Hydro

Extrusion North America

Aluminum pipe and tube

www.hydro.com

Hydro. The industry leader.

Hydro is North America's leading producer of seamless and structural aluminum pipe and tube, as well as the leader in mill standard and custom aluminum extrusions.

Hydro is the world's largest integrated aluminum company, and operates more than 20 facilities across the United States and Canada. Hydro has operations in 40 countries worldwide, and is committed to quality, environmentally responsible production. Our goal is to provide effective solutions for our customers utilizing our decades of expertise in aluminum extrusion design.

The resources to shape any solution

With competencies in design and technical support, mechanical and application engineering, metallurgy and project management, Hydro can meet any application or market demand. We will work with your engineering team to produce a final product that will best meet your needs.

Or unique manufacturing capabilities include billet casting operations, both direct and indirect extrusion methods, fabrication and finishing, a wide variety of alloys, tempers, and close tolerance specialty products.

The industry's largest tubular product line

As North America's premier supplier of aluminum pipe and tube, Hydro offers a product for virtually any type of application ranging from high pressure and mechanical to architectural and framing. Our manufacturing capabilities allow us to produce some of the largest outside diameter (OD) sizes and highest precision tolerances in the industry. Additionally, we can produce our products in a variety of surface finishes, from mill to paint or anodize.

Our structural and seamless product line includes:

- Seamless Tube up to 15.375" OD
- Seamless Pipe up to 14 Nominal Pipe Size (NPS)
- Seamless mechanical tube up to 12" OD
- Square and rectangular tube up to 11.5" circle size
- Structural Tube up to 6" OD
- Structural Pipe up to 6 Nominal Pipe Size (NPS)
- Drawn tube up to 2" OD
- Thin wall superior quality and construction tube
- Structural and seamless custom hollow shapes
- Mine and irrigation pipe with Victaulic groove option
- Electrical bus conductor pipe and tube



Which is best for your application?

While they may look the same, seamless and structural pipe and tube are two distinctly different products. The one you should choose depends on your application requirements.

Seamless pipe and tube

Hydro seamless pipe and tube products are extruded using two different methods:

- **Die and Mandrel Press** using a hollow billet
- **Piercer Press** using a solid billet

In either case, the metal will not separate as the product is extruded. The result is a monolithic structure with no weld seams and predictable strength throughout. As a result, seamless pipe and tube products are recommended for applications requiring:

- Critical pressure ratings
- Demanding forming applications
- Critical strength requirement
- Uniform anodizing appearance

Typical applications include:

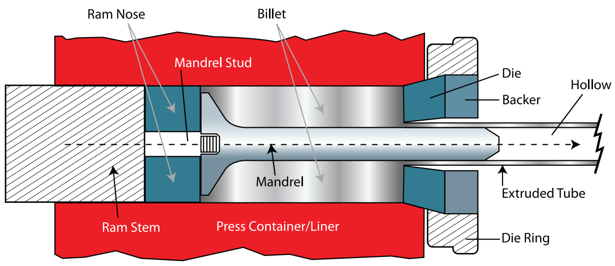
- Pressure vessels
- Hydraulic cylinders
- Lighting applications
- Hose couplings
- Compressed gas cylinders
- Drive shafts
- Electrical bus conductors

Structural pipe and tube

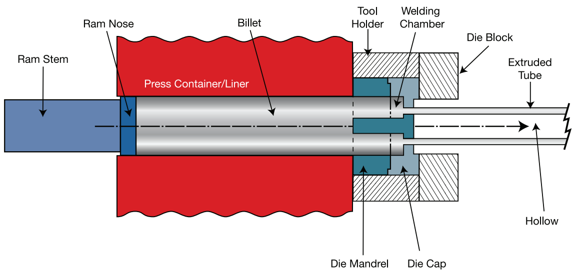
Using either the porthole or bridge die method, Hydro structural pipe and tube products start with a solid billet, which then separates into longitudinal segments that re-weld together while passing through the extrusion die. Although not visible to the eye, multiple weld seams run down the length of the extrusion that may need to be taken into consideration for certain applications. There are no published bursting pressure ratings available for pipe and tube produced via a porthole or bridge type die and weld seam locations may be noticeable after anodizing.

Typical applications include:

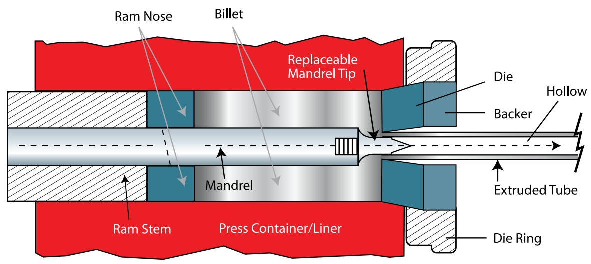
- Handrails
- Awning supports
- Sign structures
- Electrical conduit
- Highway and bridge rail
- Fence posts
- Lighting applications
- Irrigation systems



Die and Mandrel Press



Porthole Die Press



Piercer Press

Drawn tubing is the right choice when dimensional accuracy is critical and precision performance means the difference between product success and failure.

Drawn tube

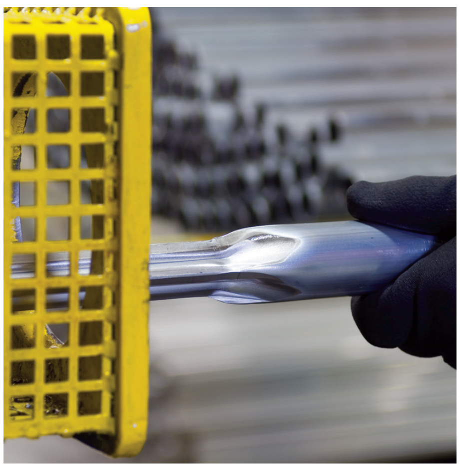
In addition to our core offerings of seamless and structural extruded tube, Hydro also offers drawn tube from our St. Augustine, FL plant.

The drawn tube process provides exceptional dimensional control, added strength, and a superior surface finish. The drawing process increases mechanical properties and further refines grain structure, enhances formability, and can be produced in thin gauges, below what can be produced using only the extrusion process.

Hydro is the North America leader in porthole drawn tubing with unmatched capabilities and the most experienced team in the industry. We can produce high-quality porthole drawn tubing in a wide variety of shapes and sizes to match your design requirements.

Typical applications include:

- Medical (wheelchairs, stretcher)
- Refrigeration, HVAC
- Automotive (HVAC, heat exchangers)
- Commercial transportation and RV
- Sporting goods (paddle handles, frames)
- Furniture, office
- Marine (handrails, ladders)
- Electrical and lighting
- Lawn & garden tools (weed trimmers)
- Military (tents)
- Distribution



Markets served

Industrial & Consumer
Hydro supplies many industrial and consumer markets with a wide range of standard and custom pipe and tube products for:

- Electrical bus conductors
- Electrical and electronic connectors
- Compressed gas storage
- Mining and irrigation pipe
- Fire hose and hydraulic fittings and couplings
- Motorcycle and bicycle frames

Residential and Commercial Building & Construction
Our project management and sales support includes complete fabricating services, advanced painting and anodizing capabilities, order coordination, and more.

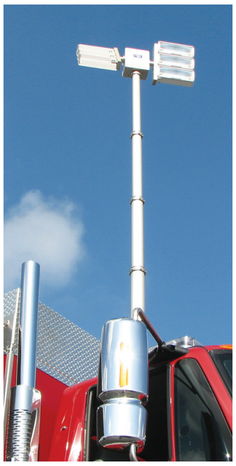
- Light and flag poles
- Electrical conduit
- Scaffolding
- Architectural railings and framing structures
- Security barriers

