TECHNICAL DATA

PHD Manufacturing, Inc. –

follows the guidelines of the Metal Framing Manufacturers Association in the manufacture and recommended use of strut systems. In all design applications using strut systems and accessories, proper engineering design practices should be applied and load limits observed. The following pages include helpful information to assist the user in the proper design of strut systems.

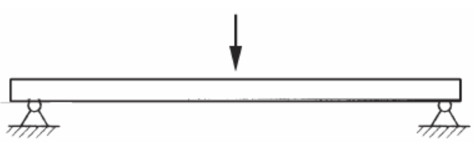
Appropriate beam and column loading information is provided with the dimensional tables accompanying each channel. In addition, the following discussion and tables are designed to assist in the proper selection and use of PHD strut products. Basic engineering information is provided to define the concepts needed to design a safe and economical strut installation.

Design of Strut Systems

PHD struts are often installed to serve either as beams or columns in structural applications. A brief discussion of these types of structural elements and their safe design follows:

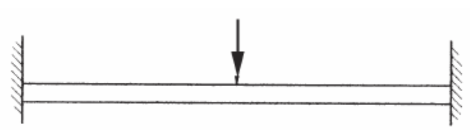
BEAMS

Structural members installed in a horizontal attitude and subject to vertical and/or horizontal loads are known as beams. The method by which a beam is mounted affects the load-carrying capability of the beam. Common mounting methods include:



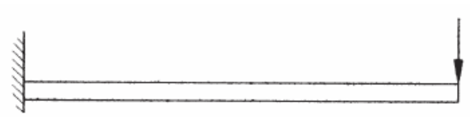
Simple Beam –

A simple beam is one that is supported at both ends without being restricted from bending or flexing. Most beams are analyzed as simply supported beams, even though they are often rigidly fixed at their supports. PHD beam load data are based upon simple beam configurations unless otherwise noted.



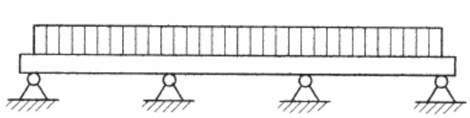
Fixed End Beam –

A fixed end beam is supported at both ends in such a way that motion or bending of the beam is restricted. An example of a fixed end beam is a strut welded at both ends to a very rigid structure. The result is a beam capable of carrying greater loads, but subject to large bending moments at the supports.



Cantilever Beam –

A cantilevered beam is one that is fixed at one end and completely unsupported at the other end.



Continuous Beam –

A continuous beam is supported at three or more points along its length. Continuous beams act similarly to simple beams, particularly at the end spans. However, the counter-balancing effect of adjacent spans restricts movement at the support, much like a fixed beam.

TECHNICAL DATA

TYPES OF BEAM LOADING

Beam Loading –

Beams are loaded in several ways, as shown below.

Concentrated Load –

Also known as a point load, this type of load is applied at one point along the span of the beam. See Figure 1. A beam may have multiple concentrated loads along its span.

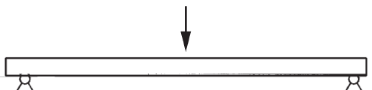


Figure 1

Uniform Load –

This is a load spread evenly over a length of the beam's span. See Figure 2. It may cover the entire span or only a portion.

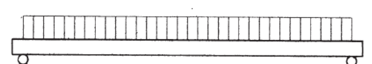


Figure 2

Combined Load –

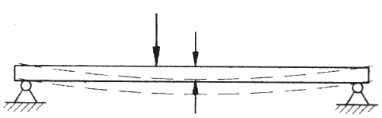
Concentrated loads and uniform loads may be carried simultaneously by a beam, arranged in any combination.

BEAM DEFLECTION

Deflection –

Deflection is the amount of displacement, or sag, experienced by a load-carrying beam. All loaded beams will deflect to a greater or lesser degree, depending upon:

- The size and placement of loads
- The beam material
- The manner of supporting the beam
- The stiffness of the beam



PHD provides deflection values for beams of various spans in the tables ac-companying each channel shape. When determining the deflection of a strut, the rule of thumb observed by the industry is that a deflection of $^{1}/_{240th}$ of the beam's span is acceptable.

The following table of beam formulas contains factors to be applied when ana-lyzing a strut/beam in various configurations. These factors account for the difference in deflection that will be experienced by beams mounted in various configurations and subject to various types of loads.

Also included in the tables of channel information are values for the Moment of Inertia (I) and Section Modulus (S) of the channel. These values are given for both the X-X and Y-Y axis of the channel. They are measures of the stiffness of the beam's cross-sectional shape, and are used to calculate deflection. Deflec-tion decreases as I and S increase. The Modulus of Elasticity (E), listed below I and S, is a measure of the beam material's resistance to bending. Again, as E increases, deflection decreases.

SAFETY FACTOR

Safety Factor –

The design loads given for strut beam loads are based on a simple beam condition using allowable stress of 25,000 psi. This allowable stress results in a safety factor of 1.68. This is based upon a virgin steel minimum yield strength of 33,000 psi cold worked during rolling to an average yield stress of 42,000 psi.

Aluminum typically has an elastic modulus which is $^{1}/_{3}$ that of steel even though they may have identical strength. As a result, the deflection of aluminum channel will be three times that of steel channel under equal loading. In areas where structures will be subject to general viewing, deflection can produce a displeasing effect. To the untrained eye, a sagging channel may appear to be a result of poor design or excessive loading. This is not usually the case. Many properly designed channel installations will show a noticeable deflection at their designed loads. In areas where cosmetics are not important, deflection should not be a factor. Designing an entire installation based on minimal deflection could result in an over designed structure. This translates into increased material and installation cost. Where cosmetics are important, it may be necessary to limit the deflection to an aesthetically pleasing amount. This "acceptable deflection" amount is typically given as a fraction of the span. $^{1}/_{240}$ span deflection is typically the limit where the amount of deflection appears negligible. For example, a beam span of 240" would be allowed 1" ($^{240}/_{240}$) of deflection at the mid point. A 120" span would only be allowed $^{1}/_{2}$" ($^{120}/_{240}$) of deflection. The maximum load for the channel must be limited in order to remain under these deflection requirements. The allowable load resulting in $^{1}/_{240}$ span deflection is posted in the beam load chart for each channel size.

