

Building Alarms – Engineering Applications

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1. General

1.1 Purpose

This practice provides standards for building alarms associated with telephone switching facilities.

NOTE: This practice does not address alarms associated with telephone equipment.

1.2 Filing Instructions and Supersedures

Discard all previous issues and associated addenda of this practice and file this issue numerically in your GTE Telephone Operations practices set.

This practice supersedes and cancels:

- All policies, procedures, general instructions, letters, and memoranda which address this subject.
- Any document which provides information contrary to the information contained in this practice.

1.3 Reason for Reissuing

This practice has been reissued to incorporate multiple changes in the content. Read this entire practice to ensure your familiarity with the new information.

1.4 Responsibility

This practice was published by the GTE Telephone Operations Administrative Services Department. For more information about this practice, contact the Headquarters Land and Buildings Engineering Department.

1.5 Disclaimer

This practice was prepared solely for the use of GTE Telephone Operations. It must be used only by its employees, contractors, customers and end users, when installing, operating, maintaining, and repairing GTE Telephone Operations' equipment, facilities and services. Any other use of this practice is forbidden. The information contained in this practice may not be applicable in all circumstances and is subject to change without notice. By using this practice the user agrees that GTE Telephone Operations will have no liability (to the extent permitted by applicable law) for any consequential, incidental, special, or punitive damages that may result.

2. Overview

2.1 Introduction

GTE Telephone Operations' telephone switching facilities are required to be equipped with complex building alarm systems. A building alarm system must monitor several building systems and conditions for:

- Hazardous environmental conditions.
- Malfunctioning systems
- The activation of automatic safeguard systems.
- Unauthorized access to particular areas or equipment.

The requirements and recommendations set forth in this practice apply to all electronic telephone switching equipment offices. This practice:

- Establishes conditions that must be monitored by building alarm systems.
- Establishes set points at which the alarms are triggered.
- Establishes responsibilities for wiring and terminating building alarms.
- Standardizes the termination of building alarms.
- Recommends standard building alarm components with wiring schematics.

2.2 Acronyms and Definitions

The following chart explains acronyms used in this practice.

Acronym	Definition
AC	Alternating Current
BAS	Building Automation System
BF&E	Buildings, Fleet, and Energy
CDF	Central Distribution Frame
CEV	Controlled Environment Vault
DLC	Digital Loop Carrier
HVAC	Heating, Ventilation, and Air Conditioning
MCFS	Microprocessor Controlled Fire System

2.3 References

For additional information related to this practice, see GTE Telephone Operations Practice 740-500-070, Remote Equipment Buildings (REBs) -Engineering Guidelines.

3. Building Systems and Conditions Requiring Alarms

3.1 Building Alarms

Building alarms fail into two categories:

- Required-Must be provided in each facility.
- Required if Available- Must be provided only when the system is present in the facility.

The following charts:

- List the systems and conditions that require monitoring.
- Describe the condition that triggers the alarm (causes the alarm to be transmitted).

3.1.1 Reaired

System or Condition	An Alarm Is Transmitted When...
Commercial Power Failure	The commercial AC power experiences under-voltage, phase failure, or phase reversal. The under-voltage set point for the alarm is approximately 85% of its nominal voltage.
Surge Arrestor	The surge arrestor elements within the unit fail and the surge arrestor no longer provides protection.
High Temperature	The switching equipment room temperature reaches a set point of 86°F. The alarm continues if the temperature rises. (The alarm set point for DLC buildings is 100°F.)
Low Temperature	The switching equipment room temperature reaches a set point of 60°F. The alarm continues if the temperature drops lower.
High Humidity	The equipment room relative humidity level reaches a set point of 60%. The alarm continues if the humidity level rises
Low Humidity	Equipment room relative humidity level reaches a set point of 25% (and continues if the humidity level drops).
intrusion Alarm	An exterior door to an equipment room is opened.

3. Building Systems and Conditions Requiring Alarms, continued

3.1 Building Alarms, continued

3.1.2 Reauired If Available

If the Following System is Present...	An Alarm is Transmitted When...
HVAC Failure	Either of the following conditions occur: <ul style="list-style-type: none"> • The air flow of the HVAC air handler unit fails. • The HVAC compressor shuts off due to abnormal operating conditions that cause high refrigerant discharge pressure, low refrigerant suction pressure, etc.
Fire Detection/Suppression System Alarm	The building fire detection/suppression control panel goes into a fire alarm condition.
Fire Detection/Suppression System Trouble	The building fire detection/suppression control panel goes into a system trouble condition.
Generator Transfer	The building is being powered by the emergency generator. NOTES: This alarm point is only used for locations with permanent, on-site generators. This alarm condition signals a system (the generator) is operating properly. All other alarm conditions signal system failures.
Generator Failure	The emergency generator fails. NOTE: This alarm point is only used for locations with on-site, permanent generators.

(cont inued)

3. Building Systems and Conditions Requiring Alarms, continued

3.1 Building Alarms, continued

3.1.2 Required If Available, continued

If the Following System is Present...

An Alarm is Transmitted When...

Low Fuel (for generator)

Generator's fuel level reaches the following set points:

- 20% fuel remaining in generator day tank.
- 100 gallons remaining in main storage tank.

NOTE: The following chart further explains requirements for monitoring generator fuel.

If the Location Has... Then...

A day tank The day tank must be equipped with an alarm.

A main tank (and no day tank) The main tank must be equipped with an alarm.

Both, main tank and day tank The day tank must be equipped with an alarm and the main tank, if it already has a tank monitoring device, must also be equipped with an alarm.

NOTE: It is not the intent of this requirement to retrofit an existing main tank for an alarm when a day tank is available to be equipped for an alarm at the location.

Fuel Leak

A fuel leak detection device detects a fuel leak in the generator underground storage tank.

Cable Vault Gas

A cable vault gas detection device detects gas or system trouble.

Cable Vault Flood

- A sump pump fails. This is indicated by a sump pump float mechanism reaching a set-point level, triggering the alarm. The set point is a water level higher than the water level required to activate the sump pump.
- A floor flood detection device indicates water on a cable floor.

NOTE: Depending on the location, a cable vault may have both or either one of the mentioned alarm systems. If both exist, both must be monitored for alarm conditions.

3. Building Systems and Conditions Requiring Alarms, continued

- 3.2 Alarm System Acceptance and Familiarization** After alarm installation is completed, Land and Buildings Engineering, in conjunction with the alarm installation contractor, will conduct alarm acceptance testing and provide appropriate alarm testing familiarization to BF&E.

