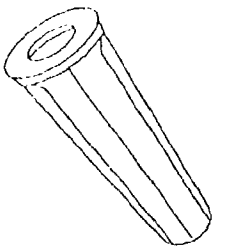


PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ATBM02-048	1/8" X 3"	100	3,000	$13.16
ATBM02-064	1/8" X 4"	100	2,000	$14.49
ATBM03-048	3/16" X 3"	50	1,000	$15.95
ATBM03-064	3/16" X 4"	50	1,000	$18.45
ATBM04-048	1/4" X 3"	50	1,000	$22.22
ATBM04-064	1/4" X 4"	50	500	$25.13

TOPLINE™ PLASTIC ANCHORS and PLASTIC ANCHOR KITS

FOR USE IN LIGHT DUTY APPLICATIONS.

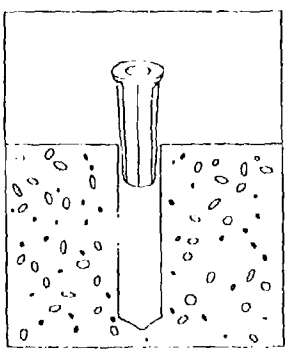
ADVANTAGES/FEATURES



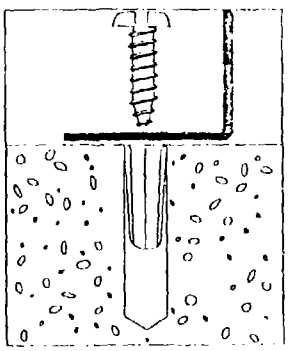
- Can be used in concrete, block, tile, brick, sheetrock, plaster, etc.
- Molded collar allows for use in hollow material.
- Can be used with sheet metal screws or wood screws.
- Made from poly-vinyl-chloride.

INSTALLATION INSTRUCTIONS

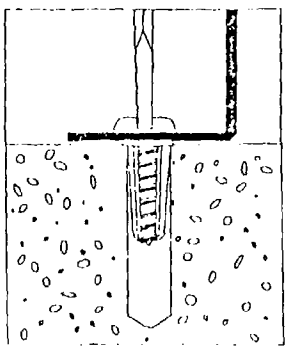
1. Drill hole 1/4" deeper than length of anchor.



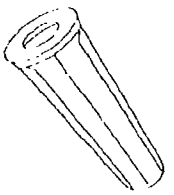
2. Tap anchor into hole flush with base material.



3. Place fixture, insert wood or sheet metal screw and fasten with ordinary screw driver. For best results, the screw should protrude 1/4" through the bottom of anchor.

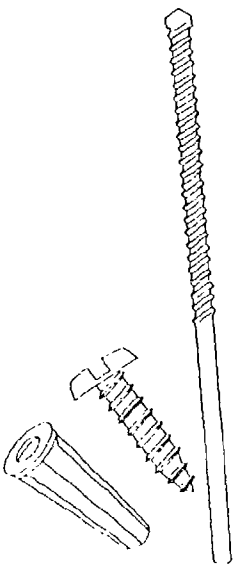


PRICING



Plastic Conical Anchors

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
APLC06-08	#6-#8 X 3/4"	100	1,000	$2.80
APLC08-10	#8-#10 X 7/8"	100	1,000	$2.76
APLC10-12	#10-#12 X 1"	100	1,000	$3.28
APLC14-16	#14 X #16 X 1 3/8"	100	1,000	$5.00



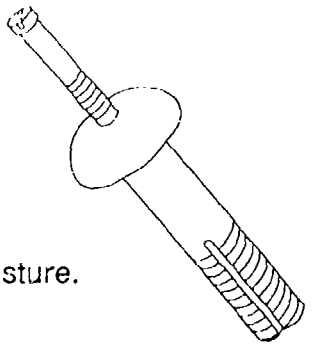
Plastic Conical Anchor Kits

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
AKIT06-016	#6-#8 KIT	1	10	$11.40
AKIT10-016	#10-#12 KIT	1	10	$11.80
AKIT14-020	#14 X #16 KIT	1	10	$15.00

TOPLINE™ NYLON NAIL-INS

FOR USE IN LIGHT DUTY APPLICATIONS.

