PHD Manufacturing, Inc.

ROOFTOP SUPPORT SYSTEMS

www.phd-mfg.com

Catalog No. 817

Pride
Honesty
Dedication

PHD Manufacturing, Inc.
44018 Columbiana-Waterford Road
Columbiana, Ohio 44408

Phone: (800) 321-2736 ▪ (330) 482-9256
Fax: (330) 482-2763 ▪ www.phd-mfg.com

YOUR LOCAL PHD REPRESENTATIVE IS:

Printed Rev. (9/17)
Web Rev. (6/29/21)

TERMS & CONDITION OF SALE

www.phd-mfg.com

AGREEMENTS:

All agreements are subject to availability of material, strikes, accidents, or other causes beyond our control.

WARRANTY:

We warrant for one year from date of shipment our manufactured products to the extent that we will replace those having manufacturing defects when used for the purpose which we recommended. If goods are defective, the amount of damage is the price of the defective goods only and no allowance will be made for labor or expense of repairing defective goods or damage resulting from the same. We warrant the products we sell of other manufacturers to the extent of the warranties of their respective maker. This is the seller's sole warranty. Seller makes no other warranty of any kind, expressed or implied; and all implied warranties of merchantability and fitness for a particular purpose which exceed seller's afore stated obligation are hereby disclaimed by seller and excluded from this warranty.

For special order products made to the customer's specification, warranty is not valid and we are not responsible for load requirements or liable for damages incurred from product failure.

CLAIMS:

No claims for shortages allowed unless made in writing within ten days of receipt of goods. All goods sent out will be carefully examined, counted and packed. Claims for goods damaged or lost in transit should be made on the carrier, as our responsibility ceases on delivery to the carrier.

SPECIAL ORDERS:

Orders covering special or nonstandard goods are not subject to cancellation except on such terms as may be agreed upon.

TERMS AND DESIGN:

Subject to change without notice. Refer to current price list for terms of sale. PHD Manufacturing, Inc. reserves the right to revise product design without notification.

RETURNS:

We cannot accept return of any goods unless PHD Manufacturing, Inc.'s written permission has been first obtained, in which case same will be credited as follows:

1) All goods must be received in our plant in first class condition, if not, the cost of putting in salable condition will be deducted from credit.
2) Twenty-five percent (25%) will be deducted from credit memoranda issued for handling and restocking, less any charges allowed or paid by PHD Manufacturing, Inc.
3) Goods must be returned prepaid.
4) P.O.A. items cannot be returned.
5) There will be no returns of goods after one year from purchase date. Customer must provide invoice number.
6) There will be no return of goods under $50.00, unless it is the result of PHD Manufacturing, Inc.'s error.

TAXES:

To the price and terms quoted, there will be added any manufacturer's or sales taxes payable on the transaction under any effective statute.

MINIMUM INVOICE:

$50.00 plus transportation.

FREIGHT ALLOWANCE:

All prices are F.O.B. point of shipment. On shipments of 2500 lbs. or more, rail freight or motor freight at the lowest published price is allowed to all U.S. highway points listed in published tariffs (Hawaii and Alaska excluded).

TERMS:

Net 30 days. Monthly settlements on all accounts. One and-a-half percent (1½%) per month or eighteen percent (18%) per annum will be charged on all past due accounts, starting on the 31st day after the date of invoice.

DIMENSIONS & WEIGHTS:

Although PHD Manufacturing, Inc. tries to be as accurate as possible, all listed dimensions and weights are an approximation and are not guaranteed.

www.phd-mfg.com

MATERIAL SPECIFICATIONS

ROOFTOP SUPPORT BASE

Test Name	Value	Test Method
Color	27.29	Spectrophotometer "L" Value
Durometer	87.00 A	ASTM D2240 (15 sec delay)
Specific Gravity	1.131	ASTM D792-91
Tensile Strength	706 psi	ASTM D412
Elongation	346%	ASTM D412
Tear	30.235 kN/m	ASTM D624
Melt Flow Rate	14.836 g/10 min 230C/5.0 Kg	ASTM D624
Percent Moisture	0.064%	Moisture Analyzer

PIPE HANGERS & DEVICES

Cast Iron:
-Grey Cast Iron, ANSI/ASTM A48, Class #20

Malleable Iron:
-ANSI/ASTM A47, Grade Number 32510

Ductile Iron:
-ASTM A536 Grade 65-45-12

Forged Steel:
-ASTM A668 or A1030

Spring Steel:
-SAE 1066-65Mn

Carbon Steel: (3 Gauge Thickness and Below)
-ASTM A1011 CS Type A, B, or C

Carbon Steel: ($^1/_4$" Thickness and Above)
-ASTM A36, Structural Quality

Pre-Galvanized Steel:
-ASTM A653 Grade 33 SS, Zinc Coated by Hot Dip Process

Stainless Steel:
-ASTM A240, Type 304
-ASTM A240, Type 316

CHANNEL STRUT & ACCESSORIES

CHANNEL

Pre-Galvanized
-ASTM A653 Grade 33 SS, Zinc Coated by Hot Dip Process

Plain, Powder Coated, or Hot Dip Galvanized
-ASTM A1011/A1011M Grade 33 SS

Stainless Steel
-ASTM A240, Type 304
-ASTM A240, Type 316

Aluminum
-Aluminum alloy 6005-T5

CHANNEL NUTS

Steel
-ASTM A576, Grade M1015, Case Hardened to RC25 min.

Stainless Steel
-ASTM A240, Type 304
-ASTM A240, Type 316
-Sintered Nuts: MPIF 35 Type 316 (Domestic only)

Aluminum
-Aluminum alloy 5052-H32

PIPE CLAMPS & ACCESSORIES

Pre-Galvanized Steel:
-ASTM A653 Grade 33 SS, Zinc Coated by Hot Dip Process

Carbon Steel: (3 Gauge Thickness and Below)
-ASTM A1011 CS Type A, B, or C

Carbon Steel: (1/4" Thickness and Above)
-ASTM A36, Structural Quality

Stainless Steel:
-ASTM A240, Type 304
-ASTM A240, Type 316

Aluminum
-Aluminum alloy 6005-T5 Structural Grade

Cast Iron:
-Grey Cast Iron, ANSI/ASTM A48, Class #20

Malleable Iron:
-ANSI/ASTM A47, Grade Number 32510

MATERIAL SPECIFICATIONS

www.phd-mfg.com

ALUMINUM

The high strength to weight ratio of PHD Manufacturing, Inc. products 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.

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

CARBON STEEL

PHD Manufacturing, Inc. products made from high-quality carbon steel are cold 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.

STAINLESS STEEL

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

Stainless steel products are available in ASTM A-240, Type 304 or 316 material. Both are low-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.

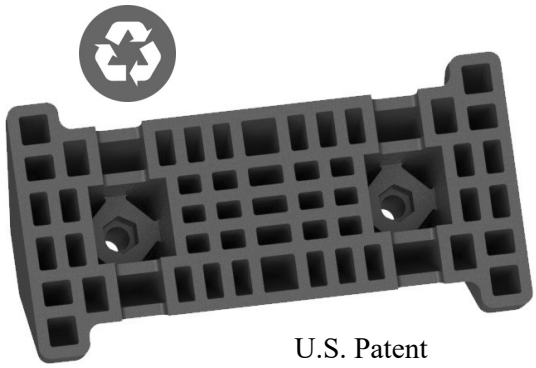
Several conditions make the use of stainless steel ideal. These include reducing long term maintenance costs, high ambient temperatures, appearance, and stable structural properties such as yield strength, and high creep strength.

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.

SPECIAL FEATURES

PHD Manufacturing, Inc. Rooftop Support Bases are made from 100% post-consumer American recycled rubber and recycled plastic, thus qualifying for LEED credits. This material will not deteriorate over time and dampens vibration. These bases are UV resistant and suitable for use on most types of roofing materials or other flat surfaces. Consult with the roofing manufacturer or an engineer to ensure safe loading and material compatibility. If necessary, a compatible swatch of roofing material may be placed under the base to limit movement, disperse load, and ensure compatibility. When utilized on a gravel topped roof, it is recommended that the gravel be removed from under the Rooftop Support Base.

Water channels designed into the bottom of these bases assist in water drainage and help to prevent damming. Hex recesses present under PHD Manufacturing, Inc. bases accept ½" standard hex nuts or bolt heads, retaining them for ease of installation. Square pockets under these bases accept PHD Manufacturing, Inc. Fig. 5000 series square washers, which can be implemented to reduce hardware or fasteners for use with through holes. Screw fasteners can be utilized to attach pipe straps or strut directly to these bases.



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

www.phd-mfg.com

FINISHES & CORROSION

PLAIN (PL)

Plain finish designation means that the product retains the oiled surface applied to the raw steel during the forming process. The fittings have the original oiled surface of the bar-stock material.

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. PVC coating is not compatible with CPVC pipe.

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.

POWDER COATING (PTD)

PHD Manufacturing, Inc. 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.

CHANNEL GREEN: POLYESTER

POWDER PROPERTIES

Test Method	Powder Properties	Tolerances
ASTM D3451 (18.30)	Specific Gravity	1.33 ± 0.03
ASTM D3451 (18.30)	Theoretical Coverage	144.58 ± 4.0 FT²/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 D522	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' @ 375°F (190°C) Recommended Minimum Film Thickness 1.5

EPOXY E-COAT

PHD Manufacturing's epoxy E-Coat offers state of the art corrosion resistance with out the use of heavy metals such as lead, chrome, and zinc. It is applied to our products by a controlled cathodic electro-deposition process. This process is accomplished by transporting the product through several cleaning, phosphatizing, rinsing, and application stages prior to being baked for 20 minutes at 375°F (190°C).

EPOXY PROPERTIES

Property	Test Method	Performance
Color	---	Various
Film Thickness	---	0.5 - 1.5 Mils
Gloss - 60 Degree	ASTM D523	65 - 85
Pencil Hardness	ASTM D3363	2H Minimum
Direct Impact	ASTM D2794	120 in-lb Minimum
Reverse Impact	ASTM D2794	100 in-lb Minimum
Cross-Hatch Adhesion	ASTM D3359	4B - 5B
Humidity	ASTM D1735	1000 Hours Minimum
Water Immersion	ASTM D870	250 Hours Minimum
Gravelometer	GM 9508P	6 Minimum
Throwpower	GM 9535P	12 - 15 Inches

All tests performed on Cold Rolled Steel Lab Panels, Zinc Phosphate Pretreatment, 0.6 Mil Average Film Thickness, Cure 20 Minutes @ 375°F

Property	Substrate / Pretreatment	Salt Spray* 500 hrs.	Salt Spray* 1000 hrs.	20 Cycle** Scab
Corrosion Resistance	CRS/Zinc Phos/Non-Chrome	0 in. (0 mm)	0 - 0.039 in. (0 - 1 mm)	0.039 - 0.079 in. (1 - 2 mm)

(Average Total Scribe Creep), * Salt Spray - ASTM B117
** Cycle Scab - GM9511P, Cold Rolled Steel Lab Panels
Cure 20 Minutes @ 375°F (190°C)

www.phd-mfg.com

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 electrolysis, 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)

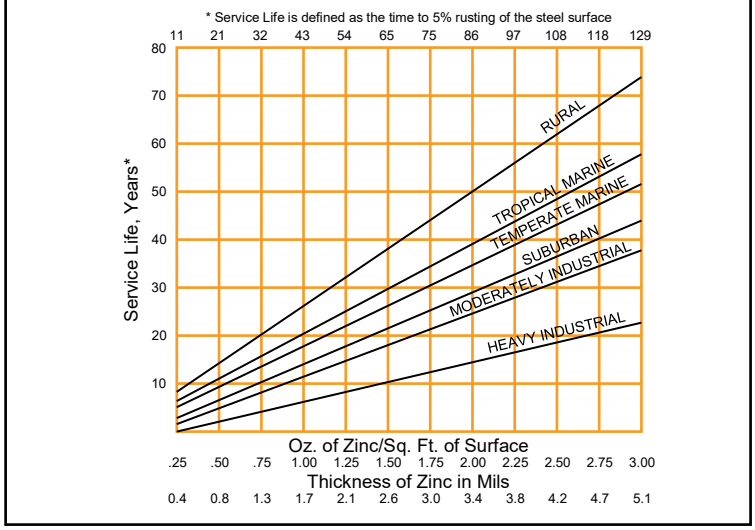
This type of coating is suitable for extended exposure in dry or mildly corrosive atmospheres but not generally recommended for use outdoors in industrial environments. Also known as "mill galvanized" or "hot-dipped mill galvanized" pre-galvanized zinc coatings are produced by rolling the steel coils 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 123)

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

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



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

CORROSION

All metal surfaces are affected by corrosion. Depending on the physical properties of the metal and the environment to which it is exposed, chemical or electromechanical corrosion may occur.

