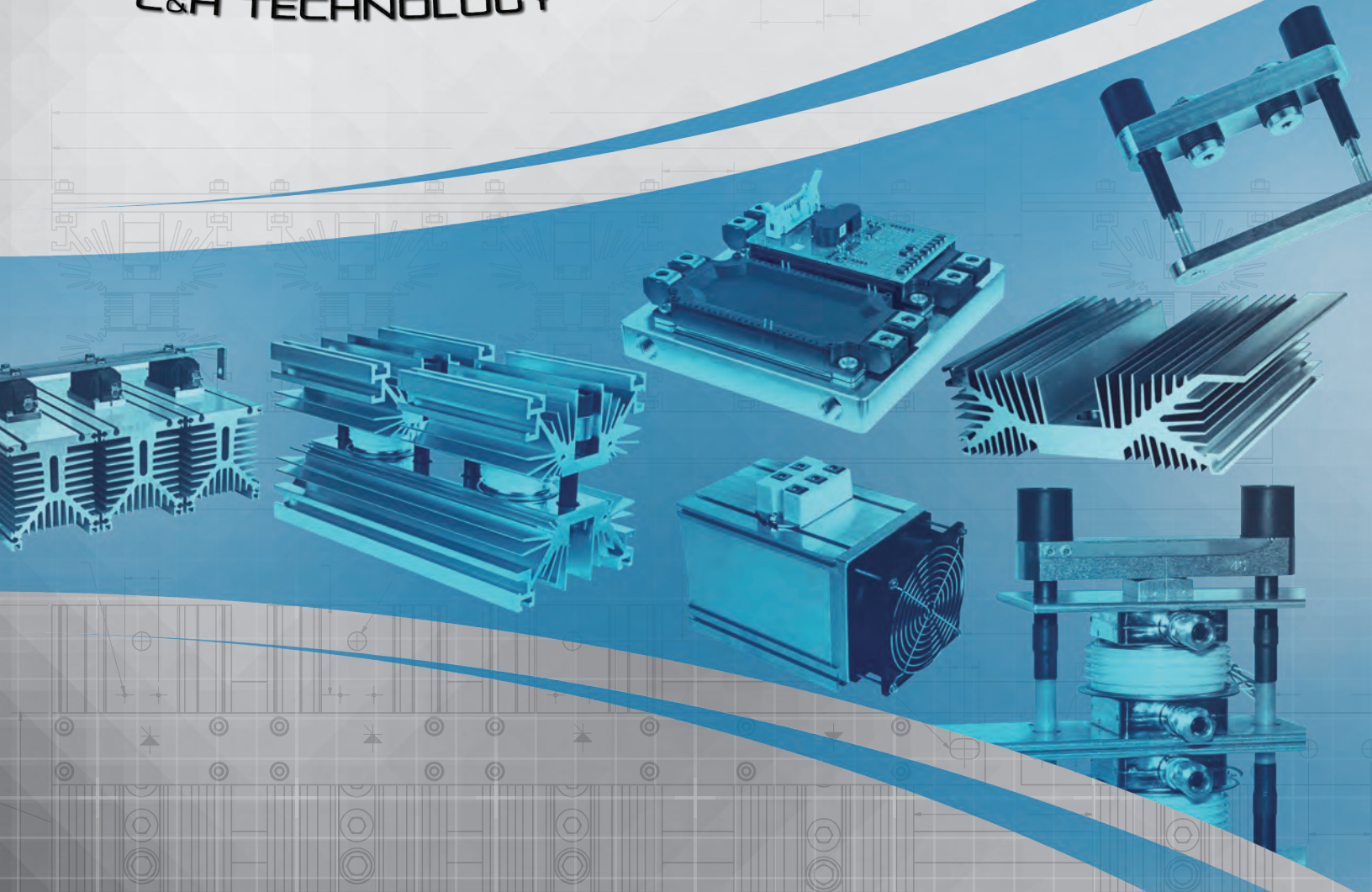




Thermal Management Semiconductor Clamps Power Assemblies



SPECIALISTS IN POWER ELECTRONIC COMPONENTS AND ASSEMBLIES

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HIGH POWER SEMICONDUCTORS

Modules, Stud-Types, and Puk (disc) packages available in a wide range of electrical ratings.

- IGBT
- Thyristor / SCR
- Rectifier / Diode
- MOSFETs



POWER CAPACITORS

High power capacitors for a wide variety of industrial applications.

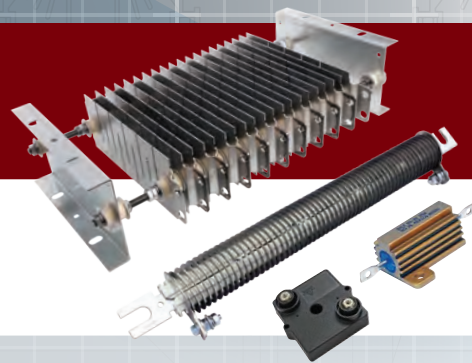
- Aluminum Electrolytic
- Film
- Heavy Current Power
- Energy Storage



POWER RESISTORS

High power ratings, large resistance range, excellent stability, also available in Heat Sink mountable packages.

- Wirewound
- Thick Film
- Grid Resistors
- Custom Configurations Available



SEMICONDUCTOR CLAMPS

Complete line of Box Clamps and Bar Clamps for Hockey Puk Type Disc Semiconductors, precalibrated to simplify the manufacturing process on the assembly line.

- 5kN – 95kN
Precalibrated Forces
- Precision Clamps Available
- Custom Configurations Available



THERMAL MANAGEMENT

High performance cooling solutions for a variety of high power applications.

- Extruded Heat Sinks
- Bonded Fin Heat Sinks
- Liquid Chill Plates
- Liquid Chill Blocks
- Custom Configurations Available



ABOUT US

This page is dedicated to the History of C&H and our core competency. C&H Technology, Inc. has celebrated 40 years of specializing in Power Electronic Components. Over the years we have added thousands of products and have become a global leader specializing in: Rectifiers (Diodes), Thyristors (SCRs), Bridge Rectifiers, IGBTs, MOSFETs, Power Assemblies, Heat Sinks, Bar Clamps, Box Clamps, Resistors, Capacitors, Thermistors, and Current Sensors.

We are proud to have earned your trust for quality products, reliability and service. C&H is committed to maintaining our excellence through the latest technology, engineering solutions, extensive inventory and world class customer service.

C&H Technology offers a wide selection of Rectifier Assemblies using Diodes, Thyristors (SCRs) and IGBTs. Choose from a large selection of standard rectifier circuits and configurations. Custom assemblies tailored to specific customer requirements are also available with different Bus Bar options. C&H Technology offers a Configuration Tool to help build the correct assembly part number based on your specific application and parameters. Many industry standard heat sinks are in stock to enable quick turnaround. C&H Technology also offers Snubber Circuits, SCR Firing Circuits, MOV Protection, Thermal Switches, and Isolation mounting feet that can be added to any of our Assemblies.

C&H Technology specializes in Extruded Aluminum Heat Sinks, Bonded Fin Heat Sinks, Liquid Cooled Chill Blocks & Friction Stir-Welded Heat Sinks for power electronic semiconductors and assemblies. We offer a full range of heat sinks for cooling your power electronic application from 10 watts to 10,000 watts. With our extensive inventory, we can accommodate any size order from prototypes to large production runs.

C&H Technology, Inc. is committed to satisfying our customer's needs by supplying products and services with a high level of reliability, maintainability, and functionality with on-time and competitive pricing. We will meet the needs and surpass the expectations of our customers by providing Excellence, Value, and Quality.



THERMAL MANAGEMENT

- Extruded heat sinks are available in many different profiles offering both natural and forced air convection. Additional machining options include drilling and tapping of holes, flycutting for surface flatness, and plating finishes.
- Bonded Fin heat sinks are designed for natural and forced air convection. C&H offers both standard and fully customized solutions with optional hole patterns, mounting feet, fans with shrouds, and plating finishes.
- Liquid Chill Plates include traditional copper press-in tubes from our standard offering of 1 to 6 pass models, and all aluminum Friction Stir-Welded plates with a patented internal fin structure.
- Liquid Chill Blocks include Cast Copper and Furnace Brazed Copper Chill blocks for hockey puk devices ranging from 30mm to 75mm in diameter.

SEMICONDUCTOR CLAMPS


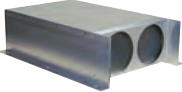
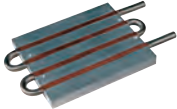
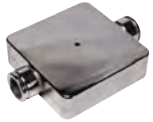
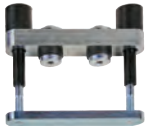




- C&H Semiconductor bar clamps use three technologies to ensure accurate clamping force - Belleville Washers, Pre-Calibrated Deflection Bar, and Precision Bar styles to meet all application requirements.
- Box Clamps for single sided cooling are available for hockey pucks up to 80mm in diameter.

POWER ASSEMBLIES

- Standard Assemblies featured use either module or hockey puk devices on various thermal solutions.
- Available in both air and liquid-cooled models. Standard Assemblies include 1-phase and 3-phase configurations for Diode Bridge, SCR Bridge, and AC Switch circuits.
- Dimensioned 3D models of each standard assembly are depicted on pages 66 - 103.
- Custom solutions are available in all categories.

Note: What is shown in this catalog is a limited representation of the capability of C&H Technology. **Custom solutions are available in all categories.**

The information presented in this book is believed to be accurate and reliable. However, C&H Technology, Inc. can assume no responsibility for its use, nor any infringements of patents, or other rights of third parties which may result from its use. No patent liability shall be incurred for the use of the circuits, devices, or assemblies described herein. We reserve the right to change specifications and data without notice.

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Thermal Management

Heat Sink Introduction

HEAT SINK INTRODUCTION

C&H Technology offers a variety of thermal solutions including extruded heat sinks, bonded fin heat sinks, and an assortment of liquid cooling options. Our experience shows an effective approach takes thermal management into consideration early in the design phase. C&H Technology engineers are on standby to assist and help choose a heat sink for your system or application.

Extruded Aluminum Heat Sinks are available in an assortment of shapes for Small Discrete components, Stud-Type, Power Modules, and Hockey Puk devices. We offer a wide selection of extruded heat sinks designed for both natural convection as well as forced air cooling.

- Custom extrusion dies available upon request.
- Wide selection of industry standard shapes as well as custom shapes.

Our Bonded Fin Heat Sinks are tailored for power electronic semiconductors and assemblies. The benefit of this technology offers high fin density and very low thermal resistance.

- Wide selection of industry standard shapes as well as custom configurations.
- Custom bonded fin copper heat sinks with up to 3x the cooling of aluminum.
- High performance impingement bonded fins with extremely low cost per watt.

Liquid Chill Plates using Embedded Copper Tubing and high-performance Friction Stir-Welding options are available.

- Standard Aluminum Chill Plates with Embedded Copper Tubing available in one, two, four or six pass configurations.
- Friction Stir-Welded custom and standard configurations available.
- Available with drilled and tapped holes for the mounting of semiconductors and brackets.

STANDARD SPECIFICATIONS:

Heat Sink Extrusions:

Aluminum 6063-T5
Aluminum 6063-T6
Aluminum C57B-T5

Bonded Fin Heat Sinks:

Base Plates: Aluminum 6063-T5 or 6061-T5
Fins: Aluminum 1100-H14, 3003 or 6061

Standard Tolerances:

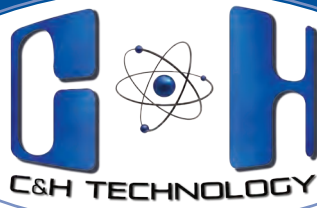
Flatness: 0.001 in/in
Roughness: #63 or better
Saw Cut: ± 0.020
Cut to Width: ± 0.010 in

Place Values:

X $\pm .1$
.X $\pm .05$
.XX $\pm .01$
.XXX $\pm .005$

Finishes:

Natural Finish
Clear Alodine 5200 – RoHS Compliant
Clear Anodized – MIL-A-8625, Type II
Black Anodized – MIL-A-8625, Type II
Gold Iridite – MIL-C-5441, Type III
Clear Chromate – MIL-C-5441
Type II Trivalent Chromate –
RoHS Compliant
MIL-DTL-5541F



Thermal Management

Extruded Heat Sinks

Model	Perimeter (in ² /in)	Width (in.)	Height (in.)	Weight (lbs/ft)	Thermal Resistance (°C/W/3in.)	Device Type	Assembly Profile	Page Number
CHEH0011	105.000	9.81	2.830	12.81	0.710	Puk	Profile G	12
CHEH0012	98.070	6.96	2.670	9.50	0.700	Module	---	12
CHEH0017	85.140	7.00	3.130	7.84	0.800	Puk	Profile F	10
CHEH0023	71.250	4.75	4.500	4.33	1.000	Stud	---	10
CHEH0031	118.250	9.25	6.750	9.60	0.400	Stud	---	13
CHEH0032	48.100	4.75	2.625	2.50	1.500	Stud	---	8
CHEH0051	108.400	9.80	2.830	11.10	0.700	Puk	---	13
CHEH0055	72.000	4.48	2.270	4.32	1.050	Module	---	10
CHEH0057	158.710	6.80	3.035	10.05	0.480	Module	---	14
CHEH0073	91.690	4.96	5.380	9.11	0.820	Module	---	11
CHEH0077	185.000	6.38	3.420	8.86	0.085*	Module	---	14
CHEH0078	137.000	12.58	3.250	23.75	0.550	Puk	Profile H	13
CHEH0090	61.850	5.99	1.107	3.51	1.220	Module	---	9
CHEH0091	167.130	6.46	2.145	7.29	0.094*	Module	---	14
CHEH0130	93.390	3.59	2.110	4.00	0.810	Module	---	11
CHEH0148	107.550	9.43	1.420	6.17	0.700	Module	---	12
CHEH0155	43.650	5.14	1.312	3.35	1.400	Module	---	7
CHEH0332	12.620	2.13	0.687	0.78	4.400	Discrete	---	6
CHEH0711	31.080	4.75	1.250	1.42	1.900	Stud	---	6
CHEH0746	78.580	9.88	1.312	6.22	0.900	Module	---	10
CHEH0811	54.810	8.24	1.050	4.79	1.000	Module	---	8
CHEH0871	39.340	4.50	1.400	2.37	1.500	Module	---	7
CHEH0930	27.720	3.25	1.000	1.42	1.800	Module	---	6
CHEH1246	41.460	4.47	1.812	3.94	1.300	Module	---	7
CHEH13450	49.570	5.00	2.250	4.30	1.400	Puk	Profile D	8
CHEH1484	55.500	4.25	4.300	3.01	1.000	Stud	---	8
CHEH1806	36.060	4.13	1.310	2.71	1.500	Module	---	6
CHEH1822	37.890	4.13	1.750	2.92	1.400	Module	---	7
CHEH1842	56.870	6.75	1.631	4.32	1.000	Module	---	9
CHEH1912	51.268	4.20	2.465	5.78	1.100	Module	---	8
CHEH1916	59.340	8.68	1.470	4.50	1.000	Module	---	9
CHEH3040	22.560	3.93	0.590	1.41	2.300	Module	---	6
CHEH3286	87.390	6.05	1.650	5.84	0.800	Module	---	11
CHEH3399	80.450	7.89	1.080	4.33	0.900	Module	---	10
CHEH3415	131.020	8.00	1.630	6.15	0.800	Module	---	13
CHEH3490	38.970	5.39	1.050	2.98	1.500	Module	---	7
CHEH3515	24.470	2.12	1.015	1.43	2.700	Discrete	---	6
CHEH3589	50.636	3.01	1.015	1.39	2.300	Module	---	8
CHEH3598	94.249	5.93	1.220	4.15	0.900	Module	---	11
CHEH3603	85.901	9.88	2.930	7.86	1.300	Module	---	11
CHEH3647	38.490	2.40	1.650	1.56	1.300	Discrete	---	7
CHEH3648	58.770	5.00	1.650	3.30	1.000	Module	---	9
CHEH3671	215.115	10.00	2.920	13.25	0.350	Module	---	14
CHEH3702	141.970	17.00	1.332	11.04	0.490	Module	---	13
CHEH3728	118.070	6.65	3.170	6.40	1.060	Module	---	13
CHEH3896	78.378	7.20	2.480	5.45	0.970	Module	---	10
CHEH3969	55.940	6.25	2.000	3.44	1.400	Stud	---	9
CHEH3973	97.846	9.75	2.280	7.55	0.770	Module	---	11
CHEH3975	102.191	12.75	1.350	9.10	1.000	Module	---	12
CHEH4025	101.500	10.16	1.876	6.60	0.670	Module	---	12
CHEHK1750-12	N/A	5.06	2.060	N/A	0.190*	Stud	---	14
CHEHK18	100.400	4.92	5.310	11.80	0.700	Module	Profile A	12
CHEHK7	58.200	5.13	2.000	6.40	1.200	Puk	Profile E	9

* Thermal Performances based on forced airflow of 500 LFM in units of °C/W/6in.

TOC

THERMAL MANAGEMENT

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POWER ASSEMBLIES

Heat Sink Introduction

Extruded Heat Sinks

Bonded Fin Heat Sinks

Liquid Chill Plates

Liquid Chill Blocks

Clamp Introduction

Bar Clamps

Box Clamps

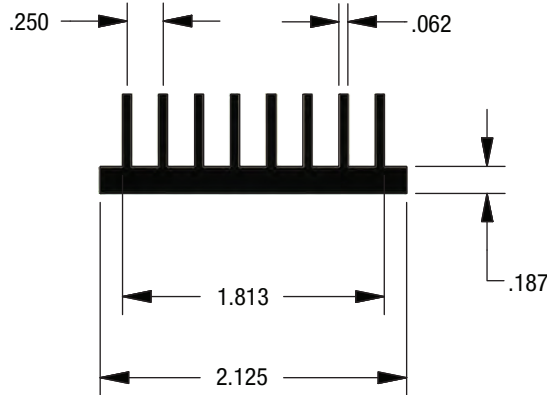
Assembly Introduction

Air Cooled Assemblies

Liquid Cooled Assemblies

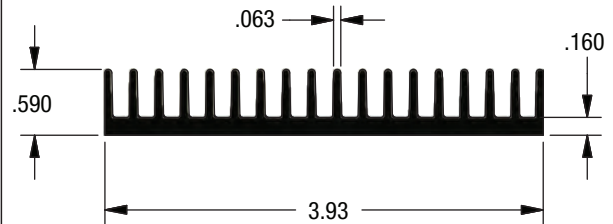
Assembly Outlines

CHEH0332



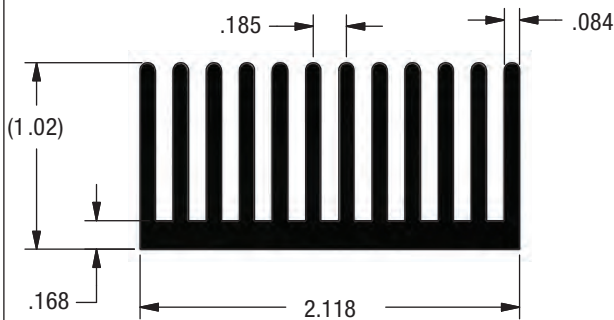
Per. 12.620 IN²/IN Wt. 0.78 LB/FT Θ_{sa} 4.400 °C/W/3"

CHEH3040



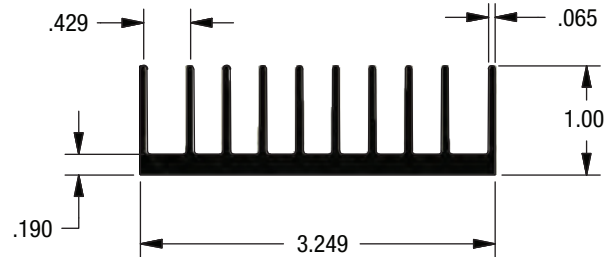
Per. 22.560 IN²/IN Wt. 1.41 LB/FT Θ_{sa} 2.300 °C/W/3"

CHEH3515



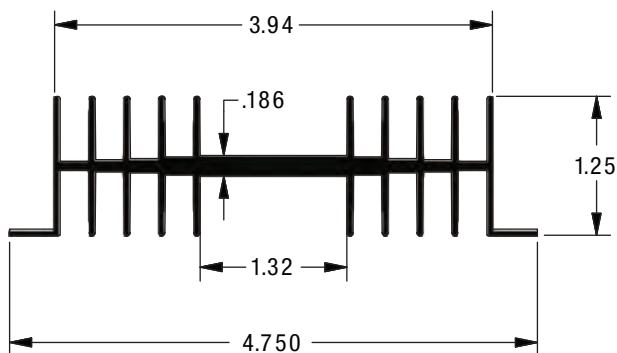
Per. 24.470 IN²/IN Wt. 1.43 LB/FT Θ_{sa} 2.700 °C/W/3"

CHEH0930



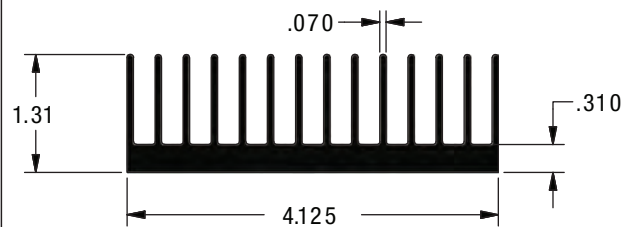
Per. 27.720 IN²/IN Wt. 1.42 LB/FT Θ_{sa} 1.800 °C/W/3"

CHEH0711



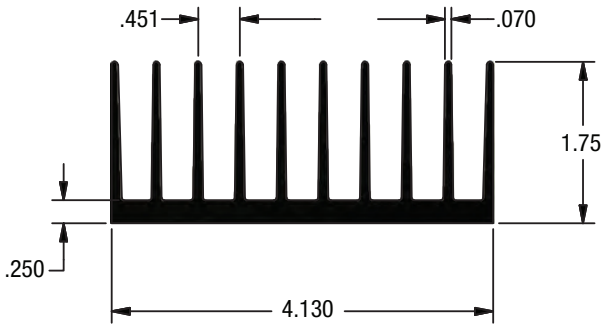
Per. 31.080 IN²/IN Wt. 1.42 LB/FT Θ_{sa} 1.900 °C/W/3"

CHEH1806



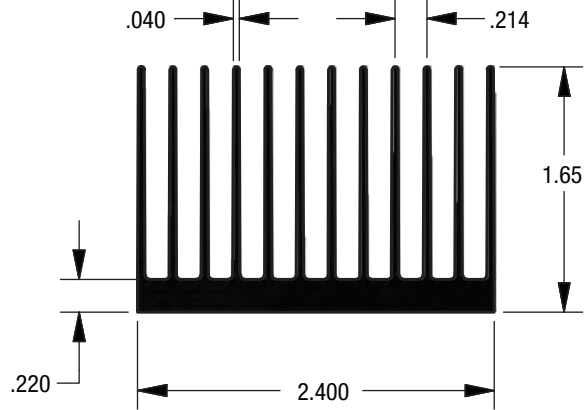
Per. 36.060 IN²/IN Wt. 2.71 LB/FT Θ_{sa} 1.500 °C/W/3"

CHEH1822



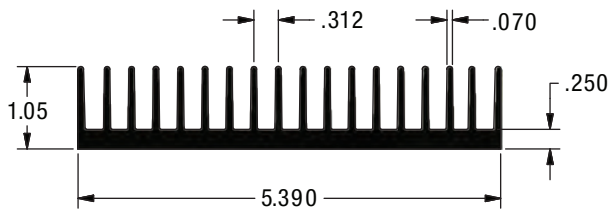
Per. 37.890 IN²/IN Wt. 2.92 LB/FT Θ_{sa} 1.400 °C/W/3"

CHEH3647



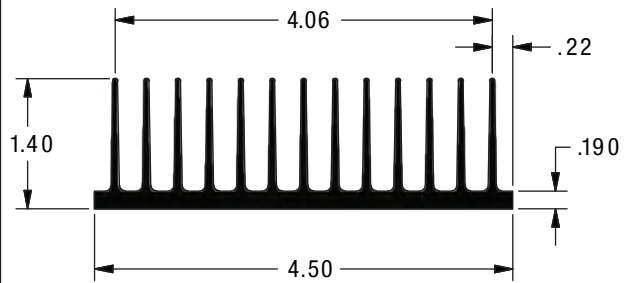
Per. 38.490 IN²/IN Wt. 1.56 LB/FT Θ_{sa} 1.300 °C/W/3"

CHEH3490



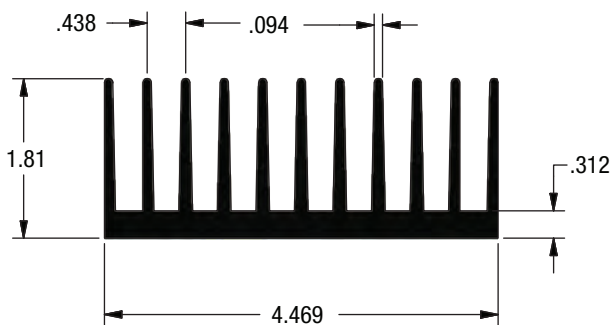
Per. 38.970 IN²/IN Wt. 2.98 LB/FT Θ_{sa} 1.500 °C/W/3"

CHEH0871



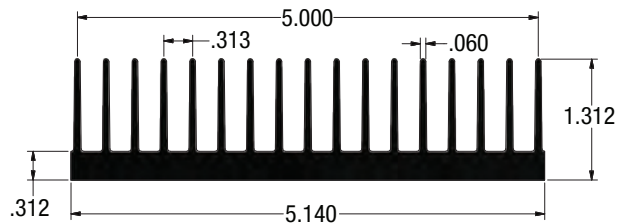
Per. 39.340 IN²/IN Wt. 2.37 LB/FT Θ_{sa} 1.500 °C/W/3"

CHEH1246



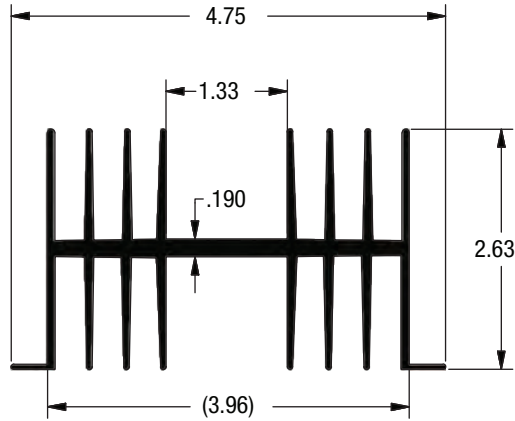
Per. 41.460 IN²/IN Wt. 3.94 LB/FT Θ_{sa} 1.300 °C/W/3"

CHEH0155



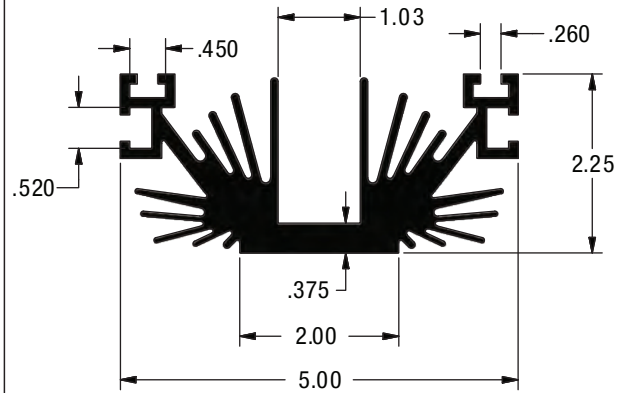
Per. 43.650 IN²/IN Wt. 3.35 LB/FT Θ_{sa} 1.400 °C/W/3"

CHEH0032



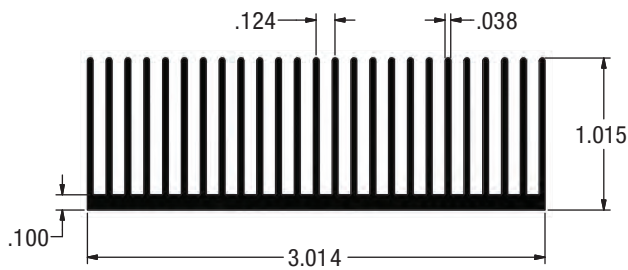
Per. 48.100 IN²/IN Wt. 2.50 LB/FT Θ_{sa} 1.500 °C/W/3"

CHEH13450



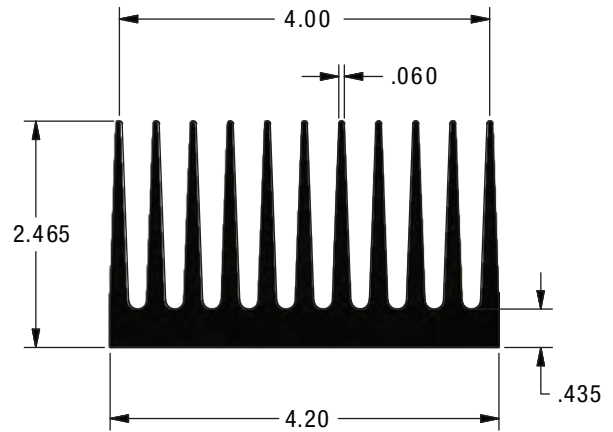
Per. 49.570 IN²/IN Wt. 4.30 LB/FT Θ_{sa} 1.400 °C/W/3"

CHEH3589



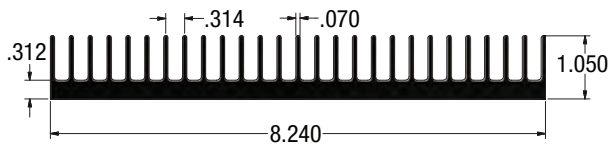
Per. 50.636 IN²/IN Wt. 1.39 LB/FT Θ_{sa} 2.300 °C/W/3"

CHEH1912



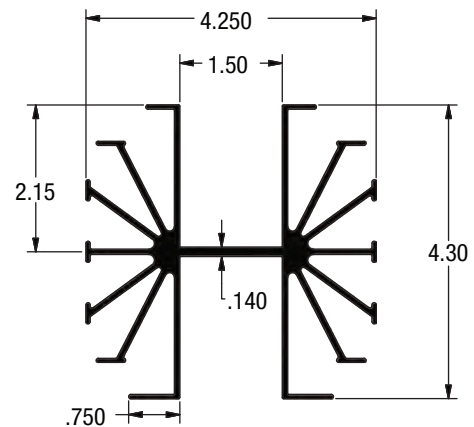
Per. 51.268 IN²/IN Wt. 5.78 LB/FT Θ_{sa} 1.100 °C/W/3"

CHEH0811



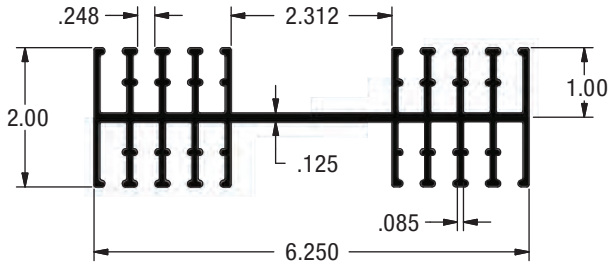
Per. 54.810 IN²/IN Wt. 4.79 LB/FT Θ_{sa} 1.000 °C/W/3"

CHEH1484



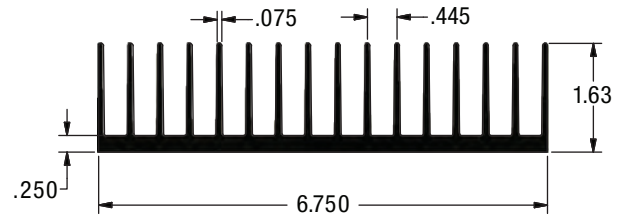
Per. 55.500 IN²/IN Wt. 3.01 LB/FT Θ_{sa} 1.000 °C/W/3"

[CHEH3969](#)



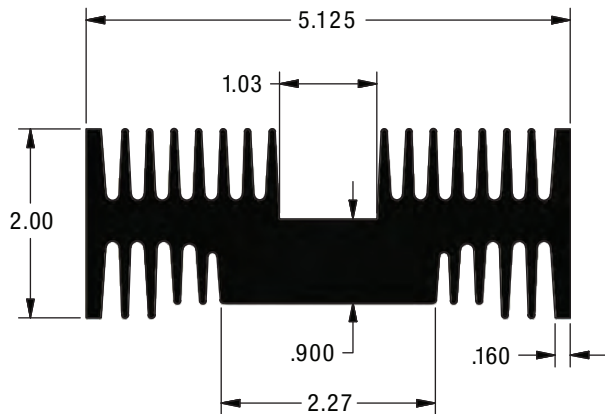
Per. 55.940 IN²/IN Wt. 3.44 LB/FT Θ_{sa} 1.400 °C/W/3"

[CHEH1842](#)



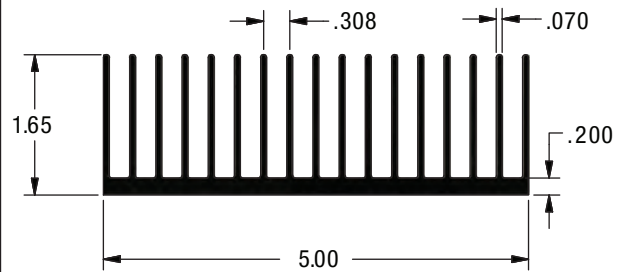
Per. 56.870 IN²/IN Wt. 4.32 LB/FT Θ_{sa} 1.000 °C/W/3"

[CHEHK7](#)



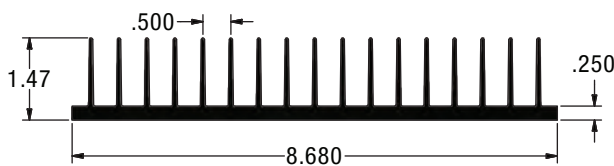
Per. 58.200 IN²/IN Wt. 6.40 LB/FT Θ_{sa} 1.200 °C/W/3"

[CHEH3648](#)



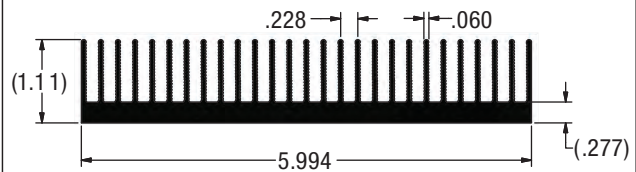
Per. 58.770 IN²/IN Wt. 3.30 LB/FT Θ_{sa} 1.000 °C/W/3"

[CHEH1916](#)



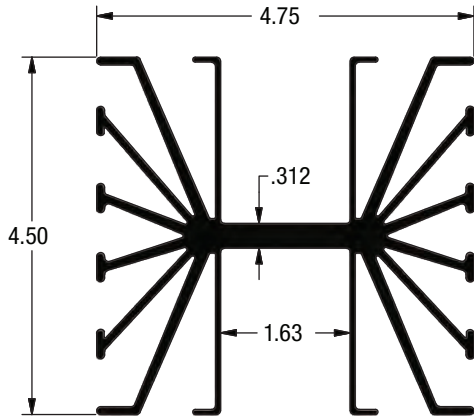
Per. 59.340 IN²/IN Wt. 4.50 LB/FT Θ_{sa} 1.000 °C/W/3"

[CHEH0090](#)



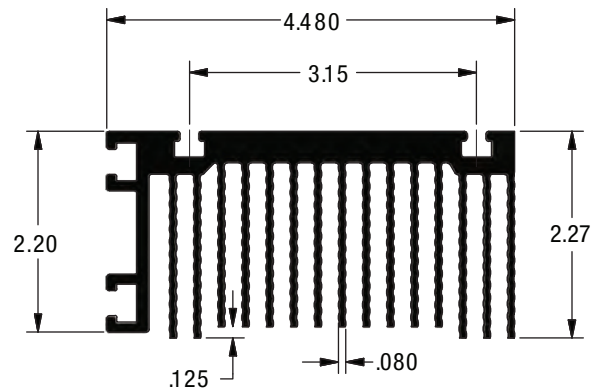
Per. 61.850 IN²/IN Wt. 3.51 LB/FT Θ_{sa} 1.220 °C/W/3"

CHEH0023



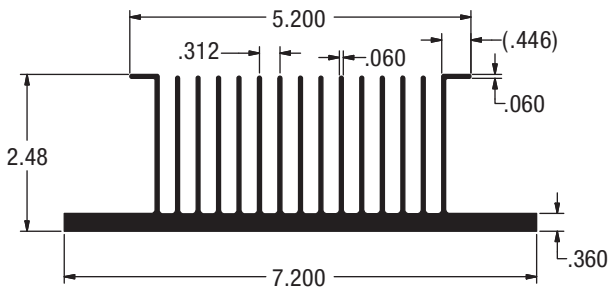
Per. 71.250 IN²/IN Wt. 4.33 LB/FT Θ_{sa} 1.000 °C/W/3"

CHEH0055



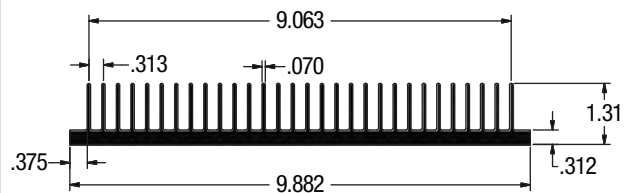
Per. 72.000 IN²/IN Wt. 4.32 LB/FT Θ_{sa} 1.050 °C/W/3"

CHEH3896



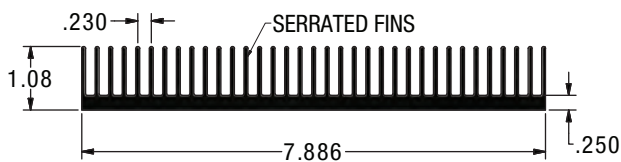
Per. 78.378 IN²/IN Wt. 5.45 LB/FT Θ_{sa} 0.970 °C/W/3"

CHEH0746



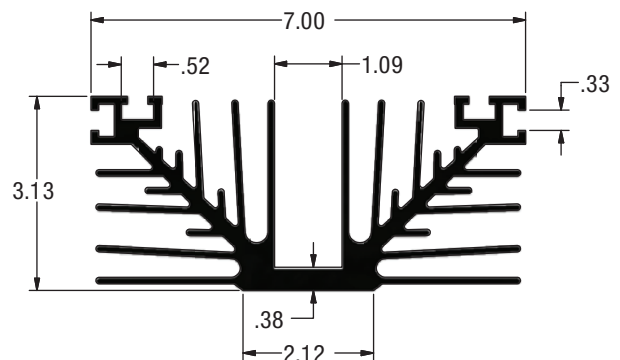
Per. 78.580 IN²/IN Wt. 6.22 LB/FT Θ_{sa} 0.900 °C/W/3"

CHEH3399



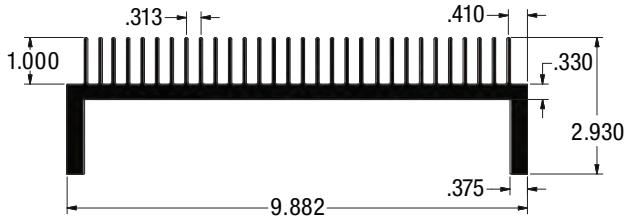
Per. 80.450 IN²/IN Wt. 4.33 LB/FT Θ_{sa} 0.900 °C/W/3"

CHEH0017



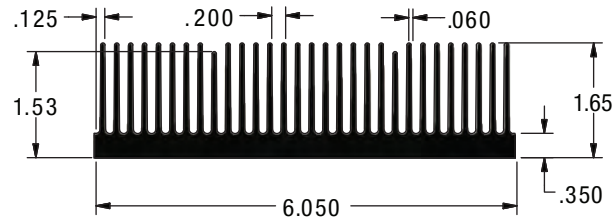
Per. 85.140 IN²/IN Wt. 7.84 LB/FT Θ_{sa} 0.800 °C/W/3"

CHEH3603



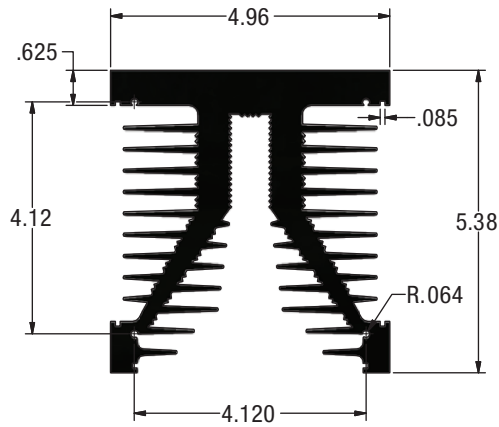
Per. 85.901 IN²/IN Wt. 7.86 LB/FT Θ_{sa} 1.300 °C/W/3"

CHEH3286



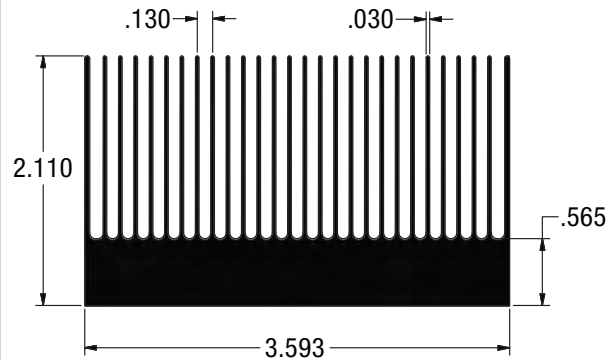
Per. 87.390 IN²/IN Wt. 5.84 LB/FT Θ_{sa} 0.800 °C/W/3"

CHEH0073



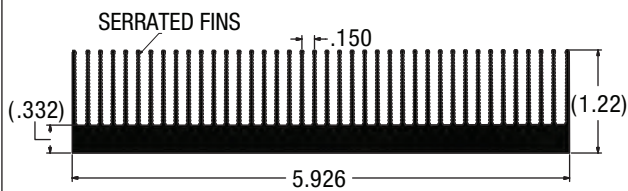
Per. 91.690 IN²/IN Wt. 9.11 LB/FT Θ_{sa} 0.820 °C/W/3"

CHEH0130



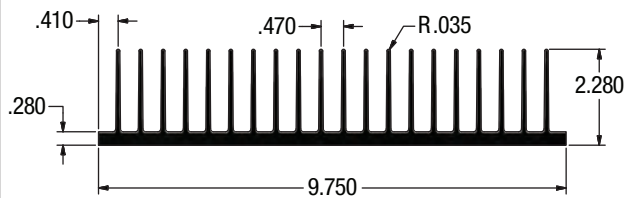
Per. 93.390 IN²/IN Wt. 4.00 LB/FT Θ_{sa} 0.810 °C/W/3"

CHEH3598



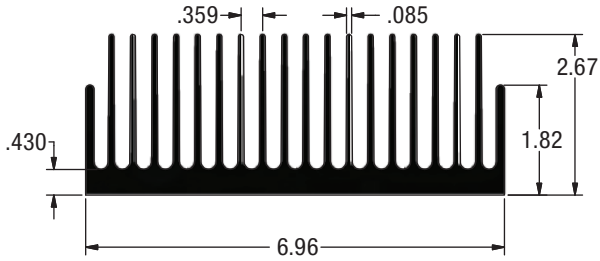
Per. 94.249 IN²/IN Wt. 4.15 LB/FT Θ_{sa} 0.900 °C/W/3"

CHEH3973



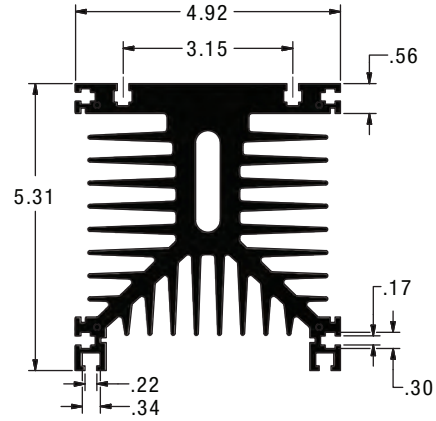
Per. 97.846 IN²/IN Wt. 7.55 LB/FT Θ_{sa} 0.770 °C/W/3"

CHEH0012



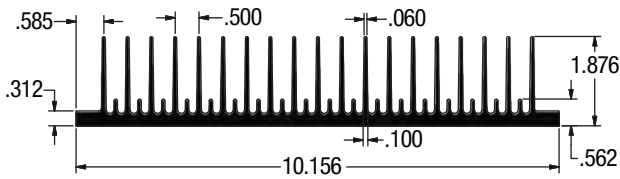
Per. 98.070 IN²/IN Wt. 9.50 LB/FT Θ_{sa} 0.700 °C/W/3"

CHEHK18



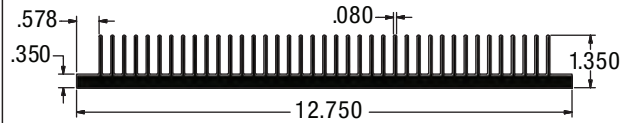
Per. 100.400 IN²/IN Wt. 11.80 LB/FT Θ_{sa} 0.700 °C/W/3"

CHEH4025



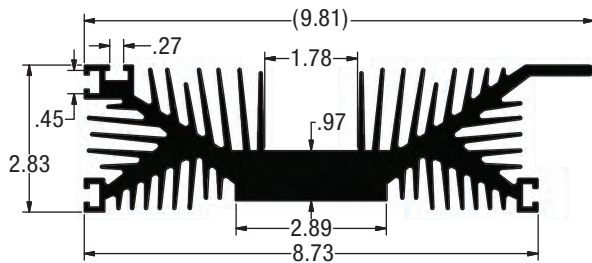
Per. 101.500 IN²/IN Wt. 6.60 LB/FT Θ_{sa} 0.670 °C/W/3"

CHEH3975



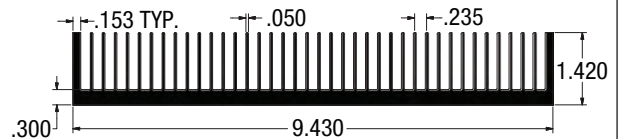
Per. 102.191 IN²/IN Wt. 9.10 LB/FT Θ_{sa} 1.000 °C/W/3"

CHEH0011



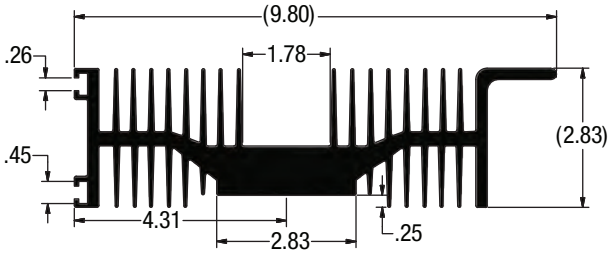
Per. 105.000 IN²/IN Wt. 12.81 LB/FT Θ_{sa} 0.710 °C/W/3"

CHEH0148



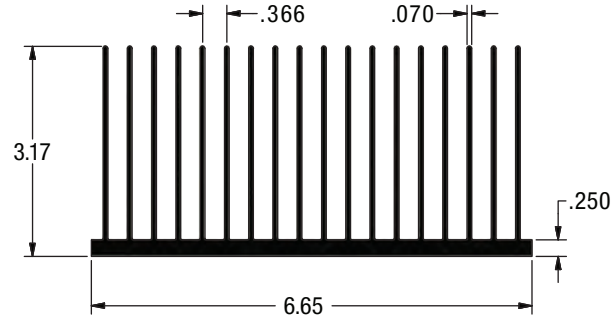
Per. 107.550 IN²/IN Wt. 6.17 LB/FT Θ_{sa} 0.700 °C/W/3"

CHEH0051



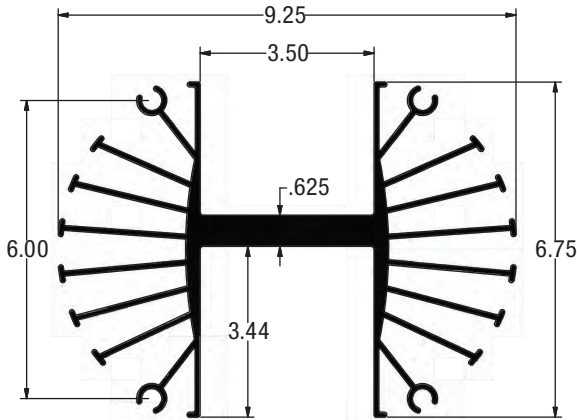
Per. 108.400 IN²/IN Wt. 11.10 LB/FT Θ_{sa} 0.700 °C/W/3"

CHEH3728



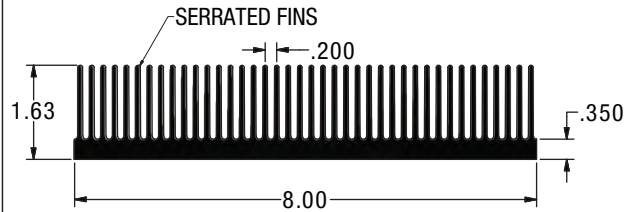
Per. 118.070 IN²/IN Wt. 6.40 LB/FT Θ_{sa} 1.060 °C/W/3"

CHEH0031



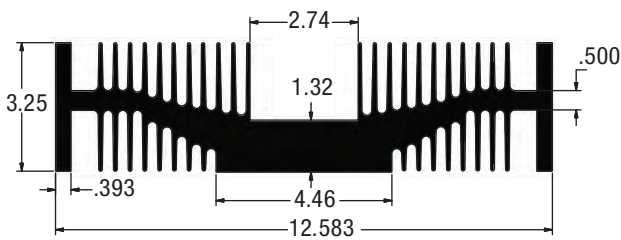
Per. 118.250 IN²/IN Wt. 9.60 LB/FT Θ_{sa} 0.400 °C/W/3"

CHEH3415



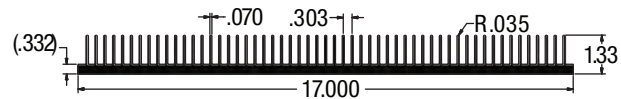
Per. 131.020 IN²/IN Wt. 6.15 LB/FT Θ_{sa} 0.800 °C/W/3"

CHEH0078



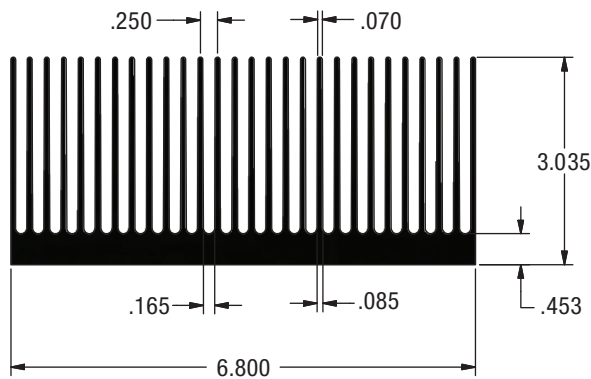
Per. 137.000 IN²/IN Wt. 23.75 LB/FT Θ_{sa} 0.550 °C/W/3"

CHEH3702



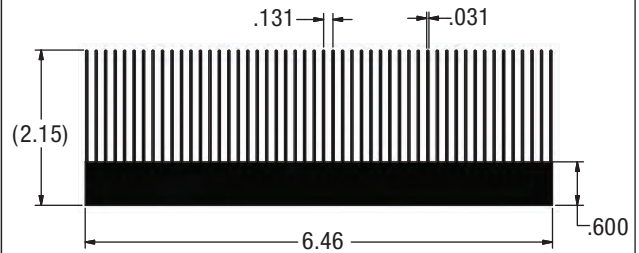
Per. 141.970 IN²/IN Wt. 11.04 LB/FT Θ_{sa} 0.490 °C/W/3"

CHEH0057



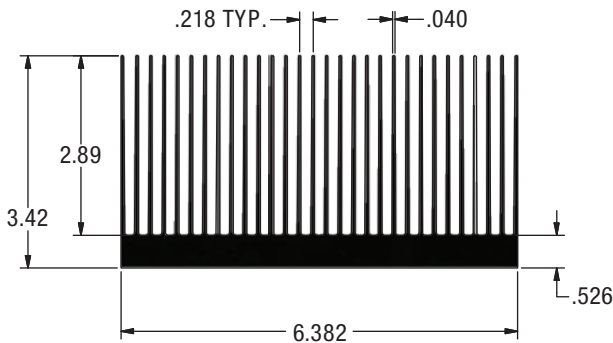
Per. 158.710 IN²/IN Wt. 10.05 LB/FT Θ_{sa} 0.480 °C/W/3"

CHEH0091



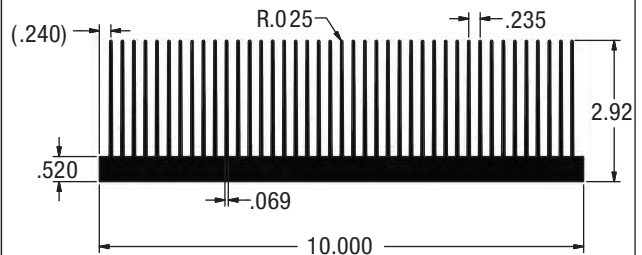
Per. 167.130 IN²/IN Wt. 7.29 LB/FT Θ_{sa} 0.094* °C/W/6"

CHEH0077



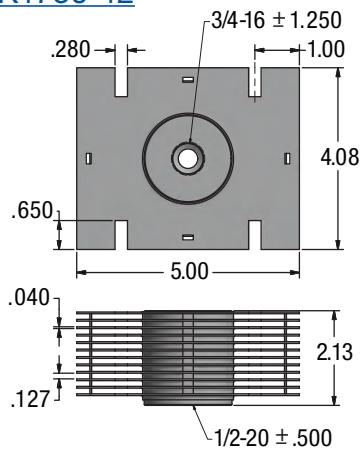
Per. 185.000 IN²/IN Wt. 8.86 LB/FT Θ_{sa} 0.085* °C/W/6"

CHEH3671



Per. 215.115 IN²/IN Wt. 13.25 LB/FT Θ_{sa} 0.350 °C/W/3"

CHEHK1750-12



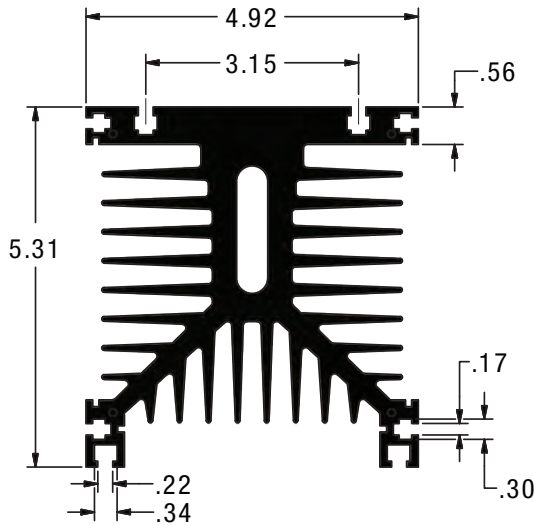
Θ_{sa} 0.280 °C/W at 300 LFM Θ_{sa} 0.190 °C/W at 500 LFM

In addition to the profiles depicted between pages 6-14, C&H Technology has access to an extensive library including hundreds of unique and high performing heat sink profiles.