4. Alarm Termination Standards

- 4.1 Introduction** This section:
- Assigns responsibilities for wiring alarms.
 - Establishes a point of demarcation (separation) between Land and Buildings Engineering's alarm wiring and COE Engineering/Construction's alarm wiring.
 - Establishes guidelines for determining the location of the terminal block assembly.
 - Describes materials to be used for a terminal block assembly.
 - Establishes a standard pattern for terminating alarms at the terminal block.
 - Establishes and describes labeling requirements for the terminal block.
- 4.2 Responsibilities/ Point of Demarcation** All building alarm system wiring must be terminated at a common terminal block. The terminal block:
- Is the responsibility of Land & Buildings Engineering.
 - Must be mounted in an enclosure.
- COE Engineering/Construction is responsible for extending alarm wiring from the terminal block to the switching equipment for remote monitoring of building alarms.
- 4.3 Location of Terminal Block Assembly** In a remote equipment building, the terminal block assembly enclosure should be located near the CDF.
- NOTE:** Refer to GTE Telephone Operations Practice 740-500-070 for standard equipment floor plans that show the terminal block assembly or alarm panel (AP) next to the fire control panel. The fire control panel happens to be near the CDF.
- For buildings other than remote buildings, the location of the terminal block assembly should be near the CDF or within the CDF room (if applicable).
- 4.4 Materials for Terminal Block Assembly** The materials to use in the terminal block assembly are:
- For the enclosure: Hoffman #AI2N126 (or its equivalent).
 - For the back panel: Hoffman #A12N12P (or its equivalent).
 - Standard terminal block that has 20 terminals per side.
- NOTE:** See Exhibit 1, Building Alarm Terminal Cabinet, for terminal block assembly detail.

4. Alarm Termination Standards, continued

4.5 Labeling the Terminal Block

Each alarm point on the terminal block must be labeled. Use a plastic-laminate tag to label each alarm point. Label the tags identical to alarm functions as detailed in Section 4.6.

4.6 Alarm Termination Points

This section establishes a standard pattern for terminating alarms at the terminal block. On a going-forward basis, alarm system wiring should not deviate from this standard pattern for points of termination. The chart on the next page lists the point of termination at the terminal block for each of the standard alarm functions described in Section 3.

Exhibit 1 illustrates the configuration of the terminal blocks in the building alarm terminal cabinet.

NOTE: Small DLC buildings may not contain more than ten alarm points that would require two terminal strips as illustrated in Exhibit 1. Where one terminal strip provides the necessary space for wiring terminations, one terminal strip may be provided in lieu of the standard of two terminal strips.

4. Alarm Termination Standards, continued

4.6 Alarm Termination Points, continued

Terminals	Alarm Function
I-2	Commercial Power Failure
3-4	Surge Arrester
5-6	High Temperature
7-8	Low Temperature
9-10	HVAC #1 Failure
I-I-12	HVAC #2 Failure
13-14	HVAC #3 Failure (See Note 1 below.)
15-16	High Humidity
17-18	Low Humidity
19-20	Intrusion
21-22	Fire System
23-24	Fire System Trouble
25-26	Generator Transfer
27-28	Generator Failure
29-30	Low Fuel (Ventilation failure <i>for CEVs</i>) (See Note 2 below.)
31-32	Fuel Leak (Toxic Gas <i>for CEVs</i>) (See Note 2 below.)
33-34	Cable Vault Gas (Explosive Gas <i>for CEVs</i>) (See Note 2 below.)
35-36	Cable Vault Flood (High Water <i>for CEVs</i>) (See Note 2 below.)

NOTE 1: When more than three HVAC units require alarms, Terminals 37 through 40 may be used as a termination point, or an additional terminal strip may be added. HVAC unit failure alarms must be wired individually (rather than being wired in parallel) to provide a clear indication of HVAC unit status.

NOTE 2: The type of building facility determines what type of alarm is terminated at Terminals 29 through 36. Aboveground buildings will have Terminals 29 through 36 assigned to the alarms printed in regular type in the list above. CEV buildings will have Terminals 29 through 36 assigned to the alarms printed in italics in the list above.

