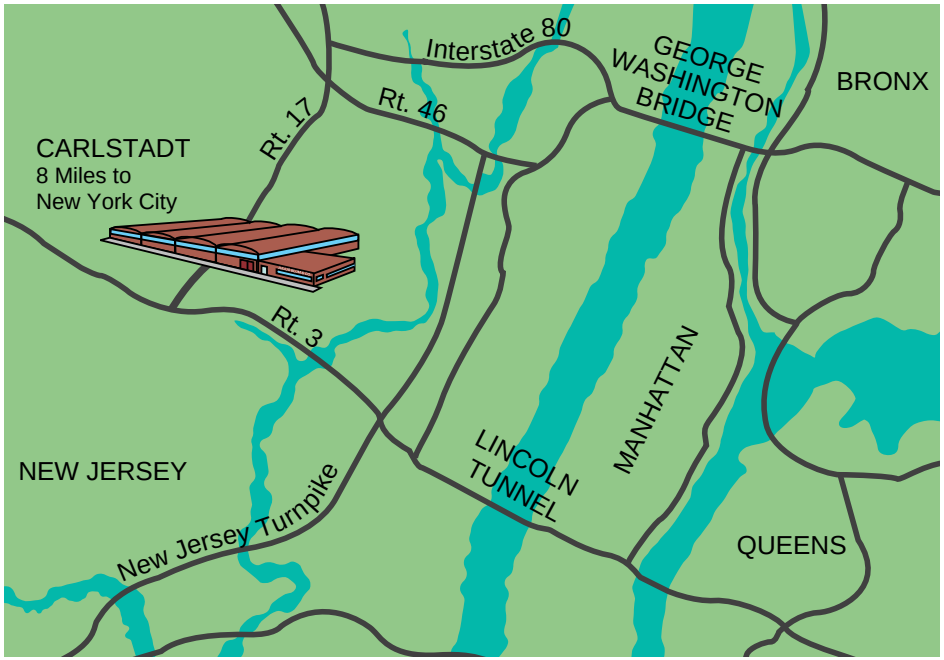
Julius Blum & Co., Inc.
P.O. Box 816 • Carlstadt, NJ 07072-0816
50 Blum Blvd. • Wood-Ridge, NJ 07075
Toll Free (U.S. & Canada) 800-526-6293
Local New Jersey 201-438-4600
FAX 201-438-6003
Visit our website www.juliusblum.com

NOMMA

ASSOCIATE SSFNE STRUCTURAL STEEL FABRICATORS OF NEW ENGLAND

COPPER & BRASS SERVICENTER ASSOCIATION

NAAD NATIONAL ASSOCIATION OF ALUMINUM DISTRIBUTORS America Needs Aluminum



WELCOME

Welcome to our first CDROM catalog. Over the years, the Julius Blum & Co., Inc. print catalog has become the *bible* of the architectural metal trades. We are pleased to now be able to present the information that architects and fabricators have come to depend on in this new electronic format.

This catalog not only contains our full line of stock components for architectural metal work but also includes an indispensible engineering data section to aid in the design of structurally sound railing systems. You will find that all the part numbers are linked to .dwg files allowing you to view a dimensioned drawing of every part we stock. These .dwg files can be downloaded for use in your own drawings.

We hope to eventually add additional information on to the CDROM including load tables, fabrication details, and design suggestions. This is a very exciting technology, and we hope to take full advantage of it in future editions. Stay in touch with our web site at www.juliusblum.com for the latest information on our products and the industry.

Our print catalogs are still available. If you do not have a copy of our current hard-cover ***Catalog 16***, please contact us and we will be happy to forward one to you. Information is also available in McGraw Hill's Sweet's *General Building and Renovation* volumes – Section 5720.BLM.

Dimensions, weights and technical data published in this catalog have been ascertained with care but cannot be guaranteed. Details and availability are subject to change. A call to our toll-free number will bring a prompt answer to any question about Blum materials.

HISTORY

Julius Blum & Co., Inc., was founded by Julius Blum in a Manhattan basement in 1910. Initially his business was limited to ornamental iron for local fabricators. Bronze handrails and door saddles were added in the 1920's, aluminum handrails in 1930, and a full line of bronze items in 1948.

The company outgrew its quarters, so a 40,000 sq. ft. warehouse was built in Carlstadt, New Jersey in 1952. The company relocated in 1953 and the warehouse has since expanded to its current size of 80,000 sq. ft.

Julius Blum's nephews, Bill Thurnauer and Walter Blum, took the helm following World War II and it remains a family business to this day with Walter Blum as president.

Despite our growth and the changes in the industry over the years, we have not lost sight of Julius Blum's desire to serve his customers by carrying quality materials – in stock and in substantial quantities – and providing prompt service.

FABRICATION

Julius Blum & Co., Inc. supplies stock materials only and does not offer custom design, fabricating or installing services. It has always been our philosophy to *never compete with our customers!*

If you need some help finding a fabricator, we are always happy to recommend firms in your area which are familiar with our products.

FITTINGS

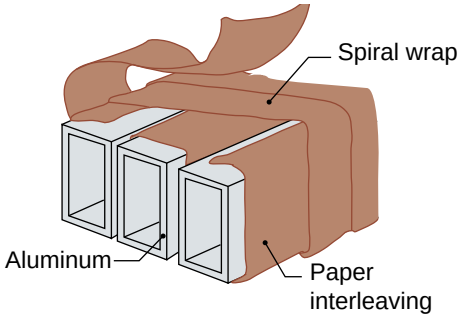
Julius Blum & Co., Inc. carries a wide range of fittings designed to match with our Connectorail® system pipe and our traditional handrail styles. Due to differences in designs and tolerances, our fittings will not necessarily match with similar handrail and pipe supplied by others.

IN STOCK – PROMPT SHIPMENT

Julius Blum & Co., Inc. is unique in the industry. While most companies choose to maintain minimal stock, we have always had substantial quantities on hand of every item we show in our catalog. We take pride in prompt service and we generally ship within a few days of receiving an order.

SHIPPING & PACKAGING

All components are produced and handled with great care and protected for shipment by wrapping and/or crating to assure a product well suited for architectural work.



Aluminum bars, angles, channels and tubing, except for structural shapes, are stocked in bundles of approximately 100 pounds. These bundles are mill wrapped with paper interleaving to protect the surface during storage and shipment.

Small package shipments are made via UPS. All other shipments are by common carrier, FOB New Jersey.

FABRICATING STAINLESS STEEL

Care should be taken when working with stainless steel so as not to contaminate the stainless with ferrous particles. This will occur if the stainless is fabricated using steel or iron tools (i.e. steel files or steel wool). Ferrous particles from steel tools will embed themselves in the stainless steel and will eventually start to rust which makes it seem that the stainless is rusting. Recovery of the finish is possible with appropriate chemical washes but proper fabrication will serve to avoid the problem.

FINISHES

Except as noted, all items in our catalog are supplied in a mill finish. Polishing, painting or anodizing of these items is not handled by Blum and would be performed by a professional polisher/finisher or the fabricator. The National Association of Architectural Metals Manufacturers (NAAMM) has an excellent metal finishing manual to assist in specifying architectural finishes. Contact them at 312-201-0101 for a copy.

BUILDING CODE REQUIREMENTS

Building code requirements and safety rules vary from one locality and from one type of structure to another, and are subject to periodic revision. Therefore it is incumbent upon designers to acquaint themselves and comply with the codes and regulations governing each project.

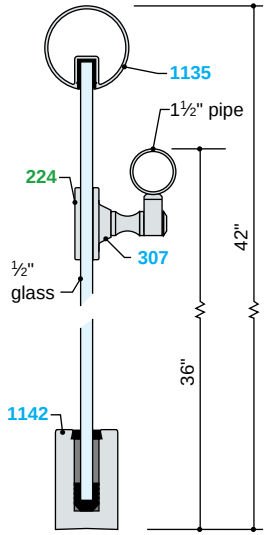
STRUCTURAL STRENGTH AND TESTING

In recent years, load requirements for handrails and guardrails have increased significantly. It is important to perform the appropriate calculations to determine the suitability of your chosen handrail and support system.

For example: many of our ornamental handrail sections, while well suited for mounting above a picket rail, would tend to exhibit too much vertical deflection when wall mounted at a standard bracket spacing of 4'-0". Bracket spacing would have to be reduced dramatically, or a structural support bar added underneath the handrail to allow for better bracket spacing.

Blum railing systems have been developed to meet industry standards and code safety requirements when railings are designed in accordance with engineering data and instructions provided in this catalog. Handrail brackets and facia mountings have been tested thoroughly. Copies of test reports are available upon request.

HANDRAIL & GUARDRAIL



Julius Blum & Co., Inc. has always stocked a wide range of handrail mouldings to suit many needs and conditions, but not all Blum handrails are suitable for all applications. Accessibility standards and code authorities often have dimensional limitations on handrail size which eliminate larger handrail mouldings from consideration. Confirm whether size limitations apply to your installation before specifying.

Most building codes differentiate between *handrail* and *guardrail.* Handrails are generally defined as being used for *guidance and support* while the purpose of guardrails is to *resist accidental falls.* Handrail heights are commonly between 34" and 38", while guardrails are 42" in height.

There is often a requirement that a guardrail have a handrail included as well.

The detail to the right shows a glass railing used as a guardrail. The 3½" cap rail is at a height of 42" – too high and too large for use as a handrail. A 1½" pipe handrail section is mounted at a proper handrail height of 36". The handrail is mounted using a 307 bracket and a 224 glass mounting adapter kit. The tempered glass must be drilled prior to tempering to permit use of the 224 (see page 83 for more information).

BRONZE VS. BRASS

One of the constant questions we get is, *What is the difference between bronze and brass?*

Brass and bronze are both copper alloys. In fact, architectural bronze is a sub-classification of brass – sometimes referred to as *leaded brass.* Blum stocks extrusions in architectural bronze, C38500, exclusively.

We stock architectural bronze for several reasons:

1. It has a rich golden color as opposed to brass which is more yellow in color.
2. It is more malleable than brass making it easier to work with.
3. Architectural bronze tubing is extruded with a thicker wall (between .100" to .125" thick) than you will find in brass (usually .062" thick) making it a stronger section and better suited for bending.

All of our cast fittings and brackets are cast in alloy C86500 while our drawn pipe is stocked in alloy C23000 – both of these alloys are considered a color match for architectural bronze. As mentioned above, our cast handrail fittings will not necessarily match with handrail supplied by others.

INTERNET

For the latest information on products and handrail related information, keep in touch with our web site at www.juliusblum.com.

TABLE OF CONTENTS

In order to facilitate ordering, components shown in this catalog are color coded for material as follows:

ACRYLIC/WOOD · ALUMINUM · BRONZE · PLASTIC · STAINLESS STEEL · NICKEL-SILVER

CAST IRON / MALLEABLE IRON / STEEL · COMPONENT AVAILABLE IN MORE THAN ONE MATERIAL

VODAVI TECHNOLOGY CORPORATION
Scottsdale, Arizona

Designer: Total Interiors
Fabr: Arizona Metal Specialties

Fabr: Duvinage Corp.
Hagerstown, Maryland

JB Glass Railing is a system of metal railing components for use with ½" or ¾" tempered glass panels as structural balusters.

Railings are supplied in aluminum, bronze, stainless steel, and oak acrylic/wood. End caps, internal splice connectors, and corner bends are available for most sections as well as a vinyl protective insert to shield the edges of the glass panels from direct contact with the moulding.

Aluminum glass rail sections are extruded from alloy 6063-T52 and, when properly fabricated, are suitable for anodizing, including most of the hard-coat anodic processes. Black anodizing may result in inconsistent matches. Consult your anodizer before specifying.

Bronze glass rail sections are extruded from alloy C38500 – architectural bronze.

Nickel-Silver extrusions are of alloy C79800. Sometimes referred to as *white bronze,* nickel-silver is a copper/nickel alloy. It is similar in appearance to stainless steel with a touch of gold.

Stainless Steel glass rail sections are roll formed, type 302/304 (18-8).

Acrylic/Wood glass rail sections are produced from oak which has been impregnated with acrylic plastic according to the Permagrain Radiation Process. This provides a hard surface and permanent finish which has twice the resistance to indentations and several times the resistance to abrasion as the same hardwood finished conventionally. It is laminated from several strips so as to obtain greater strength and continuous uniform lengths.

Aluminum shoe mouldings are designed to support a design load of 300 lbs. applied at any point at the top of a railing up to 42" in height. Test results are available upon request. Mechanical properties of glass may be verified with supplier of glass panels.

Shoe mouldings are supplied in two configurations: one is extruded in high strength alloy 6061-T6 to provide required strength with minimum weight. The heavier sections, in alloy 6063-T52, may be anodized and are better suited for bending and facia mounting. All three sections can be surface mounted – exposed or with a sheet metal trim – or set flush with the floor surface.

Resilient setting block supports and cushions the lower edge of the glass while centering it in the channel of the shoe moulding.

Glass panels are set in the shoe moulding using a filler selected at the discretion of the architect or fabricator. Do not use epoxy based fillers.

For matching wall mounted handrail, use Carlstadt® wall brackets with either JB Glass Railing with a concealed, inserted block or matching tubing sections. Wall returns may be cut from tubular corner bends.

Handrail may be mounted directly to the glass panels using Carlstadt® wall brackets and a glass bracket mounting kit.

The glass tempering process requires that all fabrication be completed prior to tempering. Attempts to cut, drill or grind the edges after tempering are likely to cause breakage.

All items are carried in stock in substantial quantities and are available for prompt shipment.

GLASS MOUNTING
Resilient setting blocks support and cushion glass panels as they are inserted in the shoe. Setting blocks should be 4" to 6" long and placed at points ¼ and ¾ of the length of the panel from each end. Space is allowed for plumbing and setting of glass – choice of filler material is at the discretion of the specifier/fabricator. ¼" spacer blocks should be inserted between adjoining glass panels to prevent glass to glass contact.

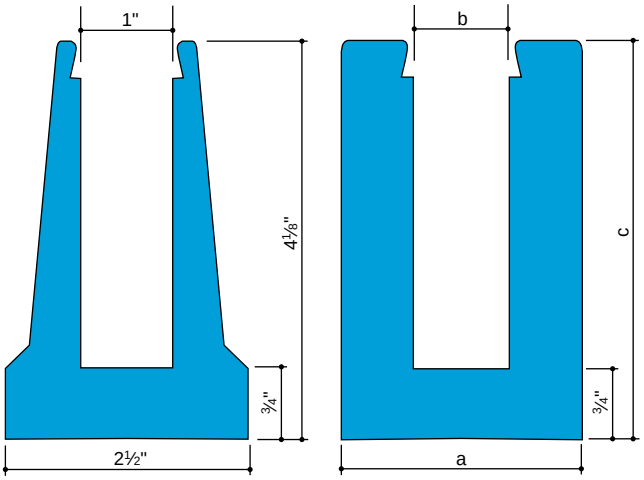
HANDRAIL ASSEMBLY
A vinyl protective insert protects the top edge of the glass panel and fits closely inside the handrail moulding – a windshield sealer type clear adhesive is recommended. End caps may be attached to handrails by use of adhesive or welding. Splice connections for tubular sections are accomplished with internal connector sleeves and structural epoxy.

HANDRAIL AND TUBING
JB Glass Railing top sections are available in several sizes in aluminum, bronze, nickel-silver, stainless steel and oak acrylic/wood. The handrails may be wall mounted using **Carlstadt**® brackets with an anchor plug or by using available matching 1.900", 2½", 3" and 3½" tubing.

CORNER BENDS AND MITER CORNERS
Corner bends match the contour of 1.900", 2½", 3" and 3½" round tubing shapes but without the recess on the underside. Mitered corners are supplied for most round tubular shapes. Either may be used as a wall return and are attached to handrail by use of internal connector sleeves and structural epoxy.

For use with ½" glass, except as noted.

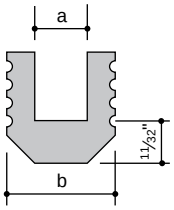
SHOE MOULDING Aluminum, 20' lengths



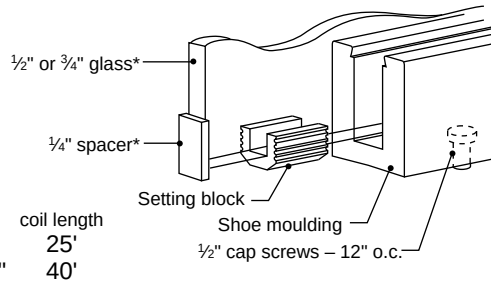
		a	b	c	lb/ft
1141	5.42 lb/ft (6061-T6)				
1142		2½"	1"	4⅛"	8.24
1143†		2¾"	1¼"	4¼"	8.64

† For use with ¾" glass

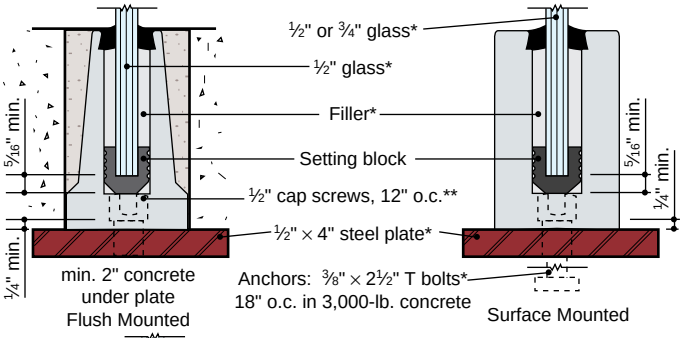
SETTING BLOCK
Polyvinyl Chloride

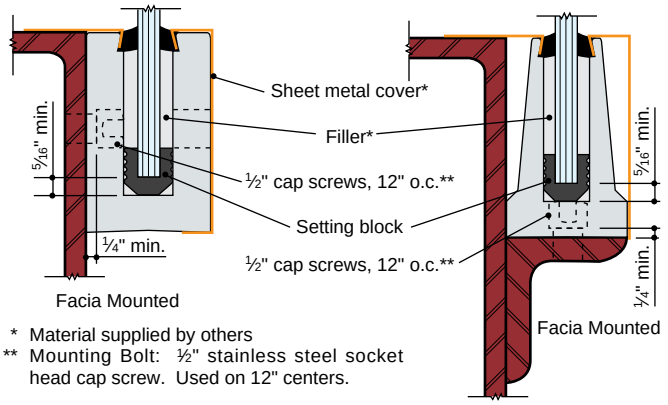


	a	b	coil length
8711	½"	1"	25'
8710	¾"	1¼"	40'

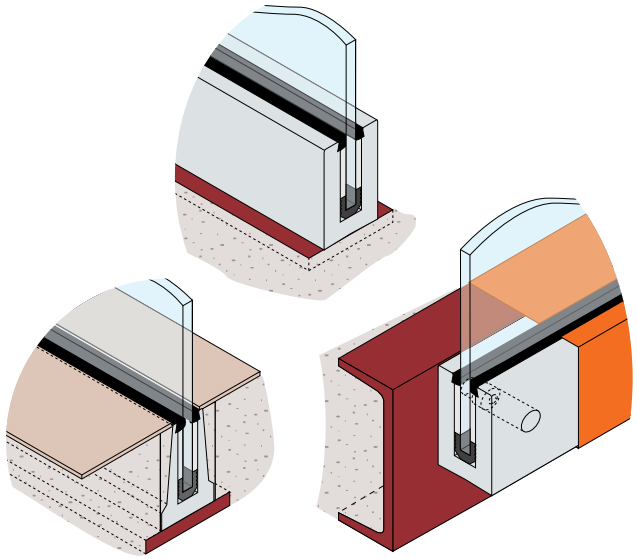


ASSEMBLY DETAILS





* Material supplied by others
** Mounting Bolt: ½" stainless steel socket head cap screw. Used on 12" centers.



Proper mounting of the shoe moulding is crucial to the strength of **JB® Glass Railing**. While there are alternate methods of attachment, the details above and to the left depict the four ways in which the shoe mouldings have been tested.

Note: Aluminum must not be placed in direct contact with concrete or dissimilar metals. Use appropriate paint or primer (see paragraph 3.02, page 126). Also, holes in steel plate/angle should be drilled and/or tapped prior to installation.

JB® Glass Rail shoe mouldings were subjected to structural testing by the independent testing lab of Wiss, Janney, Elstner Associates, Inc. of Northbrook, Illinois. The full report is available upon request. The summary of the report is reprinted below.

August 28, 1985

Julius Blum & Co., Inc.
P.O. Box 816
Carlstadt, NJ 07072

RE: WJE No. 820960
JB Glass Railing Tests

Gentlemen:

At your request, we have conducted tests on aluminum shoe mouldings specified for the JB Glass Railing System. It is our understanding that this particular railing system uses ½-in. thick tempered glass as a balustrade to support aluminum, bronze or stainless steel handrail mouldings. The glass panels are mounted in the aluminum shoe mouldings, which are the subject of this testing.

The objective of these tests was to obtain information concerning the load versus deflection characteristics of two types of shoe mouldings, mounted in several different ways. In addition, the tests were to demonstrate that the shoe mouldings could withstand loadings well in excess of current Model Code regulations, without failure or significant deformation. Most Model Code regulations require a uniform loading of 50 lbs. per lineal foot, and some require a 200-lb. concentrated load. These loads are not to be applied concurrently.

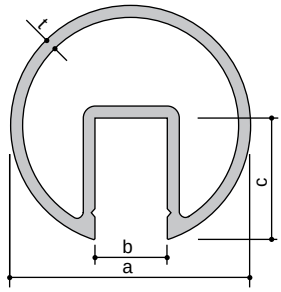
In the tests conducted and described in our report designated WJE No. 820960, dated January 13, 1983, concentrated loads of 400 lbs. to 800 lbs. were applied at approximately 42 in. from a referenced floor surface. The test sections were 4-ft. long. The test results and engineering calculations show that the strength of the shoe mouldings which were tested would exceed the above-mentioned Model Code loading criteria by a factor of four.

Very Truly Yours,
John M. Hanson
President
WISS, JANNEY, ELSTNER ASSOCIATES, INC.

HANDRAIL MOULDINGS

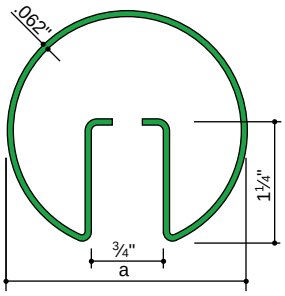
20' lengths, except as noted

For use with ½" glass, except as noted



		a	b	c	t	lb/ft
1130	Aluminum	1.900"	¾"	1¼"	.109"	1.01
1132	Aluminum	2½"	¾"	1¼"	.125"	1.52
1135	Aluminum	3½"	¾"	1¼"	.125"	1.95
1137	Aluminum	3"	¾"	1¼"	.125"	1.72
1154	Aluminum†	3"	1"	1¼"	.125"	1.73
1155	Aluminum†	3½"	1"	1¼"	.125"	1.97
1230	Bronze	1.900"	¾"	1"	.100"	2.69
1231Q	Bronze*	2½"	¾"	1¼"	.100"	3.65
1232	Bronze*	2½"	¾"	1¼"	.125"	4.51
1233	Bronze*	3"	¾"	1¼"	.125"	5.28
1235	Bronze**	3½"	¾"	1¼"	.187"	8.70
1330	Nickel-Silver*	1.900"	¾"	1"	.125"	2.74
1332	Nickel-Silver*	2½"	¾"	1¼"	.125"	4.43
1333	Nickel-Silver*	3"	¾"	1¼"	.125"	5.20

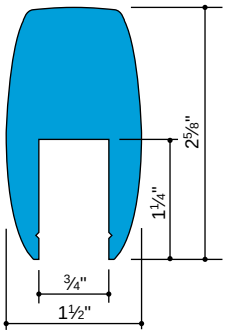
† For use with ¾" glass * 16' lengths ** 12' lengths



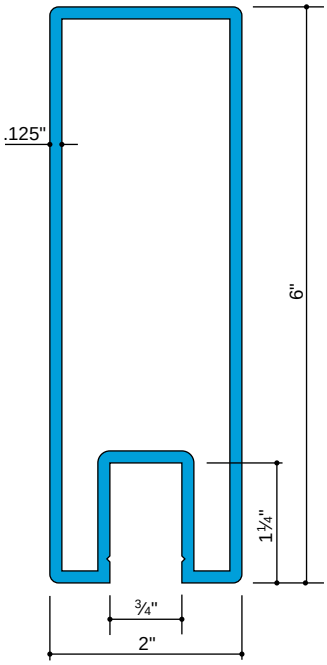
Stainless Steel

	a	lb/ft	finish
1430	1.900"	1.70	No. 2B*
1432	2½"	1.96	No. 2B*
1452	2½"	1.96	No. 4
1433	3"	2.46	No. 2B*
1453	3"	2.46	No. 4

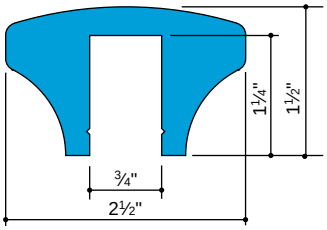
* Suitable for polishing



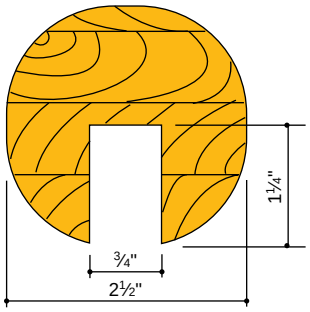
1133 Aluminum 3.02 lb/ft



1136 Aluminum 2.70 lb/ft

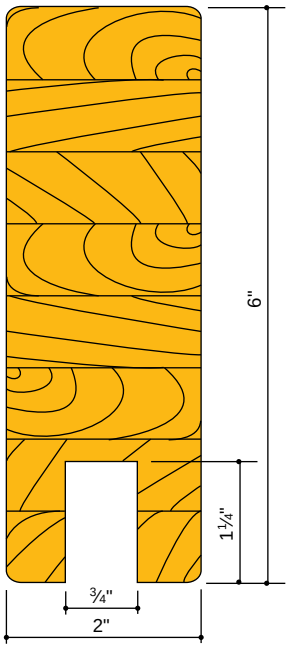


1134 Aluminum 2.40 lb/ft



8632 Oak Acrylic/Wood
16' lengths

Approximate color and grain configuration

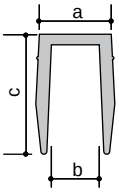


8662 Oak Acrylic/Wood
16' lengths

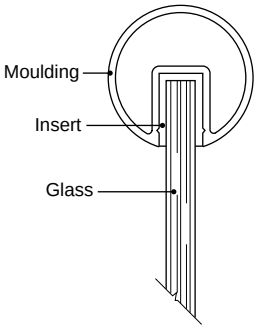
PROTECTIVE INSERT

Polyvinyl Chloride, 7' lengths

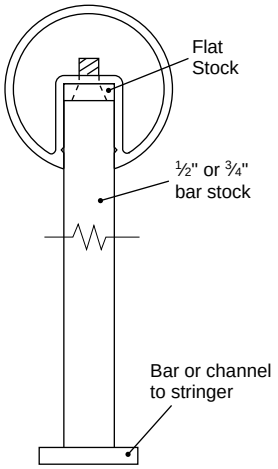
	a	b	c
8709	¾"	½"	1"
8713	¾"	½"	1¼"
8714	1"	¾"	1¼"



Fasten with windshield sealer type of clear adhesive



BALUSTER RAIL ASSEMBLY



EMILY MORGAN HOTEL
San Antonio, Texas
Arch: Hellmuth-Obata & Kassabaum Inc.
Fabr: Berger Iron Works

FITTINGS AVAILABILITY

Handrail Moulding	90° Radius Elbow	90° Miter Elbow	Connector Sleeve	End Cap	Cover Flange	Matching Tubing
1130	7210		1160	7280	711	Yes
1132	1110	1111	1163	1180	1125	Yes
1133						
1134						
1135	1122	1112	1164	1181		Yes
1136				1186		Yes
1137	1120	1115	1170	1182	1123	Yes
1154	1120	1113	1170	1182	1123	Yes
1155	1122	1114	1164	1181		Yes
1230	1222	1214†	1160	1282†	811	Yes
1231Q			1261		1325	
1232	1210	1211†	1163	1280†	1325	Yes
1233	1220	1213†	1170	1283†	1323	Yes
1235		1212†	1264	1281†		Yes
1330	1330-C		1363	1330-N†	411	Yes
1332	1332-C		1163	1332-N†	1325	Yes
1333	1333-C		1170	1333-N†	1323	Yes
8632				8632-N		
8662				8662-N		
1430	9310**	1414**	9363	9380**	211	Yes
1432/52	1410*	1411**	1463	1480**	1425	Yes
1433/53	1420*	1413**	1464	1482**	1423	Yes

* No. 2B Finish ** No. 4 Satin Finish † Polished and lacquered, 180 grit

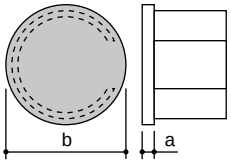
ROUND TUBING 20' lengths, except as noted, mill finish only.

Matches profile of handrail mouldings. May be used as matching wall mounted handrail, glass mounted handrail or posts.

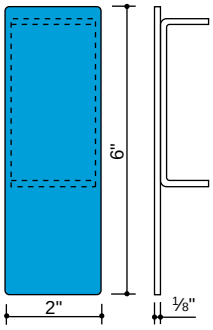
	Outside Diameter	Wall	weight lb/ft	Area	I	S
Aluminum	1.900"	.109"	.721	.614	.247	.260
Aluminum	2½"	.125"	1.119	.933	.659	.527
Aluminum	3"	.125"	1.328	1.129	1.169	.779
Aluminum	3½"	.125"	1.559	1.325	1.890	1.080
Bronze	1.900"	.100"	2.070	.565	.230	.242
Bronze	2½"	.125"	3.441	.933	.659	.527
Bronze	3"	.125"	4.500	1.129	1.169	.779
Bronze††	3½"	.125"	4.850	1.325	1.890	1.080
Nickel-Silver	1.900"	.125"	2.560	.697	.290	.278
Nickel-Silver	2½"	.125"	3.400	.933	.659	.527
Nickel-Silver	3"	.125"	4.500	1.129	1.169	.779
Stainless Steel**	1.900"	.062"	1.274	.375	.158	.166
Stainless Steel	2½"	.062"	1.691	.479	.356	.285
Stainless Steel	3"	.062"	1.930	.577	.622	.415

** No. 4 Satin Finish †† 12' lengths

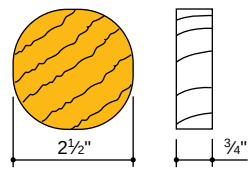
END CAPS



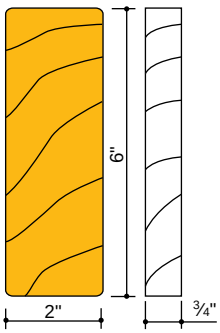
		a	b
7280	Aluminum	⅛"	1.900"
1180	Aluminum	⅛"	2½"
1181	Aluminum	⅛"	3½"
1182	Aluminum	⅛"	3"
1280	Bronze	⅛"	2½"
1281	Bronze	⅛"	3½"
1282	Bronze	⅛"	1.900"
1283	Bronze	⅛"	3"
1330-N	Nickel-Silver	⅛"	1.900"
1332-N	Nickel-Silver	⅛"	2½"
1333-N	Nickel-Silver	⅛"	3"
1480	Stainless	⅛"	2½"
1482	Stainless	⅛"	3"
9380	Stainless	⅛"	1.900"



1186 Aluminum

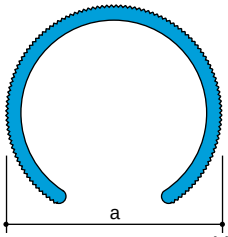


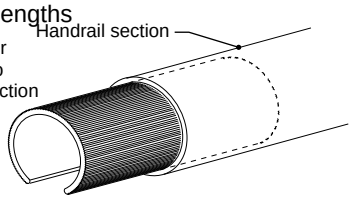
8632-N Oak Acrylic/Wood



8662-N Oak Acrylic/Wood

CONNECTOR SLEEVE 5" lengths

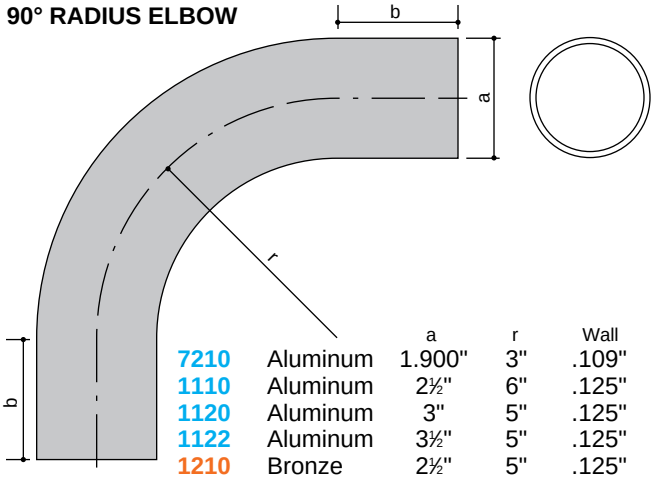




Fasten with Scotch-Weld® adhesive

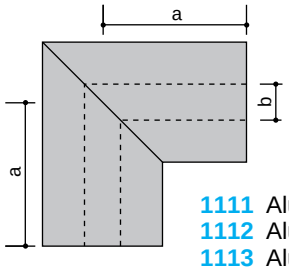
		Use with:	a
1363	Aluminum	1330	1.650"
1160	Aluminum	1130 and 1230	1.682"
1163	Aluminum	1132, 1232 and 1332	2.250"
1170	Aluminum	1137, 1154, 1233 and 1333	2.750"
1164	Aluminum	1135	3.250"
1463	Aluminum	1432 and 1452	2.375"
1464	Aluminum	1433 and 1453	2.875"
9363	Aluminum	1430	1.770"
1261	Aluminum	1231Q	2.356"
1264	Aluminum	1235	3.125"

90° RADIUS ELBOW



		a	r	Wall	b
7210	Aluminum	1.900"	3"	.109"	2"
1110	Aluminum	2½"	6"	.125"	2½"
1120	Aluminum	3"	5"	.125"	2½"
1122	Aluminum	3½"	5"	.125"	2½"
1210	Bronze	2½"	5"	.125"	2½"
1220	Bronze	3"	6"	.125"	2½"
1222	Bronze	1.900"	3"	.100"	2½"
1330-C	Nickel-Silver	1.900"	3"	.125"	2½"
1332-C	Nickel-Silver	2½"	5"	.125"	2½"
1333-C	Nickel-Silver	3"	5"	.125"	2½"
1410	Stainless	2½"	5"	.062"	2½"
1420	Stainless	3"	5"	.062"	2½"
9310	Stainless	1.900"	3"	.062"	2"

90° MITER ELBOW



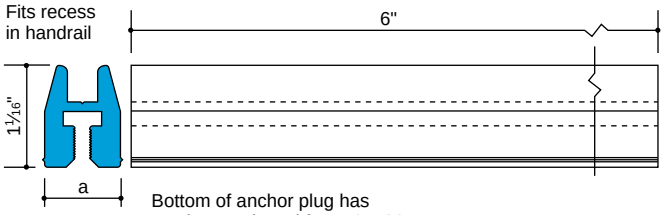
		OD	Wall	a	b
1111	Aluminum	2½"	.125"	3"	¾"
1112	Aluminum	3½"	.125"	4½"	¾"
1113	Aluminum	3"	.125"	4½"	1"
1114	Aluminum	3½"	.125"	4½"	1"
1115	Aluminum	3"	.125"	4½"	¾"
1211	Bronze	2½"	.125"	3"	¾"
1212	Bronze	3½"	.187"	4½"	¾"
1213	Bronze	3"	.125"	4½"	¾"
1214	Bronze	1.900"	.100"	3"	¾"
1411	Stainless	2½"	.062"	3"	¾"
1413	Stainless	3"	.062"	4½"	¾"
1414	Stainless	1.900"	.062"	3"	¾"

WALL MOUNTED HANDRAIL

Matching tubing sections are available for wall mount using **Carlstadt**® wall rail brackets. **JB**® **Glass Rail** sections may also be wall mounted using the appropriate hardware. An anchor plug slips into the recess of the handrail and is locked in place by the bracket mounting screws. The handrail bracket flange is concealed inside the recess of the handrail. The underside of the handrail may be closed with an aluminum closure or stainless flat.

ANCHOR PLUG Aluminum

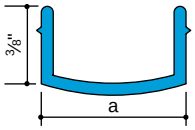
Fits recess in handrail



Bottom of anchor plug has continuous thread for #10 – 32 screw

	a
1162	¾"
1161	1"

CLOSURES



	a	lb/ft
1138	¾"	.10
1139	1"	.13

Aluminum, 5' lengths
For use with Aluminum and Bronze handrails

Stainless flat
3/16" × ¾" .48 lb/ft
12'-14' random lengths
For use with Stainless Steel handrails

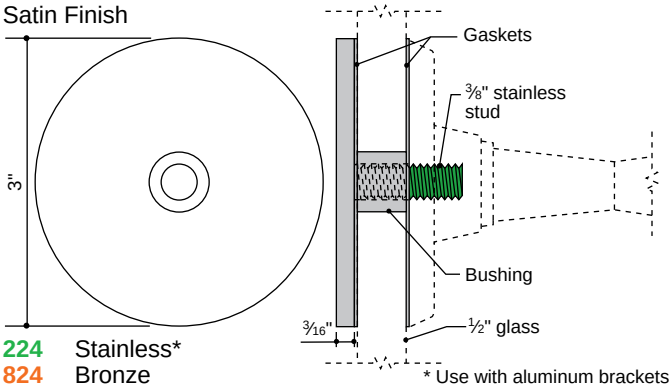
GLASS MOUNTED HANDRAIL

Handrail may be mounted to the face of the tempered glass balustrade using a combination of the **Carlstadt**® wall brackets and our new glass mounting adapter kit. The kit contains a disc with a ⅜" stud weld, a bushing, and two gaskets. These adapters have been tested. The aluminum version failed to meet structural requirements therefore the **224** is recommended for use with aluminum brackets.

TO ASSEMBLE: ① Prior to tempering, drill a ⅝" clear hole in the glass (**do not attempt to drill a hole in tempered glass – it will most likely break**); ② insert the bushing in the hole; ③ insert the stud welded disc with gasket through the bushing; place the gasket on the other side; ④ thread on bracket and tighten.

GLASS MOUNTED HANDRAIL ADAPTER KIT

Satin Finish



224	Stainless*
824	Bronze

* Use with aluminum brackets

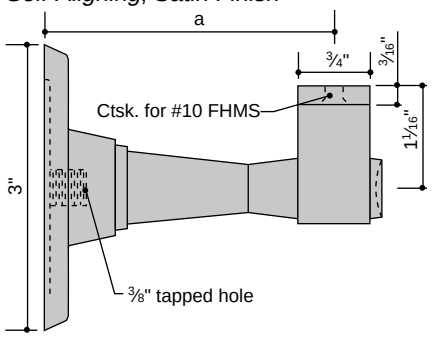
SCOTCH-WELD® EPOXY ADHESIVE

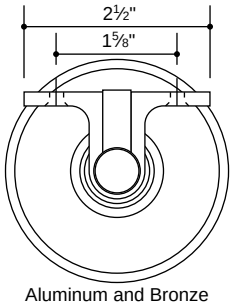
Cans – 1-qt. total Tubes – 4-oz. total

Catalog No. 3M EC-2216 B/A, Clear Amber: Recommended for splice joints using connector sleeves.
For the vinyl protective insert, a windshield sealer type of clear adhesive may be used.

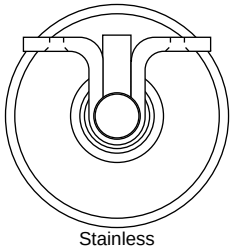
CARLSTADT® WALL BRACKETS

Self-Aligning, Satin Finish



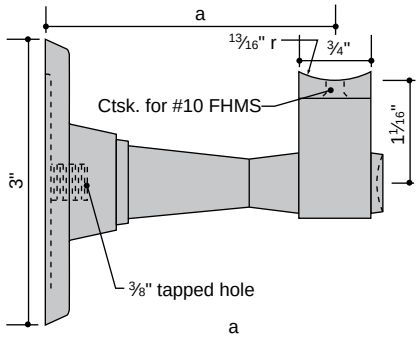


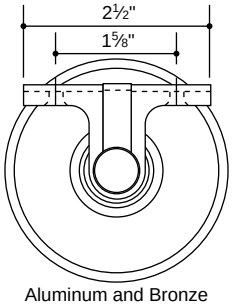
Aluminum and Bronze



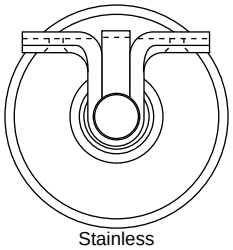
Stainless

		a
443	Aluminum	3"
444	Aluminum	3½"
843	Bronze	3"
243	Stainless	3"





Aluminum and Bronze

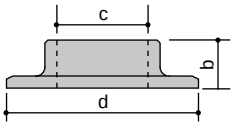


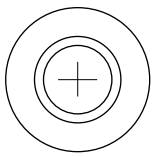
Stainless

		a
321*	Aluminum	2¼"
403	Aluminum	3"
405	Aluminum	3½"
801	Bronze	2½"
803	Bronze	3"
221	Stainless	2½"
223	Stainless	3"

* see page 82 for more accurate drawing of 321

COVER FLANGES Satin Finish





		b	c	d
711	Aluminum	1"	1.90"	4"
1125	Aluminum	1"	2½"	4¾"
1123	Aluminum	1"	3"	5"
811	Bronze	1"	1.90"	4"
1225	Bronze	1"	2½"	4¾"
1223	Bronze	1"	3"	5"
211	Stainless	1"	1.90"	4"
1425	Stainless	1"	2½"	4¾"
1423	Stainless	1"	3"	5"
411	Nickel-Silver	1"	1.90"	4"
1325	Nickel-Silver	1"	2½"	4¾"
1323	Nickel-Silver	1"	3"	5"

ASCAP BUILDING
Nashville, Tennessee

Arch: Bulla Associates
Fabr: Ameriprise

SOUTH SEATTLE TECHNICAL COLLEGE
South Seattle, Washington

Connectorail® is an easy-to-assemble pipe railing system that is fabricated quickly without welding. Components slip together and are joined by concealed mechanical fasteners at intersections and by epoxy structural adhesive at splice joints.

The **Connectorail®** system has been engineered and tested to assure structural strength and integrity when properly installed. Test results are available upon request.

Connectorail® meets established safety standards when installed in accordance with our data and instructions. See page 123 for recommended post spacing.

Aluminum Connectorail® components are stocked in 1¼" and 1½" pipe sizes – schedules 10 and 40 – in alloy 6063 with either clear anodized – AA-M10-C22-A31 (204R1) – or smooth mill finish. **Connectorail®** pipe is specially extruded to close dimensional tolerances with a clean smooth surface finish. Aluminum pipe is stocked in mill-wrapped, paper-interleaved bundles of approximately 100 pounds. Ordering in bundles speeds shipping and helps in maintaining surface quality. Aluminum pipe is suitable for anodizing, including most of the hard-coat anodic processes. Black anodizing may result in inconsistent matches. Consult your anodizer before specifying.

Stainless Steel (Type 304) components are furnished with a No. 4 satin finish in 1½" schedule 5 pipe size. The pipe is sleeved for surface protection. Stainless **Connectorail®** can also be fabricated by welding. The use of **Connectorail®** stainless steel fittings eliminates notching and grinding and permits rapid welding with a minimum addition of weld metal.

Bronze Connectorail® is supplied in drawn pipe alloy C23000 (Red Brass) with a smooth mill finish. Bronze fittings are satin finished – 180 grit – and lacquered.

Pipe railing fittings for welded assembly are available in cast aluminum, bronze, iron and malleable iron and formed steel and stainless steel.

All items are carried in stock and are produced and handled with great care for architectural finishing. Shipments are thoroughly protected by wrapping and/or crating.

Confirm dimensions of fittings prior to cutting and/or assembly.

Americans with Disabilities Act (ADA):
The Architecture and Transportation Barriers Compliance Board – the agency which created and interprets the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)* – has confirmed that 1¼" to 1½" nominal pipe sizes (1.66" to 1.9" outside diameters) are acceptable for use as handrails under *ADAAG*. A copy of this letter is printed at the beginning of this catalog. You should also note that the American National Standards Institute publication *A117.1-1992: Accessible and Useable Buildings and Facilities* states that *. . . handrails shall have a circular cross section with an outside diameter of 1¼ in. (32mm) minimum and 2 in. (51mm) maximum, or shall provide equivalent graspability. . .*

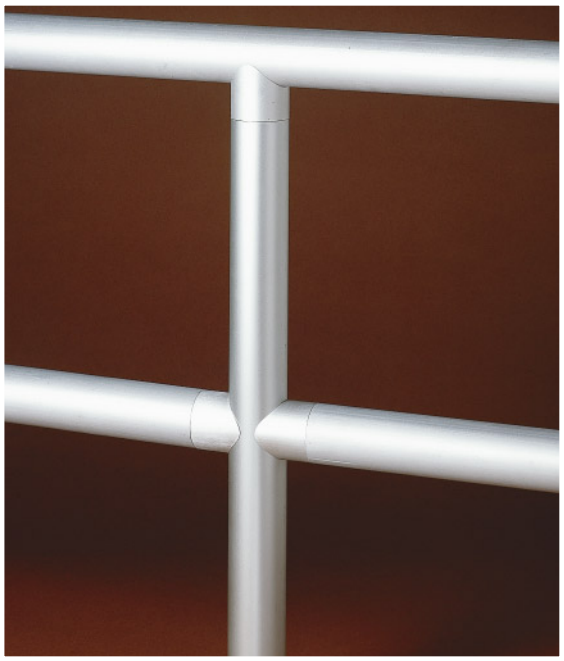
FULL RANGE OF FITTINGS

A complete selection of fittings is offered for the **Connectorail®** system. A suitable fitting is available for practically any stair or ramp railing condition. Adjustable handrail brackets and ramp rail tees are recommended for unusual ramp or stair angles.

MECHANICAL CONNECTIONS

Non-welded connections eliminate welding discoloration and expensive grinding. Structural adhesive, stainless steel machine screws with lock washers, and threaded tubular rivets provide positive connections at joints.

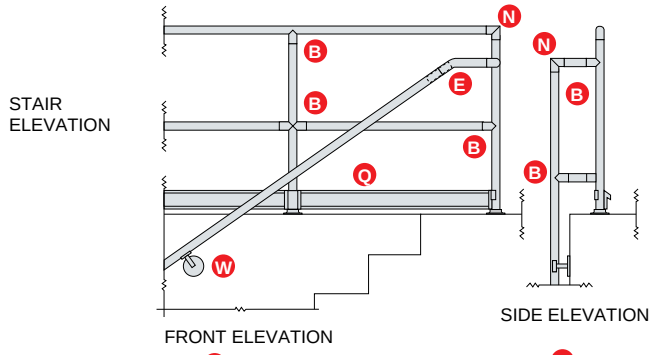
CONTINUOUS POSTS AND RAILS

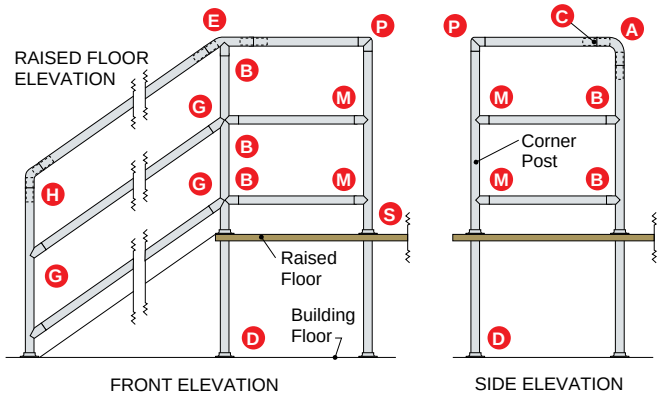


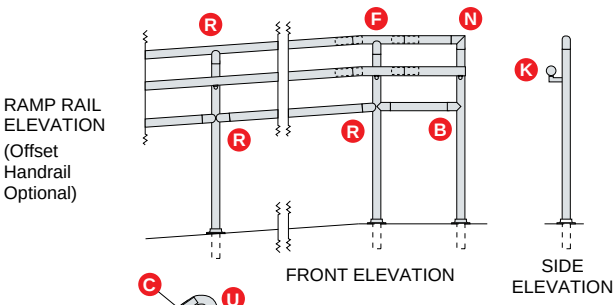
Posts and top rails run in continuous lengths, thus providing a system that is inherently stronger than one with cast tee and cross connections. **Connectorail®** has a continuous, smooth top surface as required by established safety standards.

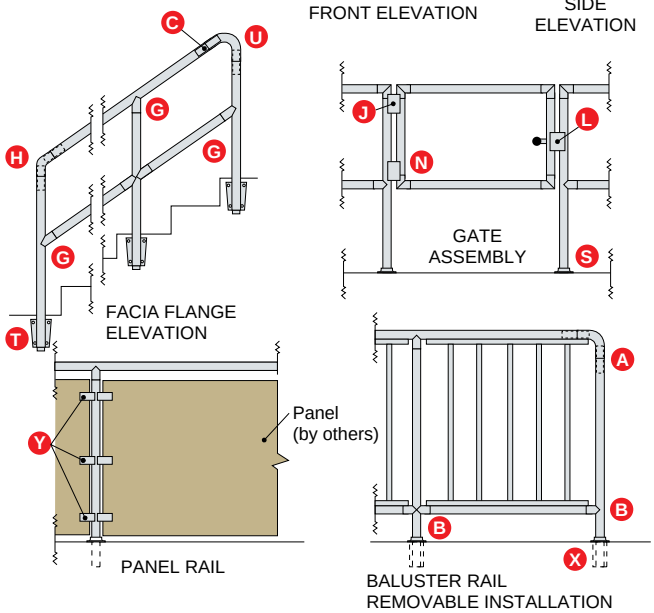
OPTIONS FOR MOUNTING

Connectorail® posts may be embedded in floor slab with a cover flange, surface mounted with a heavy-duty floor flange, or side mounted on facia or stringer by means of a facia flange. A reinforcing insert is used at the base of the post for added strength and stiffness. A socket for removable railings – with cover – is also available.







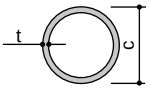


FITTINGS KEY:

A 90° Radius Elbow
B 90° Tee
C Connector Sleeve
D Heavy Duty Floor Flange
E Rail Elbow
F Ramp Rail Elbow
G Angle Tee
H Post Elbow
J Gate Hinge
K Post Bracket
L Gate Latch & Stop
M 90° Corner Tee
N 90° Miter Elbow
P 90° 3-way Elbow
Q Toe Board
R Ramp Rail Tee
S Cover Flange
T Facia Flange
U Return Elbow
W Wall Bracket
X Socket
Y Panel Clip

Aluminum components and pipe are carried in stock with a mill finish or a clear anodized finish – AA-M10-C22-A31 (204R1). When specifying anodized fittings, add the suffix -A to catalog number listed (e.g. 7140-A).

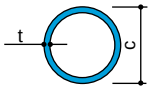
CONNECTORAIL PIPE – 20' Lengths



Aluminum: Alloy 6063-T52 and Alloy 6063-T832; clear anodized or mill finish
Stainless: Type 304, ornamental grade, No. 4 finish
Bronze: CDA 230, smooth mill finish

Pipe		Sched.	t	c	Weight lb/ft
1¼"	Aluminum	10	.109"	1.660"	.625
1½"	Aluminum	10	.109"	1.900"	.721
1¼"	Aluminum	40	.140"	1.660"	.785
1½"	Aluminum	40	.145"	1.900"	.940
1¼"	Bronze	40	.146"	1.660"	2.630
1½"	Bronze	40	.150"	1.900"	3.130
1½"	Stainless	5	.062"	1.900"	1.274

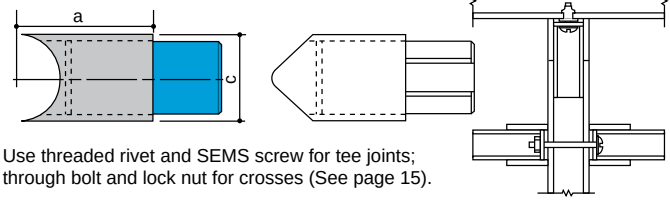
HIGH STRENGTH CONNECTORAIL POSTS
(Aluminum only)



Alloy 6063-T832
Drawn pipe precut to post lengths.
Clear anodized or mill finish.

		Pipe	Sched.	Length	c	t
7103	Aluminum	1¼"	10	38"	1.660"	.109"
7104	Aluminum	1¼"	10	50"	1.660"	.109"
7203	Aluminum	1½"	10	38"	1.900"	.109"
7204	Aluminum	1½"	10	50"	1.900"	.109"
7403	Aluminum	1¼"	40	38"	1.660"	.140"
7404	Aluminum	1¼"	40	50"	1.660"	.140"
7503	Aluminum	1½"	40	38"	1.900"	.145"
7504	Aluminum	1½"	40	50"	1.900"	.145"

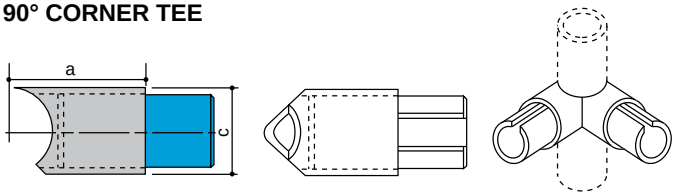
90° TEE



Use threaded rivet and SEMS screw for tee joints; through bolt and lock nut for crosses (See page 15).

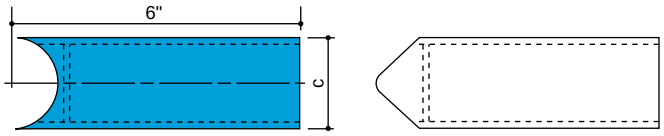
		Pipe	Sched.	c	a
7140	Aluminum	1¼"	10	1.660"	2"
7240	Aluminum	1½"	10	1.900"	2"
7440	Aluminum	1¼"	40	1.660"	2"
7540	Aluminum	1½"	40	1.900"	2"
8640	Bronze	1¼"	40	1.660"	3"
8840	Bronze	1½"	40	1.900"	3"
9340	Stainless	1½"	5	1.900"	3"

90° CORNER TEE



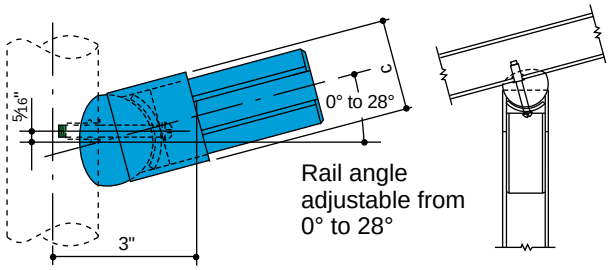
		Pipe	Sched.	c	a
7141	Aluminum	1¼"	10	1.660"	2"
7241	Aluminum	1½"	10	1.900"	2"
7441	Aluminum	1¼"	40	1.660"	2"
7541	Aluminum	1½"	40	1.900"	2"
9341	Stainless	1½"	5	1.900"	3"

90° 6" TEE (Aluminum only)



		Pipe	Sched.	c
7150	Aluminum	1¼"	10	1.660"
7250	Aluminum	1½"	10	1.900"
7450	Aluminum	1¼"	40	1.660"
7550	Aluminum	1½"	40	1.900"

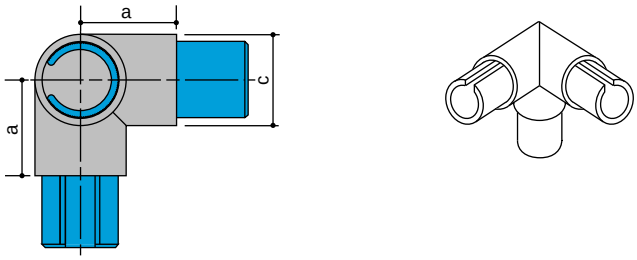
RAMP RAIL TEE (Aluminum only)



U.S. Patent No. 4,150,907

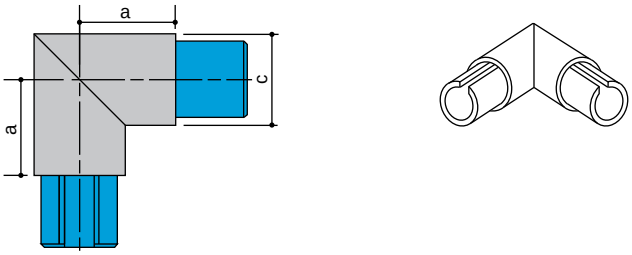
		Pipe	Sched.	c
7243	Aluminum	1½"	10	1.900"
7443	Aluminum	1¼"	40	1.660"
7543	Aluminum	1½"	40	1.900"

90° THREE-WAY ELBOW



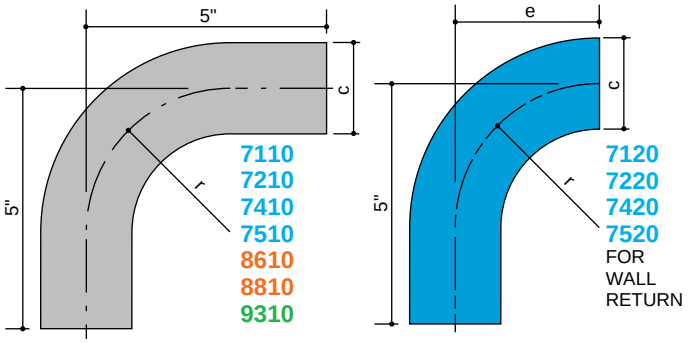
		Pipe	Sched.	c	a
7130	Aluminum	1¼"	10	1.660"	2"
7230	Aluminum	1½"	10	1.900"	2"
7430	Aluminum	1¼"	40	1.660"	2"
7530	Aluminum	1½"	40	1.900"	2"
9330	Stainless	1½"	5	1.900"	3"

90° MITER ELBOW



		Pipe	Sched.	c	a
7111	Aluminum	1¼"	10	1.660"	2"
7211	Aluminum	1½"	10	1.900"	2"
7411	Aluminum	1¼"	40	1.660"	2"
7511	Aluminum	1½"	40	1.900"	2"
9311	Stainless	1½"	5	1.900"	3"

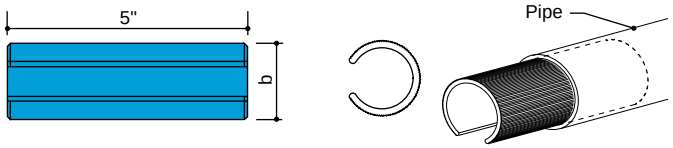
90° RADIUS ELBOW



		Pipe	Sched.	c	r	e
7110	Aluminum	1¼"	10	1.660"	2½"	
7210	Aluminum	1½"	10	1.900"	3"	
7410	Aluminum	1¼"	40	1.660"	2½"	
7510	Aluminum	1½"	40	1.900"	3"	
8610	Bronze	1¼"	40	1.660"	2½"	
8810	Bronze	1½"	40	1.900"	3"	
9310	Stainless	1½"	5	1.900"	3"	
7120	Aluminum	1¼"	10	1.660"	2½"	2½"
7220	Aluminum	1½"	10	1.900"	3"	3"
7420	Aluminum	1¼"	40	1.660"	2½"	2½"
7520	Aluminum	1½"	40	1.900"	3"	3"

CONNECTOR SLEEVES

Serrated for drive fit into **Connectorail** pipe

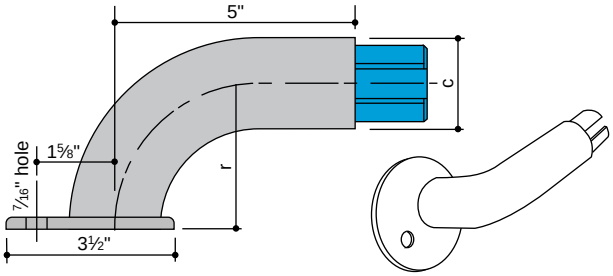


		Pipe	Sched.	b
7163	Aluminum	1¼"	10	1.442"
7263	Aluminum	1½"	10	1.682"
7463	Aluminum**	1¼"	40	1.380"
7563	Aluminum**	1½"	40	1.610"
9363	Aluminum*	1½"	5	1.770"

* For use with Stainless System

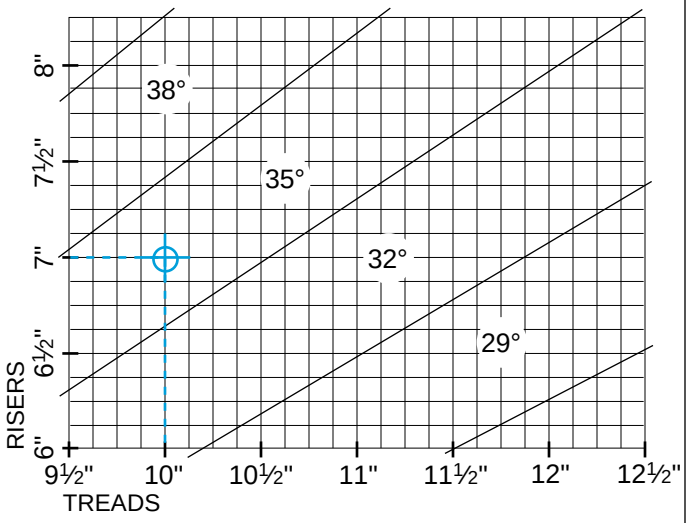
** For use with Bronze and Aluminum Systems

WALL RETURN



		Pipe	Sched.	c	r
7173	Aluminum	1¼"	10	1.660"	2½"
7273	Aluminum	1½"	10	1.900"	3"
7473	Aluminum	1¼"	40	1.660"	2½"
7573	Aluminum	1½"	40	1.900"	3"
8673	Bronze	1¼"	40	1.660"	2½"
8873	Bronze	1½"	40	1.900"	3"
9373	Stainless	1½"	5	1.900"	3"

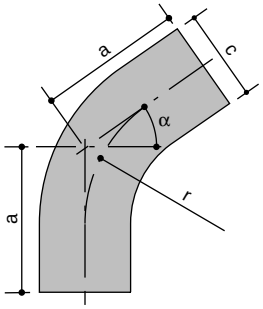
ANGLE FITTING SELECTOR CHART



Angle fittings are carried in stock for 29°, 32°, 35° and 38° angles of inclination. To select the correct angle fitting for a stairway, plot the intersection of riser and tread dimensions on the chart above. The zone into which the intersection falls will indicate the correct angle value for fittings.

Example: A 7" riser and a 10" tread require 35° angle fittings.

POST ELBOW

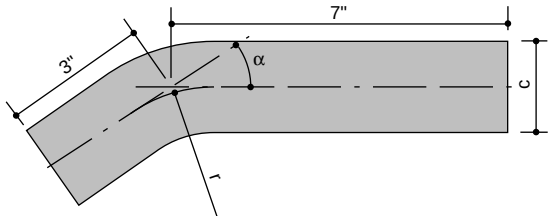


Note: *a = 4" for 4° post elbows, while a = 3" for all other post elbows.*

45°α		Pipe	Sched.	c	r
7208	Al.	1½"	10	1.900"	3"
7408	Al.	1¼"	40	1.660"	2½"
7508	Al.	1½"	40	1.900"	3"

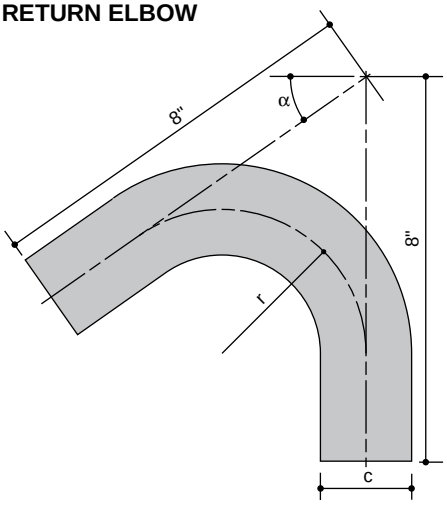
4°α	29°α	32°α	35°α	38°α		Pipe	Sched.	c	r
	7119	7122	7125	7128	Al.	1¼"	10	1.660"	2½"
7216	7219	7222	7225	7228	Al.	1½"	10	1.900"	3"
7416	7419	7422	7425	7428	Al.	1¼"	40	1.660"	2½"
7516	7519	7522	7525	7528	Al.	1½"	40	1.900"	3"
9316	9319	9322	9325	9328	St.	1½"	5	1.900"	3"

RAIL ELBOW



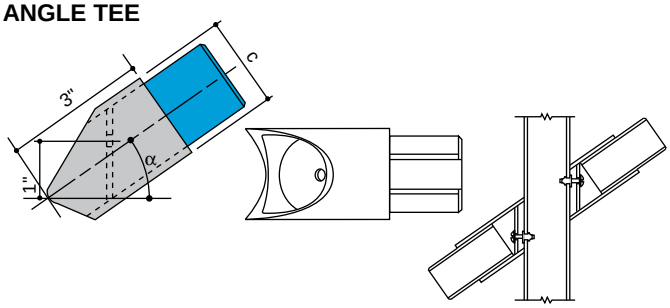
29°α	32°α	35°α	38°α		Pipe	Sched.	c	r
7109	7112	7115	7118	Aluminum	1¼"	10	1.660"	2½"
7209	7212	7215	7218	Aluminum	1½"	10	1.900"	3"
7409	7412	7415	7418	Aluminum	1¼"	40	1.660"	2½"
7509	7512	7515	7518	Aluminum	1½"	40	1.900"	3"
9309	9312	9315	9318	Stainless	1½"	5	1.900"	3"

RETURN ELBOW



29°α	32°α	35°α	38°α		Pipe	Sched.	c	r
7179	7182	7185	7188	Aluminum	1¼"	10	1.660"	2½"
7279	7282	7285	7288	Aluminum	1½"	10	1.900"	3"
7479	7482	7485	7488	Aluminum	1¼"	40	1.660"	2½"
7579	7582	7585	7588	Aluminum	1½"	40	1.900"	3"
9379	9382	9385	9388	Stainless	1½"	5	1.900"	3"

ANGLE TEE

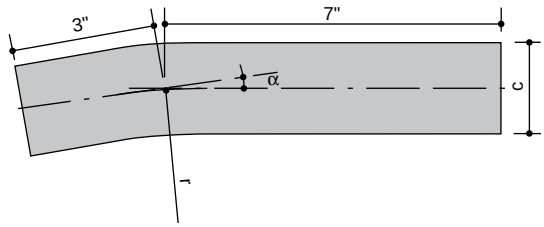


4°α	29°α	32°α	35°α	38°α		Pipe	Sched.	c
	7139	7142	7145	7148	Alumin.	1¼"	10	1.660"
7244*	7239	7242	7245	7248	Alumin.	1½"	10	1.900"
7444*	7439	7442	7445	7448	Alumin.	1¼"	40	1.660"
7544*	7539	7542	7545	7548	Alumin.	1½"	40	1.900"
9344*	9339	9342	9345	9348	Stainless	1½"	5	1.900"

*On 4°α angle tees, the screw hole is located in the center of the washer.

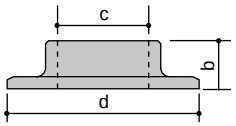
RAMP RAIL ELBOW

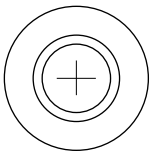
angle	slope	gradient
4°	14:1	7.0%
7°	8:1	12.3%
10°	6:1	17.6%



4°α	7°α	10°α		Pipe	Sched.	c	r
7205	7206	7207	Aluminum	1½"	10	1.900"	3"
7405	7406	7407	Aluminum	1¼"	40	1.600"	2½"
7505	7506	7507	Aluminum	1½"	40	1.900"	3"
9305			Stainless	1½"	5	1.900"	3"

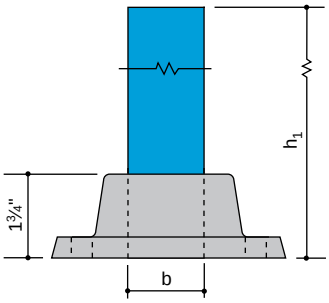
COVER FLANGE

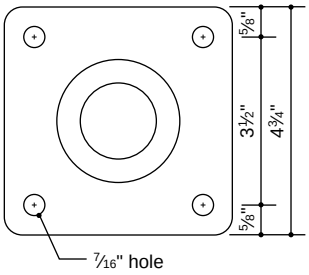




		Pipe	Sched.	b	c	d
710	Aluminum	1¼"	all	1"	1.688"	3 13/16"
711	Aluminum	1½"	all	1"	1.938"	4"
810	Bronze	1¼"	all	1"	1.688"	3 13/16"
811	Bronze	1½"	all	1"	1.938"	4"
211	Stainless	1½"	all	7/8"	1.938"	4½"

HEAVY DUTY FLOOR FLANGE



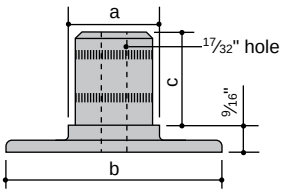


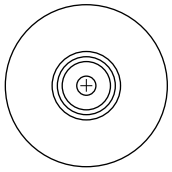
		Pipe	Sched.	h_1	b
7271	Aluminum	1½"	10	12"	1.667"
7471	Aluminum	1¼"	40	12"	1.360"
7571	Aluminum	1½"	40	12"	1.585"
9371	Nickel-Silver*	1½"	5	18"	1.750"

*For use with Stainless Steel

See page 15 for anchor bolt.

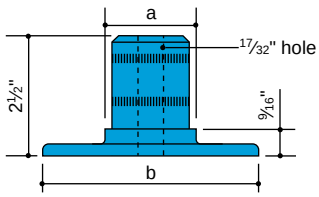
FLOOR FLANGE †

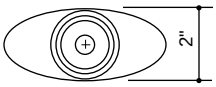




		Pipe	Sched.	a	b	c
7170	Aluminum	1¼"	10	1.660"	4"	1 13/16"
7270	Aluminum	1½"	10	1.900"	4½"	2 1/16"
727	Aluminum	1¼"	40	1.660"	4"	1 13/16"
728	Aluminum	1½"	40	1.900"	4½"	2 1/16"
827	Bronze	1¼"	40	1.660"	4"	1 13/16"
828	Bronze	1½"	40	1.900"	4½"	2 1/16"

OVAL FLOOR FLANGE † (Aluminum Only)



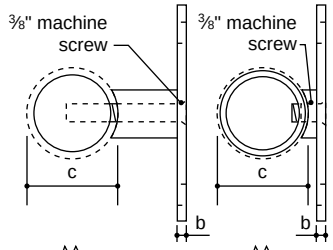


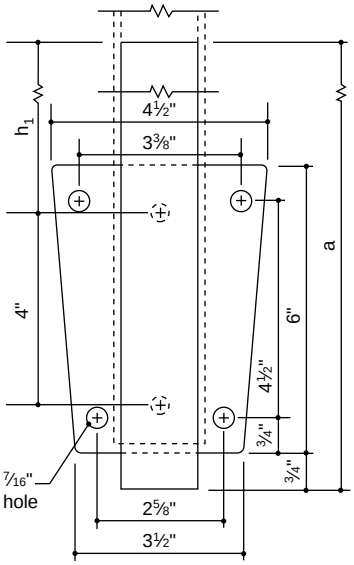
	Pipe	Sched.	a	b
749	1¼"	40	1.660"	4"
750	1½"	40	1.900"	4½"

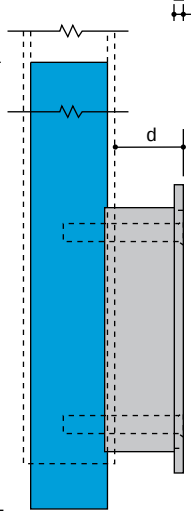
†When using these floor flanges for surface mounting of posts, care must be taken to provide adequate lateral bracing or end support. For free-standing railings, use the heavy duty floor flange.

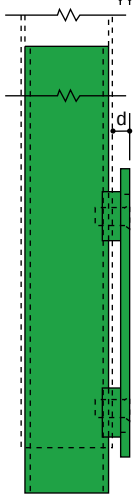
FACIA FLANGE

Facia flanges are supplied complete with two 3/8" stainless steel bolts for assembly to pipe post. Stainless steel facia flanges use two round stand-offs and a stainless steel tubular reinforcing bar. The aluminum and bronze facia flanges use a single adapter bar and a solid aluminum reinforcing bar.



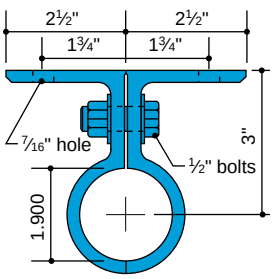


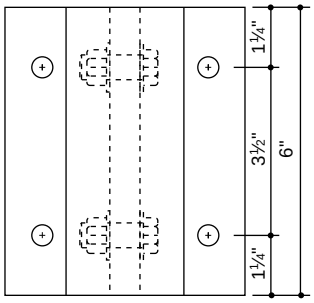




		Pipe	Sched.	a	b	c	d	h_1
7190	Aluminum	1¼"	10	15"	5/16"	1.660"	7/16"	9¼"
7191	Aluminum	1¼"	10	15"	5/16"	1.660"	1 9/16"	9¼"
755	Aluminum	1¼"	40	15"	5/16"	1.660"	7/16"	9¼"
756	Aluminum	1¼"	40	15"	5/16"	1.660"	1 9/16"	9¼"
7290	Aluminum	1½"	10	15"	5/16"	1.900"	7/16"	9¼"
7291	Aluminum	1½"	10	15"	5/16"	1.900"	1 9/16"	9¼"
7293	Aluminum	1½"	10	24"	5/16"	1.900"	7/16"	18¼"
7294	Aluminum	1½"	10	24"	5/16"	1.900"	1 9/16"	18¼"
757	Aluminum	1½"	40	15"	5/16"	1.900"	7/16"	9¼"
758	Aluminum	1½"	40	15"	5/16"	1.900"	1 9/16"	9¼"
7593	Aluminum	1½"	40	24"	5/16"	1.900"	7/16"	18¼"
7594	Aluminum	1½"	40	24"	5/16"	1.900"	1 9/16"	18¼"
8893	Bronze	1½"	40	24"	5/16"	1.900"	7/16"	18¼"
8894	Bronze	1½"	40	24"	5/16"	1.900"	1 9/16"	18¼"
9390	Stainless	1½"	5	26"	¼"	1.900"	⅜"	20¼"
9391	Stainless	1½"	5	26"	¼"	1.900"	1½"	20¼"

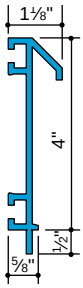
ROOF RAILING FLANGE (Aluminum Only)





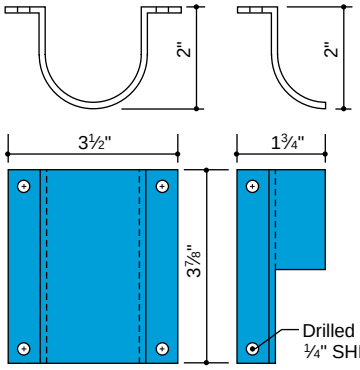
		Pipe	Sched.
748	Aluminum	1½"	all

TOE BOARD



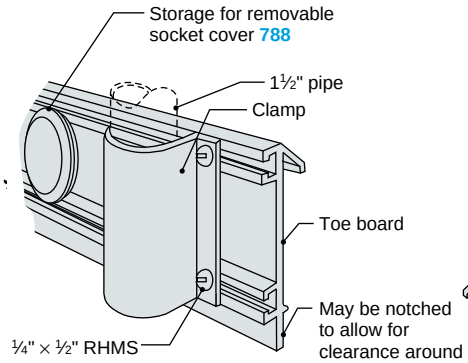
6446 Aluminum
20' lengths
1.13 lb/ft
Toe board clamps are supplied with stainless steel screws and nuts.

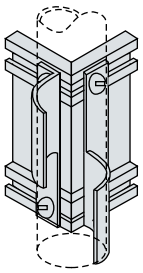
TOE BOARD CLAMPS For 1½" pipe

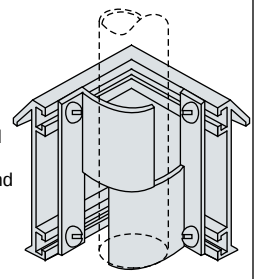


746 Aluminum **747** Aluminum

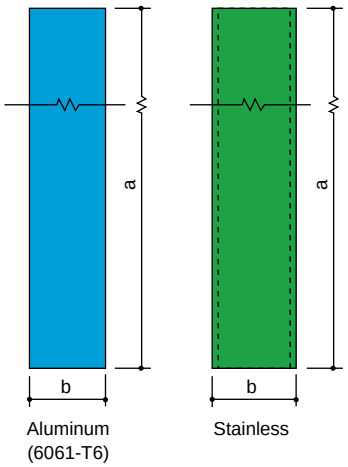
ASSEMBLY DETAILS



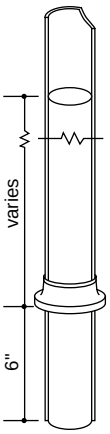

Inside Corner


Outside Corner

REINFORCING BARS



Aluminum (6061-T6) Stainless



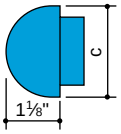
Drill weep hole in post for exterior installation

		Pipe	Sched.	b	a
7192	Aluminum	1¼"	10	1.427"	15"
7292	Aluminum	1½"	10	1.667"	15"
7295	Aluminum	1½"	10	1.667"	24"
7492	Aluminum*	1¼"	40	1.360"	15"
7592	Aluminum*	1½"	40	1.585"	15"
7595	Aluminum*	1½"	40	1.585"	24"
9392	Stainless	1½"	5	1.750" × .120" wall	26"

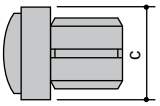
* For use with aluminum and bronze pipe
Floor mounting is best accomplished by mounting in concrete. Post inserts are recommended for reinforcing floor mounted posts.

END CAPS

Chamfer inside of pipe to start then drive cap on



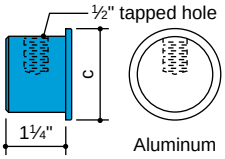
		Pipe	Sched.	c
7181	Al.	1¼"	10	1.660"
7281	Al.	1½"	10	1.900"
7481	Al.	1¼"	40	1.660"
7581	Al.	1½"	40	1.900"



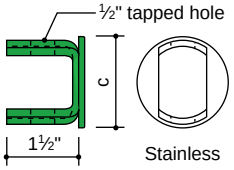
Sch. 40 only

		Pipe	c
707	Al.	1¼"	1.660"
708	Al.	1½"	1.900"
807	Br.	1¼"	1.660"
808	Br.	1½"	1.900"

POST CAPS



Aluminum

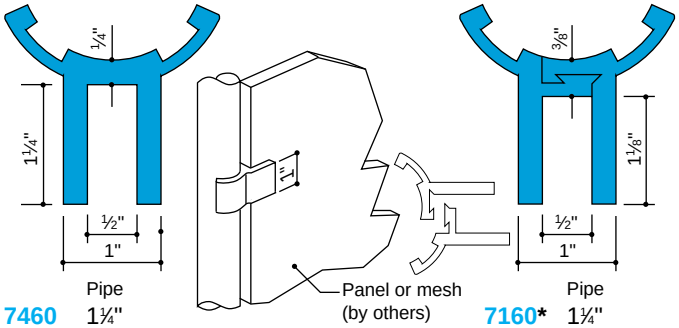


Stainless

		Pipe	Sched.	c
7180	Aluminum	1¼"	10	1.660"
7280	Aluminum	1½"	10	1.900"
7480	Aluminum	1¼"	40	1.660"
7580	Aluminum	1½"	40	1.900"
9380	Stainless	1½"	5	1.900"

Flat post caps above are drilled and tapped to provide secure mounting for handrail brackets.

PANEL CLIPS (Aluminum Only)



	Pipe
7460	1¼"
7560	1½"

See page 19 for assembly detail.

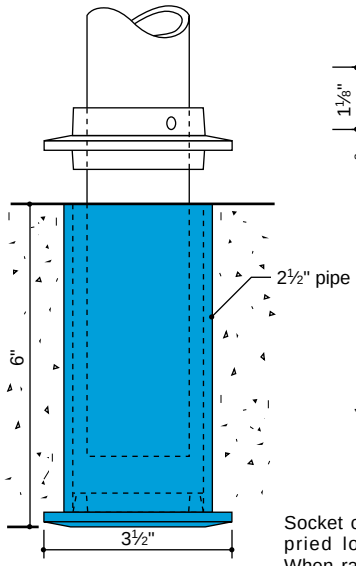
	Pipe
7160*	1¼"
7260*	1½"

* Two-piece assembly

REMOVABLE RAIL SOCKET, COVER AND COLLAR

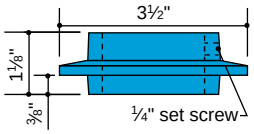
For 1½" aluminum pipe only

SOCKET



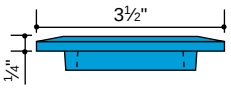
786 Aluminum

PIPE COLLAR



787 Aluminum

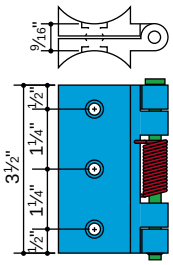
SOCKET COVER



788 Aluminum

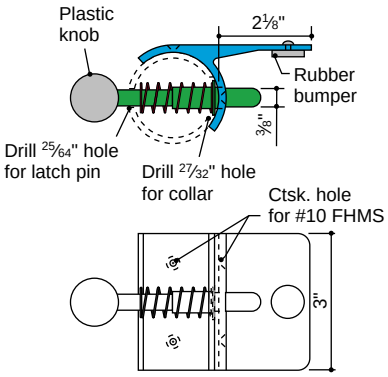
Socket cover fits tightly but can be pried loose with a screwdriver. When railing is in place, cover may be stored in the side of toe board.

GATE HINGE



782/3 Aluminum
Supplied in sets of two – one plain and one with a self-closing spring.

GATE LATCH AND STOP

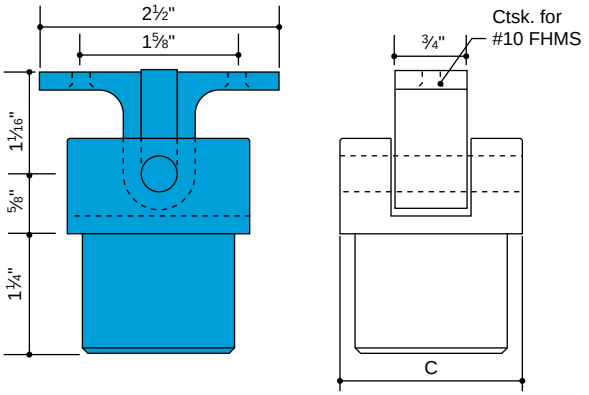


784 Aluminum

Gate hardware is available for 1½" aluminum pipe only.

CENTER POST BRACKET

For use in center mounting of flat bottomed handrail onto **Connectorail®** posts. Mill finish only.



		Pipe	Sch.	c
144	Aluminum	1¼"	40	1.660"
145	Aluminum	1½"	40	1.900"

SCOTCH-WELD® EPOXY ADHESIVE

Cans – 1-qt. total Tubes – 4-oz. total

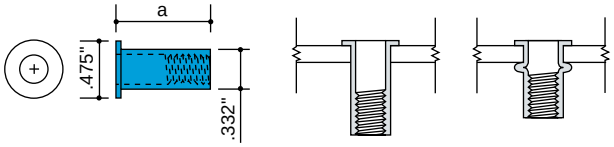
Catalog No. 3M EC-2216 B/A, Clear Amber: Recommended for splice joints using connector sleeves.

MANUAL RIVET HEADER

The **Manual Rivet Header** is a low-cost hand tool for setting the internally threaded tubular rivets.

TUBULAR RIVETS

Aluminum

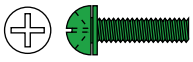


	a	
A25-140	.745"	use with schedule 5 or 10 pipe
A25-200	.808"	use with schedule 40 pipe

The internally threaded tubular rivet is easily set in **Connectorail®** pipe wall. The rivet provides high strength ¼"–20 threads for blind attachment of **Connectorail®** tee fittings.