For even more stringent deflection requirements, an allowable load is listed in the beam load charts which results in $^{1}/_{360}$ span deflection. This amount of deflection is sometimes used for beams in finished ceilings that are to be plastered.

TECHNICAL DATA

Bending Moments & Stresses –

BENDING MOMENTS & STRESSES

When loads are placed on a beam, the effect is to flex the beam across its unsupported span. The measure of this effect is called the bending moment. Formulas for bending moments created by various load and beam support combinations are given in the following tables.

When the bending moment of a loaded beam is divided by the Section Modulus of the beam, the resulting value is called bending stress. It is this bending stress that is most commonly evaluated to determine whether a beam is strong enough for the loads it must support.

The maximum bending stress prescribed by structural codes is 25,000 psi (172.37 mPa), and this is the stress upon which PHD load figures are based.

Again, the method of supporting a beam affects the maximum bending moment of the beam. The following table gives modifying factors based upon types of beam supports. Users of PHD struts should take care to apply the proper load factor for the specific beam support configuration in order to determine the proper maximum load that the strut will safely support.

Twisting & Lateral Bracing –

TWISTING & LATERAL BRACING

For long spans and when loads are apt to cause torsion on the beam, it is a good practice to brace the beam to prevent twisting or lateral bending. PHD offers various types of braces for this purpose.

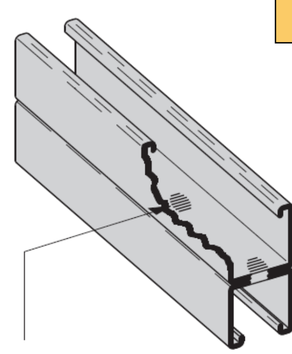
Loading of strut on long spans can cause torsional stress, resulting in the tendency of the strut to twist or bend laterally. This phenomenon reduces the allowable beam loads as shown in the beam loading charts. It is recommended that long spans be supported in a manner to prevent twisting (fixed ends), and that the channel have adequate lateral bracing. Many typical strut applications provide this support and bracing inherently. Piping, tubing, cable trays, or conduits mounted to the strut with straps and clamps prevent twisting or lateral movement. If no such lateral support exists, contact the factory for loading recommendations.

Spot Welding –

WELDING

Resistance welding of back to back strut channel is accomplished by way of an AC powered press type spot welder. This equipment produces a series of spot welds from 2" (50.8) to 4" (101.6) apart continuously down the length of the channel. Consistency is maintained by the use of a highly sophisticated constant current weld control. This processor is capable of maintaining weld sequence, duration and current control along with other variables. Any deviations in the programmed parameters will issue forth an alarm or shut down fault, which is then investigated. Weld quality is tested every 300-350 welds through the use of a destructive test method.

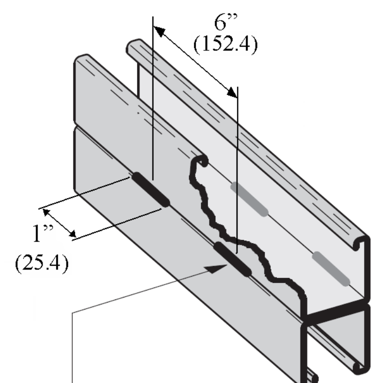
Through the use of modern technology, destructive and non-destructive testing, the quality of strut can be maintained. Spot weld strut is fabricated in accordance with the R.W.M.A. guidelines for resistance welding.



Spot Weld

MIG Welding –

MIG welded, more properly called gas metal arc welded (GMAW) combination channels and fittings, are produced when physical dimensions or certain combinations require a weld process other than automatic spot welding. The same quality control requirements are imposed on MIG welded and spot-welded products.



MIG Weld

3/16” (4.76) Fillet

Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

TECHNICAL DATA

COLUMNS

Figure 1

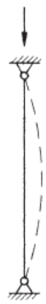


Figure 2

Figure 3

Figure 4

Columns –

Structural members installed in a vertical attitude and subject to vertical loads are known as columns. The loads on a column have the effect of compressing the column and attempting to deflect the column laterally. As with beams, the method by which a column is mounted affects the load-carrying capability of the column. The effect of each method is quantified by the value "K", given for each support condition shown below.

Loads on a column may be concentric (directly in line with the column's vertical axis) or eccentric (offset horizontally from the vertical axis). PHD provides allowable column loads for concentric loading conditions. In addition, the tables accompanying the channels contain a value called the "radius of gyration". This value can be used by a qualified structural engineer to analyze the effect of eccentric loads on strut columns.

Common mounting methods for columns include:

Fixed Top, Fixed Bottom –

Both the top and bottom of the column are rigidly mounted in such a way that rotation and displacement are prevented. The value of "K" for this configuration is .65. See Figure 1.

Pinned Top, Pinned Bottom –

Both the top and bottom of the column are mounted in such a way that rotation is permitted but displacement is prevented. The value of "K" for this configuration is 1.0. See Figure 2.

Pinned Top, Fixed Bottom –

The top of the column is pinned to allow rotation, and the bottom of the column is rigidly mounted in such a way that rotation and displacement are prevented. This is a common method. And is the "standard" for which PHD allowable column loads are listed. The value of "K" for this configuration is .80.
See Figure 3.

Free Top, Fixed Bottom –

The bottom of the column is rigidly mounted. The top of the column is free to move laterally, but is restrained to prevent rotation. The value of "K" for this configuration is 1.2. See Figure 4.

As stated above, allowable column loads published in this catalog are based on the "Pinned Top, Fixed Bottom" mounting configuration, which has a "K" factor of .80. For any of the other mounting configurations, a qualified design professional can use the "K" values given to calculate the allowable column load.

BOLT TORQUE

Bolt Torque

Bolt Size		1/4	5/16	3/8	1/2	5/8	3/4
Rec. Torque	ft-lbs	6	11	19	50	100	125
	N-m	(8)	(15)	(26)	(68)	(136)	(170)

Bolt Torque –

Bolt torque values are given to ensure the proper connection between PHD 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.