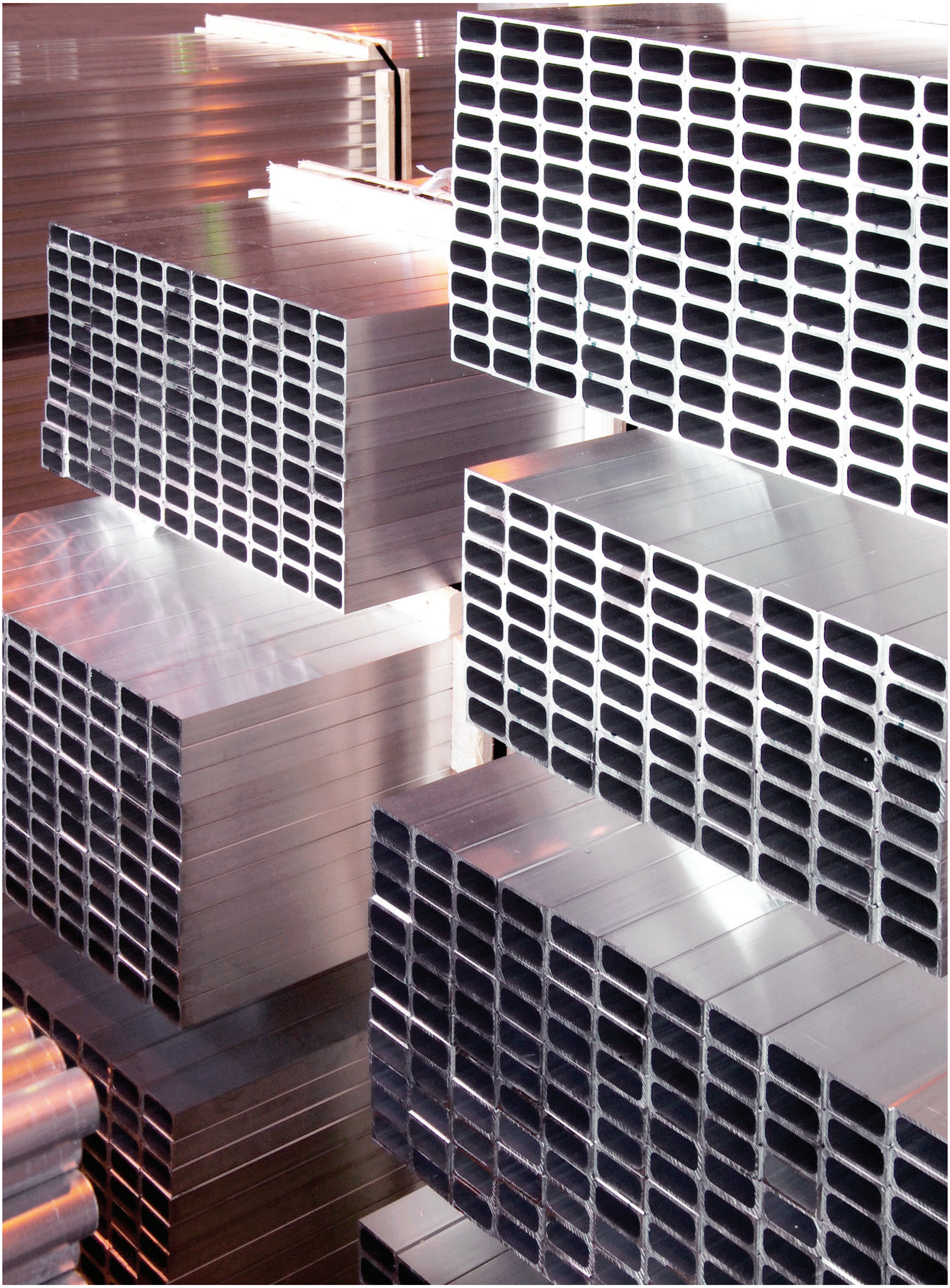
Commercial & Mass Transportation, Automotive, Marine
Hydro's extensive experience allows us to offer a full range of extrusion profiles, fabrication and assembly services for:

- Truck trailers and equipment
- Handrails, ladders and framing structures
- Alternative fuel storage systems
- Air reservoir cylinders
- Hydro-formed components (frame rails, air in-take manifolds)

Solar & Renewable Energy
Our manufacturing capabilities have earned us a strong position in the renewable energy market. Aluminum's light weight and corrosion resistant properties along with its high thermal and electric conductivity make it an ideal material for use in renewable energy applications.

- Motor housings and components
- Electrical conduit
- Solar framing and components
- Heat exchangers and thermal management equipment
- Safety railings and platforms





Pipe and tube electrical bus conductors

Our product line of electrical bus conductors includes seamless and structural, pipe and tube for the power distribution industry. In addition to tubular bus, electrical bus conductors take many shapes...from bar to integral web channel and angle bus conductors to special custom shapes.

The rigidity of pipe and tube electrical bus is particularly well suited for outdoor use in switching equipment and outdoor substations where long spans between supports are required. Specifications may require seamless produced to ASTM B 241.

Seamless and structural tubular bus conductors, produced in 6063 and 6101 alloys, offers excellent mechanical and electrical properties. 6063-T6 alloy temper is commonly used. For higher electrical current applications, 6101 alloy in various tempers, T6, T61, T63, T64 provides improved electrical and thermal conductivity and is able to conduct higher currents than 6063-T6. When higher strength for longer unsupported spans in lower current applications is required 6061-T6 tubular can be a suitable alloy temper.

Aluminum tubular bus can be easily bent and formed in the appropriate alloy temper, reducing the use of costly fittings. When bending is required, the appropriate alloy and temper will depend on the centerline bend radius and degree of bending (see chart for Forming and Bending Pipe and Tube). Seamless tubular bus conductors are often preferred and recommended for applications requiring bending or critical forming.

Our tubular bus conductor is supplied with standard extruded mill finish. Products used in Extreme High Volt-age (EHV) applications may require a special outside surface finish where raised protrusions, scratches, and handling marks are made smooth by repair to minimize corona. Please specify at time of order if your bus conductors are to be used in extreme high voltage environments. Special packing may also be required to further protect the surface finish.

In addition to electrical bus conductor pipe and tube Hydro also manufactures Rigid Aluminum Electrical Conduit. Hydro's Rigid Conduit is available in 1/2 to 6 schedule pipe sizes in lineal lengths and 45° and 90° bent elbows with non-threaded ends or threaded ends (inside or outside diameter). Our Rigid Conduit is produced in 6063-T1 alloy temper and complies with Federal specification WW-C540c, Underwriters Laboratories UL-6A, ANSI C80.5, and CSA C22.2 No. 45 specifications.

Physical and Electrical Properties of Aluminum Wrought Bus Conductor Alloys

(ASTM B 236, B 317, and The Aluminum Association)

- Applying to all alloys and tempers of wrought alloys, typical values
- Weight, density lb/cu in. (rounded) 0.098
- Specific heat, cal/gm/°C or BTU/ib/°F 0.214 at 70° for 1350 and 0.220 for 6101(a)
- Coefficient of thermal expansion (linear)/ °C 0.000023
- Specific gravity – 2.70
- Modules of Elasticity, Typical, psi 10 x 106. Up to 2% higher compression

Property	Alloy and Temper (b)							
	1350 Any Temper	6101-T6	6101-T61	6101-T63	6101-T64	6101-T65	6061-T6	6063-T6
Thermal Conductivity W/mK (typical)	234	218	222	218	226	218	167	201
Thermal Conductivity watts/sq.in/in/°C	5.9 / 6.0	5.3 / 5.4	5.5 / 5.6	5.4 / 5.5	5.7 / 5.8	5.7 / 5.8	3.9	5.1
Electrical Conductivity percent IACS at 20°C (c)	61 / 62	55 / 56	57 / 58	56 / 57	59.5 / 60.5	56.5 / 57.5	42 / 43	53
Electrical Resistivity(dc) at 20°C (68°F) micorohms/sq.in/ft (d)	13.35 / 13.14	14.81 / 14.55	14.29 / 14.04	14.55 / 14.29	13.69 /13.46	14.42 / 14.17	19.39 / 18.94	15.37
Temperature coefficient of electrical resistance at 20°C/°C (e)	.00403 / .00410	.00363 / .00370	.00377 / .00383	.00370 / .00377	.00393 / .00400	.00373 / .00380	.00284 / .00277	.00350

(a) Increasing by 0.018 for each 100°C above 70°C (specific heat).
(b) If two values are shown, the more favorable is typical. The less favorable is designated minimum.
(c) Typical conductivities of 6101 alloys from Standard of The Aluminum Association.
The conductivity of 6063-T6 alloy pipe for outdoor service may be taken as 55% IACS for current ratings, per NEMA Standard.
(d) To obtain dc resistance at 20°C in microhms multiply table value by length in feet and divide by cross sectional area in sq. in.
(e) The higher of a pair of coefficients corresponds to the higher value of the pair of conductivity values.
ref: Alum. Association Bus Conductor Handbook, Aluminum Standards and Data

Hydro Extra High Voltage Finish (EHV)

Seamless Pipe Section Numbers

Pipe Size	Sched-ule	Section Number	OD (inches)	Wall (inches)
1.5	40	585649	1.900	0.145
2.5	40	583854	2.875	0.203
	80	580981	2.875	0.276
3	40	583119	3.500	0.216
	80	583120	3.500	0.300
3.5	40	583121	4.000	0.226
	80	583122	4.000	0.318
4	40	580490	4.500	0.237
	80	580982	4.500	0.337
5	40	583123	5.563	0.258
	80	580983	5.563	0.375
6	40	580482	6.625	0.280
	80	583124	6.625	0.432
8	40	583331	8.625	0.322
	80	583126	8.625	0.500
10	40	583127	10.750	0.365
	80	583128	10.750	0.594

