

# TRIPYRAMID

STANDARD TENSION ELEMENTS



# TriPyramid Rods and Cables

TriPyramid Structures designs and supplies tension members of all description, ranging from very small stainless cables to very large galvanized cables, and from small decorative stainless steel rods and fittings to very large stainless and galvanized steel tension rods. Standard fittings are available for all sizes of cable and rod, whether steel or stainless steel.

The company's design and manufacturing team is constantly developing and supplying custom hardware for situations that are more effectively served by purpose-designed fittings and fabrications.



# Tension Member Design Basics

## Rod vs Cable

Many factors go into choosing whether to use cable or rod, galvanized or stainless, high strength or lower strength rod materials, flexible or more rigid cable construction. Cables tend to be more efficient when lengths are long, loads are high, or the member passes several struts or clamps, as might occur in a bow truss. Rods are often a better answer when the member length is relatively short (32 feet or less), clean and smooth appearance is important, or when stiffness rather than strength is the driving design consideration.

## ROD ELEMENTS

Tension rods come in a wide variety of materials and strengths, and each has its own range of parameters for which it is ideally suited. In stainless steel, TriPyramid offers three tensile strength ranges: high strength, medium strength, and LCW grade. In carbon steel, TriPyramid offers a standard range with a yield strength almost double that of A36 structural steel.

TriPyramid's A03 family of high strength rods is what is used for holding up the masts of America's Cup sailing yachts. This material offers the highest practical strength-to-weight ratio, so would offer the smallest diameter for a given strength.

TriPyramid's medium strength range of rods (A22 and A25 series) generally provides the most cost effective combination of strength and appearance. This material has a yield strength approximately three times that of normal A36 structural steel or typical threaded stainless bar systems.

The LCW (lightly cold worked) range of rods (A35 series) is lower in strength than medium strength rod, but provides the least expensive rod assemblies when a given diameter, and not strength of the rod, is the driving design consideration.

TriPyramid offers steel rods (A70 series) ranging in diameter from 1/2" (12 mm) to 4" (100 mm). This standard rod material has a yield almost double that of A36 structural steel. Rods and fittings can be galvanized for exterior applications.



## CABLE ELEMENTS

Cables are made up of strands, which, in turn, are made from very high strength steel or stainless steel material. Because of the very high material strength, cables are very material-efficient for tension members, i.e. they offer a high strength to weight ratio. Cables come in two fundamental constructions: flexible (sometimes called "wire rope") and relatively stiff (sometimes called "strand"). Typically, static tension members, such as those most commonly found in structural applications, are made from strand, as it has a higher strength and stiffness for a given diameter than wire rope.

Table with columns for TriPyramid LCW Stainless Steel, TriPyramid Medium Strength Stainless, TriPyramid High Strength Stainless, and TriPyramid Steel Tie Rods. Includes diameter, product number, breaking strength, and yield strength for various materials.

# Rod and Cable Mechanical Properties

Different rod and cable materials and different cable constructions offer widely differing mechanical properties, visual effects, and inherent costs. The tables and graph on these pages give strength and stiffness information on the variety of rod and cable choices that TriPyramid offers.

See the fitting tables for assemblies which correspond to the various rod and cable sizes and materials. Order by full assembly, that is, rod or cable, plus the fittings for both ends.

Rod and Cable Stretch Characteristics

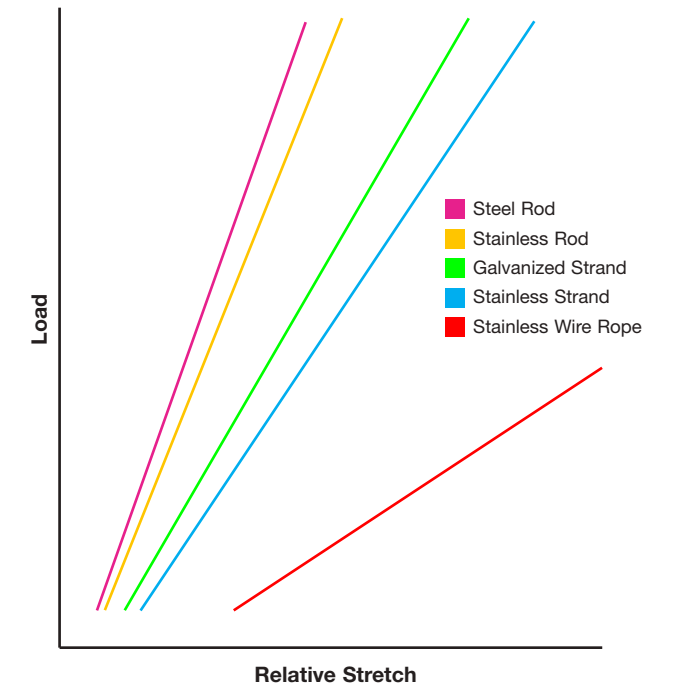
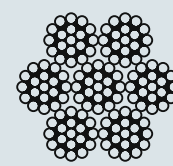


Table titled 'Typical Mechanical Properties' with columns for Elastic Modulus (E) in ksi and GPa, and Ultimate Strength in ksi and MPa. It lists properties for Solid Rods and Cables across various materials and grades.

Note: Based on actual rod diameter and nominal cable diameter

## Wire Rope

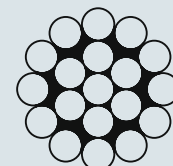
Flexible cable is commonly known as wire rope, or, in some cases, aircraft cable. Common varieties are also called 7x19 or 6x19 IWRC. It is not typically used for static, tension load-carrying structural members because, for a given strength, it is larger in diameter and lower in stiffness than structural strand or solid rods. However, in cases where relatively high stretch is desired, giving a springy effect to the member, wire rope may be the appropriate choice. Stainless steel wire ropes are also used for decorative applications where the finer stainless wires that make up the cable may give a more pleasing appearance.



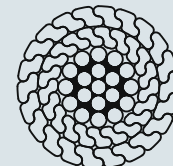
Wire Rope

## Structural Strand

Structural strand is the cable construction most commonly used in structural applications. It offers the best combination of strength and stiffness for static structures. As cables get larger in diameter, the number of strands increases. Typically cables up to 3/4" (19 mm) diameter have 19 strands (called 1x19), while cables 2" (50 mm) might have 91 strands (called 1x91). A variation for larger galvanized cables is "full locked cable". These cables have their outer strands drawn in a "Z" shape so that they interlock and form a smoother outside layer of strands. The interlocking strands also yield a denser cross section and therefore a higher effective elastic modulus.

