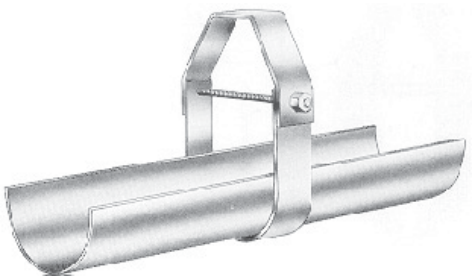
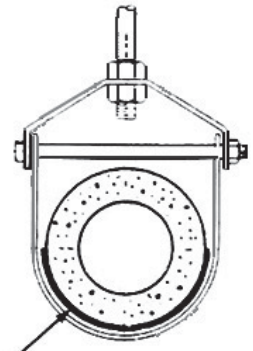
FIG. 220 CLEVIS HANGER WITH WELDED SHIELD

MATERIAL: Carbon steel or 304/316 stainless steel.
FINISH: Black or electro galvanized.
SERVICE: For vapor sealed lines.
ORDERING: Specify pipe size, figure number, insulation thickness and finish.



PIPE SIZE	HANGER SIZING GUIDE					
	THICKNESS OF PIPE INSULATION					
	½"	1"	1½"	2"	2½"	3"
½	1½	2½	3½	5	6	7
¾	2	3	3½	5	6	7
1	2	3	4	5	6	7
1¼	2½	3½	4	5	6	7
1½	2½	3½	5	6	7	8
2	3	4	5	6	7	8
2½	3½	5	6	7	8	10
3	4	5	6	7	8	10
3½	5	6	7	8	10	10
4	5	6	7	8	10	10
5	6	7	8	10	10	12
6	7	8	10	10	12	12
8	10	10	12	12	14	16
10	12	12	14	16	16	18
12	14	16	16	18	18	20
14	16	16	18	18	20	20
16	18	18	20	20	24	24

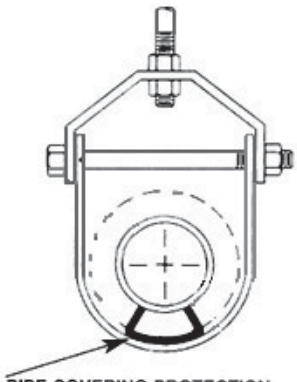


WITH WELDED SHIELD

FIG. 225 CLEVIS HANGER WITH PROTECTION SADDLE

MATERIAL: Carbon steel or 304/316 stainless steel.
FINISH: Black or electro-galvanized.
SERVICE: For supporting insulated pipe lines.
ORDERING: Specify pipe size, figure number, insulation thickness and finish.

PIPE SIZE	HANGER SIZING GUIDE				
	THICKNESS OF PIPE INSULATION				
	1"	1½"	2"	2½"	3"
½	2½	3½	5	6	7
¾	3	3½	5	6	7
1	3	4	5	6	7
1¼	3½	4	5	6	7
1½	3½	5	6	7	8
2	4	5	6	7	8
2½	5	6	7	8	10
3	5	6	7	8	10
3½	6	7	8	10	10
4	6	7	8	10	10
5	7	8	10	10	12
6	8	10	10	12	12
8	10	12	12	14	16



PIPE COVERING PROTECTION SADDLE WELDED TO LOWER STRAP

FIG. CT200

COPPER TUBING CLEVIS HANGER

MATERIAL: Carbon steel.
FINISH: Copper plated.
SERVICE: For the suspension of stationary copper tubing lines.
ORDERING: Specify tubing size and figure number.
APPROVALS: FS WW-H-171E TYPE 12.

TUBING SIZE	MATERIAL SIZE		A	B	C	E	F	WEIGHT EACH, LBS.
	UPPER	LOWER						
1/2	18ga. x 7/8	18ga. x 7/8	3/8	1 7/8	2 3/16	1 1/2	1/2	.12
3/4	18ga. x 7/8	18ga. x 7/8	3/8	1 3/4	2 1/8	1 3/8	1/2	.12
1	18ga. x 7/8	18ga. x 7/8	3/8	1 13/16	2 5/16	1 7/16	1/2	.14
1 1/4	18ga. x 7/8	18ga. x 7/8	3/8	2 1/8	2 3/4	1 11/16	3/4	.17
1 1/2	18ga. x 7/8	18ga. x 7/8	3/8	2 1/2	3 1/4	2 1/8	15/16	.20
2	14ga. x 7/8	16ga. x 7/8	3/8	2 15/16	4	2 9/16	1 1/16	.38
2 1/2	12ga. x 1 3/16	14ga. x 1 3/16	1/2	4 7/8	5 3/4	3 7/8	2 1/16	.71
3	12ga. x 1 3/16	14ga. x 1 3/16	1/2	4 1/2	6 1/8	3 15/16	2	.76
3 1/2	12ga. x 1 3/16	14ga. x 1 3/16	1/2	5 9/16	7 7/8	5	2 5/8	.82
4	11ga. x 1 3/16	14ga. x 1 3/16	1/2	5 7/8	7 7/8	5 1/4	2 9/16	1.02
5	8ga. x 1 1/4	8ga. x 1 1/4	5/8	5 7/8	8 3/4	5 3/8	1 5/8	1.68
6	8ga. x 1 1/4	8ga. x 1 1/4	5/8	6 1/16	9	5 3/8	1 1/2	1.84

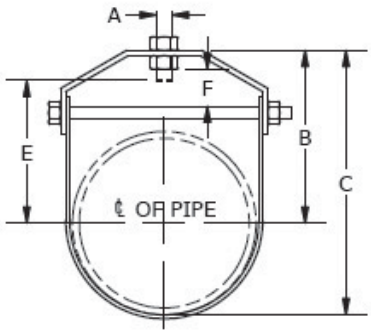
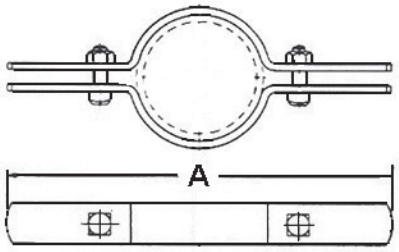


FIG. CT420

COPPER TUBING RISER CLAMP

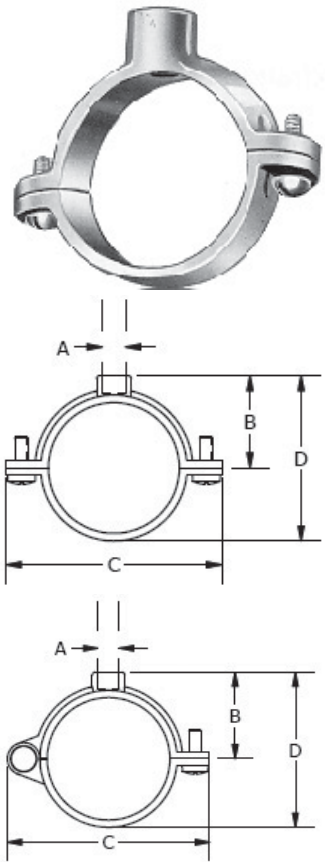
MATERIAL: Carbon steel.
FINISH: Copper plated.
SERVICE: For support of tubing risers.
ORDERING: Specify tubing size and figure number.
APPROVALS: MSS SP-58 & SP-69 TYPE 8
FS WW-H-171E TYPE 8



NOMINAL TUBING SIZE	A	MATERIAL SIZE	REC. LOAD LBS.	WEIGHT EACH, LBS.
1/2	6 3/4	1/8 x 1	225	.69
3/4	7 1/16	1/8 x 1	225	.73
1	9 1/4	1/8 x 1	250	.75
1 1/4	9 5/8	1/8 x 1	250	.77
1 1/2	10 1/8	1/8 x 1	500	.80
2	10 3/4	1/8 x 1 1/4	500	1.05
2 1/2	11 1/4	3/16 x 1 1/4	500	1.68
3	11 1/2	3/16 x 1 1/4	500	1.78
3 1/2	12 1/4	3/16 x 1 1/4	500	1.91
4	12 3/4	3/16 x 1 1/4	500	2.05
5	14	1/4 x 1 1/2	815	3.46
6	15 1/2	1/4 x 1 1/2	815	3.86

FIG. CT100

COPPER TUBING SPLIT RING HANGER



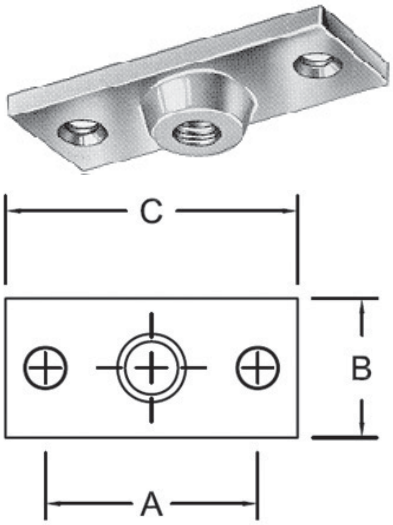
MATERIAL: Malleable iron.
FINISH: Copper epoxy coated (COPPER-GARD).
ORDERING: Specify tubing size and figure number.
SERVICE: For suspension of non-insulated stationary tubing lines.
APPROVALS: MSS SP-58 & SP-69 TYPE 12
FS WW-H-171E TYPE 25

TUBE SIZE	MAX. REC. LOAD, LBS.	A ROD SIZE	B	C	D	WEIGHT PER 100, LBS.
1/4*	180	3/8	9/16	1 3/4	7/8	7.3
3/8*	180	3/8	5/8	1 3/4	1 1/16	8.0
1/2	180	3/8	11/16	1 7/8	1 1/8	8.7
3/4	180	3/8	13/16	2 1/4	1 3/8	9.6
1	180	3/8	15/16	2 1/2	1 5/8	12.8
1 1/4	180	3/8	1 1/16	2 7/8	1 7/8	14.1
1 1/2	180	3/8	1 3/16	3	2 3/16	17.9
2	180	3/8	1 7/16	3 1/2	2 11/16	22.9
2 1/2*	300	1/2	1 7/8	4 15/16	2 7/16	44.9
3*	300	1/2	2 1/8	5 1/2	4 1/16	66.3
4*	300	1/2	2 5/8	6 5/8	5 1/16	75.3

*Sizes 1/4", 3/8", 2 1/2", 3" and 4" are hinged style

FIG. CT105

COPPER HANGER FLANGE

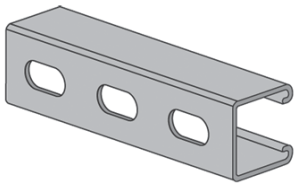


MATERIAL: Malleable iron.
FINISH: Copper epoxy coated (COPPER-GARD)
SERVICE: For suspension of non-insulated stationary tubing lines.
ORDERING: Specify tap size and figure number.

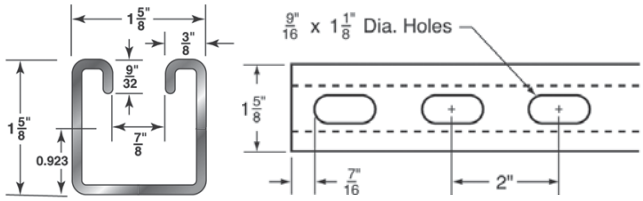
ROD SIZE	A	B	C	WEIGHT PER 100, LBS.
3/8	1 15/16	1 5/16	2 3/4	17
1/2	1 15/16	1 5/16	2 3/4	17

FIG. H132

STRUT



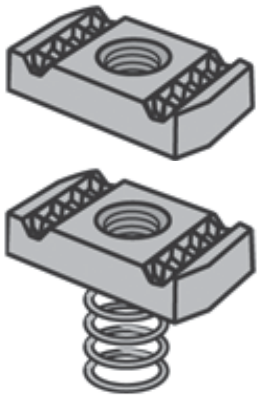
MATERIAL: Carbon steel or 304/316 stainless steel.
FINISH: Pre-galvanized (ASTM-A653) or epoxy coated green.
ORDERING: Specify size, figure number, length and finish.



1⅝" X 1⅝" X 1⅝" X 12 GA.
9/16" X 1⅛" Slot
2" On centers
189 Lbs. per 100 feet

FIG. SN

STRUT NUT

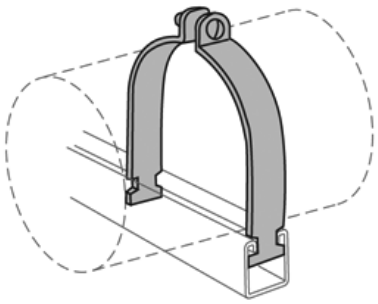


MATERIAL: Carbon steel or 316 stainless steel.
FINISH: Electro-galvanized.
ORDERING: Specify size with or without spring and figure number.

	WITHOUT SPRING		WITH SPRING	
ROD SIZE	STD. PKG.	WEIGHT EACH, LBS.	STD. PKG.	WEIGHT EACH, LBS.
¼	100	.067	100	.076
⅜	100	.094	100	.102
½	100	.09	100	.094
⅝	100	.13	50	.15
¾	100	.13	50	.15

FIG. SPC

STRUT PIPE CLAMP



MATERIAL: Carbon steel or 304 stainless steel.
FINISH: Electro-galvanized.
ORDERING: Specify pipe/tube size and figure number.

	STRUT PIPE CLAMP		STRUT TUBE CLAMP	
PIPE/TUBE SIZE	STD. PKG.	WEIGHT EACH, LBS.	STD. PKG.	WEIGHT EACH, LBS.
⅜	100	.106	100	.084
½	100	.108	100	.091
¾	100	.138	100	.102
1	100	.156	100	.15
1¼	100	.191	100	.17
1½	50	.286	100	.182
2	50	.336	50	.316
2½	50	.372	50	.346
3	50	.446	50	.386
3½	25	.576	50	.54
4	25	.628	25	.606
5	25	.732	25	.69
6	25	.976	25	.91
8	25	1.24		

NOTE: Tubing sizes only available up to 4".