Atmospheric Corrosion

Atmospheric corrosion occurs when metal is exposed to airborne liquids, solids or gases. Some sources of atmospheric corrosion are moisture, salt, dirt and sulphuric acid. This form of corrosion is typically more severe outdoors, especially near marine environments.

Chemical Corrosion

Chemical corrosion takes place when metal comes in direct contact with a corrosive solution. Some factors which affect the severity of chemical corrosion include: chemical concentration level, duration of contact, frequency of washing, and operating temperature.

Galvanic Corrosion

Galvanic corrosion occurs when two or more dissimilar metals are in contact in the presence of an electrolyte (i.e. moisture). An electrolytic cell is created and the metals form an anode or a cathode depending on their relative position on the Galvanic Series Table. The anodic material will be the one to corrode. Anodic or catholic characteristics of two dissimilar metals will depend on the type of each material. For example: If zinc and steel are in contact, the zinc acts as the anode and will corrode; the steel acts as the cathode, and will be protected. If steel and copper are in contact, the steel is now the anode and will corrode. The rate at which galvanic corrosion occurs depends on several factors:

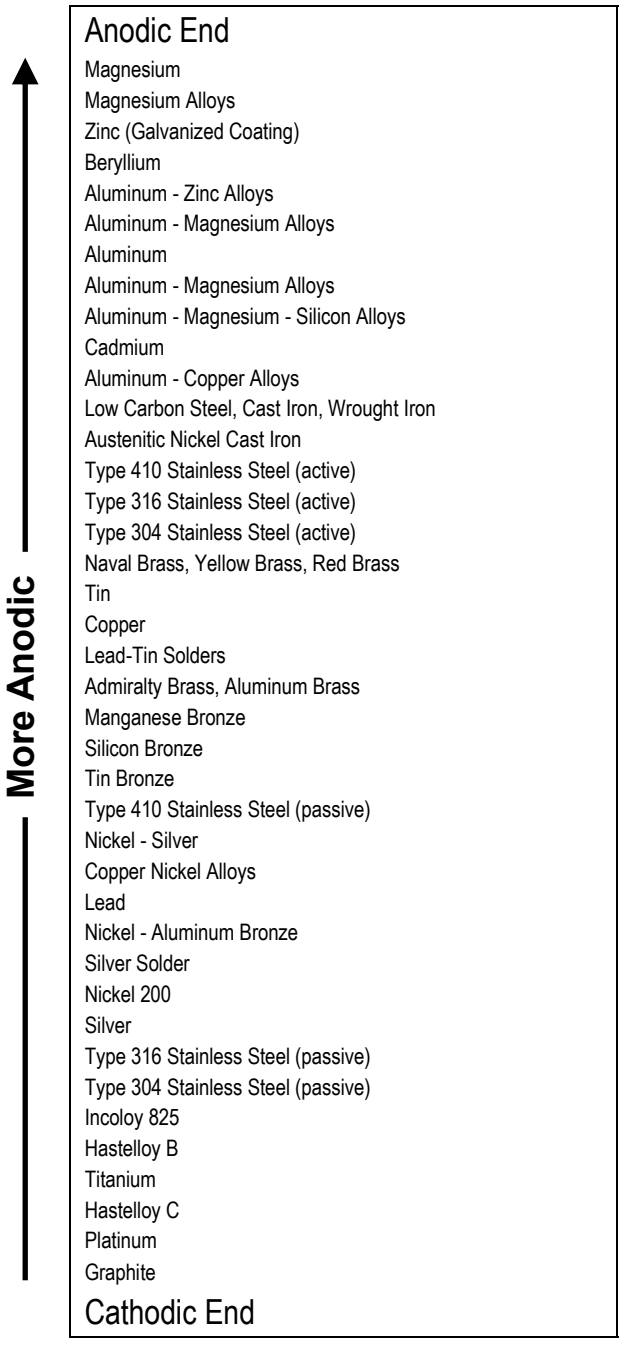
1. The relative position on the Galvanic Series Table - the further apart materials are in the Galvanic Series Table, the greater the potential for corrosion of the anodic material.
2. The amount and concentration of electrolyte present - an indoor, dry environment will have little or no galvanic corrosion compared to a wet atmosphere.
3. The relative size of the materials – a small amount of anodic material in contact with a large catholic material will result in greater corrosion. Likewise, a large anode in contact with a small cathode will decrease the rate of attack.

Storage Corrosion

Wet storage stain (white rust) is caused by the entrapment of moisture between surfaces of closely packed and poorly ventilated material for an extended period. Wet storage stain is usually superficial, having no affect on the properties of the metal.

Light staining normally disappears with weathering. Medium to heavy buildup should be removed in order to allow the formation of normal protective film. Proper handling and storage will help to assure stain-free material. If product arrives wet, it should be unpacked and dried before storage. Dry material should be stored in a well ventilated “low moisture” environment to avoid condensation formation. Outdoor storage is undesirable, and should be avoided whenever possible.

GALVANIC SERIES IN SEA WATER



Metals in descending order of activity in the presence of an electrolyte.

CORROSION

The corrosion data given in this table is for general comparison only.

The presence of contaminates and the effect of temperature in chemical environments can greatly affect the corrosion of any material.

PHD Manufacturing, Inc. strongly suggests that field service tests or simulated laboratory tests using actual environmental conditions are conducted in order to determine the proper materials and finishes to be selected.

Chemical	Aluminum	Channel Green	Type 304 Stainless	Type 316 Stainless	Zinc Coated Steel
Acetic Acid 10%	R	NR	R	R	NR
Acetic Acid 2%	R	F	R	R	NR
Acetone	R	R	R	R	R
Ammonium Hydroxide-Conc,	R	R	R	R	-
Ammonium Hydroxide 10%	F	R	R	R	-
Ammonium Hydroxide 2%	R	R	R	R	-
Benzene	R	R	R	R	-
Bromine Water	NR	R	NR	NR	-
Butanol (Butyl Alcohol)	R	R	R	R	R
Carbon Disulfide	R	R	R	R	-
Carbon Tetrachloride	F	R	R	R	-
Chlorine Water	R	R	NR	F	R
Cutting Oil	-	R	-	-	-
Diethanolamine	R	R	-	-	NR
Ethanol	R	R	R	R	R
Ethyl Acetate	R	R	-	-	R
Ethylene Dichloride	F	R	-	-	R
Formaldehyde 20%	R	R	R	R	R
Gasoline	R	R	R	R	R
Glycerine	R	R	R	R	R
Household Detergent 10%	F	R	R	R	-
Hydrochloric Acid 40%	NR	NR	NR	NR	NR
Hydrochloric Acid 10%	NR	F	NR	NR	NR
Hydrochloric Acid 2%	NR	F	NR	NR	NR
Hydrogen Peroxide 30%	R	NR	R	R	-
Hydrogen Peroxide 3%	R	R	R	R	-
Hydrogen Sulfide (Gas)	R	R	F	R	-
JP-4 Jet Fuel	R	R	R	R	-
Lactic Acid 85%	F	R	NR	-	-
Latex	R	R	R	R	NR
Linseed Oil Fatty Acid	R	F	R	R	-
Methanol	R	R	R	R	R
Methyl Ethyl Ketone	R	R	-	-	R
Methyl Isobutyl Ketone	R	R	-	-	R
Mineral Spirits	R	R	-	-	-
Motor Oil - 10W	R	R	R	R	R
Naphtha, VM&P	R	R	R	R	R
Nitric Acid 2%	F	NR	R	R	-
Perchloroethylene	R	R	-	-	NR
Petroleum Ether	-	R	R	R	R
Phenol 10%	R	R	R	R	R
Phosphoric Acid 2%	F	NR	R	R	NR
Potassium Hydroxide 50%	NR	R	R	R	-
Potassium Hydroxide 10%	NR	R	R	R	-
Potassium Hydroxide 2%	NR	R	R	R	-
Sodium Chloride 25%	F	R	R	R	F
Sodium Hydroxide 50%	NR	R	R	R	NR
Sodium Hydroxide 10%	NR	R	R	R	F
Sodium Hydroxide 2%	NR	R	-	-	-
Sodium Hypochlorite-C1. 10%	F	R	-	-	-
Sodium Hypochlorite-C1. 6%	F	R	NR	R	-
Sulfuric Acid 50%	F	NR	NR	R	NR
Tall Oil Fatty Acid 50%	R	R	-	-	-
Tannic Acid 50%	F	R	R	R	-
Water-Deionized	R	R	R	R	F
Water-Sea	F	F	R	R	F
Water-Tap	R	R	F	F	R
Xyol	R	R	-	-	-

R = Recommended

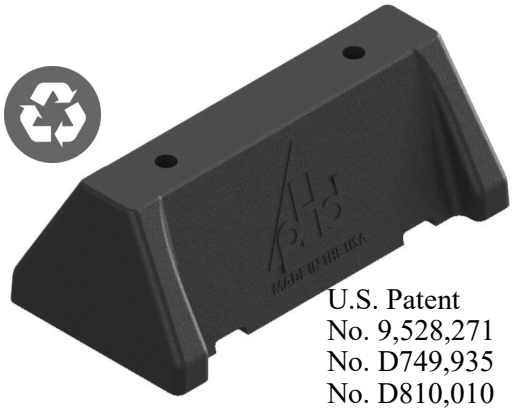
F = May be used under some conditions

NR = Not Recommended

– = Information not available

ROOFTOP SUPPORTS

FIG. RTSB — ROOFTOP SUPPORT BASE



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Function: For installation on most types of roofing material or other flat surfaces. Screw type fasteners can be used to attach strut or other applicable devices such as pipe straps. Can be used to dampen vibration without reducing the life of the roof. Water channels in base prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic.

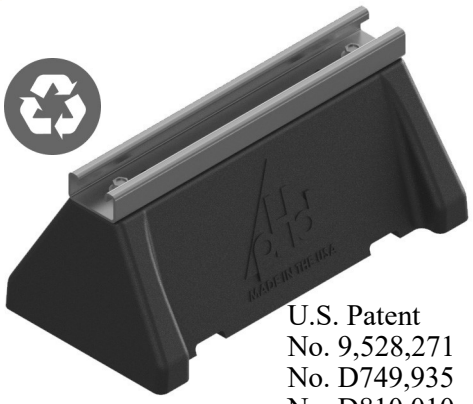
Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity.

Height		Length		Width		Holes Size		Max. Rec. Uniform Load		Wt. Each		Safety Factor
								lbs.	kN	lbs.	kg	
4	(101.60)	10 3/4	(273.05)	5 1/2	(139.70)	1/2	(12.70)	1700	(7.56)	3.10	(1.41)	3.5

Base area = 23.1 in.^{2} for use in bearing calculations.

FIG. SMSB — STRUT MOUNTED SUPPORT BASE



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Function: For installation on most types of roofing material or other flat surfaces. Pre-assembled roof top support base with mounted 1301 or 1101 series channel strut. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. Carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity. Pipe rollers are not recommended for use with 1300 series channel.

Figure Number	Channel Figure Number	Channel Length		Total Height		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each		Safety Factor
										lbs.	kN	lbs.	kg	
SMSB13	1301	10	(254.00)	4 13/16	(122.24)	5 1/2	(139.70)	10 3/4	(273.05)	1700	(7.56)	3.88	(1.76)	3.5
SMSB11	1101	10	(254.00)	5 5/8	(142.88)	5 1/2	(139.70)	10 3/4	(273.05)	1700	(7.56)	4.18	(1.90)	3.5

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

www.phd-mfg.com

STRUT OFFSET SUPPORT BASE — FIG. SOSB

Function: For installation on most types of roofing material or other flat surfaces. Pre-assembled roof top support bases with mounted 1301 or 1101 series channel strut. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. Carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity. Not recommended for use with pipe rollers. When attaching channel to base by means of base through holes, the maximum recommended torque is 3 ft.-lbs.

