

Instruction Bulletin

43500-054-31
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Monroe NC, USA

Instructions for Field Installation of Forced Air Cooling Equipment in Dry Type Transformers



SQUARE D
Schneider Electric

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Section 1-Introduction:

The following is a set of instructions describing the installation of a Model 98 Digital Temperature controller and related cooling fans or blowers into a Dry Type Transformer manufactured by Square D Company. When completed properly, this upgrade will provide the transformer with its full forced air cooling KVA.

The transformer that is receiving this upgrade should already be designed to accept forced air cooling. To verify this, look at the transformer nameplate. The transformer 'Class' should be 'AA/FFA'. If another class type is listed on the nameplate or if you are unable to visually verify the class type then please contact Square D Customer Service before beginning this upgrade for help.

This instruction bulletin is not an application guide for the Model 98 controller or a substitute for adequate training in safe working procedures for this and related electrical equipment. Installation of this electrical equipment may require special licenses or training. Consult applicable national, industry, and local codes for specific requirements that may apply.

The successful operation of this forced air upgrade kit depends on various factors such as installation, service conditions, and maintenance. Unless designed for other specific applications, this forced air upgrade kit should only be installed on a transformer that is operating under the conditions as specified in ANSI/IEEE C57.12.01.

While a great effort has been done to assure that this instruction bulletin is accurate and provides enough detail to assure a problem free upgrade installation, all retrofit installations are different and therefore your finished installation may vary from the photographs shown.

Section 2 - Safety Precautions:

**DANGER**



Hazardous Voltage. Risk of Shock, Burn or Explosion.

- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage-sensing device to confirm power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in Death or Serious Injury

Read and understand this entire instruction bulletin as well as the instruction bulletin for the Model 98 Digital temperature Controller for Medium Voltage Transformers and the instruction bulletin that was provided with the transformer before installing, operating or maintaining this equipment.

Disconnect all power and verify that the transformer is de-energized before installing this equipment. Do not rely on visual indications such as switch position or fuse removal for determining a de-energized condition. Always assume that a terminal is energized unless it has been checked with a properly rated meter to ensure that the terminal is de-energized and grounded.

Section 3 - Parts Included in Upgrade Kit:

The following parts are included in this upgrade kit. Please verify that you have all of the parts before beginning the retrofit procedure. If you are missing any of these items please contact a Square D Customer Service Representative for assistance.

- A) Qty-1 Model 98 Temperature Controller, complete with latch and hinges installed.
- B) Qty -1 Model 98 Control Box, pre-wired and ready for installation.
- C) Qty-1 Glastic Thermocouple Support Rod.
- D) Qty-60ft Thermocouple Wire.
- E) Qty-1 Model 98 Danger Decal, p/n 43500-169-09.
- F) Qty-6 Fan/Blower Danger Decal, p/n 43500-169-02.
- G) Model 98 Digital Temperature Controller Instruction Bulletin, p/n 43500-054-26.
- H) Fan or Blower Assemblies (quantity and type varies per transformer type and KVA)
- I) Hardware Assembly.
- J) Adapter Panel (Model 85 style cutout)
- K) Adapter Panel (Qualitrol 108 style cutout)
- L) Cable Support Plate

Section 4 - Cooling Fan Installation:

Remove the transformer enclosure panels to gain access to the interior. The panels are located at the front and rear of the transformer. The front and rear center panels are not removable.

The size and quantity of fans provided with each kit will vary as follows:

Table 1

Transformer Type	Cooling Type - Fans			
	(6) 6 Watt	(12) 6 Watt	(6) 50 Watt	(12) 50 Watt
Power Cast			<=1000 Kva	
Power Dry	<=1000 Kva	1500-2500Kva		>2500 Kva
Uni-Cast			<= 2500 Kva	<= 2500 Kva
Installation Dwg	43540-033-35	43540-033-98	43540-033-99	43540-037-02

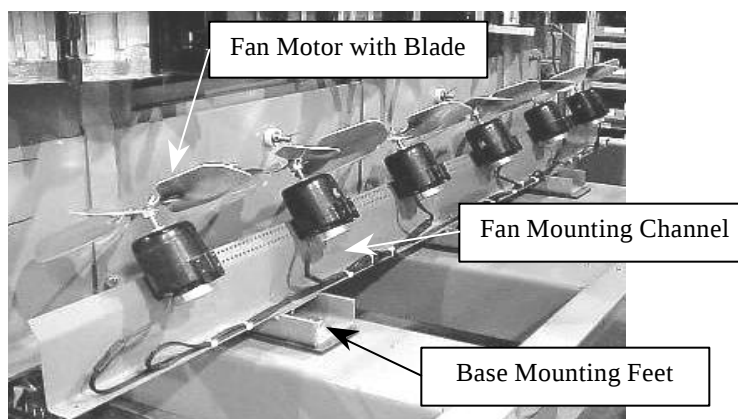


Photo 1 - Typical Fan Installation

Begin the fan installation by installing the fan mounting channels to the transformer base mounting feet using the supplied 3/8" bolts, flat and lock washers. There are two fan-mounting channels supplied in the kit. These channels mount to either side of the core/coil assembly and bolt into the threaded inserts that are factory installed in the base mounting feet. See photo 1 for typical location and mounting.

Next, mount the blades to the cooling fans. The blade on the 6-watt fan is secured with 1/4" hardware while the blade on the 50-watt fans is secured with a set screw. Verify that the blades are installed correctly on the motors so that they push air when rotated counterclockwise. See photo's 2 and 3. Before attaching to the fan-mounting channel be sure that the blades are not bent or distorted and that they spin freely. A bent or distorted blade will cause vibration that could lead to early motor bearing failure.

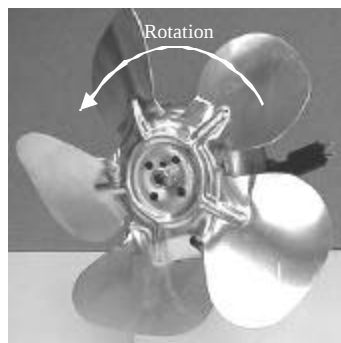


Photo 2 - 6 Watt Fan and Blade

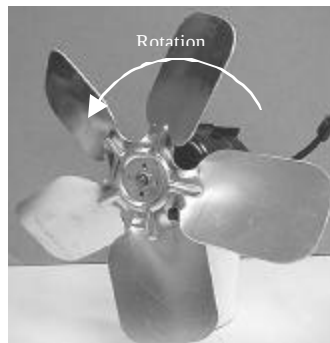


Photo 3 - 50 Watt Fan and Blade

Section 4 - Cooling Fan Installation:

An equal number of fans must be placed on each side of the core and coil assembly so that each coil has an equal amount of air blowing on it. The fans **must** also be centered under each coil. Refer to the Installation Drawings listed in table 1. Mount the fans to the perforated mounting channel using the #8 self-tapping hardware provided in the kit.

Next, install the fan power cable. Two cables are supplied in the kit. One cable is for each set of fans. The cable consists of 6 female connectors spaced along the length of the 2-wire cable. Starting with the last connector on the end of the cable, connect too the fan that is the farthest away from the Model 98 control box. Connect each remaining fan to the cable and route the cable toward the Model 98 control box (See photo 1). On transformers with only 3 fans per side you will not need to use all 6 connectors on each cable. On the connectors that you do not use, seal the connector opening with electrical tape. Secure the cable to the fan-mounting bracket using wire ties.

The mechanical installation of the cooling fans is now complete. Proceed to section 6, Model 98 Controller Installation, for the next step in installing the cooling upgrade kit.

Section 5 - Blower Installation:

Remove the transformer enclosure panels to gain access to the interior. The panels are located at the front and rear of the transformer. The front and rear center panels are not removable.

The quantity and arrangement of the blowers provided with each kit will vary as follows:

Table 2

Power Cast Transformer	Cooling Type		
	(6) Single Outlet Blowers	(3) Single/(3) Double Outlet Blowers	(6) Double Outlet Blowers
KVA Range	1500 Kva	2000-2500 Kva	>2500 Kva
Installation Dwg			
McLean Type	43540-028-17	43540-028-20	43540-026-18
Fasco Type	43540-040-27	43540-040-29	43540-040-30

Begin the blower installation by determining the type of installation based on table 2 above. Review the corresponding blower installation drawing for mounting locations and wiring instructions. If you are installing a single/double blower installation, the double blowers mount on the Low Voltage side of the transformer.

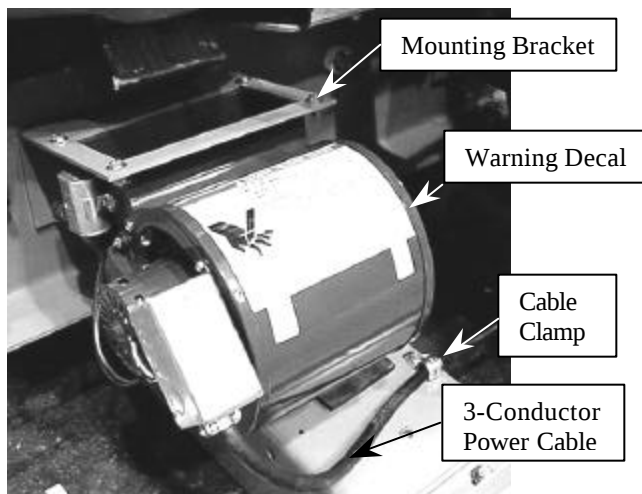


Photo 4 - Typical Blower Installation



Photo 5 - Typical Single Blower Installation

Mount each blower to it's mounting bracket using the supplied 1/4" hardware. Each blower bracket mounts to the lower core clamp on 1/2-16 studs. On transformers manufactured after 1995, these studs are factory supplied. On transformers manufactured prior to 1995, these studs will need to be added. Use the blower mounting bracket as a template and locate each blower under each coil. The blower should be centered under the coil.

! CAUTION !

Adequate strike clearance must be maintained from the transformer live parts to the blowers. Failure to do so could result in personal injury and transformer failure.

Section 5 - Blower Installation:

Once the blowers are installed they need to be wired. The blower installation drawing shows how the 3-conductor type SOW-A cable is to be routed. A common junction box is installed on a bracket mounted to the base support on each side of the transformer (See photo 7). On older transformers with the expanded metal base the cable is secured to the base mesh with wire ties.

