

PennEngineering®

SELF-CLINCHING STUDS AND PINS



BULLETIN

FH



708
REV. 809A

SELF-CLINCHING STUDS AND PINS

FH (flush-head) Studs are installed by placing them in properly sized holes in the sheets and squeezing into place with any standard press. The squeezing action embeds the head of the stud into the sheet. The metal displaced by the head flows smoothly and evenly around the ribs and into the annular groove – creating a flush-head assembly and securely locking the stud into the sheet with high torque-out and pushout resistances. **(See page FH-4)**. Also available unthreaded on special order. **(See page FH-10)**

FH4 & FHP (flush-head) Studs for Stainless Steel are designed to provide strong threads in stainless steel sheets as thin as .040" / 1 mm. Type FHP studs have high corrosion resistance. Both types are designed for use in stainless steel sheets with a hardness of 92 or less on the Rockwell "B" scale. **(See page FH-5)**

FHL (low-displacement head) Studs install closer to the edge of a sheet than PEM Types FH/FHS studs without causing that edge to bulge. **(See page FH-6)**

TFH (non-flush) Studs are for sheets as thin as .020 inches / 0.51 mm. They may also be used in thicker sheets where flush head studs are not required. TFH studs are installed in the sheets in the same manner as flush-head studs; however, different punches and anvils are required. When installed, the TFH stud will be securely locked into the thin sheet with ample torque-out and pushout resistances. The stud head will not be flush but will project above the sheet surface approximately .025 in. / 0.64 mm. **(See page FH-7)**

HFE (high-strength) Studs are designed with an enlarged head diameter to provide maximum pull through in sheets as thin as .040" / 1 mm. **(See page FH-8)**

HFH (high-strength) Studs replace weld studs with easier installation at lower costs. The large stud head which projects above the sheet material distributes the axial tightening force over a large area thereby improving pull through resistance. **(See page FH-9)**

HFHB (BUSBAR®) Studs are ideal for applications which demand superior electrical/mechanical attachment points. Phosphor bronze studs offer twice the conductivity of carbon steel studs. **(See page FH-9)**

TPS, TP4, and TPXS (flush-head) Pilot Pins satisfy a wide range of positioning, pivot, and alignment applications. The chamfered end makes mating hole location easy. **(See page FH-11)**

Dog Point and Anti Cross-Thread Options. **(See page FH-12)**

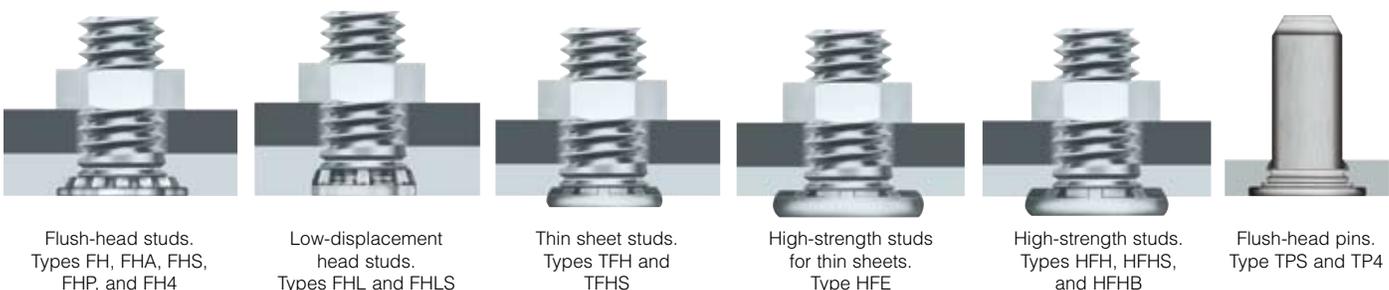
Material and finish specifications. **(See page FH-13)**

Installation. **(See pages FH-13 through FH-17)**

Performance data. **(See pages FH-18 through FH-22)**

Other considerations. **(See page FH-23)**

Self-clinching fastener installation do's and don't's. **(See page FH-24)**



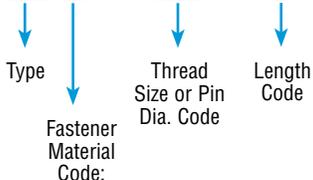
PEM® SELF-CLINCHING STUD SELECTOR GUIDE

PEM Stud Type	Page No.	Application Requires:								
		Flush-head	Superior Strength	Sheet thickness as thin as .020" / 0.51mm	Superior electrical conductivity	Installation into stainless steel sheets	Compatibility with aluminum anodizing	Superior corrosion resistance	Closest centerline-to-edge distance	Unthreaded stud/pin
FH	4	•								
FHA	4	•					•	•		
FHS	4	•						•		
FH4	5	•				•				
FHP	5	•				•		•		
FHL	6	•							•	
FHLS	6	•						•	•	
TFH	7			•						
TFHS	7			•				•		
HFE	8		•							
HFH	9		•							
HFHB	9				•			•		
HFHS	9		•					•		
FH Unthreaded	10	•								•
FHA Unthreaded	10	•					•	•		•
FHN Unthreaded	10	•								•
FHS Unthreaded	10	•						•		•
TPS	11	•						•		•
TP4	11	•				•				•
TPXS	11	•						•		•

Standard product features shown above. Studs can also be custom designed to meet your exact application requirements.

PART NUMBER DESIGNATION

FH A - 632 - 6 ZI



None = heat-treated carbon steel
 A = aluminum
 B = phosphor bronze
 S = 300 series stainless steel
 4 = 400 series stainless steel
 P = precipitation hardening grade stainless steel

Finish Code:
 ZI or ZC on steel studs.
 X on HFHB.
 None on stainless steel and aluminum studs.

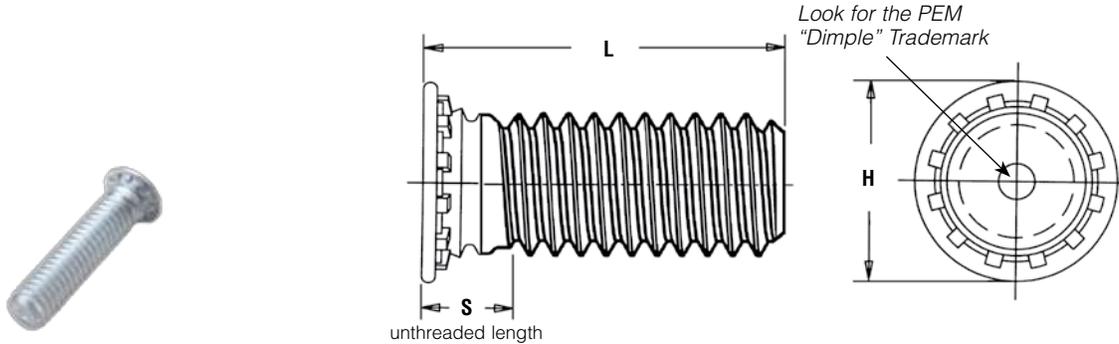
To be sure that you are getting genuine PEM® brand self-clinching studs, look for the "dimple" trademark. (Reg. Pat. & T.M. Off. of the U.S. and other countries.)

The Trademark for Quality



TYPES FH, FHS, AND FHA THREADED STUDS

- Flush-head for sheet thickness of .040" / 1 mm and greater.
- Type FH is recommended for use in steel or aluminum sheets HRB 80 or less on the Rockwell "B" scale.
- Type FHS is recommended for use in steel or aluminum sheets HRB 70 or less on the Rockwell "B" scale.
- Type FHA is recommended for use in aluminum sheets HRB 50 or less on the Rockwell "B" scale.



All dimensions are in inches.

UNIFIED	Thread Size	Type			Thread Code	Length Code "L" ±.015 (Length Code in 16ths of an inch)										Min. Sheet Thickness (1)	Hole Size in Sheet +.003 - .000	Max. Hole in Attach. Parts	H ± .015	S Max. (2)	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel	Aluminum		.250	.312	.375	.500	.625	.750	.875	1.00	1.25	1.50						
	.086-56 (#2-56)	FH	FHS	NA	256	4	5	6	8	10	12	NA	NA	NA	NA	.040	.085	.105	.144	.075	.187
	.112-40 (#4-40)	FH	FHS	FHA	440	4	5	6	8	10	12	14	16	20	NA	.040	.111	.135	.176	.085	.219
	.138-32 (#6-32)	FH	FHS	FHA	632	4	5	6	8	10	12	14	16	20	24	.040	.137	.160	.206	.090	.250
	.164-32 (#8-32)	FH	FHS	FHA	832	4	5	6	8	10	12	14	16	20	24	.040	.163	.185	.237	.090	.281
	.190-24 (#10-24)	FH	FHS	FHA	024	NA	5	6	8	10	12	14	16	20	24	.040	.189	.210	.256	.100	.281
	.190-32 (#10-32)	FH	FHS	FHA	032	NA	5	6	8	10	12	14	16	20	24	.040	.189	.210	.256	.100	.281
	.250-20 (1/4-20)	FH	FHS	FHA	0420	NA	NA	6	8	10	12	14	16	20	24	.062	.249	.270	.337	.135	.312
	.313-18 (5/16-18)	FH	FHS	NA	0518	NA	NA	NA	8	10	12	14	16	20	24	.093	.311	.333	.376	.160	.375

All dimensions are in millimeters.

METRIC	Thread Size x Pitch	Type			Thread Code	Length Code "L" ±0.4 (Length Code in millimeters)										Min. Sheet Thickness (1)	Hole Size in Sheet +0.08	Max. Hole in Attach. Parts	H ± 0.4	S Max. (2)	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel	Aluminum		6	8	10	12	15	18	20	25	30	35						
	M2.5 x 0.45	FH	FHS	FHA	M2.5	6	8	10	12	15	18	NA	NA	NA	NA	1	2.5	3.1	4.1	1.95	5.4
	M3 x 0.5	FH	FHS	FHA	M3	6	8	10	12	15	18	20	25	NA	NA	1	3	3.6	4.6	2.1	5.6
	M3.5 x 0.6	FH	FHS	FHA	M3.5	6	8	10	12	15	18	20	25	30	NA	1	3.5	4.1	5.3	2.25	6.4
	M4 x 0.7	FH	FHS	FHA	M4	6	8	10	12	15	18	20	25	30	35	1	4	4.6	5.9	2.4	7.2
	M5 x 0.8	FH	FHS	FHA	M5	NA	8	10	12	15	18	20	25	30	35	1	5	5.6	6.5	2.7	7.2
	M6 x 1	FH	FHS	FHA	M6	NA	NA	10	12	15	18	20	25	30	35	1.6	6	6.6	8.2	3	7.9
	M8 x 1.25	FH	FHS	NA	M8	NA	NA	NA	12	15	18	20	25	30	35	2.4	8	8.6	9.6	3.7	9.6

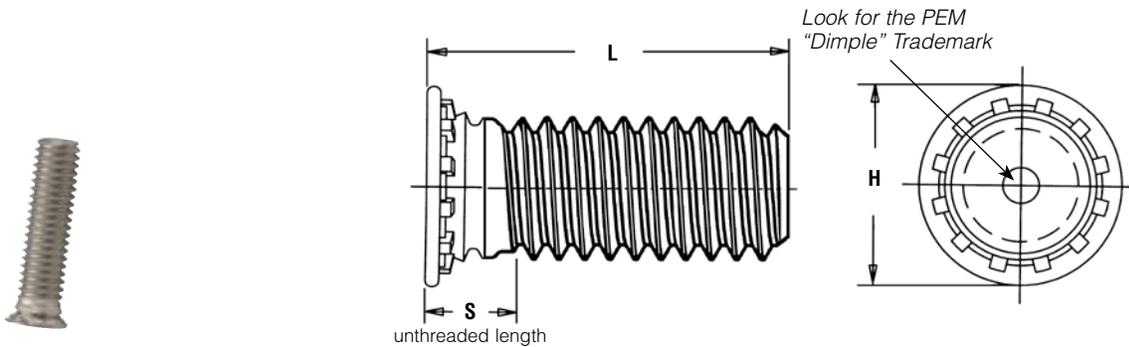
(1) See page FH-13 for installation tool requirements.

