MECHANICAL ANCHORS

Steel Dropin *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Steel Dropin is an all-steel, machine bolt anchor available in carbon steel and two types of stainless steel. It can be used in solid concrete, hard stone, and solid block base materials. A coil thread version for forming applications is also available.

GENERAL APPLICATIONS AND USES

- Suspending Conduit
- Cable Trays and Strut
- Pipe Supports
- Fire Sprinkler
- Concrete Formwork
- Suspended Lighting

FEATURES AND BENEFITS

- Internally threaded anchor for easy removability and service work
- Flanged (lipped) version installs flush for easy inspection and standard embedment
- Smooth wall dropin can be installed flush mounted or below the base material surface
- Optionally available with a knurled body
- Coil thread version accepts coil rod and typically used for concrete formwork applications

TESTING, APPROVALS AND LISTINGS

Tested in accordance with ASTM 488 and AC01 criteria
FM Global (Factory Mutual) - File No. J.I. OK4A9.AH (see ordering information)
Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)
CalTrans listing for "Shell Mechanical Expansion Anchors"

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Dropin anchors shall be Steel Dropin as supplied by Powers Fasteners, Inc., Brewster, NY.

SECTION CONTENTS

Smooth Wall Dropin

Flange (Lipped) Dropin

THREAD VERSION

UNC Coarse Thread
Coil Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel
303 Stainless Steel
316 Stainless Steel

ROD/ANCHOR SIZE RANGE (TYP.)

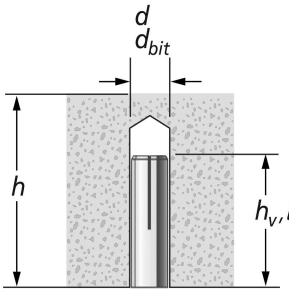
1/4" to 3/4" diameter UNC Coarse Thread
1/2" and 3/4" diameter Coil Thread

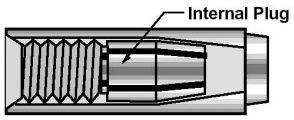
SUITABLE BASE MATERIALS

Normal-weight Concrete
Structural Lightweight Concrete
(uncracked base materials)

INSTALLATION SPECIFICATIONS

Anchor (Rod) Size	Rod/Anchor Diameter, *d*						
	1/4"	3/8"	1/2"	1/2" Coil Thread	5/8"	3/4"	3/4" Coil Thread
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8	5/8	7/8	1	1
Maximum Tightening Torque, T_{max} (ft.-lbs.)	5	10	20	20	40	80	80
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	1/2-6	5/8-11	3/4-10	3/4-4 1/2
Thread Depth (in.)	7/16	5/8	13/16	13/16	1 3/16	1 3/8	1 3/8
Flange Size (in.)	7/16	9/16	45/64	–	–	–	–
Anchor Length *l*, h_v (in.)	1	1 9/16	2	2	2 1/2	3 3/16	3 3/16

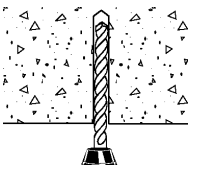




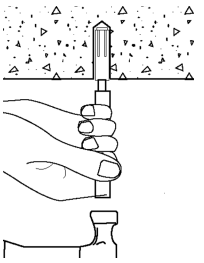
Nomenclature

d = Diameter of anchor
d_{bit} = Diameter of drill bit
h = Base material thickness.
The minimum value of *h* should be 1.5h_v or 3" min. (whichever is greater)
h_v = Minimum embedment depth
l = Overall length of anchor
T_{max} = Maximum tightening torque

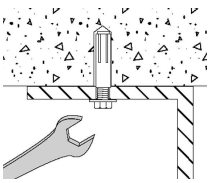
Installation Procedure



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



Blow the hole clean of dust and other materials. Insert the anchor into the hole and tap flush with surface. *Using a Powers setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor.* Anchor will not hold allowable loads required if shoulder of *Powers* setting tool does not seat against anchor.



If using a fixture, position it, insert bolt and tighten. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel	Type 303 Stainless Steel	Type 316 Stainless Steel
Anchor Body	AISI 1008	Type 303 Stainless Steel	Type 316 Stainless Steel
Plug	AISI 1018	Type 303 Stainless Steel	Type 316 Stainless Steel
Zinc Plating	ASTM B633, SC1, Type III (Fe/Zn 5)		

Stainless steel anchor components are passivated.