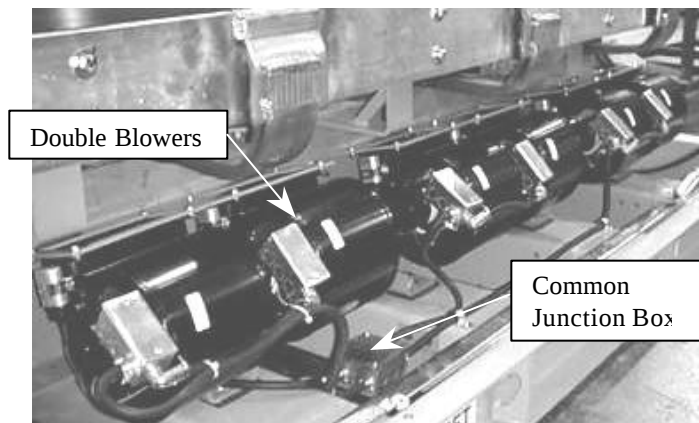


Photo 6 - Typical Double Blower Installation

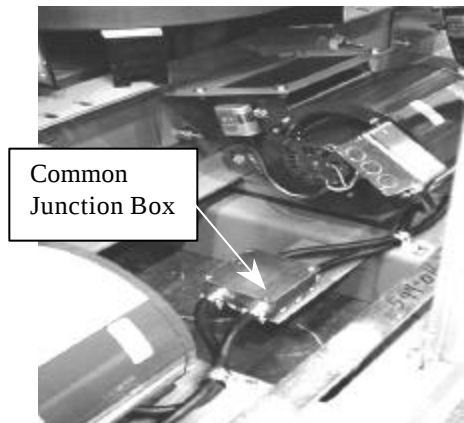


Photo 7 - Double Blower Junction Box Installation

Each blower on each side of the transformer is wired to this common junction box. A power feeder cable from the Model 98 Temperature controller is also routed to this box to provide blower power. Route the cables along the base in a neat, workman like manner. Secure the cables to the base channels using the supplied clamps (see photos 4, 6 & 7). The clamps bolt to the base channel with 1/4" self-tapping screws located in pre-drilled holes supplied by the factory. On older transformers the cable is wire tied to the base mesh. Use the supplied cable clamps to secure each cable to the junction boxes. Refer to the blower installation drawing used previously for the connections made in the common junction box.

Each blower is connectable at either 120 Vac or 240 Vac. Based on the application refer to the wiring diagram that is included in the upgrade kit. On the left side of the wiring diagram is a schematic drawing of the blowers. That schematic will show how to connect the motors to the power supply. Connect each 3-conductor cable to the motor wires inside the motor junction box.

The mechanical installation of the cooling fans is now complete. Proceed to section 6, Model 98 Controller Installation, for the next step in installing the cooling upgrade kit.

Section 6 - Model 98 Temperature Controller Installation:

Begin the installation of the new controller by removing the cover plate located on the front center panel of the transformer. Retain the bolts used to mount the cover plate. They will be reused to mount the control box. If the transformer was built after 10/98 the opening in the center panel should be similar to that shown in photo 8 and no modification to the cutout will be necessary. On transformers built prior to 10/98 the cutout in the center panel will be different.

For center panels with long rectangular cutouts similar to photo 9 use the supplied adapter plate. Bolt this adapter plate over the larger cutout using the supplied 3/8" hardware. Drill four (4) holes per drawing 43540-038-75. These holes will be used to mount the Model 98 control box.

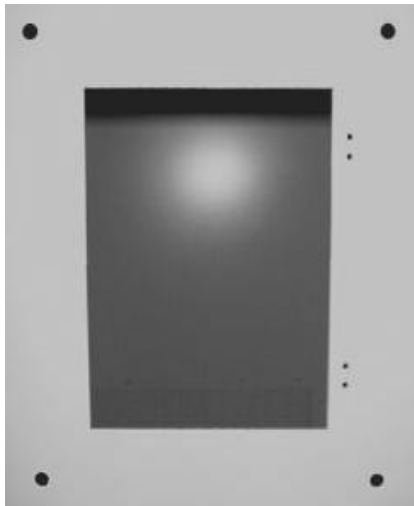


Photo 8 - Model 98 cutout On transformers Mfg. after 10/98



Photo 9 - Rectangular cutout On transformers Mfg. before 10/98

For transformers with small rectangular cutouts similar to photo 10, the center panel will require modification. A larger hole will need to be cut on the center panel before the new controller can be installed. See drawing 43534-105-93 for the cutout size, hole size and cutout location.



Photo 10 - Small cutout on transformers Mfg. before 10/98

! CAUTION !

Before cutting the center panel verify that there are no wires, cables or other obstructions within the new cutout area!

Remove any exterior unit nameplates that are within the cutout or mounting panel area and save for later re-installation. Before cutting the new opening be sure that there is adequate room for the new mounting panel to mount flush with the transformer center panel. Adjust the cutout location as necessary. Take all necessary precautions to assure that no metal fillings fall into the transformer coils.

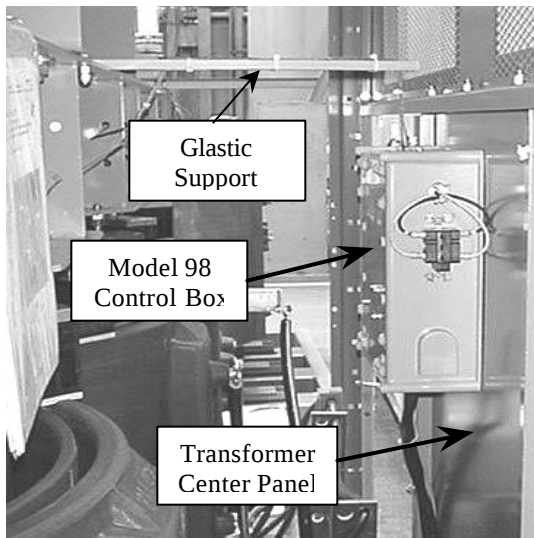
Smooth any rough edges of the cutout before installing the new controller.

Section 6 - Model 98 Temperature Controller Installation:

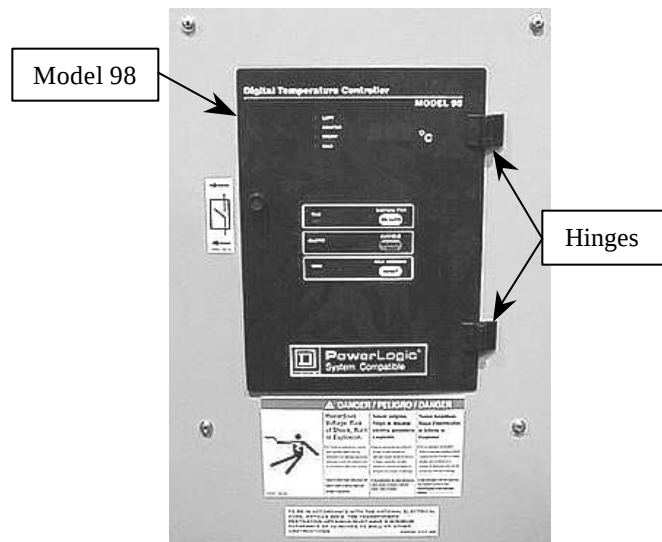
Next, mount the Model 98 control box to the back of the transformer center panel using the hardware that mounted the cover plate (see photo 11). If the transformer is equipped with an outdoor cover (see photo 13) then the outer cover and control box will need to be mounted at the same time using the plastic hardware supplied with the box.

Once the control box is mounted the Model 98 controller can be installed. Screw the self-threading nuts supplied with the controller to the studs on the controller hinges.

On transformers that required the cutout to be enlarged the control box mounts to the supplied adapter panel. The panel is then mounted to the transformer center panel. See drawings 43540-038-73 and 43540-038-74 for details.



**Photo 11 - Model 98 Control Box
Interior**



**Photo 12 - Model 98 Exterior View
Indoor Style**



**Photo 13 - Model 98 Exterior View
Outdoor Style**

Once the controller is installed it can be wired. Refer to the wiring diagram that came with the upgrade kit. The power to the controller and the power to the fans or blowers are routed to the bottom of the controller. Route these cables up the transformer center panel and secure as shown in photo 15. Install the cables in the existing holes in the bottom of the control box using the cable clamps supplied. Route the cables to the controller as shown in photo 14. Leave a loop in the cables so that they are not strained when the controller is opened.

Install the thermocouple glastic support rod by bolting the rod to the transformer top clamp. Secure the rod to the clamp using the supplied 3/8" hardware. Locate the rod in an existing hole in the top clamp that is closest to the control box. The rod does not have to be centered. If the rod is too long it can be trimmed to fit inside the cabinet. See photo 11.

Section 6 - Model 98 Temperature Controller Installation:

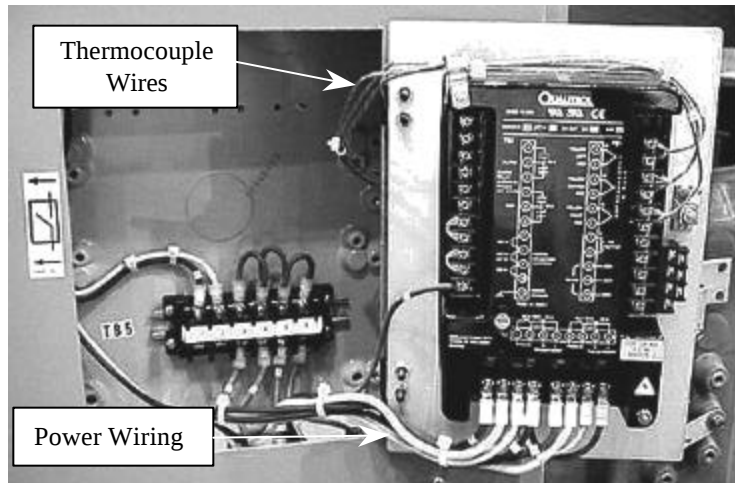
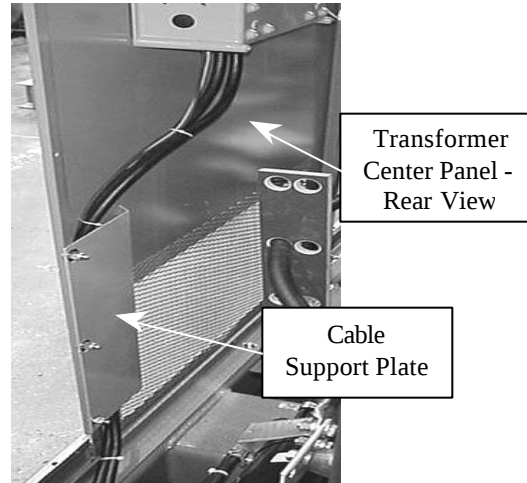


Photo 14 - Model 98 Interior View



**Photo 15 - Cable Routing into
Bottom of Model 98 Control Box**

Finally, install the Model 98 fan/blower power fuses in the rear of the controller. Refer to the wiring diagram that was furnished with the kit. The diagram will show the proper fuse size, type and location.

NOTE: When replacing fuses on the Model 98 use only fuses of the same type and rating.

The Model 98 controller wiring should now be complete except for installing the thermocouple wiring and the control power transformer, if provided.

Complete installation of the Model 98 thermocouples is covered in Section 7 - Thermocouple Installation.

If you have received a control power transformer with the upgrade kit, refer to Section 8- CPT Installation for instructions on installing the CPT.

