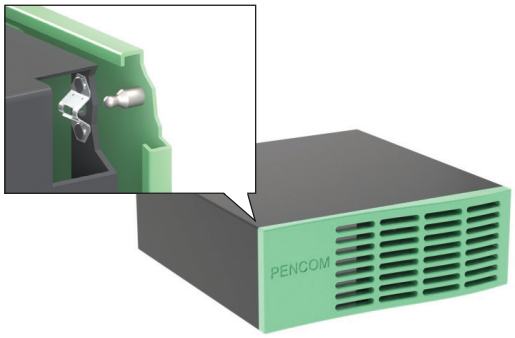
BS/BSC

PENCOM® PENINSULA COMPONENTS

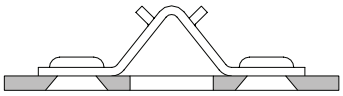
Ball Studs and Clips

FEATURES

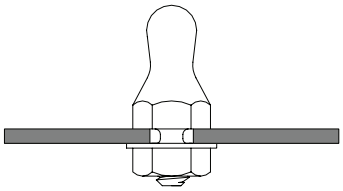
- A convenient spring catch fastener for cabinet doors, inspection panels, etc. requiring repeated disengagement.
- No direct contact between panel surfaces eliminates damaged panel finishes.
- Accommodate different panel thicknesses by varying ball stud lengths.
- Vary ball stud pull–out tension by using different clip material thicknesses.
- Ball studs and clips available in RoHS-compliant plated carbon steel and stainless steel.



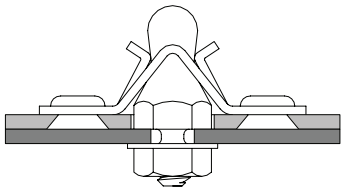
APPLICATION GUIDE



Rivet the ball stud clip onto the panel with either plain or 100° countersunk head rivets, or with screws, nuts and washers (plain rivets shown)



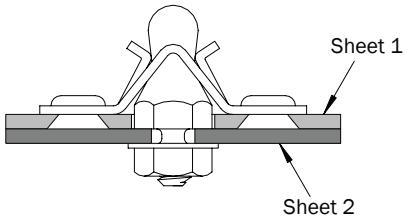
Install the ball stud onto the mating panel according to the appropriate installation method



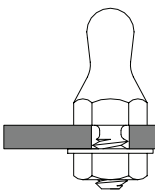
Snap panels together

SELECTION GUIDE

1. Choose a ball stud clip based on the mounting hole diameter, pull–out tension, material, and finish from pages 10 and 11. All clips fit all ball studs. Pull–out tension varies according to the clip material thickness.
2. Select a ball stud type from the installation styles below. Go to the appropriate page and choose a ball stud based on length, material and finish. Vary ball stud length to accommodate Sheet 1 thickness.

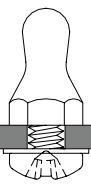


BS10
Male Thread



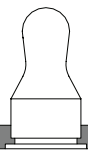
Page 2

BS11
Female Thread



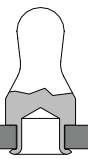
Page 4

BS12
Self-clinching



Page 6

BS13
Swage-in



Page 8

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BS10

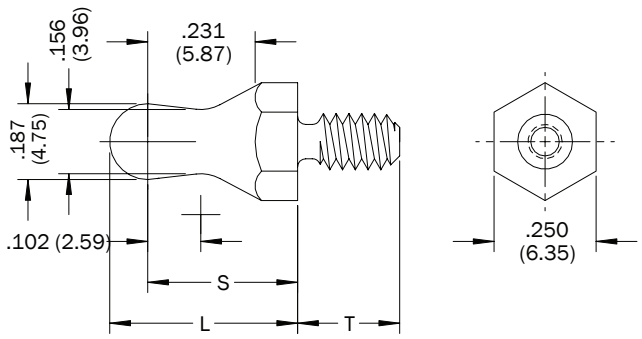
Male Thread Ball Studs

PENCOM® PENINSULA COMPONENTS

PART DESCRIPTION EXAMPLE

BS10	—	473	—	8	—	STL	—	Z
Series		Length Code		Thread Length Code		Material Code		Finish Code

Example above for 6-32 unified thread. For M3.5 metric thread use series code BS10M.



