OVERVIEW OF FEATURES

Railing frame components can be specified in a variety of materials: steel and stainless steel pipe; stainless steel flat bar; structural tubing; and wood. Please note that the Ultra-tec® Cable Railing System is not recommended for use with aluminum pipe or tube.

Type 316 stainless steel cable and hardware are used. Due to the increased amounts of nickel and the addition of molybdenum, type 316 stainless steel has excellent resistance to atmospheric and corrosive conditions.

Ultra-tec’s® exclusive Invisiware® hardware is hidden inside the end posts making it virtually invisible. We also offer hardware that is visible when installed but with smooth, rounded corners. More compact than awkward turnbuckles intended for other uses, all hardware has been designed specifically for pedestrian cable railings.

All Ultra-tec® Cable Railing System hardware can be swaged in the field by using one of our portable swaging tools. Swaging in the field permits intermediate post and braces to be bored just slightly larger than the diameter of the cable being used since only the cable will have to pass through. If purchased pre-swaged, the intermediate posts and braces have to be bored to allow for the larger diameter of the swaged fitting to pass through the intermediate post or brace.

If desired, fittings can be swaged onto one or both of the cable ends at the factory. New Ultra-tec Push-Lock fittings simplify installation – requiring only one end be pre-swaged with a tensioner and the other end field cut and assembled.

By using our pre-tensioning tool, runs of up to 150 feet and longer can be achieved while maintaining tight cable tension using Ultra-tec® hardware.

Refer to installation instructions on page 259 to 271.

Note: Due to the effects of thermal expansion and contraction, maximum run for exterior railings is 100 feet.

The Ladder Effect

The 2000 International Residential Code (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 International Building Code (IBC).

The ladder effect was removed from the IRC during the 2001 code cycle and it was noted in the 2001 IRC supplement. The current 2006 IRC and IBC contain no reference to the ladder effect.

However, many 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 will take time for the 2001 IRC supplement and the newer 2003 and 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.

Ultra-tec® Cable Railing System was created to address the deficiencies encountered in using standard tensioning mechanisms for cable barrier railings – sharp edges on retainers; long, bulky fittings; and uneven, hand-crimped shanks. Standard marine turnbuckles and stud fittings with exposed nuts and threads were the norm because that was all that was available – until now.

Exclusive Ultra-tec® Cable Railing Hardware is designed especially for cable railings. Invisiware® terminals can be concealed within the railing end post. These precision machined Type 316 stainless steel fittings are engineered to interface with standard frame components detailed in our Design & Fabrication Guide for Metal Framed Railings. Ultra-tec® railing hardware can be factory swaged by us or field swaged by the customer, using an Ultra-tec® portable swaging tool. New Push-Lock fittings now make field installation even easier.

A Cable Rail Sample Pack is available at a modest cost. It contains: ¼” cable; Invisiware® Receiver, Radius Ferrule, Adjust-A-Body® with Hanger Bolt; Clip-On Stop and Fixed Jaw; Fixed Tab Weld Fitting; Weld Receiver, Grommets, and Threaded Tab. Order Part Number CRSAMPLE.
INVISIWARE® RECEIVER – TENSIONING DEVICE
Type 316 Stainless Steel

A tensioning device is hidden inside the end post with only the head of the Receiver exposed on the outside of the post. The inside is female-threaded to accept the male-threaded Invisiware® Swaging Stud that is attached to the cable. The head of the Receiver is broached for an Allen wrench. To tension the cable, insert the Allen wrench and rotate the Receiver around the male threads on the Swaging Stud. This will draw the Swaging Stud further inside the Receiver as you continue to turn it with the Allen wrench.

Pipe ends are counterbored so the full perimeter of the head of the Receiver will rest on a flat surface in the pipe. The head rests on the outside wall of a flat-sided post. A plastic washer is included and acts as a scratch resistant barrier between the Receiver head and the post.

INVISIWARE® RADIUS FERRULE
Type 316 Stainless Steel

For use on the fixed, non-tensioning end of the cable, often in combination with the Invisiware® Receiver on the tensioning end. When installed, the fitting is hidden inside the end post with only the head exposed on the outside of the end post. Externally, it looks the same as the Invisiware® Receiver, but costs much less.

Pipe ends are counterbored, so the full perimeter of the head of the Radius Ferrule will rest on a flat surface in the pipe. The head rests on the outside wall of a flat-sided post. A plastic washer is included and acts as a scratch resistant barrier between the Radius Ferrule head and the post.

INVISIWARE® SWAGING STUD
Type 316 Stainless Steel

Swaged on the end of the cable, this part is used with the Invisiware® Receiver or the Invisiware® Welded Receiver. When installed, it is completely hidden inside the fitting, so you won’t ever see any unattractive swaging marks. The threaded surface is coated with a baked-on molybdenum based dry film lubricant to prevent the threads from galling when tensioned and in extreme environments.
NEW!
FIELD INSTALLED PUSH-LOCK™ FITTINGS MAKE CABLE RAILINGS EASY TO INSTALL

NO FIELD SWAGING!
Cables come with a tensioner on one end. Install the tensioner on one end post, then cut the cable to length. Slip the Push-Lock fitting into the other end post or mount it with the tab to the outside of the post.

*Push the cable into the Push-Lock fitting, tension the cable and you’re done.*

*Note: Push-Lock Tool Kit is required – see page 60.*

EASY TO ORDER – EASY TO INSTALL
Select the tensioners you wish to use and provide the length of each of your cable runs on the worksheet shown on page 61. The cables will be shipped with tensioners swaged on one end and bare cable on the other end. Pre-cut cable will be approximately 3” longer than required to allow for potential fraying. Cut each cable to a final length on site and push it into the opening in the Push-Lock fitting.

---

**PUSH-LOCK™ FOR LEVEL RUNS**
Type 316 Stainless Steel

![Diagram](Image)

These Push-Lock fittings with rounded ends are used on level runs. They rest in a hole in the end post. When used with an end post 1-1/2" or more in thickness, the Push-Lock fitting is hidden inside the end post with only the head exposed on the outside of the post. Pipe ends are counterbored, so the full perimeter of the head will rest on a flat surface in the pipe. A plastic washer is included and acts as a scratch-resistant barrier between the Push-Lock fitting and a metal post. The head rests on the outside wall of a flat-sided metal post or on a stainless steel washer on a wooden post. For wood applications, also order part number CR716SAE Washer.

---

**PUSH-LOCK™ FOR STAIRS OR SEVERE PITCHES**
Type 316 Stainless Steel

![Diagram](Image)

These fittings have a 5/32-28 threaded eye end and are for use on stairs. They attach to a wood end post with a CRLE6 shown on page 51. For metal posts, use a Fixed Tab or Threaded Tab. Mount with a CRSC6 Screw.

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>Stainless</th>
<th>Use with Screw #</th>
<th>For Wood Post</th>
<th>Use Lag Eye #</th>
<th>Use Fixed Tab #</th>
<th>For Stainless Post</th>
<th>For Steel Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>CRPLTE4</td>
<td>CRSC6</td>
<td>CRLE6</td>
<td>CRFT65B</td>
<td>CRTT6B</td>
<td>CRFT65A</td>
<td></td>
</tr>
<tr>
<td>3/16&quot;</td>
<td>CRPLTE6</td>
<td>CRSC6</td>
<td>CRLE6</td>
<td>CRFT65B</td>
<td>CRTT6B</td>
<td>CRFT65A</td>
<td></td>
</tr>
</tbody>
</table>

---

**SCREWS**
Type 316 Stainless Steel
For use with threaded fittings, as noted.

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>Screw Size</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>5/32-28 x 1/2&quot;</td>
<td>CRSC6</td>
</tr>
<tr>
<td>3/16&quot;</td>
<td>5/32-28 x 1/2&quot;</td>
<td>CRSC6</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>5/32-24 x 1/2&quot;</td>
<td>CRSC8</td>
</tr>
</tbody>
</table>
**INVISIWARE® THREADED TAB**  
Type 316 Stainless Steel  
Here’s a real time and money-saver. The Invisiware® Threaded Tab screws into a drilled and tapped hole on the inside wall of the end post. You save the expense of welding tees or tabs onto your end post, for mounting Adjust-A-Jaw® or Adjust-A-Body™ Tensioners or Ultra-tec® Fixed Jaws.

