Smart DI+ *Internally Threaded Expansion Anchor*

PRODUCT DESCRIPTION

The Smart DI+ is an all-steel, machine bolt anchor available in carbon steel. It can be used in solid concrete, hard stone, and solid block base materials. The Smart DI+ is specifically designed to be easier to fully set during installation as a benefit to the user.

GENERAL APPLICATIONS AND USES

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

FEATURES AND BENEFITS

+ Installs with reduced effort compared to traditional drop in style anchors.
+ Can be installed using the Powers manual setting tool or Powers Smart DI+ System with a hammer-drill
+ Setting indicater makes identification of properly set anchors easy (when installed using the Smart Tool and Smart Bit).
+ Internally threaded anchor for easy bolt removability and service work

TESTING, APPROVALS AND LISTINGS

FM Global (Factory Mutual) - Report No. 3040746 (see ordering information)
Underwriters Laboratory (UL Listed) – File No. EX1289 (N) (see ordering information)

GUIDE SPECIFICATIONS

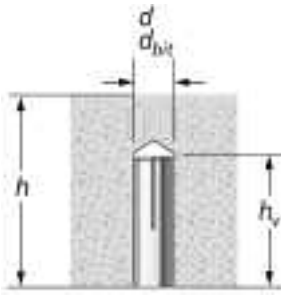
CSI Divisions: *03151-Concrete Anchoring* and *05090-Metal Fastenings.* Dropin anchors shall be Smart DI+ as supplied by Powers Fasteners, Inc., Brewster, NY.

MATERIAL SPECIFICATIONS

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

INSTALLATION SPECIFICATIONS

Anchor (Rod) Size	Rod/Anchor Diameter 1/4"	3/8"	1/2"	5/8"	3/4"
Nominal Outside Diameter d (in.)	0.375	0.500	0.625	0.875	1.000
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8	7/8	1
Maximum Tightening Torque, T_{max} (ft.-lbs.)	5	10	20	40	80
Thread Size (UNC)	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10
Thread Depth (in.)	7/16	5/8	13/16	1 3/16	1 3/8
Anchor Length l, h_v (in.)	1	1 9/16	2	2 1/2	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

SECTION CONTENTS Page No.

Smart DI+

THREAD VERSION

UNC Coarse Thread

ANCHOR MATERIALS

Zinc Plated Carbon Steel

ROD/ANCHOR SIZE RANGE (TYP.)

1/4" to 3/4" diameter
UNC Coarse Thread

SUITABLE BASE MATERIALS

Normal-weight Concrete

STANDARD DROP-IN

SMART DI+ DROP-IN

- Easier to Set
- More Expansion
- Expansion Indicator

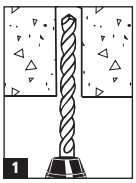
Anchor prior to installation

When properly set, anchor indicator will leave blue paint in reccessed cavities

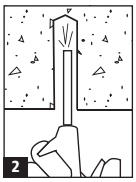
B

INSTALLATION SPECIFICATIONS (Continued)

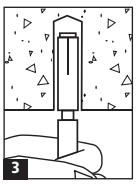
Manual Installation



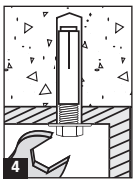
1. Drill a hole into the base material to the depth of embedment required. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Use any ANSI Standard carbide drill bit.



2. Blow the hole clean of dust and other materials. Insert the anchor into the hole and, if necessary tap flush with surface.

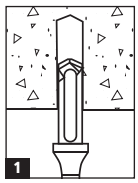


3. Using a Powers manual setting tool specifically, set the anchor by driving the tool with a sufficient number of hammer blows until the shoulder of the tool is seated against the anchor. Anchor will not hold allowable loads required if shoulder of Powers manual setting tool does not seat against anchor.

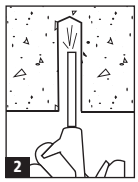


4. If using a fixture, position it, insert bolt and tighten so as not to exceed the maximum tighting torque. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

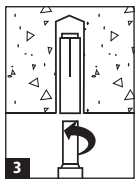
Smart Installation



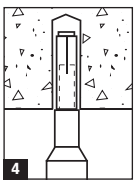
1. Drill a hole into the base material to the depth of embedment required using the appropriate Powers Smart Bit. The tolerances of the drill bit used must meet the requirements of ANSI Standard B212.15. Standard installation with a Smart Bit may result in the anchor being slightly subset from the surface. Minimum published embedment depths must be achieved by using the shoulder of the Smart Bit as a guide.