(2) Threads are gageable to within 2 pitches of the "S" Max. dimension. A class 3A/5H maximum material commercial nut shall pass up to the "S" Max. dimension.

NA Not Available.

TYPES FH4™ AND FHP™ STUDS FOR STAINLESS STEEL SHEETS

- Recommended for use in stainless steel sheets HRB 92 or less on the Rockwell “B” scale.
- Type FHP is high corrosion resistant and ideal for medical, foodservice, and marine applications.



All dimensions are in inches.

UNIFIED	Thread Size	Type		Thread Code	Length Code “L” ±.015 (Length code in 16ths of an inch)										Sheet Thickness	Hole Size in Sheet +.003 -.000	Max. Hole in Attach. Parts	H ±.015	S Max. (2)	Min. Dist. Hole C/L to Edge
		FH4	FHP		.250	.312	.375	.500	.625	.750	.875	1.00	1.25	1.50						
	.112-40 (#4-40)	FH4	FHP	440	4	5	6	8	10	12	14	16	NA	NA	.040-.095	.111	.135	.176	.085	.219
	.138-32 (#6-32)	FH4	FHP	632	4	5	6	8	10	12	14	16	20	24	.040-.095	.137	.160	.206	.090	.250
	.164-32 (#8-32)	FH4	FHP	832	4	5	6	8	10	12	14	16	20	24	.040-.095	.163	.185	.237	.090	.281
	.190-32 (#10-32)	FH4	FHP	032	NA	5	6	8	10	12	14	16	20	24	.040-.095	.189	.210	.256	.100	.281
	.250-20 (1/4-20)	FH4	NA	0420	NA	NA	6	8	10	12	14	16	20	24	.062-.117	.249	.270	.337	.135	.312

All dimensions are in millimeters.

METRIC	Thread Size x Pitch	Type		Thread Code	Length Code “L” ±0.4 (Length Code in millimeters)										Sheet Thickness	Hole Size in Sheet +0.08	Max. Hole in Attach. parts	H ±0.4	S Max. (2)	Min. Dist. Hole C/L to Edge
		FH4	FHP		6	8	10	12	15	18	20	25	30	35						
	M3 x 0.5	FH4	FHP	M3	6	8	10	12	15	18	20	25	NA	NA	1 - 2.4	3	3.6	4.6	2.1	5.6
	M4 x 0.7	FH4	FHP	M4	6	8	10	12	15	18	20	25	30	35	1 - 2.4	4	4.6	5.9	2.4	7.2
	M5 x 0.8	FH4	FHP	M5	NA	8	10	12	15	18	20	25	30	35	1 - 2.4	5	5.6	6.5	2.7	7.2
	M6 x 1	FH4	NA	M6	NA	NA	10	12	15	18	20	25	30	35	1.6 - 3	6	6.6	8.2	3	7.9

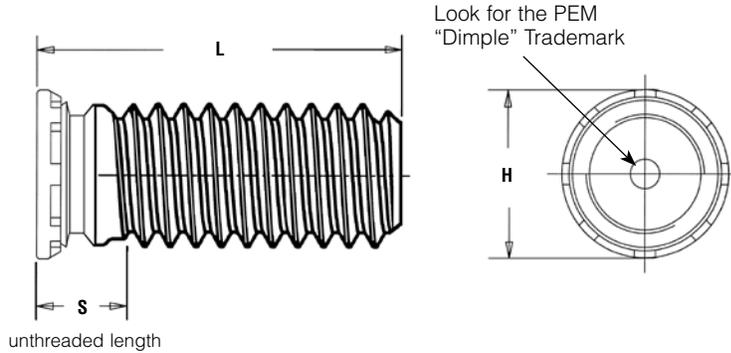
(1) See material and finish specifications chart on page FH-13 for details.

(2) Threads are gageable to within 2 pitches of the “S” Max. dimension. A class 3A/5H maximum material commercial nut shall pass up to the “S” Max. dimension.

NA Not Available.

TYPE FHL™ AND FHLS™ LOW-DISPLACEMENT HEAD STUDS

- Installs closer to the edge of a sheet than PEM Type FH/FHS studs without causing that edge to bulge.
- Flush-head for sheet thickness .040" / 1 mm and greater.
- Type FHL is recommended for use in steel or aluminum sheets HRB 80 or less on the Rockwell "B" scale.
- Type FHLS is recommended for use in steel or aluminum sheets HRB 70 or less on the Rockwell "B" scale.



All dimensions are in inches.

UNIFIED	Thread Size	Type		Thread Code	Length Code "L" ±.015 (Length Code in 16ths of an inch)									Min. Sheet Thickness (1)	Hole Size in Sheet +.003 - .000	Max. Hole in Attach. Parts	H ±.015	S Max. (2)	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel		.250	.312	.375	.500	.625	.750	.875	1.00	1.25						
	.086-56 (#2-56)	FHL	FHLS	256	4	5	6	8	10	12	NA	NA	NA	NA	.040	.085	.100	.112	.080
.112-40 (#4-40)	FHL	FHLS	440	4	5	6	8	10	12	14	16	NA	NA	.040	.111	.125	.138	.085	.124
.138-32 (#6-32)	FHL	FHLS	632	4	5	6	8	10	12	14	16	20	24	.040	.137	.150	.164	.090	.150
.164-32 (#8-32)	FHL	FHLS	832	4	5	6	8	10	12	14	16	20	24	.040	.163	.180	.190	.090	.176
.190-32 (#10-32)	FHL	FHLS	032	NA	5	6	8	10	12	14	16	20	24	.040	.189	.205	.225	.100	.210

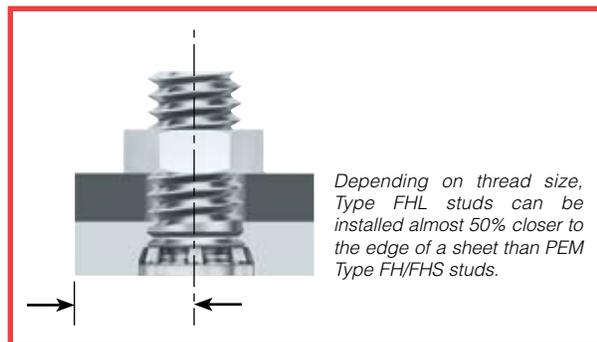
All dimensions are in millimeters.

METRIC	Thread Size x Pitch	Type		Thread Code	Length Code "L" ±0.4 (Length Code in millimeters)									Min. Sheet Thickness (1)	Hole Size in Sheet +0.08	Max. Hole in Attach. Parts	H ±0.4	S Max. (2)	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel		6	8	10	12	15	18	20	25	30						
	M2.5 x 0.45	FHL	FHLS	M2.5	6	8	10	12	15	18	NA	NA	NA	NA	1	2.5	2.9	3.15	2.1
M3 x 0.5	FHL	FHLS	M3	6	8	10	12	15	18	20	25	NA	NA	1	3	3.4	3.65	2.1	3.3
M3.5 x 0.6	FHL	FHLS	M3.5	6	8	10	12	15	18	20	25	30	NA	1	3.5	3.9	4.15	2.3	3.8
M4 x 0.7	FHL	FHLS	M4	6	8	10	12	15	18	20	25	30	35	1	4	4.4	4.65	2.4	4.3
M5 x 0.8	FHL	FHLS	M5	NA	8	10	12	15	18	20	25	30	35	1	5	5.4	5.9	2.7	5.6

(1) See page FH-15 for installation tool requirements.

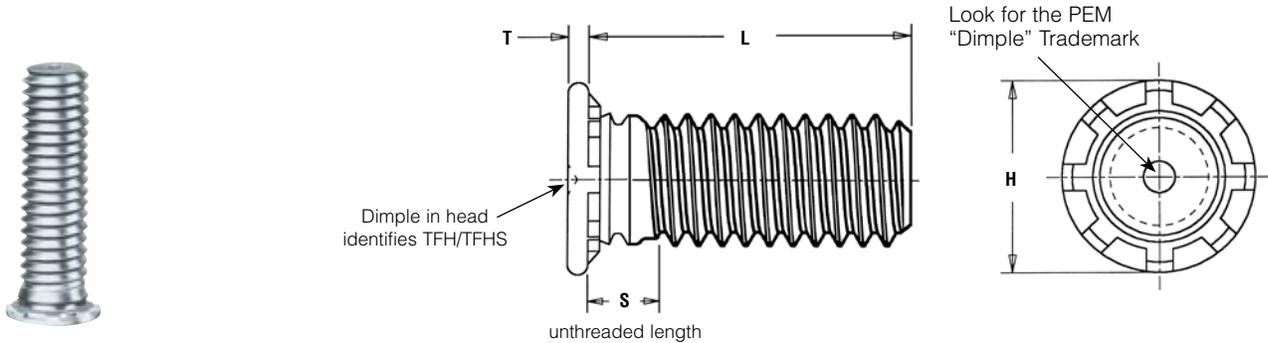
(2) Threads are gageable to within 2 pitches of the "S" Max. dimension. A class 3A/5H maximum material commercial nut shall pass up to the "S" Max. dimension.

NA Not Available.



TYPES TFH AND TFHS NON-FLUSH STUDS

- Non-flush for sheets as thin as .020" / 0.51 mm.
- Type TFH is recommended for use in steel or aluminum sheets HRB 80 or less on the Rockwell "B" scale.
- Type TFHS is recommended for use in steel or aluminum sheets HRB 70 or less on the Rockwell "B" scale.



All dimensions are in inches.

UNIFIED	Thread Size	Type		Thread Code	Length Code "L" ±.015 (Length Code in 16ths of an inch)										Min. Sheet Thickness (1)	Hole Size in Sheet +.003 -.000	Max. Hole in Attach. Parts	H ±.015	S Max. (2)	T Max.	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel		.250	.312	.375	.500	.625	.750	.875	1.00	1.25	1.50							
		.086-56 (#2-56)	TFH		TFHS	256	4	5	6	8	10	12	NA	NA							
.112-40 (#4-40)	TFH	TFHS	440	4	5	6	8	10	12	14	NA	NA	NA	.020	.111	.135	.176	.070	.025	.219	
.138-32 (#6-32)	TFH	TFHS	632	4	5	6	8	10	12	14	16	20	24	.020	.137	.160	.203	.070	.025	.250	
.164-32 (#8-32)	TFH	TFHS	832	4	5	6	8	10	12	14	16	20	24	.020	.163	.185	.234	.070	.025	.281	
.190-24 (#10-24)	TFH	TFHS	024	NA	5	6	8	10	12	14	16	20	24	.020	.189	.210	.250	.090	.025	.281	
.190-32 (#10-32)	TFH	TFHS	032	NA	5	6	8	10	12	14	16	20	24	.020	.189	.210	.250	.090	.025	.281	

All dimensions are in millimeters.

