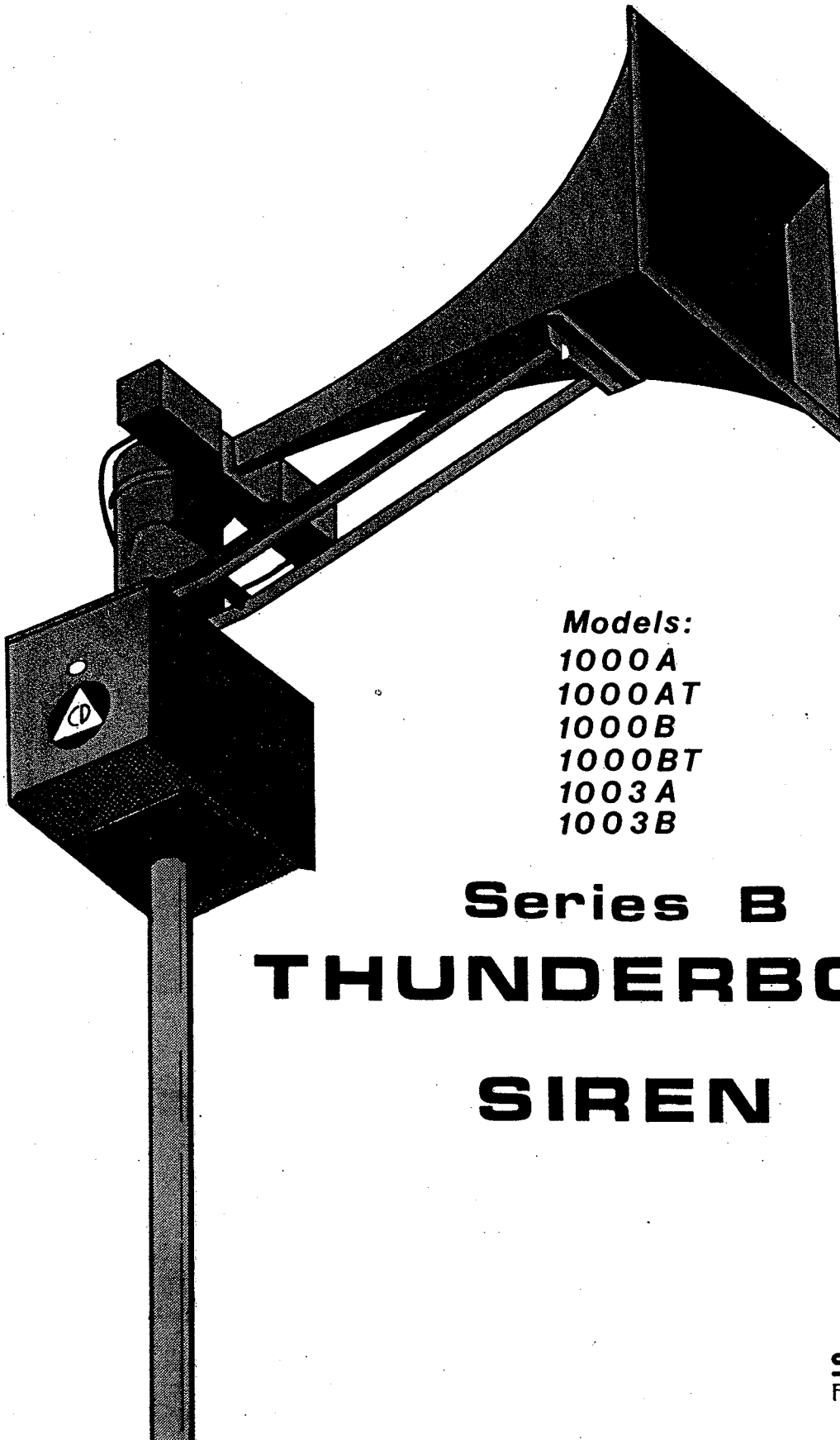


Service Manual



Models:

1000A
1000AT
1000B
1000BT
1003A
1003B

Series B THUNDERBOLT SIREN

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SECTION I

GENERAL DESCRIPTION

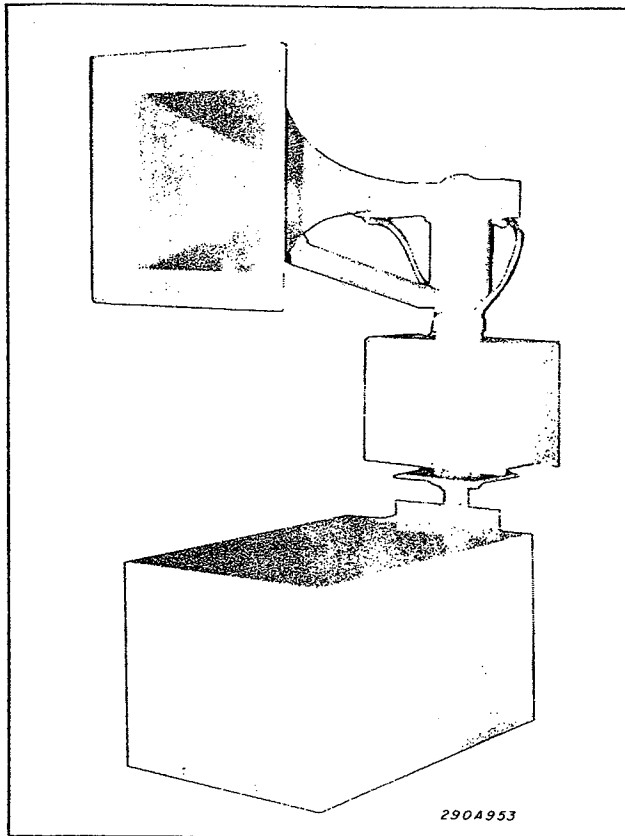


Figure 1-1. Federal's Thunderbolt Siren.

1-1. GENERAL.

The Federal Thunderbolt® Siren (figure 1-1) is a rotating-beam siren that disperses high intensity warning signals over a large area. A substantially uniform output sound level over a wide frequency range is produced by the siren. Thunderbolt signal characteristics are very distinctive. As a result, the sound output is readily distinguishable from other warning signals, such as vehicle sirens. The Thunderbolt can be installed in a wide variety of situations. High efficiency enables the siren to produce a high output sound level while making moderate demands on the power source.

1-2. SIREN DESCRIPTION.

A. General

The Model 1000 Thunderbolt Siren consists of three major assemblies; the Chopper Assembly, the Rotator Assembly, and the Blower Assembly. The Rotator Assembly and the Chopper Assembly are connected to the Blower Assembly by the standpipe.

The Model 1003 Thunderbolt is similar to the Model 1000 except that the Solenoid Assembly is added to the siren. The Solenoid Assembly is mounted on the Chopper Assembly at the throat of the Exponential Horn.

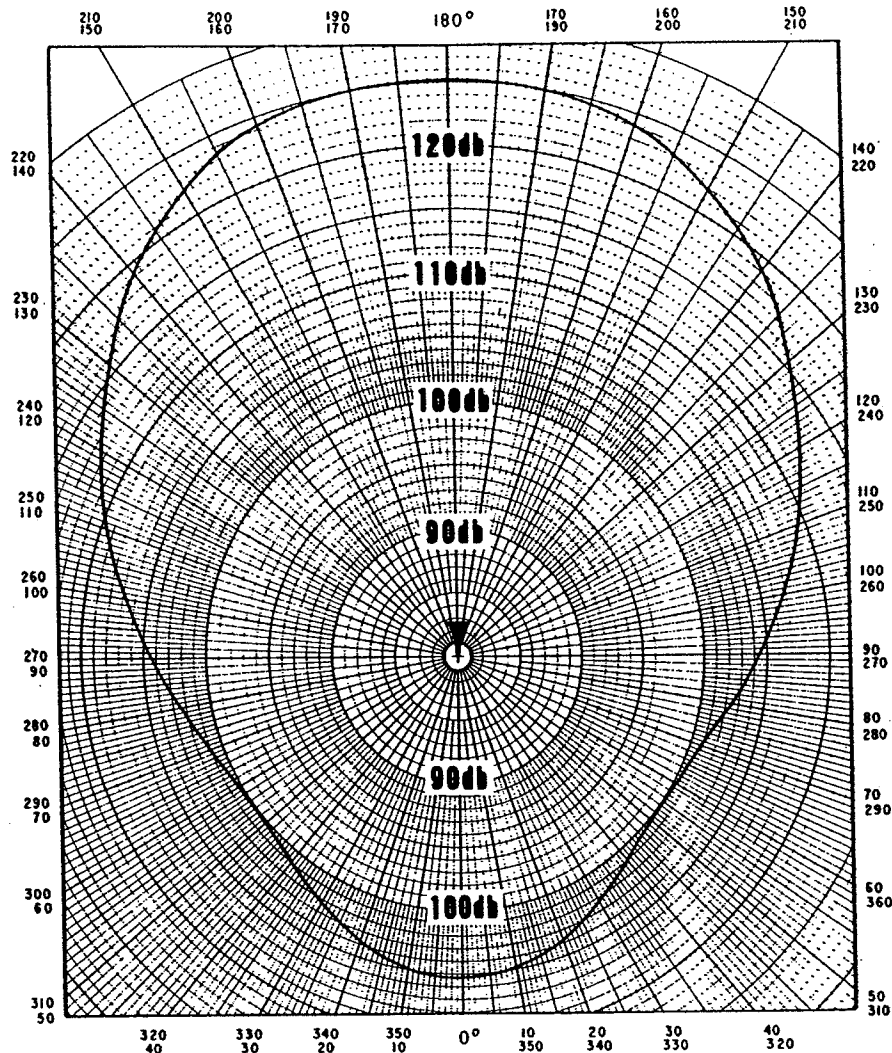
B. Chopper Assembly.

Low pressure air from the Blower Assembly is piped through the Chopper Assembly to the throat of the Exponential Horn. The Chopper Assembly consists of three major parts; the chopper motor, the rotor and the stator. The rotor is a high speed axial fan that is driven by the chopper motor. The rotor alternately opens and closes the throat of the stator-mounted horn, causing the air to enter the horn in pulses. These pulses of air produce sound waves at a frequency that is dependent on the rotational speed of the chopper motor and the number of ports in the rotor.

The rotor has two rows of ports in those siren models that have dual-tone capability. The number and spacing of the ports in each row is different. Therefore, each row of ports produces a different siren tone. In the Model 1003 Thunderbolt, the airflow through the chopper to the horn is controlled by two solenoid-operated slide valves. These slide valves control the airflow through the appropriate ports of the chopper stator at the appropriate time to produce the desired signal. The rotational speed of the chopper is adjustable so that the maximum pitch of the siren tone(s) can be changed in all Thunderbolt models.

C. Rotator Assembly.

The exponential horn, which is part of the Chopper Assembly, projects the sound waves in a directional pattern. This directional pattern of sound propagation enables the Thunderbolt to produce a sound level equivalent to that of an omnidirectional siren having 6 to 8 times the output power.



Graph 1-1. Thunderbolt Coverage Pattern.

Graph 1-1 is a polar graph of sound propagation pattern of the siren in both the horizontal and vertical planes. As indicated by the graph, the siren sound propagation pattern is directional. Therefore, the horn is rotated by the Rotator so that sound is dispersed in all directions. The rotation of the horn has the added advantage that it imparts a "sound-in-motion" effect to the siren tone, greatly enhancing the attention attracting characteristics of the siren.

D. Blower Assembly and Standpipe.

The Blower Assembly contains all of the machinery necessary to deliver a large volume (250 cubic ft. per min. - 7080 liters per min.) of low pressure air (5-6 lb. per sq. in. - .35 - .42kg per sq. cm) through the standpipe to the Chopper Assembly. The standpipe also provides vertical support for the Rotator and Chopper Assemblies.

When the siren is being tested, the blower may be operated with power to the chopper shut off. Consequently, the airflow to the horn may be cut off by the chopper. As a result, the blower could cause excess air pressure to build up in the standpipe. This excess pressure would probably overload the blower. Therefore, to prevent blower overload, the relief valve, located in the Blower Assembly, relieves the air pressure in the standpipe if the pressure exceeds approximately 6.5 pounds per square inch (.46kg per sq. cm).

1-3. MODEL AND SIGNAL DESCRIPTION.

A. Models 1000A and 1000B.

Models 1000A (3 phase) and 1000B (single phase) Thunderbolt Sirens are capable of producing a steady single-tone signal, and a wailing single-tone signal. The steady signal is frequently used as a Civil Defense

"Alert" signal and the wailing signal is used as a Civil Defense "Attack" signals. These two signals are shown graphically in figure 1-2.

B. Models 1000AT and 1000BT.

The Models 1000AT (3 phase) and 1000BT (single phase) Thunderbolt Sirens produce a steady, dual-tone signal and a wailing, dual-tone signal. The frequencies of the tones that comprise the signal have a ratio of 6 to 5. For example, if the frequency of the higher-pitched tone, at a given time is 600Hz, the pitch of the lower-pitched tone will be 500Hz. Both tones in each of the signals are produced simultaneously, lending a very distinctive sound to the siren warning signals. The steady signal is usually used as a Civil Defense "Alert" signal and the wailing signal is usually used as a Civil Defense "Attack" signal. These two signals are illustrated graphically in figure 1-2.

C. Models 1003A and 1003B.

The Model 1003A (3 phase) and Model 1003B (single phase) Thunderbolt Sirens are capable of producing coded signals, as well as the same dual tone signals as Models 1000AT and 1000BT.

As indicated in figure 1-2 any one of four possible coded signals can be selected by the user. All of the coded signals require the use of a Model AF Timer and a Model RCM3 Auxiliary control cabinet. As shipped from the factory, the Model AF causes the Model 1003 to produce the Undulating High-Low/Dual Tone Signal. However, the user can select any one of the other coded signals by performing an easily accomplished modification on the Model AF and the interconnections between the RCM3 and the solenoid operated slide valves at the time of installation. In addition, the coded signal can be changed at a future date, if required. One of the coded signals is usually used as a "Fire" signal.

The frequencies of the tones that comprise all signals produced by the Model 1003 have a ratio of 6 to 5. For example, if the frequency (pitch) of the higher pitched tone is 600Hz at a given time, the pitch of the lower tone will be 500Hz. The tones lend a very distinctive sound to the siren warning signals.

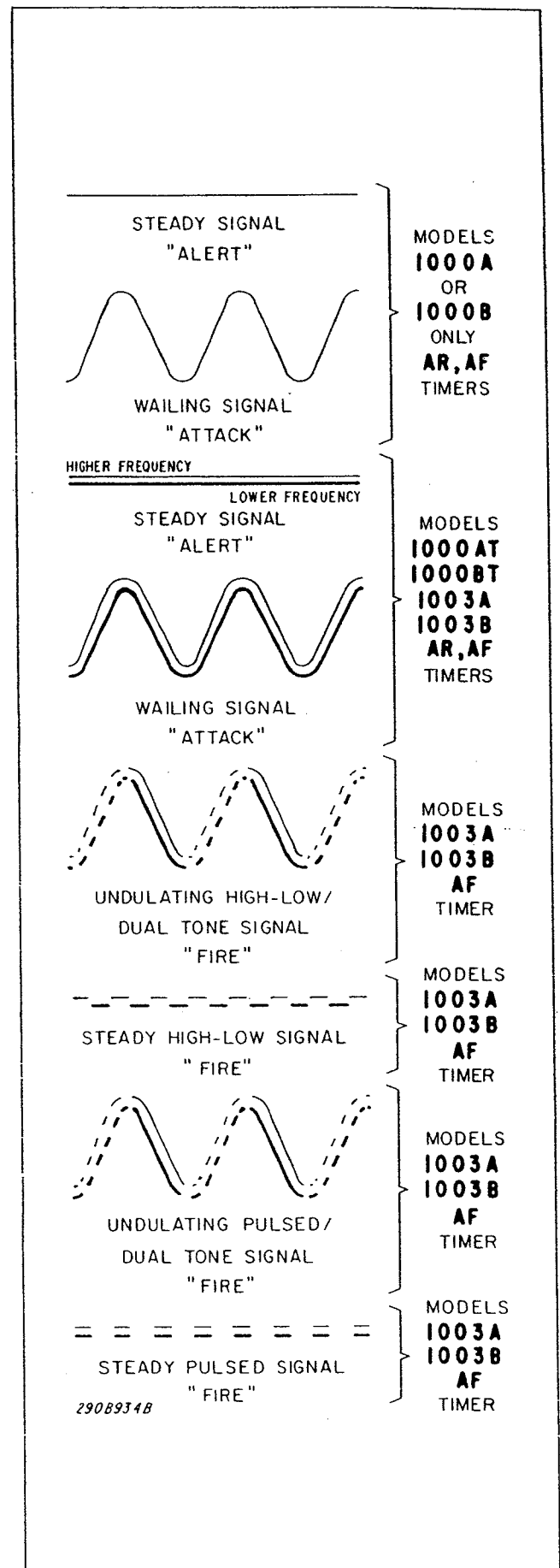


Figure 1-2. Thunderbolt Signal Characteristics.

SECTION II

SPECIFICATIONS

2-1. BLOWER ASSEMBLY.

Blower Motor
Power 10HP 3 phase
7.5HP, single phase at
1800RPM

Power Requirements

<u>Volts (AC)</u>	<u>Frequency (Hz)</u>	<u>Phase</u>	<u>Current (A)</u>
208-240	60	3	26
480	60	3	13
240	50	3	31
480	50	3	16
380	50	3	20
240	60	1	40

Blower
Type Positive displacement, rotary

Capacity 250 cubic ft. per min. (7080
liters per min.) at 5-6 psig
(.35 - .42 kg per sq. cm.) at
2770RPM

Standpipe 3-inch galvanized, schedule
40

2-2. ROTATOR ASSEMBLY.

Gear Reducer 60:1 reduction

Rotator Motor
Power 1/3 hp at 1800 RPM

Power Requirements

<u>Volts (AC)</u>	<u>Frequency (Hz)</u>	<u>Phase</u>	<u>Current (A)</u>
480	60	3	0.8
240	50	3	1.5
480	50	3	0.6
380	50	3	0.8
240	60	1	3.0

NOTE: A. 208-240V, 3 phase, 60Hz sirens use the 240V, 1 phase
rotator motor.
B. 3 phase rotator motor are used in all 50Hz sirens.

2-3. CHOPPER ASSEMBLY.

Chopper Motor

Type	Universal Series
Power	2 hp (1492W)
Power Requirements	240Vac, 1 phase, 7 A (all sirens)

2-4. SOLENOID ASSEMBLY

(Model 1003 only).

Solenoids (2)

Power Requirements	240Vac 50/60Hz, 1 phase, 1.9/1.6 A each
------------------------------	---

2-5. MISCELLANEOUS.

Sound Output

Single Tone	127dBC at 100 ft. (30.5 m)
Dual Tone	125dBC at 100 ft (30.5m)
Frequency Range.	128-700Hz (approx.)

Horn

Type.	Exponential
Cut-Off Frequency	128Hz (approx.)
Sound Beam	-6dB @ 40° off axis
Rotation Speed	4RPM (nominal)

Weight

Total (approx.)	848 lb. (382 kg.)
Blower Assembly	488 lb. (221 kg.)
Rotator Assembly.	224 lb. (102 kg.)
Chopper Assembly	36 lb. (16 kg.)
Solenoid Assembly	14 lb. (6.4 kg.)
Horn and Bracket	86 lb. (39 kg.)
RCM1 Control Cabinet	70 lb. (32 kg.)
RCM3 Auxiliary Control Panel	42 lb. (19 kg.)

Dimensions (HWD)

Blower Assembly	56" x 33" x 26" (142.2cm x 83.8cm x 66cm)
Rotator Assembly.	17" x 24" x 37 1/2"(43.2cm x 61cm x 95.3cm)
Chopper Assembly	9-1/2" (25 cm) in diameter
Solenoid Assembly	23-1/2" x 4-5/8x4 1/4 (60cm x 12 cm x 11cm)
RCM1 Control Cabinet	24" x 18 1/4 x 8-1/4" (61 cm x 74 cm x 21 cm)
RCM3 Auxiliary Control Panel	24"x18 1/2" x 8-1/4" (61 cm x 47 cm x 21 cm)
Horn.	52-1/2" x 27 1/2" x 27 1/2" (133 cm x 70cm x 70cm)

SECTION III

INSTALLATION

3-1. SIREN LOCATION.

The information in this paragraph provides guidelines to aid the user in the selection of an installation site that makes the best possible use of the siren.

If the Thunderbolt is being installed as part of a Civil Defense Warning system, ALWAYS follow Federal Emergency Management Agency (FEMA) recommendations.

Careful consideration of the factors affecting the propagation of sound from the siren and the response of the human ear to the sound will optimize the ability of the siren to effectively warn the community.

The reduction of signal intensity as the distance from the siren increases, and the minimum desired signal level at the fringe of the area to be covered are important considerations when choosing a siren installation site.

As the distance from the siren increases, sound level losses accumulate. These losses are a result of weather conditions, the terrain, obstructions in the sound path, the pitch of the sound and the height of the siren. Optimum sound propagation conditions exist when there are no obstructions in the sound path, the terrain is flat, and the air is calm. Under these conditions, each time the distance from the siren is doubled, the sound level decreases by approximately 8dB. For example, the sound level 100 feet (30.5m) from the siren is 126dB. At 200 feet (61m), the sound level drops to 118dB; at 400 feet (122m), the sound level is 110db; etc. This is referred to as the "loss per distance doubled."

A loss per distance doubled of 8dB is seldom experienced. This is because buildings and other obstructions are frequently present in the sound path. In addition, the atmosphere is rarely calm, and the terrain may not be flat. As a result, a typical loss per distance doubled in residential areas is 10dB, and as high as 12dB in areas having tall buildings.

Experience indicates that an individual with normal hearing will probably hear a warning signal whose intensity is at least as high as the ambient noise level. Experience has also shown that the ambient noise level in industrial districts is typically 90dB. Therefore, for a person to hear a warning signal in an industrial area, the sound level intensity of that signal must also be approximately 90dB. In this situation, any point receiving a signal having less than 90dB intensity is considered to be outside the effective range of the siren.

In business districts an ambient noise level of 80dB is common and in residential areas, 70dB of ambient noise is typical. Assuming a 10dB loss per distance doubled and a 70dB minimum sound level, the effective range of a single-tone Thunderbolt is approximately 5120 ft. (1560m) and 4800 ft. (1463m) for a dual-tone Thunderbolt.

Wind speed and direction often affect the propagation of sound from the siren. Consequently, the direction of the prevailing wind may also be a factor to consider when selecting the installation site(s) of a small, one or two-siren system. For example, if the prevailing wind is from the west, it may be desirable to install the siren toward the western edge of the area to be covered.

Other factors to consider before selecting the installation site include the availability of electrical power, the ease of installation and maintenance, and the height of surrounding obstructions.

3-2. PHYSICAL INSTALLATION.

A. General

This paragraph suggests several practical installation configurations. The configurations suggested make it possible to install the Thunderbolt in most situations. However, if none of the installations in this paragraph are suitable, modification of one of the configurations discussed may be practical.

In all configurations, it is suggested that the shipping crate base (blower base skid) be used as a permanent mounting base for the siren. Therefore, when uncrating the siren, do not remove the Blower Assembly from the blower base skid.

After the siren has been uncrated, perform the following checks before installing the siren:

1. Thunderbolt Sirens are properly lubricated prior to shipment. However, lubricant losses may occur in transit. Therefore, to ensure that the siren is properly lubricated, perform the lubrication procedure in paragraph 5-3A. of this manual.

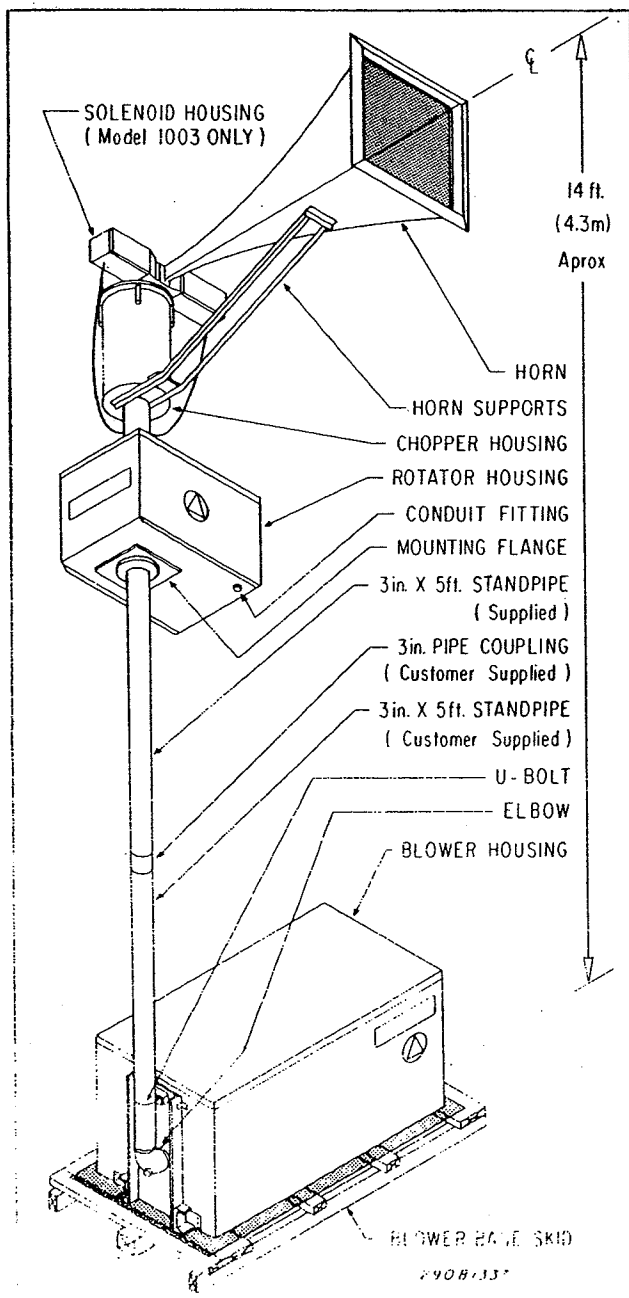


Figure 3-1. Basic Thunderbolt Installation.