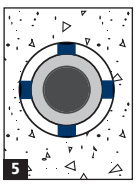
2. Blow the hole clean of dust and other materials. Insert the anchor into the hole and, if necessary, tap flush with the surface.



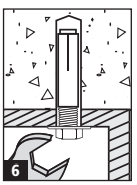
3. Slide the appropriate Powers Smart Tool over the Smart Bit used to drill the hole and twist counterclockwise to lock the setting tool onto the bit.



4. Once attached, insert the tip of the setting tool into the Smart DI+ anchor and drive the internal plug fully using the rotation with hammer mode of the SDS+ drill (see table below for suggested tools).



5. For proper installation, the shoulder of the setting tool must come briefly in full contact with the Smart DI+ resulting in the blue indicator paint being removed from the raised top of the anchor. The paint will remain in the recessed portion of the top indicating full expansion.



6. If using a fixture, position it, insert the bolt and tighten so as not to exceed the maximum tightening torque. Most overhead applications utilize threaded rod. Minimum thread engagement should be at least one anchor diameter.

Recommended SDS+ Rotary Hammer Drill Specification (for Smart DI+ with Smart Installation)

Diameter	Concrete Strength (psi)	Rated Tool Impact Energy Suggested Range* (ft-lbs)	Recommended Rotary Hammer Tool Part Number
1/4"	2,500	1.3 - 2.6	DH24PF3
	6,500	2.0 - 3.5	
3/8"	2,500	1.3 - 4.0	DH24PF3
	6,500	2.1 - 4.0	
1/2"	2,500	2.0 - 4.0	DH24PF3
	6,500	2.5 - 4.0	DH28PC

* Local concrete conditions and rotary hammer impact efficiency vary greatly. Please verify that the tool impact energy is sufficient to fully set the internal plug of the Smart DI+ prior to using the system.

PERFORMANCE DATA

Ultimate Load Capacities for Smart DI+ in Normal-Weight Concrete[1,2]

Nominal Anchor Diameter d in.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength - f'c (psi)							
		2,500		3,000		4,000		6,000	
		Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)
1/4	1	1,300	2,495	1,390	2,510	1,565	2,550	1,910	2,620
3/8	1 9/16	1,985	4,160	2,275	4,360	2,850	4,755	4,000	5,550
1/2	2	3,630	7,170	3,815	7,280	4,190	7,505	4,935	7,955
5/8	2 1/2	5,765	9,850	6,290	10,805	7,335	12,710	9,430	16,525
3/4	3 3/16	6,200	16,110	7,320	16,730	9,565	17,975	14,045	20,460

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.

Allowable Load Capacities for Smart DI+ in Normal-Weight Concrete[1,2,3]

Nominal Anchor Diameter d in.	Minimum Embedment Depth in.	Minimum Concrete Compressive Strength - f'c (psi)							
		2,500		3,000		4,000		6,000	
		Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)	Tension (lbs.)	Shear (lbs.)
1/4	1	325	623	347	627	391	637	477	655
3/8	1 9/16	496	1,040	568	1,090	712	1,188	1,000	1,387
1/2	2	907	1,792	953	1,820	1,047	1,876	1,233	1,988
5/8	2 1/2	1,441	2,462	1,572	2,701	1,833	3,177	2,357	4,131
3/4	3 3/16	1,550	4,027	1,830	4,182	2,391	4,493	3,511	5,115

1. Allowable load capacities listed are calculated using and applied safety factor of 4.0.
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.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Combined Loading

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

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

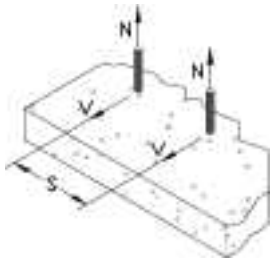
Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

NOTE: 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.

DESIGN CRITERIA (ALLOWABLE STRESS DESIGN)

Load Adjustment Factors for Normal-Weight Concrete

Spacing Distance - Tension						
Dia. (in)		1/4"	3/8"	1/2"	5/8"	3/4"
h_{ef}		1	1 9/16	2	2 1/2	3 3/16
s_{cr}		3	4 1/2	6	7 1/2	9 1/2
s_{min}		1 1/2	2 3/8	3	3 3/4	4 3/4
Spacing Distance (inches)	1/2					
	1					
	1 1/2	0.90				
	2	0.94				
	2 1/2	0.97	0.84			
	3	1.00	0.87	0.85		
	3 1/2		0.91	0.88		
	4		0.95	0.90	0.80	
	4 1/2		1.00	0.93	0.83	
	5			0.95	0.86	0.80
	5 1/2			0.98	0.89	0.82
	6			1.00	0.91	0.84
	6 1/2				0.94	0.87
	7				0.97	0.89
	7 1/2				1.00	0.91
	8					0.93
	8 1/2					0.96
	9					0.98
	9 1/2					1.00

