The Unistrut World of Support starts with our network of Unistrut Service Centers across the nation.

The Unistrut World of Support starts with our network of Unistrut Service Centers across North America. They go far beyond providing local product inventories... by offering complete application solutions, based on experience gained from thousands of projects worldwide.

It’s the kind of knowledgeable assistance that can help save time and cost now, and simplify change in the future.

Technical help? No one knows the engineering side of Unistrut support systems like your local Unistrut team. And if it’s special fabrication, cutting or custom finishing you want, the pros at your local Unistrut Service Center will make it happen...quickly, efficiently, economically.

So when it’s help you need, call your Unistrut Service Center—the quickest way to unlock Unistrut’s World of Support.
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Featuring The Unique Weldless Connection

- Hex-head bolt connects fitting to channel as it is threaded into spring nut.
- Chamfer in the nut eases starting of the bolt. Nut teeth create a strong, vise-like grip when tightened against the inturned channel edges.
- Channel edges and the nut’s tapered grooves act as guides to provide fool-proof alignment of connection.
- Nut teeth grip the channel’s inturned edges, tying the channel sides together in a "box" configuration for added strength.
- Spring allows precision placement anywhere along channel length, then holds the nut in position while the connection is completed.
Unistrut Connection

Strong, Fast, Economical and Adjustable

Insert the spring nut anywhere along the continuous slotted channel. The rounded nut ends permit easy insertion.

1. A 90° clockwise turn aligns the grooves in the nut with the inturned edges of the channel.

2. Fittings can be placed anywhere along the channel opening, permitting complete freedom of adjustment. The need for drilling holes is eliminated.

3. Insert the bolt through the fitting and into the spring nut. (See illustration 5 for end view showing the nut in place)

4. Additional channel sections can now be bolted to the fitting already in place by following procedure described in steps 1–3.

5. Tightening with a wrench locks the serrated teeth of the nut into the inturned edges of the channel, to complete a strong, vise-like connection.

- 100% Adjustable
- 100% Reusable
- No Welding
- No Drilling
- No Special Tools
Serving Design Professionals for Over 60 Years

Unistrut products have been helping to build a better world since 1924. Used extensively in nuclear, industrial and commercial construction markets for over 75 years, Unistrut Metal Framing has set the standard for product design, quality and performance. The initial Unistrut concept — a simple spring nut and bolt connecting a fitting to a continuous slotted channel — has evolved into a comprehensive engineered building and support system.

Unistrut® — The Original Metal Framing System

There is only one Unistrut Metal Framing System. It incorporates the innovative product improvements that our research and development group has created to give you the most complete and flexible support system available. Backed by our worldwide network of engineering and distribution centers, Unistrut provides customers with total-resource capability.

A North American network of Unistrut Service Centers — stocking standard Unistrut components — are located in principal cities to serve you quickly and directly. Many Service Centers are equipped to design and supply drawings for any type of metal framing application and also offer fabrication and installation services.

This catalog is a comprehensive presentation of Unistrut Metal Framing components plus technical data required by design, specification and construction professionals.
The Most Complete Metal Framing System — Three Channel-Width Options

Adjustability, demountability and reusability are engineered into each of the three Unistrut channel series. Each series offers channels of varying depth and gage plus a complete line of fittings and accessories.

1 5⁄8” (41mm) width

Designed to carry the heaviest loads and provide the widest variety of applications, the 1 5⁄8” series has become the accepted standard for use in mechanical, electrical and general construction applications where supports and attachments must meet the highest strength requirements.

1 1⁄4” (32mm) width

A framing system designed for medium loads, the 1 1⁄4” series is especially suitable for use in the OEM, commercial and display markets. It maintains a lightness in scale and a clean line that makes it aesthetically pleasing as well as functional.

13⁄16” (21mm) width

A unique half-size reduction of the 1 5⁄8” channel-width series, this smaller channel size can be used to carry light loads economically in applications such as instrumentation, retail displays and light-duty laboratory supports. It also provides the flexibility found in all Unistrut framing systems.
### Product Load Testing

Product testing is an important part of Unistrut’s Quality Assurance Program. We utilize our own testing facilities, as well as those of independent testing laboratories, to determine design loads with proper and adequate safety factors. These design loads are indicated, where applicable, throughout the catalog. Loads are based on AISI Specification For The Design Of Cold-Formed Steel Structural Members, 1996 Edition.

Destructive and non-destructive testing procedures are used to test for variables such as corrosion, conductivity, electro-static dissipation, ultra-violet resistance, wind resistance, dimensional accuracy, material integrity and slip resistance.

In short, if there’s a specification to meet, Unistrut will develop a test to quantify and verify it. Using design properties of the Unistrut framing members, load data given in this catalog, and/or design procedures of the American Iron & Steel Institute Specification For The Design Of Cold-Formed Steel Structural Members, 1996 Edition, it is possible to design any type of structure within the capabilities of the system.