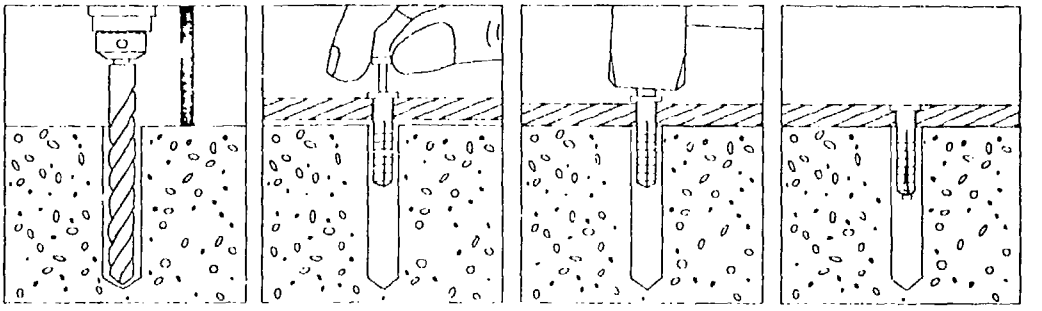
ADVANTAGES/FEATURES



- Light duty anchor effective in the following hollow and solid base material applications: concrete, block, brick, stone, sheetrock, plaster, wood, metal, plastic, tile and glass.
- Integral unit made of composition B nylon to MIL-P-20693, and steel nail made from 1039 steel - hardened to RC 44-50, conforming to FF-N-105. Nail zinc plated to ASTM B633, SC3, Type III.
- Unusually resistant to vibration, fracture, pull-out, chemicals, fungus and moisture.
- Excellent electrical and thermal insulating properties.
- Available in three head styles: round, flat, and mushroom.

INSTALLATION INSTRUCTIONS

1. Drill hole in base material same diameter as anchor. Minimum depth of hole should be overall length of anchor minus thickness of material to be fastened.
2. Insert anchor through the object to be fastened and into hole in base material.
3. Tap drive screw until it is flush with nylon nail-in.
4. Nail acts as an expander pin and locking pin. Anchor can be removed by unscrewing the nail.



PRICING

Round Head

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ANYR10-016	3/16 X 1	100	1000	$9.10
ANYR10-024	3/16 X 1 1/2	100	1000	$12.20
ANYR14-016	1/4 X 1	100	1000	$10.25
ANYR14-024	1/4 X 1 1/2	100	1000	$12.25
ANYR14-032	1/4 X 2	100	1000	$18.50

Flat Head

PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ANYF10-016	3/16 X 1	100	1000	$9.10
ANYF14-016	1/4 X 1	100	1000	$10.25
ANYF14-024	1/4 X 1 1/2	100	1000	$12.25
ANYF14-032	1/4 X 2	100	1000	$18.50

SIZING INFORMATION

SIZE	HOLE SIZE	ROUND HEAD HEAD DIA	FLAT HEAD HEAD DIA	MUSH. HEAD HEAD DIA
3/16 X 1"	3/16"	3/8"	3/8"	9/16"
3/16 X 1 1/2"	3/16"	3/8"	3/8"	
1/4 X 3/4"	1/4"	7/16"	7/16"	9/16"
1/4 X 1"	1/4"	-	-	9/16"
1/4 X 1 1/2"	1/4"	7/16"	7/16"	9/16"
1/4 X 2"	1/4"	7/16"	7/16"	9/16"
1/4 X 3"	1/4"	-	-	9/16"