2. Rotate the blower by hand. It should rotate freely.

3. Rotate the gear reducer coupling by hand. It should rotate freely (see figure 5-4).

B. Basic Installation Requirements

A typical basic Thunderbolt installation is shown in figure 3-1. This installation uses an 8-½ foot (2.6 meter), 3-inch, Schedule 40, user-supplied standpipe, a user-supplied 3" coupling, and the 18" (45cm.) long standpipe adapter (supplied). When this 10 foot (3.05m) standpipe is installed, the centerline of the horn (C in figure 3-1) is approximately 14 feet (4.3 meters) above the mounting surface. Add additional 3-inch Schedule 40 pipe when more than 14 feet of horn elevation is required. If additional 3-inch Schedule 40 pipe is required to increase the standpipe length, always install the standpipe adapter at the end of the pipe closest to the Rotator and Chopper assemblies. When the standpipe is 10 feet (3.05m) or more in height, guy wires or chains are necessary to stabilize the Rotator and Chopper Assemblies (see figure 3-5.) An installation like the one shown in figure 3-1 is practical when the installation site is on a flat roofed building.

In the installation shown in figure 3-1, the siren is mounted on a weight distribution mat. This mat is required when the siren mounting surface is unable to support weights in excess of 68 pounds per square foot (421 kg. per square meter). Therefore, if the mounting surface cannot support more than 68 pounds per square foot (421 kg. per sq. m.), construct the weight distribution mat shown in figure 3-2. This mat distributes the siren weight to approximately 14 pounds per square foot (68 kg per square meter).

To install the siren as shown in figure 3-1, proceed as follows:

1. If necessary, construct the weight distribution mat shown in figure 3-2. Locate the mat at the installation site.

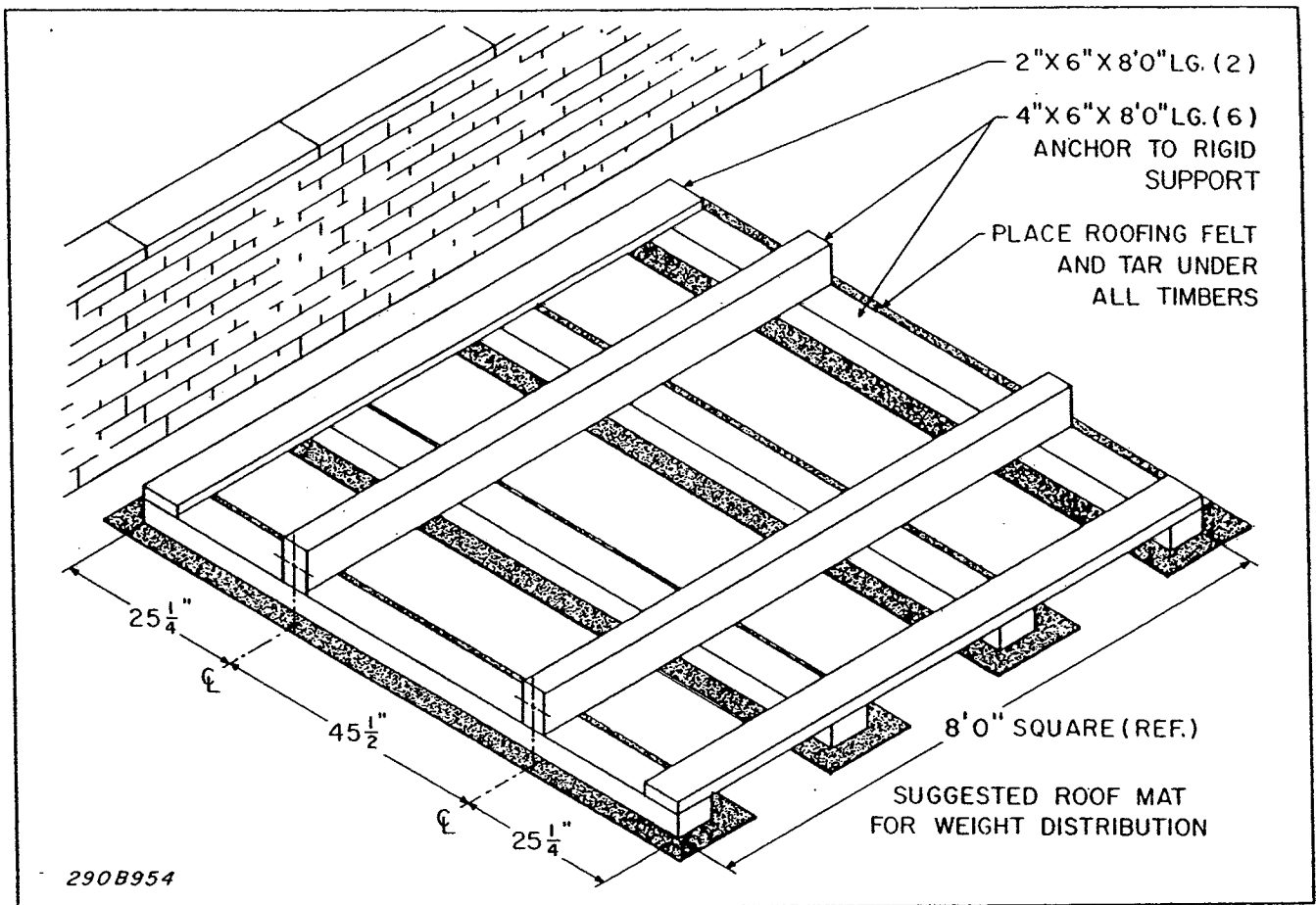


Figure 3-2. Weight Distribution Mat Construction.

2. Uncrate the Blower Assembly. Do not remove the blower base skid from the Blower Assembly.

3. Locate the Blower Assembly in its final position, secure it to the mounting surface and erect the siren. To erect the siren, proceed as follows:

(a) Remove the two 3/8" - 16 bolts that hold the blower housing on the Blower Assembly. There is one bolt on each side of the standpipe support. Retain the bolts.

(b) See figure 3-3. Remove both blower base channel space covers from the rear of the blower housing.

(c) Remove the blower housing by sliding it away from the standpipe support approximately 12 inches. Lift the housing from the blower assembly.

(d) Slide an 8-1/2 foot (2.6m) length of user-supplied, 3-inch schedule 40 pipe through the U-Bolt and thread the pipe into the elbow at the bottom of the

standpipe support. Make sure that the standpipe spacer(s) on the U-bolt is(are) between the standpipe and the standpipe support. It may be necessary to loosen the nuts on the U-bolt before the pipe will pass through the U-bolt. After the pipe has been tightened, tighten the nuts on the U-bolt. Do not tighten the U-bolt excessively, or the standpipe spacer(s) may bend.

(e) Install a user-supplied 3-inch coupling on the pipe installed in step (c).

(f) Thread the standpipe adapter with the coupling.

(g) Remove the fastening wire that holds the relief valve in place during shipment.

(h) Route a cable or chain, at least 3 feet (91 cm) in length and capable of bearing at least 500 pounds (225 kg.), through the hoist ring on the horn and the eyebolt on top of the Chopper Assembly.

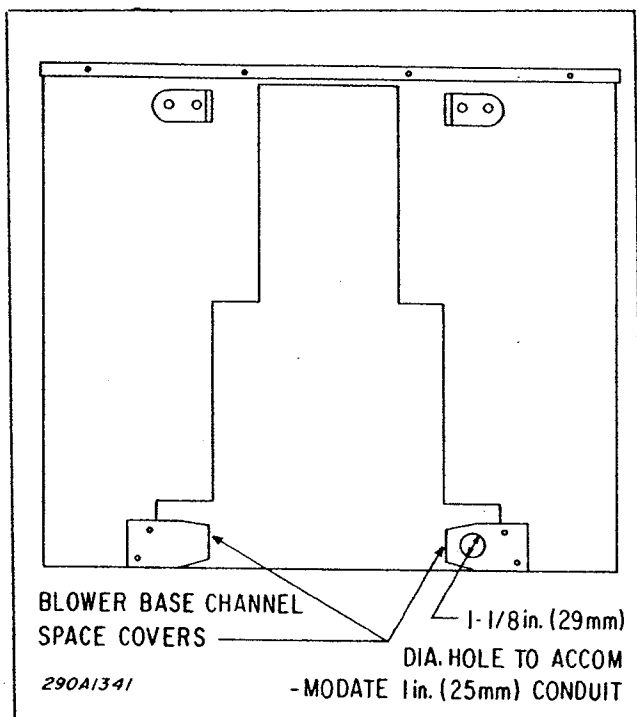


Figure 3-3. Blower Housing Detail.

(i) Use a crane or hoist capable of lifting at least 500 pounds (225 kg) to lift the Rotator and Chopper Assemblies to the height necessary to attach the assemblies to the standpipe. Attach the Rotator and Chopper Assemblies to the standpipe using the four nuts, bolts and lockwashers provided in the mounting flange.

(j) If the standpipe is 10 feet (3.05m), or more, in length, install guy wires or chains, as indicated in figure 3-5.

C. Utility Pole Installation (1).

Another installation configuration is shown in figure 3-6. In this installation, the Blower Assembly and the Rotator and Chopper Assemblies are installed on a Class 2 utility pole. This type of installation is frequently used in areas where there are few tall buildings.

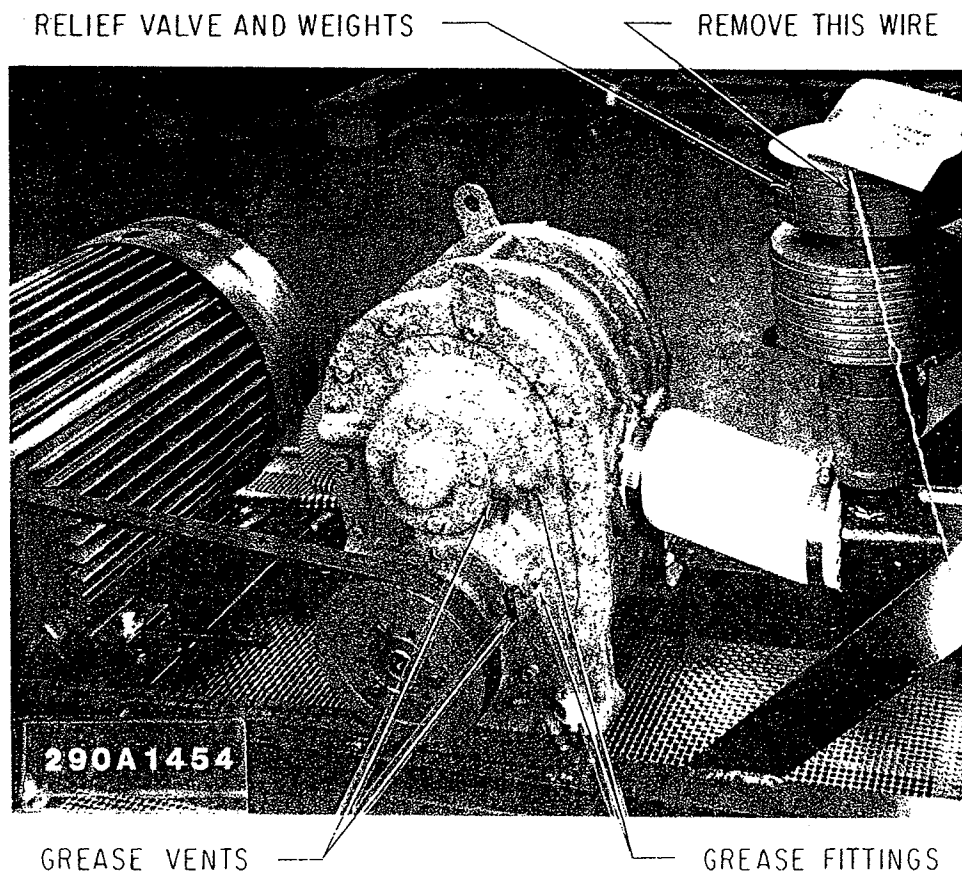


Figure 3-4. Blower Assembly Interior View.

As shown in figure 3-6, the Blower Assembly is mounted on a platform. A detailed view of this platform is shown in figure 3-7. The dimensions and the materials needed for the construction of this platform are shown in figure 3-8.

If the Blower Assembly is separated by more than 10 feet (3.05m) from the Rotator and Chopper Assembly, install additional 3-inch Schedule 40 pipe between the assemblies. Three-inch pipe may be purchased locally.

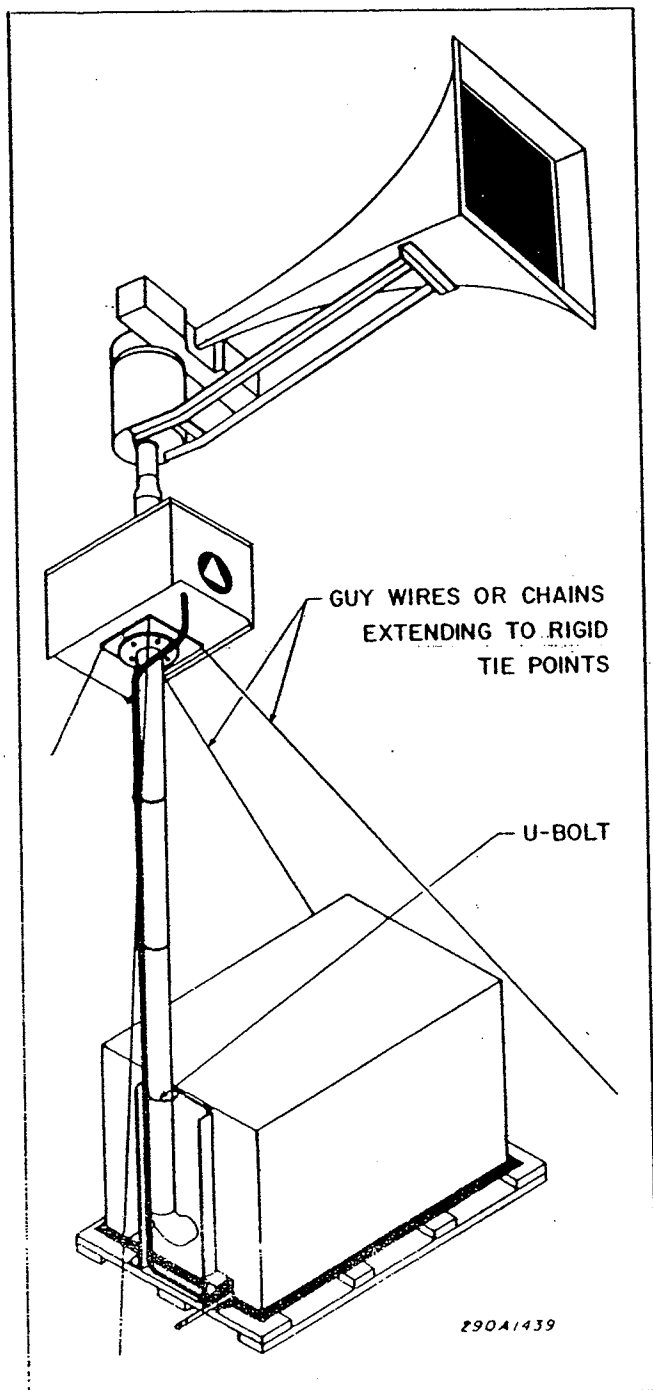


Figure 3-5. Guy Wire Installation.

Fabricate support brackets from U-bolts and steel bar stock as shown in figure 3-9. Install these support brackets approximately every four feet (1.2m) along the pole to support the pipe.

D. Utility Pole Installation (2).

Figure 3-10 shows a pole-mounted installation similar to the one shown in figure 3-6. However, in figure 3-10 the Blower Assembly is mounted on a concrete base at ground level. When pouring the concrete mounting base, ensure that the top surface of the base is at least six inches (152 mm) above the surface. Install support brackets like those shown in figure 3-9 every four feet (1.2m) along the length of the utility pole to support the stand-pipe. The use of this installation configuration is NOT recommended in climates where heavy rain or snow is frequent.

If this installation configuration is used, it may be desirable to enclose the installation with a fence to discourage vandalism.

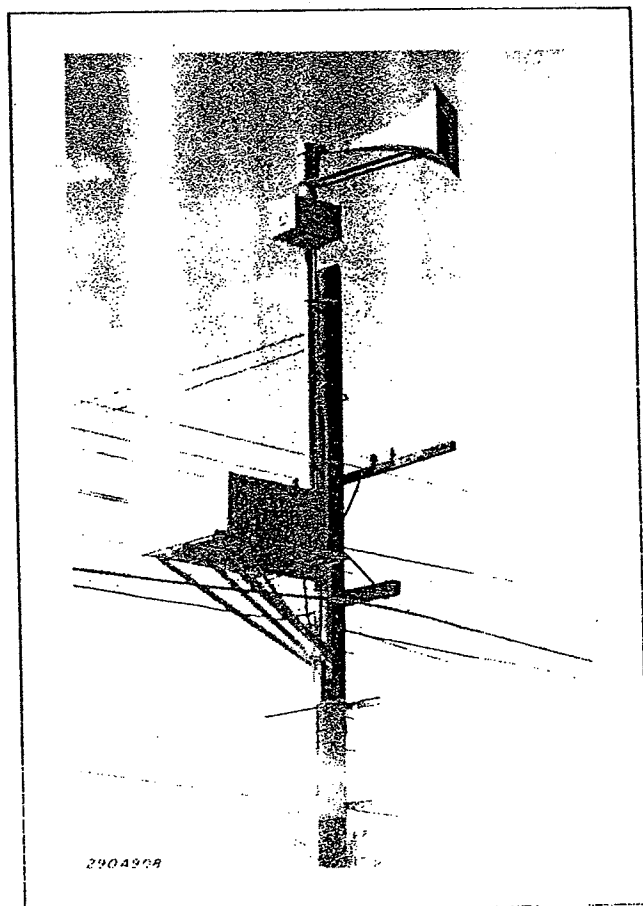


Figure 3-6. Typical Pole Mount (1).

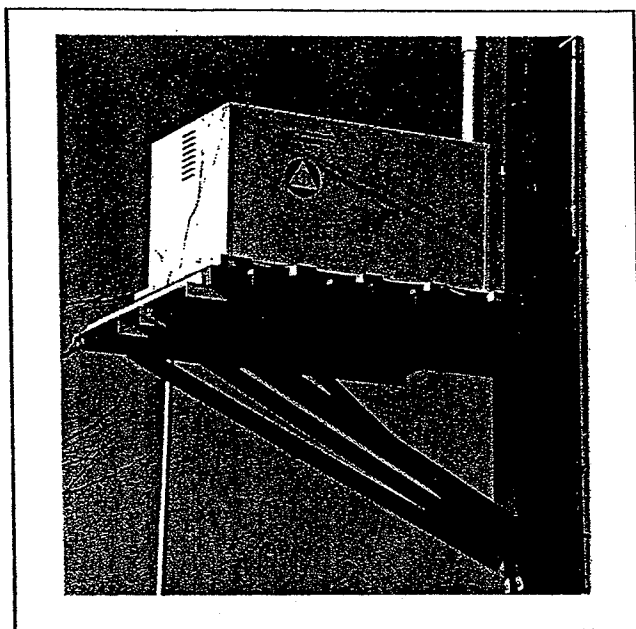


Figure 3-7. Mounting Platform Closeup View.
E. Wall-Supported Installation.

The siren standpipe is supported by a wall in the installations shown in figures 3-11 and 3-12. Either of

these installations may be used when the siren is installed on a flat-roofed building that has high parapets.

An installation like the one shown in figure 3-12 may be used when it is impractical to have the standpipe rise directly from the Blower Assembly. The length of the pipe has a relatively minor effect on the siren output sound level. Every 100 feet (30.5m) of pipe causes a reduction of 1dB in the sound output level.

F. Interior - Exterior Installation.

Figure 3-13 shows the Blower Assembly installed on the inside of a building with the standpipe passing through the roof. The Rotator and Chopper Assemblies are outside of the building. This installation includes an air intake pipe to conduct air from the outside of the building to the blower air intake. The air intake pipe is es-

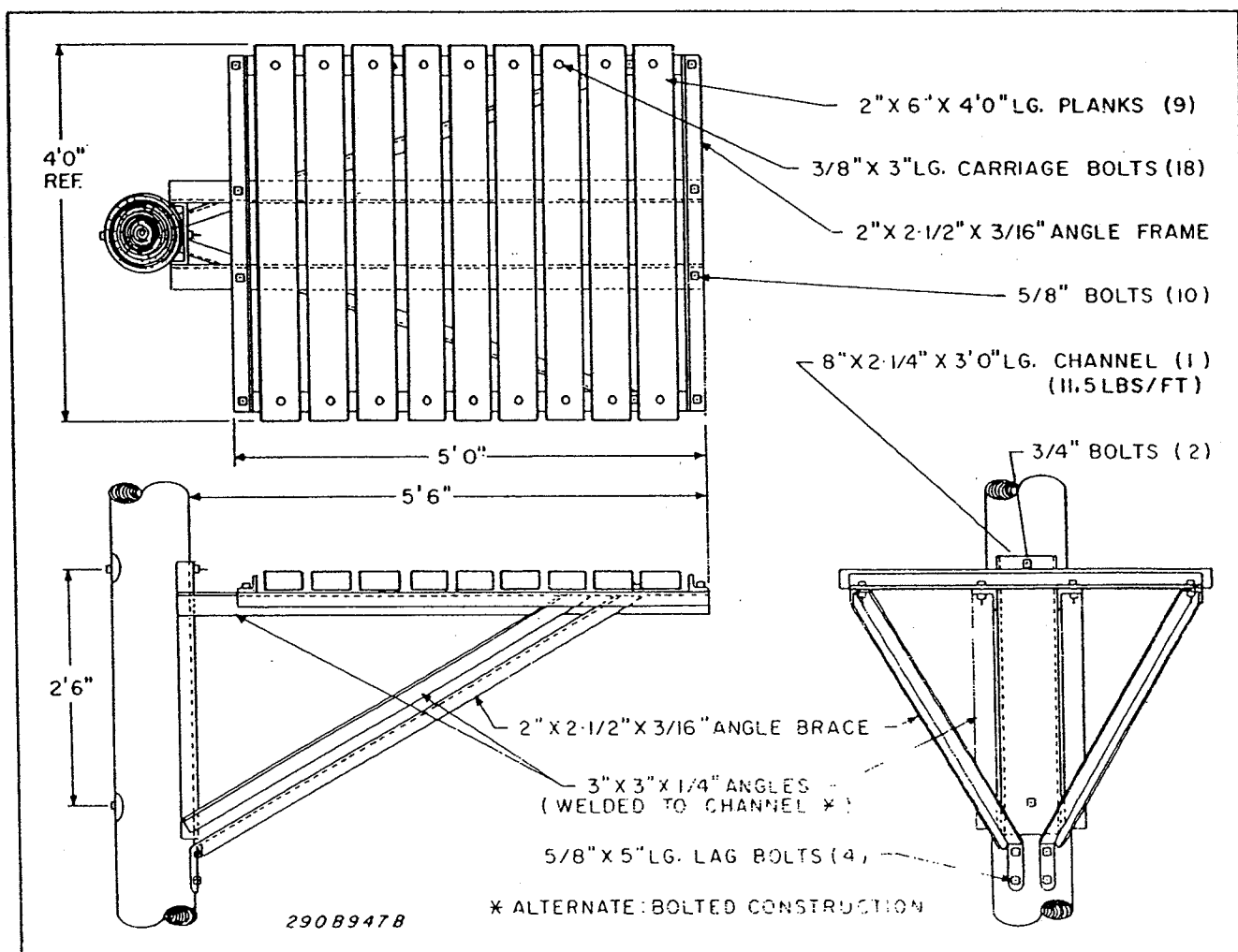


Figure 3-8. Blower Platform Construction.

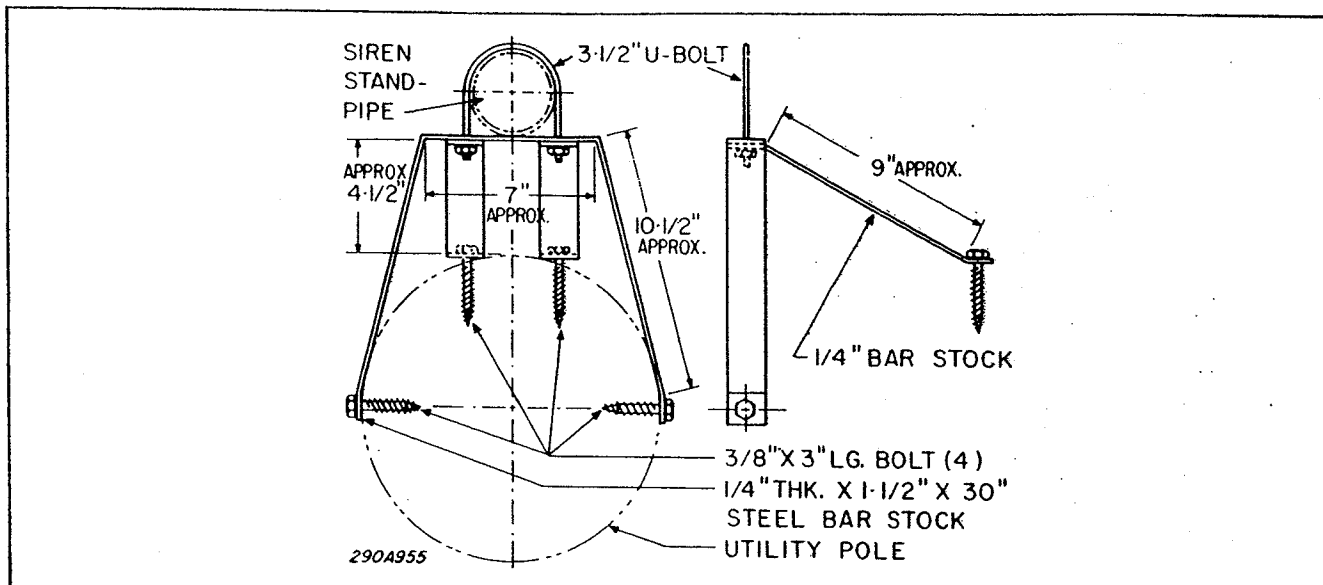


Figure 3-9. Support Bracket Construction.

pecially important in climates where winter weather becomes cold enough to cause the temperature of the parts in the Rotator and Chopper Assembly to drop below freezing. If an air intake pipe similar to the one shown in figure 3-13 is not installed, air from inside of the building will enter the blower air intake. The air from the interior of a building may contain sufficient humidity that if this air contacted cold chopper parts, condensation could form in the chopper assembly and freeze. This would lock the chopper and could cause the Chopper Motor to burn out.