METRIC	Thread Size x Pitch	Type		Thread Code	Length Code "L" ±0.4 (Length Code in millimeters)										Min. Sheet Thickness (1)	Hole Size in Sheet +0.08	Max. Hole in Attach. Parts	H ±0.4	S Max. (2)	T Max.	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel		6	8	10	12	15	18	20	25	30	35							
		M3 x 0.5	TFH		TFHS	M3	6	8	10	12	15	18	20	25							
M4 x 0.7	TFH	TFHS	M4	NA	8	10	12	15	18	20	25	30	35	0.51	4	4.6	5.8	1.8	0.64	7.2	
M5 x 0.8	TFH	TFHS	M5	NA	8	10	12	15	18	20	25	30	35	0.51	5	5.6	6.4	2.3	0.64	7.2	

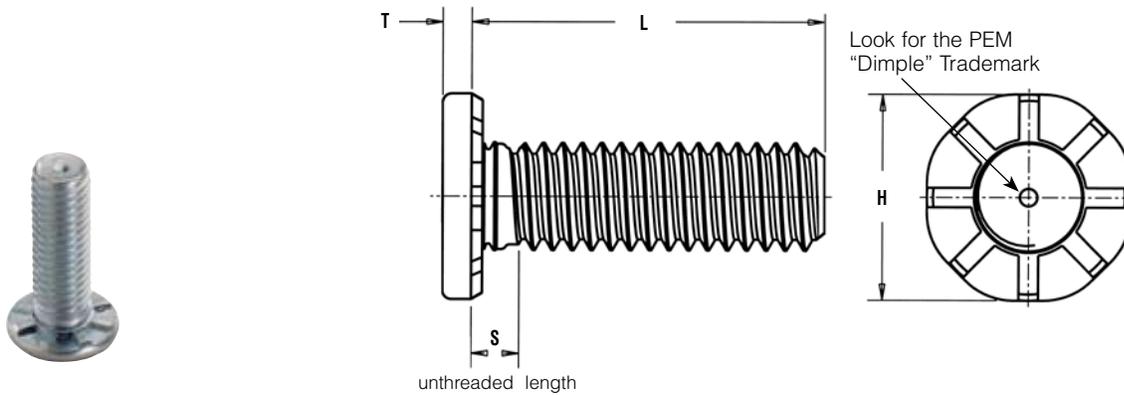
(1) See page FH-15 for installation tool requirements.

(2) Threads are gageable to within 2 pitches of the "S" Max. dimension. A class 3A/5H maximum material commercial nut shall pass up to the "S" Max. dimension.

NA Not Available.

TYPES HFE™ HIGH-STRENGTH STUDS FOR THIN SHEETS

- Enlarged head diameter provides high-strength in sheets as thin as .040" / 1 mm.
- Recommended for use in steel or aluminum sheets HRB 85 or less on the Rockwell "B" scale.



All dimensions are in inches.

UNIFIED	Thread Code	Type	Thread Code	Length Code "L" ±.015 (Length Code in 16ths of an inch)						Min. Sheet Thickness (1)	Hole Size In Sheet +.005 -.000	H ±.01	S Max. (2)	T Max.	Max. Hole In Attached Parts	Min. Dist. Hole C/L To Edge	
	Steel		.500	.750	1.00	1.25	1.50	1.75	2.00								
	.190-32 (#10-32)	HFE	032	8	12	16	20	24	28	32	.040	.190	.357	.102	.048	.280	.360
	.250-20 (1/4-20)	HFE	0420	8	12	16	20	24	28	32	.040	.250	.462	.118	.060	.340	.470
	.313-18 (5/16-18)	HFE	0518	8	12	16	20	24	28	32	.060	.312	.586	.133	.083	.402	.560

Thread strength: 120 ksi

All dimensions are in millimeters.

METRIC	Thread Code x Pitch	Type	Thread Code	Length Code "L" ±.0.4 (Length Code in Millimeters)						Min. Sheet Thickness (1)	Hole Size In Sheet +0.13	H ±0.25	S Max. (2)	T Max.	Max. Hole In Attached Parts	Min. Dist. Hole C/L To Edge	
	Steel		15	20	25	30	35	40	50								
	M5 x 0.8	HFE	M5	15	20	25	30	35	40	50	1	5	9.6	2.6	1.35	7.3	10
	M6 x 1	HFE	M6	15	20	25	30	35	40	50	1	6	11.35	2.8	1.52	8.3	11.5
	M8 x 1.25	HFE	M8	15	20	25	30	35	40	50	1.5	8	15.3	3.3	2.13	10.3	14.5

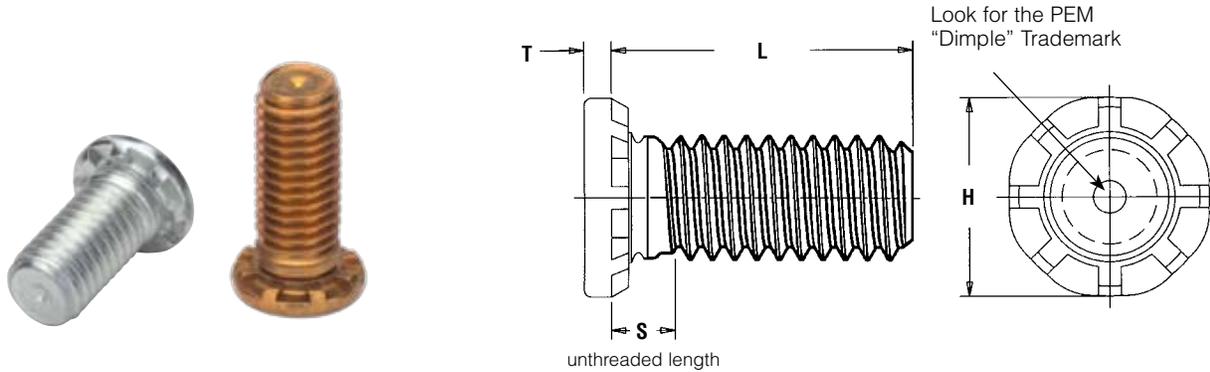
Thread strength: 900 MPa

(1) See page FH-16 for installation tool requirements.

(2) Threads are gageable to within 2 pitches of the "S" Max. dimension. A class 3A/5H maximum material commercial nut shall pass up to the "S" Max. dimension.

TYPES HFH, HFHS, AND HFHB HIGH-STRENGTH STUDS

- Types HFH and HFHS are for high-strength applications in sheets as thin as .050" / 1.3 mm.
- Type HFHB is for superior electrical/mechanical attachment in copper.
- Type HFH is recommended for use in steel or aluminum sheets HRB 85 or less on the Rockwell "B" scale.
- Type HFHS is recommended for use in steel or aluminum sheets HRB 70 or less on the Rockwell "B" scale.
- Type HFHB is recommended for use in copper sheets HRB 55 or less on the Rockwell "B" scale.



All dimensions are in inches.

UNIFIED	Thread Size	Type			Thread Code	Length Code "L" ±.015 (Length Code in 16ths of an inch)						Min. Sheet Thickness	Hole Size in Sheet +.005 -.000	Max. Hole in Attach. Parts	H ±.01	S Max. (2)	T Max.	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel	Phosphor Bronze (1)		.500	.750	1.00	1.25	1.50	1.75							
	.190-32 (#10-32)	HFH	HFHS	HFHB	032	8	12	16	20	24	28	32	.050	.190	.250	.300	.105	.040
.250-20 (1/4-20)	HFH	HFHS	HFHB	0420	8	12	16	20	24	28	32	.060	.250	.312	.380	.125	.050	.460
.313-18 (5/16-18)	HFH	HFHS	HFHB	0518	8	12	16	20	24	28	32	.075	.312	.375	.480	.140	.070	.500
.375-16 (3/8-16)	HFH	HFHS	HFHB	0616	NA	12	16	20	24	28	32	.090	.375	.437	.580	.155	.085	.530

Tensile strength: HFH - 120 ksi / HFHS - 75 ksi / HFHB - 60 ksi.

All dimensions are in millimeters.

METRIC	Thread Size x Pitch	Type			Thread Code	Length code "L" ±0.4 (Length Code in millimeters)						Min. Sheet Thickness	Hole Size in Sheet +0.13	Max. Hole in Attach. Parts	H ±0.25	S Max. (2)	T Max.	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel	Phosphor Bronze(1)		15	20	25	30	35	40							
M5 x 0.8	HFH	HFHS	HFHB	M5	15	20	25	30	35	40	50	1.3	5	6.5	7.8	2.7	1.14	10.7
M6 x 1	HFH	HFHS	HFHB	M6	15	20	25	30	35	40	50	1.5	6	7.5	9.4	2.8	1.27	11.5
M8 x 1.25	HFH	HFHS	HFHB	M8	15	20	25	30	35	40	50	2	8	9.5	12.5	3.5	1.78	12.7
M10 x 1.5	HFH	HFHS	HFHB	M10	15	20	25	30	35	40	50	2.3	10	11.5	15.7	4.1	2.29	13.7

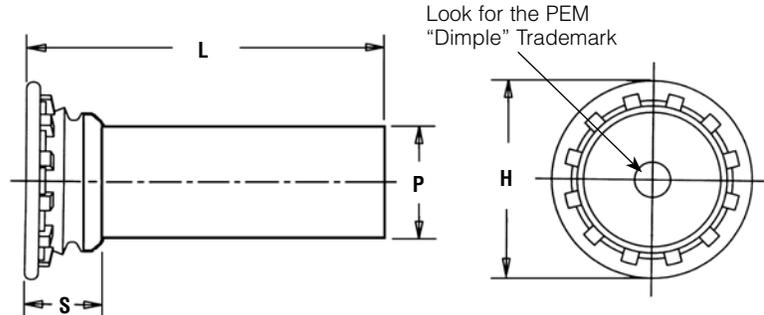
Tensile strength: HFH - 900 MPa / HFHS - 515 MPa / HFHB - 415 MPa.

- (1) The electrical resistance (tested at 10 amps DC) between phosphor bronze studs and copper busbars is below 104μ ohms and 62μ ohms for the #10-32 / M5 and 3/8-16 / M10 thread sizes respectively, after repeated thermal and mechanical cycling. For complete electrical resistance test data for type HFHB studs installed in copper, see bulletin entitled "Electrical Resistance of Type HFHB Studs Installed in Copper" on our website.
 - (2) Threads are gageable to within 2 pitches of the "S" Max. dimension. A class 3A/5H maximum material commercial nut shall pass up to the "S" Max. dimension.
- NA Not Available.

TYPES FH, FHS, AND FHA UNTHREADED STUDS

- Flush-head for sheet thickness of .040" / 1 mm and greater.
- Type FH is recommended for use in steel or aluminum sheets HRB 80 or less on the Rockwell "B" scale.
- Type FHS is recommended for use in steel or aluminum sheets HRB 70 or less on the Rockwell "B" scale.
- Type FHA is recommended for use in aluminum sheets HRB 50 or less on the Rockwell "B" scale.

