

WAGNER COMPANIES ON-LINE

The **Wagner Companies** has multiple web sites including www.wagnercompanies.com, www.wagnerail.com, www.rbwagner.com and www.jgbraun.com. They are your links to the latest information on **Wagner** architectural and industrial products including fabrication details, drawings, catalog pages, company information, engineering data, guide specifications, alloy data, photos and more.

SHOP ON-LINE

Our e-commerce site is www.shopwagner.com. In addition to placing orders and obtaining pricing, the site permits access to product availability; account review; and order status, history and tracking.

CAD DRAWINGS

CAD files for **Wagner** products may be downloaded at www.wagnercompanies.com/Part_Lookup.aspx. They are available in .pdf and .dxf formats. If you can not find the file you want online, contact **Wagner** directly.

SAMPLES

While the catalogs are helpful, we understand that nothing compares with having a sample in hand prior to purchasing. We are pleased to provide samples to qualified designers and fabricators. Contact our sales department with your request.

QUOTATION CHANGES

All quotations made by **Wagner** or its agents are subject to change without notice, subject to prior sale and, unless otherwise agreed, are binding only for immediate acceptance. All sales are made subject to strikes, accidents or other causes beyond our control.

CANCELATION

Special materials are not subject to cancelation or return without our written consent. Items remaining on hold for over thirty days may be billed at that time for materials and labor used and storage charges may be incurred. Quantities shipped may vary by +/- 5% on runs over 200 pieces.

CATALOG ACCURACY

Great care is taken to ensure the accuracy of information and dimensions contained in this catalog. Despite this effort, errors and discrepancies may occur because we are constantly updating and revising our data. Product also may become obsolete – no longer produced – for various reasons. Where a product cannot be reproduced, **Wagner** will offer the closest possible substitute.

DAMAGE OR MATERIALS LOST IN TRANSIT

If you receive a delivery with visible damage, have the driver make an immediate notation of the damage on the freight bill. Count and inspect the material immediately and, if necessary, contact the carrier to schedule an inspection of the goods. This process will assist in damage recovery from the carrier without controversy. At no time will **Wagner** be responsible for losses or damages incurred in transit. Contact **Wagner** regarding replacement material.

SHORT SHIPMENTS

Wagner fittings are counted several times in the manufacturing process. However, shortages do occur. We require that shortages received in undamaged containers be reported to us within ten days of receipt of material.

DEFECTIVE PRODUCT

All **Wagner** materials are carefully inspected and tested before shipment, but it is sometimes impossible to detect all imperfections. **Wagner** will replace defective products as noted in our *Return Policy*.

In case any shipment of product proves unsuitable, it is understood that the buyer will immediately discontinue its use and advise **Wagner**. We insist on the opportunity to determine a resolution such that loss or damage to either party shall be prevented or minimized. No charges for labor or expenses required to repair defective goods or occasioned by them will be allowed.

RETURN POLICY

Great care is taken in the manufacture, packaging and shipment of **Wagner** products. Please inspect your parts immediately upon receipt to ensure of the product fulfills your expectations.

Wagner will replace at the point where delivery of the material is first made or, at our option, will allow credit for the purchase price of such material if, and to the extent:

1. The material is defective or not in conformity with the agreed specifications.
2. You have notified us in writing of the defect with reasonable promptness after the delivery of material.
3. **Wagner** has been given reasonable opportunity to inspect the material.

Except as stated herein, **Wagner** shall not, under any circumstances, be responsible for any special, direct, indirect, incidental, consequential or other damages of any nature – including any labor or repair expense – arising out of a sale of the material covered hereby.

All returns must be authorized by **Wagner** and made within twenty (20) days of purchase. Returns are subject to a 25% re-stocking charge – minimum charge: \$40.00. After twenty (20) days, returns may still be considered but the restocking charge will increase to 50%. Cost of returning goods is the customer's responsibility unless the error is attributable to **Wagner**. Contact customer service to obtain return authorization (RMA) number.

Wagner shall not be responsible for any delay or failure to make shipment or delivery of all or any part of the merchandise being sold due directly or indirectly to any cause beyond our reasonable control; including, without limitation, inability to obtain materials; fire; flood; law or other governmental regulation, rule or order; strike or other labor difficulty; supplier or carrier failure or delay; war; accident; explosion; and riot.

MINIMUM ORDER

\$150 for long length straight footage shipments; \$75.00 for UPS shipments billed to a **Wagner** account; \$25 for UPS shipments ordered on-line and paid with a credit card. Order amounts are exclusive of freight, packing and handling charges.

PAYMENT TERMS

Terms of 30 days net with a 1% discount for payments within 10 days from date of invoice are available upon approval of credit. Contact **Wagner** to obtain a credit application.

A 1½% per month or 18% per year carrying charge will be assessed on accounts over 30 days old.

If an account does not meet our terms of payment and must be turned over for collection, we reserve the right to charge collection costs or the amount awarded by the court in addition to the amount due.

Wagner reserves the right to deny discounts to customers who fail to keep their accounts current.

Orders may also be prepaid by check or credit card.

SHIPPING DATES

Orders for stock material received by 10:30 a.m. central time are generally shipped out the same day. They are otherwise shipped as soon as possible thereafter.

Truck shipments require packaging and freight arrangements to be made and therefore are shipped within two days depending on the complexity of the order.

All orders are acknowledged with an anticipated shipping date based on current production schedules. It is not a guaranteed commitment to ship on that date and we accept no liability for unavoidable delays.

CONFIRMING ORDERS

Confirming Orders should be marked Confirmation – preferably across face of the purchase order. Confirmation orders not so marked may be treated as original open orders and duplicated. In such cases Wagner will not be responsible for expenses and inconvenience incurred.

CUSTOM PRODUCT TOLERANCES

For custom work, our quotation will be based on the tolerance chart on each drawing. If decimals are used, we will work to three places; if no tolerance is specified, we will work to the specifications of our standard railing products.

STANDARD TOLERANCES

Hole sizes are .015" – .025" over the listed dimensions unless specifically mentioned. Product ID and OD are produced within commercial dimensional tolerances. Bend tolerances and angle of bend are +/- 2°. Cutting tolerances on pipe and tube are +/- 1/16". Multiple bend tolerances are +/- 2° and +/- 1/8" center-to-center thru 2.50" OD and +/- 1/4" center-to-center above 2.50" OD.

VALUE ENGINEERING

Wagner provides in-house CAD assistance to augment customer designs and facilitate product and process development. Computerized bar-coded *Bill of Materials* and *Routings* are used to provide accurate, fast service and order delivery.

QUALITY CONTROL

The Wagner Companies is committed to providing superior value to our customers through Advanced Quality Planning Activities, Process Innovation and Team-Based Continuous Improvement.

Wagner's in-house quality engineering staff employs quality tools to ensure parts are made to specification and processes are stable. Verification activities are always available for review.

QUALITY EXPECTATIONS

For: Architectural castings, forgings, and stampings; handrail mouldings and terminals; ball style fittings and architectural shapes:

The Wagner Companies sell these products for their uniqueness and aesthetic qualities, critical to the manufacture of beautiful railings. The components which make up these families of products are manufactured using methods, tooling and patterns which have been shown to exhibit variation over time. No two products can be expected to be exactly alike. Additionally, any dimensions indicated are for reference only. The buyer must expect some fabrication to occur, as these products are not meant for simple assembly. For example, a forged baluster may need occasional straightening. A terminal casting may show an inclusion when polishing is completed. Ornamental stampings may show varying levels of detail. Ball style fittings will vary in finish and dimension.

Continuous improvement of these products is essential to the success of our customers. We use the data collected from product feedback to determine when tooling or method modification is needed. These modifications must also be weighed against the traditional expectations of end-users. Change is not made unless expectations can be satisfied while still improving the product.

Recognizing that the uniqueness of the product may not work for all situations, customers are encouraged to evaluate samples whenever possible. Wagner sales staff will make every effort to satisfy inquiries into a specific product or family of products. Should purchase be made and the product found to be unsuitable, the standard return policy of The Wagner Companies will apply.

CASTING POROSITY

Porosity is a normal attribute of cast products. Every effort is made to minimize the appearance of porosity but minor pitting can not be avoided and is to be expected.

ALUMINUM REACTION WITH CEMENT

When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces should be painted with heavy bodied bituminous paint, water-white methacrylate lacquer or zinc chromate.