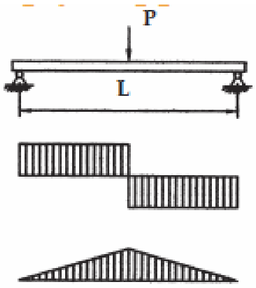
These are based on using a properly calibrated torque wrench with a clean dry (non-lubricated) PHD fitting, bolt and nut. A lubricated bolt or nut can cause extremely high tension in the connection and may lead to bolt failure. It must be noted that the accuracy of commercial torque wrenches varies widely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

Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

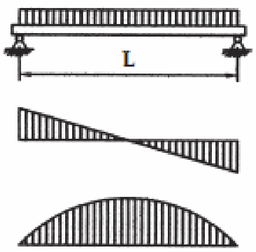
TECHNICAL DATA

BEAM DIAGRAMS AND COMMON FORMULAS

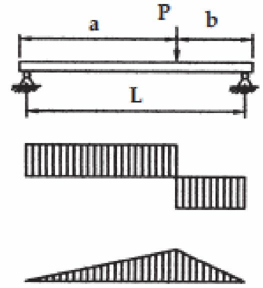
Simply Supported Beams



$R = P/2$
$V_{MAX} = P/2$
$M_{MAX} = PL/4$
□$_{MAX} = \frac{PL^3}{48EI}$

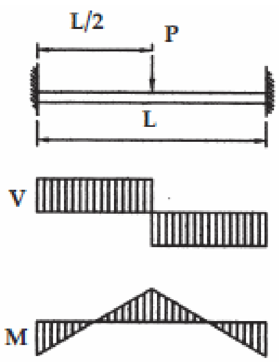


$R = W/2$
$V_{MAX} = W/2$
$M_{MAX} = WL/8$
□$_{MAX} = \frac{5WL^3}{384EI}$

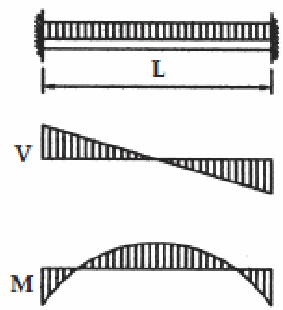


$R_1 = Pb/L$
$R_2 = Pa/L$
$V_{MAX} = Pa/L$
$M_{MAX} = Pab/L$
□$_{MAX} = \frac{Pab}{27EIL}(a+2b)\sqrt{3a(a+2b)}$

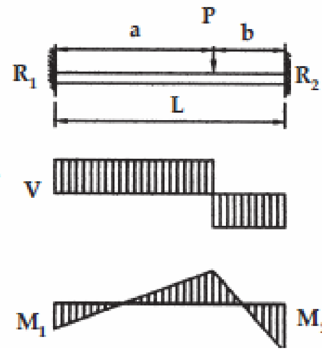
Fixed End Beams



$R = P/2$
$V_{MAX} = P/2$
$M_{MAX} = PL/8$
□$_{MAX} = \frac{PL^3}{192EI}$

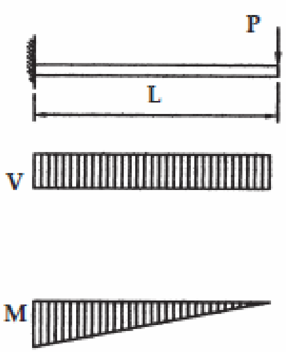


$R = W/2$
$V_{MAX} = W/2$
$M_{MAX} = WL/12$
□$_{MAX} = \frac{WL^3}{384EI}$

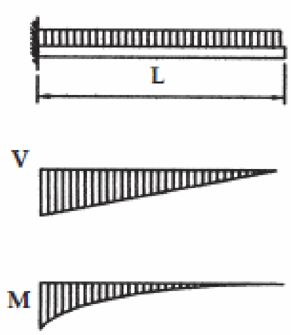


$R_1 = \frac{Pb^2}{L^3}(3a+b)$
$R_2 = \frac{Pa^2}{L^3}(a+3b)$
$M_1 = \frac{Pab^2}{L^2}$
$M_2 = \frac{Pa^2b}{L^2}$

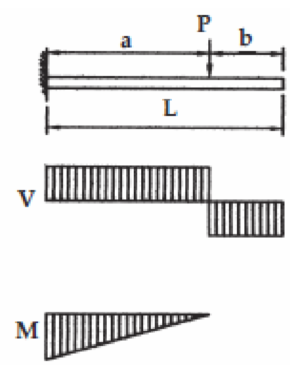
Cantilever Beams



$V_{MAX} = P$
$M_{MAX} = PL$
□$_{MAX} = \frac{PL^3}{3EI}$

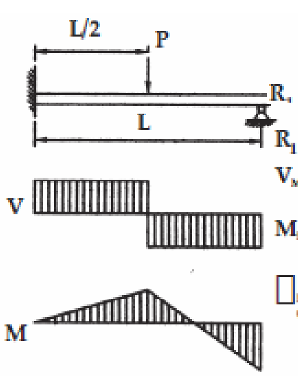


$V_{MAX} = W$
$M_{MAX} = WL/2$
□$_{MAX} = \frac{WL^3}{8EI}$

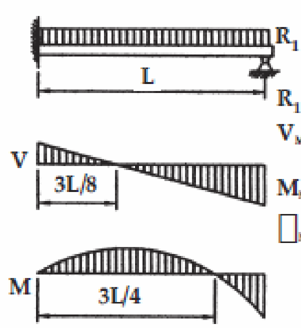


$V_{MAX} = P$
$M_{MAX} = Pb$
□$_{MAX} = \frac{Pb^2(3L-b)}{6EI}$

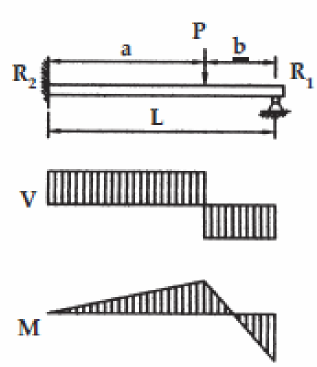
Beams with one end Fixed, one end Simply Supported