Section 7 - Thermocouple Installation:

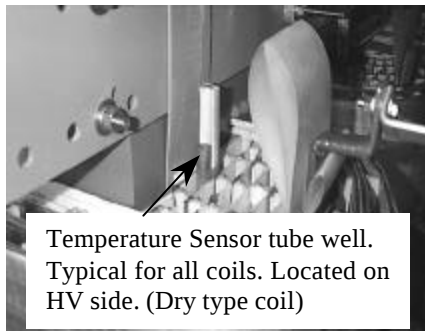


Photo 16 - Sensor Well

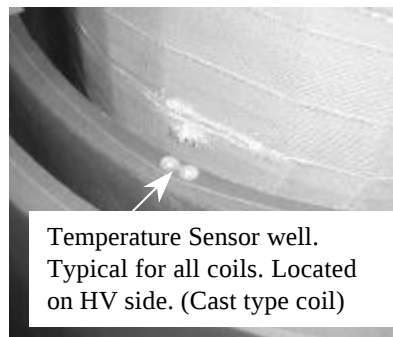


Photo 17 - Thermowell Hole



Photo 18 - Completed
Thermocouple

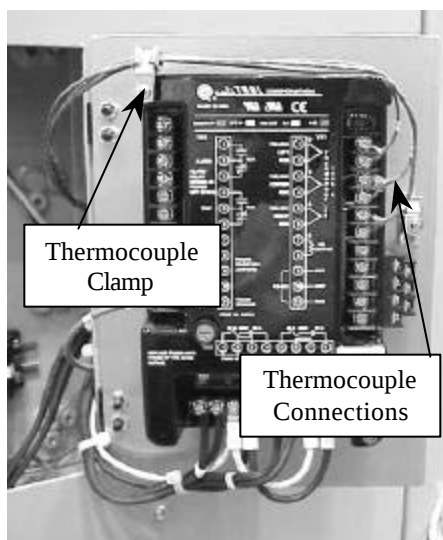


Photo 19 - Thermocouple Connections

The 3 thermocouples, one for each coil, need to be made. Begin by cutting approximately 20 feet from the coiled thermocouple wire that is provided in the kit. Strip 1.0" from one end of the thermocouple wire. (Note: There is an outer covering of insulation and each of the bimetal wires is also insulated. This insulation must be removed as well). After completely stripping the wires, twist the ends together tightly (see photo 18).

Starting on one phase of the transformer insert the stripped end of the thermocouple wire into the insulating tube or thermowell hole until it stops (approx. 4" for the tube and 2" for the hole) (see photos 16 and 17).

Route the wire up to the transformer top core clamp and toward the glastic support rod that was installed earlier. Secure the wire to the top clamp using wire ties. The thermocouple wire must be firmly supported so that proper clearance is maintained to the high voltage coil and leads. Wire should not be coiled or allowed to sag. Route the wire under the rod and through the first hole closest to the transformer clamp. The wire is then routed along the top of the rod and then down through the second hole at the end of the rod and finally into the right side of the Model 98 control box (see photo 19). Fasten the wire to the support rod with wire ties.

Once all three thermocouple wires have been run into the Model 98 control box connect the thermocouple wires to the controller as shown in photo 19. Leave enough slack in the wires to allow full opening of the Model 98. Support the wires using the provided thermocouple clamp. See the wiring diagram that was provided with the upgrade kit for the thermocouple connections.

After completing the thermocouple wire connections seal the sensor wells in the coils with clear silicone.

Section 8 - Control Power Transformer Installation:

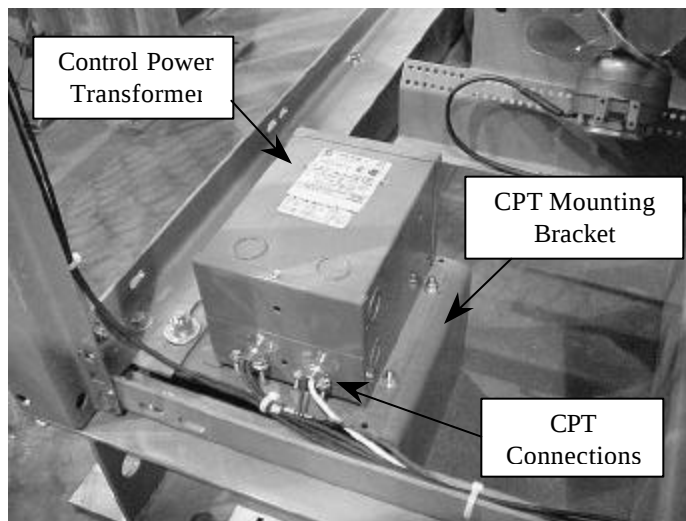


Photo 20 - Typical CPT Installation

Fasten the mounting bracket to the transformer base using the 3/8-16 hardware provided. The bent end of the bracket rests on the concrete pad (See photo 20).

If the transformer base is solid, drill and tap four (4) 1/4-20 holes and bolt the CPT to the base. If the transformer base is mesh, wire tie the CPT to the mesh.

The Model 98 control box contains the primary fuses for the CPT. The primary power must be routed from the LV bus bar to the control box. Refer to the wiring diagram to determine the size and color of the primary wire. Route two (2) primary wires from TB5 out of the bottom of the Model 98 control box, across the base, up the side channel and across the end panel to the LV bus bar.

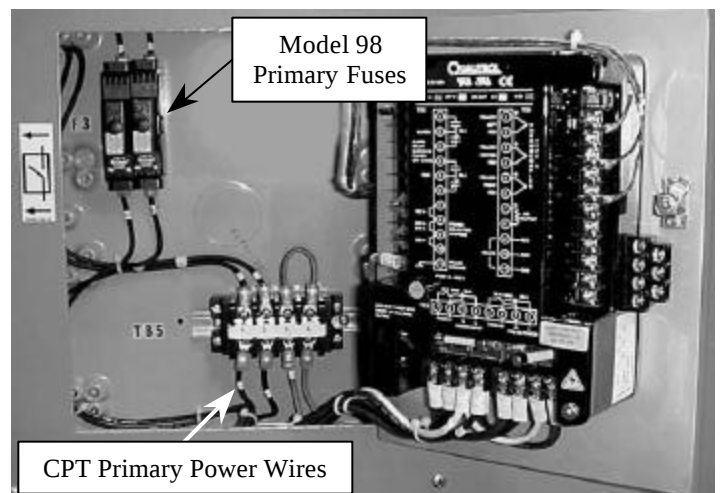


Photo 21 - CPT Primary Fuses

The wires should end directly above the LV bus bar and be long enough to attach to the bus. Secure the wires to the side channel and end panel with wire ties. Cut the wires to the correct length and crimp on the provided ring tongue lug. Connect the wires to the LV bus bars per the wiring diagram.

Remove the bottom of the CPT to gain access to the wiring. Remove two (2) of the conduit fitting knockouts in the CPT bottom and install two (2) cable clamps in these open holes. Again refer to the wiring diagram to determine the wire sizes and colors for both the primary and secondary connections to the CPT. Route these wires from the Model 98 control box to the CPT. Install the primary wires in one knockout and the secondary wires in the other knockout.

Wire the CPT per the wiring diagram. Once the CPT wiring is complete reinstall the CPT access cover. Connect the primary and secondary wires in the Model 98 control box per the wiring diagram.

The CPT Installation is now complete. Refer to the next section to complete the upgrade installation.

When the cooling upgrade kit is to be powered from the transformer secondary, a control power transformer (CPT) will need to be installed. The CPT is designed to step down the transformer secondary voltage to either 120 or 240 VAC.

NOTE: This instruction covers CPT's with primary voltages up to 600 VAC. CPT's with higher primary voltages will require special fusing and wiring. Consult the factory for instruction.

Begin the CPT installation by securing the CPT mounting bracket to the transformer base. Locate the bracket on the same side of the transformer as the Model 98 and on the low voltage end.

Section 9 - Completing the Upgrade Installation:



Photo 22 - Model 98 Warning Decal Location

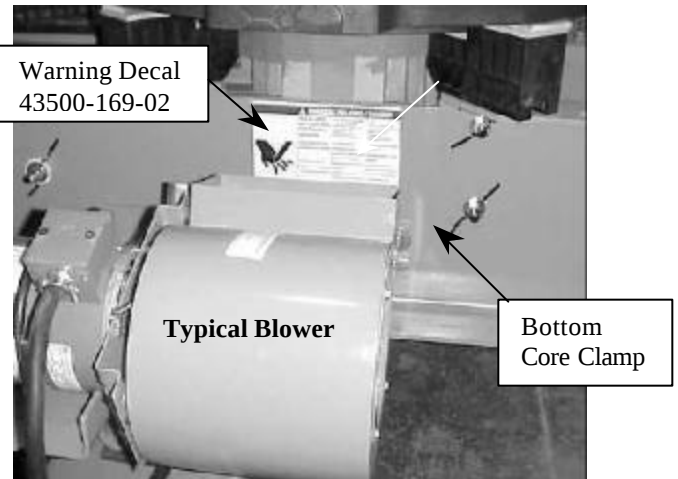


Photo 23 - Blower Warning Decal Installation

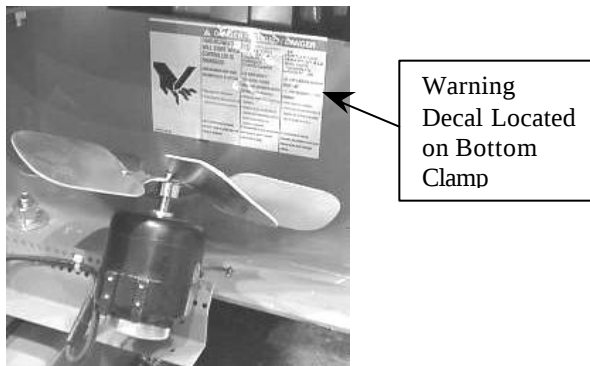


Photo 24 -Fan Warning Decal Installation

Apply the Model 98 controller Danger decal, p/n 43500-169-09 next to the Model 98 controller. The decal can be applied above or below or to the right or left of the controller (see photo 22).

Apply the Fan/Blower Danger decals, p/n 43500-169-02, to the bottom core clamp near the fans or blowers. Apply three decals on the front and the remaining three decals to the back (see photos 23 & 24).

Refer to the Model 98 Instruction Bulletin for Power Logic Monitoring connections and MODBUS-SY/MAX protocols.

Before energizing the Model 98 for the first time, please review the controller operation procedure in the Model 98 Instruction Bulletin, p/n 43500-054-26. Also refer to the transformer instruction manual that came with the transformer for any startup testing that is required before re-energizing the transformer.

**DANGER**



Hazardous Voltage. Risk of Shock, Burn or Explosion.