Mushroom Head

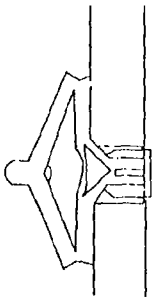
PART NUMBER	SIZE	QTY/BOX	QTY/CTN	LIST PRICE
ANYM10-016	3/16 X 1	100	1000	$9.10
ANYM14-012	1/4 X 3/4	100	1000	$10.50
ANYM14-016	1/4 X 1	100	1000	$11.00
ANYM14-024	1/4 X 1 1/2	100	1000	$12.25
ANYM14-032	1/4 X 2	100	1000	$18.50
ANYM14-048	1/4 X 3	100	1000	$27.80
ANYM14-064	1/4 X 4	100	1000	$35.75

TOPLINE™ PLASTIC TOGGLES

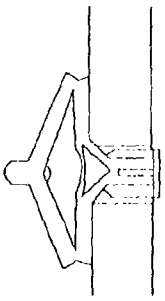
FOR USE IN LIGHT DUTY APPLICATIONS.

PRICING

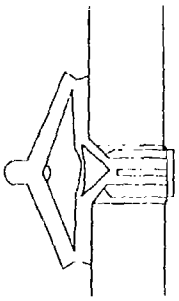
PART NUMBER	SIZE	GRIP RANGE	QTY/BOX	QTY/CTN	LIST PRICE
APLT06-008	SMALL	3/8" to 1/2"	100	1,000	$13.30
APLT08-010	MEDIUM	1/2" to 5/8"	100	1,000	$15.70
APLT10-012	LARGE	5/8" to 3/4"	100	1,000	$17.40



3/8"
SMALL



1/2"
MEDIUM



5/8"
LARGE

TOPLINE™ COUPLING NUTS

FOR USE IN LIGHT, MEDIUM and HEAVY DUTY APPLICATIONS.