DISSIMILAR METALS

Metals are rated according to their *nobility*. When dissimilar metals are in contact with each other in the presence of oxygen and moisture, the more noble metal will corrode the less noble. Contact between dissimilar metals should always be avoided. If contact can not be avoided, the adjacent surfaces should be painted with bituminous paint or zinc chromate primers or paints. Taping or gasketing with non-absorptive materials is also effective.

Care should be taken to prevent the wash from copper alloy surfaces onto adjacent, exposed, less noble metal surfaces since the traces of copper salts carried in the wash can accelerate the corrosion of less noble metals.

PRESSURE TREATED LUMBER

Pressure treated lumber – ACQ lumber – is treated with copper sulfate which will corrode steel. Use only stainless steel or heavily galvanized steel components with ACQ lumber products.

SPECIFYING PARTS FOR OD TUBE OR PIPE SIZE

IPS stands for *iron pipe size* – a standard that was originally developed for fluid transfer but has also become the standard for designing handrail sections in all alloys.

There is often confusion as to which size product the customer actually needs – *Pipe Size* or *OD Tubing Size*.

Keep in mind that pipe size refers to a *nominal* – not actual – inside pipe diameter. *Schedule* refers to the pipe's wall thickness. The dimensions provided for OD tubing on the other hand refer to the actual outside diameter and wall thickness.

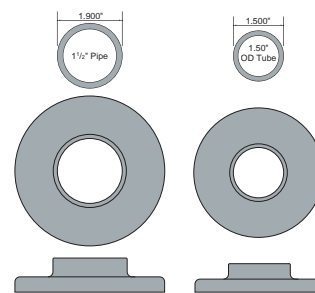
For example: 1 1/2" pipe size flanges have an opening to fit over 1.90" OD – the actual outside diameter of 1 1/2" pipe – while 1.50" OD tubing has a true 1.50" outside diameter and the flange is sized accordingly.

Refer to the chart below regarding actual dimensions for nominal pipe size.

ACTUAL DIMENSIONS FOR NOMINAL PIPE SIZE

Where OD = Outside Diameter; ID = Inside Diameter; and t = wall thickness, use the following formula to determine the ID for any given size pipe:

$$ID = OD - (2 \times t)$$



Nominal Pipe Size	Outside Diameter	Schedule (Wall Thickness)			
		Schedule 5	Schedule 10	Schedule 40	Schedule 80
1/2"	.840"	.065"	.083"	.109"	.147"
3/4"	1.050"	.065"	.083"	.113"	.154"
1"	1.315"	.065"	.109"	.133"	.179"
1 1/4"	1.660"	.065"	.109"	.140"	.191"
1 1/2"	1.900"	.065"	.109"	.145"	.200"
2"	2.375"	.065"	.109"	.154"	.218"
2 1/2"	2.875"	.083"	.120"	.203"	.276"
3"	3.500"	.083"	.120"	.216"	.300"
3 1/2"	4.000"	.083"	.120"	.226"	.318"
4"	4.500"	.083"	.120"	.237"	.337"
5"	5.560"	.109"	.134"	.258"	.375"
6"	6.630"	.109"	.134"	.280"	.432"

GENERAL INFO

STAINLESS STEEL

Stainless steels contain at least 12% chromium and form a thin, invisible protective, corrosion-resistant, passive film on their surface. This film forms spontaneously when the chromium reacts with oxygen in air and water. If the film is damaged or removed during fabrication or polishing, it self-repairs immediately so long as the surface is clean. If stainless steel corrodes, typically highly localized metal loss or pitting occurs – rarely general or uniform corrosion of the entire surface.

TECHNICAL INFO

While problems with stainless products are infrequent, the name *stainless* can be somewhat misleading. It is not actually, *stainless*, but *stain resistant* – it is a corrosion resistant alloy, not rustproof. Stainless steel may show some forms of corrosion and/or deterioration, dependent upon the degree of contaminants in its particular environment. Under certain conditions, it can rust unless a program of preventive maintenance is followed.

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The environment in and around swimming pools and salt water contain salts which actively attack stainless steel. Heat and humidity increase the corrosive activity of chlorine and bromine salts. In addition, the corrosive action caused by salts that occurs from ice melting agents such as calcium chloride and sodium chloride can create the formation of rust. Other chemical reactions that can cause deterioration include carbon pick up from bending or fabricating tools, finishing equipment or steel covered work benches. It is also typical for contractors or masons to use muriatic acid solution on masonry – even the fumes from this liquid can attack stainless steel.

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The material's mechanical finish – satin or mirror – also plays a role in corrosion resistance. Corrosion-causing agents will collect in the fine lines of a satin finish as opposed to the smooth surface of a mirror finish.

INSTALLATION GUIDES

Stainless steel is manufactured in various formats and can sometimes be selected to perform better in certain environments or applications. They are identified by T-304, T-316, etc. as well as L Grades (low carbon).

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If you experience difficulty with your stainless products, it is likely that there is a contaminant in the environment. The first step is to identify the contaminant and to eliminate it. After that, assure that a preventive maintenance program is in place and being followed.

Stainless Steel Preventive Maintenance Suggestions

- Inspect the installation on a frequent schedule taking note of discoloration and stains. Discoloration can and should be removed by cleaners recommended for stainless steel.
- Ongoing maintenance consisting of a fresh water wash and wiping with a clean cloth is recommended to minimize deterioration. In all but the most severe cases, this regular washing will eliminate the need for refinishing.
- Never use steel wool or harsh abrasive elements.

FINISHES

Many **Wagner** products are available pre-finished but others – in particular tubing, pipe and architectural shapes – are sold with a *mill finish*.

On long-length material, a *mill finish* indicates the finish on the material is as *extruded*, rolled, formed, etc. When anodizing aluminum, the best result is obtained if the material is satin finished prior to anodizing.

On brackets, elbows and fittings, *mill finish* material may have tool marks, minor dents or nicks that are the result of production processes. While **Wagner** makes every effort to minimize marking incurred during manufacturing, we must be notified at the time of order if standard *mill finish* is not acceptable.

Most items in this catalog can be provided polished, galvanized, zinc plated, anodized, satin finished or mirror finished. Contact **Wagner** with your specific requirements.

For more information on mechanical finish designations and our new line of polishing supplies, go to page 214.

AA-M32-C22-A41 CLEAR ANODIZED FINISH

Most **Wagner** Caps and Flanges are produced in alloy 3003-H14. Wagner bent aluminum elbows without seams are made of alloy 6063. To weld alloy 6063 to alloy 3003, use 5366 or 5856 rod for best color match. If the welded pieces are then to have a clear anodized finish, we recommend the following procedure:

1. Put on a satin finish.
2. 8 minute etch.
3. Up to 12 minute etch if finish is not clean or smooth.
4. Anodize 60 minutes at 15 volts.

When Wagner slip flanges with set screws are mechanically attached to aluminum pipe and are anodized, finish must match 6063-T6 aluminum pipe with AA-M32-C22-A41 clear anodized finish, we recommend the flanges to be finished separate and anodized as follows: follow step number 2 and number 4 above but omit steps number 1 and 3.

When anodizing cast aluminum brackets alloy 214 or Almag 35:

1. 8 minute etch.
2. Up to 12 minutes etch if finish is not clean and smooth.
3. 30 minute anodize 12½ to 13 volts at low voltage.

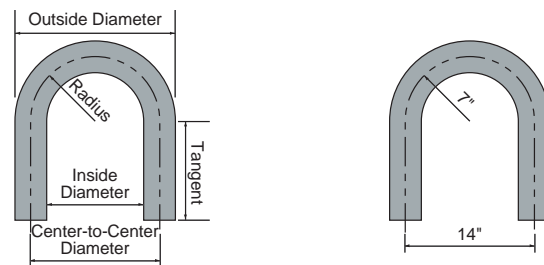
RADIUS VS. DIAMETER DIMENSIONS

Bend radii and diameters will refer to either the inside or center line of a bend. There is often confusion between radius versus diameter. Note in the diagram below that the diameter is two times the radius. Therefore a 180° bend on a 7" center line radius would yield a 14" center line diameter (14.00" center-to-center). Throughout this catalog *r* is used to refer to inside diameter while *R* represents center line radius. The inside radius (*r*) is equal to the center line radius (*R*) less half the OD or width of the tubing being bent.

$$r = R - (OD/2)$$

BUILDING CODES

Prior to using any railing products, it is incumbent on designers, fabricators and installers to make themselves familiar with local codes that apply



to their applications.

Most municipalities and local code bodies do not write code – they adopt codes prepared by various code bodies. Historically, model codes were prepared by code bodies such as the Building Officials Code Administrators International, Inc. (BOCA), the Council of American Building Officials (CABO), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International (SBCCI). Other codes often referred to include the Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), and the *Americans With Disabilities Act Accessibility Guidelines (ADAAG)*.