Failure to follow these instructions will result in Death or Serious Injury

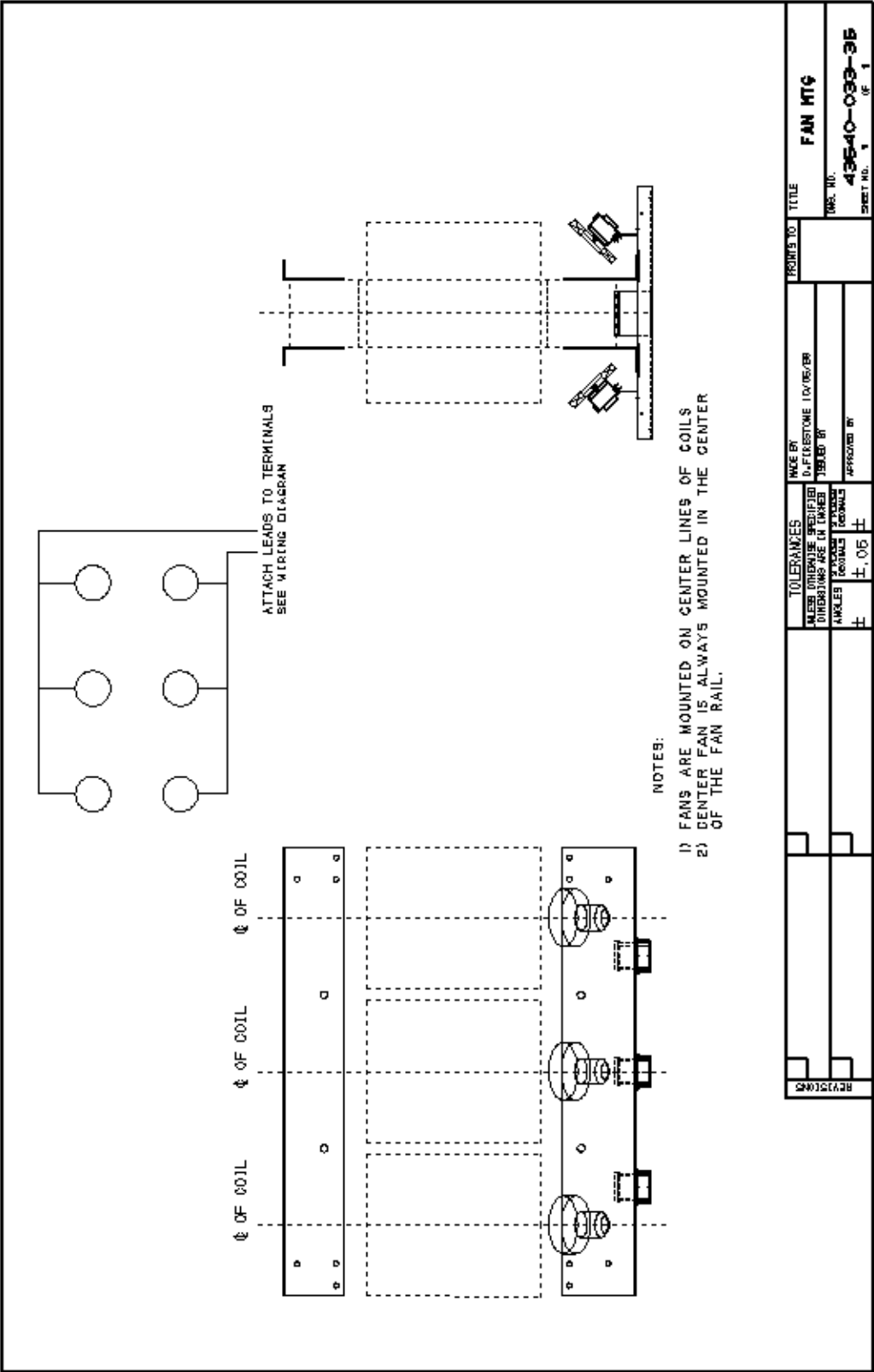
- Ensure all personnel, tools, controller wiring, and other work material or equipment are cleared from the transformer and the control box before turning ON power to the controller.
- Before applying power, make sure that all personnel and equipment are clear of the blowers or fans.
- Replace all devices, doors, and covers before turning on power to this equipment.

! CAUTION !

When the controller is powered on, the fans or blowers will turn ON, then OFF after approximately one minute.

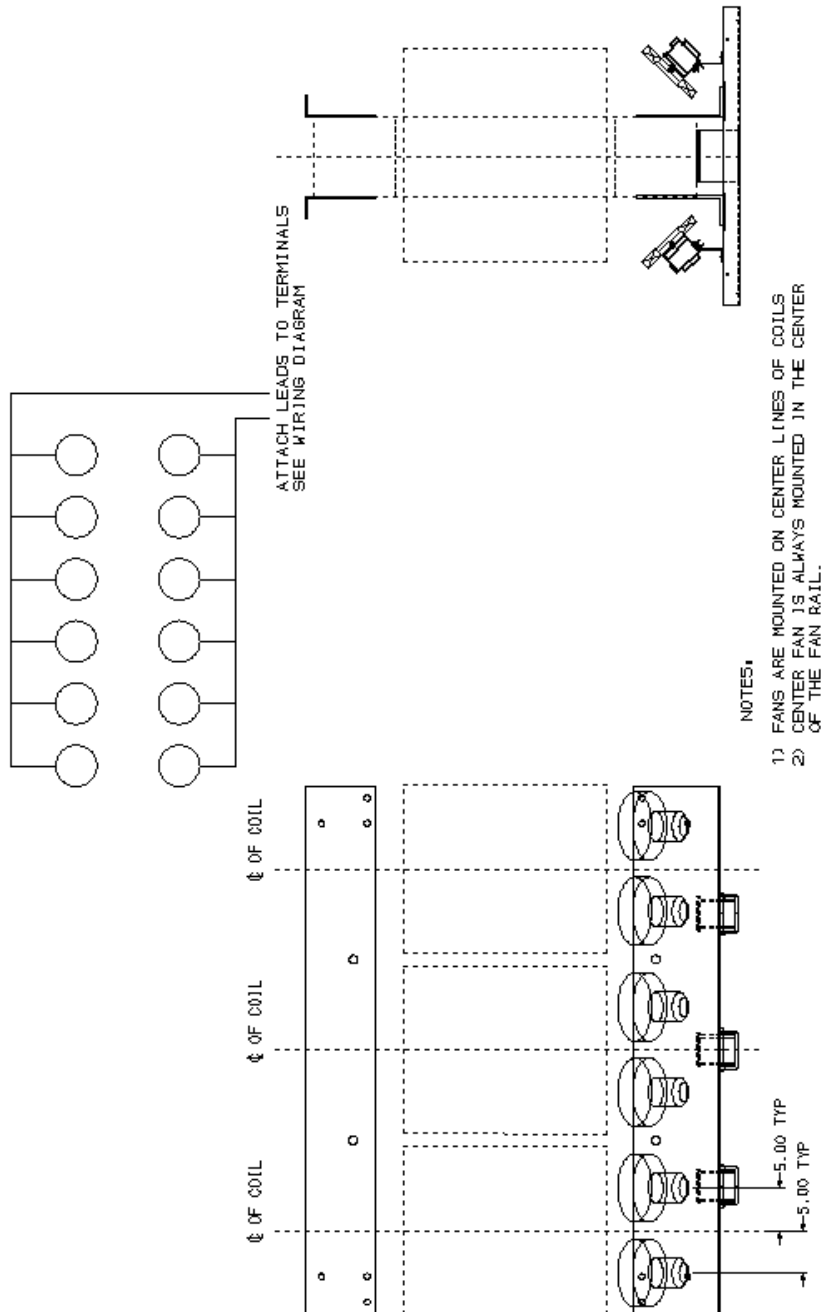


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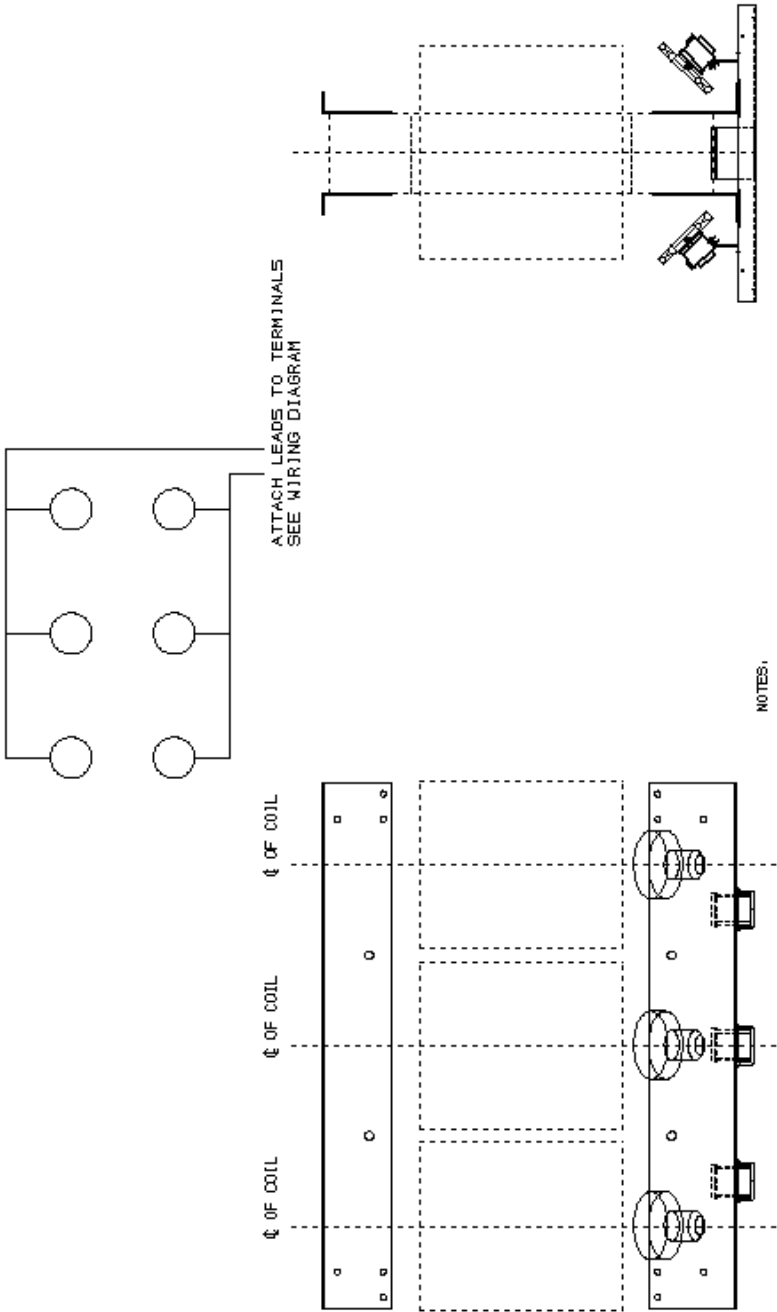


					TOLERANCES	MADE BY D. FIRESTONE 10/05/98	PRIOR TO TITLE	FAN MTG
					ANGLES OVERSHOULDERED DIMENSIONS ARE IN POUNDS	CHECKED BY	DWG. NO.	43540-033-SB
					± .06 ±	APPROVED BY	SHEET NO. 1 OF 1	