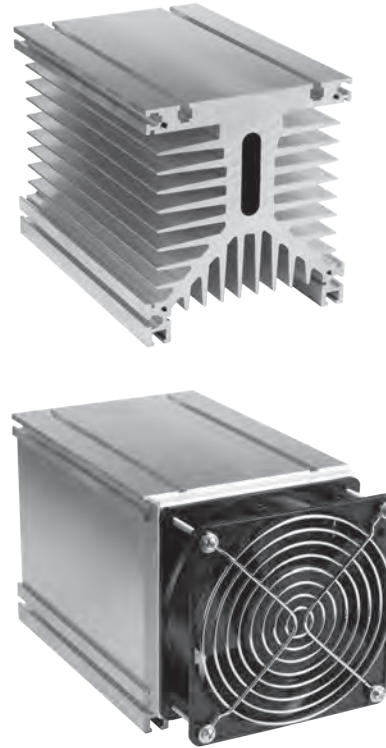
For more information on these profiles or to inquire about custom shapes, please visit our website at www.chtechnology.com or contact us at (800) 274-4284.

* Thermal Performances based on forced airflow of 500 LFM

CHEHK18 STANDARD HEAT SINK



Assembly Profile A



Standard Model	Perimeter (in ² /in)	Width (in.)	Height (in.)	Length (in.)	Weight (lbs.)	Thermal Resistance (°C/W with 800 LFM airflow)
CHEHK18-120MM	100.40	4.92	5.31	4.72	4.70	0.60*
CHEHK18-120MM-A	100.40	4.92	5.31	4.72	5.10	0.14
CHEHK18-120MM-B	100.40	4.92	5.31	4.72	6.20	0.14
CHEHK18-120MM-C	100.40	4.92	5.31	4.72	6.30	0.14
CHEHK18-180MM	100.40	4.92	5.31	7.09	7.00	0.49*
CHEHK18-180MM-A	100.40	4.92	5.31	7.09	7.60	0.12
CHEHK18-180MM-B	100.40	4.92	5.31	7.09	8.70	0.12
CHEHK18-180MM-C	100.40	4.92	5.31	7.09	8.90	0.12
CHEHK18-300MM	100.40	4.92	5.31	11.81	11.60	0.38*
CHEHK18-300MM-A	100.40	4.92	5.31	11.81	12.70	0.09
CHEHK18-300MM-B	100.40	4.92	5.31	11.81	13.80	0.09
CHEHK18-300MM-C	100.40	4.92	5.31	11.81	13.90	0.09

* Thermal Performance based on natural convection

CHEHK18-120MM-

Blank - Extrusion cut to determined length and plated with RoHS Compliant Clear Alodine 5200

A - Includes side and bottom baffle plates and fan mounting shroud

B - Includes 120mm, 100 CFM muffin type fan, and all accessories from "A"

C - Includes finger guard, AC cord, and all accessories from "B"

Standard Product - 120mm, 180mm, or 300mm lengths, flycut, includes fan mounting holes

Model CHEHK18 available in custom lengths in addition to standard configurations listed above.

BONDED FIN HEAT SINKS

C&H Technology offers bonded fin technology with models designed for both natural and forced air convection. Single, Double, and Triple Fan Bonded Fin Heat Sinks are available with thermal resistances as low as 0.0175°C/W. These Heat Sinks cool systems up to three times better than Extruded Heat Sinks (at the same mechanical size). Bonded Fin Heat Sinks offer tall fin heights with dense fin spacing. Individual fins are secured with an industrial thermal epoxy into a slotted base.

Standard Bonded Fin Heat Sinks can be tailored to your design with hole pattern, surface flycut, and plating finish.

Custom Bonded Fins are also available in a variety of base widths, fin heights, and fin spacings. For more information on custom bonded fin designs, see pages 22 and 23.

Call 800-274-4284 or email sales@chtechnology.com for questions or custom solutions.

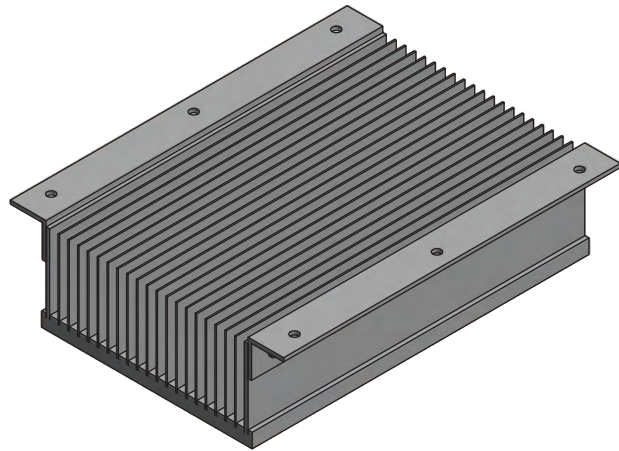
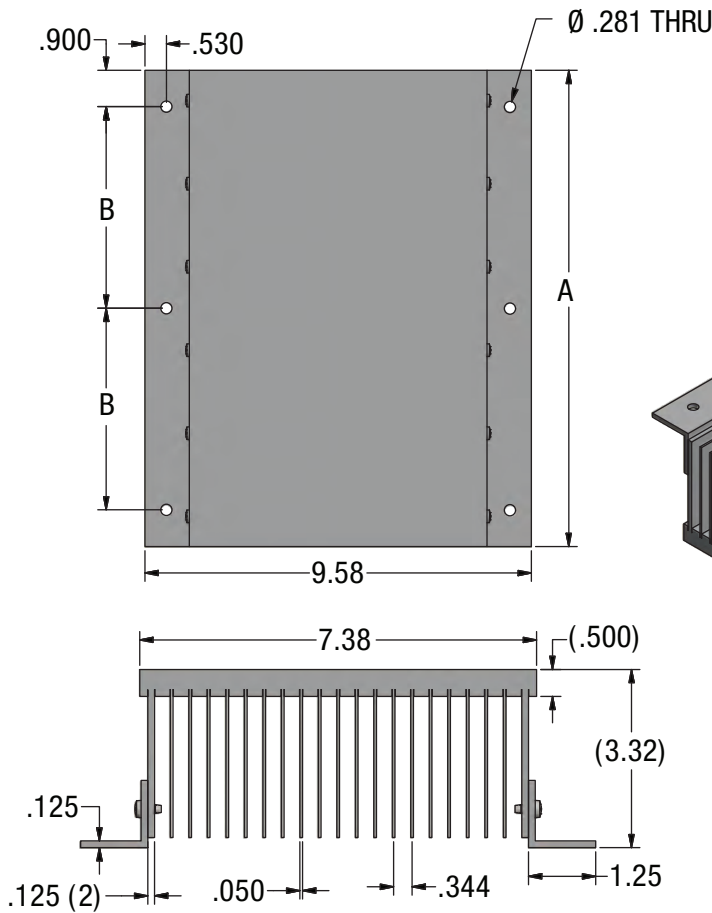
Model	Length (in.)	Width (in.)	Height (in.)	Weight (lbs)	Thermal Resistance (°C/W) with 100 CFM fans	Assembly Profile	Page Number
CH5111	7.00	9.58	3.200	4.00	0.300*	---	17
CH5112	11.81	9.58	3.200	8.00	0.220*	---	17
CH5113	7.00	9.58	3.320	5.00	0.300*	---	17
CH5114	11.81	9.58	3.320	9.00	0.220*	---	17
CH5115F	9.50	7.28	5.250	5.60	0.080	---	18
CH5116F	14.50	7.28	5.250	9.20	0.060	Profile J	18
CH5117F	14.59	13.28	5.250	21.00	0.028	---	19
CH5118F	16.59	13.28	5.250	25.00	0.025	---	19
CH5119F	18.59	13.28	5.250	27.80	0.024	Profile K	19
CH5120F	14.59	17.50	5.250	28.00	0.020	---	20
CH5121F	16.59	17.50	5.250	31.40	0.019	---	20
CH5122F	18.59	17.50	5.250	35.10	0.018	---	20
CH6500F	5.00	5.00	1.500	2.10	0.100	---	21
CH6600F	8.00	5.00	1.500	3.10	0.080	---	21

* Thermal Performance based on natural convection



NATURAL CONVECTION MODELS

Ideal for applications where forced air-cooling is not an option. While maintaining a similar thermal resistance, natural convection Bonded Fin Heat Sinks require half the amount of space as Extruded Heat Sinks. **Custom designs are available upon request.**

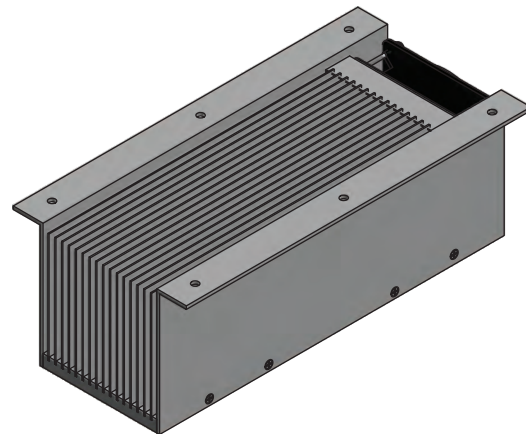
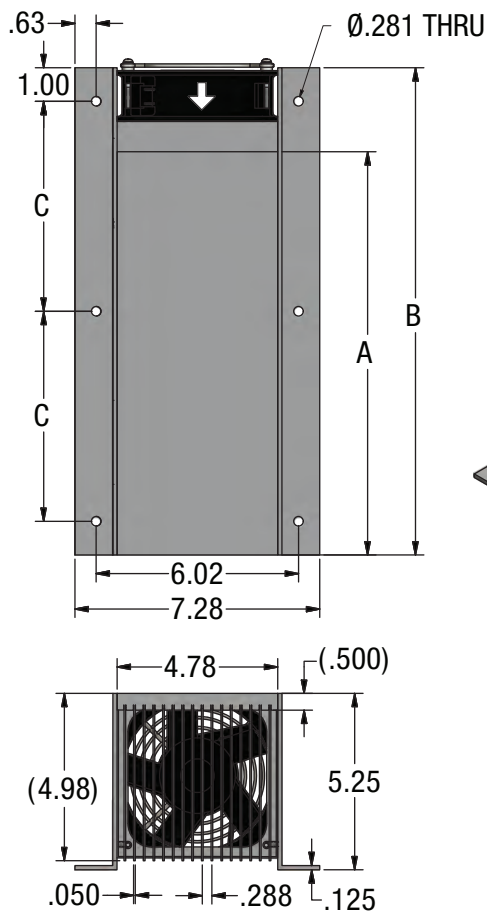


NATURAL CONVECTION SPECIFICATIONS				
MODEL #	CH5111	CH5112	CH5113	CH5114
Dimension A	7.00"	11.81"	7.00"	11.81"
Dimension B	2.50"	5.00"	2.50"	5.00"
Flanges	None	None	1.25" Wide	1.25" Wide
Thermal Resistance	0.30°C/W	0.22°C/W	0.30°C/W	0.22°C/W

Information printed in this section has been developed by dimensioning for general applications. C&H Technology is prepared to give assistance on all engineered Heat Sinks by utilizing computer software designed specifically for this type of Heat Sink.

FORCED CONVECTION – SINGLE FAN MODELS

Increased thermal performance over natural convection Bonded Fin Heat Sinks. Ideal for applications where high thermal density semiconductors, such as Power MOSFETs and IGBTs, are used. Models available fully equipped with a ball-bearing fan. **Custom designs are available upon request.**



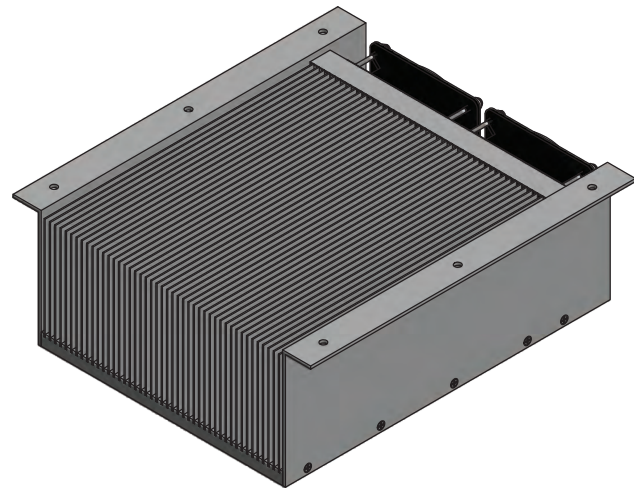
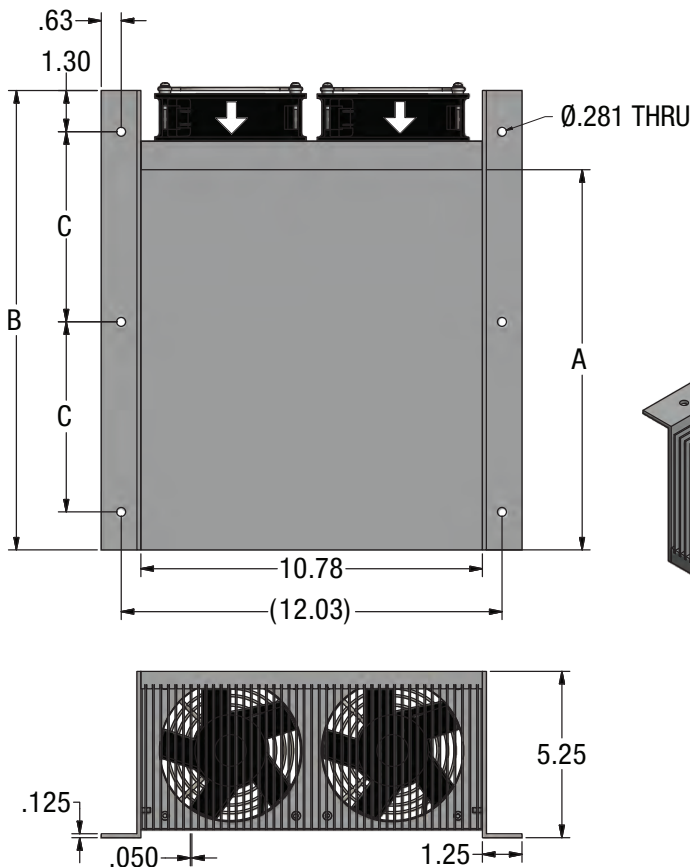
FORCED AIR CONVECTION - SINGLE FAN MODELS

MODEL #	CH5115F	CH5116F
Dimension A	7.00"	11.81"
Dimension B	9.50"	14.50"
Dimension C	3.75"	6.25"
Thermal Resistance	0.08°C/W	0.06°C/W

Thermal performances based on 100 CFM fan. Mounting pattern shown fits standard "muffin" fans.

FORCED CONVECTION – DOUBLE FAN MODELS

Ideal for designs with large IGBT, Diode, and SCR Modules in high wattage applications. Exceptional thermal performances as low as 0.024°C/W – more effective cooling per cubic inch compared to Extruded Heat Sinks. Models available fully equipped with ball-bearing fans. **Custom designs are available upon request.**



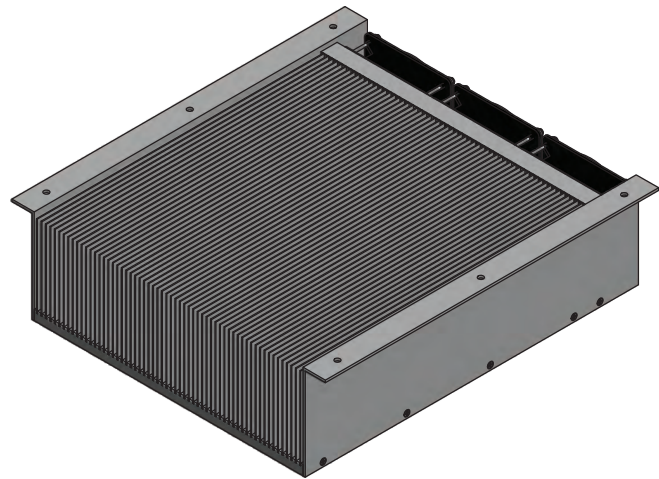
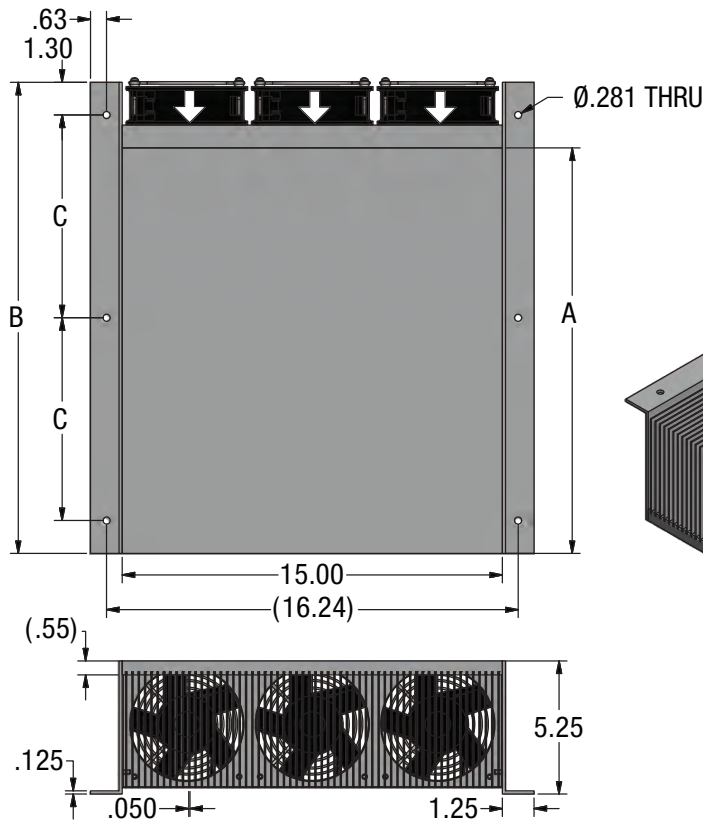
FORCED AIR CONVECTION - DOUBLE FAN MODELS

MODEL #	CH5117F	CH5118F	CH5119F
Dimension A	12.00"	14.00"	16.00"
Dimension B	14.50"	16.59"	18.59"
Dimension C	6.00"	7.00"	8.00"
Thermal Resistance	0.028°C/W	0.025°C/W	0.024°C/W

Thermal performances based on 100 CFM fan. Mounting pattern shown fits standard "muffin" fans.

FORCED CONVECTION – TRIPLE FAN MODELS

Triple Fan Forced Convection Heat Sinks have the highest watt per cubic inch performance over other Bonded Fin Heat Sink designs. Semiconductor modules can be mounted parallel to the Heat Sink fins to eliminate upstream heating effect. This allows for multiple IGBTs, Diodes and SCRs to operate at the same temperature and increase system reliability. Models available fully equipped with ball-bearing fans. **Custom designs are available upon request.**



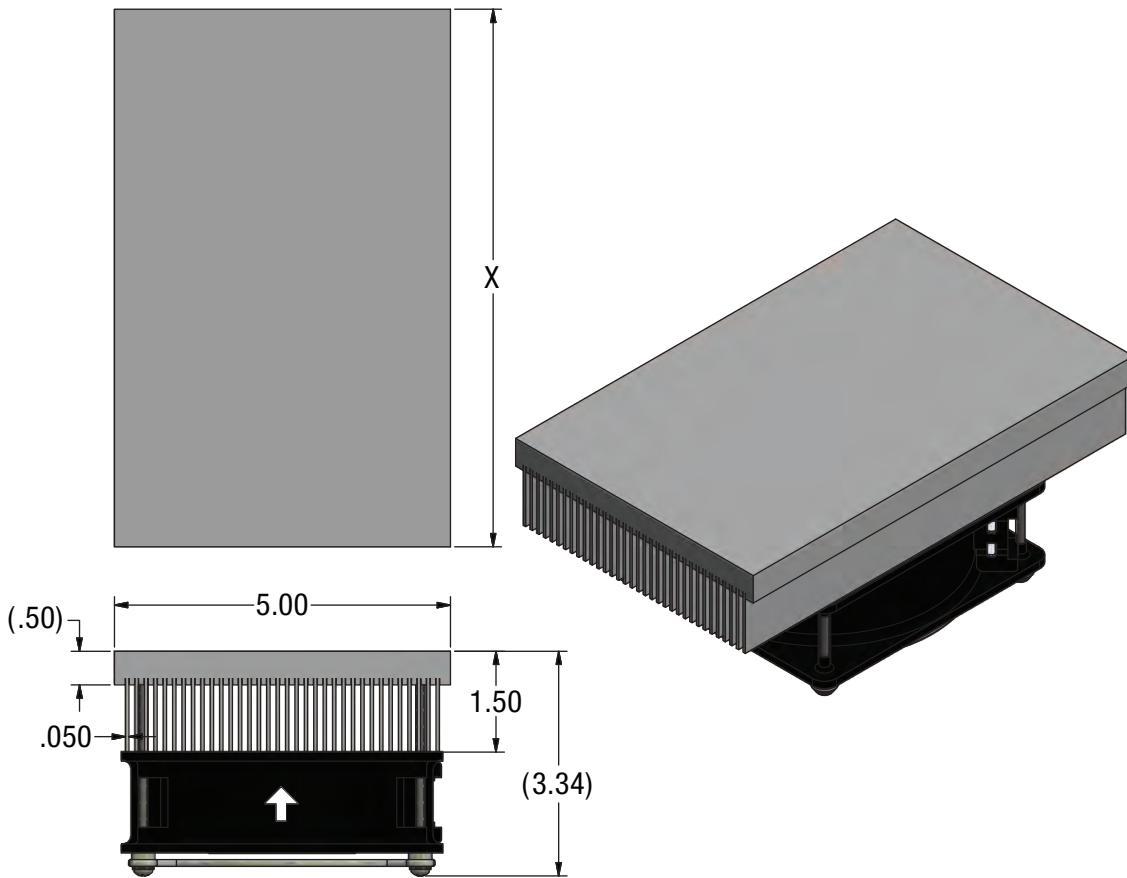
FORCED AIR CONVECTION - TRIPLE FAN MODELS

MODEL #	CH5120F	CH5121F	CH5122F
Dimension A	11.81"	14.00"	16.00"
Dimension B	14.59"	16.59"	18.59"
Dimension C	6.00"	7.00"	8.00"
Thermal Resistance	0.020°C/W	0.019°C/W	0.0175°C/W

Thermal specifications are based on 600 LFM airflow. Mounting pattern shown fits standard "muffin" fans.

IMPINGEMENT HEAT SINK

Ideal for IGBT and power MOSFET applications as well as Diode and SCR Bridges. The impingement cooling allows modules to be mounted close together while keeping an extremely low cost per watt. This results in all modules in a system to operate at the same temperature increasing system reliability. Additionally, the close mounting structure allows for shorter bus bars that reduces cost and lowers circuit inductance. The impingement style Heat Sinks provide very high performance cooling in a small package. **Custom designs are available upon request.**



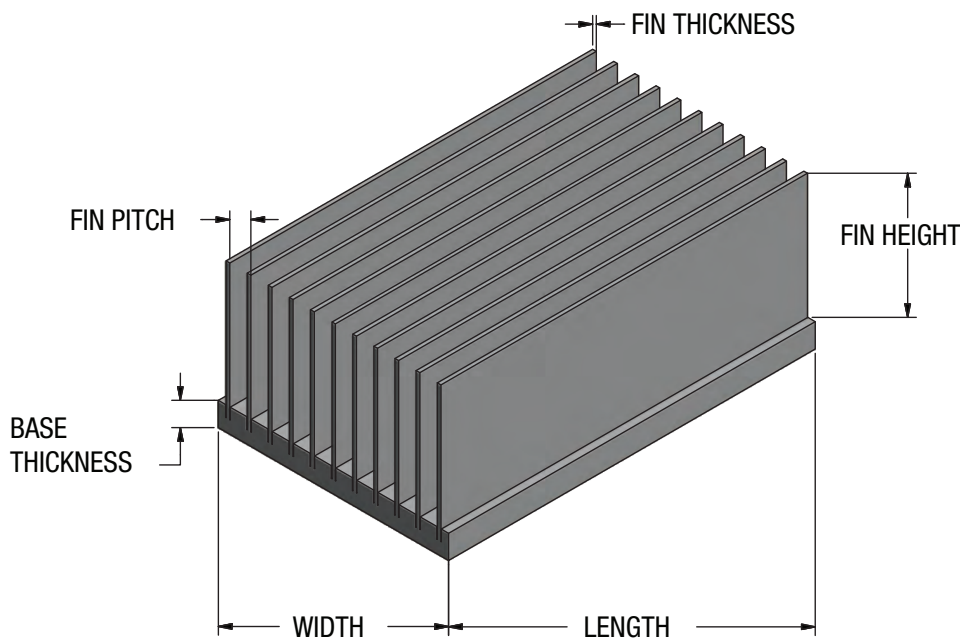
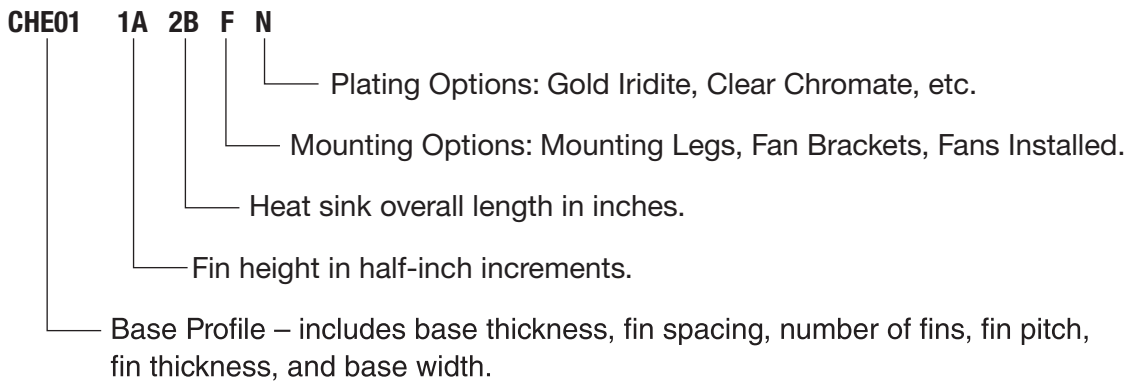
POWER-PAK IMPINGEMENT COOLING		
MODEL #	CH6500F	CH6600F
Dimension X	5.00"	8.00"
Thermal Resistance	0.10°C/W	0.08°C/W

Thermal performances based on 100 CFM fan. Mounting pattern shown fits standard "muffin" fans.

CUSTOM BONDED FIN HEAT SINKS

Forced air and natural convection profiles are available in a variety of plating finishes. The ability to choose from various configurations enables the engineer to tailor the Heat Sink profile to meet the specific thermal needs of the application. By using the chart on the following page, fin spacing, profile width, Heat Sink length, fin height, and mounting options can all be selected. Thermal resistances are calculated for the industry's common fin heights with 500 LFM airflow and a Heat Sink length of 5 inches. Increases in airflow, fin height, and Heat Sink length will all result in high thermal performances.

Create your own custom Bonded Fin Heat Sink using the example below and charts on the following page. Heat Sinks are selected from the table of options using the following format:





Thermal Management

Bonded Fin Heat Sinks

TOC

THERMAL MANAGEMENT

SEMICONDUCTOR CLAMPS

POWER ASSEMBLIES

Heat Sink Introduction

Extruded Heat Sinks

Bonded Fin Heat Sinks

Liquid Chill Plates

Liquid Chill Blocks

Clamp Introduction

Bar Clamps

Box Clamps

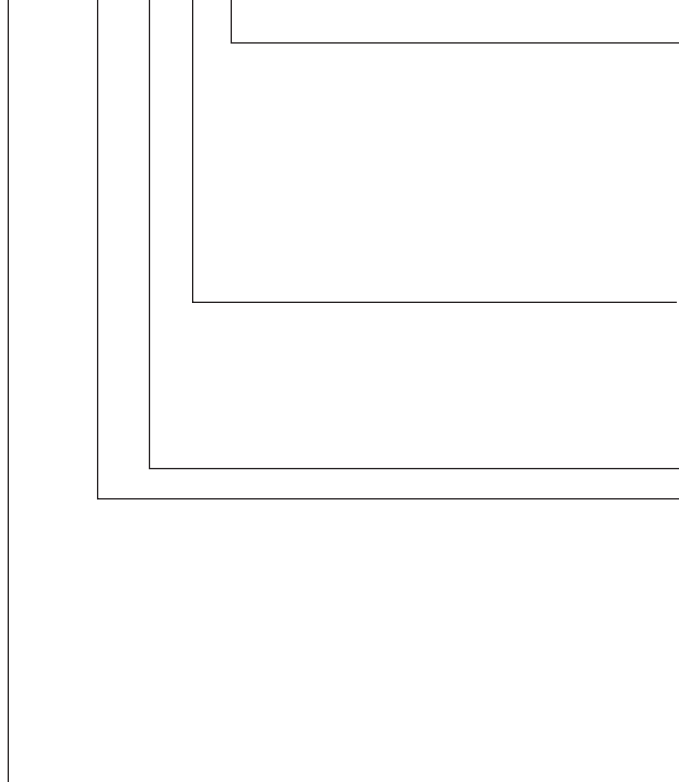
Assembly Introduction

Air Cooled Assemblies

Liquid Cooled Assemblies

Assembly Outlines

CHE01 1A 2B F N



Plating Options
N - Natural Finish (Wash)
L - Clear Alodine 5200
G - Gold Iridite
T - Type II Trivalent
C - Clear Chromate
A - Clear Anodized
O - Other (please specify)

Mounting Options
F - Fan Installed
H - Fan Shroud & Legs
L - Leg Mounts
W - No Brackets

Fin Height (in.)	Base Length (in.)	
	1A - 1.50	2A - 2.00
1B - 2.00	2B - 3.00	2L - 13.00
1C - 2.50	2C - 4.00	2M - 14.00
1D - 3.00	2D - 5.00	2N - 15.00
1E - 3.50	2E - 6.00	2O - 16.00
1F - 4.00	2F - 7.00	2P - 17.00
1G - 4.50	2G - 8.00	2Q - 18.00
1H - 5.00	2H - 9.00	2R - 19.00
1I - 5.50	2I - 10.00	2S - 20.00
	2J - 11.00	---

CUSTOM ENGINEERED PROFILES (measurements in inches)						
Base #	Base Width	Base Thickness	Fin Thickness	# of Fins	Fin Pitch	Fin Spacing
01	1.20"	0.37"	0.040"	8	0.150"	0.110"
02	2.37"	0.26"	0.040"	18	0.132"	0.092"
03	2.40"	0.25"	0.032"	16	0.150"	0.118"
04	4.00"	0.50"	0.050"	20	0.200"	0.150"
05	4.60"	0.37"	0.040"	30	0.150"	0.110"
06	4.75"	0.62"	0.050"	20	0.236"	0.186"
07	4.78"	0.50"	0.063"	16	0.288"	0.225"
08	4.78"	0.60"	0.050"	20	0.228"	0.178"
09	5.00"	0.52"	0.040"	39	0.150"	0.085"
10	5.65"	0.50"	0.050"	28	0.200"	0.150"
11	6.25"	0.60"	0.050"	33	0.158"	0.135"
12	6.61"	0.50"	0.050"	33	0.200"	0.150"
13	6.80"	0.50"	0.050"	34	0.200"	0.150"
14	6.93"	0.39"	0.050"	46	0.150"	0.100"
15	7.38"	0.50"	0.050"	19	0.340"	0.290"
16	7.37"	0.50"	0.080"	20	0.364"	0.284"
17	8.00"	0.50"	0.040"	63	0.125"	0.085"
18	8.06"	0.57"	0.032"	64	0.125"	0.093"
19	8.35"	0.56"	0.050"	33	0.238"	0.188"
20	10.78"	0.55"	0.050"	45	0.238"	0.188"
21	11.25"	0.60"	0.050"	44	0.250"	0.200"
22	12.00"	0.54"	0.040"	95	0.125"	0.085"
23	12.45"	0.54"	0.050"	60	0.185"	0.135"
24	15.00"	0.58"	0.050"	60	0.250"	0.200"
25	17.00"	0.50"	0.090"	49	0.348"	0.258"

Thermal Resistance Examples (°C/W)		
	2" Fin Height	4" Fin Height
	0.50	0.26
	0.25	0.13
	0.25	0.12
	0.20	0.11
	0.13	0.07
	0.20	0.10
	0.24	0.13
	0.20	0.10
	0.12	0.06
	0.15	0.07
	0.13	0.06
	0.12	0.06
	0.12	0.06
	0.11	0.06
	0.30	---
	0.22	0.12
	0.07	---
	0.07	0.04
	0.14	0.07
	0.09	0.05
	0.10	0.05
	0.08	---
	0.06	0.03
	0.07	0.04
	0.08	0.04

LIQUID COOLING THERMAL MANAGEMENT

Available thermal resistances as low as 0.004°C/W, our Liquid Cooled Heat Sinks are ideal for cooling Rectifiers, SCRs, and IGBTs, along with other high-power modules and puk-style devices. These chill plates can handle extremely high power densities in a small footprint. C&H Technology offers traditional chill plates, chill blocks, and patented Friction Stir-Welded plates.

Copper Press-In Tube Chill Plates

Available in our standard offering of 1-6 channel passes. The copper is embedded into the milled channel of an aluminum plate. These plates are designed primarily for the high-power inverter markets and are ideal for cooling large Diode, SCR, and IGBT Modules. They are available with drilled and tapped holes for mounting of the semiconductors and brackets.

Custom configurations are also available.

Model CH8040

This double-sided copper chill plate with an internal fin structure provides a very low thermal resistance and low pressure drop. The plate has a nickel finish with brazed hose barb fittings. The CH8040 has the highest heat exchange rate of the standard products.

Friction Stir-Welded Chill Plates

Used in high performance applications for industries in renewable energy, high-speed rail, electric vehicle, and many more. This innovative technology provides uniform cooling of power electronic devices from 30kW to 250kW with chill plates comprised solely of aluminum. Manufactured using the unique **friction stir-welding** process to incorporate exceptional cooling structures with low pressure drops.

Copper Chill Blocks

Available in two options, **cast copper** and **furnace brazed copper** chill blocks. These nickel-plated blocks operate at similar thermal performance to one another and are used for cooling applications requiring disc (puk) type semiconductors.

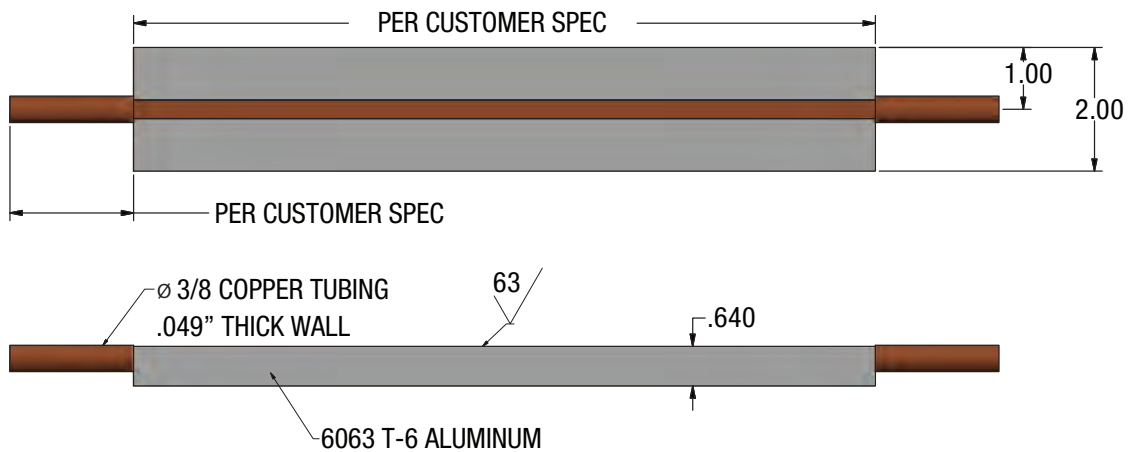
For all types of chill plates and blocks, larger sizes are available upon request.

Call 800-274-4284 or email sales@chtechnology.com for questions or Custom Solutions.

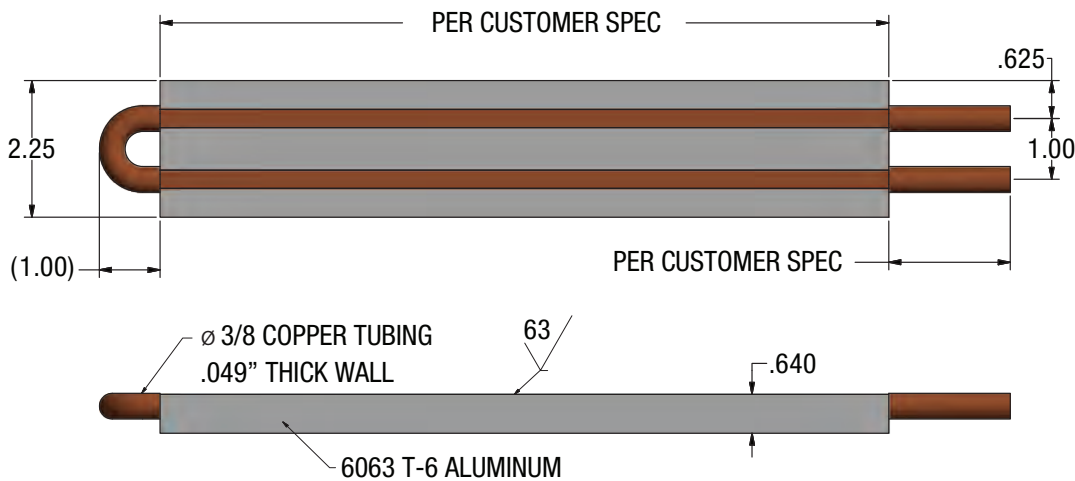
LIQUID CHILL PLATE – 1 AND 2 PASS MODELS

Low thermal resistance, ideal for cooling IGBT or other high wattage modules. Can handle extremely high heat concentrations with lower device temperature rise. Maintains lower overall junction temperatures. Precision machined module mounting surface. **Custom designs are available upon request.**

1-Pass Model: CH8001



2-Pass Model: CH8002

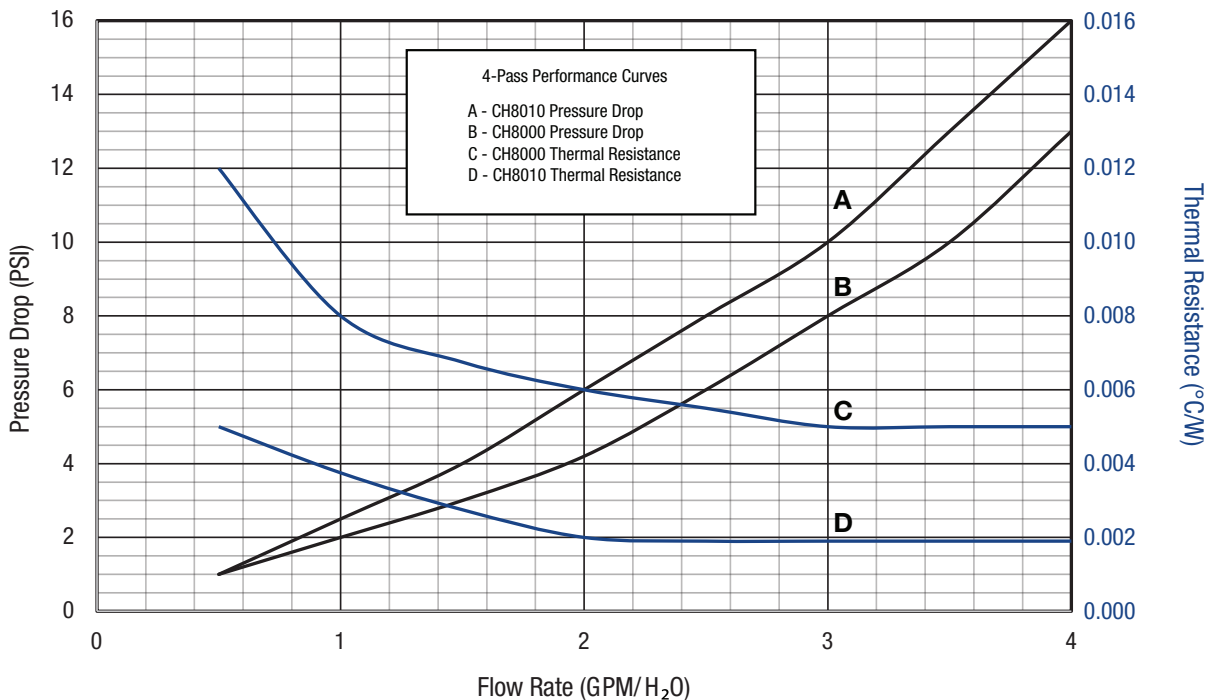
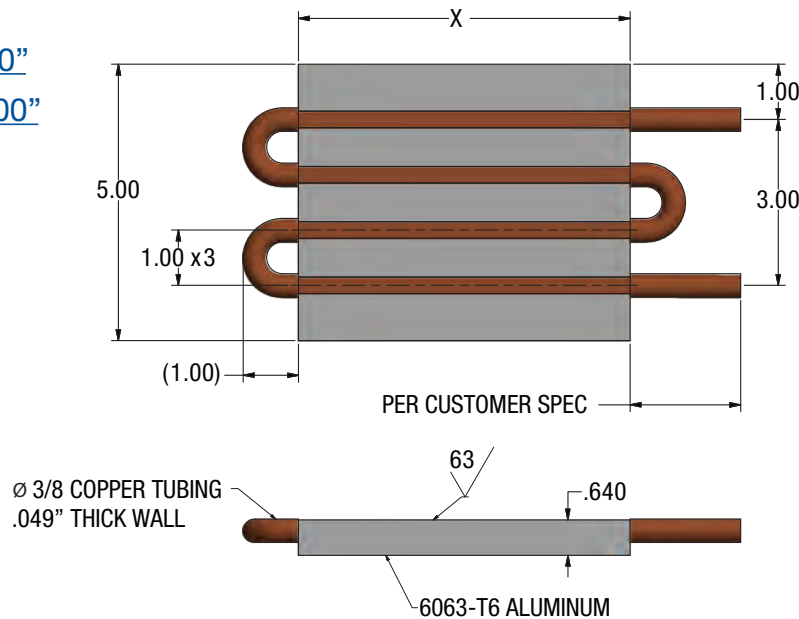


LIQUID CHILL PLATE – 4 PASS MODELS

Thermal resistance as low as 0.005°C/W. Ideal for cooling IGBT modules or other high wattage modules. Can handle extremely high heat concentrations with lower device temperature rise. Maintains lower overall junction temperatures. Precision module mounting surface. **Custom designs are available upon request.**

[CH8000: X = 6.00"](#)

[CH8010: X = 12.00"](#)

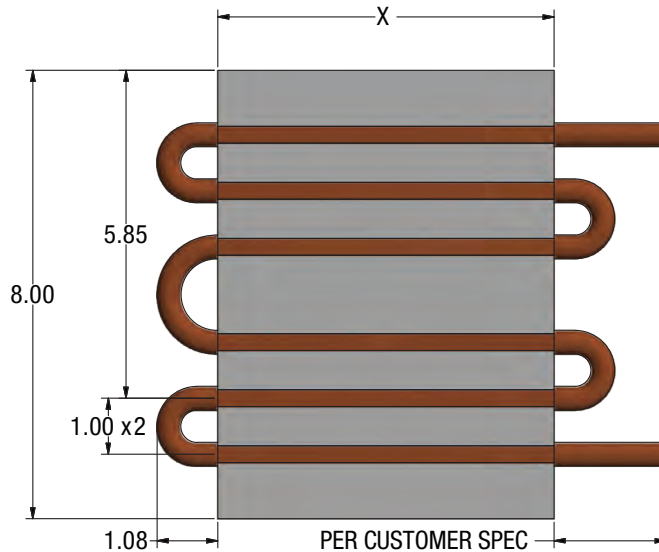


LIQUID CHILL PLATE – 6 PASS MODELS

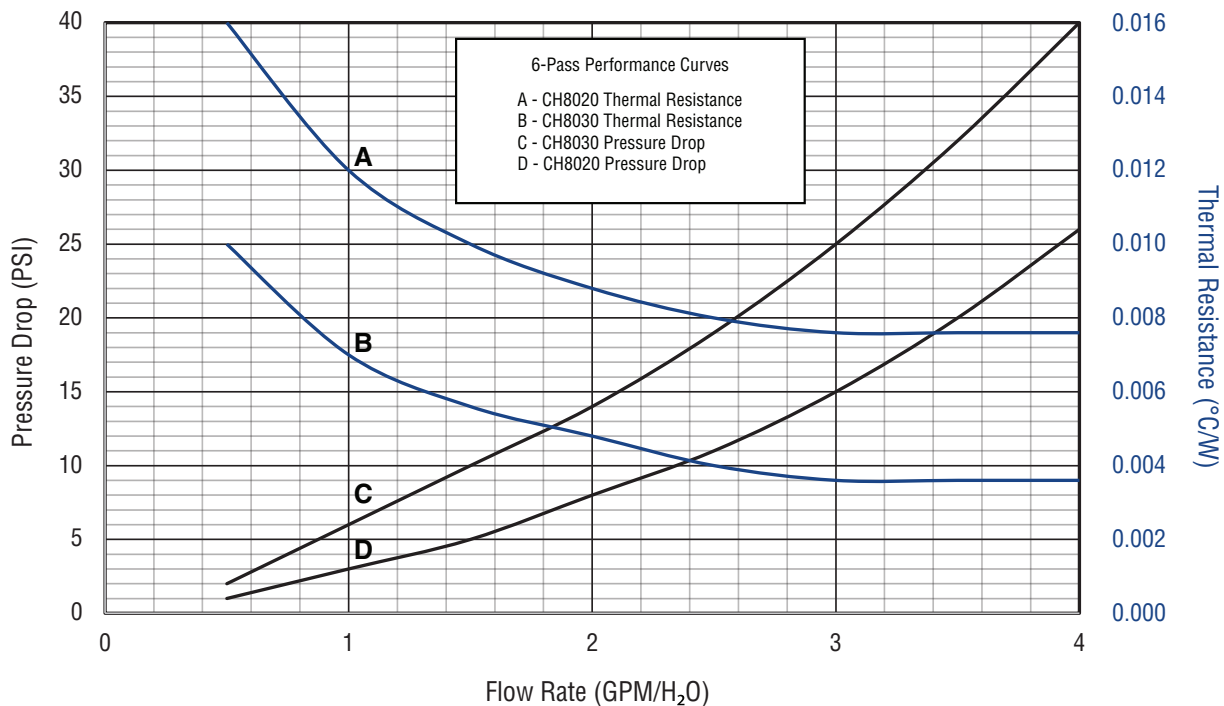
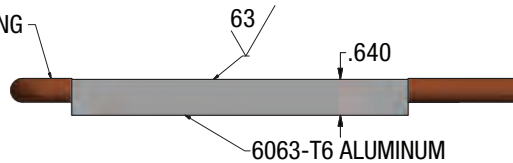
Thermal resistances as low as 0.004°C/W. Designed for larger IGBT modules or other high wattage modules. **Custom designs are available upon request.**

CH8020: X = 6.00"

CH8030: X = 12.00"



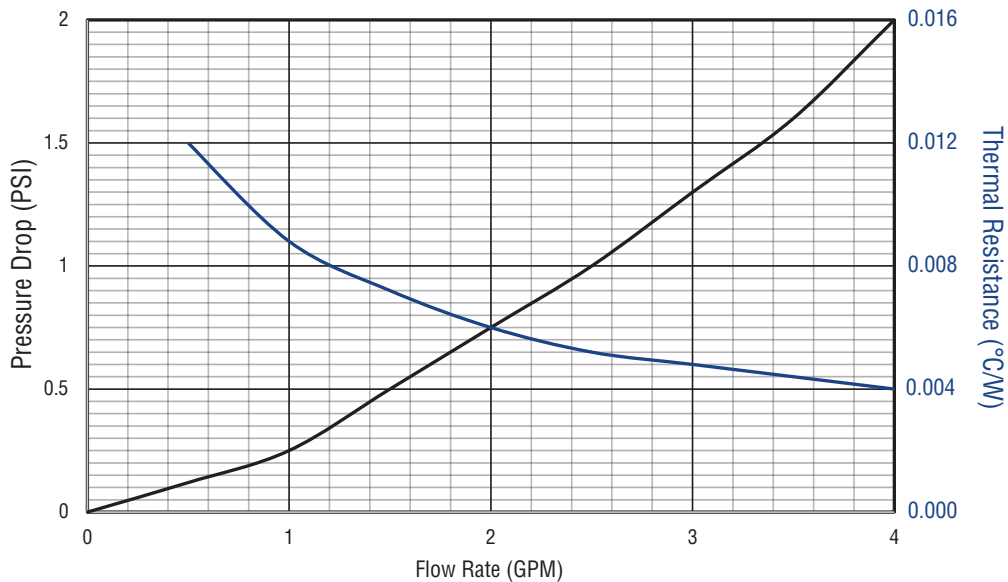
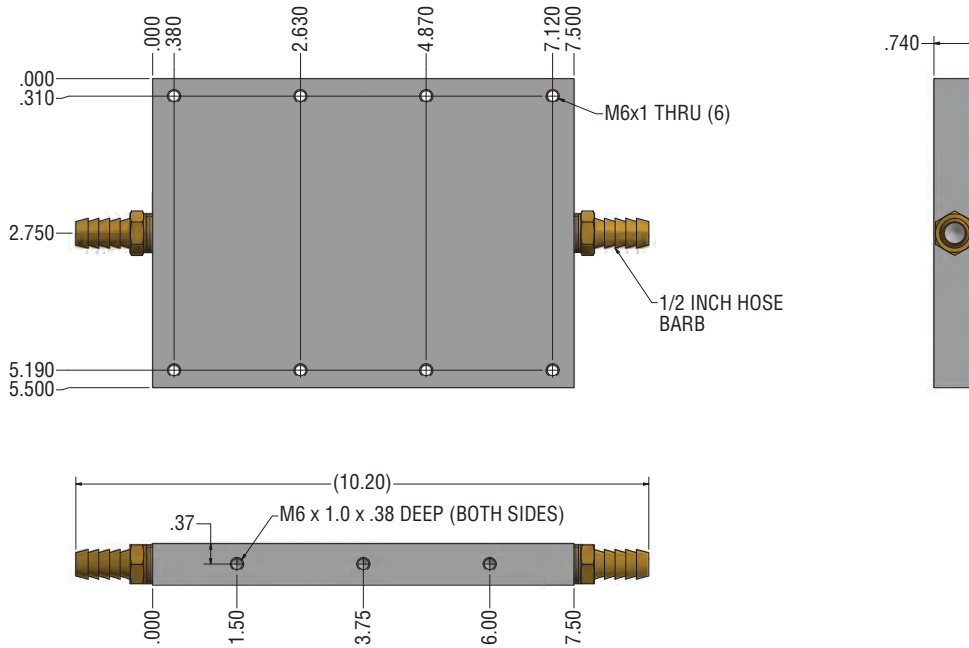
Ø 3/8 COPPER TUBING
.049" THICK WALL



LIQUID CHILL PLATE – DOUBLE SIDED COPPER PLATE

Double Sided Copper Plate designed for high efficiency cooling of large Diode, SCR, and IGBT modules. A unique internal fin structure provides a very low thermal resistance and pressure drop when uniform temperature is applied across both contact surfaces. Nickel plated with brazed hose barb fittings. **Custom designs are available upon request.**

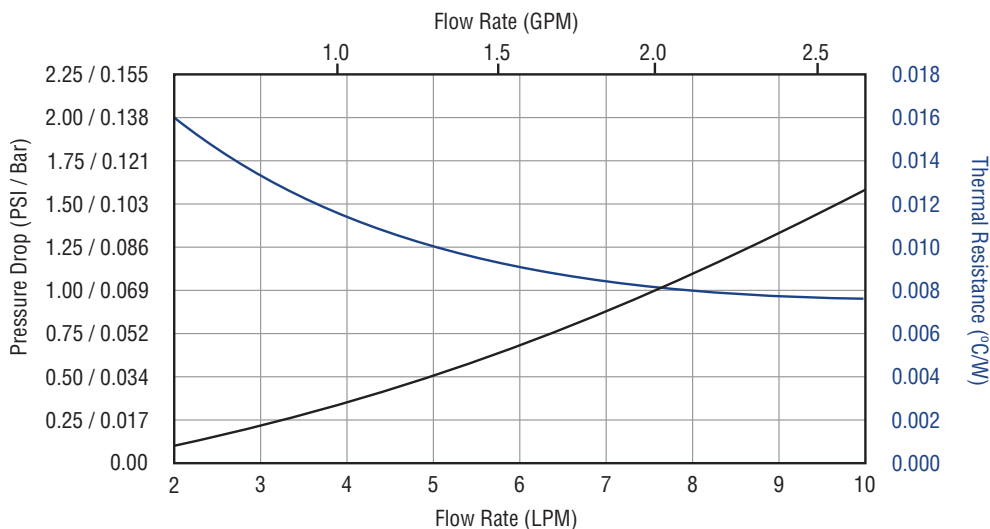
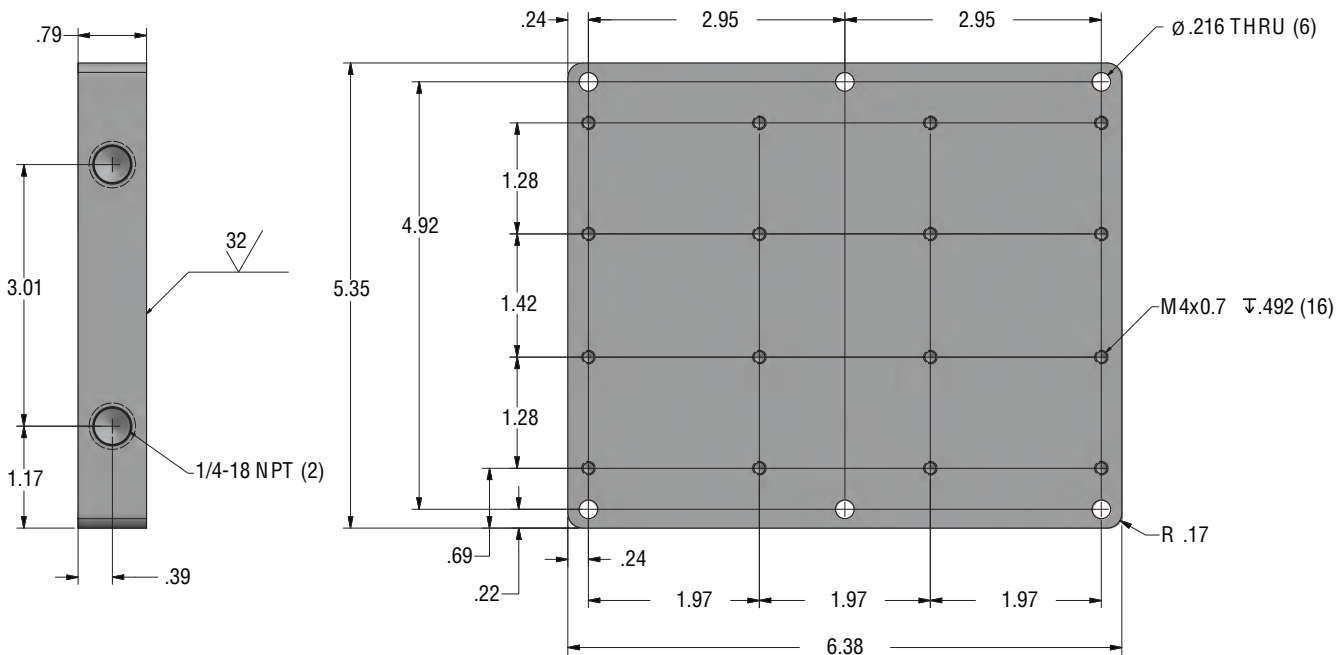
CH8040