ICC

Prior to 2000, BOCA, SBCCI and ICBO each prepared their own model codes that were regionally applied. In 1999, these three organizations began to work together to prepare a unified code under the auspices of the International Code Council (ICC). The first set of *I Codes* were published in 2000 and included the *International Residential Code (IRC)* and the *International Building Code (IBC)*. The 2000 IRC and IBC model codes have since been adopted by states throughout the country.

In 2002, BOCA, SBCCI and ICBO officially merged to form the ICC and they approved an updated IRC and IBC most recently published in 2006.

The code comparison chart on pages 250 to 253 provides information relating to handrailing listed in various codes. Consult your local authorities to see what codes apply to your project.

NFPA

The NFPA has also entered the building code arena. They have published NFPA 5000.

Handrail and Guardrail

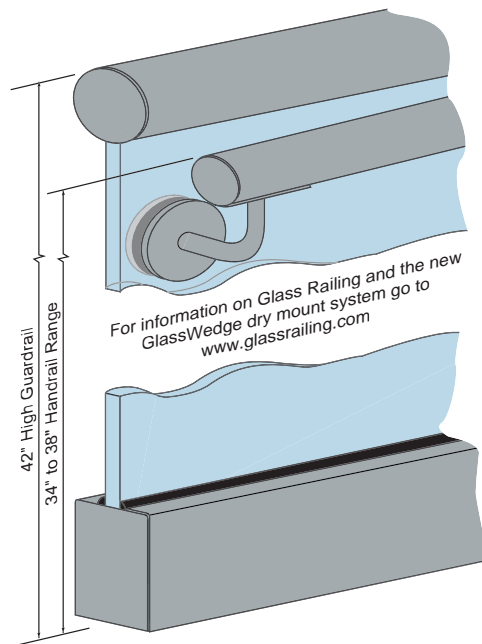
Handrails are in place to provide guidance while the purpose of a guardrail is to prevent accidental falls.

Guards are generally required for ramps, stairs or landings above 30". The height will vary depending on the code. The IBC requires a guard to be 42" in height. Handrails are located between 34" and 38" and have dimensional limitations for graspability. As such, if a 42" guardrail is called for on a stair or ramp, it will also require a secondary handrail at the appropriate height. A guard top rail that is not used as a handrail would not have a graspability size limitation.

Guards also have opening limitations to consider. The most common requirement is that no opening be large enough to allow a 4" sphere to pass.

While a handrail may need to be installed on stairs less than 30" high, it does not have to meet the opening limitations required of guardrails. This is often being misinterpreted by local inspectors who have insisted on applying guard requirements to these applications.

Refer to *Accessibility Guidelines* below regarding similar height



standards on accessible railing and the Access Board's recommendation for railing for children.

The Ladder Effect

The published 2000 IRC stated that guardrails *shall not be constructed with horizontal members or other ornamental pattern that results in a ladder effect*. The *ladder effect* has never been a part of the IBC.

The *ladder effect* was removed from the IRC during the 2001 code cycle. The change was noted in the 2001 IRC supplement and the current 2003 IRC contains no reference to the *ladder effect*.

However, some local code authorities are using older codes based on BOCA – the creator of the *ladder effect* wording – and the 2000 IRC. Many local code inspectors are not aware of the 2001 change and may reject guardrailings with infills they interpret as creating a *ladder effect*.

It is taking time for the 2001 IRC supplement and the new 2006 model codes to trickle down to the local levels. In the meantime, be prepared to address this issue should it come up in your area.

ACCESSIBILITY GUIDELINES

There are two references that are used throughout the country in relation to accessibility: *ICC/ANSI A117.1, Accessible and Usable Buildings and Facilities* and *The Americans With Disabilities Act Accessibility Guidelines (ADAAG)*

The Americans with Disabilities Act (ADA) became law in 1992. The ADA requires that all new places of public accommodation and commercial facilities be designed and constructed so as to be readily accessible and usable by persons with disabilities.

The 1992 ADAAG was prepared by The Access Board and was based on the 1986 CABO/ANSI A117.1, *Accessible and Usable Buildings and Facilities*. ANSI 117.1 has since been updated several times with 2003 being the most recent edition.

Following an extensive review process, The Access Board announced the release of a new ADAAG on July 23, 2004. One of the goals of the update was to bring harmony between the model building codes and industry standards. Items related to handrail are noted below or go to the Access Board's web site to view the entire 2004 ADAAG

The ADA is a civil rights law – it is not a building code. The ADAAG though has been incorporated into many state and local building codes.

The following references are taken from the new, 2004 *Americans with Disabilities Act Accessibility Guidelines*.

Handrail Dimensions

505.6 Gripping Surface. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1½ inches (38 mm) minimum below the bottom of the handrail gripping surface.

EXCEPTIONS:

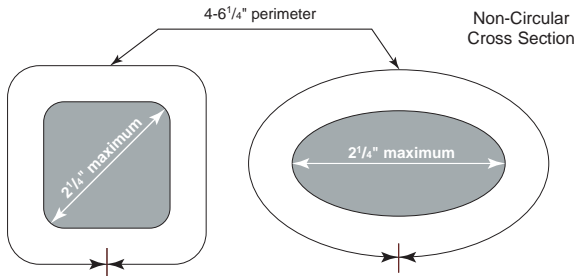
1. Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.
2. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by ¼ inch (3.2 mm) for each ½ inch (13 mm) of additional handrail perimeter dimension that exceeds 4 inches (100 mm).

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505.7.1 Circular Cross Section: Handrails gripping surfaces with a circular cross section shall have an outside diameter of 1 1/4 inches (32 mm) minimum and 2 inches (51 mm) maximum.

505.7.2 Non-Circular Cross Sections: Handrail gripping surfaces with a non-circular cross section shall have a perimeter dimension of 4 inches (100 mm) minimum and 6 1/4 inches (160 mm) maximum, and a cross-section dimension of 2 1/4 inches (57

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mm) maximum.

Handrail Clearance

While the 1992 ADAAG stated that the distance between the wall and handrail had to be 1 1/2", all subsequently published model codes – including the new ADAAG – now state this to be a *minimum* requirement.

505.5 Clearance. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1 1/2 inches (38 mm) minimum.

It is important that you confirm all code issues with your local authorities since many have not updated their requirements to currently available model codes.

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Railing Height

Top of gripping surfaces of handrails shall be 34" minimum and 38" maximum vertically above stair nosings and ramp surfaces. Handrails shall be a consistent height above stair nosings and ramp surfaces.

ADAAG Advisory: The requirements for stair and ramp handrails in this document are for adults. When children are the principle users in a building or facility (e.g., elementary schools), a second set of handrails at an appropriate height can assist them and aid in preventing accidents. A maximum height of 28 inches (710 mm) measured to the top of the gripping surface from the ramp surface or stair nosing is recommended for handrails designed for children. Sufficient vertical clearance between upper and lower handrails, 9 inches (230 mm) minimum, should be provided to help prevent entrapment.

