



SELF-CLINCHING
STUDS AND
PINS

BULLETIN



Revised 608

SELF-CLINCHING STUDS AND PINS

FH (flush-head) Studs are installed by placing them in punched or drilled 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-4)

TFH (non-flush) Studs are for sheets as thin as 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 0.64 mm. (See page FH-5)

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-5)

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-5)

FHL (low-displacement head) Studs install closer to the edge of a sheet than standard studs without causing that edge to bulge. Depending on thread size, Type FHL studs can be installed from 25% to 50% closer to the edge of a sheet than standard self-clinching studs. (See page FH-6)

FH4 (flush-head) Studs for Stainless Steel are designed to provide strong threads in stainless steel sheets as thin as 1 mm. These studs are made from 400 Series stainless steel and are designed for use in stainless steel sheets with a hardness of 92 or less on the Rockwell “B” scale. (See page FH-6)

TPS (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-7)

HFE (high-strength) Studs are designed with an enlarged head diameter to provide high-strength in sheets as thin as 1 mm. (See page FH-7)

Dog Point and Anti Cross-Thread Options
(See page FH-8)



Flush-head Studs.



Thin Sheet Studs.



High-strength Studs.

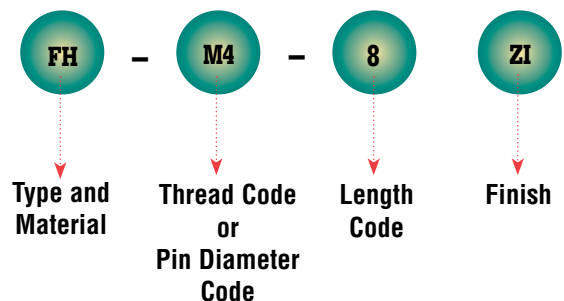


Low-displacement Head Studs.



Flush-head Pins.

Part Number Designation



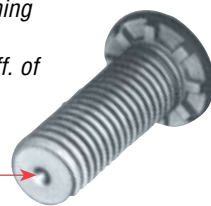
PEM® Self-clinching Stud Selector Guide

PEM Stud Type	Page No.	Application Requires:									
		Flush-head	High-strength	Sheet thickness as thin as .020" / 0.51mm	High electrical conductivity	Mounting into stainless steel sheets	Compatibility with aluminum anodizing	Limited corrosion resistance	High corrosion resistance	Reduced centerline-to-edge distance	Unthreaded pin
FH	4	•									(1)
FHA	4	•					•		•		(1)
FHL	8	•								•	
FHLS	8	•							•	•	
FHS	4	•							•		(1)
FH4	9	•				•		•			
FHP	9	•				•			•		
HFH	7		•								
HFHB	7				•						
HFHS	7		•						•		
TFH	6			•							
TFHS	6			•					•		
TPS	10	•							•		•
HFE	11		•								

Standard product features shown above. Studs can also be custom designed to meet your exact application requirements.
 (1) Also available unthreaded on special order. See page FH-4.

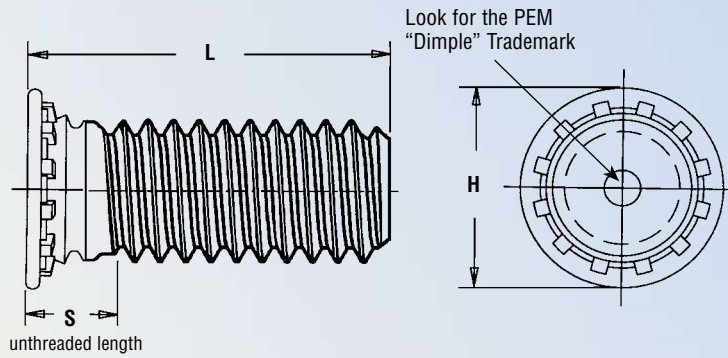
To be sure that your are getting genuine PEM® brand self-clinching studs, look for the "dimple" trademark. (Reg. Pat. & T.M. Off. of the U.S. and other countries.)

The Trademark for Quality



TYPE FH/FHS/FHA

- Flush-head for sheet thickness of 1 mm and greater.



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.	Min. Dist. Hole C/L to Edge
		Fastener Material																			
		Steel	Stainless Steel	Aluminum																	
M2.5x0.45	FH	FHS	FHA	M2.5	6 ^{NS}	8 ^{NS}	10 ^{NS}	12 ^{NS}	15 ^{NS}	18 ^{NS}	NA	NA	NA	NA	1	2.5	3.1	4.1	1.95	5.4	
M3x0.5	FH	FHS	FHA	M3	6 ^{NS}	8	10	12	15	18	20 ^{NS}	25 ^{NS}	NA	NA	1	3	3.6	4.6	2.1	5.6	
M3.5x0.6	FH	FHS	FHA	M3.5 ^{NS}	6	8	10	12	15	18	20	25	30	NA	1	3.5	4.1	5.3	2.25	6.4	
M4x0.7	FH	FHS	FHA	M4	6 ^{NS}	8	10	12	15	18	20	25	30 ^{NS}	35 ^{NS}	1	4	4.6	5.9	2.4	7.2	
M5x0.8	FH	FHS	FHA	M5	NA	8 ^{NS}	10	12	15	18	20	25	30 ^{NS}	35 ^{NS}	1	5	5.6	6.5	2.7	7.2	
M6x1	FH	FHS	FHA ^{NS}	M6	NA	NA	10	12	15	18	20	25	30	35	1.6	6	6.6	8.2	3	7.9	
M8x1.25	FH	FHS	NA	M8	NA	NA	NA	12 ^{NS}	15	18	20	25	30	35	2.4	8	8.6	9.6	3.7	9.6	

NS Not Stocked, available on special order.