FIG. 635

JUNIOR TOP BEAM CLAMP

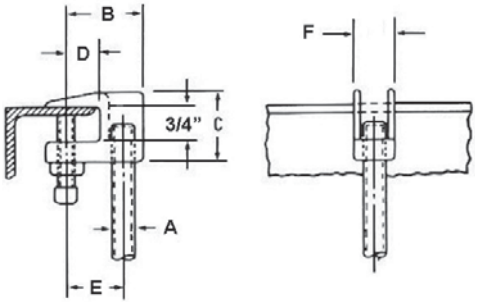
MATERIAL: Malleable Iron.

FINISH: Black or electro-galvanized.

SERVICE: For use under roof installations with bar joist type construction where the thickness of the joist does not exceed 5/8".

ORDERING: Specify size, figure number, and finish.

APPROVALS: MSS SP-58 & SP-69 TYPE 19
FM (3/8" & 1/2" rod)
UL



ROD SIZE A	SIZE PIPE	MAX RECOMMENDED LOAD, LBS.	WEIGHT PER 100, LBS.	B	C	D	E	F
3/8	1/2 to 2	350	30	1 1/2	1 7/16	3/4	1 3/16	3/4
1/2	2 1/2 to 3 1/2	470	39	1 5/8	1 1/2	3/4	1 1/4	7/8
5/8	4 to 5	550	40	1 3/4	1 1/2	3/4	1 3/32	1
3/4	6	700	67	2 1/4	1 3/4	1 1/16	1 5/16	1 1/4
7/8	8	1000	66	2 1/4	1 3/4	1 1/16	1 5/16	1 1/4

FIG. 640

TOP BEAM CLAMP

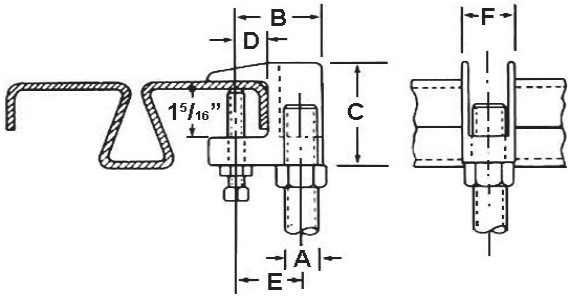
MATERIAL: Malleable Iron.

FINISH: Black or electro-galvanized.

SERVICE: For use under roof installations with bar joist type construction where the thickness of the joist does not exceed 1 1/4".

ORDERING: Specify size, figure number and finish.

ROD SIZE A	SIZE PIPE	MAX RECOMMENDED LOAD, LBS.	WEIGHT PER 100, LBS.	B	C	D	E	F
3/8	1/2 to 2	400	38	1 7/16	2	3/4	1 3/16	3/4
1/2	2 1/2 to 3 1/2	500	49	1 5/8	2 1/16	3/4	1 1/4	7/8
5/8	4 to 5	850	66	1 3/4	2 1/4	3/4	1 1/4	1
3/4	6	900	83	1 7/8	2 3/8	3/4	1 3/8	1 3/16



Double *Shield Expansion Anchor*

PRODUCT DESCRIPTION

The Double is a dual expansion machine bolt anchor particularly suited for materials of questionable strength. It can be used in solid concrete, block, brick, and stone. Job site tests are recommended when used in base materials of questionable strength.

FEATURES AND BENEFITS

- Performs in base material of questionable strength
- Internally threaded anchor for easy removability and service work
- Corrosion resistant body

APPROVALS AND LISTINGS

Federal GSA Specification – Meets the descriptive and proof load requirements of CID A-A 1923A, Type 3

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Expansion anchors shall be Double as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS Page No.

Double

THREAD VERSION

UNC Thread

ANCHOR MATERIALS

Zamac Alloy

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter

SUITABLE BASE MATERIALS

Normal-weight Concrete
Hollow Concrete Masonry (CMU)
Brick Masonry

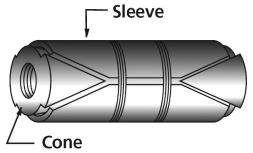
INSTALLATION AND MATERIAL SPECIFICATIONS

Installation Specifications

Dimension	Rod/Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/2	5/8	3/4	7/8	1	1 1/4
Max. Tightening Torque, T_{max} (ft.-lbs.)	5	7	10	20	30	60
Sleeve Length (in.)	1	1 3/16	1 9/16	2	2 1/4	3 1/4
Thread Size (UNC)	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11	3/4-10
Thread Length In Cone (in.)	1/2	1/2	5/8	3/4	7/8	1 1/8
Overall Anchor Length (in.)	1 3/8	1 5/8	2	2 1/2	2 3/4	3 15/16

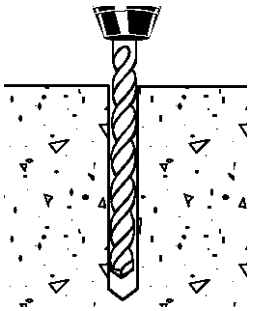
Material Specifications

Anchor Component	Component Material
Anchor Shield	Zamac Alloy
Cone	Zamac Alloy

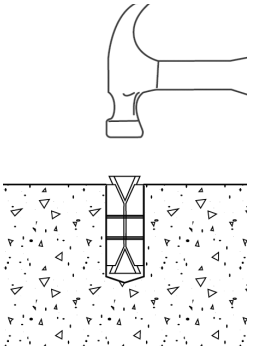


Installation Guidelines

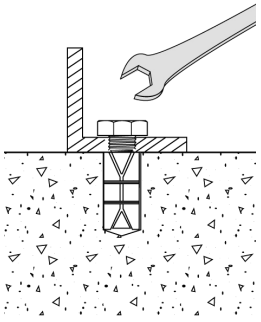
Drill a hole into the base material to the minimum depth required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15. Do not expand the anchor prior to installation. Do not over drill the hole unless the application calls for a subset anchor.



Insert anchor into the hole, threaded cone end first until the outer sleeve is flush with the surface of the base material.



Position fixture, then insert screw or bolt and tighten. For maximum expansion, the upper cone should protrude slightly before setting. The bolt must engage a minimum of 2/3 of the anchor threads.



d

PERFORMANCE DATA

Ultimate Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	710 (3.2)	1,110 (5.0)	900 (4.0)	1,135 (5.2)	1,220 (5.5)	1,335 (6.0)
5/16 (7.9)	1 1/2 (38.1)	1,130 (5.1)	1,735 (7.8)	1,500 (6.7)	2,020 (9.1)	2,160 (9.7)	2,155 (9.7)
3/8 (9.5)	1 3/4 (44.5)	1,365 (6.1)	2,690 (12.1)	2,000 (9.0)	3,000 (13.5)	3,085 (13.9)	4,030 (18.1)
1/2 (12.7)	2 1/4 (57.2)	2,590 (11.7)	3,740 (16.8)	3,550 (16.0)	4,310 (19.4)	4,645 (20.9)	6,930 (31.2)
5/8 (15.9)	2 1/2 (63.5)	4,290 (19.3)	9,640 (43.4)	6,150 (27.7)	10,270 (46.2)	6,890 (81.0)	11,580 (52.2)
3/4 (19.1)	3 1/2 (88.9)	6,000 (27.0)	10,920 (49.2)	8,150 (36.7)	13,330 (60.0)	11,510 (51.8)	14,480 (65.2)

1. Tabulated load values are for anchors installed in concrete. Concrete compressive strength must be at the specified minimum at the time of installation.
2. Ultimate load capacities must be reduced by a minimum safety factor of 4.0 or greater to determine allowable working load. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.

Allowable Load Capacities for Double Expansion Anchor in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter *d* in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	180 (0.8)	280 (1.3)	225 (1.0)	285 (1.3)	305 (1.4)	335 (1.5)
5/16 (7.9)	1 1/2 (38.1)	285 (1.3)	435 (20)	375 (1.7)	505 (2.3)	540 (2.4)	540 (2.4)
3/8 (9.5)	1 3/4 (44.5)	340 (1.5)	675 (3.0)	500 (2.3)	750 (3.4)	770 (3.5)	1,010 (4.5)
1/2 (12.7)	2 1/4 (57.2)	650 (2.9)	935 (4.2)	890 (4.0)	1,080 (4.9)	1,160 (5.2)	1,735 (7.8)
5/8 (15.9)	2 1/2 (63.5)	1,075 (4.8)	2,410 (10.9)	1,540 (6.9)	2,570 (11.6)	1,725 (20.3)	2,895 (13.1)
3/4 (19.1)	3 1/2 (88.9)	1,500 (6.8)	2,730 (12.3)	2,040 (9.2)	3,335 (15.0)	2,880 (13.0)	3,620 (16.3)

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, overhead and in sustained tensile loading applications.
2. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.
3. Allowable load capacities are multiplied by reduction factors found in the Design Criteria section when anchor spacing or edge distances are less than critical distances.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Double Expansion Anchor in Hollow Concrete Masonry[1,2,3]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	885 (4.0)	1,350 (6.1)	175 (0.8)	270 (1.2)
5/16 (7.9)	1 1/2 (38.1)	1,295 (5.8)	1,635 (7.4)	260 (1.2)	325 (1.5)
3/8 (9.5)	1 1/2 (38.1)	1,575 (7.1)	2,160 (9.7)	315 (1.4)	430 (1.9)
1/2 (12.7)	1 1/2 (38.1)	2,710 (12.2)	3,130 (14.1)	540 (2.4)	625 (2.8)

1. Tabulated load values are for anchors installed in minimum 8-inch wide, minimum Grade N, Type II, lightweight, medium-weight or normal-weight concrete masonry units conforming to ASTM C 90. Mortar must be minimum Type N. Masonry cells may be grouted. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.
3. Anchors with diameters of 3/8" and 1/2" installed in hollow concrete masonry units are limited to one anchor per unit cell.

Ultimate and Allowable Load Capacities for Double Shell Expansion Anchor in Clay Brick Masonry[1,2]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa)			
		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,175 (5.3)	1,585 (7.1)	235 (1.1)	315 (1.4)
5/16 (7.9)	1 1/2 (38.1)	1,585 (7.1)	2,040 (9.2)	315 (1.4)	410 (1.8)
3/8 (9.5)	1 3/4 (44.5)	1,830 (8.2)	3,590 (16.2)	365 (1.6)	720 (3.2)
1/2 (12.7)	2 1/4 (57.2)	3,420 (15.4)	5,185 (23.3)	685 (3.1)	1,035 (4.7)
5/8 (15.9)	2 1/2 (63.5)	4,460 (19.8)	6,055 (27.2)	890 (4.0)	1,210 (5.4)
3/4 (19.1)	3 1/2 (88.9)	6,000 (26.7)	7,935 (35.7)	1,200 (5.3)	1,585 (7.1)

1. Tabulated load values are for anchors installed in multiple wythe, minimum Grade SW, solid clay brick masonry walls conforming to ASTM C 62. Mortar must be minimum Type N. Masonry compressive strength must be at the specified minimum at the time of installation ($f'_m \geq$ 1,500 psi).
2. Allowable load capacities listed are calculated using and applied safety factor of 5.0. Consideration of safety factors of 20 or higher may be necessary depending upon the application such as life safety, and in sustained tensile loading applications.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances[1]

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 10d$	$F_{Ns} = F_{Vs} = 1.0$	$s_{min} = 5d$	$F_{Ns} = F_{Vc} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_{Nc} = 1.0$	$c_{min} = 5d$	$F_{Nc} = 0.80$
	Shear	$c_{cr} = 12d$	$F_{Vc} = 1.0$	$c_{min} = 5d$	$F_{Vc} = 0.50$

1. Allowable load values found in the performance data tables are multiplied by reduction factors when anchor spacing or edge distances are less than critical distances. Linear interpolation is allowed for intermediate anchor spacing and edge distances between critical and minimum distances.When an anchor is affected by both reduced spacing and edge distance, the spacing and edge reduction factors must be combined (multiplied). Multiple reduction factors for anchor spacing and edge distance may be required depending on the anchor group configuration.

d

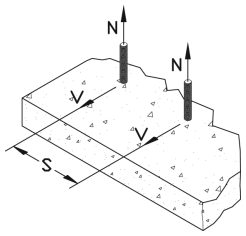
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_{N_S}) & Shear (F_{V_S})							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
s_{cr} (in.)		2 1/2	3 1/8	3 3/4	5	6 1/4	7 1/2
s_{min} (in.)		1 1/4	1 9/16	1 7/8	2 1/2	3 1/8	3 3/4
Spacing, s (inches)	1 1/4	0.50					
	1 9/16	0.63	0.50				
	1 7/8	0.75	0.60	0.50			
	2 1/2	1.00	0.80	0.67	0.50		
	3 1/8		1.00	0.83	0.63	0.50	
	3 3/4			1.00	0.75	0.60	0.50
	5				1.00	0.80	0.67
	6 1/4					1.00	0.83
	7 1/2						1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 10 anchor diameters (10d) at which the anchor achieves 100% of load.

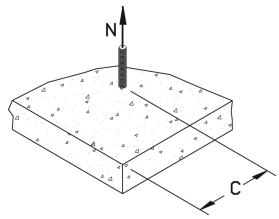
Minimum spacing (s_{min}) is equal to 5 anchor diameters (5d) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{N_C})							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.80					
	2 1/2	0.90	0.80				
	3	1.00	0.88	0.80			
	3 3/4		1.00	0.90			
	4			0.93	0.80		
	4 1/2			1.00	0.85		
	5				0.90	0.80	
	6				1.00	0.88	0.80
	7 1/2					1.00	0.90
	9						1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

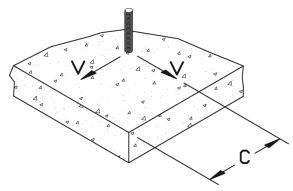
Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 80% of load.