When installing the intake pipe, connect a 3" to 2-1/2" reducing elbow to the blower intake, as shown in figure 3-14. Use 3" schedule 40 pipe for the remainder of the intake pipe installation. Install waterproof joints where the air intake pipe and siren standpipe pass through the roof so that water cannot enter the building. As shown in figure 3-14, direct the end of the pipe downward to prevent rain and snow from falling into the pipe. Install the pipe so that the intake end of the pipe is above the highest expected snow level. To prevent obstructions from entering the pipe, install a screen on the intake end of the pipe. Fabricate the screen using material such as 20 gauge hardware cloth with 1/4" x 1/4" mesh (6.4mm x 6.4mm).

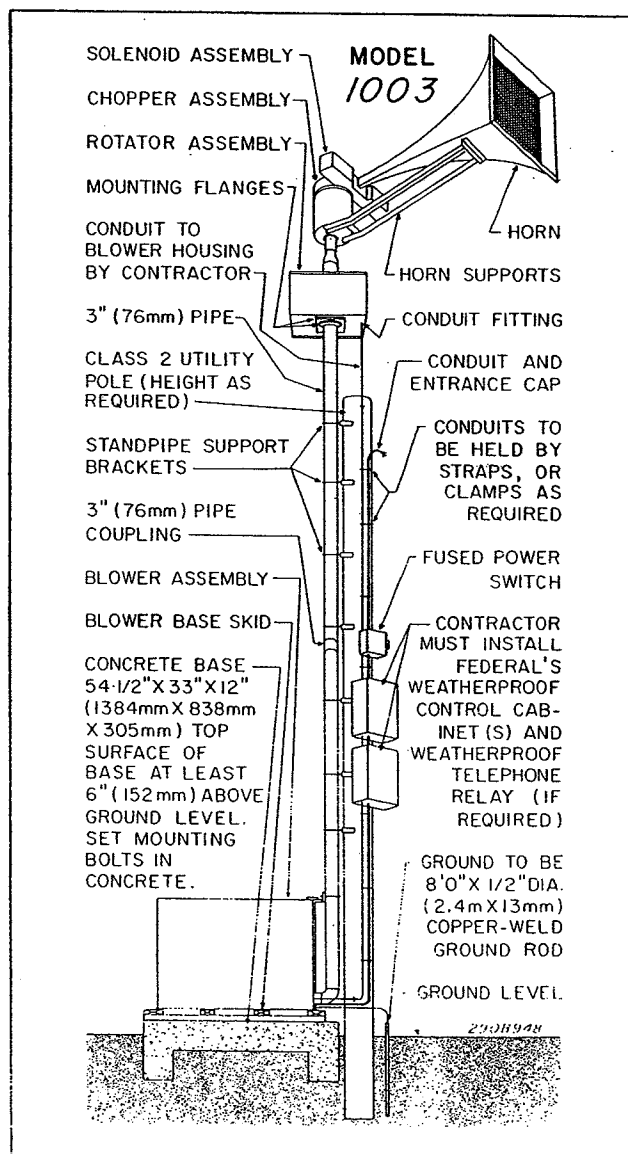


Figure 3-10. Typical Pole Mount (2).

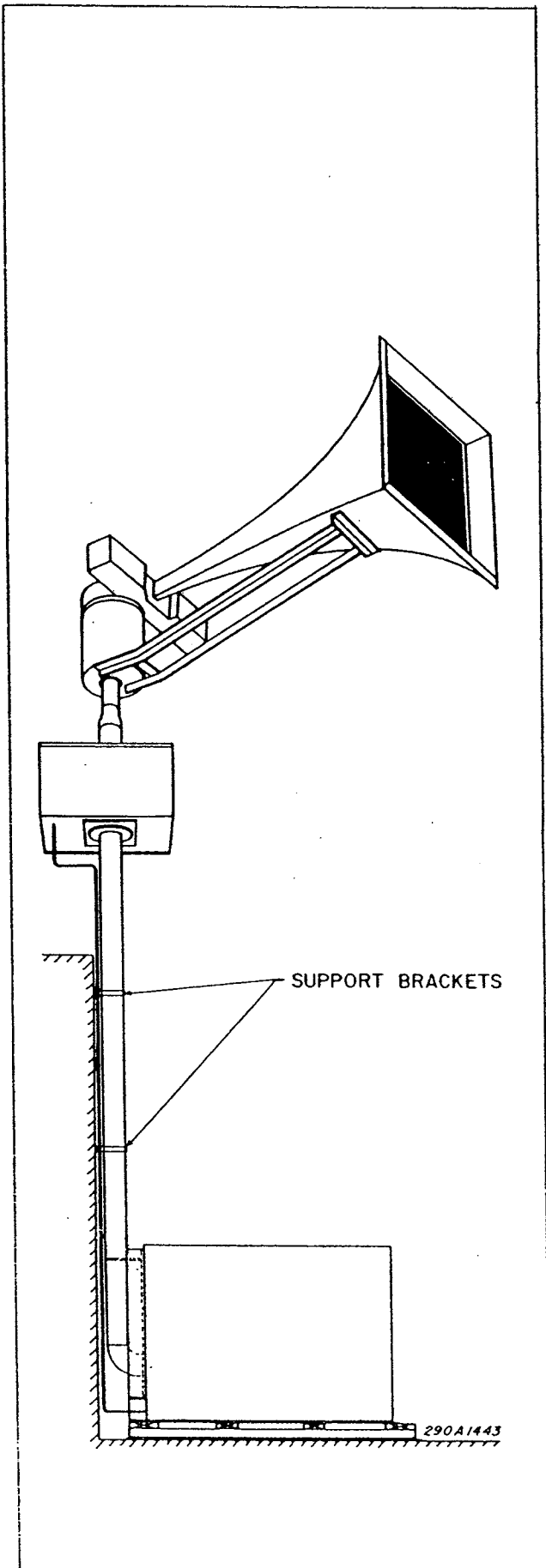


Figure 3-11. Wall-Supported Thunderbolt (1).

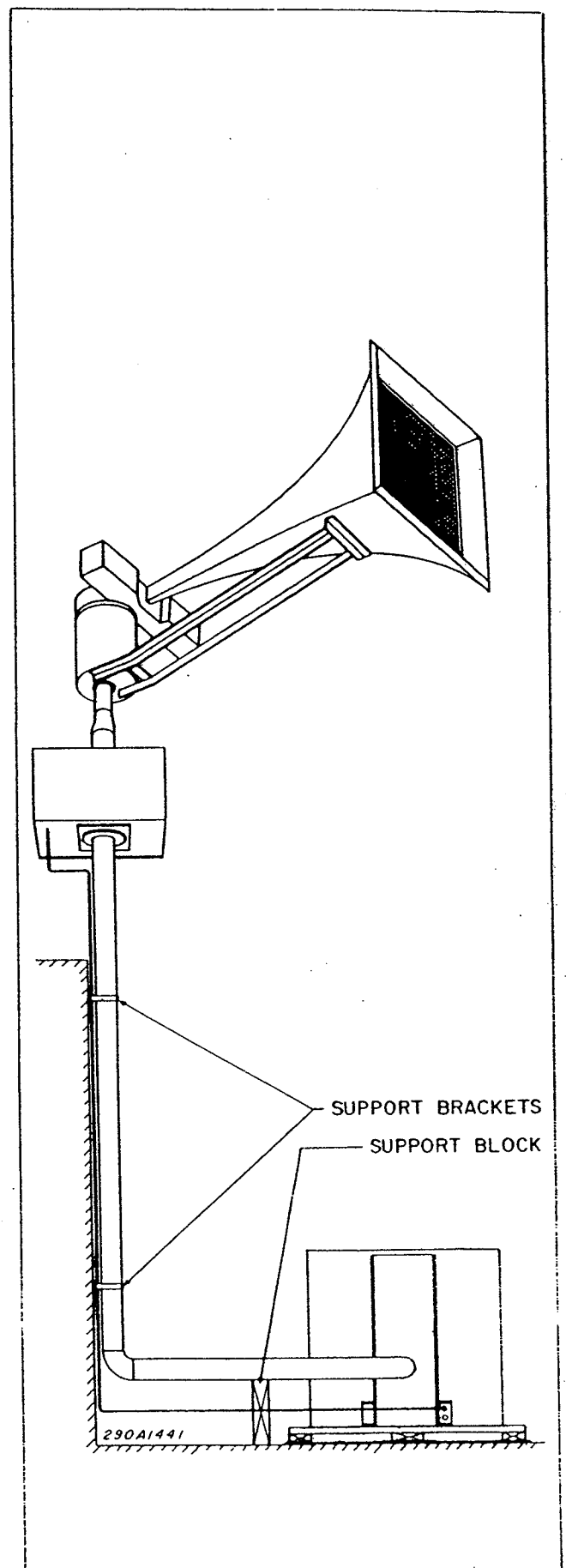


Figure 3 12. Wall Supported Thunderbolt (2).

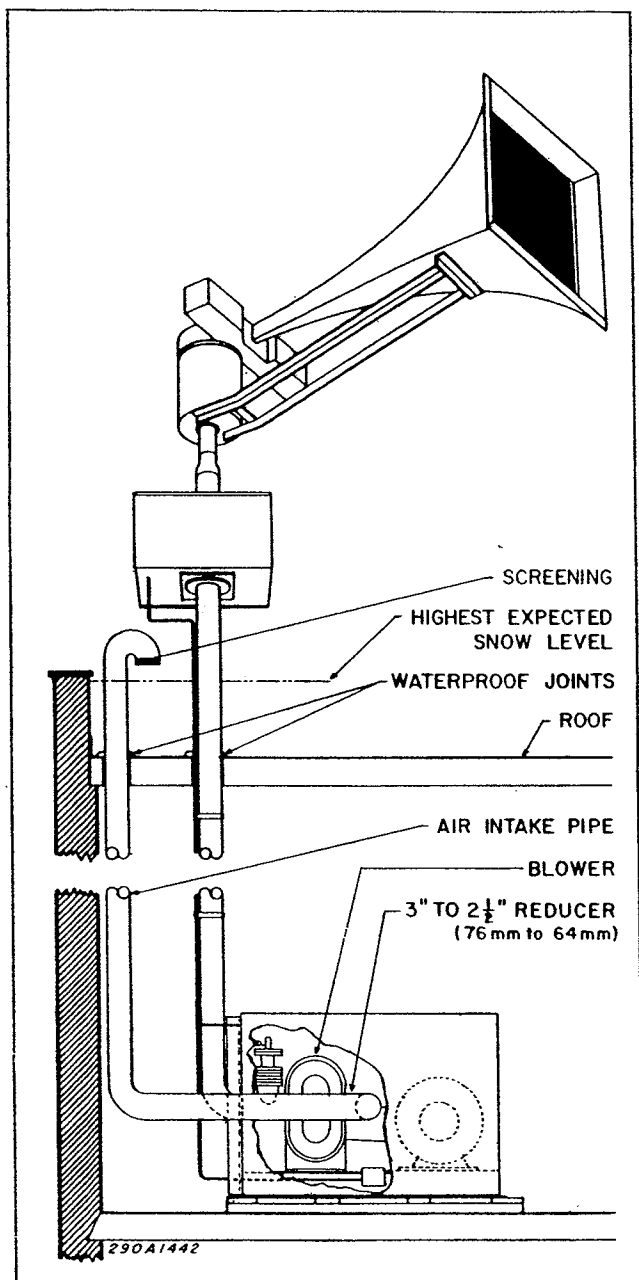


Figure 3-13. Interior-Exterior Thunderbolt Installation (2).
G. Hose or Thin-Wall Tubing.

If desired, flexible hose or thin-wall tubing may be used to conduct air from the Blower Assembly to the Rotator Assembly. The tubing or hose must be capable of withstanding pressure of at least 10 pounds per square inch (0.7kg per square centimeter). When tubing or hose is used, a structural frame similar to that shown in figure 3-15 is required. The legs of the frame can be bolted directly to the mounting flange.

When installing the hose or tubing, attach approximately one foot (30cm) of 3-inch Schedule 40 pipe to the Blower Assembly. Install the stand

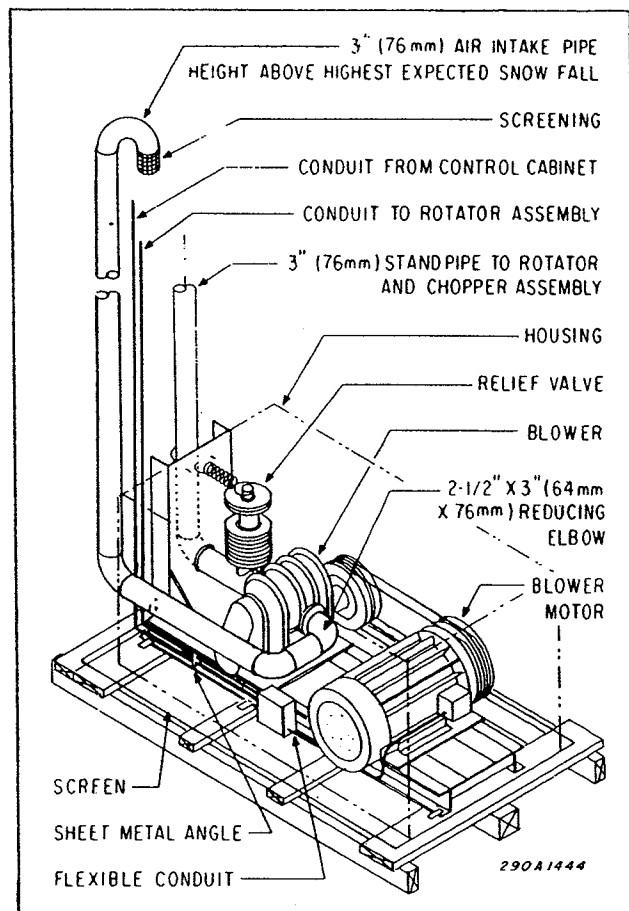


Figure 3-14. Air Intake Installation Detail.

pipe adapter (supplied) on the mounting flange on the bottom of the Rotator Assembly. Clamp the ends of the hose or tubing to these pipes, as indicated in figure 3-15.

3-3. ELECTRICAL CONNECTIONS.

A. Model 1000 Thunderbolt.

The power and control circuitry of a typical Model 1000 Thunderbolt Siren installation is shown in figures 3-17 and 3-18. The wiring diagrams of the RCM1A (3 phase) and RCM1B (single phase) Control Cabinets are shown in figures 5-11 and 5-12, respectively.

To connect the Control Cabinet and siren to the power source, proceed as follows:

1. Mount the Control Cabinet on a vertical surface as close as possible to the Blower Assembly. The motor starters cannot operate properly unless the Control Cabinet is in a vertical position.

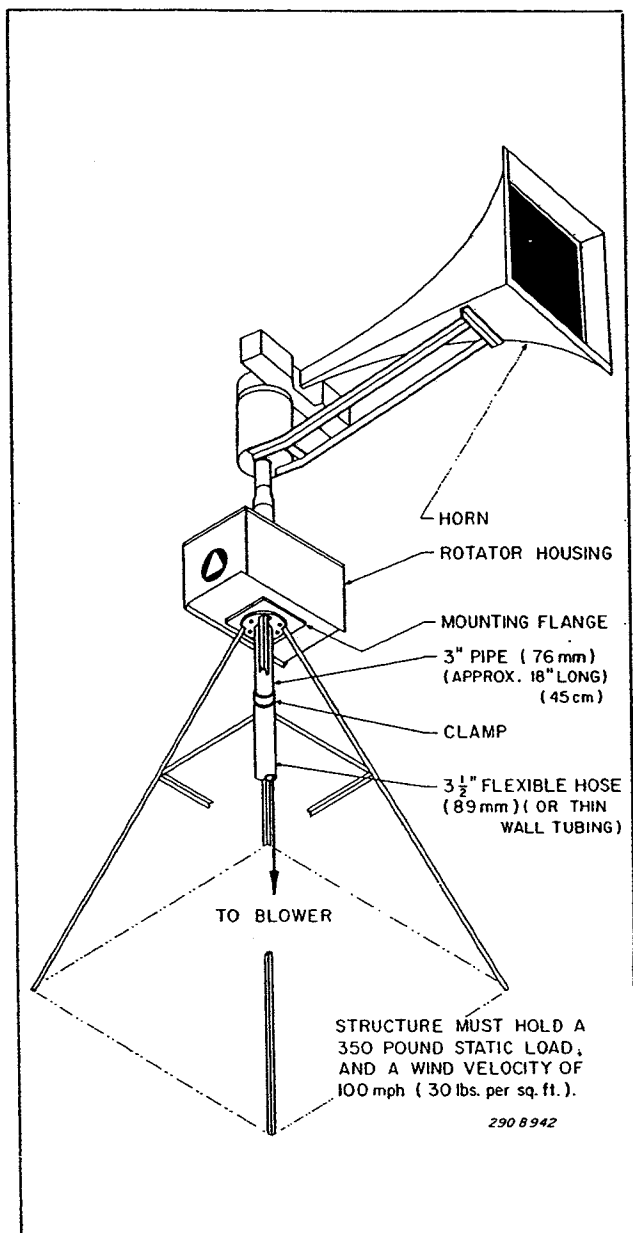


Figure 3-15. Flexible Hose Installation Detail.

2. Drill or punch a 7/8" (22mm) hole in one of the blower base channel space covers, as indicated in figure 3-3.

3. Remove the cover closest to the conduit fitting from the rotator housing. Install 3/4" (19mm) conduit between the RCM1 and the rotator assembly conduit fitting.

4. Install 3/4" (19mm) conduit between the RCM1 control cabinet and the blower junction box. Pass the conduit through the 7/8" (22mm) hole in the blower base channel space cover. Allow the blower base channel space cover to hang loosely on the conduit. It will be reattached to the blower housing later.

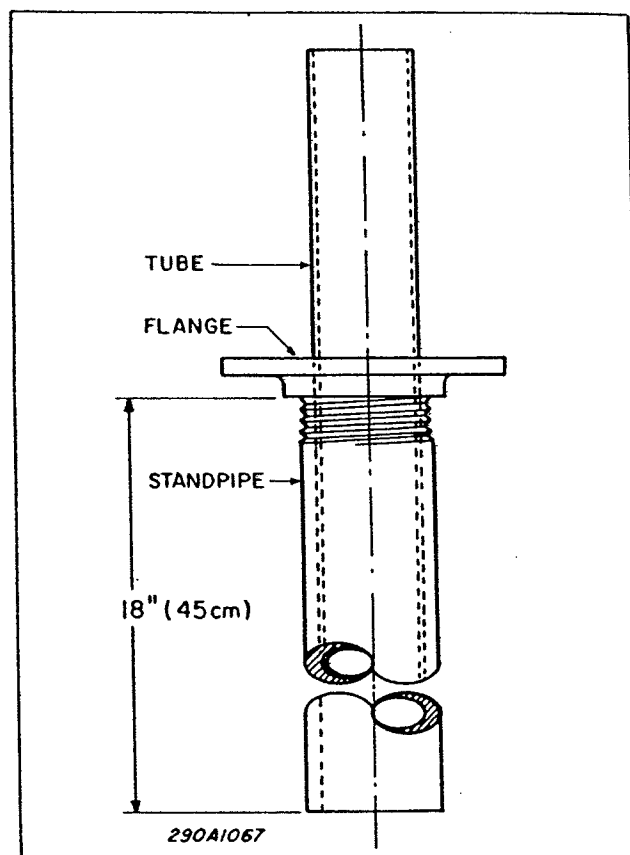


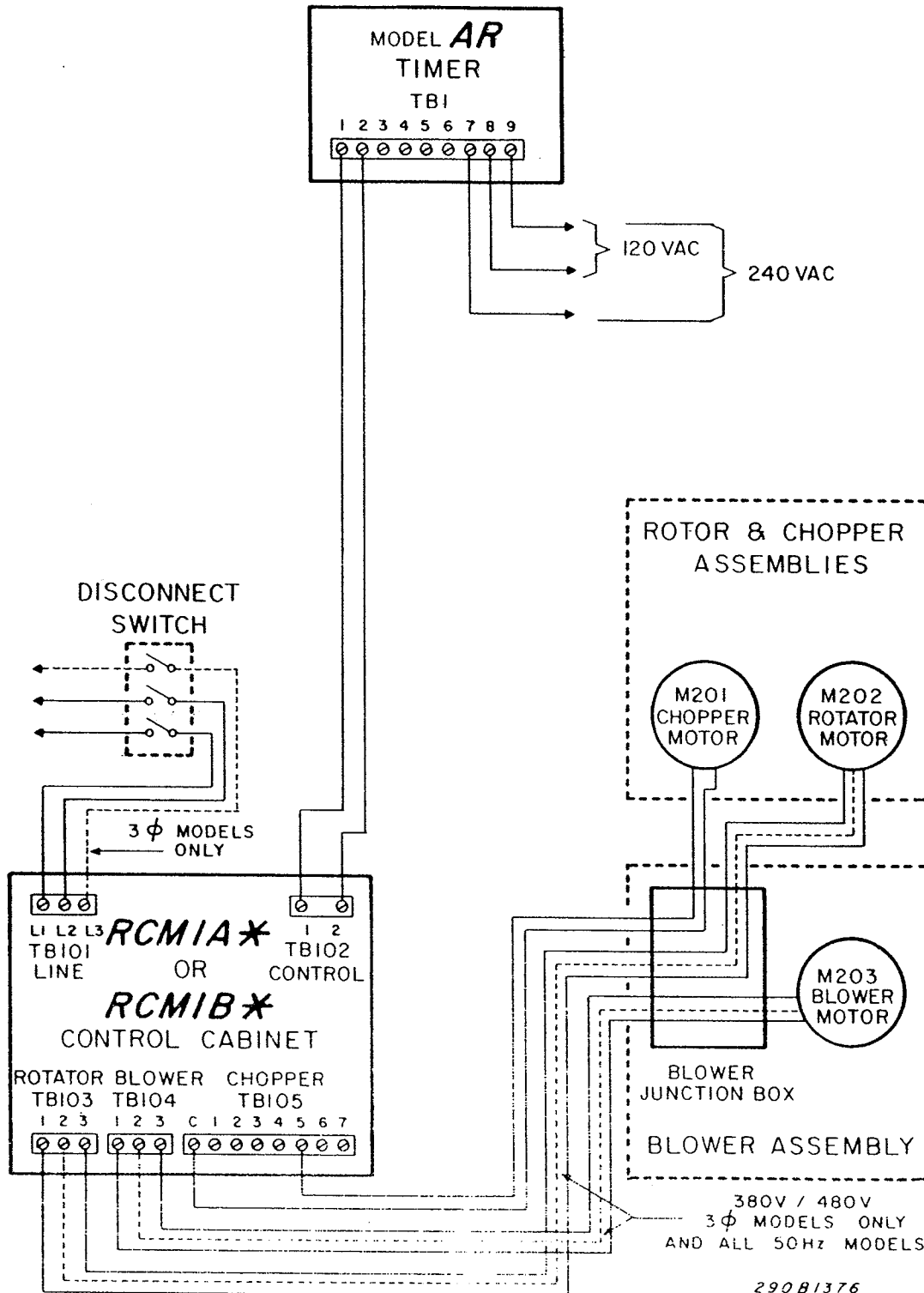
Figure 3-16. Standpipe Adapter Detail.

5. Route wires of the proper size from TB103 (Rotator) and TB105 (Chopper) in the control cabinet through the 1" (25mm) conduit to the rotator housing. Two wires are required for each motor (three are required for the rotator motor in 480Vac, 3 phase and all 50Hz model sirens). The size of the wires required for each motor in the siren depends on the operating current and the length of wire between the control cabinet and the motor. Refer to Table 3-1 for the correct wire sizes. If desired, multiconductor cabling can be used.

6. Route the wiring through the rotator housing to the terminal strip, as indicated in figure 3-19. Connect the wiring to the terminal strip as indicated in figure 3-19.

If separate wires are used, it may be desirable to tie them together with cable ties at several points along their length inside of the rotator housing. The SOLENOID COMMON, SOLENOID NO. 1 and SOLENOID NO. 2 terminals and labeling are not present in the Model 1000.