$R_1 = 5P/16$
$V_{MAX} = 11P/16$
$M_{MAX} = \frac{3PL}{16}$
□$_{MAX\ (at\ P)} = 0.447L$



$R_1 = 3W/8$
$V_{MAX} = 5W/8$
$M_{MAX} = WL/8$
□$_{MAX} = \frac{WL^3}{185EI}$

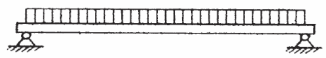
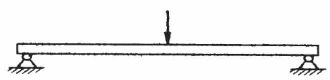
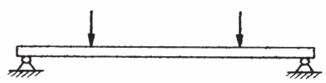
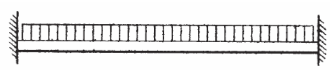
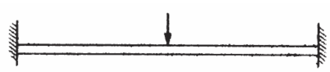
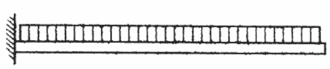
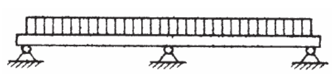
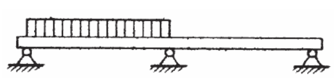
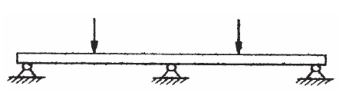
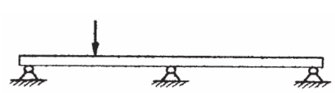


$R_1 = \frac{Pb^2}{2L^3}(a+2L)$
$R_2 = \frac{Pa}{2L^3}(3L^2 - a^2)$
$M_{(at\ P)} = R_1 a$
$M_{(at\ R_2)} = \frac{Pab}{2L^3}(a+L)$

TECHNICAL DATA

Beam Load and Deflection Conversion Factors –

The allowable beam loads listed for various spans of each channel assume that the beam is a simply supported, single-span beam. Although this is the most common condition, it is not always true. For other support conditions, multiply the listed allowable load by the factors in this table to obtain the proper load for the given mounting type.

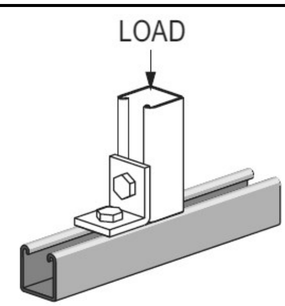
Load & Support Configuration	Diagram	Load Factor	Deflection Factor
1) Simply Supported Beam, Uniform Load		1.00	1.00
2) Simply Supported Beam, Concentrated Load at Mid-span		.50	.80
3) Simply Supported Beam, Two equal Concentrated Loads at 1/4 Points		1.00	1.10
4) Fixed End Beam, Uniform Load		1.50	.30
5) Fixed End Beam, Concentrated Load at Mid-span		1.00	.40
6) Cantilever Beam, Uniform Load		.25	2.40
7) Cantilever Beam, Concentrated Load at End		.12	3.20
8) Continuous Beam, Two Equal Spans, Uniform Load Both Spans		1.00	.42
9) Continuous Beam, Two Equal Spans, Uniform Load on One Spans		1.30	.92
10) Continuous Beam, Two Equal Spans, Concentrated Load at Mid-span of Each		.62	.71
11) Continuous Beam, Two Equal Spans, Concentrated Load at Mid-span of One		.66	.48

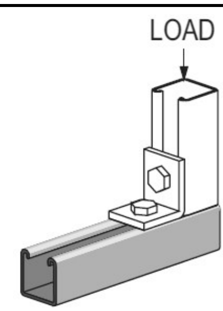
TECHNICAL DATA

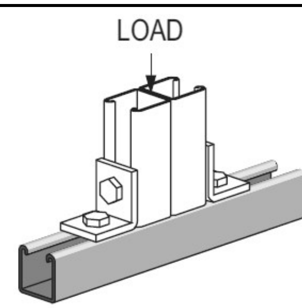
Lateral Bracing Load Reduction Factors

Beam Span or Unbraced Length		Single Channel									Double Channel								
		1000	1100	1200	1300	1400	1500	1600	1700	1800	1000	1100	1200	1300	1400	1500	1600	1700	1800
24	(609.6)	1.00	1.00	1.00	1.00	1.00	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
36	(914.4)	0.94	0.89	1.00	0.98	1.00	0.85	0.89	0.96	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
48	(1219.2)	0.88	0.78	1.00	0.94	0.98	0.70	0.77	0.91	0.88	1.00	0.98	1.00	1.00	1.00	0.97	0.98	1.00	0.98
60	(1524.0)	0.82	0.68	1.00	0.91	0.96	0.55	0.67	0.88	0.83	0.97	0.93	1.00	0.96	1.00	0.90	0.93	0.98	0.93
72	(1828.8)	0.78	0.59	0.98	0.89	0.94	0.44	0.58	0.84	0.79	0.93	0.87	0.97	0.92	0.97	0.83	0.87	0.95	0.88
84	(2133.6)	0.75	0.52	0.97	0.86	0.92	0.38	0.51	0.82	0.75	0.89	0.82	0.95	0.89	0.95	0.76	0.81	0.92	0.83
96	(2438.4)	0.71	0.47	0.96	0.84	0.91	0.33	0.46	0.79	0.72	0.85	0.76	0.92	0.85	0.92	0.68	0.76	0.88	0.79
108	(2743.2)	0.69	0.43	0.95	0.82	0.89	0.30	0.42	0.77	0.69	0.81	0.70	0.90	0.81	0.90	0.61	0.70	0.85	0.74
120	(3048.0)	0.66	0.40	0.94	0.80	0.87	0.28	0.40	0.75	0.66	0.78	0.65	0.87	0.78	0.87	0.54	0.64	0.82	0.69
144	(3657.6)	0.61	0.36	0.91	0.76	0.84	0.24	0.36	0.70	0.60	0.70	0.54	0.83	0.71	0.82	0.43	0.53	0.76	0.60
168	(4267.2)	0.55	0.32	0.89	0.73	0.81	0.22	0.32	0.66	0.55	0.63	0.45	0.78	0.64	0.77	0.35	0.45	0.70	0.51
192	(4876.8)	0.51	0.30	0.87	0.69	0.78	0.21	0.30	0.62	0.50	0.56	0.39	0.73	0.57	0.72	0.30	0.39	0.64	0.44
216	(5486.4)	0.47	0.28	0.84	0.65	0.75	0.19	0.28	0.58	0.47	0.49	0.34	0.68	0.50	0.67	0.27	0.34	0.58	0.39
240	(6096.0)	0.44	0.26	0.82	0.61	0.72	0.18	0.26	0.54	0.43	0.44	0.31	0.63	0.45	0.62	0.24	0.30	0.52	0.35