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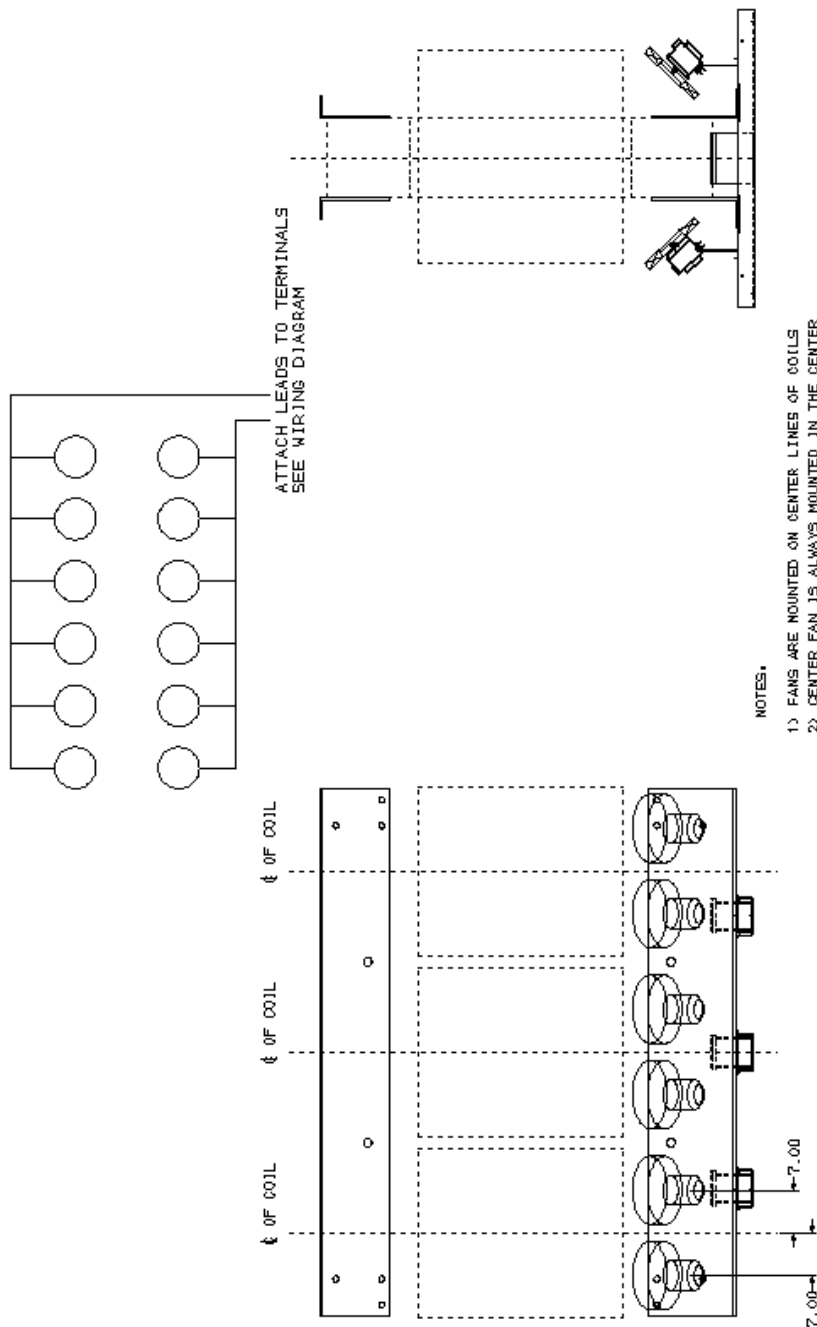


- NOTES:
- 1) FANS ARE MOUNTED ON CENTER LINES OF COILS
 - 2) CENTER FAN IS ALWAYS MOUNTED IN THE CENTER OF THE FAN RAIL.

TOLERANCES		MADE BY		DRAWN TO		TITLE	
UNLESS OTHERWISE SPECIFIED		D. FORESTONE 10/05/99				FAN MTG	
DIMENSIONS ARE IN INCHES		DESIGNED BY				Dwg. No.	
ANGLES		F. FORESTONE				43540-033-99	
±		± .06 ±				SHEET No. 1	
						OF 1	



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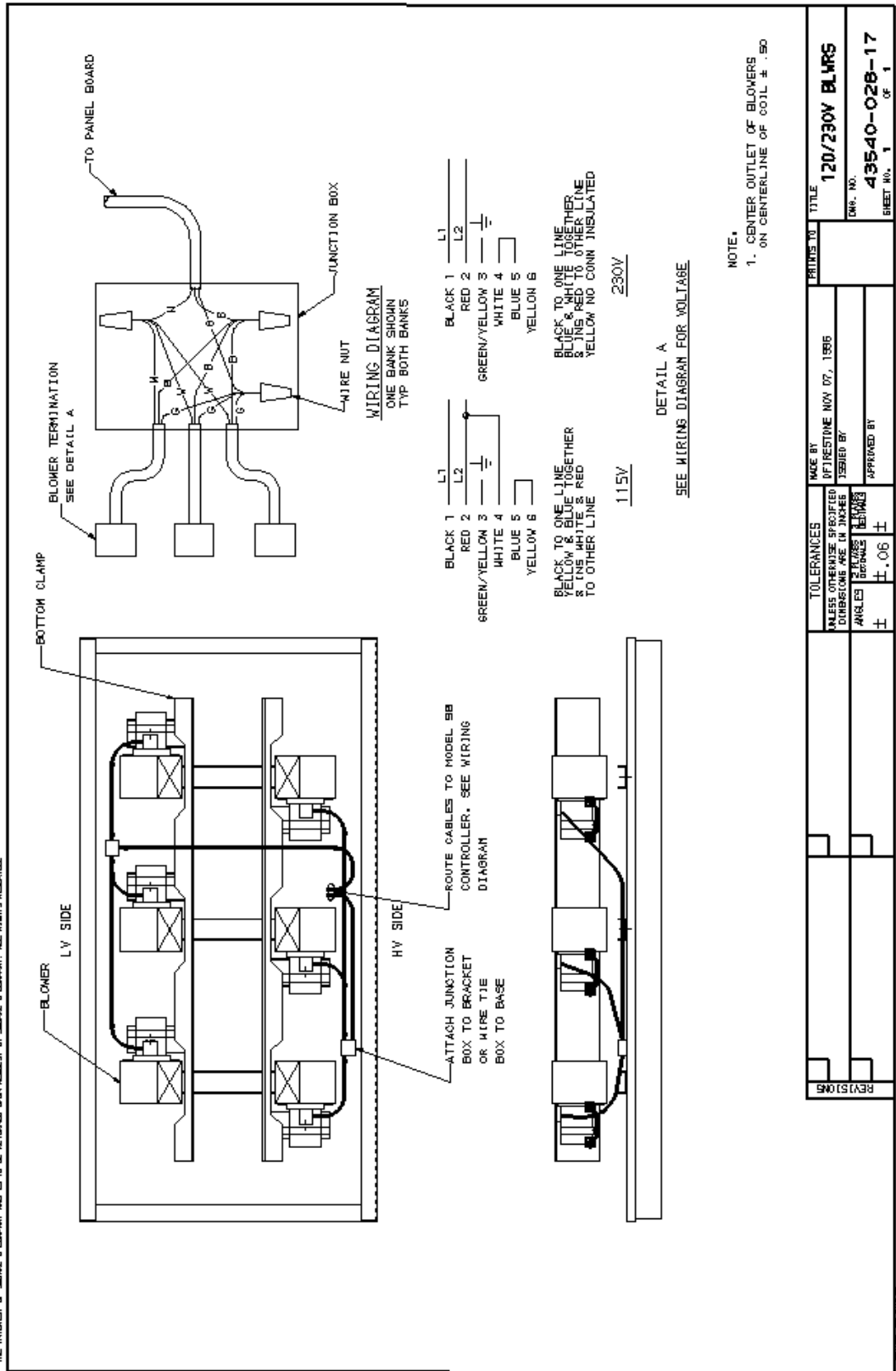
- NOTES.
- 1) FANS ARE MOUNTED ON CENTER LINES OF COILS
2) CENTER FAN IS ALWAYS MOUNTED IN THE CENTER
OF THE FAN RAIL.

[illegible]