SEMS SCREWS AND THROUGH BOLT

Stainless Steel



SEMS Screw
RHMS ¼"–20 × 1"
with lock washer

RHMS ¼"–20 × 2½" or 3"
with lock nut

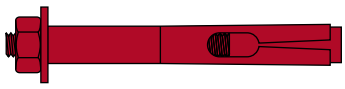
SEMS Screws: SEMS Screws prevent accidental omission of lock washers and subsequent loosening of joints. The combination of ¼"–20 × 1" stainless steel RHMS with lock washers and internally threaded tubular rivet fasteners provide connections of ample strength to develop the full loading capacity of **Connectorail®** pipe.

Through Bolts: Where two 90° tees are mounted opposite each other to form a cross assembly, a stainless steel through bolt with lock nut may be used.

For 1¼" pipe, use ¼"–20 × 2½" RHMS with lock nut.
For 1½" pipe, use ¼"–20 × 3" RHMS with lock nut.

SLEEVE ANCHOR BOLT ⅜" × 3"

Steel

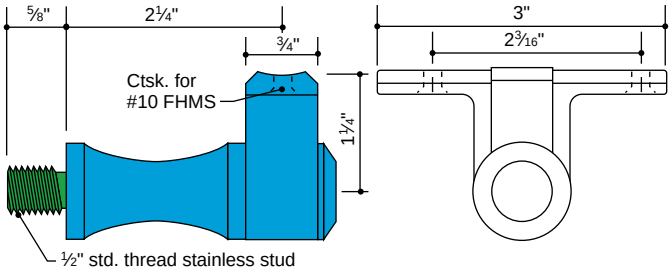


GSA Spec. FF-S-325, 3.2.2.3.1.2

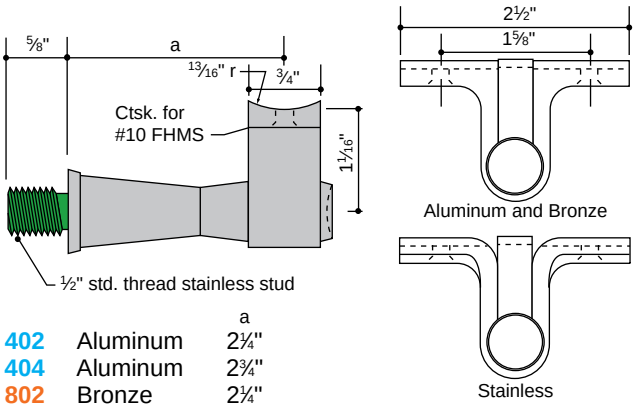
The **Sleeve Anchor Bolt** is an all steel, rust-proofed, multi-purpose anchor bolt intended for use in a wide range of masonry materials. The ⅜" bolt is recommended for use with **Heavy-Duty Floor Flanges.**

POST BRACKETS Satin Finish

Aluminum pipe brackets are available with a mill finish or a clear anodized finish – AA-M32-C22-A31 (204R1). When designating clear anodized brackets, add the suffix *-A* to catalog number listed (e.g. **322-A**).

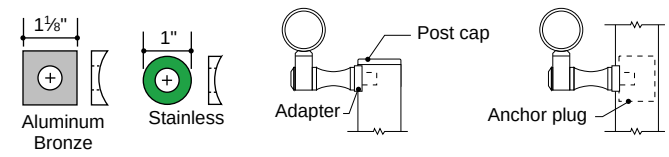


322 Aluminum



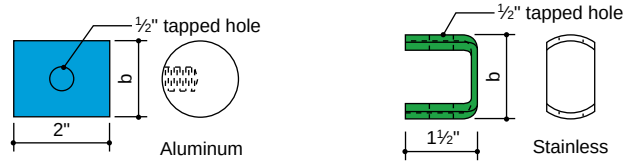
		a
402	Aluminum	2¼"
404	Aluminum	2¾"
802	Bronze	2¼"
222	Stainless	2¼"

BRACKET POST ADAPTER



		Pipe Size	Schedule	Clear Hole
7161	Aluminum	1¼"	all	½"
7261	Aluminum	1½"	all	½"
8661	Bronze	1¼"	all	½"
8861	Bronze	1½"	all	½"
9361	Stainless	1½"	all	½"

ANCHOR PLUGS

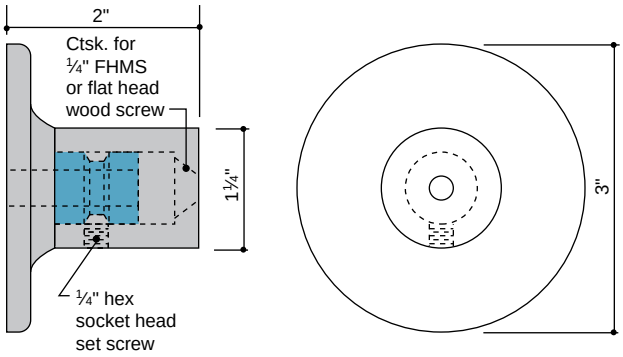


		Pipe Size	Schedule	b
7162	Aluminum	1¼"	10	1.427"
7262	Aluminum	1½"	10	1.667"
7462	Aluminum	1¼"	40	1.360"
7562	Aluminum	1½"	40	1.585"
9362	Stainless	1½"	5	1.750"

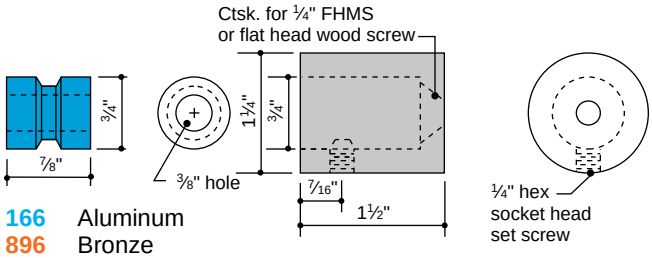
Anchor plugs provide secure mounting for brackets supporting second or third rails. Aluminum anchor plugs are machined from solid extruded stock; the stainless steel anchor plug is fabricated from heavy metal.

TWO-PIECE VERTICAL MOUNTING BRACKETS

Satin Finish

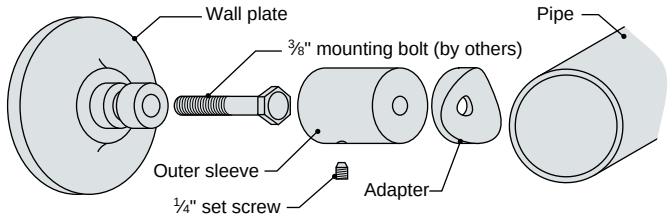


168 Aluminum
898 Bronze
298 Stainless

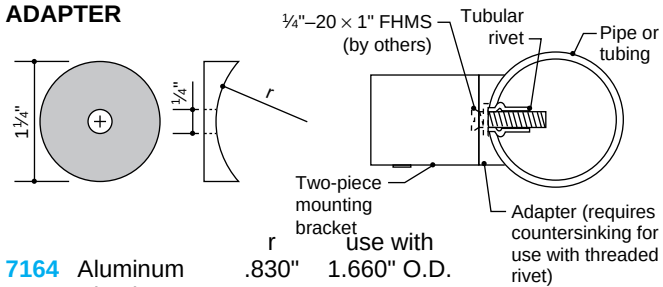


166 Aluminum
896 Bronze
296 Stainless

ASSEMBLY DETAIL



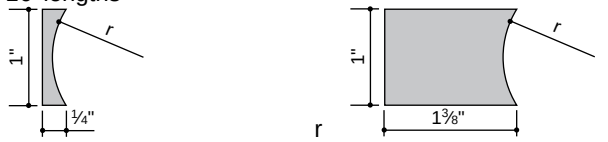
ADAPTER



		r	use with
7164	Aluminum	.830"	1.660" O.D.
7264	Aluminum	.950"	1.900" O.D.
8864	Bronze	.950"	1.900" O.D.
8964	Bronze	.750"	1.500" O.D.
9164	Stainless	.830"	1.660" O.D.
9364	Stainless	.950"	1.900" O.D.

ADAPTER

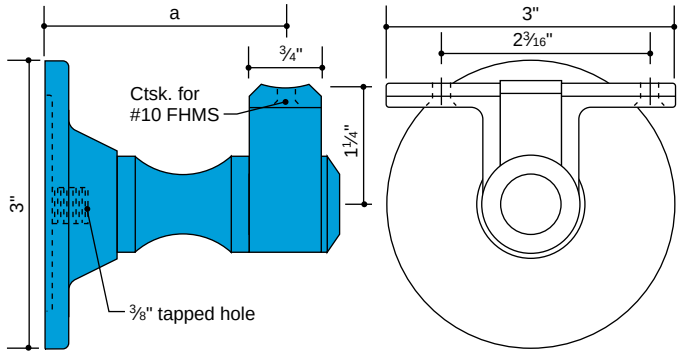
16' lengths



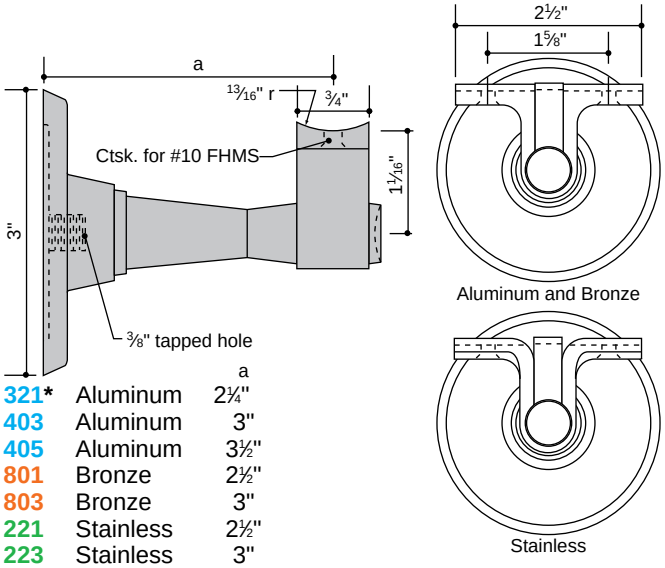
			r				r
7497	Aluminum	.19 lb./ft.	.83"	**7498**	Aluminum	1.52 lb./ft.	.83"
7597	Aluminum	.18 lb./ft.	.95"	**7598**	Aluminum	1.50 lb./ft.	.95"
8897	Bronze	.56 lb./ft.	.95"	**8898**	Bronze	4.67 lb./ft.	.95"

WALL BRACKETS Satin Finish, except as noted

Aluminum pipe brackets are available with a mill finish or a clear anodized finish – AA-M32-C22-A31 (204R1). When designating clear anodized brackets, add the suffix *-A* to catalog number listed (e.g. 307-A).



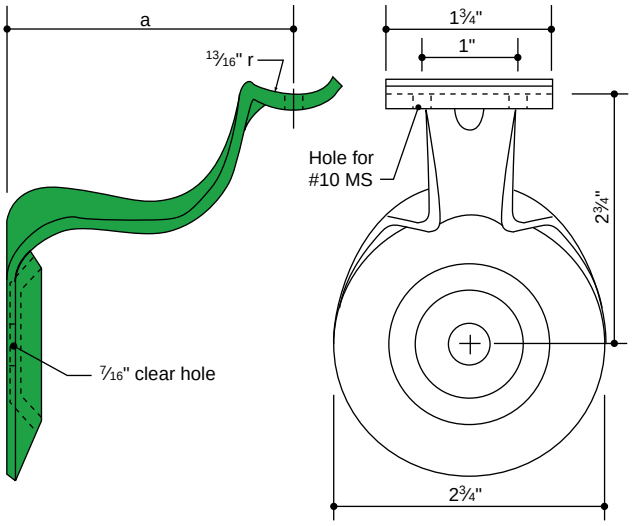
		a
307	Aluminum	2½"



		a
321*	Aluminum	2¼"
403	Aluminum	3"
405	Aluminum	3½"
801	Bronze	2½"
803	Bronze	3"
221	Stainless	2½"
223	Stainless	3"

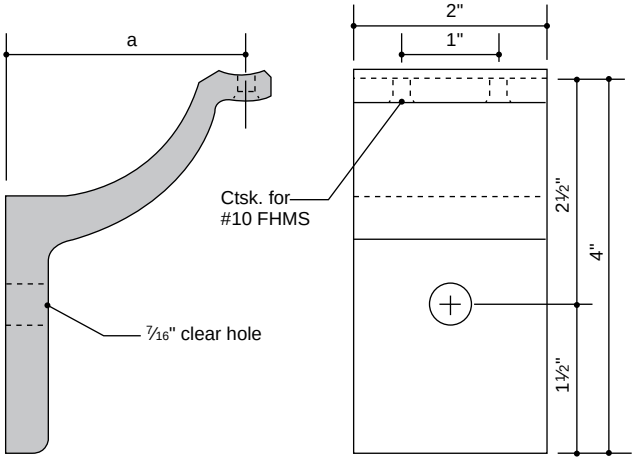
* see page 82 for more accurate drawing of 321

WALL BRACKET Stamped, burnished finish



		a			a
1022	Stainless	2½"	1026	Stainless	3"

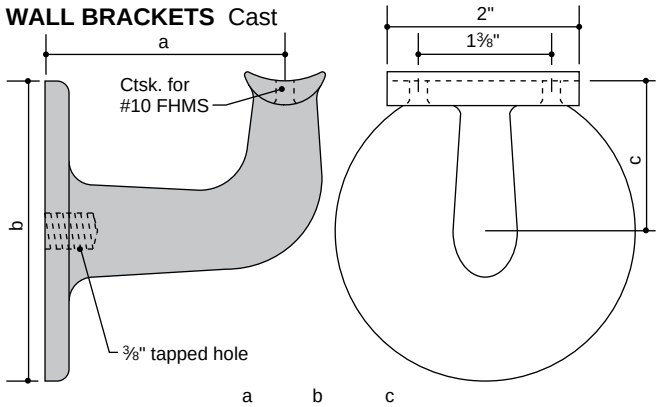
WALL BRACKET Extruded – Unpolished



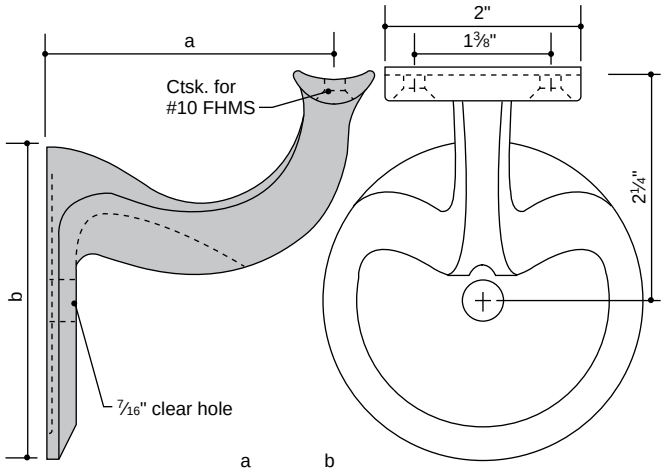
		a			a
478	Aluminum	2½"	498	Aluminum	3"
892	Bronze	2½"	894	Bronze	3"
218	Stainless**	2½"	220	Stainless**	3"

** Satin Finish

WALL BRACKETS Cast



		a	b	c
376	Aluminum	2½"	3⅛"	1 9/16"
389	Aluminum	3⅛"	3¾"	1⅞"
375	Bronze	2½"	3⅛"	1 9/16"
319	Bronze	3⅛"	3¾"	1⅞"
275	Stainless	2½"	3⅛"	1 9/16"



		a	b
384	Aluminum	2½"	2¾"
316	Aluminum	3"	3¼"
388	Bronze	2½"	2¾"
318	Bronze	3"	3¼"

SPECIAL CHARACTERISTICS

Connectorail® is a pre-engineered pipe railing system with prefabricated components. It is fabricated with ordinary tools and without welding. It is designed to meet established safety standards.

The structural integrity of the railing system depends on proper selection of components, proper number and location of supports and correct assembly and installation. The data and instructions in this catalog make it easy to meet these conditions (see engineering data on pages 114-123). Most fittings are dimensioned in whole inches to facilitate layout. Confirm dimensions prior to cutting and/or assembly.

POSTS

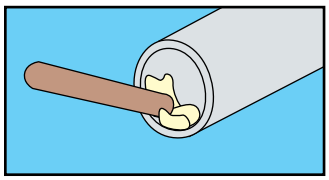
High strength posts and the use of reinforcing inserts are recommended to permit longer spans and to comply with the most stringent loading requirements. Facia Flanges and Heavy-Duty Floor Flanges include reinforcing inserts. Refer to page 123 for post spacing tables.

SPLICE JOINTS

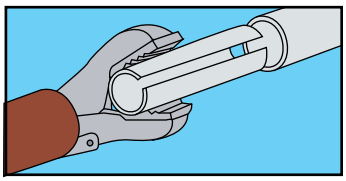
Splice joints are secured by internal connector sleeves with the use of epoxy adhesive. Connector sleeves must be ordered separately unless a sleeve is already welded into the fitting, as it is in tees, wall returns and miter elbows. Sleeves are made for a tight press fit and must be compressed with pliers to permit them to slip into the pipe. Pipe ends must be cut square and to accurate length to assure smooth, tight joints.

The areas to be joined should be cleaned thoroughly. The adhesive is mixed according to manufacturer's directions. Do not mix more than you can use within ½ hour. Apply adhesive to inside of pipe. Fit components together and wipe off excess adhesive. Leave undisturbed for eight hours – longer in cold weather.

All splices should be made as near as possible to a post, in no event more than 12" from the nearest post.



Apply adhesive to inside of pipe.



About one half of the 5"-long sleeve should be inside each of the pipe ends.

EXPANSION JOINTS

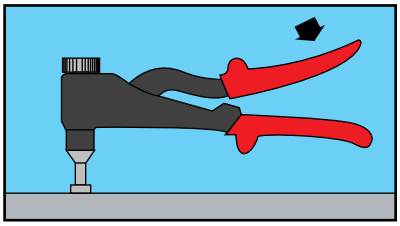
Expansion joints should be provided for continuous runs in excess of 40 feet or at places where building structure provides expansion joints. If a joint is provided every 20 feet, the width of the gap should allow ⅛" expansion for each 40°F of expected temperature rise. To make an expansion joint, the internal connector sleeve is left unattached at one end so that it is free to move in and out of the pipe.

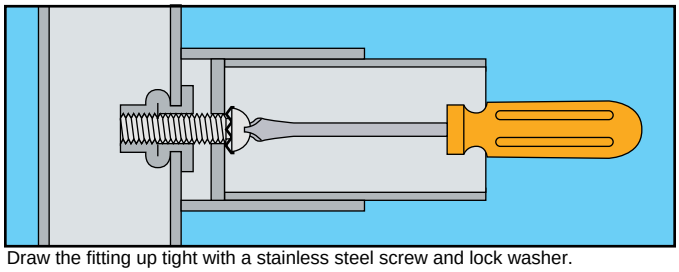
TEE FITTINGS

Tee fittings are secured to the post or rail by means of an internally threaded tubular rivet inserted into the wall of the pipe and a stainless steel machine screw and lock washer. When two 90° tees are mounted directly opposite each other to form a cross, a stainless steel through bolt and lock nut may be used.

Drill pipe with drill size Q or 11/32" hole. Screw a rivet sleeve-side first onto the mandrel of the tool. Hold the tool in one hand. Using the tool, insert the rivet into the hole until the tool comes to rest against the parent material. Upset rivet by pressing handles together.

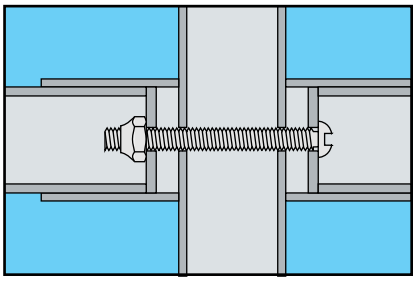
Set tubular rivet in hole, using setting tool. Upset rivet by pressing handles together.





Draw the fitting up tight with a stainless steel screw and lock washer.

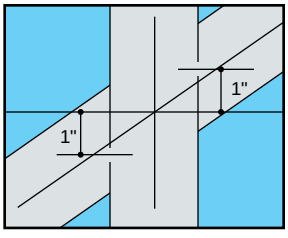
Draw the fittings up tightly from both sides, using a stainless steel lock nut.



The use of a lock washer or lock nut is essential because the assembly must remain tight once it is completed. There is no way to re-tighten an assembled railing. Stainless steel screws are required because they provide maximum strength. The 1"-long screws are supplied with the lock washer already in place.

To locate holes to be drilled for angle tees and crosses, request our drilling template or make your own template as follows: Draw a rectangle of a width equal to the circumference of the pipe (5.21" for 1¼" pipe, 5.97" for 1½" pipe), about 3" to 4" high. Draw the horizontal and vertical center lines. Draw two more vertical lines at one half the distance between center line and edges of the rectangle. On the new lines, mark 1" above and below the horizontal center line. Wrap the template around the post so that its horizontal center line is on a level with the intersection of center lines of the post and the rail. The marks on the template will indicate the location of holes.

Holes for angle tees, except 4° ramp tee, are located 1" above and below intersection of center lines of pipe, regardless of stair angle.



MOUNTING POSTS

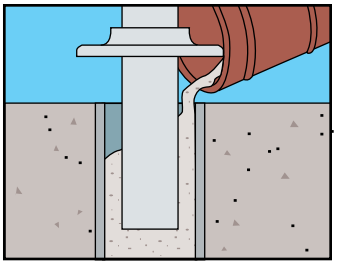
Embedding in concrete: Posts embedded in concrete should be set to a depth of 5" below the surface of floor or tread. Allow for a 1" grout pad beneath post. Provide a hole 2½" to 3" in diameter to leave room for grouting cement and to allow for adjustment to field variations. A quick setting grout is recommended for setting posts. For outdoor installation, weep holes should be drilled in the posts just above the ground. The reinforcing insert will prevent water from collecting below ground level. Where aluminum surfaces are embedded in concrete that contains corrosive components, a coat of zinc chromate primer or equivalent must be applied.

Use reinforcing bar and cover flange.

Drill weep hole ¼" above cover flange.

Apply zinc chromate primer or equivalent to surfaces embedded in concrete.

Set in floor to a depth of 5" and grout.



Surface Mounting: Sleeve anchor bolt ⅜" × 3" is recommended for use with heavy-duty floor flange. Drill ⅜" hole in concrete or masonry to 3" depth. Drill holes which conform to ANSI standard carbide bit dimension (.390" to .398"). Clean out dust in hole after drilling. Insert sleeve bolt in hole, hand tighten, then tighten with wrench to a maximum torque of 30 ft. lbs. Use heavy-duty floor flange as a template for locating holes. Minimum distance from centerline of hole to edge of concrete is 2".

Facia Mounting: Disassemble the facia flange, which includes a reinforcing bar, by removing two screws from the back of the plate. Drill two 7/16" holes in the post, one hole 1¼" from the lower end, the second one 4" on center from the first, so that they align with holes in the reinforcing insert. The reinforcing insert is slipped inside the post and the unit is reassembled and mounted, using ⅜" bolts. While the unit is disassembled, the plate of the facia flange may be used as a template to locate the holes for mounting the flange.

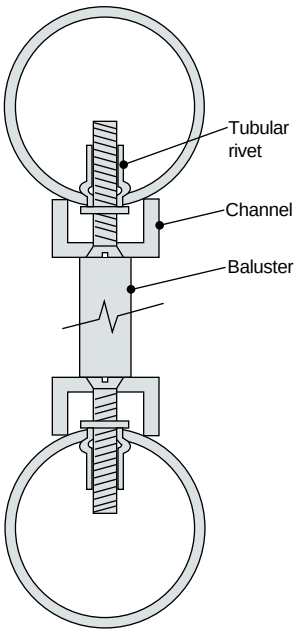
For outdoor installation of aluminum, the metal must be kept from direct contact with concrete or dissimilar metal by application of bituminous paint or methacrylate lacquer.

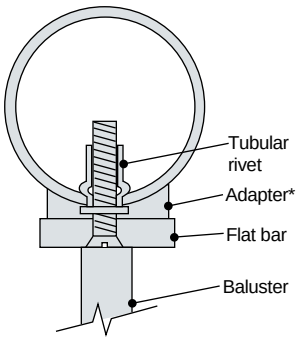
ANODIZED FINISHES

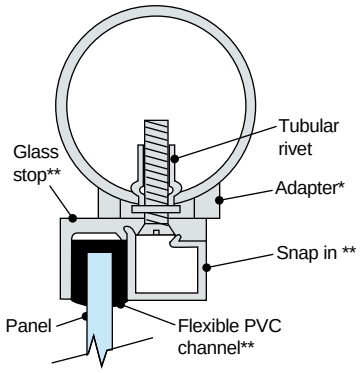
When clear anodized components are supplied, no further finishing is necessary. Any other specified finishes are the fabricator's responsibility and components will be supplied with mill finish only. **If an anodic coating other than our stock clear finish is to be applied, any stainless steel fasteners must be removed before anodizing.**

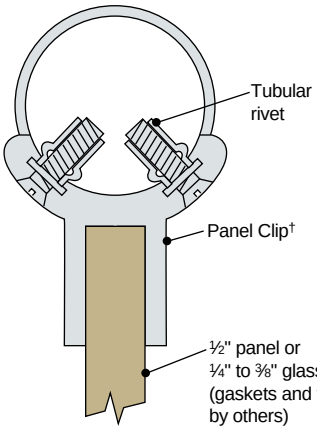
INSTALLATION OF PICKET OR PANEL RAILS

Most current safety codes require reduced openings in railings where they might present a hazard to small children. Pipe railings, including the **Connectorail® System**, are easily adapted to comply with this requirement, where it applies, by adding balusters or panels. Typical details are shown at right.









*Adapters	1¼" Pipe	1½" Pipe
Aluminum	7161	7261
Bronze	8661	8861
Stainless	9161	9361

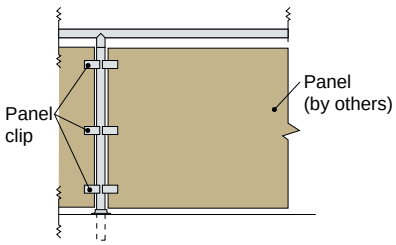
For other adapters, see page 16.

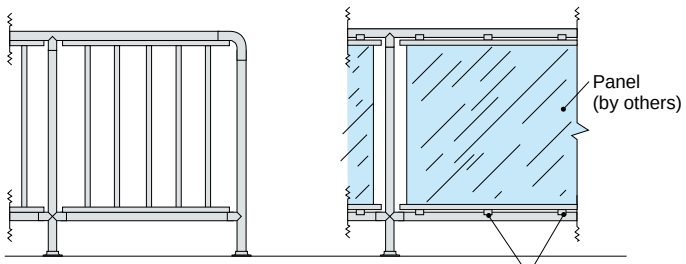
†Panel Clip – Aluminum only

7160*	7460	1¼" Pipe
7260*	7560	1½" Pipe

* two-piece panel clips, see page 14.

**Framing	Glass Stop	Snap-in
Aluminum, mill finish	8106	8107
Aluminum, anodized	8206	8207
Bronze	4506	4507
Flexible PVC	8708	





PICKET RAIL – use channel or adapters and flat bar.

PANEL RAIL

CAST FLUSH FITTINGS FOR WELDED ASSEMBLY

All non-ferrous fittings are furnished with a satin finish, except as noted.

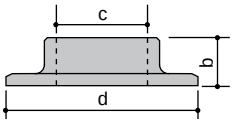
Cast aluminum components are of Almag 35.

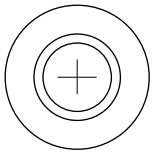
Cast bronze fittings are lacquered bronze alloy C86500 which matches the color of Red Brass (C23000) and Architectural Bronze (C38500).

Fittings shown are made to fit Schedule 40, standard pipe sizes, except as noted.

See pages 10 through 15 for other non-ferrous pipe fittings for 1¼" and 1½" pipe.

SLIP FLANGE





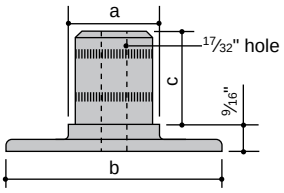
CAST IRON

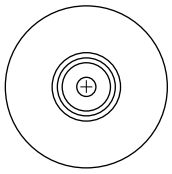
Black	Galv.	Pipe	b	c	d
614	1614	1"	13/16"	1 11/32"	3 5/8"
610	1610	1¼"	13/16"	1 11/16"	3 7/8"
611	1611	1½"	13/16"	2"	4 3/16"
612	1612	2"	13/16"	2 7/16"	4 5/8"

NON FERROUS

Alumin.	Bronze	Pipe	b	c	d
714		1"	13/16"	1 11/32"	3 5/8"
710	810	1¼"	1"	1 11/16"	3 13/16"
711	811	1½"	1"	1 15/16"	4"
712		2"	1"	2 13/32"	5"

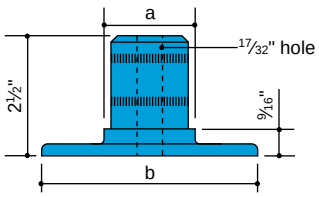
FLOOR FLANGE†

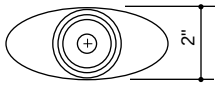




Alumin.	Bronze	Pipe	a	b	c
727	827	1¼"	1.660"	4"	1¾"
728	828	1½"	1.900"	4½"	2"
729		2"	2.375"	5"	2½"

OVAL FLOOR FLANGE†





Alumin.	Pipe	a	b
749	1¼"	1.660"	4"
750	1½"	1.900"	4½"

† When using these floor flanges for surface mounting of posts, care must be taken to provide adequate lateral bracing or end support. For free standing railings, use the heavy-duty floor flange (see page 13).

PIPE – 20' lengths

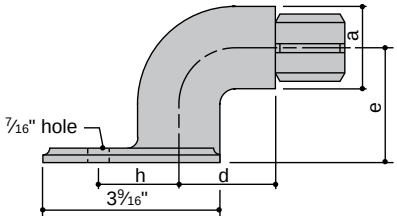
Smooth Mill Finish (except as noted)

	Size	Schedule	O.D.	Wall	lbs./ft.
Aluminum					
6063-T52*	1¼"	10	1.600"	.109"	.625
6063-T52*	1½"	10	1.900"	.109"	.721
6063-T832*	1¼"	10	1.600"	.109"	.625
6063-T832*	1½"	10	1.900"	.109"	.721
6063-T52	¾"	40	1.050"	.113"	.391
6063-T52	1"	40	1.315"	.133"	.581
6063-T52*	1¼"	40	1.600"	.140"	.785
6063-T52*	1½"	40	1.900"	.145"	.940
6063-T52	2"	40	2.375"	.154"	1.264
6063-T832*	1¼"	40	1.600"	.140"	.785
6063-T832*	1½"	40	1.900"	.145"	.940
Bronze, CDA 230	1¼"	40	1.600"	.146"	2.630
Bronze, CDA 230	1½"	40	1.900"	.150"	3.130
Bronze, CDA 385	1½"	10	1.900"	.100"	2.070
Stainless, 304**	1¼"	5	1.600"	.065"	1.110
Stainless, 304**	1½"	5	1.900"	.065"	1.274

* Mill finish or clear anodized finish

** No. 4, satin finish, sleeved

WALL RETURNS



CAST IRON — For standard pipe

Black	Galv.	Pipe	a	d	h	e
604	1604	1¼"	1 21/32"	1 15/16"	1⅝"	2½"
605	1605	1½"	1 29/32"	2 1/16"	1 11/16"	2½"
664	1664	1¼"	1 21/32"	1 15/16"	1⅝"	3"
665	1665	1½"	1 29/32"	2 1/16"	1 11/16"	3"

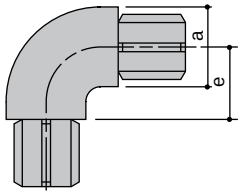
For light wall structural pipe

Black	Pipe	a	d	h	e
3604	1¼"	1 21/32"	1 15/16"	1⅝"	2½"
3605	1½"	1 29/32"	2 1/16"	1 11/16"	2½"

ALUMINUM — For schedule 40 pipe

	Pipe	a	d	h	e
705	1½"	1 29/32"	2 1/16"	1 11/16"	2½"
759	1¼"	1 21/32"	1 15/16"	1⅝"	3"

90° ELBOWS



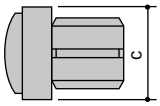
MALLEABLE IRON

Black	Galv.	Pipe	a	e
617	1617	1"	1 5/16"	1"
618	1618	1¼"	1 21/32"	1¼"
619	1619	1½"	1 29/32"	1½"
620		2"	2⅜"	1⅞"

ALUMINUM

	Pipe	a	e
720	2"	2⅜"	1⅞"

PIPE PLUGS



CAST IRON
For standard pipe

Black	Galv.	Pipe
606	1606	1"
607	1607	1¼"
608	1608	1½"
609	1609	2"

NON FERROUS
For standard pipe

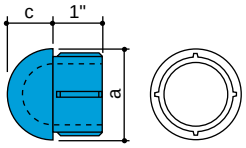
Alum.	Bronze	Pipe	c
707	807	1¼"	1 21/32"
708	808	1½"	1 29/32"
709		2"	2 3/8"

For light wall structural pipe

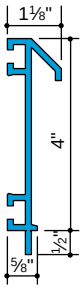
Black	Pipe
3607	1¼"
3608	1½"

TERMINAL CAP

Alum.	Pipe	a	c
715	1¼"	1 21/32"	27/32"
716	1½"	1 29/32"	31/32"

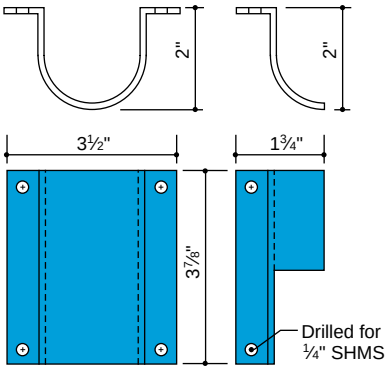


TOE BOARD



6446 Aluminum*
20' lengths
1.13 lb/ft

TOE BOARD CLAMPS For 1½" pipe

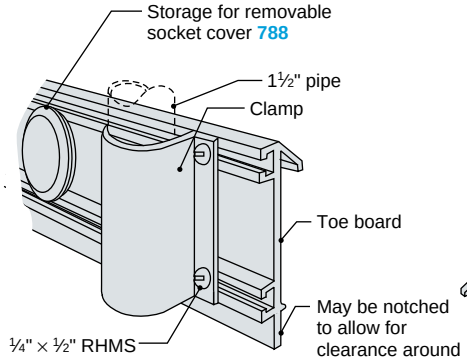


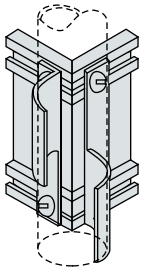
746 Aluminum* **747** Aluminum*

Toe board clamps are supplied with stainless steel screws and nuts.

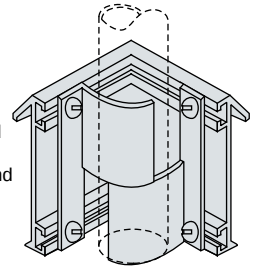
* Alloy 6063-T52, mill finish or clear anodized

ASSEMBLY DETAILS



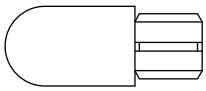


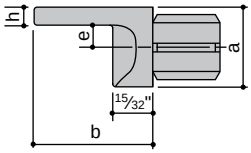
Inside Corner



Outside Corner

SQUARE POST FITTING Cast





MALLEABLE IRON

For standard pipe

Black	Pipe	a	b	h	e
601	1¼"	1 21/32"	2 15/32"	3/8"	29/64"
602	1½"	1 29/32"	2 15/32"	7/16"	33/64"

For light wall structural pipe

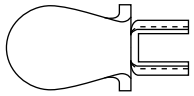
Black	Pipe	a	b	h	e
3601	1¼"	1 21/32"	2 15/32"	3/8"	29/64"
3602	1½"	1 29/32"	2 15/32"	7/16"	33/64"

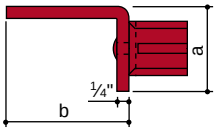
ALUMINUM

For schedule 40 pipe

	Pipe	a	b	h	e
701	1¼"	1 21/32"	2 15/32"	3/8"	29/64"
702	1½"	1 29/32"	2 19/32"	7/16"	33/64"

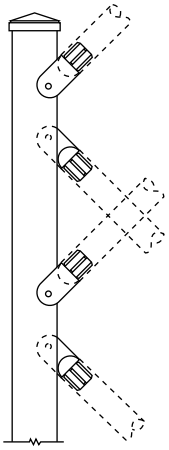
SQUARE POST FITTING Stamped Steel
For Standard Pipe

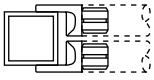




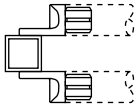
	Pipe	a	b
987	1¼"	1 5/8"	2 5/8"
988	1½"	1 7/8"	2 7/8"

SQUARE POST FITTINGS ASSEMBLY DETAIL





Square post fittings used with 4" or larger post



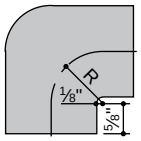
Square post fittings used with 3½" or smaller post

Square post fittings are made reversible so as to allow enough clear space between ascending and descending pipe rails regardless of size of post.

FITTINGS FOR WELDED ASSEMBLY
Stainless steel fittings are 18-8 alloy and are satin finished.
All fittings are for I.P.S., schedule 40 pipe, except as noted.

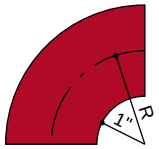
TEES
In welded railings, no fittings are used for **tee** and **cross** connections. The ends of the pipe are notched with a special tool known as the **Arc Fit Pipe Notcher** (see page 113) to match the contour of the pipe to be joined. The joint is then welded.

90° ELBOWS

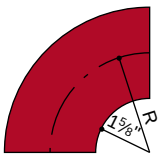


1/8" radius for sharp turns

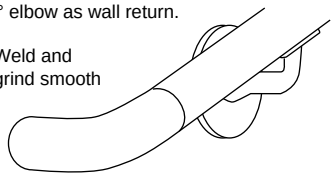
		Pipe	R
958	Steel	1¼"	15/16"
959	Steel	1½"	1 1/16"
258	Stainless	1¼"	15/16"
259	Stainless	1½"	1 1/16"



		Pipe	R
917	Steel	1"	1 1/16"
918	Steel	1¼"	1 3/16"
919	Steel	1½"	1 5/16"
920	Steel	2"	2 3/16"

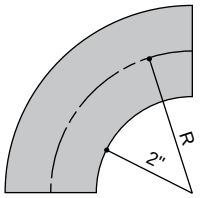


Detail showing 1⅝" radius 90° elbow as wall return.



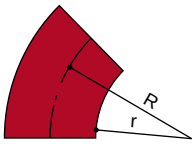
1⅝" radius elbow is suitable for use as wall return

		Pipe	R
948	Steel	1¼"	2 7/16"
949	Steel	1½"	2 9/16"



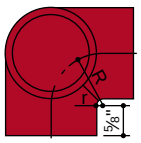
		Pipe	R
915	Steel	1"	2 1/16"
925	Steel	1¼"	2 3/16"
926	Steel	1½"	2 5/16"
232	Stainless	1"	2 1/16"
225	Stainless	1¼"	2 3/16"
226	Stainless	1½"	2 5/16"

45° ELBOW



		Pipe	r	R
929	Steel	1"	1"	1 11/16"
930	Steel	1¼"	1"	1 13/16"
931	Steel	1½"	1"	1 15/16"
932	Steel	2"	1"	2 3/16"
933	Steel	1¼"	2"	2 13/16"
934	Steel	1½"	2"	2 15/16"

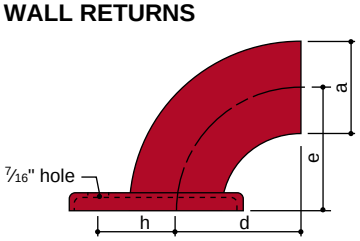
90° THREE-WAY ELBOW

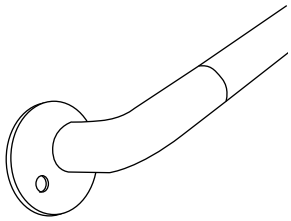


For corner posts

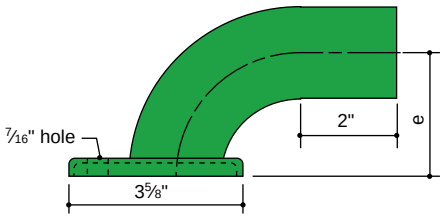
		Pipe	r	R
903	Steel	1¼"	1/8"	15/16"
904	Steel	1½"	1/8"	1 1/16"

WALL RETURNS





		Pipe	a	d	h	e
983	Steel	1¼"	1 21/32"	2 7/16"	1 5/8"	2½"
984	Steel	1¼"	1 21/32"	2 13/16"	1 5/8"	3"
985	Steel	1½"	1 29/32"	2¼"	1 15/32"	2½"
986	Steel	1½"	1 29/32"	2 15/16"	1 15/32"	3"

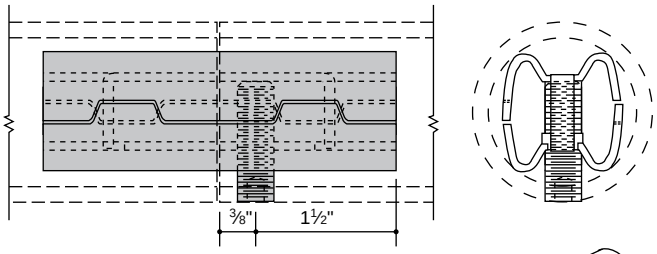


Schedule 40 pipe return and 1/8" formed flange are joined by a concealed weld.

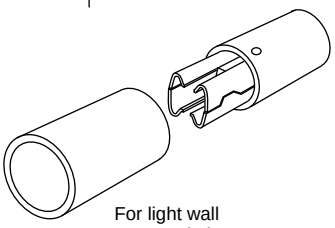
		Pipe	e
215	Stainless	1¼"	2½"
216	Stainless	1½"	2½"
212	Stainless	1¼"	3"

PIPE SPLICE LOCK

A single allen screw locks the joint



For quick, weldless end-to-end connection of pipe in the shop or in the field. Connections made with the pipe splice lock are flush, permanent and in perfect alignment. Also suited for expansion joints.



For standard pipe

		Pipe
921	Steel	1"
922	Steel	1¼"
923	Steel	1½"
924	Steel	2"

		Pipe
289	Stainless	1"
287	Stainless	1¼"
288	Stainless	1½"

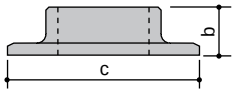
For light wall structural pipe

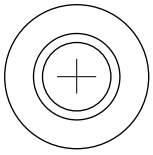
		Pipe
1922	Galv. Steel	1"
1923	Galv. Steel	1¼"
901	Steel	1½"
902	Steel	2"

For Schedule 5 pipe

		Pipe
286	Stainless	1"

ROUND SLIP FLANGE

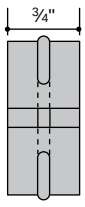


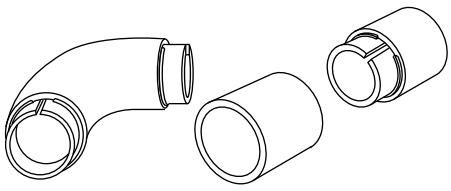


				Pipe	b	c
913	Steel			¾"	¾"	3¼"
914	Steel	214	Stainless	1"	⅞"	3¾"
910	Steel	210	Stainless	1¼"	⅞"	3¾"
911	Steel	211	Stainless	1½"	⅞"	4½"
912	Steel			2"	⅞"	4¾"

CONNECTOR

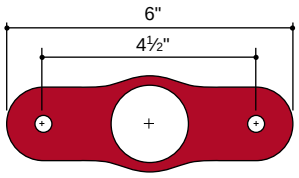
Connector snaps in place with a spring fit, holding elbow and pipe in position for welding.

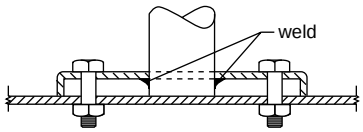




				Pipe
951	Steel			1"
952	Steel	292	Stainless	1¼"
953	Steel	293	Stainless	1½"
954	Steel			2"

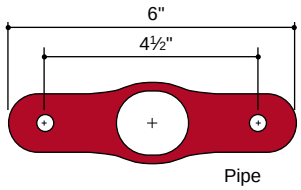
OVAL POST FLANGE, Floor

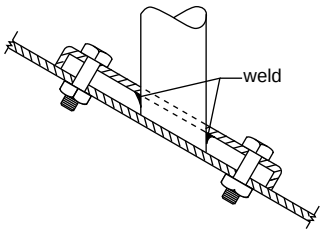




		Pipe
927	Steel	1¼"
928	Steel	1½"

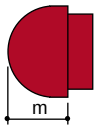
OVAL POST FLANGE, Angle

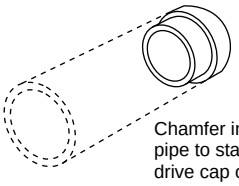




		Pipe
942	Steel	1¼"
943	Steel	1½"

DRIVE-ON CAP

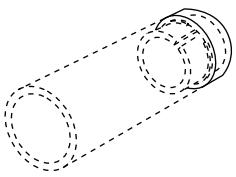




Chamfer inside of pipe to start; then drive cap on.

		Pipe	m			Pipe
906	Steel	1"	1"	277	Stainless	1¼"
907	Steel	1¼"	1⅛"	278	Stainless	1½"
908	Steel	1½"	1¼"			
909	Steel	2"	1⅜"			

WELD-ON CAP



Weld and grind smooth. Use of connector is optional.

		Pipe	m
936	Steel	1"	1"
937	Steel	1¼"	1⅛"
938	Steel	1½"	1⅛"
939	Steel	2"	1⅜"

MICHIGAN EDUCATION ASSOC. LODGE
Battle Creek, Michigan

Arch: Guido A. Binda
Fabr: Van Dam Iron Works

ONEONTA SAVINGS & LOAN
Oneonta, New York

Arch: R-G & Associates
Fabr: Titchener Iron Works, Inc.

The **Carlstadt®** railing system features a full range of components in aluminum, bronze, stainless steel and acrylic/wood to meet virtually any installation requirement.

The **Carlstadt®** system uses self-aligning **Carlstadt®** handrail brackets.

Aluminum railing components are made of alloy 6063, except cast cover flanges, corner bends and floor flanges, which are cast from Almag 35. Aluminum extrusions are suitable for anodizing, including most of the hard-coat anodic processes. Black anodizing may result in inconsistent matches. Consult your anodizer before specifying.

Bronze components are made of extruded architectural bronze alloy C38500, except for cast cover flanges and handrail corner bends and terminals, which are cast from alloy C86500.

Stainless Steel components are made of type 302/304 (18-8) stainless steel.

Acrylic/Wood rail is a prefinished composite material which retains all the beauty of natural hardwood – oak, walnut and ash – and provides it with a hard, lustrous acrylic surface. This is achieved through the Permagrain® Radiation Process, which impregnates the wood with acrylic plastic and hardens it by irradiation. The resulting composite has twice the resistance to indentation and several times the resistance to abrasion as the same hardwood finished conventionally.

Acrylic/Wood handrails are laminated from several strips so as to obtain greater strength and continuous uniform lengths. Posts have an aluminum spine for strength and ease of assembly. Exposed aluminum surfaces of the post have a clear anodized finish (AA-M10-C22-A31). Facia mounting brackets provide concealed fastening.

Acrylic/Wood contains a flame retardant to produce self-extinguishing characteristics as per ASTM-E84. The material resists fading due to sunlight exposure. Cut ends or surfaces damaged by dents or scratches are easily refinished by sanding and buffing. No liquid finish is needed except on outdoor installations.

Acrylic/Wood handrails are covered by U.S. patents.

Americans with Disabilities Act (ADA):
The Architecture and Transportation Barriers Compliance Board – the agency which created and interprets the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)* – has confirmed that 1¼" to 1½" nominal pipe size (1.66" to 1.9" outside diameters) is acceptable for use as handrails under *ADAAG*. A copy of this letter is printed at the front of this catalog. *ADAAG* also allows for handrails which provide *an equivalent gripping surface* – though they do not define this term.

The American National Standards Institute publication *A117.1-1992: Accessible and Usable Buildings and Facilities* states that *. . . handrails shall have a circular cross-section with an outside diameter of 1¼ in. (32mm) minimum and 2 in. (51mm) maximum, or shall provide equivalent graspability in accordance with the following . . . Handrails with other shapes shall be permitted provided they have a perimeter dimension of 4 in. (100 mm) minimum and 6¼ in (160 mm) maximum, and provided their largest cross-section dimension is 2¼ in (57 mm) maximum.*

SOUTHERN SERVICES BUILDING
Mountain Brook, Illinois

Colorail® with **Carlstadt®** post and post bracket.

COLORAIL® Plastic Handrail
Colorail® handrail is made of extruded polyvinyl chloride which is non-flammable and highly resistant to wear, weathering and corrosion. The color is integral with the plastic. Consult Julius Blum & Co. regarding direct sunlight exposure.

Colorail® plastic handrail is used conveniently in all types of railing systems. It may be wall mounted, post mounted (using posts chosen from the **Carlstadt®** and **Connectorail®** systems) or vertically mounted as a bumper guard or elevator cab rail.

Advantages:
- Decorative effect as a lively color accent in architectural design schemes (choice of 13 stock colors and 10 shapes).
- Pleasant feel – warm to the touch.
- Highly visible colors enhance safety in hazardous locations.
- Permanence of surface finish with a minimum of maintenance.
- Economy through ease of installation and moderate material cost.

COLORAIL® System Metal Components:
- Aluminum support bars for mounting plastic handrails.
- Handrail brackets for wall, post and vertical mounting.
- Framing sections for mounting panels of glass, metal, wood, composition board or sheet acrylic.
- Components of other Julius Blum & Co. railing systems are compatible for combination with **Colorail®**.

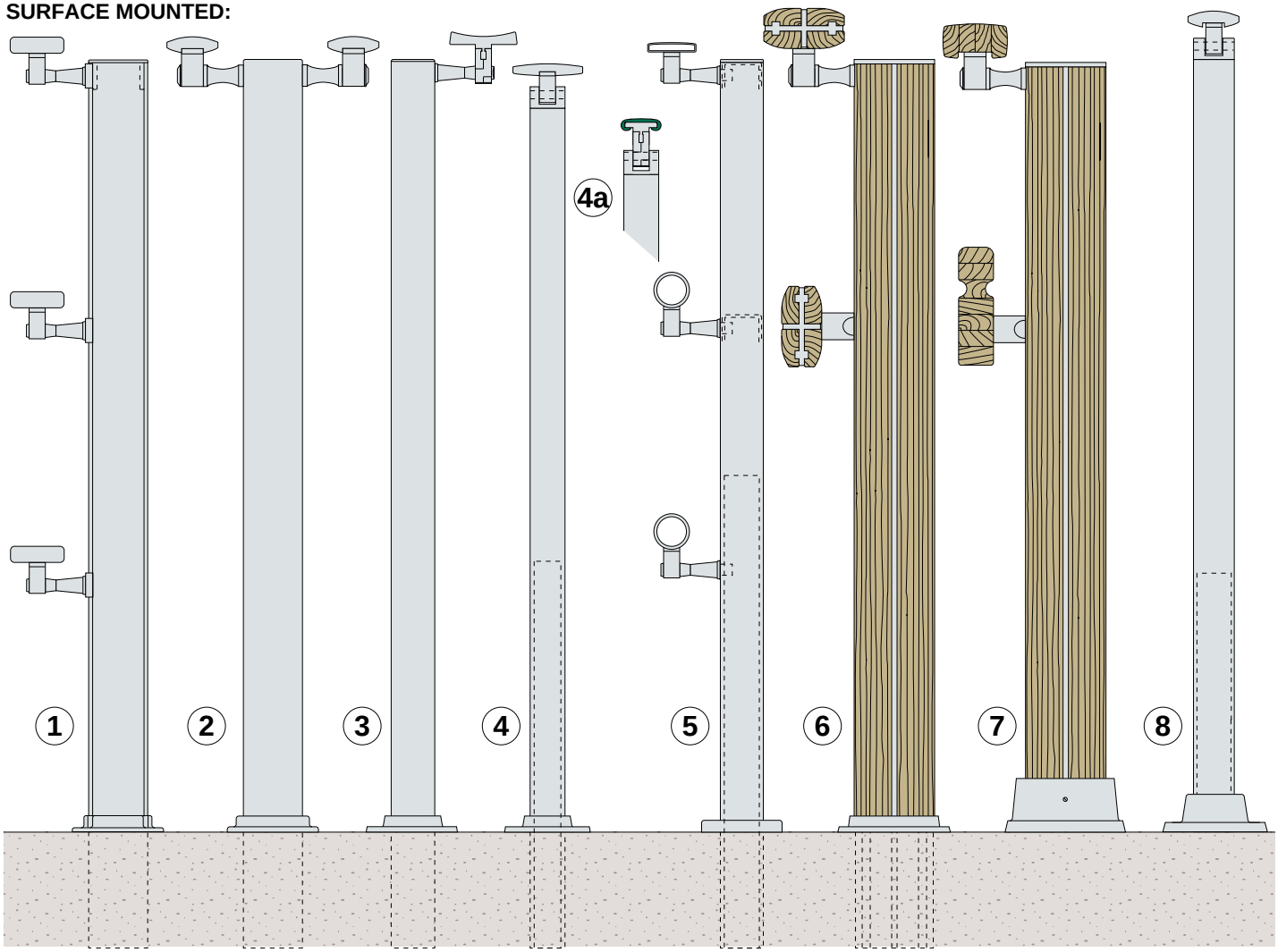
Specifications and Finishes of Metal Components:
Support Bars: Alloy 6063-T6, mill finish.
Framing Sections: Alloy 6063-T52, mill finish or clear anodized.
Handrail Brackets and Extensions: Alloy 6063-T52, satin finish.

The **Colorail®** system is covered by U.S. patents.

Americans with Disabilities Act (ADA):
The Architecture and Transportation Barriers Compliance Board – the agency which created and interprets the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)* – has confirmed that 1¼" to 1½" nominal pipe size (1.66" to 1.9" outside diameters) is acceptable for use as handrails under *ADAAG*. A copy of this letter is printed at the front of this catalog. *ADAAG* also allows for handrails which provide *an equivalent gripping surface* – though they do not define this term.

The American National Standards Institute publication *A117.1-1992: Accessible and Usable Buildings and Facilities* states that *. . . handrails shall have a circular cross-section with an outside diameter of 1¼ in. (32mm) minimum and 2 in. (51mm) maximum, or shall provide equivalent graspability in accordance with the following . . . Handrails with other shapes shall be permitted provided they have a perimeter dimension of 4 in. (100 mm) minimum and 6¼ in (160 mm) maximum, and provided their largest cross-section dimension is 2¼ in (57 mm) maximum.*

SURFACE MOUNTED:



1. Handrail moulding: **6939**
Bracket: **442**
Bracket adapter: **7161**
Post: **6435**
Post cap: **6435-N**
Cover flange: **775**

2. Handrail moulding: **6902**
Bracket: **312**
Post: **6424/6434**
Cover flange: **774**

3. Handrail moulding: **6407**
Bracket: **440**
Post: **6458/6459**
Post cap: **468/451**
Cover flange: **495/496**

4. Handrail moulding: **6905**
Bracket: **162**
Post: **6430**
Reinforcing bar: **436E**
Cover flange: **435**

4a. Handrail moulding: **Colorail®**
Bracket: **152**
Post: **6430**

5. Handrail mouldings: **6511B/6512B** and **1¼" sch. 5 pipe**
Brackets: **241** and **222**
Anchor plug: **238/279**
Post: **1" × 1½"/1" × 2" stainless tubing**
Post cap: **231/284**
Reinforcing bar: **294/295**
Cover flange: **237/285**

6. Handrail moulding: **8571/8572**
Brackets: **309** and **167**
Post: **871/872**
Post cap: **874**
Cover flange: **877**

7. Handrail mouldings: **8511**and **8591**
Brackets: **309** and **167**
Post: **8571**
Post cap: **874**
Floor flange: **876**

8. Handrail moulding: **6902**
Brackets: **145**
Post: **1½" sch. 40 pipe**
Floor flange: **7571**

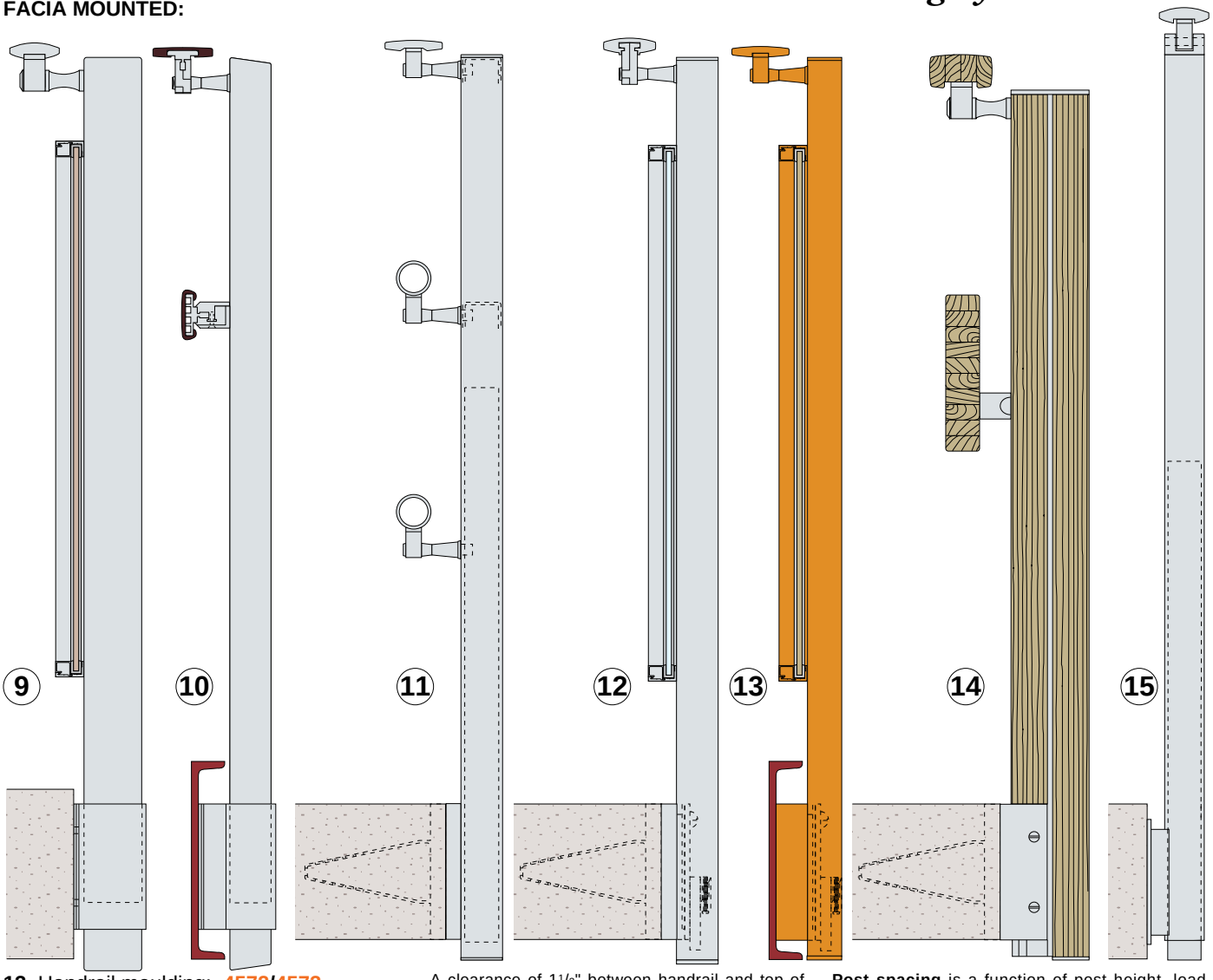
9. Handrail moulding: **6902**
Bracket: **312**
Post: **423/424**
Facia flange: **421/408**
Panel framing: **8106**, **8107** and **8708**
Panel: by others

10. Handrail mouldings: **Colorail®**
Brackets: **439/440** and **151**
Post: **427**
Facia flange: **426**

11. Handrail moulding: **6501/6502** and **1¼" sch. 5 pipe**
Brackets: **241** and **222**
Anchor plug: **238/279**
Post: **230/280**
Post cap: **231/284**
Anchor bar with lower post cap: **233B/283**
Facia bracket: **228**
Post anchor: **227**

12. Handrail moulding: **6530/6531/6532**
Bracket: **171/172**
Post: **458/459**
Upper post cap: **468/451**
Lower post cap: **469/453**
Panel framing: **8206**, **8207** and **8708**
Panel: by others
Facia bracket: **428**
Post anchor: **227**

FACIA MOUNTED:



13. Handrail moulding: **4572/4573**
Bracket: **841**
Post: **830**
Upper post cap: **831**
Lower post cap: **833**
Facia bracket: **839**
Panel framing: **4506**, **4507** and **8708**
Panel: by others

14. Handrail mouldings: **8511/8512** and **8561/8562**
Bracket: **309** and **167**
Post: **881/882**
Upper post cap: **874**
Lower post cap: **875**
Facia bracket: **878**

15. Handrail moulding: **6902**
Bracket: **145**
Post: **1½" sch. 40 pipe**
Facia flange: **7593**

A clearance of 1¹/₂" between handrail and top of post is recommended. Use bracket of sufficient length.

Surface mounted posts should be set into floor 4 to 6 inches and grouted. A cover flange conceals the floor embedment.

Post spacing is a function of post height, load requirements, section modulus for post chosen and the post's allowable stress for design. Refer to our engineering data on pages 114 to 123 to determine a post's maximum allowable span.

FITTINGS AVAILABILITY CHART

Post	Upper Cap	Lower Cap	Cover Flange	Reinforcing bar	Facia Bracket	Uncut Stock Lengths	Anchor Plug
230	231	233-B*	237	294	228/229	1" × 1½" tube	238
280	284	283*	285	295	228/229	1" × 2" tube	279
423			773		421/422	6423	
424			774		408	6424	
427			777		425/426	6427	
430	431	433	435	436E	428/429	6430	432
458	468	469	495	436E	428/429	6458	432
459	451	453	496	436E	428/429	6459	432
830	831	833	835	436E	838/839	4830	432
871	874		877		878/879	8571	
872	874		877		878/879	8572	
881	874	875	877		878/879	8571	
882	874	875	877		878/879	8572	
6434	6434-N		774			6434	432
6435	6435-N		775			6435	432

* With anchor bar

Colorail® Plastic Handrail

Colorail® handrail is made of extruded polyvinyl chloride plastic, which is highly resistant to wear, weathering and corrosion. The color is integral with the plastic and most colors are equally durable indoors and out. Consult Julius Blum & Co. regarding direct sunlight exposure. **Colorail®** is readily worked with simple tools and lends itself to a variety of installations.

Colorail® handrail does not support combustion and conforms to ASTM D 635 flame retardant specification.

Colorail® has become one of the basic means of obtaining lively color accents. Economy, durability and ease of maintenance are among its important advantages. The vivid hues are strongly resistant to darkening or fading and require only periodic cleaning with a mild detergent.

Colorail® Approximate Stock Colors

Black | Dark Gray | Dove Gray

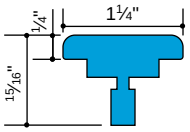
Red | Gold | Beige

Mauve | Yellow | Green

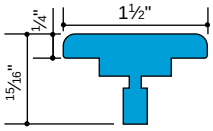
Blue | Brown | White

COLORAIL® SUPPORT BARS (6063-T6)
Mill Finish, 20' lengths

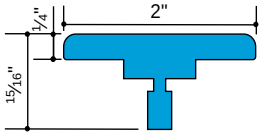
Colorail® plastic handrail requires substantial support to span the distance between posts or wall brackets. **Colorail®** support bars have been designed especially for this purpose. Support bar numbers **6444**, **6445** and **6447** are of particular use when vertically mounting **Colorail®** as a bumper or wall guard.



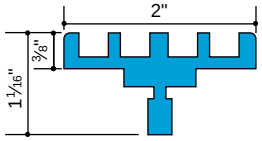
6440 Aluminum .670 lb/ft



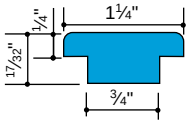
6441 Aluminum .745 lb/ft



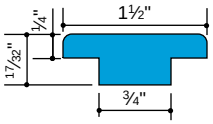
6442 Aluminum .895 lb/ft



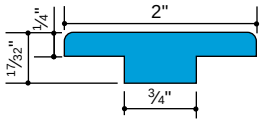
6443 Aluminum .823 lb/ft



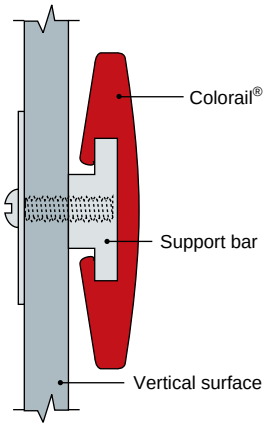
6447 Aluminum .623 lb/ft



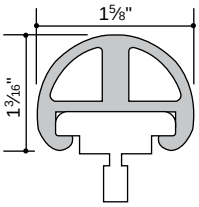
6444 Aluminum .697 lb/ft



6445 Aluminum .847 lb/ft

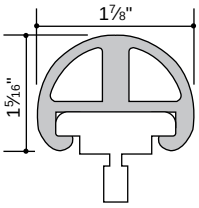


HANDRAIL MOULDINGS (25' and 50' coils)



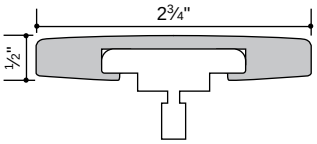
For use with **6440** or **6447**
Aluminum support bars
or ¼" × 1¼" flat bar

6651	Beige
6652	Brown
6653	Red
6654	Gold
6656	Black Satin



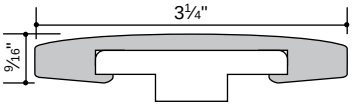
For use with **6441** or **6444**
Aluminum support bars
or ¼" × 1½" flat bar

6661	Beige
6662	Brown
6663	Red
6664	Gold
6666	Black Satin



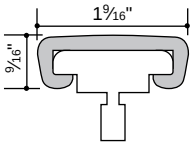
For use with **6441** or **6444**
Aluminum support bars
or ¼" × 1½" flat bar

6671	Beige
6672	Brown
6673	Red
6674	Gold
6676	Black Satin



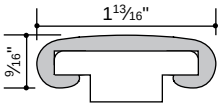
For use with **6442** or **6445**
Aluminum support bars
or ¼" × 2" flat bar

6681	Beige
6682	Brown
6683	Red
6684	Gold
6686	Black Satin



For use with **6440** or **6447**
Aluminum support bars
or ¼" × 1¼" flat bar

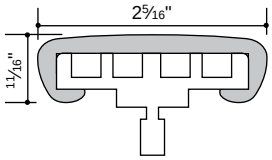
6701	Black Glossy
6702	Dark Gray
6703	Red
6704	Gold
6705	White



For use with **6441** or **6444**
Aluminum support bars
or ¼" × 1½" flat bar

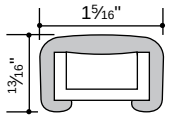
6710	Dove Gray
6711	Black Glossy
6712	Dark Gray
6713	Red
6715	White
6716	Black Satin
6717	Yellow
6718	Green
6719	Blue
6761	Beige
6762	Brown

HANDRAIL MOULDINGS (25' and 50' coils)



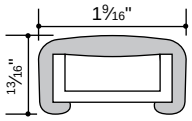
For use with **6443**
Aluminum support bar
or ⅜" × 2" flat bar

6720	Dove Gray
6721	Black Glossy
6722	Dark Gray
6723	Red
6724	Gold
6725	White
6726	Black Satin
6727	Yellow
6728	Green
6729	Blue
6771	Beige
6772	Brown
6776	Mauve



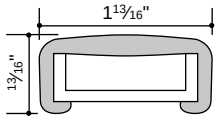
For use with
½" × 1" channel or flat bar

6731	Black Glossy
6732	Dark Gray
6733	Red
6734	Gold
6735	White



For use with
½" × 1¼" channel or flat bar

6741	Black Glossy
6742	Dark Gray
6743	Red
6744	Gold
6746	Black Satin
6747	Yellow
6748	Green
6749	Blue
6781	Beige
6782	Brown



For use with
½" × 1½" channel or flat bar

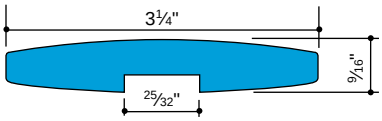
6751	Black Glossy
6752	Dark Gray
6753	Red
6754	Gold
6755	White
6756	Black Satin
6757	Yellow
6758	Green
6759	Blue
6791	Beige
6792	Brown

COLORAIL® END CAPS

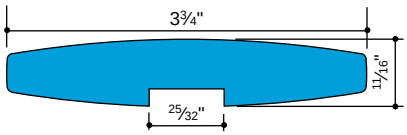
Precut end caps in twelve **Colorail®** colors are available in packages of twelve. **Colorail®** end caps are 3½" × 1½" × ¼" in size and must be trimmed to size during fabrication to match the selected handrail. **Colorail®** end caps are particularly useful for installations where contrasting end caps are specified.

670	Dove Gray
671	Black Glossy
672	Dark Gray
673	Red
674	Gold
675	White
676	Black Satin
677	Yellow
678	Green
679	Blue
681	Beige
682	Brown

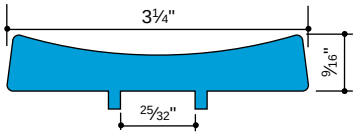
ALUMINUM (6063-T52) Mill finish
20' lengths



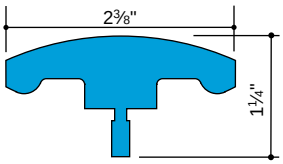
6905 Aluminum 1.752 lb/ft
Fittings: C–N



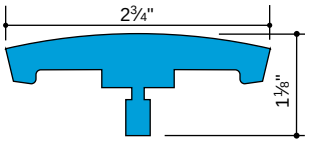
6906 Aluminum 2.448 lb/ft
Fittings: C–N



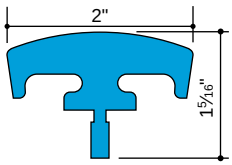
6907 Aluminum 1.776 lb/ft
Fittings: C–N



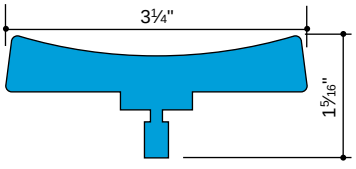
6402 Aluminum 1.51 lb/ft
Fittings: C–N (Use fittings for **6902**)



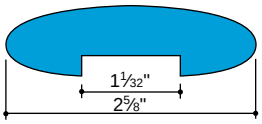
6404 Aluminum 1.57 lb/ft
Fittings: C–N (Use fittings for **6984**)



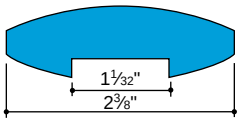
6405 Aluminum 1.39 lb/ft
Fittings: C–N (Use fittings for **6985**)



6407 Aluminum 2.00 lb/ft
Fittings: C–N (Use fittings for **6907**)



6901 Aluminum 1.661 lb/ft
Fittings: C–N

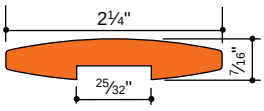


6902 Aluminum 1.464 lb/ft
Fittings: C–N

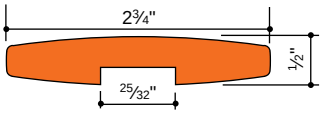
PERRY NUCLEAR TRAINING FACILITY
CLEVELAND ELECTRIC ILLUMINATING CO.
Perry, Ohio

Engr: Gilbert Associates, Inc.
Fabr: Burghardt Metal

BRONZE (CDA 385) Mill finish
20' lengths

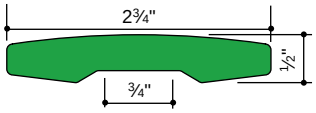


4572 Bronze 2.50 lb/ft
Fittings: C–N

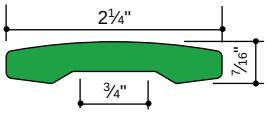


4573 Bronze 4.05 lb/ft
Fittings: C–N

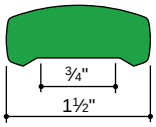
STAINLESS (Type 304) Mill finish
Lengths as noted



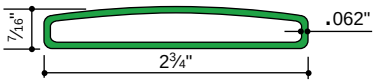
6501 Stainless 4.05 lb/ft
No fittings available. 16' lengths.



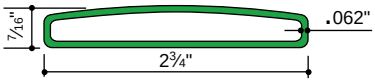
6502 Stainless 2.80 lb/ft
No fittings available. 16' lengths.



6503 Stainless 2.54 lb/ft
No fittings available. 16' lengths.



6511 Stainless 1.25 lb/ft
No fittings available. 20' lengths.

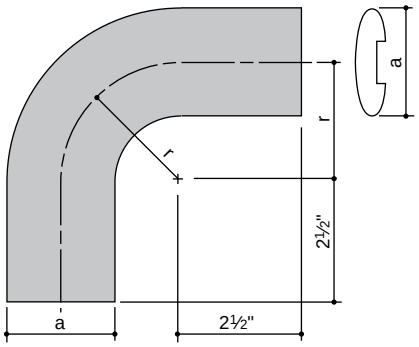


6512 Stainless 1.00 lb/ft
No fittings available. 20' lengths.

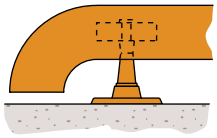
HARLECO CORPORATION
Gibbstown, New Jersey

Designer/Fabr: Southern Steel Fabricators, Inc.
Vineland, New Jersey

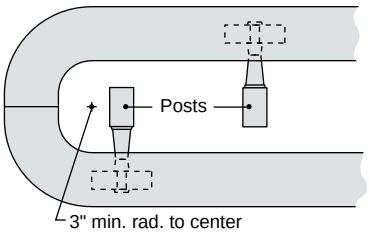
CORNER BENDS Satin Finish



		r	a
6901-C	Aluminum for handrail 6901	2½"	2⅝"
6902-C	Aluminum for handrail 6902 and 6402	2½"	2⅜"
6905-C	Aluminum for handrail 6905	3"	3¼"
6906-C	Aluminum for handrail 6906	3"	3¾"
6907-C	Aluminum for handrail 6907 and 6407	3"	3¼"
6984-C	Aluminum for handrail 6984 and 6404	2¾"	3"
6985-C	Aluminum for handrail 6985 and 6405	2"	2½"
4572-C	Bronze for handrail 4572	2½"	2¼"
4573-C	Bronze for handrail 4573	3"	2¾"



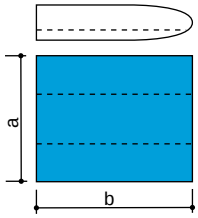
Wall return using corner bend



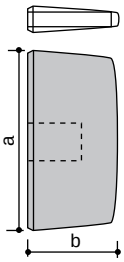
SOMERSET BANK
Somerset, Pennsylvania

Arch.: J. Richard Ross
Fabr.: Sender Ornamental Iron Works

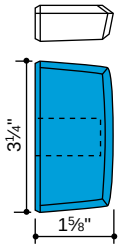
SQUARE END PIECES Satin Finish



		a	b
6901-N	Aluminum for handrail 6901	2⅝"	3¼"
6902-N	Aluminum for handrail 6902 and 6402	2⅜"	3⅛"



		a	b
6905-N	Aluminum for handrail 6905	3¼"	1⅝"
6906-N	Aluminum for handrail 6906	3¾"	1¾"
4572-N	Bronze for handrail 4572	2¼"	3"
4573-N	Bronze for handrail 4573	2¾"	3"



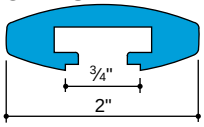
6907-N Aluminum for handrail 6907 and 6407

For 6984-N (use with 6404) and 6985-N (use with 6405) see page 55.

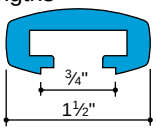
AMERICUS HIGH SCHOOL
Americus, Georgia

Arch: James W. Buckley & Assoc.
Fabr: Architectural Manufacturing Company of America

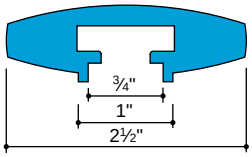
CARLSRAIL® HANDRAIL 20' lengths



6530 Aluminum .900 lb/ft
Fittings: C–N

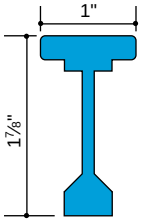


6531 Aluminum .600 lb/ft
Fittings: C–N



6532 Aluminum 1.440 lb/ft
Fittings: C–N

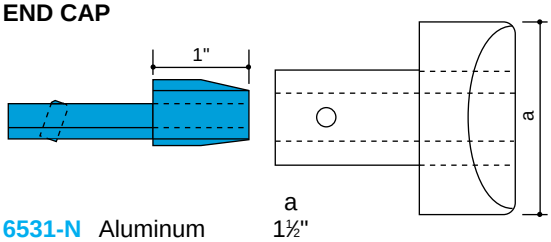
SUPPORT BAR



6540 Aluminum, 6063-T6
.753 lb/ft

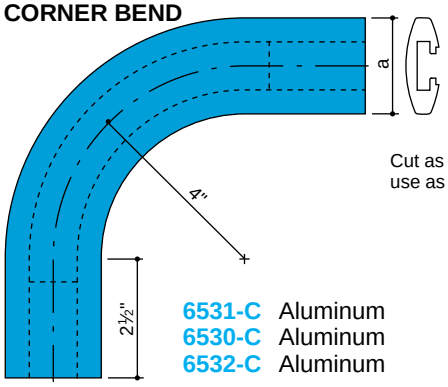
A slip fit support bar adds both vertical and horizontal stiffness to the handrail mouldings, when required.

END CAP

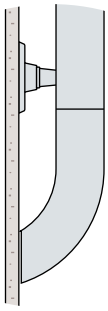


		a
6531-N	Aluminum	1½"
6530-N	Aluminum	2"
6532-N	Aluminum	2½"

CORNER BEND

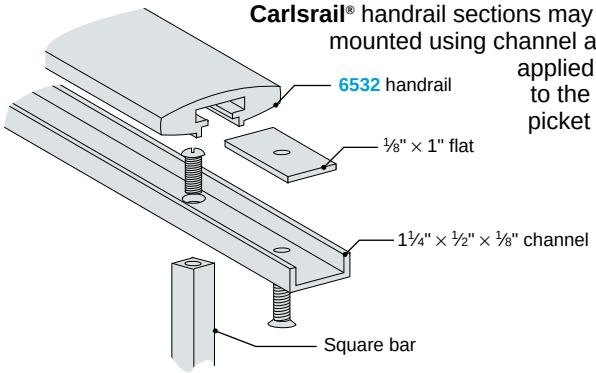


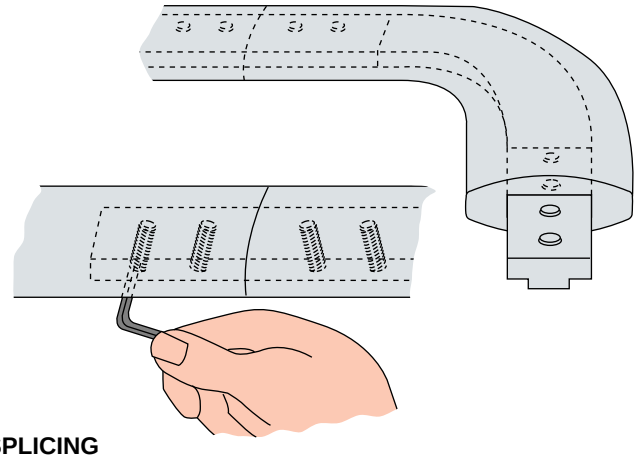
Cut as required for use as a wall return.



		a
6531-C	Aluminum	1½"
6530-C	Aluminum	2"
6532-C	Aluminum	2½"

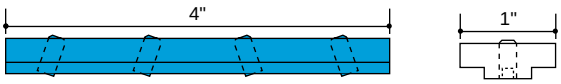
Carlsrail® handrail sections may also be mounted using channel and then applied directly to the top of a picket or post.





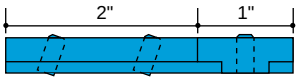
SPLICING
An internal splice is used to attach corner bends and wall returns, as a connector for continuous runs and for expansion joints. A set screw tightens and draws components together.

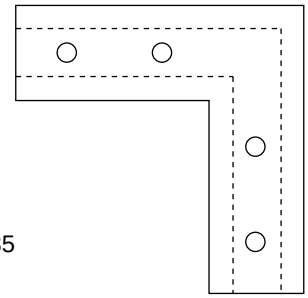
SPLICE INSERT



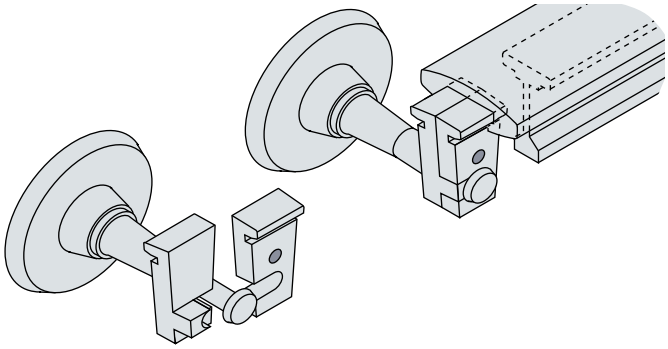
104 Aluminum
Also available in 16' lengths without holes or set screws.

CORNER SPLICE INSERT





105 Aluminum, cast, Almag 35



CARLSRAIL® BRACKET ASSEMBLY
The **Carlsrail®** bracket assembly has a two-part clamp which, in slipping together, engages the bracket arm and the handrail simultaneously, without drilling or tapping. It aligns itself on the handrail and tilts to the required stair or ramp angle. Refer to pages 40 and 41 for available **Carlsrail®** brackets.

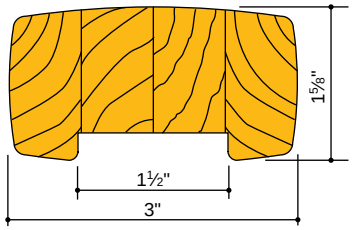
ACRYLIC/WOOD 16' lengths

Acrylic/Wood rail is a prefinished composite material which retains all the beauty of natural hardwood – oak, walnut and ash – but is provided with a hard, lustrous acrylic surface. This is achieved by impregnating the wood with acrylic plastic and hardening it by irradiation. The composite has twice the resistance to indentation and several times the resistance to abrasion as the same hardwood finished conventionally.

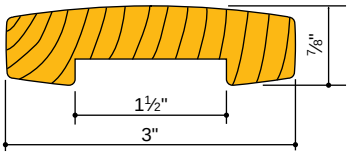
Acrylic/Wood is laminated from strips so as to obtain greater strength and continuous, uniform lengths.

Approximate color and grain configurations:

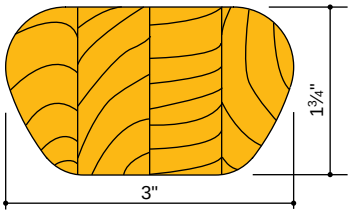
Ash color may be substituted for maple or birch.