Bearing Loads on Channel







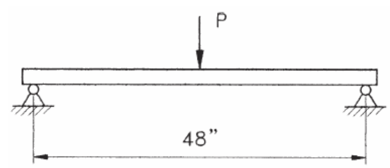
Channel	Bearing Length = $1\frac{5}{8}$ (41.3) Maximum Allowable Loads		Bearing Length = $1\frac{5}{8}$ (41.3) Maximum Allowable Loads		Bearing Length = $3\frac{1}{4}$ (82.6) Maximum Allowable Loads	
	Lbs.	kN	Lbs.	kN	Lbs.	kN
1000	6700	(29.8)	3100	(13.8)	7700	(34.3)
1100	3500	(15.6)	1700	(7.6)	4000	(17.8)
1200	7300	(32.5)	3400	(15.1)	8400	(37.4)
1300	3500	(15.6)	1800	(8.0)	4100	(18.2)
1400	7300	(32.5)	3400	(15.1)	8400	(37.4)
1500	6500	(28.9)	3000	(13.3)	7500	(33.4)
1600	6600	(29.4)	3100	(13.8)	7600	(33.8)
1700	6700	(29.8)	3200	(14.2)	7700	(34.3)
1800	2600	(11.6)	1200	(5.3)	3000	(13.3)

Loads are calculated based on 2007 Specification For The Design Of Cold Formed Steel Structural Members published by AISI.

SAMPLE PROBLEMS

Problem 1 –

The Beam at right is a PHD 1001 Channel, simply supported. What is the maximum allowable load P? How much will the beam deflect under that load?

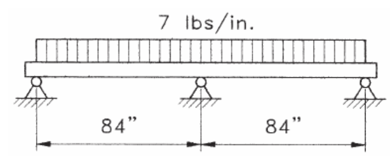


Answer –

From the table of Beam and Column Loads for 1001 Channel, the load for this span is 851 lbs. and the deflection is .22". From the table of load factors above, the load conversion factor is .50 and the deflection factor is .80. Therefore the maximum load P = 851 X .50 = 425 lbs., and the deflection is .22" x .80 = .176".

Problem 2 –

A PHD 1001 Channel is supported at 3 points as shown, making it a continuous beam with 2 spans. The required loading condition is a uniform load of 7 lbs. per inch over both spans. Is the Channel able to safely support this load?

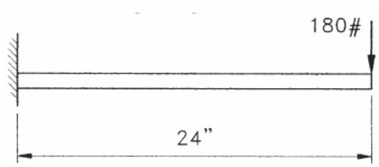


Answer –

The entire load on one span of this beam is 7 lbs./in X 84" = 588 lbs. The allowable load is 486, and the load factor is 1.00, so the allowable load remains 486 lbs. Therefore the beam is not acceptable, since the required load exceeds the allowable load. A different PHD channel must be used, or the load must be decreased.

Problem 3 –

The cantilever beam shown at right carries a concentrated load of 180 lbs. at the end of the 24" PHD 1001 Channel. Is the load acceptable? Calculate the maximum bending moment and deflection.



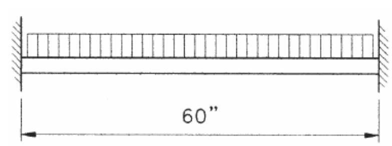
Answer –

The maximum load is 1702 lbs., and the load factor is .12, so the maximum load is 1702 X .12 = 204 lbs. The desired 180 lb. load is within the allowable.

From the table of beam formulas, the maximum bending moment for this support condition is M = PL. For the beam show, then, M = 180 lb. X 24" = 4320 inch-pounds. Deflection for this cantilever beam = PL3 /3EI. E = modulus of elasticity, which is 30 X 106 for steel. I is the Moment of Inertia, listed in the channel information as .189 in4 . The deflection then, is found by the equation 180(24) 3 /3(30 X 106)(.189) = .146".

Problem 4 –

Determine load and deflection of a PHD 1001 Channel fixed at both ends and carrying a uniform load over its entire 60" span.



Answer –

Maximum load from the chart is 681 lbs., and the load factor is 1.50, so the load for this beam is 681 X 1.50 = 1021.5 lbs. Similarly, the deflection for this beam is .35" and the deflection factor is .30, so the deflection = .35 X .30 = .105".