U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

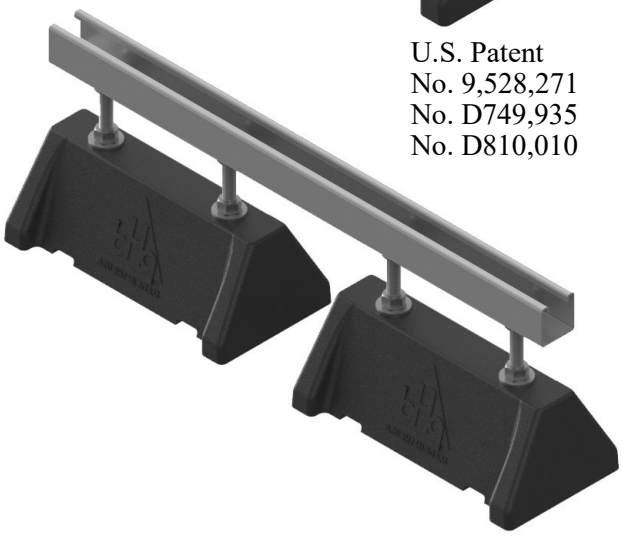
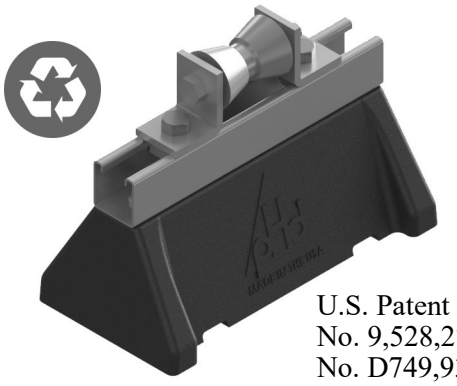


Figure Number	Channel Figure Number	Channel Length		Number of Bases	Total Height		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each		Safety Factor
											lbs.	kN	lbs.	kg	
SOSB1308	1301	10	(254.00)	1	8	(203.2)	5 1/2	(139.70)	10 3/4	(273.05)	1000	(4.45)	4.76	(2.16)	3.5
SOSB1312	1301	10	(254.00)	1	12	(304.8)	5 1/2	(139.70)	10 3/4	(273.05)	1000	(4.45)	5.08	(2.30)	3.5
SOSB1116	1101	24	(609.60)	2	16	(406.4)	5 1/2	(139.70)	24 3/4	(628.65)	1400	(6.23)	10.32	(4.68)	3.5

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

ROOFTOP SUPPORTS

FIG. RMSB — ROLLER MOUNTED SUPPORT BASE



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Function: For installation on most types of roofing material or other flat surfaces. Pre-assembled roof top support base with mounted 1100 series channel strut and Fig. 7580 series roller. Can be used to dampen vibration without reducing the life of the roof. Water channels in base prevent damming.

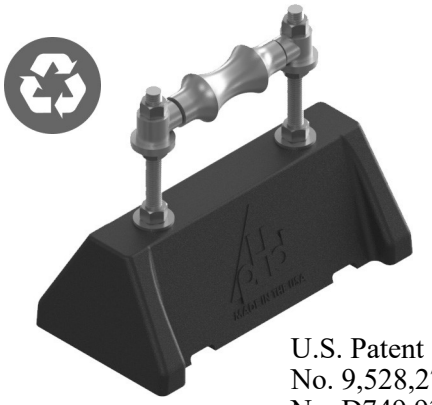
Material: 100% Post-consumer, American recycled rubber and recycled plastic base. Carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish). Cast Iron Rolls w/steel bracket and axle (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity.

Figure Number	Pipe Size		Channel Figure Number	Channel Length		Roller Figure Number	Total Height (Axle Center)		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each	
													lbs.	kN	lbs.	kg
RMSB035	1 to 3 1/2	(25 to 90)	1101	10	(254.00)	7581	6 7/8	(174.63)	5 1/2	(139.70)	10 3/4	(273.05)	390	(1.73)	6.43	(2.92)
RMSB060	4 to 6	(100 to 150)	1101	10	(254.00)	7582	6 7/8	(174.63)	5 1/2	(139.70)	10 3/4	(273.05)	600	(2.67)	6.97	(3.16)
RMSB100	8 to 10	(200 to 250)	1101	10	(254.00)	7583	7 1/2	(190.50)	5 1/2	(139.70)	10 3/4	(273.05)	800	(3.56)	10.08	(4.57)

FIG. ORSB — OFFSET ROLLER SUPPORT BASE



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Function: For installation on most types of roofing material or other flat surfaces. Pre-assembled roof top support bases with mounted Fig. 490 Pipe Roller With Sockets. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. Cast iron pipe roller and sockets (electro-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity.

Figure Number	Total Height (Axle Center)		Base Width		Base Length		Max. Pipe Size		Max. Rec. Uniform Load		Wt. Each	
									lbs.	kN	lbs.	kg
ORSB08	8	(203.2)	5 1/2	(139.70)	10 3/4	(273.05)	3 1/2	(90)	200	(0.89)	5.26	(2.39)
ORSB12	12	(304.8)	5 1/2	(139.70)	10 3/4	(273.05)	3 1/2	(90)	200	(0.89)	5.58	(2.53)

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

www.phd-mfg.com

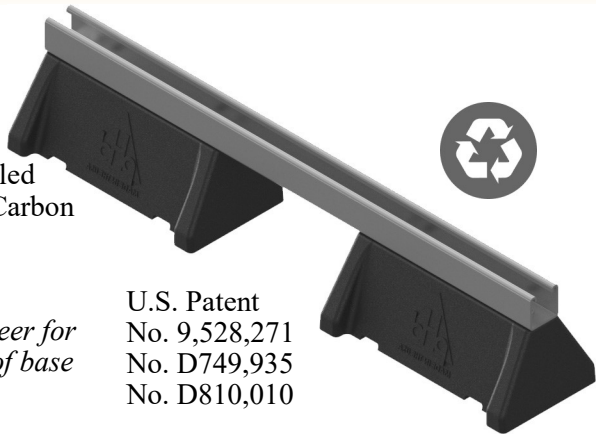
STRUT BRIDGE SUPPORT BASE — FIG. SBSB

Function: For installation on most types of roofing material or other flat surfaces. Pre-assembled duel roof top support bases with mounted 1001 series channel strut. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity. When attaching channel to base by means of base through holes, the maximum recommended torque is 3 ft.-lbs.



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Figure Number	Channel Figure Number	Channel Length		Number of Bases	Bridged Gap		Total Height		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each		Safety Factor
													lbs.	kN	lbs.	kg	
SBSB1321	1301	20 3/4	(527.05)	2	3/4	(19.05)	4 13/16	(122.23)	5 1/2	(139.70)	21 1/2	(546.10)	1300	(5.78)	7.81	(3.54)	3.5
SBSB1021	1001	20 3/4	(527.05)	2	3/4	(19.05)	5 5/8	(142.88)	5 1/2	(139.70)	21 1/2	(546.10)	1300	(5.78)	9.26	(4.20)	3.5
SBSB1028	1001	28	(711.20)	2	8	(203.20)	5 5/8	(142.88)	5 1/2	(139.70)	28.75	(730.25)	1200	(5.34)	10.33	(4.69)	3.5
SBSB1036	1001	36	(914.40)	2	16	(406.40)	5 5/8	(142.88)	5 1/2	(139.70)	36.75	(933.45)	900	(4.00)	11.51	(5.22)	3.5
SBSB1042	1001	42	(1066.80)	2	22	(558.80)	5 5/8	(142.88)	5 1/2	(139.70)	42.75	(1085.85)	800	(3.56)	12.40	(5.62)	3.5
SBSB1050	1001	50	(1270.00)	2	30	(762.00)	5 5/8	(142.88)	5 1/2	(139.70)	50.75	(1289.05)	700	(3.11)	13.58	(6.16)	3.5
SBSB1060	1001	60	(1524.00)	2	40	(1016.00)	5 5/8	(142.88)	5 1/2	(139.70)	60.75	(1543.05)	500	(2.22)	15.05	(6.83)	3.5

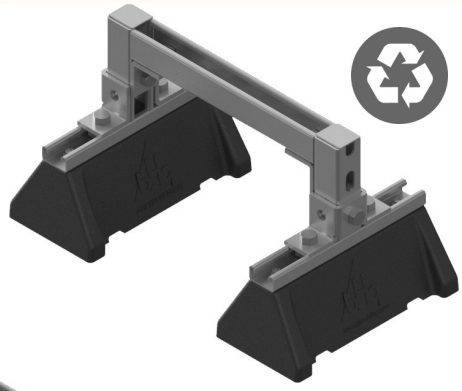
SINGLE BASE RAISED BRIDGE — FIG. SBRB

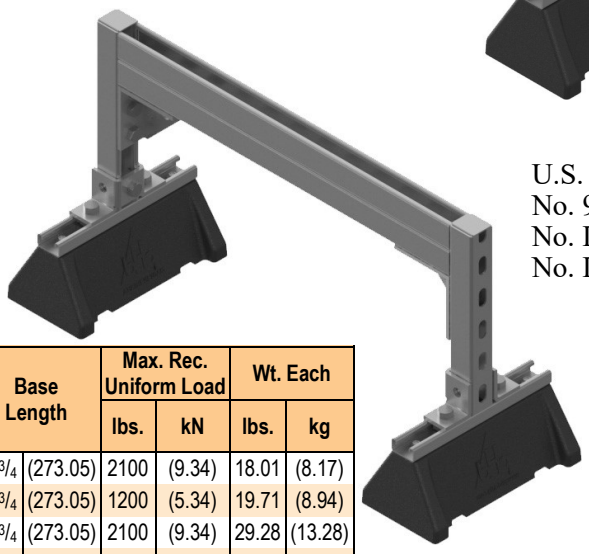
Function: For installation on most types of roofing material or other flat surfaces. Single side base roof top support kit with 1011 or 1011A series channel strut top cross member. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. Carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity.



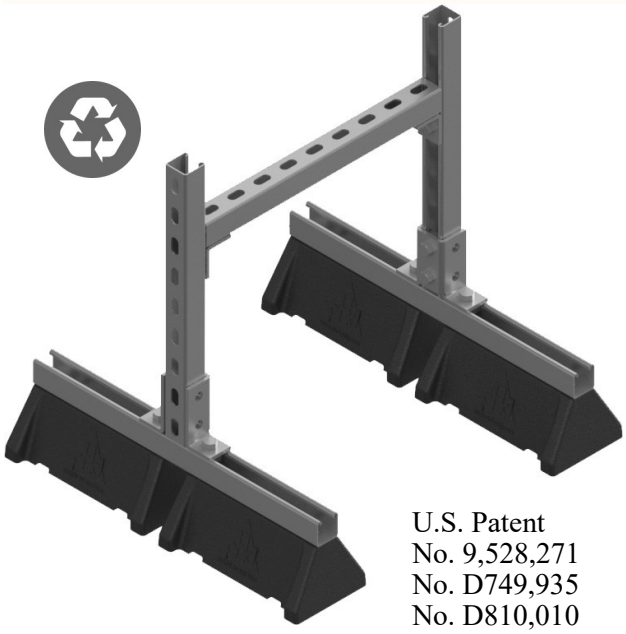


U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Figure Number	Top Channel Figure Number	Top Channel Length		Number of Bases	Total Height		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each	
											lbs.	kN	lbs.	kg
SBRB1012	1011	12	(304.80)	2	10	(254.00)	19 1/8	(485.78)	10 3/4	(273.05)	2100	(9.34)	18.01	(8.17)
SBRB1024	1011	24	(609.60)	2	10	(254.00)	31 1/8	(790.58)	10 3/4	(273.05)	1200	(5.34)	19.71	(8.94)
SBRB1024A	1011A	24	(609.60)	2	16	(406.40)	31 1/8	(790.58)	10 3/4	(273.05)	2100	(9.34)	29.28	(13.28)
SBRB1036A	1011A	36	(914.4)	2	16	(406.40)	43 1/8	(1095.38)	10 3/4	(273.05)	2100	(9.34)	31.62	(14.34)

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

FIG. DBRB DOUBLE BASE RAISED BRIDGE



U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

Function: For installation on most types of roofing material or other flat surfaces. Double side base roof top support kit with 1011 series channel strut top cross member. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. Carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied. Please consult the roofing manufacturer or an engineer for roof load capacity.