Recommended only when you are using a minimum schedule 80 pipe end post or a square or rectangular steel end post with a minimum .250” wall.

**INVISIWARE® EXTENDED LENGTH THREADED TAB**  
Extended length, same as above except there is no need to thread the hole in your end post.

Cut to desired length and secure to end post with acorn nut and thread sealant or Lido-Weld Adhesive – see page 39.

**INVISIWARE® FIXED TAB**  
Steel or Stainless Steel  
Welded into an end post to make a strong tab for use in mounting an Adjust-A-Jaw® or Adjust-A-Body™ Tensioner or Ultra-tec® Fixed Jaw. The Invisiware® Fixed Tab is cut to length as necessary, inserted in a hole drilled through the post and welded to the outside wall. The welded surface is then ground to the post’s original contour, thus hiding the weld.

**INVISIWARE® WELDED RECEIVER**  
Steel or Stainless Steel  
A fixed end, non-tensioning device, the Invisiware® Welded Receiver provides a sturdy, threaded receptacle in the end post for an Invisiware® Swaging Stud. The Invisiware® Welded Receiver is cut to length as necessary, inserted in a hole drilled through the post and welded to the outside wall. The welded surface is then ground to the post’s original contour, thus hiding the weld.

**ULTRA-TEC® LAG EYE**  
Type 304 Stainless Steel  

For use with a minimum 4 × 4 nominal wood post.
ADJUST-A-BODY™ WITH THREADED EYE TENSIONER
Type 316 Stainless Steel

Similar to the Adjust-A-Jaw® Tensioner, except it costs a lot less than the clevis-style Tensioner. See the tabulated drawing to determine how to interface this fitting with your end post or use our Fixed Tab or Threaded Tab fittings shown on page 51 of this catalog. Tension with an open-end wrench.

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>E</th>
<th>A</th>
<th>B</th>
<th>S</th>
<th>T</th>
<th>Lt</th>
<th>Ln</th>
<th>Lr</th>
<th>D</th>
<th>Use with Screw #</th>
<th>Use with Ferrule #</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td></td>
<td>.750&quot;</td>
<td>.875&quot;</td>
<td>CRF6</td>
</tr>
<tr>
<td>5/32&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td></td>
<td>.500&quot;</td>
<td>.625&quot;</td>
<td>CRF6</td>
</tr>
<tr>
<td>3/32&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td></td>
<td>.500&quot;</td>
<td>.625&quot;</td>
<td>CRF6</td>
</tr>
</tbody>
</table>

Note: Order ferrule and screw separately.

ADJUST-A-BODY™ WITH HANGER BOLT TENSIONER
Type 316 Stainless Steel

Similar to the Adjust-A-Jaw® Tensioner, except it screws right into your wooden end post. No need for special mounting hardware. A sleek, economical tensioning device that is easy to install, adjusts with an open-end wrench. Now available with a 1½" longer hanger bolt for 1/8" or 5/32" cable.

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>S</th>
<th>T</th>
<th>Ls</th>
<th>Lp</th>
<th>Lt</th>
<th>Loq</th>
<th>Ln</th>
<th>Lr</th>
<th>D</th>
<th>Use with Ferrule #</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td></td>
<td>.750&quot;</td>
<td>CRF6</td>
</tr>
<tr>
<td>5/32&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td></td>
<td>.500&quot;</td>
<td>CRF6</td>
</tr>
<tr>
<td>3/32&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td></td>
<td>.500&quot;</td>
<td>CRF6</td>
</tr>
</tbody>
</table>

Recommended for level runs and when you are using a minimum schedule 80 pipe end post or a square or rectangular steel end post with a minimum .250" wall.

ADJUST-A-BODY™ WITH THREADED BOLT TENSIONER
Type 316 Stainless Steel

Similar to the Adjust-A-Body™ With Hanger Bolt Tensioner, it screws into a drilled and tapped hole in your steel end post and adjusts with an open end wrench. A real money-saver because there is no need for special tees with holes, welded on tabs or any other mounting device — and it’s about half the price of the clevis-style Adjust-A-Jaw® Tensioner.

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>S</th>
<th>T</th>
<th>Ls</th>
<th>Lt</th>
<th>Loq</th>
<th>Ln</th>
<th>Lr</th>
<th>D</th>
<th>Use with Ferrule #</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td>.750&quot;</td>
<td>CRF6</td>
</tr>
<tr>
<td>5/32&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td>.500&quot;</td>
<td>CRF6</td>
</tr>
<tr>
<td>3/32&quot;</td>
<td>.382&quot;</td>
<td>.233&quot;</td>
<td>.229&quot;</td>
<td>.500&quot;</td>
<td>.44&quot;</td>
<td>.25&quot;</td>
<td></td>
<td></td>
<td>.500&quot;</td>
<td>CRF6</td>
</tr>
</tbody>
</table>
ADJUST-A-BODY™ WITH CONCRETE BOLT TENSIONER
Type 316 Stainless Steel

Similar to the Adjust-A-Body™ With Hanger Bolt Tensioner, it screws into a Red Head brand concrete anchor – available from your industrial supplier. It is an easy, practical way to attach your tensioner to a concrete wall. Adjusts with an open end wrench.

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>S</th>
<th>T</th>
<th>Ls</th>
<th>Lt</th>
<th>Loq</th>
<th>Ln</th>
<th>Lr</th>
<th>D</th>
<th>Red Head Brand Anchor* Use with</th>
<th>Stainless</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>1/16</td>
<td>1/16-24</td>
<td>.750&quot;</td>
<td>2.38&quot;</td>
<td>3.44&quot;</td>
<td>.375&quot;</td>
<td>2.75&quot;</td>
<td>.500&quot;</td>
<td>RL-38 SSRM-38 CRF4 CRAJAB6</td>
<td>Stainless</td>
</tr>
<tr>
<td>3/16&quot;</td>
<td>1/16</td>
<td>1/16-24</td>
<td>.750&quot;</td>
<td>2.38&quot;</td>
<td>3.44&quot;</td>
<td>.375&quot;</td>
<td>2.75&quot;</td>
<td>.500&quot;</td>
<td>RL-38 SSRM-38 CRF6 CRAJAB6</td>
<td>Stainless</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>1/16</td>
<td>1/16-20</td>
<td>1.12&quot;</td>
<td>2.50&quot;</td>
<td>3.93&quot;</td>
<td>.500&quot;</td>
<td>3.00&quot;</td>
<td>.625&quot;</td>
<td>RL-12 SSRM-12 CRF8 CRAJAB8</td>
<td>Stainless</td>
</tr>
</tbody>
</table>

CABLE

Cable Construction: 1 × 19, Type 316 stainless steel cable. 1 × 19 construction cable is engineered to hold static loads without stretching and it is relatively stiff. Left hand lay cable for use with all Ultra-tec® Fittings.

Design Parameters and Constraints: Cable has a very high tensile strength and is a suitable in-fill material for a guardrail. Spacing between posts and/or braces should not exceed 42”. Recommended maximum vertical spacing of 3” free opening between cables when they are installed. For most applications, 1/8” diameter cable is recommended.