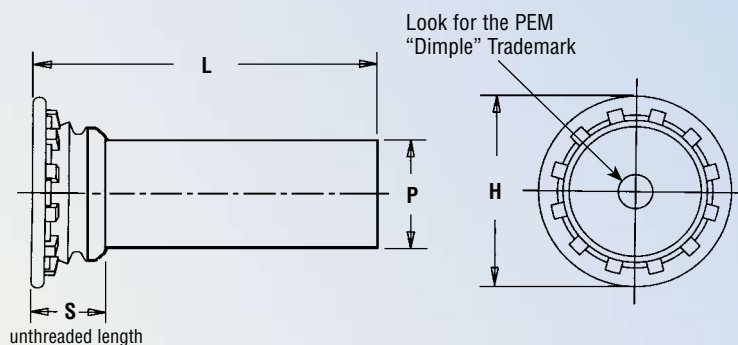
NA Not Available.

(1) See page FH-10 for installation tool requirements.

TYPE FH/FHN/FHS/FHA UNTHREADED STUDS

- Flush-head for sheet thickness of 1 mm and greater.

PEM® unthreaded studs are only available on special order. See page FH-7 for standard diameter pins.



All dimensions are in millimeters.

METRIC	(1) Nominal Pin Diameter P±.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. (3)	Min. Dist. Hole C/L to Edge
		Fastener Material																		
		Steel (2)	Stainless Steel	Aluminum																
3	FH	FHN	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	FHN	FHS	FHA	4 mm	NA	8	10	12	15	18	20	25	30	35	1	4.1	6	2.3	7.1
5	FH	FHN	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.

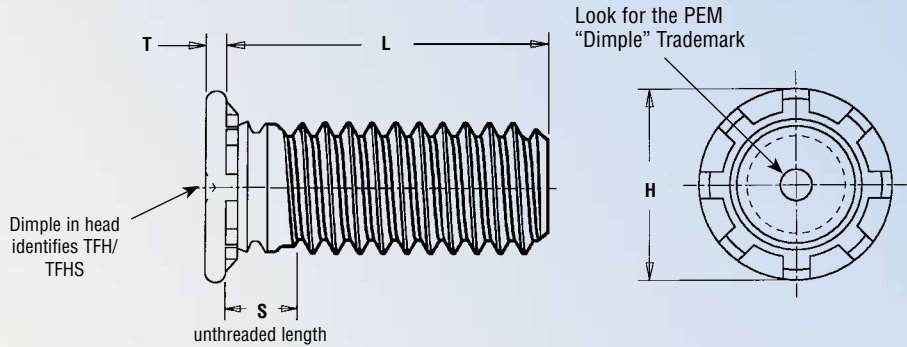
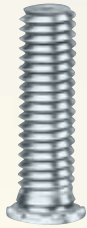
(2) See chart on page FH-10 for details.

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

NA Not Available.

TYPE TFH/TFHS

- Non-flush for sheets as thin as 0.51 mm.



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.	T Max.	Min. Dist. Hole C/L to Edge
		Fastener Material																				
		Steel	Stainless Steel	Phosphor Bronze(1)																		
M3x0.5	TFH	TFHS	M3	6	8	10	12	15	18	20 ^{NS}	25 ^{NS}	NA	NA	0.51	3	3.6	4.5	1.8	0.64	5.6		
M4x0.7	TFH	TFHS	M4	NA	8 ^{NS}	10	12	15	18	20 ^{NS}	25 ^{NS}	30 ^{NS}	35 ^{NS}	0.51	4	4.6	5.8	1.8	0.64	7.2		
M5x0.8	TFH	TFHS	M5	NA	8 ^{NS}	10	12	15	18	20 ^{NS}	25 ^{NS}	30 ^{NS}	35 ^{NS}	0.51	5	5.6	6.4	2.3	0.64	7.2		

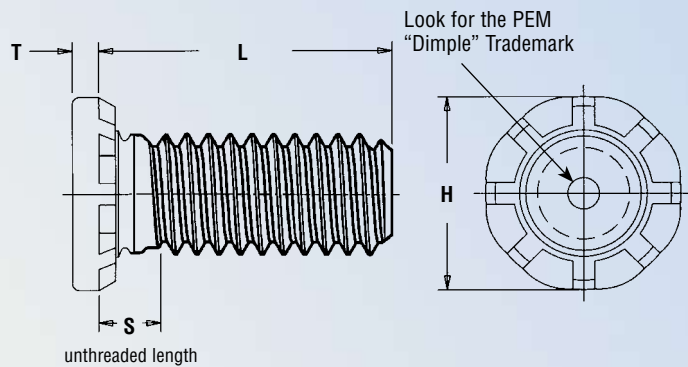
NS Not Stocked, available on special order.

NA Not Available.

(1) See page FH-10 for installation tool requirements.

TYPE HFH/HFHS/HFHB

- For high-strength applications in sheets as thin as 1.3 mm.
- Type HFHB for superior electrical/mechanical attachment in copper.



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.	T Max.	Min. Dist. Hole C/L to Edge
		Fastener Material																				
		Steel	Stainless Steel	Phosphor Bronze(1)																		
M5x0.8	HFH	HFHS	HFHB	M5	15 ^{NS}	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	1.3	5	6.5	7.8	2.7	1.14	10.7				
M6x1	HFH	HFHS	HFHB	M6	15*	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	1.5	6	7.5	9.4	2.8	1.27	11.5				
M8x1.25	HFH	HFHS	HFHB	M8	15 ^{NS}	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	2	8	9.5	12.5	3.5	1.78	12.7				
M10x1.5	HFH	HFHS	HFHB ^{NS}	M10	15 ^{NS}	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	2.3	10	11.5	15.7	4.1	2.29	13.7				

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

NS Not Stocked, available on special order.