Edge Distance, Shear (F_{V_C})							
Dia. (in.)		1/4	5/16	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	3 3/4	4 1/2	6	7 1/2	9
c_{min} (in.)		2	2 1/2	3	4	5	6
Edge Distance, c (inches)	2	0.50					
	2 1/2	0.75	0.50				
	3	1.00	0.70	0.50			
	3 3/4		1.00	0.75			
	4			0.83	0.50		
	4 1/2			1.00	0.63		
	5				0.75	0.50	
	6				1.00	0.70	0.50
	7 1/2					1.00	0.75
	9						1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters (12d) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 8 anchor diameters (8d) at which the anchor achieves 50% of load.



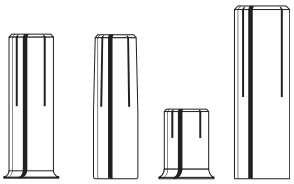
ORDERING INFORMATION

Double Expansion Anchor

Catalog Number	Rod/Anchor Diameter	Drill Diameter	Overall Length	Minimum Hole Depth	Standard Box	Standard Carton	Wt./ 100
9510	1/4"	1/2"	1 3/8"	1 1/4"	50	500	4
9515	5/16"	5/8"	1 5/8"	1 1/2"	50	500	7 1/2
9520	3/8"	3/4"	2"	1 3/4"	50	250	12 1/2
9525	1/2"	7/8"	2 1/2"	2 1/4"	25	250	18
9530	5/8"	1"	2 3/4"	2 1/2"	25	100	25 1/2
9535	3/4"	1 1/4"	3 15/16"	3 1/2"	10	50	54 1/2

c

Multi-Set II®



SPECIFIED FOR ANCHORAGE INTO CONCRETE

Drop-In, shell-type anchors feature an internally threaded, all-steel shell with expansion cone insert and flush embedment lip. "Anchors are manufactured from zinc-plated carbon steel, 18-8 stainless steel and 316 stainless steel.

Anchors should be installed with carbide tipped hammer drill bits made in accordance to ANSI B212.15-1994 specifications.

Anchors should be tested to ASTM E488 criteria and listed by ICC (formerly ICBO). Anchors should also be listed by the following agencies as required by the local building code: UL, FM, City of Los Angeles, California State Fire Marshal and Cal Trans.

APPROVALS/LISTINGS

Meets or exceeds U.S. Government G.S.A. Specification A-A-55614 Type 1 (Formerly GSA: FF-S-325 Group VIII)

Underwriters Laboratories

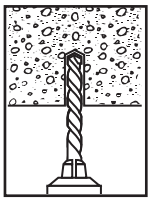
Factory Mutual

City of Los Angeles – #RR2748

California State Fire Marshal

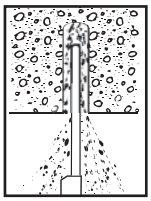
Caltrans

INSTALLATION STEPS

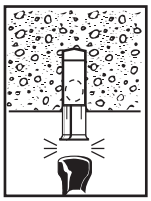


To set anchor flush with surface:

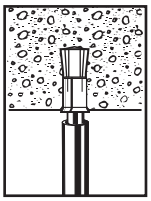
1. Drill hole to required embedment (see Table on page 73).



2. Clean hole with pressurized air.



3. Drive anchor flush with surface of concrete.



4. Expand anchor with setting tool provided (see chart). Anchor is properly expanded when shoulder of setting tool is flush with top of anchor.

To set anchor below surface:

Drill hole deeper than anchor length. Thread bolt into anchor. Hammer anchor into hole until bolt head is at desired depth. Remove bolt and set anchor with setting tool.

Multi-Set II Drop-In Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Concrete*

BOLT DIA. In. (mm)	ANCHOR DIA. In. (mm)	MIN. EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	TENSION Lbs. (kN)			SHEAR Lbs. (kN)
				f'c = 2000 PSI (13.8 MPa)	f'c = 4000 PSI (27.6 MPa)	f'c = 6000 PSI (41.4 MPa)	f'c > 2000 PSI (13.8 MPa)
1/4 (6.4)	3/8 (9.5)	1 (25.4)	RM, RL or CL-Carbon or SRM-18-8 S.S. or SSRM-316 S.S.	1,680 (7.5)	2,360 (10.5)	2,980 (13.3)	1,080 (4.8)
3/8 (9.5)	1/2 (12.7)	1-5/8 (41.3)		2,980 (13.3)	3,800 (16.9)	6,240 (27.8)	3,160 (14.1)
1/2 (12.7)	5/8 (15.9)	2 (50.8)		3,300 (14.7)	5,840 (26.0)	8,300 (36.9)	4,580 (20.4)
5/8 (15.9)	7/8 (22.2)	2-1/2 (63.5)		5,500 (24.5)	8,640 (38.4)	11,020 (49.0)	7,440 (33.1)
3/4 (19.1)	1 (25.4)	3-3/16 (81.0)		8,280 (36.8)	9,480 (42.2)	12,260 (54.5)	10,480 (46.6)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

* For continuous extreme low temperature applications, use stainless steel.

Combined Tension and Shear Loading—for Multi-Set Anchors

Allowable loads for anchors subjected to combined shear and tension forces are determined by the following equation:

$$(Ps/Pt)^{5/3} + (Vs/Vt)^{5/3} \leq 1$$

Ps = Applied tension load **Vs = Applied shear load** **Pt = Allowable tension load** **Vt = Allowable shear load**

Multi-Set II Drop-In Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Lightweight Concrete*

BOLT DIA. In. (mm)	ANCHOR DIA. In. (mm)	MINIMUM EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	LIGHTWEIGHT CONCRETE f'c = 3000 PSI (20.7 MPa)		LOWER FLUTE OF STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL f'c = 3000 PSI (20.7 MPa)	
				TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/8 (9.5)	1/2 (12.7)	1-5/8 (39.7)	RM, RL or CL-Carbon or SRM-18-8 S.S. or SSRM-316 S.S.	2,035 (9.1)	1,895 (8.4)	3,340 (14.9)	4,420 (19.6)
1/2 (12.7)	5/8 (15.9)	2 (50.8)		2,740 (12.2)	2,750 (12.2)	3,200 (14.2)	4,940 (22.0)
5/8 (15.9)	7/8 (22.2)	2-1/2 (63.5)		4,240 (18.9)	4,465 (19.9)	5,960 (26.5)	5,840 (26.0)
3/4 (19.1)	1 (25.4)	3-3/16 (81.0)		5,330 (23.7)	6,290 (28.0)	8,180 (36.4)	9,120 (40.6)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

Multi-Set II Drop-In Anchors — Recommended Edge and Spacing Distance Requirements*

BOLT DIA. In. (mm)	DRILL BIT SIZE In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. EDGE DISTANCE AT WHICH LOAD FACTOR APPLIED =.80 FOR TENSION =.70 FOR SHEAR In. (mm)	SPACING REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE SPACING BETWEEN ANCHORS LOAD FACTOR APPLIED =.80 FOR TENSION =.55 FOR SHEAR In. (mm)
1/4 (6.4)	3/8 (9.5)	1 (25.4)	RM, RL or CL-Carbon or SRM-18-8 S.S. or SSRM-316 S.S.	1-3/4 (44.5)	7/8 (22.2)	3-1/2 (88.9)	1-3/4 (44.5)
3/8 (9.5)	1/2 (12.7)	1-5/8 (41.3)		2-7/8 (73.0)	1-7/16 (36.5)	5-11/16 (144.5)	2-7/8 (73.0)
1/2 (12.7)	5/8 (15.9)	2 (50.8)		3-1/2 (88.9)	1-3/4 (44.5)	7 (177.8)	3-1/2 (88.9)
5/8 (15.9)	7/8 (22.2)	2-1/2 (63.5)		4-3/8 (111.1)	2-3/16 (55.6)	8-3/4 (222.3)	4-3/8 (111.1)
3/4 (19.1)	1 (25.4)	3-3/16 (81.0)		5-5/8 (142.9)	2-13/16 (71.4)	11-3/16 (284.2)	5-5/8 (142.9)

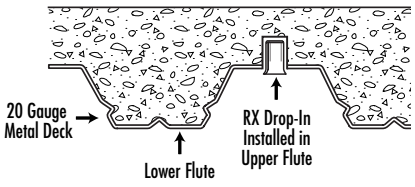
* Spacing and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete. Linear interpolation may be used for intermediate spacing and edge distances.

Multi-Set II Drop-In Anchors — Ultimate Tension and Shear Values (Lbs/kN) for RX-series (3/4" and 1" Embedment)*

BOLT DIA. In. (mm)	DRILL BIT SIZE In. (mm)	EMBEDMENT In. (mm)	2500 PSI (17.2 MPa) CONCRETE		4000 PSI (27.6 MPa) CONCRETE		HOLLOW CORE	
			TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/8 (9.5)	1/2 (12.7)	3/4 (19.1)	1,571 (7.0)	2,295 (10.2)	1,987 (8.8)	2,903 (12.9)	1,908 (8.5)	2,401 (10.7)
1/2 (12.7)	5/8 (15.9)	1 (25.4)	2,113 (9.4)	2,585 (11.5)	2,673 (11.9)	3,270 (14.5)	2,462 (11.0)	2,401 (10.7)

* The tabulated values are for RX anchors installed at a minimum of 12 diameters on center and minimum edge distance of 6 diameters for 100 percent anchor efficiency. Spacing and edge distance may be reduced to 6 diameters spacing and 3 diameter edge distance provided the values are reduced 50 percent. Linear Interpolation may be used for intermediate spacings and edge margins.

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.



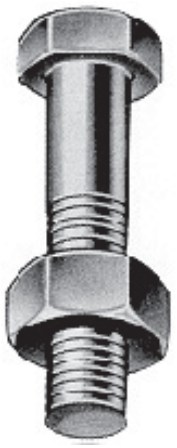
Multi-Set II Drop-In Anchors — Anchoring Overhead in 3000 PSI Lightweight Concrete On Metal Deck

ANCHOR	DRILL HOLE DIAMETER In. (mm)	EMBEDMENT In. (mm)	3000PSI (20.7 MPa) CONCRETE		
			ULTIMATE TENSION LOAD Lbs. (kN)		ALLOWABLE WORKING LOAD Lbs. (kN)
RX-38 Drop-In	1/2 (12.7)	3/4 (19.1)	Upper Flute	1,410 (6.3)	353 (1.6)
			Lower Flute	1,206 (5.4)	301 (1.3)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

FIG. 780 HEX HEAD MACHINE BOLT

MATERIAL: Carbon steel or stainless steel.
FINISH: Black, electro or hot-dipped galvanized.
SERVICE: For use as a fastening device.
ORDERING: Specify size, figure number and finish. Length of bolt is measured from under the head to the extreme point. Sizes as shown are carried in stock, other sizes are also available.



DIAMETER OF BOLT	WEIGHT PER HUNDRED, LBS.														
	LENGTH OF BOLT IN INCHES														
	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4½	5	5½	6
⅜	9	10	11	–	–	–	–	–	–	–	–	–	–	–	–
½	18	20	21	22	24	25	27	–	–	–	–	–	–	–	–
⅝	31	33	35	37	39	41	43	46	48	50	52	56	61	65	69
¾	49	52	55	58	61	64	67	70	73	76	80	86	92	98	105
⅞	–	–	–	–	89	93	98	102	106	110	115	123	131	140	148
1	–	–	–	–	–	128	134	139	145	150	156	167	178	189	200
1⅛	–	–	–	–	–	–	–	–	193	–	207	221	235	249	263
1¼	–	–	–	–	–	–	–	–	–	–	–	–	302	320	337

FIG. 785 STANDARD HEX NUTS

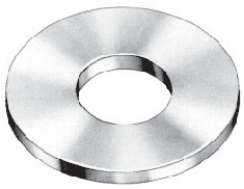
FIG. 790 HEAVY DUTY HEX NUTS

MATERIAL: Carbon steel or stainless steel.
FINISH: Black, electro or hot-dipped galvanized.
ORDERING: Specify rod size, figure number and finish.

ROD SIZE	WEIGHT PER 100, LBS.	
	FIG. 785	FIG. 790
¼	0.74	1.2
⅜	1.60	3.2
½	3.75	6.6
⅝	7.33	12
¾	11.9	19
⅞	19.0	30
1	28.3	43
1⅛	40.3	59
1¼	54.3	79
1⅜	73.0	102
1½	94.3	131

FIG. 795

ROUND STEEL WASHERS



MATERIAL: Carbon steel or 304/316 stainless steel.
FINISH: Black, electro or hot-dipped galvanized.
ORDERING: Specify rod size, figure number and finish.

SIZE OF BOLT	OUTSIDE DIAMETER	DIAMETER OF HOLE	WEIGHT PER 100, LBS.
1/4	3/4	5/16	0.67
3/8	1	7/16	1.50
1/2	1 3/8	9/16	3.90
5/8	1 3/4	11/16	7.80
3/4	2	13/16	11.00
7/8	2 1/4	15/16	15.00
1	2 1/2	1 1/16	19.00
1 1/8	2 3/4	1 1/4	22.00
1 1/4	3	1 3/8	26.00
1 1/2	3 1/2	1 5/8	38.00

FIG. 800

LOCK WASHER

MATERIAL: Carbon steel or 304/316 stainless steel.
FINISH: Black or electro-galvanized.
ORDERING: Specify size, figure number and finish.

ROD SIZE	INSIDE DIAMETER	WIDTH OF STEEL	THICKNESS OF STEEL	WEIGHT PER 100, LBS.
3/8	7/16	.141	.094	7
1/2	9/16	.171	.125	15
5/8	11/16	.203	.156	26
3/4	13/16	.234	.188	43

FIG. 805

STEEL WASHER PLATE

MATERIAL: Carbon steel or 304/316 stainless steel.
FINISH: Black, electro or hot-dipped galvanized.
SERVICE: For use as a heavy duty washer to suspend hanger rods.
ORDERING: Specify rod tapping size, figure number and finish.