Assemblies or connections that cannot be calculated using provisions of the AISI specifications must be established by application-specific tests.

### Quality Program

Unistrut is committed to being the “best” in the metal framing industry. In order to meet this goal, Unistrut has adopted the philosophy of “Zero Defects and Continuous Improvement”. This means on-going reviews of our manufacturing processes, operating procedures and quality systems to find ways of improving efficiency, productivity and quality. It means establishing process controls and problem-prevention techniques to ensure that superior quality is built into every Unistrut product.

Our drive to be the best includes not just quality products, but on-time delivery and prompt resolution of customer needs and concerns. At Unistrut, quality is number one.

### Traceability

UNISTRUT CHANNEL IS STAMPED WITH A NUMERIC CODE THAT ALLOWS TRACEABILITY TO THE ORIGIN OF THE STEEL
Materials and Finishes

Material

Framing Members

Unistrut channels and continuous inserts are accurately and carefully cold-formed to size from low carbon strip steel. One side of the channel has a continuous slot with inturned edges. Secure attachments may be made to the framing member with the use of hardened, toothed, slotted nuts which engage the inturned edges.

Raw steel shall conform to the following ASTM specifications:

<table>
<thead>
<tr>
<th>GAGE</th>
<th>FINISH</th>
<th>ASTM NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>GR &amp; HG</td>
<td>A1011 SS GR 33</td>
</tr>
<tr>
<td></td>
<td>PG</td>
<td>A653 GR 33</td>
</tr>
<tr>
<td>14</td>
<td>GR &amp; HG</td>
<td>A1011 SS GR 33</td>
</tr>
<tr>
<td></td>
<td>PG</td>
<td>A653 GR 33</td>
</tr>
<tr>
<td>16</td>
<td>GR &amp; HG</td>
<td>A1011 SS GR 33</td>
</tr>
<tr>
<td></td>
<td>PG</td>
<td>A653 GR 33</td>
</tr>
<tr>
<td>19</td>
<td>GR</td>
<td>A1008</td>
</tr>
</tbody>
</table>

Nuts and Bolts

Unistrut nuts are made from steel bars. After all machining operations are complete, they are thoroughly case hardened. Nuts are rectangular with ends shaped to permit a quarter turn clockwise in the framing member after insertion through the slotted opening in the channel. Two toothed grooves in the top of the nut engage the inturned edges of the channel and, after bolting operations are completed, will prevent any movement of the bolt and nut within the framing member. All bolts and nuts have Unified coarse screw threads. The standard framing nut is ½" and conforms to ASTM Specification A1011 SS GR 33 (material only). Screws conform to SAE J429 GR 2 (also meets and exceeds ASTM A307).

Weights and Dimensions

Weights given for all materials are approximate shipping weights. All dimensions are subject to commercial tolerance within published specifications.

WE RESERVE THE RIGHT TO MAKE SPECIFICATION CHANGES WITHOUT NOTICE.

WHILE EVERY EFFORT HAS BEEN MADE TO ASSURE THE ACCURACY OF INFORMATION CONTAINED IN THIS CATALOG AT THE TIME OF PUBLICATION, WE CANNOT ACCEPT RESPONSIBILITY FOR INACCURACIES RESULTING FROM UNDETECTED ERRORS OR OMISSIONS.

THE BLUE COLOR USED ON UNISTRUT COMPONENTS ILLUSTRATED IN THIS CATALOG IS FOR GRAPHIC ENHANCEMENT ONLY, AND DOES NOT REPRESENT ACTUAL PRODUCT COLOR.
**Perma-Green® II**

The performance of Unistrut’s Perma-Green II far exceeds that of conventional finishes. And compared to competitive “high-performance” coatings, Perma-Green II provides superior resistance to chalking, checking and fading and is far less vulnerable to common acidic atmospheres, solvents and alkalis. Just as important, Perma-Green II is the result of an environmentally neutral process that virtually eliminates the toxic metals commonly found in competitive paint-based finishes.

Unistrut Perma-Green II is a factory applied, electrodeposition acrylic coating with superior rust protection and fade-resistance. The acrylic coating is a proprietary formulation and is essentially “beauty-metal” free. The electrodeposition coating process provides a smooth, hard, durable surface which is completely cured. This inhibits introduction of airborne contaminants which can adversely affect sensitive manufacturing environments.

Before the electrodeposition acrylic coating is applied, Unistrut channel and fittings are thoroughly cleaned and coated with an iron phosphate conversion coating. Unistrut’s unique, custom-designed “prep” process consists of eight separate steps, the most thorough in the industry. The cleaning, phosphating and electrodeposition coating processes are continuous and, unlike “batch” processing, result in a uniform coating quality.