CONVERSION FACTORS FOR UNITS OF MEASUREMENT

To Convert From	To	Multiply By	To Convert From	To	Multiply By
Length					
Inch	Millimeter	25.4	Millimeter	Inch	0.03937
Foot	Meter	0.3048	Meter	Foot	3.28084
Yard	Meter	0.9144	Meter	Yard	1.09361
Mile	Kilometer	1.6093	Kilometer	Mile	0.62137
Area					
Square Inch	Sq. Millimeter	645.16	Sq. Millimeter	Square Inch	0.001550
Square Foot	Sq. Meter	0.0929	Sq. Meter	Square Foot	10.7639
Square Yard	Sq. Meter	0.8361	Sq. Meter	Square Yard	1.19599
Square Mile	Sq. Kilometer	2.5899	Sq. Kilometer	Square Mile	0.3861
Volume					
Gallon	Liter	3.7854	Liter	Gallon	0.26417
Quart	Liter	0.9463	Liter	Quart	1.05669
Cubic Inch	Cubic Millimeter	16387.06	Cubic Millimeter	Cubic Inch	0.000061
Cubic Foot	Cubic Meter	0.0283	Cubic Meter	Cubic Foot	35.31466
Cubic Yard	Cubic Meter	0.76455	Cubic Meter	Cubic Yard	1.30795
Mass					
Ounce	Gram	28.3495	Gram	Ounce	0.035274
Pound	Kilogram	0.45359	Kilogram	Pound	2.20462
Short Ton	Kilogram	907.185	Kilogram	Short Ton	0.0011
Force					
Ounce-Force	Newton	0.278014	Newton	Ounce-Force	3.59694
Pound-Force	Newton	4.44822	Newton	Pound-Force	0.22481
Pressure					
Pound-Force per Square Inch	Kilopascal	6.894757	Kilopascal	Pound-Force per Square Inch	0.145038
Foot of Water (39.2°F)	Kilopascal	2.98898	Kilopascal	Ft. of Water	0.334562
Inch of Mercury (32°F)	Kilopascal	3.38638	Kilopascal	In. of Mercury	0.295301
Bending Moment					
Pound-Force-Inch	Newton-Meter	0.112985	Newton-Meter	Pound-Force-Inch	8.85073
Pound-Force-Foot	Newton-Meter	1.355818	Newton-Meter	Pound-Force-Foot	0.73756
Energy, Work, Heat					
Foot-Pound-Force	Joule	1.355818	Joule	Foot-Pound-Force	0.73756
British Thermal Unit (BTU)	Joule	1055.056	Joule	BTU	0.000948
Calorie	Joule	4.1868	Joule	Calorie	0.23884
Kilowatt Hour	Joule	3,600,000	Joule	Kilowatt Hour	2.78^{-7}
Power					
Foot-Pound-Force Per Second	Watt	1.355818	Watt	Foot-Pound-Force Per Second	0.73756
British Thermal Unit Per Hour	Watt	0.29307	Watt	BTU/Hr	3.41214
Horsepower	Kilowatt	0.7457	Kilowatt	Horsepower	1.341022
Temperature					
Degree Fahrenheit	Degree Celsius	(°F-32)/1.8	Degree Celsius	Degree Fahrenheit	1.8x°C + 32

MATERIAL SPECIFICATIONS

MATERIAL SPECIFICATIONS

CHANNEL

Pre-Galvanized
ASTM A-653 Grade 33 Steel Sheet Zinc Coated by Hot Dip Process

Plain, Powder Coated, or Hot Dip Galvanized
ASTM A-1011/A-1011M Grade 33, Hot Rolled Carbon Steel Sheet and Strip, Structural Quality

Stainless Steel
ASTM A-240, Type 304, and ASTM A-240, Type 316

Aluminum
Aluminum alloy 6005-T5

PIPE CLAMPS

Steel
ASTM A653 Structural Steel, Grade 33
ASTM A1011 Structural Steel, Grade 33

Stainless Steel
ASTM A-240, Type 304 and ASTM A-240 Type 316

ACCESSORIES

Steel
¼" thickness and below ASTM A1011 Structural Steel, Grade 33; ⅜" thickness and above ASTM A-36, Structural Grade.

Stainless Steel
ASTM A-240, Type 304, and ASTM A-240, Type 316

Aluminum
Aluminum alloy 6005-T5 Structural Grade

CHANNEL NUTS

Steel
ASTM A-576, Grade M1015, Case Hardened to RC25 min.

Stainless Steel
ASTM A-240, Type 304, and ASTM A-240, Type 316
Sintered Nuts: MPIF 35 Type 316 (Domestic only)

Aluminum
Aluminum alloy 5052-H32

ALUMINUM

To determine the approximate load data for strut, multiply the load data found in this catalog by a factor of 0.38.

The high strength to weight ratio of channel made of aluminum greatly reduces the overall cost of installation through ease of handling and field cutting.

Aluminum owes its excellent corrosion resistance to its ability to form an aluminum oxide film that immediately reforms when scratched or cut. In most outdoor applications, aluminum has excellent resistance to “weathering”. The resistance to chemicals, indoor or outdoor, can best be determined by tests conducted by the user with exposure to the specific conditions for which it is intended.

STAINLESS STEEL

Because of its corrosion resistance, stainless steel is recommended for applications where corrosion is a problem. Load data for strut is the same as the load data in this catalog.

Stainless steel channel is available in AISI Type 304 or 316 material. Both are non-magnetic and belong to the austenitic stainless steels group, based on alloy content and crystallographic structure. Like carbon steel, stainless steel exhibits increased strength when cold worked by roll-forming.

Several conditions make the use of stainless steel ideal. These include reducing long term maintenance costs, high ambient temperatures, appearance, and stable structural properties such as yield strength, and high creep strength.

Type 304 resists most organic chemicals, dyestuffs and a wide variety of inorganic chemicals at elevated or cryogenic temperatures. Type 316 contains slightly more nickel and adds molybdenum to give it better corrosion resistance in chloride and sulfuric acid environments.

CARBON STEEL

Channels made from high-quality carbon steel are continuously roll formed to precise dimensions. By cold working the steel mechanical properties are increased, allowing lightweight structures to carry the required load. Corrosion resistance of carbon steel varies widely with coating and alloy. See “Finishes” for more detailed information.

ZINC COATING

PHD offers 3 basic forms of zinc coating on its products:

1) **Electro-Galvanized** (Electro-Plated Zinc)
2) **Pre-Galvanized**
3) **Hot Dipped Galvanized**

For best results, a zinc rich paint should be applied to field cuts. The zinc rich paint will provide immediate protection for these areas and eliminate the short time period for galvanic action to "heal" the damaged coating.

Note: *The corrosion resistance of zinc is based on its thickness, the environment, and the coating process used. The acceptability of galvanized coatings at temperatures above 450°F is at the discretion of the end user.*

Zinc offers 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.

Electro-Galvanized "EG" (ASTM B633 SC1 & SC3)

This type of coating is recommended for use indoors in relatively dry areas. The steel is submersed in a bath of zinc salts, through the process of elec-trolysis, a coating of pure zinc adheres to the steel with a molecular bond. A maximum of 0.5 mils of zinc per side can be applied using this method.

SC1 (Mild) is the standard finish thickness which has a Zinc coating of 0.2 mils per side. SC3 (Severe) has a Zinc coating of 0.5 mils per side.