GENERAL

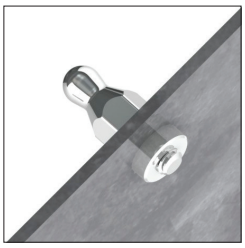
All dimensions in inches

	Thread	Series	Sheet 1 Thickness	Length Code	L ±.010	S ±.005
INCH	6-32 UNC-2A	BS10	.025-.051	421	.421	.328
			.052-.078	447	.447	.354
			.079-.105	473	.473	.380
			.106-.132	499	.499	.406
			.133-.159	525	.525	.432
			.160-.187	551	.551	.458
			.177-.203	570	.570	.477
			.230-.256	625	.625	.532

All dimensions in millimeters

	Thread	Series	Sheet 1 Thickness	Length Code	L ±0.25	S ±0.13
METRIC	M3.5 x 0.6 6g	BS10M	0.64-1.30	1069	10.69	8.33
			1.31-1.98	1135	11.35	8.99
			1.99-2.67	1201	12.01	9.65
			2.68-3.35	1267	12.67	10.31
			3.36-4.04	1334	13.34	10.97
			4.05-4.75	1400	14.00	11.63
			4.50-5.16	1448	14.48	12.12
			5.84-6.50	1588	15.88	13.51

(1) Refer to page 1 for sheet description



PENCOM carries a wide assortment of standard and self-clinching nut and washer assemblies and components. Contact a PENCOM Account Manager for recommendations and more information.

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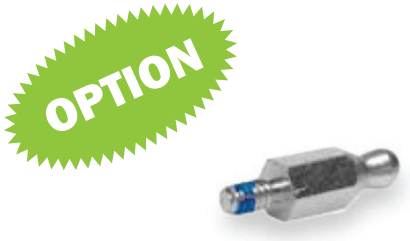
THREAD LENGTH

	Thread Length Code	T +.010 -.000
INCH	5	.156
	6	.187
	7	.218
	8	.250
	10	.312
	12	.375
	14	.437
	16	.500
	18	.562
	20	.625
	22	.687

All dimensions in inches

	Thread Length Code	T +0.25 -0.00
METRIC	400	4.00
	500	5.00
	600	6.00
	750	7.50
	900	9.00
	1050	10.50
	1200	12.00
	1350	13.50
	1500	15.00
	1650	16.50
	1800	18.00

All dimensions in millimeters



A variety of thread locking and lubricating materials can be applied to the threads. Nylon (shown), micro—encapsulated epoxy and other locking elements prevent loosening due to vibration. Lubricating coatings reduce friction, heat buildup and galling during installation of mating fasteners. To specify a nylon locking element, insert PATCH at the end of the part description. Other locking and lubricating materials available by request.

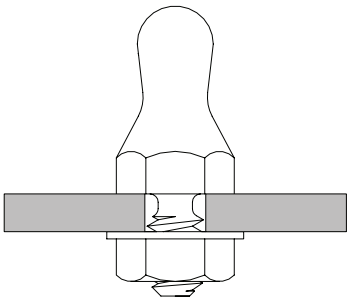
*Ex: BS10-473-8-STL-Z-**PATCH***

MATERIAL & FINISH

Material Code	Material Description	Finish Code	Finish Description
STL	Carbon Steel	Z	Zinc SC1 with Type III Clear Chromate per ASTM B 633
SS	300-Series Stainless Steel	P	Passivated and/or Tested per ASTM A 967

INSTALLATION

1. Punch or drill hole in sheet. Insert the ball stud male thread through hole in sheet and secure with female threaded fastener. In some applications it may be desirable to install a washer between the female threaded fastener and sheet.
2. Tighten the assembly by torquing the female threaded fastener 5.8 to 7.9 in-lbs (6-32) or 0.53 to 0.72 N-m (M3.5). PENCOM recommends a minimum thread engagement of .138 in (6-32) or 3.5 mm (M3.5) between the male and female threads. Installation torques are for zinc–plated carbon steel ball studs and nuts, and for reference only. Pencom recommends testing in the application.
3. Due to the inelastic nature and unpredictable friction coefficients of stainless steel, torque calculations for this material can be unreliable. One method of determining the installation torque uses 50% of the failure torque as developed through testing in the application and applying a ±20% tolerance.