Physical and Electrical Properties of Large-Diameter Round-Tube

Bus Conductors 6101-T61 Aluminum Alloy 57% IACS Conductivity (Minimum) (1) (2) (3)

OD Diameter (in.)	Wall Thickness (in.)	Area (Sq. in.)	Weight (lb/ft)	Moment of Inertia (1 in.4)	Inductive Reactance 1 ft spacing 60Hz-Xa (microhms/ft)	dc Resistance at 20°C (microhms/ft)	Rac/Rdc at 70°C	ac Resistance at 70°C 60 Hz (microhms/ft)	Current Rating 60 Hz Amp	
									Indoor	Outdoor
6	0.312	5.58	6.56	22.62	32.6	2.563	1.014	3.088	3195	4020
	0.375	6.63	7.79	26.33	32.8	2.156	1.030	2.639	3465	4360
	0.500	8.64	10.16	39.94	33.1	1.654	1.089	2.140	3845	4840
	0.625	10.55	12.41	38.63	33.4	1.354	1.200	1.931	4070	5125
7	0.250	5.30	6.23	30.23	28.9	2.696	1.006	3.222	3360	4190
	0.375	7.80	9.18	43.0	29.2	1.831	1.030	2.241	4015	5010
	0.500	10.21	12.01	54.2	29.5	1.400	1.090	1.813	4465	5575
	0.625	12.52	14.72	64.2	29.7	1.142	1.203	1.632	4635	5785
8	0.250	6.09	7.16	45.75	25.8	2.348	1.006	2.807	3805	4720
	0.375	8.98	10.56	65.44	26.0	1.591	1.030	1.947	4555	5645
	0.500	11.78	13.85	83.20	26.2	1.213	1.091	1.573	5045	6250
	0.625	14.48	17.03	99.2	26.5	0.987	1.206	1.414	5190	6435
9	0.250	6.87	8.08	65.8	23.2	2.079	1.006	2.486	4255	5245
	0.375	10.16	11.95	94.7	23.3	1.406	1.030	1.721	5100	6285
	0.500	13.35	15.70	121.0	23.4	1.070	1.092	1.389	5650	6965
	0.625	16.44	19.34	145.0	23.6	0.869	1.208	1.247	5980	7370
10	0.312	9.50	11.17	111.5	20.6	1.505	1.015	1.815	5185	6355
	0.375	11.34	13.33	131.5	20.7	1.260	1.031	1.544	5635	6910
	0.500	14.92	17.55	168.8	20.9	0.958	1.092	1.243	6255	7670
	0.625	18.41	21.65	203.1	21.0	0.776	1.210	1.116	6640	8140
12	0.312	11.46	13.47	195.8	16.3	1.247	1.015	1.504	6155	7480
	0.375	13.70	16.11	231.6	16.4	1.043	1.031	1.278	6685	8125
	0.500	18.06	21.24	299.2	16.6	0.791	1.093	1.027	7415	9015
	0.625	22.33	26.27	362.3	16.7	0.640	1.213	0.9222	7850	9545
14	0.500	21.21	24.94	483.8	12.7	0.674	1.094	0.8761	8570	10345
	0.677	28.34	33.32	630.3	12.9	0.504	1.284	0.7695	9160	11059
	0.750	31.22	36.71	687.3	13.0	0.458	1.399	0.7610	9425	11380

Physical and Electrical Properties of Aluminum Standard Pipe-Size Conductors at Typical Conductivities

53% IACS for 6063-T6 and 43% for 6061-T6

Nominal Size (in.)	OD of Tube (in.)	Wall Thick-ness (in.)	Area (sq. ft.)	Weight (lb/ft)	Inductive Reactance 1 ft spacing 60Hz-Xa (microhms/ft) (microhms/ft)	6063-T6				6061-T6			
						dc Resistance at 20°C (microhms/ft)	Rac/Rdc at 70°C	ac Resistance at 70°C 60 Hz (microhms/ft)	Current ratings Amp at 60Hz (1) (2) (3)(4)	dc Resistance at 20°C (microhms/ft)	Rac/Rdc at 70°C	ac Resistance at 70°C 60 Hz (microhms/ft)	Current ratings Amp at 60Hz (1) (2) (3)(4)
Schedule 40 Pipe													
1/2	0.84	0.109	0.2503	0.294	79.01	61.40	1.00024	72.16	416	75.68	1.00017	86.44	380
3/4	1.05	0.113	0.3326	0.391	73.55	46.20	1.00031	54.31	517	56.95	1.00024	65.05	473
1	1.315	0.133	0.4939	0.581	68.29	31.12	1.00039	36.58	681	38.36	1.00032	43.82	622
1-1/4	1.660	0.140	0.6685	0.786	62.68	22.99	1.0005	27.03	859	28.34	1.00039	32.37	705
1-1/2	1.900	0.145	0.7995	0.940	59.45	19.22	1.00064	22.60	984	23.69	1.00046	27.07	900
2	2.375	0.154	1.075	1.264	54.15	14.30	1.00082	16.82	1234	17.63	1.00055	20.14	1128
2-1/2	2.875	0.203	1.704	2.004	49.85	9.019	1.0022	10.62	1663	11.12	1.0015	12.71	1520
3	3.500	0.216	2.228	2.621	45.19	6.897	1.0030	8.128	2040	8.500	1.0018	9.725	1865
3-1/2	4.000	0.226	2.680	3.151	42.04	5.736	1.0038	6.765	2347	7.070	1.0022	8.091	2145
4	4.500	0.237	3.174	3.733	39.28	4.842	1.0047	5.717	2664	5.968	1.0027	6.834	2436
4-1/2	5.001	0.247	3.689	4.338	36.80	4.166	1.0057	4.923	2984	5.135	1.0033	5.884	2728
5	5.563	0.258	4.300	5.057	34.31	3.574	1.0068	4.229	3348	4.406	1.0040	5.051	3063
6	6.625	0.280	5.581	6.564	30.23	2.754	1.0095	3.266	4064	3.394	1.0054	3.897	3719
Schedule 80 Pipe													
1/2	0.84	0.147	0.3200	0.376	79.68	48.02	1.00053	56.46	470	59.19	1.00038	67.62	429
3/4	1.05	0.154	0.4335	0.510	74.14	35.45	1.00074	41.69	590	43.70	1.00053	49.93	539
1	1.315	0.179	0.6338	0.751	68.81	24.06	1.0010	28.30	774	29.65	1.00075	33.89	707
1-1/4	1.660	0.191	0.8815	1.037	63.14	17.44	1.0014	20.52	985	21.49	1.00105	24.57	901
1-1/2	1.900	0.200	1.068	1.256	59.89	14.39	1.0020	16.94	1137	17.73	1.0015	20.28	1039
2	2.375	0.218	1.477	1.737	54.56	10.40	1.0028	12.26	1446	12.82	1.0021	14.68	1322
2-1/2	2.875	0.276	2.254	2.650	50.23	6.820	1.0072	8.072	1907	8.406	1.0039	9.637	1746
3	3.500	0.300	3.016	3.547	45.55	5.096	1.0103	6.050	2363	6.281	1.0049	7.208	2166
3-1/2	4.000	0.318	3.678	4.326	42.39	4.178	1.0138	4.977	2735	5.150	1.0075	5.925	2507
4	4.500	0.337	4.407	5.183	39.61	3.487	1.0171	4.168	3118	4.298	1.0095	4.955	2862
4-1/2	5.001	0.355	5.180	6.092	37.13	2.967	1.0210	3.559	3505	3.657	1.0116	4.236	3221
5	5.563	0.375	6.112	7.188	34.63	2.515	1.0260	3.032	3949	3.099	1.0165	3.598	3631
6	6.625	0.432	8.405	9.884	30.58	1.829	1.0457	2.247	4891	2.254	1.0212	2.629	4532

(1) Current ratings listed in the Tables are based on 30°C temperature rise over 40°C ambient horizontally mounted conductors, with spacing sufficient to eliminate proximity effects, generally assumed not to be significant if spacing is 18-in. or over. Conduction of heat by supporting structures and taps can appreciably affect the ratings.

(2) Conductors outdoors with a 2-ft/sec crosswind. Nominal oxidized surface (e=0.50)

(3) Current ratings for direct current are close to those of alternating currents for all except the larger sizes; and for them the increase for dc bus is about 1.5 percent.

(4) NEMA Standard SG1-3.02 (7/13/60) lists current ratings for tubes of 57%-61% IACS conductivity, but without stated emissivity factors. However, even after adjustment for the 53% IACS conductivity of 6063-T6 alloy (and 43% for 6081-T6 alloy), the ratings differ somewhat from those of this table.