PEM® unthreaded studs are only available on special order. See Types TPS, TP4, and TPXS pins on page FH-11 for standard diameter pins.



All dimensions are in inches.

UNIFIED	(1) Nominal Pin Diameter P±.002	Type			Pin Dia. Code	Length Code "L" ±.015 (Length Code in 16ths of an inch)										Min. Sheet Thickness	Hole Size in Sheet +.003 -.000	H ± .015	S Max. (2)	Min. Dist. Hole C/L to Edge
		Steel	Stainless Steel	Aluminum		.250	.312	.375	.500	.625	.750	.875	1.00	1.25	1.50					
.073	FH	FHS	FHA	073	4	5	6	8	10	NA	NA	NA	NA	NA	.040	.085	.15	.075	.19	
.084	FH	FHS	FHA	084	4	5	6	8	10	12	NA	NA	NA	NA	.040	.099	.16	.085	.22	
.094	FH	FHS	FHA	094	4	5	6	8	10	12	NA	NA	NA	NA	.040	.111	.18	.085	.22	
.103	FH	FHS	FHA	103	4	5	6	8	10	12	NA	NA	NA	NA	.040	.118	.18	.085	.22	
.106	FH	FHS	FHA	106	4	5	6	8	10	12	14	16	20	NA	.040	.125	.19	.090	.22	
.116	FH	FHS	FHA	116	4	5	6	8	10	12	14	16	20	NA	.040	.137	.21	.090	.25	
.120	FH	FHS	FHA	120	4	5	6	8	10	12	14	16	20	24	.040	.137	.21	.090	.25	
.137	FH	FHS	FHA	137	4	5	6	8	10	12	14	16	20	24	.040	.157	.23	.090	.28	
.141	FH	FHS	FHA	141	4	5	6	8	10	12	14	16	20	24	.040	.163	.24	.090	.28	
.160	FH	FHS	FHA	160	4	5	6	8	10	12	14	16	20	24	.040	.189	.26	.100	.28	
.167	FH	FHS	FHA	167	NA	5	6	8	10	12	14	16	20	24	.040	.189	.26	.100	.28	
.173	FH	FHS	FHA	173	NA	5	6	8	10	12	14	16	20	24	.040	.197	.26	.100	.28	
.207	FH	FHS	FHA	207	NA	5	6	8	10	12	14	16	20	24	.062	.236	.32	.135	.31	
.215	FH	FHS	FHA	215	NA	NA	NA	8	10	12	14	16	20	24	.062	.250	.34	.135	.31	
.223	FH	FHS	FHA	223	NA	NA	NA	8	10	12	14	16	20	24	.062	.250	.34	.135	.31	
.273	FH	FHS	FHA	273	NA	NA	NA	8	10	12	14	16	20	24	.093	.312	.38	.160	.38	
.281	FH	FHS	FHA	281	NA	NA	NA	8	10	12	14	16	20	24	.093	.312	.38	.160	.38	

All dimensions are in millimeters.

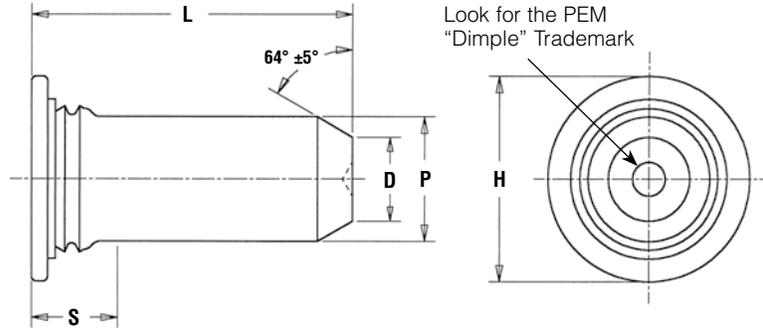
METRIC	(1) Nominal Pin Diameter P±0.05	Type			Pin Dia. Code	Length Code "L" ±0.4 (Length Code in millimeters)										Min. Sheet Thickness	Hole Size in Sheet +0.08	H ± 0.4	S Max. (2)	Min. Dist. Hole C/L to Edge
		Fastener Material				.6	.8	10	12	15	18	20	25	30	35					
		Steel	Stainless Steel	Aluminum																
3	FH	FHS	FHA	3 mm	6	8	10	12	15	18	20	25	30	NA	1	3.5	5.3	2.3	6.4	
4	FH	FHS	FHA	4 mm	NA	8	10	12	15	18	20	25	30	35	1	4.1	6	2.3	7.1	
5	FH	FHS	FHA	5 mm	NA	8	10	12	15	18	20	25	30	35	1	5.5	7.5	2.55	7.6	

(1) Other pin diameters can be specified.
 (2) Pin diameter may exceed max. in this region.
 NA Not Available.

TYPE TPS™ AND TP4™ SELF-CLINCHING PILOT PINS

- Flush-mounted, self-clinching pilot pins.
- Satisfies a wide range of positioning, pivot, and alignment applications.
- Chamfered end makes mating hole location easy.
- Type TPS recommended for use in steel or aluminum sheets HRB 70 or less on the Rockwell “B” scale.
- Type TP4 recommended for use in stainless steel sheets HRB 92 or less on the Rockwell “B” scale.

Now available for installation into stainless steel



All dimensions are in inches.

UNIFIED	Pin Diameter P ± .002	Type		Pin Diameter Code	Length Code “L” ± .015 (Length Code in 16ths of an inch)					Min. Sheet Thickness	Hole Size in Sheet +.003 -.000	D ± .006	H ± .015	S Max. (1)	Min. Distance Hole C/L to Edge
		300 Series Stainless Steel	400 Series Stainless Steel		.375	.500	.625	.750	1.00						
		TPS	TP4												
	.125	TPS	TP4	125	6	8	10	12	NA	.040	.144	.090	.205	.090	.250
	.187	TPS	TP4	187	6	8	10	12	16	.040	.205	.132	.270	.090	.280
	.250	TPS	TP4	250		8	10	12	16	.040	.272	.177	.335	.090	.310

All dimensions are in millimeters.

METRIC	Pin Diameter P ± 0.05	Type		Pin Diameter Code	Length Code “L” ± 0.4 (Length Code in millimeters)					Min. Sheet Thickness	Hole Size in Sheet +0.08	D ± 0.15	H ± 0.4	S Max. (1)	Min. Distance Hole C/L to Edge
		300 Series Stainless Steel	400 Series Stainless Steel		8	10	12	16	NA						
		TPS	TP4		3mm	4mm	5mm	6mm	NA						
	3	TPS	TP4	3mm	8	10	12	16	NA	1	3.5	2.05	5.2	2.29	6.4
	4	TPS	TP4	4mm	8	10	12	16	NA	1	4.5	2.82	6.12	2.29	7.1
	5	TPS	TP4	5mm	NA	10	12	16	20	1	5.5	3.53	7.19	2.29	7.6
	6	TPS	TP4	6mm			12	16	20	1	6.5	4.24	8.13	2.29	7.9

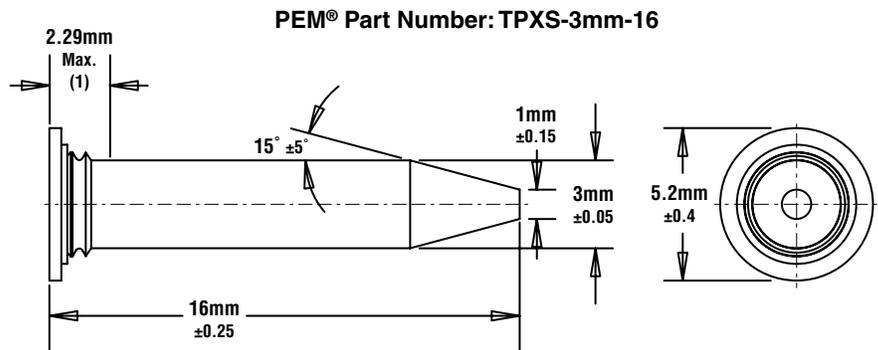
(1) Pin diameter may exceed max. in this region.
NA Not Available.

TYPE TPXS™ SELF-CLINCHING PILOT PIN

- Meets the ATCA PICMG 3.0 specification.
- 15° tapered point makes engaging the mating hole easy.



Min. Sheet Thickness: 1 mm
Hole Size In Sheet: 3.5 mm +0.08
Min. Dist. Hole C/L To Edge: 6.4 mm



(1) Pin diameter may exceed max. in this region.

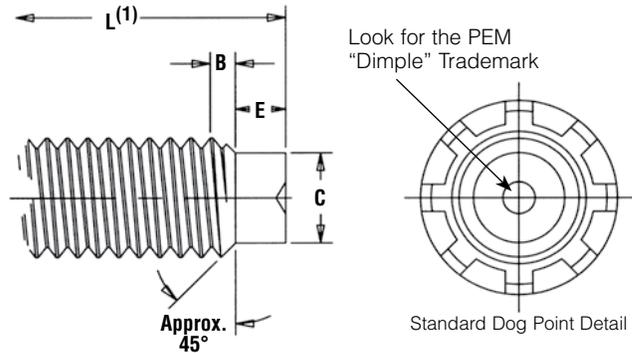
OPTIONAL FEATURES FOR STUDS

DOG POINT FEATURE

PEM® AUTOSPEC® dog point lead-in option for studs allows quick location of the mating fastener during assembly and protects the first thread of the stud during nut enagement. this feature is available on Types FH, HFH, and HFE studs.



Dog Point Stud



All dimensions are in inches.

UNIFIED	Thread Size	C ±.005 (2)	E ±.010	B Nom. Transitional Length to Full Thread
	.138-32 (#6-32)	.086	.050	.098
	.164-32 (#8-32)	.111	.055	.099
	.190-24 (#10-24)	.124	.065	.127
	.190-32 (#10-32)	.138	.065	.098
	.250-20 (1/4-20)	.173	.085	.149
	.250-28 (1/4-28)	.192	.085	.110
	.313-18 (5/16-18)	.228	.105	.164
	.313-24 (5/16-24)	.246	.105	.127
	.375-16 (3/8-16)	.282	.125	.182
.375-24 (3/8-24)	.309	.125	.126	

All dimensions are in millimeters.

METRIC	Thread Size x Pitch	C ±0.13 (2)	E ±0.25	B Nom. Transitional Length to Full Thread
	M3.5 x 0.6	2.4	1.27	1.88
	M4 x 0.7	2.79	1.4	2.26
	M5 x 0.8	3.66	1.78	2.48
	M6 x 1	4.37	2.03	3.05
	M8 x 1.25	6.05	2.67	3.73
	M10 x 1.5	7.72	3.43	4.37

TYPE DESIGNATION

FH



Type:

FH = Flush-head stud
HFH = High-strength stud
HFE = High-strength stud
for thin sheets

D



D = Dog Point
M = MATHread

S



Material:
None = heat-treated carbon steel
A = aluminum
S = 300 series stainless steel

MATHREAD® ANTI CROSS-THREAD FEATURE

PennEngineering is a licensee of MATHread® Anti Cross-Threading Technology. This unique design allows the threads to self-align and drive easily with reduced effort. This helps speed assembly, reduce or eliminate failures, repairs, scrap, downtime, and warranty service associated with thread damage. This option is available on most types of PEM studs.