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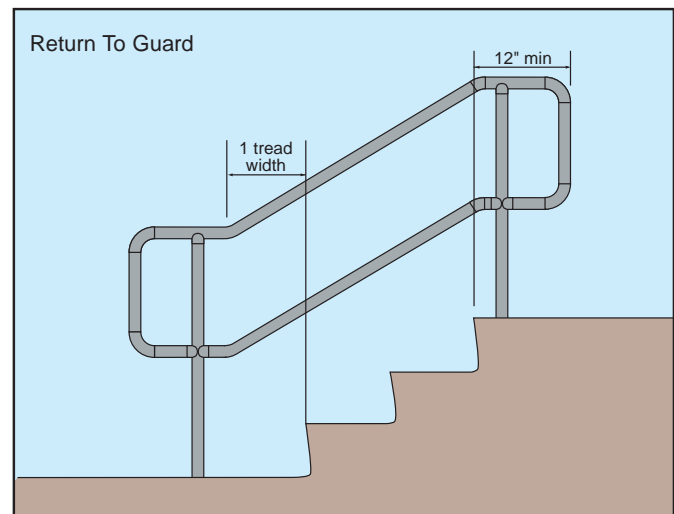
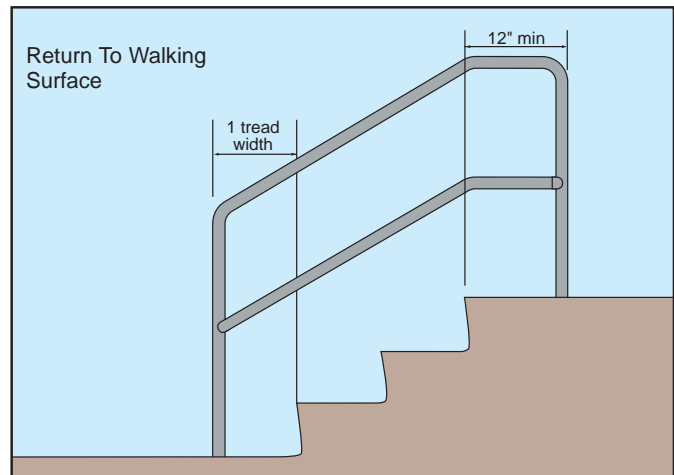
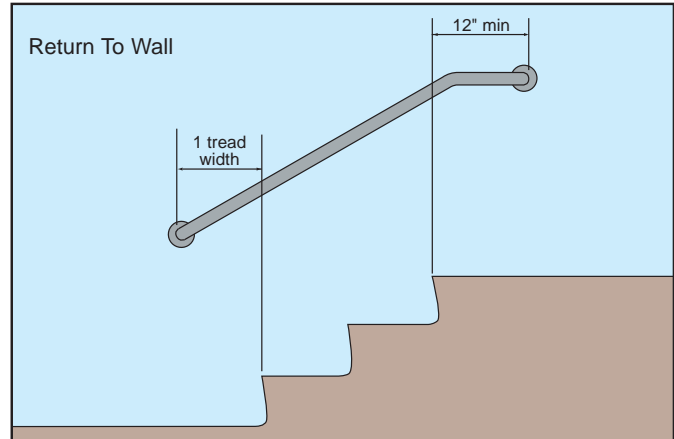
Railing Extensions

505.10.2 Top Extension at Stairs. At the top of a stair flight, handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beginning directly above the first riser nosing. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight.

505.10.3 Bottom Extension at Stairs. At the bottom of a stair flight, handrails shall extend at the slope of the stair flight for a horizontal distance at least equal to one tread depth beyond the last riser nosing. Extension shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent stair flight.

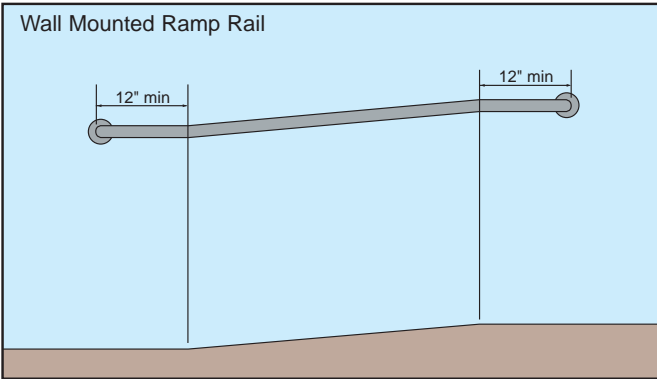
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505.10.1 Top and Bottom Extension at Ramps. Ramp handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. Extensions shall return to a wall, guard, or the landing surface, or shall be continuous to the handrail of an adjacent ramp run.



Handrail Continuity

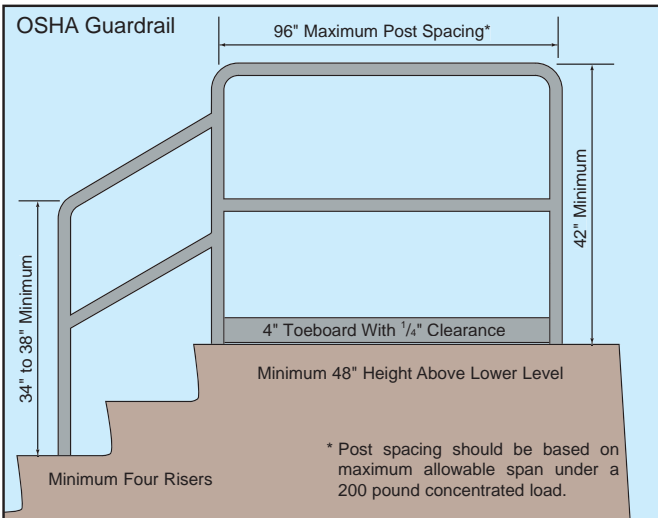
Gripping surfaces shall be continuous, without interruption by newel posts, other construction elements, or obstructions.



FOR MORE INFORMATION

For current information on accessibility issues, refer to our website at www.wagnercompanies.com. You can also access current information at the ICC web site – www.intlcode.org – and The Access Board’s site at www.access-board.gov.

OSHA STANDARD PIPE RAILING



1910.23 Guarding Floor and Wall Openings and Holes

- (e)(1) A standard railing shall consist of a top rail, intermediate rail, and posts, and shall have a vertical height of 42" nominal from upper surface of top rail to floor, platform, runway or ramp level.
- (e)(3)(i) For pipe railings, posts and top and intermediate railings shall be at least 1 1/2 inches nominal diameter with posts spaced not more than 8 feet on centers.
- (e)(3)(v) The anchoring of posts and framing of members for railings of all types shall be of such construction that complete structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail.
- (e)(4) A standard toeboard shall be 4 inches nominal from its top edge to the level of the floor, platform, runway or ramp. It shall be securely fastened in place and with not more than 1/4" above floor level.
- (c)(4) The railing shall be provided with a toeboard wherever, beneath the open sides,
 - (i) Persons can pass
 - (ii) There is moving machinery, or
 - (iii) There is equipment with which falling materials could cause a hazard.



RAILING FORMULAS

The following railing formulas may be used to determine maximum post spacing under a uniform load and stress at the base of the post under a concentrated load. Consult your local code to determine your structural requirements.

Uniform Load:

$$L = \frac{f_s \times S}{w/12 \times h}$$

Result will provide you with the maximum allowable span between the post centerlines.

Concentrated Load:

$$f = \frac{F \times h}{S}$$

Result will provide you with the stress at the base of the post. Compare to *Allowable Stress* for the aluminum alloy to determine its suitability.

- L = Span between center-line of posts (inches)
- f = Unit Stress (psi)
- f_s = Allowable Stress (psi)
- S = Section Modulus (in³)
- w = Uniform Load (lb/ft)
- F = Concentrated Load (lb)
- h = Post Height (inches)

Load Distribution:

In pipe railing load distribution is fairly uniform. On railings having two or fewer spans, multiply the concentrated load (F) by .85 for end posts and .65 for intermediate posts. On railings having three or more spans, multiply the concentrated load (F) by .84 for end posts and .60 for intermediate posts.

Aluminum Alloy	Allowable Stress (psi)	Minimum Yields (psi)	Modulus of Elasticity (psi x 10 ⁶)
6061-T6 pipe	24,000	35,000	10.0
6063-T6 pipe	18,000	25,000	10.0

Pipe Size	Schedule	Outside Diameter	Inside Diameter	Wall	Section Modulus
1 1/2"	40	1.900"	1.610"	.145"	.326 in ³
1 1/2"	80	1.900"	1.500"	.200"	.412 in ³

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The following information is based on information compiled by the National Ornamental and Miscellaneous Metals Association (NOMMA) as of June 2004.

Municipal and state authorities generally do not write their own code. They use these model codes and guidelines to create documents for use in their local jurisdictions.

Not all fabrications need to meet building codes. Some installations may be considered ornamental in nature.

Wagner manufactures products that will meet building codes and standards – when properly detailed and fabricated – however not all products in **Wagner’s** inventory are suitable for all applications or codes. It is imperative that you familiarize yourself with local code requirements prior to specifying or purchasing any products in this catalog.

Guardrail Location Requirements

IRC 2000	30 inch (762mm) above floor or grade below.
IRC 2003	R312.1 Guards required. Porches, balconies or raised floor surfaces located more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 36 inches (914mm) in height. Open sides of stairs with a total rise of more than 30 inches (762 mm) above the floor or grade below shall have guards not less than 34 inches (864 mm) in height measured vertically from the nosing of the treads. Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below. Open-sided walking surfaces, mezzanines, industrial equipment platforms, stairways, ramps and landings more than 30 inches (762mm) above floor or grade below. Also located along glazed sides of stairways, ramps and landings that are located more than 30 inches (762mm) above floor or grade below where the glazing provided does not meet the strength and attachment requirements in Section 1607.7 Live Load. Amended to add the following: IBC 2001 Exemption 2: The height in assembly seating areas shall be in accordance with Section 1008.12. Amended to add the following: IBC 2003 Exemption 7. In assembly seating where guards in accordance with Section 1024.14 are permitted and provided.