4. Alarm Termination Standards, continued

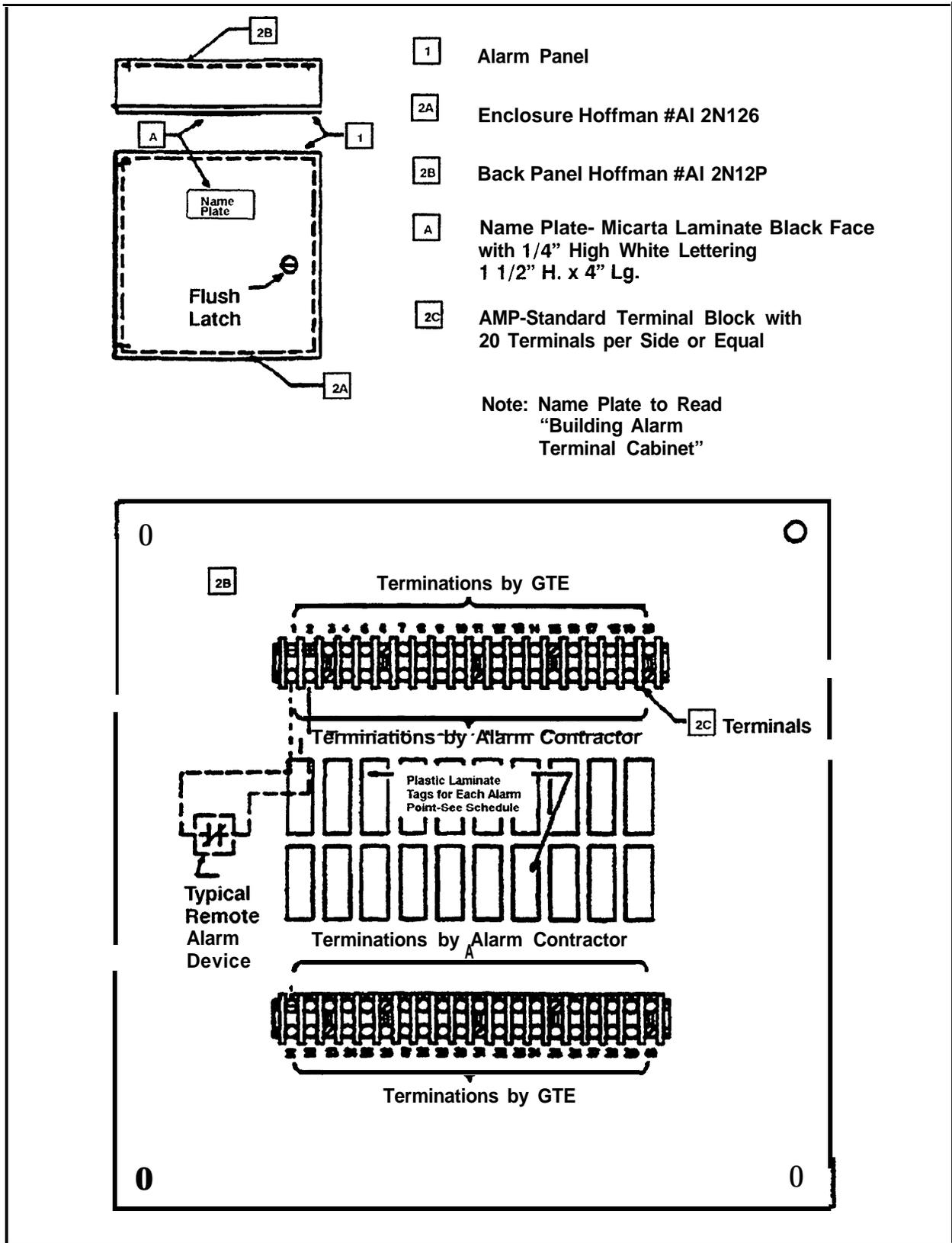


Exhibit 1 - Building Alarm Terminal Cabinet

5. Wiring Schematics

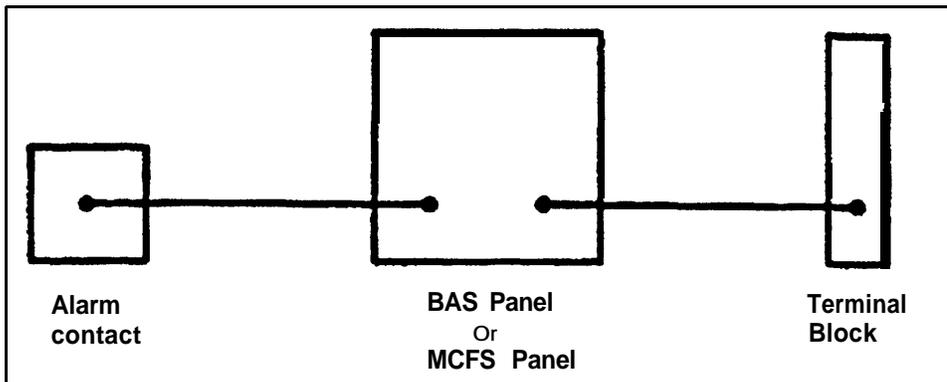
5.1 Introduction

This section provides specifications and wiring schematics for Building Alarm System components. Suggested materials and methods are also described in this section.

5.2 Generic Wiring Schematic

If a facility contains a building automation system (BAS) or a microprocessor controlled fire system (MCFS), the wiring methods will differ from the details shown in Sections 5.3.1 through 5.3.16. In buildings containing a BAS or MCFS, however, the same types of alarms must be provided.

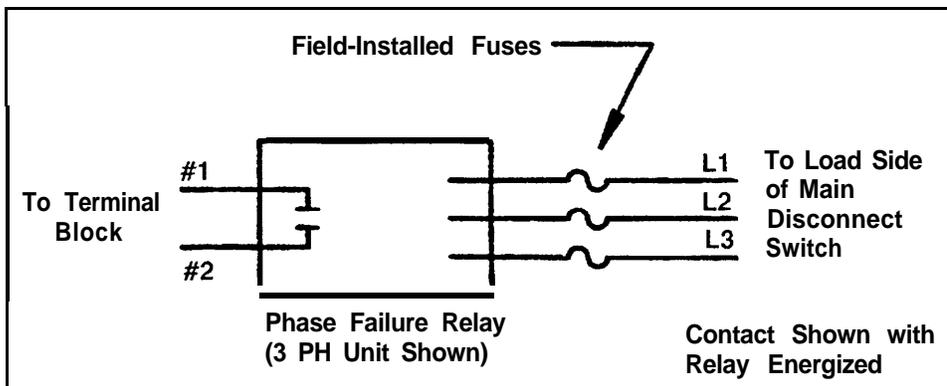
The difference in alarm wiring methods for buildings containing a BAS or MCFS necessitates a BAS panel or an MCFS panel installed between all alarm contacts and the alarm terminal block. The generic wiring schematic illustrated below shows this situation.



5.3 Wiring Schematics for Alarm Components

5.3.1 Commercial Power Failure Alarm

- Material:
 - Phase failure relay.
 - For a three-phase electrical service, the phase failure relay is equal to Square "D" type MPS, and must be UL listed.
 - For a single-phase electrical service, the phase failure relay is equal to Square "D" type DWU.
- Wiring- Relay contact closes when any of the following conditions exist:
 - Under voltage.
 - Phase failure (for three-phase application).
 - Phase reversal (for three-phase application).
 - Phase unbalance of 10% or greater (for three-phase application).

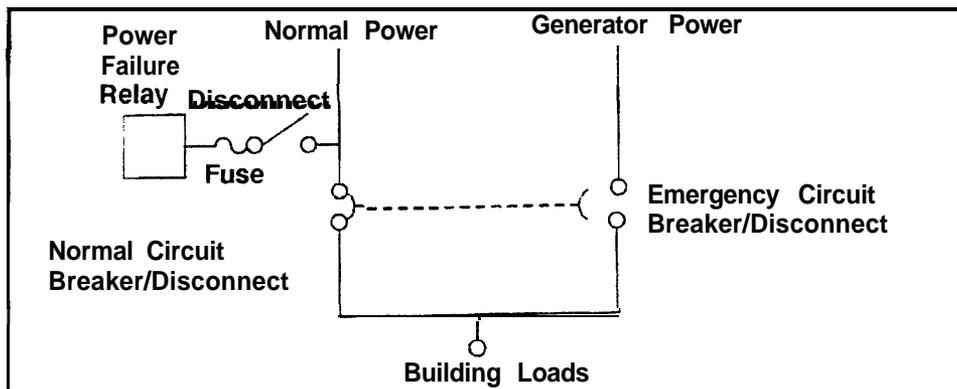


5. Wiring Schematics, continued

5.3

Wiring Schematics for Alarm Components, continued

It may be necessary to wire the phase failure relay on the service side of the main disconnect switch for switchgear that uses a “walking beam” interlock as a transfer switch. (See the following illustration.) This style of wiring monitors commercial power only. If the power relay were wired on the load side of the disconnect, the relay could be powered by the generator, which would provide a false indication that commercial power is available.



Some automatic transfer switches have the capability to provide commercial power-failure alarming. Commercial power-failure alarming is accomplished through auxiliary contacts of the automatic transfer switch. The automatic transfer switch can be used for commercial power-failure alarming in lieu of a phase failure relay, as long as the automatic transfer switch provides an alarm for the following conditions:

- Under voltage.
- Phase failure.
- Phase unbalance of 10% or greater.

