WORLD CLASS COOLING PRODUCTS

teca™

Leadership

TECA pioneered the market of solid-state air conditioners for elecronic enclosures. We have developed and manufactured thermoelectric cooling systems, for environments, as rugged as NEMA-4X, as demanding as the space shuttle, and as critical as nuclear power plants. We also offer liquid chillers and cold plates in several standard sizes.

Design Solutions

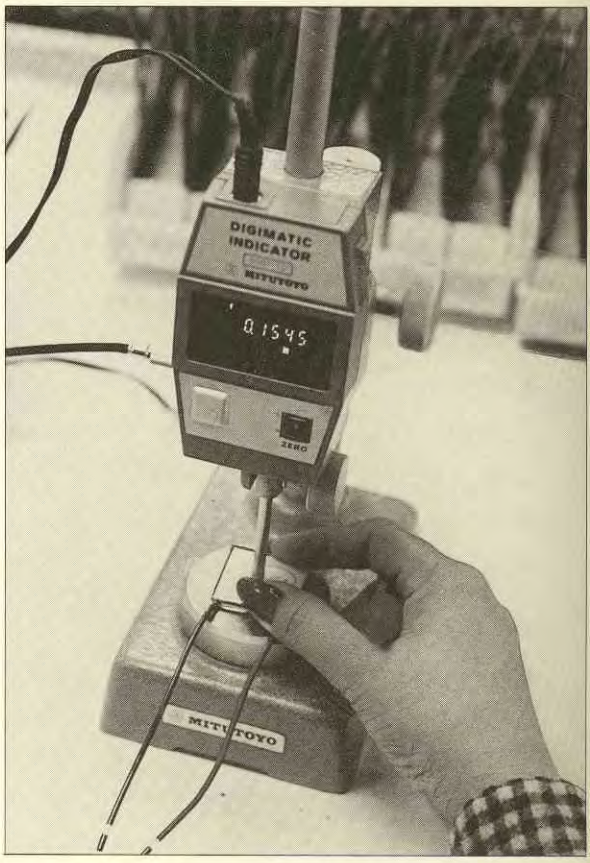
We have met the needs of the Original Equipment Market by offering complete engineering services, prototype development and custom built cooling equipment through an exclusive and confidential basis.

Total Quality Program

Continuous in-line and final quality assurance inspections are implemented. This insures that all components, throughout the assembly process, provide 100% quality for trouble-free operation.

Reliability

Our air conditioners have greatly reduced maintenance requirements. Since the cooling is based on solid-state technology, moving components that can clog or wear out are not required. All products we build are environmentally safe, unlike conventional refrigeration methods which use CFC's (chlorofluorocarbons), corrosive liquids and gases.



Whatever your application — we can fulfill all of your cooling requirements. Our engineers may have already developed a similar design solution. We are available to work with you to discuss your specifications. Together we will design and build a quality system that sets the highest standards in thermoelectric cooling. Call us at (312) 342-4900.
We'll take it from there.

teca™

Table of Contents

Product Selection Chart

		AHP-1801	AHP-1801X	AHP-1801HC	AHP-1801XHC	AHP-1700	AHP-1700HC	AHP-1200FF	AHP-1200FFHC	AHP-1201FF	AHP-1201FFHC	AHP-1200X	AHP-1200XHC	AHP-1000FF	AHP-1000FFHC	AHP-301FF	AHP-301FFHC
MODEL NO.																	
COOLING (BTU/HR)		1500	1500	1500	1500	1100	1100	600	600	600	600	600	600	560	560	200	200
HEATING (BTU/HR)				1360	1360		1360		620		680		680		680		340
HOT SIDE	LIQUID COOLED																
	AIR COOLED	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
COLD SIDE	LIQUID CHILLER																
	AIR CONDITIONER	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	COLD PLATE																
INPUT — **VOLTAGE**	12VDC												O				
	24VDC												O				
	30VDC					O		O									
	48VDC																
	115 VAC (50-60 Hz)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	230 VAC (50-60 Hz)	+	+	+	+					+	+					+	+
INPUT — **LOCATION**	INTERNAL (COLD SIDE)	+	+	+	+	X	X	+	+	+	+	+	+	+	+	+	+
	EXTERNAL (HOT SIDE)					+	+							X	X		
NEMA ENCLOSURE RATING MAINTAINED	12	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	4		+		+							+	+				
	4X		+		+							+	+				
TEMPERATURE CONTROL	TC-5F	+	+			X		+		+		+		X		X	
	TC-3F			+	+		+		+		+		+		+		+
	TC-2A	O	O			X		O									
	TC-3A			O	O		X		O								
	TC-4500 DC	O	O	O	O	X	X	O	O	O	O	O	O	X	X	X	X
MISCELLANEOUS	400 Hz	O	O	O	O	O	O	O	O	O	O	O	O			O	O
	DRIP PANS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	PLENUM (FLUSH MTG)	O		O		X	X	X	X	X	X			X	X	X	X

[1] *115 VAC FAN SUPPLIED WITH UNIT*

KEY

+ Stock (Standard)
O Custom (Made to Order)
X Option (Available)
* Adaptable (Consult Factory)

	AHP-300X	AHP-300FF	AHP-1000CP	AHP-1000CPHC	AHP-301CP	AHP-301CPHC	AHP-300CP	AHP-150	LHP-1700FF	LHP-1700FFHC	LHP-1702FF	LHP-1702FFHC	LHP-800FF[1]	LHP-300FF[1]	LHP-1700CP	LHP-1700CPHC	LHP-1702CP	LHP-1702CPHC	LHP-800CP	LHP-300CP	LHP-150	ALC-750	ALC-1200	ALC-1500
	240	240	560	560	225	225	265	125	1500	1500	1500	1500	750	290	1500	1500	1500	1500	750	300	135	750	1200	1500
				680		340				1360		1360				1360		1360						
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					O	O			O	O					+	+	+	+						
	*	*																						
		X							X	X	X	X												

Air Conditioner Sizing

To size an air conditioner, proceed with the following 12 steps... - an air cooled example has been provided.
(Choose either English or S.I. units)

STEP	DETERMINE	Air Cooled ENGLISH	Air Cooled S.I.	Liquid Cooled ENGLISH	Liquid Cooled S.I.	Example [Air Cooled 1" insulation]
1	Maximum Ambient Air Temperature (T_a)	°F	°C	°F	°C	120°F/50°C
2	Maximum Allowable Enclosure Air Temperature (T_e)	°F	°C	°F	°C	100°F/38°C
3	Maximum Inlet Coolant Temperature (T_L)			°F	°C	
4	Temperature Differential Air Cooled: $\triangle T=T_e-T_a$, Liquid Cooled: $\triangle T=T_e-T_L$ (ΔT)	°F	°C	°F	°C	-20°F/-12°C
5	Exposed Surface Area of Enclosure (Sa)	ft^2	m^2	ft^2	m^2	65ft^2/5.76m^2
6	Ambient Thermal Load (Use Equation 1 or TECA cooling design slide rule) (Q_a)	BTU/HR	W	BTU/HR	W	129.3 BTU/Hr 38.6 Watt
7	Internal Enclosure Load (Use Method 1, 2 or 3) (Q_e)	BTU/HR	W	BTU/HR	W	413 BTU/Hr 121 Watts
8	Total Load (Use Equation 2) (Q_t)	BTU/HR	W	BTU/HR	W	542.3 BTU/Hr 159.6 Watts

Equation 1

$$Q_a=x\ S_a(T_a-T_e)^y$$

EXAMPLE:

Q_a (Watts) = (.415) (5.76m^2) [(50(°C) - 38(°C)]$^{1.119}$ = 38.6 Watts

Q_a (BTU/hr) = (.073) (62 ft^2) [(120 (°F) - 100 (°F)]$^{1.119}$ = 129.3 BTU/Hr

To determine (x, y):

Approximation based on 1/16" carbon steel enclosure, assumes
K (Steel) = 22 BTU/Hr-Ft -°F
K (Urethane) = 0.15 BTU/Hr-Ft-°F

INSULATION THICKNESS	y	ENGLISH UNITS X	S.I. UNITS X
0"	1.272	.151	.859
1/2" (1.27 cm)	1.150	.104	.591
1" (2.54 cm)	1.119	.073	.415
2" (5.08 cm)	1.083	.050	.281

Method 1

Measure the electrical power into the enclosure and subtract the electrical power out to determine the electrical power generated inside the enclosure.

EXAMPLE:

Qi = (115v) (36.3A) = 4180W
Qo = (48v) (84.5A) = 4059W
Qe = Qi - Qo = 4180-4059 = 121 W

Qi (Power in) → Qe → Qo (Power out)

Method 2

If power cannot be measured directly, add the rated operating power values of all heat generating components as specified by the manufacturer.

Method 3

Measure the steady-state temperature rise from ambient to internal with the enclosure completely sealed. Substitute this value into equation 1 to estimate Qe. (Assume Qe=Qa)

Equation 2

Qt = Qa + Qe + Qmisc; where Qmisc = radiated or solar loads

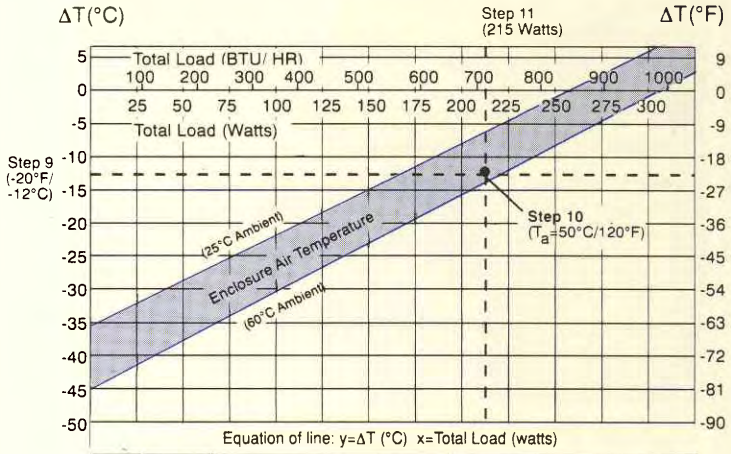
EXAMPLE:

Qt (watts) = 38.6 + 121 + 0 = 159.6 (Watts)
Qt (BTU/HR) = 129.3 + 413 + 0 = 542.3 (BTU/HR)

Using Performance Curves

STEP	
9	Using the result from step 4, extend a horizontal line from ΔT line (vertical axis).
10	Place a point near the maximum ambient temperature determined from step 1.
11	Extend a vertical line through the point, (from step 10), to intersect the ambient temperature line (horizontal axis) - This will determine the cooling capacity of this particular system, under the defined temperature constraints.
12	If the value obtained in step 11 > Qt, try the next smaller unit, if the value obtained is < Qt try the next larger unit.

Performance Curve: AHP-1801X



Equation of line: y=ΔT (°C) x=Total Load (watts)

	115 VAC		230 VAC	
AMBIENT	25°C	60°C	25°C	60°C
ENCLOSURE	y=.137x-35.8	y=.143x-41.0	y=.136x-38.1	y=.147x-45.2
COLD SINK	y=.112x-37.4	y=.110x-43.0	y=.104x-38.9	y=.113x-46.1

Conversions

Units of Length

Unit	Inches	Feet	Centimeters	Meters
Inch	1	.08333	2.54	.0254
Foot	12	1	30.48	.3048
Cm	0.3937	.03218	1	0.01
Meter	39.37	3.2808	100	1

Units of Area

Unit	Square Inches	Square Feet	Square Centimeters	Square Meters
Sq. In.	1	.006944	6.45162	.000645
Sq. Ft.	144	1	929.034	.092903
Sq. Cm	0.155	.001076	1	.0001
Sq. M	1550	10.7639	10,000	1

Units of Temperature

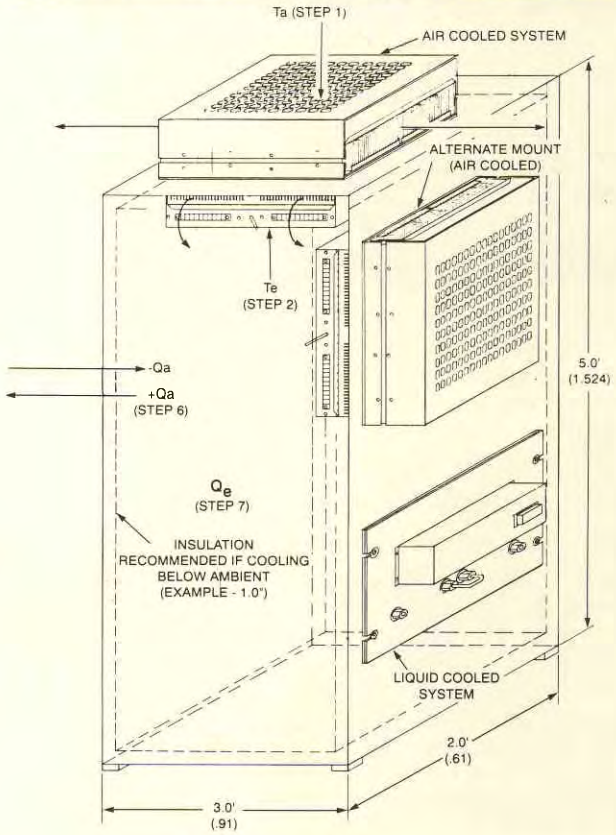
$[^9/_5 \times °C] + 32 = °F$, $^5/_9 (°F - 32) = °C$

$^9/_5 \times \triangle°C = \triangle°F$, $^5/_9 \times \triangle°F = \triangle°C$

Units of Power

1 Watt = 3.414 BTU/HR
1 BTU/HR = .2929 Watts
1 Horsepower = 746 Watts
WATT = Voltage x Current

Typical Mounting Configuration



Step 5 Sa= 2 [5 x 3] + 2 [3 x 2] + 2 [5x2] = 62 ft²
2 [1.524 x .91] + 2 [.91 x .61] + 2 [1.524 x .61] = 5.74 m²

NOTE: DIMENSIONS IN FEET (METERS)

Theory of Operation

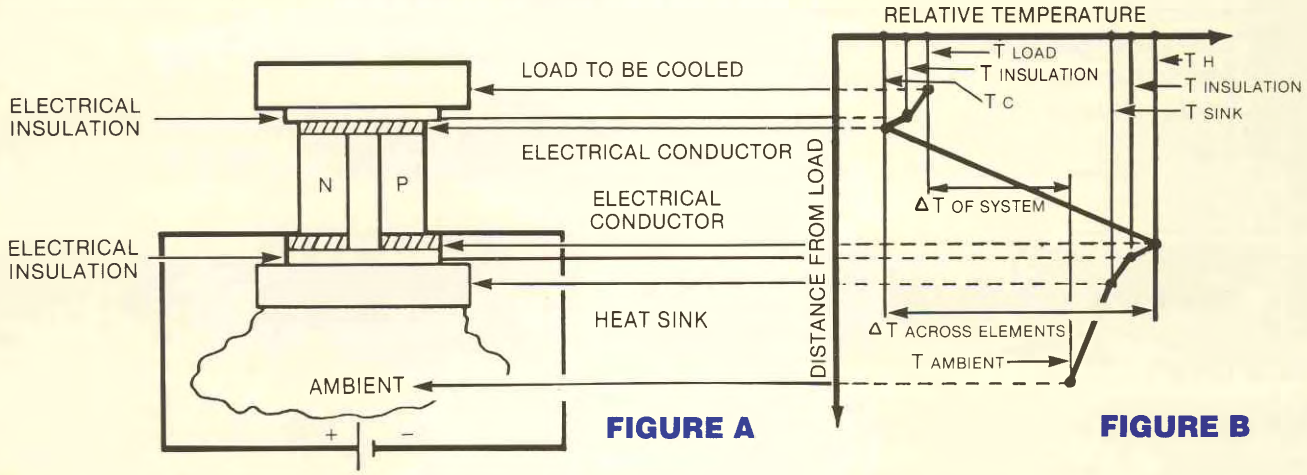
Thermoelectric cooling, or as it is sometimes called, "The Peltier Effect," is a phenomenon discovered by a French watchmaker during the early 19th century. It is described as a solid-state method of heat transfer generated primarily through the use of dissimilar semiconductor materials. To understand the cooling method, it is first necessary to know how thermoelectric cooling systems differ from their conventional refrigeration counterparts.

Like conventional refrigeration, thermoelectrics obey the basic laws of thermodynamics. Both in result and principle, then, thermoelectric cooling has much in common with conventional refrigeration methods – only the actual system for cooling is different.

Perhaps the best way to show the differences in the two refrigeration methods is to describe the systems themselves. In a conventional refrigeration system, the main working parts are the evaporator, condenser, and compressor. The evaporator surface is where the liquid refrigerant boils, changes to vapor and absorbs heat energy. The compressor circulates the refrigerant and applies enough pressure to increase the temperature above ambient level. The condenser helps discharge the absorbed heat into the ambient air.

In thermoelectric refrigeration, essentially nothing has changed. The refrigerant in both liquid and vapor form is replaced by two dissimilar conductors. The cold junction (evaporator surface) becomes cold through absorption of energy by the electrons as they pass from one semiconductor to another, instead of energy absorption by the refrigerant as it changes from liquid to vapor. The compressor is replaced by a DC power source which pumps the electrons from one semiconductor to another. A heat sink replaces the conventional condenser fins, discharging the accumulated heat energy from the system.

The difference between the two refrigeration methods, then, is that a thermoelectric cooling system refrigerates without use of mechanical devices, except perhaps in the auxiliary sense, and without refrigerant.



Thermoelectrics (Def): Semiconductor materials with dissimilar characteristics are connected electrically in series and thermally in parallel, so that two junctions are created (Figure A).

The semiconductor materials are N and P type, and are so named because either they have more electrons than necessary to complete a perfect molecular lattice structure (N-type) or not enough electrons to complete a lattice structure (P-type). The extra electrons in the N-type material and the holes left in the P-type material are called " carriers" and they are the agents that move the heat energy from the cold to the hot junction.

Heat absorbed at the cold junction is pumped to the hot junction at a rate proportional to carrier current passing through the circuit and the number of couples. Good thermoelectric semiconductor materials such as bismuth telluride greatly impede conventional heat conduction from hot to cold areas, yet provide an easy flow for the carriers. In addition, these materials have carriers with a capacity for carrying more heat.