8511 Oak 1.59 lb/ft
8512 Walnut 1.59 lb/ft

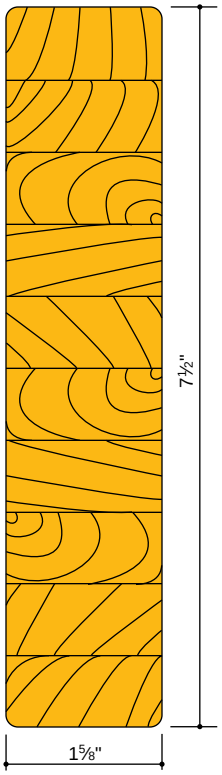


8501 Oak .73 lb/ft
8502 Walnut .73 lb/ft

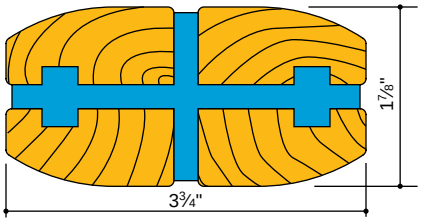


8531 Oak 1.71 lb/ft

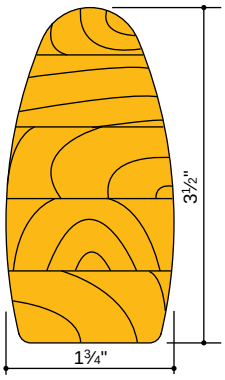
Scale: 6" = 1'-0"



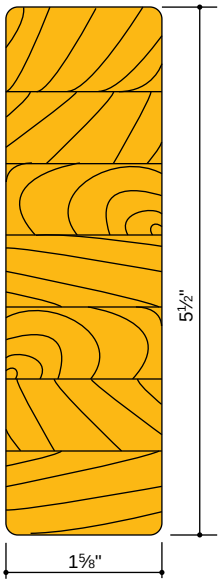
8561 Oak 4.75 lb/ft
8562 Walnut 4.75 lb/ft



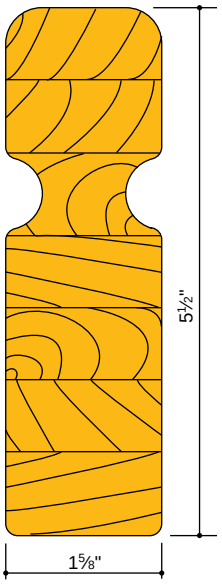
8571 Oak/Aluminum 3.34 lb/ft
8572 Walnut/Aluminum 3.34 lb/ft
Aluminum spine has a clear anodized finish.



8541 Oak 2.06 lb/ft
8542 Walnut 2.06 lb/ft

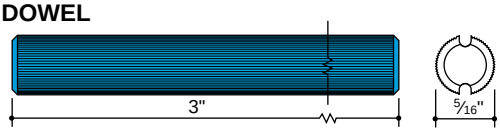


8521 Oak 3.48 lb/ft
8522 Walnut 3.48 lb/ft
8523 Ash 3.48 lb/ft



8591 Oak 3.31 lb/ft

DOWEL



800 Aluminum
For use with Acrylic/Wood handrail

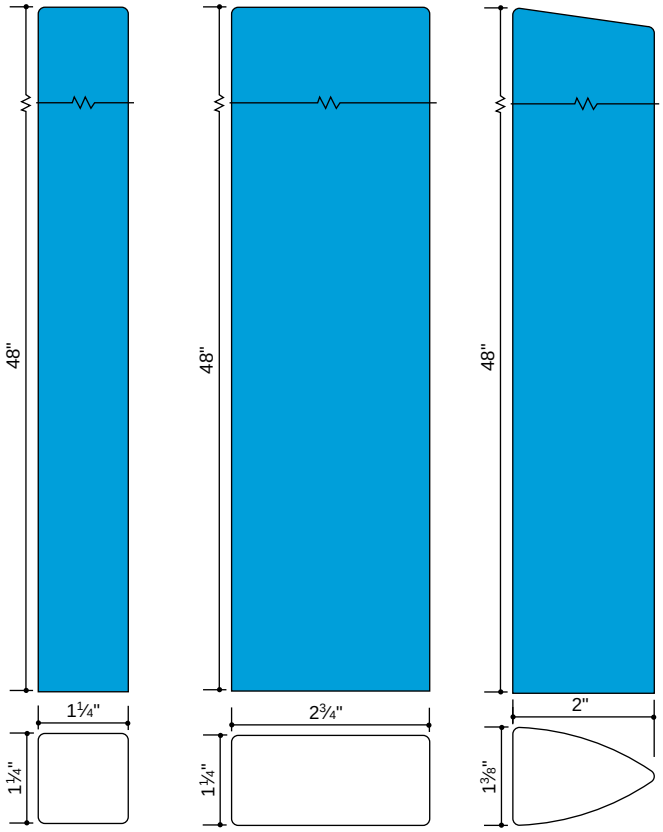
SCOTCH-WELD® EPOXY ADHESIVE

Cans – 1-qt. total Tubes – 4-oz. total

Catalog No. 3M EC-2216 B/A, Clear Amber: Recommended for splice joints using connector sleeves.

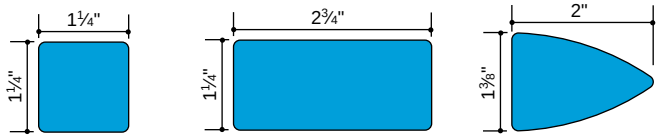
PRECUT ALUMINUM POSTS (6063-T52)

Upper end has been trimmed as shown – no post cap is required. Lower end may be cut to achieve required post height. Drill and tap to receive **Carlstadt®** handrail brackets.



423 Aluminum **424** Aluminum **427** Aluminum

BAR STOCK FOR RAILING POSTS (6063-T52)

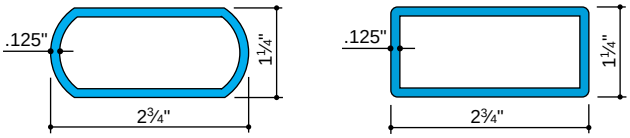


6423 Aluminum 1.876 lb/ft

6424 Aluminum 4.124 lb/ft

6427 Aluminum 2.256 lb/ft

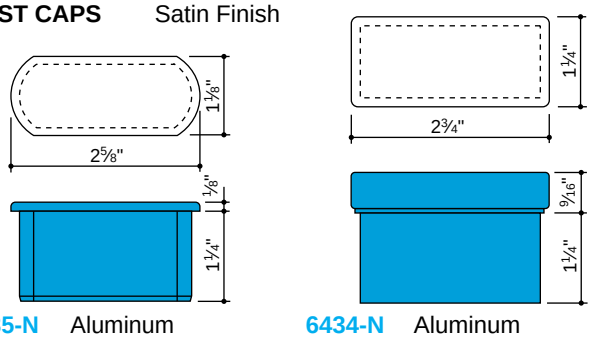
TUBING FOR RAILING POSTS (6063-T6)



6435 Aluminum 1.075 lb/ft

6434 Aluminum 1.876 lb/ft

POST CAPS Satin Finish



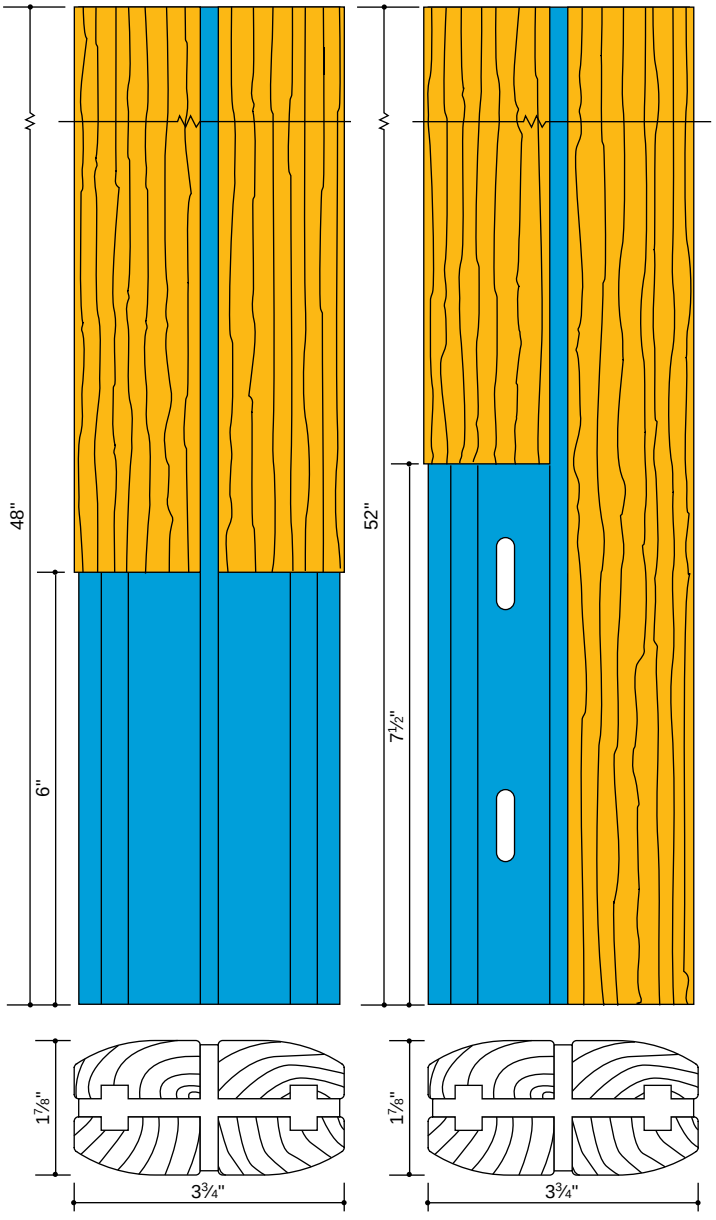
6435-N Aluminum

6434-N Aluminum

PRECUT ACRYLIC/WOOD POSTS

On **facia mounted posts** **881** and **882**, lower end of metal spine is partly exposed to accept facia flange. Provision is made for vertical adjustment. Upper end of post is trimmed to required height before post cap is attached.

On **floor mounted posts** **871** and **872**, 6" of aluminum spine is exposed for grouting in concrete. For surface mounting with heavy-duty floor flange, cut off exposed end of spine or cut post from full 16' length.



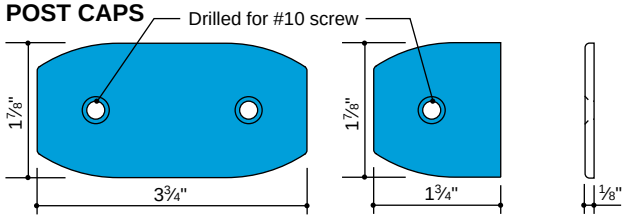
871 Oak
872 Walnut

881 Oak
882 Walnut

Slotted holes for vertical adjustment

Aluminum spine has a clear anodized finish.

POST CAPS



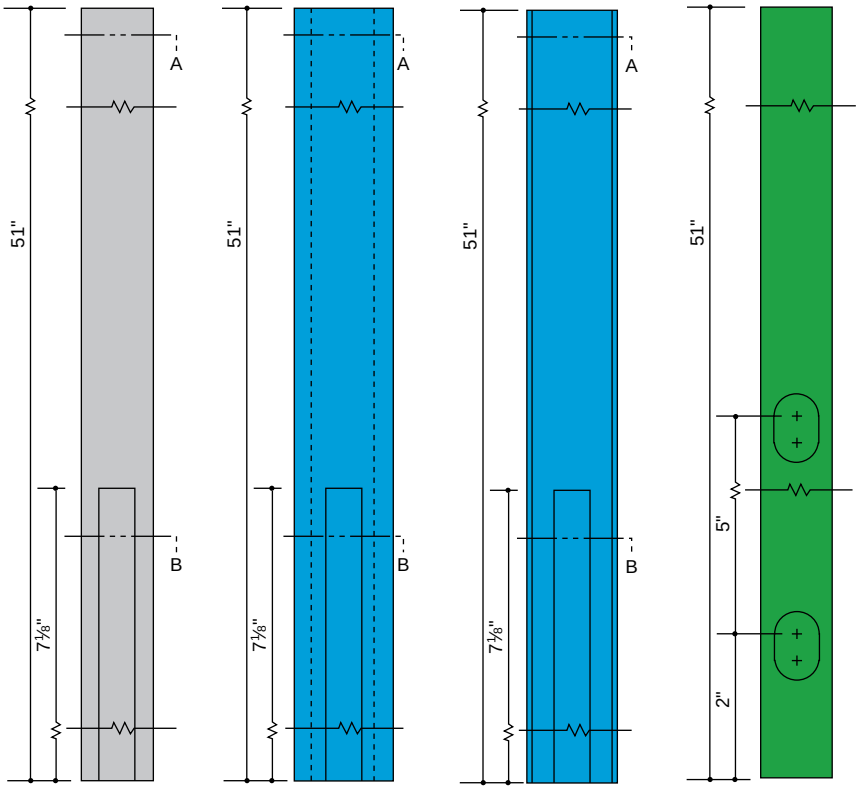
Upper Cap
874 Aluminum
For posts **871**, **872**, **881** and **882**

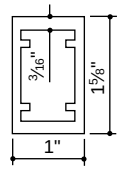
Lower Cap
875 Aluminum
For posts **881** and **882**

Aluminum items are suitable for anodizing.

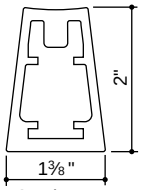
PRECUT POSTS for facia mounting, 51" lengths, mill finish

Aluminum 6063-T6 **Bronze** CDA 385 **Stainless** Type 304

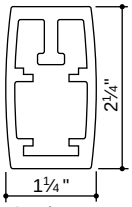




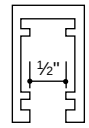
Section A



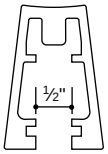
Section A



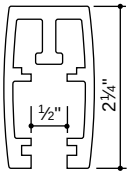
Section A



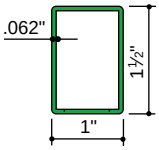
Section B



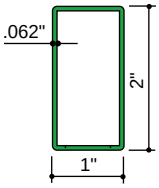
Section B



Section B



230 Stainless•



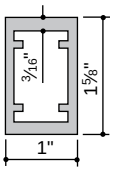
430 Aluminum*
830 Bronze*

458 Aluminum*

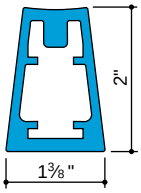
459 Aluminum*

280 Stainless•

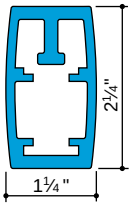
TUBING FOR FLOOR MOUNTED POSTS 20' lengths, mill finish



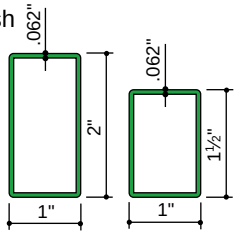
6430 Aluminum
.899 lb/ft
4830 Bronze
2.950 lb/ft



6458 Aluminum
1.326 lb/ft



6459 Aluminum
1.240 lb/ft

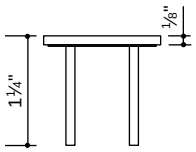


Stainless Tubing

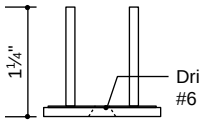
* Cut and machined for use with facia brackets (see page 38). • Cut and punched for facia block (see page 39).
Aluminum items are suitable for anodizing including most of the hardcoat color finishes.
Properties of sections for handrail posts are listed on page 117.
Refer to pages 114 to 123 for detailed information on the structural design of handrail installations.

POST CAPS Satin Finish

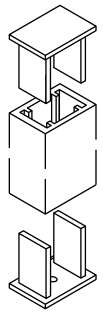
Caps for hollow **Carlstadt®** posts have a flange extending inside to receive and support the thread of the bracket arm.

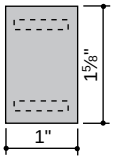


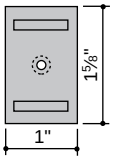
UPPER CAP



LOWER CAP



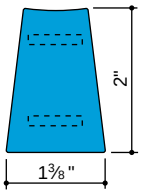


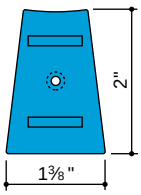


Upper Cap
431 Aluminum
831 Bronze

Lower Cap
433 Aluminum
833 Bronze

For Aluminum posts **430** and **6430** and Bronze posts **830** and **4830**

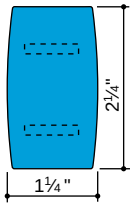


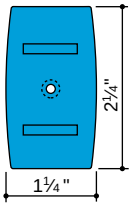


Upper Cap
468 Aluminum

Lower Cap
469 Aluminum

For Aluminum posts **458** and **6458**



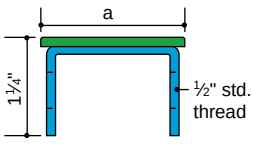


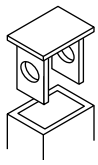
Upper Cap
451 Aluminum

Lower Cap
453 Aluminum

For Aluminum posts **459** and **6459**

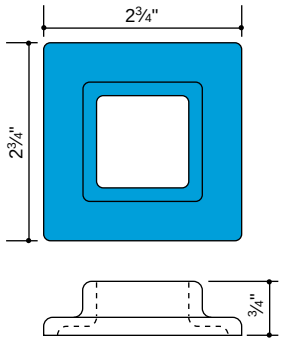
UPPER POST CAP Satin Finish



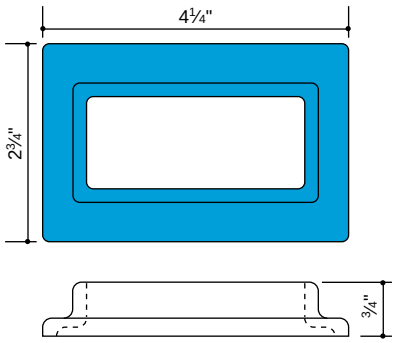


Upper Cap		a	for post
231	Stainless	1½"	**230**
284	Stainless	2"	**280**

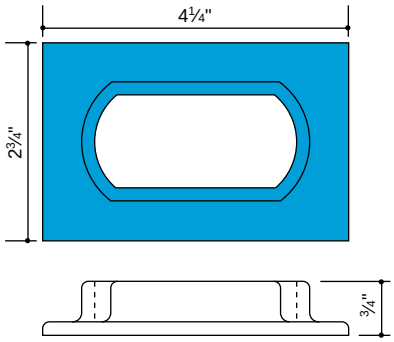
COVER FLANGES Satin Finish



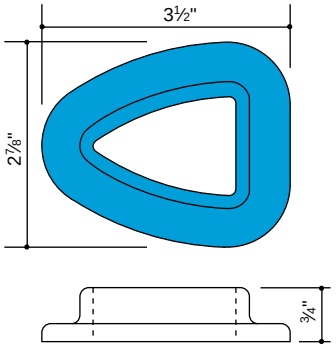
773 Aluminum
For Aluminum posts **423** and **6423**



774 Aluminum
For Aluminum posts **424**, **6424** and **6434**



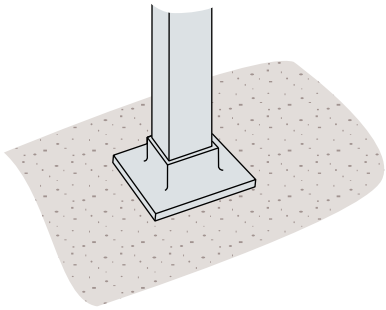
775 Aluminum
For Aluminum post **6435**

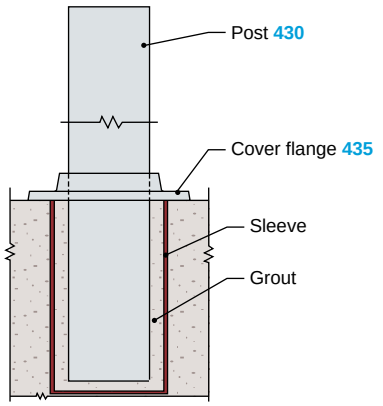


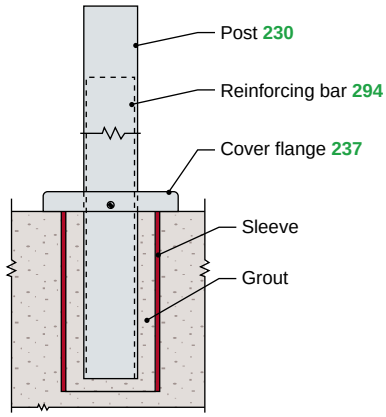
777 Aluminum
For Aluminum posts **427** and **6427**

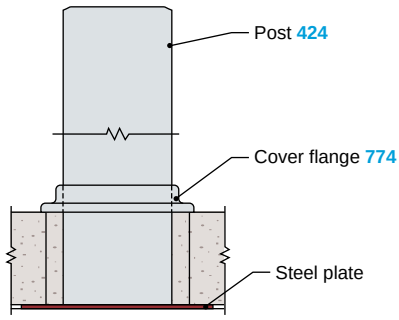
COVER FLANGE INSTALLATION DETAILS

Post is set in metal sleeve in concrete and grouted. Embed post to a depth of 4" to 6" in slab. Allow for a 1" grout pad beneath post. Sleeve should provide ample clearance around post for grouting cement and to allow for adjustment to field variations. For outdoor installations, weep holes should be drilled in the posts to prevent water from collecting below ground level. A cover flange conceals the floor opening.

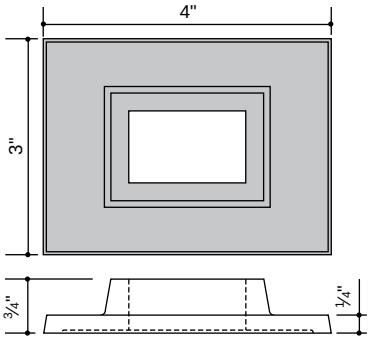




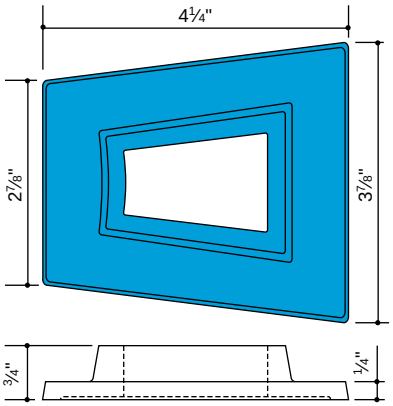




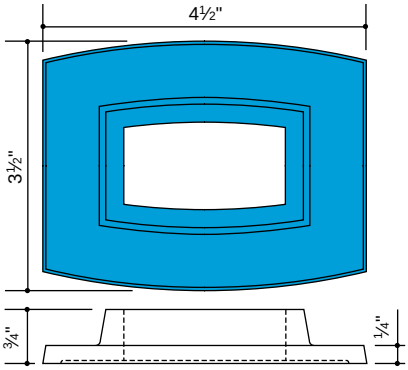
Post anchored to subtread or platform



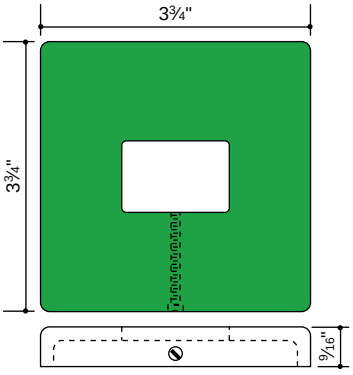
435 Aluminum for post **430** or **6430**
835 Bronze for post **830** or **4830**



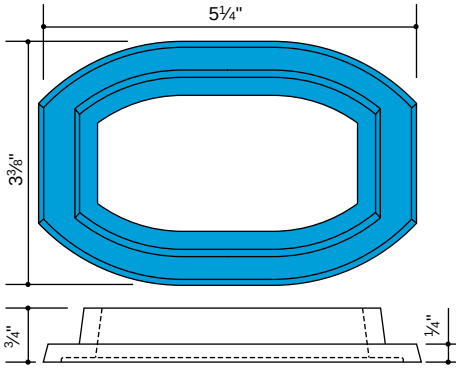
495 Aluminum
For Aluminum posts **458** and **6458**



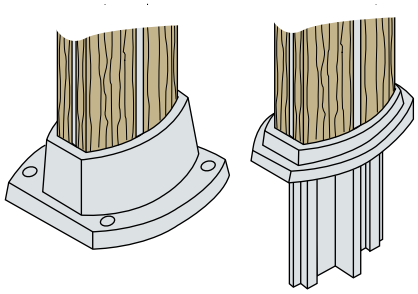
496 Aluminum
For Aluminum posts **459** and **6459**



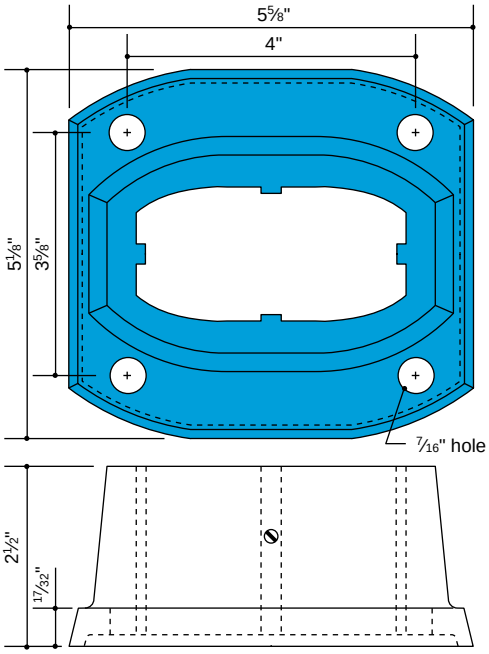
237 Stainless for post **230** or tubing
285 Stainless for post **280** or tubing



877 Aluminum
For Acrylic/Wood posts



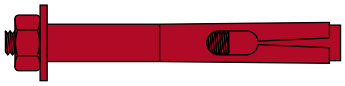
HEAVY-DUTY FLOOR FLANGE



876 Aluminum
For Acrylic/Wood posts

This heavy-duty floor flange is for use with Acrylic/Wood posts when embedment is not possible, but additional lateral bracing or end support is usually required.

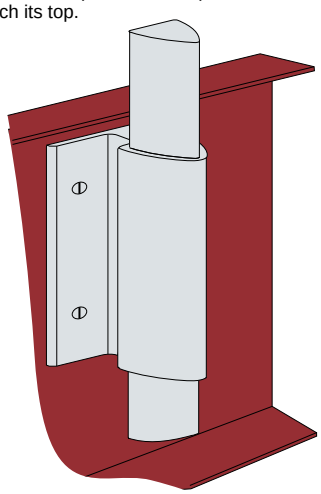
SLEEVE ANCHOR BOLT ⅜" × 3"

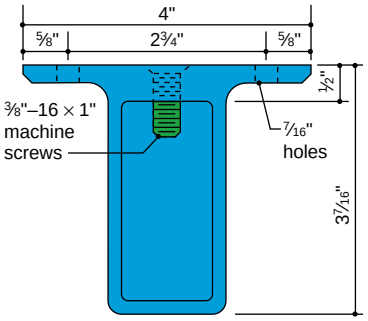


The sleeve anchor bolt is an all steel, rust-proofed multipurpose anchor bolt intended for use in a wide range of masonry materials. The ⅜" bolt is recommended for use with heavy-duty floor flange **876**.

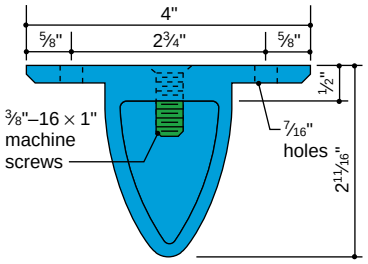
FACIA FLANGES

Sleeve type facia flanges are provided with two clearances for mounting on solid or channel facias and stringers. The post slips into the pocket of the facia flange and is anchored with concealed set screws. The bottom extension of each facia flange matches the profile of the post and is trimmed to match its top.

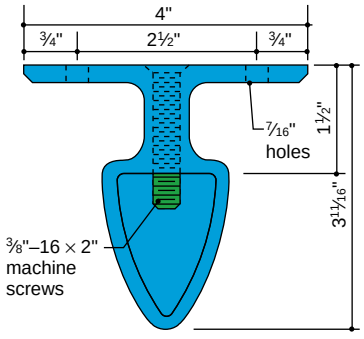




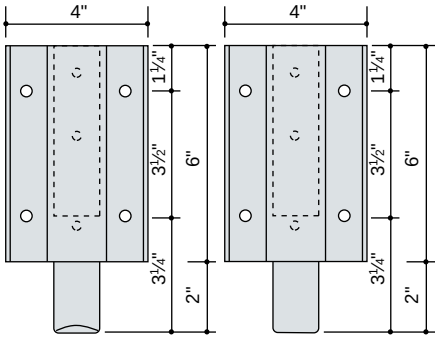
408 Aluminum
For Aluminum posts **424**, **6424** and **6434**



425 Aluminum
For Aluminum posts **427** and **6427**

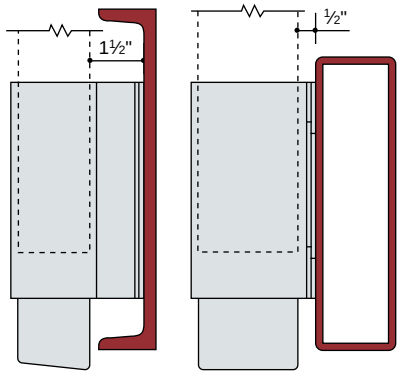


426 Aluminum
For Aluminum posts **427** and **6427**



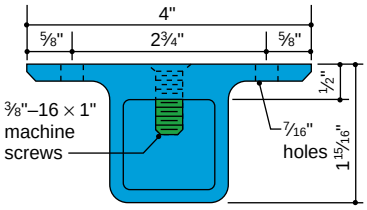
Elevation of **425** and **426**

Elevation of **408**, **421** and **422**

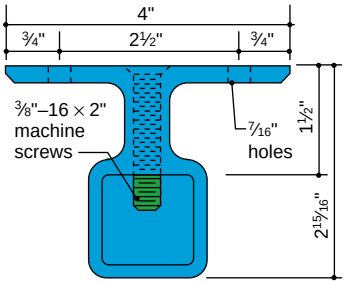


Facia flange **426** used with channel stringer. Facia flange **422** is similar.

Facia flange **408** used with box stringer. Facia flanges **421** and **425** are similar.



421 Aluminum
For Aluminum posts **423** and **6423**

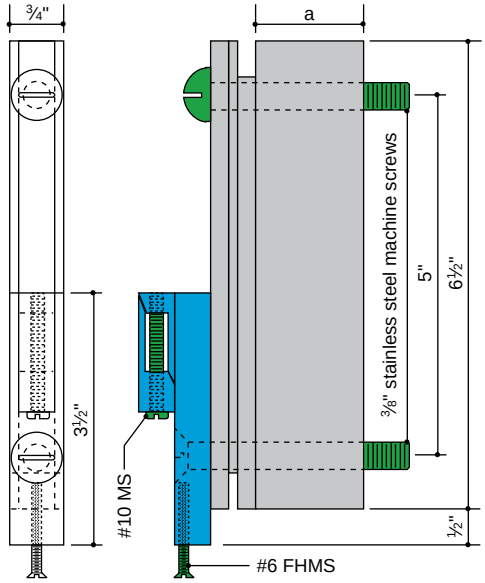


422 Aluminum
For Aluminum posts **423** and **6423**

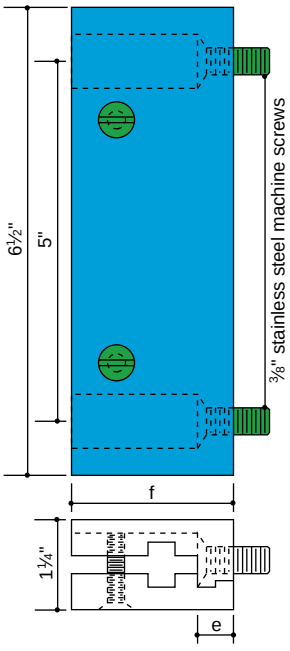
Carlstadt® Facia Brackets & Reinforcing Bars

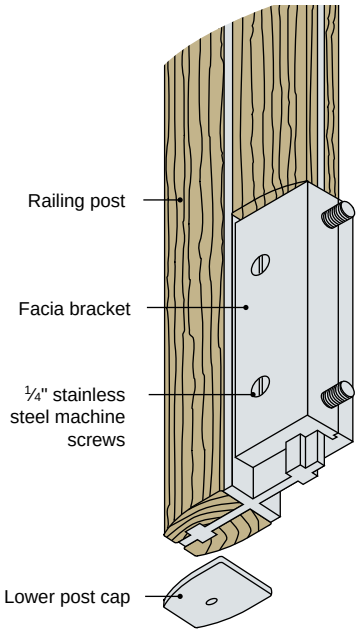
FACIA BRACKETS

Facia brackets are available for concealed fastening of acrylic/wood and hollow posts of aluminum, bronze and stainless steel – both for solid and channel facias. The fastening mechanism provides for vertical field adjustment.



For Aluminum posts 430, 458 and 459:		a
428	Aluminum for box stringers	½"
429	Aluminum for channel stringers	1½"
For Bronze post 830:		
838	Bronze for box stringers	½"
839	Bronze for channel stringers	1½"

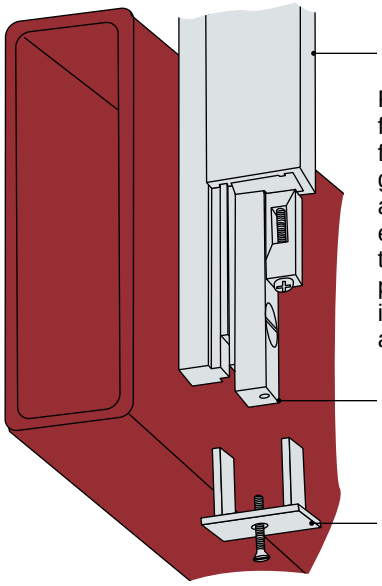




		e	f
878	Aluminum	½"	2¼"
879	Aluminum	1½"	3¼"

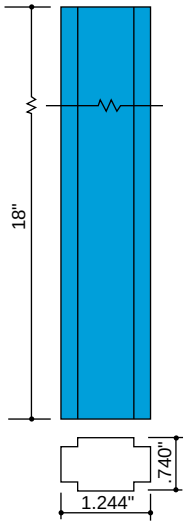
For use with posts 881 and 882

FACIA BRACKET ASSEMBLY DETAIL

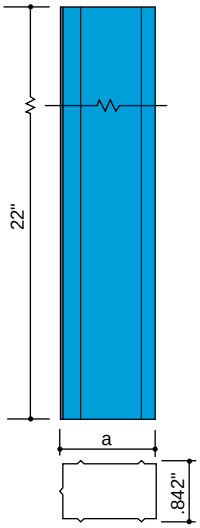


Facia bracket is bolted to facia. Slotted post (select from page 35) slides into grooves on facia bracket and is positioned for proper height. Wedge is then tightened to secure post in position. Lower post cap is attached, completing assembly.

REINFORCING BARS



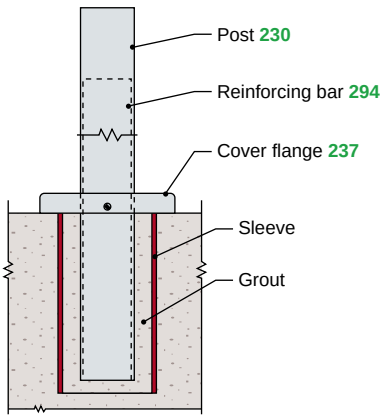
436E Aluminum (6063-T6) For posts 430, 458, 459 and 830



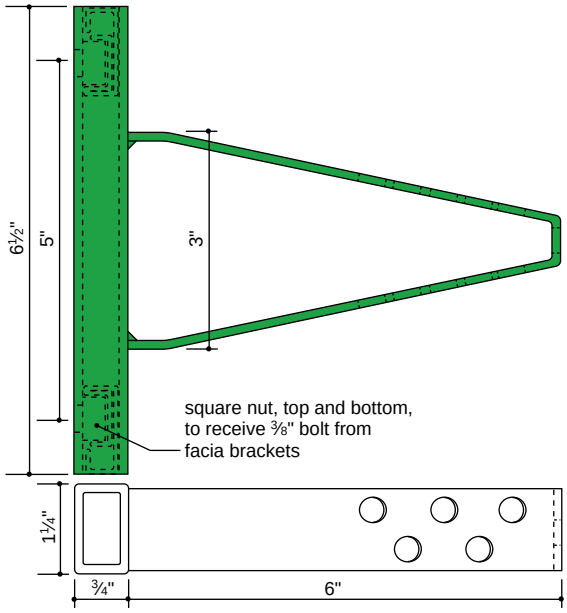
		a
294	Aluminum for post 230	1.34"
295	Aluminum for post 280	1.84"

FLOOR MOUNTED POST DETAIL

Reinforcing bar is placed within mating hollow post. Post is set in metal sleeve in concrete and grouted. Embed post to a depth of 4" to 6" in slab. Allow for a 1" grout pad beneath post. Sleeve should provide ample clearance around post for grouting cement and to allow for adjustment to field variations. For outdoor installations, weep holes should be drilled in the posts to prevent water from collecting below ground level. A cover flange conceals the floor opening.



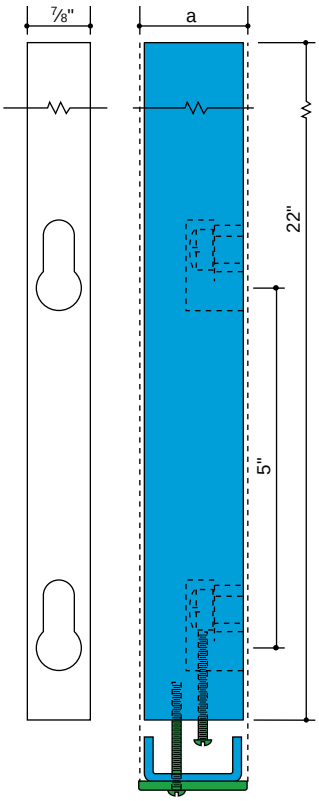
POST ANCHOR FOR CAST STEPS



227 Stainless
For use with Aluminum, Bronze and Stainless Steel railings

Post anchor **227** can be used with facia brackets **428**, **429**, **838**, **839**, **878**, **879**, **228** or **229** to mount **Carlstadt**® Aluminum, Bronze, Acrylic/Wood or Stainless Steel posts. Cast post anchor into concrete with minimum slab thickness of 3" and minimum compressive strength of 3500 psi. Maximum recommended post spacing for 3" slabs is 30"; for slabs 4" thick and thicker, recommended maximum post spacing is 48".

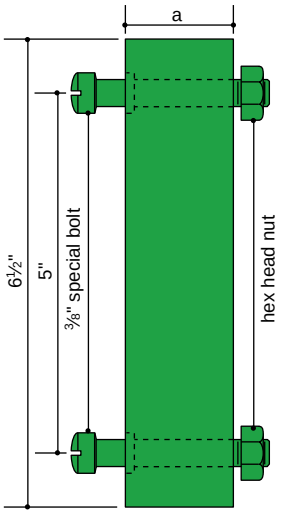
ANCHOR BAR WITH LOWER POST CAP



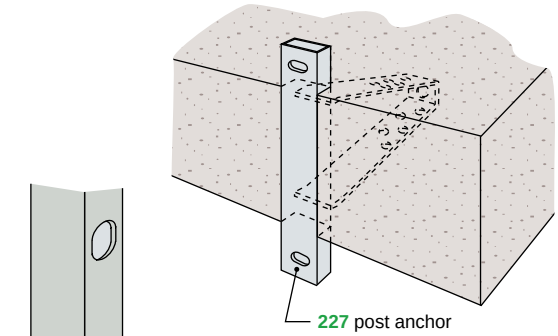
		a	post
233	Aluminum	1⅜"	**230**
(With Stainless Steel lower post cap*)			
283	Aluminum	1⅞"	**280**
(With Stainless Steel lower post cap*)			

* Satin finish

FACIA SPACER BLOCK

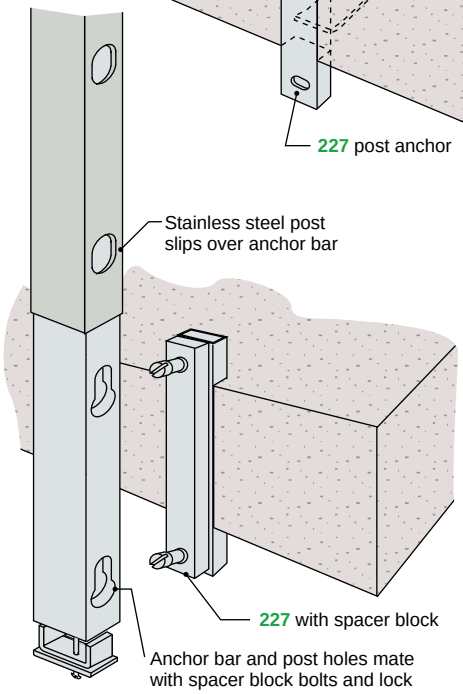


		a
228	Stainless	½"
(Use with box stringers)		
229	Stainless	1½"
(Use with channel stringers)		



POST ANCHOR INSTALLATION

Anchor is embedded in slab with anchor centered vertically in slab thickness. Front face of anchor should be flush with edge of slab. Square nuts move freely in pockets, receive ⅜" mounting bolts of **Carlstadt**® facia brackets. Wide slots provide for lateral adjustment and vertical alignment.

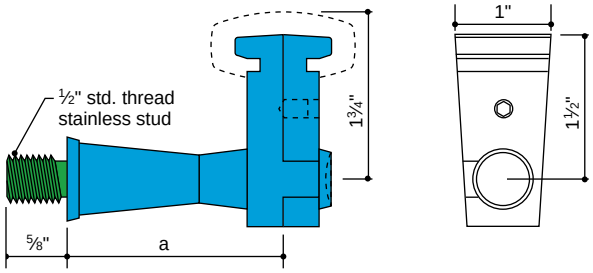


FACIA SPACER BLOCK ASSEMBLY

The spacer block is first fastened to the stringer. The keyhole in the anchor bar aligns with the holes in the tubular post. Post and anchor bar assembly are then fed over the bolt heads, into the keyhole slot and seated manually. Final tightening is achieved by drawing up the tightening screw in the lower post cap.

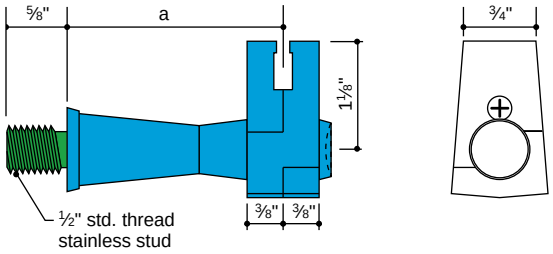
CARLSTADT® *Self-Aligning* POST BRACKETS

Satin Finish



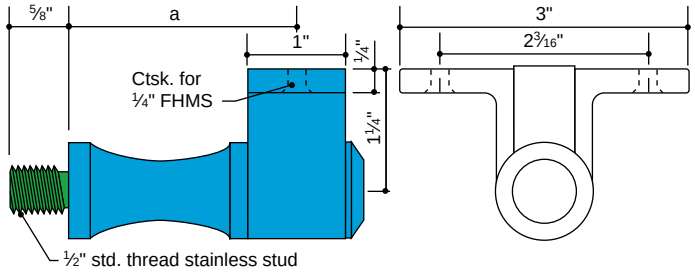
For use with **Carlsrail®** handrail moulding

		a
171	Aluminum	2¼"
172	Aluminum	2¾"



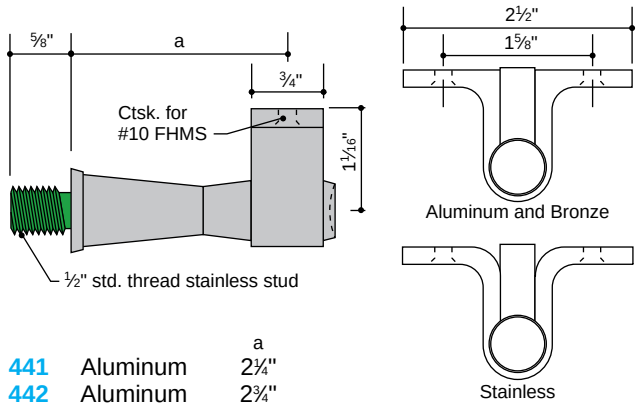
For use with **Colorail®** support section or T-handrail moulding

		a
439	Aluminum	2¼"
440	Aluminum	2¾"



For use with **Carlstadt®** handrail moulding **6901** or **6902**

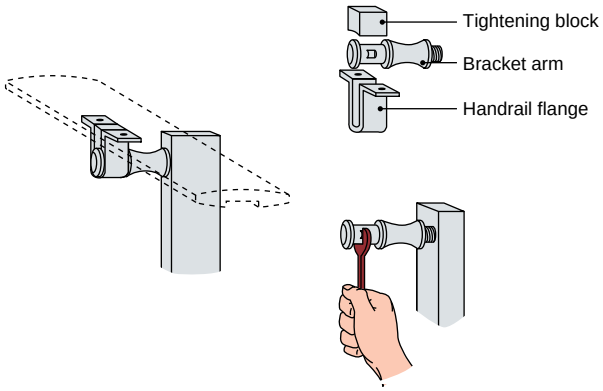
		a
309	Aluminum	3¼"
312	Aluminum	2⅜"



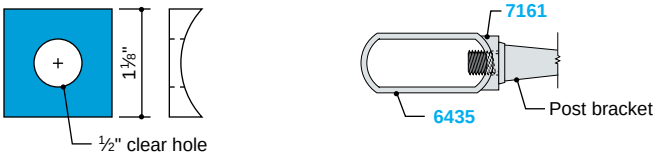
		a
441	Aluminum	2¼"
442	Aluminum	2¾"
841	Bronze	2¼"
241	Stainless	2¼"

ADJUSTABLE BRACKET DETAIL

Post and upper post caps must be drilled and tapped to accept bracket arm. Recess of bracket arm has flat sides to accommodate wrench, which permits tightening without marring exposed surfaces. Handrail flange tilts to adjust to stair angle and is attached to handrail with machine screws. Pressure on tightening block prevents looseness and rattling.

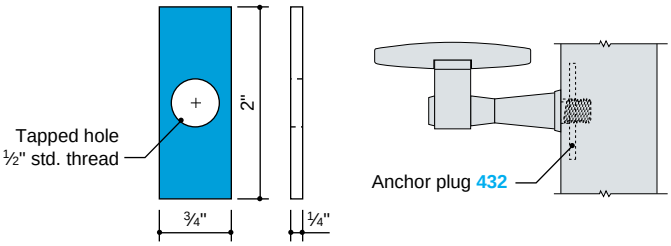


BRACKET POST ADAPTER

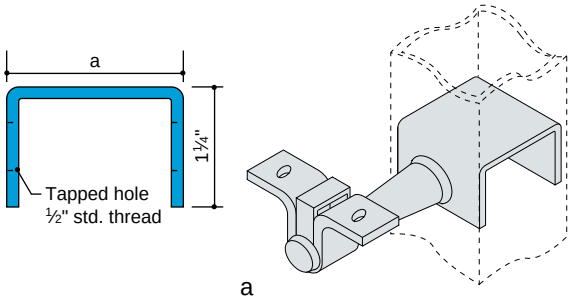


7161 Aluminum
For post **6435** or 1¼" pipe posts

BRACKET ANCHOR PLUGS



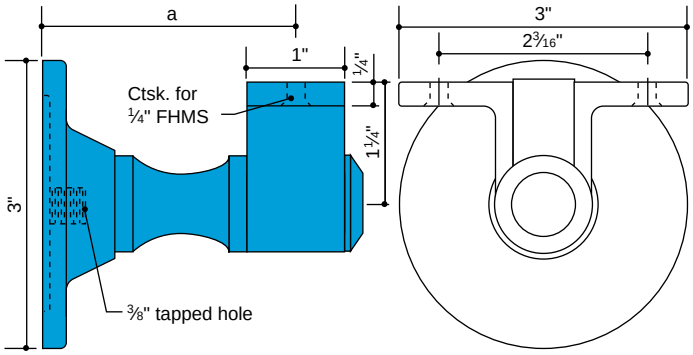
432 Aluminum
For posts **430**, **458**, **459** and **830**



		a	
238	Aluminum	1.34"	For use with stainless post **230**
279	Aluminum	1.84"	For use with stainless post **280**

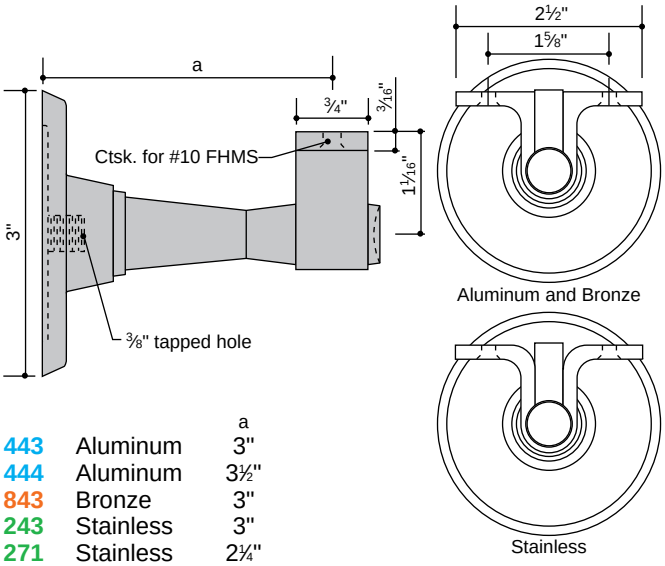
BRACKET EXTENSIONS – see page 44.

CARLSTADT® *Self-Aligning* WALL BRACKETS
Satin Finish



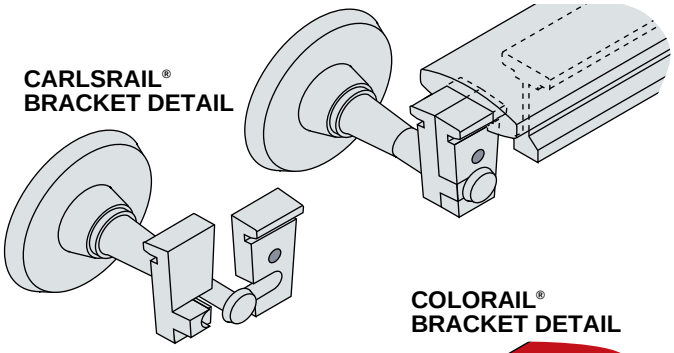
For use with **Carlstadt®** handrail moulding **6901** or **6902**

		a
313	Aluminum	2⅝"
314	Aluminum	3⅛"

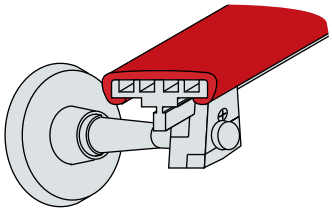


		a
443	Aluminum	3"
444	Aluminum	3½"
843	Bronze	3"
243	Stainless	3"
271	Stainless	2¼"

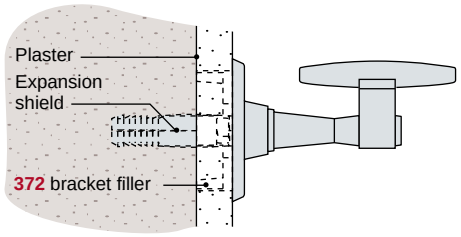
CARLSRAIL® BRACKET DETAIL



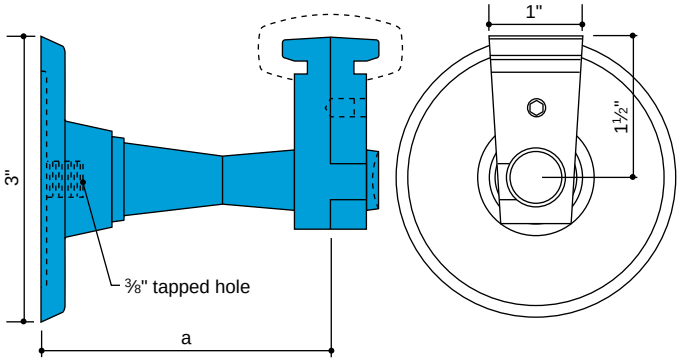
COLORAIL® BRACKET DETAIL



WALL BRACKET DETAIL

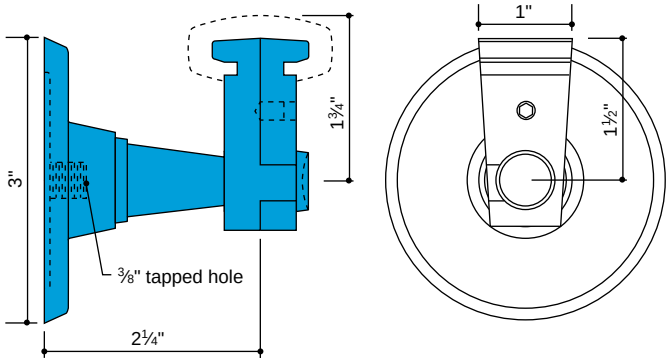


Wall brackets match the post brackets except that they come with a wall flange. Rear of wall bracket is tapped to receive an anchoring bolt. Wall bracket arm and flange may be disassembled to permit insertion of bracket extension (see p. 44).



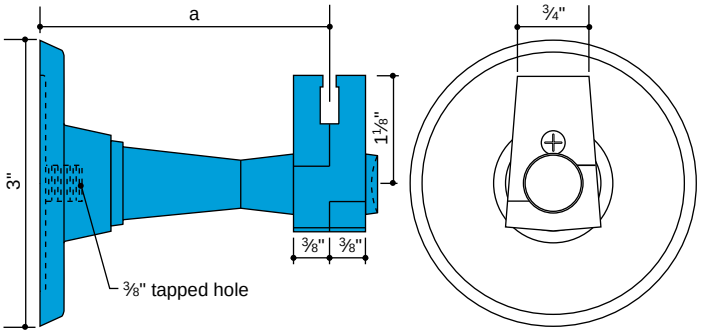
For use with **Carlsrail®** handrail moulding

		a
173	Aluminum	3"
174	Aluminum	3½"



For use with **Carlsrail®** handrail moulding

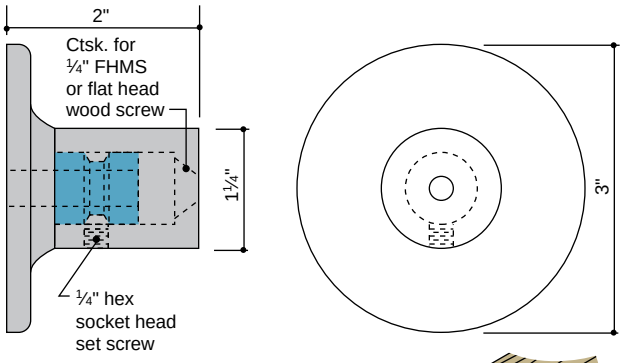
175	Aluminum



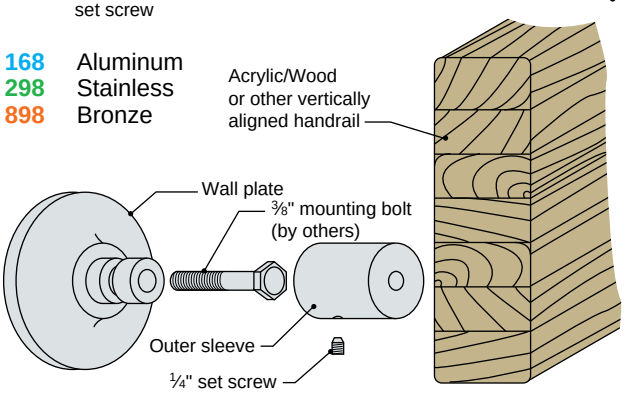
For use with **Colorail®** support section or T-handrail moulding

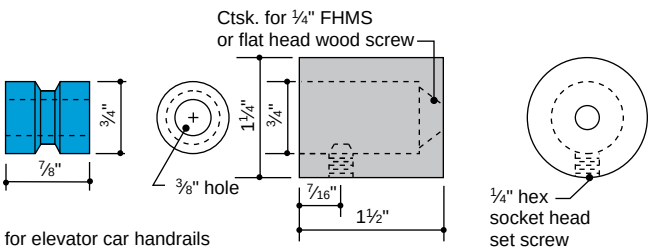
		a
418	Aluminum	3"
419	Aluminum	3½"

TWO-PIECE MOUNTING BRACKETS Satin Finish



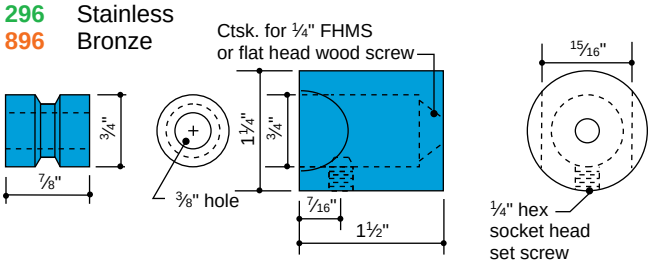
168 Aluminum
298 Stainless
898 Bronze



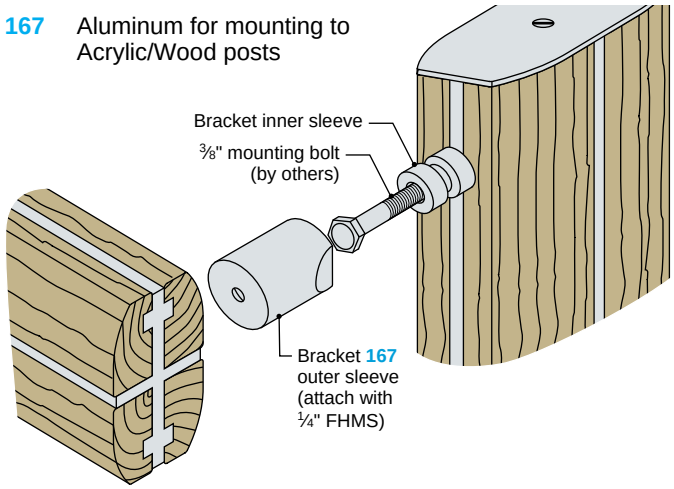


for elevator car handrails

166 Aluminum
296 Stainless
896 Bronze

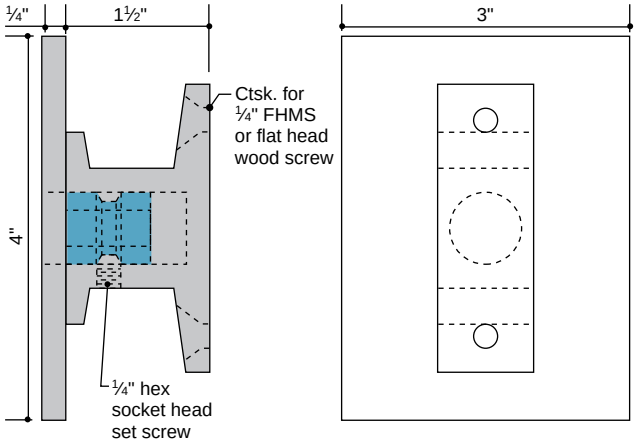


167 Aluminum for mounting to Acrylic/Wood posts

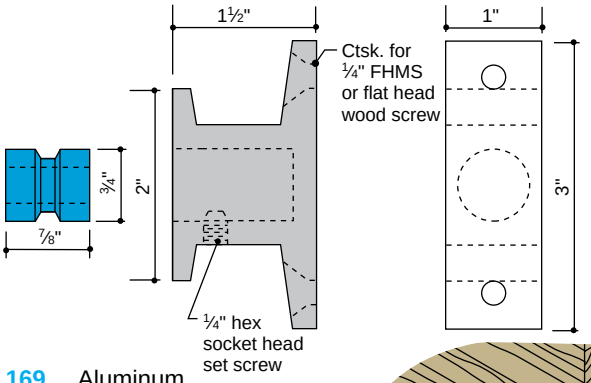


TWO-PIECE MOUNTING BRACKETS Satin Finish

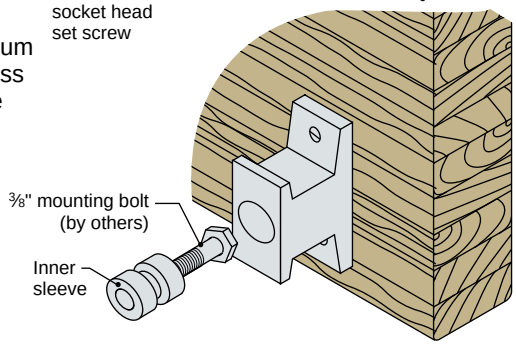
For wide wood handrails



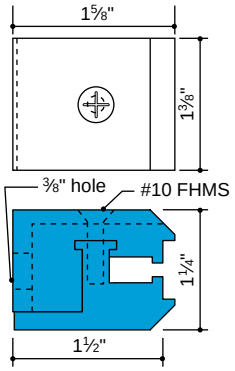
160 Aluminum
290 Stainless
890 Bronze



169 Aluminum
299 Stainless
899 Bronze



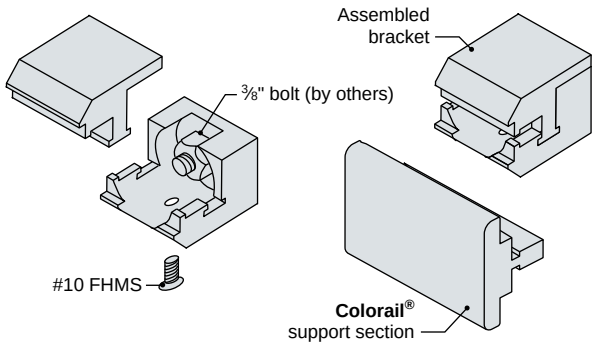
VERTICAL MOUNTING BRACKET Satin Finish



Vertical mounting bracket **151** is designed for mounting handrail on edge to provide a wall guard or *bumper*. **Colorail®** support section **6440**, **6441**, **6442** or **6443** and metal T-handrail **6402**, **6404**, **6405** or **6407** can be mounted without drilling and tapping. Bracket is also suitable for mounting handrail on top of a parapet or wall.

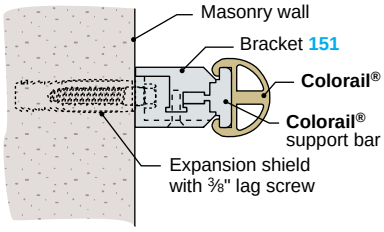
151 Aluminum

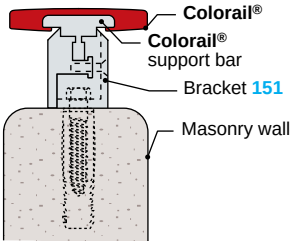
ASSEMBLY DETAIL

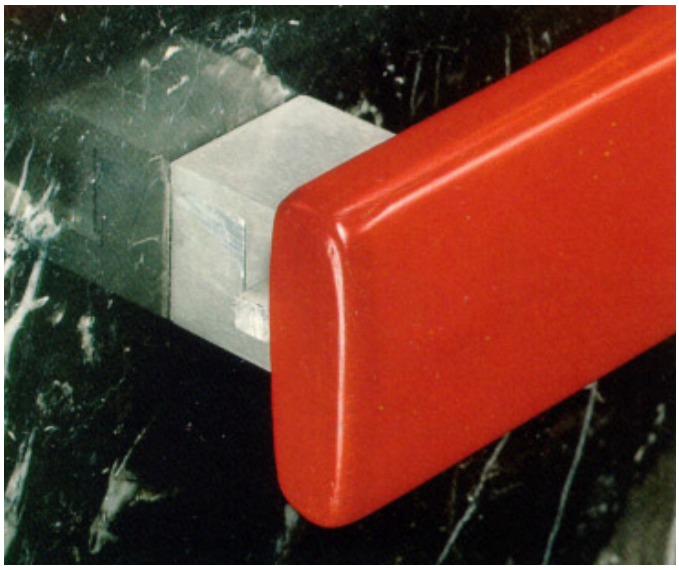


Use ⅜" machine screw, stud or hex head bolt for fastening to wall.

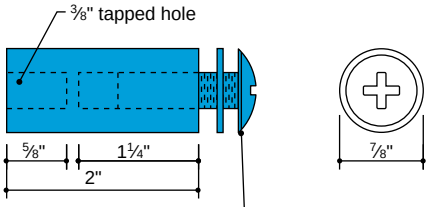
INSTALLATION DETAILS



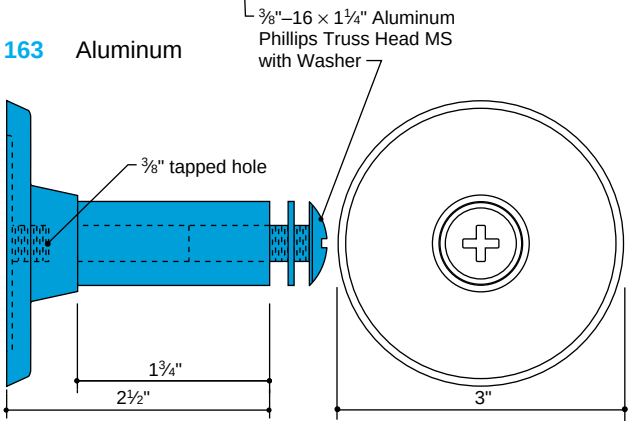




THREADED BUSHING BRACKETS Satin Finish

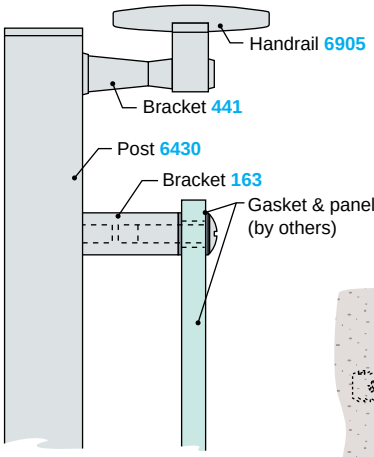


163 Aluminum

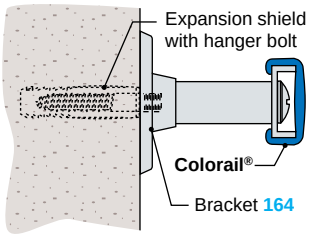


164 Aluminum

INSTALLATION DETAILS

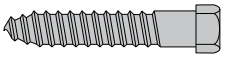


Threaded Bushing Brackets are used with threaded studs, machine screws or bolts to install handrails or panels. Brackets may be cut to length as required. Brackets are furnished with aluminum phillips truss head machine screws and washers.



BOLTS AND ANCHORS – for handrail wall brackets.

Threaded Stud – Steel
⅜" - 16 x 1½"

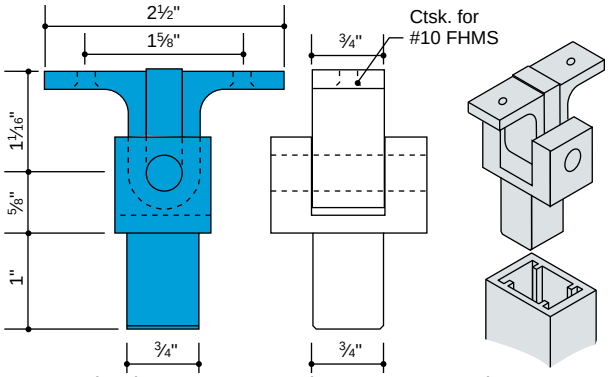


Hex Head Lag Screw
Aluminum – ⅜" x 2"
Stainless – ⅜" x 2"

Expansion Shield
For setting ⅜" lag screws and hanger bolts in concrete, brick or stone. Drill hole size of ⅝" diameter by 2½" deep.

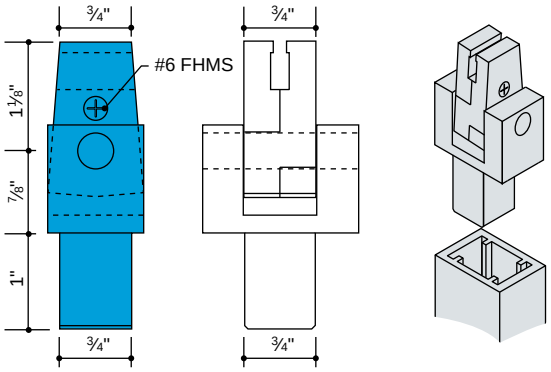
Hanger Bolt
Steel – ⅜" x 3"

CENTER POST BRACKETS Satin Finish

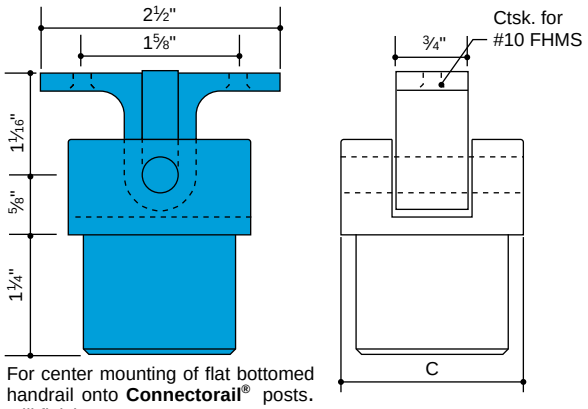


162 Aluminum Fits posts **430** and **6430**

Center post brackets permit handrail to be centered directly over post, yet allow it to tilt to conform to stair incline. Bracket is secured to post with pin or screw.



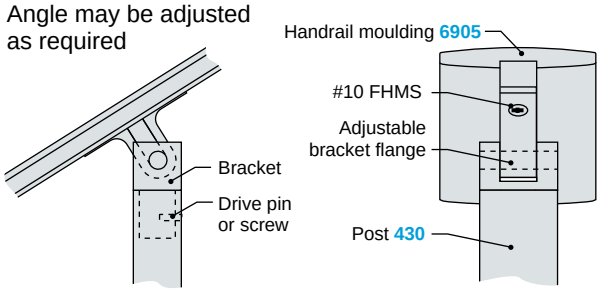
152 Aluminum for **Carlstadt®** T-handrail and **Colorail®** support bars. Fits posts **430** and **6430**



For center mounting of flat bottomed handrail onto **Connectorail®** posts. Mill finish.

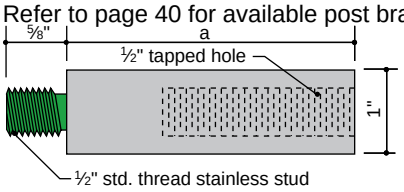
		Pipe	Sch.	c
144	Aluminum	1¼"	40	1.660"
145	Aluminum	1½"	40	1.900"

Angle may be adjusted as required



POST BRACKET EXTENSIONS Satin Finish

Refer to page 40 for available post brackets.

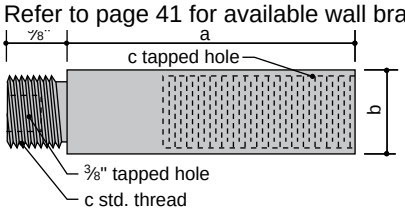


		a
462	Aluminum	1¾"
463	Aluminum	3"
862	Bronze	1¾"
863	Bronze	3"
245	Stainless	1¾"
246	Stainless	3"

Extensions may be cut to length to suit individual conditions.

WALL BRACKET EXTENSIONS Satin Finish

Refer to page 41 for available wall brackets.



For use with **313** and **314** wall brackets:

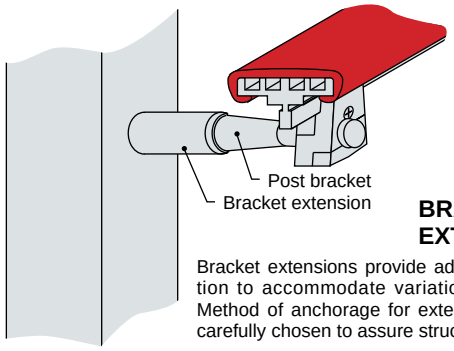
		a	b	c
414	Aluminum	1¾"	1⅛"	⅞"
415	Aluminum	3"	1⅛"	⅞"

For use with other **Carlstadt®** wall brackets:

464	Aluminum	1¾"	1"	¾"
465	Aluminum	3"	1"	¾"
864	Bronze	1¾"	1"	¾"
865	Bronze	3"	1"	¾"
247	Stainless	1¾"	1"	¾"
248	Stainless	3"	1"	¾"

Extensions may be cut to length to suit individual conditions.

Note: Extending the reach of a handrail bracket reduces its load-bearing capacity. To compensate for the reduced strength, the number of brackets may be increased and their spacing reduced.

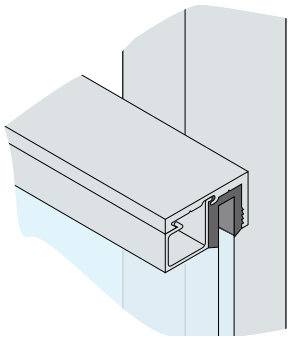


BRACKET WITH EXTENSION DETAIL

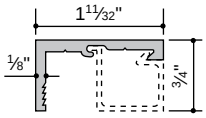
Bracket extensions provide additional horizontal projection to accommodate variations in wall construction. Method of anchorage for extended brackets should be carefully chosen to assure structural adequacy.

GLAZING MEMBERS

Aluminum and bronze glass stop/snap-in and flexible PVC glazing channel serve to mount panels of ¼" glass, plastic, wire mesh or other material.

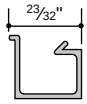


GLASS STOP



8106 Aluminum* .276 lb./ft.
4506 Bronze** .950 lb./ft.
* 20' lengths ** 16' lengths

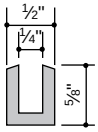
SNAP-IN



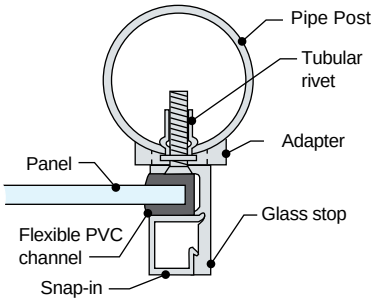
8107 Aluminum* .138 lb./ft.
4507 Bronze** .510 lb./ft.

FLEXIBLE PVC CHANNEL

50' coils



8708 Flexible PVC 90 durometer



UMBACH & VOWELLS BUILDING
Evansville, Indiana
Arch: Jack R. Kinkel & Son
Fabr: Tuttle Aluminum & Bronze, Inc.

COLORAIL® ACCESSORY EQUIPMENT

Although **Colorail®** can be fabricated and installed without special tools, the equipment shown here will greatly simplify and speed up the procedure. Labor costs can be substantially reduced by use of these convenient aids. Equipment is available from stock for immediate delivery.

COLORAIL® WELDING IRON

Electric unit for splicing and capping features a broad blade to permit simultaneous heating of surfaces to be welded. Unit eliminates heating torches and provides more uniform heat than heated knife blade. Cradle and cleaning brush included.

Note: Blade of welding iron should be cleaned after each weld with cleaning brush provided.

COLORAIL® HEATING UNIT

A lightweight, efficient hot-air blower with sleeve. **Colorail®** is fed through the sleeve to heat material prior to installation onto its support bar.

INSTALLATION

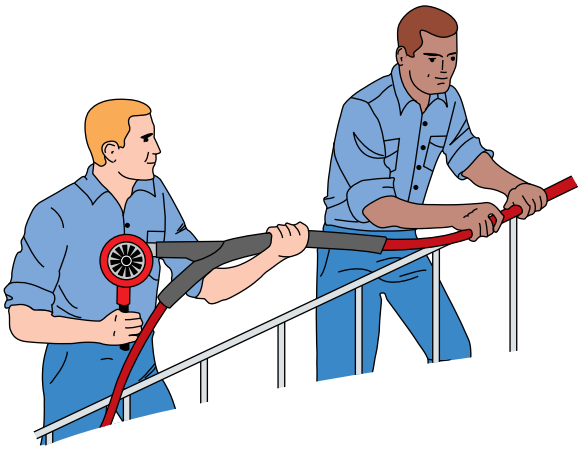
SPECIAL CHARACTERISTICS

Colorail® is a thermoplastic which can be easily worked when it is heated. Its installation is simple, requiring no special training or tools other than a heating unit and welding iron. However, a few points must be emphasized. The property which makes **Colorail®** so easy to install – its *plastic memory*, or tendency to return to its original shape after it cools – requires special attention during installation. The following precautions are especially important.

1. **PROVIDE SUFFICIENT LENGTH:** Do not cut the material too short and then try to stretch it to fit. In such cases it will eventually pull away from the ends of the railing leaving an unsightly gap.
2. **DO NOT BEND TOO SHARPLY:** Bends and curves can be made without difficulty but, to counteract **Colorail's®** tendency to return to its former shape after cooling, turning radii should be kept as large as possible. When sharp turns are unavoidable – especially when they occur near the end of a railing – the moulding must be anchored securely to its support. This can be done by welding a strap of the plastic material across the underside of the rail. At rail ends a welded cap is usually sufficient. Under no circumstances should **Colorail®** be bent laterally to a centerline radius of less than three times its width, since this will cause it to buckle or lift off its support. Possible problems in forming small radius lateral bends can be avoided by using mitered corners.
3. **PROVIDE SUFFICIENT SUPPORT:** Because **Colorail®** is somewhat flexible even at room temperatures, it must be given adequate support. When a handrail is supported only at intervals, as in wall rails or parallel bar railings, the supporting bar must be rigid enough to prevent **Colorail®** from sagging. An aluminum flat bar is not sufficient unless it is reinforced on the underside. T-shaped **Colorail®** support sections are recommended for installations with widely spaced supports.
4. **IN ESTIMATING COSTS:** Allow sufficient additional time for joints, miters and end caps.

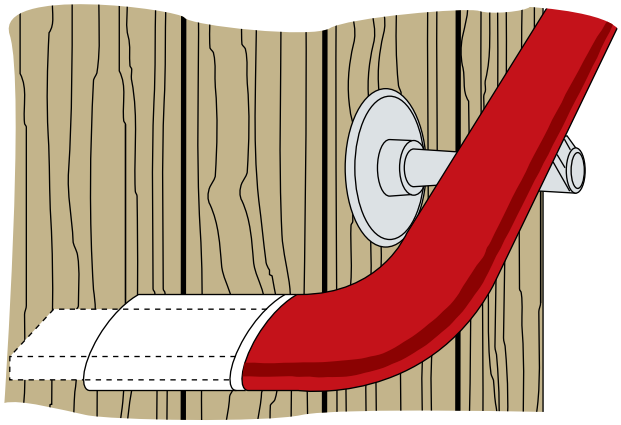
INSTALLATION

1. **CUTTING:** Material can be cut with a hand saw when cold or with a sharp knife when hot.
2. **MOUNTING:** When heated, the handrail becomes as soft and pliable as rubber. Handrail is heated to not over 165°F by means of a hot-air blower. It can then be fitted easily over the top bar of the railing. Cut handrail long enough so that it does not have to be stretched to fit, otherwise **Colorail®** may subsequently pull away from the ends.



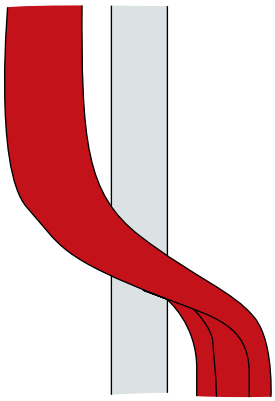
NOTE: A great deal of time and effort may be saved by preheating the handrail. This can be done by submerging it in hot water or by keeping it in a hot-air chamber of sheet metal with an opening for the **Colorail®** heating unit to heat the air inside. In cold weather, if there is no facility for preheating, it will be helpful to keep **Colorail®** in a heated room before taking it to the job.

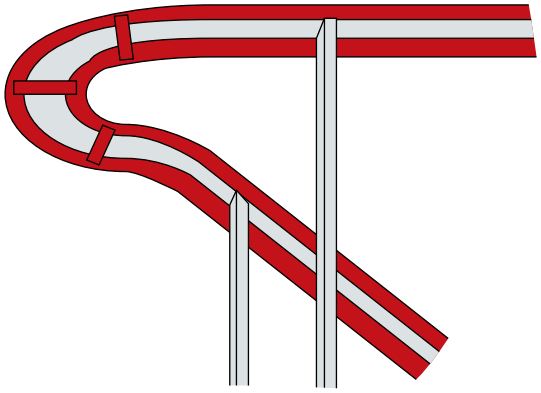
3. **BENDS AND TURNS:**



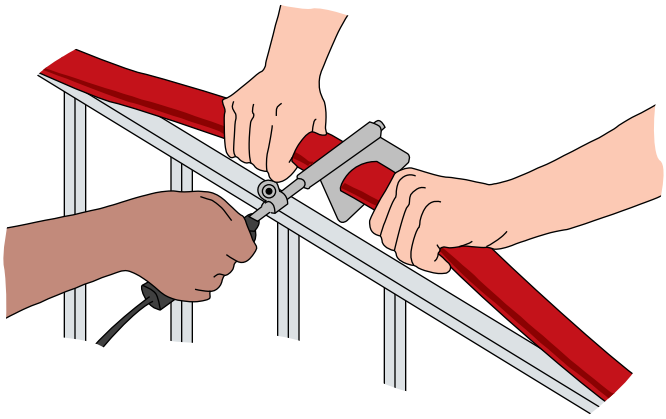
A. Where a bend extends to the very end of the rail – as in a wall return — the following is recommended: After bending the support bar or channel, leave 4" to 6" beyond the length to which it will ultimately be cut. Mount **Colorail®** on bent piece. Reheat it to relieve stress and permit to set for one day. Then cut off excess length, attach cap or anchoring strap (see above) and attach to wall brackets. The use of a suitable commercial adhesive can sometimes eliminate the need for an end cap or an anchor strap.

B. At stair landings, if the turn is combined with a drop, it is advisable to accomplish the turn through twisting rather than lateral bending. This method exerts a minimum strain on the **Colorail®** material and makes a smaller radius possible.





C. At sharp turns, a strap of **Colorail®** material should be welded across the underside to prevent the handrail from lifting off its support. If the bend is at the end of the handrail, a welded end cap may be sufficient.



4. WELDING: Splices, miters and end caps can easily be produced by welding. Square or mitered ends are pressed simultaneously against the blade of the **Colorail®** electric welding iron. When the material begins to melt, the blade is slipped out and the ends of the **Colorail®** are pressed together. A firm bond will result upon cooling. After each use the welding iron must be cleaned with the wire brush provided for this purpose. In place of the welding iron, a wide-bladed knife heated nearly red hot may be used.

NOTE: Melting during the welding process will shorten the handrail by 3/16" to 1/4", for which allowance must be made when cutting to length. Before welding, insert a short piece of the proper size bar near the ends of the **Colorail®** sections which are to be joined. This will help the plastic retain its proper shape.

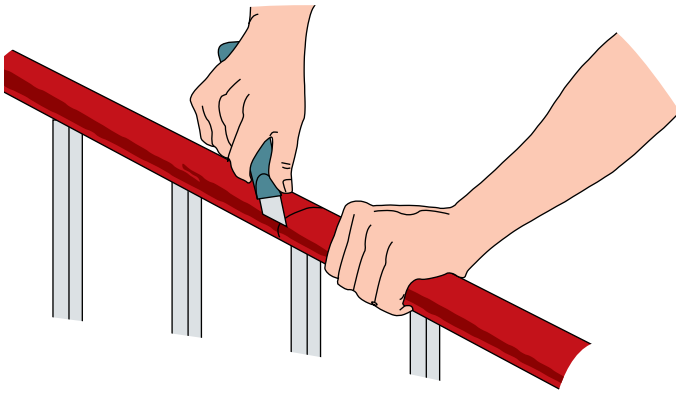
After welding any **Colorail®** other than black, a dark line may appear at the joint. If this is objectionable, the following procedure is recommended:

A. To insure perfect fit, carefully cut the ends to be joined, then dress with a file so they show only a hairline when butted together.

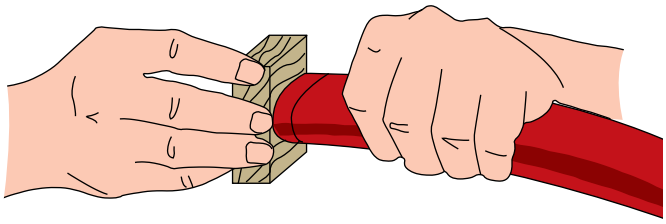
B. Mount handrail on supporting bar in the usual manner. Butt the miter or splice, but weld only the prongs on the underside of the railing.

C. Polish the top surface with tetrahydrofuron until the joint becomes almost invisible.

5. CLEANING WELDS: Welding flash can easily be removed with a knife while the material is still warm. Outside surface should then be smoothed with a file or sandpaper.