NOTES: The auxiliary contacts used for commercial power failure alarming must be controlled by commercial power. In some transfer switches, the auxiliary contacts are controlled by the action of the blade transfer. In this situation, a false commercial power failure alarm would be transmitted during generator exercising. A commercial power failure alarm must not be transmitted if merely exercising the generator. If this is the case, the transfer switch cannot be used for commercial power failure alarming.

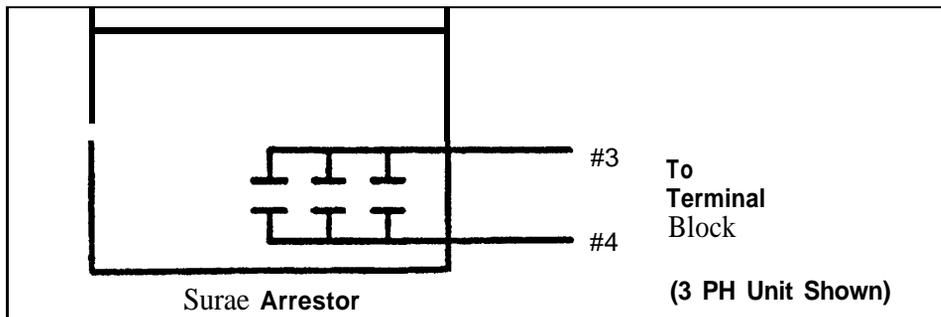
The automatic transfer switch does not require the phase reversal monitoring feature in order to qualify for use as a commercial power failure alarming device.

5. Wiring Schematics, continued

5.3 Wiring Schematics for Alarm Components, continued

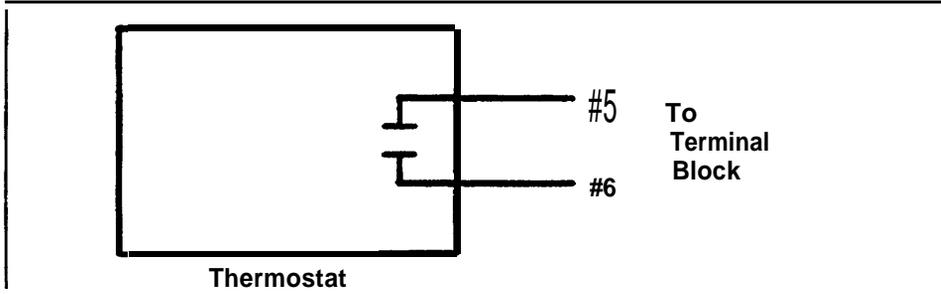
5.3.2 Surge Arrestor Alarm

- Material-Joslyn or MCG surge arrester auxiliary contact.
- Wiring-Contact closes when surge arrester fails.



5.3.3 High Temperature Alarm

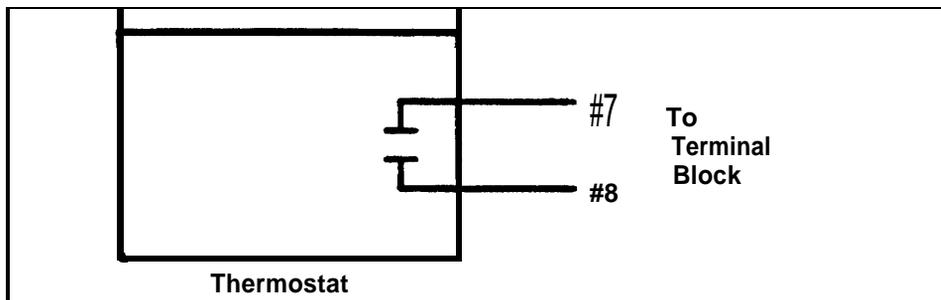
- Material -Thermostat (equal to Barber-Colman TC-1103).
- Wiring-Contact closes when temperature rises above set point.



NOTE: Buildings that have a Building Automation System (BAS) do not require an individual thermostat for high temperature alarm as indicated on this wiring schematic. A single BAS room temperature sensor provides HVAC control as well as alarm triggering capability.

5.3.4 Cow Temperature Alarm

- Material -Thermostat (equal to Barber-Colman TC-1101).
- Wiring-Contact closes when temperature falls below a set point.



NOTE: Buildings that have a Building Automation System (BAS) do not require an individual thermostat for low temperature alarm as indicated on this wiring schematic. A single BAS room temperature sensor will provide HVAC control as well as alarm triggering capability.

5. Wiring Schematics, continued

5.3

Wiring Schematics for Alarm Components, continued

5.3.5 HVAC Failure Alarm (Buildings with BAS)

For buildings that have a Building Automation System, HVAC Failure Alarm inputs into the BAS (for each HVAC unit) consist of:

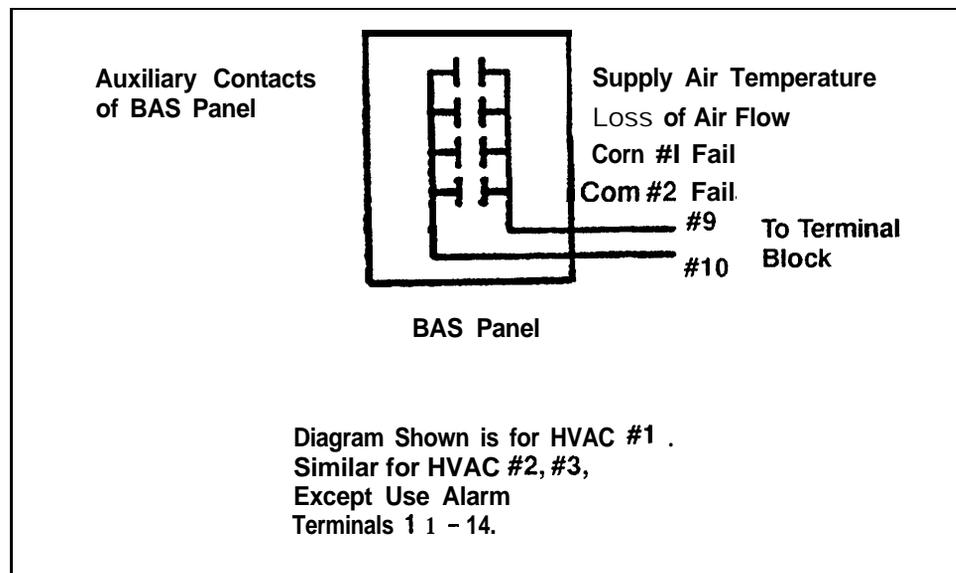
- Loss of air flow.
- Compressor #1 failure.
- Compressor #2 failure.

