



Waste Management of North America, Inc.  
Southeast Region  
500 Cypress Creek Road, West • Fort Lauderdale, Florida 33309  
Suite 300 • 305/771-9850

October 21, 1992

RECEIVED

OCT 22 1992

Bureau of  
Air Regulation

Mr. C.H. Fancy, P.E.  
Chief Bureau of Air Regulation  
Florida Department of Environmental Regulation  
Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, Fl. 32399-2400

Re: File No. AC13-218495, Medley Landfill Flare  
Air Source Permit Application

Dear M. C.H. Fancy:

Per your request, the following is additional information regarding the application for a permit to construct and operate a landfill flare at the Medley Landfill and Recycling Center. The items will be addressed sequentially in reference to your September 30, 1992 memo.

Item 1:

There are currently 48 gas collection wells at the site. As landfill expansion activities occur, additional wells will be installed.

Item 2:

The maximum average gas flow per well is 5-10 scfm (standard cubic feet per minute) depending on the quality of the gas (percentage of methane).

Item 3:

The gas flow from each well will be determined by measuring the differential pressure through an orifice plate installed at each well and at the flare by also measuring the differential pressure through an orifice plate.



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Item 4:

Per the request of this item, the following has been enclosed:

- \* An aerial map depicting the location of the landfill.
- \* The Landfill Gas Management System Engineering report which depicts the design location of the wells and details the design of the system. The report also contains blue-line drawings which detail the well construction and system operation.
- \* A Specification report from the flare manufacturer detailing the the process flow diagram of the collection and flare system and a drawing with the specifications for the LFG "Candle Stick", including the operating temperature of the flare.

Item 5:

Per the request of this item, also enclosed is a copy of the FDER Solid Waste Permit, No. CS13-179974.

Item 6:

This item references the 22.1 cu. ft. per minute (cfm) flue gas flow per cubic foot of methane used in the exit velocity calculations. Justification was requested for this number as well as accounting for the other 40% of the landfill gas in determining the flue gas velocity from the flare.

The 22.1 cfm gas flow rate was calculated with the total landfill gas constituents, including methane, carbon dioxide, and hydrogen sulfide.

This is an engineered calculation from the flare manufacturer. A Heat and Material Balance Program is used to calculate the cfm using certain assumptions and the desired gas emission temperature. The assumptions made are for the ambient air temperature and the heat loss in the stack. The flow rate is determined by combining the amount of air required for complete combustion of the landfill gas and the amount of air required to quench it down to the desired temperature range within the vessel whereby the system does not run too hot causing damage. The flow rate will vary depending on the desired temperature within the stack.

Item 7:

The flare is 14 inches in diameter.



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Item 8:

The flare will comply with the criteria listed in 40 CFR 60.18 (b). The flare will have a flame present at all times. In addition, the exit velocity of the flue gas will be within the limits specified in the application. The flare system is air assisted for effective combustion and cooling down of the stack. Propane is used for the pilot light and its flame is monitored by a thermo-couple.

I assume final processing of the application may be made with this submittal of additional information. Please contact me at (305)977-9551, ext.15, should you have any questions.

Sincerely,

Charlene Pisatowski  
Staff Engineer

cc:

Harvey Bush  
Mike Berg  
Jim Barrett  
Stephanie Brooks  
E.L. Anderson, DERM

LFG Specialties, Inc. is pleased to submit this proposal to furnish the following equipment in response to your RFP (request for proposal).

- I. Each 14 in. diameter x 34 ft. OAH utility "candle type" landfill gas flare system complete with Flame-Trol I automatic flare controller and associated peripheral equipment as described:

This flare is sized for the following conditions:

Flows

Design Point	<u>2453</u>	SCFM
Maximum	<u>3210</u>	SCFM ←
Minimum	<u>321</u>	SCFM

LFG (landfill gas)

Methane content	<u>40-60</u>	%
Supply temperature	<u>100</u>	°F
Supply pressure	<u>12</u>	in. W.C.

The flare will be LFG Specialties, Model CF1430I12 and include the following standard equipment:

FLARE STACK

- \*\*\* Constructed of 12 in. x 25 ft schedule 40 A-110 pipe
- \*\*\* Self supporting base plate with pre-drilled anchor bolt holes and support gussets
- \*\*\* 12 in. 150# flanged LFG inlet connection
- \*\*\* 2 in. NPT drain port with plug at base of stack

COMBUSTOR ASSEMBLY

- \*\*\* 14 in. x 5 ft. 304 stainless steel burner tip flange connected to stack
- \*\*\* Flame retainer, 304 stainless steel ribbing system in burner tip to produce optimum swirl, obtaining high efficiency mixing and holding the flame at the flare tip.

- \*\*\* 36 in. x 6 ft. 304 stainless steel windshield to retain flame at the flare tip and provide retention time for efficient combustion
- \*\*\* 3 each 4 in. lifting eyes, 120° apart, cut into windshield support ribs at tip of stack for ease of installation

#### IGNITOR ASSEMBLY

- \*\*\* 2 in. diameter 304 stainless steel pilot tip with integral spark plug connection/housing
- \*\*\* Spark plug igniter, eliminates gap problems often incurred with straight rod type igniters
- \*\*\* 110/5,000V single pole transformer mounted in NEMA 4 enclosure
- \*\*\* High temperature igniter leads in  $\frac{1}{2}$  in. conduit
- \*\*\* Pilot nozzle in  $\frac{1}{2}$  in. stainless steel pipe
- \*\*\* Chromel-alumel (type k) thermocouple in stainless steel thermal well to give pilot confirmation
- \*\*\* Ultraviolet flame scanner to give flame confirmation and provide flare safety shutdown

#### PERIPHERAL EQUIPMENT - INCLUDED WITH UTILITY METHANE FLARE

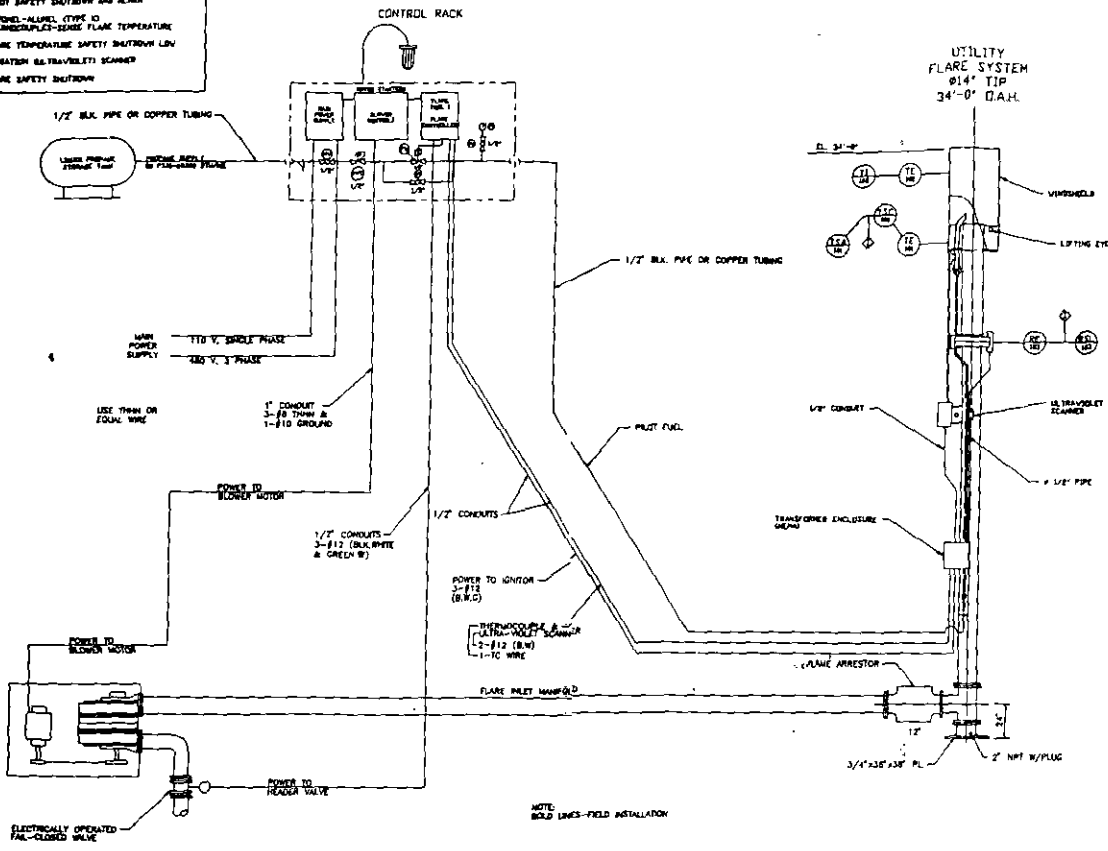
- \*\*\* 1 each 12 in. carbon steel wafer type electric actuated butterfly valve with slow opening actuator and spring operated "fail safe" closing in case of a power failure