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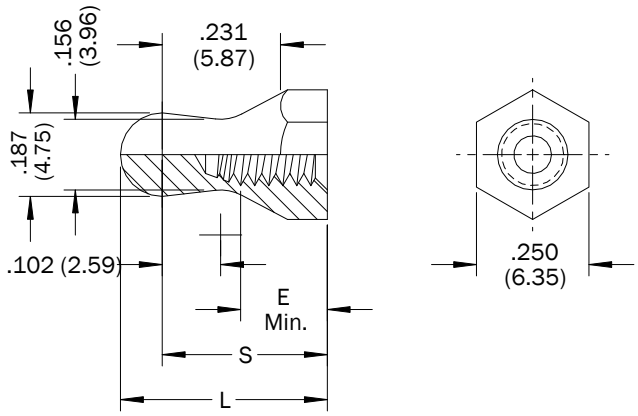
BS11

Female Thread Ball Studs

PART DESCRIPTION EXAMPLE

BS11	—	473	—	STL	—	Z
Series		Length Code		Material Code		Finish Code

Example above for 6-32 unified thread. For M3.5 metric thread use series code BS11M.



GENERAL

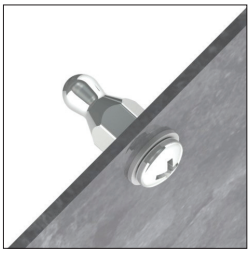
All dimensions in inches

	Thread	Series	Sheet 1 Thickness	Length Code	L ±.010	S ±.005	E Min. Full Thread
INCH	6-32 UNC-2B	BS11	.025-.051	421	.421	.328	.115
			.052-.078	447	.447	.354	.141
			.079-.105	473	.473	.380	.167
			.106-.132	499	.499	.406	.193
			.133-.159	525	.525	.432	.219
			.160-.187	551	.551	.458	.245
			.177-.203	570	.570	.477	.264
			.230-.256	625	.625	.532	.319

All dimensions in millimeters

	Thread	Series	Sheet 1 Thickness	Length Code	L ±0.25	S ±0.13	E Min. Full Thread
METRIC	M3.5 x 0.6 6H	BS11M	0.64-1.30	1069	10.69	8.33	2.92
			1.31-1.98	1135	11.35	8.99	3.58
			1.99-2.67	1201	12.01	9.65	4.24
			2.68-3.35	1267	12.67	10.31	4.90
			3.36-4.04	1334	13.34	10.97	5.56
			4.05-4.75	1400	14.00	11.63	6.22
			4.50-5.16	1448	14.48	12.12	6.71
			5.84-6.50	1588	15.88	13.51	8.10

(1) Refer to page 1 for sheet description.



PENCOM carries a wide assortment of screw and washer assemblies and components. Contact a PENCOM Account Manager for recommendations and more information.

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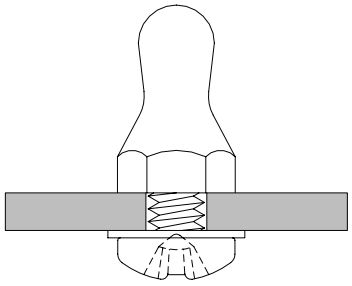
MATERIAL & FINISH

Material Code	Material Description	Finish Code	Finish Description
STL	Carbon Steel	Z	Zinc SC1 with Type III Clear Chromate per ASTM B 633
SS	300-Series Stainless Steel	P	Passivated and/or Tested per ASTM A 967

INSTALLATION

1. Punch or drill hole in sheet. Insert a male thread fastener through hole in the sheet and secure the ball stud. In some applications it may be desirable to install a washer between the head of the male threaded fastener and sheet.
2. Tighten the assembly by torquing the male threaded fastener 7 to 10 in-lbs (6-32) or 0.8 to 1.1 N-m (M3.5). PENCOM recommends a minimum thread engagement of .138 in (6-32) or 3.5 mm (M3.5) between the male and female threads. Installation torques are for zinc–plated Grade 2 (inch) or Class 4.8 (metric) carbon steel screws and for reference only. PENCOM recommends testing in the application.
3. Due to the inelastic nature and unpredictable friction coefficients of stainless steel, torque calculations for this material can be unreliable. One method of determining the installation torque uses 50% of the failure torque as developed through testing in the application and applying a ±20% tolerance.