ROD SIZE	WEIGHT PER 100, LBS.	SIZE OF STOCK
3/8	62	3 x 3 x 1/4
1/2	62	3 x 3 x 1/4
5/8	92	3 x 3 x 3/8
3/4	164	4 x 4 x 3/8
7/8	220	4 x 4 x 1/2
1	220	4 x 4 x 1/2

FIG. 755

CONTINUOUS THREADED ROD

MATERIAL: Carbon steel or 304/316 stainless steel

FINISH: Black, electro or hot-dipped galvanized.

SERVICE: For use in applications for attaching hangers to structural attachments. Continuous threaded rod can be cut to required lengths. Sizes below are stocked in 6', 10' and 12' lengths. SAE national fine thread can be furnished to order.

ORDERING: Specify rod diameter, figure number, length and finish.

ROD SIZE	WEIGHT PER 100, LBS.	MAX. REC. LOAD, LBS.
1/4	12	240
5/16	20	300
3/8	30	610
1/2	54	1130
5/8	85	1810
3/4	120	2710
7/8	170	3770
1	225	4960
1 1/8	280	6230
1 1/4	350	8000
1 3/8	450	9000
1 1/2	500	11630

FIG. 760

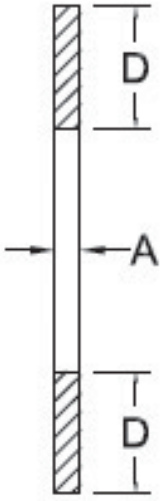
HANGER ROD

MATERIAL: Carbon steel or 304/316 stainless steel

FINISH: Black, electro or hot-dipped galvanized.

SERVICE: For use in applications for attaching hangers to structural attachments. Threaded on both ends and can be furnished in standard lengths of 8" - 240"

ORDERING: Specify rod diameter, figure number, length, thread length and finish.



ROD SIZE A	STANDARD ROD THREAD LENGTH D, IN.	MAX. REC. LOAD, LBS. 650° F
1/4	2 1/2	240
3/8	2 1/2	610
1/2	2 1/2	1130
5/8	2 1/2	1810
3/4	3	2710
7/8	3 1/2	3770
1	4	4960

Tapcon® Concrete and MasonryAnchors

SPECIFIED FOR ANCHORAGE INTO CONCRETE, BRICK OR BLOCK

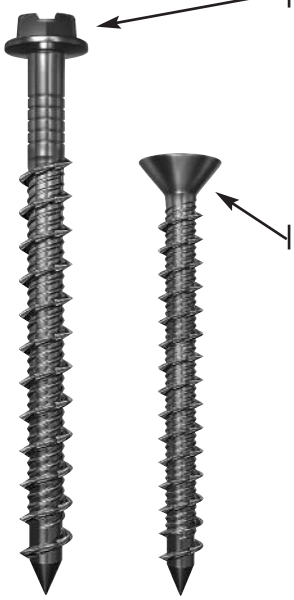
The "original masonry" anchor that cuts its own threads into concrete, brick, or block. Maximum performance is achieved because the Tapcon Anchor, the Condrive Installation Tool, and the carbide-tipped Tapcon Drill Bits are designed to work as a system. It is essential to use the Condrive tool and the correct drill bit to assure consistent anchor performance.

Now available in 410 stainless steel.

APPROVALS/LISTINGS

ICC Evaluation Service, Inc. – #ESR-1671
ICC Evaluation Service, Inc. – #ESR-2202
Miami-Dade County – #07-0315.03
Florida Building Code

THE ORIGINAL Tapcon®



Hex Head style on Tapcon Anchors is available for majority of fixture anchoring needs

Climaseal™ Coating is standard on all Tapcon anchors to provide extended corrosion resistance

Now available in 410 Stainless Steel

Phillips Flat Head style is available when flush seating is necessary in countersink applications

Advanced Threadform cuts into masonry materials for greater pullout values

Lengths of Tapcon Anchors range from 1-1/4" to 4" in 3/16" and up to 6" in 1/4" diameters.

Nail-Type Point guides the anchor into the pre-drilled hole. Excellent for wood to concrete applications

INSTALLATION STEPS

Read instructions before using (installation)!

WARNING: If there are any questions concerning proper installation, applications or appropriate use of this product, please call our Technical Services Department at 1-800-899-7890. Failure to follow these instructions can result in serious personal injury.

1. **Select proper fastener – diameter / head style / length**
   a) **Use selection chart to choose proper length.**
2. **Drill Hole – use selection chart to determine drill bit length and depth of hole**
   a) **Choose appropriate drill bit based upon diameter of Tapcon Anchor.**
   b) **Drill hole minimum ?" deeper than Tapcon Anchor to be embedded.**
   Minimum anchor embedment: 1"
   Maximum anchor embedment: 1-3/4"
3. **Drive Anchor**

WARNING: Failure to wear safety glasses with side shields can result in serious personal injury. Always wear ANSI compliant eye protection (ANSI Z87.1-2003).

WARNING: Using the wrong size drill bit will affect performance values and may cause failure.

Head Styles

3/16" diameter has a 1/4" slotted hex washer head (HWH)
1/4" diameter has a 5/16" slotted hex washer head (HWH)

3/16" diameter uses a #2 phillips flat head (PFH)
1/4" diameter uses a #3 phillips flat head (PFH)

PERFORMANCE TABLE

Tapcon® Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Concrete

ANCHOR DIA. In. (mm)	MIN. DEPTH OF EMBEDMENT In. (mm)	f'c = 2000 PSI (13.8 MPa)		f'c = 3000 PSI (20.7 MPa)		f'c = 4000 PSI (27.6 MPa)		f'c = 5000 PSI (34.5 MPa)	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	600 (2.7)	720 (3.2)	625 (2.8)	720 (3.2)	650 (2.9)	720 (3.2)	800 (3.6)	860 (3.8)
	1-1/4 (31.8)	845 (3.7)	720 (3.2)	858 (3.8)	720 (3.2)	870 (3.9)	720 (3.2)	1,010 (4.5)	860 (3.8)
	1-1/2 (38.1)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,090 (4.8)	860 (3.8)	1,220 (5.4)	860 (3.8)
	1-3/4 (44.5)	1,450 (6.5)	870 (3.9)	1,455 (6.5)	870 (3.9)	1,460 (6.5)	990 (4.4)	1,730 (7.7)	990 (4.4)
1/4 (6.4)	1 (25.4)	750 (3.3)	900 (4.0)	775 (3.4)	900 (4.0)	800 (3.6)	1,360 (6.1)	950 (4.2)	1,440 (6.4)
	1-1/4 (31.8)	1,050 (4.7)	900 (4.0)	1,160 (5.2)	900 (4.0)	1,270 (5.6)	1,360 (6.1)	1,515 (6.7)	1,440 (6.4)
	1-1/2 (38.1)	1,380 (6.1)	1,200 (5.3)	1,600 (7.2)	1,200 (5.3)	1,820 (8.1)	1,380 (6.1)	2,170 (9.7)	1,670 (7.4)
	1-3/4 (44.5)	2,020 (9.0)	1,670 (7.4)	2,200 (9.8)	1,670 (7.4)	2,380 (10.6)	1,670 (7.4)	2,770 (12.3)	1,670 (7.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

PERFORMANCE TABLE

Tapcon® Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Hollow Block

ANCHOR DIA. In. (mm)	ANCHOR EMBEDMENT In. (mm)	LIGHTWEIGHT BLOCK		MEDIUM WEIGHT BLOCK	
		TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/16 (4.8)	1 (25.4)	220 (1.0)	400 (1.8)	340 (1.5)	730 (3.2)
1/4 (6.4)	1 (25.4)	250 (1.1)	620 (2.8)	500 (2.2)	1,000 (4.4)

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

NOTE: 3/16" Tapcon requires 5/32" bit, 1/4" Tapcon requires 3/16" bit.

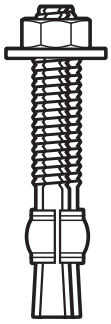
PERFORMANCE TABLE

Tapcon® Anchors — Allowable Edge and Spacing Distances

PARAMETER	ANCHOR DIA. Inch	NORMAL WEIGHT CONCRETE			CONCRETE MASONRY UNITS (CMU)		
		FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR	FULL CAPACITY (Critical Distance Inches)	REDUCED CAPACITY (Minimal Distance Inches)	LOAD REDUCTION FACTOR
Spacing Between Anchors - Tension	3/16 1/4	3 4	1-1/2 2	0.73 0.66	3 4	1-1/2 2	1.00 0.84
Spacing Between Anchors - Shear	3/16 1/4	3 4	1-1/2 2	0.83 0.82	3 4	1-1/2 2	1.00 0.81
Edge Distance - Tension	3/16 1/4	1-7/8 2-1/2	1 1-1/4	0.71 0.78	4 4	2 2	0.91 0.88
Edge Distance - Shear	3/16 1/4	2-1/4 3	1-1/8 1-1/2	0.70 0.59	4 4	2 2	0.93 0.80

For SI: 1 inch = 25.4 mm

Trubolt Wedge



SPECIFIED FOR ANCHORAGE INTO CONCRETE

Trubolt Wedge anchors feature a stainless steel expansion clip, threaded stud body, nut and washer. Anchor bodies are made of plated carbon steel, hot-dipped galvanized carbon steel, type 304 stainless steel or type 316 stainless steel as identified in the drawings or other notations.

Trubolt+ Wedge anchors consist of a high-strength threaded stud body, expansion clip, nut and washer. Anchor bodies are made of plated carbon steel. The expansion clip consists of a split cylindrical ring with undercutting grooves.

The exposed end of the anchor is stamped to identify anchor length. Stampings should be preserved during installation for any subsequent embedment verification.

Use carbide tipped hammer drill bits made in accordance with ANSI B212.15-1994 to install anchors.

Anchors are tested to ACI 355.2 and ICC-ES AC193. Anchors are listed by the following agencies as required by the local building code: ICC-ES, UL, FM, City of Los Angeles, California State Fire Marshal and Caltrans.

APPROVALS/LISTINGS

Trubolt®
Wedge Anchors

ICC Evaluation Service, Inc. # ESR-2251
- – Category 1 performance rating
- – 2006 IBC compliant
- – Meets ACI 318 ductility requirements
- – Tested in accordance with ACI 355.2 and ICC-ES AC193
- – For use in seismic zones A & B
- – 1/4", 3/8" & 1/2" diameter anchors listed in ESR-2251

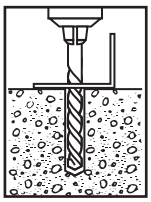
Underwriters Laboratories
Factory Mutual
City of Los Angeles - #RR2748
California State Fire Marshall
Caltrans
Meets or exceeds U.S. Government G.S.A. Specification A-A-1923A Type 4 (formerlyGSA: FF-S-325 Group II, Type 4, Class 1)

Trubolt®+
Seismic Wedge Anchors

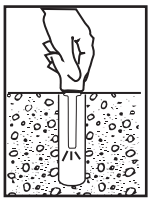
ICC Evaluation Service, Inc. # ESR-2427
- -Category 1 performance rating
- -2006 IBC and 2009 IBC compliant
- -Meets ACI 318 ductility requirements
- -Tested in accordance with ACI 355.2 and ICC-ES AC193
- -Listed for use in seismic zones A, B, C, D, E, & F
- -3/8", 1/2", 5/8" & 3/4" diameter anchors listed in ESR-2427

City of Los Angeles - #RR25867

INSTALLATION STEPS

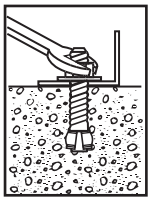


1. Select a carbide drill bit with a diameter equal to the anchor diameter. Drill hole to any depth exceeding the desired embedment. See chart for minimum recommended embedment.



2. Clean hole or continue drilling additional depth to accommodate drill fines.

3. Assemble washer and nut, leaving nut flush with end of anchor to protect threads. Drive anchor through material to be fastened until washer is flush to surface of material.



4. Expand anchor by tightening nut 3-5 turns past the hand tight position, or to the specified torque requirement.

LENGTH INDICATION CODE *

CODE	LENGTH OF ANCHOR		CODE	LENGTH OF ANCHOR	
A	1-1/2 < 2	(38.1 < 50.8)	K	6-1/2 < 7	(165.1 < 177.8)
B	2 < 2-1/2	(50.8 < 63.5)	L	7 < 7-1/2	(177.8 < 190.5)
C	2-1/2 < 3	(63.5 < 76.2)	M	7-1/2 < 8	(190.5 < 203.2)
D	3 < 3-1/2	(76.2 < 88.9)	N	8 < 8-1/2	(203.2 < 215.9)
E	3-1/2 < 4	(88.9 < 101.6)	O	8-1/2 < 9	(215.9 < 228.6)
F	4 < 4-1/2	(101.6 < 114.3)	P	9 < 9-1/2	(228.6 < 241.3)
G	4-1/2 < 5	(114.3 < 127.0)	Q	9-1/2 < 10	(241.3 < 254.0)
H	5 < 5-1/2	(127.0 < 139.7)	R	10 < 11	(254.0 < 279.4)
I	5-1/2 < 6	(139.7 < 152.4)	S	11 < 12	(279.4 < 304.8)
J	6 < 6-1/2	(152.4 < 165.1)	T	12 < 13	(304.8 < 330.2)

*Located on top of anchor for easy inspection.