#### BLOWER

System will include 1 each Lamson blower Model 602-2-3550-GB driven by a 25 Hp TEFC electric motor. Blower and motor will be assembled on a unitary base and include applicable belt, shaft and bearing guards. The blower internals will be protected with a Bisonite coating

**LEGEND - FLARE INSTRUMENTATION**

REV.	BY	DESCRIPTION
1		CIRCUIT-ALARM (TYPE ID)
1		THEMOCOUPLE-SENSITIVE PILOT TEMPERATURE
C		PILOT TEMPERATURE SCANNING CONTROLLER
A		PILOT SAFETY SHUTDOWN AND ALARM
1		CIRCUIT-ALARM (TYPE ID)
1		THEMOCOUPLE-SENSITIVE FLAME TEMPERATURE
L		FLAME TEMPERATURE SAFETY SHUTDOWN LRV
1		BARATION ULTRAVIOLET SCANNER
1		FLAME SAFETY SHUTDOWN



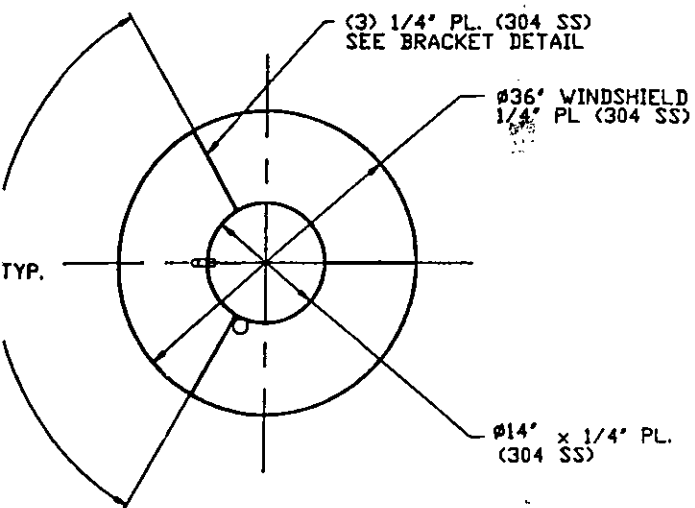
REV.	DESCRIPTION	DATE	BY

**LFG SPECIALTIES, INC.**  
 HEAD OFFICE  
 2528 LUCERNE DRIVE #100  
 CLEVELAND, OHIO 44130  
 (216) 891-8285

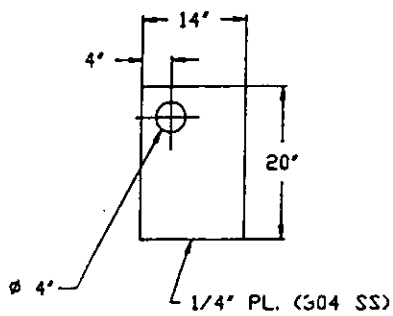
PLANT  
 745 FREEDOM DRIVE  
 NEW CONCORD, OHIO 43084  
 (614) 884-7422

DATE: 7/12/82  
 DRAWN BY: [Signature]  
 CHECKED BY: [Signature]  
 PROJECT NO.: [Blank]  
 PROJECT NAME: [Blank]  
 CUSTOMER: [Blank]

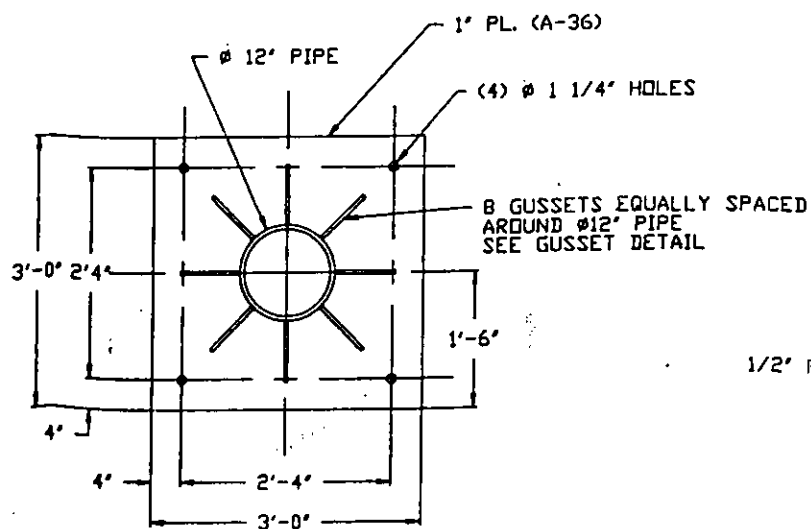
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 PROJECT: [Blank]



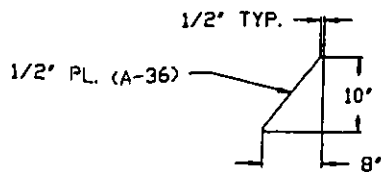
VIEW B-B



WINDSHIELD BRACKET DETAIL



VIEW A-A



GUSSET DETAIL

DATE

REV. DESCRIPTION

SCALE

TITLE LFG UTILITY FLARE ASSEMBLY

TITLE

**FLAME-TROL I**  
**UTILITY FLARE CONTROL SYSTEM**

The LFG Specialties Flame-Trol I is a technically advanced fully integrated, 100% automatic flare controller. The Flame-Trol I is specifically designed to provide the operator full flexibility to set or change any temperature and/or time setting utilized in the automatic operation of a utility "candle type" flare.

**FEATURES OF THE FLAME-TROL I INCLUDE:**

- 1) Ultraviolet Flame Scanner
  - A) The ultraviolet scanner and associated controller provide flame confirmation and initiate "flare safety shutdown". Upon loss of flame, the scanner will automatically shutdown the blowers and close the automated header valve (if utilized). The flame scanner has a maximum response time of 4 seconds, providing almost immediate system shutdown.
  - B) The scanner also provides a safety lockout on the start up of the blowers and opening of the header valve, until confirmation of the pilot flame.
  
- 2) Temperature controller which offers complete flexibility to set temperature points at which certain functions will be initiated. These functions are:
  - A) "System shutdown", should the ultraviolet scanner fail to operate for any reason, the temperature controller will act as a back-up safety shutdown. Upon loss of temperature at the flare tip the controller will also automatically shutdown the system.
  - B) "Blower on", When the pilot burner reaches the appropriate temperature, set by operator, to indicate the pilot is in fact burning, the controller starts the blower motor automatically.
  - C) "Pilot off", After the blower has been started, the pilot remains burning until the temperature at the flare tip has reached the ideal burning temperatures as set by operator, and the Flame-Trol I shuts off the propane supply to the pilot.



