PDOC-100

SAN/0499-82
MDC G9705

STMPO #244
EXTRA

10 MWe Solar Thermal
Central Receiver Pilot Plant

SOLAR FACILITIES DESIGN INTEGRATION

PLANT MAINTENANCE/TRAINING MANUAL (RADL ITEM 2-37) SECTION 10 — FACILITIES

September 1982

WORK PERFORMED UNDER CONTRACT
DE-AC03-79SF10499

MCDONNELL DOUGLAS ASTRONAUTICS COMPANY
5301 BOLSA AVENUE
HUNTINGTON BEACH, CA 92647

U.S. Department of Energy

McDonnell Douglas Corporation | Rockwell International Rocketdyne Division | Stearns | Solar Energy

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Solar Facilities Design Integration

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SOLAR ENERGY
UNDER CONTRACT DE-AC03-79SF10499

PREFACE

This document is provided by the McDonnell Douglas Astronautics Company (MDAC) in accordance with Department of Energy Contract Number DE-AC03-79SF10499, Reports and Deliverables List Item 2-37. The material presented here is intended for training and maintenance usage by Southern California Edison Operations Personnel.

Specific notes on the organization and content of the document are as follows:

1. This document is organized in major sections that reflect the top level breakdown of the Master Equipment List as defined in RADL Item 2-19. This is in contrast to the subsystem approach used in designing the plant, however, is consistent with the Southern California Edison operating plant equipment lists.

   - Section 1 - Rotating Apparatus
   - Section 2 - Stationary Apparatus
   - Section 3 - Electrical Apparatus
   - Section 4 - Valves
   - Section 5 - Instrumentation
   - Section 6 - Control and Data Systems
   - Section 7 - Collector System
   - Section 8 - Special Heliostat Instrumentation and Meteorological Measurements Equipment
   - Section 9 - Heating Ventilating and Air Conditioning
   - Section 10 - Facilities

2. Assignments to categories are made on the basis of the lowest level tag numbers. For example, maintenance information for the thermal storage extraction pump skid assembly (SA-309) is not listed in the stationary apparatus section, but broken down to the generic categories as defined by the tag number; i.e., pumps (Section 1.2), air operated stop valves (Section 4.2), pressure transmitter (Section 5.2), etc.

3. The Process Instrumentation Section (Section 5.0) is organized on the basis of sensor type as defined by the first letter of the designating tag number. It contains sensor-related information only. Signal conditioning equipment is treated in Section 6.0.

4. The information on the Collector System, which was provided by the Martin Marietta Corp. (MMC) and the major items of the Electrical Power Generation System equipment, provided by Southern California Edison is not provided herein. However, the various sections were structured for their inclusion where applicable.

Technical questions concerning this RADL Item should be directed to Mr. R. G. Riedesel at (714) 896-3357 or Mr. R. J. Perkins at (714) 896-3073.

TABLE OF CONTENTS

10.1 FIRE PROTECTION

10.1 Fire Protection

10.1.1 Fire Detectors

See the information on the following pages.

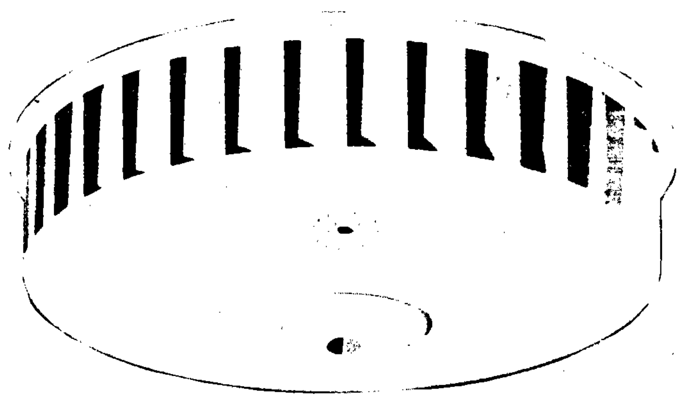
Pyrotronics

Early Warning
Fire Detection and Alarm Systems

Photoelectronic/Ionization
Fire Detector
Model DC-1

CATALOG NUMBER
6115

Engineer and Architect Specifications



Features

- **UL 268 Listed**
- **LED Alarm Indicator**
- **Concealed Test Feature**
- **Plug-in Design**
- **Superior Sensitivity & Stability**
- **Two Wire Installation — System Operated**
- **Wide Range Detection Capability**

Introduction

The DC-1 combines two advanced detection methods into one. . . new photoelectronic detector and Pyrotronics' proven ionization detector. This combination detector offers the widest range of detection capabilities currently available for any type of anticipated fire condition.

The Model DC-1 is Underwriters Laboratories Inc. listed.

Technical Description

The Model DC-1 incorporates both a photoelectronic chamber and an ionization chamber in one detector. By using two different chamber detection methods, the DC-1 offers superior sensitivity over the entire combustion products spectrum.

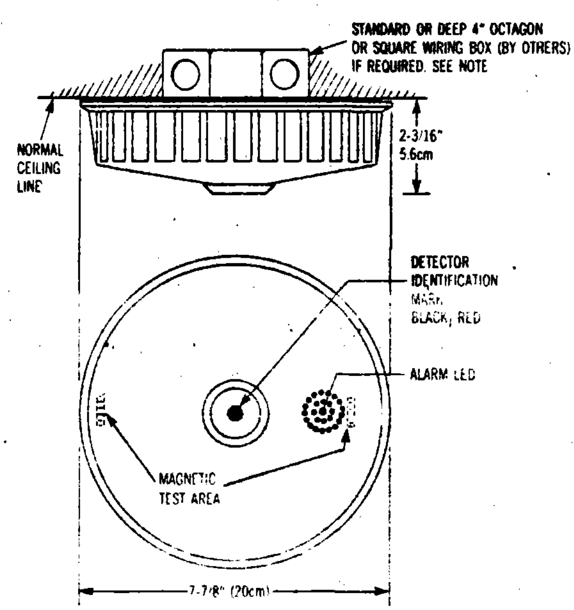
The photoelectronic chamber uses a solid state light emitting diode (LED) and a light sensing photodiode (PD) within a sensing chamber. Under normal conditions, the LED is pulsed once every twelve seconds to provide a flash of light within the sensing chamber. When smoke enters the chamber, the pulse light is scattered or reflected in sufficient quantity to be "seen" by the photodiode.

After the first sighting of smoke by the photodiode, the detector increases the time frequency of light pulses to one pulse every second and a logic circuit is activated to count the light pulses. If the logic circuit verifies the continued existence of smoke within the chamber after two consecutive pulses, the detector's alarm circuit is activated.

The ionization chamber contains two charged plates and a low-level alpha source which ionizes the air molecules. When products of combustion enter the chamber, they impede the flow of ions. This reduces the flow of current between the plates and causes a voltage shift that triggers the alarm circuit through a field effect transistor (FET).

Upon activation of either detection chamber, the DC-1 alarm circuit is activated and "locks-in." When the smoke

Mounting Data



NOTE: BOX DEPTH DETERMINED BY QUANTITY OF CONDUCTORS USED REFER TO NATIONAL ELECTRICAL CODE

Pyrotronics
A Division of Baker Industries, Inc.
Cedar Knolls, New Jersey 07927

April 1981
Supersedes Issue Dated 4/80

particles or products of combustion have cleared from the detector it can be reset by interrupting the power input from the control panel.

The Model DC-1 consists of a mounting plate with in-line connector and a plug-in detector head with an alarm indicating LED. The pre-wired plug-in connector affords easy connection to the snaplock mounting plate and system wiring. A concealed functional test feature has been provided to check the operational integrity of the detector. When a magnet is applied to the designated test point area (one for each chamber) of the detector case, a hidden reed switch is activated which will initiate a functional alarm condition. This method provides a separate test for each detection chamber and its associated electronic circuitry.

A remote alarm lamp (Model RL-3, 4 or 6) may be utilized when the detector is concealed from view, or a remote relay may be connected to the DC-1. When a relay is used and the control function is critical, no more than one DC-1 should be installed in a particular circuit or zone, and no other initiating devices should be installed in that same circuit or zone. An exception to this rule would be an application where a number of relays were used, each of which was connected to the same critical control function.

The DC-1 operates from a nominal 21 Vdc source, provided by a Pyrotronics Control Panel. The detector requires a very small standby current (less than 150 microamperes), which permits the use of a two wire detector circuit of #18 AWG, thereby reducing system installation costs.

Application Data

No more than thirty (30) Model DC-1 detectors are to be used on each ZN-30 zone circuit. The DC-1 detector is fully compatible with other Pyrotronics Detectors and may be intermixed on the same zone circuit. No more than 30 detectors of any type or combination (other than thermals or manual stations) may be used on any one detector circuit. All Series 1 detectors use a common mounting plate which provides detector interchangeability and plug-in type mounting.

This detector is applicable to the 30-foot center spacing (900 sq. ft.) as referred to in the National Fire Protection Association standard 72E. This spacing, however, is based on ideal conditions namely, smooth ceiling, no air movement, and no physical obstructions between the fire source and the detector. This spacing should be used as a guide or starting point in detector installation layout. Do not mount detectors in areas close to ventilating or air conditioning outlets. Exposed joists or beamed ceilings may also affect safe spacing limitations for detectors. It is mandatory that engineering judgment be applied regarding detector location and spacing.

Architect's Specifications

The fire detector shall be a Pyrotronics Model DC-1. It shall operate on the photo/ion combination principle and shall be UL-268 listed.

The detector head shall be a plug-in unit containing both photoelectronic and ionization detection chambers. It shall also include the detector electronics and plug-in connector for its mounting plate. The detector shall operate from a 21 Vdc power source, and shall contain an alarm indicator LED to signal actuation of the detector. It shall also be possible to connect a remote lamp or a remote relay to the detector.

The photoelectronic chamber shall incorporate a confirmation circuit which changes the scanning rate of the photo-optics.

The ionization chamber shall contain an alpha source and shall not exceed .8 microcuries. The unit shall contain no moving parts and the amplifier switching circuit in the detector shall be entirely solid-state.

A concealed calibrated test feature shall be provided to check the operational integrity of each detection chamber. The test feature shall provide a concealed, tamperproof method for testing the detector. For test purposes the generation of actual smoke or the removal of the detector from its mounting plate shall not be required.

The detector, or group of detectors, shall require a two-wire circuit of #18 AWG thermoplastic fixture wire enclosed in conduit or #18 AWG limited energy shielded cable without conduit, if permitted by local building codes.

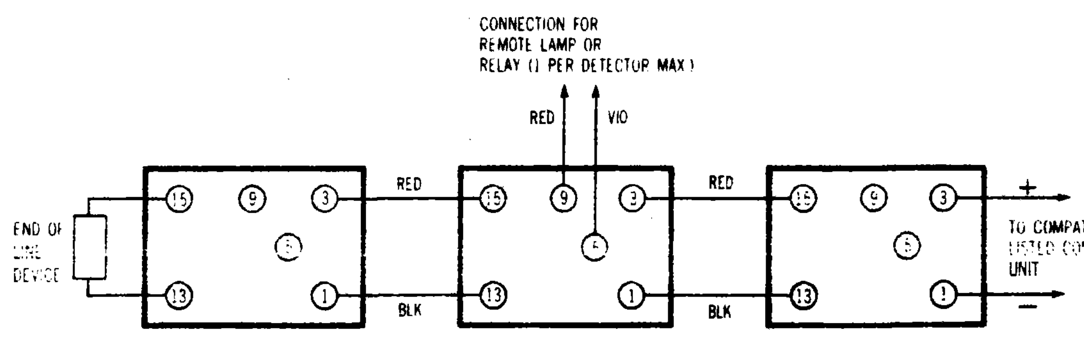
Electrical Information

Current Requirement:	Normal—150 μA Max.
	Alarm—100 mA Max.
Voltage Range:	19-23 Vdc

Ordering Information

Model	Description	Shipping Weight Lbs.	Kg.
DC-1	Combination Fire Detector, Surface Mounting (includes detector and mounting plate)	1.5	.7

Typical Wiring



Printed in U.S.A.

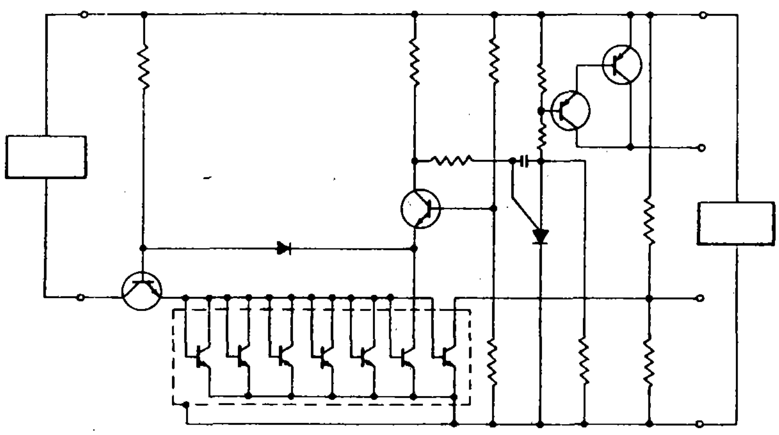
10.1.2 Halon System

A halon fire protection is installed to protect electronics equipment in remote stations 1 (tower levels 13 and 14), 2, and 3. See the following pages for operation and maintenance of the ansul auto pulse alarm/suppression control system.

ANSUL

AutoPulse™
Alarm/Suppression
Control System

Dual Zone Panel Installation, Operation and Maintenance Manual



U.S. Patent No. 4,137,467

HALON
CP9-98

This manual is intended for use with the Ansul AUTOPULSE Dual Zone Control Panel.

Persons who install, inspect, maintain or service this control panel should read the entire manual. Specific sections will be of particular interest depending upon one's responsibility.

The AUTOPULSE Dual Zone Panel is an electronic device and requires periodic maintenance. Maintenance should be conducted at six month intervals to provide maximum assurance that your control panel will operate effectively and safely.

TABLE OF CONTENTS

FORWARD

The standard Ansul AUTOPULSE Dual Zone Control Panel is to be employed only in clean, indoor locations in accordance with the following standards of the National Fire Protection Association:

NFPA No. 70 — National Electrical Code ANSI C1
NFPA No. 72A — Local Protection Signaling Systems
NFPA No. 75 — Electrical Computer Systems
NFPA No. 12A — Halogenated Extinguishing Agent Systems Halon 1301

These codes are purely advisory. They are, however, widely used as a basis of good practice by manufacturers of electrical equipment, property owners, fire authorities, and insurance companies. Regardless, the local authorities having jurisdiction (organization, office, or individual responsible for "approving" equipment, installation technique, or procedures followed) should be contacted to ensure compliance with applicable codes and regulations, i.e., local electrical wiring requirements which many differ somewhat from national codes or standards.

ANSUL AUTOPULSE DUAL ZONE CONTROL PANEL

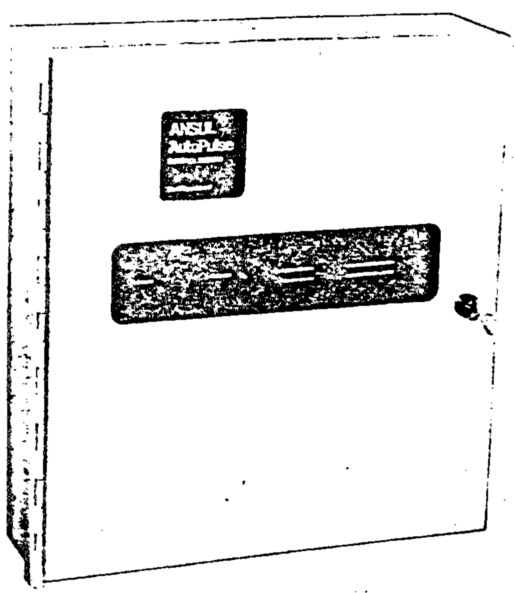


FIGURE 1

Introduction

The Ansul AUTOPULSE Dual Zone Control Panel is an automatic, electronic control unit for actuating a fire suppression system upon receipt of a fire detection input signal. It is capable of controlling one or more hazards with single, cross-zoned, or priority zoned detection. The unit is fully supervised and operates in conjunction with low voltage detectors or contact closure alarm initiating devices (manual pulls, heat detectors, etc.).

Description and Operation

The Ansul AUTOPULSE Dual Zone Control Panel is the basic controller for a fixed, dual zone AUTOPULSE system. Internal circuitry is designed using conservatively rated, long-life solid state components. The Dual Zone Panel consists of a single printed circuit board and a power supply. The Dual Zone Panel has two supervised initiating (detection) circuits (zones). These are fused at one ampere each and may be used to provide power to detection devices (refer to Installation Section of this manual for further information). Each two-wire initiating circuit will automatically current limit at approximately 115 milli-amperes when in alarm. These circuits cause immediate operation of the audible alarm circuit when in alarm. They also have a programmable output which causes operation of the release device circuit. The programming options are:

1. Single Zone Actuation – causes immediate operation of the time delay circuit if an alarm is sensed by either detection circuit.
2. Priority Zone Actuation – requires that one particular detection circuit must be in alarm before the time delay circuit is operated (i.e., if Zone 1 is made the "priority zone," whenever it alarms, the time delay circuit and the alarm circuit will be operated, however, Zone 2 will only cause the audible alarm circuit operation whenever it alarms). Either Zone 1 or Zone 2 can be made the "priority zone".
3. Cross-Zoned Actuation - requires that both detection zones be in alarm before the time delay circuit is operated. One zone in alarm will only operate the general alarm circuit and the associated zone alarm relay.

The Dual Zone Panel has two supervised output circuits. One is a polarity reversal 24 VDC circuit fused at one ampere and is intended for use with an audible alarm device. This circuit is operated by any alarm source within the panel. An alarm silence switch, mounted on the printed circuit board, is provided. The second output circuit is intended to be used with a release device. An internal time delay, adjustable from 0 – 60 seconds, is provided with this circuit. Connection and circuitry are provided for an abort switch which is used to interrupt release device operation while the source of alarm is determined. The panel is programmable for either release device operation immediately after the abort is removed or to restart the time delay from 0 seconds after the abort is removed. This release circuit is operated by the programmable inputs from the detection circuits or by a non-programmable manual pull station input which causes immediate operation of the release circuit.

Five relays each provide a set of Form C (SPDT) relay contacts rated at 3 amperes at 24 VDC, 3 amperes at 120 VAC resistive, 1/10 H.P. maximum and are operated when the following conditions exist.

1. Zone 1 alarm
2. Zone 2 alarm
3. Pre-discharge alarm
4. General alarm
5. System trouble

The pre-discharge relay is operated when the release circuit time delay cycle is started. The general alarm is activated if any alarm is generated within the system or if a general alarm input is received. The general alarm bus input is programmable to either operate or not operate the general alarm relay, but will always operate the external audible alarm circuit.

The following functions are annunciated by LED type lights which are mounted on the hinged cover of the Dual Zone Panel.

Description and Operation (Continued)

Function	LED Lamp Color
Power	Green
System Trouble	Yellow (amber)
Zone 1 Alarm	Red
Zone 2 Alarm	Red
Pre-discharge Alarm	Red
System Fired	Red

The power light remains on at all times as long as the main power source is present.

The Function Chart given in Figure 2 shows the possible alarm inputs and what the outputs would be with each of these possible inputs.

The following circuits are supervised and a system trouble is generated when a trouble condition occurs:

— Both detection circuits
— Audible Alarm Circuit
— Release Circuit
— Auxiliary Trouble Inputs (two)
— Power Supply

The audible trouble signal and the trouble LED light warn of the presence of a fault which could impair proper panel operation. A trouble silence switch in the panel provides a means to silence the audible trouble signal.

Dual Zone Function Chart (Per Typical Wiring Diagram)

Release Program Option And Alarm Input	Zone 1 Alarm L.E.D. And Relay	Zone 2 Alarm L.E.D. And Relay	General Alarm Relay	Audible Alarm Circuit	Pre-dis-charge Alarm L.E.D. And Relay	Release Circuit*	System Fired L.E.D.*
Single Zone Actuation							
Zone 1 Alarm	X		X	X	X	X	X
Zone 2 Alarm		X	X	X	X	X	X
Manual Pull			X***	X		X	X
Zone 1 and Zone 2 Alarm	X	X	X	X	X	X	X
General Alarm Input			X***	X			
Manual Release System Operation**			X***	X			X
Zone 1 Priority Zone Actuation							
Zone 1 Alarm	X		X	X	X	X	X
Zone 2 Alarm		X	X	X			
Manual Pull			X***	X		X	X
Zone 1 and Zone 2 Alarm	X	X	X	X	X	X	X
General Alarm Input			X***	X			
Manual Release System Operation**			X***	X			X
Zone 2 Priority Zone Actuation							
Zone 1 Alarm	X		X	X			
Zone 2 Alarm		X	X	X	X	X	X
Manual Pull			X***	X		X	X
Zone 1 and Zone 2 Alarm	X	X	X	X	X	X	X
General Alarm Input			X***	X			
Manual Release System Operation**			X***	X			X
Cross-Zone Actuation							
Zone 1 Alarm	X		X	X			
Zone 2 Alarm		X	X	X			
Manual Pull			X***	X		X	X
Zone 1 and Zone 2 Alarm	X	X	X	X	X	X	X
General Alarm Input			X***	X			
Manual Release System Operation**			X***	X			X

X – Indicates operation of circuit or device listed.

*Operated after time delay period.
**Mechanical operation of release system.
***Programmable

FIGURE 2

Description and Operation (Continued)

The dual zone power supply operates from 120 VAC input voltage with a maximum current of one ampere.

The power supply provides 27.1 VDC to the dual zone system and is fused at three (3) amperes. The system houses and charges its own set of "on-line" emergency batteries.

The entire system is housed in a single NEMA Type I steel enclosure with four mounting holes for surface mounting. An optional trim ring can be added to the standard enclosure to enable flush mounting of the unit.

The enclosure has a key locked hinged cover. A standard pattern of conduit entry knockouts is provided and all wiring connections are made to screw terminal barrier blocks.

INSTALLATION

The reliability of a fire suppression system depends greatly upon the proper installation of the control panel, associated equipment and their interconnecting wiring. The following requirements are critical and necessary to ensure reliable operation of the Ansul fire suppression system.

Mounting

Select a shock and vibration free surface in a clean dry area for mounting the Ansul AUTOPULSE Dual Zone Panel. The mounted enclosure should be completely visible and accessible for maintenance.

Allow sufficient room for opening the hinged cover.

After selecting an area to locate the Dual Zone Panel per the above rules, you may now proceed to the steps listed below for mounting the Ansul AUTOPULSE Dual Zone Control Panel.

1. The Dual Zone Panel shipping assembly comes in one complete piece. If the optional trim ring is to be used, it will be a separate piece. Remove the separate pieces from the shipping box.
2. If the optional trim ring for flush mounting is to be used, assemble the trim ring to the backbox. Figure 3 illustrates how the assembly goes together. The hinged cover must first be removed from the backbox, the trim ring mounted to the backbox, and then the hinged cover to the trim ring.

Trim Ring and Backbox Assembly

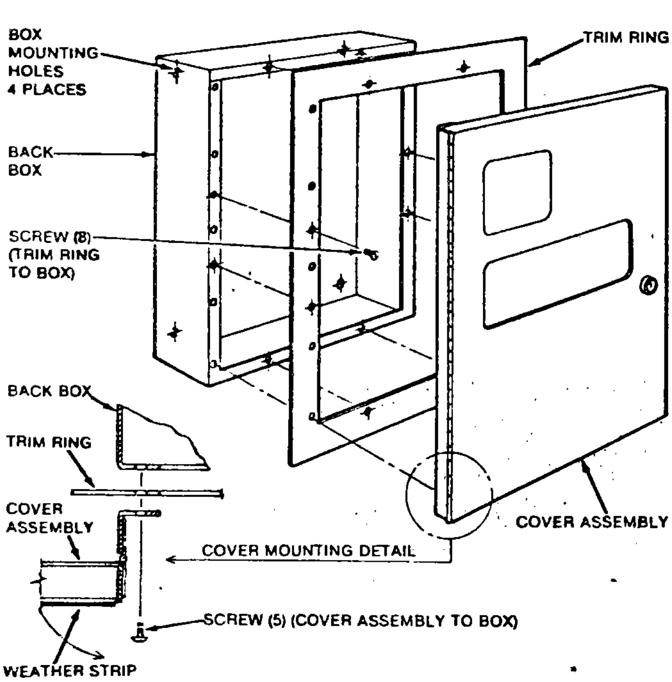


FIGURE 3

Typical Mounting Dimensions

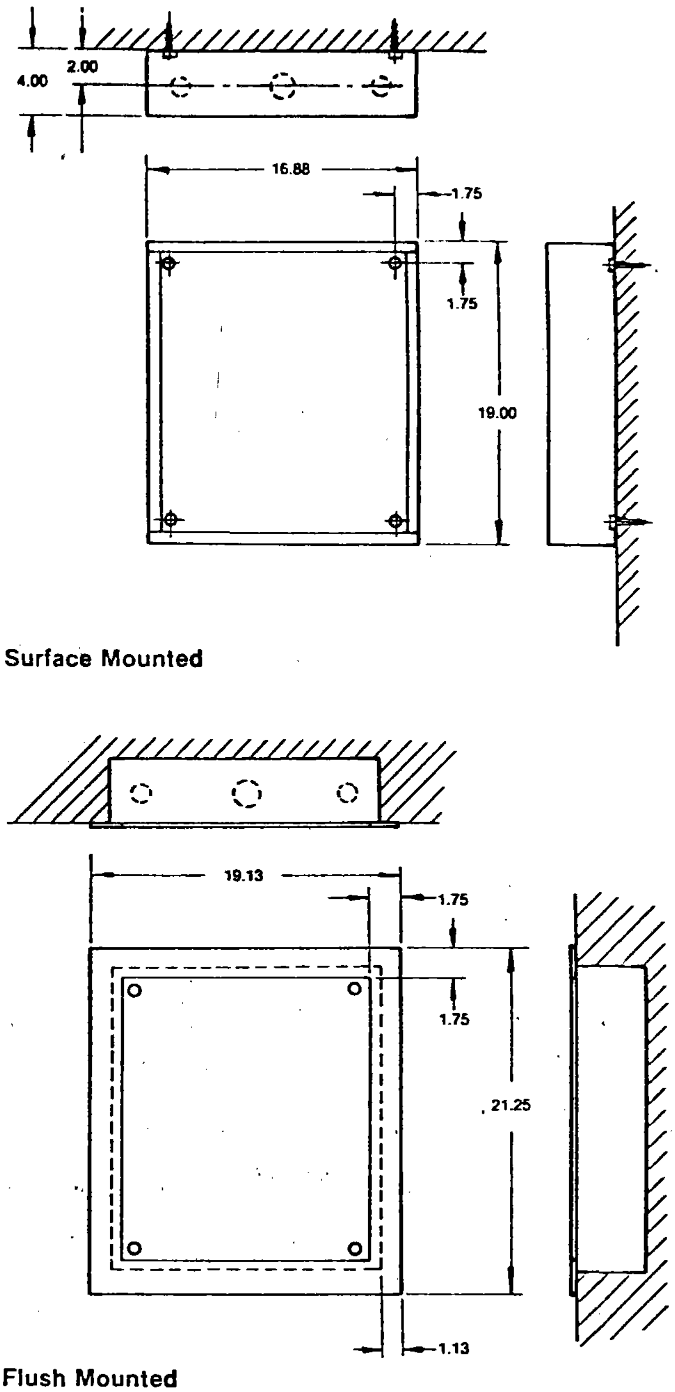


FIGURE 4

3. Secure the backbox to the selected surface utilizing the four mounting holes provided. Use lag screws or toggle bolts depending on the selected surface. Figure 4 provides mounting data.
4. The system is equipped with emergency batteries. Install the battery mounting brackets in the enclosure per the installation instructions supplied with the battery installation kit for the size batteries which are required.

Wiring Ansul Dual Zone Panel

Detailed wiring diagrams for each specific installation are furnished with the fire suppression system. These wiring diagrams as well as the instructions contained herein for the installation of the system should be followed carefully. Only complete adherence to each detail will provide reliable operation of the total fire protection system at all times.

1. **Power Requirements**
The Ansul AUTOPULSE Dual Zone Control Panel is designed to operate with its own internally mounted power supply. This power supply operates from 120 VAC (240 VAC available upon request) at 50/60 Hz input voltage with a one ampere maximum current draw. However, if an external DC power source is available, the Dual Zone Panel can be powered by that external 27-28 VDC source. A maximum of 3 amperes is required for the external DC power input.

2. **Wiring**
Unless otherwise specified by the authority having jurisdiction, local codes, or on the wiring diagrams supplied for the specific installation, No. 18 AWG, color coded wire is recommended for the detector circuits. Use No. 16 AWG wire for the DC power circuits, the audible alarm circuit, the release circuit, the abort circuit, and the auxiliary trouble circuit. Use No. 14 AWG wire for the AC power supply connections.

NOTE: The maximum loop resistance for each circuit is listed in Figure 5. Wires must be sized to comply with the listed maximum resistance.

Circuit	Max. Resistance (ohms)
Detector circuits	20
Audible alarm circuit	2
Release circuit	2
Abort circuit	2
Auxiliary trouble circuit	10

FIGURE 5

All low voltage wiring must meet or exceed the requirements of N.E.C. Article 725 for Class II wiring. Similarly, all 120 VAC wiring must meet or exceed N.E.C. Article 725 for Class I wiring requirements. All circuits must have a circuit number assigned and the leads must be tagged at both ends. If circuit numbers are not pre-assigned, this must be done at the time of installation.

3. **Conduit and Junction Boxes**
Install junction boxes and run conduit as dictated by the mounting location selected for each component in the fire suppression system. All wiring to, from, and between the control unit and all external components must be carried in ½ inch minimum thin wall or rigid conduit. Use the size junction box recommended by the manufacturer of the particular external component being mounted. Examples of external components are detectors, pull stations, or alarm devices.

The detector circuit wiring must be run in its own conduit separate from all other wiring. It is also recommended that all release circuit wiring be run in its own conduit separate from all other wiring.

4. **Detector Circuit Wiring**
Run all detector circuit wiring as shown on the installation wiring diagram. All detector circuit wires can be continuously supervised through either an end-of-line resistor (supplied with panel) or an end-of-line module (optional). These two methods of operation are shown in Figure 7. In order to keep supervision complete, parallel branching is not allowed. Every detector except the last detector in the circuit must have one set of incoming and one set of outgoing wires. Do not remove any factory installed jumpers or shorting straps from the detector bases at this phase of the installation. These shorting straps or jumpers can be used to aid the check out of circuit wiring.

Only detectors approved by The Ansul Company for use with the Dual Zone Panel may be used in a two-wire circuit configuration (shown in Figure 7, Zone 1). These detectors are listed in 3000 series catalog sheets. Non-powered contact closure devices, such as heat detectors or pull stations, may also be wired in a two-wire circuit configuration. When manual pull stations are to be used on an initiating circuit, the pull stations must be the first devices installed in the circuit (closest to the panel).

Other detectors may be connected to the Dual Zone Panel in a three-wire circuit configuration (shown in Figure 7 on Zone 2) if they conform to the following criteria.

A relay, which is operated when an alarm is sensed by the detector, must be installed in the base of the detector and the detector must be suited for operation from 21 VDC to 28 VDC. If the detector does not conform to the above, it may not be used with the Dual Zone Panel as damage to the detector, causing false alarms, may result. The maximum number of detectors which can be used per zone in this configuration must be determined by the formula in Figure 6.

Maximum Number of Detectors Per Zone in a Three-Wire Configuration.

$$\text{Maximum Number of Detectors} = \frac{1 \text{ ampere}}{I_a + I_r + I_l}$$

where I_a = current draw of detector when in alarm
I_r = current draw of relay in detector base
I_l = current draw of any annunciator light or other device powered by detector when in alarm

NOTE: For Ansul 1024E and PID-B detectors $I_a + I_r$ = 21mA

FIGURE 6

If a detector operated annunciator light is to be used, the detector must be wired in a three-wire configuration.

5. **Audible Alarm Circuit Wiring**
Run all audible alarm circuit wiring as shown on the installation wiring diagram. Because this is a supervised circuit, parallel branching of circuits is not allowed.

Because the audible alarm circuit is polarized and supervised, all devices connected must be polarized and polarity must be observed. If one device is installed backwards, the following will occur:

a. Device will not operate

Ansul AUTOPULSE Dual Zone Control Panel Typical Wiring Diagram

NOTES:

1. FACTORY INSTALLED JUMPER AT TB3 TERMINALS 9-10 (CIRCUIT 1) AND/OR 9-11 (CIRCUIT 2) MUST BE REMOVED IF THAT PARTICULAR AUXILIARY TROUBLE CIRCUIT IS TO BE USED. WHEN THE AUXILIARY TROUBLE CIRCUITS ARE CONNECTED TO D.C. RETURN (EITHER THROUGH FACTORY OR FIELD INSTALLED JUMPERS OR THROUGH FIELD INSTALLED CIRCUIT WIRING) NO TROUBLE IS INDICATED. WIRING DIAGRAM SHOWS IMMEDIATE DUMP MANUAL PULL STATION INSTALLED AT AUXILIARY TROUBLE CIRCUIT 2.
2. FACTORY INSTALLED JUMPER AT TB3 TERMINALS 13-14 MUST BE REMOVED IF A SYSTEM ABORT SWITCH IS USED.
3. AUDIBLE ALARM CIRCUIT IS A POLARITY REVERSAL CIRCUIT. ALL DEVICES INSTALLED ON THE CIRCUIT MUST BE POLARIZED.
4.

FUSE	CIRCUIT PROTECTED	VALUE (AMPS)
F1	+ 24 VDC POWER SUPPLY	3
F2	BATTERY CIRCUIT	3
F3	ZONE 1	1
F4	ZONE 2	1
F5	AUDIBLE ALARM CIRCUIT	1
F6	120 VAC POWER INPUT	1 SLO-BLO

NOTE: ALL FUSES TYPE 3AG OR EQUIVALENT.

5. ROTATING THE TIME DELAY ADJUSTMENT TO THE RIGHT INCREASES TIME DELAY PERIOD. ADJUSTABLE FROM 0-60 SECONDS.
6. RELAY CONTACT RATINGS (FOR PERFORMING AUXILIARY FUNCTIONS) ARE 3 AMPERES AT 24 VDC, 3 AMPERES AT 120 VAC RESISTIVE, 1/10 H.P. MAXIMUM.
7. INITIATING CIRCUITS ARE CLASS B, 24 VDC NOMINAL, 13.5 MA SUPERVISORY + 7.0 MA (DETECTION DEVICES) MAXIMUM, 120 MA ALARM MAXIMUM. 750 MA MAXIMUM FOR THREE-WIRE CIRCUITS. REGULATION: 2%; RIPPLE: 0.2 VOLTS MAXIMUM. INITIATING CIRCUITS REQUIRE DEVICES WHICH GENERATE 20 MA IN ALARM.
8. SEE PANEL PROGRAMMING SECTION OF INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, PART NO. 54668, FOR DETAILED INFORMATION.

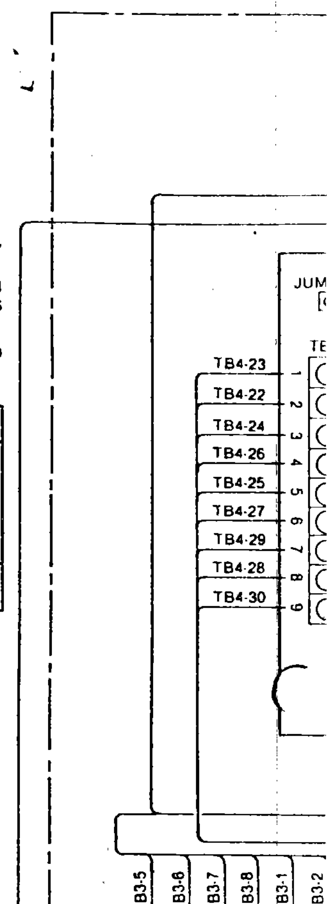
Programming Options

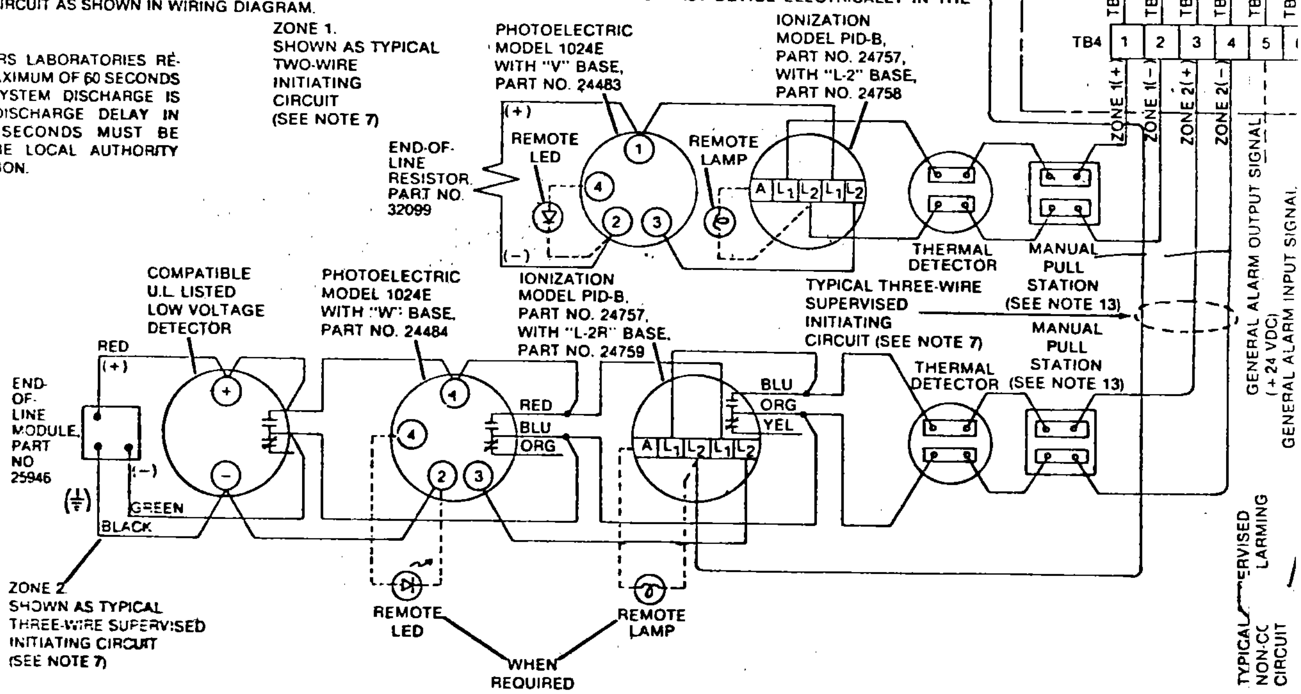
Function	Programmable Option	J1	J2	J3	J4	J5	J6
Initiating Circuit Zoning*†	Single Zone Actuation	IN	IN	IN			
	Zone 1 Priority	OUT	IN	OUT			
	Zone 2 Priority	IN	OUT	OUT			
	Cross-Zoned Actuation	IN	IN	OUT			
Time Delay After Abort*	Immediate Release Operation After Abort				OUT	IN	
	Time Delay Restart From 0 After Abort				IN	OUT	
Alarm Relay*	Alarm Relay Operation With General Alarm In						IN
	No Alarm Bell Operation With General Alarm In						OUT

*One of these options must be selected. The panel is shipped with all programming jumpers installed.
†With both jumpers J1 and J2 removed (an unauthorized combination), the release circuit will operate immediately.

9. SEE TROUBLESHOOTING SECTION OF INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, PART NO. 54668, FOR DETAILED TROUBLESHOOTING INFORMATION AT CONNECTOR "CONN. 2".
10. FRONT PANEL " SYSTEM FIRED" INDICATOR LIGHT IS NOT OPERATIVE IF A SYSTEM PRESSURE SWITCH IS NOT USED.
11. THE ANSUL DUAL ZONE PANEL IS A LOCAL CONTROL UNIT SUITABLE FOR MANUAL AND AUTOMATIC FIRE ALARM. REFER TO NFPA NO. 72A.
12. ANSUL BATTERY PACK, PART NO. 26300, CONSISTS OF 2-12 VDC 4.5 A.H. BATTERIES (GLOBE-UNION TYPE GC 1245 OR EQUIVALENT). THIS CIRCUIT IS LIMITED TO 2 AMPS MAXIMUM IN A SHORT CIRCUIT CONDITION WITH A NOMINAL CHARGING CURRENT OF APPROXIMATELY 1 MILLIAMP. TO TEST EMERGENCY STANDBY BATTERIES, DISCONNECT FROM THE SYSTEM AND MEASURE THE BATTERY TERMINAL VOLTAGE WHEN LOADED TO 100% OF ITS MARKED AMPERE-HOUR RATING (I.E., 12 VOLTS 4.5 AH BATTERIES SHOULD BE LOADED BRIEFLY WITH A 2.5 OHM 80 WATT RESISTOR). REPLACE BATTERIES IF THE TERMINAL VOLTAGE DURING TEST IS LESS THAN 90% (11 VOLTS) OF RATED.
13. WHENEVER A MANUAL PULL STATION IS USED IN THE DETECTION ZONES, IT MUST BE THE FIRST DEVICE ELECTRICALLY IN THE DETECTION CIRCUIT AS SHOWN IN WIRING DIAGRAM.

NOTE:
PER UNDERWRITERS LABORATORIES REQUIREMENTS, A MAXIMUM OF 60 SECONDS DELAY OF THE SYSTEM DISCHARGE IS ALLOWED. ANY DISCHARGE DELAY IN EXCESS OF 60 SECONDS MUST BE APPROVED BY THE LOCAL AUTHORITY HAVING JURISDICTION.





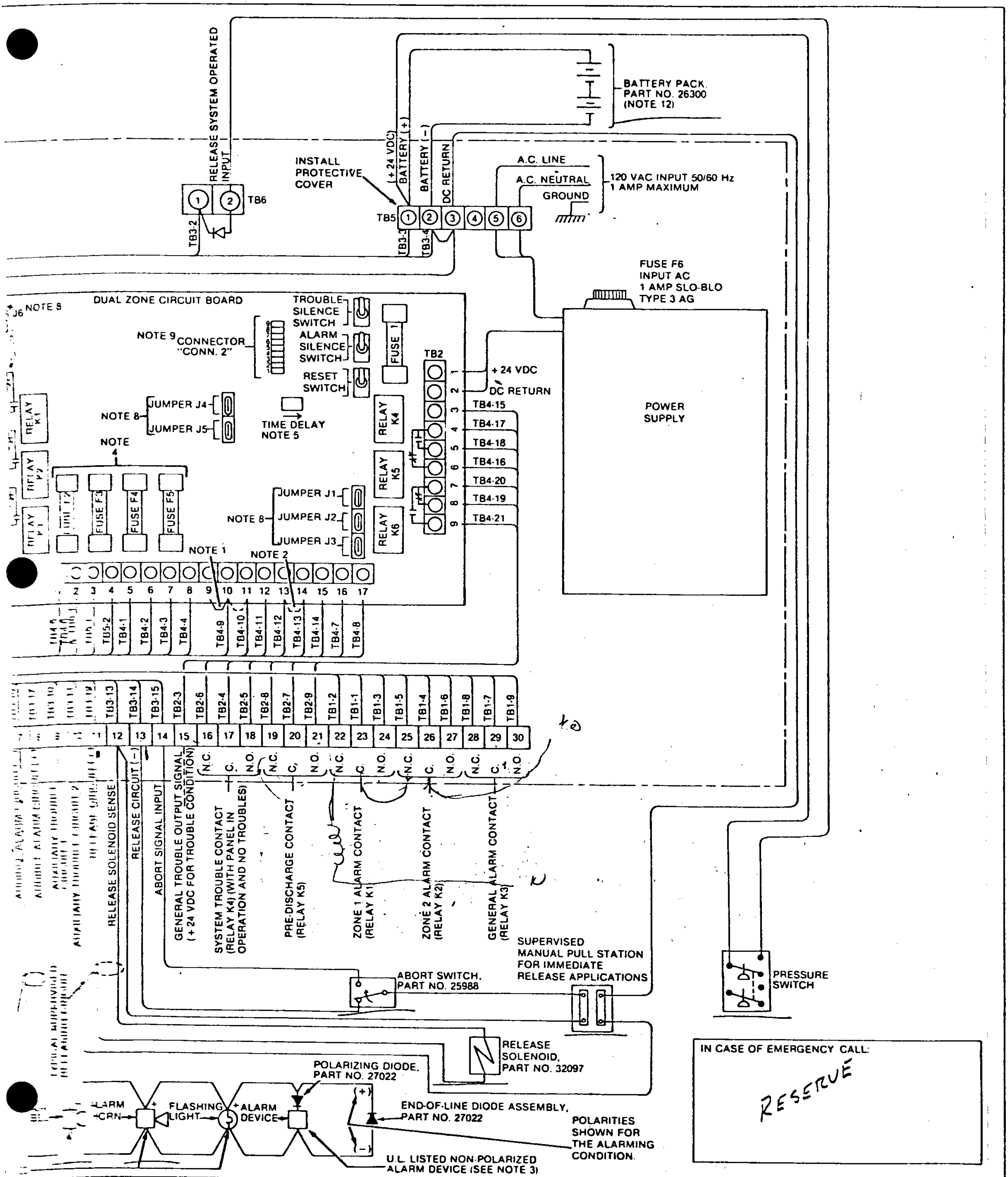

RELEASE SYSTEM OPERATED INPUT
TB6
TB3-2
INSTALL PROTECTIVE COVER
(+24 VDC) BATTERY (+)
BATTERY (−)
DC RETURN
BATTERY PACK. PART NO. 26300 (NOTE 12)
A.C. LINE
A.C. NEUTRAL
GROUND
120 VAC INPUT 50/60 Hz 1 AMP MAXIMUM
TB5
TB3-3
TB3-4
FUSE F6 INPUT AC 1 AMP SLO-BLO TYPE 3 AG
DUAL ZONE CIRCUIT BOARD
TROUBLE SILENCE SWITCH
ALARM SILENCE SWITCH
RESET SWITCH
NOTE 9 CONNECTOR "CONN. 2"
FUSE 1
TB2
+24 VDC
DC RETURN
POWER SUPPLY
NOTE 8
JUMPER J4
JUMPER J5
TIME DELAY NOTE 5
RELAY K4
RELAY K5
RELAY K6
TB4-15
TB4-17
TB4-18
TB4-16
TB4-20
TB4-19
TB4-21
NOTE 4
FUSE F3
FUSE F4
FUSE F5
JUMPER J1
JUMPER J2
JUMPER J3
NOTE 1
NOTE 2
TB5-2
TB4-1
TB4-2
TB4-3
TB4-4
TB4-9
TB4-10
TB4-11
TB4-12
TB4-13
TB4-14
TB4-7
TB4-8
TB3-13
TB3-14
TB3-15
TB2-3
TB2-6
TB2-4
TB2-5
TB2-8
TB2-7
TB2-9
TB1-2
TB1-1
TB1-3
TB1-5
TB1-4
TB1-6
TB1-8
TB1-7
TB1-9
N.C.
C.
N.O.
RELEASE SOLENOID SENSE
RELEASE CIRCUIT (−)
ABORT SIGNAL INPUT
GENERAL TROUBLE OUTPUT SIGNAL (+24 VDC FOR TROUBLE CONDITION)
SYSTEM TROUBLE CONTACT (RELAY K4) (WITH PANEL IN OPERATION AND NO TROUBLES)
PRE-DISCHARGE CONTACT (RELAY K5)
ZONE 1 ALARM CONTACT (RELAY K1)
ZONE 2 ALARM CONTACT (RELAY K2)
GENERAL ALARM CONTACT (RELAY K3)
SUPERVISED MANUAL PULL STATION FOR IMMEDIATE RELEASE APPLICATIONS
ABORT SWITCH, PART NO. 25988
PRESSURE SWITCH
RELEASE SOLENOID, PART NO. 32097
POLARIZING DIODE, PART NO. 27022
FLASHING LIGHT
ALARM DEVICE
END-OF-LINE DIODE ASSEMBLY, PART NO. 27022
POLARITIES SHOWN FOR THE ALARMING CONDITION.
U.L. LISTED NON-POLARIZED ALARM DEVICE (SEE NOTE 3)
IN CASE OF EMERGENCY CALL:
RESERVE

FIGURE 7

Audible Alarm Circuit Wiring (Continued)

b. Circuit will not be properly supervised even though no trouble will be indicated.

The polarized devices must be installed as shown in Figure 8. All non-polarized alarm devices must have an external diode installed in order to operate properly.

NOTE: The end-of-line diode, Part No. 27022, for the audible alarm circuit is provided on a 4 inch junction box cover plate and must be installed in its own box.

Audible Alarm Circuit

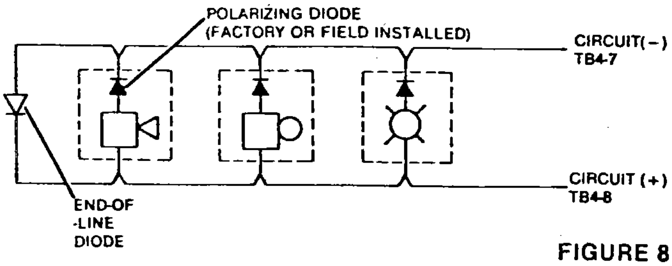


FIGURE 8

6. Release Circuit Wiring
Run all release circuit wiring as shown in the installation wiring diagram. If the optional abort circuit is used, the factory installed jumper between Terminals 13 and 14 of TB3 must be removed.

This circuit supervises the continuity of the wiring and a single 24 VDC release coil. As a result, release devices cannot be connected in parallel or supervision will not be maintained. Release devices can be connected in series, however, these devices must be able to operate at the resultant voltage level. For example, if 3 devices were to be connected, they would have to be capable of operating at 21 VDC (lowest possible output voltage) divided by the 3 devices or 7 VDC each. Typical Ansul release devices and the maximum number which can be connected in series are shown in Figure 9.

Ansul Release Devices

Release Device	Maximum No. In Series
Part No. 32353 (12 VDC Standard Electric Actuator)	2
Part No. 32097 (24 VDC Standard Electric Actuator)	1
Part No. 45531 (Electric Discharge Plug)	2
Part No. 17728 (ANSUL AUTOMAN II-C)	1

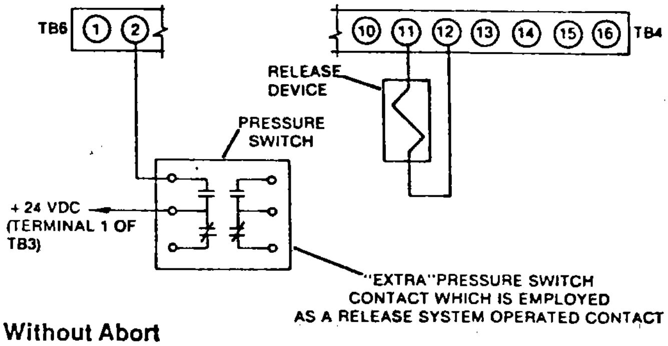
FIGURE 9

A typical wiring diagram of the release circuit with or without the abort switch circuit is shown in Figure 10.

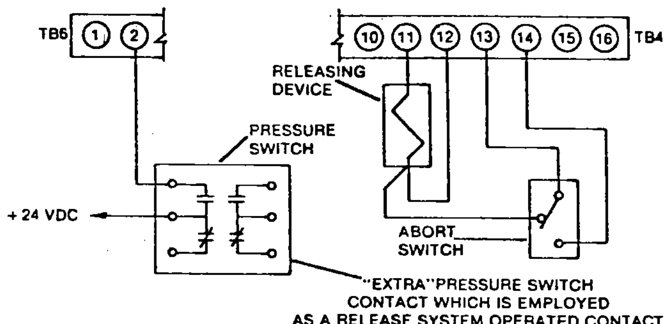
A DPDT pressure switch must be used with the Dual Zone Panel to shut down equipment and ring audible alarm devices if the system is operated manually.

7. Auxiliary Trouble Circuit Wiring
Run all auxiliary trouble circuit wires as shown on the installation wiring diagrams. If these circuits are used, the factory installed jumper across Terminals 9 to 10 and 9 to 11 of TB3 must be removed. If only one of the circuits is to be used, a jumper must be reinserted between Terminal 9 and the unused circuit (Terminal 10 or 11).

Release Circuit Wiring



Without Abort



With Abort

FIGURE 10

The auxiliary trouble circuits can be used to supervise any normally closed circuit by running a wire from Terminal 3 of TB5 thru the supervised normally closed devices back to either Terminal 9 or 10 of TB4. Common uses are critical door condition (open or closed) and remote operation status. (such as a "lockoff box").

8. Other Circuit Wiring
Run all other circuit wires as shown on the installation wiring diagrams. Connect all external circuits as shown.

9. Test of Wiring

a. All circuit wiring must be checked with an ohmmeter to ensure that no ground faults exist. Only the AC neutral and safety ground should have a ground present.

b. If an end-of-line resistor is used with the detector circuits, measure the resistance at the wire ends in the control panel. The value (1.91K) of the end-of-line resistor, Part No. 32099, should be indicated. If not, the circuit wiring is faulty. If an end-of-line module is used, the procedure does not apply and circuit continuity must be checked by shorting one lead to another at the end-of-line detector while measuring the circuit resistance

9. **Test of Wiring (Continued)**

with an ohmmeter. Be sure no power is applied to the panel when performing this check. If all wiring checks properly, connect each circuit to the proper terminals of the panel.

c. Check the audible alarm circuit by removing the end-of-line diode from the circuit, then measuring the circuit resistance with an ohmmeter. Reverse polarity of the meter and measure circuit resistance again. With polarized devices properly installed, an "infinite" reading should be found with one polarity and an approximate "short" with the other polarity. If any other readings are found, the circuit is faulty. When these readings are present, determine which meter polarity gives you a "short" and mark the circuit wires in this condition. The wire connected to the positive side of the meter should be connected to Terminal 7 of TB4 of the control panel. Reinstall the end-of-line diode. With the end-of-line diode properly installed, the circuit should measure as shorted in both polarities of the meter. If the wiring checks properly, connect to the proper terminals in the panel.

d. Check all other circuits to be sure proper continuity is present.

10. **Panel Programming**
The Ansul System Representative will now properly "set up" the system for use. The programming jumper locations are shown in Figure 11.

The programming options and how to obtain them are shown in Figure 12.

Programming Jumper Location

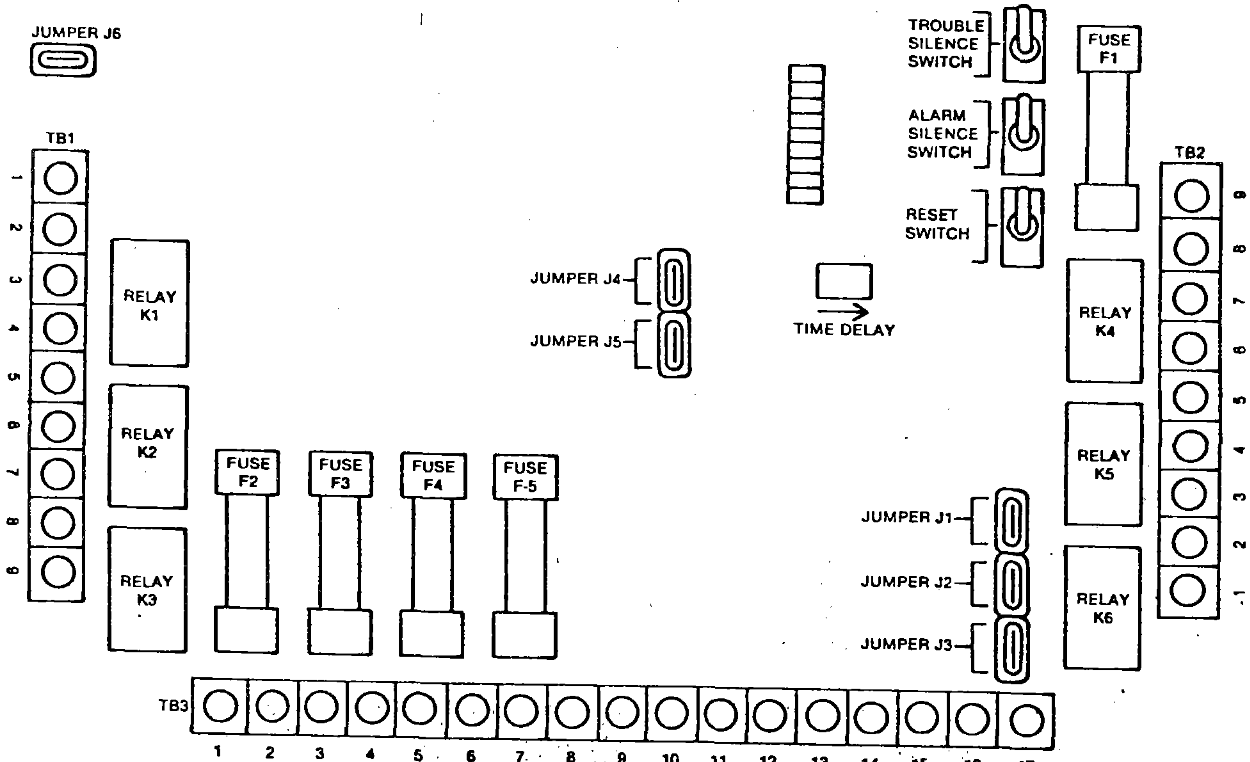


FIGURE 11

Programming Options

Function	Programmable Operation	J1	J2	J3	J4	J5	J6
Initiating Circuit Zoning*†	Single Zone Actuation	IN	IN	IN			
	Zone 1 Priority	OUT	IN	OUT			
	Zone 2 Priority	IN	OUT	OUT			
	Cross-Zoned Actuation	IN	IN	OUT			
Time Delay After Abort*	Immediate Release Operation After Abort				OUT	IN	
	Time Delay Restart From 0 After Abort				IN	OUT	
Alarm Relay*	Alarm Relay Operation With General Alarm In						IN
	No Alarm Bell Operation With General Alarm In						OUT

*One of these options must be selected. The panel is shipped with all programming jumpers installed.
†With both jumpers J1 and J2 removed (an unauthorized combination), the release circuit will operate immediately.

FIGURE 12

CHECKING SYSTEM OPERATION

WARNING: It is essential that prior to applying power to the Ansul Dual Zone Panel, the wiring tests described in the Installation Section of this manual be performed completely. Even though all circuits are fused, improperly wired circuits not only make installation checkout more difficult but can permanently damage electronics in the Ansul Dual Zone Panel. It is also necessary that the releasing device be disconnected from the suppression system to prevent accidental discharge during checkout. If the release device is a continuous duty, self-restoring device, such as the Ansul standard electric actuator or ANSUL AUTOMAN II-C, the device need only be mechanically or pneumatically isolated from the suppression system and the device may be electrically operated during checkout thereby ensuring proper device operation. If, however, the release device is of a non-repeatable type, such as the Ansul discharge plug, the device must be both mechanically disconnected from the suppression system and electrically disconnected from the Ansul Dual Zone Panel. For non-self-restoring releasing devices, a test light of the same operational voltage as the release device must be installed in the electrical system in place of the release device to enable proper system checkout.

After complying with the above, proceed to the following steps:

1. With all switches in the normal position, apply power to Ansul Dual Zone Panel. There should be no alarm, no trouble, and the release device should not operate. If one of these does occur, refer to the Trouble Shooting Section of this manual. The only LED light which should be illuminated is the green "Power" light.
2. Supervision Check – Induce the following troubles, one at a time, at the proper terminal strip in the Dual Zone Panel. With the panel in a normal condition (no troubles or alarms and switches in normal position) the trouble LED light and the audible trouble signal should be operated as each trouble is induced in the panel. As each trouble is verified, reconnect the disconnected lead to restore a normal condition.
   a. Remove one Zone 1 lead at terminal strip TB4, either Terminal 1 or 2.
   b. Remove one Zone 2 lead at terminal strip TB4, either Terminal 3 or 4.
   c. Remove one audible alarm circuit lead at terminal strip TB4, either Terminal 7 or 8.
   d. Remove one release solenoid lead at terminal strip TB4, either Terminal 11 or 12. If the abort option is being used, the leads should also be removed from Terminals 13 and 14 of TB4 one at a time to verify proper supervision.

      If the auxiliary trouble circuits (one or both) are used, remove the leads from terminal strip TB4 Terminals 9 and 10 one at a time to verify proper supervision.
   e. To check emergency batteries, remove primary AC input power from the power supply.

   If the general trouble output signal at terminal strip TB4 Terminal 15 is being used, induce a trouble in the panel by placing the trouble silent switch in the silence position (down) and verify that the desired external operation occurs.

   Verify that the trouble LED light is illuminated if the trouble silence switch is in the silence position (down).

   Verify that a trouble condition is generated when the alarm silence switch is in the silence position (down).

   Be sure panel has been restored to a normal condition before proceeding to the next check (all switches up and no troubles).
3. Audible Alarm Circuit Check – to test the audible alarm circuit disconnect any leads connected to Terminal 6 of terminal strip TB4. Then jumper Terminals 1 and 6 of terminal strip TB4. An alarm condition should be generated and all devices connected to the audible alarm circuit (Terminals 7 and 8 of terminal strip TB4) should operate.

   Verify that operation of the alarm silence switch shuts the devices off. Be sure a normal condition (remove jumper installed above and replace wire removed from TB4-6) is restored before continuing to the next check.
4. Detection Circuit Check – Each detector and manual pull station connected to the detection circuits (zones) should be activated one at a time to ensure proper operation. If a detector is supplied with an alarm lamp, it should be checked to ensure proper operation. The detection circuit alarm LED lights should be checked to ensure proper operation. The control unit must be reset after each detector and manual pull is operated. Verify that the proper zone alarm relay and the general alarm relay operate.
5. Release Circuit Check – If the unit is programmed for Single Zone Actuation, activate a detector on both zones and verify that either zone will operate the release circuit. (The pre-discharge LED light and relay should operate as the release circuit time delay is started.) If the unit is programmed for Zone 1 or Zone 2 Priority Actuation, verify that the priority relationship exists. (One zone alarm only, other zone operates release circuit always.) If the unit is programmed for Cross-Zone Actuation, verify that both zones alarm before the release circuit is operated.

   At this point, the release circuit should be adjusted for the desired time delay. Figure 13 shows the location of time delay adjustment potentiometer.

   The potentiometer should be adjusted for the desired delay between the pre-discharge LED light operation (verifys beginning of time delay) and the operation of the release device. If the release device is of the non-repeatable type as described earlier, the test lamp should light when the release would normally operate.

   After verifying proper operation of the release circuit under normal conditions, the abort circuit (if used) should now be checked. Alarm the release circuit to begin time delay and verify that operation of the abort switch causes the release operation to be prevented. Then check for the proper operation after removing the abort condition. If the panel is programmed to fire immediately after the abort, the release device should be operated immediately; if the panel is programmed

Checking System Operation (Continued)

to restart the time delay cycle, the release device should not be fired until completion of the complete time delay period.

If a manual pull station is connected to the panel and is intended to cause immediate operation of the release circuit, its operation should now be checked. Activate the manual pull station and immediate operation of the release device should occur. The system pressure switch will activate the audible alarm circuit when the release device is properly installed. However, without its operation, the manual pull station will only cause operation of the release device and a trouble signal will be generated. The trouble signal will be present until the pull station is reset.

Manually operate the pressure switch and verify that the audible alarm circuit operates. If the panel is programmed for general alarm relay operation with a general alarm input (programming jumper J6 installed), the relay should also operate but if not (programming jumper J6 removed), the relay should not operate. Verify that any external equipment connected to the pressure switch is operated.

Restore the panel to a normal condition.

6. General Alarm Output and Input Check – Activate a detector and verify that any device connected to the general alarm output (Terminal 5 of TB4) is operated. Reset the panel and operate any device connected to the general alarm input (Terminal 6 of TB4) and verify operation of the audible alarm circuit, and, depending on programming, of the general alarm relay.
7. Other Circuit Check – Check to ensure that all equipment connected to the alarm relays or trouble relay is operated when that alarm or trouble condition is present. For proper operating sequence, refer to Figure 2.
8. Set in Service – Reset panel to normal supervisory position. Reconnect the release device (both electrically and mechanically) to the suppression system. Reconnect any other circuits which may have been disconnected to enable system checkout.

Time Delay Location

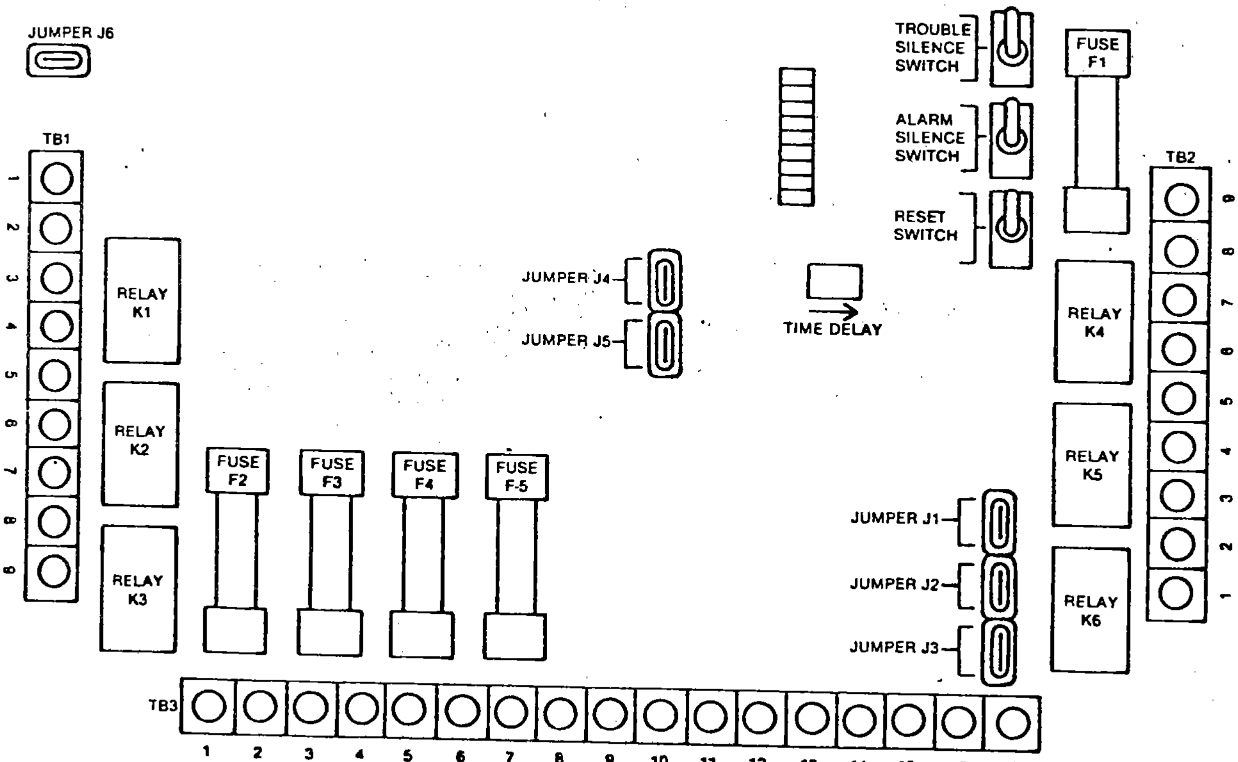


FIGURE 13

TROUBLE SHOOTING

The trouble LED light and buzzer are activated when a trouble condition is indicated by the Ansul Dual Zone Panel. Flip the trouble silence switch to the silence position (down) and call your authorized Ansul Systems Representative. The trouble should be isolated and corrected immediately.

A DC voltmeter will be required to determine the trouble source. By reading the voltage between pin 9 (D.C. return) of Connector 2 and all other pins (D.C. high) of Connector 2, it is possible to determine which circuit is the source of the trouble. Figure 14 below shows the location of Connector 2 and how the contacts are arranged. Figure 15 illustrates pin voltage reading in both normal and alarm. Possible causes of trouble on a circuit and possible corrective actions to solve the problem are shown in Figure 16.

Connector 2

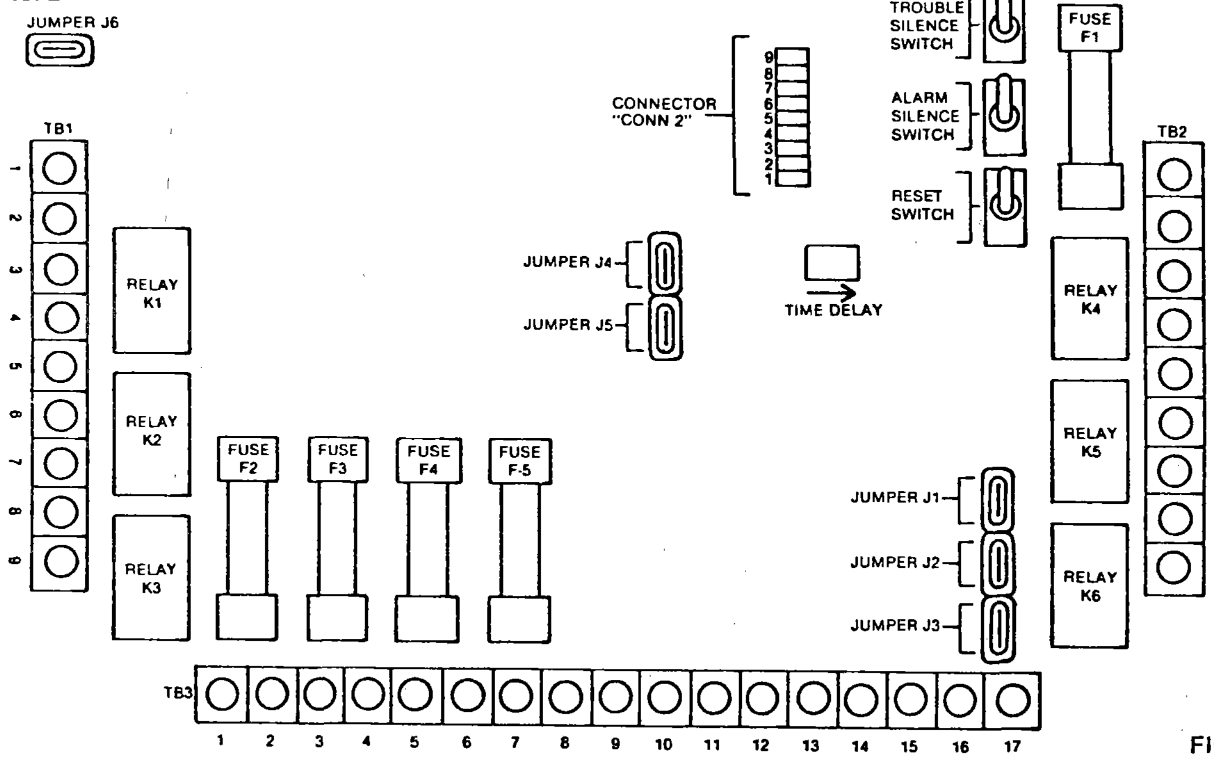


FIGURE 14

Trouble Isolation Chart

Pin No.	Normal Voltage	Trouble Voltage	Affected Circuit
1	21-28 VDC	*0 VDC	Mains Power Source
2	0 VDC	5-7 VDC	Audible Alarm Circuit
3	0 VDC	5-7 VDC	Zone 1
4	0 VDC	5-7 VDC	Zone 2
5	0 VDC	5-7 VDC	Auxiliary Trouble CKT 2
6	0 VDC	5-7 VDC	Auxiliary Trouble CKT 1
7	0 VDC	5-7 VDC	Release Circuit (optional abort circuit)
8	0 VDC	5-7 VDC	Release Circuit (release device)

*The system will shut down upon mains power failure and no audible trouble will be issued, however, the "power" light will be extinguished giving visual indication of power failure and the system will operate from the emergency batteries.

FIGURE 15

Trouble Correction Chart

Trouble Source	Possible Problem	Corrective Action
Main Power	1. Loss of 120 VAC to power supply.	Locate power panel, check for shorts or cause of power loss and restore to normal.
	2. Improperly connected power supply.	Check to ensure that D.C. power leads have not been reversed.
	3. Blown fuse in F6.	Check for shorts or defective power supply. Replace fuse.

Trouble Correction Chart (Continued)

Trouble Source	Possible Problem	Corrective Action
Main Power (Continued)	4. Blown fuse F1.	Check for short in main power supply lead. Correct and replace fuse. F1. Check for short in external devices using system power. Check for short in bell loop at release circuit. Check for proper current draw from power supply. Maximum output is 2.3 amperes.
Audible Alarm Circuit	1. Open circuit in alarm bell circuit.	Check for loose or broken wiring at control unit or alarm bells.
	2. Improperly connected or defective end-of-line diode.	Check for proper polarity of diode connection or defective diode. If defective, replace diode.
	3. Shorted alarm bell circuit wiring.	Repair any shorted wiring. Replace fuse F5.
	4. Improperly connected or defective alarm bell.	Check for proper polarity of alarm bell connections or defective alarm bell. Replace any defective components.
	5. Blown fuse F5.	Check for defective or improperly connected end-of-line diode and alarm devices. Check for shorted wiring in alarm bell circuit. Check for improper current draw by a device installed on circuit. Maximum output is .75 ampere.
	6. Defective Dual Zone Circuit Board.	Check end-of-line diode. If good, install properly across Terminals 7 and 8 of TB4. If trouble condition is still present, replace circuit board.
Zone 1 Circuit or Zone 2 Circuit	1. Open circuit in detector circuit.	Check for loose or broken wiring at control unit or detector bases.
	2. Defective or improperly connected end-of-line module or resistor.	Check for proper connection of module or resistor at end-of-line and replace defective components.
	3. Defective or improperly connected detector.	Check for proper connection and operation of detector.
	4. Blown fuse (F3 or F4)	Check for shorted or improperly connected wiring. Repair and replace fuse.
	5. Defective Dual Zone Circuit Board.	Check end-of-line device. If good, install properly on zone output terminals. If trouble condition is still present, replace circuit board.
Auxiliary Trouble Circuit 1 or 2	1. Loose jumper (if not used for external supervision).	Check to ensure jumper is properly installed across Terminals 9, 10, and 11 of TB3.
	2. Open in external circuit wiring.	If used for external supervision, there should be continuity between both Terminals 10 and 11 of TB3 to Terminal 9 of TB3. Check to ensure continuity exists.
	3. Defective Dual Zone Circuit Board.	If jumpers are in place and not loose and trouble is still present, circuit is defective, replace.
Release Circuit	1. Open in circuit.	Check to ensure there is continuity in the release circuit wiring. If an abort circuit is not used, there must be continuity between Terminals 12 and 13 of TB4 and the jumper between 13 and 14 on TB3 must be present and properly connected. If an abort circuit is used, there must be continuity between Terminals 12 and 13 of TB4

FIGURE 16

MAINTENANCE

Most authorities having jurisdiction recommend at least annual inspection and service of any fire protection equipment. To ensure proper and reliable operation, Ansul requires the following inspecting and testing procedures.

Semi-Annual

1. Disconnect release device from suppression system. If possible, leave installed in electrical system while disconnected from suppression system. If not possible, replace with test lamp. (Refer to Page 21, Checking System Operation, for more information.)
2. Activate at least one detector or manual pull station in each zone to ensure that the proper functions take place. All alarm devices, release device or test lamp, etc., should operate and any external equipment operation (i.e. fan or computer shut-down) should take place.
3. Manually operate pressure switch in release system and check for proper operation. Alarm devices should operate and external equipment operations should occur.
4. Inspect all detectors and manual pull stations for dirt and dust accumulations, damage, or anything else which may affect their operation.
5. Reset panel to normal supervisory condition. Reconnect releasing device to suppression system and reconnect any other circuits which may have been disconnected to allow system maintenance checkout.

10.1.3 Foam System

A foam fire protection system is used for the thermal storage unit and the thermal storage skid assembly area. The following pages of this section contain the available information for the foam system control panel, ultraviolet fire detectors, signal horns, and the foam tank.

ED THOMPSON
Engineering Supervisor

Fire Protection Systems
Contractor's License #304757

F.M. CHEMICAL CO. INC.
1114 E. Emporia Ave. • Ontario, CA 91761 • (714) 983-9551

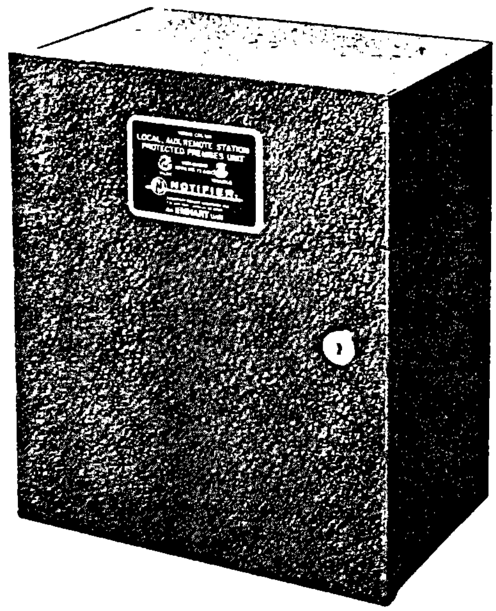
NOTIFIER®

INSTRUCTION MANUAL

CRL-124

CONTROL PANEL

DETECTION
SYSTEM CP9-95



CRL-124

Table of Contents

SECTION 1 INTRODUCTION

1.1 GENERAL

The CRL-124 is a single zone alarm detection and non-coded alarm signaling panel in compliance with NFPA-72A Local Protective Signaling Systems specifications, NFPA-72B Auxiliary Protective Signaling Systems specifications and NFPA-72C Remote Station Signaling Systems specifications to provide flexibility for single zone applications.

The CRL-124 is designed to operate Notifier products of combustion detectors as well as other automatic or manually initiated devices.

1.2 FEATURES

- Two Wire Smoke Detector Compatable
- Locking Class "B" Signaling Initiating Circuit
- Supervised Alarm Circuit
- Power Supply Supervision
- Integral Charging Circuit for Gelled Electrolyte Emergency Batteries
- Supervision of Products of Combustion Detector Power Circuit
- Supervised Reverse Polarity Transmission to Remote Receiving Station
- Visual Annunciators for Power Pilot and Common Trouble
- Auxiliary SPDT Contacts for Alarm
- Circuit Breaker Protection for Power Circuits
- Functional Circuits on One Circuit Board
- Completely Self Contained Unit
- Space provided for Gelled Electrolyte Batteries
- Underwriters Laboratory Listed
- Trouble Buzzer
- Optional Second Reverse Polarity Transmitter
- Transient Protected
- Alarm (4.7K) and Initiating (10K) Loop Test Resistors are Provided for Bench Testing Circuits

1.3 SPECIFICATIONS

Electrical

Input Power .... 120 V 60 Hz, 0.45 Amp Max.
Derate 10% for 50 Hz

Reverse Polarity
Transmitter .... 24 Vdc, 24 mA Max.

Audible Trouble Signal .... 24 Vdc, 60 mA Max.

Products of Combustion Detector
Power .... 24 Vdc, .75 mA Max. Normal
24 Vdc, 85 mA Max. Alarm

Emergency Battery .... 24 Vdc, 4.5 AH

Charging Current .... 320 mA Max.

Alarm Current Output .... 24 Vdc, 1 amp Max.

Products of Combustion Detector Loop
Loop Length .... 1000 ft. with 18 AWG. Wire

Non-Powered Detector Loop
Loop Resistance .... 500 ohms Max.

Polarized Alarm Loop .... 24 Vdc, 1 amp. Max.

Auxiliary Alarm Contacts (SPDT) 120 Vac, 1 amp.
24 Vdc, 2 amp.

1.4 APPLICATION

The CRL-124 finds application in most situations where single zone protection is required. The CRL-124 can be used with a variety of powered and automatic initiating devices such as ionization detectors, optical density smoke detectors, heat detectors, manual pull stations, and water flow detectors. Configurations can also consist of a mixture of the above devices.

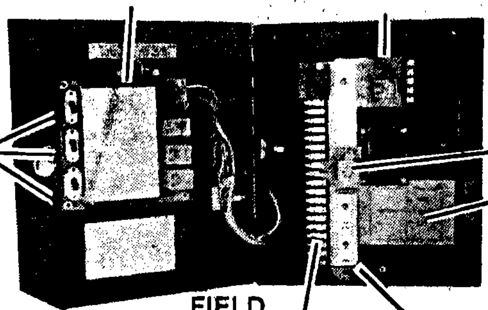


Figure 1 CRL-124-SP Internal View

1.4.1 AUXILIARY REVERSE POLARITY TRANSMITTER MODULE (SP-124)

This circuit is provided as an option for use with Notifier NGV or NIP Indicator Valve assemblies. The module provides supervision of a normally closed switch on a valve indicator assembly. Should the switch open, the reverse polarity section of the module will actuate and send the signal over a pair of leased telephone lines to a remote receiving station. In addition, a signal will cause the panel to go into the trouble condition status.

The module mounts to the power supply chassis by removing the upper nut from the chassis (see figure 1) and placing the module on the threaded stud and securing with the same nut. Wiring to the control panel is done by connecting the attached red lead to terminal 18 and the black lead to 19 of the 21 point terminal strip. A jumper must also be connected between terminal 5 of the module and terminal 16 on the strip. This applies 24 Vdc to the common trouble circuit when a trouble is detected on the supervised loop.

A detailed wiring diagram is provided depicting the above described wiring requirements.

1.5 OPERATION

Operation of the CRL-124 is controlled by three switches, RESET, ALARM SILENCE, and TROUBLE SILENCE with two light emitting diodes (LED's) for status annunciation. An amber LED lights when an alarm or trouble condition is detected in the system and a green LED is used as main power pilot.

Alarm Condition — When an alarm condition is detected, the alarm devices on the alarm circuit will sound, the condition will be transmitted via a reverse polarity transmitter to the designated receiver panel, and the auxiliary alarm contacts will actuate. Placing the ALARM SILENCE switch in the SILENCE position silences the alarm devices and activates the trouble LED. Resetting the system after an alarm requires activating the RESET switch and returning the ALARM SILENCE SWITCH to NORMAL.

There are two removable jumpers on the circuit board that affect the following functions:

J1 — Remove except when using non-powered detectors.

J2 — Remove for silenceable alarm operation. With J2 installed, alarm devices can not be silenced with the silence switch. This is a U.L. requirement when monitoring sprinkler systems.

Trouble Condition — Trouble conditions are initiated by loss of main power or faults on any of the supervised circuits. A loss of main power will extinguish the green pilot LED, light the amber LED and sound the common trouble signal, and transmit the trouble signal via reverse polarity transmitter to a remote receiver panel. The TROUBLE SILENCE SWITCH in SILENCE position silences the signal but the trouble LED remains lit. If a power failure caused the trouble, the green PILOT will relight automatically when power is restored, but TROUBLE LED will remain on until TROUBLE SILENCE SWITCH is returned to NORMAL.

1.6 FIELD WIRING

Knock outs are provided at the top, and both sides for conduit couplings to accommodate wire entry. One terminal strip provides connections for 120 Vac, emergency batteries, and all external device wiring.

NOTE

A semi-flush mounting plate is available when semi-flush installation is required. Plate is 13"x15" and secures to cabinet with screws.

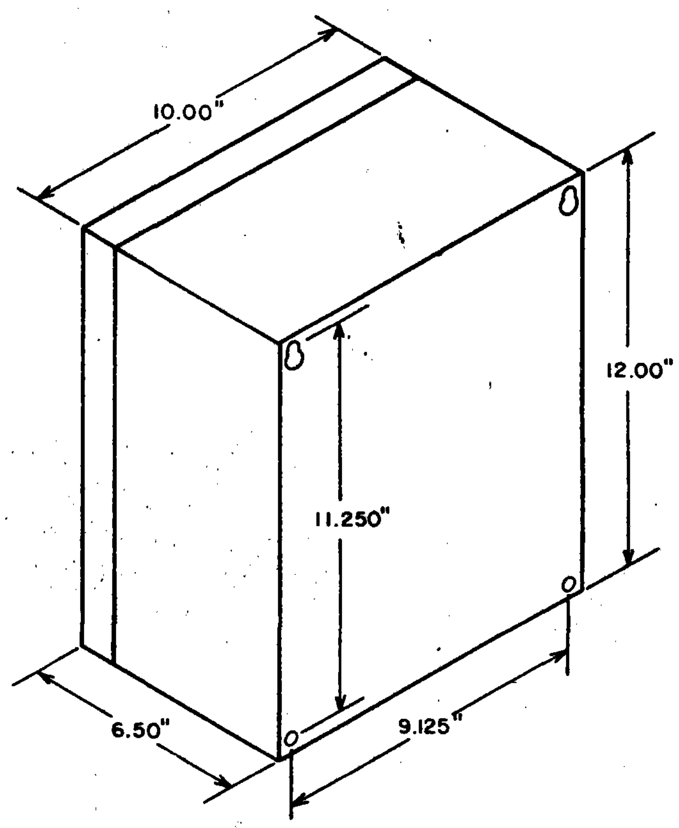


Figure 2 CRL-124 Mounting and Outline Dimensions

SECTION 2 CRL-124 WIRING SPECIFICATIONS

All wiring shall be in accordance with the National Electrical Code and the local code having jurisdiction. Minimum wire size shall be 14 AWG for ac power connections, 16 AWG for audible circuits, and 18 AWG for signal initiating circuits. Typical diagrams are provided as a guide in device wiring.

2.1 AC POWER

Power connections are made at TB1-1, 2, and 3. TB1-1 should be connected to the building electrical ground. TB1-2 (neutral) and 3 (hot) are 120 Vac 60 Hz 0.45 amp rated.

AUXILIARY ALARM CONTACTS

A set of SPDT dry contacts are provided on TB1-4 (N/O), 5 (N/C), and 6 (common) which are rated at 120 Vac, 1 amp, or 24 Vdc, 2 amp. Contacts are actuated upon receipt of an alarm signal. Functions requiring activating or deactivated during an alarm condition may be controlled with these contacts. Twenty-four volt dc panel power is available for use with these contacts on terminals TB1-17, 18, and 19. Terminal 19 is common, 17 provides 24 Vdc on main power only, 18 provides 24 Vdc on main power and emergency battery power. The current available on these terminals, when in alarm condition, is contingent on other devices utilizing 24 Vdc during alarm. Maximum current output from the panel while in an alarm condition is 1 ampere.

2.2 REVERSE POLARITY TRANSMITTER

When trouble and alarm signals are to be transmitted to a fire station or other receiving station, TB1-7 and 8 provide reverse polarity signaling via leased telephone lines. Terminal 7 is negative (—) and 8 positive (+) during normal operation and reverse when an alarm condition is detected. A trouble condition is transmitted as zero volt output. Output is rated 24 Vdc at 0.024 amp maximum. Receiver panel must be compatible with this transmitter. A second transmitter is optional.

2.3 POLARIZED ALARM LOOP

Only polarized devices can be used on this loop in order to maintain circuit supervision. This line can be loaded to 1 amp IF there is no load on TB1-7 and 8, and 17 and 18. If there is a load on any of these terminals that amount of current used in an alarm condition must be subtracted from the 1 amp that would be available for alarm devices connected to TB1-9 (—) and 10 (+). To determine the loop load, multiply the number of like devices to be used by the current rating of the device. If devices of different current ratings are used they should be added.

The end-of-line resistor shall be 4.7K, 10 percent, one-half watt.

A diagram is provided showing connections of the alarm loop to a local energy trip, municipal master box. In this configuration current available to sound alarm devices is reduced to 0.75 amp.

2.4 COMMON TROUBLE AUDIBLE DEVICE

A common trouble audible device rated at 24 Vdc, 60 mA maximum is connected to TB1-11 and 12. This circuit is not supervised.

2.5 SUPERVISED SIGNAL INITIATING CIRCUIT

Diagrams are provided depicting various configurations of devices connected to this circuit (TB1-13 and 15). When using non-powered devices, the loop resistance should not exceed 1,500 ohms. This is measured at the panel and a short placed across the last device on the loop. End-of-line resistor shall be 10K, 10 percent, one-half watt.

2.6 AUXILIARY 24 VDC OUTPUT

Terminal 17 provides 24 Vdc output on main power operations only. Terminal 18 provides power on main power and standby with terminal 19 common to both. The current available is dependent on the load on terminals 7 and 8, and 9 and 10. Again the total load shall not exceed 1 amp.

2.7 AUXILIARY BATTERY CONNECTIONS

Emergency batteries connect to TB1-20 (—) and 21 (+). A diagram is attached within the cabinet showing proper connections.

2.8 TERMINAL STRIP IDENTIFICATION

(1) CHASSIS GROUND

(2) N, (3) H — PANEL POWER
120 Vac, 60 Hz
0.45 A. MAX. NOTE 1 NOTE 3

(4) N.O., (5) N.C., (6) C — AUX. ALARM RELAY CONTACTS
(DRY CONTACTS)
1 A. MAX. @ 120 Vac
2 A. MAX. @ 24 Vdc
CONTACT RATING ONLY NOTE 1 NOTE 2

(7) −, (8) + — REVERSE POLARITY TRANSMITTER
("NORMAL" POLARITY SHOWN)
24 Vdc NOMINAL, 0.024 A. MAX.
SUPERVISED CIRCUIT NOTE 1

(9) −, (10) + — POLARIZED ALARM OUTPUT
("NORMAL" POLARITY SHOWN)
24 Vdc NOMINAL, 1.0 A. MAX.
SUPERVISED CIRCUIT NOTE 1

(11) −, (12) + — TROUBLE BUZZER/BELL OUTPUT
24 Vdc NOMINAL, 0.060 A. MAX.

(13) +, (14) −, (15) − — SIGNAL INITIATING DEVICES
POWERED DEVICES
(TWO-WIRE SMOKE DET.)
NON-POWERED DEVICES
(4-WIRE, SMOKE DET. , PULL STA., ETC.)
SUPERVISED CIRCUIT

(16) + AUX. TROUBLE INPUT (48 Vdc MAX.)

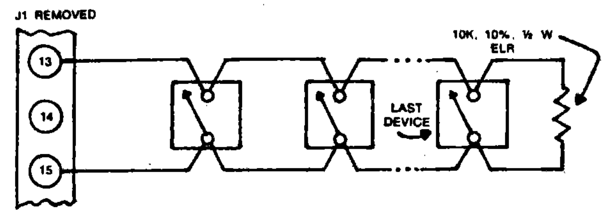
(17) +VF1, (18) +VF2, (19) −COM — LOW VOLTAGE D.C. POWER OUT
(24 V NOMINAL, F.W.R., 1.0 A. MAX.)
VF2 IS BACKED UP BY BATTERY
POWER (IF BATTERY IS INSTALLED),
VF1 IS NOT.

(20) −, (21) + — EMERGENCY BATTERY INPUT
TWO 4.5 AH, 12 V GELLED ELECTRO-
LYTE BATTERIES SERIES CONNECTED.
MAX. CHARGING CURRENT: 0.32 A.

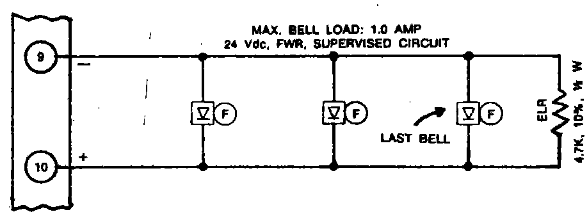
NOTES:

1. Total load current must not exceed 1.0 amp @ 24V if supplied from the panel. Greater load currents must be supplied from a separate power source.
2. Intended for connection to polarity reversal circuit of a remote station receiving unit having compatible ratings.
3. The 2.0A @ 24 Vdc rating of the aux. alarm relay contacts indicates their power handling capability and should not be mistaken as additional power available from the panel.

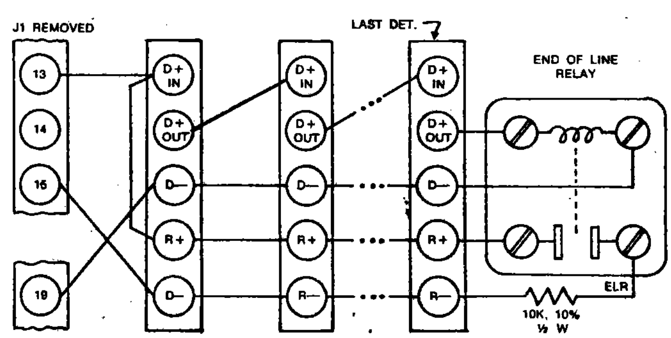
2.9 WIRING DIAGRAMS



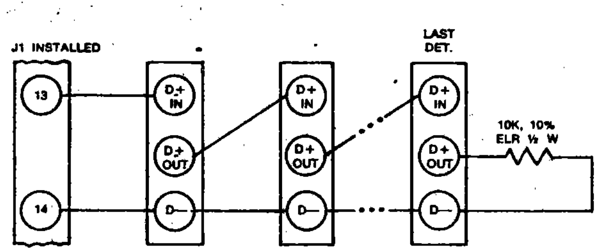
NON-POWERED, NORM. OPEN, INITIATING DEVICE CONNECTION



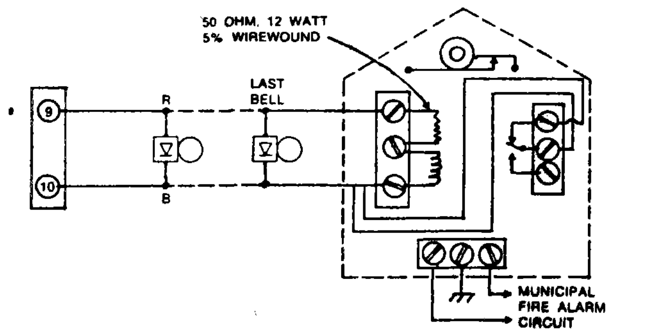
POLARIZED BELL CONNECTION



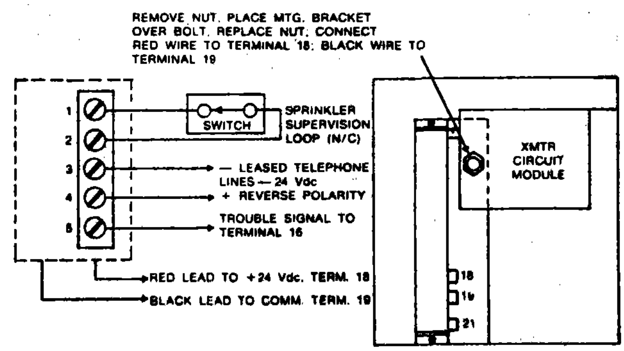
FOUR-WIRE SMOKE DETECTOR (NK-24) CONNECTION



TWO-WIRE SMOKE DETECTOR CONNECTION



LOCAL ENERGY TRIP, MUNICIPAL MASTER BOX



AUX. REVERSE POLARITY INSTALLATION

NOTES:

1. With this arrangement maximum current available (less municipal load) is 0.75 amp from CRL-124.
2. Use only on polarized loop.
3. Maximum loop resistance is 30 ohms.
4. Not for Factory Mutual Installations.

SECTION 3 CRL-124 POST INSTALLATION TEST

3.1 PRELIMINARY TEST

Upon completion of field wiring and power applied, the panel should be in a normal condition with only the green PILOT LED lit. Check 24 Vdc at TB1-7 (—) and 8 (+). This ensures that the power supply is operating and the alarm relay is not actuated.

3.2 POWER FAIL TEST

Depress ac circuit breaker and hold. Green PILOT should extinguish; yellow TROUBLE LED will light. External trouble device will be actuated, and the voltage at TB1-7 and 8 will fall to zero. The external trouble audible device may be silenced by placing the TROUBLE SILENCE SWITCH in the silence position. When power is reconnected (release circuit breaker), the trouble will not clear unless the TROUBLE SILENCE SWITCH is returned to NORMAL.

3.3 ALARM TEST

With the trouble cleared and jumper J3 installed on circuit board, cause an alarm condition by momentarily putting a 1.5K resistor across terminals TB1-13 and 14. With the panel now in the alarm condition, the yellow TROUBLE LED will light, the voltage on the reverse polarity output (TB1-7 and 8) will reverse, the alarm and remote trouble devices will actuate. The alarm may be silenced by placing the ALARM SILENCE SWITCH in the SILENCE position and then reset by operating the system RESET SWITCH. However, the trouble will not be cleared until the ALARM SILENCE SWITCH is returned to NORMAL.

3.4 TROUBLE TESTS

Loop trouble is inserted by disconnecting the lead on TB1-13 (signal initiating circuit). The trouble will be indicated by the yellow TROUBLE LED lighting and the trouble buzzer sounding. The trouble buzzer may be silenced by placing the TROUBLE SILENCE SWITCH in the SILENCE position. However, the trouble condition will remain in the panel even if the loop is restored to NORMAL, unless the TROUBLE SILENCE SWITCH is returned to the NORMAL position. Reverse polarity output on TB1-7 and 8 is zero for any trouble condition.

A trouble is inserted on the alarm device loop (TB1-9 and 10) by disconnecting one of the leads. This trouble will give the same indications just described and is silenced and restored in the same manner as described for signal initiating loop trouble.

If either the ALARM SILENCE SWITCH or the TROUBLE SILENCE SWITCH is left in the SILENCE position, a trouble condition will exist in the panel, indicated by the yellow TROUBLE LED and zero voltage on the reverse polarity output. This holds true even if the conditions causing the original alarm or trouble have been removed. This prevents accidentally disabling the audible alarm and trouble devices after alarm is reset.

3.5 AUXILIARY ALARM CONTACTS

These contacts actuate upon receipt of an alarm condition, which causes TB1-4 and 6 to be closed and TB1-5 and 6 to be open while actuated. Contacts will remain actuated until panel is reset.

SECTION 4 OPERATING AND INITIATING DEVICE TEST PROCEDURES

4.1 GENERAL

These procedures are a guide in the operation and testing of the CRL-124 Control Panel. Personnel who are responsible for its operation should become familiar with the panel and all the detectors and alarm devices it controls. Installations vary from site to site, therefore it is necessary for the operator to know what is expected of his system and apply these procedures accordingly. If there is any doubt about the operation of your system, contact your Notifier distributor for assistance.

4.2 OPERATION

4.2.1 Alarm Condition When an alarm condition is detected, the panel will respond by sounding the common trouble device, alarm devices, and lighting the common TROUBLE LED. If your panel is wired for remote transmission to local fire department, or other receiving agency, they will automatically be notified.

The first consideration when an alarm condition is reported should be to check the protected area to ensure the validity of the alarm and to follow all predetermined instructions pertaining to fire conditions. If the system is not wired to a local fire department and the condition warrants their aid, call them immediately.

To silence the system, unlock the panel and place the ALARM SILENCE and TROUBLE SILENCE switches in the SILENCE position. This will silence the alarm devices and the common trouble device. If waterflow switches are used on the detector circuit, the alarm bells will continue to ring until the water sprinkler is turned off (J2 installed) and the SYSTEM RESET switch moved to the RESET position. Returning the system to NORMAL operation after an alarm condition requires that the device in alarm first be (manually or automatically) returned to normal, the SYSTEM RESET SWITCH moved to RESET, the ALARM SILENCE SWITCH placed in the NORMAL position and the TROUBLE SILENCE SWITCH placed in NORMAL.

Failure to place the ALARM SILENCE SWITCH back to NORMAL will resound the trouble device and the TROUBLE LED will remain lit when the TROUBLE SILENCE SWITCH is returned to NORMAL.

4.2.2 Trouble Condition Trouble conditions are caused by opens or an increase to 20K ohms in loop resistance on any of the supervised circuits and a loss of main operating power. When a trouble is detected on a supervised circuit, the trouble device will sound and the amber common TROUBLE LED will light. If the system is wired for transmission of trouble conditions, the trouble will also be annunciated at the receiver station. Placing the TROUBLE SILENCE SWITCH in the SILENCE position will silence the trouble device. The TROUBLE LED will remain lit until the trouble condition is repaired. The panel will then return to normal and the TROUBLE SILENCE SWITCH can be returned to NORMAL without resounding trouble device.

In the event of a power failure, the trouble device will sound, the green PILOT LED will go out and the amber TROUBLE LED will light. Placing the TROUBLE SILENCE switch in the SILENCE position will silence the trouble device but the amber TROUBLE LED will remain on until power is restored. Under this condition no other action is required. When the main power is restored, the panel will automatically switch back to main power operation. This will be evident when the green PILOT LED comes on. Returning the TROUBLE SILENCE SWITCH to NORMAL will extinguish the TROUBLE LED.

If a power failure is annunciated and it is known that the main power is on, check the AC circuit breaker on the power supply. If, after resetting, the circuit breaker fails to hold, contact your Notifier representative or repair service.

4.3 SYSTEM TESTING

Periodic system testing is required to ensure reliability. Local fire codes may specify the frequency and depth of such tests. These codes will vary from community to community and also between installations, depending on the type of building(s) involved.

NOTE:

If your system uses remote transmitter, inform the personnel at the receiving panel of the time you anticipate testing and again when testing is completed.

Personnel in the area where alarm device testing is to take place should also be advised.

The ideal time to test the alarm system is when a minimum number of people are in the building to avoid any confusion or disrupt normal activities.

4.3.1 Supervision Test Testing the supervisory circuits can be accomplished at the panel by removing a lead associated with each field loop. When the lead is removed, note that the trouble device sounds and the common TROUBLE LED lights.

To test the power change-over circuit, depress ac circuit breaker. This causes the trouble device to sound, the green PILOT LED to extinguish, and the amber common TROUBLE LED to light. Releasing circuit breaker will return panel to normal.

4.3.2 DEVICE TESTING

A. **Break Stations** Release the break station with provided key. Note that the panel responds accordingly as described for an alarm condition. Reset the break station then reset the panel as previously described for the alarm conditions. Repeat break station check on all scheduled stations.

B. **Thermostats** When testing thermostat type heat detectors, the use of a hair dryer held approximately one foot from the unit is recommended.

NOTE:

Do not attempt to test Notifier models #503, #504, #603, and #604 temperature units. Testing the unit will melt the fuse and the whole unit will require replacing. When testing the #501, #502, #601, and #602 models, apply heat only to the side opposite the small dimple in the dome to prevent fusing the unit which would then require replacement.

Remove the heat source from the unit immediately after it has gone into alarm. Note that the panel has responded accordingly, then reset the panel as previously described. Should the panel go back into alarm, allow a minute or so for the detector to recover then repeat reset procedure. Repeat the procedure for the scheduled number of detectors to be tested.

C. **Waterflow Detectors** Sprinkler systems are normally equipped with a test valve located at the furthest point in the system to ensure waterflow. Fully open this valve and allow water to flow until the panel detects the alarm condition (usually 20 to 30 seconds) then shut the valve. Note that the panel has responded accordingly, then reset panel accordingly. J2 must be installed on circuit board when using waterflow detectors. Alarm sounding devices are not silenceable.

D. **Post Indicator Valve or Gate Valve Supervisory Switch** Close the valve two complete turns. Observe at the control panel that a trouble condition has been detected. Return the valve to the full open position. This will return the panel to normal.

E. **Smoke Detectors** To test smoke detectors it is best to burn some sort of material that would most likely be present (such as paper). However, a good universal mixture that is easy to handle and comparatively clean is three parts kerosene to one part alcohol. A quantity of the mixture ignited in a small metal panel held several feet below the head is adequate.

Apply smoke to the detector until the red alarm lamp on the base of the unit comes on. This indicates that the unit has been triggered. Note that the panel has responded accordingly, then reset the panel. If the panel goes back into alarm, allow a few seconds for the smoke to clear in the area of the detector then try again. After resetting the panel note that the red alarm lamp on the detector extinguishes.

F. **Emergency Power Check** Depress the ac circuit breaker. Note that the green PILOT LED extinguishes, the amber common TROUBLE LED lights and the trouble device sounds. Silence the trouble device. Momentarily short terminals 13 and 15 of the detector loop. The panel should respond as it did when operating on main power. Check that the alarm devices are sounding as briskly as they did under main power operation. Silence and reset the panel, then reconnect the ac. Note that the amber TROUBLE LED extinguishes and the green PILOT LED comes on.

CP 4-45

SPECIFICATION DATA

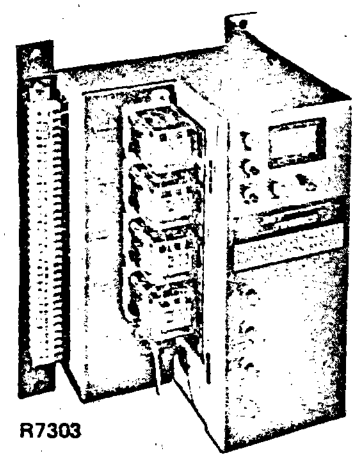
DET TRONICS

RECEIVED JUL 9 1981 TOWNSEND & BOTTUM INC.

☒ REVIEWED/NO COMMENTS
☐ REVIEWED/SEE COMMENTS
☐ REVISE PER COMMENTS & RESUBMIT FOR REVIEW
☐ SEE LETTER OF TRANSMITTAL
ENG. DEPT. BY ____ DATE JUL 20 1981
NEITHER REVIEW, COMMENT, NOR REVISION RELIEVES MANUFACTURER OR CONTRACTOR FROM RESPONSIBILITY FOR COMPLIANCE WITH SPECIFICATIONS OR WITH ALL OTHER CONTRACT REQUIREMENTS.
RETURN TO
Stearns-Roger
ON OR BEFORE

AUTOMATIC Oi *

Ultraviolet Fire Detection System C7050B, R7303B Combination



R7303

C7050

Automatic Oi System Includes C7050B Detectors Plus the R7303 Controller Equipped with Digital Display for Fault Identification

DESCRIPTION OF OPERATION

Automatic Optical Integrity (oi) is an extension of the manual oi concept originally developed by Detector Electronics. Automatic oi places important new capabilities at the disposal of the fire protection professional, and makes possible a higher degree of security for applications where fire hazard is an unavoidable risk.

Automatic oi is an important step forward in ultraviolet fire protection. Developed by Detector Electronics, it assures that the fire detection system is fully operational and ready to respond to fire or explosion.

An important consideration with any ultraviolet fire detector is that a buildup of contaminants - oil, gasoline, petrochemicals, - on the quartz window surface will absorb ultraviolet radiation. If the buildup becomes thick enough, the detector is "blinded" to ultraviolet and thus cannot "see" a fire.

Automatic Optical Integrity continuously checks the detector's optical surfaces as well as the associated electrical circuitry by a logic system in the R7303 Controller. It makes certain the ultraviolet sensing system is unimpaired and unobscured, and that all sensing and alarm circuits are operational.

The system consists of one or more C7050B Detectors (up to eight) and the R7303 Controller.

The controller is modular and consists of electronics to process the detector signal plus several switching relays. When one of the C7050B Detectors "sees" an amount of ultraviolet radiation greater than the controller sensitivity setting, one relay is energized immediately. If the ultraviolet level remains above the sensitivity setting, a second relay closes after a pre-determined (field adjustable) time delay. Should a system malfunction occur, a fault relay, which is part of the supervised circuitry, automatically responds to indicate a problem.

The C7050B/R7303 combination provides the same instantaneous response to flame as other Det-Tronics models and features the following important advances:

—A digital display located on the front of the R7303 Controller identifies by code number, fault conditions that may develop in the C7050B Detector, the controller itself, or interconnecting wires. Should a fault occur, a monitoring relay with remote indication capability, registers that fact, and the nature of the fault is shown simultaneously on the digital display. If the fault involves a reduction in the sensitivity of any detector, the display will identify the detector or detectors involved.

—Should any detector be suddenly blinded, as for example, due to the rupture of an oil line, the Automatic oi system will produce a fault signal at the R7303 Controller.

—Spurious discharges of one or more detectors, or discharges due to background radiation, will produce a fault signal and digital code number at the controller. Thus with the Automatic oi system, it is possible to identify detectors that may be failing due to self-excitation or solar sensitivity. In a similar manner, discharges due to low level background radiation can be identified at levels below the fire actuation signal.

*oi is Detector Electronics' Trademark for its patented Optical Integrity Systems. U.S. Patent 3,952,196, United Kingdom Patent 1,534,969, Canada Patent 1,059,598.

Stearns-Roger

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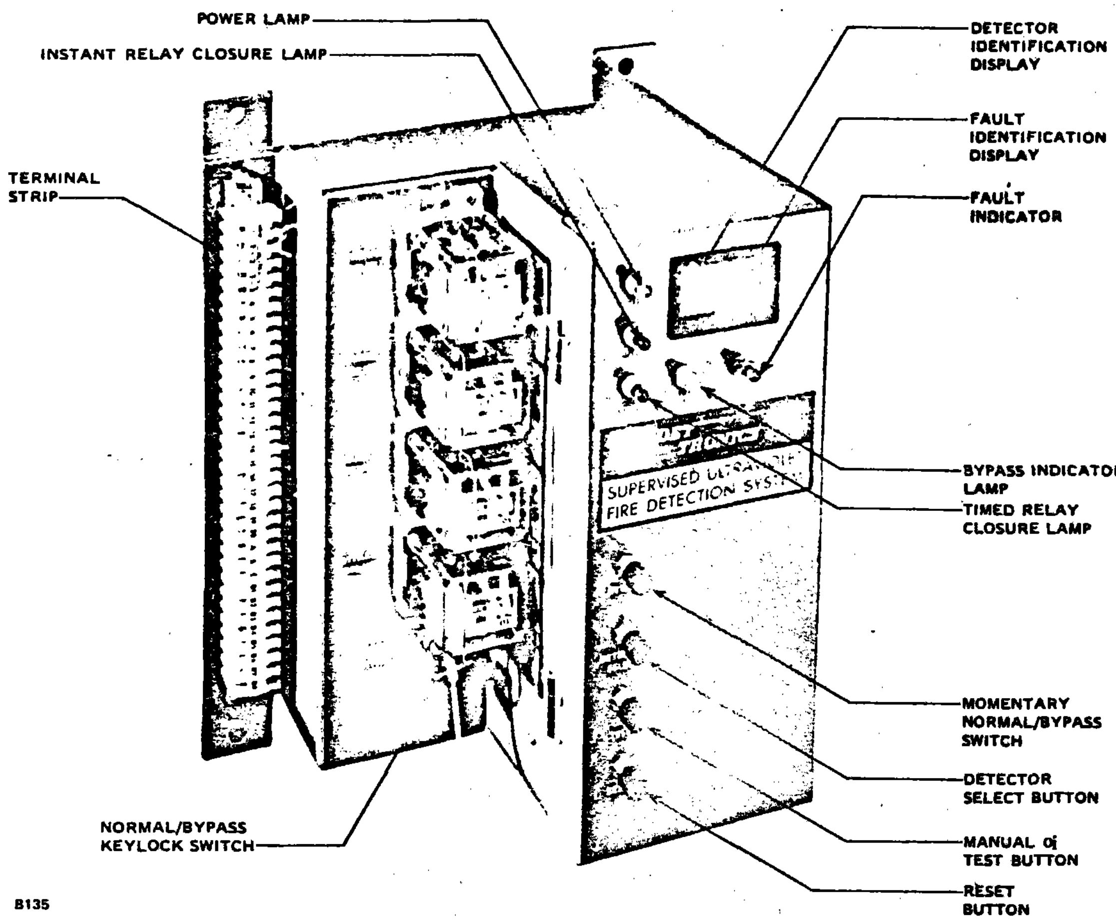

Figure 1—R7303 Controller has Digital Display for Fault and Detector Identification. Manual override of automatic Oi function is included for periodic test of output circuits.

—The Automatic Oi system employs the same detector as the manual Oi system.

—Automatic Oi tests are continuously performed without actuation of the output relays. To facilitate periodic testing of output circuits as well as to allow individual testing of each detector, a pushbutton operated manual Oi capability is provided on all Automatic Oi systems. In the manual mode, the R7303 digital display shows which detector is being tested. Selecting the detector to be tested is accomplished by depressing the DETECTOR SELECT button on the controller panel. See Figure 1.

—Construction of the UV detector is illustrated in Figure 2. A UV detector tube is mounted in the same enclosure with a UV test lamp, but they are optically isolated from each other within the enclosure by a cylindrical shield. When the test lamp is actuated, its UV radiation reaches the detector tube by traveling out through the quartz window where it encounters a reflective surface and is directed back into the detector through the portion of the window defined by the internal optical shield. **Since this is the portion of the window through which UV radiation from a fire must pass,** this test indicates the overall optical integrity of the detector.

—For applications such as powder coating booths, the R7303 Controller is available with Transient Arc Rejection circuitry as an option.

—The R7303 Controller has field adjustable sensitivity capability. The controller may be programmed to actuate output relays when the C7050B Detector discharge rate is 25, 50, 75 or 100 counts per second. A low count rate results in high sensitivity, since the detector discharge rate varies directly as the intensity of the UV radiation.

—The fault identification circuitry is designed so that the first fault occurring in a system will be retained in digital code on the LED readout until the controller is placed in the bypass mode. This ensures that transient faults will not be overlooked. Examples of digital codes used in the Automatic Oi system are as follows:

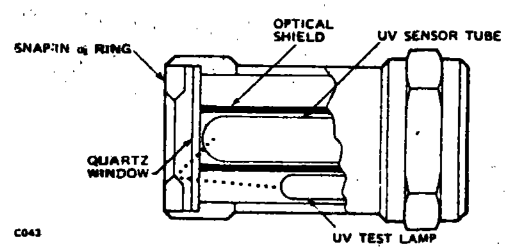

Figure 2—Automatic Oi Detector is identical to that used with Manual Oi System. Test Lamp is optically isolated from UV sensor inside detector housing. Test radiation path includes that portion of detector window through which UV radiation from a fire must pass.

Fault Identification

Digital Code	General Identification
0	Spurious detector discharge
1	DC power malfunction
2	Reduced detector sensitivity
3	Detector monitoring malfunction
4	Detector "C" lead fault
5	Module missing or "B" lead fault
6	Detector high voltage or "A" lead fault
7	Comparator board fault
8	Output circuits inhibited
Blank	Low voltage supply or detector monitor board problem

All of the above conditions de-energize the fault relay, which is normally wired to visual or audible alarms either near the controller or in a remote location. The left display is significant only when the system is in bypass, or when the "2" digit on the right display indicates reduced detector sensitivity.

GENERAL FEATURES

- Instantaneous response to ultraviolet radiation. Typical response to an intense ultraviolet source is less than 25 milliseconds. Systems are available for applications where response times of less than 10 milliseconds are needed.
- Detectors will operate under adverse weather conditions such as wind, rain, snow and extremes of temperature.
- POWER lamp and FAULT lamp provide visual status indication.
- Extra terminals for remote functions, including alarm, extinguish and fault signal.
- Input voltage and frequency selection available for applications worldwide.
- Plug-in printed wiring boards and relays for ease of maintenance.
- Detector module mounted to meet MIL SPEC 810C for shock and vibration.
- Insensitive to solar radiation and normal artificial lighting.
- Factory Mutual (FM), Canadian Standards Association (CSA) and British (BASEEFA) approved.

SPECIFICATIONS

SPECTRAL SENSITIVITY RANGE–
Det-Tronics Automatic oi ultraviolet fire detector responds to UV radiation in the range of 1850 to 2450 Angstroms. Detectors are insensitive to direct or reflected sunlight and to normal artificial light.

OPTICAL SENSITIVITY RANGE–
The standard C7050B Detector has a nominal 80° cone of vision and can be considered to have a practical application distance of about 50 feet (16 meters). The closer the detector is located to the probable hazard the better, since physical obstructions and smoke accumulations may affect its response. Under certain controlled conditions, the detectors may be used at greater distances.

Some chemical and petrochemical vapors absorb large amounts of UV radiation and could effectively "blind" the detector if they are between the fire and detectors.

FLAME SENSITIVITY–
Controller sensitivity is field adjustable for 25, 50, 75 or 100 counts per second response. For example, with a 25 cps sensitivity setting the UV radiation generated by a gasoline fire with one square foot (0.09 m^2) surface area, can be detected at a distance of about 32 feet (9.8 meters). Exposing the detectors to equipment which emits X-rays or gamma radiation is likely to produce a response. High electrostatic forces will affect the detectors if exposed directly at the window, or without the shielding provided by the metallic detector enclosure. Arc welding is a source of intense ultraviolet radiation, so special application techniques must be used to keep such radiation from the detector's cone of vision.

DETECTOR ENCLOSURE RATING–
Watertight - Dust-tight - designed to meet NEMA Standards for Type 4 enclosures. CSA certified Enclosure 4.
Hazardous locations - Factory Mutual (FM) approved for Class I, Groups A, B, C and D; Class II, Groups E, F and G. Canadian Standards Association (CSA) certified for Class I, Groups C and D; Class II Groups E, F and G. British Approvals Service (BASEEFA) certified for Group IIc (Hydrogen).

INPUT VOLTAGES–
Models rated for 120, 220 or 240 vac, 50/60 Hz, operates between 85 and 110% of the rated ac voltage; 12 vdc, operates over the range of 10.5 to 16.0 vdc; 24 vdc, operates over the range of 18.0 to 38.0 vdc.

TEMPERATURE RATING–
Operating: –40 to +158°F (–40 to +70°C) for system.
Storage: –67 to +170°F (–55 to +77°C) for system.

RESPONSE TIME–
Typically 25 milliseconds to high intensity UV radiation. Models with solid state relays respond in less than 10 milliseconds.

RELAY CONTACT RATINGS–
Instant relay, time-delayed relay, and fault relay: Form C (N.O. and N.C.) 10 amperes resistive, 8 amperes inductive. Solid state models (dc): 5 amperes intermittent, 1 ampere continuous (N.O.).

POWER REQUIREMENTS–

	Typical (watts)	Max (watts)
Standby	12	17
Fault	13	18
Fire	20	25
Fault and Fire	21	26

DETECTOR WIRING–
Three shielded leads plus one non-shielded lead are required for each detector. Wire diameter must be 22 gauge (642 circular mills) minimum. The R7303 Controller will accommodate up to eight detectors. The detectors may be located up to 1000 feet (300 meters) from the controller.

LOAD MONITORING RELAY (Optional)–
Supervises the wiring to connected loads, such as alarm and extinguishing equipment, and continuously checks the electrical continuity of the loads themselves.

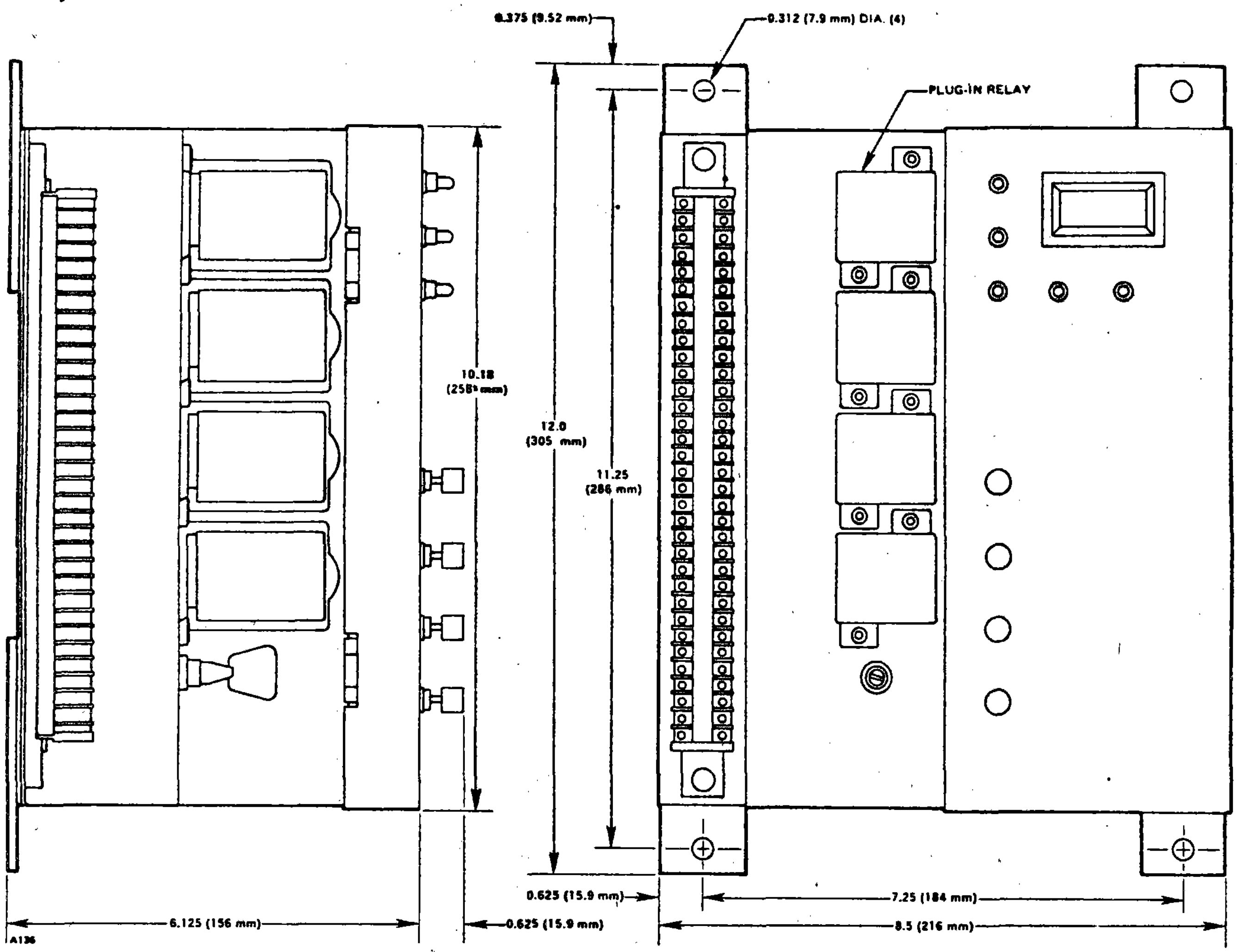

Figure 3—Dimensions of the R7303 Controller in Inches (and millimeters).

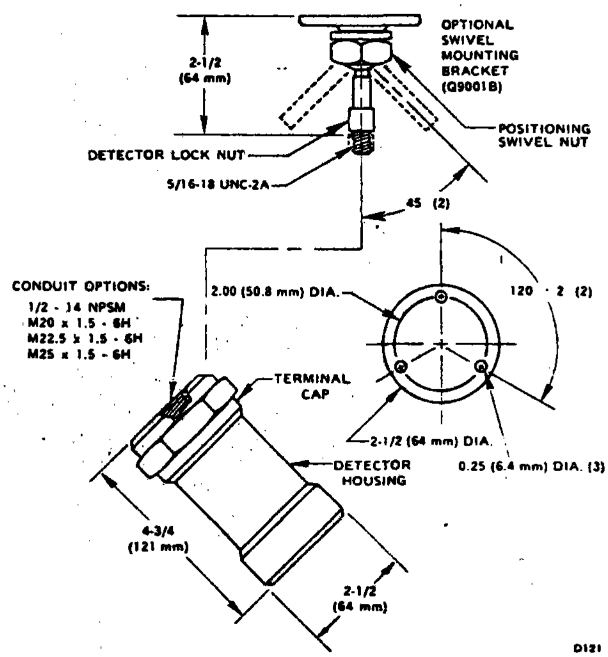

Figure 4—Dimensions of the C7050B Ultraviolet Fire Detector in Inches (millimeters).

MATERIAL (Detector)—
Anodized copper-free aluminum, nickel-plated brass or 316 stainless steel.

SHIPPING WEIGHTS (Approximate)—

	pounds	kilograms
R7303 Automatic Controller	13.0	5.9
C7050B UV Detector (aluminum)	1.25	0.56
(brass and stainless steel)	2.25	1.01
Q9001B Positioning Swivel	1.5	0.7

DETECTOR MOUNTS (Optional)—
Q9001B swivel assembly in anodized copper-free aluminum, nickel-plated brass or 316 stainless steel.

OPTIONAL ENCLOSURES (For Single Controller)—
Q1016 NEMA 4 Enclosure, see form 90-1006 for details.
Q1019 Explosion-Proof Enclosure, see form 90-1007 for details.

ORDERING INFORMATION

When ordering, specify model number, controller voltage, detector enclosure material and optional equipment needed.

Detector Electronics Corporation
6901 West 110th Street • Minneapolis, Minnesota 55438 U.S.A. • Phone: (612) 941-5665
Telex 29-0562 • Cable DETRONICS

Printed in U.S.A. 10.1-38

DET-TRONICS

☒ REVIEWED NO COMMENTS
☐ REVIEWED SEE COMMENTS
☐ REVISE PER COMMENTS & RESUBMIT FOR REVIEW
☐ SEE LETTER OF TRANSMITTAL
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RETURN TO Stearns-Roger ON OR BEFORE

RECEIVED JUL 9 1981 TOWNSEND & BOTTUM INC.

INSTRUCTIONS

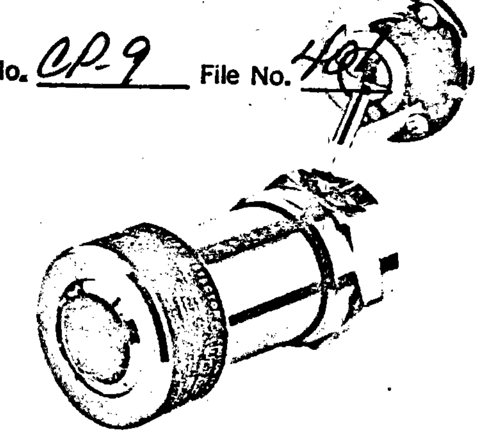
oi*

Miniature Ultraviolet Fire Detector

Stearns-Roger C7050A,B

C21700 JUL 13 '81

S-R No. CP-9 File No.



APPLICATION

The C7050 Miniature Fire Detector is designed for use with the Det-Tronics R7300 series controllers. Variations of the Detector are used with different models of the controllers, such as the models with the optical integrity (**oi**) feature. These models incorporate a reflective **oi** ring that is removable for cleaning the surface of the window, and maintenance of the reflective ring. See respective controller manual for explanation of the **oi** feature. The detector has an explosion-proof housing, allowing it to be mounted in hazardous areas. The housing is available in three different metals - anodized copper-free aluminum, nickel plated brass, or 303 or 316 stainless steel.

REQUIREMENTS

All wires between detectors and controller must be in shielded cable, 22 gauge (642 circular mils) or larger. All wiring must meet local electrical codes. The shield is grounded only at the controller.

If conduit is used, it should be used exclusively for the detector cable.

It is possible to connect up to four detectors directly to the controller and up to eight detectors to the controller with field modifications of the detectors. Terminals A, B, and C on the controller terminal panel connect to A, B and C in the detectors. The detectors are wired internally with "End Of Line" (EOL) lead monitoring resistors between terminals A and B and A and C. See Figure 1. Up to four detectors may be connected to the controller in parallel with their EOL resistors connected. If more than four detectors (up to eight) are used, two or more detectors may be connected together, but this requires a modification of all except the detector at the end of the line. The jumper shown in Figure 1 must be cut in all but the last detector and in addition the A, B, and C wires from the first detector must be connected directly to the A, B and C connections in each succeeding detector. See Figure 2 for example of wiring. The wires A, B and C from the first detector are then connected to the appropriate terminals on the controller.

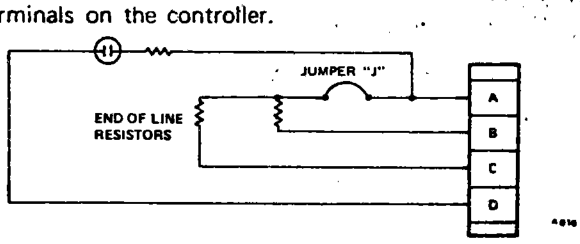


Figure 1—End Of Line Resistors.

Be sure the controller is programmed for the number of EOL resistors in the circuits, up to four. See "Installation" section of the respective controller manual for adjustment.

The C7050B Detectors shown in Figure 2 are used with controllers that have the "**oi**" feature.

RECOMMENDATIONS

A layout of the area to be supervised showing the location of each detector and the area covered to make sure there is adequate overlap. A check of the area for X or Gamma radiation, or welding radiation. If any radiations are found, special shielding and application will be required.

For outdoor applications where welding from another area can be viewed, it is recommended that detectors be pointed directly down at the area being monitored and under canopies if at all possible.

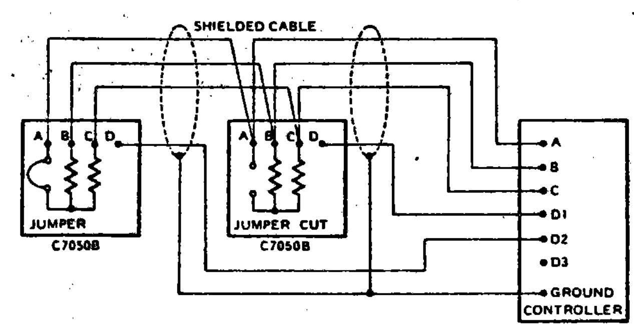


Figure 2—Typical Wiring of Parallel Detectors.

*oi is Detector Electronics' Trademark for its patented Optical Integrity Systems. U.S. Patent 3,952,196, United Kingdom Patent 1,534,969, Canadian Patent 1,059,598.

INSTALLATION

The following steps enable correct installation of the C7050 Detector.

1. Inspect carton for external damage.
2. Open and remove detector housing from carton.
3. Inspect for physical damage.
4. Check controller to make sure input power is turned off.
5. Remove detector housing from terminal cap. See Figure 3.
6. Install terminal cap to conduit with connector. See Figure 3 for connector information.
7. If optional swivel mounting bracket is used, mount bracket with terminal cap attached to appropriate surface and in the location desired. See Figure 3 for mounting dimensions.
8. Attach leads from controller to terminal block in terminal cap. See Figure 4. Be sure the A connection on the detector goes to the A connection on the controller, B to B and C to C. On the controller with the oi feature, the D lead from each detector goes directly to the D connections on the controller. See Figure 2. For further information on wiring and EOL resistors, see the respective controller manual.
9. Trim back the shield so it is isolated from ground. The shield is grounded only at the controller as shown in Figure 2.
10. If cable continues to another detector, tie shield connections together, and insulate from other connections and ground.
11. Open and remove UV sensor module from carton.

CAUTION
Do not touch end of UV sensor. Oil and contaminants from the hands on the sensor reduces UV sensitivity.

12. Check jumper "J." If detector is not the end one, as shown in Figure 2, cut jumper "J."
13. Install UV sensor onto terminal block. If terminal block has gold plated quick connect plugs, the UV module should also have gold plated mounting legs. Slide module mounting base over index pin while inserting quick connect plugs into mounting legs.

    If terminal block does not have quick connect plugs, slide module mounting base over index pin and line up mounting legs. Mount the module with the four screws provided.

    If terminal block has gold plated quick connect plugs, but the UV module has **silver legs**, it will be necessary to remove the quick connect plugs by unscrewing them from the terminal block. Slide module mounting base over index pin and line up mounting legs. Mount the module with the four screws provided.
14. Replace detector housing.
15. Aim detector at area to be monitored and tighten positioning swivel nut.
16. Remove oi reflector ring (if used).
17. Clean oi ring and window with Det-Tronics' window cleaner and a tissue.

CAUTION
Do not touch surface of oi ring or window after cleaning.

18. Re-install oi ring.
19. Position the oi ring ears opposite the threaded hole used for mounting the swivel on the rear cap.
20. Proceed to "Startup Procedure" given in the respective controller manuals.

For replacement of UV modules see instructions packed with them.

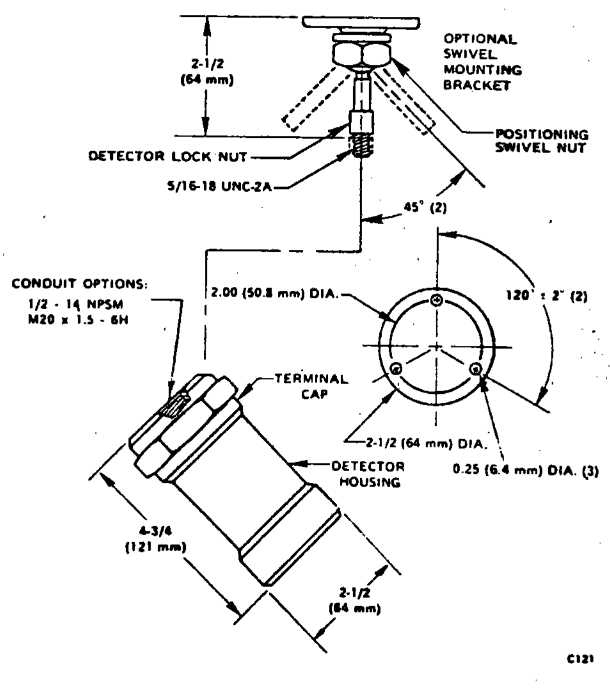


Figure 3—Mounting Dimensions and Conduit Connections.