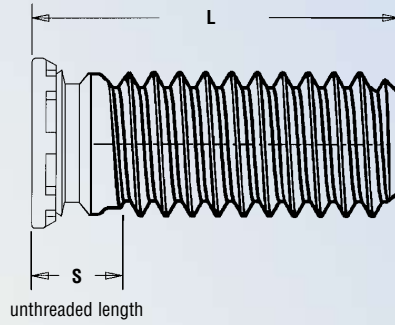
NA Not Available.

(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 M5 and M10 thread sizes respectively, after repeated thermal and mechanical cycling. Consult our Marketing department for complete electrical resistance test data for type HFHB studs installed in copper.

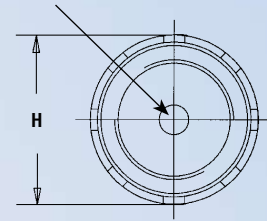
* Type HFHB-M6-15 is only available on special order.

TYPE FHL/FHLS™

- Installs closer to the edge of a sheet than standard studs with out causing that edge to bulge.
- Flush-head for sheet thickness 1 mm and greater.



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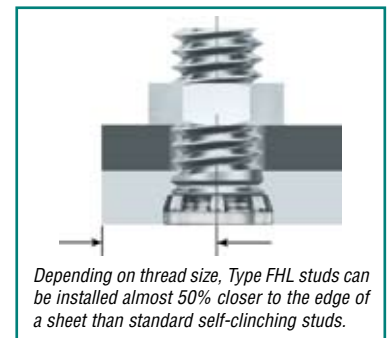


All dimensions are in millimeters.

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.	Min. Dist. Hole C/L to Edge
		Fastener Material																		
		Steel	Stainless Steel																	
M2.5x0.45	FHL	FHLS	M2.5	6	8	10	12	15	18	NA	NA	NA	NA	1	2.5	2.9	3.15	2.1	2.8	
M3x0.5	FHL	FHLS	M3	6	8	10	12	15	18	20	25	NA	NA	1	3	3.4	3.65	2.1	3.3	
M3.5x0.6	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	
M4x0.7	FHL	FHLS	M4	6	8	10	12	15	18	20	25	30	35	1	4	4.4	4.65	2.4	4.3	
M5x0.8	FHL	FHLS	M5	NA	8	10	12	15	18	20	25	30	35	1	5	5.4	5.9	2.7	5.6	

NA Not Available.

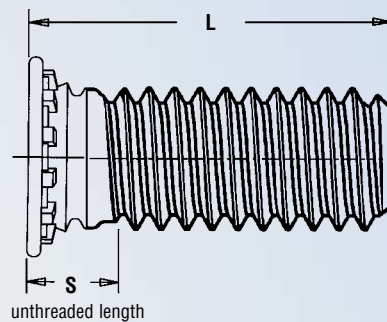
(1) See page FH-11 for installation tool requirements.



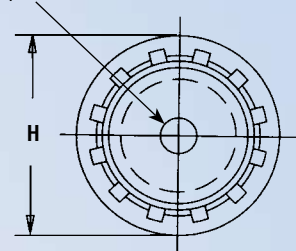
Depending on thread size, Type FHL studs can be installed almost 50% closer to the edge of a sheet than standard self-clinching studs.

TYPES FH4™ AND FHP™

- Permanent installation into stainless steel sheets as thin as .040” / 1 mm.
- For use in sheet hardness of 92 or less on the Rockwell “B” scale.
- Type FHP is high corrosion resistant and ideal for medical, foodservice, and marine applications.



Look for the PEM
“Dimple” Trademark



All dimensions are in millimeters.

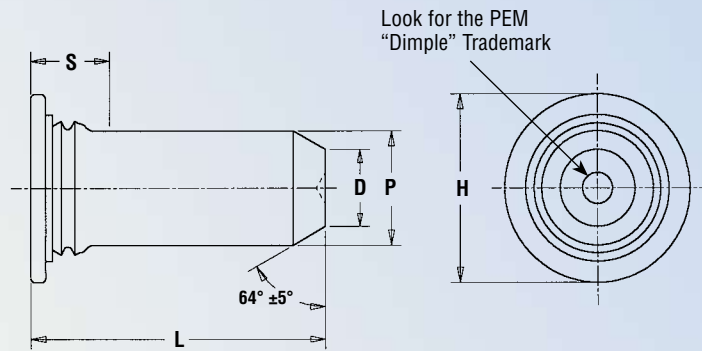
METRIC	Thread Size x Pitch	Type		Thread Code	Length Code “L” ±0.4 (Length Code in millimeters)										Sheet Thickness	Hole Size in Sheet +0.08	Max. Hole in Attach. parts	H ±0.4	S Max.	Min. Dist. Hole C/L to Edge
		Fastener Material																		
		Steel	Stainless Steel																	
M3 x 0.5	FH4	FHP	M3	6 ^{NS}	8	10	12	15	18	20 ^{NS}	25 ^{NS}	NA	NA	1 - 2.4	3	3.6	4.6	2.1	5.6	
M4 x 0.7	FH4	FHP	M4	6 ^{NS}	8	10	12	15	18	20	25	30 ^{NS}	35 ^{NS}	1 - 2.4	4	4.6	5.9	2.4	7.2	
M5 x 0.8	FH4	FHP	M5	NA	8 ^{NS}	10	12	15	18	20	25	30 ^{NS}	35 ^{NS}	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	

NS Not Stocked, available on special order.

NA Not Available.

TYPE TPS™

- Flush-mounted, self-clinching pilot pins.
- Satisfies a wide range of positioning, pivot, and alignment applications.
- Chamfered end makes mating hole location easy.