Production samples are tested on a continuous basis for corrosion resistance. Unistrut Perma-Green II exceeds 400 hours salt spray (1/8” creep from scribe) when tested to ASTM B117. Unscribed samples exceed 600 hours salt spray.
Unistrut – The Original Metal Framing

PERMA-GREEN® II TECHNICAL DATA

STEEL SUBSTRATE PREPARATION
Eight stage continuous cleaning, phosphate process.
Substrate after “prep”: sealed iron phosphate conversion coating.

COATING
Thermoset acrylic
Color:
Green Federal STD. 595A,
Color No. 14109, Dark Limit V.
Hardness: 2H.
Coating Process:
Anodic Electrodeposition.

PERFORMANCE
Salt Spray:
Scribed: exceeds 400 hours per ASTM B117.
Unscribed: exceeds 600 hours per ASTM B117.
Chalk:
Nominal at 1,000 hours per weatherometer G-23 test.
Checking:
None at 1,000 hours per weatherometer G-23 test.
Fade:
Less than 50% compared to standard epoxy E.C. coatings.

ENVIRONMENTAL ISSUES
Formulated as a “heavy metal”-free coating (trace elements only).
Outgassing in service: essentially none at 350°F for 24 hours.

PLAIN (PL)
Plain finish designation means that the channel retains the oiled surface applied to the raw steel during the rolling process. The fittings have the original oiled surface of the bar-stock material.

Zinc Coating
Unistrut products are available in three types of zinc coatings:
• electroplated
• pregalvanized
• hot dip galvanized.
Zinc coatings offer two types of protection:
• Barrier: The zinc coating protects the steel substrate from direct contact with the environment.
• Sacrificial: The zinc coating will protect scratches, cut edges, etc. through an anodic sacrificial process.
The service life of zinc coating is directly related to the zinc coating thickness as shown below.

<table>
<thead>
<tr>
<th>Finish</th>
<th>Zinc Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Dip Galvanized</td>
<td>2.6 MIL</td>
</tr>
<tr>
<td>Pregalvanized</td>
<td>.75 MIL</td>
</tr>
<tr>
<td>Electro-Galvanized</td>
<td>.2 to .5 MIL</td>
</tr>
<tr>
<td>Perma-Gold</td>
<td>.5 MIL</td>
</tr>
</tbody>
</table>

As shown in the graph, when the zinc coating is double, the service life is double under most conditions.

Electroplated Zinc–ASTM B633, Type III SC1
In the electroplating process, the part to be zinc coated is immersed in a solution of zinc ions. An electric current causes the zinc to be deposited on the part.
Zinc plated parts typically have a zinc coating of .2 to .5 MIL and are recommended for dry indoor use.
Pregalvanized Zinc–ASTM A653
Pregalvanized steel is zinc coated by a hot dip process. Steel strip from a coil is fed through a continuous zinc coater which cleans, fluxes and coats the steel with molten zinc. After cooling, the steel is recoiled.
The pregalvanized zinc coating conforms to a G-90 thickness designation per ASTM A653. The zinc thickness is .75 MIL or .45 oz./sq. ft. of surface area.
This coating is offered on Unistrut channel and tubing and is a well-proven, time-tested performer for indoor and outdoor applications. For severe corrosion applications, hot dip galvanizing, as described below, is a good alternative.

HOT DIP GALVANIZED (HG)
ASTM A123 OR A153
In hot dip galvanizing, the finished part is immersed in a bath of molten zinc. This method results in complete zinc coverage and a thicker coating than pregalvanized or plated zinc.
The zinc coating is typically 2.6 MIL or 1.5 oz./sq. ft. of surface area.
This is the coating of choice for applications where severe corrosion is a design factor.

SPECIAL COATING
When specific applications require other than standard available finishes, special finishes can be supplied per customer requirements.
Beams are structural members loaded at right angles (perpendicular) to their length. Most beams are horizontal and subjected to gravity or vertical loads, e.g. a shelf support. However a vertical member can act as a beam under certain conditions, such as a curtain wall mullion subjected to wind loading. The bending moment developed in a beam is dependent on:

(a) the amount of load applied,
(b) the type of loading applied, and
(c) the support conditions.

**BEAM LOADING - POINT LOAD**

A load concentrated onto a very small length of the beam is a point load.

**BEAM LOADING - UNIFORM LOAD**

A load spread evenly over a relatively long length of the beam is a uniform load.

Point and uniform loads can be placed on a beam in any combination. A series of point loads can approximate a uniform loading. The load charts and tables are based on a uniform load unless identified otherwise.

**SUPPORT CONDITIONS - SIMPLE BEAM**

A simple beam has supports that prevent movement left and right, or up and down, but do not restrain the beam from rotating at the supports into a natural deflected curve. Most Unistrut Metal Framing connections produce simple beams. The load charts and tables are based on simple beams unless identified otherwise.