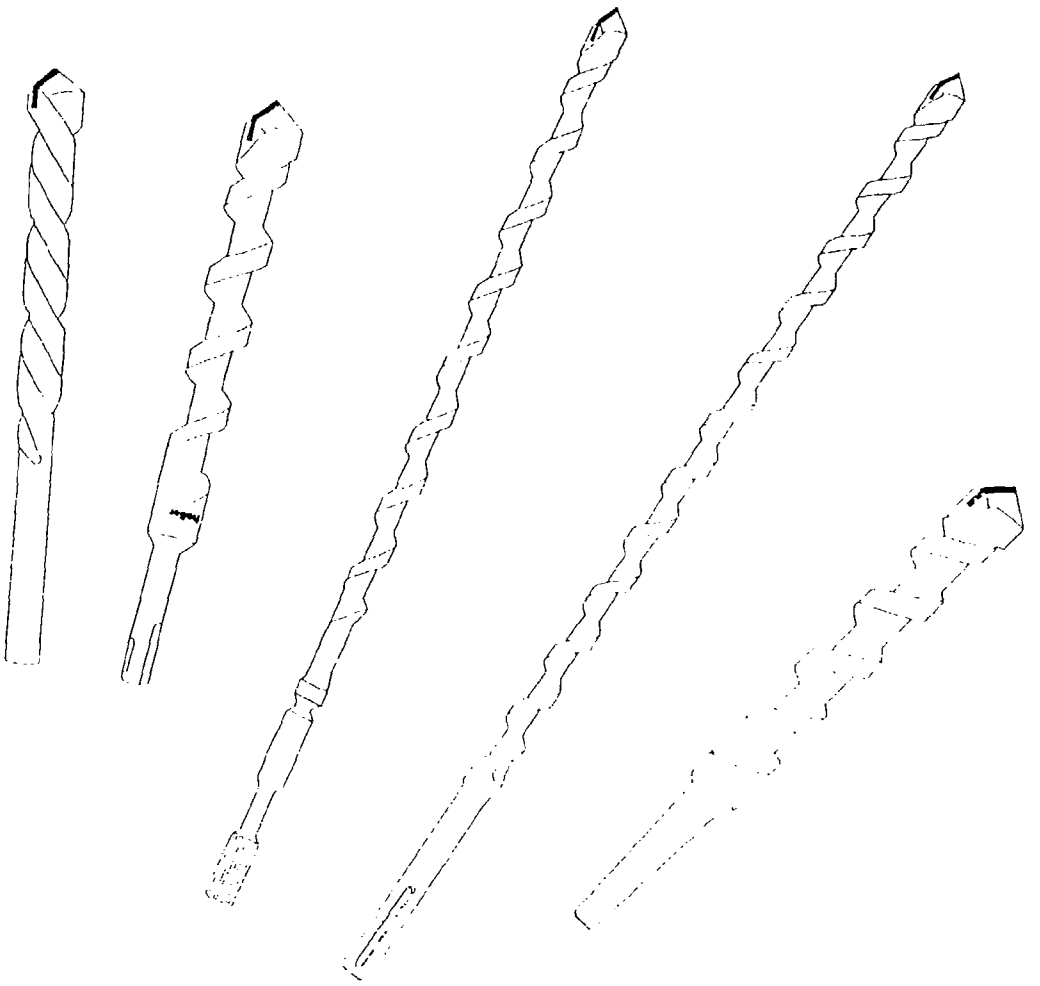
PRICING

PART NUMBER	SIZE	GRIP RANGE	QTY/BOX	LIST PRICE
NCOU04	1/4" X 7/8"	100	500	$20.64
NCOU06	3/8" X 1 1/8"	100	500	$30.00
NCOU07	3/8" X 1 3/4"	-	-	$66.76
NCOU08	1/2" X 1 3/4"	100	500	$72.00
NCOU10	5/8" X 1 1/2"	50	300	$130.00
NCOU12	3/4" X 2 1/4"	50	200	$255.00
NCOU14	7/8" X 2 1/2"	25	100	$400.00
NCOU16	1" X 2 1/2"	25	100	$490.00

TOPLINE™

ROTARY HAMMER DRILL BITS

Carbide Tipped



More Holes Per Bit, Less Cost Per Hole!

PRECISION MADE - FROM WEST GERMANY

TOPLINE™ ROTARY HAMMER DRILL BITS

FOR DRILLING IN CONCRETE, ROCK, BRICK ETC.

ADVANTAGES/FEATURES

- Bits are made of super alloy steel and a IMPAC carbide grade tip selected for the higher RPM or SDS-hammers
- High temperature brazing method and German technology give superior durability
- Excellent dust removal, rapid drilling in all positions
- Bit diameter meets ANSI Metal Standard B 94.12-1977

PRICING

Round Shank Hammer Bits

PART #	DIAMETER & O.A. LENGTH (In Inches)	USEABLE LENGTH (In Inches)	TL LIST EACH
TRSB02A056	5/32 X 3 1/2	1 3/4	$2.65
TRSB03-064	3/16 X 4	2	$2.76
TRSB03-096	3/16 X 6	4 1/2	$3.80
TRSB04-064	1/4 X 4	2 1/2	$2.76
TRSB04-096	1/4 X 6	4 1/2	$3.91
TRSB05-080	5/16 X 5	3 1/4	$3.22
TRSB05-112	5/16 X 8	5 1/2	$5.64
TRSB06-080	3/8 X 5	3 1/4	$3.68
TRSB06-112	3/8 X 8	5 1/2	$7.48
TRSB08-096	1/2 X 6	3 3/4	$5.06
TRSB08-144	1/2 X 9	6 1/2	$9.66
TRSB09-096	9/16 X 6	3 3/4	$6.67
TRSB10-096	5/8 X 6	3 3/4	$7.13
TRSB10-192	5/8 X 12	10	$14.84
TRSB11-104	11/16 X 6 1/2	4	$9.09
TRSB12-104	3/4 X 6 1/2	4	$13.57
TRSB16-104	1 X 6 1/2	4	$19.44