Here's how it works:



Anti Cross-Thread Feature

Misaligned Axis
The anti cross-threading design offers users the benefit of self-aligning, anti cross-threading threads.

Threads Cam
As the threads come into contact, the patented anti cross-thread begins to cam over the female thread.

Threads Drive Normally
The anti cross-threads promote alignment of the two thread helices. The fasteners drive easily with reduced effort.

(1) For "L" refer to type FH, HFE, or HFH lengths.

(2) Maximum dog point diameter is .003" / 0.08 mm less than minimum minor diameter of 2B or 6H nut threads.

If required, studs are supplied with raw material and plating certifications as required by automotive industry standards.

MATHread is a registered trademark of MATHread inc.

MATERIAL AND FINISH SPECIFICATIONS

Type	Threads (1)	Fastener Materials						Standard Finishes			Optional Finish (2)	For use in Sheet Hardness: (6)					
	External, ANSI B1.1, 2A ANSI/ASME B1.13M 6g	Heat-Treated Carbon Steel	300 Series Stainless Steel	Aluminum (Plain Finish)	CDA #510 Phosphor Bronze	Precipitation Hardening Grade Stainless Steel	400 Series Stainless Steel	No Finish (4)	Zinc plated, 5µm, Colorless (5)	Passivated and/or Tested Per ASTM A380	Zinc plated, 5µm, Yellow (5)	HRB 50 / HB 82 or Less	HRB 55 / HB 83 or Less	HRB 70 / HB 125 or Less	HRB 80 / HB 150 or Less	HRB 85 / HB 165 or Less	HRB 92 / HB 195 or Less
FH	•	•						•		•				•			
FHS	•		•							•			•				
FHA	•			•				• (3)			•						
FH4	•						•			•						•	
FHP	•				•					•						•	
FHL	•	•							•				•				
FHLS	•		•							•			•				
TFH	•	•							•		•			•			
TFHS	•		•							•			•				
HFE	•	•							•		•				•		
HFH	•	•							•		•				•		
HFHB	•				•			•				•					
HFHS	•		•							•			•				
TPS			•							•			•				
TP4							•			•						•	
TPXS			•							•			•				
Part Number Codes for Finishes								X	ZI	None	ZC						

- (1) For plated studs, Class 2A/6g, the maximum major and pitch diameter, after plating, may equal basic sizes and be gauged to Class 3A/4h. Per ANSI B1.1, Section 8, Table 3A and ANSI B1.13M, Section 8, paragraph 8.2.
- (2) Special order with additional charge.
- (3) Part numbers for aluminum studs have no plating suffix.
- (4) "X" suffix studs may have pitch diameters and major diameters below 2A "Basic", per ANSI B1.1, Section 7, and B1.13M, Section 8 to allow for minimum of 0.0002" of plating.
- (5) See PEM Technical Support section of our web site for related plating standards and specifications.
- (6) HRB - Hardness Rockwell "B" Scale. HB - Hardness Brinell.

INSTALLATION

FOR TYPES FH, FHS, FHA, FHL, FHLS, TFH, TFHS AND HFE STUDS

PEM brand self-clinching studs are installed by placing them in properly sized holes in the sheet material and squeezing them into place with any standard press.

All that is required is a flat or recessed punch and a plain anvil having a hole to clear the thread diameter so that force is applied between the top of the stud head and underside of the sheet material. The squeezing action forces the ribs of the stud into the sheet, displacing sheet material, causing it to fill the annular groove under the head of the stud.

The following information provides specifics with regard to stud installation.

All dimensions are in inches.

UNIFIED	Thread Code	Anvil Dimensions	
		A	C
	256	.110-.114	.087-.090
	440	.136-.140	.113-.116
	632	.162-.166	.139-.142
	832	.188-.192	.165-.168
	024 & 032	.216-.220	.191-.194
	0420	.295-.300	.250-.253
	0518	.334-.338	.3125-.3155
	0616	-	.375-.378

All dimensions are in millimeters.

METRIC	Thread Code	Anvil Dimensions	
		A + 0.1	C + 0.08
	M2.5	3.1	2.53
	M3	3.6	3.03
	M3.5	4.1	3.53
	M4	4.6	4.03
	M5	5.6	5.03
	M6	6.6	6.03
	M8	8.6	8.03
	M10	-	10.03

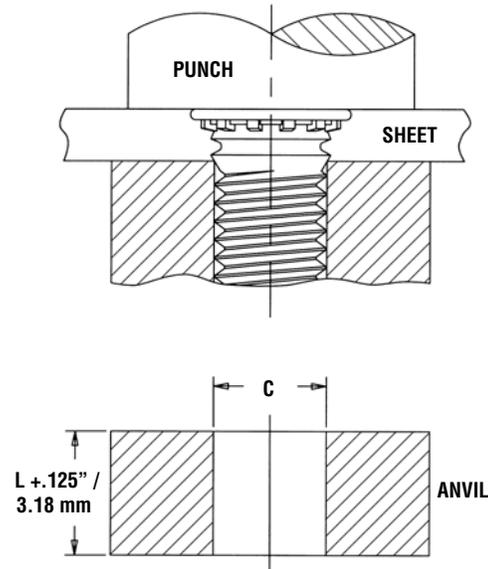
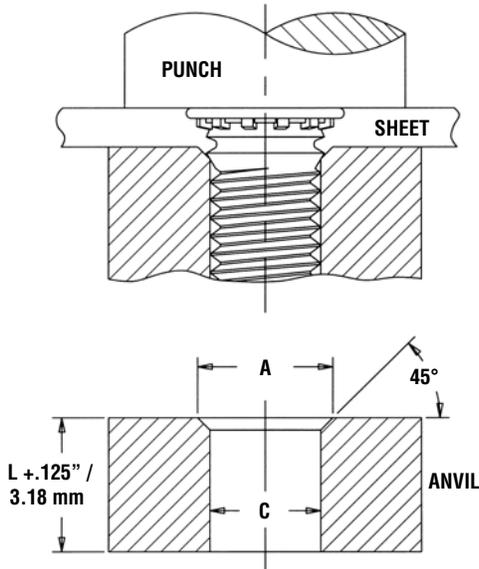
INSTALLATION (CONTINUED)

TYPE FH/FHS/FHA (FLUSH) THREADED AND UNTHREADED STUDS

The illustrations below indicate suggested tooling for applying installation forces. Note that for sheets .060" / 1.51 mm and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than .060" / 1.51 mm, the hole requires a countersink with dimension A at the top to provide for metal flow around the shank of the stud.

Tooling for sheet thicknesses less than .060" / 1.51 mm with #2 thru #10 / M3 thru M5 thread sizes and less than .093" / 2.4 mm for 1/4" / M6 threads.

Tooling for sheet thicknesses .060" / 1.51 mm and greater with #2 thru #10 / M3 thru M5 thread sizes and .093" / 2.41 mm and greater for 1/4" and 5/16" / M6 and M8 threads.



TYPE FH4 AND FHP SELF-CLINCHING STUDS FOR STAINLESS STEEL SHEETS

For Type FH4 studs, a special anvil with a raised ring is required to create a proper installation. The raised ring acts as a second displacer of the stainless sheet material, thereby ensuring that the annular groove is filled. We do not recommend the use of FH4 studs in sheet thicknesses greater than .095" / 2.41 mm.

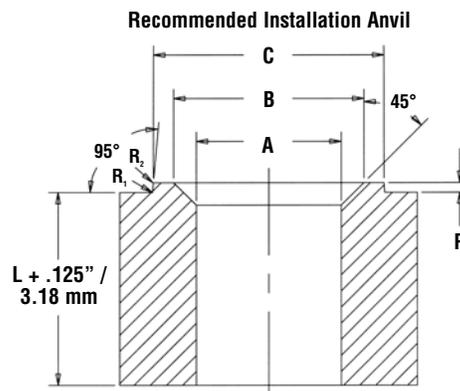
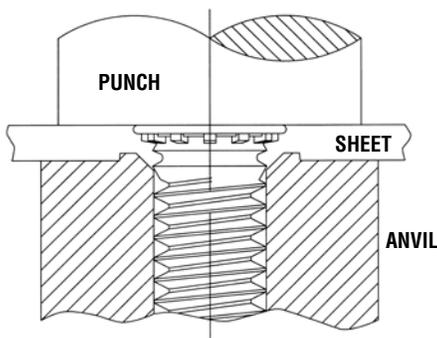
The special anvils are available from PEM stock or can be machined from suitable tool steel. A hardness of Rc55 minimum is required to provide long anvil life. We recommend measuring the "P" dimension every 5000 installations to ensure that the anvil remains within specification.

All dimensions are in inches.

UNIFIED	Thread Code	Anvil Dimensions						Anvil Part No.
		A +.003 -.000	B ±.002	C ±.002	P ±.001	R ₁ Max.	R ₂ Max.	
	440	.113	.144	.174	.010	.003	.005	8001645
	632	.140	.170	.200	.010	.003	.005	8001644
	832	.166	.202	.236	.010	.003	.005	8001643
	032	.191	.235	.275	.010	.003	.005	8001642
	0420	.252	.324	.360	.020	.003	.005	8002535

All dimensions are in millimeters.

METRIC	Thread Code	Anvil Dimensions						Anvil Part No.
		A +0.08	B ±0.05	C ±0.05	P ±0.025	R ₁ Max.	R ₂ Max.	
	M3	3.05	3.81	4.57	0.25	0.08	0.13	8001678
	M4	4.04	4.95	5.82	0.25	0.08	0.13	8001677
	M5	5.08	6.15	7.16	0.25	0.08	0.13	8001676
	M6	6.05	7.87	8.79	0.51	0.08	0.13	8002536

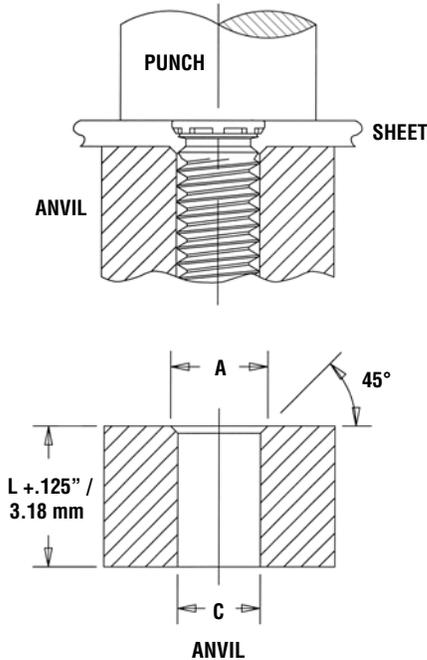


INSTALLATION (CONTINUED)

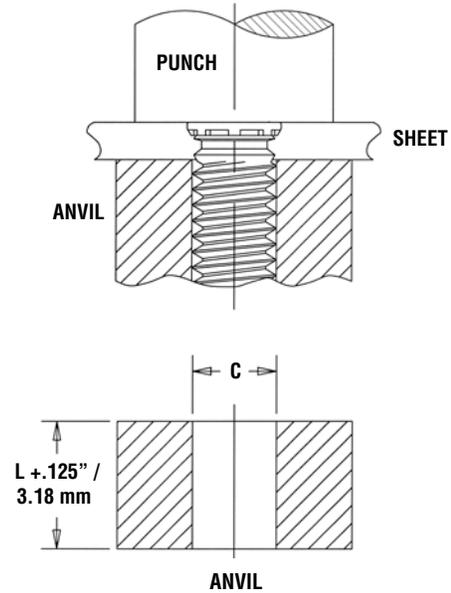
TYPE FHL/FHLS STUDS

The illustrations below indicate suggested tooling for applying installation forces. Note that for sheets $.060'' / 1.51 \text{ mm}$ and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than $.060'' / 1.51 \text{ mm}$, the hole requires a countersink with dimension A at the top to provide for metal flow around the shank of the stud.