The system will then operate as long as there is any flame at the flare tip. The controller also features a constant L-E-D temperature read-out.

3) Pilot Timer and Pilot Failure Indicator

A) This timer begins the instant the ignition cycle begins. It is set by the operator at the maximum time required for the propane pilot to achieve the blower on temperature and the methane supply to be ignited. This time will typically be 2 to 3 minutes. At the end of this time, the propane supply valve will be closed and the pilot flame extinguished, if not already shut off by the temperature controller.

B) The pilot timer also controls the "pilot failure" function of Flame-Trol I. Upon initiation of the automatic ignition cycle this timer begins timing down. Should the pilot not achieve the "blower on" temperature (set in the pilot temperature controller) in the time set in the pilot timer, the entire system will be shut down. The "pilot failure" indicator light will then come on. The system will not attempt to automatically reignite until the pilot problem has been remedied. If it is determined that the propane supply has not been exhausted or another problem with the pilot system cannot be found, the operator may attempt automatic reignition by pushing the "pilot failure reset" button.

4) Down Time Timer

A) If the methane supply to the flare tip has been exhausted or the flame is extinguished by wind or other causes, the blowers are automatically shut down and the down timer starts. This timer has a range of one second to 999 hours. The operator determines the length of time necessary to rejuvenate the methane supply and sets this timer accordingly. Once the timer has completed its cycle, the system will open the pilot valve and the igniter will fire to automatically reignite the flare. The timer has an L-E-D read-out in effect when the system is in the "down time" function.

- 5) Igniter Timer
  - A) The igniter timer allows the operator to set the time the igniter will spark during the ignition cycle. This allows for the adjustment of the spark duration to compensate for the distance of the propane supply from the flare; thus extending the life of the igniter plug, transformer and other pilot components.
- 6) Manual/Auto Switch
  - A) The system also features a convenient manual/off/auto switch which allows the operator to completely bypass the automatic controls and operate the flare manually.
- 7) The Flame-Trol I is enclosed in a NEMA 4 "outdoor" weather proof enclosure, suitable for control rack/wall mounting.
  - A) "Indicator Lights", Mounted on the controller are indication lights for; power on, ignition on, pilot on, blowers on, flare safety shutdown.

## TECHNICAL DATA

- A. Flare Tip size -- 14 in.
- B. Overall Height -- 34 ft.
- C. Turndown Ratio -- 20:1
- D. Destruction efficiency at 2453 SCFM flow with gas methane content 40 to 60% -- 98% overall destruction of total hydrocarbons  
  
Guaranteed to meet E.P.A. emission standards for methane disposal in utility "candle type" flares.
- E. Minimum flow rate to maintain stable flame and 98% destruction efficiency -- 321 SCFM
- F. Minimum methane content required to maintain stable flame and 98% destruction efficiency -- 30%
- G. Equipment drawing -- typical attached
- H. P&ID -- typical attached

### NOTE:

Wind loads:      Designed for 100 mph wind loading (per ASCE 7-88, Exp. C)

D. Equipment Warranty:

LFG Specialties guarantees the Equipment as outlined and specified in this Proposal No. 99103A for the period of eighteen (18) months from date of shipment or twelve (12) months from date of start-up, whichever occurs first.

Along with standard Material, Workmanship and Performance Warranties outlined in the standard "Terms and Conditions of Sales" attached, LFG Specialties guarantees the equipment to meet present E.P.A. emission standards when installed and operated in accordance with specified design conditions.

E. Start-up Assistance:

LFG Specialties will furnish an on site advisor during any aspect of the installation or start-up of our equipment deemed necessary by our Customers in accordance with our standard "Terms and Conditions of Sales". Included in the flare pricing, less travel and living expenses, is:

Utility Flare                      --- 2 days service time

Note:            Travel and living expenses to be charged customer at actual cost.

F. Field Service Rates and Availability

Additional field service time will be charged at \$400.00 per day for service technicians and \$660.00 per day for engineers, plus expenses. Associated travel, lodging, living, and miscellaneous expenses will be charged at actual costs.

Service personnel should be scheduled two weeks in advance for standard installation, start-up or service work. Service personnel are available on a 24 hour notice for emergency service requirements.

G. Scope of Work:

LFG Specialties will furnish all the Equipment and Services as outlined in this Proposal No. 99103A. Equipment will be fully fabricated, painted and tested as described in proposal at LFG Specialties facility, New Concord, Ohio.

Any material/instrumentation that may be damaged in shipment will be removed, tagged and boxed separately for shipment and re-assembly in field.

This proposal only covers the supply of Equipment and installation advisory service as defined. The following items are not included or should be constructed to be included in LFG Specialties scope of supply.

- \* Construction drawings. LFG Specialties drawings will outline field installation connections (location and size), foundation bolt layouts and loading data. All equipment layout, interconnect details and foundations are the responsibilities of Customer or Customer's Representatives.
- \* All installation and civil work including foundations, equipment erection, main and interconnecting piping and wiring including required equipment and materials are the responsibilities of Customer or Customer's Representatives.
- \* All permits/licenses required for installation and/or operation of the Equipment are the responsibility of Customer or Customer's Representatives. LFG Specialties will provide necessary manufacturers data on the equipment as required for permit/license applications.
- \* Compliance testing - All compliance/performance testing will be the responsibility of the Customer. LFG Specialties will have representative/s present for tests at Customer's request and expense. LFG Specialties fully guarantees the Equipment to meet E.P.A. emission standards when operated within the specified conditions.

**LFG SPECIALTIES, INC.**  
**TERMS AND CONDITIONS OF SALES**

**DEFINITIONS:** Within these "Terms and Conditions of Sales" the term "Seller" shall mean LFG Specialties, Inc. The term "Purchaser" shall mean the person, municipality, firm, or corporation to whom this quotation is addressed. The term "Equipment" means those articles, materials, supplies, drawings, data, or other property or services described herein.

**WARRANTIES**

**A. "Material and Workmanship Warranty":** LFG Specialties Inc. the "Seller" warrants to the Purchaser that the Equipment of its own manufacture will be complete in all its parts and for the Warranty Period specified will under proper application and operation be free from defects in material or workmanship. The Seller warranty obligation shall be limited to the following:

- 1) Replacement or repair of any Equipment or parts which under normal and proper operating conditions are found and confirmed defective and are returned to the Seller's works within the Warranty Period, transportation charges prepaid.
- 2) Notwithstanding the above, the Seller shall have no obligation as a result of improper storage, installation, repairs or modifications not made by Seller or as a result of removal, improper use or misapplication of the Equipment after it has been delivered to the Purchaser.
- 3) Purchaser shall be responsible for freight charges in connection with the return or replacement of any defective Equipment or parts.

**B. "Performance Warranty":** The Seller warrants that the Equipment of its own manufacture, when shipped and/or installed, will operate within any performance characteristics which are expressly specified herein as a performance guarantee. Any performance characteristics indicated herein which are not expressly stated as guarantees are expected but not guaranteed. Should Purchaser be required or desire to conduct a field compliance/performance test to verify any performance guarantee, such test will be conducted by Purchaser at his expense. Seller may be requested to have a representative/s present to witness such a test in which case Purchaser shall reimburse Seller for the time and expense of such representatives at the Seller's service rates then in effect at the time of the test. Purchaser shall give Seller fifteen (15) days written notice prior to the date Purchaser intends to commence such test.