1000 THUNDERBOLT



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Figure 3.12, Model 1000 Electrical Connections

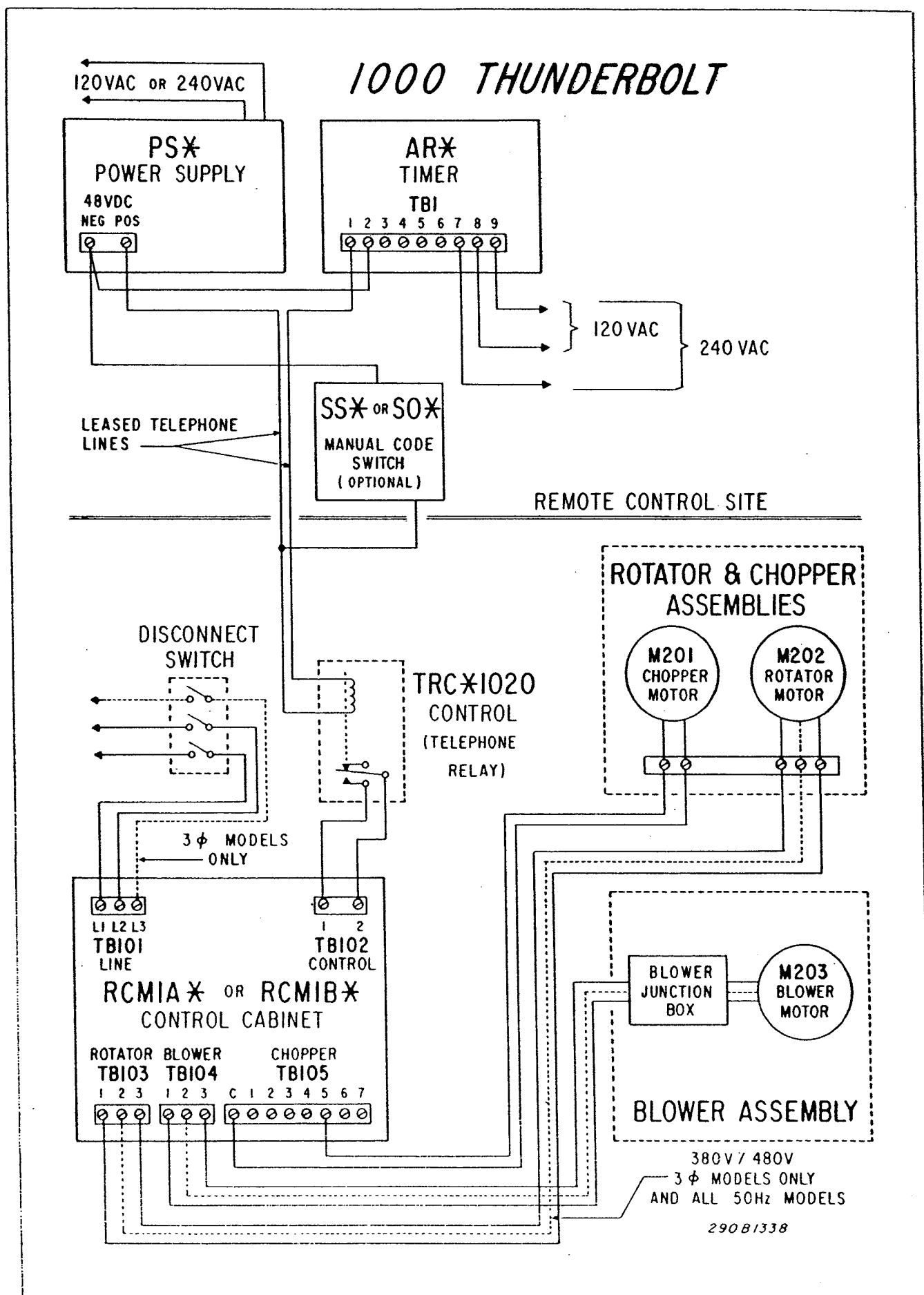


Figure 3-18. Model 1000 Power and Landline Control Connections.

Table 3-1. Wire Sizes.

208-240 Volts - 3 Phase Wire Length - feet (meters)			
	<u>Less than 100 (30.5)</u>	<u>100 - 200 (30.5 -61)</u>	<u>Over 200 (61)</u>
Control Cabinet to Blower Motor	AWG 10	AWG 8	Use AWG wire size that drops less than 5% of line voltage, between power source and the siren when the siren is drawing rated current.
Control Cabinet to Chopper Motor	AWG 14	AWG 12	
Control Cabinet to Rotator Motor	AWG 14	AWG 14	
Power Source to Control Cabinet	AWG 6	AWG 4	
Control Relay to Control Cabinet	AWG 14	AWG 14	
Control Cabinet to Solenoids*	AWG 14	AWG 14	

240 Volts - 1 Phase Wire Length - feet (meters)			
	<u>Less than 100 (30.5)</u>	<u>100 - 200 (30.5 - 61)</u>	<u>Over 200 (61)</u>
Control Cabinet to Blower Motor	AWG 6	AWG 4	Use AWG wire size that drops less than 5% of line voltage between power source and the siren when the siren is drawing rated current.
Control Cabinet to Chopper Motor	AWG 14	AWG 12	
Control Cabinet to rotator motor	AWG 14	AWG 14	
Power source to Control Cabinet	AWG 4	AWG 2	
Control relay to Control Cabinet	AWG 14	AWG 14	
Control Cabinet to Solenoids*	AWG 14	AWG 14	

480 Volts - 3 phase Wire Length - feet (meters)			
	<u>Less than 100 (30.5)</u>	<u>100 - 200 (30.5-61)</u>	<u>Over 200 (61)</u>
Control Cabinet to Blower Motor	AWG 10	AWG 8	Use AWG wire size that drops less than 5% of line voltage between power source and the siren when the siren is draw- ing rated current.
Control Cabinet to Chopper Motor	AWG 14	AWG 12	
Control Cabinet to Rotator Motor	AWG 14	AWG 14	
Power Source to Control Cabinet	AWG 6	AWG 4	
Control relay to Control Cabinet	AWG 14	AWG 14	
Control Cabinet to Solenoids*	AWG 14	AWG 14	
*Model 1003 Only			

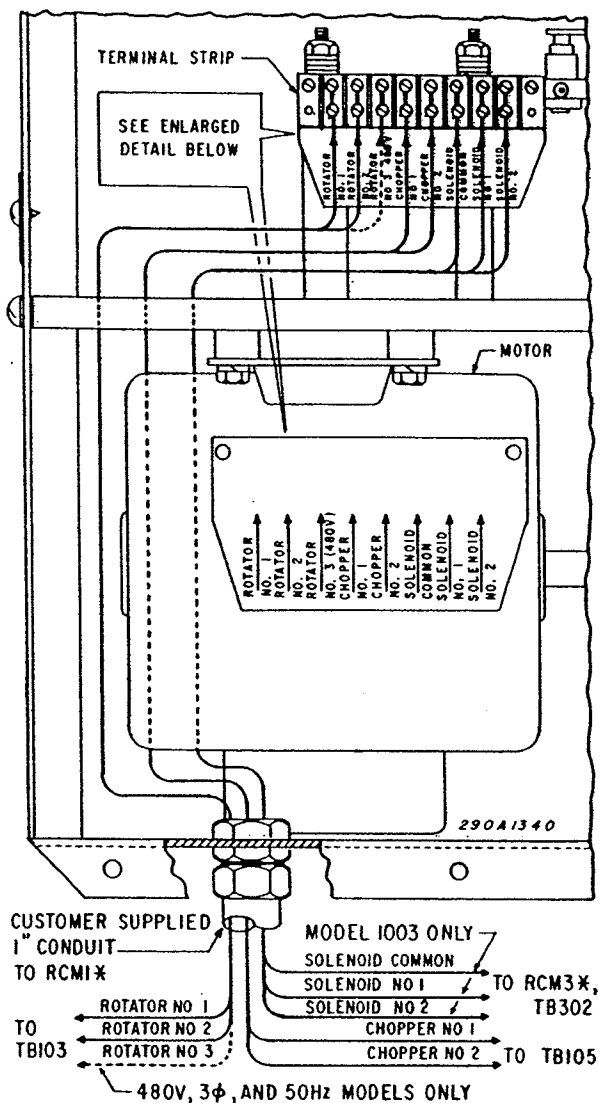


Figure 3-19. Rotator Assembly Interior Connections.

7. Route the necessary wires from TB104 through the 3/4" (19mm) conduit to the blower junction box and through the flexible conduit to the solderless lugs on the blower motor. Connect the wires to the lugs and insulate.

8. See figures 3-18 and 3-20. Install the AR Timer or other control device to TB102 in the control cabinet. If it is desired to operate the timer from user supplied remote control pushbuttons, such as Federal's SO or SS, install them at this time also. If it is required to cancel a signal from a remote location, remove the jumper between TB2-15 and TB2-16 and connect the normally closed contact of the switch or relay to TB2-15 and 16 (see figure 5-14). If the length of the wiring between the pushbuttons and the timer exceeds 2000 feet (610m), install an SPST telephone relay, such as the Federal Model TRC*1020, between each pushbutton and the timer. The timer can

also be activated by a radio signal if the Federal Siratrol® is incorporated into the System. The use of the Siratrol has the advantage that control lines are not required between the siren control site and the siren location(s).

B. Model 1003 Thunderbolt

Figure 3-21 shows the wiring diagram of the power and control circuitry of a typical Model 1003 Thunderbolt Siren installation. The wiring diagrams of the RCM1A (three phase) and RCM1B (single phase) Control Cabinets are shown in figures 5-11 and 5-12, respectively. The wiring diagram of the RCM3 Auxiliary Control Panel is shown in figure 5-13.

To connect the Control Cabinet and siren to the power source (See figures 3-21 and 3-22):

1. Mount the control Cabinet and Auxiliary Control Panel on a vertical surface and as close as possible to the Blower Assembly. The motor starters cannot operate properly unless the Control Cabinet is in a vertical position.

2. Install 3/4" (19mm) conduit between the RCM1 Control Cabinet and the RCM3 Auxiliary Control Panel.

3. Drill or punch a 7/8" (22mm) hole in one of the blower base channel space covers, as indicated in figure 3-3.

4. Remove the side cover closest to the conduit fitting, from the rotator housing. Install 1" (25mm) conduit between the RCM1 and the rotator assembly conduit fitting.

5. Install 3/4" (19mm) conduit between the control cabinet and the blower junction box. Pass the conduit through the 7/8" (22mm) hole in the blower base channel space cover. Allow the blower base channel space cover to hang loosely on the conduit. It will be reattached to the blower housing later.

The wire sizes for the motors and solenoids in the siren depend on the operating current and the length of the wires between the control cabinet and the device being powered. Refer to Table 3-1 for the correct wire sizes.

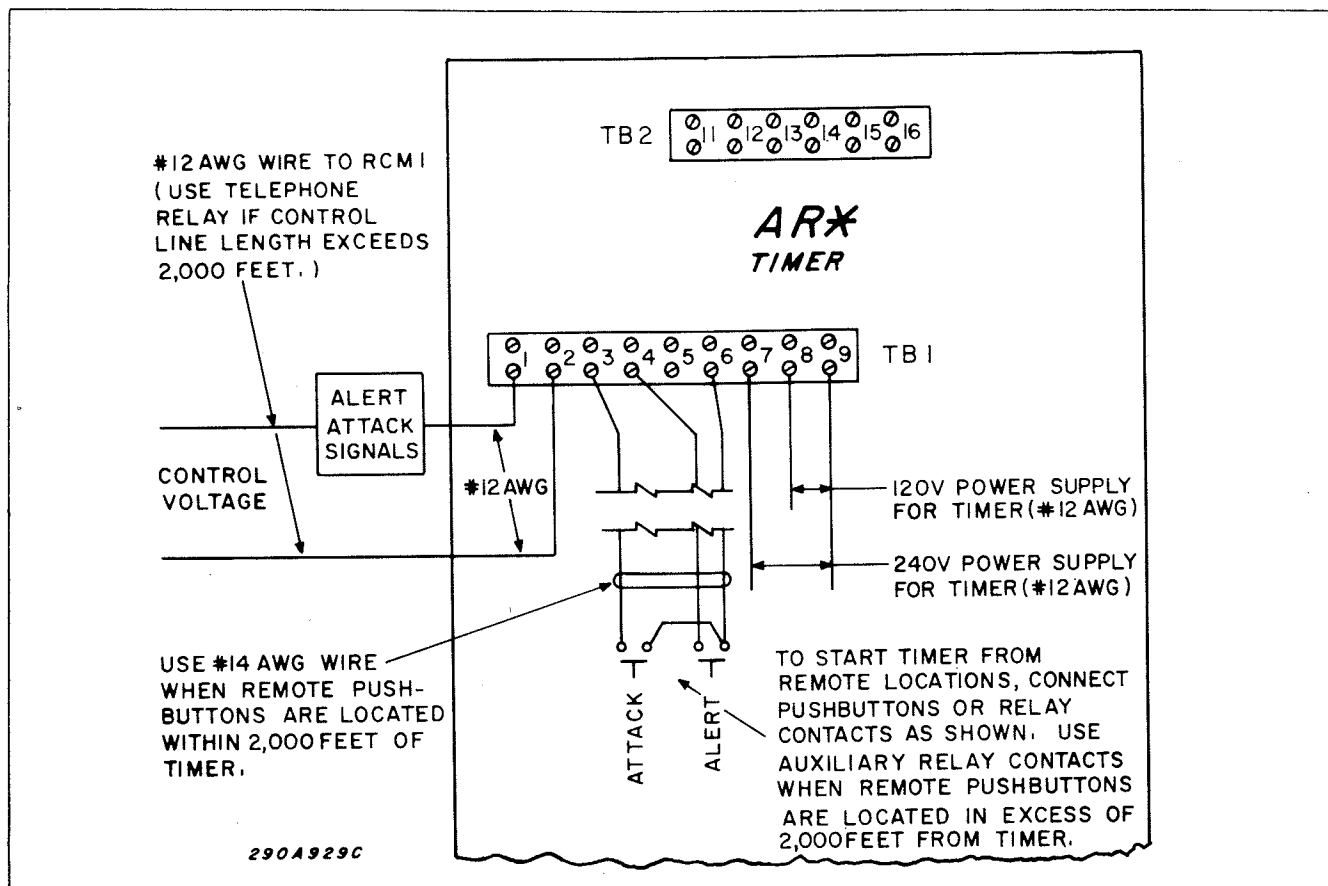


Figure 3-20. AR Timer Electrical Connections.

6. Route two AWG 14 wires from TB101 in the RCM1 to TB301 in the RCM3 through the conduit that was installed in step 2. Route a third AWG 14 wire from TB102 to TB301, as shown in figure 3-21.

7. Route three wires from TB302 in the RCM3 through the conduit to the RCM1. These wires must be long enough to reach the terminal strip in the rotator housing. If the Undulating High-Low/Dual Tone "Fire" Signal is desired, connect one wire to each terminal of TB302. If a "Fire" signal other than the Undulating High-Low/Dual Tone Signal is required, refer to paragraph 3-5. A three conductor cable may be used, if desired.

8. Route two AWG14 wires from TB101 to TB301 and one AWG 14 from TB102 to TB301.

9. Route wires of the proper size from TB103 (Rotator) and TB105 (Chopper) in the RCM1 control cabinet, and the three wires from the RCM3 that were installed in step 7 through the 1" con-

duit to the rotator housing. If desired, multiconductor cabling can be used.

10. Route the wiring through the rotator housing to the terminal strip, as indicated in figure 3-19. Connect the wiring to the terminal strip as indicated in the figure. If separate wires are used it may be desirable to tie them together with cable ties at several points along their length inside of the rotator housing.

Two wires are required for the rotator motor (three wires are required for the rotator motor in 480Vac sirens and in all 50Hz models). Connect the three wires from the RCM3 Auxiliary Control Panel to the SOLENOID COMMON, SOLENOID NO. 1 and SOLENOID NO.2 terminals. Replace the cover on the rotator housing when all electrical connections have been completed.

11. Route the necessary wires through the 3/4" conduit to the lower junction box and through the flexible conduit to the solderless lugs on the blower motor. Connect the wires to the lugs and insulate the connections.

1003 THUNDERBOLT

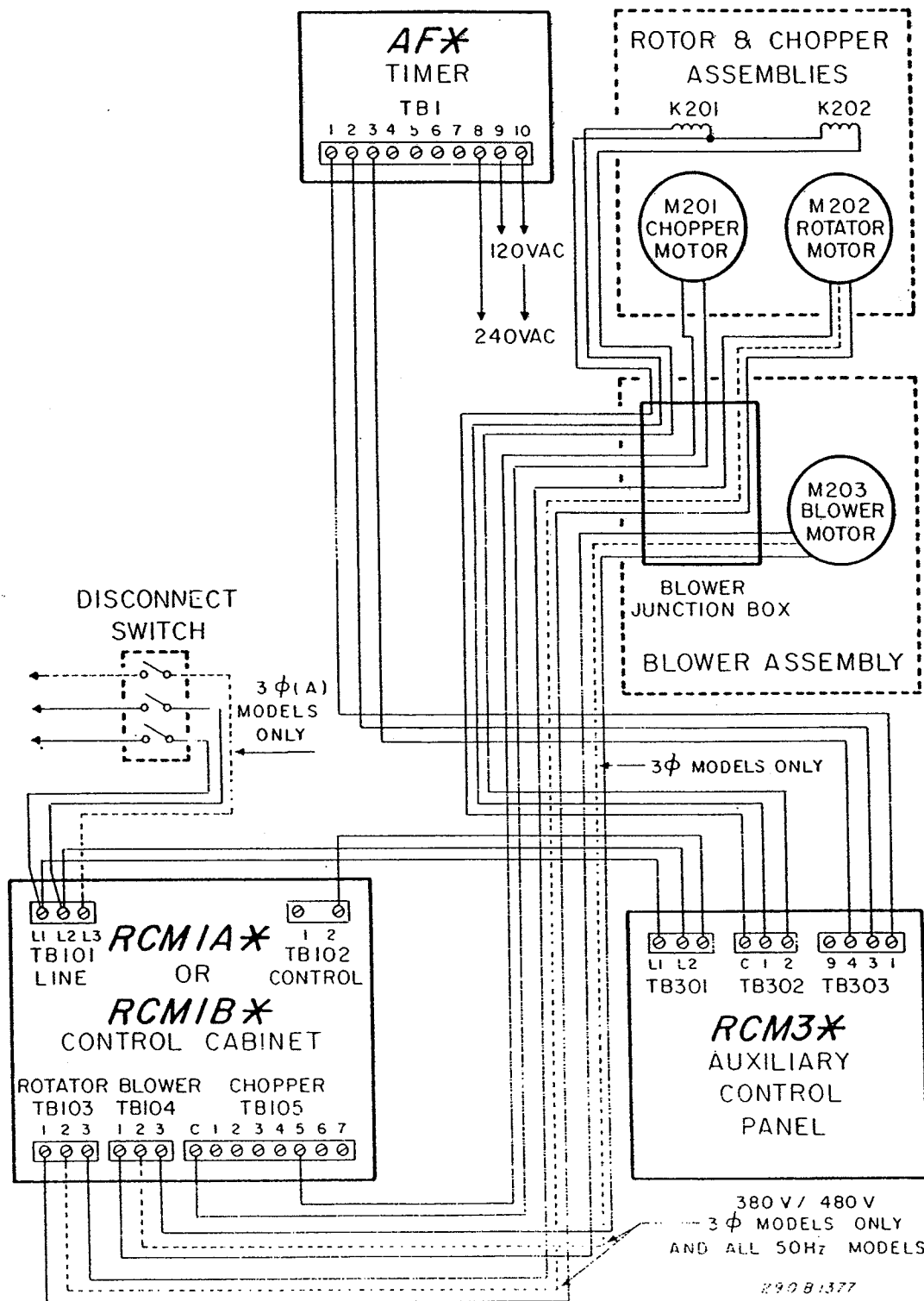


Figure 3-21. Model 1003 Electrical Connections.

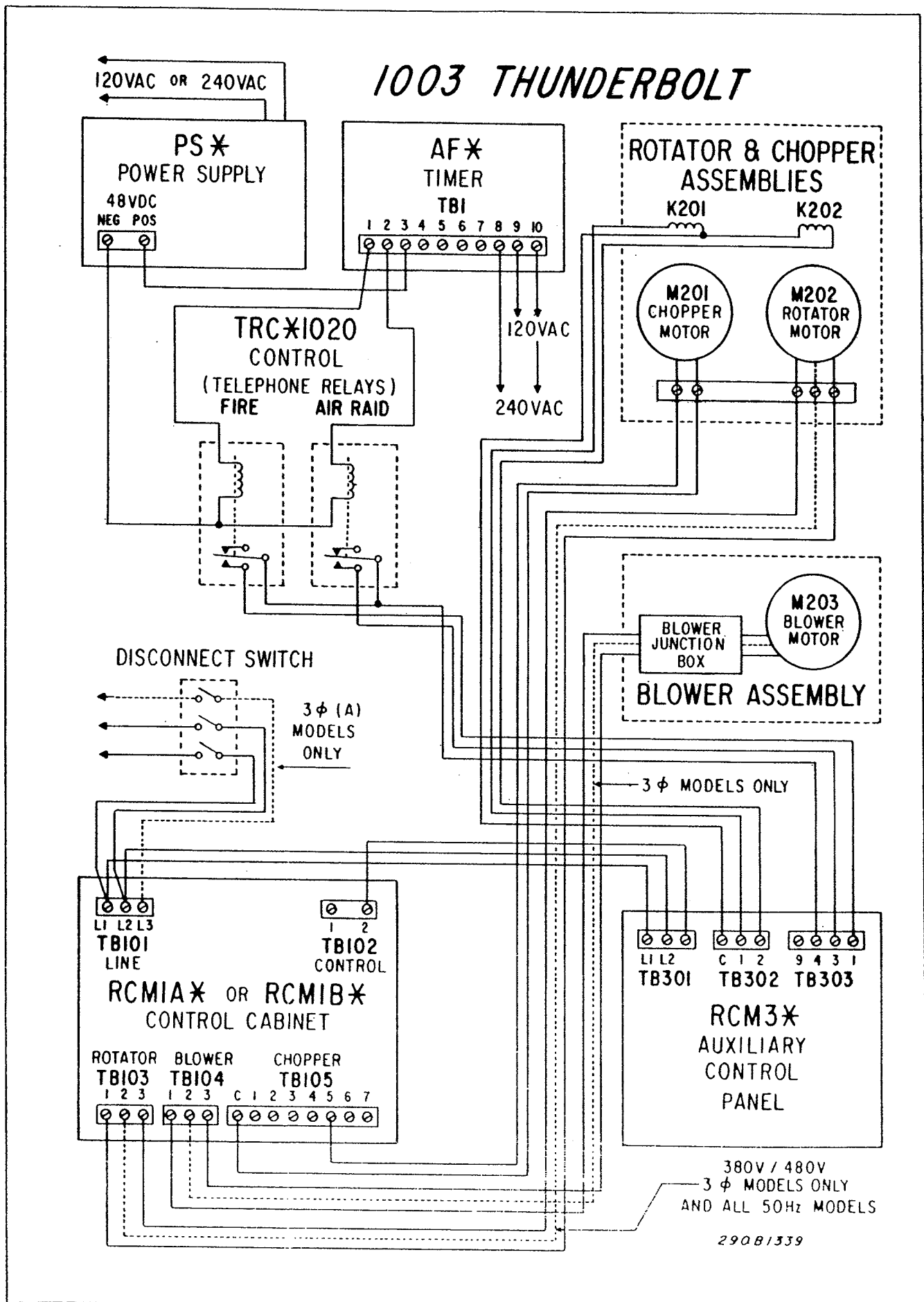


Figure 3-22. Model 1003 Power and Landline Control Connections.

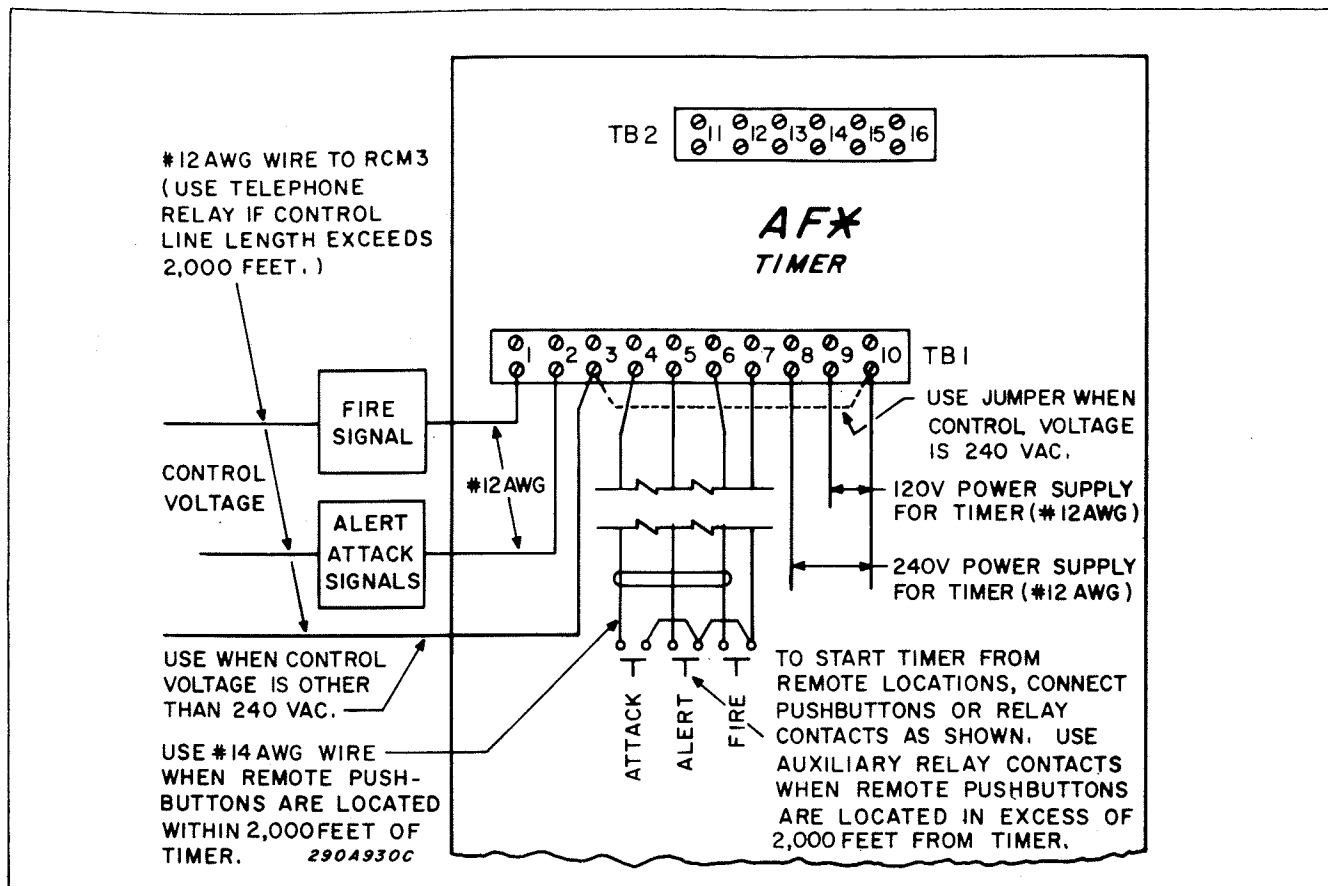


Figure 3-23. AF Timer Electrical Connections.