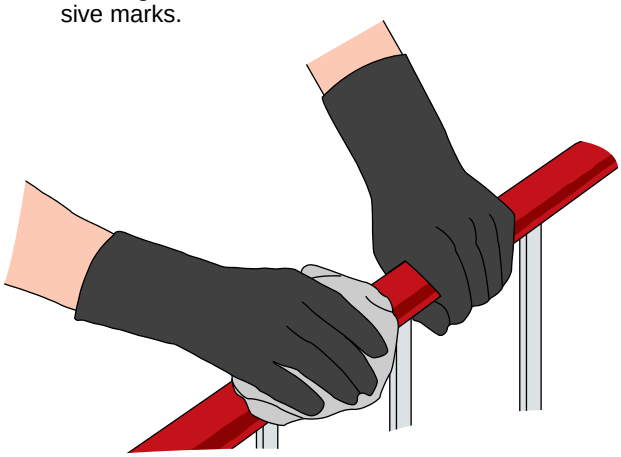


6. END CAPS: Cut **Colorail®** to extend 3/8" to 1/2" beyond the end of the support bar. Cut end cap to approximate size of handrail section and weld to end of handrail. During welding, hold the cap in place with a block of wood. After welding, trim the end cap to the proper shape with a knife, then clean the weld in the manner described above.



NOTE: The cross-section of gold **Colorail®** does not match the color of the surface. For this reason gold **Colorail®** is often capped with a contrasting color. With any **Colorail®** color, a contrasting end cap will eliminate the problem of a visible weld line.

7. FINISHING: When installation has been completed, the handrail should be cleaned with a PVC cleaner applied with a lint-free cloth. To obtain a permanent high-luster finish, wipe handrail lightly with tetrahydrofuron after cleaning. It will also remove minor scratches and abrasive marks.

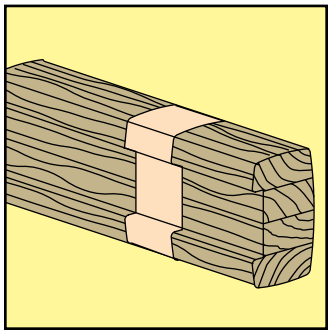


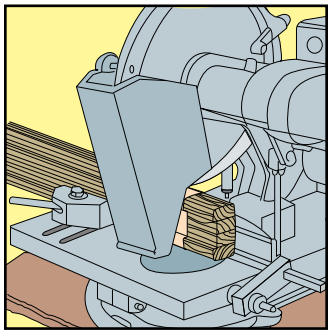
FABRICATION AND INSTALLATION PROCEDURE

A. CUTTING

Because of the hardness and density of the Acrylic/Wood material and the aluminum spine of the **8570** series moulding, metal-working equipment is best suited to cut **Carlstadt®** Acrylic/Wood handrail mouldings.

The mouldings can be cut on a saw using a standard metal cutting band saw blade (10 teeth to the inch, raker set) or a high speed cut-off saw with an alloy steel or carbide tipped blade. To avoid chipping, apply masking tape or fiberglass reinforced, pressure sensitive tape to the section to be cut and use a slow to moderate feed. After cutting, use naphtha to remove petroleum based lubricants or metal oxides from the handrail moulding material.

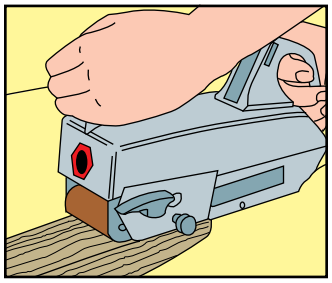


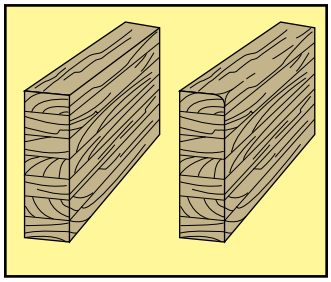


B. SHAPING ENDS AND CORNERS:

It is easy to remove sharpness from mitered corners and shape railing ends to form attractive, smoothly contoured terminals. For initial rough removal of material, use a wood rasp or a belt sander with #60 grit paper. A stationary or portable belt sander-grinder or similar equipment works best.

To smooth the work to a polished finish, use sanding belts with successively finer grits in the following sequence: #100, #120, #150, #280. With some experience, it is possible to use #120 and #280 grit sanding belts only. Following final sanding with the #280 grit belt, buff the moulding with a clean lamb's wool pad using an oil base lubricant such as *Liquid Gold*.



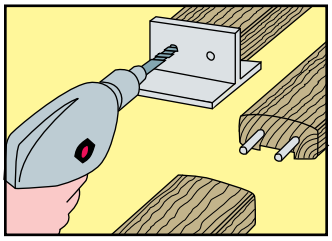


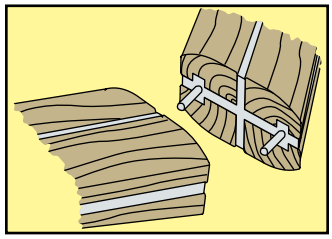
C. FORMING MITERS AND SPLICES

Miter joints can be used to make vertical and horizontal direction changes. More often, independent handrails are used on each flight without connections for changes in direction. If the mouldings are mounted securely on a metal subrail and joints are accurately cut, no doweled connections between adjacent moulding sections are required.

If a metal subrail is not used, or if heavy traffic is anticipated, miter joints and splices must be doweled and glued. The doweling and gluing technique forms strong joints that reveal only a circumferential hairline. Epoxy structural adhesive is available from Julius Blum & Co., Inc. For maximum joint strength, apply epoxy adhesive liberally to all mating surfaces and press the handrail moulding sections firmly together. Surfaces must be clean before adhesive is applied. Carefully remove all excess adhesive immediately. Structural adhesives can be applied both in the shop and in the field.

For accurate mating of butting pieces, holes for dowels should be located and drilled with the aid of a doweling jig.



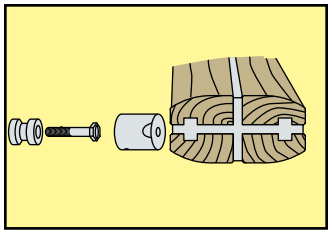


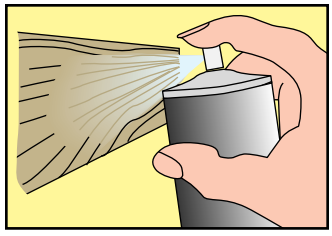
D. ATTACHMENT TO SUPPORTING STRUCTURES

Carlstadt® Acrylic/Wood handrail mouldings have exceptional screw holding power. Where fasteners smaller than ¼" are required, use Type AB sheet metal screws. Drill pilot holes the same size as required for aluminum. For larger fasteners (¼" and up), the handrails can be drilled and tapped for machine screws. Under no circumstances must screws be inserted without prior drilling – they will split the material.

Carlstadt® Acrylic/Wood handrail mouldings can be post or wall mounted using **Carlstadt®** System posts and brackets, or the mouldings can be adapted to custom designed supporting structures.

Carlstadt® Acrylic/Wood **8570** series mouldings must be attached by tapping into the aluminum spine. Attachment to the Acrylic/Wood alone could cause the facing to pull away from the spine. Direct attachment to the metal spine insures a high strength structural connection.





E. PROTECTION AND FINISHING:

Mouldings are shipped individually wrapped in a paper or plastic sleeve, which should be left in place as long as possible for protection.

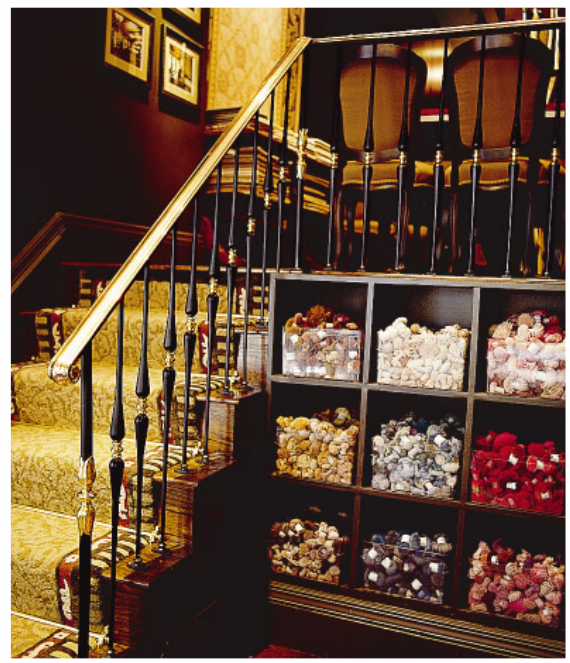
F. MAINTENANCE:

Normal maintenance requires only periodic cleaning with an oil-base furniture polish. Luster can be maintained by using light hand buffing with a soft cloth or by mechanical buffing with a lamb's wool pad.

Nicks, scratches or burn marks can be removed by sanding (finishing with #280 grit) and the finish restored to the original luster by buffing.

SLEEVE ANCHOR BOLT:

The sleeve anchor bolt is an all-steel rust-proofed multi-purpose anchor bolt intended for use in a wide range of masonry materials. The ⅜" bolt is recommended for use with heavy-duty floor flange **876**. To install, drill a ⅜" hole in concrete or masonry to 3" depth. Drill holes which conform to ANSI standard carbide bit dimension (.390" to .398"). Clean out dust in hole after drilling. Insert sleeve bolt in hole, hand tighten, then tighten with wrench to a maximum torque of 30 ft. lbs.



HOKANSON CARPETS
New York, NY

Interior Design: Micheal Siller
Fabr: New Star Brass & Bronze, Brooklyn, NY

BROOKS BROTHERS
Dallas, Texas

Arch: Mayer, Garfield, Gaworth & Associates
Fabr: Trinity Brass & Copper

This section illustrates the numerous handrail mouldings, fittings and ornamental railing components carried in stock in steel, aluminum, bronze and stainless steel.

Many of them can be used with the various railing systems described elsewhere in this catalog. Plastic **Colorail**® and Acrylic/Wood mouldings are described in other sections.

Aluminum extrusions are of alloy 6063 which is preferred for its bright color, corrosion resistance and ease of fabrication. It is suitable for anodizing, including most of the hard-coat color finishes. Black anodizing may result in inconsistent matches. Consult your anodizer before specifying.

Bronze extrusions are of alloy C38500, architectural bronze, generally favored for its rich gold color.

Nickel-Silver extrusions are of alloy C79800. Sometimes referred to as *white bronze,* nickel-silver is a copper/nickel alloy. It is similar in appearance to stainless steel with a touch of gold.

Stainless steel components are type 304, 18-8, chrome-nickel alloy which has high resistance to corrosion.

Steel handrails are hot-rolled carbon steel, C1010.

Cast aluminum fittings are produced from Almag 35, suitable for clear anodizing. Bronze castings are of alloy C86500 for good color match with extruded bronze. Nickel-silver fittings are cast using a matching casting alloy. All non-ferrous fittings are satin finished. To protect the finish, bronze and nickel-silver fittings are lacquered. Fittings for use with steel handrail are cast from malleable iron which is weldable and bendable.

Be aware that due to the difference in tolerances between extruded handrail and cast fittings, butt joints usually require special attention to assure a proper match.

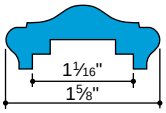
All items are carried in stock in substantial quantities and are normally available for immediate shipment. Materials are produced and handled with great care. Items are thoroughly protected for shipment by wrapping and/or crating so as to assure a product well-suited for architectural finishing.

For structural engineering data, see page 114. For handrail brackets, see pages 78 to 86.

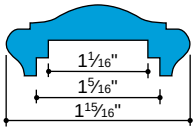
Americans with Disabilities Act (ADA):
The Architecture and Transportation Barriers Compliance Board – the agency which created and interprets the *Americans with Disabilities Act Accessibility Guidelines (ADAAG)* – has confirmed that 1¼" to 1½" nominal pipe size (1.66" to 1.9" outside diameters) is acceptable for use as handrails under *ADAAG.* A copy of this letter is printed at the front of this catalog. *ADAAG* also allows for handrails which provide *an equivalent gripping surface* – though they do not define this term.

The American National Standards Institute publication *A117.1-1992: Accessible and Usable Buildings and Facilities* states that *. . . handrails shall have a circular cross-section with an outside diameter of 1¼ in. (32mm) minimum and 2 in. (51mm) maximum, or shall provide equivalent graspability in accordance with the following . . . Handrails with other shapes shall be permitted provided they have a perimeter dimension of 4 in. (100 mm) minimum and 6¼ in (160 mm) maximum, and provided their largest cross-section dimension is 2¼ in (57 mm) maximum.*

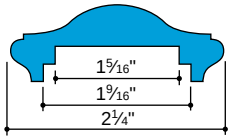
ALUMINUM (6063-T52) Mill finish
20' lengths



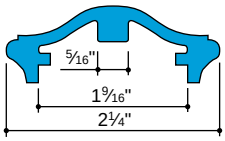
6931 Aluminum .615 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-N-S-T-V



6934 Aluminum .804 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-N-S-T-V

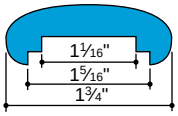


6930 Aluminum .936 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-N-S-T-V
Suitable for bending

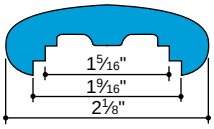


Outside profile identical to **6930**

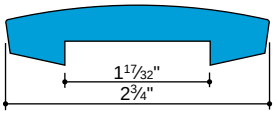
6929 Aluminum .670 lb/ft
Fittings: Same as for **6930**
For straight runs only



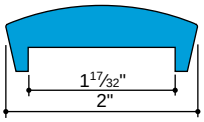
6933 Aluminum .770 lb/ft
Fittings: B-C-CC-CL-CR-GL-GR-N-S-V



6935 Aluminum .980 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-N-S-T-V

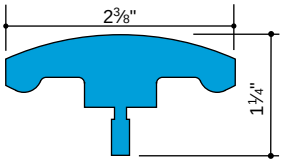


6984* Aluminum 1.301 lb/ft
Fittings: C-N

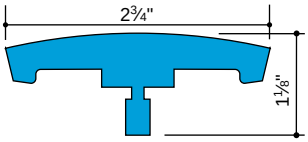


6985* Aluminum .977 lb/ft
Fittings: C-N

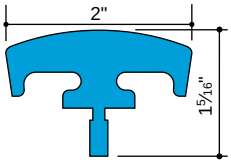
* Use 1½" × ¼" flat bar for splicing and for closing ends



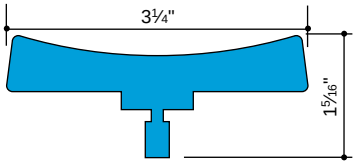
6402 Aluminum 1.51 lb/ft
Fittings: C-N (Use fittings for **6902**)



6404 Aluminum 1.57 lb/ft
Fittings: C-N (Use fittings for **6984**)

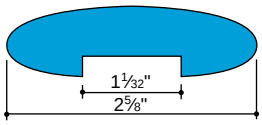


6405 Aluminum 1.39 lb/ft
Fittings: C-N (Use fittings for **6985**)

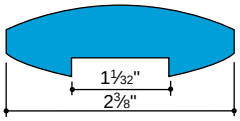


6407 Aluminum 2.00 lb/ft
Fittings: C-N (Use fittings for **6907**)

T-handrail mouldings **6402**, **6404**, **6405** and **6407** are used with **Colorail**® self-aligning brackets on pages 83 and 84. Clamping action eliminates drilling and tapping and helps in field alignment with posts and wall attachment.

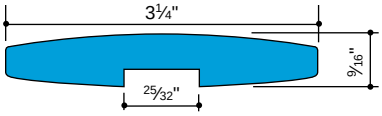


6901 Aluminum 1.661 lb/ft
Fittings: C-N

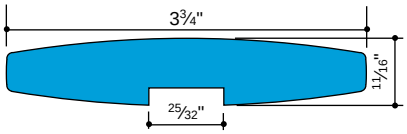


6902 Aluminum 1.464 lb/ft
Fittings: C-N

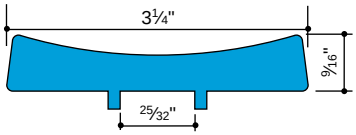
Mouldings **6901** and **6902** are specially designed for use with **Carlstadt**® aluminum self-aligning brackets **309**, **312**, **313** and **314** shown on pages 83 and 84. A 1" × ¼" flat bar can be used for splicing and for closing the recess in the handrail moulding.



6905 Aluminum 1.752 lb/ft
Fittings: C-N

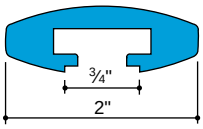


6906 Aluminum 2.448 lb/ft
Fittings: C-N

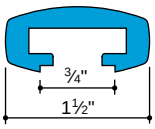


6907 Aluminum 1.776 lb/ft
Fittings: C-N

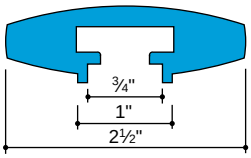
Mouldings **6905**, **6906** and **6907** are specially designed for use with **Carlstadt**® self-aligning brackets shown on pages 82 to 84. A ¾" × 3/16" flat bar may be used for closing the recess in the handrail moulding.



6530 Aluminum .900 lb/ft
Fittings: C-N (see page 32)



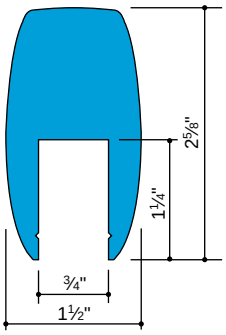
6531 Aluminum .600 lb/ft
Fittings: C-N (see page 32)



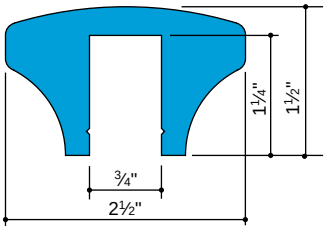
6532 Aluminum 1.440 lb/ft
Fittings: C-N (see page 32)

Mouldings **6530**, **6531** and **6532** are used with **Carlsrail**® self-aligning brackets on pages 82 and 84. Clamping action eliminates drilling and tapping and helps in field alignment with posts and wall attachments. See page 32 for splices, support bar and end cap. **Carlsrail**® mouldings are designed for non-welded assembly.

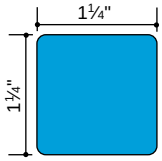
Scale: 6" = 1'-0"



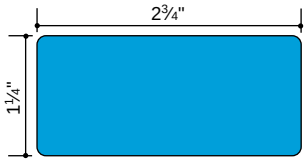
1133 Aluminum 3.02 lb/ft
No fittings available



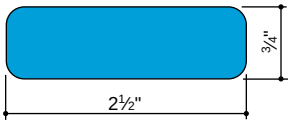
1134 Aluminum 2.40 lb/ft
No fittings available



6423 Aluminum 1.876 lb/ft
No fittings available



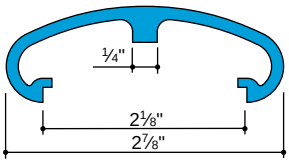
6424 Aluminum 4.124 lb/ft
No fittings available



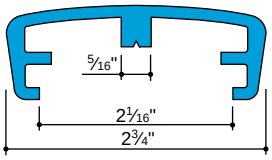
6939 Aluminum 2.214 lb/ft
No fittings available

6988 Aluminum 1.138 lb/ft
No fittings available
Suitable for elevator cab handrails

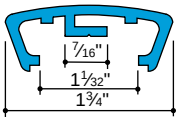
6986 Aluminum 2.684 lb/ft
No fittings available



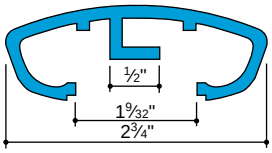
6932 Aluminum .852 lb/ft
Fittings: B-C-N-S-V



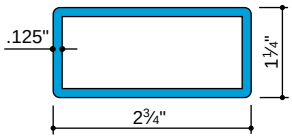
6987 Aluminum .858 lb/ft
Fittings: C-N



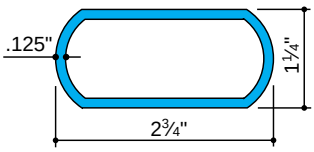
6903 Aluminum .446lb/ft
No fittings available
Use with 1" × ½" × ⅛" channel



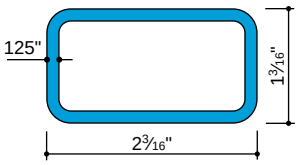
6904 Aluminum .871 lb/ft
No fittings available
Use with 1¼" × ¾" × ⅛" channel



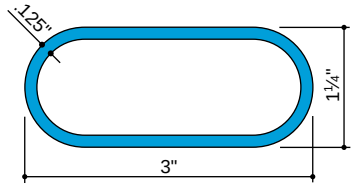
6434 Aluminum (6063-T6) 1.123 lb/ft
Fittings: N (see page 34)



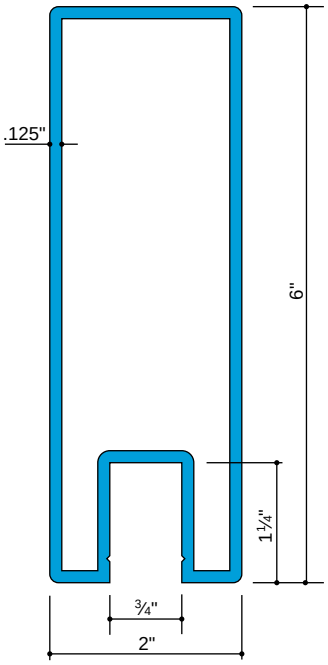
6435 Aluminum (6063-T6) 1.075 lb/ft
Fittings: C-N (see page 34)



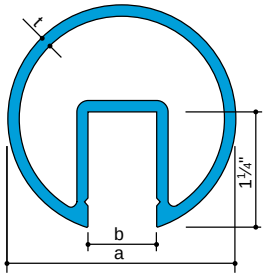
6436 Aluminum .888 lb/ft
Fittings: N



6437 Aluminum 1.057 lb/ft
Fittings: N



1136 Aluminum 2.70 lb/ft
Fittings: End Cap – **1186**

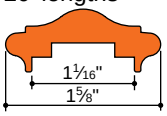


	a	b	t	lb/ft
1130	1.900"	¾"	.109"	1.01
1132	2½"	¾"	.125"	1.52
1135	3½"	¾"	.125"	1.95
1137	3"	¾"	.125"	1.72
1154	3"	1"	.125"	1.73
1155	3½"	1"	.125"	1.97

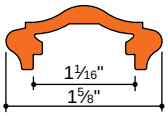
Fittings: refer to page 6

Scale: 6" = 1'-0"

BRONZE (CDA 385) Mill finish
20' lengths

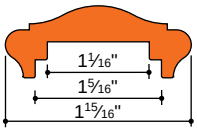


4531 Bronze 1.93 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-N-S-U-V
Suitable for bending

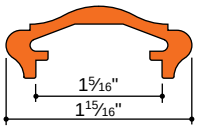


Outside profile identical to **4531**

4537 Bronze 1.28 lb/ft
Fittings: Same as for **4531**
For straight runs only

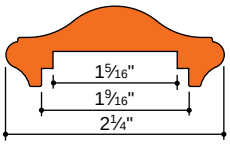


4534 Bronze 2.52 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-N-S-T-V
Suitable for bending

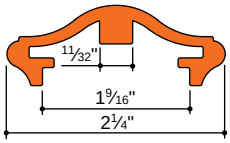


Outside profile identical to **4534**

4536 Bronze 1.83 lb/ft
Fittings: Same as for **4534**
For straight runs only

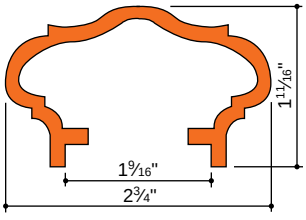


4530 Bronze 2.91 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-N-S-T-V
Suitable for bending

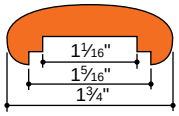


Outside profile identical to **4530**

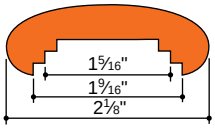
4532 Bronze 2.13 lb/ft
Fittings: Same as for **4530**
For straight runs only



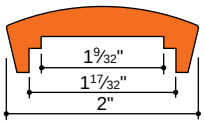
4538 Bronze 2.96 lb/ft
Fittings: N
For straight runs only



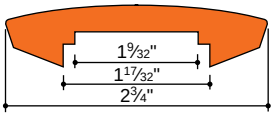
4539 Bronze 2.66 lb/ft
Fittings: B-C-CC-CL-CR-GL-GR-N-S-V



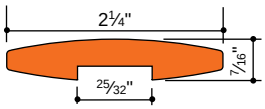
4535 Bronze 3.16 lb/ft
Fittings: B-C-CC-CL-CR-GL-GR-N-S-T-V



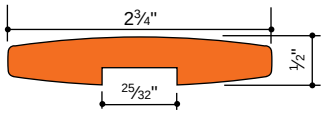
4575 Bronze 2.64 lb/ft
Fittings: C-CC-N



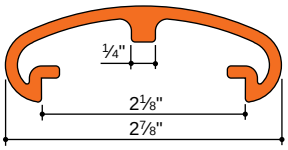
4574 Bronze 3.71 lb/ft
Fittings: C-N



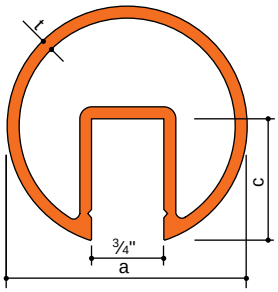
4572 Bronze 2.50 lb/ft
Fittings: C-N



4573 Bronze 4.05 lb/ft
Fittings: C-N

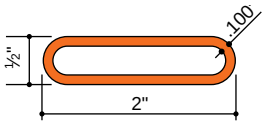


4529 Bronze 2.40 lb/ft
Fittings: B-C-N-S

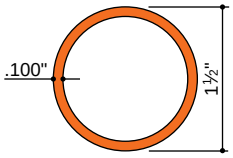


	a	c	t	lb/ft
1230*	1.900"	1"	.100"	2.69
1231Q*	2½"	1¼"	.100"	3.65
1232*	2½"	1¼"	.125"	4.51
1233*	3"	1¼"	.125"	5.28
1235**	3½"	1¼"	.187"	8.70

Fittings: refer to page 6
* 16' lengths ** 12' lengths



6488 Bronze 1.56 lb/ft
No fittings available. 16' lengths.

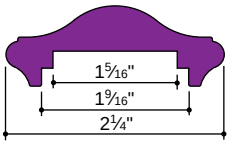


6489 Bronze 1.75 lb/ft
Fittings: N

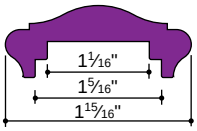
CRAMER RESIDENCE
Colorado Springs, Colorado
Fabricator: Sigma Metals

Scale: 6" = 1'-0"

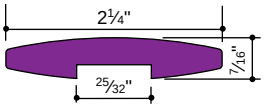
NICKEL-SILVER (CDA 798) Mill finish
20' lengths



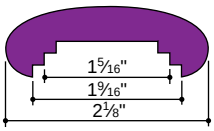
5530 Nickel-Silver 2.93 lb/ft
Fittings: C-N



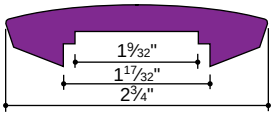
5534 Nickel-Silver 2.54 lb/ft
Fittings: C-N



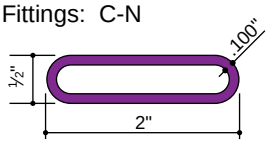
5572 Nickel-Silver 2.41 lb/ft
Fittings: C-N



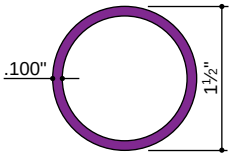
5235 Nickel-Silver 3.18 lb/ft
Fittings: C-N



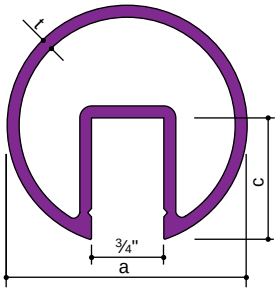
5274 Nickel-Silver 3.73 lb/ft
Fittings: C-N



5288 Nickel-Silver 1.57 lb/ft
No fittings available.



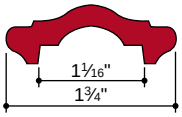
5289 Nickel-Silver 1.75 lb/ft
Fittings: N



	a	c	t	lb/ft
1330	1.900"	1"	.100"	2.69
1332	2½"	1¼"	.100"	3.65
1333	3"	1¼"	.125"	5.20

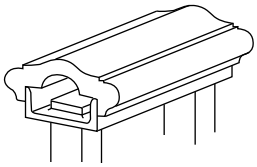
Fittings: refer to page 6

STEEL 20' lengths

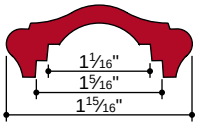


Prime domestic steel

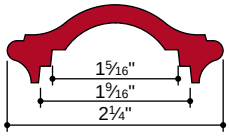
4429 Steel 1.40 lb/ft
Fittings: B-C-CC-CL-CR-E-F-GL-GR-JL-JR-L-N-S-SL-SR-T-U-UC-UL-V



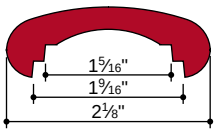
4429 used with 1" channel



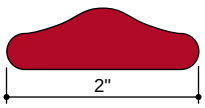
4428 Steel 2.25 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-L-S-V



4441 Steel 2.14 lb/ft
Fittings: B-C-CC-CL-CR-E-GL-GR-S-V

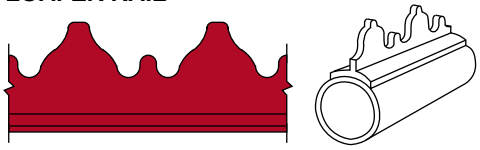


4435 Steel 2.65 lb/ft
Fittings: V



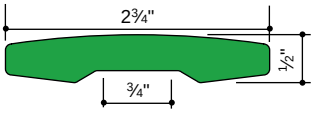
4416 Steel 3.15 lb/ft
No fittings available.

LOAFER RAIL

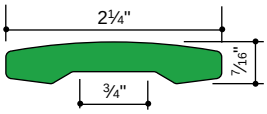


4445 Steel .688 lb/ft
Loafer rail fits over pipe or flat surface to discourage lounging on fences, planters, railings or store fronts.

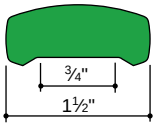
STAINLESS (Type 304) Mill finish
20' lengths, except as noted



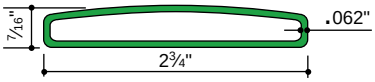
6501 Stainless 4.05 lb/ft
No fittings available. 16' lengths.



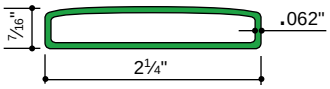
6502 Stainless 2.80 lb/ft
No fittings available. 16' lengths.



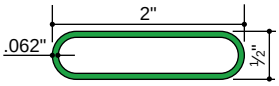
6503 Stainless 2.54 lb/ft
No fittings available. 16' lengths.



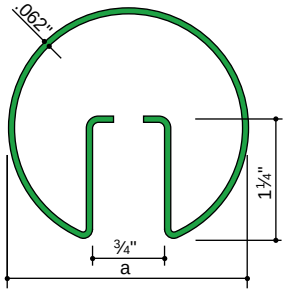
6511 Stainless 1.25 lb/ft
No fittings available.



6512 Stainless 1.00 lb/ft
No fittings available.



4488 Stainless .944 lb/ft
No fittings available.
Suitable for elevator cab handrails



	a	lb/ft	finish
1430	1.900"	1.70	No. 2B*
1432	2½"	1.96	No. 2B*
1452	2½"	1.96	No. 4**
1433	3"	2.46	No. 2B*
1453	3"	2.46	No. 4**

Fittings: refer to page 6.
* Suitable for polishing ** Satin finish

Scale: 6" = 1'-0"

MOULDING LATERAL SCROLLS

Moulding lateral scrolls may be bent to meet the pitch of stair railings. Malleable iron channel and steel flat bar scrolls fit the underside of moulding lateral scrolls. They may be punched for round or square balusters.

P Flat Bar Lateral Scroll

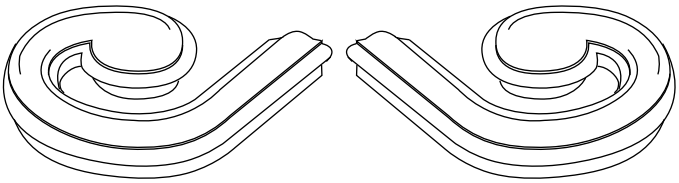
Flame cut from steel plate, matches **4530 GL/GR**

Left Hand	Right Hand			
150P	**150P**	1½"	×	½"

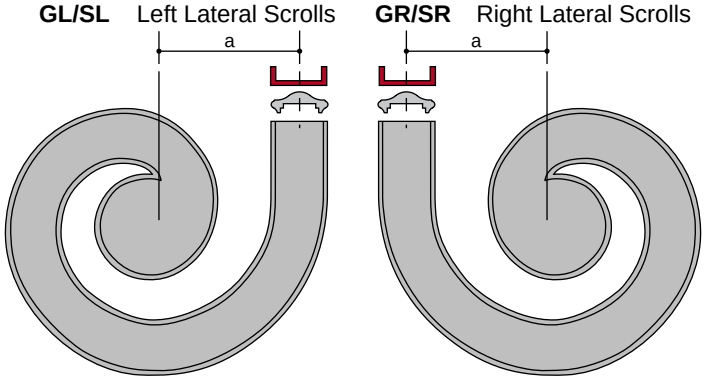
CL/CR Channel Lateral Scroll

Malleable iron, match contour of moulding scrolls

Left Hand	Right Hand	a			
100CL	**100CR**	5⅝"	1"	×	½"
100JL	**100JR**	4⅛"	1"	×	½"
125CL	**125CR**	5½"	1¼"	×	½"
150CL	**150CR**	6⅛"	1½"	×	½"



GL/SL Left Lateral Scrolls **GR/SR** Right Lateral Scrolls



Left Lateral Scroll

Left Hand	Right Hand	a
4428GL	**4428GR**	5½"
4429GL	**4429GR**	5⅝"
4429SL	**4429SR**	4⅛"
4441GL	**4441GR**	6⅛"
6930GL	**6930GR**	6⅜"
6931GL	**6931GR**	5⁹⁄₁₆"
6933GL	**6933GR**	5⁷⁄₁₆"

Right Lateral Scroll

Left Hand	Right Hand	a
6934GL	**6934GR**	5½"
6935GL	**6935GR**	6⅜"
4530GL	**4530GR**	6⅜"
4531GL	**4531GR**	5⁹⁄₁₆"
4534GL	**4534GR**	5½"
4535GL	**4535GR**	6⅜"
4539GL	**4539GR**	5⁷⁄₁₆"

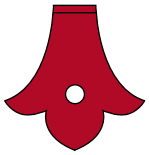
FITTINGS AVAILABILITY CHART

BE AWARE THAT DUE TO THE DIFFERENCE IN TOLERANCES BETWEEN EXTRUDED HANDRAIL AND CAST FITTINGS, BUTT JOINTS USUALLY REQUIRE SPECIAL ATTENTION TO ASSURE A PROPER MATCH.

Handrail Moulding	Bevel Lamb's Tongue (**B**)	Straight Lamb's Tongue (**S**)	Volute (**V**)	Terminal End Piece (**E**)	Corner Piece (**L**)	Center Piece (**T**)	End Urn Base (**U**)	Left Lateral Scroll (**GL**)	Right Lateral Scroll (**GR**)	Left Channel Lateral (**CL**)	Right Channel Lateral (**CR**)	Flat Bar Lateral (**P**)
6929	**6930B**	**6930S**	**6930V**	**6930E**	**6930L**	**6930T**	–	**6930GL**	**6930GR**	**150CL**	**150CR**	–
6930	**6930B**	**6930S**	**6930V**	**6930E**	**6930L**	**6930T**	–	**6930GL**	**6930GR**	–	–	**150P**
6931	**6931B**	**6931S**	**6931V**	**6931E**	**6931L**	**6931T**	–	**6931GL**	**6931GR**	**100CL**	**100CR**	–
6932	**6932B**	**6932S**	**6932V**	–	–	–	–	–	–	–	–	–
6933	**6933B**	**6933S**	**6933V**	–	–	–	–	**6933GL**	**6933GR**	**125CL**	**125CR**	–
6934	**6934B**	**6934S**	**6934V**	**6934E**	**6934L**	**6934T**	–	**6934GL**	**6934GR**	**125CL**	**125CR**	–
6935	**6935B**	**6935S**	**6935V**	**6935E**	–	**6935T**	–	**6935GL**	**6935GR**	**150CL**	**150CR**	–
4529	**4529B**	**4529S**	–	–	–	–	–	–	–	–	–	–
4530	**4530B**	**4530S**	**4530V**	**4530E**	**4530L**	**4530T**	–	**4530GL**	**4530GR**	–	–	**150P**
4531	**4531B**	**4531S**	**4531V**	**4531E**	**4531L**	–	**4531U**	**4531GL**	**4531GR**	**100CL**	**100CR**	–
4532	**4530B**	**4530S**	**4530V**	**4530E**	**4530L**	**4530T**	–	**4530GL**	**4530GR**	–	–	**150P**
4534	**4534B**	**4534S**	**4534V**	**4534E**	**4534L**	**4534T**	–	**4534GL**	**4534GR**	**125CL**	**125CR**	–
4535	**4535B**	**4535S**	**4535V**	–	–	**4535T**	–	**4535GL**	**4535GR**	**150CL**	**150CR**	–
4536	**4534B**	**4534S**	**4534V**	**4534E**	**4534L**	**4534T**	–	**4534GL**	**4534GR**	**125CL**	**125CR**	–
4537	**4531B**	**4531S**	**4531V**	**4531E**	**4531L**	–	**4531U**	**4531GL**	**4531GR**	**100CL**	**100CR**	–
4539	**4539B**	**4539S**	**4539V**	–	–	–	–	**4539GL**	**4539GR**	**125CL**	**125CR**	–
4428	**4428B**	**4428S**	**4428V**	**4428E**	**4428L**	–	–	**4428GL**	**4428GR**	**125CL**	**125CR**	–
4429	**4429B**	**4429S**	**4429V**	**4429E**	**4429L**	**4429T**	**4429U**	**4429GL**	**4429GR**	**100CL**	**100CR**	–
4435	–	–	**4435V**	–	–	–	–	–	–	–	–	–
4441	**4441B**	**4441S**	**4441V**	**4441E**	–	–	–	**4441GL**	**4441GR**	**150CL**	**150CR**	–

Handrail Moulding	Forged Lamb's Tongue (**F**)	Center Urn Base (**UC**)	Corner Urn Base (**UL**)	Left Junior Lateral Scroll(**SL**)	Right Junior Lateral Scroll (**SR**)	Left Junior Channel Lateral Scroll (**JL**)	Right Junior Channel Lateral Scroll (**JR**)
4429	**4429F**	**4429UC**	**4429UL**	**4429SL**	**4429SR**	**100JL**	**100JR**

WALL FLANGE

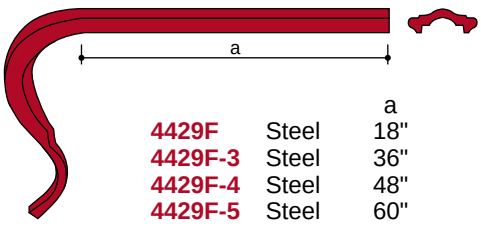


401 Steel

END PIECE AND CORNER AVAILABILITY

Handrail Moulding	Square End Piece (N)	Corner Bend (C)	Bend Radius (r)	Matching Corner Bend
4529	4529N	4529C	3"	–
4530	4530N	4530C	2½"	150CC
4531	4531N	4531C	2½"	100CC
4532	4530N	4530C	2½"	150CC
4534	4534N	4534C	2½"	125CC
4535	4535N	4535C	2½"	150CC
4536	4534N	4534C	2½"	125CC
4537	4531N	4531C	2½"	100CC
4538	4538N	–	–	–
4539	4539N	4539C	2½"	125CC
4572	4572N	4572C	2½"	–
4573	4573N	4573C	3"	–
4574	4574N	4574C	3"	–
4575	4575N	4575C	2½"	150CC
6489	6489N	–	–	–
6402	6902N	6902C	2½"	–
6404	6984N	6984C	3"	–
6405	6985N	6985C	2½"	–
6407	6907N	6907C	3"	–
6434	6434N	–	–	–
6435	6435N	6435C	3"	–
6436	6436N	–	–	–
6437	6437N	–	–	–
6530	6530N	6530C	4"	–
6531	6531N	6531C	4"	–
6532	6532N	6532C	4"	–
6901	6901N	6901C	2½"	100CC
6902	6902N	6902C	2½"	100CC
6905	6905N	6905C	3"	–
6906	6906N	6906C	3"	–
6907	6907N	6907C	3"	–
6929	6930N	6930C	2½"	150CC
6930	6930N	6930C	2½"	150CC
6931	6931N	6931C	2½"	100CC
6932	6932N	6932C	3"	–
6933	6933N	6933C	2½"	125CC
6934	6934N	6934C	2½"	125CC
6935	6935N	6935C	2½"	150CC
6984	6984N	6984C	3"	–
6985	6985N	6985C	2½"	150CC
6987	6987N	6987C	3"	–
5235	5235N	5235C	2½"	150CC
5274	5274N	5274C	3"	–
5289	5289N	–	–	–
5530	5530N	5530C	2½"	125CC
5534	5534N	5534C	2½"	150CC
5572	5572N	5572C	2½"	–
4428	–	4428C	2½"	125CC
4429	4429N	4429C	2½"	100CC
4441	–	4441C	2½"	150CC

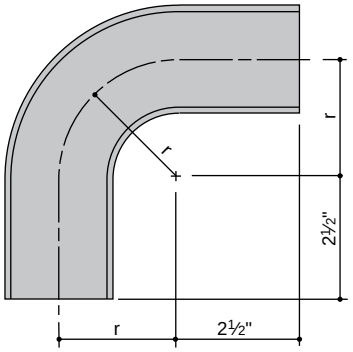
F Forged Lamb's Tongue



		a
4429F	Steel	18"
4429F-3	Steel	36"
4429F-4	Steel	48"
4429F-5	Steel	60"
4429F-6	Steel	72"

C Corner Bend

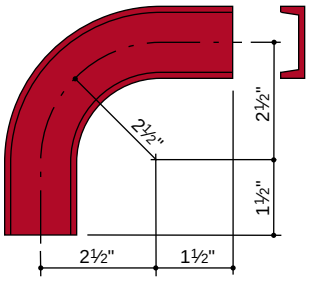
Trim one leg for use as a wall return.
Combine two corner bends together for 180° turns.



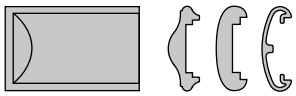
CC Channel Corner Bend Malleable Iron

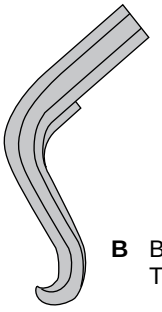
Fits the underside of moulding corner bend

100CC	1" × ½" × ⅛"
125CC	1¼" × ½" × ⅛"
150CC	1½" × ½" × ⅛"

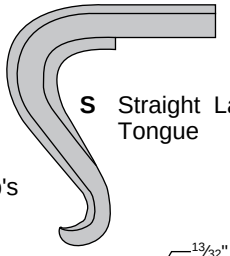


N Square End Piece

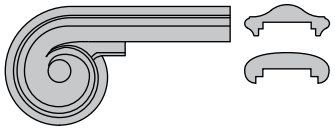




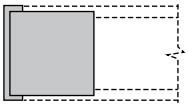
B Bevel Lamb's Tongue



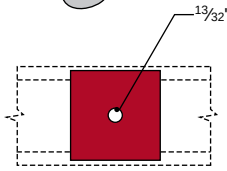
S Straight Lamb's Tongue



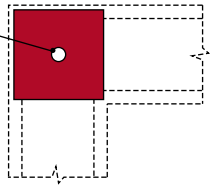
V Volute



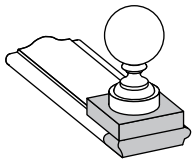
U End Urn Base

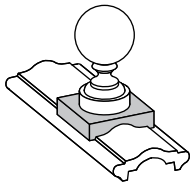


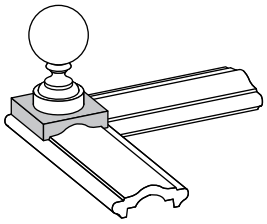
UC Center Urn Base



UL Corner Urn Base

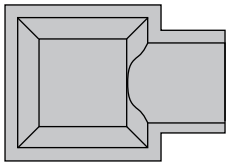




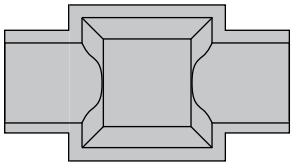


Urn bases may be welded or bolted in place with the finial stud

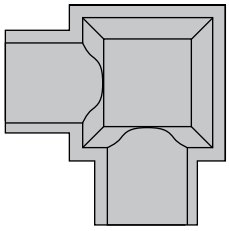
TERMINALS, CENTER PIECES AND CORNER PIECES



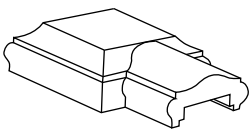
E Terminal

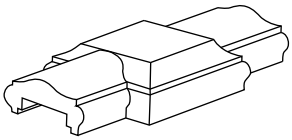


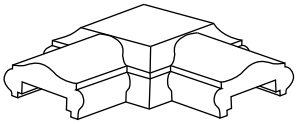
T Center Piece

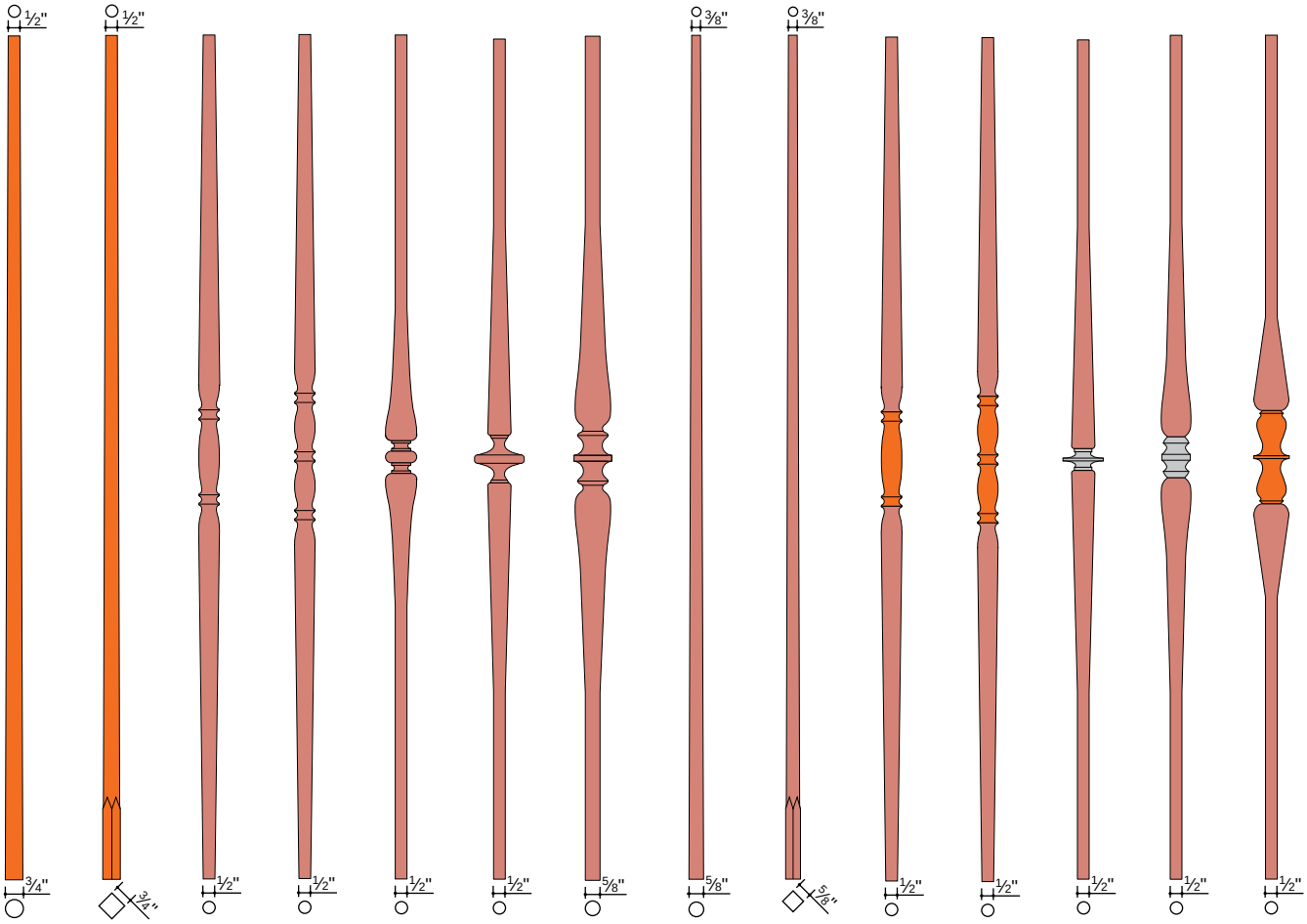


L Corner Piece









129 Bronze | **130** Bronze | **323** Forged Steel | **324** Forged Steel | **325** Forged Steel | **327** Forged Steel | **328** Forged Steel | **329** Steel | **330** Steel | **123*** Steel | **124*** Steel | **336†** **337*** Forged Steel | **358†** **338*** Forged Steel | **339*** Forged Steel

*With **Bronze** center

†With **Nickel-Silver** center

All spindles are 36" in length

Scale: 1½" = 1'-0"

Spindles are produced from solid stock. **329** and **330** are machined and have a surface suitable for painting. All other steel spindles are hammer forged. Bronze spindles **129** and **130** are machined from solid architectural bronze, mill finish.

Forged steel spindles with bronze or nickel-silver centers are permanently assembled with a ½" diameter solid rod at the center. They are equal in strength to solid spindles. Bronze centers are polished and fully protected for shipment and installation.

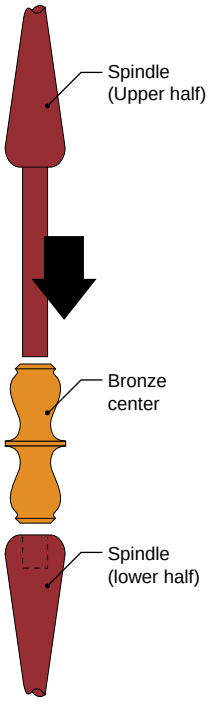
BASE AND COLLAR AVAILABILITY

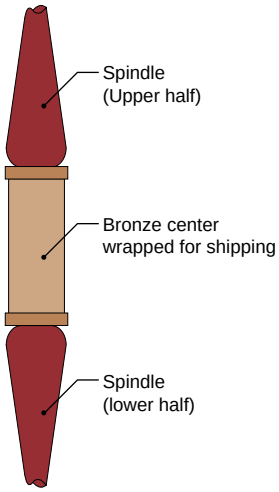
Refer to pages 60 and 61

Round Hole	Bronze Base	Nick-Sil Base	Cast Iron Base	Bronze Angle Base	Cast Iron Angle Base	Mal. Iron Flange	Bronze Ring	Steel Ring
⅜"	255		355		359	395		73
½"	256	456	356	260	360	396	272	72
⅝"	257		357	261	361	397	274	74
¾"	250							

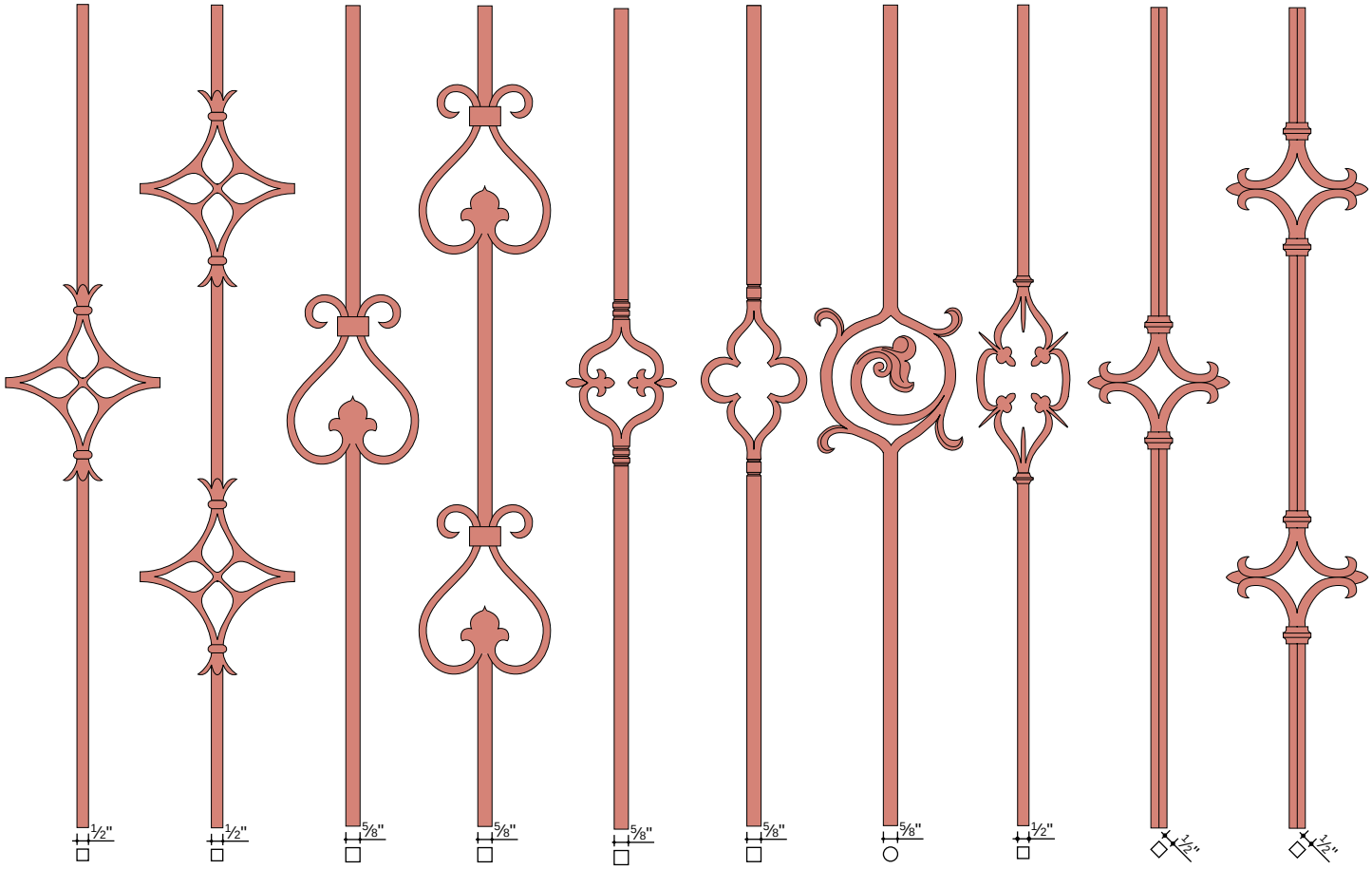
Square Hole	Bronze Base	Cast Iron Base	Bronze Angle Base	Cast Iron Angle Base	Malleable Iron Flange
½"	252	352	262	362	344/350/390
⅝"	253	353	263	363	351/391
¾"	254	354			398

BRONZE CENTER DETAIL





Forged steel spindles with bronze centers are forged in two halves with one end turned down to ½" diameter solid rod. This rod is force-fit into a recess drilled in the other half of the spindle forming a permanent assembly with a full ½" of solid steel at the center thereby overcoming the weakness of an assembly using a threaded stud.



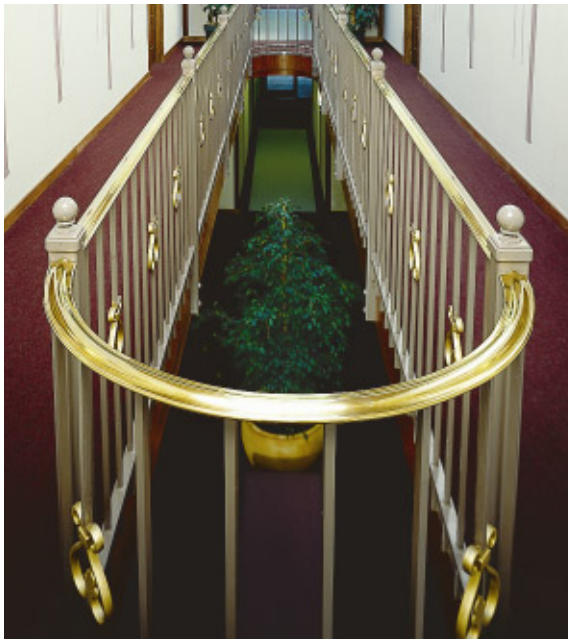
528 Malleable Iron | **158** Malleable Iron | **529** Malleable Iron | **159** Malleable Iron | **530** Malleable Iron | **531** Malleable Iron | **532** Malleable Iron | **533** Malleable Iron | **534** Malleable Iron | **153** Malleable Iron

All baluster bars are 36" in length

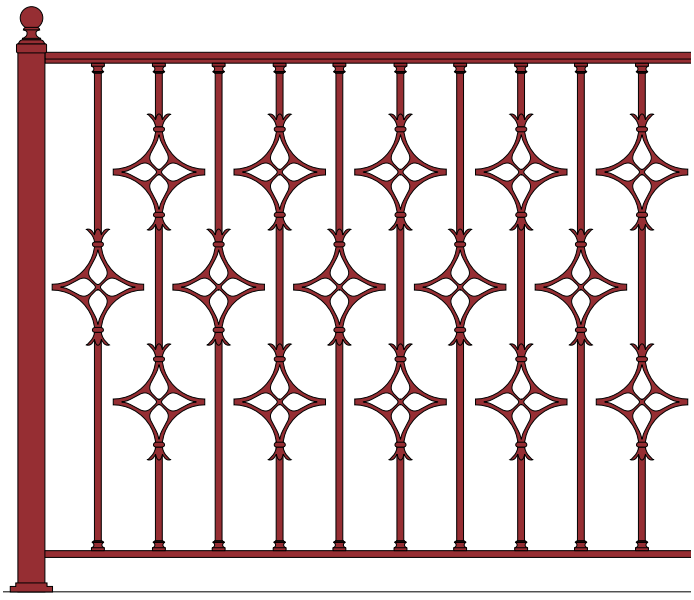
Scale: 1½" = 1'-0"

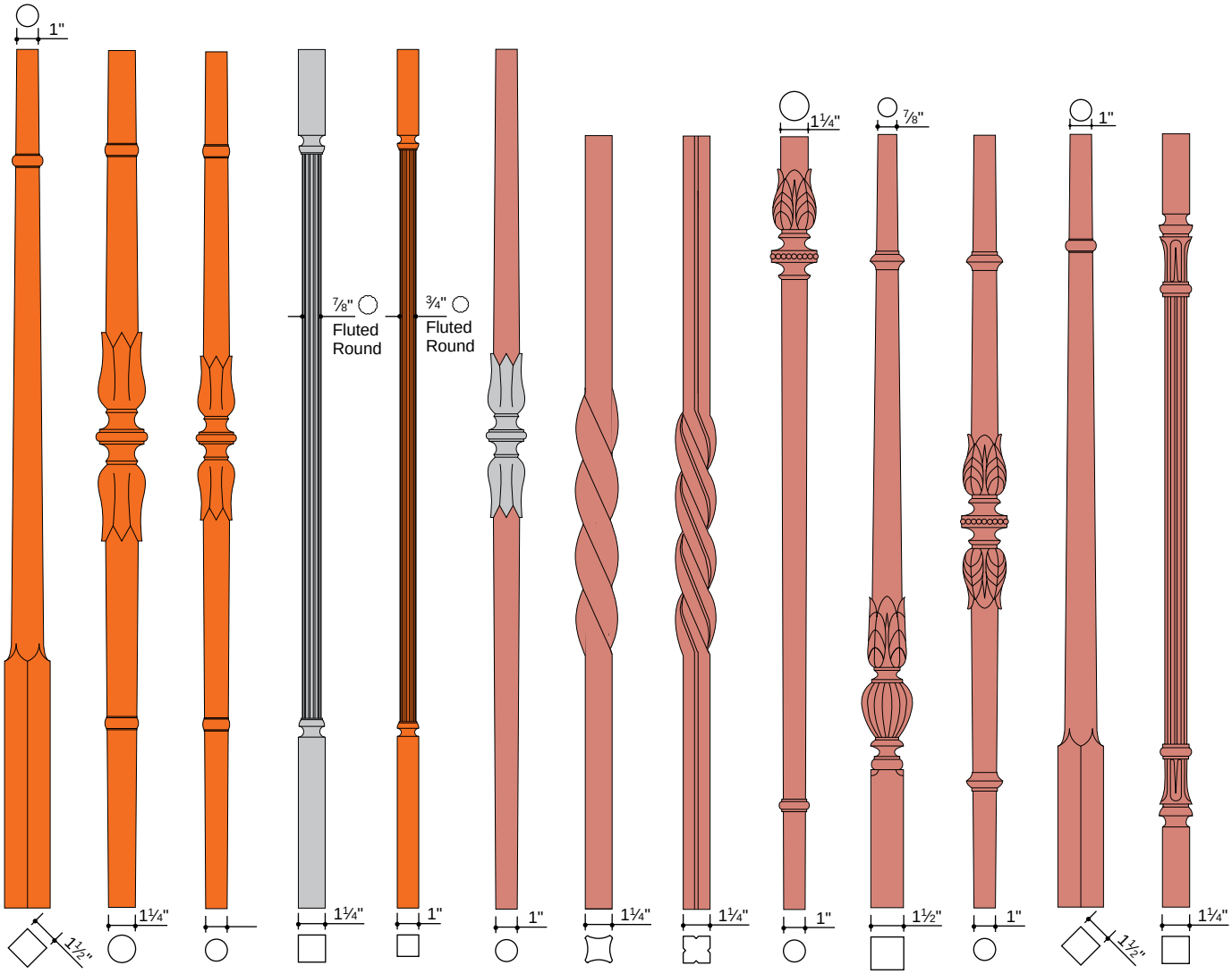
Ornamental Baluster Bars of malleable iron are cast in one solid piece. They may be welded, drilled and tapped or hammer forged. The baluster bars may even be twisted.

Many code authorities require reduced openings in railings where they might present a hazard to small children. The use of the **528**/**158**, **529**/**159** and the **534**/**153** combinations allow for close spacing of the ornamental baluster bars to meet these codes.



SPRINGLAKE VILLAGE; Santa Rosa, California
Arch: V.V. Hailozian
Fabr: C.E. Toland & Sons





131 Bronze*
134 Bronze*
234 Bronze*
235 Bronze*
236 Nick.-Silver*
239 Bronze*
340† **341**†† Steel*
†Brz. Cen.
††Ni-Sil.Cen.
332 Forged Steel
343 Forged Steel
154 Malleable Iron
333 Malleable Iron
334 Malleable Iron
331 Malleable Iron
335 Malleable Iron

* 40" long

All posts are 36" in length, except as noted

Posts are produced from solid stock.

Bronze and Nickel-Silver posts are machined from solid architectural bronze bar. **134** and **234** have a cast bronze center ornament of matching color and are polished to a satin finish. **131**, **235**, **236** and **239** are unpolished but have a smooth finish which is easily polished by buffing.

Steel posts **332** and **343** are hammer forged. **340** and **341** are machined and have a surface suitable for painting. They also have a cast bronze or nickel-silver center which is polished to a satin finish.

Ornamental posts of malleable iron are cast in one solid piece. They may be welded, drilled and tapped, and hammer forged.

In that the load bearing ability of a railing is a factor of the spacing and type of post, it is incumbent upon the designer to determine whether the post selected will meet structural requirements. Section data for bar stock matching the minimum dimension of the desired post may be used with the appropriate formulas on pages 114 to 121 (e.g., if post **331** is specified, use section data for a 1" solid round bar).

Scale: 1½" = 1'-0"

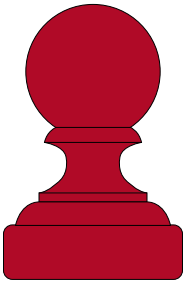
BASE AND RING AVAILABILTY

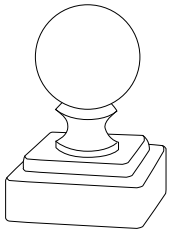
Refer to pages 60 and 61

Square Hole	Bronze Base	Cast Iron Base	Nick-Sil Base
1"	267	367	
1¼"	268	368	448
1½"	269	369	

Round Hole	Bronze Base	Cast Iron Base	Bronze Ring	Nick-Sil Base
1"	249/264	349	273	449
1¼	251			

BALL CAP





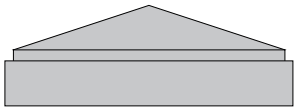
Rounded inside corners

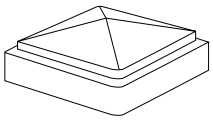
Cast Iron

	Tube Size	Ball Diam.	Height
5320	2" × 2"	1 13/16"	3¾"
5325	2½" × 2½"	2⅛"	4⅛"
5330	3" × 3"	2 3/16"	4⅝"
5335	3½" × 3½"	2½"	5⅛"
5340	4" × 4"	2¾"	5½"

CAP TYPE A

Type A bronze and aluminum caps are satin finished. Cast aluminum caps are Almag 35. Bronze caps are cast from CDA 865 bronze – to match closely the color of extruded architectural bronze – and are lacquered.





Rounded inside corners

Cast Iron

	Tube Size
5615	1½" × 1½"
5620	2" × 2"
5625	2½" × 2½"
5630	3" × 3"
5635	3½" × 3½"
5640	4" × 4"
5650	5" × 5"
5660	6" × 6"
5632	3" × 2"
5642	4" × 2"
56425	4" × 2½"
5643	4" × 3"
5652	5" × 2"
56525	5" × 2½"
5653	5" × 3"
5663	6" × 3"
5664	6" × 4"
5683	8" × 3"
5684	8" × 4"

Cast Bronze – satin finish

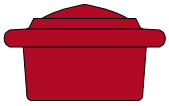
	Tube Size
5720	2" × 2"
5730	3" × 3"
5740	4" × 4"
5763	6" × 3"
5784	8" × 4"

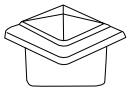
Cast Aluminum – satin finish

	Tube Size
5820	2" × 2"
5830	3" × 3"
5840	4" × 4"
5843	4" × 3"
5863	6" × 3"
5864	6" × 4"
5883	8" × 3"
5884	8" × 4"

DRIVE-ON CAP

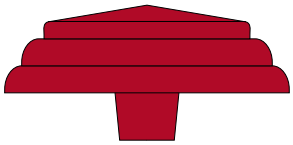
Cast Iron

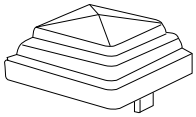




5411 Drive fit for 1" × 1" × .073" structural tubing

CAP TYPE B

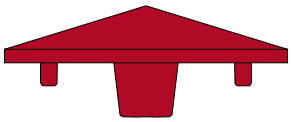


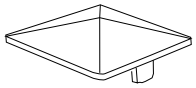


Cast Iron

	Tube Size*
5230	3" × 3"

CAP TYPE C





Cast Iron

	Tube Size*
5415	1½" × 1½"
5420	2" × 2"
5440	4" × 4"

* 11 ga. maximum thickness

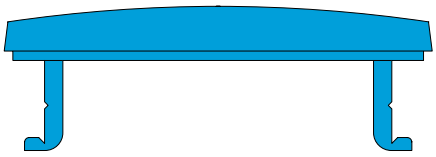
CAP TYPE D

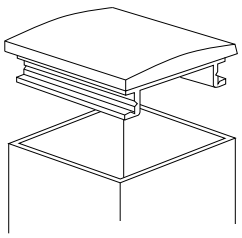
Type D Post Caps are extruded and machined from aluminum alloy 6063 and are suitable for anodizing.

Lugs fit inside ⅛" wall tubing with sharp corners and are easily ground down to fit 3/16" or ¼" wall tubing.

Extruded Aluminum

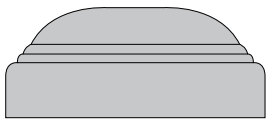
	Tube Size
5120	2" × 2"
5130	3" × 3"
5132	3" × 2"
5140	4" × 4"
5142	4" × 2"
5143	4" × 3"
5152	5" × 2"
5153	5" × 3"
5162	6" × 2"
5163	6" × 3"
5164	6" × 4"
5183	8" × 3"
5184	8" × 4"

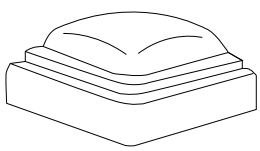




DRIVE-ON CAP, TYPE W

For drive fit. Caps do not require fastening.





Pressed Steel – 11 ga.

	Tube Size
5920	2" × 2"
5925	2½" × 2½"
5930	3" × 3"
5935	3½" × 3½"
5940	4" × 4"
5943	4" × 3"
5963	6" × 3"

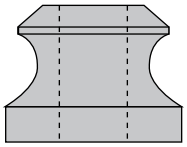
Pressed Stainless Steel – 11 ga.

	Tube Size
5933	3" × 3"
5944	4" × 4"

Bases, Collars and Flanges are furnished with clear holes for bar sizes shown.

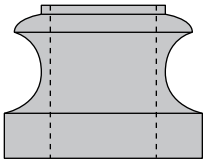
Aluminum, bronze and nickel-silver items are satin finished, except as noted. Aluminum items are cast from Almag 35. Bronze items are cast from C86500 bronze and match the color of extruded architectural bronze. Nickel-silver items are cast to match our extruded nickel-silver extrusions. Polished bronze and nickel-silver items are given a protective lacquer coating.

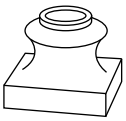
BASES




Square Hole

Bronze	Aluminum	Nickel-Silver	Hole	Width	Height
252	752		½"	1¼"	15/16"
253	753		5/8"	1¼"	15/16"
254	754		¾"	1⅜"	15/16"
267	767		1"	1¾"	1 1/16"
268	768	448	1¼"	2⅜"	1½"
269	769		1½"	3"	1½"



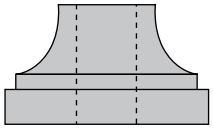
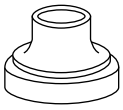


Square Hole
Cast Iron

	Hole	Width	Height
352	½"	1¼"	1 1/16"
353	5/8"	1¼"	1 1/16"
354	¾"	1⅜"	1 1/16"
367	1"	1¾"	1⅛"
368	1¼"	2¾"	1⅝"
369	1½"	3"	1¾"

Round Hole

Cast Iron	Bronze	Nickel-Silver	Hole	Width	Height
355	255		⅜"	1¼"	1"
356	256	456	½"	1¼"	1"
357	257		5/8"	1⅜"	1⅛"
	250		¾"	2½"	1⅝"
349	249	449	1"	2½"	1⅝"
	251		1¼"	2½"	1⅝"

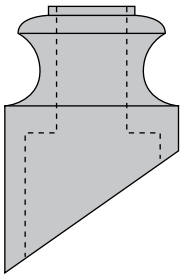
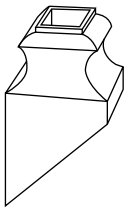
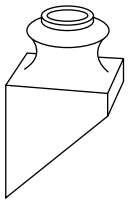
Round Hole
Turned Steel

	Hole	Width	Height
75	⅜"	1¼"	¾"
77	½"	1¼"	¾"

Round Hole
Turned Brass – unpolished

	Hole	Width	Height
80	½"	1¼"	¾"

BASES

Square Hole
Cast Iron

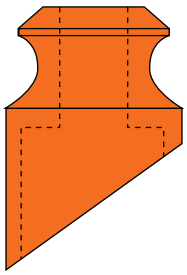
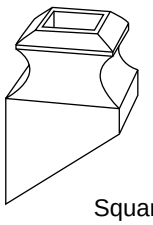
	Hole	Width
362	½"	1¼"
363	5/8"	1¼"

Round Hole
Cast Iron

	Hole	Width
359	⅜"	1¼"
360	½"	1¼"
361	5/8"	1⅜"

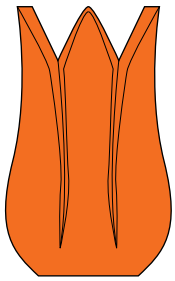
Bronze

260	½"	1¼"
261	5/8"	1⅜"

Square Hole
Bronze

	Hole	Width
262	½"	1¼"
263	5/8"	1¼"

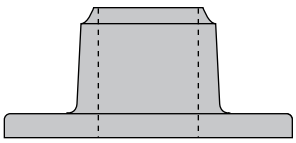
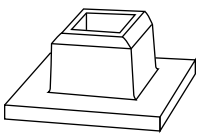


Round Hole
Bronze

	Hole
264	1"

Matches center of 234 and 340 post

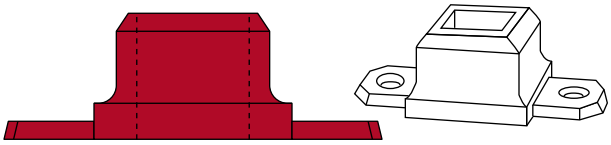
TUBE SOCKETS

Square Hole

Cast Iron	Malleable Iron	Aluminum	Hole	Base	Height
201	301	1201	1"	3"	1⅜"
202		1202	1¼"	3¼"	1½"
203		1203	1½"	3½"	1¾"
204		1204	2"	4"	1¾"
205		1205	2½"	4½"	1⅞"
206		1206	3"	5 3/16"	2⅜"

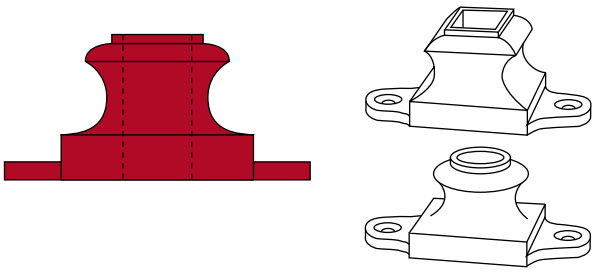
FLANGES



Square Hole
Malleable Iron

	Hole	Base	Height
342	7/16"	1⅛"	1⅛"
344*	½"	1⅛"	1⅛"
350	½"	1⅛"	13/16"
351	⅝"	1 3/16"	13/16"
398	¾"	1 7/16"	⅞"
400	⅞"	1⅝"	1"
399	1"	1¼"	1⅛"

* **344** is similar to **350** but is high enough to permit adjustment of baluster height for uneven steps



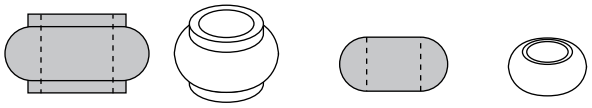
Square Hole
Malleable Iron

	Hole	Base	Height
390	½"	1 5/16"	1"
391	⅝"	1 5/16"	1"
393	1"	1 13/16"	1 3/16"

Round Hole
Malleable Iron

	Hole	Base	Height
395	⅜"	1 5/16"	1"
396	½"	1 5/16"	1"
397	⅝"	1 7/16"	1⅛"

COLLARS



Round Hole
Turned Steel

	Hole	O.D.	Height
72	½"	1"	9/16"

Round Hole
Turned Steel

	Hole	O.D.	Height
73	⅜"	¾"	13/32"
74	⅝"	1"	½"

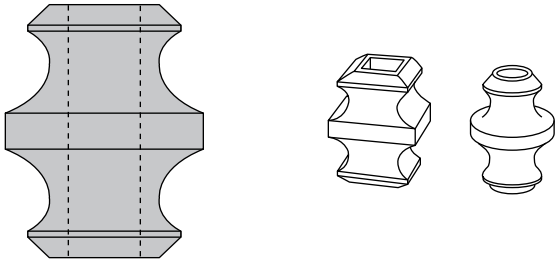
Round Hole
Turned Bronze

	Hole	O.D.	Height
272	½"	1"	9/16"
273	1"	1¼"	¾"

Round Hole
Turned Bronze

	Hole	O.D.	Height
274	⅝"	1"	½"

COLLARS



Square Hole
Aluminum

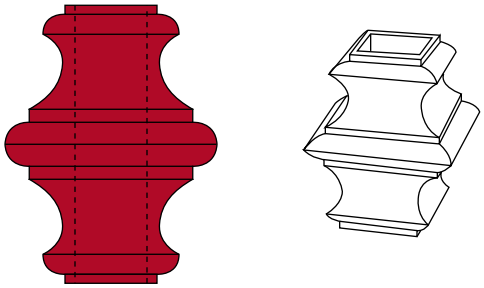
	Hole	Width	Height
765	½"	1⅜"	1¾"
766	⅝"	1⅜"	1¾"

Round Hole
Bronze

	Hole	Width	Height
281	½"	1¼"	1¾"
282	⅝"	1¼"	1¾"

Square Hole
Bronze

	Hole	Width	Height
265	½"	1⅜"	1¾"
266	⅝"	1⅜"	1¾"

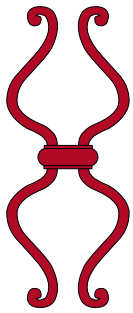


Square Hole
Cast Iron

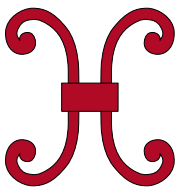
	Hole	Width	Height
365	½"	1 9/16"	2"
366	⅝"	1 11/16"	2"
348	¾"	1 15/16"	2"

ORNAMENTAL COLLARS

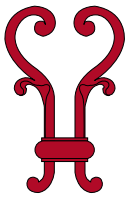
These collars are cored to slide over ½" square or ⅝" square bars. Collars are easily applied and can be fastened by screws or by tack welding. See page 64 for additional baluster ornaments.



546
547

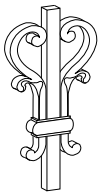


543
535

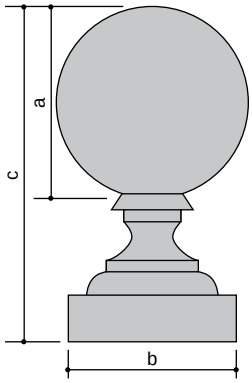


544
545

Malleable Iron	Hole	Width	Height	Weight in lbs.
546	½"	3"	7¾"	.767
547	⅝"	3"	7¾"	.865
543	½"	4⅜"	4¾"	.870
535	⅝"	4⅜"	4¾"	1.160
544	½"	3"	4¾"	.685
545	⅝"	3"	4¾"	.686



Bronze and aluminum urns and finials are polished. Bronze items are clear lacquered. All urns and finials are supplied with a ⅜" tapped hole in the base, except as noted.



Malleable Iron

Square Base	Round Base	a	b	c
3545		2"	1¾"	3½"
3544		1¾"	1½"	3⅜"
3543*		1½"	1¼"	2¾"
3542*		1¼"	1⅛"	2⅜"
3541		1"	⅞"	1¾"

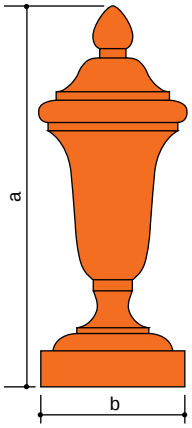
Bronze

3145	3045	2"	1¾"	3½"
3144	3044	1¾"	1½"	3⅜"
3143	3043	1½"	1¼"	2¾"
3142	3042	1¼"	1⅛"	2⅜"
	3041	1"	⅞"	1¾"

Aluminum

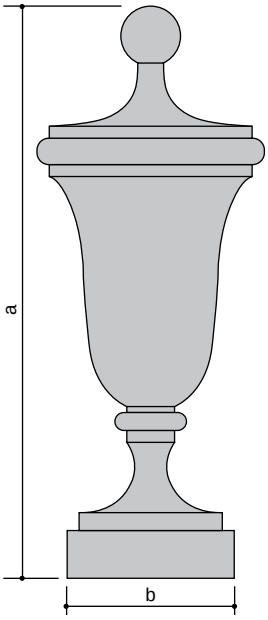
	3243	1½"	1¼"	2¾"

* Available with and without a ⅜" tapped hole.



Bronze

Square Base	Round Base	a	b
3134	3034	4"	1½"
3133	3033	3"	1"



Malleable Iron

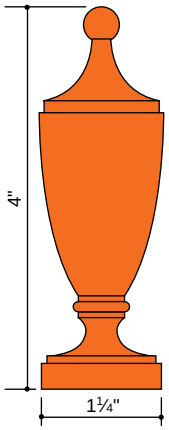
Square Base	Round Base	a	b
3526		6"	1¾"
3525		5"	1½"
3524		4"	1¼"
3523		3"	1"

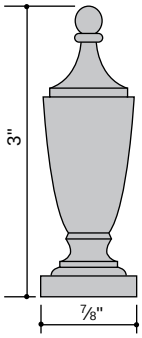
Bronze

3126		6"	1¾"
3125	3025	5"	1½"
3124	3024	4"	1¼"
3123	3023	3"	1"

Aluminum

	3224	4"	1¼"
3323		3"	1"

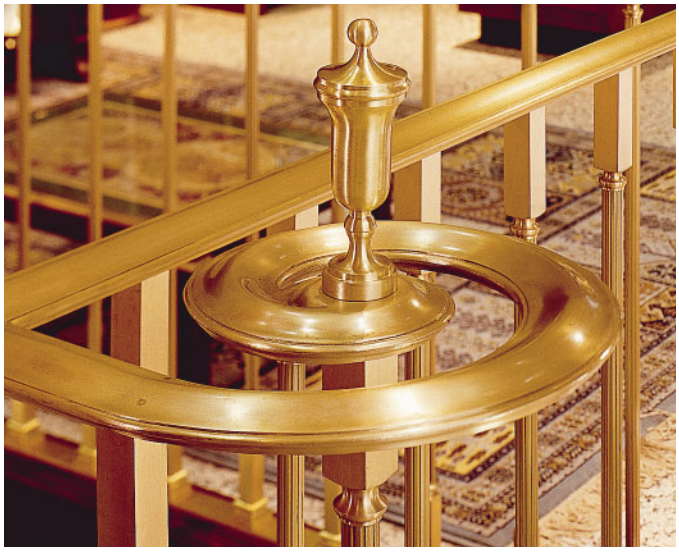




3064 Bronze Round Base

3073 Bronze Round Base
3277 Aluminum* Round Base

* Unpolished



ST. LANDRY BANK & TRUST
Opelousas, Louisiana

MANOR RESTAURANT
West Orange, New Jersey
521 railing panel with **Colorail**® handrail

Many of the Julius Blum treillage patterns are available in both aluminum and malleable iron. Aluminum castings are recommended where it is important to keep weight at a minimum, as in gates or removable screens. Otherwise, malleable iron castings are preferred for their strength and resistance to breakage. **All castings are double faced and cleanly finished.**

Aluminum items are cast from Almag 35. Anodizing of aluminum panels is not recommended as the material will not anodize consistently and does not match the color of anodized extruded aluminum.

Malleable Iron is similar in weight, feel and appearance to gray iron – commonly known as *cast iron.* Gray iron is suitable for small, simple pieces such as post caps, or heavy, solid pieces such as manhole covers. It is not suitable for delicate ornamental cast patterns such as scrolls and flowers. Gray iron is brittle and shatters easily when dropped or hit and it is subject to cracking when exposed to uneven heat during welding.

Malleable Iron will not break or shatter in the course of ordinary handling or shipping and withstands considerable abuse. To some degree, malleable iron castings can be bent cold and they are easily welded. The special properties of malleable iron are produced by heat treating specially alloyed castings in large furnaces under precisely controlled temperature conditions for 8 to 10 days.

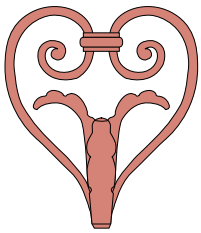
Malleable Iron castings are not priced to compete with gray iron castings. Despite the unsuitability of gray iron for intricate ornamental castings, many ornamental patterns are offered in this cheaper material. Since the manufacture of gray iron castings requires fewer operations than heat-treated malleable iron, and since they are not finished with the care of Julius Blum ornamental castings, they can be sold for less. However, breakage during shipping, fabrication, installation and everyday use often eradicates savings due to the initial lower cost. In the long run, its permanence and the quality of the final product make malleable iron more desirable.

When panels are assembled into screens spanning more than three panels' width or height, it is important to provide adequate intermediate supports.