Figure Number	Top Channel Figure Number	Top Channel Length		Number of Bases	Total Height		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each	
											lbs.	kN	lbs.	kg
DBRB102318	1011	18	(457.20)	4	23 5/8	(600.08)	25 1/8	(638.18)	22 1/2	(571.50)	1700	(7.56)	37.12	(16.84)
DBRB102324	1011	24	(609.60)	4	23 5/8	(600.08)	31 1/8	(790.58)	22 1/2	(571.50)	1200	(5.34)	38.00	(17.24)
DBRB102336	1011	36	(914.40)	4	23 5/8	(600.08)	43 1/8	(1095.38)	22 1/2	(571.50)	800	(3.56)	39.65	(17.98)
DBRB102348	1011	48	(1219.20)	4	23 5/8	(600.08)	55 1/8	(1400.18)	22 1/2	(571.50)	600	(2.67)	41.31	(18.74)
DBRB102918	1011	18	(457.20)	4	29 5/8	(752.48)	25 1/8	(638.18)	22 1/2	(571.50)	1700	(7.56)	38.90	(17.64)
DBRB102924	1011	24	(609.60)	4	29 5/8	(752.48)	31 1/8	(790.58)	22 1/2	(571.50)	1200	(5.34)	39.73	(18.02)
DBRB102936	1011	36	(914.40)	4	29 5/8	(752.48)	43 1/8	(1095.38)	22 1/2	(571.50)	800	(3.56)	41.40	(18.78)
DBRB102948	1011	48	(1219.20)	4	29 5/8	(752.48)	55 1/8	(1400.18)	22 1/2	(571.50)	600	(2.67)	43.06	(19.53)
DBRB104118	1011	18	(457.20)	4	41 5/8	(1057.28)	25 1/8	(638.18)	22 1/2	(571.50)	1700	(7.56)	42.39	(19.23)
DBRB104124	1011	24	(609.60)	4	41 5/8	(1057.28)	31 1/8	(790.58)	22 1/2	(571.50)	1200	(5.34)	43.22	(19.60)
DBRB104136	1011	36	(914.40)	4	41 5/8	(1057.28)	43 1/8	(1095.38)	22 1/2	(571.50)	800	(3.56)	44.88	(20.36)
DBRB104148	1011	48	(1219.20)	4	41 5/8	(1057.28)	55 1/8	(1400.18)	22 1/2	(571.50)	600	(2.67)	46.54	(21.11)
DBRB105318	1011	18	(457.20)	4	53 5/8	(1362.08)	25 1/8	(638.18)	22 1/2	(571.50)	1700	(7.56)	59.55	(27.01)
DBRB105324	1011	24	(609.60)	4	53 5/8	(1362.08)	31 1/8	(790.58)	22 1/2	(571.50)	1200	(5.34)	60.38	(27.39)
DBRB105336	1011	36	(914.40)	4	53 5/8	(1362.08)	43 1/8	(1095.38)	22 1/2	(571.50)	800	(3.56)	62.04	(28.14)
DBRB105348	1011	48	(1219.20)	4	53 5/8	(1362.08)	55 1/8	(1400.18)	22 1/2	(571.50)	600	(2.67)	63.70	(28.89)

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

www.phd-mfg.com

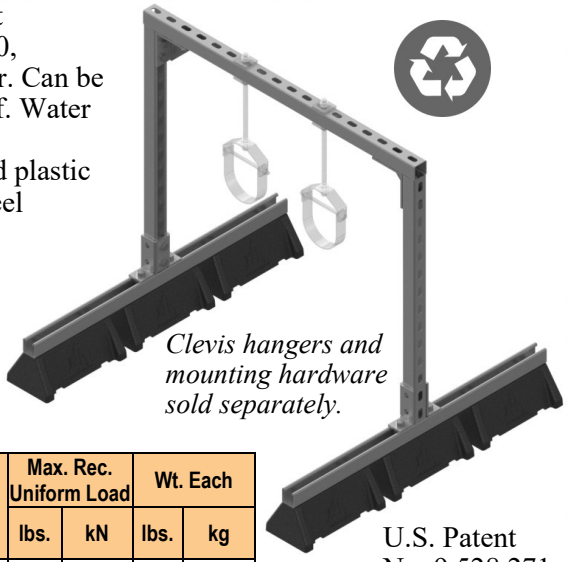
TRIPLE BASE RAISED BRIDGE — FIG. TBRB

Function: For installation on most types of roofing material or other flat surfaces. Triple side base roof top support kit with 1000, 1500, 1500A, 1600, or 1600A series channel strut top cross member. Can be used to dampen vibration without reducing the life of the roof. Water channels in bases prevent damming.

Material: 100% Post-consumer, American recycled rubber and recycled plastic base. carbon steel channel (pre-galvanized finish). Carbon steel hardware (electro-galvanized finish).

Ordering: Specify figure number.

NOTE: Maximum Recommended Loads are specific to the components supplied and with pipe hangers positioned ¼ of the top channel length from each end of the top channel. Please consult the roofing manufacturer or an engineer for roof load capacity.



Clevis hangers and mounting hardware sold separately.

U.S. Patent
No. 9,528,271
No. D749,935
No. D810,010

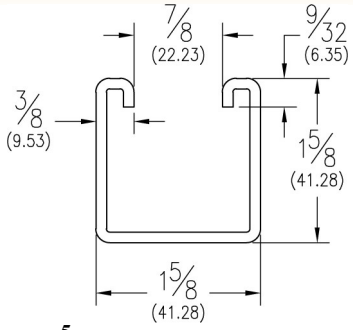
Figure Number	Top Channel Figure Number	Top Channel Length		Number of Bases	Total Height		Base Width		Base Length		Max. Rec. Uniform Load		Wt. Each	
											lbs.	kN	lbs.	kg
TBRB103636	1011	36	(914.40)	6	35 1/4	(895.35)	39 7/8	(1012.83)	34 1/4	(869.95)	800	(3.56)	58.0	(26.31)
TBRB103648	1011	48	(1219.20)	6	35 1/4	(895.35)	51 7/8	(1317.63)	34 1/4	(869.95)	600	(2.67)	60.0	(27.22)
TBRB103660	1011	60	(1524.00)	6	35 1/4	(895.35)	63 7/8	(1622.43)	34 1/4	(869.95)	400	(1.78)	62.0	(28.12)
TBRB103672	1011	72	(1828.80)	6	35 1/4	(895.35)	75 7/8	(1927.23)	34 1/4	(869.95)	300	(1.33)	64.0	(29.03)
TBRB104836	1011	36	(914.40)	6	47 1/4	(1200.2)	39 7/8	(1012.83)	34 1/4	(869.95)	800	(3.56)	62.0	(28.12)
TBRB104848	1011	48	(1219.20)	6	47 1/4	(1200.2)	51 7/8	(1317.63)	34 1/4	(869.95)	600	(2.67)	64.0	(29.03)
TBRB104860	1011	60	(1524.00)	6	47 1/4	(1200.2)	63 7/8	(1622.43)	34 1/4	(869.95)	400	(1.78)	66.0	(29.94)
TBRB104872	1011	72	(1828.80)	6	47 1/4	(1200.2)	75 7/8	(1927.23)	34 1/4	(869.95)	300	(1.33)	68.0	(30.84)
TBRB153636	1511	36	(914.40)	6	35 1/4	(895.35)	39 7/8	(1012.83)	34 1/4	(869.95)	2800	(12.46)	61.0	(27.67)
TBRB153648	1511	48	(1219.20)	6	35 1/4	(895.35)	51 7/8	(1317.63)	34 1/4	(869.95)	2000	(8.90)	64.0	(29.03)
TBRB153660	1511	60	(1524.00)	6	35 1/4	(895.35)	63 7/8	(1622.43)	34 1/4	(869.95)	1600	(7.12)	67.0	(30.39)
TBRB153672	1511	72	(1828.80)	6	35 1/4	(895.35)	75 7/8	(1927.23)	34 1/4	(869.95)	1400	(6.23)	70.0	(31.75)
TBRB154836	1511	36	(914.40)	6	47 1/4	(1200.2)	39 7/8	(1012.83)	34 1/4	(869.95)	2800	(12.46)	65.0	(29.48)
TBRB154848	1511	48	(1219.20)	6	47 1/4	(1200.2)	51 7/8	(1317.63)	34 1/4	(869.95)	2000	(8.90)	68.0	(30.84)
TBRB154860	1511	60	(1524.00)	6	47 1/4	(1200.2)	63 7/8	(1622.43)	34 1/4	(869.95)	1600	(7.12)	71.0	(32.21)
TBRB154872	1511	72	(1828.80)	6	47 1/4	(1200.2)	75 7/8	(1927.23)	34 1/4	(869.95)	1400	(6.23)	74.0	(33.57)
TBRB153636A	1511A	36	(914.40)	6	35 1/4	(895.35)	39 7/8	(1012.83)	34 1/4	(869.95)	4100	(18.24)	69.0	(31.30)
TBRB153648A	1511A	48	(1219.20)	6	35 1/4	(895.35)	51 7/8	(1317.63)	34 1/4	(869.95)	4100	(18.24)	75.0	(34.02)
TBRB153660A	1511A	60	(1524.00)	6	35 1/4	(895.35)	63 7/8	(1622.43)	34 1/4	(869.95)	4100	(18.24)	81.0	(36.74)
TBRB153672A	1511A	72	(1828.80)	6	35 1/4	(895.35)	75 7/8	(1927.23)	34 1/4	(869.95)	4100	(18.24)	87.0	(39.46)
TBRB154836A	1511A	36	(914.40)	6	47 1/4	(1200.2)	39 7/8	(1012.83)	34 1/4	(869.95)	4100	(18.24)	73.0	(33.11)
TBRB154848A	1511A	48	(1219.20)	6	47 1/4	(1200.2)	51 7/8	(1317.63)	34 1/4	(869.95)	4100	(18.24)	78.0	(35.38)
TBRB154860A	1511A	60	(1524.00)	6	47 1/4	(1200.2)	63 7/8	(1622.43)	34 1/4	(869.95)	4100	(18.24)	84.0	(38.10)
TBRB154872A	1511A	72	(1828.80)	6	47 1/4	(1200.2)	75 7/8	(1927.23)	34 1/4	(869.95)	4100	(18.24)	90.0	(40.82)
TBRB163636	1611	36	(914.40)	6	35 1/4	(895.35)	39 7/8	(1012.83)	34 1/4	(869.95)	1600	(7.12)	59.0	(26.76)
TBRB163648	1611	48	(1219.20)	6	35 1/4	(895.35)	51 7/8	(1317.63)	34 1/4	(869.95)	1200	(5.34)	62.0	(28.12)
TBRB163660	1611	60	(1524.00)	6	35 1/4	(895.35)	63 7/8	(1622.43)	34 1/4	(869.95)	1000	(4.45)	64.0	(29.03)
TBRB163672	1611	72	(1828.80)	6	35 1/4	(895.35)	75 7/8	(1927.23)	34 1/4	(869.95)	800	(3.56)	67.0	(30.39)
TBRB164836	1611	36	(914.40)	6	47 1/4	(1200.2)	39 7/8	(1012.83)	34 1/4	(869.95)	1600	(7.12)	63.0	(28.58)
TBRB164848	1611	48	(1219.20)	6	47 1/4	(1200.2)	51 7/8	(1317.63)	34 1/4	(869.95)	1200	(5.34)	66.0	(29.94)
TBRB164860	1611	60	(1524.00)	6	47 1/4	(1200.2)	63 7/8	(1622.43)	34 1/4	(869.95)	1000	(4.45)	68.0	(30.84)
TBRB164872	1611	72	(1828.80)	6	47 1/4	(1200.2)	75 7/8	(1927.23)	34 1/4	(869.95)	800	(3.56)	71.0	(32.21)
TBRB163636A	1611A	36	(914.40)	6	35 1/4	(895.35)	39 7/8	(1012.83)	34 1/4	(869.95)	3000	(13.35)	66.0	(29.94)
TBRB163648A	1611A	48	(1219.20)	6	35 1/4	(895.35)	51 7/8	(1317.63)	34 1/4	(869.95)	3000	(13.35)	71.0	(32.21)
TBRB163660A	1611A	60	(1524.00)	6	35 1/4	(895.35)	63 7/8	(1622.43)	34 1/4	(869.95)	3000	(13.35)	76.0	(34.47)
TBRB163672A	1611A	72	(1828.80)	6	35 1/4	(895.35)	75 7/8	(1927.23)	34 1/4	(869.95)	2500	(11.12)	80.0	(36.29)
TBRB164836A	1611A	36	(914.40)	6	47 1/4	(1200.2)	39 7/8	(1012.83)	34 1/4	(869.95)	3000	(13.35)	70.0	(31.75)
TBRB164848A	1611A	48	(1219.20)	6	47 1/4	(1200.2)	51 7/8	(1317.63)	34 1/4	(869.95)	3000	(13.35)	75.0	(34.02)
TBRB164860A	1611A	60	(1524.00)	6	47 1/4	(1200.2)	63 7/8	(1622.43)	34 1/4	(869.95)	3000	(13.35)	79.0	(35.83)
TBRB164872A	1611A	72	(1828.80)	6	47 1/4	(1200.2)	75 7/8	(1927.23)	34 1/4	(869.95)	2500	(11.12)	84.0	(38.10)

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

www.phd-mfg.com

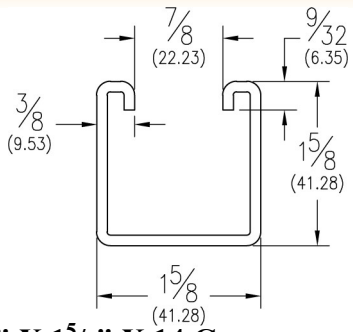
CHANNEL & ACCESSORIES

FIG. 1001-1042



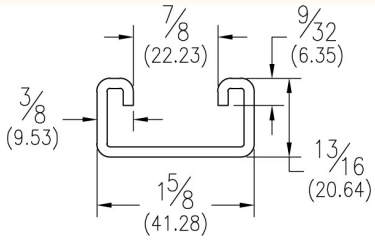
$1^5/_8$" X $1^5/_8$" X 12 Gauge
Available in pre-galvanized, plain, powder coated, or type 304 or type 316 stainless steel in 10ft. (3.05m) and 20ft. (6.10m) lengths.