Trubolt®+
Seismic Wedge Anchors

APPENDIX C: Strength Design Performance values in accordance to 2006 and 2009 IBC

ITW RED HEAD TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION TESTED TO ICC-ES AC 193 AND ACI 355.2, IN ACCORDANCE WITH 2006 and 2009 IBC

Trubolt® Seismic Wedge Anchors

TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION[1]

Characteristic	Symbol	Units	Nominal Anchor Diameter (inch)[4]									
			3/8"		1/2"				5/8"		3/4"	
Anchor category	1, 2 or 3	—	1		1				1		1	
Minimum effective embedment depth	h_{ef}	in	1-5/8		2		3-1/4		2-3/4	4-1/4	3-3/4	
Minimum concrete member thickness	h_{min}	in	4	5	4	6	6	8	6	6-1/4	7	8
Critical edge distance	c_{ac}	in	5	3	6	6	7-1/2	6	7-1/2	6-1/2	12	10
Data for Steel Strengths – Tension and Shear												
Minimum specified yield strength	f_y	psi	60,000		55,000				55,000		55,000	
Minimum specified ultimate strength	f_{uta}	psi	75,000		75,000				75,000		75,000	
Effective tensile stress area (neck)	A_{se}	in^2	0.056		0.119				0.183		0.266	
Effective tensile stress area (thread)	A_{se}	in^2	0.075		0.142				0.217		0.332	
Steel strength in tension	N_{sa}	lbf	4,200		8,925				13,725		19,950	
Steel strength in shear, uncracked or cracked concrete [6]	V_{sa}	lbf	1,830		5,175				8,955		14,970	
Steel strength in shear – seismic loads	V_{eq}	lbf	1,545		5,175				8,955		11,775	
Strength reduction factor f for tension, steel failure modes [2]			0.75		0.75				0.75		0.75	
Strength reduction factor f for shear, steel failure modes [2]			0.60		0.65				0.65		0.65	
Data for Concrete Breakout Concrete Pryout Strengths in Tension and Shear												
Effectiveness factor – uncracked concrete	k_{uncr}	—	24		24				24		24	
Effectiveness factor – cracked concrete	k_{cr}	—	17		17				17		17	
Modification factor for cracked and uncracked concrete [3]	$\Psi_{c,N}$	—	1.0		1.0				1.0		1.0	
Coefficient for pryout strength	k_{cp}	—	1.0		1.0		2.0		2.0		2.0	
Load-bearing length of anchor	l_e	in	1.625		2.0		3.25		2.75	4.25	3.75	
Strength reduction factor ϕ for tension, concrete failure modes, Condition B [2]			0.65		0.65				0.65		0.65	
Strength reduction factor ϕ for shear, concrete failure modes, Condition B [2]			0.70		0.70				0.70		0.70	
Data for Pullout Strengths												
Pullout strength, uncracked concrete	$N_{p,uncr}$	lbf	See Footnote [5]		See Footnote [5]		6,540		5,430	8,900	See Footnote [5]	
Pullout strength, cracked concrete	$N_{p,cr}$	lbf	See Footnote [5]		See Footnote [5]				See Footnote [5]		See Footnote [5]	
Pullout strength for seismic loads	N_{eq}	lbf	See Footnote [5]		See Footnote [5]				See Footnote [5]	6,715	See Footnote [5]	
Strength reduction factor f for tension, pullout failure modes, Condition B [2]			See Footnote [5]		0.65				0.65		See Footnote [5]	
Additional Anchor Data												
Axial stiffness in service load range in uncracked concrete	b_{uncr}	lbf/in	100,000		250,000				250,000		250,000	
Axial stiffness in service load range in cracked concrete	b_{cr}	lbf/in	40,000		20,000				20,000		20,000	

For SI: 1 inch = 25.4 mm, 1 in2 = 645.16mm2, 1 lbf = 4.45 N, 1 psi = 0.006895 MPa, 1 lbf • 102/in - 17,500 N/m.

[1] The 1/2", 5/8" and 3/4" diameter Trubolt+ Wedge Anchors are ductile steel elements as defined by ACI 318 D.1. The 3/8" diameter Trubolt+ is considered ductile under tension loading and brittle under shear loading.

[2] All values of ϕ apply to the load combinations of IBC Section 1605.2, ACI 318 Section 9.2 or UBC Section 1612.2. If the load combinations of Appendix C or UBC Section 1909.2 are used, the appropriate value of ϕ must be determined in accordance with ACI 318 D.4.5. For installations where reinforcement that complies with ACI 318 Appendix D requirements for Condition A is present, the appropriate ϕ factor must be determined in accordance with ACI 318 D.4.4.

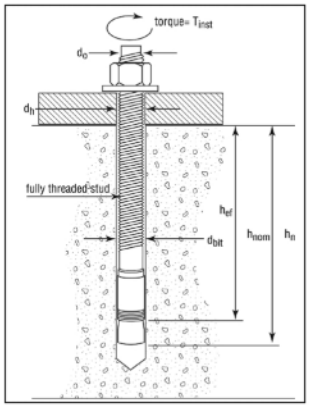
[3] For all design cases $\Psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete (k_{cr}) or uncracked concrete (k_{uncr}) must be used.

[4] The actual diameter for the 3/8" diameter anchor is 0.361" for the 5/8" diameter anchor is 0.615" and the 3/4" diameter anchor is 0.7482".

[5] Anchor pullout strength does not control anchor design. Determine steel and concrete capacity only.

[6] Steel strength in shear values are based on test results per ACI 355.2, Section 9.4 and must be used for design.

TRUBOLT+ WEDGE ANCHOR (INSTALLED)



TRUBOLT+ WEDGE INSTALLATION INFORMATION

Parameter	Notation	Units	Nominal Achor Diameter (inch)									
			3/8		1/2				5/8		3/4	
Anchor outer diameter	d_o	inches	0.361		0.5				0.615		0.7482	
Nominal carbide bit diameter	d_{bit}	inches	3/8		1/2				5/8		3/4	
Effective embedment depth	h_{ef}	inches	1-5/8		2		3-1/4		2-3/4	4-1/4	3-3/4	
Minimum anchor embedment depth	h_{nom}	inches	2		2-1/2		3-3/4		3-1/4	4-3/4	4-3/8	
Minimum hole depth[1]	h_o	inches	2-1/4		2-3/4		4		3-1/2	5	4-5/8	
Minimum concrete member thickness[1]	h_{min}	inches	4	5	4	6	6	8	6	6-1/4	7	8
Critical edge distance[1]	c_{ac}	In.	5	3	6	6	7-1/2	6	7-1/2	6-1/2	12	10
Minimum anchor spacing[1]	s_{min}	In.	3-1/2	2-1/2	6	5-3/4	4	5-3/4	8	6	6	6
Minimum edge distance[1]	c_{min}	In.	3		6				7-1/2	5	7-1/2	7-1/2
Minimum overall anchor length	l	inches	2-1/2		3-3/4		4-1/2		4-1/4	6	5-1/2	
Installation torque	T_{inst}	ft-lb	30		45				90		110	
Minimum diameter of hole in fastened part	d_h	inches	1/2		5/8				3/4		7/8	

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m.

ITW Red Head®

Call our toll free number **800-899-7890** or visit our web site for the most current product and technical information at **www.itwredhead.com**

APPENDIX C: Strength Design Performance values in accordance to 2006 and 2009 IBC

TRUBOLT+ WEDGE ANCHOR ALLOWABLE STRESS DESIGN (ASD) VALUES FOR ILLUSTRATIVE PURPOSES

Anchor Notation	Anchor Embedment Depth	Effective Embedment Depth	Allowable Tension Load
	(inches), h_{nom}	(inches), h_{ef}	(lbs)
3/8	2	1-5/8	1,090
1/2	2-1/2	2	1,490
	3-3/4	3-1/4	2,870
5/8	3-1/4	2-3/4	2,385
	4-3/4	4-1/4	3,910
3/4	4-3/8	3-3/4	3,825

For SI: 1 inch = 25.4 mm, 1 ft-lb = 4.45N.
Design Assumptions:
1 Single anchor with static shear load only.
2 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
3 Thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
4 Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
5 Values do not include edge distance or spacing reductions.

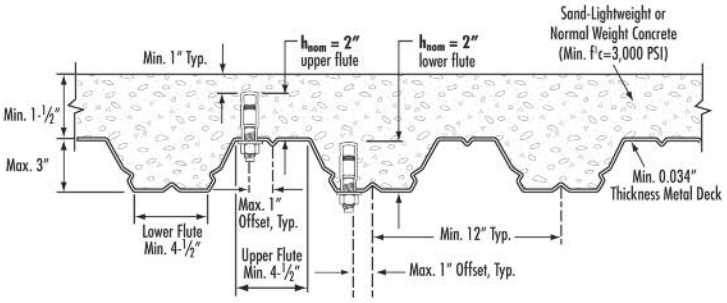
ITW RED HEAD TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION FOR INSTALLATION IN THE SOFFIT OF CONCRETE FILL ON METAL DECK FLOOR AND ROOF ASSEMBLIES

TRUBOLT+ WEDGE ANCHOR DESIGN INFORMATION

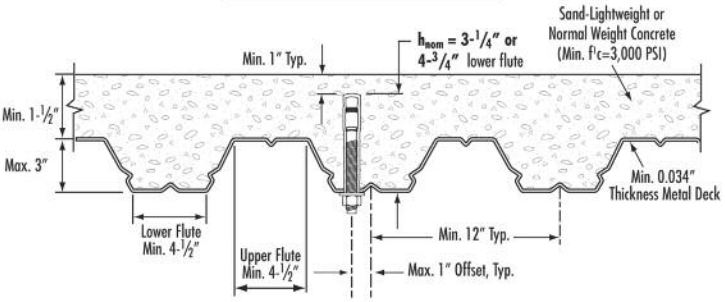
Characteristic	Symbol	Units	Nominal Anchor Diameter				
			3/8"	1/2"		5/8"	
			Upper /Lower	Upper /Lower	Lower Only	Lower Only	Lower Only
			h_{ef} = 1-5/8"	h_{ef} = 2"	h_{ef} = 3-1/4"	h_{ef} = 2-3/4"	h_{ef} = 4-1/4"
Pullout strength, uncracked concrete over metal deck	$N_{p, deck, uncr}$	lbf	2,170	2,515	5,285	3,365	6,005
Pullout strength, cracked concrete over metal deck	$N_{p, deck, cr}$	lbf	1,650	1,780	4,025	2,405	5,025
Reduction factor for pullout strength in tension, Condition B	ϕ	––	0.65				
Shear strength, uncracked concrete over metal deck	$V_{p, deck, uncr}$	lbf	1,640	2,200	3,790	2,890	6,560
Reduction factor for steel strength in shear	ϕ	––	0.60	0.65			
Anchor embedment depth	h_{nom}	in	2.0	2.5	3.75	3.25	4.75

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N

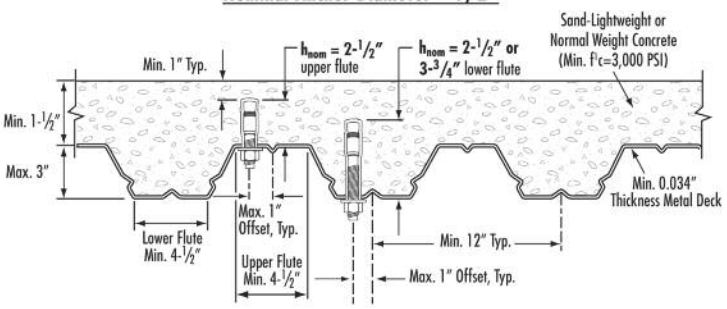
Nominal Anchor Diameter = 3/8"



Nominal Anchor Diameter = 5/8"



Nominal Anchor Diameter = 1/2"



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APPENDIX B: Strength Design Performance values in accordance to 2006 IBC

ITW RED HEAD TRUBOLT WEDGE ANCHOR

DESIGN INFORMATION TESTED TO ICC-ES AC193 AND ACI 355.2, IN ACCORDANCE WITH 2006 IBC

Trubolt® Wedge Anchors

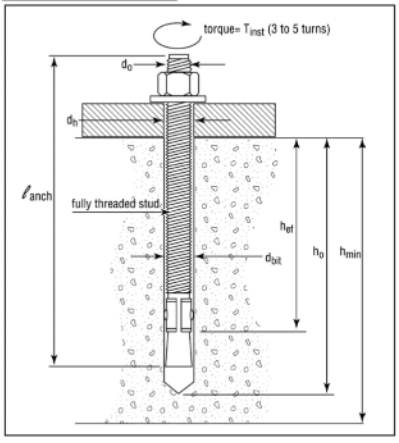
TRUBOLT WEDGE ANCHOR DESIGN INFORMATION[1,2,3]

DESIGN INFORMATION	Symbol	Units	Nominal Anchor Diameter									
			1/4		3/8		1/2		5/8		3/4	
Anchor O.D.	d_o	in	0.250		0.375		0.500		0.625		0.750	
Effective embedment	h_{ef}	in	1-1/2	2	1-3/4	2-5/8	1-7/8	3-3/8	2-1/2	4	3-1/2	4-3/4
Minimum member thickness	h_{min}	in	4	4	4	5	5	6	5	8	6	8
Critical edge distance	c_{ac}	in	2-5/8	3	2-5/8	5-1/4	3-3/4	6-3/4	5	8	7	9
Minimum edge distance	c_{min}	in	1-3/4	1-1/2	2-1/4	2	3-3/4	3-3/4	4-1/4	3-1/4	3-3/4	3-1/2
Minimum anchor spacing	s_{min}	in	1-3/4	1-1/2	2-1/4	2	3-3/4	3-3/4	4-1/4	3-1/4	3-3/4	3-1/2
Min. Specified Yield Strength	f_y	lb/in^2	55,000									
Min. Specified Ultimate Strength	f_{uta}	lb/in^2	75,000									
Effective tensile stress area	A_{se}	in^2	0.032		0.078		0.142		0.226		0.334	
Steel strength in tension	N_s	lb	2,385		5,815		10,645		16,950		25,050	
Steel strength in shear	V_s	lb	1,430		2,975	3,490	4,450	6,385	6,045	10,170	10,990	15,030
Pullout strength, uncracked concrete	$N_{p,uncr}$	lb	1,392	1,706	2,198	3,469	2,400	4,168	4,155	6,638	8,031	10,561
Anchor Category (All anchors are ductile)			1									
Effectiveness factor k_{uncr} uncracked concrete			24									
Axial stiffness in service load range	β	lb/in	14,651	9,385	17,515	26,424	32,483	26,136	42,899	21,749	43,576	28,697
Coefficient for variation for axial stiffness in service load range			34	47	28	45	17	33	55	22	63	28
Strength reduction factor ϕ for tension, steel failure modes			0.75									
Strength reduction factor ϕ for shear, steel failure modes			0.65									
Strength reduction factor ϕ for tension, concrete failure modes, Condition B			0.65									
Strength reduction factor ϕ for shear, concrete failure modes, Condition B			0.70									

[1] Trubolt+ Anchor Design Strengths must be determined in accordance with ACI 318-05 Appendix D and this table
[2] The Trubolt+ Wedge Anchor is a ductile steel element as defined by ACI 318 D.1
[3] 1/4", 3/8", & 1/2" diameter data is listed in ICC-ES ESR-2251.