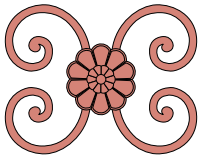
All items are carried in stock in substantial quantities and are normally available for prompt shipment.

CAMBRIDGE

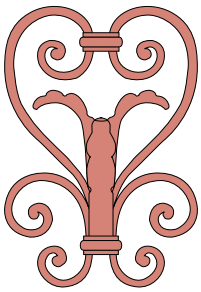
The four elements of the **Cambridge** design can be combined in many different ways to form panels, columns or friezes. The castings are cored to slide over a ½" square bar.



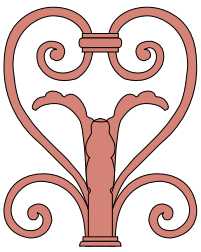
597 2.6 lb
Ht: 9 5/16"; Wd: 8"
Ornamental Panel



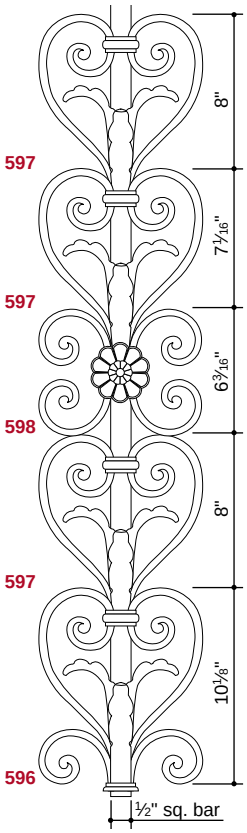
598 2.8 lb
Ht: 6 3/16"; Wd: 8"
Ornamental Panel



599 4.1 lb
Ht: 11⅞"; Wd: 8"
Ornamental Panel

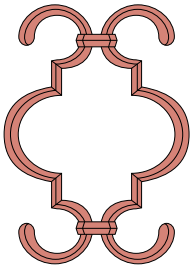


596 3.6 lb
Ht: 10⅜"; Wd: 8"
Ornamental Panel

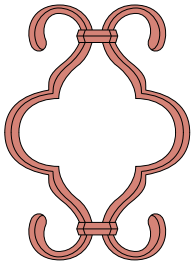


EMPIRE

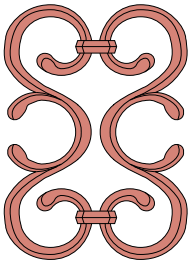
Diamond-shaped cross section gives these panels a distinctive style.



963



964



965

966

967

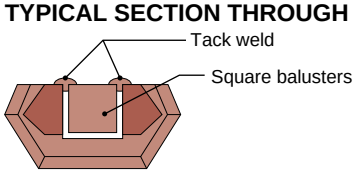
968

969

	height	width	weight (in lb)
963	11"	8"	1.76
964	11"	8"	2.03
965	11"	8"	2.72

	height	width	weight (in lb)
966	5½"	5¼"	1.11
967	5½"	5¼"	1.04
968	5½"	5¼"	1.14
969	5"	5"	.82

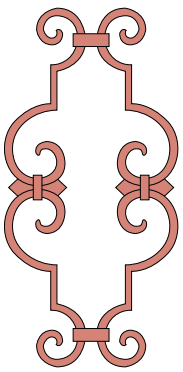
TYPICAL SECTION THROUGH COLLARS



Empire and **Florentine** collars are open on the reverse to fit over square bar. **Cambridge** and **Ornamental Collars** are cored to slide over square bar.

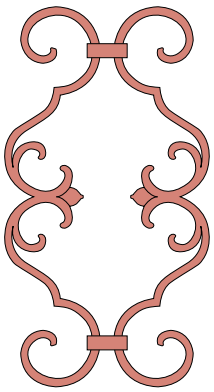
FLORENTINE

Florentine collars are open on one side for easy installation over square bar by tack welding.



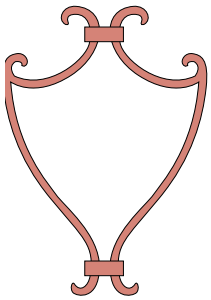
559 3.0 lb
Ht: 15"; Wd: 7"
Railing Panel
for ½" square bar

562 3.8 lb
Ht: 15"; Wd: 7"
Railing Panel
for ⅝" square bar



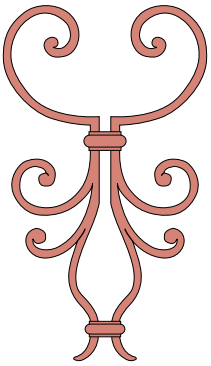
560 3.6 lb
Ht: 16"; Wd: 8½"
Railing Panel
for ½" square bar

563 1.9 lb
Ht: 16"; Wd: 8½"
Railing Panel
for ⅝" square bar

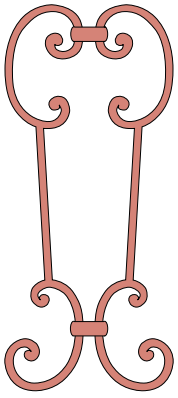


561 1.9 lb
Ht: 12"; Wd: 8½"
Railing Panel
for ½" square bar

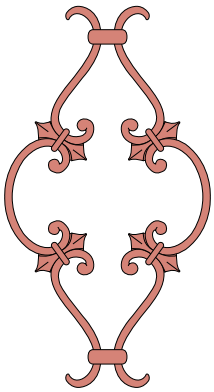
564 2.6 lb
Ht: 12"; Wd: 8½"
Railing Panel
for ⅝" square bar



565 3.3 lb
Ht: 15"; Wd: 8½"
Railing Panel
for ½" square bar



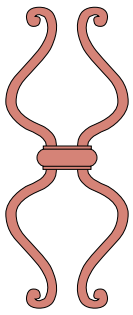
566 2.9 lb
Ht: 16"; Wd: 7"
Railing Panel
for ½" square bar



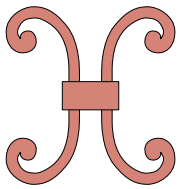
567 3.3 lb
Ht: 16"; Wd: 8½"
Railing Panel
for ½" square bar

ORNAMENTAL COLLARS

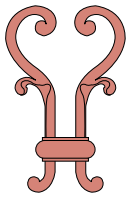
These collars are cored to slide over ½" or ⅝" square bars. Collars are easily applied and can be fastened by screws or by tack welding.



546
547

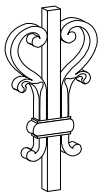


543
535



544
545

	hole	width	height	weight (in lb)
546	½"	3"	7¾"	.767
547	⅝"	3"	7¾"	.865
543	½"	4⅜"	4¾"	.870
535	⅝"	4⅜"	4¾"	1.160
544	½"	3"	4¾"	.685
545	⅝"	3"	4¾"	.686



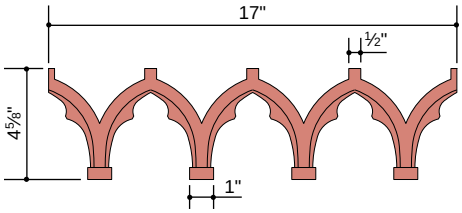
Scale: 1½" = 1'-0"

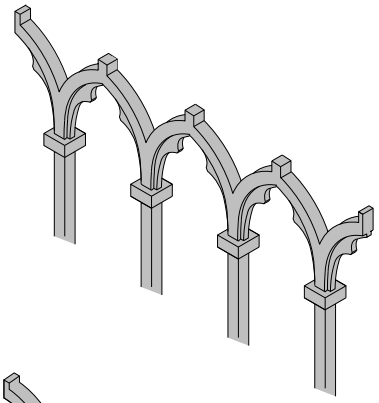
NEW ITEM

ORNAMENTAL VALANCES

Many code authorities require reduced openings in railings where they might present a hazard to small children.These newly introduced castings are useful in various combinations to create ornamental railings which meet these codes. When used with ½" square bars, the maximum opening will be 3¾".

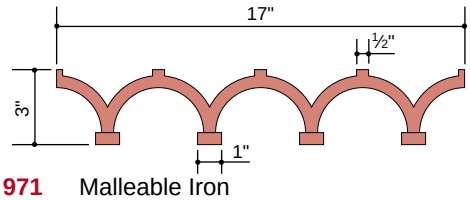
Since the choice of picket is variable, these castings offer an excellent means of creating some unique and interesting designs. They may be used with twisted bar; round or square bars with decorative collars (see pages 60 and 61); or with the ornamental spindles shown on page 56.

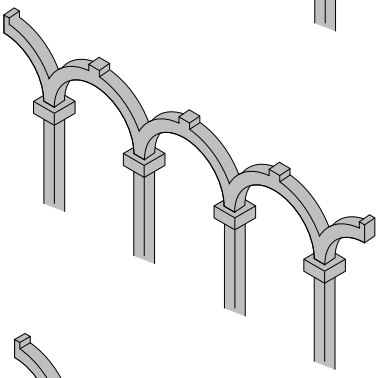




970 Malleable Iron

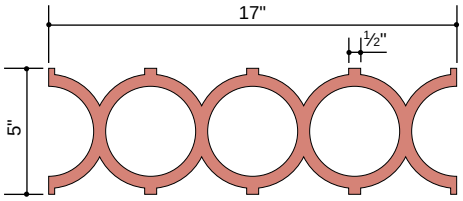
Bases have 9/16" square hole (¼" deep) for insertion of bars or balusters.

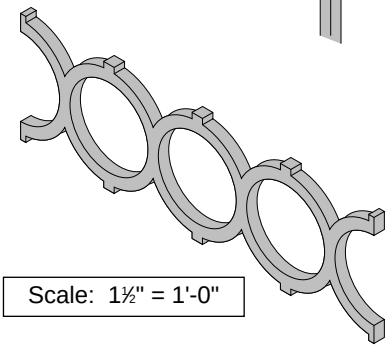




971 Malleable Iron

Bases have 9/16" square hole (¼" deep) for insertion of bars or balusters.

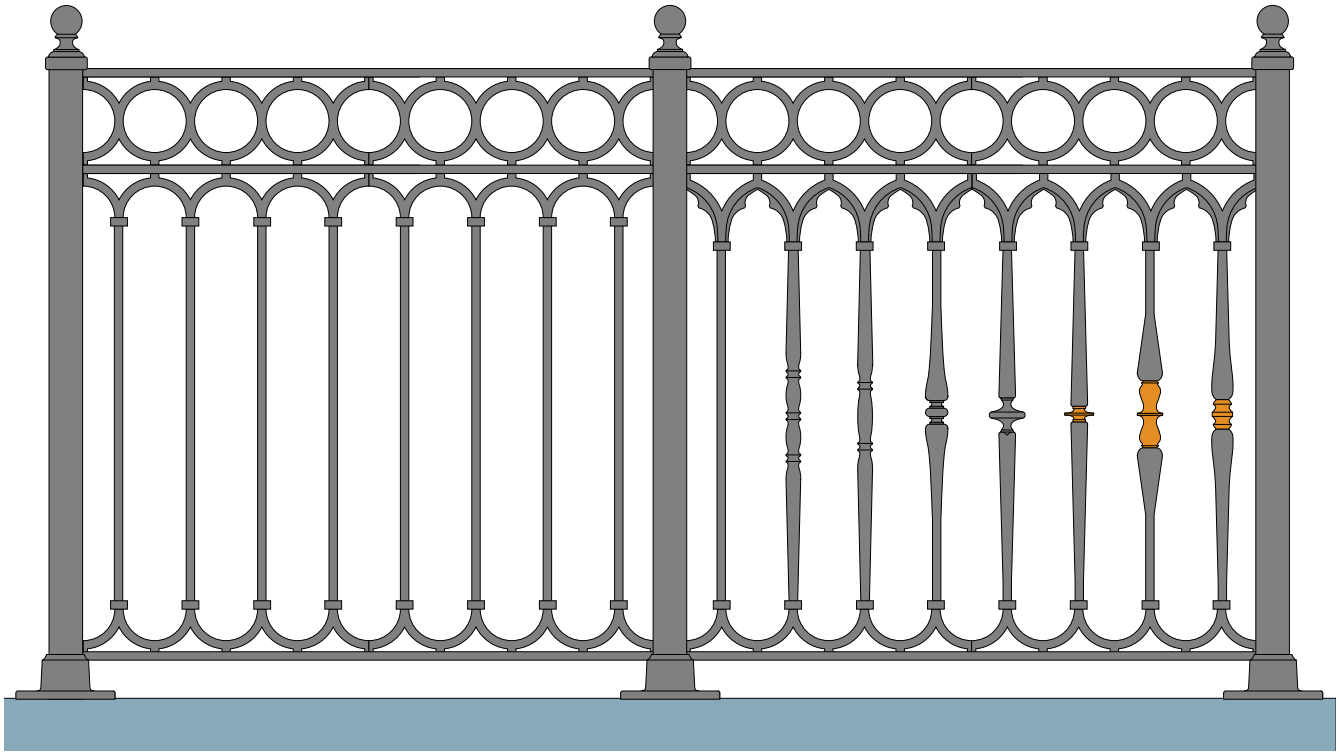




972 Malleable Iron

Scale: 1½" = 1'-0"

ASSEMBLY DETAIL

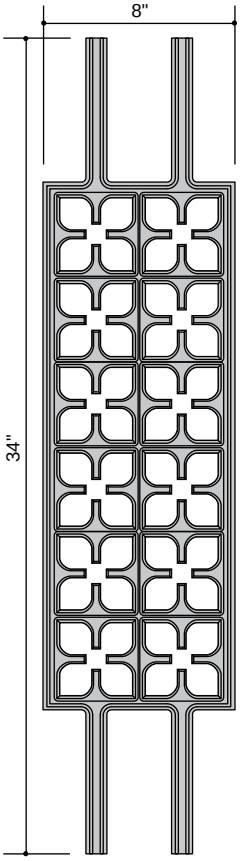


TRECENTO

Trecento panel **1963** dovetails with mullions **6433** or **6432**. Panels can be arranged in continuous runs or make right-angle turns, tees or crosses. Panels can be stacked to form solid screens or separated by lengths of filler rod **6431** to achieve a more open effect. Filler rod **6431** may also be used to close the recess in the exposed sides of the mullion. Panels may be locked into position by tack welding, caulking, set screws or pins.

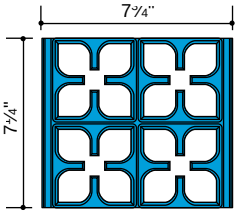
Panel **1962** in aluminum or **962** in malleable iron are self-framed units suitable for use as baluster panels for railings. Panel legs may be trimmed to adjust to railing height or cut at an angle to conform to stair incline.

Railing Panel



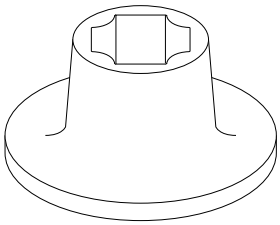
1962 Aluminum 4.3 lb
962 Malleable Iron 12.6 lb

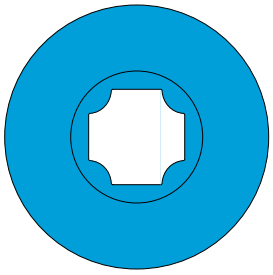
Modular Panel



1963 Aluminum .80 lb

Socket

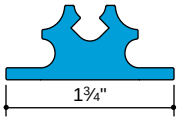




763 Aluminum
for mullion **6433**
2¾" diameter flange

Edge Mullion

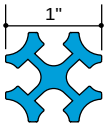
20' lengths



6432 Aluminum .660 lb/ft

Mullion

20' lengths



6433 Aluminum .493 lb/ft

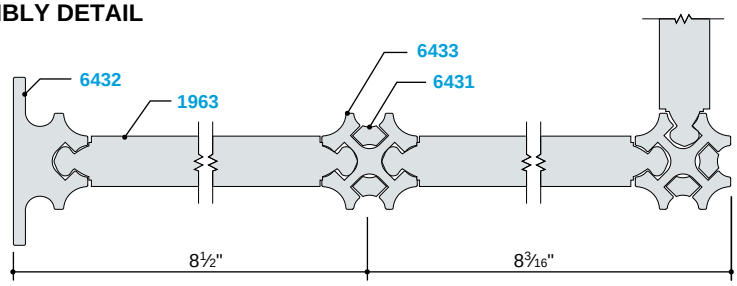
Filler Rod

For mullions **6432** and **6433**

6' lengths

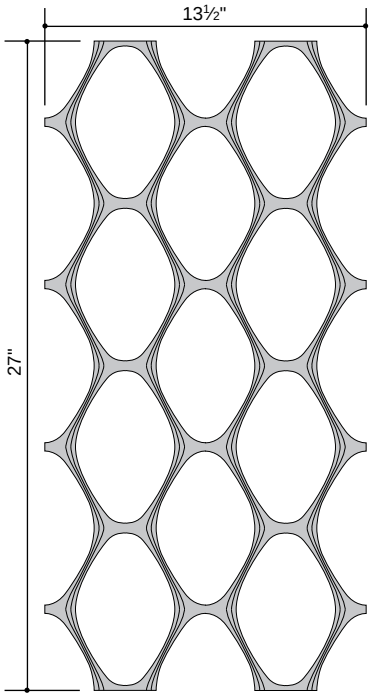
6431 Aluminum .063 lb/ft

ASSEMBLY DETAIL



Panels can be joined both vertically and horizontally to form screens and grilles.

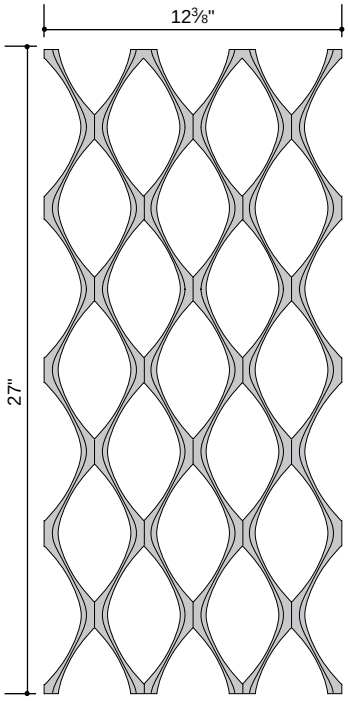
GOSSAMER



1585 Aluminum 3.4 lb
585 Malleable Iron 10.2 lb

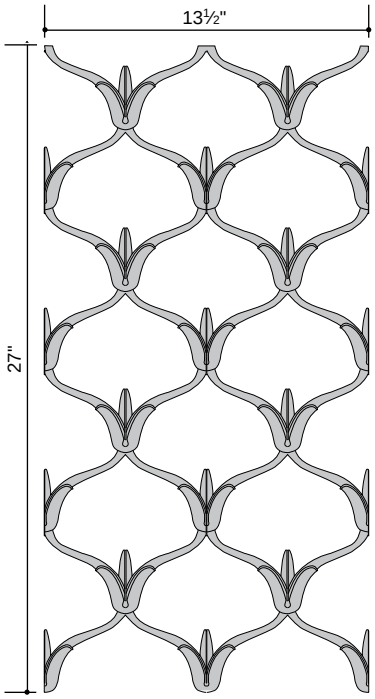
Scale: 1½" = 1'-0"

ONDINE



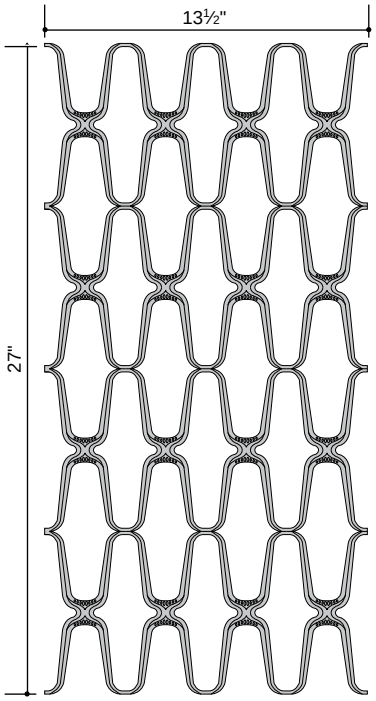
1960 Aluminum 2.6 lb
960 Malleable Iron 7.9 lb

AMSTERDAM

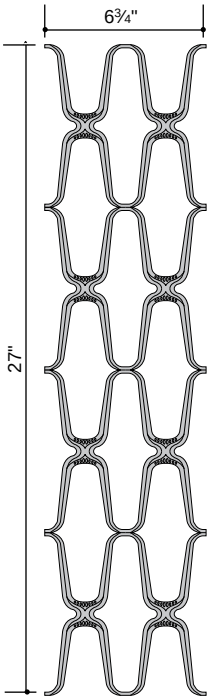


1590	Aluminum	3.5 lb
590	Malleable Iron	10.5 lb

LATTICE



1508	Aluminum	3.1 lb
508	Malleable Iron	9.3 lb

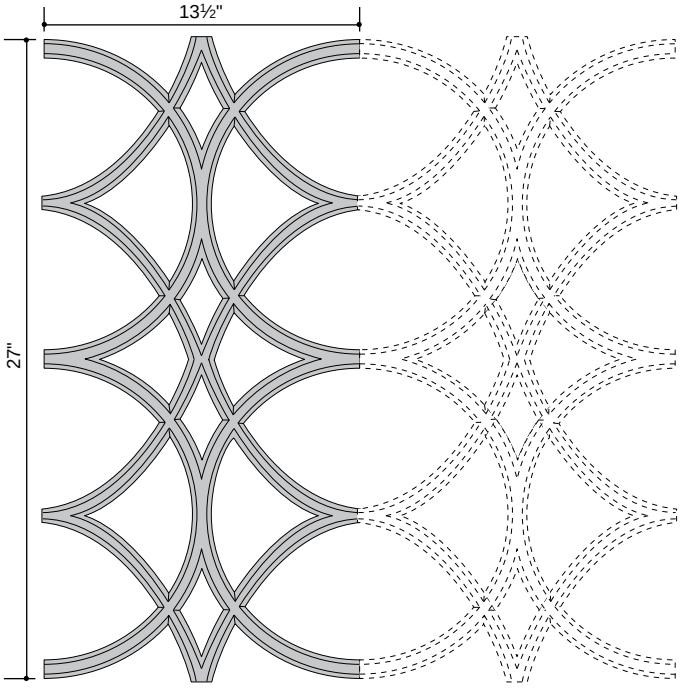


504	Malleable Iron	4.5 lb

Panels can be joined both vertically and horizontally to form screens and grilles.

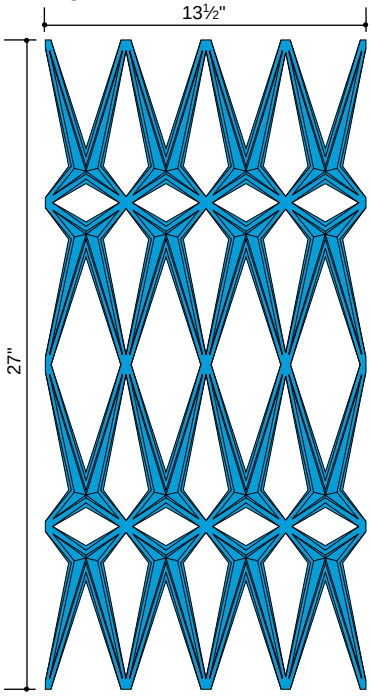
Scale: 1½" = 1'-0"

ARABESQUE

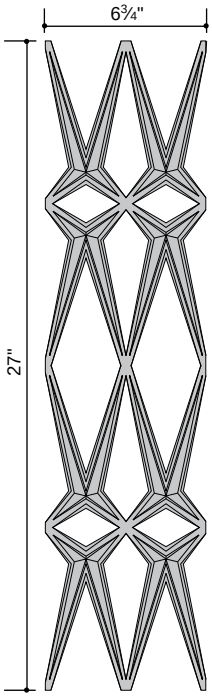


1961	Aluminum	2.6 lb
961	Malleable Iron	7.7 lb

DIAMOND



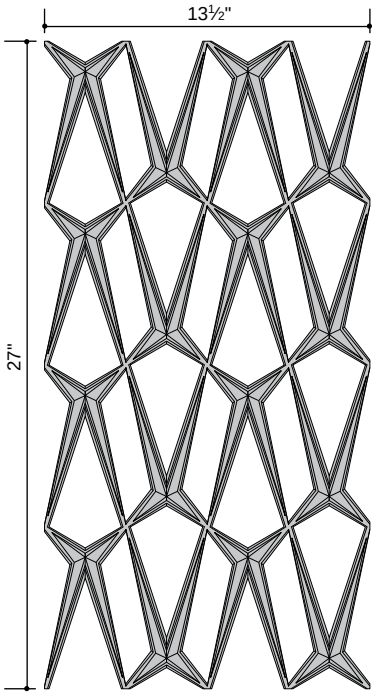
1575 Aluminum 4.3 lb



1542 Aluminum 2.1 lb
542 Malleable Iron 6.4 lb

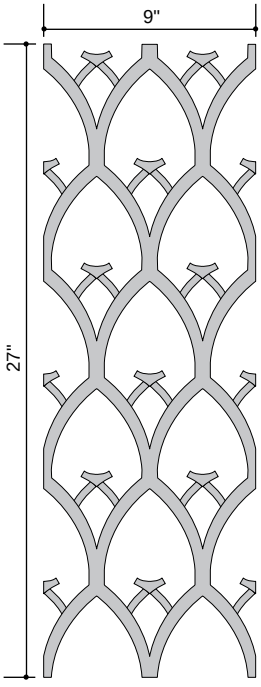
Panels can be joined both vertically and horizontally to form screens and grilles.

CASCADE



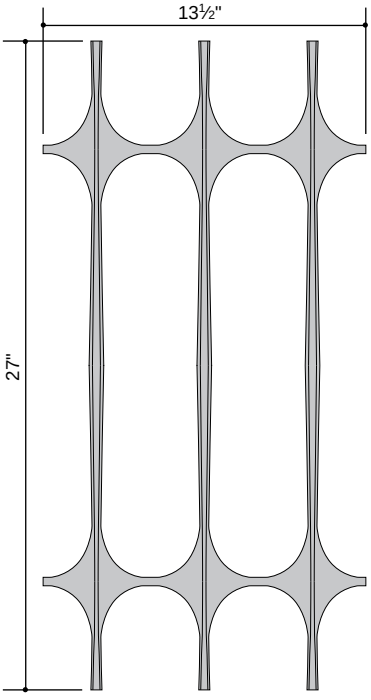
1583 Aluminum 4.3 lb
583 Malleable Iron 12.8 lb

CANTERBURY



1589 Aluminum 3.0 lb
589 Malleable Iron 8.8 lb

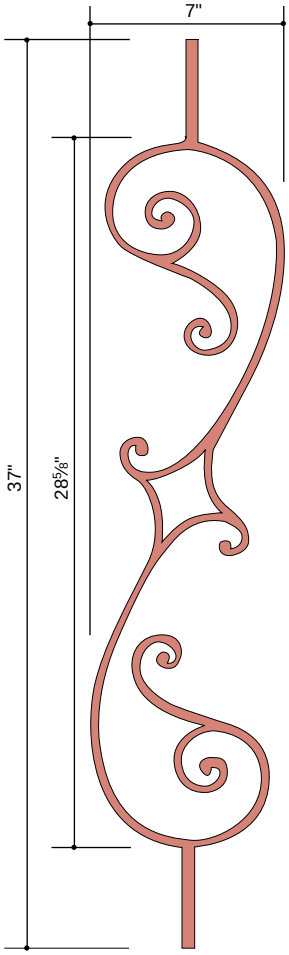
SENTRY



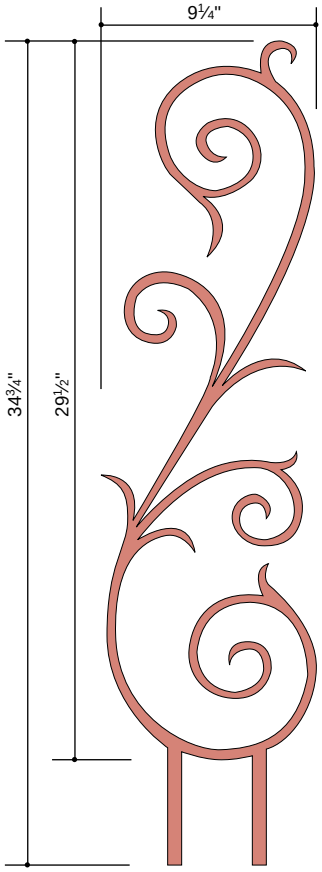
1579 Aluminum 2.8 lb
579 Malleable Iron 8.4 lb

Scale: 1½" = 1'-0"

CHATEAU

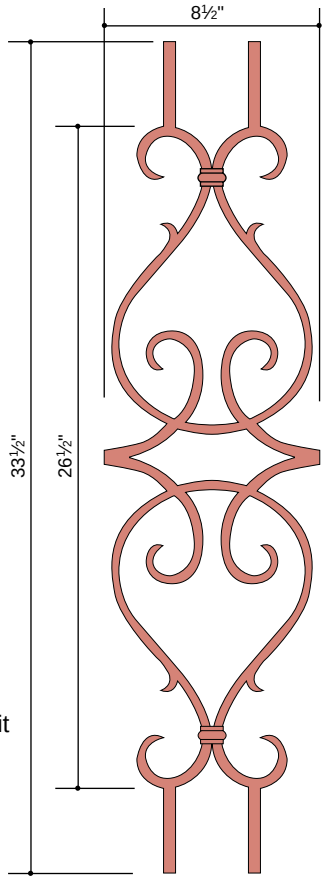


537 Railing Panel 4.4 lb
Cross Section:
Scroll – ½" × 5⁄16"
Ends – ½" × ½"



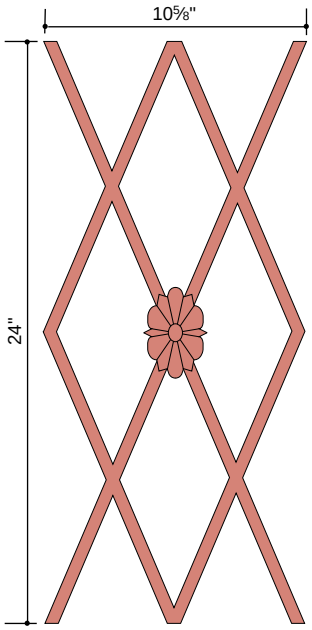
538 Railing Panel 6.8 lb
Cross Section:
Scroll – ⅝" × 7⁄16"
Ends – ½" × ½"

Panel **539** may be split lengthwise to form a valance or frieze.

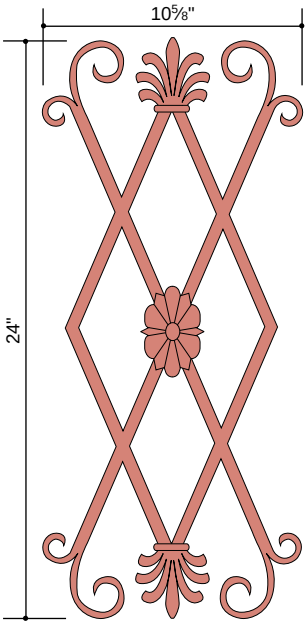


539 Railing Panel 7.8 lb
Cross Section:
Scroll – ⅝" × 7⁄16"
Ends – ½" × ½"

Scale: 1½" = 1'-0"



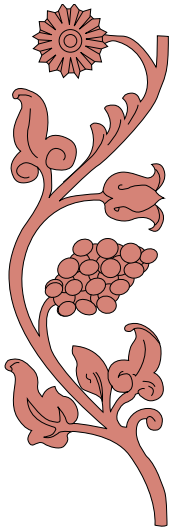
Panels **540** and **541** are often combined both horizontally and vertically.



540 Railing Panel 9 lb
Cross Section: ⅝" × ½"

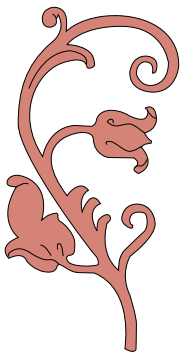
541 Railing Panel 10 lb
Cross Section: ⅝" × ½"

SIENA

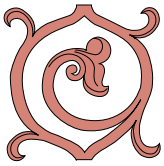


522 8.4 lb
Ht: 20⅜"; Wd: 6⁷⁄₁₆"
Continuous Design

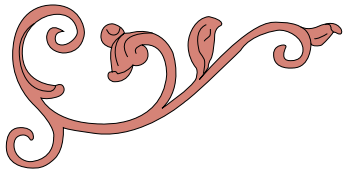
Repeat or alternate **522** and **523** for continuous runs in columns or friezes.



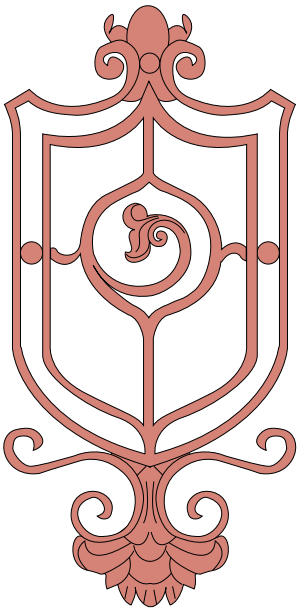
525 4.2 lb
Ht: 13⅝"; Wd: 6⁷⁄₁₆"
End Panel



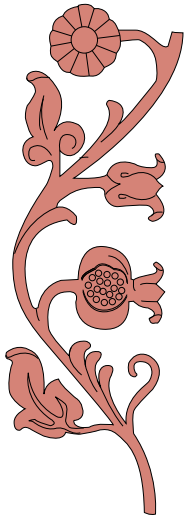
526 2.6 lb
Ht: 6⁷⁄₁₆"; Wd: 6⁷⁄₁₆"
Corner Rosette



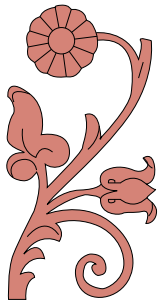
527 3.7 lb
Ht: 7"; Wd: 13⅜"
Corner Bracket



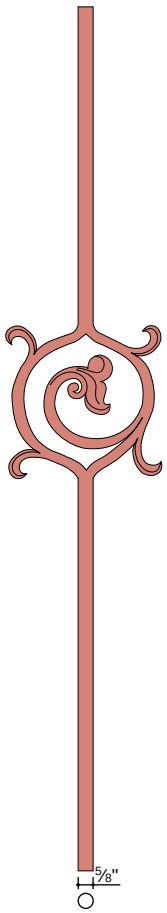
521 16.0 lb
Ht: 24⅞"; Wd: 12"
Railing Panel



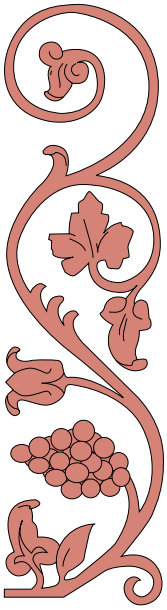
523 6.9 lb
Ht: 20¼"; Wd: 6⁷⁄₁₆"
Continuous Design



524 4.3 lb
Ht: 10¾"; Wd: 6⁷⁄₁₆"
Starting Panel

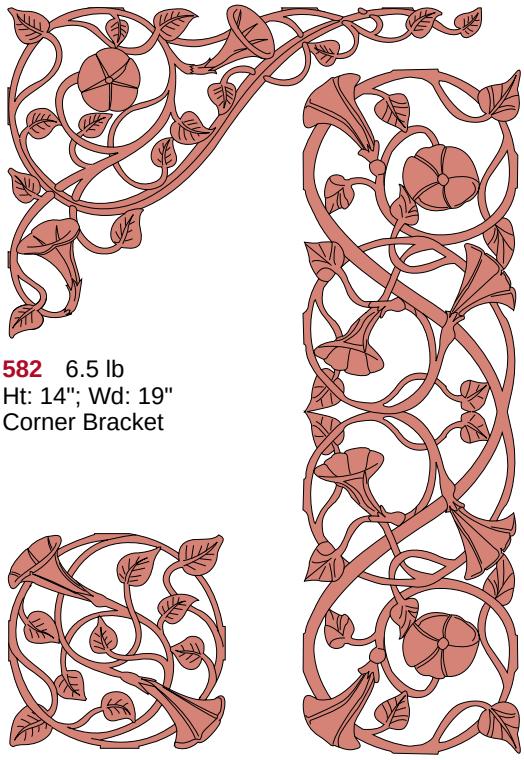


532 5.0 lb
Ht: 36"
Baluster Bar



520 10.5 lb
Ht: 24⅞"; Wd: 6⁷⁄₁₆"
Railing Panel

SOMERSET

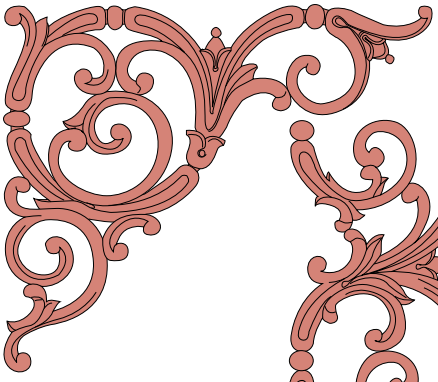


582 6.5 lb
Ht: 14"; Wd: 19"
Corner Bracket

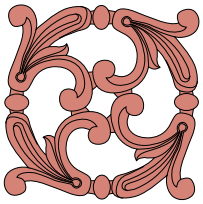
581 4.1 lb
Ht: 9"; Wd: 9"
Corner Rosette

580 13.0 lb
Ht: 28"; Wd: 9"
Railing Panel

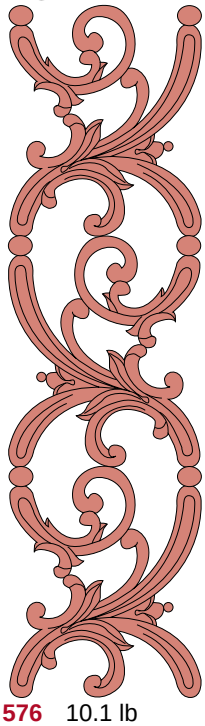
REGENCE



577 8.2 lb
Ht: 15¼"; Wd: 18"
Corner Bracket



578 3.2 lb
Ht: 8"; Wd: 8"
Corner Rosette

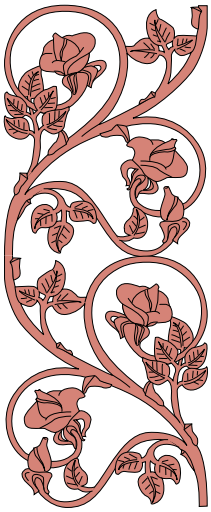


576 10.1 lb
Ht: 29"; Wd: 8"
Railing Panel

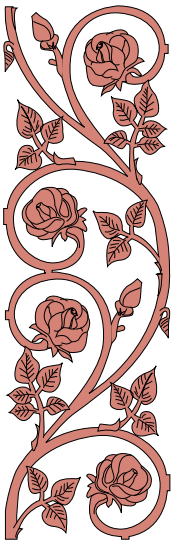
Scale: 1½" = 1'-0"

DRESDEN

568 8.7 lb
Ht: 28"; Wd: 8½"
Railing Panel
Use together with **569**



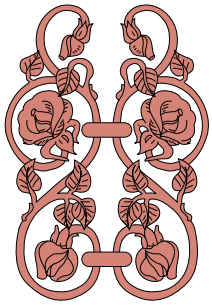
569 6.5 lb
Ht: 21"; Wd: 8½"
Continuous Design



572 5.7 lb
Ht: 22½"; Wd: 6⅞"
Continuous Design

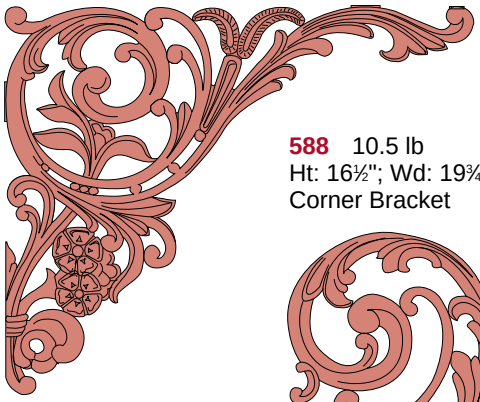
574 5.0 lb
Ht: 10¼"; Wd: 16"
Corner Bracket

573 2.3 lb
Ht: 6⅞"; Wd: 6⅞"
Corner Rosette

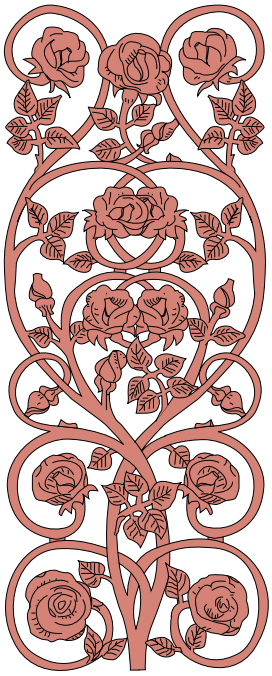


570 4.1 lb
Ht: 12½"; Wd: 8½"
Collar
Collar is open on one side to fit over ½" square bar.

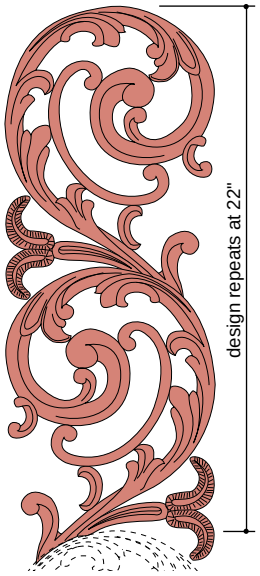
ROCOCO



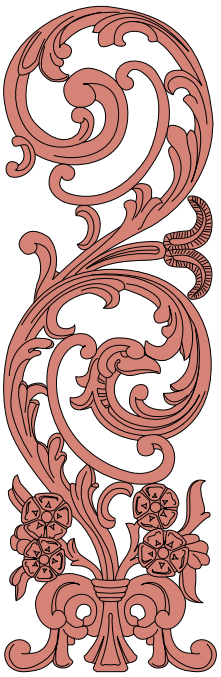
588 10.5 lb
Ht: 16½"; Wd: 19¾"
Corner Bracket



571 14.0 lb
Ht: 28"; Wd: 11"
Railing Panel

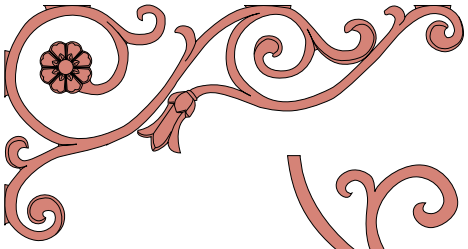


587 10.7 lb
Ht: 23¼"; Wd: 8¾"
Continuous Design

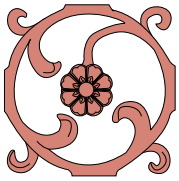


586 14.9 lb
Ht: 28"; Wd: 8¾"
Railing Panel

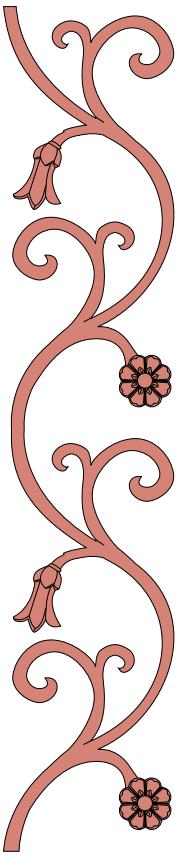
CORINTHIAN



552 4.3 lb
Ht: 10"; Wd: 19"
Corner Bracket



551 2.4 lb
Ht: 7⅛"; Wd: 7⅛"
Corner Rosette

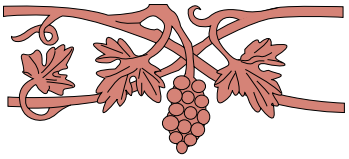


550 6.7 lb
Ht: 34"; Wd: 7⅛"
Continuous Design

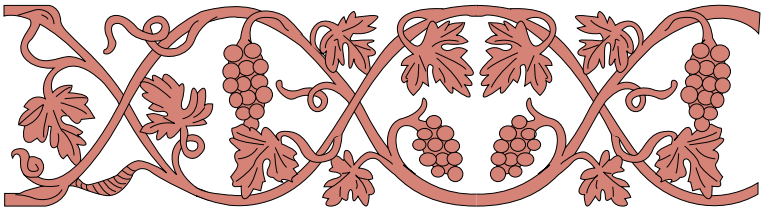
Scale: 1½" = 1'-0"

BORDEAUX

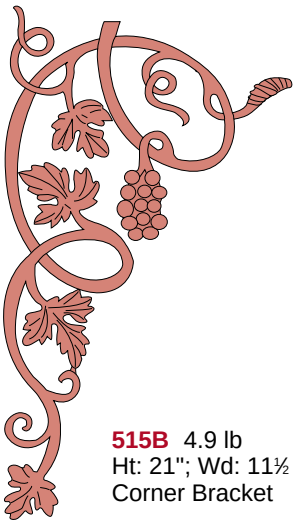
513 25.2 lb
Ht: 36"; Wd: 36"
Corner Bracket
Furnished in three sections.



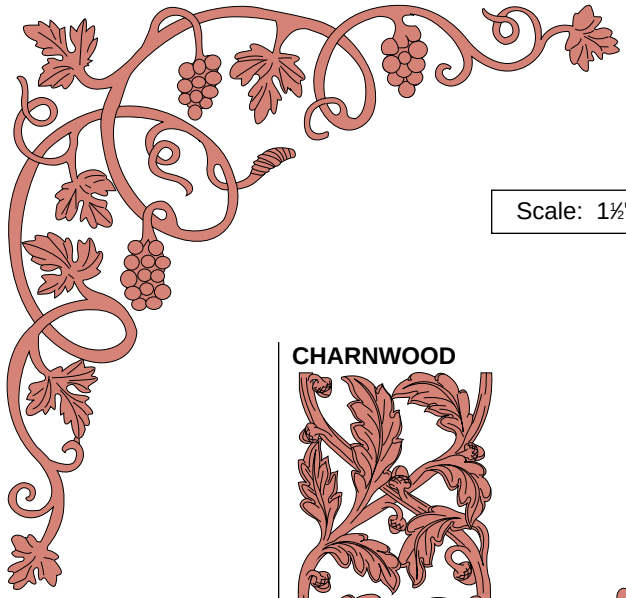
514 3.4 lb
Length: 14"; Wd: 6½"
Valance



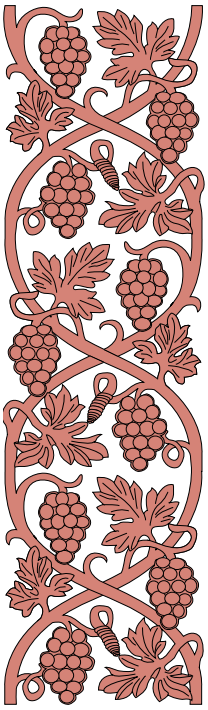
511 11.2 lb
Length: 31"; Wd: 8¼"
Frieze



515B 4.9 lb
Ht: 21"; Wd: 11½
Corner Bracket

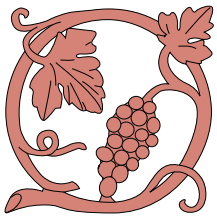


Scale: 1½" = 1'-0"



510 13.6 lb
Ht: 29"; Wd: 8¼"
Railing Panel

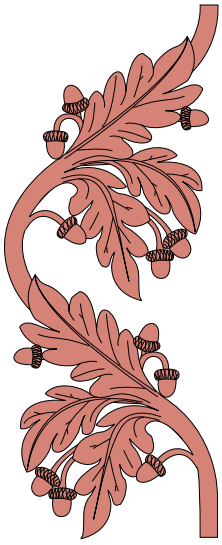
515 8.7 lb
Ht: 23½"; Wd: 25"
Corner Bracket
Furnished in two sections.



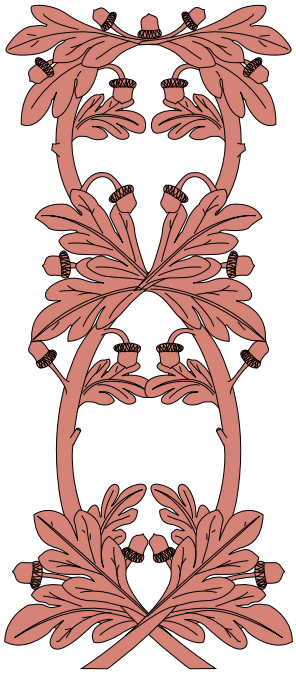
512 4.0 lb
Ht: 8¼"; Wd: 8¼"
Corner Rosette

CHARNWOOD

548 12.3 lb
Ht: 27¾"; Wd: 8"
Railing Panel



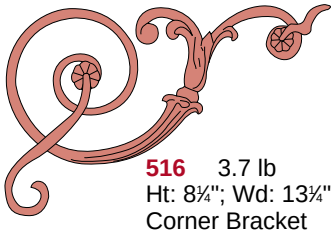
555 9.2 lb
Ht: 20¾"; Wd: 9¼"
Continuous Design



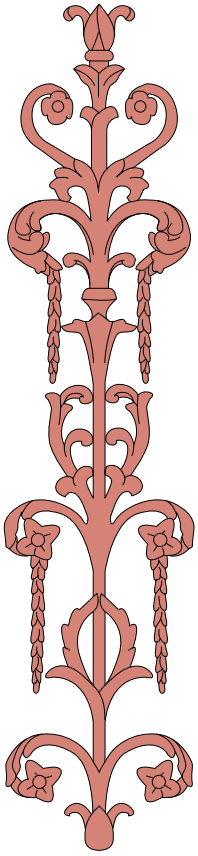
558 16.8 lb
Ht: 28"; Wd: 11½"
Railing Panel

MILAN Malleable Iron
Being of equal width, **Milan** panels may be stacked vertically.

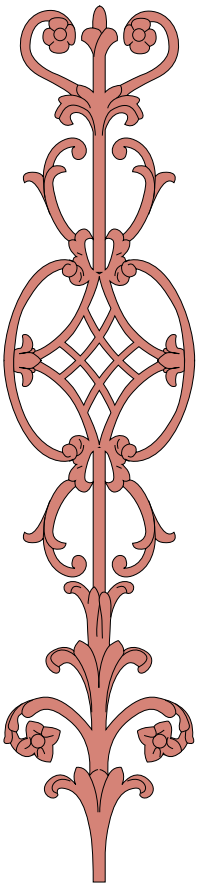
All castings are double faced



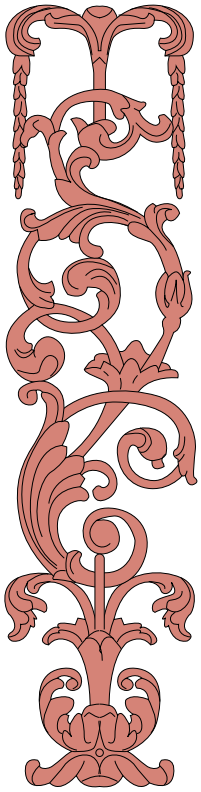
516 3.7 lb
Ht: 8¼"; Wd: 13¼"
Corner Bracket



517 12.0 lb
Ht: 34½"; Wd: 7⅝"
Railing Panel



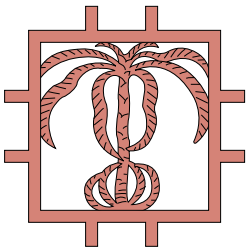
518 11.3 lb
Ht: 35½"; Wd: 7⅝"
Railing Panel



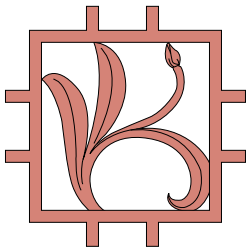
519 12.5 lb
Ht: 32"; Wd: 7⅝"
Railing Panel

Scale: 1½" = 1'-0"

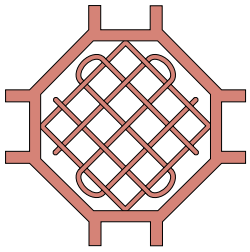
PRIMAVERA Malleable Iron
Ornamental Panels
Ht: 10"; Wd: 10" (without legs: 8" × 8")



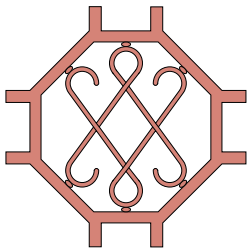
591 3.9 lb



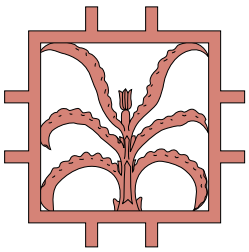
592 3.4 lb



593 3.2 lb



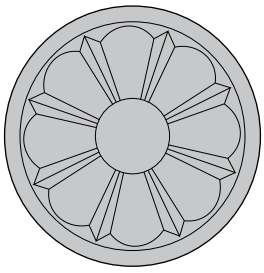
594 3.0 lb



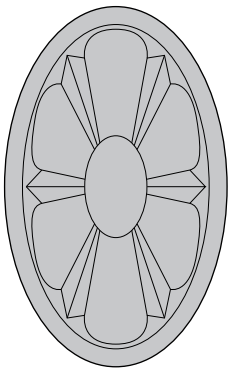
595 3.7 lb

584 9.9 lb
Ht: 29"; Wd: 6½"
Railing Panel

CAST ROSETTES
Thickness: approx. ¼"
* Burnished finish

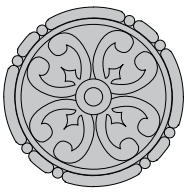


2554 Cast Iron
2654 Bronze*
2454 Aluminum*
2¾" diameter



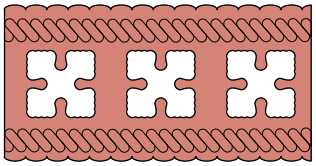
2553 Cast Iron
Oval: 3½" × 2³⁄₁₆"
2653 Bronze*
Oval: 3⁵⁄₁₆" × 2¹⁄₁₆"
2453 Aluminum*
Oval: 3⁵⁄₁₆" × 2¹⁄₁₆"

6203 Cast Iron
6603 Bronze*
1¾" diameter

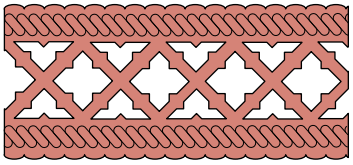


6201 Cast Iron
6601 Bronze*
1⅞" diameter

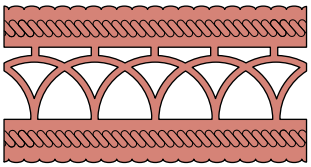
PRESSED STEEL MOULDINGS 10' lengths



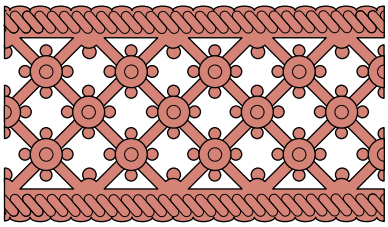
2855 3¼" wide



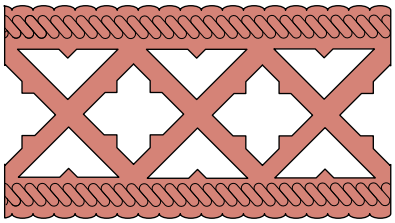
2866 3¼" wide



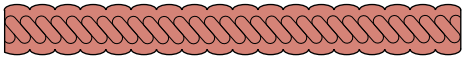
2870 3¼" wide



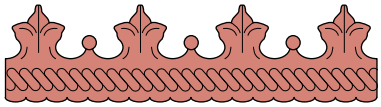
2858 4½" wide



2856 4½" wide

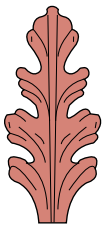


2861 15⁄16" wide



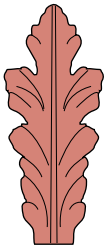
2859 2" wide

PRESSED STEEL LEAVES

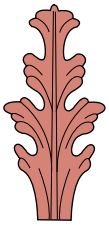


2016 4½" long

2003 3½" long

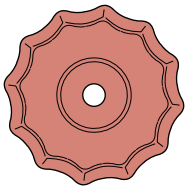


2023 5" long

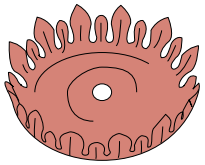


2017 4½" long

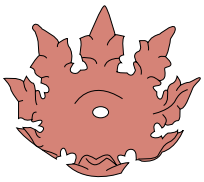
PRESSED STEEL CANDLE PANS AND HUSKS



2640 3¾" diam.

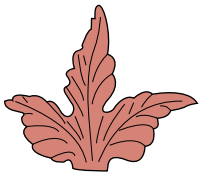


2620 4" diam.



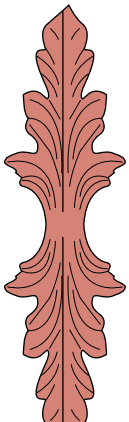
2629 4" diam.

2905 5" long
2908 8" long
2910 10" long

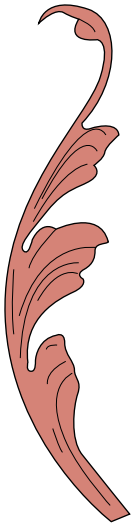


2962 4" wide

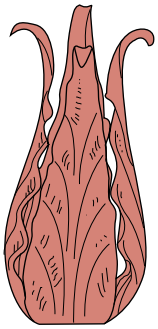
2932 2½" wide



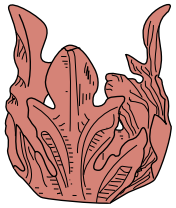
2982 9¼" long



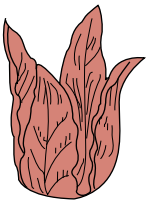
2012 6" long
2014 10¾" long
2015 11" long



2719 2¼" wide 5½" high

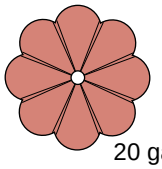


2717 3¼" wide 3¼" high



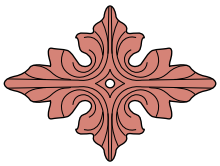
2726 1¼" wide 2¾" high

PRESSED STEEL ROSETTES



20 gauge

	diameter
2503	1"
2515	1½"
2528	2"
2538	3"



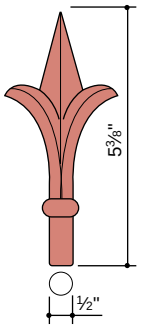
2608 3¼" high 4⅜" wide

	diameter
2611	2⅜"
2616	3⅝"

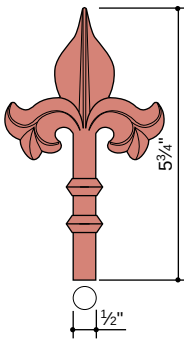
2524 1⅜"wide

PICKETS

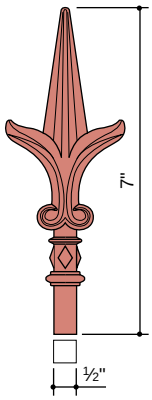
Shanks are 1" long



4 Malleable Iron



12 Malleable Iron



54 Malleable Iron

This section contains details on the Julius Blum & Co. components which are of particular use in the assembly of elevator cabs. Included are elevator door saddles and flat fluted sections in aluminum, bronze and nickel-silver, and handrail mouldings and brackets which are suitable for vertical mounting.

Aluminum components are of alloy 6063 – extrusions are T52 temper while machined brackets are T6 temper. When properly fabricated, they are suitable for anodizing, including most of the hard-coat anodic processes. Black anodizing may result in inconsistent matches – consult your anodizer before specifying.

Bronze components are of extruded architectural bronze alloy, C38500.

Nickel-Silver saddles, fluted sections and handrail are extruded from copper-nickel-zinc alloy, C79800.

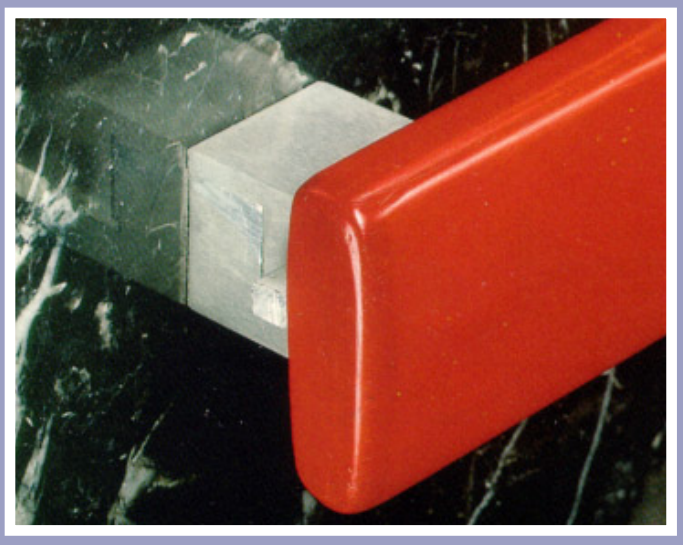
Stainless Steel components are made of Type 302/304 (18-8) stainless steel.

All brackets are satin finished.

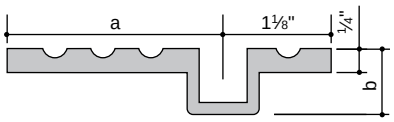
Acrylic/Wood handrail mouldings – in oak, walnut and ash – are impregnated with acrylic plastic according to the Permagrain Radiation Process. This provides a hard surface and permanent finish which has twice the resistance to indentation and several times the resistance to abrasion as the same hardwood finished conventionally. It is laminated from several strips so as to obtain greater strength and continuous uniform lengths. For more information, see page 33.

Colorail® handrail is made of extruded polyvinyl chloride – non-flammable and highly resistant to wear, weathering and corrosion. It is available in thirteen stock colors – **Black Satin**, **Black Glossy**, **White**, **Dove Gray**, **Dark Gray**, **Gold**, **Red**, **Green**, **Yellow**, **Blue**, **Beige**, **Brown** and **Mauve** – and ten shapes (refer to pages 28 and 29 for shapes and approximate color samples).

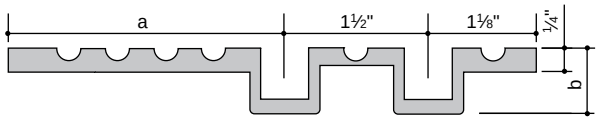
Refer to pages 95 to 112 for our full range of tubing, bars and shapes in aluminum, bronze, steel and stainless steel.



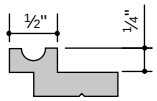
ELEVATOR DOOR SADDLES



		a	b	lb/ft	Lengths
6963	Aluminum	2¼"	11/16"	.85	20'
6969	Aluminum	2⅜"	11/16"	1.08	20'
4563	Bronze	2¼"	11/16"	2.85	6', 8', 16'
4569	Bronze	2⅜"	11/16"	3.31	6', 8', 10', 20'
5563	Nickel-Silver	2¼"	¾"	3.41	6', 8', 10'
5569	Nickel-Silver	2⅜"	11/16"	3.44	6', 8', 10'



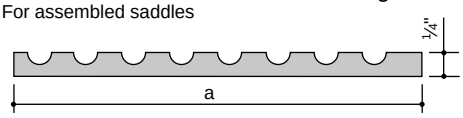
		a	b	lb/ft	Lengths
6964	Aluminum	2¼"	11/16"	1.25	20'
6979	Aluminum	2⅜"	11/16"	1.44	20'
4564	Bronze	2¼"	11/16"	4.25	6', 8', 10', 16'
4579	Bronze	2⅜"	11/16"	5.09	6', 8', 10', 16'
5564	Nickel-Silver	2¼"	¾"	4.63	6', 8', 10'
5579	Nickel-Silver	2⅜"	11/16"	4.90	6', 8', 10'



		lb/ft	Lengths
6967	Aluminum	.314	20'
4567	Bronze	1.040	20'
5567	Nickel-Silver	.950	20'

FLAT FLUTED SECTIONS 20' lengths, except as noted

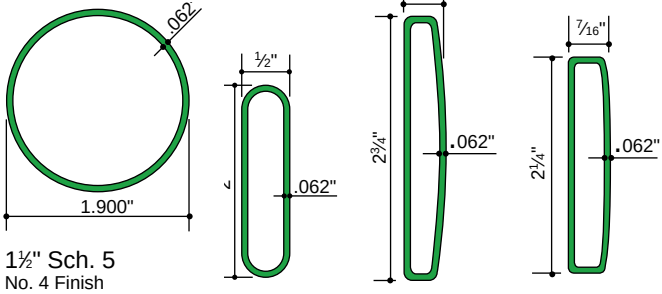
For assembled saddles



		a	lb/ft
6980	Aluminum	1"	.234
6970	Aluminum	1½"	.361
6971	Aluminum	2"	.482
6973	Aluminum	3"	.723
6975	Aluminum	4"	.964
4566	Bronze	1"	.72
4558	Bronze	1½"	1.15
4557	Bronze	2"	1.48
4556	Bronze	2½"	1.84
4555	Bronze	3"	2.23
4554	Bronze	3½"	2.55
4553	Bronze	4"	2.89
4553-Q	Bronze	4¼"	3.26
4552	Bronze	4½"	3.29
4551	Bronze	5"	3.67
4550	Bronze*	5½"	4.05
4559	Bronze*	6⅛"	4.55
5553	Nickel-Silver	4"	2.89
5558	Nickel-Silver	1½"	1.15

* 16' lengths

STAINLESS 20' lengths



1½" Sch. 5
No. 4 Finish
1.274 lb/ft
Fittings: end cap
elbows

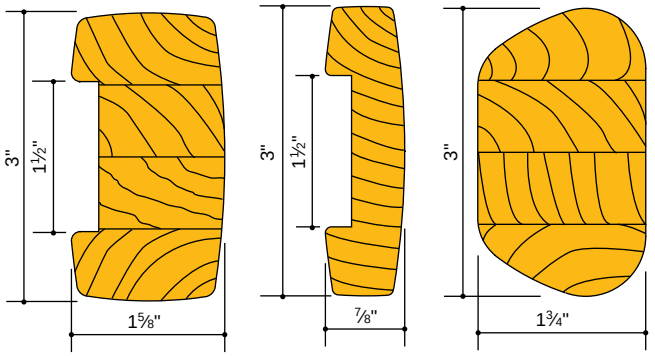
4488* .944 lb/ft

6511* 1.25 lb/ft

6512* 1.00 lb/ft

*No fittings available. Smooth mill finish.

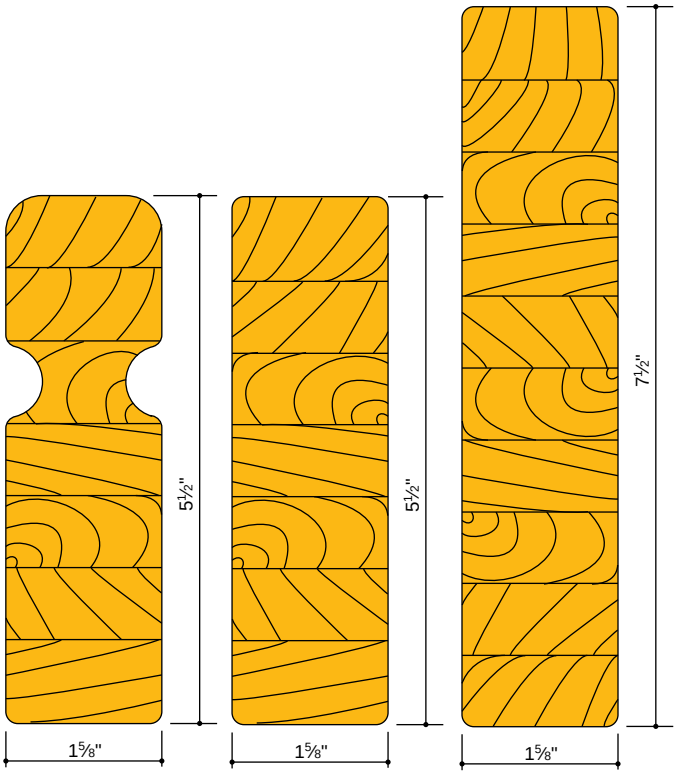
ACRYLIC/WOOD 16' lengths



8511 Oak
8512 Walnut

8501 Oak
8502 Walnut

8531 Oak



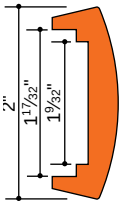
8591 Oak

8521 Oak
8522 Walnut
8523 Ash

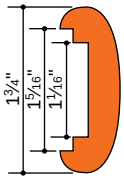
8561 Oak
8562 Walnut

Scale: 6" = 1'-0"

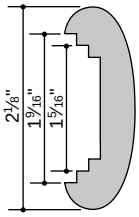
BRONZE (C38500) and **NICKEL-SILVER** (C79800)
20' lengths, except as noted



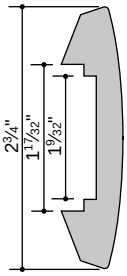
4575 2.64 lb/ft
Fittings: end cap



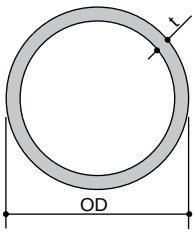
4539 2.66 lb/ft
Fittings: end cap



4535 3.16 lb/ft
Fittings: end cap
5235 3.18 lb/ft
Fittings: end cap

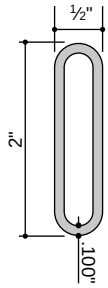


4574 3.71 lb/ft
Fittings: end cap
5274 3.73 lb/ft
Fittings: end cap



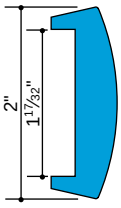
		O.D.	t	lb/ft
6489	Bronze	1½"	.100"	1.75
	Bronze	1.90"	.100"	2.07
	Bronze	1.90"	.150"	3.13
5289	Nickel-Silver	1½"	.100"	1.75
	Nickel-Silver	1.90"	.125"	2.56

Fittings: end cap *Red Brass C23000

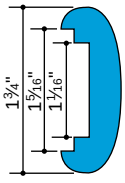


6488 Bronze 1.56 lb/ft
5288 Nickel-Silver 1.57 lb/ft
16' lengths

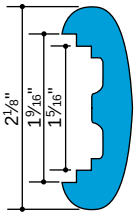
ALUMINUM (6063-T52) 20' Lengths



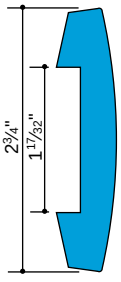
6985 .98 lb/ft
Fittings: end cap



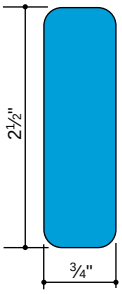
6933 .77 lb/ft
Fittings: end cap



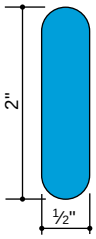
6935 .98 lb/ft
Fittings: end cap



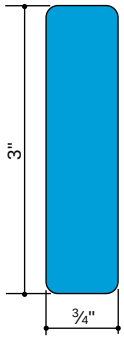
6984 1.30 lb/ft
Fittings: end cap



6939 2.21 lb/ft

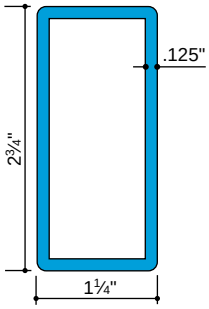


6988 1.14 lb/ft

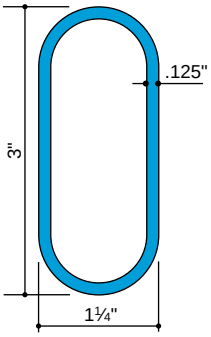


6986 2.68 lb/ft

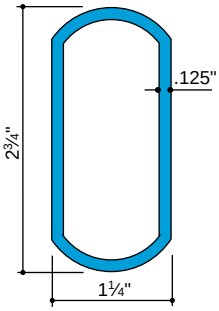
ALUMINUM (6063-T52) 20' lengths



6434* 1.123 lb/ft
Fittings: end cap

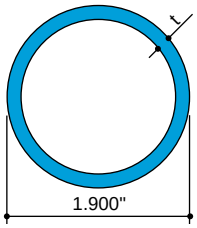


6437 1.057 lb/ft
Fittings: end cap



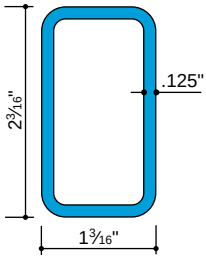
6435* 1.075 lb/ft
Fittings: end cap

* 6063-T6

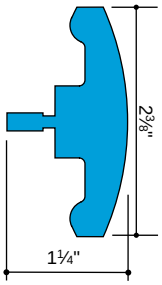


Pipe size	Sch.	t	lb/ft
1½"	10	.109"	.721
1½"	40	.145"	.940

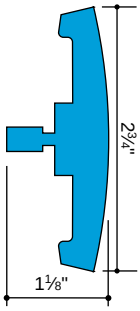
Fittings: end cap



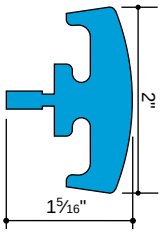
6436 .888 lb/ft
Fittings: end cap



6402 1.51 lb/ft
Fittings: end cap

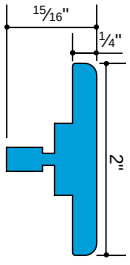


6404 1.57 lb/ft
Fittings: end cap

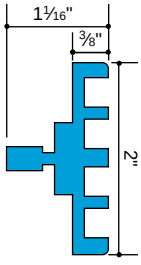


6405 1.39 lb/ft
Fittings: end cap

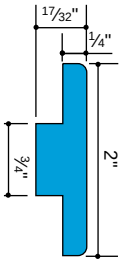
COLORAIL® SUPPORT SECTIONS 20' lengths
See page 28 for **Colorail**® cover moulding in 13 colors and 10 shapes



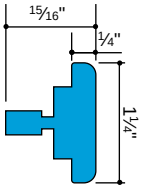
6442 .895 lb/ft



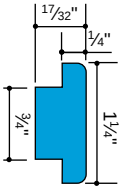
6443 .823 lb/ft



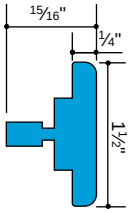
6445 .847 lb/ft



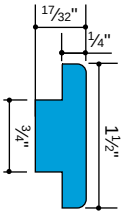
6440 .67 lb/ft



6447 .60 lb/ft

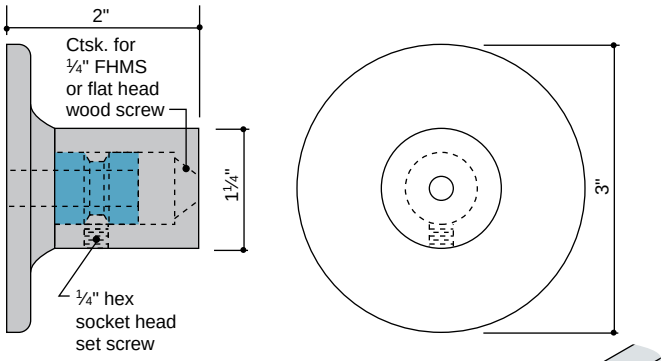


6441 .745 lb/ft

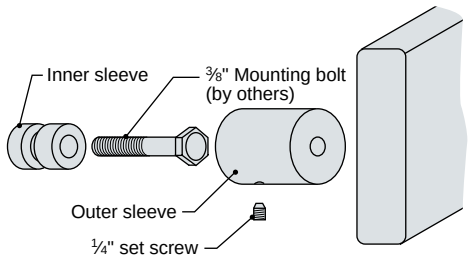


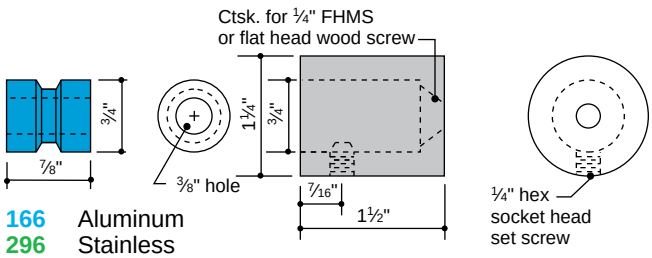
6444 .697 lb/ft

TWO-PIECE MOUNTING BRACKETS Satin Finish



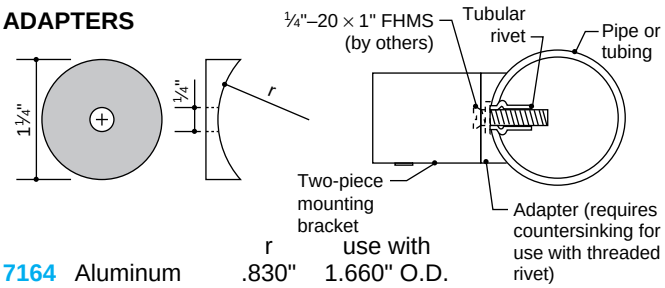
168 Aluminum
298 Stainless
898 Bronze





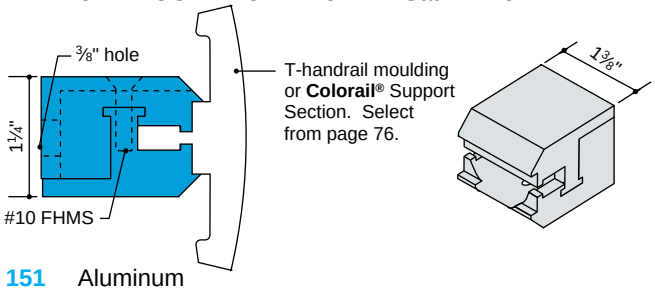
166 Aluminum
296 Stainless
896 Bronze
196 Nickel-Silver

ADAPTERS



		r	use with
7164	Aluminum	.830"	1.660" O.D.
7264	Aluminum	.950"	1.900" O.D.
8864	Bronze	.950"	1.900" O.D.
8964	Bronze	.750"	1.500" O.D.
9164	Stainless	.830"	1.660" O.D.
9364	Stainless	.950"	1.900" O.D.
5364	Nickel-Silver	.950"	1.900" O.D.
5264	Nickel-Silver	.750"	1.500" O.D.

VERTICAL MOUNTING BRACKET Satin Finish

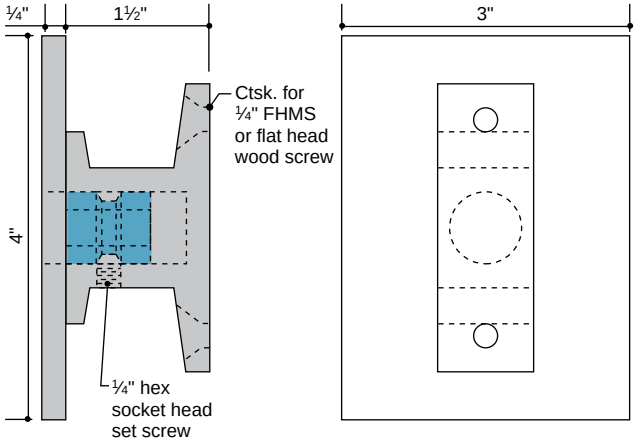


151 Aluminum

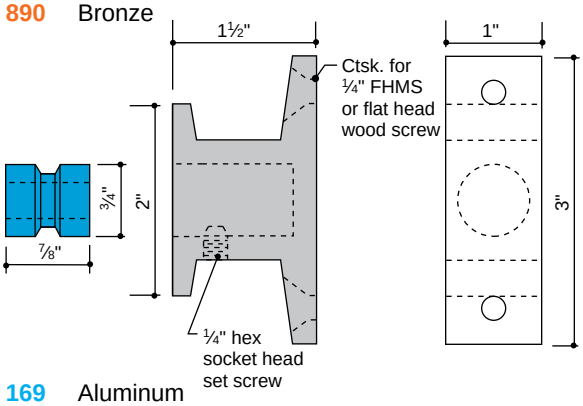
Colorail® mouldings may be selected from page 28.

TWO-PIECE MOUNTING BRACKETS Satin Finish

For wide wood handrails

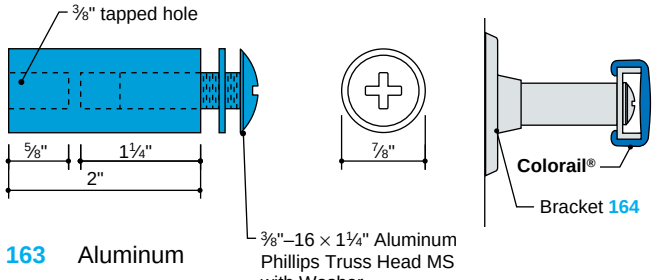


160 Aluminum
290 Stainless
890 Bronze

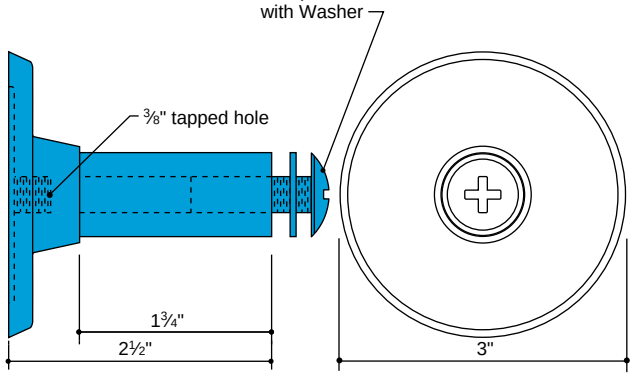


169 Aluminum
299 Stainless
899 Bronze

THREADED BUSHING BRACKETS Satin Finish



163 Aluminum



164 Aluminum

NEW ITEM
Item **224**, glass mounted handrail adapter kit. Permits the mounting of **Carlstadt®** handrail brackets directly to predrilled, tempered glass.

For convenience and ease of reference, all of the handrail brackets which appear in various sections of our catalog are brought together in this section. Included are brackets for wall, post, center rail and vertical mounting; for use with mouldings or flat bars; for pipe railings; and for specific items such as **Colorail®** support bars and **Carlstadt®** handrail mouldings.

Aluminum: Cast brackets are made of high strength alloy Almag 35 — suitable for clear anodizing. Extruded and machined brackets are of alloy 6063 — suitable for anodizing, including most of the hard coat anodic processes (black anodizing may result in inconsistent matches; consult your anodizer before specifying). All, except as noted, are satin finished. Pipe rail brackets are stocked with a clear anodized finish – AA-M32-C22-A31 (204R1) – as well as plain. Aluminum brackets cover a wide range of applications, including wall and post mounted brackets, and brackets for center rails and for vertical mounting of rails or panels.

Bronze: Cast brackets are made of alloy C86500 for close color match with extruded architectural bronze C38500 and red brass C23000. Extruded and machined brackets are of alloy C38500. All, except as noted, are satin finished and lacquered.

Nickel-Silver: Extruded brackets are of alloy C79800. Sometimes referred to as *white bronze,* nickel-silver is a copper/nickel alloy. It is similar in appearance to stainless steel with a touch of gold.

Stainless Steel: Brackets are made of 18-8 chrome-nickel alloy, stainless type 304, for high corrosion resistance. All have a satin finish.

Malleable Iron and Stamped Steel: All types are stocked with flat top member for mouldings and with curved top member for pipe rails. They may be welded or mechanically fastened to the rail. Pipe rail brackets are supplied galvanized as well as plain. These brackets are often used with wood handrails.

Julius Blum handrail brackets have been designed to meet or exceed accepted safety standards and have been laboratory tested. Test results are available upon request.

All items are carried in stock in substantial quantities and are available for prompt shipment.

CARLSTADT® SELF-ALIGNING WALL BRACKETS

These wall brackets, available in aluminum, bronze and stainless steel, are self-aligning. Once the concealed wall attachment is made, the bracket yoke – which attaches to the handrail – rotates freely until the chosen handrail is properly aligned. Several styles are available to match with various handrail styles and pipe.

CARLSTADT® SELF-ALIGNING POST BRACKETS

These post brackets, available in aluminum, bronze and stainless steel, are post-mounted variations of the **Carlstadt®** wall brackets. A solid post is prepared by drilling and tapping to provide a match to the ½" stainless stud included as part of the brackets (be sure to remove this stud prior to anodizing the aluminum brackets). Hollow posts require a clear hole to be drilled with a tapped post cap or anchor plug inserted to accept the stud.