NOTE: Compressor failure results from:

- High head pressure.
 - Low suction pressure.
 - Compressor overload.
- Supply air temperature.

Internal BAS programming closes an auxiliary contact to transmit alarm signal when supply air temperature is above a set point *and* HVAC unit compressor is operating.

- Material – (furnished by BAS vendor).
- Wiring-The HVAC Failure Alarm schematic shown below is for buildings that have a Building Automation System.



5. Wiring Schematics, continued

5.3 Wiring Schematics for Alarm Components, continued

5.3.6 HVAC Failure Alarm (Buildings without BAS)

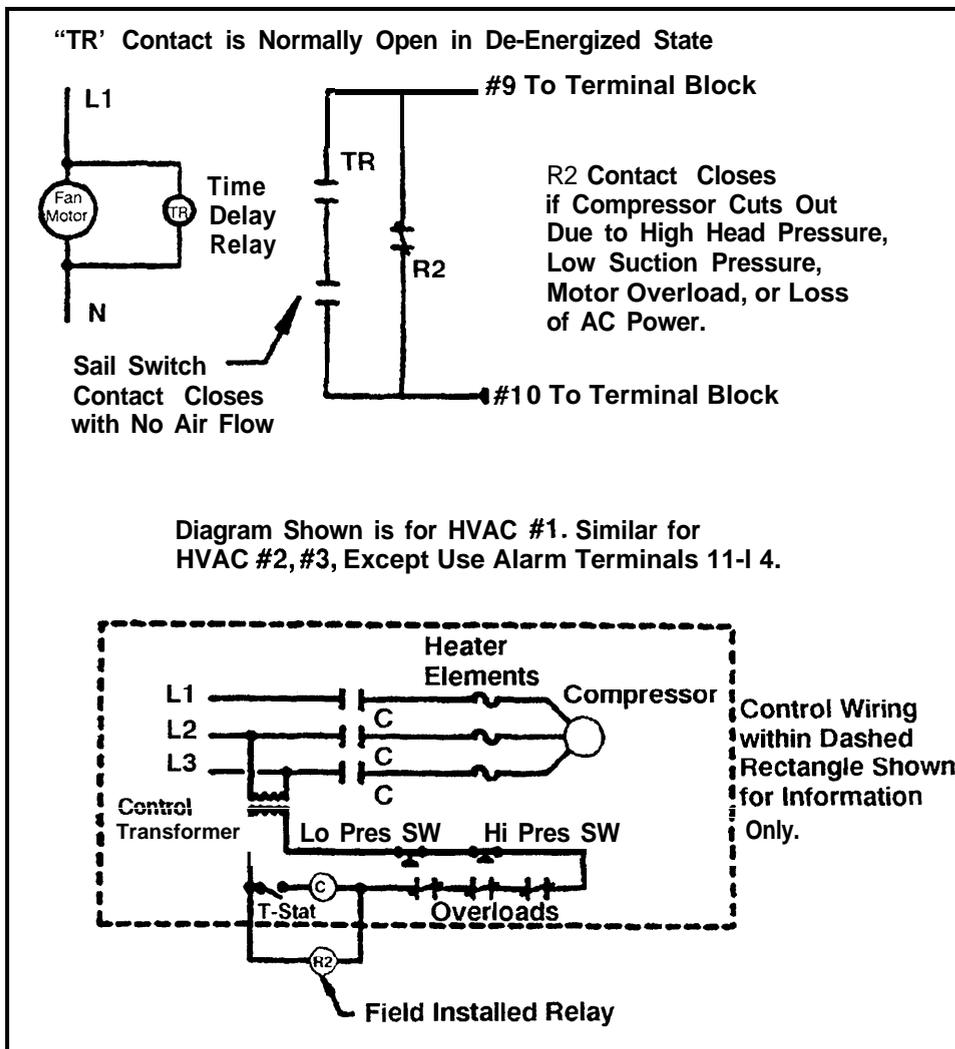
HVAC Failure Alarm in buildings without a building automation system consists of monitoring air flow and compressor operation. There are two methods available for monitoring compressor operation:

- Monitoring the compressor protective devices, such as the high or low pressure switches, motor overloads, etc.
- Monitoring the supply air temperature when the system is calling for cooling.

The following HVAC Failure Alarm schematic shows a method of monitoring compressor operation by way of the compressor protective devices.

- Material:
 - Sail switch (equal to Johnson Controls F62AA-8).
 - Timed delay relay – “On delay” – (equal to Square “D” type JCK).
- Wiring-Wire as illustrated below.

NOTE: An alternative method for HVAC Failure Alarm is to use Monitec Systems PM1 00 monitor. (Monitec Systems: 409/775-8615.)