RECEIVED BY 5/25/05

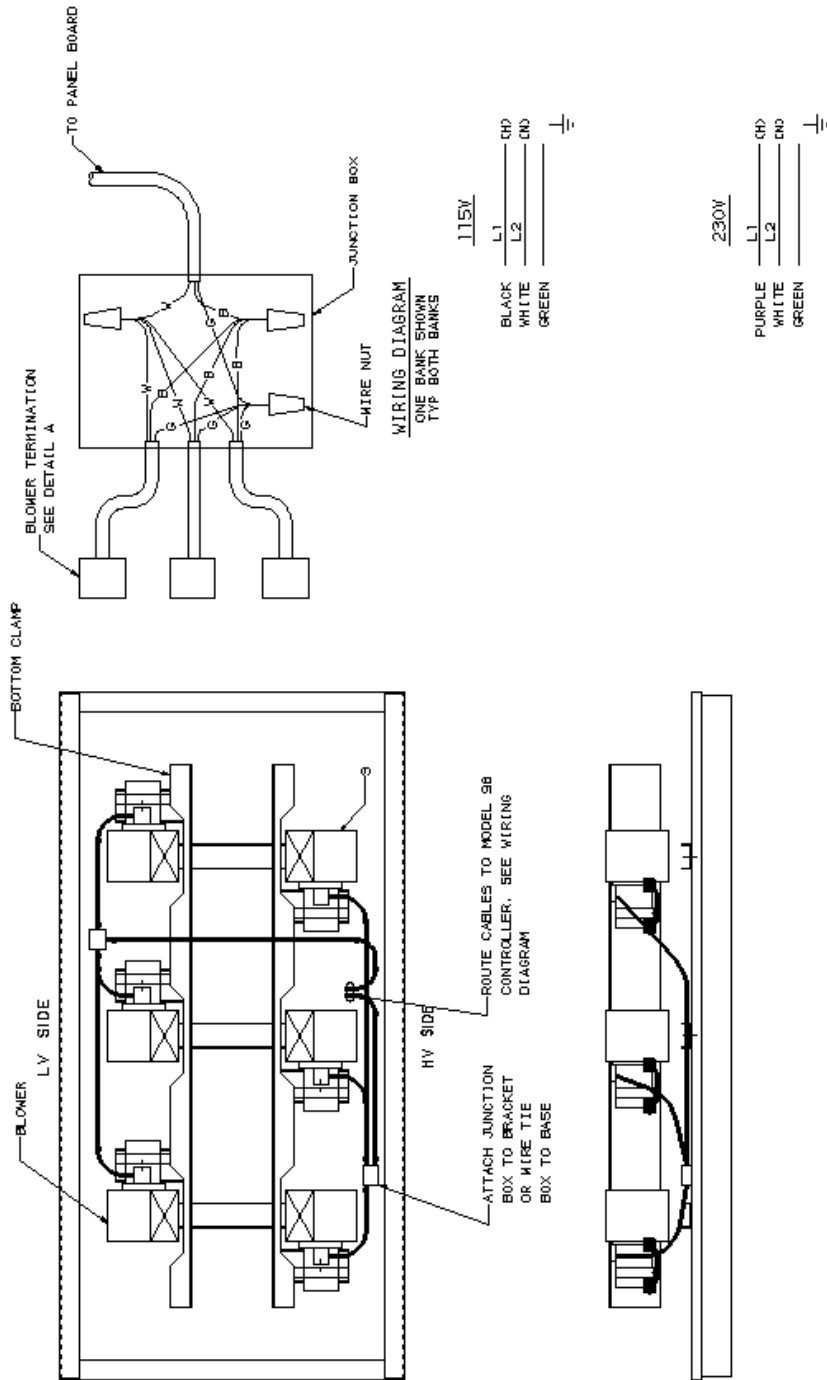


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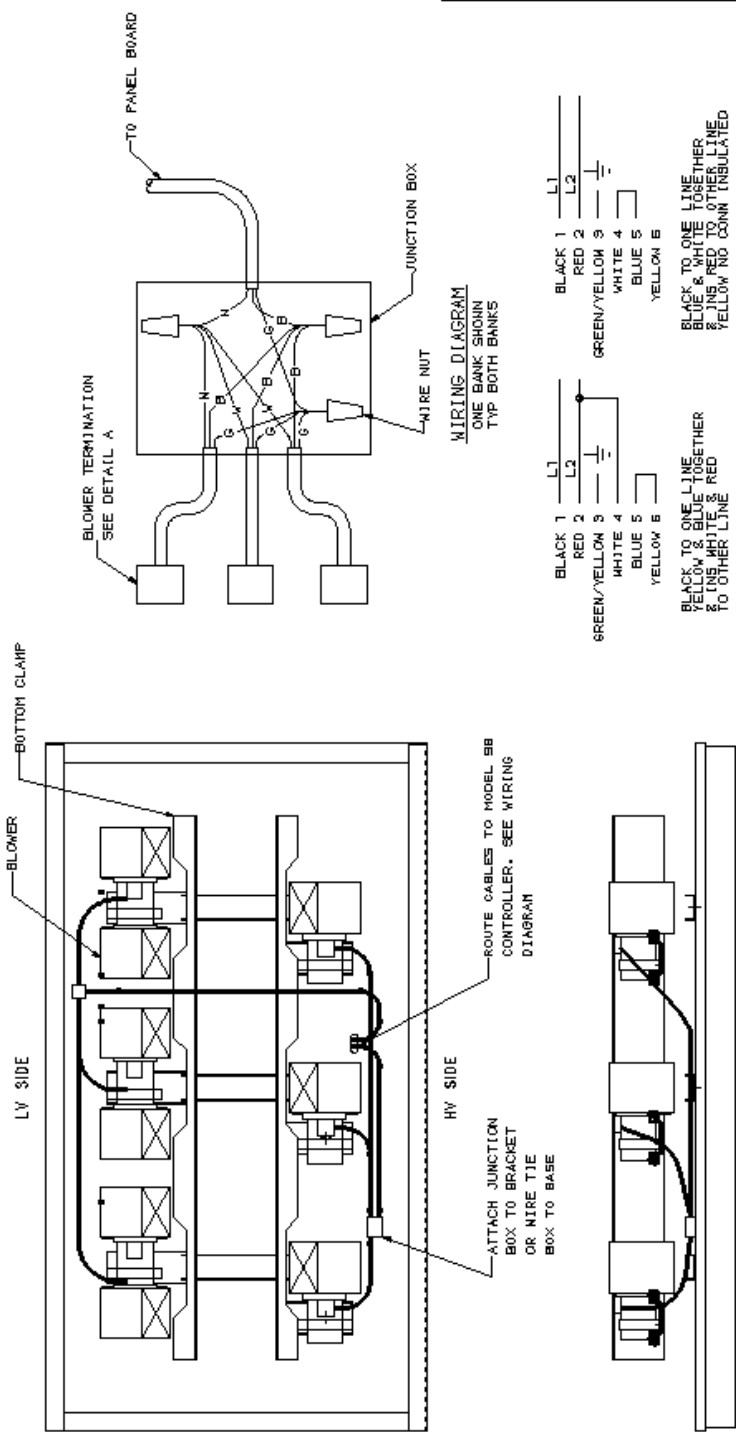
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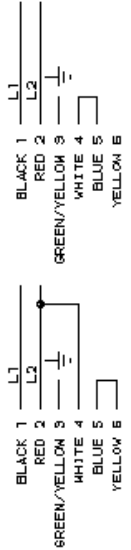
REVISED		TOLERANCES		MADE BY		PRINTS TO		TITLE	
±		± .05 ±		E. HADIN FEB. 97, 2000				120/230V FASCO BLWRS	
±		± .05 ±		ISSUED BY				DAS. N.	
±		± .05 ±		APPROVED BY				43540-040-27	
								SHEET NO. 1 OF 1	



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WIRING DIAGRAM
ONE BANK SHOWN
TYP BOTH BANKS



115V
230V
DETAIL A
SEE TOP LEVEL BILL FOR VOLTAGE

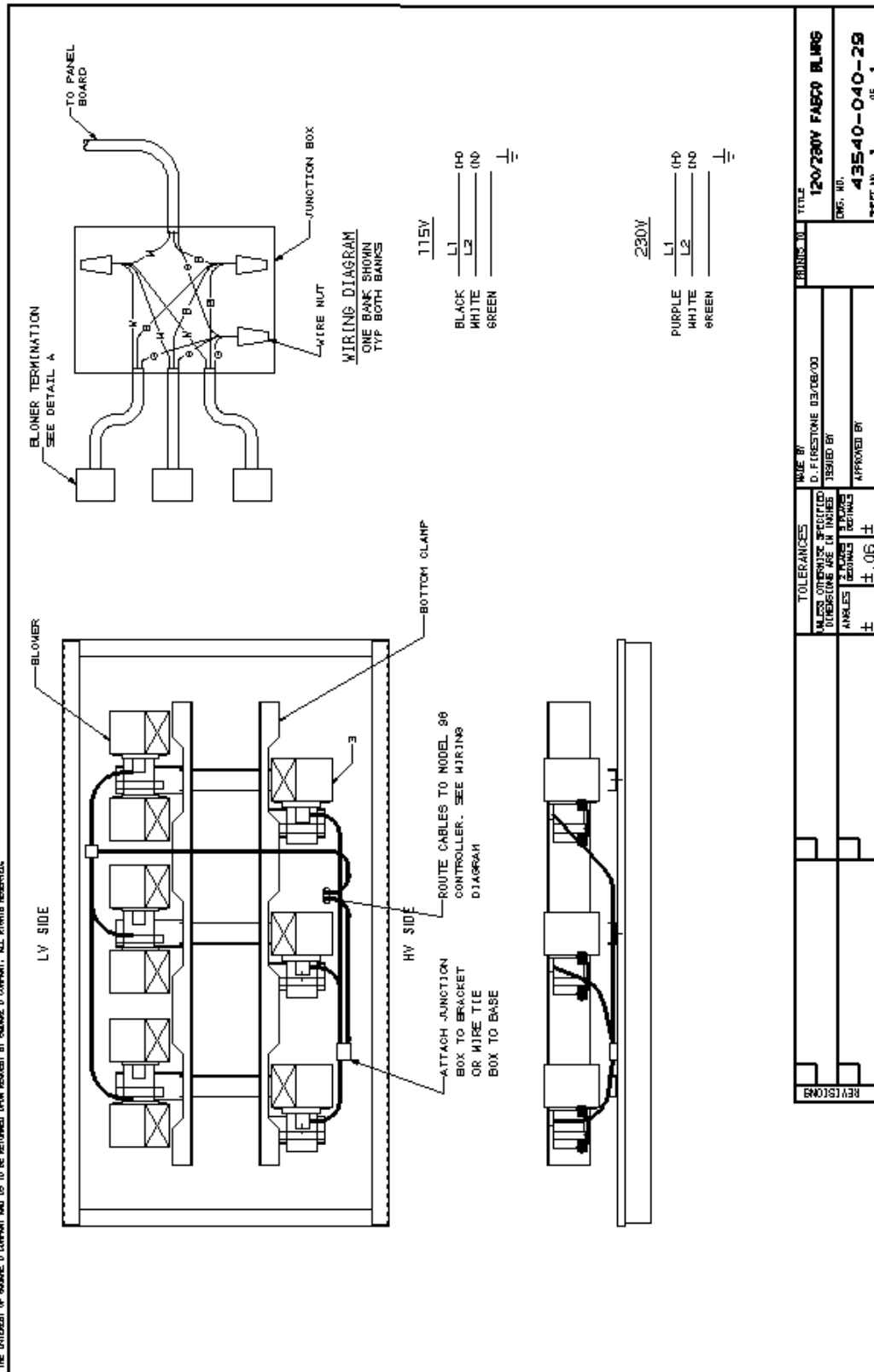
NOTE:
1. CENTER OUTLET OF BLOWERS
ON CENTERLINE OF COIL ± .50

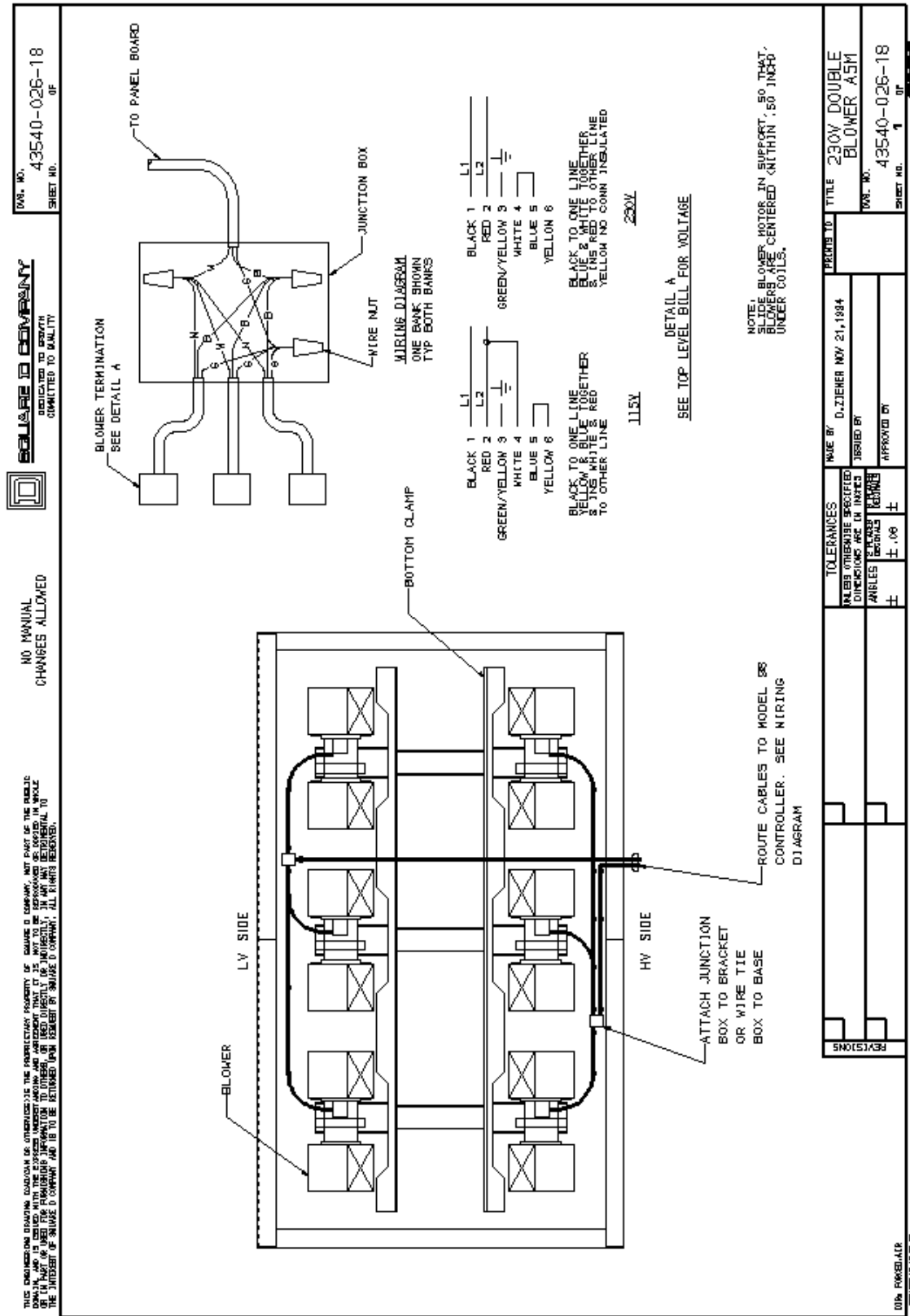
TOLERANCES		MADE BY		PRINTS TO TITLE	
OVERALL DIMENSIONS	± .06	DATE OF DESIGN	NOV 07, 1995	DATE OF DESIGN	NOV 07, 1995
OVERALL DIMENSIONS	± .06	DESIGNED BY		DESIGNED BY	
ANGLES	± .06	APPROVED BY		APPROVED BY	
DETAILS	± .06				
REVISED		120/240V BLNR		43540-028-20	
		SHEET NO. 1		OF 1	