Handrail Location Requirements

IRC 2000	Handrails required on at least one side of ramps exceeding a slope of 1:12. Handrail required on at least one side of stairway.
IRC 2001	Handrail required on at least one side of stairway with two or more risers.
IRC 2003	Handrails shall be provided on at least one side of each continuous run of treads or flight with four or more risers.
IBC 2000	Handrails required on both sides of stairs and ramps.
IBC 2001	Amended to add the following: Aisle stairs complying with Section 1008 provided with a center handrail need not have additional handrails.

Handrail Location Requirements (Continued)

IBC 2003	1009.11 Handrails. Stairways shall have handrails on each side. Handrails shall be adequate in strength and attachment in accordance with Section 1607.7. Handrails for ramps, where required by Section 1010.8, shall comply with this section. Exceptions: 1. Aisle stairs complying with Section 1024 provided with a center handrail need not have additional handrails. 2. Stairways within dwelling units, spiral stairways and aisle stairs serving seating only on one side are permitted to have a handrail on one side only. 3. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails. 4. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require handrails. 5. Changes in room elevations of only one riser within dwelling units and sleeping units in Group R-2 and R-3 occupancies do not require handrails.
ANSI A117.1	Handrails required on both sides of stairs and ramps. EXCEPTION: Aisle stairs and aisle ramps provided with a handrail either at the side or within the aisle width.
ADAAG	Ramps - both sides, if rise exceeds 6 inches or a horizontal length more than 72 inches. Not required next to seating in assembly areas. Stairs - both sides.

[IRC – International Residential Code](#)
[IBC – International Building Code](#)
[ANSI – American National Standards Institute](#)
[ADAAG – Americans With Disabilities Act Accessibility Guidelines](#)

Live Load, Uniform

IRC 2000	50 lbs/ft
IRC 2003	200 lb. Uniform Live Load. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.
IBC 2000	50 lbs/ft in any direction (handrails and guards).
IBC 2003	Handrail assemblies and guards shall be designed to resist a load of 50 plf (0.73 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure. 1607.7.1.2 Components. Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds (0.22 kN) on an area equal to 1 square foot (0.093m ²), including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of Section 1607.7.1 or 1607.7.1.1.

Live Load, Concentrated

IRC 2000	200 lbs
IRC 2003	200 lb Uniform Live Load. A single concentrated load applied in any direction at any point along the top.
IBC 2000	200 lbs In any direction (handrails and guards).
IBC 2003	Handrail assemblies and guards shall be able to resist a single concentrated load of 200 pounds (0.89 kN), applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building.
ANSI A117.1	250 lbs (grab bars for toilets, tubs and showers)

Allowable Opening, Maximum

IRC 2000	4" sphere – general; 6" sphere – at triangle formed by riser, tread and bottom rail. Required guards shall not be constructed with horizontal rails or other ornamental pattern that results in a ladder effect.
IRC 2001	4" sphere – general; 6" sphere – at triangle formed by riser, tread and bottom rail. <i>Ladder Effect</i> removed.
IRC 2003	R312.2Guard opening limitations. Required guards on open sides of stairways, raised floor areas, balconies and porches shall have intermediate rails or ornamental closures which do not allow passage of a sphere 4 inches (102mm) or more in diameter. Exceptions: 1. The triangular openings formed by the riser, tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6 inches (152 mm) cannot pass through. 2. Openings for required guards on the sides of stair treads shall not allow a sphere 4 $\frac{3}{8}$ inches (107mm) to pass through.
IBC 2000	4" sphere – general – to a height of 34"; 6" sphere – at triangle formed by riser, tread and bottom rail; 8" sphere from a height of 34" to 42" Exceptions: 21" sphere for elevated walk for electrical, mechanical and plumbing systems and Group I-3, F, H, or S occupancies, balusters, horizontal intermediate rails or other construction.
IBC 2003	3. In areas which are not open to the public within occupancies in Group I-3, F, H or S, balusters, horizontal intermediate rails or other construction shall not permit a sphere with a diameter of 21 inches (533 mm) to pass through any opening.4. In assembly seating areas, guards at the end of aisles where they terminate at a fascia of boxes, balconies and galleries shall have balusters or ornamental patterns such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067mm) above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.

Height Requirements, Minimum for Handrails

IRC 2000	Measured vertically above stair nosings and ramp surfaces: 34" minimum; 38" maximum.
IRC 2003	Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864mm) and not more than 38 inches (965 mm).
IBC 2000	Measured vertically above stair nosings and ramp surfaces: 34" minimum; 38" maximum
ANSI A117.1	Measured vertically above stair nosings and ramp surfaces: 34" minimum; 38" maximum.
ADAAG	38" maximum. ADAAG Advisory: The requirements for stair and ramp handrails in this document are for adults. When children are the principle users in a building or facility (e.g., elementary schools), a second set of handrails at an appropriate height can assist them and aid in preventing accidents. A maximum height of 28 inches (710 mm) measured to the top of the gripping surface from the ramp surface or stair nosing is recommended for handrails designed for children. Sufficient vertical clearance between upper and lower handrails, 9 inches (230 mm) minimum, should be provided to help prevent entrapment.

Height Requirements, Minimum for Guardrails

IRC 2000	36" (residential) – porches, balconies, raised floor surfaces 34" minimum on open side of stairs.
IBC 2000	42" except where top rail also serves as a handrail it shall have a height not less than 34" and not more than 38".
IBC 2001	Amended to add the following: The height in assembly areas shall be in accordance with Section 1008.12.
IBC2003	Amended to add the following: Exemption 2: The height in assembly areas shall be in accordance with Section 1024.14.

Height Requirements (of Guardrails) For Balconies, Galleries & Bleachers

IBC 2000	All portions of the stairway width required for egress capacity are within 30 inches (762mm) of a handrail.
IBC 2003	Intermediate handrails are required so that all portions of the stairway width required for egress capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.

End Details, Handrails

IRC 2000	Ends shall return or shall terminate in newel posts or safety terminals.
IBC 2000	Return to wall, guard or the walking surface or continuous to the handrail of an adjacent stair flight.
ANSI A117.1	Return to wall, guard or the walking surface or continuous to the handrail of an adjacent stair flight.
ADAAG	Return smoothly to walls, post, or floors.

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GENERAL
INFO**Wall Clearance, Handrails**

IRC 2000	1½ inch minimum.
IRC 2003	1½ inch (38mm) minimum between wall and the handrail

IBC 2000	1½ inch minimum.
IBC 2003	Clear space between a handrail and a wall or other surface shall be a minimum of 1.50 inches (38mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

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ANSI A117.1	1½ inch minimum.
ADAAG	1½ inch minimum.

Project from Wall, Handrails

IBC 2000	4.50" maximum.
ANSI A117.1	4.50" maximum.

BUILDING
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IBC 2000	All portions of the stairway width required for egress capacity are within 30" of a handrail.
IBC 2003	Intermediate handrails are required so that all portions of the stairway width required for egress capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.

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Grip Size, Handrails

IRC 2000	Circular shapes: 1.25" minimum 2.625" maximum. Non-Circular: Other shapes that provide an equivalent grasping surface are permissible. Edges shall have .125" minimum radius.
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IRC 2001	Type 1: Circular shapes: 1.25 inch minimum 2.625" maximum. Type 2: Handrails with a perimeter greater than 6.25" shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of .750" vertically from the tallest portion of the profile and achieve a depth of at least .031" within .875" below the widest portion of the profile. This required depth shall continue for at least .375" to a level that is not less than 1.75" below the tallest portion of the profile. The minimum width of the handrail above the recess shall be 1.25" to a maximum of 2.75". Edges shall have a minimum radius of .010".
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IRC 2003	Type I. Handrails with a circular cross section shall have an outside diameter of at least 1¼ inches (32mm) and not greater than 2 inches (51 mm). If the handrail is not circular it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6¼ inches (160 mm) with a maximum cross section of dimension of 2¼ inches (57 mm). Type II. Handrails with a perimeter greater than 6¼ inches (160mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of ¾ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of at
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Grip Size, Handrails (continued)