Other cable constructions can be used, such as 7 × 7 or 7 × 19, but they are rarely recommended because of their elevated levels of stretch and lower breaking strengths in comparison to 1 × 19 construction.

Measuring Cable:
The factory can cut cable and swage fittings on cables up to 60 feet in length.

To measure cable when ordering pre-cut and swaged cable:
- Clearly identify fittings – by part number – that are to be used with the cable.
- For Invisiware® Receiver, Radius Ferrule or Clip-On Stop hardware, measure from back side of the post.
- For Adjust-A-Jaw®, Adjust-A-Body™, Threaded Stud with Welded Receiver or Fixed Jaw hardware, measure from the inside surface of the post.
- For Adjust-A-Jaw®, Adjust-A-Body™ or Fixed Jaw hardware, you may also measure from the center of the mounting hole.
- Measure rail as if all are straight from tensioning post to anchor post. If rail is on a slope, measure on the slope.

Note: Re-spooling charges apply for orders under 5,000 feet.
ADJUST-A-JAW® TENSIONER – CLEVIS STYLE
Type 316 Stainless Steel

The Adjust-A-Jaw® Tensioner is a precision machined, sleek, streamlined tensioning device that is used where a high-tech look is desired. It is suitable for level runs or stair pitches. The clevis portion of the fitting attaches to the end post with a button head socket screw that threads directly into a tapped hole on one side of the clevis fitting.

Unlike common turnbuckles, the Adjust-A-Jaw® Tensioner has no sharp edges, no crevices to collect dust and dirt, no large areas of exposed threads or exposed swaged shanks, and nothing that will scratch or snag. See the tabulated drawing to determine how to interface this fitting with your end post, or use our Fixed Tab or Threaded Tab fittings shown on page 51 of this catalog.

The Clevis has a male thread that mates with the female thread within the Body. The Invisiware® Swaging Ferrule is swaged onto the cable and holds the cable inside the Body. The Body rotates on the cable and provides a considerable amount of take-up during tensioning with an open-end wrench. After tensioning, the Lock Nut locks the assembly in place.

Ultra-tec® FIXED JAW
Type 316 Stainless Steel

Similar in appearance, the Ultra-tec® Fixed Jaw is about one-half the price of the clevis-style Adjust-A-Jaw® Tensioner. Where you do not need a tensioner on both ends of the cable run, the economical Ultra-tec® Fixed Jaw is frequently used on the fixed, non-tensioning end of the cable with the clevis-style Adjust-A-Jaw® Tensioner on the tensioning end.

The Ultra-tec® Fixed Jaw makes a very attractive fitting where a high-tech look is desired on level runs as well as on pitches. The Invisiware® Swaging Ferrule is swaged onto the cable and holds the cable inside the clevis.

See the tabulated drawing to determine how to interface this fitting with your end post, or use our Fixed Tab or Threaded Tab fittings shown on page 51 of this catalog.

Ultra-tec® Clip-on FIXED JAW for pre-swaged cable
Type 316 Stainless Steel

Same as our regular Ultra-tec® Fixed Jaw, except the cable attaches with a special clip that is installed by hand. All fittings are swaged on the cable at the factory, so no field swaging is required. An Adjust-A-Jaw® or Adjust-A-Body™ style tensioner or Invisiware® Receiver is used on the opposite end. Order using part numbers below and check with the factory to determine cable lengths to be provided with swaged fittings. Available for 1/8" and 3/16" cable only. Refer to Clip-On Stop on page 55.
INVISIWARE® SWAGING FERRULE
Type 316 Stainless Steel

The Invisiware® Swaging Ferrule is used to retain an Adjust-A-Jaw® or Adjust-A-Body™ Tensioner or an Ultra-tec® Fixed Jaw onto a piece of cable. When installed, the Ferrule is locked inside the fitting, so you never see unattractive swage marks with an Invisiware® Swaging Ferrule.

ULTRA-TEC® CLIP-ON STOP
Type 316 Stainless Steel

For use in posts with cables cut and fittings attached – preswaged – at the factory. No field swaging is required. A special clip and washer secure the Stop to the end post. Used on the non-tensioning end of the cable. An Adjust-A-Jaw®, Adjust-A-Body™ or Invisiware® Receiver is used on the opposite end to tension the cable. Available for \( \frac{1}{16} \)" and \( \frac{1}{8} \)" diameter cable only. Includes Stop, Washer and Clip. Refer to page 54 for Clip-On Fixed Jaw.

ULTRA-TEC® CABLE GROMMETS

Cable Grommets are offered for popular cable diameters of \( \frac{1}{8} \)", \( \frac{3}{16} \)" and \( \frac{1}{4} \)". They help prevent rust in exterior applications or elsewhere where moisture is a factor by providing a barrier between the cable and the painted or powder coated surface through which the cable is drawn when being installed. Ultra-tec® Cable Grommets are installed – after the paint or powder coating is applied – into holes in intermediate posts, cable braces and – in the case of the Invisiware® Radius Ferrule – into the end post holes through which the cable exits. They are offered in black UV resistant HDPE.

Order Cable Grommets by diameter of cable and post through which the cable will be drawn. Sold in lots of 100. Specify quantity when ordering.

### Cable Grommet Chart

<table>
<thead>
<tr>
<th>Cable Size</th>
<th>Intermediate Post Material Not slotted for Stairways</th>
<th>End Post Material Using Radius Ferrule</th>
<th>Intermediate Post Material Slotted For Stairway Pitch Up To 37 Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1}{8} )&quot; or ( \frac{3}{16} )&quot;</td>
<td>CRGC61100 \ CRGC62100 \ CRGC64100</td>
<td>CRGC63100 \ CRGC64100 \ CRGC64100</td>
<td>CRGC61100 \ CRGC62100 \ CRGC64100</td>
</tr>
<tr>
<td>( \frac{1}{8} )&quot;</td>
<td>CRGC81100 \ CRGC82100 \ CRGC84100</td>
<td>CRGC83100 \ CRGC84100 \ CRGC84100</td>
<td>CRGC81100 \ CRGC82100 \ CRGC84100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate Post Material</th>
<th>Not slotted for Stairways</th>
<th>Square or Rect. Tube</th>
<th>( \frac{1}{8} )&quot; Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRGC61100</td>
<td>CRGC62100</td>
<td>CRGC64100</td>
<td></td>
</tr>
<tr>
<td>CRGC81100</td>
<td>CRGC82100</td>
<td>CRGC84100</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** After Swaged
GLASS RAILING
CABLE RAILING
Spiral Stairs
Balconies
Aluminum Railings
Brass / SS Fittings

PRE-DRILLED POSTS FOR WELDED ASSEMBLY
All posts are custom made based on customer provided, detailed shop drawings. Upon request, Wagner can provide shop drawings — standard charges will apply.

- **End Posts** are drilled through or drilled and tapped on one side for use with Invisiware® Threaded Tab.
- **Intermediate Posts** are provided with through holes.

Wagner can also customize your posts with counterbored holes, coped connections, special bends, or miters. Download a Post Order Form at www.wagnercablerailing.com or Contact Wagner for pricing.

**Material Options:** Steel and Stainless Steel in sizes as indicated. When ordering, note size of cable to be used. Wood posts — minimum 4 x 4 nominal lumber — are supplied by others.