FRICION STIR-WELDED STANDARD CHILL PLATE

The CHW001-MXQ-01 can dissipate 3000 watts of heat at a flow rate of 8 LPM. This results in a 25°C temperature rise from the fluid inlet to the maximum coldplate temperature. The internal fin structure also results in a pressure loss of 1.1 PSI at this flow rate. This performance is achieved with an empty weight of the coldplate of less than 1.0 kg. **Custom designs and various hole patterns available upon request. Model available for both prototype test purposes and full production.**

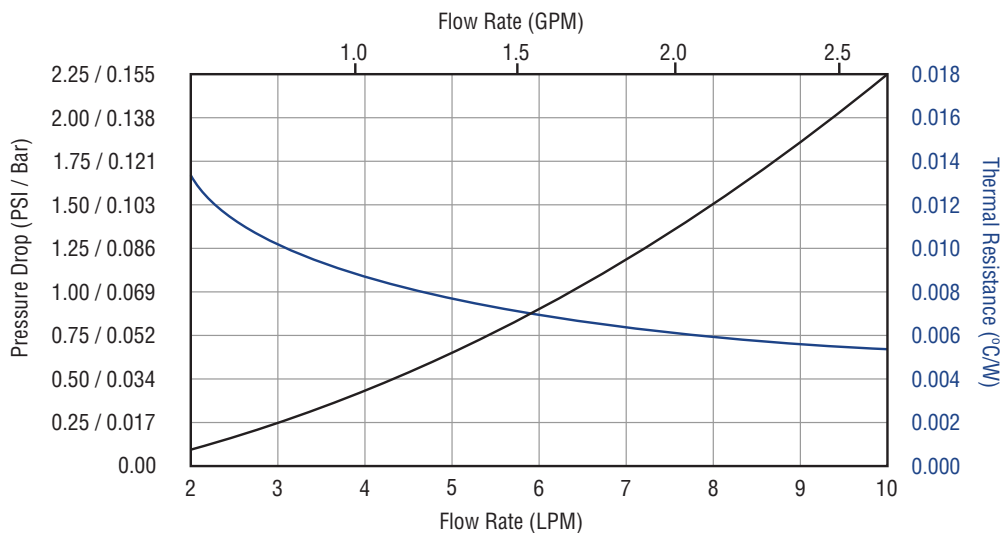
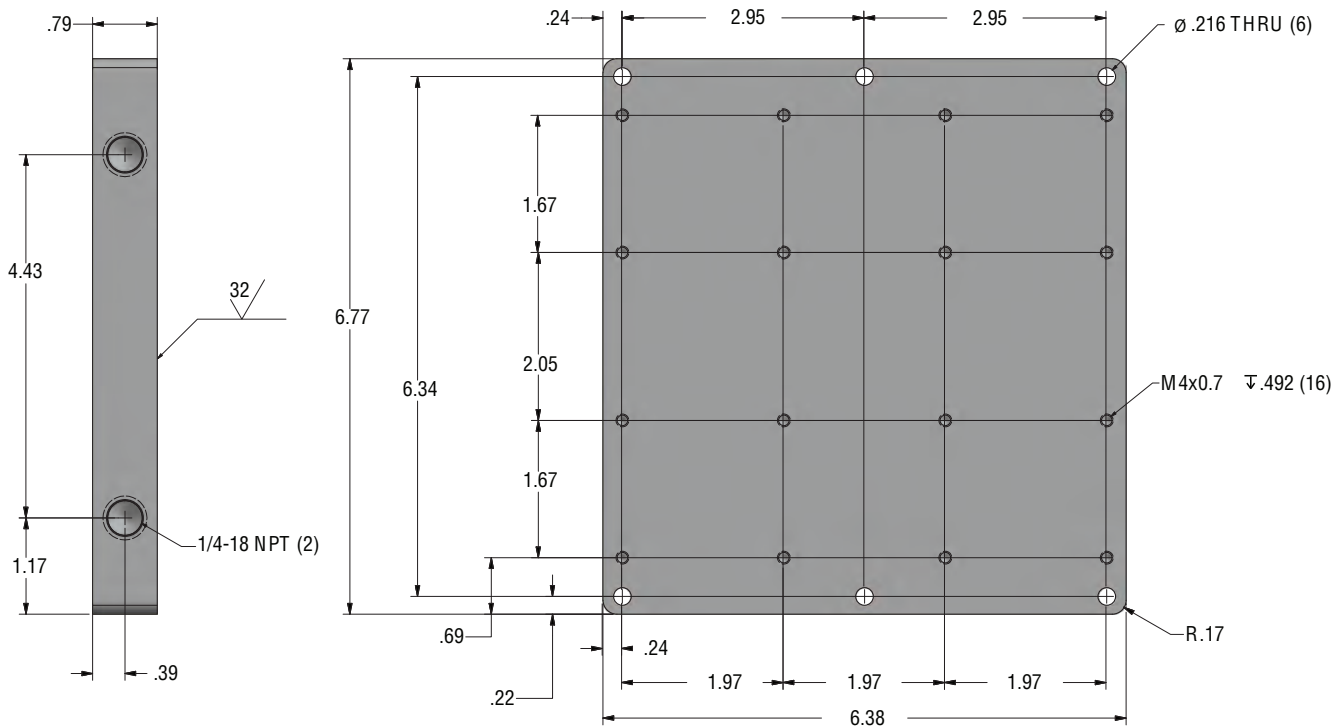
CHW001-MXQ-01



FRICION STIR-WELDED STANDARD CHILL PLATE

The CHW003-MXQ-01 can dissipate 3000 watts of heat at a flow rate of 8 LPM. This results in only an 18°C temperature rise from the fluid inlet to the maximum coldplate temperature. The internal fin structure also results in a pressure loss of 1.5 PSI at this flow rate. This performance is achieved with an empty weight of the coldplate of less than 1.3 kg. **Custom designs and various hole patterns available upon request. Model available for both prototype test purposes and full production.**

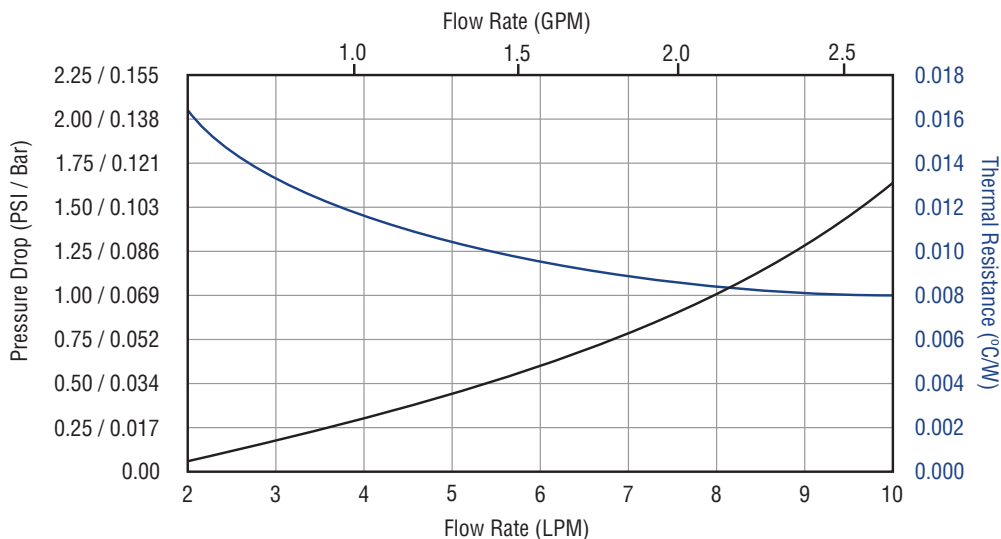
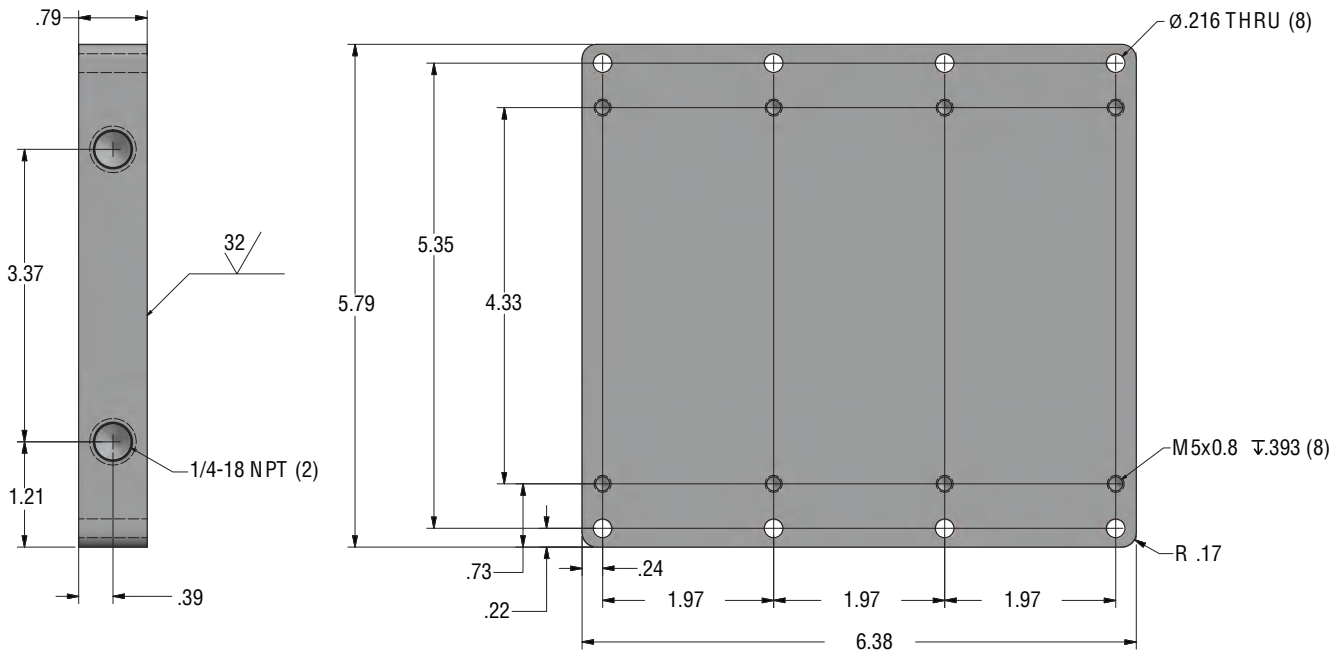
CHW003-MXQ-01



FRICION STIR-WELDED STANDARD CHILL PLATE

The CHW005-MXQ-01 can dissipate 3000 watts of heat at a flow rate of 8 LPM. This results in a 25.7°C temperature rise from the fluid inlet to the maximum coldplate temperature. The internal fin structure also results in a pressure loss of 1.03 PSI at this flow rate. This performance is achieved with an empty weight of the coldplate of less than 1.1 kg. **Custom designs and various hole patterns available upon request. Model available for both prototype test purposes and full production.**

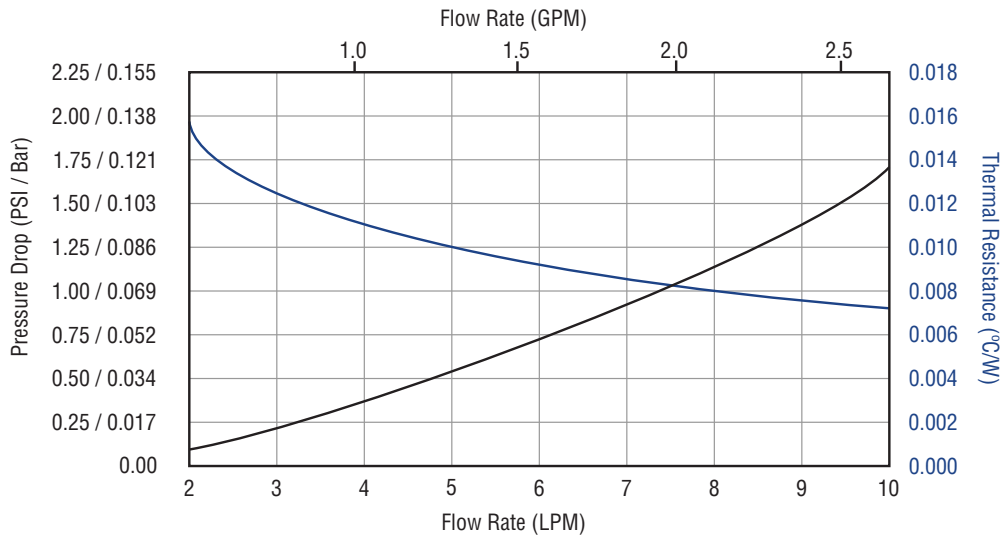
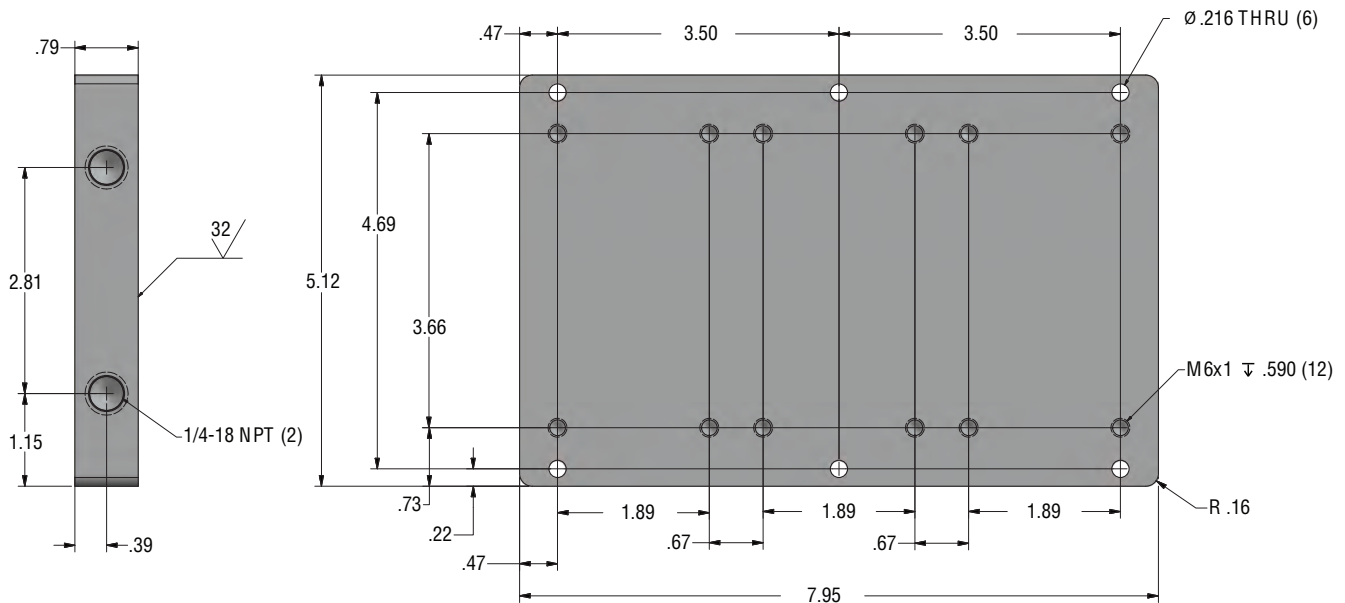
CHW005-MXQ-01



FRICION STIR-WELDED STANDARD CHILL PLATE

The CHW007-MXQ-01 can dissipate 3000 watts of heat at a flow rate of 8 LPM. This results in a 24°C temperature rise from the fluid inlet to the maximum cold plate temperature. The internal fin structure also results in a pressure loss of 1.16 PSI at this flow rate. This performance is achieved with an empty weight of the coldplate of less than 1.2 kg. **Custom designs and various hole patterns available upon request. Model available for both prototype test purposes and full production.**

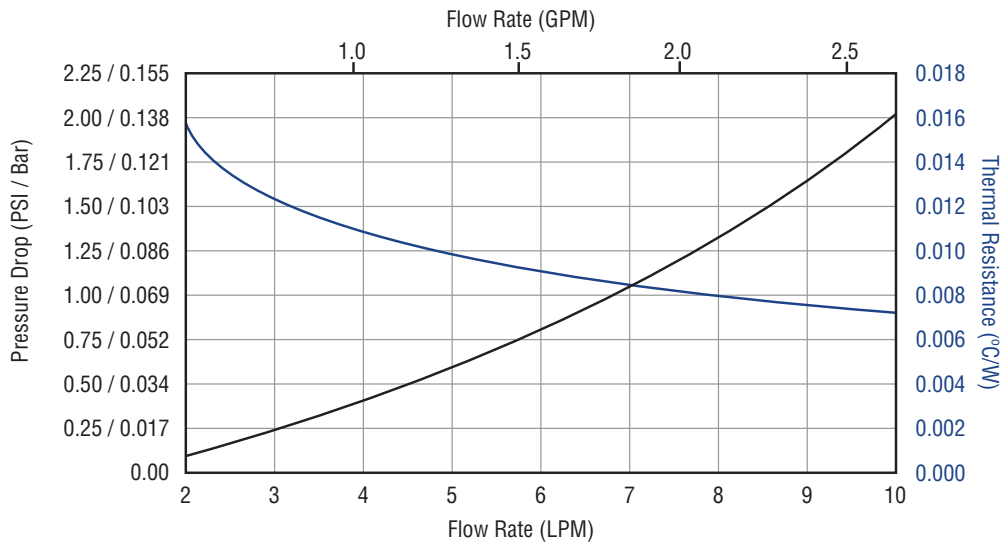
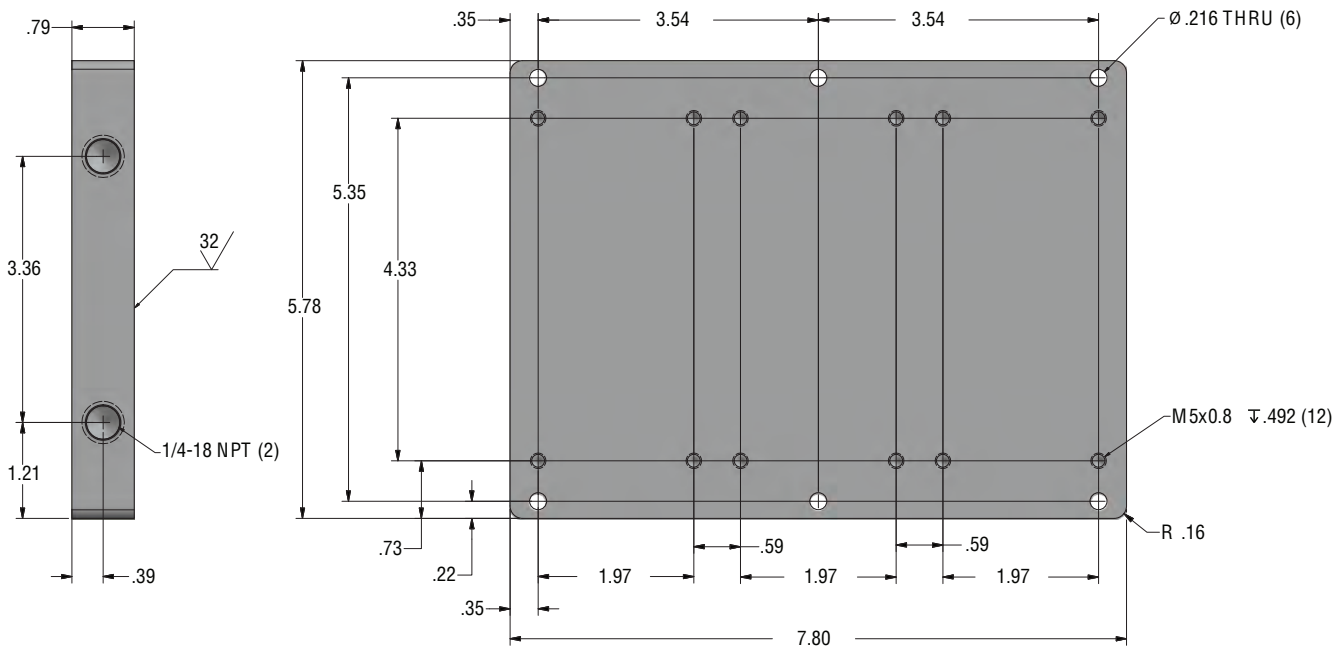
CHW007-MXQ-01



FRICION STIR-WELDED STANDARD CHILL PLATE

The CHW009-MXQ-01 can dissipate 3000 watts of heat at a flow rate of 8 LPM. This results in a 24°C temperature rise from the fluid inlet to the maximum coldplate temperature. The internal fin structure also results in a pressure loss of 1.35 PSI at this flow rate. This performance is achieved with an empty weight of the coldplate of less than 1.33 kg. **Custom designs and various hole patterns available upon request. Model available for both prototype test purposes and full production.**

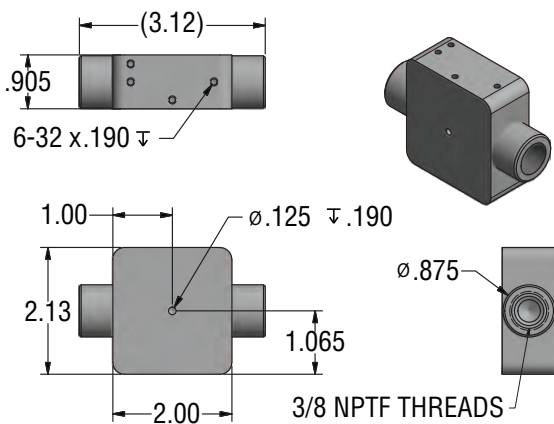
CHW009-MXQ-01



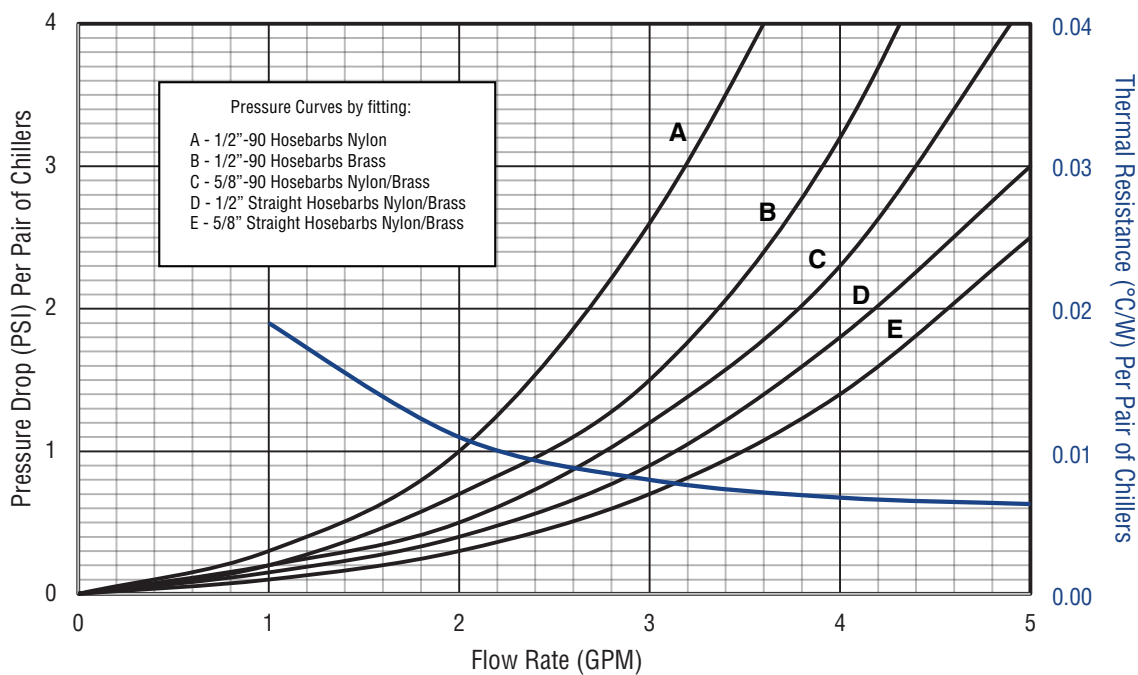
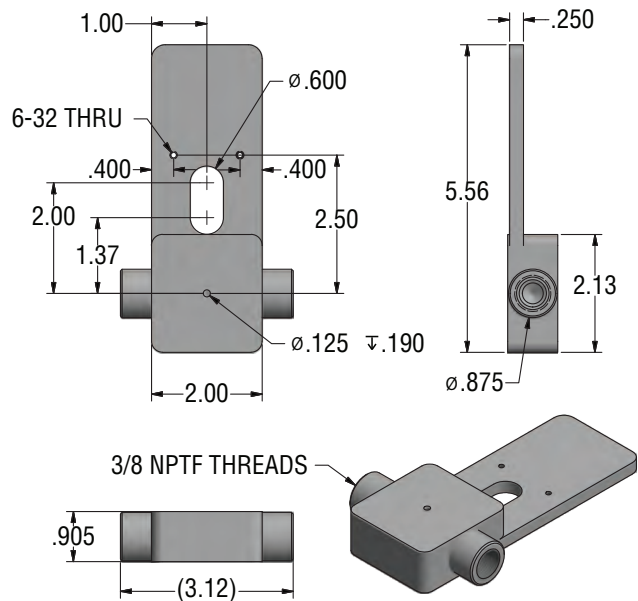
CHWC200 SERIES

This premium Furnace Brazed Copper Chill Block is ideal for cooling disc (puk) semiconductors between 30mm and 55mm in diameter. They can achieve a thermal resistance as low as 0.008°C/W by mounting the blocks on either side of a semiconductor disc. **Custom designs and custom hole patterns on the powertab available upon request.**

CHWC200SCU



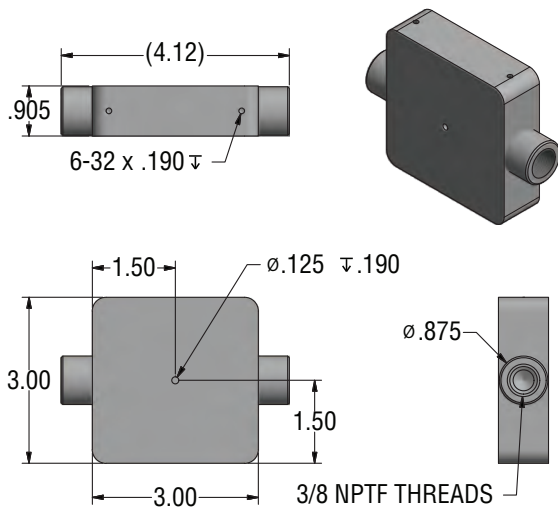
CHWC200TSCU



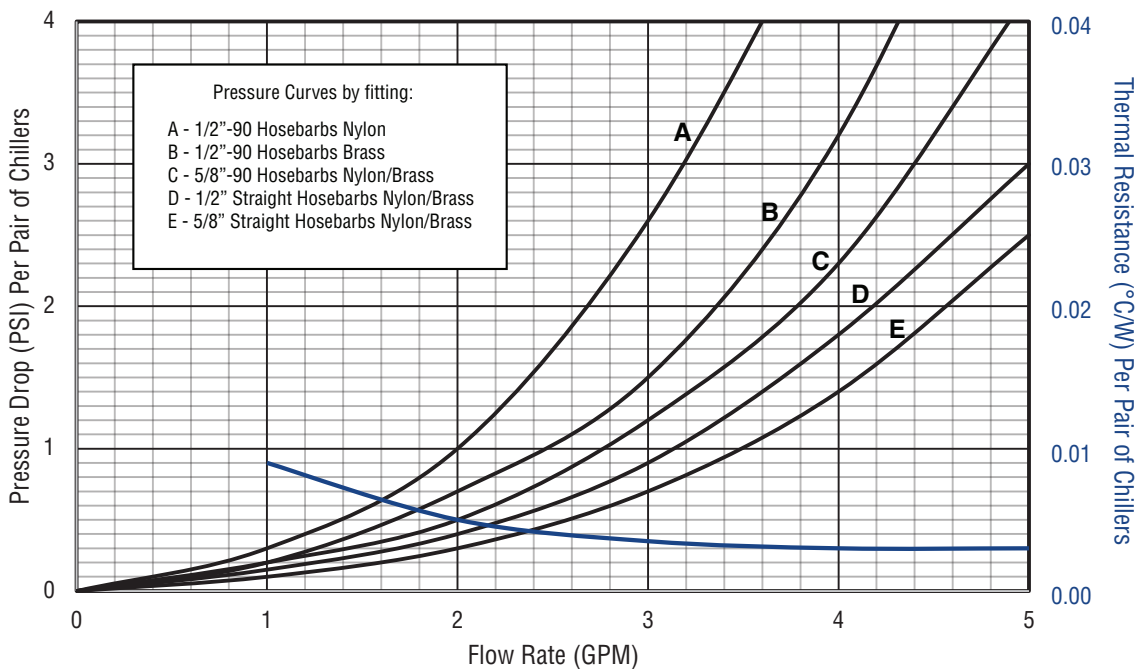
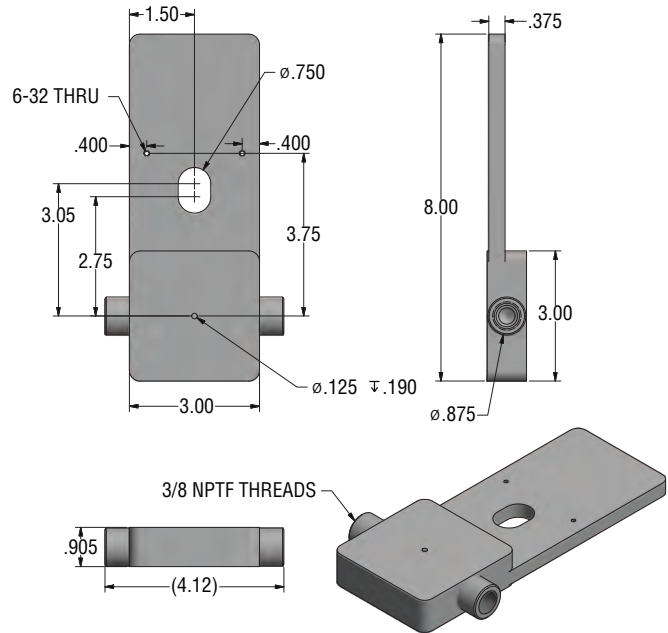
CHWC300 SERIES

This premium Furnace Brazed Copper Chill Block is ideal for cooling disc (puk) semiconductors between 63mm and 75mm in diameter. They can achieve a thermal resistance as low as 0.005°C/W by mounting the blocks on either side of a semiconductor disc. **Custom designs and custom hole patterns on the powertab available upon request.**

CHWC300SCU



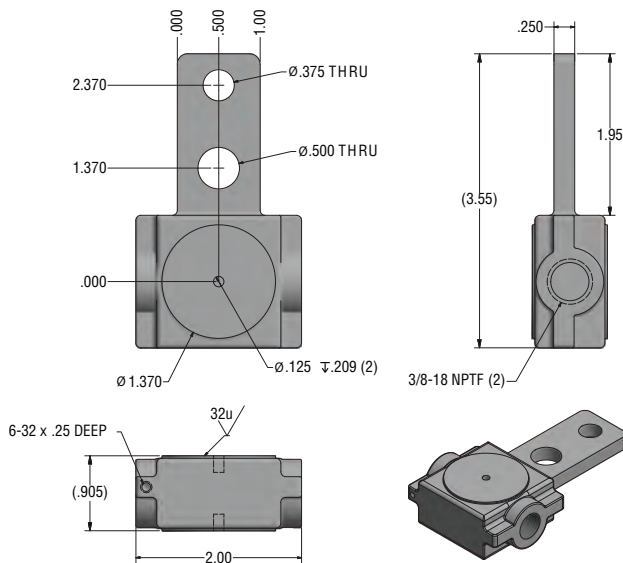
CHWC300TSCU



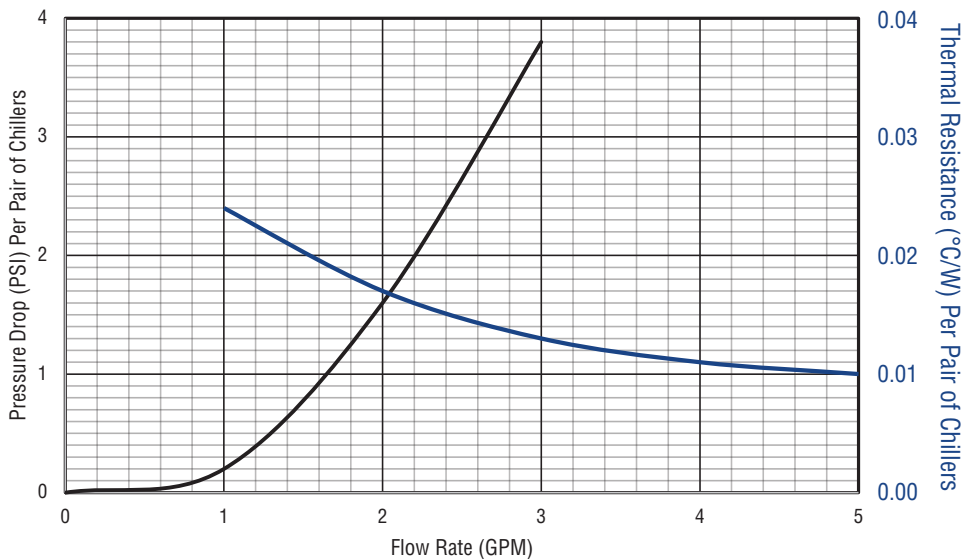
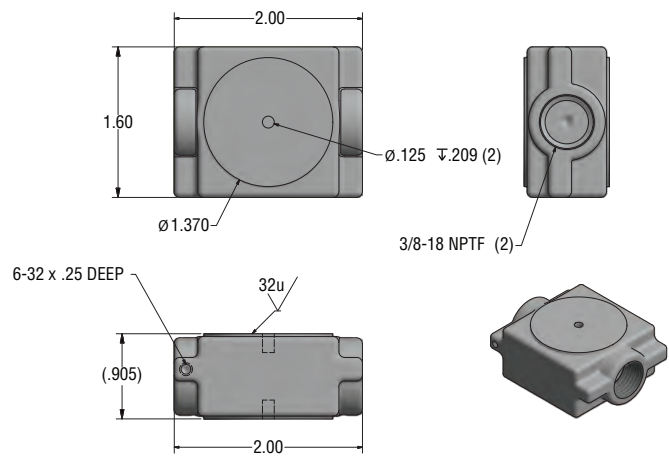
106 SERIES

This Cast Copper Chill Block is ideal for cooling disc (puk) semiconductors between 19mm and 29mm in diameter. They can achieve a thermal resistance as low as 0.010°C/W by mounting the blocks on either side of a semiconductor disc. **Custom designs and custom hole patterns on the powertab available upon request.**

106-1



106-2

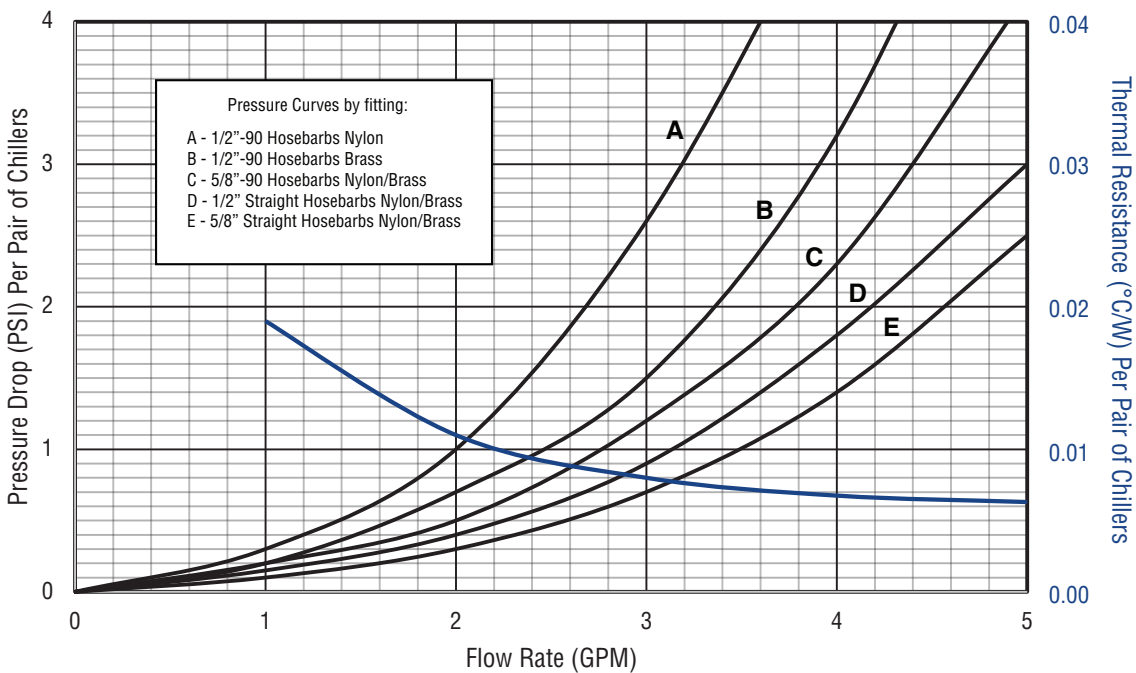
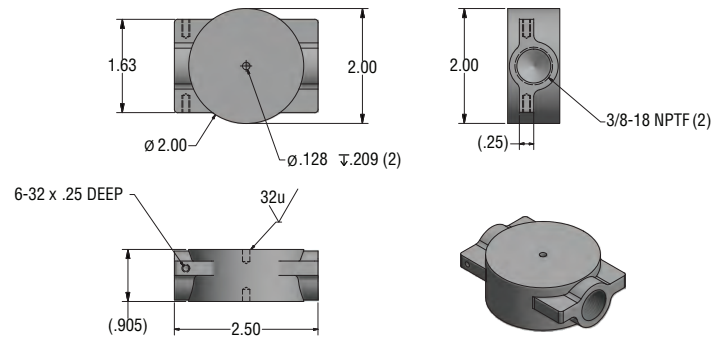
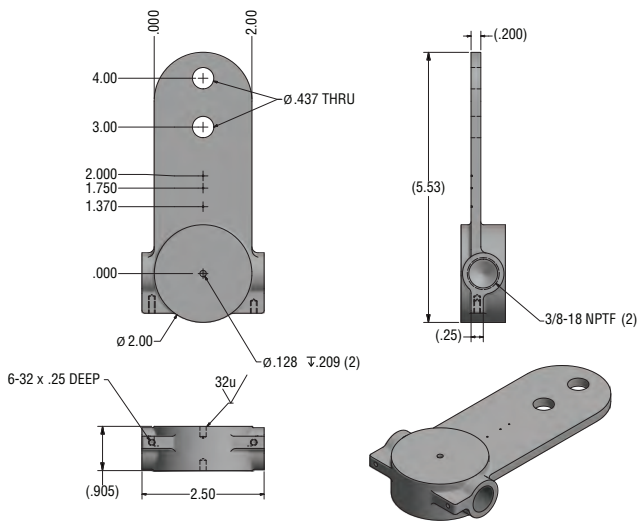


120 SERIES

This Cast Copper Chill Block is ideal for cooling disc (puk) semiconductors between 30mm and 55mm in diameter. Achieve a thermal resistance as low as 0.006°C/W by mounting the blocks on either side of a semiconductor disc. **Custom designs and custom hole patterns on the powertab available upon request.**

120-1

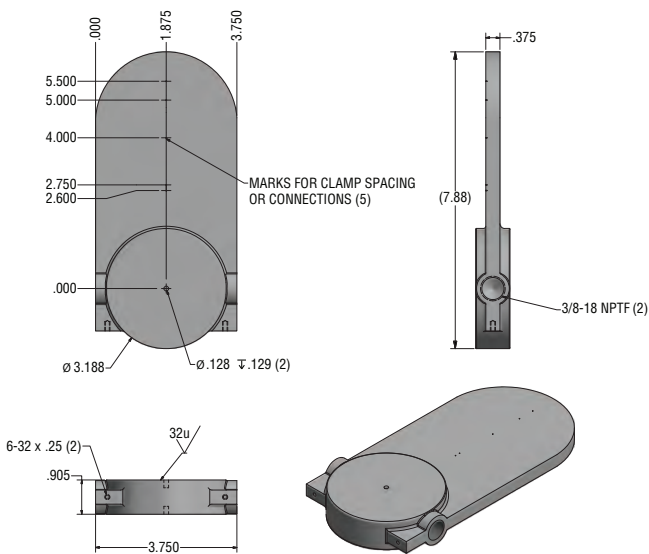
120-2



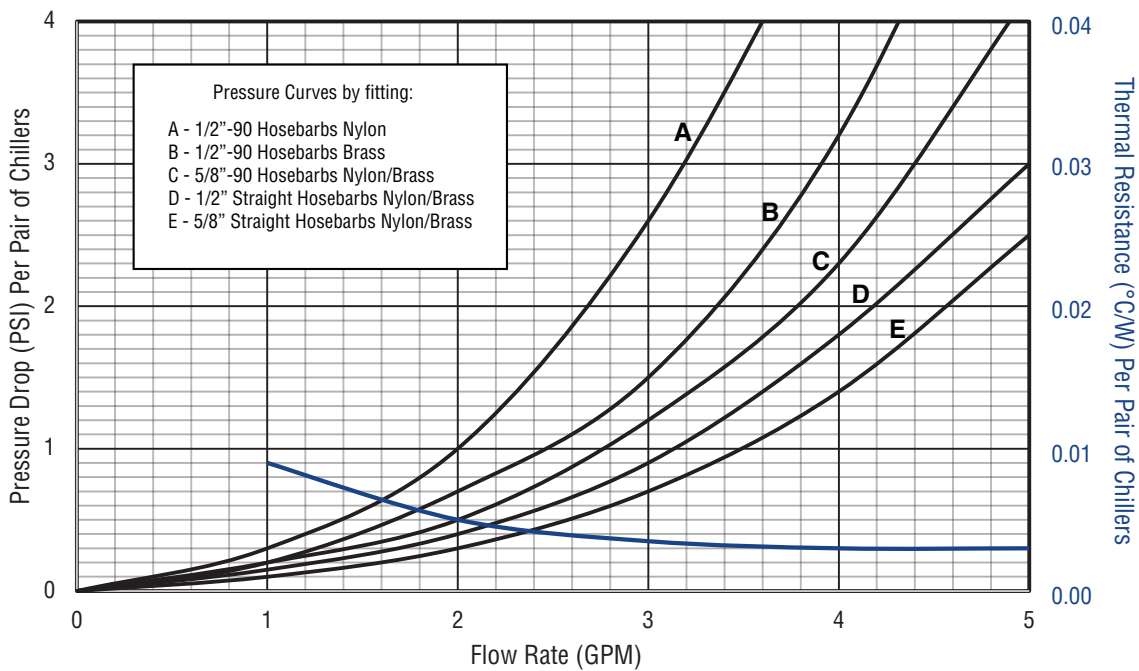
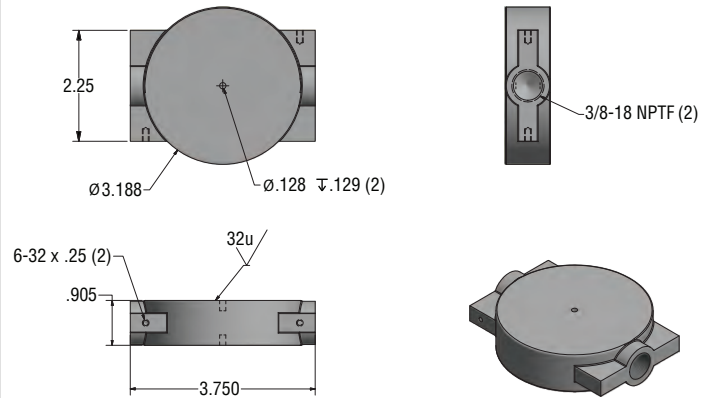
130 SERIES

This Cast Copper Chill Block is ideal for cooling disc (puk) semiconductors between 63mm and 75mm in diameter. Achieve a thermal resistance as low as 0.003°C/W by mounting these blocks on either side of a semiconductor disc. **Custom designs and custom hole patterns on the powertab available upon request.**

130-1



130-2



CLAMP INTRODUCTION

C&H Technology manufactures Hockey Puk Style Semiconductor Clamps for all ranges of device diameters and clamping forces. Bar clamp designs fall into three categories; Belleville Washers, Pre-Calibrated Bar, and Precision Clamps.

Belleville Washer Clamps functions by utilizing applied force in conjunction with Belleville Washers to compress and spin a flat washer indicating the precalibrated force has been met.

Pre-Calibrated Bar Clamps takes advantage of the metal elasticity of the bar material. When under the proper amount of force, an indicator arm attached to the side of the clamp snaps into the small indentation in the cross bar to indicate the precalibrated force has been met.

Precision Clamps electronically measures the deflection of the clamp under load. This technology is recommended for applications with highly accurate clamping and isolation requirements.

C&H also offers Box Clamps for single side cooling of hockey puk style semiconductors. Clamping force automatically adjusts with the thickness of the device. This family of clamps are available for devices up to 80mm in diameter.

C&H Standard Insulators have a working temperature of 105°C and a voltage capacity of 4KV for M8 models, and 7KV for M10 models. High Temperature Insulators are rated up to 170°C with an insulation voltage rating of 6kV are available upon request.

Clamping Force Conversions: 1 kN = 225 lbs, 1 kg = 9.806 N, 1 kg = 2.2 lbs

		C054D	C070D	C089D	C102B	C118B	C140	C155A	C170A	C180
Preset Clamping Force as Required by Device	4kN (900 lbs)	✓	---	---	---	---	---	---	---	---
	5kN (1125 lbs)	✓	✓	---	---	---	---	---	---	---
	9.8kN (2205 lbs)	---	✓	✓	---	---	---	---	---	---
	14kN (3150 lbs)	---	✓	✓	✓	✓	---	---	---	---
	18kN (4050 lbs)	---	---	✓	✓	✓	---	---	---	---
	21kN (4725 lbs)	---	---	✓	---	---	---	---	---	---
	22kN (4950 lbs)	---	---	---	✓	✓	---	---	---	---
	24kN (5400 lbs)	---	---	---	✓	✓	---	---	---	---
	26kN (5850 lbs)	---	---	---	---	---	---	---	✓	---
	27kN (6075 lbs)	---	---	---	---	---	✓	---	---	---
	40kN (9000 lbs)	---	---	---	---	---	✓	✓	✓	---
	45kN (10125 lbs)	---	---	---	---	---	✓	✓	✓	---
	55kN (12375 lbs)	---	---	---	---	---	---	✓	✓	---
	67kN (15075 lbs)	---	---	---	---	---	---	✓	---	---
80kN (18000 lbs)	---	---	---	---	---	---	---	---	✓	
95kN (21375 lbs)	---	---	---	---	---	---	---	---	✓	

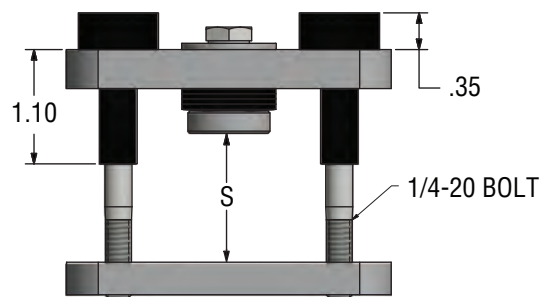
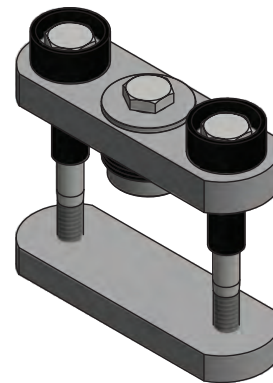
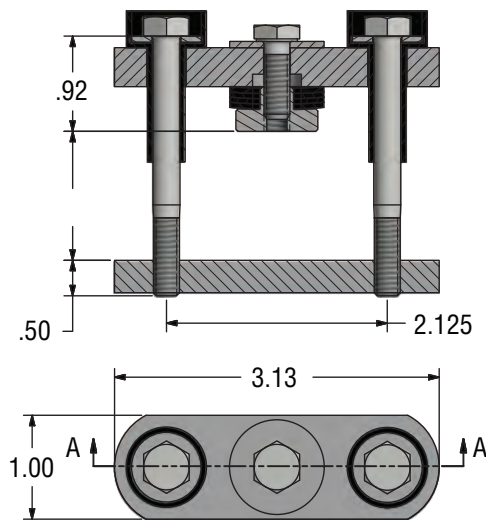
CLAMP MODEL: C054D

PRECALIBRATED FORCES - 4, 5 kN
 BOLT INTERAXYS - 54mm
 MAXIMUM PUK DIAMETER - 42mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in Inches

L	S MIN	S MAX
2.50"	0.82"	1.22"
2.75"	1.07"	1.47"
3.00"	1.32"	1.72"
3.25"	1.57"	1.97"
3.50"	1.82"	2.22"
3.75"	2.07"	2.47"
4.00"	2.32"	2.72"



ORDERING INFORMATION EXAMPLE:

C054D-5KNS(H)-2.50

CLAMP MODEL ————
 PRECALIBRATED CLAMPING FORCE ————
 BOLT LENGTH (in.)
 "H" DENOTES HIGH TEMP INSULATOR
 Note: Additional bolt lengths available

Note: Bolt Insulator dimension "H" available in either 14mm or standard 24mm height
 Standard Insulator working temperature is 105°C, insulation voltage 4 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

Semiconductor Clamps

Bar Clamps

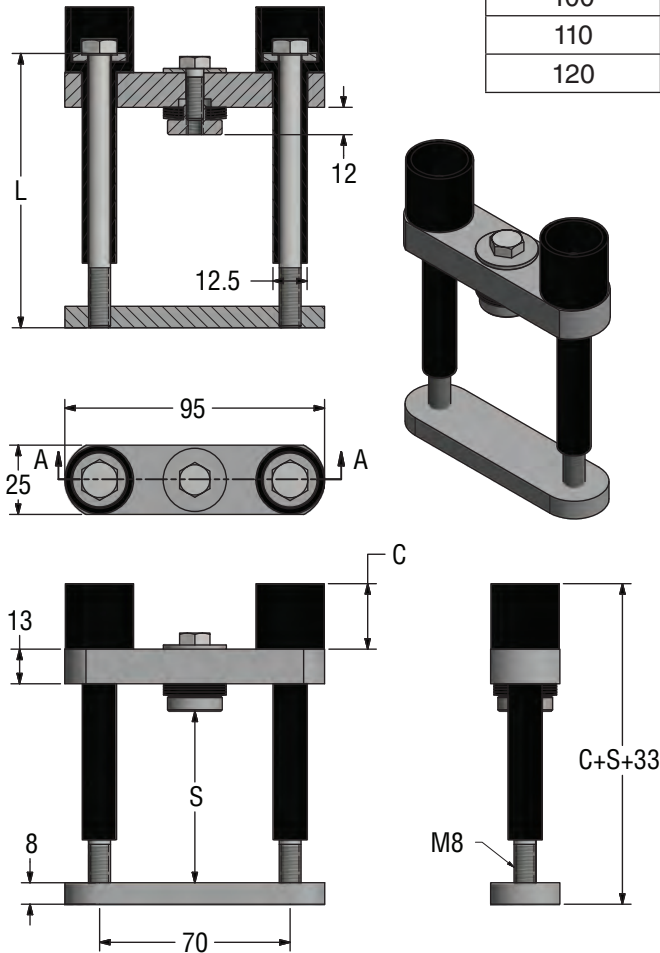
CLAMP MODEL: C070D

PRECALIBRATED FORCES - 5, 9.8 kN
 BOLT INTERAXYS - 70mm
 MAXIMUM PUK DIAMETER - 56mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
70	18	30
80	28	40
90	38	50
100	48	60
110	58	70
120	68	80



ORDERING INFORMATION EXAMPLE:

C070D-5KNS(H)-90

CLAMP MODEL PRECALIBRATED CLAMPING FORCE BOLT LENGTH (mm)
 "H" DENOTES HIGH TEMP INSULATOR
 Note: Additional bolt lengths available

Note: Bolt Insulator dimension "H" available in either 14mm or standard 24mm height
 Standard Insulator working temperature is 105°C, insulation voltage 4 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

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Box Clamps

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Air Cooled Assemblies

Liquid Cooled Assemblies

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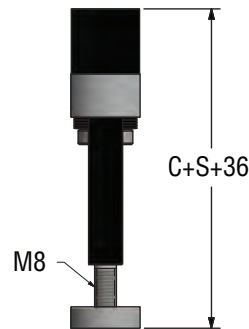
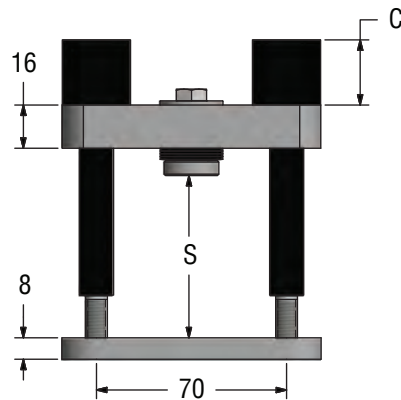
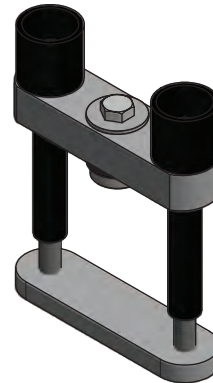
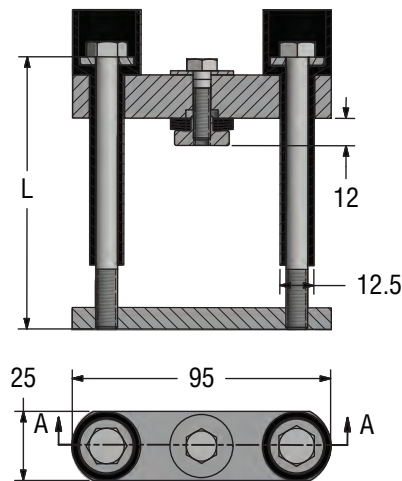
CLAMP MODEL: C070D-14KNS

PRECALIBRATED FORCES - 14 kN
 BOLT INTERAXYS - 70mm
 MAXIMUM PUK DIAMETER - 56mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
80	26	38
90	36	48
100	46	58
110	56	68
120	66	78
130	76	88
140	86	98



ORDERING INFORMATION EXAMPLE:

C070D-14KNS(H)-90

CLAMP MODEL ———— ↑

PRECALIBRATED CLAMPING FORCE ———— ↑

BOLT LENGTH (mm) ———— ↑

“H” DENOTES HIGH TEMP INSULATOR

Note: Additional bolt lengths available

Note: Bolt Insulator dimension “H” available in either 14mm or standard 24mm height
 Standard Insulator working temperature is 105°C, insulation voltage 4 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

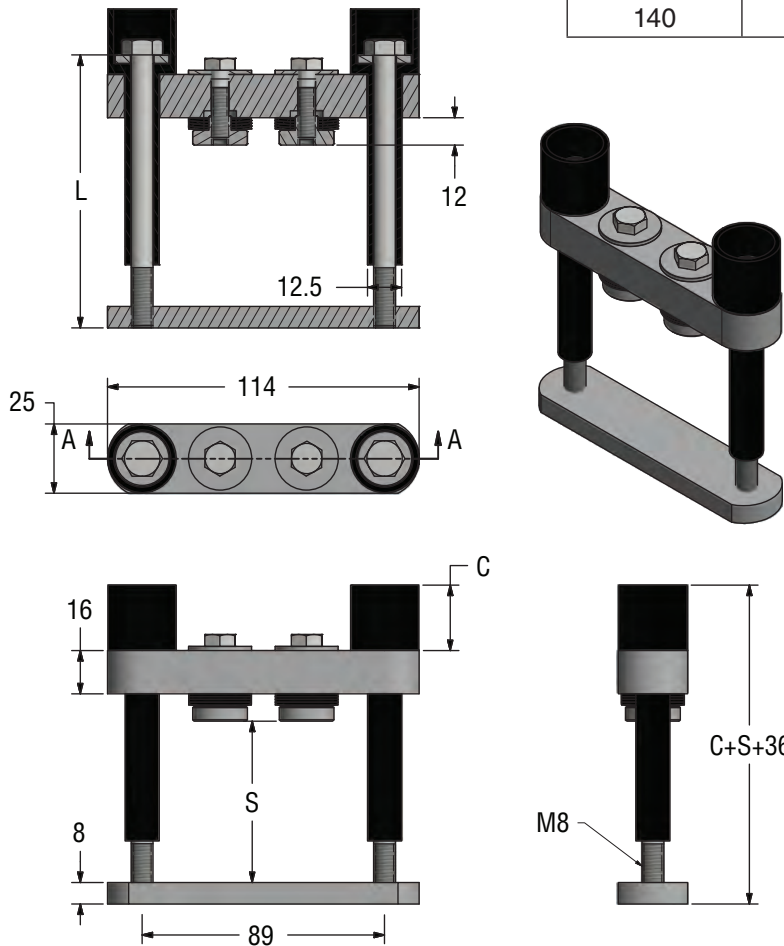
CLAMP MODEL: C089D

PRECALIBRATED FORCES - 9.8, 14, 18, 21 kN
 BOLT INTERAXYS - 89mm
 MAXIMUM PUK DIAMETER - 76mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
100	48	60
110	58	70
120	68	80
130	78	90
140	88	100



ORDERING INFORMATION EXAMPLE:

C089D-18KNS(H)-110

CLAMP MODEL ↑ BOLT LENGTH (mm)
 PRECALIBRATED CLAMPING FORCE ↑ "H" DENOTES HIGH TEMP INSULATOR
 Note: Additional bolt lengths available

Note: Bolt Insulator dimension "H" available in either 14mm or standard 24mm height
 Standard Insulator working temperature is 105°C, insulation voltage 4 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

Semiconductor Clamps

Bar Clamps

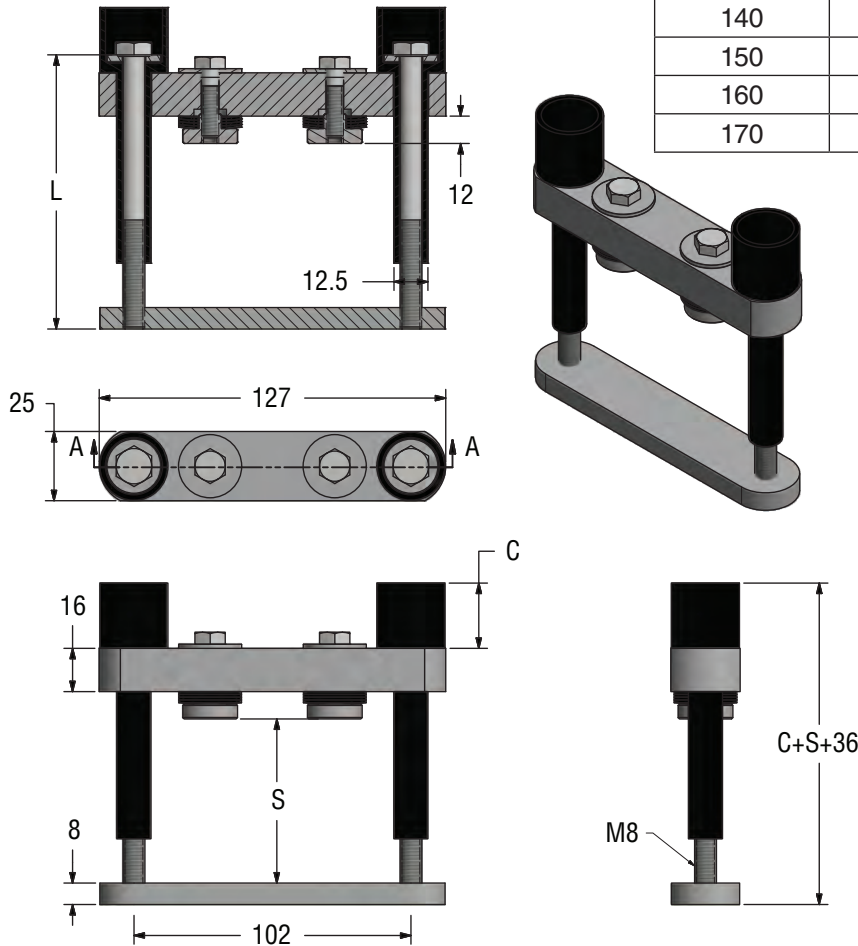
CLAMP MODEL: C102B

PRECALIBRATED FORCES - 14, 18, 22, 24 kN
 BOLT INTERAXYS - 102mm
 MAXIMUM PUK DIAMETER - 88mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
100	48	60
110	58	70
120	68	80
130	78	90
140	88	100
150	98	110
160	108	120
170	118	130



ORDERING INFORMATION EXAMPLE:

C102B-22KNS(H)-110

CLAMP MODEL ↑ BOLT LENGTH (mm)

PRECALIBRATED CLAMPING FORCE ↑ "H" DENOTES HIGH TEMP INSULATOR

Note: Additional bolt lengths available

Note: Bolt Insulator dimension "H" available in either 14mm or standard 24mm height
 Standard Insulator working temperature is 105°C, insulation voltage 4 kV.