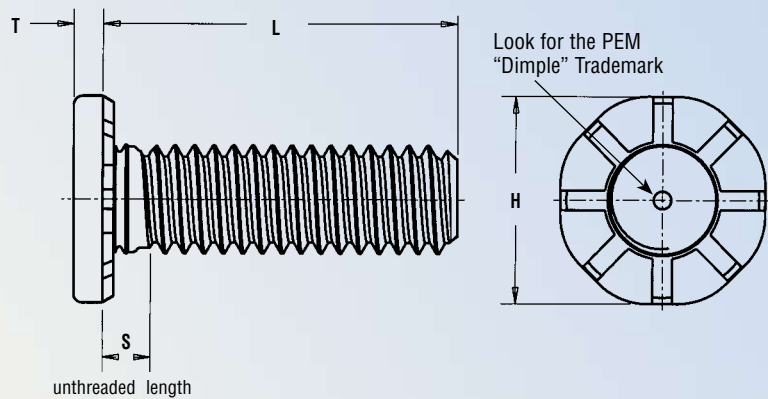
All dimensions are in millimeters.

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
		3	TPS	3mm	8	10	12	16	NA	1	3.5	2.05	5.2	2.29
	4	TPS	4mm	8	10	12	16	NA	1	4.5	2.82	6.12	2.29	7.1
	5	TPS	5mm	NA	10	12	16	20	1	5.5	3.53	7.19	2.29	7.6
	6	TPS	6mm	NA	NA	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 HFE™

- Enlarged head diameter provides high-strength in sheets as thin as / 1 mm.



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.	T Max.	Max. Hole In Attached Parts	Min. Dist. Hole C/L To Edge		
		M5 x 0.8	HFE	M5	15 ^{NS}	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	1	5	9.6	2.6	1.35	7.3
	M6 x 1	HFE	M6	15 ^{NS}	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	1	6	11.35	2.8	1.52	8.3	11.5
	M8 x 1.25	HFE	M8	15 ^{NS}	20	25 ^{NS}	30	35 ^{NS}	40 ^{NS}	50 ^{NS}	1.5	8	15.3	3.3	2.13	10.3	14.5

Thread strength: 900 MPa

NS Not Stocked, available on special order.

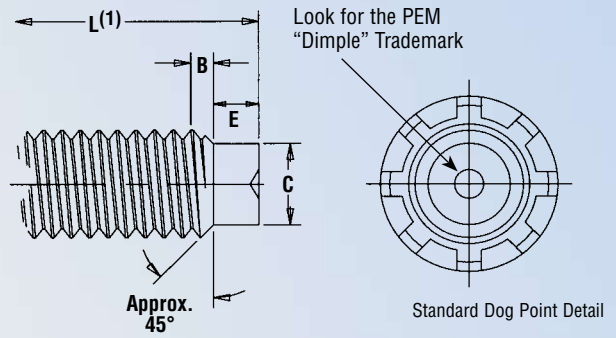
(1) See page FH-13 for installation tool requirements.

Dog Point And Anti Cross-Threading Options For Studs

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 engagement. This feature is available on Types FH, HFH, and HFE studs.



Dog Point Stud



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 Stud
with dog
point



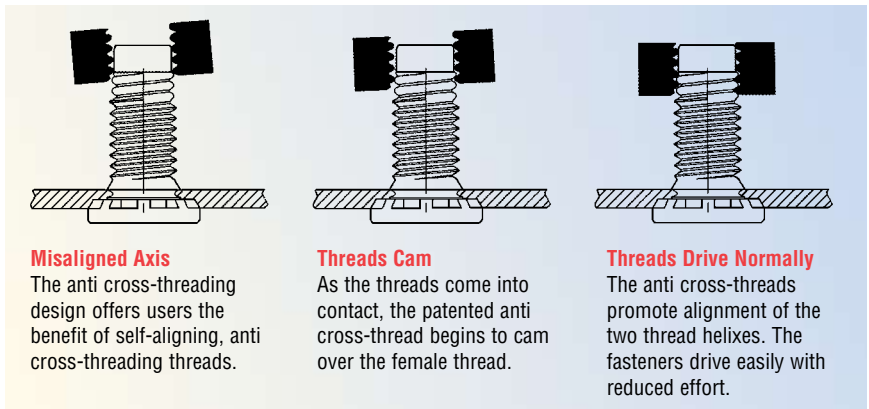
Material
(if applicable)

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.



Anti Cross-Thread Feature

Here's how it works:



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

(2) Maximum dog point diameter is 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 & FINISH SPECIFICATIONS

Type	Threads (1)	Fastener Materials							Standard Finishes			Optional Finish (2)	For use in Sheet Hardness: (7)					
	External, ANSI B1.1, 2A ANSI/ASME B1.13M 6g	Heat-Treated Carbon Steel	Carbon Steel	300 Series Stainless Steel	2024-T4 Aluminum (Plain Finish)	CDA #510 Phosphor Bronze (3)	Precipitation Hardening Grade Stainless Steel	400 Series Stainless Steel	No Finish (4) (5)	Zinc plated, 5µm, Colorless (6)	Passivated and/or Tested Per ASTM A380	Zinc plated, 5µm, Yellow (6)	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	•				•			•				•						
FHN	•		•						•		•	•						
FH4	•									•							•	
FHP	•						•			•							•	
FHL	•	•							•						•			
FHLS	•			•						•				•				
TFH	•	•							•		•				•			
TFHS	•			•						•				•				
HFH	•	•							•		•					•		
HFHB	•					•		•					•					
HFHS	•			•						•				•				
TPS				•						•				•				
HFE	•	•							•		•					•		
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) Material properties – yield strength: 50,000 psi (345 MPa), tensile strength: 63,000 psi (434 MPa).
- (4) Part numbers for aluminum studs have no plating suffix.
- (5) “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.
- (6) See PEM Technical Support section of our web site for related plating standards and specifications.
- (7) HRB - Hardness Rockwell “B” Scale. HB - Hardness Brinell.

INSTALLATION

For Types FH, FHS, FHA, FHL, FHLS, TFH, TFHS, HFH, HFHB, HFHS and HFE studs

PEM brand self-clinching studs are installed by placing them in punched or drilled 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 millimeters.