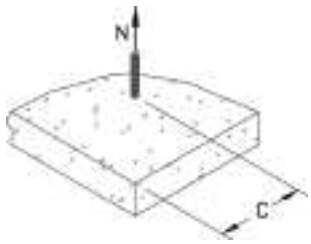


Spacing Reduction Factors -Shear						
Dia. (in)		1/4"	3/8"	1/2"	5/8"	3/4"
h_{ef}		1	1 9/16	2	2 1/2	3 3/16
s_{cr}		3	5	6	7 1/2	9 1/2
s_{min}		1 1/2	2 3/8	3	3 3/4	4 3/4
Spacing Distance (inches)	1/2					
	1					
	1 1/2	0.62				
	2	0.75				
	2 1/2	0.88	0.65			
	3	1.00	0.73	0.62		
	3 1/2		0.81	0.69		
	4		0.89	0.75	0.60	
	4 1/2		0.97	0.81	0.66	
	5		1.00	0.88	0.71	0.60
	5 1/2			0.94	0.77	0.64
	6			1.00	0.83	0.69
	6 1/2				0.89	0.73
	7				0.94	0.78
	7 1/2				1.00	0.82
	8					0.87
	8 1/2					0.91
	9					0.96
	9 1/2					1.00

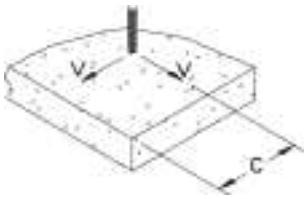
DESIGN CRITERIA (ALLOWABLE STRESS DESIGN) CONTINUED

Load Adjustment Factors for Normal-Weight Concrete

Edge Distance - Tension						
Dia. (in)		1/4"	3/8"	1/2"	5/8"	3/4"
h_{ef}		1	1 9/16	2	2 1/2	3 3/16
c_{cr}		2	4 11/16	6	7 1/2	9 9/16
c_{min}		2	3 1/8	4	5	6 3/8
Edge Distance (inches)	1/2					
	1					
	1 1/2					
	2	1.00				
	2 1/2					
	3					
	3 1/2		0.98			
	4		0.99	0.93		
	4 1/2		1.00	0.95		
	5			0.97	0.85	
	5 1/2			0.98	0.88	
	6			1.00	0.91	
	6 1/2				0.94	0.85
	7				0.97	0.88
	7 1/2				1.00	0.90
	8					0.93
	8 1/2					0.95
	9					0.98
	9 1/2					1.00



Edge Reduction Factors -Shear						
Dia. (in)		1/4"	3/8"	1/2"	5/8"	3/4"
h_{ef}		1	1 9/16	2	2 1/2	3 3/16
c_{cr}		3	4 11/16	6	7 1/2	9 9/16
c_{min}		2	3 1/8	4	5	6 3/8
Edge Distance (inches)	1/2					
	1					
	1 1/2					
	2	0.87				
	2 1/2	0.94				
	3	1.00				
	3 1/2		0.96			
	4		0.98	0.91		
	4 1/2		1.00	0.93		
	5			0.95	0.85	
	5 1/2			0.98	0.88	
	6			1.00	0.91	
	6 1/2				0.94	0.85
	7				0.97	0.88
	7 1/2				1.00	0.90
	8					0.93
	8 1/2					0.95
	9					0.98
	9 1/2					1.00



ORDERING INFORMATION

Smart DI+ Carbon Steel Smooth Wall Dropin

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

Smart Tool

Cat. No.	00425SD	00427SD	00429SD
Rod/Anchor Size	1/4"	3/8"	1/2"
Pin Length	39/64"	61/64"	1 3/16"

Smart Bit

Cat. No.	00391SD	00397SD	00410SD
Description	Smart Bit for 1/4"	Smart Bit for 3/8"	Smart Bit for 1/2"
Bit Diameter	3/8″	1/2″	5/8″

Manual Setting Tools for Smart DI+

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"

Recommended Rotary Hammer Drills

Powers Cat. No.	Description
DH24PF3	**Hitachi DH24PF3,** 15/16″ SDS Plus Rotary Hammer, 3-Mode (D-Handle)
DH25DAL	**Hitachi DH24DAL,** 25.2V Lithium Ion SDS Plus Rotary Hammer (3.0Ah)
DH28PC	**Hitachi DH28PC,** 720W SDS Plus Rotary Hammer(110 Volt) For High Strength Concrete