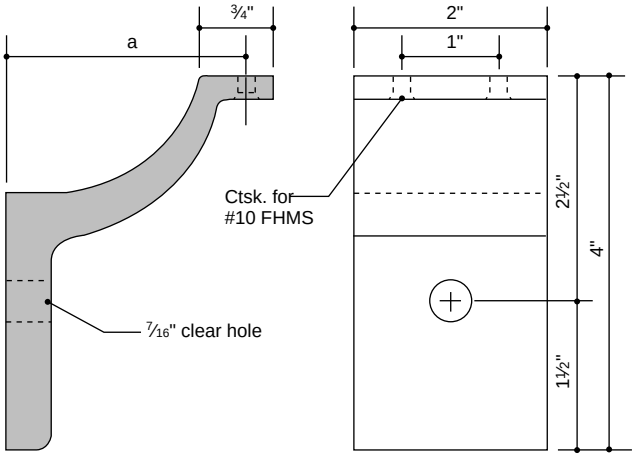
CAST, STAMPED AND EXTRUDED BRACKETS

These wall brackets are more traditional in style and are of use in a multitude of applications. The various styles allow for concealed fastening or by attachment with a single ⅜" mounting bolt through the wall flange center.

VERTICAL MOUNTING BRACKETS

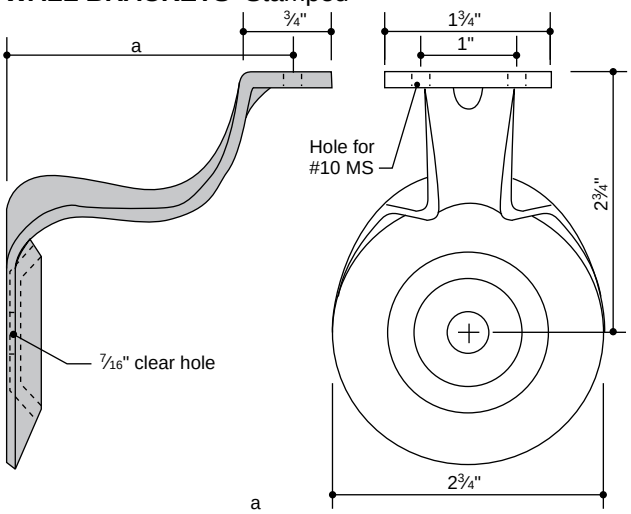
These mounting brackets are useful for mounting handrails vertically as in an elevator cab or hospital corridor. They are also suitable for mounting handrails on top of a parapet or *knee* wall.

WALL BRACKETS Extruded – Unpolished



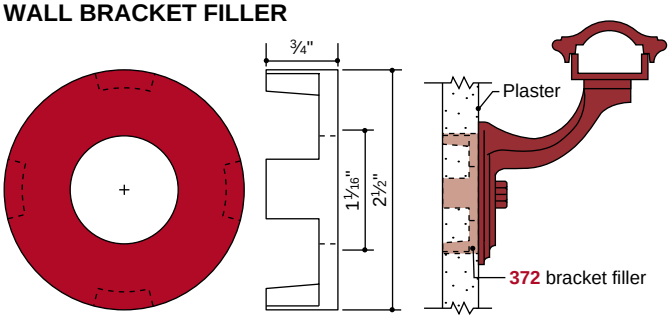
		a			a
477	Aluminum	2½"	497	Aluminum	3"
891	Bronze	2½"	893	Bronze	3"
217	Stainless †	2½"	219	Stainless †	3"
			193	Nickel-Silver	3"

WALL BRACKETS Stamped



		a
621	Steel	2½"
625	Steel	3"
1021	Stainless ††	2½"

WALL BRACKET FILLER

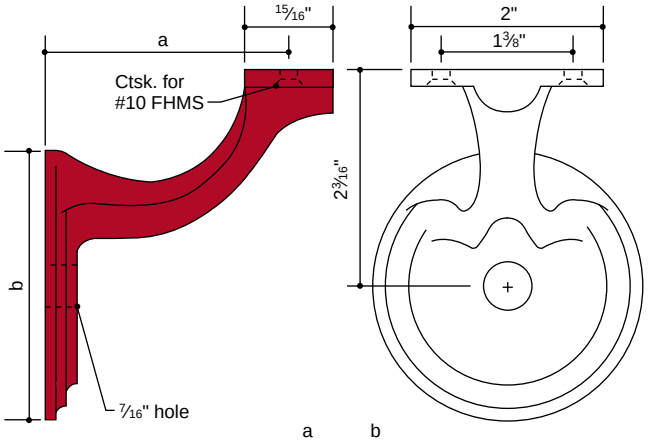


372 Cast Iron

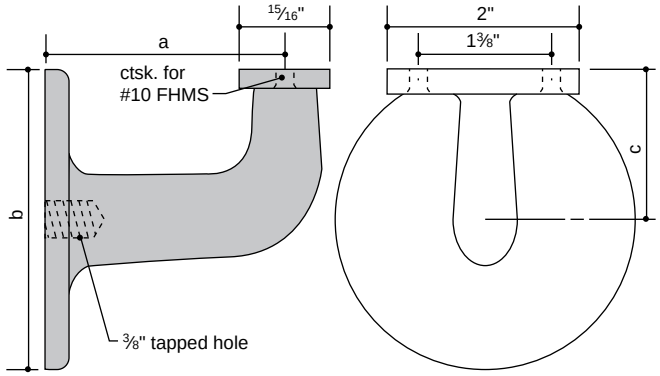
Set bracket filler in plaster wall before mounting handrail bracket.

† Satin Finish
†† Burnished

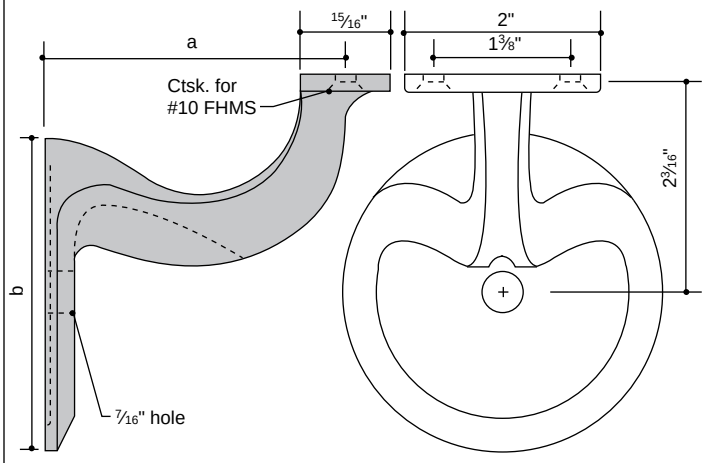
WALL BRACKETS Cast



		a	b
305	Malleable Iron	3"	3¼"
381	Malleable Iron	2½"	2¾"

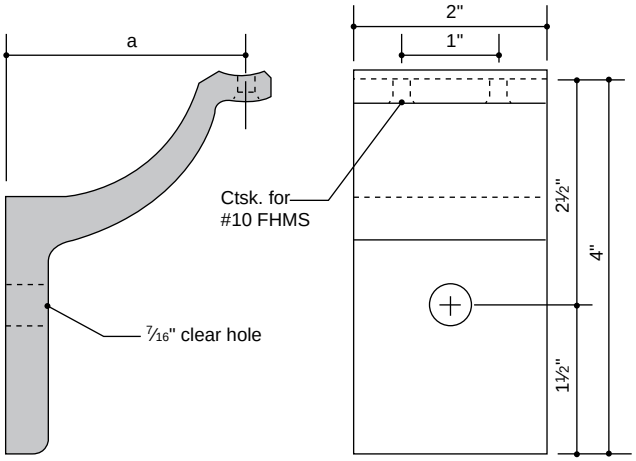


		a	b	c
371	Aluminum †	2½"	3⅛"	1 9⁄16"
302	Aluminum †	3⅛"	3¾"	1⅞"
370	Bronze †	2½"	3⅛"	1 9⁄16"
304	Bronze †	3⅛"	3¾"	1⅞"
270	Stainless †	2½"	3⅛"	1 9⁄16"
377	Malleable Iron	2½"	3⅛"	1 9⁄16"
385	Malleable Iron	3"	3⅛"	1 9⁄16"



		a	b
315	Aluminum †	3"	3¼"
383	Aluminum †	2½"	2¾"
317	Bronze †	3"	3¼"
387	Bronze †	2½"	2¾"

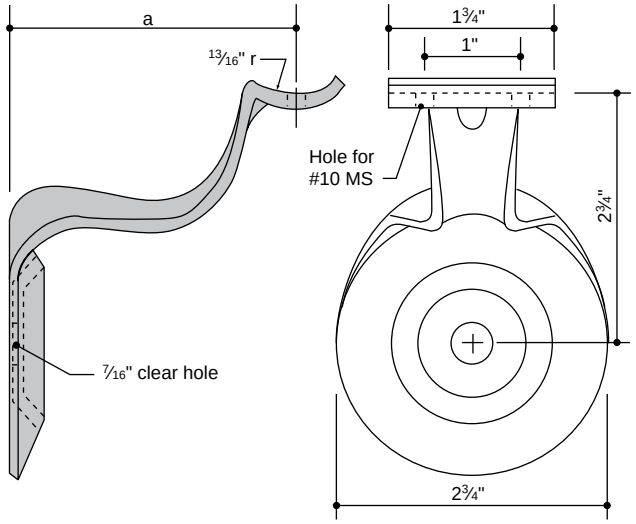
WALL BRACKETS Extruded – Unpolished



		a			a
478	Aluminum	2½"	498	Aluminum	3"
478A	Aluminum•	2½"	498A	Aluminum•	3"
892	Bronze	2½"	894	Bronze	3"
218	Stainless†	2½"	220	Stainless†	3"
192	Nickel-Silver	2½"			

• Clear anodized AA-M10-C22-A31 (204R1)

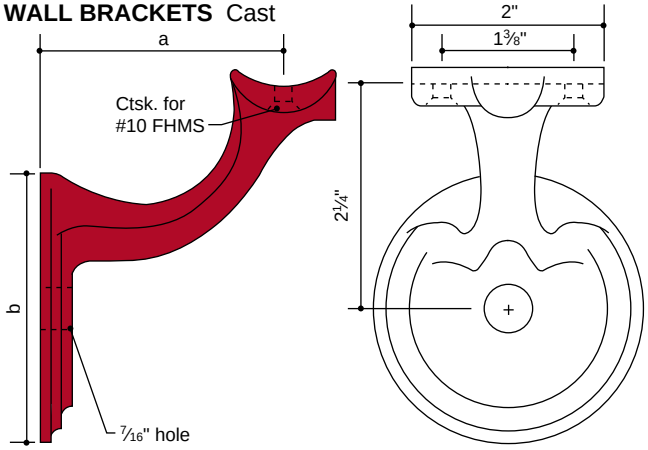
WALL BRACKETS Stamped



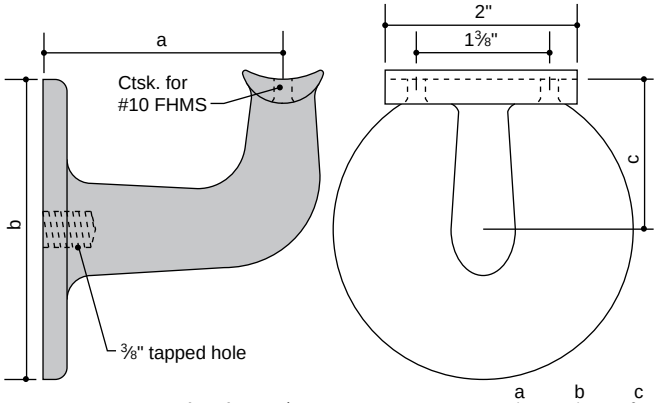
		a			a
622	Steel	2½"	626	Steel	3"
1622	Steel (Galvanized)**	2½"	1626	Steel (Galvanized)**	3"
1022	Stainless ††	2½"	1026	Stainless ††	3"

* Clear anodized AA-M32-C22-A31 (204R1)
† Satin Finish †† Burnished
** Galvanized brackets may require redrilling and tapping of holes fouled by zinc.

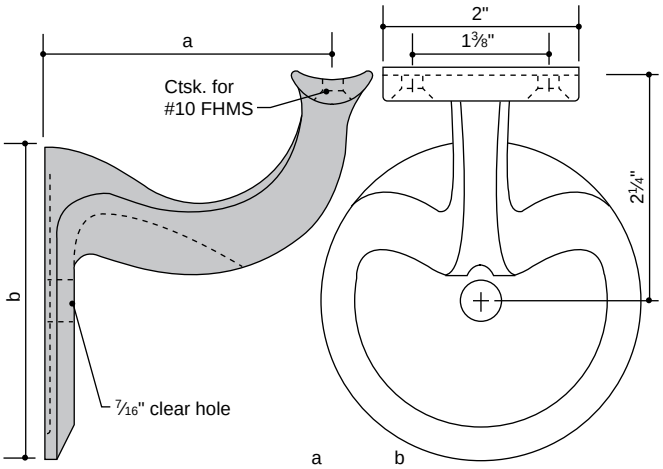
WALL BRACKETS Cast



		a	b
306	Malleable Iron	3"	3¼"
1306	Malleable Iron (Galvanized)**	3"	3¼"
382	Malleable Iron	2½"	2¾"
1382	Malleable Iron (Galvanized)**	2½"	2¾"

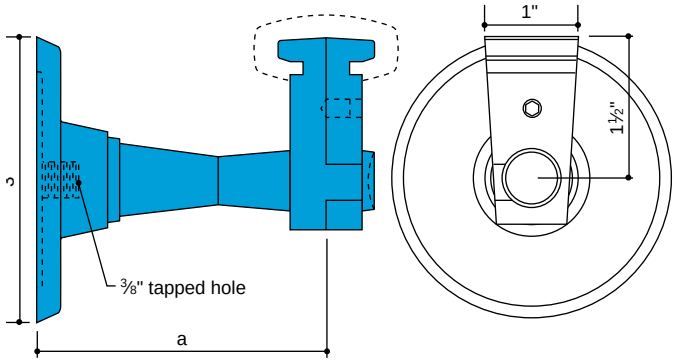


			a	b	c
376	376A*	Aluminum †	2½"	⅜"	1 9/16"
389	389A*	Aluminum †	3⅛"	¾"	1⅞"
375		Bronze †	2½"	⅜"	1 9/16"
319		Bronze †	3⅛"	¾"	1⅞"
275		Stainless †	2½"	⅜"	1 1/16"
378		Malleable Iron	2½"	⅜"	1 1/16"
1378		Malleable Iron (Galvanized)**	2½"	⅜"	1 1/16"
386		Malleable Iron	3"	⅜"	1 1/16"
1386		Malleable Iron (Galvanized)**	3"	⅜"	1 1/16"



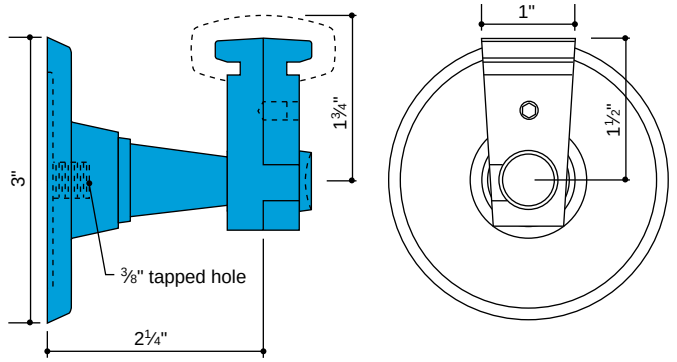
			a	b
316	316A*	Aluminum†	3"	3¼"
384	384A*	Aluminum†	2½"	2¾"
318		Bronze†	3"	3¼"
388		Bronze†	2½"	2¾"

CARLSTADT® *Self-Aligning* WALL BRACKETS
Satin Finish



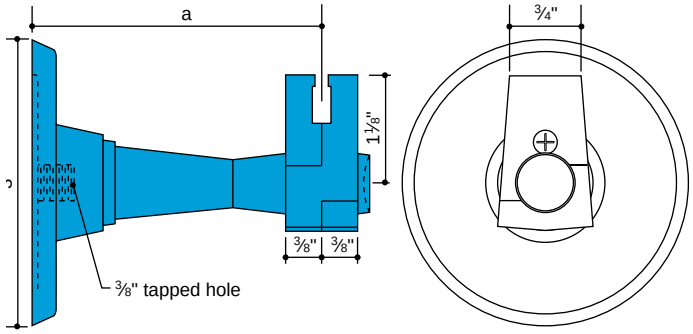
For use with **Carlsrail®** handrail moulding

		a
173	Aluminum	3"
174	Aluminum	3½"



For use with **Carlsrail®** handrail moulding

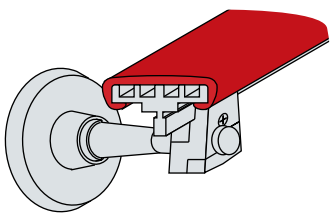
175	Aluminum	



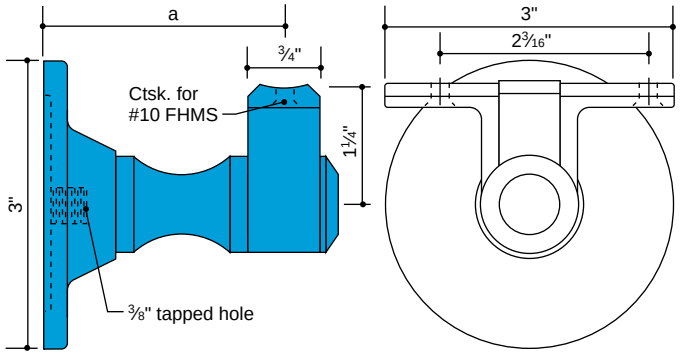
For use with **Colorail®** support section or T-handrail moulding

		a
418	Aluminum	3"
419	Aluminum	3½"

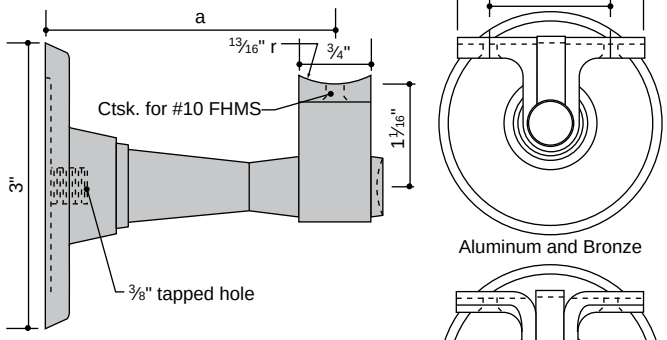
WALL BRACKET DETAIL



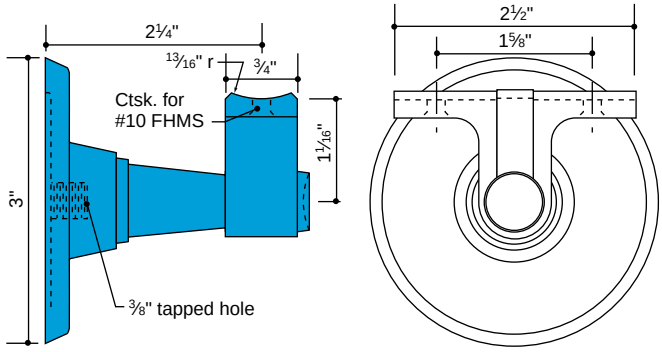
CARLSTADT® *Self-Aligning* WALL BRACKETS
Satin Finish For use with Pipe Railings



			a
307	307A*	Aluminum	2½"
308	308A*	Aluminum	3"



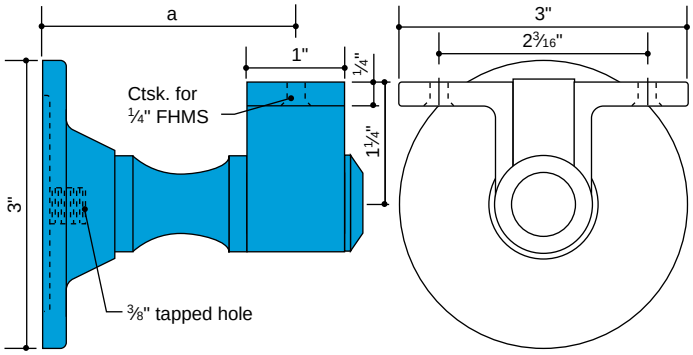
			a
403	403A*	Aluminum	3"
405	405A*	Aluminum	3½"
801		Bronze	2½"
803		Bronze	3"
221		Stainless	2½"
223		Stainless	3"



321	321A*	Aluminum

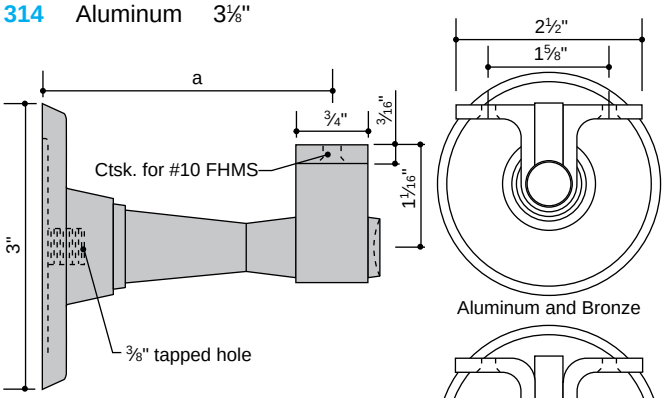
* Clear anodized AA-M32-C22-A31 (204R1)

CARLSTADT® *Self-Aligning* WALL BRACKETS
Satin Finish



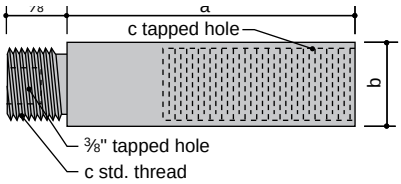
For use with **Carlstadt®** handrail moulding:

		a
313	Aluminum	2⅝"
314	Aluminum	3⅛"



		a
443	Aluminum	3"
444	Aluminum	3½"
843	Bronze	3"
243	Stainless	3"
271	Stainless	2¼"

WALL BRACKET EXTENSIONS Satin Finish



For use with **307**, **308**, **313** and **314** wall brackets:

		a	b	c
414	414A* Aluminum	1¾"	1⅛"	⅞"
415	415A* Aluminum	3"	1⅛"	⅞"

For use with other **Carlstadt®** wall brackets:

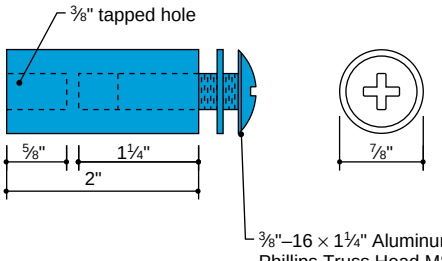
464	Aluminum	1¾"	1"	¾"
465	Aluminum	3"	1"	¾"
864	Bronze	1¾"	1"	¾"
865	Bronze	3"	1"	¾"
247	Stainless	1¾"	1"	¾"
248	Stainless	3"	1"	¾"

Extensions may be cut to length to suit individual conditions.

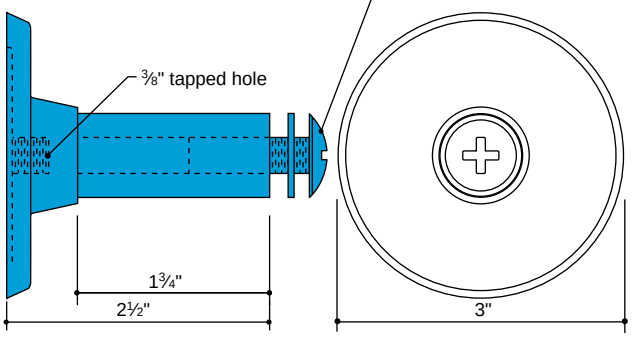
Note: Extending the reach of a handrail bracket reduces its load-bearing capacity. To compensate for the reduced strength, the number of brackets may be increased and their spacing reduced.

* Clear anodized AA-M32-C22-A31 (204R1)

THREADED BUSHING BRACKETS Satin Finish

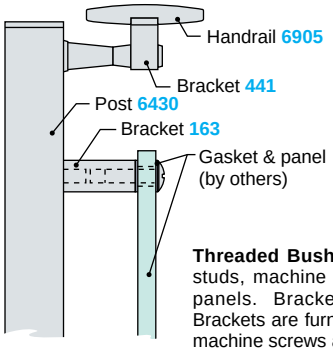


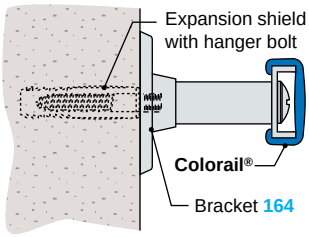
163 Aluminum



164 Aluminum

INSTALLATION DETAILS





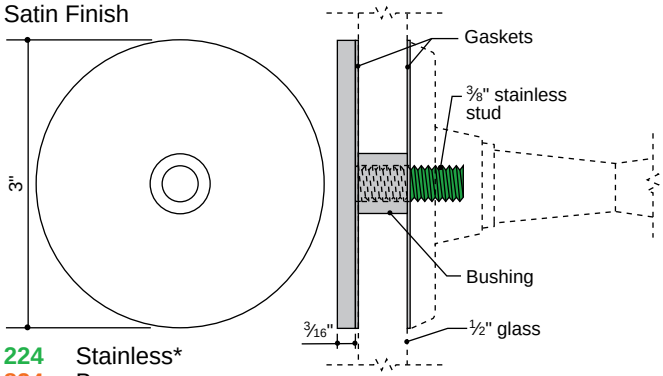
Threaded Bushing Brackets are used with threaded studs, machine screws or bolts to install handrails or panels. Brackets may be cut to length as required. Brackets are furnished with aluminum phillips truss head machine screws and washers.

GLASS MOUNTED HANDRAIL

Handrail may be mounted to the face of the tempered glass balustrade using a combination of the **Carlstadt®** wall brackets and our new glass mounting adapter kit. The kit contains a disc with a ⅜" stud weld, a bushing, and two gaskets. These adapters have been tested. The aluminum version failed to meet structural requirements therefore the **224** is recommended for use with aluminum brackets.

TO ASSEMBLE: ① Prior to tempering, drill a ⅝" clear hole in the glass (**do not attempt to drill a hole in tempered glass – it will most likely break**); ② insert the bushing in the hole; ③ insert the stud welded disc with gasket through the bushing; place the gasket on the other side; ④ thread on bracket and tighten.

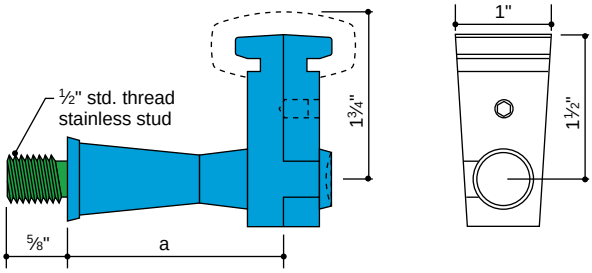
GLASS MOUNTED HANDRAIL ADAPTER KIT
Satin Finish



224 Stainless*
824 Bronze

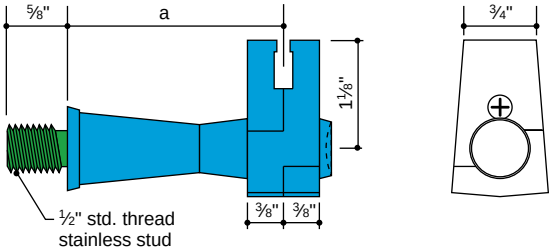
* Use with aluminum brackets

CARLSTADT® *Self-Aligning* POST BRACKETS
Satin Finish



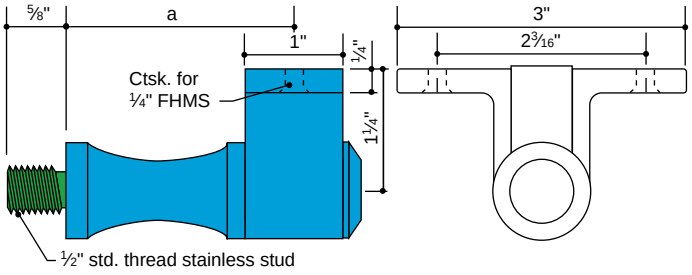
For use with **Carlsrail**® handrail moulding

		a
171	Aluminum	2¼"
172	Aluminum	2¾"



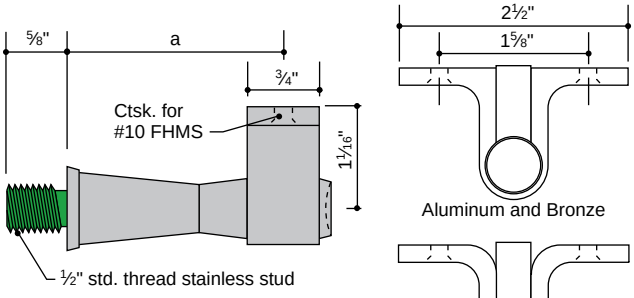
For use with **Colorail**® support section or T-handrail moulding

		a
439	Aluminum	2¼"
440	Aluminum	2¾"



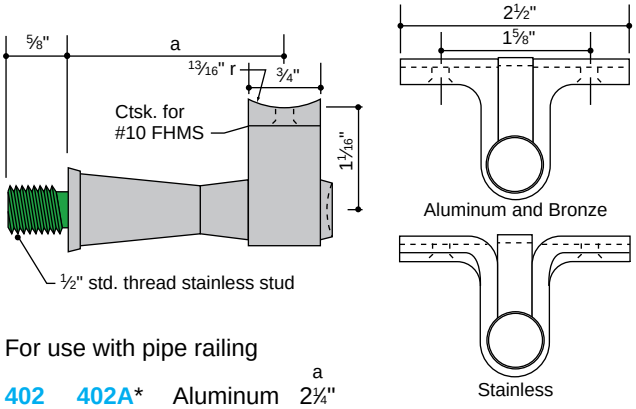
For use with **Carlstadt**® handrail moulding

		a
309	Aluminum	3¼"
312	Aluminum	2⅜"



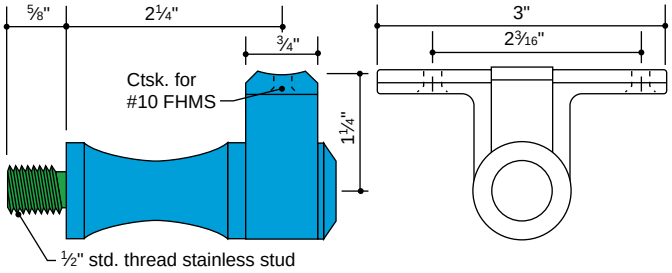
		a
441	Aluminum	2¼"
442	Aluminum	2¾"
841	Bronze	2¼"
241	Stainless	2¼"

CARLSTADT® *Self-Aligning* POST BRACKETS
Satin Finish For use with Pipe Railings



For use with pipe railing

			a
402	402A*	Aluminum	2¼"
404	404A*	Aluminum	2¾"
802		Bronze	2¼"
222		Stainless	2¼"

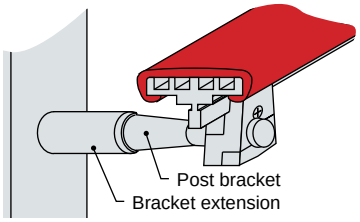


For use with pipe railing

322	322A*	Aluminum

*Clear anodized AA-M32-C22-A31 (204R1)

POST BRACKET WITH EXTENSION DETAIL

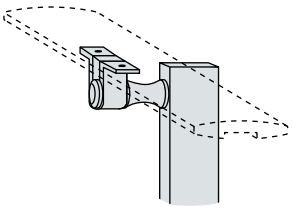


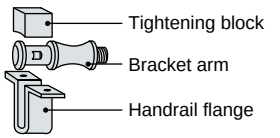
Bracket extensions provide additional horizontal projection to accommodate variations in wall construction.

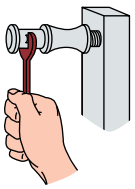
Method of anchorage for extended brackets should be carefully chosen to assure structural adequacy. Bracket extensions are shown on page 85.

ADJUSTABLE BRACKET DETAIL

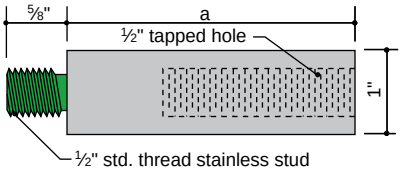
Post and upper post cap must be drilled and tapped to accept bracket arm. Recess of bracket arm has flat sides to accommodate wrench, which permits tightening without marring exposed surfaces. Handrail flange tilts to adjust to stair angle and is attached to handrail with machine screws. Pressure on tightening block prevents looseness and rattling.







POST BRACKET EXTENSIONS Satin Finish



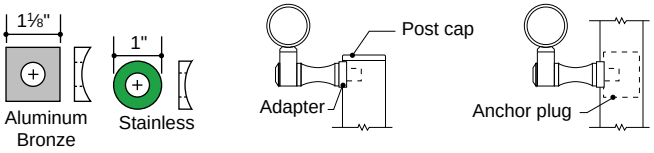
			a
462	462A*	Aluminum	1¾"
463	463A*	Aluminum	3"
862		Bronze	1¾"
863		Bronze	3"
245		Stainless	1¾"
246		Stainless	3"

Extensions may be cut to length to suit individual conditions.

Note: Extending the reach of a handrail bracket reduces its load-bearing capacity. To compensate for the reduced strength, the number of brackets may be increased and their spacing reduced.

* Clear anodized AA-M32-C22-A31 (204R1)

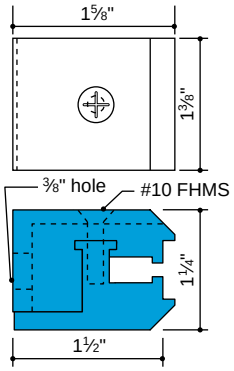
BRACKET POST ADAPTER Satin Finish



			Pipe Size	Schedule	Clear Hole
7161	7161A*	Aluminum	1¼"	all	½"
7261	7261A*	Aluminum	1½"	all	½"
8661		Bronze	1¼"	all	½"
8861		Bronze	1½"	all	½"
9161		Stainless	1¼"	all	½"
9361		Stainless	1½"	all	½"

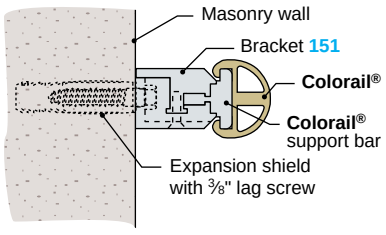
* Clear anodized AA-M10-C22-A31 (204R1)

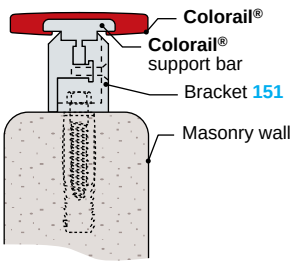
VERTICAL MOUNTING BRACKETS Satin Finish



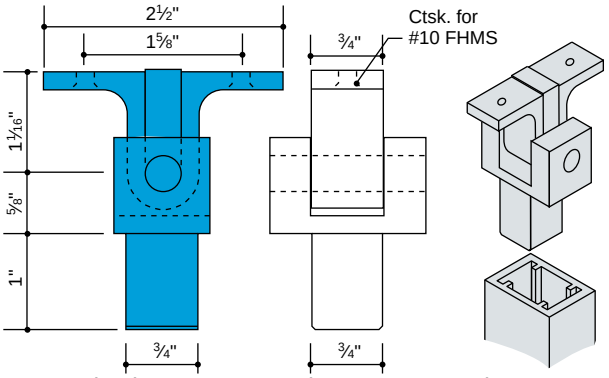
Vertical mounting bracket **151** is designed for mounting handrail on edge to provide a wall guard or *bumper*. **Colorail®** support section **6440**, **6441**, **6442** or **6443** and metal T-handrail **6402**, **6404**, **6405** or **6407** can be mounted without drilling and tapping. Bracket is also suitable for mounting handrail on top of a parapet or wall.

151 Aluminum



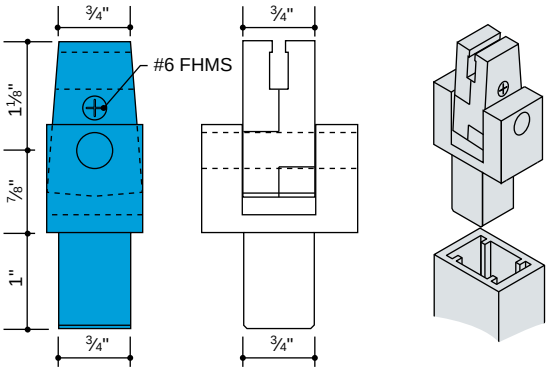


CENTER POST BRACKETS Satin Finish

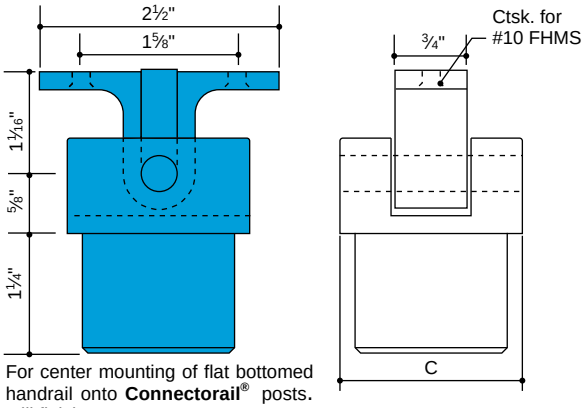


162 Aluminum Fits posts **430** and **6430**

Center post brackets permit handrail to be centered directly over post, yet allow it to tilt to conform to stair incline. Bracket is secured to post with pin or screw.



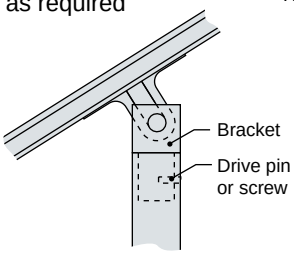
152 Aluminum for **Carlstadt®** T-handrail and **Colorail®** support bars. Fits posts **430** and **6430**

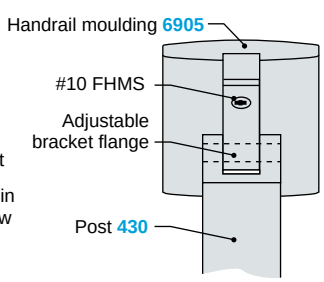


For center mounting of flat bottomed handrail onto **Connectorail®** posts. Mill finish.

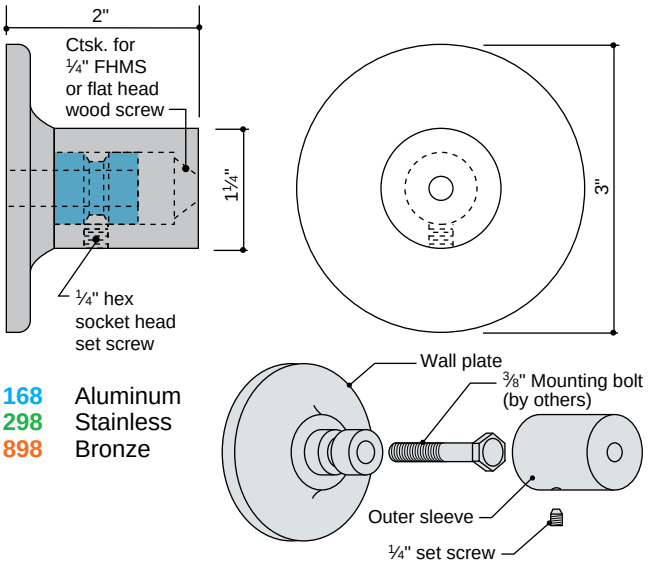
		Pipe	Sch.	c
144	Aluminum	1¼"	40	1.660"
145	Aluminum	1½"	40	1.900"

Angle may be adjusted as required



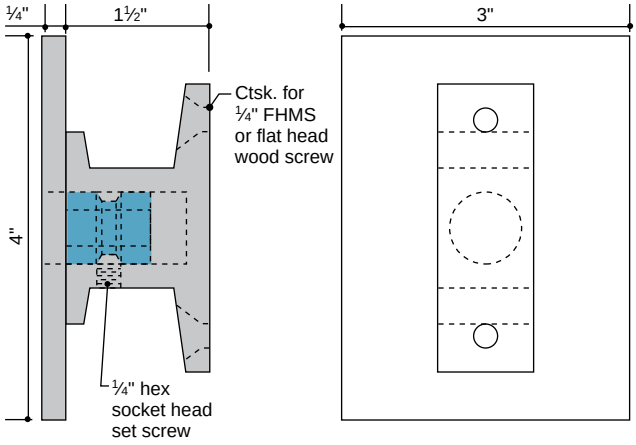


TWO-PIECE MOUNTING BRACKETS Satin Finish

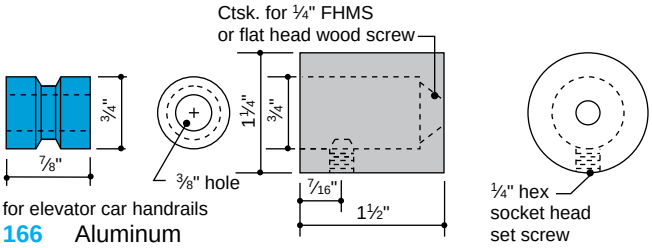


168 Aluminum
298 Stainless
898 Bronze

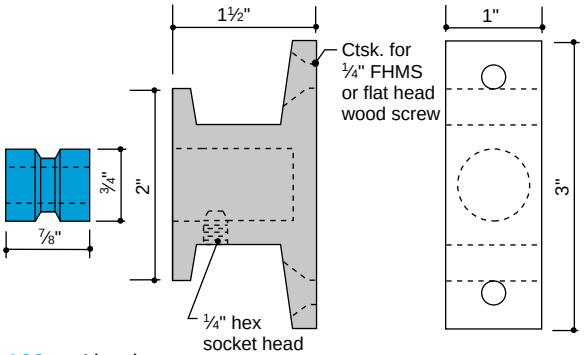
TWO-PIECE MOUNTING BRACKETS Satin Finish
For wide wood handrail



160 Aluminum
290 Stainless
890 Bronze

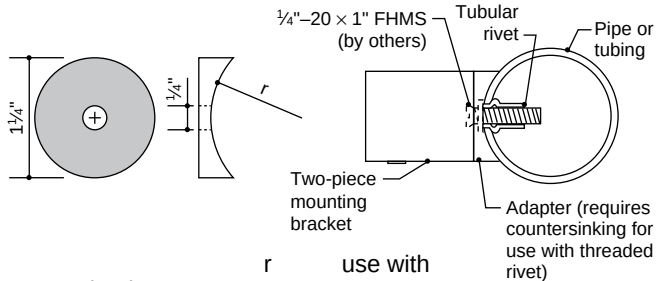


for elevator car handrails
166 Aluminum
296 Stainless
896 Bronze
196 Nickel-Silver



169 Aluminum
299 Stainless
899 Bronze

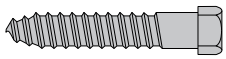
ADAPTER



		r	use with
7164	Aluminum	.830"	1.660" O.D.
7264	Aluminum	.950"	1.900" O.D.
8864	Bronze	.950"	1.900" O.D.
8964	Bronze	.750"	1.500" O.D.
9164	Stainless	.830"	1.660" O.D.
9364	Stainless	.950"	1.900" O.D.
5364	Nickel-Silver	.950"	1.900" O.D.
5264	Nickel-Silver	.750"	1.500" O.D.

BOLTS AND ANCHORS – for handrail wall brackets.

Hanger Bolt
Steel – ⅜" × 3"

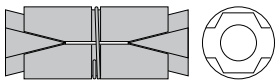


Hex Head Lag Screw
Aluminum – ⅜" × 2"
Brass – ⅜" × 2"
Stainless – ⅜" × 2"

EXPANSION SHIELDS – Lead

For setting ⅜" lag screws and hanger bolts in concrete, brick or stone. Drill hole size of ⅝" diameter by 2½" deep.

HEAVY-DUTY DOUBLE MACHINE BOLT ANCHOR – Zinc Alloy
Non-calking machine bolt anchor for use in masonry materials of questionable strength or where heavy shear loads are encountered. Thread accommodates ⅜" – 16 stud or machine bolt (supplied by others). Drill hole size of ¾" diameter by 2¼" deep.



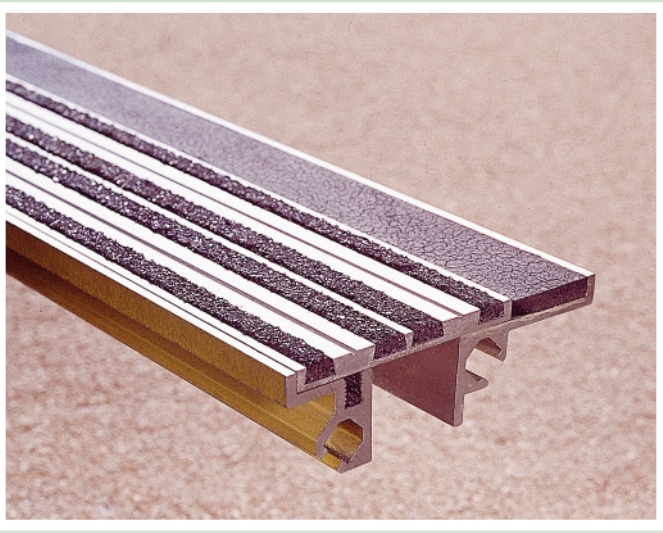
This section contains details on the **Julius Blum & Co.** components which are of particular use in the assembly of expansion joints, door thresholds and door and window framing.

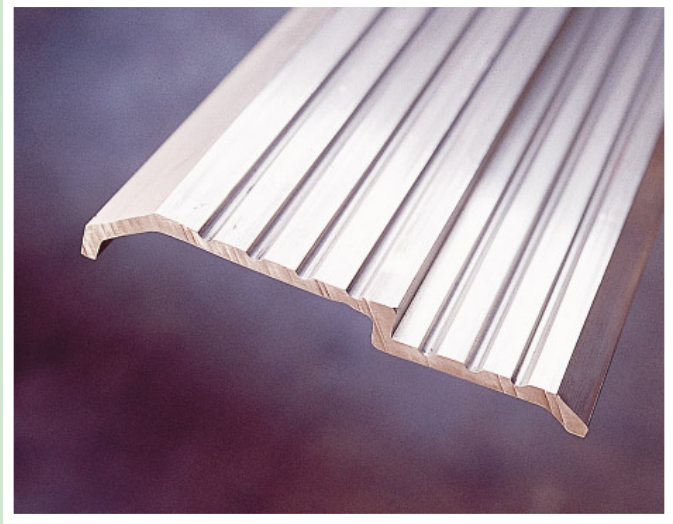
Aluminum components are of alloy 6063-T52. When properly fabricated, they are suitable for anodizing — including most of the hard coat anodic processes. Black anodizing may result in inconsistent matches. Consult your anodizer before specifying.

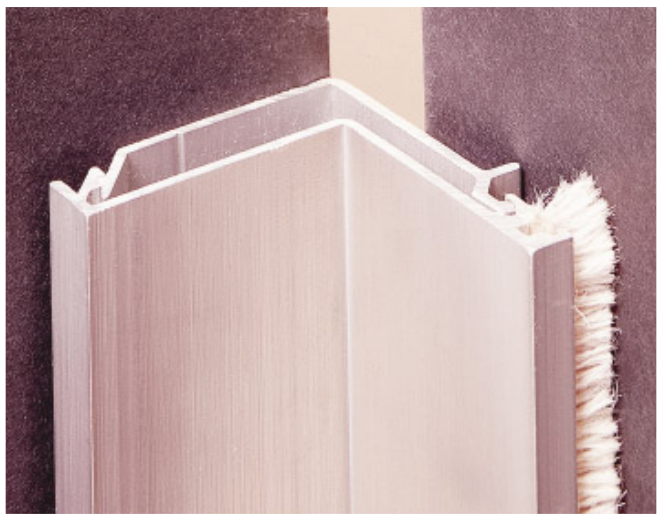
Bronze components are of extruded architectural bronze alloy, C38500.

Nickel-Silver extrusions are of alloy C79800. Sometimes referred to as *white bronze,* nickel-silver is a copper/nickel alloy. It is similar in appearance to stainless steel with a touch of gold.

Steel items are carbon steel C 1010, hot rolled.

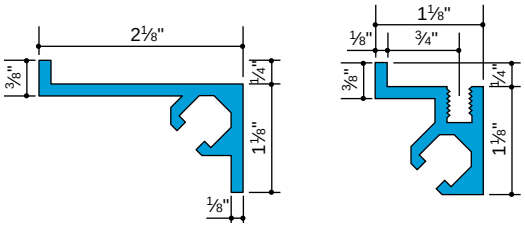






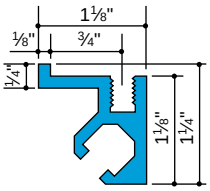
JB expansion joint and trench cover frames are extruded from 6063-T52 aluminum alloy and are furnished in stock lengths as indicated.

EXPANSION JOINT COVER FRAME 20' lengths



6977 Aluminum .649 lb/ft **6976** Aluminum .600 lb/ft

TILE INSET COVER FRAME 20' lengths

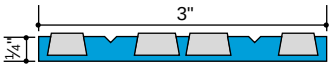


Continuous extruded thread for ¼"–20 screw eliminates drilling and tapping.

6966 Aluminum .581 lb/ft

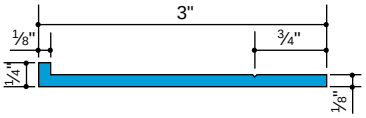
Sections **6966**, **6976** and **6977** are finished with a coat of zinc-chromate on the underside to protect the aluminum from direct contact with concrete. Sections **6966** and **6976** have extruded threads to accept ¼"–20 machine screws.

ABRASIVE COVER PLATE 12' lengths



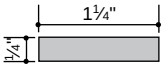
6974 Aluminum with abrasive inserts .917 lb/ft

TILE INSET COVER PLATE 20' lengths



6968 Aluminum .469 lb/ft

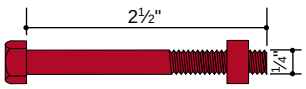
NEOPRENE INSERT 50' coils



6978 Neoprene

Neoprene insert is designed to close a 1" opening. The insert can be compressed from 1¼" to ¾". The underside of the insert is coated with a pressure sensitive adhesive.

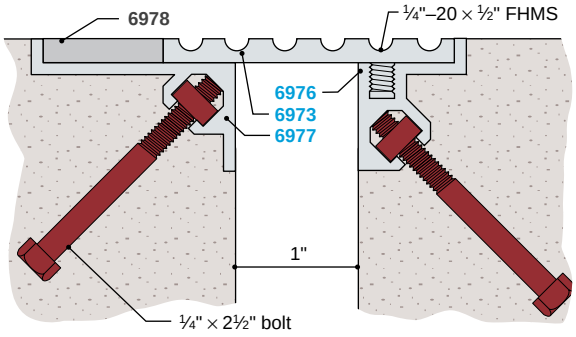
ANCHOR BOLT



¼"–20 × 2½" galvanized bolt with square nut.

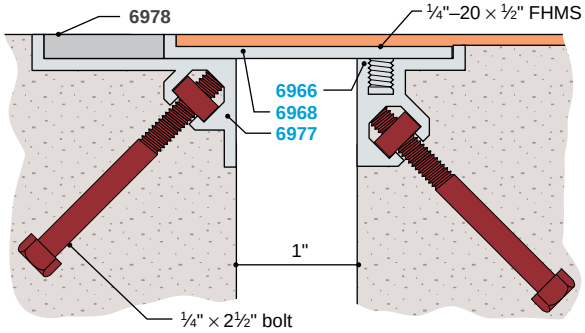
These galvanized bolts provide corrosion resistant anchorage for expansion joint and trench cover frames. Bolts should be spaced approximately 18" on center to obtain adequate anchorage.

EXPANSION JOINT WITH FLUTED COVER

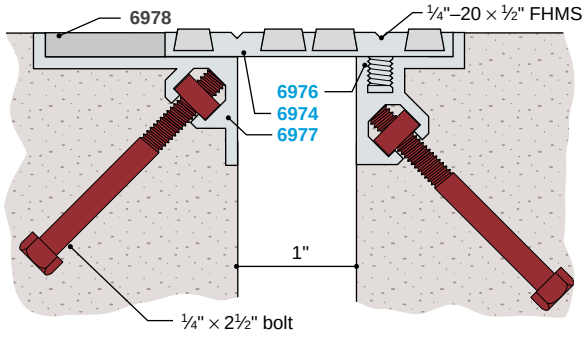


See flat fluted covers on page 91. Plain flat bar (page 100) may also be used.

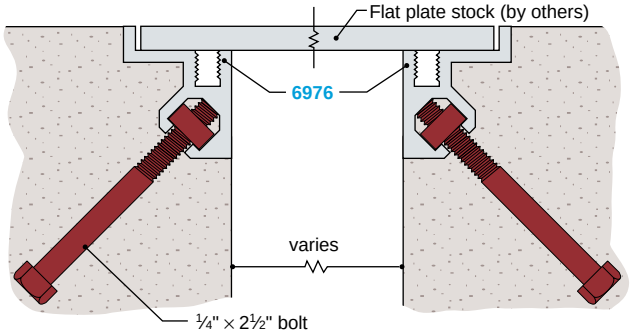
EXPANSION JOINT WITH TILE INSERT



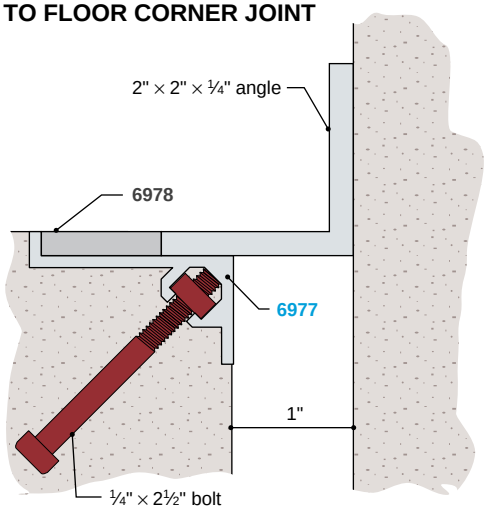
EXPANSION JOINT WITH ABRASIVE COVER PLATE



TRENCH COVER FRAME

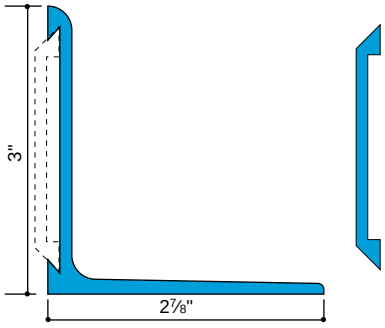


WALL TO FLOOR CORNER JOINT

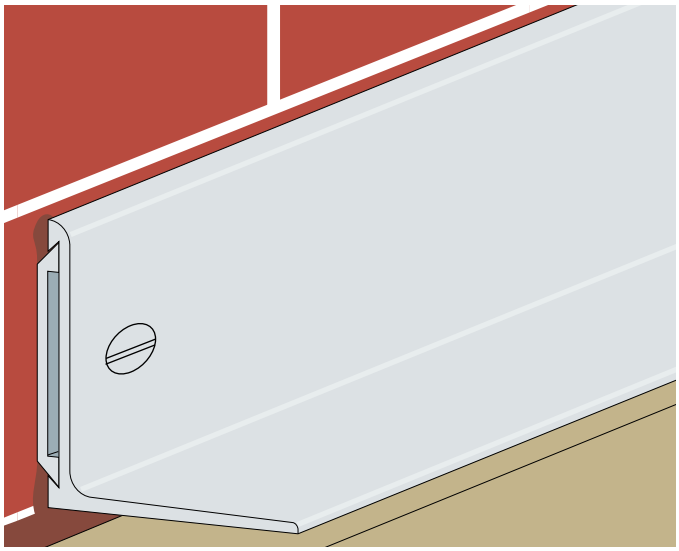


Detail shows how a 2" × 2" × ¼" angle (see page 98) may be used as an expansion joint cover for floor to wall applications.

GYMNASIUM FLOOR JOINT COVER



6805 Aluminum .870 lb/ft 20' lengths **6806** Aluminum 2" lengths

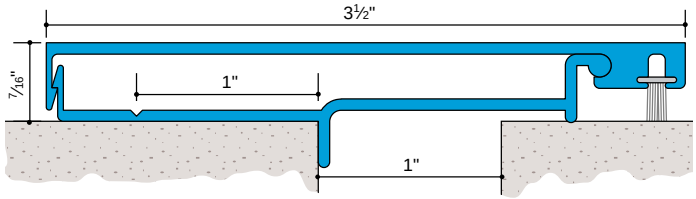


Gymnasium floor cover **6805** with clip **6806** permits air circulation to combat moisture accumulation and features a smoothly tapered contour to prevent tripping and simplify cleaning.

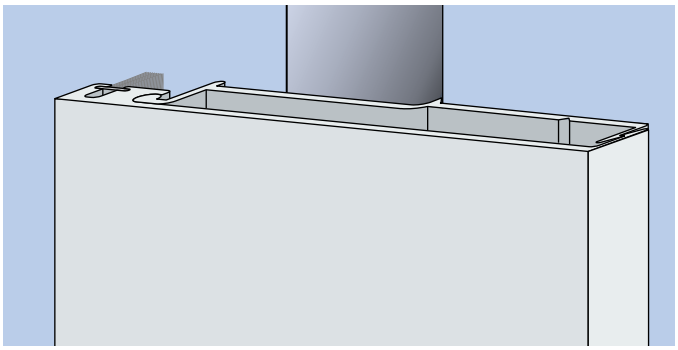
JB wall and ceiling covers, featuring snap-in construction, eliminate exposed fasteners and permit quick, easy installation. A pile weatherstrip controls air flow and prevents marring of finishes when building movement occurs.

Expansion joint cover sections **6801/2** and **6803/4** are extruded from 6063-T52 aluminum alloy and are packed in eight 20' lengths of each section per carton.

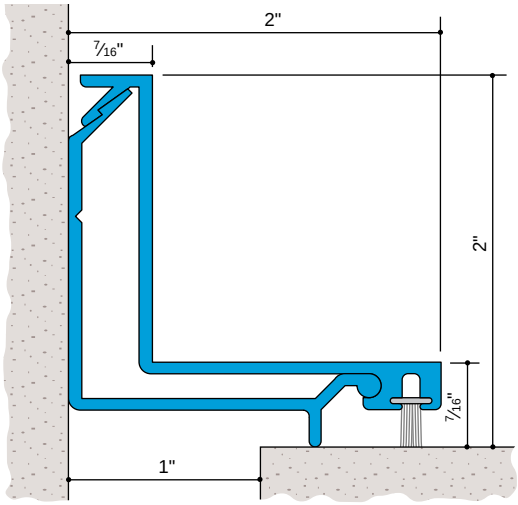
WALL OR CEILING JOINT COVER 20' lengths



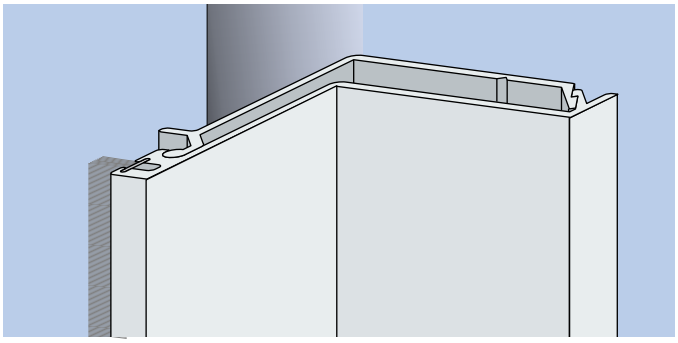
6801/2 Aluminum .579 lb/ft



WALL OR CEILING CORNER JOINT COVER 20' lengths

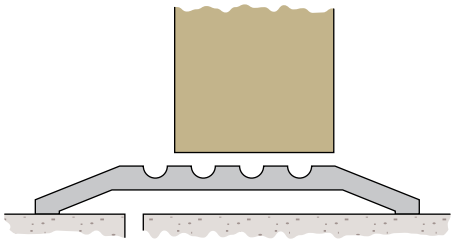


6803/4 Aluminum .648 lb/ft



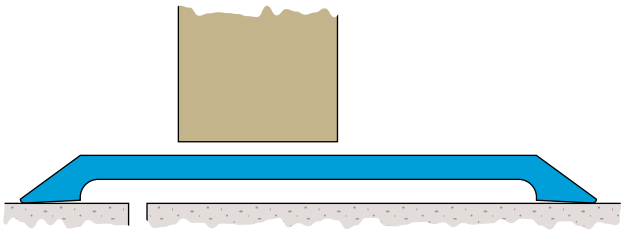
DOOR SADDLES 20' lengths, except as noted

FLUTED



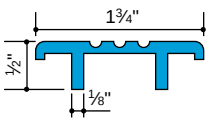
		lb/ft	width	height	lengths
4504	Steel	2.45	3"	½"	21'-7"
6924	Aluminum	.72	3"	½"	16'-3"
6923	Aluminum	1.05	4"	½"	20'
6926	Aluminum	.83	4"	17/32"	16'-3"
6922	Aluminum	1.27	5"	½"	20'
6920	Aluminum	1.53	6"	⅝"	20'
6921	Aluminum	1.23	6"	½"	16'-3"
6925	Aluminum	1.76	7"	½"	20'
4524	Bronze	2.11	3"	⅜"	20'
4523	Bronze	3.05	4"	½"	20'
4522	Bronze	3.79	5"	½"	20'
4520	Bronze	4.64	6"	⅝"	20'
4519	Bronze	5.14	7"	½"	12'

SMOOTH



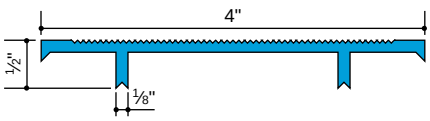
		lb/ft	width	height	lengths
6910	Aluminum	.365	2½"	¼"	20'
6914	Aluminum	.476	3"	¼"	16'-3"

BUTT SADDLE 21'-1" lengths



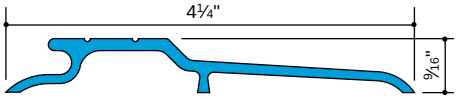
6915 Aluminum .398 lb/ft

CARPET SADDLE 21'-1" lengths

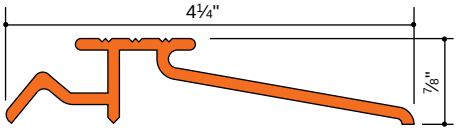


6916 Aluminum .653 lb/ft

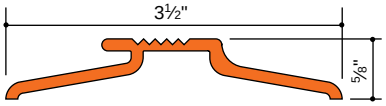
WEATHER STRIP DOOR SADDLES
20' lengths, except as noted



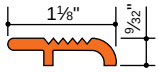
6991 Aluminum .689 lb/ft 16'-3" lengths



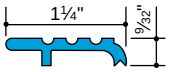
4596 Bronze 2.21 lb/ft



4590 Bronze 1.92 lb/ft

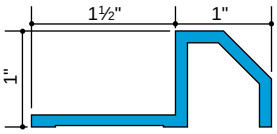


4598 Bronze .62 lb/ft

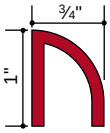


6998 Aluminum .18 lb/ft 16'-3" lengths

BATHROOM DOOR SADDLES 20' lengths

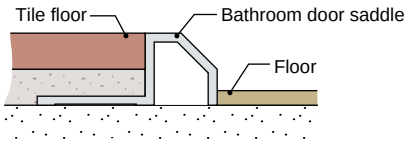


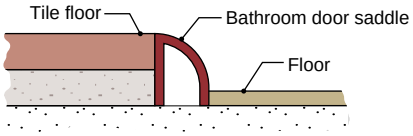
6948 Aluminum .576 lb/ft



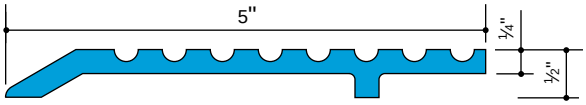
4487 Steel .93 lb/ft

TYPICAL DETAILS



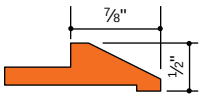


DOOR SADDLE SECTION 21'-4" lengths

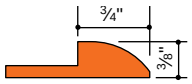


6913 Aluminum 1.48 lb/ft

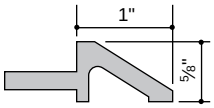
BEVEL END SECTIONS 20' lengths



4526 Bronze 1.50 lb/ft

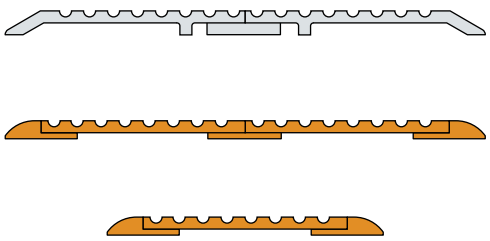


4528 Bronze 1.09 lb/ft



4527 Bronze 1.48 lb/ft
6927 Aluminum .45 lb/ft

TYPICAL DOOR SADDLE DETAILS

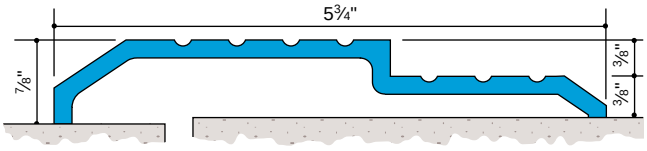


Cutouts for floor hinges can be made easily before assembly.

Wider saddles can be constructed by adding a flat fluted section in the center. The pattern of all fluted sections is identical, and joints with saddle sections will not be apparent.

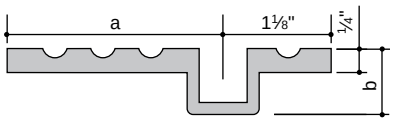
Saddles of extreme width can be constructed by using bevel end sections and two or more flat fluted sections with a plate underneath.

ROOF DOOR SADDLE 20' lengths

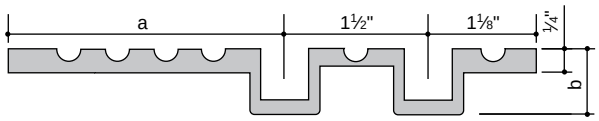


6997 Aluminum 1.45 lb/ft

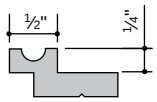
ELEVATOR DOOR SADDLES



		a	b	lb/ft	lengths
6963	Aluminum	2¼"	11/16"	.85	20'
6969	Aluminum	2⅞"	11/16"	1.08	20'
4563	Bronze	2¼"	11/16"	2.85	6', 8', 16'
4569	Bronze	2⅞"	11/16"	3.31	6', 8', 10', 20'
5563	Nickel-Silver	2¼"	¾"	3.41	6', 8', 10'
5569	Nickel-Silver	2⅞"	11/16"	3.44	6', 8', 10'



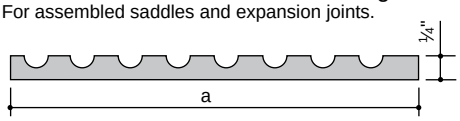
		a	b	lb/ft	lengths
6964	Aluminum	2¼"	11/16"	1.25	20'
6979	Aluminum	2⅞"	11/16"	1.44	20'
4564	Bronze	2¼"	11/16"	4.25	6', 8', 10', 16'
4579	Bronze	2⅞"	11/16"	5.09	6', 8', 10', 16'
5564	Nickel-Silver	2¼"	¾"	4.63	6', 8', 10'
5579	Nickel-Silver	2⅞"	11/16"	4.90	6', 8', 10'



		lb/ft	lengths
6967	Aluminum	.314	20'
4567	Bronze	1.040	20'
5567	Nickel-Silver	.950	20'

FLAT FLUTED SECTIONS 20' lengths, except as noted

For assembled saddles and expansion joints.

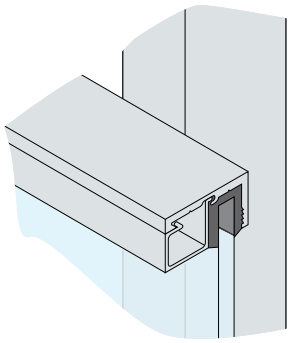


		a	lb/ft
6980	Aluminum	1"	.234
6970	Aluminum	1½"	.361
6971	Aluminum	2"	.482
6973	Aluminum	3"	.723
6975	Aluminum	4"	.964
4566	Bronze	1"	.72
4558	Bronze	1½"	1.15
4557	Bronze	2"	1.48
4556	Bronze	2½"	1.84
4555	Bronze	3"	2.23
4554	Bronze	3½"	2.55
4553	Bronze	4"	2.89
4553-Q	Bronze	4¼"	3.26
4552	Bronze	4½"	3.29
4551	Bronze	5"	3.67
4550	Bronze*	5½"	4.05
4559	Bronze*	6⅛"	4.55
5553	Nickel-Silver*	4"	2.89
5558	Nickel-Silver	1½"	1.15

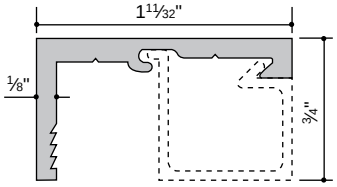
* 16' lengths

GLAZING MEMBERS
20' lengths, except as noted

Aluminum and bronze glass stop/snap-in and flexible PVC glazing channel serve to mount panels of ¼" glass, plastic, wire mesh or other material.

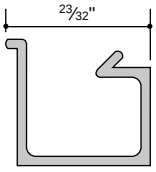


GLASS STOP



8106 Aluminum .276 lb/ft
Mill finish
8206 Aluminum .276 lb/ft
Clear anodized
AA-M10-C22-A31 (204R1)
4506 Bronze* .950 lb/ft

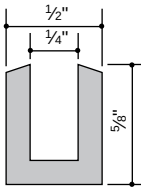
SNAP-IN



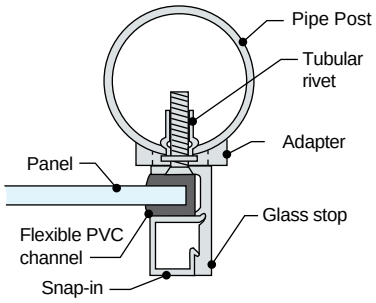
8107 Aluminum .138 lb/ft
Mill finish
8207 Aluminum .138 lb/ft
Clear anodized
AA-M10-C22-A31 (204R1)
4507 Bronze* .510 lb/ft

* 16' lengths

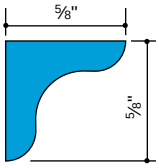
FLEXIBLE PVC CHANNEL 50' coils



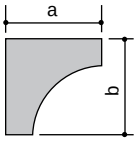
8708 Flexible PVC



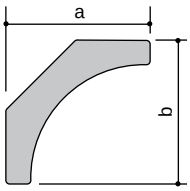
COVE MOULDINGS AND GLASS STOPS
20' lengths, except as noted



6950 Aluminum* .228 lb/ft
*16' lengths

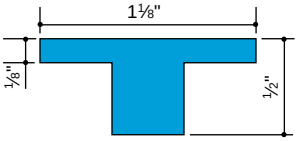


		lb/ft	a	b
6102	Bronze	.500	½"	½"
6951	Aluminum	.106	⅜"	⅜"
6952	Aluminum	.166	½"	½"

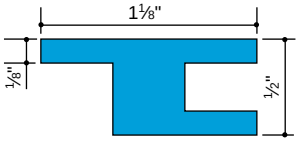


		lb/ft	a	b
6105	Bronze	.670	¾"	¾"
6955	Aluminum	.260	¾"	¾"

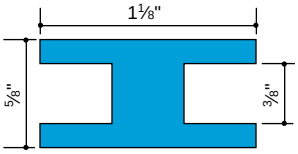
GLASS FRAMING SECTIONS 20' lengths



6958 Aluminum .338 lb/ft

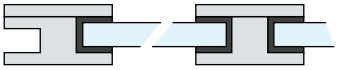


6959 Aluminum .394 lb/ft

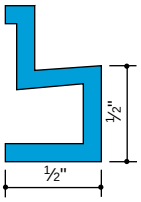


6960 Aluminum .507 lb/ft

FRAMING DETAIL

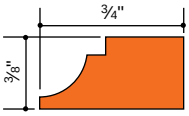


Sections **6958** and **6959** with flat bars

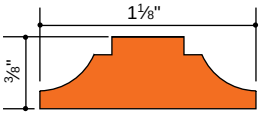


6953 Aluminum* .183 lb/ft
*16' lengths

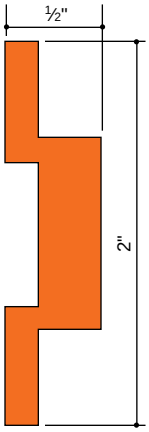
VARIOUS MOULDINGS 20' lengths



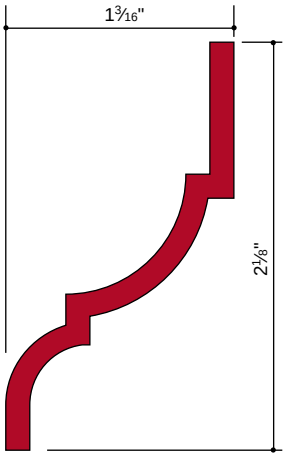
6473 Bronze .76 lb/ft



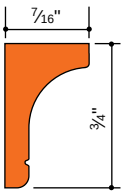
6474 Bronze 1.01 lb/ft



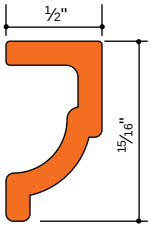
6140 Bronze 1.97 lb/ft



4302 Steel 1.15 lb/ft

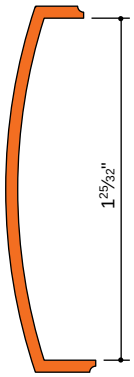


6121 Bronze .60 lb/ft

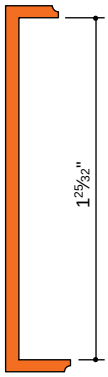


6130 Bronze .70 lb/ft

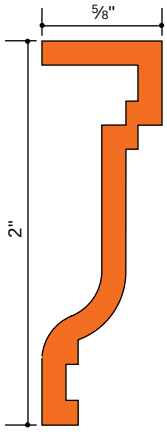
DOOR EDGINGS 16' lengths, except as noted



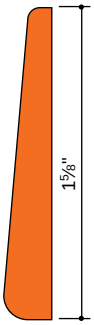
6642 Bronze .56 lb/ft



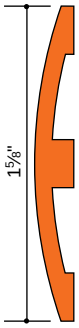
6643 Bronze .56 lb/ft



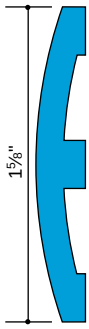
6138 Bronze 1.35 lb/ft



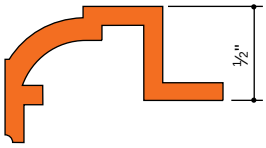
6648 Bronze* 1.10 lb/ft



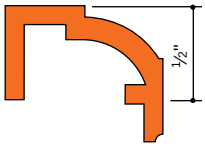
6647 Bronze .64 lb/ft



6947 Aluminum .384 lb/ft



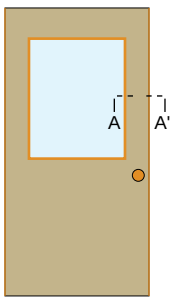
6645 Bronze* .79 lb/ft



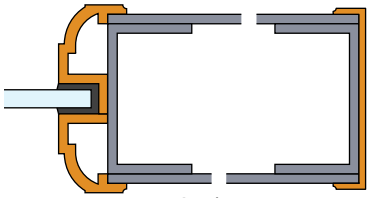
6646 Bronze* .67 lb/ft

* 20' lengths

TYPICAL DETAILS



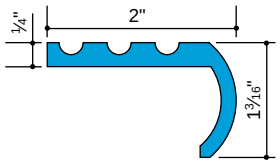
Elevation



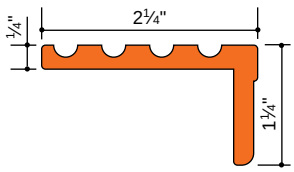
Section A–A'

Detail at A–A' with **6643**, **6645** and **6646**

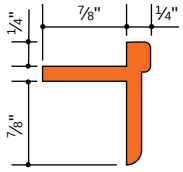
NOSINGS 20' lengths



6961 Aluminum .722 lb/ft

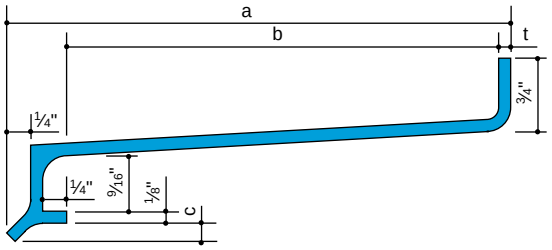


4560 Bronze 2.45 lb/ft



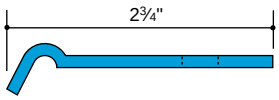
4565 Bronze 1.31 lb/ft

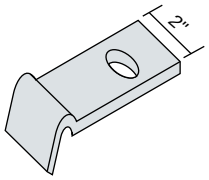
WINDOW SILLS, TYPE AA 21' lengths
Aluminum, 6063-T52
SA-100 anchor clip spacing to be not more than 3'-0"



ALCOA	lb/ft	a	b	t	c
54684	.767	3½"	2¾"	⅛"	3/16"
54685	.842	4"	3¼"	⅛"	3/16"
54686	.919	4½"	3¾"	⅛"	3/16"
54687	.994	5"	4¼"	⅛"	3/16"
54688	1.067	5½"	4¾"	⅛"	3/16"
54689	1.141	6"	5¼"	⅛"	3/16"
54690	1.529	6 9/16"	5¾"	5/32"	3/16"
54693	2.414	9⅛"	8¼"	3/16"	¼"

ANCHOR CLIP FOR TYPE AA WINDOW SILLS
ALCOA **SA-100**





Our extensive stock of tubing, bars and shapes in aluminum, bronze, steel and stainless steel has been selected especially to meet the requirements of ornamental and miscellaneous metal work. All items are carried in stock in substantial quantities and shipment can usually be made promptly upon receipt of order.

All tubing, bars and shapes are supplied in stock lengths with a mill finish, except as noted. **Julius Blum & Co**. does not provide cutting or metal finishing services.

Aluminum architectural shapes, bars and tubes are extruded from alloy 6063-T52, except as noted. These items have a smooth, uniform surface and, when properly fabricated, are suitable for anodizing — including most of the hard coat anodic processes. Black anodizing may result in inconsistent matches. Consult your anodizer before specifying.

Aluminum extrusions are packed in bundles of approximately 100 lbs. which are wrapped and paper interleaved at the mill. Ordering in full bundles is the best way to guarantee surface quality and speed shipment. Additional discounts are available on bundle purchases up to 1000 lbs.

Aluminum Structural shapes are extruded from alloy 6061-T6.

Bronze tubing, bars and shapes are of extruded alloy C38500, architectural bronze. Round pipe is drawn alloy C23000, red brass. When polished, red brass will provide a generally acceptable match to architectural bronze.

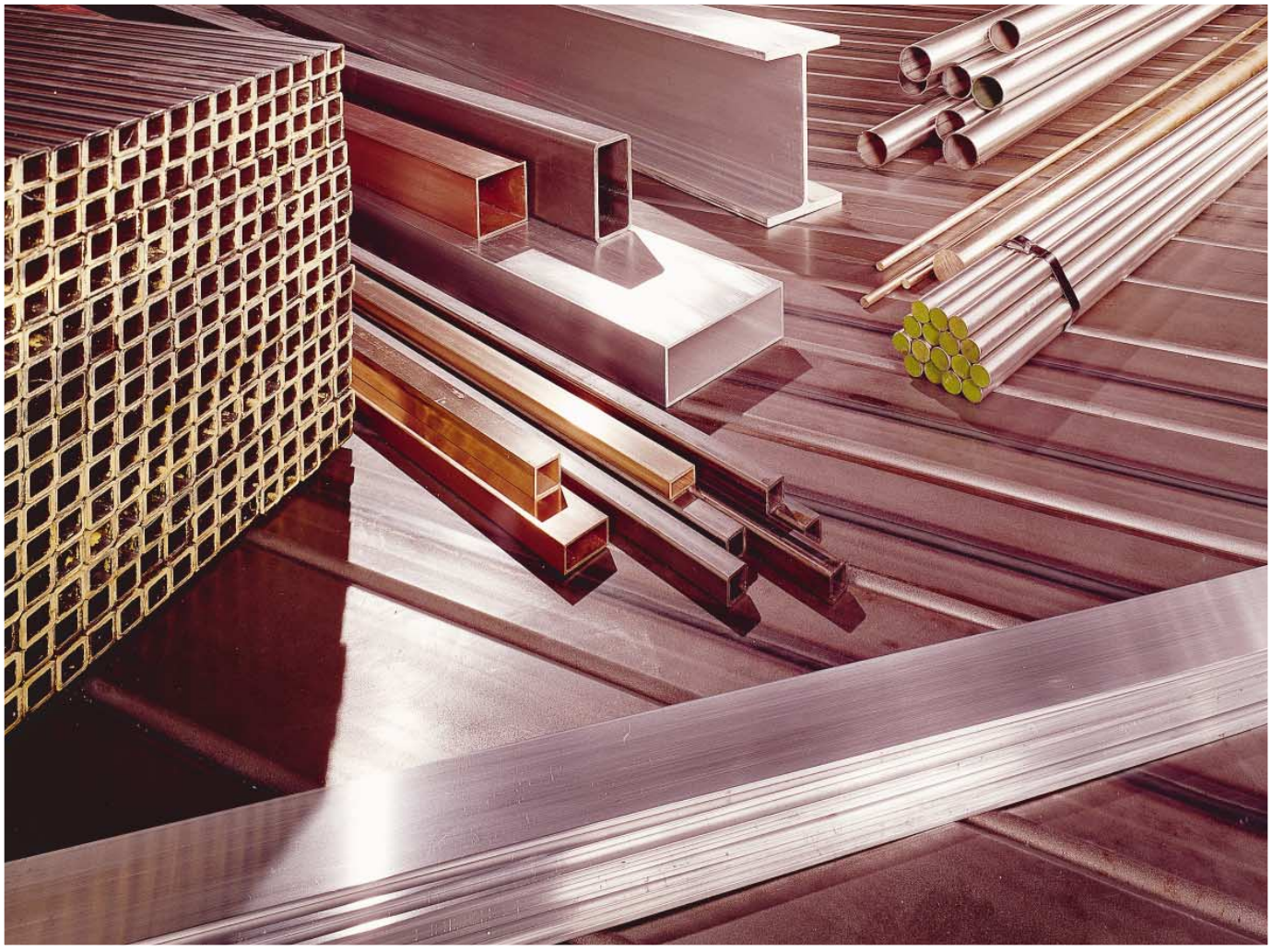
Stainless Steel items are type 304 (18-8), except as noted. Stainless steel tubing is of ornamental grade with a smooth surface which is simple to polish.

Steel items are carbon steel C1010, except as noted. Mechanical welded tubing is hot rolled, pickled and annealed. It has a clean, bright surface and is suitable for use where dimensional accuracy and straightness are essential. Cold rolled channel and angle have a square root and square edge.

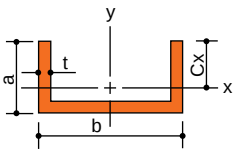
Nickel-Silver extrusions are of alloy C79800. Sometimes referred to as *white bronze,* nickel-silver is a copper/nickel alloy. It is similar in appearance to stainless steel with a touch of gold.

All extrusions are produced and handled with great care to assure a product well suited for architectural finishing. Items are thoroughly protected for shipment by wrapping and/or crating, with the exception of aluminum structural and steel shapes, which are normally shipped in strapped bundles.

Elements of sections are shown alongside each item in this section. This data has been ascertained with care but cannot be guaranteed. For additional engineering information, see pages 114 to 123.