Tooling for sheet thicknesses less than $.060'' / 1.51 \text{ mm}$.



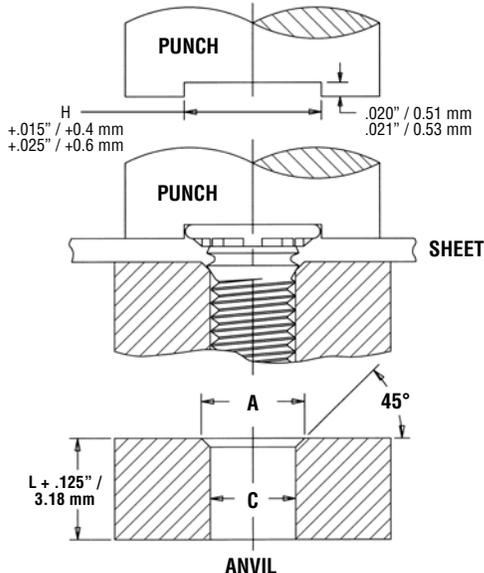
Tooling for sheet thicknesses $.060'' / 1.51 \text{ mm}$ and greater.



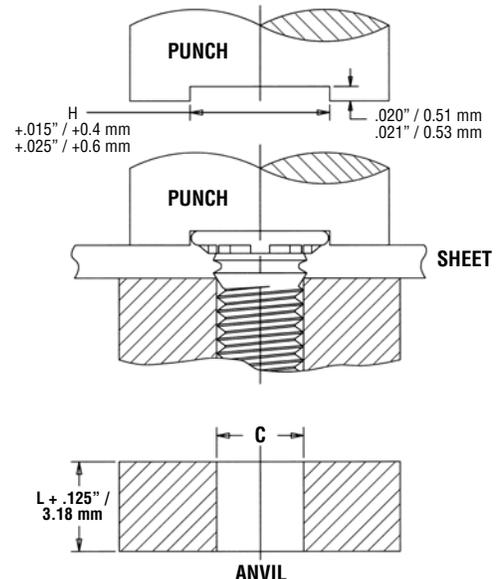
TYPE TFH/TFHS (NON-FLUSH) STUDS

The illustrations below indicate suggested tooling for type TFH studs. Note that for sheets $.030'' / 0.76 \text{ mm}$ and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than $.030'' / 0.76 \text{ mm}$ down to $.020'' / 0.51 \text{ mm}$, the hole requires a countersink with dimension A at the top to provide for metal flow around the shank of the stud. The standard punch design below provides clearance for the stud head and reduces chances of over squeezing the head of the stud into the sheet metal. When installed, the stud head is not flush but will protrude approximately $.025'' / 0.64 \text{ mm}$.

Tooling for sheet thicknesses less than $.030'' / 0.76 \text{ mm}$ down to $.020'' / 0.51 \text{ mm}$.



Tooling for sheet thicknesses $.030'' / 0.76 \text{ mm}$ and greater.

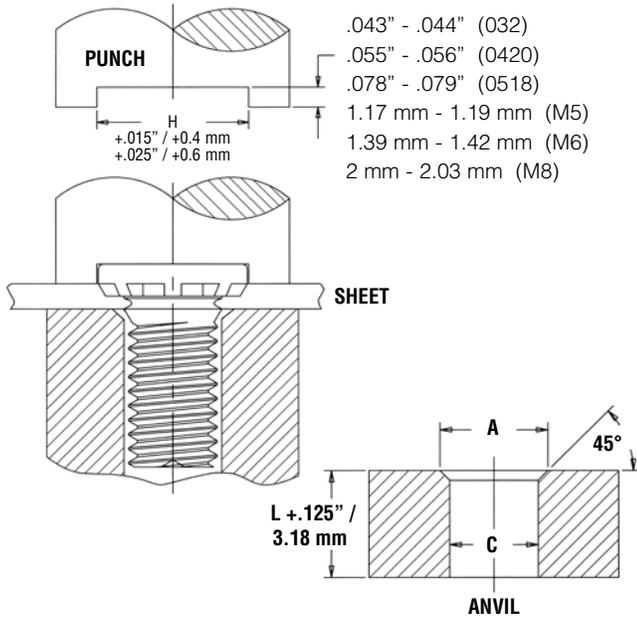


INSTALLATION (CONTINUED)

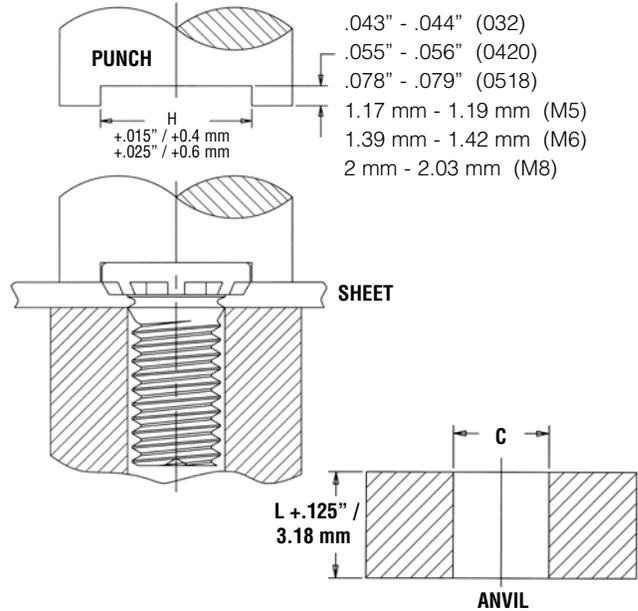
TYPE HFE STUDS

The illustrations below indicate suggested tooling for applying installation forces. Note that for sheets .060" / 1.51 mm and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than .060" / 1.51 mm to less than .075" / 1.9 mm, the hole requires a countersink with dimension A at the top to provide for metal flow around the shank of the stud.

Tooling for sheet thicknesses less than .060" / 1.51 mm with #10 / M5 and 1/4" / M6 thread sizes and less than .075" / 1.9 mm with 5/16" / M8 threads.



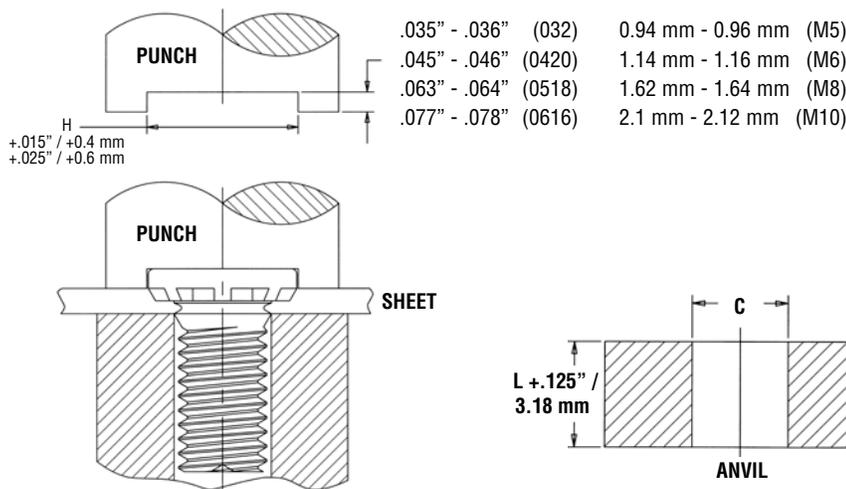
Tooling for sheet thicknesses .060" / 1.51 mm and greater with #10 / M5 and 1/4" / M6 thread sizes and .075" / 1.9 mm and greater with 5/16" / M8 threads.



TYPE HFH/HFHB/HFHS STUDS

Apply squeezing force on the punch sufficient only to embed the ribs on the head of the stud into the sheet.

The illustration below indicates suggested tooling for Type HFH self-clinching studs. The standard punch design provides clearance for the stud head and reduces chances of over squeezing.



All dimensions are in inches.

UNIFIED	Thread Code	Anvil Dimensions
		C
	032	.191 - .194
	0420	.250 - .253
	0518	.3125 - .3155
	0616	.375 - .378

All dimensions are in millimeters.

METRIC	Thread Code	Anvil Dimensions
		C + 0.08
	M5	5.03
	M6	6.03
	M8	8.03
	M10	10.03

INSTALLATION (CONTINUED)

TYPE TPS, TP4, AND TPXS FLUSH-MOUNTED, SELF-CLINCHING PILOT PINS

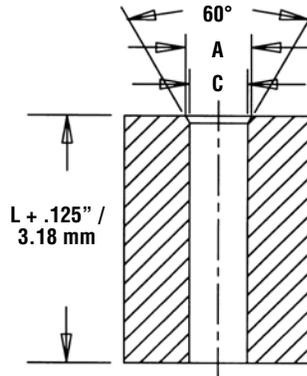
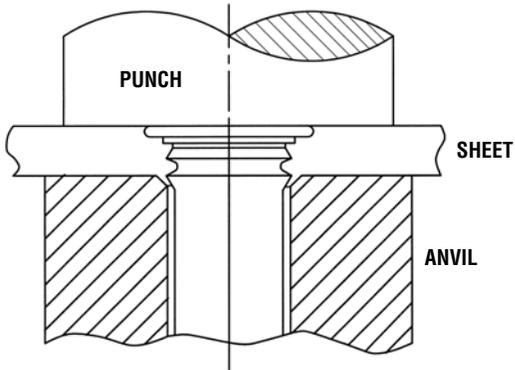
All dimensions are in inches.

UNIFIED	Type	Pin Dia. Code	Test Sheet Thickness	Anvil Dimensions	
				A ±.002	C ±.002
	TPS/TP4	125	.040 - .060 Over .060	.160 (1)	.130
TPS/TP4	187	.040 - .065 Over .065	.220 (1)	.192	
TPS/TP4	250	.040 - .075 Over .075	.285 (1)	.255	

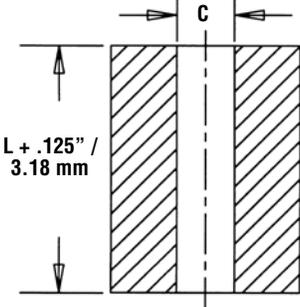
(1) Chamfered anvil not required.

All dimensions are in millimeters.

METRIC	Type	Pin Dia. Code	Test Sheet Thickness	Anvil Dimensions	
				A ±0.05	C ±0.05
	TPS/TP4/ TPXS	3mm	1 - 1.7 Over 1.7	3.88 (1)	3.13
TPS/TP4	4mm	1 - 1.7 Over 1.7	4.88 (1)	4.13	
TPS/TP4	5mm	1 - 1.8 Over 1.8	5.89 (1)	5.13	
TPS/TP4	6mm	1 - 1.9 Over 1.9	6.89 (1)	6.13	



Recommended tooling
when a chamfered
anvil is required.



Recommended tooling
when a chamfered
anvil is not required.