Pre-Galvanized "PG" (ASTM A653 COATING G90)

This type of coating is suitable for extended exposure in dry or mildly cor-rosive atmospheres but not generally recommended for use outdoors in industrial environments. Also known as "mill galvanized" or "hot-dipped mill galvanized" pre-galvanized zinc coatings are produced by rolling the steel coils or sheets through molten zinc, at the steel mill, the material is then cut or slit to size. Zinc near the uncoated edges or weld areas becomes a sacrificial anode which protects the bare areas.

The pre-galvanized material conforms to ASTM A653 with a G90 zinc coating. The zinc thickness per side is nominally 0.75 mils thick or 0.45 oz /sq ft.

Hot-Dip Galvanized "HDG" (ASTM A123)

Recommended for prolonged outdoor exposure and will usually protect steel in most atmospheric environments. After fabrication the part is im-mersed in a bath of molten zinc. A metallurgical bond is formed resulting in a zinc coating that coats all surfaces including edges. Please note that some items cannot be hot-dipped galvanized due to design, tolerances, or threaded components. Check with the PHD factory or your local representa-tive when questionable.

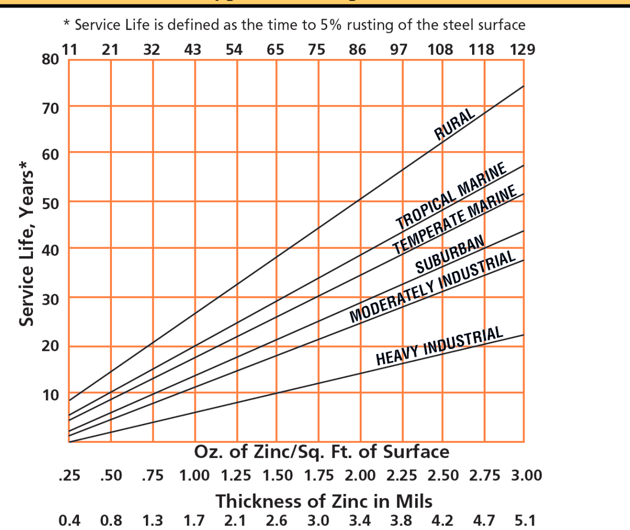
Threaded components on hot dipped galvanized products will be electro-plated.

The hot-dip galvanized coating is typically 2.6 mils or 1.5 oz/sq ft per side.

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

Comparison of Zinc Finishing	
Finish	**Zinc Thickness (mils)**
Hot-Dip Galvanized	2.6
Pre-Galvanized	0.75
Electro-Galvanized (SC1)	0.2
Electro-Galvanized (SC3)	0.5

Life of Protection vs. Thickness of Zinc and Type of Atmosphere



FINISHES

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.

POWDER COATING "PTD"

PHD offers a polyester powder coating that utilizes powder material conforming to ASTM D3451. It is applied by means of an electrostatic spray at ambient temperature.

PVC COATING "PVC"

PVC coating helps reduce noise and protect the pipe or tubing from the metal surface of the hanger. Corrosion resistance protection is minimal.

COPPER COLOR EPOXY FINISH "CCEF"

Designed for use with copper tubing. This coating provides a better level of corrosion resistance than the traditional copper plated finish. It also acts as a protective barrier, avoiding contact between dissimilar metals. The copper color epoxy powder is applied by an elec-trostatic method, and the coated parts are baked at 180 degrees for 20 minutes.

CHANNEL GREEN:
QUALITY: POLYESTER

Powder Properties

Test Method	Powder Properties	Tolerances
ASTM D3451 (18.30)	Specific Gravity	1.33 ± 0.03
ASTM D3451 (18.30)	Theoretical Gravity	144.58 ± 4.0 FT^2/Lb./Mil.
ASTM D3451 (13)	Volatile Content	Max. 2.5%
ASTM D3451 (13)	Storage Temperature Max	80°F

Coating Properties

All tests performed on Substrate 0.032 CRS
Pretreatment Bonderite 1000

Test Method	Coating Properties	Tolerances/ Specifications
ASTM D523	Gloss 20°/60°	70-80
ASTM D2454	Over Bake Resistance Time	100%
ASTM D3363	Pencil Hardness	H - 2H
ASTM D2794 (Modified)	Direct Impact (Gardner)	80 in. Lbs.
ASTM D2794 (Modified)	Reverse Impact (Gardner)	80 in. Lbs.
ASTM D3359	Adhesion (Cross Hatch)	Pass No Adhesion Loss
ASTM D411	Flexibility (Mandrel)	1/8 Bend No Fracture
ASTM B117	Salt Spray	1000 Hrs.
ASTM D2247	Humidity	500 Hrs.

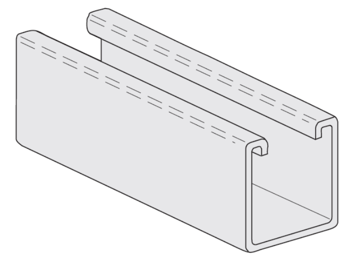
Application

Test Method	Application	Cure Schedule
Electrostatic Spray	Ambient Temperature	15′ @ 190°C (375°F) Recommended Minimum Film Thickness 1.5

CHANNEL

Selection Chart

Figure Number	Width		Height		Material Size	See Page Number
1001 – 1042	$1\frac{5}{8}$	(41.28)	$1\frac{5}{8}$	(41.28)	12 Ga.	26
1101 – 1142	$1\frac{5}{8}$	(41.28)	$1\frac{5}{8}$	(41.28)	14 Ga.	28
1201 – 1242	$1\frac{5}{8}$	(41.28)	$\frac{13}{16}$	(20.64)	12 Ga.	30
1301 – 1342	$1\frac{5}{8}$	(41.28)	$\frac{13}{16}$	(20.64)	14 Ga.	32
1401 – 1442	$1\frac{5}{8}$	(41.28)	1	(25.40)	12 Ga.	34
1501 – 1542	$1\frac{5}{8}$	(41.28)	$3\frac{1}{4}$	(82.55)	12 Ga.	36
1601 – 1642	$1\frac{5}{8}$	(41.28)	$2\frac{7}{16}$	(61.91)	12 Ga.	38
1701 – 1742	$1\frac{5}{8}$	(41.28)	$1\frac{3}{8}$	(34.93)	12 Ga.	40
1801 – 1842	$1\frac{5}{8}$	(41.28)	$\frac{13}{16}$	(20.64)	16 Ga.	-
1950	$1\frac{7}{8}$	(47.63)	$1\frac{7}{8}$	(47.63)	12 Ga.	-
1960	$1\frac{5}{8}$	(41.28)	$1\frac{5}{8}$	(41.28)	12 Ga.	-



Channel

PHD's metal framing channel is cold formed on our modern rolling mills from 12 Ga., 14 Ga., and 16 Ga. low carbon steel strips. A continuous slot with inturned lips provides the ability to make attachments at any point.

