

Application Note 1030

M & P-series Multi-Position Air Handling Unit
Electric Heater Configuration, Electric Heat Kit
Information & ETC setup

Table of Contents

Introduction.....	3
SVZ/PVA Initial Settings	3
Fan Settings (Default):.....	4
Fan Settings (Mode 23 set to 2):.....	5
Backup Heat Sequence of Operations:.....	6
SVZ/PVA Required Changes When Using Electric Heat Kit	7
Electric Heat Kits	8
Basic Information:	8
Electrical Specs:.....	9
Safeties:.....	10
Electric Heat Lockout – ETC-211000-MIT	11
Controller Setup	12
Typical Application	13

Introduction

The SVZ-KP/PVA-AA7 vertical air handling units are units designed to be used with a Mitsubishi Electric Heat Kit (EH##-MPA/SVZ-S/M/L) as opposed to a third party auxiliary heater. As such the unit's default settings have been set to ensure that the Electric Heat Kit will operate effectively out of the box. These settings can be modified as desired to fit specific applications.

This document is meant as a supplement to the SVZ-KP/PVA-AA7 installation & service manuals as well as the Electric Heat Kit installation manual. For additional details please consult these manuals.

SVZ/PVA Initial Settings

Both units are configured from the factory assuming that an Electric Heat Kit is not installed. If the Electric Heat Kit will be utilized then Mode 11 (function setting 111) should be set to **2**. This will force the fan to run at high fan speed anytime the heater is on, regardless of what the fan speed setting is on the thermostat.

Function Table

Mode	Settings	Mode (function) No.	Setting no.	Initial setting	Check
		Wired remote controller (RF thermostat)			
Heater control	Heater Not Present	11	1	1	
	Heater Present ¹	(111)	2		

¹ While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller

² Heater will not operate during all error modes. Heater will only operate during a communication error between indoor unit and outdoor unit

Fan Settings (Default):

No CN4Y jumper present, Mode 23 (function setting 123) set to **1**, Mode 25 (function setting 125) set to **1** (Default):

The fan operates in extra low fan speed during thermo-off (modifiable). Fan operates at speed indicated at controller during thermo-on. Fan operates at high fan speed when Electric Heat Kit is enabled (overrides fan speed setting at controller). The fan is stopped during defrost operation and the heater is disabled:

By setting the Mode No. 23 in the Function Table in section 9-1 and using CN4Y from the CN24RELAY-KIT-CM3 kit, the following patterns of fan control will become possible.

Fan Control Patterns

CN4Y for FAN control (CN24RELAY-KIT-CM3)	Mode (function) No. 23 (123)	Heater operation in defrost and error ¹	Fan operation in defrost and error	Fan (All modes other than defrost and error)	Factory Setting
Enabled	1	OFF	STOP	Set (Heater ON) High ²	○
	2	ON	STOP	(Heater ON)	—

¹ Heater will not operate during all error modes. Heater will only operate during a communication error between indoor unit and outdoor unit.

² While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller.



WARNING

If a heater is installed in the duct, do not use CN4Y. By doing so, the fan will turn off when the heater is on, which may result in fire.

Fan Speed Setting During Heating Thermo-OFF:

Fan Speed Setting¹

Mode	Setting		Mode No.	Setting	Initial Setting
	Heating Thermo-OFF	DEFROST or ERROR			
Fan Control	Very Low	Very Low	25	1	○
	STOP	Remote Controller Setting	25	2	—
	Remote Controller Setting	Remote Controller Setting	25	3	—

Note: If stopping fan during heating thermo-off or cooling thermo-off it is recommended to sense at the wall controller as opposed to the unit's return air thermistor.

Fan Settings (Mode 23 set to 2):

If switching Mode 23 (function setting 123) to **2** this will allow the heater to run during both error and defrost operation. When the heater is operating the fan will run at high fan speed. CN22 should not be modified if using the electric heat kit. Note that the heater will only operate during a communication error between outdoor unit and indoor unit.