FIG. 1101-1142



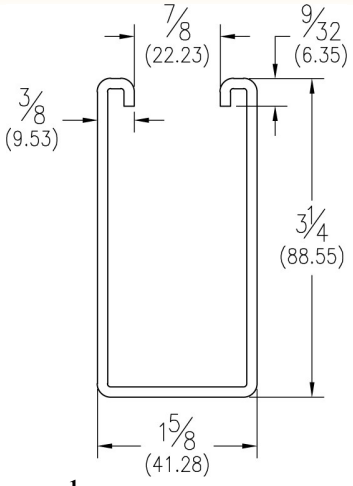
$1^5/_8$" X $1^5/_8$" X 14 Gauge
Available in pre-galvanized, plain, or powder coated in 10ft. (3.05m) and 20ft. (6.10m) lengths.

FIG. 1301-1342



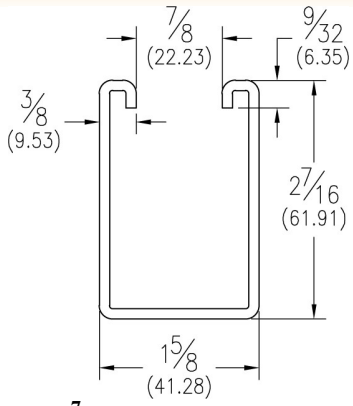
$1^5/_8$" X $^{13}/_{16}$" X 14 Gauge
Available in pre-galvanized, plain, or powder coated in 10ft. (3.05m) and 20ft. (6.10m) lengths.

FIG. 1501-1542



$1^5/_8$" X $3^1/_4$" X 12 Gauge
Available in pre-galvanized, plain, powder coated, or type 304 or type 316 stainless steel in 10ft. (3.05m) and 20ft. (6.10m) lengths.

FIG. 1601-1642



$1^5/_8$" X $2^7/_{16}$" X 12 Gauge
Available in pre-galvanized, plain, powder coated, or type 304 or type 316 stainless steel in 10ft. (3.05m) and 20ft. (6.10m) lengths.

FIG. 3108

$^1/_2$" Strut Nut with Spring
Available in electro-galvanized or type 304 or type 316 stainless steel.

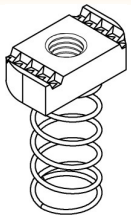


FIG. 3208

$^1/_2$" Strut Nut with Short Spring
Available in electro-galvanized finish.

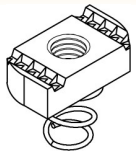


FIG. 3308

$^1/_2$" Strut Nut with Long Spring
Available in electro-galvanized finish.

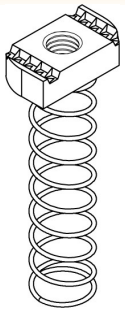


FIG. 3408

$^1/_2$" Squeeze Nut
Available in electro-galvanized finish.

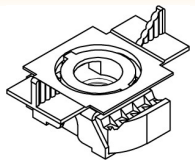


FIG. 20

$^1/_2$" Continuous Threaded Rod
Available in plain, electro-galvanized, or type 304 or type 316 stainless steel in 6ft. (1.83m), 10ft. (3.05m), and 12ft. (3.66m) lengths.

FIG. 110

$^1/_2$" Hex Nut
Available in plain, electro-galvanized, or type 304 or type 316 stainless steel.

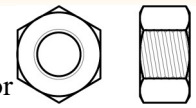
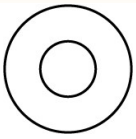


FIG. 130

$^1/_2$" Flat Washer
Available in plain, electro-galvanized, or type 304 or type 316 stainless steel.

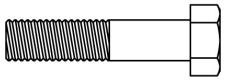


Unless otherwise specified, all dimensions on drawings and in charts are in inches and dimensions shown in parentheses are in millimeters.

ACCESSORIES

www.phd-mfg.com

FIG. 41
Hex Head Bolt



Diameter	Length		Wt. Each	
			lbs.	kg
1/2	1	(25.4)	.09	(.04)
1/2	1 1/4	(31.8)	.10	(.05)
1/2	1 1/2	(38.1)	.12	(.05)
1/2	1 3/4	(44.5)	.13	(.06)
1/2	2	(50.8)	.15	(.07)
1/2	2 1/4	(57.2)	.16	(.07)
1/2	2 1/2	(63.5)	.18	(.08)

FIG. 490
Pipe Roller with Sockets

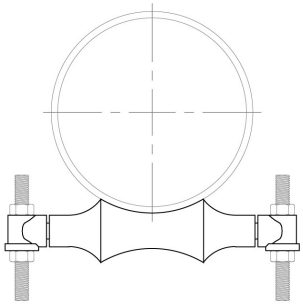


FIG. 2000-2712
Strut Clamps

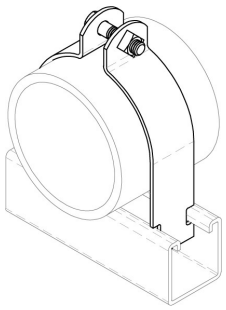


FIG. 3900
1/2" 12-Point Flange Nut

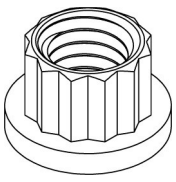


FIG. 4405-4406
Type A End Caps

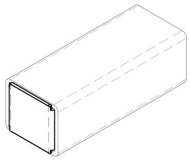


Figure Number	Use With Fig. Number	Wt. Each	
		lbs.	kg
4405	1001 & 1101	.10	(.05)
4406	1201 & 1301	.05	(.02)

FIG. 5000-5004
Square Washers

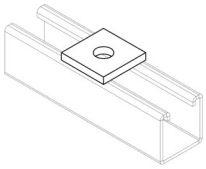


Figure Number	Rod Size	Wt. Each	
		lbs.	kg
5000	1/4	.18	(.08)
5001	3/8	.17	(.08)
5002	1/2	.17	(.08)
5003	5/8	.16	(.07)
5004	3/4	.16	(.07)

FIG. 5005-5009
No Turn Square Washers

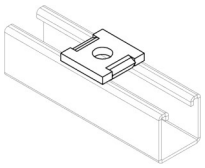


Figure Number	Rod Size	Wt. Each	
		lbs.	kg
5005	1/4	.18	(.08)
5006	3/8	.17	(.08)
5007	1/2	.17	(.08)
5008	5/8	.16	(.07)
5009	3/4	.16	(.07)

FIG. 5110
2-Hole Corner Angle

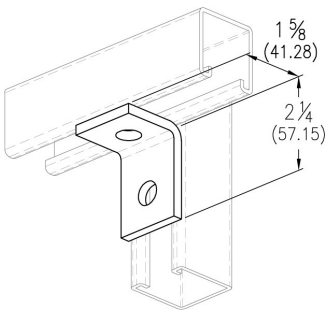


FIG. 5112
2-Hole Corner Angle

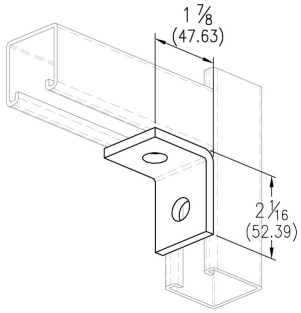


FIG. 5119
No Turn 2-Hole Corner Angle

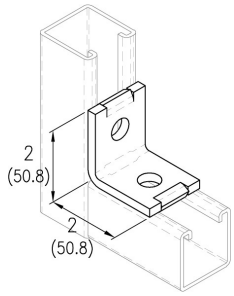


FIG. 5130
4-Hole Corner Angle

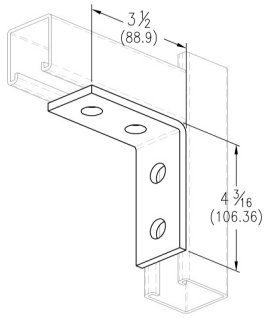
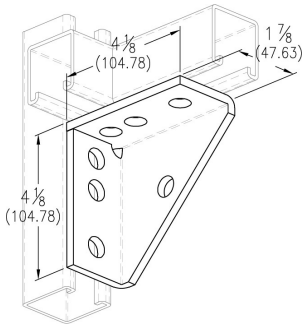


FIG. 5165
Universal Shelf Bracket



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

www.phd-mfg.com

ACCESSORIES

FIG. 5501
3-Hole "U" Support

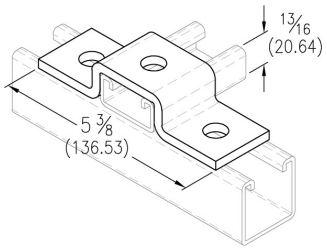


FIG. 5503
5-Hole "U" Support

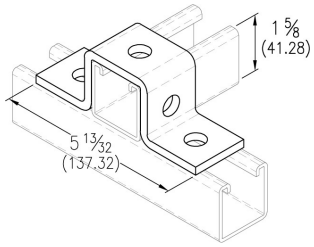


FIG. 5507
6-Hole "U" Support

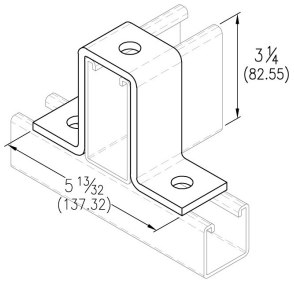


FIG. 5521
6-Hole "U" Support

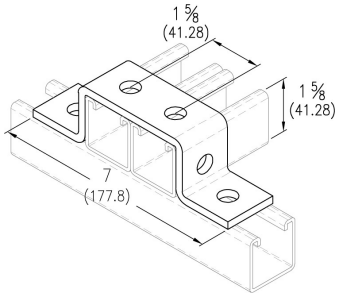


FIG. 5635
5-Hole Double Wing Connector

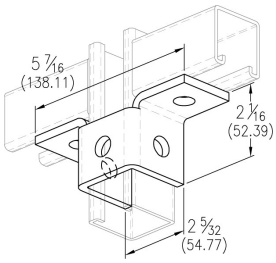


FIG. 5640
8-Hole Double Wing Connector

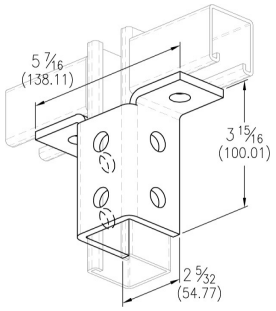


FIG. 5645
10-Hole Double Wing Connector

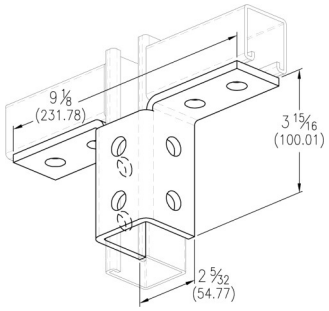


FIG. 7231-7238
One Hole Clamp for O.D. Tube

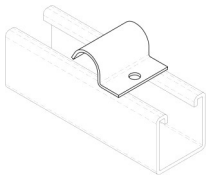


Figure Number	Tube O.D.		Wt. Each lbs.	Wt. Each kg
7231	1/4	(6.35)	.03	(.01)
7232	5/16	(7.94)	.03	(.01)
7233	3/8	(9.53)	.04	(.02)
7234	1/2	(12.70)	.04	(.02)
7235	5/8	(15.88)	.05	(.02)
7236	3/4	(19.05)	.06	(.03)
7237	7/8	(22.23)	.06	(.03)
7238	1	(25.40)	.07	(.03)

FIG. 7251-7263
Standard Pipe Strap

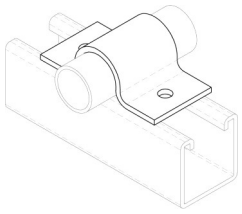


Figure Number	Pipe Size		Wt. Each lbs.	Wt. Each kg
7251	1/2	(15)	.29	(.13)
7252	3/4	(20)	.32	(.15)
7253	1	(25)	.35	(.16)
7254	1 1/4	(32)	.41	(.19)
7255	1 1/2	(40)	.45	(.20)
7256	2	(50)	1.00	(.45)
7257	2 1/2	(65)	1.13	(.51)
7258	3	(80)	1.32	(.60)
7259	3 1/2	(90)	1.51	(.68)
7260	4	(100)	1.66	(.75)
7261	5	(125)	1.91	(.87)
7262	6	(150)	2.23	(1.01)
7263	8	(200)	2.97	(1.35)

FIG. 7581-7585
Roller Support

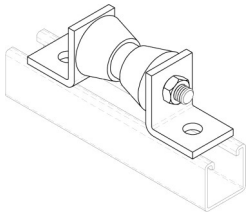


Figure Number	Pipe Size		Wt. Each lbs.	Wt. Each kg
7581	2	(50)	1.77	(.80)
7581	2 1/2	(65)	1.77	(.80)
7581	3	(80)	1.77	(.80)
7581	3 1/2	(90)	1.77	(.80)
7582	4	(100)	2.31	(1.05)
7582	5	(125)	2.31	(1.05)
7582	6	(150)	2.31	(1.05)
7583	8	(200)	5.42	(2.46)
7583	10	(250)	5.42	(2.46)
7584	12	(300)	10.40	(4.72)
7584	14	(350)	10.40	(4.72)
7585	16	(400)	15.08	(6.84)
7585	18	(450)	15.08	(6.84)
7585	20	(500)	15.08	(6.84)

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

DESIGN OF STRUT SYSTEMS

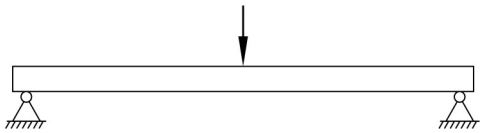
PHD Manufacturing, Inc. follows the guidelines of the Metal Framing Manufacturers Association in the manufacture and recommended use of strut systems. In all design applications using strut systems and accessories, proper engineering design practices should be applied and load limits observed. The following 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.