**CABLE BRACES**

1/8" x 1" Cable Braces are used to support the cables between End or Intermediate Posts. They keep the cable from flexing excessively when a load is applied. Cable Braces are attached to the top rail and to the lower mounting surface — either a bottom rail or deck. Download a Cable Brace Order Form at www.wagnercablerailing.com

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Tube Size</th>
<th>Schedule</th>
<th>Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>1.660&quot;</td>
<td>40</td>
<td>.140&quot;</td>
</tr>
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<td>1/8&quot;</td>
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<td>2.375&quot;</td>
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<td>.120&quot;</td>
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<tr>
<td>2&quot; x 2&quot;</td>
<td></td>
<td></td>
<td>.250&quot;</td>
</tr>
</tbody>
</table>

**TYPICAL POST ASSEMBLY CONFIGURATIONS**

These details are some of the more common cable rail configurations. For complete design and fabrication information, please download Product Design and Fabrication Guide for Metal Framed Railings at www.wagnercompanies.com/cablerailing. Cable must be supported every 42" mid run by either a Cable Brace or Intermediate Post.

**RECTANGULAR TUBE POST**

End Post: Double 1" x 3" or 1" x 2" tube separated by stainless steel spacer with Invisiware® Fitting.

Cable Brace: 1/4" x 1" bar with through holes for cable.

Intermediate Post: 1" x 3" or 1" x 2" tube with through hole and grommets.

**SQUARE TUBE POST**

End Post: 2" x 2" tube with 1" x 2" top rail.

Cable Brace: 1/4" x 1" bar with through holes for cable.

Intermediate Post: Double 1" x 2" tube with through hole and grommets.

**Building Code Issues:**

To meet most code requirements restricting guard openings, cables are spaced between 3" and 3 3/8" on center—depending on frame construction.

Refer to page 248 for information regarding the ladder effect.
PIPE OR ROUND TUBE POST

End Post: 1 1/4" (1.660" OD), 1 1/2" (1.900" OD), or 2" (2.375" OD), Schedule 80 pipe.
Cable Brace: 1/4" × 1" bar, notched for pipe with through holes for cable.
Intermediate Post: Schedule 40 pipe with through holes for cable.

90° FORMED ELBOWS

Pipe Size, Tube Size, Height, Steel, Satin Finish

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Tube Size</th>
<th>Height</th>
<th>Steel</th>
<th>Satin Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4&quot;</td>
<td>1.660&quot;</td>
<td>36&quot;</td>
<td>CR166ST36</td>
<td>CR166SS36.4</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>1.900&quot;</td>
<td>36&quot;</td>
<td>CR190ST36</td>
<td>CR190SS36.4</td>
</tr>
</tbody>
</table>

*Note: These elbows have a visible seam. For other elbows refer to pages 165 to 181.

COMPONENTS FOR THE ASSEMBLY OF TUBE CORNER SECTIONS

These stylish tube corner sections allow a change in direction without risk of damage to the cables. At the same time, they offer the streamlined look of a continuous piece of cable – that runs through the tube – and eliminates the cost and visual obstruction of additional mounting and tensioning hardware.

These corner sections are provided as components: elbows, posts and cable tubes. Each post is custom designed per job requirements with holes pre-drilled to accept cable tubes. Posts can also be provided pre-copied and in various styles and angles. All posts are custom made based on customer provided, detailed shop drawings. Upon request, Wagner can provide shop drawings – standard charges will apply.

To use cable tubes, clear holes are drilled in the posts to accept these smaller diameter elbows. The cable tubes are then inserted through the holes and welded into place. The cable may now be inserted through the tube providing a uniquely attractive fabrication.

For complete design and fabrication information, download our Product Design and Fabrication Guide for Metal Framed Railings at www.wagnercablerailing.com.

CABLE TUBE

- Steel and Stainless Steel
- Drill 3/8" through hole in post and chamfer one side for welding
- Insert Cable Tube into pre-drilled posts and weld into place.

90° ELBOW WITH TWO 2" TANGENTS

Pipe Size, Tube OD, Satin Finish

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Tube OD</th>
<th>Steel</th>
<th>Satin Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4&quot;</td>
<td>1.660&quot;</td>
<td>5640</td>
<td>5656</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>1.900&quot;</td>
<td>5670</td>
<td>5690</td>
</tr>
</tbody>
</table>

• Steel and Stainless Steel
• Welded tops and bases
• Manufactured to eliminate distortion
• r = 4"

For other elbows, refer to pages 166 to 180.
MOUNTING PLATES
For installation details and mounting options using these components, refer to Cable Railing Mounting Options and Mounting Hardware Catalog available online or directly from Wagner.

Steel: 1018  Stainless Steel: Type 304

CABLE BRACE FLOOR PLATE
- ¼" Thick
- For ¼" × 1" Cable Braces
- Countersunk for ¼" mounting bolts.
- Weld to cable brace from the back side of the plate

Brace Size  ½" × 1"
Steel  1018  Stainless  Type 304

FASCIA MOUNTING PLATE WITH WELD SLOTS AND FOUR HOLES
- Four 7/16" holes for ¼" mounting bolts.
- Attach to tube with 7/16" weld all around inside of ¼" × 2½" slot.
- Weld to post from the back side.
- Use spacer shown below between posts for double post applications.
- Double posts with 1" spacer will use plate with two slots as noted below.
- 5" high.

FLOOR PLATES WITH CENTER HOLE FOR PIPE
- ¼" Thick
- Countersunk for ¼" mounting screws
- Weld to pipe from the back side

Pipe Size  Tube Size  Double Post With 1" Spacer  Weld Slots  Steel  Stainless
1 1/8" 1.660" 5" 6" 1  CRFAP4  CRFAP4S
1 ½" 1.900" 5" 6" 1  CRFAP4  CRFAP4S
2" 2.375" 6" 7" 1  CRFAP5  CRFAP5S
1" × 3" 4" 5" 1  CRFAP1  CRFAP1S
3" × 3" 1" × 3" 6" 7" 2  CRFAP3  CRFAP3S
1" × 2" 4" 5" 1  CRFAP1  CRFAP1S
2" × 3" 1" × 2" 6" 7" 2  CRFAP3  CRFAP3S
2" × 2" 5" 6" 1  CRFAP2  CRFAP2S

SPACER
Only available in stainless steel. Insert between rectangular tube posts.

Pipe Size  Outside Diameter  a  b  Steel  Stainless
1 1/4" 1.660" 3" 2½" CRFLP1M  CRFLP1MS
1 ½" 1.900" 3" 2½" CRFLP2M  CRFLP2MS
2" 2.375" 3½" 3½" CRFLP3M  CRFLP3MS

FOR SQUARE OR RECTANGULAR TUBING
- Countersunk for ¼" mounting screws.
- Use for square tube or rectangular tube.
- Use spacer shown to the right between posts for double post applications.
- Butt weld to tube.

Pipe Size  Outside Diameter  a  b  Steel  Stainless
1 1/4" 1.660" 3" 2½" CRFAP4  CRFAP4S
1 ½" 1.900" 3" 2½" CRFAP5  CRFAP5S
2" 2.375" 3½" 3½" CRFAP6  CRFAP6S

WASHERS
Available in Stainless Steel and Delrin® plastic.

BEVELED WASHERS
Stainless steel. For use with solid bar or posts drilled at an angle.
USING ULTRA-TEC® HARDWARE
WITH WOOD POSTS
These drawings illustrate some of the ways Ultra-tec® hard-ware is used in wood end and corner posts. A minimum of a nominal 4 × 4 (3½" × 3½" actual) is recommended for any post where cable hardware is mounted.
Cables should be spaced on end posts on centers of no more than 3.25", and the cable should be supported in some fashion no more than every 42" along the cable run.
Cables can be cut and fittings swaged in the field using Ultra-tec® swaging equipment – available for rent or purchase.
With some hardware, the cable can be cut to customer pro-vided lengths and the fittings swaged on at the factory thus providing ready to install hardware.
Go to page 258 for more information on installing Ultra-tec cable rail with wood posts.