Custom calibrated clamping forces available upon request.

For complete mounting instructions, please visit www.chtechnology.com

Semiconductor Clamps

Bar Clamps

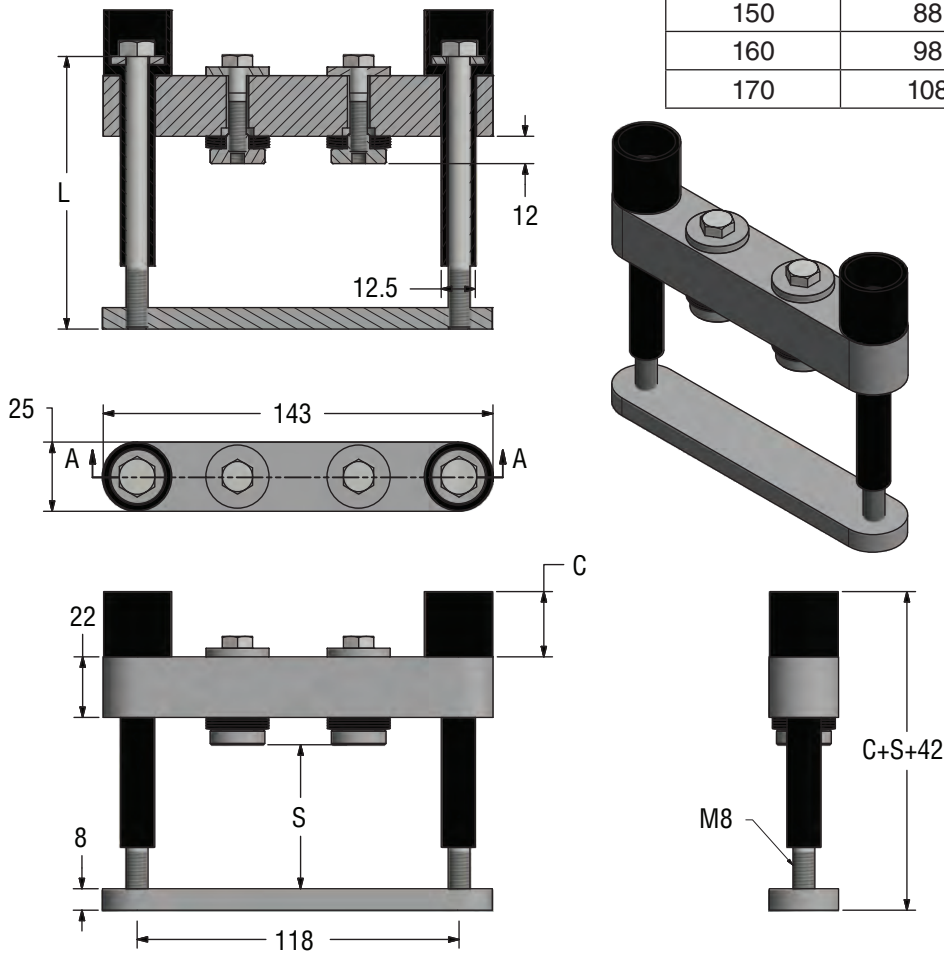
CLAMP MODEL: C118B

PRECALIBRATED FORCES - 14, 18, 22, 24kN
 BOLT INTERAXYS - 118mm
 MAXIMUM PUK DIAMETER - 88mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
100	38	50
110	48	60
120	58	70
130	68	80
140	78	90
150	88	100
160	98	110
170	108	120



ORDERING INFORMATION EXAMPLE:

C118B-22KNS(H)-110

CLAMP MODEL ↑ BOLT LENGTH (mm)
 PRECALIBRATED CLAMPING FORCE ↑ "H" DENOTES HIGH TEMP INSULATOR
 Note: Additional bolt lengths available

Note: Bolt Insulator dimension "H" available in either 14mm or standard 24mm height
 Standard Insulator working temperature is 105°C, insulation voltage 4 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

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Bar Clamps

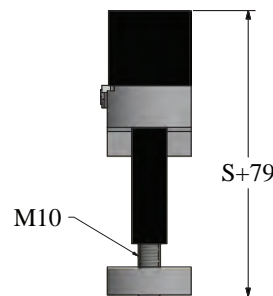
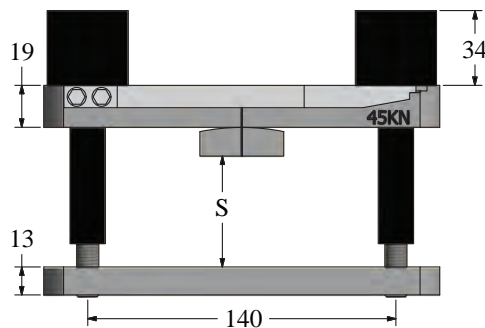
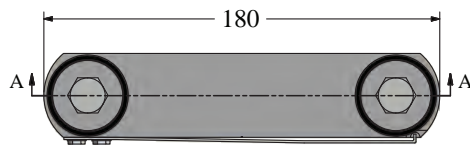
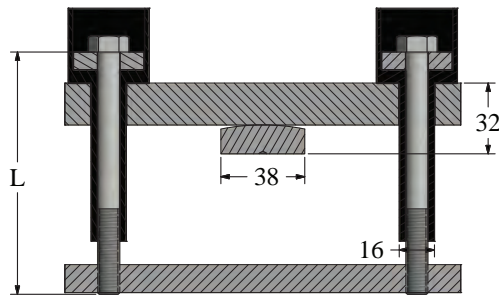
CLAMP MODEL: C140

PRECALIBRATED FORCES - 27, 40, 45kN
 BOLT INTERAXYS - 140mm
 MAXIMUM PUK DIAMETER - 101mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
100	28	41
110	38	51
120	48	61
130	58	71
140	68	81
150	78	91
160	88	101
170	98	111



ORDERING INFORMATION EXAMPLE:

C140-45KNS-110
 CLAMP MODEL ———— ↑
 PRECALIBRATED CLAMPING FORCE ———— ↑ BOLT LENGTH (mm)
 Note: Additional bolt lengths available

Note: Standard Insulator working temperature is 105°C, insulation voltage 7 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

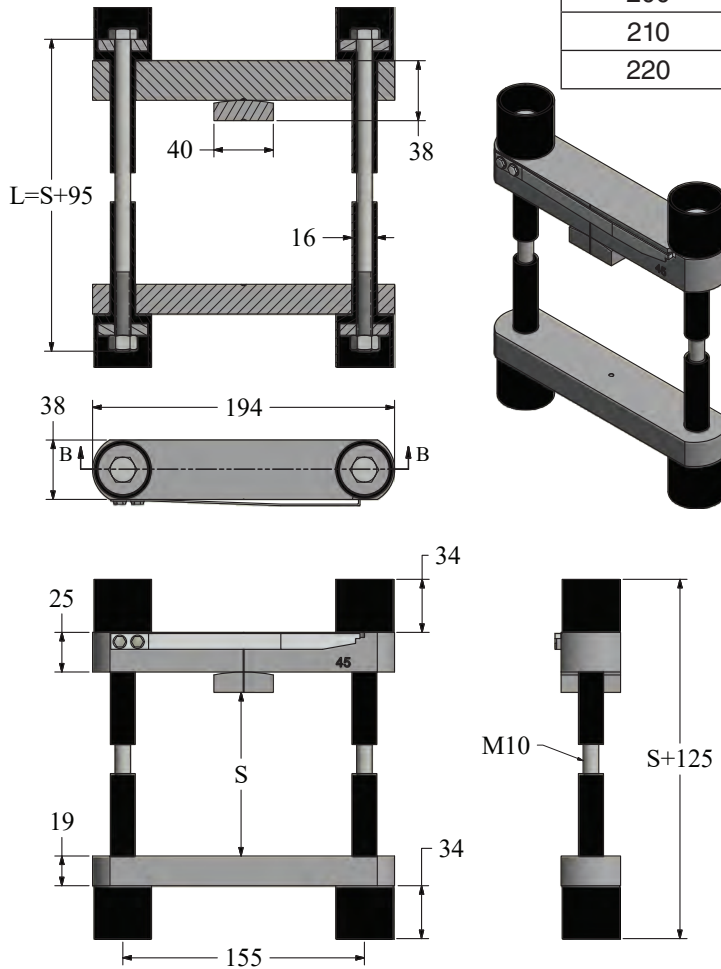
CLAMP MODEL: C155A

PRECALIBRATED FORCES - 40, 45, 55 kN
 BOLT INTERAXYS - 155mm
 MAXIMUM PUK DIAMETER - 138mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
160	52	66
170	62	76
180	72	86
190	82	96
200	92	106
210	102	116
220	112	126



ORDERING INFORMATION EXAMPLE:

C155A-45KNS-200

CLAMP MODEL PRECALIBRATED CLAMPING FORCE BOLT LENGTH (mm)

Note: Additional bolt lengths available

Note: Standard Insulator working temperature is 105°C, insulation voltage 7 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

Semiconductor Clamps

Bar Clamps

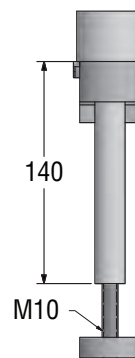
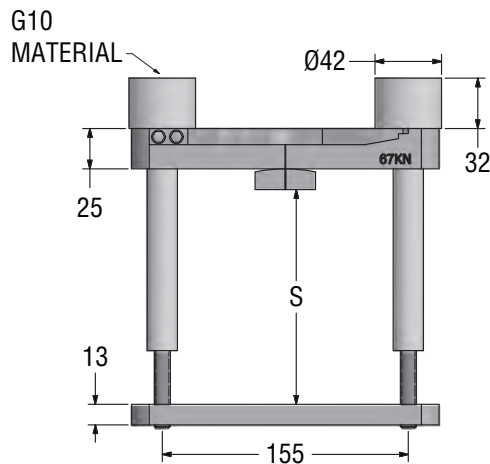
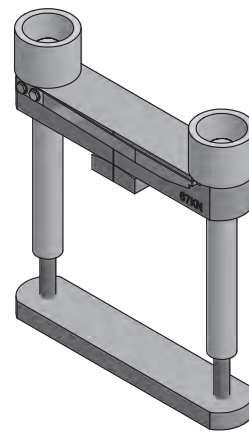
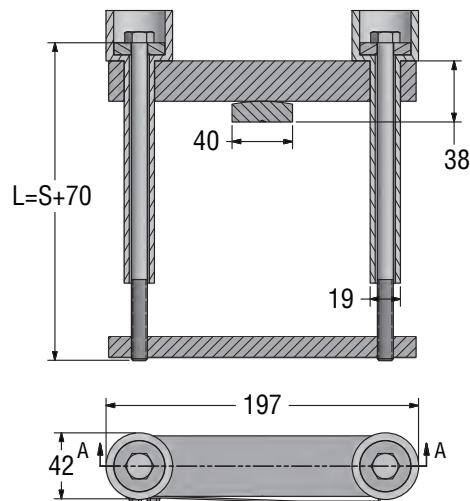
CLAMP MODEL: C155A-67KNS

PRECALIBRATED FORCES - 67 kN
 BOLT INTERAXYS - 155mm
 MAXIMUM PUK DIAMETER - 138mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
160	74	87
170	84	97
180	94	107
190	104	117
200	114	127
210	124	137
220	134	147



ORDERING INFORMATION EXAMPLE:

C155A-67KNS-200
 CLAMP MODEL ———— ↑
 PRECALIBRATED CLAMPING FORCE ———— ↑ BOLT LENGTH (mm)
 Note: Additional bolt lengths available

Note: Standard Insulator working temperature is 170°C, insulation voltage 7 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

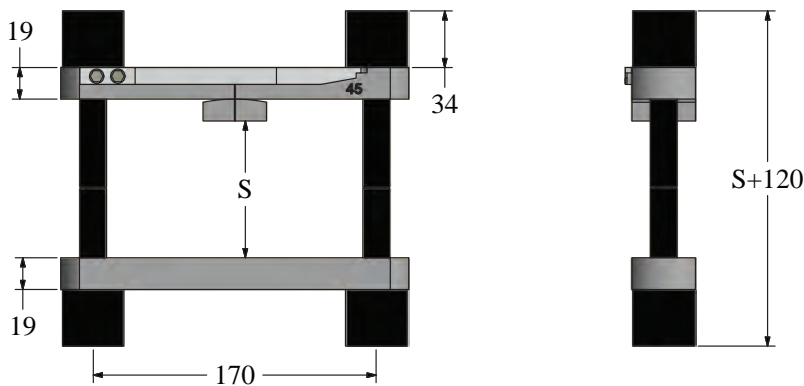
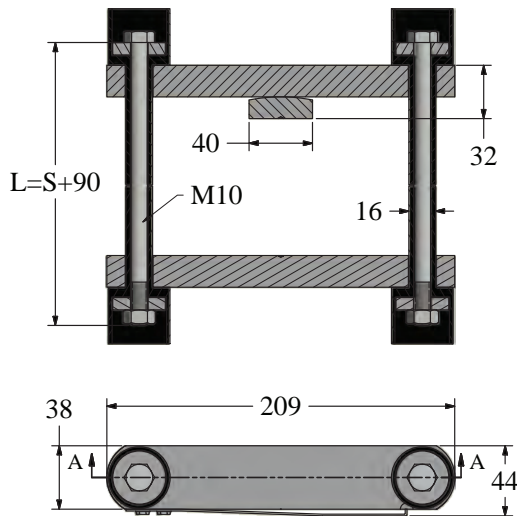
CLAMP MODEL: C170A

PRECALIBRATED FORCES - 26, 40, 45, 55 kN
 BOLT INTERAXYS - 170mm
 MAXIMUM PUK DIAMETER - 150mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
160	70	80
170	80	90
180	90	100
190	100	110
200	110	120
210	120	130
220	130	140



ORDERING INFORMATION EXAMPLE:

C170A-45KNS-200

CLAMP MODEL PRECALIBRATED CLAMPING FORCE BOLT LENGTH (mm)

Note: Additional bolt lengths available

Note: Standard Insulator working temperature is 105°C, insulation voltage 7 kV.

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

Semiconductor Clamps

Bar Clamps

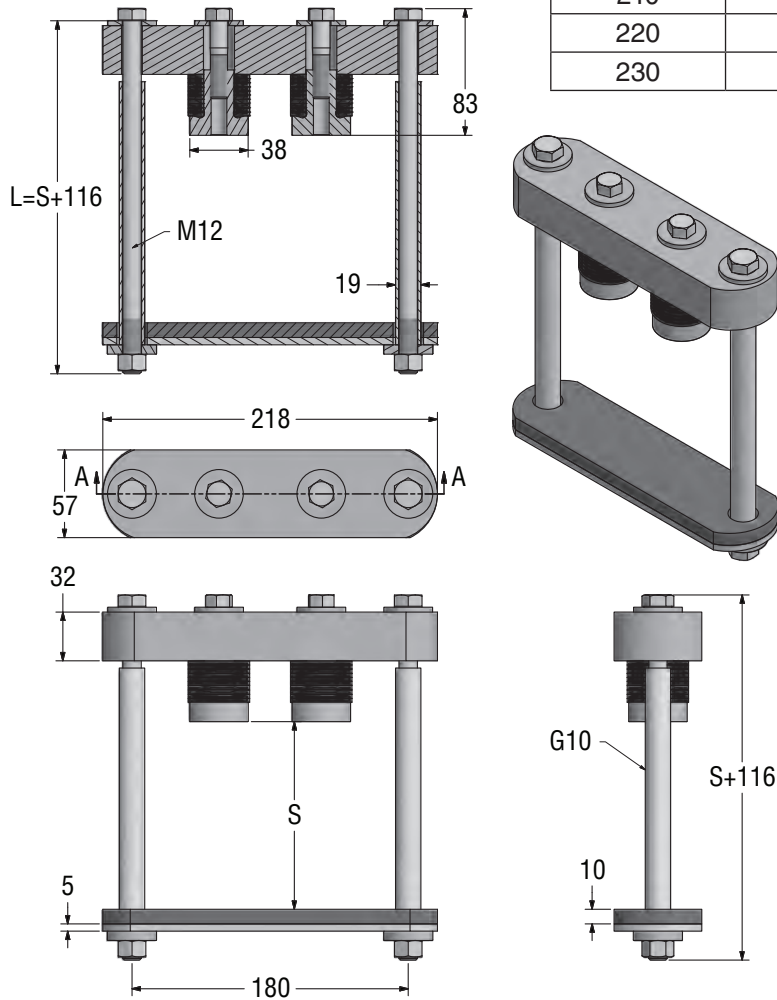
CLAMP MODEL: C180

PRECALIBRATED FORCES - 80, 95 kN
 BOLT INTERAXYS - 180mm
 MAXIMUM PUK DIAMETER - 150mm

BOLT LENGTH CALCULATOR

Note: All Dimensions are in mm

L	S MIN	S MAX
180	46	70
190	56	80
200	66	90
210	76	100
220	86	110
230	96	120



ORDERING INFORMATION EXAMPLE:

C180-95KNS-210

CLAMP MODEL

PRECALIBRATED CLAMPING FORCE

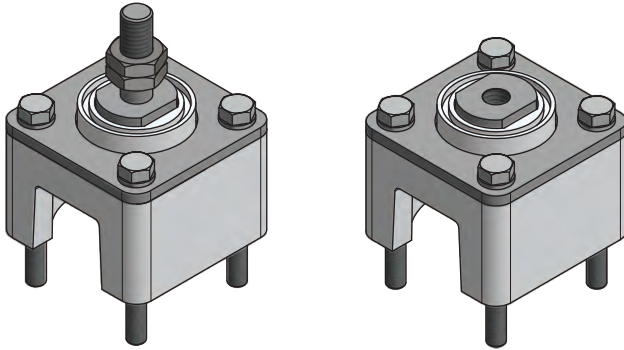
BOLT LENGTH (mm)

Note: Additional bolt lengths available

Custom calibrated clamping forces available upon request.
 For complete mounting instructions, please visit www.chtechnology.com

BOX CLAMPS

C&H Technology's Box Clamps utilize Belleville Spring Technology for single sided cooling applications. Proper clamping force is achieved when the four corner bolts are tightened evenly, and the Box Clamp housing comes in contact with the Heat Sink.



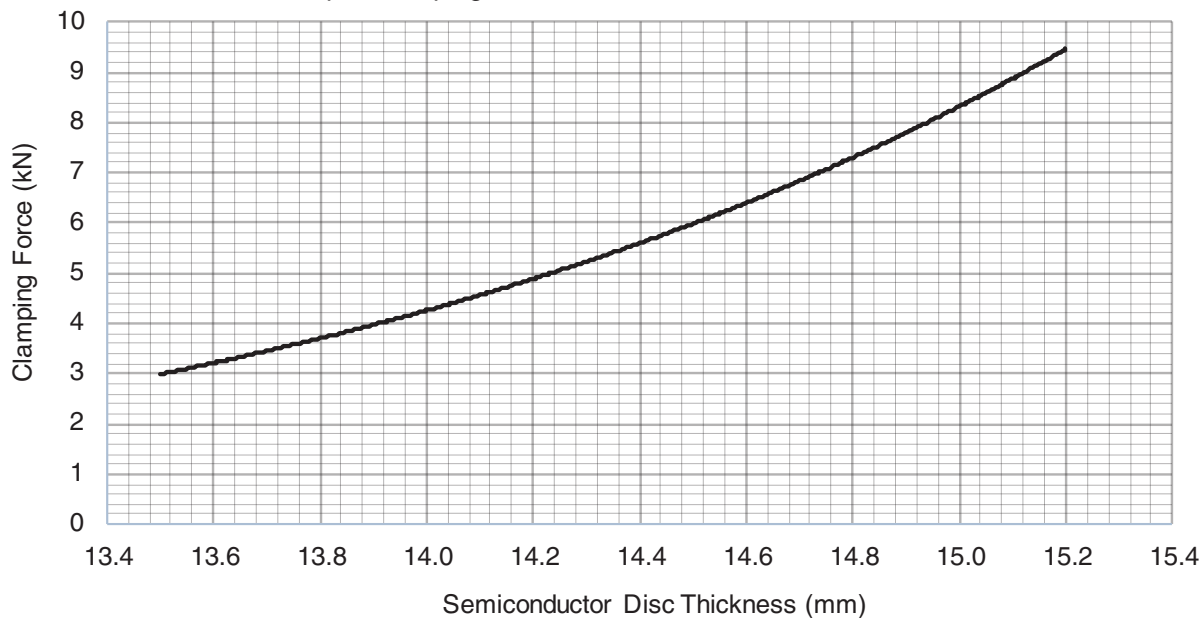
- User friendly assembly
- UL 94V0 plastic material
- M8 or M10 upper threads for threaded holes
- Rugged construction

**Manufactured for Hockey Puks
DO-200AA, B-3, TO-200AB (A and E Type)
Larger Sizes available upon request.**

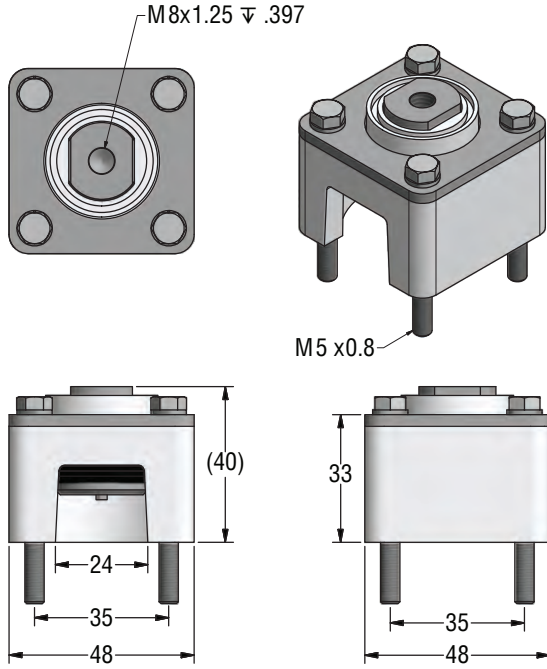
BOX CLAMP SPECIFICATIONS

Model #	SBVR-M8	SBVR-M10	SBMR-M8	SBMR-M10
Upper Threaded Connection	M8	M10	---	---
Threaded Hole x Depth	---	---	M8 x 10	M10 x 12
Max Operating Temperature	90°C	90°C	90°C	90°C
Maximum Semiconductor Diameter	42mm	42mm	42mm	42mm
Mass (without nuts and bolts)	200 g	220 g	190 g	210 g

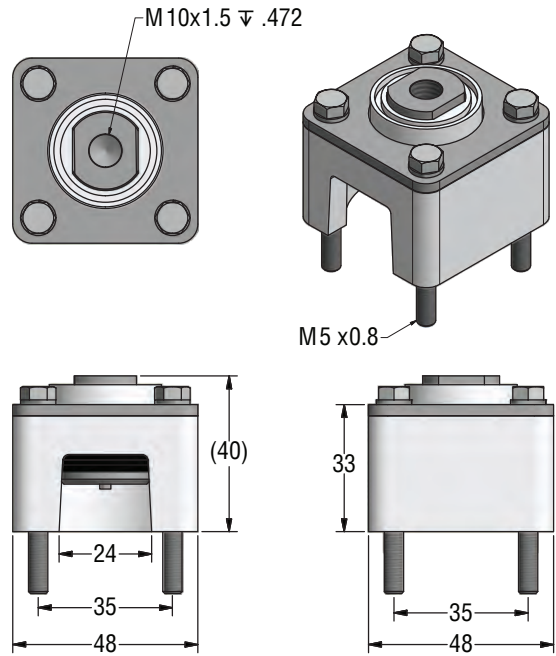
Box Clamp – Clamping Force vs. Semiconductor Disc Thickness



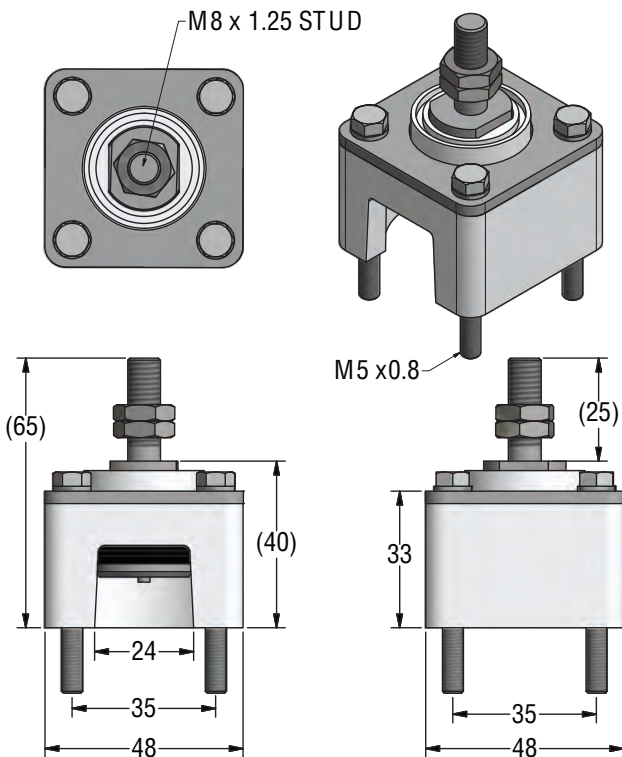
SBMR-M8



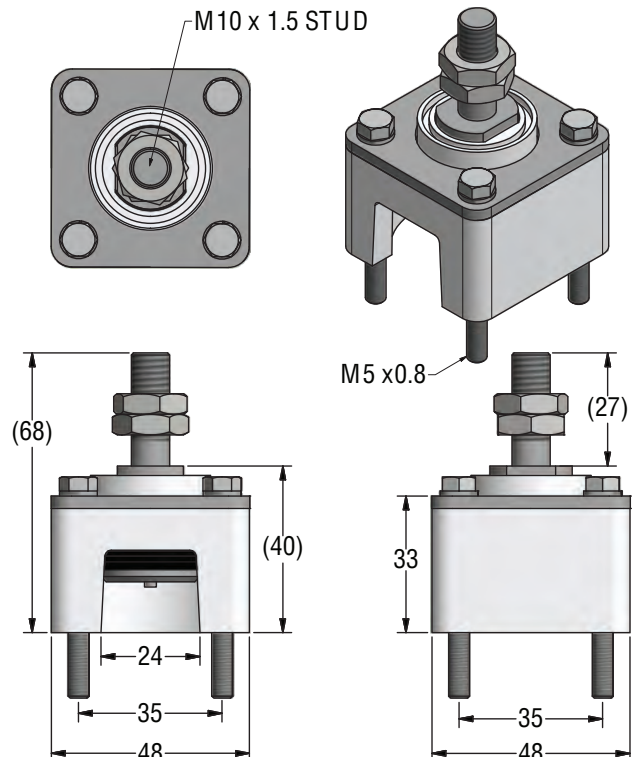
SBMR-M10



SBVR-M8



SBVR-M10



ASSEMBLY INTRODUCTION

C&H Technology is a leading manufacturer of high power diode, thyristor and IGBT assemblies. We offer a large portfolio of standard assemblies in single and three phase configurations of diode bridge, thyristor bridge, and AC-switch circuits. These assemblies are classified in current ranges between 50A to 50,000A, and voltage ranges from 100V to 8,500V.

With our large inventory of thermal management solutions and high-power semiconductors, C&H Technology can offer many custom solutions. These sub-assemblies can be engineered using natural convection, forced air convection, and liquid cooled configurations.

Visit our website and use the assembly configuration tool to help build the correct assembly part number based on your specific application and parameters.

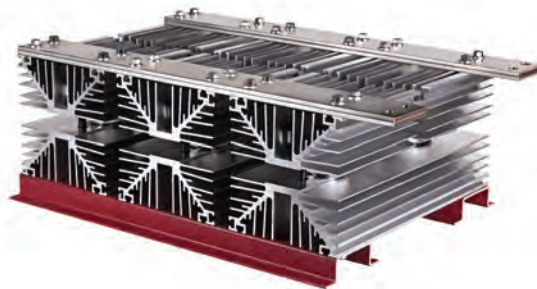
Additional value-added accessories include the following:

- Semiconductor Fuses
- Terminal Blocks
- Copper Bus Bars
- Bimetallic Thermal Switches
- Thermistors
- Snubber Circuits
- MOV's
- Glastic Mounting Feet
- Leads
- Jumpers

Our products are used worldwide in all industrial sectors including:

- | | | |
|------------------------|--------------------------|--------------------|
| Welding Power Supplies | Electric Vehicles | Transportation |
| Battery Chargers | Power Supplies | Power Generation |
| Steel Mills | Forklifts | Wind Turbines |
| Aluminum Smelters | Overhead Cranes | Solar Inverters |
| Mining Equipment | Industrial Motor Control | And Many Others... |

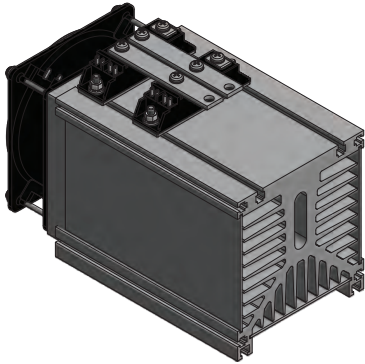
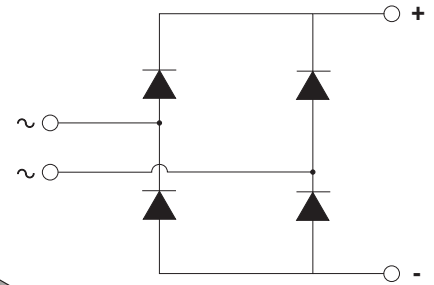
Call 800-274-4284 or email sales@chtechnology.com for questions or custom solutions.



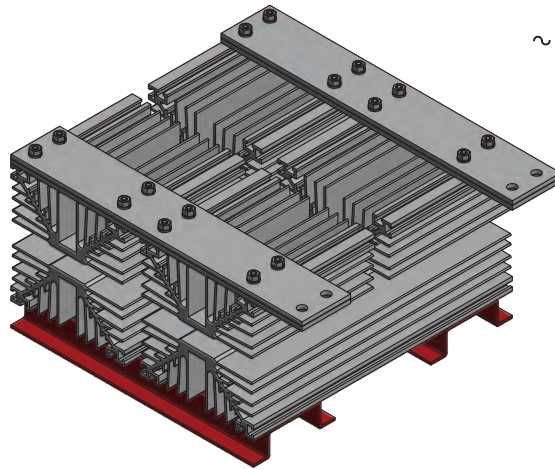
Power Assemblies

Air Cooled

SINGLE PHASE DIODE BRIDGE

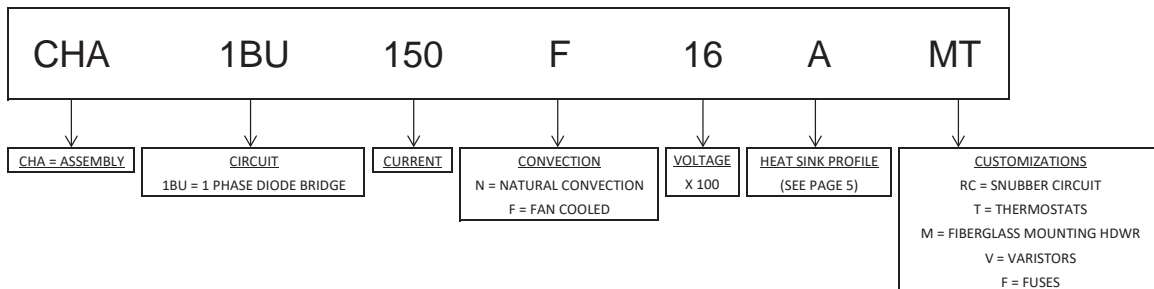


Outline 1



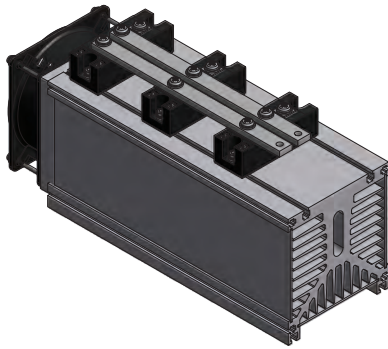
Outline 16

Output Current I (avg) Maximum Ambient Temperature = 45°C						
Natural Convection	Fan Cooled		Device P/N	Maximum Voltage	Heat Sink Profile	Assembly Outline
0 LFM	500 LFM 2.5 m/s	1000 LFM 5.0 m/s				
90	150	---	VSKD91/..	1600	CHEHK18 (Profile A)	Assembly 1
130	230	---	VSKD236/..	1600	CHEHK18 (Profile A)	Assembly 2
160	320	---	VSKD320-..	2000	CHEHK18 (Profile A)	Assembly 3
---	475	---	VSKD320-..	2000	CH5116 (Profile J)	Assembly 31
---	900	---	VSKD600-..	2000	CH5119 (Profile K)	Assembly 32
350	640	770	SD400C..C	2400	CHEH13450 (Profile D)	Assembly 14
450	840	1050	SD1100C..C	3200	CHEH13450 (Profile D)	Assembly 14
560	1120	1330	SD1500C..L	3000	CHEH0017 (Profile F)	Assembly 16
700	1400	1680	SD2500C..K	2500	CHEH0017 (Profile F)	Assembly 35
980	2030	2450	SD3000C..K	1000	CHEH0017 (Profile F)	Assembly 35

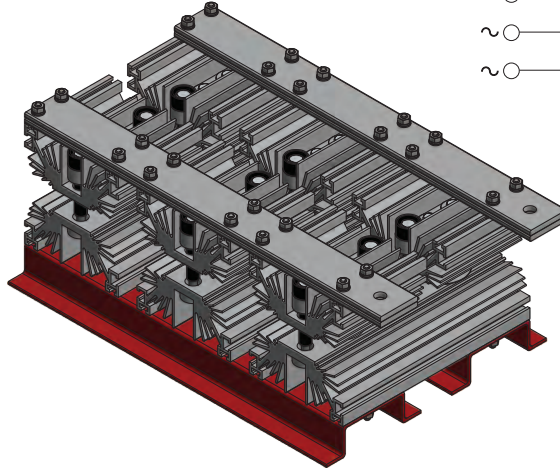


For Fully Customizable Configurations, please contact C&H Technology today.

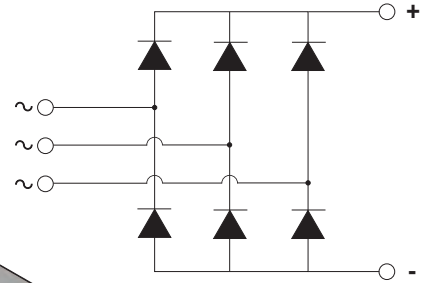
THREE PHASE DIODE BRIDGE



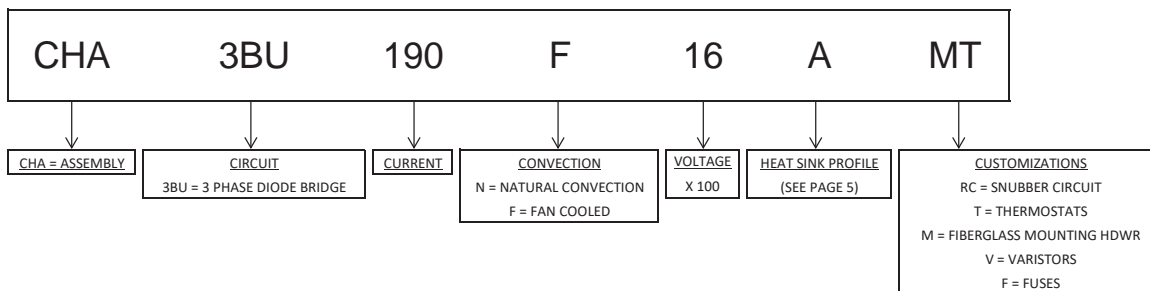
Outline 5



Outline 15

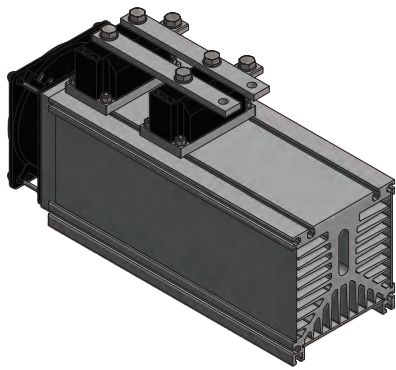


Output Current I (avg) Maximum Ambient Temperature = 45°C						
Natural Convection	Fan Cooled		Assembly			
0 LFM	500 LFM 2.5 m/s	1000 LFM 5.0 m/s	Device P/N	Maximum Voltage	Heat Sink Profile	Assembly Outline
---	55	---	70MT160P-P	1600	CHEH3648	Assembly 71
---	---	160	200MT40KPBF	400	CH6600	Assembly 70
75	175	---	300MT..C	1800	CHEHK18 (Profile A)	Assembly 78
100	190	---	VSKD91/..	1600	CHEHK18 (Profile A)	Assembly 4
150	300	---	VSKD236/..	1600	CHEHK18 (Profile A)	Assembly 5
170	450	---	VSKD320-..	2000	CHEHK18 (Profile A)	Assembly 6
---	600	---	VSKD320-..	2000	CH5116 (Profile J)	Assembly 33
---	1100	---	VSKD600-..	2000	CH5119 (Profile K)	Assembly 34
500	920	1100	SD400C..C	2400	CHEH13450 (Profile D)	Assembly 13
650	1200	1500	SD1100C..C	3200	CHEH13450 (Profile D)	Assembly 13
800	1600	1900	SD1500C..L	3000	CHEH13450 (Profile D)	Assembly 15
1000	2000	2400	SD2500C..K	2500	CHEH0017 (Profile F)	Assembly 36
1400	2900	3500	SD3000C..K	1000	CHEH0017 (Profile F)	Assembly 36
1350	3800	4500	5SDD48H	3200	CHEH0011 (Profile G)	Assembly 72
2200	4000	5000	5SDD60Q	2800	CHEH0078 (Profile H)	Assembly 73

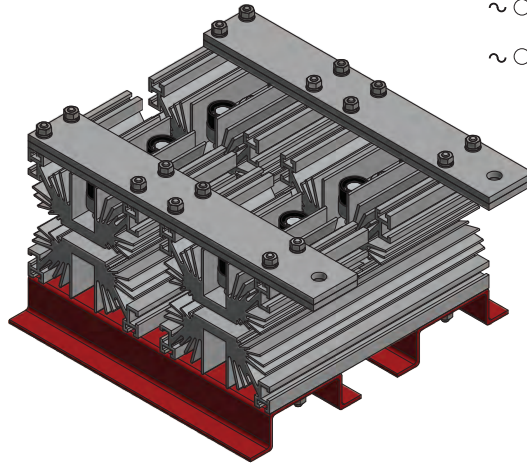


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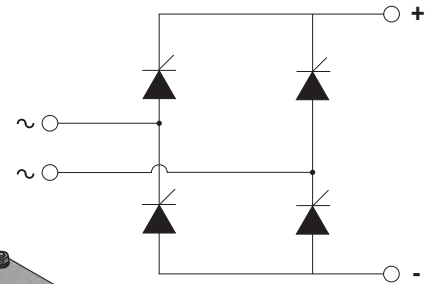
SINGLE PHASE THYRISTOR BRIDGE



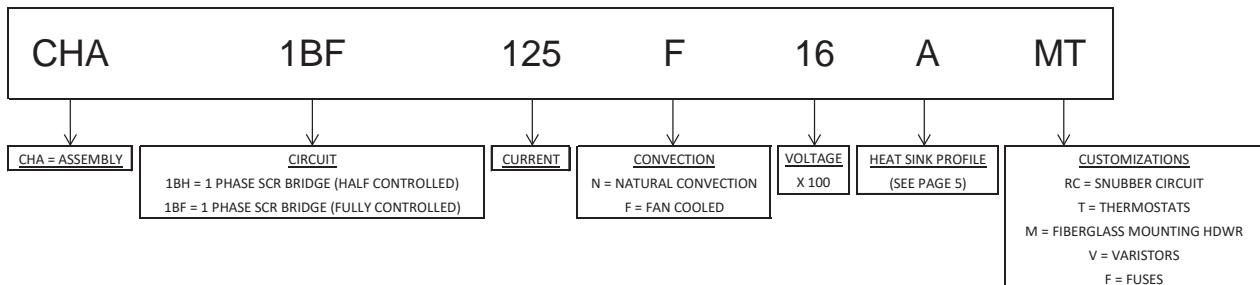
Outline 3



Outline 38

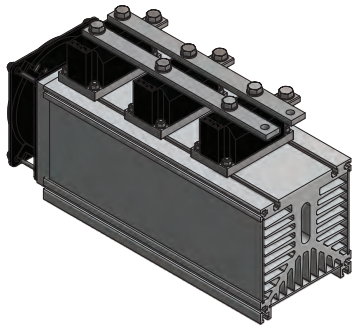


Output Current I (avg) Maximum Ambient Temperature = 45°C						
Natural Convection	Fan Cooled				Assembly	
0 LFM	500 LFM 2.5 m/s	1000 LFM 5.0 m/s	Device P/N	Maximum Voltage	Heat Sink Profile	Assembly Outline
65	125	---	VSKT91/..	1600	CHEHK18 (Profile A)	Assembly 1
105	200	---	VSKT162/..	1600	CHEHK18 (Profile A)	Assembly 2
130	240	---	VSKT250-..	1600	CHEHK18 (Profile A)	Assembly 3
---	450	---	VSKT250-..	1600	CH5116 (Profile J)	Assembly 31
---	700	---	VSKT570-..	1800	CH5119 (Profile K)	Assembly 37
200	400	480	ST180C..C0	2000	CHEH13450 (Profile D)	Assembly 14
250	520	650	ST330C..C0	1800	CHEH13450 (Profile D)	Assembly 14
240	460	580	5STP04D	4200	CHEH13450 (Profile D)	Assembly 38
490	980	1150	5STP16F	2800	CHEH0017 (Profile F)	Assembly 35
560	1150	1400	5STP18F	1800	CHEH0017 (Profile F)	Assembly 35
900	1850	2000	AT607S..	800	CHEH0011 (Profile G)	Assembly 18
1280	2370	2510	5STP27H	2800	CHEH0078 (Profile H)	Assembly 20

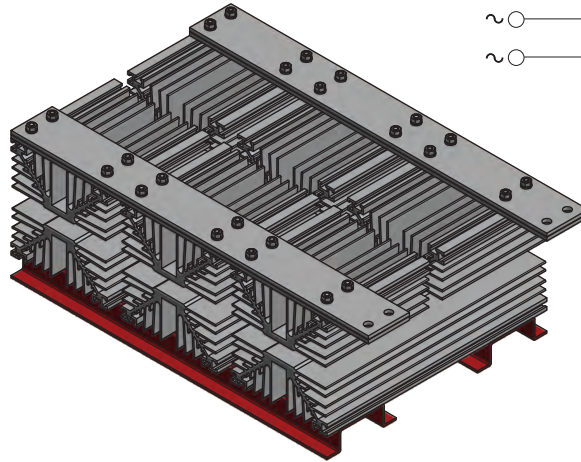


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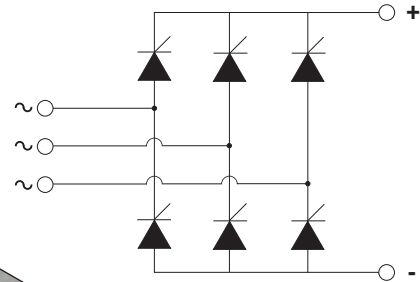
THREE PHASE THYRISTOR BRIDGE



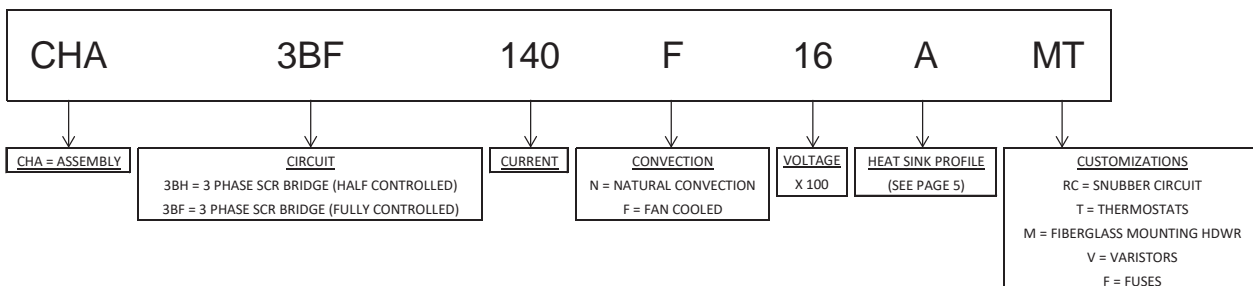
Outline 6



Outline 36

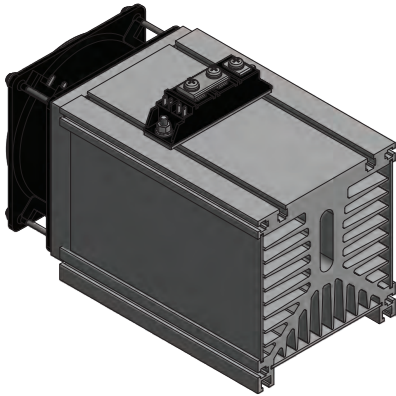
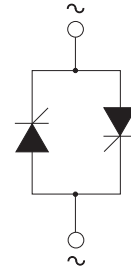


Output Current I (avg) Maximum Ambient Temperature = 45°C						
Natural Convection	Fan Cooled		Assembly			
0 LFM	500 LFM 2.5 m/s	1000 LFM 5.0 m/s	Device P/N	Maximum Voltage	Heat Sink Profile	Assembly Outline
68	140	---	VSKT91/..	1600	CHEHK18 (Profile A)	Assembly 4
110	240	---	VSKT162/..	1600	CHEHK18 (Profile A)	Assembly 5
140	360	---	VSKT250-..	1600	CHEHK18 (Profile A)	Assembly 6
200	420	510	ST180C..C0	2000	CHEH13450 (Profile D)	Assembly 13
---	450	---	VSKT250-..	1600	CH5116 (Profile J)	Assembly 33
300	630	800	ST330C..C0	1800	CHEH13450 (Profile D)	Assembly 13
380	790	980	5STP04D	4200	CHEH13450 (Profile D)	Assembly 51
---	900	---	VSKT570-..	1800	CH5119 (Profile K)	Assembly 39
---	1000	---	PD43..07	1800	CH5119 (Profile K)	Assembly 74
700	1550	1850	5STP16F	2800	CHEH0017 (Profile F)	Assembly 36
800	1750	2100	5STP18F	1800	CHEH0017 (Profile F)	Assembly 36
1200	2240	2560	AT607S..	800	CHEH0011 (Profile G)	Assembly 17
1825	3390	3590	5STP27H	2800	CHEH0078 (Profile H)	Assembly 19
---	3500	4200	5STP45Q	2800	CHEH0078 (Profile H)	Assembly 73

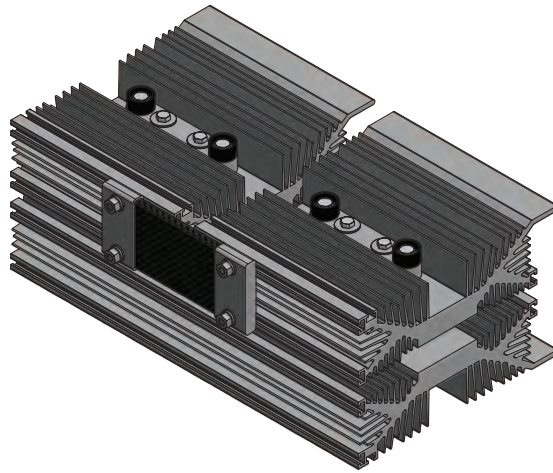


For Fully Customizable Configurations, please contact C&H Technology today.