**C. "Warranty as to Equipment not made by Seller":** Equipment, parts and accessories made by other manufacturers and supplied hereunder by the Seller are warranted only to the extent of the original manufacturer's warranty to the Seller.

**D. "Except as outlined herein, and to Title, it is expressly agreed":**

- 1) "That there is no implied warranty of merchantability, nor other warranty, express implied or statutory, nor any affirmation of fact, of promise by the Seller with reference to the Equipment or parts thereof, or otherwise, which extends beyond the description of the Equipment as set forth herein, and
- 2) that the Purchaser acknowledges that it is purchasing the Equipment solely on the basis of the commitments of the Seller expressly set forth herein.
- 3) That the Seller shall have the sole and exclusive right to determine and confirm if warranties apply, and that in no event shall Seller's liability exceed the purchase price of the Equipment, less a reasonable charge for any utilization by Purchaser.

**INSTALLATION AND ERECTION**

The Equipment shall be transported, installed on a foundation, and connected at the Purchaser's expense unless otherwise expressly agreed herein. Upon request of Purchaser, Seller will furnish a field service representative to assist Purchaser during the installation, erection and start up of the Equipment, and instruction of its personnel, for which the Purchaser shall pay the then-current published rates per day plus actual living and traveling expenses. A day shall mean any one eight (8) consecutive hour shift, or part thereof.

Purchaser shall pay one and one-half times the current hourly rate for any time in excess of eight (8) hours per day and for the first (12) hours worked on Saturdays and double the current hourly rate for Sundays, locally observed holidays, and any time working in excess of (12) hours per day. Travel, working and standby time and travel and living expenses shall be charged from the time the Seller's representative leaves his home base or other equivalent starting point until his return thereto.

The field service representative furnished by Seller will be qualified to assist in the installation, erection and start up of the Equipment, but it is understood and agreed that should Purchaser utilize the field service representative in any manner as a foreman, supervisor, etc., that said representative shall become for that purpose, the Purchaser's employee, for whom Purchaser shall be liable, shall maintain adequate insurance coverage and shall hold harmless and indemnify Seller from and against any and all claims arising out of said representative's acts or omissions while serving in such capacity.

**DAMAGES**

In no event shall the Seller be liable for special, consequential or incidental damages, nor for loss of anticipated profits nor for loss of use of the equipment or of any installation, system, operation or services into which the equipment or parts may be put, or with respect to which any service may be performed by Seller. This limitation on the Seller's liability shall apply to any liability for default under or in connection with the equipment, parts or services delivered hereunder, whether based on warranty, failure of or delay in delivery or otherwise.

**CANCELLATION**

Order shall not be subject to cancellation or modification, either in whole or in part, without the Seller's consent, and then only under terms that will reimburse the Seller for all applicable costs incurred, including but not limited to costs of purchased materials, engineering and labor expenses, and a reasonable allowance for profit.

**TITLES AND REMEDIES**

Until full payment of all obligation by the Purchaser, the Seller reserves the title to all Equipment furnished hereunder. If the Purchaser defaults in payment or performance or becomes subject to insolvency, receivership, or bankruptcy proceedings or makes any assignment for the benefit of creditors, or without the consent of the Seller voluntarily or involuntarily sells, transfers, leases or permits any lien or attachment on the Equipment delivered hereunder, the Seller may treat all amounts then or thereafter owed by the Purchaser to be immediately due and payable and the Seller may repossess and Equipment by any means available under law.

**CONFIDENTIALITY**

All proposals, drawings, design data and technical information developed and/or provided by the Seller shall be considered "confidential" and the sole property of the Seller. All such information disclosed to the Purchaser shall not be reproduced in whole, or in part, or used to furnish information to others, without the written permission of the Seller.

**PURCHASER'S DRAWINGS AND SPECIFICATIONS**

Seller is furnishing only the Equipment specified herein and does not assume any responsibility for other equipment and material not being supplied by Seller, nor the effect thereof on the overall operation of the system of which the Equipment is a part. Accordingly, any comments from the Seller regarding Purchaser's drawings are responsive only and Seller shall not be liable therefor.

**SELLER'S DRAWINGS AND ENGINEERING DATA**

Prints of Seller's and data representing the Seller's application of the purchased equipment to the requirement of the contract will be submitted for approval. Upon the return of such prints, within ten (10) working days, the requested changes, if any, will be made to correct misinterpretations. Certified prints of Seller's drawings will then be furnished. Any Purchaser-requested changes thereafter will be subject to added cost and delivery considerations.

**DESIGN CHANGES**

While the Seller reserves the right where possible, to include changes in design or material which are improvements, it cannot be responsible for including improvements, effected after beginning of production on Equipment. Design changes suggested by Purchaser after beginning of production shall require Seller's agreement, including agreements as to price and shipping schedules.

**MISCELLANEOUS**

- A. "Applicable Law" The definition of terms used, interpretation of this Agreement and rights of parties hereto shall be construed under and governed by the Uniform Commercial Code of the State of Ohio.
- B. "Acceptance" If this proposal constitutes an acceptance of an offer, such acceptance is expressly made conditional on Purchaser's assent solely to the terms of this proposal, and acceptance of any part of the Equipment or services covered hereunder shall be deemed to constitute such assent.
- C. This proposal is subject to change or prior sale of Equipment until accepted as an order by an officer of the Seller.

**FLAME-TROL I  
UTILITY FLARE CONTROL SYSTEM**

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5) Igniter Timer

A) The igniter timer allows the operator to set the time the igniter will spark during the ignition cycle. This allows for the adjustment of the spark duration to compensate for the distance of the propane supply from the flare; thus extending the life of the igniter plug, transformer and other pilot components.

6) Manual/Auto Switch

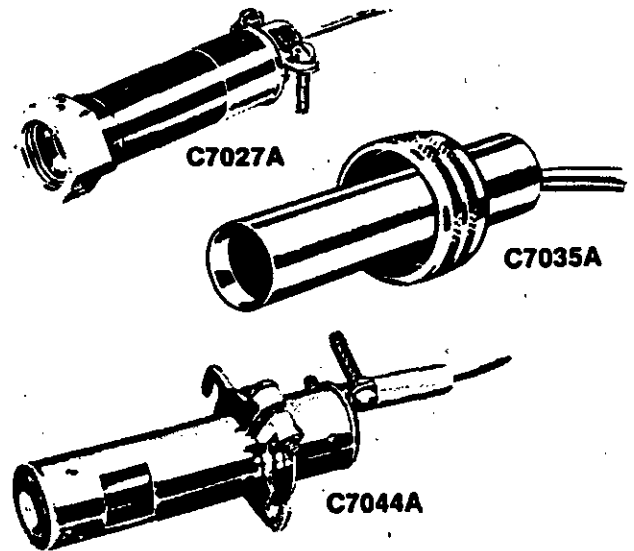
A) The system also features a convenient manual/off/auto switch which allows the operator to completely bypass the automatic controls and operate the flare manually.

7) The Flame-Trol I is enclosed in a NEMA 4 "outdoor" weather proof enclosure, suitable for control rack/wall mounting.

A) "Indicator Lights", Mounted on the controller are indication lights for; power on, ignition on, pilot on, blowers on, flare safety shutdown.