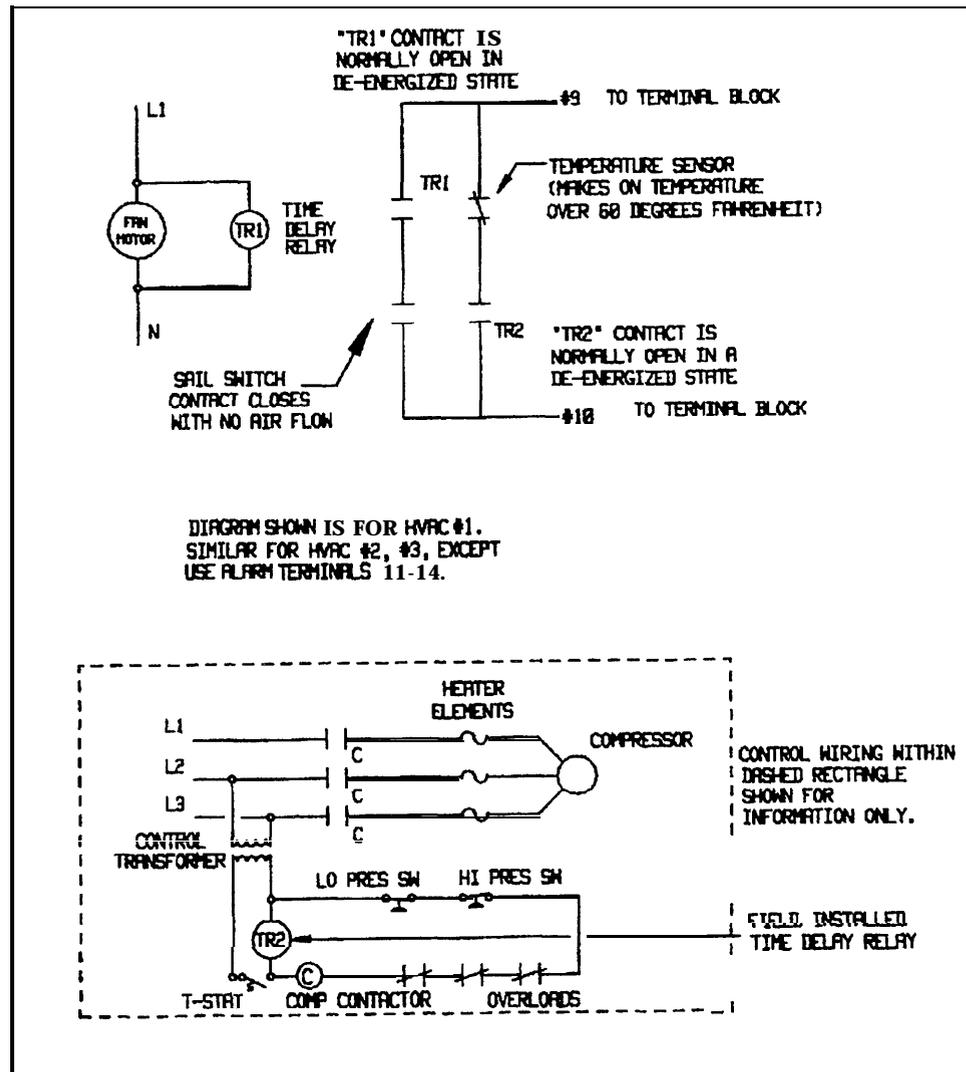
5. Wiring Schematics, continued

5.3 Wiring Schematics for Alarm Components, continued

The following HVAC Failure Alarm Schematic shows a method of monitoring compressor operation with a supply air temperature sensor located in the discharge duct. Fan failure alarm wiring is identical to the previous method.

- Material:
 - Duct temperature sensor (equal to Barber Colman TC-41 11).
 - Timed delay relay- "on delay"- (equal to square "D" type JCK).
- Wiring-Wire as illustrated below.

NOTE: A prefabricated electrical device containing the required electrical components for HVAC Failure Alarming is available. For installation, wires are connected between the HVAC unit and the prefabricated device. For information, contact the following vendor: Havel Brothers (21 9/487-7900).

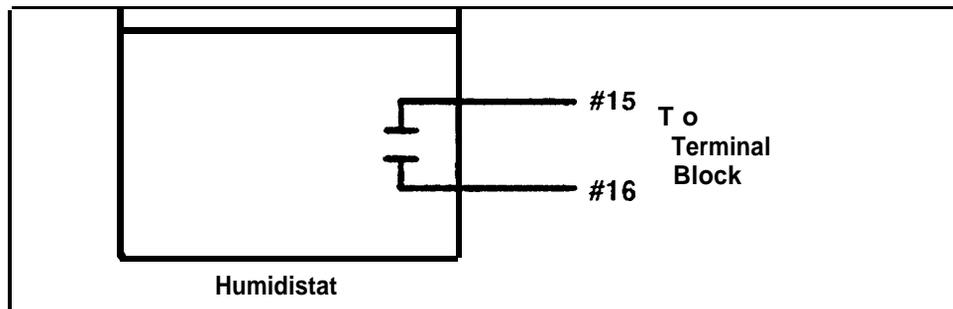


5. Wiring Schematics, continued

5.3 Wiring Schematics for Alarm Components, continued

5.3.7 High Humidity Alarm

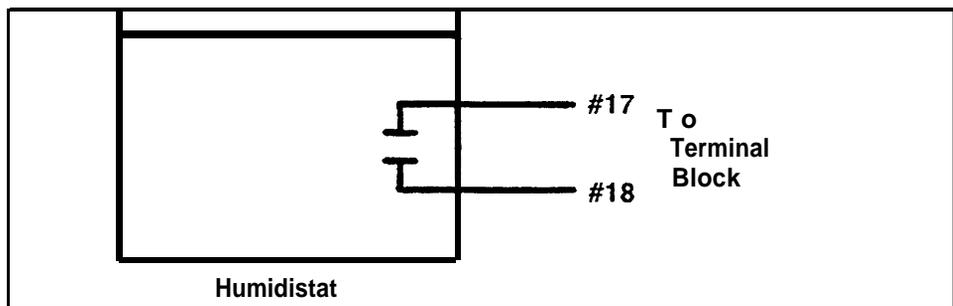
- Material-Humidistat (equal to Honeywell H-600-A-1 014).
- Wiring – Contact closes when humidity rises above set point.



NOTE: Buildings that have a Building Automation System (BAS) do not require an individual humidistat for high humidity alarm as indicated on this wiring schematic. A single BAS room humidity sensor will provide HVAC control as well as alarm triggering capability.

5.3.8 Low Humidity Alarm

- Material – Humidistat (equal to Honeywell H-600-A-1 014).
- Wiring-Contact closes when humidity falls below set point.



NOTE: Buildings that have a Building Automation System (BAS) do not require an individual humidistat for low humidity alarm as indicated on this wiring schematic. A single BAS room humidity sensor will provide HVAC control as well as alarm triggering capability.

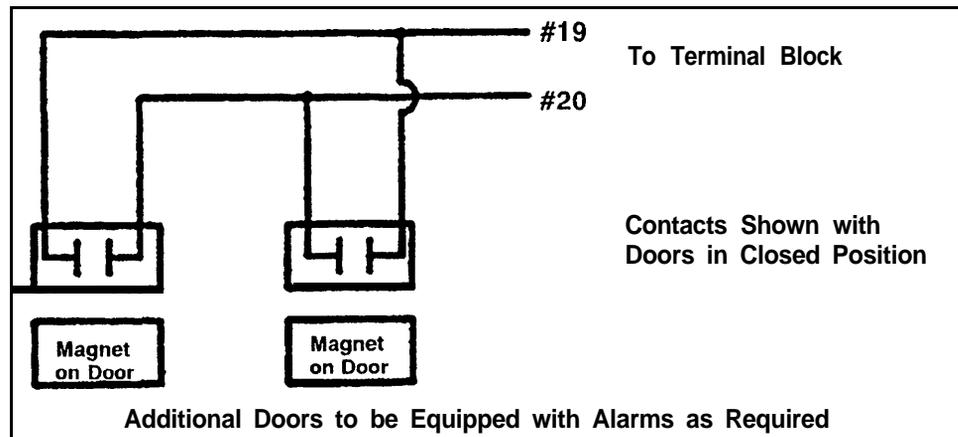
5. Wiring Schematics, continued

5.3

Wiring Schematics for Alarm Components, continued

5.3.9 Intrusion Alarm

- Material – Magnetic door-alarm contact (equal to Edwards #61).
- Wiring- Wire as illustrated below.