PERFORMANCE DATA

The pushout, torque-out, and pull thru values reported here pertain only to the holding power of the stud to the sheet into which it is installed. These values in no way pertain to the axial strength of the threads, allowable tightening torque or design loading of an assembly. The values reported are anticipated **destructive averages** when all installation specifications and procedures are followed. When properly installed, PEM self-clinching studs should perform better than the values given here.

TYPE FH AND FHS FLUSH-HEAD STUDS

UNIFIED	Thread Code	Max. Nut Tightening Torque (in. lbs.) ⁽¹⁾	Type	Test Sheet Thickness & Material	Sheet Hardness HRB	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Pull Thru (lbs.)
	256	2.3	FH	.062" Aluminum	29	2000	100	5	425
			FHS	.062" Aluminum	29	2000	100	4.5	300
			FH	.060" Steel	59	2500	180	5	425
			FHS	.060" Steel	59	2500	180	4.5	300
	440	5	FH	.064" Aluminum	29	3800	170	10	650
			FHS	.064" Aluminum	29	3200	170	8	500
			FH	.060" Steel	59	4300	275	10	650
			FHS	.060" Steel	59	4700	275	8	500
	632	9	FH	.064" Aluminum	29	3800	180	17	850
FHS			.064" Aluminum	29	3500	180	16	775	
FH			.060" Steel	59	4700	300	20	850	
FHS			.060" Steel	59	5000	300	16	775	
832	17	FH	.064" Aluminum	29	4800	220	28	1000	
		FHS	.064" Aluminum	29	4500	220	28	940	
		FH	.060" Steel	59	6800	375	40	1270	
		FHS	.060" Steel	59	5500	375	28	1130	
032	27	FH	.064" Aluminum	29	5500	270	30	1220	
		FHS	.064" Aluminum	29	5500	270	30	1220	
024	24	FH	.060" Steel	59	7500	450	60	1410	
		FHS	.060" Steel	59	6800	450	50	1410	
0420	58	FH	.093" Aluminum	28	6500	310	65	2300	
		FHS	.093" Aluminum	28	6500	310	65	2100	
		FH	.088" Steel	46	9500	575	100	2550	
		FHS	.088" Steel	46	10000	575	100	2550	
0518	120	FH	.093" Aluminum	28	6500	430	100	2260	
		FHS	.093" Aluminum	28	6700	430	100	2260	
		FH	.093" Steel	46	10000	650	175	3475	
		FHS	.093" Steel	46	11200	650	175	3120	

METRIC	Thread Code	Max. Nut Tightening Torque (N•m) ⁽¹⁾	Type	Test Sheet Thickness & Material	Sheet Hardness HRB	Installation (kN)	Pushout (N)	Torque-out (N•m)	Pull Thru (N)
	M2.5	0.41	FH	1.6 mm Aluminum	29	8.9	465	1.0	2600
			FHS	1.6 mm Aluminum	29	11.6	465	0.8	1820
			FH	1.5 mm Steel	59	11.1	740	1.0	2800
			FHS	1.5 mm Steel	59	13.8	740	0.8	1820
	M3	0.74	FH	1.6 mm Aluminum	29	12.9	600	1.7	3150
			FHS	1.6 mm Aluminum	29	12.9	600	1.3	2570
			FH	1.5 mm Steel	59	14.7	820	1.7	3840
			FHS	1.5 mm Steel	59	14.7	820	1.3	2440
	M3.5	1.15	FH	1.6 mm Aluminum	29	15.6	800	1.7	3780
FHS			1.6 mm Aluminum	29	15.6	800	1.7	3445	
FH			1.5 mm Steel	59	22.3	1335	2.8	3780	
FHS			1.5 mm Steel	59	22.3	1335	2.0	3445	
M4	1.7	FH	1.6 mm Aluminum	29	20	975	2.9	4448	
		FHS	1.6 mm Aluminum	29	22.3	975	2.9	4180	
		FH	1.5 mm Steel	59	28.9	1780	4.2	5650	
		FHS	1.5 mm Steel	59	26.7	1780	2.9	4775	
M5	3.5	FH	1.6 mm Aluminum	29	24.5	1070	3.5	5170	
		FHS	1.6 mm Aluminum	29	24.5	1070	3.5	4760	
		FH	1.5 mm Steel	59	33.4	2000	6.5	6270	
		FHS	1.5 mm Steel	59	32.5	2000	6.3	6000	
M6	5.9	FH	2.4 mm Aluminum	28	28.9	1660	7.3	10200	
		FHS	2.4 mm Aluminum	28	28.9	1660	7.3	9090	
		FH	2.2 mm Steel	46	44.5	2560	11.3	11300	
		FHS	2.2 mm Steel	46	44.5	2560	10.1	10600	
M8	14.2	FH	2.4 mm Aluminum	28	29.8	1910	11.3	10500	
		FHS	2.4 mm Aluminum	28	29.8	1910	11.3	9540	
		FH	2.4 mm Steel	46	44.5	2890	19.2	15450	
		FHS	2.4 mm Steel	46	49.8	2890	17.5	13630	

(1) Maximum recommended tightening torques for aluminum studs are 60 percent of these values.

PERFORMANCE DATA (CONTINUED)

TYPE FH4 SELF-CLINCHING STUDS⁽¹⁾

UNIFIED	Thread Code	Max. Nut Tightening Torque (in. lbs.)	Test Sheet Thickness and Material	Sheet Hardness HRB Max.	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Pull Thru (lbs.)
	440	6	.060" Stainless Steel	92	9000	450	16	800
	632	11	.060" Stainless Steel	92	9500	540	27	1350
	832	21	.060" Stainless Steel	92	11200	780	58	1800
	032	33	.060" Stainless Steel	92	12000	1050	95	2250
	0420	70	.060" Stainless Steel	92	23000	1600	156	3900

METRIC	Thread Code	Max. Nut Tightening Torque (N•m)	Test Sheet Thickness and Material	Sheet Hardness HRB Max.	Installation (kN)	Pushout (N)	Torque-out (N•m)	Pull Thru (N)
	M3	.9	1.5 mm Stainless Steel	92	40	2220	1.8	3500
	M4	2.1	1.5 mm Stainless Steel	92	50	3210	6.5	8000
	M5	4.3	1.5 mm Stainless Steel	92	53	3575	10.7	10000
	M6	7.2	1.5 mm Stainless Steel	92	71	4200	15.9	14900

TYPE FHP SELF-CLINCHING STUDS⁽¹⁾

UNIFIED	Thread Code	Max. Nut Tightening Torque (in. lbs.)	Test Sheet Thickness and Material	Sheet Hardness HRB Max.	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Pull Thru (lbs.)
	440	6	.045" Stainless Steel	92	9000	520	10.6	605
	632	11	.045" Stainless Steel	92	9500	670	19.5	940
	832	21	.045" Stainless Steel	92	11200	785	37.5	1415
	032	33	.045" Stainless Steel	92	12000	920	59.5	1500

METRIC	Thread Code	Max. Nut Tightening Torque (N•m)	Test Sheet Thickness and Material	Sheet Hardness HRB Max.	Installation (kN)	Pushout (N)	Torque-out (N•m)	Pull Thru (N)
	M4	2.1	1.14 mm Stainless Steel	92	50	3000	3.9	6000
	M5	4.3	1.14 mm Stainless Steel	92	53	3890	7.35	7320

TYPE FHL AND FHLS SELF-CLINCHING STUDS

UNIFIED	Thread Code	Max. Nut Tightening Torque (in. lbs.)	Type	Test Sheet Thickness and Material	Sheet Hardness HRB	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Pull Thru (lbs.)	Pull Thru Test Bushing Hole Size (in.)
	256	2.3	FHL / FHLS	.047" Aluminum	33	700	55	4	230	.106
		2.3	FHL / FHLS	.045" Steel	54	1200	85	8	425	.106
	440	4.0	FHL / FHLS	.047" Aluminum	33	1000	60	5	300	.132
		5.0	FHL / FHLS	.045" Steel	54	1200	105	11	580	.132
	632	5.4	FHL / FHLS	.047" Aluminum	33	1000	65	6.5	325	.158
		9.0	FHL / FHLS	.045" Steel	54	1500	110	15	650	.158
	832	6.9	FHL / FHLS	.047" Aluminum	33	1200	80	9	350	.184
		15.2	FHL / FHLS	.045" Steel	54	1500	125	18	740	.184
	032	9.7	FHL / FHLS	.047" Aluminum	33	2500	115	18	395	.210
		19.4	FHL / FHLS	.045" Steel	54	4500	210	38	800	.210

METRIC	Thread Code	Max. Nut Tightening Torque (N•m)	Type	Test Sheet Thickness and Material	Sheet Hardness HRB	Installation (kN)	Pushout (N)	Torque-out (N•m)	Pull Thru (N)	Pull Thru Test Bushing Hole Size (mm)
	M2.5	0.41	FHL / FHLS	1.2 mm Aluminum	33	3.1	285	0.55	1200	3
		0.41	FHL / FHLS	1.1 mm Steel	54	5.3	450	1.1	2250	3
	M3	0.46	FHL / FHLS	1.2 mm Aluminum	33	4.4	285	0.65	1300	3.5
		0.74	FHL / FHLS	1.1 mm Steel	54	5.3	475	1.25	2500	3.5
	M3.5	0.58	FHL / FHLS	1.2 mm Aluminum	33	4.4	290	0.76	1400	4
		1.15	FHL / FHLS	1.1 mm Steel	54	6.6	500	1.75	2800	4
	M4	0.75	FHL / FHLS	1.2 mm Aluminum	33	5.3	365	1.1	1550	4.5
		1.7	FHL / FHLS	1.1 mm Steel	54	6.6	550	2.1	3300	4.5
	M5	1.11	FHL / FHLS	1.2 mm Aluminum	33	11.1	530	2.2	1850	5.5
		2.25	FHL / FHLS	1.1 mm Steel	54	20	1000	4.4	3750	5.5

(1) Performance values shown are typical for fasteners properly installed using raised ring tooling in good condition. We recommend replacing installation tooling when the height of the "P" (see page FH-16) dimension is reduced to .005" / 0.13 mm due to wear. Reductions in performance may occur as the height of the protrusion wears. Variations in hole preparation, installation force, and sheet material type, thickness, and hardness will affect both performance and tooling life.