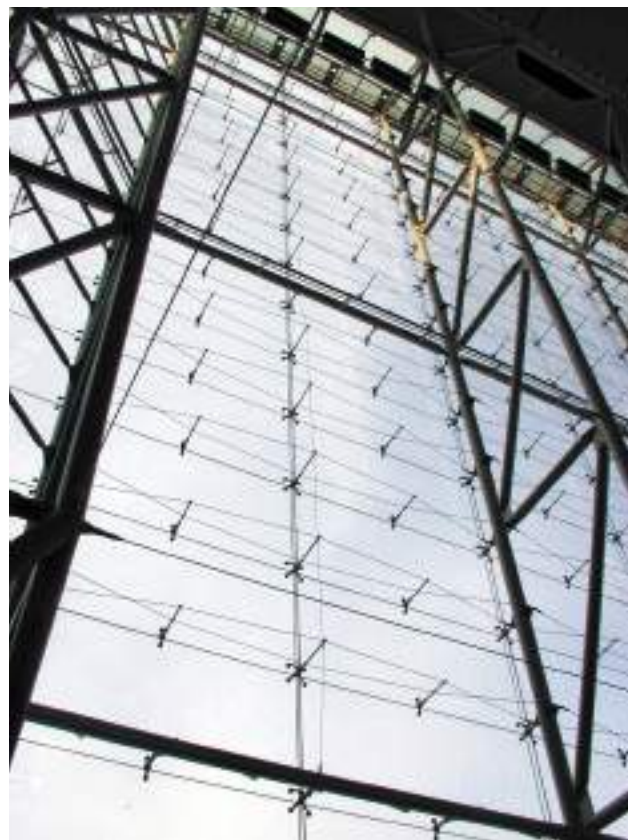


1 x 19



Full Locked

Large table with columns for Stainless Steel Structural Cables, Stainless Steel Wire Rope, Galvanized Structural Cables, and Galvanized Wire Rope. It lists product numbers, breaking strength, and diameter for various cable types.



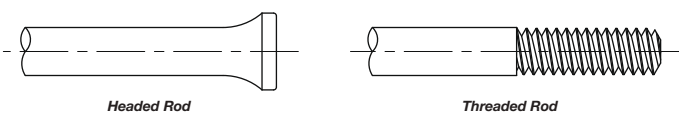
In most architectural applications where stainless steel rods are called for, TriPyramid's medium strength rods are the most cost-effective combination of strength and stiffness. These materials have yield strengths about three times that of commonly available annealed stainless steel or A36 structural steel. This means smaller diameter for a given strength. For instance, a 1/2" (12.7 mm) diameter annealed rod can be replaced by a 5/16" (8 mm) diameter medium strength rod.

TriPyramid uses two different materials for medium strength rod, depending on diameter. TriPyramid Series A22 rod, in sizes up to 5/8" (16 mm) diameter, is cold drawn austenitic stainless steel, typically type 304 alloy. Yield strength is in the range of 110 ksi and ultimate strength is in the range of 140 ksi. For structural tension members, A22 rods are usually terminated by cold heading the rods. This technique allows the rod to develop its full tensile strength, as the diameter is never decreased below the basic rod diameter.

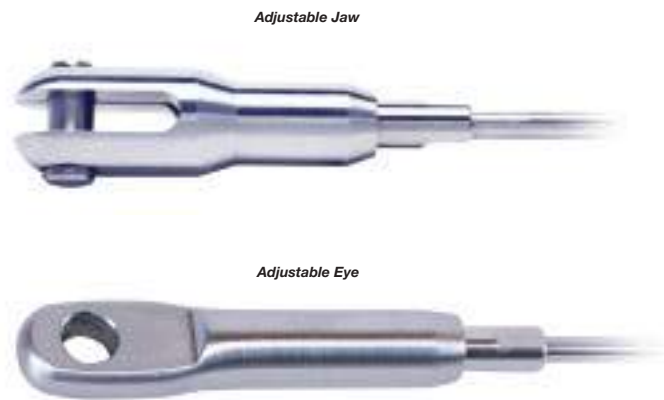
TriPyramid Series A25 rod in diameters 3/4" (19 mm) and larger is made from heat treated stainless steel with yield strength of 105 ksi and ultimate strength of 135 ksi. Cold heading these rods is not practical, therefore the A25 series of rods uses a threaded attachment system for the fittings.

Small diameter medium strength rods, 1/4" and 3/16" diameter, are often ideal for railing infill. The rod's smooth brushed surface makes it easy to clean, and its high yield strength makes it virtually kink-proof. (See page 11 for railing infill fittings.)

A variety of standard and custom fittings is available for medium strength rod. Standard fittings include both fixed and adjustable jaws. Eye fittings are made on a semi-custom basis with dimensions as required.

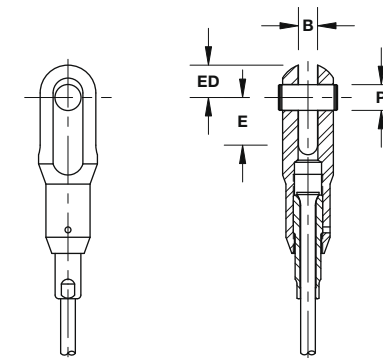


Fixed Jaw Assembly (B225)    Adjustable Jaw Assembly (B215)    Threaded Jaw Assembly (B230)



**Jaw Assemblies for Medium Strength Headed Rod**

Fittings for the A22 range of rods are attached by cold heading the rods. Adjustment of these fittings is provided by the threaded bushing (nose) that is captured by the head on the end of the rod. The bushing is free to rotate about the rod, threading into or out of the fitting to provide length adjustment. Threads are always concealed. Fixed jaw assemblies, also attached by cold heading the rod, are appropriate if no adjustment is required.