Extrusion North America

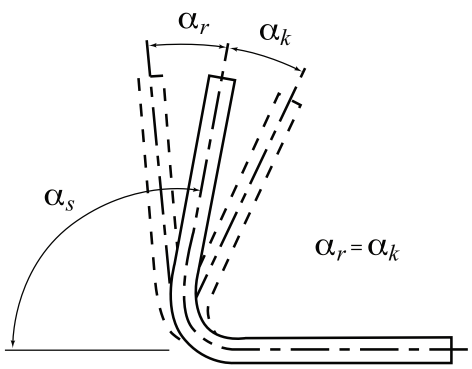
Aluminum Pipe and Tube Bending/Forming

Forming Methods

Aluminum pipe and tube can be formed using a variety of methods including, bending (roll, rotary, stretch, compression methods), end forming, swaging, expanding, flaring, spinning, drawing, hydroforming. Forming adds improved functionality to the finished product while minimizing assembly time and costs. Improved dimensional tolerances can also be achieved using certain forming methods.

Tube Bending

Bending is one of the most commonly used forming methods performed on pipe and tube. The degree of bend, centerline bend radius, type of bending equipment, type of internal flexible mandrels, bending speed, distance between bends, amount and type of lubricants, and alloy temper selection all need to be taken into consideration for each application and finished product. Generally pipe and tube bends can be more easily accomplished with a larger radius and minimal degree of bend. Softer unaged temper conditions such as -T1 or -T4 , or even fully annealed -O temper may be required for tight complex bends. An advantage of bending an unaged -T1 or -T4 temper is improved formability in the softer condition and the ability to heat treat and harden the part to a -T6 temper after bending or forming.



α_s: Target angle
α_r: Springback angle
α_k: Compensation angle

The following bending formulas can be used as a guideline to determine the approximate centerline bend radius for round and square tubing. Trials to determine the optimal bend radius, spring back allowances, and optimal bending conditions are recommended prior to production to achieve the desired results.

Minimum Center Line Bend Radius Formulas*

Round Tube formed with Internal Mandrel: $\frac{D^2F}{T} + .75D$

Round Tube formed without Internal Mandrel: $\frac{D^2F}{T} + .50D$

Square Tube formed with Internal Mandrel: $\frac{E^2F}{T} + .95S$

Alloys	Forming Factors
6061-T6	0.0759
6063, 6101 -T6	0.0759
6063-T52	0.0622
6101-T61, T63, T65	0.0622
6061, 6063-T1, T4	0.0554
6061-O	0.0487
6063-O	0.0426
1100, 3003-O, 6101-T64	0.0352

Forming factors depend upon specified minimum elongation (E) in 2" or 4D.

FORMULA KEY

D = Maximum Diameter (in inches)
F = Forming Factor (see table below)
T = Wall Thickness of Tube (in inches)
S = Specified Side Dimension of Square Tube (in inches)
E = Equivalent Diameter: $\frac{4S}{3.14}$ (in inches)

(1) Data based upon tooling and equipment being properly designed, precisely constructed, and professionally operated.

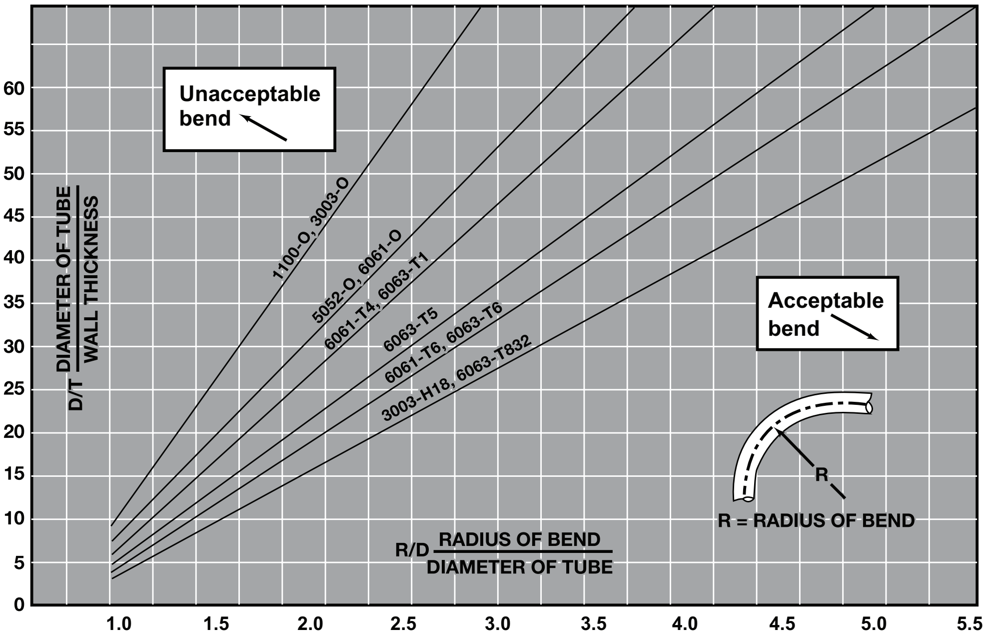
(2) Allowances must be made for the springback encountered when bending tube and pipe. The minimum centerline bend radius as calculated above determines the minimum forming hub radius only and does not include springback.

(3) This formula is based on the bare minimum centerline bend radius. If it is not necessary to tool for these small radius bends, a larger radius should be used decreasing the possibility of tube orange peel and fracture.

(4) For bends other than draw bends, multiply above results by 2.5.

* Structural Aluminum Design by Karl Andermayer, CPE Corp., 1987.

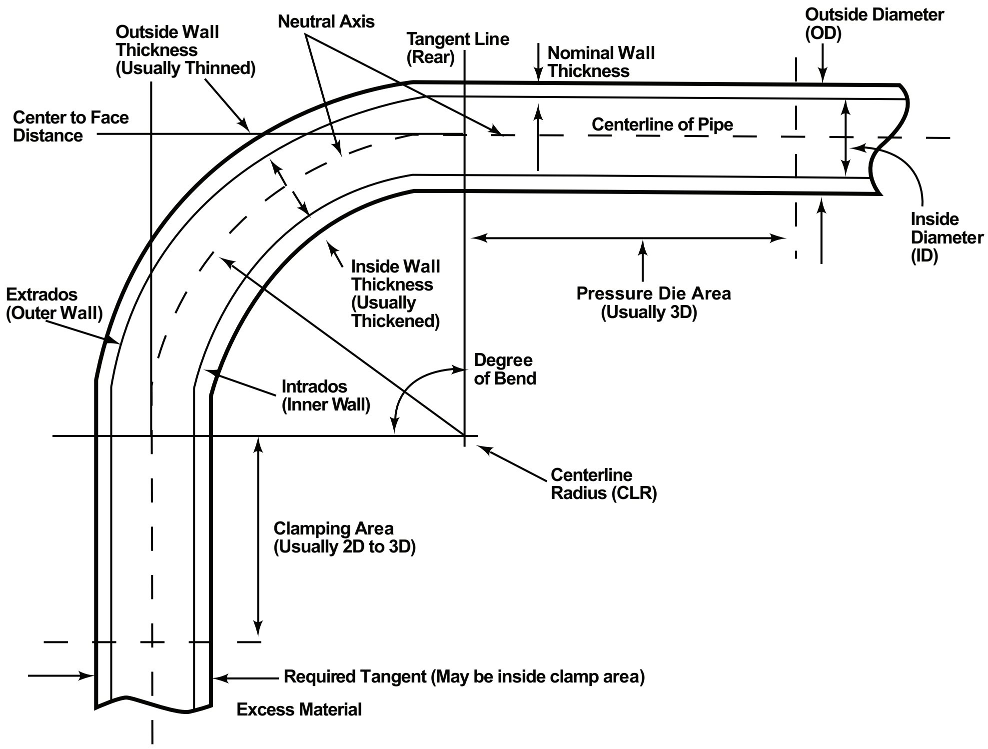
Tube Bending/Forming



Minimum centerline bend radii for 90° bends on various aluminum alloy round tube. This curve assumes fully tooled draw type bending machine and ideal bending conditions.

Source: Forming and Machining Aluminum Handbook

Key Elements of a Bend



Source: Pipe & Tube Bending Manual, 2nd Edition, Fabricators & Manufacturers Assoc.