## C7027A, C7035, C7044A Minipeeper Ultraviolet Flame Detectors

*The C7027A, C7035A and C7044A detect the ultraviolet radiation emitted by combustion flames. The flame detectors are used with Honeywell flame safeguard controls to provide flame supervision for gas, oil, or combination gas-oil burners.*



- C7027A, C7035A, and C7044A Flame Detectors are used with R7249A, R7290A, R7749B and R7849A,B amplifiers and the appropriate Honeywell controls.
- C7044A may also be used with the following 50 Hz Honeywell combustion controls/amplifiers:  
R4341/R7323  
R4343/R7323  
R4344/R7323
- C7027A has an integral collar threaded (internal 1/2-14 NPSM) for mounting on a 1/2-inch sight pipe.
- C7035A has an integral collar threaded (internal 1-11-1/2 NPSM) for mounting on a one inch sight pipe.
- C7035A housing meets Underwriters Laboratories Inc. requirements for raintightness and complies with NEMA enclosure standards, types 4 and 4X.
- C7044A mounts with a two screw bracket. The UV sensor tube is enclosed in a stainless steel housing.
- C7044A has the capability of side or end viewing in flame monitoring applications.
- Because of their compact size, the C7027A and C7044A are particularly suitable for blast tube mounting.
- Properly installed the C7027A and C7035A are pressure rated for 5 psi.
- C7035A ultraviolet radiation sensor tube is field replaceable.
- Two C7027A, C7035A, or C7044A flame detectors can be wired in parallel for difficult flame sighting installations.

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# Specifications

## SUPER TRADELINE MODELS

SUPER TRADELINE models offer features not available on TRADELINE or standard models, and are designed to replace a wide range of Honeywell and competitive controls. SUPER TRADELINE models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. Specifications of SUPER TRADELINE models are the same as those of standard models except as noted below.

### SUPER TRADELINE MODEL AVAILABLE:

C7027A1080—includes C7027A1023 Detector, 136733 Heat Block, and 390427B Bushing.

### SUPER TRADELINE FEATURES:

- Heat block for insulating the detector from sight pipe temperatures above 215° F [102° C] up to 266° F [130° C].
- Bushing for mounting the detector on a 3/8 in. sight pipe.
- SUPER TRADELINE pack with cross reference label and Instructions, form 60-0638.

## STANDARD MODELS

### C7027A MINIPEEPER ULTRAVIOLET FLAME DETECTOR

#### AMBIENT OPERATING TEMPERATURE RATINGS:

0° F to 215° F [-18° C to 102° C], or -40° F to 215° F [-40° C to +102° C], depending on model.

MAXIMUM PRESSURE RATING: 5 psi [34.5 kPa].

MOUNTING: Collar with 1/2-14 NPSM internal threads for mounting on a 1/2 in. sight pipe.

WIRING CONNECTIONS: Two 6 ft [1.83 m], color-coded, NEC Class 1 leadwires. (One model is available with 24 ft [7.32 m] leadwires.) Rear of detector has a clamp type connector for 1/2 in. flexible metallic conduit. (Models are available with 1/2 in. internally threaded spud connector instead of the clamp.)

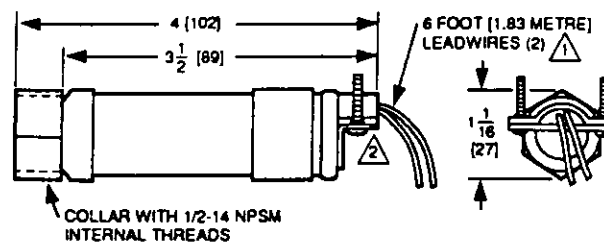
DIMENSIONS: See Fig. 1.

REPLACEMENT PART: 129685 Flange Gasket.

NOTE: The ultraviolet radiation sensing tube is not field replaceable.

ACCESSORY: 136733 Heat Block, laminated plastic, for insulating the flame detector from sight pipe temperatures up to 266° F [130° C], 1/2-14 NPSM external threads on one end and 1/2-14 NPSM internal threads on the other end (see Fig. 5).

Fig. 1—Installation dimensions of C7027A, in in. [mm in brackets].



▲ MODEL AVAILABLE WITH 24 FOOT [7.32 METRE] LEADWIRES.

▲ MODELS AVAILABLE WITH SPUD CONNECTOR (1/2-14 NPSM INTERNAL THREADS) INSTEAD OF CLAMP TYPE CONNECTOR.

M1943

# Ordering Information

When purchasing replacement and modernization products from your Flame Safeguard Authorized Distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number, and specify:

1. Order number.
2. Operating temperature range.

#### ORDER SEPARATELY:

1. Replacement parts, if desired.
2. Accessories, if desired.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Residential and Building Controls Division Sales Office (check white pages of phone directory).
2. Residential and Building Controls Division Customer Satisfaction  
Honeywell Inc., 1885 Douglas Drive North  
Minneapolis, Minnesota 55422-4386 (612) 542-7500

(In Canada—Honeywell Limited/Honeywell Limitee, 740 Ellesmere Road, Scarborough, Ontario M1P 2V9) International Sales and Service offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

**C7035A MINIPEEPER ULTRAVIOLET FLAME DETECTOR**

FLAME DETECTION: End viewing.

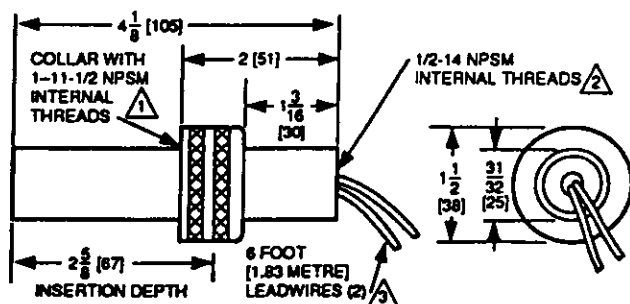
AMBIENT OPERATING TEMPERATURE RATINGS:  
0° F to 250° F [-18° C to 121° C], or -40° F to 250° F  
[-40° C to 121° C], depending on model.

MAXIMUM PRESSURE RATING: 5 psi [34.5 kPa].  
MOUNTING: Collar with 1-11-1/2 NPSM internal threads  
for mounting on a 1 in. sight pipe. (The DIN approved  
C7035A1064 has 1-11 BSP.P1 threads.)

WIRING CONNECTIONS: Two 6 ft. [1.83 m], color-coded  
NEC Class 1 leadwires rated for 600° F [204° C]. One  
model is available with 12 ft. [3.66 m] leadwires. Rear of  
detector has 1/2-14 NPSM internal threads for connecting  
to a conduit. The DIN approved C7035A1064 has 1/2-14  
BSP-F threads.

DIMENSIONS: See Fig. 2.

Fig. 2—Installation dimensions of C7035A, in in. [mm in brackets].



- ① DIN APPROVED C7035A1064 HAS 1-11 BSP.P1 INTERNAL THREADS.
- ② DIN APPROVED C7035A1064 HAS 1/2-14 BSP-F INTERNAL THREADS.
- ③ MODEL AVAILABLE WITH 12 FOOT [3.66 METRE] LEADWIRES. M1945

**REPLACEMENT PARTS:**

- 129808 Flange Gasket.
- 129464M Ultraviolet Sensing Tube, 0° F to 250° F [-18° C to 121° C].
- 129464N Ultraviolet Sensing Tube, -40° F to 250° F [-40° C to 121° C].

**C7027A AND C7035A APPROVALS:**

- Underwriters Laboratories Inc. listed: File No. MP268.
- Canadian Standards Association certified: Master Report LR 95329-1.
- Factory Mutual approved.
- Industrial Risk Insurers acceptable.
- DIN approved models: C7027A1056, C7035A1049, C7035A1064.

**ACCESSORIES:**

- 118367A Swivel Mount; provides adjustable positioning of the C7027A or C7035A.

**C7044A MINIPEEPER ULTRAVIOLET FLAME DETECTOR**

DETECTION: Housing has two openings to permit either side or end viewing. Side viewing is 1/8 as sensitive as end viewing.