SINGLE PHASE AC SWITCH

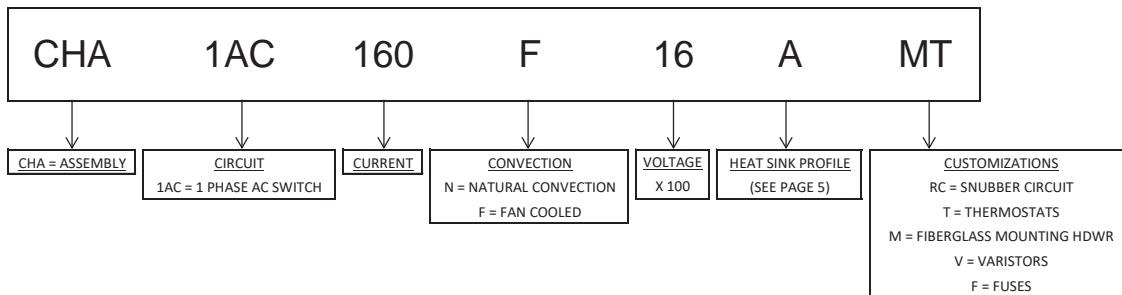


Outline 7



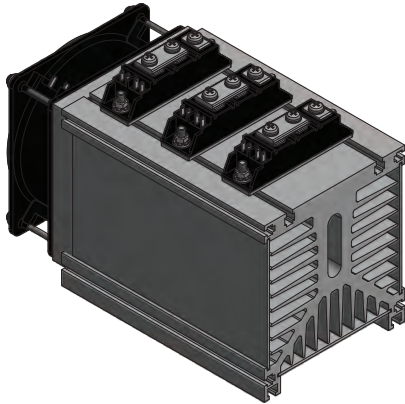
Outline 12

Output Current I (avg) Maximum Ambient Temperature = 45°C						
Natural Convection	Fan Cooled				Assembly	
0 LFM	500 LFM 2.5 m/s	1000 LFM 5.0 m/s	Device P/N	Maximum Voltage	Heat Sink Profile	Assembly Outline
100	160	---	VSKT91/..	1600	CHEHK18 (Profile A)	Assembly 7
170	270	---	VSKT162/..	1600	CHEHK18 (Profile A)	Assembly 8
220	400	---	VSKT250-..	1600	CHEHK18 (Profile A)	Assembly 9
300	600	730	ST330C..C	1800	CHEH13450 (Profile D)	Assembly 10
---	725	---	VSKT570..18	1800	CH5117	Assembly 76
500	950	1100	5STP08D	2800	CHEHK7 (Profile E)	Assembly 21
---	1100	---	PA43..06	2400	CH5117	Assembly 75
600	1200	1350	5STP16F	2800	CHEH0011 (Profile G)	Assembly 12
650	1250	1450	5STP18F	1800	CHEH0011 (Profile G)	Assembly 12
950	1800	1970	AT607S..	800	CHEH0011 (Profile G)	Assembly 12
1420	2540	2700	5STP27H	2800	CHEH0078 (Profile H)	Assembly 23

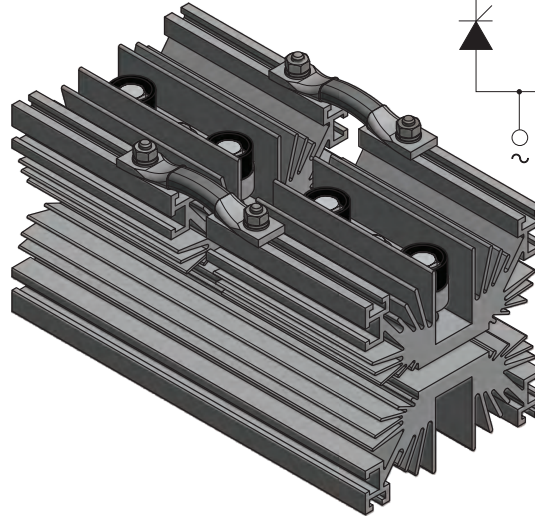


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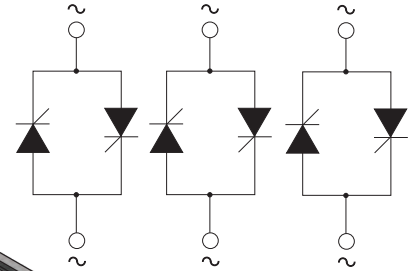
THREE PHASE AC SWITCH



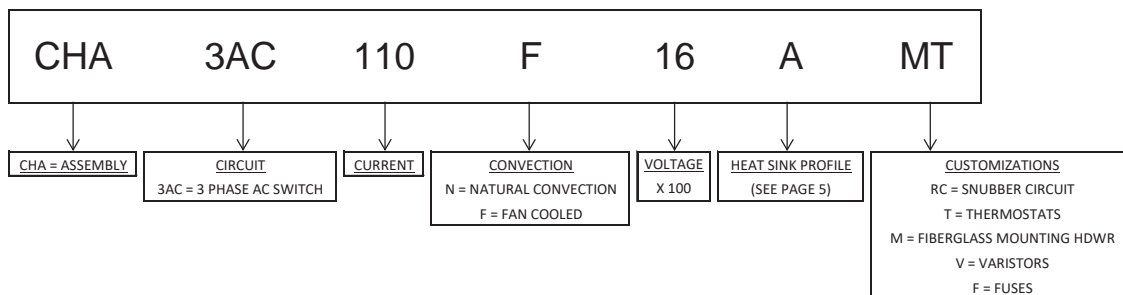
Outline 55



Outline 10

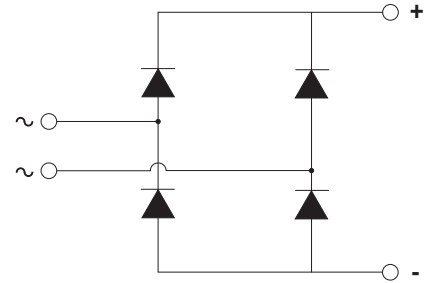
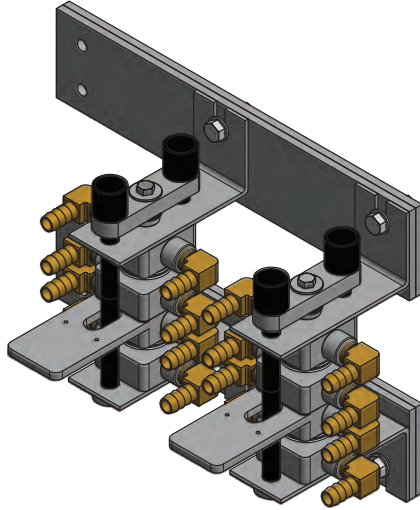


Output Current I (avg) Maximum Ambient Temperature = 45°C						
Natural Convection	Fan Cooled		Assembly			
0 LFM	500 LFM 2.5 m/s	1000 LFM 5.0 m/s	Device P/N	Maximum Voltage	Heat Sink Profile	Assembly Outline
55	110	---	VSKT91/..	1600	CHEHK18 (Profile A)	Assembly 55
90	170	---	VSKT162/..	1600	CHEHK18 (Profile A)	Assembly 56
100	260	---	VSKT250-..	1600	CHEHK18 (Profile A)	Assembly 57
200	400	500	ST230C..C	1800	CHEH13450 (Profile D)	Assembly 10
300	600	730	ST330C..C	1800	CHEH13450 (Profile D)	Assembly 10
---	725	---	VSKT570-..	1800	CH5121	Assembly 77
500	950	1100	5STP08D	2800	CHEHK7 (Profile E)	Assembly 21
600	1200	1350	5STP16F	2800	CHEH0011 (Profile G)	Assembly 12
650	1250	1450	5STP18F	1800	CHEH0011 (Profile G)	Assembly 12
950	1800	1970	AT607S..	800	CHEH0011 (Profile G)	Assembly 12
1420	2540	2700	5STP27H	2800	CHEH0078 (Profile H)	Assembly 23



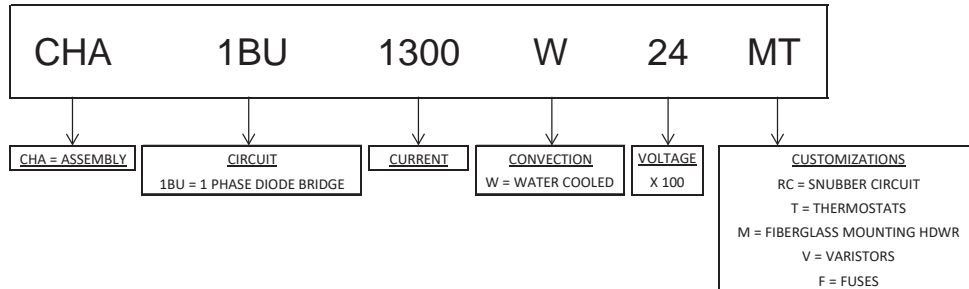
For Fully Customizable Configurations, please contact C&H Technology today.

SINGLE PHASE DIODE BRIDGE



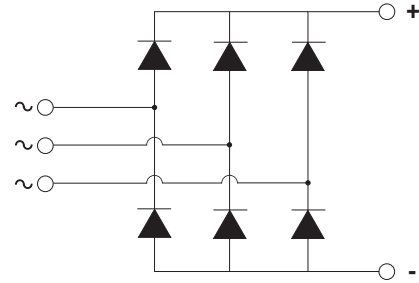
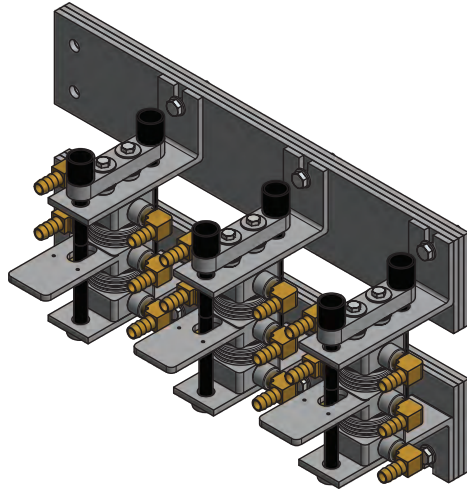
Outline 41

Output Current I (avg)						
Water Temp = 25°C		Water Temp = 40°C		Device P/N	Maximum Voltage	Assembly Outline
1.0	Water Flow Rate (gpm) 2.0	1.0	2.0			
1300	1350	1150	1200	SD400C..C	2400	Assembly 40
1550	1600	1350	1400	SD400C..C	2400	Assembly 41
1800	1850	1600	1650	SD1100C..C	3200	Assembly 41
2200	2300	2000	2100	SD1500C..L	3000	Assembly 42
3000	3100	2700	2800	SD1500C..L	3000	Assembly 43
4600	4700	4200	4300	SD2500C..K	2500	Assembly 44
6600	6800	6200	6400	5SDD48H	3200	Assembly 45



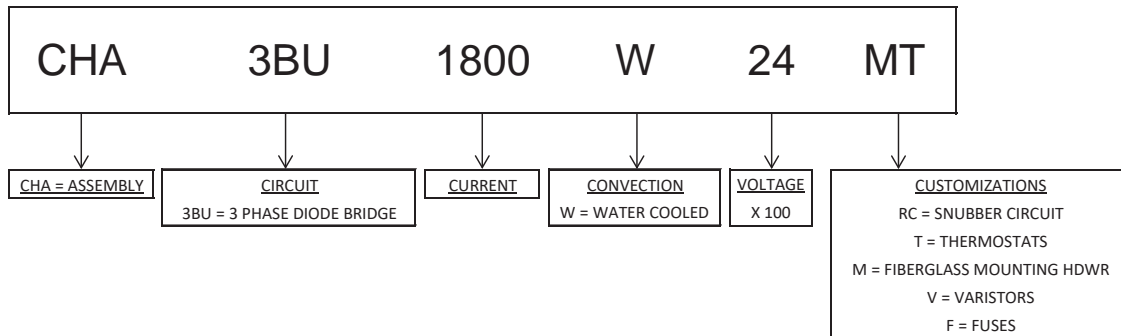
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THREE PHASE DIODE BRIDGE



Outline 48

Output Current I (avg)						
Water Temp = 25°C		Water Temp = 40°C		Device P/N	Maximum Voltage	Assembly Outline
1.0	Water Flow Rate (gpm) 2.0	1.0	2.0			
1800	1840	1600	1650	SD400C..C	2400	Assembly 46
2100	2150	1800	1900	SD400C..C	2400	Assembly 47
2500	2550	2200	2300	SD1100C..C	3200	Assembly 47
3000	3100	2700	2800	SD1500C..L	3000	Assembly 48
4000	4100	3600	3800	SD1500C..L	3000	Assembly 49
6300	6400	5800	5900	SD2500C..K	2500	Assembly 50
9000	9200	8500	8700	5SDD48H	3200	Assembly 52

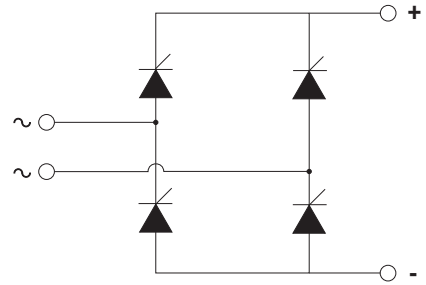
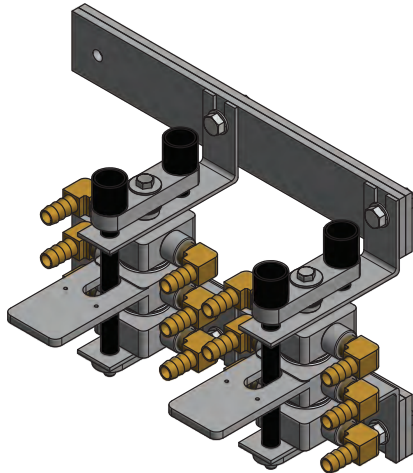


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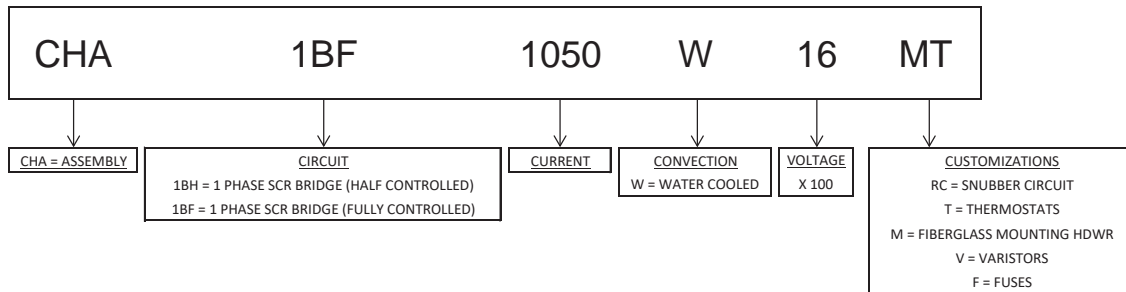
Liquid Cooled

SINGLE PHASE THYRISTOR BRIDGE



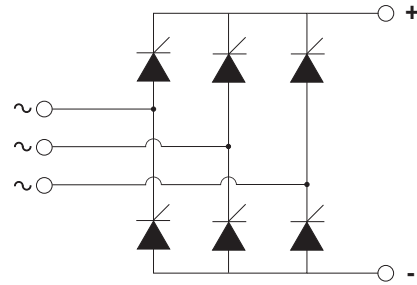
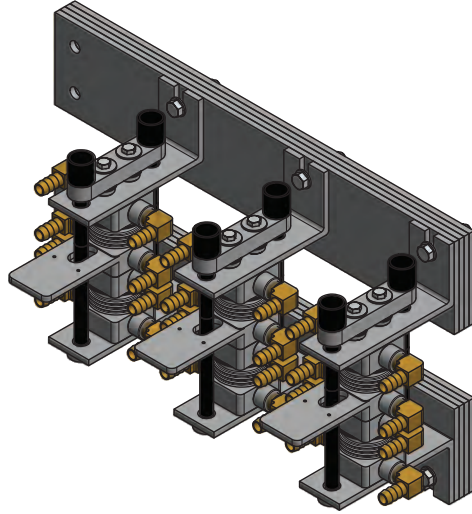
Outline 40

Output Current I (avg)						
Water Temp = 25°C		Water Temp = 40°C		Device P/N	Maximum Voltage	Assembly Outline
1.0	Water Flow Rate (gpm) 2.0	1.0	2.0			
1050	1150	900	1000	ST330C..C0	1600	Assembly 40
1350	1450	1200	1300	ST330C..L0	1600	Assembly 42
1600	1650	1400	1450	ST730C..L0	1800	Assembly 42
2400	2650	2100	2200	ST1230C..K0	1600	Assembly 44
2900	3200	2500	2700	5STP27H	2800	Assembly 45



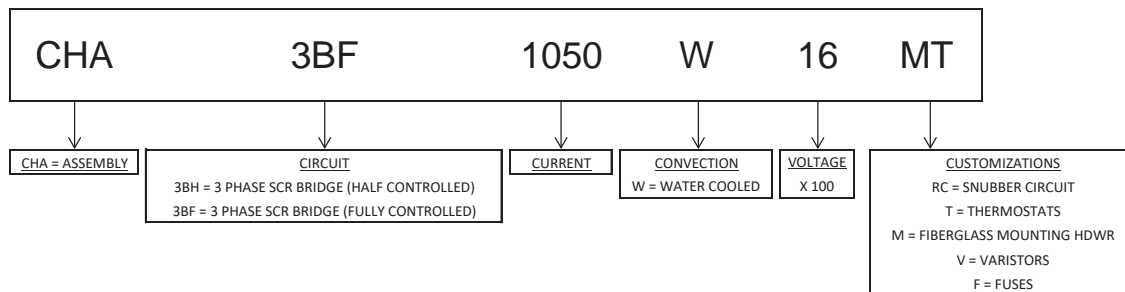
For Fully Customizable Configurations, please contact C&H Technology today.

THREE PHASE THYRISTOR BRIDGE



Outline 49

Output Current I (avg)						
Water Temp = 25°C		Water Temp = 40°C		Device P/N	Maximum Voltage	Assembly Outline
1.0	Water Flow Rate (gpm) 2.0	1.0	2.0			
1500	1600	1300	1400	ST330C..C0	1600	Assembly 46
1900	2000	1700	1800	ST330C..L0	1600	Assembly 48
2200	2300	2000	2100	ST730C..L0	1800	Assembly 48
3300	3600	3000	3200	ST1230C..K0	1600	Assembly 53
4000	4300	3500	3800	5STP27H	2800	Assembly 54



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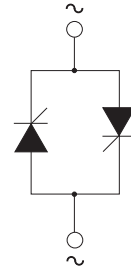
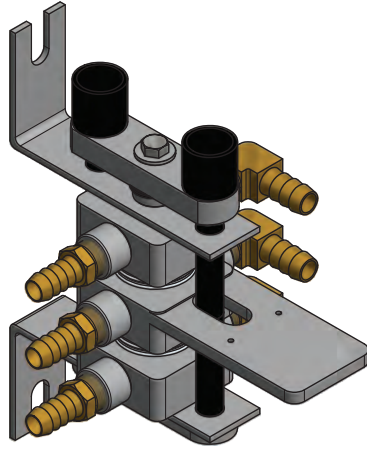
Box Clamps

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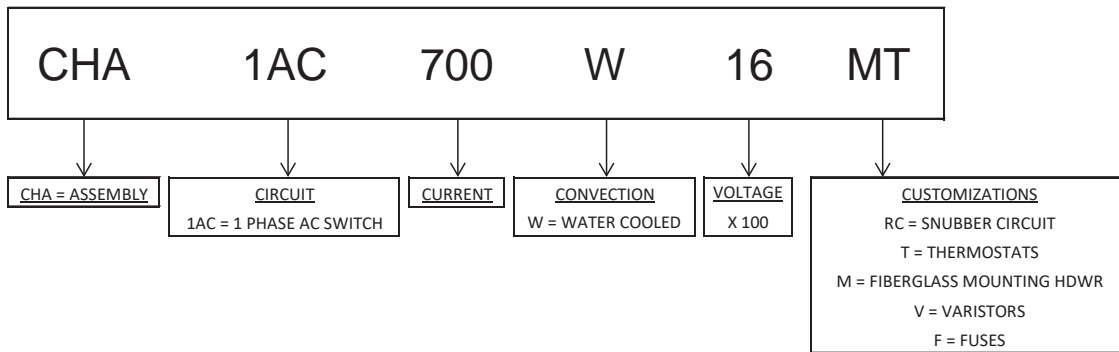
Liquid Cooled Assemblies

SINGLE PHASE AC SWITCH



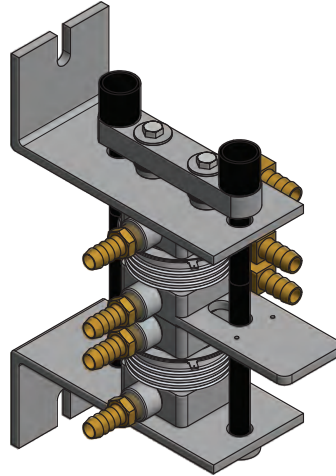
Outline 25

Output Current I (avg)						
Water Temp = 25°C		Water Temp = 40°C		Device P/N	Maximum Voltage	Assembly Outline
1.0	Water Flow Rate (gpm) 2.0	1.0	2.0			
700	750	600	640	ST230C..C	1600	Assembly 25
1200	1300	1000	1100	ST330C..C	1600	Assembly 25
1800	2000	1500	1600	ST730C..C	1800	Assembly 27
2500	2700	2200	2400	ST1000C..C	2400	Assembly 29
2800	3000	2500	2700	ST1200C..C	2000	Assembly 30

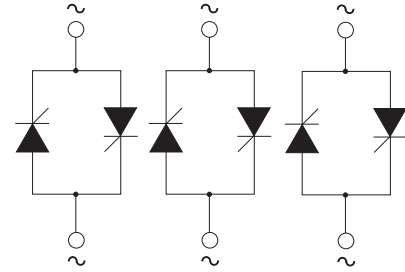


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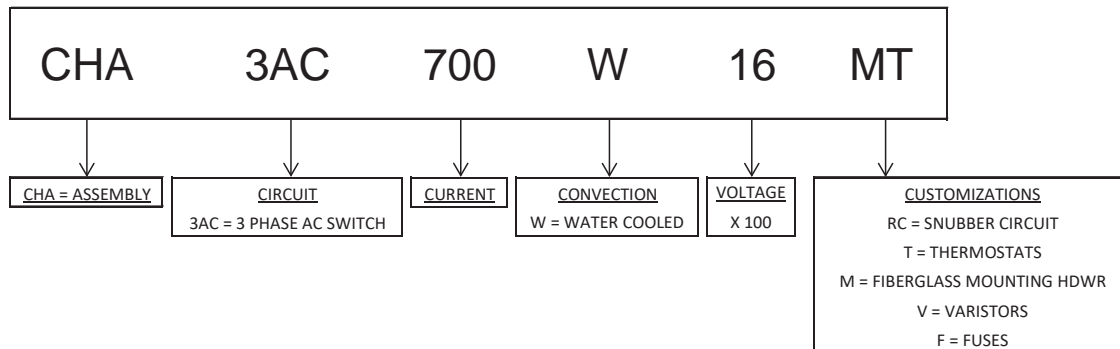
THREE PHASE AC SWITCH



Outline 29



Output Current I (rms)						
Water Temp = 25°C		Water Temp = 40°C		Device P/N	Maximum Voltage	Assembly Outline
1.0	Water Flow Rate (gpm) 2.0	1.0	2.0			
700	750	600	640	ST230C..C	1600	Assembly 46
1200	1300	1000	1100	ST330C..C	1600	Assembly 49
1800	2000	1500	1600	ST730C..C	1800	Assembly 52
2500	2700	2200	2400	ST1000C..C	2400	Assembly 52
2800	3000	2500	2700	ST1200C..C	2000	Assembly 54

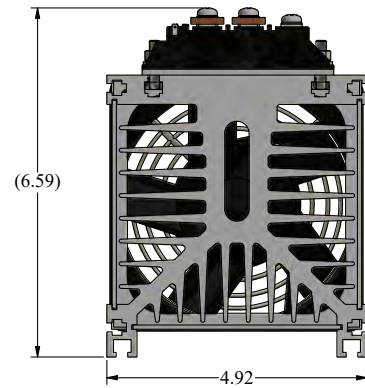
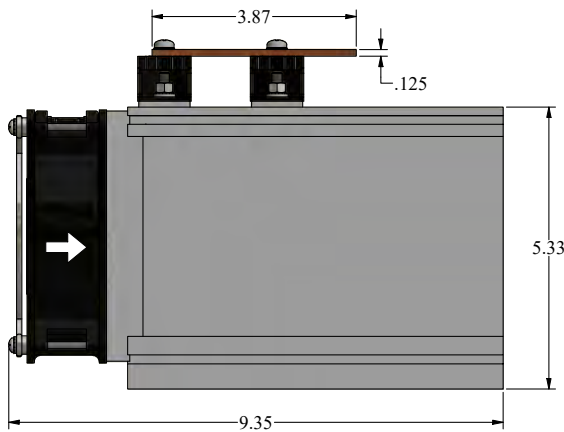
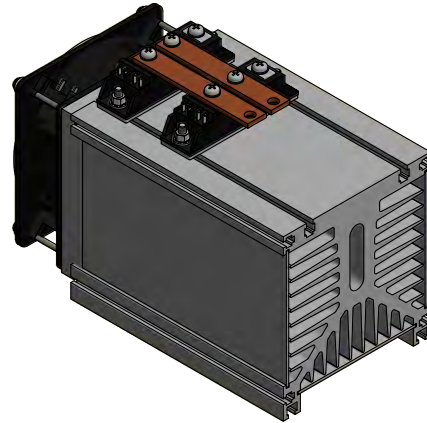
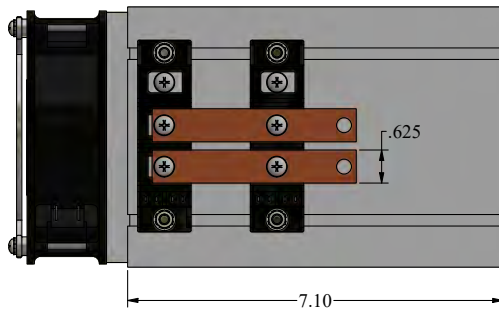


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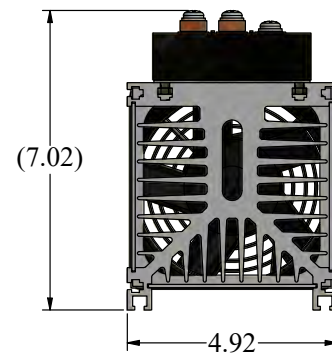
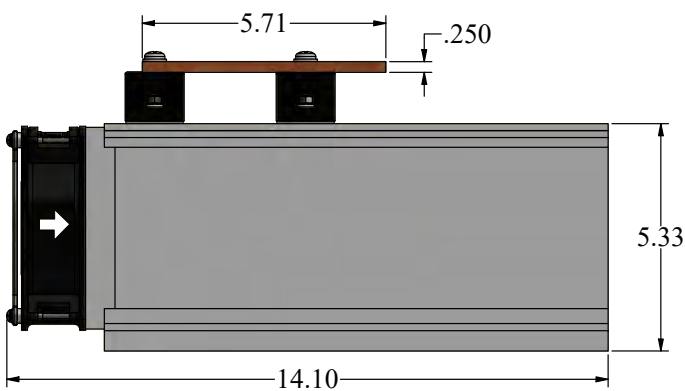
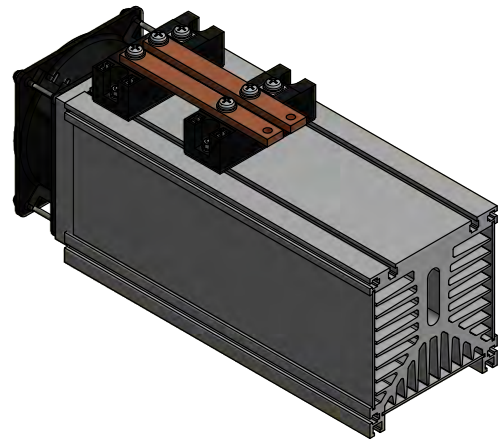
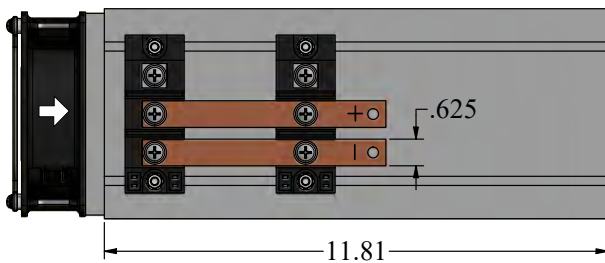
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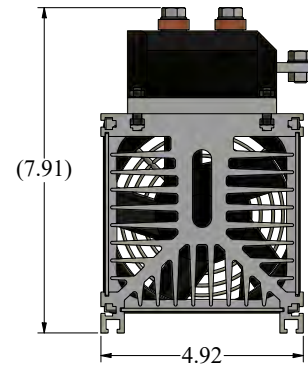
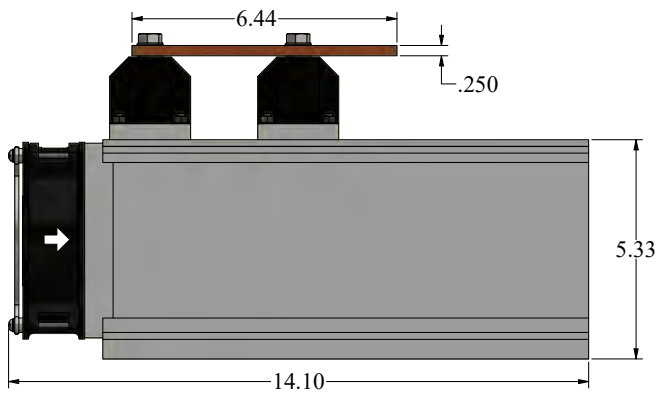
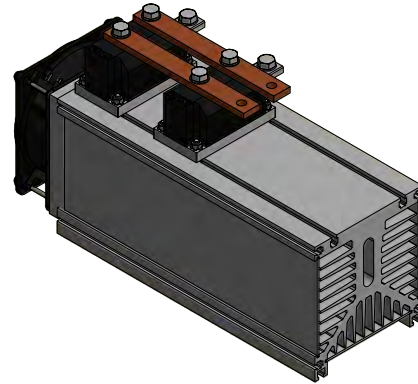
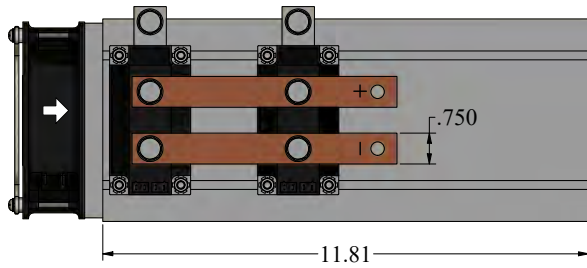
OUTLINE 1



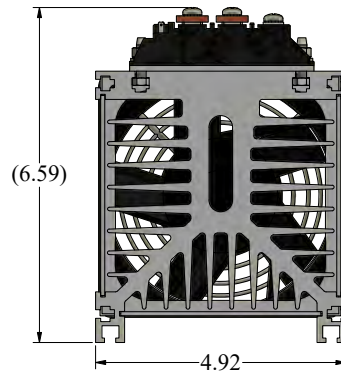
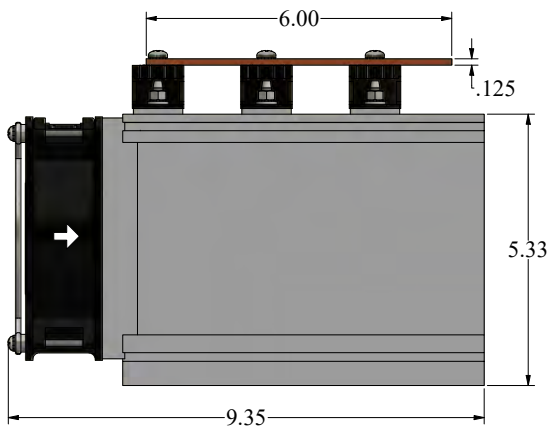
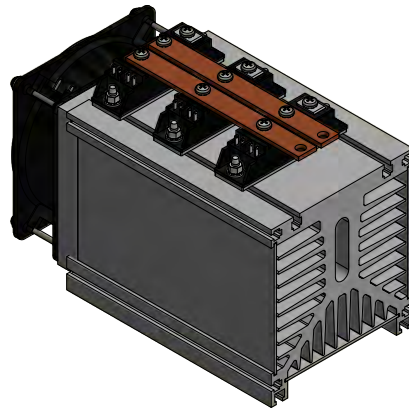
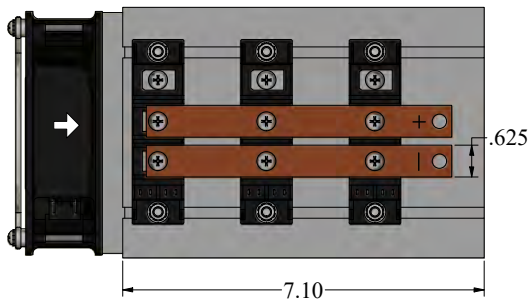
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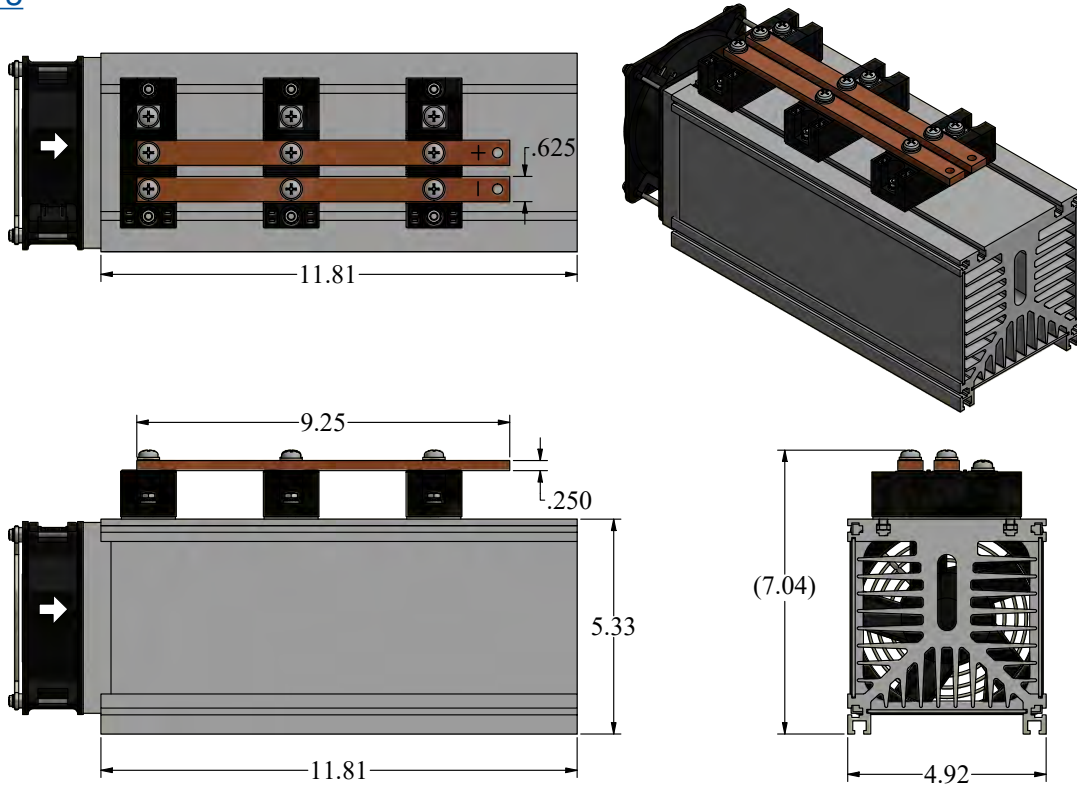
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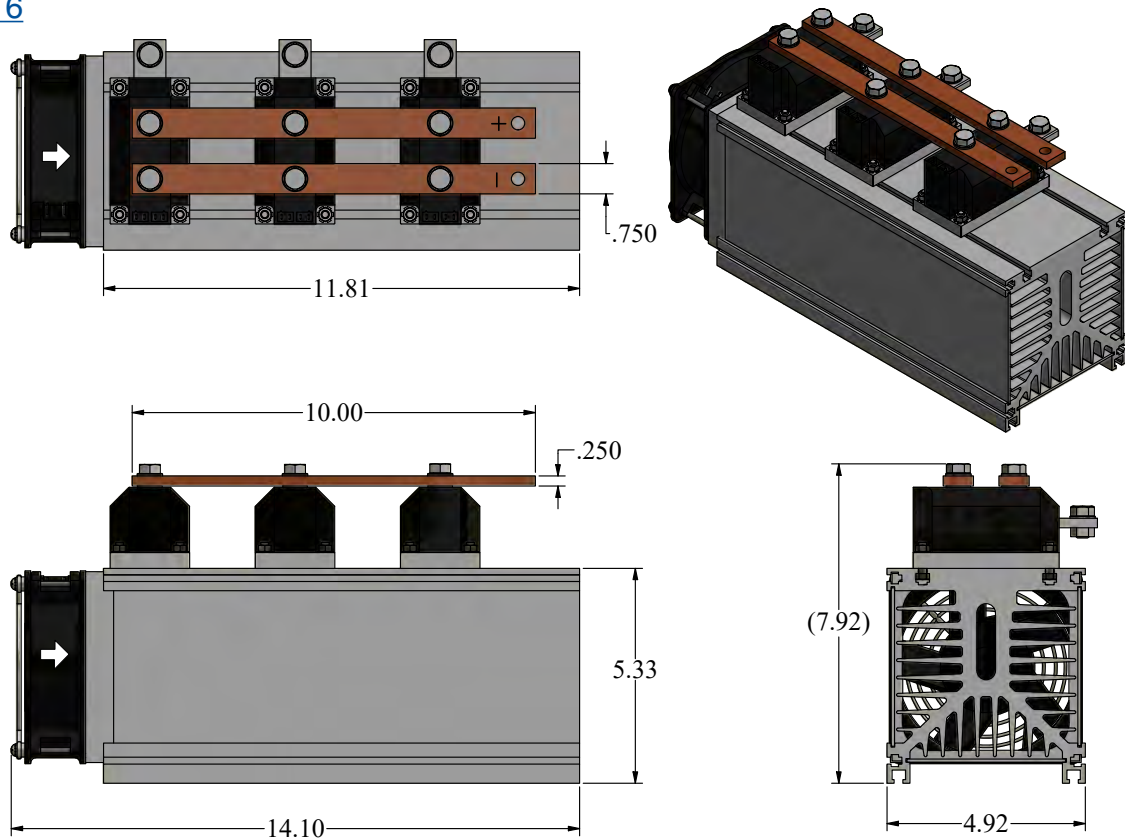
Air Cooled Assemblies