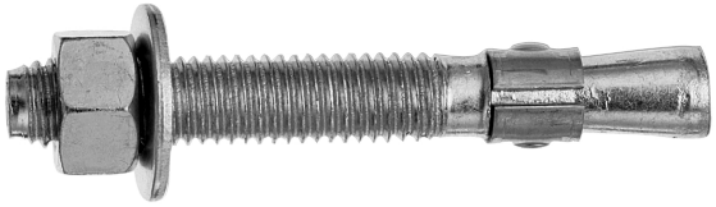
Trubolt® Wedge Anchors

TRUBOLT WEDGE ANCHOR (INSTALLED)



TRUBOLT WEDGE INSTALLATION INFORMATION

	Symbol	Units	Nominal Anchor Diameter (in.)									
			1/4		3/8		1/2		5/8		3/4	
Anchor outer diameter	d_o	in	0.25		0.375		0.5		0.625		0.750	
Nominal carbide bit diameter	d_{bit}	in	1/4		3/8		1/2		5/8		3/4	
Effective embedment depth	h_{ef}	in	1-1/2	2	1-3/4	2-5/8	1-7/8	3-3/8	2-1/2	4	3-1/2	4-3/4
Min hole depth	h_o	in	2	2-1/2	2-1/2	3-3/8	2-3/4	4-1/4	3-3/4	5-1/4	4-3/4	6
Min slab thickness	h_{min}	in	4		4	5	5	6	5	8	6	8
Installation torque	T_{inst}	ft-lb	4		25		55		90		110	
Min hole diameter in fixture	d_h	in	5/16		7/16		9/16		11/16		13/16	



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APPENDIX B: Strength Design Performance values in accordance to 2006 IBC

Trubolt®
Wedge Anchors

TRUBOLT WEDGE PULLOUT STRENGTH ($N_{p, unc}$) (POUNDS) [1]

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength			
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi	f'c = 6,500 psi
1/4	1-1/2	1,392	1,525	1,610	1,822
	2	1,706	1,869	1,947	2,151
3/8	1-3/4	2,198	2,408	2,621	3,153
	2-5/8	3,469	3,800	3,936	4,275
1/2	1-7/8	2,400	2,629	3,172	4,520
	3-3/8	4,168	4,520	4,520	4,520
5/8	2-1/2	4,155	4,155	4,376	5,578
	4	6,638	6,900	7,968	10,157
3/4	3-1/2	8,031	8,322	9,610	12,251
	4-3/4	10,561	10,561	10,561	12,251

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa
1 Values are for single anchors with no edge distance or spacing reduction.

TRUBOLT WEDGE ANCHOR ALLOWABLE STATIC TENSION (ASD), NORMAL-WEIGHT UNCRACKED CONCRETE [1-6]

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Concrete Compressive Strength			
		f'c = 2,500 psi	f'c = 3,000 psi	f'c = 4,000 psi	f'c = 6,500 psi
1/4	1-1/2	611	670	707	800
	2	749	821	855	945
3/8	1-3/4	965	1,058	1,151	1,385
	2-5/8	1,524	1,669	1,729	1,878
1/2	1-7/8	1,054	1,155	1,393	1,985
	3-3/8	1,831	1,985	1,985	1,985
5/8	2-1/2	1,825	1,825	1,922	2,450
	4	2,915	3,030	3,499	4,461
3/4	3-1/2	3,527	3,655	4,221	5,381
	4-3/4	4,638	4,638	4,638	5,381

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa
Design Assumptions:
1 Single anchor with static tension load only.
2 Concrete determined to remain uncracked for the life of the anchorage.
3 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
4 Thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
5 Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
6 Values do not include edge distance or spacing reductions.

2006 IBC Compliant

TRUBOLT WEDGE ANCHOR ALLOWABLE STATIC SHEAR (ASD), STEEL (POUNDS)[1-5]

Nominal Anchor Diameter (in.)	Effective Embedment Depth (in.)	Allowable Steel Capacity, Static Shear
1/4	1-1/2	628
	2	
3/8	1-3/4	1,307
	2-5/8	1,533
1/2	1-7/8	1,954
	3-3/8	2,804
5/8	2-1/2	2,655
	4	4,467
3/4	3-1/2	4,827
	4-3/4	6,601

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 0.006895 Mpa
Design Assumptions:
1 Single anchor with static shear load only.
3 Load combinations from 2006 IBC, Sections 1605.2.1 and 1605.3.1 (no seismic loading).
3 Thirty percent dead load and 70 percent live load, controlling load combination 1.2D + 1.6L
4 Calculation of weighted average: 1.2D + 1.6L = 1.2 (0.3) + 1.6 (0.7) = 1.48
5 Values do not include edge distance or spacing reductions.

PERFORMANCE TABLE

Trubolt Wedge Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Concrete*

ANCHOR DIA. In. (mm)	INSTALLATION TORQUE Ft. Lbs. (Nm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	f'c = 2000 PSI (13.8 MPa)		f'c = 4000 PSI (27.6 MPa)		f'c = 6000 PSI (41.4 MPa)	
				TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
1/4 (6.4)	4 (5.4)	1-1/8 (28.6)	WS-Carbon or WS-G Hot-Dipped Galvanized or WW-304 S.S. or SWW-316 S.S.	1,180 (5.2)	1,400 (6.2)	1,780 (7.9)	1,400 (6.2)	1,900 (8.5)	1,400 (6.2)
		1-15/16 (49.2)		2,100 (9.3)	1,680 (7.5)	3,300 (14.7)	1,680 (7.5)	3,300 (14.7)	1,680 (7.5)
		2-1/8 (54.0)		2,260 (10.1)	1,680 (7.5)	3,300 (14.7)	1,680 (7.5)	3,300 (14.7)	1,680 (7.5)
3/8 (9.5)	25 (33.9)	1-1/2 (38.1)		1,680 (7.5)	2,320 (10.3)	2,240 (10.0)	2,620 (11.7)	2,840 (12.6)	3,160 (14.1)
		3 (76.2)		3,480 (15.5)	4,000 (17.8)	5,940 (26.4)	4,140 (18.4)	6,120 (27.2)	4,500 (20.0)
		4 (101.6)		4,800 (21.4)	4,000 (17.8)	5,940 (26.4)	4,140 (18.4)	6,120 (27.2)	4,500 (20.0)
1/2 (12.7)	55 (74.6)	2-1/4 (57.2)		4,660 (20.7)	4,760 (21.2)	5,100 (22.7)	4,760 (21.2)	7,040 (31.3)	7,040 (31.3)
		4-1/8 (104.8)		4,660 (20.7)	7,240 (32.2)	9,640 (42.9)	7,240 (32.2)	10,820 (48.1)	8,160 (36.3)
		6 (152.4)		5,340 (23.8)	7,240 (32.2)	9,640 (42.9)	7,240 (32.2)	10,820 (48.1)	8,160 (36.3)
5/8 (15.9)	90 (122.0)	2-3/4 (69.9)		6,580 (29.3)	7,120 (31.7)	7,180 (31.9)	7,120 (31.7)	9,720 (43.2)	9,616 (42.8
		5-1/8 (130.2)		6,580 (29.3)	9,600 (42.7)	14,920 (66.4)	11,900 (52.9)	16,380 (72.9)	12,520 (55.7)
		7-1/2 (190.5)		7,060 (31.4)	9,600 (42.7)	15,020 (66.8)	11,900 (52.9)	16,380 (72.9)	12,520 (55.7)
3/4 (19.1)	110 (149.2)	3-1/4 (82.6)		7,120 (31.7)	10,120 (45.0)	10,840 (48.2)	13,720 (61.0)	13,300 (59.2)	15,980 (71.1)
		6-5/8 (168.3)		10,980 (48.8)	20,320 (90.4)	17,700 (78.7)	23,740 (105.6)	20,260 (90.1)	23,740 (105.6)
		10 (254.0)		10,980 (48.8)	20,320 (90.4)	17,880 (79.5)	23,740 (105.6)	23,580 (104.9)	23,740 (105.6)
7/8 (22.2)	250 (339.0)	3-3/4 (95.3)		9,520 (42.3)	13,160 (58.5)	14,740 (65.6)	16,580 (73.8)	17,420 (77.5)	19,160 (85.2)
		6-1/4 (158.8)		14,660 (65.2)	20,880 (92.9)	20,940 (93.1)	28,800 (128.1)	24,360 (108.4)	28,800 (128.1)
		8 (203.2)		14,660 (65.2)	20,880 (92.9)	20,940 (93.1)	28,800 (128.1)	24,360 (108.4)	28,800 (128.1)
1 (25.4)	300 (406.7)	4-1/2 (114.3)		13,940 (62.0)	16,080 (71.5)	20,180 (89.8)	22,820 (101.5)	21,180 (94.2)	24,480 (108.9)
		7-3/8 (187.3)		14,600 (64.9)	28,680 (127.6)	23,980 (106.7)	37,940 (168.8)	33,260 (148.0)	38,080 (169.4)
		9-1/2 (241.3)		18,700 (83.2)	28,680 (127.6)	26,540 (118.1)	37,940 (168.8)	33,260 (148.0)	38,080 (169.4)

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

* For Tie-Wire Wedge Anchor, TW-1400, use tension data from 1/4" diameter with 1-1/8" embedment.

* For continuous extreme low temperature applications, use stainless steel.

Trubolt Wedge Anchors — Ultimate Tension and Shear Values (Lbs/kN) in Lightweight Concrete*

ANCHOR DIA. In. (mm)	INSTALLATION TORQUE Ft. Lbs. (Nm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	LIGHTWEIGHT CONCRETE f'c = 3000 PSI (20.7 MPa)		LOWER FLUTE OF STEEL DECK WITH LIGHTWEIGHT CONCRETE FILL f'c = 3000 PSI (20.7 MPa)	
				TENSION Lbs. (kN)	SHEAR Lbs. (kN)	TENSION Lbs. (kN)	SHEAR Lbs. (kN)
3/8 (9.5)	25 (33.9)	1-1/2 (38.1)	WS-Carbon or WS-G Hot-Dipped Galvanized or WW-304 S.S. or SWW-316 S.S.	1,175 (5.2)	1,480 (6.6)	1,900 (8.5)	3,160 (14.1)
		3 (76.2)		2,825 (12.6)	2,440 (10.9)	2,840 (12.6)	4,000 (17.8)
1/2 (12.7)	55 (74.6)	2-1/4 (57.2)		2,925 (13.0)	2,855 (12.7)	3,400 (15.1)	5,380 (23.9)
		3 (76.2)		3,470 (15.4)	3,450 (15.3)	4,480 (19.9)	6,620 (29.4)
		4 (101.6)		4,290 (19.1)	3,450 (15.3)	4,800 (21.4)	6,440 (28.6)
5/8 (15.9)	90 (122.0)	3 (76.2)		4,375 (19.5)	4,360 (19.4)	4,720 (21.0)	5,500 (24.5)
		5 (127.0)		6,350 (28.2)	6,335 (28.2)	6,580 (29.3)	9,140 (40.7)
3/4 (19.1)	110 (149.2)	3-1/4 (82.6)		5,390 (24.0)	7,150 (31.8)	5,840 (26.0)	8,880 (39.5)
		5-1/4 (133.4)		7,295 (32.5)	10,750 (47.8)	7,040 (31.3)	--- ---

* Allowable values are based upon a 4 to 1 safety factor. Divide by 4 for allowable load values.