**SUPPORT CONDITIONS - CONTINUOUS BEAM**

Any simple beam that is supported at one or more intermediate points is a continuous beam. A mezzanine joist that passes over three or more columns is an example of a continuous beam.

**SUPPORT CONDITIONS - FIXED-END BEAM**

Supports that prevent the beam from rotating into a natural deflected curve produce a fixed-end beam. A welded end connection to very rigid support produces a fixed-end beam.

**SUPPORT CONDITIONS - CANTILEVER BEAM**

A cantilever beam is a fixed-end beam that is supported at one end only, while the other end is unsupported. Unistrut brackets are examples of cantilever beams.

**DEFLECTION**

All beams deflect under load. The amount of deflection is dependent on:

(a) the amount of load,
(b) the support conditions,
(c) the stiffness of the beam’s cross-sectional shape, and
(d) the stiffness of the beam material.

The stiffness of the beam’s cross-sectional shape is measured by its “Moment Of Inertia” or “I”. The larger a beam’s “I”, the stiffer it is and the less it will deflect. A beam’s “I” can change for each major axis. The “I” of both major axes (I 1-1 and I 2-2) are provided.

The stiffness of a beam’s material is measured by its “Modulus of Elasticity” or “E”. The larger a material’s “E”, the stiffer it is and the less it deflects. For example, steel is about three times stiffer than aluminum and as a result, deflects only one-third as much. Do not confuse stiffness with strength. Two materials may have identical strengths yet still have different “E”s. A high-strength aluminum may be as strong as steel and still deflect three times as much.

The load charts and tables give calculated deflections for the loads shown. In many cases, a final design will be determined by the maximum deflection, not the maximum load.

**BENDING MOMENT**

Is it strong enough? This is the final consideration for any beam. A beam must not only hold up the anticipated loads, but must also have sufficient additional capacity to safely hold unforeseen variations in applied loads and material strengths. This additional capacity is called a safety factor and is usually regulated by the various design codes and standards. A beam’s strength is usually measured by an allowable bending moment or an allowable stress. The traditional approach is the allowable stress method, where a beam is determined to have a maximum allowable stress (in pounds per square inch) which is not to be exceeded.

The approach of the current AISI “Specification For The Design Of Cold-Formed Steel Structural Members” is to use a maximum allowable bending moment (in inch-pounds) which is not to be exceeded. Bending moment divided by a beam’s section modulus or “S” equals stress.
### Columns

Columns are structural members that are loaded parallel to their length. Most columns are vertical and are used to carry loads from a higher level to a lower level. However, any member subjected to compression loads, such as a diagonal or prop brace, is a column.

A column fails by “buckling”, which is a sudden loss of straightness and subsequent collapse. Allowable column load is dependent on:

(a) the length of column,
(b) the type of loading,
(c) the support conditions, and
(d) the column’s cross-sectional shape and material.

### COLUMN LENGTH

The column length is measured from braced point to braced point. A braced point is where the column is restrained from lateral movement (translation) in all directions.

### COLUMN LOADING – CONCENTRIC LOADING

Loads applied to the center of gravity of the column cross-section are considered concentric. A beam that passes over and rests on the top of a column is an example of concentric loading.

### COLUMN LOADING – ECCENTRIC LOADING

Any load which is not concentric is eccentric. The amount of eccentricity (in inches) has a major effect on the load-carrying capacity of any particular column. A load that is transmitted to a Unistrut Metal Framing column using a standard fitting bolted to the slot face is considered eccentric.

The load tables give allowable loads for both concentric (loaded at C.G.) and certain eccentric (loaded at slot face) loading. Allowable loads for other eccentric loading must be determined by a qualified design professional.

### SUPPORT CONDITIONS

Based on the support conditions, an appropriate “K” value is selected. This “K” value, which mathematically describes the column end conditions, is used in the column design equations. The most common support condition combinations are as follows:

#### SUPPORT CONDITIONS - FIXED TOP – FIXED BOTTOM

Both ends are restrained against rotation and lateral movement (translation).

#### SUPPORT CONDITIONS - PINNED TOP – FIXED BOTTOM

The top is restrained against lateral movement (translation) but is allowed to rotate. The bottom is restrained against rotation and lateral movement.

This is a common support condition and is used to construct the allowable column load applied at the Slot Face tables.

#### SUPPORT CONDITIONS - PINNED TOP – PINNED BOTTOM

Both ends are restrained against lateral movement (translation) but, are allowed to rotate.

#### SUPPORT CONDITIONS - FIXED / FREE TOP – FIXED BOTTOM

The top is restrained against rotation but is allowed to move laterally. The bottom is restrained against rotation and lateral movement (translation).