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BS12

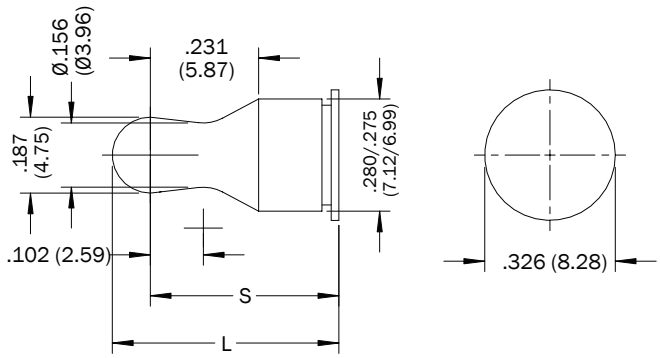
Self–clinching Ball Studs

PENCOM® PENINSULA COMPONENTS

PART DESCRIPTION EXAMPLE

BS12 — 466 — STL — Z

- 466: Length Code
- STL: Material Code
- Z: Finish Code

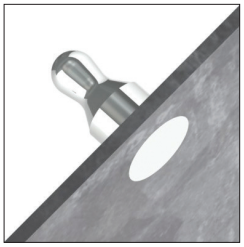


GENERAL

All dimensions in inches (millimeters)

Sheet 1 Thickness	Sheet 2 Thickness	Length Code	L ±.010 (±0.25)	S ±.005 (±0.13)
.025-.051 (0.64-1.30)	.040-.049 (1.02-1.25)	466	.466 (11.84)	.373 (9.47)
	.050-.059 (1.27-1.50)	476	.476 (12.09)	.383 (9.73)
.052-.078 (1.31-1.98)	.040-.049 (1.02-1.25)	492	.492 (12.50)	.399 (10.13)
	.050-.059 (1.27-1.50)	502	.502 (12.75)	.409 (10.39)
.079-.105 (1.99-2.67)	.040-.049 (1.02-1.25)	518	.518 (13.16)	.425 (10.80)
	.050-.059 (1.27-1.50)	528	.528 (13.41)	.435 (11.05)
.106-.132 (2.68-3.35)	.040-.049 (1.02-1.25)	544	.544 (13.82)	.451 (11.46)
	.050-.059 (1.27-1.50)	554	.554 (14.07)	.461 (11.71)
.133-.159 (3.36-4.04)	.040-.049 (1.02-1.25)	570	.570 (14.48)	.477 (12.12)
	.050-.059 (1.27-1.50)	580	.580 (14.73)	.487 (12.37)
.160-.187 (4.05-4.75)	.040-.049 (1.02-1.25)	596	.596 (15.14)	.503 (12.78)
	.050-.059 (1.27-1.50)	606	.606 (15.39)	.513 (13.03)
.177-.203 (4.50-5.16)	.040-.049 (1.02-1.25)	615	.615 (15.62)	.522 (13.26)
	.050-.059 (1.27-1.50)	625	.625 (15.88)	.532 (13.51)
.230-.256 (5.84-6.50)	.040-.049 (1.02-1.25)	670	.670 (17.02)	.577 (14.66)
	.050-.059 (1.27-1.50)	680	.680 (17.27)	.587 (14.91)

(1) Refer to page 1 for sheet descriptions. Ball studs mount in sheet 2.



BS12 Self–clinching Ball Studs provide a permanent and reliable installation that creates a flush appearance on the back side of aluminum, carbon steel and stainless steel sheets.