Heat Sinks:

The design of the heat exchanger is a very important aspect of a good thermoelectric system.

Figure B illustrates the steady-state temperature profile across a typical thermoelectric device from the load side to the ambient. In figure B, the total steady-state heat which must be rejected by the heat sink to the ambient may be expressed as follows:

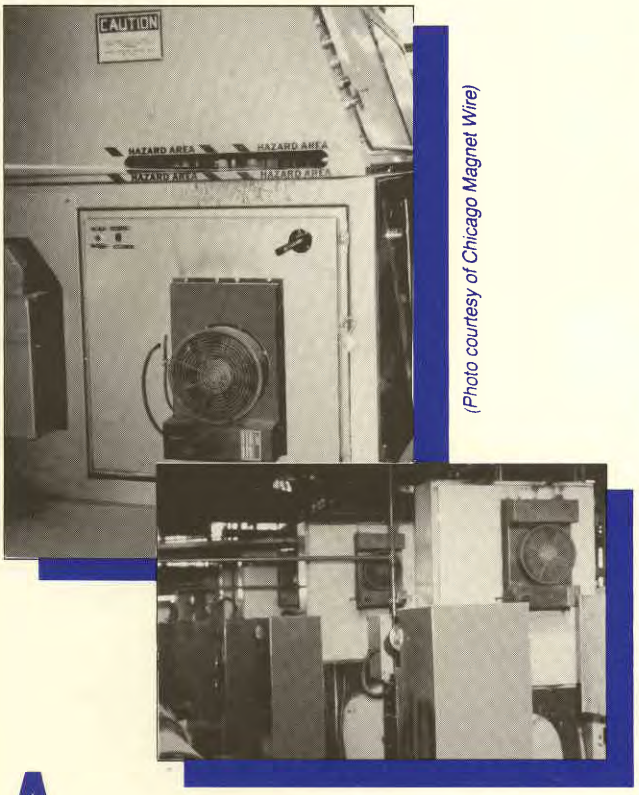
$$\text{Heat Rejected } (Q_s) = \text{Heat Absorbed From the Load } (Q_c) + \text{Power Input } (V \cdot I) + \text{Heat Leakage } (Q_1)$$

If the heat sink is not capable of rejecting the required Qs from the given system, the temperature of the entire system will rise and the cold junction temperature will increase. If the thermoelectric current is increased to maintain the load temperature, the COP (coefficient of performance) tends to decrease. Thus, a good heat sink contributes to improved COP.

Energy may be transferred to or from the thermoelectric system by three basic modes: conduction, convection, and radiation. The values of Qc and Q1 may easily be estimated; their total along with the power input gives Qs, the energy the hot-junction heat sink must dissipate.

Applications

There are many successful users of thermoelectric cooling systems. Here are a few examples you may find helpful...



(Photo courtesy of Chicago Magnet Wire)

A manufacturer of wire and coil products uses several solid state air conditioners to maintain safe operating temperatures for control and process equipment.

(Photo courtesy of Seabrook Medical Systems)

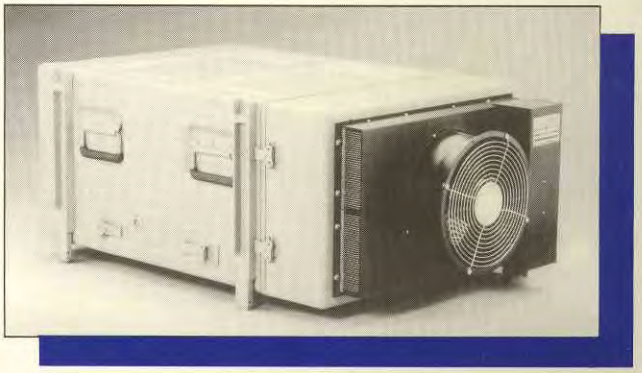
An Original Equipment Manufacturer utilizes a solid state liquid heating/cooling system to deliver localized therapy for outpatient and physical therapy treatment.

(Photo courtesy of New Zealand Dairy Research Institute)

One of the world's leading centers for dairy research uses thermoelectric cold plates with temperature control for tempering fat samples prior to pulsed NMR measurement of solid fat content.

(Photo courtesy of Noah Precision)

A manufacturer in the semiconductor industry uses a solid state liquid chiller to precisely control fluid temperatures for water jacketed columns and etch baths.



(Photo courtesy of EDAK)

A manufacturing specialist of transport equipment uses a solid state cooling system to protect electronic equipment from harsh, high stress conditions.

Air Conditioners
(Air Cooled)

teca

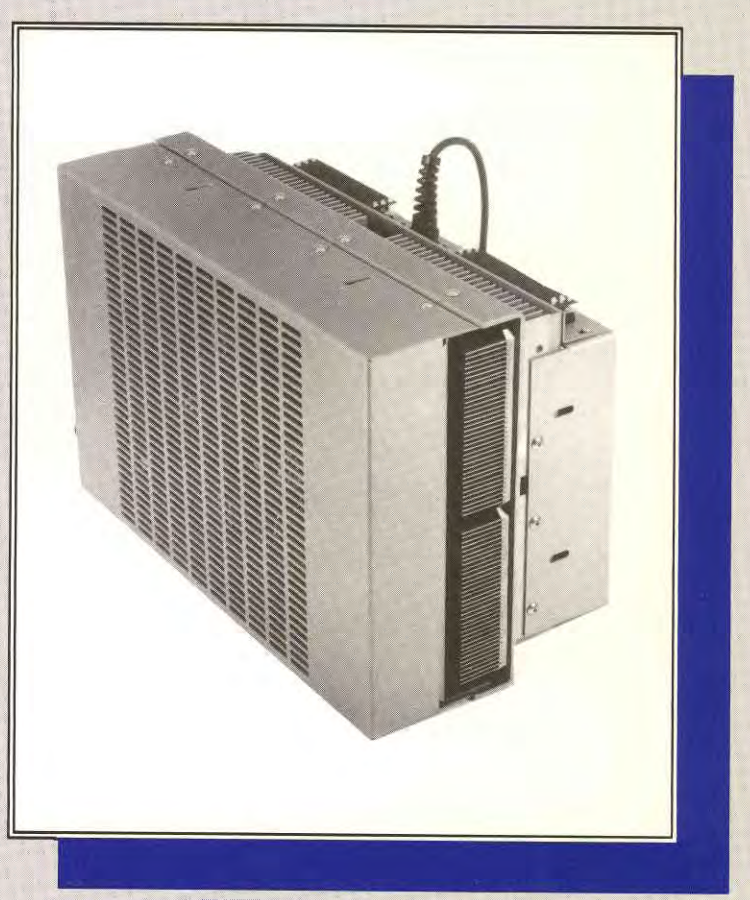
ThermoElectric Cooling America Corporation

AHP-1801/ AHP-1801X Solid State Air Conditioners

Rating: 1500 BTU/ HR Cooling, 1360 BTU/HR Heating (Optional)

Features:

- Dual voltage 115/230 VAC
- Environmentally safe
- No fluorocarbons, compressor or piping
- Temperature controller included (TC-5F)
- No load cooling to -15°C (5°F) at room temperature of 20°C (68°F)
- Operates in any orientation horizontal, vertical, etc.
- Excels in high ambients -30°C(-22°F) to +80°C(176°F)
- Compact, weighs only 46 lbs.(20.9 kg.)
- Withstands corrosive environments, shock and vibration
- Sealed power supply
- Mil-spec fans
- Low vibration, noise, maintenance
- Mounting hardware and gasket material included



Please Note:

Model	NEMA
AHP-1801	12
AHP-1801X	12, 4, 4X

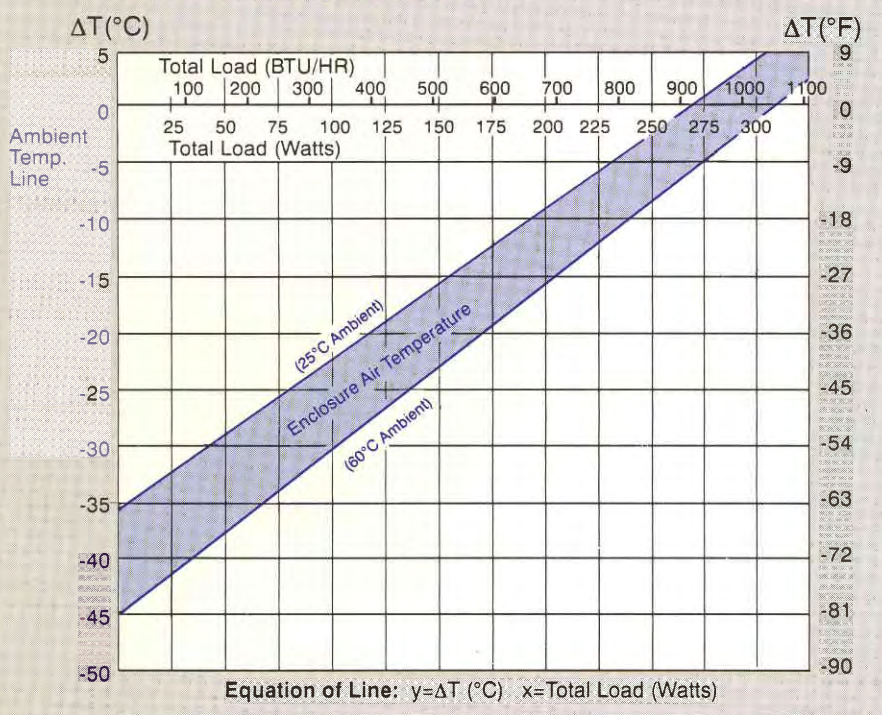
Applications in Remote Equipment Panels and Instrumentation Cooling

The AHP-1801X is a cooler designed for harsh industrial environments such as NEMA-4X. It can withstand corrosive salt spray, shock, vibration, windblown dust, rain, and water hose down in outdoor and indoor use. The AHP-1801X provides total protection from heat buildup in sealed electronic enclosures. It is used outdoors or indoors in steel mills, foundries, paper mills, communication and microwave antenna installations.

The AHP-1801 differs from the AHP-1801X in that it is designed for NEMA-12 enclosures. Both systems come complete with temperature control and mounting gaskets. A dual input of 115 or 230 VAC is standard.

Heating is offered as an option for both units, models AHP-1801XHC and AHP-1801HC. They come complete with thermostatic fixed point temperature control.

Performance Curve: AHP-1801/ 1801X



Equation of Line: y=ΔT (°C) x=Total Load (Watts)

	115 VAC		230 VAC	
Ambient	25°C	60°C	25°C	60°C
Enclosure	y=.137x-35.8	y=.143x-41.0	y=.136x-38.1	y=.147x-45.2
Cold Sink	y=.112x-37.4	y=.110x-43.0	y=.104x-38.9	y=.113x-46.1

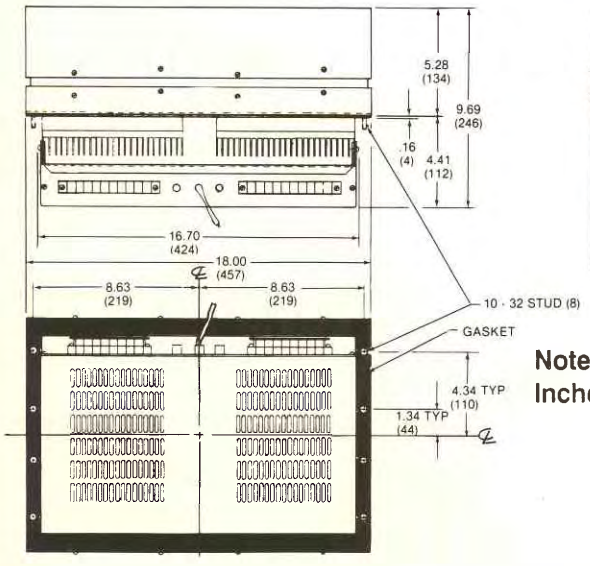
Specifications:

	AHP-1801	AHP-1801X
Input Voltage	115/230 VAC	
Current	6.0/3.5 AMPS	
Frequency	50-60 HZ	
Temp. Range	-30°C(-22°F)to +60°C(+140°F)	-30°C(-22°F)to +80°C(176°F)
NEMA	12	12, 4, 4X
Weight	46 lbs.(20.9 kg.)	

Temperature Controls:

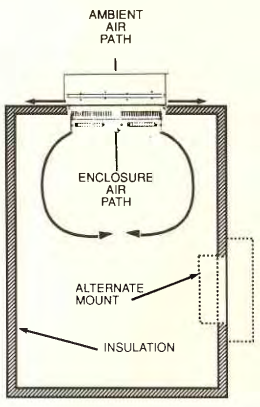
	AHP-1801 AHP-1801X (cool only)	AHP-1801HC AHP-1801XHC (heat/cool)
Standard	TC-5F	TC-3F
Optional	TC-2A TC-4500 DC	TC-3A TC-4500 DC

Refer to page(s) 42, 43 for further description on temperature controllers



Note: Dimension; Inches(millimeters)

Typical Mounting Method

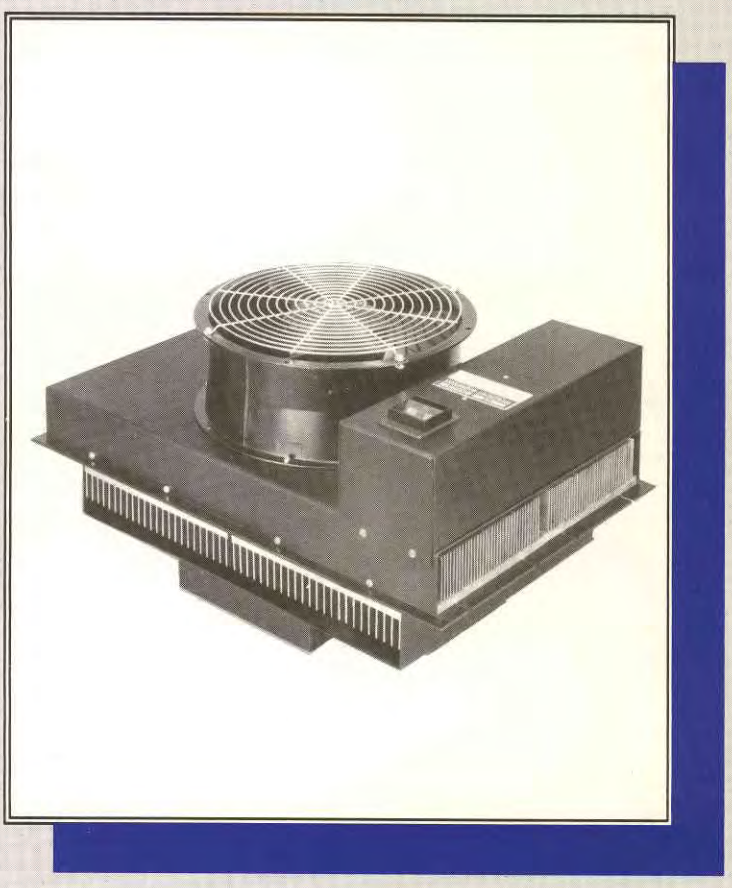


AHP-1700 Solid State Air Conditioner

Rating: 1100 BTU/ HR Cooling, 1360 BTU/ HR Heating (Optional)

Features:

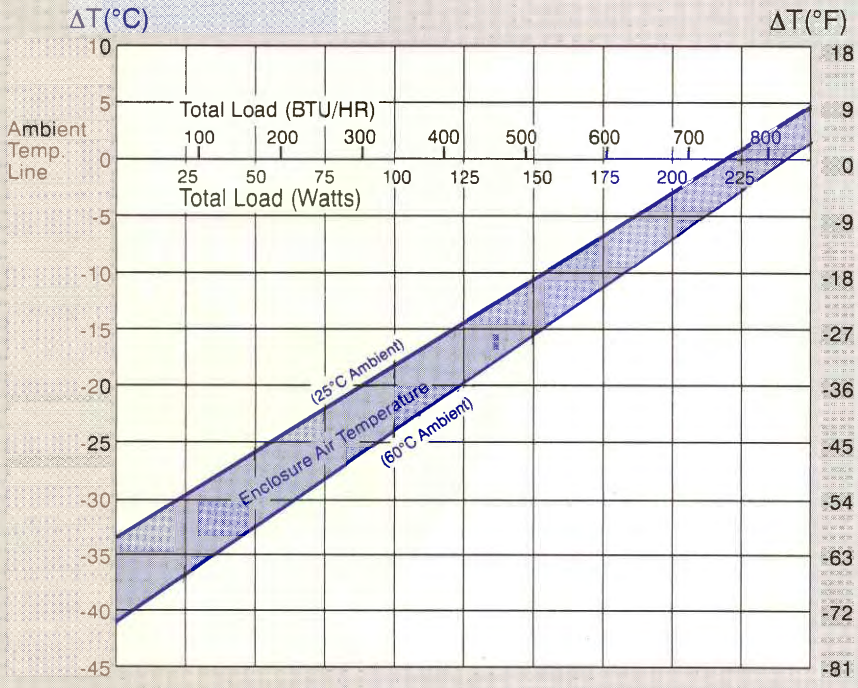
- Standard 19" rack mount
- Weighs under 18.2 kg. (40 lbs.)
- No fluorocarbons, compressor or piping
- No load cooling to -10°C (14°F) at room temperature of 25°C (77°F)
- Operates in any orientation horizontal, vertical, etc.
- Operates in -30°C (-22°F) to +60°C (+140°F)
- Low vibration, noise, maintenance
- Runs direct from 115 VAC input
- Environmentally safe



Applications in Computers, Machine Tools, Electronic Control Systems

Thousands of TECA's AHP-1700 NEMA-12 enclosure coolers are in use today in environments ranging from steel mills and assembly lines to computer rooms and robotics. The AHP-1700 is capable of cooling to temperatures below ambient without the use of a compressor, refrigerant or piping. This makes the AHP-1700 a rugged, dependable air conditioner. Because the AHP-1700 does not exchange air between the outside and the inside of the enclosure, clean air environment is maintained in the electronic enclosure. This is accomplished by using solid state thermoelectric modules to remove heat energy from any enclosure. Reliable fans are used to circulate cooling air.