REVISED BY 6/2000



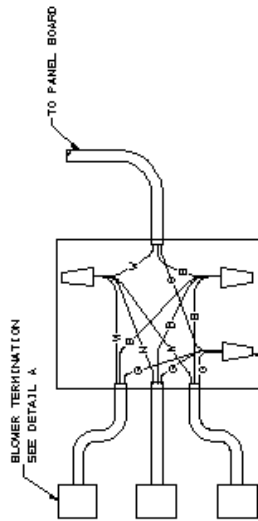
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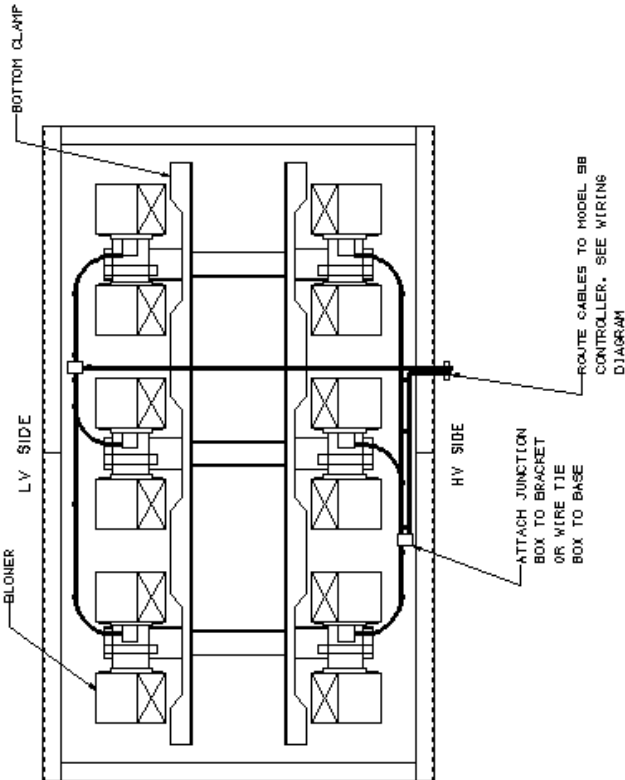


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WIRING DIAGRAM
ONE BANK SHOWN
TYP BOTH BANKS

200V
L1
L2
CN
GND
PURPLE
WHITE
GREEN

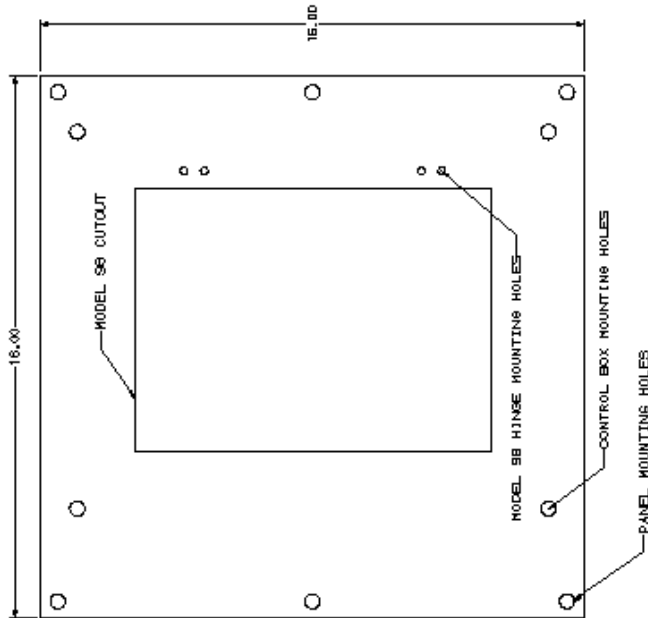


REVISED		TOLERANCES		MADE BY		ISSUED BY		TITLE	
±		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES ANGLES TO BE SHOWN ± .06 ±		D. FIDESTONE 03/08/00		D. FIDESTONE 03/08/00		230V FASCO BLWS	
±		± .06 ±		APPROVED BY		D. FIDESTONE 03/08/00		DRAW. NO.	
±		± .06 ±		APPROVED BY		D. FIDESTONE 03/08/00		SHEET NO. 1	
±		± .06 ±		APPROVED BY		D. FIDESTONE 03/08/00		43540-040-30	
±		± .06 ±		APPROVED BY		D. FIDESTONE 03/08/00		OF 1	

REVISED 03/08/00

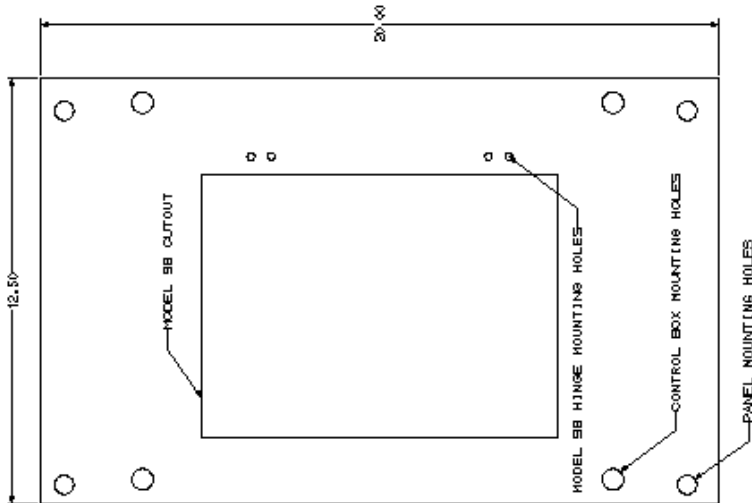


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ADAPTER PANEL PART # 43534-105-97

THIS PANEL IS USED TO ADAPT A MODEL SB
IN PLACE OF A MODEL 65

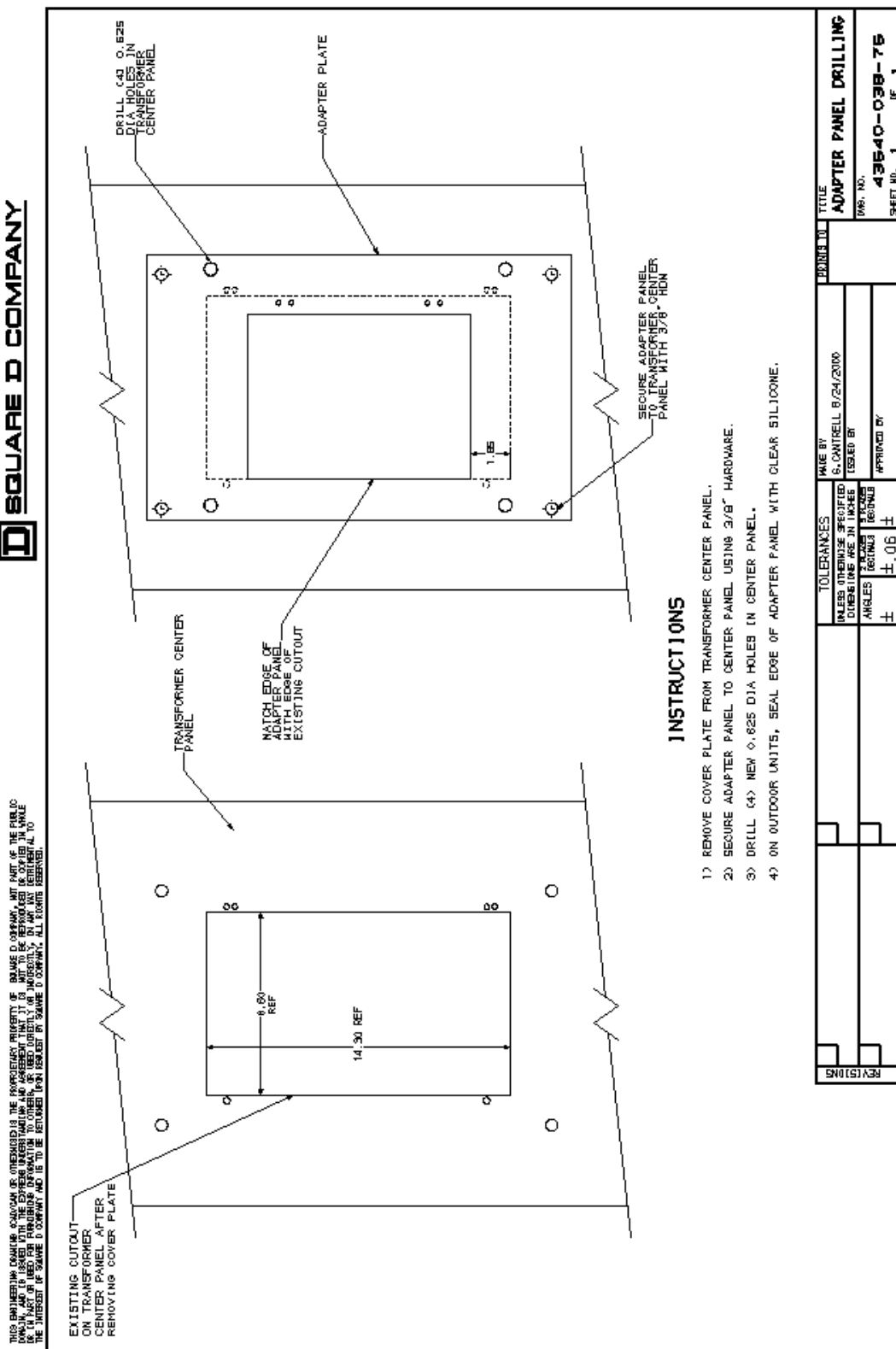


ADAPTER PANEL PART # 43534-118-71

THIS PANEL IS USED TO ADAPT A MODEL SB
IN PLACE OF A QUALITROL SERIES 108

REVISED		TOLERANCES		MADE BY		TITLE	
1		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		S. CANTRELL AUG 24, 2000		ADAPTER PANELS	
2		FRACTIONAL DIMENSIONS ARE IN INCHES		TESTED BY		OWN. NO.	
3		DECIMAL DIMENSIONS ARE IN INCHES		APPROVED BY		43540-001-01	
4		± .06 ±				SHEET NO. 1	
5						OF 1	