S/D/S Roofing Bits-High Tolerance

PART #	DIAMETER & O.A. LENGTH (In Inches)	USEABLE LENGTH (In Inches)	TL LIST EACH
TCTB04-076	.202 X 4 3/4	2 3/4	$10.06
TCTB04-104	.202 X 6 1/2	4 1/2	$14.49
TCTB04-132	.202 X 8 1/4	6 1/4	$15.53
TCTB04-148	.202 X 9 1/4	7 1/4	$19.67
TCTB04-181	.214 X 11 5/8	9 5/8	$23.00
TCTB04-228	.214 X 14 1/4	12 1/4	$25.99

S/D/S Rotary Hammer Bits

PART #	DIAMETER & O.A. LENGTH (In Inches)	USEABLE LENGTH (In Inches)	TL LIST EACH
TSDS03-072	3/16 X 4 1/2	2	$7.82
TSDS03-096	3/16 X 6	4	$9.32
TSDS03-136	3/16 X 8 1/2	6	$11.96
TSDS03-184	3/16 X 11 1/2	9	$21.05
TSDS03A072	7/32 X 4 1/2	2	$8.97
TSDS03A136	7/32 X 8 1/2	6	$12.31
TSDS03A184	7/32 X 11 1/2	9	$24.27
TSDS04-072	1/4 X 4 1/2	2	$8.97
TSDS04-104	1/4 X 6 1/2	4	$9.66
TSDS04-136	1/4 X 8 1/2	6	$12.31
TSDS04-184	1/4 X 11 1/2	9	$27.49
TSDS05-104	5/16 X 6 1/2	4	$10.12
TSDS05-136	5/16 X 8 1/2	6	$13.11
TSDS06-104	3/8 X 6 1/2	4	$12.08
TSDS06-136	3/8 X 8 1/2	6	$16.22
TSDS06-168	3/8 X 10 1/2	8	$18.06
TSDS06-288	3/8 X 18	16	$25.88
TSDS07-136	7/16 X 8 1/2	6	$15.76
TSDS08-096	1/2 X 6	4	$14.84
TSDS08-160	1/2 X 10	8	$21.28
TSDS08-288	1/2 X 18	16	$33.12
TSDS09-160	9/16 X 10	8	$22.89
TSDS10-128	5/8 X 8	6	$25.07
TSDS10-288	5/8 X 18	16	$44.28
TSDS12-128	3/4 X 8	6	$41.17
TSDS12-288	3/4 X 18	16	$54.97
TSDS14-160	7/8 X 10	8	$51.41
TSDS14-288	7/8 X 18	16	$65.49
TSDS16-160	1 X 10	8	$60.54
TSDS16-288	1 X 18	16	$71.47