Performance Curve: AHP-1700



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Ambient Temp.	25°C	60°C
Enclosure	y=.16x-34.5	y=.17x-40.8
Cold Sink	y=.13x-37.0	y=.13x-43.4

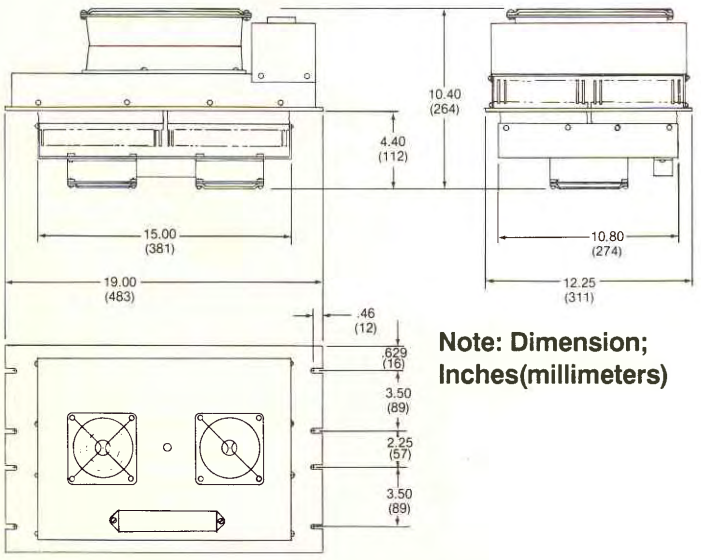
Specifications:

	AHP-1700
Input Voltage	115 VAC
Current	5.9 AMPS
Frequency	50-60 Hz
Temp. Range	-30°C(-22°F)to+60°C(+140°F)
NEMA	12
Weight	40 lbs. (18.2 kg.)

Temperature Controls:

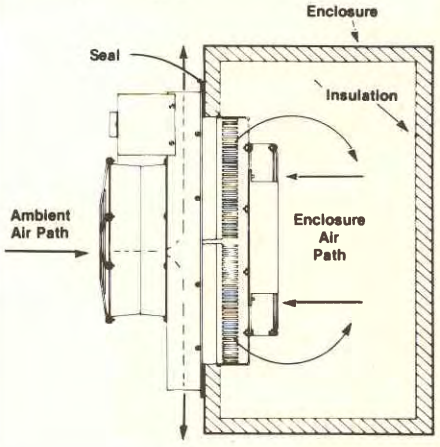
	AHP-1700 (cool only)	AHP-1700HC (heat/cool)
Standard	–	TC-3F
Optional	TC-5F TC-2A TC-4500 DC	TC-3A TC-4500 DC

Refer to page(s) 42, 43 for further description on temperature controllers



Note: Dimension; Inches(millimeters)

Typical Mounting Method

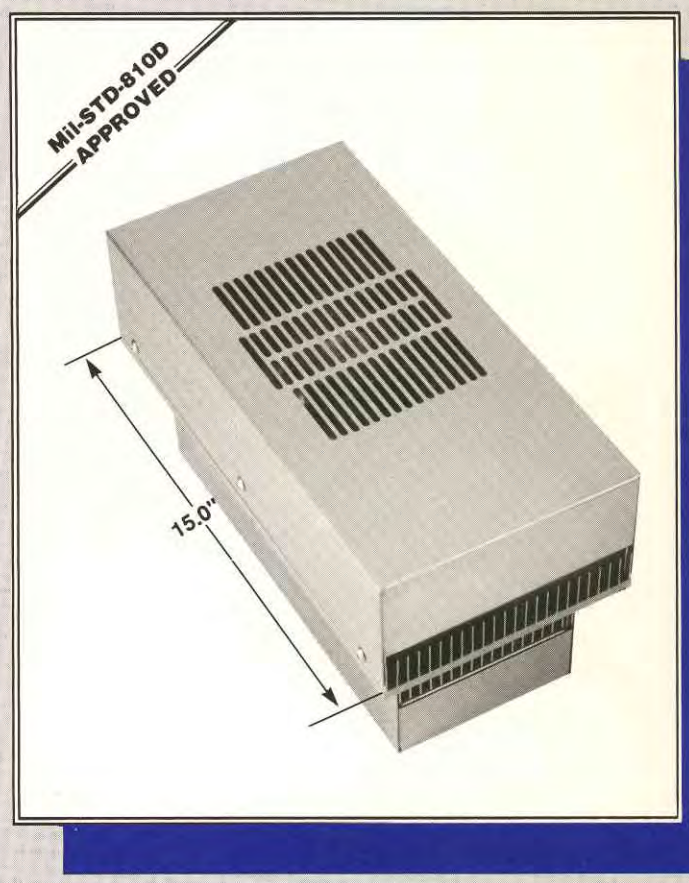


AHP-1200FF
AHP-1201FF/ AHP-1200X Solid State Air Conditioners

Rating: 600 BTU/ HR Cooling, 680 BTU/HR Heating (Optional)

Features:

- No fluorocarbons, compressor, or piping
- Temperature control included (TC-5F)
- Compact - only 15.0" x 7.4" x 8.0", weighs only 21 lbs. (9.5 kg)
- Operates in -30°C (-22°F) to +60°C (+140°F) (NEMA-12) -30°C (-22°F) to +80°C (+176°F) (NEMA 4, 4X)
- No moving parts except fans, military grade fan on exterior hot side (NEMA 4X)
- Operates in any orientation horizontal, vertical, etc.
- Gasket and mounting hardware included
- Environmentally safe.
- Low vibration, noise, maintenance



Please Note:

Model	AC Input	NEMA	Mil-STD-810D
AHP-1200FF	115	12	-
AHP-1201FF	115/ 230	12	-
AHP-1200X	115	12,4,4X	Salt Fog
AHP-1200XM	115	12,4,4X	Salt Fog, Shock & Vibration

Applications for outdoor instrumentation, mills, foundries, remote communications

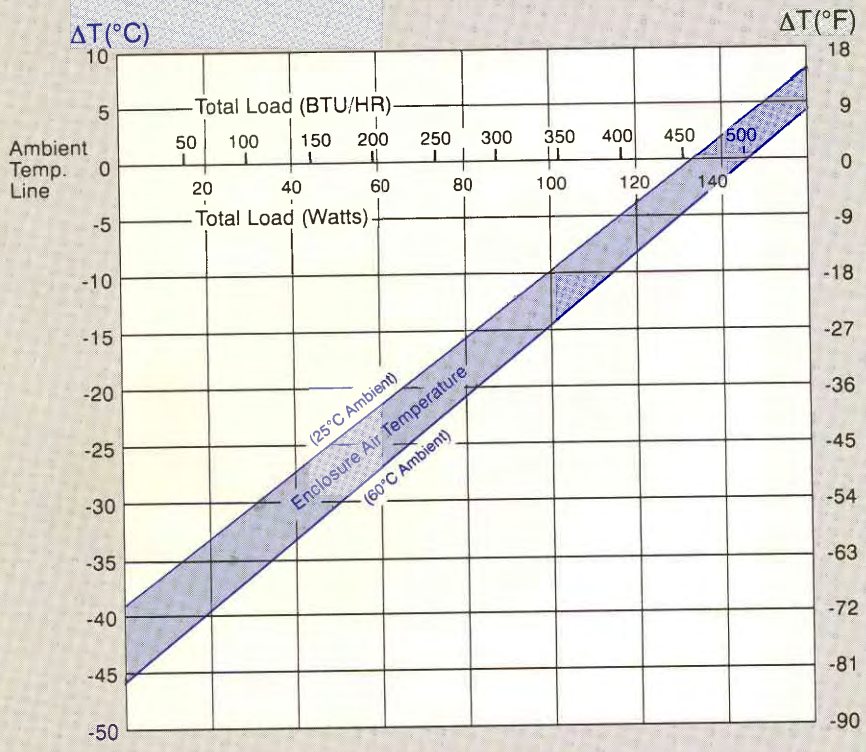
The AHP-1200X is a cooler designed to excel in harsh industrial environments such as NEMA 4X. It can withstand corrosive salt spray, shock, vibration, wind blown dust, rain, and water hose down in outdoor and indoor use. The AHP-1200X provides total protection from heat buildup in sealed electronic enclosures. Used outdoors or indoors in steel mills, foundries, paper mills, shipboard, offshore, food processing plants, remote telephone communication and microwave antenna installations.

A combination of compact size, weight, and top quality components makes the AHP-1200X easy to use with the expectation of a long, service-free life. It is the most rugged fractional ton air conditioner ever offered. The AHP-1200FF is designed for NEMA-12 enclosures and accepts 115 VAC. The AHP-1201FF is also designed for NEMA 12 enclosures but has a dual primary input of 115/230 VAC. All systems are supplied with mounting hardware and a neoprene gasket, for snug, trim mounting.

teca

ThermoElectric Cooling America Corporation

Performance Curve: AHP-1200FF/ 1201FF/ 1200X



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Ambient Temp.	25°C	60°C
Enclosure	y=.30x-38.9	y=.31x-45.6
Cold Sink	y=.22x-40.3	y=.23x-47.0

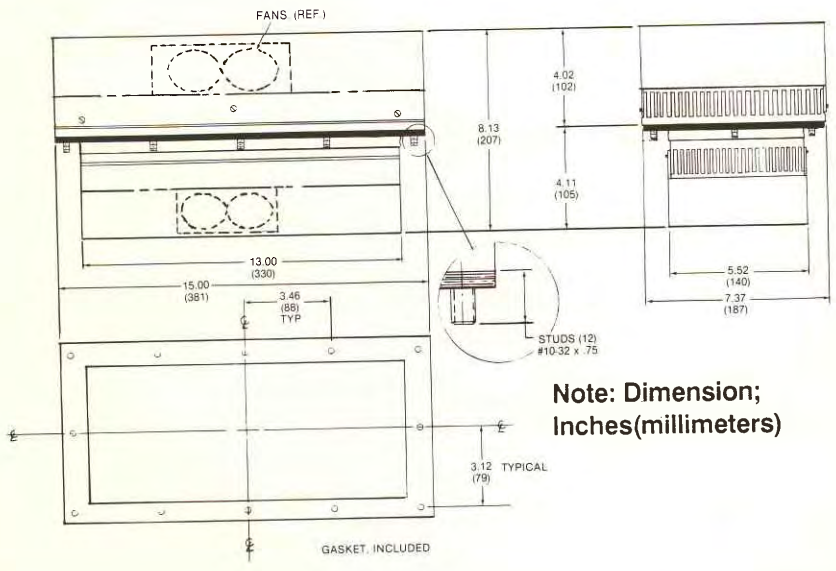
Specifications:

	AHP-1200FF	AHP-1201FF	AHP-1200X
Input Voltage	115 VAC	115/230 VAC	115 VAC
Current	3.1 A	3.1/2.0A	3.1 A
Frequency	50-60 Hz	50-60 Hz	50-60 Hz
Temp. Range	-30°C/+60°C	-30°C/+60°C	-30°C/+80°
NEMA	12	12	12, 4, 4X
Weight	21 lbs.(9.5 kg.)		

Temperature Controls:

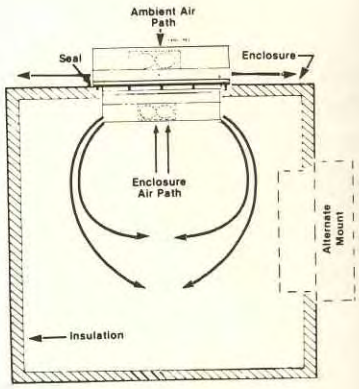
Cool only	AHP-1200FF AHP-1201FF	AHP-1200X
Standard	TC-5F	TC-5F
Custom	TC-2A TC-4500 DC	
(heat/ cool)	AHP-1200FFHC AHP-1201FFHC	AHP-1200XH
Standard	TC-3F	TC-3F
Custom	TC-3A, TC-4500 DC	

Refer to page(s) 42, 43 for further description on temperature controllers



Note: Dimension; Inches(millimeters)

Typical Mounting Method

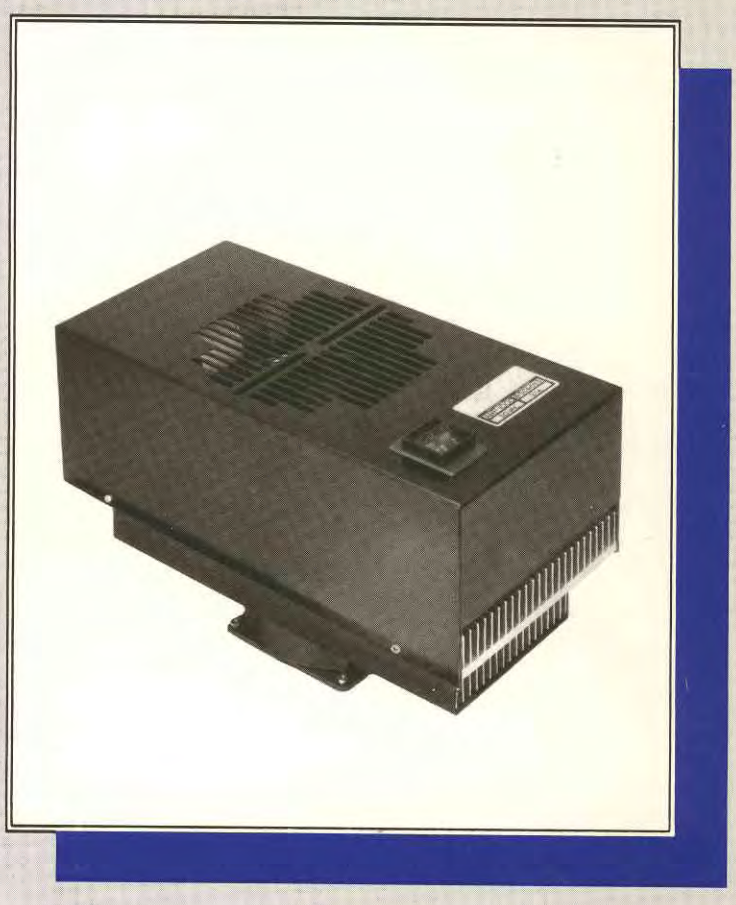


AHP-1000FF Solid State Air Conditioners

Rating: 560 BTU/ HR Cooling, 680 BTU/HR Heating (Optional)

Features:

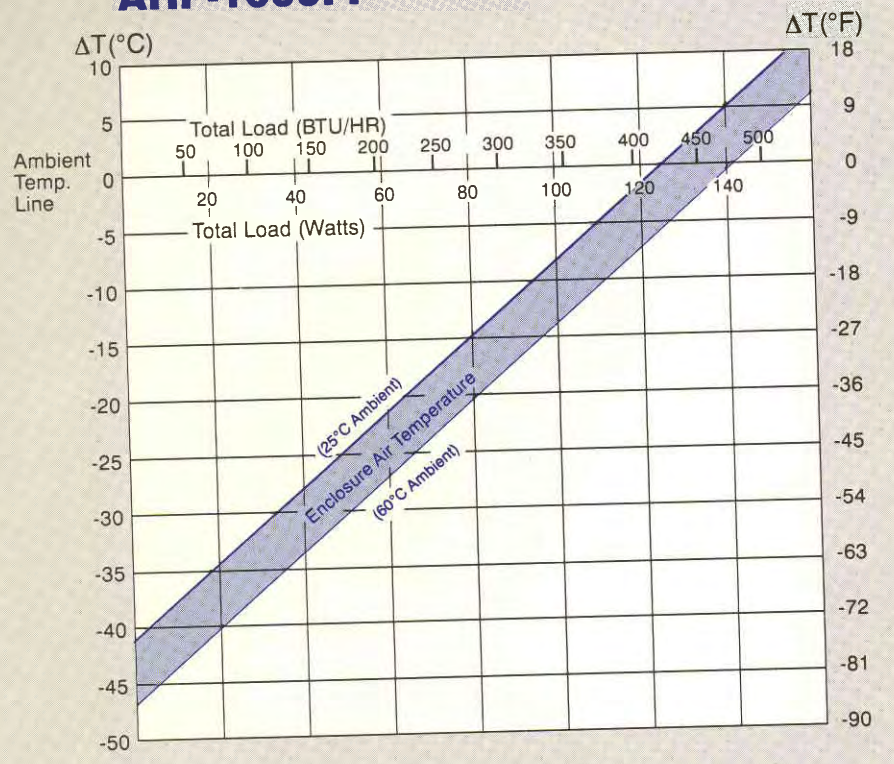
- No load cooling to -16°C (3°F) at room temperature of +25°C (+77°F)
- Weighs 24 lbs (10.9 kg)
- Closed system protection from dust, chips, moisture
- No fluorocarbons, compressor or piping
- Operates in any orientation, horizontal, vertical, etc.
- Low vibration, noise, maintenance
- Operates in -30°C (-22°F) to +65°C (+149°F)
- Gasket and mounting hardware included
- Environmentally safe



Applications in computers, machine tools, instrumentation or package cooling.

A combination of convenient size, light weight, and an integral power supply make the AHP-1000FF one of TECA's most versatile units. Applications of the AHP-1000FF range from the factory to the laboratory. Used as a NEMA-12 cabinet cooler, the AHP-1000FF removes heat energy without exchanging air between the outside and the inside of the cabinet. Heat removal and temperatures below ambient are accomplished by an efficient combination of solid state thermoelectric modules, heat sinks and fans.

Performance Curve: AHP-1000FF



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Ambient Temp.	25°C	60°C
Enclosure	y=.33x-41.1	y=.33x-46.9
Cold Sink	y=.26x-42.6	y=.26x-48.3

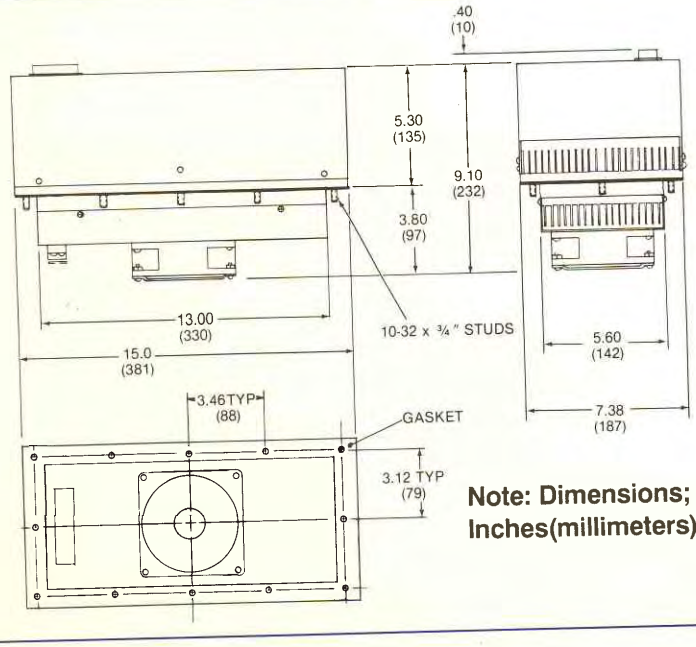
Specifications:

	AHP-1000FF
Input Voltage	115 VAC
Current	2.8 AMPS
Frequency	50-60 Hz
Temp. Range	-30°C (-22°F) to +65°C (+149°F)
NEMA	12
Weight	24 lbs. (10.9 kg.)