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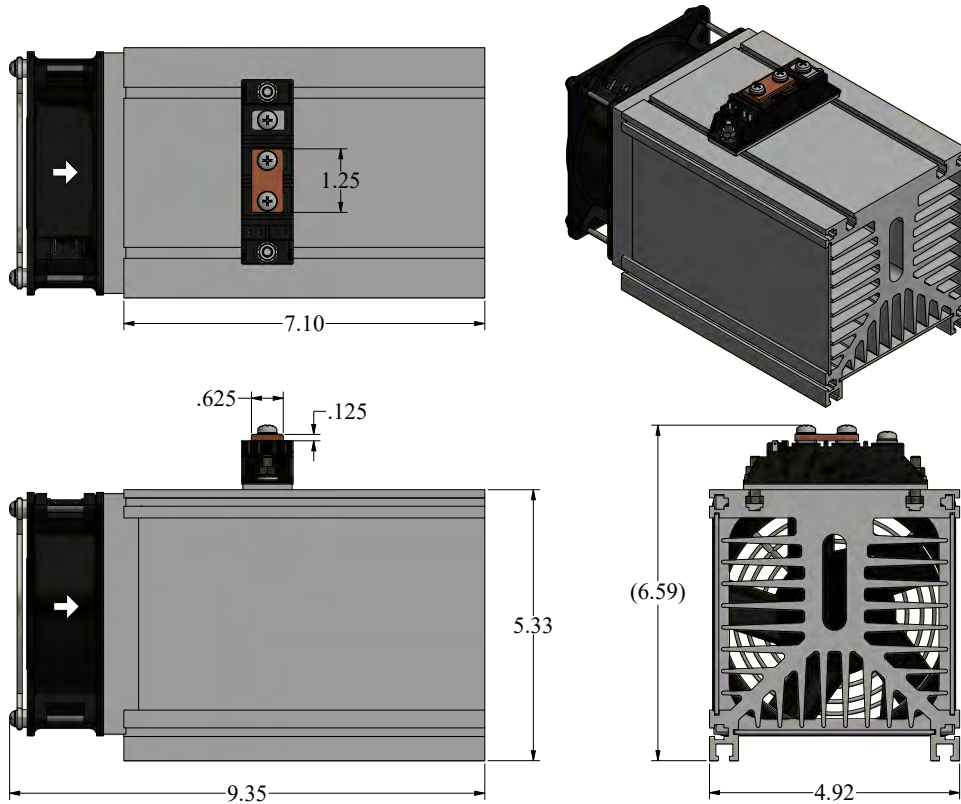
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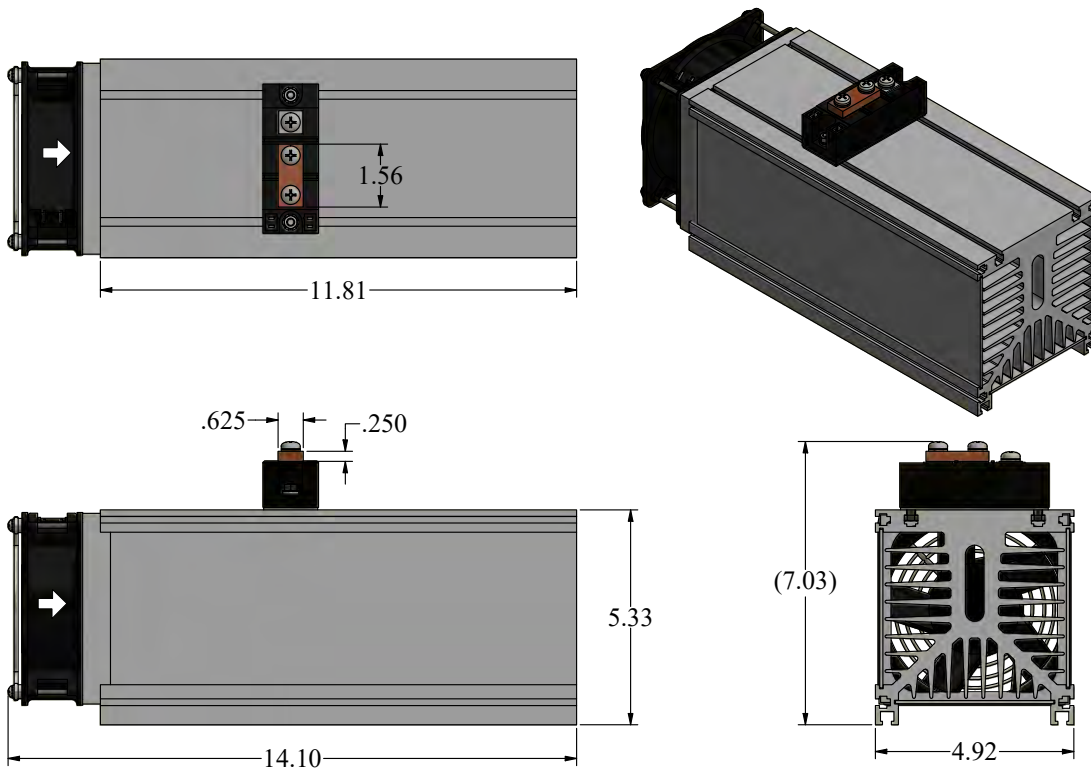
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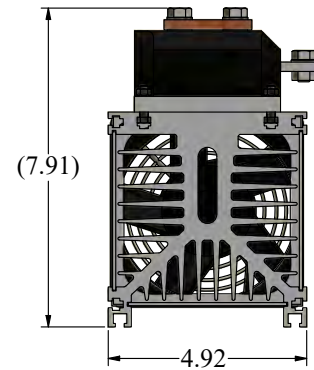
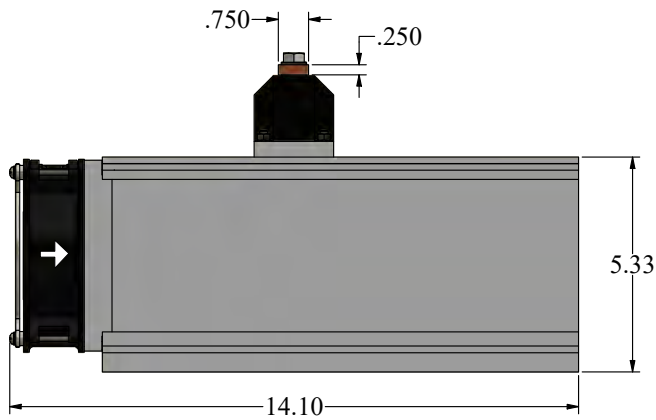
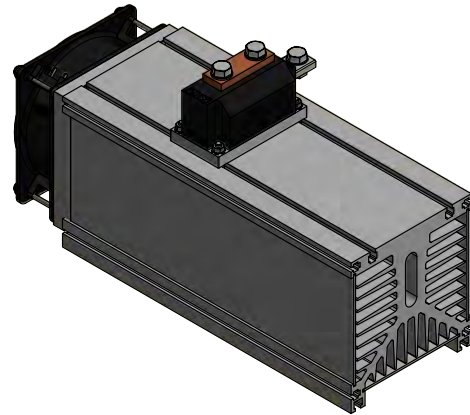
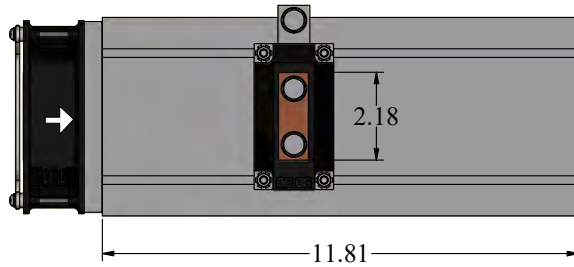
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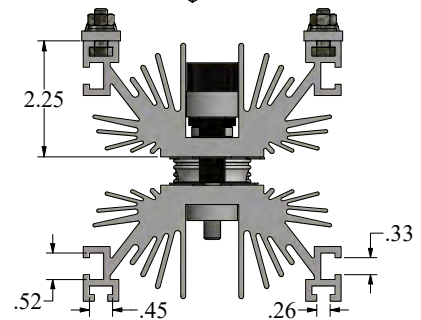
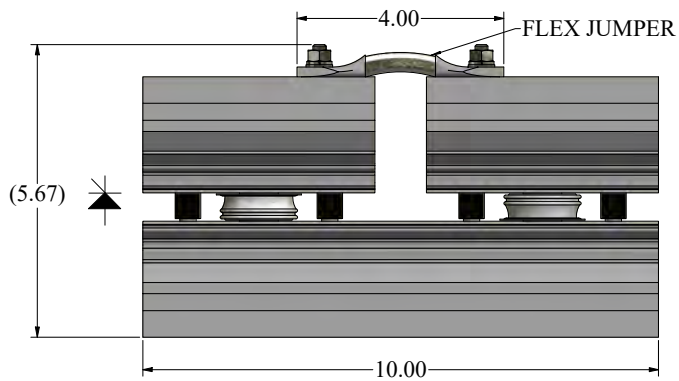
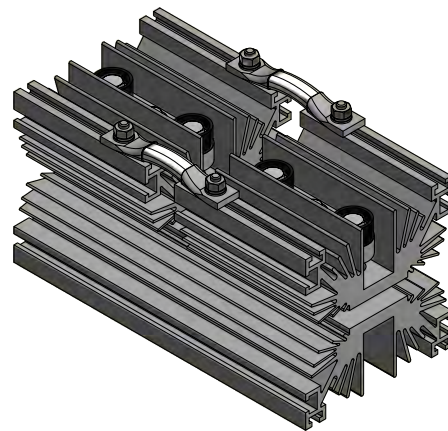
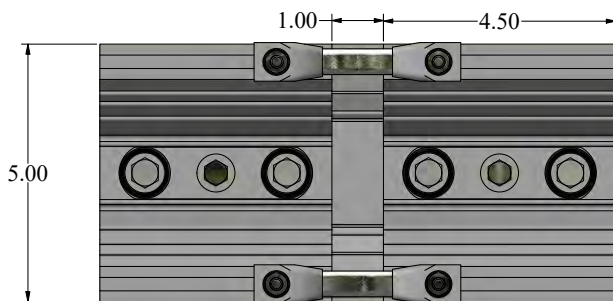
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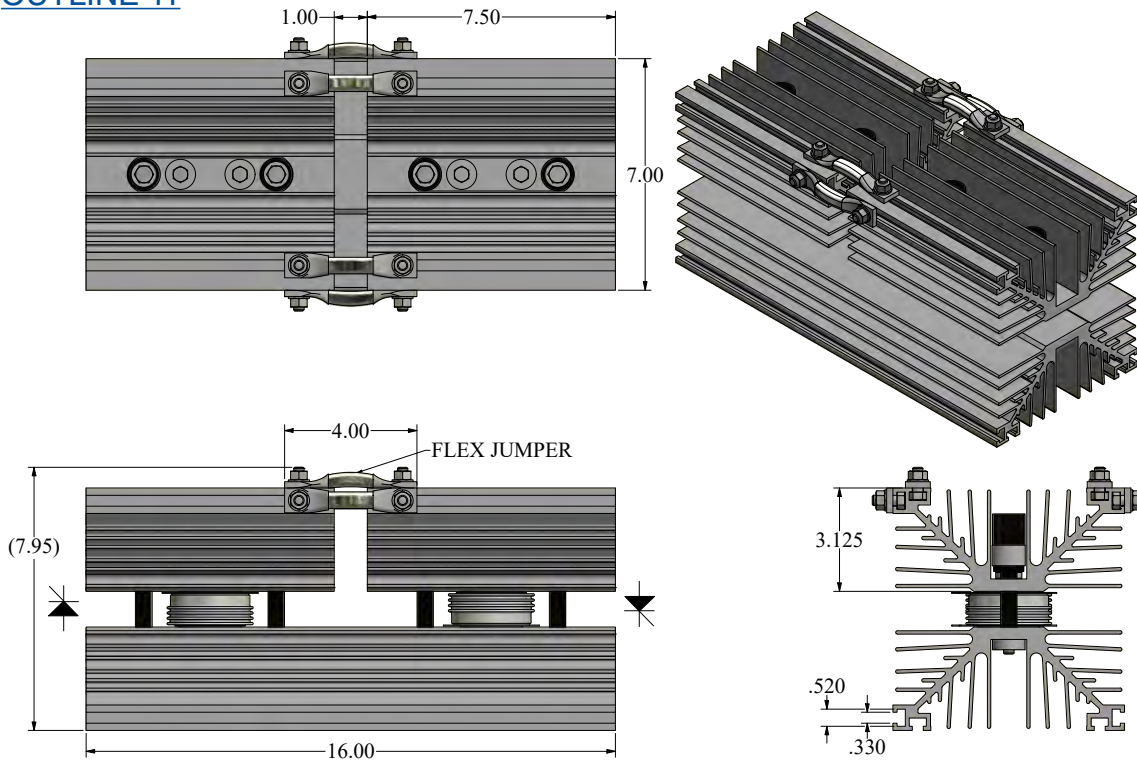
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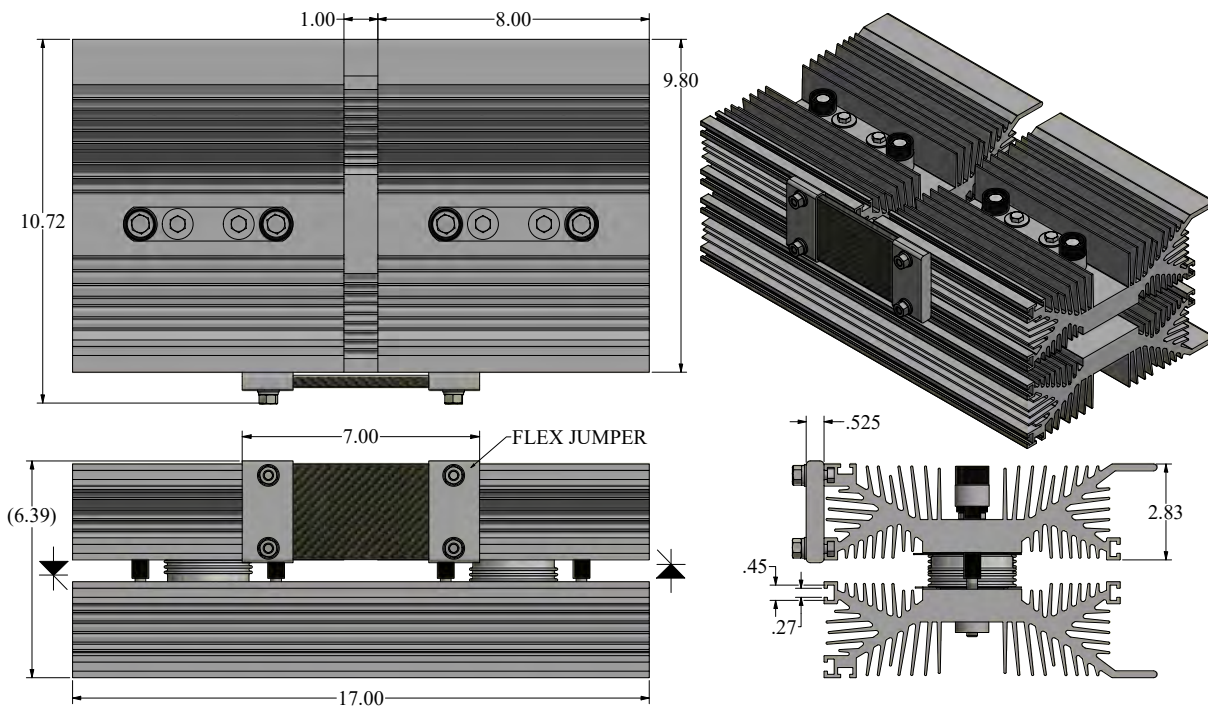
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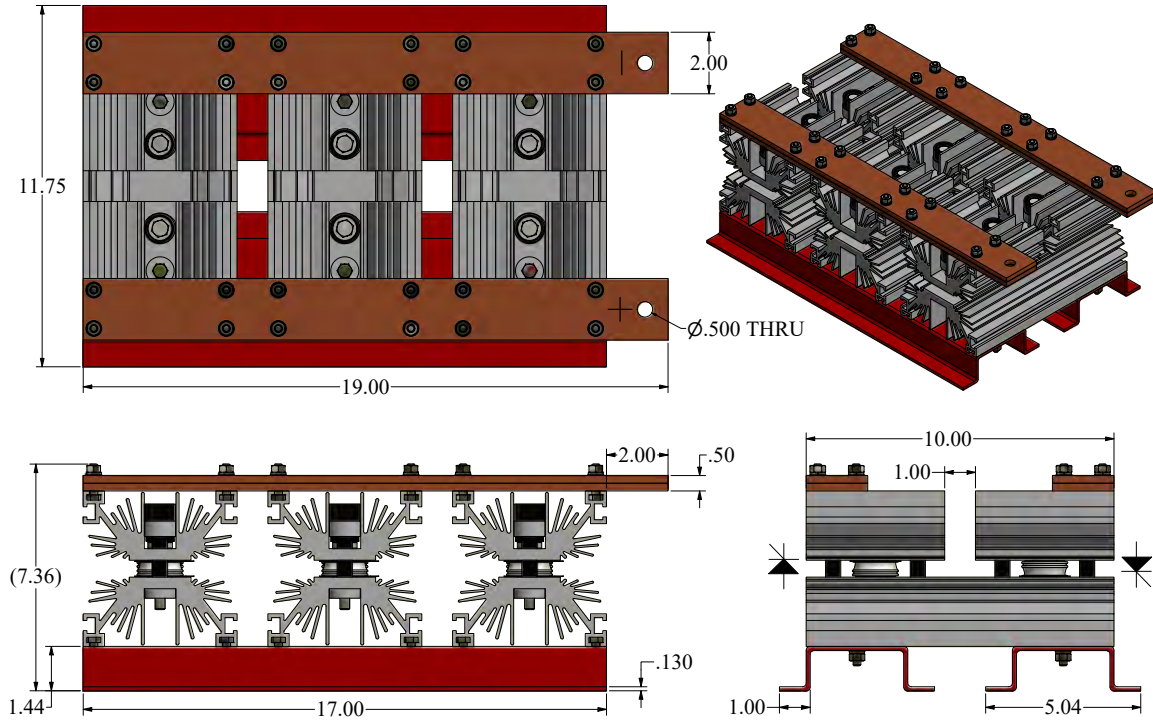
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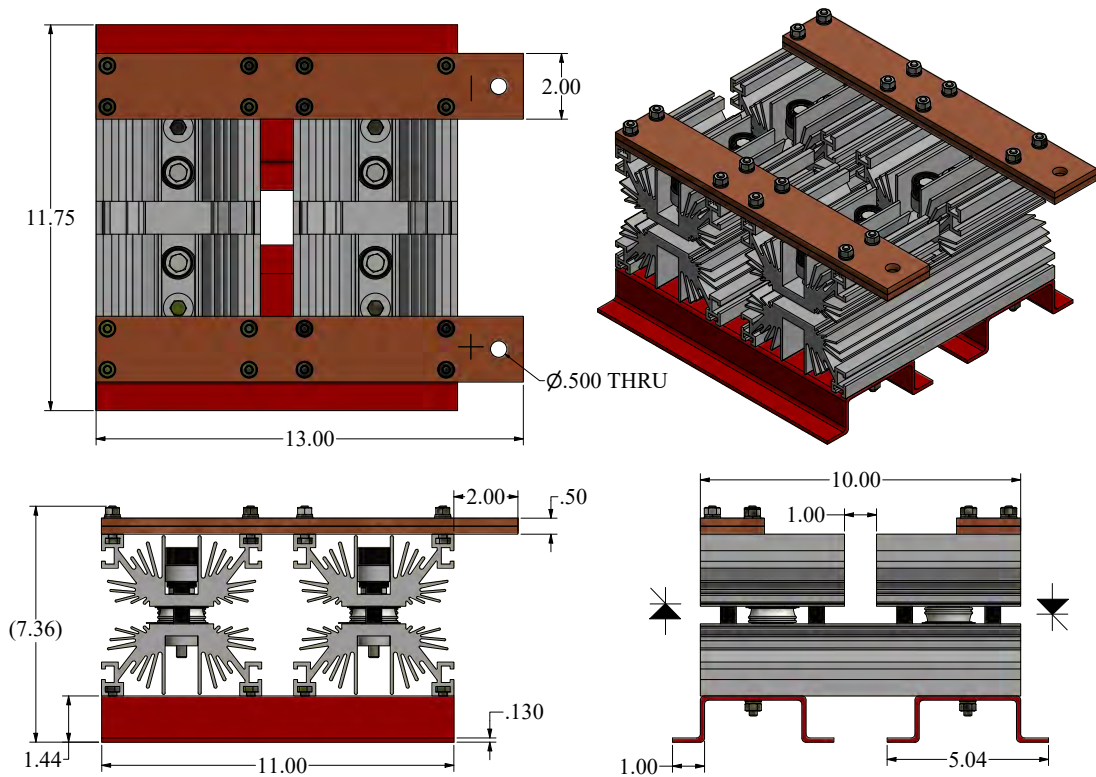
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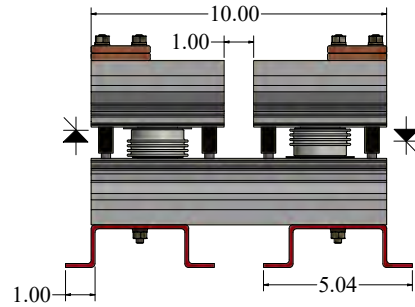
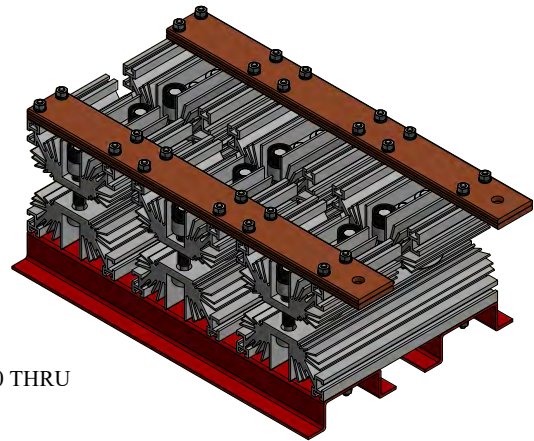
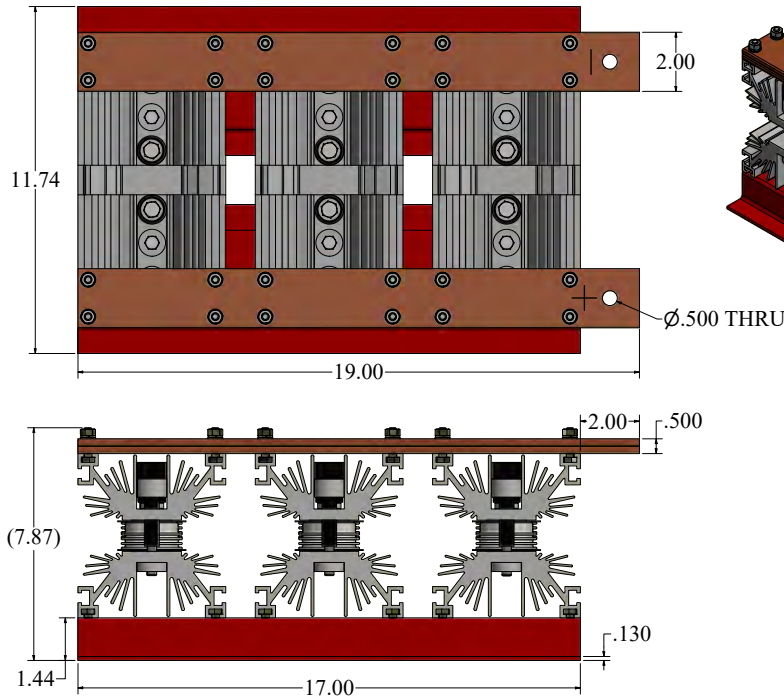
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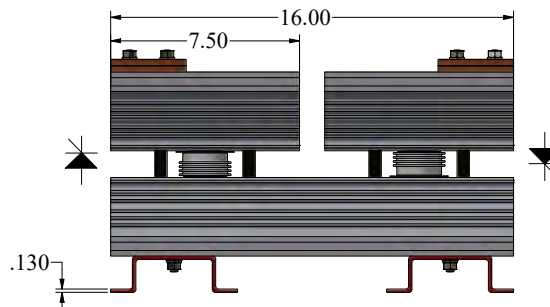
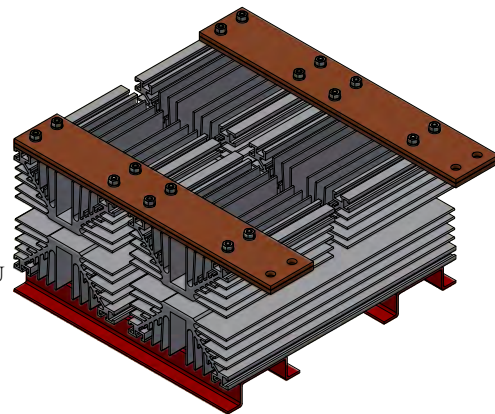
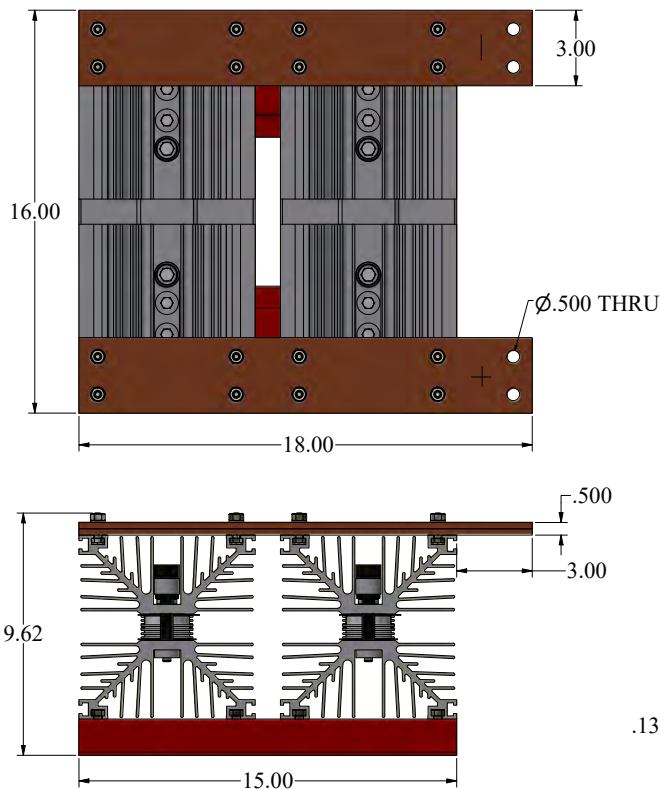
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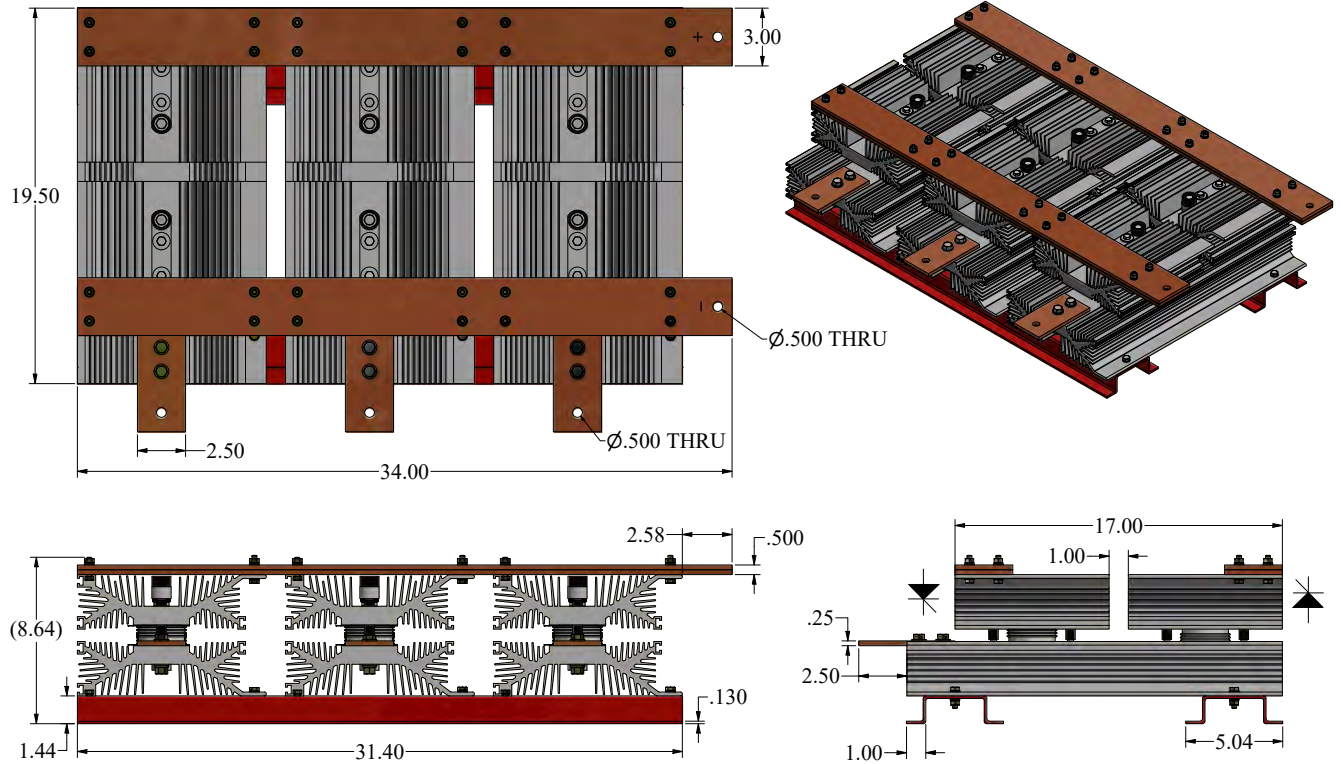
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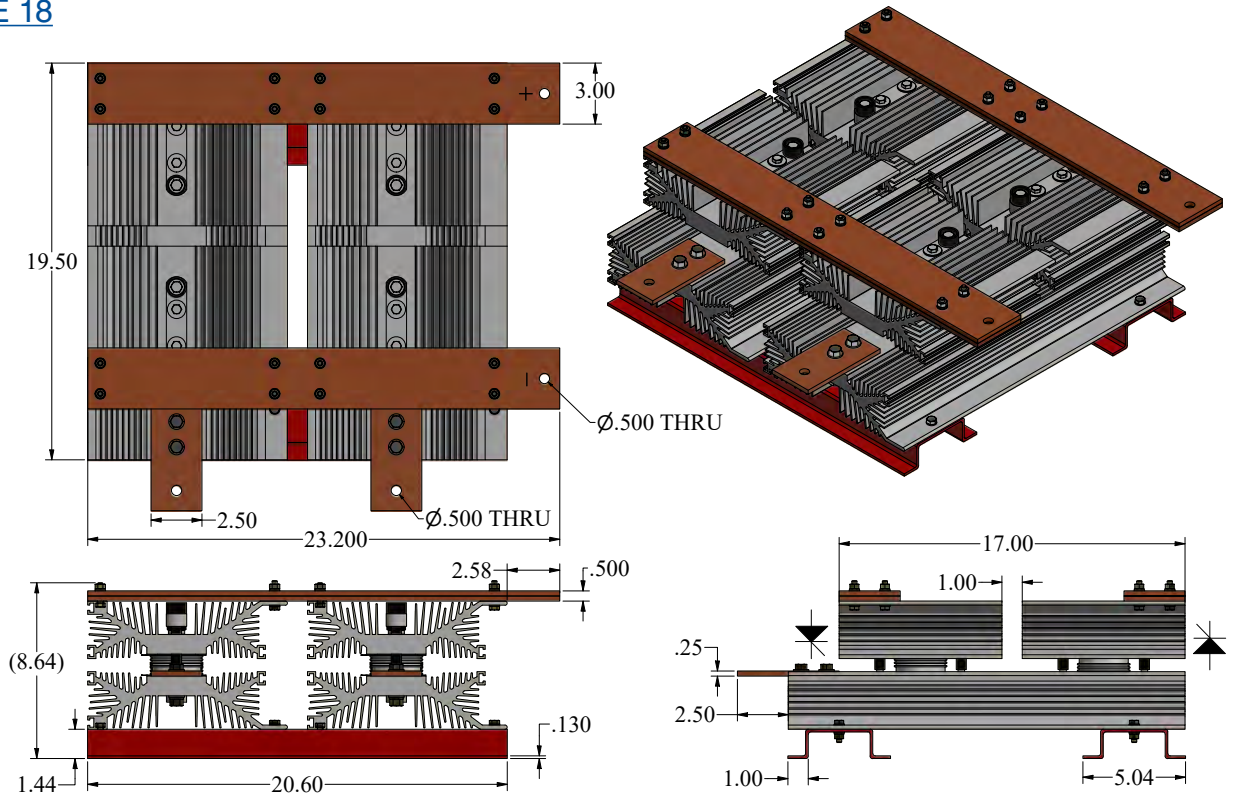
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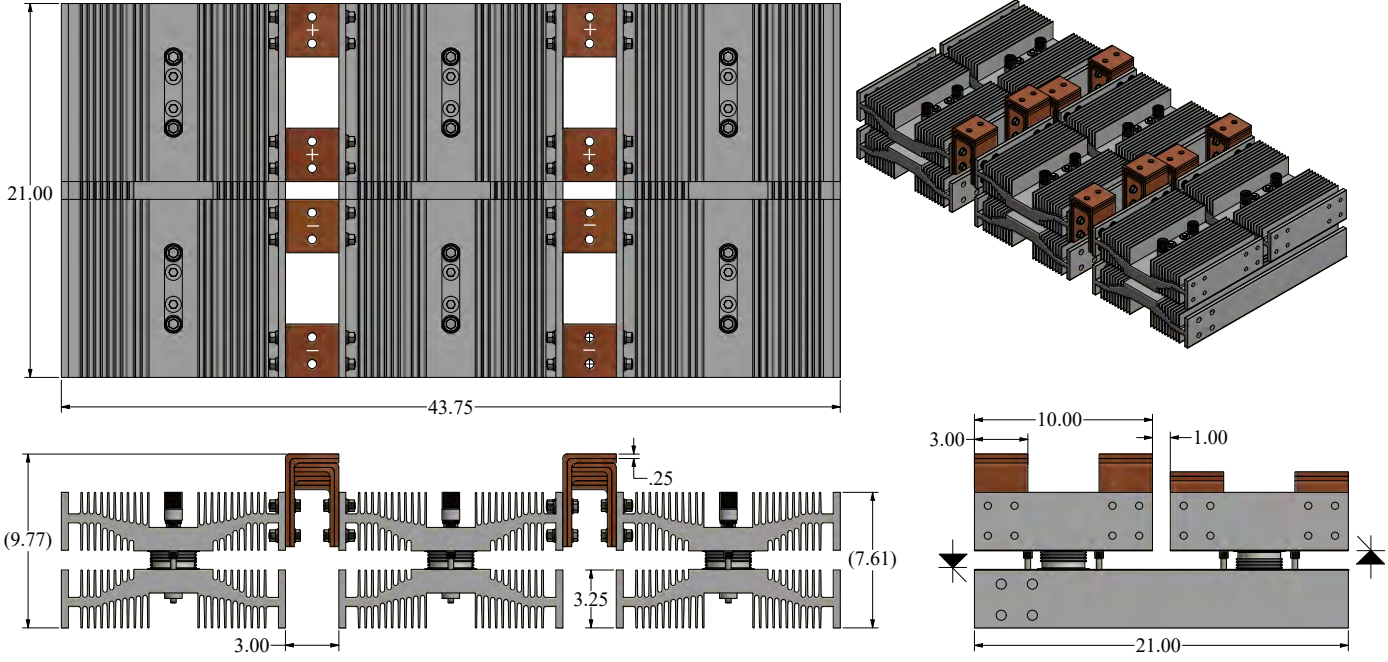
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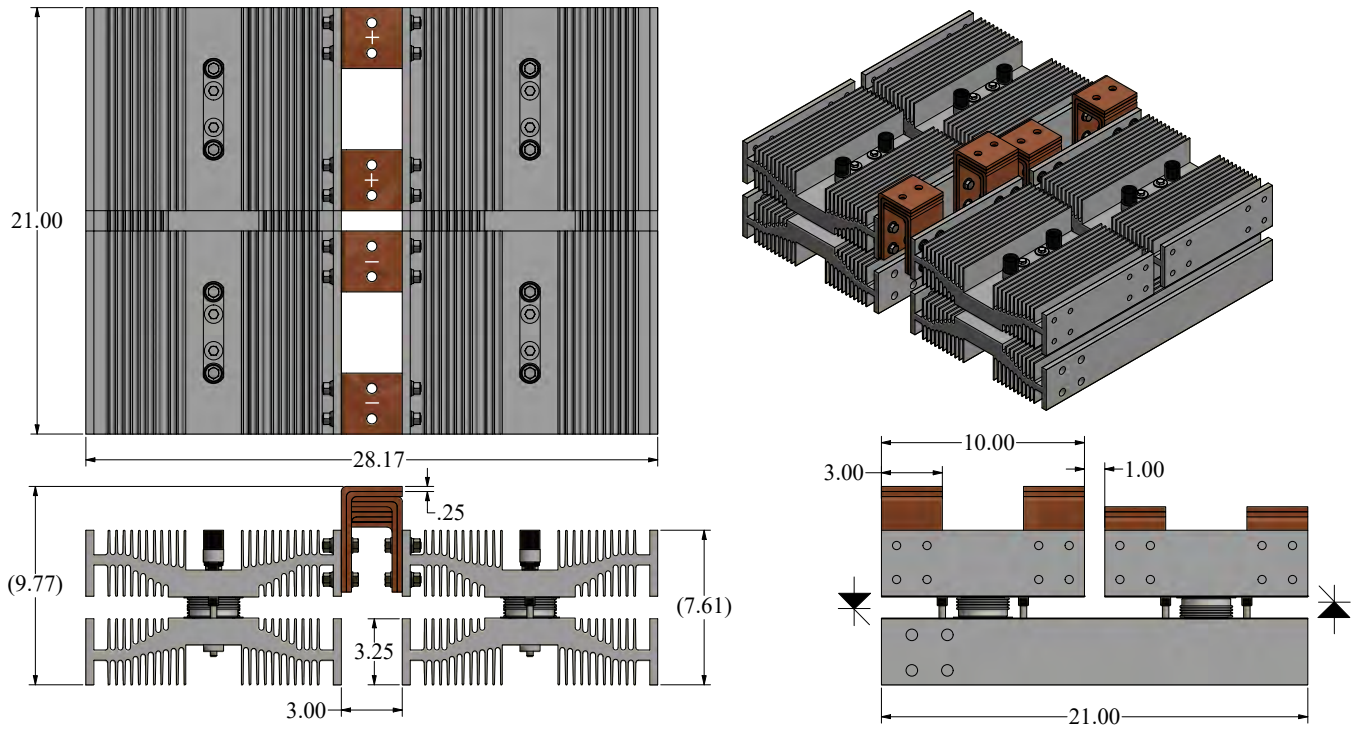
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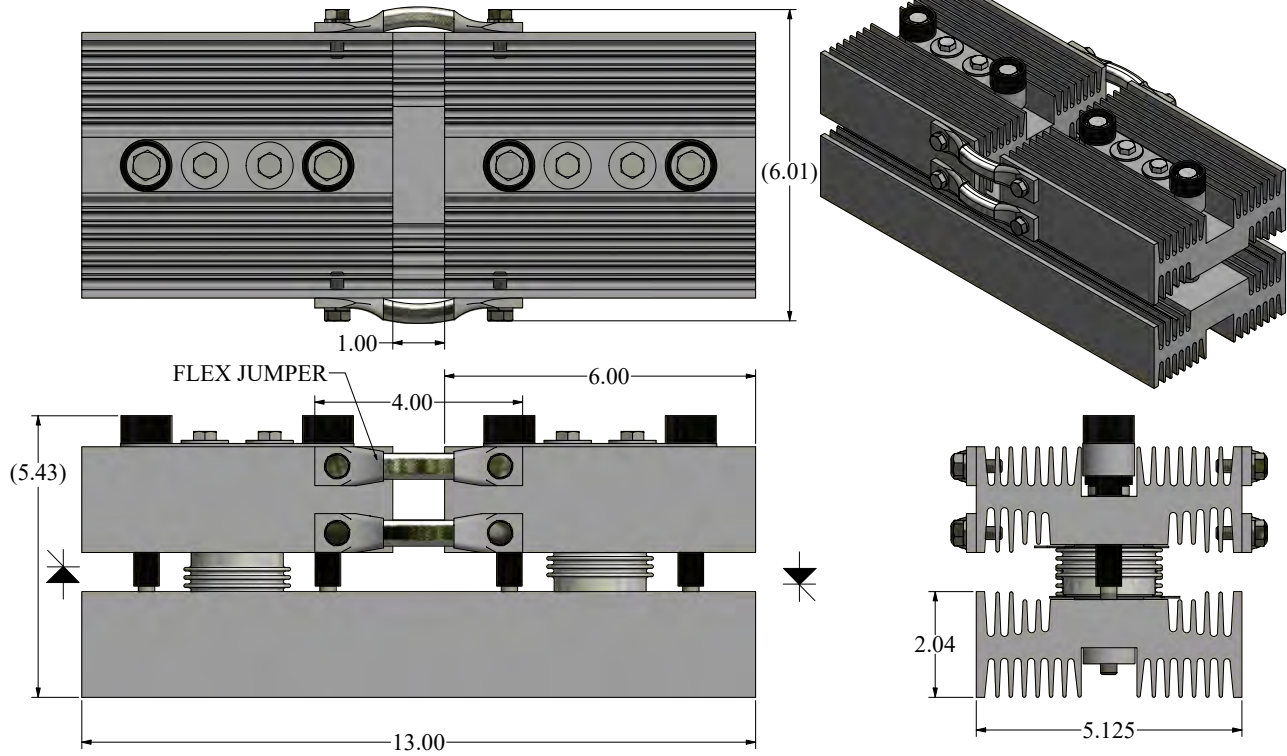
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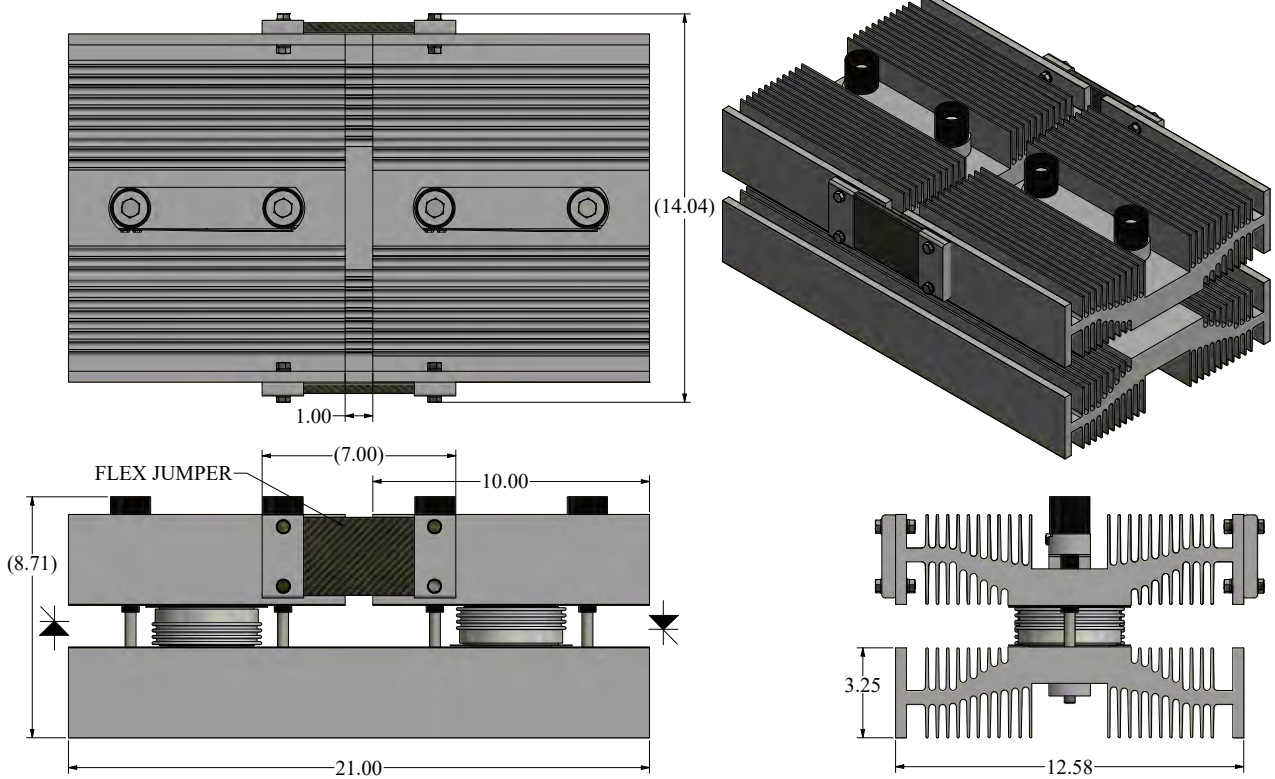
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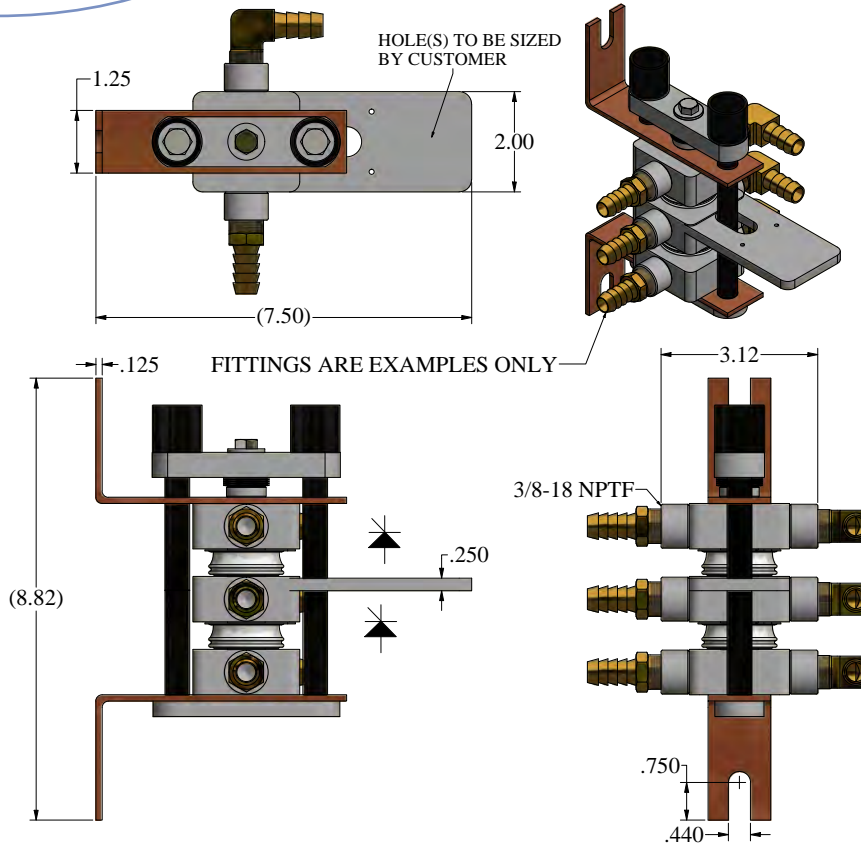
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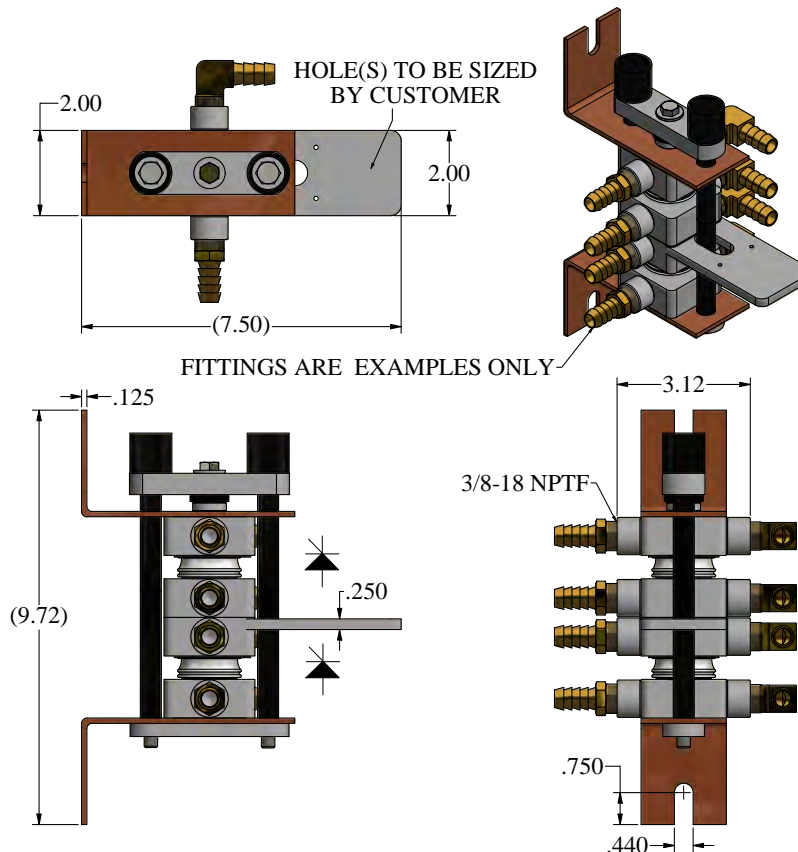
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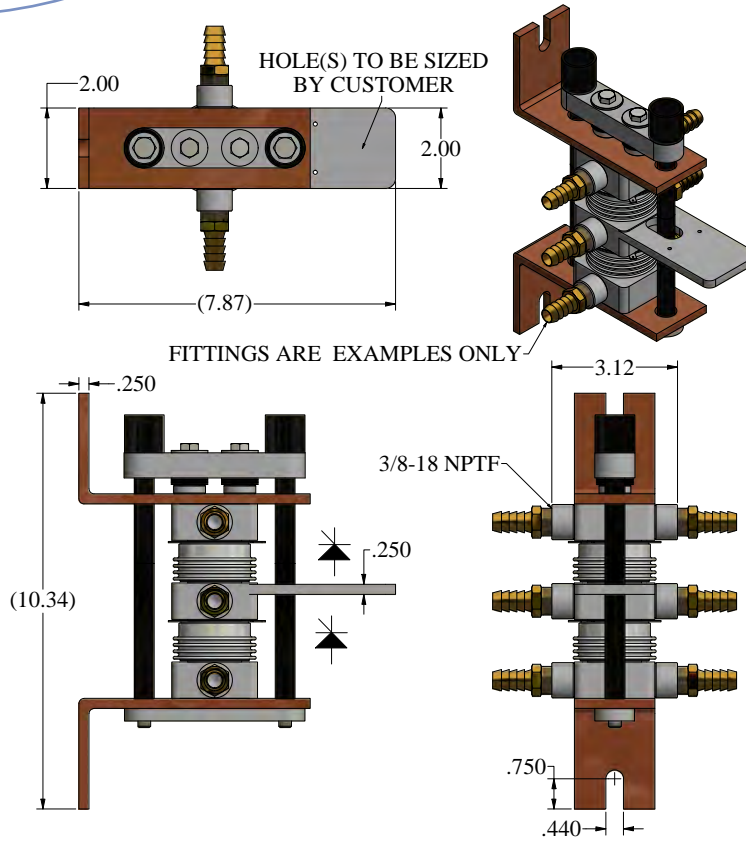
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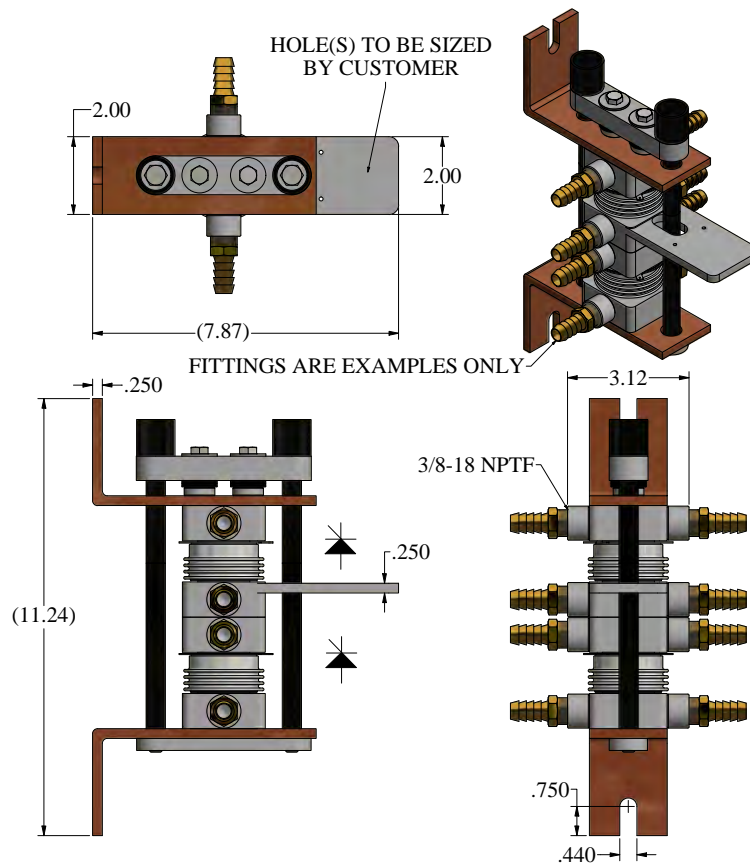
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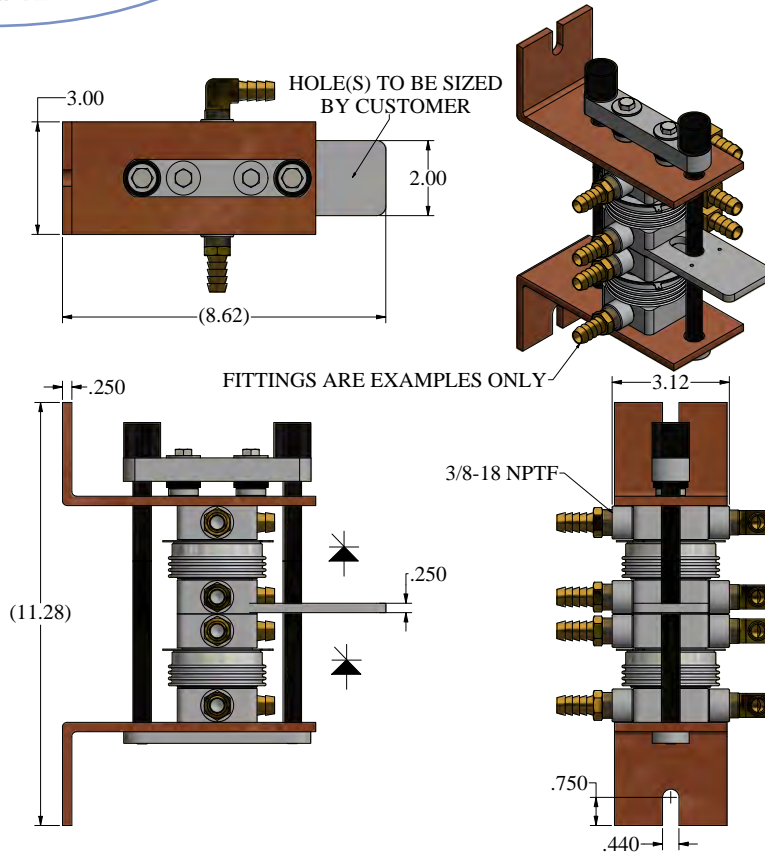
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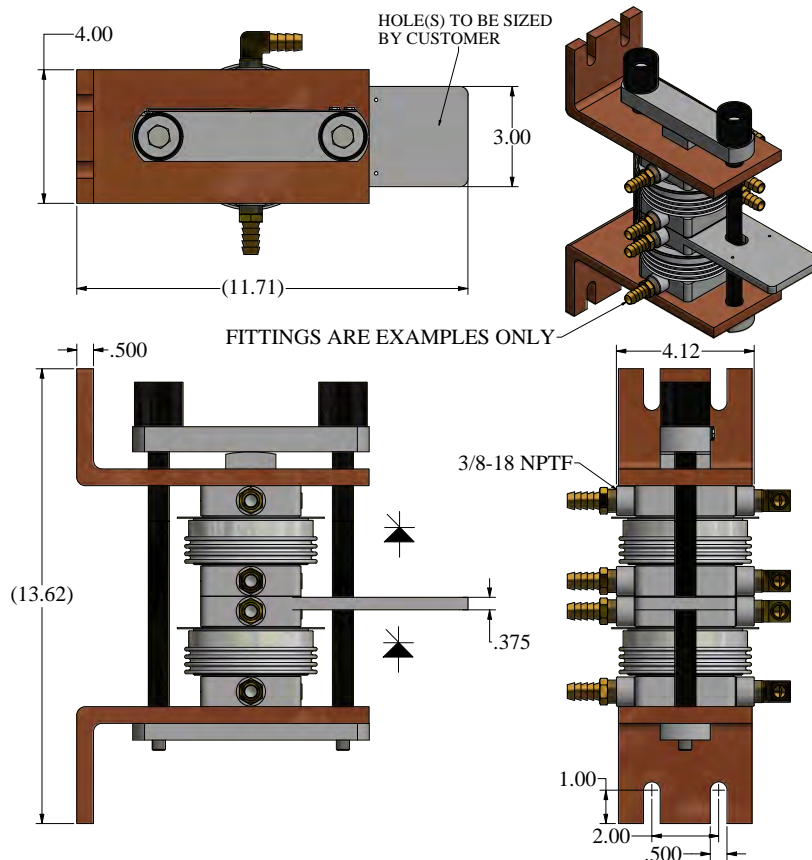
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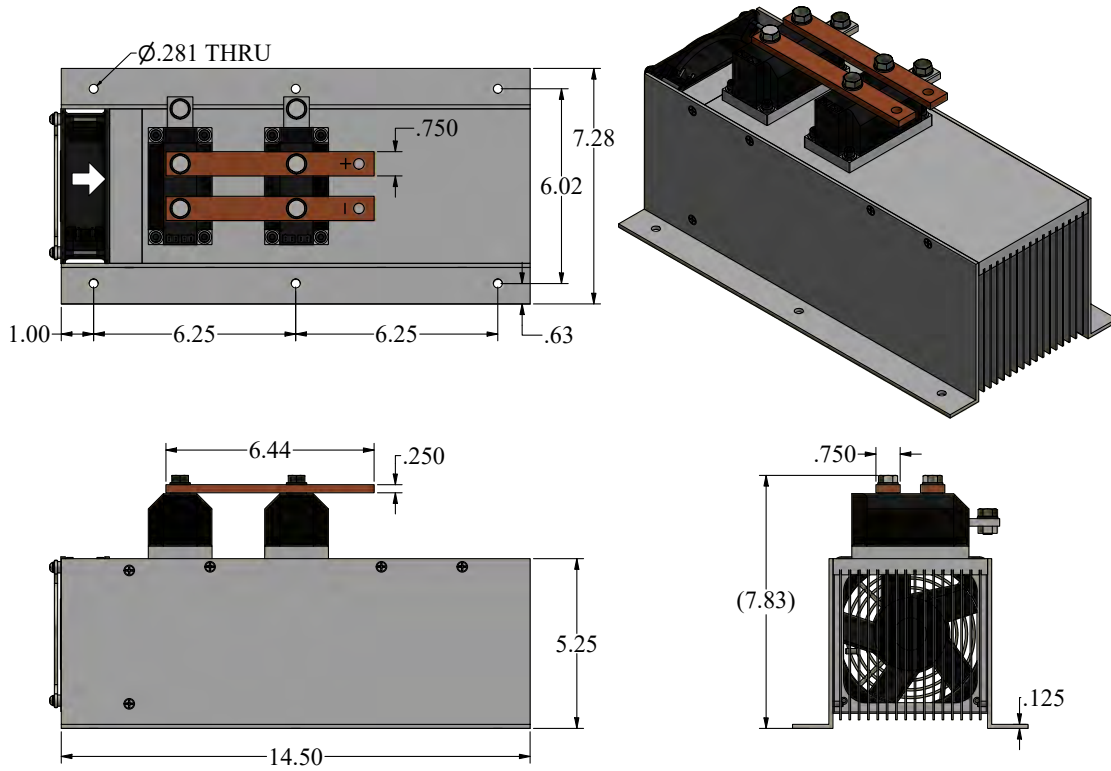
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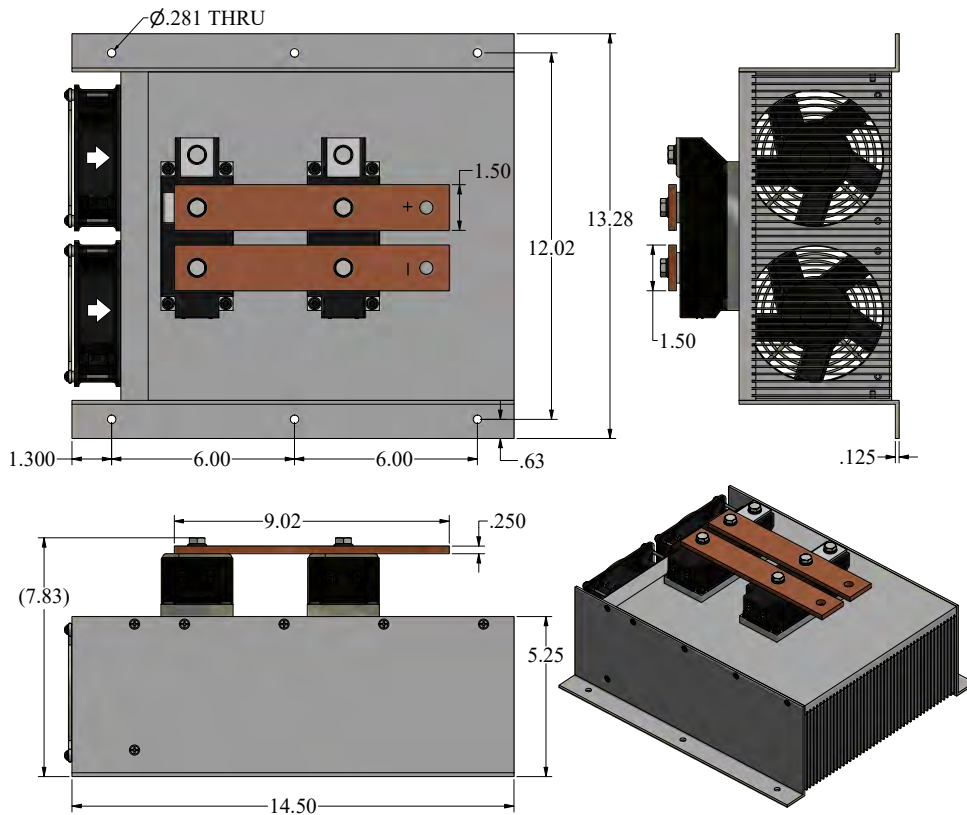
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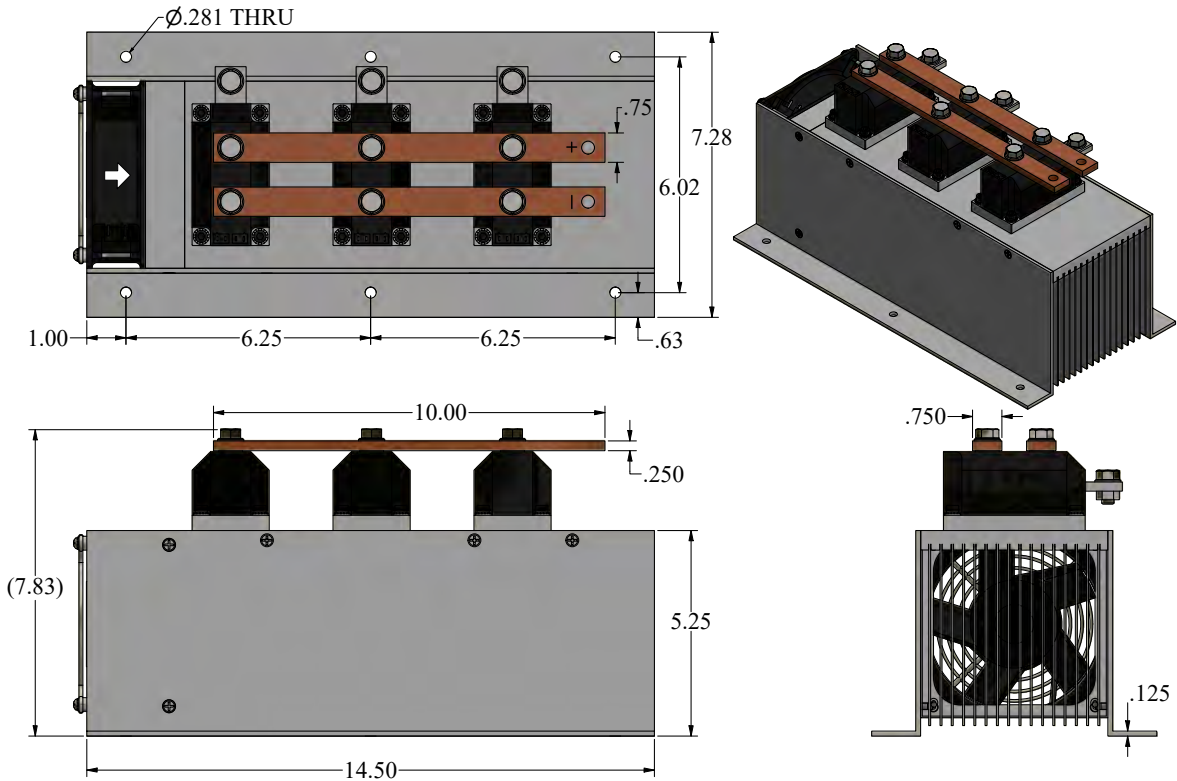
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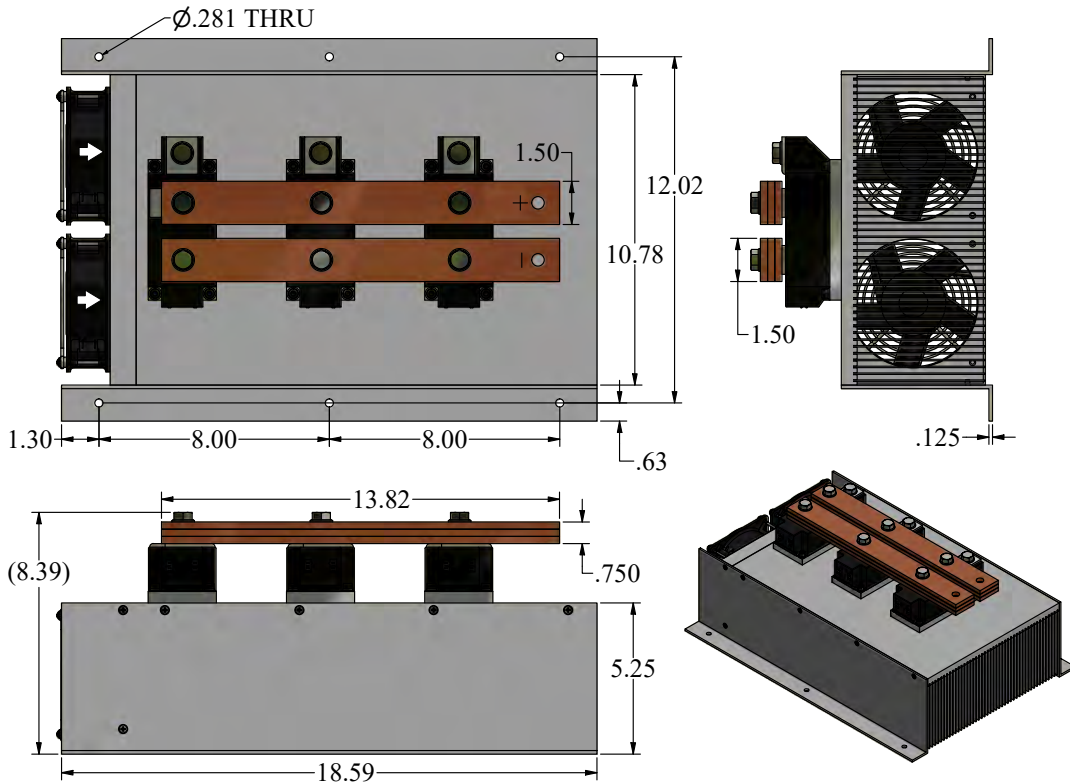
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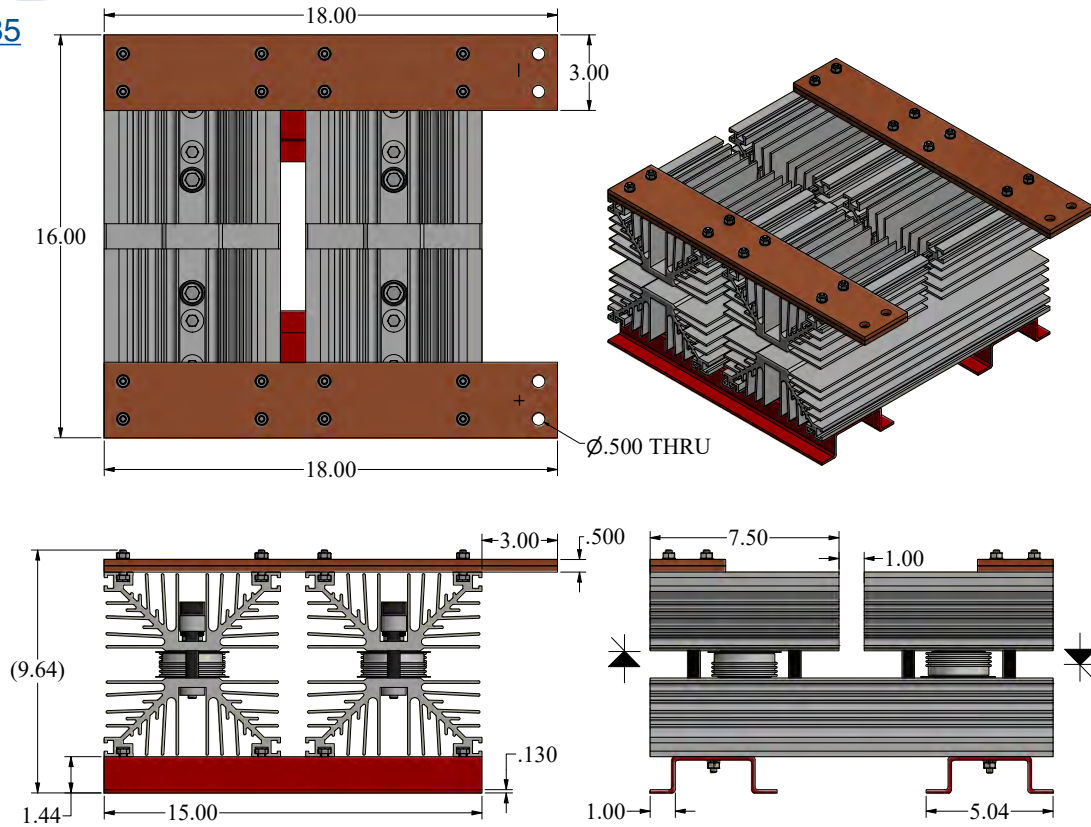
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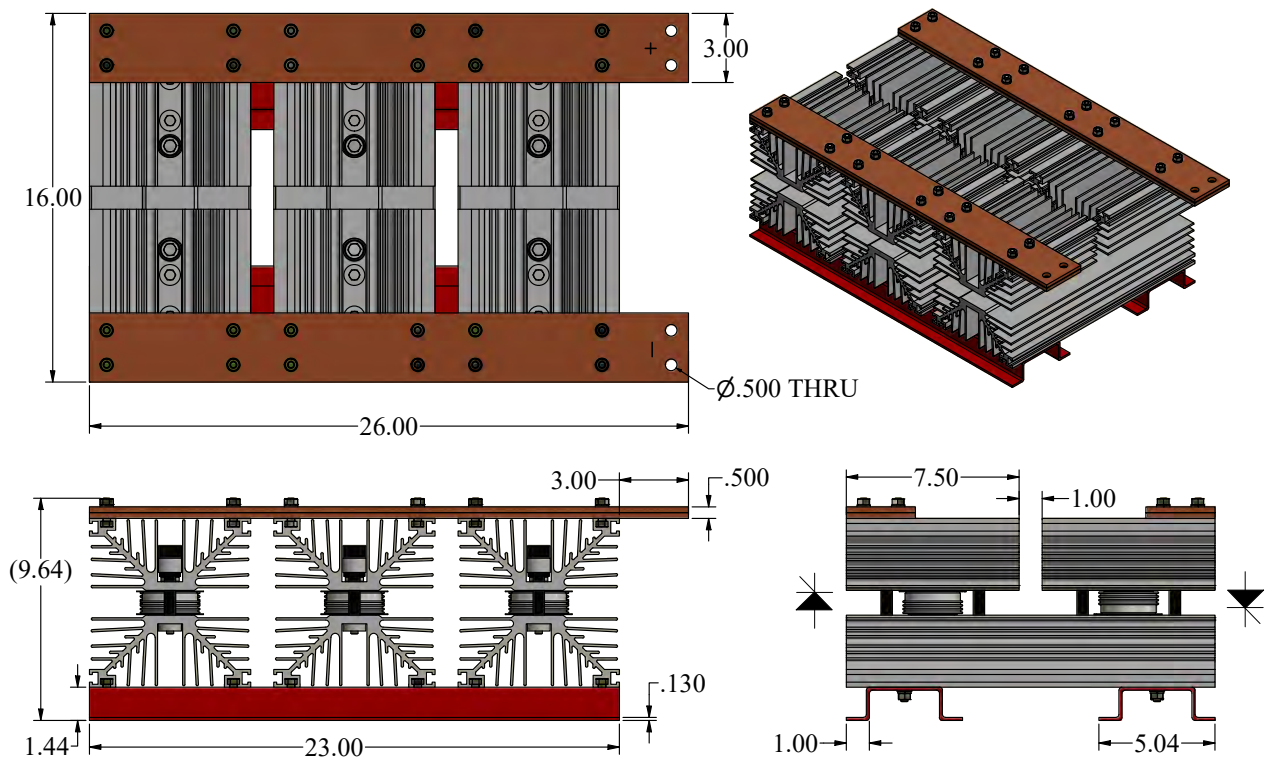
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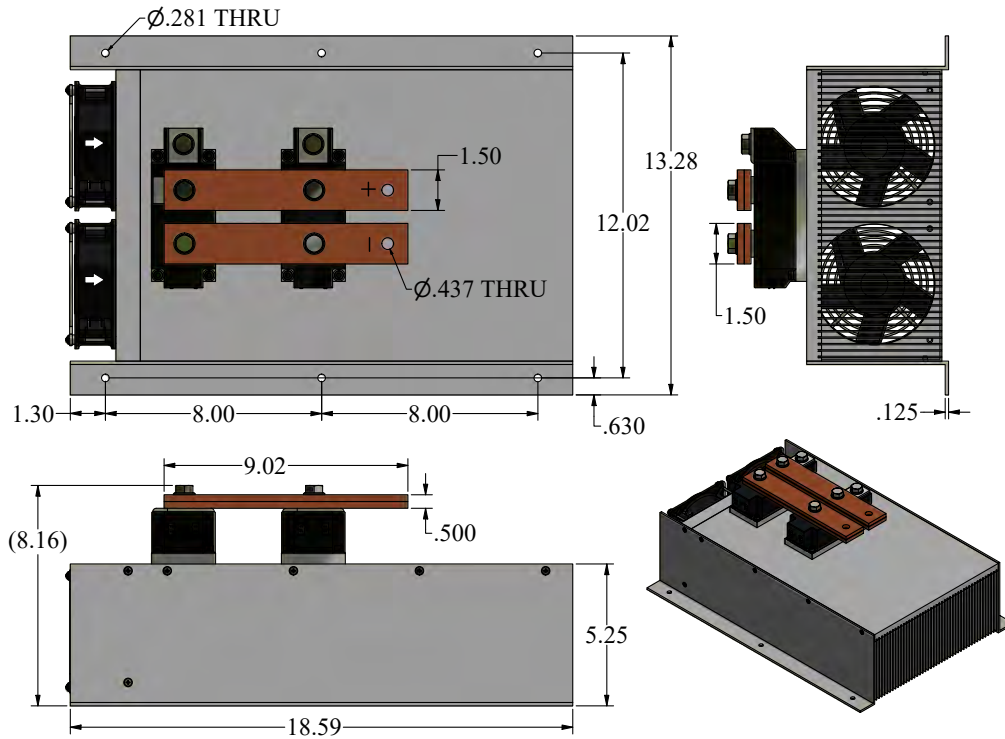
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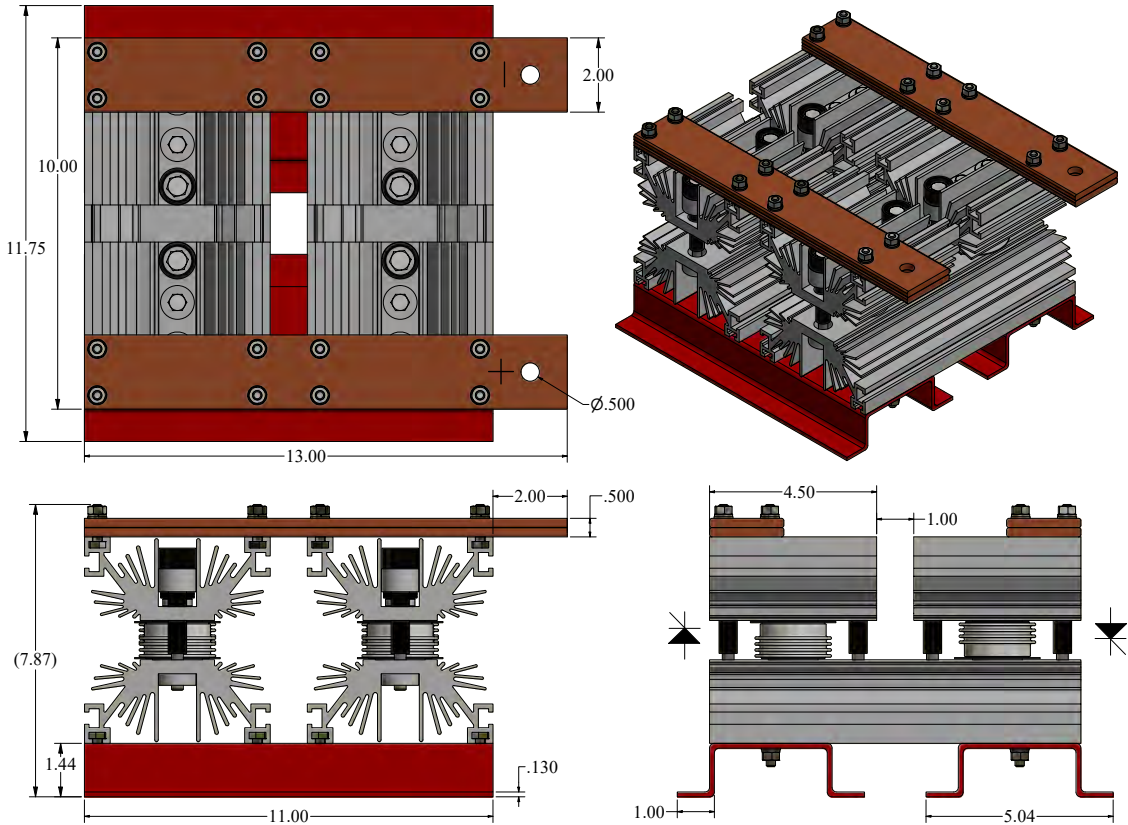
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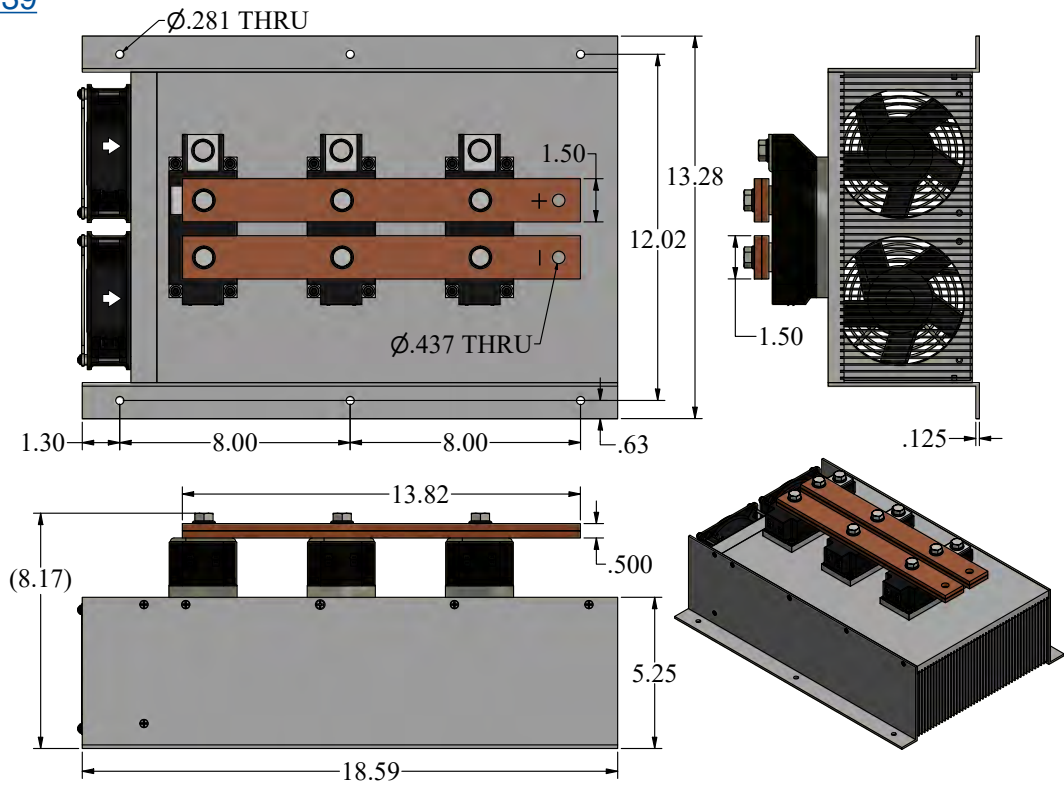
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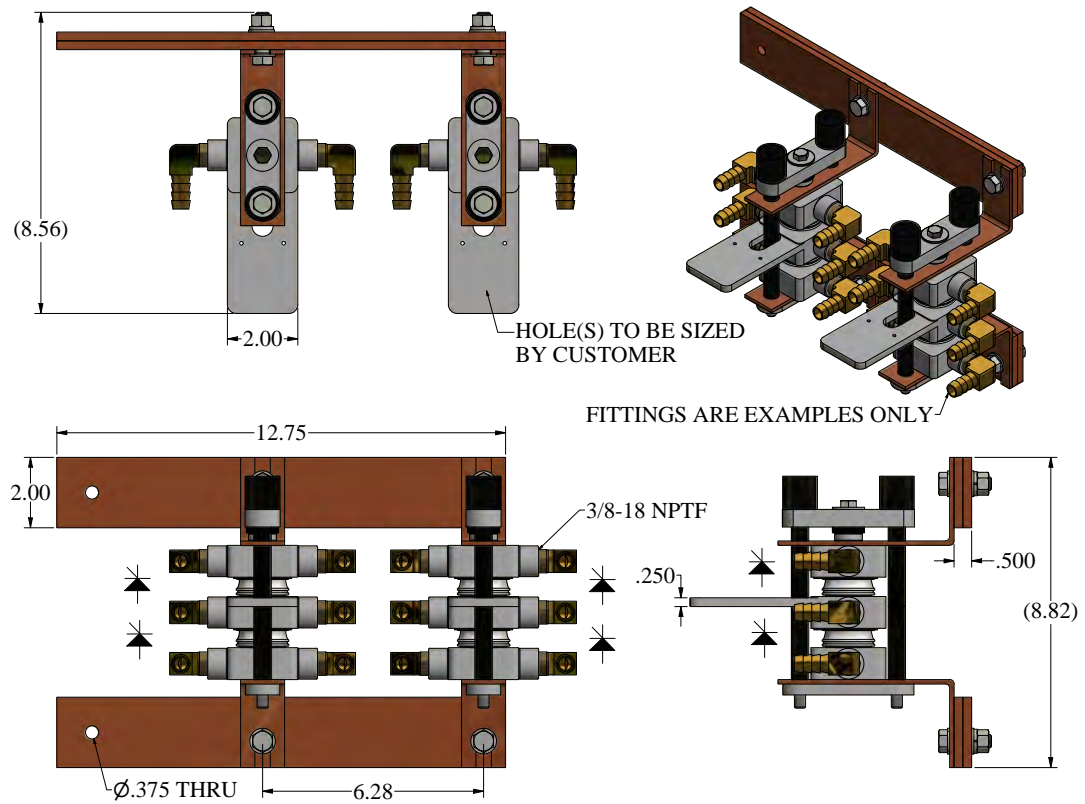
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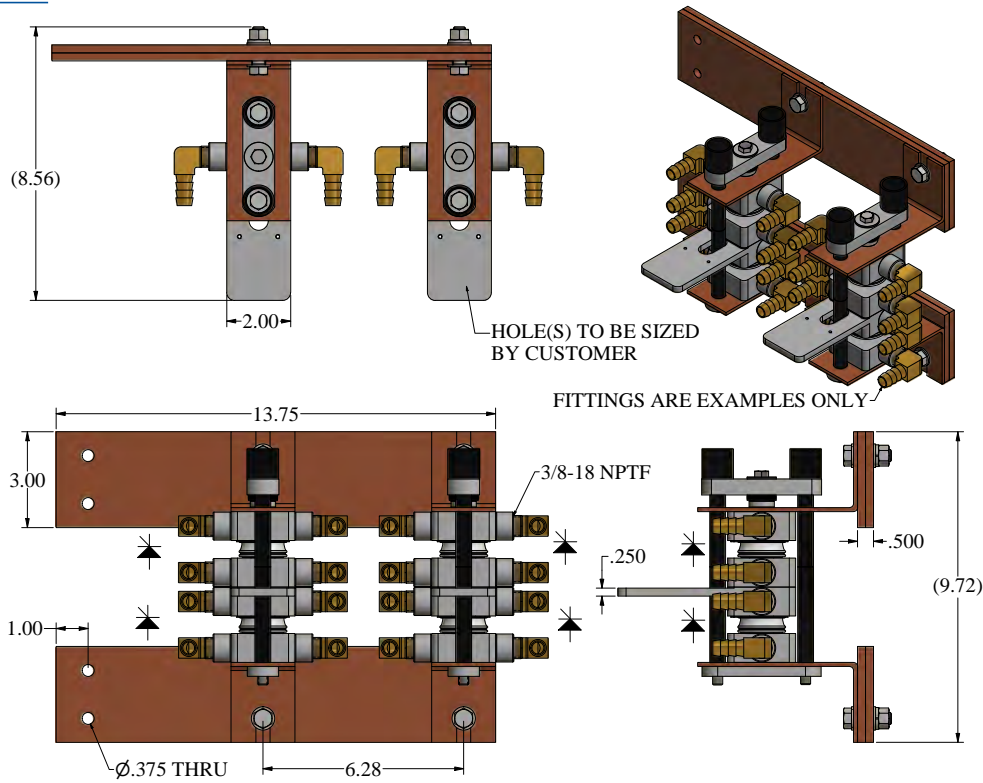
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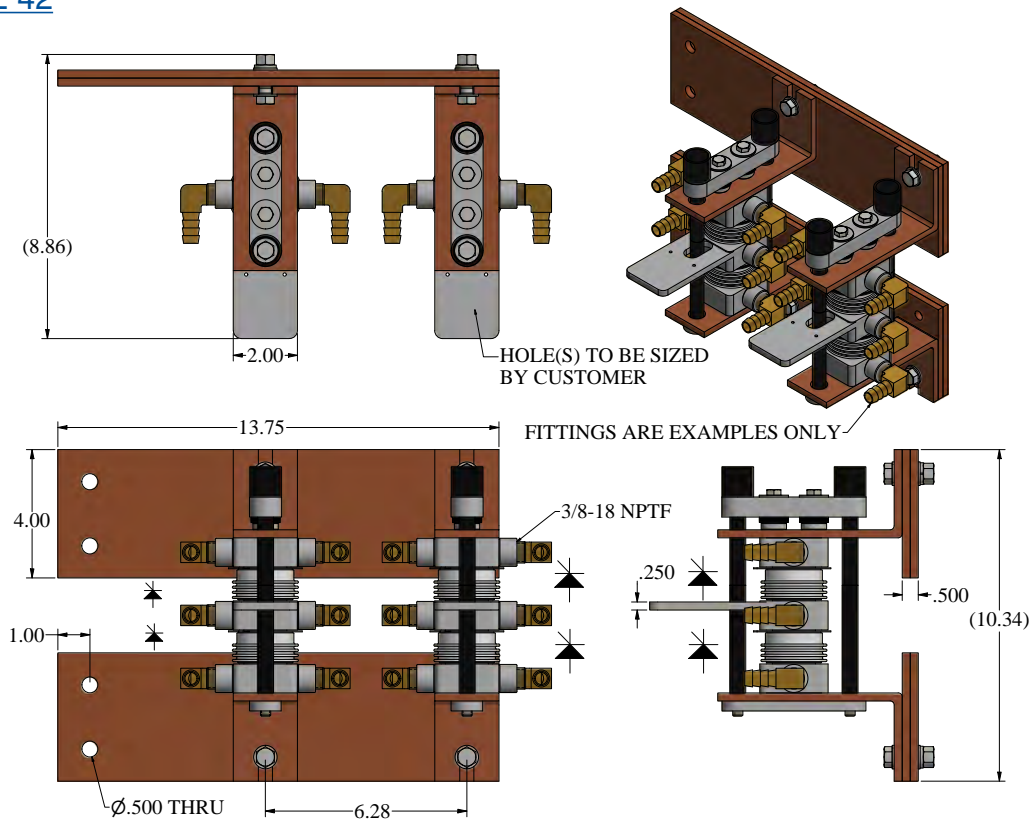
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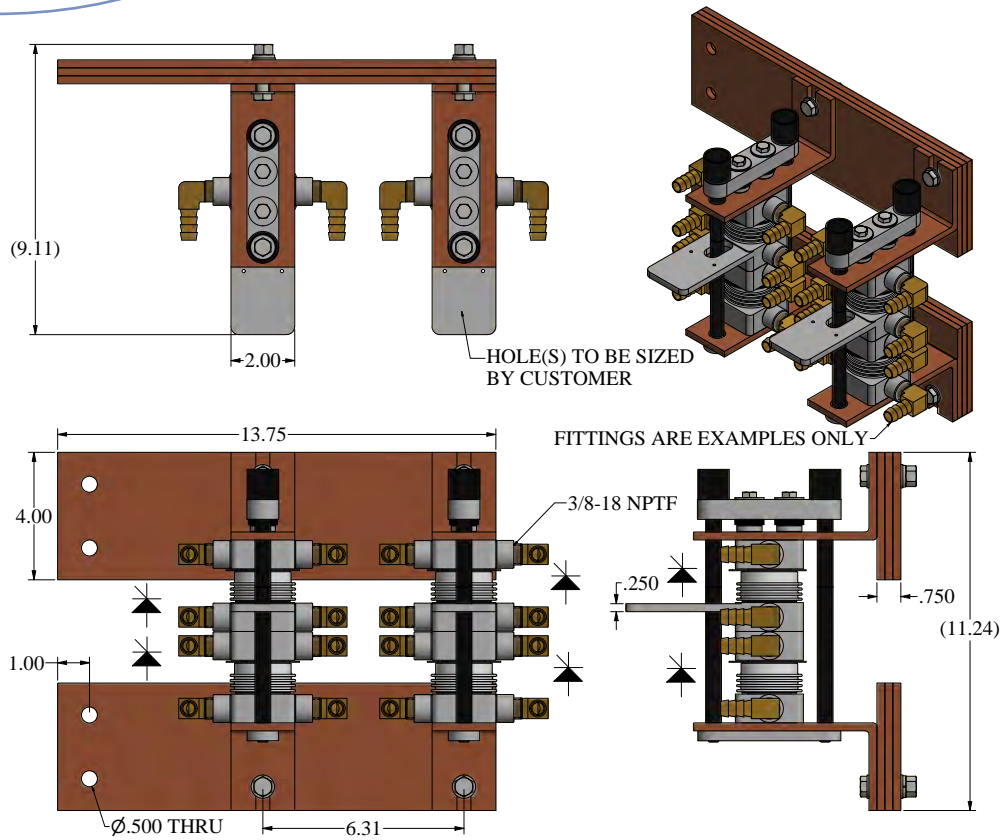
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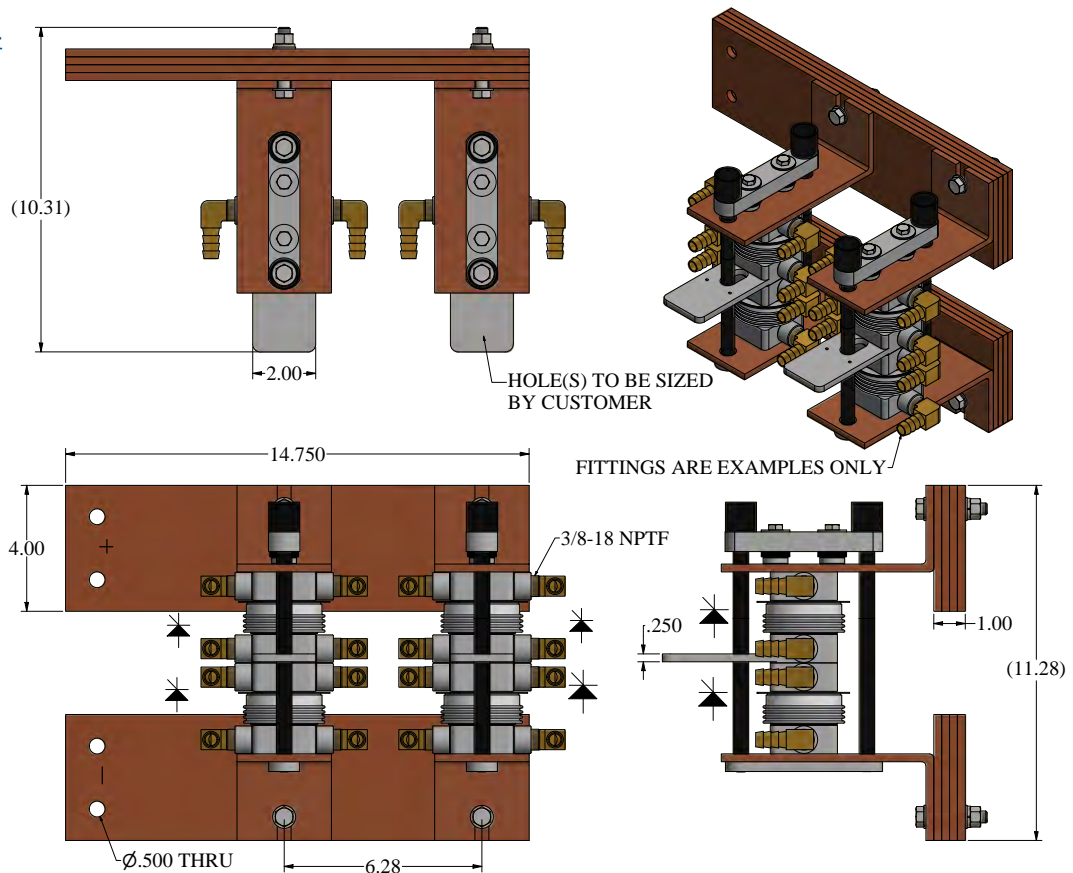
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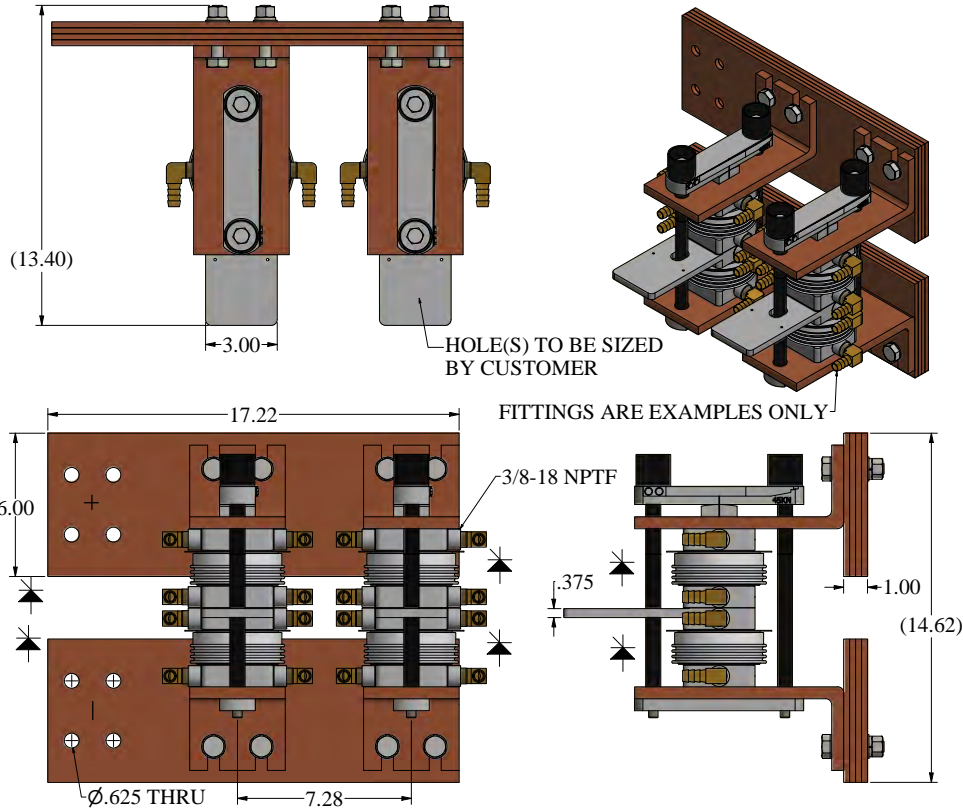
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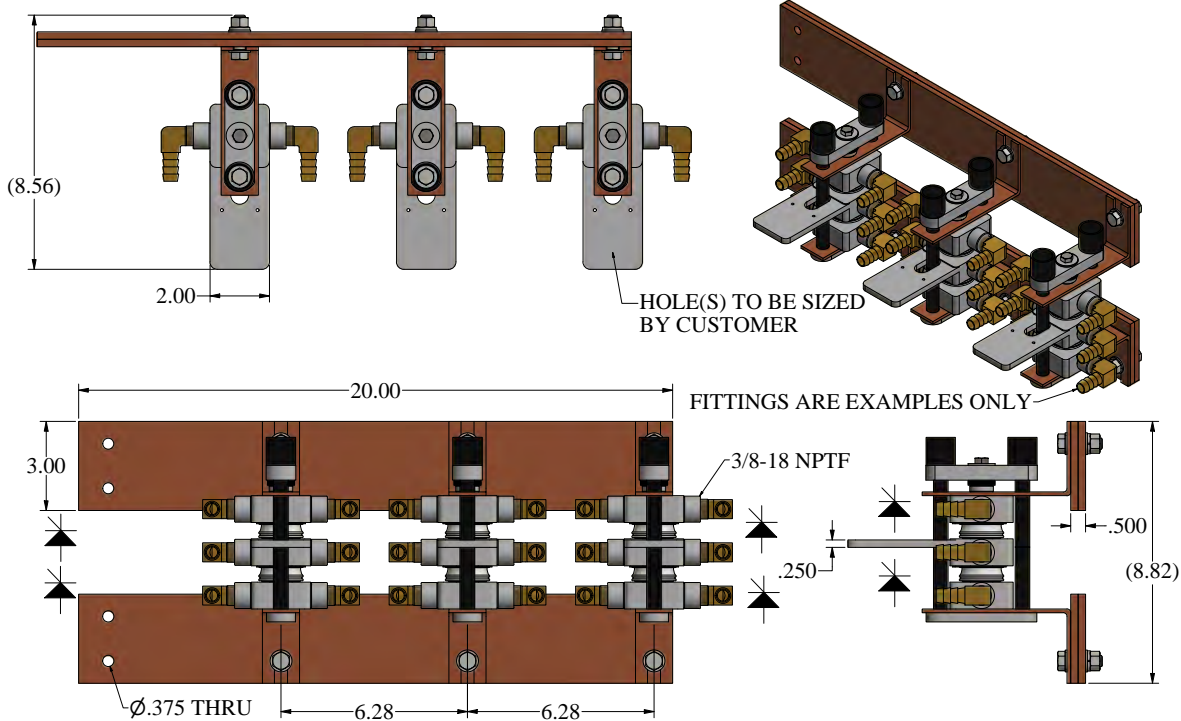