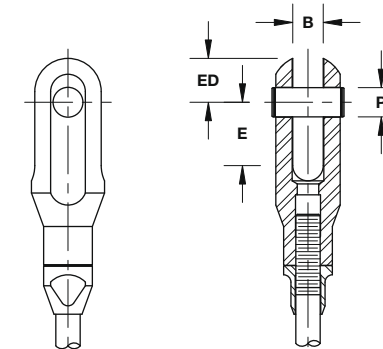


Jaw Assemblies for Medium Strength Headed Rod															
Jaw Part Number	Rod Diameter		Compatible Rod	Rod Breaking Strength		Pin Diameter (P)		Jaw Gap (B)		Throat Depth (E)		Edge Distance (ED)		Take Up	
	inch	(mm)		kips	(kN)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
B215-0188	0.188	(4.8)	A22-0188	3.8	(16.9)	0.31	(8.0)	0.28	(7.1)	0.58	(14.7)	0.44	(11.1)	0.75	(19.1)
B215-0225	0.225	(5.7)	A22-0225	5.5	(24.5)	0.38	(9.5)	0.28	(7.1)	0.69	(17.5)	0.50	(12.7)	0.75	(19.1)
B215-0250	0.250	(6.4)	A22-0250	6.8	(30.2)	0.50	(12.7)	0.40	(10.2)	0.92	(23.4)	0.63	(15.9)	1.00	(25.4)
B215-0330	0.330	(8.4)	A22-0330	11.9	(52.9)	0.56	(14.3)	0.40	(10.2)	1.04	(26.4)	0.65	(16.5)	1.00	(25.4)
B215-0375	0.375	(9.5)	A22-0375	15.4	(68.5)	0.63	(15.9)	0.53	(13.5)	1.16	(29.4)	0.75	(19.1)	1.25	(31.8)
B215-0437	0.437	(11.1)	A22-0437	20.0	(89.0)	0.75	(19.1)	0.53	(13.5)	1.39	(35.3)	0.88	(22.2)	1.25	(31.8)
B215-0500	0.500	(12.7)	A22-0500	27.5	(122.3)	0.88	(22.2)	0.65	(16.5)	1.62	(41.1)	1.10	(27.9)	1.25	(31.8)
B215-0625	0.625	(15.9)	A22-0625	42.0	(186.8)	1.13	(28.6)	0.78	(19.8)	2.08	(52.9)	1.50	(38.1)	1.75	(44.5)

Notes: Material is type 304 stainless steel with a brushed finish. Stock rod length 32'. If pretensioning of more than 200 pounds is required, special rotating bearings can be incorporated within the adjustable noses. Fittings are all designed to be stronger than the corresponding TriPyramid Series A22 rod. Other materials and finishes, and custom pin, gap and edge distances are readily available on a custom basis. Custom adjustable eye assemblies are also available. Dimensions for fixed jaws are the same as those shown in the table above for adjustable jaws, except that fixed jaws have no take-up.

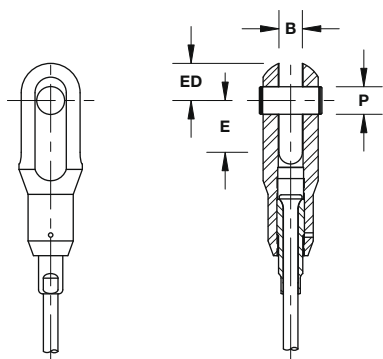
**Jaw Assemblies for Medium Strength Heat Treated Threaded Rod**

Fittings for the A25 range of rods are attached by threading the rod. Special lock nuts cover the threads to give a smooth, clean appearance. These fittings are designed to provide length adjustment, not pretensioning. Fittings are made from the same material as the rods themselves, to keep fitting size as small as possible. Standard finish is brushed.



Jaw Assemblies for Medium Strength Threaded Rod															
Jaw Part Number	Rod Diameter		Compatible Rod	Rod Breaking Strength		Pin Diameter (P)		Jaw Gap (B)		Throat Depth (E)		Edge Distance (ED)		Take Up	
	inch	(mm)		kips	(kN)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
B230-0750	0.750	(19.1)	A25-0750	50.0	(222.4)	1.00	(25.4)	1.06	(27.0)	2.00	(50.8)	1.50	(38.1)	1.50	(38.1)
B230-0875	0.875	(22.2)	A25-0875	68.5	(304.7)	1.13	(28.6)	1.31	(33.3)	2.25	(57.2)	1.69	(42.9)	1.50	(38.1)
B230-1000	1.000	(25.4)	A25-1000	81.8	(363.9)	1.25	(31.8)	1.31	(33.3)	2.75	(69.9)	1.88	(47.6)	1.75	(44.5)
B230-1125	1.125	(28.6)	A25-1125	103.0	(458.2)	1.38	(34.9)	1.56	(39.7)	3.13	(79.4)	2.06	(52.4)	1.75	(44.5)
B230-1250	1.250	(31.8)	A25-1250	130.8	(581.8)	1.50	(38.1)	1.56	(39.7)	3.25	(82.6)	2.25	(57.2)	2.00	(50.8)
B230-1375	1.375	(34.9)	A25-1375	166.5	(740.6)	1.75	(44.5)	1.81	(46.0)	3.50	(88.9)	2.63	(66.7)	2.00	(50.8)
B230-1500	1.500	(38.1)	A25-1500	201.0	(894.1)	2.00	(50.8)	2.06	(52.4)	4.00	(101.6)	3.00	(76.2)	2.50	(63.5)
B230-1750	1.750	(44.5)	A25-1750	281.0	(1250)	2.25	(57.2)	2.06	(52.4)	5.00	(127.0)	3.38	(85.7)	2.50	(63.5)
B230-2000	2.000	(50.8)	A25-2000	374.0	(1664)	2.50	(63.5)	2.56	(65.1)	5.50	(139.7)	3.85	(97.8)	2.50	(63.5)

Notes: Stock rod length 20'. Larger sizes, for rods up to 4" in diameter, are available on a custom basis. Strengths noted are strength in threaded area. Fittings are all designed to be stronger than the corresponding TriPyramid Series A25 rod. Other materials and finishes, and custom pin, gap and edge distances, are readily available on a custom basis. Custom adjustable eye assemblies are also available.



**Jaw Assemblies for High Strength Headed Rod**

TriPyramid high strength stainless steel rod, developed for America's Cup racing yachts, is used where the ultimate in high strength, minimum diameter rod is required.