INVISIWARE® RECEIVERS, RADIUS FERRULES AND CLIP-ON STOP WITH WOODEN END POSTS
The Invisiware® Receiver, Radius Ferrule and Clip-On Stop may be used with wooden end posts. We recommend one of these ways to accomplish this.
Surface Mount: Drill a hole in the post to accept the selected fitting such that the head sits on the outside of the post.
Counter Bore: Drill a counter bored hole to accept the appropriate fitting such that the head lies below the face of the post.
Stainless Steel washers – page 58 – are required. They are supplied with the Clip-On Stop but are to be purchased separately for the Invisiware® Receiver and Radius Ferrule.
Refer to page 258 for installation information.

Note: ACQ pressure treated lumber is now being used in many parts of the country. Use only stainless steel or galvanized hardware with ACQ treated lumber.

Download the Drill Guide Order Form and Cable Support Order Form from www.wagnercablerailing.com or contact Wagner.
Cable can be provided pre-swaged or you may purchase the cable, tensioners and hardware as components and swage the fittings prior to install. Tools are available for purchase or rental. Rental includes all tools required for installation except for an air compressor.

Before beginning your project, download the Design and Fabrication Guide at www.wagnercablerailing.com and review installation instructions on pages 258 to 271 of this catalog.

**INSTALLATION TOOLS**

Cable can be provided pre-swaged or you may purchase the cable, tensioners and hardware as components and swage the fittings prior to install. Tools are available for purchase or rental. Rental includes all tools required for installation except for an air compressor.

Before beginning your project, download the Design and Fabrication Guide at www.wagnercablerailing.com and review installation instructions on pages 258 to 271 of this catalog.

**MODEL 650 SWAGER**

For 1/8" - 3/16" cable
Requires a hydraulic power source capable of 10,000 psi.

**MODEL 610 SWAGER**

For 1/8" cable and smaller
Requires a hydraulic power source capable of 10,000 psi.

**AIR OVER HYDRAULIC PUMP**

Air driven. Capable of delivering a maximum of 10,000 psi. A 20 gallon minimum tank size is recommended. A functional pressure regulator set at 100 psi maximum is required – 90 psi minimum to get swager to apply full force – otherwise swaging pump may be damaged. Minimum 1/4" ID air hose with a 1/4" male pipe thread.

*Note: Should you experience any leakage during operation, discontinue use and contact Wagner.*

**ELECTRIC HYDRAULIC 120V PUMP**

Increases swaging speed versus the Air Over Hydraulic Pump.

**CABLE TENSIONING GAUGE**

Check the tension on your cables with this simple to use gauge.

**GROMMET INSTALLATION TOOLS**

Set of four for each size and shape of grommet.

Installation Tool CRGIT

**LAG EYE DRIVER**

For driving Lag Eyes into wood posts. Lag Eye not included.

Lag Eye Driver CRDRIVERHB6N

**JAWED PLIERS WITH PRE-TENSIONER**

When tensioning, grip cable with special Jawed Pliers to prevent damage to the cable. Pre-Tensioner can be used when installing longer runs of Invisiware® since it may have a minimum take-up.

**JAWED PLIERS WITH PRE-TENSIONER**

When tensioning, grip cable with special Jawed Pliers to prevent damage to the cable. Pre-Tensioner can be used when installing longer runs of Invisiware® since it may have a minimum take-up.

**HYDRAULIC PUMP**

CRHP

**ELECTRIC HYDRAULIC 120V PUMP**

CRHPE

**RADIUS FERRULE/CLIP-ON STOP GAUGE**

Use this gauge to confirm that your fittings have been properly swaged. If the swaged fitting does not fit the appropriate slot, the fitting is not suitable for use.

**PUSH-LOCK FITTING TOOL KIT**

Kit includes the Cable Cutter and Jawed Pliers.
CABLE RAILING WORKSHEETS
Use these two worksheets to assist in determining the requirements for your application. Larger versions of these sheets may be downloaded from our website.

We are presently working on an online configuration tool to assist in determining pricing. We expect to have this in place by the middle of 2007. Go to wagnercompanies.com for the latest information and changes to this product line.

Photo courtesy of Don Duperault.
PREVIOUS PAGE

BEFORE YOU GET STARTED

Rail Finish
If your rail is to be painted, powder coated or otherwise finished in any way, we strongly recommend that you apply the finish after all holes are drilled and prior to stringing the cable.

Materials Required
If screws for mounting Adjust-A-Jaw™ or Adjust-A-Body™ with Threaded Eye Tensioners and Ultra-tec® Fixed Jaws were not ordered from the factory, you will need one of the following screws for each of these items:

In areas prone to tampering, a permanent setting thread sealant is recommended for use with screws.

Tools Required
The tools listed here assume you will be swaging at least one end of the cable in the field using an Invisiware® Field Swager. If no field swaging is required, only those tools indicated with * may be required. Most tools are available for purchase or rental.

Installing Grommets

IMPORTANT NOTE: If grommets are being used on intermediate posts, cable braces, or in the cable exit hole of end posts, then grommets should be installed before cable is run.

To install grommets, see figure below. Place the larger diameter of the grommet onto the grommet installation tool and the smaller diameter at the hole in the post. Tap the tool lightly with a hammer.

Installing Cable

MEASURING AND INSTALLING CABLE

Horizontal Railings, Measuring Cable Lengths

If you have ordered your cables cut to length from the factory, you can skip this section on Measuring Cable Length.

A. Measure the length of the run from the outside of one terminating end post to the outside of the other terminating end post. Over estimate as shown, when corners are involved. See Figures A & B on next page. Note that Post “A” is always the first end to which hardware is attached. When only one end has a tensioning device (Invisiware® Receiver or Adjust-A-Jaw™ Tensioner), that tensioning device is attached to Post “B” and the non-tensioning device is attached to Post “A”. Post “B” is always a terminating end.

CABLE Diameters

1/8"
27/64"
CRR6
3/32"

1/4"
CRR8
7/32"

3/8"
CRR12
5/32"
B. Measure out cable on a relatively clean surface (see Figure C above). A lawn or swept concrete surface would be fine.

C. Cut cable to length, using Cable Cutter.

NOTE: Make sure you have a positive holding device at the zero end. Cutting the cables takes very little time. It is best to have one person stand at the zero mark while another operates the cable cutter at the cut mark.

Installing Cable

A. Unless already swaged, swage the fittings to be used on Post “A” onto one end of the cut cables (See “Swaging Instructions” section of these instructions).

NOTE: Where only one end of the cable has an adjusting fitting (Invisiware® Receiver or Adjust-A-Jaw™ Tensioner), we recommend that you swage the unadjusting end, Post “A,” first (before the cables are strung) and the adjusting end, Post “B,” last (after the cables have been strung).

Where Invisiware® Radius Ferrules will be used:

1. Slide the Washer onto the cable.
2. Swage the Radius Ferrule onto the end of the cable (see “Swaging Instructions”).

Where Ultra-tec® Fixed Jaws are being used, slide the Fixed Jaw onto the cable and swage the Ferrule onto the end of the cable to be attached to Post “A” (see “Swaging Instructions”).

B. String Cable through intermediate posts and braces to Post “B.” If you are using Ultra-tec® “Clip-on” Fixed Jaws with the Ferrule already swaged onto the cable or Ultra-tec® “Clip-on” Stops, you will have to feed the cable from the Post “B” end through all intermediate posts to Post “A,” before installing the Fixed Jaw onto the Post “A” end of the cable. See “Ultra-tec” Clip-On Fixed Jaw Installation Instructions” or “Ultra-tec “Clip-on Stop Installation Instructions” elsewhere in this guide for attaching the Fixed Jaw or “Clip-on Stop” to the cable.