PERFORMANCE TABLE

Trubolt Wedge Anchors — Recommended Edge and Spacing Distance Requirements for Shear Loads*

ANCHOR DIA. In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. EDGE DISTANCE AT WHICH THE LOAD FACTOR APPLIED = .60 In. (mm)	MIN. EDGE DISTANCE AT WHICH THE LOAD FACTOR APPLIED = .20 In. (mm)	SPACING REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE SPACING BETWEEN ANCHORS In. (mm) LOAD FACTOR APPLIED = .40
1/4 (6.4)	1-1/8 (28.6) 1-15/16 (49.2)	WS-Carbon or WS-G Hot-Dipped Galvanized or WW-304 S.S. or SWW-316 S.S.	2 (50.8) 1-15/16 (49.2)	1-5/16 (33.3) 1 (25.4)	--- ---	3-15/16 (100.0) 3-7/8 (98.4)	2 (50.8) 1-15/16 (49.2)
3/8 (9.5)	1-1/2 (38.1) 3 (76.2)		2-5/8 (66.7) 3-3/4 (95.3)	1-3/4 (44.5) 3 (76.2)	--- 1-1/2 (38.1)	5-1/4 (133.4) 6 (152.4)	2-5/8 (66.7) 3 (76.2)
1/2 (12.7)	2-1/4 (57.2) 4-1/8 (104.8)		3-15/16 (100.0) 5-3/16 (131.8)	2-9/16 (65.1) 3-1/8 (79.4)	--- 1-9/16 (39.7)	7-7/8 (200.0) 6-3/16 (157.2)	3-15/16 (100.0) 3-1/8 (79.4)
5/8 (15.9)	2-3/4 (69.9) 5-1/8 (130.2)		4-13/16 (122.2) 6-7/16 (163.5)	3-1/8 (79.4) 3-7/8 (98.4)	--- 1-15/16 (49.2)	9-5/8 (244.5) 7-11/16 (195.3)	4-13/16 (122.2) 3-7/8 (98.4)
3/4 (19.1)	3-1/4 (82.6) 6-5/8 (168.3)		5-11/16 (144.5) 6-5/16 (160.3)	3-3/4 (95.3) 5 (127.0)	--- 2-1/2 (63.5)	11-3/8 (288.9) 9-15/16 (252.4)	5-11/16 (144.5) 5 (127.0)
7/8 (22.2)	3-3/4 (95.3) 6-1/4 (158.8)		6-9/16 (166.7) 8-1/2 (215.9)	4-5/16 (109.5) 6-1/4 (158.8)	--- 3-1/8 (79.4)	13-1/8 (333.4) 12-1/2 (317.5)	6-9/16 (166.7) 6-1/4 (158.8)
1 (25.4)	4-1/4 (108.0) 7-3/8 (187.3)		7-7/8 (200.0) 10-1/16 (255.6)	5-1/8 (130.2) 7-3/8 (187.3)	--- 3-11/16 (93.7)	15-3/4 (400.1) 14-3/4 (374.7)	7-7/8 (200.0) 7-3/8 (187.3)

* Spacing and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete. Linear interpolation may be used for intermediate spacing and edge distances.

Trubolt Wedge Anchors — Recommended Edge and Spacing Distance Requirements for Tension Loads*

ANCHOR DIA. In. (mm)	EMBEDMENT DEPTH In. (mm)	ANCHOR TYPE	EDGE DISTANCE REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE EDGE DISTANCE AT WHICH THE LOAD FACTOR APPLIED = .65 In. (mm)	SPACING REQUIRED TO OBTAIN MAX. WORKING LOAD In. (mm)	MIN. ALLOWABLE SPACING AT WHICH THE LOAD FACTOR APPLIED = .70 In. (mm)
1/4 (6.4)	1-1/8 (28.6) 1-15/16 (49.2) 2-1/8 (54.0)	WS-Carbon or WS-G Hot-Dipped Galvanized or WW-304 S.S. or SWW-316 S.S.	2 (50.8) 1-15/16 (49.2) 1-5/8 (41.3)	1 (25.4) 1 (25.4) 13/16 (20.6)	3-15/16 (100.0) 3-7/8 (98.4) 3-3/16 (81.0)	2 (50.8) 1-15/16 (49.2) 1-5/8 (41.3)
3/8 (9.5)	1-1/2 (38.1) 3 (76.2) 4 (101.6)		2-5/8 (66.7) 3 (76.2) 3 (76.2)	1-5/16 (33.3) 1-1/2 (38.1) 1-1/2 (38.1)	5-1/4 (133.4) 6 (152.4) 6 (152.4)	2-5/8 (66.7) 3 (76.2) 3 (76.2)
1/2 (12.7)	2-1/4 (57.2) 4-1/8 (104.8) 6 (152.4)		3-15/16 (100.0) 3-1/8 (79.4) 4-1/2 (114.3)	2 (50.8) 1-9/16 (39.7) 2-1/4 (57.2)	7-7/8 (200.0) 6-3/16 (157.2) 9 (228.6)	3-15/16 (100.0) 3-1/8 (79.4) 4-1/2 (114.3)
5/8 (15.9)	2-3/4 (69.9) 5-1/8 (130.2) 7-1/2 (190.5)		4-13/16 (122.2) 3-7/8 (98.4) 5-5/8 (142.9)	2-7/16 (61.9) 1-15/16 (49.2) 2-13/16 (71.4)	9-5/8 (244.5) 7-1/16 (195.3) 11-1/4 (285.8)	4-13/16 (122.2) 3-7/8 (98.4) 5-5/8 (142.9)
3/4 (19.1)	3-1/4 (82.6) 6-5/8 (168.3) 10 (254.0)		5-11/16 (144.5) 5 (127.0) 7-1/2 (190.5)	2-7/8 (73.0) 2-1/2 (63.5) 3-3/4 (95.3)	11-3/8 (288.9) 9-15/16 (252.4) 15 (381.0)	5-11/16 (144.5) 5 (127.0) 7-1/2 (190.5)
7/8 (22.2)	3-3/4 (95.3) 6-1/4 (158.8) 8 (203.2)		6-9/16 (166.7) 6-1/4 (158.8) 6 (152.4)	3-5/16 (84.1) 3-1/8 (79.4) 3 (76.2)	13-1/8 (333.4) 12-1/2 (317.5) 12 (304.8)	6-9/16 (166.7) 6-1/4 (158.8) 6 (152.4)
1 (25.4)	4-1/2 (114.3) 7-3/8 (187.3) 9-1/2 (241.3)		7-7/8 (200.0) 7-3/8 (187.3) 7-1/8 (181.0)	3-15/16 (100.0) 3-11/16 (93.7) 3-9/16 (90.5)	15-3/4 (400.1) 14-3/4 (374.7) 14-1/4 (362.0)	7-7/8 (200.0) 7-3/8 (187.3) 7-1/8 (181.0)

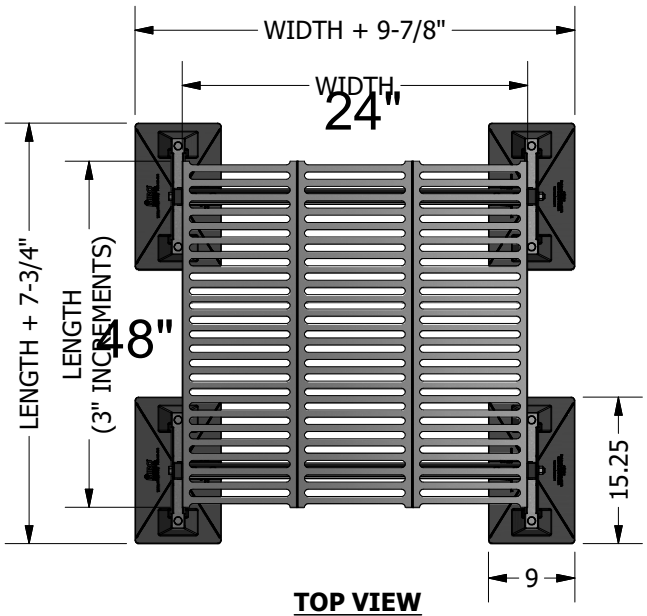
* Spacing and edge distances shall be divided by 0.75 when anchors are placed in structural lightweight concrete. Linear interpolation may be used for intermediate spacing and edge distances.

Combined Tension and Shear Loading—for Trubolt Anchors

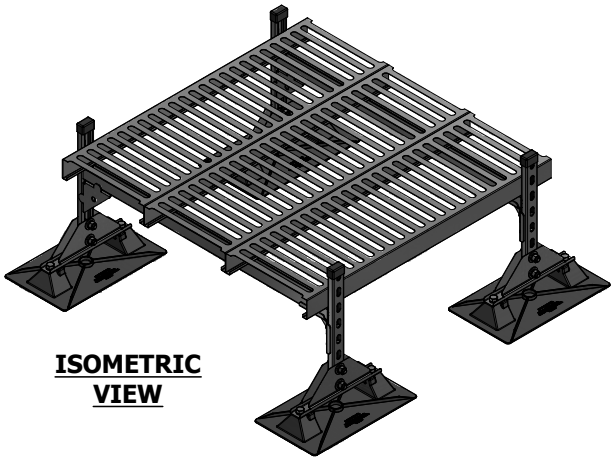
Allowable loads for anchors subjected to combined shear and tension forces are determined by the following equation:

$$(Ps/Pt)^{5/3} + (Vs/Vt)^{5/3} \leq 1$$

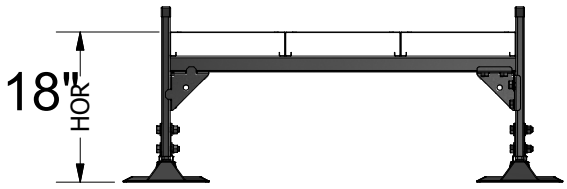
Ps = Applied tension load Vs = Applied shear load Pt = Allowable tension load Vt = Allowable shear load



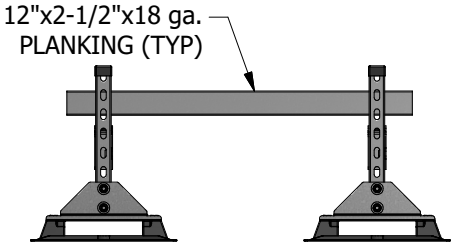
TOP VIEW



ISOMETRIC VIEW



FRONT VIEW



SIDE VIEW

ACCESSORIES

- 9 x 15.25 Support pad
- Eternabond® 2-sided tape

PRODUCT DESCRIPTION

The MIRO HD-Mechanical Supports are designed to elevate rooftop mechanical units, cabinets and other devices.
The HD-Mechanical Support deck is 12" x 2-1/2" x 18 ga. planking. The supports are adjustable in height per the project requirements. All metal parts are hot-dip galvanized for outdoor weathering protection. The support bases are injection molded Polycarbonate.

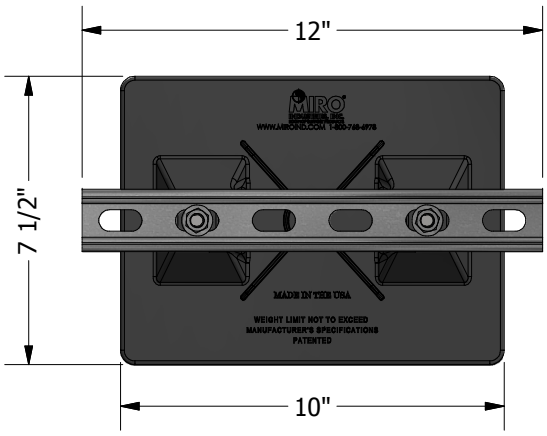
KEY INFORMATION

- Designed to support mechanical units, cabinets and other devices.
- Designed to meet project specific dimensions with adjustability as specified.
- Support Deck is constructed of 12" x 2-1/2" x 18 ga. metal planking. (Bar Grating may be specified or required depending on loading and dimensional requirements)
- Support is designed to not exceed 3.0 psi to the finished roof surface under each base.
- Base Material: Polycarbonate
- All metal parts are either stainless steel, hot-dip galvanized or pre-galvanized.
- Non-Anchored supports do not provide significant resistance to wind or seismic loading. Contact MIRO Industries for wind and seismic solutions.
- Manufacturer suggested loading is not to exceed 300 lbs to each base. Contractor to ensure load distribution to each base does not exceed suggested loading to each base.

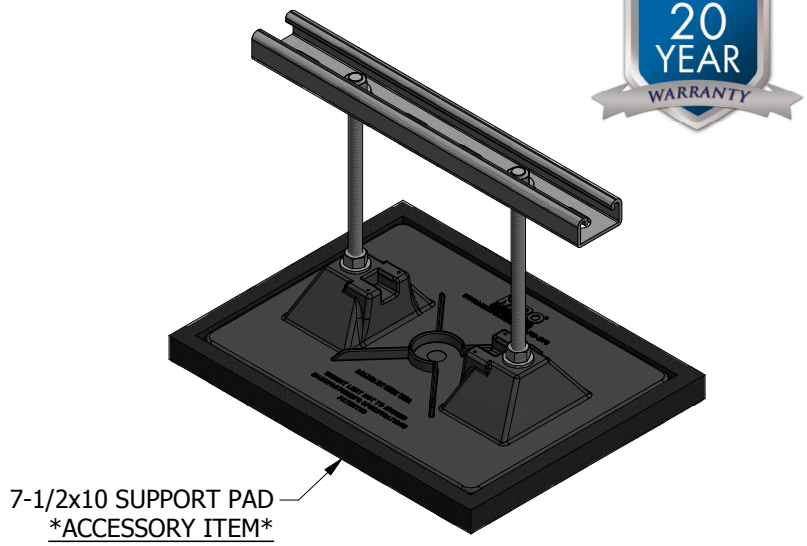
DATE: JAN 2019

6-HD(P) Mechanical Support

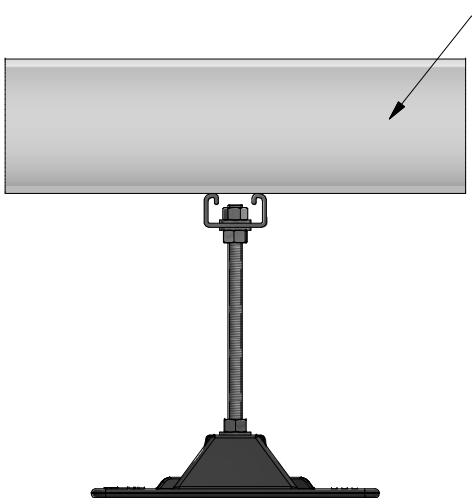
ELEVATE SERIES | CONDUIT SUPPORT 2.5



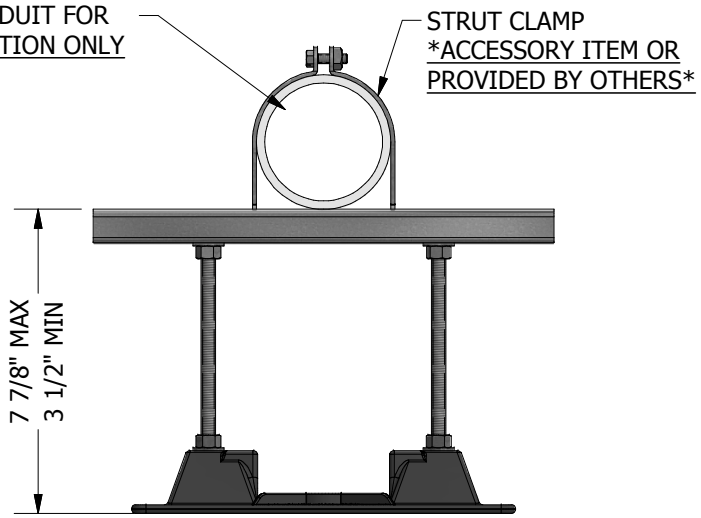
TOP VIEW



ISOMETRIC VIEW



SIDE VIEW



FRONT VIEW

ACCESSORIES

- Strut Clamp - Order to Pipe O.D.
- 7-1/2 x 10 Support pad
- Eternabond® 2-sided tape

PRODUCT DESCRIPTION

A pipe support with "strut" used to support roof-mounted electrical conduit, solar piping, gas pipes and other mechanical piping. Pipes rest on a 12" length of strut which is mounted on the base. The pipes can be fastened by using the appropriate pipe clamp.