### CROSS-SECTIONAL SHAPE

The cross-sectional shape of a column member determines the value of its “Radius of Gyration” or “r”. In general, a member with a large “r” makes a better column than a member with a small “r”. Each axis of a column has a different “r”. Typically the axis with the smallest “r” determines the final design.

### BOLT TORQUE

Bolt torque values are given to ensure the proper connection between Unistrut Metal Framing components. It is important to understand that there is a direct, but not necessarily consistent, relationship between bolt torque and tension in the bolt. Too much tension in the bolt can cause it to break or crush the component parts. Too little tension in the bolt can prevent the connection from developing its full load capacity. The torque values given have been developed over many years of experience and testing.

<table>
<thead>
<tr>
<th>Recommended Bolt Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolt</strong></td>
</tr>
<tr>
<td><strong>Size</strong></td>
</tr>
<tr>
<td><strong>Foot Lbs.</strong></td>
</tr>
<tr>
<td><strong>N•m</strong></td>
</tr>
</tbody>
</table>

These are based on using a properly calibrated torque wrench with a clean dry (non-lubricated) Unistrut fitting, bolt and nut. A lubricated bolt or nut can cause extremely high tension in the connection and may lead to bolt failure. It must be noted that the accuracy of commercial torque wrenches varies widely and it is the responsibility of the installer to ensure that proper bolt torque has been achieved.
### Unit Conversions

#### English To Metric

<table>
<thead>
<tr>
<th>To Convert From</th>
<th>To</th>
<th>Multiply By</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inch [in]</td>
<td>Millimeter [mm]</td>
<td>25.400000</td>
</tr>
<tr>
<td>Foot [ft]</td>
<td>Meter [m]</td>
<td>0.304800</td>
</tr>
<tr>
<td>Yard [yd]</td>
<td>Meter [m]</td>
<td>0.914400</td>
</tr>
<tr>
<td>Mile [mi] (U.S. Statute)</td>
<td>Kilometer [km]</td>
<td>1.609347</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square Inch [in²]</td>
<td>Square Millimeter [mm²]</td>
<td>645.16</td>
</tr>
<tr>
<td>Square Foot [ft²]</td>
<td>Square Meter [m²]</td>
<td>0.092903</td>
</tr>
<tr>
<td>Square Yard [yd²]</td>
<td>Square Meter [m²]</td>
<td>0.836127</td>
</tr>
<tr>
<td>Square Mile [mi²]</td>
<td>(U.S. Statute)</td>
<td>2.589998</td>
</tr>
<tr>
<td>Acre</td>
<td>Square Meter [m²]</td>
<td>4046.873</td>
</tr>
<tr>
<td>Acre</td>
<td>Hectare</td>
<td>0.404687</td>
</tr>
<tr>
<td><strong>Volume</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cubic Inch [in³]</td>
<td>Cubic Millimeter [mm³]</td>
<td>16387.06</td>
</tr>
<tr>
<td>Cubic Foot [ft³]</td>
<td>Cubic Meter [m³]</td>
<td>0.028317</td>
</tr>
<tr>
<td>Cubic Yard [yd³]</td>
<td>Cubic Meter [m³]</td>
<td>0.764555</td>
</tr>
<tr>
<td>Gallon [gal] (U.S. Liquid)</td>
<td>Litre [l]</td>
<td>3.785412</td>
</tr>
<tr>
<td>Quart [qt] (U.S. Liquid)</td>
<td>Litre [l]</td>
<td>0.946353</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ounce (Avoirdupois) [oz]</td>
<td>Gram [g]</td>
<td>28.349520</td>
</tr>
<tr>
<td>Pound (Avoirdupois) [lb]</td>
<td>Kilogram [kg]</td>
<td>0.453592</td>
</tr>
<tr>
<td>Short Ton</td>
<td>Kilogram [kg]</td>
<td>907.185</td>
</tr>
<tr>
<td><strong>Force</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ounce-Force</td>
<td>Newton [N]</td>
<td>0.278014</td>
</tr>
<tr>
<td>Pound-Force [lbf]</td>
<td>Newton [N]</td>
<td>4.448222</td>
</tr>
<tr>
<td><strong>Bending Moment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pound-Force-Inch [lbf-in]</td>
<td>Newton-Meter [N-m]</td>
<td>0.112985</td>
</tr>
<tr>
<td><strong>Pressure, Stress</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot of Water [39.2 F]</td>
<td>Kilopascal [kPa]</td>
<td>2.988980</td>
</tr>
<tr>
<td>Inch of Mercury [32 F]</td>
<td>Kilopascal [kPa]</td>
<td>3.386380</td>
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<tr>
<td><strong>Energy, Work, Heat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>British Thermal Unit [Btu]</td>
<td>Joule [J]</td>
<td>1055.056</td>
</tr>
<tr>
<td>Kilowatt Hour [kW-h]</td>
<td>Joule [J]</td>
<td>3,600,000</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>British Thermal Unit /Hour [Btu/h]</td>
<td>Watt [W]</td>
<td>0.293071</td>
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<tr>
<td>Horsepower [hp] (550 Ft. Lbf/s)</td>
<td>Kilowatt [kW]</td>
<td>0.745700</td>
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<tr>
<td><strong>Angle</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>Radian [rad]</td>
<td>0.017453</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree Fahrenheit [°F]</td>
<td>Degree Celsius [°C]</td>
<td>(°F-32)/1.8</td>
</tr>
</tbody>
</table>