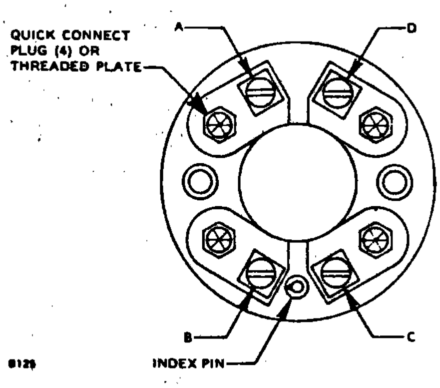


Figure 4—Terminal Block.

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PROCEDURE FOR THE PROPER INSTALLATION OF DETECTOR ELECTRONICS

EXPLOSION-PROOF DETECTOR HOUSINGS

To meet and maintain a water-tight housing, it is necessary to follow the following guidelines:

1. Use a water-tight conduit seal such as the Crouse-Hinds EYS series, with as short a nipple connecting the seal to the housing as possible. This nipple should have either teflon tape or an acceptable pipe-dope applied to the threads.

2. The seal should be poured using first a Fiberdam such as Chico-X to restrict the Chico-A compound from traveling through the nipple into the housing, and then Chico-A poured behind it. It is important that the Chico-A not be poured at below freezing temperatures, since this will cause the water in the Chico compound to freeze, rather than to evaporate.

3. The shielding of the shield cable should be stripped back past the Chico-A compound so that the Chico-A seals around the individual detector leads, rather than the outside of the shield. This will stop any siphoning action that might occur through the inside of the shield.

Whereas the need for a breather and drain on the conduit immediately before the seal is not normally required, it is recommended, especially in the situation where that conduit run is in a vertical position, since in this situation, water would tend to sit on top of the seal for long periods of time.

- [x] REVIEWED/NO COMMENTS
- [ ] REVIEWED/SEE COMMENTS
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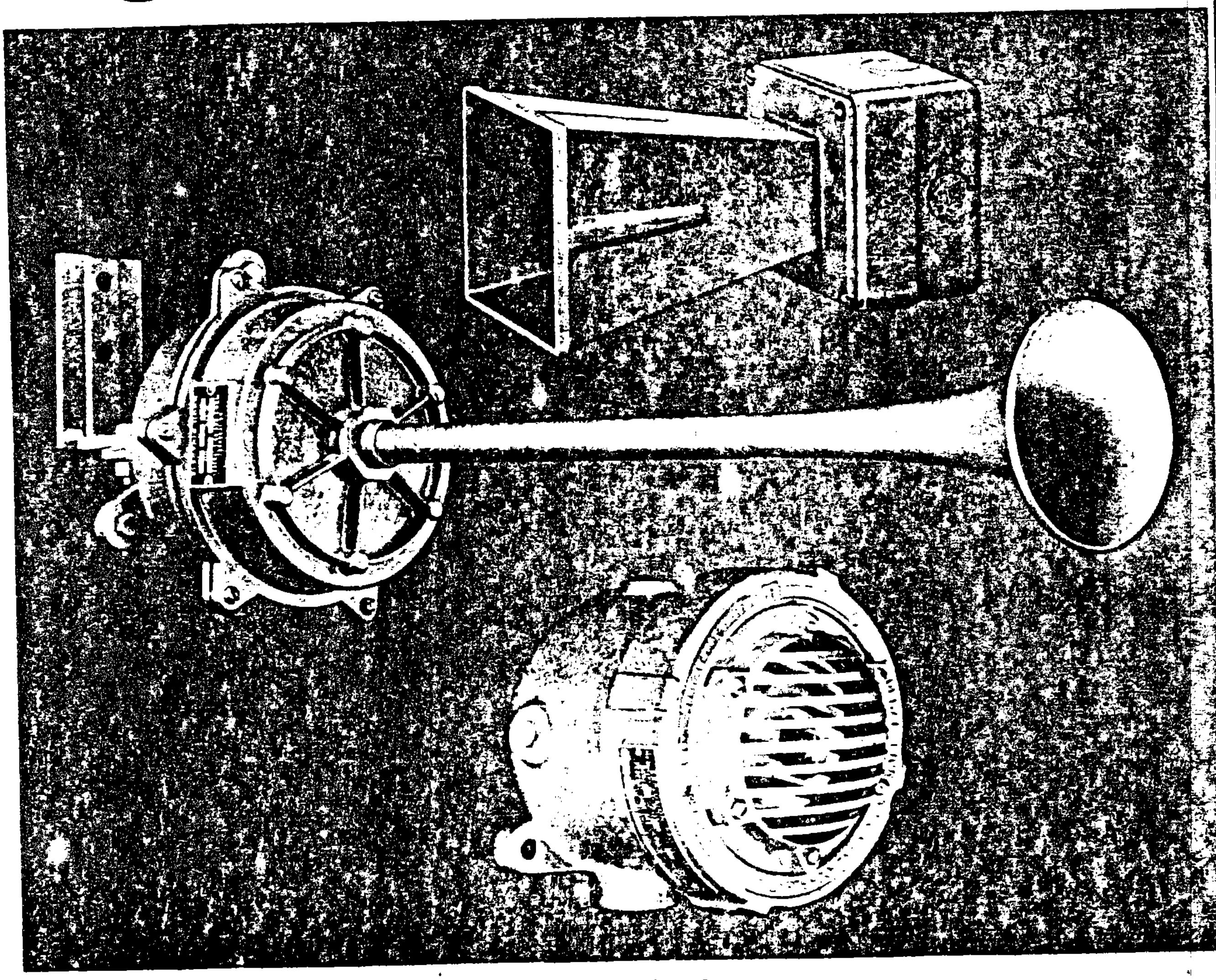
10.1-39 S-R No. CP-9 File No. 402

BULLETIN 105

Federal Electric Signal Horns

for industries and public buildings



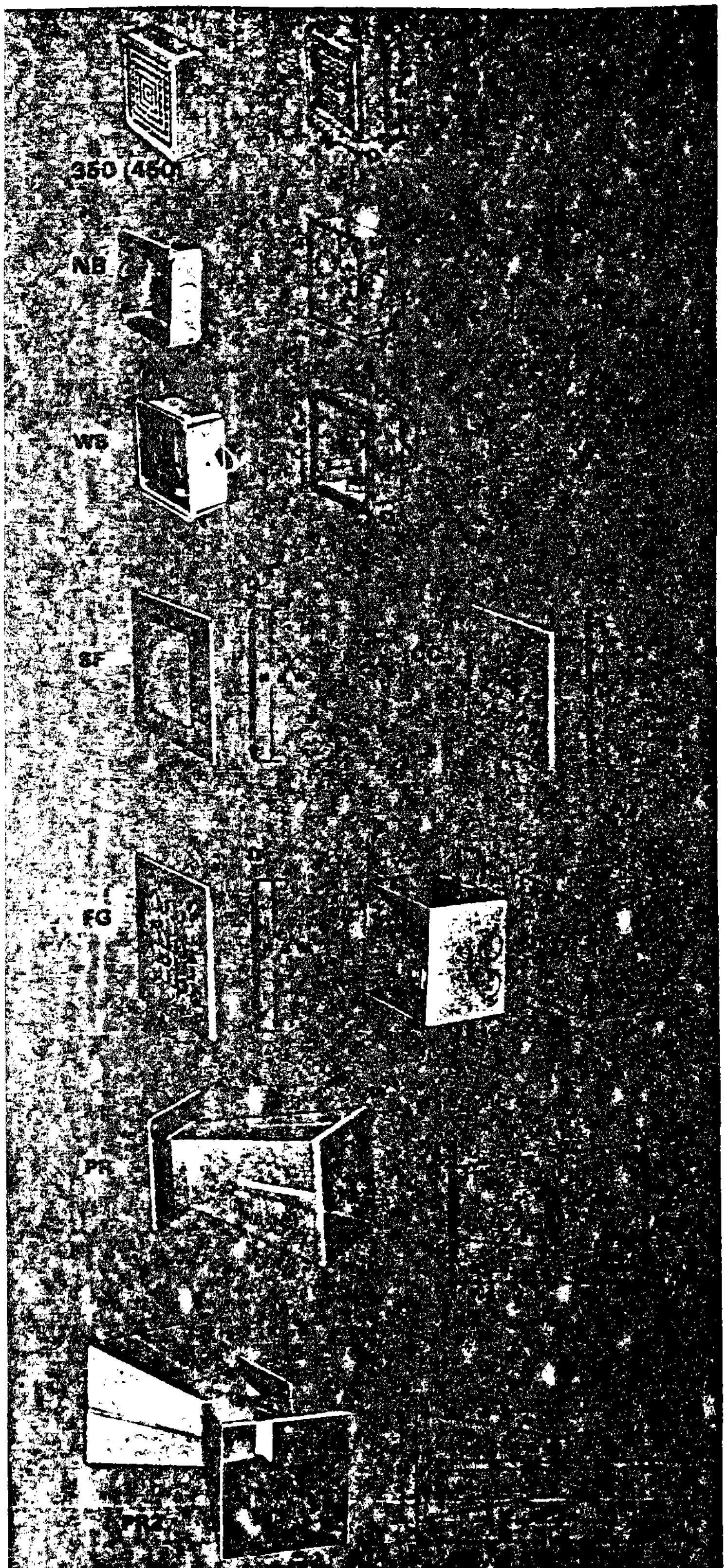
Characteristics

Federal electric signal horns produce coded blasts or sustained tones in three different ways to provide three different kinds of sound. Vibrating horns and motor driven horns produce sound by mechanical vibration of a diaphragm. In vibrating horns, this sound is a sustained tone, however in our motor driven horn, the tone is modulated as the motor speed picks up and diminishes. In resonating horns, the diaphragm resonates a column of air to generate a powerful, musical tone.

Applications

Electric horns are suitable for use as general alarm signals, for start and dismissal or, with the exception of motor driven horns, for paging signals. Our Vibratone® horns are compact and attractively styled for use in offices, public buildings, or in plants where ambient noise is not exceedingly high. If a louder signal or explosion-proof unit is needed, a variety of models are available.

Vibratone® Components and Accessories
for All AC and DC Units



10.1-41

Vibratone horns are not packaged with accessories attached. A basic horn mechanism should be ordered by model and voltage along with the mounting accessories to suit your requirements.

Distributors or contractors can order a selection of modular components with a few basic horn units and with minimum stock space or expense give the customer whichever model he desires.

NB A 4" square box with ½" & ¾" knockouts for interior mountings. Electroplated and painted gray hammertone enamel.

WB The cast aluminum neoprene gasketed weatherproof housing for outside use complete with mounting lugs is tapped for ½" conduit. Gray hammertone enamel.

SF The stamped surface plate used for installations on plastered-in 4" outlet switch boxes for semi-flush mountings. Gray hammertone enamel.

CC The adapter plate for installing the 350 or 450 interior types on a variety of boxes. Gray hammertone enamel.

FG The flush grille which attaches to the basic unit and serves as the cover of the plastered-in FB flush box. Gray hammertone enamel.

FB The wall box for flush mounting in stud, 4 inch block, or other shallow wall construction. Electroplated.

FBL Same as above but with greater depth for 6"x8" concrete block or cinder block walls or other deep wall construction. Electroplated.

PR The projector which, attached to the basic 350 or 450 units, concentrates sound into a basic area. Gray hammertone enamel.

PR2 The double projector that, added to the basic 350 or 450 units, directs sound to both sides. Ideal for use in areas such as hallways. Gray hammertone enamel.

Specifications

MODEL NO.	DESCRIPTION	DIMENSIONS H	W	D	WEIGHTS NET	SHIP
350	Basic AC horn	4"	4"	2½"	1 lb.6 oz.	1½ lbs.
450	Basic DC horn	4"	4"	2½"	1 lb.6 oz.	1½ lbs.
NB	4" Interior type knockout box	4"	4"	1½"	11 oz.	14 oz.
WB	Gasketed-cast weatherproof box	4⅜"	5⅛"	2"	11 oz.	1 lb.
SF	Semi-flush wall plate	6"	6"	⅛"	4 oz.	7 oz.
CC	Concealed conduit adapter plate	6"	6"	⅛"	6 oz.	9 oz.
FG	Grille for flush mounting	6"	6"	⅛"	7 oz.	10 oz.
FB	Wallbox for flush mounting	4⅜"	4⅜"	2⅞"	1 lb.9 oz.	2 lbs.
FBL	Deep box for flush mounting	4⅜"	4⅜"	3⅝"	1 lb.14 oz.	2 lbs.8 oz.
PR	Single projector	4"	4"	6"	13 oz.	2 lbs.4 oz.
PR2	Double projector	4"	11½"	4"	1 lb.15 oz.	2 lbs.

GLOBE gel/cell®

Battery Specifications

GC Part Number	Volts	Capacity 20 Hr	5 Hr	1 Hr	Weight Pounds (Grams)	Dimensions, Inches (MM) Length	Width	Height (Incl. Term.)	Available Terminals (Type)	Internal Impedance Milliohms
GC410	4	0.9	.75	0.5	37 (168)	1.65 (42)	1.36 (35)	2.24 (57.5)	4	60
GC610	6	0.9	.75	0.5	.55 (250)	1.99 (51)	1.65 (42)	2.24 (57.5)	1	90
GC1215	12	1.5	1.25	.83	1.5 (681)	7.00 (179)	1.34 (34)	2.64 (68)	1	150
GC620	6	1.8	1.5	1.0	1.0 (454)	2.95 (75)	2.00 (56)	2.36 (60)	1	50
GC426	4	2.6	2.17	1.40	.9 (409)	3.54 (90)	1.34 (34)	2.63 (67)	1	47
GC626	6	2.6	2.17	1.4	1.35 (613)	5.28 (135)	1.34 (34)	2.63 (67)	1, 2	70
GC826	8	2.6	2.17	1.4	1.75 (794)	7.01 (179)	1.32 (34)	2.64 (67)	1	110
GC645	6	4.5	3.75	2.5	2.3 (1044)	5.96 (152)	1.33 (34)	3.96 (101)	1	30
GC1245	12	4.5	3.75	2.5	4.5 (2042)	5.96 (152)	2.56 (65)	3.98 (102)	1	60
GC1260	12	6.0	5.75	3.8	5.7 (2587)	5.96 (152)	3.16 (80)	3.98 (102)	1	80
GC660	6	6.0	5.0	3.3	2.6 (1180)	4.57 (117)	1.99 (51)	3.81 (98)	1	25
GC665	6	6.5	5.4	3.6	3.4 (1542)	4.30 (109)	2.80 (71)	4.20 (107)	7, 8	27
GC280	2	7.5	6.2	4.1	1.2 (545)	2.06 (53)	1.97 (51)	3.97 (102)	1	6
GC680	6	7.5	6.2	4.1	3.3 (1497)	5.96 (152)	1.97 (51)	3.97 (102)	1	20
GC690	6	9.0	7.5	5.0	4.4 (1995)	4.30 (109)	2.80 (71)	5.55 (141)	7, 8	20
GC6100	6	10.0	8.3	6.2	5.0 (2268)	4.30 (109)	2.80 (71)	5.55 (141)	7, 8	18
GC6120	6	12.0	10.0	8.0	5.5 (2495)	4.30 (109)	2.80 (71)	5.55 (141)	7, 8	15
GC6200	6	20.0	16.5	11.0	8.8 (3992)	7.00 (178)	3.42 (87)	5.25 (134)	5	9
GC12230	12	23.0	19.5	14.0	19.0 (8618)	6.59 (167)	6.94 (176)	4.92 (125)	5, 6	14
U128	12	28.0	21.0	9.8	21.0 (9525)	7.75 (197)	5.18 (132)	7.12 (181)	3	10
GC12550	12	55.0	41.0	29.5	39 (17690)	11.00 (279)	6.75 (171)	8.70 (221)	3	7

GLOBE
gel/cell®

INSTALLATION NOTE:

Because the Gel/Cell® is sealed and the case is electrically non-conductive, it is ideal for mounting within equipment. When mounting within equipment, care should be taken to insure adequate ventilation. Towards the end of charge, and under overcharge conditions, the moisture (H_2O) in the electrolyte can be dissociated through electrolysis. This generates hydrogen and oxygen gas. This gas is normally readily dissipated into the atmosphere. If, however, hydrogen and oxygen gas are allowed to accumulate in a confined area and then a *spark* is introduced, an explosion might result. For this reason, do not make it possible for the hydrogen and oxygen to accumulate. Make provision for ventilation and air circulation within the battery enclosure, particularly during recharge.

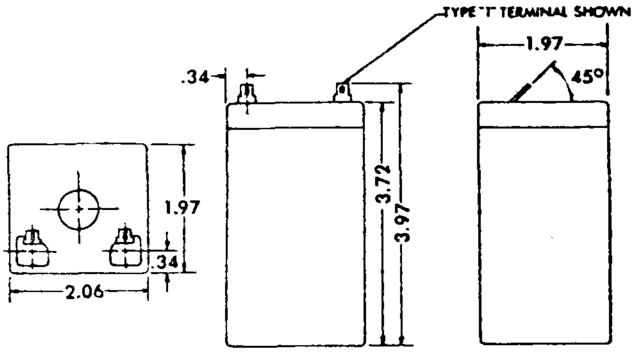
YOUR REQUEST FOR APPLICATION ASSISTANCE WILL BE WELCOMED BY:

Globe Battery Division   JOHNSON CONTROLS

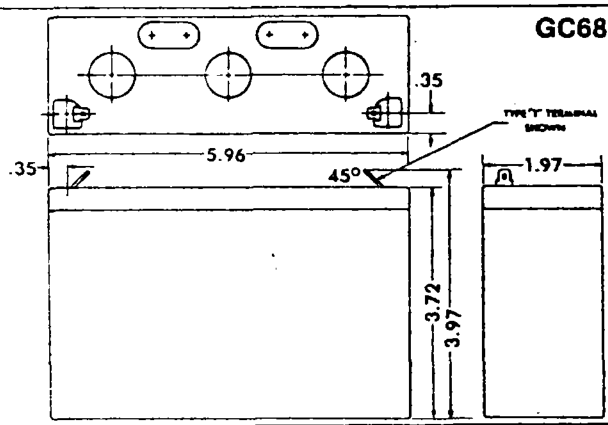
Globe Battery Division
Johnson Controls
Attn: Gel/Cell Marketing
5757 North Green Bay Avenue
Post Office Box 591
Milwaukee, Wisconsin 53201
Telephone (414) 228-2393

GLOBE gel/cell®

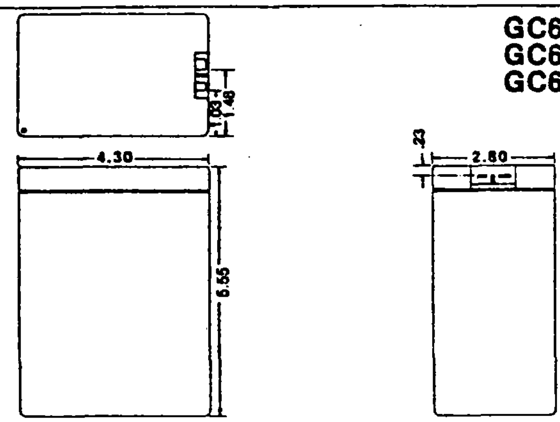
GC280



GC680



GC690
GC6100
GC6120



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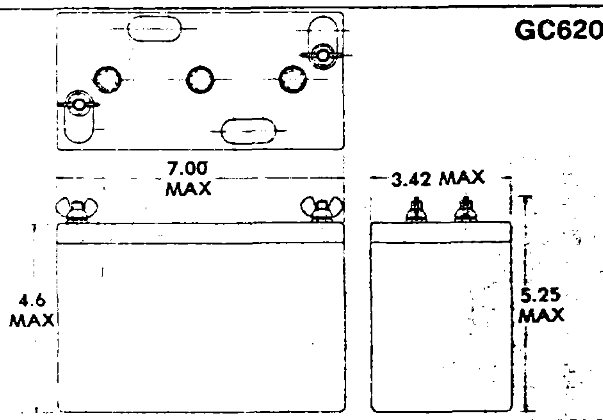
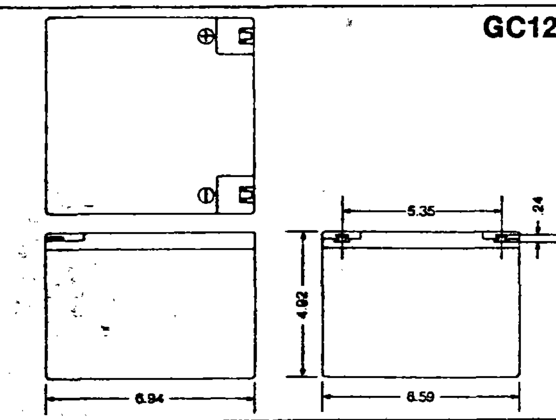


GC12230



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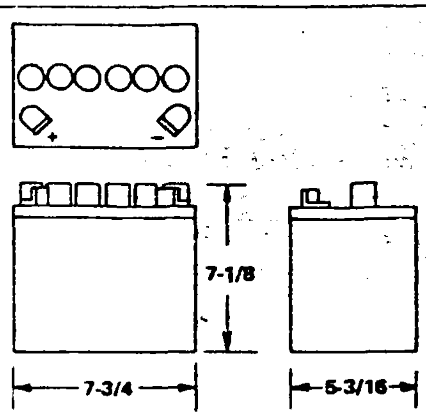
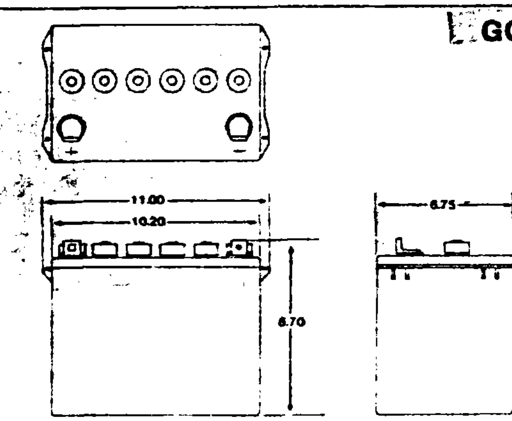


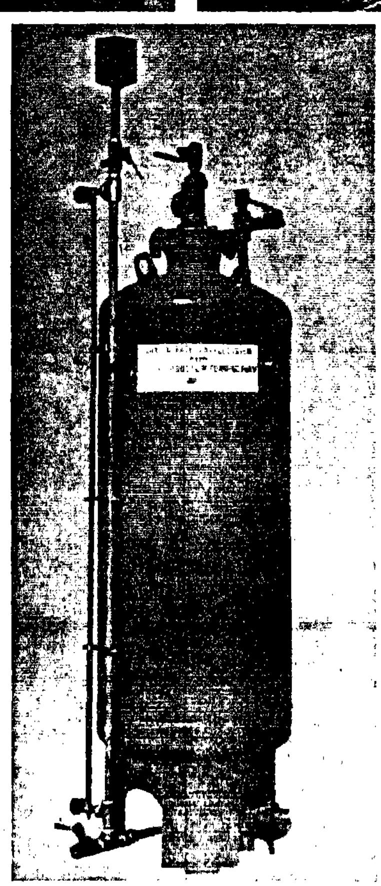
GC12550



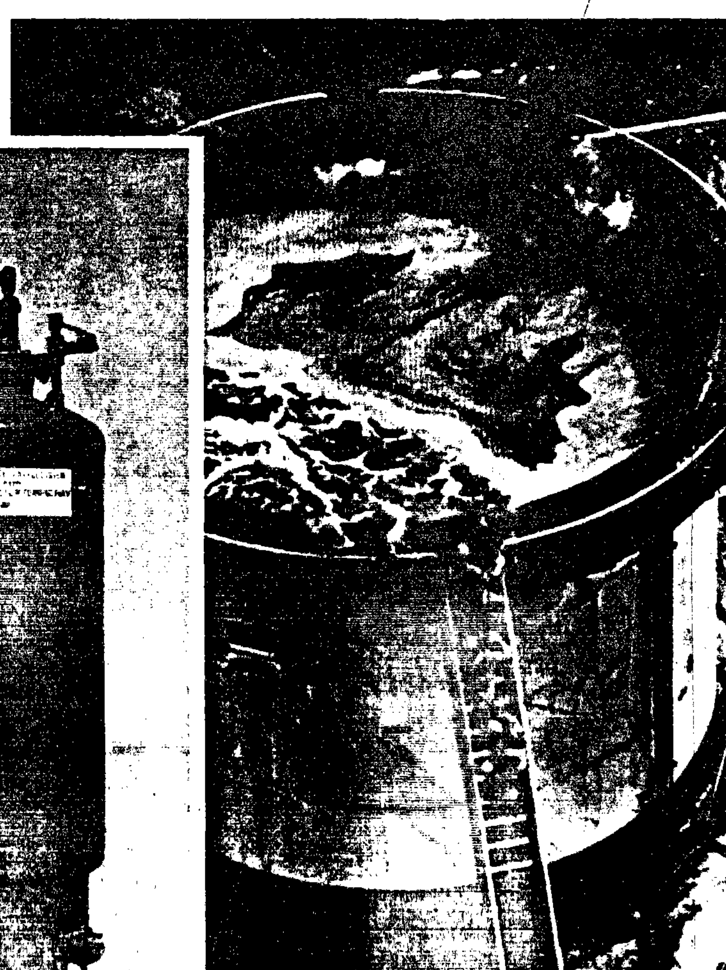
CONCENTRATE CONTROL SYSTEM

A proven proportioning system designed for use in new or existing fire protection installations

Typical storage tank fires can cause massive property and personal loss



A PROVEN AND RELIABLE BALANCED PRESSURE PROPORTIONER

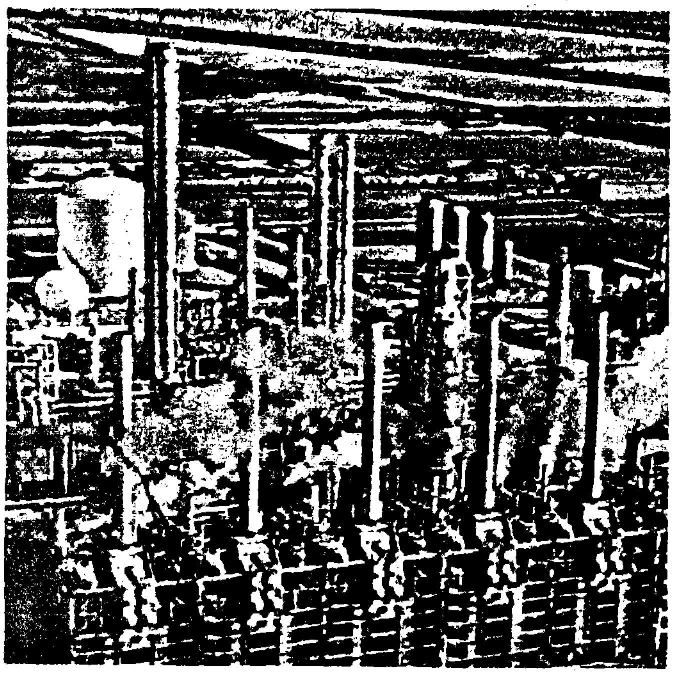


These types of fires can be extinguished quickly with Arrow hardware and "Light Water" brand AFFF.

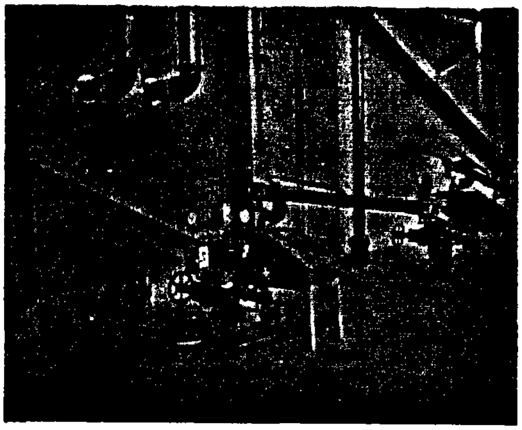
The Arrow Concentrate Control System provides effective fire protection for Class B and certain Class A fires that threaten industrial plants, petroleum processing, chemical processing sites and a wide variety of transportation system locations. **10.I-45**

The Arrow CCS (Concentrate Control System) supplies dependable, economical fire protection for a wide variety of applications.

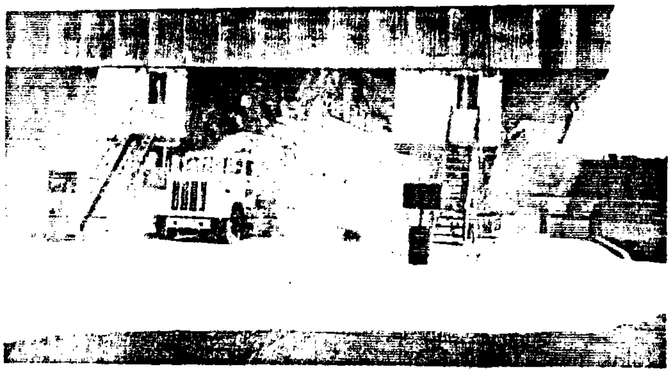
• INDUSTRIAL PLANTS • CHEMICAL PROCESSING • TRANSPORTATION • PETROLEUM OPERATIONS



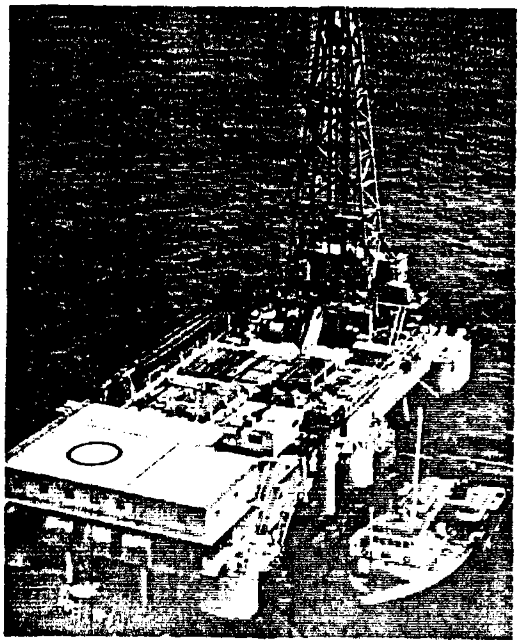
Manufacturing plants which use and store a wide range of flammables must be protected by high quality fire protection.



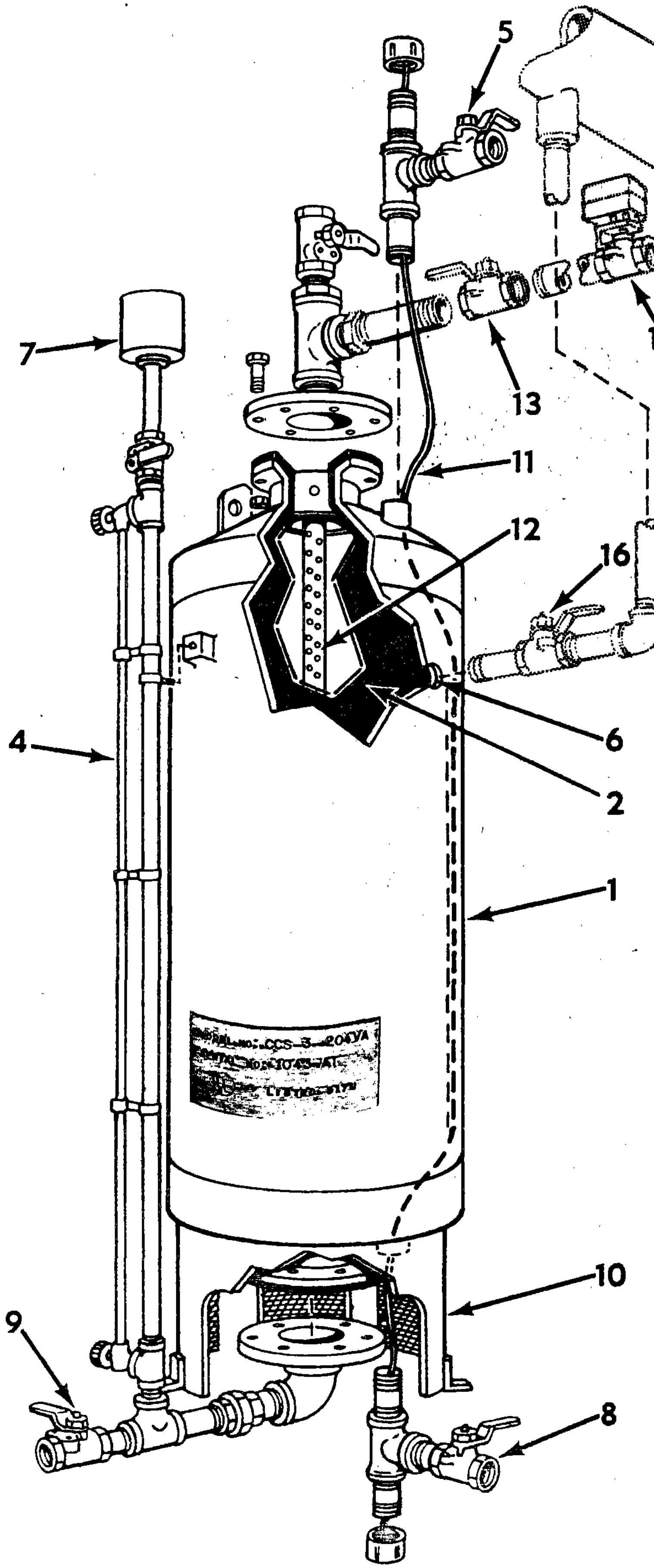
Arrow's versatile Concentrate Control System can deliver AFFF solution to standard sprinkler and underwing fire protection vital to aircraft fire safety.



The fast response the Arrow CCS provides is a must for truck loading racks and distribution terminals.



Simple, dependable design makes the Arrow CCS ideal for use in off-shore petroleum operations where pumping horsepower and maintenance manpower are at a premium. Arrow installations provide fire protection on the Alaskan pipeline.



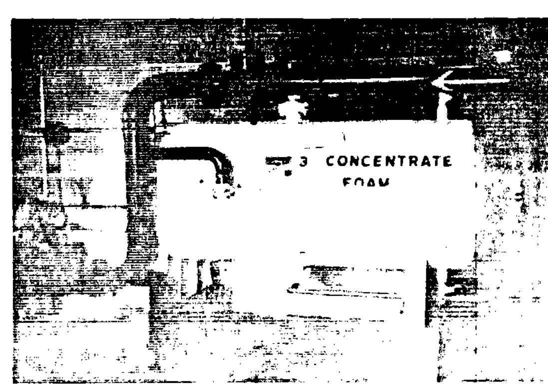
These outstanding construction and design advantages assure you of efficient, reliable fire protection:

- UL listed

1. ASME code pressure-vessel
2. Flexible, nylon reinforced elastomeric concentrate bag
3. Concentrate Controller(s) (As required—priced separately)
4. Sight gauge
5. Vent valves
6. Water balancing opening
7. Fill cup
8. Water filling valve
9. Concentrate filling valve
10. Vessel skirt (Stand)
11. Water channel cable
12. Total discharge pipe

OPTIONS

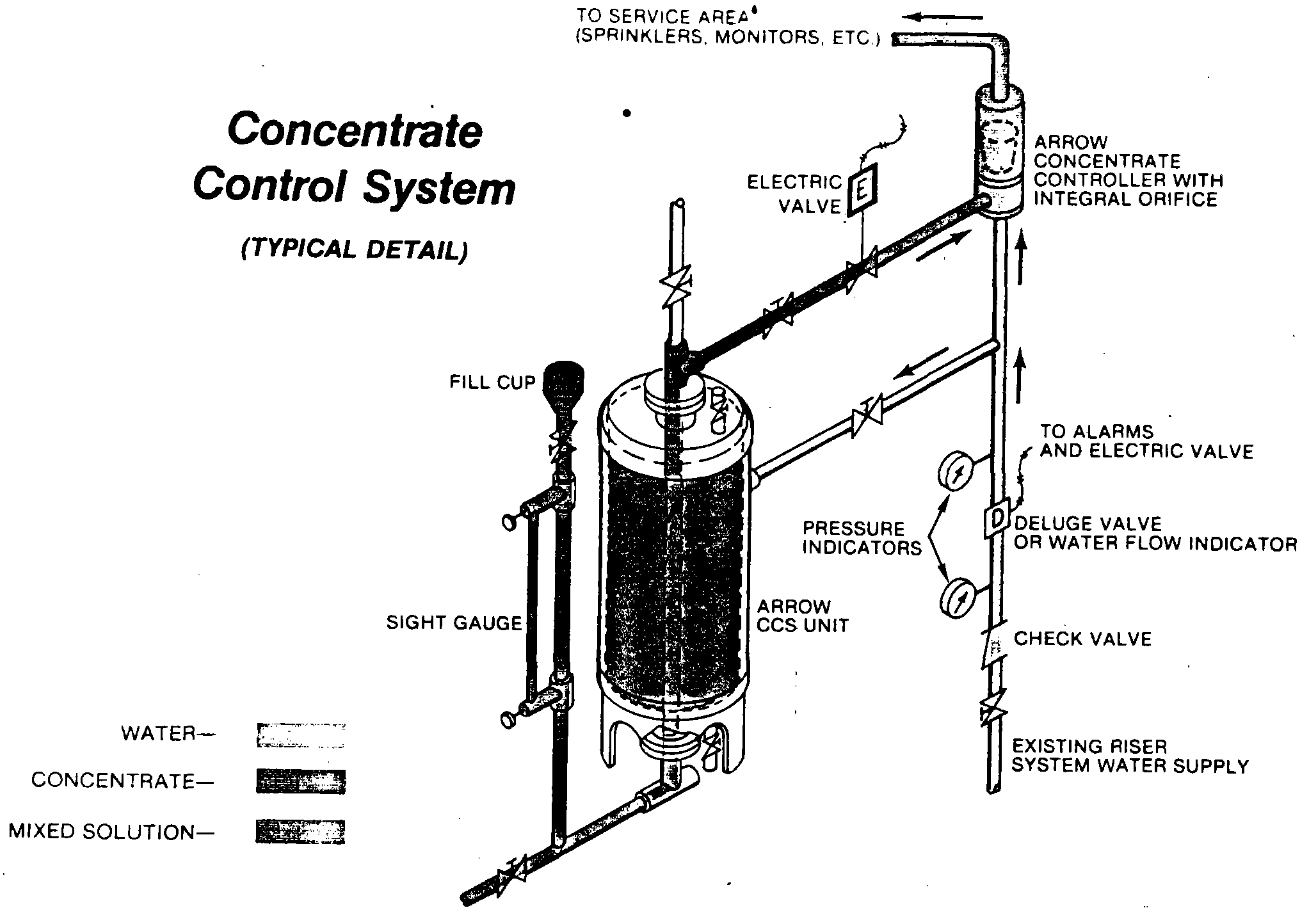
13. Concentrate discharge valve
14. Electric valve (Fail Safe Open optional)
15. Flanged piping for Concentrate Controller
16. Water balancing valve



HORIZONTAL INSTALLATION

Concentrate Control System

(TYPICAL DETAIL)



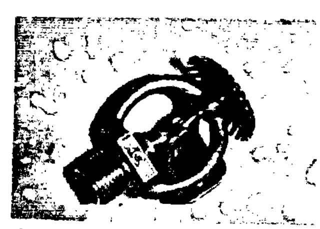
The Arrow CCS (Concentrate Control System) is designed for use in all new Class B flammable liquid installations or to upgrade existing Class B fire protection systems. Wet or dry pipe standard closed head sprinklers or deluge sprinkler may be used, as well as the conventional foam water sprinkler heads.

The Arrow CCS (in conjunction with "Light Water" AFFF) can be used with THESE TYPICAL DISPENSING DEVICES:

- Foam chambers
- Hose reels and hand lines
- Standard sprinklers
  Foam/water sprinklers
- Manual and oscillating turret nozzles
- Non-aspirating spray nozzles
- Sub-surface injection (forcing foam maker)

. . . and other dispensing devices

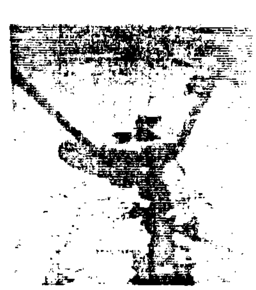
FOAM WATER

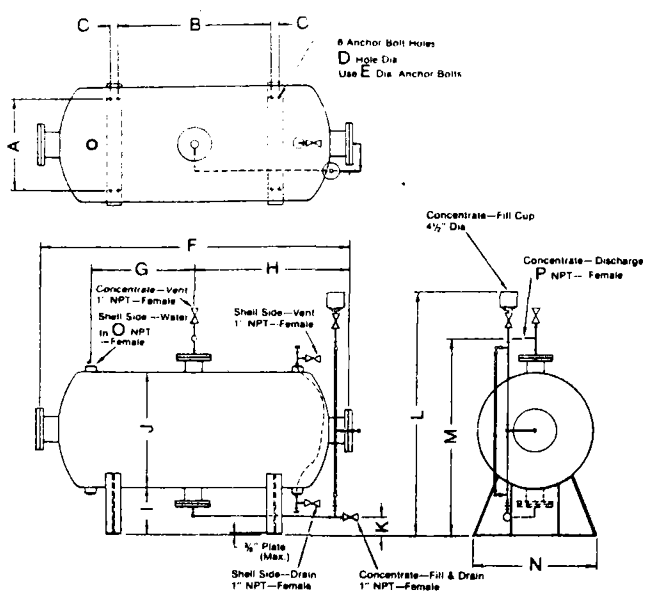


STANDARD CLOSED

STANDARD OPEN

OSCILLATING OR MANUAL TURRET NOZZLES

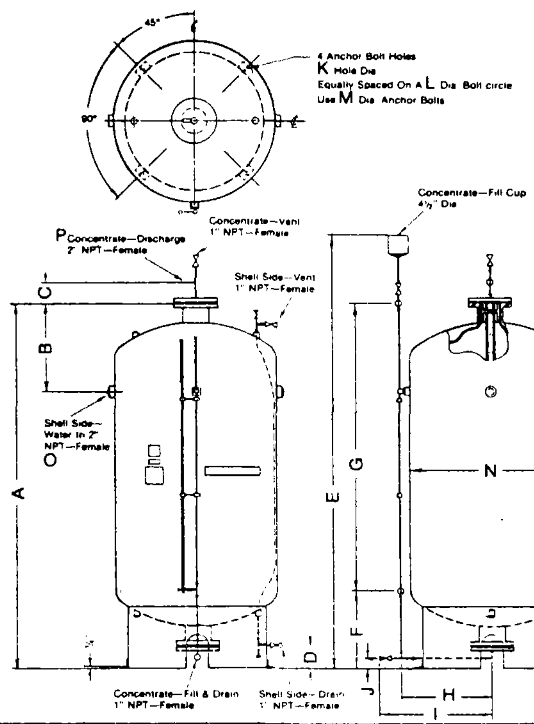




NOTE:
ALL DIMENSIONS
SHOWN ARE
NOMINAL.

CONCENTRATE CONTROL SYSTEMS
TABULATED DIMENSIONS

	CCS SIZE (GALLONS)			
	600	750	1000	1500
A	30"	34"	34"	44"
B	69¼"	63¼"	93¼"	92½"
C	2¾"	2¾"	2¾"	3½"
D	¾"	¾"	¾"	¾"
E	⅝"	⅝"	⅝	⅝"
F	122"	116"	160"	168"
G	42"	39"	60"	60"
H	61"	58"	80"	84"
I	12"	12"	12"	12"
J	42"	48"	48"	60"
K	4¾"	4¾"	4¾"	4¾"
L	70"	76"	76"	88"
M	63"	69"	69"	81"
N	40"	44"	44"	54"
O	2½"	2½"	2½"	3"
P	2½"	2½"	2½"	2½"



CONCENTRATE CONTROL SYSTEMS
TABULATED DIMENSIONS

	CCS SIZE (GALLONS)							
	50	100	200	300	400	500	600	750
A	46"	74"	86"	92"	92"	112"	128"	128"
B	16"	16"	17"	18"	19"	19"	19"	20"
C	5⅛"	5⅛"	5⅛"	5⅛"	5⅛"	5⅛"	5⅛"	5¼"
D	6"	6"	6"	6"	6"	6"	6"	7½"
E	63"	95"	104"	110"	110"	129"	145"	141"
F	6¼"	6¼"	14"	20"	20"	40"	56"	56"
G	40"	72"	72"	72"	72"	72"	72"	72"
H	14½"	14½"	17½"	20½"	23½"	23½"	23½"	27"
I	19⅞"	19⅞"	22⅞"	26"	29"	29"	29"	32"
J	2¾"	2¾"	2¾"	2¾"	2¾"	2¾"	2¾	8¾"
K	⅝"	⅝"	⅝"	⅝"	¾"	¾"	¾"	⅞"
L	22½"	22½"	27¾"	32¾"	37½"	37½"	37½"	50¾"
M	½"	½"	½"	½	⅝"	⅝"	⅝"	¾"
N	24"	24"	30"	36"	42"	42"	42"	48"
O	2"	2"	2"	2"	2"	2"	2"	2"
P	2"	2"	2"	2"	2"	2"	2"	2"

NOTE—ALL DIMENSIONS SHOWN
ARE NOMINAL.

IMPORTANT NOTICE TO PURCHASER: All statements, technical information and recommendations contained herein are based on information and tests we believe to be reliable. The accuracy or completeness thereof are not guaranteed. In accordance with Arrow's "Terms and Conditions of Sale" and since conditions of use are outside our control, the purchaser should determine the suitability of the product for its intended use and assumes all risk and liability whatsoever in connection therewith.

ARROW TANK & ENGINEERING COMPANY
8950 Evergreen Blvd., Minneapolis, MN 55433
Phone: 612 . 786-9510

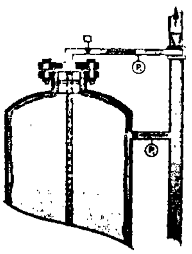
V-FCCS-B

How Arrow's CCS (Concentrate Control System) can work at your location.

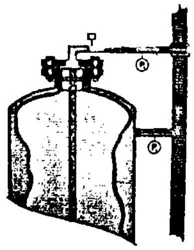
The Arrow CCS when coupled with "Light Water" brand Aqueous Film Forming Foam (AFFF) or Alcohol Type Concentrate (A TC) is a system specifically designed for the protection of flammable liquid hazards.

How does Arrow's balanced pressure proportioning function?

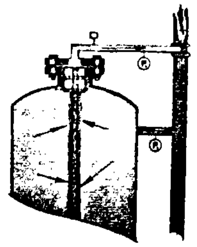
A flexible concentrate bag within the ASME pressure tank contains concentrate. The concentrate bladder physically separates stored concentrate from the water supply. When the system is activated, fire water supply pressure transmits force through the flexible concentrate bladder, which forces concentrate to the Arrow Concentrate Controller.



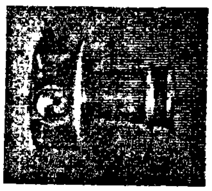
Concentrate Control System in static (ready) condition.



System in operation. (CCS is "called")



Totally evacuated system



The Concentrate Controller is precisely machined component with a venturi and recovery section metering orifice that accurately proportions concentrate into the fire water stream to produce the optimum extinguishing solution, over wide changes in water flow rates.

Pressure Loss vs Flow Rate*

Pressure loss is dependent on flow rate of water in mains and controller size. As shown, remarkably low pressure drops are exhibited.

GALLONS PER MINUTE (WATER FLOW RATE)	CONTROLLER SIZE 4"	6"	8"
GPM	PSI	PSI	PSI
200	0.5		
300	1.0		
400			
		0.5	
500	2.5		
		1.0	
750	5.0		
			0.5
1000	10.0	2.5	1.0
	20.0	5.0	
2000			2.5
		10.0	
3000			5.0
		20.0	
4000			
			10.0
5000			
6000			
			20.0

FEATURES:

1. The system operates without dependence on external pumping—only flowing water under pressure is required for delivery of foam solution.

2. Extremely accurate concentrate proportioning (metering) is maintained over a wide range of water flow rates.

3. The system exhibits a very low permanent pressure drop.

Percent of Concentrate at Various Flow Rates (GPM)*
(Using 3% Concentrate as Norm)

Optimum concentration is maintained within ±10% over recommended flow ranges

GPM	CONTROLLER SIZE 4"	6"	8"
75	1.5%		
100	2.0%		
150	3.0%	1.5%	
200	|	2.0%	
300	|	3.0%	1.5%
400	|	|	2.0%
500	|	|	3.0%
1000	3.0%	|	|
2000		|	|
3000		3.0%	|
4000			|
5000			3.0%

4. Dependability is assured by the excellent storage capabilities of the Arrow CCS and the indefinite shelf life of "Light Water" brand agents.

5. The construction of the Arrow CCS System provides that there is no dilution of the concentrate that is not used after activation of the system.

6. Low installation cost—especially when compared to other balanced pressure proportioning methods that require concentrate pumps.

7. Easy retrofit of existing fire protection systems can reduce expensive redesign and refitting.

8. The effectiveness of the Arrow CCS and "Light Water" agent with non-air aspirating dispensing devices provides system design flexibility.

9. The unit is adaptable to nearly all types of fixed fire protection systems.

10. Design simplicity minimizes chance of system failure.

11. Quick opening valves.

12. Automatic or manual operation available.

*Figures shown are based on proper location of concentrate controller

DET
TRONICS

INSTRUCTIONS

Ultraviolet Fire Detection System
with Optical Integrity Feature
Models R7300B, C7050B

CP 9-95
(Ref. Info)

10.1-51

12/76

Form 95-8212

WARRANTY POLICY

Detector Electronics Corporation ultraviolet detectors are manufactured from high quality components and the completed device is rigorously inspected and tested before shipment; however, any electronic device is subject to failure beyond the control of the manufacturer. To insure system reliability, it is important for the user to maintain the system as recommended by the instruction manuals and to determine the frequency of functional checking of the system required for each specific installation. The more frequent the checking, the greater the system reliability. For the highest reliability, a completely redundant system is necessary. The manufacturer warrants its products against defective parts and workmanship, and will replace or repair equipment returned to the manufacturer for these reasons within 12 months after purchase date. See manufacturer's Standard Terms and Conditions on the invoice for complete details. Please note that no other warranties, written or implied, will be honored by the manufacturer.

Table of Contents

DET TRONICS

INSTRUCTIONS
UV Fire Detection System
C7050B R7300B

SYSTEM APPLICATION

Designed for use in the protection of hazardous locations, the Detector Electronics R7300B Controller and the C7050B Detector provide a system for instantaneous response to flames and detection of fires generating ultraviolet (UV) radiation. The patented "oi" feature provides supervision of the lens and critical circuit components.

The R7300B Controller is a surface-mount unit for enclosure inside cabinets or cubicles.

The C7050B Detector, assembled in an explosion-proof enclosure is designed for use in hazardous locations. It may be mounted in direct sunlight because it is designed to be completely solar blind. Indoor applications will not respond to normal artificial light. Up to eight detectors may be attached to each controller.

Typical applications for the Det-Tronics ultraviolet detection system are:

- Wherever highly combustible materials are involved.
- Where there is a need for highly reliable and instantaneous response to flame.
- Wherever unsupervised areas require automated fire protection.
- Where there is a large capital investment to be protected.

Examples of actual installations using the Det-Tronics UV detector in automated fire protection systems include:

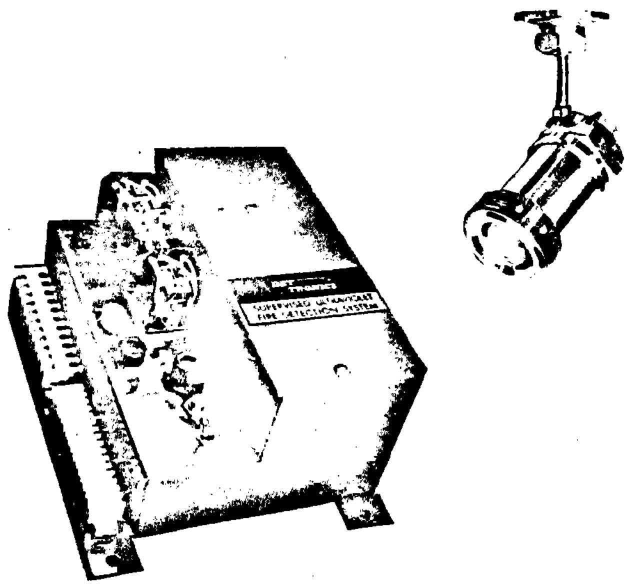


Figure 1—Fire Protection System.

Petroleum Products
- Gasoline transport loading terminals
- Offshore drilling and production platforms
- Pipeline pumping stations
- Tank farms
- Refineries
- Marine engine rooms
- Jet engine test cells

Gaseous Fuels
- Butane and propane loading and storage
- Pipeline compressor stations
- Gas gathering facilities
- Pipelines in highly populated areas
- LNG and SNG loading, transfer, and storage facilities
- LNG Marine tankers
- Methane gas ignitions in coal mines
- Hydrogen fires in ammonia production and refinery reformers

Solid Materials
- Munitions productions, illuminating flame material, TNT, black powder, and other propellants
- Electrostatic powder coating booths
- Magnesium fires
- Metal powders

Chemicals - Petrochemicals
- Toluene storage
- Ethylene production
- Xylene production
- Precipitron air make-up system
- Paint spray booths

Information on these and a wide variety of potential applications is available from Detector Electronics.

*oi is Detector Electronics' trademark for its patented Optical Integrity system.

FEATURES

- Monitoring of all circuitry by utilizing the "oi" feature insures proper functioning of critical components.
- Fast response—Typical response to an intense ultraviolet source is less than 25 milliseconds. Systems are available for applications where response times of less than 10 milliseconds are needed. Write for additional information.
- Not sensitive to solar radiation.
- Not sensitive to normal artificial lighting.
- Field adjustable controller sensitivity.
- Two independent relay actions. First relay responds instantly and second relay has field adjustable time delay from 0.2 to 12 seconds.
- Not sensitive to voltage fluctuations.
- Plug-in printed circuit boards and relays for ease of maintenance.
- Detector housing is corrosion resistant nickel-plated brass, stainless steel or anodized aluminum. Other types of material available for specific applications.
- Sensor tube is shock and vibration mounted inside the detector housing to meet rugged industrial applications.
- Fungus-proof treated sensor tube module.
- Connections provided to the trouble relay for external visual and/or audible status indication.
- Connections provided for remote functions, including alarm, extinguish, and trouble signal.
- Wide range of input voltages and frequency options available for worldwide applications.

OPTIONS

The extinguish relay circuit may be furnished with zero time delay 120 volts A.C. or 24 volts D.C. solid state relays for munitions or other extremely hazardous applications.

Separate load monitoring circuits available where required.

Latching relay circuit (alarm and extinguish relays) available.

SYSTEM DESCRIPTION

The Det-Tronics UV fire protection system consists of a UV detector housed in an explosion-proof corrosion resistant enclosure, and a remotely mounted controller which incorporates all the electronic and switching components. The controller is designed for use in non-hazardous areas. See Figure 1.

oi Feature*

The patented Optical Integrity feature, known as **oi*** was developed and perfected by Detector Electronics. It provides a simple means of assuring that the entire fire detection system is operational and ready to respond to fire or explosion, by checking the detector's optical surfaces as well as the associated electrical circuitry at the controller. It makes certain the ultraviolet sensing system is unimpaired and unobscured and that all sensing and alarm circuits are operational.

UV Detector

The UV detector is a Geiger-Mueller tube that is sensitive to ultraviolet radiation, and is mounted in an explosion-proof housing. When UV strikes the tube, a signal is sent to the controller. If the UV sensitivity of the controller is exceeded, an output circuit is instantaneously actuated and, after a timed delay, a second circuit is actuated.

Controller

The controller contains all the electronic circuitry for processing the signals from the detector to actuate the relays that control the fire alarm and fire protection equipment.

It also contains the bypass switch for temporarily dis-arming the fire protection equipment, and indicators to tell the condition of the lens, detector, and controller while making the **oi*** check.

***oi** is a Detector Electronics trademark for its patented Optical Integrity System.

System Checkout

oi - The Optical Integrity feature developed and manufactured by Detector Electronics provides the user with a method for remote system checking of the optical integrity of each detector, and also checks all sensing and alarm circuits to be sure they are operational. See "Checkout Procedure" section for usage.

Dimensions

The controller may be mounted using the four mounting brackets as furnished or the brackets may be reversed. See Figure 2 for mounting dimensions of the detector. See Figure 3 for mounting dimensions of the controller.

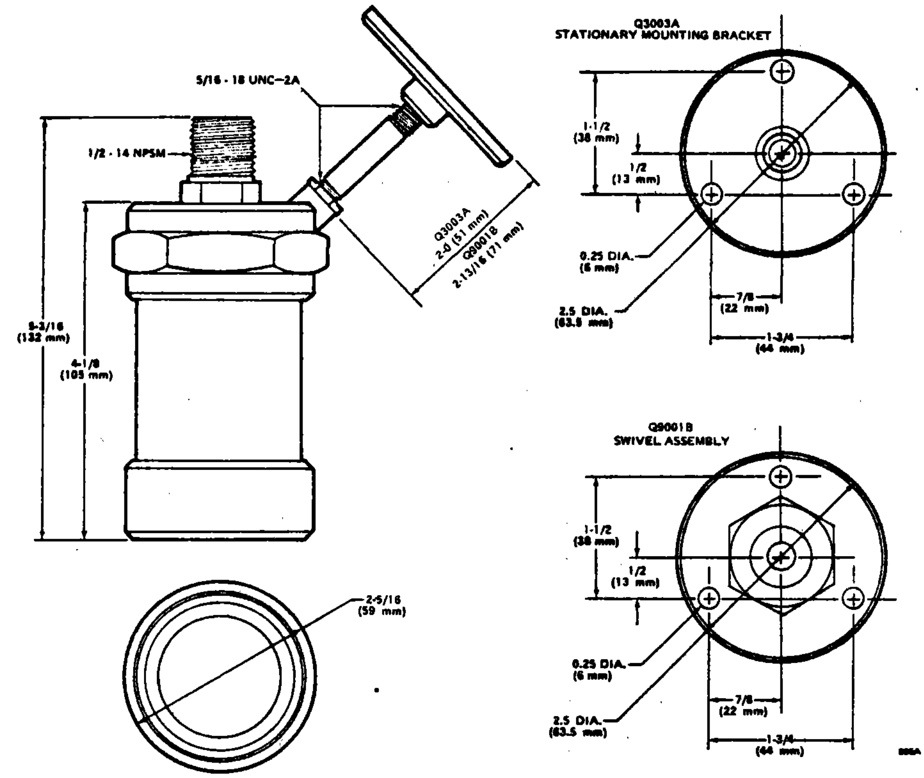


Figure 2—Mounting Dimensions of the Detector in Inches (mm).

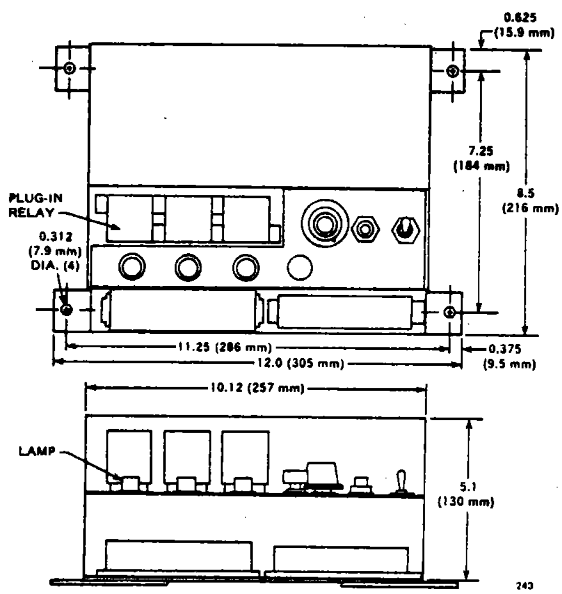


Figure 3—Mounting Dimensions of the Controller in Inches (mm).

Controller Sensitivity

Controller sensitivity is field adjustable for 10, 25, and 100 counts per second response, such that a reference flame (consisting of a gasoline fire generated from a one-square-foot surface) can be detected at distances ranging from less than 10 to greater than 45 feet. See "Theory of Operation" section for explanation of count rate.

Detector Enclosure Rating

C7050B: Class I, Group D
Class II, Groups E, F and G
U.L. 698 Standards for Safety

CSA certified C7050B models are available. Models meeting other requirements are available upon request.

Wiring Requirements

A shielded three wire cable plus one more wire, minimum 22 gauge 400 volt rating must be used to connect the controller to the detectors. If the cable is installed in conduit to the detectors, it should be used exclusively for the signal cable to avoid noise pulses. The detectors may be located up to 1000 feet from the controller. See "Installation" section and Figure 14 for wiring connections.

We recommend the use of Belden cable #8770 or equivalent.

SPECIFICATIONS

Electrical Ratings

INPUT VOLTAGE–
100, 120, 208, or 240 volts, 50/60 Hz; 12 and 24 volt D.C. models available. Fluctuations between 85% and 110% of rated voltage have no effect on detector sensitivity or system operation.

RELAY CONTACT RATINGS–
For the three relays (instantaneous relay, time delayed relay and fault relay): Form C (N.O. and N.C.) 10 amperes resistive, 8 amperes inductive.

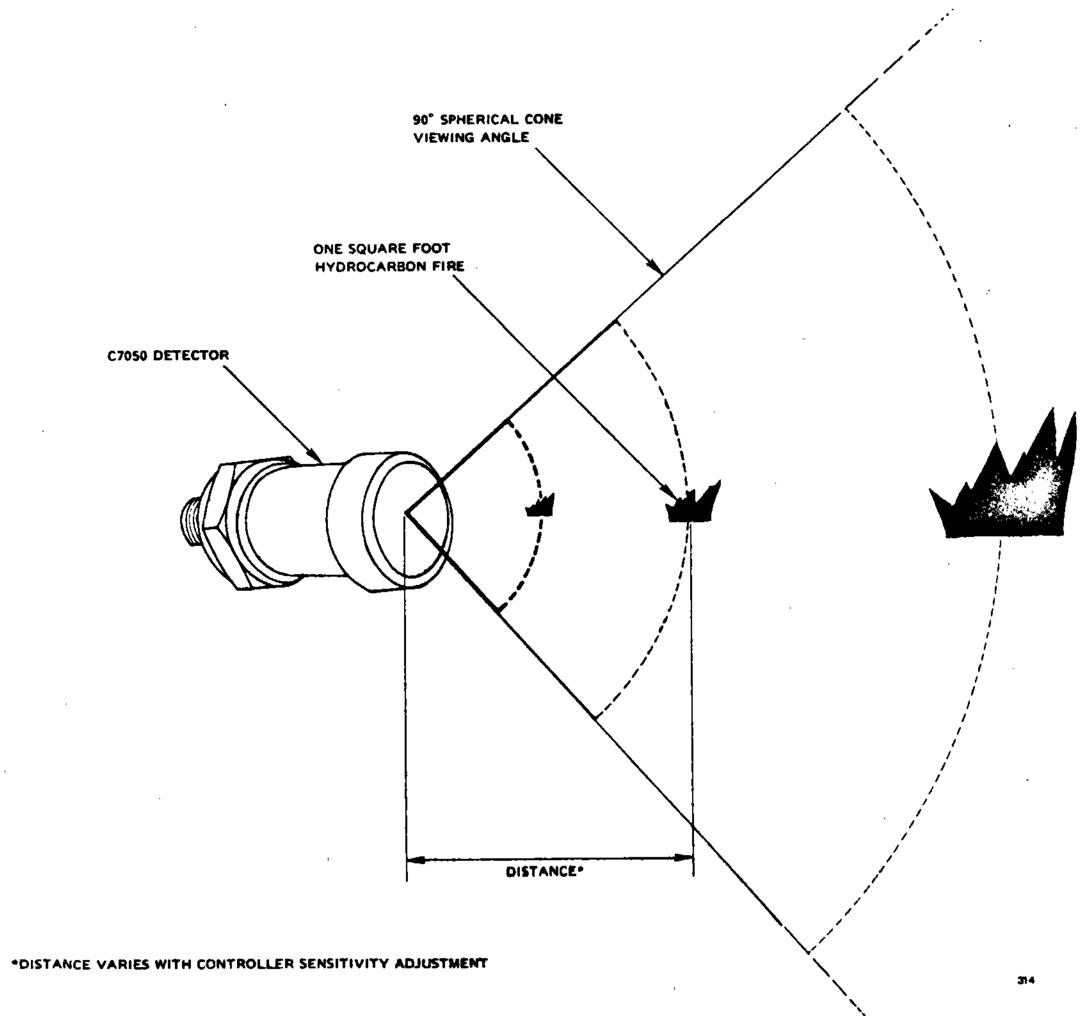


Figure 4—UV Fire Detector Cone of Vision.

SOLID STATE RELAY RATINGS–
Optional for use in the time delay circuit. Form A (N.O.).
24 volt D.C. model: 1 ampere continuous, 5 amperes intermittent.
120 volt A.C. model: 7 amperes.

MANUAL SWITCH RATINGS–
10 amperes resistive, 8 amperes inductive.

POWER CONSUMPTION–
A.C. only, quiescent state is typically 5 watts. Maximum power required for actuation is 7.5 watts.
D.C. only, quiescent state is typically 7.5 watts. Maximum power required for actuation is 10 watts.

CONE OF VISION–
The Detector has a 90 degree cone of vision. See Figure 4 - UV Fire Detector Cone of Vision.

SPECTRAL SENSITIVITY RANGE–
The Det-Tronics UV Detector responds in the range of 1850 to 2450 Angstroms. Detectors are not sensitive to direct or reflected sunlight or to normal artificial light. *NOTE: Intense levels of X-ray and Gamma radiation will cause the system to operate. See "Theory of Operation" section.*
Also note that arc welding is an intense UV source, requiring special application techniques to restrict this radiation from the detector's cone of vision.

TEMPERATURE RATING–
Operating: -40 to +170°F (-40 to +77°C).
Storage: -67 to +170°F (-55 to +77°C).

WEIGHT–

	Pounds	Kilograms (Approx.)
R7300B Controller	10-1/8	4.59
C7050B Detector	1-7/8	0.85

THEORY OF OPERATION

Detector

The Detector Electronics ultraviolet fire detector uses a Geiger-Mueller type detector designed to detect radiation in wavelengths from 1850 to 2450 Angstrom units. (10,000 Angstroms = 1 micron = 0.001 millimeter.)

Figure 5 illustrates the detector's range of sensitivity, and compares this range to other forms of radiation. Note that the UV radiation from the sun reaching the earth does not extend into the detector's region of sensitivity. Radiation from normal artificial lighting, such as fluorescent, mercury-vapor and incandescent lamps also does not extend into the detector's spectral range. As a result, the detector is not sensitive to these forms of radiation. Because of this feature, the detector may be used outdoors in direct sunlight, or it may be used in areas of intense lighting.

Radiation is not emitted continuously, but is emitted in small bundles called photons. The energy of a photon is dependent on the wavelength of the radiation. When a photon of radiation is absorbed into a metal such as the cathode (negative plate) of the UV detector, the energy of the photon is imparted to an electron within the metal, causing it to leave the surface of the metal and be drawn toward the anode (positive plate). The energy that the electron must have to leave the metal is called the work function of the metal. The sensitivity range of a radiation detector is dependent upon the work function of the metal used in the cathode. Tungsten is used in the Det-Tronics UV detector and it is not sensitive to the sun's radiation at the earth's surface.

The cathode of the UV detector will emit electrons if exposed to UV radiation shorter than 2450 Angstroms; the Detector's envelope will not pass UV radiation that has a wavelength shorter than 1850 Angstroms. Therefore, the spectral response of the Detector is 1850 to 2450 Angstroms.

The detector is filled with an ionizable gas, such that when an electron is emitted from the cathode and is rapidly drawn to the anode (See Figures 6 and 7) it strikes a gas molecule with enough energy to cause electrons to be emitted from the gas molecule; these strike other gas molecules releasing other electrons. The total number of electrons generated in this manner is typically several million times more than were emitted from the cathode.

The current can be stopped by reducing the applied voltage to the tube so that the emitted electron does not have sufficient energy to cause other electrons to be emitted when it collides with the gas molecules. In the Det-Tronics UV Detector, the current is allowed to flow for a very short period of time before the voltage is reduced and the current stopped.

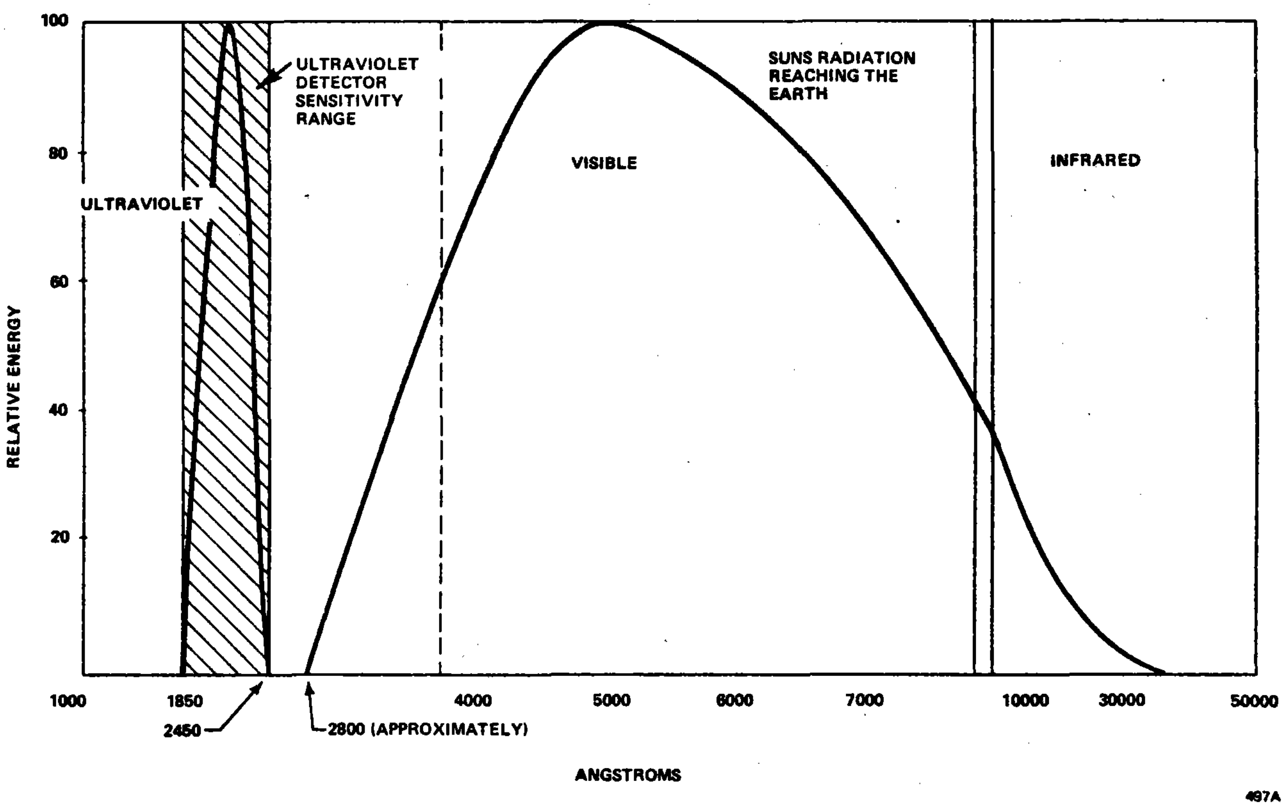


Figure 5—UV Detector's Range of Sensitivity in Reference to Other Forms of Radiation.

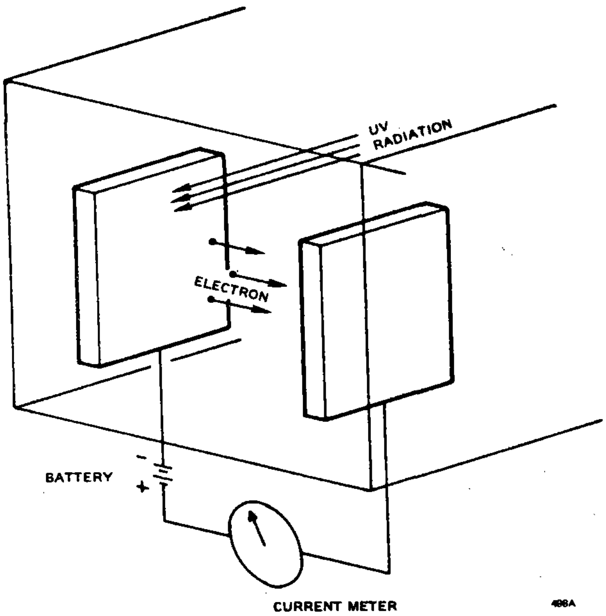


Figure 6—Schematic Illustration of a "Geiger-Mueller Detector".

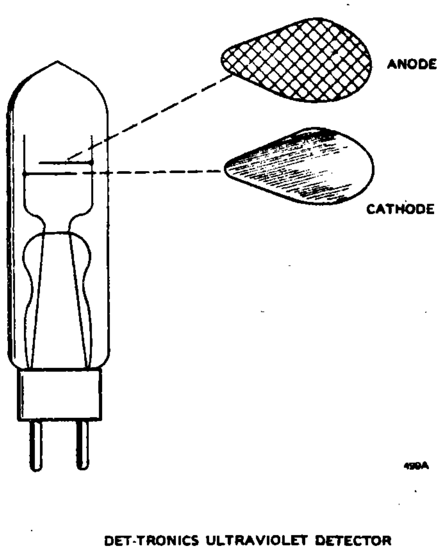


Figure 7—Det-Tronics Ultraviolet Detector.

The output of the Detector is a voltage pulse. In the Det-Tronics system, the frequency of these pulses is proportional to the intensity of the UV striking the detector.

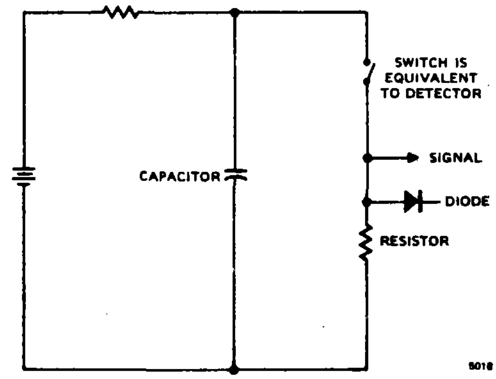


Figure 8—Circuit Showing Switch Acting as Detector Equivalent.

The Det-Tronics UV Detector can be thought of as a normally open switch (see Figure 8) that is momentarily closed when a UV photon with a wavelength of 1850 to 2450 Angstroms strikes it. The frequency of this switch operation increases as the intensity of the UV increases.

oi Checking Feature

An important consideration with any ultraviolet fire detector is that a gradual buildup of contaminants - oil, gasoline, petrochemicals, dirt, grime, salt - on the lens surface will absorb ultraviolet radiation. When the buildup is heavy enough, the detector is blind.

Making the problem more difficult is the fact that a buildup great enough to completely obscure the detector can be virtually undetectable to the human eye.

Until now, the only way to spot such a buildup was with a portable ultraviolet "flashlight" that would simulate a fire. This procedure is reliable, but slow and cumbersome, and requires two men - one with the flashlight, the other at the controller.

A simpler procedure is incorporated in Detector Electronics' "**oi**" system. Here the detector itself has a tiny ultraviolet test lamp inside the housing, but screened by a special shield so the ultraviolet sensor cannot see it directly. Instead, ultraviolet radiation from the test lamp goes through the lens, reflects off a beveled ring mirror, and goes back through the lens to the detector's ultraviolet sensor. See Figure 9 for illustration.

Putting the Normal/Bypass switch at the controller in bypass position locks out the alarm circuits. Pushing the **oi** pushbutton turns on the detector's test lamp. Controller response indicates a clean lens, and also checks that the detector and all electronic circuits are operational. Lack

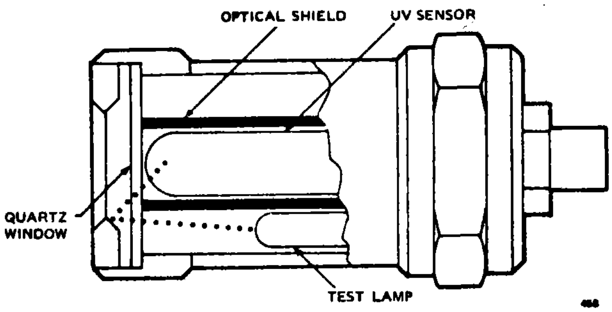


Figure 9—"oi" Test Lamp in Detector Housing.

of response indicates that the sensitivity has been reduced due to contamination on the lens, or electronic circuit problems.

The detector has an explosion-proof cylindrical body of nickel-plated brass, stainless steel (303 or 316) or anodized aluminum engineered to withstand high saline and pH atmospheres as well as temperatures and humidity extremes; it resists shock and vibration.

The detector may be mounted with one of three optional mountings - a rigid bracket for stationary mounting, a swivel bracket with a 240 degree sweep adjustment or a quick-connect mounting (on the lens end) for looking inside mixers, kettles, conveyors, and other inaccessible areas.

Controller

The R7300B controller contains three independent relays: The first relay (called the Instantaneous relay) is energized immediately when the UV radiation received by the C7050B detector exceeds a preset level.

The second (called the Time-Delayed relay) is energized if the detector signal is continuous for a preset time. The time delay is field adjustable over the range of 0.2 seconds to 12 seconds. The time delay feature can be used, for example, to assure that a fire of sufficient magnitude exists before an extinguishing system is energized. In many applications the instantaneous relay is used to sound an alarm and to cut off the source of fuel causing the fire, and the time delay relay is used to cause the fire extinguishing agent to be dispensed if the fire continues.

The third relay (called the Fault Relay) is normally energized, and monitors for electrical faults within the system that could prevent proper operation in the event of a fire.

The Fault Relay will be de-energized if one or more of the following occurs:

- If the system is in bypass.
- If any of the three leads to the detector open, short to each other or short to ground.
- If any of the power supplies within the Controller fail.
- If the Alarm, Extinguish or Trouble Relay coils are open or if a relay is removed.
- If any of the four printed circuit boards are removed.

The Fault Relay contacts can be connected to external equipment to sound an alarm or remove power from a hazardous process in the event that the system has a malfunction.

The Standard Controller also contains four printed circuit boards.

Relay Drive - Board No. 1

The relay board shown in Figure 10 provides the following:
- Circuitry to operate the instantaneous relay
- Circuitry for the time delay relay control
- Circuitry to operate the trouble relay
- Time delay adjustment potentiometer

Integrator and Comparator - Board No. 2

This board, shown in Figure 11, provides amplification and integration of the Detector signal, and contains the sensitivity adjustment terminal block.

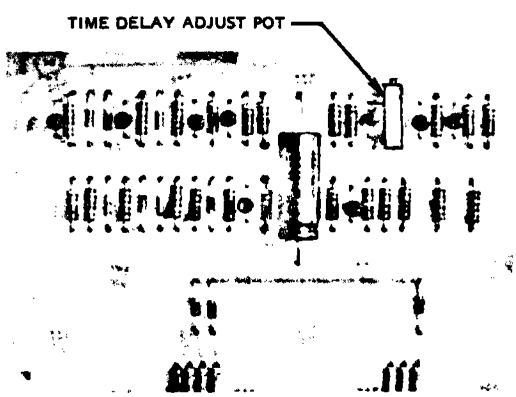


Figure 10—Board No. 1, Relay Drive.

Detector Monitor - Board No. 3

The purpose of the detector monitor board is to continuously check the wiring between the detectors and the controller. See Figure 12. If a fault occurs in the detector circuit, the Fault Relay will be de-energized.

Power Supply - Board No. 4

The power supply board shown in Figure 13 provides the regulated D.C. voltage for the amplifiers, the relay drive voltage and the 290 volts D.C. for the Detectors.

Inverter Board

The 12 volt D.C. or 24 volt D.C. controller has one inverter board in addition to the four boards mentioned above.

The inverter board shown in Figure 14 replaces the line voltage transformer when the 12 volt D.C. or 24 volt D.C. versions of the R7300B are ordered. The Controller is not field convertible from A.C. to D.C. power supply.

The 12 volt D.C. version of the R7300B operates over a range of 10.5 volts D.C. to 16 volts D.C. maximum including any ripple factor.

The 24 volt D.C. version of the R7300B operates over a range of 18.0 volts D.C. to 38.0 volts D.C. maximum including any ripple factor. If the Controller is operated with a power supply or battery having a float charger, the ripple factor must be added to the D.C. voltage so that the output voltage supplied to the controller, including the ripple, does not exceed the maximum values given above.

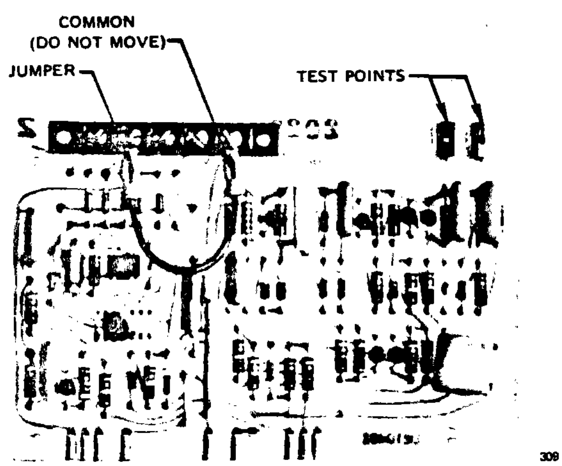


Figure 11—Board No. 2, Integrator and Comparator.

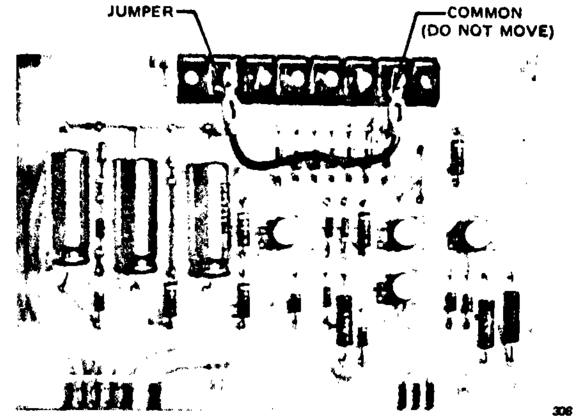


Figure 12—Board No. 3, Detector Monitor.

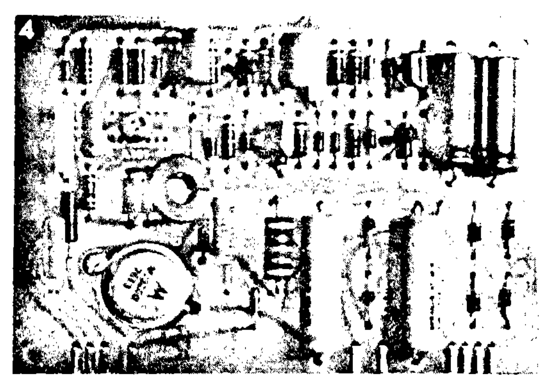


Figure 13—Board No. 4, Power Supply.

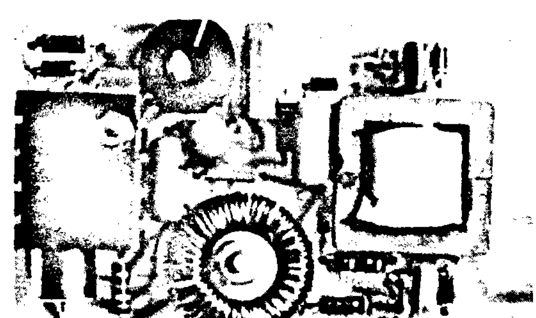


Figure 14—Inverter Board.

Controller Sensitivity

The selection of the controller sensitivity and the time delay to be used in a given application is dependent on the level of hazard present, and the action to be taken in the event of a fire. The adjustable sensitivity and time delay features of the R7300B system allow it to meet the requirements of virtually any application. For sensitivity adjustment information, see the "Installation" section of this form.

As previously stated, the detectors are sensitive to welding, and if this type of interference can be expected, it must be controlled through proper application. Successful application techniques include careful positioning or shielding of the detector, and adjusting the controller to a low sensitivity (high count) setting.

Since the UV sensor of this device is a Geiger-Mueller type detector, it will, of course, detect any radiation which can penetrate the glass envelope and thus create ion pairs. The glass envelope is thick enough so that no Alpha or Beta particles will be detected, but it permits both Gamma and X-rays to pass through. If these rays create ion pairs between the electrodes near the cathode, the normal discharge process will then occur and the detector will produce a count. Thus, if the X or Gamma ray flux is sufficient to produce a count rate high enough to trigger the detector, a false fire alarm will occur.

Data on the sensitivity of the C7050 detector to various radiation intensities is impossible to relate to a typical detector exposure, due to the many variables which are needed to specify any given exposure. Atomic Energy Commission limits specify a maximum allowable dose for atomic workers of 300 mR per week. The limits are 500 mR/year for non-atomic workers, i.e.--the general population. In the case of X-rays, most states have specified the same 300 mR maximum allowable doses for workers. These limits can easily be exceeded by the fluxes which will cause a large number of counts in the detectors. The normal precaution against false actuation due to this radiation is to turn off the detection system when intermittently used sources of radiation are present, or to use a low sensitivity setting on the controller when the sources are continuously present.

System Sensitivity

The output signal from the UV detector is a voltage pulse, the frequency of which is determined by the size of the fire, the type of fuel that is burning, and the distance from the detector to the fire. The term "counts per second" (cps) will be used to designate the number of voltage pulses generated per second by the UV detector. The closer a fire is to the detector, the smaller the flame that is needed to actuate the system. Figure 15 shows the relation between

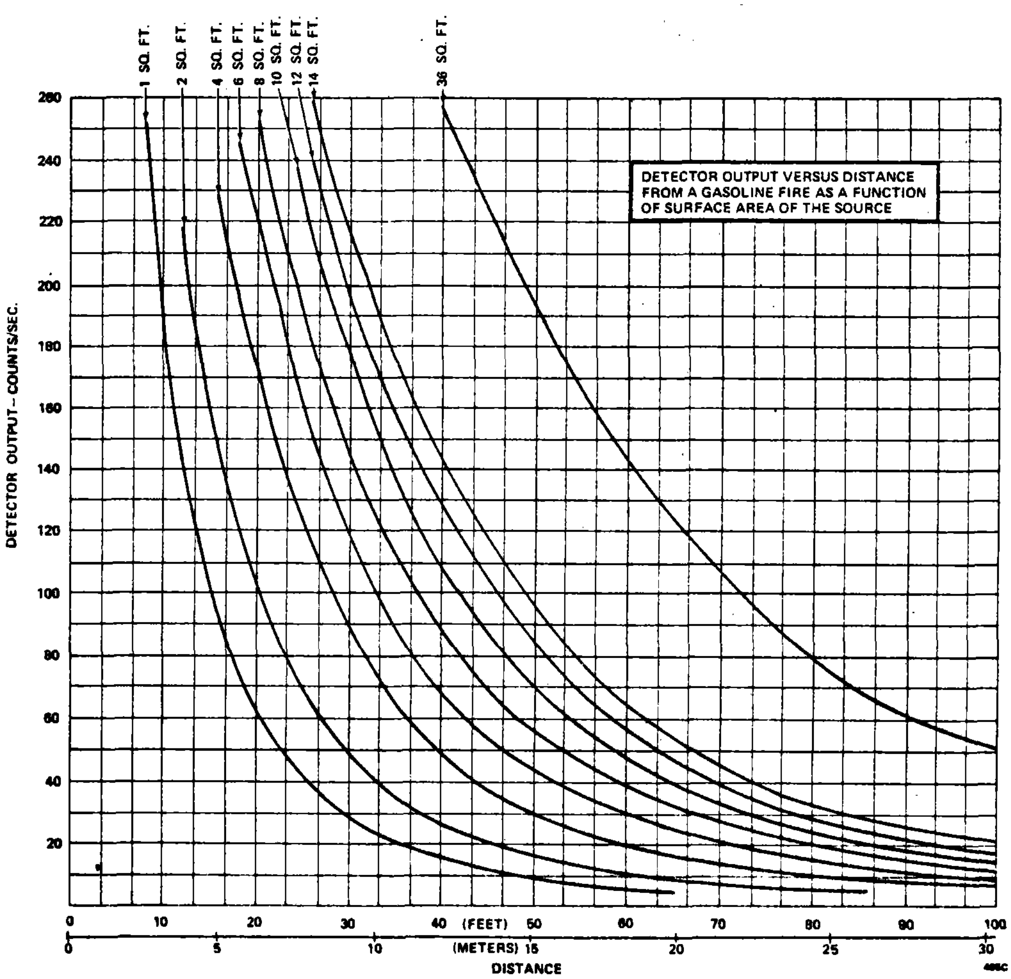


Figure 15—Sensitivity To A Gasoline Reference Fire.

counts per second (cps) and distance. From this curve it can be seen, for example, that if a gasoline fire at 60 feet causes the detector to generate 25 cps, the same fire at 40 feet will generate 80 cps. Another example would be if a fire at 20 feet generated 100 cps, it would generate 10 cps at 70 feet. Because of the complexity of the combustion process, the count rate generated by two different size fires at the same distance is difficult to predict. In general, however, if a fire is doubled in size, the count rate is increased by approximately 60%. See "Startup Procedure" for changing count rate.

INSTALLATION

Mounting

Detector - The detector may be mounted in any position, however, care must be taken so that dirt or other foreign materials will not accumulate on the lens. Each detector may be separated from the controller by a distance of up to 1000 feet. See Figure 2 for basic mounting dimensions.

The wiring to each detector should be in a three conductor shielded cable plus one more wire, 22 gauge or larger with at least a 400 volt D.C. rating. The shielded cable is common to all detectors but each detector needs a separate lead from the detector directly to the controller - the "D" lead. The shield is grounded only at the controller. When more than one detector is used the shields are connected together. See Figure 27 for illustration of typical installation. When the cable is run in conduit, it must be in a separate conduit from other electrical equipment.

It is also recommended that conduit sealing compound and conduit breathers be used because in some applications, such as outdoor locations, alternate changes in temperature and barometric pressure causes "breathing", which allows the entry and circulation of air throughout the detector and connected conduit. Joints in the conduit system and its components are seldom tight enough to prevent this "breathing". Moisture in the air condenses at the base of vertical conduit runs and equipment enclosures, and may cause high humidity conditions. This can be detrimental to electronic devices. To eliminate this condition, explosion-proof drains and breathers, such as Crouse-Hinds types ECD, should be installed to automatically bleed off the water.

1. Detectors are located for the best view of the area to be protected. A swivel mounting bracket (Q9001 assembly) is available for ease of installation. For outdoor applications the detectors must be directed downward to prevent the cone of vision from scanning the horizon, as the detectors may be affected by long term lightning flashes or arc welding. See Figure 2 for mounting dimensions.
2. Remove the detector housing by turning the housing cover counterclockwise. See Figure 16 for example of detector housing.
3. Install cable or conduit connector and wiring to connections A, B, C and D in terminal block. If the shielded cable is to continue to another detector, tie the shields together and isolate. If not, trim back shield so that it will not touch any connections. The shield is grounded **only** at the controller.
4. Remove tube module from packing and install, locating the correct terminal positions by the index pin.
5. Install four screws and tighten.
6. Replace detector housing.

Controller - The R7300B may be mounted in any position. See Figure 3 for mounting dimensions. It should be mounted in a permanent location where it can be easily monitored and checked regularly. If the controller is mounted outdoors, a weather-resistant enclosure must be provided. If it is necessary to mount the controller in a hazardous location, an explosion-proof enclosure must be provided.

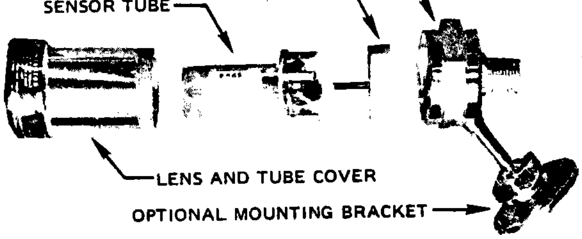


Figure 16—Detector Housing.

Electrical Connections

Controller

Figure 17 shows the standard A.C. terminal configuration of the controller. Figure 17A shows the D.C. terminal configuration. The A.C. terminal configuration is as follows:

Terminal 1 - connects to earth ground as indicated
Terminal 2 - connects to the neutral of the input power line
Terminal 3 - connects to the hot side of the input power line
Terminal 4 - } normally closed contacts } Instantaneous relay
Terminal 5 -
Terminal 6 - } normally open contacts
Terminal 7 -

Terminal 8 - } normally closed contacts } Time Delay relay
Terminal 9 -
Terminal 10 - } normally open contacts
Terminal 11 -
Terminal 12 - common } Fault Relay
Terminal 13 - normally open
Terminal 14 - normally closed

(These relay contacts are isolated and may be connected to any external power source within the electrical rating of the contacts in the relays.)

Terminal 15 - } Remote reset (switch) of the Fault Relay
Terminal 16 -

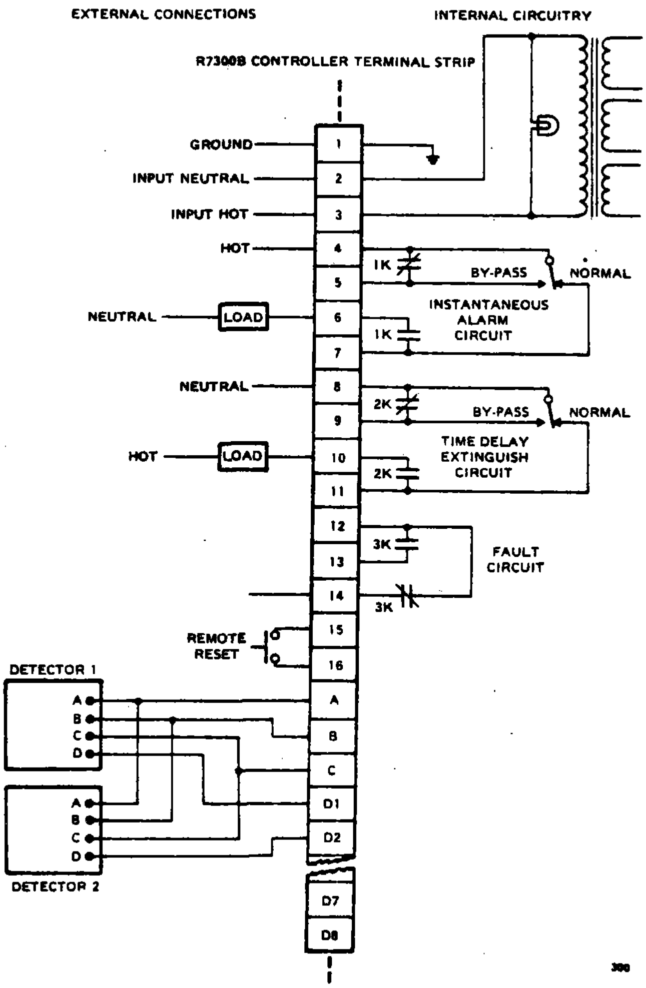


Figure 17—R7300B Controller Terminal Strip, All A.C. Operation.

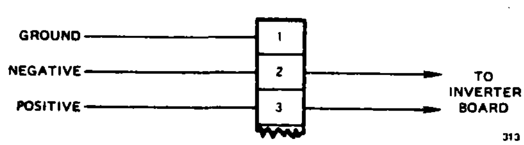


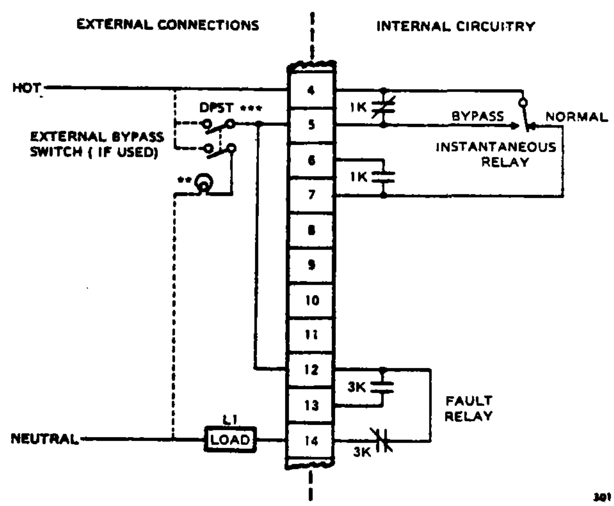
Figure 17A—R7300B Controller Terminal Strip, 12/24 Volt D.C. Operation.

Terminal A - connects from the Detector (s)
Terminal B - connects from the Detector (s).
Terminal C - connects from the Detector (s)
Terminal D1 - connects individual wire from Detector 1
Terminal D2 - connects individual wire from Detector 2
Terminal D3 - connects individual wire from Detector 3
Terminal D4 - connects individual wire from Detector 4
Terminal D5 - connects individual wire from Detector 5
Terminal D6 - connects individual wire from Detector 6
Terminal D7 - connects individual wire from Detector 7
Terminal D8 - connects individual wire from Detector 8

The shield on the cable containing leads A, B, and C is connected to Terminal 1.

Figures 18 to 23 show typical wiring diagrams for controllers using standard mechanical relays.

Figures 24 and 25 show typical wiring diagrams for controllers using solid state relays. ***NOTE: The solid state relays have zero time delay.***



**INDICATING LIGHT FOR EXTERNAL BYPASS (IF USED)
***EXTERNAL BYPASS SWITCH SHOWN IN NORMAL POSITION

Figure 18—Normally Energized Load Circuit Connected to Instantaneous (Alarm) Relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

Power to external load (L1) is removed when "fault" occurs in supervised circuitry or when Instantaneous relay is in "fire" mode.

The purpose of the bypass switch in this type circuit is to allow checkout of the instantaneous relay without interrupting power to the normally energized external load.

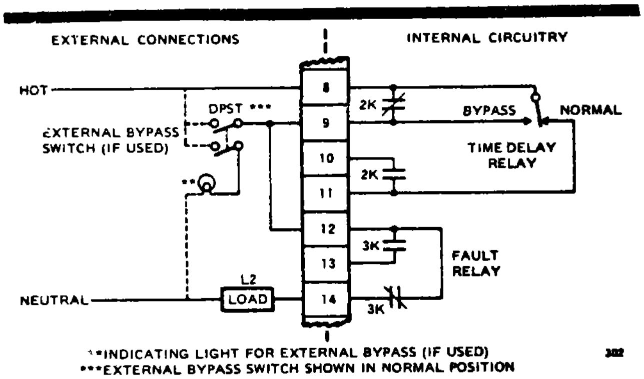


Figure 19—Normally Energized Load Circuit Connected to Time-Delayed (Extinguish) Relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

Power to external load (L2) is removed when "fault" occurs in supervised circuitry or when Time-Delayed relay is in "Extinguish" mode.

Purpose of the bypass switch in this type circuit is to allow checkout of the Time Delay relay without interrupting power to the normally energized external load.

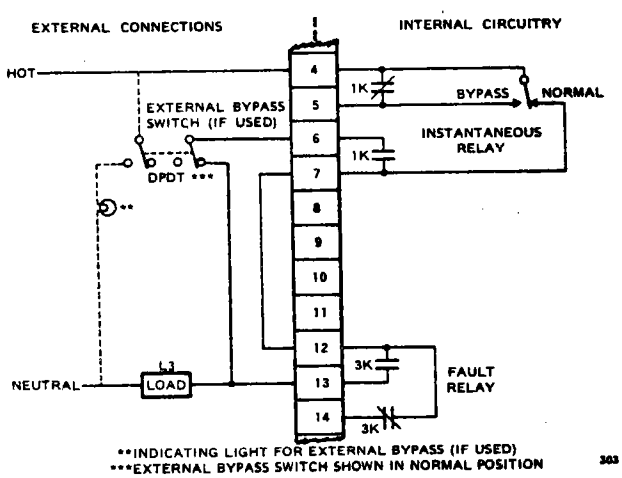


Figure 20—Normally Unenergized Load Circuit Connected to Instantaneous (Alarm) Relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

Power is applied to external load (L3) when "fault" occurs in supervised circuit or when instantaneous relay is in "fire" mode.

Bypass switch allows checkout of the instantaneous relay without applying power to the unenergized external load.

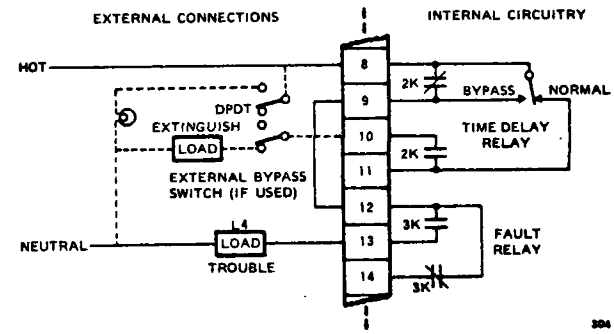


Figure 21—Normally Unenergized Load Circuit Connected to Time-Delayed (Extinguish) Relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).
Power is applied to "trouble load" (L4) when fault occurs in supervised circuitry.

Power is applied to "extinguish load" when time-delayed relay is energized with bypass switch in normal position.

Bypass switch allows checkout of the time delay relay without applying power to the "trouble" and "extinguish" loads.

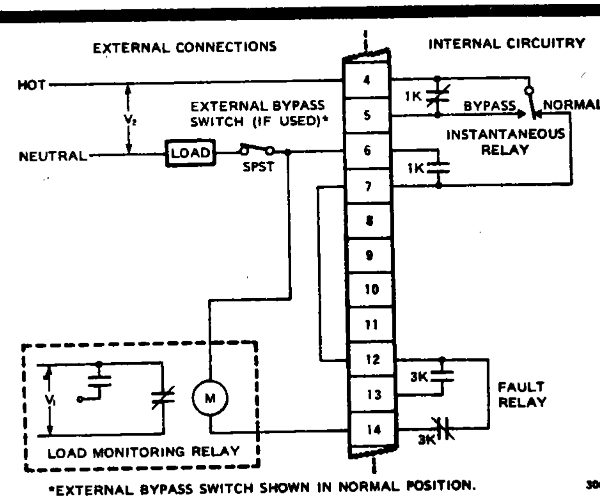


Figure 22— Normally Unenergized Load Circuit Connected to Instantaneous (Alarm) Relay with Load Monitoring Relay External.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

External bypass switch shown in normal position.

Load monitoring external relay will de-energize under the following conditions: (1) a fault in the controller, (2) lead wires to detectors short or open, (3) open circuit in the external load, or (4) leads to the external load open. If protection against shorted connections as well as open circuits to the external load is desired, connect the load to the "Hot" side of the line rather than the neutral. If connected to neutral, a short in the leads would result in actuation of the load.

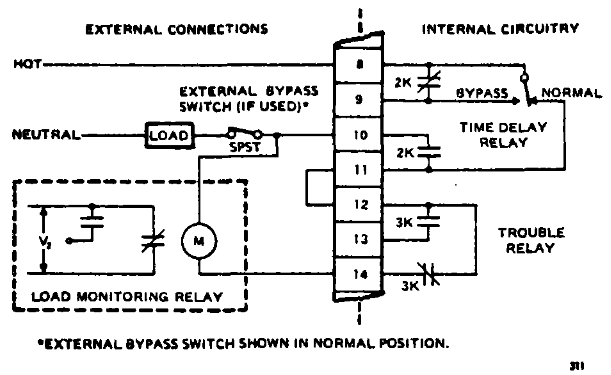


Figure 23— Normally Unenergized Load Connected to Time-Delay (Extinguish) Relay with Load Monitoring Relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

External bypass switch shown in normal position.

Load monitoring external relay will de-energize under the following conditions: (1) a fault in the controller, (2) lead wires to detector short or open, (3) open circuit in the external load, or (4) leads to the external load open. If protection against shorted connections as well as open circuits to the external load is desired, connect the load to the "Hot" side of the line rather than the neutral. If connected to neutral, a short in the leads would result in actuation of the load.

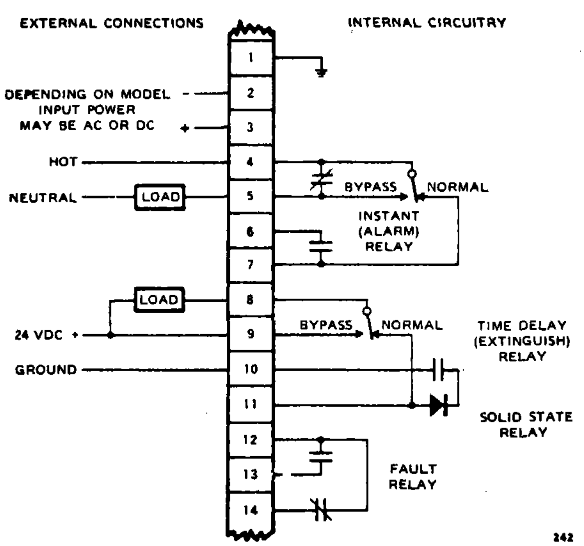


Figure 24—Typical R7300B Wiring Connections Using a 24 Volt D.C. Solid State Relay.

Normally unenergized load circuit connected to Time Delay (Extinguish) solid state relay and energized load circuit connected to Instant (Alarm) relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

Purpose of the bypass switch in this type circuit is to allow checkout of the Instant and the Time Delay relays without interrupting power to the normally energized Instant load, and without applying power to the unenergized load on the Time Delay relay.

The load (10 amperes maximum) on the Instant relay may be either 120 volts A.C. or 24 volts D.C.

The load (1 ampere constant, 5 amperes intermittent) on the Time Delay solid state relay is shown as a 24 volt D.C. load.

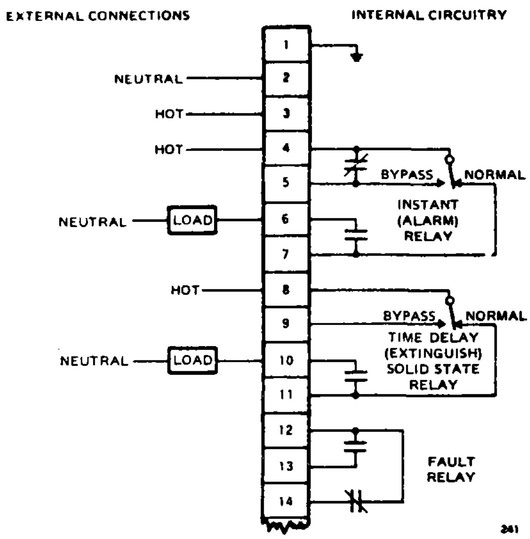


Figure 25—Typical R7300B Wiring Connections Using a 120 volt A.C. Solid State Relay.

Normally unenergized load circuit connected to Instant relay.

Normally unenergized load circuit connected to Time Delay solid state relay.

Fault Relay contacts are shown with relay energized (no trouble in circuit).

Power is applied to the external loads when the relays are energized (fire mode).

Purpose of the bypass switch in this type circuit is to allow checkout of the Instant and the Time Delay relays without applying power to the unenergized loads.

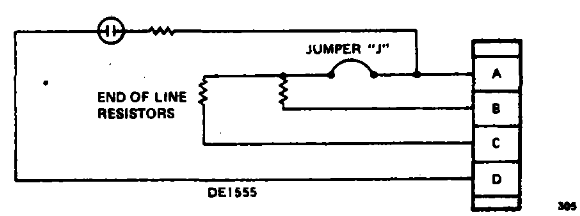
The load (10 amperes maximum) on the Instant relay may be either 120 volt A.C. or 24 volt D.C.

The load (7 amperes maximum) on the Time Delay solid state relay is 120 volts A.C.

Detector

It is possible to connect four detectors directly to the controller and up to eight detectors to the controller with field modification. Terminals A, B and C on the Controller terminal panel connect to A, B and C in the detectors. The detectors are wired internally with EOL lead monitoring (end of line) resistors between terminals A and B and A and C. See Figure 26. Terminal D in **each** detector is connected directly to the individual terminals D1 to D8 on the controller terminal panel. Up to four detectors may be connected to the controller in parallel with their end of line resistors connected. If more than four detectors (up to eight) are used, two or more detectors may be connected together, but this requires a modification of all except the detector at the end of the line. The jumper shown in Figure 26 must be cut in all but the last detector and **in addition** the A, B and C wires from the first detector must be connected directly to the A, B and C connections in each succeeding detector. See Figure 27 for example of wiring. The wires A, B and C from the first detector are then connected to the appropriate terminals on the controller.

Be sure the jumper wire on the detector monitor board, Board No. 3 in the controller, is programmed for the number of EOL resistors in the circuits, up to four. See "Startup Procedure" for further information.



DETECTOR

Figure 26—End Of Line Resistors.

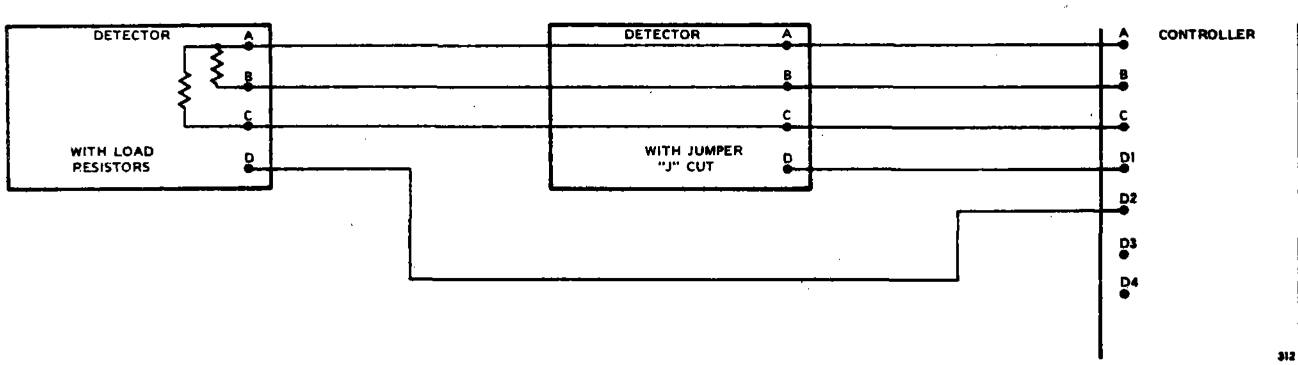


Figure 27—Wiring for Parallel Detectors.

STARTUP PROCEDURE

The following startup procedure should be performed immediately after installation of the equipment has been completed. The Normal/Bypass switch on the controller **must** be in the Bypass position.

CAUTION: Always remove input power before removing printed circuit boards.

1. Sensitivity Adjustment

The controller is shipped with the sensitivity set at 25 cps. If it is desired to change this setting, remove the printed circuit board No. 2 labeled "Integrator and Comparator". Position the wire on the terminal block to the desired sensitivity by moving the spade lug to the appropriate terminal. The numbers below the terminal block indicate the available sensitivity settings in counts per second, e.g. 10, 25 or 100. Firmly reinsert the printed circuit board. See "System Operation" section and Figure 15 regarding sensitivity levels.

2. Detector Monitor

The detector monitor board is shipped with the number of detectors to be connected set on one. If more detectors are used, remove the printed circuit board No. 3 labeled "Detector Monitor" and position the spade lug end of the jumper wire under the appropriate terminal for the number of EOL resistors in the detector circuits. The system can use up to a maximum of eight detectors, but can have only four detectors with EOL lead resistors connected. To use over four detectors, up to a maximum of eight detectors, it is necessary to modify the detectors that are connected in parallel so that the detector with the EOL lead resistors is connected to a detector that has been modified by disconnecting the EOL lead resistors (cutting jumper "J" in the detector). See Figure 26.

3. Time Delay

The time delay is adjusted at the factory for 5 seconds. The total adjustment range is from 0.2 seconds to 12 seconds. If it is desired to change the time delay, put the Normal/Bypass switch on the controller in the bypass position and turn on input power.

Pushing the **oi** switch turns on the instant light. Begin timing until the timed light turns on. It should be approximately 5 seconds. To change the time, adjust the potentiometer on the relay drive board (printed circuit board No. 1) to provide the desired time delay between the instant and timed lights. See Figure 10 for location of potentiometer on board. Turning the potentiometer counterclockwise increases the time delay and turning clockwise reduces the delay. Approximately one turn equals one second.

NOTE: If controller is to be mounted in a hazardous area, adjust the time delay to desired setting before installation. Do not apply power to the controller in a hazardous area unless completely enclosed in explosion-proof housing.

Startup Check

After the above adjustments are made, the sensitivity of the system should be checked. This requires two people, the use of the W866 test lamp, and a D.C. voltmeter with at least 20,000 ohm/volt movement. Put the Detector Test switch on the controller in position No. 1. Push the "**oi**" button. The "instant" lamp should light immediately and the "timed" lamp should light when the time delay passes. If the lamps do not light, see "Troubleshooting" section for corrective measures. Proceed to test each position of the detector test switch for each position or number of detectors used in the system as given above.

Next, locate one person in front of Detector No. 1 at the maximum distance to be covered. Turn on the W866 test lamp and shine into the lens of the first detector. The "instant" lamp should light almost immediately and "timed" lamp should light when the time delay passes. If the lamps do not light, move closer to the lens until the "instant" lamp turns on. This is the "maximum" distance for this detector. The distance should be recorded for future reference when an overall checkup of the system is scheduled. See recommended test form, Figure 28. Repeat the above procedure for every detector in the system and record data.

Next, attach a voltmeter to the test points provided on Board No. 2, Integration and Comparator board. Set the meter on a scale where 0.2 volts D.C. can be read. See Figure 11 for location of test points. When the detectors are not exposed to UV signals, the voltage should be less than 0.2 volts D.C. If the voltage is above this level, it indicates that one or more detectors are responding to spurious radiation or discharging due to internal fault. Cover the lens of each detector to determine whether the problem is internal or external. If covering the lens removes the signal and the voltage drops to normal, locate the external source of spurious radiation and either shield the detector or remove the source. If no external signal is found, a detector module may be at fault. Successively disconnect each detector until the faulty unit is found. Replace the faulty detector and recheck the voltage to see that it has returned to normal.

Some sources of spurious radiation are the following:
1. Welding operations (detectors may respond to arc up to one-half mile.
2. High inductive load switching nearby or in same conduit.
3. Gamma or X radiation from weld testing equipment.

The system is now ready to be put into operation by placing the Normal/Bypass switch in the Normal position.

Periodic System Checkout Procedure

A periodic system checkout should be scheduled to insure that the system is always in proper operating condition. Depending on the potential hazard, the frequency of check-out may be once a day, once a week or less frequent. Experience will allow determination of the optimum test frequence. See the "Recommended Test Form" shown in Figure 28.

The R7300B uses the patented "**oi**" feature for checkout of the complete system. Put the Normal/Bypass switch at the controller in the Bypass position. This disconnects the controller from the loads, and brings power to the **oi** test switch.

Place the detector test switch in Position No. 1.

Push the **oi** button on the controller. The "instant" lamp for the instantaneous relay turns on if the system is operating correctly. After the time delay passes, the "timed" lamp for the time delay relay lights. If the "instant" lamp does not turn on, clean the lens of the detector with Det-Tronics' lens cleaner using an oil-free cloth or tissue and repeat above operation. If the above checkout procedure reveals a continuing malfunction, refer to the "Troubleshooting" section.

Repeat the above operation for each detector in the system by rotating the detector test switch to each position used and perform the test. It is recommended that the lens of each detector be cleaned during each checkout of the system. Do not use solvents that will leave a residue since this may absorb significant amounts of UV radiation.

The above procedure must be performed on all detectors in the system to make sure they are all operational and of the proper sensitivity. After completing the checkout, return the system to operation by placing the "Normal/Bypass" switch in the "Normal" position.

TROUBLESHOOTING

If the "Checkout Procedure" reveals a malfunction in the system, take the following steps to isolate the defective part.

NOTE: Make sure the alarm and extinguish systems are disarmed while performing these tests.

1. Check the input power to the controller by observing the "Power" lamp on the R7300B panel. If the lamp is not turned on but you have input power, check the bulb to see if it is burned out.
2. Check the optical integrity of each detector. Put the "Normal/Bypass" switch in the Bypass position. The "Fault" lamp comes on. Place the detector test switch in Position No. 1. Push the "**oi**" button. The "instant" lamp should light immediately, and the "timed" lamp after the time delay has passed. Release the "**oi**" button and the lamps go out. If the lamps did not come on, clean the lens of the detector with Detector Electronics' lens cleaner using a clean, oil-free cloth or tissue and repeat the above steps. If the lamps now light when the "**oi**" button is pushed, the trouble was a contaminated lens. This indicates the need for a more frequent preventive maintenance cleaning schedule. Repeat the above steps for each detector in the system.
3. If the "Fault" lamp is on when the Normal/Bypass switch is in the Normal position, reset the lamp by pushing the combination fault signal lamp/reset switch. If the lamp goes out it indicates there was a power interruption. If the lamp does not go out when the switch is reset it indicates an electrical fault.

   a. Check Normal/Bypass switch to insure that it is in Normal Position.

   b. Check for loose connections on A, B or C terminals at the detectors and the controller.

   c. Check for 290 volts D.C. between terminals A and C on the controller.

   d. If no 290 volts D.C. is found between terminals A and C, turn off input power and replace Board No. 4 - Power Supply Board.

   e. Check for 400 millivolts D.C. per detector with load resistors from terminal B to C. For example, three detectors give a reading of 1200 millivolts.
4. Check jumper on Board No. 3 to see that it is set for the number of detectors with EOL resistors in the system.
5. If there is 290 volts D.C. between terminals A and C but the instant and timed lamps do not light when the "**oi**" button is pushed, attach a voltmeter to test points (plus on red, minus on black) provided on Board No. 2 - Integrator and Comparator Board. The voltage should measure less than 0.2 volts D.C. Push the "**oi**" button and the voltage should rise to over 1.0 volt. If the voltage does not rise, turn off power and replace Board No. 2.

6. If there is 290 volts D.C. between terminals A and C and the voltage across the test points rises as stated in Step 5, but the lamps do not come on, turn off power and replace Board No. 1 - Relay Drive Board.

7. If there is 290 volts D.C., the voltage rises as stated in Step 5, and the relays close as expected, again check to see if the "Fault" lamp goes out when the "Normal/Bypass" switch is placed in the Normal position and the Fault Signal/Reset switch is pushed.

   If the "Fault" lamp stays on, turn off the input power and replace Board No. 3 - Detector Monitor Board.

8. If the "Fault" lamp still stays on, there is a fault in the external leads to the detectors. Turn off input power and check leads A, B and C from the controller to the detectors for open and shorts.

9. If one detector does not respond to Step 2, but all the other detectors in the system respond, check the "D" leads from that detector to the controller.

After correcting and performing the troubleshooting tests, restore the alarm and extinguish system to operation and return the Normal/Bypass switch to the Normal position.

TABLE I

Replacement Parts

Part Number	Description	Used On	Quantity Recommended
DE1555	UV Sensor Tube Module	C7050B	1
**DE1049	Relay Drive Board No. 1	R7300B	1
**DE1048	Integrator and Comparator Board No. 2	R7300B	1
DE1047A	Detector Monitor Board No. 3	R7300B	1
DE1046A	Power Supply Board No. 4	R7300B	1
DE7403E	Inverter Board (12 volts D.C.)	R7300B	1
DE7403C	Inverter Board (24 volts D.C.)	R7300B	1
DE101164-01	Plug-in Relays	R7300B	1
*DE1017F	Lamp, 120 volt	R7300B	1
*DE1017B	Lamp, 12 volt	R7300B	1
*DE1017D	Lamp, 28 volt (Trouble)	R7300B	1
DE001112-03	Solid State D.C. Relay	R7300B	1
DE101167-01	Solid State A.C. Relay	R7300B	1

*120 volt A.C. models have a 120 volt lamp in the "Power" socket and 28 volt lamps in all the other sockets. The 24 volt D.C. models are equipped with 28 volt lamps in all sockets. The 12 volt D.C. model has 12 volt lamps in the "instant", "timed" and "power" sockets. A 28 volt lamp is used in the "fault" socket.

**These boards vary according to model. Check board for code letter.

ORDERING INFORMATION

When ordering specify model numbers:
R7300B Controller Unit
C7050B Detector
Q9001B Swivel Positioning Assembly
W866A UV Test Lamp

Order from:
1. Your usual source, or
2. **Detector Electronics Corporation**
   7351 Washington Avenue South
   Minneapolis, Minnesota 55435
   612/941-5665

DEVICE REPAIR

For devices in need of repair, contact your local source or return to:

Detector Electronics Corporation
7351 Washington Avenue South
Minneapolis, Minnesota 55435

Attention: Returned Goods Department

Detector Number	Detector Location	Date Installed	Date Checked	Date Lens Cleaned	Maximum Response Distance with W866	Remarks

Figure 28—Recommended Test Form.

DETECTOR ELECTRONICS CORPORATION
7351 Washington Avenue South
Minneapolis, Minnesota 55435
Phone: (612) 941-5665
Telex: 29-0562
Cable: Detronics

Printed in U.S.A.

DET TRONICS

RECEIVED JUL 9 1981 TOWNSEND & BOTTUM INC.

SPECIFICATION DATA

AUTOMATIC Oi*

Ultraviolet Fire Detection System C7050B, R7303B Combination

DESCRIPTION OF OPERATION

Automatic Optical Integrity (**oi**) is an extension of the manual **oi** concept originally developed by Detector Electronics. Automatic **oi** places important new capabilities at the disposal of the fire protection professional, and makes possible a higher degree of security for applications where fire hazard is an unavoidable risk.

Automatic **oi** is an important step forward in ultraviolet fire protection. Developed by Detector Electronics, it assures that the fire detection system is fully operational and ready to respond to fire or explosion.

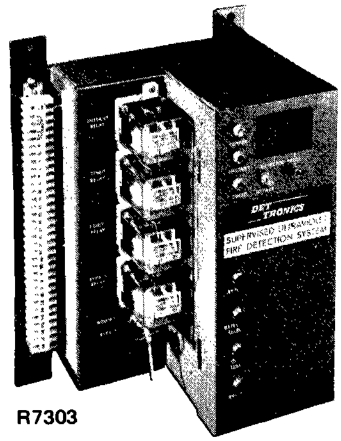
An important consideration with any ultraviolet fire detector is that a buildup of contaminants - oil, gasoline, petrochemicals, - on the quartz window surface will absorb ultraviolet radiation. If the buildup becomes thick enough, the detector is "blinded" to ultraviolet and thus cannot "see" a fire.

Automatic Optical Integrity continuously checks the detector's optical surfaces as well as the associated electrical circuitry by a logic system in the R7303 Controller. It makes certain the ultraviolet sensing system is unimpaired and unobscured, and that all sensing and alarm circuits are operational.

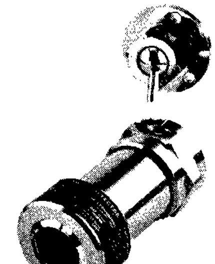
The system consists of one or more C7050B Detectors (up to eight) and the R7303 Controller.

The controller is modular and consists of electronics to process the detector signal plus several switching relays. When one of the C7050B Detectors "sees" an amount of ultraviolet radiation greater than the controller sensitivity setting, one relay is energized immediately. If the ultraviolet level remains above the sensitivity setting, a second relay closes after a pre-determined (field adjustable) time delay. Should a system malfunction occur, a fault relay, which is part of the supervised circuitry, automatically responds to indicate a problem.

The C7050B/R7303 combination provides the same instantaneous response to flame as other Det-Tronics models and features the following important advances:



R7303


C7050

Automatic Oi System Includes C7050B Detectors Plus the R7303 Controller Equipped with Digital Display for Fault Identification

—A digital display located on the front of the R7303 Controller identifies by code number, fault conditions that may develop in the C7050B Detector, the controller itself, or interconnecting wires. Should a fault occur, a monitoring relay with remote indication capability, registers that fact, and the nature of the fault is shown simultaneously on the digital display. If the fault involves a reduction in the sensitivity of any detector, the display will identify the detector or detectors involved.

—Should any detector be suddenly blinded, as for example, due to the rupture of an oil line, the Automatic **oi** system will produce a fault signal at the R7303 Controller.

—Spurious discharges of one or more detectors, or discharges due to background radiation, will produce a fault signal and digital code number at the controller. Thus with the Automatic **oi** system, it is possible to identify detectors that may be failing due to self-excitation or solar sensitivity. In a similar manner, discharges due to low level background radiation can be identified at levels below the fire actuation signal.

*Oi is Detector Electronics' Trademark for its patented Optical Integrity Systems. U.S. Patent 3,952,196, United Kingdom Patent 1,534,969, Canada Patent 1,059,598.

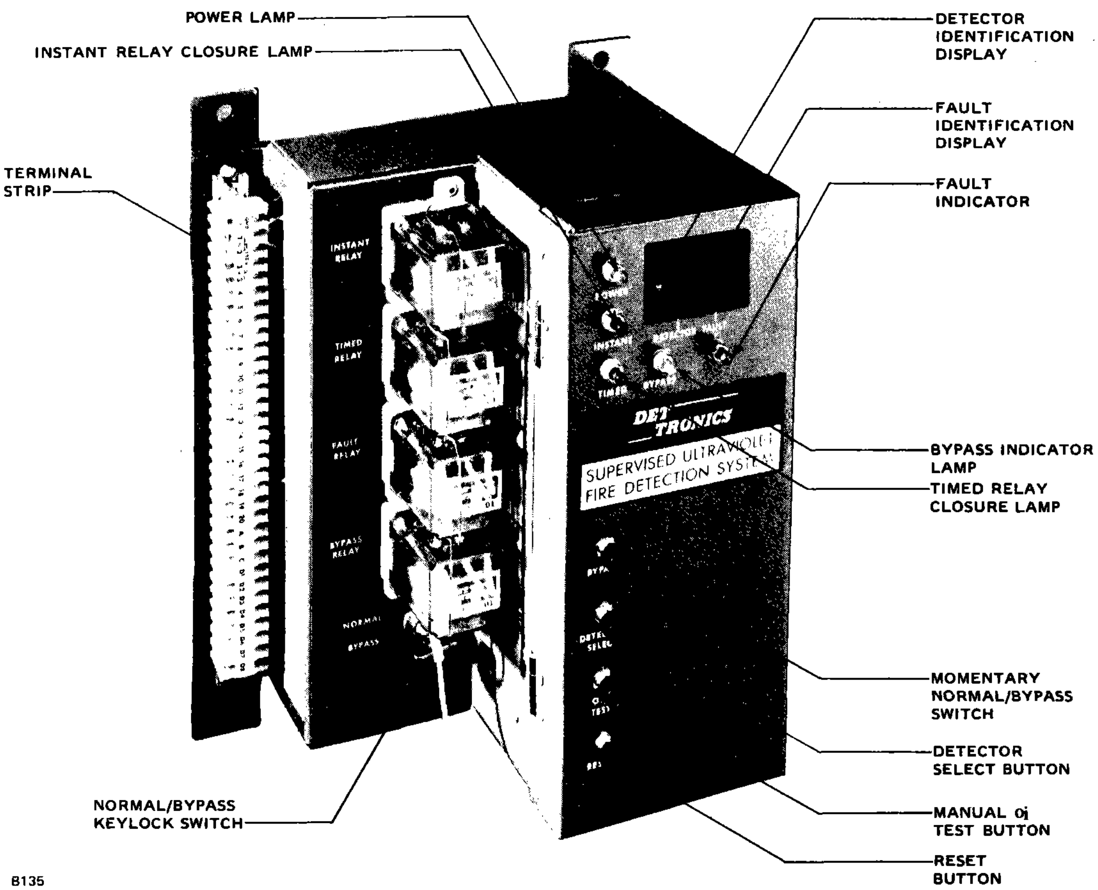


Figure 1—R7303 Controller has Digital Display for Fault and Detector Identification. Manual override of automatic Oi function is included for periodic test of output circuits.

—The Automatic Oi system employs the same detector as the manual Oi system.

—Automatic Oi tests are continuously performed without actuation of the output relays. To facilitate periodic testing of output circuits as well as to allow individual testing of each detector, a pushbutton operated manual Oi capability is provided on all Automatic Oi systems. In the manual mode, the R7303 digital display shows which detector is being tested. Selecting the detector to be tested is accomplished by depressing the DETECTOR SELECT button on the controller panel. See Figure 1.

—Construction of the UV detector is illustrated in Figure 2. A UV detector tube is mounted in the same enclosure with a UV test lamp, but they are optically isolated from each other within the enclosure by a cylindrical shield. When the test lamp is actuated, its UV radiation reaches the detector tube by traveling out through the quartz window where it encounters a reflective surface and is directed back into the detector through the portion of the window defined by the internal optical shield. **Since this is the portion of the window through which UV radiation from a fire must pass,** this test indicates the overall optical integrity of the detector.

—For applications such as powder coating booths, the R7303 Controller is available with Transient Arc Rejection circuitry as an option.

—The R7303 Controller has field adjustable sensitivity capability. The controller may be programmed to actuate output relays when the C7050B Detector discharge rate is 25, 50, 75 or 100 counts per second. A low count rate results in high sensitivity, since the detector discharge rate varies directly as the intensity of the UV radiation.

—The fault identification circuitry is designed so that the first fault occurring in a system will be retained in digital code on the LED readout until the controller is placed in the bypass mode. This ensures that transient faults will not be overlooked. Examples of digital codes used in the Automatic Oi system are as follows:

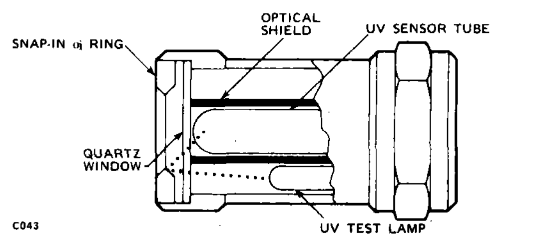


Figure 2—Automatic Oi Detector is identical to that used with Manual Oi System. Test Lamp is optically isolated from UV sensor inside detector housing. Test radiation path includes that portion of detector window through which UV radiation from a fire must pass.

Digital Code	Fault Identification General Identification
0	Spurious detector discharge
1	DC power malfunction
2	Reduced detector sensitivity
3	Detector monitoring malfunction
4	Detector "C" lead fault
5	Module missing or "B" lead fault
6	Detector high voltage or "A" lead fault
7	Comparator board fault
8	Output circuits inhibited
Blank	Low voltage supply or detector monitor board problem

All of the above conditions de-energize the fault relay, which is normally wired to visual or audible alarms either near the controller or in a remote location. The left display is significant only when the system is in bypass, or when the "2" digit on the right display indicates reduced detector sensitivity.

GENERAL FEATURES

- Instantaneous response to ultraviolet radiation. Typical response to an intense ultraviolet source is less than 25 milliseconds. Systems are available for applications where response times of less than 10 milliseconds are needed.
- Detectors will operate under adverse weather conditions such as wind, rain, snow and extremes of temperature.
- POWER lamp and FAULT lamp provide visual status indication.
- Extra terminals for remote functions, including alarm, extinguish and fault signal.
- Input voltage and frequency selection available for applications worldwide.
- Plug-in printed wiring boards and relays for ease of maintenance.
- Detector module mounted to meet MIL SPEC 810C for shock and vibration.
- Insensitive to solar radiation and normal artificial lighting.
- Factory Mutual (FM), Canadian Standards Association (CSA) and British (BASEEFA) approved.

SPECIFICATIONS

SPECTRAL SENSITIVITY RANGE–
Det-Tronics Automatic oi ultraviolet fire detector responds to UV radiation in the range of 1850 to 2450 Angstroms. Detectors are insensitive to direct or reflected sunlight and to normal artificial light.

OPTICAL SENSITIVITY RANGE–
The standard C7050B Detector has a nominal 80° cone of vision and can be considered to have a practical application distance of about 50 feet (16 meters). The closer the detector is located to the probable hazard the better, since physical obstructions and smoke accumulations may affect its response. Under certain controlled conditions, the detectors may be used at greater distances.

Some chemical and petrochemical vapors absorb large amounts of UV radiation and could effectively "blind" the detector if they are between the fire and detectors.

FLAME SENSITIVITY–
Controller sensitivity is field adjustable for 25, 50, 75 or 100 counts per second response. For example, with a 25 cps sensitivity setting the UV radiation generated by a gasoline fire with one square foot (0.09 m^2) surface area, can be detected at a distance of about 32 feet (9.8 meters). Exposing the detectors to equipment which emits X-rays or gamma radiation is likely to produce a response. High electrostatic forces will affect the detectors if exposed directly at the window, or without the shielding provided by the metallic detector enclosure. Arc welding is a source of intense ultraviolet radiation, so special application techniques must be used to keep such radiation from the detector's cone of vision.

DETECTOR ENCLOSURE RATING–
Watertight - Dust-tight - designed to meet NEMA Standards for Type 4 enclosures. CSA certified Enclosure 4.
Hazardous locations - Factory Mutual (FM) approved for Class I, Groups A, B, C and D; Class II, Groups E, F and G. Canadian Standards Association (CSA) certified for Class I, Groups C and D; Class II Groups E, F and G. British Approvals Service (BASEEFA) certified for Group IIc (Hydrogen).