By setting the Mode No. 23 in the Function Table in section 9-1 and using CN4Y from the CN24RELAY-KIT-CM3 kit, the following patterns of fan control will become possible.

Fan Control Patterns

CN4Y for FAN control (CN24RELAY-KIT-CM3)	Mode (function) No. 23 (123)	Heater operation in defrost and error ¹	Fan operation in defrost and error	Fan (All modes other than defrost and error)	Factory Setting
Enabled	1	OFF	STOP	Set (Heater ON) High ²	○
	2	ON	STOP	(Heater ON)	—

¹ Heater will not operate during all error modes. Heater will only operate during a communication error between indoor unit and outdoor unit.

² While the heater is on, the fan will operate at high speed regardless of the fan setting on the remote controller.



WARNING

If a heater is installed in the duct, do not use CN4Y. By doing so, the fan will turn off when the heater is on, which may result in fire.

Backup Heat Sequence of Operations:

The SVZ-KP/PVA-AA7 units use a different sequence for enabling the backup heat source, regardless of if the electric heat kit is used or not. As opposed to the standard CN24 backup heat sequence which only uses the variable of differential between space temperature and set temperature the SVZ-KP/PVA-AA7 use the variables of differential between space temperature and set temperature and duration of this differential.

Table. 2 [Heater Control Table]

Mode Change	Condition								
	(To -T _{RA}) > 2.7 ° F [1.5 ° C]	AND	T _{RA} has not increased by 0.9 ° F [0.5° C] in X min	EH1 ON for > 7 min	AND	(To -T _{RA}) > 2.7 ° F [1.5 ° C]	AND	T _{RA} has not increased by 0.9 ° F [0.5° C] in 7 min	(To -T _{RA}) < 0.9 ° F [0.5° C]
EH1 ON	○	AND	○						
EH2 ON				○	AND	○	AND	○	
EH1 OFF									○
EH2 OFF									○
KEY • EH1: Electric Heater 1 • EH2: Electric Heater 2 • To: Set point temperature • T _{RA} : Return Air temperature • X: Time delay (Selectable. Default is 24 min. Selectable to 14, 19, or 29 min)									

The time duration variable is adjustable via function settings through the MA controller (excludes Simple MA):

Request Code ¹	Action ²
390	Monitor Time Delay Setting
391	Set Time Delay to <u>14</u> minutes
392	Set Time Delay to <u>19</u> minutes
393	Set Time Delay to <u>24</u> minutes ³
394	Set Time Delay to <u>29</u> minutes

¹ Time delay can only be selected with MA controller. If use of a non-MA controller is desired, the time delay must first be selected with the MA controller. Then the non-MA controller can be attached and used.

² Delay times are approximate to ± 1 minute.

³ The default time delay setting is 24 minutes.

SVZ/PVA Required Changes When Using Electric Heat Kit

The approximate pressure drop attributed to the Electric Heat Kit is 0.20inWG. When calculating the duct pressure drop 0.20inWG should be added to the cumulative system pressure drop. The SVZ-KP/PVA-AA7 units have a default static pressure setting of 0.50inWG (Mode 8 (function setting 108) set to **2**, Mode 10 (function setting 110) set to **1**). The maximum static pressure setting is 0.80inWG; therefore, the maximum ESP due to the ductwork cannot exceed 0.60inWG. Again, the unit will operate at high fan speed any time the Electric Heat Kit is operating. Consult the SVZ-KP/PVA-AA7 engineering manuals for the units' fan curves at different static pressure settings.