12. Install the AF Timer (see figure 3-23) or other control device. If it is desired to operate the timer by means of user supplied remote control pushbuttons such as Federal's SO or SS, install them at this time. If it is required to cancel a signal from a remote location, remove the jumper between TB2-15 and TB2-16 and connect the normally closed contacts of the switch or relay to TB2-15 and TB2-16 (see figure 5-15). If the length of the wires between the pushbuttons and timer exceeds 2000 ft. (610m) install a SPST telephone relay, such as Federal Model TRC*1020, between each pushbutton and timer.

As

As shipped from the factory, the AF Timer causes the Model 1003 Thunderbolt to produce the Undulating High-Low/Dual Tone "Fire" Signal. If a "Fire" signal other than the Undulating High-Low/Dual Tone Signal is required, refer to paragraph 3-5.

The timer can also be activated by a radio signal if the Federal Siratrol is incorporated into the System. The use of the

Siratrol has the advantage that control lines are not required between the siren control site and the siren location(s).

3-4. THREE PHASE MOTOR CONNECTIONS.

A three phase motor can be operated from either a 208-240Vac or a 480Vac source when the appropriate arrangement of electrical connections is used. The siren is shipped with the motor wired to operate at the voltage specified by the customer. This voltage is stamped on the nameplate of the motor. However, if it is ever necessary to change the motor operating voltage, connect the wires in the appropriate arrangement as shown in figure 3-24. NOTE: If it is ever necessary to change the siren operating voltage, the controls must also be modified or exchanged.

3-5. "FIRE" SIGNAL MODIFICATIONS (Model 1003 only).

As shipped from the factory the AF Timer causes the Model 1003 Thunderbolt to produce the Undulating High-Low/Dual Tone "Fire" Signal. If a

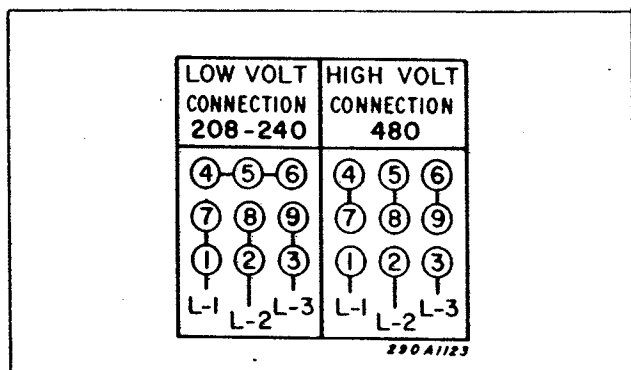


Figure 3-24. Three Phase Motor Power Connections.

"Fire" signal other than the Undulating High-Low/Dual Tone Signal is required follow the appropriate procedure in this paragraph. These procedures affect the operation of the "Fire" (coded) signal only. The modifications described in this paragraph have no effect on any other signals produced by the Thunderbolt. See figure 3-25 as necessary while performing the selected procedure in this paragraph.

A. Steady High-Low Signal.

(1) Remove Cam No. 4 from the AF Timer by loosening the set screw and sliding the cam off the shaft. This causes the coded signal to be produced for three minutes.

(2) Connect one wire to each terminal of TB302, in the RCM3. Make sure that the wire connected to SOLENOID COMMON in the rotator assembly is connected to TB302-C; SOLENOID No. 1 is connected to TB302-1; and SOLENOID No. 2 is connected to TB302-2.

B. Undulating Pulsed/Dual Tone Signal.

Connect the wires from SOLENOID NO. 1 AND SOLENOID NO.2 in the rotator assembly, to either TB302-1 OR TB302-2 in the RCM3. Connect the wire from SOLENOID COMMON to TB 302-C. It is NOT necessary to modify the AF Timer for this signal.

C. Steady Pulsed Signal.

(1) Remove Cam No. 4 from the AF Timer by loosening the set screw and sliding the cam off of the shaft. This causes the coded signal to be produced for three minutes.

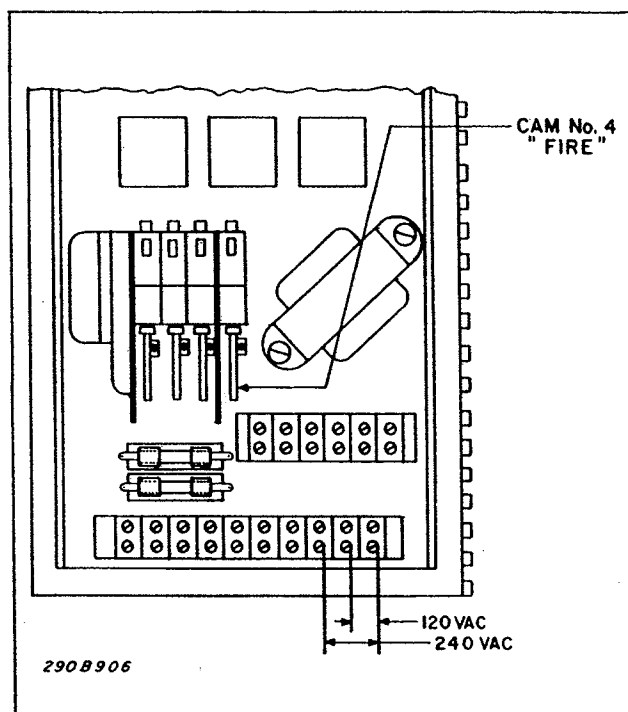


Figure 3-25. "Fire" Cam Location.

(2) Connect the wires from SOLENOID NO. 1 AND SOLENOID NO.2, in the rotator assembly, to either TB 302-1 OR TB302-2. Connect the wire from SOLENOID COMMON to TB302-C.

3-6. SYSTEM GROUNDING.

As a safety precaution to protect both personnel and equipment, it is highly recommended that the siren and all control devices be solidly connected to an earth ground. If the siren is installed on a building, ground the system to a metallic object known to be grounded. For pole mounted installations, drive a metal rod or bar at least 2 feet (61 mm) into the ground, as close as practical to the base of the pole. For maximum protection, use a separate, continuous 10AWG, or larger, wire from the blower frame to ground and from the cabinet of each control device to ground.

3-7. PREOPERATION CHECKS.

After the siren has been completely installed, perform the following checks before operating the siren:

1. Ensure that all control circuits are open and set all toggle switches in both the RCM1 and RCM3 (Model 1003 only) to the AUTOMATIC position. Apply power to the Control Cabinet.

2. Set the BLOWER switch to the TEST position. Observe the blower shaft from the pulley end. The shaft should be rotating in a counterclockwise direction. If the direction of rotation is incorrect, turn off the power to the siren and reverse two of the blower motor power lead connections. (3 phase motors only), Energize the blower motor again and observe the blower shaft for proper operation. After completing this test, return the BLOWER switch to the AUTOMATIC position.

3. Set the CHOPPER switch to the TEST position while the horn is rotating. However, do not turn on the blower. After the chopper has reached top speed, return the CHOPPER switch to AUTOMATIC and allow the chopper to coast to a stop. Low level sound should be generated. Repeat this test several times and return both the ROTATOR and CHOPPER switches to AUTOMATIC.

4. Set the CONTROL switch to TEST. Initiate a siren signal from the siren control device. Only the Time Delay Relay, K102, and the Chopper Motor Starter, K103, should energize. If a Model AR or AF Timer is installed with the siren, the chopper motor starter should be energized for about four seconds and deenergized for about eight seconds. This is a silent test of the control circuits; the siren should not produce any sound. After this test is complete, set the CONTROL switch to AUTOMATIC.

WARNING

The output sound level of a Model 1000 or 1003 Thunderbolt is capable of causing permanent hearing damage, especially at short distances. Therefore, ALWAYS wear hearing protection when performing tests or maintenance on the siren.

When ALL switches are set to AUTOMATIC, the siren is ready for operation. Test the siren for full sound output by operating the timer or manual code switch. The siren may also be tested locally by setting the BLOWER and ROTATOR switches to TEST and using the CHOPPER switch to operate the siren up and down scale.

Before replacing the blower housing on the blower assembly, slide the blower base channel space cover, on the conduit, away from blower assembly to ensure that the cover is outside of the housing after the blower housing is replaced. Replace the blower housing on the blower assembly and reattach both blower base channel space covers to the housing.

After the installation is complete and it has been established that the siren is operating properly, Federal recommends that all control devices be padlocked to discourage tampering and vandalism.

SECTION IV

CIRCUIT DESCRIPTION

4-1. GENERAL.

Most Thunderbolt Siren installations include a Model AR or Model AF Timer. The Model AR Timer is usually installed with a Model 1000 siren. In order to utilize the full capability of the Model 1003 Thunderbolt, a Model AF Timer is required.

The Models RCM1A and RCM1B Control Cabinets contain the motor starters necessary for the Models 1000 and 1003 Thunderbolt Sirens. The Model RCM3 Auxiliary Control Panel is used with the Model 1003 only. The Auxiliary Control Panel controls the solenoid-operated slide valves in the Solenoid Assembly of the Model 1003.

The operation of the Models AR and AF Timers is nearly identical. Therefore, unless otherwise specified, all descriptions of the timer circuits apply equally to both timer models.

4-2. TIMER CIRCUIT DESCRIPTION.

The Federal Model AR and Model AF Timers contain the devices necessary for the control of the Model 1000 and 1003 Thunderbolt Sirens, respectively.

The Model AR Timer (see figure 5-14) causes the Model 1000 to produce a steady three-minute "Alert" signal and a three minute, undulating, up and down scale "Attack" signal. The Model AF Timer (see figure 5-15) causes the Model 1003 to produce a "Fire" signal as well as the "Attack" and "Alert" signals. The "Fire" signal is a two minute, undulating, rapidly alternating high and low pitched signal, up scale, and a continuous, dual-tone signal down scale.

The timers control undulating signals ("ATTACK" and "FIRE" by applying a three-minute series of eight-second control contact closures separated by four-second opens at TB102 in the RCM1 (Model 1000) or TB303 in the RCM3 (Model 1003).

Both timer models include a TEST pushbutton (S4 in the AR, S5 in the AF). The TEST pushbutton operates the control devices and the siren only for the time that it is pressed. The timer is not activated because the TEST pushbutton is in the timer output circuit.

The CANCEL button (S3 in the AR, S4 in the AF) enables the siren operator to stop the siren in the event an error was made in the selection of a signal. If a signal is cancelled, the timer motor continues through the 3-minute cycle. If another signal is selected during the cycle, it will be produced only for the remainder of the three-minute cycle.

The AR and AF Timers may be operated from either a 120 volt or 240 volt, 50-60Hz source. When properly connected, to the power source, transformer, T1 provides 120 volts to the 120 volt components.

The output circuitry is electrically independent of the timing circuitry. Consequently, the output circuit can utilize up to 480V. The capacity of the micro-switch contacts in the signal circuits is 15 amperes ac, 1/4 ampere dc.

The timer is activated by pressing the appropriate local or remote pushbutton for at least two seconds.

The red pilot light, DS2, on the front panel of the timer, indicates that the timer is cycling. The yellow pilot light, DS1, indicates that power is available to the timer.

When the ALERT, ATTACK or FIRE (Model AF Timer only) pushbutton is pressed, the respective relay energizes, establishing a holding circuit through the relay holding contacts. Simultaneously, the motor feed contacts apply operating voltage to the timer motor, M, and the motor begins to rotate the cams. After the cams rotate slightly, the motor feed cam contacts close to provide a parallel circuit to the timer motor.

The Control closures required for the production of the "Attack" and "Fire" signals are generated by cam-operated contacts in the Timer. These control closures are applied to the siren Control Cabinet of auxiliary control panel through the signal contacts of the selected relay in the timer. There are no cam-operated contacts for "Alert" signal. As a result, when the "Alert" signal is selected, a sustained closure is applied to the siren Control Cabinet or auxiliary control cabinet and the siren produces a constant level signal for three minutes.

Several seconds before the end of the three-minute timer cycle, the cam-operated hold contacts open momentarily, releasing the relay holding circuit. The control circuit closure to the Control Cabinet or auxiliary control panel opens, and the motor feed cam contacts open, stopping the timer motor.

The "Attack" signal has priority over all other signals. If "Attack" is initiated while either "Alert" or "Fire" is sounding, "Attack" automatically overrides the signal being sounded until the end of the timer cycle or the CANCEL pushbutton is pressed. Similarly, "Alert" has priority over "Fire".

The CANCEL pushbutton can be used to override a higher priority signal. For example, to override "Attack" with "Alert", press the CANCEL pushbutton and then press "Alert".

4-3. CONTROL CABINET CIRCUIT DESCRIPTION (See figures 5-11 and 5-12).

Application of a control signal to the Control Cabinet energizes the Chopper Motor Starter, K103, starting the chopper motor. Simultaneously, the Time Delay Relay, K102, energizes, activating the Blower Motor Starter, K101, and the Rotator Motor Starter, K104. These starters then apply power to these respective motors.

As shown in figures 5-11 and 5-12, each motor starter includes at least one thermal overload relay. Each of these relays protect their respective motor starters and associated motor in the event that excess current is drawn.

An overload relay is activated when there is excessive current through one or more of its heaters to open the relay contacts. The opening of the relay contacts opens the control circuit of the associated motor starter. As a result, the motor starter deenergizes, protecting the circuit against damage. After the motor starter deenergizes, the heater(s) reset automatically after the heaters and contacts cool sufficiently. The overload relays can also be reset manually.

The siren produces the "Attack" or "Fire" (Model 1003 only) signal because the timer opens the control circuit periodically. When the control circuit opens, K102 and K103 deenergize, deenergizing the chopper motor. As the chopper motor coasts toward a stop, the pitch of the sound from the siren decreases. At the end of the adjustable time delay, K102 reapplies control voltage to K103, reenergizing the chopper motor. The blower motor and rotator motor starters drop out and immediately pull in again. However, the motors do not detect the resulting brief power interruption and they continue to run. As the speed of the chopper motor increases, the pitch of the siren tone(s) increases. The alternate energizing and deenergizing of the chopper motor causes the siren to produce a wailing signal.

When the "Alert" signal is selected, all three of the siren motors are energized continuously during the entire three-minute timer cycle. As a result, the "Alert" signal is a three-minute signal having constant frequency and sound level.

The speed of the chopper determines the top frequency of the siren. The rotor is driven by a universal series motor whose rotational speed is determined by the voltage applied to it. Autotransformer, T101 allows the user to change the pitch of the siren signal by changing the chopper motor speed.

Four toggle switches, S101, S102, S103, and S104 are located in the Control Cabinet. These switches allow individual testing of the siren motors and

control circuits. When the CONTROL switch, S101 is set to the TEST position, the siren control circuit can be tested without sounding the siren. When S101 is set to TEST, the siren does not sound because the autotransformer, T101, the blower motor, and the rotator motor control circuits are open. Consequently, the motor starters do not energize their respective motors when a closure is applied to TB102 in the Control Cabinet. The time delay relay and chopper motor starter circuits are unaffected when S101 is set to TEST. Therefore, when a closure is applied to TB102 in the Control Cabinet, the time delay relay and the chopper motor starter energize to provide an indication that the siren control device is operating.

Only the chopper motor starter and the chopper motor energize when S102 is set to TEST. Similarly, when the BLOWER switch, S103, is set to TEST, the blower motor starter and the motor are energized. The ROTATOR switch, S104, energizes the rotator motor starter and rotator motor when S104 is set to the TEST position. Always set S104 to its center-OFF position before performing maintenance on the rotator assembly.

4-4. AUXILIARY CONTROL PANEL CIRCUIT DESCRIPTION (See figure 5-13).

The Model RCM3 Auxiliary Control Panel is used with the Model 1003

Thunderbolt only. The Auxiliary Control Panel controls the solenoid-operated slide valves, K201 and K202, in the Solenoid Assembly, so that an alternating high-low signal is produced by the siren when the "Fire" signal is selected.

When the "Fire" signal is initiated by the Model AF Timer, a series of control closures is present across TB303-1 and 4. This series of closures is then applied to the Control Relay, K301, energizing K301, K301 then energizes the Tone Modulator, M301, causing M301 to rotate. As M301 rotates, it alternately actuates cam-operated contacts S304 and S305; when S304 is open, S305 is closed, and vice versa. S304 and S305 control power to K201 and K202, respectively, in the Solenoid Assembly. As a result of the alternate opening and closing of S304 and S305, the solenoid operated slide valves alternately open and close the two ports in the chopper stator. As the valves open and close the ports, they allow air from each row of chopper ports to alternately enter the throat of the horn. This causes the siren to produce an alternating high-low tone.

At the end of approximately four seconds, the chopper motor deenergizes and the chopper begins to coast to a stop, decreasing the pitch of the siren signal. Simultaneously, the timer deenergizes K301, M301 and both of the solenoid-operated slide valves.

SECTION V

SERVICE AND MAINTENANCE

5-1. GENERAL.

Service Department
Federal Signal Corporation
136th and Western Avenue
Blue Island, Illinois 60406

5-2. SIREN TONE FREQUENCY ADJUSTMENT.

To change the siren tone frequency, proceed as follows:

A. Turn off the power to the RCM1 Control Cabinet at the disconnect switch.

B. Move the chopper motor power lead connected to one of the numbered terminals on TB105 to one of the other terminals.

As indicated in figure 5-1, the higher the terminal number, the higher the pitch of the tone.

5-3. PREVENTIVE MAINTENANCE.

A. Lubrication

1. Blower Assembly (see figure 5-2).

To check the oil in the blower, turn off the power to the siren, remove the screws that hold the blower

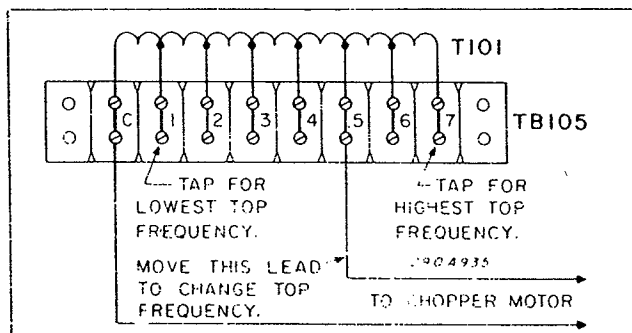


Figure 5-1. Siren Tone Frequency Adjustment.

base channel space covers on the blower housing, and lift off the blower housing. Remove the oil level plug on the side of the blower. If oil does not drip from the opening add a heavy duty oil, such as SAE 10W40, through the oil fill hole until dripping begins. Do not continue to add oil after it begins to drip from the oil level hole. Over-lubrication may cause hard starting and oil leakage. Replace the oil level plug and oil fill plug.

The bearings at the drive (pulley) end of the blower are packed with grease before the siren is shipped. Add or renew grease through the two grease fittings; one on each bearing at the drive end of the blower, as shown in figure 5-3. The old grease is forced out of the vents as new grease is added.

To lubricate the relief valve, lift the weights from the valve. Clean all machined surfaces and cover them with a film of SAE 10W40 oil.

The blower motor bearings are sealed and prelubricated. Therefore, this motor requires no additional lubrication.

2. Rotator and Chopper Assemblies.

(a) Turn off the power to the siren. Remove the cover from the rotator housing closest to the conduit fitting. Remove the oil level plug from the rotator gear reducer housing (see figure 5-4). If oil does not drip from the oil level hole, remove the oil breather plug and add SAE 10W40 motor oil through the breather plug until oil begins to drip from the oil level hole. Replace both plugs.

Cover the rotator spur and pinion gears with a light film of grease, such as Texaco Regal AFB2, to prevent oxidation.

(b) Grease is dispensed to the chopper tube bearings by two grease cups. As shown in figure 5-5, one of the grease cups is located on the rotator

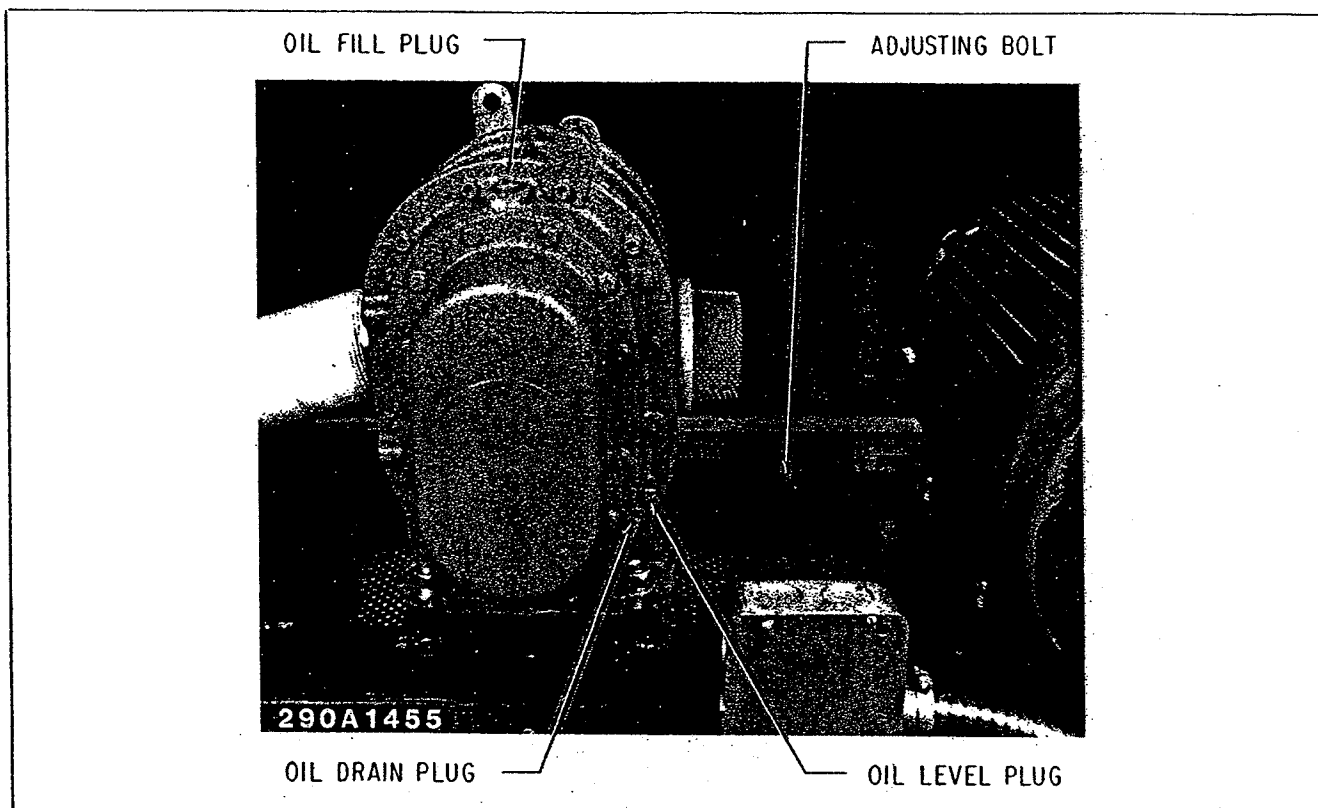


Figure 5-2. Blower Lubrication.

spur gear in the rotator housing. The other grease cup is located just below the chopper housing.

To apply grease to the chopper tube bearings, rotate each grease cup approximately two turns clockwise. When the grease cups cannot be rotated any further, refill them with a high quality grease, such as Texaco Regal AFB2.

Both the rotator motor and chopper motor have sealed and prelubricated bearings. Therefore, neither of these motors require any additional lubrication.

B. Annual Inspection and Maintenance

In order to minimize the possibility of siren failure, inspection and maintenance at regular intervals is desirable. Therefore, the following schedule is suggested as a guideline. However, it may be necessary to vary the schedule if the siren is used frequently or if it is used in an extreme climate.

1. Remove the weights from the blower relief valve. Clean all machined surfaces and cover them with a film of SAE 10W40 motor oil. See figure 5-3 to locate the blower relief valve.

2. Examine the blower drive belts for excessive wear. Depress each belt individually with one finger. The belts should not depress more than about 1/2" (13mm). Replace both belts if either belt is excessively worn or frayed. Tighten the belts if they depress more than 1/2 inch. Refer to paragraph 5-4B. for the belt tightening procedure.