INPUT VOLTAGES–
Models rated for 120, 220 or 240 vac, 50/60 Hz, operates between 85 and 110% of the rated ac voltage; 12 vdc, operates over the range of 10.5 to 16.0 vdc; 24 vdc, operates over the range of 18.0 to 38.0 vdc.

TEMPERATURE RATING–
Operating: -40 to +158°F (-40 to +70°C) for system.
Storage: -67 to +170°F (-55 to +77°C) for system.

RESPONSE TIME–
Typically 25 milliseconds to high intensity UV radiation. Models with solid state relays respond in less than 10 milliseconds.

RELAY CONTACT RATINGS–
Instant relay, time-delayed relay, and fault relay: Form C (N.O. and N.C.) 10 amperes resistive, 8 amperes inductive. Solid state models (dc): 5 amperes intermittent, 1 ampere continuous (N.O.).

POWER REQUIREMENTS–

	Typical (watts)	Max (watts)
Standby	12	17
Fault	13	18
Fire	20	25
Fault and Fire	21	26

DETECTOR WIRING–
Three shielded leads plus one non-shielded lead are required for each detector. Wire diameter must be 22 gauge (642 circular mills) minimum. The R7303 Controller will accommodate up to eight detectors. The detectors may be located up to 1000 feet (300 meters) from the controller.

LOAD MONITORING RELAY (Optional)–
Supervises the wiring to connected loads, such as alarm and extinguishing equipment, and continuously checks the electrical continuity of the loads themselves.

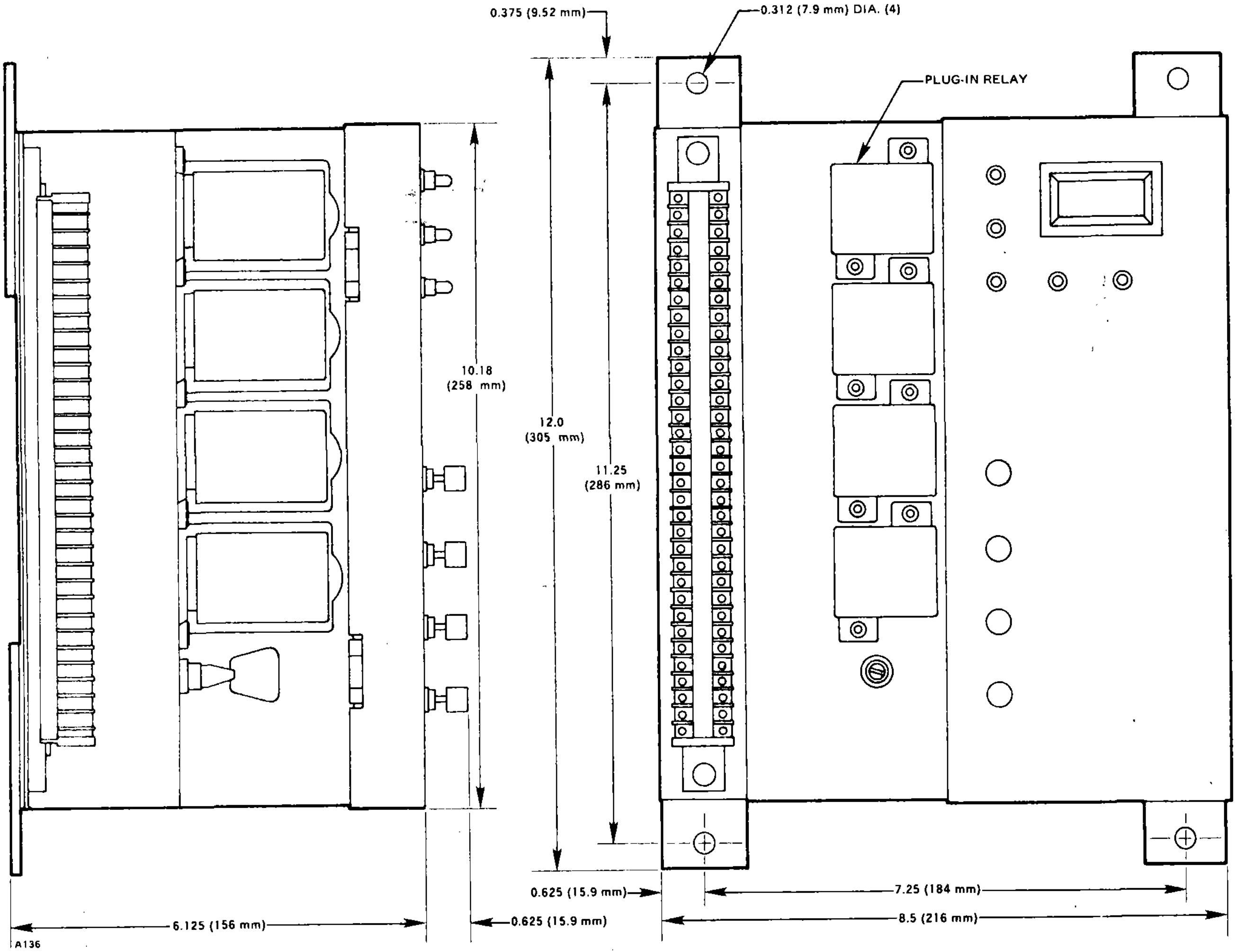


Figure 3—Dimensions of the R7303 Controller in Inches (and millimeters).

MATERIAL (Detector)—
Anodized copper-free aluminum, nickel-plated brass or 316 stainless steel.

SHIPPING WEIGHTS (Approximate)—

	pounds	kilograms
R7303 Automatic oi Controller	13.0	5.9
C7050B UV Detector (aluminum)	1.25	0.56
(brass and stainless steel)	2.25	1.01
Q9001B Positioning Swivel	1.5	0.7

DETECTOR MOUNTS (Optional)—
Q9001B swivel assembly in anodized copper-free aluminum, nickel-plated brass or 316 stainless steel.

OPTIONAL ENCLOSURES (For Single Controller)—
Q1016 NEMA 4 Enclosure, see form 90-1006 for details.
Q1019 Explosion-Proof Enclosure, see form 90-1007 for details.

ORDERING INFORMATION

When ordering, specify model number, controller voltage, detector enclosure material and optional equipment needed.

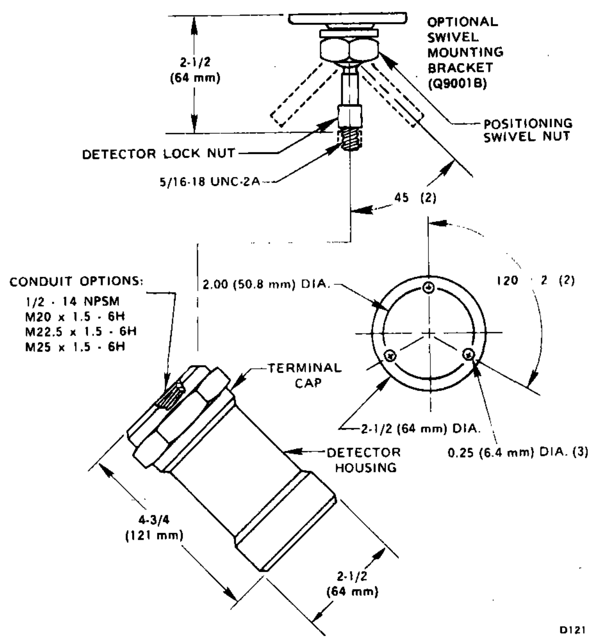


Figure 4—Dimensions of the C7050B Ultraviolet Fire Detector in Inches (millimeters).

Detector Electronics Corporation
6901 West 110th Street • Minneapolis, Minnesota 55438 U.S.A. • Phone: (612) 941-5665
Telex 29-0562 • Cable DETRONICS

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DET TRONICS

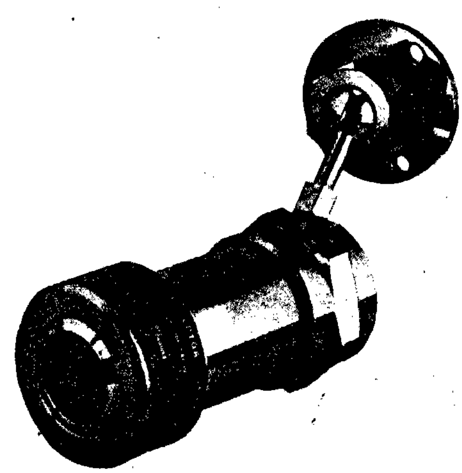
INSTRUCTIONS

Oi*

Ultraviolet Fire Detector C7050A,B

APPLICATION

The C7050 Detector is designed for use with Det-Tronics controllers. The detector consists of an ultraviolet sensitive (sensor) tube, electronic circuitry to generate a voltage signal, an explosion-proof enclosure and a quartz viewing lens. Detectors used in systems with the optical integrity feature include an ultraviolet emitting (source) lamp and a reflective ring.



FEATURES

- Designed for use in hazardous locations.
- Will operate under adverse weather conditions such as wind, rain, snow, high humidity and extremes of temperature and pressure.
- Insensitive to solar radiation and to normal artificial lighting.
- Sensor tube is mounted to withstand shock and vibration - meets MIL SPEC 810C.
- Enclosure available in nickel-plated brass, anodized aluminum or 316 stainless steel.
- Meets FM, CSA and BASEEFA requirements.

SPECIFICATIONS

SPECTRAL SENSITIVITY RANGE–
Det-Tronics' ultraviolet fire detectors respond to radiation over the range of 1850 to 2450 Angstroms (see Figure 1). Detectors are insensitive to direct or reflected sunlight and to normal artificial lighting.

OPTICAL SENSITIVITY RANGE (Cone of Vision)–
The C7050 Detector has a nominal 80 degree cone of vision with the highest sensitivity lying along its central axis. Figure 2 shows a composite view of the cone of vision and the detector response to a constant UV source at various relative distances. Depending upon the intensity of the ultraviolet radiation source, the C7050 can be considered to have a practical application distance of up to about 50 feet (15 meters). Under certain controlled conditions, detectors may be used at greater distances. Since physical obstructions, smoke accumulation or UV absorbing chemical vapors will prevent UV from reaching the detectors, they should be mounted as close as practical to the probable hazard. The chart of the gasoline reference fire (Figure 3) shows how detector response is related to distance.

DIMENSIONS–
Figure 4 illustrates the mounting dimensions of the detector.

DETECTOR ENCLOSURE MATERIALS–
Models available in anodized copper-free aluminum, nickel-plated brass or 316 stainless steel.

DETECTOR ENCLOSURE RATINGS–
Watertight, dust-tight, designed to meet NEMA standards Publication IS 1.1-1975 for Type 4 enclosures. CSA certified Enclosure 4.

Hazardous locations - FM approved for Class I, Groups A, B, C and D; Class II, Groups E, F and G. CSA certified for Class I, Groups C and D; Class II, Groups E, F and G. BASEEFA certified for Group Ex d IIC T6 (hydrogen). P.T.B. approved for Ex Sd2 G5.

TEMPERATURE RATING–
Operating: -40 to +77°C (-40 to +170°F).
Storage: -55 to +77°C (-67 to +170°F).
Models with other temperature ratings are available. Contact Detector Electronics Corporation for details.

*Oi is Detector Electronics' Trademark for its patented Optical Integrity Systems. U.S. Patent 3,952,196, United Kingdom Patent 1,574,969, Canadian Patent 1,059,598.

9/81 95-8214-04

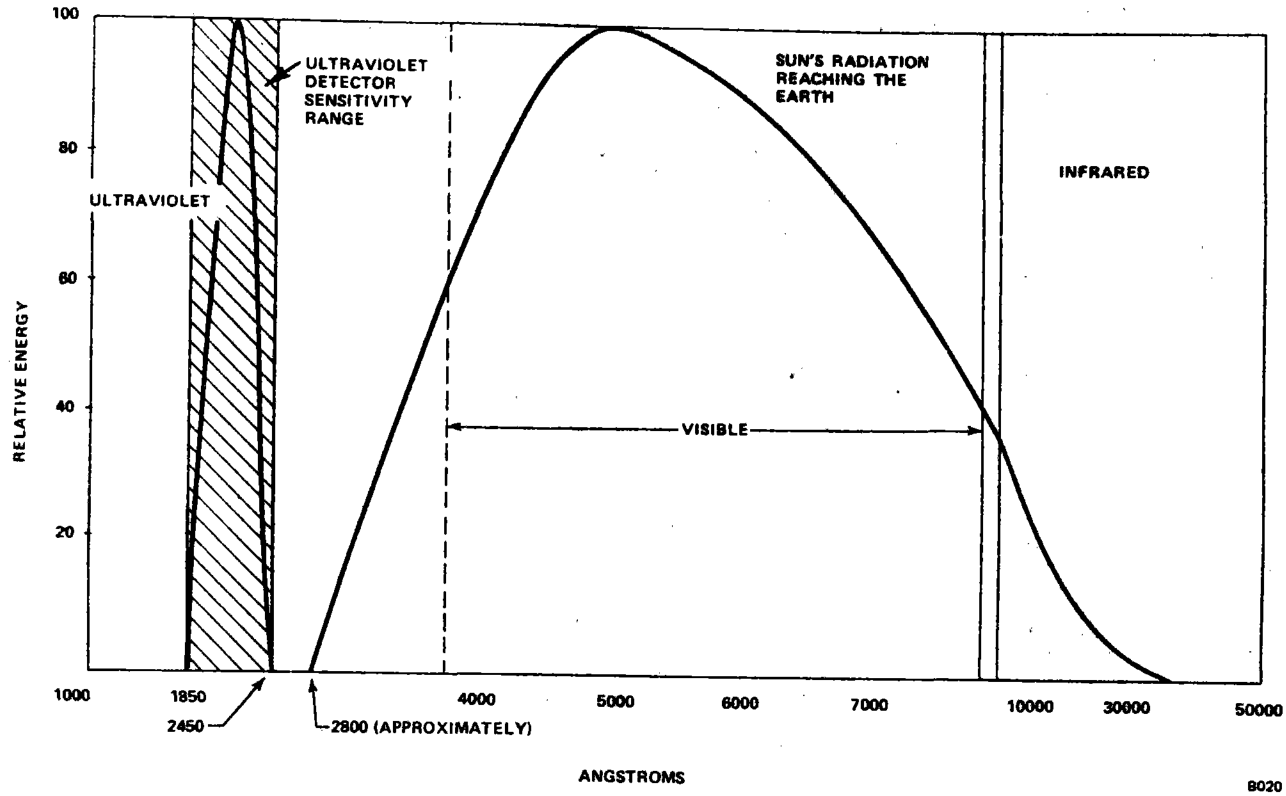


Figure 1—UV Detector's Range of Sensitivity

SHIPPING WEIGHT (Approximate)—

	Pounds	Kilograms
Aluminum	1.25	0.56
Stainless steel or brass	2.25	1.01

OPTIONS

- C7050A Detector without oi.
- C7050B Detector with oi.
- C7050C Front Mount Detector with oi.

ACCESSORIES

Q9001B Swivel Mounting Assembly

Q1101 Air Shield for use with C7050C

Cover Locking Assembly to meet BASEEFA or P.T.B. requirements.

INSTALLATION

Requirements

The terminal block of each detector incorporates four screw terminals labeled A, B, C and D (see Figure 5). Refer to the controller manual for instructions on connecting wires to the detector and controller screw terminals and for wiring multiple detector applications.

The wiring to each detector must be 22 gauge (0.643 mm diameter) minimum with at least a 300 volt rms rating. The B-lead must be shielded with the shield grounded **only** at the controller. If the B-lead is run in conduit, the conduit must not be used for wiring from other electrical equipment. An external grounding screw is provided on the terminal cap for applications where local wiring codes require that the detector enclosure be connected to earth ground. Each UV sensor tube module is supplied with a jumper plug "J." Whether the jumper "J" must be installed or removed depends on the type of controller being employed. The jumper plug "J" is only used with R7300, R7301, R7302 and R7303 Controllers. **Do not use** the plug with other types of controllers. Refer to the controller manual for specific instructions.

Recommendations

Since it is essential that moisture not be allowed to come in contact with the electrical connections of the UV sensor tube module, it is recommended that conduit sealing compound and conduit breathers be used. In some applications, alternate changes in temperature and barometric pressure cause "breathing," which allows the entry and circulation of moist air throughout the detector and connected conduit. Joints in the conduit system and its components are seldom tight enough to prevent this "breathing." Moisture in the air condenses at the base of vertical conduit runs and equipment enclosures, and will build up over a period of time. This can be detrimental to electronic devices. To

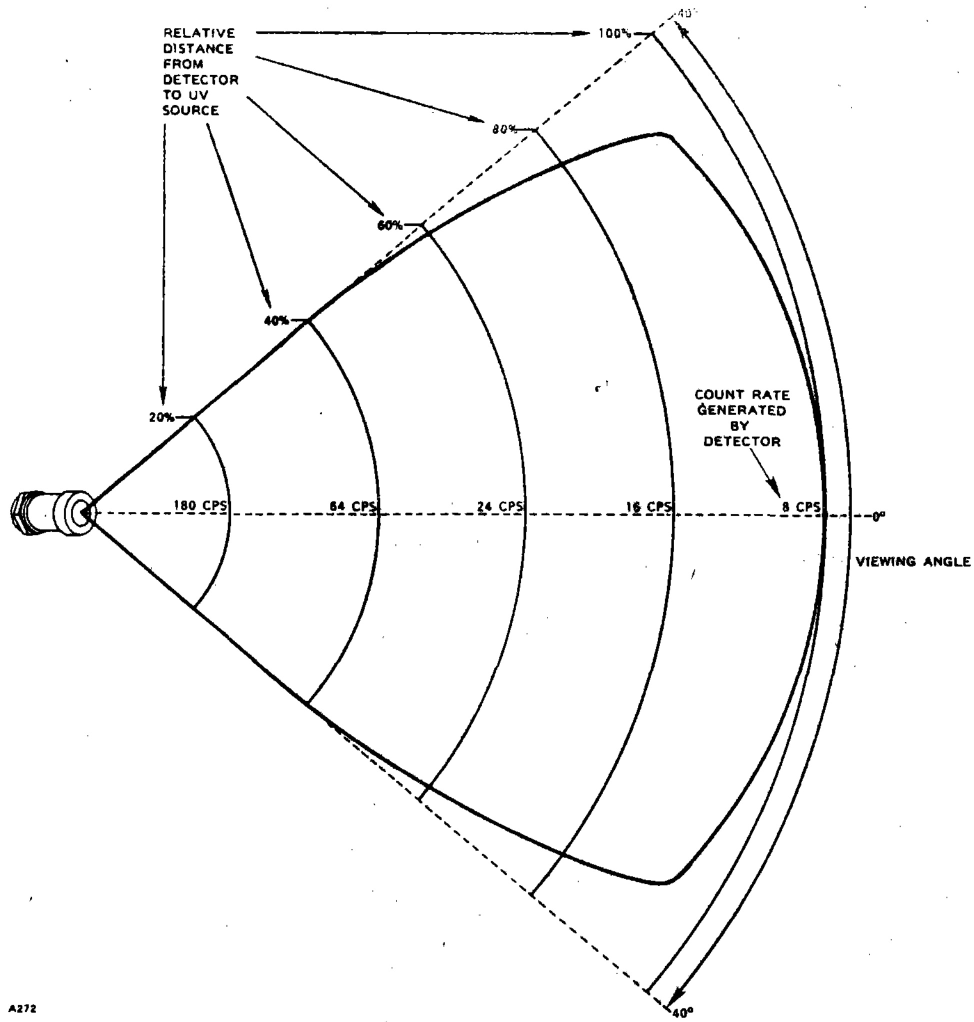


Figure 2—Detector Cone of Vision and Response to Constant UV Source

eliminate this condition, explosion-proof drains and breathers (such as Crouse-Hinds type ECD) should be installed to automatically bleed off accumulated water. When ambient temperature is below freezing, be sure that the sealing compound is dry before installing the tube module.

Mounting and Wiring

The following steps should be used for mounting and wiring the detectors:

CAUTION
Do not apply power to the controller when detector housing is removed.

1. Detectors should be located for the best unobstructed view of the area to be protected. **Detectors must be accessible for cleaning the window and reflector rings.** A swivel mounting assembly (Q9001B) is available for ease of installation. For outdoor applications, fire detectors should be pointed downward to prevent the cone of vision from scanning the horizon because the detector could respond to long duration lightning flashes. When practical, mount the detectors so that the UV test lamp on the tube module is on top, since dirt accumulation between the window and the reflector ring may interfere with the automatic **oi** function. (See Figure 6 for location of the **oi** test lamp.) Refer to the controller manual for instructions on specific detector positioning considerations (e.g. outdoor application, arc welding, and remote surveillance).

2. Disassemble the detector enclosure (Figure 6) by turning the housing cover counterclockwise. If the detector is equipped with a cover locking device, loosen the clamp using a tool as described in step 7 below, and disengage the "catch" from the terminal cap.

3. Connect the terminal cap to the conduit or the optional swivel mounting bracket so that the wires from the controller can be installed and trimmed.

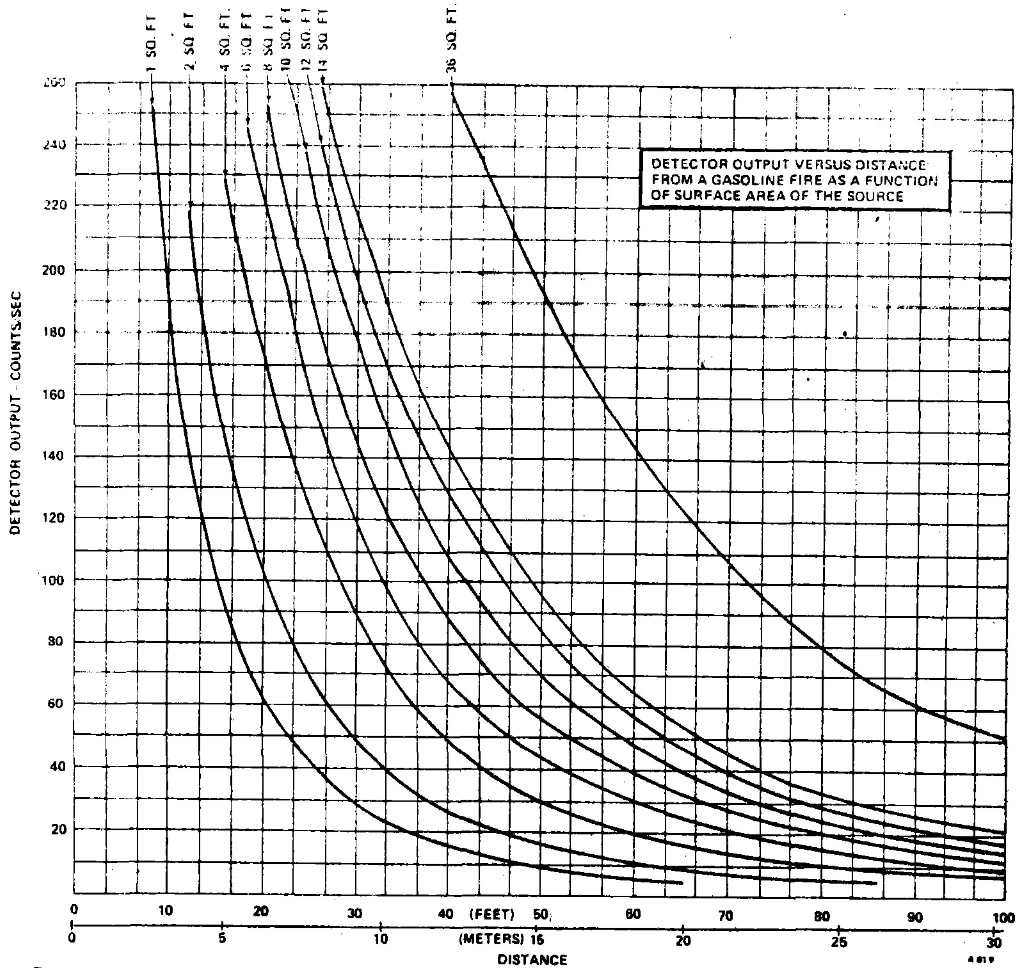


Figure 3—Sensitivity to a Gasoline Reference Fire

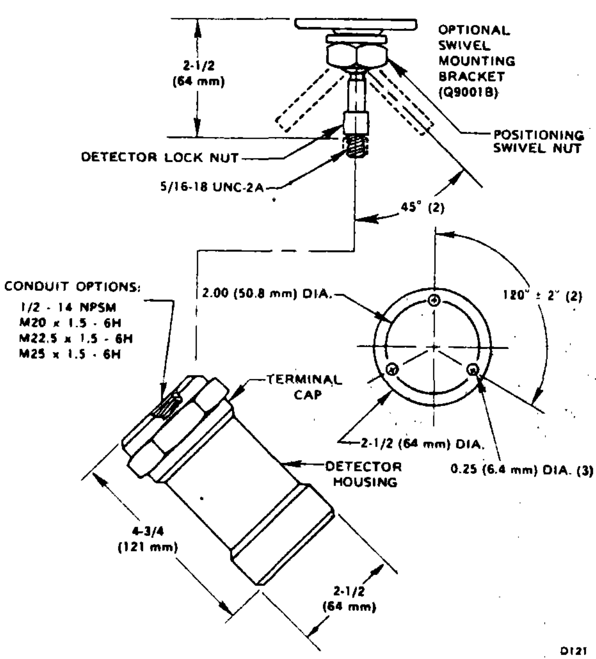


Figure 4—Dimensions of the C7050 Detector in Inches (Millimeters)

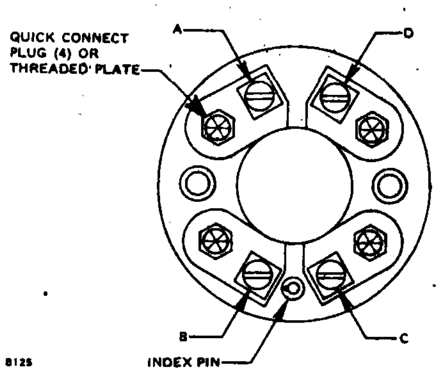


Figure 5—Terminal Block

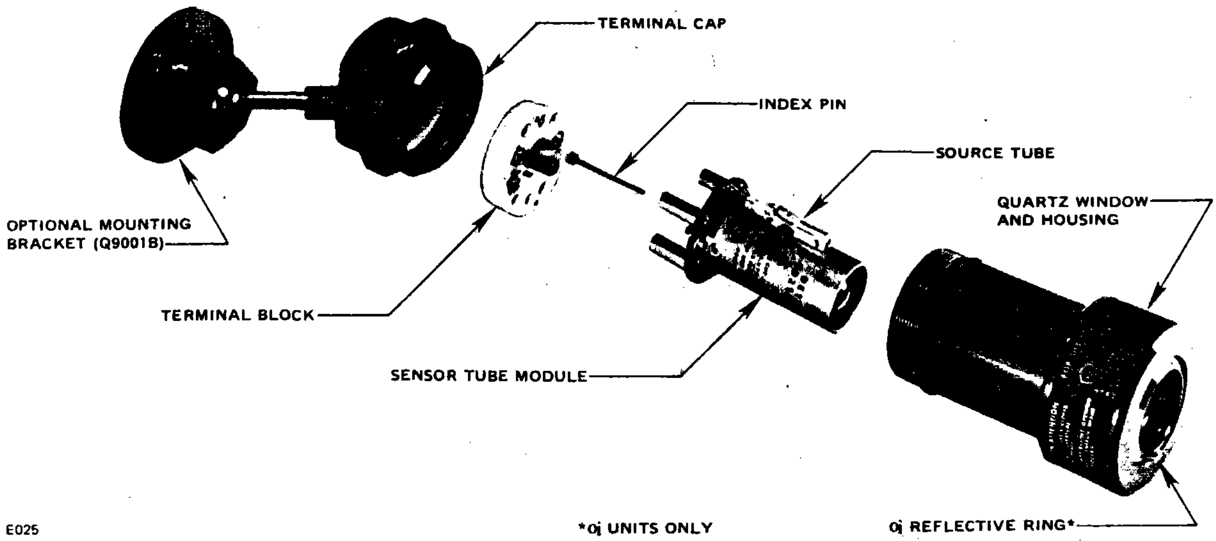


Figure 6—C7050 Detector Assembly

4. Connect the leads to the terminal block screw connectors (Figure 5). Refer to the controller manual for specific instructions. If the shielded B-lead is to continue to another detector, tie the shields together but make sure that the shields are **NOT** grounded to the detector. Always insulate the shield from the detector housing and ground the shield at the controller only.

5. Remove UV sensor tube module from its shipping package, avoid touching the exposed glass envelope of the tube, since oil from fingerprints can absorb UV and reduce the tube's sensitivity. Locate the correct terminal position by observing the index pin. (See Figure 5.)

6. Install the four mounting screws and tighten (some C7050 Detectors have gold-plated plug-in connections and screws are not needed). Clean the glass envelope of the sensor tube using a clean cloth and Det-Tronics window cleaner (part number 001680-01).

7. Replace detector housing. If the detectors are equipped with cover locking devices, loosen the clamp sufficiently so that the "catch" can be seated in the "blind" hole provided on the terminal cap. (See Figure 7.) The clamp must then be fastened securely around the detector barrel by tightening the clamp with the proper tool. This locking cover feature is required for equipment approved by BASEEFA and P.T.B. The tool required for the BASEEFA clamp is 5/32-inch hexagonal (Allen) wrench. For the P.T.B. clamp, a triangular m4 (7 mm) wrench (Din 22417) must be used.

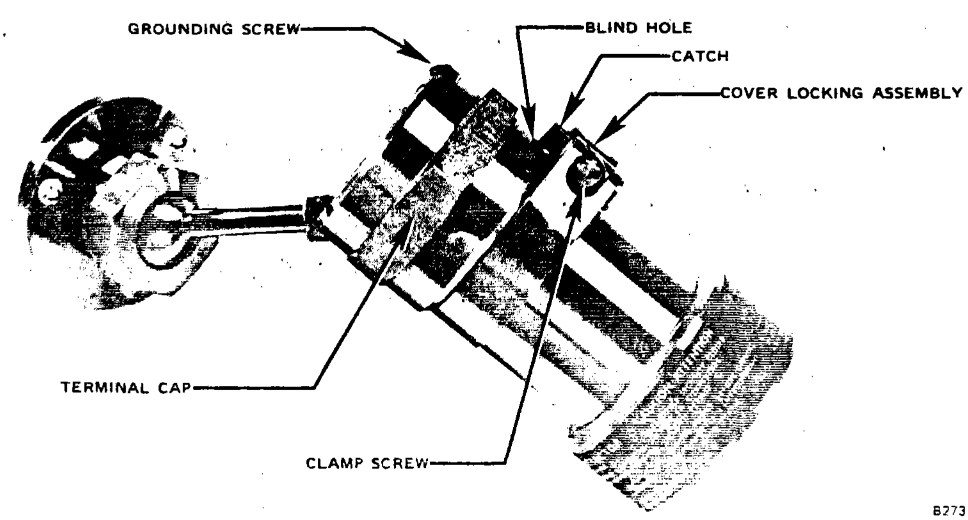


Figure 7—C7050 Detector with Cover Locking Assembly

8. Thoroughly clean the detector window and the reflective ring. Det-Tronics' window cleaner solution is specially designed for this application. Many of the commercial cleaners leave a residue on the surface that absorbs UV radiation. Clean the window out to the edge. After cleaning, re-install the ring so that the split is 180 degrees from the oi test lamp (opening down to prevent water buildup). Hold the ring by the tabs being careful not to leave fingerprints on the reflective surface when re-installing.

NOTE

Use a clean cloth or tissue for cleaning. DO NOT use commercial glass cleaning tissues since many of these contain a silicone substance, which remains on the cleaned surface and will absorb UV radiation.

9. Perform "Startup" and "Checkout" procedures in the controller manual.

Controller Instruction Manuals

Controller Type	Instruction Manual Form Number
R7300A	95-8171
R7300B	95-8212
R7301A & B	95-8215
R7302	95-8219
R7303	95-8226
R7404	95-8242

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Telex 29-0562 • Cable DETRONICS
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DET TRONICS

ADDENDUM

oi*

Replaceable oi Ring

C7050, U7600

The oi reflective ring for the C7050 and U7600 is designed to be removable in the field to facilitate cleaning of the window and cleaning or replacement of the ring. It is installed and removed by squeezing the two ears together. To remove the ring, squeeze the two ears together and pull firmly out on one of the ears. To install the ring, insert one of the ears into the slot provided and seat the entire ring in place by a "wiping" action with your finger from the inserted end to the free end.

The oi ring is made the same as the metallized parts on your car to resist corrosion. In a corrosive atmosphere the rings can be easily replaced on a regular schedule to facilitate continued operation of the oi circuit and the self-checking feature.

When the ring is removed, its oi reflective surface and the whole surface of the window are exposed for cleaning. Clean the window with Det-Tronics window cleaner and a clean soft cloth or tissue. A tissue is preferred. Polish the window with a dry tissue until it has a clean polished appearance. **DO NOT** use solvents or abrasive cleaners.

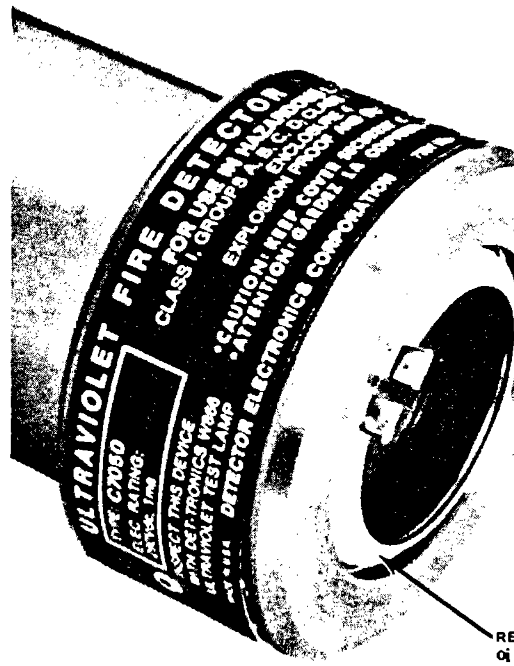
Check the ring for degradation of the plated surface, and if it is corroded or damaged, replace with a new one. Replacement rings are readily available under part number 001811-01. We recommend having a replacement ring for each detector in use.

Clean all rings before installing (including the new rings, to remove any finger prints and residue) with Det-Tronics window cleaner.

When the window and rings have been cleaned, re-install the oi ring.

CAUTION

Do not touch the window or the inside reflective surface of the oi ring during installation.



REPLACEABLE oi RING

Position the oi ring's ears opposite the threaded hole used for mounting the swivel on the rear cap. Then perform the manual checkout for the appropriate controller. See Instruction manual for procedure.

CAUTION

Remove power to the controller or place Normal/Bypass switch in Bypass position when cleaning the detector windows. It is possible to create a charge on the windows causing the detector to respond and actuate controller relays.

*A oi is Detector Electronics' Trademark for its patented Optical Integrity Systems. U.S. Patent 3,952,196, United Kingdom Patent 1,534,969.

DET TRONICS

INSTRUCTIONS

Window Cleaner for Detectors C7037, C7050 Detector/Controllers U7600, U7602

FUNCTION

Detector Electronics has developed an aqueous solution to clean windows and oi rings of UV detectors. Many commercial window cleaners leave a residue on the surface of the glass to give it a "sparkling" look, but this residue may reduce the transmission of UV to the detector. Det-Tronics window cleaner was developed to remove any film buildup on the window and to provide an antistatic barrier. It is available in plastic squeeze bottles that make it easy to dispense a few drops on a clean cloth or tissue for application to the window. A few quick strokes with a cloth cleans the window for maximum transmission of UV to the detector.

NOTE

Place the system controller in BYPASS before cleaning windows. Rubbing motion on the surface of the window creates static electricity and could cause a discharge of the UV detector before the antistatic barrier is established. Note also that the cleaning fluid must be applied sparingly during freezing weather conditions to prevent freezing on the surface of the window.

A sample bottle of window cleaner is included with every order received for a complete UV detection system. Additional quantities may be purchased from Detector Electronics, part number 001680-01, which is a package of 6 squeeze bottles.

APPLICATION

Shake bottle vigorously before application to thoroughly mix the contents. If nozzle becomes plugged, open orifice by inserting small nail, pin or straightened paper clip.

CAUTION

Wipe dry with a clean cloth. DO NOT use commercial glass cleaning paper or tissues since many of these contain a silicone substance that remains on the window after cleaning. Silicone substances readily absorb UV radiation and will effectively "blind" the detector even though the window appears clean.

oi is Detector Electronics' Trademark for its patented Optical Integrity Systems.
U.S. Patent 3,952,196, United Kingdom Patent 1,534,969, Canada Patent 1,059,598.

6901 West 110th Street • Minneapolis, Minnesota 55438 U.S.A. • Phone: (612) 941-5665
Telex 29-0562 • Cable DETRONICS

Printed in U.S.A.

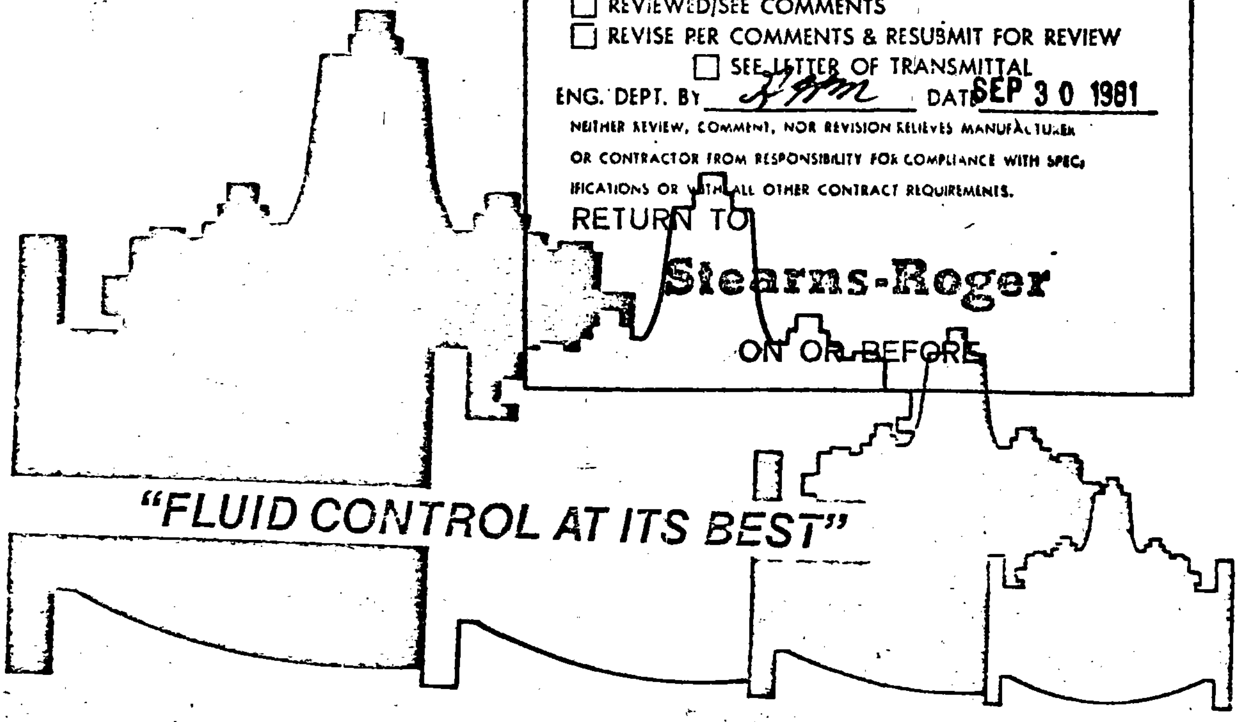
10.1.4 Warehouse Deluge System

The warehouse deluge system consists of a deluge valve, two firehose stations, and automatic detection equipment located inside the warehouse building. The following pages contain the instruction manual for the Cla-Val automatic control valve.

Place this manual with personnel responsible
for maintenance of this valve.

CLA-VAL CO.

automatic control valves



☒ REVIEWED/NO COMMENTS
☐ REVIEWED/SEE COMMENTS
☐ REVISE PER COMMENTS & RESUBMIT FOR REVIEW
☐ SEE LETTER OF TRANSMITTAL

ENG. DEPT. BY ~~RAM~~ DATE SEP 30 1981

NEITHER REVIEW, COMMENT, NOR REVISION RELIEVES MANUFACTURER OR CONTRACTOR FROM RESPONSIBILITY FOR COMPLIANCE WITH SPECIFICATIONS OR WITH ALL OTHER CONTRACT REQUIREMENTS.

RETURN TO

Stearns-Roger

ON OR BEFORE

"FLUID CONTROL AT ITS BEST"

INSTRUCTION MANUAL

Stearns-Roger

C21700753 SEP 22 '81

S-R No. CP-9 File No. 481

CLA-VAL CO. *Newport Beach, California*

Warehouse Deluge Valve

10.1-86

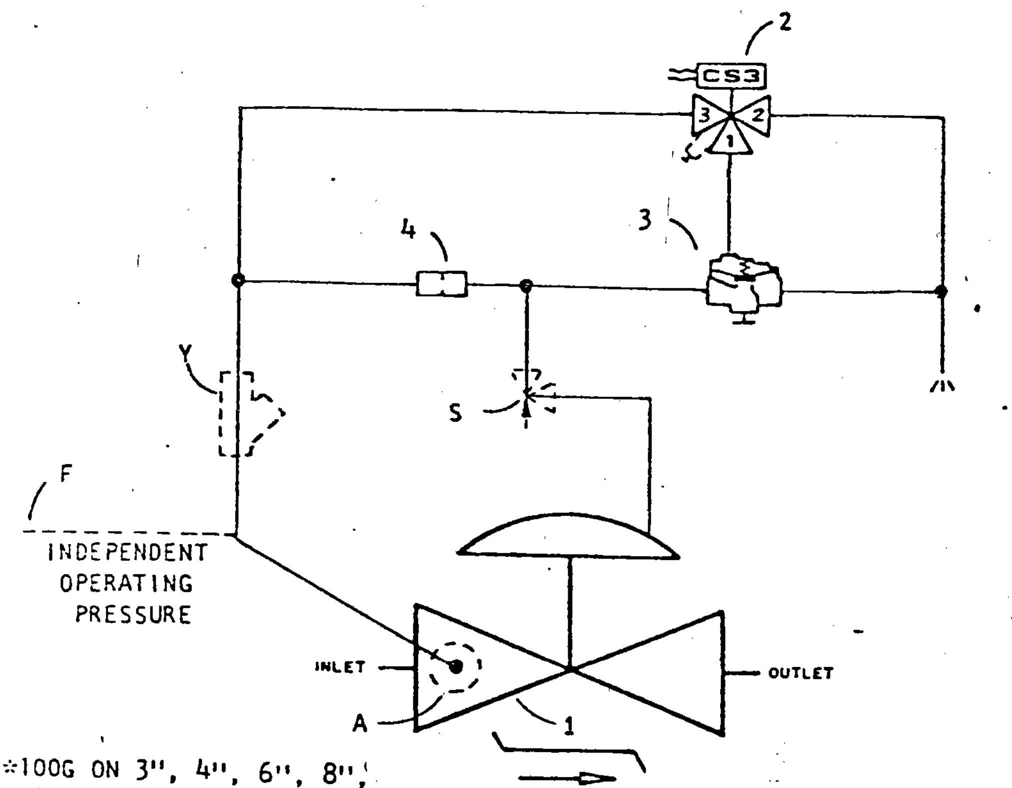
CLA-VAL CO. NEWPORT BEACH, CALIFORNIA	CATALOG NO. 134-05	DRAWING NO. 91043	REV. G

TYPE OF VALVE AND MAIN FEATURES

SOLENOID CONTROL VALVE (FOR FIRE DELUGE SERVICE)

DESIGN		
DRAWN	3-30-79	CH
CHK'D.	4-3-79	DP
APP'D.	4-3-79	JLS

——— NOT FURNISHED BY CLA-VAL CO. - - - - - OPTIONAL FEATURES



*100G ON 3", 4", 6", 8", & 10" ONLY
100GKX ON 12" & 16" ONLY
KX= WITH STANDARD HYTROL BODY

ITEM NO.	BASIC COMPONENTS	QTY.
1	*100G/100GKX HYTROL (MAIN VALVE)	1
2	CS3M SOLENOID CONTROL	1
3	100-01 AUXILIARY HYTROL	1
4	X58C RESTRICTION TUBE ASSEMBLY	1

OPTIONAL FEATURE SUFFIX ADD TO CATALOG NUMBER

A	X46A FLOW CLEAN STRAINER	1
F	INDEPENDENT OPERATING PRESS.	
S	CV FLOW CONTROL (OPENING)	1
Y	X43 "Y" STRAINER	1

REVISION RECORD

LTR	DESCRIPTION	BY	DATE
E	REVISED & REDRAWN	CH	3-30-79
F	CHG * NOTE, ECO 001659	BR	6-20-80
G	ITEM 3 WAS 100-01KR HYTROL ECO 001900	DG	10-01-80

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA CVCL 1(2)3 4	CATALOG NO. 134-05	DRAWING NO 91043	REV G

SOLENOID CONTROL VALVE
(FOR FIRE DELUGE SERVICE)

DESIGN
DRAWN 3-30-79 CH
CHK'D. 4-3-79
APP'D. 4-3-79
SCALE DIST. CODE 002

OPERATING DATA

I. SOLENOID CONTROL FEATURE:

SOLENOID CONTROL (2) IS A DIRECT ACTING, 3-WAY SOLENOID CONTROL THAT CHANGES POSITION WHEN THE COIL IS ENERGIZED OR DE-ENERGIZED. THIS APPLIES OR RELIEVES PRESSURE IN THE COVER CHAMBER OF AUXILIARY HYTROL (3) PROVIDING THE OPERATION SHOWN IN THE FOLLOWING TABLE:

SOLENOID (2)		AUXILIARY HYTROL (3) POSITION	MAIN VALVE (1) POSITION
POSITION	PORTS CONNECTED		
ENERGIZED	"1" & "2"	OPEN	OPEN
DE-ENERGIZED	"1" & "3"	CLOSED	CLOSED

NOTE: SOLENOID CONTROL (2) IS EQUIPPED WITH A MANUAL ACTUATOR WHICH CAN BE USED TO OPERATE THE SOLENOID WITHOUT ELECTRICAL POWER. AFTER MANUAL ACTUATION, ALWAYS RETURN THE ACTUATOR TO ITS ORIGINAL POSITION OR THE SOLENOID WILL NOT RETURN TO THE "DE-ENERGIZED" POSITION.

II. OPTIONAL FEATURE OPERATING DATA:

SUFFIX "A" (FLOW CLEAN STRAINER) A SELF-CLEANING STRAINER IS INSTALLED IN THE MAIN VALVE INLET BODY BOSS WHICH PROTECTS THE PILOT SYSTEM FROM FOREIGN PARTICLES.
SUFFIX "F" (INDEPENDENT OPERATING PRESSURE) - (PILOT SUPPLY PRESSURE IS OBTAINED FROM THE MAIN VALVE INLET IF SUFFIX "F" IS NOT SPECIFIED.) NOTE: INDEPENDENT OPERATING PRESSURE MUST BE EQUAL TO OR GREATER THAN PRESSURE AT THE MAIN VALVE INLET AT ALL TIMES.
SUFFIX "S" (OPENING SPEED CONTROL) FLOW CONTROL (S) CONTROLS THE OPENING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE OPEN SLOWER.
SUFFIX "Y" (Y-STRAINER) A Y-PATTERN STRAINER IS INSTALLED IN THE PILOT SUPPLY LINE TO PROTECT THE PILOT SYSTEM FROM FOREIGN PARTICLES. THE STRAINER SCREEN MUST BE CLEANED PERIODICALLY.

III. CHECK LIST FOR PROPER OPERATION:

[ ] SYSTEM VALVES OPEN UPSTREAM AND DOWNSTREAM.
[ ] AIR REMOVED FROM THE MAIN VALVE COVER AND PILOT SYSTEM AT ALL HIGH POINTS.
[ ] CORRECT VOLTAGE TO SOLENOID CONTROL (2).
[ ] MANUAL OPERATOR OF SOLENOID CONTROL (2) MUST BE DISENGAGED DURING NORMAL OPERATION.

BY DG DATE 10-01-9?

HYTROL REMOTE CONTROL VALVE

GLOBE	ANGLE
Model 100-01	*Model* 100-01

DESCRIPTION

The Clayton Hytrol Valve is the basis for Clayton Automatic Valves. It is a hydraulically operated, diaphragm actuated, globe, or angle pattern valve. This valve consists of three major components, the body, diaphragm assembly and cover. The diaphragm assembly is the only moving part.

The body contains a seat insert that forms a tight seal with the body. The diaphragm assembly uses a diaphragm of nylon fabric bonded with synthetic rubber. A synthetic rubber disc, contained on three sides by a disc retainer, forms a seal with the valve seat when pressure is applied above the diaphragm. The diaphragm assembly forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

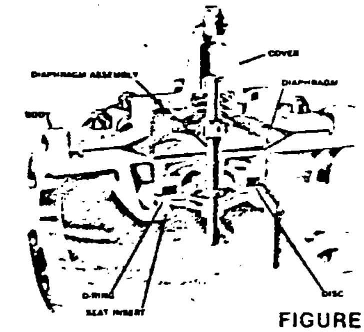


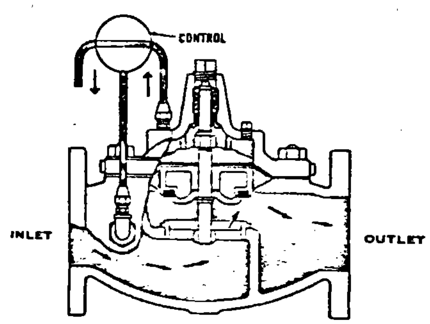
FIGURE 1

INSTALLATION

1. Before valve is installed, pipe lines should be flushed of all chips, scale and foreign matter.
2. It is recommended that either gate or block valves be installed on both ends of the Clayton Hytrol Valve to facilitate isolating the valve for preventive maintenance.
3. Place valve in the line with flow through the valve in the direction indicated on inlet plate or by flow arrows.
4. Allow sufficient room around valve to make adjustments, and for disassembly.
5. Clayton Hytrol Valves operate with maximum efficiency when mounted in horizontal piping with the cover UP, however, other positions are acceptable. Due to size and weight of cover and internal components of 6 inch valves and larger, installation with cover UP is advisable. This makes periodic inspection of internal parts readily accessible.
6. If a pilot control system is installed on the Hytrol Valve, use care to prevent damage. If necessary to remove fittings or components, be sure they are kept clean and replaced exactly as they were.
7. After the valve is installed and the system is first pressurized, vent air from the cover chamber and tubing by loosening fittings at all high points.

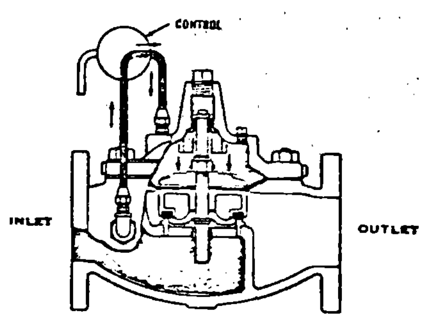
OPERATION, *OPEN-CLOSED SERVICE*

When equipped with a three way control valve the Clayton Hytrol Valve either opens wide or closes tight.



VALVE OPEN

The Clayton Hytrol Valve opens fully when there is no pressure in the cover chamber above the diaphragm, and there is at least five psi line pressure at the valve inlet.



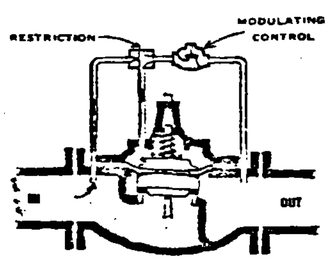
VALVE CLOSED

The Clayton Hytrol Valves close when the line pressure is directed into the cover chamber above the diaphragm. An independent operating supply may be used if its pressure is equal to, or greater than, pressure at the valve inlet.

FIGURE 2

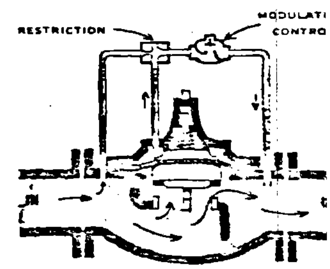
OPERATION, *MODULATING SERVICE*

Modulating action can be obtained by installing a factory designed control system to the basic Clayton Hytrol Valve. Various types of modulating control systems are available to control pressure flow rates and liquid levels.



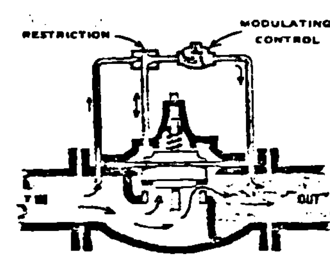
VALVE CLOSED

When the modulation control closes sufficiently to direct a great enough pressure into the cover chamber to overcome opening forces of line pressure, the main valve closes.



VALVE OPEN

When the modulating control opens to a point where more pressure is relieved from the cover chamber than the restriction can supply, cover pressure is reduced and the valve opens.



VALVE MODULATING

The main valve modulates to any degree of opening in response to changes in the modulating control. At an equilibrium point the main valve opening and closing forces hold the valve in balance. This balance holds the valve partially open, but immediately responds and readjusts its position to compensate for any changes in the controlling condition.

FIGURE 3

CLA-VAL CO. *Newport Beach, California*

TROUBLE SHOOTING

The following trouble shooting information deals strictly with the "Hytrol Valve". This assumes that everything but the main valve itself has been completely isolated, i.e. each part of the control system is hydraulically blocked from the main valve. All trouble shooting is possible without removing the valve from the line.

SERVICE SUGGESTIONS

SYMPTOM	*PROBABLE CAUSE	REMEDY
Fails to close	Closed cocks in control system, or in main line.	Open cocks.
	Lack of cover chamber pressure.	Check upstream pressure, strainer, tubing, cocks, needle valves for restriction.
	Diaphragm damaged. (See note)	Replace diaphragm.
	Diaphragm assembly inoperative. Corrosion or excessive scale build up on valve system.	Clean and polish stem. Replace any defective part, damaged, badly eroded.
	Mechanical obstruction. Object lodged in valve.	Remove obstruction.
	Worn disc.	Replace disc.
	Badly scored seat.	Replace seat.
Fails to open	Closed isolation valves or cocks in pilot system, or in main line.	Open valves or cocks.
	Insufficient line pressure.	Check pressure.
	Diaphragm assembly inoperative. Corrosion on valve stem.	Clean and polish stem. Replace any defective part, damaged, badly eroded.
*Assuming control system is functioning properly.		

NOTE: The following method will determine if there is a damaged diaphragm without removing the valve cover: Put pressure into the valve and close all control lines to the valve cover chamber. Remove a fitting on the valve cover; if there is continuous flow out of the cover chamber through this opening, the diaphragm is damaged, or the diaphragm assembly on the stem is loose.

Freedom of Movement

1. Shut off pressure to the control system. On larger valves this can be done simply by closing cocks in the control system. On the smaller valves without shutoff cocks, it is necessary to shut off the main line pressure while disconnecting and blocking off the control system.

   CAUTION: Care should be taken when doing the above since removal of pressure from the cover chamber while pressure exists in the valve body will permit the valve to open wide. This will either permit a high flow rate through the valve, or the downstream pressure will quickly increase to a point close to or equal to the inlet pressure. In some cases, this can be very harmful. Where this is the case, and there are no block valves in the system to protect the downstream piping, it should be realized that the valve cannot be serviced under pressure. Steps should be taken to remedy this situation before proceeding any further.

   Usually, there is a block valve within close proximity downstream which can be closed to prevent the high inlet pressure from getting into the downstream piping even though the Hytrol valve is permitted to go wide open. Once it is clear that a wide open valve can be tolerated, then the trouble shooting can proceed.

2. Disconnect all control lines to the valve cover and leave fittings in cover open to atomosphere.

3. With the cover vented to atmosphere and pressure in the valve body, observe the open cover tapping for signs of continuous flow. If the fluid appears to flow continuously there is a good reason to believe the diaphragm is either damaged, or it is loose on the stem. In either case, this is sufficient cause to remove the valve cover and investigate the leakage. Caution — make sure up stream block valve is closed before cover is removed. If there is no continuous flow, you can be quite certain the diaphragm is sound and the diaphragm assembly tight.

4. If the valve has a valve position indicator, observe the indicator to see that the valve opens wide. Mark the point of maximum opening.

5. If the valve isn't equipped with an indicator, the trouble shooter should install one. This is part of the indispensable equipment the service man should have.

6. Re-connect enough of the control system to permit the application of inlet pressure to the cover. Open cock or valve so pressure flows from the inlet into the cover.

7. While pressure is building up in the cover, the valve should go closed smoothly with out any hesitations. There is a hesitation in every Hytrol valve closure, however, which can be mistaken for a mechanical bind. The stem will appear to stop moving very briefly before going to the closed position. This slight pause is caused by the diaphragm flexing at a particular point in the valve's travel and not caused by a mechanical bind of some kind.

8. When closed, a mark should be made on the indicator corresponding to the "closed" position. The distance between the two marks should be approximately .28 × valve size.

   EXAMPLE: The stroke on a 4" valve is 4 × .28 or 1.12 inches from full open to full close.

   If the stroke is very much different than that calculated, there is a good reason to believe something is mechanically restricting the stroke of the valve at one end of its travel. If the flow doesn't stop through the valve when in the indicated "closed" position, the obstruction probably is between the disc and the seat. If the flow does stop, then the obstruction is more likely in the cover. In either case, operation of the valve two or three times by alternately applying and relieving pressure is a good idea. Sometimes this will serve to dislodge a foreign object from the seat, or clear whatever is obstructing the valve movement. If this is not successful, then the cover must be removed, and the obstruction located and removed.

Tight Sealing

If the trouble-shooting to this point has disclosed no problems relative to freedom of movement or a damaged diaphragm, the only other problem of any concern is whether or not the valve shuts off tight under the conditions of operation. If it does not shut off tight, check disc and seat for wear.

MAINTENANCE

Preventive Maintenance

Clayton Hytrol Valves require no lubrication or packing and a minimum of maintenance. However, a periodic inspection schedule should be established to determine how the fluid velocity as well as the substances occurring in natural waters, such as dissolved minerals, colloidal and suspended particles, are effecting the valve. Effect of these actions or substances must be determined by inspection.

Disassembly

The Hytrol Valve inspection or maintenance can be accomplished without removal from the line. Shut off all pressure to the valve, both line, and independent operating pressure when used.

WARNING Maintenance personnel can be injured and equipment damaged if disassembly is attempted with pressure in the system.

1. After pressure has been released from the valve and cover chamber, remove the controls and tubing. Obtain a schematic of the assembly or note and sketch position of tubing and controls for reassembly.

2. Remove cover nuts (2) Figure 6 and remove cover. If the valve has been in service for any length of time, chances are the cover will have to be loosened by driving upward along the edge of the cover with a dull cold chisel. See Figure 4. When block and tackle or a power hoist is to be used to lift valve cover insert proper size eye bolt in place of the center cover plug (4) Figure 6. Pull cover straight up to keep from damaging bottom seat and stem.

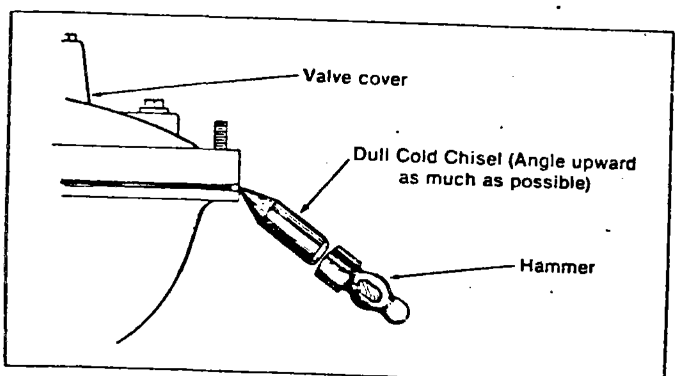


FIGURE 4

3. Remove the diaphragm and disc assembly from the valve body. With smaller valves this can be accomplished by hand, pulling straight up on the stem so as not to damage the seat or stem. On large valves, an eye bolt of proper size can be installed in the stem and the disc assembly can then be lifted with a block and tackle or power hoist.

4. The next item to remove is the stem nut. Examine the stem threads above the nut for signs of mineral deposits or corrosion deposits. If the threads are not clean, use a wire brush to remove as much of the residue as possible. Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually this is sufficient to loosen the nut for further removal. On smaller valves where the entire diaphragm assembly can be removed, hold the stem in a vice equipped with soft brass jaws and following the same suggestion outlined above.

CAUTION: DO NOT USE A PIPE WRENCH OR VICE WITHOUT SOFT BRASS JAWS ON THE UPPER OR LOWER END OF THE VALVE STEM. This practice scars the fine finish on the stem, and no amount of careful dressing can restore the stem to its original condition.

5. After the stem nut has been removed, the diaphragm assembly breaks down into its component parts quite easily. Removal of the disc from the disc retainer can be a problem if the valve has been in service for a long time. Using two screwdrivers inserted along the outside edge of the disc usually will accomplish its removal. Care should be taken to preserve the space washers (18) particularly if no new ones are available for reassembly.

6. The only part left in the valve is the seat ring which ordinarily does not require removal. If, however, it is badly worn and replacement is necessary, it can be removed. For 6" and smaller valves obtain a seat driver X109 from the factory. On 8" and larger valves, the seat is held in place by a number of flat head screws. After the screws have been removed, the seat can be loosened from the body quite easily using a piece of angle or channel iron with a hole drilled in the center. Place it across the body so a long bolt or stud can be inserted through the center hole in the seat and the hole in the angle iron. By tightening a nut an upward force is exerted on the seat. See Figure 5.

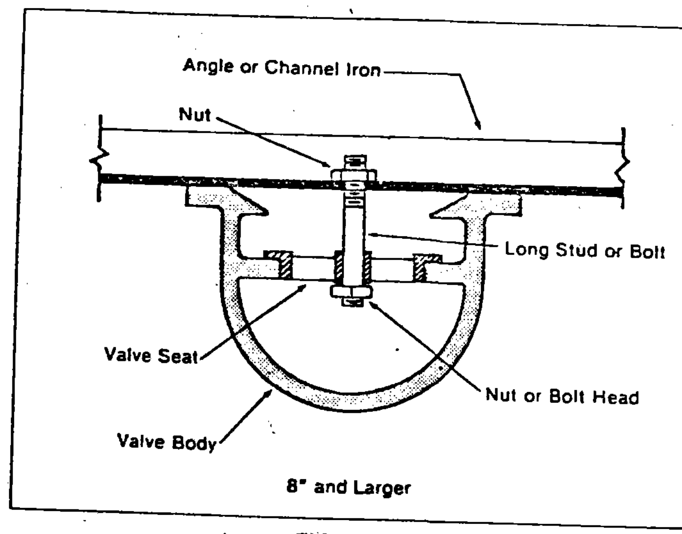


FIGURE 5

Lime Deposits

One of the easiest ways to remove lime deposits from the valve stem is to dip it in a 5-percent muriatic acid solution just long enough for the deposit to dissolve. This will remove most of the common types of deposits. If the deposit is not removed by acid, then a fine grit (400) wet or dry paper can be used with water. If the build-up of deposits on the valve stem is a consistent problem, there are stems that have been sleeved with a plastic material called Delrin that have been very successful in eliminating lime deposits that tend to form on the valve stem. These stems are available in new valves and as a replacement part for existing valves. Contact your Cla-Val Co. representative for complete details.

Inspection of Parts

After a valve has been disassembled, each part should be examined carefully for signs of wear, corrosion, or any other abnormal condition. Usually, it is a good idea to replace the resilient parts (diaphragm and disc) unless they are free of signs of wear. Any parts which appear doubtful should be replaced.

NOTE: If a new disc isn't available, the existing disc can be turned over, exposing the unused surface for contact with the seat.

Reassembly

1. Reassembly is the reverse of the disassembly procedure. If a new disc (17) has been installed, it may require a different number of spacer washers (18) to obtain the right amount of "grip" on the disc. When the diaphragm assembly has been tightened to a point where the diaphragm cannot be twisted, the disc should be compressed very slightly by the disc guide. Excessive compression should be avoided. Use just enough spacer washers to hold it firmly.

2. Make sure the stem nut is made up very tight. Failure to do so could allow the diaphragm to pull loose and tear when subjected to pressure.

3. Re-install the diaphragm assembly in the valve, and line up the diaphragm holes with the stud or bolt holes on the body. On larger valves with studs, it may be necessary to hold the diaphragm assembly up while stretching the diaphragm over the studs.

4. Put spring in place and replace cover. Make sure diaphragm is lying smooth under the cover.

5. Tighten cover nuts firmly using a cross-over pattern until all nuts are tight.

6. Re-install the pilot system and tubing exactly as it was prior to removal.

Test Procedure for Valve Assembly

There are a few simple tests which can be made in the field to make sure the valve has been assembled properly.

1. It is possible to check the diaphragm assembly for freedom of movement by inserting a rod into the threaded hole in the top of the valve stem and lifting the diaphragm assembly manually. The rod should be threaded on one end and have a "T" bar handle of some kind on the other end for easy gripping. The diaphragm assembly should move freely without any signs of sticking or grabbing. Due to the weight of the diaphragm assembly this procedure is not possible on valves larger than 10".

2. On the larger valves, the same determination can be made by very carefully introducing a low pressure (less than five psi) into the valve body with the cover vented. The diaphragm assembly sould lift easily without any jerkiness, and then settles back easily when the pressure is removed.

3. To check the valve for drip-tight closure, a line should be connected from the inlet to the cover, and pressure applied at the inlet of the valve. If properly assembled, the valve should hold tight with as low as ten psi at the inlet.

4. With the line still connected from the inlet to the cover, apply full working pressure to the inlet. Check all around the cover for any leaks. Re-tighten cover nuts if necessary to stop leaks past the diaphragm.

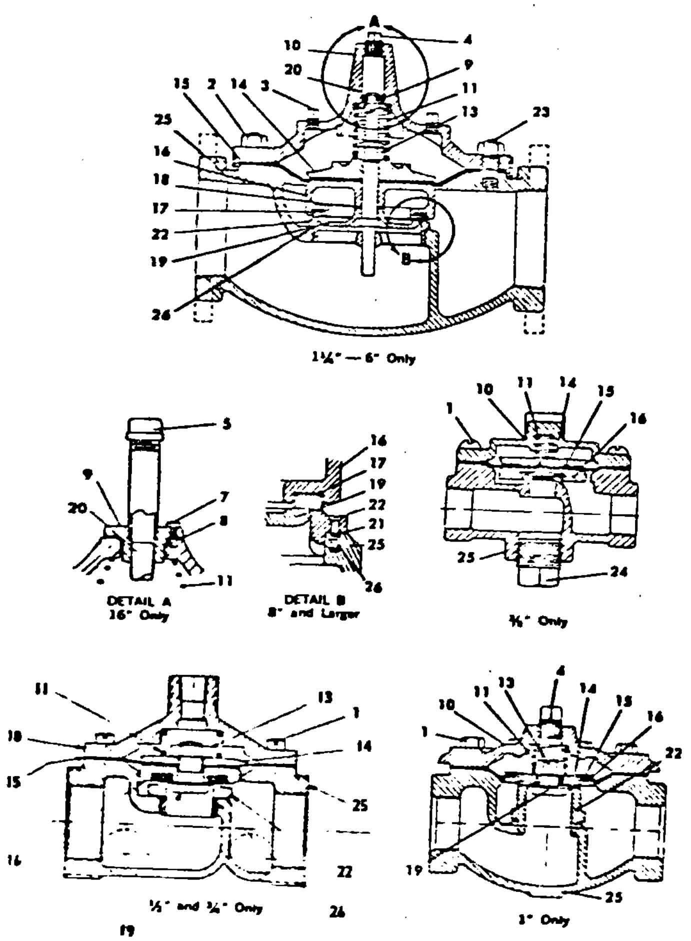


FIGURE 6

PARTS LIST

ITEM	DESCRIPTION
1	Cover Retaining Screw (3/8" thru 4" Sizes Only)
2	Cover Retaining Nut (6" and Larger)
3	Cover Plug
4	Center Cover Plug
5	Pipe Cap (16" Size Only)
7	Cover Bearing Screw (16" Size Only)
8 *	Cover Bearing Gasket (16" Size Only
9	Cover Bearing
10	Cover
11 *	Spring
13	Stem Nut
14	Diaphragm Washer
15 *	Diaphragm
16 * **	Disc Retainer
17 *	Disc
18 *	Spacer Washer
19	Disc Guide
20	Stem
21	Seat Screw (8" & Larger Only)
22	Seat
23	Body Stud (6" and Larger)
24	Body Plug
25	Body
26	O-Ring, Seat

* RECOMMENDED SPARE PARTS ** FOR 3/8" - 1" SIZE ONLY

When ordering parts specify
- All nameplate data
- Item Number
- Description
- Material
- Size

INSTALLATION AND MAINTENANCE INSTRUCTIONS

3-WAY SOLENOID VALVES, NORMALLY OPEN NORMALLY CLOSED AND UNIVERSAL CONSTRUCTION

BULLETIN

8320

FORM NO. V-5291R2

DESCRIPTION

Bulletin 8320 is a small 3-way solenoid operated valve with all three pipe connections located in the body. The bodies are of brass or stainless steel construction. Standard valves have General Purpose, Nema Type I Solenoid Enclosures. Valves that are equipped with a solenoid enclosure which is designed to meet Nema Type 4-Watertight, Nema Type 7 (C or D) Hazardous Locations — Class I, Group C or D, and Nema Type 9 (E, F or G) Hazardous Locations — Class II, Group E, F or G are shown on separate sheets of Installation and Maintenance Instructions, Form Numbers V-5391 and V-5381.

MANUAL OPERATORS (OPTIONAL)

Valves with suffix "MO" or "MS" in catalog number are provided with a Manual Operator which allows manual operation when desired or during an interruption of electrical power.

OPERATION

Normally Closed: Applies pressure when solenoid is energized; exhausts pressure when solenoid is de-energized.

Normally Open: Applies pressure when solenoid is de-energized; exhausts pressure when solenoid is energized.

Universal: For normally closed or normally open operation, selection or diversion of pressure can be applied at Port 1 (A), 2 (B), or 3 (C).

FLOW DIAGRAMS

NORMALLY OPEN PRESS AT 3 (C)	NORMALLY CLOSED PRESS AT 2. (B)	UNIVERSAL-PRESS AT ANY ORIFICE.	FORM
3 (C) 1 (A) 2 (B)	3 (C) 1 (A) 2 (B)	3 (C) 1 (A) 2 (B)	SOLENOID DE-ENERGIZED
3 (C) 1 (A) 2 (B)	3 (C) 1 (A) 2 (B)	3 (C) 1 (A) 2 (B)	SOLENOID ENERGIZED

NOTE: ***Port Markings 1, 2, and 3 correspond directly to A, B and C.***

INSTALLATION

Check Nameplate for correct Catalog Number, pressure, voltage and service.

POSITIONING

Valve may be mounted in any position.

PIPING

Connect piping to valve according to markings on valve body. Refer to Flow Diagram provided. Apply pipe compound sparingly to male pipe threads only; if applied to valve threads, it may enter valve and cause operational difficulty. Pipe strain should be avoided by proper support and alignment of piping. When tightening pipe, do not use valve as a lever.

IMPORTANT: For protection of the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required depending on the service conditions. See Bulletin 8600, 8601 and 8602 for strainers.

WIRING

Wiring must comply with Local and National Electrical Codes. For valves equipped with an explosion-proof, watertight solenoid enclosure, the electrical fittings must be approved for use in the approved hazardous locations. Housings for all solenoids are made with connections for 1/2 inch conduit. The general purpose enclosure may be rotated to facilitate wiring by removing the retaining cap.

NOTE

Alternating Current (A-C) and Direct Current (D-C) solenoids are built differently. To convert from one to the other, it is necessary to change the complete solenoid, including the core assembly.

SOLENOID TEMPERATURE

Standard catalog valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched with the bare hand for only an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

MAINTENANCE

WARNING: Turn off electrical power and line pressure to valve before making repairs. It is not necessary to remove valve from pipe line for repairs.

CLEANING

A periodic cleaning of all solenoid valves is desirable. The time between cleanings will vary, depending on the media and service conditions. In general, if the voltage to the coils is correct, sluggish valve operation or excessive leakage will indicate that cleaning is required.

IMPROPER OPERATION

1. **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic click signifies the solenoid is operating. Absence of the click indicates loss of power supply. Check for loose or blown-out fuses, open-circuited or grounded coil, broken lead wires or splice.
2. **Burned-Out Coil:** Check for open-circuited coil. Replace coil, if necessary.
3. **Low Voltage:** Check voltage across the coil leads. Voltage must be at least 85% of nameplate rating.
4. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within the range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve and clean all parts. Replace parts that are worn or damaged with a complete Spare Parts Kit for best results.

COIL REPLACEMENT (REF. FIG. 2)

Turn off electrical power, disconnect coil lead wires and proceed as follows:

1. Remove retaining cap, nameplate and cover.
2. Slip yoke containing coil, sleeves and insulating washers off the solenoid base sub-assembly. Insulating washers are omitted when molded coil is used. In some D. C. Constructions, a single flux plate over the coil replaces yoke, sleeves and insulating washers.
3. Reassemble in reverse order of disassembly.

VALVE DISASSEMBLY AND REASSEMBLY (REF. FIG. 2)

Turn off electrical power supply and de-pressurize valve.

1. Remove retaining cap and slip entire solenoid off solenoid base sub-assembly or plugnut/core tube sub-assembly.
2. Unscrew bonnet or solenoid base sub-assembly. Remove core assembly, core spring and body gasket.
3. Remove end cap, body gasket, disc spring, disc holder, disc or disc holder assembly.
4. All parts are now accessible for cleaning or replacement. Replace worn or damaged parts with a complete Spare Parts Kit for best results.
5. Reassemble in reverse order of disassembly paying careful attention to exploded view provided.

Spare Parts Kits and Coils are available for ASCO valves. Parts marked with an asterisk (*) are supplied in Spare Parts Kits.

ORDERING INFORMATION FOR SPARE PARTS KITS
When Ordering Spare Parts Kits or Coils Specify Valve Catalog Number, Serial Number and Voltage.

FORM NO. V-5291R2 PRINTED IN U.S.A. 1969

ASCO Valves

Automatic Switch Co. FLORHAM PARK, NEW JERSEY 07932

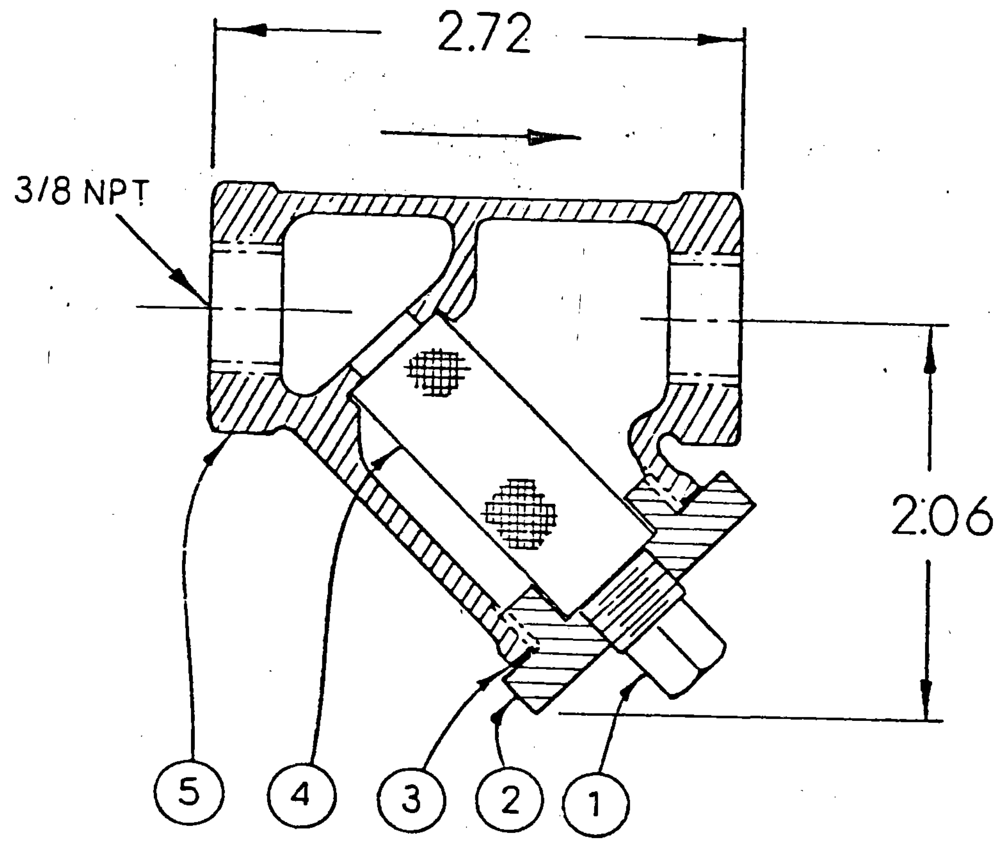
CLA-VAL CO.

PARTS LIST

STRAINER

Model X43

SIZE	STOCK NUMBER
3/8 X 3/8	33450



ITEM NO.	DESCRIPTION	MATERIAL
1	PIPE PLUG (1/2 NPT)	STEEL
2 †	STRAINER PLUG	BRASS
3 *	GASKET	COPPER
4 *	SCREEN	MONEL
5 †	BODY	BRASS

† AVAILABLE ONLY IN ASSEMBLY

When ordering parts specify: • All nameplate data • Item Number • Description * Recommended Spare Parts

PATENTS ISSUED AND/OR PENDING

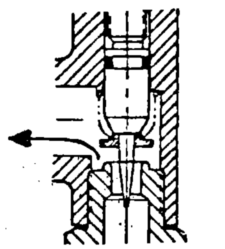
CLA-VAL CO. *Newport Beach, California*

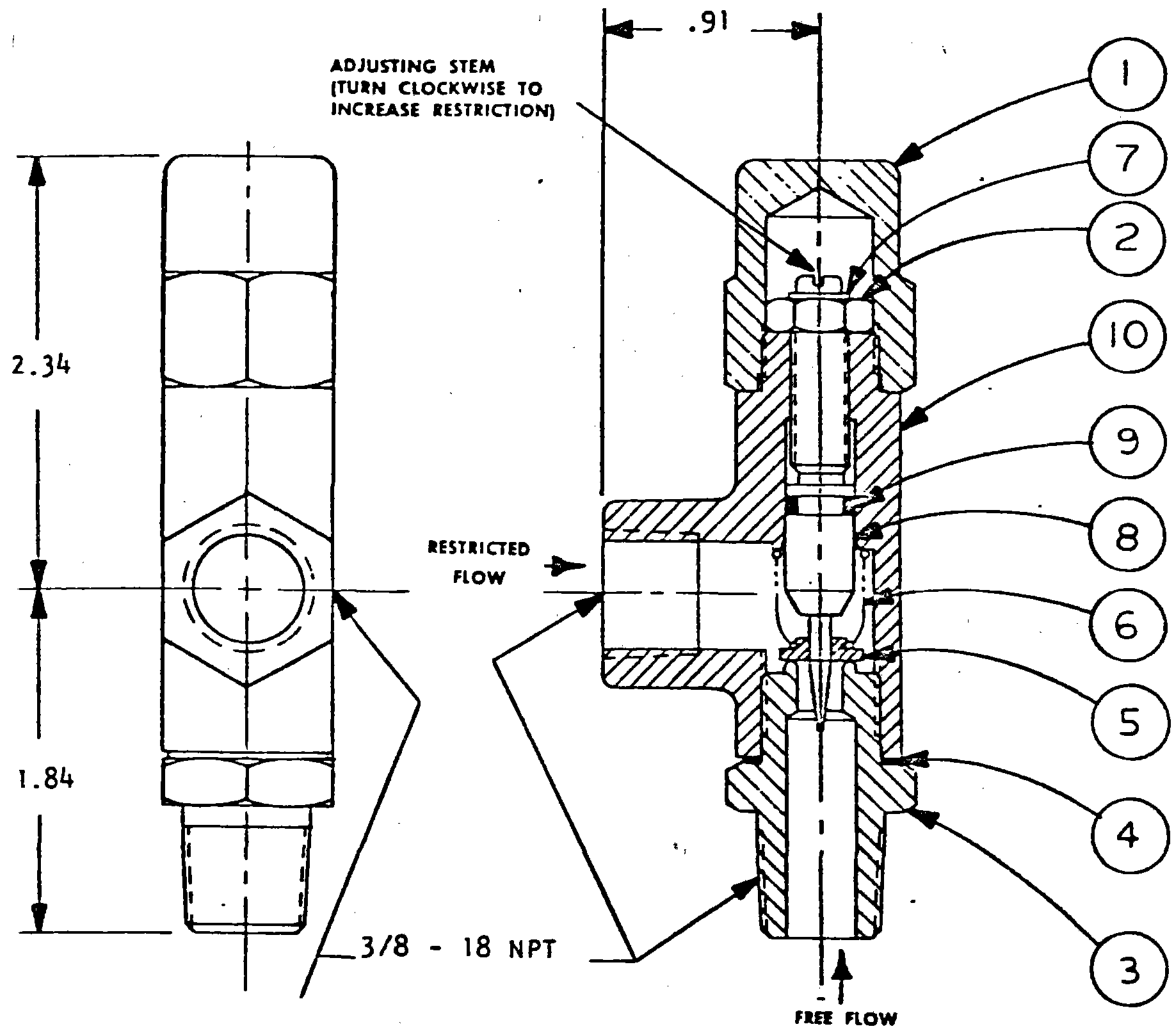
C		CLAYTON® *automatic* VALVES	PARTS LIST
		FLOW CONTROL	*Clayton* CV 3/8"

MATERIAL	STOCK NUMBER	FORMERLY
Bronze Body Stainless Steel Trim	97015-01A	C-5464
Stainless Steel Body and Trim (303)	97015-02J	37104
Bronze Body Monel Trim	97015-03G	37161

ITEM NO.	DESCRIPTION	QUAN.
1	Cap	1
2	Jam Nut	1
3	Seat	1
4 ★	Gasket	1
5 ★	Disc	1
6 ★	Spring	1
7	Snap Ring	1
8	Adjusting Stem	1
9 ★	"O" Ring	1
10	Housing Assembly	1

WITH DISC OPEN FOR "FREE FLOW"





When ordering parts specify:	• All nameplate data	• Description	• Part Number
	• Item Number	• Material	★ Recommended Spare Parts

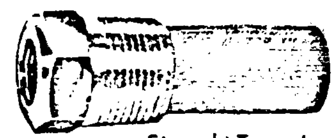
CLA-VAL CO.

FLOW CLEAN STRAINER

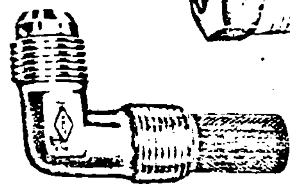
STRAIGHT TYPE
ANGLE TYPE

X46

The Cla-Val Co. X46 strainer is composed of a heavy mesh monel inner screen covered with a fine mesh monel outer screen. These two elements are securely soldered to a sturdy brass bar stock housing. The outer screen is a 40 x 40 mesh screen with .008" wire. This strainer is designed to prevent passage of foreign particles larger than .015". It is especially effective against such contaminents as algae, mud, scale, wood pulp, moss, and root fibres. Available in several different sizes as shown. There is a model for every Cla-Val Co. Valve.



Straight Type A



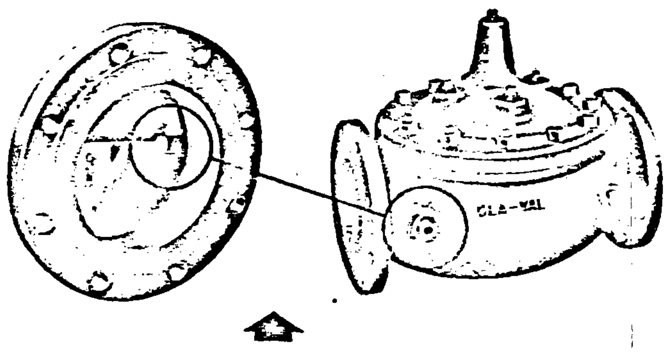
Angle Type B

OPERATION

The Flow Clean strainer operates on a velocity principle utilizing the circular "air foil" section to make it self-cleaning. Impingement of particles is on the "leading edge" only. The low pressure area on the down stream side of the screen prevents foreign particles from clogging the screen. There is also a scouring action, due to eddy currents, which keeps most of the screen area clean.

INSTALLATION

The strainer can be installed in any piping system where there is a moving stream to keep it clean. On Cla-Val Co. Valves the installation is made in the body tapping so the screen is projecting into the flow stream.



Inlet end view of valve with strainer installed

The strainer with the SELF-SCRUBBING CLEANING ACTION

SPECIFICATIONS

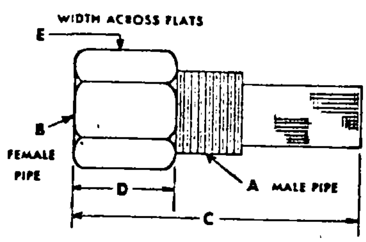
Body—Brass (also available in stainless steel on special order)
Strainer Screen—fabricated from monel wire.

WHEN ORDERING PLEASE SPECIFY:

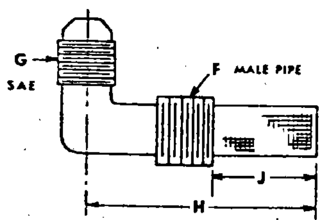
- Catalog No. X46
- Straight Type or Angle Type
- Strainer Stock Number

The angle type strainer is a standard tube elbow with strainer cylinder soldered into the pipe thread end.

DIMENSIONS



DIMENSIONS IN INCHES



STRAIGHT TYPE A

A	B	C	D	E	STOCK NO.
1/8	1/8	1 3/4	1 3/4	1/2	C-2889
1/4	1/4	2 1/4	3/4	11/16	C-2890
3/8	3/8	2 1/2	7/8	7/8	C-2891
1/2	3/8	2 1/2	1/2	7/8	C-3084
1/2	1/2	2 3/4	1	1 1/16	C-2892
3/4	3/8	3 3/8	1/2	1 1/16	C-3085
3/4	1/2	3 3/8	1/2	1 1/16	35894
3/4	3/4	3 1/2	1	1 7/16	C-2893
1	3/8	4 1/4	1/2	1 3/8	C-3086
1	1/2	4 1/2	1/2	1 3/8	C-9042
1	1	4 1/2	1 1/4	1 3/4	C-2872

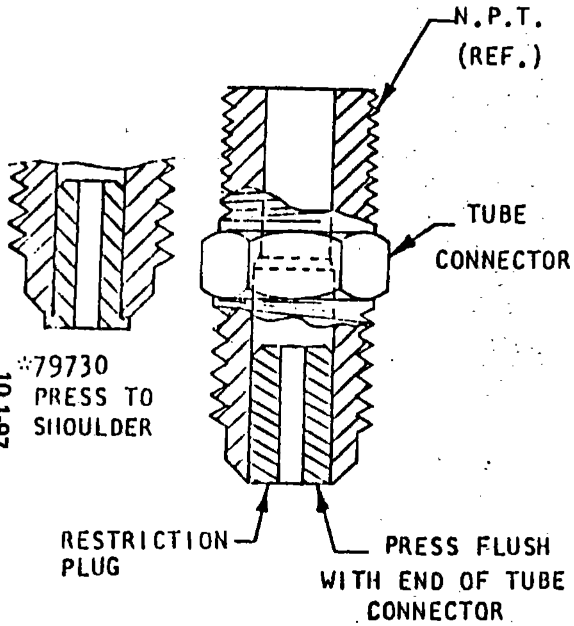
ANGLE TYPE B

F	G	H	J	STOCK NO.
1/8	1/4	1 3/8	5/8	C-4375
1/4	1/4	1 3/4	3/4	C-4376
3/8	1/4	2	7/8	C-4377
3/8	3/8	1 7/8	7/8	C-4378
1/2	3/8	2 3/8	1	C-5467

It is important to determine pipe size of the tapped hole into which the strainer will be inserted (See dimensions A or F) and size of external connection (See dimensions B or G) to obtain strainer model from above table.

48834

REF. NOTE:
SEE 76740 FOR S.S X58C



B/M & ASSEMBLY DRAWING

	TUBE CONNECTOR				RESTRICTION PLUG		
X58C STOCK NO.	PART NO.	SIZE TUBE X NPT	MATERIAL	TYPE FITTING	PART NO.	MATERIAL	ORIFICE DIA.
37814	37815	1/4 x 1/8	BRASS	45° FLARE	37816	S.ST.	1/32 (.031)
85484	37815	1/4 x 1/8	BRASS	45° FLARE	82603	DELRIN	1/32 (.031)
85486	37815	1/4 x 1/8	BRASS	45° FLARE	85485	DELRIN	.040
80500	37815	1/4 x 1/8	BRASS	45° FLARE	43396	S.ST.	1/16 (.062)
88409	42347	3/8 x 1/8	BRASS	45° FLARE	88408	DELRIN	.052
42346	42347	3/8 x 1/8	BRASS	45° FLARE	42345	DELRIN	1/16 (.062)
67739	42347	3/8 x 1/8	BRASS	45° FLARE	70339	S.ST.	.040
42775	42776	3/8 x 1/4	BRASS	45° FLARE	42345	DELRIN	1/16 (.062)
*63604 D	42776	3/8 x 1/4	BRASS	45° FLARE	63607	DELRIN	5/32 (.156)
44734	44735	3/8 x 3/8	ALUM.	37° FLARE	44875	S.ST.	1/8 (.125)
43302	43303	3/8 x3/8	BRASS	45° FLARE	43304	DELRIN	3/16 (.188)
46946	43303	3/8 x 3/8	BRASS	45° FLARE	42345	DELRIN	1/16 (.062)
64672	43303	3/8 x 3/8	BRASS	45° FLARE	C9447	S.ST.	1/16 (.062)
64673	43303	3/8 x 3/8	BRASS	45° FLARE	79912	DELRIN	1/8 (.125)
68565	43303	3/8 x 3/8	BRASS	45° FLARE	82285	DELRIN	3/32 (.094)
*79730J	67307-12	1/2 x 1/2	BRASS	45° FLARE	79741	S.ST.	1/8 (.125)

* SEE COMPUTER B/M

B/M & ASSEMBLY DRAWING D.C. -011

LTR	DESCRIPTION	BY	DATE
W	REDRAWN & RETYPED	WP	9-17-80
A-V.	SEE REVISION FILE		

REVISION RECORD

DO NOT SCALE PRINT

PART NO. | MATERIAL | MATERIAL SPEC.

MACH TOLERANCE UNLESS OTHERWISE NOTED
SURFACE FINISH 125
BREAK CORNERS .010 MAX
ANGULAR ± 1/2°
.00 = ± .030
.000 = ± .010
MAX. = + .00 - .09
MIN = + .09 - .00

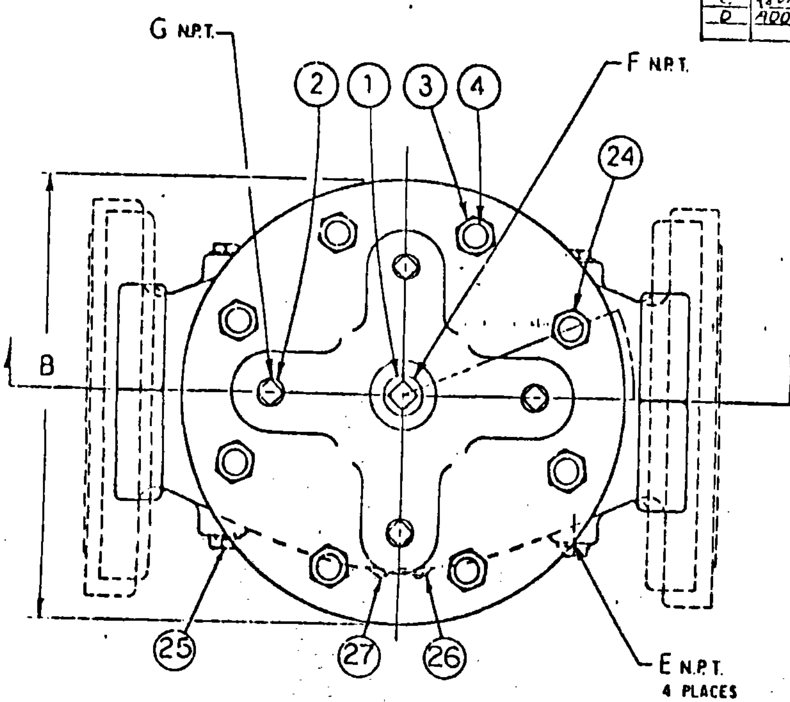
FINISH | SIZE
HEAT TREAT | FT/PC

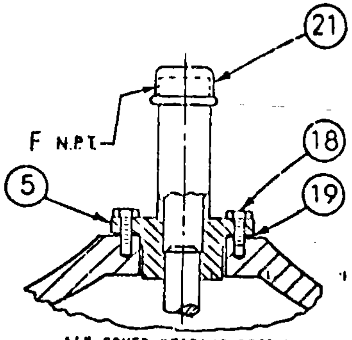
DRAWING TITLE
X58C RESTRICTION ASSEMBLIES AND B/M

DESIGN
DRAWN 9/17/80 W.E.P.
CHECKED 10-14-80
APPROVED 10-20-80
SCALE NONE
DRAWING NUMBER 48834
REV W

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

REV	REVISIONS DESCRIPTION	BY	DATE
A	DELET... 20 (PIPE NIPPLE)	CH	[illegible]
B	ADD I... 23 & 24	CH	[illegible]
C	REVISED DIMENSION TABLE	AIF	[illegible]
D	ADD ITEMS 25,26 & 27	JD	3/3/[illegible]





16" COVER BEARING DETAIL

NO. 100 HYTROL VARIATIONS

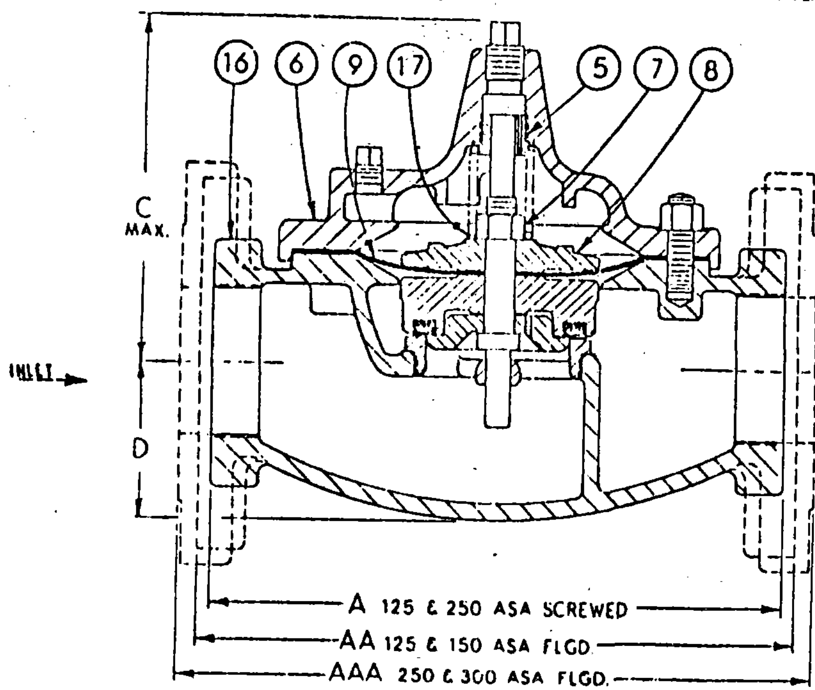
CATALOG NO.	DESCRIPTION
100	NORMAL FLOW HYTROL AS SHOWN (FLOW UNDER THE SEAT)
100KR	REVERSE FLOW HYTROL (FLOW OVER THE SEAT)
100KZ	OMIT SPRING (ITEM 17)
100KH	WITH HEAVY SPRING
100KT	WITH HIGH TEMPERATURE DIAPHRAGM (250° F. MAXIMUM)

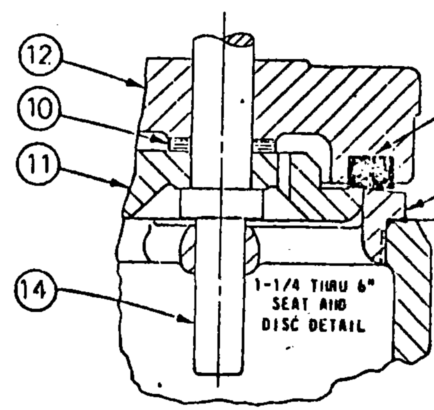
PARTS LIST

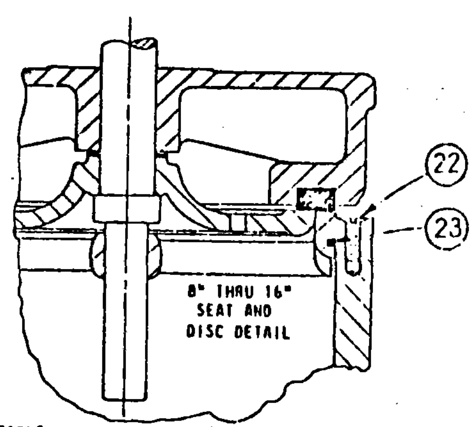
ITEM NO	DESCRIPTION
1	CENTER COVER PLUG
2	COVER PLUG
3	STUD NUT
4	STUD
5	COVER BEARING
6	COVER
7	STEM NUT
8	DIAPHRAGM WASHER
9	DIAPHRAGM
10	SPACER WASHER
11	DISC GUIDE
12	DISC RETAINER
13	DISC
14	STEM
15	SEAT
16	BODY
17	SPRING
18	COVER BEARING SCREW (16" ONLY)
19	COVER BEARING GASKET (16" ONLY)
20	
21	PIPE CAP (16" ONLY)
22	SEAT SCREW (8" - 16" ONLY)
23	O-RING SEAT
24	BOLT, COVER (4" & SMALLER)
25	PLUG, BODY
26	NAMEPLATE
27	SCREW, DRIVE

* RECOMMENDED SPARE PARTS

10.1-98







DIMENSION TABLE

	1¼-1½	2	2½	3	4	6	8	10	12	14	16
A	7-1/4	9-3/8	11	12-1/2							
AA	8-1/2	9-3/8	11	12	15	20	25-3/8	29-3/4	34	39	41-3/8
AAA	9	10	11 5/8	13-1/4	15-5/8	21	26-3/8	31-1/8	35-1/2	40-1/2	43-1/2
B	5-5/8	6-5/8	8	9-1/8	11-1/2	15-3/4	20	23-5/8	28	32-3/4	35-1/2
C	4-15/16	5-3/4	6-7/8	7-1/2	9-7/8	12-1/2	13-7/8	16-3/8	20	23-1/4	25
D	2	2-1/2	2-7/8	3-1/8	4-1/4	6	7-9/16	9-1/4	10-3/4	12-5/8	15-1/2
E NPT	3/8"	3/8"	1/2"	1/2"	3/4"	3/4"	1"	1"	1"	1"	1"
F NPT	1/4"	1/2"	1/2"	1/2"	3/4"	3/4"	1"	1"	1-1/4"	1 1/2"	1 1/2"*
G NPT	1/4"	3/8"	1/2"	1/2"	3/4"	3/4"	1"	1"	1"	1"	1"

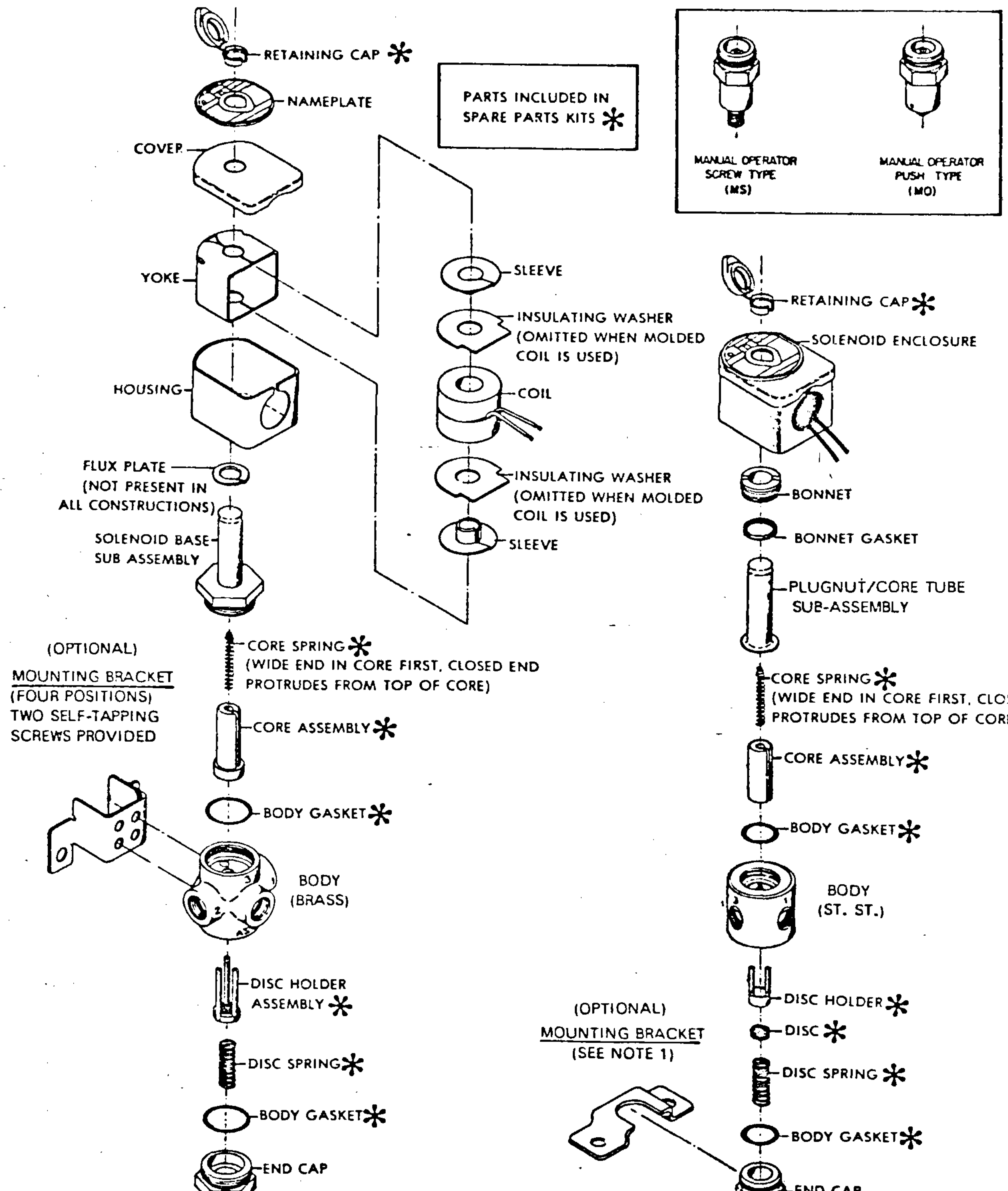
*1-1/2 ONLY

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA, U.S.A.

DESCRIPTION: NO. 100 HYTROL VALVE 1-1/4" THRU ... ZES

CODE IDENT. NUMBER: 86184

DRAWING NUMBER: ...1024



NOTE:

1. FOR MOUNTING, A FLAT SURFACE MUST BE PROVIDED ACROSS THE ENTIRE LENGTH OF THE BRACKET. THE VALVE BODY BECOMES SECURE TO BRACKET, WHEN BRACKET IS TIGHTENED IN TO POSITION. IF THE VALVE HAS A MANUAL OPERATOR, A HOLE MUST BE MADE THROUGH THE MOUNTING SURFACE FOR THE OPERATOR STEM.

Figure 2

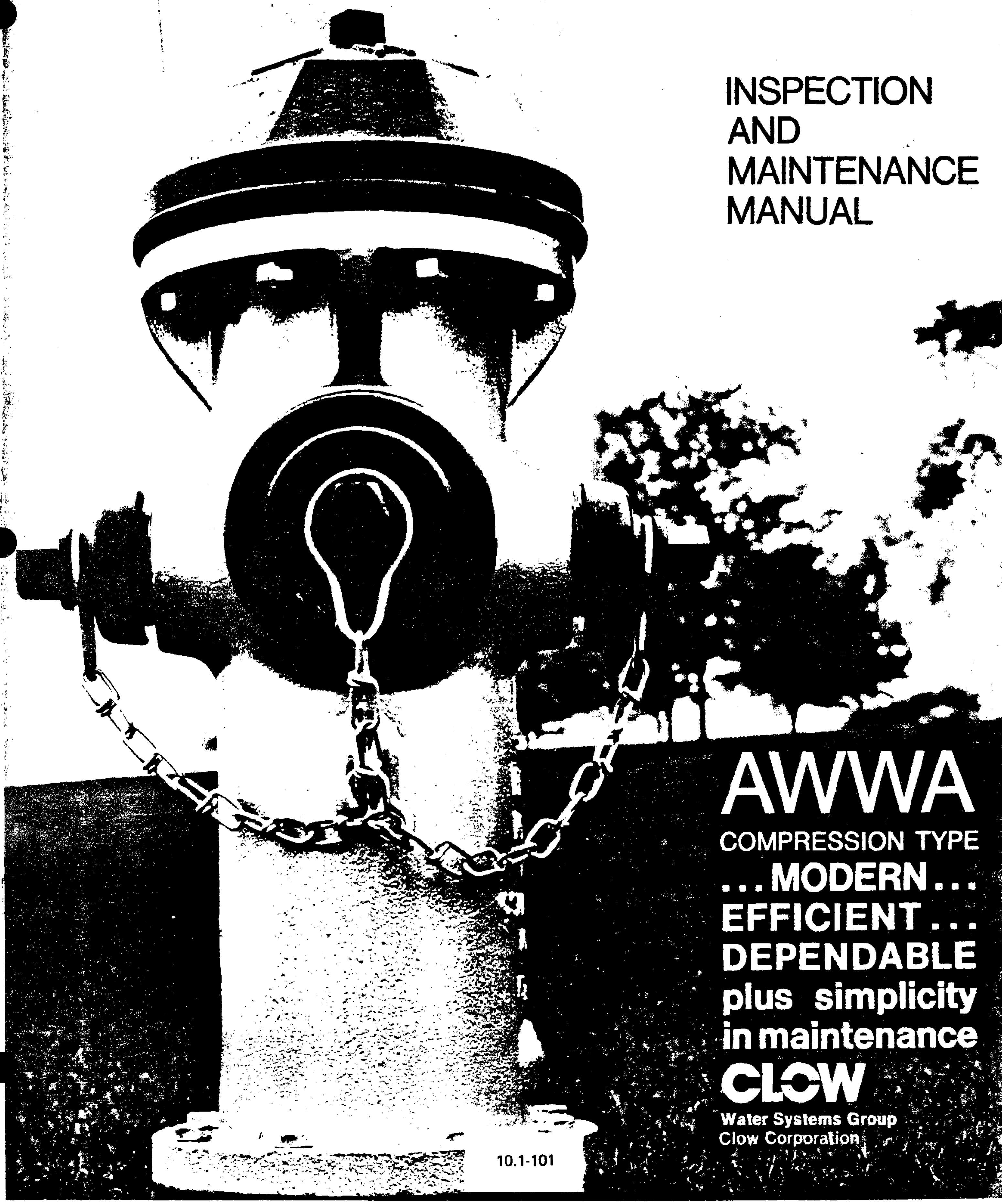
ASCO Valves
Automatic Switch Co. FLORHAM PARK, NEW JERSEY 07932 FORM NO V-5291R2 PRINTED IN U. S. A. 1969

10.1.5 Hydrants (Water System)

Sixteen water hydrants are located throughout the plant site as part of the fire protection system. The following pages contain the inspection and maintenance manual for the Iowa Fire Hydrants used.

IOWA FIRE HYDRANTS

INSPECTION
AND
MAINTENANCE
MANUAL



AWWA

COMPRESSION TYPE

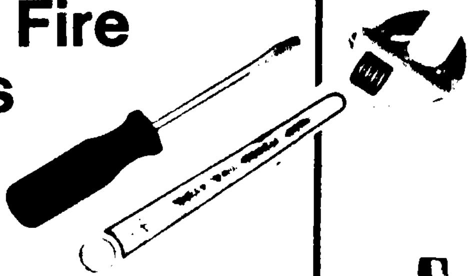
. . . MODERN . . .
EFFICIENT . . .
DEPENDABLE
plus simplicity
in maintenance

CLOW

Water Systems Group
Clow Corporation

10.1-101

Inspection and maintenance of IOWA Fire Hydrants

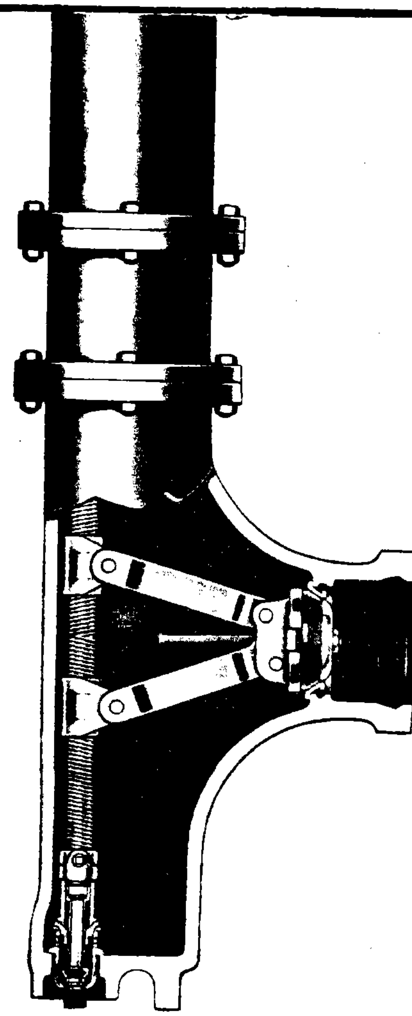


Only two handtools are needed for the complete removal and reassembly of working parts in the Iowa Fire Hydrant—an ordinary adjustable wrench and a standard screwdriver.

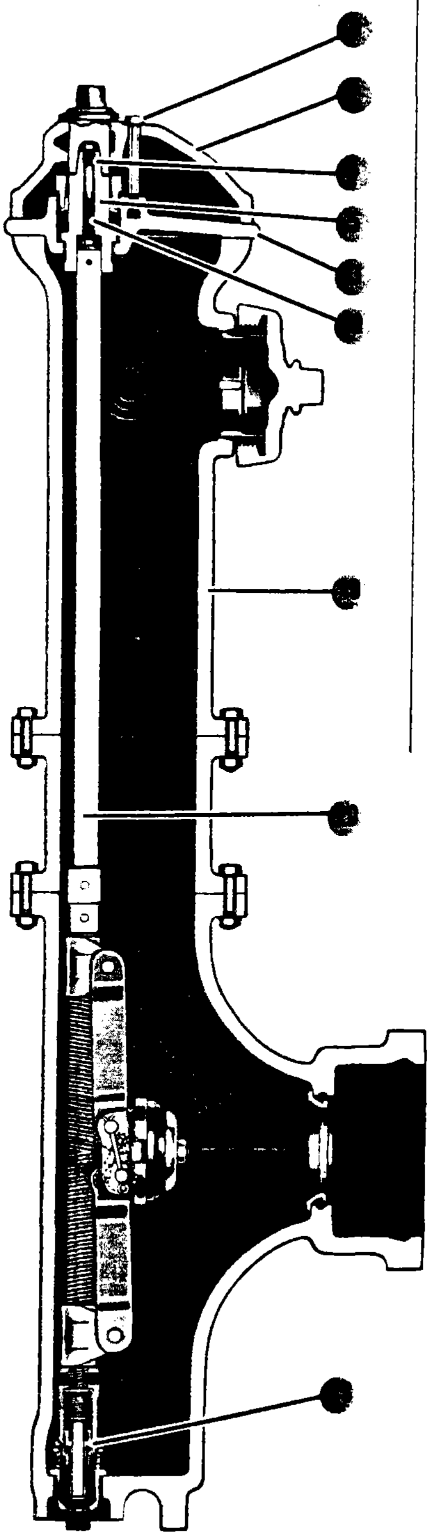
All parts are easily removed and replaced from the top, eliminating any need for special tools or heavy, cumbersome wrenches.

The advanced design of the Iowa hydrant provides minimum friction losses, maximum water delivery. Superior engineering, construction and materials assure operational dependability through the years and when maintained by regular periodic inspection of internal working parts, continued efficiency is sustained.

Ease of maintenance is one of the many advantages of the Iowa Fire Hydrant—systematic inspections, following the simple procedures outlined here, will assure its dependability for generations.



MAIN VALVE CLOSED Drain Valve Open

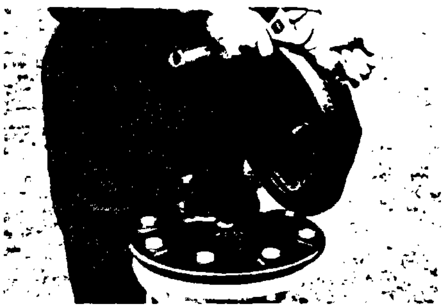


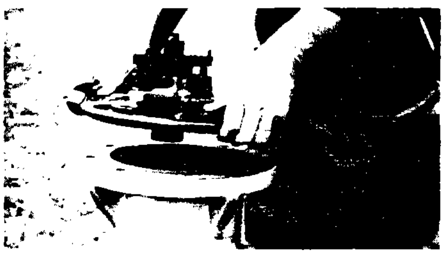
MAIN VALVE OPEN Drain Valve Closed

Directions for Removal and Reassembly of Iowa Fire Hydrant Internal Parts

Circled part numbers at left and right are keyed to instructions below.

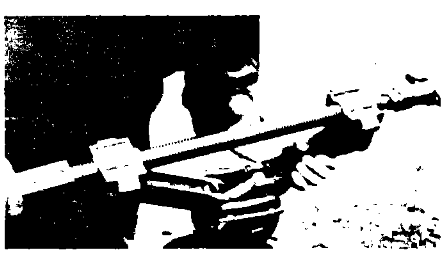
Before commencing disassembly procedure, shut off water valve in main, controlling flow to hydrant inlet, and open hydrant valve completely.





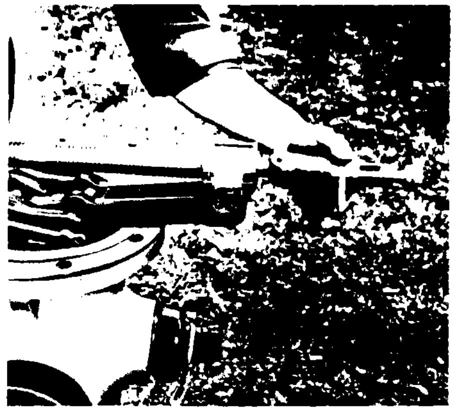
Unscrew single dome bolt 3 and lift off dome 2 . Unscrew series of head bolts 42 and remove head 41 .

Grasp square operating rod 20 and lift to remove working parts from hydrant barrel. Note position of all parts before disturbing.



Examine parts carefully to see that they are in good working condition.

Although seldom necessary, it is a wise practice while the hydrant is apart to make certain the drain is clear by driving a ⅝" dia. steel rod down through the drain barrel opening. The ability to clear the drain without digging is one of the superior features of the Iowa hydrant design.



Unscrew lifter guide 43 to attain full open position of the drain valve assembly, then turn guide back one full turn. Adjust to position it in line with the assembly.

With drain lifter guide 43 in line with the assembly, lower and insert into channel at hydrant bottom, taking care to hold drain valve snugly against back of the hydrant during lowering. If guide 43 is not in line, it will not enter the channel located at the back of the hydrant bottom and the assembly will not slide into proper position.

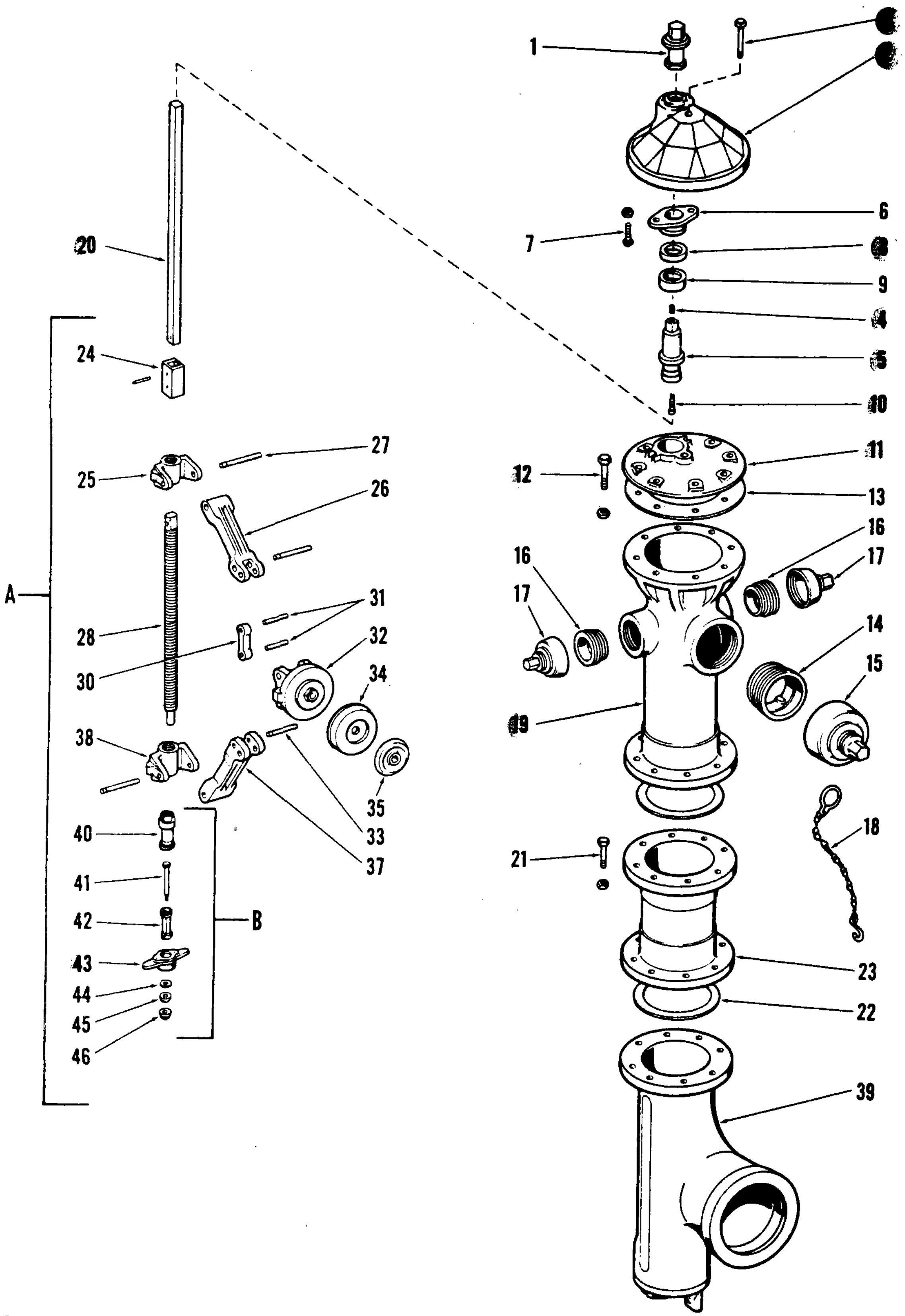
Replace complete head assembly 41 over operating rod 20 and bolt to standpipe [illegible] in original position. Unscrew bronze cap screw [illegible] from [illegible] , insert screwdriver and turn adjusting screw [illegible] down against top of operating rod 20 , then back off one-half turn. Replace cap screw [illegible] . Examine packing [illegible] and replace if necessary.

Replace hydrant dome 2 , tighten bolt 3 .

Close hydrant valve, open valve in the main controlling flow to the hydrant.

To test drain valve, remove one hose nozzle cap and open hydrant three turns. Allow water to rise to level of nozzle, then close hydrant. Place palm of hand firmly over the 2½" nozzle opening. A strong suction will indicate hydrant is draining properly. If the water does not recede or suction cannot be felt, the drain needs to be unplugged as mentioned in step 3, or reassembly operations 4 and 5 have not been followed correctly. With drain functioning properly, replace nozzle cap, and open hydrant fully to test gaskets and packing for leaks.

Close hydrant—with inspection and tests now completed, the Iowa hydrant is again ready to continue protection of home, life and property, fulfilling the purpose for which it was designed and sold.



Hydrant Repair Assemblies

	Assembly	Parts
A	Complete Hydrant Valve Assembly Including Drain	24 thru 46, but not Part 39
B	Drain Valve Assembly	40 thru 46

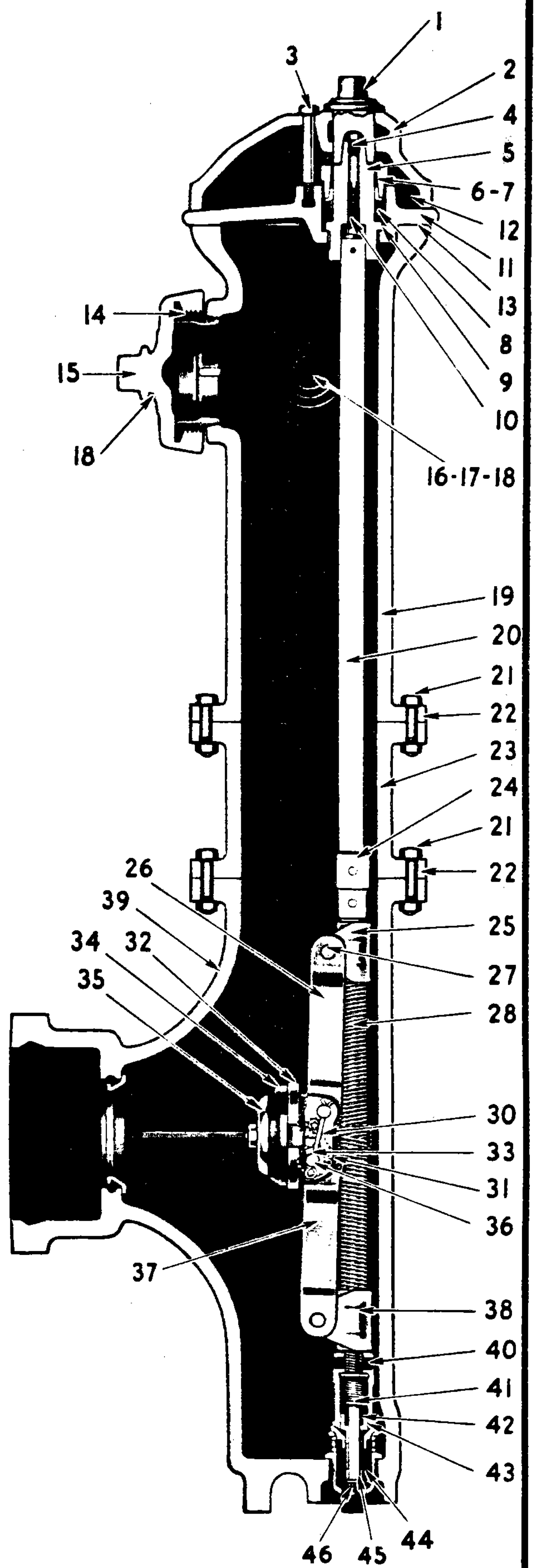
Iowa Fire Hydrants Parts List

Part No.	Part	Number Required	Material
1	Operating nut and retaining ring	1	Cast iron and bronze
2	Dome	1	Cast iron
3	Dome bolt	1	Steel
4	Cap screw	1	Bronze
5	Operating sleeve	1	Cast iron
6	Stuffing box follower and gland	1	Cast iron, bronze bushed
7	Follower bolts	2	Steel—nuts bronze
8	Stuffing box packing		Lubricated
9	Stuffing box packing ring	1	Bronze
10	Adjusting screw	1	Bronze
11	Head	1	Cast iron
12	Head bolts and nuts	8*	Steel
13	Head gasket	1	
14	Pumper nozzle	1	Bronze
15	Pumper nozzle cap	1	Cast iron
16	Hose nozzle	1	Bronze
17	Hose nozzle cap	1	Cast iron
18	Nozzle chain	1 Set	Steel
19	Stand pipe	1	Cast iron
20	Square operating rod	1	Steel
21	Flange bolts and nuts	8*	Steel
22	Flange gasket	2	
23	Extension piece	1	Cast iron
24	Coupling and pin	1	Bronze
25	Top stem nut	1	Bronze
26	Upper operating arm	1	Cast iron
27	Operating arm pins and cotter pins	2	Everdur bronze
28	Threaded stem	1	Bronze or Stainless
30	Connecting link	1	Bronze
31	Connecting link pins	2	Everdur bronze
32	Gate, cap screw and nut	1	Cast iron—stainless
33	Gate pins	2	Everdur bronze
34	Main valve	1	Rubber
35	Gate washer	1	Cast iron
36	Cotter pins for gate	2	Brass
37	Lower operating arm	1	Cast iron
38	Bottom stem nut	1	Bronze
39	Bottom, seat ring, and drain barrel	1	Cast iron—bronze
40	Drain valve holder	1	Bronze
41	Drain valve lifter stem	1	Bronze
42	Drain valve lifter	1	Bronze
43	Drain valve lifter guide	1	Bronze
44	Drain valve washer	1	Bronze
45	Drain rubber valve	1	Rubber
46	Drain valve lifter washer nut	1	Bronze

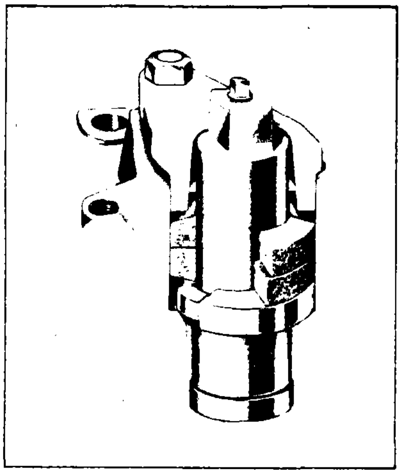
*4¼" hydrant requires 4.

Specify both part number and size of main valve opening when ordering.

CLOW

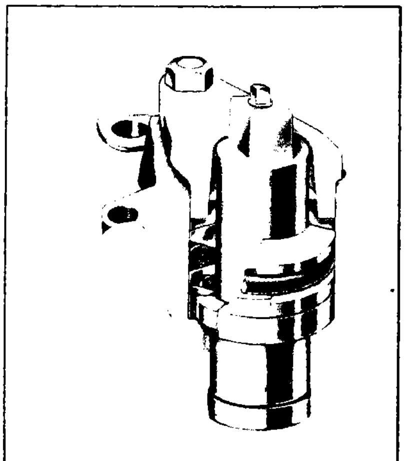


Parts and Accessories



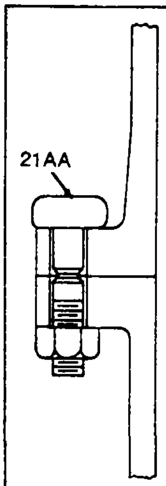
CONVENTIONAL STUFFING BOX CONSTRUCTION

Iowa hydrants, unless otherwise specified, are furnished with the conventional braided, graphited, asbestos packing—quickly and easily replaced whenever necesary.

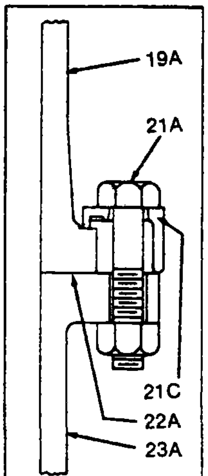


O-RING SEAL STUFFING BOX

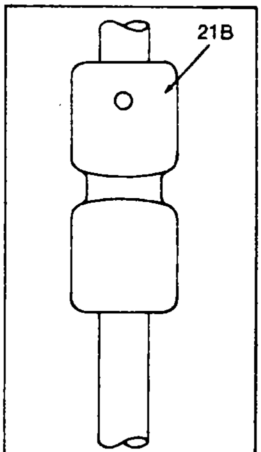
The O-Ring packing incorporates two specially designed O-Ring seals. This construction provides an excellent seal, and can be made part of any Iowa hydrant no matter when it was installed.



BREAK BOLT TYPE



BREAK FLANGE TYPE



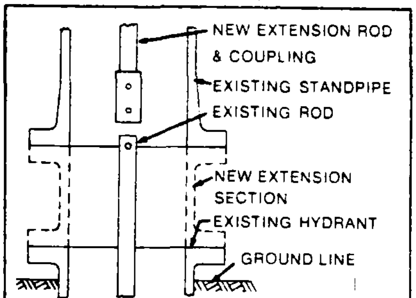
BREAK COUPLING (common to both types)

BREAK BOLT AND BREAK FLANGE HYDRANTS

Part No.	Part	Number Required
	Break Bolt Type	
21AA	Break bolts, cast iron	8*
21B	Break coupling, cast iron	1
	*4¼" hydrants require four (4) break bolts.	
	Break Flange Type	
19A	Standpipe, Break Flange, cast iron	1
21A	Break Flange Bolts and Nuts, steel	8
21B	Break Coupling, cast iron	1
21C	Break Flange, cast iron	1
22A	Break Flange Gaskets	1
23A	Break Flange Extension Piece, cast iron	1

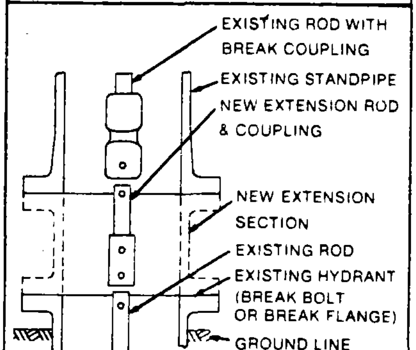
TO EXTEND INSTALLED IOWA HYDRANTS—(NO DIGGING OR WATER SHUT-OFF REQUIRED).

Iowa fire hydrants can be extended, without water shut-off and digging, by the use of an intermediate extension section. Available in lengths from 6" to 60" in 6" increments, sections are flanged at both ends and furnished with gaskets, bolts and nuts, extension rod, coupling and pins.



Procedure For Extending Ground Line Hydrants

1. Remove dome, head and standpipe.
2. Attach new rod with coupling to top of existing lower square operating rod.
3. Mount and bolt new extension section to existing pipe.
4. Replace standpipe and bolt to extension. Reassemble head and dome of hydrant as outlined under Inspection and General Maintenance Instructions steps 6 and 7.



Procedure For Extending Break Flange Type Hydrants

1. Remove dome, head and standpipe.
2. Disconnect existing break coupling from lower square operating rod.
3. Attach new extension rod with standard coupling to lower existing rod.
4. Mount and bolt new extension section to existing pipe.
5. Attach existing upper rod with break coupling, to top of new extension rod.
6. Replace standpipe and bolt to extension. Reassemble head and dome of hydrant as outlined under Inspection and General Maintenance Instructions steps 6 and 7.