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PERFORMANCE DATA

Ultimate Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	1,140 (5.1)	2,120 (9.5)	1,985 (8.9)	2,120 (9.5)	2,080 (9.4)	2,120 (9.5)
3/8 (9.5)	1 9/16 (39.7)	2,180 (9.8)	4,585 (20.6)	4,180 (18.8)	4,585 (20.6)	4,950 (22.3)	4,585 (20.6)
1/2 (12.7)	2 (50.8)	4,105 (18.5)	6,400 (28.8)	5,760 (25.9)	6,400 (28.8)	6,585 (29.6)	6,400 (28.8)
5/8 (15.9)	2 1/2 (63.5)	4,665 (21.0)	12,380 (55.7)	7,440 (33.5)	12,380 (55.7)	10,920 (49.1)	12,380 (55.7)
3/4 (19.1)	3 3/16 (81.0)	8,580 (38.6)	15,680 (70.6)	14,405 (64.8)	15,680 (70.6)	17,300 (77.9)	15,680 (70.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

Allowable Load Capacities for Steel Dropin in Normal-Weight Concrete[1,2,3]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	285 (1.3)	530 (2.4)	495 (2.2)	530 (2.4)	520 (2.3)	530 (2.4)
3/8 (9.5)	1 9/16 (39.7)	545 (2.5)	1,145 (5.2)	1,045 (4.7)	1,145 (5.2)	1,240 (5.6)	1,145 (5.2)
1/2 (12.7)	2 (50.8)	1,025 (4.6)	1,600 (7.2)	1,440 (6.5)	1,600 (7.2)	1,645 (7.4)	1,600 (7.2)
5/8 (15.9)	2 1/2 (63.5)	1,165 (5.2)	3,095 (13.9)	1,860 (8.4)	3,095 (13.9)	2,730 (12.3)	3,095 (13.9)
3/4 (19.1)	3 3/16 (81.0)	2,145 (9.7)	3,920 (17.6)	3,600 (16.2)	3,920 (17.6)	4,325 (19.5)	3,920 (17.6)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate Load Capacities for Steel Dropin in Structural Lightweight Concrete[1,2,3]

Rod/Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)					
		2,000 psi (13.8 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	1,060 (4.8)	1,920 (8.6)	1,360 (6.1)	1,920 (8.6)	1,660 (7.5)	1,920 (8.6)
3/8 (9.5)	1 9/16 (39.7)	3,040 (13.7)	4,120 (18.5)	3,780 (17.0)	4,120 (18.5)	4,520 (20.3)	4,120 (18.5)
1/2 (12.7)	2 (50.8)	4,240 (19.1)	5,680 (25.6)	4,840 (21.8)	5,680 (25.6)	5,460 (24.6)	5,680 (25.6)
5/8 (15.9)	2 1/2 (63.5)	6,860 (30.9)	9,640 (43.4)	7,840 (35.3)	9,640 (43.4)	8,840 (39.8)	9,640 (43.4)
3/4 (19.1)	3 3/16 (81.0)	10,280 (46.3)	16,460 (74.1)	11,700 (52.7)	16,460 (74.1)	13,120 (59.0)	16,460 (74.1)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used to determine ultimate loads for intermediate compressive strengths.

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PERFORMANCE DATA

Allowable Load Capacities for Steel Dropin in Structural Lightweight Concrete[1,2,3]

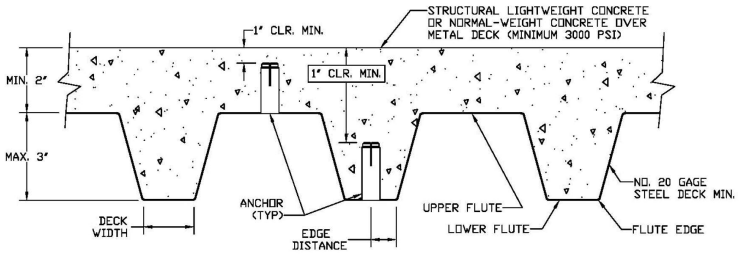
Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)					
		3,000 psi (20.7 MPa)		**4,000 psi** (27.6 MPa)		**5,000 psi** (34.5 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	265 (1.2)	480 (2.2)	340 (1.5)	480 (2.2)	415 (1.9)	480 (2.2)
3/8 (9.5)	1 9/16 (39.7)	760 (3.4)	1,030 (4.6)	945 (4.3)	1,030 (4.6)	1,130 (5.1)	1,030 (4.6)
1/2 (12.7)	2 (50.8)	1,060 (4.8)	1,420 (6.4)	1,210 (5.4)	1,420 (6.4)	1,365 (6.1)	1,420 (6.4)
5/8 (15.9)	2 1/2 (63.5)	1,715 (7.7)	2,410 (10.8)	1,960 (8.8)	2,410 (10.8)	2,210 (9.9)	2,410 (10.8)
3/4 (19.1)	3 3/16 (81.0)	2,570 (11.6)	4,115 (18.5)	2,925 (13.2)	4,115 (18.5)	3,280 (14.8)	4,115 (18.5)

1. Tabulated load values are applicable to carbon and stainless steel anchors.
2. Allowable load capacities listed are calculated using an applied safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Linear interpolation may be used to determine allowable loads for intermediate compressive strengths.