PHD channel strut is 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:

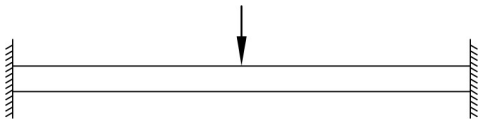
BEAMS

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:



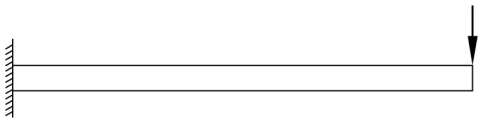
Simple Beam –

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.



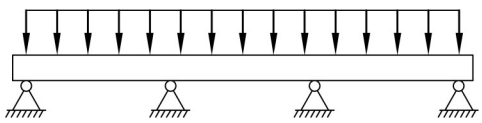
Fixed End Beam –

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.

TYPES OF BEAM LOADING

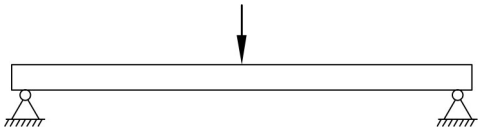


Figure 1

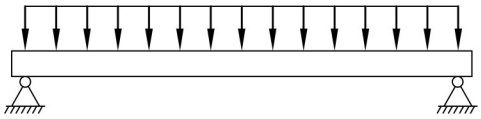


Figure 2

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.

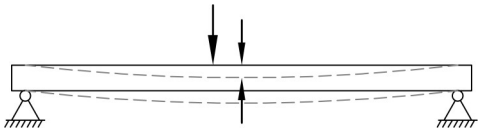
Uniform Load –

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.

Combined Load –

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

BEAM 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 accompanying 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

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.

BENDING MOMENT & 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

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.

WELDING

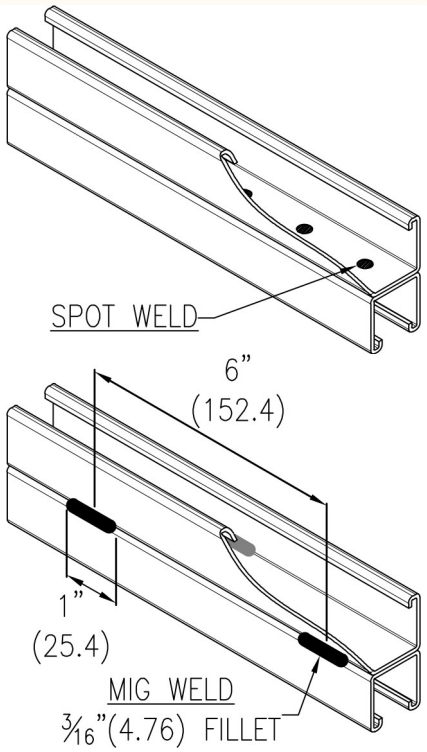
Spot Welding –

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.

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.



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:

Fig. 1

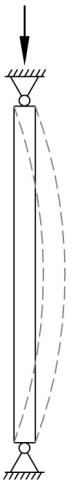


Fig. 2

Fig. 3

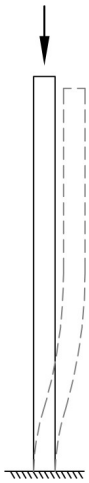


Fig. 4

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

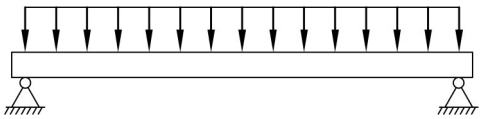
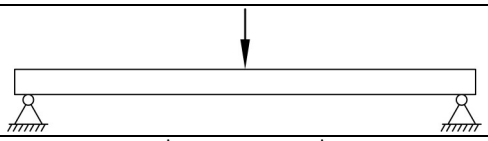
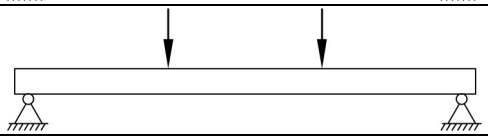
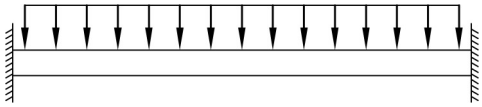
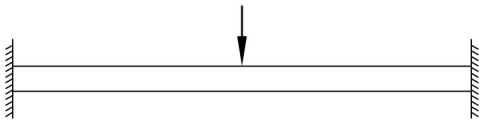
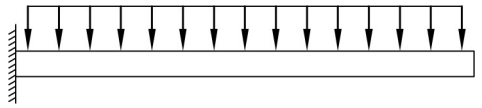
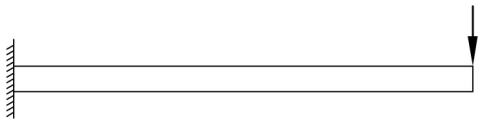
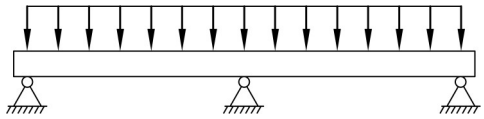
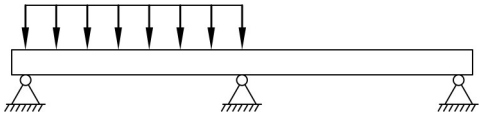
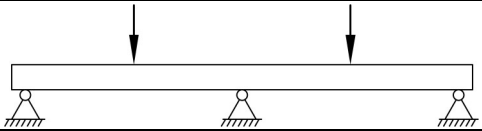
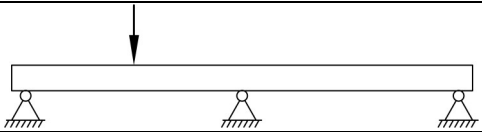
Bolt torque values are given to ensure the proper connection between PHD Metal Framing components. It is important to understand that there is a direct, but not necessarily consistent, relationship between bolt torque and tension in the bolt. Too much tension in the bolt can cause it to break or crush 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.

Recommended Bolt Torque						
Bolt Size	1/4"-20	5/16"-18	3/8"-16	1/2"-13	5/8"-11	3/4"-10
ft.-lbs	6	11	19	50	65	75
N-m	(8)	(15)	(26)	(68)	(88)	(102)

BEAM LOAD & 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 ad $^1/_4$ 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 Span		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

STEEL PIPE DATA

Pipe Size		Schedule No.	O.D.		Wall Thickness		Weight			
							Water		Pipe	
							lbs/ft	kg/m	lbs/ft	kg/m
3/8	(10)	10	0.675	(17.15)	.066	(1.68)	0.100	(0.15)	0.4325	(0.64)
		40			.091	(2.31)	0.083	(0.12)	0.567	(0.84)
		80			.126	(3.20)	0.061	(0.09)	0.738	(1.10)
1/2	(15)	10	0.84	(21.34)	.083	(2.11)	0.155	(0.23)	0.671	(1.00)
		40			.109	(2.77)	0.132	(0.20)	0.85	(1.26)
		80			.147	(3.73)	0.102	(0.15)	1.087	(1.62)
3/4	(20)	10	1.05	(26.67)	.083	(2.11)	0.266	(0.40)	0.8572	(1.28)
		40			.113	(2.87)	0.231	(0.34)	1.13	(1.68)
		80			.154	(3.91)	0.187	(0.28)	1.473	(2.19)
1	(25)	10	1.315	(33.40)	.109	(2.77)	0.410	(0.61)	1.404	(2.09)
		40			.133	(3.38)	0.375	(0.56)	1.678	(2.50)
		80			.179	(4.55)	0.312	(0.46)	2.171	(3.23)
1 1/4	(32)	10	1.66	(42.16)	.109	(2.77)	0.708	(1.05)	1.806	(2.69)
		40			.14	(3.56)	0.648	(0.96)	2.272	(3.38)
		80			.191	(4.85)	0.556	(0.83)	2.996	(4.46)
1 1/2	(40)	10	1.9	(48.26)	.109	(2.77)	0.963	(1.43)	2.085	(3.10)
		40			.145	(3.68)	0.883	(1.31)	2.717	(4.04)
		80			.2	(5.08)	0.766	(1.14)	3.631	(5.40)
2	(50)	10	2.375	(60.33)	.109	(2.77)	1.584	(2.36)	2.638	(3.93)
		40			.154	(3.91)	1.455	(2.16)	3.652	(5.43)
		80			.218	(5.54)	1.280	(1.91)	5.022	(7.47)
2 1/2	(65)	10	2.875	(73.03)	.12	(3.05)	2.364	(3.52)	3.531	(5.25)
		40			.203	(5.16)	2.076	(3.09)	5.79	(8.62)
		80			.276	(7.01)	1.837	(2.73)	7.66	(11.40)
3	(80)	10	3.5	(88.90)	.12	(3.05)	3.619	(5.39)	4.332	(6.45)
		40			.216	(5.49)	3.205	(4.77)	7.57	(11.27)
		80			.3	(7.62)	2.864	(4.26)	10.25	(15.25)
3 1/2	(90)	10	4	(101.60)	.12	(3.05)	4.814	(7.16)	4.973	(7.40)
		40			.226	(5.74)	4.286	(6.38)	9.11	(13.56)
		80			.318	(8.08)	3.853	(5.73)	12.51	(18.62)
4	(100)	10	4.5	(114.30)	.12	(3.05)	6.179	(9.20)	5.613	(8.35)
		40			.237	(6.02)	5.519	(8.21)	10.79	(16.06)
		80			.337	(8.56)	4.984	(7.42)	14.98	(22.29)
5	(125)	10	5.563	(141.30)	0.134	(3.40)	9.55	(14.21)	7.77	(11.56)
		40			0.258	(6.55)	8.67	(12.91)	14.62	(21.76)
		80			0.375	(9.53)	7.89	(11.74)	20.78	(30.92)
6	(150)	10	6.625	(168.28)	0.134	(3.40)	13.76	(20.48)	9.289	(13.82)
		40			0.28	(7.11)	12.52	(18.64)	18.97	(28.23)
		80			0.432	(10.97)	11.30	(16.82)	28.57	(42.52)
8	(200)	10	8.625	(219.08)	0.148	(3.76)	23.62	(35.15)	13.4	(19.94)
		40			0.322	(8.18)	21.69	(32.28)	28.55	(42.49)
		80			0.5	(12.70)	19.80	(29.46)	43.39	(64.57)
10	(250)	10	10.75	(273.05)	0.165	(4.19)	36.97	(55.02)	18.7	(27.83)
		40			0.365	(9.27)	34.19	(50.87)	40.48	(60.24)
		80			0.593	(15.06)	31.14	(46.35)	64.4	(95.84)
12	(300)	10	12.75	(323.85)	0.18	(4.57)	52.27	(77.79)	24.2	(36.01)
		40			0.406	(10.31)	48.53	(72.21)	53.6	(79.77)
		80			0.687	(17.45)	44.06	(65.57)	88.6	(131.85)
14	(350)	10	14	(355.60)	0.25	(6.35)	62.05	(92.35)	36.71	(54.63)
		40			0.437	(11.10)	58.66	(87.30)	63	(93.75)
		80			0.75	(19.05)	53.20	(79.17)	107	(159.23)
16	(400)	10	16	(406.40)	0.25	(6.35)	81.80	(121.74)	42.05	(62.58)
		40			0.5	(12.70)	76.61	(114.01)	83	(123.52)
		80			0.843	(21.41)	69.76	(103.82)	137	(203.88)
18	(450)	10	18	(457.20)	0.25	(6.35)	104.27	(155.18)	47.39	(70.52)
		40			0.563	(14.30)	96.95	(144.27)	105	(156.26)
		80			0.937	(23.80)	88.54	(131.77)	171	(254.48)
20	(500)	10	20	(508.00)	0.25	(6.35)	129.47	(192.67)	62.73	(93.35)
		40			0.593	(15.06)	120.52	(179.36)	123	(183.04)
		80			1.031	(26.19)	109.56	(163.04)	209	(311.03)
24	(600)	10	24	(609.60)	0.25	(6.35)	188.04	(279.83)	63.41	(94.36)
		40			0.687	(17.45)	174.31	(259.40)	171	(254.48)
		80			1.218	(30.94)	158.33	(235.62)	297	(441.98)
30	(750)	20	30	(762.00)	.5	(12.70)	286.00	(425.61)	158	(235.13)
36	(900)	API	36	(914.40)	.5	(12.70)	417.00	(620.56)	190	(282.75)