Throughout the full size range of high strength rod, fittings are attached by cold heading. As described in the earlier section on medium strength rod fittings, adjustment is provided by the threaded bushing, or nose.

Fixed jaws, eyes and custom fittings are available. Material is typically type 304 stainless steel with a brushed finish.

**Jaw Assemblies for High Strength Threaded Rod**

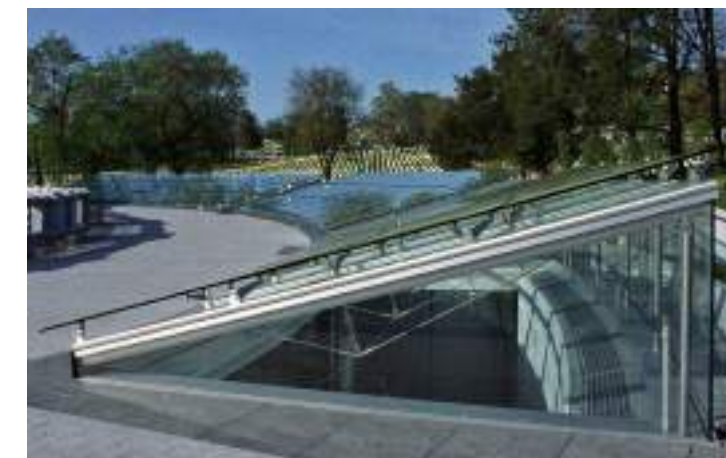
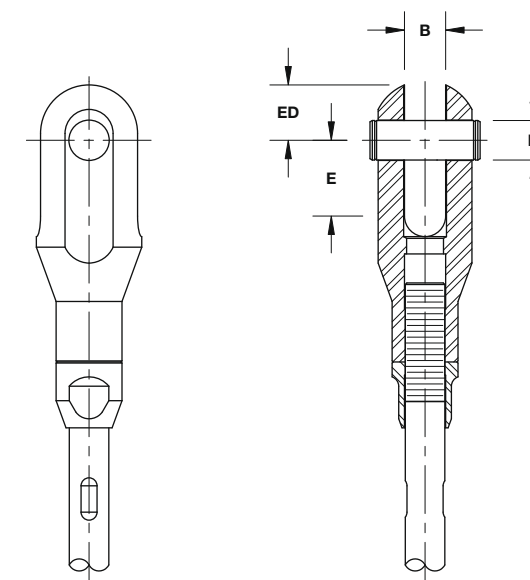
Jaw Part Number	Rod Diameter		Compatible Rod	Rod Breaking Strength		Pin Diameter (P)		Jaw Gap (B)		Throat Depth (E)		Edge Distance (ED)		Take Up	
	inch	(mm)		kips	(kN)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
<b>B210-0198</b>	0.198	(5.0)	<b>A03-0198</b>	6.3	(28.0)	0.44	(11.1)	0.30	(7.6)	0.81	(20.7)	0.53	(13.3)	1.00	(25.4)
<b>B210-0225</b>	0.225	(5.7)	<b>A03-0225</b>	8.2	(36.5)	0.50	(12.7)	0.33	(8.4)	0.93	(23.5)	0.60	(15.2)	1.00	(25.4)
<b>B210-0250</b>	0.250	(6.4)	<b>A03-0250</b>	10.3	(45.8)	0.50	(12.7)	0.38	(9.6)	1.00	(25.4)	0.67	(17.1)	1.00	(25.4)
<b>B210-0281</b>	0.281	(7.1)	<b>A03-0281</b>	12.5	(55.6)	0.63	(15.9)	0.46	(11.7)	1.13	(28.6)	0.73	(18.4)	1.00	(25.4)
<b>B210-0330</b>	0.330	(8.4)	<b>A03-0330</b>	17.5	(77.8)	0.63	(15.9)	0.53	(13.5)	1.13	(28.6)	0.90	(22.9)	1.25	(31.8)
<b>B210-0375</b>	0.375	(9.5)	<b>A03-0375</b>	22.5	(100.1)	0.75	(19.1)	0.53	(13.5)	1.37	(34.8)	1.10	(27.9)	1.25	(31.8)
<b>B210-0437</b>	0.437	(11.1)	<b>A03-0437</b>	30.0	(133.4)	0.88	(22.2)	0.65	(16.5)	1.60	(40.6)	1.25	(31.8)	1.50	(38.1)
<b>B210-0500</b>	0.500	(12.7)	<b>A03-0500</b>	36.0	(160.1)	1.00	(25.4)	0.79	(20.1)	1.85	(47.0)	1.35	(34.3)	1.50	(38.1)
<b>B210-0562</b>	0.562	(14.3)	<b>A03-0562</b>	46.0	(204.6)	1.13	(28.6)	0.91	(23.1)	2.06	(52.4)	1.50	(38.1)	1.75	(44.5)
<b>B210-0660</b>	0.660	(16.8)	<b>A03-0660</b>	59.0	(262.4)	1.25	(31.8)	1.06	(27.0)	2.35	(59.7)	1.69	(42.8)	1.75	(44.5)
<b>B210-0705</b>	0.705	(17.9)	<b>A03-0705</b>	76.0	(338.1)	1.13	(28.6)	1.31	(33.3)	2.13	(54.0)	1.60	(40.6)	1.75	(44.5)
<b>B210-0768</b>	0.768	(19.5)	<b>A03-0768</b>	90.0	(400.3)	1.25	(31.8)	1.38	(34.9)	2.38	(60.3)	1.75	(44.5)	1.75	(44.5)
<b>B210-0875</b>	0.875	(22.2)	<b>A03-0875</b>	117.0	(520.4)	1.38	(34.9)	1.44	(36.5)	2.63	(66.7)	1.88	(47.6)	1.88	(47.6)
<b>B210-1000</b>	1.000	(25.4)	<b>A03-1000</b>	150.0	(667.2)	1.50	(38.1)	1.56	(39.7)	2.91	(73.8)	2.13	(54.0)	2.00	(50.8)

Notes: Stock rod length, sizes up to 0.66 diameter, unlimited. Stock rod length, larger sizes, 45'. Larger fitting sizes, for rods up to 1.5" in diameter, are available on a custom basis. If pretensioning of more than 200 pounds is required, special rotating bearings can be incorporated within the adjustable noses. Fittings are all designed to be stronger than the corresponding TriPyramid Series A03 rod. Other materials and finishes, and custom pin, gap and edge distances, are readily available on a custom basis. Custom adjustable eye assemblies are also available.