	least 5/16 inch (8mm) within 7/8 inch (22mm) below the widest portion of the profile. This required depth shall continue for at least 3/8 inch (10mm) to a level that is not less than 1 3/4 inches (45 mm) below the tallest portion of the profile. The minimum width of the handrail above the recess shall be 1 1/4 inches (32 mm) to a maximum of 2 3/4 inches (70mm). Edges shall have a minimum radius of .01 inches (.25 mm).
IBC 2000	Circular shapes: 1.25" minimum 2" maximum. Non-Circular: Perimeter dimension 4" minimum a 6.25" maximum and 2.25" maximum cross-section. Edges shall have .125" minimum radius.
IBC 2001	No change to dimensions other than following: Edges shall have a minimum radius of .010".
IBC2003	1009.11.3 Handrail graspability. Handrails with a circular cross section shall have an outside diameter of at least 1.25 inches (32 mm) and not greater than 2 inches (51 mm) or shall provide equivalent graspability. If the handrail is not circular, it shall have a perimeter dimension of at least 4 inches (102 mm) and not greater than 6.25 inches (160 mm) with a maximum cross-section dimension of 2.25 inches (57mm). Edges shall have a minimum radius of .01 inch (.25mm) Exception 3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within 1.50 inches (38 mm) of the bottom of the handrail shall not be considered to be obstructions and provided further that for each .50 inch (13 mm) of additional handrail perimeter dimension above 4 inches (102mm), the vertical clearance dimension of 1.5 inches (38 mm) shall be permitted to be reduced by .125 inch (3 mm).
ANSI A117.1 and ADAAG	Circular shapes: 1 1/4 inch (32mm) minimum; 2 inch (51mm) maximum Non-Circular: Perimeter dimension 4 inch (100mm) minimum and 6 1/4 inch (160mm) maximum and 2 1/4 inch (57 mm) maximum cross-section. Edges shall be "rounded".

Extension Requirements at Ends

IRC 2003	R311.5.6.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1 1/2 inch (38mm) between the wall and the handrails. Exceptions: 1. Handrails shall be permitted to be interrupted by a newel post at the turn. 2. The use of a volute, turnout, starting easing or starting newel shall be allowed over the lowest tread.
IBC 2000	12" horizontally beyond top stair riser. 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. No extension required (residential).
IBC 2003	1009.11.4 Continuity. Handrail-gripping surfaces shall be continuous, without interruption by newel posts or other obstructions. Exceptions: 1. Handrails within dwelling units are permitted to be interrupted by a newel post at a stair landing. 2. Within a dwelling unit, the use of a volute, turnout or starting easing is allowed on the lowest tread. 3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within 1.50 inches (38 mm) of the bottom of the handrail shall not be considered to be obstructions and provided further that for each .50 inch (13 mm) of additional handrail perimeter dimension above 4 inches (102mm), the vertical clearance dimension of 1.50 inches (38 mm) shall be permitted to be reduced by .125 inch (3 mm).
ANSI A117.1	12" horizontally beyond top stair riser. 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. 12" horizontally after slope at bottom. 12" horizontally minimum beyond top and bottom of ramp runs.
ADAAG	12" horizontal at both top and bottom of ramp runs.



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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 then deleted, while 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.

These guide specifications may be downloaded in MSWord or text formats at www.wagnercompanies.com.

[SECTION 05521 -- SERIES 500 NON-WELDED PIPE] [SECTION 05521 - - SERIES 550 NON-WELDED PIPE] [SECTION 05521 -- SERIES 900 ALUMINUM] [SECTION 05521 -- SERIES 950 ALUMINUM] [SECTION 05720 - (J.G. BRAUN ARCHITECTURAL GLASS)] [HANDRAILS AND RAILINGS] [SECTION 05720 -- HANDRAILS AND RAILINGS WITH (HORIZONTAL) (VERTICAL) CABLE RAILING COMPONENTS]

PART 1 - GENERAL

Section 1.01 WORK INCLUDED

- A. Furnish and install [aluminum] [brass] [bronze] [stainless steel] [steel] [pipe] [tube] railings and [horizontal] [vertical] cable railing components.
- B. WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS
 - 1. Furnish [anchors] [fabrications] to be cast in concrete to Section [03001 - Concrete] [03300 - Cast-in-Place Concrete].
 - 2. Furnish [anchors] [fabrications] for embedding in masonry to Section [04300 - Masonry Unit System] [_____].
 - 3. Furnish anchors for placement in [_____] walls to Section [_____ - _____].
- C. RELATED WORK
 - 1. Concrete: _____
 - 2. Cast-in-Place Concrete: _____
 - 3. Unit Masonry Systems: Grout
 - 4. Metal Finishes: _____
 - 5. Metal Fabrications: Welding Methods
 - 6. Metal Stairs: Handrailing at Stairs
 - 7. Rough Carpentry: _____
 - 8. Finish Carpentry: Wood Stairs
 - 9. Wood Stairs and Railings
 - 10. Painting: Paint Finish

Section 1.02 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. .
- 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.

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- 2. A 36 Carbon Structural Steel
- 3. A 53 Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless
- 4. A 108 Steel Bars, Carbon, Cold Finished, Standard Quality
- 5. A 269 Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- 6. A 276 Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
- 7. A 312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
- 8. A 320 Alloy Steel Bolting Materials for Low Temperature Service
- 9. A 500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- 10. A 512 Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing.
- 11. A 554 Welded Stainless Steel Mechanical Tubing
- 12. A 582 Free Machining Stainless and Heat Resisting Steel Bars.
- 13. A 743 Specification for Corrosion-Resistant Iron Chromium, Iron Chromium-Nickel, and Nickel Base Alloy Castings for General Application.
- 14. A1264-1 Safety Requirements for Workplace Floor and Wall Openings, Stairs and Railing Systems
- 15. B 43 Specification for Standard Sizes of Seamless Red Brass Pipe.
- 16. B 211 Aluminum and Aluminum Alloy Bar, Rod and Wire
- 17. B 221 Specification for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.
- 18. B 429 Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- 19. B 455 Specification for Copper-Zinc-Lead Alloy (Leaded Brass) Extruded Shapes.
- 20. B 483 Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
- 21. C 595 Specification for Blended Hydraulic Cements.
- 22. D 1730 Recommended Practices for Preparation of Aluminum and Aluminum Alloy Surfaces for Painting.
- 23. E 84 Test Method for Surface Burning Characteristics of Building Materials.
- 24. E 894 Standard Test Methods for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
- 25. E 935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- 26. E 985 Specification for Permanent Metal Railing Systems and Rails for Buildings
- G. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
- H. 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.
- I. 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.
- J. International Code Council (ICC)
 - 1. International Building Code (IBC)
 - 2. International Residential Code (IRC)
- K. Military Specifications (MIL)
 - 1. MIL-A-46104 Aluminum Alloy Extruded Rod, Bar, and Shapes, 7001.
 - 2. MIL-C-5688 Pre-Stretching and Proof-Testing of Wire Rope Assemblies
 - 3. MIL-P-1144 Pipe, Corrosion Resistant, Stainless Steel, Seamless or Welded.
 - 4. MIL-P-25995 Pipe, Aluminum Alloy, Drawn or Extruded.
 - 5. MIL-R-36516 Rail, Restraint.
 - 6. MIL-W-87161 Wire Strand, Non-Flexible, for Aircraft Control. Oil Free Condition.
- L. National Association of Architectural Metal Manufacturers (NAAMM)
 - 1. Metal Finishes Manual
 - 2. Pipe Railing Manual

3. Stair Manual
- M. National Fire Protection Association (NFPA)
 1. 101 Life Safety Code
- N. National Ornamental and Miscellaneous Metals Association (NOMMA)
 1. Metal Rail Manual
- O. National Institute of Building Sciences
 1. Metric Guide for Federal Construction
- P. Society of Automotive Engineers (SAE)
 1. SAE/AMS QQ-S-763 Steel Bars, Wire, Shapes and Forgings; Corrosion Resistant.

Section 1.03 REQUIREMENTS

- A. Check governing codes for requirements.
 1. [Handrail] [and wall rail] [Guardrail] assemblies and attachments shall withstand a minimum uniform load of _____ pounds applied horizontally or vertically down at any point on the top rail.
- OR -
 1. [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.
 2. Guardrail intermediate rails, balusters, panel fillers, posts or cables 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.
 3. Railing frame components and cable hardware shall be designed to withstand loads encountered without excessive deflection or distortion when cables are tensioned to conform to building code requirements.