CHANNELS



Alloy C38500
Sharp Corners
20' Lengths

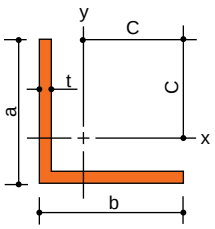
Equal Sides

b	a	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
½	½	3/32	.44	.126	.003	.009	.348	.004	.017
¾	¾	⅛	.90	.250	.014	.030	.453	.020	.053
1	1	⅛	1.25	.344	.034	.055	.619	.053	.105
1¼	1¼	⅛	1.60	.438	.069	.088	.853	.110	.176
1½	1½	⅛	1.94	.531	.123	.129	.952	.198	.264

Unequal Sides

b	a	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
⅝	5/16	3/32	.36	.099	.001	.004	.201	.005	.015
¾	⅜	⅛	.57	.159	.002	.009	.238	.011	.028
1	½	⅛	.85	.219	.005	.014	.330	.028	.057
1	¾	⅛	1.04	.281	.015	.031	.479	.040	.081
1¼	½	⅛	.91	.250	.005	.015	.344	.050	.080
1¼	⅝	⅛	1.06	.281	.010	.023	.424	.060	.096
1½	½	⅛	1.02	.281	.005	.015	.354	.080	.106
1½	⅝	⅛	1.12	.312	.010	.023	.437	.094	.126
1½	1	⅛	1.47	.406	.039	.059	.668	.139	.185
2	¾	⅛	1.47	.406	.025	.039	.543	.221	.221
2¼	⅞	⅛	1.75	.469	.031	.048	.637	.331	.294
2½	1	⅛	1.94	.531	.046	.064	.732	.471	.377

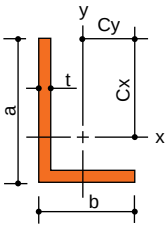
ANGLES
Equal Legs



Alloy C38500
Sharp Corners
20' Lengths,
except as noted
*16' Lengths

a	b	t	Weight	Area	I	S	C
½	½	⅛	.42	.109	.002	.006	.330
⅝	⅝	⅛	.52	.141	.005	.011	.424
¾	¾	⅛	.64	.172	.009	.017	.517
1	1	⅛	.89	.234	.022	.031	.704
1	1	3/16	1.24	.341	.030	.044	.682
1¼	1¼	⅛	1.09	.297	.044	.049	.891
1¼	1¼	3/16	1.60	.435	.062	.071	.869
1¼	1¼	¼	2.05	.562	.077	.091	.847
1½	1½	⅛	1.35	.359	.078	.072	1.079
1½	1½	3/16	1.92	.529	.110	.104	1.056
1½	1½	¼	2.52	.688	.139	.134	1.034
2	2	⅛	1.79	.484	.190	.131	1.454
2	2	3/16	2.61	.717	.273	.191	1.431
2	2	¼	3.37*	.938	.348	.247	1.408
2½	2½	⅛	2.24	.609	.378	.206	1.829
2½	2½	¼	4.33*	1.187	.703	.394	1.783
3	3	¼	5.25*	1.437	1.244	.577	2.160

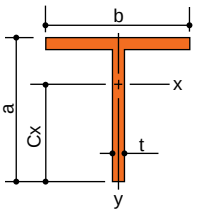
ANGLES
Unequal Legs



Alloy C38500
Sharp Corners
20' Lengths,
except as noted
*16' Lengths

a	b	t	Weight	Area	Ix	Sx	Cx	Iy	Sy	Cy
¾	⅜	⅛	.45	.125	.007	.015	.453	.001	.004	.266
1	½	⅛	.65	.172	.017	.027	.619	.003	.008	.369
1	¾	⅛	.75	.203	.020	.029	.668	.009	.017	.543
1¼	¾	⅛	.88	.234	.037	.045	.812	.010	.018	.562
1½	¾	⅛	.97	.266	.061	.064	.952	.010	.018	.577
1½	1	⅛	1.10	.300	.068	.068	1.003	.024	.032	.753
2	1	⅛	1.33	.359	.150	.117	1.285	.026	.033	.785
3	2	¼	4.32*	1.187	1.087	.542	2.007	.392	.260	1.507
4	2½	¼	5.70*	1.562	2.602	.973	2.675	.805	.418	1.925

TEES

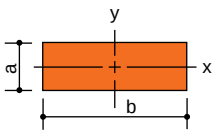


Alloy C38500
Sharp Corners
20' Lengths

a	b	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
¾	¾	⅛	.64	.171	.009	.017	.518	.004	.012
1	1	⅛	.89	.233	.022	.031	.705	.011	.021
1½	1½	⅛	1.35	.358	.077	.072	1.080	.035	.047
1½	1½	3/16	1.94	.529	.110	.104	1.056	.054	.071
2	2	3/16	2.61	.717	.271	.190	1.430	.126	.126

All dimensions in inches and weight in pounds per lineal foot

FLAT BARS

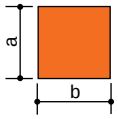


Alloy C38500
Sharp Corners
16' Lengths

a	b	Weight	Area	Ix	Sx	Iy	Sy
⅛	½	.23	.063	.000	.001	.001	.005
⅛	⅝	.29	.078	.000	.002	.003	.008
⅛	¾	.35	.094	.000	.002	.004	.012
⅛	1	.46	.125	.000	.003	.010	.020
⅛	1¼	.58	.156	.000	.003	.020	.032
⅛	1½	.69	.188	.000	.004	.035	.047
⅛	2	.92	.250	.000	.005	.083	.083
⅛	3	1.38	.375	.000	.008	.281	.187
3⁄16	½	.35	.094	.000	.002	.002	.008
3⁄16	⅝	.43	.118	.000	.004	.004	.012
3⁄16	¾	.52	.141	.000	.004	.007	.018
3⁄16	1	.69	.188	.001	.006	.016	.032
3⁄16	1½	1.04	.282	.001	.009	.053	.071
3⁄16	2	1.38	.376	.001	.012	.125	.125
3⁄16	2½	1.73	.470	.001	.015	.244	.195
3⁄16	3	2.08	.564	.002	.018	.422	.281
3⁄16	3½	2.42	.658	.002	.021	.670	.383
3⁄16	4	2.76	.752	.002	.023	1.000	.500
¼	⅜	.34	.094	.000	.004	.001	.006
¼	½	.46	.125	.001	.005	.003	.010
¼	⅝	.58	.156	.001	.007	.005	.016
¼	¾	.69	.188	.001	.008	.009	.023
¼	1	.92	.250	.001	.008	.021	.042
¼	1¼	1.15	.313	.002	.016	.041	.066
¼	1½	1.38	.375	.002	.016	.070	.093
¼	2	1.84	.500	.003	.024	.167	.167
¼	2½	2.30	.625	.003	.024	.326	.261
¼	3	2.77	.750	.004	.032	.563	.375
¼	4	3.65	1.000	.005	.040	1.333	.667
5⁄16	6	6.67	1.875	.015	.096	5.625	1.875
⅜	½	.68	.188	.002	.012	.004	.016
⅜	⅝	.87	.234	.003	.015	.008	.024
⅜	¾	1.04	.281	.003	.018	.013	.035
⅜	1	1.38	.375	.004	.021	.031	.062
⅜	1¼	1.73	.469	.005	.027	.061	.098
⅜	1½	2.07	.563	.007	.037	.106	.141
⅜	2	2.76	.750	.009	.048	.250	.250
⅜	2½	3.42	.938	.011	.059	.488	.390
⅜	3	4.11	1.125	.013	.069	.844	.563
⅜	4	5.53	1.500	.018	.096	2.000	1.000
½	¾	1.37	.375	.008	.031	.018	.047
½	1	1.84	.500	.010	.040	.042	.084
½	1¼	2.28	.625	.013	.052	.081	.130
½	1½	2.76	.750	.016	.064	.141	.188
½	2	3.68	1.000	.021	.084	.333	.333
½	2½	4.60	1.250	.026	.104	.651	.520
½	3	5.48	1.500	.031	.124	1.125	.750
¾	1	2.74	.750	.035	.094	.063	.125
¾	1½	4.11	1.125	.053	.141	.210	.281
¾	2	5.53	1.500	.070	.188	.500	.500

Fabr: Vega Metals
Durham, North Carolina

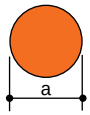
SQUARES



Alloy C38500
Sharp Corners
16' Lengths

a	b	Weight	Area	I	S
¼	¼	.23	.063	.000	.003
5/16	5/16	.36	.097	.001	.005
⅜	⅜	.52	.141	.002	.009
½	½	.92	.250	.005	.021
⅝	⅝	1.44	.391	.013	.041
¾	¾	2.08	.563	.026	.070
1	1	3.69	1.000	.083	.167
1¼	1¼	5.76	1.563	.204	.326
1½	1½	8.28	2.250	.422	.563

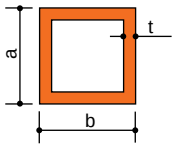
ROUNDS



Alloy C38500
16' Lengths,
except as noted
*12' lengths

a	Weight	Area	I	S
⅜	.41	.110	.001	.005
½	.72	.196	.003	.012
⅝	1.13	.307	.008	.024
¾	1.63	.442	.016	.041
⅞	2.22*	.601	.029	.066
1	2.89	.785	.049	.098
1⅛	3.66	.994	.079	.140
1¼	4.52	1.227	.120	.192
1½	6.51	1.767	.249	.331
2	11.57*	3.142	.785	.785

SQUARE TUBING

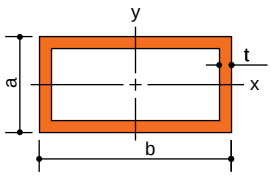


Alloy C38500
Sharp Corners
16' Lengths

* Rounded inside corners, r = 1/4"

a	b	t	Weight	Area	I	S
½	½	.093	.56	.151	.004	.018
⅝	⅝	.093	.73	.198	.010	.031
¾	¾	.093	.90	.244	.018	.048
1	1	.100	1.32	.360	.049	.098
1¼	1¼	.100	1.70	.460	.102	.163
1½	1½	.100	2.07	.560	.184	.245
1¾	1¾	.100	2.43	.660	.300	.344
2	2	.100	2.83	.760	.458	.459
2½	2½	.100	3.48	.960	.923	.740
3	3	.125	5.27*	1.437	1.984	1.323

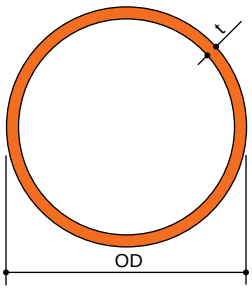
RECTANGULAR TUBING



Alloy C38500
Sharp Corners
16' Lengths

a	b	t	Weight	Area	Minor Axis Ix	Minor Axis Sx	Major Axis Iy	Major Axis Sy
½	1	.100	.95	.260	.009	.034	.029	.058
¾	1½	.100	1.50	.410	.035	.093	.110	.147
1	1½	.100	1.70	.460	.070	.139	.135	.180
½	2	.100	1.70	.460	.017	.068	.252	.252
1	2	.100	2.07	.560	.090	.180	.278	.278
1¼	2½	.125	3.23	.875	.219	.351	.678	.543
1	3	.125	3.46	.937	.153	.307	.950	.633
1¼	3	.125	3.69	1.000	.259	.415	1.071	.720
1½	3	.125	3.88	1.022	.384	.512	1.167	.778
1¾	3	.125	4.15	1.125	.566	.647	1.338	.892
2	3	.125	4.48	1.187	.772	.772	1.467	.978
1¾	4	.125	5.28	1.375	.732	.836	2.742	1.371

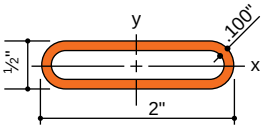
ROUND TUBING



Alloy C38500
20' Lengths

OD	t	Weight	Area	I	S
1½	.100	1.75	.440	.108	.144
1.900	.100	2.07	.565	.230	.242
2½	.125	3.44	.933	.659	.527
3	.125	4.50	1.129	1.169	.779
3½	.125	4.85	1.325	1.890	1.080

OVAL TUBING

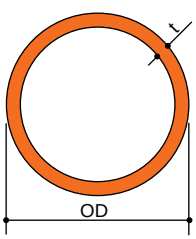


Alloy C38500
16' Lengths

	Weight	Area	Major Axis Ix	Major Axis Sx	Minor Axis Iy	Minor Axis Sy
6488	1.56	.426	.011	.044	.152	.152

HANDRAIL PIPE

Red Brass

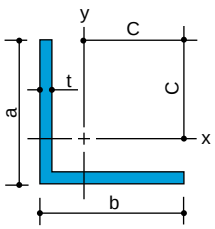


Alloy C23000
Standard Pipe Sizes
20' Lengths

Nominal Pipe Size	Sched.	OD	ID	t	Weight	Area	I	S	r
1¼	40	1.660	1.368	.146	2.63	.695	.201	.242	.538
1½	40	1.900	1.600	.150	3.13	.825	.318	.335	.621

This pipe size tubing is furnished with plain ends, unmarked, and with a smooth finish suitable for polishing.
See pages 10 to 23 for stock pipe fittings.

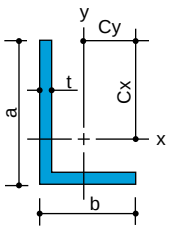
ANGLES
Equal Legs



Alloy 6063-T52
Sharp Corners
16' Lengths

a	b	t	Weight	Bars per Bundle†	Area	I	S	C
½	½	1/16	.070	78	.058	.001	.004	.352
½	½	⅛	.131	40	.109	.002	.006	.330
⅝	⅝	⅛	.168	39	.141	.005	.011	.424
¾	¾	1/16	.108	47	.089	.005	.009	.540
¾	¾	⅛	.206	30	.172	.009	.017	.517
1	1	1/16	.145	40	.120	.012	.016	.727
1	1	⅛	.281	20	.234	.022	.031	.704
1	1	3/16	.408	15	.341	.030	.044	.682
1¼	1¼	⅛	.356	15	.297	.044	.049	.891
1¼	1¼	3/16	.519	11	.435	.062	.071	.869
1½	1½	⅛	.431	14	.359	.078	.072	1.079
1½	1½	3/16	.633	10	.529	.110	.104	1.056
1½	1½	¼	.824	7	.688	.139	.134	1.034
1¾	1¾	⅛	.506	12	.422	.126	.099	1.266
2	2	⅛	.581	11	.484	.190	.131	1.454
2	2	3/16	.857	6	.717	.273	.191	1.431
2	2	¼	1.124	5	.938	.348	.247	1.408
2½	2½	⅛	.731	8	.609	.378	.206	1.829
3	3	⅛	.881	6	.734	.661	.300	2.203
3	3	3/16	1.308	5	1.093	.964	.442	2.180
3½	3½	⅛	1.031	6	.859	1.059	.411	2.578
4	4	⅛	1.181	5	.984	1.591	.539	2.953

ANGLES
Unequal Legs

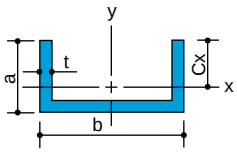


Alloy 6063-T52
Sharp Corners
16' Lengths

b	a	t	Weight	Bars per Bundle†	Area	Ix	Sx	Cx	Iy	Sy	Cy
⅜	¾	3/32	.116	60	.096	.003	.007	.465	.001	.001	.277
½	1	⅛	.206	29	.172	.017	.027	.619	.003	.008	.369
½	1¼	⅛	.244	25	.203	.032	.042	.755	.003	.008	.380
½	1½	⅛	.281	25	.234	.053	.060	.888	.003	.008	.388
½	2	⅛	.355	20	.297	.118	.103	1.148	.003	.008	.398
¾	1	⅛	.244	25	.203	.020	.029	.668	.009	.017	.543
¾	1½	⅛	.319	18	.266	.061	.064	.952	.010	.018	.577
¾	2	⅛	.394	15	.328	.136	.111	1.223	.011	.019	.598
1	1½	⅛	.356	15	.300	.068	.068	1.003	.024	.032	.753
1	1¾	⅛	.394	16	.328	.104	.091	1.146	.025	.033	.771
1	2	⅛	.431	15	.359	.150	.117	1.285	.026	.033	.785
1	2	3/16	.633	10	.529	.215	.170	1.262	.037	.048	.762
1	2½	⅛	.506	12	.422	.277	.178	1.558	.028	.034	.808
1	3	⅛	.581	10	.484	.456	.250	1.825	.029	.035	.825
1¼	3½	⅛	.694	9	.578	.750	.347	2.160	.057	.055	1.035
1½	1¾	⅛	.469	14	.391	.120	.097	1.233	.081	.073	1.108
1½	2	⅛	.506	12	.422	.173	.125	1.382	.085	.075	1.132
1½	2½	⅛	.581	10	.484	.319	.191	1.671	.090	.077	1.171
2	2½	⅛	.656	10	.554	.344	.194	1.779	.196	.129	1.523
2	3	⅛	.731	9	.069	.580	.282	2.053	.213	.137	1.553
2	3½	⅛	.806	8	.672	.881	.377	2.339	.222	.140	1.589
2	4	⅛	.881	7	.734	1.266	.483	2.618	.229	.141	1.382
2¼	5¼	⅛	1.106	6	.992	2.749	.817	3.363	.340	.182	1.863
2½	3½	⅛	.881	7	.734	.951	.391	2.432	.416	.215	1.932
3	3½	⅛	.956	6	.797	1.009	.402	2.511	.692	.306	2.261
3	4	⅛	1.031	6	.859	1.452	.517	2.810	.719	.311	2.310
3	5	⅛	1.181	5	.984	2.658	.784	3.390	.762	.319	2.390
4	5	⅛	1.331	5	1.109	2.924	.820	3.564	1.698	.554	3.064

† Aluminum extrusions are packed in 100-lb. wrapped, paper interleaved bundles to speed shipment and prevent damage. Quantities are subject to change without notice.

CHANNELS



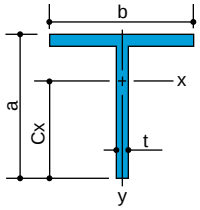
Alloy 6063-T52
Sharp Corners
16' Lengths,
except as noted

* 20' Lengths
** For glass block

† Aluminum extrusions are packed in 100-lb. wrapped, paper interleaved bundles to speed shipment and prevent damage. Quantities are subject to change without notice.

b	a	t	Weight	Bars per Bundle†	Area	Ix	Sx	Cx	Iy	Sy
⅜	⅜	.109	.120	46	.102	.001	.006	.211	.002	.008
½	⅜	⅛	.150	38	.128	.002	.007	.219	.004	.014
½	½	3⁄32	.148	35	.126	.003	.009	.348	.004	.017
½	¾	⅛	.263	22	.224	.011	.027	.420	.007	.028
⅝	⅝	⅛	.244	23	.207	.007	.020	.370	.011	.034
⅝	1	⅛	.356	16	.297	.028	.050	.569	.017	.053
¾	⅜	⅛	.187	35	.159	.002	.009	.238	.011	.028
¾	½	⅛	.225	30	.191	.004	.013	.323	.014	.037
¾	¾	⅛	.300	20	.250	.014	.030	.453	.020	.053
1	½	⅛	.263*	18	.219	.005	.014	.330	.028	.057
1	⅝	⅛	.304	20	.250	.009	.022	.406	.034	.069
1	¾	⅛	.337	20	.281	.015	.031	.479	.040	.081
1	1	⅛	.413	12	.344	.034	.055	.619	.053	.105
1¼	½	⅛	.300*	16	.250	.005	.015	.344	.050	.080
1¼	⅝	⅛	.337*	12	.281	.010	.023	.424	.060	.096
1¼	¾	⅛	.374*	12	.312	.016	.032	.500	.070	.112
1¼	1¼	⅛	.526	12	.438	.069	.088	.853	.110	.176
1½	½	⅛	.337*	16	.281	.005	.015	.354	.080	.106
1½	⅝	⅛	.374*	12	.312	.010	.023	.437	.094	.126
1½	¾	⅛	.413	16	.344	.017	.033	.517	.109	.146
1½	1	⅛	.487	12	.406	.039	.059	.668	.139	.185
1½	1½	⅛	.637	8	.531	.123	.129	.952	.198	.264
1¾	½	⅛	.374	15	.312	.005	.015	.362	.118	.135
1¾	¾	⅛	.450	12	.375	.018	.034	.531	.159	.182
1¾	1	⅛	.524	12	.438	.042	.060	.688	.200	.229
2	½	⅛	.413	14	.344	.006	.015	.369	.166	.166
2	1	⅛	.564*	8	.469	.043	.062	.704	.276	.276
2	2	⅛	.863	6	.719	.301	.234	1.285	.496	.496
2¼	⅞	⅛	.563	11	.469	.031	.048	.637	.331	.294
2½	¾	⅛	.564	10	.469	.020	.036	.562	.383	.307
2½	1½	⅛	.787	8	.656	.147	.140	1.045	.648	.518
2½	2½	⅛	1.062	6	.906	.599	.370	1.619	1.001	.801
3	½	⅛	.563	11	.469	.006	.017	.387	.475	.317
3	1	⅛	.713	8	.594	.049	.065	.753	.734	.489
3	2	⅛	.955	6	.844	.346	.250	1.382	1.250	.834
3	3	⅛	1.293	4	1.094	1.050	.538	1.952	1.767	1.178
4	1½	⅛	1.013	6	.844	.169	.150	1.132	1.960	.979
4½	2	⅛	1.238**	4	1.031	.394	.265	1.483	3.190	1.420
5	2	5⁄16	1.940	2	1.621	.584	.393	1.486	5.900	2.360

TEES

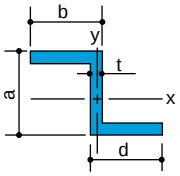


Alloy 6063-T52
Sharp Corners
16' Lengths

b	a	t	Weight	Bars per Bundle†	Area	Ix	Sx	Cx	Iy	Sy
¾	¾	⅛	.206	30	.171	.009	.017	.518	.004	.012
¾	1¼	⅛	.280		.233	.037	.045	.814	.004	.012
1	¾	⅛	.244	23	.202	.009	.017	.544	.010	.021
1	1	⅛	.281	20	.233	.022	.031	.705	.011	.021
1⅛	½	*	.338		.282	.005	.016	.318	.020	.032
1⅛	1⅛	⅛	.319	19	.265	.031	.039	.924	.015	.027
1¼	⅞	⅛	.300	21	.249	.016	.024	.649	.020	.033
1½	1½	⅛	.431	12	.358	.077	.072	1.080	.035	.047
2	¾	⅛	.394	16	.322	.010	.017	.600	.083	.083
2	2	5⁄16	.856	6	.717	.271	.190	1.430	.126	.126

* Item No. **6958**; Table ⅛", Leg ⅜"

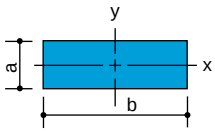
ZEES



Alloy 6063-T52
Sharp Corners
16' Lengths

a	b	d	t	Weight	Bars per Bundle†	Area	Minor Axis Ix	Minor Axis Sx	Major Axis Iy	Major Axis Sy
½	½	½	3⁄32	.148	40	.169	.004	.017	.006	.016
¾	¾	¾	⅛	.300	21	.250	.020	.053	.027	.039
⅞	¾	¾	⅛	.319		.266	.029	.067	.027	.039
1	⅝	⅞	⅛	.337	18	.281	.056	.063	.015	.047
1	1⅛	1⅛	⅛	.450	14	.375	.058	.117	.100	.094

FLAT BARS

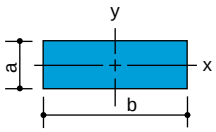


Alloy 6063-T52
Sharp Corners
16' Lengths

a	b	Weight	Bars per Bundle†	Area	Ix	Sx	Iy	Sy
⅛	½	.075	60	.063	.000	.001	.001	.005
⅛	⅝	.094	48	.078	.000	.002	.003	.008
⅛	¾	.113	59	.094	.000	.002	.004	.012
⅛	1	.150	48	.125	.000	.003	.010	.020
⅛	1⅛	.169	29	.141	.000	.003	.015	.026
⅛	1¼	.187	29	.156	.000	.003	.020	.032
⅛	1½	.226	27	.188	.000	.004	.035	.047
⅛	1¾	.263	19	.219	.000	.005	.056	.064
⅛	2	.300	20	.250	.000	.005	.083	.083
⅛	2½	.376	15	.313	.000	.007	.163	.130
⅛	3	.450	12	.375	.000	.008	.281	.187
⅛	3½	.526	12	.438	.001	.009	.447	.255
⅛	4	.600	10	.500	.001	.010	.667	.334
⅛	5	.750	8	.625	.001	.013	1.302	.521
3⁄16	½	.113	60	.094	.000	.002	.002	.008
3⁄16	¾	.169	37	.141	.000	.004	.007	.018
3⁄16	1	.226	30	.188	.001	.006	.016	.032
3⁄16	1¼	.282	23	.235	.001	.007	.031	.050
3⁄16	1½	.337	19	.282	.001	.009	.053	.071
3⁄16	1¾	.394	16	.329	.001	.010	.084	.096
3⁄16	2	.450	12	.376	.001	.012	.125	.125
3⁄16	2½	.564	12	.470	.001	.015	.244	.195
3⁄16	3	.677	10	.564	.002	.018	.422	.281
3⁄16	4	.900	7	.752	.002	.023	1.000	.500
¼	½	.150	50	.125	.001	.005	.003	.010
¼	⅝	.187	31	.156	.001	.007	.005	.016
¼	¾	.224	28	.188	.001	.008	.009	.023
¼	1	.300	20	.250	.001	.008	.021	.042
¼	1¼	.374	16	.313	.002	.016	.041	.066
¼	1½	.450	12	.375	.002	.016	.070	.093
¼	1¾	.525	12	.438	.002	.016	.112	.128
¼	2	.600	10	.500	.003	.024	.167	.167
¼	2½	.750	9	.625	.003	.024	.326	.261
¼	3	.900	7	.750	.004	.032	.563	.375
¼	3½	1.050	5	.875	.005	.040	.893	.510
¼	4	1.200	5	1.000	.005	.040	1.333	.667
¼	5	1.500	4	1.250	.007	.056	2.604	1.042
¼	6	1.800	3	1.500	.008	.064	4.500	1.500
5⁄16	1	.374		.313	.003	.019	.026	.052
5⁄16	1½	.562	11	.469	.004	.026	.088	.117
5⁄16	2	.749	8	.625	.005	.032	.208	.208
5⁄16	6	2.170	3	1.875	.015	.096	5.625	1.875
⅜	½	.224	24	.188	.002	.012	.004	.016
⅜	⅝	.281	20	.234	.003	.015	.008	.024
⅜	¾	.338	15	.281	.003	.018	.013	.035
⅜	1	.450	12	.375	.004	.021	.031	.062
⅜	1¼	.563	10	.469	.005	.027	.061	.098
⅜	1½	.674	9	.563	.007	.037	.106	.141
⅜	1¾	.784	7	.656	.008	.043	.168	.192
⅜	2	.900	7	.750	.009	.048	.250	.250
⅜	2½	1.126	5	.938	.011	.059	.488	.390
⅜	3	1.350	4	1.125	.013	.069	.844	.563
⅜	3½	1.576	4	1.313	.015	.080	1.340	.767
⅜	4	1.800	3	1.500	.018	.096	2.000	1.000

† Aluminum extrusions are packed in 100-lb. wrapped, paper interleaved bundles to speed shipment and prevent damage. Quantities are subject to change without notice.

FLAT BARS (continued)

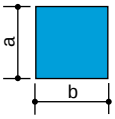


Alloy 6063-T52
Sharp Corners
16' Lengths

a	b	Weight	Bars per Bundle†	Area	Ix	Sx	Iy	Sy
½	¾	.450	14	.375	.008	.031	.018	.047
½	1	.600	10	.500	.010	.040	.042	.084
½	1¼	.750	8	.625	.013	.052	.081	.130
½	1½	.900	6	.750	.016	.064	.141	.188
½	1¾	1.050	5	.875	.018	.072	.223	.255
½	2	1.200	6	1.000	.021	.084	.333	.333
½	2½	1.500	4	1.250	.026	.104	.651	.520
½	3	1.800	3	1.500	.031	.124	1.125	.750
½	3½	2.100	3	1.750	.036	.144	1.787	1.020
½	4	2.400	2	2.000	.042	.168	2.667	1.333
⅝	1	.750	8	.625	.020	.064	.052	.104
⅝	1¼	.937	6	.781	.025	.080	.102	.163
⅝	1½	1.124	5	.938	.031	.099	.176	.235
⅝	2	1.500	4	1.250	.041	.131	.417	.417
⅝	3	2.250	2	1.875	.061	.195	1.406	.937
¾	1	.900	6	.750	.035	.094	.063	.125
¾	1¼	1.126	5	.938	.044	.117	.122	.195
¾	1½	1.350	5	1.125	.053	.141	.210	.281
¾	1¾	1.576	4	1.313	.062	.166	.335	.388
¾	2	1.800	3	1.500	.070	.188	.500	.500
¾	2½	2.250	2	1.875	.088	.234	.977	.781
¾	3	2.700	2	2.250	.106	.281	1.688	1.125
¾	3½	3.150	2	2.625	.123	.329	2.680	1.530
¾	4	3.600	1	3.000	.141	.375	4.000	2.000
1	1¼	1.500	4	1.250	.104	.208	.163	.261
1	1½	1.800	3	1.500	.125	.250	.281	.375
1	1¾	2.100	3	1.750	.146	.292	.447	.510
1	2	2.400	2	2.000	.167	.333	.667	.667
1	2½	3.000	2	2.500	.208	.417	1.302	1.042
1	3	3.600	1	3.000	.250	.500	2.250	1.500
1	4	4.800	1	4.000	.333	.667	5.333	2.667

† Aluminum extrusions are packed in 100-lb. wrapped, paper interleaved bundles to speed shipment and prevent damage. Quantities are subject to change without notice.

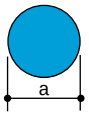
SQUARE BARS



Alloy 6063-T52
Sharp Corners
16' Lengths, except as noted
*20' Lengths

a	b	Weight	Bars per Bundle†	Area	I	S
¼	¼	.075	88	.063	.000	.003
5/16	5/16	.116	48	.097	.001	.005
⅜	⅜	.169	40	.141	.002	.009
½	½	.300*	20	.250	.005	.021
⅝	⅝	.468*	12	.391	.013	.041
¾	¾	.674	10	.563	.026	.070
1	1	1.200	5	1.000	.083	.167
1¼	1¼	1.875	3	1.563	.204	.326
1½	1½	2.700	2	2.250	.422	.563
1¾	1¾	3.676	1	3.063	.782	.893
2	2	4.800		4.000	1.333	1.333

ROUND BARS

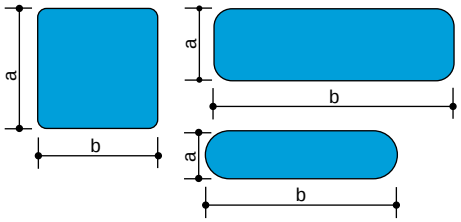


Alloy 6063-T52,
except as noted
* 6063-T6
** 6061-T6

a	Weight	Bars per Bundle†	Length	Area	I	S
⅜	.132	50	16'	.110	.001	.005
½	.235	25	16'	.196	.003	.012
⅝	.368	18	16'	.307	.008	.024
¾	.530	12	16'	.442	.016	.041
⅞	.727*	12	12'	.601	.029	.066
1	.942*	7	12' & 16'	.785	.049	.098
1⅛	1.192*	7	12'	.994	.079	.140
1¼	1.472*	3	16'	1.227	.120	.192
1½	2.120	3	16'	1.767	.249	.331
1.600	2.415**		16'	2.010	.322	.402
1.680	2.662**		16'	2.216	.391	.465
1.688	2.684*		12'	2.237	.398	.470
2	3.770*		16'	3.142	.785	.785

All dimensions in inches and weight in pounds per lineal foot

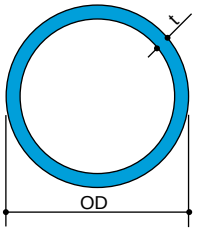
ROUND CORNER BARS



	a	b	Corner Radius	Weight		Bars per Bundle†	Area	Ix	Sx	Iy	Sy
6423	1¼	1¼	3/32	1.876	Sq.	2	1.555	.201	.321	.201	.321
6424	1¼	2¾	3/32	4.124	Rect.	1	3.430	.445	.712	2.153	1.566
6939	¾	2½	3/16	2.214	Rect.	2	1.845	.085	.225	.932	.746
6986	¾	3	⅛	2.684	Rect.	2	2.237	.104	.277	1.658	1.106
6988	½	2	¼	1.138	Oval	4	.946	.019	.075	.285	.285

Alloy 6063-T52
Round Corners
20' Lengths

EXTRUDED HANDRAIL PIPE



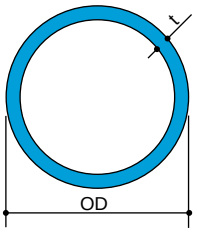
Alloy 6063-T52
20' Lengths

Nominal Size	Sched.	OD	ID	t	Weight	Bars per Bundle†	Area	I	S	r
¾	40	1.050	.824	.113	.391	14	.333	.037	.071	.334
1	40	1.315	1.049	.133	.581	9	.494	.087	.133	.421
1¼*	10	1.660	1.442	.109	.625	6	.531	.161	.193	.550
1¼*	40	1.660	1.380	.140	.785	6	.669	.195	.235	.540
1½*	10	1.900	1.682	.109	.721	5	.614	.247	.260	.634
1½*	40	1.900	1.610	.145	.940	5	.800	.310	.326	.623
2	40	2.375	2.067	.154	1.264	3	1.075	.666	.561	.787

*Carried in stock with mill finish and with a clear anodized – AA-M10-C22-A31 (204R1) – finish.

This pipe is of tubing quality, having a smooth, clean surface and close dimensional tolerances which make it suitable for architectural work and for anodizing. It is easy to bend. Pipe is furnished carefully wrapped for protection in handling and shipping. See pages 10 to 23 for stock pipe fittings.

DRAWN HANDRAIL PIPE



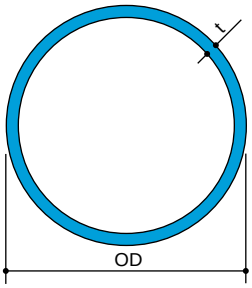
Alloy 6063-T832
20' Lengths

Nominal Size	Sched.	OD	ID	t	Weight	Area	I	S	r
1¼*	10	1.660	1.442	.109	.625	.531	.161	.193	.550
1¼*	40	1.660	1.380	.140	.785	.669	.195	.235	.540
1½*	10	1.900	1.682	.109	.721	.614	.247	.260	.634
1½*	40	1.900	1.610	.145	.940	.800	.310	.326	.623

*Carried in stock with mill finish and with a clear anodized – AA-M10-C22-A31 (204R1) – finish.

This premium quality drawn pipe has an extra smooth surface. Its harder temper gives it high strength. See pages 10 to 23 for stock pipe fittings.

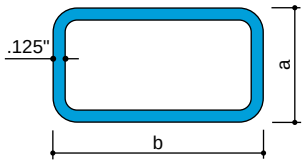
ROUND TUBING



OD	t	Weight	Bars per Bundle†	Area	I	S
2½	.125	1.119	6	.933	.659	.527
3	.125	1.330		1.129	1.169	.779
3½	.125	1.560		1.325	1.890	1.080

Alloy 6063-T52
20' Lengths

ROUND CORNER TUBING

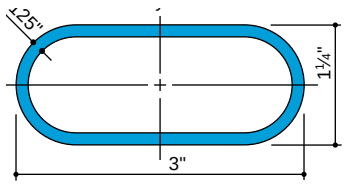


	a	b	Weight	Bars per Bundle†
6434*	1¼	2¾	1.123	5
6436	1 3/16	2 3/16	.888	6

Alloy 6063-T52
20' Lengths

For elements of section, see page 117.
* 6063-T6

OVAL TUBING

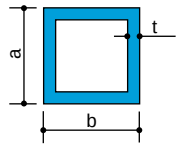


	Weight	Bars per Bundle†	Area	Ix	Sx	Iy	Sy
6437	1.057	5	.879	.210	.336	.799	.532

Alloy 6063-T52
20' Lengths

† Aluminum extrusions are packed in 100-lb. wrapped, paper interleaved bundles to speed shipment and prevent damage. Quantities are subject to change without notice.

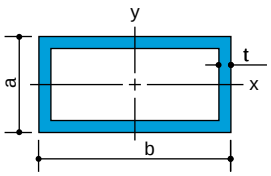
SQUARE TUBING



Alloy 6063-T52
Sharp Corners
21'-1" Lengths

a	b	t	Weight	Bars per Bundle†	Area	I	S
½	½	.062	.130	36	.109	.003	.014
⅝	⅝	.062	.167	31	.142	.007	.024
¾	¾	.062	.205	24	.171	.013	.036
¾	¾	.125	.374	10	.312	.021	.056
1	1	.062	.278	16	.233	.034	.068
1	1	.125	.525	8	.437	.057	.114
1¼	1¼	.078	.438	9	.366	.084	.134
1¼	1¼	.125	.675	8	.562	.120	.192
1½	1½	.078	.532	8	.444	.150	.200
1½	1½	.125	.825	6	.687	.218	.291
1¾	1¾	.125	.975	4	.812	.360	.411
2	2	.078	.720	6	.600	.370	.370
2	2	.125	1.124	4	.937	.552	.552
2½	2½	.125	1.424	3	1.187	1.119	.896
3	3	.125	1.724	2	1.437	1.984	1.323
4	4	.125	2.324	2	1.937	4.854	2.427

RECTANGULAR TUBING

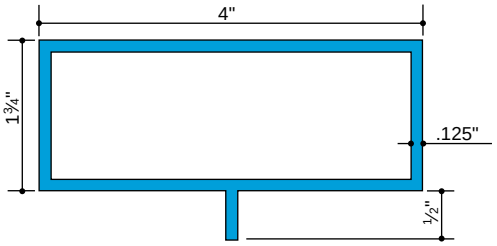


Alloy 6063-T52
Sharp Corners
21'-1" Lengths, except as noted
*20', 24' and 25' Lengths

† Aluminum extrusions are packed in 100-lb. wrapped, paper interleaved bundles to speed shipment and prevent damage. Quantities are subject to change without notice.

a	b	t	Weight	Bars per Bundle†	Area	Minor Axis Ix	Minor Axis Sx	Major Axis Iy	Major Axis Sy
½	1	.125	.374	12	.312	.009	.003	.033	.066
¾	1½	.125	.588	8	.500	.040	.106	.130	.173
1	1½	.125	.661	6	.562	.081	.162	.159	.212
1	2	.125	.825	6	.687	.105	.210	.332	.332
1	3	.125	1.119	4	.937	.153	.307	.950	.633
1¼	2½	.125	1.050	4	.875	.219	.351	.678	.543
1¼	3	.125	1.200	4	1.000	.259	.415	1.079	.720
1½	2	.125	.967	4	.812	.278	.370	.442	.442
1½	2½	.125	1.124	4	.937	.337	.449	.767	.613
1½	3	.125	1.276	4	1.022	.384	.512	1.167	.778
1½	6	.125	2.135	2	1.812	.752	1.002	7.197	2.399
1¾	2¼	.125	1.125	4	.937	.442	.505	.661	.588
1¾	3	.125	1.323	3	1.125	.566	.647	1.338	.892
1¾	3½	.125	1.470	3	1.250	.649	.742	1.962	1.121
1¾	4	.125	1.650	3	1.375	.732	.836	2.742	1.371
1¾	4½	.125	1.765	2	1.500	.814	.931	3.693	1.641
1¾	5	.125	1.910	2	1.625	.897	1.025	4.833	1.933
2	2½	.125*	1.280	4	1.062	.662	.662	.943	.754
2	3	.125	1.395	3	1.187	.772	.772	1.467	.978
2	4	.125	1.710	3	1.438	.992	.992	2.976	1.488
2	5	.125	2.025	2	1.687	1.212	1.212	5.204	2.082
2	6	.125	2.326	2	1.937	1.432	1.432	8.276	2.759
3	5	.125	2.326	2	1.937	3.018	2.012	6.690	2.676
3	6	.188	3.882		3.226	5.010	3.340	15.032	5.010

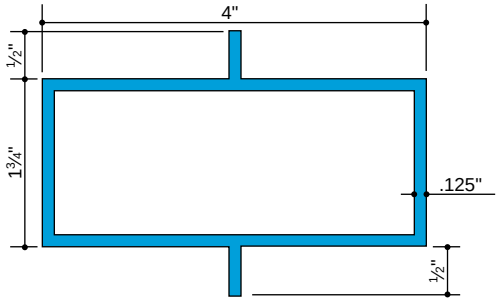
SINGLE FIN MULLION



Alloy 6063-T52
Sharp Corners
21'-1" Lengths

Weight	Bars per Bundle†
1.724	3

DOUBLE FIN MULLION

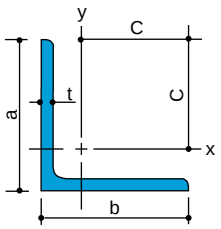


Weight	Bars per Bundle†
1.800	3

Alloy 6063-T52
Sharp Corners
21'-1" Lengths

All dimensions in inches and weight in pounds per lineal foot

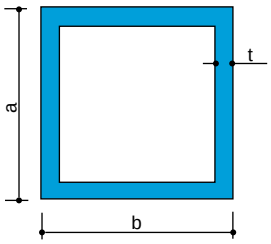
STRUCTURAL ANGLES
Equal Leg



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	I	S	r	C
¾	¾	⅛	.20	.17	.008	.016	.219	.523
1	1	⅛	.28	.23	.021	.029	.298	.71
1	1	3/16	.40	.34	.029	.042	.293	.686
1	1	¼	.51	.44	.036	.054	.287	.664
1¼	1¼	⅛	.35	.30	.042	.046	.37	.90
1¼	1¼	3/16	.51	.43	.059	.068	.37	.88
1¼	1¼	¼	.66	.56	.074	.087	.36	.85
1½	1½	⅛	.43	.36	.074	.068	.45	1.09
1½	1½	3/16	.62	.53	.107	.100	.45	1.06
1½	1½	¼	.83	.69	.135	.130	.44	1.04
1¾	1¾	⅛	.51	.42	.121	.094	.53	1.28
1¾	1¾	3/16	.74	.63	.174	.139	.53	1.25
1¾	1¾	¼	.96	.81	.223	.181	.52	1.23
2	2	⅛	.57	.49	.18	.13	.61	1.47
2	2	3/16	.85	.72	.27	.19	.61	1.44
2	2	¼	1.11	.94	.34	.24	.60	1.42
2	2	5/16	1.36	1.16	.41	.30	.60	1.39
2	2	⅜	1.59	1.37	.47	.35	.59	1.37
2½	2½	⅛	.72	.62	.37	.20	.77	1.85
2½	2½	3/16	1.07	.91	.54	.30	.77	1.82
2½	2½	¼	1.40	1.19	.69	.39	.76	1.79
2½	2½	5/16	1.73	1.47	.84	.48	.76	1.77
2½	2½	⅜	2.05	1.74	.98	.56	.75	1.74
3	3	3/16	1.28	1.09	.91	.41	.91	2.21
3	3	¼	1.68	1.43	1.18	.54	.91	2.18
3	3	5/16	2.08	1.77	1.45	.67	.91	2.15
3	3	⅜	2.47	2.10	1.70	.80	.90	2.13
3	3	½	3.41	2.74	2.16	1.04	.89	2.08
3½	3½	¼	1.99	1.69	1.93	.76	1.07	2.56
3½	3½	⅜	2.93	2.49	2.79	1.11	1.06	2.50
3½	3½	½	3.83	3.25	3.56	1.45	1.05	2.45
4	4	¼	2.28	1.94	2.94	1.00	1.23	2.93
4	4	5/16	2.83	2.41	3.61	1.24	1.23	2.90
4	4	⅜	3.38	2.86	4.26	1.48	1.22	2.88
4	4	½	4.41	3.75	5.46	1.93	1.21	2.83
5	5	⅜	4.28	3.60	8.37	2.30	1.52	3.64
5	5	½	5.58	4.74	10.89	3.03	1.52	3.59
6	6	⅜	5.12	4.35	14.85	3.38	1.85	4.40
6	6	½	6.75	5.74	19.38	4.46	1.84	4.34
8	8	½	9.14	7.77	47.74	8.16	2.48	5.85

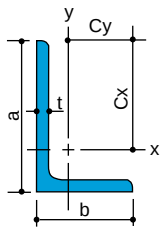
STRUCTURAL SQUARE TUBING



Alloy 6061-T6
24' Lengths

a	b	t	Weight	Area	I	S
2	2	⅛	1.126	.937	.552	.552
2	2	3/16	1.627	1.363	.754	.754
2½	2½	3/16	2.087	1.739	1.559	1.247
3	3	3/16	2.538	2.115	2.798	1.865
4	4	3/16	3.440	2.867	6.957	3.479

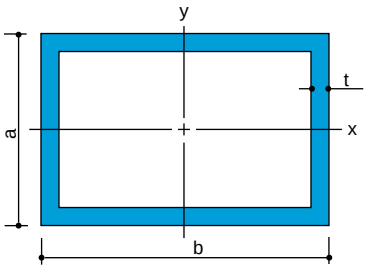
STRUCTURAL ANGLES
Unequal Leg



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Cx	Iy	Sy	ry	Cy
1½	1¼	¼	.74	.63	.127	.126	.45	1.13	.079	.090	.36	.76
1¾	1¼	⅛	.42	.36	.108	.090	.55	1.45	.046	.048	.36	.71
1¾	1¼	3/16	.62	.53	.156	.132	.54	1.43	.066	.071	.35	.68
1¾	1¼	¼	.81	.69	.199	.172	.54	1.40	.083	.092	.35	.65
2	1½	⅛	.50	.42	.17	.12	.63	1.64	.08	.07	.44	.90
2	1½	3/16	.73	.62	.24	.18	.62	1.62	.12	.10	.43	.87
2	1½	¼	.96	.81	.31	.23	.62	1.59	.15	.14	.43	.84
2½	1½	¼	1.11	.94	.59	.36	.79	1.13	.16	.14	.41	1.64
2½	2	3/16	.96	.82	.50	.29	.78	1.99	.29	.19	.59	1.25
2½	2	¼	1.26	1.07	.65	.38	.78	1.97	.37	.25	.58	1.22
2½	2	5/16	1.55	1.32	.78	.46	.77	1.95	.44	.30	.58	1.20
3	2	3/16	1.07	.91	.82	.40	.95	2.54	.29	.19	.56	1.06
3	2	¼	1.40	1.19	1.06	.52	.94	2.52	.38	.25	.56	1.03
3	2	⅜	2.05	1.74	1.51	.76	.93	2.47	.53	.36	.55	.97
3	2½	¼	1.54	1.31	1.12	.53	.92	2.36	.70	.38	.73	1.61
3	2½	⅜	2.25	1.92	1.60	.78	.91	2.31	1.00	.55	.72	1.56
3½	2½	¼	1.68	1.43	1.73	.72	1.10	2.90	.73	.38	.71	1.41
3½	2½	5/16	2.08	1.77	2.12	.89	1.09	2.88	.89	.48	.71	1.38
3½	2½	⅜	2.47	2.10	2.49	1.06	1.09	2.85	1.05	.57	.71	1.36
3½	3	¼	1.84	1.57	1.84	.74	1.08	2.74	1.28	.57	.90	1.91
4	3	¼	1.99	1.69	2.68	.96	1.26	3.28	1.29	.56	.87	1.79
4	3	⅜	2.93	2.49	3.88	1.42	1.25	3.23	1.86	.83	.86	1.74
4	3	½	3.83	3.25	4.96	1.85	1.24	3.18	2.36	1.08	.85	1.69
5	3	⅜	3.35	2.85	7.15	2.15	1.59	4.31	1.93	.84	.82	1.32
5	3	½	4.40	3.74	9.24	2.83	1.57	4.26	2.48	1.10	.81	1.27
5	3½	5/16	3.01	2.56	6.39	1.85	1.58	4.19	2.58	.96	1.00	1.95
5	3½	⅜	3.58	3.05	7.56	2.21	1.58	4.16	3.04	1.15	1.00	1.92
5	3½	½	4.70	4.00	9.77	2.90	1.56	4.11	3.91	1.50	.99	1.87
6	3½	5/16	3.39	2.88	10.64	2.64	1.92	5.26	2.70	.98	.97	1.53
6	3½	½	5.31	4.51	16.34	4.14	1.90	5.18	4.11	1.53	.95	1.44
6	4	⅜	4.24	3.60	13.02	3.17	1.90	5.09	4.63	1.50	1.13	2.10
6	4	½	5.58	4.74	16.95	4.19	1.89	5.03	6.01	1.98	1.13	2.04
8	6	¾	11.68	9.93	62.60	11.47	2.51	6.45	30.15	6.77	1.74	3.46

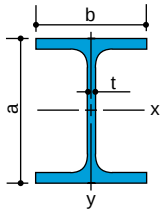
STRUCTURAL RECTANGULAR TUBING



a	b	t	Weight	Area	Minor Axis Ix	Minor Axis Sx	Major Axis Iy	Major Axis Sy
2	3	3/16	2.123	1.739	1.064	1.064	2.055	1.370
2	4	3/16	2.538	2.115	1.374	1.374	4.226	2.113
3	6	3/16	3.892	3.226	5.010	3.340	15.032	5.010

Alloy 6061-T6
24' Lengths

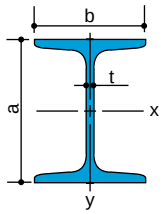
STRUCTURAL I-BEAMS
Aluminum Association Standard



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry
3.00	2.50	.13	1.637	1.392	2.24	1.49	1.27	.52	.42	.61
3.00	2.50	.15	2.030	1.726	2.71	1.81	1.25	.68	.54	.63
4.00	3.00	.15	2.310	1.965	5.62	2.81	1.69	1.04	.69	.73
4.00	3.00	.17	2.793	2.375	6.71	3.36	1.68	1.31	.87	.74
5.00	3.50	.19	3.699	3.146	13.94	5.58	2.11	2.29	1.31	.85
6.00	4.00	.19	4.030	3.427	21.99	7.33	2.53	3.10	1.55	.95
6.00	4.00	.21	4.693	3.990	25.50	8.50	2.53	3.74	1.87	.97
7.00	4.50	.23	5.800	4.932	42.89	12.25	2.95	5.78	2.57	1.08
8.00	5.00	.23	6.181	5.256	59.69	14.92	3.37	7.30	2.92	1.18
8.00	5.00	.25	7.023	5.972	67.78	16.94	3.37	8.55	3.42	1.20
10.00	6.00	.25	8.646	7.352	132.09	26.42	4.24	14.78	4.93	1.42
10.00	6.00	.29	10.286	8.747	155.79	31.16	4.22	18.03	6.01	1.44
12.00	7.00	.29	11.671	9.925	255.57	42.60	5.07	26.90	7.69	1.65

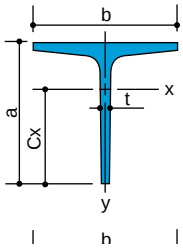
STRUCTURAL I-BEAMS
American Standard



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry
3	2.330	.170	1.960	1.67	2.52	1.68	1.23	.46	.39	.52
3	2.509	.349	2.590	2.21	2.93	1.95	1.15	.59	.47	.52
4	2.660	.190	2.640	2.25	6.06	3.03	1.64	.76	.57	.58
4	2.796	.326	3.280	2.79	6.79	3.39	1.56	.90	.65	.57
5	3.000	.210	3.430	2.92	12.26	4.90	2.05	1.21	.81	.64
5	3.284	.494	5.100	4.34	15.22	6.09	1.87	1.66	1.01	.62
6	3.330	.230	4.300	3.66	22.08	7.36	2.46	1.82	1.09	.71
6	3.443	.343	5.100	4.34	24.11	8.04	2.36	2.04	1.19	.69
8	4.000	.270	6.350	5.40	57.55	14.39	3.27	3.73	1.86	.83
8	4.262	.532	8.810	7.49	68.73	17.18	3.03	4.66	2.19	.79
10	4.600	.310	8.760	7.45	123.39	24.68	4.07	6.78	2.91	.95
12	5.000	.350	10.990	9.35	218.13	36.35	4.83	9.35	3.74	1.00

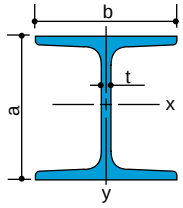
STRUCTURAL TEES



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Cx	Iy	Sy	ry
2	2	¼	1.26	1.07	.37	.26	.59	1.42	.18	.18	.41
3	3	⅜	2.72	2.31	1.83	.86	.89	2.12	.90	.60	.63
4	4	⅜	3.74	3.18	4.56	1.58	1.20	3.89	2.12	1.06	.82

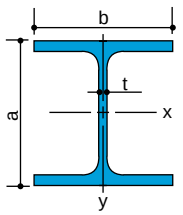
STRUCTURAL H-COLUMNS



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry
4	4	.313	4.76	4.05	10.80	5.40	1.63	3.52	1.76	.93
5	5	.313	6.49	5.52	23.94	9.58	2.08	7.73	3.09	1.18
6	6	.250	7.85	6.68	44.25	14.75	2.57	14.02	4.67	1.45

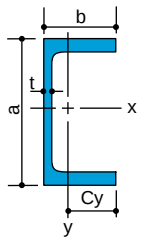
STRUCTURAL WIDE FLANGE BEAMS



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry
6	4	.230	4.16	3.54	21.75	7.25	2.48	2.98	1.49	.92
6	6	.240	5.40	4.59	30.17	10.06	2.56	9.69	3.23	1.45
8	5¼	.230	5.90	5.02	56.73	14.18	3.36	7.44	2.83	1.22
8	6½	.245	8.32	7.08	84.15	21.04	3.44	18.23	5.61	1.61
8	8	.288	10.72	9.12	109.66	27.41	3.47	36.97	9.24	2.01
10(9.90)	5¾	.240	7.30	6.21	106.74	21.56	4.15	10.77	3.75	1.32

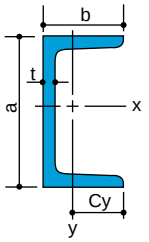
STRUCTURAL CHANNELS
Aluminum Association Standard



Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry	Cy
2.00	1.00	.13	.577	.491	.288	.288	.766	.045	.064	.303	.704
2.00	1.25	.17	1.071	.911	.546	.546	.774	.139	.178	.391	.779
3.00	1.50	.13	1.135	.965	1.41	.94	1.21	.22	.22	.47	1.01
3.00	1.75	.17	1.597	1.358	1.97	1.31	1.20	.42	.37	.55	1.13
4.00	2.00	.15	1.738	1.478	3.91	1.95	1.63	.60	.45	.64	1.35
4.00	2.25	.19	2.331	1.982	5.21	2.60	1.62	1.02	.69	.72	1.47
5.00	2.25	.15	2.212	1.881	7.88	3.15	2.05	.98	.64	.72	1.52
5.00	2.75	.19	3.089	2.627	11.14	4.45	2.06	2.05	1.14	.88	1.80
6.00	2.50	.17	2.834	2.410	14.35	4.78	2.44	1.53	.90	.80	1.71
6.00	3.25	.21	4.030	3.427	21.04	7.01	2.48	3.76	1.76	1.05	2.13
7.00	2.75	.17	3.205	2.725	22.09	6.31	2.85	2.10	1.10	.88	1.91
7.00	3.50	.21	4.715	4.009	33.79	9.65	2.90	5.13	2.23	1.13	2.30
8.00	3.00	.19	4.147	3.526	37.40	9.35	3.26	3.25	1.57	.96	2.07
8.00	3.75	.25	5.789	4.923	52.69	13.17	3.27	7.13	2.82	1.20	2.53
9.00	4.00	.29	6.970	5.927	78.31	17.40	3.63	9.61	3.49	1.27	2.75
10.00	3.50	.25	6.136	5.218	83.22	16.64	3.99	6.33	2.56	1.10	2.48
10.00	4.25	.31	8.360	7.109	116.15	23.23	4.04	13.02	4.47	1.35	2.91
12.00	4.00	.29	8.274	7.036	159.76	26.63	4.77	11.03	3.86	1.25	2.86
12.00	5.00	.35	11.822	10.053	239.69	39.95	4.88	25.74	7.60	1.60	3.39

STRUCTURAL CHANNELS
American Standard



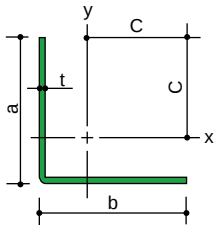
Alloy 6061-T6
25' Lengths

a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry	Cy
3	1.410	.170	1.420	1.21	1.66	1.10	1.17	.20	.20	.40	.970
3	1.498	.258	1.730	1.47	1.85	1.24	1.12	.25	.23	.41	1.058
3	1.596	.356	2.070	1.76	2.07	1.38	1.08	.31	.27	.42	1.136
4	1.580	.180	1.850	1.57	3.83	1.92	1.56	.32	.28	.45	1.120
4	1.647	.247	2.160	1.84	4.19	2.10	1.51	.37	.31	.45	1.197
4	1.720	.320	2.500	2.13	4.58	2.29	1.47	.43	.34	.45	1.260
5	1.750	.190	2.320	1.97	7.49	3.00	1.95	.48	.38	.49	1.270
5	1.885	.325	3.110	2.64	8.90	3.56	1.83	.63	.45	.49	1.405
5	2.032	.472	3.970	3.38	10.43	4.17	1.76	.81	.53	.49	1.522
6	1.920	.200	2.830	2.40	13.12	4.37	2.34	.69	.49	.54	1.410
6	1.945	.225	3.000	2.55	13.57	4.52	2.31	.73	.51	.54	1.435
6	2.034	.314	3.630	3.09	15.18	5.06	2.22	.87	.56	.53	1.534
6	2.157	.437	4.480	3.82	17.39	5.80	2.13	1.05	.64	.52	1.647
7	2.110	.230	3.540	3.01	21.84	6.24	2.69	1.01	.64	.58	1.570
7	2.194	.314	4.230	3.60	24.24	6.93	2.60	1.17	.70	.57	1.674
8	2.290	.250	4.250	3.62	33.85	8.46	3.06	1.40	.81	.62	1.730
8	2.343	.303	4.750	4.04	36.11	9.03	2.99	1.53	.85	.61	1.793
8	2.435	.395	5.620	4.78	40.04	10.01	2.90	1.75	.93	.61	1.885
8	2.527	.487	6.480	5.51	43.96	10.99	2.82	1.98	1.01	.60	1.957
9	2.430	.230	4.600	3.91	47.68	10.60	3.49	1.75	.96	.67	1.830
9	2.648	.448	6.910	5.88	60.92	13.54	3.22	2.42	1.17	.64	2.068
10	2.600	.240	5.280	4.49	67.37	13.47	3.87	2.28	1.16	.71	1.970
10	2.886	.526	8.640	7.35	91.20	18.24	3.52	3.36	1.48	.68	2.266
12	2.960	.300	7.410	6.30	131.84	21.97	4.57	3.99	1.76	.80	2.250
12	3.047	.387	8.640	7.35	144.37	24.06	4.43	4.47	1.89	.78	2.377
12	3.170	.510	10.370	8.82	162.08	27.01	4.29	5.14	2.06	.76	2.500
15	3.400	.400	11.710	9.96	314.76	41.97	5.62	9.63	3.11	.90	2.610

All dimensions in inches and weight in pounds per lineal foot

ROLLED ANGLES

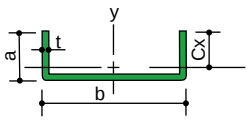
Equal Legs



Type 304 (18-8)
Mill Finish
20' Lengths

a	b	t	Weight	Area	I	S	C
½	½	.062	.192	.058	.001	.004	.352
⅝	⅝	.062	.247	.074	.003	.006	.446
¾	¾	.062	.296	.089	.005	.009	.539
¾	¾	.125	.596	.172	.009	.017	.517
1	1	.062	.410	.120	.012	.016	.727
1	1	.125	.808	.234	.022	.031	.704
1¼	1¼	.062	.507	.151	.023	.025	.914
1¼	1¼	.125	1.020	.297	.044	.049	.891
1½	1½	.062	.605	.182	.041	.037	1.102
1½	1½	.125	1.240	.359	.078	.072	1.079

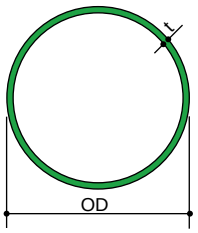
ROLLED CHANNELS



Type 304 (18-8)
Mill Finish
20' Lengths,
except as noted
*22' Length

b	a	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
½	½	.062	.284	.085	.002	.007	.310	.003	.013
⅝	5/16	.078*	.293	.085	.001	.003	.206	.004	.014
¾	⅜	.062	.279	.085	.001	.004	.259	.001	.003
¾	¾	.062	.451	.132	.015	.024	.621	.012	.033
1	½	.062	.385	.116	.003	.007	.350	.017	.034
1	1	.062	.591	.178	.019	.029	.643	.031	.062
1¼	½	.062	.452	.132	.003	.008	.366	.029	.047
1½	½	.062	.492	.147	.003	.008	.377	.046	.061

HANDRAIL PIPE

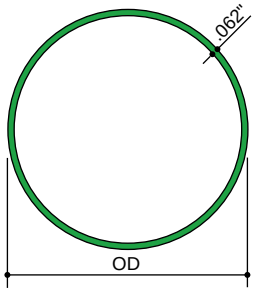


Type 304 (18-8)
Ornamental Grade
20' Lengths

Nominal Pipe Size	Sched,	OD	ID	t	Weight	Area	I	S	r
1	40*	1.315	1.075	.120	1.460	.494	.087	.133	.421
1¼	5	1.660	1.535	.062	1.110	.326	.104	.125	.564
1¼	40*	1.660	1.364	.148	2.150	.669	.195	.235	.540
1½	5	1.900	1.775	.062	1.274	.375	.158	.166	.649
1½	40*	1.900	1.604	.148	2.550	.800	.310	.326	.623

No. 4, 180 grit, satin finish; paper wrapped
See pages 10 - 23 for stock pipe fittings
* Cold rolled

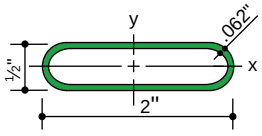
ROUND TUBING



Type 304 (18-8)
Ornamental Grade
20' Lengths

OD	ID	Weight	Area	I	S
2½	2.375	1.691	.497	.369	.295
3	2.875	1.930	.577	.622	.415

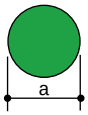
OVAL TUBING



	Weight	Area	Minor Axis Ix	Minor Axis Sx	Major Axis Iy	Major Axis Sy
4488	.944	.284	.011	.046	.107	.107

Type 304 (18-8)
Ornamental Grade
20' Lengths
For elevator cab handrails

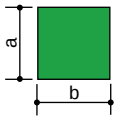
ROUND BARS



Type 304 (18-8)
Centerless Ground
12' to 14' Lengths
except as noted
* 12' Lengths, Type 303
Smooth surface, suitable for polishing

a	Weight	Area	I	S
⅜	.378	.110	.001	.005
½	.671	.196	.003	.012
9/16	.850 *	.249	.005	.018
⅝	1.050	.307	.008	.024
¾	1.510	.442	.016	.041
⅞	2.060 *	.601	.029	.066
1	2.680 *	.785	.049	.098
1¼	4.200 *	1.227	.120	.192

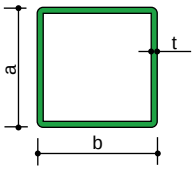
SQUARE TRUE BARS



Type 304 (18-8)
Sharp Corners
12' to 14' Lengths
Smooth surface, suitable for polishing

a	b	Weight	Area	I	S
½	½	.855	.250	.005	.021
⅝	⅝	1.330	.391	.013	.041
¾	¾	1.920	.563	.026	.070
1	1	3.420	1.000	.083	.167
1¼	1¼	5.310	1.563	.204	.326

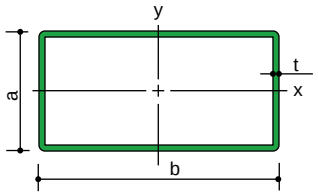
SQUARE TUBING



Type 304 (18-8)
Ornamental Grade
20' Lengths
Smooth surface, suitable for polishing

a	b	t	Weight	Area	Ix	Sx	Cx
¾	¾	.049	.472	.137	.011	.030	.287
1	1	.062	.835	.234	.034	.069	.384
1¼	1¼	.062	1.058	.297	.070	.112	.486
1½	1½	.062	1.281	.359	.124	.166	.588
1¾	1¾	.062	1.505	.422	.200	.230	.690
2	2	.062	1.728	.484	.303	.304	.792

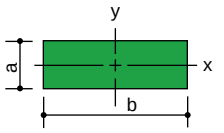
RECTANGULAR TUBING



Type 304 (18-8)
Ornamental Grade
20' Lengths, except as noted
* 21'-1" Length
Smooth surface, suitable for polishing

					Minor Axis			Major Axis		
a	b	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry
¾	1½	.062	.946	.266	.025	.066	.305	.076	.101	.533
1	1½	.062	1.048	.297	.048	.096	.403	.092	.122	.556
1	2	.062	1.281	.359	.062	.124	.415	.186	.186	.719
1	3	.062	1.728	.484	.089	.179	.430	.517	.345	1.033
1¼	2½	.062	1.616	.453	.125	.200	.525	.372	.297	.906
1¾	3	.062	2.062*	.578	.312	.356	.734	.720	.480	1.116
1¾	4	.062	2.683*	.703	.401	.458	.755	1.454	.727	1.438

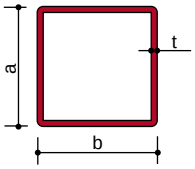
FLAT TRUE BARS



Type 304 (18-8)
Sharp Corners
12' to 14' Lengths
Smooth surface, suitable for polishing

a	b	Weight	Area	Ix	Sx	Iy	Sy
3/16	¾	.478	.141	.000	.004	.007	.018
3/16	1	.638	.188	.001	.006	.016	.032
3/16	1¼	.797	.235	.001	.007	.031	.050
3/16	1½	.957	.282	.001	.009	.053	.071
3/16	2	1.280	.376	.001	.012	.125	.125
3/16	3	1.990	.564	.002	.018	.422	.281
¼	¾	.636	.188	.001	.008	.009	.023
¼	1	.850	.250	.001	.008	.021	.042
¼	1¼	1.060	.313	.002	.016	.041	.066
¼	1½	1.280	.375	.002	.016	.070	.093
¼	2	1.700	.500	.003	.024	.167	.167
¼	2½	2.120	.625	.003	.024	.326	.261
¼	3	2.550	.750	.004	.032	.563	.375
¼	4	3.400	1.000	.005	.040	1.333	.667
⅜	1	1.280	.375	.004	.021	.031	.062
⅜	1¼	1.590	.469	.005	.027	.061	.098
⅜	1½	1.920	.563	.007	.037	.106	.141
⅜	2	2.550	.750	.009	.048	.250	.250
⅜	2½	3.190	.938	.011	.059	.488	.390
⅜	3	3.830	1.125	.013	.069	.844	.563
⅜	4	5.100	1.500	.018	.096	2.000	1.000
½	¾	1.280	.375	.008	.031	.018	.047
½	1	1.700	.500	.010	.040	.042	.084
½	1½	2.550	.750	.016	.064	.141	.188
½	2	3.400	1.000	.021	.084	.333	.333
½	2½	4.250	1.250	.026	.104	.651	.520
½	3	5.100	1.500	.031	.124	1.125	.750
½	4	6.800	2.000	.042	.168	2.667	1.333
¾	1	2.550	.750	.035	.094	.063	.125
¾	1½	3.830	1.125	.053	.141	.210	.281
¾	2	5.100	1.500	.070	.188	.500	.500
¾	3	7.650	2.250	.106	.281	1.688	1.125
1	1½	5.100	1.500	.125	.250	.281	.375

SQUARE TUBING
Mechanical Welded Tubing



Carbon Steel C1010
20' Lengths, except as noted
* 24' Lengths

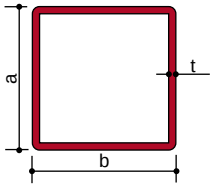
Mechanical Welded Tubing has a clean, bright surface. It is suitable for use where dimensional accuracy and straightness are essential.

Corner radius of tubing usually equals about twice the wall thickness.

Where wall thickness according to gauge no. and decimal dimension are not identical, the decimal measurement is true – the gauge no. is approximate.

a	b	ga.	t	Weight	Area	I	S	r
⅜	⅜	18	.049	.217	.064	.001	.006	.135
½	½	20	.035	.221	.065	.002	.009	.192
½	½	18	.049	.300	.088	.003	.012	.185
½	½	16	.065	.384	.113	.004	.015	.178
⅝	⅝	20	.035	.281	.083	.005	.015	.241
⅝	⅝	18	.049	.384	.113	.006	.020	.236
⅝	⅝	16	.065	.495	.146	.008	.025	.230
¾	¾	18	.049	.466	.137	.011	.030	.287
¾	¾	16	.065	.606	.178	.014	.038	.281
¾	¾	14	.083	.753	.221	.017	.045	.275
⅞	⅞	16	.065	.716	.211	.023	.053	.332
1	1	18	.049	.634	.186	.028	.056	.389
1	1	16	.065	.826	.243	.036	.071	.383
1	1	14	.083	1.035	.304	.043	.086	.376
1	1	11	.120	1.436	.422	.056	.111	.363
1⅛	1⅛	16	.065	.937	.276	.052	.092	.434
1¼	1¼	18	.049	.800	.235	.057	.091	.491
1¼	1¼	16	.065	1.048	.308	.072	.116	.485
1¼	1¼	14	.083	1.317	.387	.088	.141	.478
1¼	1¼	11	.120	1.844	.542	.117	.187	.464
1½	1½	16	.065	1.269	.373	.128	.171	.586
1½	1½	14	.083	1.600	.470	.158	.211	.580
1½	1½	11	.120	2.252	.662	.212	.282	.565
1¾	1¾	16	.065	1.490	.438	.208	.237	.668
1¾	1¾	14	.083	1.882	.553	.257	.294	.682
1¾	1¾	11	.120	2.660	.782	.348	.398	.667
2	2	16	.065	1.711	.503	.314	.314	.790
2	2	14	.083	2.164	.636	.391	.391	.783
2	2	11	.120	3.068	.902	.534	.534	.769
2½	2½	16	.065	2.153	.633	.626	.501	.995
2½	2½	14	.083	2.728	.802	.782	.626	.987
2½	2½	11	.120	3.884	1.142	1.081	.865	.973
3	3	14	.083	3.293	.968	1.374	.916	1.191
3½	3½	11	.120	5.516*	1.622	3.093	1.767	1.381
4	4	11	.120	6.331*	1.862	4.677	2.339	1.585

SQUARE TUBING
Structural Steel

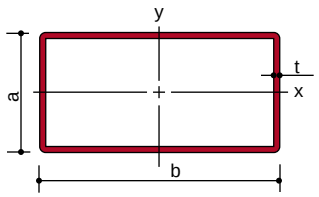


20' Lengths, except as noted
* 18' to 22' Lengths
† Hot Rolled, Butt Welded Tubing (Square Pipe)

Structural Tubing may have a bright or a black surface, but is equal to Mechanical Tubing in straightness and accuracy.

a	b	ga.	t	Weight	Area	I	S	r
1	1	15	.073	.920	.267	.039	.077	.380
1½	1½	10	.140	2.500*†	.762	.237	.316	.558

RECTANGULAR TUBING
Mechanical Welded Tubing



Carbon Steel C1010
20' Lengths

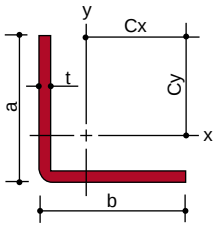
Mechanical Welded Tubing has a clean, bright surface. It is suitable for use where dimensional accuracy and straightness are essential.

Corner radius of tubing usually equals about twice the wall thickness.

Where wall thickness according to gauge no. and decimal dimension are not identical, the decimal measurement is true – the gauge no. is approximate.

						Minor Axis			Major Axis		
b	a	ga.	t	Weight	Area	Ix	Sx	rx	Iy	Sy	ry
1	⅜	16	.065	.550	.162	.003	.018	.143	.018	.036	.332
1	½	16	.065	.606	.178	.007	.027	.194	.021	.043	.347
1¼	1	14	.083	1.176	.346	.052	.104	.387	.074	.119	.463
1½	¾	16	.065	.937	.276	.025	.068	.304	.078	.104	.532
1½	¾	14	.083	1.176	.346	.031	.082	.297	.095	.127	.526
1½	1	16	.065	1.048	.308	.050	.100	.402	.095	.126	.555
1½	1	14	.083	1.317	.387	.060	.121	.395	.116	.155	.548
1½	1	11	.120	1.844	.542	.079	.158	.381	.155	.206	.534
2	⅝	14	.083	1.458	.408	.026	.083	.252	.181	.181	.665
2	1	16	.065	1.269	.373	.064	.128	.414	.193	.193	.718
2	1	14	.083	1.600	.470	.078	.156	.407	.238	.238	.711
2	1	11	.120	2.252	.662	.102	.204	.392	.322	.322	.697
2	1¼	14	.083	1.741	.512	.131	.209	.506	.276	.276	.734
2	1½	14	.083	1.882	.553	.200	.266	.601	.314	.314	.753
2	1½	11	.120	2.660	.781	.270	.359	.588	.429	.429	.739
2½	1	14	.083	1.882	.553	.095	.191	.415	.418	.335	.869
2½	1½	14	.083	2.164	.636	.241	.322	.616	.540	.432	.921
2½	1½	11	.120	3.068	.902	.326	.435	.601	.741	.593	.906
3	1	14	.083	2.164	.636	.113	.226	.421	.668	.445	1.025
3	1¼	14	.083	2.305	.678	.187	.300	.526	.756	.505	1.057
3	1½	14	.083	2.446	.720	.283	.377	.627	.845	.563	1.084
3	1½	11	.120	3.476	1.022	.384	.512	.613	1.167	.778	1.069
3	2	14	.083	2.728	.802	.543	.543	.823	1.021	.681	1.128
3	2	11	.120	3.884	1.142	.746	.746	.808	1.416	.944	1.113
3½	1½	14	.083	2.728	.802	.325	.433	.636	1.240	.708	1.243
4	2	14	.083	3.293	.968	.696	.696	.848	2.053	1.027	1.456
4	2	11	.120	4.700	1.382	.958	.958	.833	2.870	1.435	1.441

COLD ROLLED ANGLES
Square Root and Square Edge



Steel C1010
20' Lengths

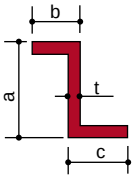
Equal Legs

a	b	t	Weight	Area	I	S	C
½	½	⅛	.38	.109	.002	.007	.330
⅝	⅝	⅛	.48	.141	.005	.011	.424
¾	¾	1/16	.30	.089	.005	.009	.539
¾	¾	⅛	.59	.172	.009	.017	.517
1	1	⅛	.81	.234	.022	.031	.704
1	1	3/16	1.16	.341	.030	.044	.682
1¼	1¼	⅛	1.02	.297	.044	.049	.891
1¼	1¼	3/16	1.48	.435	.062	.071	.869
1½	1½	⅛	1.24	.359	.078	.072	1.079
1½	1½	3/16	1.80	.529	.110	.104	1.056
2	2	⅛	1.65	.484	.190	.131	1.454
2	2	3/16	2.44	.717	.273	.191	1.431

Unequal Legs

a	b	t	Weight	Area	Ix	Sx	Cx	Iy	Sy	Cy
1	⅝	⅛	.64	.187	.018	.029	.646	.005	.012	.163
1¼	¾	⅛	.80	.234	.037	.045	.812	.010	.018	.562
1½	1	⅛	1.01	.297	.068	.068	1.003	.024	.032	.753
2	1	⅛	1.23	.359	.149	.116	1.285	.026	.033	.785

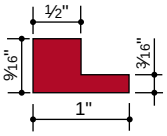
HOT ROLLED ZEES
Square Root



Steel C1010
20' Lengths

	a	b	c	t	Weight
4721	1 3/16	⅝	¾	⅛	.94
4722	1	½	⅝	⅛	.74

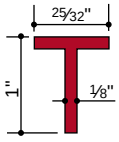
HOT ROLLED ANGLES
Square Root



Steel C1010
20' Lengths

Weight
4460 1.36

HOT ROLLED TEE

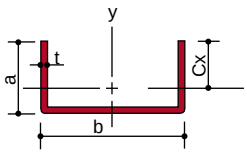


Steel C1010
20' Lengths

Weight
4619 .65

All dimensions in inches and weight in pounds per lineal foot

COLD ROLLED CHANNELS
Square Root and Square Edge



Steel C1010
20' Lengths,
except as noted
* 22' Lengths

Equal Sides

	b	a	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
4730	½	½	.093	.40	.122	.003	.010	.299	.004	.016
4732	¾	¾	.093	.57	.192	.011	.023	.465	.017	.044
4734	1	1	.109	1.03	.303	.030	.049	.625	.048	.096
4744	1¼	1¼	.109	1.32	.385	.061	.078	.792	.099	.158
4750	1½	1½	.109	1.59	.467	.109	.114	.958	.178	.237
4752	2	2	.125	2.41	.719	.309	.240	1.285	.496	.496

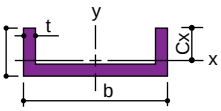
Unequal Sides

	b	a	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
4735	⅝	5/16	.078*	.29	.085	.001	.003	.206	.004	.014
4736	¾	⅜	.083*	.40	.111	.001	.005	.252	.008	.022
4753	2⅜	2 3/16	.156	3.41	1.005	.499	.351	1.420	1.880	1.583
4754	1½	1	.109	1.22	.358	.035	.052	.674	.117	.155
4759	1¾	1⅛	.109	1.40	.412	.052	.067	.768	.198	.226
4760	2	1	.125	1.59	.469	.044	.062	.704	.276	.276

NICKEL-SILVER

All dimensions in inches and weight in pounds per lineal foot

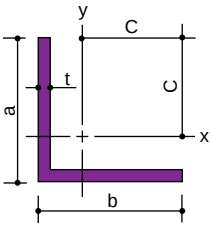
CHANNEL



Alloy C79800
Sharp Corners
20' Lengths

b	a	t	Weight	Area	Ix	Sx	Cx	Iy	Sy
1½	½	⅛	1.02	.281	.005	.015	.354	.080	.106
1¼	½	⅛	.91	.250	.005	.015	.344	.050	.080

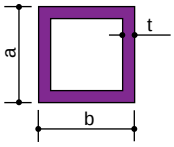
ANGLE



Alloy C79800
Sharp Corners
20' Lengths

a	b	t	Weight	Area	I	S	C
1½	1½	¼	2.52	.688	.139	.134	1.034

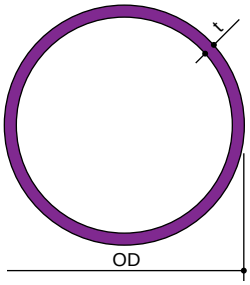
SQUARE TUBING



Alloy C79800
Sharp Corners
16' Lengths

a	b	t	Weight	Area	I	S
1	1	.100	1.317	.360	.049	.098

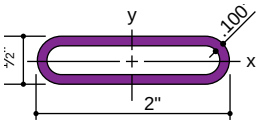
ROUND TUBING



Alloy C79800
Sharp Corners
20' Lengths

OD	t	Weight	Area	I	S
1½	.100	1.75	.440	.108	.144
1.900	.125	2.56	.697	.290	.278
2½	.125	3.40	.933	.659	.527
3	.125	4.50	1.129	1.169	.779

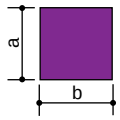
OVAL TUBING



Alloy C79800
Sharp Corners
16' Lengths

	Weight	Area	Major Axis Ix	Major Axis Sx	Minor Axis Iy	Minor Axis Sy
5288	1.57	.426	.011	.044	.152	.152

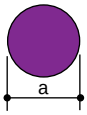
SQUARES



Alloy C79800
16' Lengths

a	b	Weight	Area	I	S
½	½	.92	.250	.005	.021
¾	¾	2.08	.563	.026	.070
1	1	3.69	1.000	.083	.167
1¼	1¼	5.76	1.563	.204	.326

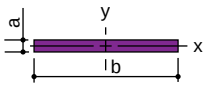
ROUNDS



Alloy C79800
16' Lengths

a	Weight	Area	I	S
½	.72	.196	.003	.012
¾	1.63	.442	.016	.041
1	2.89	.785	.049	.098
1¼	4.52	1.227	.120	.192
2	6.51	3.142	.785	.785

FLAT BAR



Alloy C79800
Sharp Corners
16' Lengths

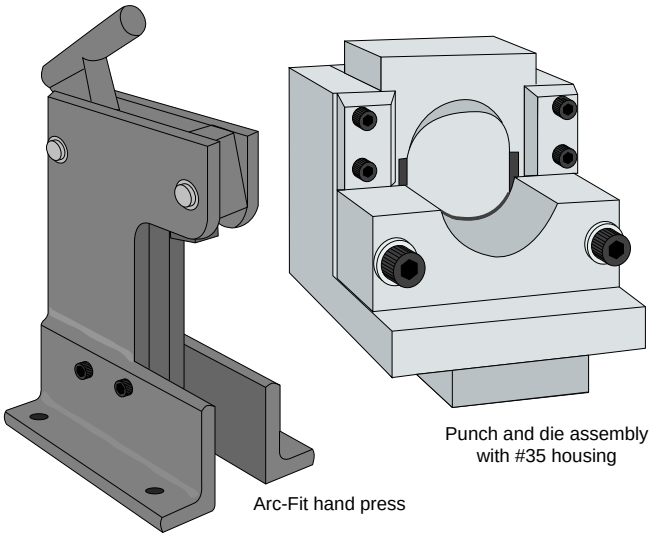
a	b	Weight	Area	Ix	Sx	Iy	Sy
⅛	1¼	.58	.156	.000	.003	.020	.032
⅛	1½	.69	.188	.000	.004	.035	.047
⅜	1	1.38	.375	.004	.021	.031	.062
⅜	1¼	1.73	.469	.005	.027	.061	.141
⅜	1½	2.07	.563	.007	.037	.106	.141
⅜	2	2.76	.750	.009	.048	.250	.250
⅜	3	4.11	1.125	.013	.069	.844	.563

Metal Working Machinery

ARC-FIT PIPE NOTCHER FOR 90° TEE JOINTS

The Arc-Fit notches one side of the pipe end to match the contour of a pipe of the same size. The pipe is then rotated 180° and the operation repeated on the opposite side. The resulting notch forms a tee joint without burr or deformation, ready for welding.

The Arc-Fit unit consists of a #35 standard housing with the appropriate punch and die assembly. Assemblies are interchangeable and are stocked for ¾" to 2" standard pipe sizes. The spring loaded unit may be operated in a power press — 8 ton capacity; 6" shut height; ⅝" min. stroke — or the #1400 Arc-Fit hand press.



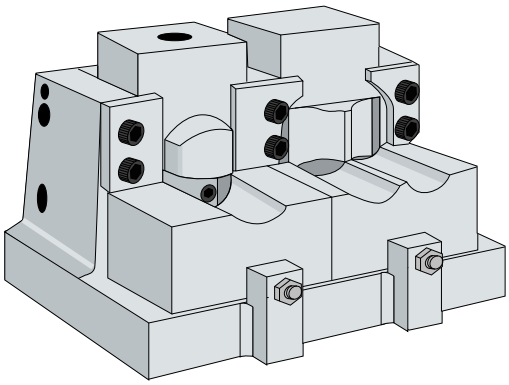
Punch and die assembly with #35 housing

Arc-Fit hand press

1400 Arc-Fit Hand Press
35 Arc-Fit Standard Housing
9201 Punch & Die Assembly for ¾" Pipe
9202 Punch & Die Assembly for 1" Pipe
9203 Punch & Die Assembly for 1¼" Pipe
9204 Punch & Die Assembly for 1½" Pipe
9205 Punch & Die Assembly for 2" Pipe

ARC-FIT PIPE NOTCHER FOR ANGLE JOINTS

Notching pipe for angle joints requires two die assemblies for each size mounted in a #75AB Arc-Fit Double Housing and operated by a power press – 15 ton capacity; 6" shut height; 1" stroke. Since 35° is considered an average for railing work, die assemblies are stocked for that angle only in 1" to 1½" standard pipe sizes. Joint angle can be varied by a few degrees in assembly.



75AB Arc-Fit Double Housing
9215 Punch & Die Assembly for 1¼" Pipe, 35° Angle
9216 Punch & Die Assembly for 1½" Pipe, 35° Angle

A greater concern for safety has caused code authorities and other regulatory agencies to include more stringent structural requirements for railings, handrails and guardrails in their codes and regulations. **Julius Blum & Co.** has been aware of the importance of safety in railing construction for many years and has been a pioneer in the compilation and dissemination of easily applied engineering data for the structural design of railing systems since 1965.

A testing program was instituted to confirm the structural soundness of **Julius Blum & Co.** railing components and, whenever necessary, mounting devices and connections were re-designed to improve their performance. Test results are available upon request.