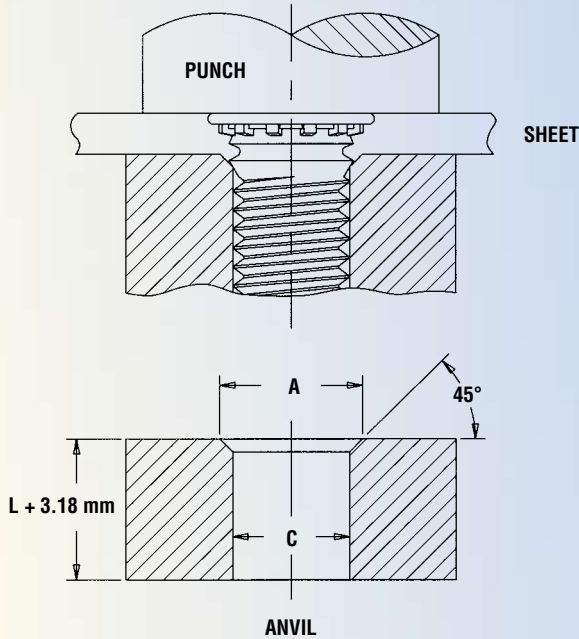
	Thread Code	Anvil Dimensions	
		A + 0.1	C + 0.08
METRIC	M2.5	3.1	2.53
	M3	3.6	3.03
	M3.5	4.1	3.53
	M4	4.6	4.03
	M5	5.6	5.03
	M6	6.6	6.03
	M8	8.6	8.03
	M10	—	10.03

INSTALLATION (Continued)

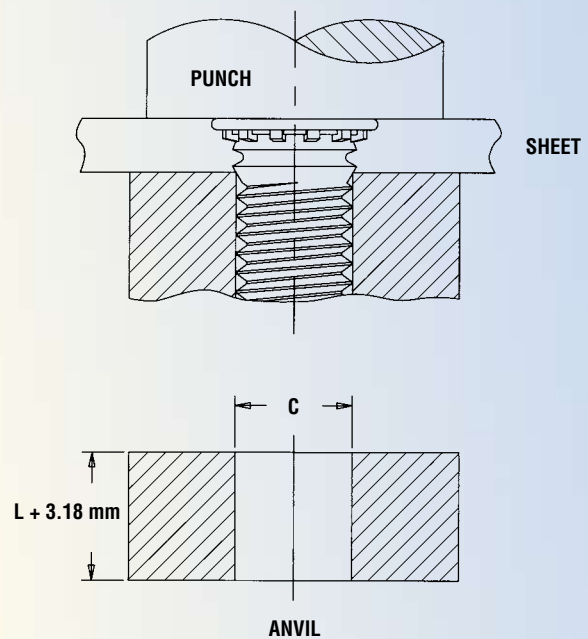
Type FH/FHN/FHS/FHA (Flush) Threaded and Unthreaded Studs

The illustrations below indicate suggested tooling for applying installation forces. Note that for sheets 1.51 mm and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than 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 1.51 mm with M3 thru M5 thread sizes and less than 2.4 mm for M6 threads.



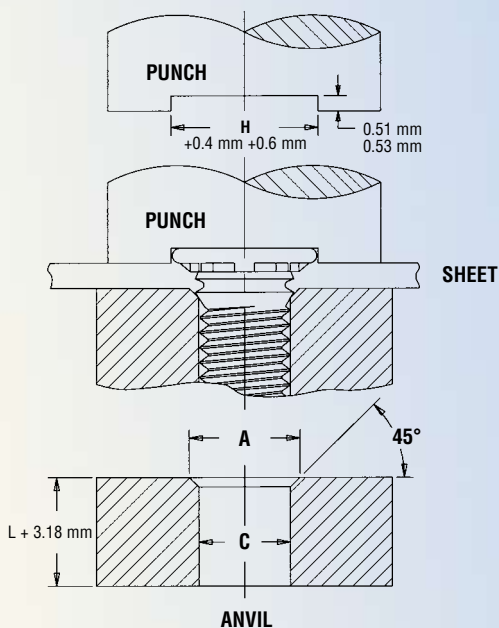
Tooling for sheet thicknesses 1.51 mm and greater with M3 thru M5 thread sizes and 2.41 mm and greater for M6 and M8 threads.



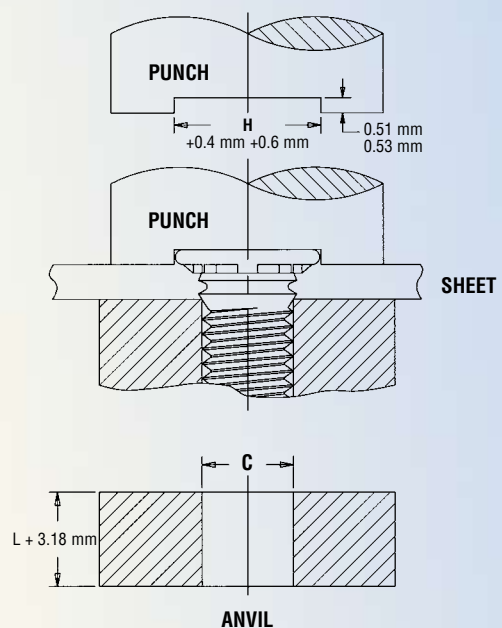
Type TFH/TFHS (Non-Flush) Studs

The illustrations below indicate suggested tooling for type TFH studs. Note that for sheets 0.76 mm and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than 0.76 mm down to 0.51 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 0.64 mm.

Tooling for sheet thicknesses less than 0.76 mm down to 0.51 mm.



Tooling for sheet thicknesses 0.76 mm and greater.