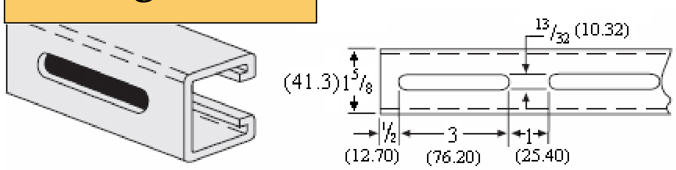
Lengths

Standard lengths are 10′ (3.05m) and 20′ (6.09m) with length tolerance of ±1/8″ (+3.2mm). Custom lengths are available upon request.

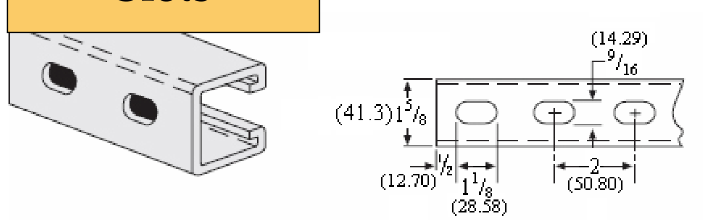
Design Load (Steel & Stainless Steel)

The design loads given for strut beam loads are based on a simple beam condition using an allowable stress of 25,000 psi (172.37mPa). This allowable stress results in a safety factor of 1.68. This is based upon virgin steel minimum yield strength of 33,000 psi (227.53mPa) cold worked during rolling to an average yield stress of 42,000 psi (289.58mPa). For aluminum channel loading multiple steel loading by a factor of 0.38.

Long Slots

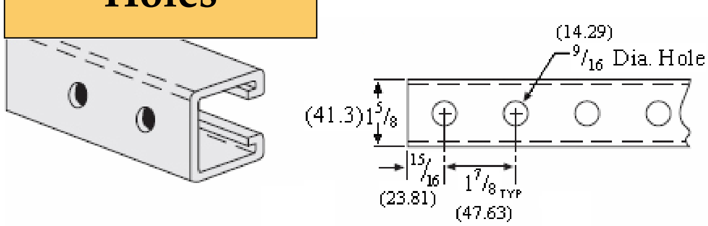


Slots



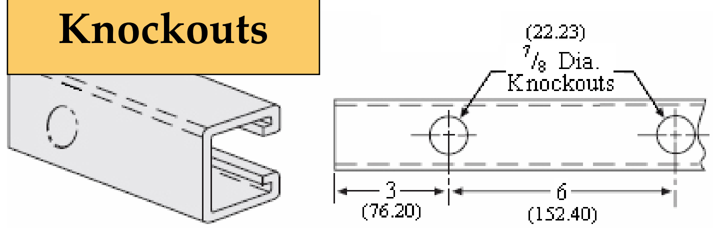
PHD's slotted series of channels offer full flexibility. A variety of pre-punched slot patterns eliminate the need for precise field measuring for hole locations. Slots offer wide adjustments in the alignment and bolt sizing.

Holes



A variety of pre-punched 9/16″ (14.3 mm) diameter hole patterns are available in PHD channels. These hole patterns provide an economical alternative to costly field drilling required for many applications.

Knockouts



PHD Channels are furnished with 7/8″ (22.2 mm) knockouts on 6″ (152 mm) centers, allowing for perfect fixture alignment on spans up to 20′ (6.09 m).

Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

CHANNEL

Channel Combinations


1000 A

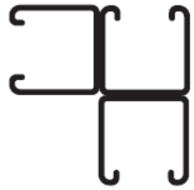

1000 B

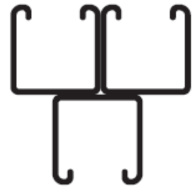

1000 C

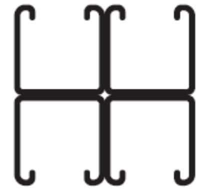

1000 D


1000 E-3


1000 F-3


1000 G-3


1000 H-3

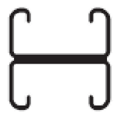

1000 I-4

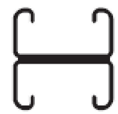

1100 A

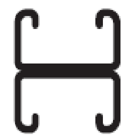

1100 B

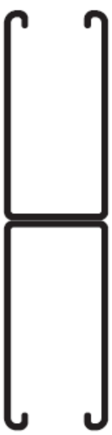

1100 C

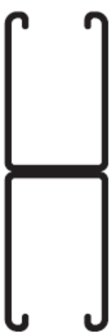

1100 D

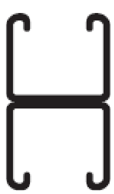

1200 A


1300 A


1400 A


1500 A


1600 A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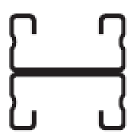
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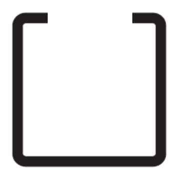
1960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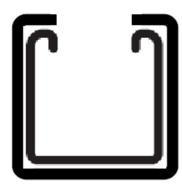
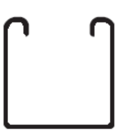

1950 & 1960


1000 SERIES


1100 SERIES


1200 SERIES


1300 SERIES


1400 SERIES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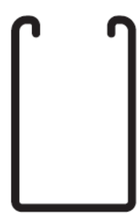
1600 SERIES


1700 SERIES


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