SPACING OF HANGERS FOR STEEL PIPE

Nominal Pipe Size	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
	(15)	(20)	(25)	(32)	(40)	(50)	(65)	(80)	(90)	(100)	(125)	(150)	(200)	(250)	(300)	(350)	(400)	(450)	(500)	(600)
Max. Span	7	7	7	7	9	10	11	12	13	14	16	17	19	22	23	25	27	28	30	32
	(2.13)	(2.13)	(2.13)	(2.13)	(2.74)	(3.05)	(3.35)	(3.66)	(3.96)	(4.27)	(4.88)	(5.18)	(5.79)	(6.71)	(7.01)	(7.62)	(8.23)	(8.53)	(9.14)	(9.75)
Recommended Hanger Rod Size	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2	5/8	5/8	3/4	3/4	7/8	7/8	1	1	1 1/8	1 1/4	1 1/4
																		OR TRAPEZE		

Note: *Spacing and capacities are based on pipe filled with water. Additional valves and fittings increase the load and therefore closer hanger spacing is required.*

***Many Codes and specifications require pipe hangers to be spaced every 10 ft (3.05m) regardless of size. Check local codes.**

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

TECHNICAL DATA

www.phd-mfg.com

COPPER TUBE DATA

TYPE L

Tube Size		Tubing O.D.		Wall Thickness		Weight			
						Water		Pipe	
						lbs/ft.	kg/m	lbs/ft.	kg/m
1/4	(6)	.375	(9.53)	.030	(0.76)	.034	(.051)	.126	(.188)
3/8	(10)	.500	(12.70)	.035	(0.89)	.062	(.092)	.198	(.295)
1/2	(15)	.625	(15.88)	.040	(1.02)	.100	(.149)	.285	(.424)
5/8	(17)	.750	(19.05)	.042	(1.07)	.151	(.225)	.362	(.539)
3/4	(20)	.875	(22.23)	.045	(1.14)	.209	(.311)	.455	(.677)
1	(25)	1.125	(28.58)	.050	(1.27)	.357	(.531)	.655	(.975)
1 1/4	(32)	1.375	(34.93)	.055	(1.40)	.546	(.813)	.884	(1.316)
1 1/2	(40)	1.625	(41.28)	.060	(1.52)	.767	(1.141)	1.140	(1.697)
2	(50)	2.125	(53.98)	.070	(1.78)	1.341	(1.996)	1.750	(2.604)
2 1/2	(65)	2.625	(66.68)	.080	(2.03)	2.064	(3.072)	2.480	(3.691)
3	(80)	3.125	(79.38)	.090	(2.29)	2.949	(4.389)	3.330	(4.956)
3 1/2	(90)	3.625	(92.08)	.100	(2.54)	3.989	(5.936)	4.290	(6.384)
4	(100)	4.125	(104.78)	.110	(2.79)	5.188	(7.721)	5.380	(8.006)
5	(125)	5.125	(130.18)	.125	(3.18)	8.081	(12.026)	7.610	(11.325)
6	(150)	6.125	(155.58)	.140	(3.56)	11.616	(17.287)	10.200	(15.179)
8	(200)	8.125	(206.38)	.200	(5.08)	20.289	(30.193)	19.260	(28.662)
10	(250)	10.125	(257.18)	.250	(6.35)	31.590	(47.011)	30.100	(44.794)
12	(300)	12.125	(307.98)	.280	(7.11)	45.426	(67.601)	40.400	(60.122)

TYPE K

Tube Size		Tubing O.D.		Wall Thickness		Weight			
						Water		Pipe	
						lbs/ft.	kg/m	lbs/ft.	kg/m
1/4	(6)	.375	(9.53)	.035	(0.89)	.032	(.048)	.145	(.216)
3/8	(10)	.500	(12.70)	.049	(1.24)	.055	(.082)	.269	(.400)
1/2	(15)	.625	(15.88)	.049	(1.24)	.094	(.140)	.344	(.512)
5/8	(17)	.750	(19.05)	.049	(1.24)	.144	(.214)	.418	(.622)
3/4	(20)	.875	(22.23)	.065	(1.65)	.188	(.280)	.641	(.954)
1	(25)	1.125	(28.58)	.065	(1.65)	.337	(.502)	.839	(1.249)
1 1/4	(32)	1.375	(34.93)	.065	(1.65)	.527	(.784)	1.040	(1.548)
1 1/2	(40)	1.625	(41.28)	.072	(1.83)	.743	(1.106)	1.360	(2.024)
2	(50)	2.125	(53.98)	.083	(2.11)	1.310	(1.949)	2.060	(3.066)
2 1/2	(65)	2.625	(66.68)	.095	(2.41)	2.000	(2.976)	2.920	(4.345)
3	(80)	3.125	(79.38)	.109	(2.77)	2.960	(4.405)	4.000	(5.953)
3 1/2	(90)	3.625	(92.08)	.120	(3.05)	3.900	(5.804)	5.120	(7.619)
4	(100)	4.125	(104.78)	.134	(3.40)	5.060	(7.530)	6.510	(9.688)
5	(125)	5.125	(130.18)	.160	(4.06)	8.000	(11.905)	9.670	(14.391)
6	(150)	6.125	(155.58)	.192	(4.88)	11.200	(16.667)	13.870	(20.641)
8	(200)	8.125	(206.38)	.271	(6.88)	19.500	(29.019)	25.900	(38.543)
10	(250)	10.125	(257.18)	.338	(8.59)	30.423	(45.274)	40.300	(59.973)
12	(300)	12.125	(307.98)	.405	(10.29)	43.675	(64.996)	57.800	(86.016)

SPACING OF HANGERS FOR COPPER TUBING

Tubing Size		1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12
		(15)	(20)	(25)	(32)	(40)	(50)	(65)	(80)	(90)	(100)	(125)	(150)	(200)	(250)	(300)
Span	ft	5	5	6	7	8	8	9	10	11	12	13	14	16	18	19
	m	(1.5)	(1.5)	(1.8)	(2.1)	(2.4)	(2.4)	(2.7)	(3.0)	(3.4)	(3.7)	(4.0)	(4.3)	(4.9)	(5.5)	(5.8)

Note: *Spacing and capacities are based on pipe filled with water. Additional valves and fittings increase the load and therefore closer hanger spacing is required.*

AWWA DUCTILE IRON PIPE DATA

Nominal Pipe Size		Class	O.D. D.I. Pipe		Wall Thick		Weight			
							Pipe		Water	
							lbs/ft.	kg/m	lbs/ft.	kg/m
3	(80)	53	3.96	(100.58)	.31	(7.87)	11.2	(16.67)	3.8	(5.66)
4	(100)	53	4.80	(121.92)	.32	(8.13)	14.2	(21.13)	5.9	(8.78)
6	(150)	53	6.90	(175.26)	.34	(8.64)	22.0	(32.74)	13.1	(19.49)
8	(200)	53	9.05	(229.87)	.36	(9.14)	31.0	(46.13)	23.0	(34.23)
10	(250)	53	11.1	(281.94)	.38	(9.65)	40.4	(60.12)	36.4	(54.17)
12	(300)	53	13.2	(335.28)	.40	(10.16)	50.7	(75.45)	52.3	(77.83)
14	(350)	53	15.3	(388.62)	.42	(10.67)	62.4	(92.86)	71.1	(105.81)
16	(400)	53	17.4	(441.96)	.43	(10.92)	72.8	(108.34)	93.1	(138.55)
18	(450)	53	19.5	(495.30)	.44	(11.18)	83.6	(124.41)	117.9	(175.45)
20	(500)	53	21.6	(548.64)	.45	(11.43)	95.2	(141.67)	145.8	(216.97)
24	(600)	53	25.8	(655.32)	.47	(11.94)	119.2	(177.39)	210.2	(312.81)
30	(750)	53	32.0	(812.80)	.51	(12.95)	161.3	(240.04)	326.5	(485.89)
36	(900)	53	38.3	(972.82)	.58	(14.73)	219.5	(326.65)	469.3	(698.40)
42	(1050)	53	44.5	(1130.30)	.65	(16.51)	285.2	(424.42)	634.9	(944.84)
48	(1200)	53	50.8	(1290.32)	.72	(18.29)	360.3	(536.19)	828.9	(1233.54)

Based on AWWA C108-70, Table 8.2.
Add flange weight for flanged cast iron pipe.

GLASS PIPE DATA

REGULAR SCHEDULE

Nominal Pipe Size		O.D. D.I. Pipe		Wall Thick		Weight			
						Pipe		Water	
						lbs/ft.	kg/m	lbs/ft.	kg/m
1 1/2	(40)	1.84	(46.74)	.12	(3.05)	.64	(.95)	.89	(1.32)
2	(50)	2.34	(59.44)	.14	(3.56)	.94	(1.40)	1.45	(2.16)
3	(80)	3.41	(86.61)	.17	(4.32)	1.60	(2.38)	3.19	(4.75)
4	(100)	4.53	(115.06)	.20	(5.08)	2.60	(3.87)	5.79	(8.62)
6	(150)	6.66	(169.16)	.24	(6.10)	4.70	(6.99)	12.78	(19.02)

HEAVY SCHEDULE

1	(25)	1.31	(33.27)	.16	(4.06)	.60	(.89)	.35	(.52)
1 1/2	(40)	1.84	(46.74)	.17	(4.32)	.87	(1.29)	.76	(1.13)
2	(50)	2.34	(59.44)	.17	(4.32)	1.10	(1.64)	1.36	(2.02)
3	(80)	3.41	(86.61)	.20	(5.08)	2.00	(2.98)	3.06	(4.55)
4	(100)	4.53	(115.06)	.26	(6.60)	3.40	(5.06)	5.44	(8.10)
6	(150)	6.66	(169.16)	.33	(8.38)	6.30	(9.38)	12.42	(18.48)

Spacing of Hangers for glass pipe support every 8-10 ft. (2.44 - 3.05 m). Pad all hangers. Use only clevis or trapeze, do not tie down pipe.

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

TECHNICAL DATA

PVC PLASTIC PIPE DATA

Pipe Size		Sch. No.	O.D.		Wall Thickness		Weight Water lbs/ft.	Weight Water kg/m	Weight Pipe lbs/ft.	Weight Pipe kg/m
1/8	(3)	40	.405	(10.3)	.068	(1.73)	.025	(.037)	.043	(.064)
		80			.095	(2.41)	.016	(.024)	.055	(.082)
1/4	(6)	40	.540	(13.7)	.088	(2.24)	.045	(.067)	.074	(.110)
		80			.119	(3.02)	.031	(.046)	.094	(.140)
3/8	(10)	40	.675	(17.15)	.091	(2.31)	.083	(.124)	.100	(.149)
		80			.126	(3.20)	.061	(.091)	.129	(.192)
1/2	(15)	40	.840	(21.34)	.109	(2.77)	.132	(.196)	.150	(.223)
		80			.147	(3.73)	.101	(.150)	.200	(.298)
3/4	(20)	40	1.050	(26.67)	.113	(2.87)	.230	(.342)	.199	(.296)
		80			.154	(3.91)	.186	(.277)	.259	(.385)
1	(25)	40	1.315	(33.40)	.133	(3.38)	.374	(.557)	.295	(.439)
		80			.179	(4.55)	.311	(.463)	.382	(.568)
1 1/4	(32)	40	1.660	(42.16)	.140	(3.56)	.647	(.963)	.400	(.595)
		80			.191	(4.85)	.555	(.826)	.527	(.784)
1 1/2	(40)	40	1.900	(48.26)	.145	(3.68)	.882	(1.313)	.479	(.713)
		80			.200	(5.08)	.765	(1.138)	.639	(.951)
2	(50)	40	2.375	(60.33)	.154	(3.91)	1.452	(2.161)	.643	(.957)
		80			.218	(5.54)	1.279	(1.903)	.884	(1.316)
2 1/2	(65)	40	2.875	(73.03)	.203	(5.16)	2.072	(3.08)	1.020	(1.518)
		80			.276	(7.01)	1.834	(2.73)	1.350	(2.009)
3	(80)	40	3.500	(88.9)	.216	(5.49)	3.20	(4.76)	1.333	(1.984)
		80			.300	(7.62)	2.86	(4.26)	1.804	(2.685)
3 1/2	(90)	40	4.000	(101.6)	.226	(5.74)	4.28	(6.37)	1.598	(2.378)
		80			.318	(8.08)	3.85	(5.73)	2.195	(3.267)
4	(100)	40	4.500	(114.3)	.237	(6.02)	5.51	(8.20)	1.899	(2.826)
		80			.337	(8.56)	4.98	(7.41)	2.636	(3.923)
5	(125)	40	5.563	(141.30)	.258	(6.55)	8.66	(12.89)	2.770	(4.122)
		80			.375	(9.53)	7.87	(11.71)	4.126	(6.140)
6	(150)	40	6.625	(168.28)	.280	(7.11)	12.51	(18.62)	3.339	(4.969)
		80			.432	(10.97)	11.92	(17.74)	5.028	(7.482)
8	(200)	40	8.625	(219.08)	.322	(8.18)	21.60	(32.14)	5.280	(7.858)
		80			.500	(12.70)	19.80	(29.47)	8.023	(11.940)
10	(250)	40	10.75	(273.05)	.365	(9.27)	34.10	(50.75)	7.505	(11.169)
		80			.593	(15.06)	31.10	(46.28)	11.894	(17.700)
12	(300)	40	12.75	(323.85)	.406	(10.31)	48.50	(72.18)	10.023	(14.916)
		80			.687	(17.45)	44.00	(65.48)	16.365	(24.354)