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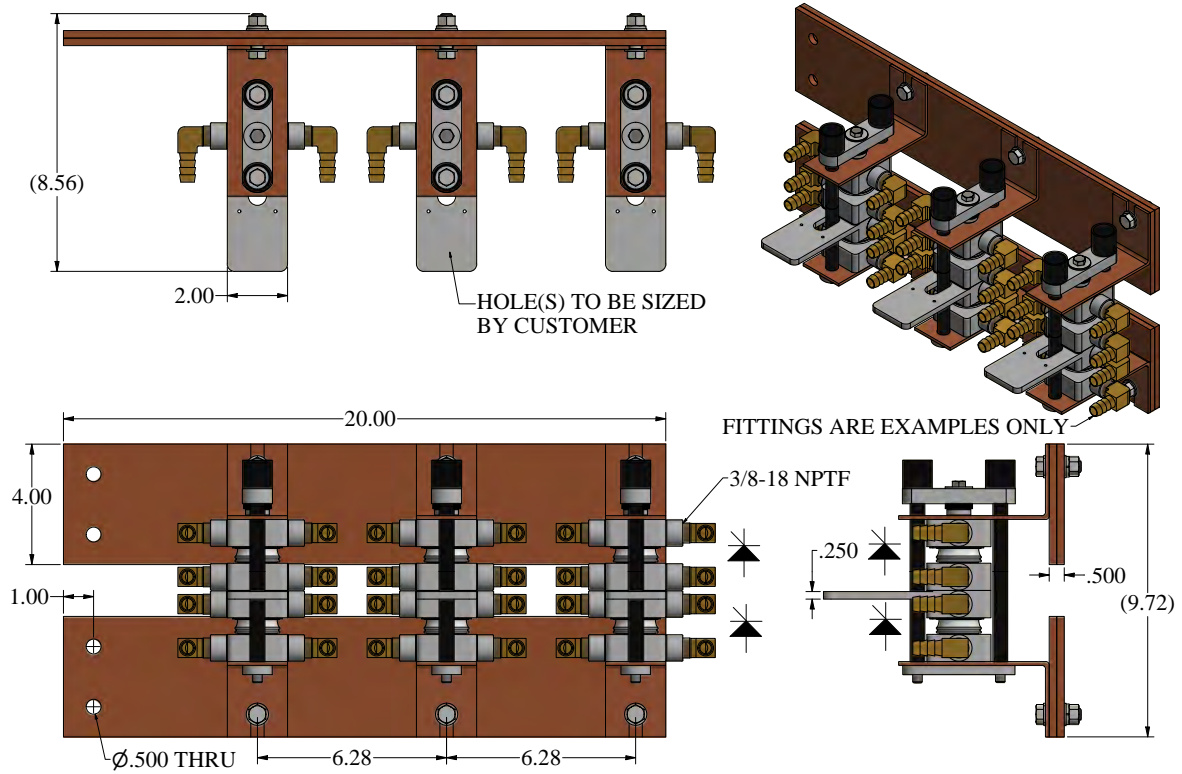
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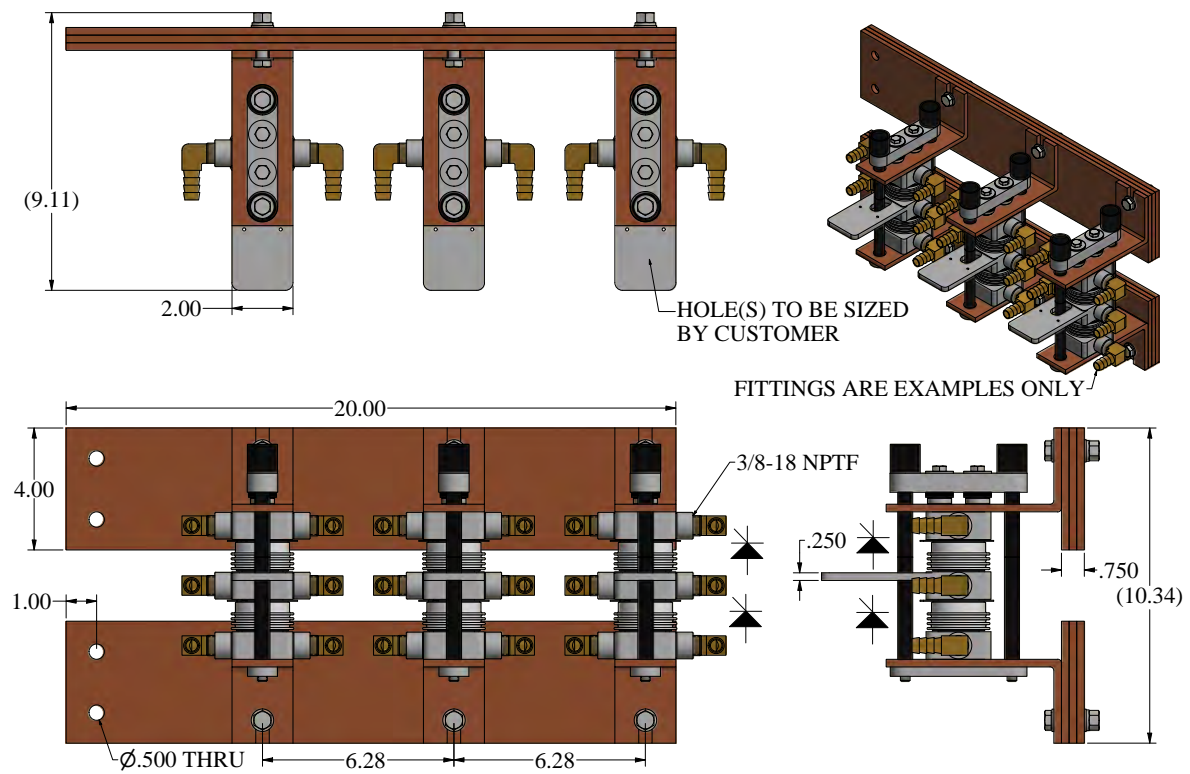
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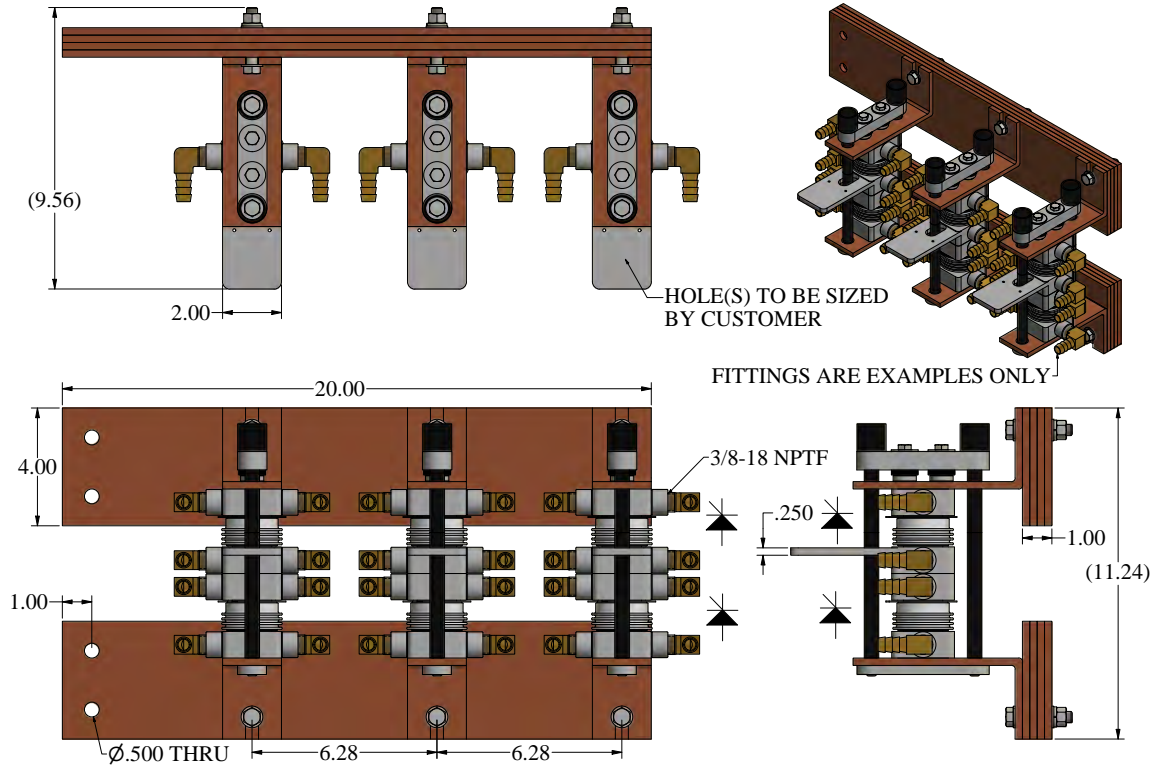
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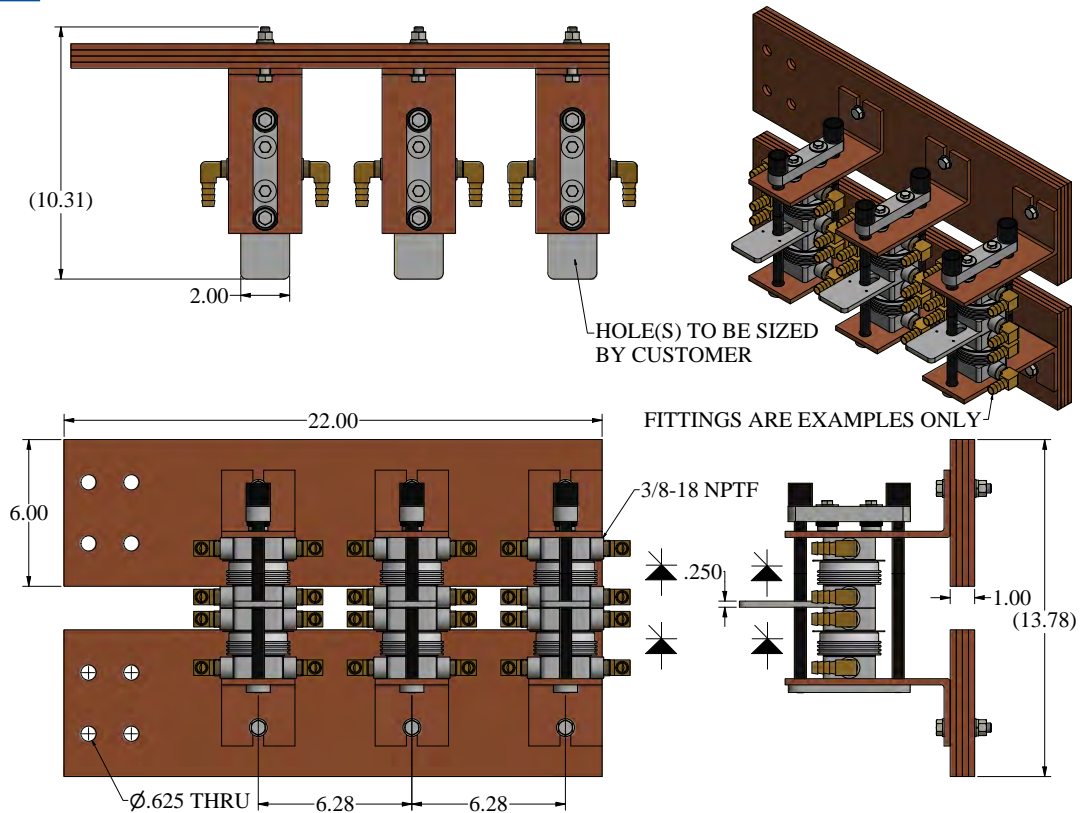
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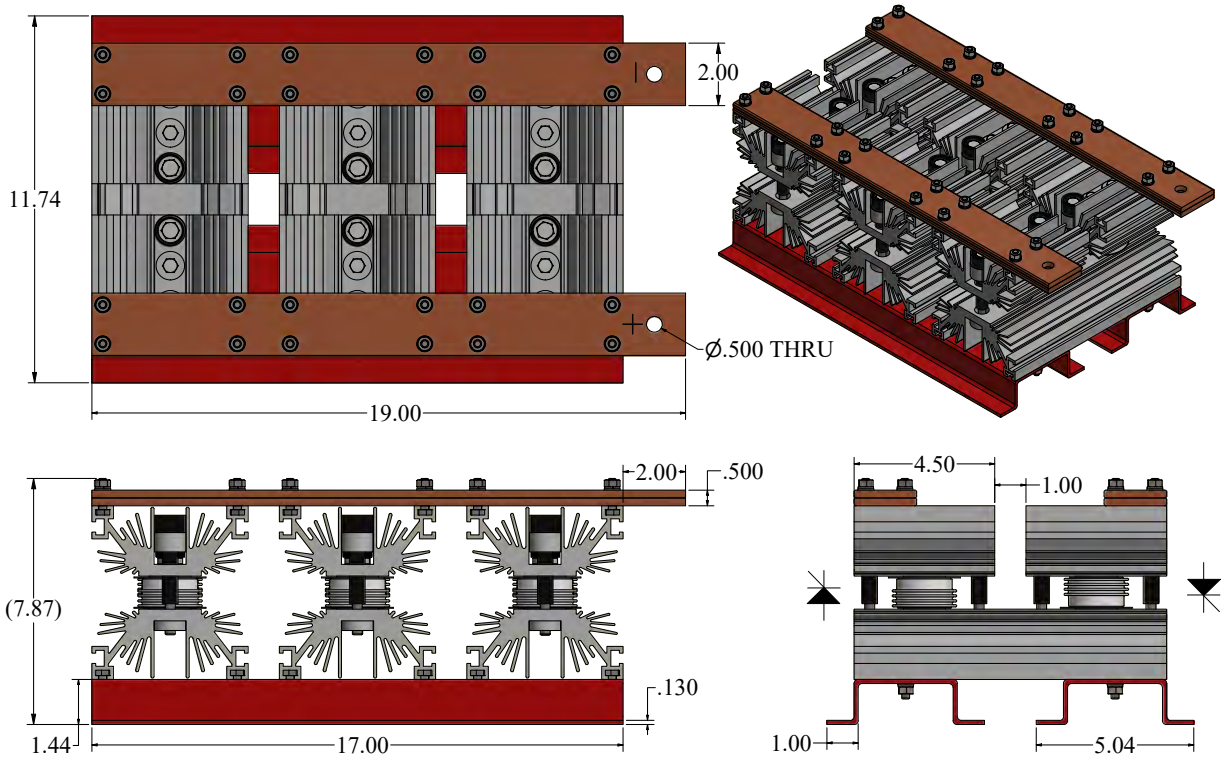
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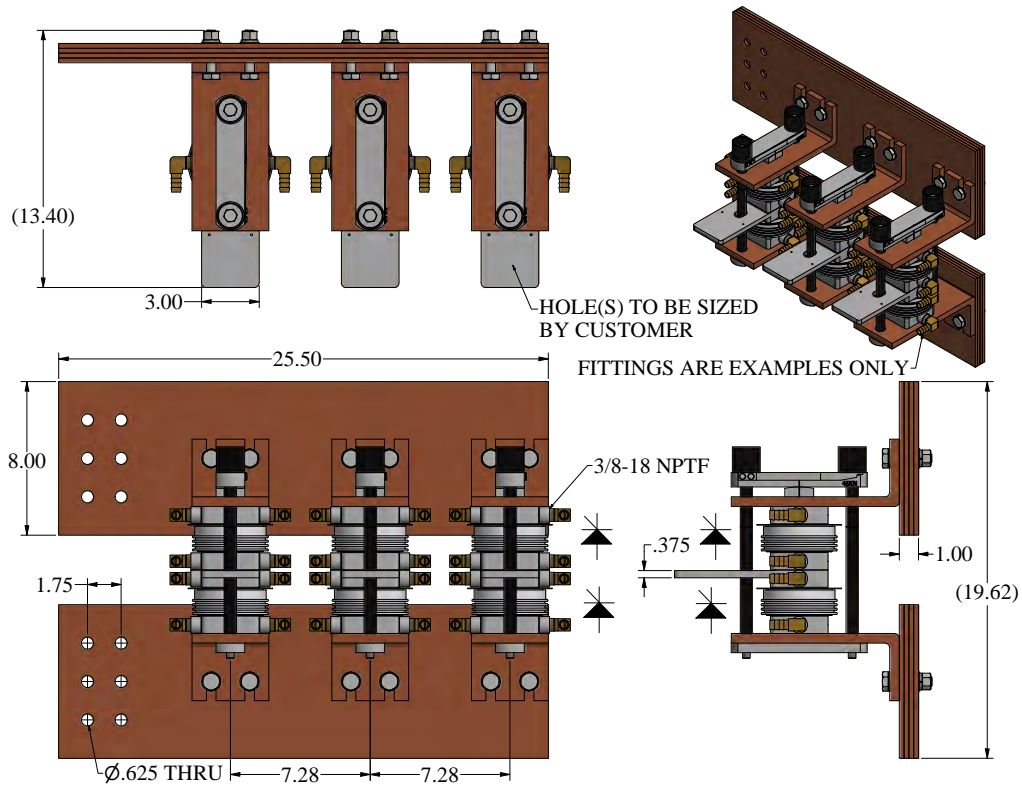
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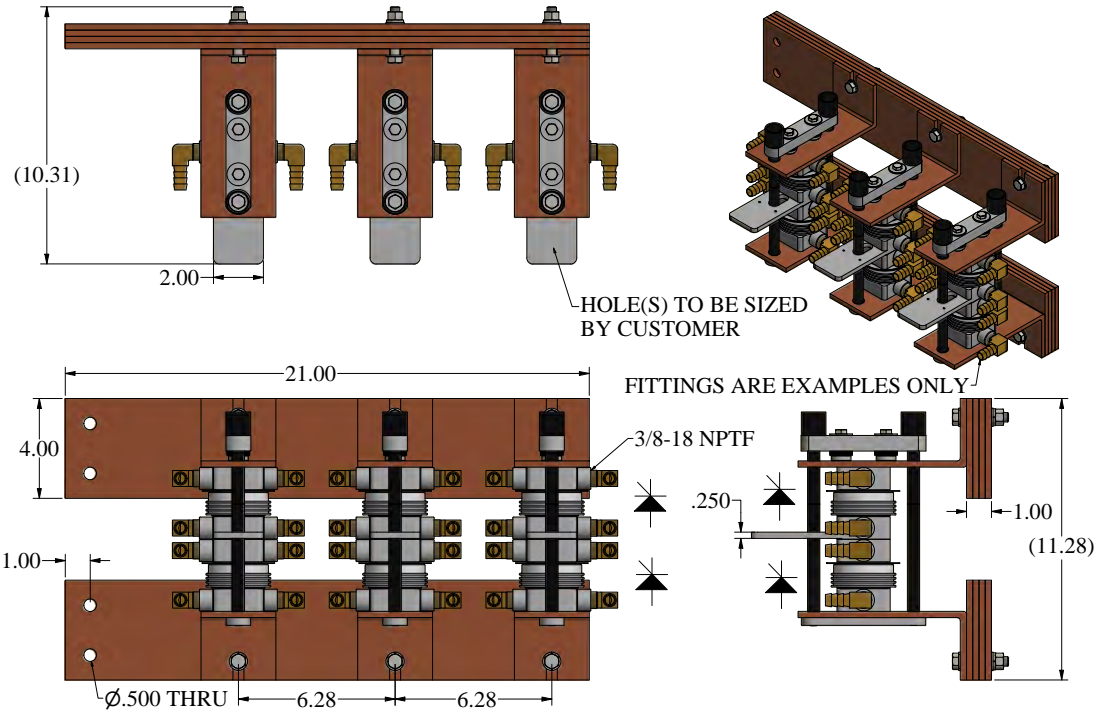
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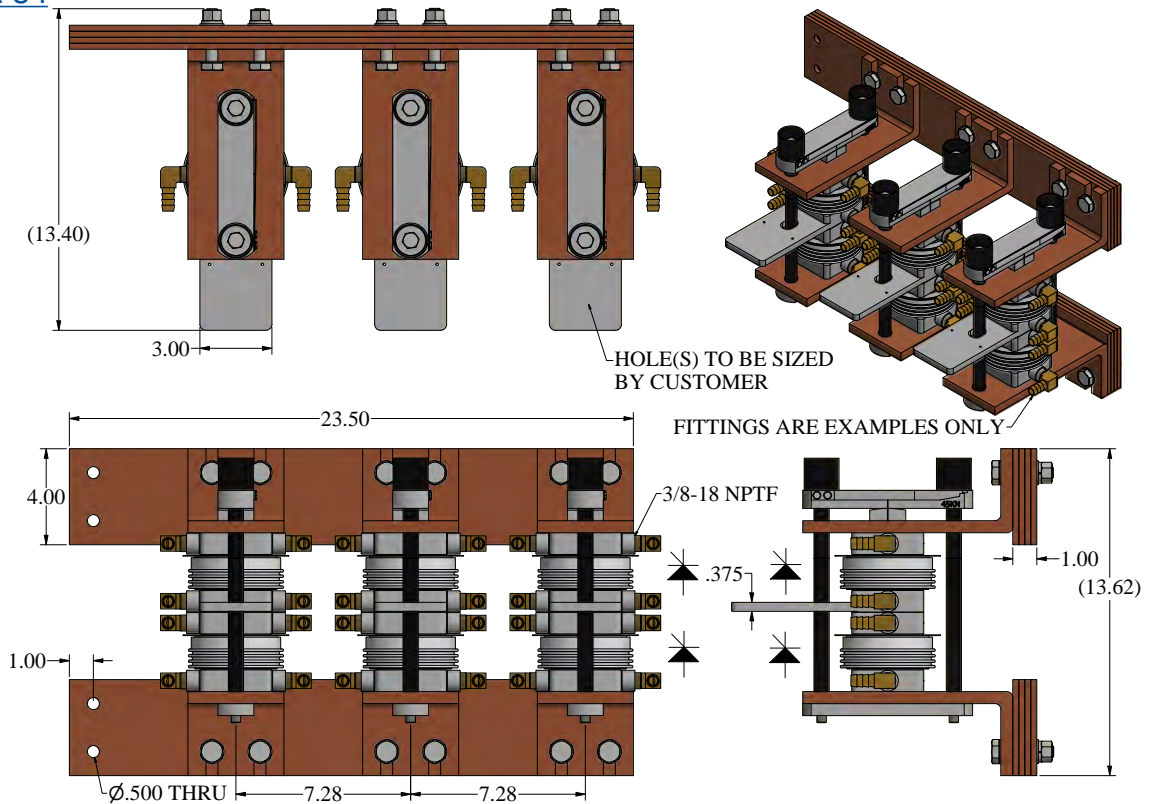
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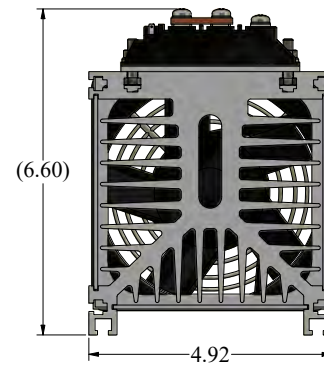
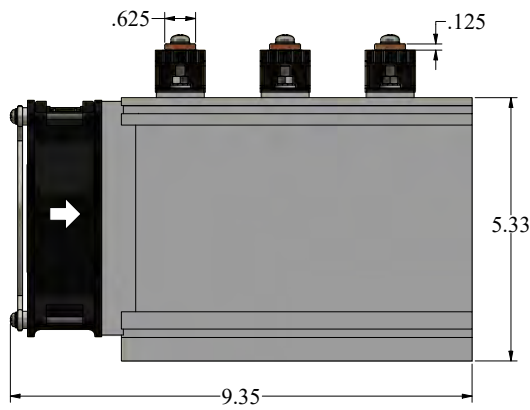
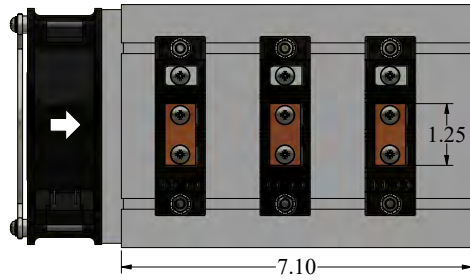
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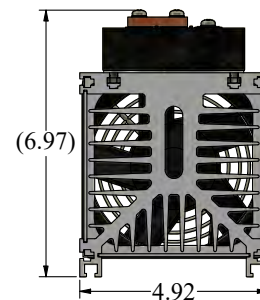
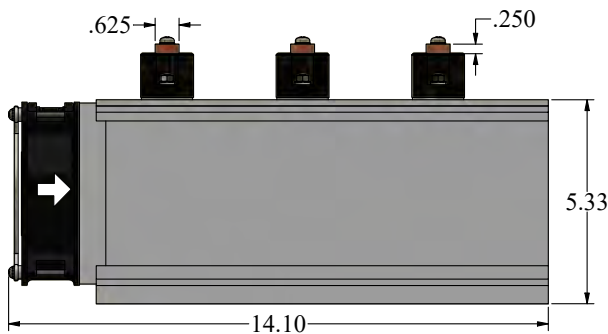
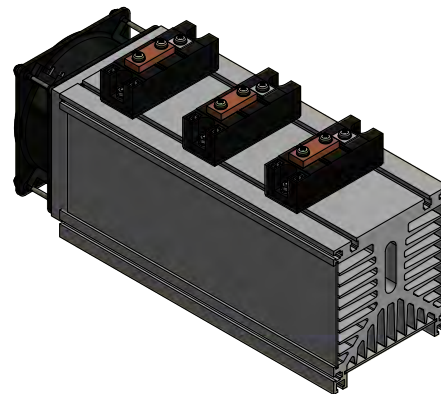
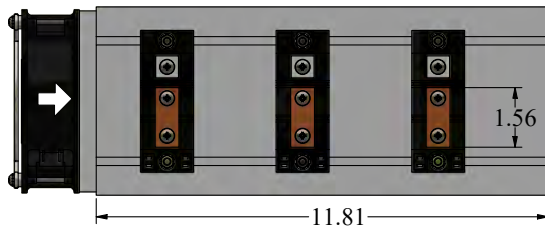
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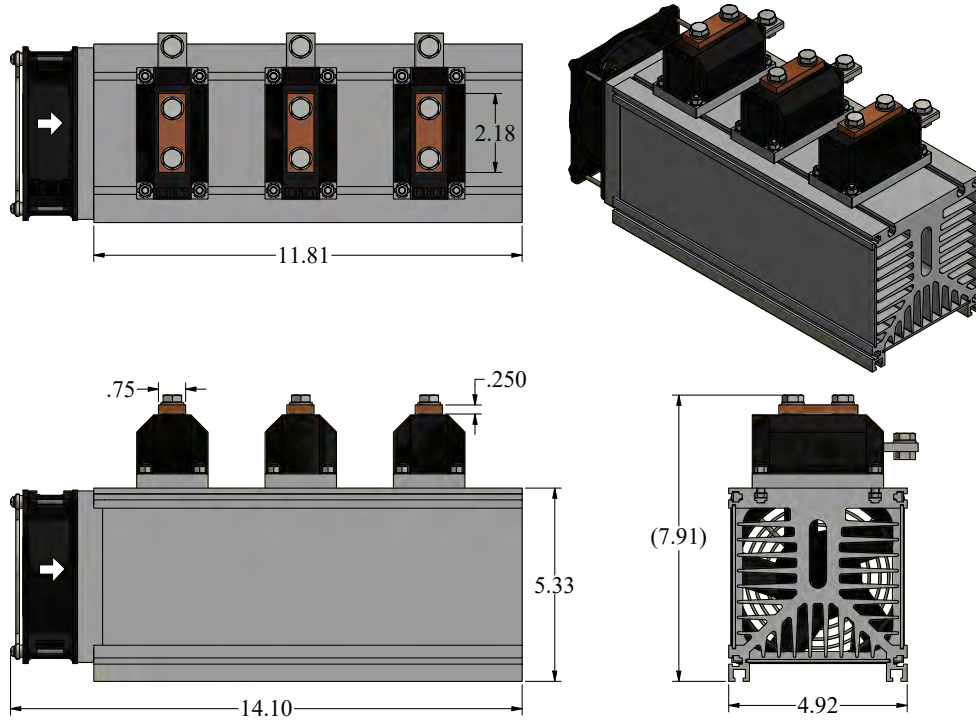
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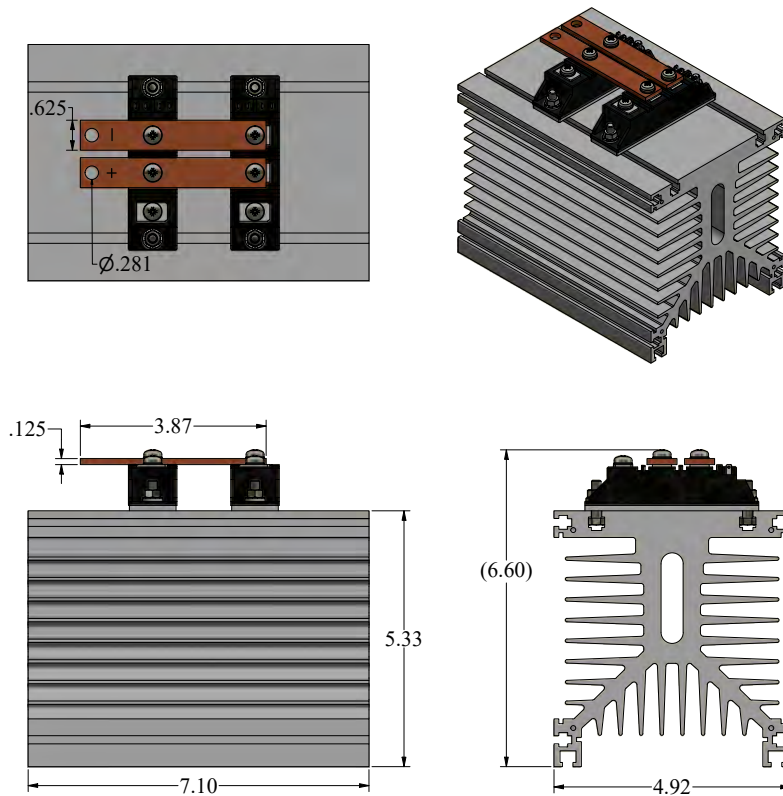
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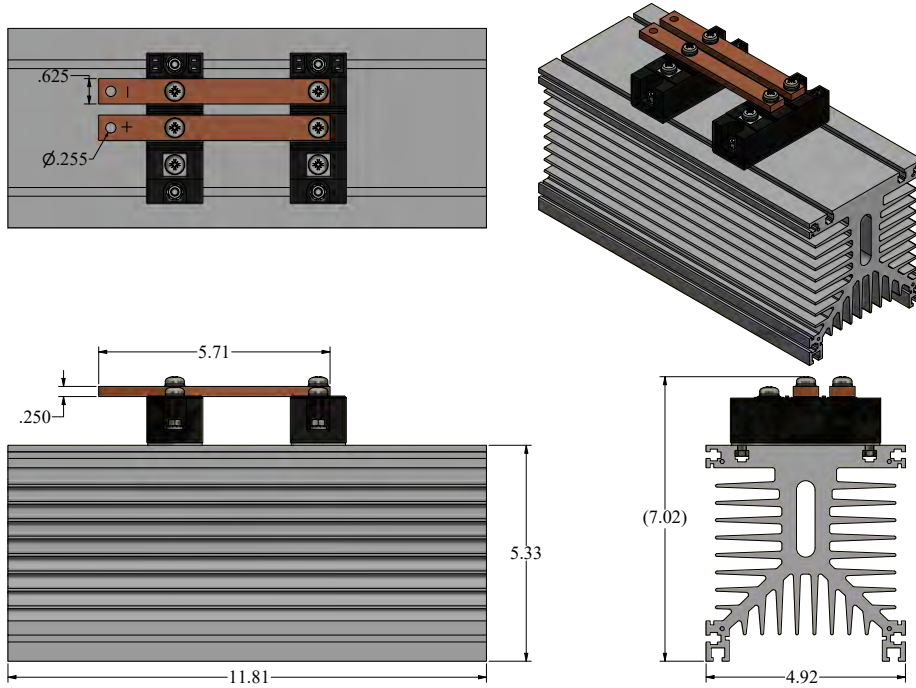
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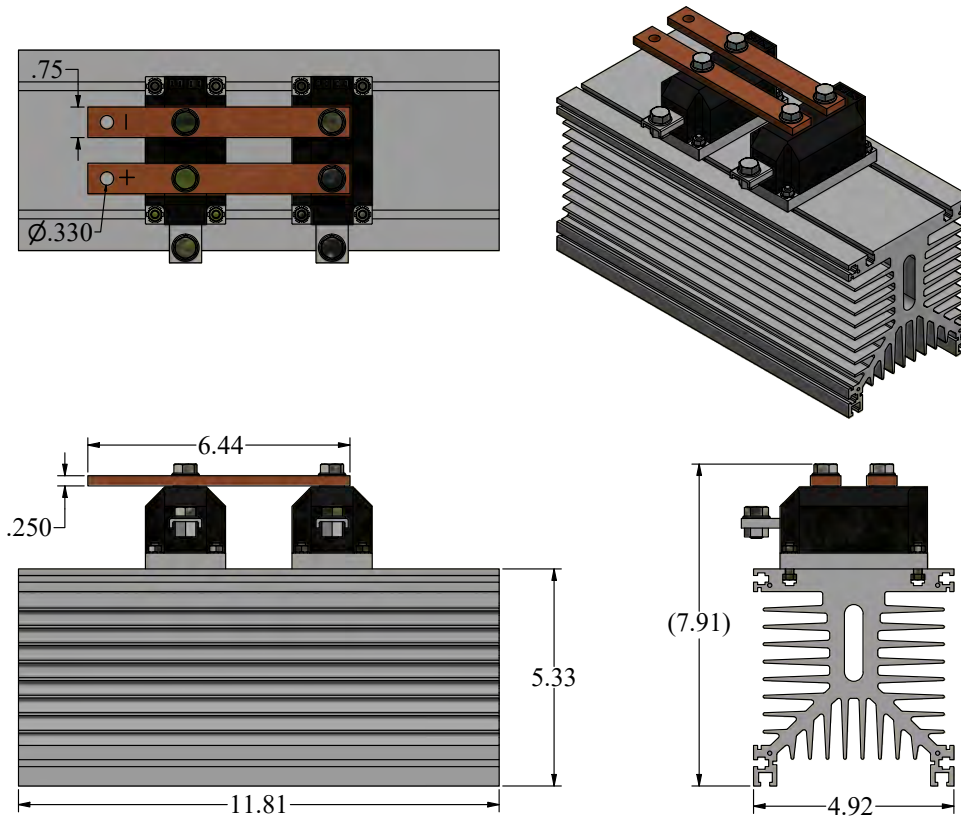
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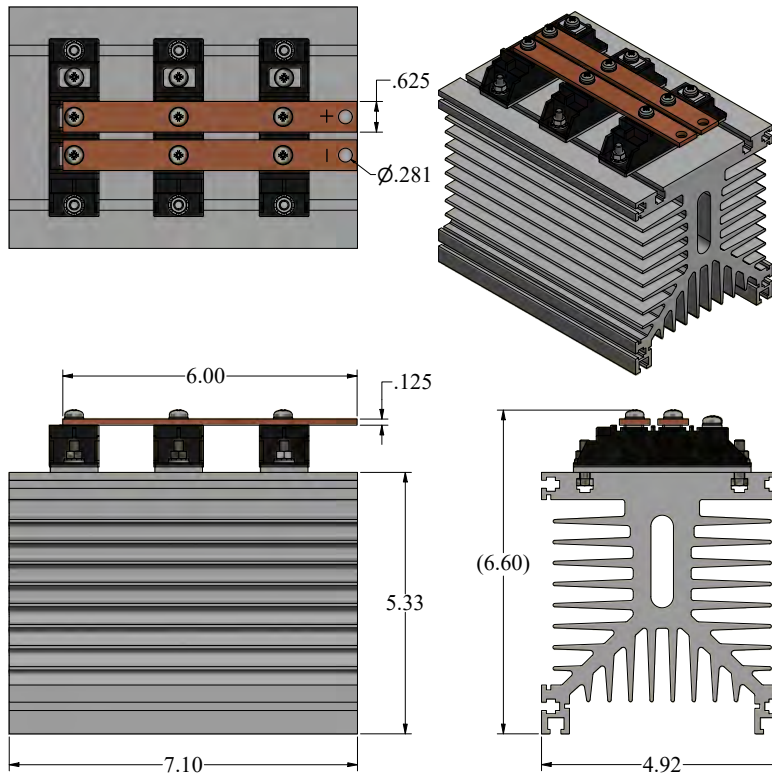
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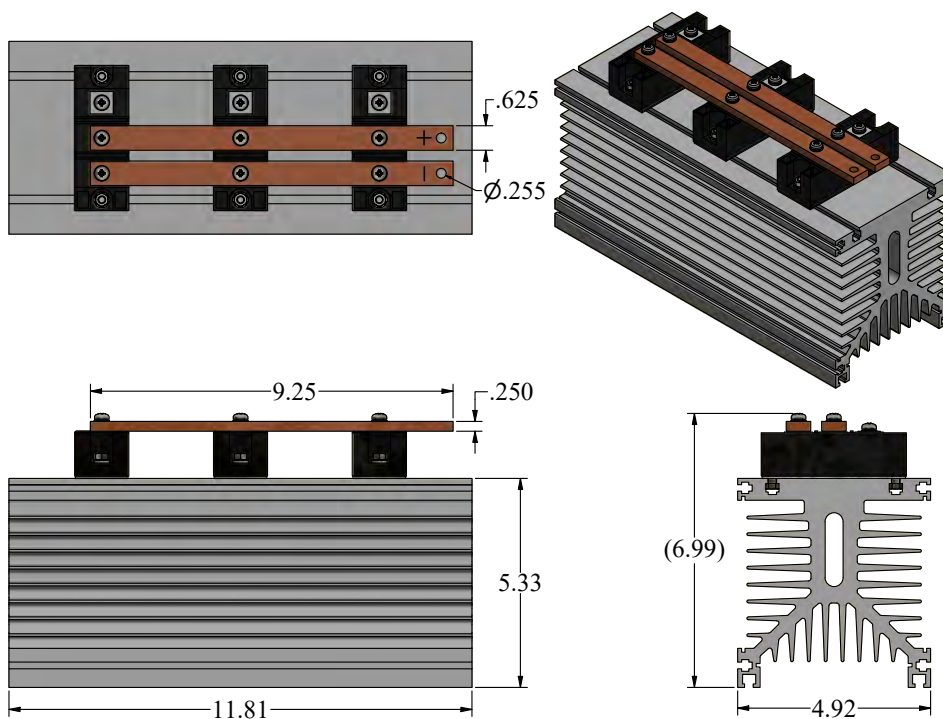
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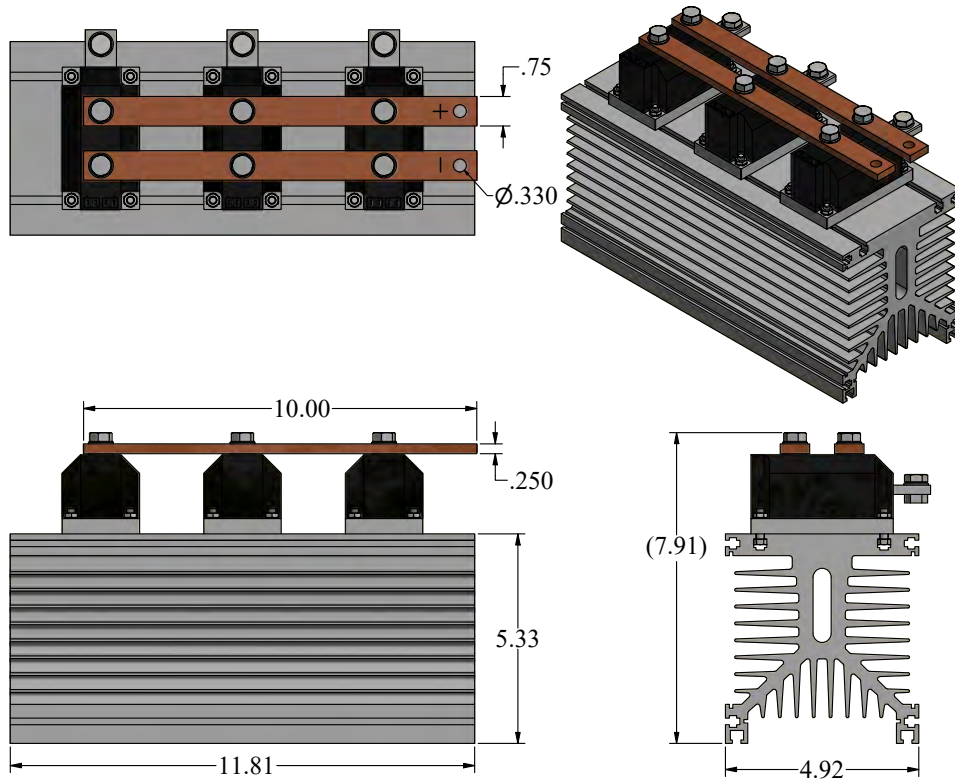
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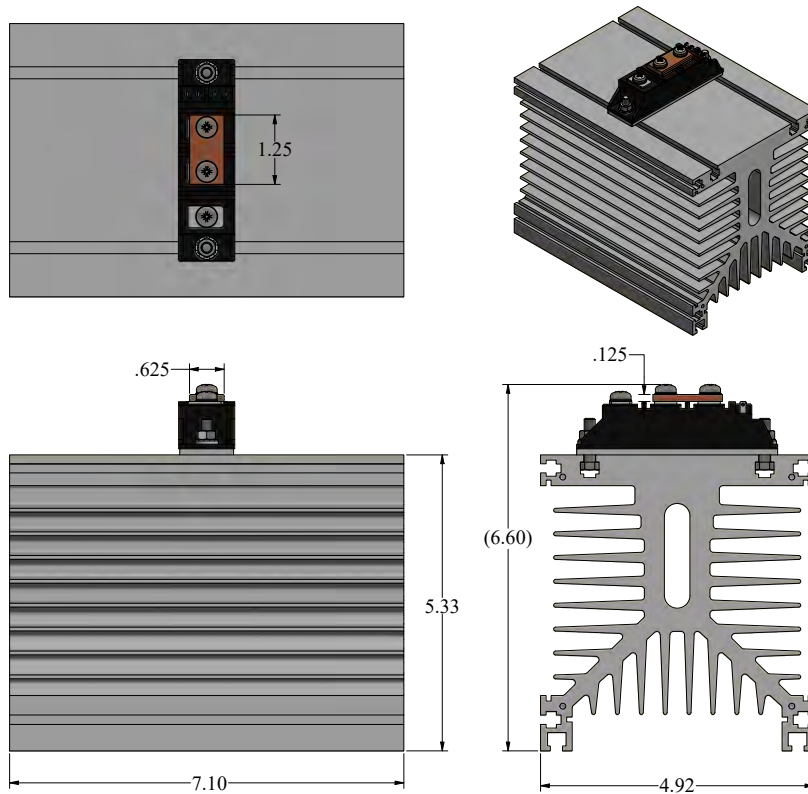
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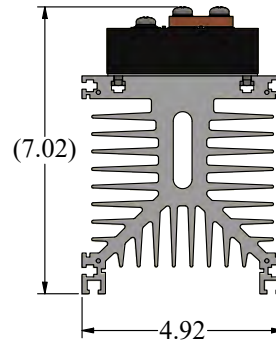
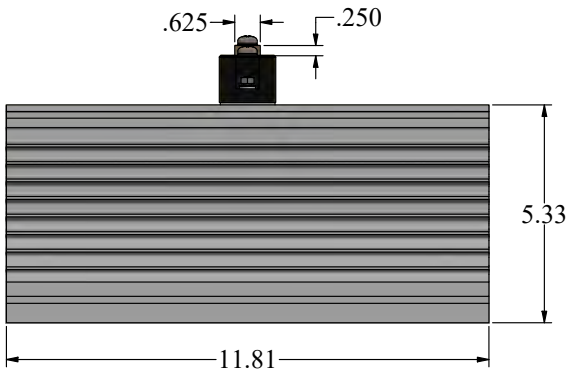
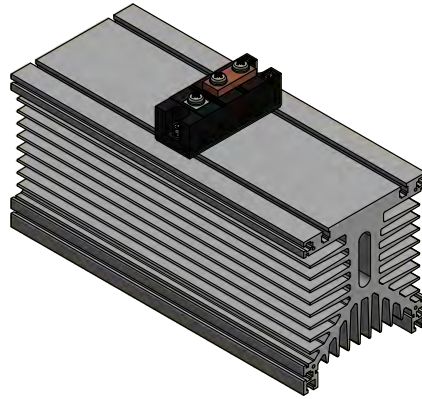
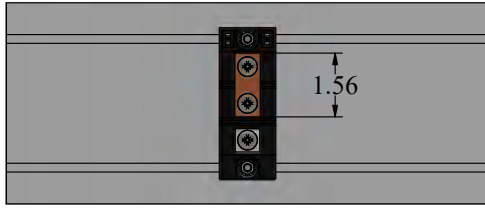
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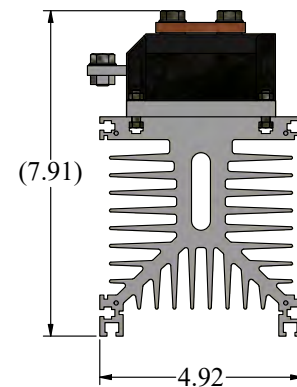
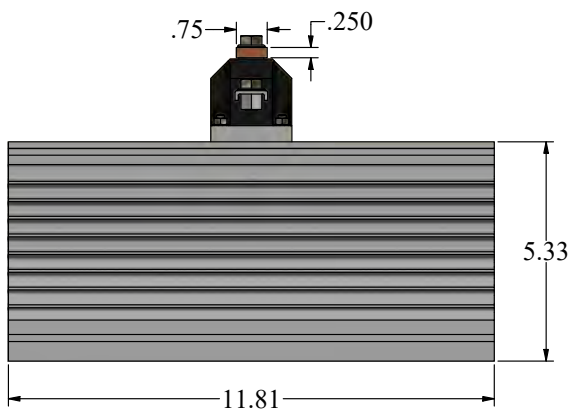
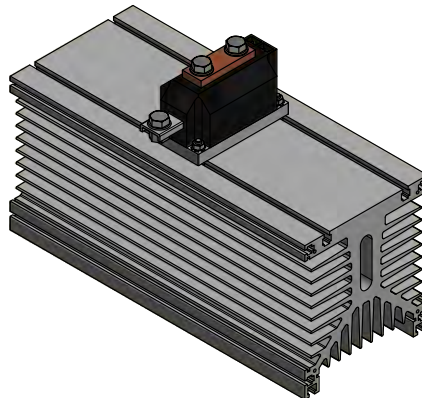
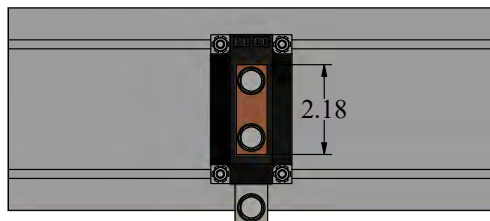
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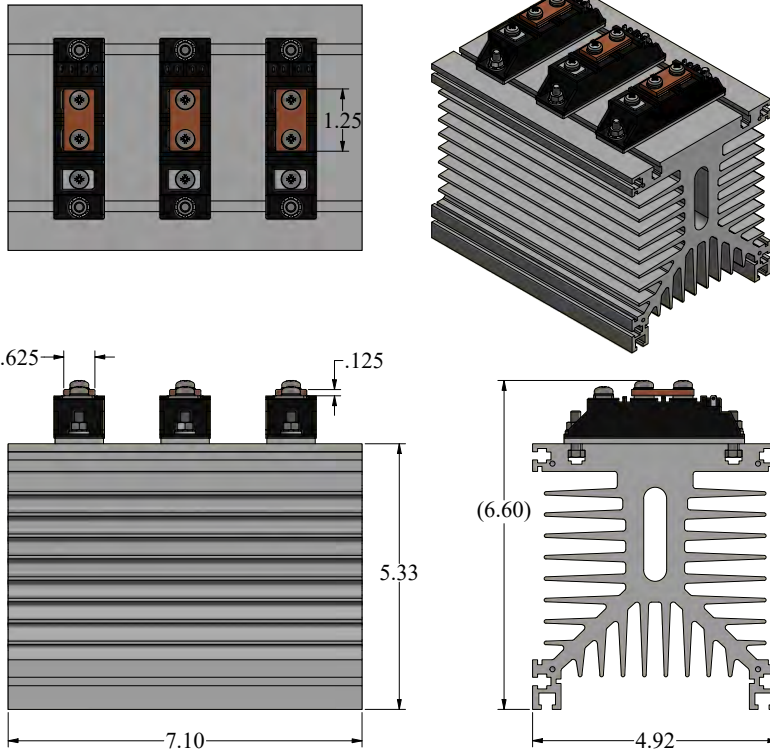
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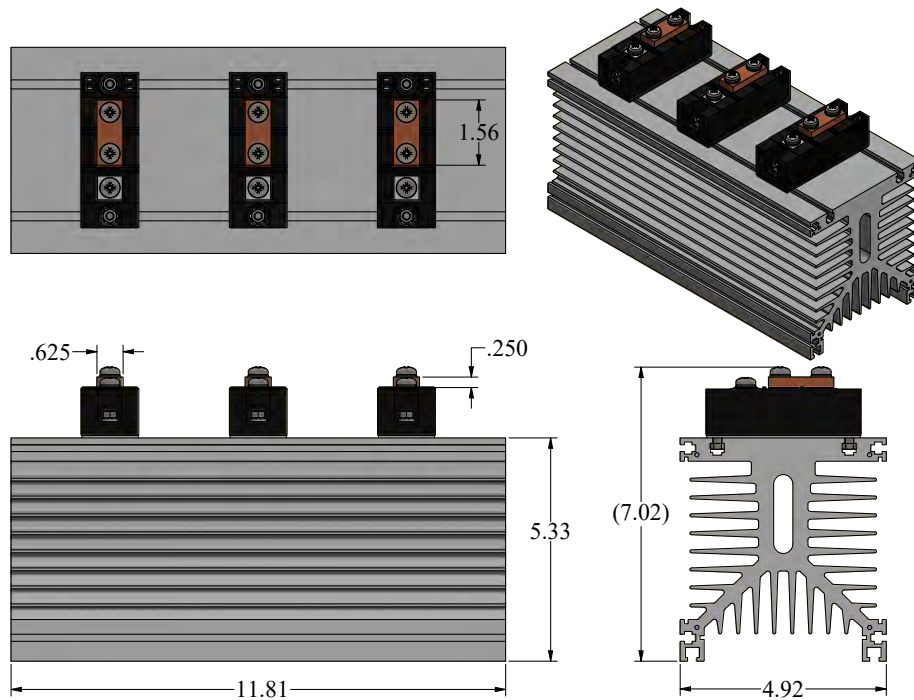
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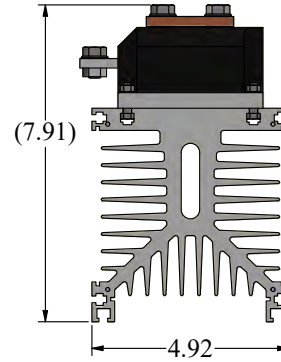
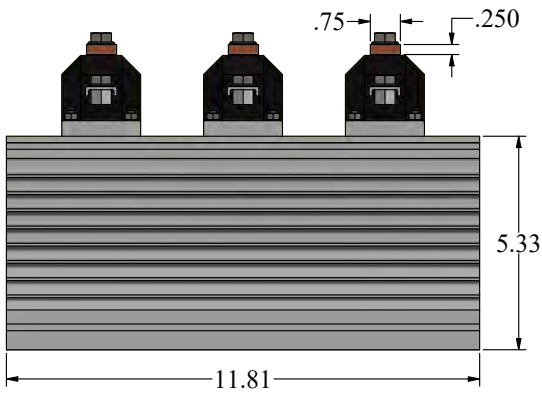
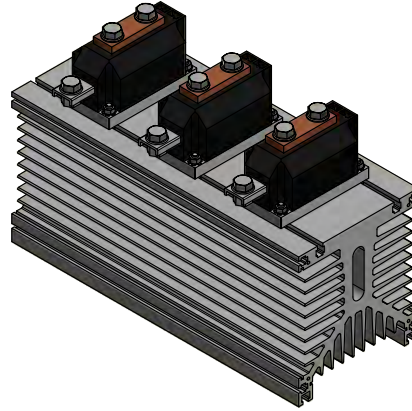
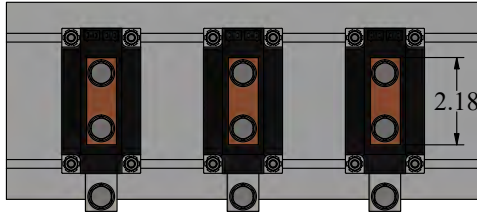
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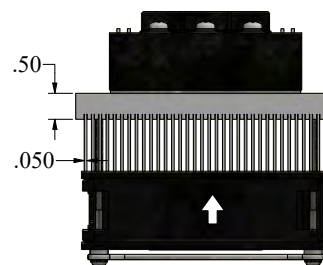
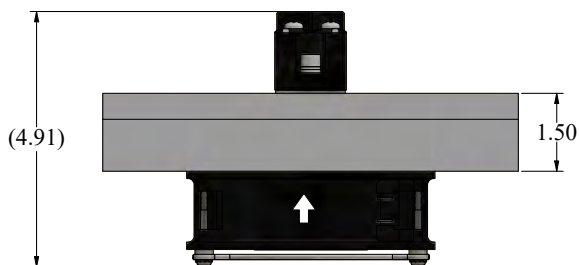
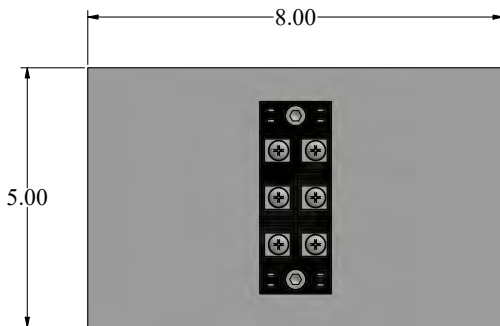
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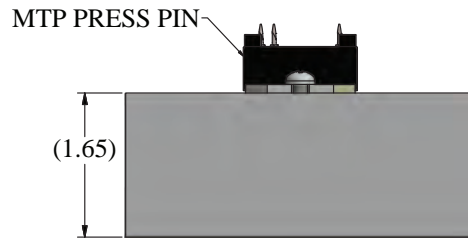
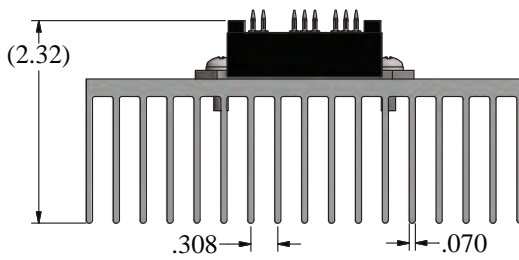
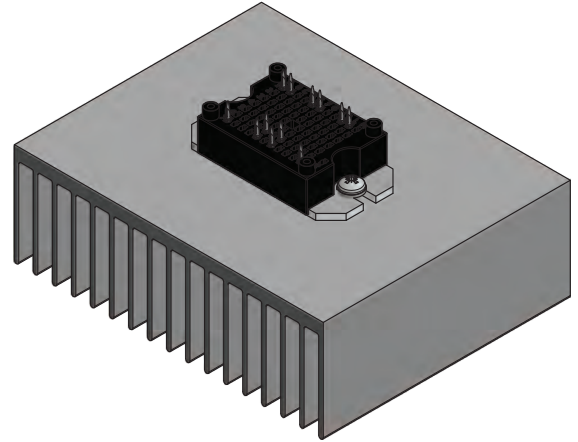
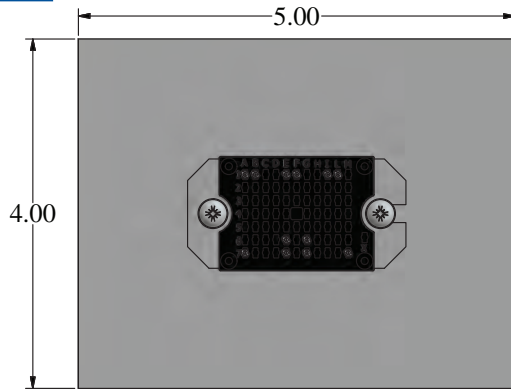
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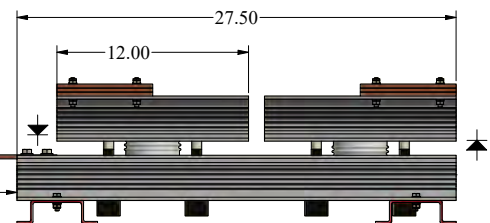
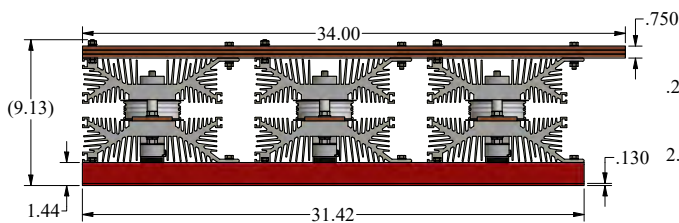
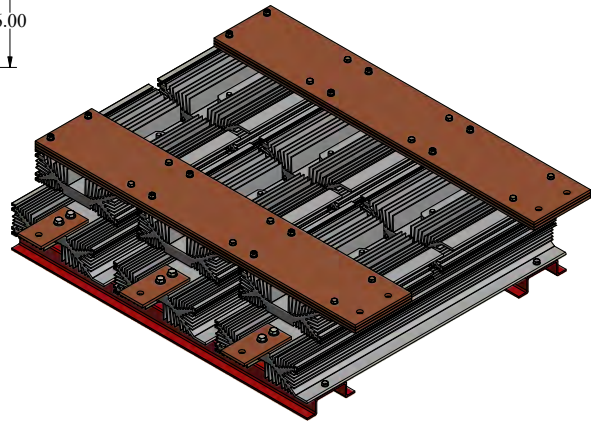
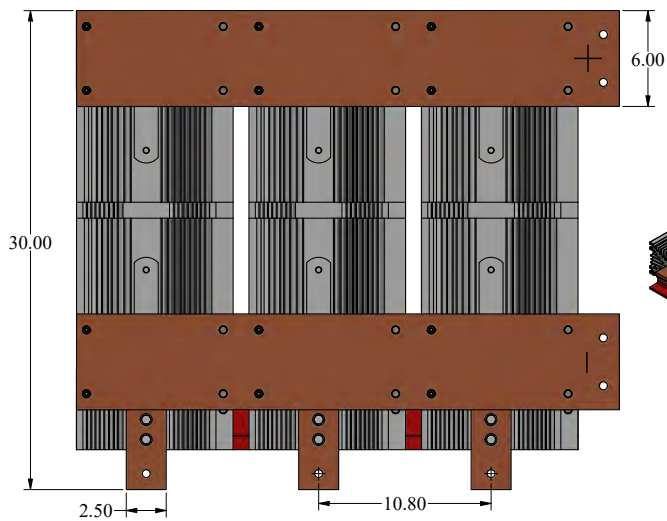
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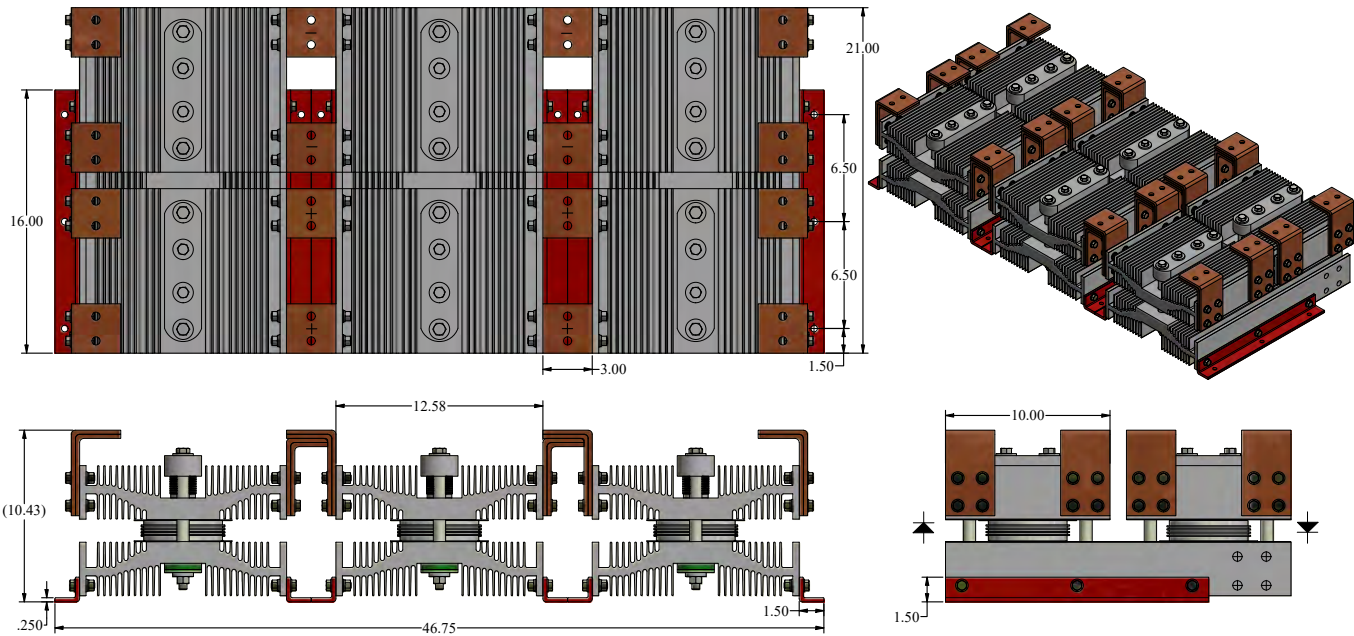
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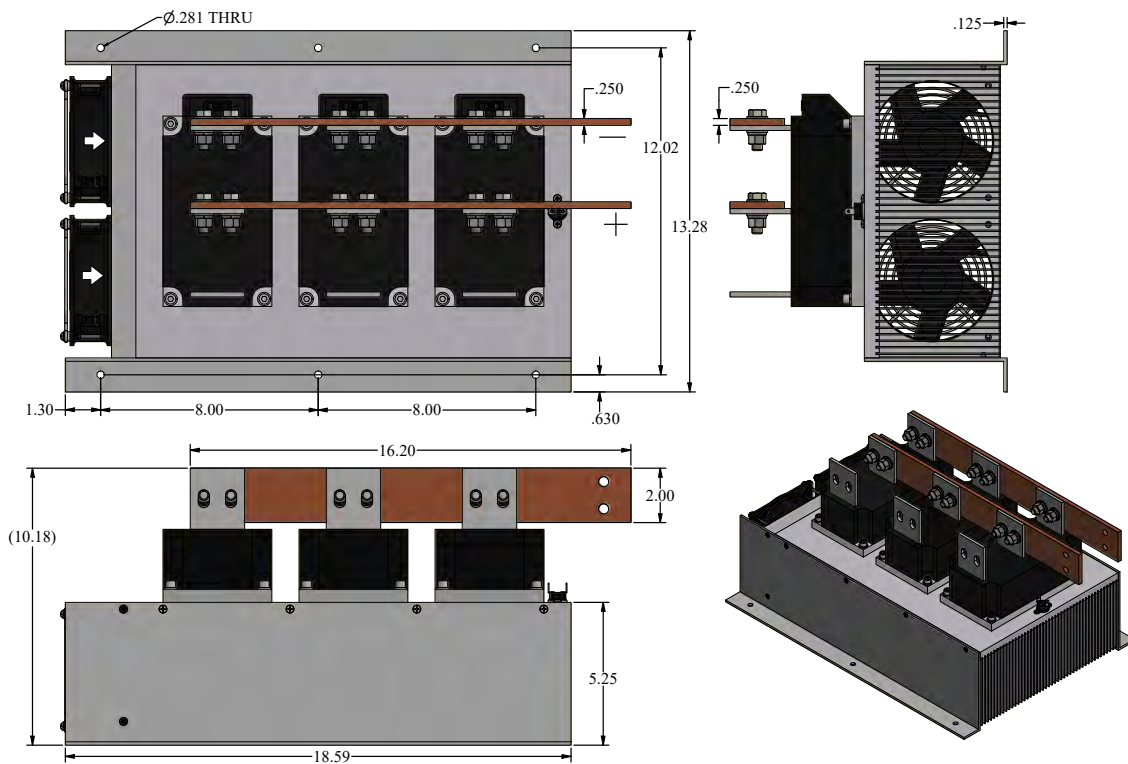
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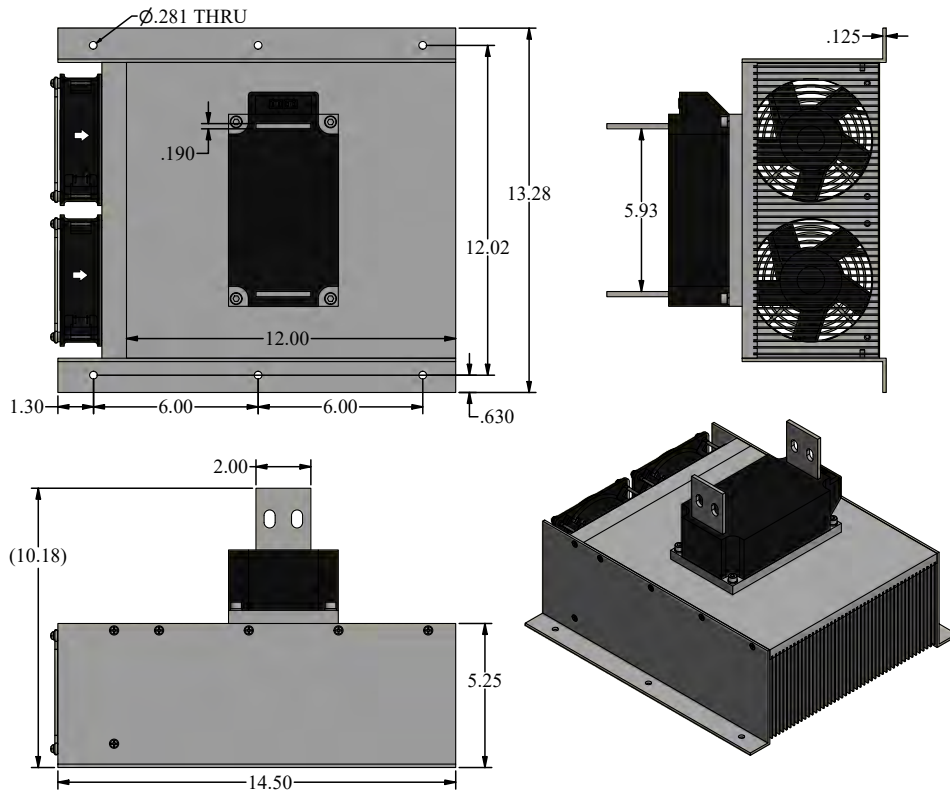
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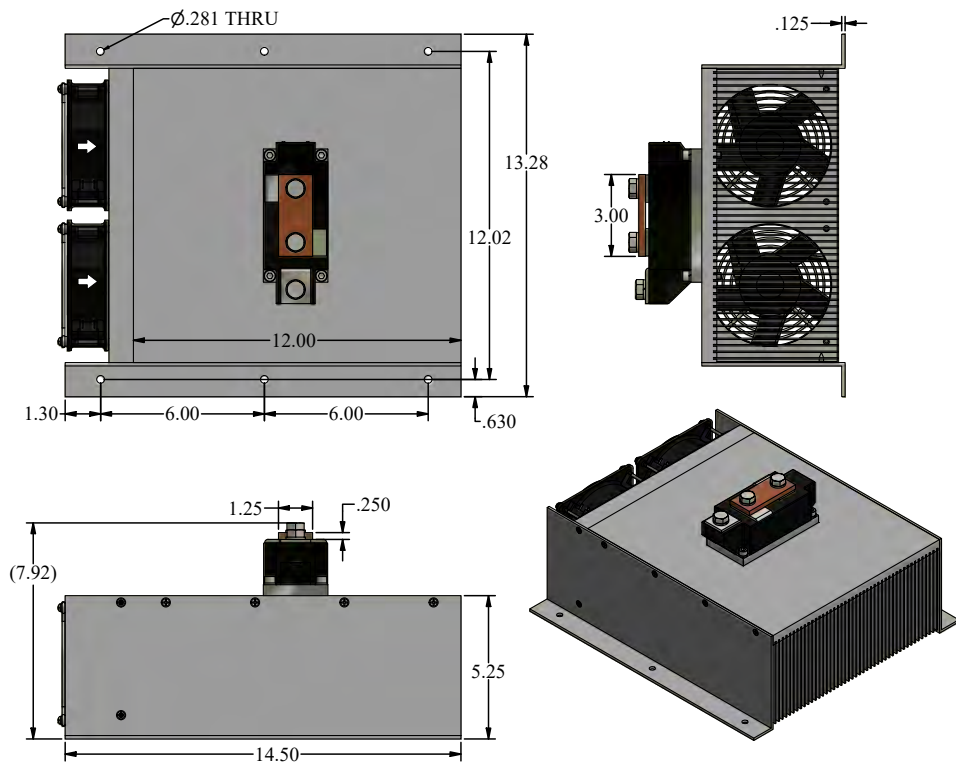
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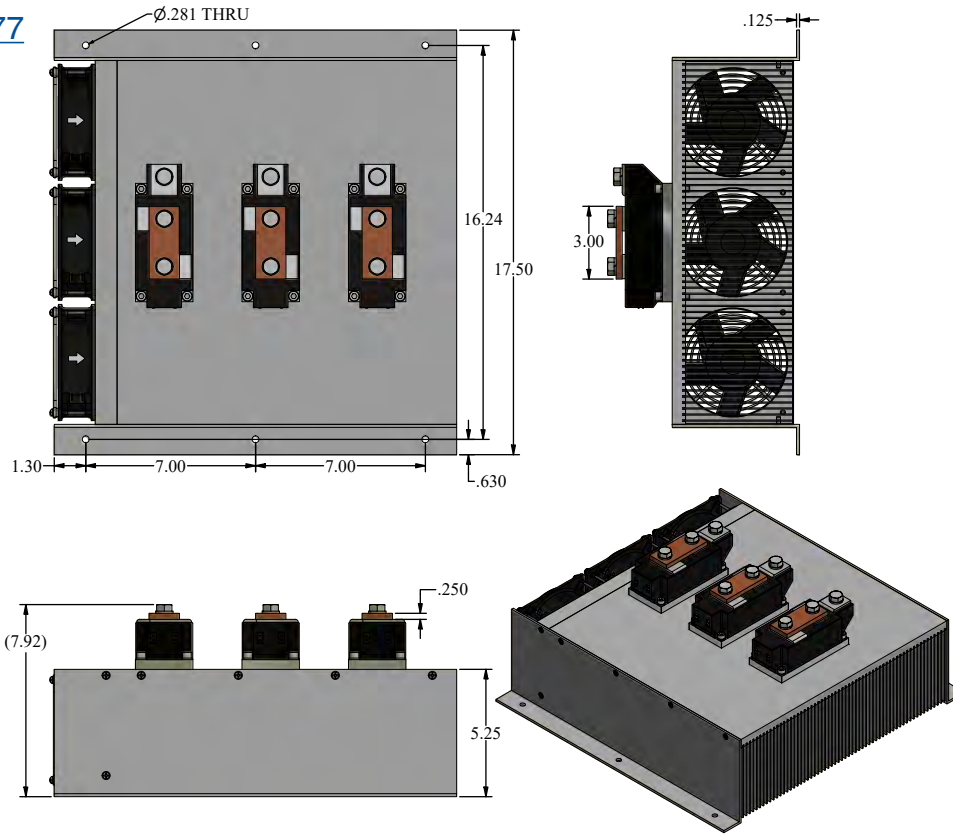
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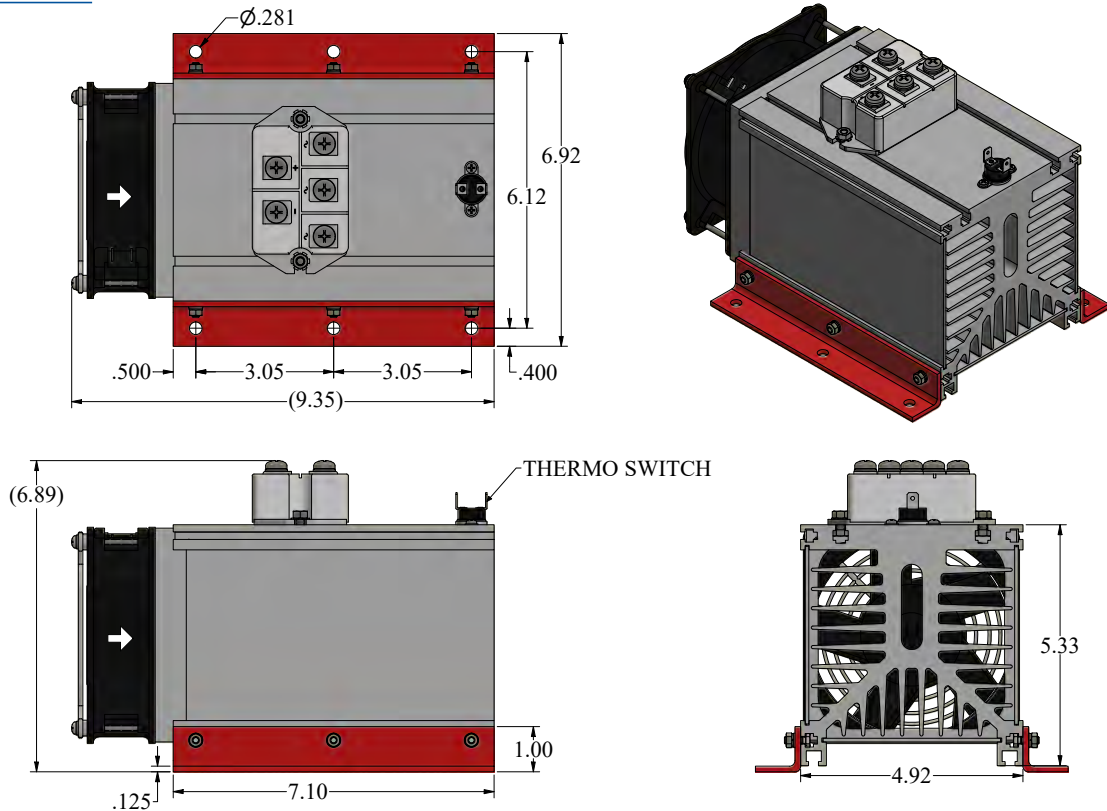
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CONTACT US
C&H Technology, Inc.