PERFORMANCE DATA (CONTINUED)

TYPE TFH AND TFHS NON-FLUSH STUDS

UNIFIED	Thread Code	Max. Nut Tightening Torque (in. lbs.)	Type	Test Sheet Thickness and Material	Sheet Hardness HRB	(1) Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)
	440	5	TFH	.020" Aluminum	28	1300	45	7
			TFHS	.020" Aluminum	28	1200	45	7
			TFH	.023" Steel	52	2800	100	8
			TFHS	.025" Steel	52	1500	100	8
	632	9	TFH	.020" Aluminum	28	2100	50	8
			TFHS	.020" Aluminum	28	1500	50	8
			TFH	.023" Steel	52	2500	110	16
			TFHS	.025" Steel	52	2500	110	16
	832	17	TFH	.020" Aluminum	28	2100	60	10
TFHS			.020" Aluminum	28	2200	60	11	
TFH			.023" Steel	52	3100	120	26	
TFHS			.025" Steel	52	2700	120	26	
024	24	TFH	.020" Aluminum	28	2300	65	14	
		TFHS	.020" Aluminum	28	2500	65	14	
032	27	TFH	.023" Steel	52	3700	150	30	
		TFHS	.025" Steel	52	3000	130	28	

METRIC	Thread Code	Max. Nut Tightening Torque (N•m)	Type	Test Sheet Thickness and Material	Sheet Hardness HRB	(1) Installation (kN)	Pushout (N)	Torque-out (N•m)
	M3	0.74	TFH	0.5 mm Aluminum	28	5.8	195	0.6
			TFHS	0.5 mm Aluminum	28	5.3	195	0.6
			TFH	0.6 mm Steel	52	12.5	300	1
			TFHS	0.6 mm Steel	52	6.7	300	1
	M4	1.7	TFH	0.5 mm Aluminum	28	12.5	250	0.7
			TFHS	0.5 mm Aluminum	28	9.8	250	0.7
			TFH	0.6 mm Steel	52	17.8	500	2.5
			TFHS	0.6 mm Steel	52	13.4	500	2.5
	M5	3.5	TFH	0.5 mm Aluminum	28	15.6	270	1.3
TFHS			0.5 mm Aluminum	28	13.4	270	1.3	
TFH			0.6 mm Steel	52	26.7	670	3	
TFHS			0.6 mm Steel	52	17.8	670	3	

TYPE HFE SELF-CLINCHING STUDS

UNIFIED	Thread Code	Max. Nut Tightening Torque (ft. lbs.)	Test Sheet Thickness and Material (in.)	Sheet Hardness HRB	Installation (lbs.) (1)	Pushout (lbs.)	Torque-out (in. lbs.)	Pull Thru (lbs.)	Test Bushing Hole Size For Pull Thru Tests
	032	3.25	.040" Aluminum	27	7500	170	60	1900	.279
			.040" Cold-rolled Steel	67	9500	300	60	2200	
	0420	8	.040" Aluminum	27	8000	180	120	3200	.335
			.040" Cold-rolled Steel	67	13500	340	130	3600	
	0518	16	.060" Aluminum	22	9000	275	240	6000	.407
			.060" Cold-rolled Steel	65	15500	575	290	6400	

METRIC	Thread Code	Max. Nut Tightening Torque (N•m)	Test Sheet Thickness and Material (mm)	Sheet Hardness HRB	Installation (kN) (1)	Pushout (N)	Torque-out (N•m)	Pull Thru (kN)	Test Bushing Hole Size For Pull Thru Tests
	M5	4.4	1 mm Aluminum	27	37.7	690	8.1	9.7	7.4
			1 mm Cold-rolled Steel	67	51.1	1350	8.1	10.6	
	M6	10	1 mm Aluminum	27	39	750	11.8	14.2	8.2
			1 mm Cold-rolled Steel	67	60	1400	14.4	15.5	
	M8	21.7	1.5 mm Aluminum	22	42	1230	23.5	25	10.3
			1.5 mm Cold-rolled Steel	65	71.1	2400	33.9	27.5	

(1) Installation controlled by proper cavity depth in punch.

PERFORMANCE DATA (CONTINUED)

TYPE HFH AND HFHS HIGH-STRENGTH STUDS AND TYPE HFHB PHOSPHOR BRONZE STUDS

UNIFIED	Thread Code	Type	Max. Nut Tightening Torque (ft. lbs.)	Test Sheet Thickness and Material	Sheet Hardness HRB	(1) Installation (lbs.)	Pushout (lbs.)	Torque-out (ft. lbs.)	(2) Tensile Strength (lbs.)
	032	HFH	3.25	.060" Aluminum	15	3000	180	4	2400
		HFH	3.25	.060" Steel	65	6000	375	5	2400
		HFHS	3.25	.050" Aluminum	38	3000	180	4	1500
		HFHS	3.25	.058" Steel	52	4500	325	4	1500
	0420	HFHB	2.56	.061" Copper CDA-110	28	3400	250	4.5	1200
		HFH	8	.060" Aluminum	43	5500	285	11	3820
		HFH	8	.060" Steel	59	7000	480	11	3820
		HFHS	8	.064" Aluminum	32	4000	285	8	2385
	0518	HFHS	8	.072" Steel	43	6500	480	8	2385
HFHB		4.35	.061" Copper CDA-110	28	6000	380	5	1908	
HFH		16	.091" Aluminum	39	8000	380	22	6280	
HFH		16	.090" Steel	58	10000	590	22	6280	
0616	HFHS	16	.087" Aluminum	41	5500	380	15	3930	
	HFHS	16	.099" Steel	44	7500	590	15	3930	
	HFHB	10.55	.126" Copper CDA-110	32	7500	500	11	3140	
	HFH	27	.091" Aluminum	39	9000	550	25	9300	
0616	HFH	27	.090" Steel	58	12000	780	36	9300	
	HFHS	27	.123" Aluminum	44	7500	560	25	5810	
	HFHS	27	.099" Steel	44	10500	780	25	5810	
	HFHB	21	.126" Copper CDA-110	32	9500	560	18	4650	

METRIC	Thread Code	Type	Max. Nut Tightening Torque (N•m)	Test Sheet Thickness and Material	Sheet Hardness HRB	(1) Installation (kN)	Pushout (N)	Torque-out (N•m)	(2) Tensile Strength (kN)
	M5	HFH	4.4	1.5 mm Aluminum	15	13	800	5.4	12.8
		HFH	4.4	1.5 mm Steel	65	26	1500	7.6	12.8
		HFHS	4.4	1.62 mm Aluminum	35	12.4	800	5.4	7.3
		HFHS	4.4	1.47 mm Steel	54	21.7	1500	6.4	7.3
		HFHB	3.47	1.5 mm Copper CDA-110	28	15.6	1115	3.4	5.9
	M6	HFH	10	1.5 mm Aluminum	43	29	1270	14	18.1
		HFH	10	1.5 mm Steel	59	33	1750	14	18.1
		HFHS	10	1.62 mm Aluminum	35	15.4	1270	11	10.3
		HFHS	10	1.6 mm Steel	45	24.6	1750	11	10.3
HFHB		5.9	1.5 mm Copper CDA-110	28	25.3	1600	6.7	8.3	
M8	HFH	21.7	2.3 mm Aluminum	39	35.6	1700	30	32.9	
	HFH	21.7	2.3 mm Steel	58	44.5	2200	30	32.9	
	HFHS	21.7	2.23 mm Aluminum	44	24.4	1700	20	18.8	
	HFHS	21.7	2.48 mm Steel	43	37.8	2100	20	18.8	
	HFHB	14.3	3.2 mm Copper CDA-110	32	33	2250	15.3	15.1	
M10	HFH	36.6	2.3 mm Aluminum	39	40	2445	36	52.2	
	HFH	36.6	2.3 mm Steel	58	54	3470	49	52.2	
	HFHS	36.6	2.3 mm Aluminum	44	33.3	2445	36	29.9	
	HFHS	36.6	2.3 mm Steel	44	46.7	3470	36	29.9	
	HFHB	28.5	3.2 mm Copper CDA-110	32	42	2500	25	24	

- (1) Installation controlled by proper cavity depth in punch.
 (2) Head size is adequate to ensure failure in threaded area.

PERFORMANCE DATA (CONTINUED)

TYPE TPS™ FLUSH-MOUNTED, SELF-CLINCHING PILOT PINS

UNIFIED	Pin Dia. Code	Test Sheet Material	Sheet Hardness HRB	Installation (lbs.)	Pushout (lbs.)
	125	Aluminum	20	4500	150
Steel		62	6500	250	
187	Aluminum	18	6500	230	
	Steel	60	8000	400	
250	Aluminum	18	7000	270	
	Steel	62	9000	500	

METRIC	Pin Dia. Code	Test Sheet Material	Sheet Hardness HRB	Installation (kN)	Pushout (kN)
	3mm	Aluminum	22	12	0.56
Steel		65	22	0.98	
4mm	Aluminum	19	22	0.89	
	Steel	66	26.4	1.54	
5mm	Aluminum	18	28.6	1.01	
	Steel	60	35.2	1.76	
6mm	Aluminum	18	30.8	1.1	
	Steel	62	39.6	2.1	

TYPE TP4™ FLUSH-MOUNTED, SELF-CLINCHING PILOT PINS

UNIFIED	Pin Diameter Code	Installation (lbs.)	Pushout (lbs.)
	125	8000	350
	187	12000	570
	250	14000	650

METRIC	Pin Diameter Code	Installation (kN)	Pushout (N)
	3mm	35	1556
	4mm	45	2335
	5mm	54	2535
	6mm	60	2891

TYPE TPXS™ FLUSH-MOUNTED, SELF-CLINCHING PILOT PINS

METRIC	Pin Dia. Code	Test Sheet Material	Sheet Hardness HRB	Installation (kN)	Pushout (kN)
	3mm	Aluminum	22	12	0.56
		Steel	65	22	0.98

OTHER CONSIDERATIONS

THREAD MASK

PEM® Blu-Coat™ thread mask is available for applications where hardware is installed prior to painting. During assembly, the threads of the mating hardware will remove paint, electro deposited automotive under coatings, and weld spatter upon application of torque. PEM studs can be specially ordered with thread mask applied.

"BC" suffix will be added to part number to designate Blu-Coat thread mask to fastener.



CONCEALED-HEAD STUDS

Concealed-head studs are installed into a blind milled hole where surface opposite stud must remain unmarred.

(For more information, see PEM® Bulletin CH on our website)



INSTALLATION EQUIPMENT

For best results we recommend using a PEMSERTER® press for either manual or automatic installation of PEM® fasteners. To further reduce costs, the PEMSERTER In-die system allows you install PEM brand studs during the stamping process. This eliminates secondary insertion operations and improves quality.

(For more information, see PEM® Bulletin PS on our website)



STUDS FOR P.C. BOARD

Broaching threaded studs are for use as solderable connectors or as permanently mounted studs in P.C. boards.

(For more information, see PEM® Bulletin K on our website)



SELF-CLINCHING FASTENER INSTALLATION DO'S AND DON'TS

“Do’s”

- Do** provide mounting hole of specified size for each stud.
- Do** install stud into punch side of hole.
- Do** make certain that the stud is properly located within the hole before applying installation force.
- Do** apply squeezing force between parallel surfaces.
- Do** apply sufficient force to totally embed ribs of stud around entire circumference. For some studs, installation is complete when the head is flush with the panel surface and for some others when the head of the stud contacts the panel.

“Don’ts”

- Don’t** attempt to install a 300 series stainless steel stud into a stainless steel sheet.
- Don’t** install steel or stainless steel studs in aluminum panels before anodizing or finishing.
- Don’t** deburr mounting holes on either side of sheet before installing studs – deburring will remove metal required for clinching the stud into sheet.
- Don’t** install stud closer to edge of sheet than minimum edge distance indicated or reduced performance will result. A special fixture may be used to restrict bulging of sheet edge.
- Don’t** over-install. Be certain to determine optimum installation force by testing prior to production runs.
- Don’t** attempt to insert stud with a hammer blow – under any circumstances. A hammer blow won’t permit the sheet metal to flow and develop an interlock with the fastener’s contour.
- Don’t** install stud on pre-painted side of panel.

RoHS compliance information can be found on our website.

Specifications subject to change without notice.
Check our website for the most current version of this bulletin.

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