CLOW

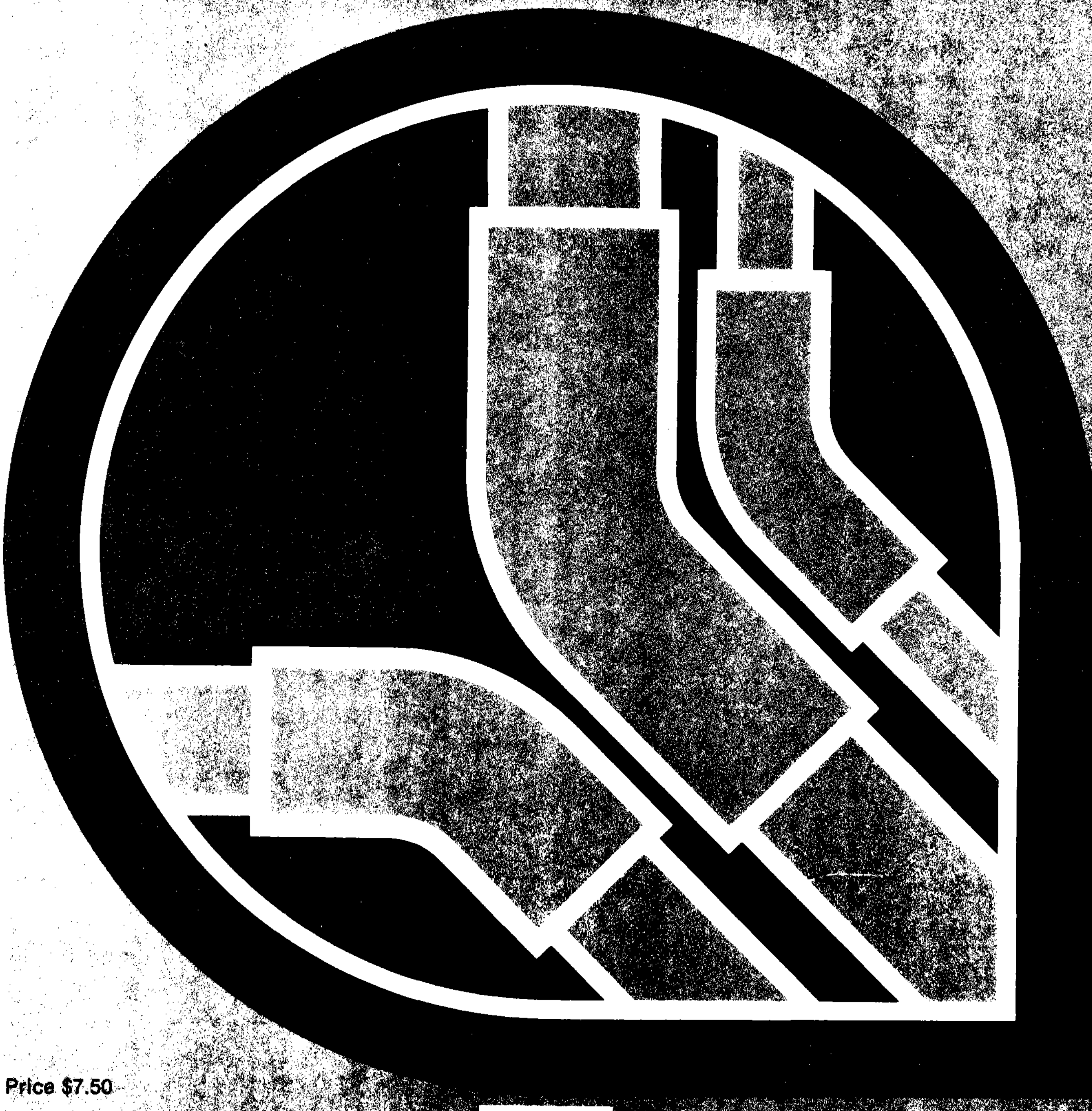
Water Systems Group
Clow Corporation
P.O. Box 350 Oskaloosa, Iowa 52577
Phone (515) 673-3443

10.1.6 Piping

The underground piping in the fire protection system is reinforced epoxy material. The following pages contain a pipe installation manual for CIBA-GEIGY piping materials.

Pipe Installation Manual

CIBA-GEIGY



Price $7.50

10.1-108

Pipe Installation Manual

CIBA–GEIGY

Important

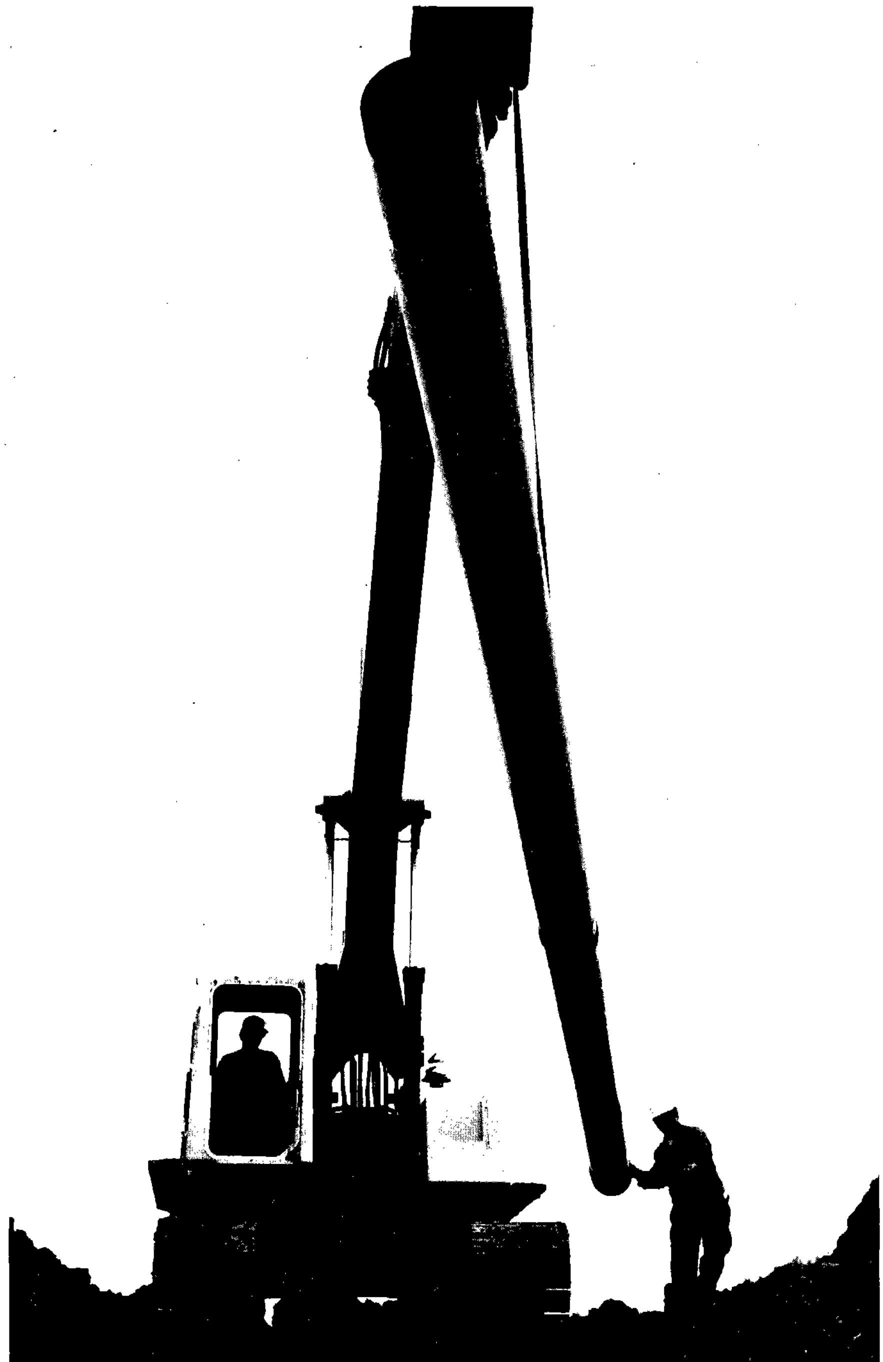
CIBA-GEIGY warrants that the products mentioned in this manual are free of defects due to materials or workmanship. **No. other warranties, whether expressed or implied, including warranties of merchantability or of fitness for a particular purpose shall apply to these products.** No statements or recommendations contained herein are to be construed as inducements to infringe any relevant patent, now or hereafter in existence. CIBA-GEIGY neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than such as is expressly set forth herein. **Under no circumstances shall CIBA-GEIGY be liable for incidental, consequential or other damages arising out of a claim from alleged negligence, breach of warranty, strict liability or any other legal theory, through the use or handling or these products.**

Tables

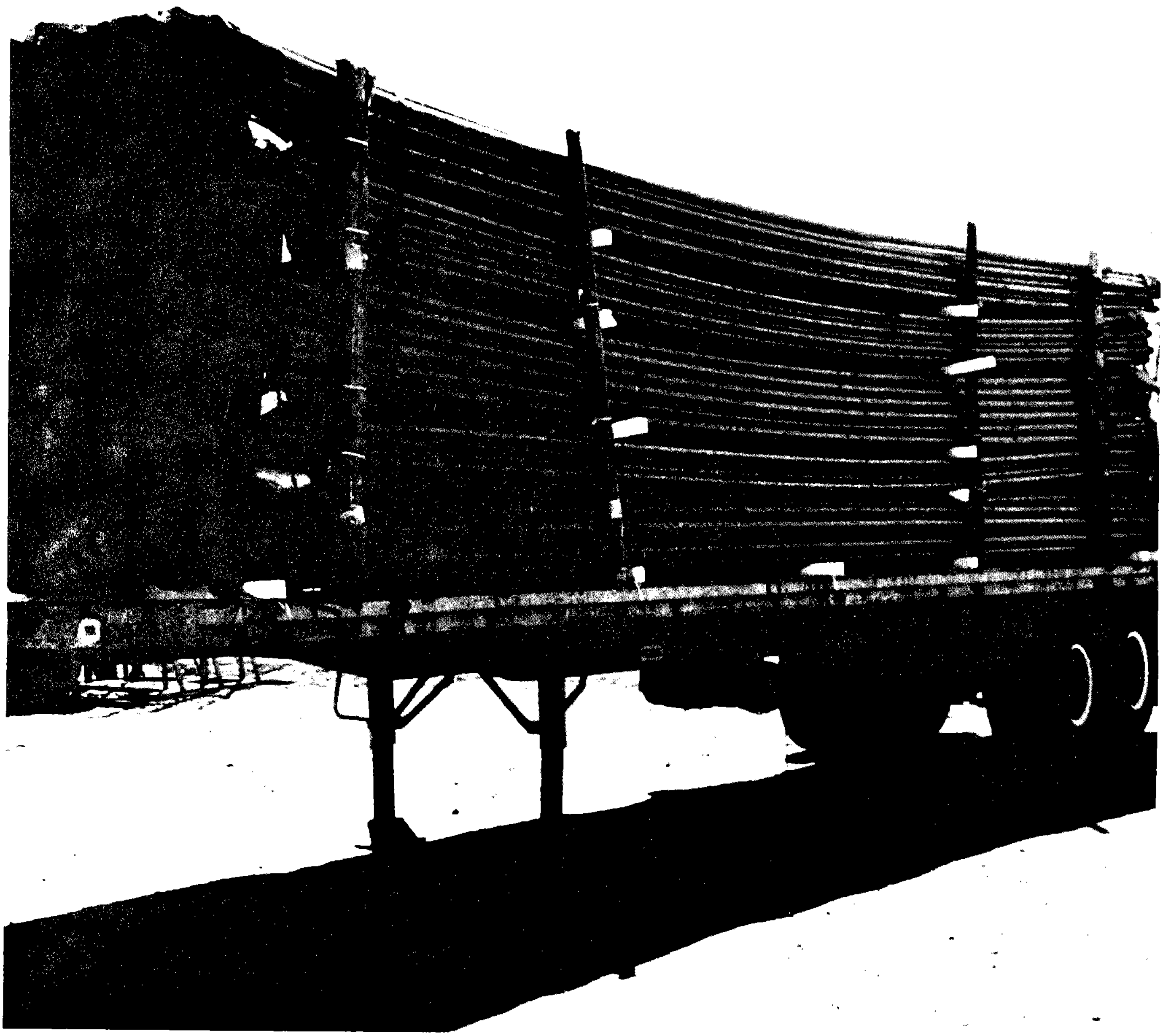
Figures

Introduction

This Installation Manual is intended to assist supervisors and their employees in understanding the proper procedure for installing CIBA-GEIGY fiberglass pipe. This installation guide is **not** a design or system engineering manual, but rather a manual which provides **practical** field installation information. It serves as a source of data for reference and fc solving on-the-job problems which may be encountered. If a situation whic is not covered by this manual arises during installation, consult the CIBA GEIGY Pipe Systems Department. It must be remembered that these instructions are intended only as a guide and the individual job engineerin specifications are the final authority. Because any specification should b properly administered and enforced, there is no assurance that inclusion c this manual in a specification will assure a successful job; however, it shoul assist materially in accomplishing this objective.



Handling, Storage, Inspection



Upon receiving a shipment of CIBA-GEIGY pipe at the jobsite, it is necessary to follow certain procedures prior to installation in order to insure a high performance pipeline installation.

10.1-114

A. Handling

CIBA-GEIGY pipe is a high performance product which must be handled with a reasonable amount of care. The following recommendations shou be observed in order to protect the pipe wall and fittings from possible damage.

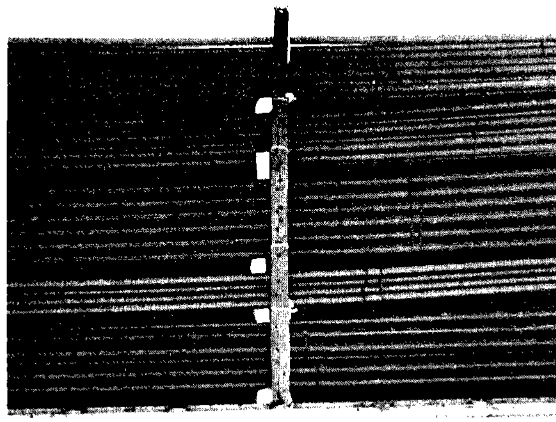
1. Transportation

a) Let the factory arrangement of the pipe be your guide for the correct supporting and spacing in rearranging for transport. Don't let the pipe rest on the floor of the truck where nails, studs, and other objects might damage it.

b) The pipe should be securely fastened directly *over* the dunnage with tie downs consisting of nylon straps or manila rope. Avoid over tightening which may cause excessive localized deformation in the pipe.

c) Do not allow the pipe to extend more than 3 ft. beyond the truck or trail bed because permanent damage can result from excessive flexing.

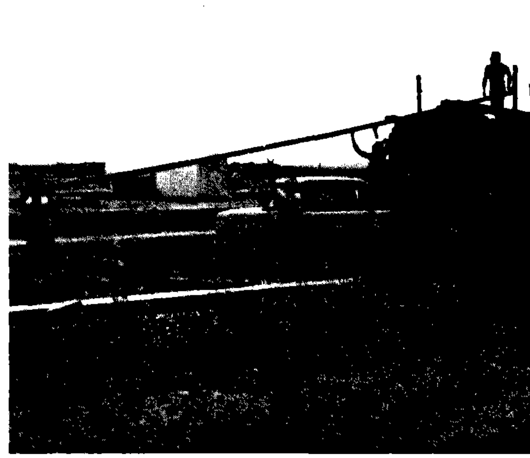
d) CIBA-GEIGY pipe is a light load, particularly with larger diameter pip Therefore, reduced speeds should be used on rough roads to minimize bouncing.

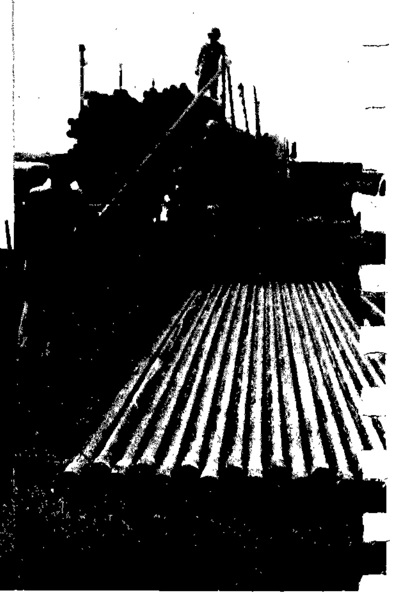


2. Loading and Unloading

a) Pipe and fittings should *never* be thrown or dropped under any circumstances.

b) The pipe should be carefully loaded and unloaded one length at a time, by hand. Table 1 outlines the nominal weight of each respective pipe size.





10.1-115

c) If the pipe load is properly separated and supported, fork lifts can be us Table 1 should be used to determine how many pipe lengths the lifting equipment can handle at one time.

Table 1.

Nominal Weight of Pipe

Pipe Diameter	Weight per Foot	Weight per 20 ft Length	Weight per 42 ft Length
2 in	0.5 lb (0.23 kg)	10 lb (4.5 kg)	21 lb (9.5 kg)
3 in	0.7 lb (0.32 kg)	14 lb (6.4 kg)	29 lb (13 kg)
4 in	1.0 lb (0.45 kg)	20 lb (9.1 kg)	42 lb (19 kg)
6 in	1.7 lb (0.77 kg)	34 lb (15 kg)	71 lb (32 kg)
8 in	3.3 lb (1.5 kg)	66 lb (30 kg)	139 lb (63 kg)
10 in	4.8 lb (2.1 kg)	94 lb (43 kg)	197 lb (89 kg)
12 in	6.3 lb (2.9 kg)	126 lb (57 kg)	265 lb (120 kg)
14 in	8.0 lb (3.4 kg)	148 lb (67 kg)	311 lb (141 kg)
16 in	10.1 lb (4.8 kg)	212 lb (96 kg)	445 lb (202 kg)

3. Truckload Make-up

The following information is offered as a guide to estimate the quantities pipe that can be loaded on Oil Field Hauler floats. The loads are based standard floats loaded 12½ ft. high with standard 42 ft. pipe lengths. Loa will be less than shown when shorter lengths are shipped and diameters a mixed. A standard load consists of pipe bound in master bundles and a collars loaded on the same end of the float. Figure 1 lists the Standard Lo pipe footages and illustrates the percent of truckload make-up per pipe footage for various types and sizes of pipe.

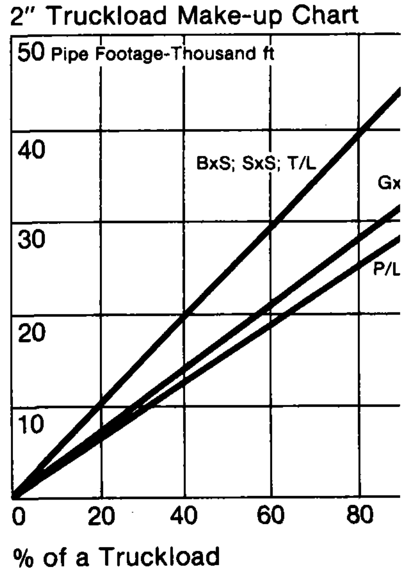
Figure 1.
Truckload Make-up

Standard Load

2" Bell x Spigot (BxS) Spigot x Spigot (SxS) Taper-Lock (T/L)	51,500 ft (15,700 m)
2" Grooved (GxG)	37,000 ft (11,200 m)
2" Pronto-Lock (P/L)	33,600 ft (10,200 m)
3" BxS, SxS, T/L	24,700 ft (7,500 m)
GxG	21,000 ft (6,900 m)
PL*	18,400 ft (5,600 m)
4" BxS, SxS, T/L	15,200 ft (4,600 m)
GxG	12,600 ft (3,800 m)
PL*	11,100 ft (3,300 m)
6" BxS, SxS	7,500 ft (2,300 m)
GxG	6,900 ft (2,100 m)
PL	6,600 ft (2,000 m)
C-500 PL**	5,800 ft (1,750 m)
8" BxS	3,700 ft (1,120 m)
8" PL II	3,450 ft (1,050 m)
10" PL II	2,200 ft (670 m)
12" PL II	1,680 ft (510 m)
14" PL II	1,230 ft (370 m)
16" PL II	1,025 ft (310 m)

* Includes C-300/C-400/C-500 and Dualoy 3000, 3200, 3500, 4000
** Includes C-400/C-500 and Dualoy 3500, 4000

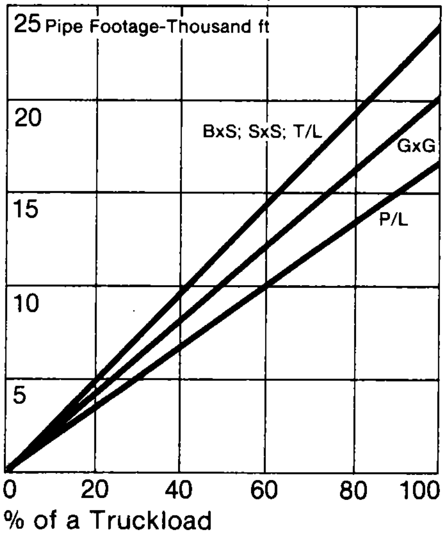
2" Truckload Make-up Chart



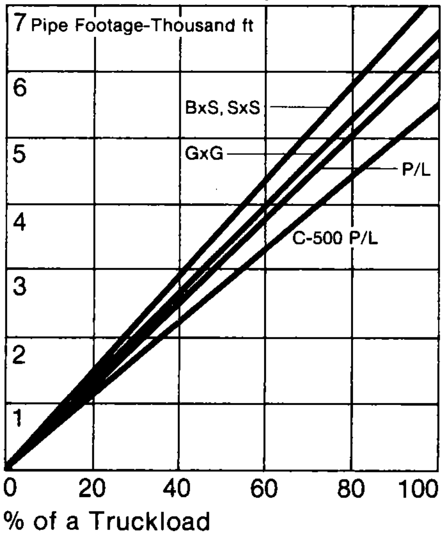
(Truckload Make-up Continued On Page 4.)

Truckload Make-up
(Continued)

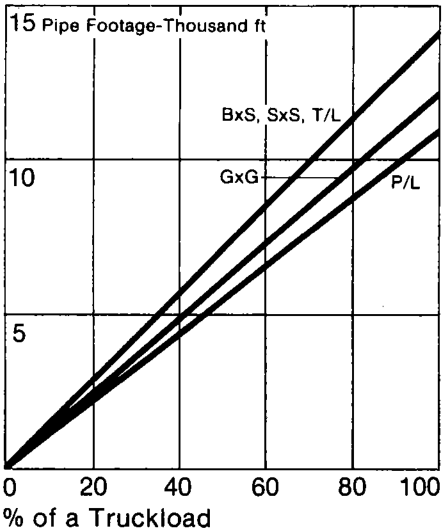
3" Truckload Make-up Chart



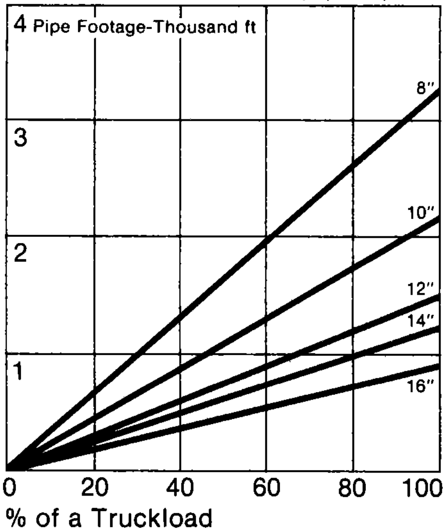
6" Truckload Make-up Chart



4" Truckload Make-up Chart



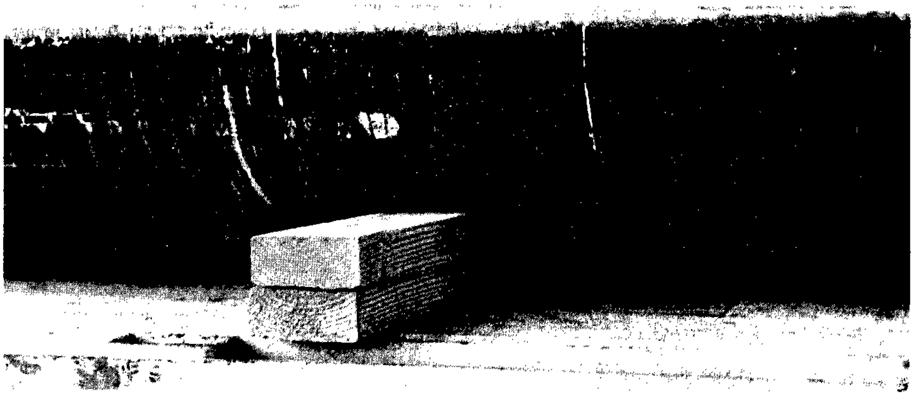
8"-16" Truckload Make-up (PLII)



B. Storage

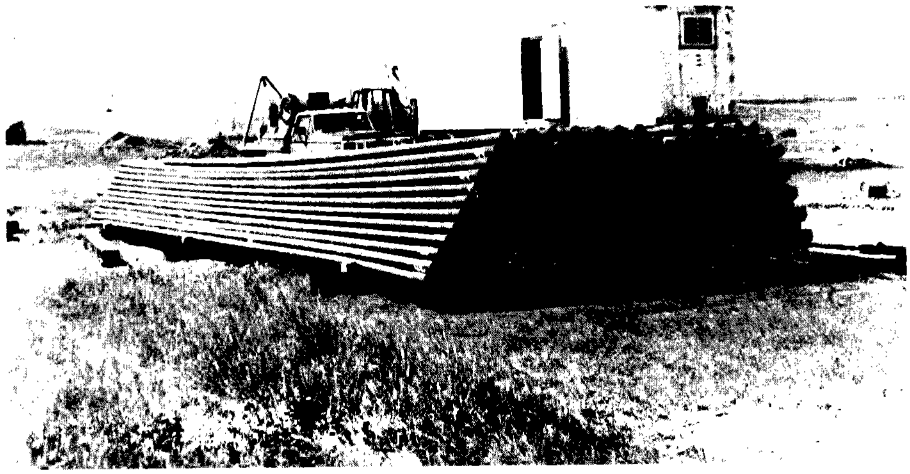
CIBA-GEIGY pipe may be safely stored outside for extended periods provided the following recommended storage procedures are observed.

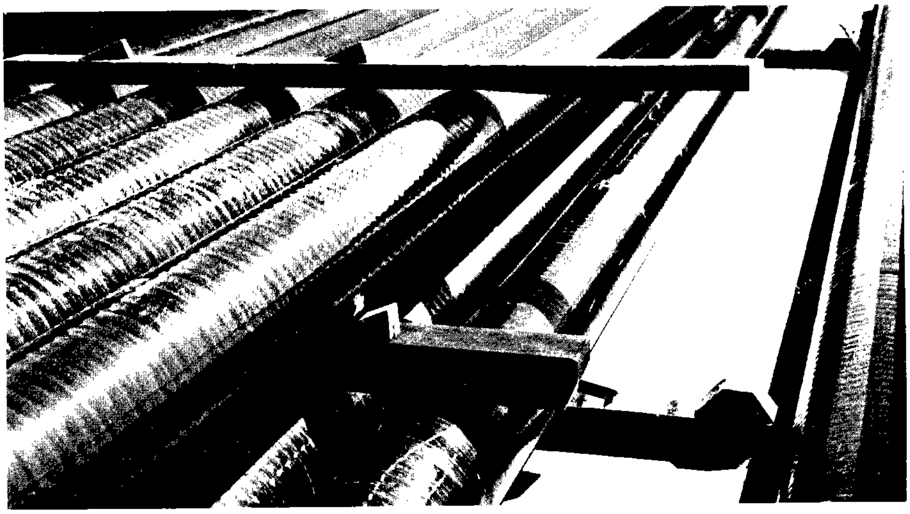
1. Supports should be spaced in 10 foot intervals and approximately 5 feet from each end. The supports should have a minimum 4 inch wide bearing surface.



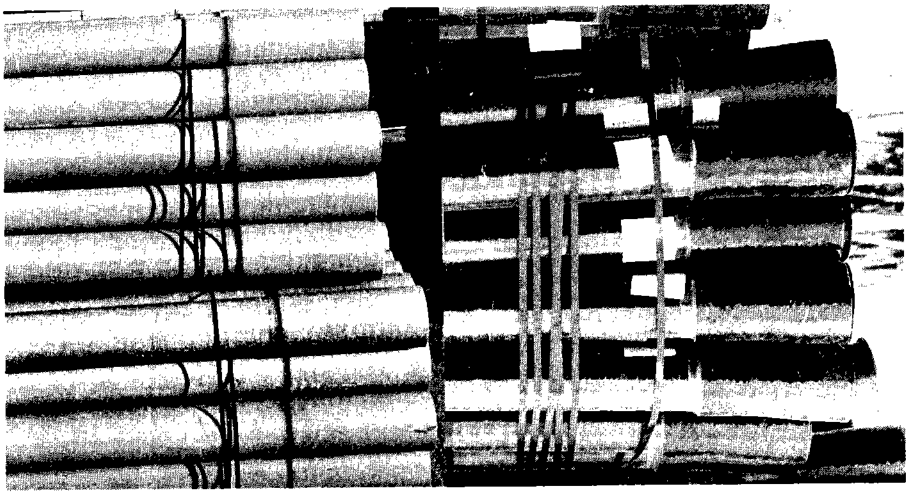
10.1-117

2. A pipe stack should not exceed 10 feet in height and should have side supports or blocks to prevent rolling or slipping of the stack.





3. Tie downs should consist of nylon straps or manila rope. Avoid over-tightening which may cause excessive localized deformation in the pipe.

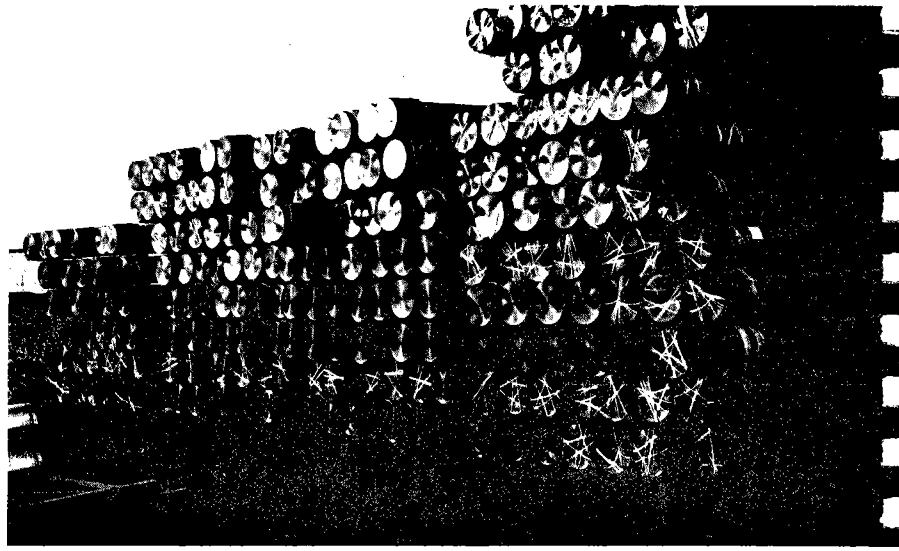


4. If stacking directly on the ground becomes necessary, a leveled, soft earth surface, free of rocks or sharp objects should be used.

10.1-118

5. Protective end coverings should be left intact until the time of installation to provide protection to the pipe ends, as well as guard against dirt or oth materials entering the pipe.

6. Fittings, adhesives, and tools should be stored in the shipping boxes under cover and protected from water, mud, and extreme heat or cold.



C. Inspection

Since, during transportation, storage, and handling, pipe may be subject to rough treatment, it is imperative that all pipe and fittings be fully inspecte for possible impact damage (detected by localized color differences as shown below), cracking, or manufacturing defects. Inspection of the pip and fittings should be undertaken upon delivery, and just prior to installation. At delivery, check the load carefully and report any damage or shortage to the transportation agent and CIBA-GEIGY prior to accepting the shipment. During inspections, immediately isolate any damaged sections on the jobsite to avoid any chance of damaged material being installed. All damage must be cut out and repaired as outlined in Chapter 9 "Repair Procedures."

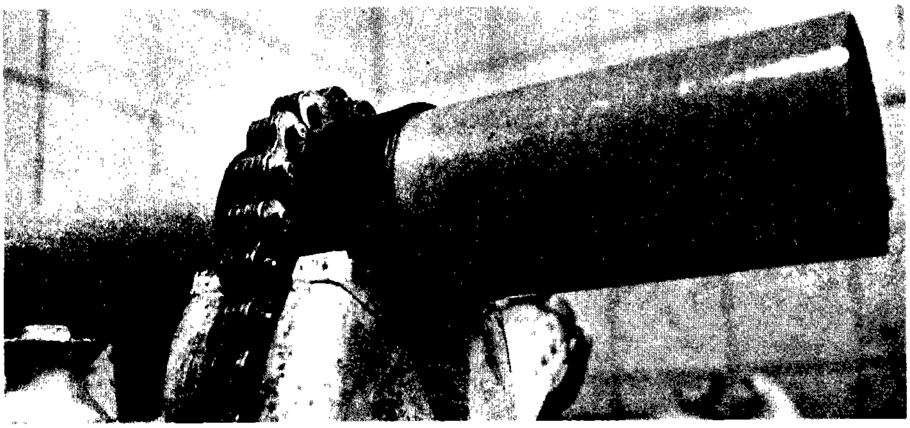
Inspection plays a major role in the ultimate success of an installed pipeline. If damaged or defective pipe can be detected prior to installation, the installer will avoid frustration and delays caused by necessary rework. All parties involved benefit from careful and thorough inspection.

Preparation

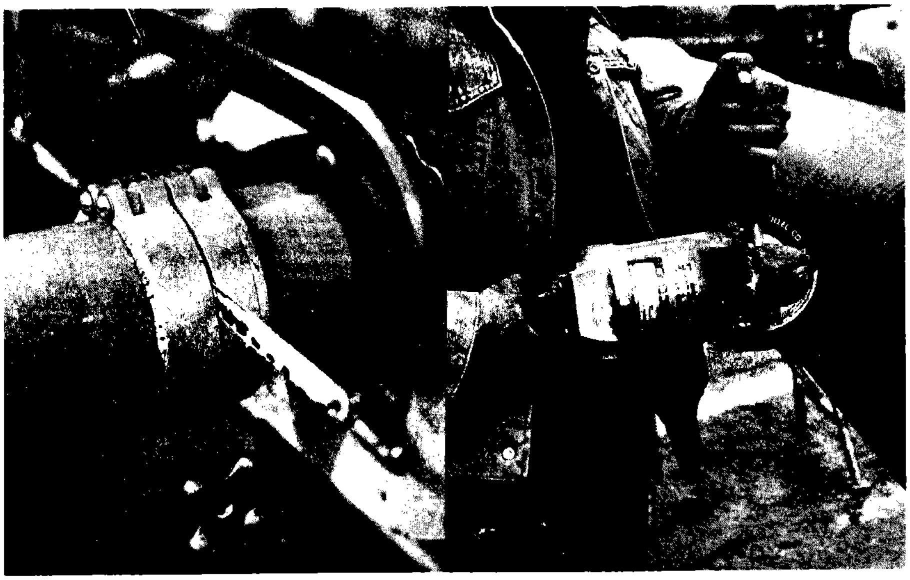
Cutting

In the process of field fabrication of CIBA-GEIGY pipe, proper cutting and tapering is essential for correct installation and performance.

1. For all cutting and tapering, the pipe must be held securely with a strap wrench, saw guide/clamp assembly, or a chain vise.
When a chain vise is used to hold the pipe, always wrap the pipe with protective material (rubber) to prevent damage to the outer surface.

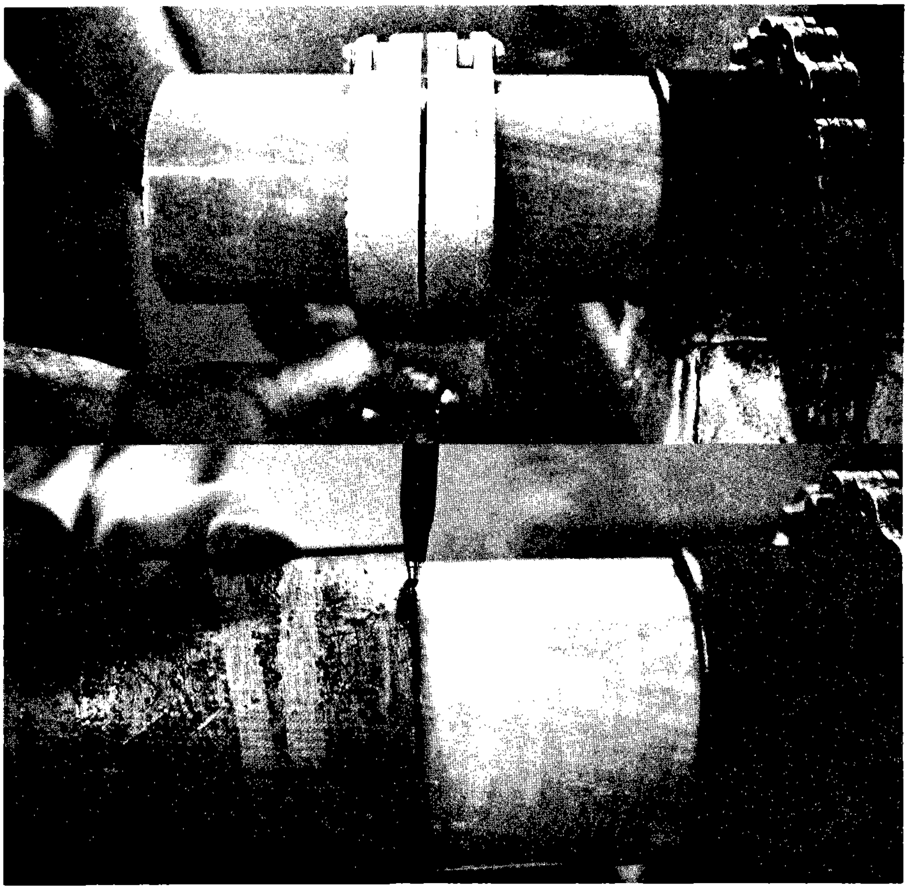


2. Cutting CIBA-GEIGY pipe should be done with a fine-toothed hacksaw for 2"-6" pipe and a power driven circular abrasive cut-off wheel for 8"-16" pipe.
Note: Protective respirators should be worn when using powered cut-off or tapering equipment.



10.1-120

3. The cut made on a pipe must be straight as possible to insure proper tapering. Saw guides are recommended, but when not available, a wrap-around may be used to scribe or mark a cutting guideline. Maximum out of square tolerances are shown in Tables 2 & 3 on pages 10 and 27 respectively.

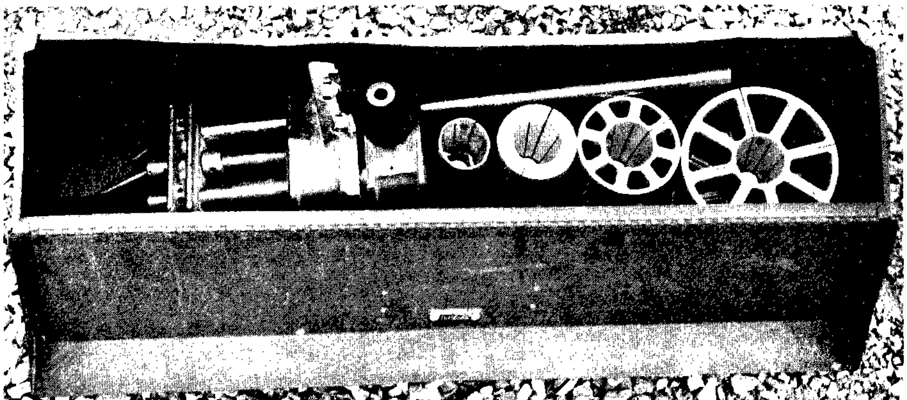


B. Tapering

Tools which are available from CIBA-GEIGY for manufacturing a field taper include the Taper-Maker®, Taper-Tool®, and the Taper-Tool II®. The Taper-Maker is operated manually and is used for tapering 2"-6" pipe. The Taper-Tool is designed for both manual and power operation and is also used on 2"-6" pipe. The third tool, the Taper-Tool II, is designed for tapering 8"-16" pipe and is fully power operated.

1. Taper-Maker

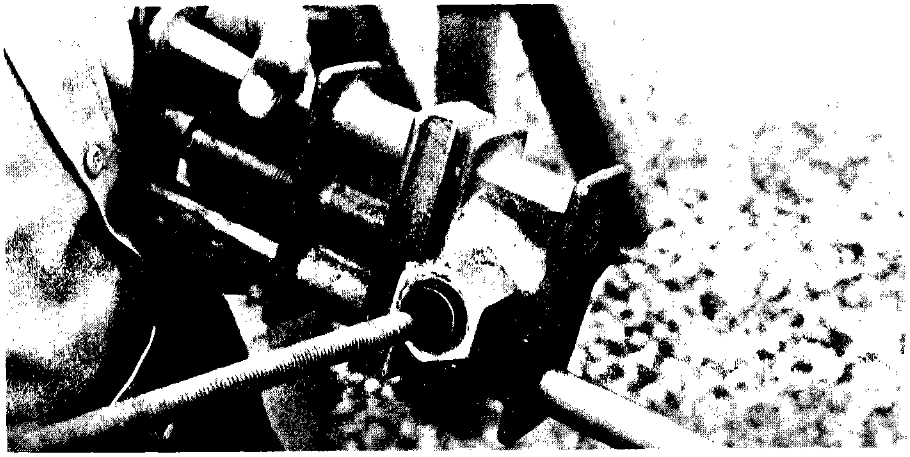
The Taper-Maker is a lightweight tool operated manually to produce a 1 ¾° taper on 2"-6" fiberglass/epoxy pipe.



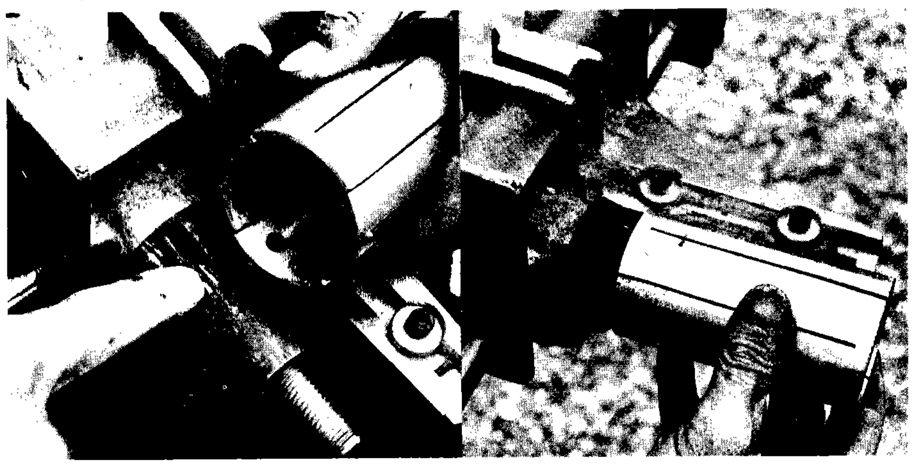
10.1-121

Taper-Maker Set-Up Instructions

a) Holding the Collet Control Knob (Refer to numerical identification key, Figure 2, page 12, item 21), insert the threaded collet shaft through the Base Casting (1) and the Mandrel (20).

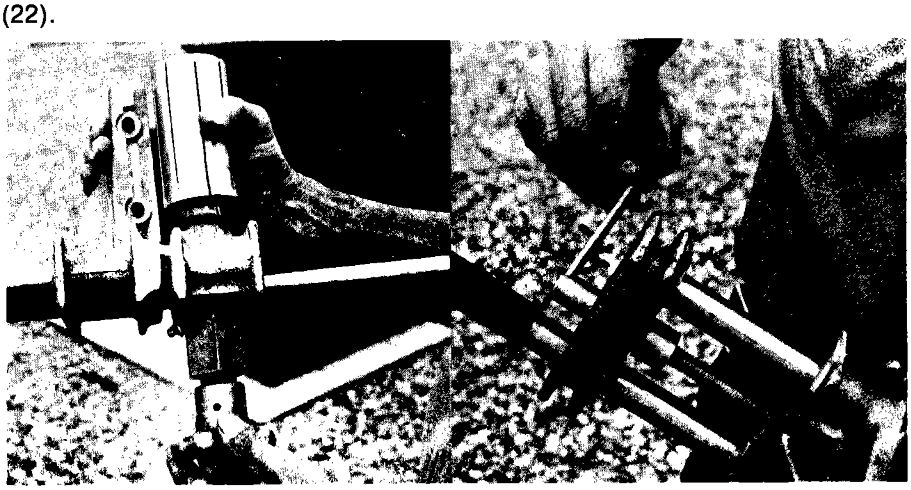


b) Select Collet (91) of the proper size and slide it onto the Mandrel (20) making sure the key inside the collet is engaged in the slot of the mandrel.

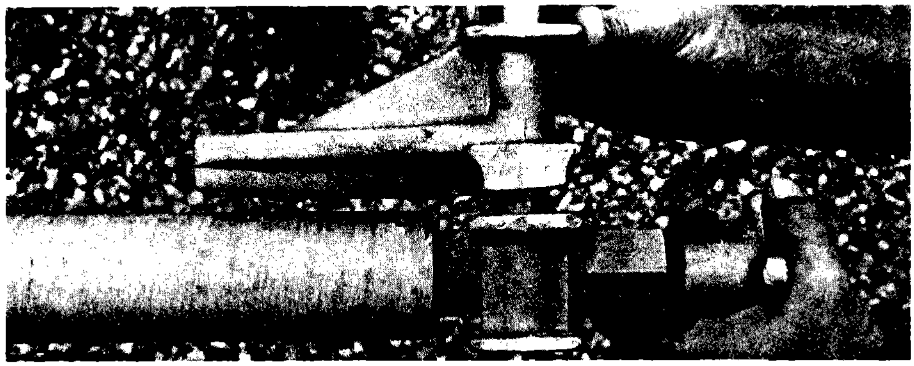


c) Tighten the collet by firmly holding the collet and turning the Collect Control Knob (21) clockwise until expansion of the collet begins.

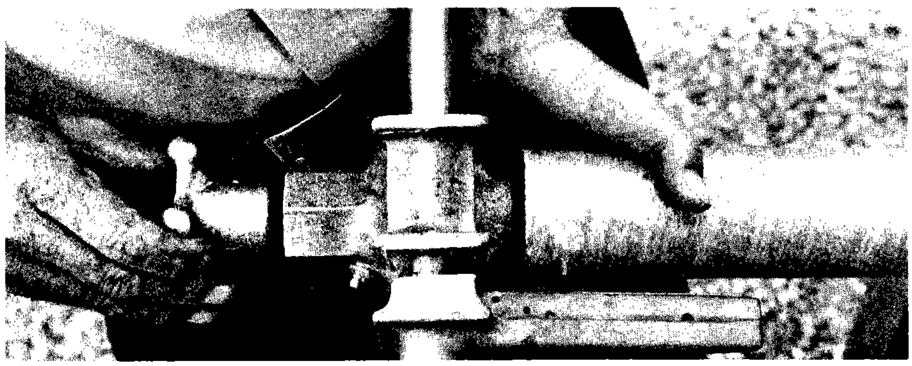
It may be necessary to reposition the cutting head to accommodate different diameter collets. This is done by turning the Cutting Head Adjusting Handle (22).



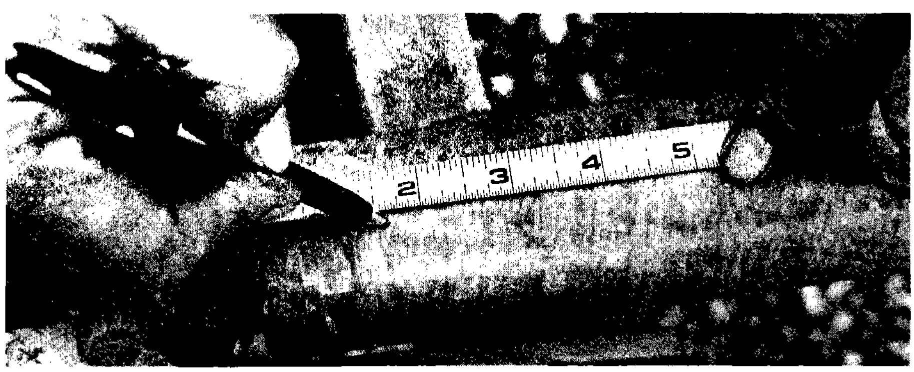
d) Insert the collet into the pipe so that the end of the collet is flush with the end of the pipe.



e) Turn the Collet Control Knob (21) clockwise to expand the collet inside the pipe.



f) Mark the pipe as a guide in making a proper length taper. Dimensions of tapers for each pipe size are shown in Table 2.

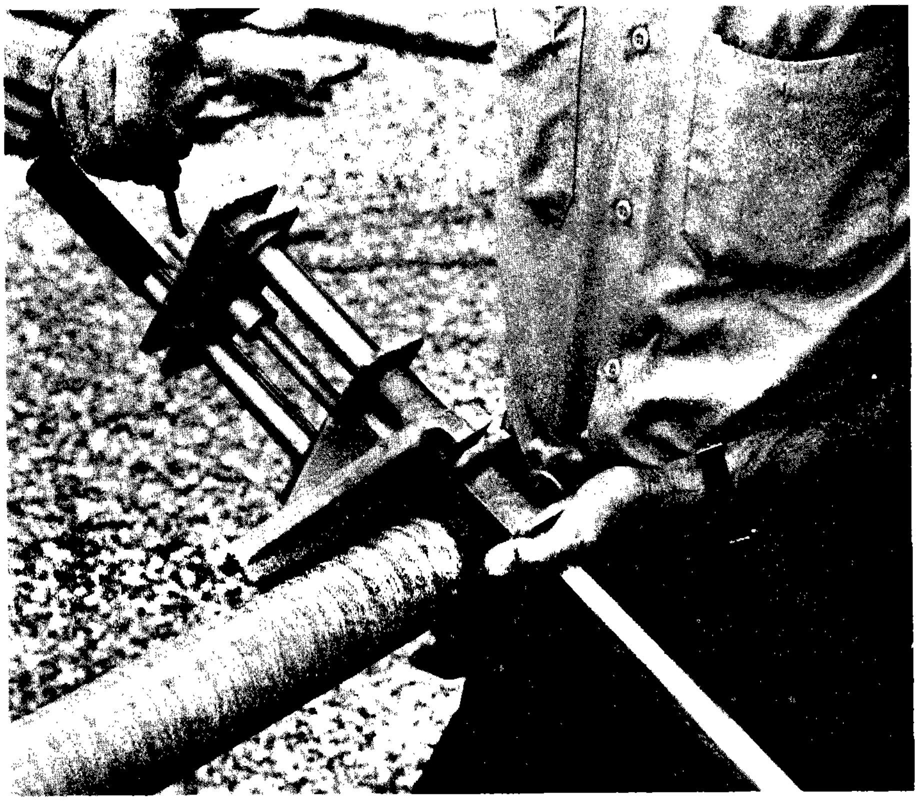


ble 2

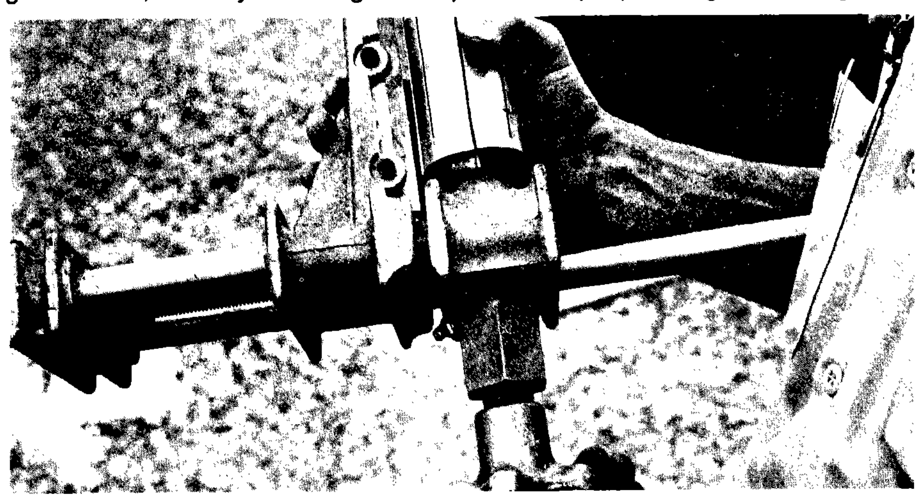
Taper Length/Angle/Out of Square, 2-6 Inch Pipe

Pipe Size	2 in	3 in	4 in	6 in
Taper Length	1-5/8 in	1-3/4 in	1-7/8 in	3 in
Taper Angle	1 3/4°	1 3/4°	1 3/4°	1 3/4°
Maximum Out of Square	3/16 in	3/16 in	3/16 in	3/16 in

g) After determining the proper taper length and marking the pipe, proceed to turn the Cutting Head Adjusting Handle (22) to bring the Cutting Blade (10) in contact with the pipe.



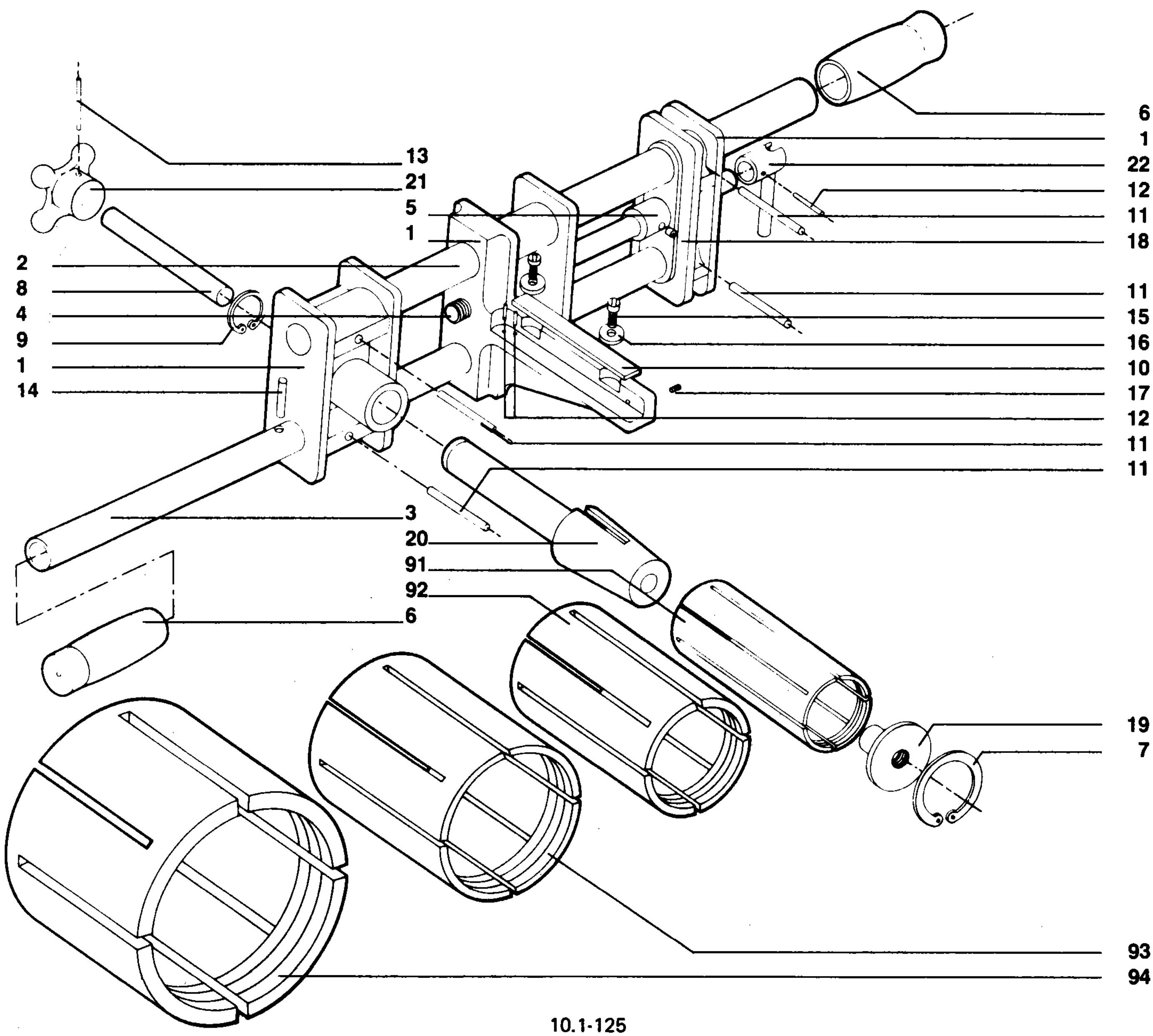
h) Start the taper by turning the tool in a **clockwise** direction. Use both handles for turning the tool.
i) Gradually tighten the cutting head adjusting handle to make a smooth, even taper. Continue turning and cutting until the taper edge reaches the guide mark, thereby resulting in a taper of the proper length and angle.



j) When the taper is completed, turn the collet control knob **counterclockwise** to loosen and then remove the tool from the pipe.
k) The Cutting Blade (10) has two cutting edges and can be repositioned or replaced by loosening the two Cutting Blade Retaining Screws (15). Make sure the blade is tight and flush with guide to insure proper taper angle. Replacement cutting blades are available.

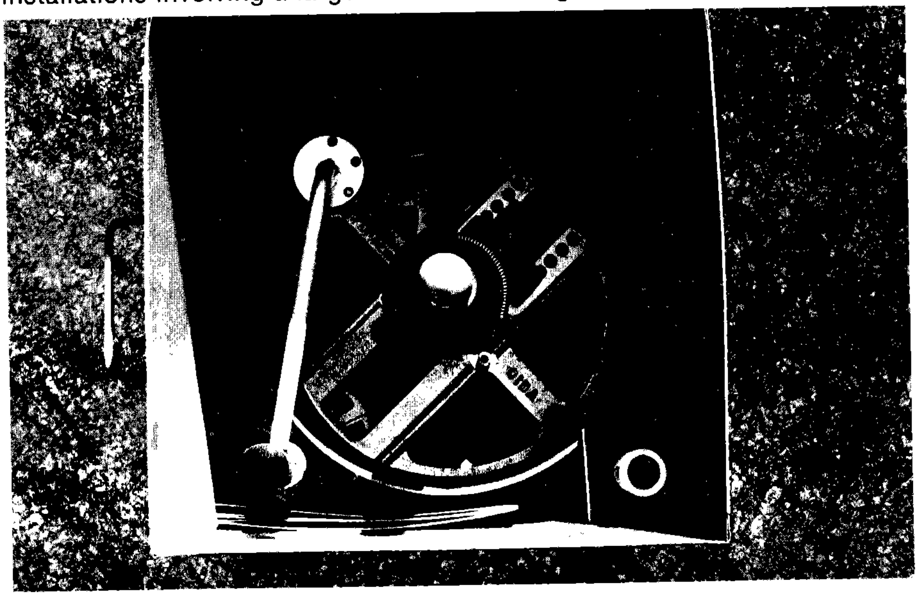
Figure 2. Taper-Maker Part List

Item	Description	Item	Description
1	Base Casting	14	Roll Pin
2	Guide Tube	15	Cutting Blade Ret. Screw
3	Guide Tube	16	Washer
4	Adjusting Screw	17	Set Screw
5	Screw Collar	18	Set Screw
6	Handle Grip	19	Collet Adapter
7	Snap Ring	20	Mandrel
8	Draw Bar	21	Collect Control Knob
9	Snap Ring	22	Cutting Head Adj. Handle.
10	Cutting Blade	91	Collet (2 in)
11	Roll Pin	92	Collet (3 in)
12	Roll Pin	93	Collet (4 in)
13	Roll Pin	94	Collet (6 in)



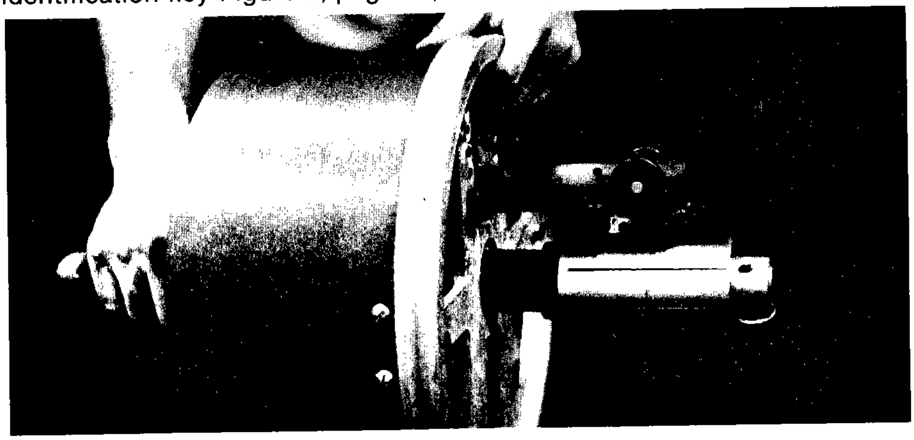
2. Taper-Tool®
(U.S. Pat.#3540328)

The Taper-Tool is an easy-to-use portable, precision lathe. It is designed for both manual or power operation. The Taper-Tool may be used anywhere without a power source. An optional power train is available to speed up installations involving a large number of fittings.

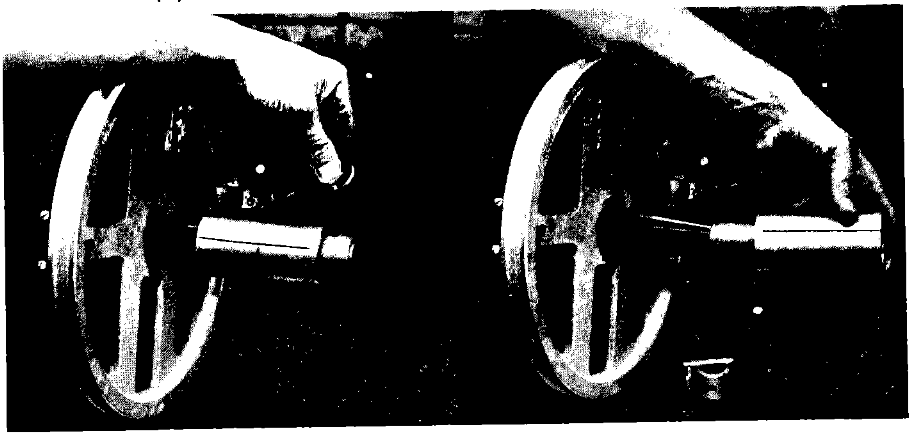


Taper-Tool
Set-Up Instructions

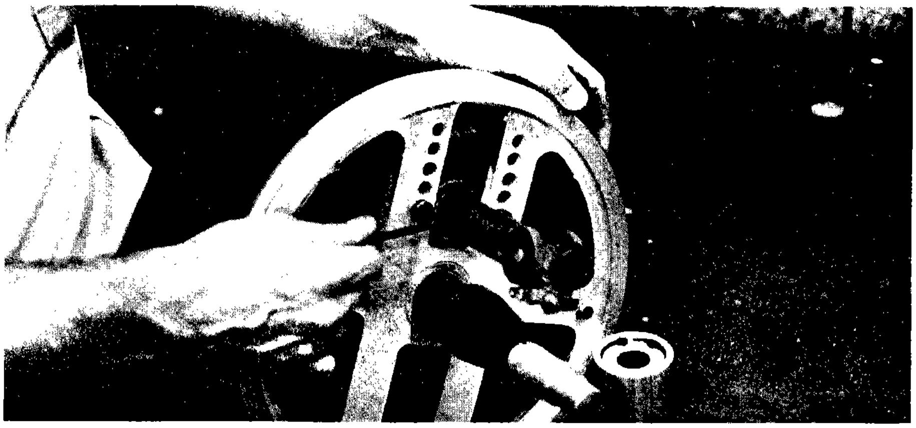
a) The Taper-Tool comes assembled with a 2" Collet. (Refer to numerical identification key Figure 3, page 20, item 81.)



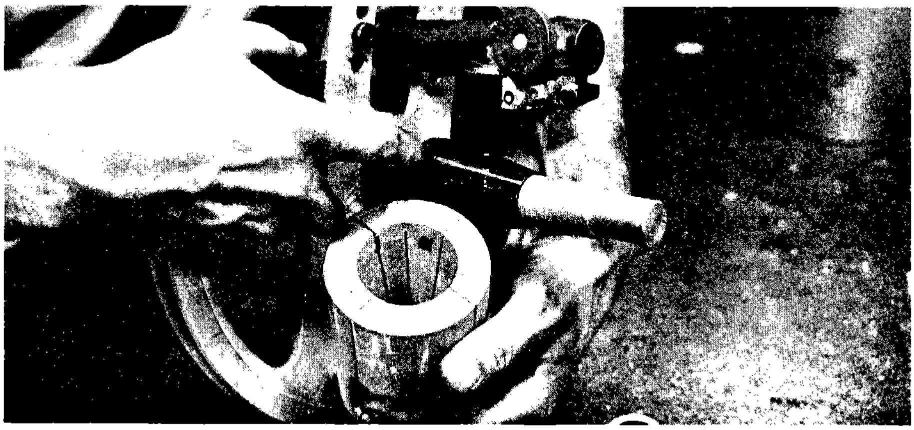
b) In order to change from 2" pipe to other sizes, remove the 2" collet by pulling the Ring Pin (12) and slipping the Collet Retainer (11) and collet off the Mandrel (3).



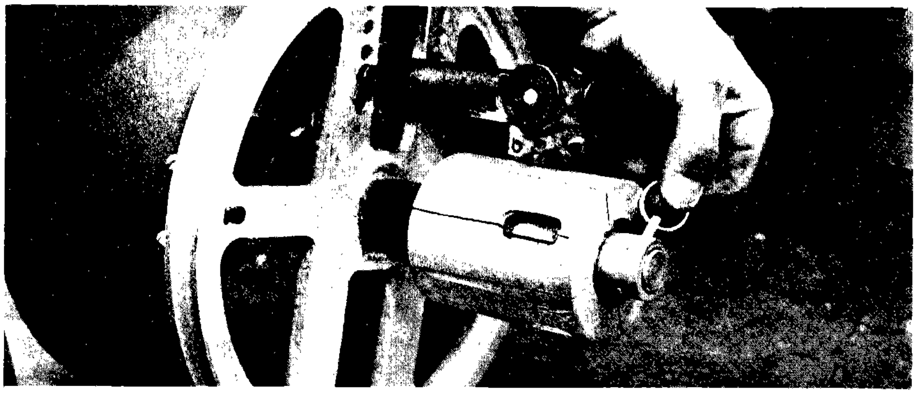
c) To adjust the Cutting Head (72) on the Sheave Spoke (1), loosen and remove the two Allen Screws (70) from the Tool Bar Bushing Housing (68).



d) Select the proper location holes for the size pipe to be tapered, the set of locating holes closet to the hub for the 2" diameter position; the next 3"—the next 4"—and the farthest out for 6".
e) Place the cutting head in the proper locating holes making sure that there is no dirt between the cutting head and the sheave spoke. Replace the two screws.
f) Then select the collet of the proper size and slide it onto the mandrel making sure that the key inside the collet is engaged in the slot of the mandrel.



g) Replace the collet retainer and the ring pin. The tool is now set to taper. **Caution:** Do not expand collet outside of pipe, since damage to the tool may result. Table 2 (Page 10) shows the required length of taper for each pipe size.

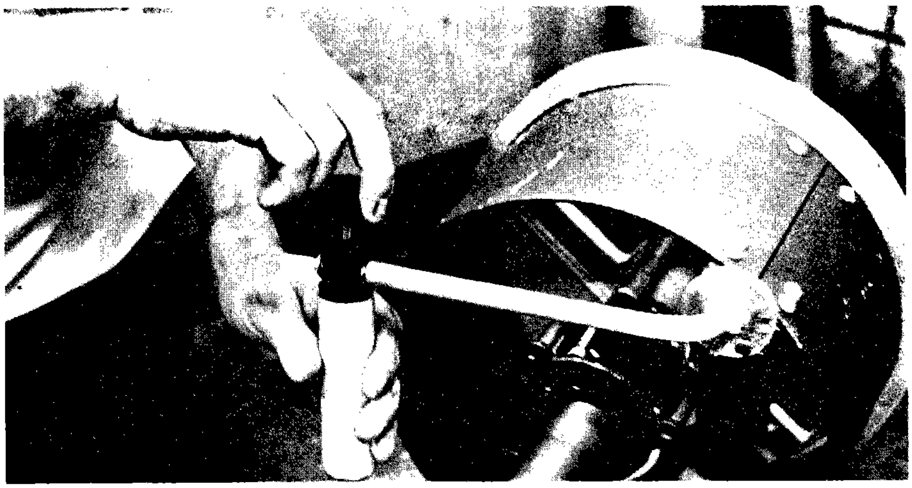


10.1-127

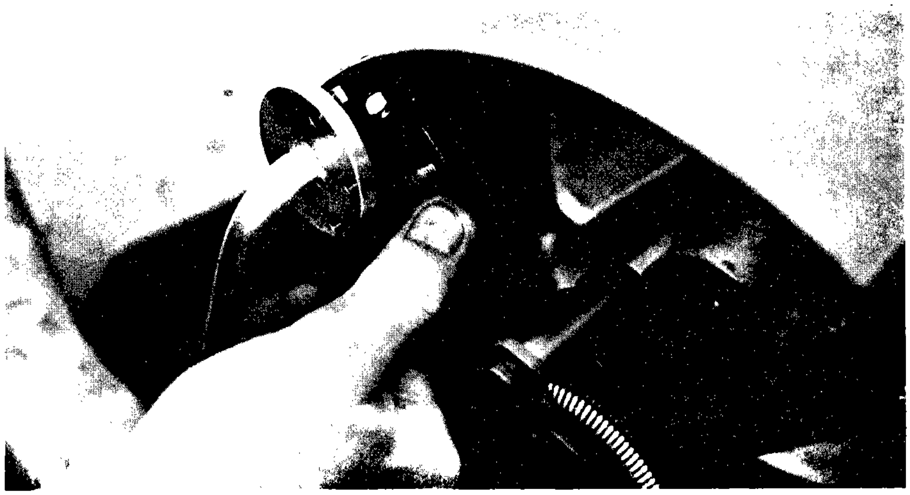
h) In order to verify the taper length setting, a test cut **must** be performed.

Taper-Tool Operation

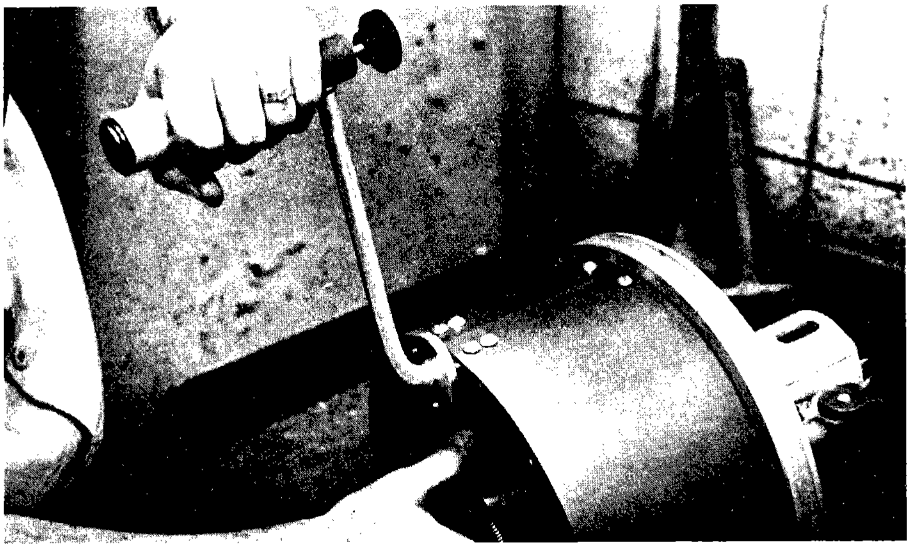
a) To ready the tool for the test cut, loosen the Knob (34) to release the Knurled Crank Handle (33).



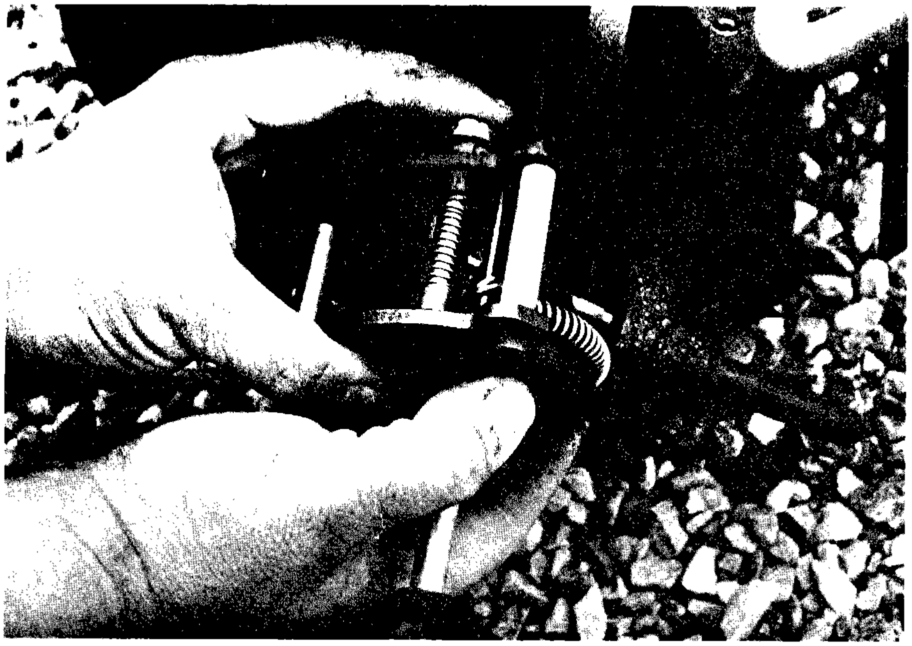
b) Depress Roll Pin (30) and rotate handle assembly to full extension.



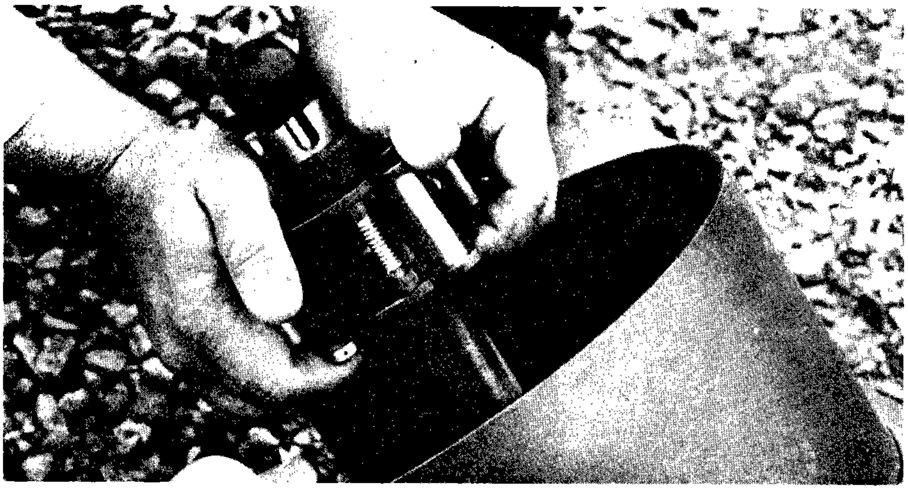
c) Tighten the knob with the knurled handle facing away from the pipe.



d) Before making the test cut, you must also make the final adjustment on the cutting head. This is done by depressing the Nut Release Pressure Plate (46), allowing the Drive Nut (50) to open. **Caution:** Keep fingers clear of drive nut when releasing.

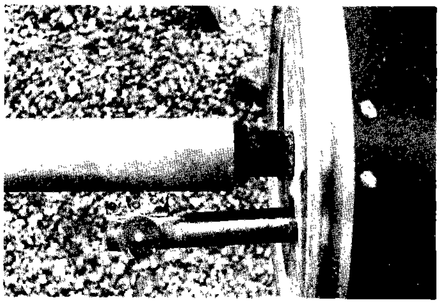


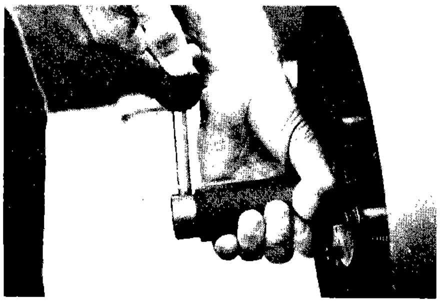
e) Push the drive nut forward on the threaded drive shaft toward spoke.



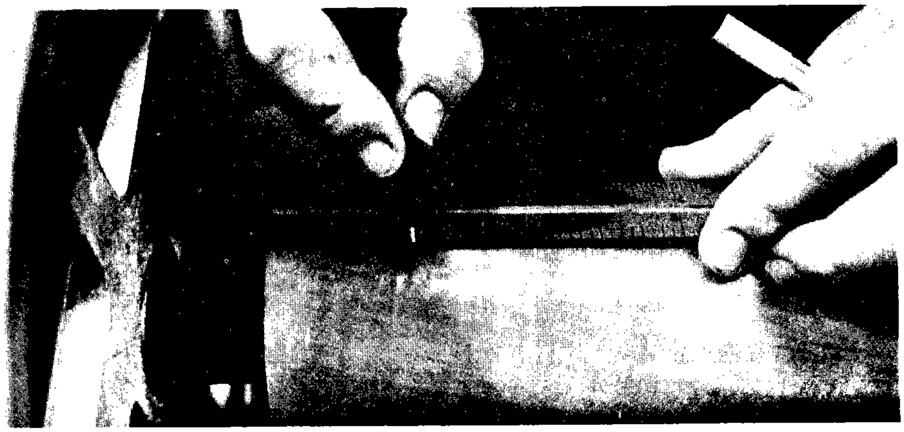
f) Insert the collet into the pipe until it is flush with the end of the pipe.

g) Pull out the retractable Draw Bar Handle (19) and turn it to the right to expand the collet inside the pipe to secure a snug fit. Do not overtighten.

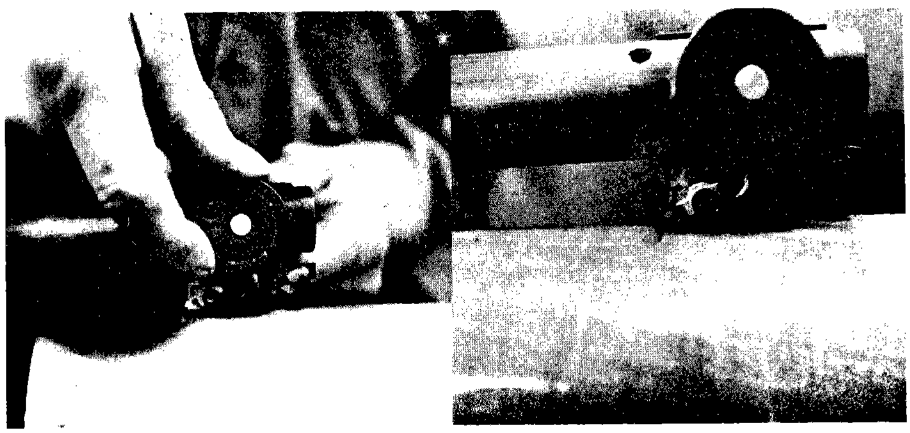




h)Mark pipe at the appropriate taper length distance as shown in Table 2.



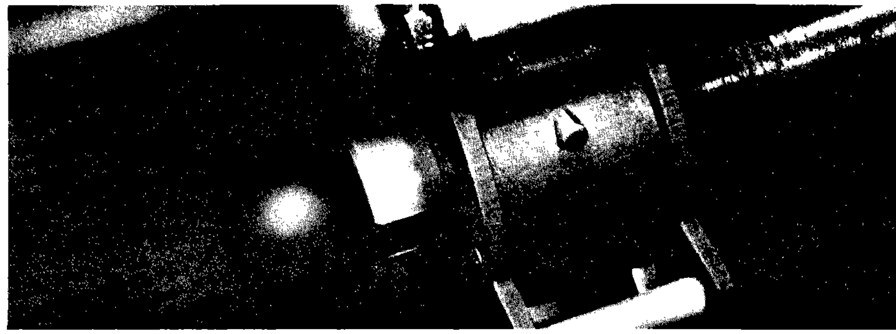
i) Pull drive nut back until the lowest Cutter Blade (75), the one nearest the spoke, is directly above the mark designating the required length of taper.
j) For adjustment of the cutting head, loosen retaining Knurl Nuts (90). Rotate adjusting knurl nuts until the cutter blade nearest the spoke just touches the pipe surface at the indicated mark. Retighten retaining knurl nuts and check that the cutter blade is still just touching the pipe.



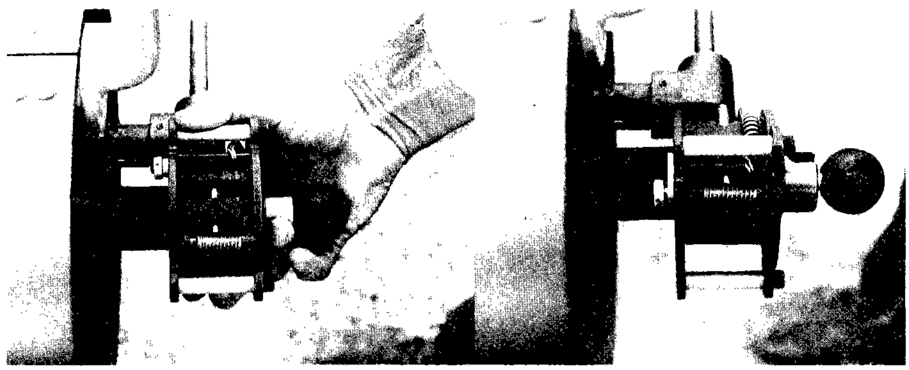
k) Before starting the taper, the tool must be drawn out of the pipe. To remove the tool from the pipe, turn the draw bar handle counterclockwise until the collet is loose, then pull the tool from the pipe.

10.1-130

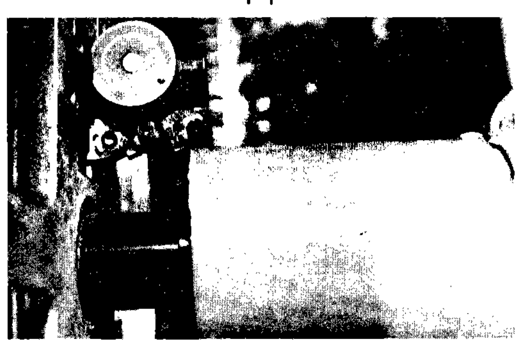
l) Pull the Tool Bar (61) back until the rear plate of Drive Nut (40) is flush with the end of the threaded drive shaft.



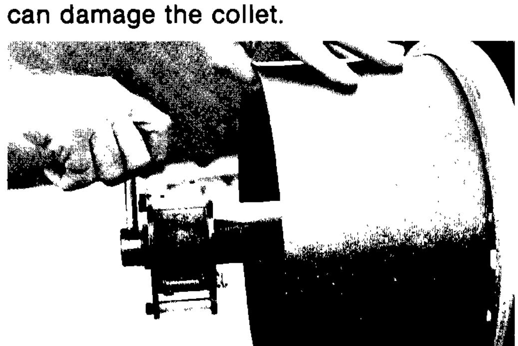
m) Engage the tool by grasping the drive nut and turning it counterclockwise until the nut locator pin locks. Usually a click will be heard when you do this.



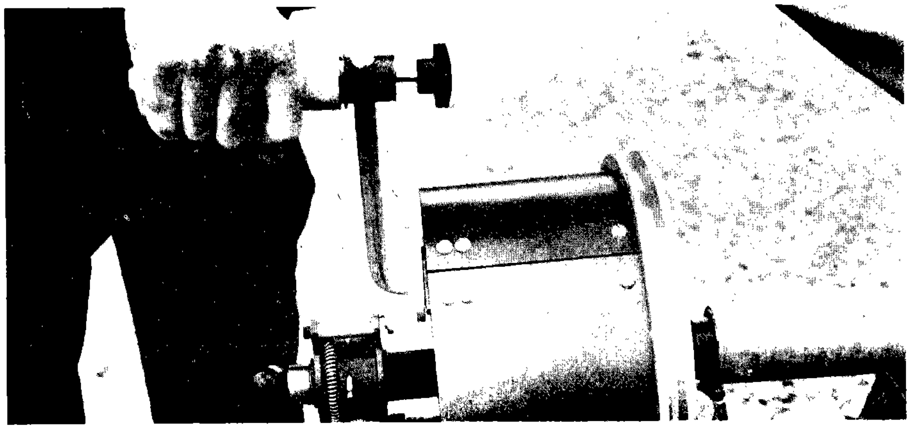
n) The Taper-Tool should now be ready for making the test cut. Insert the collet into the pipe for the second time so that the end of the collet is flush with the end of the pipe.



o) Expand the collet by pulling out the retractable draw bar handle and turning it clockwise. Never expand the collet outside of the pipe because it can damage the collet.



p) To start the test cut, turn the knurled crank handle clockwise. **Never turn the crank handle counterclockwise.**



q) Continue turning until the drive nut which is advancing on the threaded drive shaft opens and a loud click is heard. The loud click is a signal that the taper is completed.
r) After the test taper has been completed, loosen the collet in the pipe by turning the draw bar handle to the left, and remove the tool.
s) Check the taper on the test cut. If the taper length is incorrect, adjust the cutting head as necessary in accordance with procedure listed in "j". Check the dry insertion fit in a fitting or coupling bell.

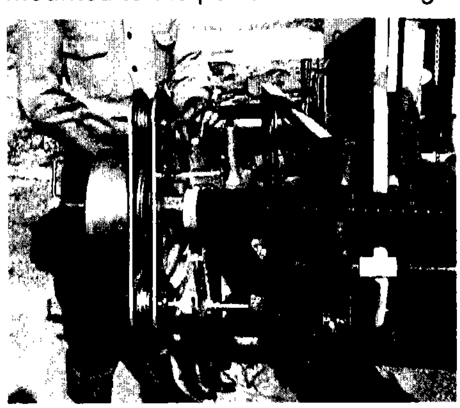
The fit should be snug without play.

The tool is now correctly adjusted to taper the particular pipe diameter for which you have set the tool.

Important: It is necessary to release the collet before pulling back the cutting head to prevent the cutters from making a longitudinal cut in the finished taper.

t) There is one additional adjustment which must be made when making tapers on 6" pipe. A one-inch portion of the Release Strike Pin (88) extends beyond the spoke of the wheel. This pin extension is removable for tapering 6" pipe. This pin must be removed before attempting to taper of 6" pipe to allow for complete taper run-out.

u) The Taper-Tool is also designed for power operation. The Power Train Assembly is mounted on a tripod which locks onto the Taper-Tool and has as its power source a 120v AC 1/2" chuck electric drill motor. The motor is mounted to the power train housing with a "V" belt drive and pulley system.



10.1-132

Manufacture of Close Nipple

When a situation calls for the tapering of a close nipple that is too short to be held in a chain vise or clamp, an adapter can be added to the Taper-Tool.

a) Remove the collet retainer and replace it with the Hex Bar (79).
b) Place the Hex Bar Chain Vise Adapter (80) in the chain vise.
c) Slide the pipe nipple to be tapered over the collet.
d) Insert the hex bar into the hex bar chain vise adapter.
e) Proceed to taper the nipple.
f) When making many close nipples, the Power Train Assembly is recommended.

To Change or Revolve Carbide Cutter

As wear becomes evident on the Carbide Inserts (75), they can be revolved to a new cutting surface. Each triangle is sharp on all three sides of each face, thus giving 6 cutting edges. Loosen blade clamps with the Allen wrench supplied by turning to the right. These clamps are fitted with **left-hand** threads to prevent loosening during Taper-Tool operation. Inserts can then be lifted off and turned to a new cutting edge. Retighten, and proceed with the new cutting surface. New carbide inserts can be ordered.

Figure 3. Taper-Tool

note:
All threaded parts assembled with proper lock fit

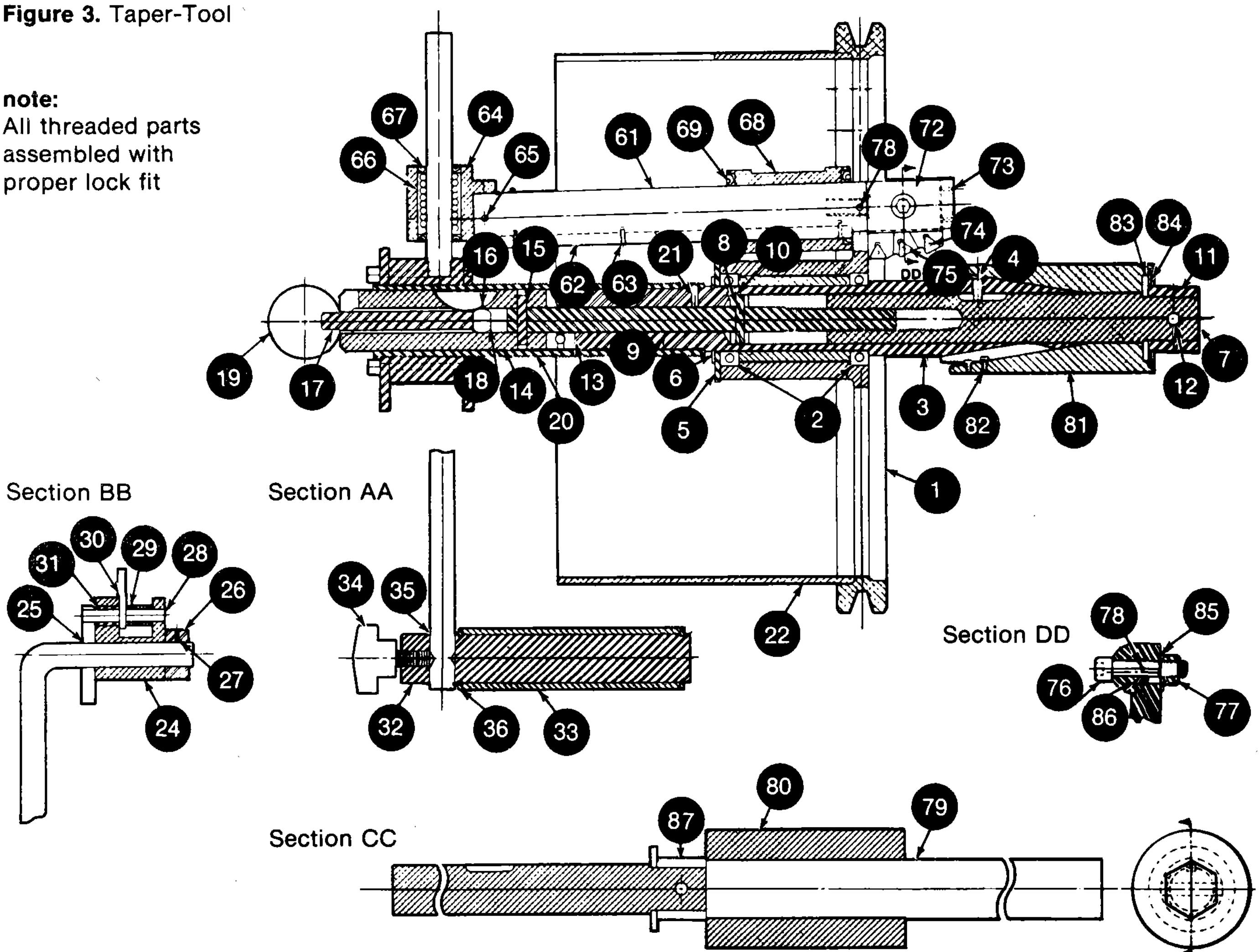
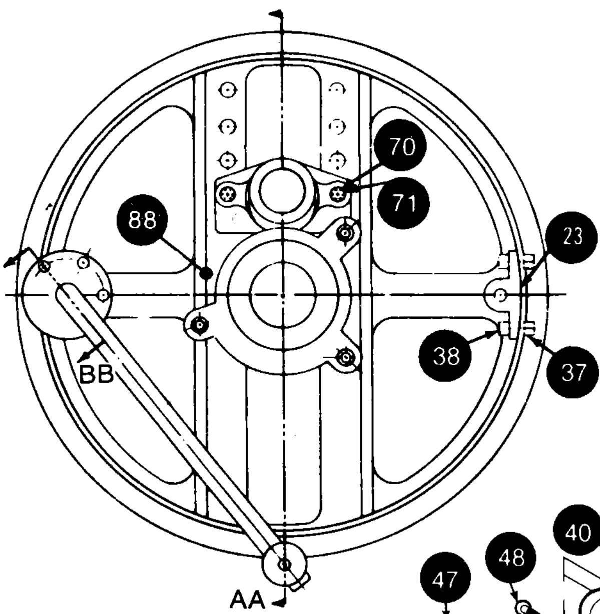
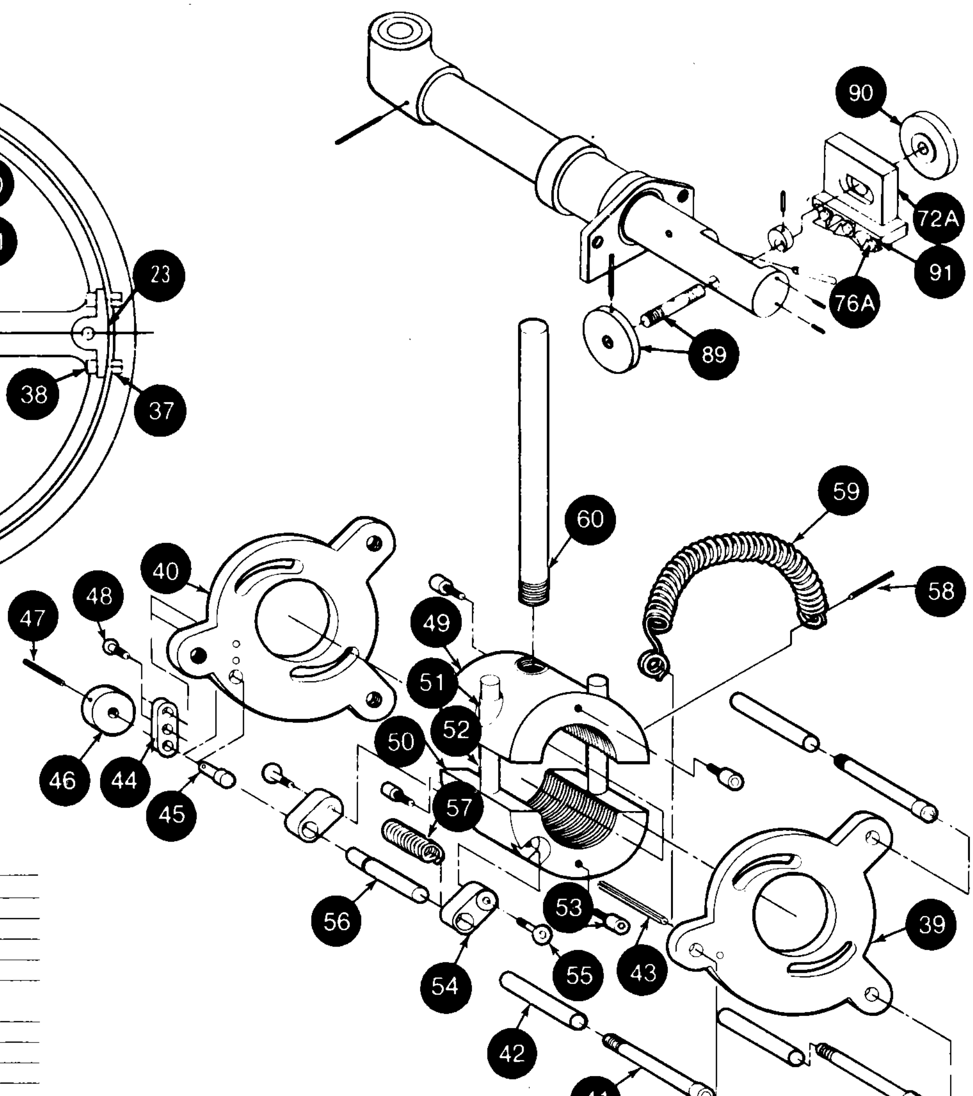


Figure 4. Taper-Tool, Details & Parts List

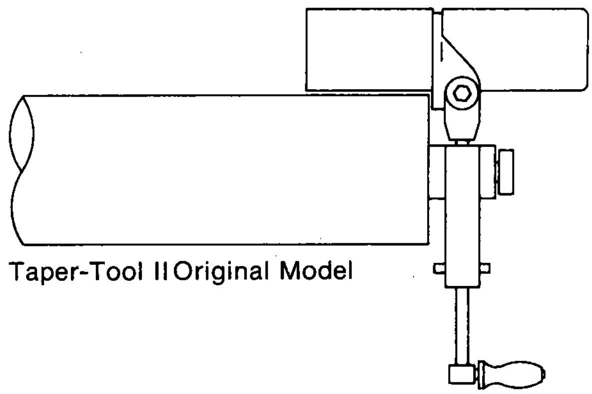




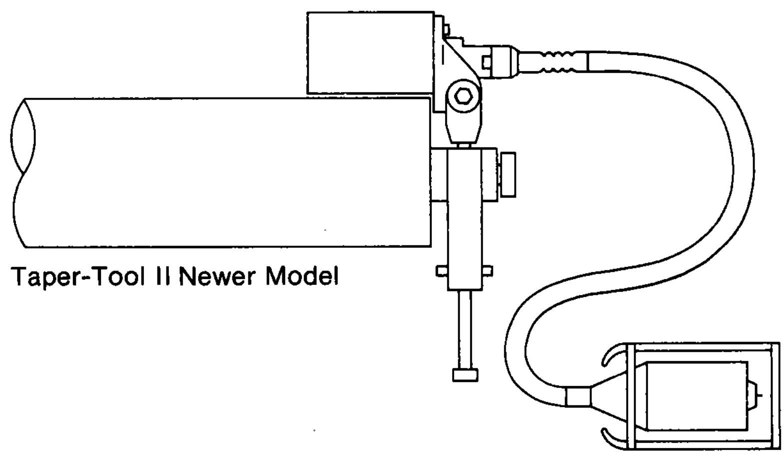
Item	Quan.	Description
1	1	V-Belt Sheave Spoke
2	2	Bearings
3	1	Mandrel
4	1	Half Dog
5	1	Mandrel Washer Obsolete After Serial #1050
6	1	Snap Ring
7	1	Draw Bar
8	1	Roll Pin
9	1	Threaded Rod
10	1	Threaded Rod Collar
11	1	Collet Retainer
12	1	Collet Retainer Ring Pin
13	1	Thrust Bearing
14	1	Drawbar Handle Adapter
15	1	Roll Pin
16	1	Drawbar Handle Spring
17	1	Drawbar Handle
18	1	Drawbar Handle Sphere
19	1	Drawbar Handle Ball
20	1	Threaded Drive Shaft
21	3	Roll Pin
22	1	Shroud
23	1	Shroud Mount
24	1	Handle Adapter Assembly
25	1	Handle Assembly
26	1	Handle Collar
27	1	Socket Set Screw
28	1	Handle Locator Pin
29	1	Spring Handle Locator
30	1	Roll Pin
31	1	Jig Bushing
32	1	Grip Core
33	1	Knurled Grip
34	1	Plastic Knob
35	2	Snap Rings
36	2	Snap Rings
37	6	Hex Nuts
38	6	Socket Head Cap Screws
39	1	Nut Slide Plate—Front
40	1	Nut Slide Plate—Rear
41	3	Socket Head Cap Screws
42	3	Nut Spacer
43	1	Roll Pin
44	1	Nut Release Pin Housing
45	1	Nut Release Pin
46	1	Nut Release Pin Pressure Plate
47	1	Roll Pin
48	2	Flat Head Screw
49	1	Drive Nut Upper Half
50	1	Drive Nut Lower Half
51	2	Dowel Ppn Bushings
52	2	Dowel Pins
53	4	Cams
54	2	Locator Arms
55	2	Flat Head Screws
56	1	Nut Locator Pin
57	1	Nut Locator Pin Spring
58	1	Roll Pin
59	1	Nut Release Spring
60	1	Verticle Shaft Vertical
61	1	Tool Bar
62	1	Tool Bar Key
63	4	Flat Head Socket Screws
64	1	Ball Bushing Housing
65	1	Roll Pin
66	1	Ball Bushings
67	2	Dust Seals
68	2	Tool Bar Bushing Housing
69	2	Dust Seals
70	2	Socket Head Shoulder Screw
71	2	Washers
72	1	Cutting Head
72-A	1	Cutting Head
73	2	Space Adjusting Screws
74	3	Locking Screws
75	3	Carbide Inserts
76	1	Socket Head Cap Screw
76-A	3	Socket Head Cap Screw
77	1	Hex Nut
78	1	Roll Pin
79	1	Hex Bar
80	1	Hex Bar Vise Adapter
81	1	Collet
82	2	Socket Head Cap Screws
83	1	Collet Retaining Washer
84	1	Snap Ring
85	1	Washer
86	1	Cam
87	1	Hex Bar Collar
88	1	Release Strike Pin Assy.
89	1	Adjusting Knurl Nut
90	1	Retinaing Knurl Nut
91	3	Blade Clamps

Figure 5. Taper-Tool II Original & Newer Models

Taper-Tool II is a precisely engineered tapering machine designed to accurately grind a taper which will mate perfectly with the other system components. The original model Taper-Tool II has the motor mounted on the grinding drum while the newer Taper-Tool II has the motor separate from the grinding drum. The high speed motor (120v AC/DC) and diamond surfaced grinding drum assure a smooth and uniform taper for maximum bond strength.



Taper-Tool II Original Model

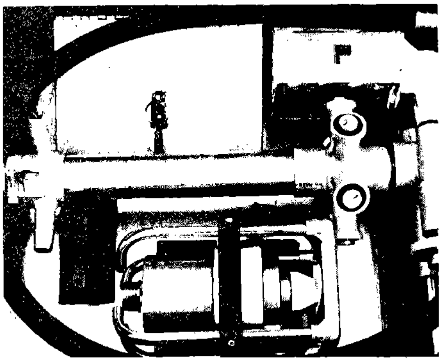


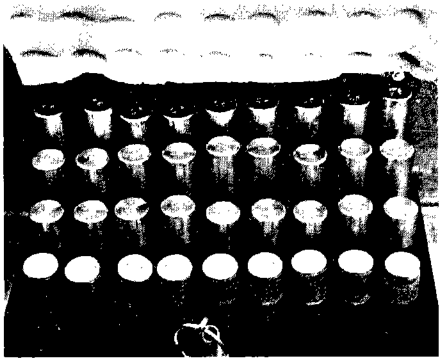
Taper-Tool II Newer Model

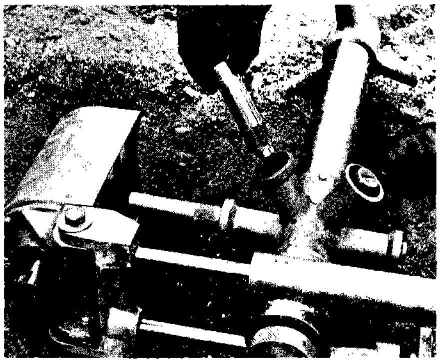
As with all precision equipment, care during use and proper storage are very important in order to maintain the equipment in good working order. The Taper-Tool II is designed to give many years of service when maintained properly.

Taper Tool II
Set-Up Instructions

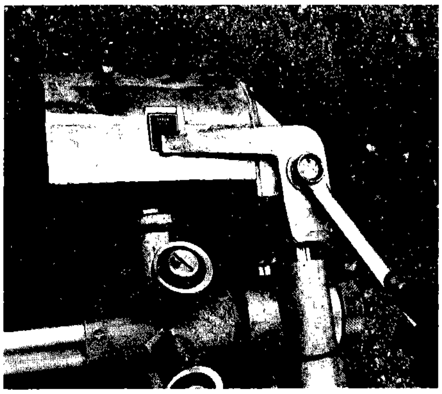
a) The tool comes packaged with nine 8" Extension Pins (Refer to numerical identification key Figure 6, Part 9) installed in the two Spiders (1 & 10). There are pins for each of the pipe sizes, 8", 10", 12", 14" and 16". The tool will not fit into the storage case with any size pins larger than 8" installed. The 8" pins are slotted to be tightened or loosened with a coin, **not a screwdriver.** The other sizes are knurled to be **hand tightened only.** Install appropriate size extension pins into the spiders. Check that the mating surfaces of the pins and spiders are clean prior to installing different pins. It may be necessary to reposition the grinding drum to install different sized pins. Adjustment is made by loosening the Allen Screw (54) and sliding Sleeve (55) and Housing (48) down the shaft.

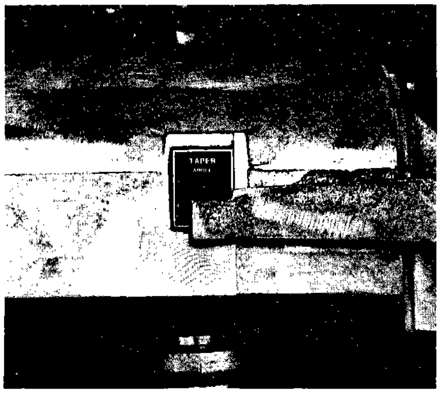




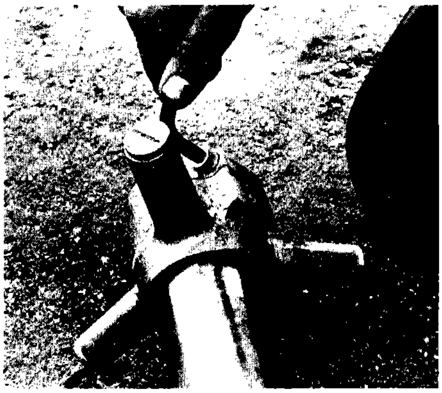


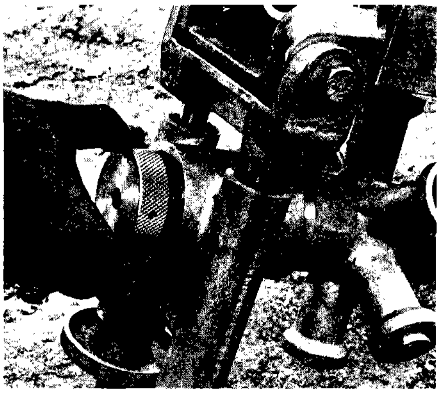
b) Be sure the pointer, on the Degree Plate (59), is set at 2 degrees for standard CIBA-GEIGY pipe tapers. Loosen Bolts (44) to adjust taper angle, and then retighten. Dropping the tool will result in knocking the set angle off or damaging the tool. **Do Not Drop.**





c) Set rear spider at the end of the Extension Tube (3). Loosen Screw (2) if necessary to move spider. Next, retract the extension pins fully by turning the Extension Pin Adjusting Knob (22) **counterclockwise until it stops.**



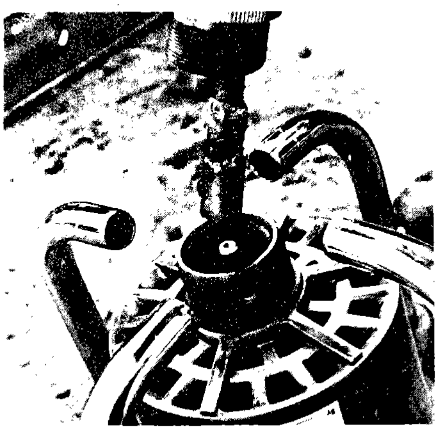
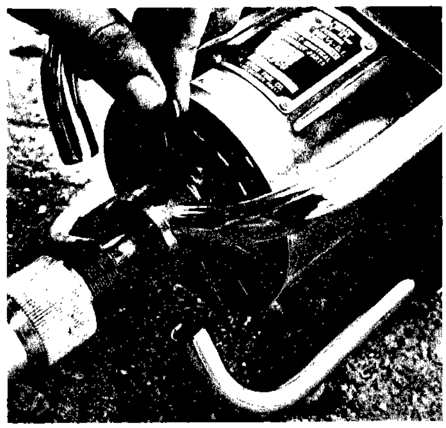


10.1-136

d) Motor assembly of the new model Taper-Tool II should be performed as follows:

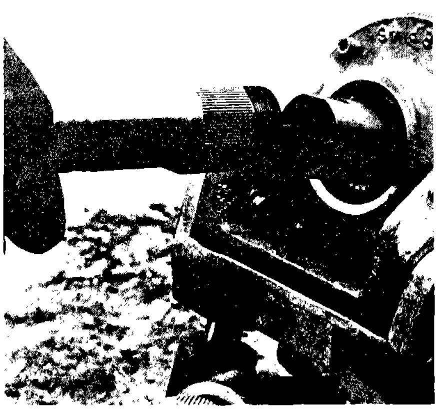
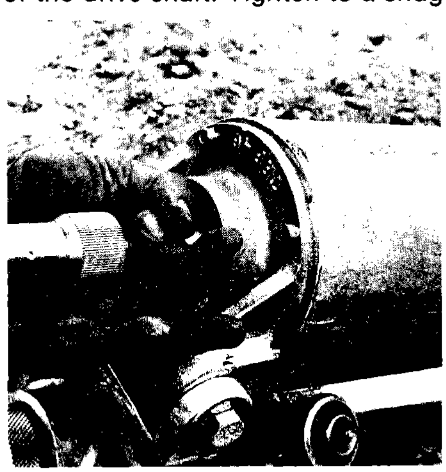
Motor Connection

1. Remove dust covers from Flexible Drive Shaft Ends (57).
2. Push on the male hexagonal end of the drive shaft to extend the female end beyond the drive shaft housing.
3. Rotate motor shaft so the **flat side** is facing up.
4. Insert the female end of the drive shaft over the male end of the motor shaft.
5. Through hole in motor housing, lock the set screw very tightly on the **flat** of the motor shaft.
6. Screw the outer flexible drive shaft housing to motor.

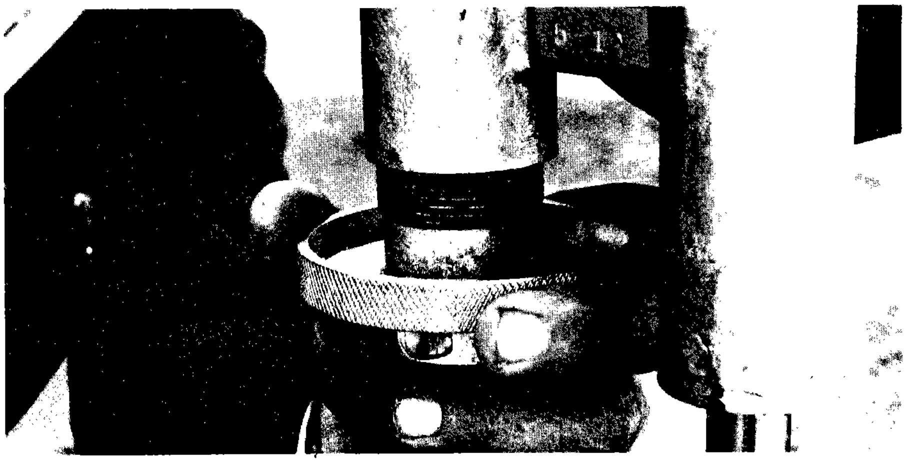




Grinding Drum Connection

7. Insert hexagonal end of drive shaft into the Female Hexagonal Drum Opening (38). After insertion has been completed, screw on the outer casing of the drive shaft. Tighten to a snug fit.

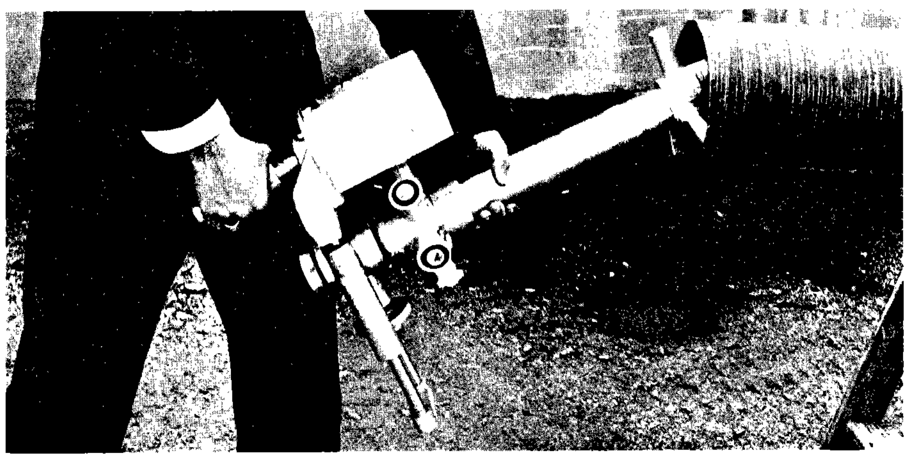



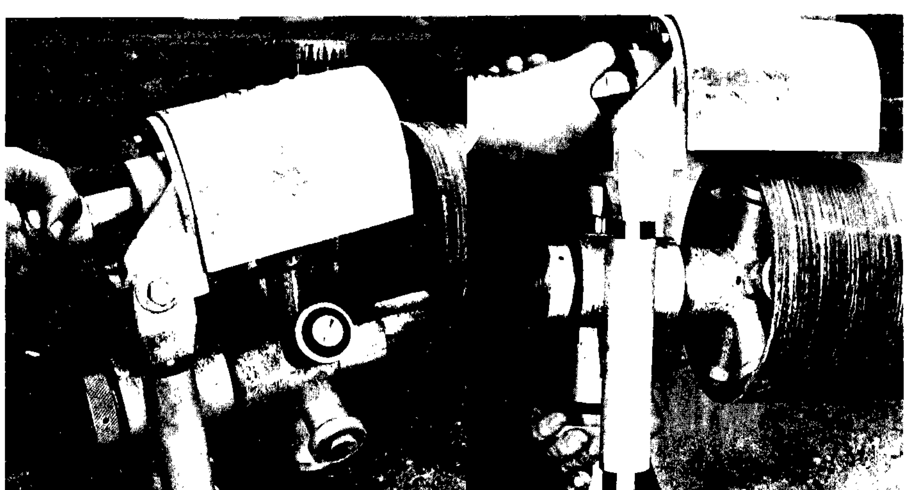

e) In order to insert the tool into the pipe, loosen Locking Sleeve (55) by unscrewing Allen Screw (54) sliding sleeve and Housing (48) away from the spiders. Temporarily lock sleeve on shaft. Turn adjusting knob until all threads disappear into housing.



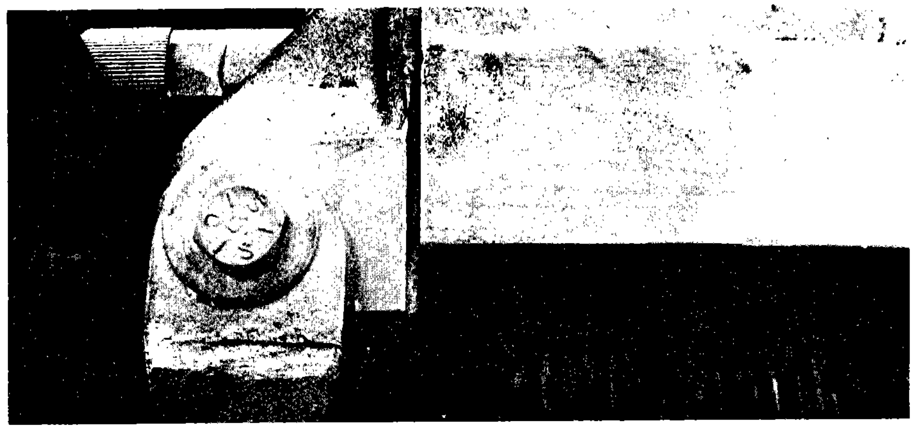
f) It is important that the pipe end be cut square. The tolerance is shown in Table 3 on page 27.

Side Rear Spider (1) into pipe with Extension Tube (3) in a cocked position. Push rear spider into pipe until Front Spider (10) is against pipe. Raise the tool so front spider enters and fits snugly into pipe.

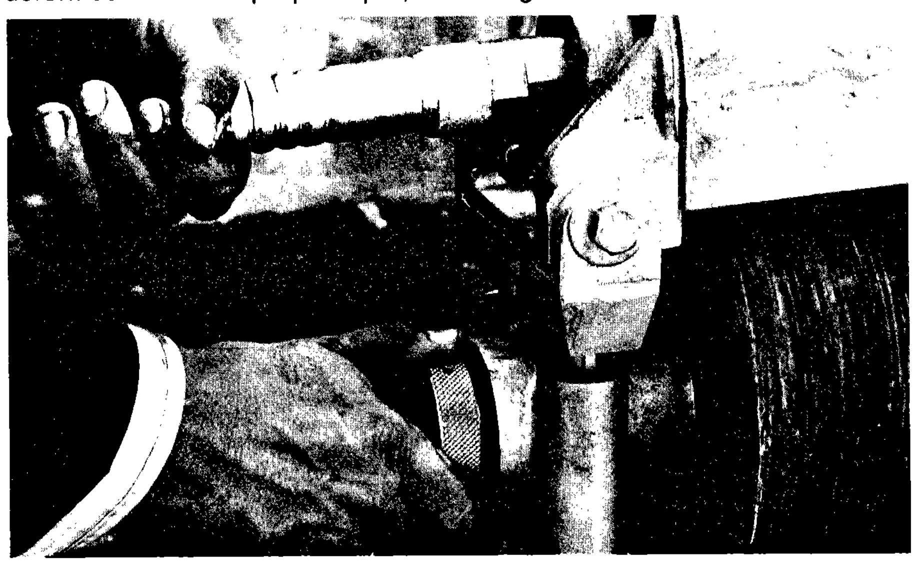


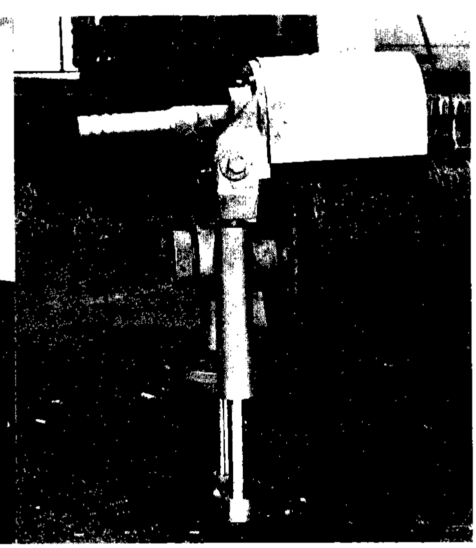


g) Slide the tool until the pipe and the grinding drum are in the proper position. For the original model Taper-Tool II, set pipe within 1/4" of fully depressed brake button. In the case of the newer Taper-Tool II, set the pipe 1/4" from the bottom lip of the Grinding Drum Guard (23).



h) Turn Extension Pin Adjusting Knob (22) **clockwise** by hand until the tool cannot slip or turn in the pipe. **Do Not Overtighten!** The pipe can be deformed and an improper taper, or damage to the tool can result.

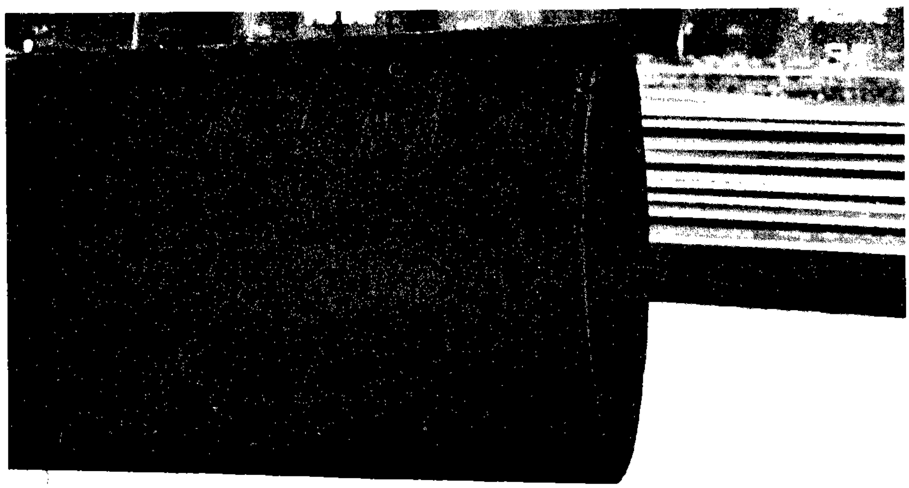


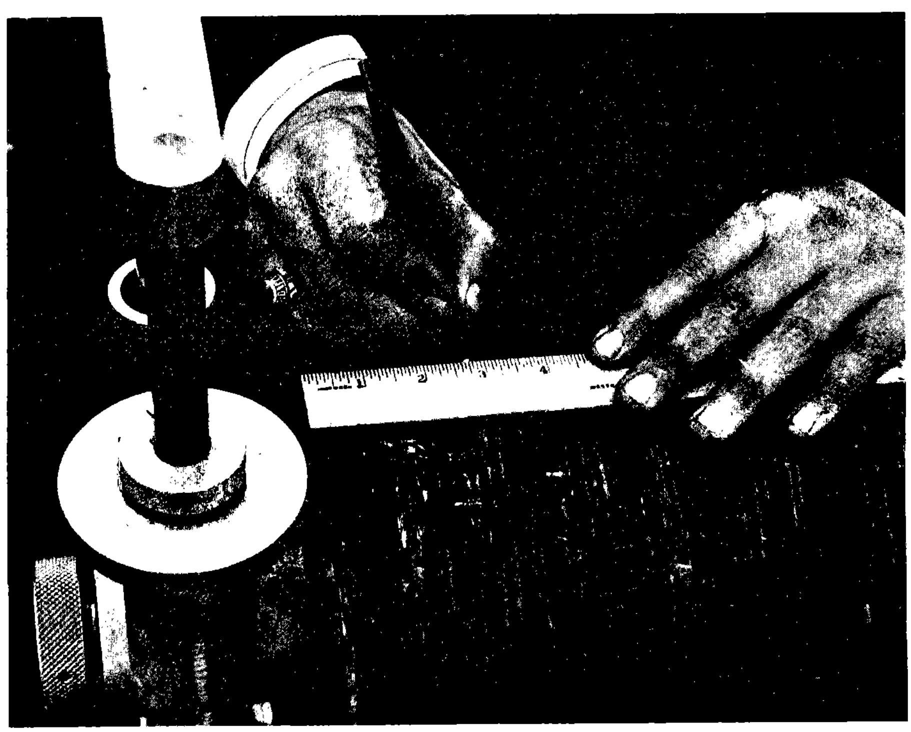


l) The following are the approximate taper lengths for the various pipe sizes:

Table 3. Taper Length/Angle/Out of Square 8-16 Inch Pipe

Nominal Pipe Size	8 in	10 in	12 in	14 in	16 in
Taper Length	2 3/4"	3 1/2"	4"	4 1/4"	5 1/4"
Taper Angle	2°	2°	2°	2°	2°
Maximum Out of Square	3/16"	1/4"	1/4"	1/4"	5/16"



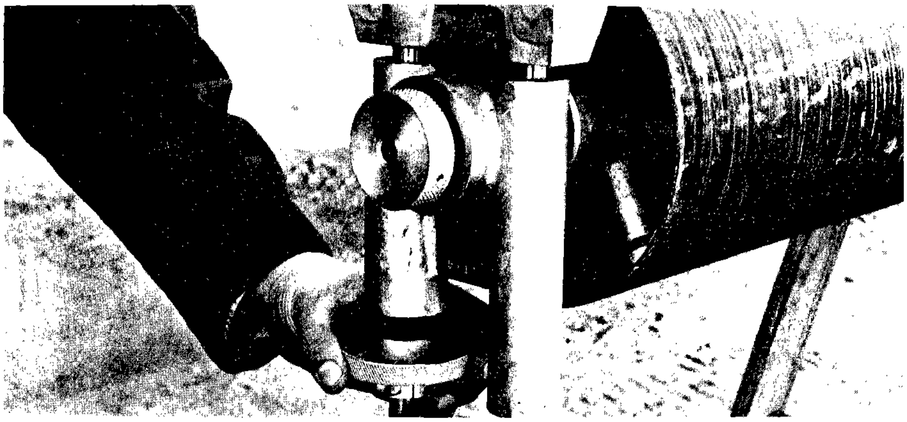


Proper and consistent insertion depths can be maintained by grinding all tapers until the thin end reaches 0.050 to 0.060" thickness.

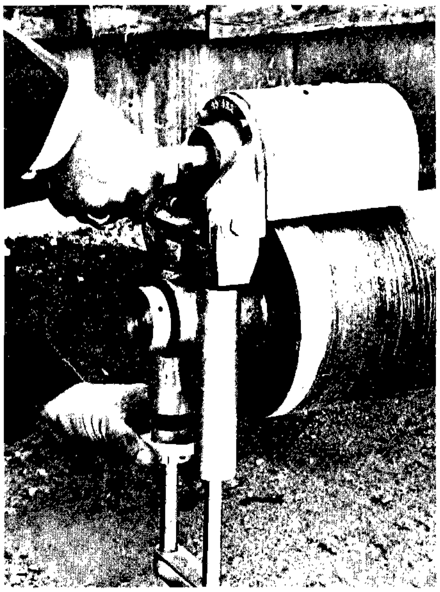
10.1-140

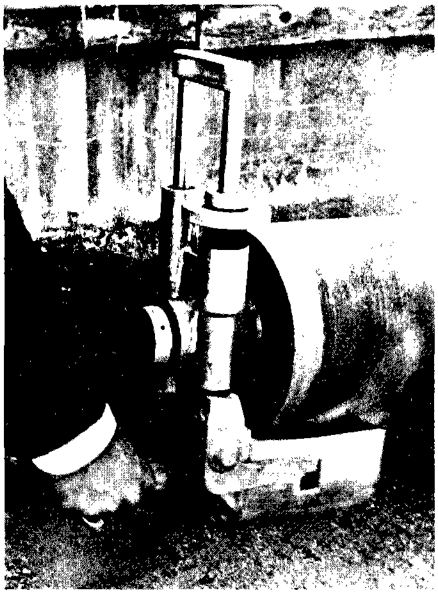
Taper-Tool® Operation

a) Plug the electric cord into either 115 volt AC or DC power source. Test the tool for smooth operation. There should be no vibration. **Caution:** The motor turns at 20,000 RPM and tapering pipe causes large volumes of dust. **Wear a dust mask and goggles.**
b) Turn on motor switch. Carefully turn Taper Depth Adjusting Knob (53) **counterclockwise** until the grinding drum comes in contact with the pipe.

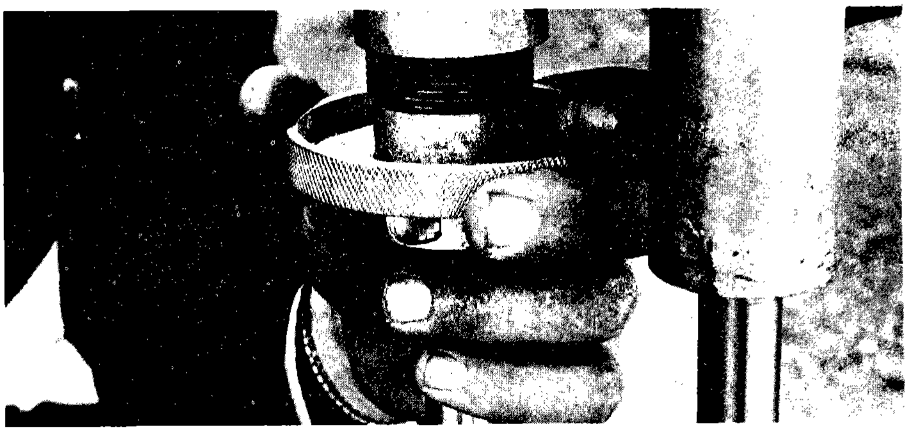


c) Rotate the old model Taper-Tool II by *turning handle* **clockwise**. (A one-way internal clutch prevents turning the wrong way). Caution should be exercised to avoid twisting of electric cord. The preferred method of accomplishing this is to use pipe rollers and keep tool stationary. A two man crew, one to turn the pipe and one to operate the tool, would be necessary. For the new model Taper-Tool II, grasp the drive shaft and rotate the tool **clockwise** around the pipe taking care not to twist the grinding drum thereby changing the taper angle.
d) Rotation should be continuous and uniform. After one complete turn of the tool, repeat procedure of turning taper depth adjusting knob and rotating tool until proper taper length is obtained. Avoid heavy cuts that slow motor down drastically. Be sure tool vibration does not loosen the extension pin adjusting knob. Observe the taper while it is being ground. If there are six high (or low) spots, this is an indication that the extension pins are too tight and are deforming the pipe. Loosen the extension pins until a smooth taper is being ground. Rotate the pipe during tapering to eliminate the effects of high and low grinding.

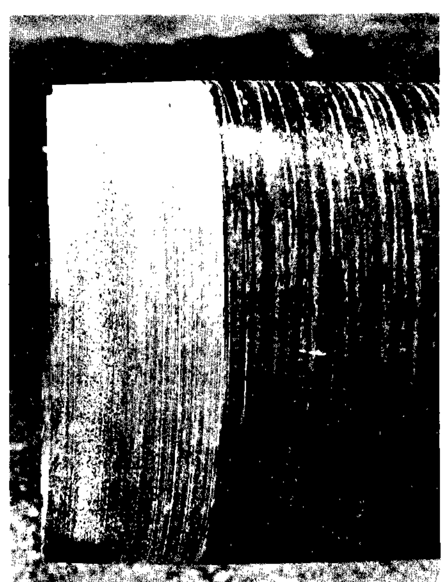




e) To stop the tool after proper taper length has been obtained, turn the taper depth adjusting knob three complete turns **clockwise** to clear the grinding drum from the pipe. Turn motor off and stop the grinding drum by depressing the brake button (old style only).



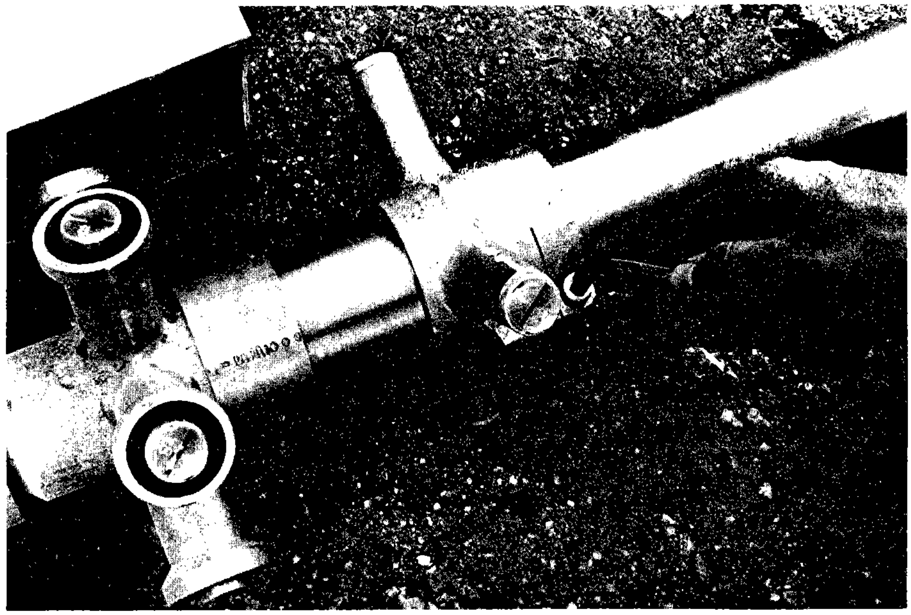
f) Remove by turning extension pin adjusting knob **counterclockwise** until it stops and pull tool out of pipe. Be sure threads on adjusting knob are cleaned thoroughly.



10.1-142

Manufacture of Close Nipples

The rear spider should remain at the end of the extension tube except for nipples shorter than 26". For nipples shorter than 26", loosen screw and slide the rear spider into position and retighten screw. An alternate grinding procedure for close nipples is to hold the tapering tool stationary and rotate each nipple by hand or with a strap wrench.



Reversing Grinding Drum

The grinding drum is diamond coated and should be turned end for end to extend service life after it becomes dull. This will resharpen the drum by exposing new diamonds to the cutting surface. A dull grinding drum can cause overheating of the drum and/or the motor. To turn it around, remove guard first and place a strap wrench around the drum. Remove cap and use a socket wrench to remove nut. Note that this is a **left hand thread.** Pull the drum off the shaft, turn drum and replace. Tighten nut and replace cap and guard.

Maintenance

Keep your Taper-Tool II clean. Use compressed air if possible to keep all passage ways of motor free of dust. The motor must have adequate ventilation during operation or overheating will result. Remove the filter on back of motor to blow or wash clean (old model). Be sure it is dry before replacing. Do not let any dust get into pistons when changing extension pins. Keep shafts lightly oiled and wiped dry to prevent rust. Periodically the flexible drive shaft should be lubricated with Lubriplate type 807 grease. Keep the tool in the case when not in use. Do not attempt to disassemble the tool except as stated in these instructions. If necessary to contact manufacturer regarding this tool, be sure to refer to the motor serial number.