### Metric to English

<table>
<thead>
<tr>
<th>To Convert From</th>
<th>To</th>
<th>Multiply By</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Millimeter [mm]</td>
<td>Inch [in]</td>
<td>0.039370</td>
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<tr>
<td>Meter [m]</td>
<td>Foot [ft]</td>
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<tr>
<td>Meter [m]</td>
<td>Yard [yd]</td>
<td>1.093613</td>
</tr>
<tr>
<td>Kilometer [km]</td>
<td>Mile [mi] (U.S. Statute)</td>
<td>0.621370</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square Millimeter [mm²]</td>
<td>Square Inch [in²]</td>
<td>0.001550</td>
</tr>
<tr>
<td>Square Meter [m²]</td>
<td>Square Foot [ft²]</td>
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<tr>
<td>Square Yard [yd²]</td>
<td>Square Meter [m²]</td>
<td>1.195991</td>
</tr>
<tr>
<td>Square Kilometer [km²]</td>
<td>(U.S. Statute)</td>
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</tr>
<tr>
<td>Square Meter [m²]</td>
<td>Acre</td>
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</tr>
<tr>
<td>Acre</td>
<td>Hectare</td>
<td>2.471046</td>
</tr>
<tr>
<td><strong>Volume</strong></td>
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<td></td>
</tr>
<tr>
<td>Cubic Millimeter [mm³]</td>
<td>Cubic Inch [in³]</td>
<td>0.000061</td>
</tr>
<tr>
<td>Cubic Meter [m³]</td>
<td>Cubic Foot [ft³]</td>
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<tr>
<td>Cubic Meter [m³]</td>
<td>Cubic Yard [yd³]</td>
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<tr>
<td>Litre [l] (U.S. Liquid)</td>
<td>Gallon [gal]</td>
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<tr>
<td>Litre [l]</td>
<td>Quart [qt] (U.S. Liquid)</td>
<td>1.056688</td>
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<tr>
<td><strong>Mass</strong></td>
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<tr>
<td>Gram [g]</td>
<td>Ounce (Avoirdupois) [oz]</td>
<td>0.035274</td>
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<tr>
<td>Kilogram [kg]</td>
<td>Pound (Avoirdupois) [lb]</td>
<td>2.204624</td>
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<tr>
<td>Kilogram [kg]</td>
<td>Short Ton</td>
<td>0.001100</td>
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<tr>
<td><strong>Force</strong></td>
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<td></td>
</tr>
<tr>
<td>Newton [N]</td>
<td>Ounce-Force</td>
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<tr>
<td>Newton [N]</td>
<td>Pound-Force [lbf]</td>
<td>0.224809</td>
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<td><strong>Bending Moment</strong></td>
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<td></td>
</tr>
<tr>
<td>Newton-Meter [N-m]</td>
<td>Pound-Force-Foot [lbf-ft]</td>
<td>0.737562</td>
</tr>
<tr>
<td><strong>Pressure, Stress</strong></td>
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<td></td>
</tr>
<tr>
<td>Kilopascal [kPa]</td>
<td>Pound-Force per Inch [lbf/in²]</td>
<td>0.145038</td>
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<tr>
<td>Kilopascal [kPa]</td>
<td>Square Inch [in²]</td>
<td>0.000061</td>
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<tr>
<td>Kilopascal [kPa]</td>
<td>Foot of Water [39.2 F]</td>
<td>0.334562</td>
</tr>
<tr>
<td>Kilopascal [kPa]</td>
<td>Inch of Mercury [32 F]</td>
<td>0.295301</td>
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<tr>
<td><strong>Energy, Work, Heat</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joule [J]</td>
<td>Foot-Pound-Force [ft-lbf]</td>
<td>0.737562</td>
</tr>
<tr>
<td>Joule [J]</td>
<td>British Thermal Unit [Btu]</td>
<td>0.009948</td>
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<tr>
<td>Joule [J]</td>
<td>Calorie [cal]</td>
<td>0.238846</td>
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<td>Joule [J]</td>
<td>Kilowatt Hour [kW-h]</td>
<td>2.787</td>
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<td><strong>Power</strong></td>
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<td></td>
</tr>
<tr>
<td>Watt [W]</td>
<td>Foot-Pound-Force /Second [ft-lbs/s]</td>
<td>0.737562</td>
</tr>
<tr>
<td>Watt [W]</td>
<td>British Thermal Unit /Hour [Btu/h]</td>
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<td>Kilowatt [kW]</td>
<td>Horsepower (550 Ft. Lbf/s) [hp]</td>
<td>1.341022</td>
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<tr>
<td><strong>Angle</strong></td>
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<td></td>
</tr>
<tr>
<td>Radian [rad]</td>
<td>Degree</td>
<td>57.295788</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree Celsius [°C]</td>
<td>Degree Fahrenheit [°F]</td>
<td>1.8xC+32</td>
</tr>
</tbody>
</table>
### Beam Support Conditions