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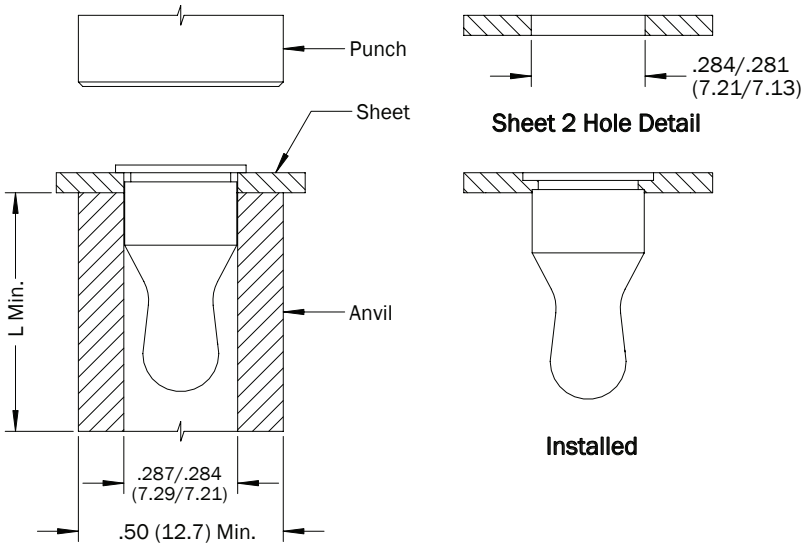
MATERIAL & FINISH

Material Code	Material Description	Finish Code	Finish Description	For Use in Sheet Hardness		
				HRB 70 Max.	HRB 80 Max.	HRB 88 Max.
STL	Heat Treated Carbon Steel	Z	Zinc SC1 with Type III Clear Chromate per ASTM B 633		•	
SS	300-Series Stainless Steel	P	Passivated and/or Tested per ASTM A 967	•		
S4	Heat Treated Stainless Steel	P	Passivated and/or Tested per ASTM A 967			•

INSTALLATION

1. Punch or drill hole in sheet a minimum distance of .37in (9.4mm) from the hole center to edge of sheet. Do not deburr edges.
2. Insert the ball stud through hole in sheet and into the anvil as shown.
3. Squeeze the sheet and ball stud head between parallel punch and anvil surfaces. Use only enough pressure to seat the ball stud head flush with the sheet. Punch and anvil should be made from hardened steel.



PERFORMANCE

Ball Stud Material Code	Test Sheet Material					
	5052-H32 Aluminum		1008 Carbon Steel HRB 60		304 Stainless Steel HRB 70	
	Installation lbs (kN)	Push–out lbs (N)	Installation lbs (kN)	Push–out lbs (N)	Installation lbs (kN)	Push–out lbs (N)
STL	1700-2000 (7.6-8.9)	230 (1023)	3600-4400 (16.0-19.6)	360 (1601)	(2)	(2)
SS	1700-2000 (7.6-8.9)	230 (1023)	3600-4400 (16.0-19.6)	360 (1601)	(2)	(2)
S4	—	—	—	—	5900-7200 (26.2-32.0)	470 (2090)

(1) Performance data represents the average destructive result when all installation specifications are strictly followed. Variations in sheet hole size, thickness, material and installation methods will affect the loads. PENCOM strongly encourages testing in the application.
(2) Not recommended.

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BS13

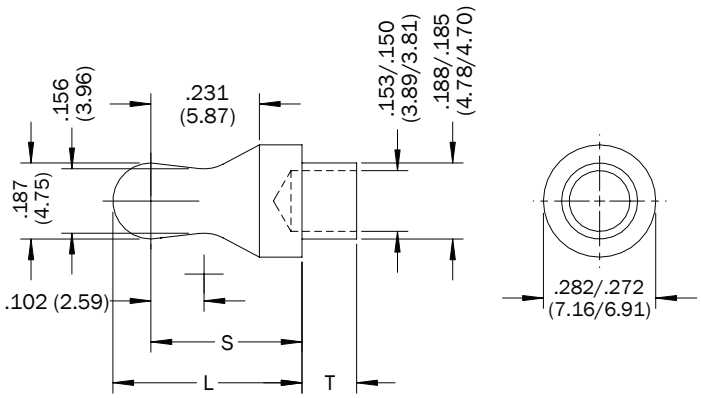
Swage–in Ball Studs

PENCOM® PENINSULA COMPONENTS

PART DESCRIPTION EXAMPLE

BS13 — 473 — B — SS — P

- 473: Length Code
- B: Shank Length Code
- SS: Material Code
- P: Finish Code



GENERAL

All dimensions in inches (millimeters)