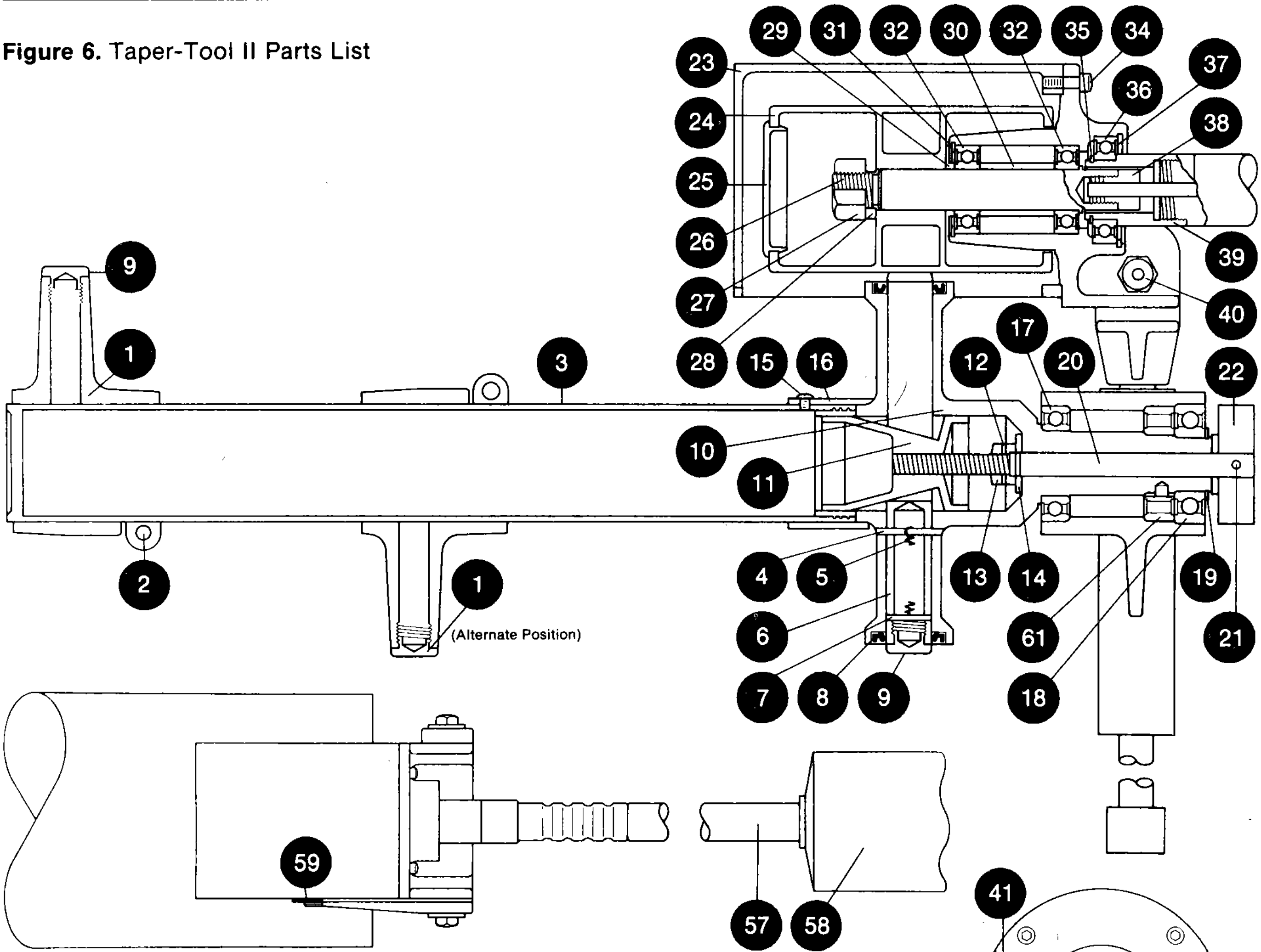
Do's

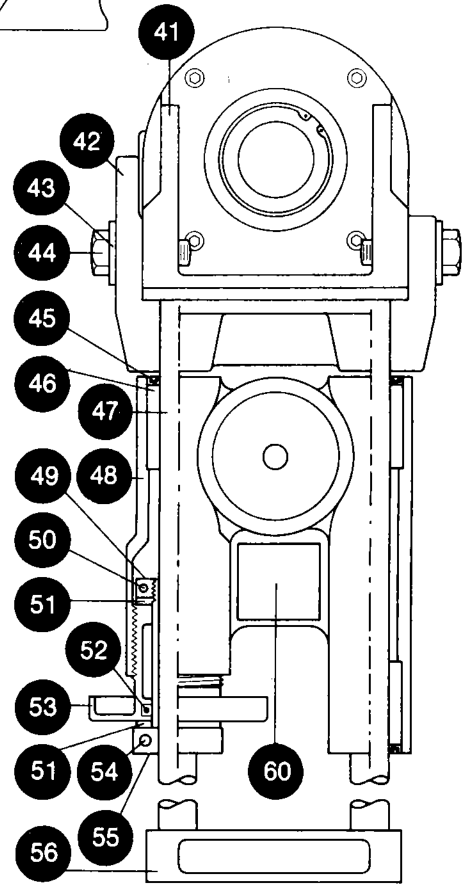
Keep it clean.
Keep in case when not in use.
Keep shafts lightly oiled and wiped.
Keep motor free of dust.
Keep bolts and screws tight.

Don't's

Use a pipe wrench or hammer on tool.
Stand directly in front of grinding drum.
Use any voltage but 115 volt AC/DC.
Over tighten adjusting knobs.
Leave extension pins out.
Run motor with excess vibration.
Run motor with no load or over load.
Lubricate anything but shafts.

Figure 6. Taper-Tool II Parts List



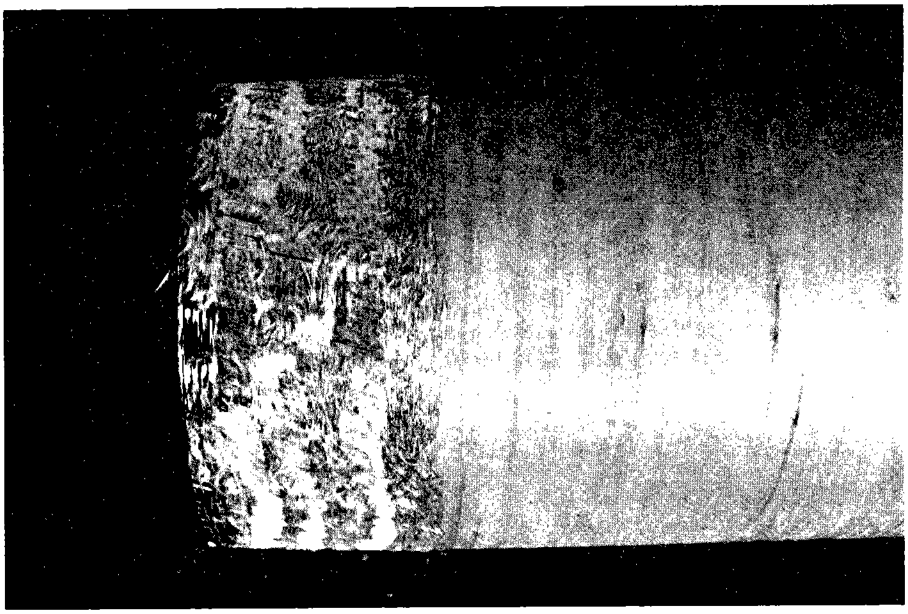


Ref.No.	Description
1	Rear Spider (TRP 24)
2	Screw 3/8"-16 N.C., S.H. x 1 1/2" Long (Plated)
3	Tube. Extension
4	Roll Pin, 1/8" x 1 1/2"
5	Spring, Lane (Factory Plated)
6	Pistons
7	Roll Pin, 1/8" x 1"
8	Thompson Seals
9	Extensions Pins (8-16" Pipe)
10	Front Spider & Bearing Shaft (TRP 23)
11	Wedge, Screw
13	Nut, 1/2"-13 N.C.
14	Spacer
15	Screw, 10-24 x 3/8" (Factory Plated)
16	Collar, Locking
17	Fafnir Bearing
18	Schatz Bearing
19	National Snap Ring
20	Screw, Clamping
21	Roll Pin, 1/8" x 1 1/4"
22	Extension Pins Knob, Adjustment
23	Grinding Drum Guard
24	Wheel, Diamond Grinding
25	Cap, Grinding Wheel
26	Shaft, Grinding Wheel
27	Nut, 3/4-16 (Left Hand)
28	Washer, Wheel Shaft
29	Spacer, Wheel Shaft
30	Spacer, Wheel Shaft Bearing
31	National Snap Ring
32	N.D. Bearing
34	Screws 1/4"-20 N.C., S.H. x 3/4" Long (Plated)
35	National Snap Ring
36	N.D. Bearing
37	National Snap Ring
38	Female Adapter, Hex Drive
39	Adapter, Flexible Shaft
40	Nut 1/2"-20 N.F. Hex. (Plated)
41	Housing, Wheel Bearing (TRP-46)
42	Bracket, Pivot Mounting (TRP-48)
43	Flat Washer 1/2" (Plated)
44	Screw 1/2"-20 N.F. H.H. x 1 1/2" Long (Plated)
45	Thompson Seals
46	Thompson Linear Bearings
47	Shaft, Bearing Slide (Thompson)
48	Housing, Adjustment Bearing (TRP 25)
49	Lock Nut
50	Screw, 8-32 N.C., S.H. x 5/8" Long
51	Washer
52	National O-ring
53	Nut, Cut-Depth Adjustment (Plated)
54	Screw, 1/4-28 N.V. S.H. x 5/8" Long (Plated)
55	Sleeve, Locking (Plated)
56	Cross Bar (TRP-47)
57	Wyco Flexible Shaft
58	Wyco Double Insulated Motor
59	Degree Plate
60	Plate, Serial No. & Name
61	Morse Ramp Clutch

C. Joint Cleaning

Before adhesive is applied to the bell and spigot, the tapered bonding surfaces must be inspected for contamination.

1. Remove end protectors sufficiently far in advance to allow any trapped moisture to evaporate from tapered surfaces. It is imperative that the bonding surfaces be dry because the adhesive will not penetrate and bond to a wet surface.
2. Inspect tapers and remove any damaged sections to be repaired.
3. Any "factory" tapers or old (weathered) field tapers which show evidence of oxidation, chalky surface, and/or fuzzy glass reinforcement (as shown below) should be lightly sanded with a strip of sandpaper or flapper sander.



4. Using joint cleaner found in adhesive kit, thoroughly clean the inside of the bell and the outside of the spigot making sure all dirt, grease and foreign material has been removed.
5. Once cleaned, these surfaces should not be touched with hands or gloves or otherwise contaminated.
6. When temperature in the joint assembly area is below sixty degrees Fahrenheit, the bonding surfaces may be warmed and a heat assist (Chem Cure Pak® or heat blanket) **must** be used.

Adhesives

Adhesives used in the joining of bell and spigot joints are supplied as two-part systems. Each adhesive kit contains resin, hardener, instructions, and (except for 1 oz. kits) cleaning solvent, towels, mixing stick, and an application brush.

10.1-146

A. Adhesive Selection

Table 4 shows the number of bonds a kit will make for each respective pipe size. This table is based on the quantity of adhesive required by an experienced crew working at a temperature of 75°.

Table 4.

Bonds Per Adhesive Kit

Kit Size:	1.0 oz.	6.8 oz.	10.0 oz.
Nominal Pipe Size	Bonds per Kit	Bonds per Kit	Bonds per Kit
2 in	2	14	—
3 in	1	9	14
4 in	1	7	9
6 in	—	3	4
8 in	—	2	3
10 in	—	2	3
12 in	—	2	3
14 in	—	1	2
16 in	—	1	2

B. Adhesive Mixing

Mixing instructions are packaged with each adhesive kit. When using these materials, avoid direct contact with skin or eyes. Use soap and water to wash off any of these materials from skin. If any of the liquid materials get into the eyes, flush immediately with water, not solvent, and get medical aid immediately.

1. In cold weather, warming the resin to 60° F is recommended to permit good mixing and easier application.
2. To mix the adhesive, first empty *all* the hardener into the can of resin. Mix *all* of the hardener and resin in the recommended proportions; never try to split a kit.

3. Mix the hardener and resin thoroughly with the wooden spatula until all streaks are gone and the adhesive has a smooth uniform color (pink). Take care to scrape and mix all resin from the lid and from under the upper lip of the can. Stirring too vigorously can either cause some hardener to splash out or result in excessive air entrapment.

C. Adhesive Work Life

The working life (pot life) of adhesives (Table 5) or the time it takes for the adhesive to harden—is measured from the time the hardener and resin are first mixed, until the adhesive begins to set and can no longer be used. In hot weather, keep adhesive kits cool to extend the pot life. To prolong the pot life, mixed adhesive may be poured and spread out onto aluminum foil (spreading cools the adhesive, slows the chemical reaction, and prolongs the useful life of the adhesive).

Table 5.

Adhesive Working Life/Time to Cure*

Temperature	60° F** (16° C)	70° F (21° C)	85° F (29° C)	100° F (38° C)	120° F (49° C)	150° F (66° C)
Pot Life	30 min.	25 min.	15 min.	10 min.	8 min.	—
Time to Cure	12 hr. (8 hr.)	5 hr. (3 hr.)	4 hr. (2 hr.)	3 hr. (1½ hr.)	2½ hr. (1½ hr.)	1½ hr. (45 min.)

*Time shown in parentheses indicates when sufficient cure will have been obtained to permit moving of the assembly.

**Note that at temperatures below 60° F, a heat assist method must be utilized to force cure. The joint and the adhesive must be warmed (to 60° F) for proper mixing. See the section on Heat Assist Adhesive Cure Methods (Section E).

D. Adhesive Curing Time

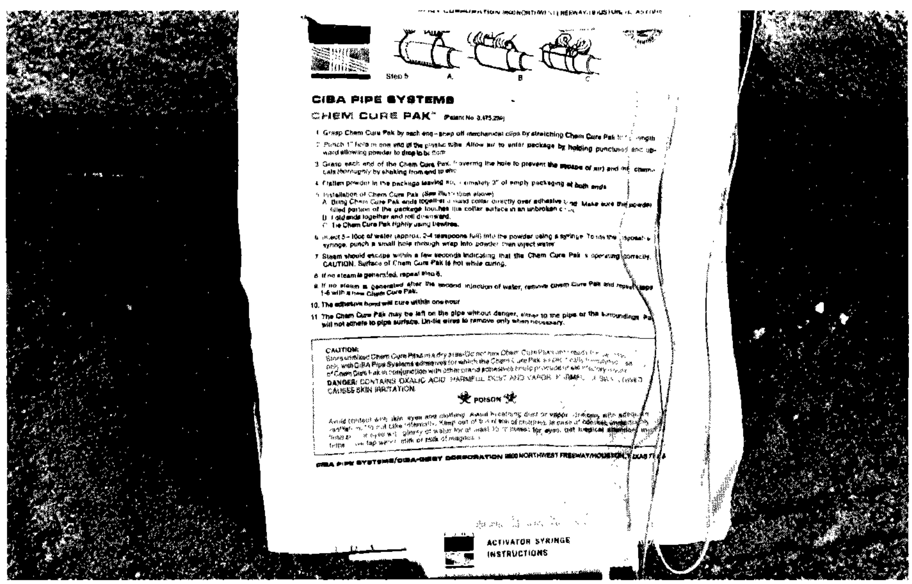
Cure time (Table 5) is the time required for the adhesive in the assembled joint to harden fully. Only at this time is the adhesive fully set up and the assembled joint ready for testing. The time to cure is dependent on the type of adhesive and the ambient temperature. Cure time can be shortened by the application of heat as reviewed in the section on Heat Assist Adhesive Cure Methods (Section E).

E. Heat Assist Adhesive Cure Methods

Typically, adhesives will not readily cure or set up at temperatures below 45°F, and cure times are very long at temperatures below 60°F. Therefore, when ambient temperatures fall below this point, heat must be applied to the bonded joint. The "time to cure" for CIBA-GEIGY adhesive at various temperatures, is shown in Table 5, (page 35).

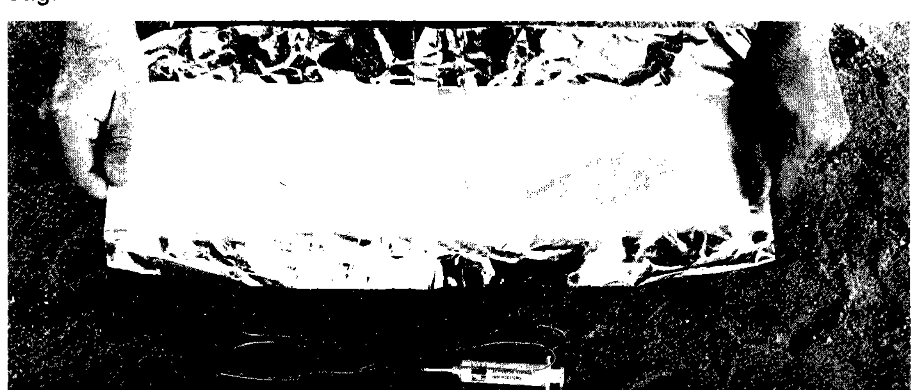
The Chem Cure Pak® or a heat blanket is recommended for use at temperatures below 60°F in the work area. These cure methods can also be used at higher temperatures when a rapid cure is required.

1. Chem Cure Pak. (U.S. Pat.#3475238) The Chem Cure Pak consists of two acids mixed together as one component, and lime (CaO) as the second component. When water is added after the two components have been thoroughly mixed, a heat generating chemical reaction occurs.



Preparation of Chem Cure Pak

a) Remove the clips which hold the bag in a folded position and unfold the bag.



b) Punch a 1" hole in the acid end of the bag. The acids are coarse granules while the lime is a fine powder. Allow the acid to fall into the lime section. The hole will let air into the bag making it easier to mix the two components.

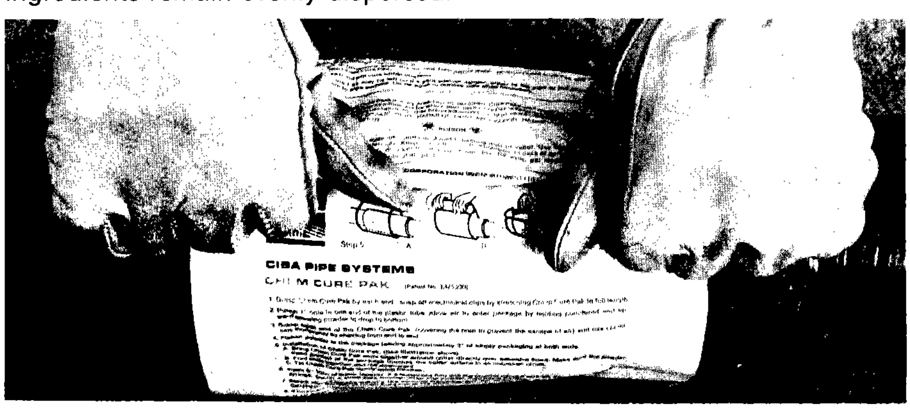
c) Grasp the ends of the plastic bag and mix the chemicals by turning the bag vertically end over end. Continue in this manner until a thorough mixture has been obtained.

d) Flatten the powder in the package leaving approximately 3" of empty packaging at both ends.

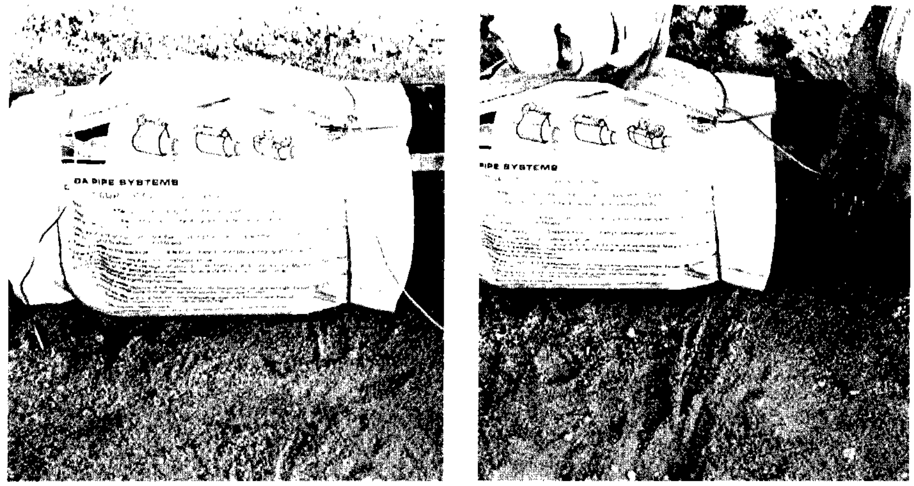
Installation of the Chem Cure Pak

e) Place the bag under the joint to be cured making sure that the center of the Chem Cure Pak is aligned with the center of the tapered pipe spigot in the joint.

f) Wrap the bag tightly around the joint to be cured ensuring that the ingredients remain evenly dispersed.

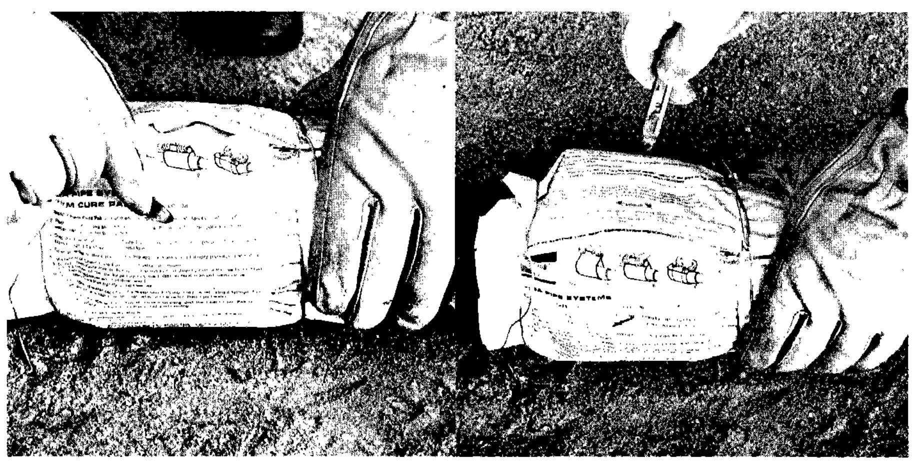


g) Secure the Chem Cure Pak tightly into place using tie wires.

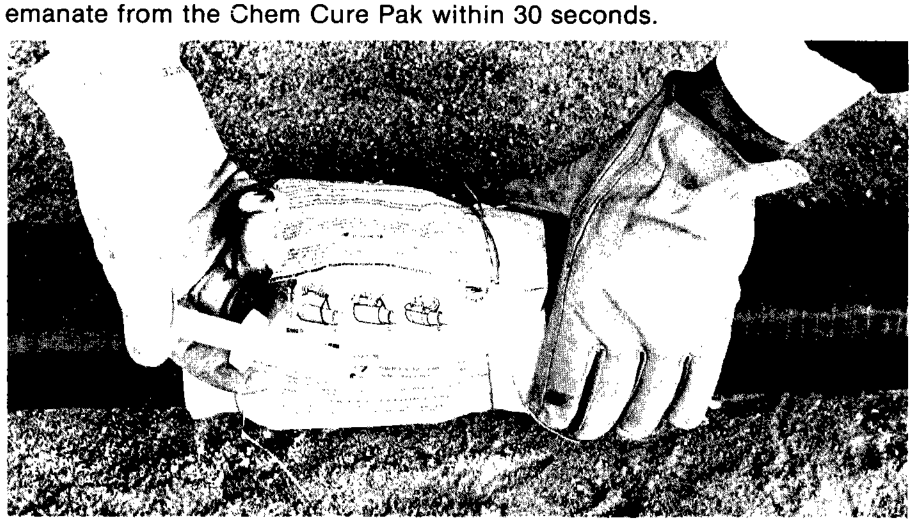


Activation of Chem Cure Pak

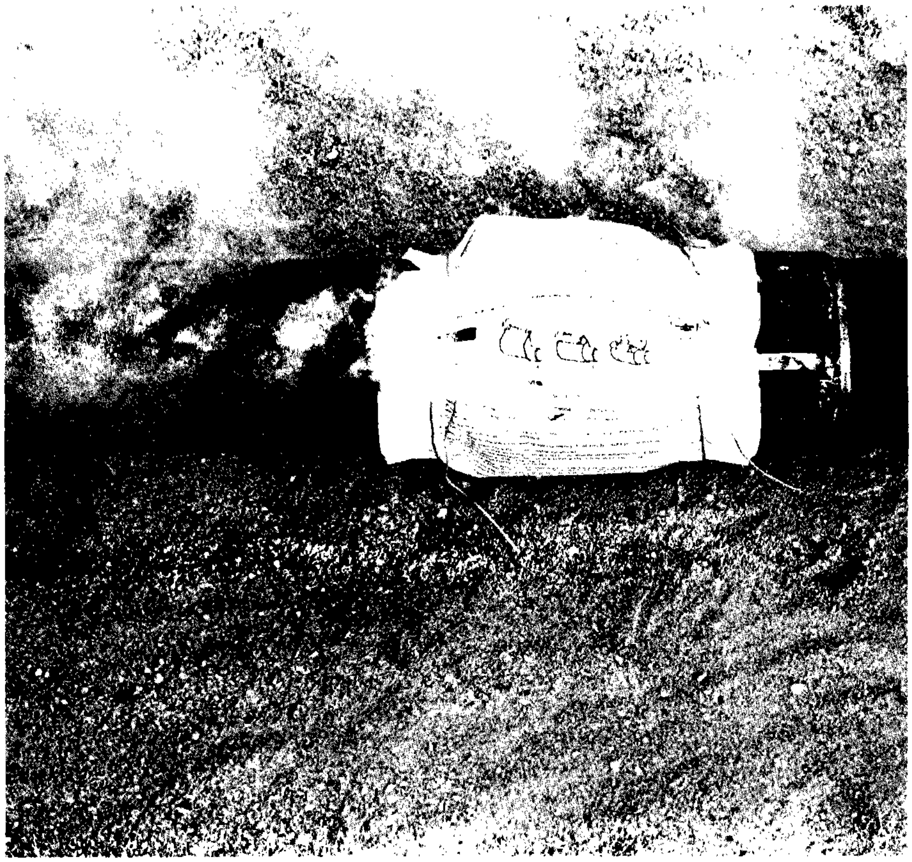
h) Using a pocketknife or other sharp instrument, puncture a small hole through the backing and into the plastic bag on both sides of the Pak—180° apart.



i) Fill the syringe supplied with the Chem Cure Pak with water. Insert the syringe into each hole and discharge ½ the syringe (approx. 1/3 oz. [10 ml]) into each hole. The reaction should begin and steam should begin to emanate from the Chem Cure Pak within 30 seconds.



j) Steam should escape within a few seconds indicating that the Chem Cure Pak is operating correctly. **Caution:** Surface of Chem Cure Pak is hot while curing.



k) If no steam is generated, repeat step (i). If no steam is generated after the second injection of water, remove Chem Cure Pak and repeat steps (a) through (c) with a new Chem Cure Pak. The adhesive bond will cure within one hour. The Chem Cure Pak may be left on the pipe without danger, either to the pipe or surroundings. Pak will not adhere to pipe surface. Untie wires to remove only when necessary.

Caution:
Store unmixed Chem Cure Paks in a dry area. Do not mix Chem Cure Paks until ready for use. Use only with CIBA-GEIGY Pipe Systems adhesives for which the Chem Cure Pak is specifically formulated. Use of Chem Cure Pak in conjunction with other brand adhesives could produce unsatisfactory results. **Danger: Contains Oxalic Acid. Harmful Dust and Vapor. Harmful If Swallowed. Causes Skin Irritation.**

Poison
Avoid contact with skin, eyes, and clothing. Avoid breathing dust or vapor. Use only with adequate ventilation. Do not take internally. Keep out of the reach of children. In case of external contact immediately flush skin or eyes with plenty of water for at least 15 minutes; for eyes, get medical attention. Internal: Give tap water, milk or milk of magnesia.

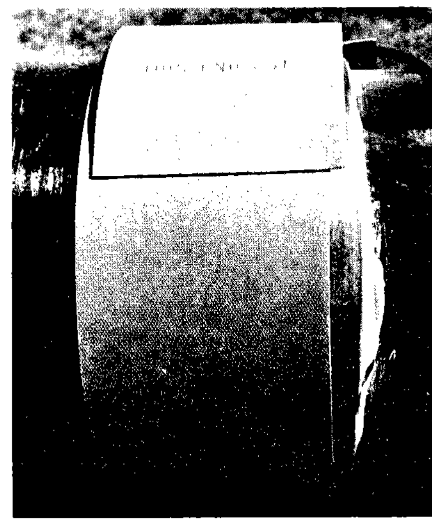
2. Heat Blanket
The Heat Blanket is a silicone rubber heater that is thin, flexible, lightweight, and corrosion resistant. It provides an effecient method for the rapid cure of adhesively bonded joints. The Heat Blanket is available in three sizes:

Table 6. Heat Blanket Sizes

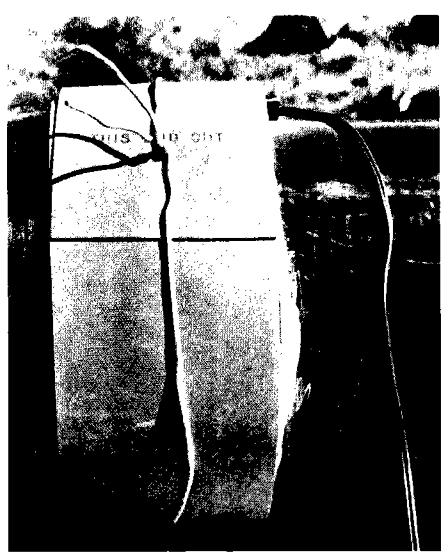
Size	Dimensions	Nominal Pipe Diameters
I	4.5"x16"	2",3",4"
II	5"x36.5"	6",8",10"
III	6"x55"	12",14",16"

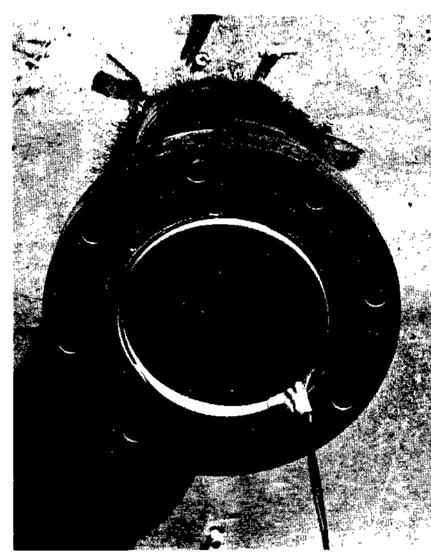
The Heat Blanket has a wattage of 2 watts/in.^{2} and will reach a maximum of 240° F providing adhesive cure in approximately 30-40 minutes.

Installation:
a) Center Heat Blanket over joint to be cured.

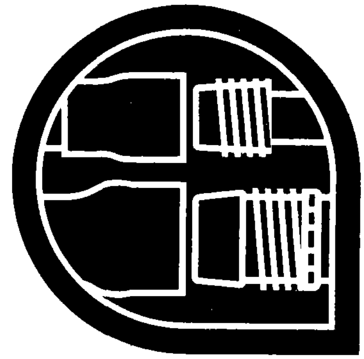


b) Wrap a insulated wire around the blanket and tighten to secure a firm fit.
c) In the case of bonding on an open-ended pipe, insert the rolled up blanket inside the pipe and allow it to unfold to the shape of the pipe.





d) Plug in heat blanket and allow joint to fully cure (30-40 min.). If it is exposed to an extremely cold or windy environment, the blanket should be wrapped with aluminum foil or fiberglass insulation.



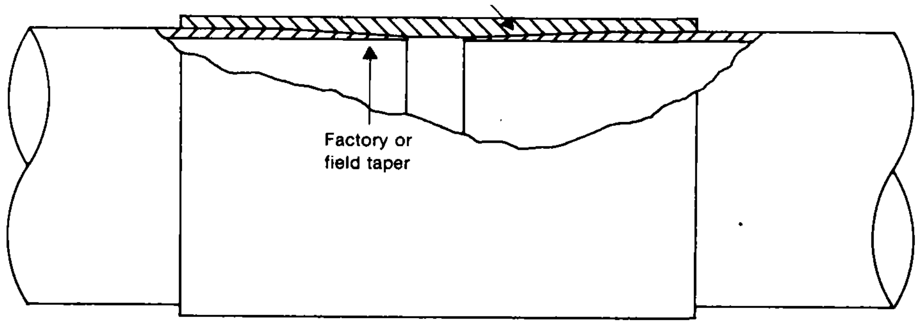
Joining Systems

A. Bell & Spigot

The bell and spigot joint is made by the adhesive bonding of a tapered spigot into a tapered bell. The tapers machined in the bell and on the spigot end are "matching tapers" of a pre-determined angle, 1¾° (2"-6") and 2° (8"-16"). Each length of bell and spigot pipe will have a factory-tapered spigot on one end and a tapered coupling attached to the other end. Fittings are manufactured to accept the tapered spigot end of the pipe.

Figure 7.

Bell & Spigot
Adhesive



Installation Preparation

a) String the pipe along the right-of-way.

b) After ensuring that the tapered bell & spigot end are **clean** and **dry**, the end caps should be replaced until the joint is ready to be made.
c) Make a quick inspection of the pipe wall and tapered spigot end for any signs of cracking or impact damage.

10.1-154

Adhesive Mixing and Application

a) Insure that the taper and bonding surfaces are clean. If the surfaces are oily or greasy, they should be cleaned with the joint cleaner found in the adhesive kit. It is imperative that the bonding surfaces be clean and dry before adhesive application.

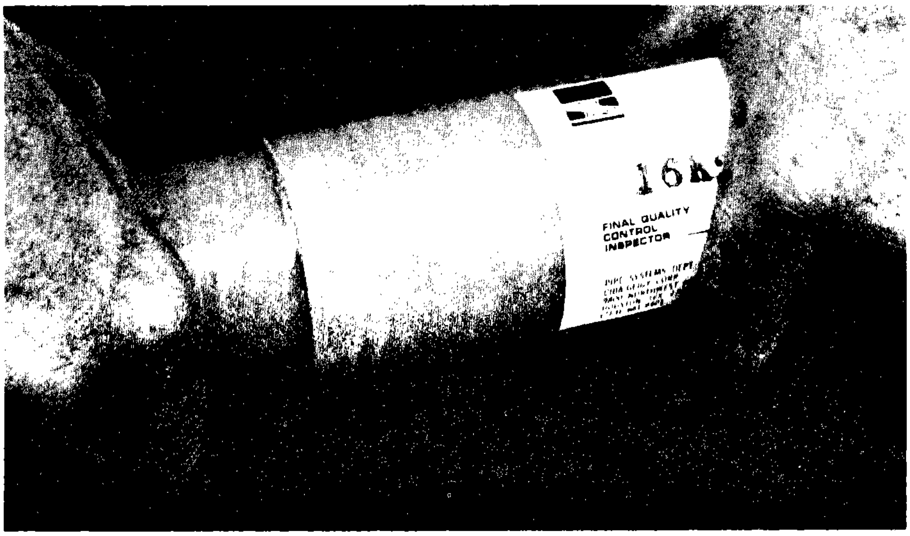
b) Mix adhesive according to directions taking careful notice of the working life which will be approximately 20 minutes at 75°F (Table 5 page 35).

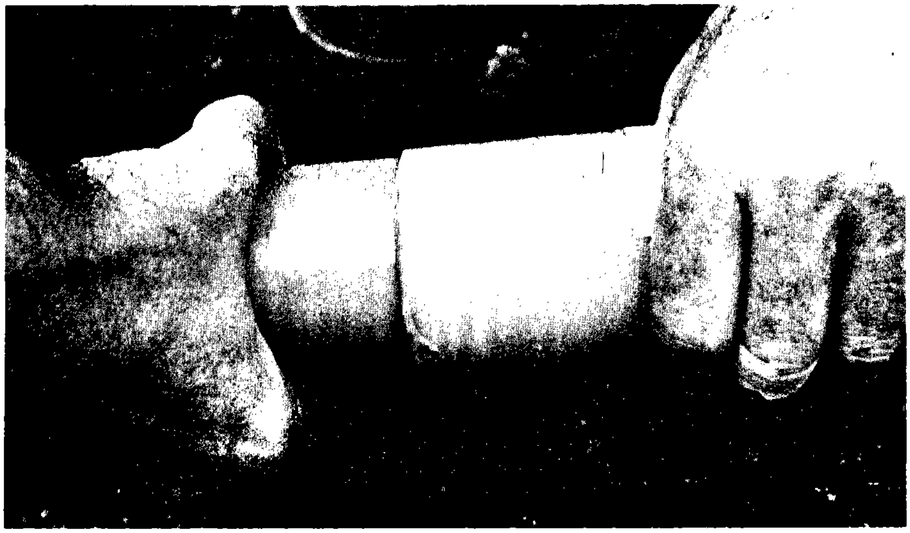
c) Apply a thin coating of adhesive to both bonding surfaces. Enough adhesive should be used to form a bead surrounding the pipe when insertion has been completed.

10.1-155

2"-6" Pipe

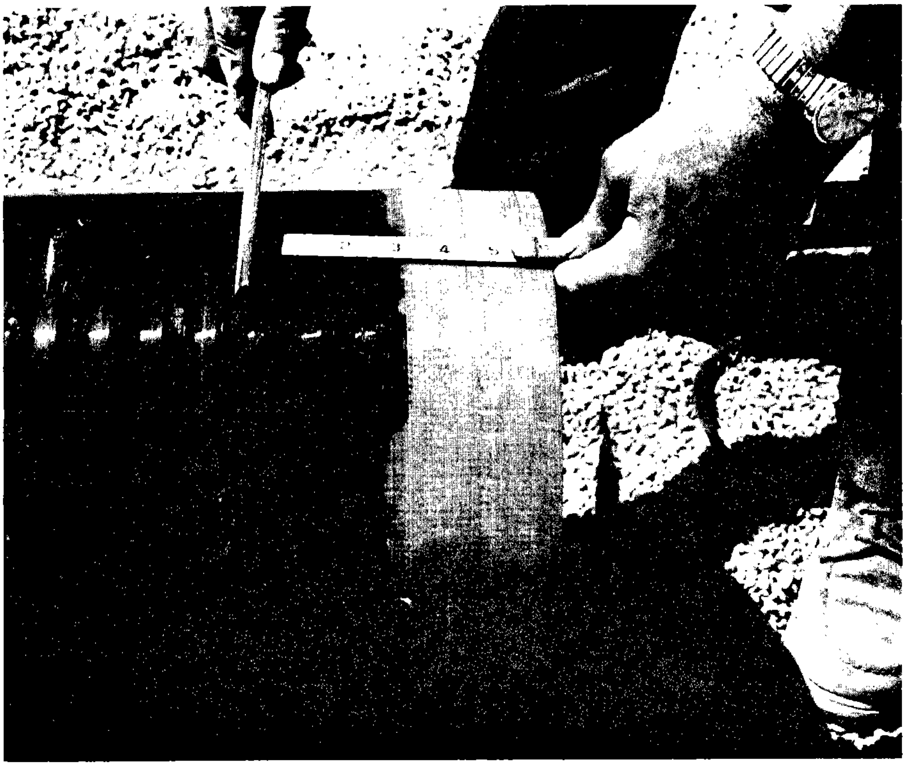
The spigot end should be inserted without rotation until contact of the matching taper in the bell is felt. At this point, the spigot end should be rotated slightly while applying force to lock the joint. The rotation of the spigot end will redistribute the adhesive evenly and work any air out of the joint.





8"-16" Pipe

a) Insert dry, then measure and mark the insertion depth of the spigot end on the exterior pipe wall. (See Chapter 8, Figures 29 and 31 for insertion depths in pipe and fittings, respectively.)

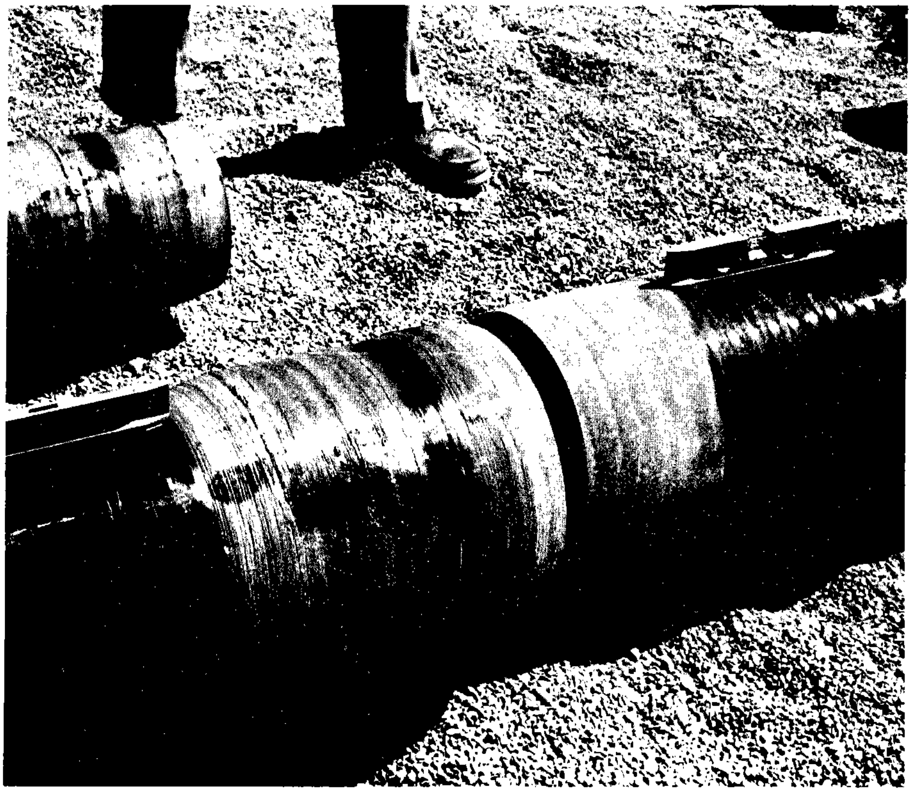


b) Remove the exterior gloss up to the recorded insertion depth using a flapper sander or sandpaper.

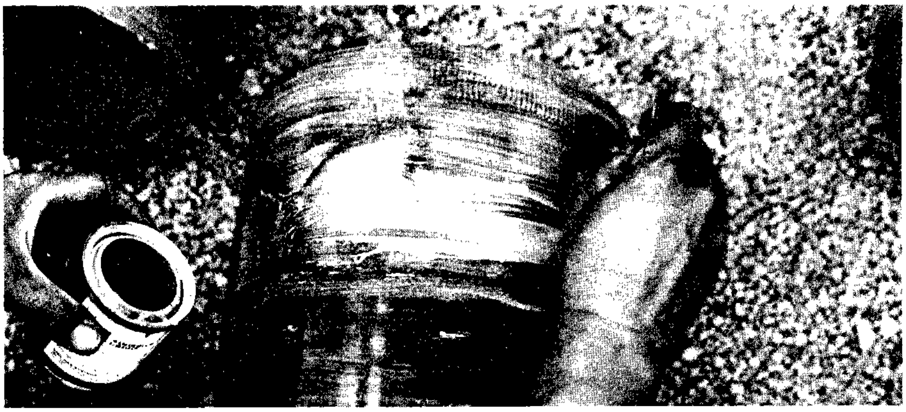
10.1-157

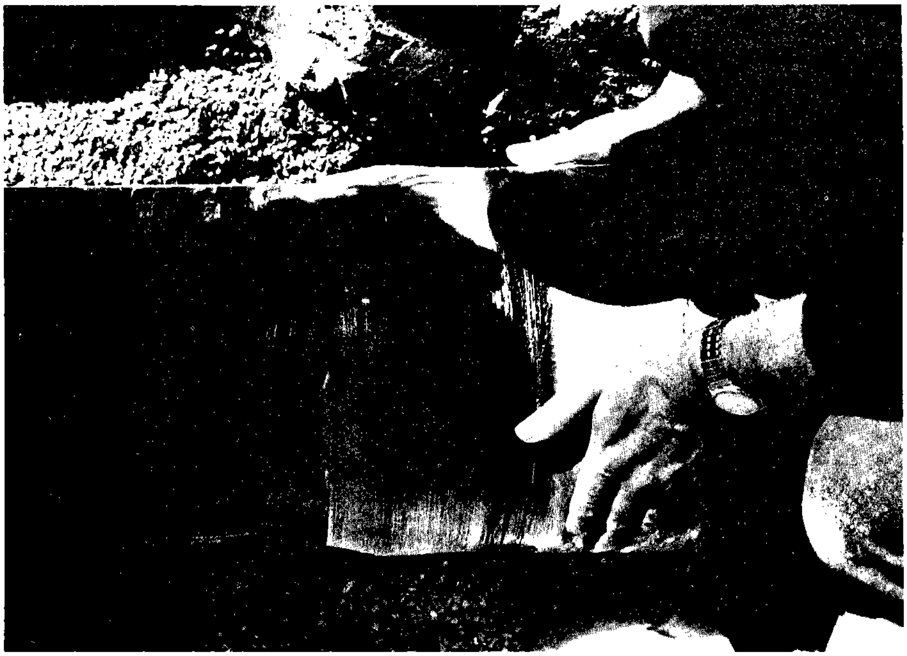
c) A second mark, 3 inches past the original measurement, should be made in order to double check the insertion depth upon final joint makeup.
d) Buff up the interior of the bell and remove any rough edges using a flapper sander or sandpaper.

e) Align the mating surfaces so that they may be brought together in a straight, even line.



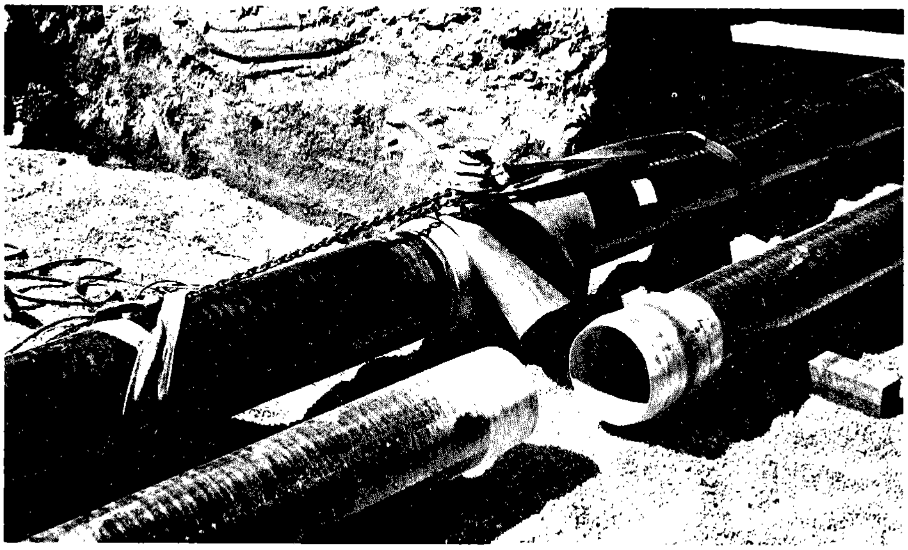
f) Apply properly mixed adhesive to both the bell and spigot bonding surfaces as described on page 42.

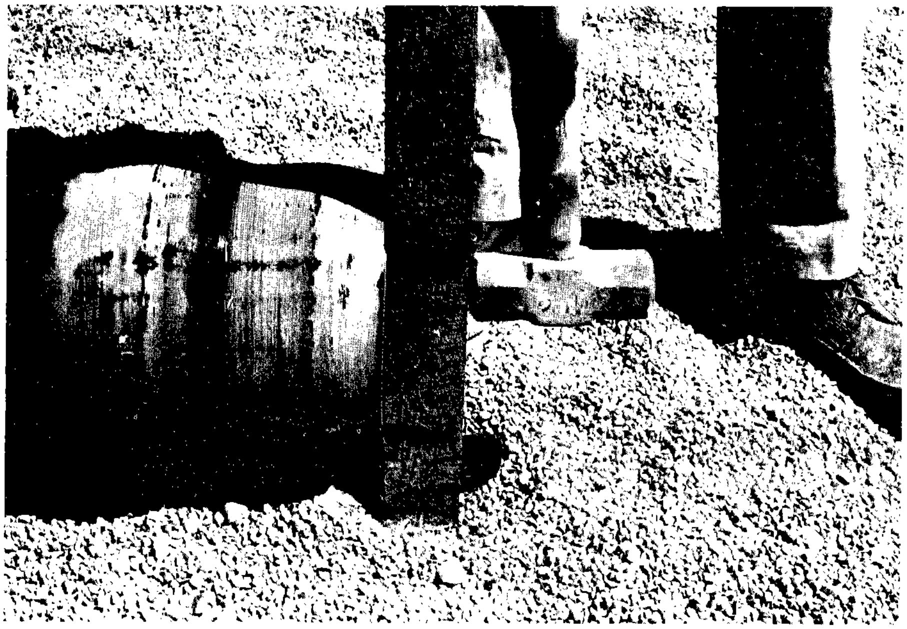




10.1-159

g) The spigot end should be inserted in an uncocked position without rotation. After initial insertion has been made, a come-a-long should be used to insure that the proper insertion depth has been obtained. Use ⅝" (16mm) or larger manila rope with the come-a-long, taking careful notice to protect pipe with padding where the come-a-long is fastened. Take up the come-a-long slowly and work joint together taking care to maintain alignment. Tap a wooden block held against the end of the pipe, to be sure the spigot end has been fully inserted.





General Considerations

a) Over insertion should be avoided because it can crack the spigot end and result in a faulty joint.

b) After proper insertion has been accomplished, check for possible backout at the joint.

c) If temperature is below 60°F (16°C), heat assist methods such as the Chem Cure Pak® or heat blanket (Chapter 3, Section E) **must** be used in order for the adhesive to cure.

d) Do not pressurize the line until adhesive has fully cured. Curing time at various temperatures are shown on Table 5, page 35.

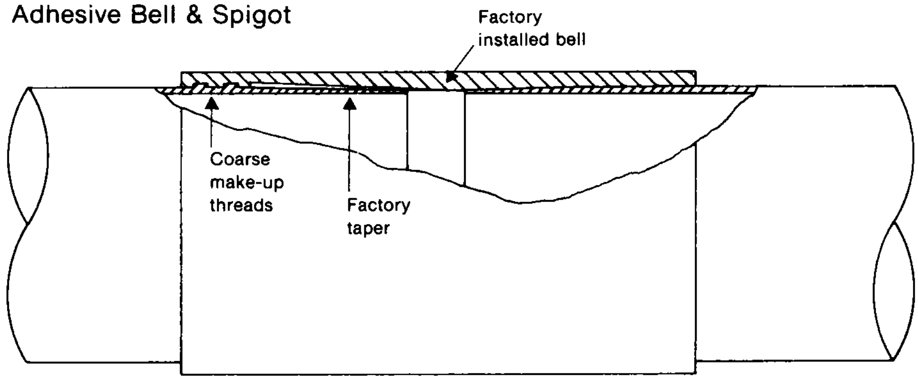
10.1-160

B. Taper-Lock®
(U.S. Pat.#3540757)

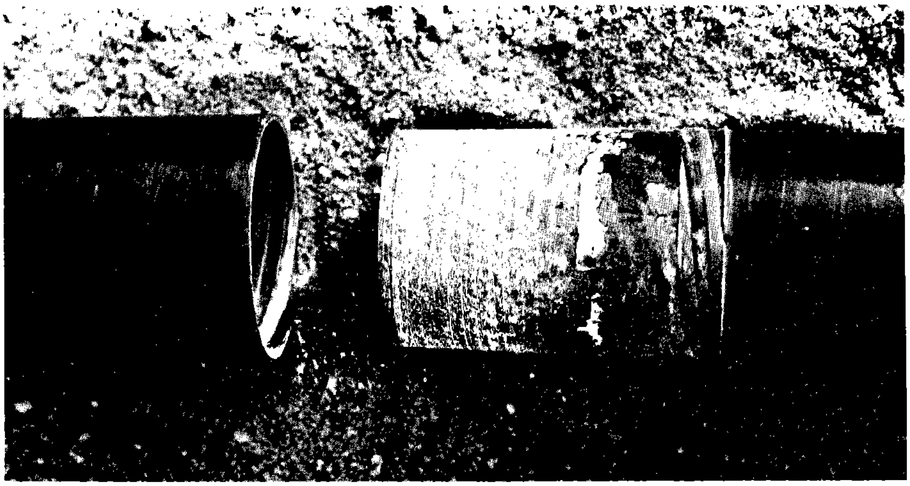
The CIBA-GEIGY Taper-Lock joining system is available on 2", 3", and 4" pipe. The factory applied Taper-Lock gives users the soundness of an epoxy adhesive system with the installation ease and security of a mechanical joint. The Taper-Lock system consists of matching open-ended coarse threads which are molded in the collar and on the pipe at the factory. The Taper-Lock joining system assures perfect alignment and immobilizes the joint during adhesive cure. The matching tapers on this joint should be prepared in the same way as the standard bell and spigot.

Figure 8.

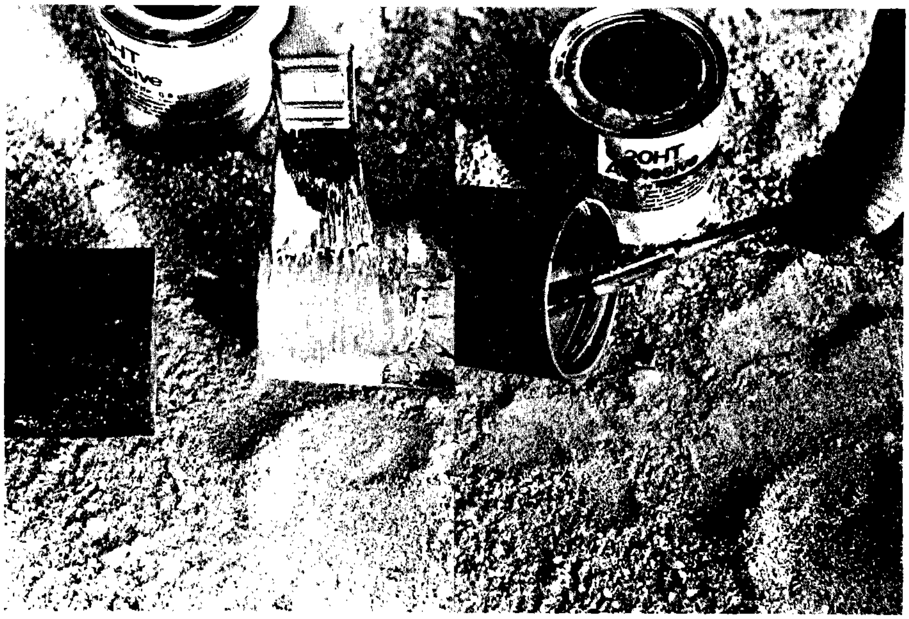
Taper-Lock
Adhesive Bell & Spigot

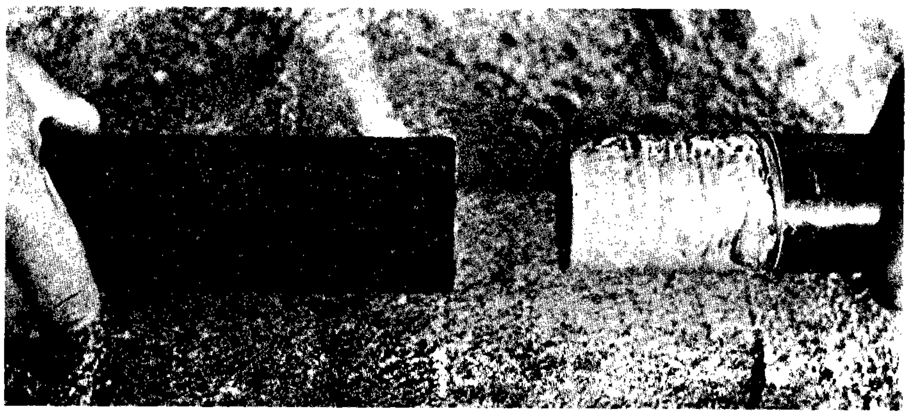


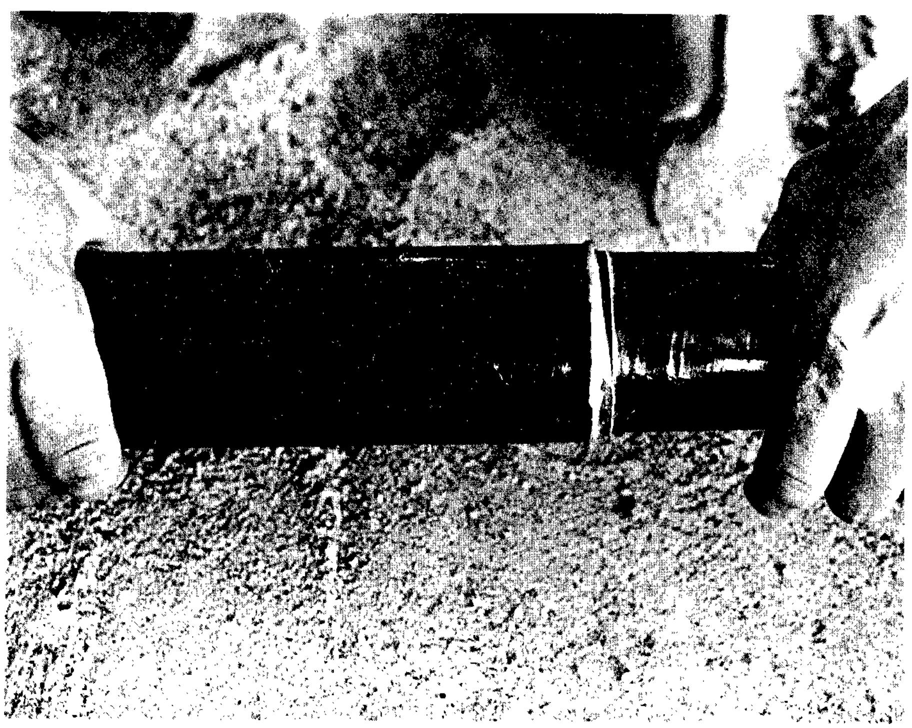
Installation Procedure
a) String the pipe along the right-of-way.
b) After ensuring that the tapered bell & spigot ends are clean and dry, the end caps should be replaced until the joint is ready to be made.
c) Inspect the pipe wall and tapered spigot end for any signs of cracking or impact damage.
d) Insure that the taper and bonding surfaces are clean. If the surfaces are oily or greasy, they may be cleaned with the joint cleaner found in the adhesive kit. It is imperative that the bonding surfaces be clean and dry before adhesive application.
e) Mix adhesive according to directions taking careful notice of the pot life which will be approximately 20 minutes at 75°F(24°C). (See Table 5, page 35)
f) Apply adhesive to both tapered surfaces and insert the spigot end into the bell, engage the threads and turn to the right. In less than one turn the joint is fully locked.



10.1-161







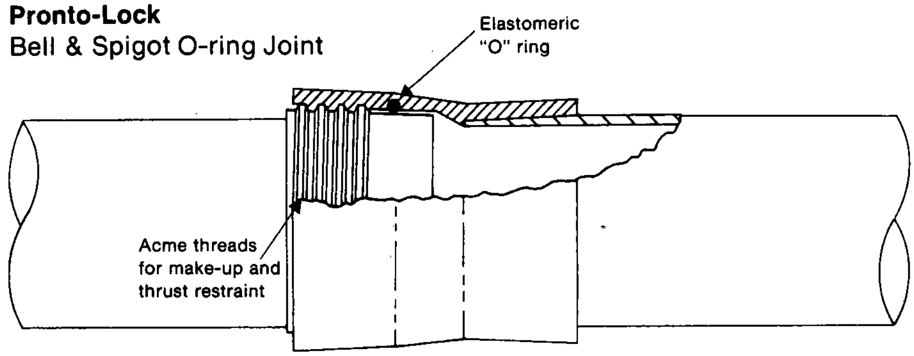
10.1-162

C. Pronto-Lock®
(2"-6" Pipe Only)
(U.S. Pat.#3784239)

The CIBA-GEIGY Pronto-Lock mechanical joining system utilizes an O-ring seal and is designed to provide a fast, simple, rugged, and reliable method of installing pipe. The O-ring fits in a groove in the female end of the joint and is installed in the factory. The sealing surface is the smooth tapered section of the male end of the joint. Any irregularity, discontinuity, or foreign material either on this surface, in the groove, or on the O-ring itself may prevent the joint from properly sealing upon make-up. The heavy duty molded ACME type threads in this joint start easily and make-up quickly with minimum danger of cross threading or jamming.

Figure 9.

Pronto-Lock
Bell & Spigot O-ring Joint



1. Lubricants
In order to minimize installation effort and permit disassembly when necessary, it is recommended that a lubricant be used on all Pronto-Lock joints. Teflon-based lubricants such as Jet-Lube* TF-15 or Thredon** 100 have been used successfully. In general, lubricants such as motor oil, ethylene glycol, petroleum jelly, lard, or vegetable shortening may be used. Liquid detergent is also very effective and is the preferred lubricant for potable water lines. Lubricants containing granular fillers or solid particles should not be used because these may prevent the O-ring from properly sealing. Those lubricants containing powdered or flaked metal or hardening type thread dopes should not be used. In cold weather, vigorous stirring will reduce the viscosity of the Teflon-basd lubricants, making them easier to use and apply.

A major consideration regarding all types of lubricants is as follows: They will catch and hold any dirt, dust, or sand which might come in contact with the joint and thus possibly might contaminate the O-ring or gall the threads and cause problems. For this reason, it is necessary to emphasize cleanliness and care on the part of the installation crew.

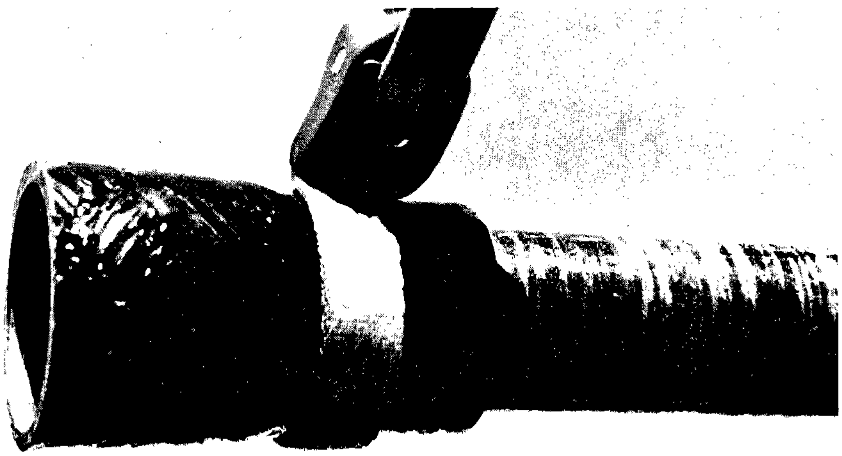
2. Strap Wrenches
Standard strap wrenches, or chain tongs may be used to make up the Pronto-Lock (2"-6") joint. When using one of the accepted wrenches, the following rules must be followed:
a) Always apply wrenches to the straight section of the Pronto-Lock female end. **Never apply any kind of wrench directly on the pipe wall.**

*Registered Trademark of Jet Lube Inc.
**Registered Trademark of Chemola Mfg. Co.

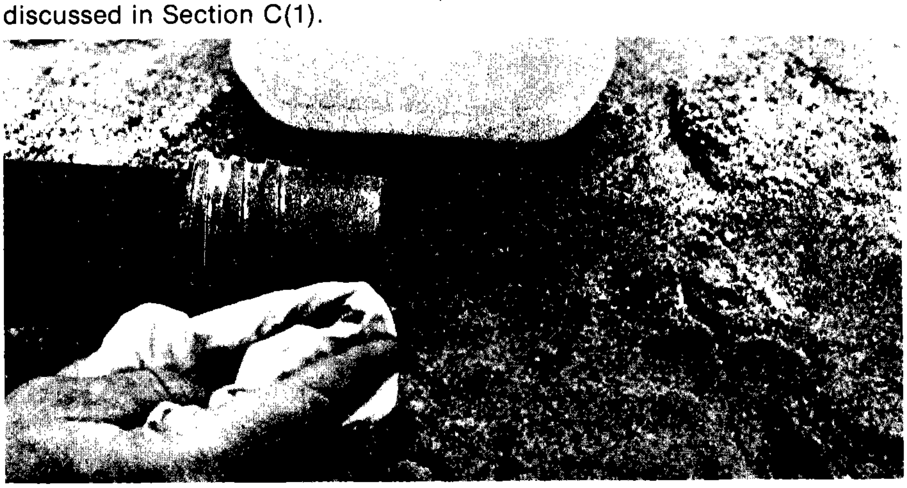
b) Never use a tool or "Cheater" with a longer than 24" handle. The joints will turn and make up easily if they are clean, lubricated, and properly aligned. Any difficulties encountered are usually the result of misalignment. When resistance is felt, the joint should be either backed off and cleaned, or the alignment should be checked.

3. Installation Procedure

a) String the pipe along the right-of-way.
b) Remove the protector from the female end of one length of pipe.
c) Inspect the pipe wall for any sign of cracking or impact damage.
d) Inspect the female end to be sure it is free of dirt, sand, or any foreign particles which could prevent complete make-up of the joint.
e) Check the O-ring to be sure it is properly seated in the O-ring groove.
f) Support the female end from falling into the dirt by placing the strap wrench (or other acceptable wrench) around the **collar** in the back-up position.
Do **not** use any wrenches on the pipe wall itself.

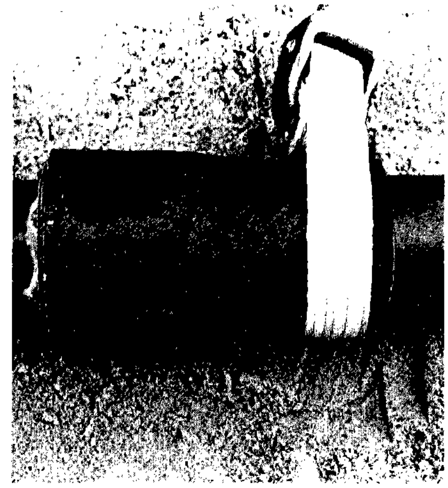


g) Remove the protective end cap from the male end of the adjacent length of pipe.
h) Insure that the sealing surface is clean and free from any roughness or foreign material which might prevent the O-ring from sealing.
i) Inspect the second length of pipe for any sign of cracking or impact damage.
j) Insure that the threads are clean and free of any foreign material which might prevent complete joint make-up.
k) Lubricate the male end and the O-ring with the appropriate lubricant as discussed in Section C(1).



10.1-164

l) Insert the male end of the second length into the female end of the first length as far as possible and begin turning clockwise so that the threads engage.

m) Apply a strap wrench or chain tong to the female end of the second length of pipe and tighten. Use the strap wrench on the straight section of the collar only. Do **not** use on the pipe wall.
Note: It is not necessary to apply excessive pressure on the wrench to "insure a seal." These are not sealing threads.

4. Variations in Joint Make-Up
Due to make-up tolerances, some joints will make-up flush while some will stand off 3/8" or more. This standoff does not affect performance because it is the O-ring which provides the seal, not the threads. Attempts to make all the joints flush or deeper may result in damage to the pipe. Experience with joint make-up will dictate the amount of torque necessary to insure complete make-up. In no case is a lever arm greater than 24" to be used in making up the joints. "Cheater" extensions of existing tools are also not to be used.

5. O-rings
The standard O-rings recommended by CIBA-GEIGY for use with the Pronto-Lock joint are listed in Table 8, Use of O-rings other than these without formal approval is not recommended and performance cannot be guaranteed.

Table 7.

O-Ring & Dimensional Data (2"-6")

Supplier	Compound Number	Part Number 2"	3"	4"	6"
Hercules	7446-70	231	240	352	365
Parker	N103-70	231	240	352	365
National	B-46	NS-231	NS-240	NS-352	NS-365

Standard Dimensions in inches

	2"	3"	4"	6"
O-Ring I.D.	2 5/8	3 3/4	4 7/8	7
O-Ring O.D.	2 7/8	4	5 1/4	7 3/8
O-Ring Width	1/8	1/8	3/16	3/16

6. Pronto-Lock Female and Male Ends

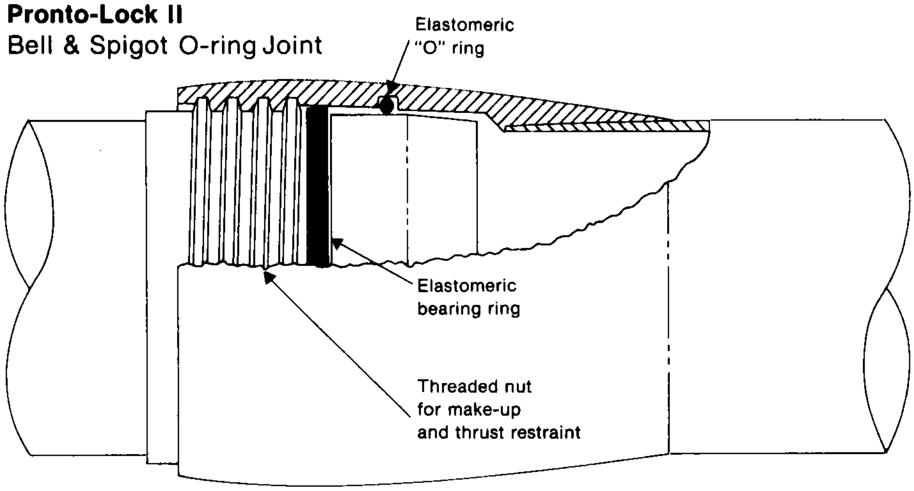
Separate Pronto-Lock female and male ends are available and can be bonded onto tapered pipe for field fabrication as described in Bell & Spigot Joints on page 41. The Pronto-Lock joint is **not** available in 2"-6" fittings.

D. Pronto-Lock II (8"-16" Pipe and Fittings) (U.S. Pat.#4014568)

The CIBA-GEIGY Pronto-Lock II mechanical joining system utilizes an O-ring seal and is designed to provide a fast, simple, rugged, and reliable method of installing pipe. The O-ring fits in a groove in the box (female) end and is installed in the field. The male portion of the Pronto-Lock II joint is a combination pin end (male) and sliding threaded sleeve, separated by a bearing ring. The threaded sleeve enables complete joint make-up without rotating the pipe. The pin end is tapered at two distinct angles which gives the Pronto-Lock II joint the capability of a 2 degree angular deflection so that installed pipe has the ability to conform much more readily to changes in terrain.

Figure 10.

Pronto-Lock II
Bell & Spigot O-ring Joint

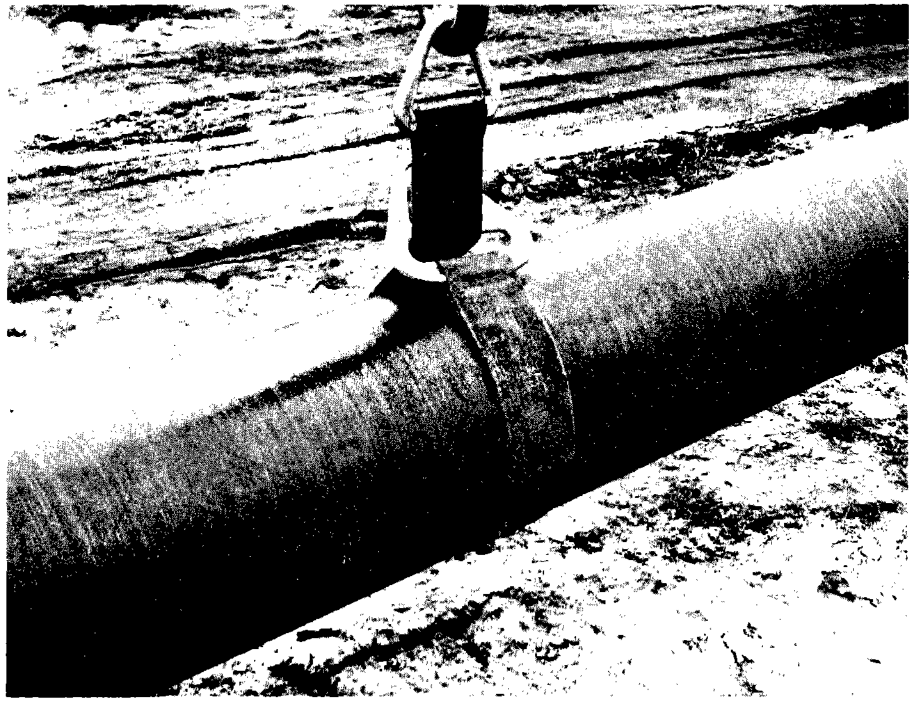


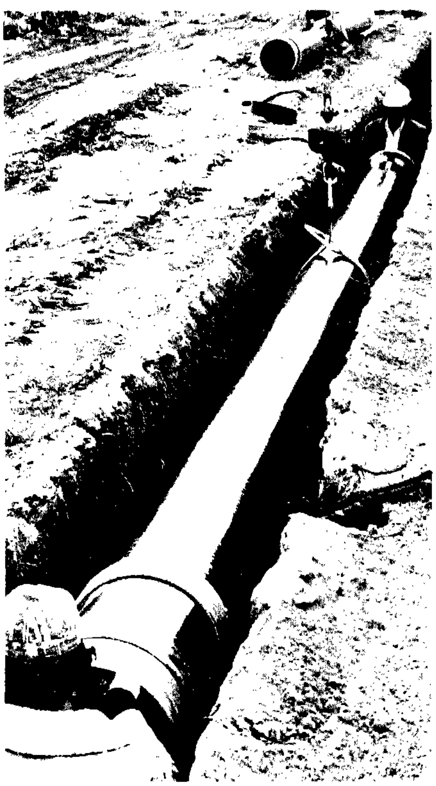
1. Installation Procedure

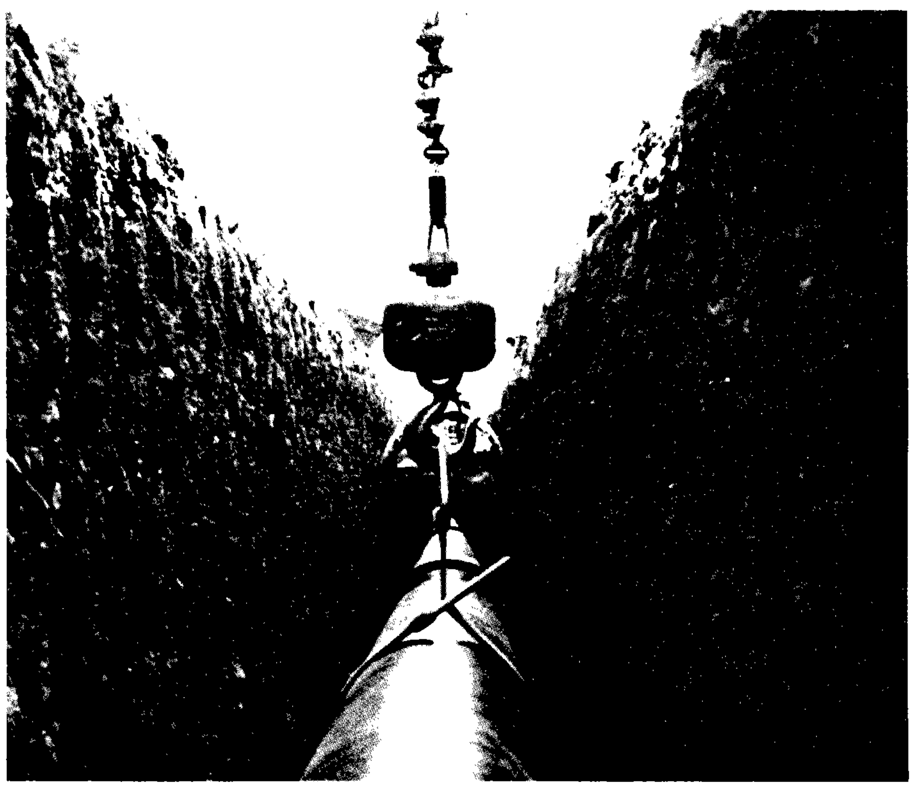
a) String the pipe along the right-of-way.

10.1-166

b) For 8"-12" pipe, carefully hand lower two lengths of pipe into the ditch.
c) For 14" and 16" pipe, it is easier to lower the pipe into position with the assistance of a front-end loader or equivalent. The pipe should be lifted with the use of a nylon strap fastened at the middle of a length of pipe. When handling 60 ft lengths, a two point supporting system with a spreader bar should be incorporated.



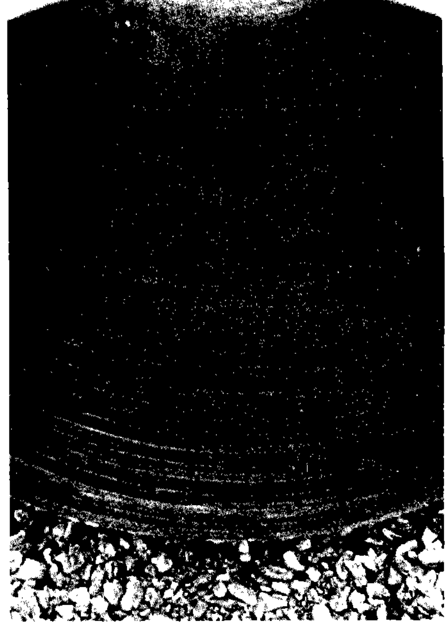




d) Remove the protector from the box (female) end of one length of pipe.

10.1-167

e) Inspect the pipe wall for damage.
f) Inspect the box end, especially the O-ring groove to be sure it is free of dirt, sand, or any foreign particles which would prevent proper sealing of the O-ring or complete make-up of the joint. In order to keep the box free of grit it is advisable to elevate the box from the ditch bed with a 4"x4".



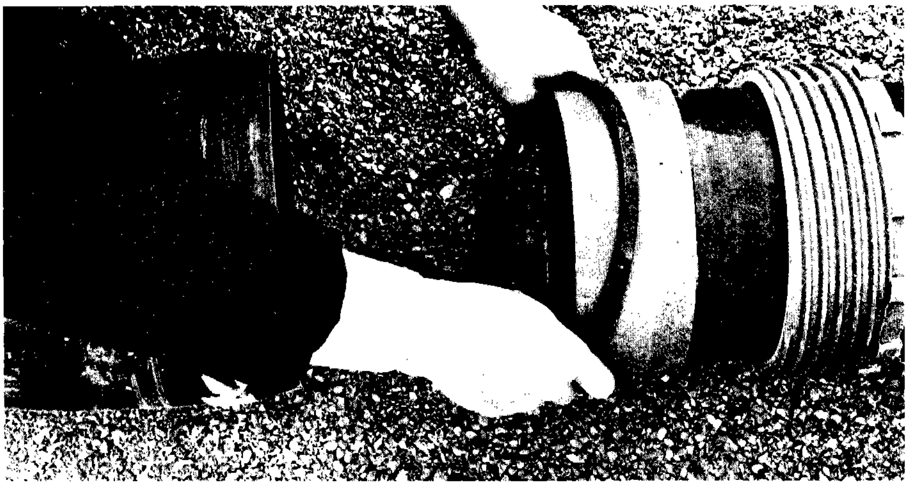
g) Install a lubricated O-ring into the clean O-ring groove using the correct lubricant as discussed in Chaper 4, Section C. The O-ring is larger than the circumference of the O-ring groove and the final portion needs to be pinched into place. Smooth out any twist in the O-ring once installation has been completed.

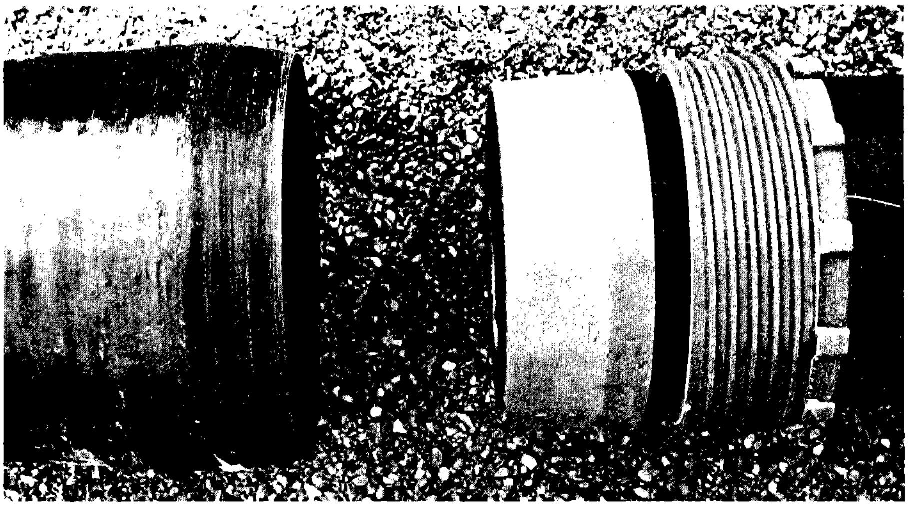
h) Lubricate the entire installed O-ring and its surrounding area.

10.1-168

i) Remove the protective end cap from the pin end of the adjacent length of pipe.
j) Insure that the sealing surface is clean and free from any roughness or foreign material which might prevent the O-ring from sealing.

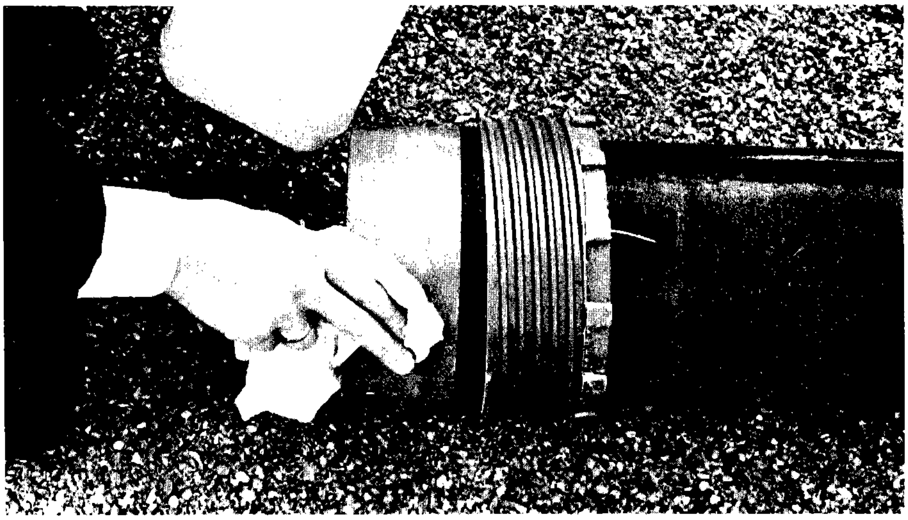
k) Install the square bearing ring between the pin end and the threaded sleeve.



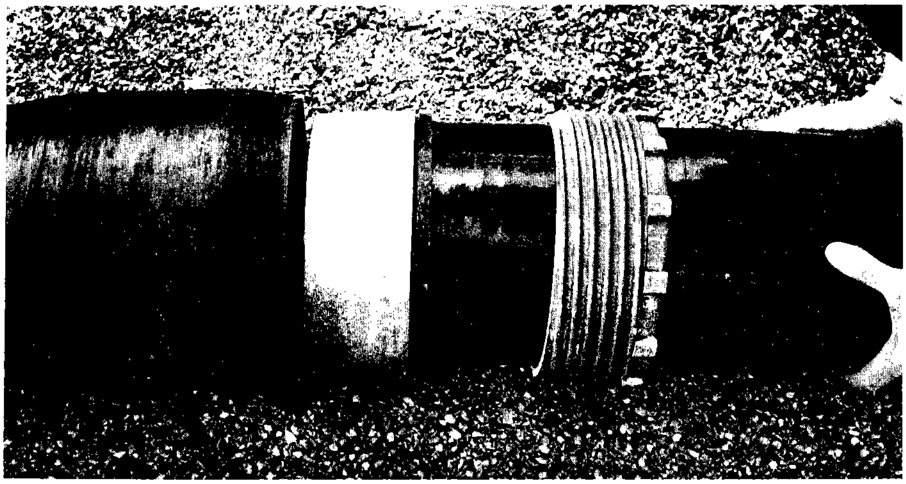


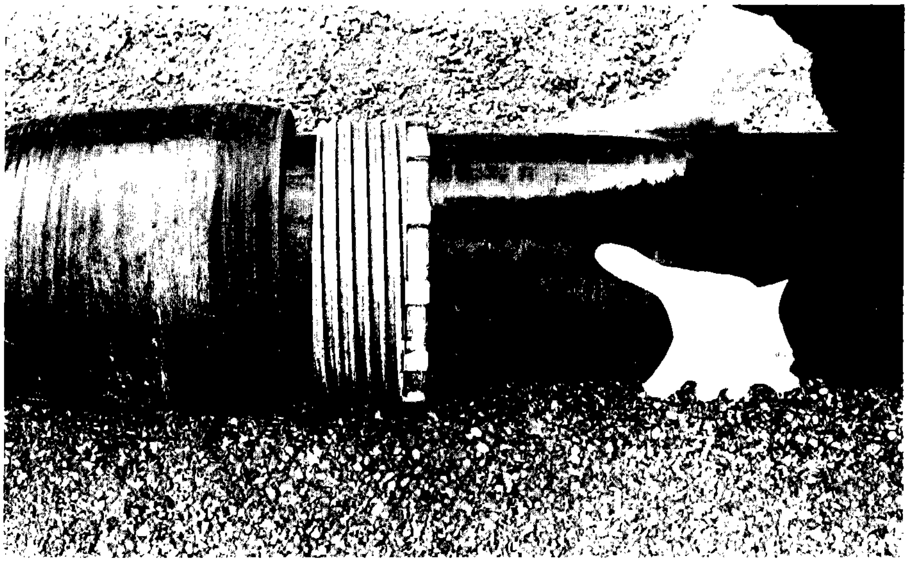
l) Make a quick inspection of the second length of pipe for damage.

m) Lubricate the pin end of the second length of pipe.



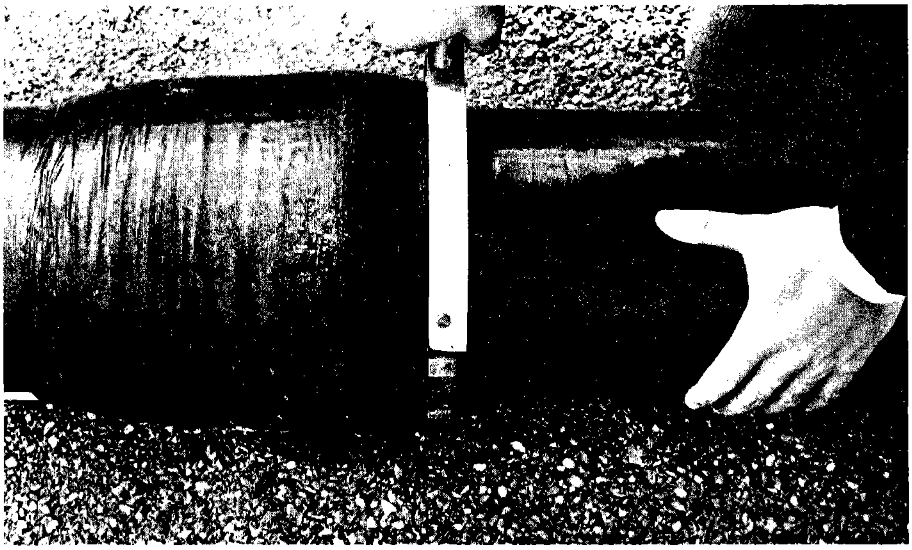
n) Insure that the adjacent length of pipe is correctly aligned.
o) Stab the lubricated pin end firmly into the box using a battering ram type of motion. Straight insertion is required to avoid pinching the O-ring out of the O-ring groove.

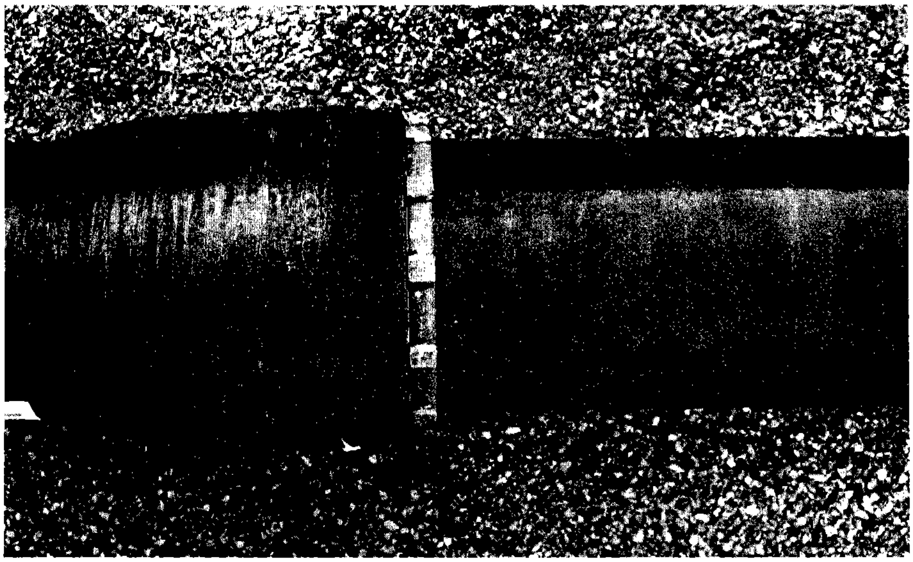




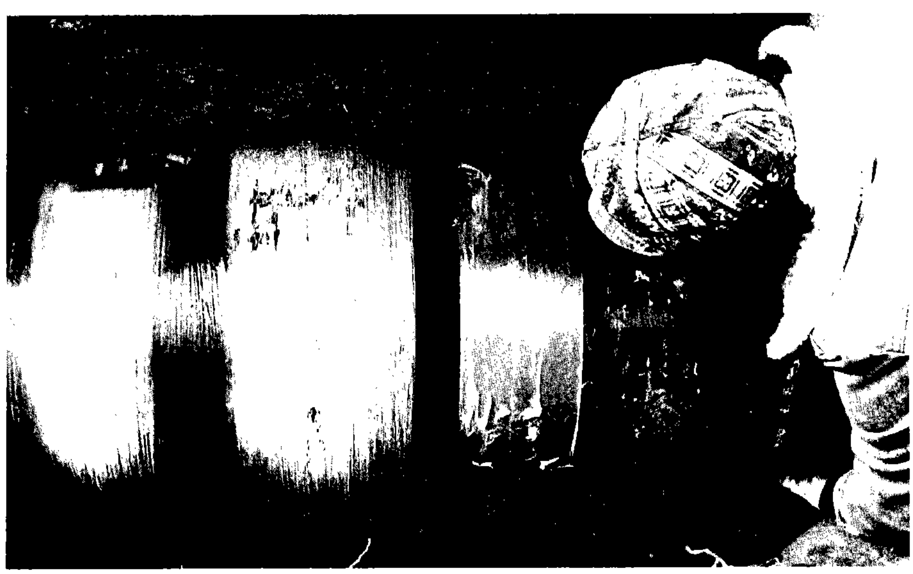
p) Slide the threaded sleeve into position and turn to the right. When the joint is properly aligned, the threads can be made up by hand.

q) Snug-up the threaded sleeve with the spanner wrench.





r) For 14" and 16" pipe, stabbing is easier with the assistance of a front-end loader or equivalent. Position the machinery so that the pipe ends to be joined overlap by approximately 12". With this positioning, the installer will not be fighting the cable when inserting the pipe. Pull back on the suspended pipe and lower it into position so that both lengths of pipe are directly aligned. Stab the lubricated pin end firmly into the box using a battering ram type motion and complete the joint make-up following steps p) and q).



10.1-172

2. O-Rings

The installer must only use the O-rings supplied by CIBA-GEIGY with the Pronto-Lock II joint. The use of O-rings other than these without formal approval is not recommended and performance cannot be guaranteed.

3. Pronto-Lock II Pin Ends and Fittings

Pronto-Lock II pin (male) ends are available and may be bonded on tapered pipe for field fabrication by the procedure outlined for Bell & Spigot Joints on page 33. The Pronto-Lock II joint is available for 8"-16" fittings.

Burial Recommendations

It is recommended that fiberglass pipe be buried where possible. While fiberglass pipe is frequently used in above ground service, proper precautions are needed to protect the pipe against impact damage and abrasion. Burial is usually the most practical method of protecting the pipe.

The load carrying capacity of CIBA-GEIGY pipe is exceptional because of its ability to redistribute crush, shear, and beam loads to safe levels through deflection. Table 8, below, lists the recommended range for heights of cover for CIBA-GEIGY pipe installed in a trench under conditions as noted.

Table 8. Recommended Earth Cover Height Limits

Nominal Pipe Diameter	Maximum Earth Cover	Minimum Earth Cover
2 in	25 ft (8m)	2 ft (0.6m)
3 in	25 ft (8m)	2 ft (0.6m)
4 in	25 ft (8m)	3 ft (1m)
6 in	25 ft (8m)	3 ft (1m)
8 in	25 ft (8m)	3 ft (1m)
10 in	25 ft (8m)	3 ft (1m)
12 in	25 ft (8m)	3 ft (1m)
14 in	25 ft (8m)	3 ft (1m)
16 in	25 ft (8m)	3 ft (1m)

m=meters

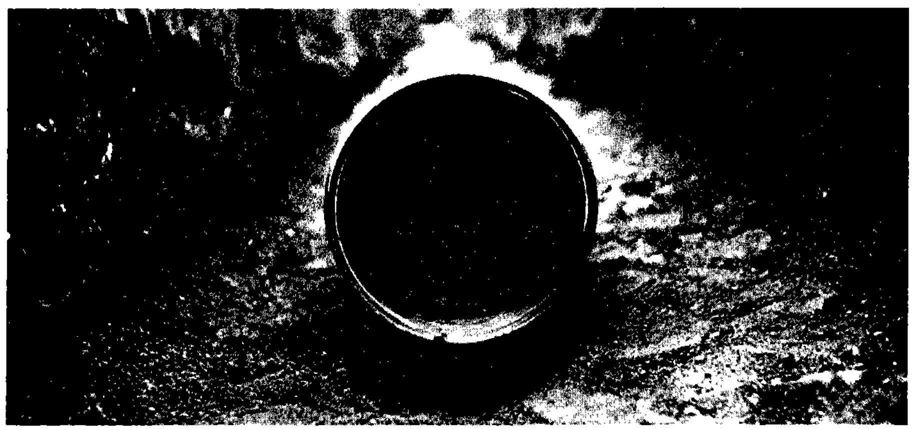
Note: These values are based on obtaining 85% minimum compaction of the side fill material prior to backfilling the remainder of the trench. For special installations outside these limits, consult CIBA-GEIGY Pipe Systems Department.

A. Excavation

The following excavation procedures should be observed in order to insure proper pipe installation and performance.

1. The excavation should be dug to enable the pipe to be laid to the grades and alignments shown on the plans. Figure 15, page 75, Recommended Depth of Cover, illustrates the minimum earth cover in varying parts of the country to insure against freezing.

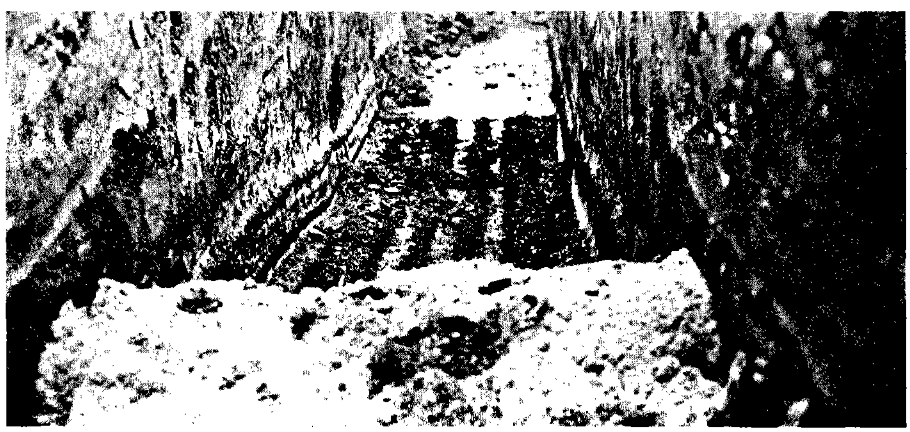
2. The narrowest practical trench width which will allow proper densification of the pipe zone backfill materials should be maintained with the minimum trench width equal to the inside diameter of the pipe plus 12". (Refer to Figure 14, Trench Excavation and Backfill).

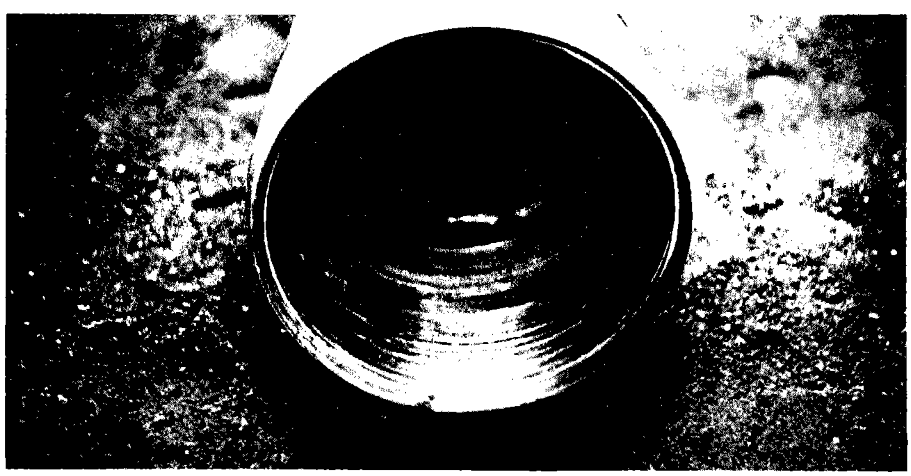


3. Vertical sidewalls should be maintained from the trench foundation to at least the top of the pipe.

4. The foundation should be firm and consist of sound earth or granular soil, free from stones or lumps exceeding 1" in diameter, which could bear against the pipe wall.

5. Prepare foundation by overexcavating the trench not less than 1" and backfilling the subgrade with loose bank run material graded uniformly in one plane for the full length of the pipe. Slight excavation should be performed at the location of each bell so that the pipe barrel is resting on the bottom of the ditch.





6. When excavation is in soft or wet unstable soils which will not provide sufficient support for the pipe, the trench should be over-excavated at least 6", and backfilled to 1" below subgrade with solid granular soil compacted to at least 85% relative density. The subgrade should then be completed as outlined in paragraph 5. (Figure 14, Trench Excavation & Backfill)
7. When solid rock, hardpan, or other hard foundation is encountered during excavation, the trench should be over-excavated at least 6" and backfilled to 1" below subgrade with sound earth or granular soil compacted to at least 85% relative density. The subgrade should then be completed as described in paragraph 5.
8. Beneath vehicular traffic, the height of earth cover over the top of the installed incased pipe (Section D, page 67, Figure 11) must not be less than 3 feet.

B. Pipe Laying

Assemble the pipe in accordance with the appropriate installation instructions for the joining system being used as outlined in Chapter 4.

CIBA-GEIGY fiberglass pipe has deflection capabilities, as outlined in Table 9 (below) which allow the installed pipe to conform to changes in trench depth and direction.

Table 9.

Pipe Deflection Capability

Nominal Pipe Size	Minimum Bending Radius	Maximum Deflection Per 39 ft Joint	Minimum Length Required for 10° Change	
2 in	75 ft (23 m)	30°[1]	13 ft	(4m)
3 in	100 ft (30 m)	20°	20 ft	(6m)
4 in	150 ft (46 m)	15°	27 ft	(8m)
6 in	200 ft (61 m)	10°	40 ft	(12m)
8 in	300 ft (91 m)	7°+2°[2]	57-13=44[3] ft	(13m)
10 in	350 ft (107 m)	6°+2°	67-13=54 ft	(16m)
12 in	400 ft (122 m)	5°+2°	80-13=67 ft	(20m)
14 in	450 ft (137 m)	4°+2°	100-13=87 ft	(27m)
16 in	500 ft (152 m)	3°+2°	133-13=120 ft	(37m)

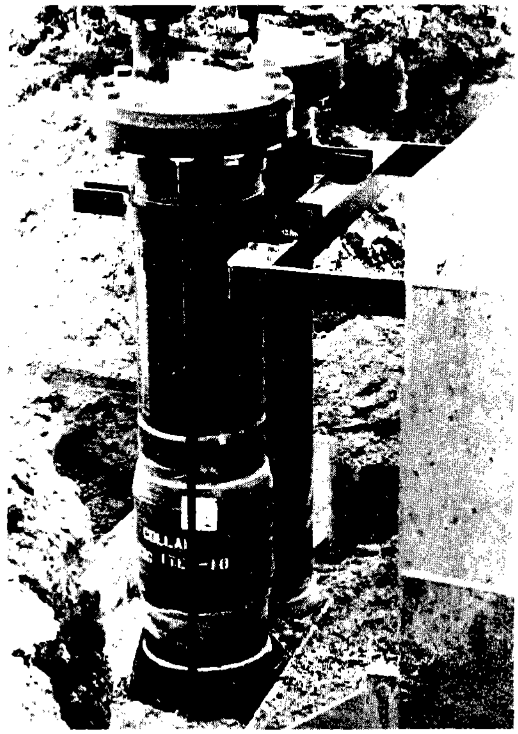
[1] Pipe Only
[2] Pipe Plus Pronto-Lock II Joint
[3] Pipe Minimum Minus Effect of Pronto-Lock II

On grades exceeding 10% the pipe should be laid uphill. In order to insure against line movement in the ditch after each joint is laid, a small quantity of selected backfill (no rocks or heavy clods) should be tamped thoroughly around the bottom of the pipe.

When work is not in progress, the pipe ends should be covered to prevent entry of debris, rodents, etc.

C. Thrust Blocks

For normal service, thrust blocks are not required for CIBA-GEIGY fiberglass pipe. Prudence, however, would dictate that where a change in direction occurs close to a large positive displacement pump, the fittings be thrust blocked to prevent racking of the line when the pump cycles. The evaluation of the need for thrust blocks is the responsibility of the engineering agency designing the system. Successful blocking is dependent upon factors such as location, availability and placement of concrete, and possible disturbance through future excavation. Concrete blocks are readily utilized in combination with tie rods, structural anchoring, and thrust collars.



1. Thrusts

The hydrostatic thrusts for any system may be determined by proportion from Table 10 , Thrust at Fittings at 100 psi Water Pressure. The thrust forces acting on a bend are defined as follows:

$$T = 2PA\sin\frac{\theta}{2}$$

Where: T=Thrust at fitting in pounds
P=Hydrostatic pressure in psi
A=Flow area of pipe in square inches
θ =Angle of bend in degrees

Table 10.

Total Pounds Thrust at Fittings at 100 psi Water Pressure

Nom. Pipe Diameter	Dead End (Tee)	90° Bend	45° Bend	22½° Bend	11¼° Bend
2 in	381 (173 kg)	538 (244 kg)	291 (132 kg)	148 (67 kg)	75 (34 kg)
3 in	855 (388 kg)	1,209 (548 kg)	655 (297 kg)	334 (152 kg)	157 (76 kg)
4 in	1,452 (1,460 kg)	2,053 (931 kg)	1,112 (504 kg)	567 (257 kg)	285 (129 kg)
6 in	3,218 (2,455 kg)	4,549 (2,063 kg)	2,462 (1,117 kg)	1,255 (569 kg)	631 (286 kg)
8 in	5,412 (3,854 kg)	7,652 (3,471 kg)	4,141 (1,878 kg)	2,111 (958 kg)	1,060 (481 kg)
10 in	8,497 (5,391 kg)	12,013 (5,449 kg)	6,502 (2,949 kg)	3,315 (1,504 kg)	1,665 (755 kg)
12 in	11,886 (6,985 kg)	16,804 (7,622 kg)	9,095 (4,125 kg)	4,636 (2,103 kg)	2,329 (1,056 kg)
14 in	15,398 (6,985 kg)	21,770 (9,875 kg)	11,782 (5,344 kg)	6,007 (2,725 kg)	3,017 (1,369 kg)
16 in	20,112 (9,123 kg)	28,434 (12,898 kg)	15,389 (6,980 kg)	7,845 (3,558 kg)	3,941 (1,788 kg)

Note: To determine thrust at pressures other than 100 psi, multiply the thrust obtained in the table by the ratio of the pressure to 100.

Example: 8 in., 90° bend at 150 psi = $7{,}652 \times \frac{150}{100} = 11{,}478$

2. Thrust Block Design
Once the applied thrusts are determined, the designer of the thrust blocks must consider soil strength, soil stability, and the location of the water table. Blocks must have the following physical characteristics in order to be effective.
a) An adequate bearing area to resist the soil thrust.
b) A bearing surface which is directly against undistrubed soil.
c) The resultant thrust vector must pass perpendicularly through the center of the bearing surface.
d) Should the soil be unstable or the installation below the water table, the engineer will have to introduce special provisions such as piles or tie rods to insure stability.

Table 11, Safe Bearing Pressure of Soils*, reviews the safe bearing pressure of various soils which my be encountered during installation.

Table 11.
Safe Bearing Pressure of Soils

Nature of Soil	Safe Bearing Pressure (S_p) lbs/ft.^{2}
Solid ledge of hard rock, such as granite, trap, etc.	50,000-200,000 (244,000-977,000 kg/m^2)
Sound shale and other medium rock, requiring blasting for removal	20,000-30,000 (98,000-146,000 kg/m^2)
Hardpan, cemented sand and gravel, difficult to remove by picking	16,000-20,000 (78,000-98,000 kg/m^2)
Soft rock, disintegrated ledges	10,000-20,000 (49,000-98,000 kg/m^2)
Compact sand and gravel, requiring picking for removal	8,000-12,000 (39,000-59,000 kg/m^2)
Hard clay, requiring picking for removal	8,000-10,000 (39,000-49,000 kg/m^2)
Gravel, coarse sand, in natural thick beds	8,000-10,000 (39,000-49,000 kg/m^2)
Loose, medium, and coarse sand; fine compacts sand	2,000-8,000 (15,000-39,000 kg/m^2)
Medium clay, stiff but capable of being spaded	4,000-8,000 (19,500-39,000 kg/m^2)
Fine loose sand	2,000-4,000 (9,800-19,500 kg/m^2)
Soft clay	2000 (9,800 kg/m^2)
Quicksand	0

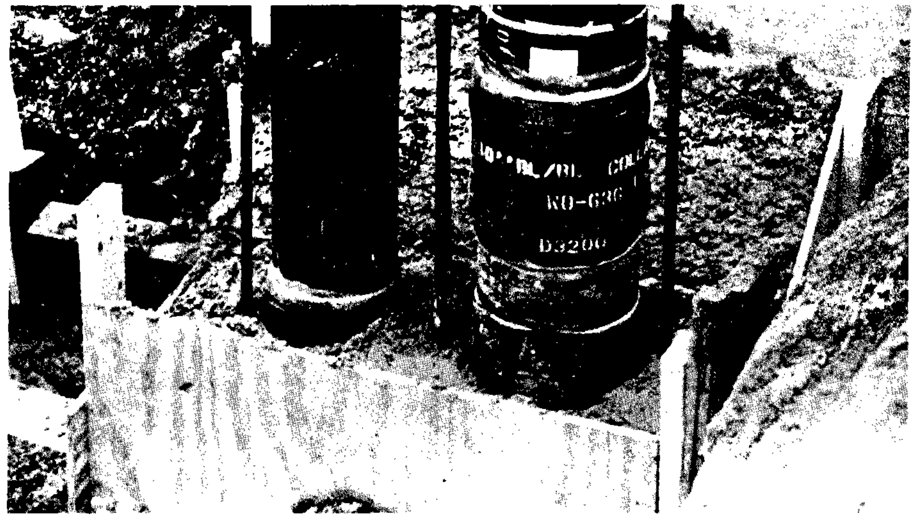
The bearing area required to provide a successful thrust block is computed as follows:

$$A_b = \frac{T}{S_p}$$

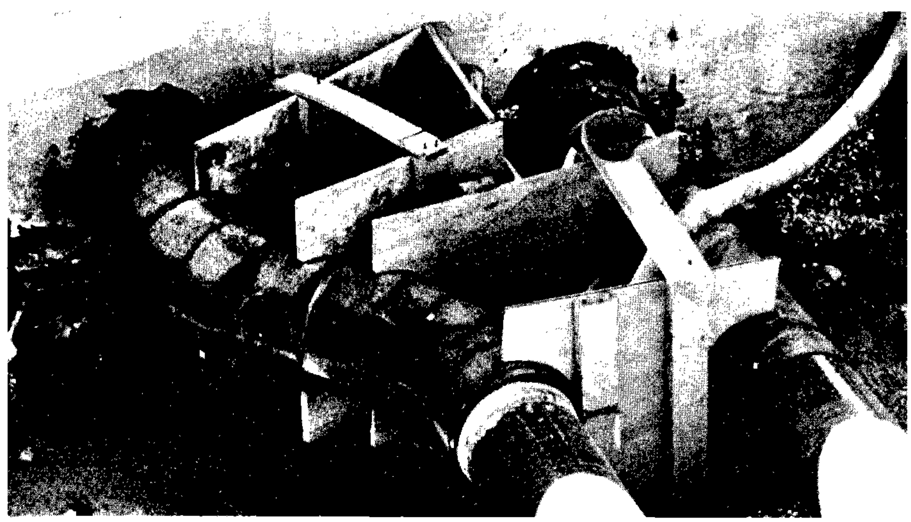
Where: A_b=Bearing area of thrust block in square feet
T=Thrust at fitting in pounds
S_p=Allowable soil bearing pressure in pounds/square ft

3. Thrust Block Construction
Thrust blocks should be poured after hydrostatic testing of the pipe. This will allow for clear visual inspection of all fitting joints during the test. To prevent excessive pipe movement and possible shear or bending failures, temporary thrust blocking consisting of floor jacks and wooden timbers should be used. The following procedures should be closely observed during the construction of a thrust block.
a) The thrust block should be shaped with the "designed bearing area" against virgin earth of the trench wall.
b) Thrust blocks which are two square feet or greater in size will require forms for shaping. Position the forms so that the joints of the fitting will not be covered with concrete. Smaller thrust blocks using a dry mix can be shaped by hand.

*See *Marks' Standard Handbook for Mechanical Engineers*, eds. Theodore Baumeister, Eugene Avallone and Theodore Baumeister III (New York: McGraw-Hill Book Company, 1967, 1978)



c) The trench should be undercut within the boundaries of the form at least 6 inches to give additional thrust resistance and to provide for an adequate concrete envelope around the fitting.
d) If more than one line is installed in the ditch, it may become necessary to encapsulate a pipe in concrete to reach the desired undisturbed or virgin trench wall. In this situation, neoprene rubber of 40 to 70 durometer, 1/2" thick, and of sufficient length to extend 2" beyond the face of the thrust block, must be wrapped around the pipe wall.



e) Unless otherwise specified by the engineer, an acceptable concrete mix is 1 part Portland cement, 2 part washed sand, and 3 parts washed gravel with enough water for a relatively dry mix.
f) When pouring the thrust block, it is important that the concrete be "worked" thoroughly around the fitting for maximum surface contact. Take care that the entire area between the fitting and the freshly cut trench wall is filled with concrete and free of voids. A minimum of 6" of concrete should be over the top of the fitting.
g) Maintain at least a 2" space between a concrete vibrator and the pipe or fitting while compacting the concrete.
h) In the case of valves installed in-line, a valve block must be poured under the valve with the necessary supporting steel. The steel will support the valve and resist any torque or twisting action caused by the opening or closing of the valve.

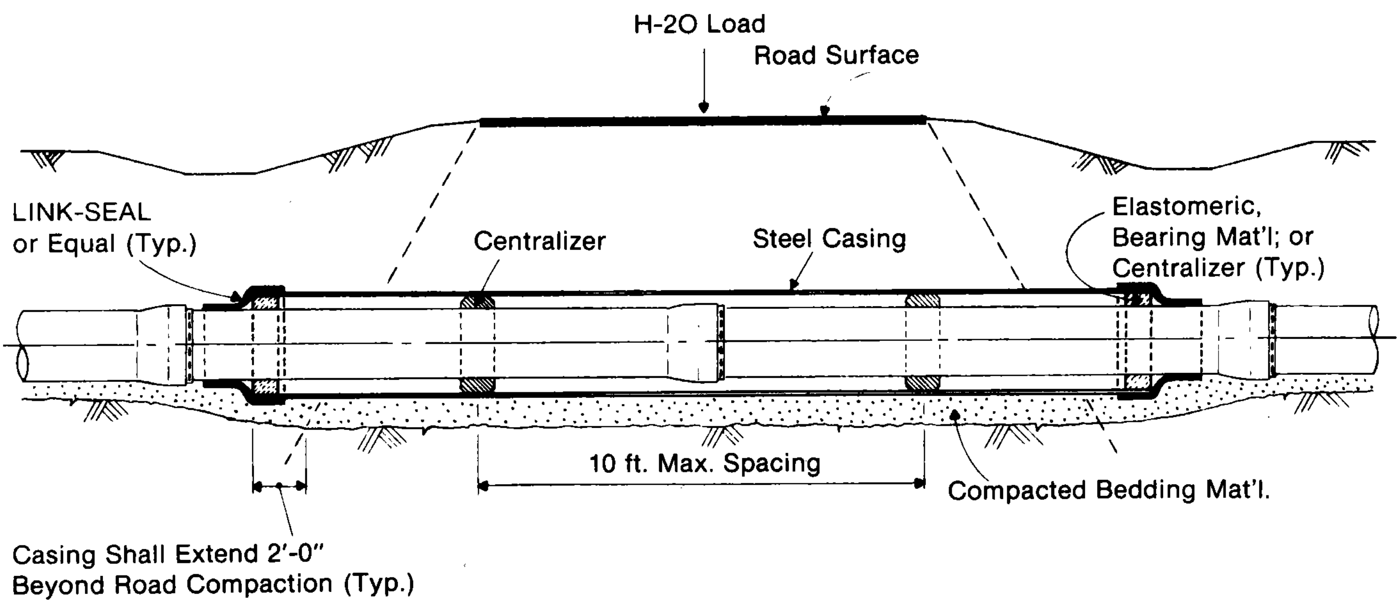
D. Casing

Protective casing is recommended for pipe which will be buried beneath heavy vehicular traffic. The casing should consist of conventional steel pipe. The following installation techniques are advised for the casing of CIBA-GEIGY fiberglass pipe. Refer to Figure 11, Typical Sleeved Road Crossing and Figure 12, Typical Sleeved Railroad Crossing.

1. Thoroughly compact the ditch bed along the entire reach of the crossing, especially at each end.
2. Install a sufficient length of steel casing so that it extends two feet beyond the road compaction wedge on each side of the road.
3. If the length of the crossing dictates that more than one length of pipe will be needed, the joint(s) makeup procedure should be in strict accordance with the respective procedure outlined in Chapter 4, Joining Systems.
4. Install centralizers or padding on the fiberglass pipe every ten feet to protect the pipe wall from abrasion.
5. Carefully slide the fiberglass pipe inside the steel casing making sure that the centralizers are securely in place.
6. Install centralizers at each end of the casing in order to protect the fiberglass pipe from point loading due to settling overburden.
7. Install a LINK-SEAL* for equivalent at each end of the casing to protect the casing from flooding and consequential floating of the fiberglass pipe.
8. Backfill the casing in accordance with the recommended backfill procedures discussed in sections F & G of this chapter.

Note: LINK-SEAL may be used as combination centralizer and casing seal.

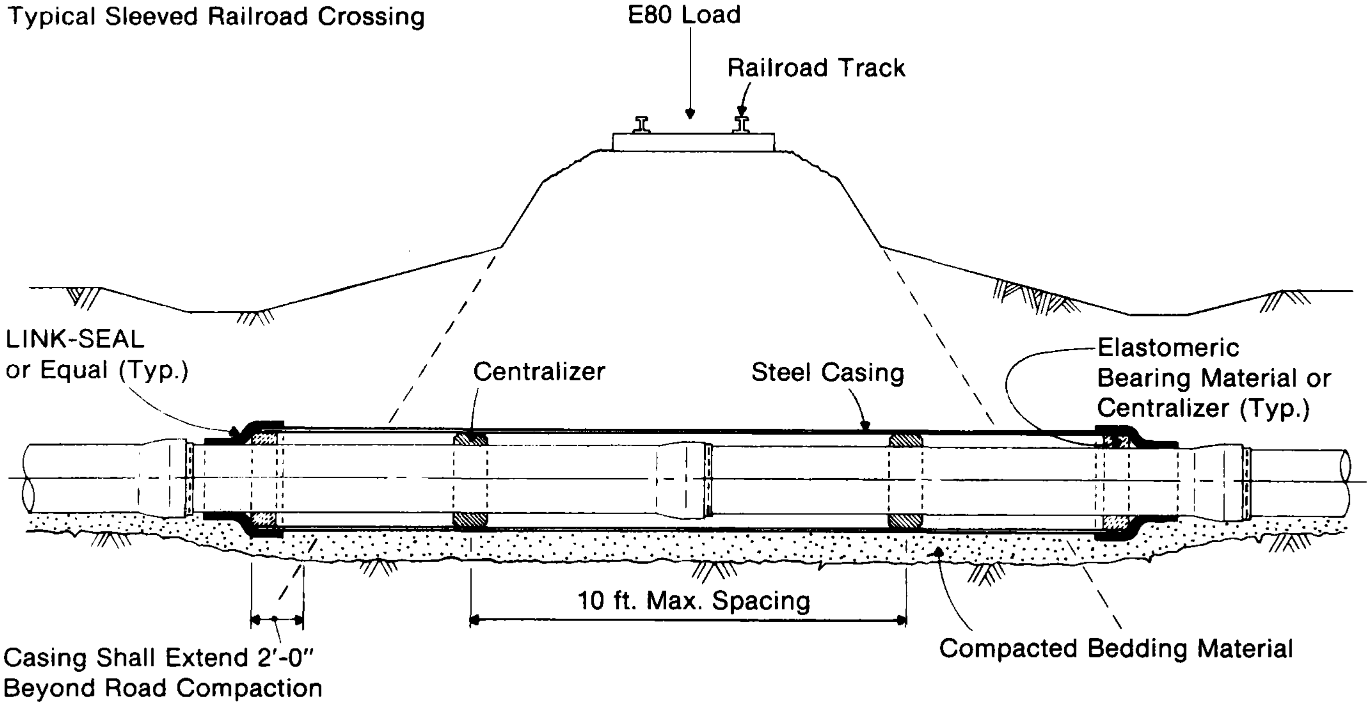
Figure 11.
Typical Sleeved Road Crossing



*LINK-SEAL is a registered trademark of THUNDERLINE Corporation.

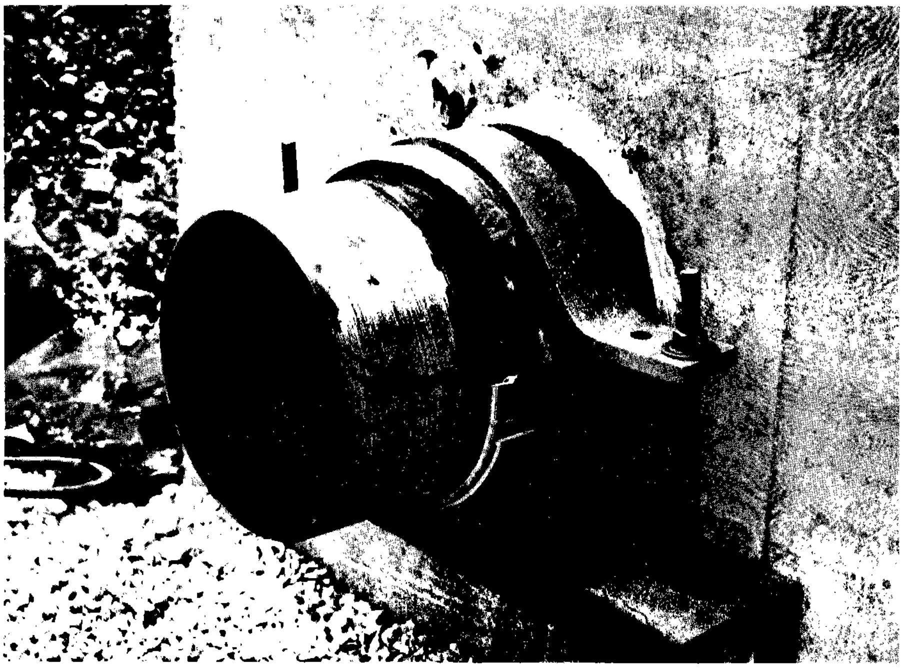
10.1-180

Figure 12.
Typical Sleeved Railroad Crossing



E. Wall Penetration

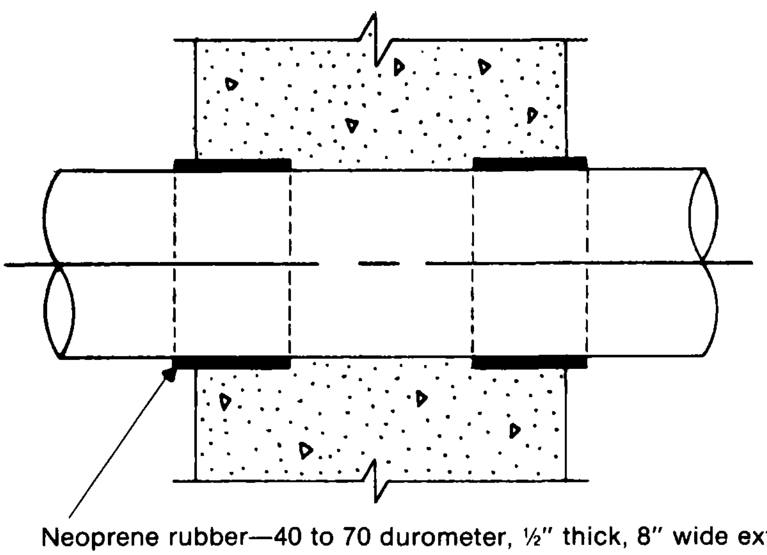
It is important to observe certain precautionary installation procedures when pipe passes through a wall. If the pipe is **not** properly installed and differential movement occurs between the pipe and the wall, bending stresses may develop in the pipe which could ultimately cause failure. The following wall penetration details should be observed with CIBA-GEIGY fiberglass pipe in order to prevent the development of excessive pipe stresses. (Refer to Figure 13, Typical Wall Penetration Details.)



1. Carefully examine the design of the structure vs. the soil stability to prevent any excessive settling of the structure relative to the pipe.
2. Overexcavate the trench 2 times the pipe diameter for 2"-6" pipe and 1½ times the pipe diameter for 8"-16" pipe for a distance of 2 feet from the face of the wall.
3. Backfill the overexcavated area with pea gravel, crushed stone, or crushed gravel at a grain size of less than 1 inch.
4. Compact the overexcavated area using a mechanical compactor or equivalent to the compaction requirements outlined by the job specifications.
5. The pipe may be cast in place if neoprene rubber of 40 to 70 durometer, ½ inch thick, and 8 inches wide is wrapped around the pipe. Position the rubber so that upon completion of the wall penetration, it will extend 2 inches beyond the face of the wall.
6. For 8"-16" pipe, where poor soil stability could cause settling of the structure, a Pronto-Lock II joint may be cast in place following the installation procedure outlined in paragraph 5. The Pronto-Lock II joint has (±) 2 degree deflection capability and will accommodate most settling. Where severe settling is expected, a short nipple and a second Pronto-Lock II joint may be incorporated.
7. The pipe may be fitted through a steel pipe sleeve that is a minimum of 2 inches larger in diameter and caulked into place with a waterproof compound which will dry to a firm but pliable mass.
8. For a hydrant system, the pipe must be securely fastened to the structure with an angle iron and pipe clamp assembly to prevent any movement at the point of wall penetration due to wave action.
9. Valves must be supported independently of pipe.

Figure 13.
Typical Wall Penetration Details

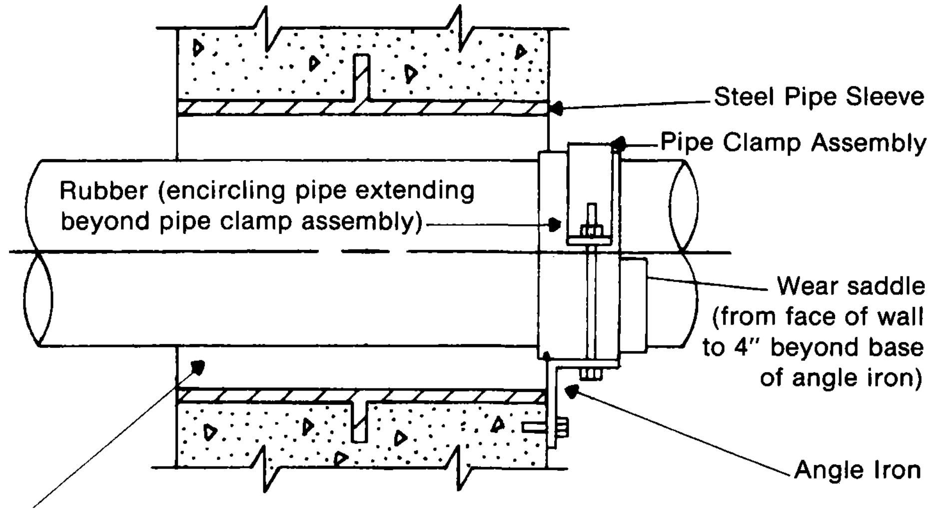
Cast in Place



Neoprene rubber—40 to 70 durometer, ½" thick, 8" wide extending 2" beyond the face of the concrete

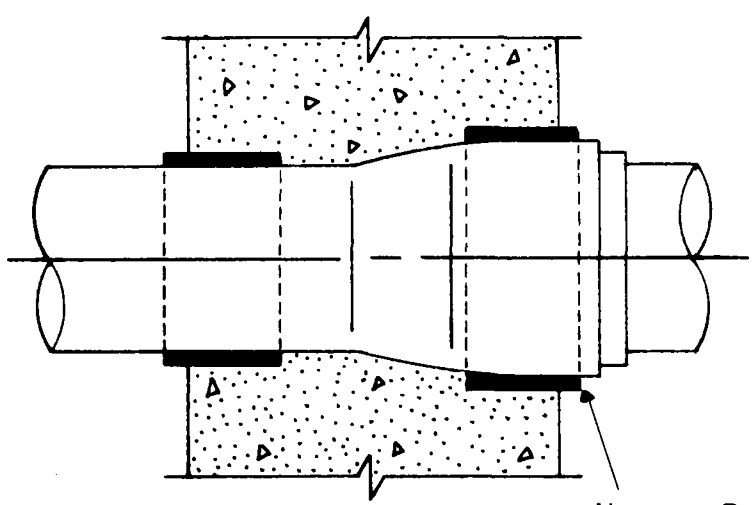
Figure 13.
Typical Wall Penetration Details (con't.)

Steel Pipe Sleeve with Restraint



Note: Angle iron & pipe clamp assembly are recommended when entering a valve pit on a hydrant system.

Cast in Place—Pronto-Lock II



Note: The 8"-16" Pronto-Lock II has a ± 2 degree deflection capability and will accommodate most settling. Where severe settling is expected, a short nipple and a second Pronto-Lock II joint may be incorporated.

F. Pipe Zone Backfill

The primary pipe zone backfill (see Fig. 14) provides continuous sidewall support for the pipeline. Since CIBA-GEIGY pipe functions as a "flexible conduit," vertical loads imposed from the above result in vertical pipe deflection and attendant sidewall expansion. The passive resistance of the soil to this sidewall expansion acts to help support the external load. It is important to limit vertical pipe deflection to 5% of the inside diameter, therefore the primary pipe zone backfill should be placed in layers on each side of the pipe and compacted as outlined below to insure adequate sidewall support.

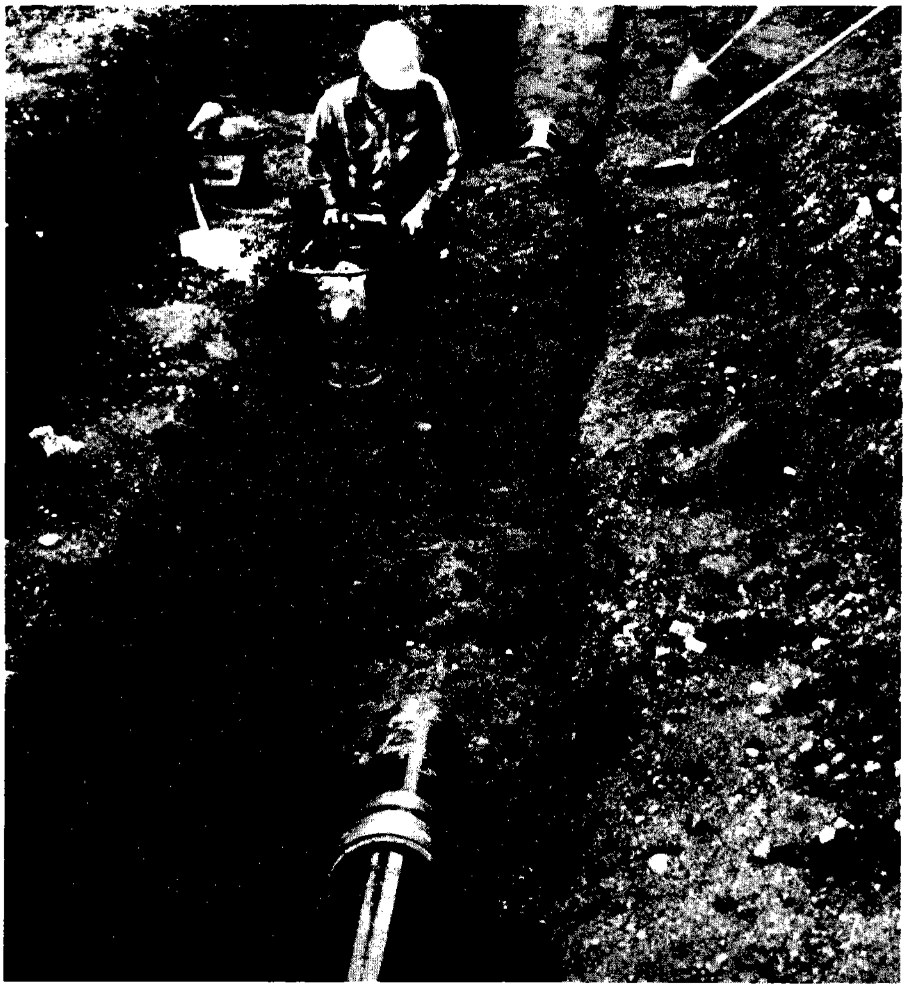
1. The primary pipe zone backfill material should consist of sound earth or granular material free of stones or lumps exceeding 1 inch in diameter. Also, the material should not contain vegetation or debris which could leave unfilled pockets. Granular materials such as sand, gravel, or crushed rock yield high densities with a minimum of compaction effort and are ideal for the primary zone backfill.
2. The primary pipe zone backfill should be compacted in 6" lifts up to a minimum depth of 70% of the outside diameter of the pipe.
3. The primary pipe zone backfill material should be blended sufficiently to secure the best possible degree of compaction and stability. Compaction may be performed by mechanical, hydraulic, or hand tamping methods. In the case of hydraulic compaction, the following considerations must be observed.
a) Where soils are claylike or silty and would impede free drainage, hydraulic methods shall not be used.
b) Free draining granular soils may be compacted by hydraulic methods with or without the aid of surface or internal vibration as required to achieve specified compactions.

10.1-184

Secondary Pipe Zone Backfill
The secondary pipe zone backfill extends from 70% of the pipe diameter (0.7D) to one diameter above the pipe and should consist of the same materials as the primary pipe zone backfill. The secondary pipe zone backfill should be brought up in 6" lifts uniformly on both sides of the pipe and compacted in accordance with the engineering specifications.

Notes
1. Backfill and compaction should be specified by the engineer along the entire length of the pipeline as shown on the plans and drawings.
2. Fittings and joints should be left open for inspection during testing (Chapter 10). Once testing is completed, the entire pipe zone backfill should be brought up uniformly on both sides of the pipe.

3. Care should be taken during compaction to prevent displacement of the pipe due to floating or shifting, and to prevent impact damage to the pipe wall. Do not use mechanical compactors *directly over* the pipe until at least 12 inches of fill has been placed over the pipe, or at least 24 inches if heavy compaction equipment is used. Regardless of the compaction method, the primary backfill material should be packed and compacted to the dimensions and compactions outlined by the job specifications which are the controlling authority.
4. Backfill and compaction recommendations are in accordance with ASTM D-2321; "Standard Recommended Practice for Underground Installation of Flexible Reinforced Thermosetting Resin Pipe & Reinforced Plastic Mortar Pipe."



10.1-185

G. Secondary Backfill

The secondary backfill follows the completion of the compaction of the pipe zone backfill and involves the backfilling of the entire trench. The following secondary backfill procedures should be observed in order to insure proper pipe installation and performance.