**Jaw Assemblies for LCW Threaded Rods**

LCW (Lightly Cold Worked) stainless rods are typically used in applications where strength is not the primary consideration. Rods are threaded and adjustment is provided by threaded fittings with thread-covering locknuts, similar to the threaded fittings for larger medium strength rod. When properly adjusted, no threads will be showing.



**Jaw Assemblies for LCW Threaded Rod**

Jaw Part Number	Rod Diameter		Compatible Rod	Rod Breaking Strength		Pin Diameter (P)		Jaw Gap (B)		Throat Depth (E)		Edge Distance (ED)		Take Up	
	inch	(mm)		kips	(kN)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
<b>B250-0250</b>	0.250	(6.4)	<b>A35-0250</b>	3.1	(13.8)	0.25	(6.4)	0.28	(7.1)	0.53	(13.5)	0.35	(8.9)	0.50	(12.7)
<b>B250-0375</b>	0.375	(9.5)	<b>A35-0375</b>	7.5	(33.4)	0.38	(9.5)	0.41	(10.3)	0.72	(18.3)	0.53	(13.3)	0.63	(15.9)
<b>B250-0500</b>	0.500	(12.7)	<b>A35-0500</b>	13.6	(60.5)	0.50	(12.7)	0.53	(13.5)	0.94	(23.8)	0.70	(17.8)	0.75	(19.1)
<b>B250-0625</b>	0.625	(15.9)	<b>A35-0625</b>	21.8	(97.0)	0.63	(15.9)	0.66	(16.7)	1.19	(30.2)	0.88	(22.2)	0.88	(22.2)
<b>B250-0750</b>	0.750	(19.1)	<b>A35-0750</b>	31.7	(141.0)	0.75	(19.1)	0.78	(19.8)	1.44	(36.5)	1.05	(26.7)	1.00	(25.4)
<b>B250-1000</b>	1.000	(25.4)	<b>A35-1000</b>	53.0	(235.8)	1.00	(25.4)	0.81	(20.6)	1.88	(47.6)	1.38	(34.9)	1.00	(25.4)
<b>B250-1250</b>	1.250	(31.8)	<b>A35-1250</b>	80.0	(355.9)	1.25	(31.8)	1.06	(27.0)	2.44	(61.9)	1.73	(43.8)	1.25	(31.8)
<b>B250-1500</b>	1.500	(38.1)	<b>A35-1500</b>	111.9	(497.8)	1.50	(38.1)	1.06	(27.0)	2.88	(73.0)	2.00	(50.8)	1.50	(38.1)

Notes: Strengths noted are strength in threaded area. Fittings are for length adjustment, not for pretensioning to more than 200 pounds. Fittings are all designed to be stronger than the corresponding TriPyramid Series A35 rod. Other materials and finishes, and custom pin, gap and edge distances, are readily available on a custom basis. Custom adjustable eye assemblies are also available.

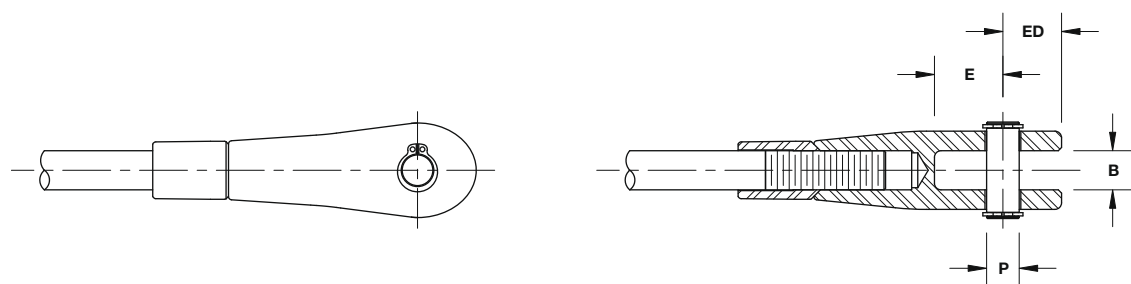


**Jaw Assemblies for Steel Rods**

TriPyramid's standard steel rods have a yield strength of 67 ksi (460 MPa), almost two times the yield strength of A36 structural steel, and 1/3 higher than Grade 50 steel. These rods offer a good balance of strength, stiffness and cost for structural tension rods.

Fittings are designed to provide the same aesthetic as TriPyramid's other threaded fittings, with the locknut also serving to cover the threads on the rod. Standard jaw fittings are designed and manufactured by our partners at Pfeifer in Germany. These are cast fittings, designed to be stronger than the rods they are attached to. Pfeifer fittings are tested and certified to the highest German standards.

Fittings and rods can be supplied either galvanized or bare, with a mill finish ready for blasting and painting.