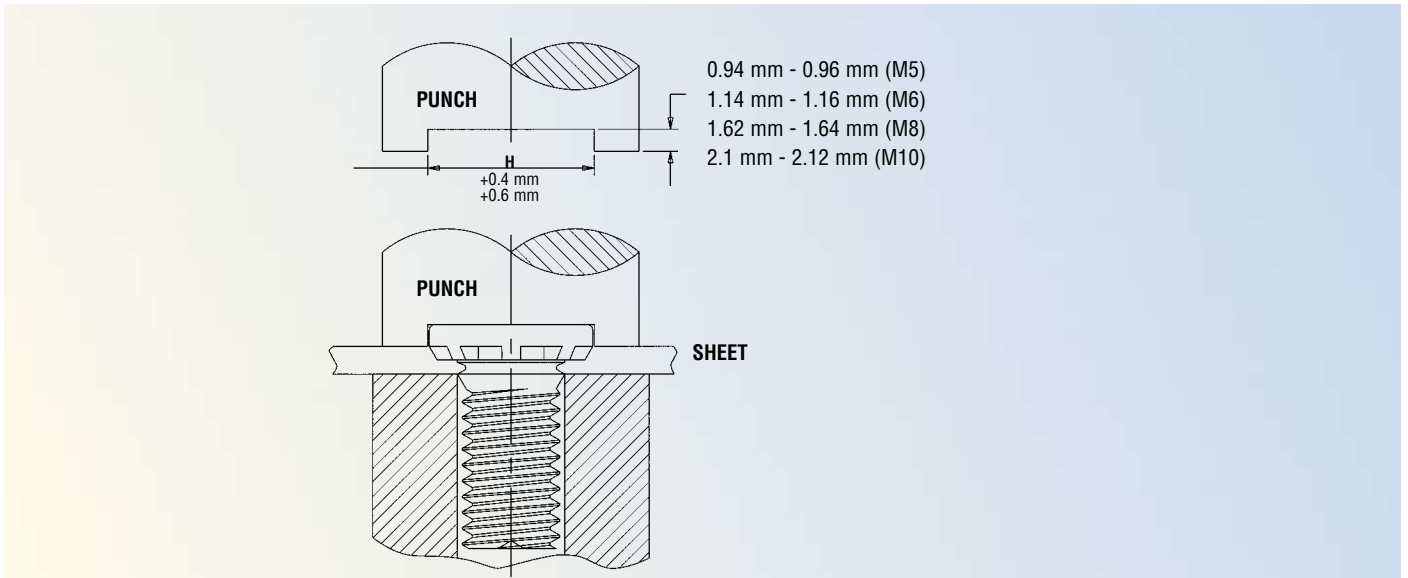


INSTALLATION (Continued)

Type HFH/HFHB/HFHS Studs

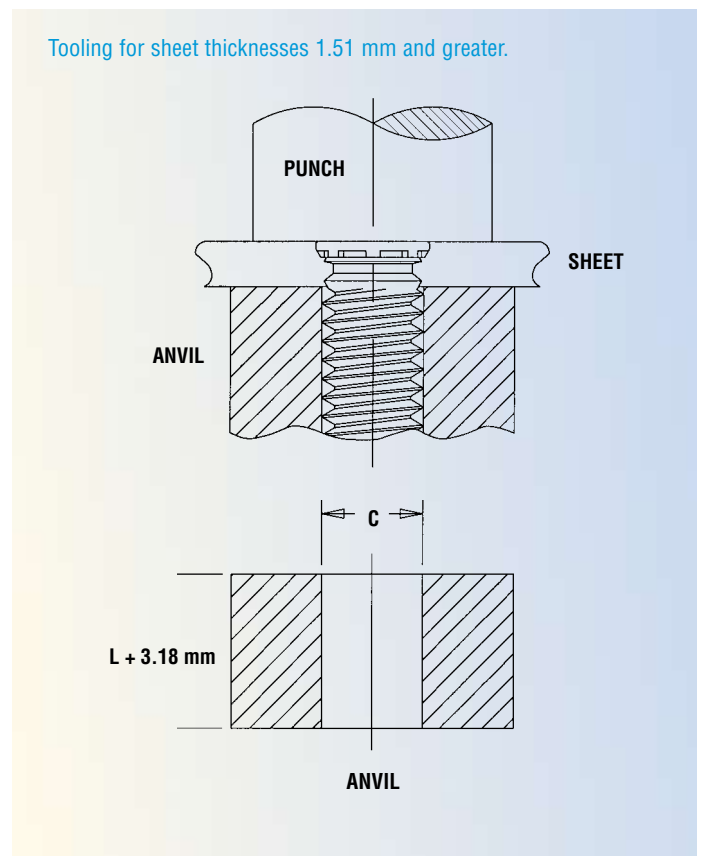
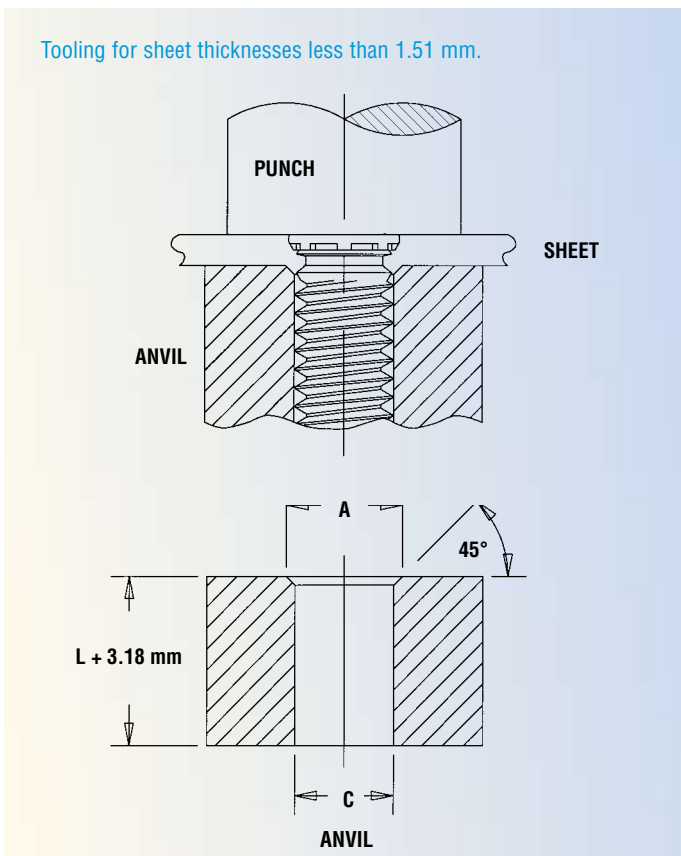
Apply squeezing force on the punch sufficient only to embed the ribs on the head of the stud into the sheet.