1. Secondary backfill should not be placed until conformance with specified compactions of the pipe zone backfill materials has been confirmed.
2. The secondary backfill material can include the native soil if it has been adequately graded to eliminate vegetation, debris, and large stones or lumps.
3. The secondary backfill material should be carefully placed over the pipe zone backfill making sure that all fittings and joints remain uncovered for testing.
4. Do not use mechanical compactors directly over the pipe until at least 12 inches of fill has been placed over the pipe, or at least 24 inches if heavy compaction equipment is used.
5. If there are to be live loads over the pipeline, the secondary backfill should be placed and compacted in 6" lifts as described in "Pipe Zone Backfill."
6. Backfilling on hills should receive extra attention and heavier compaction to prevent washout. Backfilling should be done in short lifts almost to the top of the trench, then rocks and stones added to the top layer to avoid soil erosion.
7. After burying a portion of the line, ring deflections may be checked to evaluate backfill techniques.

$$\text{Deflection \%} = \frac{\text{Nominal I.D.-Installed vertical I.D.}}{\text{Nominal I.D.}} \times 100$$

Figure 14.
Trench Excavation & Backfill Terminology

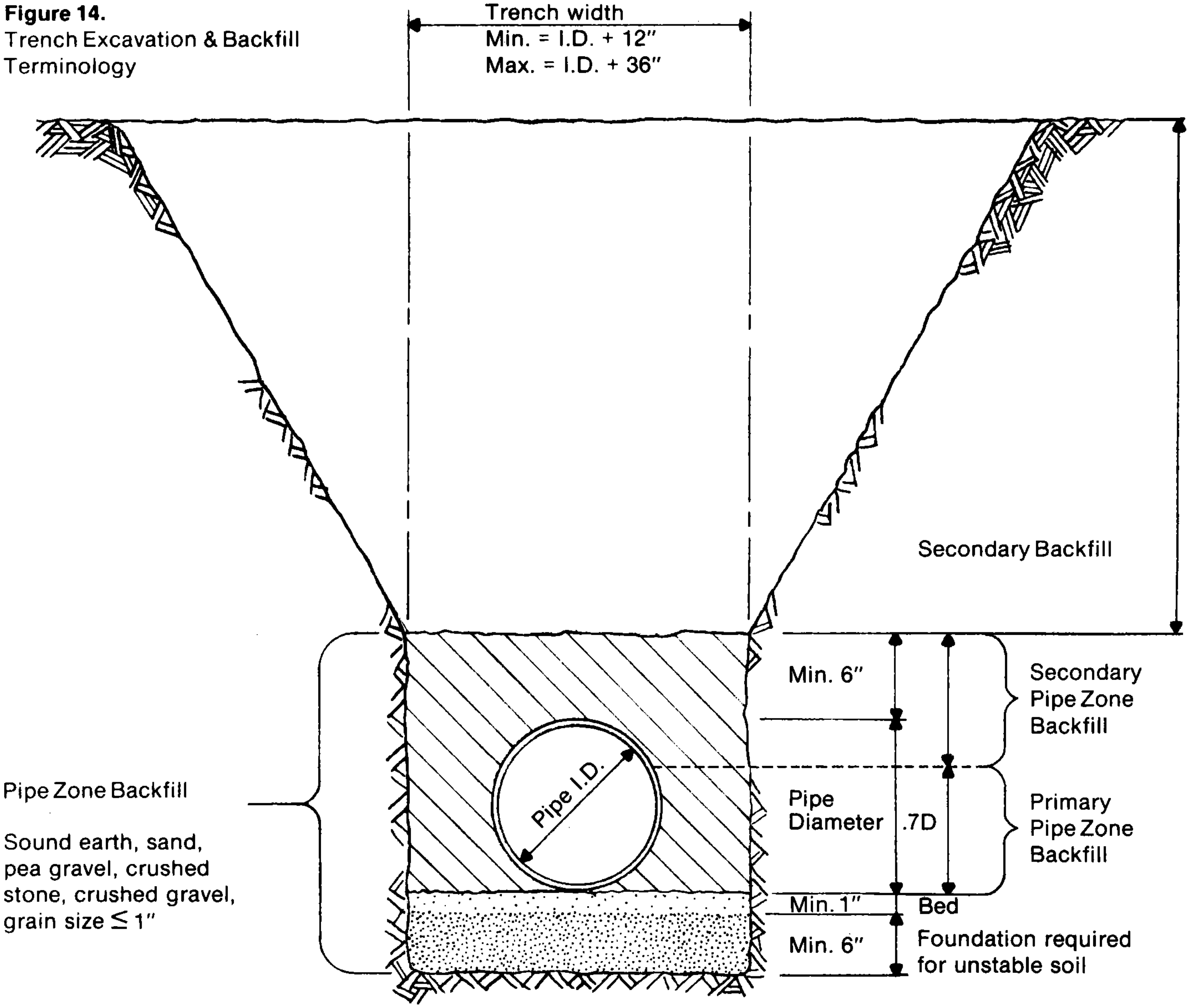
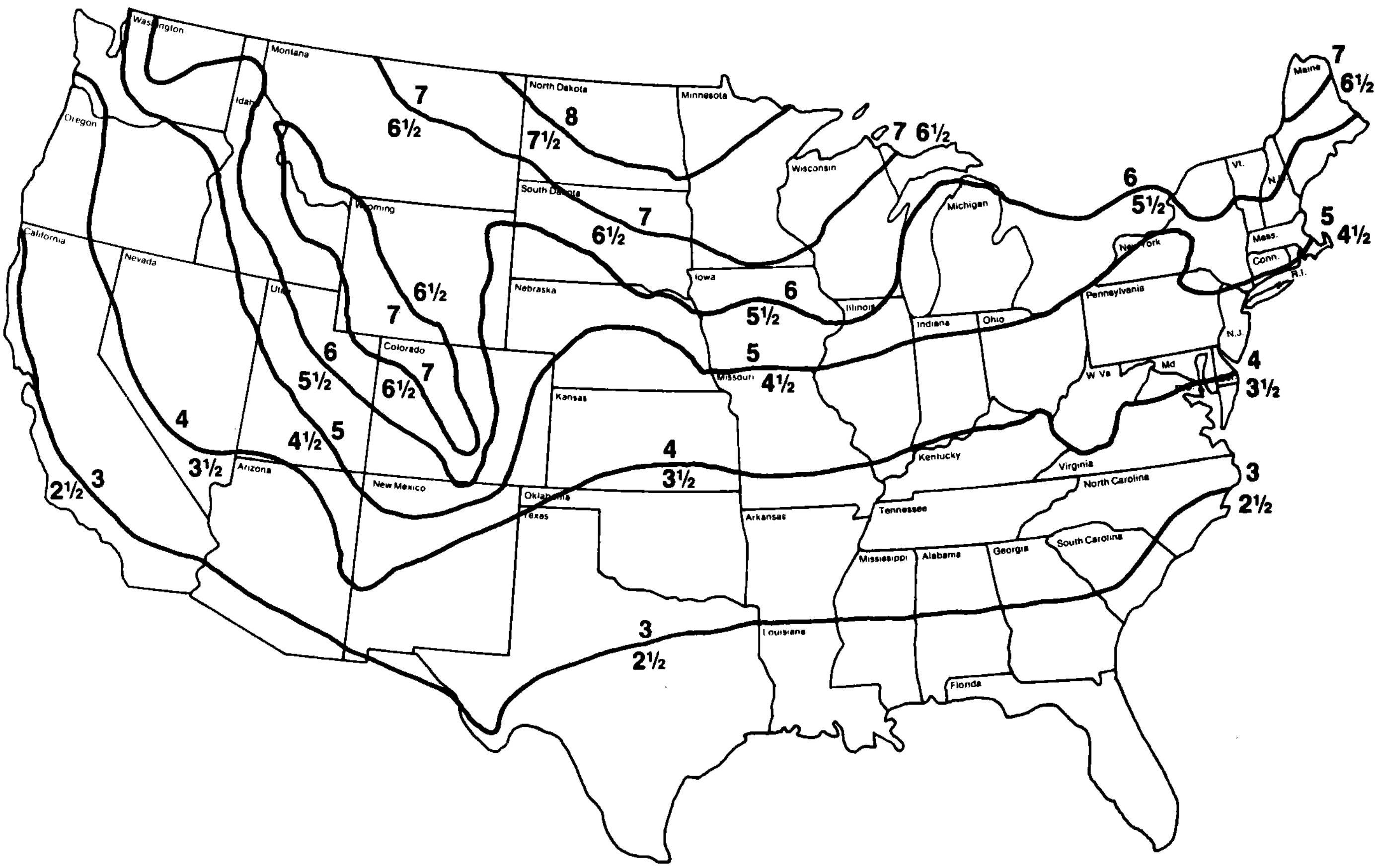


Figure 15. Recommended Depth of Cover for Frost Protection* (in feet)



H. River and Canyon Crossings

Occasionally during the course of installation of a cross-country pipeline, environmental obstacles such as rivers and canyons are encountered. To successfully cross these barriers with CIBA-GEIGY fiberglass pipe entails the observance of certain recommended installation procedures which are outlined below.

Rivers

The methods of pipe installation for the successfull crossing of rivers can be divided into two categories: supported above and buried. The specific mode of installation utilized is dependent upon the physical characteristics of the river (width, depth, current, etc.), the river traffic, the expected working life of the installation, the materials available on site, and the type of pipe joining system used.

1. Supported Above

The pipe can be supported above the river if the design of the supporting system is in accordance with the design recommendations detailed in Figure 16, Typical Supported River Crossing. A summary of these recommendations include the following:

a) The supports should be sturdily built and have legs which are long enough to adequately penetrate the riverbed and remain intact. If timber is to be used in building supports, it must be pretreated to guard against biological attack.

b) A cradle in the shape of the pipe should be cut in the horizontal cross

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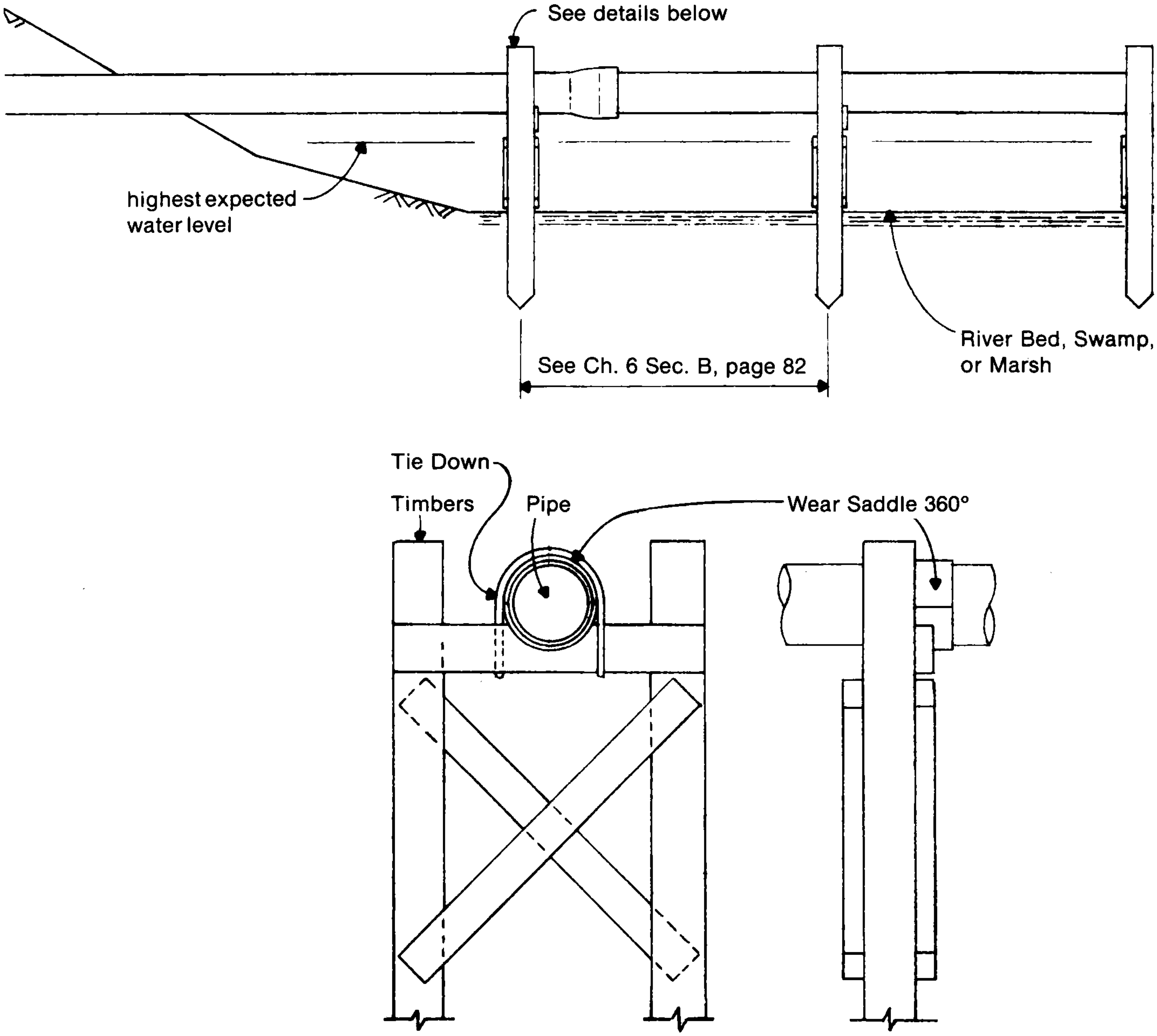
Figure 16. Typical Supported River Crossing



member of each support to provide more bearing surface and prevent horizontal movement of the pipeline.
c) The spacing of supports should be in agreement with the spacing requirements specified in Chapter 6, Section B, page 82.
d) At each support, install two 180° wear saddles to encircle the pipe and consequently protect the pipe wall from point loadings.
e) Securely fasten the pipe at each support with the use of nylon rope. A crisscross pattern is suggested to prevent slippage of the tiedown.

The installation of a pipeline which is supported above a river is most appropriate when the river is shallow, the needed materials are easily available, the river has no traffic, and the installation is expected to be temporary. Care should also be taken to allow for thermal expansion/contraction as well.

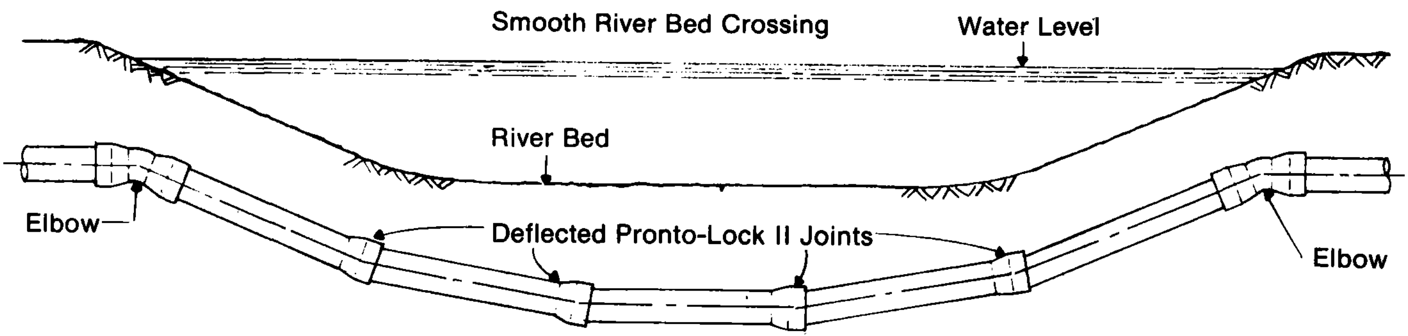
2. Buried

The installation of a buried pipeline beneath a riverbed can be successfully completed by observing one of the following burial techniques. (Refer to Figure 17, Typical River Crossings)

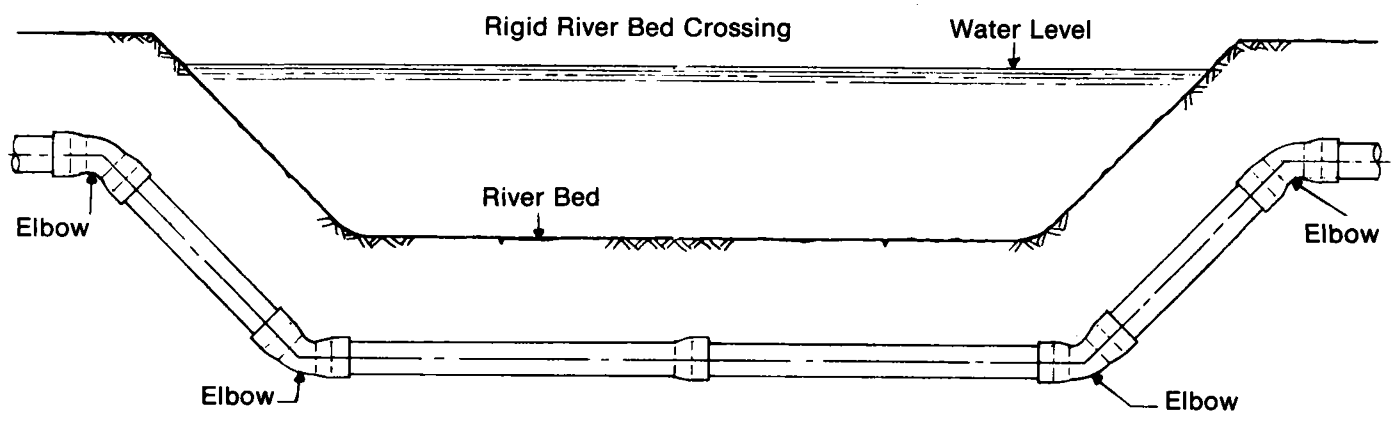
a) Smooth Riverbed Crossing

A smooth riverbed crossing is a crossing in which the pipeline makes a constant but gradual direction change. In such a crossing with CIBA-GEIGY fiberglass pipe, the Pronto-Lock II joint should be incorporated. This unique joint possesses a 2° deflection capability and therefore allows a smooth or gradual change in the direction of the line without the use of elbows. Use the guidelines for deflection of both pipe and joint outlined in Table 9, "Pipe Deflection Capability," when determining the number of Pronto-Lock II joints needed to produce the required directional change for a given installation.

Figure 17. Typical River Crossings



Note: Pipe can be pre-assembled and pulled wet, or floated into place Max. deflection of each Pronto-Lock II Joint = 2°



b) Rigid Riverbed Crossing

A rigid riverbed crossing entails the installation of a straight section of pipe which is subsequently connected to an elbow on each side of the crossing. The elbow provides the necessary change in direction for the scaling of the transition from the riverbed to the desired height on the riverbank. This type of installation is applicable for all types of joining systems.

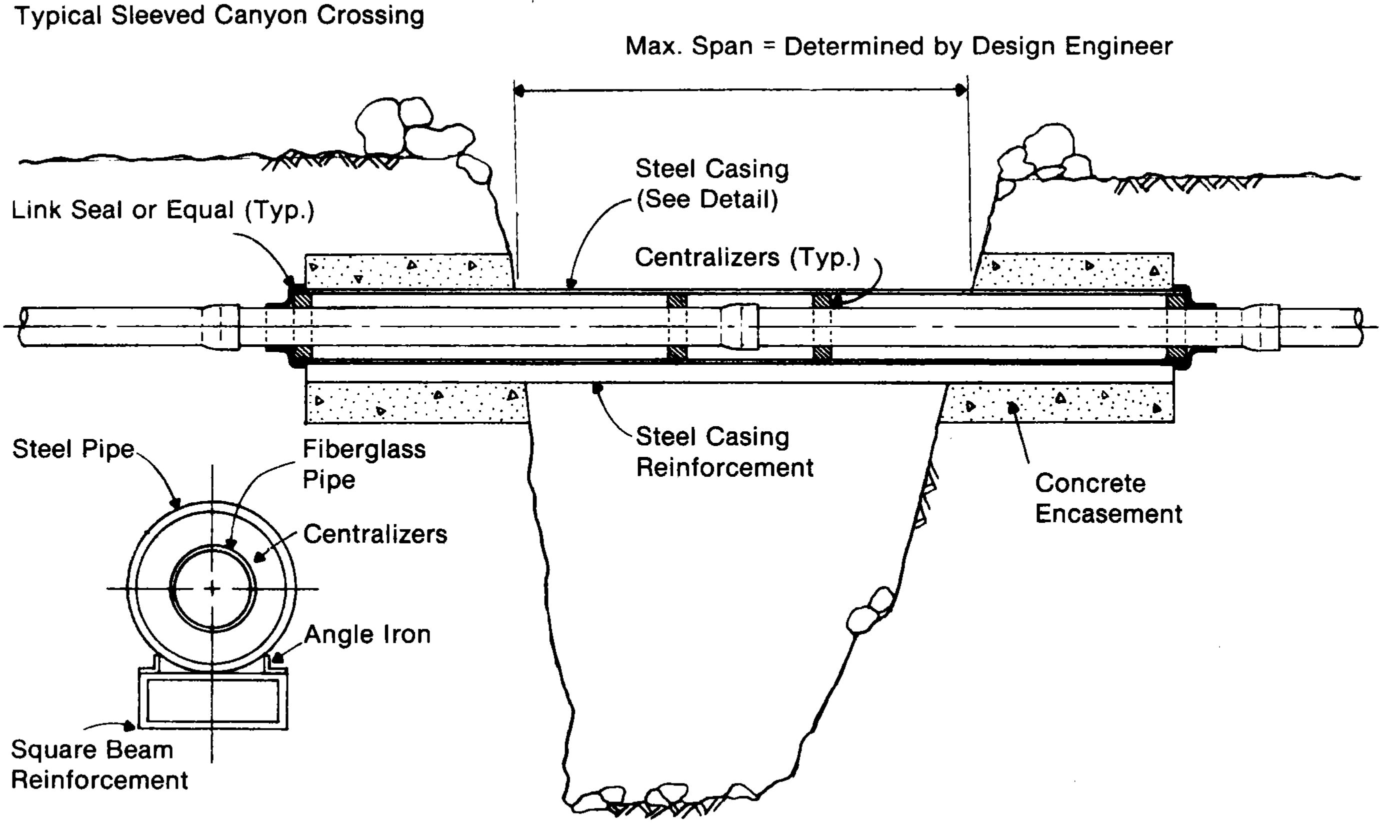
Prior to the installation of a buried river crossing, the riverbed must be properly dredged to acquire the necessary ditch and to remove all debris and objects which may damage the pipe wall. The pipeline can be installed by either floating a preassembled line into place and sinking it into position or by pulling the line across as it is assembled with the use of a winch. Whichever method is employed, it is highly advisable to inspect the pipe wall for any signs of damage and to test all joints prior to installation.

The installation of a buried pipeline is most applicable when the river is deep, experiences heavy traffic, and the installation is permanent. Consult the CIBA-GEIGY Pipe Systems Department for the specifics of installation mentioned above.

Canyons
There are two methods of pipe installation for the successful crossing of canyons: sleeved and buried. The specific mode of installation utilized is dependent upon the physical characteristics of the canyon (width and depth) and the materials available on site.

1. Sleeved
The pipe can be sleeved above a canyon if the design of the casing is in accordance with the design specifications detailed in Figure 18, "Typical Sleeved Canyon Crossing." A summary of the recommendations include the following:
a) Overexcavate the ditch at least twice the pipe diameter at each face of the canyon wall for a distance to be determined by the design engineer.
b) Install a sufficient length of square beam reinforcement and steel casing to bridge the canyon, penetrate the canyon walls, and extend

Figure 18.
Typical Sleeved Canyon Crossing



to the end of each overexcavated area. Angle irons must be welded to the square beam reinforcement to guide the steel casing. The maximum span feasible to effect a successful canyon crossing must be determined by the design engineer.

c) The sleeve and the entire overexcavated area must be encased in concrete to the face of the canyon wall.

d) If the length of the canyon crossing dictates that more than one length of pipe will be needed, the joint(s) makeup procedure should be in strict accordance with the respective procedure outlined in Chapter 4, "Joining Systems."

e) Install centralizers or padding on the fiberglass pipe every 10 ft. to protect the pipe wall from abrasion.

f) Carefully slide the fiberglass pipe inside the steel casing making sure the centralizers are securely in place.

g) Install centralizers at each end of the casing in order to protect the fiberglass pipe from point loading due to settling overburden.

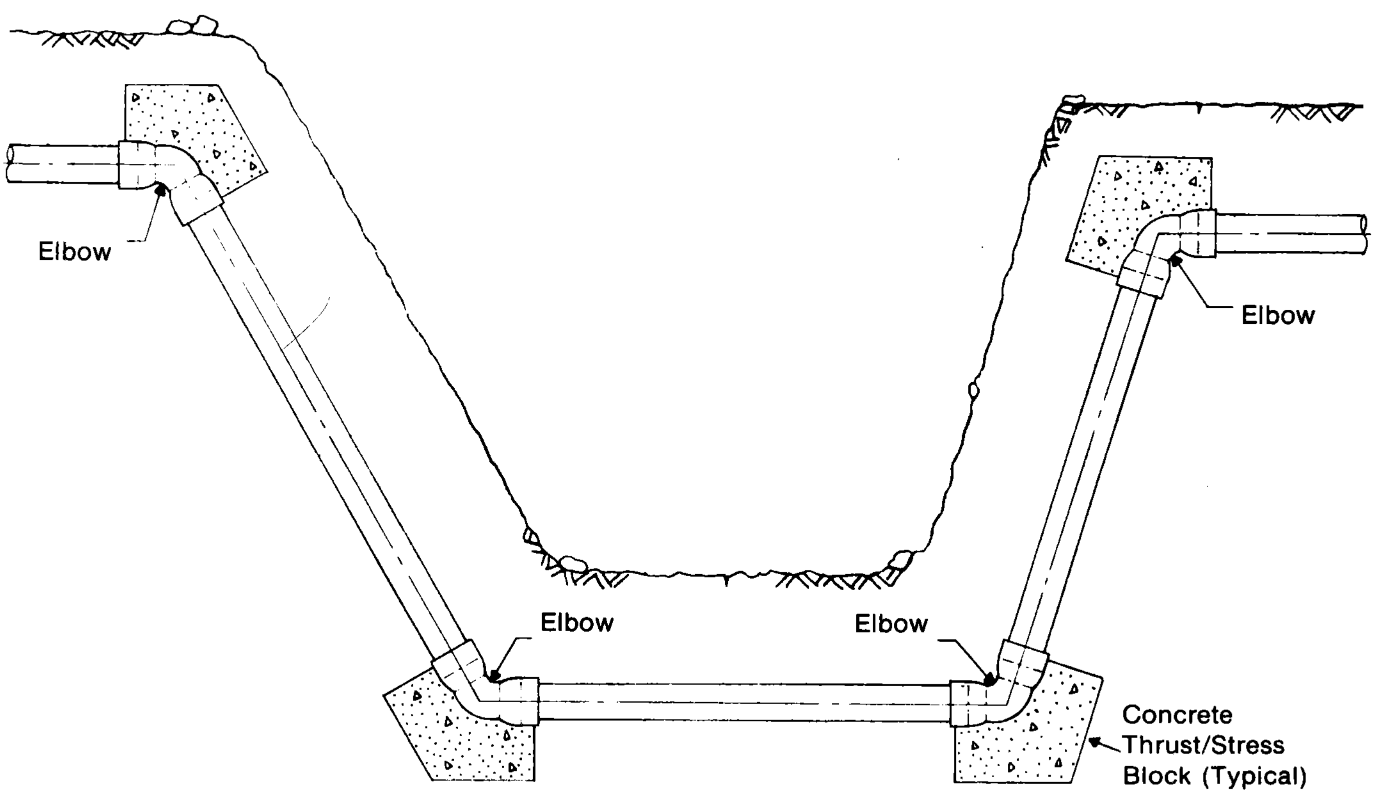
h) Install a Link-Seal or equivalent at each end of the casing in order to protect the casing from flooding.

The installation of a sleeved canyon crossing is most advantageous when the canyon is narrow and deep, and the required materials are easily available.

2. Buried

The installation of a buried canyon crossing should be in agreement with the design recommendations detailed in Figure 19, Typical Buried Canyon Crossing. The layout of the pipeline should basically follow the terrain of the canyon. Thrust blocks should be installed at all severe directional changes in order to help stabilize the system. (Refer to Thrust Blocks, Section C.) The installation of a buried canyon crossing is most appropriate when the canyon's dimensions are wide and shallow.

Figure 19. Typical Buried Canyon Crossing

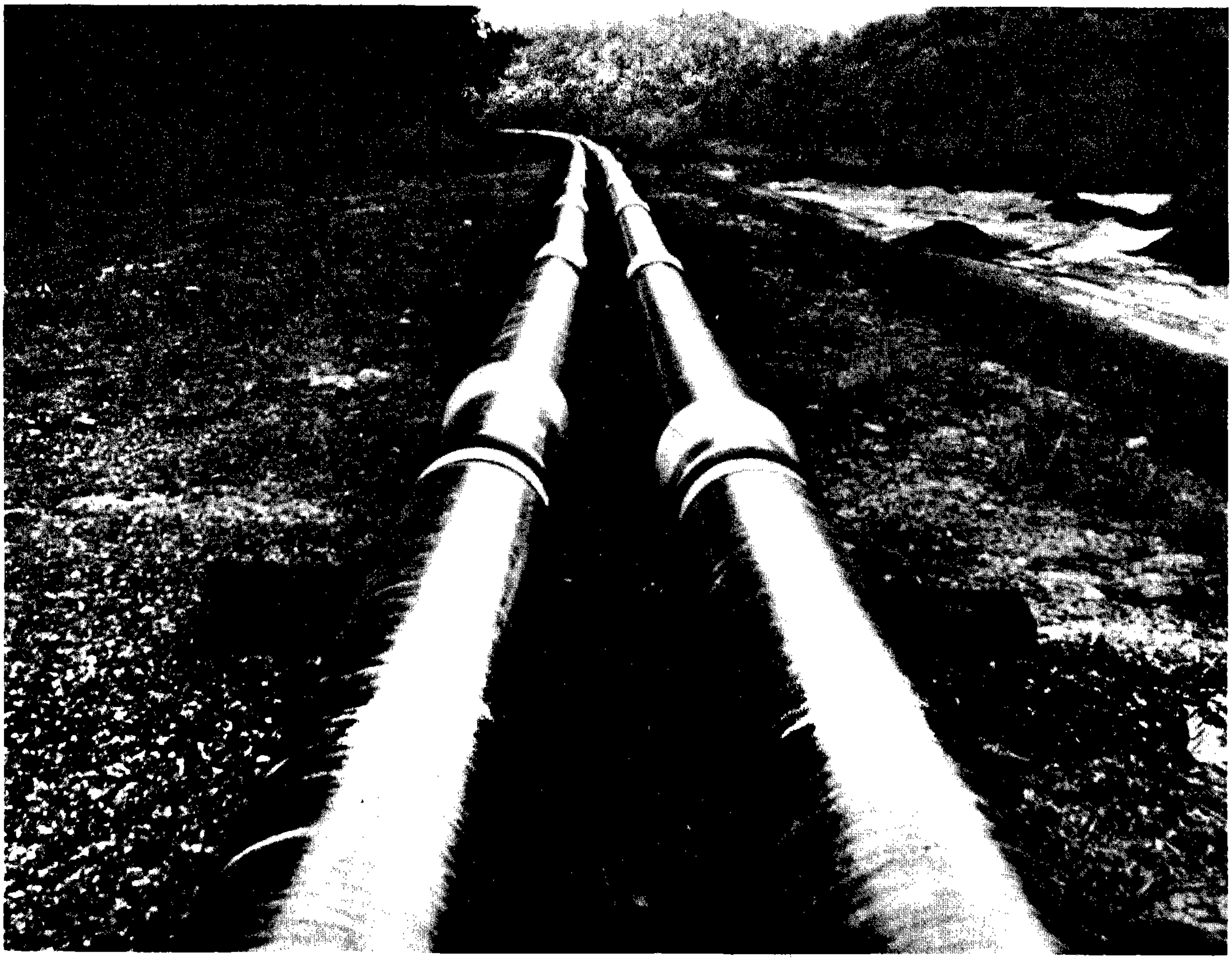


Above Ground Installations

Above ground installations can be divided into two broad categories: lines which are laid directly on the surface of the ground and lines which are suspended overhead. In either case, it is important to understand the physical characteristics and the recommended installation guidelines for above ground CIBA-GEIGY piping to insure maximum pipeline performance.

A. Surface Installation

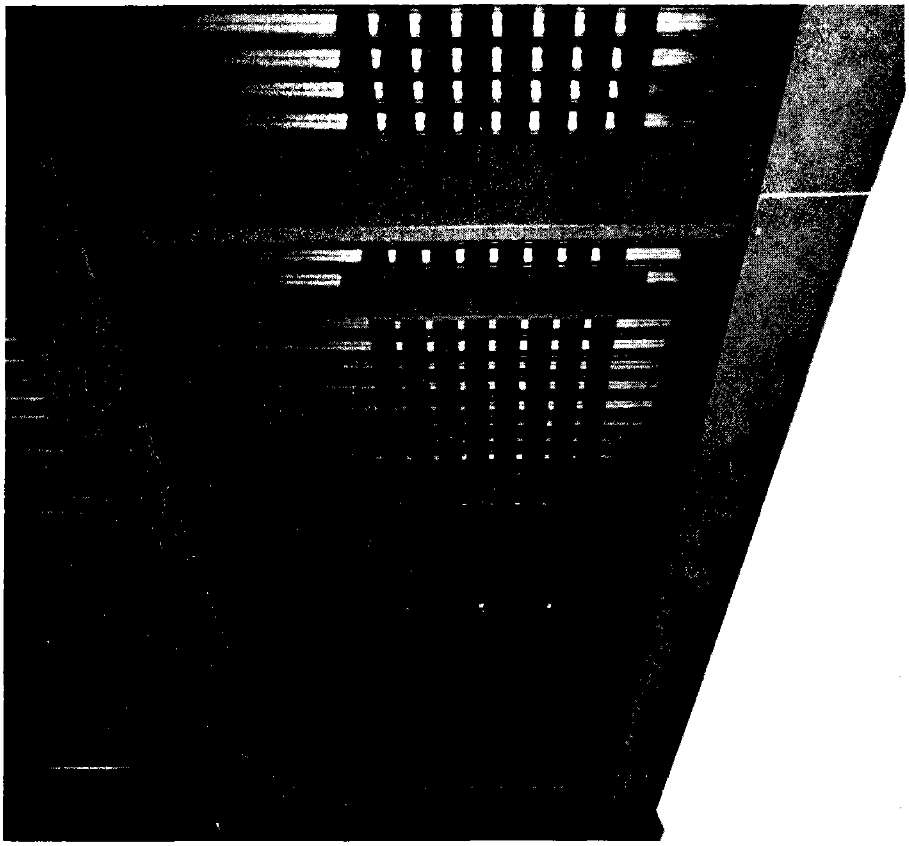
The advantages of surface pipe are the ease and speed of installation. However, there are certain installation procedures and precautions which must be followed to insure optimum performance.



1. The ground on which the pipe is to be laid should be level and free of rocks or sharp objects which might bear against the pipe wall.
2. The pipe may be supported by a support and guide system as detailed in Figure 22, page 86, "Typical Pipe Supports." The spacing of such supports should be in accordance with Figures 20 and 21, page 83, "Single Span Support Spacing." Surface installation on sleepers is highly recommended for 8"-16" pipe.
3. If the pipe is to be laid directly on the ground, slight excavation at the bells should be undertaken to provide uniform support.
4. The pipe should **not** be thrown into place but gently laid into position to protect against possible impact damage as discussed in Chapter 1, Section C.
5. The pipe should be joined following the appropriate joining recommendations presented in Chapter 4, Joining Systems.
6. Care should be taken to insure that there are no excessive bends that would impose undue stress on the pipe. Table 9, page 63, outlines the deflection capabilities of CIBA-GEIGY pipe.
7. If the line is connected to a system which could produce vibration or a pulsing action on the pipe, the areas of support should be protected to prevent the pipe from abrading.
8. Pipe sections should be anchored at valves, changes in direction, and major branch connections. In most cases, pumps, tanks, and other similar equipment can function as anchors. (See Figure 23, page 87, "Restrained Elbow").
9. All thermosetting materials will weather to some degree. If signs of weathering of the pipe are detected by evidence of a chalky surface and/or fuzzy glass reinforcement, the pipe can be painted for protection.

B. Overhead Installation

Correct overhead installation of CIBA-GEIGY pipe requires close attention to the following recommended installation techniques and procedures.



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1. Prepare and assemble joints in accordance with the recommendations in Chapter 4, Joining Systems.
2. Complicated subassemblies such as loops and headers may often be preassembled in a convenient work area for easier, more economical installation.
3. The maximum support spacing recommendations at a given operating temperature for a liquid (specific gravity=1.0) and for a gas are illustrated graphically by Figures 20 and 21. Do not exceed these distances between hangers if deflections are to be 1/2 inch or less.

Figure 20.

Single Span Support Spacing
Liquid (Specific Gravity=1.0)

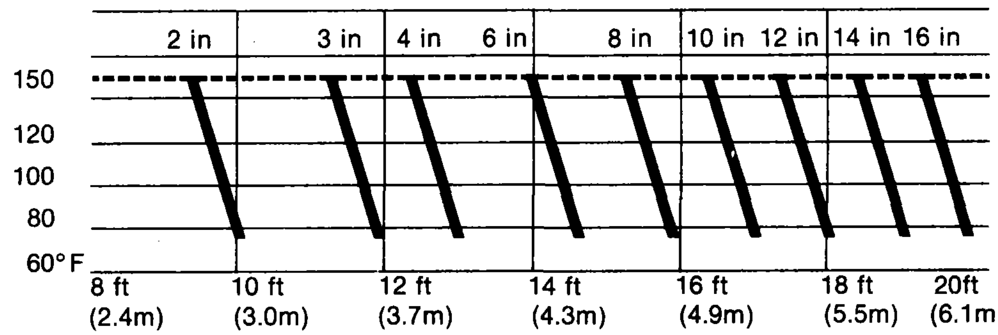
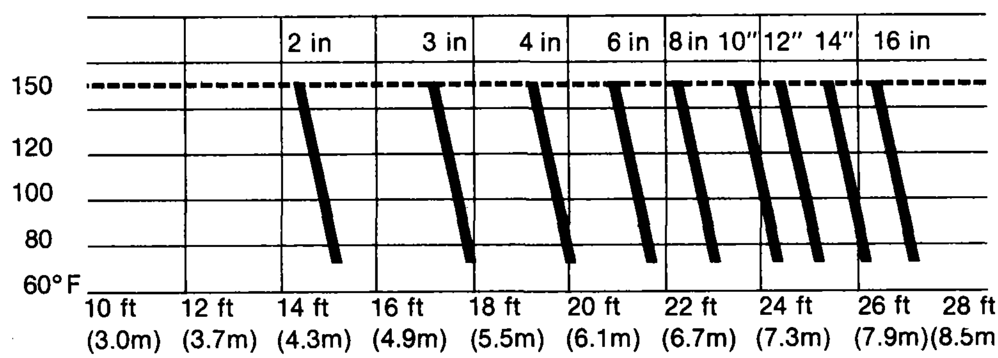


Figure 21.

Single Span Support Spacing
Gases



4. Pipe hanger supports must include the installation of a 180° wear saddle bonded to the bottom of the pipe to protect the pipe wall against a point loading condition and from abrasion due to line movement. The length of the saddle should be two inches greater than the expected movement but should not be less than four inches wide. (See Figure 22, page 86, Typical Pipe Supports). When long hanger rods are used, lateral support may be necessary to prevent excessive movement due to surge and vibration.
5. Pipe hanger clamps should be installed loosely to allow for slight movement of the line and Table 12 outlines the minimum standard clamp width acceptable for each respective pipe size.

Table 12.

Recommended Hanger Clamp Width									
Nominal Pipe Size, Inches	2	3	4	6	8	10	12	14	16
Clamp Width, Inches	1.5	2	2	2.5	3	3	3.5	4	4

6. When wall supports, beams, or concrete sleepers are used, a fiberglass wear saddle must be bonded to the bottom of the pipe and sized as outlined in (4), preceding page. (See Figure 22, Typical Pipe Supports.)
7. Vertical runs may be suspended and attached to the wall with clamps which transfer the vertical loads and thrust to the supporting structure. Wear saddles are required between the pipe wall and the clamp as detailed in Figure 24 , Vertical Pipe Supports. Table 13 shows the required spacing of supports and wear saddle lengths for vertical pipe runs.

Table 13.

Vertical Pipe Support

Nominal Pipe Diameter	Maximum Support Spacing 100°F or less	Maximum Support Spacing 150°F	Wear Saddle Length
2 in	25 ft (8m)	20 ft (6m)	4 in
3 in	25 ft (8m)	20 ft (6m)	4 in
4 in	25 ft (8m)	20 ft (6m)	4 in
6 in	30 ft (9m)	25 ft (8m)	6 in
8 in	30 ft (9m)	25 ft (7.6m)	6 in
10 in	30 ft (9m)	25 ft (7.6m)	6 in
12 in	30 ft (9m)	25 ft (7.6m)	6 in
14 in	30 ft (9m)	25 ft (7.6m)	8 in
16 in	30 ft (9m)	25 ft (7.6m)	8 in

m=meters

Note: Columns more than 200 ft high should be treated as a special design and engineered accordingly.

8. If the pipe is subjected to extreme temperature and pressure changes, expansion joints should be installed to absorb the line expansion and contraction. Table 14 gives the longitudinal expansion of CIBA-GEIGY pipe due to thermal changes.

Table 14.

Longitudinal Pipe Growth	2″-16″	8″-16″
Thermal Growth	All Filament Wound Wall	Composite Wall
(in/100 ft/°F)	.008	.011

Longitudinal pipe stresses & strains due to pressure vary according to wall thickness, pipe design, and installation design. Consult the appropriate product literature or CIBA-GEIGY for individual applications.

9. All valves in a CIBA-GEIGY fiberglass pipe system must be supported independently.
10. When fiberglass pipe is connected to metal pipe, the metal pipe should be anchored at the point of connection so that the expansion and contraction of the metal line is not transferred to the fiberglass line.
11. All connections to tanks or vessels require attention to design details to eliminate transmission of tank wall flexing to the line through the flange. It may be necessary to include an expansion joint to absorb movements.
12. Operating vibration from pumping or other sources, if within reason, will not damage CIBA-GEIGY pipe, providing the line is allowed to move freely and at no point is the line rubbing on rough surfaces or point loaded.
13. Lines which are emptied and filled during the cycle of operation should be anchored or blocked at changes in direction.

Caution: In the event of certain types of suspended pipe failures, at high pressures, a potential safety hazard exists due to the fluid pressure and accompanying pipe recoil reaction. Tests have determined that if the pipe wall is completely cut through or a joint is completely opened up, the resulting rapid loss of pressure can cause a recoil reaction in an unrestrained closed pipeline. Pipe wall failure due to impact damage causes no recoil reaction. Instead, the failure is localized at the exact point of impact, causing a weep-type failure resulting in slow, localized loss of fluid.

This potential safety hazard can be reduced by providing adequate, secure restraints along the length of the pipe installation. CIBA-GEIGY, therefore, recommends that wherever such failure is possible, the pipe be secured in a manner to restrain free movement of the pipeline.

Figure 22. Typical Pipe Supports

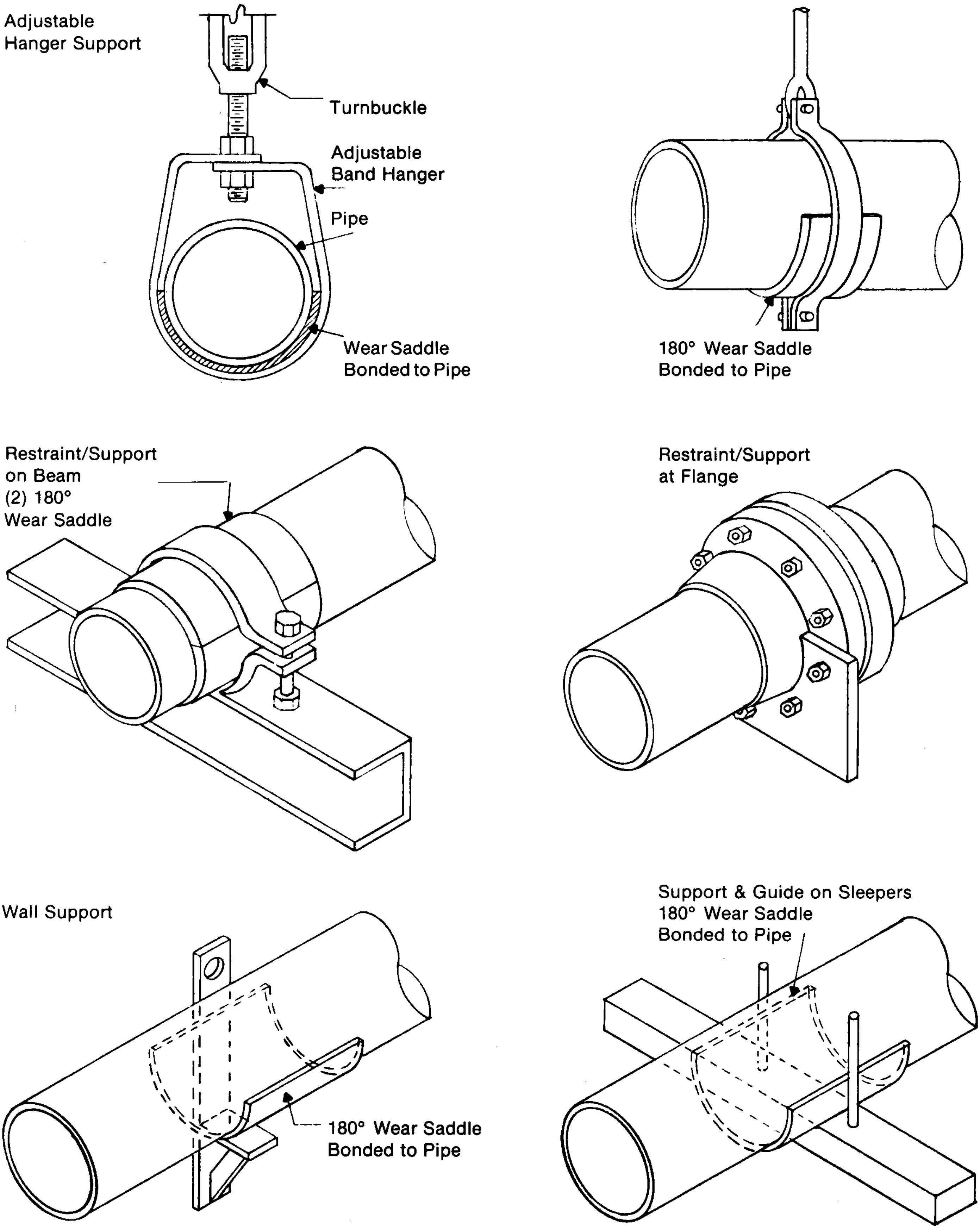


Figure 23. Restrained Elbow

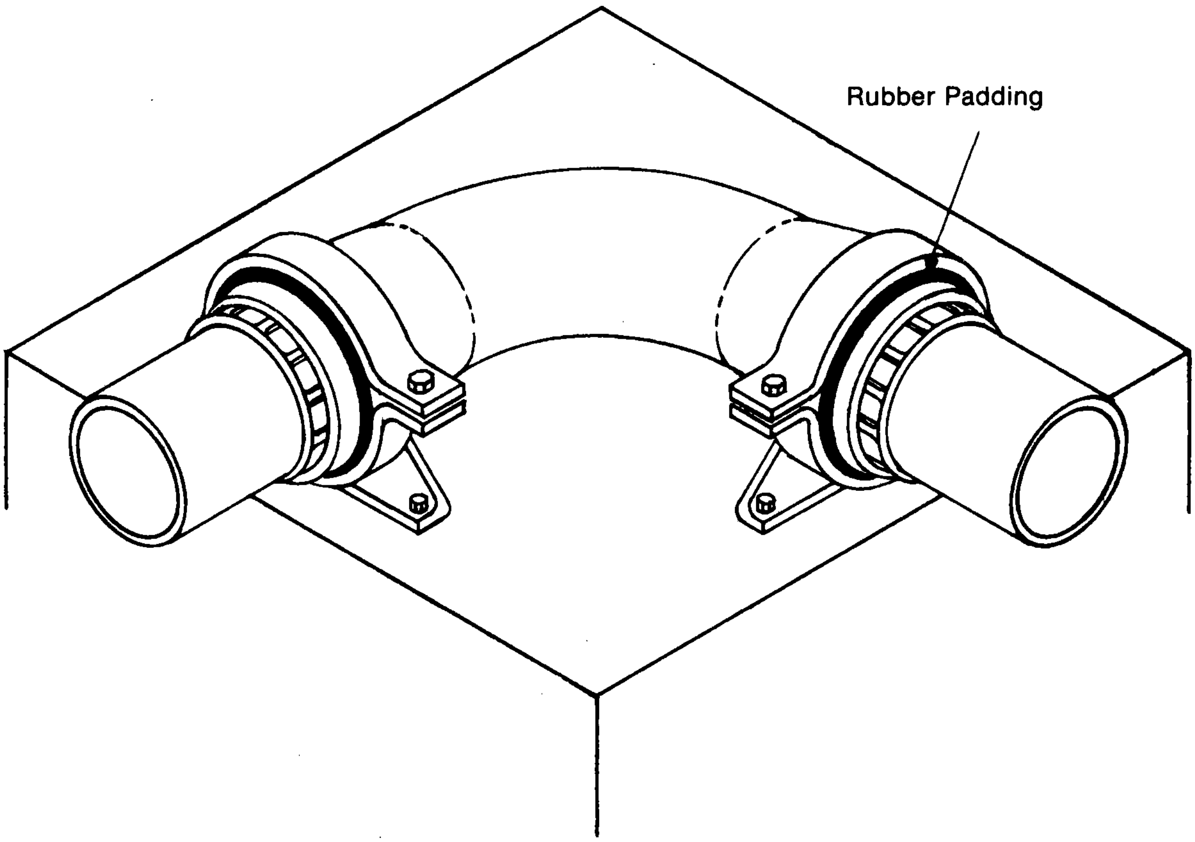
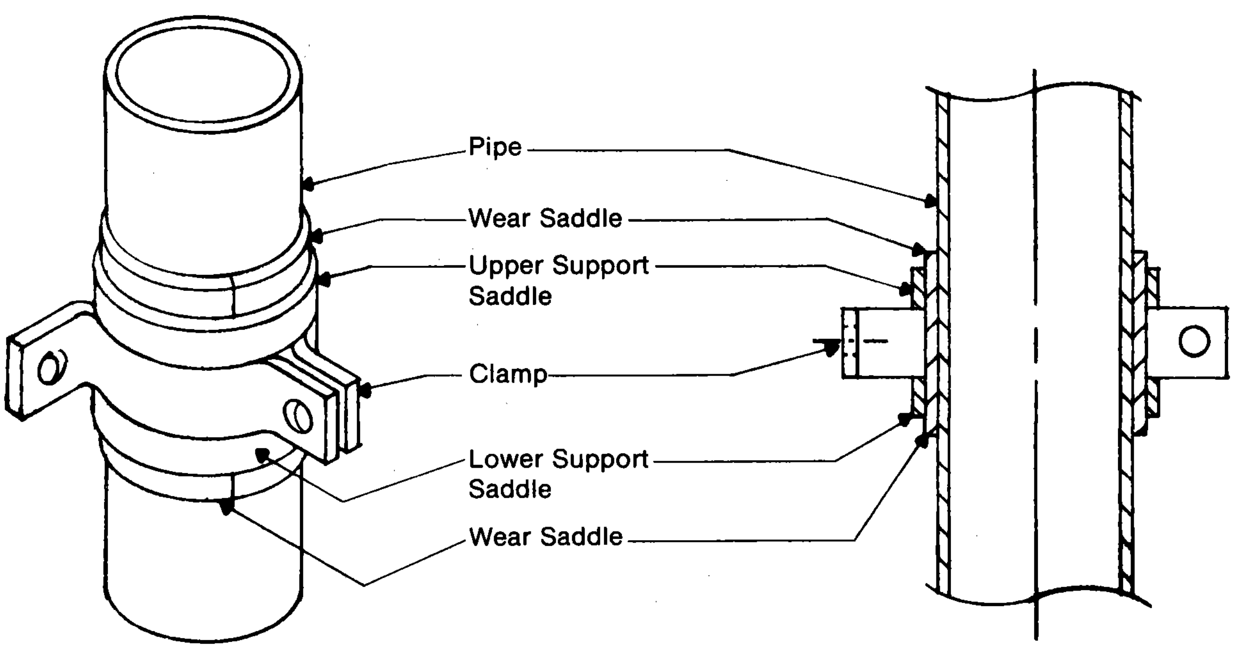
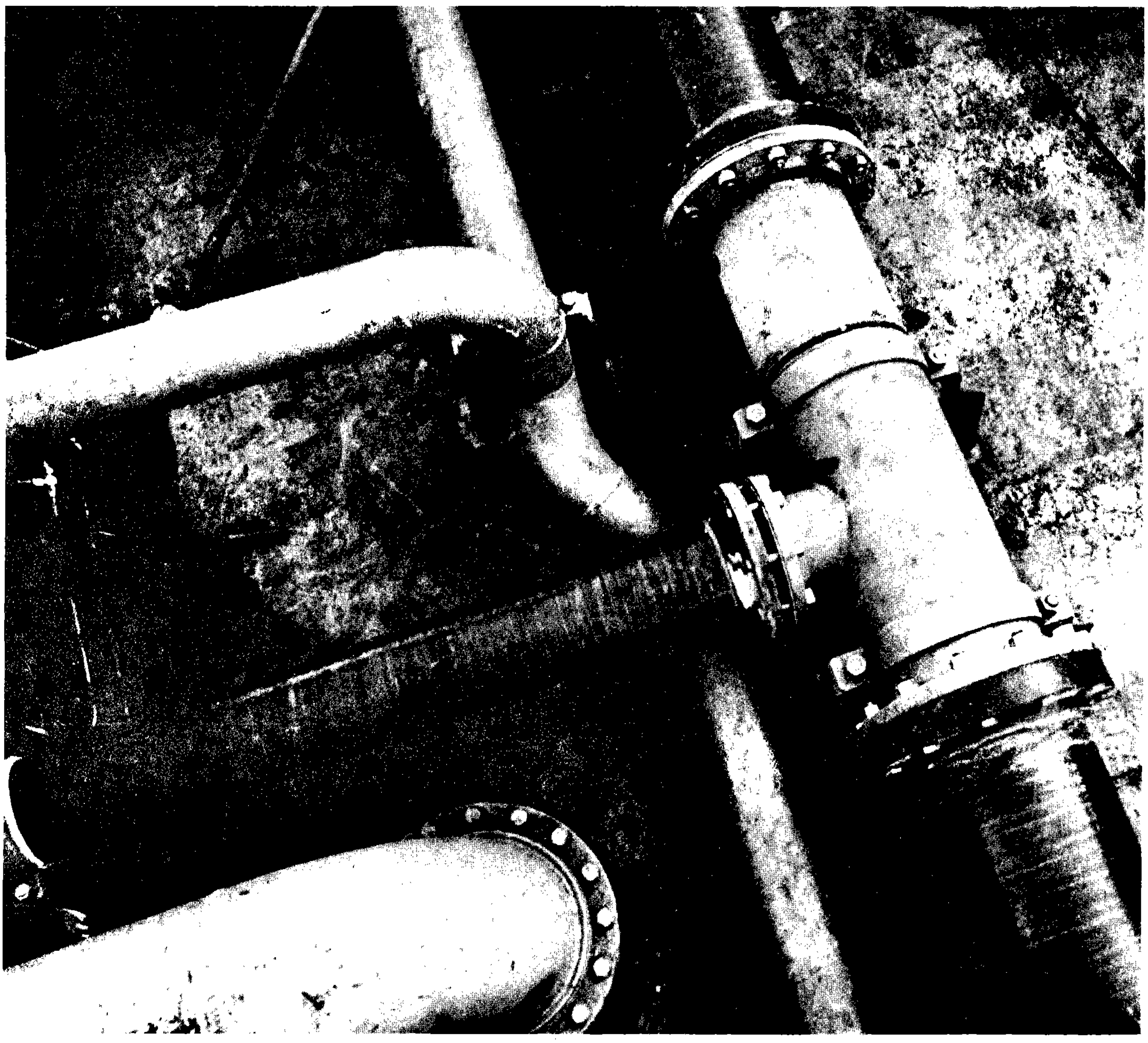


Figure 24. Vertical Pipe Supports



Connecting to Other Systems



During installation of CIBA-GEIGY pipe, it may become necessary to connect to other piping materials. CIBA-GEIGY supplies a variety of fittings capable of inter-system connection.

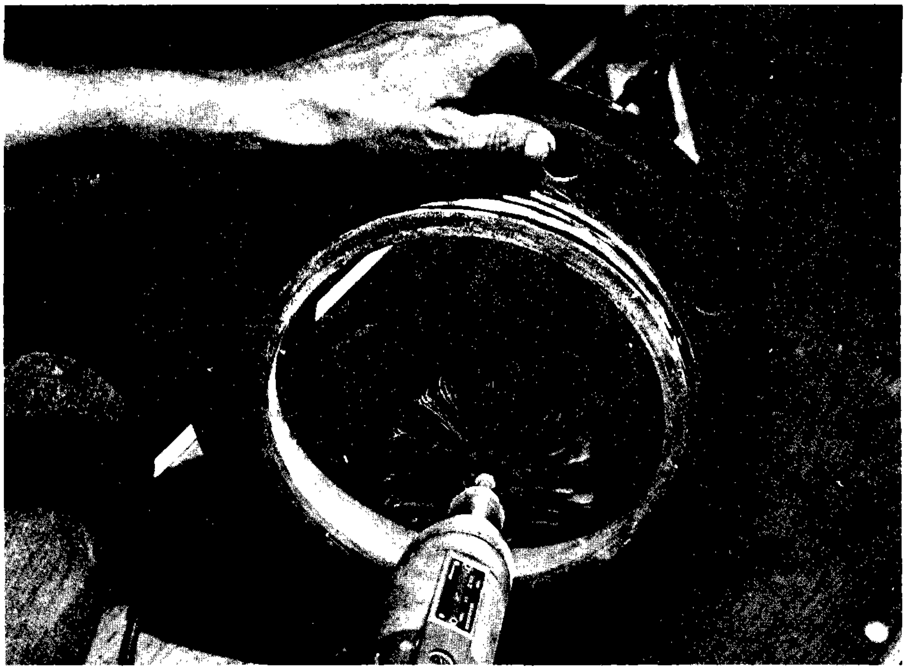
10.1-200

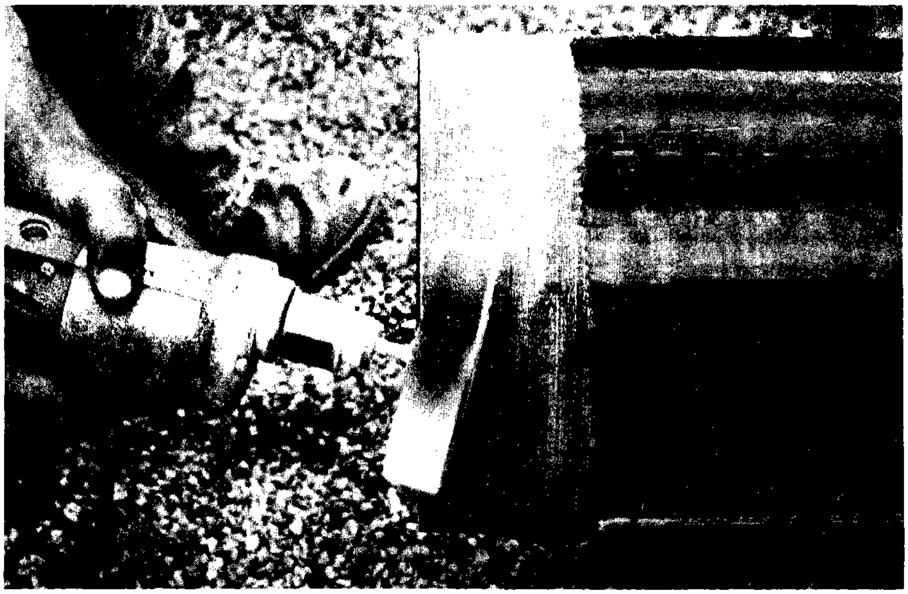
A. Flanges

CIBA-GEIGY compression molded flanges are drilled to the standard ANSI 150 lb. hole pattern, the two piece Van Stone type flange is standard for 2"-16" pipe.

The following flange installation procedures should be observed in order to insure optimum performance.

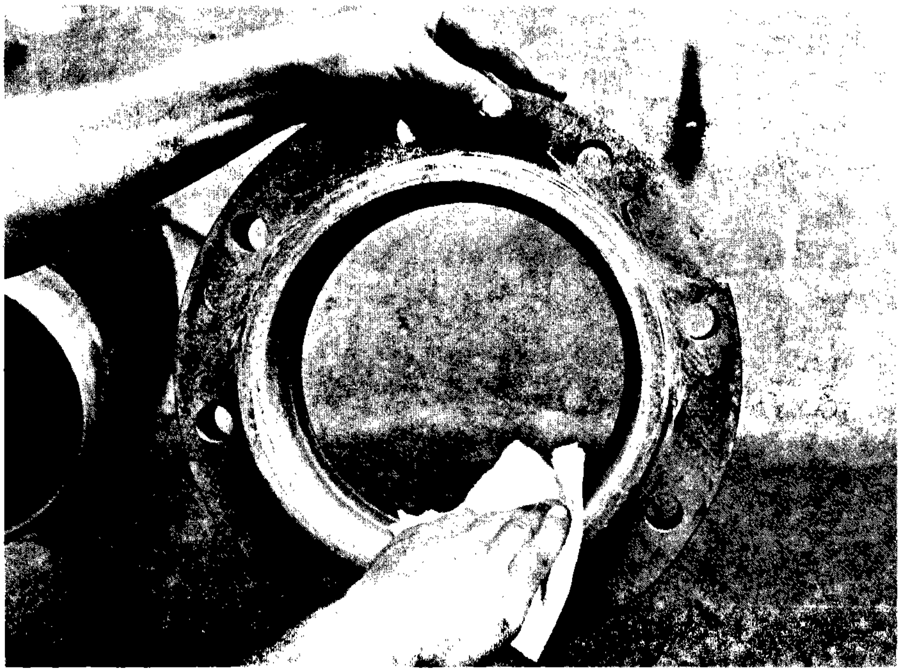
1. Determine the exact length of pipe required to secure a flush alignment of the connecting flanges as described in Chapter 8, Close Tolerance Piping.
2. Manufacture a field taper on the pipe as discussed in the field tapering instructions in Chapter 2, Section B.
3. To insure a good bond, lightly sand the inside surface of the flange socket to completely remove the smooth, press-molded surface. Also sand the field taper on the pipe.



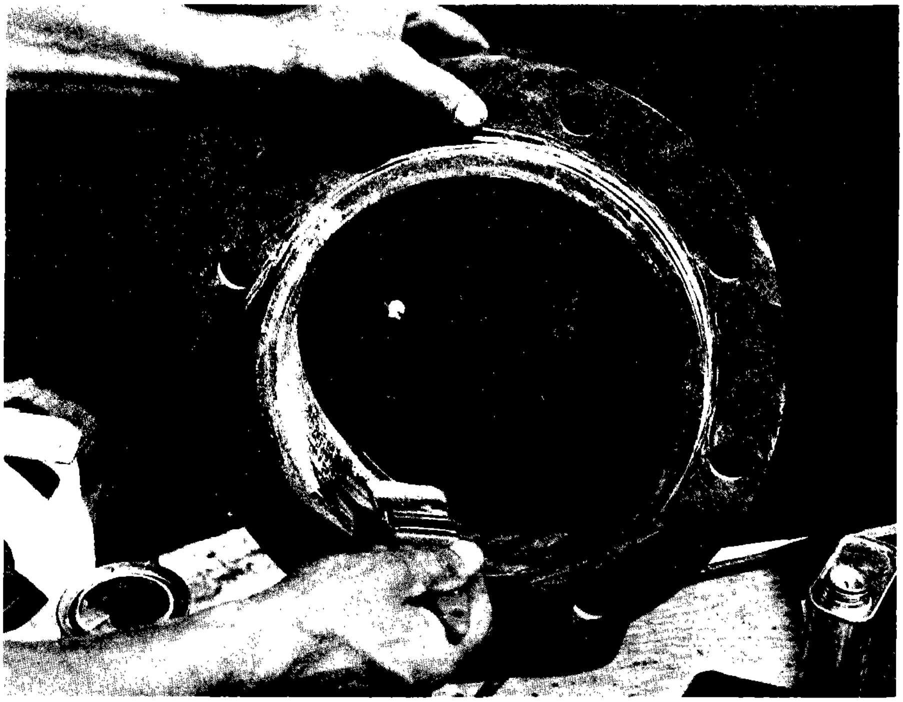


10.1-201

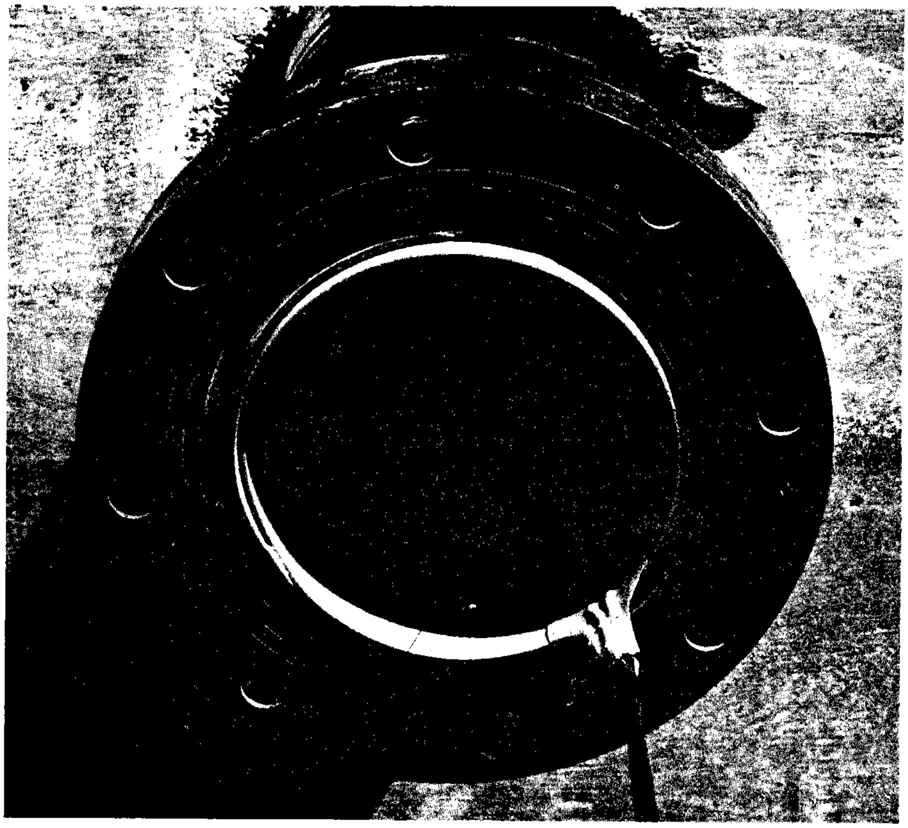
4. Insure that the taper and bonding surfaces are clean. If the surfaces are oily or greasy, they may be cleaned with the joint cleaner found in the adhesive kit. It is imperative that the bonding surfaces be clean and dry before applying adhesive.



5. Mix adhesive according to directions taking careful notice of the pot life, approximately 20 minutes at 75°F (Table 5, Page 35).
6. For two piece flanges (Van Stone), place the flange ring on the pipe.
7. Apply adhesive to all bonding surfaces and insert the flange (flange stub end for two piece Van Stone type) on the pipe with a rotating motion in order to distribute adhesive evenly. For one piece flanges, it is important to make sure the bolt holes line up with the mating bolt holes on the other system.



8. If temperature is below 60° F, heat assist methods such as the Chem Cure Pak or Heat Blanket (Chapter 3 , Section E) must be used in order for the adhesive to cure.



9. Use the proper size gaskets: ¼"- 3/16" fabric reinforced Buna-N or Neoprene, 50-70 Durometer.
10. Use washers under **both** nuts and heads to protect back facing of the flange.
11. Tighten all nuts in increments following a diagonal sequence to the required torque as shown in Figure 25.

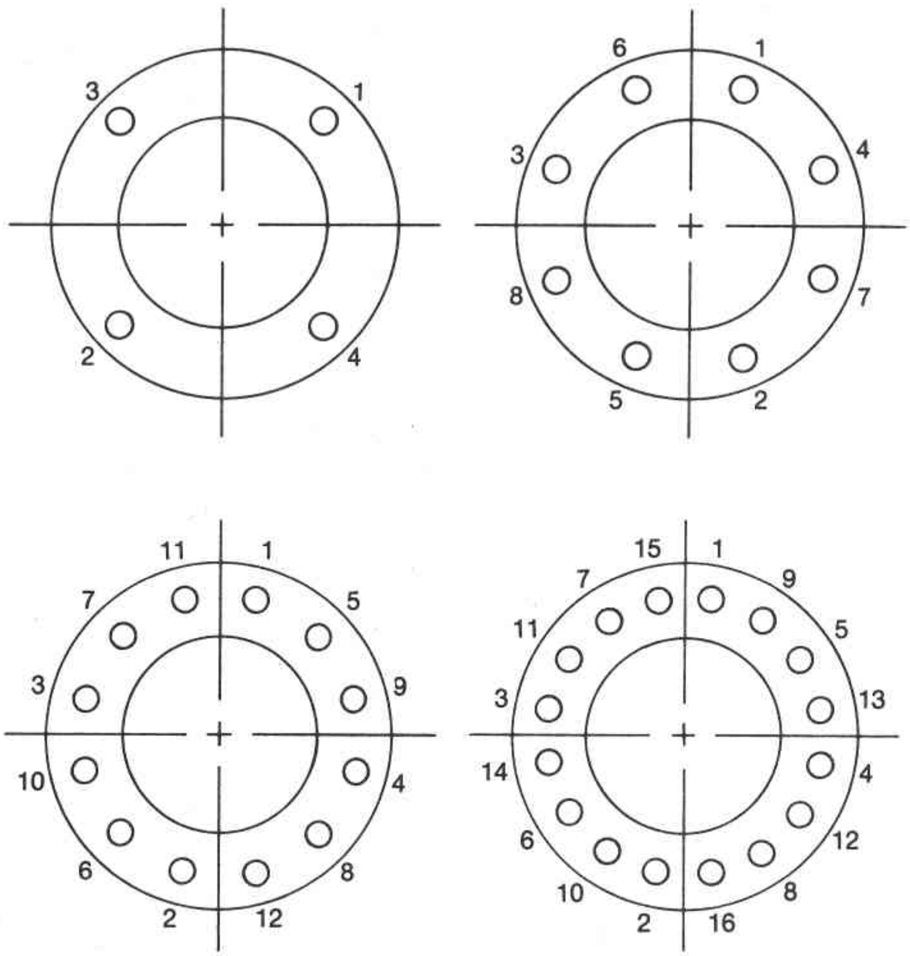
Table 15.

Flange Data

Flange Size (in)	Flange Pressure Rating (psi)	(bar)	Number of Bolts	Bolt Hole Diameter (in)	Bolt Torque Ft-lbs	Minimum Bolt (in)
2	300* (400)	21 (28)	4	75	35	5
3	250 (300)	17 (21)	4	.75	50	5
4	225 (250)	15.5 (17)	8	.75	50	6
6	125 (150)	8.5 (10)	8	.88	50	6
8	150	10	8	.88	60	7
10	150	10	12	1.00	70	8
12	150	19	12	1.00	80	7
14	150	19	12	1.12	100	8
16	150	19	15	1.12	100	8

* cyclic pressure rating.

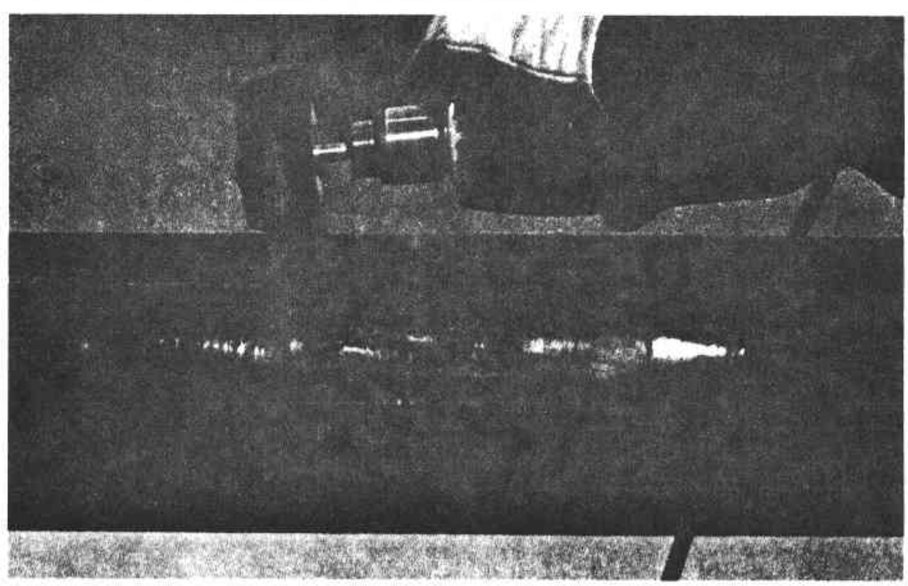
Figure 25.
Flange Bolt Tightening Sequence



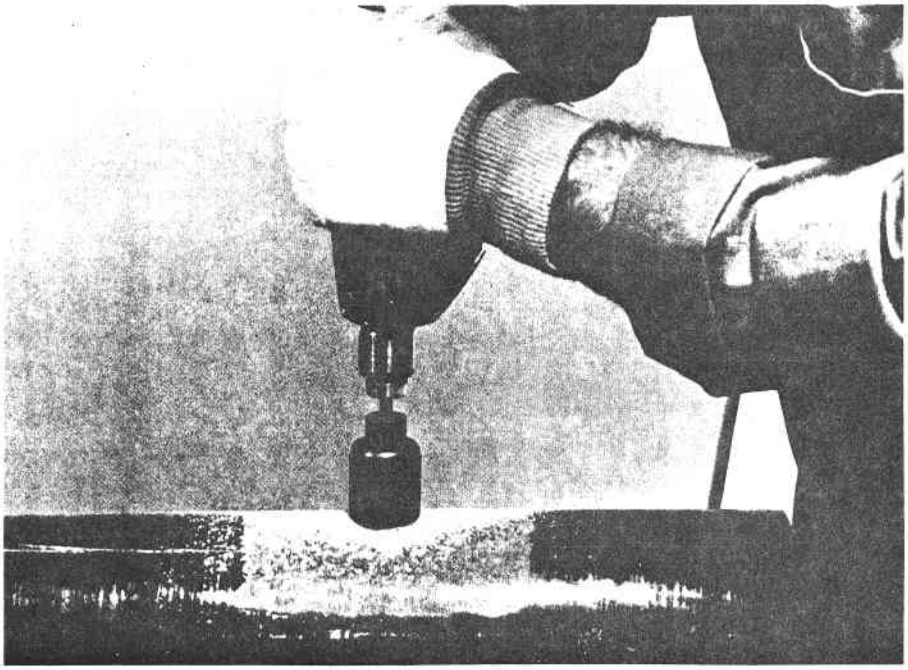
B. Saddles

The following saddle installation procedures should be observed in order to insure maximum performance.

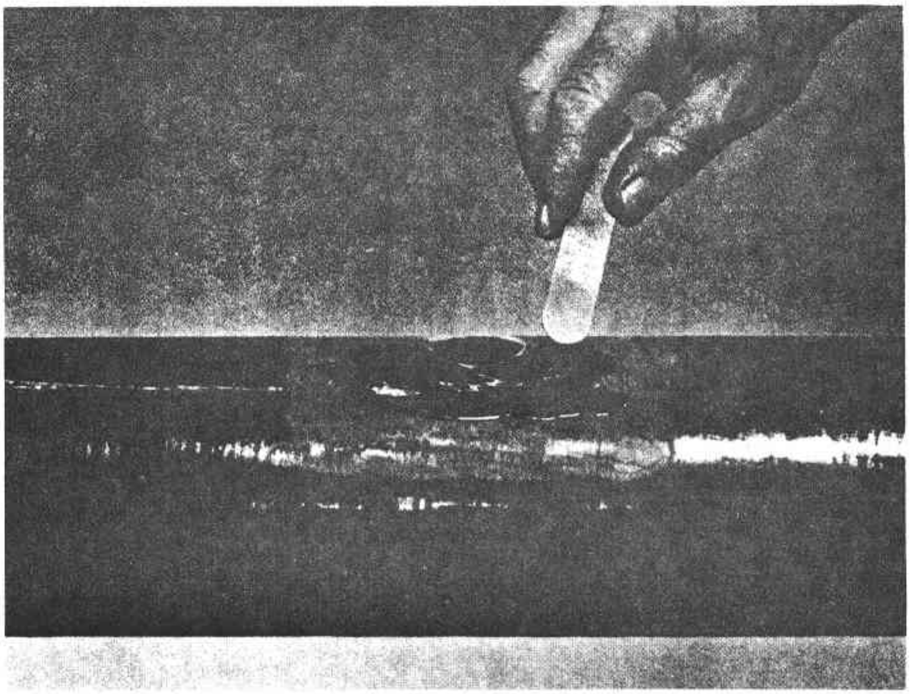
1. Sand with rough sandpaper or flapper sander all surface gloss from the pipe wall where the saddle is to be bonded.



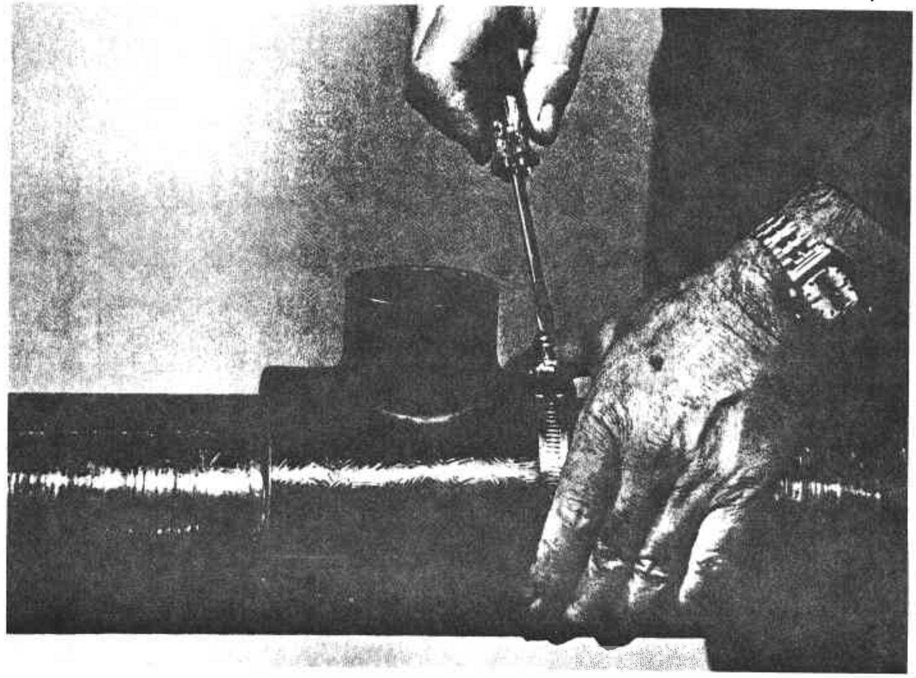
2. Locate the saddle on the pipe and trace the hole to be cut and the saddle's outer perimeter.
3. Cut a hole of the desired size using a pilot drill and a circular hole saw. For 8"- 16" pipe a carbide tipped or diamond hole saw is necessary. Do not force the cutter or it will fray the edges of the hole.



4. Insure that the bonding surfaces are clean. If the surfaces are oily or greasy, they may be cleaned with the joint cleaner found in the adhesive kit. It is imperative that all surfaces be clean and dry before applying adhesive.
5. Mix adhesive according to directions, taking careful notice of the working life, approximately 20 minutes at 75°F (Table 5, page 35).
6. Apply adhesive to the pipe wall, interior of the saddle, and the edges of the pipe wall exposed by the hole.



7. Align the saddle over the hole and clamp to pipe with two hose clamps.

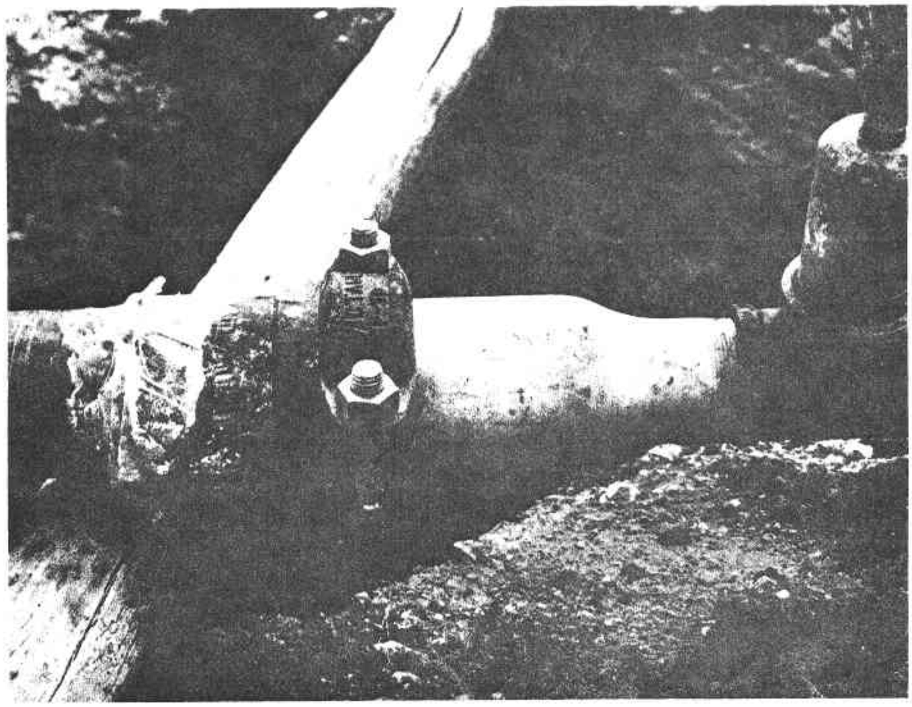


8. Tighten the clamps alternately until secure and an adhesive bead surrounds the saddle.
9. If temperature is below 60° F, heat assist methods such as the Chem Cure Pak or Heat Blanket (Chapter 3, Section E) must be used in order for the adhesive to cure.
10. Do not pressurize the line until the adhesive has fully cured. Table 16 lists the pressure ratings for the various size saddles. It must be remembered that a pipe system's lowest rated component is the system's controlling pressure capacity. If the required pressure rating for a particular service exceeds the capacity of a saddle, an alternate fitting such as a tee should be installed.

Table 16.

Saddle Pressure Ratings

Nominal Pipe Size	Cyclic Pressure Rating (psi)	(bar)	Static Pressure Rating (psi)	(bar)
2 in	150	10	200	15
3 in	150	10	300	21
4 in	150	10	300	21
6 in	150	10	250	17
8 in	100	7	150	10
10 in	75	5	100	7
12 in	50	3.5	75	5
14 in	50	3.5	50	3.5
16 in	50	3.5	50	3.5



C. Grooved & Threaded Adapters

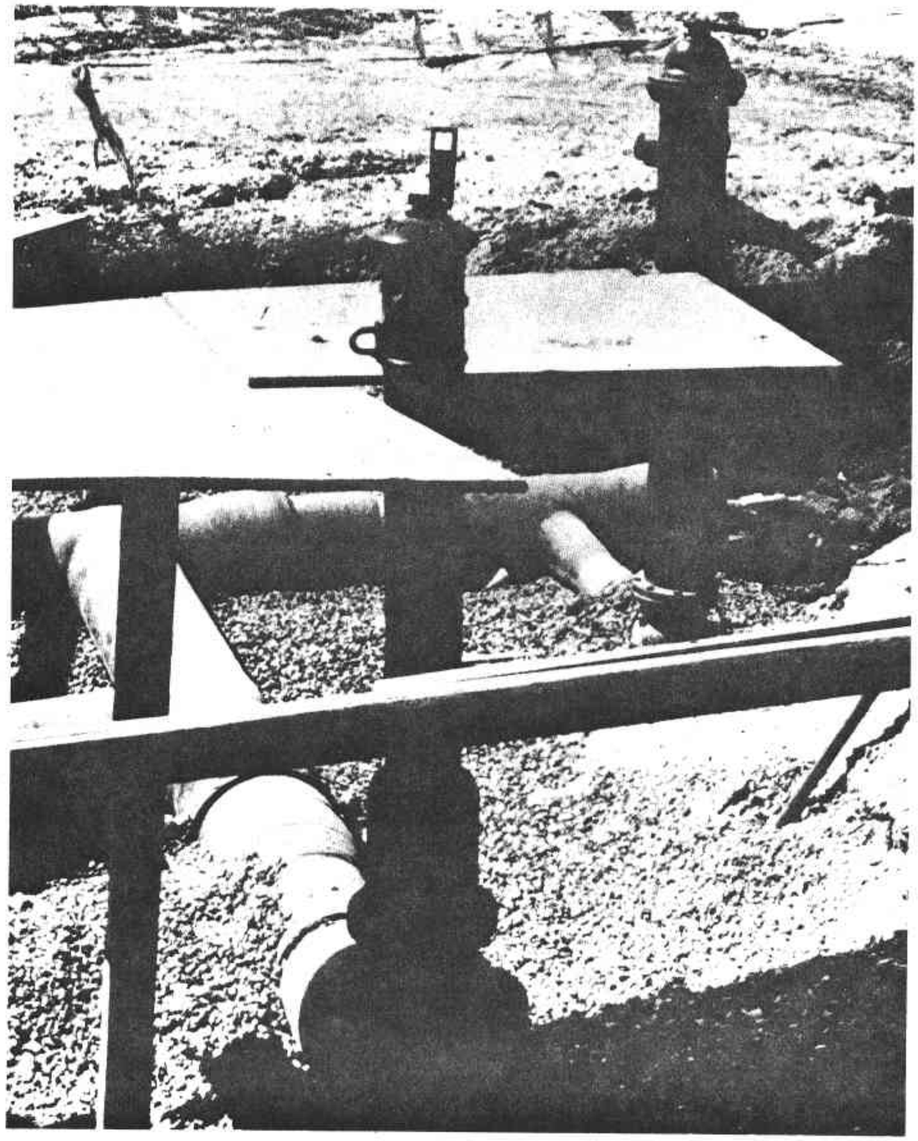
CIBA-GEIGY supplies compression molded fiberglass or stainless steel grooved and threaded adapters. The stainless steel threaded adapter consists of male threads only. Factory made crossovers equipped with the required adapter are available and provide a quick and easy inter-system connection.

The following installation recommendations for adapters should be observed:

1. Determine the exact length of pipe required to secure a snug fit as described in Chapter 8, Close Tolerance Piping.
2. Manufacture a field taper on the CIBA-GEIGY pipe as discussed in the field tapering instructions in Chapter 2, Section B.
3. To insure a good bond, lightly sand the bonding surface of the adapter.
4. Insure that the taper and bonding surfaces are clean. If the surfaces are oily or greasy, they may be cleaned with the joint cleaner found in the adhesive kit. It is imperative that the bonding surfaces be clean and dry before adhesive application.
5. When using a **threaded** adapter, thread it into the other system prior to bonding onto the CIBA-GEIGY pipe. Otherwise it may be impossible to turn the adapter into the mating thread. Apply a nonmetallic thread dope before make-up. Teflon tape is not recommended.
6. Mix adhesive according to directions taking careful notice of the pot life, approximately 20 minutes at 75° F (Table 5, page 35).
7. Apply the adhesive to all bonding surfaces and secure the adapter on the CIBA-GEIGY pipe with a rotating motion in order to distribute adhesive evenly.
8. If temperature is below 60° F, heat assist methods such as the Chem Cure Pak or Heat Blanket (Chapter 3, Section E) must be used in order for the adhesive to cure.
9. Grooved adapters are designed for use with either standard Victaulic Style 77 or with HP-70 (ES) clamps. When installing the clamps, make sure the grooved ends are properly aligned and spaced before tightening coupling.

D. CIPE Crossover

The CIPE Crossover is used exclusively with Dualoy-3200 pipe. Dualoy-3200 pipe is utilized in the installation of water mains and fire loops and should be installed according to the installation recommendations discussed in this manual. The National Fire Protection Association (NFPA) "Standard for Outside Protection" No. 24 covers the general details of yard piping for fire protection systems. The installation details contained in this manual are intended to supplement those of NFPA No. 24 with which the design and installation must comply.



The CIPE Crossover is installed for a hydrant connection or an in-line transition from CIBA-GEIGY fiberglass pipe to cast iron pipe. (Refer to Figures 26 & 27, Fire Hydrant Connection and Cast Iron to Fiberglass Transition.)The CIPE Crossover will connect to gasketed bell or mechanical joint cast iron pipe and **must always be restrained.** For an 8"-16" CIPE Crossover, two 180° wear saddles fabricated from split pipe sections must be placed between the fibeglass pipe and the retaining clamp, and the clamp tightened to a snug fit only. The clamp is not gripping the pipe, but rather it is bearing against the Pronto-Lock II box. For a 3"-6" CIPE Crossover, wear saddles are not necessary, but again the retaining clamp should be tightened to a snug fit only and should bear against the filament wound raised shoulder on the Crossover.

Figure 26. Fire Hydrant Connection

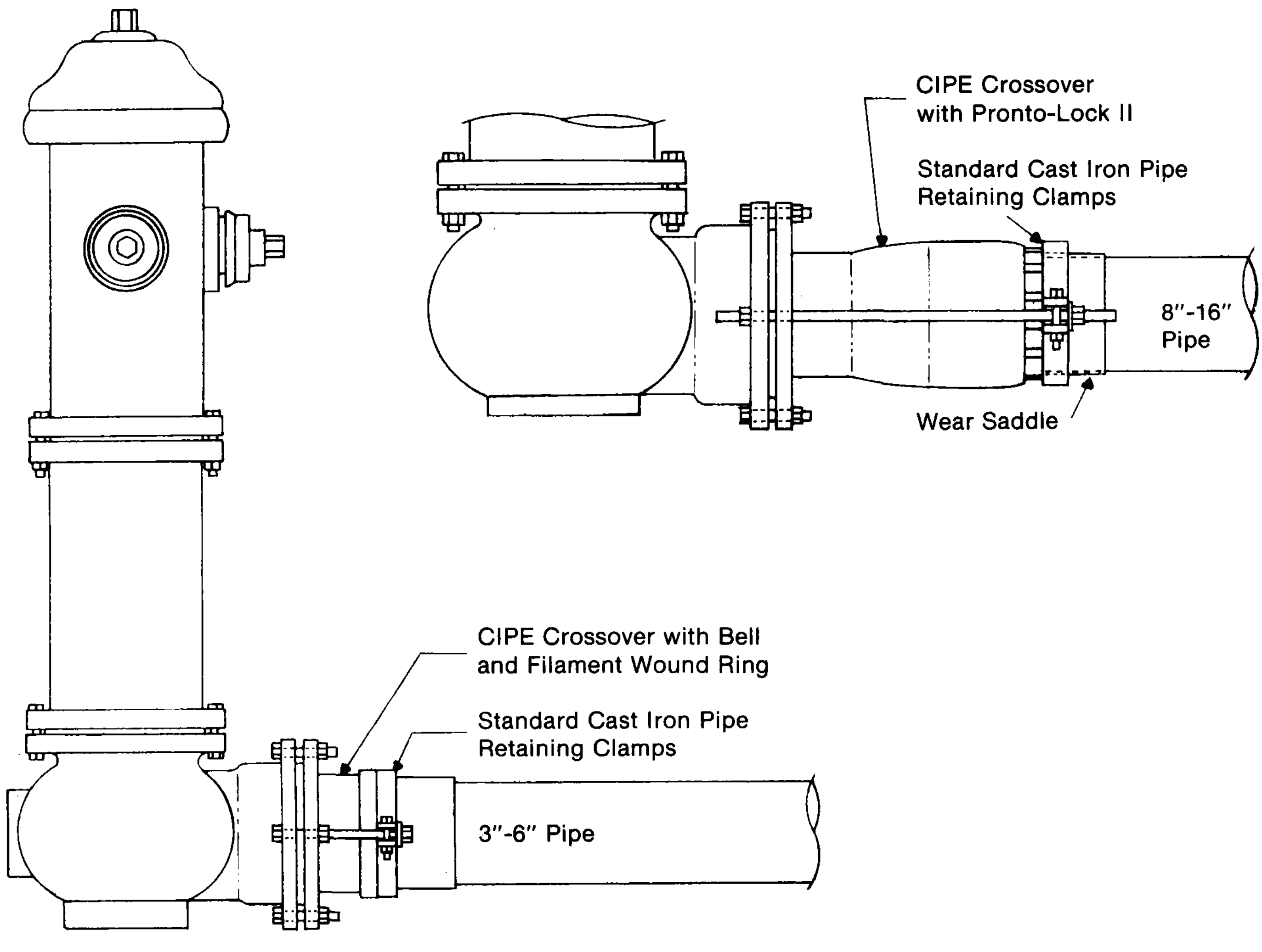
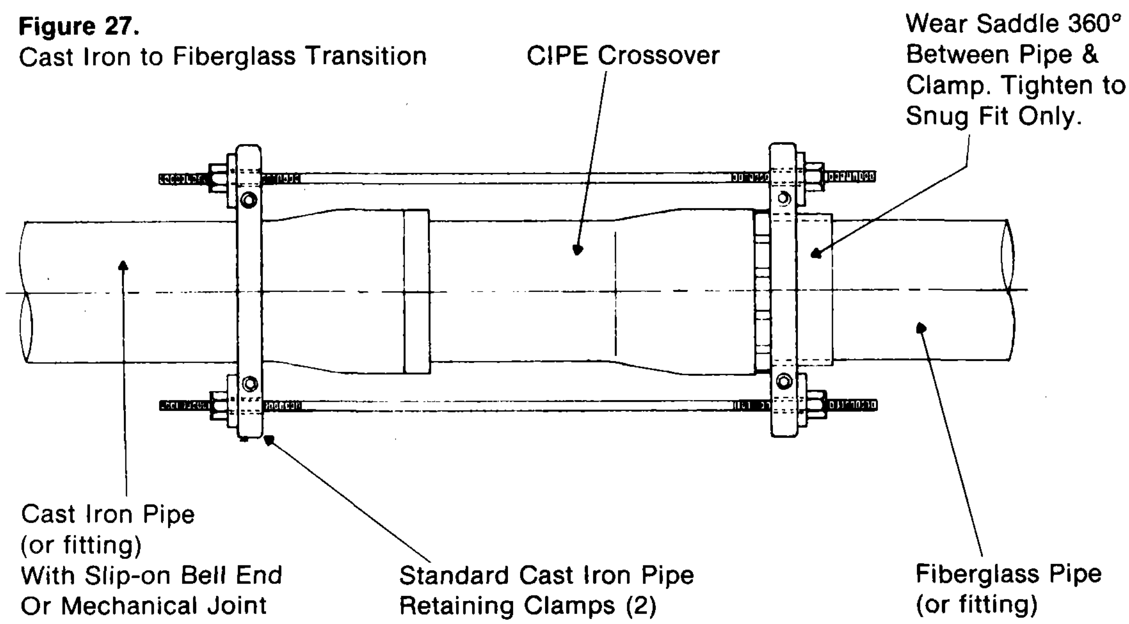


Figure 27.
Cast Iron to Fiberglass Transition



E. Compression Couplings

The standard Compression Coupling consists of one cylindrical steel middle ring, two steel follower rings, two gaskets, and a set of steel trackhead bolts. Tightening the bolts draws the follower rings toward each other, compressing the gaskets in the spaces formed by the follower rings, middle ring flares, and the pipe surface. Standard Compression Couplings can be used for the successful transition from CIBA-GEIGY fiberglass pipe to steel pipe while special reducing compression couplings are required for the transition from cast iron and asbestos cement pipe to CIBA-GEIGY pipe. The correct installation procedure for the Compression Coupling is detailed in Chapter 7, Section C. Two sources of the Compression Coupling are Dresser and Smith-Blair.

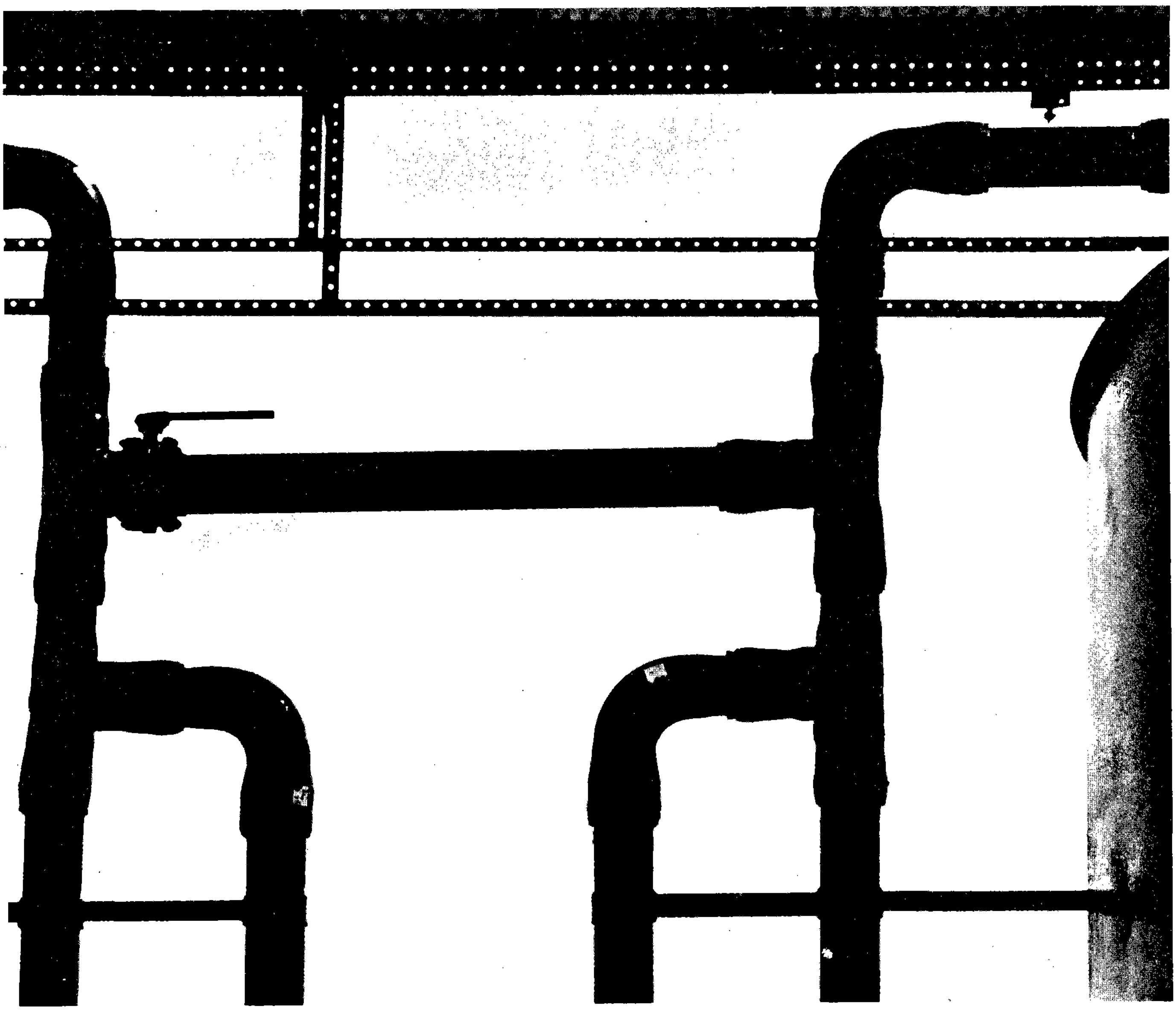
F. Compression x Flange Adapters

Compression/Flanged Adapters are used to connect plain end pipe of all sizes and types including fiberglass, cast iron, asbestos cement, and steel to flanged valves, pumps, or other flanged fittings. Independent bolting of the flange-end and the compression-end allows for more flexibility to absorb pipe offset and deflection and provides for axial pipe movement to absorb expansion-contraction stresses. For the correct installation of a flanged adapter with CIBA-GEIGY pipe, proceed as follows.

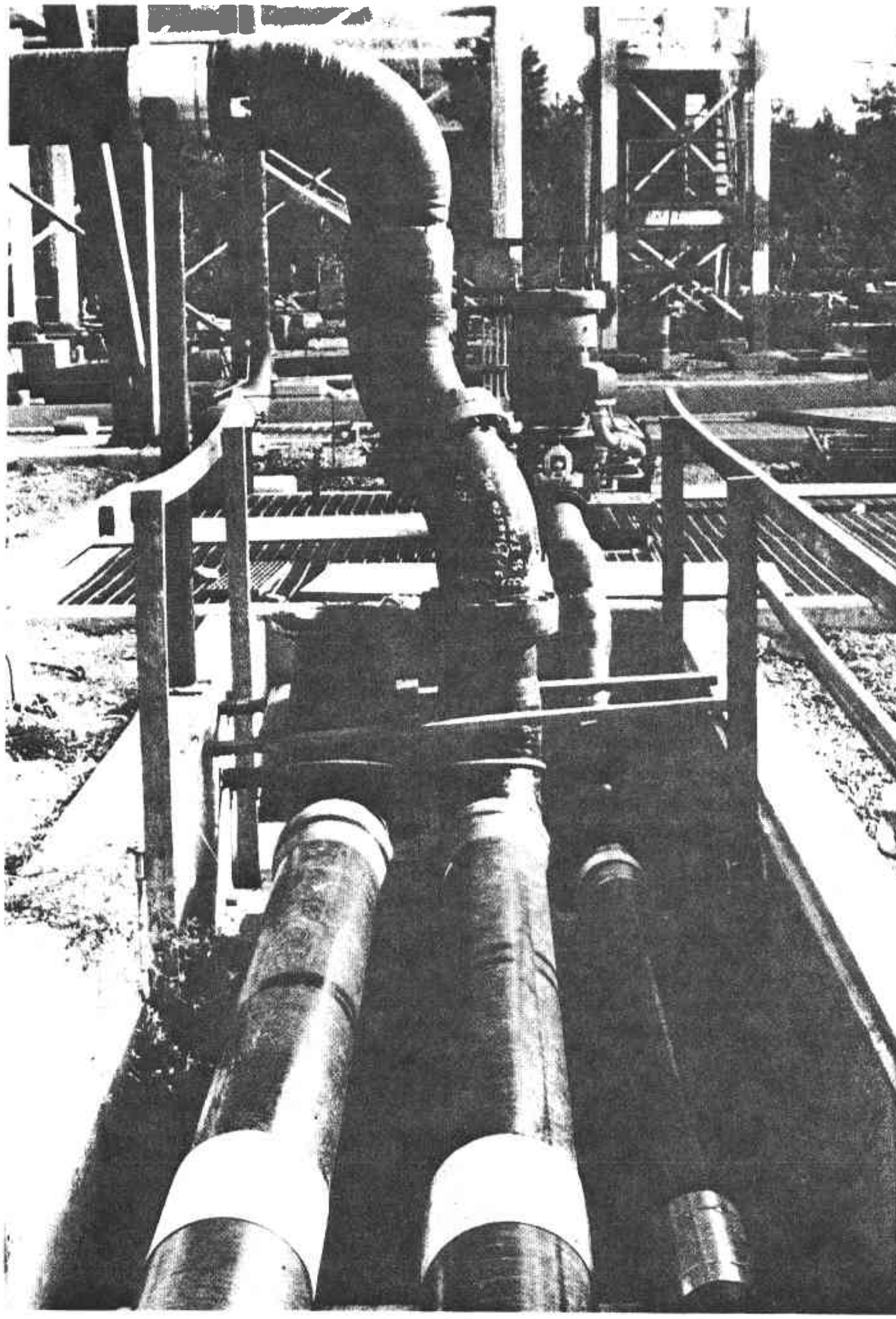
1. Cut the pipe at a point which will allow for sufficient insertion into the adapter.
2. Thoroughly clean the cut end of the pipe. It is important that the pipe end be clean and dry before adhesive application.
3. Mix adhesive according to directions taking careful notice of the working life, approximately 20 minutes at 75°F (24°C) Table 5, Page 35.
4. Apply an adhesive bead to the cut end of the pipe and allow it to harden before installing the adapter. The adhesive will protect the freshly cut fiberglass-epoxy pipe wall from any possible contamination from the internal media.
5. For an operating pressure of less than 40 psi, tighten the bolts with care.
6. For an operating pressure of over 40 psi, internal stiffening rings must be used to protect against pipe collapse due to overtightening of bolts.

Two sources of the above mentioned adapter include Smith-Blair and Dresser.

Close Tolerance Piping



During installation of CIBA-GEIGY pipe, a situation requiring precise dimensional accuracy may arise. In this circumstance, certain procedures should be followed to insure exact joint makeup and alignment. Compensation must be made for close tolerances in final joint makeup by the use of precise measurement techniques.



The following steps provide a means of achieving the needed dimensional accuracy in close tolerance piping.

A. Fittings Layout

A diagram of the layout and alignment of fittings is always recommended for a close tolerance piping installation. Work delays can be avoided by having the right fittings on hand and by taking the time to lay out the job in advance. When laying out a system, it is important to code each fitting for easy identification and orientation.

B. Alignment and Make-Up

Follow the recommended procedures outlined in Chapter 4, Joining Systems, for proper joint alignment and makeup. The insertion depths of all CIBA-GEIGY fittings are specified in Figures 28-32. A variation in final joint makeup between identical fittings may be attributed to manufacturing tolerances, differences in taper lengths cut on the jobsite, and the difference of insertion when fitted dry and when fitted after the adhesive has been applied (the adhesive lubricates the tapered surfaces and allows closer makeup than is possible when the surfaces are dry. Allow 1/8" for makeup on 2" through 4" and 1/4" for 6" through 12" and 3/8" for 14" and 16" pipe).

C. Measurement Techniques

In order to insure precise fitting at all joints, the following measurement techniques should be closely observed.

1. Centerline-to-Centerline

Centerline-to-centerline (CL to CL) measurement or dimensions are utilized with directional fittings such as elbows and tees. The following is a **general** outline of the procedure to be used when fabricating to this type of dimension.

a) Determine the required CL to CL distance between fittings from the engineering drawings.

b) Determine the centerline to face dimension of the fitting as specified in Figures 28-32. If the specification is not listed, check fittings data literature or measure the fitting with an adjustable square, or as a last resort, a tape measure.

c) Manufacture a short nipple following the instructions outlined in Chapter 2, Section B. This nipple will serve as a standard insertion gauge because it is best to measure insertion depths with a taper manufactured by the taper-tool which will be used for the job.

d) Measure the insertion depths of each fitting using the standard insertion gauge.

e) To each measured insertion depth value for adhesive joints, add 1/8" (2" through 4"), 1/4" (6" through 12"), or 3/8" (14" and 16") make-up dimension since the adhesive will act as a lubricant and allow greater penetration than when the surfaces are dry.

f) The final value for the insertion depth should be clearly marked on the sides of the fitting for future reference.

g) To achieve a specified CL to CL dimension, the length of pipe to cut is equal to the CL to CL distance (a) minus the sum of the centerline to face dimension of the fittings (b) plus the sum of the measured insertion depths (d) plus the makeup allowance (e).

Length of pipe=a - (b+b) + (d+d) + (e+e)

Figures 28 & 29 outline the recommended centerline to centerline measurement procedure for Pronto-Lock II pipe and Bell and Spigot pipe respectively. The dimension values are subject to manufacturing tolerance and should be double-checked to insure an exact fit.

Figure 28.

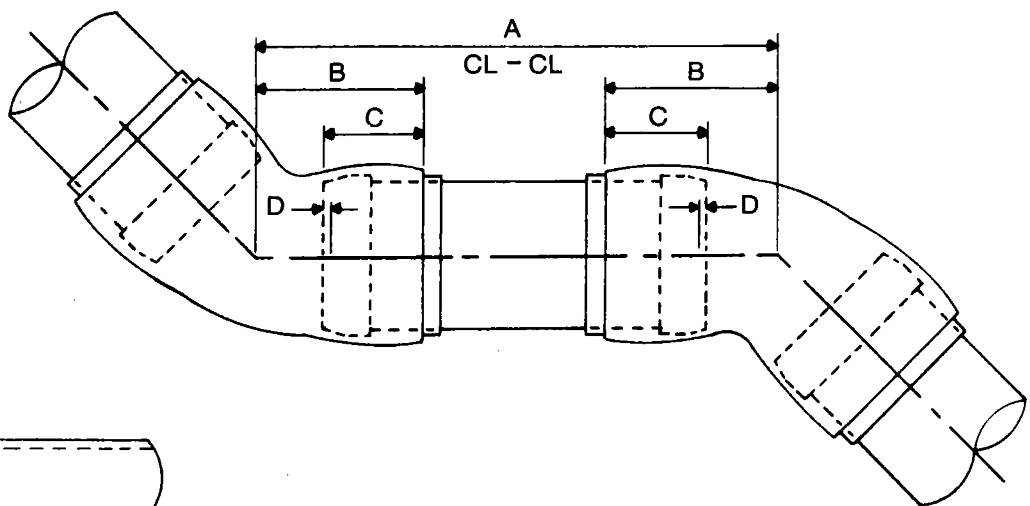
Pronto-Lock II Elbows Centerline To Centerline

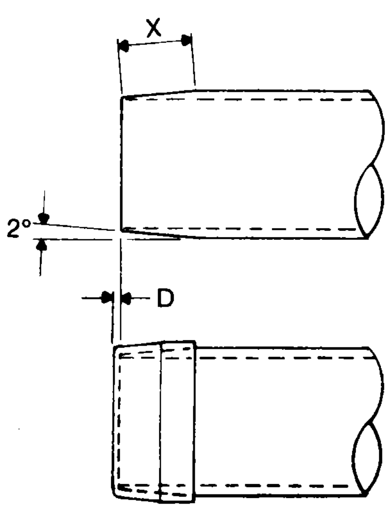
Mark II					
Dia.	8″	10″	12″	14″	16″
B(90°)	19	22¼	24¾	27¾	30¾
B(60°)	15½	17¾	19½	21¾	23¾
B(45°)	14¼	16	17½	19½	21¼
B(30°)	13	14½	15¾	17½	19
B(22½°)	12½	13¾	15	16½	17¾
B(11¼°)	11¾	12¾	13¾	15	16¼
C	7½	8½	9	10	11
D	½	½	½	½	½

Mark III					
Dia.	8″	10″	12″	14″	16″
B(90°)	15¼	18½	21	24	26¾
B(60°)	11¾	14	15¾	18	20
B(45°)	10½	12¼	13¾	15¾	17½
B(30°)	9¼	10¾	12	13¾	15¼
B(22½°)	8¾	10	11¼	12¾	14
B(11¼)	8	9	10	11¼	12
C	7½	8½	9	10	11
D	½	½	½	½	½

All Dimensions in Inches

*Consult local CIBA-GEIGY representative regarding availability of Mark III fittings.





X = Taper Length
A = Centerline to Centerline Dimension
B = Centerline to Face of Fittings
C = Insertion Depth
D = Male Make-Up Allowance

Formula:
A-(B+B) + (C+C) - (D+D) = Length of Pipe to Cut

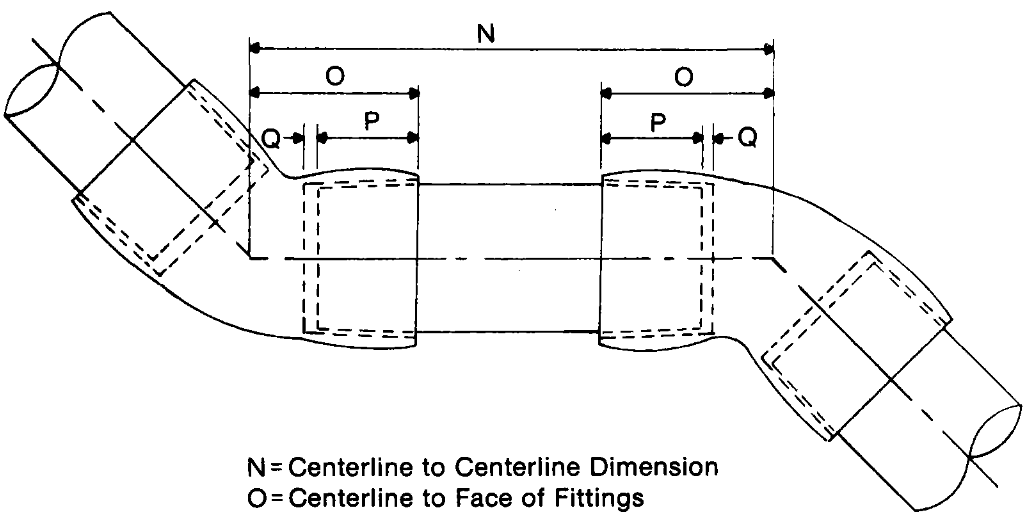
Figure 29.

Bell & Spigot Elbows Centerline to Centerline

Molded					
Pipe Size	2"	3"	4"	6"	
O(90°)	3¾	5¾	7	9	
O(45°)	3⅛	4¾	5¾	7⅛	
P	2⅜	3⅞	4½	5½	
Q	⅛	⅛	⅛	¼	
Mark II					
Pipe Size	8"	10"	12"	14"	16"
O(90°)	17¼	19½	22	24½	27¼
O(60°)	13¾	15	16¾	18½	20½
O(45°)	12½	13¼	14¾	16¼	18
O(30°)	11¼	11¾	13	14¼	15½
O(22½°)	10¾	11	12	13¼	14½
O(11¼°)	9¾	10	10¾	12	12¾
P	4¾	5	5¼	6½	6¾
Q	¼	¼	¼	⅜	⅜
Mark III					
Pipe Size	8"	10"	12"	14"	16"
O(90°)	13	15½	17¾	20¾	23
O(60°)	9¾	11	12½	14¾	16¼
O(45°)	8¼	9¼	10½	12½	13¾
O(30°)	7	7¾	8¾	10½	11¼
O(22½°)	6½	7	8	9½	10¼
O(11¼°)	5¾	6	6¾	8¼	8½
P	4¾	5	5¼	6½	6¾
Q	¼	¼	¼	⅜	⅜

All Dimensions in Inches

*Consult local CIBA-GEIGY representative regarding availability of Mark III fittings.



N = Centerline to Centerline Dimension
O = Centerline to Face of Fittings
P = Dry Insertion Depth
Q = Lubrication Factor

Formula:
N - (O+O) + (P+P)+ (Q+Q) = Length of Pipe to Cut

2. Face-to-Face

Face-to-face (F to F) measurements or dimensions are utilized with straight in-line fittings such as flanges and grooved adapters. The following is a **general** outline of the procedure to be used when fabricating to this type of dimension:

a) Determine the exact face-to-face distance required between fittings from the engineering drawings.

b) Manufacture a short nipple following the instructions outlined in Chapter 2, Section B. This nipple will serve as a standard insertion gauge because it is best to measure insertion depths with a taper manufactured by the taper-tool which will be used for the job.

c) Measure the insertion depth of each fitting using the standard insertion gauge.

d) To each measured insertion depth value, add 1/8" (2"-4"), 1/4" (6"-12"), or 3/8" (14" and 16") makeup dimension since the adhesive will act as a lubricant and allow greater penetration than when the surfaces are dry.

e) The final value for the insertion depth should be clearly marked on the side of the fitting for future reference.

f) Measure the overall length of the fittings to be installed.

g) Subtract the final value for insertion depth (c+d) from the overall length of the fitting (f).

h) To achieve a specified F to F dimension, the length of pipe to cut is equal to the F to F dimension (a) minus the calculated distance from the face of fitting to where insertion of the pipe stops [f - (c+d)].

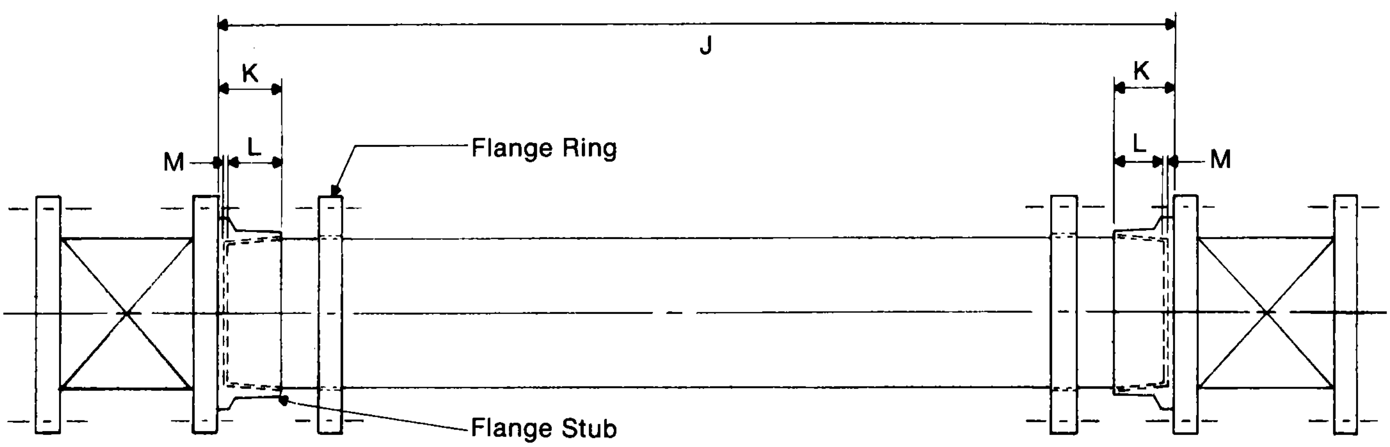
Length of pipe to cut=a - 2[f-(c+d)]

Figures 28-32 outline the recommended Face-to-Face measurement procedure for Flange, Bell and Spigot, and Pronto-Lock II respectively. The dimension values are subject to a manufacturing tolerance and should be double checked to insure an exact fit.

Figure 30.

Flange Face To Face

Pipe Size	2"	3"	4"	6"	8"	10"	12"	14"	16"
K	2¾	2⅞	2⅞	3⅞	4	5	5	6	6
L	2⅜	2½	2½	3⅜	3½	4½	4½	5⅜	5⅜
M	⅛	⅛	⅛	¼	¼	¼	¼	⅜	⅜



K = Flange Stub Length
L = Dry Insertion Depth
M= Lubrication Factor

Formula:
J - 2 [K - (M+L)] =
Length of Pipe to Cut

Figure 31.

Bell & Spigot Face To Face

Pipe Size	2″	3″	4″	6″	8″	10″	12″	14″	16″
S	2¾	3½	4⅛	6¾	4¾	5	5¼	6½	6¾
T	⅛	⅛	⅛	¼	¼	¼	¼	⅜	⅜
X	1⅝	1¾	1⅞	2¾	2¾	3½	4	4½	5¼

All Dimensions in Inches

R = Overall Length (SxB)
S = Dry Insertion Depth
T = Lubrication Factor
U = Face To Face (BxS)
V = Face to Face BxB
W = Overall Length (SxS)
X = Taper Length
Y = Length of Pipe to Cut

Formulas:
Bell x Spigot U + 2S + 2T = Y
Spigot x Spigot V + 2S + 2T = Y

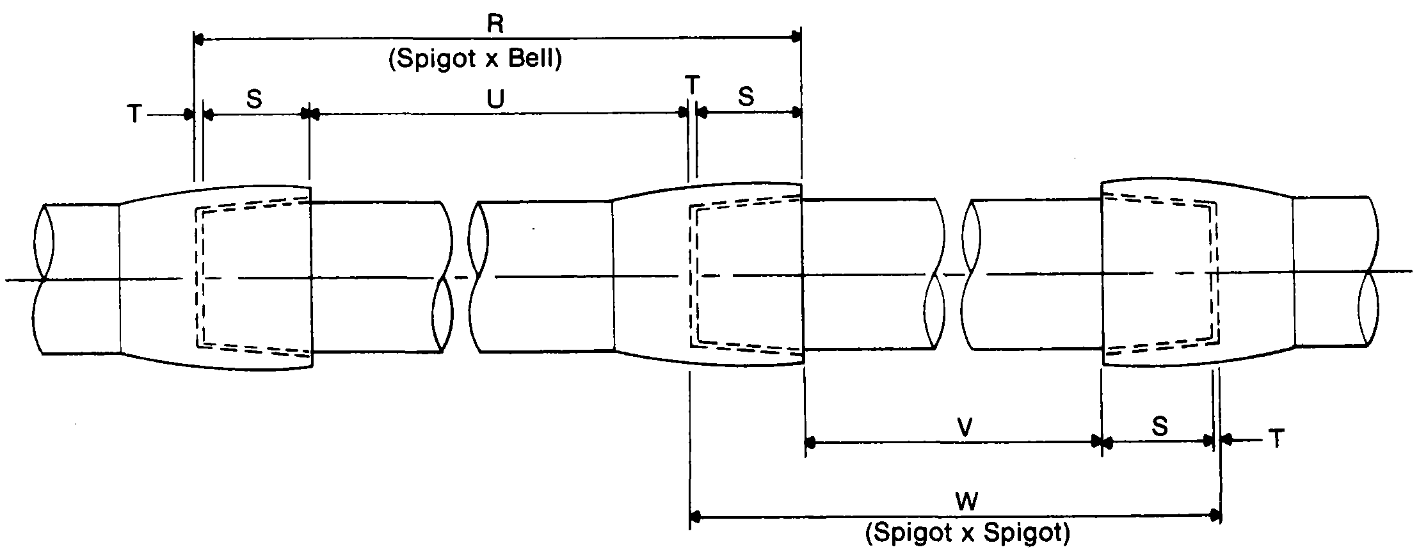
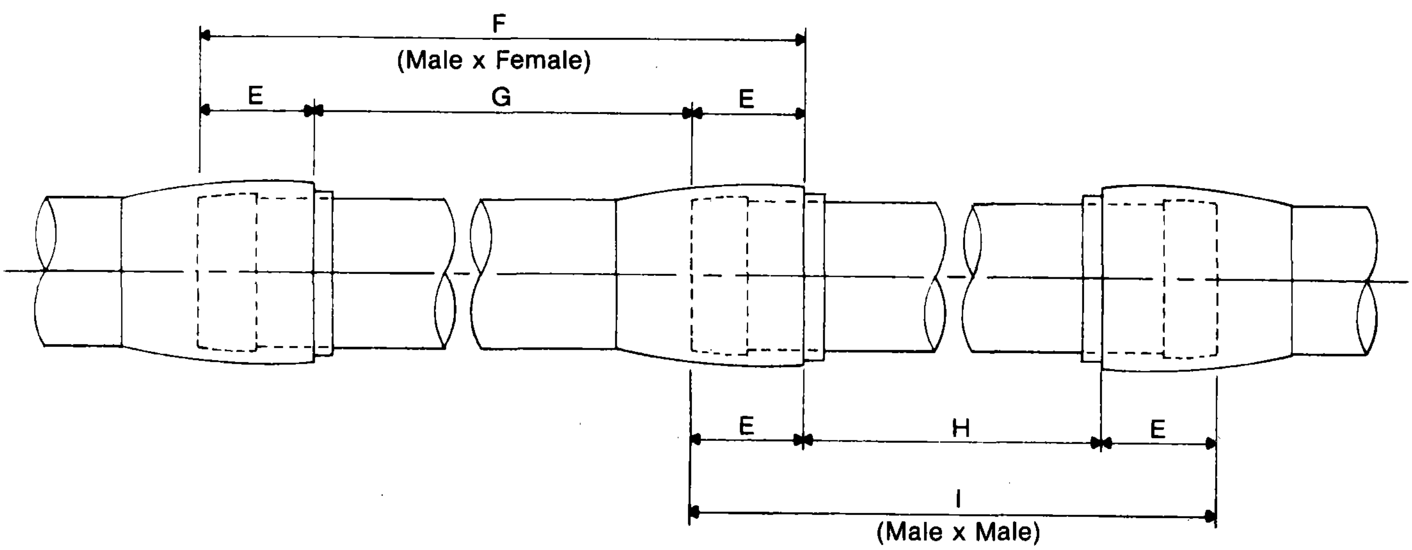


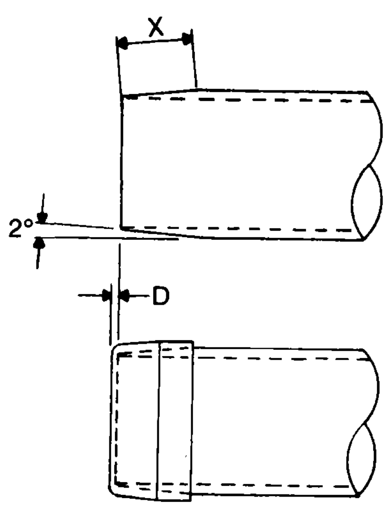
Figure 32.

Pronto-Lock II Face To Face

Pipe Size	8″	10″	12″	14″	16″
E	7½	8½	9	10	11
D	½	½	½	½	½
X	2¾	3½	4	4½	5¼

All Dimensions in Inches





D = Male Make-Up Allowance
E = Insertion Depth
F = Overall Length (MxF)
G = Face to Face (MxF)
H = Face to Face (FxF)
I = Overall Length (MxM)
X = Taper Length
Y = Length of Pipe to Cut

Formulas:
Male x Female G + 2E - D = Y
Male x Male H + 2E - 2D = Y

10.1-218

Repair Procedures

A. General

Repair procedures recommended by CIBA-GEIGY are based on the philosophy that the repair should be permanent and last as long as the pipe itself. It is therefore recommended that all damaged, impacted or sheared areas be cut out and replaced with a *spooled* repair section. Repairs should only be undertaken when the pipe is empty and depressurized.

A *spooled* repair section is a premeasured pipe length with appropriate joining ends bonded in place. Tapering of the pipe left in place, along with bonding of compatible pieces is also necessary for installation of these repair spools. Dry fitting of the repair section, prior to bonding, is recommended to insure a perfect fit.

Alternate repair methods, which do not require tapering for installation, include compression couplings, and O-ring couplings (either steel or fiberglass).

B. Leaks in Pipe Wall or Bell & Spigot Joint

If leakage is observed in the pipe wall or bell & spigot joint, the damaged area must be cut out and replaced. Proceed as follows:

1. Careful inspection should be made to insure that all imperfections, leaks, etc., are identified.
2. Cut out damaged section of pipe and/or joint.
3. Taper pipe left in place with appropriate tool:
a) 2"-6" Manual Taper-Tool or Taper-Maker
b) 8"-16" Taper-Tool II
In the case of buried pipe, it may be necessary to excavate around the pipe ends to manufacture a proper taper.

4. Calculate the length of pipe required for the repair spool. Refer to Figures 29, 30 & 31.
5. Taper cut ends of the premeasured repair spool when using flanges and grooved adapters.
6. Dry fit the repair spool to insure a perfect fit.
7. Thoroughly clean the tapered surfaces, either with light sanding, or if the surfaces are oily or greasy, use the joint cleaner found in the adhesive kit. It is imperative that the tapers be **clean and dry** before applying adhesive.
8. Mix adhesive according to directions taking careful notice of the pot life, approximately 20 minutes at 75°F(24°C) (Table 5, page 35).
9. Apply adhesive to all bonding surfaces and insert the repair section into the line making certain all surfaces are tightly locked as outlined in Bell & Spigot Joining, Chapter 4, Section A.
10. If temperature is below 60°F(16°C), heat assist methods such as the Chem Cure Pak® or heat blanket must be used in order for the adhesive to cure.
11. Do not pressurize the line until adhesive has fully cured.

C. Leaks in 2"-6" Pronto-Lock Joint

1. Leakage through the Pronto-Lock joint is usually the result of improper seating of the O-ring in the O-ring groove. If inspection of the leaking joint determines there are no signs of cracking or impact damage, proceed as follows:
a) Dissassemble the leaking joint. If this cannot be accomplished without cutting into the line, proceed as in (2) below.
b) Remove the O-ring from the groove and inspect thoroughly for cuts, scratches, abrasions, or signs of pinching.
c) Clean and inspect both the pin (male) end and the O-ring groove for signs of roughness, gravel, gouges, etc. Any scratches or gouges in the O-ring sealing area greater than 1/32" deep can allow fluid to escape past the O-ring. Minor scratches can be sanded smooth with fine (100 grit or finer) emery paper. Any discontinuity deeper than 1/32" should be cause for replacement.
d) Install a new lubricated O-ring. Use appropriate lubricant as discussed in Chapter 4, Section C (1).
e) Re-install the Pronto-Lock pipe in accordance with the instructions.

2. If leakage is observed to be the result of impact damage or cracking, or if the joint cannot be conveniently disassembled, cut out the damaged area adjacent to the joint, break the joint apart and replace with a spooled repair section comprised of male/female by flange, male/female by Dresser Coupling, or male/female by grooved adapter. Proceed as follows:
a) Cut out damaged section of joint.
b) Careful inspection should be made to insure that all imperfections are cut out.
c) Taper cut end of pipe with the appropriate tool.
2"-6", Manual Taper-Tool or Taper-Maker
8"-16", Taper-Tool II

In the case of buried pipe, it may be necessary to excavate around the pipe ends to manufacture a proper taper.

d) Calculate the length of pipe required for the repair spool.
e) Taper the cut end of a premeasured repair spool when using a flange, grooved adapter, male, or female (2"-6") fitting.
f) Dry fit the repair spool to insure a perfect fit.
g) Insure that the taper and bonding surfaces are clean. If the surfaces are oily or greasy, they may be cleaned with the joint cleaner found in the adhesive kit. It is imperative that the tapers be clean and dry before applying adhesive.
h) Mix adhesive according to directions taking careful notice of the working life, approximately 20 minutes at 75°F(24°C) (Table 5, page 35).
i) Apply adhesive to all bonding surfaces and insert the repair spool into the line making certain all surfaces are tightly locked.
j) If temperature is below 60°F(16°C), heat assist methods such as the Chem Cure Pak or heat blanket must be used in order for the adhesive to cure.
k) Do not pressurize the line until adhesive has fully cured.

D. Leaks in Pronto-Lock Pipe Wall

Follow the identical procedures for repairing damaged areas in the Pronto-Lock pipe wall as in Section B. If the damaged area is adjacent to the joint, cut out the damaged area, break the joint apart and replace with a spooled repair section as outlined in Part C, Section 2. In the case of 2"-6" pipe, where the pipe must be rotated, two piece flanges or grooved adapters may be used.

E. Leaks In 8"-16" Pronto-Lock II Joint

Again, leakage through the Pronto-Lock II joint is usually the result of improper seating of the O-ring in the O-ring groove.

1. If inspection reveals no cracking or impact damage, proceed as follows:
a) Disassemble the threaded sleeve portion of the leaking joint and free up at least three adjacent pipe lengths to allow for enough slack to "spring" the joint apart. (If this cannot be done, refer to Part C, Section 2.)
b) Remove the O-ring from the groove and inspect thoroughly for cuts, scratches, abrasion, or signs of pinching.
c) Clean and inspect both the pin (male) end and the O-ring groove for signs of roughness, gravel, gouges, etc. Any scratches or gouges in the O-ring sealing area greater than 1/32" deep can allow fluid to escape past the O-ring. Minor scratches can be sanded smooth with fine (100 grit or finer) emery paper. Any discontinuity deeper than 1/32" should be cause for replacement.
d) Install a new lubricated O-ring. Use appropriate lubricant as discussed in Chapter 4, Section C (1).
e) Re-install the Pronto-Lock II pipe in accordance with the instructions.

F. Compression Couplings

For correct installation of compression couplings, proceed as follows:

1. Cut out damaged section of pipe.
2. Careful inspection should be made to insure that all imperfections are cut out.
3. Cut a spool piece of the appropriate length to replace the removed pipe.
4. Thoroughly clean cut ends of pipe. It is imperative that each pipe end be clean and dry before applying adhesive.
5. Mix adhesive according to directions taking careful notice of the working life, approximately 20 minutes at 75°F(24°C). (Table 5, Page 35).
6. Apply an adhesive bead to the cut ends of the pipe, and allow to harden before installing the coupling.
7. End restraints must be used.
8. For operating pressure of less than 40 psi, tighten bolts with care.
9. For operating pressure of over 40 psi, internal stiffening rings must be used to protect against pipe collapse due to overtightening of bolts.

G. O-ring Couplings (2"-6")

For correct installation of O-ring couplings, proceed as follows:
1. Cut out damaged section of pipe.
2. Careful inspection should be made to insure that all imperfections are cut out.
3. Cut a spool piece of the appropriate length to replace the removed pipe.
4. Thoroughly clean cut pipe ends and sand any roughness on existing pipe exterior.
5. Mix adhesive according to directions taking careful notice of the working life, approximately 20 minutes at 75°F. (Table 5, Page 35)
6. Apply an adhesive bead to the cut ends of the pipe and allow to harden before installing coupling.
7. Lubricate rubber seals with lubricant (oil, liquid detergent, lard, etc.).
8. Center coupling over pipe ends.
9. Make-up clamp being careful not to overtighten.