Ultimate and Allowable Load Capacities for Steel Dropin Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4,5]

Rod/Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, $f'_c \geq$ **3,000** (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 (25.4)	400 (1.8)	2,040 (9.2)	100 (0.4)	510 (2.3)	760 (3.4)	2,040 (9.2)	190 (0.8)	510 (2.3)
3/8 (9.5)	1 9/16 (39.7)	600 (2.7)	2,760 (12.3)	150 (0.7)	690 (3.1)	960 (4.3)	2,760 (12.3)	240 (1.1)	690 (3.1)
1/2 (12.7)	2 (50.8)	-	-	-	-	2,740 (12.3)	5,560 (25.0)	685 (3.1)	1,390 (6.3)

1. The values listed above are ultimate and allowable load capacities for carbon steel anchors installed in sand-lightweight concrete.
2. Allowable load capacities are calculated using a safety factor of 4.0. Consideration of safety factors of 10 or higher may be necessary depending on the application, such as life safety or overhead.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria.
4. Flute edge distance equals one-half the minimum deck width.
5. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



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DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

$$\left(\frac{N_u}{N_n}\right)^{\frac{5}{3}} + \left(\frac{V_u}{V_n}\right)^{\frac{5}{3}} \leq 1 \quad \text{or} \quad \left(\frac{N_u}{N_n}\right) + \left(\frac{V_u}{V_n}\right) \leq 1$$

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

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	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{N_C} = 1.0$	$c_{min} = 7d$	$F_{N_C} = 0.90$
	Shear	$c_{cr} = 14d$	$F_{V_C} = 1.0$	$c_{min} = 7d$	$F_{V_C} = 0.50$

Anchor Installed in Lightweight 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	$s_{cr} = 3.0h_v$	$F_{N_S} = F_{V_S} = 1.0$	$s_{min} = 1.5h_v$	$F_{N_S} = F_{V_S} = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 14d$	$F_{N_C} = 1.0$	$c_{min} = 7d$	$F_{N_C} = 0.80$
	Shear	$c_{cr} = 14d$	$F_{V_C} = 1.0$	$c_{min} = 7d$	$F_{V_C} = 0.50$

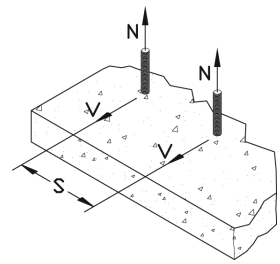
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight and Lightweight Concrete

Spacing, Tension (F_{NS}) & Shear (F_{VS})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
h_v (in.)		1	1 1/2	2	2 1/2	3
s_{cr} (in.)		3	4 1/2	6	7 1/2	9
s_{min} (in.)		1 1/2	2 1/4	3	3 3/4	4 1/2
Spacing, s (inches)	1 1/2	0.50				
	2 1/4	0.75	0.50			
	3	1.00	0.67	0.50		
	3 3/4		0.83	0.63	0.50	
	4		0.89	0.67	0.53	
	4 1/2		1.000	0.75	0.60	0.50
	5			0.83	0.67	0.56
	6			1.00	0.80	0.67
	7 1/2				1.00	0.83
	9					1.00

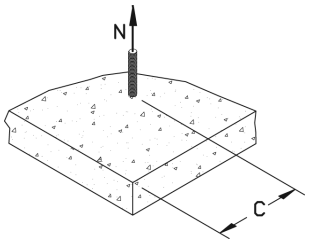
Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 3 embedment depths ($3h_v$) at which the anchor achieves 100% of load. Minimum spacing (s_{min}) is equal to 1.5 embedment depths ($1.5h_v$) at which the anchor achieves 50% of load.



Edge Distance, Tension (F_{NC}) (Normal-Weight concrete only)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3 1/2	5 1/4	7	8 3/4	10 1/2
c_{min} (in.)		1 3/4	2 5/8	3 1/2	4 3/8	5 1/4
Edge Distance, c (inches)	1 3/4	0.90				
	2	0.91				
	2 5/8	0.95	0.90			
	3	0.97	0.91			
	3 1/2	1.00	0.93	0.90		
	4 3/8		0.97	0.93	0.90	
	5 1/4		1.00	0.95	0.92	0.90
	6			0.97	0.94	0.91
	7			1.00	0.96	0.93
	8				0.98	0.95
	8 3/4				1.00	0.97
	10 1/2					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 90% of load for normal-weight concrete and 80% of load for lightweight concrete.