Vertical, Horizontal Left, Horizontal Right External Static Pressure Setting

External Static Pressure	Setting No. of Mode/Function 08/108	Setting No. of Mode/Function 10/110 (Factory Setting)
0.3 in. WG [75Pa]	1	1
0.5 in. WG [125Pa] (Factory Setting)	2	1
0.8 in. WG [200Pa]	3	1

Downflow External Static Pressure Setting

External Static Pressure	Setting No. of Mode/Function 08/108	Setting No. of Mode/Function 10/110
0.3 in. WG [75Pa]	1	2
0.5 in. WG [125Pa] (Factory Setting)	2	2
0.8 in. WG [200Pa]*	3	2

*SVZ-KP36 in Downflow External Static pressure: 0.60

*PVA-A42 in Downflow External Static pressure: 0.70

Note: In order to install the SVZ-KP units in a downflow position, the Downflow Kit DFK-M/S is required.

Electric Heat Kits

Basic Information:

Depending on the size of the unit and additional heat needed there will be either a single stage or two stages of backup heat. The electric heater model numbers denote the kW rating e.g. a EH03-MPA-S(B) is a 3kW small chassis electric heater.

		Electric Heat Kit															
		EH03-MPA-S(B)	EH05-MPA-S(B)	EH08-MPA-S(B)	EH03-SVZ-S	EH05-SVZ-S	EH08-SVZ-S	EH03-MPA-M(B)	EH05-MPA-M(B)	EH08-MPA-M(B)	EH05-SVZ-M	EH08-SVZ-M	EH10-SVZ-M	EH10-MPA-M(B)	EH10-MPA-L(B)	EH15-MPAS-L(B)	EH17-MPAS-L(B)
Stages (1st + 2nd)		3	5	4+4	3	5	4+4	3	5	4+4	5	4+4	5+5	5+5	5+5	7.5+7.5	8.75+8.75
Air Handler Model	SVZ-KP12NA				o	o											
	SVZ-KP18NA				o	o	o										
	SVZ-KP24NA				o	o	o			o							
	SVZ-KP30NA																
	SVZ-KP36NA																
	PVA-A12AA7	o	o														
	PVA-A18AA7	o	o	o													
	PVA-A24AA7			o											o		
	PVA-A30AA4							o	o	o					o		
	PVA-A30AA7								o	o	o				o		
	PVA-A36AA4															o	o
	PVA-A36AA7															o	o
	PVA-A42AA4															o	o
	PVA-A42AA7																o

Electrical Specs:

The heaters are powered separately from the SVZ-KP/PVA-AA7 unit and require 208/240V single phase electrical service. Electrical specifications can be seen below. The units include the necessary relays and wiring harnesses to integrate the unit with CN24-1 and CN24-2 (if 2 stages are present).

Electric Heat Part Number	Heater kW		Heater Amps ¹	MCA ¹	MOP ¹	Htr & Mtr Amps ²	MCA ²	MOP ²	Factory Installed Circuit Breaker
	208V/240V		208V/240V	208V/240V	208V/240V	208V/240V	208V/240V	208V/240V	
EH03-SVZ-S	2.3/3.0		10.8/12.5	13.5/15.6	15/20	13.2/14.9	16.5/18.6	20/20	20
EH05-SVZ-S	3.8/5.0		18.1/20.8	22.6/26	25/30	20.5/23.2	25.6/29	30/30	30
EH08-SVZ-S	6.0/8.0		28.9/33.3	36.1/41.7	40/45	31.3/35.7	39.1/44.7	40/45	45
EH05-SVZ-M	3.8/5.0		18.1/20.8	22.6/26	25/30	21.4/24.1	26.7/30.2	30/30	30
EH08-SVZ-M	6.0/8.0		28.9/33.3	36.1/41.7	40/45	32.2/36.6	40.2/45.8	45/50	50
EH10-SVZ-M	7.5/10		36.1/41.7	45.1/52.1	50/60	39.4/45	49.3/56.2	50/60	60
EH03-MPA-S(B)	2.3/3.0		10.8/12.5	13.5/15.6	15/20	13.2/14.9	16.5/18.6	20/20	20
EH05-MPA-S(B)	3.8/5.0		18.1/20.8	22.6/26	25/30	20.5/23.2	25.6/29	30/30	30
EH08-MPA-S(B)	6.0/8.0		28.9/33.3	36.1/41.7	40/45	31.3/35.7	39.1/44.7	40/45	45
EH03-MPA-M(B)	2.3/3.0		10.8/12.5	13.5/15.6	15/20	14.1/15.8	17.7/19.8	20/20	20
EH05-MPA-M(B)	3.8/5.0		18.1/20.8	22.6/26	25/30	21.4/24.1	26.7/30.2	30/30	30
EH08-MPA-M(B)	6.0/8.0		28.9/33.3	36.1/41.7	40/45	32.2/36.6	40.2/45.8	45/50	50
EH10-MPA-M(B)	7.5/10		36.1/41.7	45.1/52.1	50/60	39.4/45	49.3/56.2	50/60	60
EH10-MPA-L(B)	7.5/10		36.1/41.7	45.1/52.1	50/60	40.6/46.2	50.8/57.7	60/60	60
EH15-MPAS-L(B)	11.3/15	Circuit 1	27.1/31.2	33.9/39.1	35/40	31.6/35.8	39.5/44.7	40/45	45
		Circuit 2	27.1/31.2	33.9/39.1	35/40	27.1/31.2	33.9/39.1	35/40	40
EH17-MPAS-L(B)	13.2/17.5	Circuit 1	31.6/36.5	39.5/45.6	40/50	36.1/41	45.1/51.2	45/60	60
		Circuit 2	31.6/36.5	39.5/45.6	40/50	31.6/36.5	39.5/45.6	40/50	50