Temperature Controls:

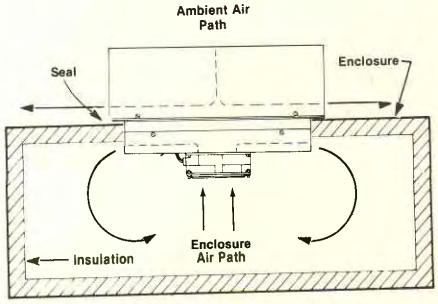
	AHP-1000FF (cool only)	AHP-1000FFHC (heat/cool)
Standard	–	TC-3F
Optional	TC-5F TC-4500 DC	TC-4500 DC

Refer to page(s) 42, 43 for further description on temperature controllers



Note: Dimensions; Inches(millimeters)

Typical Mounting Method

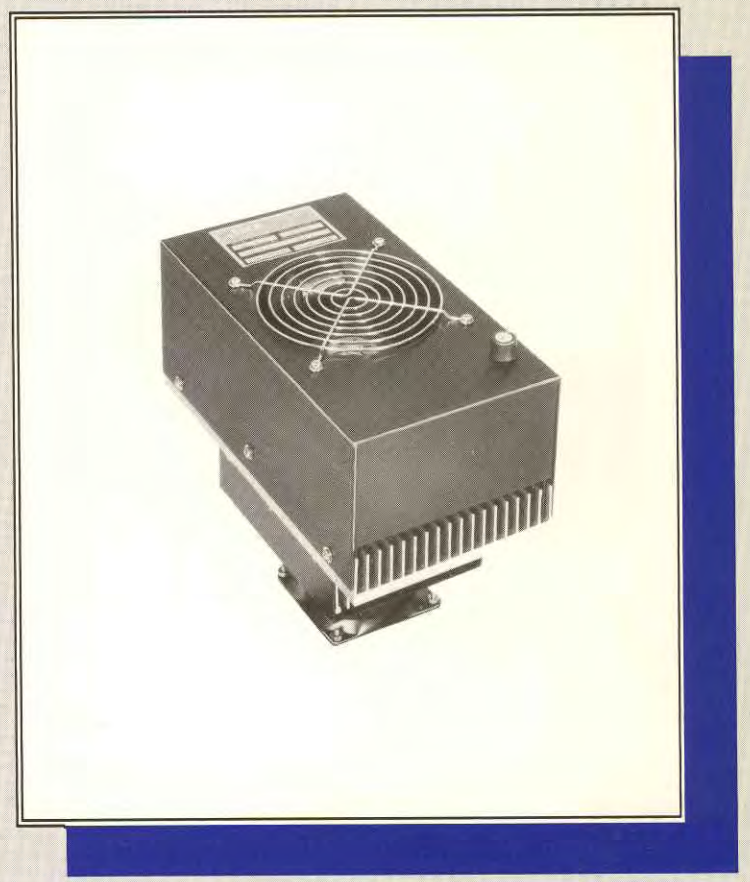


AHP-301FF Solid State Air Conditioner

Rating: 210 BTU/HR Cooling, 340 BTU/HR Heating (optional)

Features:

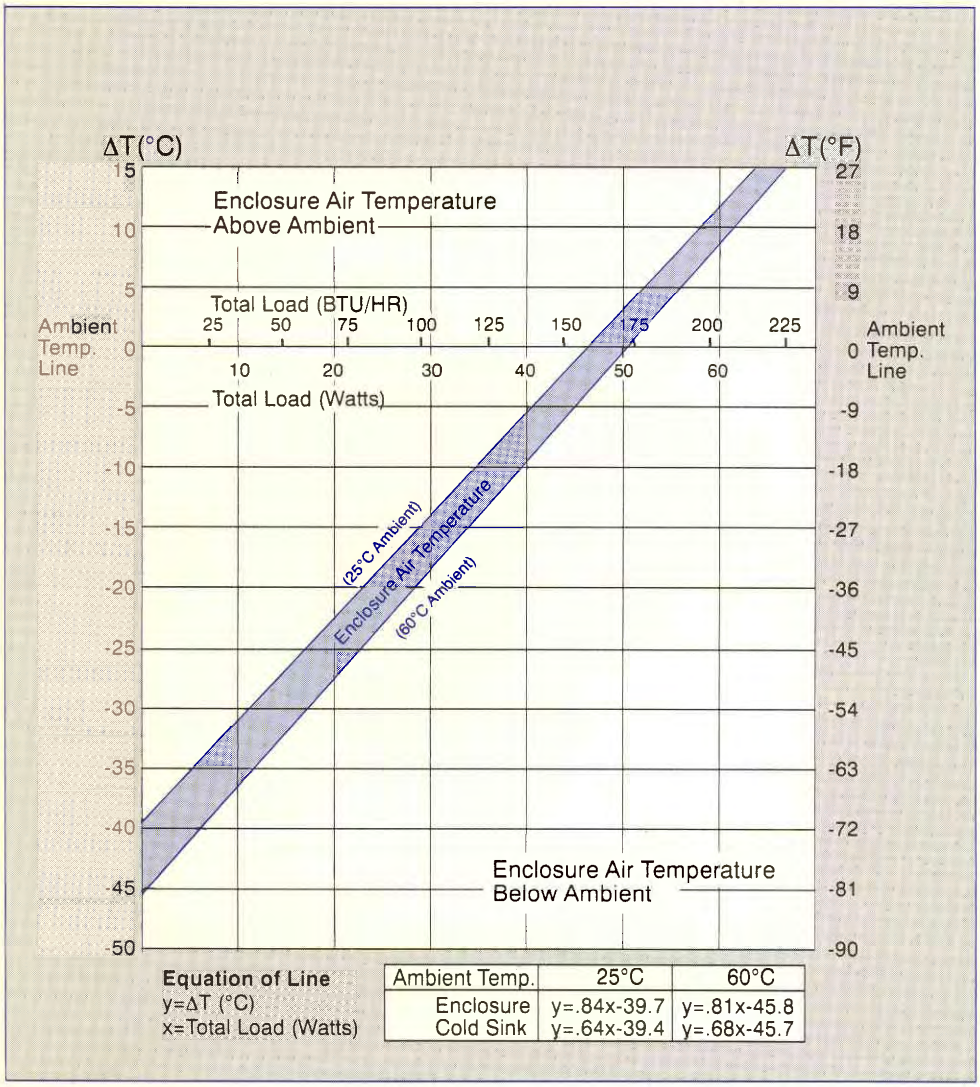
- Operates from 115 or 230 VAC, 50 or 60 Hz
- No load cooling to -15°C (5°F), at room temperature of +25°C(+77°F)
- Weighs only 5.4 kg. (12 lbs.)
- No compressor
- Closed system protection from dust, chips, moisture
- No moving parts except fans
- Low vibration, noise, maintenance
- Anodized aluminum finish
- Operates in any orientation–horizontal, vertical, etc.
- Operates in -30°C (-22°F) to +60°C (+140°F) ambients
- Mounting Hardware and Gasket included
- Environmentally safe



Applications in Computers and Control Instrumentation Cooling

TECA's AHP-301FF is a solid-state enclosure cooler designed for compact enclosure cooling. It is the smallest air conditioner in the world to operate directly from either 115 or 230 VAC input power. Ideal for computers, disk drives, camera housings, and control instrumentation.

Heating is offered as an option, model AHP-301FFHC. It comes complete with a TC-3F temperature controller. Plenum housings are also offered for applications where internal enclosure space is limited and flush mounting with no intrusion is required, consult the factory for further details.



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Ambient Temp.	25°C	60°C
Enclosure	y=.84x-39.7	y=.81x-45.8
Cold Sink	y=.64x-39.4	y=.68x-45.7

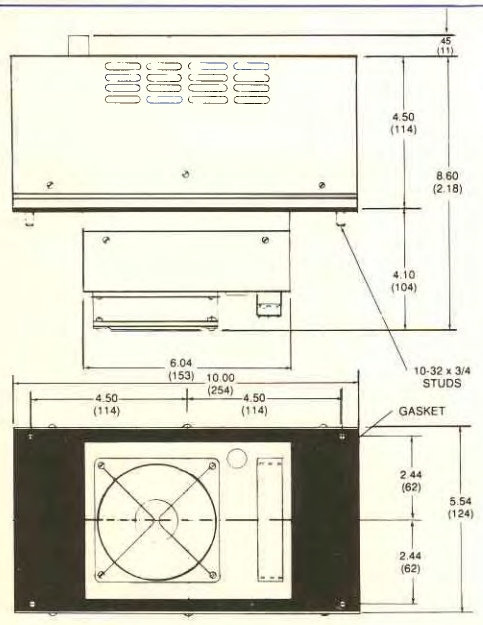
Specifications:

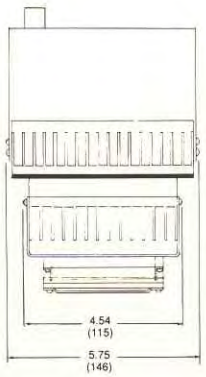
	AHP-301FF
Input Voltage	115/230 VAC
Current	1.2/0.6 AMPS
Frequency	50/60 Hz
Temp. Range	-30°C (-22°F) to +60°C (+140°F)
NEMA	12
Weight	12 lbs. (5.4 kg.)

Temperature Controls:

	AHP-301FF (cool only)	AHP301FFHC (heat/cool)
Standard	–	TC-3F
Optional	TC-5F TC-4500 DC	TC-4500 DC

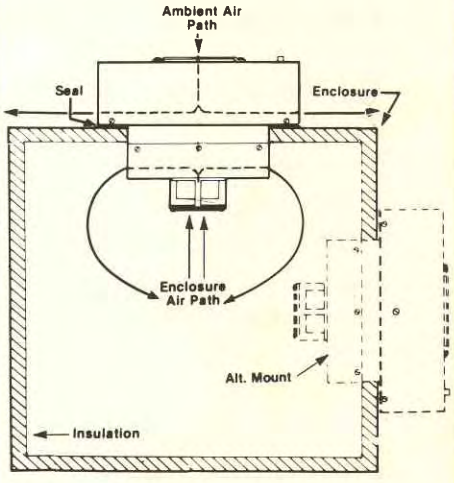
Refer to page(s) 42, 43 for further description on temperature controllers





Note: Dimension; Inches(millimeters)

Typical Mounting Method



AHP-300FF Solid State Air Conditioner

Rating: 240 BTU/HR Cooling

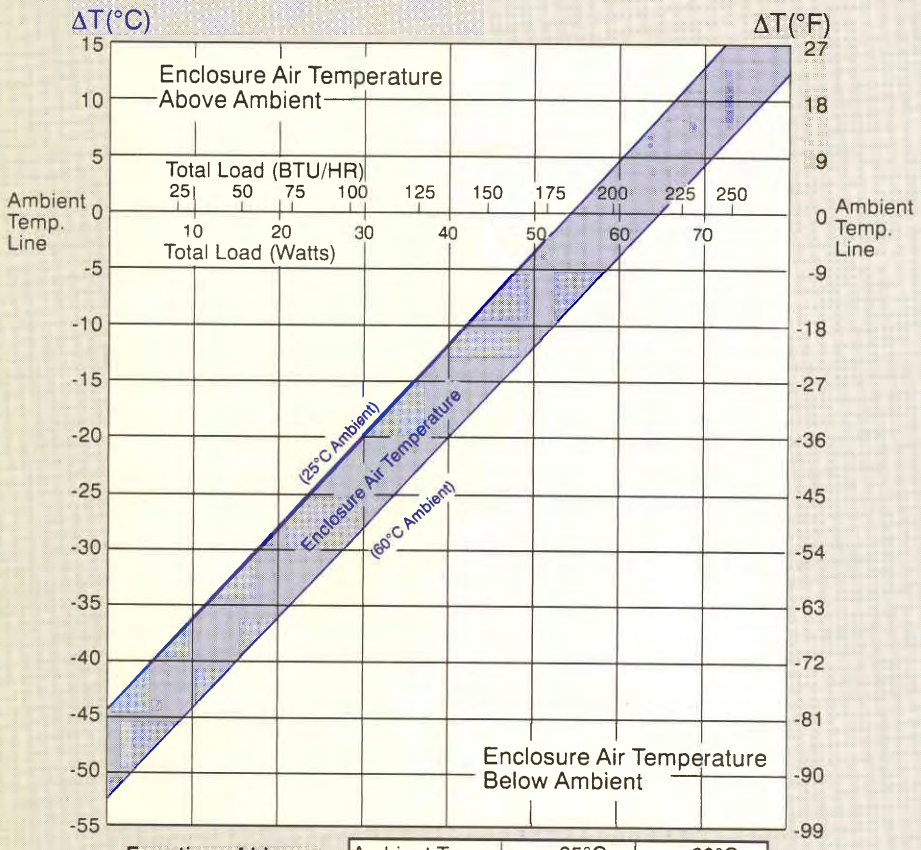
Features:

- No load cooling to -20°C (-4°F), at room temperature of +24°C (+75°F)
- Weighs only 3.4 kg. (7.5 lbs.)
- No compressor
- Closed system protection from dust, chips, moisture
- No moving parts except fans
- Low vibration, noise, maintenance
- Anodized aluminum finish
- Operates in any orientation - horizontal, vertical, etc.
- Operates in -30°C (-22°F) to +60°C (+140°F)
- Brushless DC Fans
- Input voltage 12/24/48 VDC
- Available in NEMA -4/4x version (option)

Applications in Motor Vehicles and Control Instrumentation Cooling

TECA's model AHP-300FF is the smallest air cooled heat pump which comes in the fin and fan style. Thermoelectric modules are utilized to transfer the heat from the cold side to the hot side. This makes the AHP-300FF ideal for cooling small enclosures where it will provide both cooling and a clean environment for sensitive electronics. A gasket and mounting hardware are provided to maintain NEMA-12 integrity. For harsh, corrosive environments, TECA offers model AHP-300X, it is designed with Mil-spec components capable of withstanding NEMA-4X environments. Consult the factory for further information.

Performance Curve: AHP-300FF



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Ambient Temp.	25°C	60°C
Enclosure	y=.82x-44.3	y=.86x-53.3
Cold Sink	y=.64x-44.3	y=.68x-53.3

Specifications:

Power Input: Nominal

- 12VDC @ 12.5 A
- 24 VDC @ 6.3 A
- 48 VDC @ 3.1 A

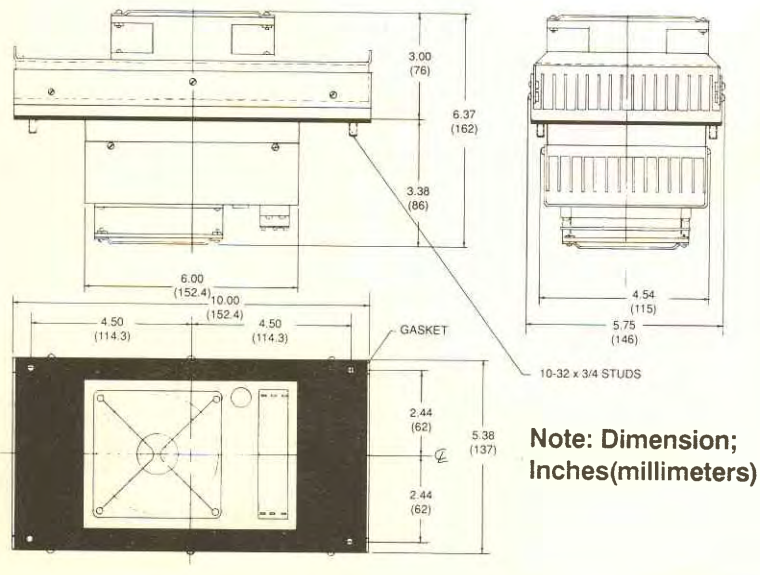
Power Input: Range

- 6-14 VDC @ 6.5-14.3 A
- 13.5-28VDC @ 3.6-6.9 A
- 28-56 VDC @ 1.8-3.5 A

Note:
Performance Curves relative to nominal power input

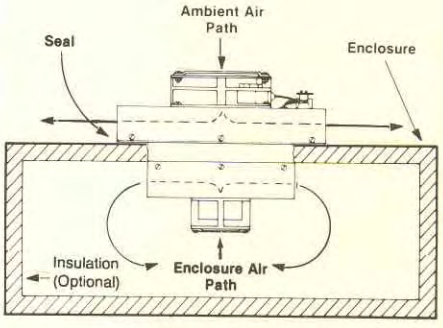
Standard factory wiring 24VDC

Weight: 3.4 kg (7.5lbs.)