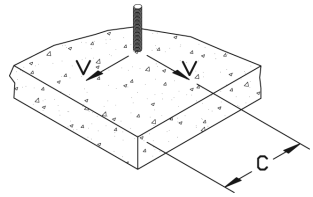
Edge Distance, Tension (F_{NC}) (Lightweight concrete only)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3 1/2	5 1/4	7	8 3/4	10 1/2
c_{min} (in.)		1 3/4	2 5/8	3 1/2	4 3/8	5 1/4
Edge Distance, c (inches)	1 3/4	0.80				
	2	0.83				
	2 5/8	0.90	0.80			
	3	0.94	0.83			
	3 1/2	1.00	0.87	0.80		
	4 3/8		0.93	0.85	0.80	
	5 1/4		1.00	0.90	0.84	0.80
	6			0.94	0.87	0.83
	7			1.00	0.92	0.87
	8				0.97	0.90
	8 3/4				1.00	0.93
	10 1/2					1.00

Edge Distance, Shear (F_{VC})

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3 1/2	5 1/4	7	8 3/4	10 1/2
c_{min} (in.)		1 3/4	2 5/8	3 1/2	4 3/8	5 1/4
Edge Distance, c (inches)	1 3/4	0.50				
	2	0.57				
	2 5/8	0.75	0.50			
	3	0.86	0.57			
	3 1/2	1.00	0.67	0.50		
	4 3/8		0.83	0.63	0.50	
	5		0.95	0.71	0.57	
	5 1/4		1.00	0.75	0.60	0.50
	6			0.86	0.69	0.57
	7			1.00	0.80	0.67
	8				0.91	0.76
	8 3/4				1.00	0.83
	10					0.95
	10 1/2					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 14 anchor diameters ($14d$) at which the anchor achieves 100% of load. Minimum edge distance (c_{min}) is equal to 7 anchor diameters ($7d$) at which the anchor achieves 50% of load.



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ORDERING INFORMATION

Carbon Steel Smooth Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6304	1/4"	1"	7/16"	100	1,000	2	-
6306	3/8"	1 9/16"	5/8"	50	500	6	FM/UL
6308	1/2"	2"	13/16"	50	250	12	FM/UL
6320	5/8"	2 1/2"	1 3/16"	25	125	32	FM/UL
6312	3/4"	3 3/16"	1 3/8"	10	50	48	FM/UL

Carbon Steel Knurled Wall Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6340	1/4"	1"	7/16"	100	1,000	2	-
6342	3/8"	1 9/16"	5/8"	50	500	6	-
6344	1/2"	2"	13/16"	50	250	12	-

Carbon Steel Flanged Dropin (Lipped)

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6324	1/4"	1"	7/16"	100	1,000	2	-
6326	3/8"	1 9/16"	5/8"	50	500	6	FM/UL
6328	1/2"	2"	13/16"	50	250	12	FM/UL

Type 303 Stainless Steel Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6204	1/4"	1"	7/16"	100	1,000	2	-
6206	3/8"	1 9/16"	5/8"	50	500	6	FM/UL
6208	1/2"	2"	13/16"	50	250	12	FM/UL
6210	5/8"	2 1/2"	1 3/16"	25	125	32	FM/UL
6212	3/4"	3 3/16"	1 3/8"	10	50	48	FM/UL

Type 316 Stainless Steel Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6224	1/4"	1"	7/16"	100	1,000	2	-
6226	3/8"	1 9/16"	5/8"	50	500	6	FM/UL
6228	1/2"	2"	13/16"	50	250	12	FM/UL
6230	5/8"	2 1/2"	1 3/16"	25	125	32	FM/UL
6232	3/4"	3 3/16"	1 3/8"	10	50	48	FM/UL

Carbon Steel Coil Thread Dropin

Cat. No.	Rod/Anchor Size	Overall Length	Thread Depth	Std. Box	Std. Carton	Wt./100	FM or UL
6330	1/2"	2"	13/16"	50	250	12	-
6332	3/4"	3 3/16"	1 3/8"	10	50	48	-

Setting Tools for Steel Dropin

Cat. No.	6305	6307	6309	6311	6313
Rod/Anchor Size	1/4"	3/8"	1/2"	5/8"	3/4"
Pin Length	39/64"	61/64"	1 3/16"	1 5/16"	1 61/64"