Safeties:

The Electric Heat Kits have built in circuit breakers for overload scenarios and to function as a local disconnect. The units also have multiple built in fusible links rated at a maximum temperature. These are one time use and replaceable as individual components. If the coil/element fails the entire heater assembly must be replaced.

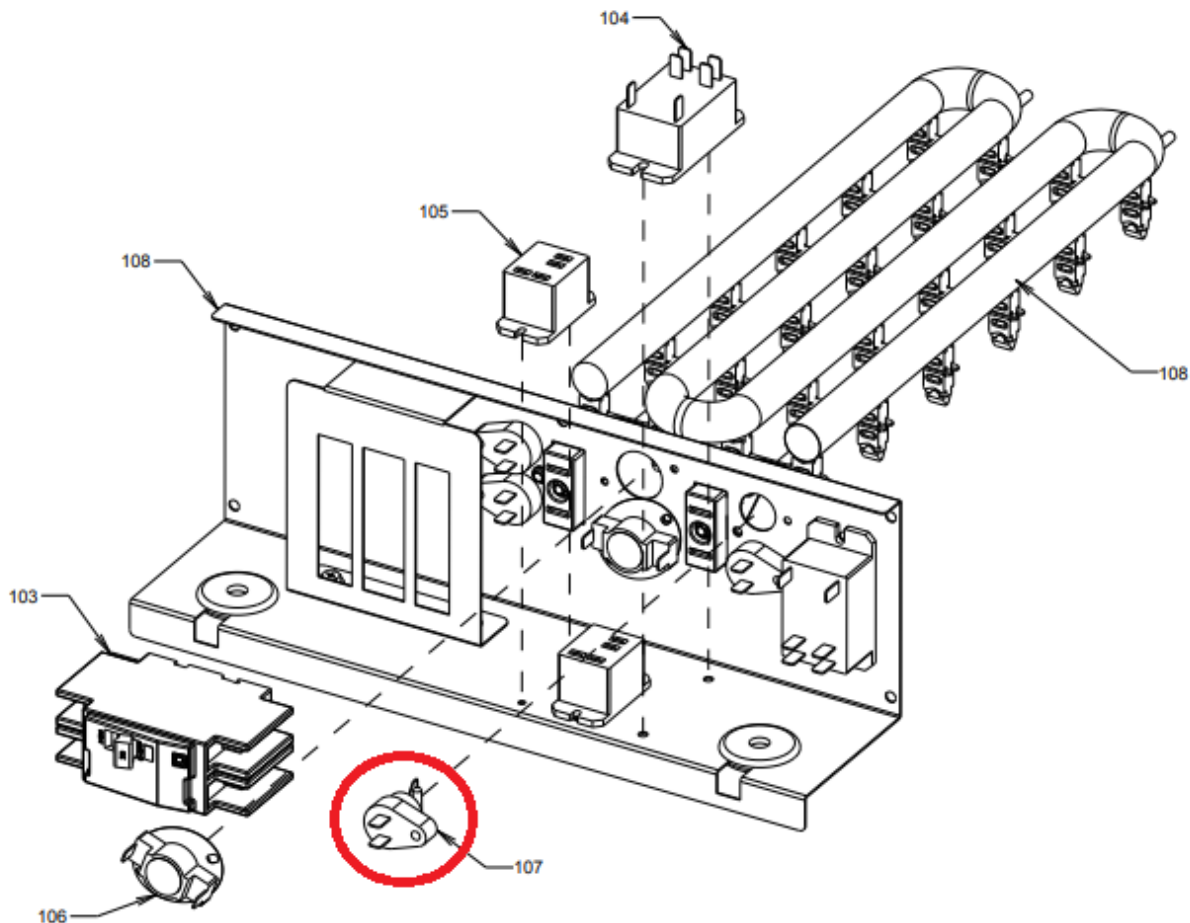
No.	Part No.	Part Name	Spec.	EH03-SVZ-S	EH05-SVZ-S	EH08-SVZ-S	EH03-MPA-S (B)	EH05-MPA-S (B)	EH08-MPA-S (B)	EH05-SVZ-M	EH08-SVZ-M	EH10-SVZ-M	EH03-MPA-M (B)	EH05-MPA-M (B)	EH08-MPA-M (B)	EH10-MPA-M (B)	EH10-MPA-L (B)	EH15-MPA-S-L (B)	EH17-MPA-S-L (B)	Notes for models	Revision info.
107	0200-218-001P	FUSIBLE LINK 117C																	4	thermal fuse	
107	0200-200-001P	FUSIBLE LINK 110C							4											thermal fuse	
107	0200-196-001P	FUSIBLE LINK 104C									2				2			4		thermal fuse	
107	0200-150-001P	FUSIBLE LINK 98C				4									4		2			thermal fuse	
107	0200-086-001P	FUSIBLE LINK 93C						1												thermal fuse	
107	0200-195-001P	FUSIBLE LINK 84C			2					4										thermal fuse	
107	0200-228-001P	FUSIBLE LINK 77C		2						2				2						thermal fuse	
107	0200-221-001P	FUSIBLE LINK 72C					2						2							thermal fuse	

Notes:

* In the event of a heater coil/element failure, the entire heater assembly will have to be replaced. Item 108.