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.



Type FHL/FHLS Studs

The illustrations below indicate suggested tooling for applying installation forces. Note that for sheets 1.51 mm and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than 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.



INSTALLATION (Continued)

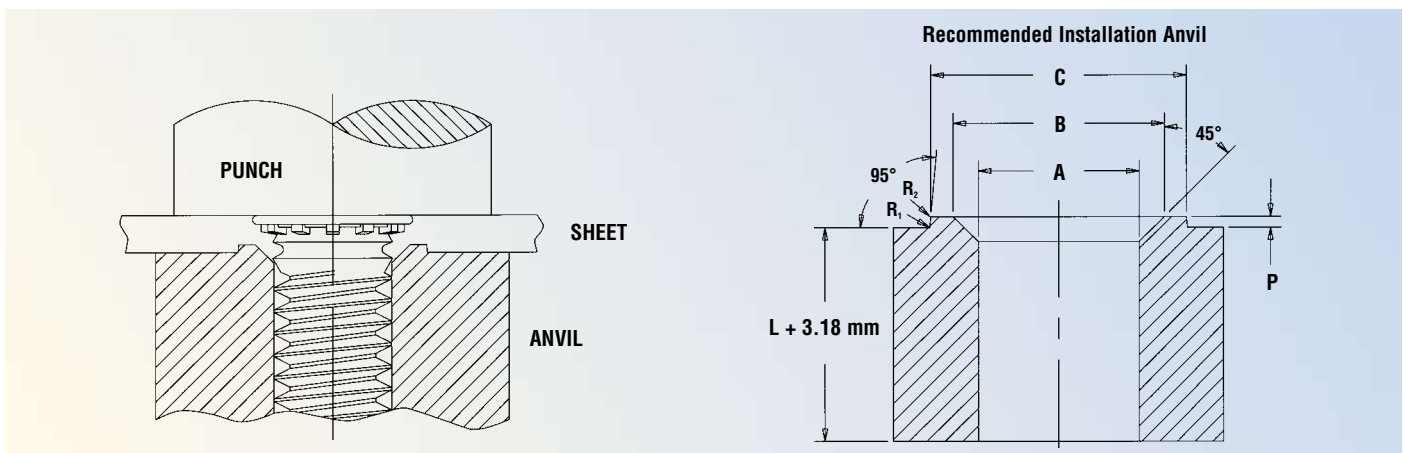
Type FH4 and FHP Self-Clinching Studs for Stainless Steel

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 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 millimeters.

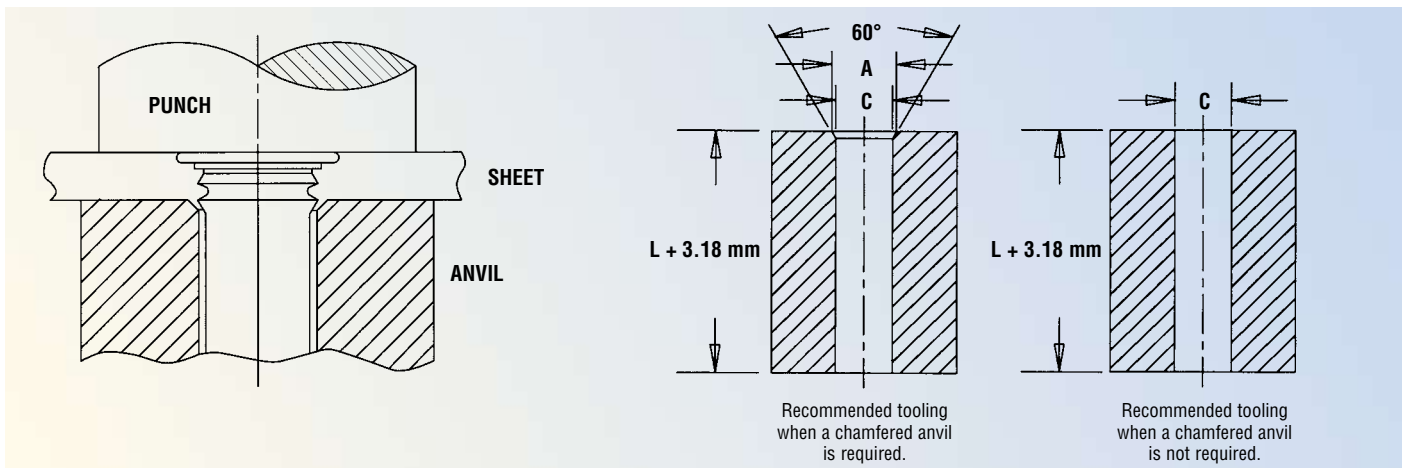
METRIC	Thread Code	Anvil Dimensions					Anvil Part No.	
		A +0.08	B ±0.05	C ±0.05	P ±0.025	R ₁ Max.		R ₂ Max.
	M3	3.05	3.81	4.57	0.25	0.08	0.13	8001678
	M4	4.04	4.95	5.82	0.25	0.08	0.13	8001677
	M5	5.08	6.15	7.16	0.25	0.08	0.13	8001676
	M6	6.05	7.87	8.79	0.51	0.08	0.13	8002536



Type TPS Flush-Mounted, Self-Clinching Pilot Pins

All dimensions are in millimeters.