Note: Dimension; Inches(millimeters)

Typical Mounting Method



Air Conditioners
(Liquid Cooled)

teca

ThermoElectric Cooling America Corporation

LHP-1700FF/ LHP-1702FF Solid State Air Conditioners

Rating: 1500 BTU/ HR Cooling, 1360 BTU/HR Heating (Optional)

Features:

- No load cooling to -22°C (-7°F) at 25°C coolant temperature
- Standard 19" rack mount
- No fluorocarbons or compressor required
- Operates in -30°C (-22°F) to +80°C (+176°F) ambients
- Less than 1-1/4 sq. ft. panel space
- No exposed fans
- Integral DC power supply
- Operates in any orientation horizontal, vertical, etc.
- Weighs under 21 lbs (9.5 kg)
- Adaptable to NEMA-4 and explosion proof applications
- Available in 115 or 230 VAC
- Environmentally safe

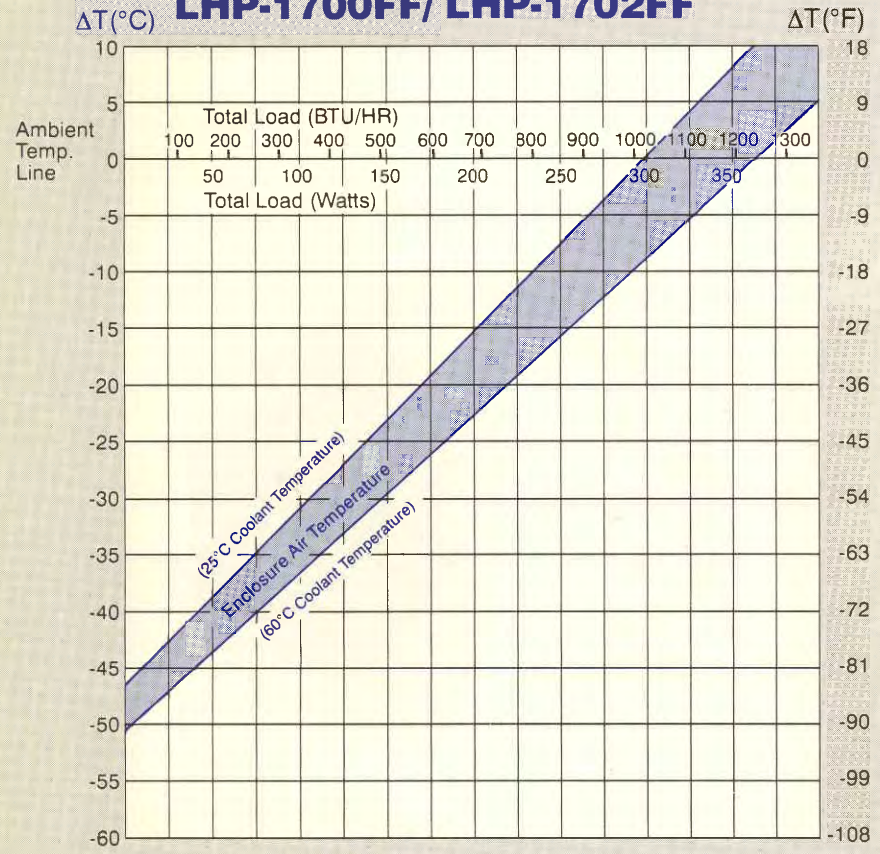
Please Note:

Model	AC Input
LHP-1700FF	115
LHP-1702FF	230

Applications in Paper Mills, Machine Tools, Electronics

The LHP-1700FF is the largest liquid cooled air conditioner we make. It is constructed of aluminum with brass fittings. You provide a constant flow of liquid as a heat removal source. Combining these features with thermoelectric modules make the LHP-1700FF capable of both high capacity and high temperature differentials. The unit comes complete with its own integral power supply, 19" rack panel for mounting, and easy to access liquid fittings. The LHP-1700 is becoming TECA's fastest selling liquid cooled air-conditioner, popular in paper mills, steel mills, refineries, and explosion-proof applications. Liquid heat exchangers can be ordered in copper with an ebonyl C finish.

Performance Curve: LHP-1700FF/ LHP-1702FF



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Coolant Temp.	25°C	60°C
Enclosure	y=.16x-47.0	y=.14x-51.0
Cold Sink	y=.12x-52.0	y=.11x-56.0

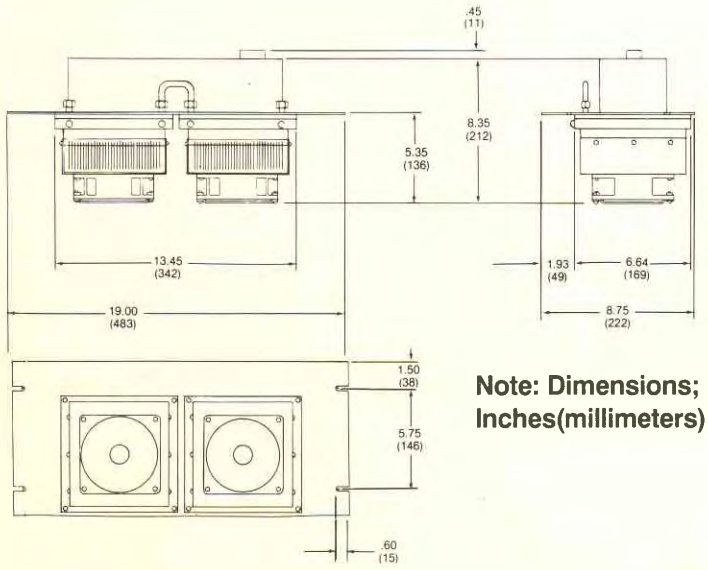
Specifications:

	LHP-1700FF	LHP-1702FF
Input Voltage	115 VAC	230 VAC
Current	6.1 A	3.05 A
Frequency	50-60 HZ	
Temp. Range	-30°C(-22°F) to +80°C(+176°F)	
Min Flow Req'd	0.5 Gal/Min (2.0 L/Min)	
NEMA	12	
Weight	21 lbs.(9.8 kg.)	

Temperature Controls:

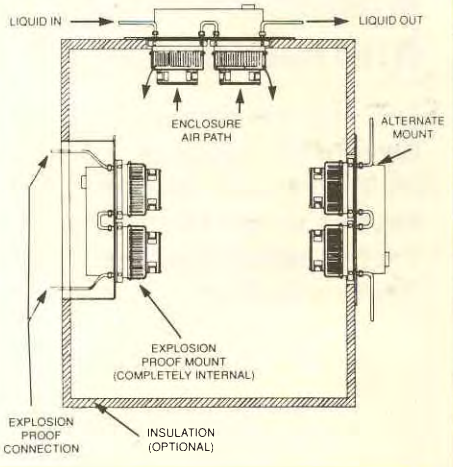
Cool only	LHP-1700FF	LHP-1702FF
Option	TC-5F, TC-2A, TC-4500 DC	TC-5F
Custom	–	TC-4500 DC
Heat Cool	LHP-1700FFHC	LHP-1702FFHC
Standard	TC-3F	TC-3F
Option	TC-3A, TC-4500 DC	–
Custom	–	TC-4500 DC

Refer to page(s) 42, 43 for further description on temperature controllers



Note: Dimensions; Inches(millimeters)

Typical Mounting Method

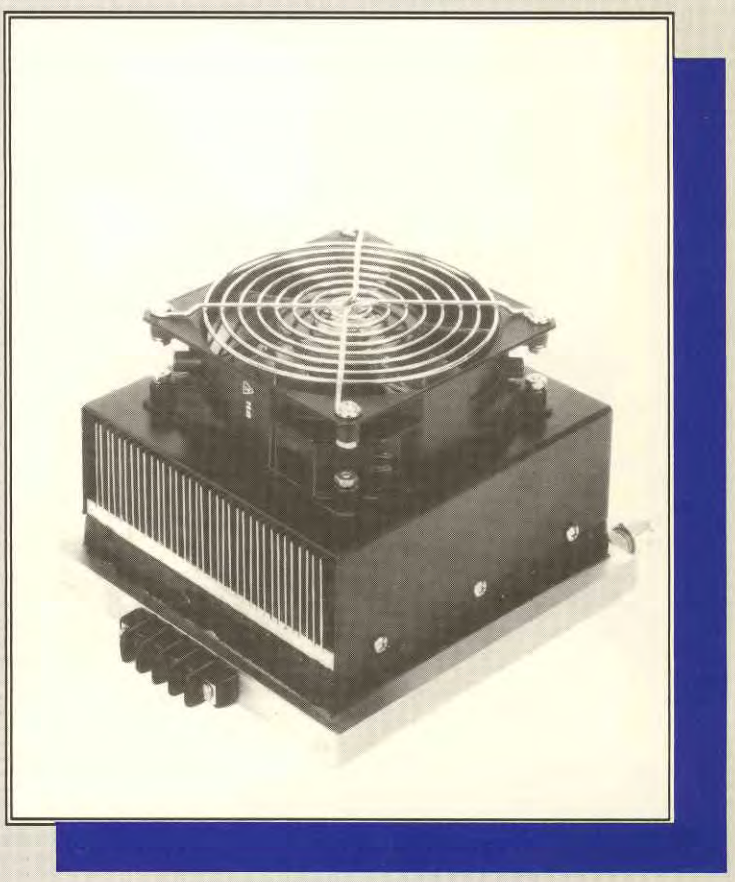


LHP-800FF Solid State Air Conditioner

Rating: 750 BTU/ HR Cooling, 680 BTU/HR Heating (Optional)

Features:

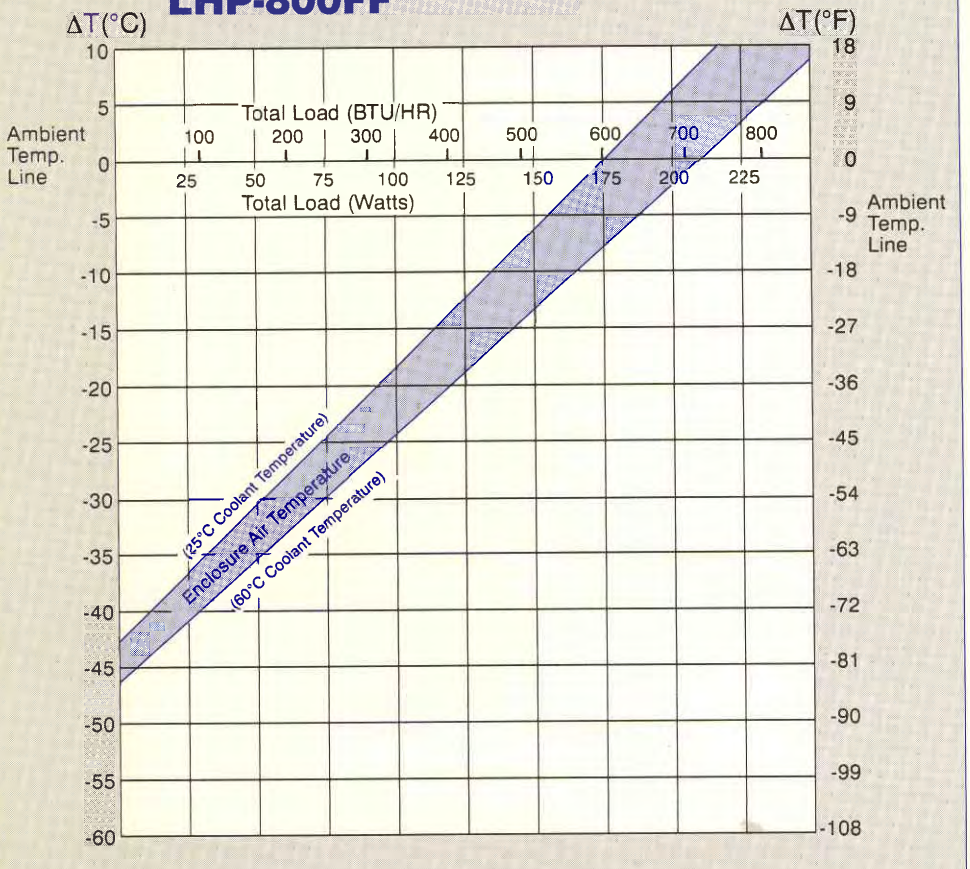
- Operates in any orientation horizontal, vertical, etc.
- Low vibration, noise, maintenance
- Closed system protection from dust, chips, moisture
- No moving parts except internal circulation fan
- Operation in -30°C (-22°F) to +80°C (+176°F) ambients
- No fluorocarbons or compressor required
- Adaptable to NEMA 4 and explosion proof applications
- Environmentally safe
- No load cooling to -17°C (1.4°F) at 25°C coolant temperature



Applications in Electronics, Instrumentation and Control Panels

The LHP-800FF can be mounted entirely inside an enclosure or through an enclosure wall, leaving the liquid jacket outside the enclosure. Mounted inside of an enclosure the unit becomes an ideal cooler for pressurized cabinets or explosion proof applications. The only intrusion to the cabinet would be the input and output liquid lines. The high density cold side heat sink provides the necessary surface area to handle the capacity and temperature differential generated by the thermoelectric modules.

Performance Curve: LHP-800FF



Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Coolant Temp.	25°C	60°C
Enclosure	y=.24x-42.5	y=.22x-47.0
Cold Sink	y=.21x-48.0	y=.20x-52.5

Specifications:

Power Required:

T.E. (0-35 VDC)
Curves taken at nominal 30 VDC @ 10 amps.

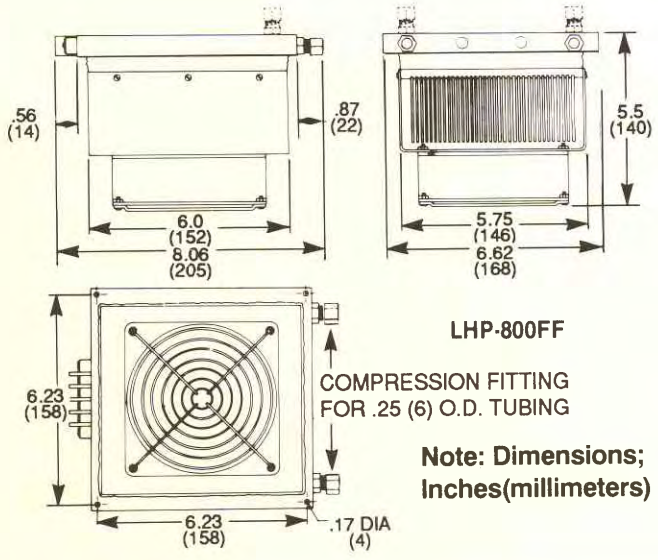
Fan: (115 VAC) 50-60 Hz
230 VAC, (Optional)

Weight: 7 lbs. (3.2 kg)

Minimum flow rate:
2L/min (0.5 gal/min)

Options:

Cool Only	LHP-800FF
Power supply	PS-400-30
Temperature Control	TC-2A TC-4500 DC
Heat/Cool	LHP-800FFHC
Power supply	PS400-30HC
Temperature Control	TC-3A TC-4500 DC

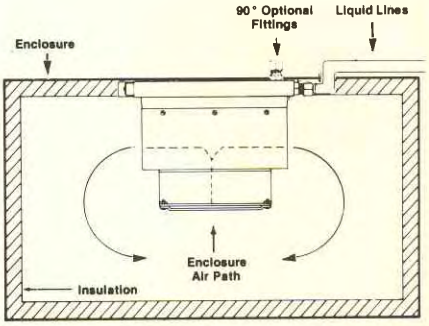


LHP-800FF

COMPRESSION FITTING FOR .25 (6) O.D. TUBING

Note: Dimensions; Inches(millimeters)

Typical Mounting Method

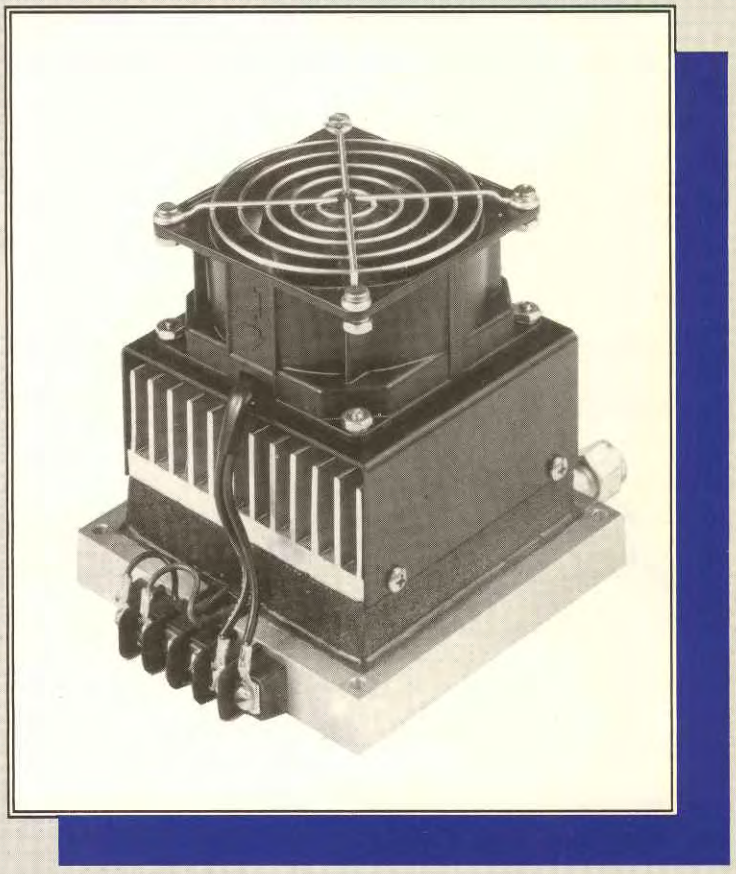


LHP-300FF Solid State Air Conditioner

Rating: 290 BTU/HR Cooling, 340 BTU/ HR (OPTIONAL)

Features:

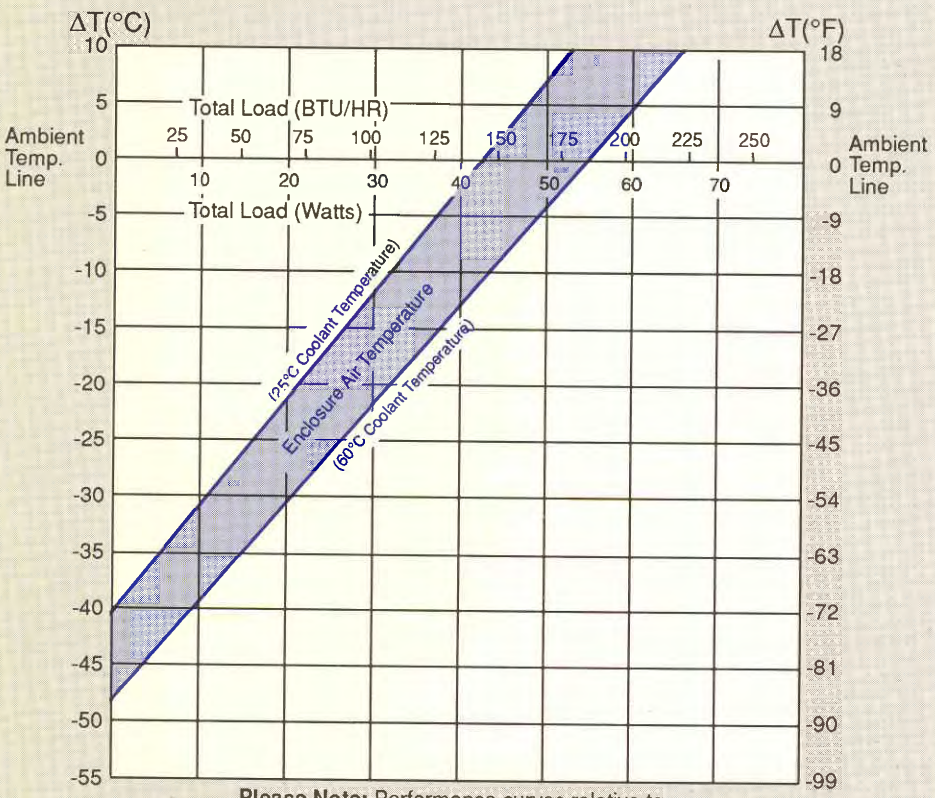
- No load cooling to -10°C, (14°F) at 25°C coolant temperature
- Weighs only 2.75 lbs (1.25 kg)
- Low vibration, noise, maintenance
- Closed system protection from dust, chips, moisture
- No fluorocarbons, compressor required
- Operates in -30°C (-22°F) to +80 °C (+176°F) ambients
- Operates in any orientation horizontal, vertical, etc.
- Adaptable to NEMA-4 and explosion proof applications
- Environmentally safe



Applications in Electronics, Instrumentation and Control Panels

Possibly the smallest stock air conditioner made today, the LHP-300FF provides cooling while maintaining a clean environment for delicate electronics. The combination of fluid heat transfer and thermoelectric cooling allows for small size and high capacity. Temperature differentials are determined from the cooling liquid temperature, which typically yields large temperature differentials from ambient.