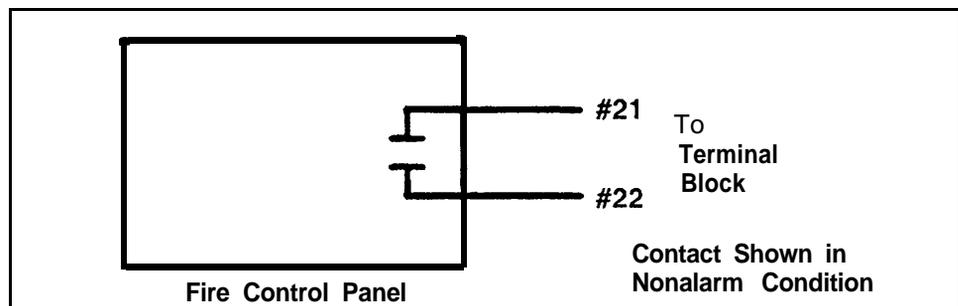


NOTE: Sites that use a card access system may not require this wiring arrangement. The card access system may provide door alarm functions.

NOTE: Security requirements for multiple use facilities (e.g., switching equipment and administrative office personnel in the same building) may require various doors of the building to provide individual alarms. This is to be determined on a site by site basis in conjunction with the local Security Department.

5.3.10 Fire System Alarm

- Material-Fire alarm control panel auxiliary contact.
- Wiring- Wire as illustrated below.

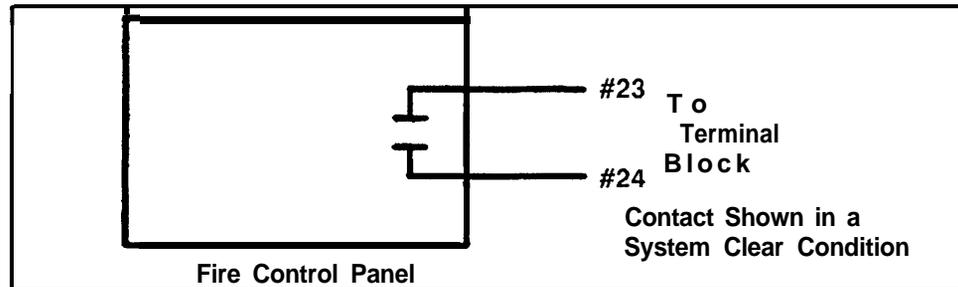


5. Wiring Schematics, continued

5.3 Wiring Schematics for Alarm Components, continued

5.3.11 Fire System Trouble Alarm

- Material-Fire alarm control panel auxiliary contact.
- Wiring-Wire as illustrated below.



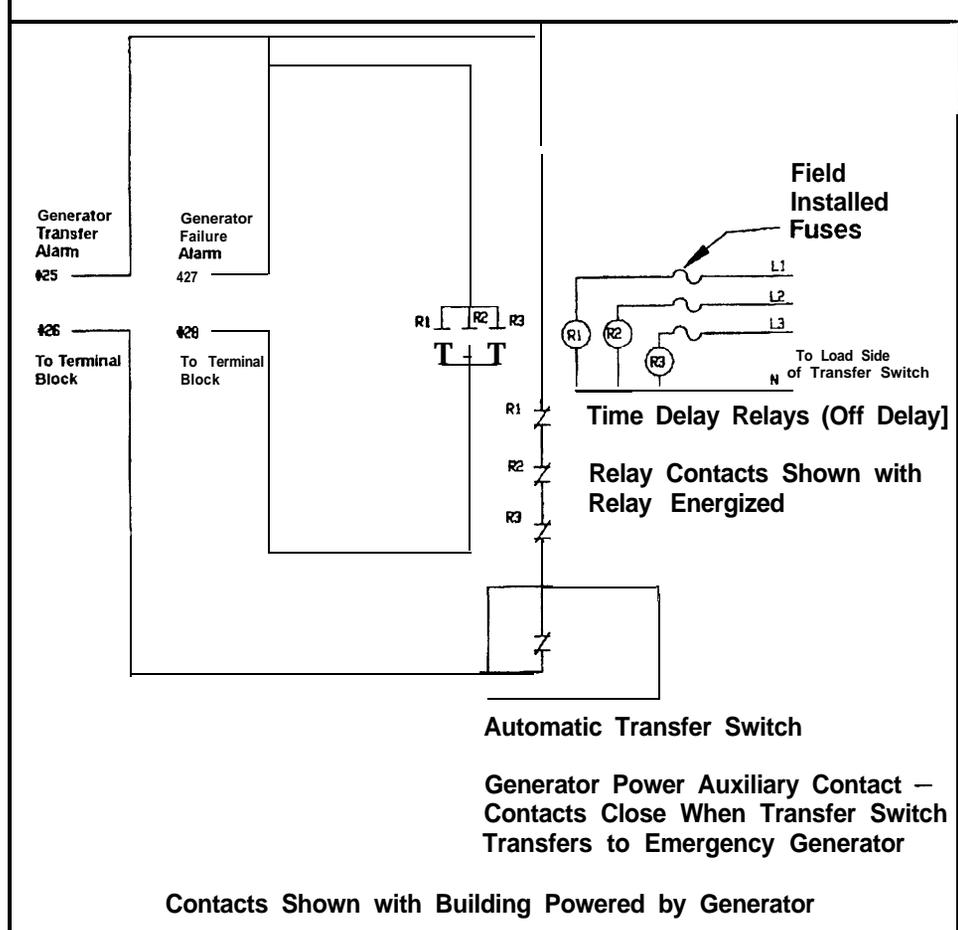
5.3.12 Generator Failure and Transfer Alarm

- Generator Failure Alarm Description:
 - When commercial power is interrupted, there is a period of time (usually 6-10 seconds) when the building is without commercial or emergency power. This time period allows the generator to come up to speed and to transfer the building load to the emergency generator. An off-delay relay will prohibit a false generator failure alarm during the generator start interval. Upon interruption of power, the contacts of the relay will not close until after the "off-delay" time period. If the generator and transfer switch are functioning properly, power is restored to the relay, maintaining the open contacts, and therefore no generator failure alarm would be transmitted.
 - The type of off-delay relay for this application must be selected based on a timing device that operates with no power to the relay. The specified Signaline Model 339 is electronically configured for off-delay timing effects. The specified Square D model is pneumatically configured for off-delay timing effects.
 - The off-delay relay has an adjustable range of time delay. The time delay selected should be greater than the cranking cycle of the generator. For example, if the generator has 4 cranking cycle attempts at 30 seconds per cranking cycle, set the time delay relay greater than 120 seconds (4 crank cycles X 30 seconds per cycle = 120 seconds total cranking time).
 - Normally closed contacts (contacts are closed when the relay is de-energized and not in a timing mode) of the time delay relay are wired in parallel so that failure in any one phase will transmit a generator failure alarm.
- Generator Transfer Alarm Description – Normally open contacts (contacts are open when the relay is de-energized and not in a timing mode) of the time delay relay are wired in series so that all phases are at nominal voltage before a generator transfer alarm is transmitted.
- Material -off-delay relay equal to:
 - Signaline (division of Mark Time Corporation) Model 339.
 - OR
 - Square D Class 9050, Model AOIOD (pneumatic).
- Wiring- Upon loss of power to the relay, a timing device is initiated and contacts change position after time-out of the timing device.