METRIC	Pin Dia. Code	Test Sheet Thickness	Anvil Dimensions	
			A ±0.05	C ±0.05
	3mm	1 - 1.7	3.88	3.11
		Over 1.7	(1)	
	4mm	1 - 1.7	4.88	4.11
		Over 1.7	(1)	
	5mm	1 - 1.8	5.89	5.13
		Over 1.8	(1)	
	6mm	1 - 1.9	6.89	6.12
		Over 1.9	(1)	

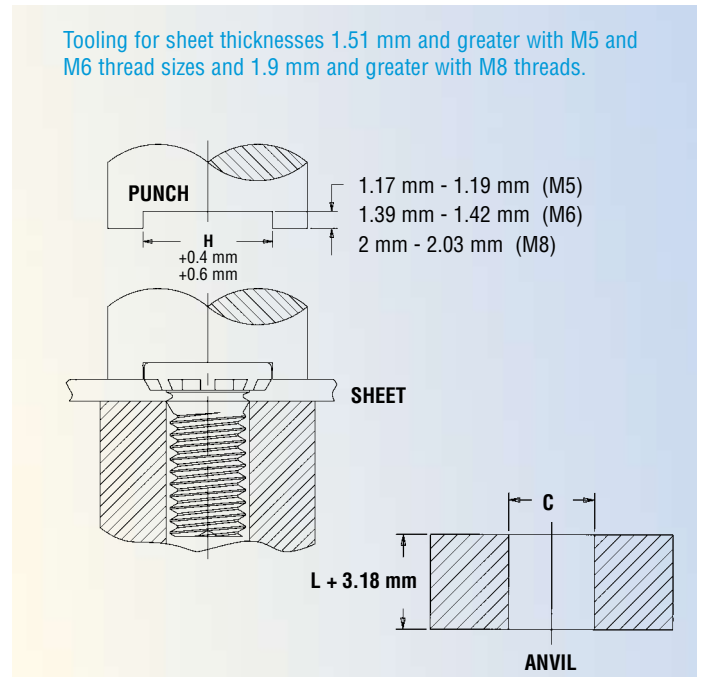
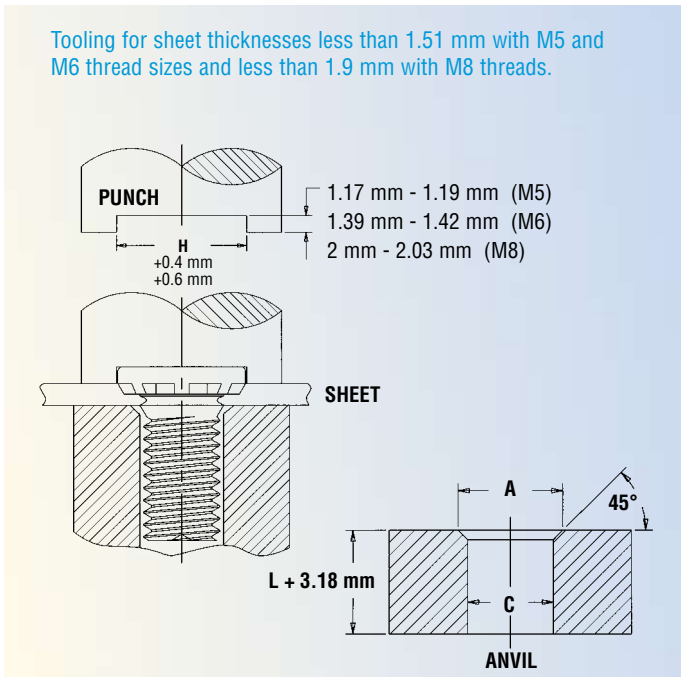


(1) Chamfered anvil not required.

INSTALLATION (Continued)

Type HFE Studs

The illustrations below indicate suggested tooling for applying installation forces. Note that for sheets 1.51 mm and thicker, the anvil requires only a straight thru hole to accommodate the stud. For sheets less than 1.51 mm to less than 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.



Other Considerations

Installation Equipment

For best results we recommend using a PEMSERTER® press for either manual or automatic installation of PEM® FH, FHS, FHA, FHL, FHLS, FH4, TFH, TFHS, HFH, HFHB, HFHS and TPS 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 on our line of presses call 1-800-523-5321 (USA only).

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.



PERFORMANCE DATA (Continued)

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

METRIC	Thread Code	Max. Nut Tightening Torque (N•m) ⁽¹⁾	Type	Test Sheet Thickness and 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
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.

Type TFH and TFHS Non-Flush Studs

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
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

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

Type FH4 Self-Clinching Studs⁽¹⁾

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	

(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-12) dimension is reduced to 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 HFH and HFHS High Strength Studs and Type HFHB Phosphor Bronze Studs

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
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.

Type FHL and FHLS Self-clinching Studs

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
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

Type TPS™ 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	
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 FHP Self-Clinching Studs⁽³⁾

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)
	M5	4.3	1.14 mm Stainless Steel	92	53	3890	7.35	7320

(3) 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 HFE Self-Clinching Studs

MERTIC	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.

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PennEngineering®



North America: Danboro, PA 18916 USA • E-mail: info@pemnet.com • Tel: +1-215-766-8853 • Fax: +1-215-766-0143 • 800-237-4736 (USA Only)
U.K. And Europe: Doncaster, England • E-mail: uk@pemnet.com Tel: +44 (0)1302 765700 • Fax: +44 (0)1302 367580
Asia/Pacific: Singapore • E-mail: singapore@pemnet.com • Tel: +65-6-745-0660 • Fax: +65-6-745-2400
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