#### Cantilever Beams

<table>
<thead>
<tr>
<th>Condition</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>V max.</td>
<td>$P$</td>
</tr>
<tr>
<td>M max.</td>
<td>$PL$</td>
</tr>
<tr>
<td>$\Delta$ max.</td>
<td>$\frac{PL^3}{3EI}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>V max.</td>
<td>$W$</td>
</tr>
<tr>
<td>M max.</td>
<td>$\frac{WL}{2}$</td>
</tr>
<tr>
<td>$\Delta$ max.</td>
<td>$\frac{WL^3}{8EI}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>V max.</td>
<td>$Pb$</td>
</tr>
<tr>
<td>M max.</td>
<td>$\frac{Pb^2}{6EI}$</td>
</tr>
<tr>
<td>$\Delta$ max.</td>
<td>$\frac{Pb^2(3L-b)}{6EI}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>V max.</td>
<td>$W$</td>
</tr>
<tr>
<td>M max.</td>
<td>$\frac{5WL^3}{384EI}$</td>
</tr>
<tr>
<td>$\Delta$ max.</td>
<td>$\frac{5WL^3}{384EI}$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>V max.</td>
<td>$P$</td>
</tr>
<tr>
<td>M max.</td>
<td>$\frac{Pb^2}{2L^3}$</td>
</tr>
<tr>
<td>$\Delta$ max.</td>
<td>$\frac{Pb(a+2b) \sqrt{3a(a+2b)}}{27EIL}$</td>
</tr>
</tbody>
</table>

### Diagrams

- Diagram 1: Cantilever beam with reaction $R$, moment $M$, shear $V$, and load $P$.
- Diagram 2: Cantilever beam with reaction $R$, moment $M$, shear $V$, and load $P$.
- Diagram 3: Cantilever beam with reaction $R_1$ and $R_2$, moment $M_1$, shear $V$, and load $P$.
- Diagram 4: Cantilever beam with reaction $R_1$ and $R_2$, moment $M_1$, shear $V$, and load $P$.

### Definitions

- **R** – Reaction
- **M** – Moment
- **P** – Concentrated Load
- **W** – Total Uniform Load
- **V** – Shear
- **L** – Length
- **$\Delta$** – Deflection
- **E** – Modulus of Elasticity
- **I** – Moment of Inertia
### CONVERSION FACTORS FOR BEAMS WITH VARIOUS STATIC LOADING CONDITIONS

All Beam Load tables are for single-span (simple) beams supported at the ends. These can be used in the majority of the cases. However, there are times when it is necessary to know what happens with other loading and support conditions. Some common arrangements are shown below. Simply multiply the values from the Beam Load tables by factors given below.

<table>
<thead>
<tr>
<th>Load and Support Condition</th>
<th>Load Factor</th>
<th>Deflection Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Simple Beam, Uniform Load</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>2. Simple Beam, Concentrated Load at Center</td>
<td>.50</td>
<td>.80</td>
</tr>
<tr>
<td>3. Simple Beam, Two Equal Concentrated Loadcs at 1/4 pts</td>
<td>1.00</td>
<td>1.10</td>
</tr>
<tr>
<td>4. Beam Fixed at Both Ends, Uniform Load</td>
<td>1.50</td>
<td>.30</td>
</tr>
<tr>
<td>5. Beam Fixed at Both Ends, Concentrated Load at Center</td>
<td>1.00</td>
<td>.40</td>
</tr>
<tr>
<td>6. Cantilever Beam, Uniform Load</td>
<td>.25</td>
<td>2.40</td>
</tr>
<tr>
<td>7. Cantilever Beam, Concentrated Load at End</td>
<td>.12</td>
<td>3.20</td>
</tr>
<tr>
<td>8. Continuous Beam, Two Equal Spans, Uniform Load on One Span</td>
<td>1.30</td>
<td>.92</td>
</tr>
<tr>
<td>9. Continuous Beam, Two Equal Spans, Uniform Load on Both Ends</td>
<td>1.00</td>
<td>.42</td>
</tr>
<tr>
<td>10. Continuous Beam, Two Equal Spans, Concentrated Load at Center of One Span</td>
<td>.62</td>
<td>.71</td>
</tr>
<tr>
<td>11. Continuous Beam, Two Equal Spans, Concentrated Load at Center of Each Span</td>
<td>.67</td>
<td>.48</td>
</tr>
</tbody>
</table>

**EXAMPLE I:**
Determine load and deflection of a P 1000 beam continuous over one support and loaded uniformly on one span.