Sheet 1 Thickness	Length Code	L ±.010 (±0.25)	S ±.005 (±0.13)	Anvil A
.025-.051 (0.64-1.30)	421	.421 (10.69)	.328 (8.33)	.313 (7.95)
.052-.078 (1.31-1.98)	447	.447 (11.35)	.354 (8.99)	.339 (8.61)
.079-.105 (1.99-2.67)	473	.473 (12.01)	.380 (9.65)	.365 (9.27)
.106-.132 (2.68-3.35)	499	.499 (12.67)	.406 (10.31)	.391 (9.93)
.133-.159 (3.36-4.04)	525	.525 (13.34)	.432 (10.97)	.417 (10.59)
.160-.187 (4.05-4.75)	551	.551 (14.00)	.458 (11.63)	.443 (11.25)
.177-.203 (4.50-5.16)	570	.570 (14.48)	.477 (12.12)	.462 (11.73)
.230-.256 (5.84-6.50)	625	.625 (15.88)	.532 (13.51)	.517 (13.13)

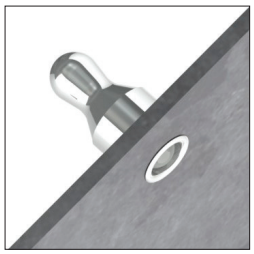
(1) Refer to page 1 for sheet description.

SHANK LENGTH

All dimensions in inches (millimeters)

Sheet 2 Thickness		Shank Length Code	T ±.003 (±0.08)	Sheet B
Swage–In	Flare–In Min.			
.031 (0.79)	.095 (2.41)	A	.075 (1.91)	.015 (0.38)
.062 (1.59)	.125 (3.18)	B	.105 (2.67)	.035 (0.89)
.094 (2.38)	.155 (3.94)	C	.135 (3.43)	.065 (1.65)
.125 (3.18)	.185 (4.70)	D	.165 (4.19)	.095 (2.41)
.187 (4.76)	.250 (6.35)	E	.230 (5.84)	.160 (4.06)
.250 (6.35)	.310 (7.87)	F	.290 (7.37)	.220 (5.59)

(1) Refer to page 1 for sheet description.



BS13 Swage–in Ball Studs can be flared in as well and are popular choices for painted sheets and close–to–edge applications (swaged installation shown).

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MATERIAL & FINISH

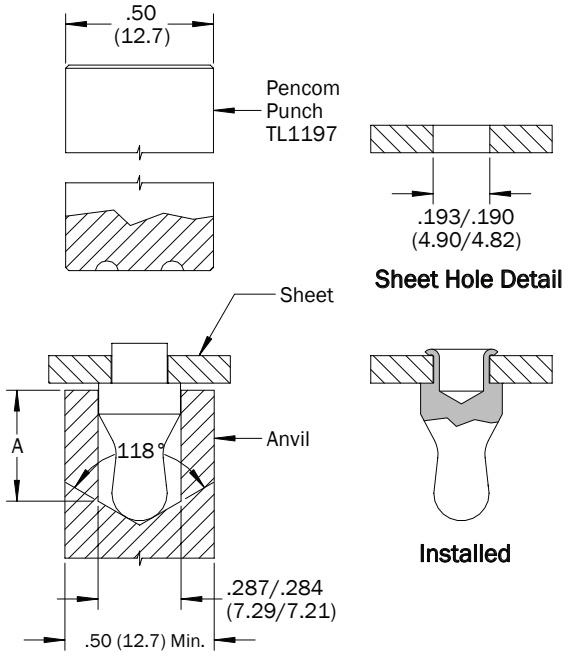
Material Code	Material Description	Finish Code	Finish Description
SS	300–Series Stainless Steel	P	Passivated and/or Tested per ASTM A 967