C. Attach fittings to end Post “A.”

If using Ultra-tec® Fixed Jaw, bolt the fitting to the tab, through the hole in the structural tee, or the lag eye (in wood post) on the end post, using the screws specified under “Materials Required.”
If using Adjust-A-Jaw™ or Adjust-A-Body™ with Threaded Eye Tensioners:

- If using Adjust-A-Jaw™ or Adjust-A-Body™ with Threaded Eye Tensioners:
  - Screw the lock nut onto the threads of the Clevis or Eye, then hold the cable closely behind the body and turn the body by hand a minimum of 8 turns onto the threaded end of the Clevis. (See note*)

If you are installing into wood with a hanger bolt, screw the hanger bolt into a pre-drilled pilot hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand a minimum of 8 turns onto the threaded end of the bolt. (See note*).

- If you are installing into wood with a hanger bolt, screw the hanger bolt into a pre-drilled pilot hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand a minimum of 8 turns onto the threaded end of the bolt. (See note*).

- If you are installing into a threaded hole in a metal post, screw the bolt into the threaded hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns. (See note*).

- If you are installing into a threaded hole in a metal post, screw the bolt into the threaded hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns. (See note*).

*NOTE: This will allow for maximum take-up. The fewer turns you make at this step, the more thread that will be exposed when the installation is complete. Each job is different, so we suggest that you string and lightly tension one cable between end posts, to determine how many turns you will make in turning the body onto the male threaded end in order to minimize the amount of exposed thread at both ends.

- If you are installing into a threaded hole in a metal post, screw the bolt into the threaded hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns. (See note*).

- If you are installing an Adjust-A-Body™ concrete anchor bolt end into a concrete anchor bolt, screw the bolt into the threaded hole in the anchor bolt. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns. (See note*)

*NOTE: This will allow for maximum take-up. The fewer turns you make at this step, the more thread that will be exposed when the installation is complete. Each job is different, so we suggest that you string and lightly tension one cable between end posts, to determine how many turns you will make in turning the body onto the male threaded end in order to minimize the amount of exposed thread at both ends.

- If you are installing an Adjust-A-Body™ concrete anchor bolt end into a concrete anchor bolt, screw the bolt into the threaded hole in the anchor bolt. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns. (See note*)

- If you are installing an Adjust-A-Body™ concrete anchor bolt end into a concrete anchor bolt, screw the bolt into the threaded hole in the anchor bolt. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns. (See note*)

If you are installing the tensioner using tabs, holes in a structural tee or lag eyes (in wood) attach the clevis portion of the fitting to the tab, lag eye or through the hole in structural tee on the end post, using the screws specified under "Materials Required."
For wood posts, follow the same instructions, except you will have to feed the cable – with the Stud swaged on the end – through the post from the inside to meet the Receiver inside the post, where you will turn the Receiver onto the Stud using an Allen wrench.

If you are using Invisiware® Radius Ferrule, make sure the fitting is through the hole in the back of the post with the head with washer resting against the back side of the post (or in the counterbore if applicable) as you proceed to the next step.

D. Pull cable toward end Post “B.” Use Ultra-tec® Pre-tensioning Tool, if required (see Figure S).

E. Attach fittings at end Post “B”

If installing Invisiware® Receiver at Post “B”

NOTE: If installing Invisiware® Receiver on a stairway, see “Using Invisiware® Receivers on Stairways” before proceeding.

1. Cut Cable at Post “B” End. (Assumes cable is already attached to Post “A.”) Mark and cut the cable at the location shown in relation to end Post “B” (see Figure R below for steel posts, Figure RW below for wood posts). NOTE: this cut mark will allow for maximum take-up. However, it may leave more thread exposed than necessary after tensioning. This length can be altered to achieve the most favorable results.

2. Swage Stud onto cable (see “Swaging Instructions” section in these instructions).

3. Slide the washer over the body of the Receiver, then feed the Receiver through the hole in the back of the post. If you have a double post end post construction, be sure to
place spacers between the double posts, as you feed the fitting through. By hand, screw the Receiver onto the swaged Stud at least 6 full turns. Do not tension cables until all cables have been installed between end posts “A” and “B.”

For wood posts using 3.50” long Receiver, follow the same instructions

4. Repeat above steps for each cable to be installed between end posts “A” and “B.”

5. After all the cables have been installed, tension the cable to approx. 400 lbs. by holding the cable (using cable grip locking pliers) closely behind the Stud. Turn the Receiver clockwise with an Allen Wrench. See “Tensioning Cables” for sequence to use in tensioning cables.

If installing Adjust-A-Jaw™ or Adjust-A-Body™ type tensioner at Post “B”

1. Cut Cable at Post “B” End. (Assumes cable is already attached to Post “A.”) If you are attaching the tensioner to a tab, lag eye or hole in a structural tee, mark and cut the cable at the location shown in relation to the center of the mounting hole at Post “B” (see Figure T). NOTE: this cut mark will allow for maximum take-up. However, it may leave more thread exposed than necessary after tensioning. This length can be altered to achieve the most favorable results.

If the tensioner is mounted with the bolt screwed into a wood post, a threaded hole in a metal railing, or a concrete anchor, mark and cut the cable at the location shown in relation to end Post “B” (see Figures below). NOTE: this cut mark will allow for maximum take-up. However, it may leave more thread exposed than necessary after tensioning. This length can be altered to achieve the most favorable results.
2. Slide the Body onto the cable and swage the Ferrule onto the end of the cable (see "Swaging Instructions").

3. Attach Tensioner to Post.
   If you are installing the tensioner using tabs, holes in a structural tee or lag eyes (in wood) attach the Clevis or Eye portion of the fitting to the tab, lag eye or through the hole in structural tee on the end post, using the screws specified under “Materials Required.”

   If you are installing into wood with a hanger bolt, screw the hanger bolt into a pre-drilled pilot hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns.

   If you are installing into a threaded hole in a metal post, screw the bolt into the threaded hole in the post. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns.

   If you are installing an Adjust-A-Body™ concrete anchor bolt end into a concrete anchor bolt, screw the bolt into the threaded hole in the anchor bolt. Screw the lock nut onto the threads of the bolt, then hold the cable closely behind the body and turn the body by hand onto the threaded end of the bolt at least 6 full turns.

4. Repeat the above steps for each cable to be installed. Do not tension the cables, until all cables have been installed between end posts “A” and “B.”

5. After all the cables have been installed, tension the cable (to approximately 400 lbs.) with an open end wrench, holding the cable with cable grip locking pliers to prevent it from rotating. See “Tensioning Cables” for sequence to use in tensioning cables.

6. If tensioners are mounted to tabs, structural tees or lag eyes, tighten the mounting screws.

7. On all installations, tighten the lock nut against the body of the fitting with an open end wrench.

   NOTE: In areas prone to tampering, the use of permanent setting thread sealant is recommended for mounting screws and lock nuts.
**F. Tensioning cables**

*NOTE: Tension in sequence, beginning with cable nearest center of post (see Figure V below).*

![Diagram](image)

**RECOMMENDED TENSIONING SEQUENCE**

**FIG. V**

Following are illustrations of several hardware mounting alternatives and some techniques for mounting hardware to the end posts.

**For Wood Posts**

Drilling Holes in End Posts for Cable Mounting Hardware

Where Ultra-tec® Fixed Jaws are being used, drill holes in the end posts using the drill size shown on the following chart and screw Lag Eyes into the holes. Fixed Jaws will be mounted to the Lag Eyes (see “Installing Cable”).

<table>
<thead>
<tr>
<th>Cable Diameter</th>
<th>Using Lag Eye Part No.</th>
<th>Drill Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>CRLE6</td>
<td>17/64&quot;</td>
</tr>
<tr>
<td>3/16&quot;</td>
<td>CRLE6</td>
<td>17/64&quot;</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>CRLE8</td>
<td>1/8&quot;</td>
</tr>
</tbody>
</table>

Where Adjust-A-Body™ with Hanger Bolt Tensioners are being used, drill holes in the end posts using the drill size shown on the following chart and screw the Hanger Bolt into the holes. Adjust-A-Body will be mounted to the Hanger Bolts (see “Installing Cable”).