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Pipe and Tube Pressure Rating Guide and Pipe Schedule Sizes

Bursting and Collapse Pressures

Determining bursting as well as collapse pressures are important considerations when designing pressurized applications. Bursting and collapse pressures can be calculated using the formulas provided below however the resulting values do not include a design factor of safety and are not guaranteed. These formulas are only applicable for use with seamless extruded pipe and tube. The bursting and collapse pressures shown in the table have been determined theoretically using nominal wall thickness and minimum ultimate tensile strength and minus size OD and wall tolerances are not taken into consideration. For internal and external pressure applications only seamless extruded pipes should be used. These recommendations and data are offered as guidelines only – we assume no responsibility to the accuracy or applicability of such information or data with respect to the design, engineering or construction of any pipeline. Additional information on determining bursting pressures can be found in the Aluminum Associations Design of Aluminum Pipe for Internal Pressures publication and Code of Federal Regulations Part 192, Title 49.

Bursting Pressures are based on the formula specified in the American Standard Code for Pressure Piping (ASA-B 31.1). Seamless extruded pipe and tube is produced to ASTM B 241 and ASME SB 241 specifications.

$$P = \frac{2*t*s}{D-(.8*t)}$$

Collapse Pressures are based on Roark's Stress & Strain formula and modified Al. Assn. formula Table 3.3.1b for 6061-T6 and 6063-T6

For 2.96 $D/t>S_2$: $\mathbf{p = (2*E)/(1-m^2) * (t/d)^3 = 23200000/(D/t)^3}$

For 2.96 $D/t>S_2$: $\mathbf{p = 2*t/D*B_c - 5.92*D_c}$

For thin wall tubes where D/t is >10 the compressive stress in the tube wall needs to be calculated at the external pressure and compared to the ultimate tensile strength. If the compressive stress fc = (D * p) / (2* t) is less than the tensile strength, the tube will fail due to bucking before the ultimate tensile strength was reached.

FORMULA KEY

P = bursting pressure (psi)
t = nominal wall thickness (in)
s = minimum tensile strength (psi)
D = outside diameter (in)
* = multiply by
p = collapse pressure
$S_2 = C_c$ (Upper Slenderness Limit)
m = Poissen's ration = 0.33
E = modulus of elasticity = 10300000
(average of E for all aluminum alloys)

VALUES

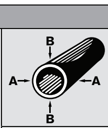
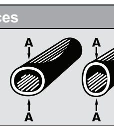
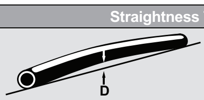
For 6061-T6

B_c = 39400
D_c = 246
C_c = 66

For 6063-T6

B_c = 27600
D_c = 145
C_c =78

Extruded Pipe Tolerances*

Outside Diameter Tolerances		
Pipe Size	 Allowable deviation of Mean (2) Diameter from Nominal Difference between 1/2 (AA + BB) and Nominal Diameter	 Allowable deviation of Diameter from any point from Difference AA and Nominal Diameter
	Schedule 5 and 10	Schedule 20 and Greater
Under 2"	+.015 - .031	+.015 - .031
2-4"	+.031 - .031	+1% - 1%
5-7"	+.062 - .031	+1% - 1%
8-12"	+.093 - .031	+1% - 1%
Wall Thickness Tolerances		
	Schedule 5 and 10	Schedule 20 and Greater
Allowable Deviation of Wall Thickness at any point from Nominal (1) Wall Thickness	+/-12.5%, +/-.012 in. min.	12.5% (3)
Weight Tolerances		
	Schedule 5 and 10	Schedule 20 and Greater
Allowable Deviation from Theoretical Weight	Only Wall Thickness and Length Tollerances apply	+8% (6)
Length Tolerances		
	Up through 20 feet	Over 20 and thru 40 feet
Allowable Deviation from Specified Length	0.25	0.05
Straightness Tolerances		
		Allowable Deviation from Straight when Weight of Pipe on Flat Surface minimizes Deviation
	Under 6" Pipe Size	6-12" Pipe Size
In Total Length or in any measured segment of one foot or more of Total Length	0.25	0.05

(1) Nominal diameter and wall thickness are listed in chart on Seamless Mechanical Tube sheet.

(2) Mean diameter is the average of any two diameter measurements taken at right angles to each other at any point along the length.

(3) Maximum wall thickness is controlled by weight tolerance.

(6) Minimum weight is controlled by tolerances for outside diameter and wall thickness.