Performance Curve: LHP-300FF



Please Note: Performance curves relative to flow rate of 0.6 L/Min

Equation of Line
y=ΔT (°C)
x=Total Load (Watts)

Coolant Temp.	25°C	60°C
Enclosure	y=.59x-35.5	y=.59x-41.5
Cold Sink	y=.51x-43.0	y=.52x-49.0

Specifications:

Power Required:

T.E. (0-32 VDC)
Curves taken at nominal 24 VDC @ 4.5A

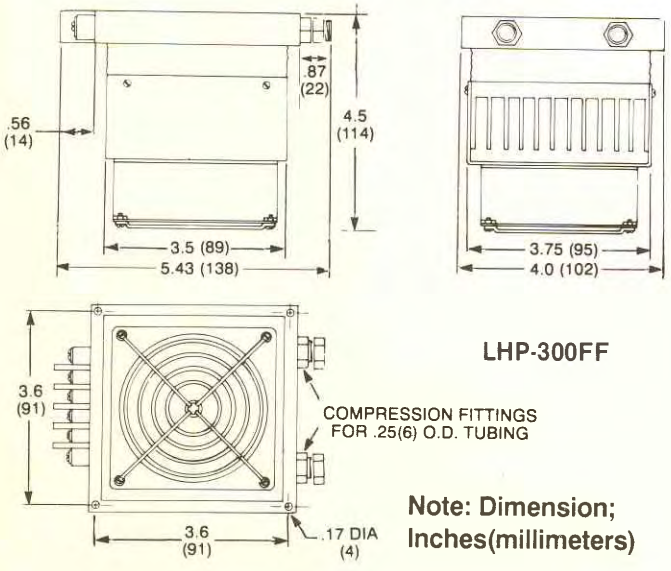
Fan (115 VAC) 50-60 Hz
230 VAC, (Optional)
24 VDC, (Optional)

Weight: 2.75 lbs (1.25 kg)

Minimum Recommended Coolant Flow Rate:
0.2 L/min (0.05 gal/min)

Options:

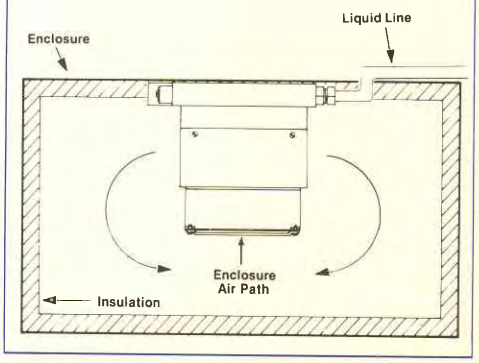
Cool Only	LHP-300FF
Power supply	PS-160-24
Temperature Control	TC-2A TC-4500 DC
Heat/Cool	LHP-300FFHC
Power supply	PS160-24 HC
Temperature Control	TC-3A TC-4500 DC



LHP-300FF

Note: Dimension; Inches(millimeters)

Typical Mounting Method



Cold Plates

(Air Cooled & Liquid Cooled)

teca

ThermoElectric Cooling America Corporation

Solid State Cold Plates (Air Cooled)

Model Number	AHP-150	AHP-300CP	AHP-301CP	AHP-1000CP
Cooling capacity	125 BTU/ HR	265 BTU/ HR	225 BTU/ HR	560 BTU/ HR
Heating capacity (Opt.)			340 BTU/ HR	680 BTU/ HR

Features:

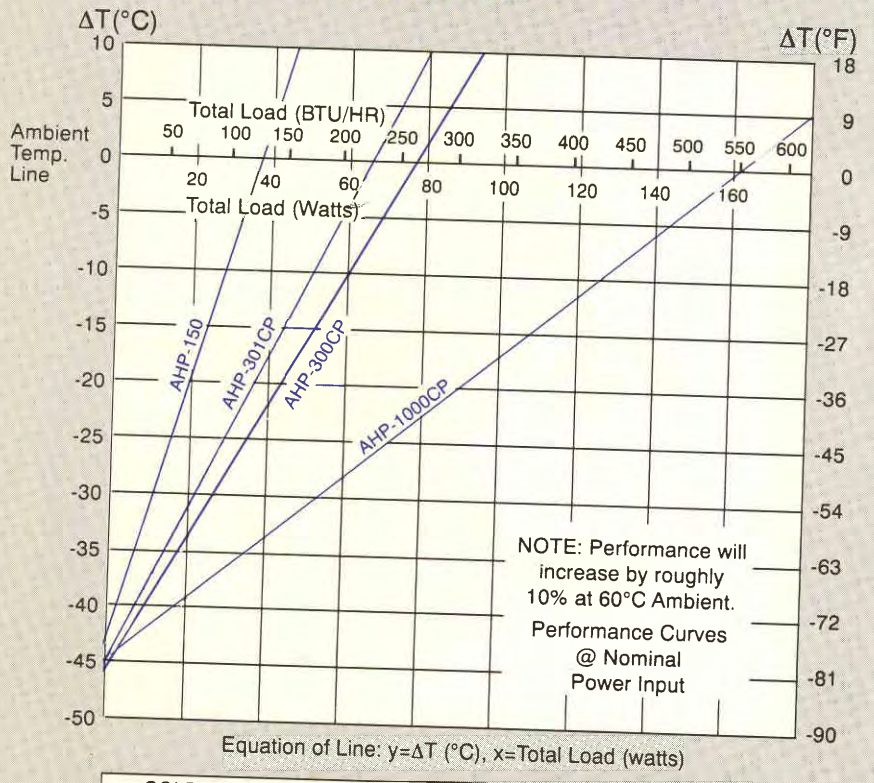
- No load cooling to -20°C (-4°F) at room temperature of 25°C (+77°F)
- Compact
- No fluorocarbons, compressors, or piping required
- No moving parts except fan
- Operates in -30°C (-22°F) to +60°C (+140°F)
- Low vibration, noise, maintenance
- Adaptable to benchtop laboratory use
- Environmentally safe
- Operates in any position- horizontally, vertical, etc.

Please Note: If optional heating is required add "HC" suffix, example: AHP-301CPHC

Applications in Instrumentation, Laboratory and Component Cooling

TECA's smallest air cooled heat pump, the AHP-150 comes only in the cold plate style. Its small size and D.C. voltage requirements make it ideal for mobile and laboratory applications. Heat is transferred from the cold plate via thermoelectric modules to the heat sink where it is dissipated into the ambient air. The AHP-300CP is designed to operate from a DC voltage range of 6-56 volts. The AHP-301CP is our smallest cold plate designed to operate directly from either 115 or 230 VAC input power. The AHP-1000CP also operates directly from 115 VAC. It is ideal for bench-top applications, as a sample cooler or a laboratory cold plate.

Performance Curve: AHP-150/ AHP-300CP/ AHP-301CP/ AHP-1000CP



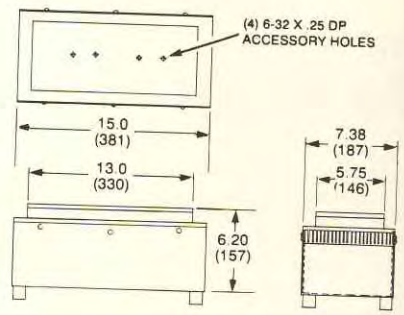
Equation of Line: y=ΔT (°C), x=Total Load (watts)

COLD PLATE PERFORMANCE @ 25°C AMBIENT TEMPERATURE				
MODEL	AHP-150	AHP-300CP	AHP-301CP	AHP-1000CP
EQUATION	y=1.2x-44.0	y=.60x-46.4	y=.69x-45.2	y=.28x-45.0

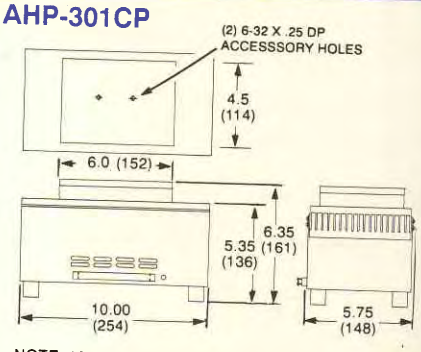
Model Number	Nominal Input	Input Range	Weight lbs. (kg)
AHP-150	*12 VDC @ 6A 24 VDC @ 3A	6-14 V@ 3.5-7A 13.5-28 V@ 1.7-3.5A	3.5(1.6)
AHP-300CP	12 VDC @ 12.5A *24 VDC @ 5.3A 48 VDC @ 3.1A	6-14 V@ 6.5-14.3A 13.5-28 V@ 3.6-6.9A 28-56 V@ 1.8-3.6A	6.0(2.7)
AHP-301CP	*115 VAC @1.1A 230 VAC @0.5A (50-60 Hz)	–	10.5(4.8)
AHP-1000CP	115V@2.7A (50-60 Hz)	–	25.7(11.7)

Standard Factory Wiring

AHP-1000CP

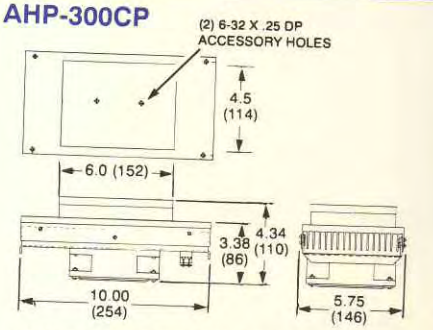


AHP-301CP



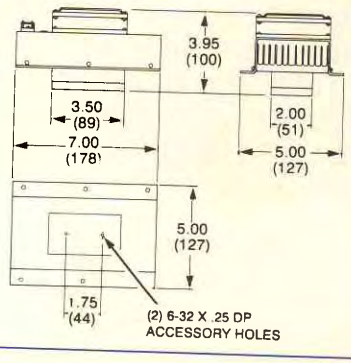
NOTE: 10-32 X 3/4 STUDS AND GASKET NOT SHOWN

AHP-300CP



NOTE: 10-32 X 3/4 STUDS AND GASKET NOT SHOWN

AHP-150CP



Dimensions: Inches (millimeters)

Solid State Cold Plates (Liquid Cooled)

Model Number	LHP-150	LHP-300CP	LHP-800CP	LHP-1700CP, LHP-1702CP
Cooling capacity	135 BTU/ HR	300 BTU/ HR	750 BTU/ HR	1500 BTU/ HR
Heating capacity (Opt.)	170 BTU/ HR	340 BTU/ HR	680 BTU/ HR	1360 BTU/ HR

Features:

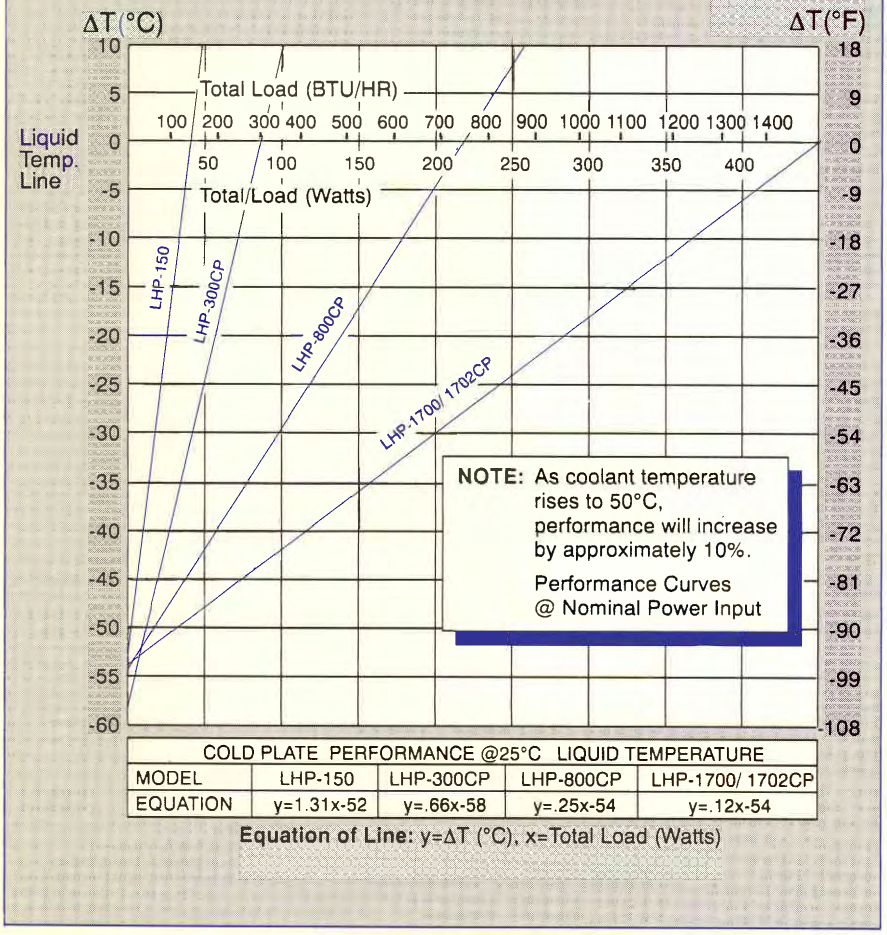
- No load cooling to -25°C (-13°F), at 25°C coolant temperature
- High efficiency
- No moving parts
- Operates in -30°C (-22°F) to +80°C (+175°F)
- Low vibration, noise, maintenance
- Compact, low profile
- Adaptable to NEMA type explosion proof applications (consult factory)
- Environmentally safe
- Operates in any position horizontal, vertical etc.

Please Note: If optional heating is required add "HC" suffix. Example: LHP-800CPHC

Applications in Instrumentation, Laboratory and Component Cooling.

The LHP-series of cold plates are used in environments where space and large temperature differentials are of high concern. The LHP-150 is currently the smallest cold plate manufactured by TECA. It combines the use of thermoelectric cooling and liquid heat transfer to maximize the performance and efficiency. Greater C.O.P.'s can be achieved by operating at lower power levels. The LHP-1700CP is our largest liquid cooled cold plate designed to operate direct from 115 VAC input, model LHP-1702CP operates at 230 VAC.