Section 1.04 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].
- D. Submit samples of the following:
 1. _____

Section 1.05 QUALITY ASSURANCE

- A. Qualifications:
 1. Furnish references listing projects of similar size and scope
- B. Regulatory Requirements:
 1. Components and installation are to be in accordance with state and local code authorities
 2. Components and installation are to follow current ADA and ICC/ANSI A117.1 guidelines.
- C. Certifications
 1. Furnish certification that all components and fittings are furnished by the same manufacturer or approved by the primary component manufacturer.
 2. Furnish certification that components were installed in accordance to the manufacturer's engineering data to meet the specified design loads.
- D. Pre-Installation Meeting
 1. Prior to the beginning of work, conduct a pre-job conference at the job site.
 2. Provide seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the fabricator, building owner's representative, architect and subcontractors whose work interfaces with the work of this section.
 3. Review the specifications to determine any potential problems, changes, scheduling, unique job site conditions, installation requirements and procedures and any other information pertinent to the installation.
 4. Record the results of the conference and furnish copies to all participants.

Section 1.06 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.

3. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 – PRODUCTS**Section 2.01 ACCEPTABLE MANUFACTURER**

- A. Railing [pipe] [tube] and components shall be as manufactured or supplied by The Wagner Companies.; P.O. Box 423; Butler, WI 53007. Phone: 888-243-6914. Fax: 414-214-0550. Web site: www.wagner-companies.com. E-mail: info@mailwagner.com.

Section 2.02 MATERIALS AND FINISHES

- A. Aluminum:
 1. Extruded Pipe: Alloy 6063-T6 meeting ASTM B 221
 2. Extruded Bars, Shapes and Mouldings: [Alloy 6063-T52] [Alloy 6063-T6] meeting ASTM B 221
 3. Castings: Almag 35 meeting ASTM B 26
 4. Finish (refer to NAAMM Metal Finishes Manual):
 5. 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)]
 6. 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. Cable: MIL-W-97161, Type II, Composition B
 3. Cable Hardware: ASTM A 276 and A 479, SAE/AMS QQ-S-763, Type 316
 4. Finish: [Ornamental Grade, AISI No. 4] [AISI No.____].
 5. [_____]
- C. Copper Alloys:
 1. Drawn Pipe: C23000 (Red Brass) meeting ASTM B 43
 2. Drawn Tube: C27000
 3. Castings: [C86500 meeting ASTM B 584 for sand castings]
 4. Extrusions: [C38500 (Architectural Bronze) meeting ASTM B 455] [C33000]
 5. Finish (refer to NAAMM Metal Finishes Manual):
 6. Mechanical: [M32-Medium Satin] [M - _____]
 7. Chemical: C _____ - _____
 8. Coating: [Clear Organic: O _____ - _____] [Laminated: L _____ - _____] [Wax: _____] [Oil: _____]
- D. Steel:
 1. Pipe: meeting ASTM A 53
 2. Tubing: meeting ASTM A 512
 2. Bars and Shapes: meeting ASTM A 36.
 3. Castings: [Malleable] [Ductile] [Cast] Iron meeting ASTM [A 47]
 4. Painted finish shall be _____ type and _____ color.

Section 2.03 RAILING SYSTEM**(WAGNER ARCHITECTURAL GLASS RAIL SYSTEM)**

- A. Material shall conform to 2.02. and be finished in accordance with 2.02.
- B. Railing system shall be [surface] [flush] [fascia] mounted.
- C. Rails
 1. Fabricate rails from [aluminum] [bronze] [brass] [stainless steel] Wagner No. _____
- D. Posts
 1. Fabricate posts from [_____] inch outside diameter by [_____] inch wall [aluminum] [bronze] [brass] [stainless steel] tubing.
- E. Glass Structural Balustrade shall be [1/2] [3/4] inch tempered glass and conform to the safety requirements of ANSI Z97.1.
- F. Shoe Moulding
 1. Extruded aluminum alloy Wagner No. _____
- G. Cladding [aluminum] [brass] [stainless steel], Wagner No. ____.
- H. Fittings
 1. Fittings shall be of wrought material of [aluminum] [bronze] [brass] [stainless steel]. Miter elbows shall be of welded construction.
- I. Glazing Accessories
 1. Setting block shall be Wagner No. [GR9392] [GR9393].
 2. Protective insert shall be of polyvinyl chloride (PVC); Wagner No. GR9394

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3. [Filler: Type _____ ; Color: _____] [Glass Wedge] [GR9500] [GR9750]
4. Shoe Moulding insert [GR9396] [GR9398]
 - OR -

(ULTRA-TEC CABLE RAILING)

Specify horizontal or vertical cable railing system required for the specific application. When using horizontal cable railing, vertical elements should be specified with the thicker components. When using vertical cable railing, top and bottom rails should be specified with the thicker components. Delete choices not required. The cable railing system can be custom designed.

- A. Material shall conform to 2.02 and be finished in accordance with 2.02
- B. [Horizontal] [Vertical] Stainless Steel Cable Railing System: Ultra-tec Railing System.

Specify either Decorail or Contempo Rail style railing frame components in either carbon steel or stainless steel. Delete choices not required.

- C. Style: Decorail.
 1. Members: [1¼" pipe] [1½" pipe] [2" pipe]
 - OR -

- C. Style: Contempo Rail
 1. Members: [3 inch x 1 inch rectangular structural tubing] [2 inch x 1 inch rectangular structural tubing] [2 inch x 2 inch square structural tubing.]

Delete the bottom rail if not required. For the rails and posts, specify pipe for the Decorail style railing frame components and specify structural tubing and structural tees for the Contempo Rail style.

- D. Top Rail [and Bottom Rail]: [Schedule (40) (80) pipe] [Minimum (.120) (.188) inch wall thickness round or structural tubing].

- E. Intermediate Posts:
 1. [Schedule (40) (80) pipe] [Minimum (.120) (.188) inch wall thickness round or structural tubing] [Minimum .187 inch wall thickness 2 inch x 1 inch structural tee].
 2. Maximum Spacing: [_____ inches] [as indicated on drawings.]
 3. Connect top rail to mounting surface.

- F. End Posts: [Schedule (80) (160) pipe] [Minimum .250 inch wall thickness 2 inch x 2 inch structural tubing] [Minimum .250 inch wall thickness 2 inch x 2 inch square tubing with 2 inch x 2 inch x ¼ inch bar size tee] [Two pieces of rectangular structural tubing, 2 inch x 1 inch with minimum .120 inch wall thickness, placed in tandem, separated by a minimum 5/8 inch diameter spacer] [Two pieces of rectangular structural tubing, 3 inch x 1 inch with minimum .120 inch wall thickness, placed in tandem, separated by a minimum 5/8 inch diameter spacer].

- G. Corner Posts:
 1. When Radiused Tubes Are Used: [Minimum Schedule 40 pipe] [Minimum .120 inch wall round or structural tubing].
 2. Single Post Corner: [Schedule (80) (160) pipe] [minimum .250" wall thickness 2 inch x 2 inch square tubing] [As indicated on drawings].

- H. Welded Receiver: [ASTM A 108, Type 1018 carbon steel] [Type 304 stainless steel]. Weld into outside wall of an end post. Hide weld by grinding welded surface to original contour.

- I. Welded Tab: [ASTM A 108, Type 1018 carbon steel] [Type 304 stainless steel]. Weld into outside wall of an end post. Hide weld by grinding welded surface to original contour.

- J. Invisiware Threaded Tab: Screws into drilled and tapped hole in the inside wall of an end post.

- K. Rail Height: [36 ½"] [42 ½"] [As indicated on the drawings].

- L. Pipe Railing End Post Transition to Top Rail: [Miter] [Radius] [Overhung] [As indicated on the drawings].

- M. Post Mounting: [Foot mounting] [6 inch extension into concrete] [As required for fascia mounting] [As indicated on the drawings].

- N. Intermediate Cable Braces: for horizontal cable railing
 1. Type: 1-piece.
 2. Size: ¼" x 1"
 3. Spacing: As indicated on the drawings.
 4. Material: [steel] [stainless steel]
 - OR -

- N. Intermediate Rail Braces: for vertical cable railing
 1. Material: .625 inch diameter x .120 inch wall thickness [Type 4130 Chrom/Moly tubing] [seamless stainless steel tubing]
 2. Spacing: [Maximum 26 inches on center between end and/or intermediate posts] [As indicated on the drawings]

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- O. Finish:
 1. [Mill] [Primed] [Primed and painted] [Powder coated].
 2. Apply final finish before installation of cable hardware and cables.
- P. Grommets:
 1. Material: UV-resistant HDPE.
 2. Cable Grommets: Provides barrier to abrasion of intermediate posts and cable braces bored for cables.
 3. Color: Black
 - OR -

Specify the following if railing frame components are wood instead of metal. Consult Wagner for additional information regarding wood railing frame components. The Wagner Companies. does not provide wood railing frame components. Refer to Section 06430 - Wood Stairs and Railings.