<table>
<thead>
<tr>
<th>Cable Diameter</th>
<th>Using Adjust-A-Body Part No.</th>
<th>Drill Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>CRAJB6 CRAJB6L</td>
<td>13/64&quot;</td>
</tr>
<tr>
<td>3/16&quot;</td>
<td>CRAJB6 CRAJB6L</td>
<td>13/64&quot;</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>CRAJB8</td>
<td>7/64&quot;</td>
</tr>
</tbody>
</table>

*Due to the differences in different types of woods, slightly smaller or larger holes may be required for your particular application.

**Options for Mounting Invisiware® Receivers and Radius Ferrules.**

When using Invisiware Receivers, Radius Ferrules and/or Clip-on Stops, see the illustration below for different mounting options. Drill holes in your end posts using sizes shown in the chart. Ultra-tec Receivers, Radius Ferrules and Clip-on Stops will be mounted in the drilled holes. The hole depth will depend upon the mounting option you choose and the thickness of the post.
relying on the shear strength of the nails or screws to support the tension applied to the end post.

**Configuration of any corners in a wood post design**

At corners or turns of more than approximately 45 degrees, it is best to terminate your runs in each direction with an end post (minimum of a nominal 4x4). The following illustrations demonstrate how this is done. One such corner, however, may be designed using two posts on the corner and running the cables between the posts as illustrated below.

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**Drilling Holes in Intermediate Posts and Cable Braces**

<table>
<thead>
<tr>
<th>Option</th>
<th>Cable Diameter</th>
<th>Stud Hole for Cable, Threaded Stud or Clip-On Stop</th>
<th>Diameter of Hole for Receiver in Radius Ferrule</th>
<th>Use Stainless SAE Flat Washer</th>
<th>For Countersunk Screws or Flat Washer</th>
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<tbody>
<tr>
<td>A &amp; B Mount: Receiver using Flat Washer (See Note below)</td>
<td>1/8&quot;</td>
<td>11/32&quot;</td>
<td>17/64&quot;</td>
<td>NA</td>
<td>NA</td>
<td>E &amp; F Mount: Clip-On Stop</td>
<td>1/8&quot;</td>
<td>17/64&quot;</td>
<td>NA</td>
<td>NA</td>
<td>15/16&quot;</td>
</tr>
<tr>
<td>C &amp; D Mount: Radius Ferrule using Flat Washer</td>
<td>1/16&quot;</td>
<td>11/32&quot;</td>
<td>17/64&quot;</td>
<td>1/8&quot;</td>
<td>15/64&quot;</td>
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<td></td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**Wood Rail Applications**

A substantial end post is necessary, to prevent the end post from bending, which will cause the cables to sag. In wood, a minimum 4x4 nominal – 3/4" square – end post is required. End posts must be securely fastened to the deck or other surface, to prevent the post from coming loose with the forces applied through the tensioned cables. Support members between end posts are also necessary. In wood, we recommend support members running between posts, such as a 2x4 secured to the inside of each post, so you are not relying on the shear strength of the nails or screws to support the tension applied to the end post.

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“A stainless steel flat bar (Cable Support) with holes for the cable to pass through is mounted on each surface where the cable enters or exits the post at an angle, to prevent the cable from biting into the wood when it is tensioned. Cable Supports are available from Wagner.

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*Note: Do not counterbore if you are using CRR662 (3¼" long) Receivers in a 4x4 (3½") post on a pitch.*

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We do not recommend using this type of corner post configuration on more than one corner between any two-end posts (with tensioning hardware). When using this configuration, you will need tensioning hardware on both ends of the run, and you will need to tension the cables from both ends.
On a turn of less than approximately 45 degrees, you can run your cables through a single post, but you will still need to use a Cable Support where the cable enters or exits the post at an angle, to prevent the cable from biting into the wood when it is tensioned.

**Configuration of Single Wood Corner Post**

The following illustrations demonstrate how the hardware can be used on a single corner post. They also illustrate how some hardware can be countersunk into the post or mounted flush with the back of the post. Not all combinations are shown here. If the hardware and cable run all the way through the post in one direction, you will need to use a hanger bolt end or hardware that is mounted to a lag eye for the perpendicular direction, as shown in the first three illustrations that follow.

**Selection of Appropriate Hardware for Wood Posts**

In selecting hardware, you will need to consider:

- a) whether you want to field cut and swage the cables or have them factory cut and swaged;
- b) hardware preferences for end posts;
- c) how you wish to configure your corners (if applicable);
- d) hardware used for stairs or severe slopes.

a) Field cut and swage or factory cut and swage fittings on the cables.

When the fittings are swaged on at the factory, some fittings are larger in diameter than the size of the holes you want to drill in your intermediate members (posts or cable braces). The fittings illustrated below, however, require relatively small holes in your intermediate members. If the hardware is swaged on at the factory and if the cable will pass through intermediate posts or cable braces, one end of each cable should have one of the following fittings. The holes in your intermediate member will be drilled for the diameter of the swaged fitting passing through the intermediate member as shown in the following illustrations:

Where the cable will not pass through any intermediate members, you can order factory cut and swaged cables using any hardware. You are not limited to the fittings shown above.

If your cables will be cut and the fittings swaged on at the factory, you will need to provide the factory with measurements for your cable runs after the posts have been installed. Contact the factory for the measurements required.

**Vertical Railings – for Metal Railings Only**

If you have ordered your cables cut to length from the factory, you can skip the steps indicated with * on measuring cable length and swaging fittings onto cable.

A. *Measure the distance between the bottom of the top rail to the top of the bottom rail and add 2.187" (2 5/32").*
G. Tension the cables (to approximately 400 lbs.) by holding the cable (using jawed pliers) closely above the Stud in the bottom rail. Turn the Receiver clockwise with an Allen Wrench from underneath the bottom rail. First, tension the cable nearest the center point between posts and/or cable braces. Then, tension the rest of the cables in sequence, by alternating from one side of the center cable to the other, as you move outward toward the posts and/or cable braces. (For tensioning sequence illustration, see “Tensioning Cables” in preceding Installing Cables Section of this guide.)

Before you begin swaging

NOTE: If you are using coated cable, be sure to strip the coating from the end of the cable before swaging.

If you are using the Adjust-A-Jaw™ or Adjust-A-Body™ Type Tensioner or Ultra-tec® Fixed Jaw fitting, make sure the cable has been inserted through the body of the fitting prior to swaging the ferrule onto the cable. See illustrations below.

If you are using the Invisiware® Receiver or Welded Receiver (threaded receiver inside post), the Stud will be swaged onto the end of the cable and will install directly into the fitting.

If you are using the Invisiware® Radius Ferrule or Clip-on Stop, the fitting will be swaged onto the end of the cable and no further operation will be required.

NOTE: Swage the fitting on one end of the cable only, before stringing cables through posts and braces. Where only one end of the cable has an adjusting fitting (Invisiware® Receiver or Adjust-A-Jaw™ or Adjust-A-Body™ Type Tensioner), we recommend that you swage the unadjusting end first and the adjusting end last (after the cables have been strung).

Swaging

A. If you are using any fittings other than Radius Ferrules or Clip-on Stops, position the Ferrule or (threaded) Stud onto the Cable as shown in Figure D below.

If you are using Radius Ferrules or Clip-on Stops, slide the Cable into the open end of the fitting until it stops (see Figures E and I on next page).
B. Place Ferrule or Stud into Open Swager Dies

If you are using the Ultra-tec® Model 610 Portable Swager for 1/8" and 3/16" diameter cable (for CRS4 & CRS6 Studs and CRF4 & CRF6 Ferrules), see Figure F.