Performance Curves: LHP-150/ LHP-300CP/ LHP-800CP/ LHP-1700CP/ LHP-1702CP

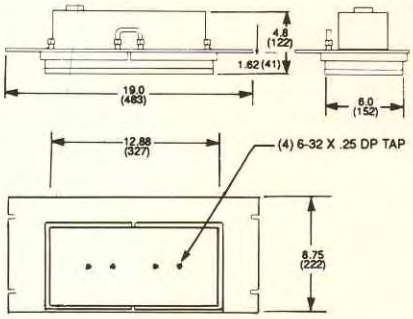


COLD PLATE PERFORMANCE @25°C LIQUID TEMPERATURE				
MODEL	LHP-150	LHP-300CP	LHP-800CP	LHP-1700/ 1702CP
EQUATION	y=1.31x-52	y=.66x-58	y=.25x-54	y=.12x-54

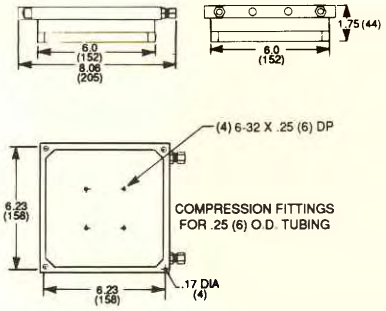
Equation of Line: y=ΔT (°C), x=Total Load (Watts)

MODEL NUMBER	NOMINAL INPUT	RANGE INPUT	WEIGHT lbs.(kg)	MINIMUM RECOMMENDED FLOW RATE Gal/Min(L/Min)
LHP-150	12 VDC @4.5A	0-16 VDC	0.75 (.34)	.05 (.2)
LHP-300CP	24 VDC @4.5A	0-32 VDC	1.75 (0.8)	.05 (.2)
LHP-800CP	30 VDC @10A	0-35 VDC	5.2 (2.4)	0.5 (2.0)
LHP-1700CP	115 VAC @6A	0-135 VAC	19.75 (9.0)	0.5 (2.0)
LHP-1702CP	230 VAC @3A	0-270 VAC	19.75 (9.0)	0.5 (2.0)

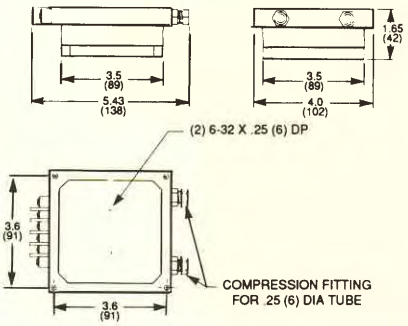
LHP-1700CP/ LHP-1702CP



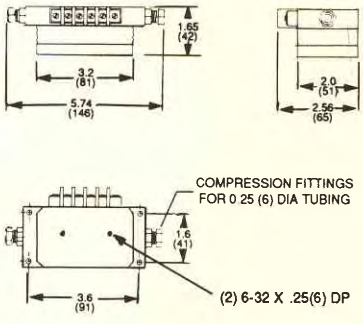
LHP-800CP



LHP-300CP



LHP-150



Dimensions: Inches (millimeters)

Liquid Chillers
(Air Cooled)

teca

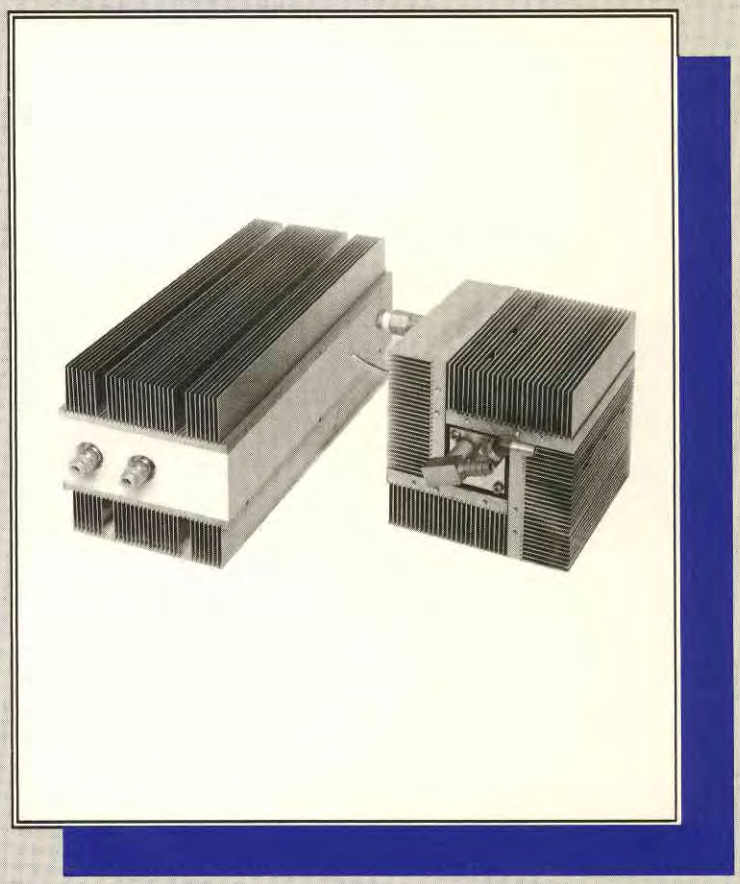
ThermoElectric Cooling America Corporation

Model	ALC-750*	ALC-1200*	ALC-1500*
Rating	750 BTU/HR	1200 BTU/HR	1500 BTU/HR

Heating optional (consult factory)

Features:

- High efficiency; compact design
- No chloro-fluorocarbons (CFC's) or compressor required
- Reliable, completely solid state
- Low vibration, noise, maintenance
- No load cooling to -15°C (-5°F) at room temperature of 20°C (77°F)
- Excels in high ambients -30°C (-23°F) to +60°C (140°F)
- Adaptable for retrofit and standard O.E.M. applications
- Runs on 115 VAC



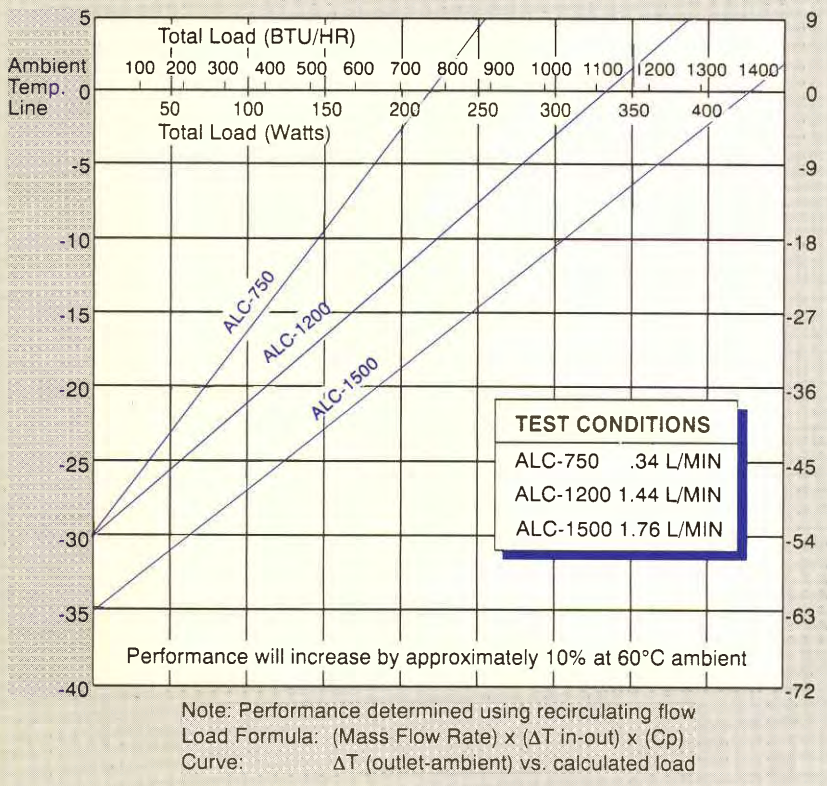
NOTE: Above picture shows chillers in subassembly form. Actual assembly consists of fan(s), shroud(s), and power supply.

In Line Process and Instrumentation Liquid Cooling

In keeping with today's demand for high capacity in compact packaged cooling, TECA would like to introduce its latest development. Models (ALC-750, 1200, 1500) are designed to maximize liquid cooling potentials in less than 1/2 the required space. A combination of thermoelectric cooling modules and an efficient heat sink design give the ALC- Chiller systems the edge in liquid cooling. Traditional conventional based cooling systems are usually expensive to maintain, bulky, hard to control, and inconvienent to operate. With solid-state cooling, temperature control within one degree along with maintenance-free operation are just some of the benefits that will be experienced. And with today's growing concern about the adverse effect that CFC's (chloro-fluorocarbons) have on the environment, thermoelectric cooling technology is an environmentally friendly solution to tomorrow's problems.

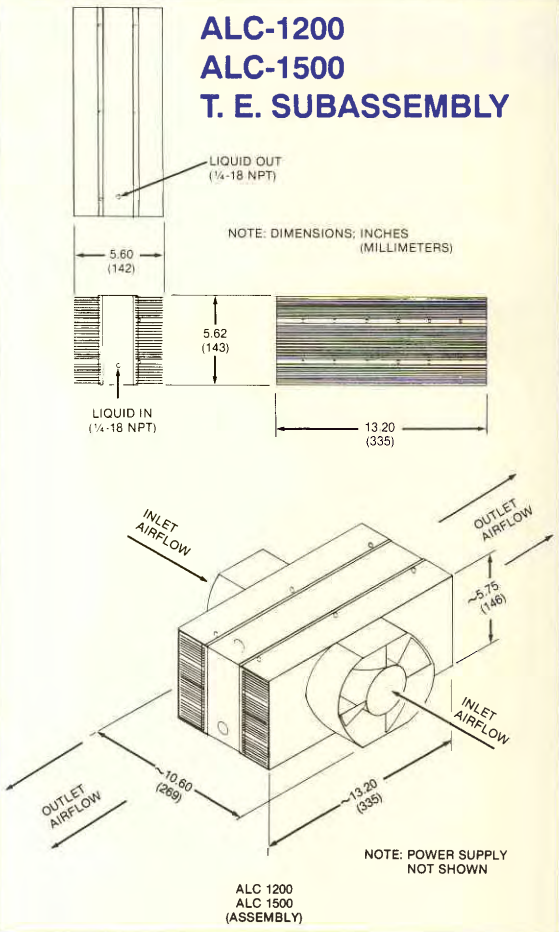
All models come with forced convection and a DC power supply to run direct from 115 VAC input.

Performance Curve: T. E. Liquid Chillers



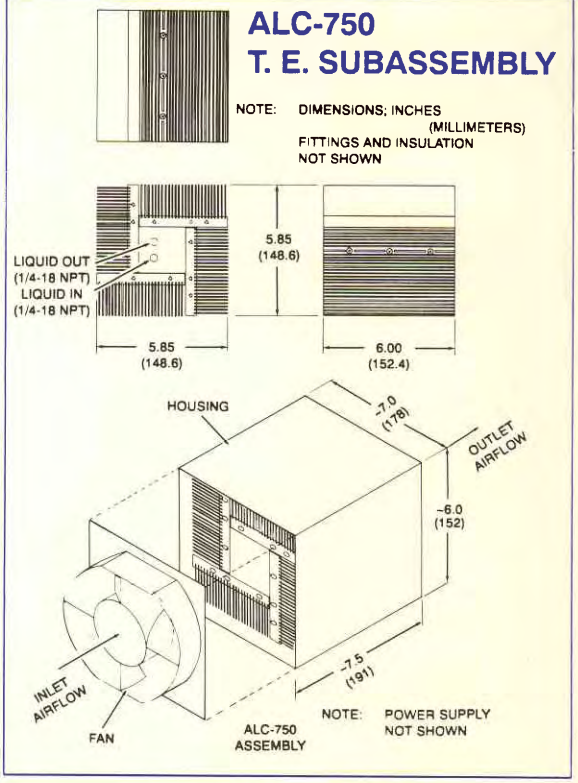
Note: Performance determined using recirculating flow
Load Formula: (Mass Flow Rate) x (ΔT in-out) x (Cp)
Curve: ΔT (outlet-ambient) vs. calculated load

ALC-1200 ALC-1500 T. E. SUBASSEMBLY



ALC 1200
ALC 1500
(ASSEMBLY)

ALC-750 T. E. SUBASSEMBLY



ALC-750
ASSEMBLY

Specifications

Model Number	Power Required Voltage/ Amps	Weight lb (kg)
ALC-750	115 VAC/ 2.8 A	16 (7.3)
ALC-1200	115 VAC/ 6.3 A	22 (10)
ALC-1500	115 VAC/ 5.1 A	22 (10)

NOTE: If pump is required please consult factory for sizing details.

Temperature Controls

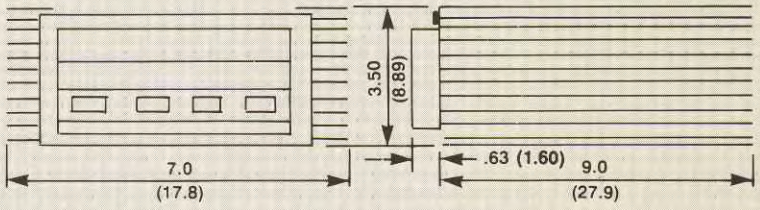
teca

ThermoElectric Cooling America Corporation

Features:

- Time proportioning or on/off control
- Front panel selection of temperature range, dead band, and integral-derivative control
- Solid state circuitry with switching output for 8 amperes AC
- Flexible industrial microprocessor master control
- Adjustment of conversion/ display update rate

Microprocessor Dual Cool/ Heat Temperature Control (TC-4500)



Note: Dimensions, inches(cm)

SPECIFICATIONS

Power Input	115 VAC @ 0.1 Amp
Solid State Relay	8 Amperes AC
Weight	6 lbs (2.7 kg)
(Control Signal)	
TC-4500 DC	3-32 VDC
TC-4500 AC	115 VAC

Model

TC-4500 DC	To be used in conjunction with TECA supplied heating/cooling systems
TC-4500 AC	To be used as a general purpose temperature controller (115 VAC switching relays included)

Temperature Control Specification Chart

MODEL #	COOL ONLY	HEAT/COOL	SENSOR TYPE	MOUNTING	TEMPERATURE RANGE	ACCURACY (TYPICAL)
TC-5F	X		Reed Switch	Factory	(3) Fixed	+/- 9°F (5°C)
TC-3F		X	Reed Switch	Factory	(Hi, Lo) Fixed	+/- 9°F (5°C)
TC-2A	X		AD590 Sensor	Factory	115°F/48°C 60°F/16°C	+/- 5°F (2.5°C)
TC-3A		X	AD590 Sensor	Factory	115°F/48°C 32°F/0°C	+/-5°F (2.5°C)
TC-4500		X	T-Type Thermocouple	Remote	741°F/394°C -380°F/-229°C	+/- 1°F (.5°C)

NOTE: For model compatability please refer to product selection chart on pages (2, 3)

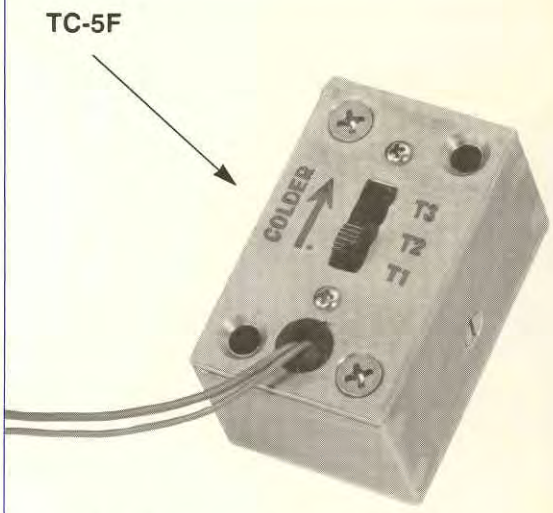
Fixed Point Thermostatic Control TC-5F, TC-3F

TC-5F (COOL ONLY) 3 SET POINT ADJUSTMENT

SET POINTS	ON	OFF
T_1	36°C/96°F	28°C/82°F
T_2	26°C/78F	19°C/67°F
T_3	CONSTANT	

TC-3F (HEAT/COOL)

	ON	OFF
COOL	36°C/96°F	28°C/82°F
HEAT	5°C/ 40°F	14°C/ 58°F



*NOTE: Solid state relay not shown

Adjustable Set Point Control TC-2A, TC-3A

TC-2A (COOL ONLY)

Test points:

- Black (Ground)
- White (Actual Temp)
- Green (Cool Set Point)

Set point adjustment: Measure the DC voltage between black (-) and green (+) Adjust cool trimpot to change set point.
Conversion: (°F x 0.01 volts)

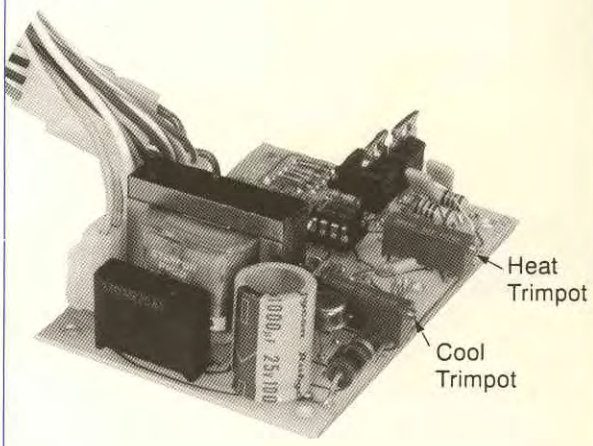
TC-3A (HEAT/COOL)

Test points:

- Black (Ground)
- White (Actual Temp)
- Green (Cool Set Point)
- Red (Heat Set Point)

Set point adjustment: Cool: (same as above)
Heat: measure DC voltage between black (-) and red (+).
Adjust heat trimpot to change set point.
Conversion (°F x 0.01 volts)

Test points are typically on exterior (hot side) of unit



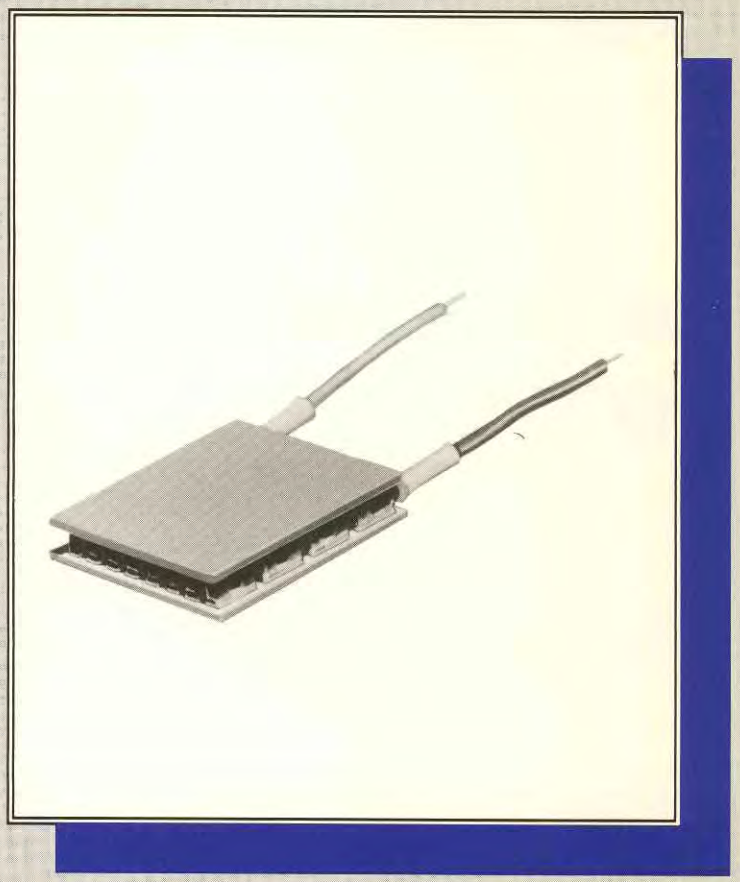
*NOTE: Solid state relay(s) not shown

Single Stage ThermoElectric Modules

Rating: 0-235 BTU/ HR Cooling

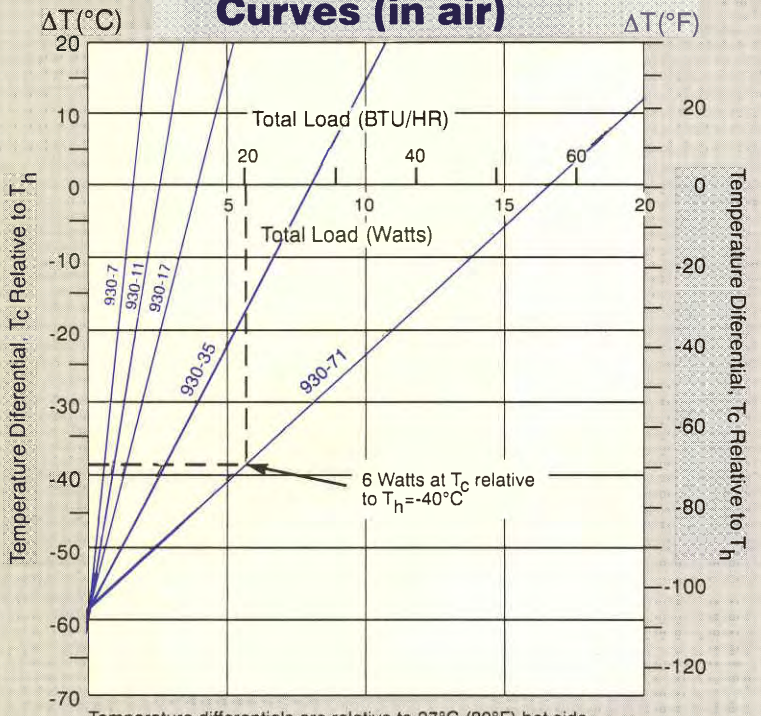
Features:

- Operates in -150°C (-238°F) to 80°C (+176°F) Temperature Range
- No vibration, noise
- Operates in any orientation, horizontal, vertical, etc.
- Can operate in cooling or heating mode
- No moving parts, compressor, or piping required.
- No load cooling to -41°C (-42°F) With Hot side at +25°C (+77°F)

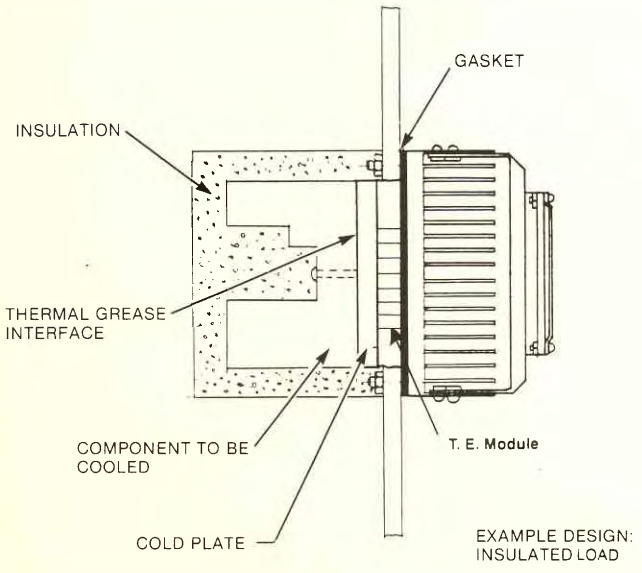


Solid state thermoelectric modules are a silent, compact, and reliable method of heat removal. Applications, ranging from missile guidance systems to portable refrigerators, are only limited by the imagination of the designer. System simplicity assures ease of adapting to thermoelectric heat pumping. Thermoelectrics have no compressor or piping, eliminating compressor maintenance and coolant leakage. Modules can be converted from cooling to heating by a reversal of polarity from the power input.

Series 930 Actual Performance Curves (in air)



Temperature differentials are relative to 27°C (80°F) hot side temperature (Th).
Note: As hot side temperature rises to 50°C (122°F) temperature differential and load capacity will improve by approximately 10%. For improved efficiency and smaller heat sink dimensions the performance curves shown have been operated at 75% of the maximum rated current and voltage.



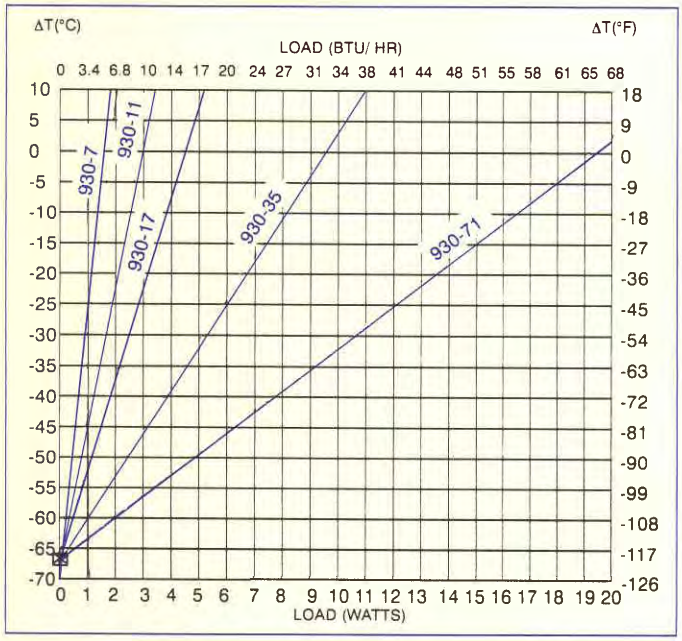
4 Easy Steps To Design Of ThermoElectrics

1. The designer must know three essential values; required cooling temperature of the load, ambient temperature and useful thermal load.
2. Determine actual requirements of TE module. Find the TE module cold side temperature (Tc), hot side temperature (Th), and heat pumped by TE module (Q). Note that a temperature difference (Th-Tc) in excess of 50°C generally requires a multi-stage design.
3. Select a TE module which operates in the current range you are willing to supply and supplies the heat pumping at the required temperature differential. (Single stage module specification chart, pg 46, 47)
4. With the module type, find module voltage and calculate electrical input power and hot side output to determine power supply and heat sink requirements.

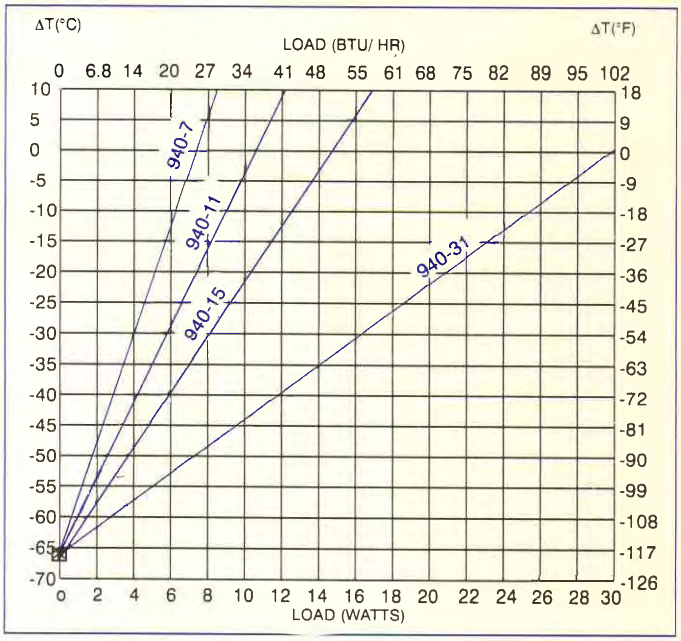
Example

1. Assume the load temperature is +5°C (+41°F), ambient air temperature is +25°C (+77°F) and useful load is 4 watts (14 BTU/hr).
2. In this practical case with well designed heat transfer and isolation, expect a 5°C temperature drop on the cold side to the load and a 15°C rise on the hot side to ambient with a forced convection heat exchanger. Leakage losses should not exceed 10% of the load. Thus, you have a 0°C (+32°F) cold side, +40°C (+104°F) hot side and 4.4 watt (15 BTU/hr) module load.
3. A single stage 930-35 module operating at Th = 40°C was found to provide 3.5 watts (12 BTU/hr) of cooling. This unit is undersized. A 930-71 module operating at Th = 40°C provides 6 watts (20 BTU/hr) cooling. This module has amble capacity. (See curve on left.)
4. Module voltage is 6 volts, current is 2.8 amps. The heat load of the hot side heat exchanger is 4.4 watts, +6 volts x 2.8 amps = 21 watts.

930 Series



940 Series

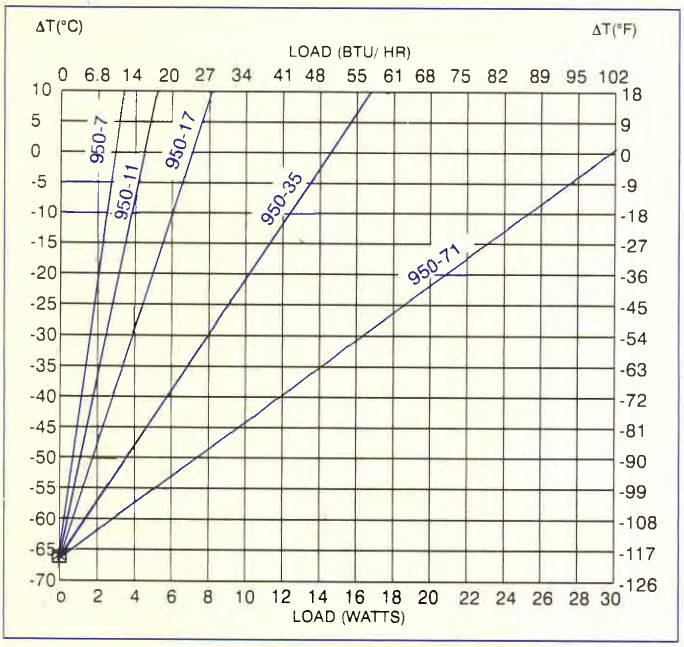


Temperature differentials relative to+27°C (80°F) hot side temperature (Th).

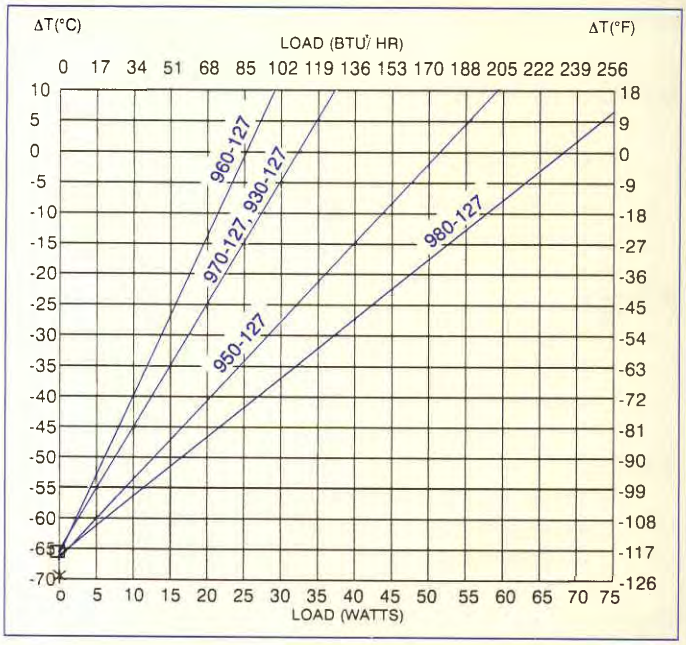
Single Stage Module Specification Chart

Module Series/ Couples	Performance								
	Th=27°C			Th=35°C			Th=50°C		
	MaxΔT @Q_C=0 (ΔT°C)	Max Q_C @ΔT=0 (Q_C watts)	Equation of Line	MaxΔT @Q_C=0 (ΔT°C)	Max Q_C @ΔT=0 (Q_C watts)	Equation of Line	MaxΔT @Q_C=0 (ΔT°C)	Max Q_C @ΔT=0 (Q_C watts)	Equation of Line
930-7	66	1.8	ΔT=36.7Qc-66	73.6	1.9	ΔT=38.7Qc-73.6	78.1	2.0	ΔT=39.1Qc-7
930-11	66	2.9	ΔT=22.76Qc-66	73.6	3.1	ΔT=23.7Qc-73.6	78.1	3.2	ΔT=24.4Qc-7
930-17	66	4.5	ΔT=14.67Qc-66	73.6	4.7	ΔT=15.7Qc-73.6	78.1	5.0	ΔT=15.6Qc-7
930-35	66	9.4	ΔT=7.02Qc-66	73.6	9.9	ΔT=7.43Qc-73.6	78.1	10.4	ΔT=7.51Qc-7
930-71	66	19.0	ΔT=3.7Qc-66	73.6	20.0	ΔT=3.65Qc-73.6	78.1	21.0	ΔT=3.68Qc-7
940-7	66	6.8	ΔT=9.70Qc-66	70.0	7.0	ΔT=10Qc-70	75.4	7.5	ΔT=10.1Qc-7
940-11	66	10.6	ΔT=6.23Qc-66	70.0	11.0	ΔT=6.4Qc-70	75.4	11.7	ΔT=6.4Qc-7
940-15	66	14.5	ΔT=4.55Qc-66	70.0	15.0	ΔT=4.67Qc-70	75.4	16.0	ΔT=4.71Qc-7
940-31	66	30.0	ΔT=2.23Qc-66	70.0	31.0	ΔT=2.25Qc-70	75.4	33.0	ΔT=2.27Qc-7
950-7	66	3.0	ΔT=22Qc-66	70.0	3.1	ΔT=2.2Qc-70	75.0	3.3	ΔT=22.7Qc-
950-11	66	4.6	ΔT=14.35Qc-66	70.0	4.8	ΔT=14.6Qc-70	75.0	5.1	ΔT=14.7Qc-
950-17	66	7.2	ΔT=9.17Qc-66	70.0	7.4	ΔT=9.46Qc-70	75.0	7.9	ΔT=9.50Qc-
950-35	66	14.8	ΔT=4.46Qc-66	70.0	15.3	ΔT=4.58Qc-70	75.0	16.3	ΔT=4.60Qc-
950-71	66	30.0	ΔT=2.3Qc-66	70.0	31.0	ΔT=2.26Qc-70	75.0	33.0	ΔT=2.23Qc-
930-127	70	33.4	ΔT=2.10Qc-70	75.0	38.1	ΔT=1.97Qc-75	80.0	38.6	ΔT=2.07Qc-
950-127	66	51.4	ΔT=1.28Qc-66	71.0	54.4	ΔT=1.30Qc-71	74.4	60.0	ΔT=1.24Qc-7
960-127	66	26.0	ΔT=2.54Qc-66	75.0	29.4	ΔT=2.55Qc-75	80.0	30.0	ΔT=2.67Qc-
970-127	66	33.4	ΔT=1.98Qc-66	75.0	37.8	ΔT=1.98Qc-75	80.0	38.6	ΔT=2.07Qc-
980-127	65	68.8	ΔT=.94Qc-65	72.2	83.2	ΔT=.87Qc-72.2	77.2	84.9	ΔT=.91Qc-7

950 Series

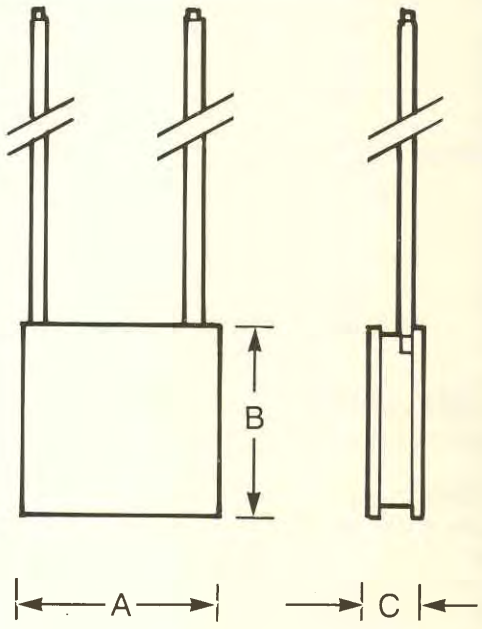


127 Couple Modules

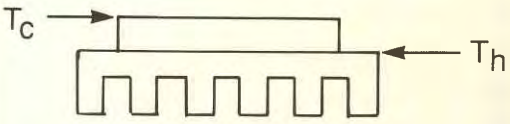


Temperature differentials relative to+27°C (80°F) hot side temperature.

Module Series/ Couples	Electrical			Dimensons		
	Max Current (amps)	Max DC Voltage (volts)	Nominal Resistance (Ω)	A in(cm)	B in (cm)	C in (cm)
930-7	3.7	0.8	0.22	0.38 (.965)	0.38 (.97)	0.19 (.48)
930-11	3.7	1.2	0.32	0.38 (.965)	0.57 (1.46)	0.19 (.48)
930-17	3.7	1.9	0.49	0.57 (1.46)	0.57 (1.46)	0.19 (.48)
930-35	3.7	3.9	0.93	0.57 (1.46)	1.20 (3.05)	0.19 (.48)
930-71	3.7	8.0	2.00	1.2 (3.05)	1.2 (3.05)	0.19 (.48)
940-7	14.0	0.8	0.06	0.57 (1.46)	0.57 (1.46)	0.18 (.45)
940-11	14.0	1.2	0.08	0.57 (1.46)	0.85 (2.16)	0.18 (.46)
940-15	14.0	1.7	0.11	0.57 (1.46)	1.20 (3.05)	0.18 (.46)
940-31	14.0	3.5	0.20	1.2 (3.05	1.2 (3.05)	0.18 (.46)
950-7	6.0	0.8	0.15	0.38 (.97)	0.38 (.97)	0.15 (.38)
950-11	6.0	1.2	0.18	0.38 (.97)	0.57 (1.46)	0.15 (.38)
950-17	6.0	1.9	0.29	0.57 (1.46)	0.57 (1.46)	0.15 (.38)
950-35	6.0	3.9	0.61	0.57 (1.46)	1.20 (3.05)	0.15 (.38)
950-71	6.0	8.0	1.20	1.2 (3.05)	1.2 (3.05)	0.15 (.38)
930-127	3.9	15.4	3.24	1.57 (3.99)	1.57 (3.99)	0.185 (.47)
950-127	6.0	15.4	2.11	1.57 (3.99)	1.57 (3.99)	0.15 (.38)
960-127	3.0	15.4	4.08	1.18 (3.00)	1.18 (3.00)	0.142 (.36)
970-127	3.9	15.4	3.14	1.18 (3.00)	1.18 (3.00)	0.126 (.32)
980-127	8.5	15.4	1.49	1.57 (3.99)	1.57 (3.99)	0.130 (.33)



NOTE: For improved efficiency and smaller heat sink dimensions, operate T.E. modules at 75% of the maximum rated current and voltage.



For Equations:

Max ΔT=temperature differential (T_c-T_h) (°C)

Max Q_c=heat pumped by module (watts)

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