*Reference: The Aluminum Association

Bursting Pressure/Pipe Schedule Chart

Nominal Pipe Size (in.) [1]	Schedule Number	Outside Diameter (in.)			Inside Dia (in.)	Wall Thickness (in.)			Weight Per Foot (lb.)		Expected Bursting Pressure		Expected Collapse Pressure	
		Nom. [1]	Min. [2] [4]	Max. [2] [4]	Nom.	Nom. [1]	Min [2]	Max [2]	Nom. [3]	Max. [2] [3]	6063-T6 (psi)	6061-T6 (psi)	6063-T6 (psi)	6061-T6 (psi)
1	5	1.315	1.284	1.330	1.185	0.065	0.053	0.077	0.300	-	3090	3910	1870	2439
	10	1.315	1.284	1.330	1.097	0.109	0.095	0.123	0.486	-	5340	6750	3717	5075
	40	1.315	1.284	1.330	1.049	0.133	0.116	-	0.581	0.627	6600	8350	4725	6514
	80	1.315	1.284	1.330	0.957	0.179	0.157	-	0.751	0.811	9160	11600		
	160	1.315	1.284	1.330	0.815	0.250	0.219	-	0.984	1.062				
1 1/4	5	1.660	1.629	1.675	1.530	0.065	0.053	0.077	0.383	-	2430	3080	1303	1393
	10	1.660	1.629	1.675	1.442	0.109	0.095	0.123	0.625	-	4160	5260	2766	3718
	40	1.660	1.629	1.675	1.380	0.140	0.122	-	0.786	0.849	5430	6880	3797	5189
	80	1.660	1.629	1.675	1.278	0.191	0.167	-	1.037	1.120	7610	9640		
	160	1.660	1.629	1.675	1.160	0.250	0.219	-	1.302	1.407	10280	13020		
1 1/2	5	1.900	1.869	1.915	1.770	0.065	0.053	0.077	0.441	-	2110	2670	929	929
	10	1.900	1.869	1.915	1.682	0.109	0.095	0.123	0.721	-	3610	4570	2308	3064
	40	1.900	1.869	1.915	1.610	0.145	0.127	-	0.940	1.015	4880	6175	3354	4557
	80	1.900	1.869	1.915	1.500	0.200	0.175	-	1.256	1.357	6900	8730	4952	6838
	160	1.900	1.869	1.915	1.338	0.281	0.246	-	1.681	1.815	10080	12780		
2	5	2.375	2.344	2.406	2.245	0.065	0.053	0.077	0.555	-	1680	2130	475	475
	10	2.375	2.344	2.406	2.157	0.109	0.095	0.123	0.913	-	2860	3620	1675	2160
	40	2.375	2.351	2.399	2.067	0.154	0.135	-	1.264	1.365	4120	5210	2721	3653
	80	2.375	2.351	2.399	1.939	0.218	0.191	-	1.737	1.876	5950	7535	4208	5777
	160	2.375	2.351	2.399	1.687	0.344	0.301	-	2.581	2.788	9800	12420		
2 1/2	5	2.875	2.844	2.906	2.709	0.083	0.071	0.095	0.856	-	1770	2250	558	558
	10	2.875	2.844	2.906	2.635	0.120	0.105	0.135	1.1221	-	2590	3290	1446	1687
	40	2.875	2.846	2.904	2.469	0.203	0.178	-	2.004	2.164	4490	5690	3039	4108
	80	2.875	2.846	2.904	2.323	0.276	0.242	-	2.650	2.862	6240	7900	4041	6108
	160	2.875	2.846	2.904	2.125	0.375	0.328	-	3.464	3.741	8740	11070		
3	5	3.500	3.469	3.531	3.334	0.083	0.071	0.095	1.048	-	1450	1840	309	309
	10	3.500	3.469	3.531	3.260	0.120	0.105	0.135	1.498	-	2110	2680	935	935
	40	3.500	3.465	3.535	3.068	0.216	0.189	-	2.621	2.830	3895	4935	2548	3407
	80	3.500	3.465	3.535	2.900	0.300	0.262	-	3.547	3.830	5520	6995	3873	5298
	160	3.500	3.465	3.535	2.624	0.438	0.383	-	4.955	5.351	8320	10530		
3 1/2	5	4.000	3.969	4.031	3.834	0.083	0.071	0.095	1.201	-	1270	1600	207	207
	10	4.000	3.969	4.031	3.760	0.120	0.105	0.135	1.720	-	1850	2340	626	626
	40	4.000	3.960	4.040	3.548	0.226	0.198	-	3.151	3.403	3550	4495	2260	2996
	80	4.000	3.960	4.040	3.364	0.318	0.278	-	4.326	4.672	5100	6450	3530	4808
4	5	4.500	4.469	4.531	4.334	0.083	0.071	0.095	1.354	-	1125	1420	145	145
	10	4.500	4.469	4.531	4.260	0.120	0.105	0.135	1.942	-	1635	2070	440	440
	40	4.500	4.455	4.545	4.026	0.237	0.207	-	3.733	4.031	3300	4180	2049	2694
	80	4.500	4.455	4.545	3.826	0.337	0.295	-	5.183	5.598	4780	6050	3275	4445
	120	4.500	4.455	4.545	3.624	0.438	0.383	-	6.573	7.099	6320	8000	4502	6196
	160	4.500	4.455	4.545	3.438	0.531	0.465	-	7.786	8.409	7820	9900		
5	5	5.563	5.532	5.625	5.345	0.109	0.095	0.123	2.196	-	1190	1510	174	174
	10	5.563	5.532	5.625	5.295	0.134	0.117	0.151	2.688	-	1470	1870	324	324
	40	5.563	5.507	5.619	5.047	0.258	0.226	-	5.057	5.461	2890	3660	1702	2198
	80	5.563	5.507	5.619	4.813	0.375	0.328	-	7.188	7.763	4280	5410	2863	3856
	120	5.563	5.507	5.619	4.563	0.500	0.438	-	9.353	10.10	5810	7360	4103	5626
	160	5.563	5.507	5.619	4.313	0.625	0.547	-	11.40	12.31	7410	9390		
6	5	6.625	6.594	6.687	6.407	0.109	0.095	0.123	2.624	-	1000	1270	103	103
	10	6.625	6.594	6.687	6.357	0.134	0.117	0.151	3.213	-	1230	1560	192	192
	40	6.625	6.559	6.691	6.065	0.280	0.245	-	6.564	7.089	2620	3320	1475	1751
	80	6.625	6.559	6.691	5.761	0.432	0.378	-	9.884	10.67	4130	5220	2741	3682
	120	6.625	6.559	6.691	5.501	0.562	0.492	-	12.59	13.60	5450	6910	3824	5228
	160	6.625	6.559	6.691	5.187	0.719	0.629	-	15.69	16.94	7110	9000		
8	5	8.625	8.594	8.718	8.407	0.109	0.095	0.123	3.429	-	765	970	47	47
	10	8.625	8.594	8.718	8.329	0.148	0.130	0.166	4.635	-	1040	1320	117	117
	20	8.625	8.539	8.711	8.125	0.250	0.219	-	7.735	8.354	1780	2250	565	565
	30	8.625	8.539	8.711	8.071	0.277	0.242	-	8.543	9.227	1980	2500	768	768
	40	8.625	8.539	8.711	7.981	0.322	0.282	-	9.878	10.67	2310	2920	1207	1207
	60	8.625	8.539	8.711	7.813	0.406	0.355	-	12.33	13.31	2930	3720	1740	2253
	80	8.625	8.539	8.711	7.625	0.500	0.438	-	15.01	16.21	3650	4620	2342	3112
	100	8.625	8.539	8.711	7.437	0.594	0.520	-	17.62	19.03	4300	5440	2937	3961
	120	8.625	8.539	8.711	7.187	0.719	0.629	-	21.00	22.68	5350	6770	3737	5103
	140	8.625	8.539	8.711	7.001	0.812	0.710	-	23.44	25.31	6100	7730	4338	5962
	160	8.625	8.539	8.711	6.813	0.906	0.793	-	25.84	27.90	6880	8720		
10	5	10.750	10.719	10.843	10.482	0.134	0.117	0.151	5.256	-	755	955	45	45
	10	10.750	10.719	10.843	10.420	0.165	0.144	0.186	6.453	-	930	1180	84	84
	20	10.750	10.642	10.858	10.250	0.250	0.219	-	9.698	10.47	1420	1800	292	292
	30	10.750	10.642	10.858	10.136	0.307	0.269	-	11.84	12.79	1760	2220	540	540
	40	10.750	10.642	10.858	10.020	3.365	0.319	-	14.00	15.12	2090	2650	908	908
	60	10.750	10.642	10.858	9.750	0.500	0.438	-	18.93	20.45	2900	3670	1709	2209
	80	10.750	10.642	10.858	9.562	0.594	0.520	-	22.29	24.07	3460	4380	2187	2891
	100	10.750	10.642	10.858	9.312	0.719	0.629	-	26.65	28.78	4230	5350	2828	3807
12	5	12.750	12.719	12.843	12.438	0.156	0.136	0.176	7.258	-	785	995	50	50
	10	12.750	12.719	12.843	12.390	0.180	0.158	0.202	8.359	-	855	1080	65	65
	20	12.750	12.622	12.878	12.250	0.250	0.219	-	11.55	12.47	1195	1515	175	175
	30	12.750	12.622	12.878	12.090	0.330	0.289	-	15.14	16.35	1590	2020	402	402
	40	12.750	12.622	12.878	11.938	0.406	0.355	-	18.52	20.00	1960	2480	749	749
	60	12.750	12.622	12.878	11.626	0.562	0.492	-	25.31	27.33	2430	3080	1306	1399
	80	12.750	12.622	12.878	11.374	0.688	0.602	-	30.66	33.11	3380	4280	2116	2790

(1) In accordance with ANSI/ASME Standards B36, 10M and B36.19M.
(2) Based on ANSI standard pipe tolerance.
(3) Based on nominal dimensions, plain ends, and a density of 0.098 lb per cu in., the density of 6061 alloy. For alloy 6063 multiply by 0.99 and for alloy 3003 multiply by 1.01.
(4) For schedules 5 and 10 these values apply to mean outside diameters.

Source: Structural Aluminum Design by Karl Andermayer, CPE Corp., 1987.

Hydro

Extrusion North America

Seamless Mechanical Tube

Seamless Mechanical Tube, often referred to as "hollow bar", has improved dimensional tolerances designed for machining applications. Outside diameter tolerances (ovality) are one half of standard extruded tube and a specified wall thickness tolerance to allow for consistent machining clean up. Because it is seamless, you can relay on uniform machinability and predictable strength, part after part. With improved tolerances less stock needs to be machined resulting in less time to machine a finished part and improved accuracy of finished part dimensions. Machined hollow parts can be machined directly from hollow stock... resulting in substantial savings on material and machining time.

With a wide variety of sizes available, Seamless Mechanical Tube is an economical alternative to machining parts from solid rod stock that can be used for various applications such as couplings, fittings, rings, sleeves, adapters, rollers, shafts, and telescoping assemblies. And, since extrusion tooling is relatively inexpensive, it is easy to accommodate frequent design changes.

We offer a wide range of seamless mechanical tube in sizes with nominal O.D.'s from 1.5 to 12 inches and wall thickness' ranging from .125 to 2 inches depending on diameter. Available alloys include 6061, 6063, 6082 and for improved machinability, alloys 6042 and 6262.

To order the stock size that will assure the correct size of a finished part and machining clean up on all outside and inside surfaces, see the Size Recovery Chart located on the back of this sheet.

Mechanical Tube Seamless Extruded OD to Minimum Wall Criteria (inches)	
OD	**Minimum Wall**
1.500 - 2.000	0.125
2.001 - 3.500	0.188
3.501 - 8.000	0.250
8.001 - 10.750	0.375
10.751 - 12.000	0.500

Mechanical Seamless Tube Tolerances	
Diameter Size (OD)	**Individual Reading (IR) (+/-) (inches)**
1.500 - 1.999	0.012
2.000 - 3.999	0.015
4.000 - 5.999	0.025
6.000 - 7.999	0.035
8.000 - 9.999	0.045
10.000 - 11.999	0.055
12.000	0.065