- C. Wood Railing Frame Components: As specified in Section 06430.
 - OR-

(ORNAMENTAL RAILINGS)

- C. Material shall conform to 2.02. and be finished in accordance with 2.02.

- D. Rails [and Posts]
 1. Fabricate [rails] [posts] [spindles] from [anodized] [painted] [aluminum] [bronze] [brass] [steel] [stainless steel] [wood] [Wagner No. _____]
 2. Railing Width: _____.
 3. Railing Cross Section Height: _____; Wagner No. _____.
 4. Railing End Style: _____, Wagner No. _____.

- E. Posts [and Spindles]
 1. Fabricate [posts] [spindles] from [anodized] [painted] [aluminum] [bronze] [brass] [steel] [stainless steel] [Wagner No. _____]

- F. Newel Posts:
 1. Wagner No.: _____.
 2. Height: _____.

- G. Balusters:
 1. Wagner No.: _____.
 2. Height: _____.

- H. Shoes and Knuckles:
 1. Wagner No.: _____.

- I. Scrolls:
 1. Wagner No: _____.

- J. Rosettes, Leaves, and Ornaments:
 1. Wagner No.: _____.
 2. Diameter: _____.
 3. Dimensions: _____.
 4. Member Thickness: _____ by _____.

- K. Finials, Baskets, and Spears: Ornamentation for vertical members.
 1. Wagner No.: _____.
 2. Dimensions: _____.

- L. Fittings
 1. Fittings are to be of a cast alloy to best match the color of the handrail alloy
 - OR-

- A. Material shall conform to 2.02. and be finished in accordance with 2.02.

- B. Railings:
 1. Baluster and Rail Configuration: Baluster connected to rail at top, substrate at bottom.
 2. Baluster and Rail Configuration: Baluster connected to rail at top, horizontal member at bottom, above substrate.
 3. Baluster and Rail Configuration: Baluster connected to horizontal member at top, below railing, and horizontal member at bottom, above substrate.
 1. Guard Rails: 42 inches (1067 mm) high to top of railing.
 2. Stairs: 34 inches (1067 mm) high to top of railing from nosing of stair tread.

- C. Ramps: _____ inches (1067 mm) high to top of railing.
- D. Baluster Spacing: _____ on center.
- E. Handrail Extension, Top and Bottom of Stairs: Comply with requirements of authorities having jurisdiction.
- F. Newel Post: Provide newel post at each end of railing and at _____ on center in railing run.
- G. Scrolls, Rosettes, Finials, and Other Ornaments and Fittings: Locate at _____.
- H. Shoes and Knuckles: Provide on every member, at bottom.

Section 2.05 FASTENERS

- A. All mechanical fasteners used in the assembly of stainless steel or aluminum railings shall be manufactured from stainless steel.
- B. Exposed mechanical fasteners for use with bronze materials shall be manufactured from yellow brass.
- C. Cement: Hydraulic, ASTM C 595, factory prepared with accelerator.

Section 2.06 CABLES AND CABLE HARDWARE

- A. Cables:
 1. Material: 1 x 19 Type 316 stainless steel strand.
 2. Compliance: MIL-W-87161, Type II, Composition B, Construction 1 right-hand lay or Construction 2 left-hand lay.

Fill-in the minimum breaking strength of the cable as found in Wagner product information. The minimum breaking strength depends on the cable diameter and cable construction.

- a) Minimum Breaking Strength, MIL-C-5688: _____ pounds.
- b) Diameter: _____.
- c) Orientation: [Horizontal] [Vertical] [Slope parallel to stair pitch] [As indicated on the drawings].
- d) Spacing: As indicated on the drawings
3. Finish: [Mill] [PVC coated: PVC coating Color: (_____)] (As indicated on the drawings).

B. Cable Hardware, General:

1. Stainless Steel: ASTM A 276 and A 479, SAE/AMS QQ-S-763, Type 316 stainless steel.
2. Swaging: Swage hardware onto ends of cables [in manufacturer's shop] [in field, using manufacturer's recommended methods] [as indicated on the drawings].

C. Cable Hardware Components:

1. Swaging Ferrule: Retains nonadjustable and adjustable clevis fittings onto cables.
2. Swaging Stud: Use with receiver to provide a means of tensioning cables. Use with welded receiver to connect to end post, non-tensioning end. Threaded surface treated with baked-on moly-based surface treatment to prevent thread galling and sticking.
3. Receiver: Invisiware Receiver. Allows tensioning hardware to be hidden within end post.
4. Nonadjustable Clevis Fitting: Fixed Jaw. Held onto cables by swaging ferrule. Connects to end post by means of welded tab or hole drilled in tee.
5. Adjustable Clevis Fitting: Adjust-A-Jaw. Provides a considerable amount of take-up in cables. Connects to end post by means of welded tab or hole drilled in tee.
6. Adjustable Fitting: Adjust-A-Jaw Body and Nut with Threaded Bolt: Screws into a drilled and tapped hole in the inside wall of an end post.
7. Radius Ferrule: Nonadjustable. Attaches cable to post with hardware hidden inside post.

Specify the following cable hardware if railing frame components are wood instead of metal. Consult Wagner for additional information regarding wood railing frame components.

A. Cable Hardware For Use With Wood Railing Frame Components:

1. Material: ASTM A 276 and A 479, SAE/AMS QQ-S-763, Type 316 stainless steel.
2. Swaging: Swage hardware onto ends of cables [in manufacturer's shop] [in field using manufacturer's recommended methods] [as indicated on the drawings].
3. Swaging Ferrule: Retains nonadjustable and adjustable clevis fitting onto cables.
4. Swaged Ferrule with Flat Washers: Retains washers on cables placed into counterbore. Use with counterbored hole in end post. Hanger Bolt Fitting: Screw lag threaded end into end post. Expose fine screw thread for mating with body section of adjustable clevis fitting and lock nut.
6. Lag Eye Fitting: Screw lag threaded end into end post. Expose paddle-shaped eye to accommodate nonadjustable or adjustable clevis fitting.
7. Swaging Stud: Use with receiver. Provides a means of tensioning cables in as small an area as is feasible.
8. Receiver: Invisiware Receiver. Allows tensioning hardware to be hidden within end post. Use with [1/4"] [3/16" thick] x 1 inch wide flat bar attached to outside of end post with stainless steel flat head screws. Use with washer to place into counterbore. Use with counterbored hole in end post.
9. Nonadjustable Clevis Fitting: Fixed Jaw. Held onto cables by swaging ferrule.

10. Adjustable Clevis Fitting: Adjust-A-Jaw Tensioner. Provides a considerable amount of take-up in cables. Held onto cables by swaging ferrule.
11. Radius Ferrule: Nonadjustable. Attaches cable to post with hardware hidden inside post.

Section 2.07 HANDRAIL BRACKETS

- A. [Aluminum] [Bronze] [Stainless steel]; [cast] [extruded] [stamped] [machined]: Wagner No. _____

Section 2.08 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**Section 3.01 PREPARATION**

- A. Supply items to be [cast in concrete] [embedded in masonry] [placed in partitions].
- B. Examine areas to receive cable railing system. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

Section 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].

Section 3.03 INSTALLATION

- A. Install in accordance with shop drawings [and manufacturer's instructions] at locations indicated on the drawings.
- B. Erect work [square and level,] [horizontal or parallel to rake of steps or ramp,] rigid, [and] free from distortion or defects detrimental to appearance or performance.
- C. Anchor cable railing system to mounting surface as indicated on the drawings.
- E. Use manufacturer's supplied cable hardware.
- F. Terminate and tension cables in accordance with manufacturer's instructions.
- G. Tension cables to a minimum of 400 pounds each in sequence in accordance with manufacturer's instructions.
- H. Ensure cables are clean, parallel to each other and without kinks or sags.
- I. Adjust cables and cable hardware as required to provide properly installed cable railing system as directed by Architect.
- J. Expansion joints shall be provided as needed to allow for thermal expansion or contraction.

Section 3.04 PROTECTION

- A. Protect cable railing system and finish from damage during construction.

Section 3.05 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.
- D. Finish must not be removed from anodized aluminum. Reanodizing can only be done by removing railing and returning it to the anodizer.

Section 3.06 REPAIR OF DEFECTIVE WORK

- A. Remove stained or otherwise defective work and replace with material that meets specification requirements.
- B. Repair damaged finish as directed by Architect.
- C. Replace defective or damaged components as directed by Architect.