3. Change the oil and grease in the blower. Refer to paragraph 5-3A.1.

4. Change the oil in the rotator gear reducer. Refer to paragraph 5-3A.2.

5. Clean the rotator spur and pinion gears. Apply a light film of fresh grease, such as Texaco Regal AFB2, to the gears.

6. Lubricate the chopper tube bearings by rotating the grease cups approximately two turns. Refer to paragraph 5-3A.2 (b) for details.

7. Test operate the siren and controls following the procedure in paragraph 3-5. In addition, it is also recommended that the siren be activated from the control site using the radio link or land lines.

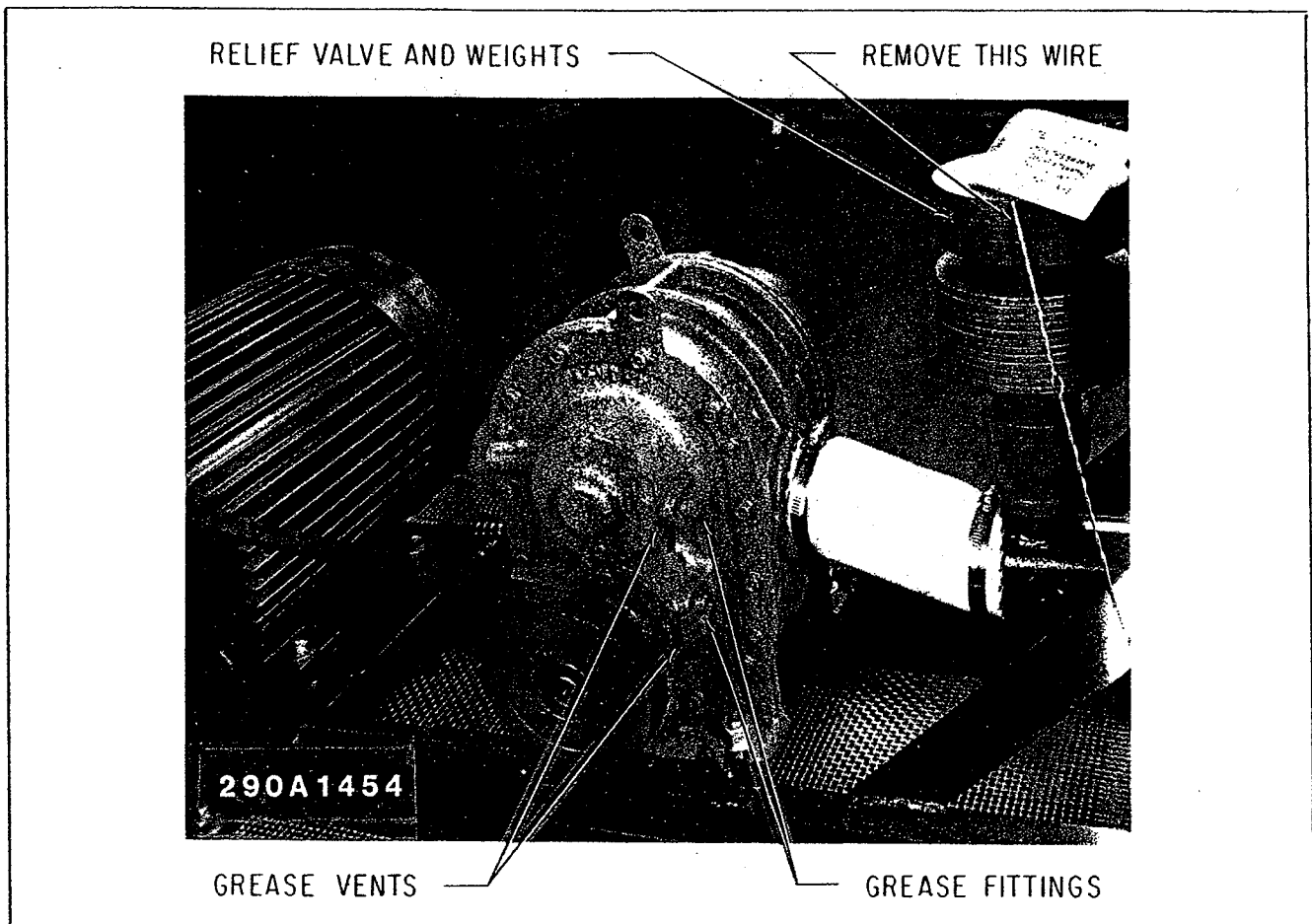


Figure 5-3. Blower Assembly Lubrication.

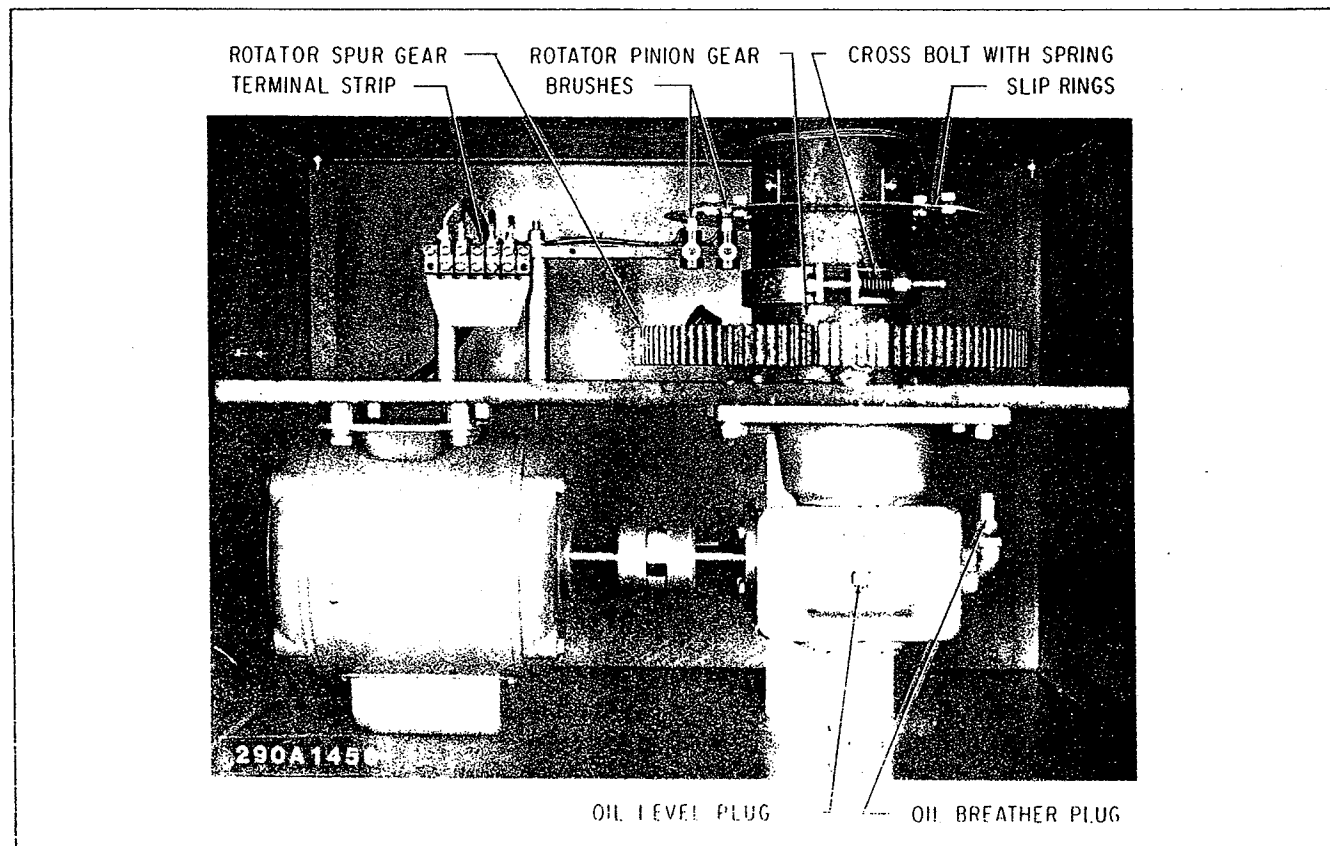


Figure 5-4. Rotator Lubrication.

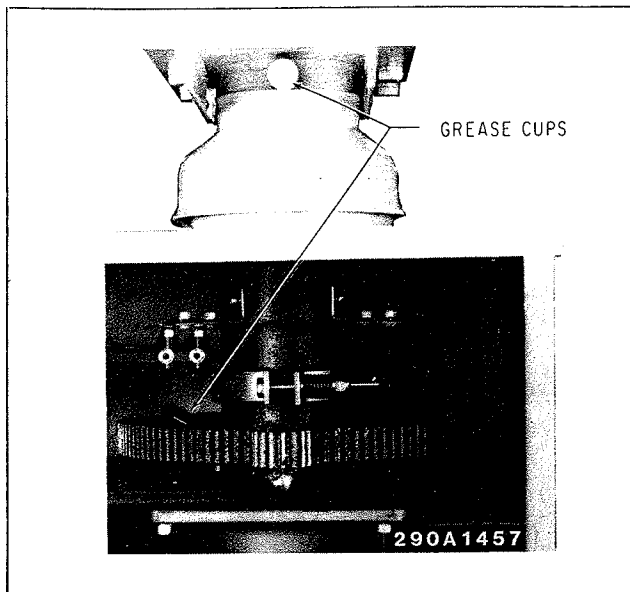


Figure 5-5. Chopper Tube Grease Cup Location.

8. Inspect the siren installation to be sure that it is vertically oriented. Take corrective action if a pole mounted installation is more than 5° from vertical or a roof or flat surface mount is more than 10° from vertical to prevent lubrication losses and excessive motor bearing wear.

It is also recommended that all painted surfaces be inspected and repainted as necessary.

It is recommended that the Thunderbolt be tested for proper operation at least once a month. However, a daily test of the siren at noon, curfew, or other selected time, provides a more reliable test of system readiness. In addition, the daily test enhances the usefulness of the siren and instills public confidence in the reliability of the warning system.

5.4. CORRECTIVE MAINTENANCE.

A. Troubleshooting

The Troubleshooting Chart, Chart 5-1 is provided to assist repair personnel when troubleshooting a siren malfunction. The following diagrams may also be helpful to repair personnel when control devices require repair.

Fig.

Diagram

- 5-11 Model RCM1A Control Cabinet Wiring Diagram
- 5-12 Model RCM1B Control Cabinet Wiring Diagram.
- 5-13 Model RCM3 Auxiliary Control Panel Wiring Diagram.
- 5-14 Model AR Timer Wiring Diagram
- 5-15 Model AF Timer Wiring Diagram
- 5-16 Thunderbolt Siren Parts Index
- 5-17 Model RCM1 Control Panel Parts Index
- 5-18 Model RCM3 Auxiliary Control Panel Parts Index
- 5-19 Model AF and AR Timer Parts Index

B. Blower Belt Changing and Tightening.

NOTE

The blower motor drives the blower by means of a matched pair of belts. If the belts are not matched, the blower may not operate properly. Therefore, whenever it is necessary to replace a belt, both belts should be changed.

1. Turn off the power to the siren at the disconnect switch.
2. Remove the screws that hold the blower base channel space cover on the blower housing. Remove the two bolts that attach the blower housing to the standpipe support. Slide the housing approximately 1 foot (30cm) from the standpipe support and lift the blower housing from the assembly.
3. Turn the adjusting bolt clockwise until the blower motor can slide approximately two inches (50mm) toward the blower (see figure 5-6).
4. Loosen the four motor mounting bolts (see figure 5-6).
5. Slide the blower motor toward the blower by pressing firmly on the belts.
6. Replace both belts.

Chart 5-1. Troubleshooting Chart.

TROUBLE	POSSIBLE CAUSE	REMEDY
Horn does not rotate	ROTATOR switch in Control Cabinet in center-OFF position.	Set ROTATOR switch to TEST. Observe horn rotation. If horn rotates, set switch to AUTOMATIC.
	Rotator motor starter overload relay tripped	Reset (Refer to paragraph 5-4.D).
	Open circuit between Control Cabinet and motor.	Check wiring for continuity.
	Rotator motor starter control winding defective.	Check coil and replace if necessary.
	Rotator motor defective.	Check motor and repair or replace, if necessary.
	Reducer gear mechanism jammed.	Turn coupling by hand. Locate source of binding if coupling turns hard.
Horn rotates erratically	Chopper tube bearing binding	Lubricate bearing (Refer to paragraph 5-3A.2(b)).
	Grease on drive bands.	Remove bands, clean and readjust.
	Insufficient drive band tension.	Tighten drive band cross bolt. Refer to paragraph 5-4.E.
Blower does not operate	Blower motor starter overload relay tripped.	Reset blower overload relay (see paragraph 5-4.D).
	Open circuit between Control Cabinet and motor.	Check wiring for continuity.
	Blower motor defective.	Check motor and repair or replace if necessary.
	Blower motor starter control winding defective.	Check coil and replace, if necessary.
	Blower jammed.	Turn blower pulley by hand. Blower should turn easily. Look for cause of jamming if not free.
Blower motor overloaded	Voltage at siren is low.	Install shorter length or heavier gauge wires to siren. Source of power may not be adequate.
	Lubricants in blower gear housing too heavy for cold weather.	Drain and refill with proper lubricants (refer to paragraph 5-3A.1.)

TROUBLE	POSSIBLE CAUSE	REMEDY
Chopper motor does not operate	Chopper motor starter overload relay tripped	Reset relay (refer to paragraph 5-4.D).
	Open circuit between Control Cabinet and motor	Check wiring for continuity.
	Chopper rotor jammed	Check rotor for free rotation. Remove obstruction(s).
	Collector ring dirty or collector ring brushes excessively worn	Clean or replace brushes as required
	Chopper motor defective	Check motor and repair or replace, if necessary.
Chopper motor operates but blower and rotator do not start when a siren signal is initiated.	Time delay coil open	Check coil for continuity. Replace, if necessary. Check circuit for continuity. Repair, if necessary.
	Time delay relay inoperative	Check for proper operation. Replace if necessary.
	Faulty circuit between time delay relay and motor starters.	Check circuits for continuity. Repair, if necessary.
No two-tone modulation of "Fire" signal (Model 1003 only)	Tone modulator relay K301 or tone modulator timer, M301, faulty	Check K301 and M301 for operation, repair or replace, as required.
	Open circuit between Auxiliary Control Panel and solenoid-operated slide valves.	Check circuit for continuity. Repair, if necessary.
	Solenoid-operated slide valve(s) inoperative	Check slide valves for possible mechanical jamming. Solenoid(s) faulty. Check solenoids and replace, if necessary.
	Collector ring dirty or collector ring brushes excessively worn	Clean or replace brushes as required
	Solenoid return springs dislodged or broken	Replace springs.

ADJUSTING BOLT

MOTOR MOUNTING BOLTS



Figure 5-6. Blower Belt Adjustment.

7. Slide the blower motor away from the blower. Use a pry bar, if necessary.

8. Tighten the motor mounting bolts only until the bolts are snug.

9. Using a yardstick or similar straight edge, align the blower motor sheave with the blower sheave.

10. Turn the adjusting bolt counterclockwise until the belts do not depress more than $1/2$ " (13mm) when pressure is applied with one finger. Do not overtighten the adjusting bolt or the belts may break or wear excessively.

11. Tighten all motor mounting bolts.

12. Replace the blower housing on the blower assembly.

C. Pulley Removal and Reinstallation.

1. The pulleys on the blower motor and blower drive shafts consist of two major parts; the hub and the sheave.

(a) Remove the belts from the blower and blower motor in accordance with the instructions in paragraph 5-4B.

(b) Remove the three bolts from the clearance (untapped) holes in the sheave. Move the bolts to the tapped holes in the sheave. (See figure 5-7).

(c) Tighten all three bolts with your fingers until the bolts make contact with the hub.

(d) Use a wrench to tighten all three bolts evenly, approximately one-half turn.

(e) As indicated in figure 5-7, use a hammer and large pin punch or similar tool to strike the hub firmly in two places diametrically opposite of each other. Do NOT strike the drive shaft. Do NOT strike the hub near the slot.

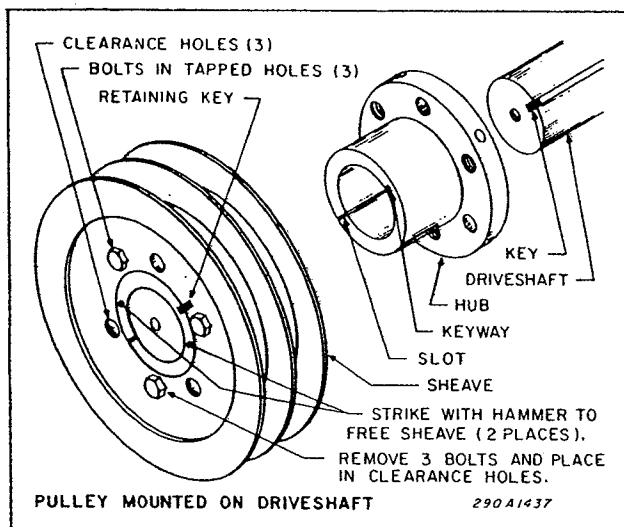


Figure 5-7. Pulley Removal and Reinstallation.

(f) Repeat steps (d) and (e) until the sheave and hub separate. After the sheave and hub separate, slide the sheave off the hub.

(g) Insert a screwdriver into the slot in the hub. Gently tap the screwdriver with a hammer until the hub can be removed from the drive shaft. Use caution to avoid cracking or otherwise damaging the hub. Slide the hub from the shaft and lift the retaining key from the slot in the motor drive shaft.

2. To install the pulley on the blower, proceed as follows:

(a) If necessary, install the retaining key in the keyway on the motor shaft. Remove the bolts from the threaded holes in the sheave.

(b) Insert a screwdriver into the slot in the hub. Gently tap the screwdriver with a hammer until the hub will slide on the motor shaft. Use caution to avoid damaging the hub. Press the hub on the shaft until the hub is flush with the end of the shaft.

(c) Using a yardstick, or similar straight edge, align the blower motor sheave with the blower sheave.

(d) Insert the bolts into the clearance holes. Screw these three bolts into the threaded holes in the hub and tighten them evenly, one turn at a time.

(e) Replace the belts in the pulleys following the procedure in steps (6) through (12) in paragraph 5-4.B.

D. Manual Resetting of Overload Relays. (See Figure 5-8)

Turn off the power at the disconnect switch, and firmly press the appropriate reset button until it "clicks". If the reset button does not reset on the first attempt, allow the overload relay to cool for at least one minute before attempting to reset the relay again.

NOTE

Some single phase blower motors have a built-in circuit breaker. Therefore, if resetting the overload relay on the blower motor starter does not allow the blower motor to run, it may be necessary to reset the breaker on the motor. The circuit breaker is located in the motor conduit box.

E. Drive Band Adjustment.

1. When the drive band requires adjustment, tightening is almost always necessary. To determine if a drive band adjustment is required:

(a) Turn off the power to the siren at the disconnect switch.

(b) Attach a spring scale having a capacity of at least 50 pounds (22 kg.) to the Horn Support Bracket, as shown in figure 5-9.

(c) Pull on the scale until the horn begins to rotate. Continue to rotate the horn by pulling on the scale while reading the scale. The scale should indicate between 35 and 40 pounds (16 and 18 kg.). It may require more than 40 pounds of force to start the horn moving. However, after the horn is moving, the scale indication should decrease to some force within the specified range. If the scale does not indicate between 35 and 40 pounds (16 and 18 kg.), the drive band requires adjustment.

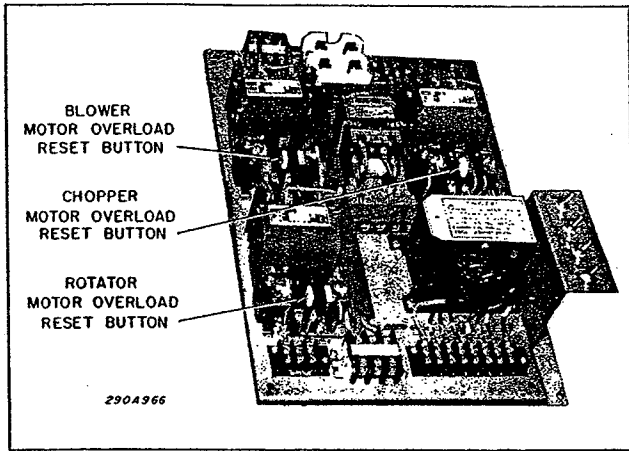


Figure 5-8. Overload Reset Button Location.

2. To adjust the drive band:

(a) Perform steps (a), (b), and (c) in paragraph 5-4E.1 (above) to determine if a drive band adjustment is necessary.

(b) Ensure that the power to the siren is turned off.

(c) Remove the large panel opposite the conduit fitting on the rotator housing.

(d) If necessary, manually rotate the coupling until the cross bolt having the spring is accessible (see figure 5-4).

(e) Tighten the cross bolt having the spring one or two turns. DO NOT tighten or loosen the cross bolt without the spring. Attach the scale to the horn support bracket and pull on the scale to rotate the horn. If the scale does not indicate between 35 and 40 pounds (16 and 18 kg), repeat this step until the scale indicates the proper force.

CAUTION

If the spring cross bolt is tightened so that more than 40 pounds (18 kg) of pull is necessary to maintain manual horn rotation, high winds may cause damage to the rotator drive mechanism.

(f) Replace the large panel on the rotator housing.

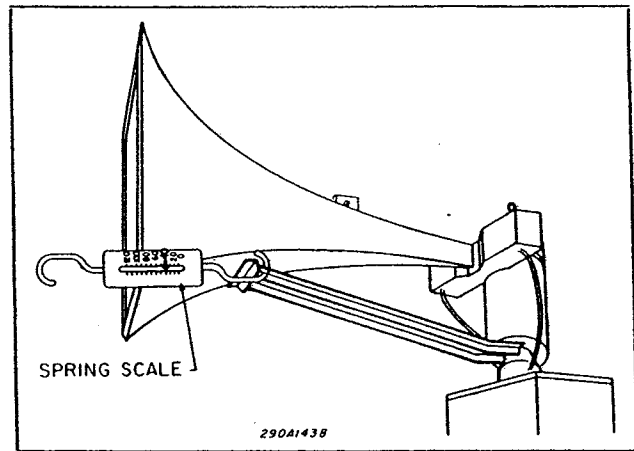


Figure 5-9. Attachment of Spring Scale to Horn.

F. Collector Ring Replacement.

1. Turn off the power to the siren at the disconnect switch.

2. Remove both side covers from the rotator housing.

3. Using an offset (right angle) screwdriver, remove all brushes from their respective brush holders. It may be desirable to replace the brushes when the chopper assembly is re-assembled.

4. Remove both cross bolts from the drive bands. Remove the drive band from the chopper housing assembly.

5. Remove the horn and bracket assembly from the chopper stator.

6. (Model 1003 only) Remove the cover from the solenoid housing. Disconnect the wiring to the solenoids. Loosely replace the covers on the solenoid housing.

7. Remove the four bolts that hold the stator on top of the chopper assembly.

8. Remove the four bolts that hold the stator on top of the chopper assembly. Lift off the stator.

9. Lift the chopper motor out of the chopper tube. Rest the motor on the edge of the chopper tube.

10. Disconnect the chopper motor from the wiring at the connectors.

11. Remove the four bolts that hold the chopper locking ring to the chopper tube.

12. Remove the four bolts, nuts, and lockwashers from the top of the rotator housing.

13. Lift off the chopper housing and rotator housing from the rotator.

14. Cut the waxed lacing twine that holds the slip ring wiring to the chopper housing. Remove the lacing twine.

15. Remove the four brass screws that hold the printed circuit slip rings on the chopper housing assembly. Retain the screws.

16. Slide the printed circuit collector ring off of the chopper housing.

17. Install the replacement collector ring on the chopper housing.

18. Reassemble the siren, following the procedure in steps 1 through 14 in reverse. Replace the lacing twine, that was removed in step 14, with new waxed lacing twine, or similar moisture resistant material. If necessary, replace the collector ring brushes at this time.

19. After the rotator and chopper assemblies have been reassembled, adjust the drive band following the procedure in paragraph 5-14.E.

G. Solenoid Replacement (Model 1003 Only - see figure 5-10)

1. Turn off the power to the siren at the disconnect switch.

2. Remove the cover and gasket from the solenoid housing.

3. Remove the two return springs.

4. Slide out the return spring rod.

5. Disconnect the wiring from the solenoid.

6. Remove the four solenoid retaining nuts from the outside of the solenoid housing and remove the solenoid from the housing.

7. Separate the solenoid mounting bracket from the solenoid.

8. Disconnect the solenoid link and slide valve from the solenoid.

9. To install the replacement solenoid, perform the above procedure in reverse.

CAUTION

The solenoid housing is fabricated from aluminum. Therefore, to prevent the cover screws from stripping the threaded holes in the housing, do NOT tighten the screws excessively.