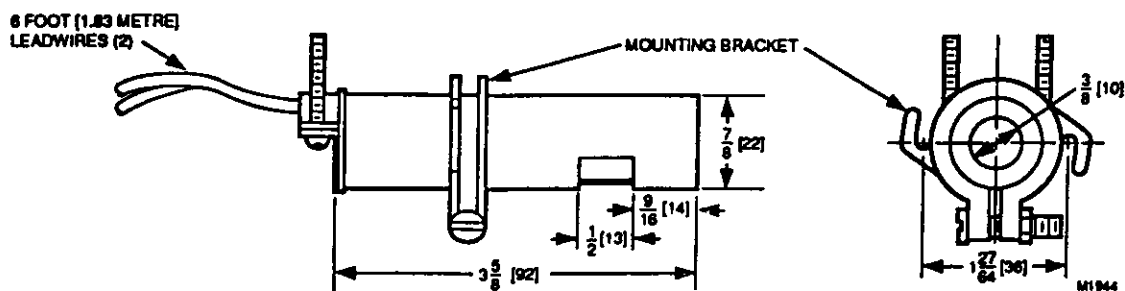
AMBIENT OPERATING TEMPERATURE RATINGS:  
0° F to 215° F [-18° C to 102° C].

MOUNTING: Bracket (included in 4074 BVK Bag Assembly), secured by two 8-32 RHIS (European M-4) screws (not included).

WIRING CONNECTIONS: Two 6 ft. [1.83 m], color-coded, NEC Class 1 leadwires. Rear of detector has a clamp type connector for 1/2 inch flexible metallic conduit.

DIMENSIONS: See Fig. 3.

Fig. 3—Installation dimensions of C7044A, in in. [mm in brackets].





## CAUTION

Ultraviolet radiation sensing tubes have a life expectancy of 40,000 hours of continuous use within the flame detector's specified ambient temperature and voltage ratings. Wearout of an ultraviolet radiation sensing tube results in failure of the UV sensor to properly discriminate between flame conditions.

The C7027A, C7035A and C7044 flame detectors should only be used on burners that cycle on-off at least once every 24 hours. Appliances with burners that remain on continuously for 24 hours or longer should use the C7012E Dynamic Self-Check Flame Detector with R7247C, R7747C or R7847C amplifiers and the appropriate Honeywell flame safeguard control. For highest sensitivity requirements, the C7076A,D Flame Detectors with the R7476A or R7886A Dynamic Self-Check Amplifiers and the appropriate Honeywell flame safeguard control should be used.

### WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced, flame safeguard control technician.
4. After installation is complete, check out product operation as provided in these instructions.



## CAUTION

1. The C7027A, C7035A and C7044A Flame Detectors must be used with Honeywell flame safeguard controls (primaries, programmers, multiburner systems, and burner management systems). Using with controls not manufactured by Honeywell could result in unsafe conditions.
2. Disconnect power supply before beginning installation to prevent electrical shock or equipment damage, more than one disconnect may be involved.
3. Read the installation instructions before starting the installation.
4. All wiring must be NEC Class 1 (line voltage).
5. The flame detector must be positioned so that it sights the flame and does not respond to the UV radiation emitted by sparks generated by a spark ignitor. The Q624A solid-state igniter may be useful in difficult installations.

### DETECTOR INSTALLATIONS

All flames emit ultraviolet radiation, invisible to the human eye but detected by the UV sensing tube. There are two important factors in UV detector installation:

1. The detector must have a line-of-sight view of the flame.
2. The detector must not be exposed to other sources of ultraviolet radiation, the most common being ignition spark. Other sources are listed in the next section.

Because it is necessary for the detector to actually see the flame, it is desirable to locate the detector as close to the flame as physical arrangement and temperature restrictions permit.

Sighting requirements for different types of flame supervision are:

1. Pilot flame only—Sighting must be along the axis of the pilot flame. The smallest pilot flame that can be sighted must be capable of igniting the main burner (see Pilot Turndown Test, page 9).
2. Main flame only—Sighting must be at the most stable part of the flame for all firing rates.
3. Pilot and main flame—Sighting must be at the junction of both flames.

### OTHER RADIATION SOURCES SENSED BY THE UV DETECTOR

Examples of radiation sources (other than flame) that could actuate the detection system are:

#### Ultraviolet Sources:

Hot refractory above 2800° F [1371° C].

#### Spark:

- ignition transformers.
- welding arcs.
- lightning.

Gas lasers.

Sun lamps.

Germicidal lamps.

#### Gamma Ray and X-ray Sources:

Diffraction analyzers.

Electron microscopes.

Radiographic X-ray machines.

High voltage vacuum switches.

High voltage condensers.

Radioscopes.

Except under unusual circumstances, none of these sources except hot refractory and ignition spark would be present in or near the combustion chamber.

The detector may respond to hot refractory above 2800° F [1371° C] if the refractory surface represents a significant percentage of the field of view of the detector. If the temperature of the hot refractory causes the flame relay (in the flame safeguard control) to pull in, re-position the sight pipe so the detector views a cooler area of the refractory.

Ignition spark is a source of ultraviolet radiation. When installing the C70217A, C7035A, or C7044A Flame Detector, make sure it does not respond to ignition spark (see *Ultraviolet Response Test*, page 9.) If the installation is such that response to the ignition sparks cannot be avoided, the Q624A solid-state ignition transformer may eliminate the ignition spark response. The Q624A, when properly installed, prevents C7027A, C7035A, and C7044A ignition spark response by alternately activating the spark generator and the UV sensing tube.

#### MOUNTING A C7027A OR C7035A LOCATE THE SIGHT PIPE

The location of the sight pipe is the most critical part of the installation. A black iron pipe is recommended. Do not use a stainless steel or galvanized pipe because its internal surface blackens with use as deposits from the combustion chamber settle on it. Initially, its shiny internal surface reflects ultraviolet radiation, which could result in a satisfactory flame signal, even though the pipe may be improperly located. As it blackens, less ultraviolet radiation is reflected and the flame signal may become marginal.

Under optimum sighting conditions, the C7027A and C7035A Flame Detectors can detect most common gas and oil combustion flames at a distance of six feet. The critical factors in determining the flame-detector distance separation are the optimized flame signal (current or voltage) and the flame detector temperature. Other factors may be influential and are associated with the specific installation. For minimum flame signals, see Table 1 and for ambient operating temperatures, refer to Specifications, page 2.

Use 1/2 in. pipe for a C7027 and 1 in. pipe for a C7035. Since no two situations are likely to be the same, length and sighting angle of the pipe must be determined at the time and place of installation. Generally, it is desirable to have the sight pipe tilting downward to prevent soot or dirt buildup.

If a C7027A is to be used for a blast tube installation, its location should be determined by the burner manufacturer; contact the manufacturer before making any modifications to the installation.

In locations where water is usually sprayed on the body of the detector, use a C7035A. Internal threads in its base permit the use of waterproof flexible conduit for this type of application.

#### PREPARE HOLE IN WALL OF COMBUSTION CHAMBER

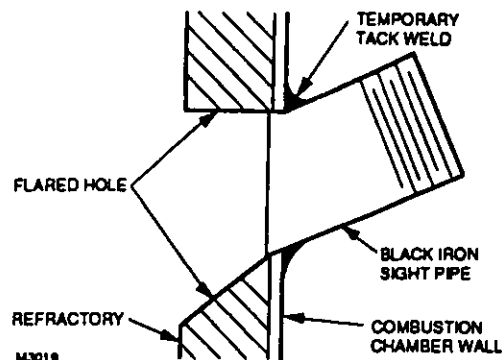
Cut a hole of the proper diameter for the sight pipe in the wall of the combustion chamber at the selected location. Flare the hole to leave room for small adjustments of the sighting angle. The taper of the hole should be about 1 in. for every 3 in. [25 mm for every 76 mm] of wall thickness.