**SOLUTION:**
A. From load table for P1000 on page 26 load for a 5'-0" span is 680# and deflection is .35".
B. Multiply by factors from Table above.
   Load = 680# x 1.30 = 884#
   Deflection = .35" x .92 = .32"

**EXAMPLE II**
Determine load and deflection of a P 5500 cantilever beam with a concentrated load on the end.

**SOLUTION:**
A. From load table P5500 on page 57 load for a 3'-0" span is 2190# and deflection is .09".
B. Multiply by factors from Table above.
   Load = 2190# x .12 = 263#
   Deflection = .09" x 3.20 = .29"
PART I - GENERAL

1.01 SCOPE OF WORK
A. Provide all Unistrut Metal Framing material, fittings and related accessories (Strut System) as indicated on the Contract Drawings.
B. Provide all labor, supervision, engineering, and fabrication required for installation of the Strut System in accordance with the Contract Drawings and as specified herein.
C. Related work specified elsewhere.

1.02 QUALITY ASSURANCE
A. Manufacturer’s qualifications:
   1. The manufacturer shall not have had less than 10 year’s experience in manufacturing Strut Systems.
   2. The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.
B. Installer’s qualifications:
   1. Installer must be a Unistrut trained manufacturer’s authorized representative/installer with not less than 5 years experience in the installation of Strut Systems of this size and conformation.
   2. All Strut System components must be supplied by a single manufacturer.
C. Standards:
   1. Work shall meet the requirements of the following standards:
      a. Federal, State and Local codes.

1.03 SUBMITTALS
A. Structural Calculations and Shop Drawings
   1. Submit structural calculations for approval by the project engineer. Calculations may include, but are not limited to:
      a. Description of design criteria.
      b. Stress and deflection analysis.
      c. Selection of Unistrut framing members, fittings, and accessories.
2. Submit all shop/assembly drawings necessary to completely install the Strut System in compliance with the Contract Drawings.
3. Submit all pertinent manufacturer’s published data.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING
A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.
B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.05 GUARANTEE
A. Separate guarantees shall be issued from the erector and manufacturer, valid for a period of 1 year, against any defects that may arise from the installation or manufacture of the Strut System components.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. All Strut System components shall be manufactured by UNISTRUT CORPORATION or approved equal as determined by the Architect or Engineer of record in writing 10 days prior to bid date.

2.02 MATERIALS
A. All channel members shall be fabricated from structural grade steel conforming to one of the following ASTM specifications:
   A 1011 S5 GR 33, A 653 GR 33.
   B. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications:
      A 575, A 576, A 36 or A 635.
C. Substitutions
   Any substitutions of product or manufacturer must be approved in writing ten days prior to bid date, by Architect or Engineer of record.

2.03 FINISHES
A. Strut System components shall be finished in accordance with one of the following standards:
   1. PERMA-GREEN® II (GR)
      Rust inhibiting acrylic enamel paint applied by electro-deposition, after cleaning and phosphating, and thoroughly baked. Color is per Federal Standard 595a color number 14109 (dark limit V-). Finish to withstand minimum 400 hours salt spray when tested in accordance with ASTM B 117.
   2. ELECTRO-GALVANIZED (EG)
      Electrolytically zinc coated per ASTM B 635 Type III SC 1
   3. PRE-GALVANIZED (PG)
      Zinc coated by hot-dipped process prior to roll forming. The zinc weight shall be G90 conforming to ASTM A 653.
   4. HOT-DIPPED GALVANIZED (HG)
      Zinc coated after all manufacturing operations are complete. Coating shall conform to ASTM A 125 or A 153.

5. SPECIAL COATING / MATERIAL
   (Describe as applicable)

PART 3 - EXECUTION

3.01 EXAMINATION
A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

3.02 INSTALLATION
A. Installation shall be accomplished by a fully trained manufacturer authorized installer.
B. Set Strut System components into final position true to line, level and plumb, in accordance with approved shop drawings.
C. Anchor material firmly in place. Tighten all connections to their recommended torques.

3.03 CLEANUP
A. Upon completion of this section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.04 PROTECTION
A. During installation, it shall be the responsibility of the installer to protect this work from damage.
B. Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.