** All components individually packaged and labeled with Mitsubishi service part number

*** Actual configuration and number of components may differ from image shown on previous pages

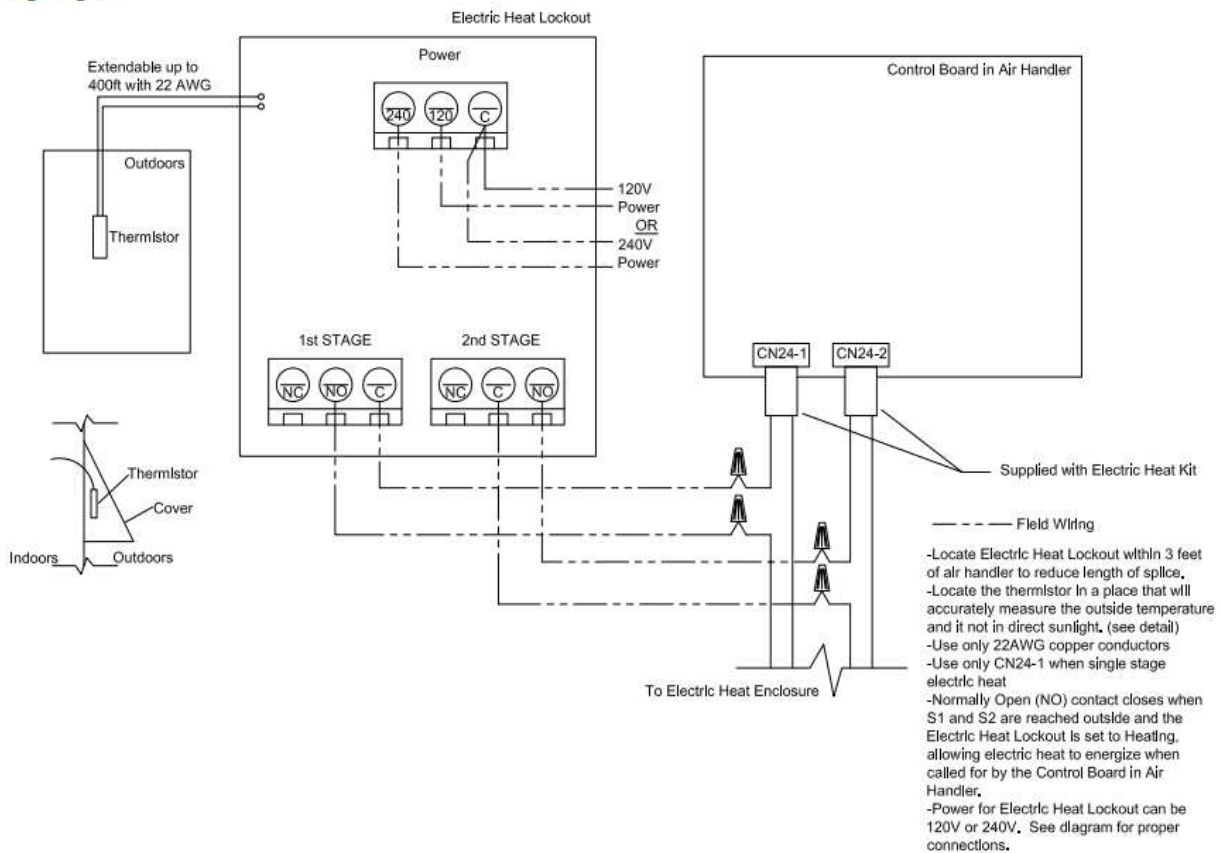


Electric Heat Lockout – ETC-211000-MIT

The Electric Heater Kit's operation is not locked out by default i.e. the heater will energize anytime the space temperature drops -1.8F below the set temp (default value, value is adjustable based on heater control mode). If an ambient temperature lockout is desired the ETC-211000-MIT accessory can be utilized.