The information contained in these pages is applicable not only to Julius Blum railing systems but to all kinds of guardrails and handrails — of whatever design.

Engineering data has been developed in cooperation with various manufacturers, engineering consultants and trade associations and, while published values have been determined with care, their accuracy cannot be guaranteed.

Availability of complete structural information enables architects and designers to make proper use of Blum's component systems to provide safe, durable handrail installations. The designer can engineer installations to conform to specific building code loading criteria or can establish design requirements for a given installation on the basis of anticipated traffic exposure.

The five major considerations for the structural design of handrails are:

1. Structural loading criteria as established by governing building codes or special design requirements.
2. Properties of railing materials and allowable stresses for design.
3. Elements of sections for railing components.
4. Load, stress and deflection relationships expressed as formulas for engineering design.
5. Proper attachment and sound supporting structure.

CODE REQUIREMENTS AND REGULATIONS

Structural requirements for railings usually are expressed in one of two ways, depending on governing codes and regulations. Some of these specify an applied loading distributed uniformly along the rail while others specify loading concentrated on the top rail. The designer should consult governing codes, local ordinances, project specifications and regulatory authorities to determine requirements for compliance.

The Americans with Disabilities Act (ADA) went into effect January 26, 1992. The ADA's guideline regarding handrail size states that *. . . the diameter or width of the gripping surfaces of a handrail . . . shall be 1¼ in to 1½ in . . . or the shape shall provide an equivalent gripping surface.*

The Architecture and Transportation Barriers Compliance Board – the agency which created and interprets the ***Americans with Disabilities Act Accessibility Guidelines (ADAAG)*** – has confirmed that 1¼ in. to 1½ in. pipe sizes (1.66 in. O.D. and 1.9 in. O.D., respectively) are acceptable for use as handrails within the ADA guidelines. A copy of the letter from the Access Board's general counsel is shown on page ii. Copies of this letter are available upon request.

ADAAG was based on ***ANSI 117.1-1980***: ***Accessible and Usable Buildings and Facilities.*** The **Council of American Building Officials (CABO)** has since published a revision of that document – ***CABO/ANSI A117.1-1992.*** That publication states:

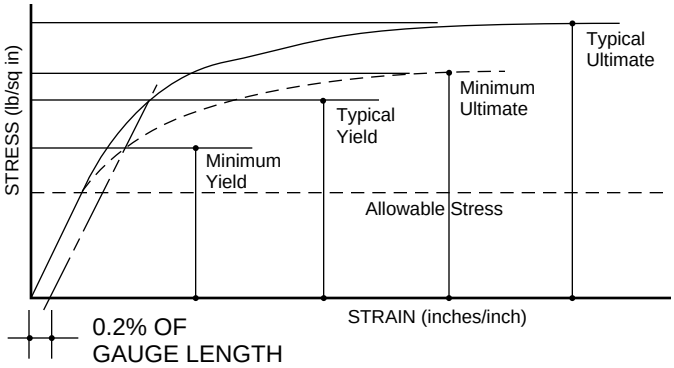
Handrails shall have a circular cross-section with an outside diameter of 1¼ in (32 mm) minimum and 2 in (51 mm) maximum, or shall provide equivalent graspability in accordance with the following requirement. Handrails with other shapes shall be permitted provided they have a perimeter dimension of 4 in (100 mm) minimum and 6¼ in (160 mm) maximum, and provided their largest cross-section dimension is 2¼ in (57 mm) maximum.

Refer to page iii for more information

ALLOWABLE STRESSES

To provide adequate safety factors, the engineering profession assigns to each material an allowable design stress which is usually expressed as a specific fraction of minimum yield, or sometimes as a smaller fraction of minimum ultimate strength. Allowable stresses vary with the composition and temper of the material and also, to some degree, with the kind of shape and the direction of stress.

Yield strength is the point of stress (in pounds per square inch) at which material fails to return to its original position after the stress has been removed and takes a permanent set. Minimum yield is defined as the test value exceeded by 99% of a large number of specimens. For non-ferrous metals, the yield point is arbitrarily defined as the point of stress at which permanent set is a specific fraction of 1% of the length of the test piece (0.2% offset as shown below or 0.5% elongation). Ultimate strength is considerably higher (see graph).



TEST DATA

In a typical test of a railing designed to meet allowable stress, permanent deformation will occur at approximately twice the design load, and failure will usually occur at about 2½ times the design load.

Mounting and connecting devices such as brackets and facia flanges have been tested to determine that they will sustain the load to which they may be subjected by the members they are designed to support.

For example, wall bracket No. 384 was tested in pairs, spaced 7" on centers. Designed for a load of 200 lbs., it was found that – whether the load is applied at 90° or 180° to the wall – no permanent set was recorded until the applied load exceeded 800 lbs. The failure load for this bracket pair averaged 985 lbs. which is 2.46 times the design load. In tests of other brackets, the majority did not fail at all and loading was terminated at a common point. Copies of test reports are available upon request.

ELEMENTS OF SECTIONS

The section properties of handrail mouldings, posts, handrail support sections, and post reinforcing inserts are listed on page 117. Section properties for other shapes, bars and tubing are shown on pages 95 to 112.

GENERAL NOTE: *The engineering data supplied apply to straight run railing with uniform post spacing. For installations where a railing is braced laterally by changes in direction or attachment to other structures, bending moments may be reduced significantly. However, since the variety of possible installation conditions is virtually limitless, only the basic, statically determinate condition is considered here. Its application provides conservative design values for all situations.*

LOAD DISTRIBUTION

The graph below is used to determine railing load distribution. It has been determined by computer analysis and confirmed by laboratory test. The formula used in determining the graph assumes that all posts are of identical material and section.

The *Stiffness* (k) of a rail or post is:

$$k_r = \frac{E \times I}{L} \quad \text{for the rail}$$

$$k_p = \frac{E \times I}{h} \quad \text{for the post}$$

(see page 116 for definition of symbols)

The *Stiffness Ratio* (R) is determined as:

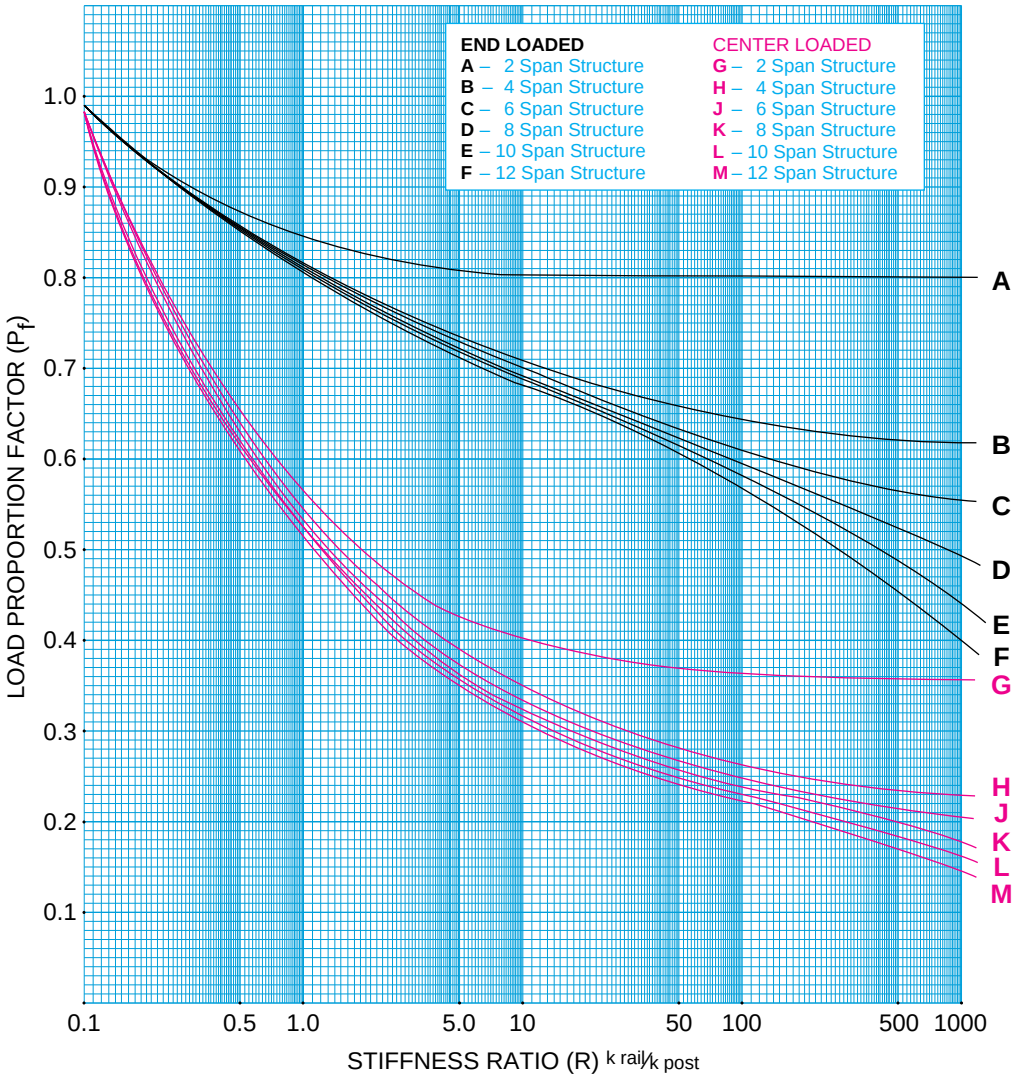
$$R = \frac{k_r}{k_p}$$

The Stiffness Ratio is then plotted on the graph to obtain a *Load Proportion Factor* (P_f). When the load proportion factor has been determined, it is multiplied by the total load to determine the load one post must sustain.

If one or both ends of the railing are free standing, the *end loaded* condition must be assumed. If both ends of the run are laterally braced by a change in direction or attachment to a firm structure, the *center loaded* load proportion factor may be used.

Note: If end posts differ from intermediate posts in strength, the load distribution pattern becomes indeterminate and end posts should then be designed to carry 100% of the concentrated load. Intermediate posts may then be designed to the center loaded condition.

In single span railings, each post must be designed to carry the full concentrated load.



When posts and rails are of identical material and section (as in pipe railing), and post spacing varies between 3 and 6 feet while post height is between 30 and 42 inches, load distribution is fairly uniform. In this situation, the greatest proportion of a concentrated load carried by any post can be estimated as follows:

End posts:

2 span railing	$P_f = 0.85$
3 or more spans	$P_f = 0.82$

Intermediate posts:

2 span railing	$P_f = 0.65$
3 or more spans	$P_f = 0.60$

Thus, if a 200 lb concentrated load is specified for a pipe railing, actual design load to be applied at the top of the end post is .82 × 200 lb (164 lb) while design load to be applied to intermediate posts is .60 × 200 lb (120 lb).

If railing posts are reinforced, the load proportion factor for posts is about 3 percentage points higher.

MECHANICAL PROPERTIES OF RAILING MATERIALS

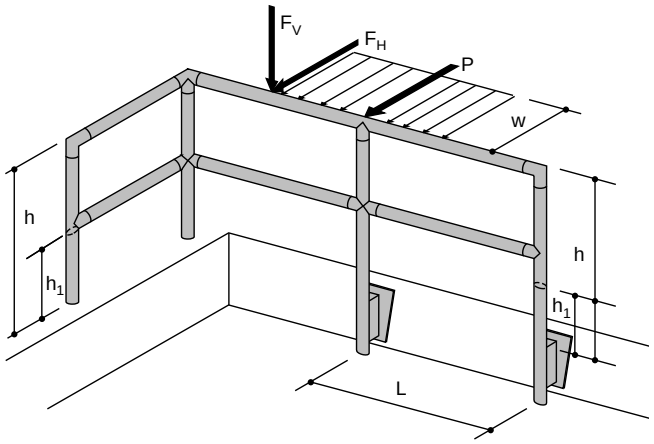
Below is a table of metals used in the architectural components described in this catalog, together with their yields, allowable stresses and moduli of elasticity. These mechanical properties have been established by producers of the various materials.

Material	Allowable Bending Stress for Design: Bars, Shapes Minor Axis psi	Allowable Bending Stress for Design: Rect. Tubes, Struct. Shapes Major Axis psi	Allowable Bending Stress for Design: Round and oval tubes psi	Expected Minimum Yield psi	Modulus of Elasticity psi × 10^6
Aluminum 6061-T6*	27,700	19,500	24,200	35,000	10.0
Aluminum 6063-T6*	19,700	15,200	17,700	25,000	10.0
Aluminum 6063-T52*	12,600	9,700	11,300	16,000	10.0
Aluminum 6063-T832*			24,800	35,000	10.0
Bronze C38500†, extruded ASTM B455	9,700	9,700		16,000	14.0
Bronze C38500††, handrail moulding and tubing	14,500		14,500	24,000	14.0
Bronze C38500††, rectangular tubing, bars and shapes	21,200	21,200		35,000	14.0
Red Brass C23000†, drawn pipe ASTM B43			11,000	18,000	17.0
Nickel-Silver C79800, extruded	24,000			40,000	18.0
Stainless Steel type 304, extruded, ASTM A276	18,000	18,000		30,000	28.0
Stainless Steel type 304, hot rolled, ASTM A276	18,000	18,000		30,000	28.0
Stainless Steel type 304, cold formed	15,100	15,100		28,000	28.0
Stainless Steel• type 304, round tubing (as welded)			30,000	55,000	28.0
Carbon Steel•• C1010, roll formed ASTM A29	16,800	16,800		28,000	29.0
Carbon Steel C1010, hot rolled ASTM A29	16,800	16,800		28,000	29.0
Carbon Steel struct. tubing, ASTM A500, grade B		27,700		42,000	29.0
Acrylic/Wood	3,750			4,975	1.8

Test values indicate minimum yields as noted. Allowable stress for design is based on a safety factor of 1.65.

* Aluminum Association: *Specifications for Aluminum Structures*.
† Bronze and Brass products do not have ASTM specifications for all product lines and production methods.
†† Obtained from lab tests of sample material.
• American Iron & Steel Institute: *Stainless Steel Cold-Formed Structural Design Manual*.
•• American Iron & Steel Institute: *Specifications for the Design of Cold-Formed Steel Structural Members*.

LOADING DIAGRAM

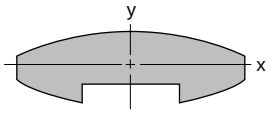


EXPLANATION OF SYMBOLS

w* = Uniform horizontal loading, perpendicular to the rail (lb/ft).
L = Span between centerlines of posts or brackets (in).
P = Horizontal force, perpendicular to rail applied at top of post (lb).
F_H = Horizontal force, perpendicular to rail at any point along the railing (lb).
F_V = Vertical force, perpendicular to rail at any point between posts (lb).
h = Height of post. Distance from point of load application above top of attachment (in).
h_1 = Distance from top of post attachment to top of reinforcing insert (in).
M = Bending moment (in-lb).
f = Unit stress (psi).
f_s = Allowable fiber stress for design (psi).
S_x & S_y = Section modulus about the x- or y-axis respectively (in^3).
I_x & I_y = Moment of inertia about the x- or y-axis respectively (in^4).
k = Stiffness of member.
K = Bending moment constant.
c = Distance from the neutral axis to the extreme fiber of any section (in).
E = Modulus of elasticity (psi × 10^6).
Δ = Deflection (in).
R = Stiffness ratio.
P_f = Load proportion factor.
F_r = Reaction force (psi).

* Values for w (uniform load in lb/ft) are converted to lb/in by dividing by 12.

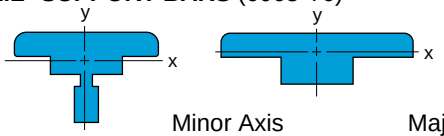
HANDRAILS



Shape	Area	Minor Axis I_x	Minor Axis S_x	Minor Axis C_x	Major Axis I_y	Major Axis S_y	Major Axis C_y
4488†	0.284	0.011	0.046	0.250	0.107	0.107	1.000
6501	1.054	0.017	0.067	0.256	0.629	0.457	1.375
6502	0.740	0.008	0.033	0.235	0.314	0.280	1.125
6503	0.739	0.143	0.042	0.341	0.126	0.168	0.750
6511†	0.386	0.006	0.031	0.238	0.189	0.137	1.375
6512†	0.291	0.008	0.034	0.236	0.136	0.121	1.125
4416	0.927	0.021	0.073	0.291	0.232	0.231	1.000
4428	0.569	0.017	0.041	0.416	0.209	0.215	0.969
4429	0.403	0.008	0.022	0.375	0.104	0.119	0.875
4435	0.746	0.018	0.044	0.406	0.349	0.328	1.062
4441	0.594	0.024	0.055	0.432	0.291	0.258	1.125
4529	0.684	0.059	0.100	0.586	0.616	0.429	1.438
4530	0.779	0.023	0.052	0.449	0.300	0.267	1.125
4531	0.527	0.011	0.030	0.358	0.108	0.133	0.813
4532	0.557	0.018	0.042	0.425	0.260	0.231	1.125
4534	0.669	0.017	0.040	0.427	0.208	0.214	0.969
4535	0.799	0.024	0.052	0.454	0.344	0.323	1.063
4536	0.434	0.017	0.040	0.423	0.171	0.176	0.969
4537	0.359	0.010	0.028	0.346	0.095	0.116	0.813
4538	0.806	0.194	0.202	0.958	0.661	0.481	1.375
4539	0.670	0.013	0.035	0.369	0.175	0.200	0.875
4572	0.701	0.008	0.032	0.239	0.299	0.266	1.125
4573	1.054	0.016	0.059	0.268	0.654	0.476	1.375
4574	0.919	0.020	0.053	0.376	0.654	0.476	1.375
4575	0.645	0.014	0.033	0.437	0.232	0.232	1.000
6488†	0.426	0.011	0.044	0.250	0.152	0.152	1.000
6489†	0.440	0.108	0.144	1.250	0.108	0.144	1.250
5235	0.799	0.024	0.052	0.454	0.344	0.323	1.063
5274	0.919	0.020	0.053	0.376	0.654	0.476	1.375
5288†	0.426	0.011	0.044	0.250	0.152	0.152	1.000
6402	1.250	0.083	0.098	0.845	0.412	0.347	1.188
6404	1.250	0.066	0.082	0.795	0.573	0.416	1.375
6405	1.330	0.097	0.110	0.882	0.263	0.263	1.000
6407	1.680	0.088	0.104	0.844	1.311	0.807	1.625
6436	0.741	0.159	0.268	0.594	0.422	0.386	1.094
6437	0.879	0.210	0.336	0.625	0.799	0.532	1.500
6530	0.810	0.032	0.082	0.395	0.315	0.315	1.000
6531	0.573	0.023	0.056	0.411	0.132	0.175	0.750
6532	1.090	0.039	0.084	0.465	0.616	0.493	1.250
6540	0.628	0.312	0.284	1.099	0.034	0.068	0.500
6901	1.387	0.042	0.106	0.396	0.709	0.540	1.313
6902	1.227	0.034	0.084	0.409	0.520	0.438	1.188
6903	0.361	0.013	0.029	0.448	0.109	0.125	0.875
6904	0.726	0.072	0.118	0.612	0.519	0.377	1.375
6905	1.414	0.026	0.089	0.297	1.167	0.718	1.625
6906	2.051	0.058	0.161	0.358	2.195	1.171	1.845
6907	1.441	0.031	0.077	0.402	1.263	0.777	1.625
6929	0.557	0.018	0.042	0.425	0.260	0.231	1.125
6930	0.779	0.023	0.052	0.449	0.300	0.267	1.125
6931	0.527	0.011	0.030	0.358	0.108	0.133	0.813
6932	0.684	0.059	0.100	0.586	0.616	0.429	1.438
6933	0.670	0.013	0.035	0.369	0.175	0.200	0.875
6934	0.669	0.017	0.040	0.427	0.208	0.214	0.969
6935	0.843	0.024	0.053	0.451	0.343	0.323	1.065
6939	1.845	0.085	0.225	0.375	0.932	0.746	1.250
6984	1.079	0.021	0.056	0.367	0.676	0.492	1.375
6985	0.805	0.017	0.040	0.413	0.254	0.254	1.000
6986	2.237	0.104	0.277	0.375	1.658	1.106	1.500
6987	0.746	0.056	0.084	0.662	0.648	0.471	1.375
6988†	0.946	0.019	0.075	0.250	0.285	0.285	1.000

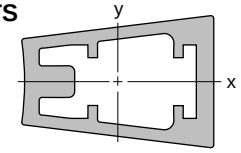
† = Tubing

COLORAIL® SUPPORT BARS (6063-T6)



Shape	Area	Minor Axis I_x	Minor Axis S_x	Minor Axis C_x	Major Axis I_y	Major Axis S_y	Major Axis C_y
6440	0.558	0.032	0.050	0.641	0.046	0.074	0.625
6441	0.621	0.034	0.052	0.658	0.076	0.101	0.750
6442	0.746	0.037	0.055	0.684	0.170	0.170	1.000
6443	0.686	0.041	0.060	0.684	0.169	0.169	1.000
6444	0.571	0.125	0.409	0 306	0.073	0.098	0.750
6445	0.696	0.151	0.469	0.322	0.164	0.164	1.000
6447	0.509	0.012	0.039	0.293	0.046	0.073	0.625

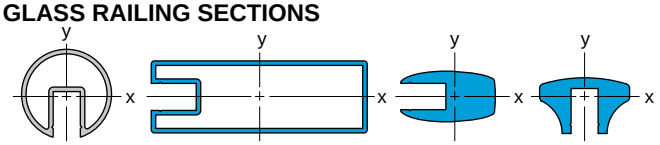
CARLSTADT® POSTS



Shape	Area	Minor Axis I_x	Minor Axis S_x	Minor Axis C_x	Major Axis I_y	Major Axis S_y	Major Axis C_y
230†	0.308	0.050	0.100	0.500	0.095	0.126	0.750
233B(294)★**	1.021	0.052	0.133	0.390	0.146	0.223	0.655
283(295)★**	1.412	0.072	0.184	0.390	0.385	0.426	0.905
280†	0.373	0.064	0.128	0.500	0.193	0.193	1.000
436E★	0.655	0.029	0.078	0.370	0.087	0.140	0.622
4830(830)	0.726	0.096	0.192	0.500	0.241	0.297	0.813
6423(423)	1.555	0.201	0.321	0.625	0.201	0.321	0.625
6424(424)	3.430	0.445	0.712	0.625	2.153	1.566	1.375
6427(427)	1.926	0.208	0.303	0.687	0.496	0.409	0.789
6430(430)†	0.726	0.096	0.192	0.500	0.241	0.297	0.813
6434†	0.930	0.237	0.379	0.625	0.851	0.619	1.375
6435★	0.871	0.210	0.337	0.625	0.710	0.516	1.375
6458(458)★	1.110	0.177	0.258	0.687	0.529	0.508	1.042
6459(459)★	1.030	0.201	0.322	0.687	0.708	0.679	1.041
8571/72*	1.563	0.135	0.154	0.875	1.487	0.820	1.813

* data for aluminum spine only (6063-T6) † = Tubing ★ = T6 temper
** aluminum, for use with stainless steel posts

GLASS RAILING SECTIONS



Railing Number	Area	Minor Axis I_x	Minor Axis S_x	Minor Axis C_x	Major Axis I_y	Major Axis S_y	Major Axis C_y
1130	0.874	0.227	0.236	0.962	0.295	0.311	0.950
1132/1232	1.245	0.632	0.500	1.263	0.717	0.574	1.250
1133	2.414	0.416	0.583	0.714	0.970	0.619	1.566
1134	1.980	0.296	0.300	0.988	1.022	0.817	1.250
1135	1.632	1.910	1.030	1.855	1.947	1.113	1.750
1136	2.250	1.488	1.488	1.000	9.196	2.821	3.260
1137	1.427	1.206	0.755	1.598	1.230	0.820	1.500
1154	1.442	1.105	0.721	1.532	1.268	0.845	1.500
1155	1.638	1.875	1.024	1.831	1.989	1.136	1.750
1430	0.501	0.142	0.154	0.927	0.183	0.192	0.950
1432/1452	0.643	0.358	0.280	1.280	0.395	0.316	1.250
1433/1453	0.712	0.630	0.386	1.632	0.643	0.429	1.500
1230	0.766	0.202	0.223	0.907	0.278	0.292	0.950
1231Q	0.980	0.518	0.409	1.177	0.585	0.468	1.250
1233/1333	1.442	1.160	0.743	1.568	1.229	0.819	1.500
1235	2.360	2.704	1.471	1.838	2.772	1.584	1.750
1330	0.840	0.236	0.262	0.901	0.324	0.340	0.950
1332	1.245	0.632	0.500	1.263	0.717	0.574	1.250
8632	3.971	1.422	1.072	1.326	1.872	1.498	1.250
8662	11.062	3.954	3.954	1.000	30.152	9.420	3.201
1141	4.353	6.068	4.106	1.478	2.314	1.851	1.250
1142	6.828	10.206	5.449	1.873	5.121	4.097	1.250
1143	7.199	12.497	6.598	1.894	6.735	4.898	1.375

Unless designated as T6 temper, all aluminum alloy is in the T52 temper.
The values of these elements of sections are approximate and – while they have been ascertained with care – they cannot be guaranteed.
See p. 122 for properties of **Connectorail®** pipe and reinforcing bars.

BENDING MOMENTS AND STRESSES

Determination of bending moments and stress in structural railing members follows conventional engineering design procedures. The resisting moment – calculated from the *Section Modulus* (S, which equals I/C) and *Allowable Design Stress* (f_s) – must equal the *Applied Bending Moment* (M).

$$\frac{I}{C} \times f_s = S \times f_s = M$$

This translates into railing formulas as described below.

RAILS: Connections between posts and rails are assumed to be free to pivot. Distribution of loads through multiple spans decreases maximum bending moment in horizontal members. The effect of different numbers of spans may be taken into account by varying the *Bending Moment Constant* (K). Calculation of *Unit Stress* (f) and *Length of Span* (L) are accomplished by using the following formulas:

1. For uniform vertical or horizontal loads (w):

$$M = \frac{w/12 \times L^2}{K} \qquad M = S \times f$$

$$f = \frac{w/12 \times L^2}{S \times K}$$

$$L = \sqrt{\frac{f \times K \times S}{w/12}}$$

K = 8 for one or two spans
K = 9.5 for three or more spans of a continuous rail

2. For concentrated loads (F) applied at mid span:

$$M = \frac{F \times L}{K} \qquad M = S \times f$$

$$f = \frac{F \times L}{S \times K}$$

$$L = \frac{S \times K \times f}{F}$$

K = 4 for one span
K = 5 for two or more spans of a continuous rail

Note: Values of K are defined based on the maximum bending moment developed under various numbers of spans.

POSTS: Posts act as vertical cantilever beams in resisting horizontal thrust applied at the top rail. Bending moment produced by horizontal thrust normally controls design and post spacing may be calculated using the following equations.

1. For uniform horizontal loading (w):

$$M = P \times h \qquad P = w/12 \times L \qquad M = S \times f$$

$$f = \frac{w/12 \times L \times h}{S}$$

$$L = \frac{S \times f}{w/12 \times h}$$

2. For concentrated horizontal loading (F_h):
When concentrated loading is specified, the horizontal load on the top rail is distributed among several posts adjacent to the point of loading. The load distribution is a function of the relative stiffness of post and top rail and of the number of spans in the railing. For a straight run of railing it may be calculated with the aid of the graph on page 115. This calculation will show what proportion (P_f) of the total load any one post may have to sustain. To the extent that it is less than 100%, it will justify the use of lighter and more economical construction. The following equation applies:

$$M = P \times h \qquad P = F_h \times P_f$$

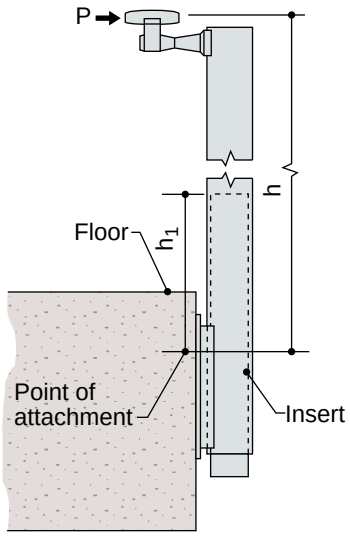
$$f = \frac{F_h \times h \times P_f}{S}$$

INTERNALLY REINFORCED POSTS

The load-carrying capacity of a post with reinforcing insert is limited by the allowable fibre stress at one of three points.

1. The post at the top of the insert, above which it is not reinforced.
2. The insert at its base, at the highest point of its attachment to the supporting structure.
3. The post at the same point of attachment.

The lowest of these three loading limits controls design for the combined post and reinforcing insert.



A. Post at top of insert:

Moment in post (top of insert): $M = P \times (h - h_1)$

Fibre stress in post (top of insert):

$$f = \frac{M}{S} = \frac{P \times (h - h_1)}{S}$$

Loading limit: $P = \frac{f_s \times S}{h - h_1}$

At the point of contact between the railing post and the reinforcing insert, the deflection of each is assumed to be the same but the resisting force of each is a function of its *Moment of Inertia* (I) and *Modulus of Elasticity* (E). The resultant combined *Reaction Force* (F_r) at the top of the insert is determined as follows:

$$F_r = \left(\frac{h}{2 \times h_1} - 0.167\right) \div \left(\frac{E_p \times I_p}{3 \times E_r \times I_r} + 0.333\right)$$

E_r and I_r refer to the reinforcing insert

E_p and I_p refer to the post

The loading limits for points 2 and 3 are then determined as follows:

B. Insert at base:

Moment in insert: $M = P \times (h - h_1)$

Fibre stress in insert:

$$f = \frac{M}{S_r} = \frac{P \times F_r \times h_1}{S_r}$$

Loading limit: $P = \frac{f_s \times S_r}{F_r \times h_1}$

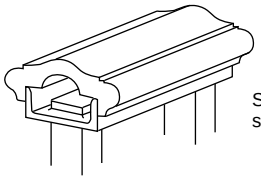
C. Post at base:
Moment in post: $M = P \times \left[h - (F_r \times h_1)\right]$

Fibre stress in post: $f = \frac{M}{S_p} = \frac{P \times \left[h - (F_r \times h_1)\right]}{S_p}$

Loading limit: $P = \frac{f_s \times S_p}{h - (F_r \times h_1)}$

COMBINED HANDRAIL SECTIONS

When two sections of the same metal are combined by being fastened together to form a handrail (e.g. a steel moulding mounted on a steel channel), the sections develop the same deflection under load but act independently about their respective neutral axes.



Steel handrail with steel channel

I_a and I_b are the moments of inertia of the two sections. Since the *Section Modulus* (S) equals I/C, the combined value for S of the two sections would be:

$S = \frac{I_a + I_b}{C_{max}}$ (C_{max} is either C_a or C_b, whichever is greater)

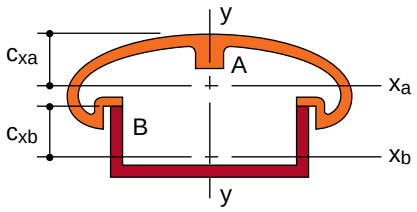
In the railing formulas, substitute the above equation for the value of S whenever combined sections of the same material are used.

COMBINED SECTIONS OF DISSIMILAR MATERIALS

To compute the loading of combined sections of dissimilar materials (e.g. a bronze handrail mounted on a steel channel) calculations involve the determination of the relative portion of the load carried by each section. The load distribution is a function of the relative stiffness of the two sections, which is determined by the *Moments of Inertia* (I) and their *Moduli of Elasticity* (E). The distribution of the total load between two sections is determined as follows:

Load Carried by A $= \frac{\text{Total Load}}{1 + \frac{E_b \times I_b}{E_a \times I_a}}$

Load Carried by B = Total Load – Total Load Carried by A



Individual calculation to determine the fibre stress for each material, using the load portion of each section, will then determine which section controls design; namely, the section giving the lesser result (see example 6 on page 121).

DEFLECTION CONSIDERATIONS

Excessive deflection of a railing under load, even though it meets strength requirements, will give the user a feeling of insecurity and may cause tripping or stumbling.

Lateral deflection of posts or vertical deflection of horizontal rails under load are computed as follows – **these formulas must be used with caution:**

For posts without reinforcing insert:

$\Delta = \frac{P \times h^3}{3 \times E \times I}$ or $\frac{w/12 \times L \times h^3}{3 \times E \times I}$

For posts with reinforcing insert of similar or dissimilar material:

$\Delta = \frac{P \times (h - h_1)^3}{3 \times E_p \times I_p} + \frac{P \times \left[h^3 - (h - h_1)^3\right]}{3 \times \left[(E_p \times I_p) + (E_r \times I_r)\right]}$

Where E_p and I_p apply to post

E_r and I_r apply to reinforcing insert

For rails (concentrated load, F):

$\Delta = \frac{F \times L^3}{K \times E \times I}$

where K = 48 for simple span
66 for two or more spans, load on end span
87 for three or more spans, load on intermediate span

For rails (uniform load, w):

$\Delta = \frac{5 \times w/12 \times L^4}{384 \times E \times I}$ for simple spans

$\Delta = \frac{w/12 \times L^4}{145 \times E \times I}$ for two or more spans

There are few, if any, regulations or code requirements limiting deflection in a railing but ASTM has put forth the following criteria regarding *Maximum Allowable Deflection* (Δ_{max}) in their specification E985.

For horizontal load at midspan:

$\Delta_{max} = h/24 + L/96$

For horizontal load at top of post:

$\Delta_{max} = h/12$

For vertical load at midspan:

$\Delta_{max} = L/96$

In many instances, the anchorage of the railing to the floor, tread or facia is subject to a degree of rotation which will add an indeterminate amount to the deflection on the post and rail. **Anchorage and supporting structure must be as secure and rigid as possible.**

EXAMPLE PROBLEMS AND SOLUTIONS

These sample problems demonstrate how engineering data provided by **Julius Blum & Co**., Inc. can be used to obtain solutions to practical handrail design problems. Problems are solved by equating the maximum bending moment resulting from applied loading to the resisting moment determined from geometrical section properties and allowable stress. This method can be used to obtain solutions for most installation and loading conditions.

EXAMPLE 1:
DETERMINE MAXIMUM POST SPACING
REQUIREMENTS:

Uniform load, w = 50 lb/ft
Railing height, h = 38 in

MATERIAL SPECIFIED:

Post: #**423** aluminum, 6063-T52
allowable stress, f_s = 12,600 psi (refer to page 116);
section modulus, S = .321 in^3 (refer to page 117).

DETERMINE:

Maximum post spacing (simple span), L (in)

Resisting bending moment, $M_{(resisting)} = f_s \times S$
Applied bending moment, $M_{(applied)} = w/12 \times L \times h$
$M_{(resisting)}$ must equal $M_{(applied)}$

$$f_s \times S = w/12 \times L \times h$$

$$L = \frac{f_s \times S}{w/12 \times h}$$

$$L = \frac{12{,}600 \times .321}{50/12 \times 38}$$

$$L = 25.60 \text{ in}$$

EXAMPLE 2:
DETERMINE REQUIRED SECTION MODULUS OF POST
REQUIREMENTS:

Concentrated load, F = 200 lb
Railing height, h = 42 in

MATERIAL SPECIFIED:

Post: Steel tubing
allowable stress, f_s = 16,800 psi (refer to page 116).

DETERMINE:

Section modulus, S, and select a suitable section

Resisting bending moment, $M_{(resisting)} = f_s \times S$
Applied bending moment, $M_{(applied)} = F \times h$
$M_{(resisting)}$ must equal $M_{(applied)}$

$$f_s \times S = F \times h$$

$$S = \frac{F \times h}{f_s}$$

$$S = \frac{200 \times 42}{16{,}800}$$

$$S = 0.500 \text{ in}^3$$

By referring to the section moduli for square steel tubing shown on page 110, it is determined that a tubing of at least 2"× 2" × .120" (S = .534) would be required. Required section modulus may be reduced by considering load distribution and reducing the value of F accordingly.

EXAMPLE 3:
DETERMINE MAXIMUM SPAN FOR HANDRAIL MOULDINGS, CONCENTRATED LOAD
REQUIREMENTS:

Concentrated load, F = 200 lb

MATERIAL SPECIFIED:

Handrail moulding: #**6489**, 1½" O.D. bronze tubing
f_s = 14,500 psi; S_x = .144 in^3

The railing will be installed with more than two consecutive spans, therefore the *Bending Moment Constant,* K = 5 (refer to page 118).

DETERMINE:

Maximum span for handrail moulding, L (in)

Resisting bending moment, $M_{(resisting)} = f_s \times S$

Applied bending moment, $M_{(applied)} = \frac{F \times L}{K}$

$M_{(resisting)}$ must equal $M_{(applied)}$

$$f_s \times S = \frac{F \times L}{K}$$

$$L = \frac{f_s \times S \times K}{F}$$

$$L = \frac{14{,}500 \times .144 \times 5.0}{200} = 52.2 \text{ in}$$

EXAMPLE 4:
DETERMINE MAXIMUM SPAN FOR A COMBINED HANDRAIL SECTION USING SECTIONS OF THE SAME METAL
REQUIREMENTS:

Concentrated load, F = 200 lb

MATERIALS SPECIFIED:

Handrail moulding: #**6932**, aluminum, 6063-T52
f_s = 12,600 psi; I_{xa} = .059 in^4; C_{xa} = .586 in
Support channel: 2" × ½" × ⅛" aluminum channel
f_s = 12,600 psi; I_{xb} = .006 in^4; C_{xb} = .369 in
C_{max} = .586 in (greater of C_{xa} vs. C_{xb})

The railing will be installed with more than two consecutive spans, therefore the *Bending Moment Constant,* K = 5 (refer to page 118).

DETERMINE:

Maximum span for combined handrail section, L (in)

Resisting bending moment, $M_{(resisting)} = f_s \times \left(\frac{I_{xa} + I_{xb}}{C_{max}}\right)$

Applied bending moment, $M_{(applied)} = \frac{F \times L}{K}$

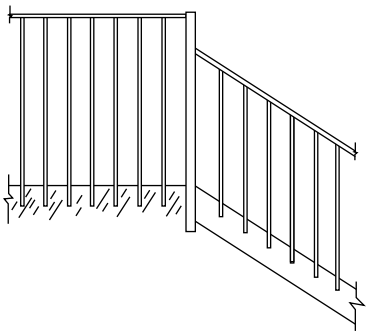
$M_{(resisting)}$ must equal $M_{(applied)}$

$$f_s \times \left(\frac{I_{xa} + I_{xb}}{C_{max}}\right) = \frac{F \times L}{K}$$

$$L = \frac{f_s \times (I_{xa} + I_{xb}) \times K}{F \times C_{max}}$$

$$L = \frac{12{,}600 \times (.059 + .006) \times 5.0}{200 \times .586} = 35 \text{ in}$$

EXAMPLE 5: CONCENTRATED LOAD. LOAD DISTRIBUTION AMONG POSTS



DESCRIPTION:
Railing for an air terminal public area – heavy pedestrian traffic is expected.

REQUIREMENTS:
Loading, F = 300 lb
Railing height = 42" at platforms; 34" at stairs
Post height, h: Posts are facia mounted; top of post attachment is 2" below walking surface. Therefore post height is railing height plus 2".
Maximum opening to be no more than 4"; 12 or more spans between posts.

MATERIALS SPECIFIED:
Handrail moulding: #6901, aluminum 6063-T52
f_s = 9,700 psi; E = 10×10^6; I_y = .709 in^4; S_y = .540 in^3
Intermediate posts: #430, aluminum 6063-T6
f_s = 15,200 psi; E = 10×10^6; I_x = .241 in^4; S_x = .297 in^3
End posts: 2½" × 2½" × 3/16" square aluminum – 6061-T6 – tubing
f_s = 19,500 psi; E = 10×10^6; S = 1.247 in^3

DETERMINE:
Structural compliance of proposed construction

1. **Stress at base of end posts** (end posts are dissimilar from intermediate posts – they have to resist 100% of horizontal load):

$$f = \frac{P \times h}{S} = \frac{300 \times 44}{1.247} = 10{,}585 \text{ psi}$$

(19,500 psi allowable)

2. **Stress at base of intermediate posts at platform** (L= 4 in, h = 44 in):
A. Stiffness ratio:

$$R = \frac{E_r \times I_r}{L} \div \frac{E_p \times I_p}{h} = \frac{.709 \times 44}{4 \times .241} = 32.36$$

B. Load proportion factor (see graph, p. 115) = .230
C. Load per post: 300 × .230 = 69 lb
D. Stress at base of post:

$$f = \frac{P \times H}{S} = \frac{69 \times 44}{.297} = 10{,}222 \text{ psi}$$

(15,200 psi allowable)

3. **Stress at base of intermediate post at stairs** (L= 4 in, h = 36 in):
A. Stiffness ratio:

$$R = \frac{E_r \times I_r}{L} \div \frac{E_p \times I_p}{h} = \frac{.709 \times 36}{4 \times .241} = 26.47$$

B. Load proportion factor (see graph, p. 115) = .238
C. Load per post: 300 × .238 = 73.5 lb
D. Stress at base of post:

$$f = \frac{P \times h}{S} = \frac{73.5 \times 36}{.297} = 8{,}909 \text{ psi}$$

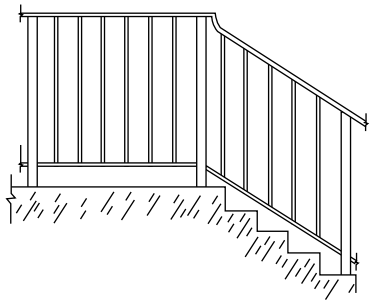
(15,200 psi allowable)

4. **Stress on handrail at mid-span:**

$$f = \frac{F_h \times L}{S \times K} = \frac{300 \times 4}{.540 \times 5} = 444 \text{ psi}$$

(9,700 psi allowable)
Railing meets structural designer's requirements.

EXAMPLE 6: UNIFORMLY DISTRIBUTED LOAD. COMBINED HANDRAIL SECTION OF DISSIMILAR MATERIALS



DESCRIPTION:
Stair railing of steel balusters, mounted between steel channel top and bottom rails, attached to square steel posts, with a bronze handrail.

REQUIREMENTS:
Loading, w = 50 lb/ft, horizontal and vertical
Railing height, h = 34" at stair, 42" at landings
Post spacing, L = 40"; 3 or more spans in each run

MATERIALS SPECIFIED:
Handrail moulding: #4530, bronze 385
f_s = 9,700 psi; I_x = .023 in^4; C_x = .444 in; E = 14×10^6 psi
Posts: 1½" × 1½" × .140" structural steel tubing
f_s = 27,700 psi; S = .316 in^3
Sub-rails: 1½" × ½" × ⅛" steel (C1010) channel – top and bottom: f_s = 16,800 psi; I_x = .005 in^4; C_x = .250 in; E = 29×10^6 psi

DETERMINE:
Structural compliance of proposed construction

1. **Stress at base of post:**

$$\frac{M}{S} = \frac{w/12 \times L \times h}{S}$$

At Stairs: $\dfrac{50 \times 40 \times 34}{12 \times .316} = 17{,}932$ psi

At Landings: $\dfrac{50 \times 40 \times 42}{12 \times .316} = 22{,}152$ psi

(27,700 psi allowable)

2. **Stress on rail:**
Since I_y of both bronze$_{(b)}$ and steel$_{(s)}$ sections is greater than I_x, vertical load controls design.
A. Total load:

$$w/12 \times L = \frac{50 \times 40}{12} = 167 \text{ lb}$$

B.

$$w_b = w \div \left(1 + \frac{E_s \times 2 \times I_{xs}}{E_b \times I_{xb}}\right)$$

$$w_b = 50 \div \left(1 + \frac{29 \times 10^6 \times 2 \times .005}{14 \times 10^6 \times .023}\right) = 26.31 \text{ lb/ft}$$

C. Load per foot on steel, w_s:

$$w_s = w - w_b$$

$$w_s = 50 - 26.31 = 23.69 \text{ lb/ft}$$

D. Stress on bronze, f_{sb}:

$$f_{sb} = \frac{w_b/12 \times L^2 \times C_{max}}{I_{xb} \times K} = \frac{26.31/12 \times 40^2 \times .444}{.023 \times 9.5}$$

$$= 7{,}128 \text{ psi } (9{,}700 \text{ psi allowable})$$

E. Stress on steel, f_{ss}:

$$f_{ss} = \frac{w_b/12 \times L^2 \times C_{max}}{I_{xs} \times K} = \frac{23.69/12 \times 40^2 \times .444}{2 \times .005 \times 9.5}$$

$$= 14{,}763 \text{ psi } (16{,}800 \text{ psi allowable})$$

Design meets code structural requirements.
Note: Resistance to vertical loading of upper and lower steel channels is additive. Therefore the value of I_{xs} is doubled. The additional resistance to vertical load by the truss action of the balusters has not been considered, making the result of the calculation more conservative.

MECHANICAL PROPERTIES

Material	Allowable Stress (psi)	Minimum Yield (psi)	Modulus of Elasticity (psi × 10^6)
Aluminum*			
6061-T6	19,500	35,000	10.0
6063-T52 pipe	11,300	16,000	10.0
6063-T832 pipe	24,800	35,000	10.0
Red Brass C23000	11,000	18,000	17.0
Stainless• Type 304	30,000	55,000	28.0

* Aluminum Association *Specifications for Aluminum Structures*.

• American Iron & Steel Institute *Stainless Steel Cold-Formed Structural Design Manual*.

SECTION PROPERTIES

CONNECTORAIL® PIPE (Aluminum, Bronze, Stainless)

Nominal Size	Sched.	Outside Diameter	Wall	Area	I	S
1¼"	10	1.660"	.109"	.531	.161	.193
1¼"	40	1.660"	.140"	.669	.195	.235
1¼"	40	1.660"	.146"	.695	.201	.242
1½"	5	1.900"	.062"	.375	.158	.166
1½"	10	1.900"	.109"	.614	.247	.260
1½"	40	1.900"	.145"	.800	.310	.326
1½"	40	1.900"	.150"	.825	.318	.335

CONNECTORAIL® REINFORCING BARS (6061-T6)

No.	Sched.	Nominal Size	Outside Diameter	Area	I	S
7192	10	1¼"	1.427"	1.599	.204	.285
7292/7295	10	1½"	1.667"	2.183	.379	.455
7492	40	1¼"	1.328"	1.452	.168	.247
7592/7595	40	1½"	1.585"	1.973	.310	.391
9392**	5	1½"	1.750"	.615	.205	.239

****Tubing with .120" wall, type 304 Stainless Steel

NOTE ON WELDED PIPE RAILINGS

An important consideration for welded pipe railings is the effect of welding heat on the structural properties of aluminum handrail pipe. For example, extruded pipe of aluminum alloy 6063-T52 has an allowable design stress of 11,300 psi. After welding, the allowable stress must be reduced to 8,000 psi within 1" of the weld. Since maximum bending moment generally occurs at points of support or attachment, the reduced stress will often control design. This consideration does not apply to non-welded **Connectorail®.**

LOADING TABLES

The values tabulated in the following page apply to installations fabricated and erected in accordance with **Connectorail®** specifications and using **Connectorail®** components exclusively. Chart values have been determined by assuming that reinforcing inserts are included with facia mounted railings and with railings set into the floor, except where *no insert* is indicated.

For these tables, various post heights have been selected arbitrarily. Values of maximum post spacing for other post heights can be interpolated easily.

When **Connectorail®** posts are surface mounted on floors, treads or stringers, using a floor flange, the entire bending moment of the post is transferred to the reinforcing insert and the allowable post loading has to be computed accordingly. The allowable load will be determined by the resisting moment of the reinforcing insert alone or the unreinforced post above the insert ($h - h_1$), whichever is less.

CONNECTORAIL® TEST RESULTS

1½" Aluminum and Stainless Steel Pipe – Single Span

	RAIL										POST					
Span (L) or Height (h)	57"		75"		96"		96"		96"		42" w/24" re-bar		42" w/15" re-bar		42" w/26" re-bar	
Schedule	10		40		10		40		5		10		40		5	
Alloy and Temper	6063-T52		6063-T52		6063-T832		6063-T832		Type 304		6063-T832		6063-T832		Type 304	
Load (P)	Deflection	Permanent Set	Deflection	Permanent Set	Deflection	Permanent Set	Deflection	Permanent Set	Deflection	Permanent Set	Deflection	Permanent Set	Deflection	Permanent Set	Deflection	Permanent Set
200 lb	.344"	.000"	.547"	.000"	1.466"	.000"	1.021"	.000"	.867"	.025"	1.389"	.000"	1.724"	.000"	1.006"	.036"
250 lb	.388"	.000"	.669"	.000"	1.818"	.000"	1.317"	.000"	1.120"	.040"	1.659"	.000"	2.122"	.000"	1.160"	.056"
300 lb	.496"	.000"	.845"	.000"	2.214"	.000"	1.594"	.000"	1.395"	.128"	1.926"	.000"	2.537"	.000"	1.369"	.080"
350 lb	.565"	.000"	.998"	.000"	2.483"	.000"	1.882"	.000"	1.728"	.205"	2.206"	.000"	2.849"	.000"	1.633"	.112"
400 lb	.739"	.047"	1.189"	.000"	2.984"	.000"	2.178"	.000"	1.992"	.322"	2.601"	.000"	3.211"	.000"		
450 lb	1.368"	.488"	1.654"	.151"	3.464"	.047"	2.488"	.000"	2.563"	.652"	2.811"	.000"	3.603"	.000"	2.131"	.238"
500 lb			1.990"	.656"	4.510"	.406"	2.775"	.000"	2.972"	.994"	3.122"	.000"	4.278"	.109"	2.270"	.452"
550 lb							3.080"	.000"	4.176"	1.726"	3.484"	.000"	4.868"	.266"		
600 lb							3.424"	.000"	5.591"	2.886"	3.860"	.146"			2.765"	
650 lb							3.754"	.031"			4.267"	.391"				
700 lb							4.213"	.192"							3.880"	
0.2% Specified Permanent set load	430 lb		440 lb		470 lb		700 lb		350 lb		590 lb		490 lb		340 lb	

MAXIMUM ALLOWABLE SPANS – Post Spacing
Based on bending stress in post and insert.
Load: 50 lbs. per foot, applied horizontally at top rail

Post Material / Pipe size	Post height (h)	No insert	15" insert h_1 = 9"	h_1 = 12"	25" insert h_1 = 19"
Aluminum 6063-T832 1¼" Sch. 10	• 30"	38"	55"	64"	85"
	• 34"	34"	46"	52"	73"
	• 38"	30"	40"	44"	61"
	• 42"	27"	35"	38"	50"
	• 46"	25"	31"	34"	43"
Aluminum 6063-T832 1¼" Sch. 40	• 30"	47"	67"	78"	89"
	• 34"	41"	56"	64"	77"
	• 38"	37"	48"	54"	67"
	• 42"	33"	42"	47"	59"
	• 46"	30"	38"	41"	52"
Aluminum 6063-T832 1½" Sch. 10	• 30"	52"	74"	86"	126"
	• 34"	46"	62"	70"	108"
	• 38"	41"	53"	60"	81"
	• 42"	37"	47"	52"	67"
	• 46"	34"	42"	46"	57"
Aluminum 6063-T832 1½" Sch. 40	• 30"	65"	92"	108"	131"
	• 34"	57"	78"	88"	112"
	• 38"	51"	67"	75"	98"
	• 42"	46"	59"	65"	84"
	• 46"	42"	52"	57"	72"
Bronze (Red Brass) C23000 1¼" Sch. 40	• 30"	21"	30"		34"
	• 34"	18"	25"		31"
	• 38"	16"	21"		28"
	• 42"	15"	19"		26"
	• 46"	13"	17"		23"
Bronze (Red Brass) C23000 1½" Sch. 40	• 30"	29"	41"		51"
	• 34"	25"	34"		46"
	• 38"	23"	30"		42"
	• 42"	21"	26"		37"
	• 46"	19"	23"		32"

	Post height (h)	No insert	h_1 = 18"	26" insert h_1 = 20"
Stainless Steel Type 304 1½" Sch. 5	• 30"	40"	83"	85"
	• 34"	35"	71"	73"
	• 38"	32"	62"	64"
	• 42"	29"	50"	54"
	• 46"	26"	43"	46"

MAXIMUM ALLOWABLE SPANS – Handrail
Based on bending stress in rail.
Load: 50 lbs. per foot

	1 or 2 spans	3 or more spans
Aluminum 6063-T52		
1¼" Sch. 10	65"	71"
1¼" Sch. 40	71"	78"
1½" Sch. 10	75"	82"
1½" Sch. 40	84"	92"

If it is desired to use longer rail spans than allowed by the limits above, alloy 6063-T832 pipe should be used. Allowable rail span for 6063-T832 pipe is usually greater than allowable post spacing.

Bronze (Red Brass) C23000		
1¼" Sch. 40	70"	77"
1½" Sch. 40	83"	90"
Stainless Steel Type 304		
1½" Sch. 5	98"	107"

MAXIMUM ALLOWABLE SPANS – Post Spacing
Based on bending stress in post and insert.
Load: 100 lbs. per foot, applied horizontally at top rail

Post Material / Pipe size	Post height (h)	No insert	15" insert h_1 = 9"	h_1 = 12"	25" insert h_1 = 19"
Aluminum 6063-T832 1¼" Sch. 10	• 30"	19"	27"	32"	42"
	• 34"	17"	23"	26"	36"
	• 38"	15"	20"	22"	30"
	• 42"	14"	17"	19"	25"
	• 46"	13"	16"	17"	21"
Aluminum 6063-T832 1¼" Sch. 40	• 30"	23"	33"	39"	45"
	• 34"	21"	28"	32"	38"
	• 38"	18"	24"	27"	33"
	• 42"	17"	21"	23"	30"
	• 46"	15"	19"	21"	26"
Aluminum 6063-T832 1½" Sch. 10	• 30"	26"	37"	43"	63"
	• 34"	23"	31"	35"	54"
	• 38"	20"	27"	30"	41"
	• 42"	18"	23"	26"	34"
	• 46"	17"	21"	23"	29"
Aluminum 6063-T832 1½" Sch. 40	• 30"	32"	46"	54"	66"
	• 34"	29"	39"	44"	56"
	• 38"	26"	33"	37"	48"
	• 42"	23"	29"	32"	42"
	• 46"	21"	26"	29"	36"
Bronze (Red Brass) C23000 1¼" Sch. 40	• 30"	10"	15"		17"
	• 34"	9"	12"		15"
	• 38"	8"	11"		14"
	• 42"	7"	9"		13"
	• 46"	7"	8"		11"
Bronze (Red Brass) C23000 1½" Sch. 40	• 30"	14"	21"		26"
	• 34"	13"	17"		23"
	• 38"	11"	15"		21"
	• 42"	10"	13"		19"
	• 46"	9"	12"		16"

	Post height (h)	No insert	h_1 = 18"	26" insert h_1 = 20"
Stainless Steel Type 304 1½" Sch. 5	• 30"	20"	41"	43"
	• 34"	18"	36"	36"
	• 38"	16"	31"	32"
	• 42"	14"	25"	27"
	• 46"	13"	21"	23"

MAXIMUM ALLOWABLE SPANS – Handrail
Based on bending stress in rail.
Load: 100 lbs. per foot

	1 or 2 spans	3 or more spans
Aluminum 6063-T52		
1¼" Sch. 10	46"	50"
1¼" Sch. 40	50"	55"
1½" Sch. 10	53"	58"
1½" Sch. 40	59"	65"

If it is desired to use longer rail spans than allowed by the limits above, alloy 6063-T832 pipe should be used. Allowable rail span for 6063-T832 pipe is usually greater than allowable post spacing.

Bronze (Red Brass) C23000		
1¼" Sch. 40	50"	54"
1½" Sch. 40	59"	64"
Stainless Steel Type 304		
1½" Sch. 5	69"	75"

GUIDE SPECIFICATIONS: These guide specifications are intended to be used as the basis for developing job specifications and must be edited to fit specific job requirements. Inapplicable provisions should be deleted, appropriate information should be provided in the blank spaces, and provisions applicable to the job should be added as necessary. Items which represent an option or choice are enclosed in brackets. Notes to specifiers are given in italics directly following the paragraphs to which they apply.

[SECTION 05521—CONNECTORAIL® NON-WELDED PIPE]
[SECTION 05720—(CARLSTADT®) (COLORAIL®) (JB® GLASS)]
[SECTION 06430—ACRYLIC/WOOD] HANDRAILS AND RAILINGS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Furnish and install [aluminum] [bronze] [stainless steel] [poly vinyl chloride] [acrylic/wood] [pipe] railings and components.

1.02 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish [anchors] [fabrications] to be cast in concrete to Section [03001 – Concrete] [03300 – Cast-in-Place Concrete].
B Furnish [anchors] [fabrications] for embedding in masonry to Section [04300 - Masonry Unit System] [_____].
C. Furnish anchors for placement in [_____] walls to Section [_____–_____].

1.03 RELATED WORK

A. Section 03001 - Concrete: _____
B. Section 03300 - Cast-in-Place Concrete: _____
C. Section 04300 - Unit Masonry Systems: Grout
D. Section 05030 - Metal Finishes: _____
E. Section 05510 - Metal Stairs: Handrailing at Stairs
F. Section 06100 - Rough Carpentry: _____
G. Section 08800 - Glazing: Glass; Plastic Glazing; Glazing Accessories
H. Section 09900 - Painting: Paint Finish

1.04 REFERENCES

Include only reference standards that are to be indicated within the text of this section. Edit the following, adding and deleting as required for project and product selection.

A. Aluminum Association (AA)
   1. ABH-21 Aluminum Brazing Handbook
   2. ASD-1 Aluminum Standards and Data
   3. DAF-45 Designation System for Aluminum Finishes
   4. SAA-46 Standards for Anodized Architectural Aluminum
B. American Architectural Manufacturers Association (AAMA)
   1. AAMA 605.1 Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
   2. AAMA 606.1 Voluntary Guide Specifications and Inspection Methods of Integral Color Anodic Finishes for Architectural Aluminum.
   3. AAMA 607.1 Voluntary Guide Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
   4. AAMA 608.1 Voluntary Guide Specifications and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
C. American Concrete Institute (ACI)
   1. ACI 347-78 Recommended Practice for Concrete Formwork
D. American Iron and Steel Institute (AISI)
   1. Steel Products Manual; Stainless and Heat Resisting Steel.
E. American National Standards Institute (ANSI)
   1. A21.1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.
   2. A58.1 Minimum Design Loads in Buildings and Other Structures.
   3. A117.1 Accessible and Usable Buildings and Facilities.
   4. Z97.1 Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.
F. American Society for Testing and Materials (ASTM)
   1. A 29 Specification for Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for.
   2. A 47 Specification for Ferritic Malleable Iron Castings.
   3. A 269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   4. A 276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
   5. A 312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
   6. A 500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   7. A 512 Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing.
   8. A 743 Specification for Corrosion-Resistant Iron Chromium, Iron Chromium-Nickel, and Nickel Base Alloy Castings for General Application.
   9. B 26 Specification for Aluminum-Alloy Sand Castings.
   10. B 43 Specification for Standard Sizes of Seamless Red Brass Pipe.
   11. B 221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.
   12. B 429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
   13. B 455 Specification for Copper-Zinc-Lead Alloy (Leaded Brass) Extruded Shapes.
   14. B 483 Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
   15. B 584 Specification for Copper Alloy Sand Castings for General Applications.
   16. C 509 Specification for Cellular Elastometric Pre-Formed Gasket and Sealing Material.
   17. C 595 Specification for Blended Hydraulic Cements.
   18. C 1048 Standard Specification for Heat Treated Glass – Kind HS, Kind FT – Coated and Uncoated.
   19. D 635 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   20. D 1730 Recommended Practices for Preparation of Aluminum and Aluminum Alloy Surfaces for Painting.
   21. D 1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
   22. E 84 Test Method for Surface Burning Characteristics of Building Materials.
   23. E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
   24. E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
   25. E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings.
G. Copper Development Association (CDA)
   1. Standards Handbook, Wrought Copper and Copper Alloy Mill Products, Part 2 - Alloy Data.
   2. Standards Handbook, Cast Copper and Copper Alloy Products, Part 7 - Alloy Data.
   3. Copper, Brass and Bronze Design Handbook for Architectural Applications.
H. General Service Administration (GSA), Federal Specifications (FS)
   1. DD-G 1403 Glass, Plate (Float), Sheet, Figured, and Spandrel (Heat Strengthened and Fully Tempered).
   2. QQ-C-390 Copper Alloy Castings.
   3. QQ-S-766 Stainless Steel, Class 302 or 304.
   4. TT-P-645 Primer, Paint, Zinc Chromate, Alkyd Type.
I. Military Specifications (MIL)
   1. MIL-A-46104 Aluminum Alloy Extruded Rod, Bar, and Shapes, 7001.
   2. MIL-P-1144 Pipe, Corrosion Resistant, Stainless Steel, Seamless or Welded.
   3. MIL-P-25995 Pipe, Aluminum Alloy, Drawn or Extruded.
   4. MIL-R-36516 Rail, Restraint.
J. National Association of Architectural Metal Manufacturers (NAAMM)
   1. Metal Finishes Manual
   2. Pipe Railing Manual
   3. Stair Manual
K. National Fire Protection Association (NFPA)
   1. 101 Life Safety Code

L. National Ornamental and Miscellaneous Metals Association (NOMMA)
   1. Metal Rail Manual
M. National Institute of Building Sciences
   1. Metric Guide for Federal Construction

1.05 STRUCTURAL REQUIREMENTS

Check governing codes for requirements.

A. [Handrail and wall rail] [Guardrail] assemblies and attachments shall withstand a minimum concentrated load of _____ pounds applied horizontally or vertically down at any point on the top rail.

– OR –

A. [Handrail and wall rail] [Guardrail] assemblies and attachments shall withstand a minimum uniform load of _____ pounds per foot applied [vertically down] [and] [horizontally], but not simultaneously on the top rail.
B. Guardrail intermediate rails, balusters, and panel fillers shall be designed for a uniform load of not less than_____ pounds per square foot over the gross area of the guard of which they are part. Reactions due to this loading need not be added to the loading specified for the main supporting members of the guardrails.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section [01300] [01340].
B. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.
C. Submit manufacturer's installation instructions under provisions of Section [01300] [01340].

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
B. Storage on site:
   1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.
   2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
C. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

Railing [pipe] and components shall be as manufactured by JULIUS BLUM & CO., INC., of Carlstadt, New Jersey for its [ACRYLIC/WOOD RAIL] [CARLSTADT® RAIL] [COLORAIL®] [CONNECTORAIL®] [JB® GLASS RAIL] System.

2.02 MATERIALS AND FINISHES

A. Aluminum:
   1. Extruded Pipe: Alloy 6063-T52 meeting ASTM B 221
   2. Drawn Pipe: Alloy 6063-T832 meeting ASTM B 483
   3. Reinforcing Bars: Alloy 6061-T6 meeting ASTM B 221
   4. Extruded Bars, Shapes and Mouldings: Alloy 6063-T52 meeting ASTM B 221
   5. Extruded Posts: Alloy 6063-T6 meeting ASTM B 221
   6. Castings: Almag 35 meeting ASTM B 26
   7. Extruded Toe Board: Alloy 6063-T52 meeting ASTM B 221. Shall conform to the safety requirements of ANSI A21.1
   8. Finish (refer to NAAMM *Metal Finishes Manual*):
      a. Anodized finish shall be [AA-M10-C22-A31 (204R1)] [provided in accordance with AA-M___-C___-A___ and shall meet requirements of AAMA (606.1) (607.1) (608.1)]
      b. Painted finish shall be _____type and _____ color and shall meet the requirements of AAMA 605.1 specification for high performance organic coatings.
B. Stainless Steel: Type 304 (18-8)
   1. Tubing: ASTM A 269
   2. Bars, Shapes and Mouldings: ASTM A 276
   3. Finish: [Ornamental Grade, AISI No. 4] [AISI No. _____].
   4. [_____]
C. Copper Alloys:
   1. Drawn Pipe: CDA 230 (Red Brass) meeting ASTM B 43
   2. Castings: [CDA 865 meeting ASTM B 584 for sand castings] [Nickel-Silver]
   3. Extrusions: [CDA 385 (Architectural Bronze) meeting ASTM B 455] [CDA 798 (Nickel-Silver)]
   4. Finish (refer to NAAMM *Metal Finishes Manual*):
      a. Mechanical: [M32-Medium Satin] [M ___-_____]
      b. Chemical: C ___-_____
      c. Coating: [Clear Organic: O ___-_____] [Laminated: L___-_____] [Wax: _____] [Oil: _____]
D. Acrylic/Wood:
   1. Handrail Moulding: [Ash] [Oak] [Walnut] processed according to the specification of the Permagrain® Radiation Process Center.
   2. Composite [Handrail Moulding] [Posts]: [Oak] [Walnut], processed according to the specification of the Permagrain® Radiation Process Center with aluminum alloy 6063-T6 spine (clear anodized, AA-M10-C22-A31).

2.03 RAILING SYSTEM

A. Material shall conform to 2.02.___ and be finished in accordance with 2.02.___

Select railing systems from options below.

(CONNECTORAIL®)

B. Railing system shall be [permanently anchored] [removable].
C. Rails [and Posts]
   1. Fabricate rails [and posts] from [(anodized) (painted) aluminum, 6063-T52] [stainless steel] [bronze] [pipe] [tube] with nominal size of [1¼] [1½] inches ([1.660] [1.900] inches outside diameter), Schedule [5] [10] [40] ([.062] [.109] [.140] [.145] [.146] [.150] inch wall). [Provide post reinforcement of ([1.360] [1.427] [1.600] [1.667] inch diameter solid aluminum reinforcing bar) (1.750 inch diameter by .120 inch wall stainless steel tube)].
D. Posts
   1. Fabricate posts from [anodized] [painted] aluminum 6063-T832 pipe with a nominal size of [1¼] [1½] inches ([1.660] [1.900] inches outside diameter). Schedule [10] [40] ([.109] [.140] [.145] inch wall). Provide post reinforcement of [1.360] [1.427] [1.600] [1.667] inch diameter solid aluminum reinforcing bar.
E. Fittings
   1. Fittings shall be of wrought material of [aluminum] [stainless steel] [bronze]. Tee-fittings and elbows which are fabricated from more than one piece shall be of welded construction with no weld marks visible when the fitting is installed.
F. Connector Sleeves
   1. Internal connector sleeves shall be of extruded aluminum.
G. Mounting Flanges
   1. [Floor] [Cover] [Roof railing] flanges shall be of [cast] [aluminum] [bronze] [stainless steel].
   2. Heavy-duty floor flange shall be of cast [aluminum] [nickel-silver] with a solid aluminum reinforcing bar.
   3. Facia flanges shall be of [aluminum] [bronze] [stainless steel] with a solid aluminum reinforcing bar.
H. Toe Board
   1. Toe Board shall be of extruded aluminum; BLUM No. 6446.

– OR –

(JB® GLASS RAIL SYSTEM)

B. Railing system shall be [surface] [flush] [facia] mounted.
C. Rails
   1. Fabricate rails from [aluminum] [bronze] [stainless steel] [nickel-silver] [acrylic/wood]; BLUM No. _____
D. Posts
   1. Fabricate posts from [_____] inch outside diameter by [_____] inch wall [aluminum] [bronze] [nickel-silver] [stainless steel] tubing.

E. Glass Structural Balustrade shall be [½] [¾] inch tempered glass and conform to the safety requirements of ANSI Z97.1.
F. Shoe Moulding
   1. Fabricate shoe moulding from extruded aluminum alloy [6061-T6] [6063-T52]; BLUM No. _____
G. Fittings
   1. Fittings shall be of wrought material of [aluminum] [bronze] [stainless steel]. Miter elbows shall be of welded construction with no weld marks visible when the fitting is installed.
H. Connector Sleeves
   1. Internal connector sleeves shall be of extruded aluminum.
I. Glazing Accessories
   1. Setting block shall be of polyvinyl chloride (PVC); BLUM No. [8710] [8711].
   2. Protective insert shall be of polyvinyl chloride (PVC); BLUM No. [8709] [8713] [8714].
   3. Filler: Type _____; Color: _____
   4. _____

– OR –

(COLORAIL® SYSTEM)

B. Rails
   1. Fabricate rails from aluminum [flat] [channel] [tee] [support bar] with polyvinyl chloride (PVC) handrail cover conforming to ASTM E84; BLUM No._____; Color _____
C. Posts
   1. Fabricate posts from [(oak) (walnut) acrylic/wood composite] [aluminum] [bronze] [stainless steel] [tubing] [pipe]; BLUM No._____

– OR –

(CARLSTADT® RAIL or ACRYLIC/WOOD RAIL SYSTEM)

B. Rails [and Posts]
   1. Fabricate rails [and posts] from [(ash) (oak) (walnut) acrylic/wood] [aluminum] [bronze] [stainless steel]; BLUM No. _____
C. Posts
   1. Fabricate posts from [(oak) (walnut) acrylic/wood composite] [aluminum] [bronze] [stainless steel] [tubing]; BLUM No.____
D. Mounting Flanges
   1. [Heavy-duty floor] [Cover] [Facia] flanges shall be of [cast] [extruded] [aluminum] [bronze] [stainless steel]; BLUM No. _
E. Panel
   1. ¼ inch [glass] [plastic] [_____] with [aluminum] [bronze] panel framing (BLUM Nos. _____ and _____). [Glass shall conform to the safety requirements of ANSI Z97.1]
F. Glazing Accessories:
   1. Glazing Channel shall be flexible PVC, BLUM No. 8708.

2.04 FASTENERS

A. Mechanical Fasteners:
   1. CONNECTORAIL®
      a. RHMS ¼"-20 × 1" SEMS with lock washer, stainless steel.
      b. ¼"-20 × [2½"] [3"] RHMS with lock nut, stainless steel.
      c. [A25-140] [A25-200] internally threaded tubular rivets, aluminum.
      d. ⅜" × 3" sleeve anchor bolt, cadmium plated steel.
      e. Machine screws used to mount facia flanges to stringers shall be of [stainless] [galvanized] [cadmium plated] steel, ⅜ inch diameter.

   – OR –

   1. All mechanical fasteners used in the assembly of [CARLSTADT® RAIL] [ACRYLIC/WOOD RAIL] [JB® GLASS RAIL] [COLORAIL®] shall be manufactured from stainless steel.
   2. Exposed mechanical fasteners for use with bronze materials shall be manufactured from yellow brass.
B. Dowels for use with ACRYLIC/WOOD shall be 5/16 inch diameter extruded aluminum; BLUM No. 800.
C. Adhesive: Scotch-Weld epoxy adhesive, Catalog No. 3M EC-2216 B/A Clear Amber.
D. Cement: Hydraulic, ASTM C 595, factory prepared with accelerator.

2.05 HANDRAIL BRACKETS

A. [Aluminum] [Bronze] [Stainless steel] [Nickel-Silver]; [cast] [extruded] [machined]: BLUM No. _____

2.06 FABRICATION

A. Form [rail-to-end post connections and] all changes in rail direction by [miter] [radius] elbows.
B. Cut material square and remove burrs from all exposed edges, with no chamfer.
C. Make exposed joints butt tight and flush.
D. Close exposed ends of [pipe] [handrail] by use of appropriate end cap.
E. For posts set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
F. Locate intermediate rails [midway] [equally spaced] between top rail and finished floor or center line of tread.
G. Verify dimensions on site prior to shop fabrication.

PART 3 – EXECUTION

3.01 PREPARATION

A. Supply items to be [cast in concrete] [embedded in masonry] [placed in partitions].

3.02 DISSIMILAR METALS

A. When bronze and aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with [a heavy coat of a proper primer] [asphalt paint].
B. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with [heavy bodied bituminous paint] [water-white methacrylate lacquer] [zinc chromate].

3.03 INSTALLATION

A. Install in accordance with shop drawings [and manufacturer's instructions].
B. Erect work [square and level,] [horizontal or parallel to rake of steps or ramp,] [and] free from distortion or defects detrimental to appearance or performance.
C. Expansion joints shall be provided as needed to allow for thermal expansion or contraction.

3.04 CLEANING

A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.
B. Do not use acid solution, steel wool or other harsh abrasives.
C. If stain remains after washing, remove finish and restore in accordance with NAAMM Metal Finishes Manual.
   Finish must not be removed from anodized aluminum. Reanodizing can only be done by removing railing and returning it to the anodizer.

3.05 REPAIR OF DEFECTIVE WORK

A. Remove stained or otherwise defective work and replace with material that meets specification requirements.

THE METRIC CONVERSION ACT

The Metric Conversion Act of 1975, as amended by the *Omnibus Trade and Competitiveness Act of 1988*, establishes the modern metric system (System International or SI) as the preferred system of measurement in the United States. It requires that, to the extent feasible, the metric system be used in all federal procurement, grants and business-related activities.

RULES FOR WRITING METRIC SYMBOLS AND NAMES

- Print unit symbols in upright type and in lower case except for liter (L) or unless the unit name is derived from a proper name.
- Print unit names in lower case, even those derived from a proper name.
- Print decimal prefixes in lower case for magnitudes 10^3 and lower and print the prefixes in upper case for magnitudes 10^6 and higher.
- Leave a space between a numeral and a symbol (write 45 kg or 37 °C, not 45kg or 37°C or 37° C).
- Do not leave a space between a unit symbol and its decimal prefix (write kg, not k g).
- Do not use the plural of unit symbols (write 45 kg, not 45 kgs), but do use the plural of written unit names (several kilograms).
- For technical writing, use symbols in conjunction with numerals (the area is 10 m^2); write out unit names if numerals are not used (carpet is measured in square meters). Numerals may be combined with written unit names in non-technical writing (10 meters).
- Indicate the product of two or more units in symbolic form by using a dot positioned above the line (kg•m).
- Do not mix names and symbols (write N•m or newton meter, not N•meter or newton•m).
- Do not use a period after a symbol (write 12 g, not 12 g.) except when it occurs at the end of a sentence.

RULES FOR WRITING NUMBERS

- Always use decimals, not fractions (write 0.75 g, not ¾ g).
- Use a zero before the decimal marker for values less than one (write 0.45 g, not .45 g).
- Use spaces instead of commas to separate blocks of three digits for any number over four digits (write 45 138 kg or 0.004 46 kg or 4371 kg). Note that this does not apply to the expression of amounts of money.
- In the United States, the decimal marker is a period; in other countries a comma usually is used.

CONVERSION AND ROUNDING

- When converting numbers from inch-pounds to metric, round the metric value to the same number of digits as there were in the inch-pound number (11 miles at 1.609 km/mi equals 17.699 km, which rounds to 18 km).
- Convert mixed inch-pound units (feet and inches, pounds and ounces) to the smaller inch-pound unit before converting to metric and rounding (10 feet, 3 inches = 123 inches; 123 inches × 25.4 mm = 3124.2 mm; round to 3124 mm).
- In a "soft" conversion, an inch-pound measurement is mathematically converted to its exact (or nearly exact) metric equivalent. With "hard" conversion, a new rounded rationalized metric number is created that is convenient to work with and remember.

CONVERSION TABLE

The following conversion tables are provided to assist in converting dimensions and engineering data shown in this catalog to their metric equivalents.

from	to	mulitply by	from	to	mulitply by
cm	ft	0.032 81	kPa	psi	0.145 037 7
cm	in	0.3937	kPa	lb/ft^2	20.885 4
cm	m	0.01	lb	g	453.5924
cm	mm	10	lb	kg	0.453 592 4
cm^2	in^2	0.155	lb	N	4.448 22
cm^2	mm^2	100	lb/in	g/cm	178.6
cm^3	ft^3	0.000 035 31	lb/in^2	kg/m^2	703.1
cm^3	in^3	0.061 02	lb/in^2	lb/ft^2	144
cm^3	m^3	0.000 001	lb/ft	kg/m	1.488 16
ft	cm	30.48	lb/ft	N/m	14.593 9
ft	km	0.000 304 8	lb•ft	kg•m	0.138 255
ft	m	0.3048	lb/ft^2	lb/in^2	0.006 944
ft	mm	304.8	lb/ft^2	kg/m^2	4.882 43
ft^2	in^2	144	lb/ft^2	Pa	47.880 3
ft^2	m^2	0.0929	lb/ft^2	kPa	0.047 880 3
ft^3	cm^3	28 320	$lb•ft^2$	$kg•m^2$	0.042 140 1
ft^3	in^3	1 728	m	cm	100
ft^3	m^3	0.028 32	m	ft	3.281
ft•lb	N•m	1.355 82	m	in	39.37
g	kg	0.001	m	mm	1000
g	lb	0.002 205	m^2	ft^2	10.76
g/cm	lb/in	0.0056	m^3	cm^3	1 000 000
in	cm	2.54	m^3	ft^3	35.31
in	m	0.0254	m^3	in^3	61 023
in	mm	25.4	mm	cm	0.1
in^2	cm^2	6.452	mm	ft	0.003 281
in^2	ft^2	0.006 944	mm	in	0.039 37
in^2	mm^2	645.16	mm	m	0.001
in^3	cm^3	16.387 064	mm^2	cm^2	0.01
in^3	ft^3	0.000 578 7	mm^2	in^2	0.001 55
in^3	m^3	0.000 016 39	mm^3	in^3	0.000 061
in^3	mm^3	16 387.064	mm^4	in^4	0.000 002 4
in^4	mm^4	416 231	N	lb	0.224 809
kg	g	1000	N/m	lb/ft	0.068 521 8
kg	lb	2.205	N/m^2	Pa	1
kg/m	lb/ft	0.672	N•m	ft•lb	0.737 561
kg/m^2	psi	0.001 422	Pa	lb/ft^2	0.020 885 4
kg/m^2	lb/ft^2	0.204 816	Pa	N/m^2	1
kg•m	lb•ft	7.233 011 5	psi	kPa	6.894 76
$kg•m^2$	$lb•ft^2$	23.730 366 1	psi	kg/m^2	703.1
km	ft	3281	psi	lb/ft^2	144

ABBREVIATIONS:

centimeter	cm	kilopascal	kPa
cubic centimeter	cm^3	meters	m
cubic foot	ft^3	millimeter	mm
cubic inch	in^3	newton	N
cubic meter	m^3	square centimeter	cm^2
cubic millimeter	mm^3	square foot	ft^2
foot	ft	square inch	in^2
gram	g	square meter	m^2
inch	in	square millimeter	mm^2
kilo	k	pascal	Pa
kilogram	kg	pound	lb
kilometer	km	pounds/square inch	psi

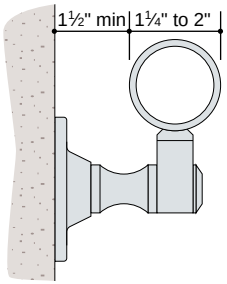
ACCESSIBLE RAILINGS

The Americans with Disabilities Act (ADA) went into effect January 26, 1992. The ADA *. . . requires that all new places of public accommodation and commercial facilities be designed and constructed so as to be readily accessible to and usable by persons with disabilities . . .*

In regards to handrail size, the ***Americans with Disabilities Act Accessibility Guidelines (ADAAG)*** state that: *. . . the diameter or width of the gripping surfaces of a handrail . . . shall be 1¼ in to 1½ in . . . or the shape shall provide an equivalent gripping surface.* ***ADAAG*** does not define *equivalent gripping surface.*

This section of ADAAG was taken directly from the American National Standards Institute (ANSI) document ***ANSI 117.1-1980: Accessible and Usable Buildings and Facilities.*** The **Council of American Building Officials (CABO)** has since published two revisions of ***ANSI 117.1.*** The latest revision, ***CABO/ANSI A117.1-1992*** is very specific regarding accessible railings. It states:

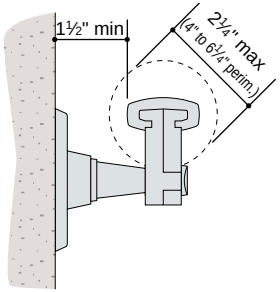
4.3.10.4 Top of gripping surfaces of handrails shall be 34 in (865 mm) minimum and 38 in (965 mm) maximum vertically above stair nosings and ramp surfaces. Handrails shall be at a constant height above stair and ramp surfaces.



4.3.10.5 Clear space between handrail and wall shall be 1½ in (38 mm) minimum.

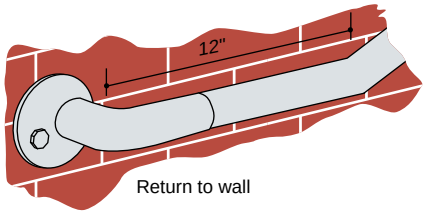
4.3.10.6 Gripping surfaces shall be continuous, without interruption by newel posts, other construction elements, or obstructions.

4.3.10.7 Handrails shall have a circular cross section with an outside diameter of 1¼ in (32 mm) minimum and 2 in (51 mm) maximum, or shall provide equivalent graspability in accordance with the following requirement. Handrails with other shapes shall be permitted provided they have a perimeter dimension of 4 in (100 mm) minimum and 6¼ in (160 mm) maximum, and provided their largest cross-section dimension is 2¼ in (57 mm) maximum.

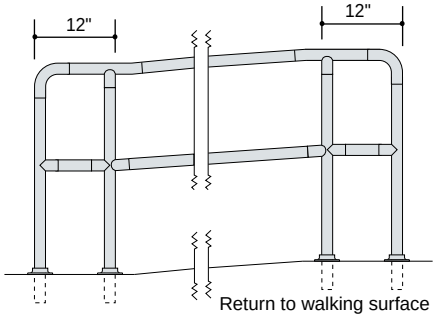


4.3.11.1 Ramp handrails shall extend horizontally 12 in (305 mm) minimum beyond the top and bottom of ramp runs. Such extension shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent run.

4.3.11.2 At the top of a stair flight, handrails shall extend horizontally above the landing for 12 in (305 mm) minimum beginning directly above the first riser nosing. Such extension shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent stair flight.



4.3.11.3 At the bottom of a stair flight, handrail shall extend at the slope of the stair flight for a horizontal distance equal to one tread depth beyond the last riser nosing. Such extension shall continue with a horizontal extension complying with 4.3.11(4) or shall return to a wall, guard or the walking surface.



4.3.11.4 At the bottom of a stair flight, where a guard or wall is located so as to permit a 12 in (305 mm) minimum horizontal extension of the handrail, in addition to the extension required by 4.3.11(3), such a 12 in (305 mm) minimum extension shall be provided. The height of this extension shall equal the height of the handrail above the stair nosing. Such extension shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent stair flight.

ADAAG has not been brought in line with ***ANSI 117.1-1992.*** Any changes that may be made in ***ADAAG*** must be made by the Justice Department. Keep in mind that the ADA is not a building code – it is a civil rights law. As such, it is neither required nor anticipated that the ADA will be enforced by local building departments or inspectors. As a civil rights law, enforcement is authorized by the Attorney General but it should be expected that enforcement will be effected primarily through complaints and civil suits by private citizens and public interest groups. Be aware, though, that many states and municipalities are incorporating ***ADAAG*** into their building codes.

At the present time, we at least have a written clarification from the Architecture and Transportation Barriers Compliance Board (the Access Board) – the agency which created and interprets the ***ADAAG*** – regarding handrail size. The Access Board has confirmed that 1¼" to 1½" pipe sizes (1.66" O.D. and 1.9" O.D., respectively) are acceptable for use as handrails within the ***ADAAG***. Their letter of October 16, 1992 states:

> *This is to confirm that the Access Board has been informing persons who request technical assistance regarding the requirements for handrail size in section 4.26.2 of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) that standard pipe sizes designated by the industry as 1¼ inch to 1½ inch are acceptable for purposes of that section.*
>
> *You should be aware that although the Americans with Disabilities Act (ADA) authorizes the Access Board to provide technical assistance with respect to ADAAG, the Department of Justice is responsible for enforcement of certain titles of the Act. This letter provides informal guidance only. It is not a determination of your legal rights or responsibilities under the ADA and is not binding on the Access Board or the Department of Justice.*

The letter is signed by James J. Raggio, General Counsel, Access Board.

Even though the Access Board has clarified that 1¼" to 1½" pipe sizes are acceptable for accessible railings, many local inspectors are not aware of this clarification and still reject pipe railings. Consult your local authorities regarding their position. Copies of the letter from the Access Board are available upon request.

For the latest information regarding ***ADAAG*** and ***CABO/ANSI 117.1-1992***, or to obtain your own copy, contact the Access Board at 1-800-USA-ABLE or CABO at 212-642-4900.