Wall Thickness
Individual Reading (IR)
+/- 10% of specified wall thickness

Size Recovery Chart

Nominal OD	Max Expected Finish-Machined OD	Max Expected Finish-Machined OD	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"
Col A.	Col B.	Col C.	Minimum Expected Finish-Machined Inside Diameter (Reads Down)										
1 3/4	1.720	-	1.555	-	-	-	-	-	-	-	-	-	-
2	1.965	-	1.810	1.697	1.585	1.473	1.360	1.248	1.135	-	-	-	-
2 1/2	2.465	-	-	2.197	2.085	1.973	1.860	1.748	1.635	-	-	-	-
2 5/8	2.590	-	-	2.322	2.210	2.097	1.985	1.873	1.760	-	-	-	-
2 3/4	2.715	2.700	-	2.447	2.335	2.223	2.110	1.998	1.885	-	-	-	-
2 7/8	2.840	-	-	2.572	2.460	2.347	2.235	2.123	2.010	-	-	-	-
3	2.965	2.950	-	2.697	2.585	2.473	2.360	2.248	2.135	1.905	1.655	1.405	1.165
3 1/8	3.090	-	-	2.822	2.710	2.597	2.485	2.373	2.260	2.030	1.780	-	-
3 1/4	3.215	3.200	-	2.947	2.835	2.723	2.610	2.498	2.385	2.155	1.905	-	1.405
3 3/8	3.340	-	-	3.072	2.960	2.847	2.735	2.623	2.510	2.280	2.030	-	-
3 1/2	3.465	3.450	-	3.197	3.085	2.973	2.860	2.748	2.635	2.405	2.155	1.905	1.655
3 5/8	3.590	-	-	-	3.210	3.097	2.985	2.873	2.760	2.530	2.280	2.030	-
3 3/4	3.715	3.700	-	-	3.335	3.223	3.110	2.998	2.885	2.655	2.405	2.155	1.905
3 7/8	3.840	-	-	-	3.460	3.347	3.235	3.123	3.010	2.780	2.530	2.280	-
4	3.955	3.930	-	-	3.595	3.482	3.370	3.258	3.145	2.915	2.665	2.415	2.165
4 1/4	4.205	4.180	-	-	3.845	3.732	3.620	3.508	3.395	3.165	2.915	2.665	2.415
4 1/2	4.455	4.430	-	-	4.095	3.982	3.870	3.758	3.645	3.415	3.165	2.915	2.665
4 3/4	4.705	4.680	-	-	4.345	4.232	4.120	4.008	3.895	3.665	3.415	3.165	2.915
5	4.955	4.930	-	-	4.595	4.482	4.370	4.258	4.145	3.915	3.655	3.415	3.165
5 1/4	5.205	5.180	-	-	4.870	4.732	4.620	4.508	4.395	4.165	3.915	3.665	3.415
5 1/2	5.455	5.430	-	-	5.120	4.982	4.870	4.758	4.645	4.415	4.165	3.915	3.665
5 3/4	5.705	5.680	-	-	5.370	5.232	5.120	5.008	4.895	4.665	4.415	4.165	3.915
6	5.942	5.905	-	-	5.645	5.495	5.383	5.270	5.158	4.928	4.678	4.428	4.178
6 1/4	6.192	6.155	-	-	5.895	5.745	5.633	5.520	5.408	5.178	4.928	4.678	4.428
6 1/2	6.442	6.405	-	-	6.145	6.033	5.883	5.770	5.658	5.428	5.178	4.928	4.678
6 3/4	6.692	6.655	-	-	6.395	6.283	6.133	6.020	5.908	5.678	5.428	5.178	4.928
7	6.942	6.905	-	-	6.645	6.533	6.383	6.270	6.158	5.928	5.678	5.428	5.178
7 1/4	7.192	7.155	-	-	6.895	6.783	6.633	6.520	6.408	6.178	5.928	5.678	5.428
7 1/2	7.442	7.405	-	-	7.145	7.033	6.883	6.770	6.658	6.428	6.178	5.928	5.678
7 3/4	7.692	7.655	-	-	7.395	7.283	7.170	7.020	6.908	6.678	6.428	6.178	5.928
8	7.930	7.880	-	-	7.670	7.558	7.445	7.283	7.170	6.940	6.690	6.440	6.19
8 1/2	8.430	-	-	-	-	8.008	7.895	7.782	7.670	7.440	7.190	6.940	6.69
9	8.930	-	-	-	-	8.508	8.395	3.282	8.170	7.940	7.690	7.440	7.19
9 1/2	9.430	-	-	-	-	9.008	8.895	8.782	8.670	8.440	8.190	7.940	7.69
10	9.917	-	-	-	-	9.521	9.408	9.295	9.183	8.953	8.703	8.453	8.203
11	10.917	-	-	-	-	-	10.408	10.295	10.183	9.953	9.703	9.453	9.202*
12	11.900	-	-	-	-	-	-	11.312	11.200	10.970	10.720	10.470	10.222*

SHADED AREA: Minimum Expected Finish-Machined I.D. sizes falling within shaded area have wall thickness less than 5% of stock O.D. Stock O.D. should therefore be selected from Column C (Maximum Expected Finish-Machined O.D.).

NOTES: Use of this chart is based on chucking Seamless Aluminum Mechanical Tube on the outside diameter, and parts to be produced will not exceed six inches in length.

By referring to the Size Recovery Chart, here's how to obtain the correct stock size that assures complete clean-up of parts:

1. Check maximum OD of finished part
2. Find nearest larger OD in Col. B (max. expected finished machined OD).
3. Read Mechanical Tube OD to be specified from Col. A
4. Check minimum ID of finished part
5. Locate nearest smaller ID in columns, following across same line on which OD was found
6. Read-up and obtain correct fraction wall thickness of mechanical tube to be specified

* Available in T6 temper only for 11" OD x 1" Wall and 12" OD x 1" Wall

Hydro

Extrusion North America

Victaulic® Groove Aluminum Pipe & Tube

The Victaulic® grooved end piping system is the most versatile, economical and reliable mechanical joining system available for pipe and tube.

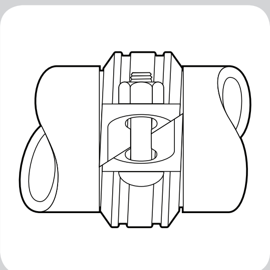
By specifying and installing Victaulic®, engineers, owners and installation contractors conserve time and financial resources through:

- Compressed project schedules
- Lowered total installed cost
- Safer work environment
- Reduced system downtime

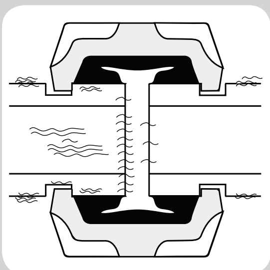
Benefits of the grooved systems:

- Rigidity
- Flexibility
- Noise and vibration attenuation
- Seismic stress absorption
- System maintenance and expansion
- Alignment ease

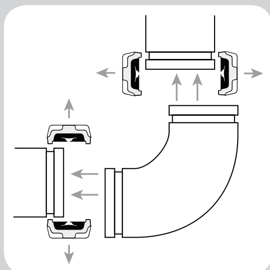
Features:



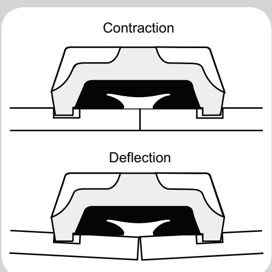
Rigidity
Rigidity is achieved with standard couplings. The unique angled pad design of Zero-Flex and other couplings provides positive clamping of the pipe to resist torsional and flexural loads.



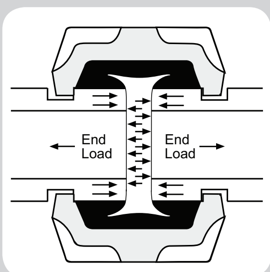
Noise and Vibration Attenuation
The basic design of independently grooved pipe sections reduces noise and vibration transmission, thus delivering superior vibration attenuation throughout the system.



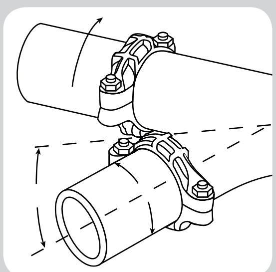
System Maintenance and Expansion
Coupling disassembly provides easy access for maintenance or system expansion. Victaulic butterfly valves provide “deadend” shut-off service to isolate equipment.



Flexibility
The Victaulic grooved end solution accommodates expansion/ contraction / deflection and enables designing that takes advantage of these built-in system features.



Seismic Stress Absorption
The full engagement of the housing keys into grooves around the pipe circumference provides significant pressure restraint and end load capability to withstand pipe movement from internal and external sources.



Alignment Ease
The grooved system allows full rotation of the pipe and system components before tightening so that proper alignment can be achieved.

Victaulic® Groove Aluminum Pipe & Tube Available Sizes

Roll Grooved Seamless[1]

- 2 Schedules 5, 10, 40
- 2-1/2 Schedules 5, 10, 40, 80
- 3 Schedules 5, 10, 40
- 3-1/2 Schedules 5, 10, 40
- 4 Schedules 5, 10, 40
- 5 Schedules 5, 10, 40
- 6 Schedules 5, 10, 40
- 8 Schedules 5, 10, 20, 30, 40
- 10 Schedules 5, 10, 40
- 12 Schedules 5, 10, 40
- 3.000 OD x .083 to .280 Wall
- 4.000 OD x .083 to .280 Wall
- 6.000 OD x .109 to .280 Wall
- 8.000 OD x .109 to .322 Wall

Roll Grooved Structural (Porthole)

- 2 Schedules 5, 10, 40
- 2-1/2 Schedules 5, 10, 40, 80
- 3 Schedules 5, 10, 40
- 3-1/2 Schedules 5, 10, 40
- 4 Schedules 5, 10, 40
- 5 Schedules 5, 10, 40
- 6 Schedules 10, 40[2]
- 8 Schedules 10, 20, 40[2]
- 3.000 OD x .083 to .250 Wall
- 4.000 OD x .083 to .250 Wall
- 6.000 OD x .148 to .250 Wall[2]

Cut Grooved Structural (Porthole)[2]

2 Schedule 40	3 Schedule 40
4 Schedule 40	6 Schedules 40, 80

Roll grooving removes no metal, cold forming a groove by the action of an upper male roll being forced into pipe as it is rotated by a lower female drive roll.