SPACING OF HANGERS FOR PVC PLASTIC PIPE

Schedule 40 Pipe Size		Support Spacing – Temperature																			
		20°F (-6.6°C)		40°F (4.4°C)		60°F (15.6°C)		80°F (26.7°C)		100°F (37.8°C)		110°F (43.3°C)		120°F (48.9°C)		130°F (54.4°C)		140°F (60°C)		150°F (65.6°C)	
		ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m
1/2 - 3/4	(15-20)	5.00	(1.52)	4.75	(1.45)	4.50	(1.37)	4.25	(1.30)	4.00	(1.22)	3.75	(1.14)	3.33	(1.01)	3.00	(.91)	2.66	(.81)	2.00	(.61)
1 - 1 1/4	(25-32)	5.50	(1.68)	5.25	(1.60)	5.00	(1.52)	4.66	(1.42)	4.33	(1.32)	4.00	(1.22)	3.75	(1.14)	3.33	(1.01)	2.80	(.85)	2.25	(.69)
1 1/2 - 2	(40-50)	5.80	(1.77)	5.50	(1.68)	5.25	(1.60)	5.00	(1.52)	4.66	(1.42)	4.33	(1.32)	3.80	(1.16)	3.50	(1.07)	3.00	(.91)	2.50	(.76)
2 1/2	(65)	6.66	(2.03)	6.33	(1.93)	6.00	(1.83)	5.50	(1.68)	5.25	(1.60)	4.80	(1.46)	4.50	(1.37)	4.00	(1.22)	3.50	(1.07)	2.80	(.85)
3	(80)	6.80	(2.07)	6.50	(1.98)	6.25	(1.91)	5.80	(1.77)	5.50	(1.68)	5.25	(1.60)	4.75	(1.45)	4.25	(1.30)	3.66	(1.12)	3.00	(.91)
4	(100)	7.33	(2.23)	7.00	(2.13)	6.50	(1.98)	6.25	(1.91)	5.80	(1.77)	5.50	(1.68)	5.00	(1.52)	4.50	(1.37)	3.80	(1.16)	3.25	(.99)
6	(150)	7.80	(2.38)	7.50	(2.29)	7.00	(2.13)	6.80	(2.07)	6.33	(1.93)	5.80	(1.77)	5.33	(1.62)	4.80	(1.46)	4.25	(1.30)	3.50	(1.07)

Schedule 80 Pipe Size		Support Spacing – Temperature																			
		20°F (-6.6°C)		40°F (4.4°C)		60°F (15.6°C)		80°F (26.7°C)		100°F (37.8°C)		110°F (43.3°C)		120°F (48.9°C)		130°F (54.4°C)		140°F (60°C)		150°F (65.6°C)	
		ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m	ft.	m
1/2 - 3/4	(15-20)	5.75	(1.75)	5.50	(1.68)	5.25	(1.60)	4.80	(1.46)	4.50	(1.37)	4.33	(1.32)	3.80	(1.16)	3.50	(1.07)	3.00	(.91)	2.50	(.76)
1	(25)	6.33	(1.93)	6.00	(1.83)	5.75	(1.75)	5.33	(1.62)	5.00	(1.52)	4.60	(1.40)	4.33	(1.32)	3.80	(1.16)	3.33	(1.01)	2.75	(.84)
1 1/4 - 1 1/2	(32-40)	6.66	(2.03)	6.33	(1.93)	6.00	(1.83)	5.66	(1.73)	5.25	(1.60)	4.80	(1.46)	4.50	(1.37)	4.00	(1.22)	3.50	(1.07)	3.00	(.91)
2	(50)	7.00	(2.13)	6.50	(1.98)	6.25	(1.91)	6.00	(1.83)	5.50	(1.68)	5.12	(1.56)	4.75	(1.45)	4.33	(1.32)	3.66	(1.12)	3.12	(.95)
2 1/2	(65)	7.80	(2.38)	7.50	(2.29)	7.00	(2.13)	6.66	(2.03)	6.33	(1.93)	5.80	(1.77)	5.33	(1.62)	4.75	(1.45)	4.25	(1.30)	3.33	(1.01)
3	(80)	8.20	(2.50)	7.75	(2.36)	7.33	(2.23)	7.00	(2.13)	6.50	(1.98)	6.00	(1.83)	5.50	(1.68)	5.00	(1.52)	4.33	(1.32)	3.50	(1.07)
4	(100)	8.66	(2.64)	8.25	(2.51)	7.80	(2.38)	7.33	(2.23)	6.80	(2.07)	6.33	(1.93)	5.80	(1.77)	5.25	(1.60)	4.66	(1.42)	3.75	(1.14)
6	(150)	9.80	(2.99)	9.33	(2.84)	8.80	(2.68)	8.33	(2.54)	7.80	(2.38)	7.33	(2.23)	6.50	(1.98)	6.00	(1.83)	5.12	(1.56)	4.25	(1.30)

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

CONDUIT DATA

ELECTRICAL METALLIC TUBING DATA

Nominal Size EMT Conduit		O.D. Conduit		Weight Conduit W/C Plg.		Approx. Max. Weight Conduit And Conductor Not Lead Covered	
				lbs/ft.	kg/m	lbs/ft.	kg/m
1/2	(15)	.706	(17.93)	.29	(0.43)	.54	(0.80)
3/4	(20)	.922	(23.42)	.45	(0.67)	1.16	(1.73)
1	(25)	1.163	(29.54)	.65	(0.97)	1.83	(2.72)
1 1/4	(32)	1.510	(38.35)	.96	(1.43)	2.96	(4.40)
1 1/2	(40)	1.740	(44.20)	1.11	(1.65)	3.68	(5.48)
2	(50)	2.197	(55.80)	1.41	(2.10)	4.45	(6.62)
2 1/2	(65)	2.875	(73.03)	2.15	(3.20)	6.41	(9.54)
3	(80)	3.500	(88.90)	2.60	(3.87)	9.30	(13.84)
3 1/2	(90)	4.000	(101.60)	3.25	(4.84)	12.15	(18.08)
4	(100)	4.500	(114.30)	3.90	(5.80)	15.40	(22.92)

Note: *2 1/2" through 4" EMT is the same as steel rigid conduit*

STEEL RIGID CONDUIT DATA

Nominal Size EMT Conduit		O.D. Conduit		O.D. Coupling		Weight Conduit W/C Plg.		Approx. Max. Weight Conduit And Conductor Lead Covered		Not Lead Covered	
						lbs/ft.	kg/m	lbs/ft.	kg/m	lbs/ft.	kg/m
1/2	(15)	.840	(21.34)	1.010	(25.65)	.80	(1.19)	1.17	(1.74)	1.04	(1.55)
3/4	(20)	1.050	(26.67)	1.250	(31.75)	1.09	(1.62)	1.75	(2.60)	1.40	(2.08)
1	(25)	1.315	(33.40)	1.525	(38.74)	1.65	(2.46)	2.62	(3.90)	2.35	(3.50)
1 1/4	(32)	1.660	(42.16)	1.869	(47.47)	2.15	(3.20)	4.31	(6.41)	3.58	(5.33)
1 1/2	(40)	1.900	(48.26)	2.155	(54.74)	2.58	(3.84)	5.89	(8.77)	4.55	(6.77)
2	(50)	2.375	(60.33)	2.650	(67.31)	3.52	(5.24)	8.53	(12.69)	7.21	(10.73)
2 1/2	(65)	2.875	(73.03)	3.250	(82.55)	5.67	(8.44)	11.51	(17.13)	10.22	(15.21)
3	(80)	3.500	(88.90)	3.870	(98.30)	7.14	(10.63)	16.51	(24.57)	14.51	(21.59)
3 1/2	(90)	4.000	(101.60)	4.500	(114.30)	8.60	(12.80)	19.05	(28.35)	17.49	(26.03)
4	(100)	4.500	(114.30)	4.875	(123.83)	10.00	(14.88)	24.75	(36.83)	21.48	(31.97)
5	(125)	5.563	(141.30)	6.000	(152.40)	13.20	(19.64)	35.87	(53.38)	30.83	(45.88)
6	(150)	6.625	(168.28)	7.200	(182.88)	17.85	(26.56)	50.69	(75.44)	43.43	(64.63)

INTERMEDIATE METAL CONDUIT DATA

Nominal Size EMT Conduit		O.D. Conduit		O.D. Coupling		Weight Conduit W/C Plg.		Approx. Max. Weight Conduit And Conductor Lead Covered		Not Lead Covered	
						lbs/ft.	kg/m	lbs/ft.	kg/m	lbs/ft.	kg/m
1/2	(15)	.815	(20.70)	1.010	(25.65)	.60	(0.89)	.97	(1.44)	.84	(1.25)
3/4	(20)	1.029	(26.14)	1.250	(31.75)	.82	(1.22)	1.48	(2.20)	1.13	(1.68)
1	(25)	1.290	(32.77)	1.525	(38.74)	1.16	(1.73)	2.13	(3.17)	1.86	(2.77)
1 1/4	(32)	1.638	(41.61)	1.869	(47.47)	1.50	(2.23)	3.66	(5.45)	2.93	(4.36)
1 1/2	(40)	1.883	(47.83)	2.155	(54.74)	1.82	(2.71)	5.13	(7.63)	3.79	(5.64)
2	(50)	2.360	(59.94)	2.650	(67.31)	2.42	(3.60)	7.43	(11.06)	6.11	(9.09)
2 1/2	(65)	2.857	(72.57)	3.250	(82.55)	4.28	(6.37)	10.12	(15.06)	8.83	(13.14)
3	(80)	3.476	(88.29)	3.870	(98.30)	5.26	(7.83)	14.63	(21.77)	12.63	(18.80)
3 1/2	(90)	3.971	(100.86)	4.500	(114.30)	6.12	(9.11)	16.57	(24.66)	15.01	(22.34)
4	(100)	4.466	(113.44)	4.875	(123.83)	6.82	(10.15)	21.57	(32.10)	18.30	(27.23)

THREADED ROD DATA

Nominal Rod Dia.	Root Area Thread		Max. Rec. Load 650°F (343°C)		750°F (399°C)	
	in.²	mm²	lbs	kN	lbs	kN
1/4	.027	(17.42)	240	(1.07)	210	(0.93)
3/8	.068	(43.87)	730	(3.25)	572	(2.54)
1/2	.126	(81.29)	1350	(6.01)	1057	(4.70)
5/8	.202	(130.32)	2160	(9.61)	1692	(7.53)
3/4	.302	(194.84)	3230	(14.37)	2530	(11.25)
7/8	.419	(270.32)	4480	(19.93)	3508	(15.60)
1	.552	(356.13)	5900	(26.24)	4620	(20.55)
1 1/8	.693	(447.10)	7450	(33.14)	5830	(25.93)
1 1/4	.889	(573.55)	9500	(42.26)	7440	(33.09)
1 1/2	1.293	(834.19)	13800	(61.39)	10807	(48.07)
1 3/4	1.744	(1125.16)	18600	(82.74)	14566	(64.79)
2	2.300	(1483.87)	24600	(109.43)	19625	(87.30)
2 1/4	3.023	(1950.32)	32300	(143.68)	25295	(112.52)
2 1/2	3.719	(2399.35)	39800	(177.04)	31169	(138.65)

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

Your Local PHD Representative:

PHD Manufacturing, Inc.

44018 Columbiana-Waterford Road
Columbiana, OH 44408
(800) 321-2736
www.phd.mfg.com