Jaw Assemblies for Threaded Grade 460 Steel Rod								
Jaw Part Number	Rod Diameter inch (mm)	Compatible Rod	Rod Breaking Strength kips (kN)	Pin Diameter (P) inch (mm)	Jaw Gap (B) inch (mm)	Throat Depth (E) inch (mm)	Edge Distance (ED) inch (mm)	Take Up inch (mm)
B275-860-012	0.472 (12.0)	A70-012	11.4 (50.8)	0.43 (11.0)	0.47 (12.0)	0.83 (21.0)	0.71 (18.0)	0.47 (12.0)
B275-860-016	0.630 (16.0)	A70-016	21.3 (94.6)	0.55 (14.0)	0.59 (15.0)	1.18 (30.0)	1.02 (26.0)	0.91 (23.0)
B275-860-020	0.787 (20.0)	A70-020	33.2 (147.8)	0.63 (16.0)	0.71 (18.0)	1.38 (35.0)	1.22 (31.0)	1.14 (29.0)
B275-860-024	0.945 (24.0)	A70-024	47.8 (212.8)	0.87 (22.0)	0.91 (23.0)	1.81 (46.0)	1.54 (39.0)	1.38 (35.0)
B275-860-027	1.063 (27.0)	A70-027	62.4 (277.7)	0.94 (24.0)	0.91 (23.0)	1.85 (47.0)	1.73 (44.0)	1.57 (40.0)
B275-860-030	1.181 (30.0)	A70-030	76.2 (338.7)	1.10 (28.0)	1.10 (28.0)	2.05 (52.0)	2.01 (51.0)	1.69 (43.0)
B275-860-036	1.417 (36.0)	A70-036	111.0 (493.7)	1.26 (32.0)	1.10 (28.0)	2.52 (64.0)	2.28 (58.0)	2.05 (52.0)
B275-860-042	1.654 (42.0)	A70-042	152.4 (677.9)	1.42 (36.0)	1.30 (33.0)	2.76 (70.0)	2.60 (66.0)	2.40 (61.0)
B275-860-048	1.890 (48.0)	A70-048	200.3 (891.1)	1.57 (40.0)	1.50 (38.0)	3.07 (78.0)	2.91 (74.0)	2.68 (68.0)
B275-860-052	2.047 (52.0)	A70-052	239.2 (1064)	1.77 (45.0)	1.69 (43.0)	3.35 (85.0)	3.31 (84.0)	2.95 (75.0)
B275-860-056	2.205 (56.0)	A70-056	276.2 (1229)	1.97 (50.0)	1.69 (43.0)	3.74 (95.0)	3.58 (91.0)	3.23 (82.0)
B275-860-060	2.362 (60.0)	A70-060	321.6 (1430)	2.17 (55.0)	1.89 (48.0)	4.17 (106.0)	3.94 (100.0)	3.35 (85.0)
B275-860-064	2.520 (64.0)	A70-064	364.2 (1620)	2.17 (55.0)	2.09 (53.0)	4.21 (107.0)	4.06 (103.0)	3.50 (89.0)
B275-860-070	2.756 (70.0)	A70-070	443.3 (1972)	2.36 (60.0)	2.28 (58.0)	4.61 (117.0)	4.45 (113.0)	3.98 (101.0)
B275-860-080	3.150 (80.0)	A70-080	592.3 (2634)	2.76 (70.0)	2.68 (68.0)	5.24 (133.0)	5.20 (132.0)	4.57 (116.0)
B275-860-090	3.543 (90.0)	A70-090	762.8 (3393)	3.11 (79.0)	3.07 (78.0)	5.91 (150.0)	5.91 (150.0)	5.04 (128.0)
B275-860-100	3.937 (100.0)	A70-100	954.8 (4247)	3.50 (89.0)	3.27 (83.0)	6.69 (170.0)	6.50 (165.0)	5.55 (141.0)

Notes: Stock rod length 40'. Strengths noted are strength in threaded area. Fittings are for length adjustment, not for pretensioning. Fittings are all designed to be stronger than the corresponding TriPyramid Series A70 rod. Custom adjustable eye assemblies are also available.

**Railing Components**

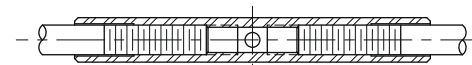
Medium strength rod is ideal for railing infill. Its smooth brushed surface makes it easy to keep clean, and its high yield strength makes it virtually kink-proof. The most frequently used fitting is the adjusting nipple, which serves as both a length adjuster and rod termination. Beveled washers are available to accommodate any stair angle. Washers can also be coped to accommodate round stanchions. Nipple tangs, either straight or swivel, are used for attaching to wood stanchions or walls. Thread-concealing turnbuckles are used for mid-span adjustment. All railing fittings are designed to conceal the rod threads for a completely clean appearance. Fittings are type 304 stainless steel with a brushed finish. Other materials and finishes are available on a custom basis.



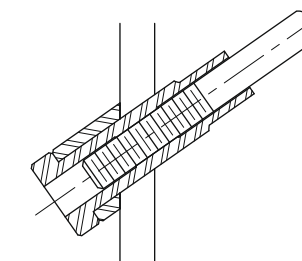
Adjusting Nipple						
Part Number	Rod Diameter inch (mm)	Head Diameter inch (mm)	Shank Diameter inch (mm)	Length inch (mm)	Take Up inch (mm)	
B101-188	0.188 (4.8)	0.562 (14.3)	0.375 (9.5)	1.625 (41.3)	0.625 (15.9)	
B101-250	0.250 (6.4)	0.625 (15.9)	0.437 (11.1)	1.625 (41.3)	0.625 (15.9)	



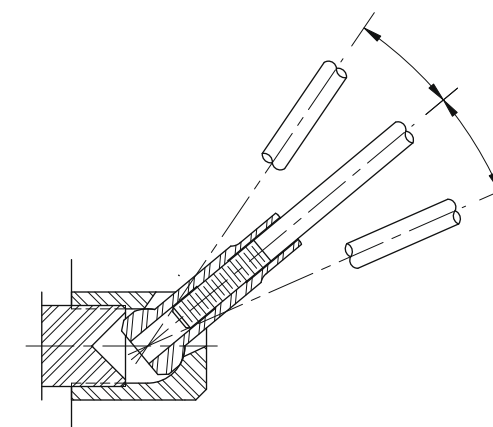
Nipple Tang Assembly					
Part Number	Rod Diameter inch (mm)	Cap Diameter inch (mm)	Bolt Diameter inch (mm)	Length inch (mm)	Take Up inch (mm)
B115-188	0.188 (4.8)	1.0 (25.4)	3/8 (9.5)	1.20 (30.5)	0.625 (15.9)
B115-250	0.250 (6.4)	1.0 (25.4)	3/8 (9.5)	1.20 (30.5)	0.625 (15.9)



Thread-Concealing Turnbuckle				
Part Number	Rod Diameter inch (mm)	Diameter inch (mm)	Length inch (mm)	Take Up inch (mm)
B120-188	0.188 (4.8)	0.313 (7.9)	3.0 (76.2)	1.0 (25.4)
B120-250	0.250 (6.4)	0.375 (9.5)	3.0 (76.2)	1.0 (25.4)



Beveled Washer with Adjusting Nipple



Swivel Tang Assembly



Swage Fittings



Spelter Fittings

**Standard and Custom Cable Fittings**

TriPyramid provides cable assemblies of all description, ranging from small diameter stainless steel to large galvanized cables. In some cases a job may require just standard end-fittings such as turnbuckles, eyes, or jaws. But in many cases a total solution calls for specially designed hardware in addition to the cables with standard end fittings.