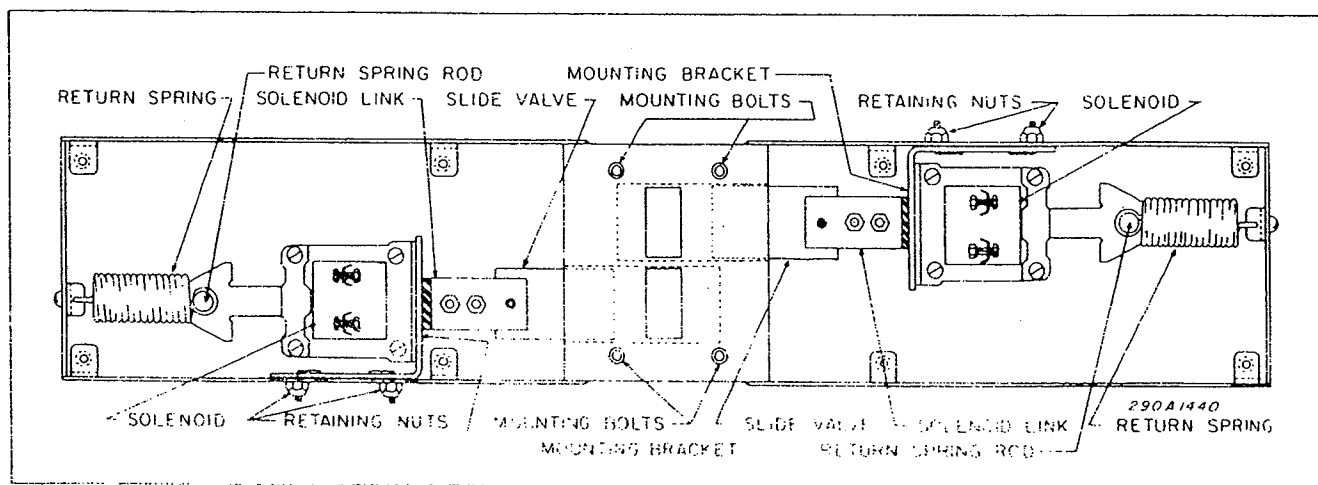


Figure 5-10. Slide Valve Assembly Interior View.

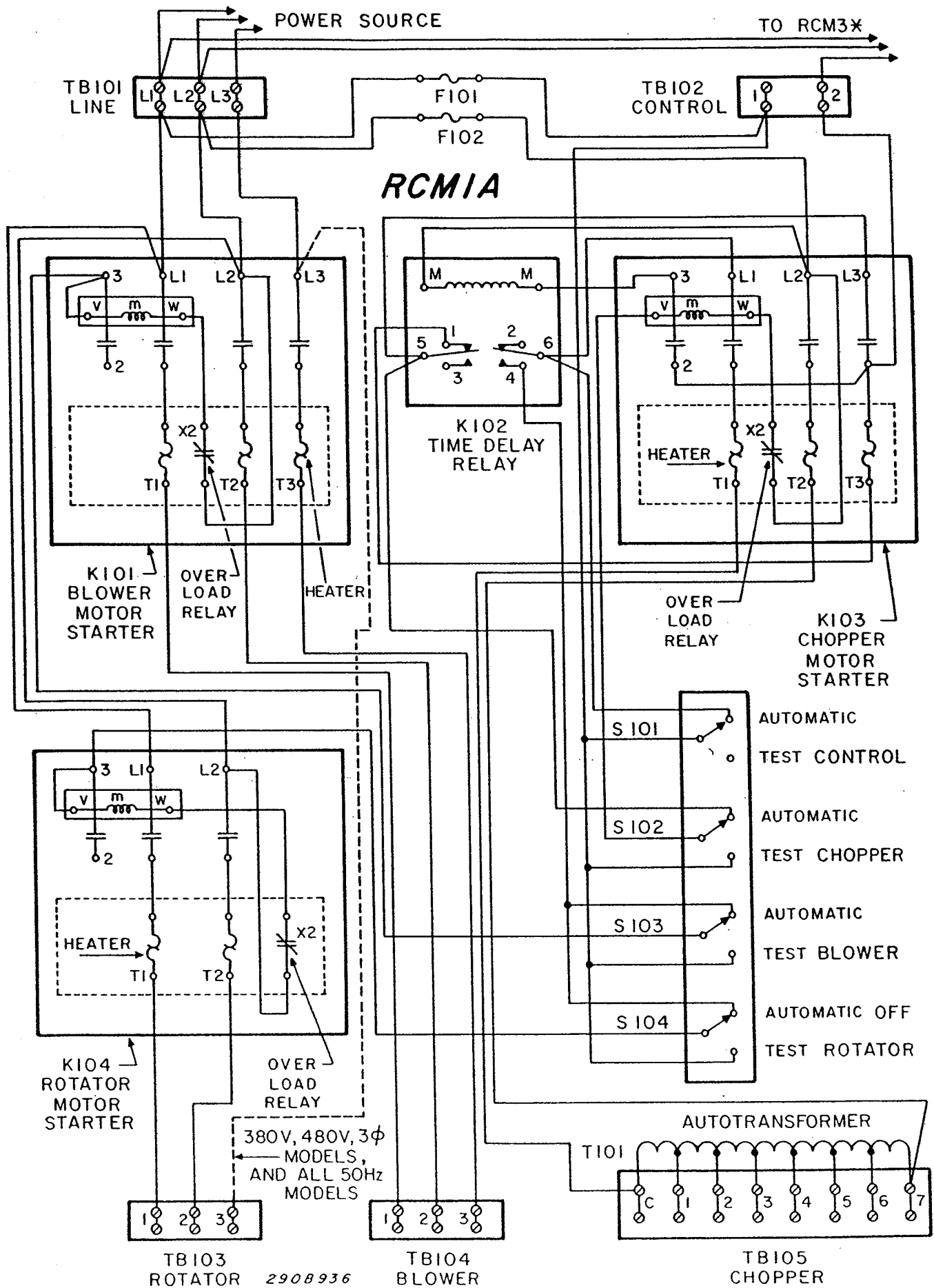


Figure 5-11. Model RCM1A Control Cabinet Wiring Diagram.

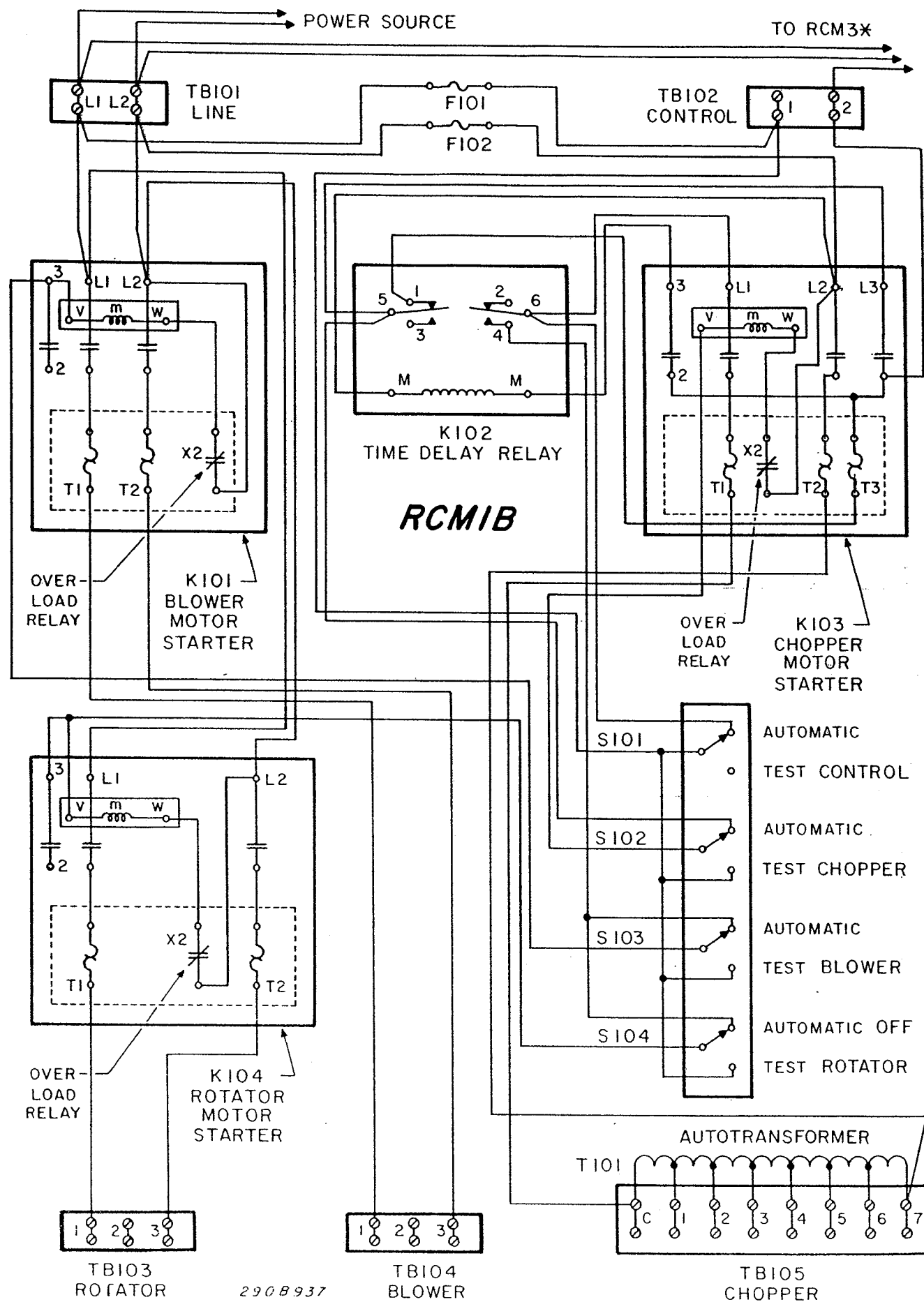


Figure 5-12. Model RCM1B Control Cabinet Wiring Diagram.

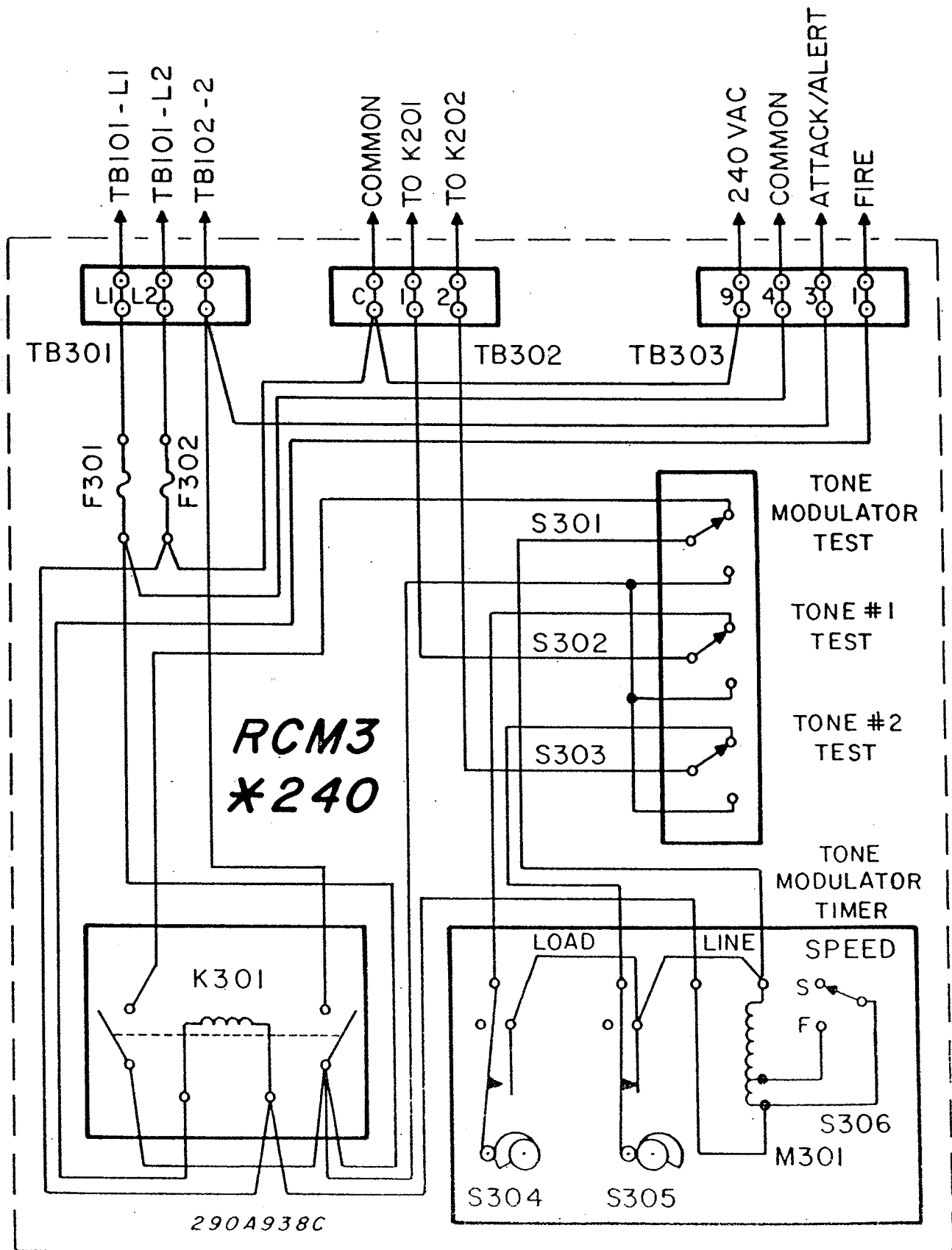


Figure 5 13A. Model RCM3 *240 Auxiliary Control Panel Wiring Diagram.

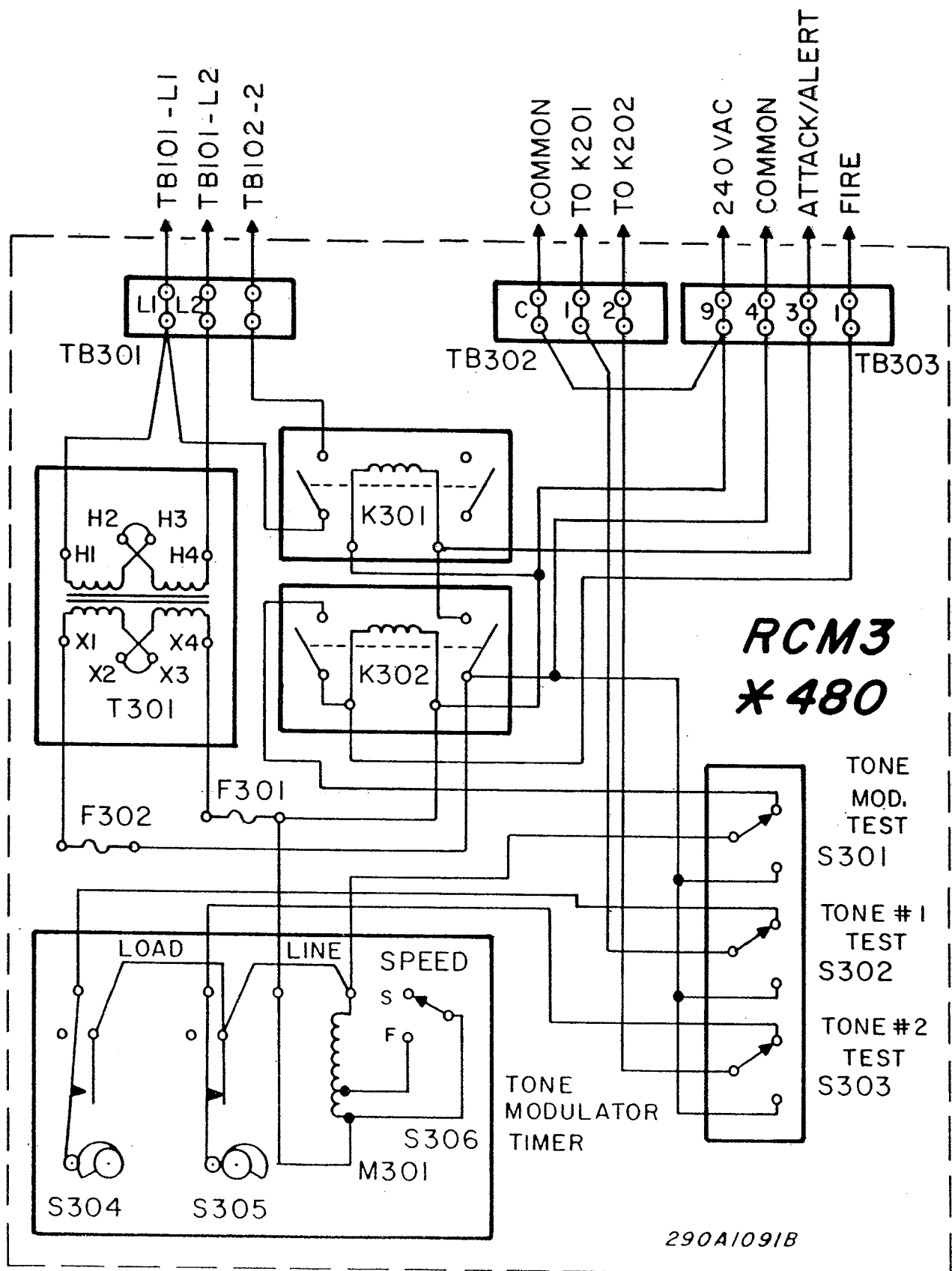


Figure 5-13B. Model RCM3*480 Auxiliary Control Panel Wiring Diagram.

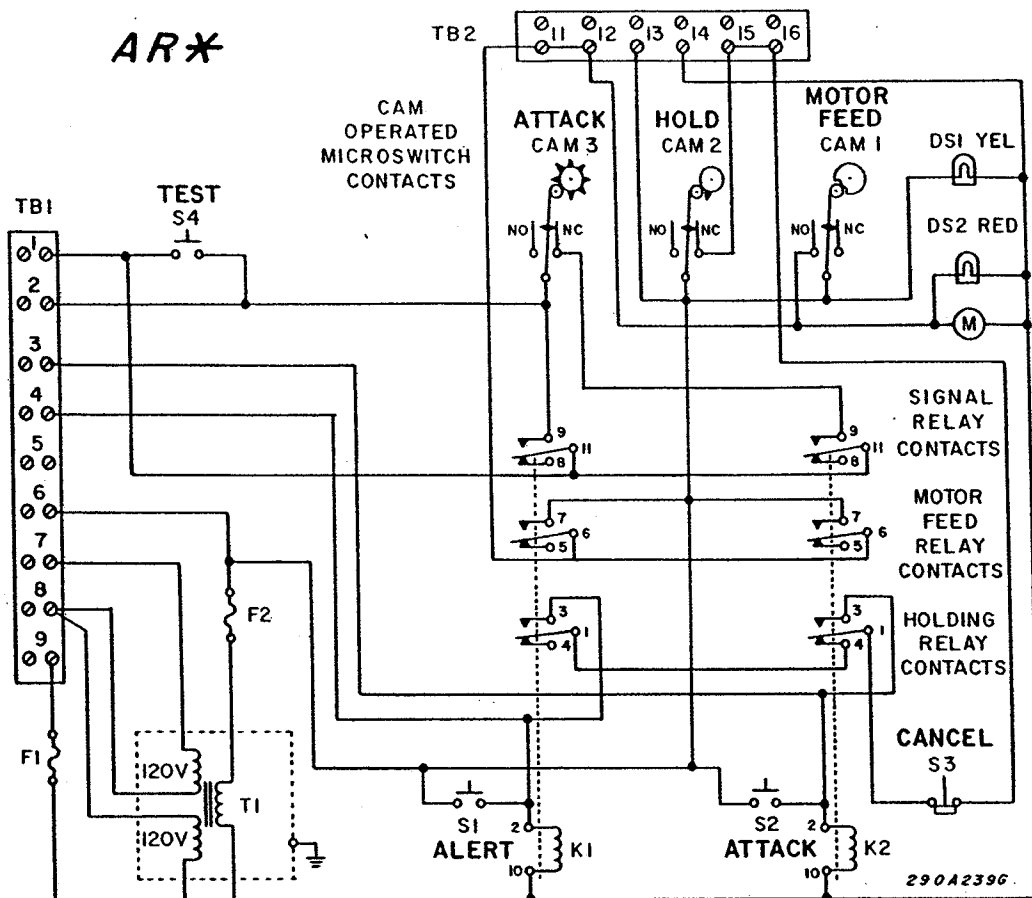


Figure 5-14. Model AR Timer Wiring Diagram.

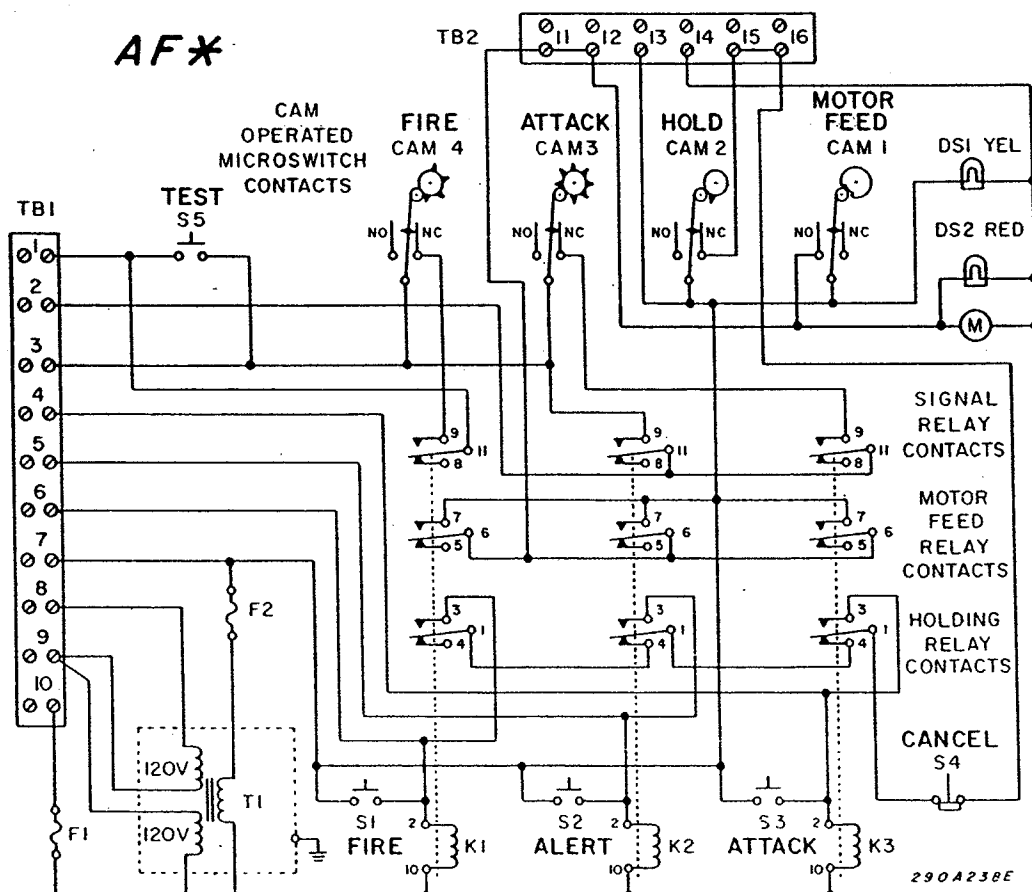


Figure 5-15. Model AF Timer Wiring Diagram.

PARTS INDEX **MODELS** **1000 & 1003** **SERIES B**

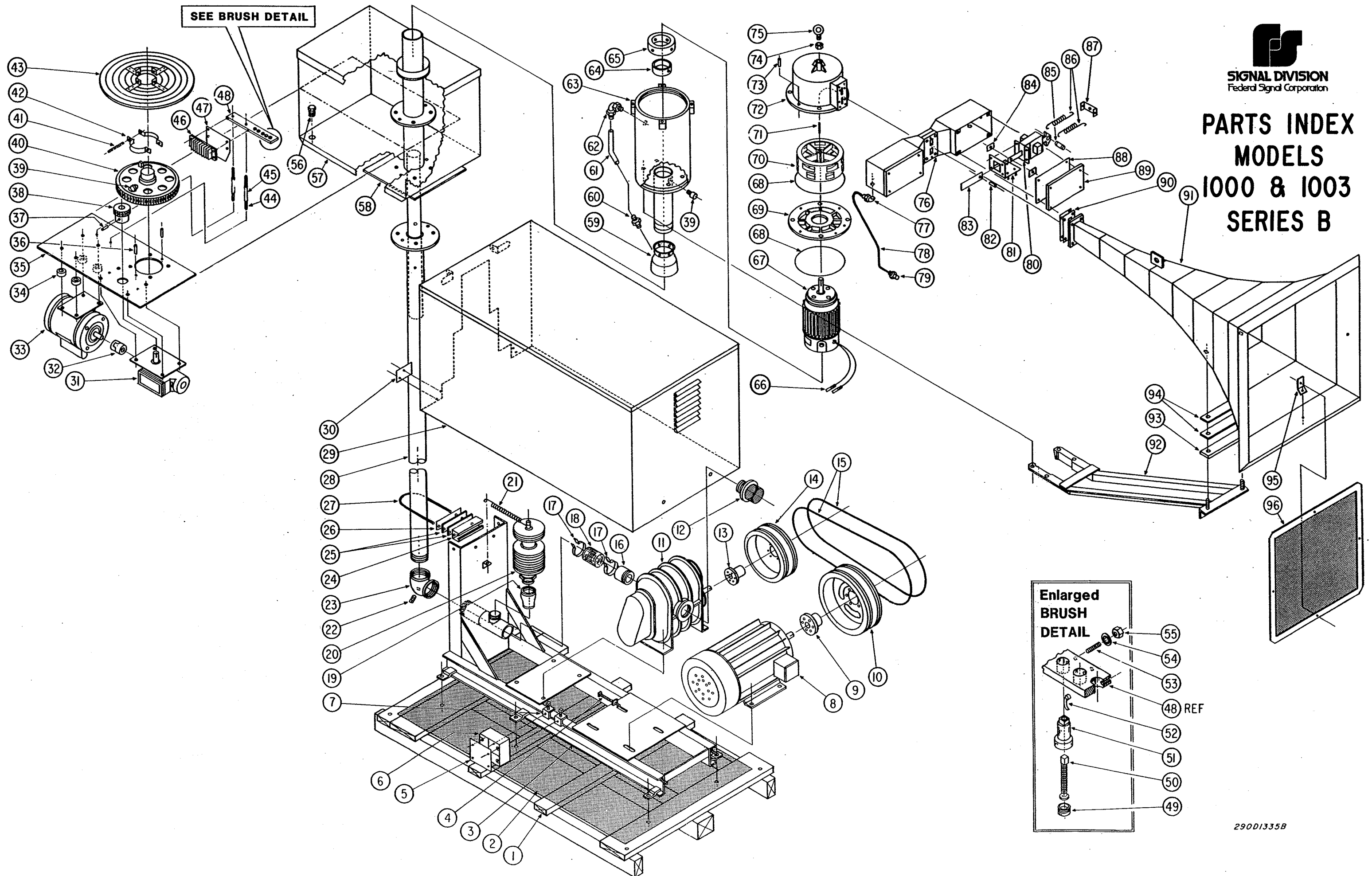


Figure 5-16. Thunderbolt Siren Parts Index.