PRICING

Spline Shank Rotary Hammer Bits

PART #	DIAMETER & O.A. LENGTH (In Inches)	USEABLE LENGTH (In Inches)	TL LIST EACH
TSPL06-144	3/8 X 9	3	$43.01
TSPL06-192	3/8 X 12	6	$47.15
TSPL08-160	1/2 X 10	5	$44.97
TSPL08-256	1/2 X 16	11	$51.18
TSPL08-384	1/2 X 24	18	$60.72
TSPL08-448	1/2 X 28	22	$68.77
TSPL09-160	9/16 X 10	5	$46.23
TSPL10-160	5/8 X 10	5	$47.73
TSPL10-256	5/8 X 16	11	$53.82
TSPL10-384	5/8 X 24	18	$64.75
TSPL10-448	5/8 X 28	22	$71.88
TSPL10-544	5/8 X 34	28	$170.43
TSPL12-256	3/4 X 16	11	$56.93
TSPL12-352	3/4 X 22	16 3/4	$67.05
TSPL12-448	3/4 X 28	22	$76.48
TSPL12-544	3/4 X 34	28	$199.53
TSPL14-256	7/8 X 16	11	$63.14
TSPL14-352	7/8 X 22	16 3/4	$68.89
TSPL16-256	1 X 16	11	$68.77
TSPL16-352	1 X 22	16 3/4	$77.63
TSPL16-544	1 X 34	28	$234.14
TSPL18-256	1 1/8 X 16	11	$76.82
TSPL18-352	1 1/8 X 22	16 3/4	$90.28
TSPL20-256	1 1/4 X 16	11	$84.87
TSPL20-352	1 1/4 X 22	16 3/4	$101.09
TSPL20-544	1 1/4 X 34	28	$283.59
TSPL22-256	1 3/8 X 16	11	$98.67
TSPL22-352	1 3/8 X 22	16 3/4	$120.06
TSPL24-352	1 1/2 X 22	16 3/4	$142.60
TSPL28-352	1 3/4 X 22	16 3/4	$264.62
TSPL32-352	2 X 22	16 3/4	$296.59

A Taper Bits

PART #	DIAMETER & O.A. LENGTH (In Inches)	USEABLE LENGTH (In Inches)	TL LIST EACH
TATB03-064	3/16 X 4	2	$9.20
TATB04-064	1/4 X 4	2	$9.32
TATB04-096	1/4 X 6	4	$10.24
TATB05-096	5/16 X 6	4	$10.93
TATB05-128	5/16 X 8	6	$15.53
TATB06-096	3/8 X 6	4	$13.00
TATB06-160	3/8 X 10	8	$15.99
TATB08-096	1/2 X 6	4	$16.33
TATB08-160	1/2 X 10	8	$20.13
TATB09-160	9/16 X 10	8	$25.19
TATB10-096	5/8 X 6	4	$20.82
TATB10-160	5/8 X 10	8	$25.19
TATB12-096	3/4 X 6	4	$26.22
TATB12-160	3/4 X 10	8	$31.40

Big Two Slot Hammer Bit, TE Type

PART #	DIAMETER & O.A. LENGTH (In Inches)	USEABLE LENGTH (In Inches)	TL LIST EACH
TTEB08-344	1/2 X 21 1/2	16	$55.09
TTEB09-344	9/16 X 21 1/2	16	$62.68
TTEB10-216	5/8 X 13 1/2	8	$53.02
TTEB10-344	5/8 X 21 1/2	16	$60.38
TTEB12-256	3/4 X 13	8	$56.81
TTEB12-336	3/4 X 21	16	$69.58
TTEB14-336	7/8 X 21	16	$72.68
TTEB16-256	1 X 13	8	$65.78
TTEB16-336	1 X 21	16	$81.08
TTEB18-360	1 1/8 X 22 1/2	18	$90.62
TTEB20-232	1 1/4 X 14 1/2	10	$78.43
TTEB20-360	1 1/4 X 22 1/2	18	$99.59
TTEB22-360	1 3/8 X 22 1/2	18	$128.11
TTEB24-360	1 1/2 X 22 1/2	18	$166.18

TOPLINE PERFORMANCE GUARANTEE

Topline Construction Products will stand behind all Topline tools, 100% GUARANTEE ON QUALITY and WORKMANSHIP (under normal usage).

There will be an inspection report done on every tool that does not meet Topline's Quality Standards. Return the tool and it will be inspected and replaced with a new tool or a credit towards a new tool. However, our liability is limited to payment of the purchase price, repair, or replacement at our option. All merchandise claimed must be returned to us, prepaid for our inspection.

QUALITY ASSURANCE

SPECIFICATIONS: ALL TOPLINE ANCHORS CONFORM TO FEDERAL G.S.A. SPECIFICATIONS. ALL HEAVY DUTY ANCHORS HAVE BEEN FULLY TESTED BY INDEPENDENT TESTING LABORATORIES. TEST REPORTS ARE AVAILABLE UPON REQUEST. UNDERWRITER'S LABORATORY LISTING & FACTORY MUTUAL APPROVAL IN PROGRESS.