SWAGE–IN INSTALLATION

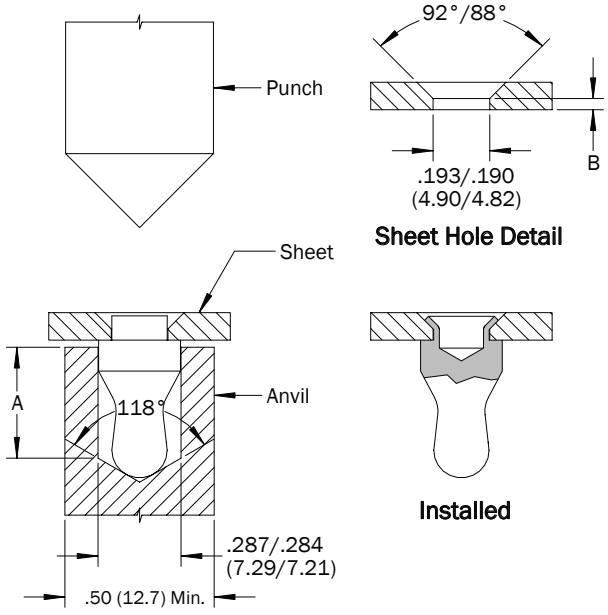
1. Prepare the sheet as shown for swage–in installation.
2. Insert the ball stud into recessed anvil and place sheet hole over ball stud shank.
3. Squeeze the ball stud between parallel and concentric anvil and punch. Swage the ball stud shank using light pressure. Anvil should be made from hardened steel. Punch may be ordered using PENCOM part number TL1197.

FLARE–IN INSTALLATION

1. Prepare the sheet as shown for flare–in installation.
2. Insert the ball stud into recessed anvil and place sheet hole over ball stud shank.
3. Squeeze the ball stud between parallel and concentric anvil and punch. Flare the ball stud shank into the sheet countersink using light pressure. Punch flare angle should match the sheet hole countersink angle. Anvil and punch should be made from hardened steel.



Swage-In Installation



Flare-In Installation

 ©PENCOM 2022

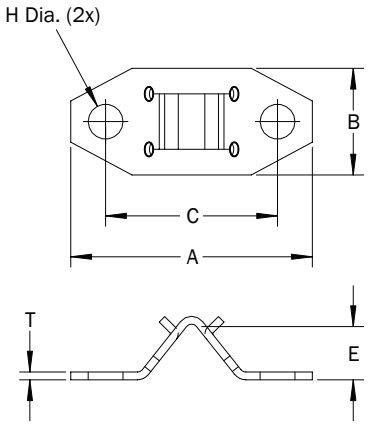
BSC

Ball Stud Clips

PART DESCRIPTION EXAMPLE

BSC — 135 — 017 — STL — Z

- 135: Hole Diameter Code
- 017: Material Code
- STL: Finish Code
- Z



GENERAL

All dimensions in inches (millimeters)

Hole Diameter Code	H Hole Diameter	Ball Stud Pull-out Tension lbs (N) ±30%	Material Thickness Code	T Material Thickness	A	B	C	E
105	.105 (2.67)	3.5 (15)	012	.012 (0.30)	.970 (24.64)	.440 (11.18)	.685 (17.40)	.220 (5.59)
		8.0 (35)	017	.017 (0.43)				
		12.0 (53)	022	.022 (0.56)				
		18.0 (80)	028	.028 (0.71)				
		30.0 (133)	031	.031 (0.79)				
135	.135 (3.43)	3.5 (15)	012	.012 (0.30)	.970 (24.64)	.440 (11.18)	.685 (17.40)	.220 (5.59)
		8.0 (35)	017	.017 (0.43)				
		12.0 (53)	022	.022 (0.56)				
		18.0 (80)	028	.028 (0.71)				
		30.0 (133)	031	.031 (0.79)				
145	.145 (3.68)	3.5 (15)	012	.012 (0.30)	.970 (24.64)	.440 (11.18)	.685 (17.40)	.220 (5.59)
		8.0 (35)	017	.017 (0.43)				
		12.0 (53)	022	.022 (0.56)				
		18.0 (80)	028	.028 (0.71)				
		30.0 (133)	031	.031 (0.79)				

(1) All dimensions are reference unless toleranced.

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MATERIAL & FINISH

Material Code	Material Description	Finish Code	Finish Description
STL	Carbon Steel	Z	Zinc SC1 with Type III Clear Chromate per ASTM B 633
STL	Carbon Steel	OIL	Soluble Oil
STL	Carbon Steel	PHOS-OIL	Phosphate with Oil
SS	300-Series Stainless Steel	P	Passivated and/or Tested per ASTM A 967

(1) Other finishes available by request.

INSTALLATION

1. Drill or punch clip mounting and ball stud clearance holes in sheet.
2. Rivet the ball stud clip onto the sheet with either plain or 100° countersunk head rivets (plain rivet installatoin shown on left) or with screws, nuts and washers (shown on right).

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