5. Wiring Schematics, continued

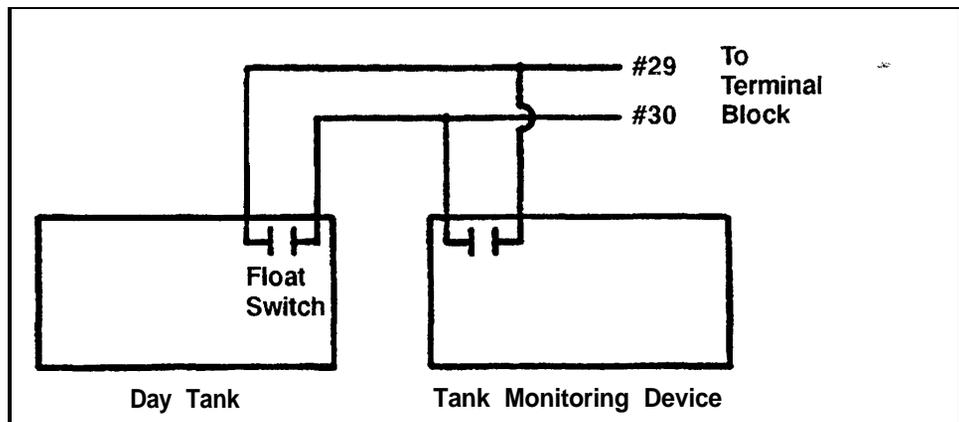
5.3 . Wiring Schematics for Alarm Components, continued

5.3.12 Generator Failure and Transfer Alarm. continued



5.3.13 Low Fuel Alarm

- Material:
 - Day tank float switch.
 - Main tank monitoring device (Andover TMU, etc.).
- Wiring-Contact closes when fuel reaches a predetermined set point.



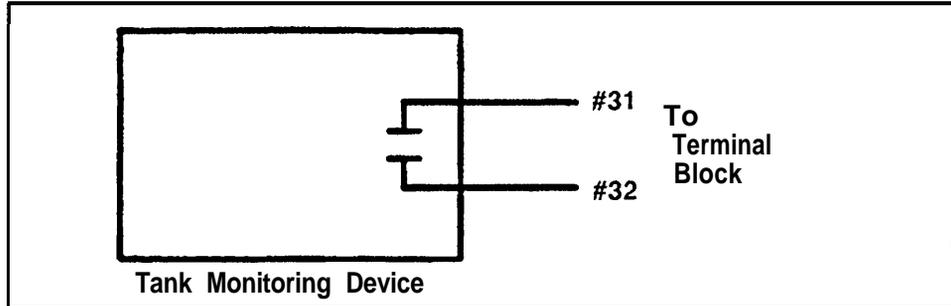
5. Wiring Schematics, continued

5.3

Wiring Schematics for Alarm Components, continued

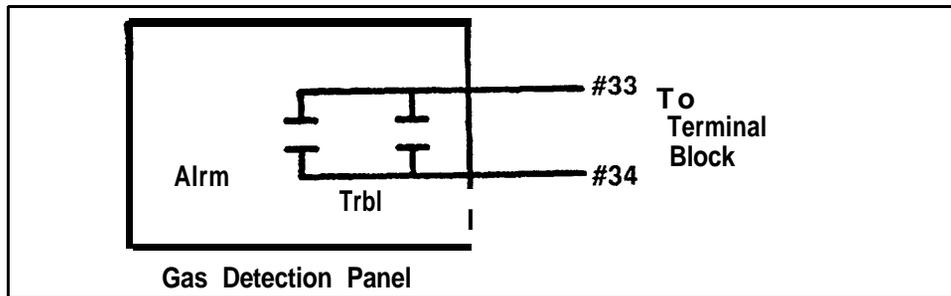
5.3.14 Fuel Leak Alarm

- Material -Tank monitoring device (Andover TMU, etc.).
- Wiring-Contact closes when monitoring device detects a fuel leak.



5.3.15 Cable Vault Gas Alarm

- Material -Cable vault gas detection panel auxiliary contacts_
- Wiring-Contacts closes when either of the following conditions exist:
 - Gas-detection alarm sounds.
 - There is system trouble with the gas-detection panel.

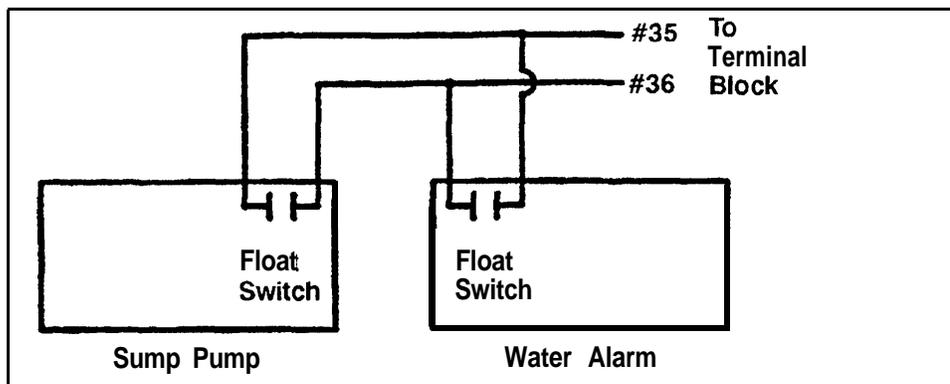


5. Wiring Schematics, continued

5.3 Wiring Schematics for Alarm Components, continued

5.3.16 Cable Vault Flood Alarm

- Material:
 - Sump pump float mechanism.
- AND/OR
 - Floor mounted water alarm (equal to Standard Telephone Design, Inc., Model STD-2010).
- Wiring -Contacts close when water level reaches a predetermined, unsatisfactory level.



6. Supplementary Reading

6.1 Additional Information

The following chart provides sources of supplementary information related to this practice.

For Information About...	See Practice...
Alarms for Electronic Switching Equipment	205-000-002
Emergency Generators – Engineering Application	743-200-070
Fire Prevention and Protection Guide	742-100-I 00
Minimum Alarm Configuration – New Switching Equipment	200-000-007
Petroleum Storage Tanks – Specifications	122-740-001