#### MOUNTING THE SIGHT PIPE (FIG. 4)

Thread one end of the pipe to fit the mounting collar on the detector. Cut the pipe to the desired length (as short as practicable), and at an angle so it fits flush with the wall of the combustion chamber. Tack weld the pipe to the wall in a trial position. Do not permanently weld the sight pipe in place until after completing the Adjustments and Checkout beginning on page 7.

NOTE: If you use a swivel mount (part no. 118367A) and you are positive about the location and sighting angle, you can permanently weld the pipe.

Fig. 4—Mounting sight pipe.



#### SIGHT PIPE VENTILATION

It may be necessary to ventilate the sight pipe to cool the flame detector or to clear the sight pipe of UV radiation absorbing substances such as smoke, excessive moisture or, in some instances, unburned fuel.

For a negative pressure combustion chamber, drilling a few holes in the section of the sight pipe outside of the combustion chamber will allow air at atmospheric pressure to flow through the sight pipe into the chamber. A perforated pipe nipple between the sight pipe and the detector can also be used (see Fig. 5).

Fig. 5—Mounting a C7027A on a combustion chamber (viewed from above). C7035A mounting is similar.

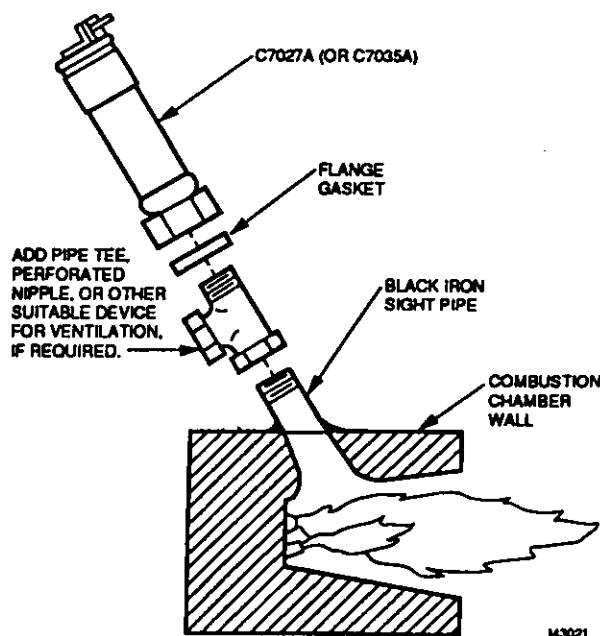
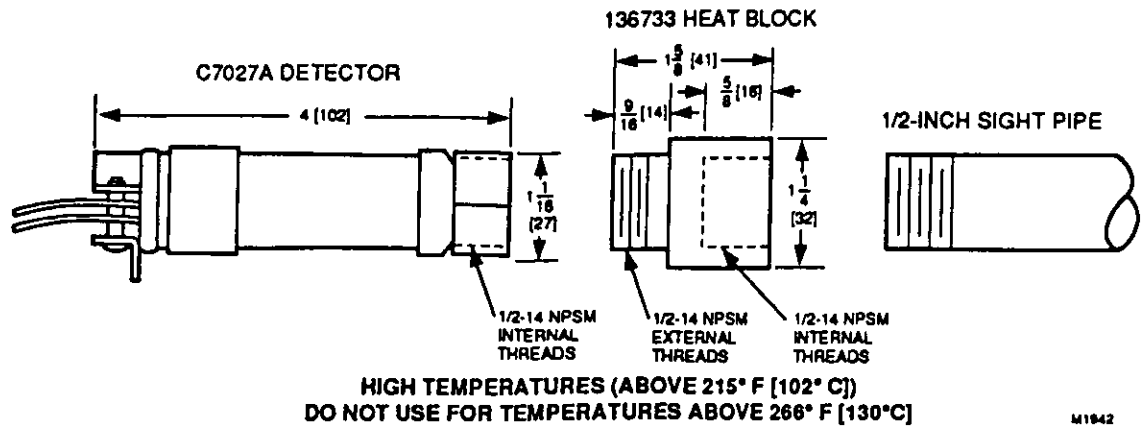


Fig. 6—Mounting dimensions of 136733 heat block, in in. [mm in brackets].



For a positive pressure combustion chamber, connect a supply of pressurized air from the burner blower through the sight pipe into the chamber. The supply air pressure must be greater than the chamber pressure.

**SWIVEL MOUNT**

To facilitate proper sighting of the flame, a swivel mount (part no. 118367A) is available. The swivel mount will require a 3/4 to 1/2 in. reducer and a 1/2 in. close nipple to mount a C7027A, or a 1 in. pipe at least 2-1/2 in. [63.5 mm] long to mount a C7035A. For mounting details, refer to form 60-0361 for the 118367A Swivel Mount.

**USING A HEAT BLOCK WITH A C7027 (Fig. 6)**

If the temperature of the sight pipe will become high enough to cause the C7027A to overheat (above 215° F [102° C] up to 266° F [130° C], screw a 136733 Heat block (order separately) onto the sight pipe before mounting the detector.

**MOUNT THE DETECTOR (Fig. 5)**

Mount the detector onto the sight pipe, pipe tee, nipple, or other fitting. Make sure the flange gasket is in place inside the mounting collar on the detector, and then screw the collar onto the sight pipe or fitting.

**NOTE:** If a window is installed between the UV detector and the flame, it must be fabricated from quartz or fused silica. Ordinary glass filters out ultraviolet radiation.

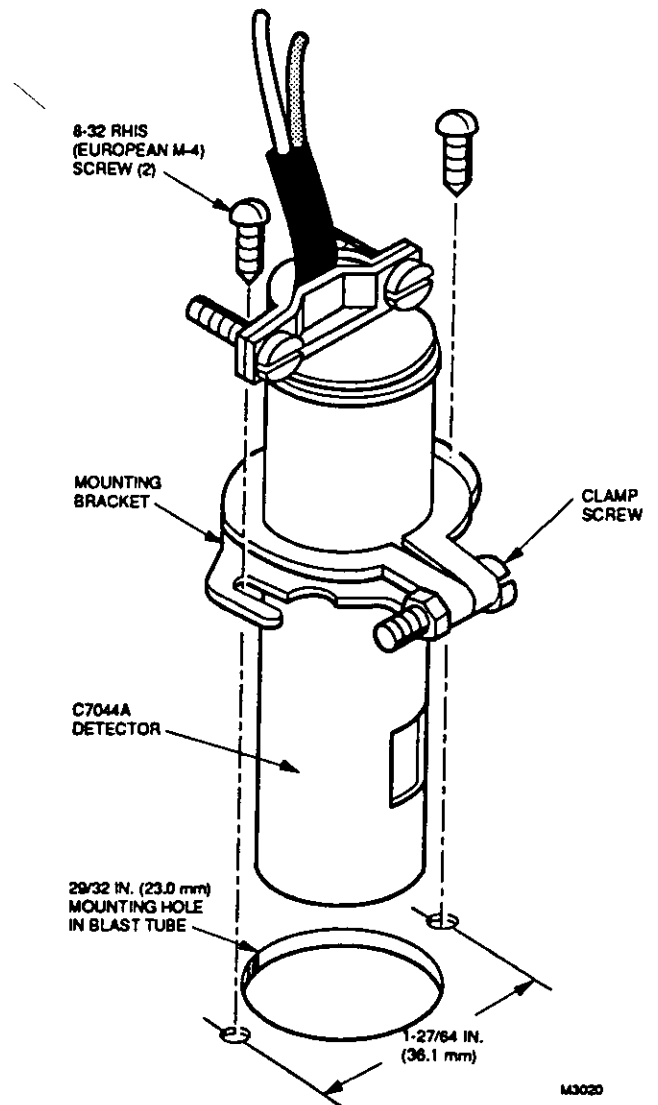
**MOUNTING A C7044A ON A BLAST TUBE (Fig. 7)**

The C7044 is designed to be mounted on the blast tube of a burner. The exact location should be determined by the burner manufacturer. Contact the manufacturer before making any modifications to the installation.