H. Temporary Repair

A temporary repair should only be utilized when it is unfeasible to shut down the pipe system to install a permanent repair (B-G). Temporary repairs include the application of a repair saddle, complete circle repair clamp, or use of a hand lay-up kit. It must be recognized that CIBA-GEIGY does not endorse the long term performance of the temporary repair and recommends the installation of a permanent repair as soon as circumstances permit.

1. Repair Saddle
For correct installation of the repair saddle, proceed as follows:

a) Cut a length of pipe to adequately cover and extend at least 4" to either side of the damaged area.
b) Slit the "repair pipe" in half producing two 180° sections. Only one section need be installed per damaged area.
c) Thoroughly sand the inner surface of the saddle and the corresponding damaged area on the pipe removing all gloss from the pipe exterior and saddle interior.
d) Insure that the bonding surfaces are clean. If the surfaces are oily or greasy, they may be cleaned with the joint cleaner found in the adhesive kit. It is imperative that the surfaces be clean and dry before applying adhesive.
e) Mix adhesive according to directions taking careful notice of the working life, approximately 20 minutes at 75°F (Table 5, page 35).
f) Apply adhesive to the inner surface of the saddle and the corresponding damaged area on the pipe.
g) Center the saddle over the damaged area and snap into place.
h) Tighten the saddle into place using a hose clamp or a banding tool. The clamping device should be left on the pipe.
i) If temperature is below 60°F, heat assist methods, such as the Chem Cure Pak or heat blanket, must be used in order for the adhesive to cure.
j) Do not pressurize the line until the adhesive has fully cured.

2. Full Circle Repair Clamps
The full circle repair clamps are temporary repair devices which are easy and quick to install. A broad range of types and styles are available from numerous manufacturers such as Vega and Smith Blair. To install these clamps, proceed as follows:

a) Sand around the damaged area of the pipe to remove any rough spots.
b) Check to be sure all surfaces are clean prior to the application of the repair clamp.
c) Center the repair clamp over the damaged area making certain that the defective area is completely covered.
d) Make-up clamp bolts being careful not to overtighten.

3. Hand Lay-Up
Although CIBA-GEIGY does not supply hand lay-up kits, it is recognized that the hand lay-up repair has been used successfully in many instances to effect a temporary pipeline repair. One source for such a kit would be Wallace Murray. The directions included in the kit should be followed explicitly.

If a kit is not readily available, the following hand lay-up repair procedure should be used. (Refer to Figure 33, Hand Lay-Up Repair.)

a) Obtain the following required materials:
1. Glass fiber veil or chopped strand mat
2. Glass cloth
3. Epoxy resin (Araldite® 6010/Araldite LY556/Araldite CY206* or similar) and amine hardener (Hardener HY956* or similar) for room temperature cure
4. Sandpaper or power sander
5. Roller
6. Paint brush
7. Stirring stick
8. Scissors
9. Wax paper

*All available from CIBA-GEIGY Corp.

b) Clean the puncture and its external and internal surrounding area removing any foreign matter.
c) Make sure that the bond area of the pipe structure is dry.
d) Thoroughly sand (sandpaper/power sander) the entire bond area removing all exterior gloss and exposed internal liner.
e) Pre-cut the glass fiber veil/chopped strand mat and the glass cloth as follows:

1. The first layer (smallest) consists of glass fiber veil/chopped strand mat and is approximately 4 inches (10cm) wider than the puncture and 1 inch (2.5cm) longer than the circumference of the pipe.
2. The second layer is composed of glass cloth and should be 2 inches (5 cm) wider and the same length as the first layer.
3. The following layers should alternate between glass fiber veil/chopped strand mat and glass cloth each 2 inches (5 cm) wider than the preceding layer.
4. The last layer applied should always be glass cloth.
5. The total number of layers to pre-cut, usually six, will depend on the service requirements of each individual application. The total thickness of the hand lay-up repair should never be less than the thickness of the existing pipe wall.

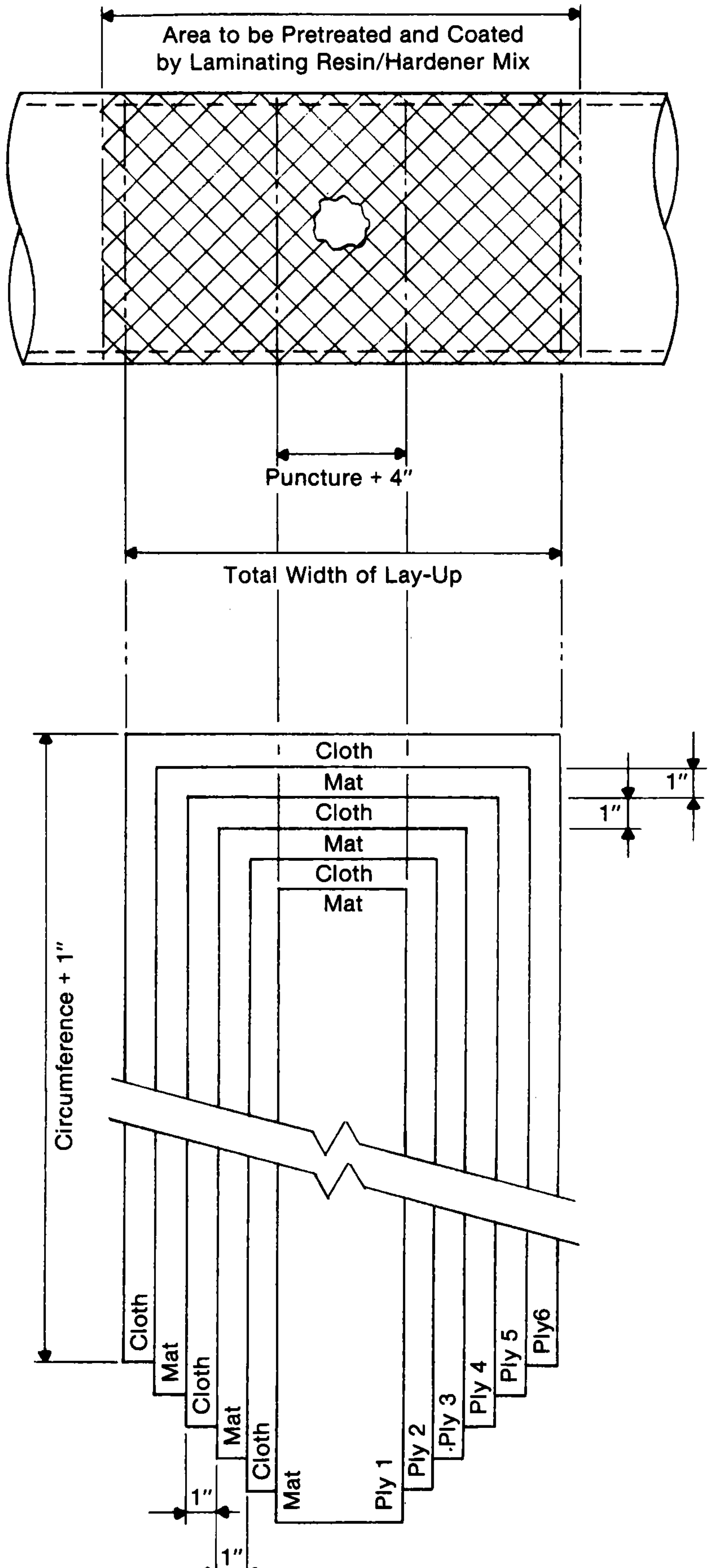
f) Mix the epoxy resin and the amine hardener according to the directions taking careful notice of the working life.
g) Apply a thick coat of the catalyzed resin to the abraded bonding surface of the pipe wall. In the case of a puncture, butter the edges of the hole and any associated exposed glass with the resin.
h) Place the narrowest layer of glass fiber veil/chopped strand mat on wax paper and saturate it with the catalyzed resin using a paint brush or roller.
i) Center the impregnated layer over the puncture and wrap it around the pipe.
j) Roll out the layer as smooth as possible to avoid the inclusion of air bubbles or dry areas.
k) Place the narrowest layer of glass cloth on the wax paper and saturate it with the catalyzed resin using a paint brush or roller. Apply the impregnated layer as reviewed above staggering the ends 1 inch. (Figure 33, "Hand Lay-Up Repair")
l) Continue the sequence of applying alternating layers of saturated glass fiber veil/chopped strand mat and glass cloth taking careful notice of the working life of the catalyzed resin.
m) Apply a final coat of catalyzed resin to the final saturated layer (glass cloth) of the hand lay-up.
n) Care should be taken to avoid sagging of the uncured hand lay-up repair prior to curing.
o) In the case where an internal laminate is applied, special care must be exercised to avoid any areas of exposed glass edges or areas which would cause an uneven or disturbed flow.
p) The hand lay-up repair should be cured in a totally immobilized condition under strict observation of the respective cure recommendations.

The mechanical performance of the above hand lay-up repair should be close to the performance of the undamaged pipe. This does not apply to the chemical resistance as brought about by the original internal liner. Again it must be stressed that CIBA-GEIGY does not endorse the long term performance of the temporary repair and strongly recommends the installation of a permanent repair as soon as possible.

Figure 33. Hand Lay-Up Repair

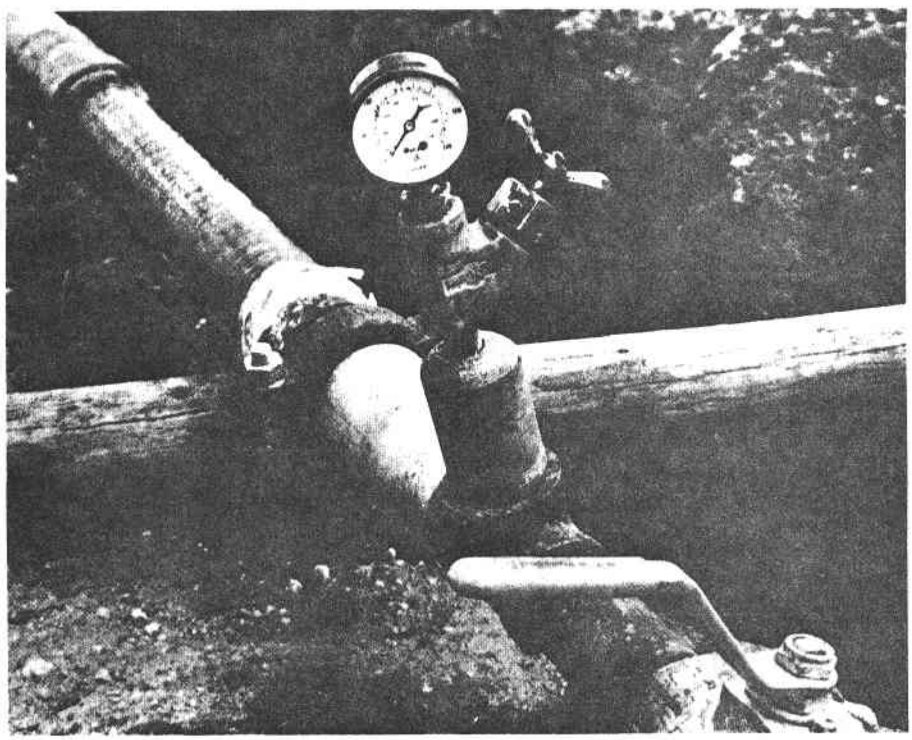
Pipe Preparation

Pre-Cut Glass Fiber Reinforcement



Testing

Installed piping systems should be tested prior to use to assure soundness of all joints and connections. The pressurizing equipment should be suited to the size of the line, the test pressure required, and have the capability of approaching the test pressure on a gradual basis.



A. Test Equipment Hookup

If the system is not flanged or otherwise fitted to permit tying in with standard fittings, a threaded or grooved adapter from the fiberglass pipe to steel can be obtained from CIBA-GEIGY (Chapter 7). Field test plugs (8"-16") for sealing off the open end(s) of the pipe system can also be furnished by CIBA-GEIGY.

The pressure gauge should be installed between the valve and the line so that it indicates the line's pressure after the valve is closed. Whenever possible, locate the pressure gauge at a low point in the line, where pressures are naturally higher. Table 17 illustrates the conversion from head (ft of water) into pressure (psi). Gauges should have a full scale reading of no more than twice the test pressure, i.e., don't use a 100 psi gauge for a 10 psi test. The gauges should be reliable, calibrated against a dead weight tester, and zeroed for atmospheric pressure.

Table 17. Head to Pressure

Head	Pressure		Head	Pressure	
1 ft	0.43 psi	.03 bar	160 ft	69.3 psi	4.8 bar
10 ft	4.3 psi	.3 bar	180 ft	78.0 psi	5.4 bar
20 ft	8.6 psi	.6 bar	200 ft	86.6 psi	6.0 bar
40 ft	17.2 psi	1.2 bar	225 ft	97.4 psi	6.7 bar
60 ft	26.0 psi	1.8 bar	250 ft	108.3 psi	7.5 bar
80 ft	34.6 psi	2.4 bar	275 ft	119.1 psi	8.2 bar
100 ft	43.3 psi	3.0 bar	300 ft	129.9 psi	9.0 bar
120 ft	52.0 psi	3.6 bar	325 ft	140.7 psi	9.7 bar
140 ft	60.6 psi	4.2 bar	350 ft	151.6 psi	10.5 bar

B. Test Pressures

The recommended test pressure is equal to 1½ times the anticipated or design operating pressure. When higher test pressures are desired, the test pressure should never exceed 1½ times the maximum rated operating pressure for the **lowest** rated element in the system. Therefore, it is important to check the pressure rating of all components of the system, not just the pipe, because fittings, tanks, or hoses may carry a pressure rating lower than that of the pipe.

A more severe cyclic test may be used for critical applications. In the cyclic test, the system is subjected to 5-10 pressurization cycles at 1½ times the maximum pressure rating of the lowest rated element in the system. Sudden pressure surges or "water hammer" should be avoided during testing. In some instances, surge or hammer can produce pressures of several times the rating of the pipe and fittings. In order to prevent water hammer or over-pressurization, quick closing valves and booster pumps without suitable controls must **not** be used.

Temperature changes have a definite effect on the pressure in the line. In closed systems, where a pipe is directly exposed to the sun, pressure increases up to 25% may occur. An overnight decrease in pressure from afternoon to early morning is normal due to temperature changes and does not necessarily indicate a leak.

C. Filling The System

Introduce water at the lowest point in the pipeline system, preferably with a small diameter line. The turbulent flow of the rushing water will cause air to become entrapped in the water and escape in the pipeline once the water has settled. Bleed off this entrapped air at the highest point in the system through appropriate valving. The released air should then be replaced by more water so that the line is filled with water before adding pressure to the line.

On long, straight pipe runs, the use of a soft pig ahead of the test fluid is recommended to ensure purging of the air.

D. Test Frequency

It is recommended that large or complex installations be tested in subsections as they are completed. Therefore, it is suggested that pressure tests be performed on a small section of the installation as early as possible to assure that the installation techniques are satisfactory. This is particularly important for installation personnel who have not previously used CIBA-GEIGY pipe.

E. Safety Precautions

As in any system where pressure is employed, adequate safety precautions

should be exercised. The following safety precautions should be considered:
1. There is no safe pressure. **Any** pressure is potentially dangerous. The fact that some practices, which are not safe, are used because "we never had any trouble before" should never be accepted.
2. Pressurizing equipment should be operated by qualified and experienced personnel. Untrained or unauthorized personnel should not be around the pressurizing equipment.
3. Do not make any adjustments on pressurized fittings. For example, if a threaded adapter is leaking, take the pressure off the line before attempting to tighten.
4. The test operation should be well-planned and carried out with all due precautions. It is always best for one man to be in charge of the operation so that all other persons on the job take their direction from him.
5. Testing with air or gaseous media is particularly dangerous and should be avoided if at all possible. Gas or air lines may be hydraulically tested then "de-watered" by pigging after the line is fully backfilled and restrained. **Never test with flammable fluids or gases.**
6. When testing underground systems, the line should be partially backfilled and temporarily blocked at directional changes to prevent excessive movement during the test or should a sudden loss of pressure occur, care should also be taken to prevent above ground systems from buckling or moving excessively during test or in case of sudden depressurization.

F. Causes for Leakage

If the line appears to be leaking, the following check list may be of some help in locating the problem:
1. A valve held open by a piece of rag, wood or some other foreign matter.
2. Dirt or foreign material in the O-ring groove.
3. Pipe not sufficiently covered in trench.
4. Fittings and valves in test section not sufficiently blocked.
5. Air in line (no relief valve).
6. Leakage through valve at end of test section.
7. Valve Bonnet plug leaking.
8. Packing on valves and wet-barrel hydrants leaking.
9. Test pump leaking. Check-valve as well as gate-valve.
10. Curves not sufficiently covered in trench.
11. Testing too long a section of pipeline.
12. Insufficient saturation time (24 hours).
13. Ruptured pipe—cracked, blown out.
14. Broken fittings.
15. Faulty accessory equipment—valves, fittings, hydrants, saddles, relief valves.
16. Faulty test gauge.
17. Test pump suction line drawing air.

Occasionally a leak will not show on the surface due to good draining soil under the pipe. Sensitive transistorized leak detectors can be employed to locate a hard-to-find leak.

After all tests are made, all joints left open for inspection should be covered, tamped and final backfill completed.
CIBA-GEIGY assumes no responsibility or liability for the consequences of any testing practices and strongly recommends that all safety precautions be strictly followed.

Appendix A
Engineering Thrust Block Design

Figure A-1, Thrust Block Design, provides a detailed evaluation of the forces involved in the design of a thrust block. Tables A-1 & A-2 are required for the calculation of the desired thrust block area.

Table A-1

Reduction Factor (R)

Existing Condition	Reduction Factor, R
1. General construction backfill soils compacted to critical void ratio.	2/3
2. Well-compacted backfill and select backfill	3/4

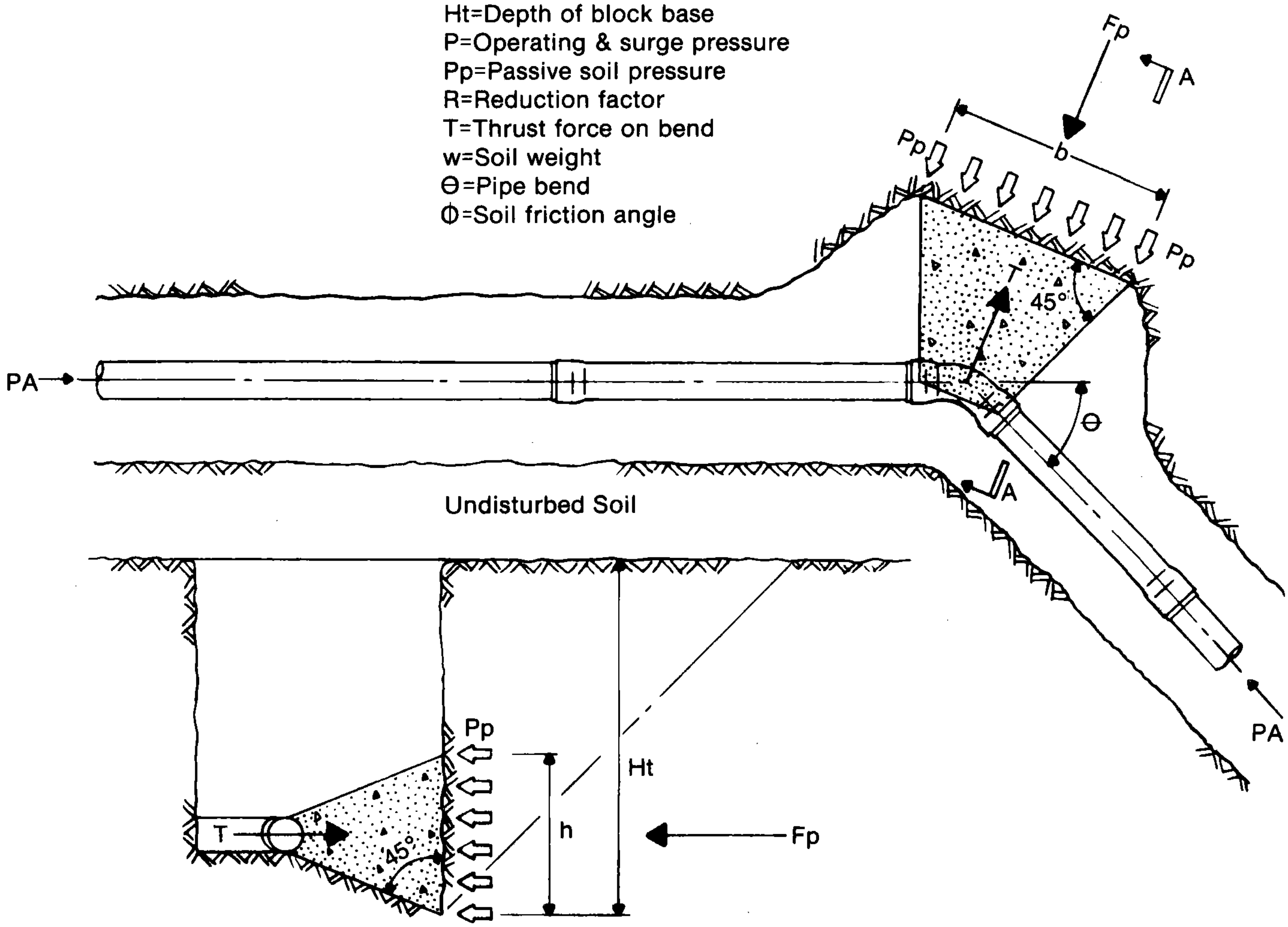
Table A-2.

Soil Friction and Cohesion Factors

Soil Description	Friction Angle Φ (Degrees)	Cohesion Cs (sf)
Well graded sand (dry)	44.5	0
(sat.)	39	0
Silt (passing 200 sieve		
(dry)	40	0
(sat.)	32	0
Cohesive granular soil		
(wet to moist)	13-22	385-920
Clay (wet to moist)		
(at max. comp.)	11.5-16.5	460-1,175

Figure A-1. Thrust Block Design*

A=Crosssectional area of pipe
Ab=Block bearing area
Cs=Soil cohesion
D=O.D. of pipe
Fp=Soil pressure
H=Depth of cover
h=Height of block bearing area
Hc=Burial depth
Ht=Depth of block base
P=Operating & surge pressure
Pp=Passive soil pressure
R=Reduction factor
T=Thrust force on bend
w=Soil weight
Θ=Pipe bend
Φ=Soil friction angle



Formulas:

$T = 2PA \sin \Theta$

Assume: $h = \frac{1}{2} Ht$

$Pp = wH_C N\Phi + 2Cs\sqrt{N\Phi}$

$\therefore b = \dfrac{2PA \sin \Theta/2}{3/8 W Ht^2 N\Phi + Cs Ht \sqrt{N\Phi}}$

$Ab = hb = \dfrac{T}{Pp}$

Where: $W = RwHD$

$N\Phi = \tan^2(45° + \Theta/2)$

*Reproduced by permission from NFPA 24, Standard for Outside Protection, Copyright© 1977, National Fire Protection Association, Boston, MA.

Calculate:
Thrust block area (Ab) for 12 in. pipe for both a 90° and 45° horizontal bend.

Project Data:

I.D.=12.3 inches
D=12.75 inches=1.06 ft

$$A=\frac{\pi(I.D.)^2}{4}=118.8\ in^2$$

P=200 psi (operating plus surge pressure)
W=100 lb/ft^3 for dry sandy soil
Cs=O
Φ=44.5
H=5 ft
Safety Factor (fs)=1.5

Computations:

90° bend
Assume $h=H_t/2$ and try Ht=7 ft

$$b=\frac{2PA\ Sin\ \theta/2}{3/8W\ H_t^2N\phi+CsH_t\sqrt{N\phi}}$$

$$b=\frac{2\ PA\ Sin\ \theta/2}{3/8\ W\ H_t^2\ TAN^2(45°+\Phi/2)+O}$$

$$b=\frac{(2)(200\ lb/in^2)(118.8\ in^2)(Sin\ 90°/2)}{3/8(100\ lb/ft^3)(7ft)^2(TAN^2 45°+44.5°/2)}$$

$$b=\frac{33{,}601.7\ ft}{10{,}449.7}=3.22\ ft$$

b=3.22 ft h=7/2=3.5 ft

$Ab=hbf_S=(3.22\ ft)(3.5\ ft)(1.5)=16.9\ ft^2$

45° bend
Try Ht=6 ft

$$b=\frac{(2)(200\ lb/in^2)(118.2\ in^2)(Sin\ 45°/2)}{3/8\ (100\ lb/ft^3)(6\ ft)^2(TAN^2 45°+44.5°/2)}$$

$$b=\frac{18{,}185.1\ ft}{7{,}677.3}=2.37\ ft$$

b=2.37 ft h=6/2=3 ft

$Ab=hbf_S=(2.37\ ft)(3\ ft)(1.5)=10.7\ ft^2$

In the U.S.

CIBA-GEIGY Corporation
Pipe Systems Department
9800 Northwest Freeway
Houston, Texas 77092
Telephone (713) 681-8401
Telex 131411 (Ardsley, New York, USA)

Regional Offices:

Dublin, California	(415) 829-1250
Denver, Colorado	(303) 759-8511
Chicago, Illinois	(312) 280-5300
Dallas, Texas	(214) 647-2117
Houston, Texas	(713) 681-8401
Midland, Texas	(915) 563-2110

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CIBA-GEIGY Canada Ltd.
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Don Mills, Ontario M3B 3A8
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In Switzerland

CIBA-GEIGY AG
Department KA 5.723
Post Office Box
CH 4002 Basel
Telephone 061-376098
Telex 62355

Contact the Pipe Systems representative at the nearest office listed above.

10.1.7 Fire Protection Supervisory Panel

The fire protection supervisory panel is a Honeywell fire alarm control unit, Model No. W940A. It was procured for this program by Southern California Edison, and it is located in the main control room. See the following pages for additional information.

Honeywell

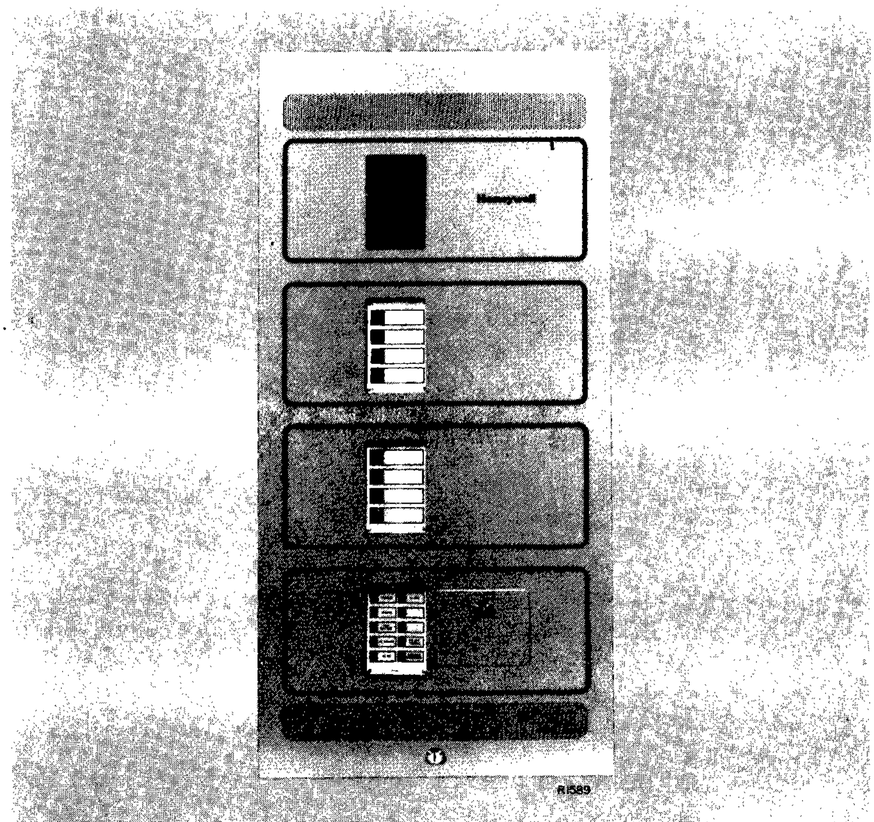
Fire Alarm Control Unit

MODEL NUMBER W940A

General

The W940A Fire Alarm Control Unit is a multizone, solid-state, low-voltage fire alarm system. The W940A consists of standard modules which can be combined according to the specific requirements of the job. The W940A is UL and ULC listed and FM approved.

The W940A system monitors TC100 Ionization Smoke Detectors, manual stations, thermal detectors, and other N.O. contact initiating devices. Zones can be wired as Class A (four-wire) or Class B (two-wire) circuits. The system provides either noncoded or coded operation of polarized bells and horns. The wiring to all initiating devices and indicating devices is electrically supervised for opens, shorts, and grounds. In addition, the municipal master box wiring is supervised for opens and grounds. Standby battery operation is an available option.



W940A FIRE ALARM CONTROL UNIT

The W940A system is constructed of system modules factory assembled and wired as a subpanel which installs in a separately ordered enclosure (rough-in box). The enclosure is available in a two-module or four-module size. The W940A subpanel and cover are ordered, assembled, identified, and shipped in the same way as is a custom panel to meet job requirements but has the advantage of being made up of standard modules for reliability and quality assurance. (See Ordering Procedure.)

Specifications

W940A FIRE ALARM CONTROL UNIT

AMBIENT OPERATING TEMPERATURE
32 to 122 F (0 to 50 C)
32 to 108 F (0 to 40 C) for enclosure with batteries.

RELATIVE HUMIDITY
0 to 95% at 120 F (49 C).

STANDBY BATTERY WIRING
0.1 ohm or less.

INTERMODULE POWER WIRING
0.1 ohm or less.

DIMENSIONS
See Figure 1.

OUTSIDE WIRING
Lightning protection should be used at wire entrance to building for municipal trip circuit and initiating device circuits. No other circuits should be run outside.

APPROVALS
UL and ULC listed, FM approved.

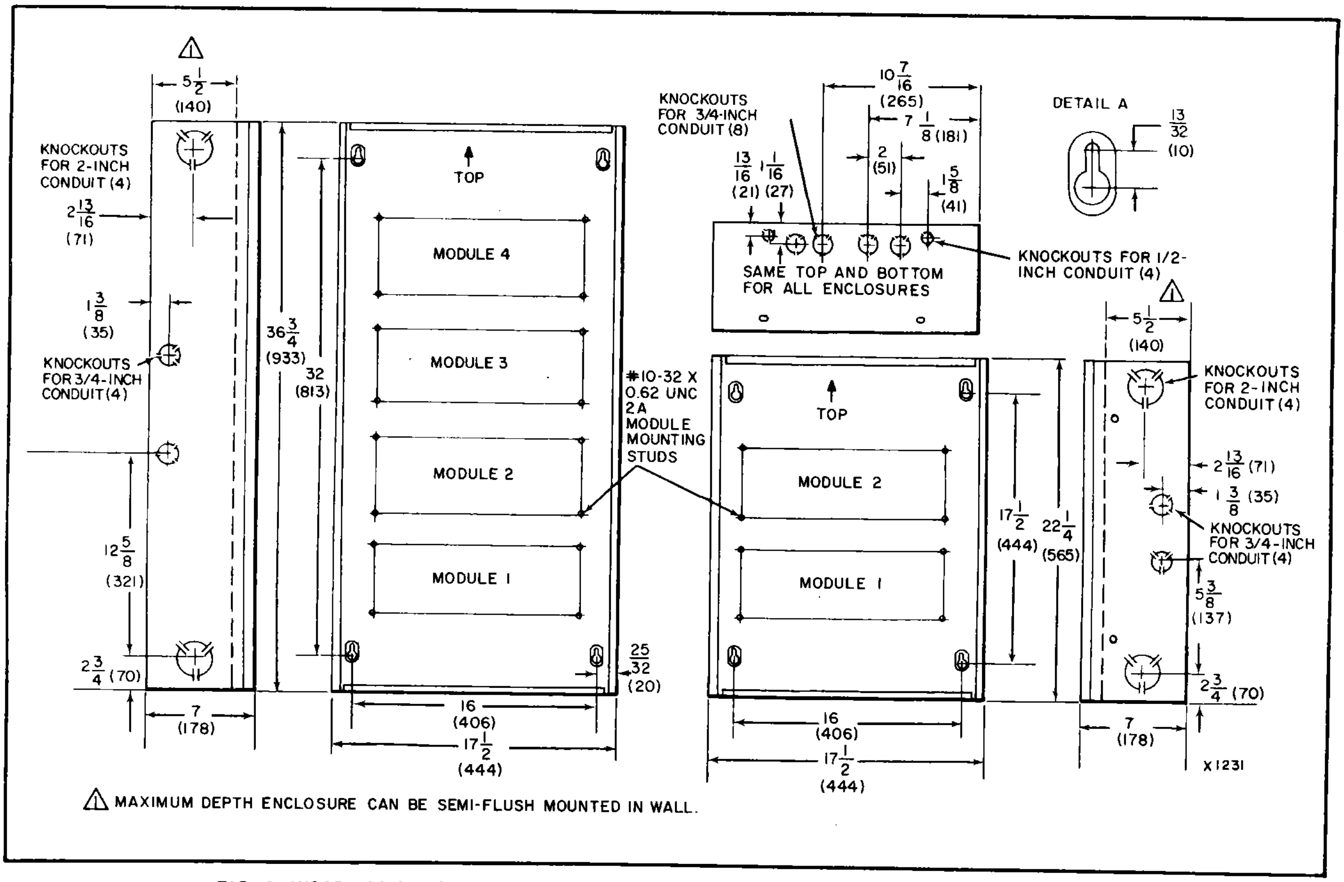
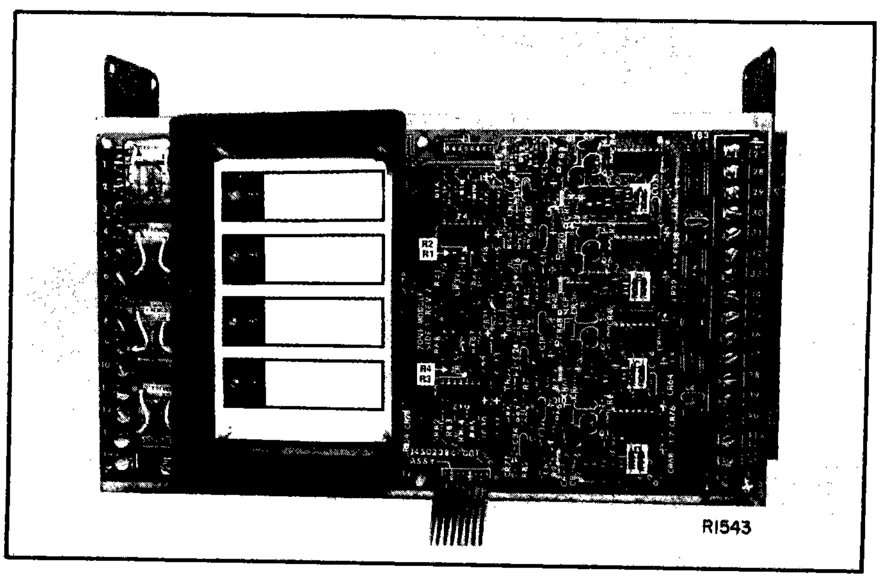


FIG. 1. W940A ENCLOSURE APPROXIMATE DIMENSIONS IN INCHES (MILLIMETERS)

ZONE MODULE (A)

Provides four zones of power for TC100 Ionization Smoke Detectors, supervision and detection for fire alarm functions connected in four-wire (Class A) or two-wire (Class B) initiating device circuits. Silenceable and nonsilenceable alarm outputs and trouble output functions are available. Optional spdt zone alarm relays are also available. The Zone Module (A) must be used with a Common Module (C). One to eight zone modules (up to 32 zones) can be used with one common module. Zone alarm and trouble lamps are provided on this module.



ZONE MODULE (A)

MODEL

Zone Module (A1) without zone alarm relays.

Zone Module (A2) with zone alarm relays.

Zone Module (A3) with zone alarm relays and march time coder.

ZONES PER MODULE

Four.

OPERATING VOLTAGE

22.5 to 30.0V dc supplied by Common Module (C).

INITIATING DEVICE CIRCUIT

30 TC100C smoke detectors max., and/or any number of N.O. contact devices per zone. Contact devices must be rated at 0.25 ampere minimum unless used with series limiting resistor.

RELAY CONTACT RATINGS

Relays	28V DC	120V AC	220/240V AC
Resistive	3A	3A	3A
Pilot Duty	- -	0.4A	0.2A
Lamp	2A	0.4A	0.2A

SPACE REQUIRED

One module location.

FIELD OPTIONS

One to seventeen or eighteen to thirty TC100C smoke detectors per zone.

Silenceable or nonsilenceable zone alarm outputs.

Zone can be wired for two-wire operation (Class B).

ACCESSORIES

End of line resistor (EOLR) for 2-wire operation (1.91K ohms): 14501600-001.

Series Limiting Resistor (910 ohms): 14501600-004.

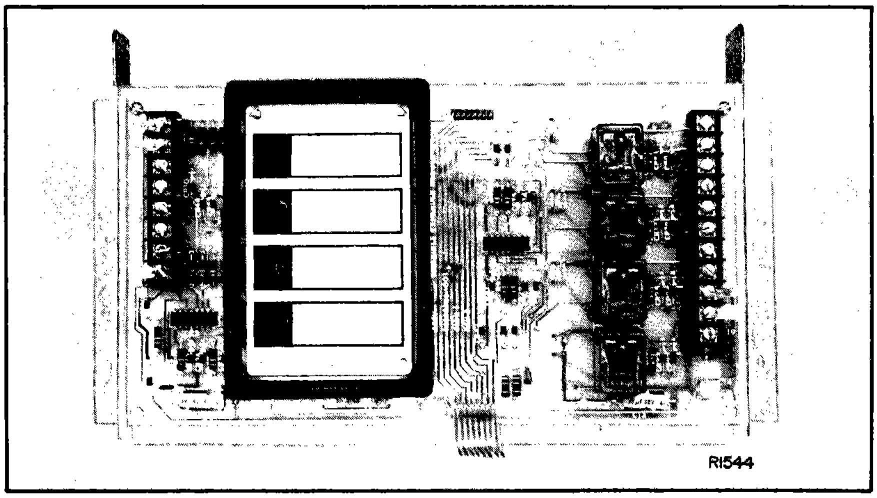
INDICATORS

Four red zone alarm lamps.

Four yellow zone trouble lamps.

SIGNALING MODULE (B)

Provides power, supervision, and control for four zones of polarized bells and horns. The Signaling Modules (B) are used when the two audible alarm circuits of the Common Module (C) are not sufficient for the system alarm indicating requirements. Input signals from Zone Modules (A) and Coder Module (F) are used to provide the desired audible alarms for the appropriate bell or horn circuits. A zone energized lamp is provided for each signal circuit.



SIGNALING MODULE (B)

MODELS

Signaling Module (B1)

Signaling Module (B2) International Model

OPERATING VOLTAGE (Primary Supply)

Signaling Module (B1): 120v, 60 Hz.

Signaling Module (B2): 100/120/220/240v, 50/60 Hz.

AUDIBLE DEVICES

Polarized bells or horns. Four zones up to 1 ampere each.

STANDBY BATTERY VOLTAGE

24V dc.

POWER REQUIRED (Primary Supply)

330 VA maximum.

SPACE REQUIRED

One module location.

FIELD OPTIONS

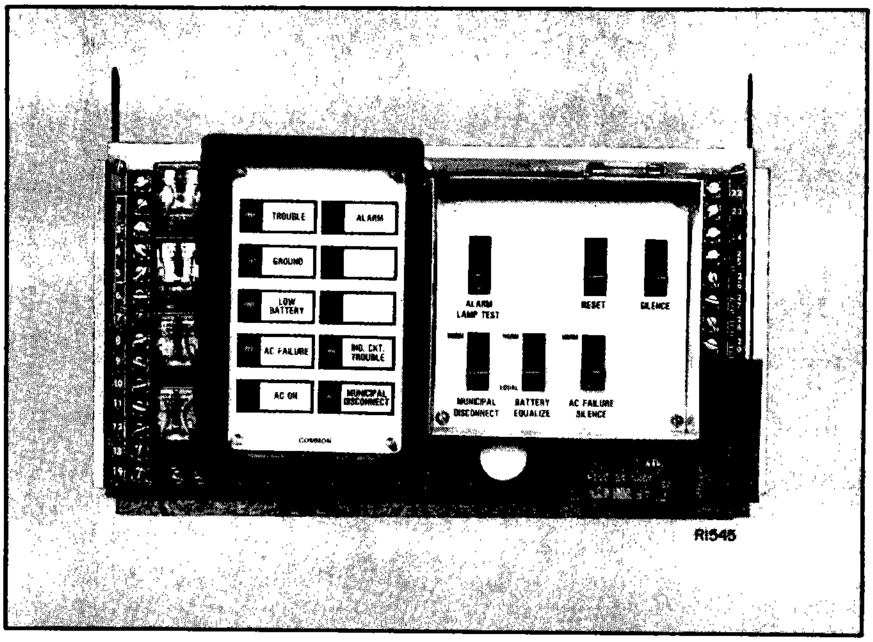
Voltage selection for International Model.

INDICATORS

Four red "loop energized" lamps.

COMMON MODULE (C)

Provides the common circuitry necessary to interface with the other modules of the W940A Fire Alarm Control Unit. The Common Module (C) provides sufficient power for two zones of alarm indicating bells and horns and up to eight fully loaded Zone Modules (A). Output signals include common trouble and alarm logic outputs and relay outputs. Controls are provided for reset, silence, municipal trip disconnect and alarm lamp test. Provisions are available to allow either two- or three-wire single phase power input wiring. Models having battery charger can be adjusted for sealed lead cell, lead-calcium, lead-antimony, or nickel-cadmium batteries for standby power.



COMMON MODULE (C)

MODELS

Common Module (C1) without battery charger.
Common Module (C2) with battery charger.
Common Module (C3) International Model without battery charger.
Common Module (C4) International Model with battery charger.

OPERATING VOLTAGE (Primary Supply)

Common Module (C1) and (C2): 120V, 60 Hz. Common Module (C3) and (C4): 100/120/220/240V, 50/60 Hz.

INDICATING DEVICES

Polarized bells or horns. Two zones up to 1 ampere each.

STANDBY BATTERY VOLTAGE

24V dc.

POWER REQUIRED (Primary Supply)

330 VA maximum.

SPACE REQUIRED

One module location.

FIELD OPTIONS

Voltage selection for International Models.
Power wiring selection for two- or three-wire single phase connection.
Battery type selection for models with battery charger.

INDICATORS

Two red "loop energized" lamps for indicating device circuits.
One red common alarm lamp.
One yellow common trouble lamp.
One yellow lamp to indicate ground fault.
One yellow lamp to indicate ac power failure.
One yellow lamp to indicate low battery voltage.
One yellow lamp to indicate municipal trip disconnect.
One yellow lamp to indicate trouble in the indicating device circuits.
One green lamp to indicate power on.

RELAY CONTACT RATINGS

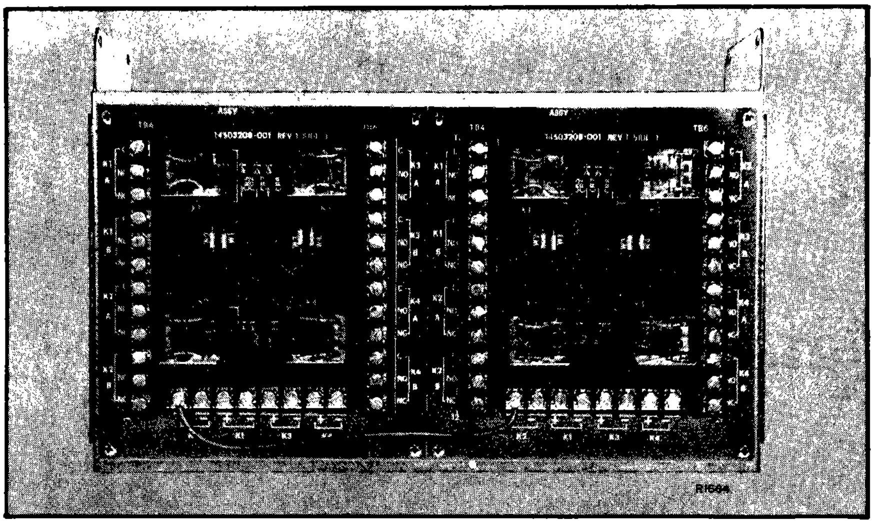
Relays	Alarm			Trouble		
	28V DC	120V AC	220/240V AC	28V DC	120V AC	220/240V AC
Resistive	5A	5A	3A	3A	3A	3A
Pilot Duty	- -	1A	0.5A	- -	0.4A	0.2A
Lamp	0.5A	0.5A	0.3A	2A	0.4A	0.2A

CONTROLS

Reset switch.
Silence switch.
Alarm lamp test switch.
Muncipal disconnect switch.
AC failure silence switch.
Battery equalize switch.

ACCESSORY RELAY MODULE (D)

Provides eight relays which can be driven by any of the logic outputs from the Zone Module (A) or Common Module (C) or any other 24V dc sources. The module is used to provide functions such as releasing door holders, remote annunciation, closing fire dampers, etc.



ACCESSORY RELAY MODULE (D)

MODEL
Accessory Relay Module (D2)

NUMBER OF RELAYS
Eight.

OPERATING VOLTAGE
22.5 to 30V dc.

RELAY CONTACT CONFIRGURATION
Two Form "C" (SPDT).

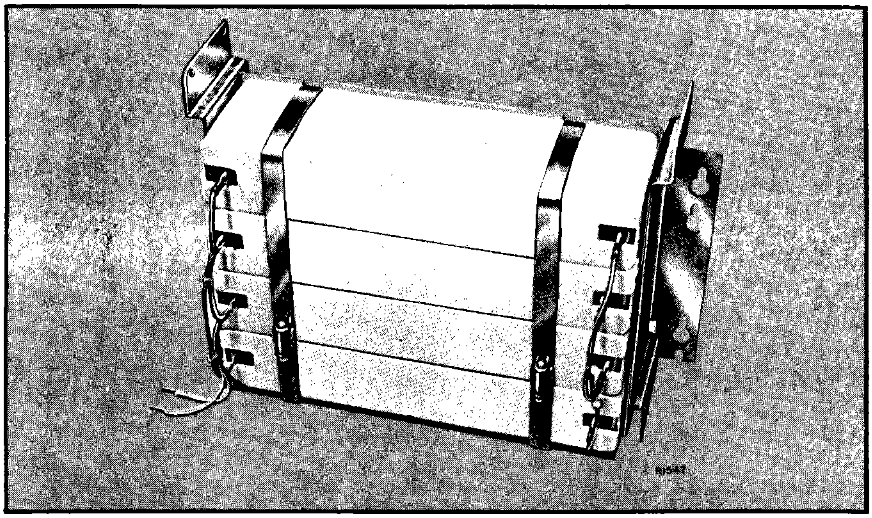
SPACE REQUIRED
One module location.

RELAY CONTACT RATING

Relays	28V DC	120V AC	220/240V AC
Resistive	5A	5A	5A
Pilot Duty	- -	0.7A	0.3A
Lamp	0.8A	0.7A	0.3A

STANDBY BATTERY MODULE (E)

Provides standby power for the W940A Fire Alarm Control Unit in the event of a commercial power failure. The Standby Battery Module (E) consists of maintenance-free, sealed lead cells and supplies 24 volts in capacities of 10 or 20 ampere-hours.



STANDBY BATTERY MODULE (E)

MODELS
Standby Battery Module (E1): 10 Ampere-Hours.
Standby Battery Module (E2): Additional 10 Ampere-Hours (20 Ah total with E1).

BATTERY VOLTAGE
24V dc.

CHARGING VOLTAGE
Supplied by Common Module (C).

SPACE REQUIRED
One module location (10Ah)*. Two module locations (20Ah)*.

BATTERY SIZING (for 24 hours)
One or two modules use Standby Battery Module (E1). Three to five modules use Standby Battery Modules (E1 and E2).

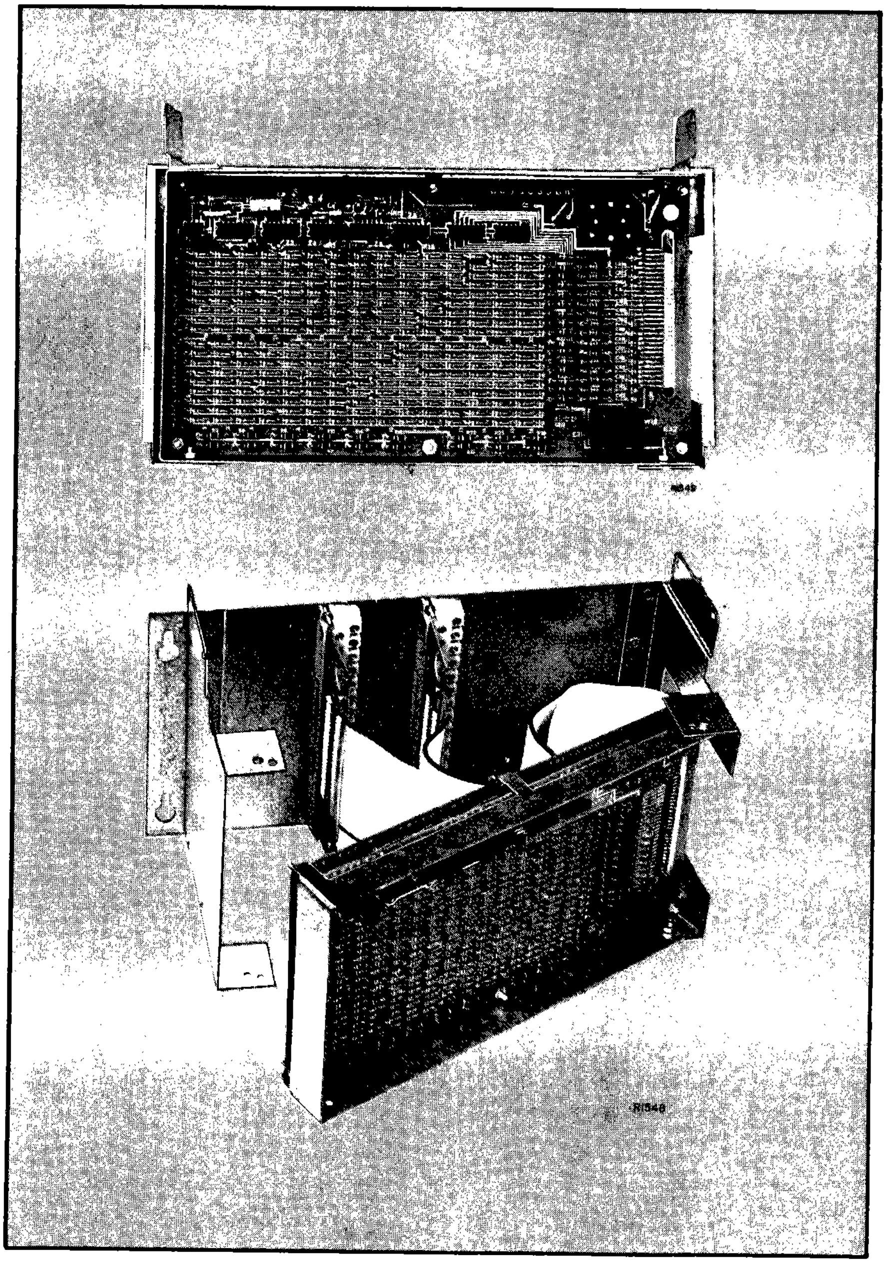
BATTERY SIZING (General)
Ampere-hour capacity of standby batteries is determined by length of time required for standby operation and alarm.

*Standby Battery Module (E) must be topmost module in enclosure.

CODER MODULE (F)

Provides up to 343 distinct codes for audible devices on the alarm indicating circuit. The 32 zone inputs to the Coder Module (F) are silenceable or non-silenceable output signals from the Zone Modules (A). Each of the 32 zones can be assigned a specific code. The Coder Module (F) outputs are used to drive Common Module (C) and Signaling Module (B) alarm indicating circuits.

For large systems, several Coder Modules (F) can be connected together. Modules will code in sequence when several alarms occur simultaneously.



CODER MODULE (F)

MODEL
Coder Module (F1).

OPERATING VOLAGE
22.5 to 30.0V dc power supplied from Common Module (C).

INPUT SIGNALS
Output signals from Zone Module (A) logic outputs or N.O. contacts. Up to 32 different zones can be connected.

ZONE CODING
One to three digits. Numbers one through seven can be used for each digit. Up to 343 different codes available.

CODER OUTPUTS
Logic output or optional relay (two sets of Form C contacts).

RELAY CONTACT RATINGS

Relays	28V DC	120V AC	220/240V AC
Resistive	3A	3A	3A
Pilot Duty	-	0.4A	0.2A
Lamp	2A	0.4A	0.2A

SELECTABLE PULSE RATES
120, 60, 30, and 20 pulses per minute.

SPACE REQUIRED
One module location.

FIELD OPTIONS
Normal coded operation.
Continuous master code.
March time.
Continuous after-ring.
General evacuation after-ring.

Ordering Procedures

ACCESSORIES (Optional)

14503590-001: Two-module enclosure
14502145-001: Two-module mounting kit for 19-inch rack
14503591-001: Four-module enclosure
14502145-002: Four-module mounting kit for 19-inch rack
14503745-001: Trim Ring Bag Assembly (Corners and hardware only)
14503384-001: Trim Ring Extrusion
14500087-001: Coder module relay
14501600-001: 1.91K EOLR (two for Common Module (C), four for Signaling Module (B), four for Zone Module (A) if two-wire loop)
14501600-004: 910 ohm current limiting resistor for use with N.O. contact devices in same loop at TC100 with accessory relay.
14502412-005: Lightning protector for municipal trip or initiating device circuits.
14502412-007: Lightning protector for municipal trip circuitry.
14502412-001: Lightning protector for 120V ac power.
14502412-016: Lightning protector for indicating device circuits.

SYSTEM RESTRICTIONS

1. Enclosures, accessories, and additional equipment required must be ordered separately. Proper cover is automatically provided for, and shipped with subpanel.
2. Modules within each subpanel will be factory wired to interconnect Zone Modules (A), Common Modules (C), and Signaling Modules (B) so all zones ring all bells (alarm indicating devices).
3. Letter "A" at end of order number is used to indicate that the interenclosure wiring terminal assembly is not required on the subpanel being ordered.
4. Letter "B" at end of order number is used to indicate that the interenclosure wiring terminal assembly is required on the subpanel being ordered.
5. Common Modules (C), where specified, must always be in bottom position of subpanel. Only one Common Module (C) may be specified per subpanel.
6. Common Module (C) and Signaling Module (B) must always be specified with the same power supply option.
7. A maximum of two modules with power supplies [one Signaling Module (B) and one Common Module (C) or two Signaling Modules (B)] are allowed in one enclosure.
8. A maximum of one Standby Battery Module (E1) and one Standby Battery Module (E2) are allowed per system. A Standby Battery Module (E2), when specified, must be positioned above a Standby Battery Module (E1).
9. Standby Battery Modules (E1) and (E2) can be installed in same enclosure with one (1) Signaling Module (B) *or* one (1) Common Module (C) only if ambient temperature around enclosure will not exceed 92 degrees F (33 degrees C).
10. The modules for each subpanel must be ordered (as needed) in the sequence Common Module (C), Signaling Module (B), Zone Module (A), Accessory Relay Module (D), Coder Module (F), and Standby Battery Module (E).
11. Vacant positions are not allowed below or between modules.
12. Violations of any of the above restrictions will result in a rejection of the order.

BATTERY SIZING

STANDBY BATTERY MODULE (E) FORMULA

Ampere-hours
$= I_sT_s + T_a (I_s + I_a)$

ALL OTHER BATTERIES

Ampere-hours
$= 1.25 (I_sT_s + T_a [I_s + I_a])$

Where:
I_s = Total Standby Current Determined from Table
T_s = Hours of Standby Required
I_a = Total Alarm Current Determined from Table
T_a = Hours of Alarm Condition Required

Module	Supervisory Current (I_s in Amperes)	Additional Current in Alarm (I_a in Amperes)
Zone Module (A1) and (A2)	0.120	0.22 per zone without alarm relay 0.27 per zone with alarm relay
Zone Module (A3)	0.140	0.22 per zone without alarm relay 0.27 per zone with alarm relay
Signaling Module (B)	0.10	1.25 per zone
Common Module (C)	0.210	0.40
Audible Circuit	-----	1.0 per circuit
Accessory Relay Module (D)	0.040 per energized relay	
Coder Module (F)	0.09	0.15

Example:
W940A System wih one Zone Module (A), one Common Module (C) and one Signaling Module (B), with three initiating zones and five audible circuits. Standby capacity of 24 hours plus 15 minutes of alarm is desired. Use the Standby Battery Module (E) Formula.

Therefore, $I_s = 0.43$, $T_s = 24$ Hours, $I_a = 6.81$, $T_a = 0.25$

Ampere-hours = 0.43 x 24 + 0.25 (0.43 + 6.81) = 12.13

Since Standby Battery Modules (E) are 10 ampere-hours each, two Standby Battery Modules (E1 + E2) will be required.

Modules	Qty	Standby Current (I_s in Amperes)	Additional Current in Alarm (I_a in Amperes)
Zone Module (A1) (3 zones)	1	1 x 0.12 = 0.12	3 x 0.22 = 0.66
Signaling Module (B) (3 circuits)	1	1 x 0.10 = 0.10	3 x 1.25 = 3.75
Common Module (C) Audible Circuits (2 Circuits)	1 2	1 x 0.21 = 0.21 ...	1 x 0.40 = 0.40 2 x 1.0 = 2.00
Total	--	I_s = 0.43A	I_a = 6.81A

NFPA Battery Standby Capacity Required:
72A System: None
72B System: 60 Hours
72C System: 60 Hours
72D System: 24 Hours

W940A System Battery Charger Rating: Trickle Charge 12-60 milliampere, Maximum Fast Charge 2.5 ampere.

LIFE SAFETY FIRE ALARM SPECIFICATIONS

SCOPE

Provide and install a complete, electrically supervised, four-wire Class A zoned (continuous ringing), (continuous march-time code at [120] [60] [30] [20] pulses per minute) (continuous master code) (four rounds selective coded positive noninterfering successive [pick *one* of the following options if desired]

[with continuous after ring]
[with continuous after ring and new alarm interrupt]
[with continuous general evacuation signal]
[with continuous general evacuation signal and new alarm interrupt])

fire alarm system as described herein and as shown on the plans. All components of the entire system shall be listed, labeled, or approved for its application as fire alarm equipment for NFPA (72A) (72B) (72C) by Underwriters' Laboratories, Inc. (and Factory Mutual).

The system herein specified and shown on the drawing is manufactured by Honeywell Inc. as base bid. If this contractor elects to submit a voluntary alternate manufacturer at time of bidding, the alternate manufacturer shall comply with the full intent of this specification. If the alternate manufacturer's system requires any additional panel space or different power requirements from the system specified, the electrical contractor shall obtain written approval from the architect ten (10) days prior to bidding. Also, if any additional conduit or writing is required that is not shown on the drawings, the electrical contractor shall include all costs in his voluntary alternate bid.

SYSTEM OPERATION

ALARM

Upon actuation of any detector, all alarm signaling units shall sound (continuously) ([120] [60] [30] [20] beats per minute) (the master code) (the code of the zone in alarm), (light all visual alarm lamps) (flash all visual alarm lamps), light the respective zone alarm lamp on the central control panel (and annunciator), (send a signal to the fire department) (trip the city municipal system), (trip a Remote Station connection), shut down all air handling units and release all door holders.

TROUBLE

A break in the detector loop wiring shall light the respective zone trouble lamp on the central control panel (and a common trouble lamp on the annunciator) and sound a trouble signal at the central control panel (and engineer's office). Since the detection circuit is Class A, the system will still be able to receive an alarm from any detector even if there is a trouble condition on that zone.

A break in the signaling loop wiring shall light the trouble lamp on the central control panel (and a common trouble lamp on the annunciator) and sound a trouble signal at the central control panel (and engineer's office). A signaling loop "activated" lamp shall be provided for each signaling loop for system testing and troubleshooting.

To prevent the panel from inadvertently being left in the Silence condition, the trouble signal and indicating signal silence switch shall be of the self-restoring type which cannot be left in an abnormal position.

Control panel shall have a four-wire Class A wiring for each detection circuit, (4) (8) (12) (16) (20) (24) (28) (32) zones shall be provided. Systems that cannot receive an alarm from all detectors even though there is a trouble condition in the detection loop, shall not be acceptable. Power for all remote detectors such as Ionization detectors shall be provided by the detection (four-wire Class A) wiring. Systems that power detectors from a power source separate from the detector circuit with Class A wiring shall monitor the power source and independent wiring to each zone so "true" trouble and alarm by zone is achieved for reliability and ease of maintenance. All detectors shall be operable even with a single fault condition on the detector power wiring.

The control panel shall have a trouble and an alarm lamp for each detection circuit. Systems that have a common trouble lamp only and/or rely on a combination of indicators that requires operator interpretation to determine if there is an alarm or trouble or which zone has a given condition, shall not be acceptable.

Twenty-four hour (Sealed Lead Cell) (Lead-Calcium) (Lead-Antimony) (Nickel-Cadmium) standby batteries and charger shall be provided for all detectors that require power and for the central control panel. (Batteries and charger shall be furnished in an enclosure of similar size and painted the same as the fire control panel.) (A battery rack shall be provided for the batteries.) A locked door shall be provided to allow access to the control switches on the front of the control panel to prevent unauthorized control. Access shall be to the switches only and shall not expose wiring or components.

(100) (120) (220) (240) ac primary power shall be monitored and a power-on lamp shall be provided. Upon failure of the primary power source the system shall light a power trouble condition lamp, indicate a trouble condition (and automatically change to standby batteries) (automatically change over to secondary power). The control panel shall also monitor the batteries and, upon a low battery condition, light the low battery lamp and indicate a trouble condition. System ground detection shall be provided for the entire system. Upon ground detection the ground detection lamp shall light and a trouble signal indicated. Provide a lamp test switch to test all alarm lamps on the control panel.

Provide a municipal trip circuit that is a distinct separate circuit utilized for no other purpose. A municipal disconnect test switch shall be provided. The municipal disconnect lamp shall indicate that the municipal trip circuit is disconnected. Output terminal connections shall be provided for (future connection) (connection to a remote station transmitter) (connection to a [local energy] [shunt trip] [modified shunt trip] municipal master fire alarm box). (Provide [remote station receiver] [municipal master fire alarm box] as part of this contract and coordinate the telephone connection. All installation and monthly charges for telephone leased line shall be paid directly by the owner.)

EQUIPMENT

FIRE ALARM CONTROL UNIT, Honeywell W940A, shall be a solid state modular unit consisting of the following modules.

Zone Module (A) shall have four zones of supervised initiating circuits with a trouble and an alarm lamp for each zone. Detection circuit wiring shall be four-wire Class A and shall power all detectors. (Relay outputs and) voltage outputs for each zone alarm and voltage outputs for each zone trouble shall be provided.

Signaling Module (B) shall provide four supervised control circuits for polarized alarm signaling devices. Zone activated lamp shall be provided for each zone to aid in system testing and troubleshooting. Provide (2) (6) (10) indicating circuits.

Common Module (C) shall supply the necessary power for the W940A system and all detectors (and shall contain a battery charger to charge the batteries). An ac power-on lamp shall be provided to indicate the normal condition of the panel. Individual supervisory lamps shall be provided for ac power failure indication, ground fault detection, municipal disconnect, and low battery. All controls shall be behind a key-locked door to prevent unauthorized operation. Two supervised control circuits for audible signaling shall be provided as part of this module. Common trouble and common alarm relay and logic outputs shall be provided.

The enclosure shall be (surface) (semi-flush) mounted with Module termination drawings mounted on the inside of the panel cover. The panel cover shall be key-locked to prevent unauthorized access.

Manual Stations shall be Honeywell S464A. Stations shall be red with raised white lettering. A spare glass rod shall be provided with all stations. Surface mounted stations shall mount to a surface box provided under this contract. Semiflush stations shall mount to standard electrical boxes.

Thermal Detectors, Honeywell T4057, shall be either fixed temperature with 25-foot spacing (625 square feet of coverage) or combination fixed temperature and rate of rise with 50-foot spacing (2500 square feet of coverage) as indicated on the drawings.

Ionization Detectors - Area, Honeywell TC100C, shall be dual chamber low voltage self-compensating type. Detectors that are single chamber only and rely on electronic circuits for compensation shall not be acceptable. Duct Mounted, Honeywell TC100D, shall be provided for duct applications and shall meet NFPA 90A requirements. Sampling tubes for all duct detectors shall be provided. Alarm lamp and a key operated reset switch shall be provided as part of each duct mounted detector.

Photoelectric Smoke Detectors, Area, Honeywell TC803A, shall operate on the multiple cell concept and the light emitting diode intensity shall be controlled by a regulating photocell circuit matched to the smoke detection circuit. The detector shall lock in on alarm and have a lock in on alarm/trouble indicator lamp.

Fire Alarm (Horns) (Bells) shall be Honeywell SC806 series. Units shall be red (flush) (semiflush) mounted in finished areas and surface mounted in unfinished areas.

Remote Annunciator (The Honeywell W940A system shall also be utilized as the annunciator). A Graphic Annunciator, Honeywell W649A, shall be provided and installed which shall show by graphic representation the location or zone of the fire upon operation of a manual or automatic detector. The presentation shall show the building floor plan and exits in black, extinguisher locations and fire zones in red. Background shall be white. The annunciator shall be a lucite faced, black lighted unit in which the alarm shall be indicated in individual 1-inch square representations. Provide one alarm zone for each zone on the control panel and one common trouble zone.

Sprinkler Systems: Water Flow Switch (Honeywell PTRVSRA) with pneumatic retard shall be provided as indicated. Sprinkler contractor shall mount the flow switch and this contractor shall wire the switch. Valve Switches: (Honeywell PTROSYSB) gate valve switches and (Honeywell PTRPIVSC) post indicator valve switches shall be provided, mounted, and wired as indicated.

Magnetic Door Holders, Honeywell S4003A, shall be (flush) (surface) wall mounted. Electrical wall boxes shall be securely mounted and tested to withstand a minimum of 50 pounds pulling force. Each unit shall have a holding force of 25 pounds nominal. (Floor mounted units, Honeywell S4003B, shall mount to a floor mounting bracket supplied with the unit.)

Fan Shutdown Relays, Honeywell R8407A, shall be provided with SPDT 5 amp contacts for each fan to be shutdown.

GENERAL

Prior to installation of any equipment, the contractor shall submit for approval six (6) copies of submittals. (Shop drawings shall include riser and terminal to terminal wiring diagrams and specification data sheets. Submittals indicating typical one line risers and typical specifications data sheets only will not be acceptable.)

The system supplier shall review with the electrical contractor the total system point to point wiring layout to assure that the correct number and type of wires and conduit sizes are installed. He shall also review the proper installation of each type of device and provide on-site inspection and supervision as requested by the electrical contractor. (All final connections, testing, adjusting and calibrating shall be made under the direct supervision of a factory trained technician of the system supplier.)

Upon completion, the electrical contractor shall conduct a total system test for the owner, architect, and engineer where line supervision and each device shall be tested.

Provide three sets of detailed written operating instructions.

Provide to the architect three (3) sets of "As Built" drawings, including plan layout, conduit runs, and wiring diagrams as finally installed.

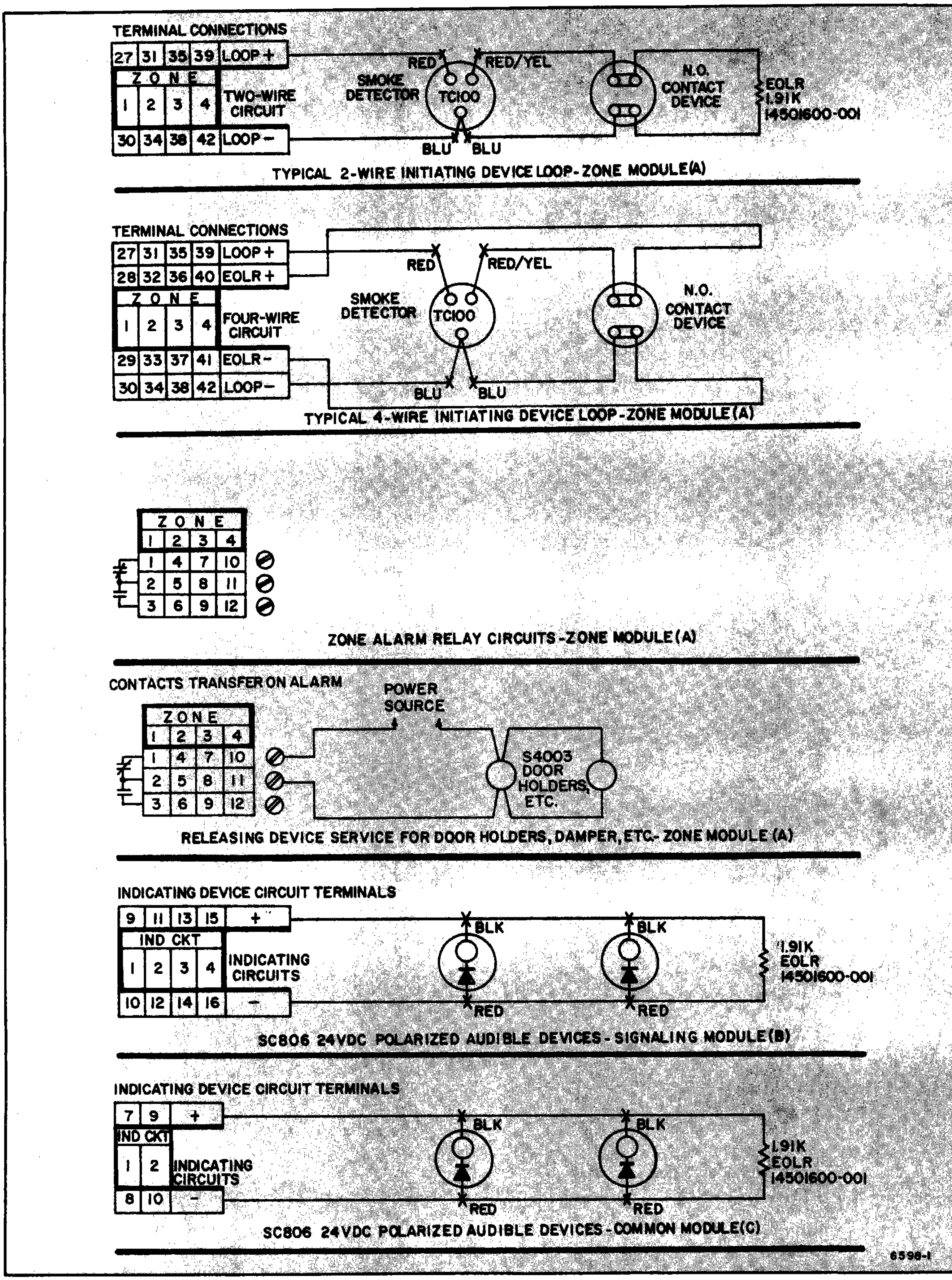


FIG. 2. (PART 1 OF 4)—FIELD WIRING CONFIGURATIONS

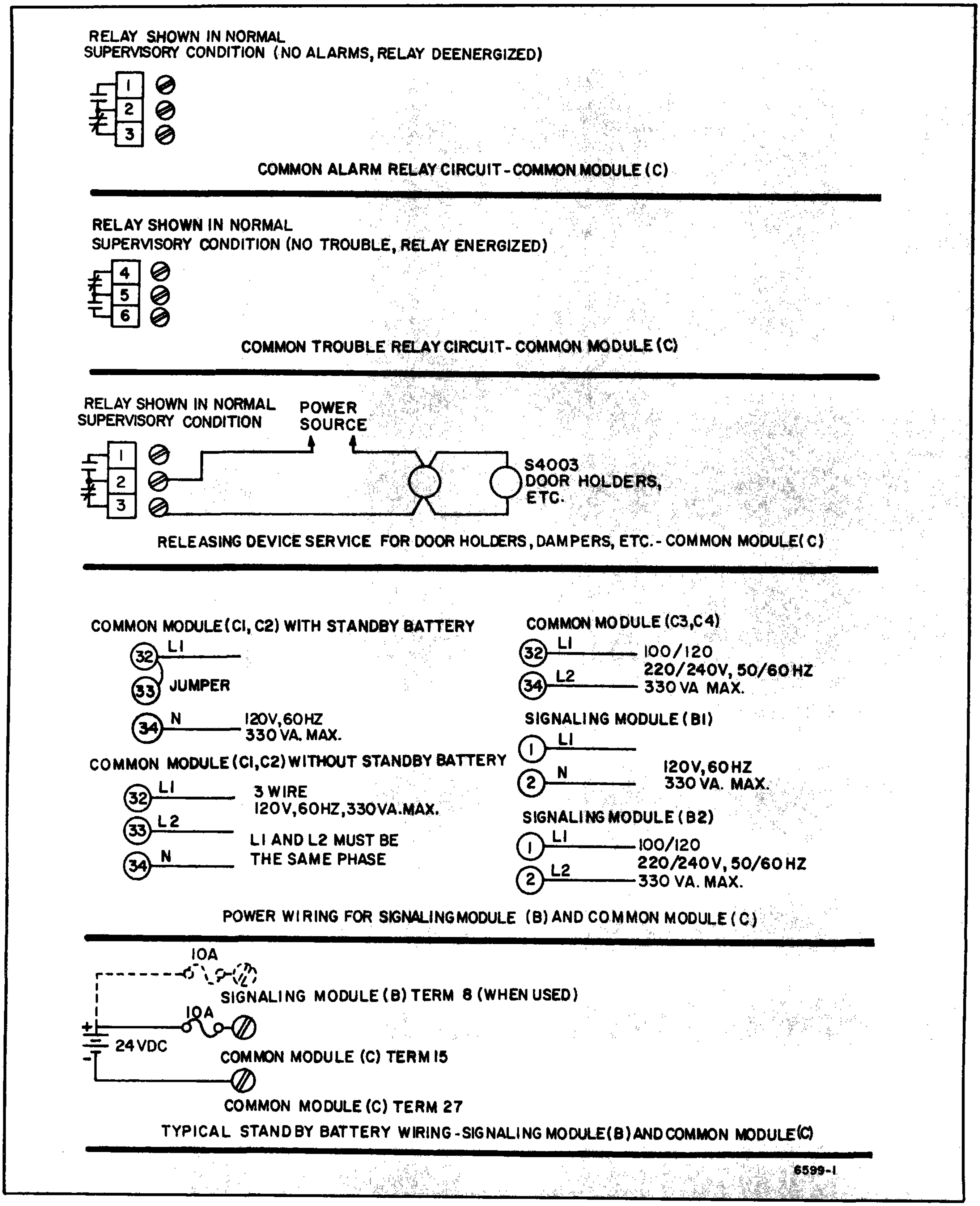


FIG. 2. (PART 2 OF 4)—FIELD WIRING CONFIGURATIONS

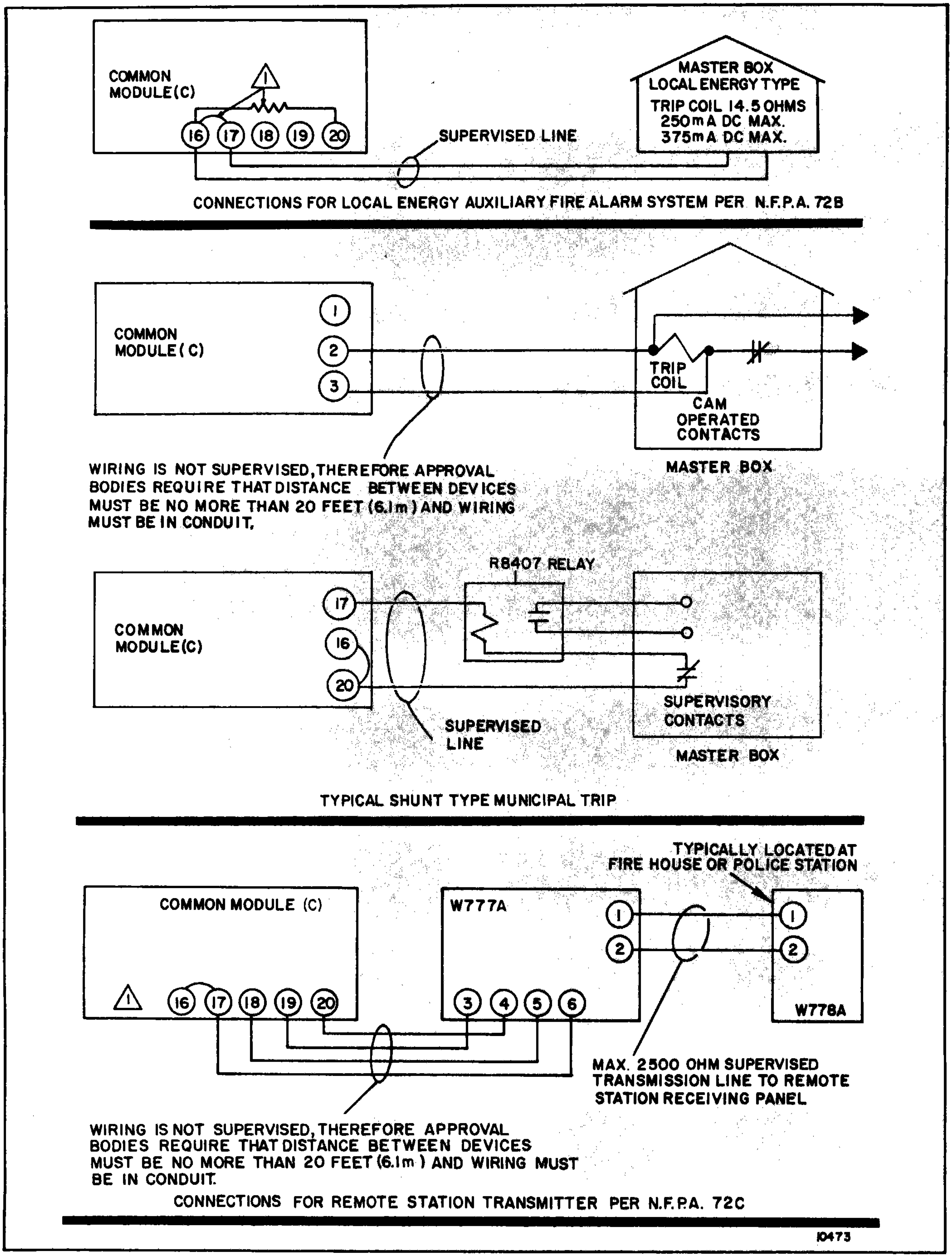
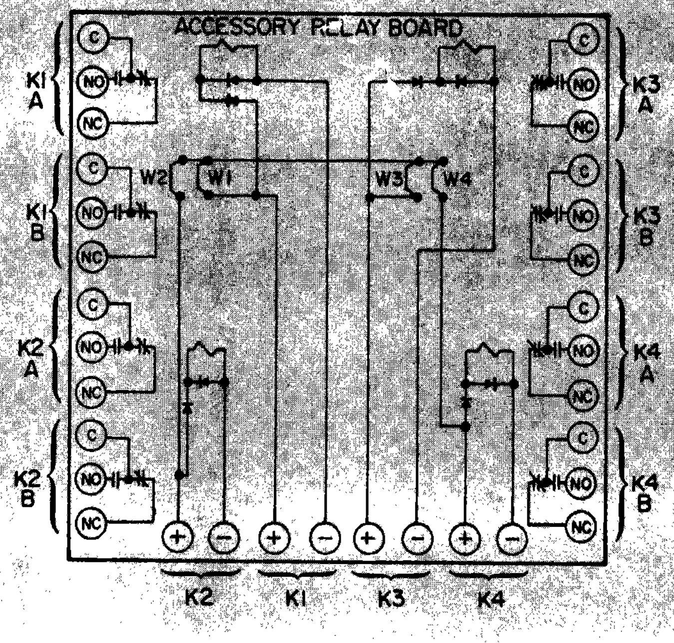


FIG. 2. (PART 3 OF 4)—FIELD WIRING CONFIGURATIONS



TWO CIRCUIT BOARDS PER MODULE
ACCESSORY RELAY CIRCUITS - ACCESSORY RELAY MODULE(D)

⚠ MUNICIPAL CIRCUIT PROGRAMMING MODULE IS SHIPPED WITH BOTH JUMPER AND RESISTOR INSTALLED.

MUNICIPAL CIRCUIT	JUMPER	RESISTOR
NOT USED	IN	OUT
LOCAL ENERGY	OUT	IN
W777A-W778A	IN	OUT

6600-1

FIG. 2. (PART 4 OF 4)—FIELD WIRING CONFIGURATIONS

10.2 ELEVATOR

10.2 ELEVATOR

The Receiver Tower Personnel Hoist, HS-701, is a Rack and Pinion Elevator located on the outside of the Receiver Tower.

Information describing the operation and maintenance of the Unidynamic Rack and Pinion Hoist is contained in the following sections.

DESCRIPTION, OPERATION AND MAINTENANCE

OF THE

RACK AND PINION HOIST

INSTALLED AT THE SOLAR PILOT PLANT AT

DAGGETT, CALIFORNIA

ELEVATOR SYSTEMS

UNIDYNAMICS/ST. LOUIS, INC.

UNIDYNAMICS

Unidynamics' Document No. USTL81-1343 February 1981

DESCRIPTION, OPERATION AND MAINTENANCE

OF THE

RACK AND PINION HOIST

INSTALLED AT THE SOLAR PILOT PLANT AT

DAGGETT, CALIFORNIA

Prepared For:

CHRISTOFF CONSTRUCTION CO.
Santa Barbara, Calif.

Reference:

S/C
Christoff Standard Agreement of 5/8/80

Prepared By:

THE ELEVATOR SYSTEMS GROUP

OF

UNIDYNAMICS/ST. LOUIS, INC.

472 Paul Avenue St. Louis, Missouri 63135

SECTION 1 - DESCRIPTION

GENERAL

The Personnel Hoist described in this manual is a rack and pinion system with a load carrying capacity of 2000 pounds and an average speed of 120 feet per minute. The hoist travels from the base of the receiver tower to the receiver tower room, a distance of 191 feet, and serves four stops; the bottom of the tower, the tower room, and two intermediate stops. Car motion is achieved by means of two motor-driven, rotating pinions, mounted atop the hoist car, which mesh with a stationary rack which is part of a rack and rail assembly secured to the side of the solar receiver tower.

Technical Data

Hoist Type	Tower
Drive	Rack and Pinion
Capacity	2000 Pounds
Traveling Distance	191 Feet
Control System	Automatic, Pushbutton
Number of Stops	Four
Speed (Average)	120 Feet Per Minute
Car Door	Manual Opening, Swinging
Hoistway Gates (4)	Manual Opening, Swinging
Motor Size (Two)	10 Horsepower (ea.)
Power Requirements	480 Volts, 3 Phase, 60 Hz

The major system components are the hoist car assembly, the machinery package, the rack and rail assembly, control system, and associated system components. (See Drawing 1343.)

HOIST CAR ASSEMBLY

The hoist car assembly (see Drawing 13431000) is a bolted and welded steel enclosure, reinforced as required, and equipped with a steel sling which also serves as the mounting structure for the machinery package located atop the car. The weathertight car has inside dimensions of 38" x 68" x 88" high, and is equipped with a two panel, swinging door. Each panel is equipped with a vision panel. Other car equipment includes a car control panel, an emergency escape hatch, folding steps (3), light fixture, brake release handle, motor controller, telephone box, emergency light, and roller assemblies (4).

The door is interlocked such that normal operation is prevented unless the door is closed securely. The car control panel is equipped with lever type controls for CAR UP, CAR DOWN, STOP AT NEXT LANDING, plus controls for LIGHT, EMERGENCY STOP and ALARM. The brake release handle is connected to the motor brakes and is designed to release the two motor brakes simultaneously to permit lowering of the car thru gravitational action in the event of a power failure. The emergency escape hatch is located in the roof of the car and also is interlocked so that the car cannot be moved under power when the hatch is opened. Three folding steps, secured to the side of the car, provide access to the escape hatch. The lighting fixture operates from a 120 volt power source, and is secured to the roof of the car.

The motor controller houses the motor contactors, electrical relays, fuses, terminal boards, etc., and is secured to the car sling. The telephone box is mounted inside the car and contains a buyer-supplied phone. The roller assemblies (4) are secured to the frame of the car and "ride" the guide rails to maintain car alignment during travel.

MACHINERY PACKAGE ASSEMBLY

The machinery package assembly (see Drawing 13431200) consists primarily of two electric motors with associated brakes, which through gear reducers, drive rotating pinions which mesh with a stationary rack to produce car motion. The motors are 10 horsepower, single speed (1800 rpm), totally enclosed, fan-cooled devices which operate from a 480 volt, three phase, 60 Hz power source. Each motor is equipped with an integral, solenoid-released, spring-set brake and a brake release handle. The two brake release handles are ganged together and connected to a single release handle located in the elevator car to permit a passenger to simultaneously release the brakes of both drive motors so that the car may be lowered manually in the event of a power failure. A centrifugal brake is also provided to limit downward motion when the car is lowered manually. The gear reducers are splash lubricated and transmit motor power to the two pinions. The reducers have a reduction ratio of 20:1. Each pinion has a pitch diameter of 4-1/2 inches and a two-inch face. Each is hardened to Rockwell C45/50. The machinery package assembly is also equipped with an overspeed safety which is pinion driven and designed to shut off the power and set the safety should an overspeed occur in the downward direction.

RACK AND RAIL ASSEMBLY

The rack and rail assembly (Tower Assembly-Dwg. 13081400) runs the entire length of the hoistway, and consists of a steel rack, two guide rails, and supporting members, all welded and bolted together to form the proper configuration. The rack "teeth" have a face dimension of two inches and are two inches deep. The guide rails are standard T161, eight pounds per foot, elevator rails. The standard tower section is approximately seven feet long. The sections are tongue and grooved to ensure alignment. Supporting members are made from various channels, flats, and angles. The assembly is secured to the tower through use of mounting brackets and bolts.

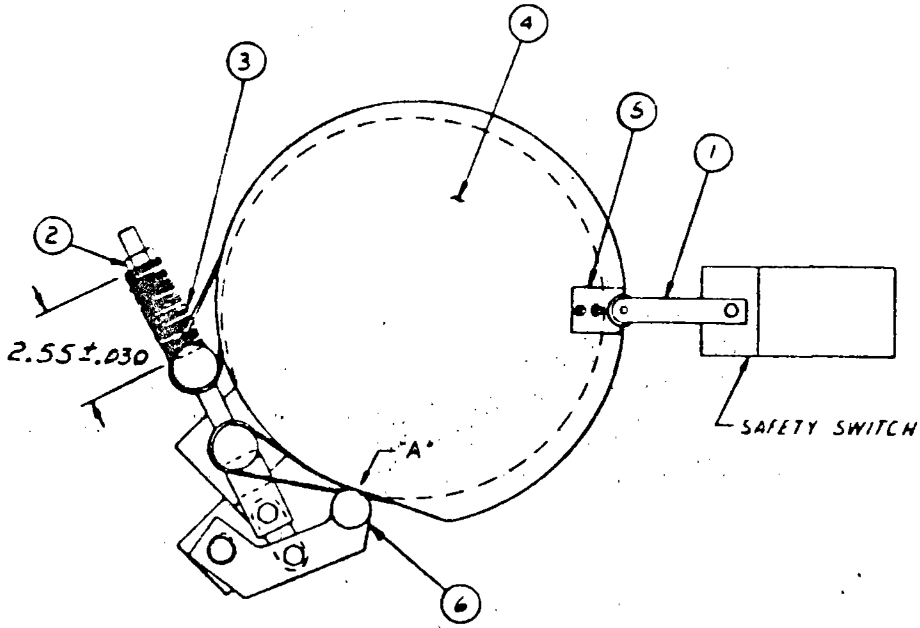
CONTROL SYSTEM

The control system is automatic and is acutated by means of control switches located in the car and at each of the four levels served. Car controls include CAR UP, CAR DOWN, STOP AT NEXT LANDING, CAR STOP, CAR LTE, and ALARM. Depressing the CAR UP or the CAR DOWN pushbuttons causes the car to proceed in the selected direction. Automatic stops are provided for the top and bottom landings; however, the STOP AT NEXT LANDING pushbutton must be used to stop the car at either of the two intermediate levels. The CAR STOP pushbutton is an emergency switch used to stop the car should an unforeseen situation occur. The CAR LITE switch switches on the car light, and the ALARM switch sounds the system alarm. Call switches located at the levels served are used to call the empty car to any of the four levels.

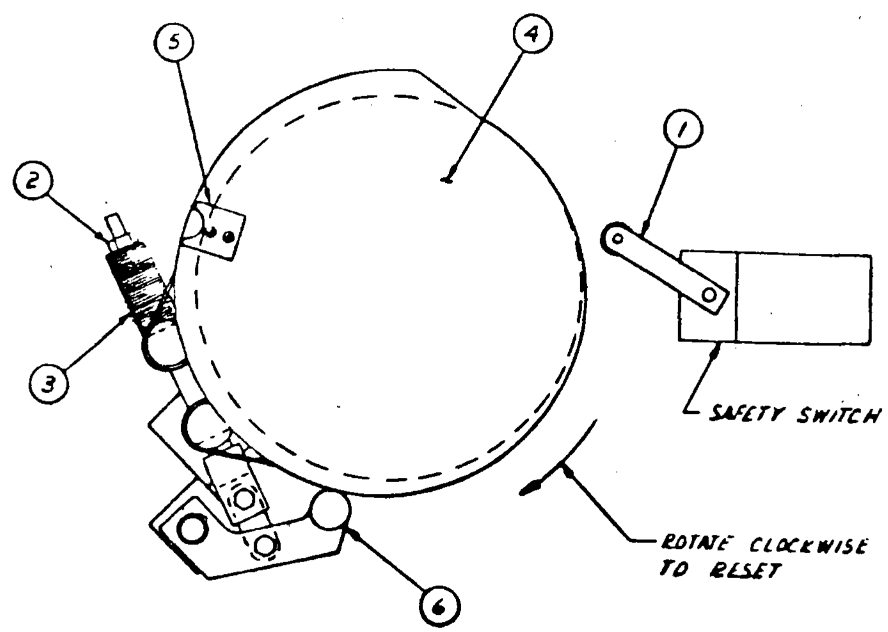
The system is fused and interlocked and operates from a reduced voltage of 120 volts a.c. Switches that appear in the interlock circuit are the motor overload switches, CAR STOP switch, Governor Safety switch, Car Gate switch, Emergency Escape Hatch switch, hoistway door interlocks (4), Pit switch, and Upper and Lower Final Terminal Limit switches. All these switches must be in the closed position before the system is operable in normal operation. Further information on the control system can be found in the sections entitled, Operation and Troubleshooting.

ASSOCIATED SYSTEM COMPONENTS

Associated system components include the system controller, buffer assembly, hoistway enclosures, hoistway doors, and traveling cable. The system controller is located at the base of the elevator, and contains the system turn on mechanism and circuit breaker, relays, terminal board and transformer. The buffer is located in the pit and is designed to stop and hold the elevator car should it be lowered to that point. The hoistway enclosures (2) are located at the top and bottom levels. Hoistway doors are provided at each level served. Each door is mechanically interlocked so that it cannot be opened unless the elevator car is at that level. Each door is also electrically interlocked such that the control system is inoperative unless each door is closed securely. The traveling cable transmits all power and signals and electrically connects the car to the rest of the system. Five junction boxes are located in the hoistway to assist making up the electrical hookup.



FRONT VIEW 1
SAFETY NOT ACTIVATED



FRONT VIEW 2
SAFETY ACTIVATED

Figure II-1

SECTION II

OPERATION

GENERAL

The Unidynamics' elevator has been designed for continuous service, and once energized may be left in this operating mode. However, extraordinary circumstances, test, or maintenance procedures may require shutting down and then reenergizing the system. This section provides instructions for energizing the system, normal operation, and system shutdown.

ENERGIZING THE SYSTEM

CAUTION

PERFORM THE FOLLOWING STEPS IN THE SEQUENCE GIVEN TO ENERGIZE THE ELEVATOR SYSTEM:

1. PERFORM AN OVERALL VISUAL INSPECTION OF THE ELEVATOR SYSTEM SO THAT:

    a. ALL TOOLS, EQUIPMENT, ETC., HAVE BEEN REMOVED FROM THE ELEVATOR AREA.

    b. NO PHYSICAL INTERFERENCE EXISTS BETWEEN THE ELEVATOR AND TEMPORARY OBSTRUCTIONS USED DURING REPAIR, MAINTENANCE, ETC.

    c. ALL DOORS, LIDS, PANELS, ETC., HAVE BEEN REPLACED.

2. AT THE SYSTEM CONTROLLER, CLOSE THE OPERATING LEVER. (THIS MAKES THE 480 VOLT POWER AVAILABLE TO THE SYSTEM).

NORMAL MODE OF OPERATION

Following is the normal mode of operation for the Unidynamics' elevator.

1. Open the hoistway and car doors, enter the elevator car, and make sure both doors are closed securely behind you.

2. At the car control panel, verify that the car STOP switch is in the out or run position.

3. Select and depress the desired directional switch (Up or Down). The car will then proceed in the selected direction.

4. If your destination is either the top or bottom level, no further action is required. The car will proceed to the selected level and stop.

5. If your destination is either of the two intermediate levels (levels 2 or 3), it is necessary to depress the STOP AT NEXT LEVEL switch as the car approaches the desired intermediate level. The car will then proceed to that level and stop automatically.

6. When the car has stopped at the desired destination, open the car and hoistway doors. Leave elevator and make sure both car and hoistway doors are closed before leaving.

7. If the car is to be called to any of the four operating levels, merely depress the call pushbutton at the level to be served. The car will start, travel and stop automatically at the corresponding level.

DEENERGIZING THE SYSTEM

To deenergize the system, merely place the operating switch on the system controller to the Off position. This removes all power from the elevator car and drive motors.

EMERGENCY PROCEDURE

WARNING

THE FOLLOWING PROCEDURE CAN BE FOLLOWED IN THE EVENT OF AN EMERGENCY; HOWEVER, THE PROCEDURE MUST BE FOLLOWED AS WRITTEN TO PREVENT POSSIBLE EQUIPMENT DAMAGE DUE TO THE BUILDUP OF EXCESSIVE HEAT.

Should the power fail for any reason, the operator can manually lower the car as follows:

1. Allow car to descend for one minute by actuating the motor brake release handle in the car.

2. After one minute, return the brake release handle to the original position to stop the car. Wait at least 30 seconds to allow heat at the centrifugal brake to dissipate.

3. Repeat procedure until the car reaches the bottom level.

The drive motor is equipped with overloads designed to deenergize the motor should excessive current cause the unit to overheat. These overloads must be reset after normal conditions return. This is accomplished by opening the door of the motor controller and depressing the overload RESET pushbutton.

RESETTING THE OVERSPEED SAFETY

Should the overspeed safety set, two actions occur. First, the overspeed locking device is set to stop and hold the elevator car; and Second, an electrical switch located adjacent to the safety is actuated to the open position to remove system power. To return the system to the normal operating mode, both the mechanical locking device and the electrical switch must be reset. This is accomplished as follows: (Refer to Figure II-1 on Page III-4).

SAFETY RESET PROCEDURE

In the event the safety device should activate, the malfunction which caused the overspeed <u>must</u> first be eliminated.

After the problem has been corrected, use the following steps to reset governor/safety: (Refer to Front View 1 for correct orientation.)

Step 1 - Return switch arm (Item 1) to its original (horizontal) position. This re-establishes power to the drive motor. Then drive elevator upward approximately three (3) inches to reset internal mechanisms.

Step 2 - Loosen 1/2-13 nut (Item 2) until Belleville springs (Item 3) are slightly loose. Then rotate drum (Item 4) clockwise by hand until switch arm (Item 1) is nested into notch of Item 5. Switch arm (Item 1) will have to be rotated slightly to allow clearance for Item 5. Note that Item 6 is contacting lowest point of cam plate at Point A.

Step 3 - Retighten 1/2-13 nut (Item 2) until springs (Item 3) are compressed to 2.55" as indicated. Safety is now reset. Secure sheet metal cover before operating elevator.

SECTION III

PREVENTIVE MAINTENANCE

CAUTION

FAILURE TO FOLLOW MAINTENANCE PROCEDURES MAY RESULT IN SYSTEM MALFUNCTIONS AND HAZARDS TO PERSONNEL.

GENERAL

Preventive maintenance involves periodic inspection, servicing, and checkout of the elevator system to insure continuity of service at peak performance by preventing failure and decreasing operating efficiency. To be effective, preventive maintenance must be performed regularly. If the equipment fails to meet proper operational standards, corrective maintenance or repair must be performed. The following paragraphs provide Precautionary Measures which should be followed by maintenance personnel as a general rule; Lubrication Instructions which should be accomplished at the intervals given; Inspection Procedures which should be performed by personnel every three months; and Overall System Inspection which should be performed yearly by professional elevator inspectors.

PRECAUTIONARY MEASURES

Most of the elevator equipment requires no more preventive maintenance other than regular inspection, cleaning, and lubrication. The following precautions should be observed generally to aid in keeping the equipment operational and prolonging equipment life:

1. Keep the elevator car, hoistway, and general area free of litter and other clutter to maintain working surfaces free to operate.

2. Maintain the paint on all painted surfaces, including the elevator car, and driving mechanisms (where applicable), etc.

3. Scale and clean down any painted surfaces that are pitted or corroded before restoring the original finish.

4. Keep all closures, inspection covers, and access doors in place, tightly secured with their gaskets or seats in good condition.

5. Maintain a protective coating of lubricant on all unpainted surfaces.

6. Keep all bolts, fittings, etc. tightened as required.

LUBRICATION

System lubrication consists of keeping the gear reducer filled with fresh gear oil, maintaining a protective coat of lubricant on the rack, maintaining grease in all grease fittings, and normal oil-can type lubrication where required.

The gear reducer unit should be kept filled to the proper level with a good AGMA 5 gear oil, such as Engineered Lubricants ENLUBE 135 EP, or equivalent. The fluid should be drained and fresh gear oil inserted periodically, depending upon the amount of use. However, even with infrequent use, the gear oil should be replaced on a yearly basis because of contaminents caused by condensation, etc.

If the system is to set for long periods of time, it is recommended that the gear boxes be filled to the top with gear oil and drained to the operating level before using. It is also recommended that if the system is to set for long periods of time that the system be energized, exercised, and then de-energized to distribute lubricants and prevent components from taking set.

The rack should be lubricated with Open Gear Barium (N.L.G.I. Grade #2) produced by MOLY-XL Company, Inc., P. O. Box 7414, Fort Wayne, Indiana 46807 (Phone: 219/456-6126). The barium lubricant should be applied once every six months using a caulking gun and applying a 1/4 inch wide strip along the rack. (More frequent applications should be made if the equipment is used excessively and the lubricant is worn away.)

System couplings should be kept greased in accordance with drawings included at the rear of this publication. The grease should be removed and replaced on a yearly schedule to eliminate contamination.

For miscellaneous grease fittings found throughout the system, use a grease gun and a good, all purpose, water resistant grease. For miscellaneous metal to metal points in rubbing contact, use an oil can and a good all purpose lubricating oil.

CAUTION

DO NOT ALLOW LUBRICANTS TO COME INTO CONTACT WITH THE ELEVATOR TRAVELING CABLE.

INSPECTION PROCEDURES (Facility Personnel)

The following procedures should be accomplished every three months by facility personnel to verify proper operation of the elevator system. Before beginning test, suitable signs indicating that the elevator system is under test should be placed at all levels served.

Door Inspection

Visually examine car and hoistway doors and note any damaged members. Operate doors to verify that they operate freely and that the guides are in place, securely fastened, and not worn sufficiently to permit a door to come out of its tracks.

Inside of Car Inspection

Visually determine that the car enclosure is structurally sound and is securely fastened to the platform. Verify that capacity plates and any required certificates are properly posted. Verify that the escape hatch can be opened and that it is properly secured.

With the elevator in normal operation, operate the car in both the up and down direction. At each stop, open the car and hoistway doors, and verify that the car has leveled properly. Close car and hoistway doors and begin travel to the other level. While the car is moving, operate the Emergency Stop switch; the car should stop immediately. Repeat procedure, this time carefully opening the car door as the car is traveling. The car should stop as soon as the door interlock is opened.

OVERALL SYSTEM INSPECTION (Professional Elevator Inspectors)

THE FOLLOWING INSTRUCTIONS SHOULD BE ACCOMPLISHED YEARLY BY A PROFESSIONAL ELEVATOR INSPECTION TEAM. BEFORE BEGINNING, IT IS IMPORTANT THAT THE INSPECTION TEAM OBSERVE THE FOLLOWING PRECAUTIONS:

1. IF THE CAR IS TO BE MOVED DURING TEST, A PERSON FAMILIAR WITH THE OPERATION OF AN ELEVATOR SHOULD BE STATIONED IN THE CAR.

2. THE CAR SHOULD BE MOVED ONLY WHEN AND AS THE INSPECTOR DIRECTS.

3. THE OPERATOR IN THE CAR SHOULD REPEAT THE INSPECTOR'S DIRECTION AND RECEIVE THE INSPECTOR'S O.K. BFORE MOVING THE CAR.

4. TO PREVENT ACCIDENTAL STARTING OF THE CAR, THE OPERATOR SHOULD ACTUATE THE EMERGENCY STOP SWITCH IN THE CAR IMMEDIATELY FOLLOWING EACH STOP. THE SWITCH SHOULD REMAIN IN THIS POSITION UNTIL THE INSPECTOR ORDERS THE CAR TO BE MOVED TO ANOTHER POSITION.

5. EXTREME CARE MUST BE EXERCISED DURING INSPECTIONS AT THE ELEVATOR'S UPPER AND LOWER LIMITS OF TRAVEL WHERE THE CLEARANCE MAY BE INSUFFICIENT TO ACCOMMODATE THE INSPECTOR.

NOTE: Additional precautions are given as applicable in the following paragraphs.

Inspection Made From Car Top

1. IF POSSIBLE, USE AN ELECTRIC LAMP ATTACHED TO AN EXTENSION CORD WITH A SUITABLE LAMP GUARD AND REFLECTOR.

2. MAKE SURE YOU HAVE A FIRM AND SECURE PLACE TO STAND; ONE THAT IS FREE OF OIL AND GREASE.

3. MAKE SURE YOU HAVE A FIRM GRIP ON THE CROSSHEAD OR OTHER PARTS OF THE CAR STRUCTURE BEFORE THE CAR IS MOVED.

4. TEST STRENGTH OF THE CAR TOP BEFORE SUBJECTING IT TO YOUR ENTIRE WEIGHT. AVOID STANDING ON THE CAR TOP EMERGENCY EXIT PANEL.

5. KEEP YOUR BODY INSIDE THE LIMITS OF THE CAR AREA WHEN THE CAR IS MOVING TO AVOID INJURY FROM PROJECTIONS IN THE HOISTWAY.

6. NOTE ANY OBSTRUCTIONS OR PROJECTIONS OF THE ELEVATOR EQUIPMENT OR SURROUNDING STRUCTURE. PROCEED WITH INSPECTION AS FOLLOWS:

Rack and Rail Inspection

HAZARD WARNING

THE FOLLOWING PROCEDURE CALLS FOR CAR MOVEMENT AT THE UPPER LIMITS OF TRAVEL; EXTREME CARE SHOULD BE TAKEN TO PREVENT POSSIBLE INJURY WHICH COULD OCCUR IF AN INSPECTOR BECAME TRAPPED BETWEEN THE MOVING ELEVATOR AND UPPER OBSTRUCTIONS.

NOTE

ACCOMPLISHMENT OF THE FOLLOWING PROCEDURE REQUIRES AN ELEVATOR INSPECTOR AND A CAR OPERATOR.

1. The car operator should bring the car to the lowest level and operate the emergency STOP pushbutton to the STOP position.

2. The inspector should then station himself on top of the elevator car, making sure he has a firm grip on the handrails to prevent being thrown from the car.

3. At the inspector's command, the car operator should return the emergency STOP pushbutton to the run position and use the UP switch to raise the car about three feet. At that point, depress the STOP pushbutton to halt the car.

4. Make inspection as per the following paragraphs.

5. Repeat procedure, raising the car another three feet, then stopping and making the required inspections.

6. Repeat procedure until the entire length of rails and rack have been inspected.

Examine all guide rails, paying particular attention to the condition of the surfaces and the correct alignment of the joints. If serious wear or scoring is found, determine its cause, if possible. Note if rails are free of lint and dirt and adequately lubricated (see lubrication instructions in this section).

Check the following fastenings to determine whether they are sound and tight and that there are no missing bolts or guide clips.

1. Rails to brackets
2. Brackets to facility structure
3. Car guide roller bolts

Check rail alignment by operating the elevator car at the rated speed from one end of travel to the other. There should be no excessive or irregular motion of the car to indicate that the car rails are not properly aligned. It should be noted that misaligned guide rollers cause the same motion; therefore, guide roller alignment should be checked before attaching blame to the rails.

Check the rack for proper alignment and to verify that wear is not excessive. Make sure the rack is properly secured to the tower structure and that rack teeth have not become chipped or broken. Check lubrication. (Refer to lubrication instructions in this section.)

Traveling Cable Inspection

Examine the traveling cable. Observe if any portion of the cable is being chafed on rough surfaces. Watch particularly for any evidence of broken wires and damged insulation. Lower or raise the car as necessary to inspect the entire cable.

Overspeed Safety Inspection

With the elevator deenergized, make the following inspections to verify proper operating condition of the overspeed safety:

1. Examine safety stand fastening bolts to determine that the safety is securely fastened in place.

2. Examine all linkages, pins, bushings, etc., for evidence of excessive wear and lost motion; also verify that all bearings and rubbing surfaces are free of paint and foreign substances.

Switch Inspection

WARNING

. PORTIONS OF THE FOLLOWING PROCEDURES CALL FOR CAR MOVEMENT WHILE MANUALLY ACTUATING A SWITCH LOCATED ON THE OUTSIDE OF THE CAR OR IN THE HOISTWAY. EXTREME CARE SHOULD BE TAKEN TO ENSURE PERSONNEL ARE NOT TRAPPED BETWEEN THE MOVING CAR AND STATIONARY SUPPORTING STRUCTURE.

There are two, three-position switches located on the car which are cam-operated. The switch on the left (as you face the tower) is the Intermediate Level Stop Switch. To check this switch for proper operation, deenergize system, disconnect one lead of switch and connect an ohmmeter across the switch. With switch in the spring-return-to center position, the meter should read continuity. With the switch actuated (either up or down), an open should be present. Replace disconnected switch lead after check.

The switch to the right serves as the Upper and Lower Normal Stop Switch. To verify switch performance, manually hold the switch lever in the DOWN position; the hoist car should respond only to a depressed car DOWN switch. When the switch lever is in the Up position, the car should respond only to a car up signal.

The Upper Final Terminal Limit Switch is located on the tower at the upper limits of travel. The Lower Final Terminal Limit Switch is located at the lower limits of travel. To check the Upper Final Terminal Limit Switch, raise car to within a few feet of the switch. Then manually actuate the switch. With the switch actuated, the car should be inoperative. Repeat procedure at the lower limits of travel. Again the car should be inoperative with the switch actuated.

Inspections Made from the Base of Tower

HAZARD WARNING

BEFORE ANY INSPECTIONS ARE MADE FROM THE BASE OF TOWER, THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED:

1. PLACE THE CAR EMERGENCY STOP SWITCH IN THE STOP POSITION. THIS SWITCH SHOULD BE CLOSED ONLY WHEN IT IS NECESSARY TO MOVE THE CAR.

2. OPEN PIT SWITCH.

3. WHILE IN THE TOWER BASE AREA, THE INSPECTOR SHOULD SELECT A SAFE RETREAT IN THE EVENT THE CAR IS INADVERTENTLY RUN TOWARDS THE TOWER BASE.

4. IF ADEQUATE UNDER CAR CLEARANCE IS NOT AVAILABLE, TEMPORARY CAR BLOCKING SHOULD BE PROVIDED TO INSURE THE NECESSARY CLEARANCE.

Buffer, and Misscellaneous Inspections

Enter the tower base area and examine the spring buffers to determine that:

1. Buffers and their supports are securely fastened in place.
2. The buffers are vertical and in alignment with the striker plates.
3. The buffer springs are properly seated in the mountings provided.
4. The buffer springs have not been deformed.

Examine lower rail segments, their fastenings, and supports for any evidence of excessive wear, weakening, missing or loosened bolts, etc. Return switches to the normal operating position.

Machinery Inspections

HAZARD WARNING

OBSERVE THE FOLLOWING PRECAUTION BEFORE MAKING ANY INSPECTIONS OF THE ELEVATOR MACHINERY:

> BE SURE THE POWER SUPPLY TO THE EQUIPMENT UNDER INSPECTION IS OPENED SO THAT THE MACHINERY IS SHUT DOWN BEFORE INSPECTING ANY MOVING PARTS, SUCH AS MOTOR, BRAKES, ETC.

Inspect machinery package mounting bolts to verify that the entire unit is secured to the mounting skid and supporting structure. Note any cracks or other signs of weakening.

Inspect all motor-fastening bolts to dermine that they are in place and tight. Make sure the motors are kept clean and free of grease, dust, etc. (Lubrication is in accordance with the lubrication instructions in this section.)

Inspect the gear reducer by having the elevator operated in each direction, making frequent stops. Observe if there is any excessive play or backlash in the gearing. Unusual noise or play is usually an indication of gear or thrust trouble, or damage to liners, rollers or balls.

Examine all bearings for excessive lost motion or wear. Note whether bearings are lubricated. The oil level in the gear reducer reservoir should be checked and replenished, if necessary.

Check pinion to verify that wear is not excessive and that the pinion teeth are not chipped or broken.

Motor and System Controller Inspection

With the elevator system deenergized, inspect the motor controller and system controller wiring and fuses. Examine all relays, switches, contactors, transformers, etc., and note:

1. Any excessively worn or burned contacts or broken connectors.
2. Any fuses which are shorted with wire, solder, metal strips, etc.
3. Whether the equipment is clean.
4. Whether there is any accumulation of combustible materials.
5. If there are any excessively worn pin hinges on relays or contactors.

Then with the elevator operating, observe operation of the control equipment when the elevator is run in each direction. Note any abnormal arcing of the contacts, excessive heating of coils, and any misalignment of relays, contactors, and switches.

SECTION IV

TROUBLESHOOTING

GENERAL

The elevator produced by Unidynamics/St. Louis, Inc., has been designed for long and trouble-free operation. However, as with all electromechanical equipment, malfunctions can occur because of equipment misuse, neglect, or simple component wear out. It is the purpose of this section to provide necessary information and set forth procedures to enable field personnel to isolate, detect, and resolve equipment problems.

System malfunctions can generally be classified into two general areas; namely mechanical failures or electrical problems. Mechanical difficulties are generally due to component breakdown and can usually be detected visually and the problem solution is often quite obvious. For these reasons, this section will be devoted to the system's electrical circuits, that is the power circuits, control system, and the system interlocks. Circuitry will be discussed and reference should be made to the schematics contained in the next section.

POWER CIRCUITS

System power (480 volts, three phase, 60 Hz.) is applied to the two electric drive motors via the circuit breaker on the system controller, the UP and DOWN motor contactors in the motor controller, the motor overloads, and the contacts of KM1 and KM2 (two relays which are energized sequentially to eliminate simultaneous startup of both drive motors).

CONTROL CIRCUITS

The control circuits consist of the car operating controls, the hoistway call pushbuttons, the various switches and interlocks, the UP and DOWN motor contactors, and the upper motor and lower motor startup relays, KM1 and KM2. For purposes of discussion, assume the elevator is at the bottom level, the operator has entered the car, closed both car and hoistway doors, and has depressed the UP pushbutton.

The UP motor contactor then becomes energized through the following voltage path. Voltage is passed from the 120 volt side of transformer T2 thru fuse F2, the phase protection relay), thru the normally closed motor overloads UOL and LOL, the normally closed contacts of the governor safety switch, the closed contacts of the car gate switch, the closed contacts of the emergency escape hatch interlock, the now depressed CAR UP switch, the inspection switch now in the OPERATE position, the closed Car Upper Stop switch, the closed 3 and 4 contacts of the down motor contactor, the coil of the UP contactor, and back to the control transformer.

This action also energizes K12, the UP Relay whose 8 and 5 contactors close to energize the up windings of the upper motor and whose 7 and 4 contacts close to energize the time delay relay K14.

This action also energizes K12, the UP Relay, whose 8 & 5 contacts close to energize the Upper Motor Relay KM1 to energize the up winding of the upper drive motor. K12's 7 & 4 contacts also close to energize the time delay relay K14. When this timer times out, its 1 & 3 contacts close to energize the Lower Motor Relay KM2 which causes the Up windings of the lower motor to become energized. At this point, we have both motors driving in the Up direction.

If the car's destination is the top level, no further actions are necessary. The car will continue in the Up direction until a cam on the tower encounters the Car Upper Stop Switch at the top level. When that switch is cammed open, the UP motor contactor is deenergized to disconnect power from both drive motors. The car then automatically stops.

If the car's destination is one of the intermediate levels, the operator depresses the STOP AT NEXT LANDING pushbutton in the car as the car approaches the desired stop. When the STOP AT NEXT LANDING pushbutton is depressed, its 3 & 4 contacts open to deenergize K9, the UP CALL relay which locks in the CAR UP switch and allows it to be released after it is actuated. At this point, the UP motor contactor is held energized by voltage thru the normally closed CAR INTERMEDIATE LVL LANDING SWITCH, contacts 1 & 2 and 3 & 4, the now closed 1 & 2 contacts of the Up motor contactor, the normally closed CAR UPPER STOP Switch and the normally closed 3 & 4 contacts of the DOWN motor contactor. The car continues its travel until the cam on the tower cams opens the CAR INTERMEDIATE LEVEL STOP switch. This action causes the UP motor contactor to be deenergized and the car stops.

Down travel is accomplished in a similar fashion, except that the CAR DOWN Switch is used.

If the car is to be called to a level, the hoistway call pushbuttons are used. As an example, let's assume the elevator is at the lowest level and a passenger is at the second level and wants to call the elevator to that level. The LVL 2 pushbutton is depressed at the second level. Relay K2U is energized thru the closed LVL switch and the 1 & 3 contacts of the LVL 2 Tower Position Switch. (The 1 & 3 contacts since the car is below the second level.) The closed contacts 7 & 4 now close and pass the control voltage thru rectifier D1 which produces positive pulses which are passed thru the closed 3 & 4 contacts of the STOP AT NEXT LANDING switch, the closed 4 & 7 contacts of K10 (the time delay relay), and thru D3 to energize K9. When this relay is energized, its 7 & 4 contacts close to bypass the open CAR UP switch and energize the UP motor contactor. Thus, the drive motors are energized to drive the car in the up direction. This motion continues until the car cam moves the Level 2 position switch from the 1 & 3 position to the 1 & 2 position (at level 2). This drops out relay K2U to deenergize the UP motor contactor and the car stops.

INTERLOCKS

The interlocks are provided to prevent possible injury or equipment damage through improper equipment usage, and consist of the following:

Interlock	Location	Function
Phase Protection Relay K6	Motor Controller	Energized When Phasing is Proper
Hoistway Door Interlocks	Hoistway Doors	Each Closed When Associated Door is Closed and Locked
Overspeed Safety Switch	On Safety	Opens When Overspeed Safety is Actuated
Car Gate Switch	On Car Gate	Open if Car Gate is Open
Final Terminal Limit Switches (Upper and Lower)	In Hoistway	Cammed to Open Position if Car Exceeds Normal Limit of Travel
Car Station STOP Switch	Car Control Panel	Opens When Depressed for Emergency Stop
Emergency Escape Hatch Interlock Switch	On Escape Hatch	Opens if Hatch is Open

All of the above interlocks and switches must be in the closed position for normal car operation.

TROUBLESHOOTING PROCEDURES

The following procedures are given to aid service personnel in isolating a trouble to a particular area in the system. Once this has been accomplished, it will be up to the individual to pinpoint the trouble and rectify the problem using normal skills and hand tools. Electrical checks can be made using a Simpson 260 multimeter or equal.

Electrical System Trouble Isolation

In the event the system fails to respond to control switches, the electrical system should be checked as follows:

1. Check for loss of power or tripped motor overloads.
2. Check for open interlocks.
3. Isolate problem to power or control circuits.

Quick Checks for Loss of Power

1. Check operating switch on the Motor Controller to verify the switch is in the ON position. Check circuit breaker.
2. At the Motor Controller, use a Simpson 260 or equal to verify presence of the 480 volt power at K6, the phase protection relay.
3. At the Motor Controller, check for 120 volts at the secondary winding. Verify that fuse F1 is good.

Problem Isolation

The motor contactors are the interfacing components between the control circuits and the driving forces. If a contactor is energized, but the associated drive is motionless, the motor and power circuits should be suspect. Conversely, if a signal has been entered calling for motor movement, but the appropriate motor contactor does not become energized, control circuit components should be checked.

SECTION V

DRAWINGS AND REPAIR PARTS

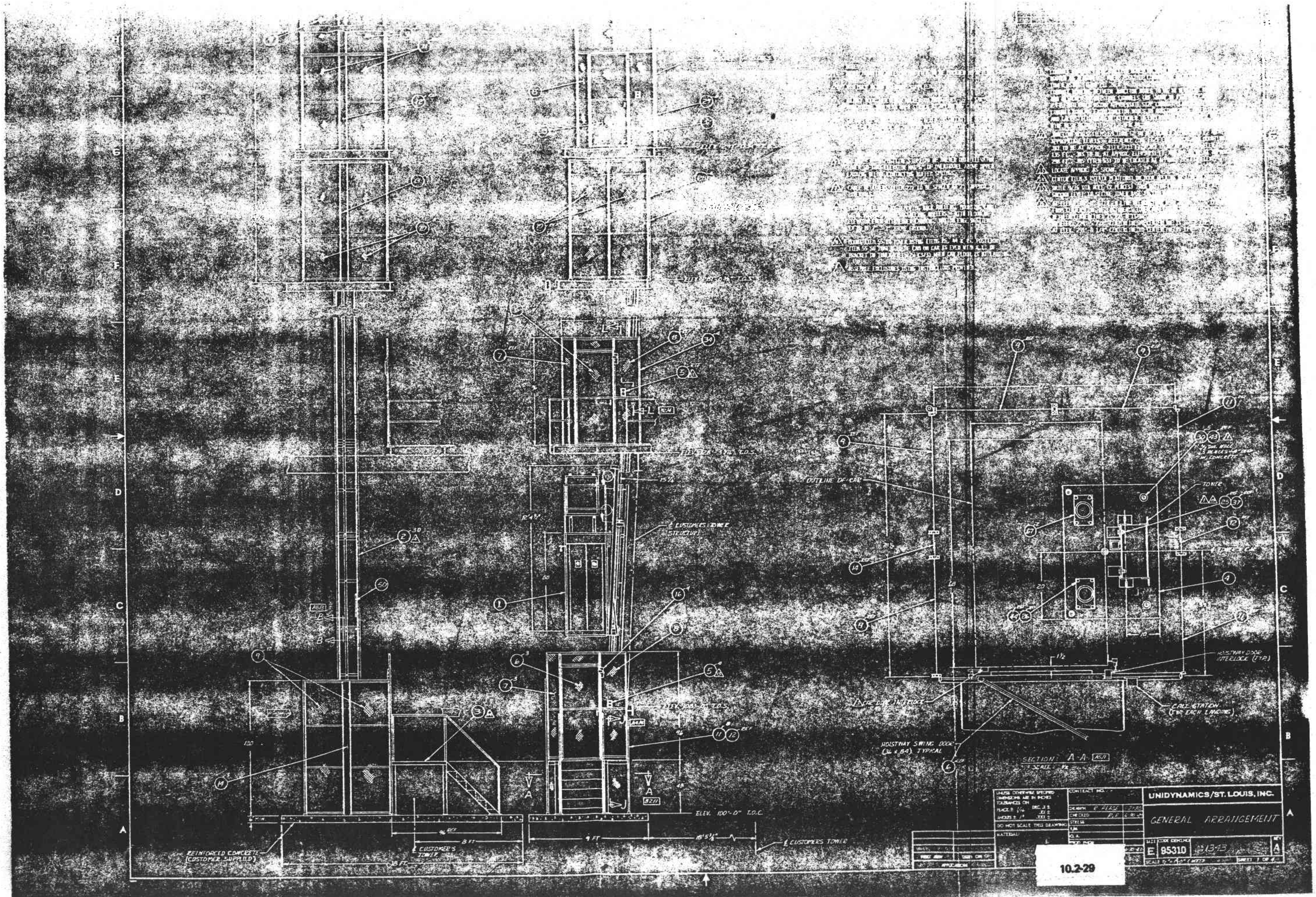
GENERAL

Special repair and maintenance procedures have been detailed in the preceding sections. Other equipment malfunctions that may occur can be corrected using normal hand tools and normal replacement procedures. To aid the repairman in this endeavor, this section contains system schematics, and system drawings complete with component part numbers and the names of the manufacturer. All parts can be easily located on the drawings through use of "find" numbers provided.

LIST OF TOP ASSEMBLY DRAWINGS AND SCHEMATICS

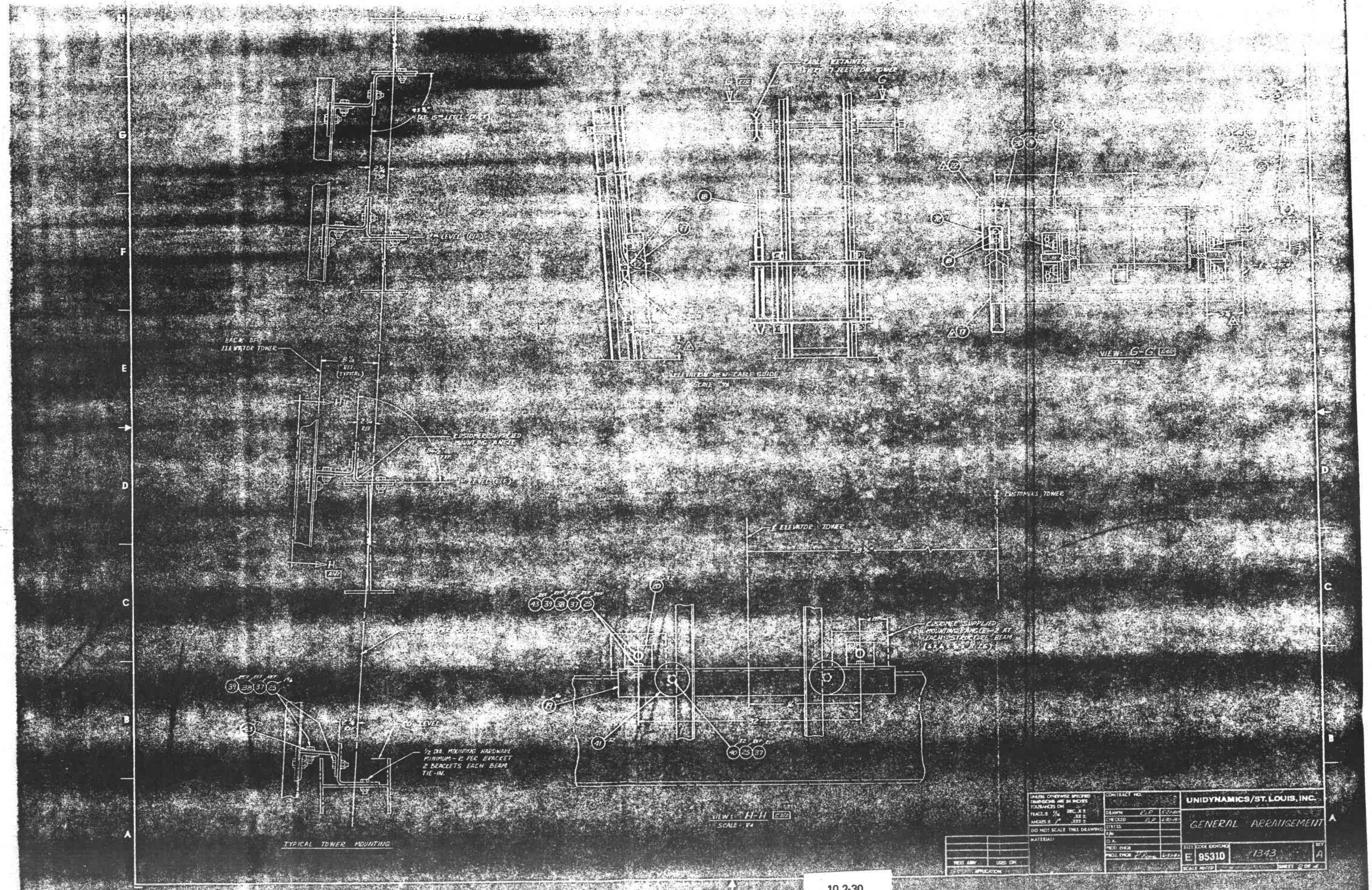
Drawing Numbers	Nomenclature
1343	General Arrangement
13431000	Car Assembly
13431200	Machinery Assembly
13438010	System Electrical Schematic & Cable Block Diagram
13081400	Tower Section Assembly

The vendor instruction manual on the elevator drive motor is also included in this section.

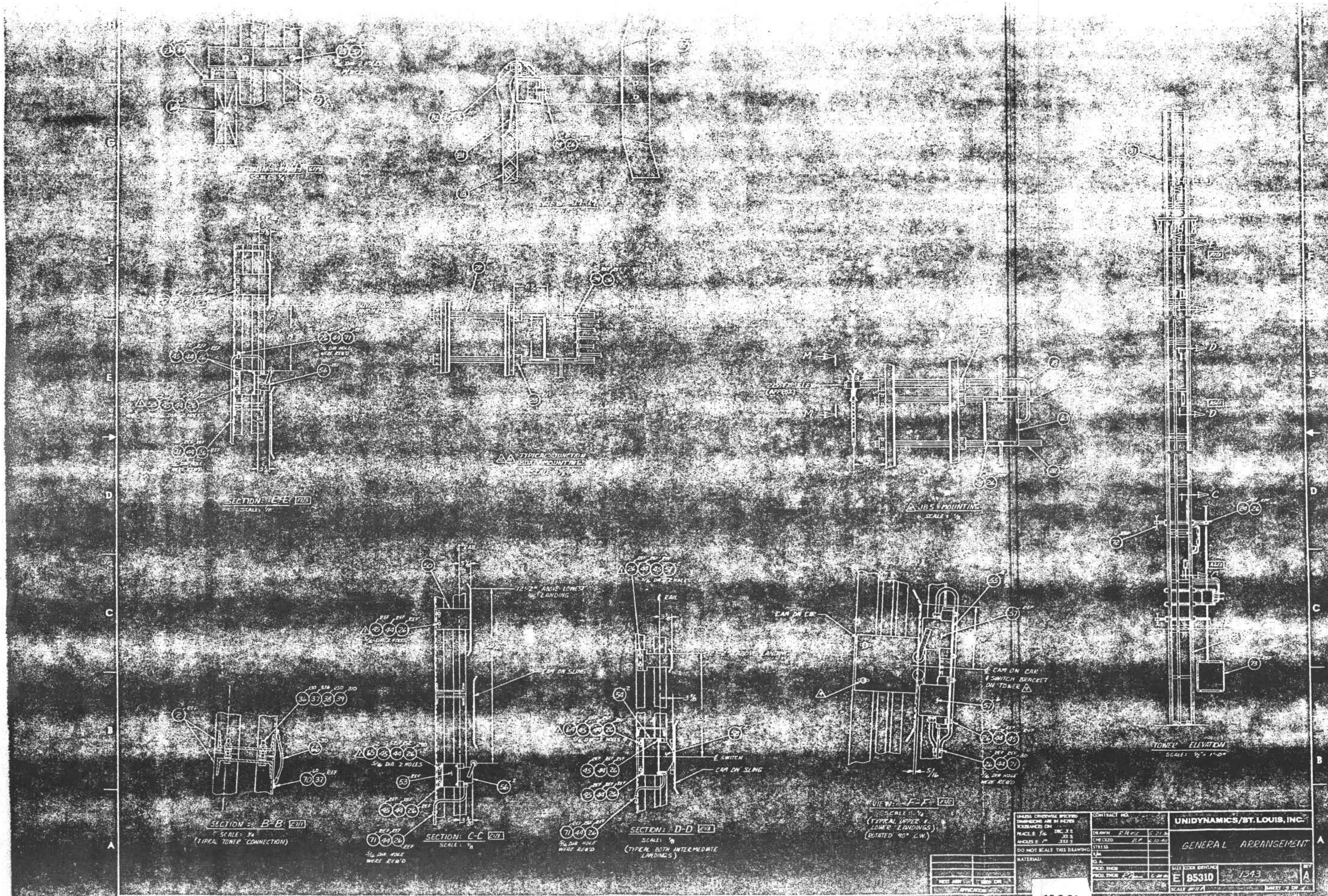


OUTLINE OF CAR
℄ CUSTOMERS TOWER STRUCTURE
HOISTWAY DOOR INTERLOCK (TYP)
CALL STATION (FOR EACH LANDING)
HOISTWAY SWING DOOR (36 x 84) TYPICAL
SECTION: A-A
SCALE - 1/2
ELEV. 100'-0" T.O.C.
REINFORCED CONCRETE (CUSTOMER SUPPLIED)
℄ CUSTOMER'S TOWER
℄ CUSTOMERS TOWER
UNIDYNAMICS/ST. LOUIS, INC.
GENERAL ARRANGEMENT
E 85310
DO NOT SCALE THIS DRAWING

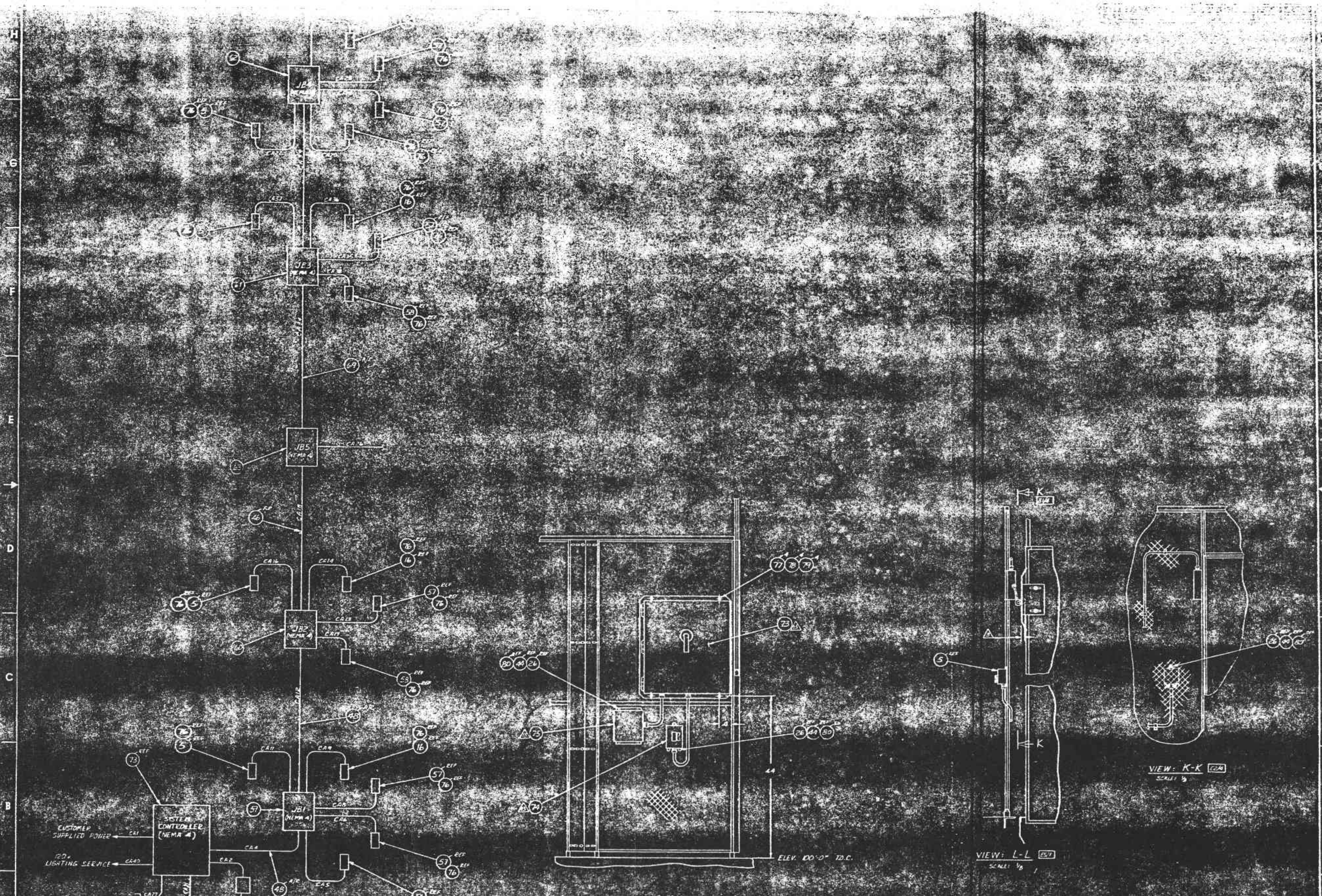
10.2-29



BACK OF ELEVATOR TOWER
CUSTOMER SUPPLIED MOUNTING ANGLE
½ DIA. MOUNTING HARDWARE MINIMUM - 2 PER BRACKET 2 BRACKETS EACH BEAM TIE-IN.
TYPICAL TOWER MOUNTING
ELEVATION VIEW CABLE GUIDE
VIEW: G-G
CUSTOMERS TOWER
ELEVATOR TOWER
CUSTOMER SUPPLIED MOUNTING ANGLE - 2 AT EACH STRUCTURE BEAM
VIEW: H-H
SCALE: ¼
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DO NOT SCALE THIS DRAWING
MATERIAL
CONTRACT NO.
DRAWN
CHECKED
STRESS
PROD. ENGR
PROJ. ENGR
NEXT ASSY
USED ON
APPLICATION
UNIDYNAMICS/ST. LOUIS, INC.
GENERAL ARRANGEMENT
SIZE E
CODE IDENT NO 85310
1343
REV A
SHEET 2 OF 4



SECTION: E-E
SECTION: B-B
(TYPICAL TOWER CONNECTION)
SECTION: C-C
SECTION: D-D
(TYPICAL BOTH INTERMEDIATE LANDINGS)
VIEW: F-F
(TYPICAL UPPER & LOWER LANDINGS) (ROTATED 90° C.W.)
TOWER ELEVATION
SCALE: 1/2" = 1'-0"
CAM ON SLING
CAM ON CAR
SWITCH
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DO NOT SCALE THIS DRAWING
MATERIAL:
CONTRACT NO.
DRAWN
CHECKED
STRESS
Q.A.
PROJ. ENGR
UNIDYNAMICS/ST. LOUIS, INC.
GENERAL ARRANGEMENT
E 85310 1343 A



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACT. ± 1/16 DEC. .X ± .XX ± ANGLES ± 1° .XXX ±	CONTRACT NO.	UNIDYNAMICS/ST. LOUIS, INC.
DO NOT SCALE THIS DRAWING	DRAWN R. PEASE	GENERAL ARRANGEMENT
MATERIAL:	CHECKED P. P.	
	STRESS	
	R/M	
	Q.A.	
	PROD. ENGR	SIZE E · CODE IDENT NO. 95310 · 1343 · REV A
	PROJ. ENGR	SCALE · SHEET 4 OF 4

NEXT ASSY	USED ON
APPLICATION	

1. [illegible] ITEM [illegible] TO BE MOUNTED [illegible]

2. LOCATE APPROX. AS SHOWN.

3. STEEL STAMP PART NO. 13431000-1 ON IDENT. PLATE & FILL WITH BLACK ENAMEL.

4. CLEAN SURFACES TO BE PRIMED & PAINTED. TOUCH-UP UNPRIMED SURFACES WITH TWO (2) COATS OF TT-P-645 ZINC CHROMATE PRIMER.