ALL TOPLINE PRODUCTS ARE MADE TO THE HIGHEST STANDARDS. AN IN-HOUSE QUALITY ASSURANCE PROGRAM FULLY INSPECTS OUR PRODUCTS, AT EACH STAGE OF PRODUCTION. YOUR SATISFACTION IS FULLY GUARANTEED!

ANCHOR SELECTION & INSTALLATION

ALL ANCHORS ARE DESIGNED TO MEET A VARIETY OF DIFFERENT HOLDING REQUIREMENTS. EACH APPLICATION SHOULD CONSIDER THE HOLDING POWER TO SUIT THE JOB. THE LOAD FACTOR OR WEIGHT MAY SUBJECT THE ANCHOR TO TENSILE, SHEAR, OR COMBINED LOADS. ADDITIONALLY, THE ANCHOR MAY BE SUBJECT TO VIBRATION, OR SHOCK LOADS. THESE VARYING CONDITIONS OF FIELD INSTALLATIONS REQUIRE THAT A MINIMUM SAFETY FACTOR OF 4:1 OR 25% OF THE"DESIGN LOAD" BE APPLIED FOR STATIC LOADS OR NORMAL CONDITIONS. FOR OVERHEAD LOADS , VIBRATORY LOADS, OR CRITICAL CONDITIONS, A SAFETY FACTOR AS MUCH AS 10:1 MAY BE REQUIRED.

HOLDING POWER IS ALSO A FUNCTION OF THE STRENGTH OF THE MASONRY MATERIAL. TOPLINE HEAVY DUTY ANCHORS ARE USUALLY INSTALLED IN STONE , OR DENSE CONCRETE. SUCH ANCHORS CAN WITHSTAND FAR GREATER "PULLOUT LOADS" THAN OTHER TYPES. TOPLINE MEDIUM DUTY ANCHORS, INSTALLED IN LIGHT WEIGHT CONCRETE, BRICK, OR BLOCK; CAN ALSO WITHSTAND MEDIUM TO HEAVY LOADS DUE TO THEIR DESIGN FEATURES.

INTALLATION METHODS & TOOLS MAY AFFECT THE "HOLDING POWER" OF ANCHORS. CARBIDE TIPPED DRILL BITS MUST BE SIZED PROPERLY TO MATCH THE ANCHOR USED. IF AN OVERSIZED BIT IS USED THE ANCHOR STRENGTH WILL BE AFFECTED. ALL BITS SHOULD MEET THE ANSI SPECIFICATION. B94.12.

FOR FUTHER INFORMATION ON INSTALLATION PROCEDURES, & APPLICATIONS , PLEASE REFER TO TOPLINE CONSTRUCTION PRODUCT'S PRODUCT CATALOG, OR WRITE THE ENGINEERING DEPARTMENT AT P.O. BOX 547, 2910 EXPRESSWAY DRIVE SO., HAUPPAUGE N.Y. 11788

TERMS AND CONDITIONS

TERMS:	NET 30 DAYS.
PRICES:	PUBLISHED PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.
FREIGHT:	F.O.B. PREPAID ON ALL CONSTRUCTION FASTENERS SHIPMENTS $450.00.
MINIMUM:	MINIMUM ORDER IS $75.00.
RETURNS:	RETURNS AND DEDUCTIONS MUST BE AUTHORIZED BY OUR SALES DEPARTMENT. CLAIMS FOR SHORTAGES, DAMAGE, OR PRICE CORRECTIONS MUST BE MADE WITHIN 15 DAYS.

PRODUCT LIABILITY - $4,000,000 COVERAGE

FIREMAN'S FUND INSURANCE CO. NY STATE APPROVED - A+