NOTED BY S. CANTRELL

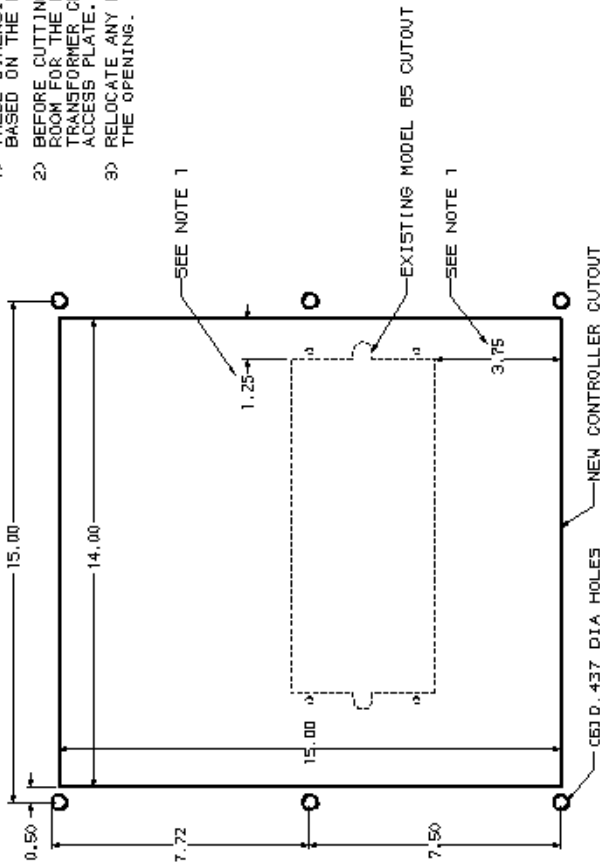




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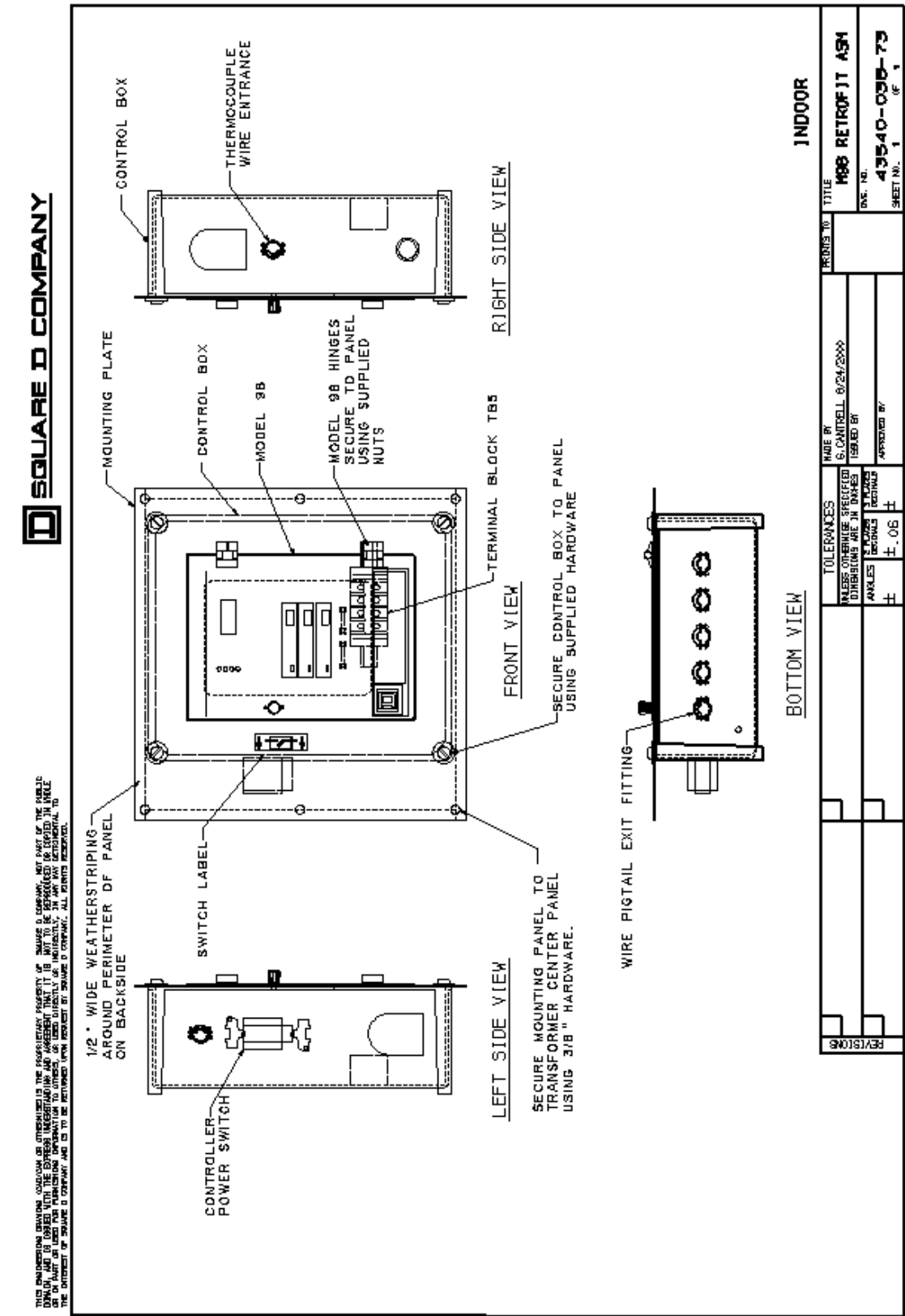
NOTES:

- 1) THESE DIMENSIONS ARE APPROXIMATE AND WILL VARY BASED ON THE LOCATION OF THE OLD MODEL 85 CUTOUT.
- 2) BEFORE CUTTING THE NEW OPENING VERIFY THAT THERE IS ADEQUATE ROOM FOR THE NEW MOUNTING PANEL TO MOUNT FLUSH WITH THE TRANSFORMER CENTER PANEL AND CLEAR THE EXISTING CONTROL PANEL ACCESS PLATE.
- 3) RELOCATE ANY NAMEPLATES, WARNING LABELS ETC. BEFORE CUTTING THE OPENING.



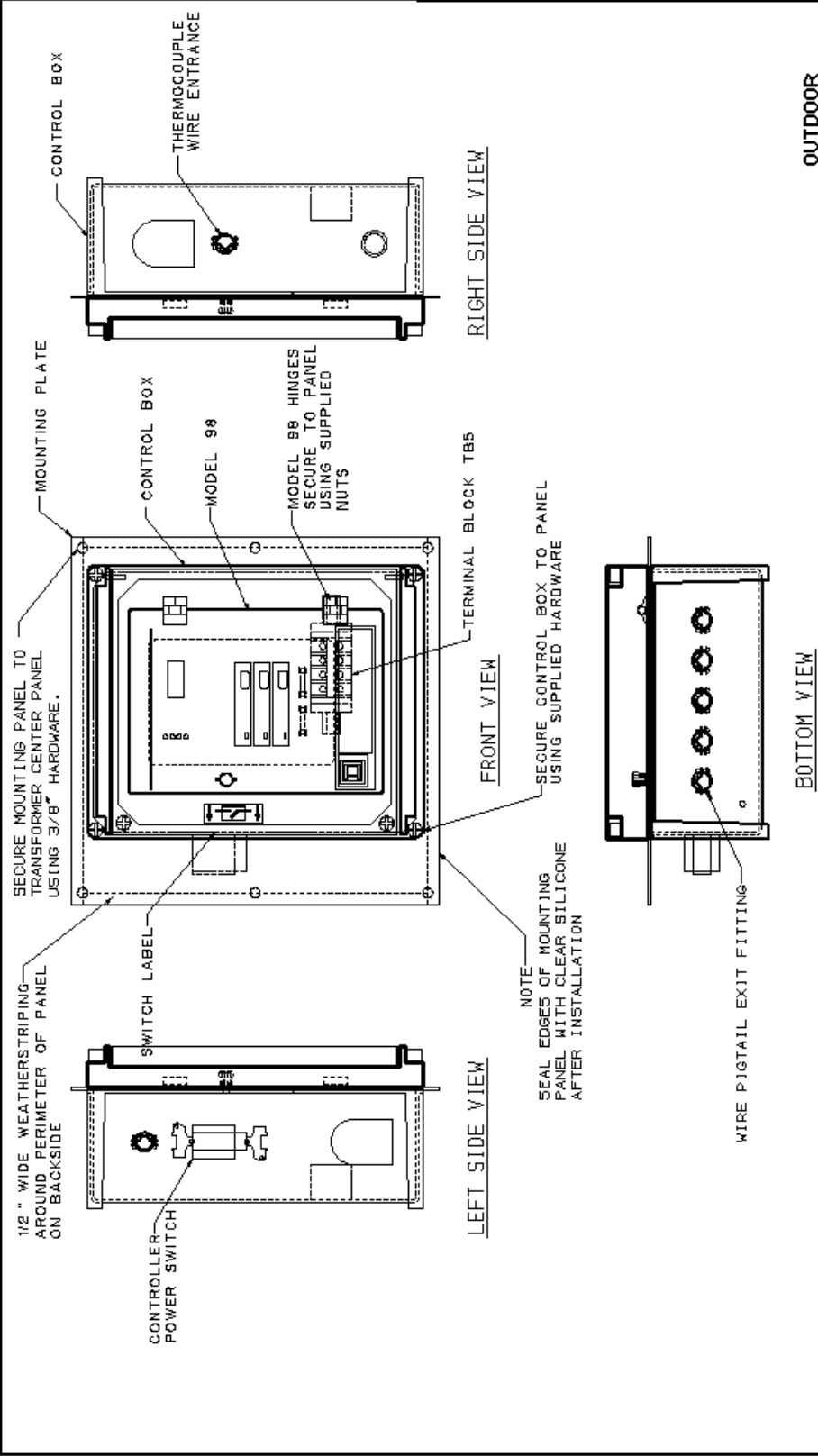
CAUTION
BEFORE CUTTING PANEL VERIFY THAT THERE ARE
NO WIRES, CABLES OR OTHER OBSTRUCTIONS
WITHIN THE NEW CUTOUT AREA!

TOLERANCES		MADE BY	ISSUED BY	TITLE	
ANGLES	± .05	B. CANTRELL JUN 26, 1918	ISSUED BY	PANEL CUTOUT DETAIL	
LOCATIONS	± .05		APPROVED BY	43534-105-93	
REV'S		SHEET NO. 1		OF 1	





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REVISIONS		TOLERANCES		MADE BY		ISSUED BY		TITLE	
		UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES		G. CANTRELL	9-24-2000			MODEL 98 RETROFIT ASM	
		ANGLES						ENR. NO.	
		DIMENSIONS						43540-038-74	
								SHEET NO.	OF 1