KEY INFORMATION

- Designed to support conduit (ganged) cable trays or other mechanical piping.
- Adjustable height from 3-1/2" to 7-7/8", even load required, maximum load is 115 lbs.
- 12 per case, 31 lbs. per case
- Recommended spacing is not to exceed 10 feet centers depending upon the load. Make certain each stand is properly elevated to even load weight at all stands.
- Base Material: Polycarbonate
- All metal parts are either stainless steel or hot-dip galvanized.

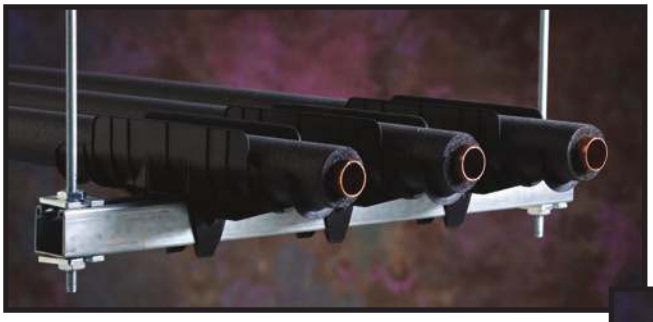
Snap 'N Shield™ Pipe Support

Size Range:
2 1/4" (57.1mm), 3 1/4" (82.5mm), 4 1/4" (107.9mm), 5 1/4" (133.3mm), 6 1/4" (158.7mm), and 8 5/8" (219.1mm) Shield Openings

Material: Plastic - Black & White

Features:
- Ideal for horizontal pipe runs.
- Offers maximum protection for insulated pipe.
- Snaps directly onto channel.
- Shield length is 12" (304.8mm).
- Fast, easy installation – no tools required.
- Snap-on design eliminates shield movement, preventing insulation damage that can lead to costly leaks.
- Allows pipe to expand without damaging the insulation.
- Protects insulation from damage caused by rubbing against other pipes and fittings.
- Designed for side-by-side installations.
- The most reliable, durable, and cost-effective way to protect your insulation.
- Patent Pending.

Order By: Part number.



Technical Specifications

Applications: Refrigeration, Air Conditioning, and Plumbing

Material: Basell Pro-Fax 8523 Polypropylene Copolymer
- UV resistant
- Operating temperature -40°F (-40.0°C) to +178°F (81.1°C)
- Paintable (Preserves mechanical properties even after painting)
- Non-adhesive surface for linear expansion of thermal insulation

Certification: UL Classified for USA (UL-723 (ASTM E84)) and ULC listed for Canada (ULC-S102.2). Meets UL94 HB flammability standards

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

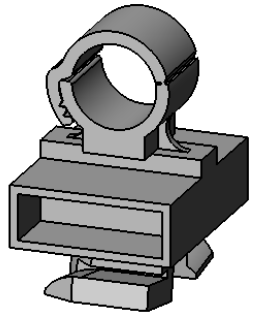
Snap'N Shield™ Pipe Support

Black Shields Part Number	White Shields Part Number	Gray Shields Part Number	Inside Opening in. (mm)	Approx. Wt./100 Lbs. (kg)
BPS225B	BPS225W	--	2 1/4" (57)	26 (11.8)
BPS325B	BPS325W	--	3 1/4" (82)	37 (16.8)
BPS425B	BPS425W	--	4 1/4" (108)	52 (23.6)
BPS525B	BPS525W	--	5 1/4" (133)	69 (31.3)
BPS625B	BPS625W	--	6 1/4" (159)	83 (37.6)
BPS825B	BPS835W	BPS825G	8 1/4" (209)	103 (46.7)
BPSCB	BPSCW		Universal Cover	22 (10.0)

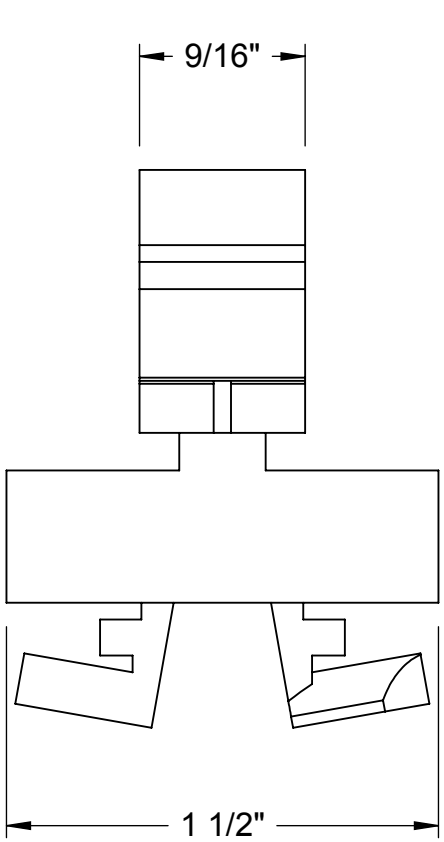
Copper Tubing Size	Insulation Thickness 1/2"	3/4"	1"	1 1/2"	2"
1/4"	BPS225	BPS225	BPS325	BPS425	BPS525
3/8"	BPS225	BPS225	BPS325	BPS425	BPS525
1/2"	BPS225	BPS225	BPS325	BPS425	BPS525
5/8"	BPS225	BPS325	BPS325	BPS425	BPS525
3/4"	BPS225	BPS325	BPS325	BPS425	BPS525
1"	BPS225	BPS325	BPS325	BPS425	BPS525
1 1/4"	BPS325	BPS325	BPS425	BPS525	BPS625
1 1/2"	BPS325	BPS325	BPS425	BPS525	BPS625
2"	BPS325	BPS425	BPS425	BPS525	BPS625
2 1/2"	BPS425	BPS425	BPS525	BPS625	BPS825
3"	BPS425	BPS525	BPS525	BPS625	BPS825
3 1/2"	BPS525	BPS525	BPS625	BPS825	BPS825
4"	BPS525	BPS625	BPS625	BPS825	BPS825

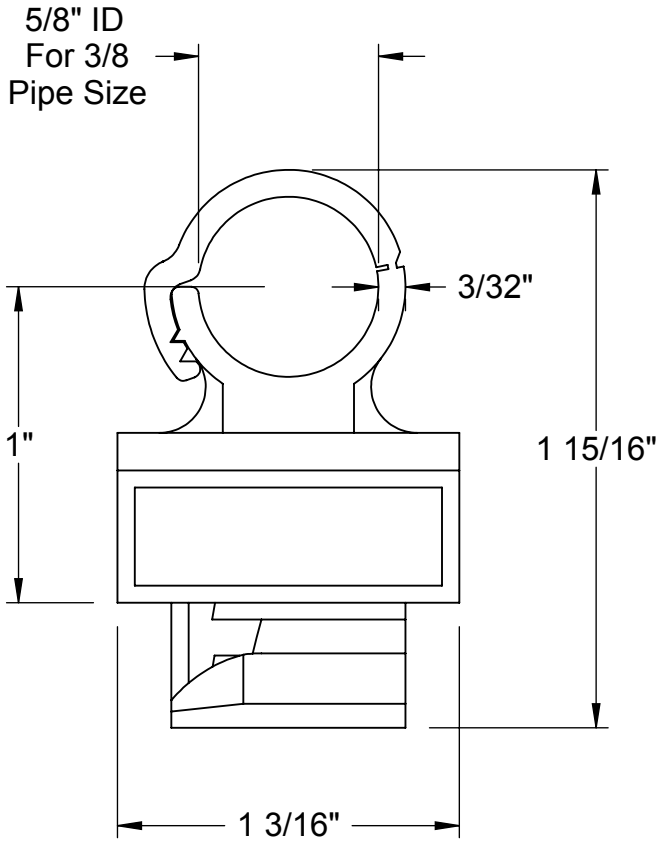
Sch. 40/80 Pipe	Insulation Thickness 1/2"	3/4"	1"	1 1/2"	2"
1/4"	BPS225	BPS225	BPS325	BPS425	BPS525
3/8"	BPS225	BPS225	BPS325	BPS425	BPS525
1/2"	BPS225	BPS325	BPS325	BPS425	BPS525
3/4"	BPS225	BPS325	BPS325	BPS425	BPS525
1"	BPS325	BPS325	BPS425	BPS525	BPS625
1 1/2"	BPS325	BPS325	BPS425	BPS525	BPS625
1 1/2"	BPS325	BPS425	BPS425	BPS525	BPS625
2"	BPS425	BPS425	BPS425	BPS525	BPS625
2 1/2"	BPS425	BPS525	BPS525	BPS625	BPS825
3"	BPS525	BPS525	BPS625	BPS625	BPS825
3 1/2"	BPS525	BPS625	BPS625	BPS825	BPS825
4"	BPS625	BPS625	BPS825	BPS825	BPS825

All dimensions in charts and on drawings are in inches. Dimensions shown in parentheses are in millimeters unless otherwise specified.

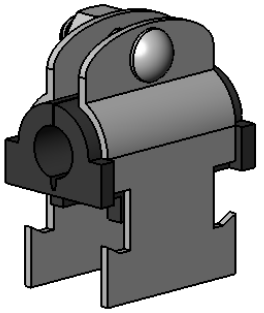


For 1 5/8"
Strut Channel
Width

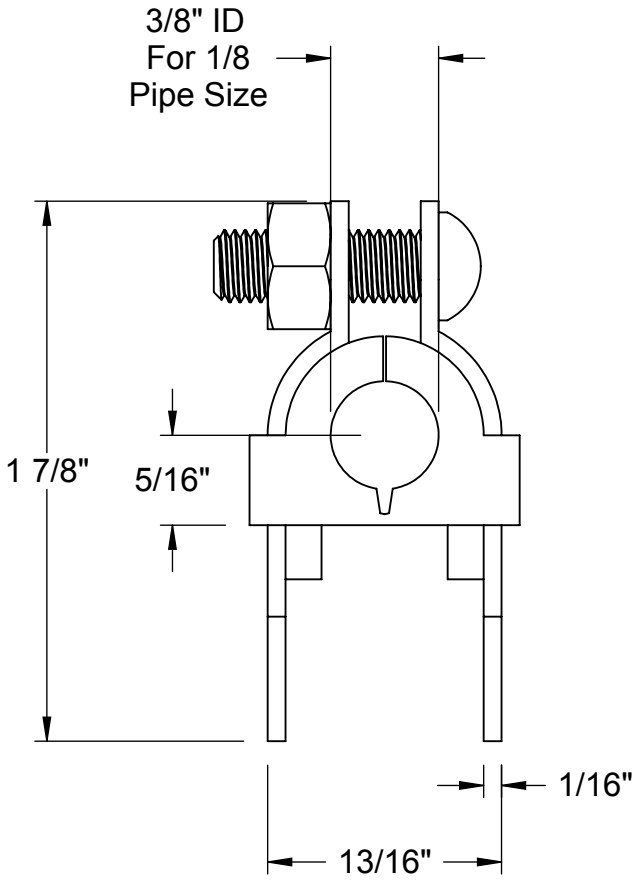


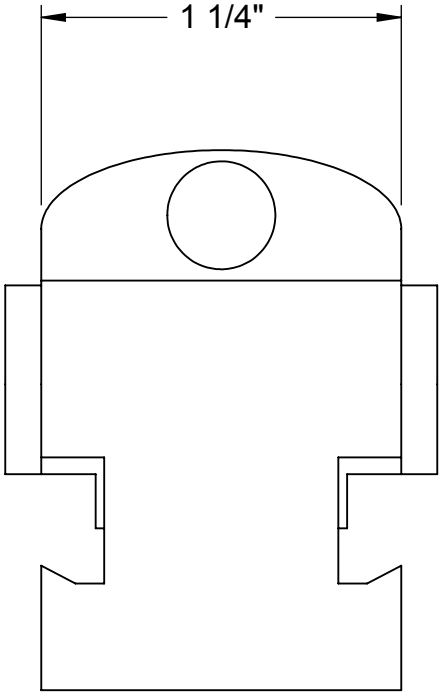


McMASTER-CARR® CAD http://www.mcmaster.com 	PART NUMBER **3656T83** Strut-Mount Clamp for Insulated Tubing



For 1 5/8"
Strut Channel
Width





McMASTER-CARR® CAD	PART NUMBER **32625T51**
http://www.mcmaster.com © 2016 McMaster-Carr Supply Company Information in this drawing is provided for reference only.	Vibration-Damping Strut-Mount Clamp