Item No.	Description	Part No.	1000		1003	
			A	B	A	B
1/30	Blower Assembly	8400D434	1	1	1	1
1	Skid , Blower Base	8400B254-01	1	1	1	1
2	Screen	8400B253	1	1	1	1
3	Base Assembly , Blower	8400C402	1	1	1	1
4	Screw , Set Sq. Hd. 1/2-13 x 4-1/2	7008A009-72	1	1	1	1
5	Cover , Outlet Box	8400A241	1	1	1	1
6	Box , Outlet	8400A202	1	1	1	1
7	Clamp , Beam	8400A411	2	2	2	2
8	Motor , Blower 10 Hp. , 3 Ph. (shown) 7-1/2 Hp. , 1 Ph.	8400B286 8287B184	1 0	0 1	1 0	0 1
9	Hub , QD # SDS 1-3/8 Bore	8400A366	1	1	1	1
10	Sheave QD 2/3 8.0	8400B389	1	1	1	1
11	Blower	8400B391	1	1	1	1
12	Strainer , Blower	8400A452	1	1	1	1
13	Hub , QD # SH 7/8 Bore	8400A372	1	1	1	1
14	Sheave , QD 2/3V 5.0	8400B388	1	1	1	1
15	Belt , V	8400A377	2	2	2	2
16	Nipple , Pipe 2-1/2"	8400B373	1	1	1	1
17	Clamp , Hose	8400A369	2	2	2	2
18	Hose , Cotton Polyester	8400A367	1	1	1	1
19	Reducer , Pipe	8400A218	1	1	1	1
20	Valve , Relief Weights 2.562 ID Weights 0.500 ID	8400A217 8400A217 8400A217-01	1 5 12	1 5 12	1 5 12	1 5 12
21	Spring	8300A049	1	1	1	1
22	Plug , Pipe	8400A203	1	1	1	1
23	Elbow , Reducing	8400A371	1	1	1	1
24	Spacer , Standpipe	8400A412	1	1	1	1
25	Shim , 3/16" thk. (2 shown)	8400A073-01	AR	AR	AR	AR
26	Shim , 1/8" thk. (1 shown)	8400A073	AR	AR	AR	AR
27	Bolt , U	8400A375	1	1	1	1
28	Standpipe Assembly	8400B076-03	1	1	1	1
29	Housing Assembly , Blower	8400D410	1	1	1	1
30	Cover , Blower Base Channel	8400A374	2	2	2	2
31/65	Rotator Assembly 1000	8400D437	1	1	0	0
	Rotator Assembly 1003	8400D437-01	0	0	1	1
31	Coupling , Direct Drive	8400A401	1	1	1	1
32	Reducer , Gear	8400A068	1	1	1	1
33	** Motor , 1/3 Hp. , 115/230VAC	8283A852	1	1	1	1
34	Spacer , Motor	8400A050	4	4	4	4
35	Plate , Rotor Base	8400C395	1	1	1	1
36	Pin , Roll	8400A280	2	2	2	2
37	Pin , Roll 3/16 x 1-1/4	7091A008	1	1	1	1
38	Gear , Pinion	8400A018	1	1	1	1
39	Cup , Grease	8400C419	2	2	2	2
40	Gear , Spur	8400C008	1	1	1	1
41	Spring	8283A886	1	1	1	1
42	Drive Band Assembly	8400B055	2	2	2	2
43	Collector Ring Assembly 1000	8400C439	1	1	0	0
	Collector Ring Assembly 1003	8400C440	0	0	1	1
44	Stud , 1/4-20 x 5-1/2	7009A007-88	2	2	2	2
45	Spacer , .493 ID x 3.53 Ig.	8400A384	2	2	2	2
46	Block , Terminal , 5 Pos. Block , Terminal , 8 Pos.	8400A382 8400A382-01	1 0	1 0	0 1	0 1
47	Strip , T.B. Marking , 5 Strip , T.B. Marking , 8	8400A381 8400A385	1 0	1 0	0 1	0 1
48	Bar , Brush Holder , 2 Bar , Brush Holder , 5	8400B380 8400B390	1 0	1 0	0 1	0 1
49	Cap , Brush Holder	8442A026	2	2	5	5
50	Brush	8442A028	2	2	5	5
51	Holder , Brush	8442A025	2	2	5	5
52	Clip , Brush	8442A027	2	2	5	5

Item No.	Description	Part No.	1000		1003	
			A	B	A	B
53	Screw , Set , 10-32 x 3/4	7008A002-12	2	2	5	5
54	Lockwasher , Int. Tth.	7075A014	2	2	5	5
55	10-32 Nut , Hex Brass	7059A015	2	2	5	5
56	Connector , CG 3750	8400A234	1	1	1	1
57	Rotator Housing Assembly	8400D428	1	1	1	1
58	Chopper Tube Assembly	8400D429	1	1	1	1
59	Seal , Rotator 1000 Seal , Rotator 1003	8400C430 8400C430-01	1 0	1 0	0 1	0 1
60	Connector , Conduit 3/8	8400A418	1	1	1	1
61	Conduit , Flex. 3/8	8400A417	1	1	1	1
62	Connector , Conduit 3/8, 90°	8400A419	1	1	1	1
63	Chopper Housing Assembly	8400D431	1	1	1	1
64	Bearing , Chopper Sleeve	8400A017	1	1	1	1
65	Ring , Locking Chopper Tube	8400A416	1	1	1	1
66/75	Chopper Assembly Single Tone Dual Tone	 8400C438 8400C438-01	 1 0	 0 1	 1 0	 0 1
66	Connector , Chopper Motor	8400A421	2	2	2	2
67 ***	Motor , Chopper	8400A378	1	1	1	1
68	O - Ring , 8" ID	8400A230	2	2	2	2
69	Ring , Motor Mounting	8400D413	1	1	1	1
70	Rotor , Single Tone Rotor , Dual Tone (shown)	8400C435 8400D436	1 0	0 1	1 0	0 1
71	Key , .125 Sq. x 2" Ig.	8247A057	1	1	1	1
72	Stator , Single Port	8400D420	1	1	1	1
73	Pin , Taper	8400A229	5	5	5	5
74	1/2-13 Nut , Hex	7057A037	1	1	1	1
75	1/2-13 Eyebolt	7003A007	1	1	1	1
76/89	Code Mechanism Assembly	8300D140	0	0	1	1
76	Solenoid Housing Assembly	8300D138	0	0	1	1
77	Connector , 90° Elbow	8287A145	0	0	2	2
78	Conduit , Thinwall 3/4"	R007-03-01	0	0	AR	AR
79	Connector , Thinwall 3/4	8287A199	0	0	2	2
80	Solenoid CR9500B108A3A	8300A054	0	0	2	2
81	Bracket Assembly , Solenoid Mounting	 8300A052	 0	 0	 2	 2
82	Pin , Roll	7091A011	0	0	2	2
83	Valve , Slide	8300A132	0	0	2	2
84	Link , Solenoid	8300A027	0	0	4	4
85	Shaft	8300A053	0	0	2	2
86	Spring	8300A049	0	0	4	4
87	Bracket	8300A050	0	0	2	2
88	Gasket	8300B018	0	0	2	2
89	Cover , Solenoid Housing	8300B134	0	0	2	2
90/96	Projector Assembly (individual parts only)					
90	Gasket , Projector	8400A054	2	2	2	2
91	Projector (Horn) Assembly	8400D022	1	1	1	1
92	Support Assembly , Projector	8400B426	1	1	1	1
93	Plate , Filler (1/4")	8400B078-02	1	1	1	1
94	Plate , Filler (1/8")	8400B078-01	2	2	2	2
95	Bracket , Screen Mounting	8400A111	4	4	4	4
96	Screen , Projector	8400A083	1	1	1	1
Not Shown **	Motor , Rotator 480Volt (Used in place of Item No. 33)	8283A853	1	1	1	1
***	Parts required for field installation of item 67, Chopper Motor					
	Cap , Brush Holder	8400A460	AR	AR	AR	AR
	Brush Holder	8400A461	AR	AR	AR	AR

DO NOT ORDER PARTS BY ITEM NUMBER.
Give model , series , voltage , description , and part number.

Refer to PARTS PRICE LIST (Part No. 1001) for prices of parts.
Federal Signal Corporation
Signal Division
136th and Western Avenue
Blue Island , Illinois 60406

PARTS INDEX
MODELS
RCM 1A*240
RCM 1A*480
RCM 1B*240
SERIES A2

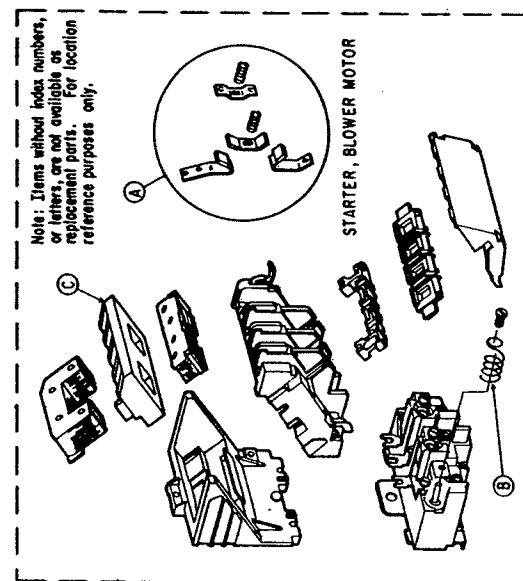
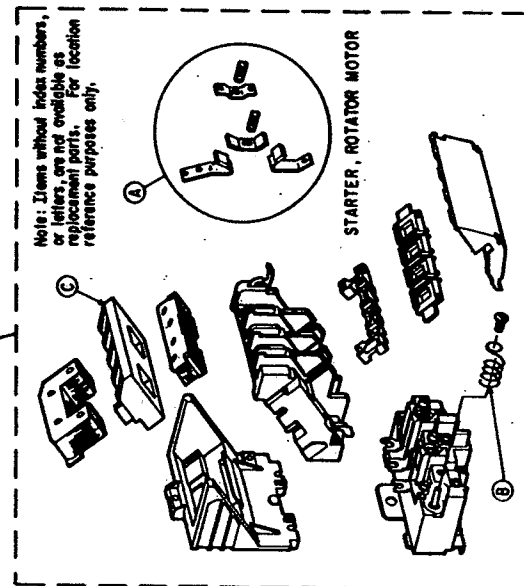
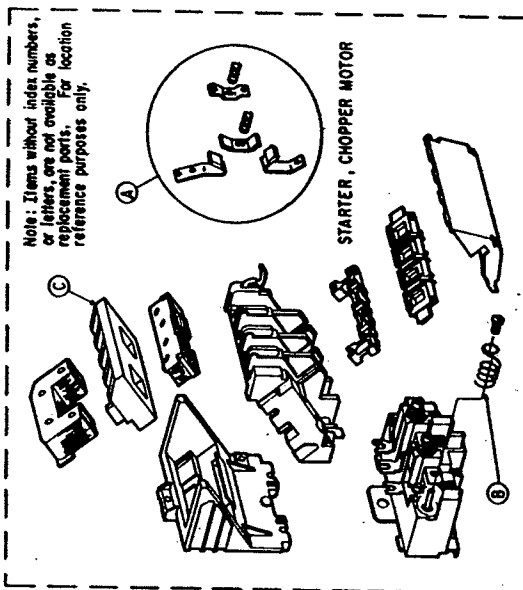


Figure 5-17. Model RCM1 Control Cabinet Parts Index.

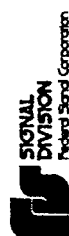
Index No.	Description	Part No.	Qty.
1	Cabinet, Control	8400D275	1
2	Panel, Control	8400D171	1
3	Transformer, Auto (240-volt)	8400A248	1AR
3	Transformer, Auto (480-volt)	8400A092	
4	Relay, Time Delay (240-volt)	8287A098	1AR
4	Relay, Time Delay (480-volt)	8287A098-01	
5	Bracket, Switch (240-volt)	8400B030	1AR
5	Bracket, Switch (480-volt)	8400B103	
6	Spacer	8400A050	4
7	Terminal Block	8283A885	2
8	Terminal Block	8400A245	1
9	Terminal Block	8283A902	1
10	Terminal Block	8400A246	1
11	Nameplate, Control Switch (240-volt)	8400A052	1AR
11	Nameplate, Control Switch (480-volt)	8400A104	
12	Switch, Toggle, SPDT (240-volt)	8283A871	1AR
12	Switch, Toggle, SPDT (480-volt)	8283A874	
13	Switch, Toggle, SPDT (240-volt)	8283A872	2AR
13	Switch, Toggle, SPDT (480-volt)	8283A876	
14	Switch, Toggle, SPDT (240-volt)	8283A883	1AR
14	Switch, Toggle, SPDT (480-volt)	8283A875	
15	Fuse, FRS-15 (240-volt)	8400A262	2AR
15	Fuse, FRS-10 (480-volt)	8400A351	
16	Base, Fuse, Multi 2502 (240-volt)	8445A074	1AR
16	Base, Fuse, Multi 2520 (480-volt)	8400A350	
17	Starter, Blower Motor (240-volt, 3-phase)	8217C188	1AR
17	Starter, Blower Motor (480-volt, 3-phase)	8217C188-01	
17	Starter, Blower Motor (240-volt, 1-phase)	8217C189	
17A	Contacts and Springs, Interlock Pole 75AF14	8217C180-12	1
17A	Contacts and Springs, Power Pole 75DF14 (3-phase)	8217C188-11	3AR
17A	Contacts and Springs, Power Pole 75EF14 (1-phase)	8217C180-11	3AR
17B	Heater, H42 (240-volt, 3-phase)	8217C188-21	3
17B	Heater, H34 (480-volt, 3-phase)	8217C188-22	3
17B	Heater, H47 (240-volt, 1-phase)	8217C189-20	1
17C	Coil, Motor Starter 75D73070C	8217C180-17	1
18	Starter, Rotator Motor (240-volt)	8217C186	1AR
18	Starter, Rotator Motor (480-volt)	8217C192	
18A	Contacts and Springs, Interlock Pole 75AF14	8217C180-12	1
18A	Contacts and Springs, Power Pole 75BF14	8217C186-11	3
18B	Heater, H21 (240-volt)	8217C186-19	1
18B	Heater, H9 (480-volt)	8217C192-19	3
18C	Coil, Motor Starter 75D73070C	8217C180-17	1AR
19	Starter, Chopper Motor (240-volt)	8217C187	1AR
19	Starter, Chopper Motor (480-volt)	8217C187-01	
19A	Contacts and Springs, Interlock Pole 75AF14	8217C180-12	1
19A	Contacts and Springs, Power Pole 75CF14	8217C187-11	3
19B	Heater, H32 (240-volt)	8217C187-19	1AR
19B	Heater, H27 (480-volt)	8217C187-20	
19C	Coil, Motor Starter 75D73070C	8217C180-17	1
Not Shown	Cover, Front	8400D276	1

DO NOT ORDER PARTS BY INDEX NUMBER.
Give model, voltage, description and part number.

Refer to PARTS PRICE LIST (Part No. PPL1001) for prices of parts.

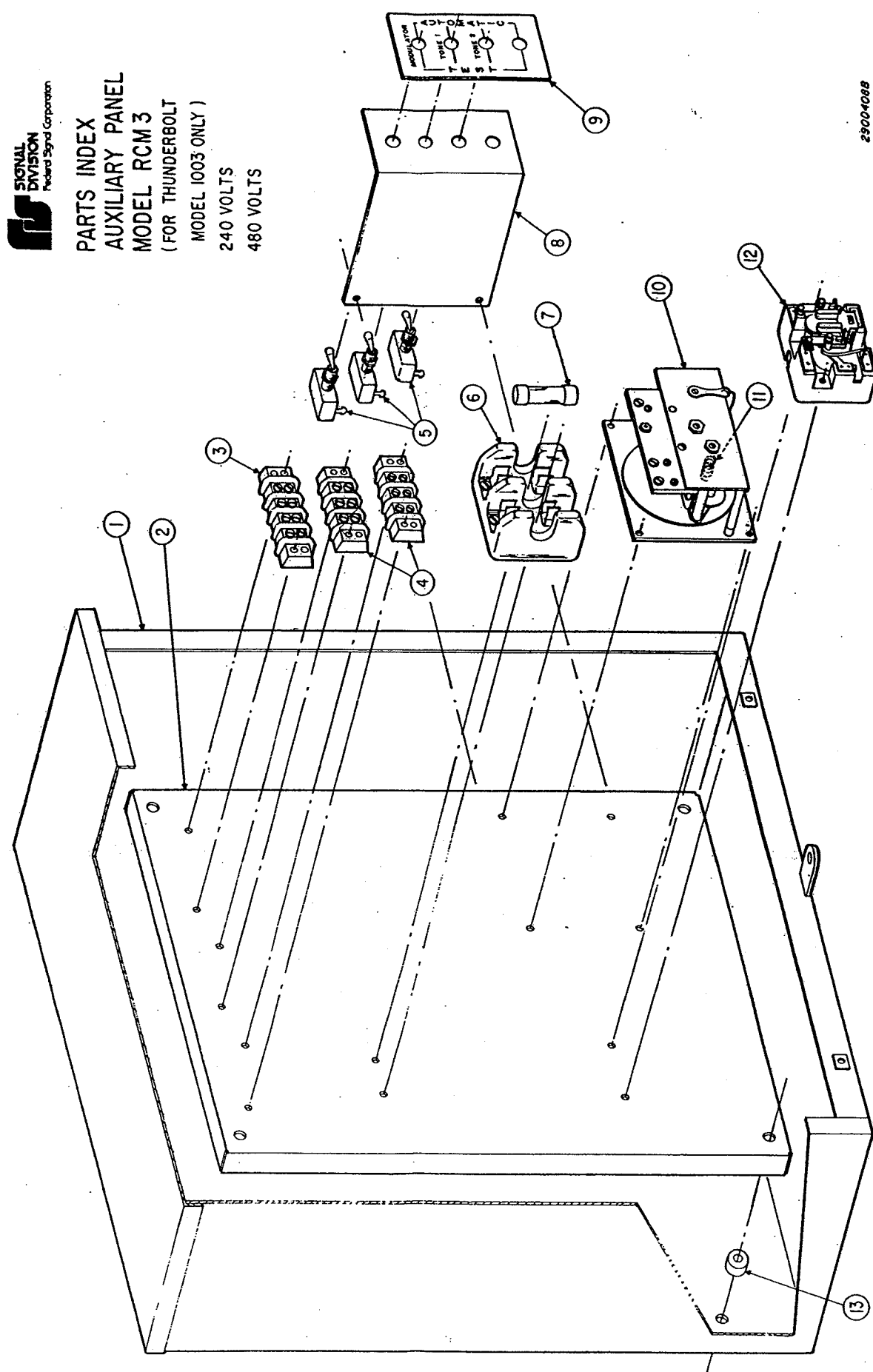
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PARTS INDEX
AUXILIARY PANEL
MODEL RCM 3
(FOR THUNDERBOLT)

MODEL 1003 ONLY)
240 VOLTS
480 VOLTS



29004088

PPL 0112
PARTS LIST

MODEL RCM 3
AUXILIARY PANEL

JUNE 1979

Index No.	Description	Part No.	Qty.
1	Control Cabinet Assembly	8400D275	1
2	Panel, Control	8300D058	1
3	Block, Terminal	8400A244	1
4	Block, Terminal	8283A902	2
5	Switch, Toggle SPDT	8283A872	3
6	Base, Fuse Cutout	8445A074	1
7	Fuse ECN-10	8445A085	2
8	Bracket, Switch	8400B030	1
9	Nameplate	8400A180	1
10	Flasher	8217A054	1
11	Coil, 240V (for item 10)	8217A066	1
12	Relay, 240V, DPST	8283A880	1
	Relay, 480V, DPST	8283A880	2
13	Spacer	8400A050	4
Not Shown	Transformer (480V ONLY)	8287A078	1
	Cover, Front	8400D276	1

DO NOT ORDER PARTS BY INDEX NUMBER.
Give model, voltage, description and part number.

Refer to PARTS PRICE LIST (Part No. 1001) for prices of parts.

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Figure 5-18. Model RCM3 Auxiliary Control Panel Parts Index.

**PARTS INDEX
MODELS AF & AR
SERIES AI**

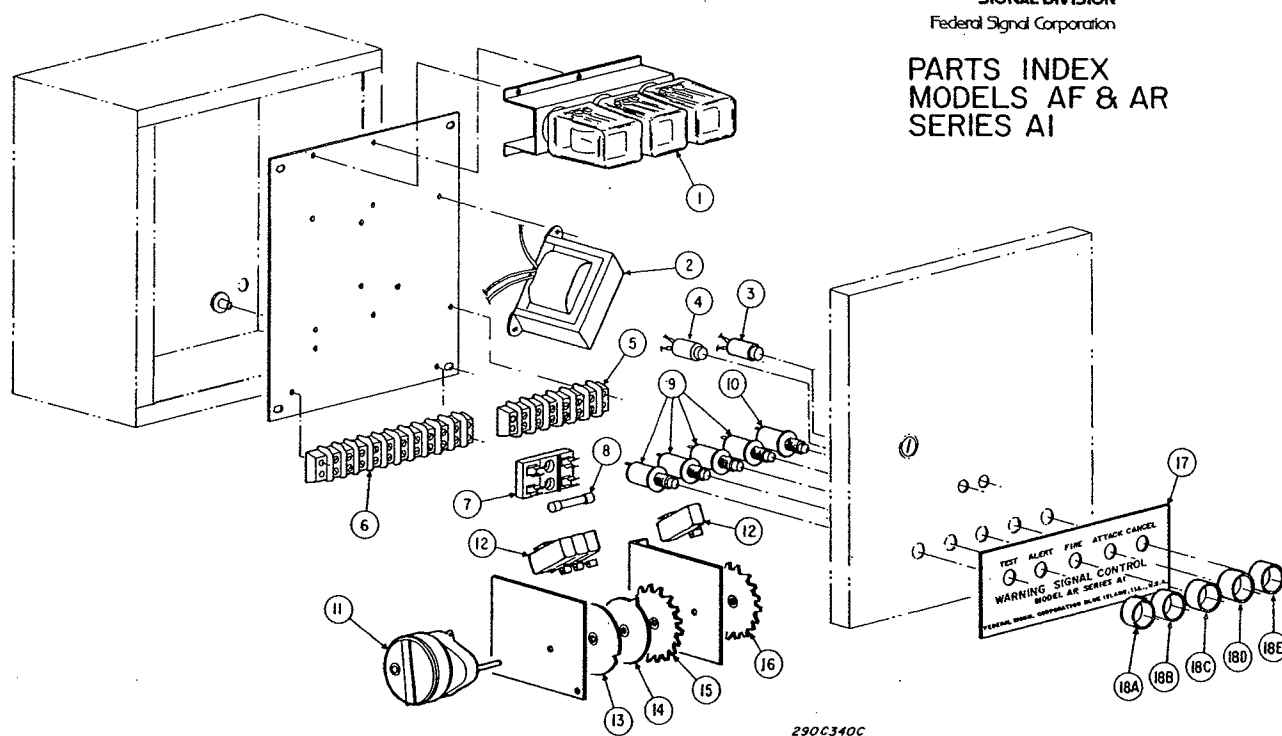


Figure 5-19. Models AF and AR Timers Parts Index.

PPL 0060
PARTS LIST

MODELS MODELS AR and AF TIMERS

JUNE 1979

Index No.	Description	Part No.	Qty.
1	Relay (2 used on AR, 3 used on AF)	8217A082	AR
2	Transformer	8217A083	1
3	Motor Pilot Light Assembly	8217A087	1
4	Power Pilot Light Assembly	8217A213	1
5	Terminal Block, 6 terminal	8217A086	1
6	Terminal Block, 9 terminal (Model AR)	8217A173	1 AR
	Terminal Block, 10 terminal (Model AF)	8217A085	
7	Fuseholder	8217A091	1
8	Fuse, one ampere	8217A090	2
9	Switch, Red Push-button		
	(3 used on AR, 4 used on AF)	8217A089	AR
10	Switch, Black Push-button	8217A088	1
11	Motor	8217A084	1
12	Microswitch (3 used on AR, 4 used on AF)	8217A081	AR
13	Cam Number 1	8217A092	1
14	Cam Number 2	8217A093	1
15	Cam Number 3	8217A094	1
16	Cam Number 4 (Model AF only)	8217A095	1 AR
17	Nameplate, Model AR	8146A331	1 AR
	Nameplate, Model AF	8146A330	
18A	Switch Guard, Silver	8217A097-05	1
18B	Switch Guard, Blue	8217A097-03	1
18C	Switch Guard, Red (Model AF only)	8217A097-01	1 AR
18D	Switch Guard, Yellow	8217A097-02	1
18E	Switch Guard, Black	8217A097-04	1

DO NOT ORDER PARTS BY INDEX NUMBER.
Give model, voltage, description and part number.

Refer to PARTS PRICE LIST (Part No. 1001) for prices of parts.
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