Phone: 952-933-6190
Toll Free: 800-274-4284
Fax: 952-933-6223

6121 Baker Road, Suite 108
Minnetonka, MN 55345

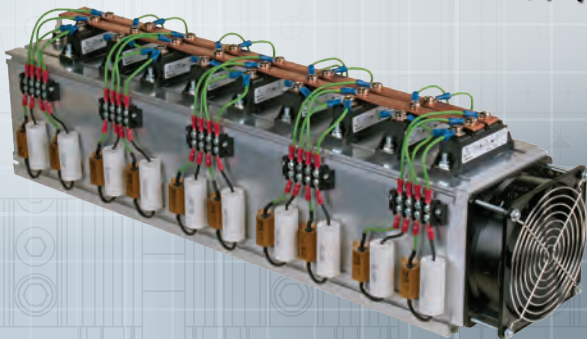
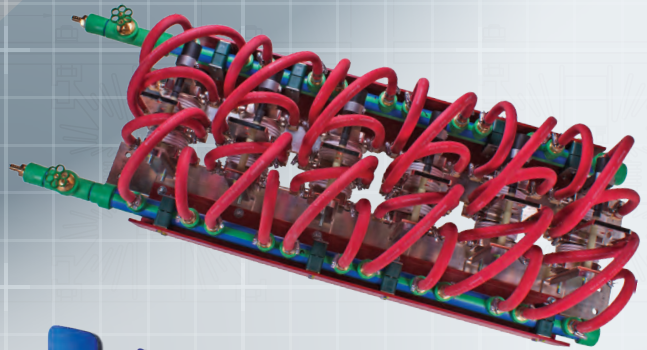
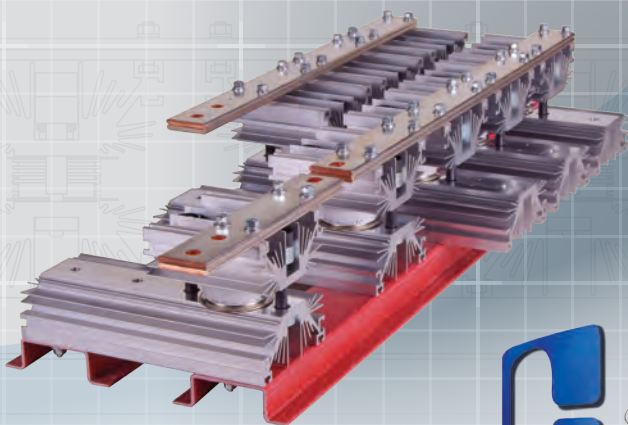
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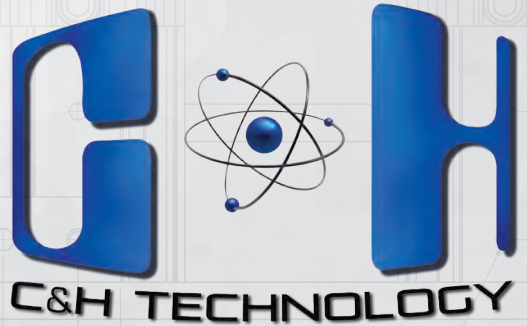


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