TriPyramid has designed and produced many custom cable fittings such as strut-end clamp assemblies, stainless steel glass holding fittings for cable net walls, and end fittings for special conditions. The design group works with architects and engineers to develop hardware that celebrates the structure and is at the same time cost effective and structurally sound.

**Termination Methods**

There are a variety of ways to affix fittings to the various forms of cable. For structural applications the termination should be stronger than the cable it is attached to and it should retain the cable until the cable breaks.

Swage fittings have a hollow shank that is about 12 cable diameters in length. The cable is inserted into the hollow shank, and then the shank is cold-formed (swaged) around and into the cable, resulting in a mechanical connection that is as strong as the cable itself. Swage fittings can be used for both wire rope and structural strand, either stainless steel or galvanized. They cannot be used for full-locked cables.

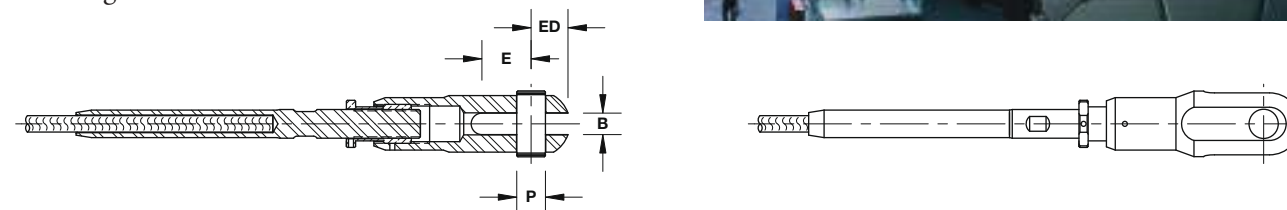
Larger galvanized cables (and all full-locked cables) are typically terminated with poured, sometimes called spelter, sockets. In this case the fitting is slid onto the cable, the cable end is splayed out and molten zinc is then poured into the socket, around the splayed out cable strands. Once the zinc solidifies the termination is strong enough to break the cable without slipping.

For architectural applications, cables with diameters less than about 1.25" (32 mm) are most often terminated with swage type fittings.

**Swage Turnbuckles**

TriPyramid has two standard stainless steel turnbuckle ranges for architectural applications. The turnbuckles are compact and have thread-free appearance. Adjustment is provided by rotating the adjusting sleeve, which telescopes with the swage stud into the machined jaw.

The B310 range is designed for standard type 316 stainless steel structural strand, and galvanized or stainless steel wire rope. The B315 range is stronger for a given cable size, designed for high strength stainless structural strand and for galvanized structural strand.



Turnbuckles: Standard Stainless Structural Strand, Galvanized Wire Rope, Stainless Steel Wire Rope														
Turnbuckle Part Number	Cable Diameter		Cable Breaking Strength Limit		Pin Diameter (P)		Jaw Gap (B)		Throat Depth (E)		Edge Distance (ED)		Take Up	
	inch	(mm)	kips	(kN)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
B310-0375	0.375	(9.5)	15	(67)	0.63	(15.9)	0.53	(13.5)	1.20	(30.5)	0.90	(22.9)	1.50	(38.1)
B310-0500	0.500	(12.7)	26	(116)	0.88	(22.2)	0.66	(16.6)	1.50	(38.1)	1.13	(28.6)	1.50	(38.1)
B310-0625	0.625	(15.9)	41	(182)	1.13	(28.6)	0.91	(23.1)	1.85	(47.0)	1.50	(38.1)	3.00	(76.2)
B310-0750	0.750	(19.1)	52	(231)	1.25	(31.8)	1.06	(27.0)	2.03	(51.4)	1.69	(42.9)	3.00	(76.2)
B310-0875	0.875	(22.2)	70	(311)	1.38	(34.9)	1.06	(27.0)	2.44	(62.0)	1.86	(47.2)	3.00	(76.2)
B310-1000	1.000	(25.4)	91	(405)	1.50	(38.1)	1.31	(33.3)	2.63	(66.7)	2.00	(50.8)	3.50	(88.9)
B310-1125	1.125	(28.6)	116	(516)	1.50	(38.1)	1.31	(33.3)	3.00	(76.2)	2.10	(53.3)	3.50	(88.9)
B310-1250	1.250	(31.8)	144	(641)	1.75	(44.5)	1.56	(39.7)	3.13	(79.4)	2.40	(61.0)	3.50	(88.9)
B310-1375	1.375	(34.9)	176	(783)	1.88	(47.6)	1.81	(46.0)	3.30	(83.8)	2.70	(68.6)	3.50	(88.9)
B310-1500	1.500	(38.1)	208	(925)	2.00	(50.8)	1.81	(46.0)	3.80	(96.5)	2.75	(69.9)	4.00	(101.6)

Notes: B310 turnbuckles can be used for stainless steel strand, such as standard type 316 1x19 cable, as long as the cable strength is not greater than that shown in the table above. Fittings are for length adjustment, not for pretensioning to more than 2000 pounds.