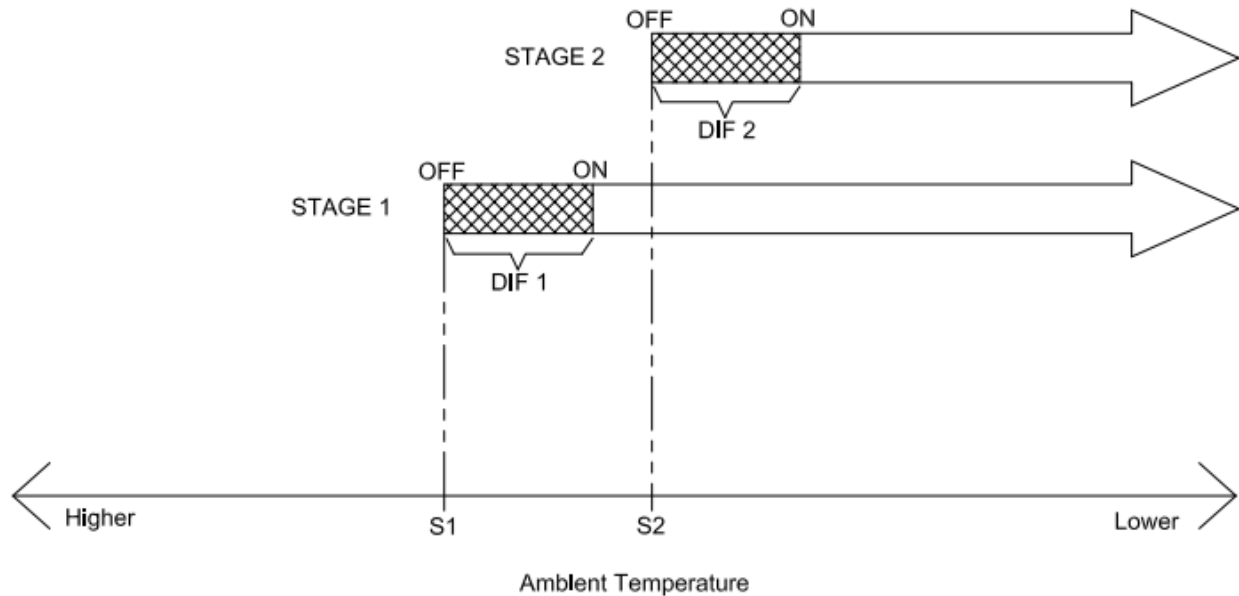
The ETC kit comes with a control module and ambient temperature sensor module. The control module accessory requires 120 or 208/240V single phase power for operation. The ambient temperature sensor module comes with an 8' cable which can be extended to 800' with 22 AWG or larger copper cable to avoid added resistance. The control module is designed to be installed indoors, within 3' of the AHU to reduce the length of the splice. The ambient temperature sensor should be mounted outside, on the north side of the building (to reduce direct sunlight) and above the snow line.

Wiring Diagram



Controller Setup

The controller has 2 ambient temperature settings, one for Stage 1 (S1) and one for Stage 2 (S2). In addition, each stage has a selectable temperature differential associated with it.



Example:

S1 = 32F, DIF 1 = 3F

S2 = 25F, DIF 2 = 3F

Given the above parameters, stage 1's normally open contact within the control module will close at 29F (32F – 3F) which allows the first stage of electric heat to turn on if there is a demand (if the space temp is 1.8F below the set temperature of the controller). Stage 2's normally open contact within the control module will close at 22F (25F – 3F) which allows the second stage of electric heat to turn on if there is a demand (if the space temp is 2.7F below the set temperature of the controller).

It's important to note that the ETC solely uses ambient temperature for the enabling/disabling of the 2 stages of electric heat. If the heat pump goes into an error condition the 2 stages of electric heat **WILL NOT ENABLE UNLESS THE AMBIENT TEMPERATURE(S) SET IN THE ETC ALLOW.**

Typical Application

Example:

Structure heat loss is "55,000 Btu/h at -10° F" outdoor design temperature
PUZ-HA36 Hyper Heat Outdoor unit with a PVA-36 multi-position air handler
10 KW (34,120 Btu/h) Electric heat with two stages of 5 KW (17,060 Btu/h) each

The best way to set the outdoor electric heat lockout is to do a load calculation and load profile as shown below. This will provide the most energy efficient operation and homeowner comfort. As usual, calculate the structure heat loss at the local outdoor design temperature. In this example, the heating loss is 55,000 Btu/h at an outdoor design temperature of -10°F. This is shown at the point "L". Plot a line from there to the outdoor temperature of "70° F" with no heat loss. This is the load profile of the structure.

Next, plot the capacity of the heat pump as shown below including the derate at lower outdoor temperatures. The point where these lines cross will show where the first stage electric heat should be allowed to energize at point ("A"). Plot the electric heating capacity for the first stage electric heat as shown. The point where this line crosses the load line ("B") indicates where the second stage electric heat should be allowed to energize. In this example the first stage electric heat (CN24-1) should be allowed to energize at approximately "12° F" outdoor temperature. The second stage electric heat (CN24-2) should be allowed to energize at approximately "-5° F" outdoor temperature. If there is only one stage of electric heat, only (CN24-1) needs to be set at point ("A")