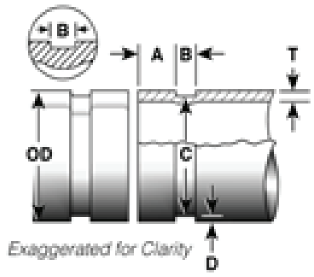
Roll groove configuration has rounded edges that reduce the available pipe end movement (expansion, contraction and deflection).

Victaulic flexible coupling performance data reflects roll-grooving specifications. For standard cut grooved pipe the allowable pipe end separation and deflection figures may be doubled. Refer to coupling manufacturer for details on groove geometry and appropriate couplings.

Note: Coatings applied to the interior surfaces, including bolt pad mating surfaces, of grooved and bolted plain end couplings should not exceed 0.010” (0,25 mm). Also, the coating thickness applied to the gasket seating surface and within the groove on the pipe exterior should not exceed 0.010” (0,25 mm).

(1) Seamless pipe & tube are only available from Cressona, PA location
(2) Victaulic cut groove structural pipe and certain roll groove structural pipe sizes are only available from Phoenix, AZ location

Standard Roll Groove Specifications for Pipe†



A – Gasket seat
B – Groove Width
C – Groove Diameter D – Groove Depth
T – Minimum allowable wall thickness
OD – Outside diameter

Dimensions - Inches/millimeters										
Nom. Pipe Sizes Inches mm	Pipe Outside Dia. O.D.			Gasket Seat - A ±0.03 ±0,76	Grv. Width - B ±0.03 ±0,76	Groove Dia. - C		Groove Depth D (ref.)	Min. Allow. Wall Thk. T	Max. Allow. Flare Dia.
	Basic	Tolerance + / -				Basic	Tol. +0.000 +0.00			
2 50	2.375 60,3	0.024 0,61	0.024 0,61	0.625 15,88	0.344 8,74	2.250 57,15	-0.015 -0,38	0.63 1,60	0.065 1,65	2.48 63,0
2.50 65	2.875 73,0	0.029 0,74	0.029 0,74	0.625 15,88	0.344 8,74	2.720 69,09	-0.018 -0,46	0.078 1,98	0.083 2,11	2.98 75,7
76,1mm	3.000 76,1	0.030 0,76	0.030 0,76	0.625 1,88	0.344 8,74	2.845 72,26	-0.18 -0,46	0.078 1,98	0.83 2,11	3.10 78,7
3 80	3.500 88,9	0.035 0,89	0.31 0,79	0.625 15,88	0.344 8,74	3.344 84,94	-0.018 -0,46	0.078 1.98	0.083 2,11	3.60 91,4
30.50 90	4.000 101,6	0.040 1,02	0.031 0,79	0.625 15,88	0.344 8,74	3.834 97,38	-0.020 -0,51	0.083 2,11	0.083 2,11	4.10 104,1
4 100	4.500 114,3	0.045 1,14	0.031 0,79	0.625 15,88	0.344 8,74	4.334 110,08	-0.020 -0,51	0.083 2,11	0.083 2,11	4.60 116,8
108,0 mm	4.250 108,0	0.043 1,09	0.031 0,79	0.626 15,88	0.344 8,74	4.084 103.73	-0.020 -0,51	0.083 2,11	0.083 2,11	4.35 1,8
4.50 120	5.000 127,0	0.050 1,27	0.031 0,79	0.625 15,88	0.344 8,74	4.834 122,78	-0.020 -0,51	0.083 2,11	0.095 2,41	5.10 129,5
133.0 mm	5.250 133,0	0.053 1,35	0.031 0,79	0.625 15,88	0.344 8,74	5.084 129.13	-0.020 -0.51	0.083 2.11	0.109 2.77	5.35 135.9
139.7 mm	5.500 139,7	0.056 1,42	0.031 0,79	0.625 15,88	0.344 8,74	5.334 135,48	-0.020 -0,51	0.083 2,11	0.109 2,77	5.60 142,2
5 125	5.563 141,3	0.056 1,42	0.031 0,79	0.625 15,88	0.344 8,74	5.395 137,03	-0.022 -0,56	0.084 2,13	0.109 2,77	5.66 143,8
152,4 mm	6.000 152,4	0.056 1,42	0.031 0,79	0.625 15,88	0.344 8,74	5.830 148,08	-0.022 -0,56	0.085 2,16	0.109 2,77	6.10 154,9
159,0 mm	6.250 159,0	0.063 1,60	0.031 0,79	0.625 15,88	0.344 8,74	6.032 153,21	-0.030 -0,76	0.085 2,16	0.109 2.77	6.35 161,3
165,1 mm	6.500 165,1	0.063 1,60	0.031 0,79	0.625 15,88	0.344 8,74	6.330 160.78	-0.022 -0,56	0.085 2,16	0.109 2,77	6.60 167,6
6 150	6.625 168,3	0.063 1,60	0.031 0,79	0.625 15,88	0.344 8,74	6.455 163,96	-0.022 -0.56	0.085 2,16	0.109 2,77	6.73 170,9
203,2 mm	8.000 203,2	0.063 1,60	0.031 0,79	0.750 19,05	0.469 11,91	7.816 198,53	-0.025 -0,64	0.092 2,34	0.109 2,77	8.17 207,5
8 200	8.625 219,1	0.063 1,60	0.031 0,79	0.750 19,05	0.469 11,91	8.441 214,40	-0.025 -0,64	0.092 2,34	0.109 2,77	8.80 223,5
254,0 mm	10.000 254,0	0.063 1,60	0.031 0,79	0.750 19,05	0.469 11.91	9.812 249,23	-0.027 -0,69	0.094 2,39	0.134 3,40	10.17 258,3
10 250	10.750 273,0	0.063 1,60	0.031 0,79	0.750 19,05	0.469 11,91	10.562 268,28	-0.027 -0,69	0.094 2,39	0.134 3,40	10.92 277,4
304,8 mm	12.000 304,8	0.063 1,60	0.031 0,79	0.750 19,05	0.469 11,91	11.781 299,24	-0.030 -0,76	0.109 2,77	0.156 3,96	12.17 309,1
12 300	12.750 323,9	0.063 1,60	0.031 0,79	0.750 19,05	0.469 11,91	12.531 318,29	-0.030 -0.76	0.109 2,77	0.156 3,96	12.92 328,2

†On roll grooved pipe, allowable pipe end separation and deflection from centerline will be 1/2 values listed for cut grooved pipe. For 30-42" (750-1050 mm) roll groove dimensions contact Victaulic

Column 1: **Nominal IPS Pipe size**
Column 2: **IPS outside diameter.** The outside diameter of roll grooved pipe shall not vary more than the tolerance listed. For IPS pipe the maximum allowable tolerance from square cut ends is 0.030" for . -3 ."; 0.045" for 4-6"; and 0.060" for sizes 8" O.D. and above (measured from true square line).
Column 3: **Gasket seat.** The pipe surface shall be free from indentations, roll marks, and projections from the end of the pipe to the groove, to provide a leak-tight seal for the gasket. All loose paint, scale, dirt, chips, grease and rust must be removed. It continues to be Victaulic's first recommendation that pipe be square cut. When using beveled pipe contact Victaulic for details. Square cut pipe must be used with FlushSeal® and EndSeal® gaskets. Gasket seat "A" is measured from the end of the pipe. IMPORTANT: Roll grooving of beveled end pipe may result in unacceptable pipe end flare. See column 8.
Column 4: **Groove width.** Bottom of groove to be free of loose dirt, chips, rust and scale that may interfere with proper coupling assembly. Corners at bottom of groove must be radiused.
Column 5: **Groove outside diameter.** The groove must be of uniform depth for the entire pipe circumference. Groove must be maintained within the "C" diameter tolerance listed.
Column 6: **Groove depth.** For reference only. Groove must conform to the groove diameter "C" listed.
Column 7: **Minimum allowable wall thickness.** This is the minimum wall thickness that may be roll grooved.
Column 8: **Maximum allowable pipe end flare diameter.** Measured at the most extreme pipe end diameter, square cut or beveled.

Notes

Notes

Hydro

We are aluminum

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