5. CLEAN SURFACES TO BE PAINTED, THEN APPLY (2) COATS OF MIL-E-15130C ENAMEL PAINT HAZE GRAY NO. 27, FORMULA NO. 58.

6. [illegible] ROLLER ASSEMBLIES AFTER ADJUSTMENT, THE CLEARANCE BETWEEN EACH SIDE ROLLER AND RAIL SHOULD BE .047/.077 AND FRONT ROLLER CONTACTS RAIL WHEN RAIL IS 5-3/16 ± 1/16 FROM FRONT EDGE OF VERTICAL TUBE. DRILL AND PIN LOWER ROLLERS IN PLACE. NEXT, ADJUST TOP ROLLER ASSEMBLIES SO THAT BACK ROLLERS CONTACT RAIL AND RAIL IS 5-3/16 ± 1/16 FROM FRONT EDGE OF TUBE. END OF RAIL SHOULD BE 5-1/16 ± 1/16 FROM EDGE OF VERTICAL TUBE.

7. USE MOUNTING HARDWARE SUPPLIED WITH ITEM.

8. REFER TO [illegible] AND 13430020 FOR ELECTRICAL WIRING INSTRUCTIONS.

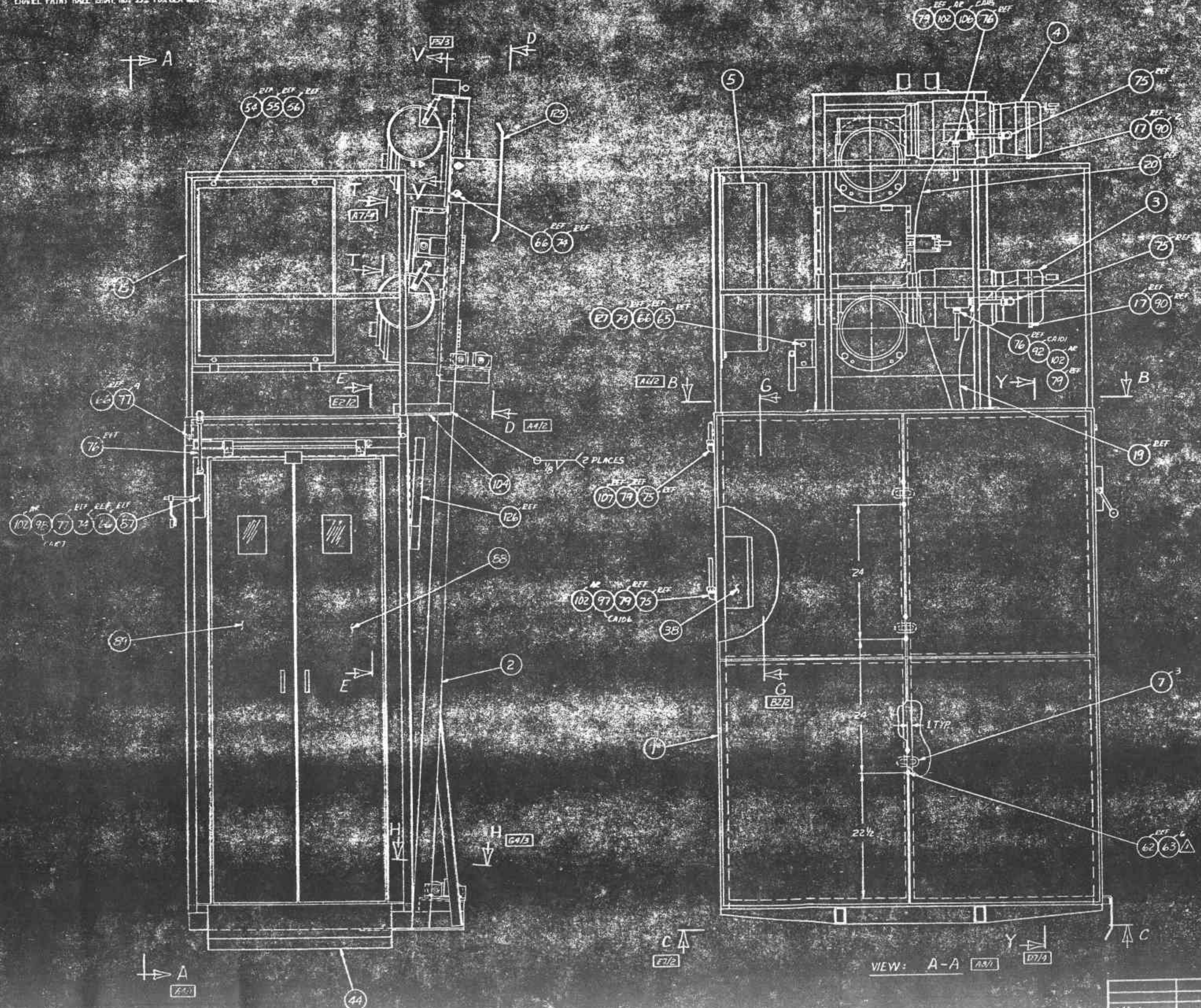
9. CLAMPS FOR ATTACHING ELECTRICAL CABLE ARE TO BE SPACED AS FOLLOWS:
VERTICALLY: 18" MAX.
HORIZONTALLY: 14" MAX.

10. ADJUST BREAK RELEASE MECHANISM TO OBTAIN INDICATED TRAVEL.

11. STEEL STAMP CAPACITY PLATE (ITEM 81) AS FOLLOWS:
CAPACITY: 2000LBS.
NO. OF PASSENGERS: 10

12. LOCATE DOOR INTERLOCK (ITEM 87) TO ALLOW PROBE ATTACHED TO ITEM 84 TO SWING FREELY INTO INTERLOCK. WITH DOORS CLOSED AND PROBE ENGAGE IN INTERLOCK, TIGHTEN ITEM 84 IN PLACE TO ITEM 83 WITH SET SCREWS.

13. USE ITEM 122 AS REQ'D TO LIMIT HORIZONTAL MOVEMENT OF DOOR LATCH BAR TO APPROX. 1/16". POSITION ITEM 50 ON ITEM 83 TO GIVE SAME 1/16" HORIZONTAL MOVEMENT.



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACT. ± 1/64 DEC. .X ± .XX ± .XXX ±
ANGLES ± 1°
DO NOT SCALE THIS DRAWING
MATERIAL:

CONTRACT NO.		
DRAWN	E. PEASE	5-23-80
CHECKED	R.P.	5-30-80
STRESS		
R/M		
Q.A.		
PROD. ENGR		
PROJ. ENGR	[illegible]	

UNIDYNAMICS/ST. LOUIS, INC.

ELEVATOR CAR ASSEMBLY

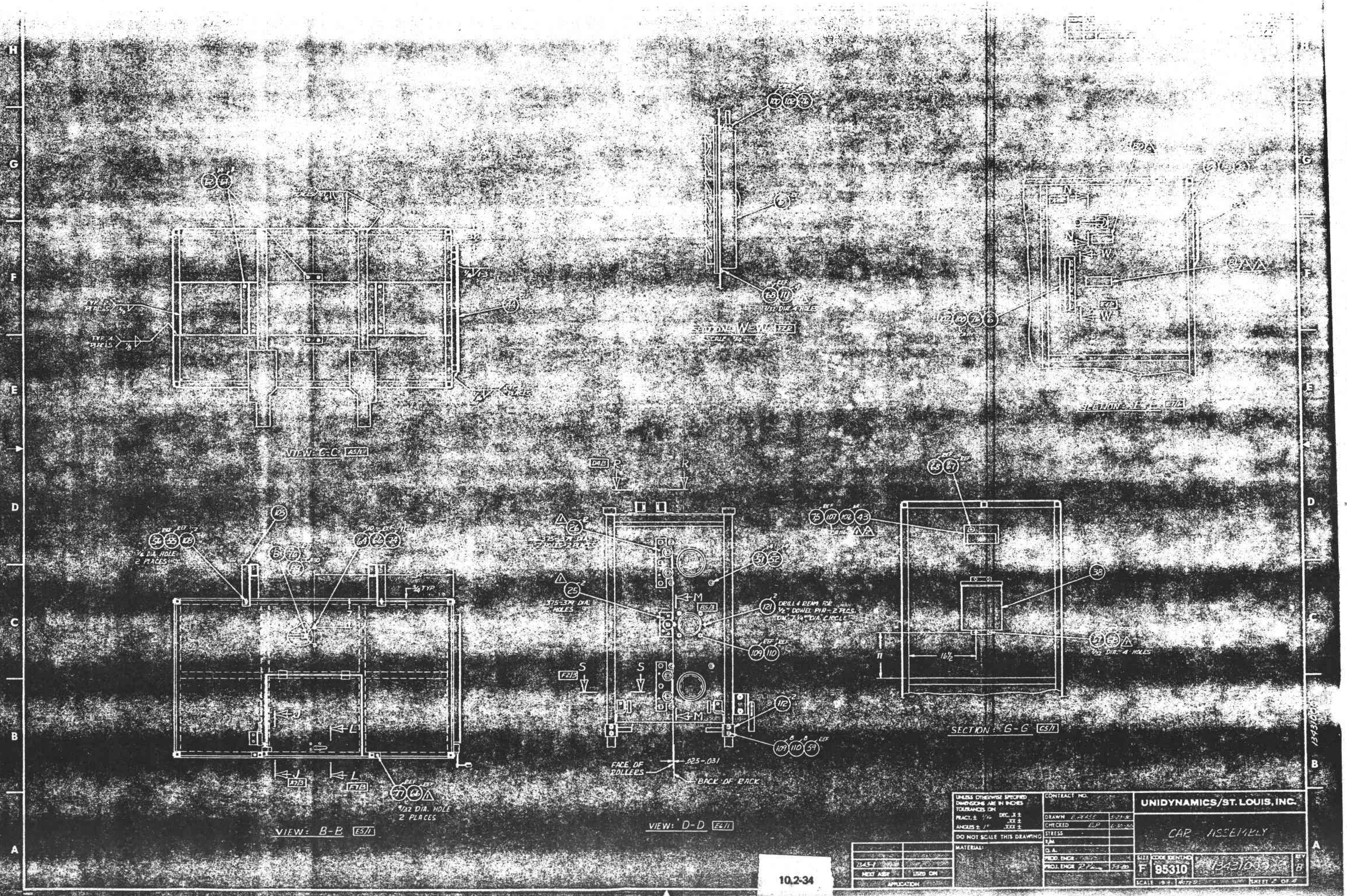
SIZE	CODE IDENT. NO.		REV
	95310	13431000	B

SHEET 1 OF 4

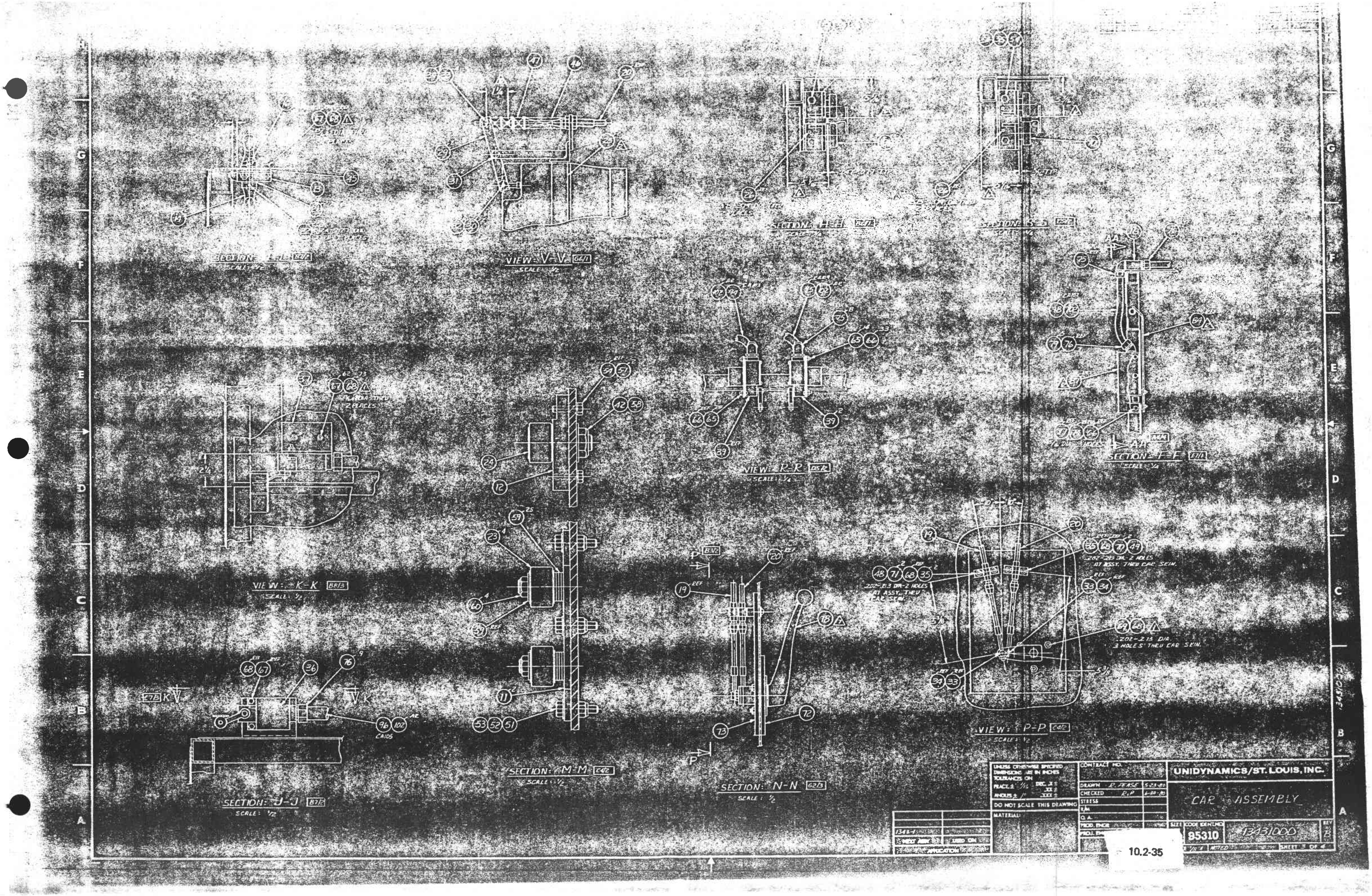
NEXT ASSY	USED ON
1343-1	

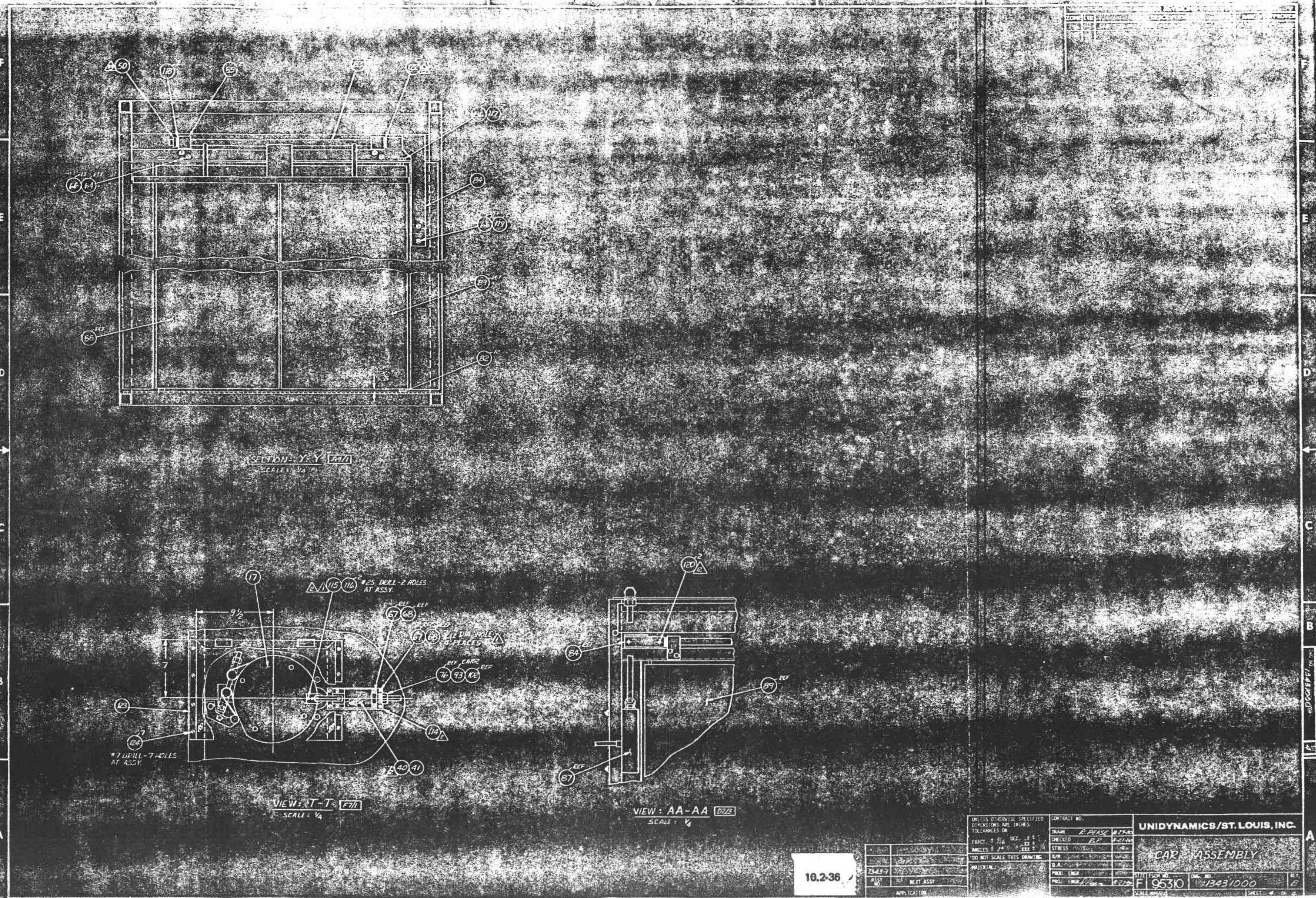
APPLICATION

10.2-32


VIEW: C-C
SECTION: W-W
SECTION: E-E
VIEW: B-B
VIEW: D-D
SECTION: G-G
FACE OF ROLLERS
BACK OF RACK
1/4 DIA. HOLE 2 PLACES
DRILL & REAM FOR 1/2" DOWEL PIN - 2 PLCS.
3/4 TYP
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACT. ± 1/16
DEC. .X ±
.XX ±
ANGLES ± 1°
.XXX ±
DO NOT SCALE THIS DRAWING
MATERIAL:
CONTRACT NO.
DRAWN E. PEASE 5-27-80
CHECKED EP 6-30-80
STRESS
R/M
Q.A.
PROD. ENGR.
PROJ. ENGR.
NEXT ASSY
USED ON
APPLICATION
UNIDYNAMICS/ST. LOUIS, INC.
CAR ASSEMBLY
SIZE F
CODE IDENT NO. 95310
REV B
SCALE
SHEET 2 OF 4

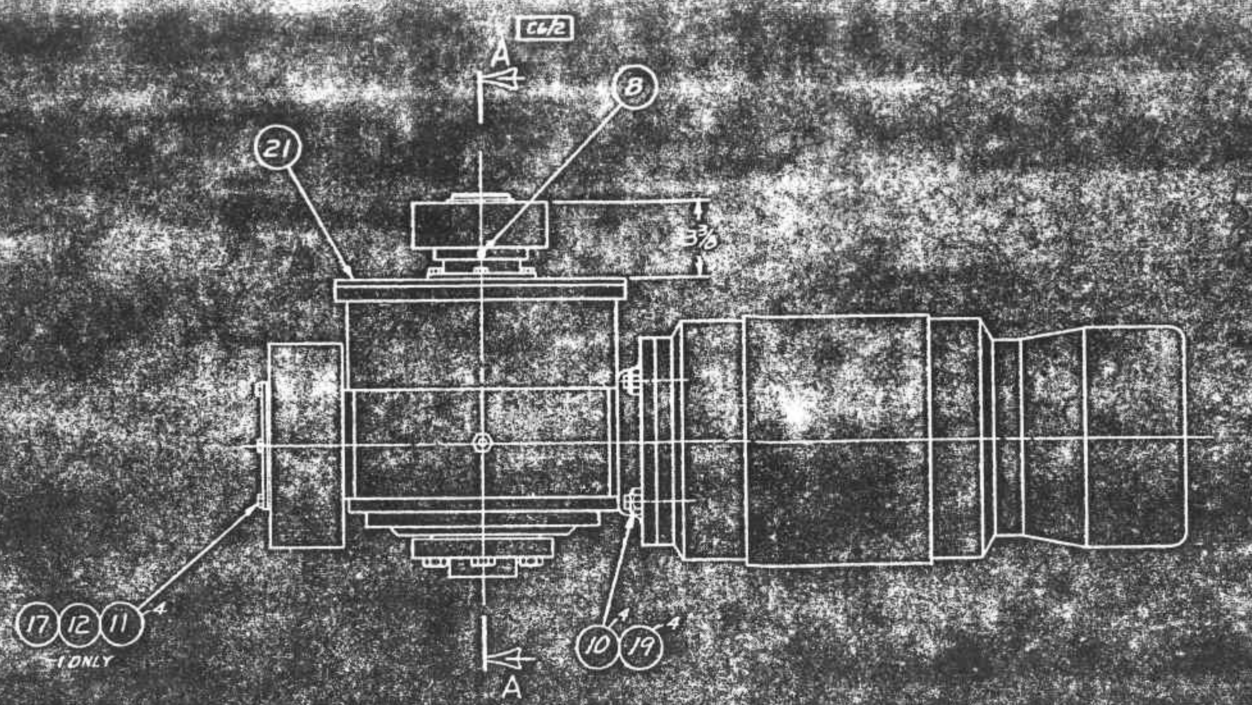
10.2-34

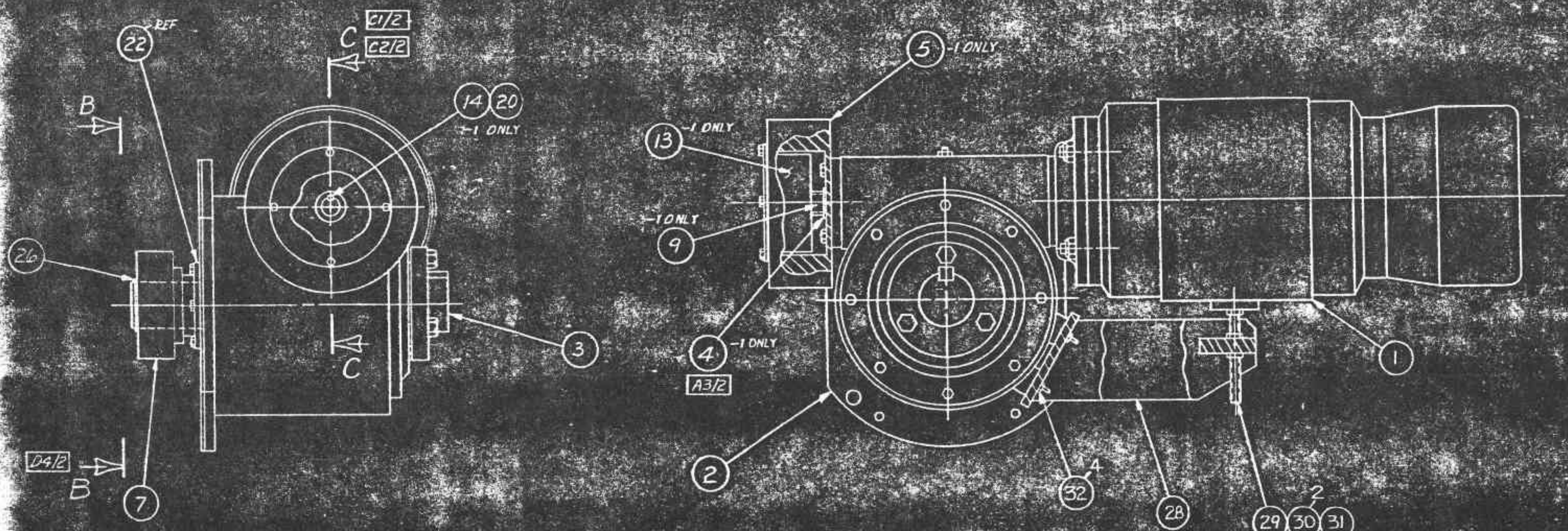

SECTION: L-L
VIEW: V-V
SECTION: H-H
SECTION: S-S
SECTION: F-F
VIEW: R-R
VIEW: K-K
SECTION: J-J
SECTION: M-M
SECTION: N-N
VIEW: P-P
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DO NOT SCALE THIS DRAWING
MATERIAL
CONTRACT NO.
DRAWN R. PEASE 5-23-80
CHECKED R.P. 6-30-80
STRESS
Q.A.
PROD. ENGR
UNIDYNAMICS/ST. LOUIS, INC.
CAR ASSEMBLY
SIZE
CODE IDENT NO
85310
13431000
REV
B
SHEET 3 OF 4
NEXT ASSY
USED ON
APPLICATION


SECTION: Y-Y
SCALE: 1/4
#25 DRILL-2 HOLES AT ASSY.
#7 DRILL-7 HOLES AT ASSY.
VIEW: T-T
SCALE: 1/4
VIEW: AA-AA
SCALE: 1/4
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES. TOLERANCES ON
DO NOT SCALE THIS DRAWING
MATERIAL
CONTRACT NO.
DRAWN R. PEASE
CHECKED R.P.
STRESS
PROD. ENGR.
PROJ. ENGR.
NEXT ASSY
APPLICATION
UNIDYNAMICS/ST. LOUIS, INC.
CAR ASSEMBLY
F
95310
13431000
B

E EXISTING 3/8 DIA BOLTS IN END CAP TO ATTACH ITEM
TO REDUCER.
"QD" BUSHING WITH KEYWAY AND KEY ARE TO BE USED ON
INION SIDE IN SECTION A-A. BUSHING WITHOUT KEYWAY TO
E INSTALLED ON OPPOSITE END WITH ITEMS 16 AND 18.
RILL 1/8" DIA HOLE THRU KEY IN APPROX. CENTER FOR ITEM
7. HOLE TO EXTEND INTO SHAFT (ITEM 3) APPROX. 1 1/4".
PRING PIN TO BE DRIVEN INTO SHAFT TO RETAIN KEY IN
OSITION SHOWN.
OTOR ORDERING DATA DEPENDANT UPON CONTRACT REQUIREMENTS.
2 ASSEMBLY DOES NOT REQUIRE CENTRIFICAL BRAKE. SAW
HAFT EXTENSION TO DIM. SHOWN IN SECTION C-C.
EMOVE ALL FOREIGN MATTER, MILL SCALE, RUST, WELD
PLATTER ETC., AND APPLY TWO COATS OF TT-P-645 ZINC
HROMATE PRIMER.
LEAN SURFACES TO BE PAINTED, THEN APPLY ONE COAT
IL-E-15135DC ENAMEL PAINT, HAZE GRAY NO. 27, FORMULA NO.52.

SH 1	SH 2	SH	SH	ZONE	LTR	DESCRIPTION	DATE	APPROVED
A	—				—	RELEASED	6-26-80	RCG
					A	INCORPORATED EDCO	7-5-80	TVG





QTY -2	QTY -1	ITEM	PART NO.	DESCRIPTION	MATL/SPEC	MANUFACTURER
4	4	32	5/16-18UNC-2B	NUT, HEX S/L	STL ZINC PLT	COM'L
1	1	31	13431200-13	THRD. RD. 1/2-13UNC-2A x 5LG	STL. ZINC PLT	COM'L
2	2	30	1/2-13UNC-2B	NUT, HEX	STL. ZINC PLT	COM'L
1	1	29	13432003-1	SADDLE		
1	1	28	12951203-1	MOTOR SUPPORT		
1	1	27	1/8 x 3/4 LG.	SPRING PIN	STL. ZINC PLT	COM'L
1	1	26	5100-243	RETAINING RING		TRUARC
4	4	25	7/16 DIA x 1	DOWEL PIN	STL.	COM'L
4	4	24	1/4-20UNC-2B	NUT, HEX S/L	STL. ZINC PLT.	COM'L
4	4	23	1/4-20UNC-2A x 1	BOLT, HEX HD. GR. 5	STL. ZINC PLT.	COM'L
1	1	22	12951201-15	TUBING		
1	1	21	12951201-14	PLATE		
—	1	20	37228-SC100	COLLAR, SET SCREW	STL	BOSTON GEAR
4	4	19	1/2-13UNC-2B	NUT, HEX SELF-LOCKING	STL. ZINC PLT.	COM'L
1	1	18	1/4-20UNC-2A x 1	SET SCREW-CONE PT. HEX SOC.	STL. ZINC PLT.	COM'L
—	1	17	12951200-14	GASKET		
1	1	16	12951200-12	KEY		
1	1	15	02-23-02689-520	"QD" BUSHING KIT		HUB CITY
—	1	14	1/4 SQ x 1 3/4	KEY	STL.	COM'L
—	1	13	554H-0-410 D	CENTRIFICAL BRAKE		HILLIARD
—	1	12	12951011-1	COVER PLATE		
—	4	11	10-32UNF-2A x 5/8	SCREW, HEX HD.	STL. ZINC PLT.	COM'L
4	4	10	12951200-13	THR. ROD 1/2-13UNC-2A x 2 1/2	STL. ZINC PLT.	COM'L
—	1	9	12951200-15	BEARING (31938 MI620-6)	BRONZE	BOSTON
1	1	8	3/8-16UNC-3A x 1/2	SET-SCREW - HEX. SOC.-CUP PT.	STL. ZINC PLT.	COM'L
1	1	7	300114-3	PINION		
1	1	6	13431200-12	KEY 5/8 SQ. x 2 3/8	STL.	COM'L
—	1	5	12951010-1	ADAPTER PLATE		
—	1	4	13431200-11	FLG. BEARING FF-1213-1	BRONZ-OIL	OILITE
1	1	3	13431200-10	SHAFT 2 7/16 DIA x 17 1/16 LG.	1045 TGP	COM'L
1	1	2	12951202-1	GEAR REDUCER		
1	1	1	10 HP "C" FLG 215TC	MOTOR		RELIANCE

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACT. ± 1/16   DEC. .X ± .XX ± .XXX ±
ANGLES ± 1°
DO NOT SCALE THIS DRAWING
MATERIAL:

NEXT ASSY	USED ON
13431000-1	CHRISTOFF - RLP

APPLICATION

CONTRACT NO.

DRAWN	R. PEASE	6-16-80
CHECKED	R.P	6-24-80
STRESS		
R/M		
Q.A.		
PROD. ENGR		
PROJ. ENGR	R. Pease	6-25-80

UNIDYNAMICS/ST. LOUIS, INC.

MACHINERY ASSEMBLY

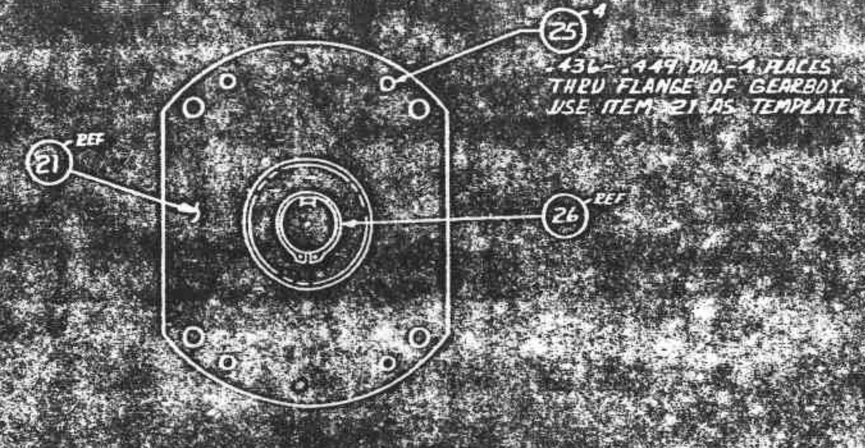
SIZE	CODE IDENT. NO.		REV
D	95310	13431200	A

1/4 NOTED   SHEET 1 OF 2

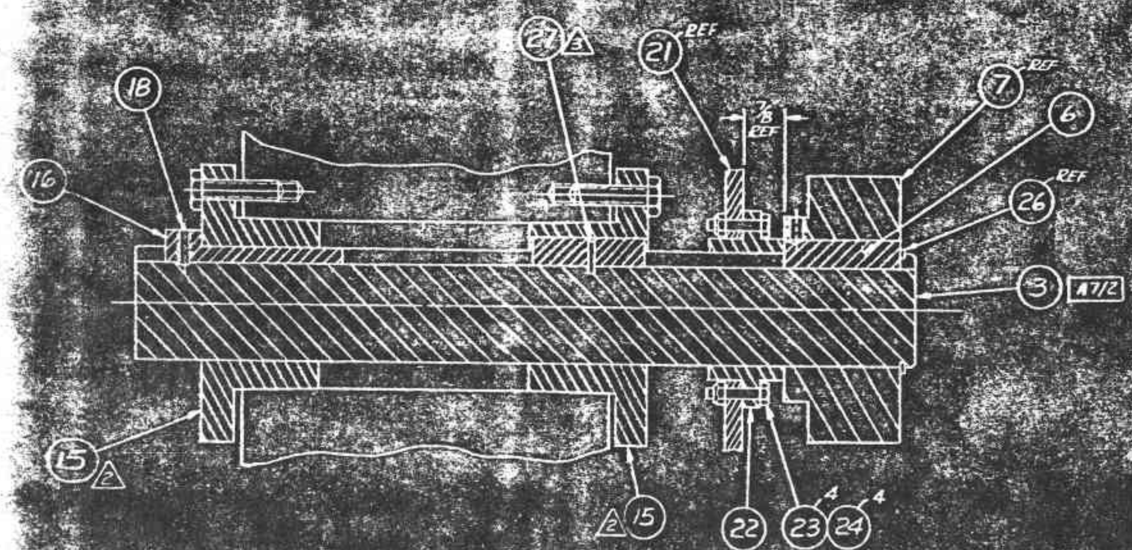
13431200

10.2-37

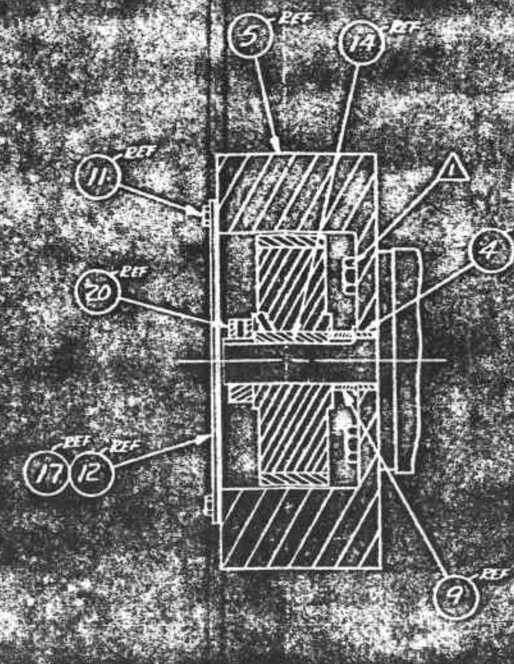
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		RELEASED	6-26-80	[illegible]



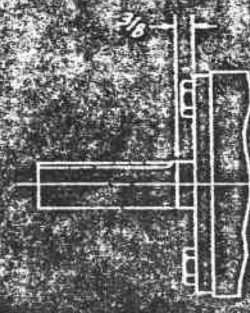
VIEW: B-B B8/1
SCALE: 1/4



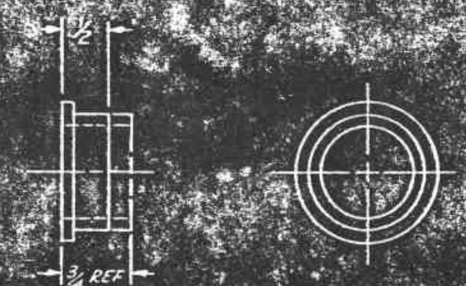
SECTION: A-A D5/1
SCALE: 1/2
ROTATED 90° CW



SECTION: C-C C7/1
SCALE: 1/2
-1 ASSY. ONLY



SECTION: C-C C7/1
SCALE: 1/2
-2 ASSY. ONLY



4 13431200-11 B6/1
SCALE: 1/1

C5/2 3 13431200-10
SCALE: 1/2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACT. ± 1/16 DEC. .X ± .XX ± ANGLES ± 1° .XXX ±	CONTRACT NO.
DO NOT SCALE THIS DRAWING	DRAWN R. PEASE 6-16-80
MATERIAL	CHECKED R.P 6-24-80
	STRESS
	R/M
	Q.A.
	PROD. ENGR
	PROJ. ENGR 6-25-80

NEXT ASSY	USED ON
13431000	CHDS...

APPLICATION

UNIDYNAMICS/ST. LOUIS, INC.

MACHINERY ASSEMBLY

SIZE	CODE IDENT NO.		REV
D	95310	13431200	

SCALE 1/4 & NOTED SHEET 2 OF 2

13431200

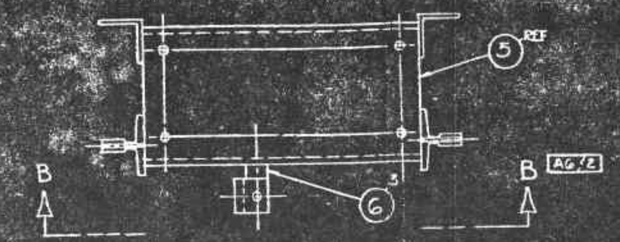
NOTES:
1. REMOVE BURRS AND BREAK SHARP EDGES.
2. REMOVE ALL FOREIGN MATTER, MILL SCALE, RUST, WELD SPLATTER, ETC. AND APPLY PRIMER, PAINT OR GALV. PER CONTRACT REQUIREMENTS

3 TORQUE TO 55-60 FT. - LBS.
4 OMIT PAINT AND PRIMER FROM THESE SURFACES.
5 GREASE PROTECT AFTER FABRICATION.
7 RACK TO HAVE 2 IN. FACE, 2 IN. DEPTH AND BE 83.252 ± .010 INCHES LONG. RACK SHALL BEGIN AND END AT THE MID-POINT OF A TOOTH SPACE. PRESSURE ANGLE TO BE 20°.
8. VISUALLY INSPECT WELDS.
9 HOLES TO BE ADDED IN 2½ x 2½ x ¼ ANGLE FOR 1343 PROGRAM ONLY.

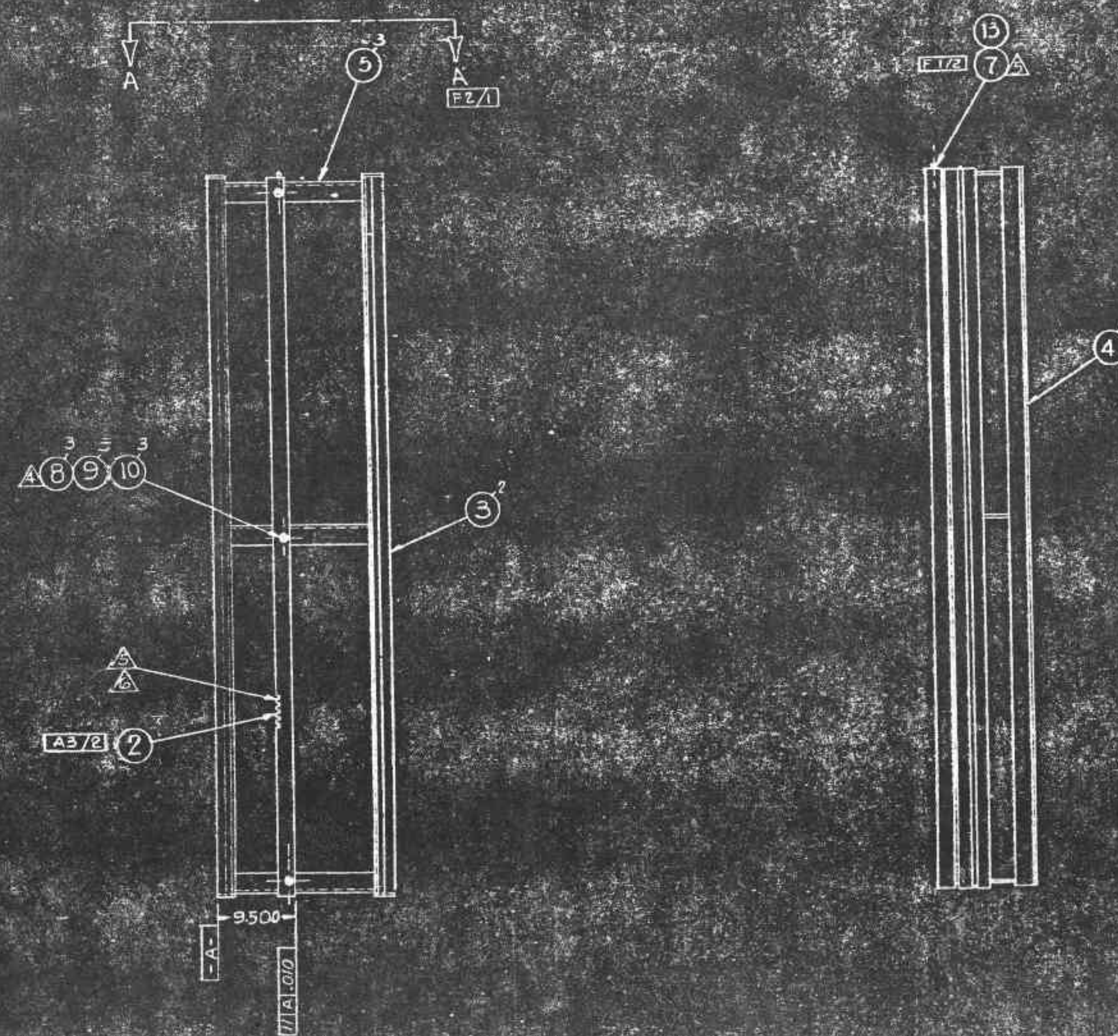
REVISION STATUS OF SH			
SH 1	SH 2	SH	SH
A	A		
B	B		
C	C		
D	D		

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	—	RELEASED	4-25-79	[illegible]
	A	INCORPORATED EDCO	5-1-79	[illegible]
	B	CHGD SHEET 2	5-17-79	[illegible]
	C	CHGD ITEM 7, DELETED NOTES 9 & 10 AND DELETED ITEM 12	6-20-79	MY/EJK
	D	MC ECO C1; ADDED SECT. C-C & NOTE 9	7-8-80	RP/RG



VIEW A-A EG/1
SCALE 1/4



–	AR	13	601	LOCTITE RETAINING COMPOUND		LOCTITE CORP.
–						
		11				
–	3	10	½ DIA	SQ. MALLEABLE BEVEL WSHR	HOT GALV.	COM'L
–	3	9	½-13UNC-2B	NUT, HEX. SELF LOCKING	STL. ZINC PLTD	COM'L
–	3	8	½-13UNC-2A x 4	SOC. HD. CAP SCREW	STL. ZINC PLTD	COM'L
–	1	7	13081400-14	BULLET NOSE DOWEL	11L17 STEEL	
3	–	6	13081400-13	FLAT ¾ x 1¼ x 2 11/32	M1020	STEEL
3	–	5	13081400-12	CHANNEL 8 x 13.75 LB/FT x 16	ASTM-A36	STEEL
2	–	4	13081400-11	ANGLE 2½ x 2½ x ¼ x 83 7/32	ASTM-A36	STEEL
2	–	3	T-161	GUIDE RAIL 7FT		STD STL SPEC
–	1	2	13081400-10	RACK, 4 D.P. 106 PITCHES	AISI-C1045	STEEL C.D.
–	1	1	13081400-2	TOWER WELDMENT		
QTY -2	QTY -1	ITEM	PART NO.	DESCRIPTION	MATL/SPEC	MANUFACTURER

PARTS LIST

SCHEDULE ITEM NO. 1

SPEC. NO. DC-7346

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
FRACT. ± 1/16 DEC. .X ± .1 .XX ± .03
ANGLES ± 1° .XXX ± .010
DO NOT SCALE THIS DRAWING
MATERIAL:

1308	GRAND COULEE
NEXT ASSY	USED ON
APPLICATION	

CONTRACT NO.

DRAWN	EP	3-26-79
CHECKED	[illegible]	3-27-79
STRESS		
R/M		
Q.A.		
PROD. ENGR	LOTTE	3/27/79
PROJ. ENGR	[illegible]	3-27-79

UNIDYNAMICS/ST. LOUIS, INC.

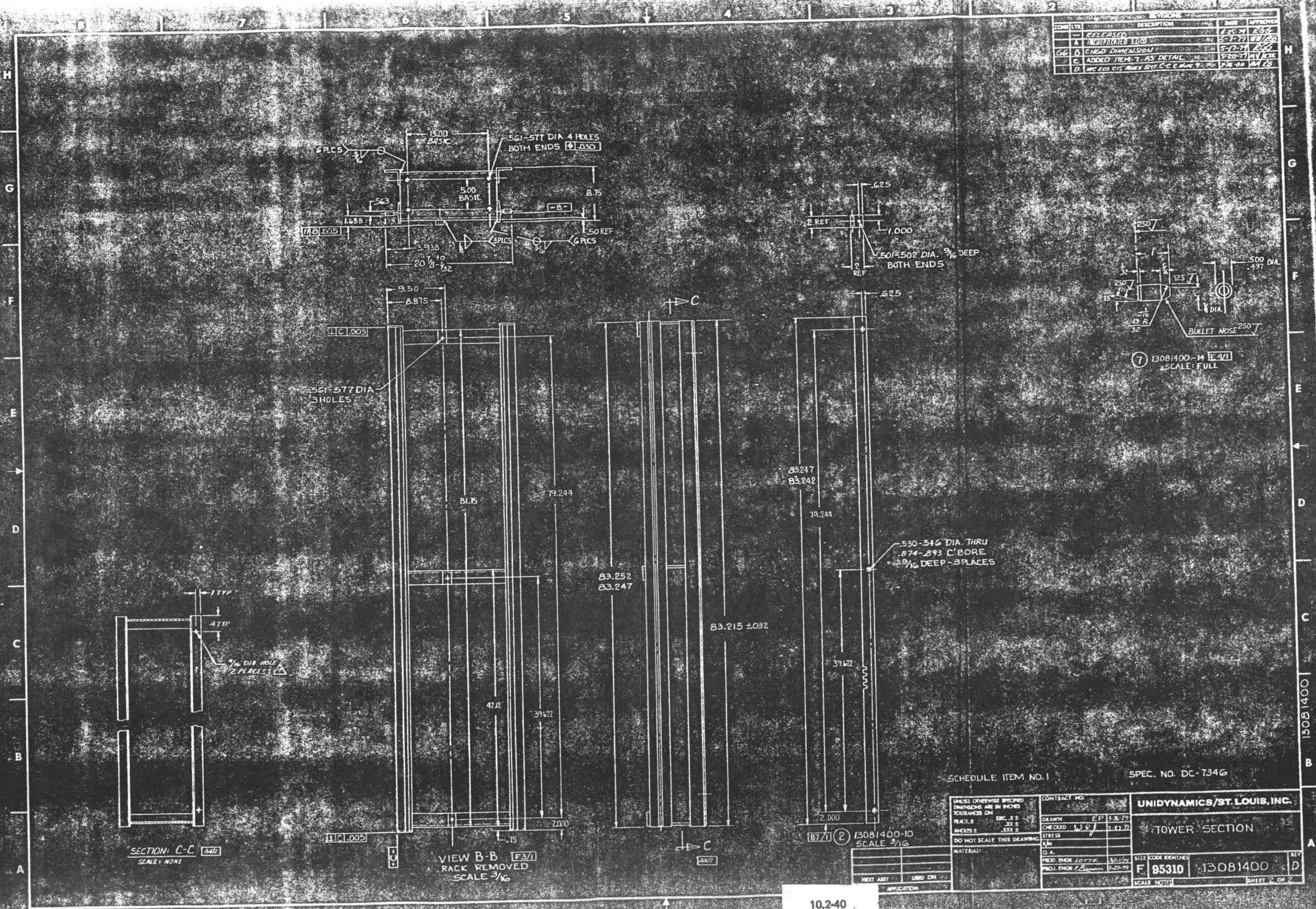
TOWER SECTION

SIZE E CODE IDENT NO. 95310 13081400 REV D

SHEET 1 OF 2

13081400

10.2-39



REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
— RELEASED 4-25-79
A INCORPORATED EDCO 5-7-79
G6 B CHGD DIMENSION 5-17-79
C ADDED ITEM 7 AS DETAIL 5-20-79
D 7-16-80
3.00 BASIC
.561-.577 DIA 4 HOLES BOTH ENDS .030
6 PLCS
5.00 BASIC
8.75
.563
1.688
-B-
.005
3.938
3 PLCS
6 PLCS
.50 REF
.625
2 REF
1.000
.501-.502 DIA. 9/16 DEEP BOTH ENDS
2 REF
.250
.500 DIA
.437
.125
BULLET NOSE .250
13081400-14 E 4/1
SCALE: FULL
9.50
8.875
C .005
.561-.577 DIA 3 HOLES
81.75
79.244
47.12
39.622
2.000
.75
C .005
VIEW B-B F3/1
RACK REMOVED
SCALE 3/16
C
83.252
83.247
83.215 ±.032
C
A4/2
.625
83.247
83.242
79.244
.530-.546 DIA. THRU
.874-.893 C'BORE
3/16 DEEP-3 PLACES
39.622
2.000
B7/1
13081400-10
SCALE 3/16
1 TYP
4 TYP
9/16 DIA. HOLE 2 PLACES
SECTION: C-C A4/2
SCALE: NONE
SCHEDULE ITEM NO. 1
SPEC. NO. DC-7346
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON
FRACT. ± DEC. .X ± .XX ± ANGLES ± .XXX ±
DO NOT SCALE THIS DRAWING
MATERIAL
CONTRACT NO.
DRAWN EP 4-26-79
CHECKED
STRESS
R/M
Q.A.
PROD. ENGR
PROJ. ENGR 5-23-79
NEXT ASSY
USED ON
APPLICATION
UNIDYNAMICS/ST. LOUIS, INC.
TOWER SECTION
SIZE F
CODE IDENT NO. 85310
13081400
REV D
SCALE
NOTED
SHEET 2 OF 2
13081400

1\. REFER TO [illegible] LIST OF ELECTRICAL TERMINATIONS DWG. [illegible] FOR SYSTEM CABLE TERMINATION INFORMATION.

2\. UP AND DOWN CONTACTORS ARE MECHANICALLY INTERLOCKED TO PREVENT SIMULTANEOUS OPERATION.

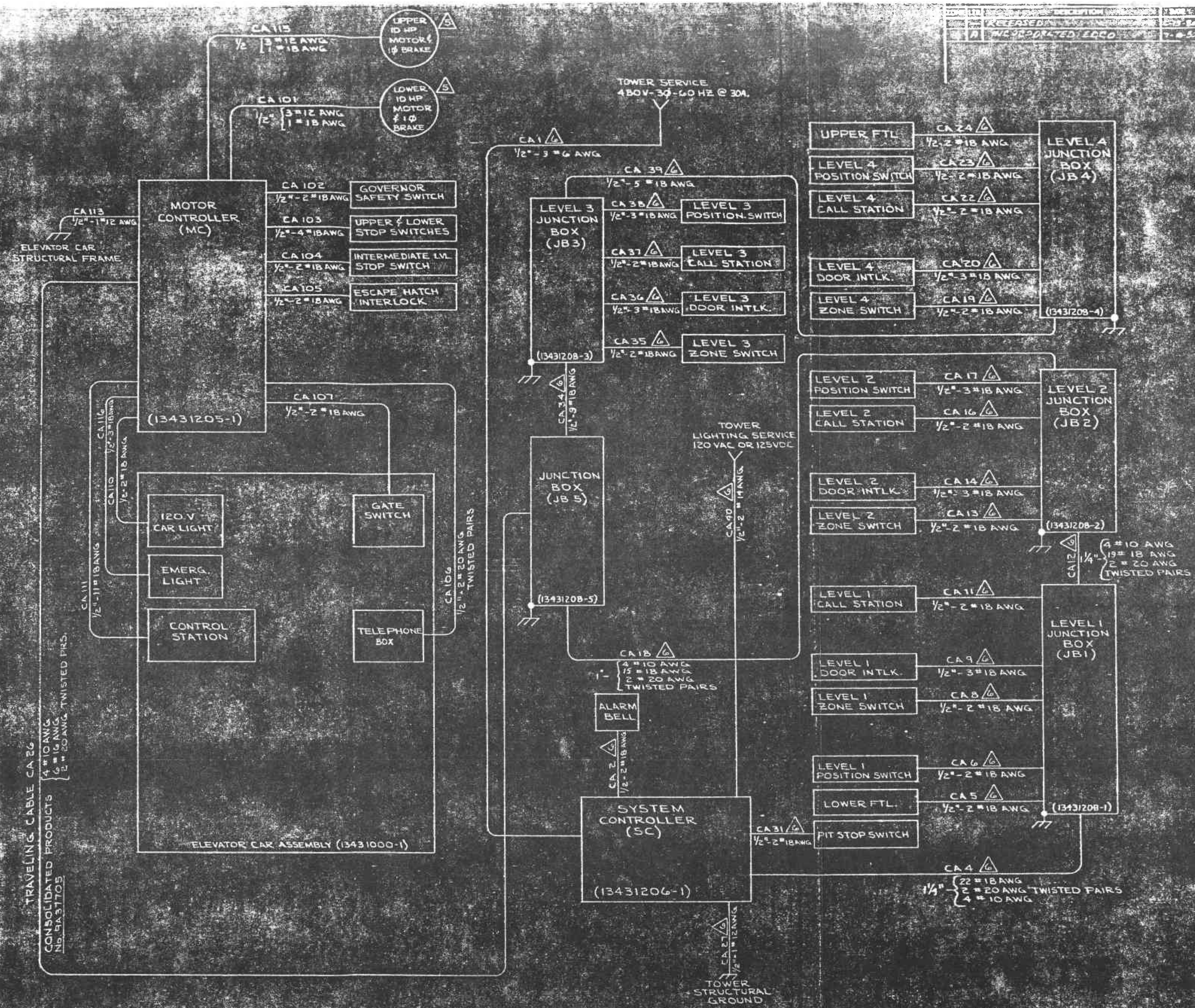
3\. SPECIAL REFERENCE DESIGNATIONS:
- FTL - FINAL TERMINAL LIMIT SWITCH
- K - RELAY OR CONTACTOR
- MC - MOTOR CONTROLLER
- SC - SYSTEM CONTROLLER
- JB - JUNCTION BOX

4\. WIRE ROUTING THRU TERMINAL BOARDS IN THE SYSTEM IS DENOTED AS FOLLOWS:

MC -3 -10
- 3RD GROUP OF CHARACTERS TERMINAL OF BOARD WHERE CONNECTION IS MADE.
- 2ND GROUP OF CHARACTERS ASSY TERMINAL BOARD NUMBER
- 1ST GROUP OF CHARACTERS ASSY IN WHICH TERMINAL BOARD IS LOCATED.

5\. CORRECT MOTOR ROTATION IS TO BE DETERMINED DURING SYSTEM CHECK-OUT AND THE MOTOR LEADS TO BE MARKED AS SHOWN ON THE DRAWING.

6\. THESE ITEMS TO BE FURNISHED AND INSTALLED BY CUSTOMER.



	RECEIVER TOWER
ASSY NO.	NEXT ASSY
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE INCHES TOLERANCES ON FRACT. ± DEC. .X ± .XX ± ANGLES ± .XXX ±

DO NOT SCALE THIS DRAWING

MATERIAL:

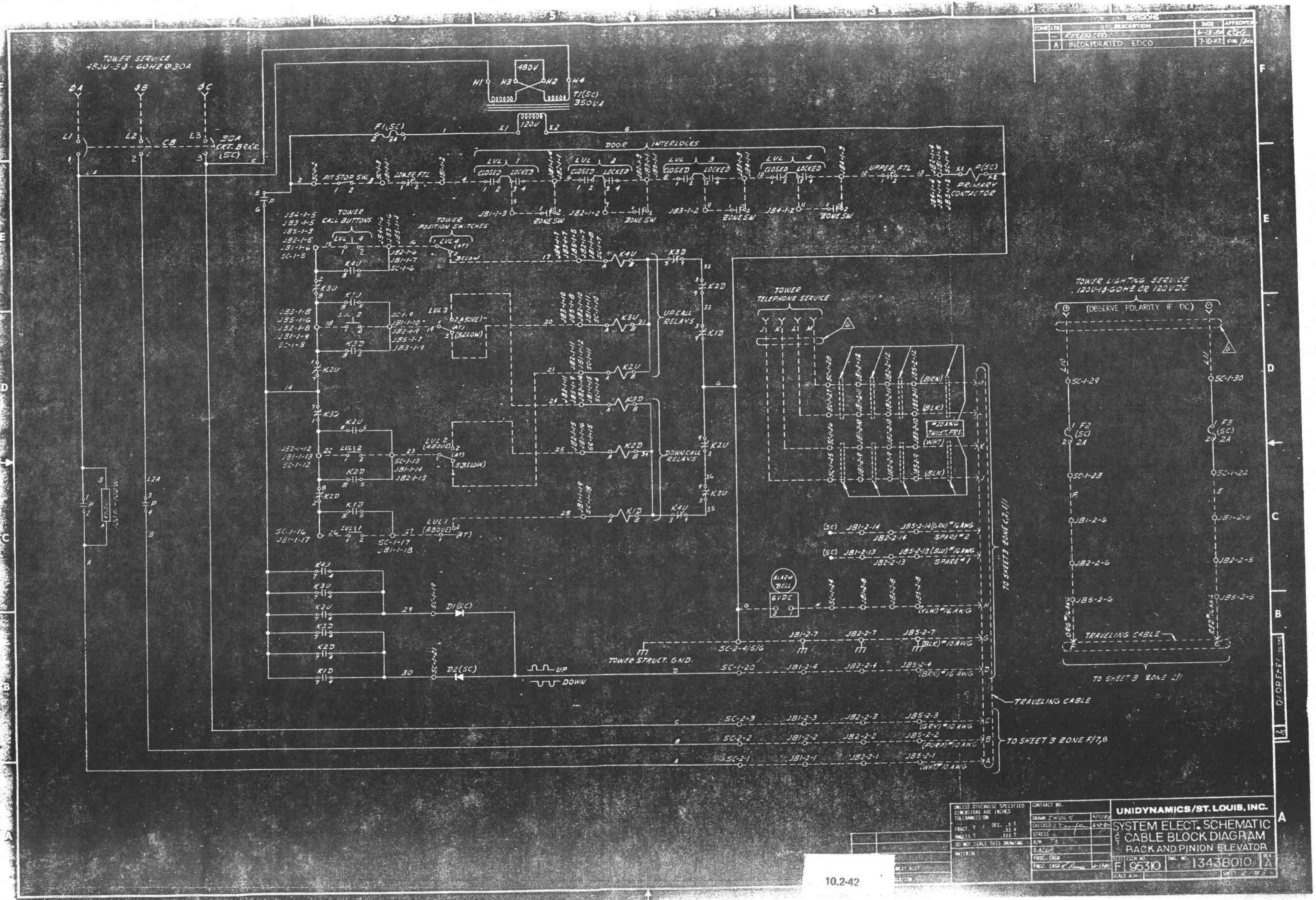
CONTRACT NO. F80-208-01
DRAWN HALVERSON 6-6-83
CHECKED 6-11-83
STRESS
R/M
Q.A.
PROD. ENGR
PROJ. ENGR

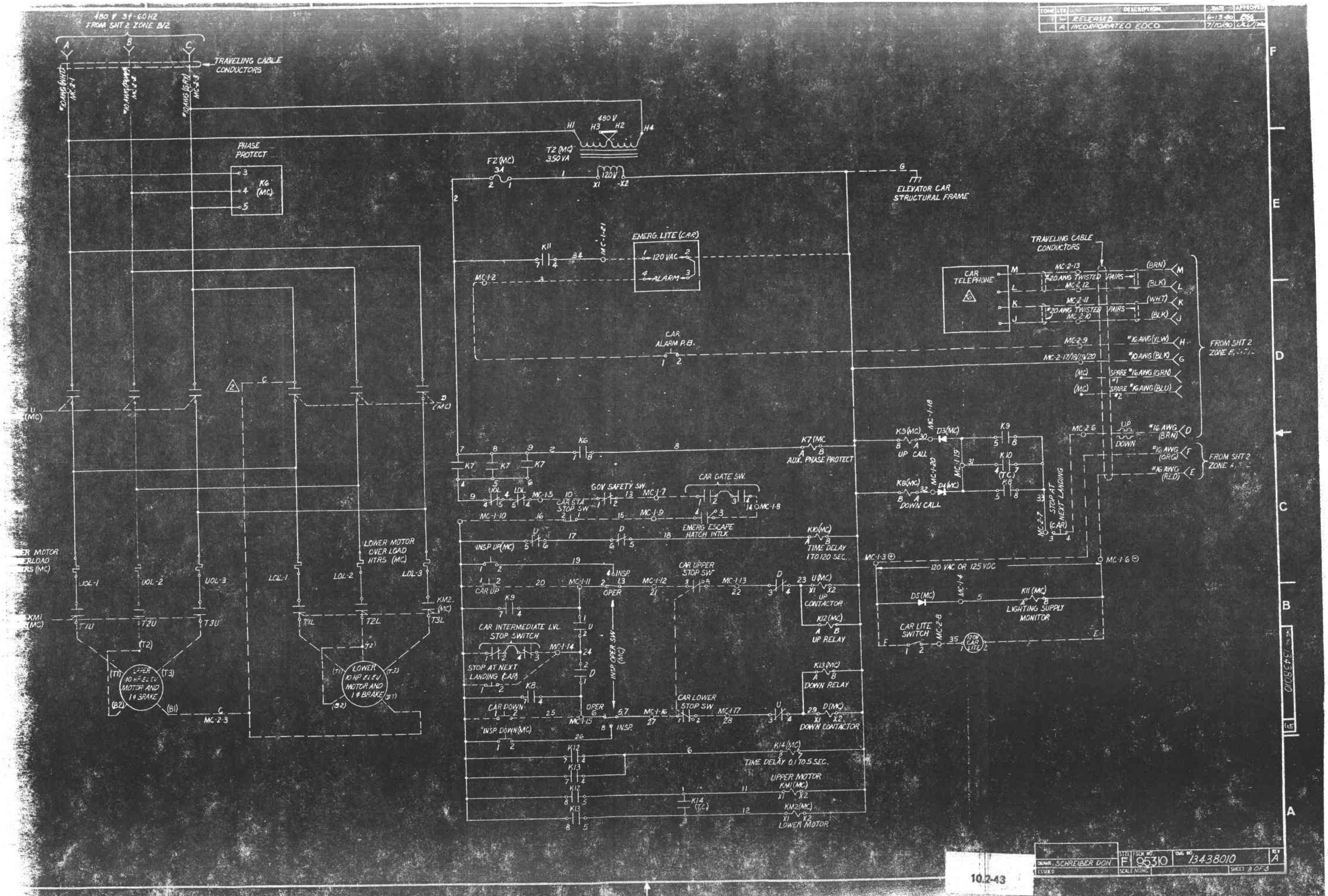
UNIDYNAMICS/ST. LOUIS, INC.

SYSTEM ELECTRICAL SCHEMATIC AND CABLE BLOCK DIAGRAM RACK & PINION ELEVATOR

SIZE | FSCM NO. [illegible]6310 | DWG. NO. 13438010 | REV A

SHEET 1 OF [illegible]


UNIDYNAMICS/ST. LOUIS, INC.
SYSTEM ELECT. SCHEMATIC & CABLE BLOCK DIAGRAM
RACK AND PINION ELEVATOR
F 95310 13438010 A
REVISIONS
RELEASED
A INCORPORATED EDCO
TOWER SERVICE 480V-3Ø-60HZ @ 30A
30A CKT. BRKR. (SC)
T1(SC) 350VA
480V
120V
F1(SC)
DOOR INTERLOCKS
PIT STOP SW
LOWER FTL
UPPER FTL
P(SC) PRIMARY CONTACTOR
ZONE SW
TOWER CALL BUTTONS
TOWER POSITION SWITCHES
UP CALL RELAYS
DOWN CALL RELAYS
TOWER TELEPHONE SERVICE
TOWER LIGHTING SERVICE 120V-1Ø-60HZ OR 120VDC
(OBSERVE POLARITY IF DC)
ALARM BELL 6VDC
TOWER STRUCT. GND.
TRAVELING CABLE
TO SHEET 3 ZONE C,D,E/1
TO SHEET 3 ZONE F/7,8
TO SHEET 3 ZONE C/1
UP
DOWN


480 V 3φ 60 HZ FROM SHT 2 ZONE B/2
TRAVELING CABLE CONDUCTORS
PHASE PROTECT
K6 (MC)
480 V
H1 H3 H2 H4
T2 (MC) 350 VA
F2 (MC) 3A
120 V
X1 X2
ELEVATOR CAR STRUCTURAL FRAME
EMERG. LITE (CAR)
120 VAC
ALARM
CAR ALARM P.B.
CAR TELEPHONE
TRAVELING CABLE CONDUCTORS
#20 AWG TWISTED PAIRS
(BRN) (BLK) (WHT) (BLK)
#16 AWG (YLW)
#10 AWG (BLK)
SPARE #16 AWG (GRN)
SPARE #16 AWG (BLU)
FROM SHT 2 ZONE E
#16 AWG (BRN)
#16 AWG (ORG)
#16 AWG (RED)
FROM SHT 2 ZONE
UP DOWN
K7 (MC) AUX. PHASE PROTECT
UP CALL
DOWN CALL
STOP AT NEXT LANDING
GOV SAFETY SW
CAR STA STOP SW
CAR GATE SW.
EMERG ESCAPE HATCH INTLK
K10 (MC) TIME DELAY 1 TO 120 SEC.
INSP UP (MC)
CAR UP
OPER
INSP
CAR UPPER STOP SW
U (MC) UP CONTACTOR
K12 (MC) UP RELAY
CAR INTERMEDIATE LVL STOP SWITCH
STOP AT NEXT LANDING (CAR)
INSP OPER SW (MC)
K13 (MC) DOWN RELAY
CAR DOWN
CAR LOWER STOP SW
D (MC) DOWN CONTACTOR
INSP DOWN (MC)
K14 (MC) TIME DELAY 0.1 TO 0.5 SEC.
UPPER MOTOR KM1 (MC)
KM2 (MC) LOWER MOTOR
120 VAC OR 125 VDC
D5 (MC)
K11 (MC) LIGHTING SUPPLY MONITOR
CAR LITE SWITCH
120V CAR LITE
UPPER MOTOR OVERLOAD HTRS (MC)
UOL-1 UOL-2 UOL-3
LOWER MOTOR OVER LOAD HTRS (MC)
LOL-1 LOL-2 LOL-3
UPPER 10 HP ELEV MOTOR AND 1φ BRAKE
LOWER 10 HP ELEV MOTOR AND 1φ BRAKE
T1U T2U T3U T1L T2L T3L
RELEASED 6-13-80
A INCORPORATED EDCO 7/10/80
DRAWN SCHREIBER DON
F 95310 13438010 A
SCALE NONE
SHEET 3 OF 3

10.3 BUILDINGS

10.3 BUILDINGS

10.3 BUILDINGS

10.3.1 Warehouse

The Warehouse, BL-703, is a 60 ft x 100 ft insulated metal building. The following pages contain Mark Cox Electric information provided for the building.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 3. Also see Stearns-Roger Architectural Drawing No. A5-1.

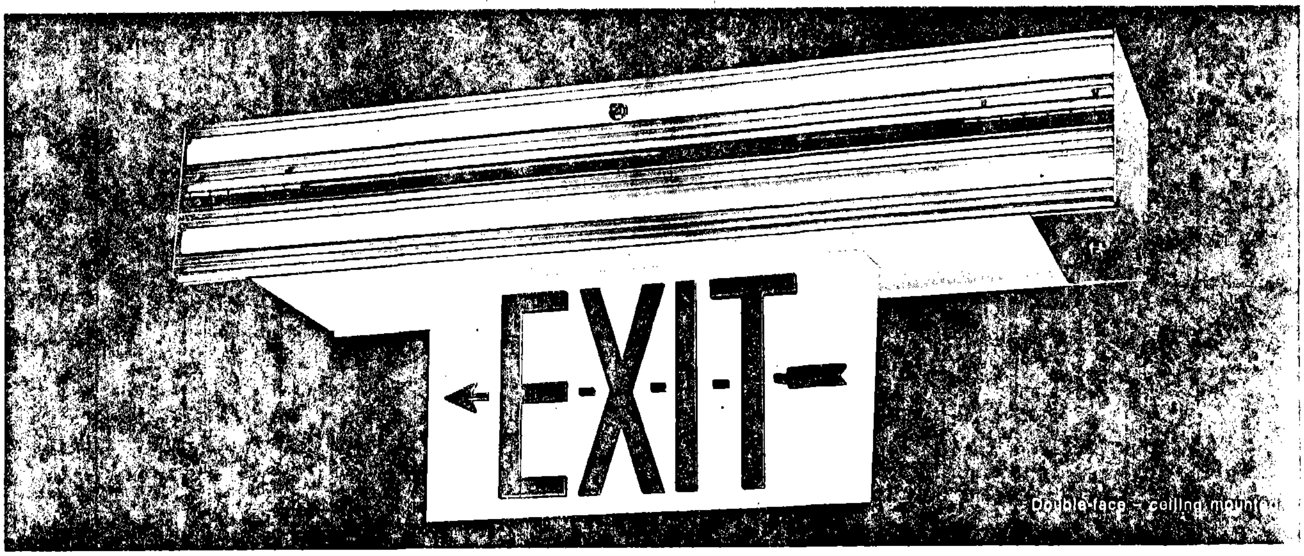
Holophane Sign-Lensafe,™

TYPE EA

the new concept in exit signs.

Three functions with one luminaire:
Exit sign
Security lighting for hallways and stairs
Emergency lighting

Single-face – wall mounted



Double-face – ceiling mounted

Newly-designed Holophane Sign-Lensafe features:

TYPE EA

Reliability
Solid state switch, fail-safe construction, rapid and reliable battery recharging, and a long-life fluorescent light source.

Legal Exit Sign
Size of letters and construction meet all requirements for a legal exit sign, as specified in all National and State Codes as of 1970.

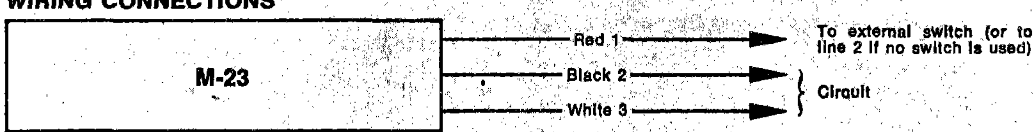
Minimum Maintenance
Simple observation of the "flashing light" indicates unit is functioning properly. Test switch provides double safety check. Hinged housing construction permits easy accessibility for battery replacement (about every 8 years).

Versatility
SIGN-LENSAFE can be used to indicate exits, flow of pedestrian traffic, special rooms, important areas and special rules.

Clean Appearance
Aesthetically designed, compact modern construction permits use in all areas and buildings.

Emergency Operation
Three hours of emergency power keeps sign lighted plus lighting of adjacent areas; i.e., corridors, means of egress, doorways and stairs.

WIRING CONNECTIONS



For M-21 and M-22 only line 2 and line 3 is provided and are connected to the Circuit.

M-22 and M-23 are listed by Underwriters' Laboratories, Inc., as Emergency Lighting Equipment

Specification and ordering data.

Catalog No.	Description of Unit	Lamps	Overall Dimensions (Inches)			Net Weight Lbs. ea.
			Length	Width	Depth	
M-21	General*	One F20T12 (20 watt)	28⅜	5¼	7	12
M-22	Emergency†		"	"	"	23
M-23	Security†		"	"	"	27
-DF	Add Suffix to Catalog No. for Double Faced Sign					
MG-3	Add Suffix to Catalog No. for Wire Guard (Not suitable for use with "-DF" option)					

*Lamp furnished with each luminaire.
†Lamp and two batteries furnished with each luminaire.
For black, silver or bronze anodized finish, add suffix "Black", "Silver" or "Bronze" to catalog number.

Specify lettering on luminaire face (if required)

Suggested Lettering:

EXIT (plus arrow if necessary)

DEPOSITS	QUIET
NO SMOKING	ELEVATORS
DANGER	STAIRS
MAIL ROOM	OPEN

All lettering can be provided in either "Red" or "Green".

Contact your local Holophane sales engineer for application assistance, computer-aided design and cost studies, and sample units for trial installation. He can also give you information on LENSAFE™ and LENSAFE™ II (1-lamp and 2-lamp) fluorescent general, emergency and security lighting.

Holophane®
A Johns-Manville Company
Holophane Company, Inc., Woodbro Division
13500 Saticoy Street, Van Nuys, California 91402

Printed in U.S.A. 7335-10-873

2 LAMP

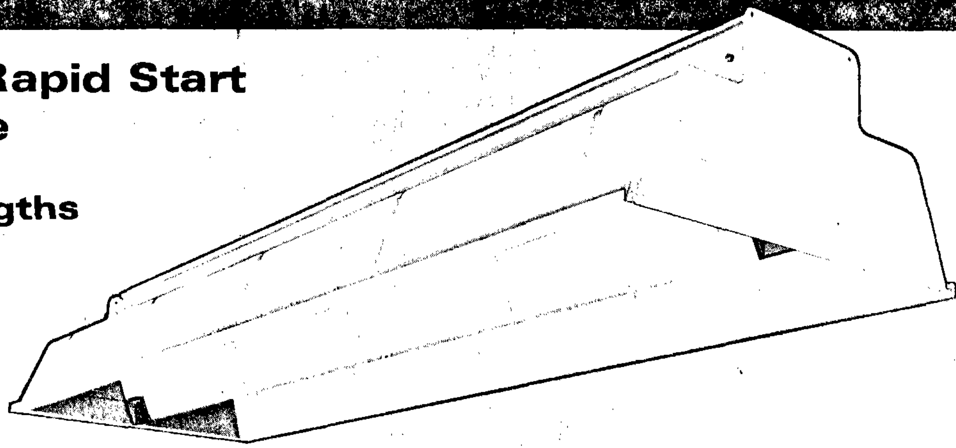
TYPE FA

PV INDUSTRIAL SERIES

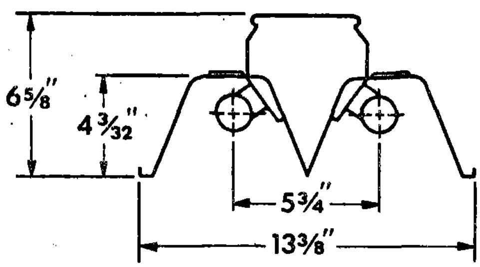
PV SERIES

430 M. A. Rapid Start and Slimline

4–8 Foot Lengths



30° Crosswise Shielding
20% Uplight



APERTURED BAKED ENAMEL AND PORCELAIN REFLECTORS

SPECIFICATIONS

Die formed channel constructed of 20 gauge cold-rolled steel.

Full length grooves provided on sides of channel for slide clamp hanger and added rigidity.

Socket track constructed of 20 gauge cold-rolled steel.

Spring loaded lampholders to provide positive lamp insertion.

One piece vee reflector is fabricated of 20 gauge steel in four foot lengths and die embossed for added rigidity. Apertures are formed in the flat crown section of the reflector to provide 20% uplight.

Die cast quarter turn reflector latch, captive type, contoured to match the shape of the center vee when fastened.

Reflector aligners and channel connector supplied with each fixture.

Full end plate available for end of row or individually mounted fixtures.

U.L. listed and labeled I.B.E.W. – A.F. of L.

Fixture guaranteed for one year against mechanical defects in manufacture.

ORDERING INFORMATION

Type	Catalog No.	No. and Type of Lamps	Dimensions	Approx. Shipping Wt.
	BAKED ENAMEL REFLECTORS			
	PV 240	Two F40	13-3/8" x 49¾"	29
	8TPV 240	Four F40	13-3/8" x 99½"	57
	PV 248	Two F48T12	13-3/8" x 48"	31
	PV 296	Two F96T12	13-3/8" x 96"	51
	PORCELAIN ENAMEL REFLECTORS			
	PV 240 PO	Two F40	13-3/8" x 49¾"	34
	8TPV 240 PO	Four F40	13-3/8" x 99½"	67
	PV 248 PO	Two F48T12	13-3/8" x 48"	36
	PV 296 PO	Two F96T12	13-3/8" x 96"	61
	FULL END PLATE			
Type	Catalog No.	For Use With	Description	Approx. Shipping Wt.
	PCEP*	PV Series	Two reflector end plates	2

*Full end plates must be ordered separately and field installed. Order one pair per fixture if individually mounted. For continuous row mounting order one pair per row. No end plates furnished with fixture.

VOLTAGE MUST BE SPECIFIED. i.e.: PV 240 120.

REMARKS

C.E.C. File E-16.1

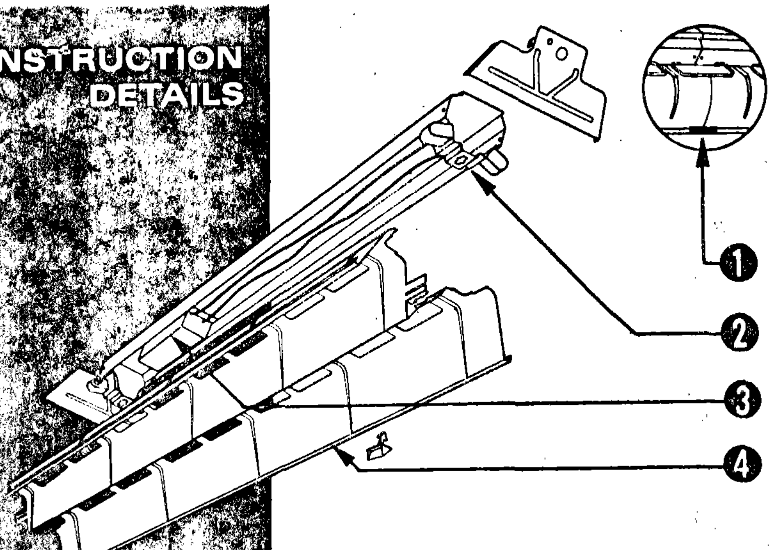
A.I.A File 31-F-2

LITHONIA®
DIVISION OF NATIONAL SERVICE INDUSTRIES, INC.
Box A • Conyers, Georgia 30207 • 404/483-8731

CONSTRUCTION DETAILS

PV SERIES

TYPE FA



1. Snap-on reflector aligners supplied with each fixture.
2. Lampholder track and individual lampholders can easily be removed for ease of maintenance.
3. Ballast is held in place by a metal screw and positive lock ballast lance for easy replacement.
4. Reflector is held in place with two quarter turn latches and can be removed with ease for cleaning and servicing.

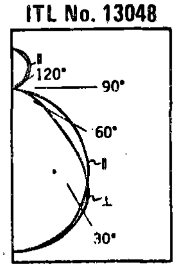
ILLUMINATION DATA

Typical lighting curves and coefficients of utilization

ZONAL CAVITY

Pfc	20%													
Pcc	80%				70%				50%			30%		
Pw	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%
1	92	89	86	83	88	85	82	80	78	76	74	72	70	69
2	85	79	74	70	81	76	71	68	70	66	63	65	62	59
3	78	71	65	60	75	68	62	58	63	58	55	58	55	52
4	72	63	56	51	69	61	55	50	56	51	48	52	48	45
5	66	56	49	44	63	54	48	43	50	45	41	47	43	39
6	61	51	44	39	58	49	42	38	46	40	36	42	38	34
7	55	46	39	34	54	44	38	33	41	36	31	38	34	30
8	52	41	34	29	50	40	33	29	37	31	27	35	30	26
9	48	37	30	25	46	36	29	26	33	28	24	31	26	23
10	44	33	27	22	43	32	28	22	30	25	21	28	24	20

ITL No. 13048



SPACING RATIO: To assure uniform light pattern, the distance between rows should not exceed mounting height x 1.3.

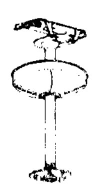
***Full photometric reports available upon request**

INSTALLATION

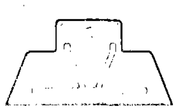
NOT TO SCALE

Dimensions are subject to change. Please consult factory or check sample for verification.

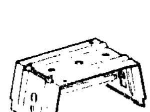
ACCESSORIES



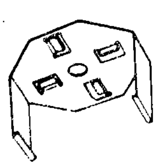
CAT. NO. SQ SWIVEL STEM HANGER



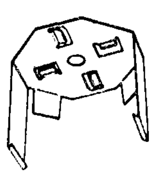
CAT. NO. PCEP FULL END PLATE



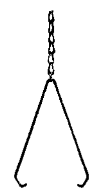
CAT. NO. 102B TONG (SLIDE CLAMP) HANGER



CAT. NO. HR UN CEILING TYPE HOOKER HANGER*



CAT. NO. HR UN1 1½" SPACER TYPE HOOKER HANGER*



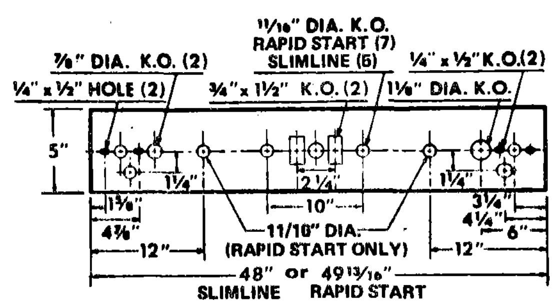
CAT. NO. HC CHAIN HANGER

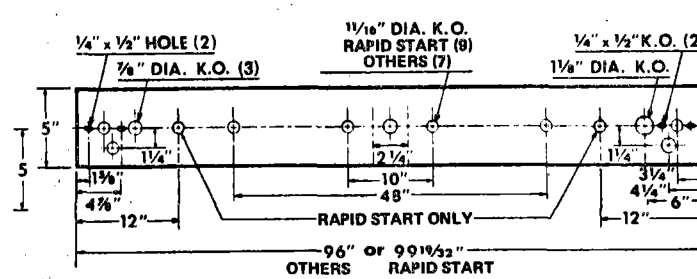
MOUNTING RECOMMENDATIONS

Individual Fixtures: Minimum of two hangers or one double stem hanger (4 ft. only).

Continuous Rows: Minimum of one hanger per channel plus one extra hanger per row.

Hooker Hanger: Minimum of two hangers per channel, either individual or continuous rows.





LITHONIA

*T.M., Patent No. 3,589,660

Supercedes previous sheet N-15/1975

2 AND 4 LAMP

TYPE F-B

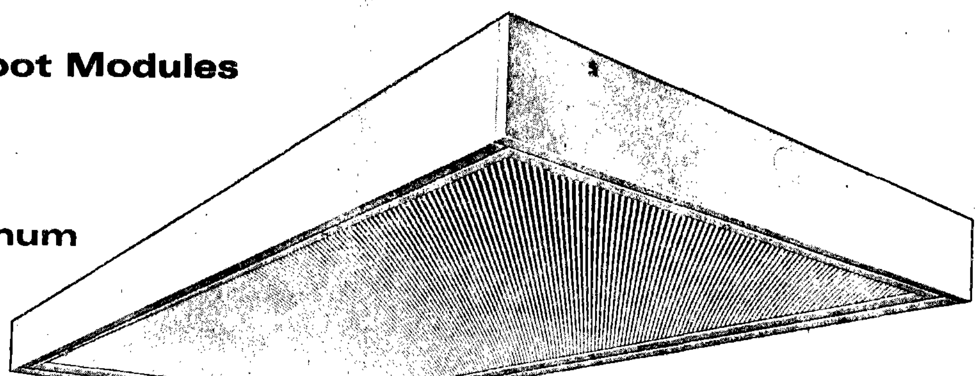
MODULAR SERIES

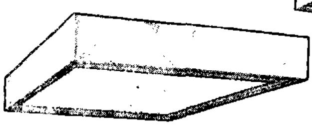
2M SERIES

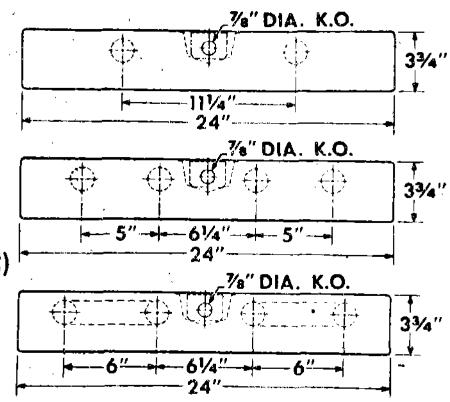
Rapid Start
2x2 and 2x4 Foot Modules

METAL SIDES

Steel or Extruded Aluminum Diffuser Frame







DIFFUSING MEDIA:

- ACRYLIC PRISMATIC LENS (A12)
- PLASTI-CUBE LOUVER (PL)
- DROPPED DISH ACRYLIC (AC)
- OTHERS AVAILABLE

SPECIFICATIONS

Metal parts are die formed and constructed from heavy gauge cold-rolled steel.

Five stage process degreases and phosphatizes metal, insuring paint adhesion and rust resistance.

Electrostatically finished in a high gloss baked white enamel.

Pressure lock lampholders.

For single or continuous row installations, either surface or pendant mounted.

Fixtures are exact modular sizes, allowing continuous rows to be laid out on 48" centers.

Shielding Media – **Flush Steel Frames:** Acrylic (A12), light stabilized polystyrene (P12), and injection molded acrylic (IMB) prismatic lenses, completely framed in heavy-gauge steel door and secured with nylon clips. Plasti-cube louver (PL), dropped dish acrylic (AC), and others available. **Aluminum Frames:** Acrylic (A12), light stabilized polystyrene (P12), and injection molded acrylic (IMB) prismatic lenses are completely framed in flush or regressed extruded aluminum door.

Hinged door frames are completely gasketed to prevent light leaks. Flush steel door frame is heavy-gauge steel, aluminum door frames have positive action spring-loaded latches. Spring-loaded latches optional on steel frame.

U.L. listed and labeled I.B.E.W. – A.F. of L.

Fixture guaranteed for one year against mechanical defects in manufacture.

ORDERING INFORMATION

Type	Frame Style	Catalog No.	No. and Type of Lamps	Dimensions
		ACRYLIC PRISMATIC LENS		
	FLUSH STEEL	2M 2U40 M A12 2M 240 M A12 2M 440 M A12	Two F40/U Two F40 Four F40	24" x 24" 24" x 48" 24" x 48"
		PLASTI-CUBE LOUVER		
	FLUSH STEEL	2M 2U40 M PL 2M 240 M PL 2M 440 M PL	Two F40/U Two F40 Four F40	24" x 24" 24" x 48" 24" x 48"
		DROPPED DISH ACRYLIC		
	FLUSH STEEL	2M 2U40 M AC 2M 240 M AC 2M 440 M AC	Two F40/U Two F40 Four F40	24" x 24" 24" x 48" 24" x 48"

VOLTAGE MUST BE SPECIFIED. Ex: 2M 240 M A12 120.
ALUMINUM FRAME: Natural Anodized Aluminum (**RN** or **FN**, to designate Regressed Natural or Flush Natural) is available. Other aluminum frame finishes can be ordered by substituting W (for Baked White Enamel) or M (for Matte Black) in place of N in the catalog number. Examples: 2M 240 M **RN** A12 120; 2M 240 M **FM** A12 120.

SHIELDING: Polystyrene (**P12**) or injection molded acrylic (**IMB**) prismatic lenses can be ordered by substituting **P12** or **IMB** for A12 in the catalog number.
Examples: 2M 240 M **P12** 120; 2M 240 M RN **IMB** 120.

C.E.C. File E-16.1

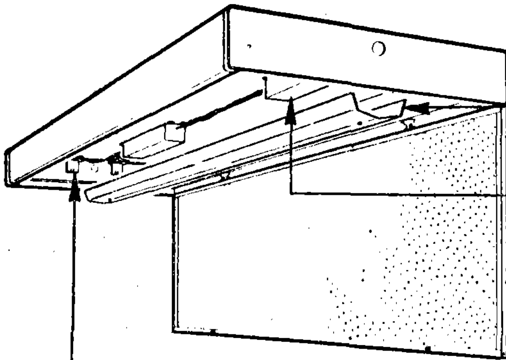
A.I.A File 31-F-2

LITHONIA®
DIVISION OF NATIONAL SERVICE INDUSTRIES, INC.
Box A • Conyers, Georgia 30207 • 404/483-8731

CONSTRUCTION DETAILS

TYPE FB

2M SERIES



1. Reflector snaps into place and can be removed by simple finger pressure leaving ballast and wiring easily accessible.
2. Ballasts are held in place by one self-tapping sheet metal screw, to prevent backoff, and a positive lock ballast lance, for easy replacement.
3. Removable diffuser frame is secured to the fixture by positive action latches (spring loaded optional), and may be hinged from either side.
4. Metal mounted pressure lock sockets can be individually removed or replaced by simple snap-in action.

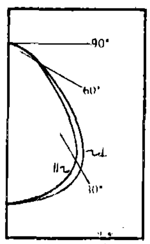
ILLUMINATION DATA*

Typical lighting curves and coefficients of utilization

*Full photometric reports available upon request

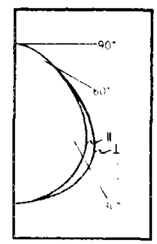
2 U LAMP — **ZONAL CAVITY**

Pfc	20%													
Pcc	80%				70%				50%			30%		
Pw	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%
1	63	61	59	57	61	59	58	56	57	56	54	55	54	53
2	58	54	51	49	57	53	51	48	52	49	47	50	48	46
3	54	49	45	42	53	48	45	42	47	44	41	45	43	40
4	50	44	40	37	49	44	40	36	42	39	36	41	38	36
5	46	40	35	32	45	39	35	32	38	34	31	37	34	31
6	43	36	32	28	42	36	31	28	35	31	28	34	30	28
7	40	33	28	25	39	32	28	25	31	28	25	31	27	25
8	37	30	25	22	36	29	25	22	28	25	22	28	24	22
9	34	27	22	19	33	26	22	19	26	22	19	25	22	19
10	32	24	20	17	31	24	20	17	23	20	17	23	19	17



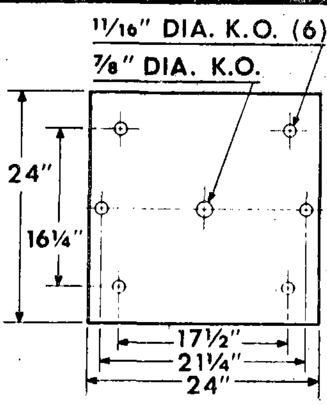
4 LAMP — **ZONAL CAVITY**

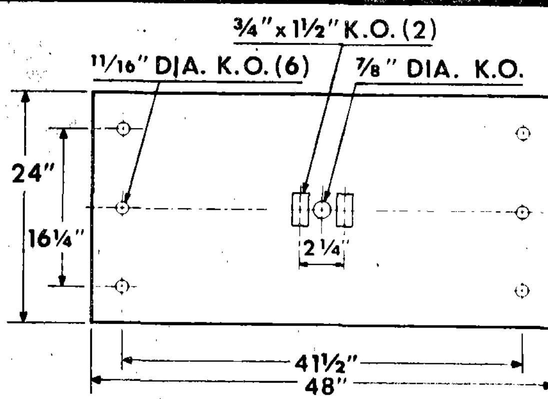
Pfc	20%													
Pcc	80%				70%				50%			30%		
Pw	70%	50%	30%	10%	70%	50%	30%	10%	50%	30%	10%	50%	30%	10%
1	73	70	68	66	71	69	67	65	66	64	63	63	62	61
2	67	63	59	58	66	62	59	56	60	67	55	58	56	63
3	63	57	63	49	61	56	52	49	53	51	48	52	49	47
4	58	51	47	43	57	51	46	43	49	45	42	48	44	41
5	64	46	41	37	52	46	41	37	44	40	37	43	39	36
6	60	42	37	33	49	41	36	33	40	36	33	39	35	32
7	46	38	33	29	45	37	33	29	37	32	29	36	32	29
8	42	34	29	25	41	34	29	25	33	28	25	32	28	25
9	30	31	26	22	38	30	25	22	30	25	22	29	25	22
10	36	28	23	20	35	28	23	20	27	23	20	26	22	19



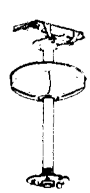
SPACING RATIO: To assure uniform light pattern, the distance between rows should not exceed mounting height x 1.3 for 2 lamp and 4 lamp fixtures.

INSTALLATION

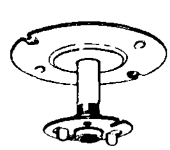




ACCESSORIES



CAT. NO. SQ
SWIVEL STEM
HANGER



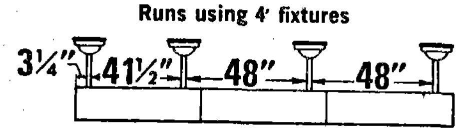
CAT. NO. 1B
CEILING SPACER

NOT TO SCALE

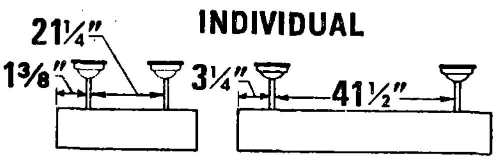
Dimensions are subject to change. Please consult factory or check sample for verification.

CONTINUOUS ROWS

Runs using 4' fixtures



INDIVIDUAL



SINGLE STEM

LITHONIA

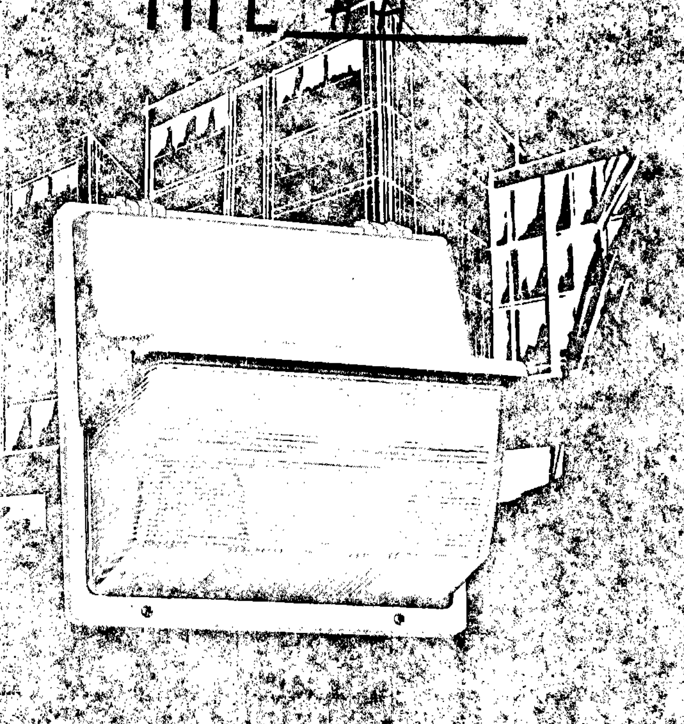
Supercedes previous sheet C-35/0676

WALL-TEK

TYPE #A

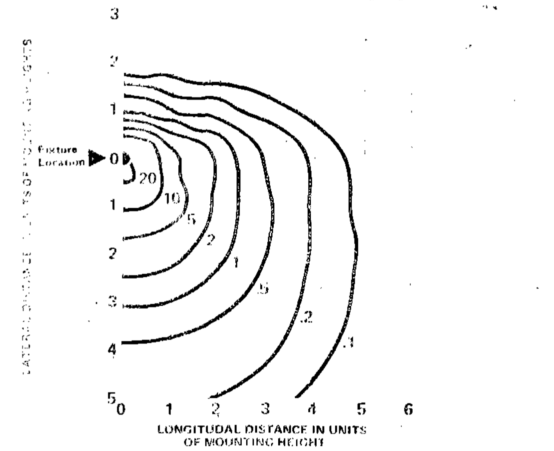
MERCURY 100, 175 and 250 WATTS
METAL HALIDE 175 and 250 WATTS
HIGH PRESSURE SODIUM 70, 100 and 150 WATTS
LOW PRESSURE SODIUM 35 WATTS

- RUGGED DIE CAST ALUMINUM HOUSING
  - corrosion resistant
  - baked, silicone polyester enamel finish
  - U.L. listed suitable for wet locations
- FLEXIBLE MOUNTING PROVISIONS
  - surface mounted on a 3" or 4" outlet box
  - surface mounted 3/4" top conduit entrance
  - surface mounted or feed-thru with thru-wire conduit tee
- QUALITY OPTICAL SYSTEM
  - specular aluminum reflector
  - prismatic borosilicate glass refractor
  - adjustable socket
- DEPENDABLE ELECTRICAL SYSTEM
- COMPLETE LINE OF OPTIONS AND ACCESSORIES



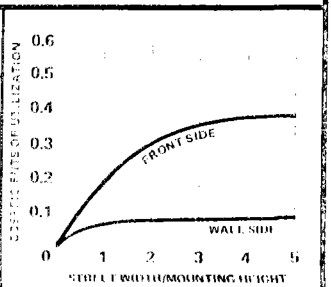
PHOTOMETRICS

ISOFOOTCANDLE DIAGRAM
Test Report No. 17208
Lamp: 250-watt Deluxe White Mercury, rated 12100 Lumens.
Footcandle values based on 8 foot mounting height.

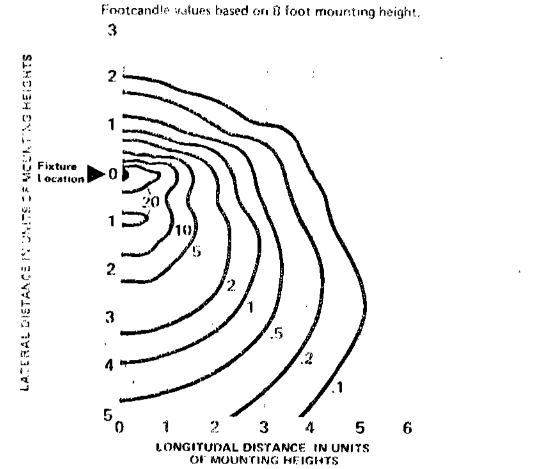


COEFFICIENTS OF UTILIZATION AND FLUX DISTRIBUTION
REPORT NO. 17208

	LUMENS	PERCENT OF LAMP
Downward Street Side	5146	42.5
Downward House Side	1046	8.6
Downward Total	6193	51.1
Upward Street Side	675	5.6
Upward House Side	[illegible]	1.0
Upward Total	[illegible]	6.6
Total Flux	[illegible]	57.7

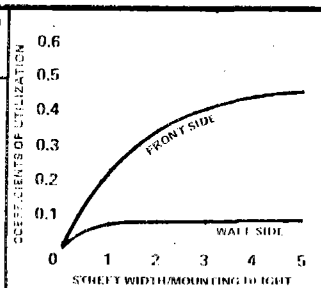


ISOFOOTCANDLE DIAGRAM
Test Report No. 20056
Lamp: 150-watt H.P.S. Lamp rated 16000 Lumens.
Footcandle values based on 8 foot mounting height.



COEFFICIENTS OF UTILIZATION AND FLUX DISTRIBUTION
REPORT NO. 20056

	LUMENS	PERCENT OF LAMP
Downward Street Side	7766	48.5
Downward House Side	1342	8.4
Downward Total	9108	56.9
Upward Street Side	766	4.8
Upward House Side	99	0.6
Upward Total	[illegible]	5.4
Total Flux	9973	62.3



MOUNTING HEIGHT CORRECTION FACTORS

Mounting Height (feet)	8	10	12	14	16	18
Correction Factor	1	.64	.44	.33	.25	.20

hi-tek™ LIGHTING DIVISION
LITHONIA®

ORDERING INFORMATION

TYPE	LAMP	CATALOG NUMBER	VOLTAGE (Specify One)	WEIGHT LBS.
	MERCURY	TW 100 H TW 175 H TW 250 H		19.5 21 23.75
	METAL HALIDE	TW 175 MP* TW 250 M	120 208 240 277 480	24.5 25.75
	HIGH PRESSURE SODIUM	TW 70 S TW 100 S TW 150 S†		22.5 22.75 24
	UNALUX†† E-Z LUX	TW 175 UH		21.5
	LOW-PRESSURE SODIUM	TW 35 LPS		23

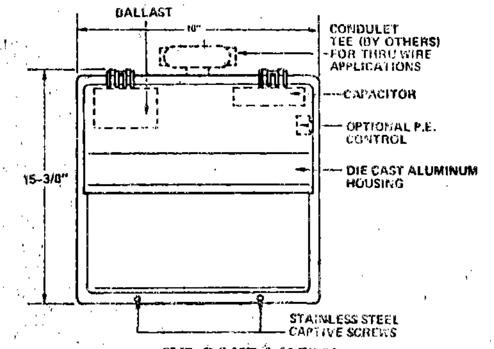
VOLTAGE MUST BE SPECIFIED. Example: TW 250 H 277.

†† Unalux is a registered Trademark of Sylvania. E-Z Lux is a Trademark of General Electric.

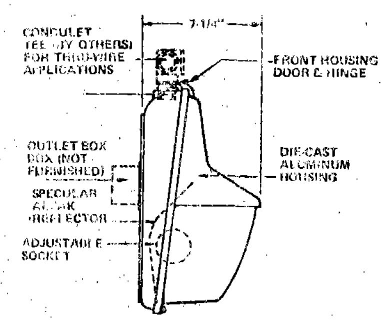
*Requires Special Position Orienting Lamp. M175 HOR.

†Uses Nominal 55-volt lamp. 100-volt lamp ballast available upon request.

DIMENSIONS AND CONSTRUCTION DETAILS

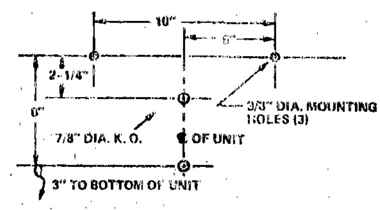


FRONT VIEW



SIDE VIEW

MOUNTING DIMENSIONS



ELECTRICAL CHARACTERISTICS*

LAMP	WATTAGE	BALLAST TYPE	/OPERATING CURRENT AMPS 120	208	240	277	480	LINE WATTS	REGULATION LINE V = LAMP WATTS
MERCURY	100	CWA	1.1	.6	.55	.49	.28	125	± 10% = ± 5%
	175		1.9	1.1	.95	.8	.48	205	± 10% = ± 5%
	250		2.6	1.6	1.4	1.2	.7	290	± 10% = ± 5%
METAL-HALIDE	175	Peak-Lead Auto-Transformer	1.8	1.0	.9	.8	.45	210	± 10% = ± 10%
	250		2.5	1.45	1.25	1.10	.63	300	± 10% = ± 10%
HIGH PRESSURE SODIUM	70	High Leakage Reactance	.81	.47	.4	.35	.21	[illegible]	± 5% = ± 12%
	100		1.15	.67	.58	.50	.29	130	± 5% = ± 12%
	150		1.65	.95	.83	.72	.42	188	± 5% = ± 12%
UNALUX & E-Z LUX	150	LAG	1.6	.9	.8	.7	.4	172	± 5% = ± 10%
LOW-PRESSURE SODIUM	35	LPS	.56	.32	.28	.24	.15	60	± 10% = ± 5%

*Typical data at nominal input values. All ballasts have at least 90% power factor.

NOTES

OPTIONS

SUFFIX CAT. NO. WITH:	DESCRIPTION
–SF	Single Fuse
–DF	Double Fuse (208, 240, 480V)
–PE	Photo-control (120, 208, 240, 277 volt only) †
–TB	Tapped Ballast (120, 208, 240, 277V)
–TP	Tamper proof screws
–DC	Decorative Colors — Consult factory for standard colors.
–VG	Polycarbonate Vandal Guard*
–WG	Wire Guard

*Shipped as separate item.
†Consult factory for use with tapped ballasts.

TYPE HA

hitek T.M. | LIGHTING DIVISION • LITHONIA LIGHTING

P. O. Box 72, Crawfordsville, Ind. 47933 | PHONE/ 1-317-362-1837

QUOTATION C813-0610	SQUARE D COMPANY ASSEMBLY DIVISION	A-	
CONTRACTOR MARK COX EL.		REV. 1	DRN. GEC
DISTRIBUTOR CED-S/BERDU	10 MEGA WATT SOLAR WHSE	REV. 2	CHKD.
P.O. 0903 T 0364 D	DAGGETT, CALIF.		DATE 9/19/80

NOTES

BRANCHES: SQUARE D TYPE FY, FA, AND FAH, 1, 2, and 3 POLE TYPE KA, KAH, LA, LAH AND Q2, 2 and 3 POLE THERMAL MAGNETIC CIRCUIT BREAKERS.

BOX: CODE GAUGE STEEL, WITHOUT KNOCKOUTS, FINISHED SQUARE D GRAY BAKED ENAMEL, REMOVABLE ENDWALLS. (TYPE: HCN 26" WIDE WITH STD. KO'S.)

FRONTS: CODE GAUGE FULL FINISHED FLAT STEEL WITH RUST INHIBITING PRIMER AND SQUARE D GRAY BAKED ENAMEL FINISH.

LOCK: 63" HIGH FRONTS HAVE BRUSHED, STAINLESS STEEL, FLUSH TYPE WITH SR-251 KEY CHANGE.

72"-90" HIGH FRONTS HAVE 3 POINT CHROME FINISH VAULT TYPE WITH SR-251 KEY CHANGE.

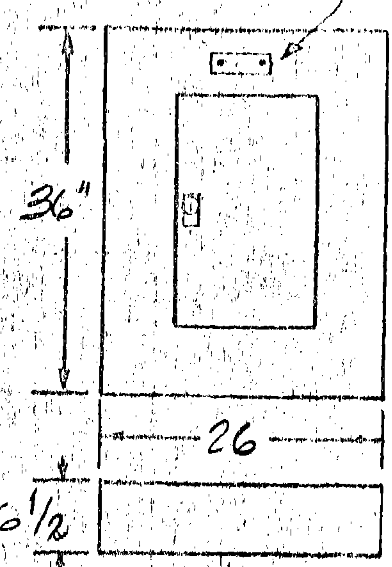
GUTTERS:
SIDE – 5" MIN.
END –
OPPOSITE MAIN-BREAKER & MAIN LUG – 5" MIN.
MAIN LUG – 8" MIN. (400A)
8" MIN. (600A)
10" MIN. (800A)

CIRCUIT BREAKERS
14,000 AIC

PANEL CANS TO BE PAINTED SQ D. GREY BAKED ENAMEL

ITEM # A QTY. REQ'D 1 SHIPPER
DESIGNATION PANEL LP6
CAT. NUMBER & TYPE NHIB
INT. HCN 1436-2N
3 φ 4 W 277/480 VOLTS 100 AMPS
MOUNTING: X SURFACE ____ FLUSH
BOX HC2636B DOOR & TRIM HC2636TS

N/P = PANEL LP6
277/480V



N

Ckt	Breaker	Breaker	Ckt
1	20/1	20/1	2
3	20/1		4
5	20/1		6
7	60A		8
9	3P		10
11			12
13	80	20/1	14
15	A	40A	16
17	3P	2P	18

MAIN C/B

A.

QUOTATION C813-0610	**SQUARE D COMPANY** ASSEMBLY DIVISION	A- REV. 1	DRN. GEC
CONTRACTOR MARK COX ELECZ.			
B.O.			
DISTRIBUTOR CED- S/BERDO	10 MEGA WATT SOLAR WHSE	REV. 2	CHKD.
P.O. 62903-70564 D	DAGGETT, CALIF		DATE 9/19/80

ITEM # B QTY. REQ'D 1 SHIPPER 1
DESIGNATION PANEL LP-7
CAT. NUMBER & TYPE NH1B
INT HCN 1436-2N
3 ϕ 4 W 277/480 VOLTS 100 AMPS
MOUNTING: ✓ SURFACE FLUSH
BOX HC 2636 B DOOR & TRIM HC 2636 TS

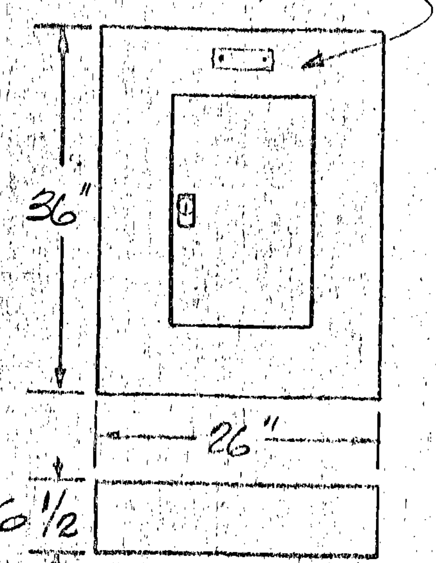
NOTES

BRANCHES: SQUARE D TYPE FY, FA, AND FAH; 1, 2, and 3 POLE TYPE KA, KAH, LA, LAH AND 1, 2, 2 and 3 POLE THERMAL MAGNETIC CIRCUIT BREAKERS.
BOX: CODE GAUGE STEEL, WITHOUT KNOCKOUTS, FINISHED SQUARE D GRAY BAKED ENAMEL, REMOVABLE ENDWALLS, (TYPE: HCN-26" WIDE WITH STD. KO'S.)
FRONTS: CODE GAUGE FULL FINISHED FLAT STEEL WITH RUST INHIBITING PRIMER AND SQUARE D GRAY BAKED ENAMEL FINISH.
LOCK: 63" HIGH FRONTS HAVE BRUSHED, STAINLESS STEEL FLUSH TYPE WITH SR-251 KEY CHANGE.
72"-90" HIGH FRONTS HAVE 3 POINT CHROME FINISH VAULT TYPE WITH SR-251 KEY CHANGE.
GUTTERS:
SIDE – 5" MIN.
END –
OPPOSITE MAIN-BREAKER & MAIN LUG – 5" MIN.
MAIN LUG 8" MIN. (400A)
8" MIN. (600A)
10" MIN. (800A)

CIRCUIT BREAKERS @ 14,000 AIC.

PANEL CANS TO BE PAINTED SQ.D GREY BAKED ENAMEL

N/P – PANEL LP-7 277/480V



N

1	20/1	20/1	2
3			4
5			6
7			8
9			10
11	20/1		12
13	80 ~~100~~A	20/1	14
15	3P	40A	16
17	MAIN	2P	18

FORM 410

QUOTATION C813-0610	**SQUARE D COMPANY** ASSEMBLY DIVISION
CONTRACTOR MARK COX	
P.O.	
DISTRIBUTOR CED-S/BERDU	10 MEGA WATT SOLAR WHSE
P. G903-J0564 D	DAGGETT, CALIF.

A-		
REV. 1		DRN. GEC
REV. 2		CHKD.
		DATE 9/19/80

GENERAL NOTES

1. BOXES MADE OF GALVANIZED SHEET-STEEL.
2. STD. K.O.'S FURNISHED.
3. DOORS & TRIMS MADE OF 12GA. H.R.S.
4. D/T'S ARE MONO-FLAT CONSTRUCTED WITH FULLY CONCEALED HINGES.
5. FLUSH TRIM EXTENDS ¾" EACH SIDE BEYOND DIM'S SHOWN.
6. FLUSH LOCK #116001 & 2 - KEYS #NSR 251 FURNISHED AS STANDARD.
7. DIRECTORY FRAME & CARD INSIDE DOOR.
8. D/T'S FINISH: SQ. D STANDARD - GREY.
9. BRANCH CIRCUIT BRKRS INTERRUPTING CAPACITY RATED AT 10,000 A.I.C.
10. BARRIERS FURNISHED AS REQUIRED IN RELAY, CONTACTOR OR T/C-COMPT.
11. STD. TOP & BOTTOM GUTTER: 5" MIN.

ITEM # C4D QTY. REQ'D. (2) SHIPPER 1
DESIGNATION: PANEL PP6, PP7
CAT. NUMBER & TYPE: NQOB 12-2AB
INT. ☐ DOUBLE ROW ☒ SINGLE ROW
1 φ 3 W. 120/240 VOLTS
MOUNTING: ☐ FLUSH ☒ SURFACE
BOX MH 26 DOOR & TRIM MSC 26TS

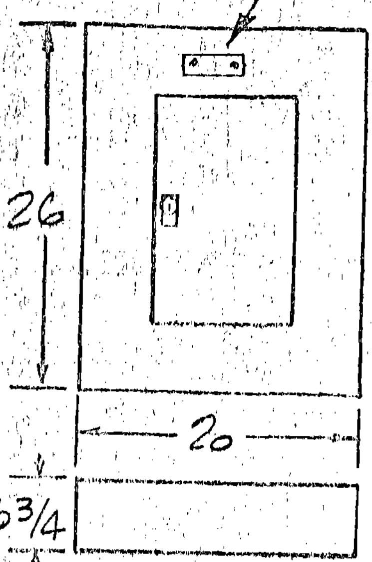
TOP FEED

60A, 2P MAIN C/B.			
1	20/1	20/1	2
3	20/1	20/1	4
5	20A,	20/1	6
7	2P	20/1	8
9	20/1	20/1	10
11	20/1	20/1	12

N

N/P = PANEL PP6
120/240V 1φ3W
PANEL PP7
120/240V 1φ3W

PANEL CANS TO BE PAINTED SQ. D. GREY BAKED ENAMEL.

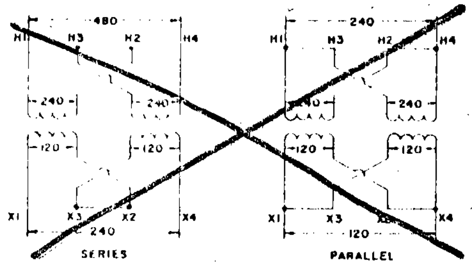


SHIPMENT: This equipment cannot be scheduled for production engineering and manufacture until this drawing is approved and returned.

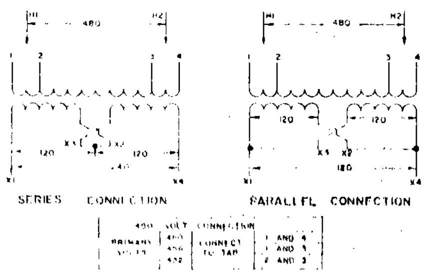
Approved by ____________ Date ________

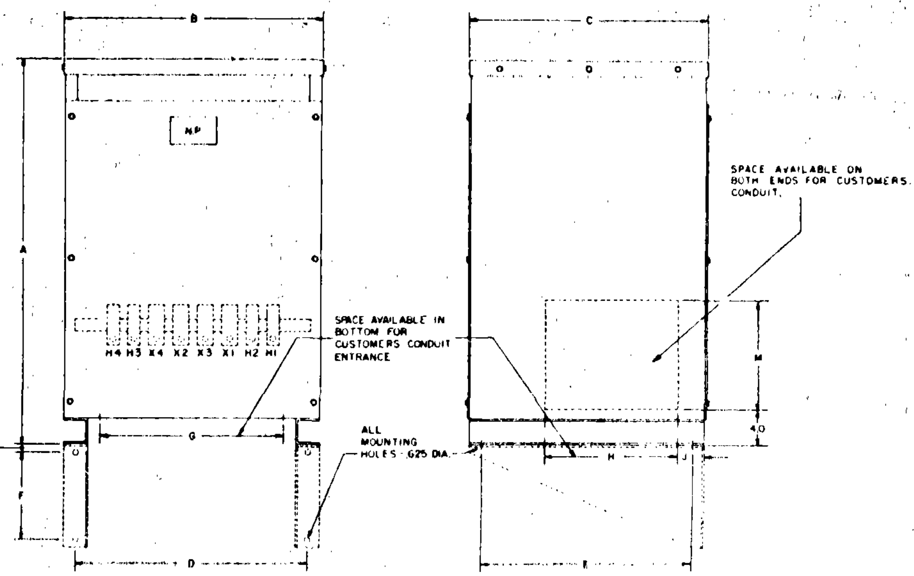
418C

Connection Diagram For 15KVA, 15S1H (480 V.)

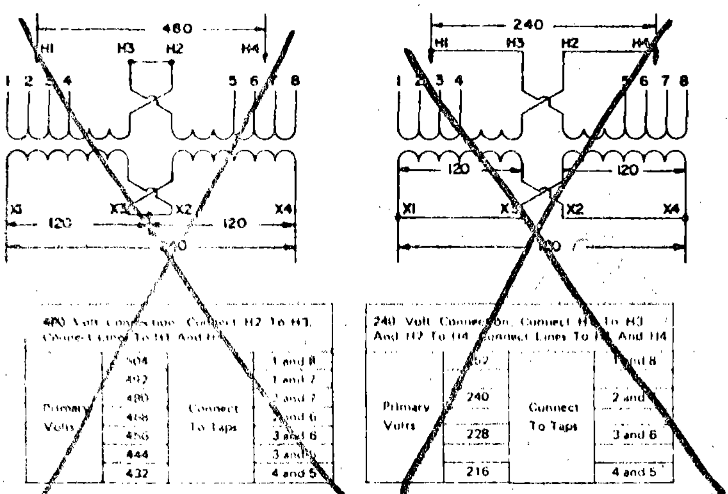


Connection Diagram for 15KVA, 15S40H (480 V.)





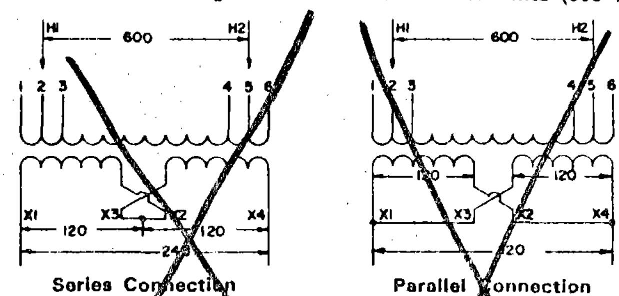
Connection Diagram for 25 Thru 100 KVA Units (480 V.)



Series Connection

Parallel Connection

Connection Diagram for 15 Thru 50 KVA Units (600 V.)



Series Connection

Parallel Connection

600 VOLT CONNECTION			
PRIMARY VOLTS	600	CONNECT TO TAP	1 and 6
	585		1 and 5
	570		2 and 5
	555		2 and 4
	540		3 and 4

120/240 VOLTS SECONDARY,1 PHASE, 60 HERTZ, 150°C. RISE ABOVE 40°C. AMBIENT (H)

KVA	CATALOG NUMBERS			DIMENSION IN INCHES											DESIGN SOUND LEVEL IN DB'S	WGT.	AV. %Z
	240x480 PRIMARY	480 PRIMARY	600 PRIMARY	A	B	C	D	E	F	G	H	J	K	M			
15	[illegible]	15S40H	[illegible]	31	16	16	14	11	8	10.25	8.5	1.25	1.125	6.5	42	215	4.8
~~25~~	~~25S3H~~		~~25S5H~~	~~31~~	~~16~~	~~16~~	~~14~~	~~11~~	~~8~~	~~10.25~~	~~8.5~~	~~1.25~~	~~1.125~~	~~6.5~~	~~42~~	~~225~~	~~6.0~~
37.5	37S3H		37S5H	37	20	20	18	15	11.25	13.375	9	1.25	1.125	7.5	42	320	6.1
50	50S3H		50S5H	37	20	20	18	15	11.25	13.375	9	1.25	1.125	7.5	42	445	4.8
75	75S3H			42	24	24	21	22	18	12.5	11	5.75	3	8.25	45	615	6.6
100	100S3H			48	32	29.50	29	28		20.5	21	4		8	45	905	4.7

*Wall Mounting Brackets Not available for 100 KVA

2-REQ'D

Power Zone Dry-Type Transformers Single Phase 60 HERTZ 15 to 100 KVA UL LISTED (UL)	SORGEL TRANSFORMERS SQUARE D COMPANY
	DM1-R7 DATE: October, 1979

SAFETY SWITCHES — HEAVY DUTY
VISIBLE BLADES

600 VOLT

SINGLE THROW—NOT FUSIBLE

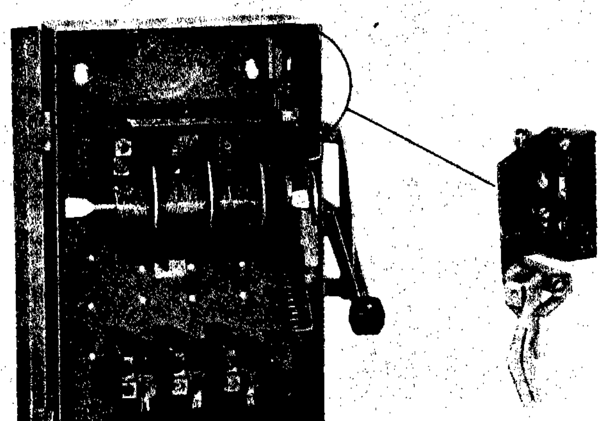
System	Amps.	NEMA 1 Indoor Catalog Number	NEMA 1 Price	NEMA 3R Rainproof (Bolt-on Hubs-p. 39) Catalog Number	NEMA 3R Price	NEMA 4 and 5 Dusttight, Watertight Stainless Steel (Hubs-p. 41) Catalog Number	NEMA 4 and 5 Price	JIC-Mill & Foundry Type NEMA 12K With Knockouts Catalog Number	JIC-Mill & Foundry Type NEMA 12 Without Knockouts Catalog Number	Price	HP 240V. ac 1φ	HP 240V. ac 3φ	HP 480V. ac 1Ø	HP 480V. ac 3Ø	HP 600V. ac 1Ø	HP 600V. ac 3Ø	HP dc 250	HP dc 600
2 POLE, 480 VOLTS AC — 600 VOLTS AC OR DC																		
	30	HU261	$ 64.	Use 3 Pole Switch for 2 Pole Application		HU261 DS	$ 427.	HU261A	HU261AWK	$116.	..	..	7½	..	10		5	15
	60	HU262	116.			HU262 DS	616.	HU262A	HU262AWK	129.	..	..	20	..	25		10	25
	100	★HU263	183.			★HU263 DS	1118.	★HU263A	★HU263AWK	208.	..	..	30	..	40	..	20	..
	200	HU264	283.			HU264 DS	1480.	HU264A	HU264AWK	288.	..	..	50	..	50	..	40	50
	400	HU265	628.	HU265R	$ 881.	HU265DS	2780.	....	HU265AWK	673.	..	..	..	..	..	..	50	..
	600	HU266	1118.	HU266R	1723.	HU266DS	4008.	....	HU266AWK	1132.	..	..	..	..	..	..	..	..
	800	△HU267	1896.	△HU267R	2826.	....	....	‡	‡	....	..	..	..	..	..	..	..	..
	1200	△HU268	2322.	△HU268R	4059.	....	....			....	..	..	..	..	..	..	..	..
3 POLE, 480 VOLTS AC — 600 VOLTS AC OR 250 VOLTS DC																		
	30	HU361	$ 64.	HU361RB	$ 116.	HU361DS	$ 488.	HU361A	HU361AWK	$142.	5	10	..	20	..	30	5	15
	30	HU361-EI	143.	HU361RB-EI	195.	HU361DSEI	648.	HU361A-EI	HU361AWK-EI	222.	5	10	..	20	..	30	5	15
	60	HU362	116.	HU362RB	205.	....	....	....	....	....	10	20		50		60	10	25
	60	HU362-EI	195.	HU362RB-EI	284.	....	....	....	....	....	10	20		50		60	10	25
	60	....	....	....	....	HU362DS	554.	HU362A	HU362AWK	177.	..	15	..	50	..	40	10	..
	60	....	....	....	....	HU362DSEI	836.	HU362A-EI	HU362AWK-EI	250.	..	15	..	50	..	40	10	..
	100	HU363	183.	HU363RB	285.	HU363DS	1132.	HU363A	HU363AWK	263.	15	40	..	75	..	100	20	..
	200	HU364	283.	HU364RB	347.	HU364DS	1646.	HU364A	HU364AWK	339.	15	60	..	125	..	150	40	..
	400	HU365	628.	HU365R	861.	HU365DS	3103.	HU365A	HU365AWK	875.	..	125	..	250	..	300	..	..
	600	HU366	1118.	HU366R	1723.	HU366DS	4140.	....	HU366AWK	1406.	..	..	..	400	..	500	..	..
	800	△HU367	2268.	△HU367R	2903.	....	....	‡	‡	....	..	..	..	..	..	..	..	..
	1200	△HU368	3049.	△HU368R	4059.	....	....			....	..	..	..	..	..	..	..	..
													2Ø	3Ø	2Ø	3Ø		
▲4 POLE, 480 VOLTS AC — 600 VOLTS AC																		
	60	HU462	$204.	....	....	....	....	....	....	....	..	..	40	30	60	50	..	..
	60	....	....	....	....	....	....	....	HU462AWK	$222.	..	..	40	30	40	40	..	..
	100	HU463	387.	....	....	....	....	....	HU463AWK	395.	..	..	50	..	50	..	..	..
	200	HU464	634.	....	....	....	....	....	HU464AWK	624.	..	..	50	..	50	..	..	..
	400	HU465	1132.	....	....	....	....	....	HU465AWK	1234.	..	..	..	..	..	..	..	..
	600	HU466	1976.	....	....	....	....	....	....	....	..	..	..	..	..	..	..	..

Dimensions: NEMA 1 & 3R—Page 44
NEMA 4 & 5, 12—Page 45

Switches with EI suffix are stocked with pre-installed electrical interlocks with one normally open and one normally closed contacts—Except HU261 & HU361—one N.O. or one N.C.
★600V. ac—250 V. dc only.
△AC only.
‡For application above 600 amperes, refer to BOLT-LOC switches on page 49.
▲Not suitable for use as service equipment.

ELECTRICAL INTERLOCKS

Electrical interlocks for Heavy Duty Visible Blade Safety Switches are available in kit form for field or factory installation. Each kit contains instructions for proper field mounting. A pivot arm operates from switch mechanism, breaking the control circuit before the main switch blades break. Electrical Interlock Kits are UL listed.



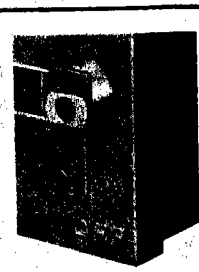
EK-1020-1

	Interlock Kit Catalog Number	Price Kit Only	Price Factory Installed
See page 44 or 45 for proper interlock for heavy duty visible blade switches	EI-300*	$48.	$ 79.
	EK-300-1 or 2▲	48.	79.
	EI-306-1 or 2▲	48.	79.
	EK-306-1 or 2 ▲	48.	79.
	EI-1020-1 or 2 ▲	78.	114.
	EK-1020-1 or 2▲	78.	114.
	EIK-4060-1 or 2▲	116.	146.

*One normally open or one normally closed contact.
▲-1 indicates one normally open and one normally closed contact.
-2 indicates two normally open and two normally closed contacts.

PARTS KITS

Description	Cat. No.	Price
16 oz. Aerosol Paint Can, containing Sq. D Gray Paint..........	PK-49SP	$8.80
Cover Padlock Attachment for NEMA 12 Switches (Std. Pkg 5)..	CPA-100	5.60
Cover Release Handle for NEMA 12 Switches & Brkrs..........	C1H-100	5.60



CPA-100

C1H-100

10.3.2 Secondary Firepump Building

The Secondary Firepump Building, BL-706, is a 44 ft x 20 ft insulated metal building located on the Solar One Site.

There was no operations and maintenance data furnished on this building by the contractor.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 5. Also, see Stearns-Roger Architectural Drawing No. A8-1.

10.3.3 Thermal Storage Control Buildings

The Thermal Storage Control Buildings, BL-709 and BL-710, are used to enclose electronic equipment. These buildings are also referred to as Remote Stations 3 and 2 respectively.

No operations and maintenance information was furnished by the contractor.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 5. Also, see Stearns-Roger Architectural Drawing No. A6-1.

10.3.4 Thermal Storage Electrical Equipment Building

The Thermal Storage Electrical Equipment Building, BL-712, is a 20 ft x 24 ft insulated metal building located in the thermal storage area of the Solar One Plant.

There was no operations and maintenance information furnished by the contractor for the building.

Additional detailed drawing information is available in Southern California Edison drawing files titled Construction Package No. 5. Also, see Stearns-Roger Architectural Drawing No. A6-2.

10.4 ELECTRONIC ENCLOSURES

10.4 ELECTRONIC ENCLOSURES

The Receiver Tower has two electronic enclosures on the 13th and 14th levels, BL-708A and B respectively, which are often referred to collectively as Remote Station 1.

There was no operations and maintenance information furnished on the enclosures by the contractor.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 9. Also, see Stearns-Roger Architectural Drawing No. A12-1.

10.4 ELECTRONIC ENCLOSURES

The Receiver Tower has two electronic enclosures on the 13th and 14th levels, BL-708A and B respectively, which are often referred to collectively as Remote Station 1.

There was no operations and maintenance information furnished on the enclosures by the contractor.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 9. Also, see Stearns-Roger Architectural Drawing No. A12-1.

10.5 RECEIVER TOWER

10.5 RECEIVER TOWER

The Receiver Support Tower, BL-707, is a 211 ft high steel structure.

There are no operations and maintenance data available on this structure.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 5A. Also, see Stearns-Roger Structural Steel Drawing No. S32-1.

10.6 PIPE RACK

10.6 PIPE RACK

The Solar One Pipe Rack, BL-705, is a steel structure used for the support of piping, cable trays, and TSU access.

There are no operations and maintenance data available on this structure.

Additional detail drawing information is available in Southern California Edison drawing files titled Construction Package No. 5. Also, see Stearns-Roger Structural Steel Drawing No. S33-1.