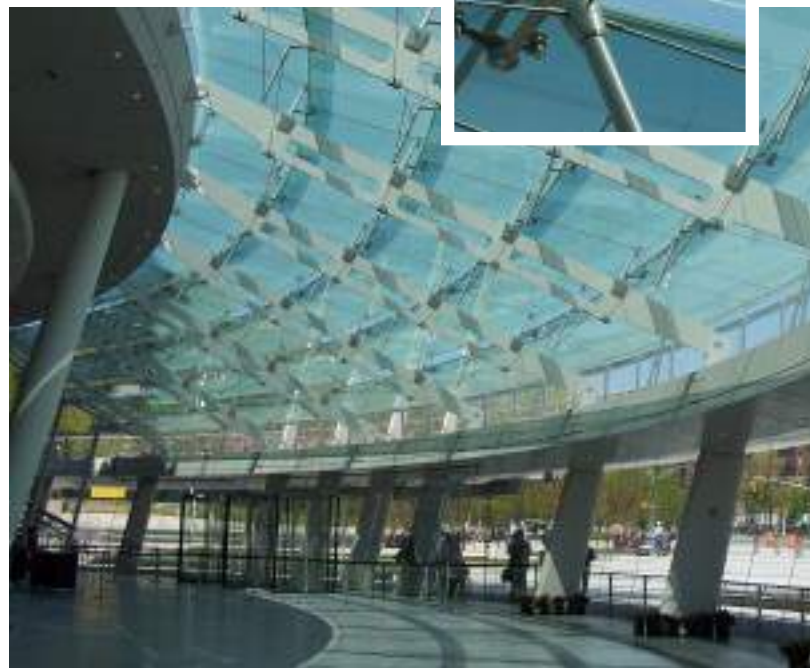
Turnbuckles: High Strength Stainless Steel Structural Strand, Galvanized Structural Strand														
Turnbuckle Part Number	Cable Diameter		Cable Breaking Strength Limit		Pin Diameter (P)		Jaw Gap (B)		Throat Depth (E)		Edge Distance (ED)		Take Up	
	inch	(mm)	kips	(kN)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)	inch	(mm)
B315-0500	0.500	(12.7)	30	(133)	1.00	(25.4)	0.66	(16.6)	1.78	(45.1)	1.25	(31.8)	1.50	(38.1)
B315-0625	0.625	(15.9)	48	(214)	1.25	(31.8)	0.91	(23.0)	2.10	(53.3)	1.60	(40.6)	2.00	(50.8)
B315-0750	0.750	(19.1)	68	(302)	1.50	(38.1)	1.06	(27.0)	2.50	(63.5)	1.88	(47.6)	2.50	(63.5)
B315-0787	0.787	(20.0)	67	(298)	1.50	(38.1)	1.06	(27.0)	2.50	(63.5)	1.88	(47.6)	2.50	(63.5)
B315-0875	0.875	(22.2)	92	(409)	1.50	(38.1)	1.19	(30.2)	2.75	(69.9)	2.10	(53.3)	2.50	(63.5)
B315-1000	1.000	(25.4)	122	(543)	1.50	(38.1)	1.31	(33.3)	3.10	(78.7)	2.13	(54.1)	3.00	(76.2)
B315-1024	1.024	(26.0)	112	(498)	1.50	(38.1)	1.31	(33.3)	3.10	(78.7)	2.13	(54.1)	3.00	(76.2)
B315-1125	1.125	(28.6)	156	(694)	1.75	(44.5)	1.56	(39.7)	3.40	(86.4)	2.50	(63.5)	3.00	(76.2)
B315-1181	1.181	(30.0)	149	(663)	1.75	(44.5)	1.56	(39.7)	3.40	(86.4)	2.50	(63.5)	3.00	(76.2)
B315-1250	1.250	(31.8)	192	(854)	2.00	(50.8)	1.81	(46.0)	3.80	(96.5)	2.75	(69.9)	3.00	(76.2)
B315-1375	1.375	(34.9)	232	(1032)	2.25	(57.1)	1.81	(46)	4.25	(108.0)	2.87	(72.9)	4.00	(101.6)
B315-1417	1.417	(36.0)	214	(952)	2.25	(57.1)	1.81	(46)	4.25	(108.0)	2.87	(72.9)	4.00	(101.6)
B315-1500	1.500	(38.1)	276	(1228)	2.50	(63.5)	2.06	(52.4)	4.60	(116.8)	3.25	(82.55)	4.00	(101.6)

Note: Fittings are for length adjustment, not for pretensioning to more than 2000 pounds.



**Custom Structural Hardware**

In many cases, custom-designed hardware is a better, more cost effective, design solution than TriPyramid's standard fittings. TriPyramid's design staff has collaborated with many architects, artists, and engineers over the past 15 years to develop project-specific solutions to myriad design challenges. See our website, or ask for our general catalog, to see the wide range of projects that have benefited from this sort of custom design work.



**Custom Glass Hardware**

TriPyramid creates glass hardware for a wide range of applications, from integrated glass structures like glass walls and the Apple stairs to custom castings or just simple glass panel mounting hardware. Like all of TriPyramid's custom work, these designs are the result of collaboration with creative architects, designers and engineers.





# TriPyramid Tension Assemblies

THE BROADEST RANGE OF ENGINEERED SOLUTIONS

STAINLESS STEEL RODS

**Medium Strength Rod (4mm-50mm)**

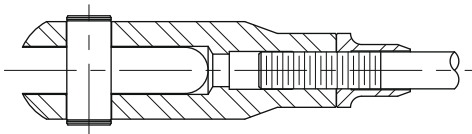
*the most efficient/cost effective stainless steel tie rod available*

**High Strength Rod (4mm-38mm)**

*the highest load carrying capacity in the industry*

**Lightly Cold Worked Rod (6mm-38mm)**

*elegant and inexpensive for light loads*



TriPyramid threaded rod clevises for use with LCW rod and medium strength rod larger than 16mm.

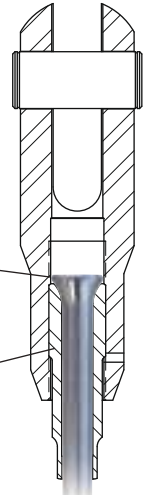
**THE GOLD STANDARD**

**TriPyramid Cold Headed Rod**  
*the industry leader*

A tie rod system that utilizes 100% of the bar's strength and is beautiful.

100% efficient cold formed rod head – no threads to reduce the rod's strength

Length adjuster is threaded, but all threads are hidden for a clean look

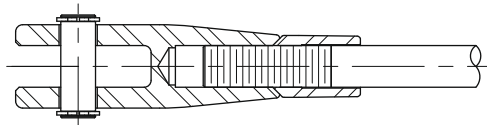


STEEL RODS

**Grade 460 Rod (12mm-100mm)**

*yield strength 80% greater than A36*

Either galvanized or mill finish bars

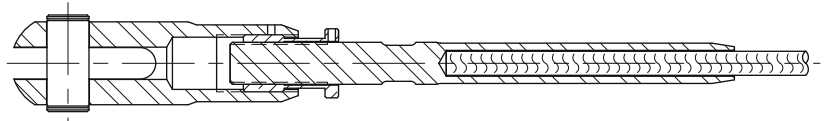


Sculpted cast clevis fittings have thread-covering locknuts.

CABLES

**Stainless Steel Cables and Fittings (6mm-36mm)**

**Galvanized Cables and Fittings (6mm-100mm)**



TriPyramid cable turnbuckles conceal all threads and are simply elegant.



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