If you are using the Ultra-tec® Model 650 Portable Swager for all sizes of cable, see Figure G. Make sure the die size you use in the swager is the one marked for the diameter of the cable onto which the fitting is being swaged.

C. Depress the foot pedal to introduce pressure into the swaging tool. Do not let the dies close all the way on the first cycle.

D. Release the foot pedal and apply foot pressure in the opposite direction (this will re-open the dies). Turn the fitting 45 degrees and repeat Step C. Do not let the die close all the way.

E. Turning the fitting 45 degrees each time, swage the fitting, letting the die close completely at least three more times.

NOTE: When swaging a Stud, the non-threaded end of the Stud should face the end of the cable. When properly swaged, the Ferrule will look like Figure H and the Stud will look like Figure J below after swaging and will slide easily into the body of the fitting.

For the Radius Ferrule or Clip-on Stop, use the appropriate “GO” gauge. The swaged Radius Ferrule should fit the slot in the “GO” gauge when properly swaged. If you do not have a “GO” gauge, use calipers to check diameter of the swaged portion of the Radius Ferrule. See the chart below for the correct diameter of the Radius Ferrule after it has been swaged.

<table>
<thead>
<tr>
<th>Radius Ferrule</th>
<th>Clip-On Stop</th>
<th>For Cable Diameter</th>
<th>Diam of Swaged Portion of Fitting Should Be</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRRF4 or CRRF6</td>
<td>CRCOS4 or CRCOS6</td>
<td>1/8&quot; or 1/4&quot;</td>
<td>.250&quot; Max.</td>
</tr>
<tr>
<td>CRRF8</td>
<td>NA</td>
<td>1/8&quot;</td>
<td>.375&quot; Max.</td>
</tr>
<tr>
<td>CRRF10 or CRRF12</td>
<td>NA</td>
<td>1/8&quot; or 1/4&quot;</td>
<td>.500&quot; Max.</td>
</tr>
</tbody>
</table>
The following instructions illustrate how you can use an Invisiware® Receiver and Stud on stairway end posts, without having to drill holes on an angle.

A. Swage the Stud onto the end of the cable to be installed at the bottom of the stairway. See “Swaging Instructions.”
B. Grip the cable with cable grip locking pliers approximately 1/8” from the swaged Stud. Screw the Receiver onto the Stud for leverage, and bend the cable by hand to the approximate angle desired. This bend does not have to be precise.

C. Install the Receiver in the post at the bottom of the stairway, following the instructions in the Installing Cable section for installing Invisiware® Receiver at Post A. Make sure the stud is flush with the outside wall of the post. See illustration at right.

D. Pull the cable to the hole in the post at the top of the stairway where the Receiver will be installed on the other end of the cable. Mark the cable at the center point of the hole. See illustration to the right.

E. Swage the Stud onto the end of the cable with the threaded end at the mark made in Step D. See “Swaging Instructions” and illustration at right. Cut off any excess cable, leaving a small "tail" out of the end of the Stud.

F. Bend the cable to the approximate angle desired as done in Step B above. Make sure bends are on the same plane.

G. Install the Receiver in the post at the top of the stairway, following the instructions in the Installing Cable section for installing Invisiware® Receivers at Post B. When tensioned, the cables will self-align at each end post.
Push-Lock™ Fittings Installation Instructions

A. Instructions in this section apply if the cables are supplied with excess length and you will be cutting the cables to size during installation. If cables are supplied cut to length, see Section B below.

Install tensioning end of run to one end post and run cables through intermediate posts, before installing Push-Lock™ Fitting.

1. Make sure the holes are drilled properly in the end post where you will be installing the Push-Lock™ Fitting.

   If you are installing the Push-Lock™ Fittings in a metal railing, see Metal Railings/Hardware Mounting Holes/Boring Guide for boring instructions for your end post.

   If you are using wood end posts, see Wood Railings-Mounting Alternatives section of this guide for hole sizes and depths.

2. Slip the Washer over the body of the fitting (CR716SAE washer for wood posts, black Delrin® washer for metal posts), then slide the Push-Lock™ Fitting into the hole in your end post with the hole in the fitting facing the inside (cable side) of the post. If you are using the Push-Lock™ Fitting with Threaded Eye, attach the fitting to the end post.

3. Pull the cable tight and mark the cable at a point ½” from the shoulder at the cap end of the Push-Lock™ Fitting or from the eye end of the body of the fitting. Cut the cable at the mark, using a cable cutter.

4. Push the cable into the hole in the Push-Lock™ Fitting as far as it will go (approximately 1 1/16”)

5. Pull cable to set gripping action of the Push-Lock™ Fitting.

6. Tension the cable with the tensioner installed at the other end of the cable.

B. This section applies if your cables have been cut to length with a tensioner swaged on one end. If they are supplied with excess length to be cut to size during installation, see Section A above.

   Important Note: Be sure to run the bare end of cable through all of your intermediate posts, before installing the Push-Lock™ Fitting. Do not install the tensioner on the other end, until you have installed the Push-Lock™ Fitting.

1. Make sure the holes are drilled properly in the end post where you will be installing the Push-Lock™ Fitting.

   If you are installing the Push-Lock™ Fittings in a metal railing, see Metal Railings/Hardware Mounting Holes/Boring Guide for boring instructions for your end post.

   If you are using wood end posts, see Wood Railings-Mounting Alternatives section of this guide for hole sizes and depths.

2. Attach the Push-Lock™ Fitting

   If you are using the Push-Lock™ Fitting with a cap end: Slip the Washer over the body of the fitting (CR716SAE washer for wood posts, black Delrin® washer for metal posts), then:

   A. Run the cable into the end post and push the cable into the Push-Lock™ Fitting as far as it will go – approximately 1 1/8";
B. Pull cable to set gripping action of the Push-Lock™ Fitting:

C. Pull the cable with the Push-Lock™ Fitting attached so that the fitting rests firmly against the back side of the post.

If you are using the Push-Lock™ Fitting with Threaded Eye:

A. Push the cable into the Push-Lock™ Fitting as far as it will go (approximately 1 1/16”).

B. Pull cable to set gripping action of the Push-Lock™ Fitting.

C. Attach the fitting to the end post.

3 Install the tensioner on the other end post, and tension the cables.

Ultra-tec® “Clip-On” Stop Installation Instructions
Feed cables through intermediate posts, and install “Clip-on” Stop first, before installing tensioning end of cable.

1. Drill 1/8” (.266”) hole all the way through the post.

2. If you wish to countersink the Stop in a wood post, then drill a 1/4” (.938”) hole to a depth of 3/16” in the back side of the post. If you are using round tube or steel pipe, see Fabrication Instructions. There should be a 9/32” (.531”) hole counterbored to a .100” depth, so the full diameter of the Washer will rest on a flat surface in the pipe.

3. From the inside side of the post, slide the cable through the hole, Stop end first, and out the back side of the post.

4. Slide the Washer over body of the Stop.

5. Force the Clip into the slot in the Stop, and press it in by hand. Press Clip with pliers to secure it in slot.

6. Pull cable back through the hole, until the Washer stops against the post, with the Clip resting in the recess of the Washer.

7. Install the hardware on the post at the tensioning end of the cable.

Ultra-tec® “Clip-on” Fixed Jaw Installation Instructions

1. Slide Swaged Cable Ferrule end through throat of Fixed Jaw.

2. Grasp top of Clip with pliers, and force Clip over Cable immediately behind Ferrule.

3. Pull Cable back through throat of Fixed Jaw until it stops. Ferrule is captured inside Fixed Jaw.