**CAUTION**

The C7044 will allow air leakage through its housing. It should not be located in an atmosphere of fuel vapors under positive pressure. The C7027 or C7035 should be used if internal pressure sealoff is required.

Fig. 7—Mounting C7044A on blast tube.



The C7044 is mounted in a 29/32 in. [23.0 mm] hole in the blast tube. The mounting bracket is fastened to the blast tube with 2 screws on 1-27/64 in. [36.1 mm] centers.

The mounting bracket is designed so that the detector can be removed from the blast tube for cleaning and then replaced without disturbing the sighting angle. Loosen the 2 screws holding the bracket to the blast tube, but do not loosen the clamp screw on the bracket. Twist both the bracket and detector to remove them.

#### WIRING (All Models—Fig. 8)

### CAUTION

The *blue* (tan with blue tracer with C7035A1080) leadwire must be connected to the F terminal of the flame safeguard control subbase or terminal strip and the *white* (tan leadwire without blue tracer with C7035A1080) to the G terminal (see Fig. 8). Failure to observe the circuit polarity by reversing the leadwires (even momentarily) may cause the flame detector to improperly supervise the combustion flame.

1. Disconnect power supply before beginning installation to prevent electrical shock and equipment damage. All wiring must comply with applicable electrical codes, ordinances, and regulations. Use NEC Class 1 wiring.
2. If the leadwires are not long enough to reach the terminal strip or wiring subbase, make the required splices in a junction box.
3. If splicing is necessary, use moisture-resistant wire suitable for at least 167° F [75° C] if the detector is used with a flame safeguard *primary* control, or at least 194° F [90° C] if used with a flame safeguard *programming* control.
4. For *high temperature installations*, use Honeywell Specification no. R1298020 or equivalent for the F leadwire. (This wire is rated up to 400° F [204° C] for continuous duty. It is tested for operation up to 600V and breakdown up to 7500V.) For the other leadwires, use moisture-resistant wire selected for a temperature rating above the maximum operating temperature.

**IMPORTANT:** Do not run the flame detector wiring in the same conduit with high voltage ignition transformer wires.

#### CONNECTING DETECTORS IN PARALLEL

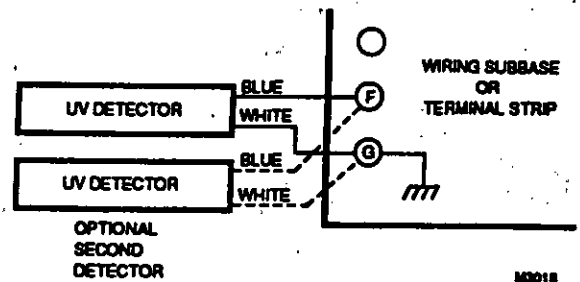
For a flame that is difficult to sight, using two flame detectors connected in parallel will reduce the occurrence of nuisance shutdowns. If only one of the parallel detectors loses the flame signal, the other will continue to indicate the presence of the flame and keep the burner in operation.

When the flame detectors are connected in parallel, the low level background signals are additive. Therefore, no more than two C7027A, C7035A, or C7044A flame detectors should be paralleled. Furthermore, the background signal increases as temperature decreases. Because of this, the minimum ambient operating temperature must be increased when the C7027A, C7035A or C7044A flame detectors are paralleled.

When using detectors rated for a minimum of 0° F [-18° C], limit the minimum ambient temperature at the detectors to 32° F [0° C]. When using detectors rated for a minimum of -40° F [-40° C], limit the minimum ambient temperature at the detectors to -10° F [-23° C].

Connect the *blue* leadwires of both detectors to the F terminal of the wiring subbase or terminal strip, and the *white* leadwires of both detectors to the G terminal, as shown in Fig. 8.

Fig. 8—Wiring C7027A, C7035A, and C7044A flame detectors in parallel.



#### EARTH GROUND

The detector and the flame safeguard control must be connected to earth ground. A convenient method of accomplishing this is to connect the detector to the flame safeguard control with a flexible conduit, or ensure a good ground connection at the mounting bracket.

## Adjustments and Checkout

Before welding the C7027A or C7035A sight pipe in its final location, or before tightening the C7044A clamp screw, complete both the adjustments and checkout tests that follow and any required by the burner manufacturer.

#### UV SENSOR TUBE TEST

**NOTE:** For initial burner lightoff, consult the burner manufacturer instructions or the instructions for the flame safeguard control.

During the initial burner lightoff, make sure the flame safeguard control starts (i.e., the load relay, usually 1K, pulls in). If it does not start, visually check the sensing tube in the C7027A, C7035A, or C7044A flame detector. If the tube continues to glow when no flame is present, replace the sensing tube (C7035A), or replace the detector (C7027A or C7044A).



**ADJUST DETECTOR SIGHTING POSITION**

With the flame detector installed and burners running, adjust the position of the flame detector for optimum flame signal. The flame signal will be read in microamps or voltage (Vdc) depending on the Honeywell flame safeguard combustion control used.

Most existing Honeywell flame safeguard controls incorporate a flame current jack on the flame amplifier or on the control itself. The flame signal can be measured with a volt-ohmmeter such as the Honeywell W136A. To measure the flame current (signal), use a cable connector (part number 196146, included with the W136A) must be used in conjunction with the meter. With the W136A (or equivalent) positioned at the zero to 25 microampere scale, make connections from the meter probes to the two ends of the cable connector plug (red to red, black to black). Make these connections before inserting the plug end of the connector plug into the flame jack of the control or control amplifier (see Fig. 9a). Read the flame signal in microamperes directly from the W136A meter. Refer to Table 1 for the minimum acceptable flame currents.

The R7749B and R7849A,B amplifiers used with the Honeywell, BCS 7700 and 7800 SERIES controls, respectively, have a dc voltage flame signal output.

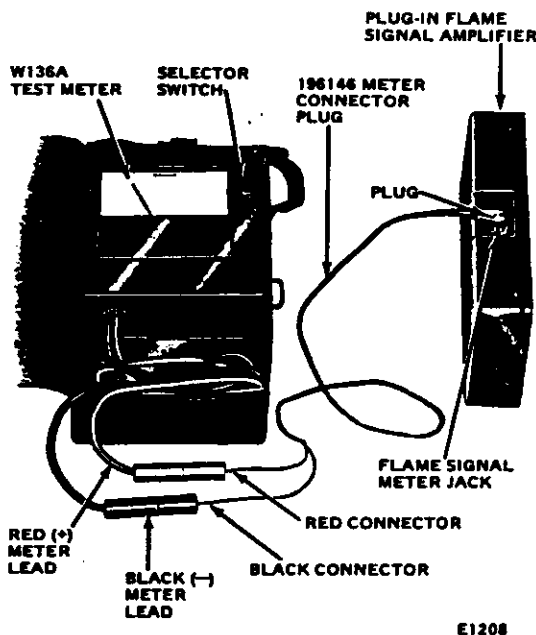
For the R7749B amplifier, a volt-ohmmeter with a zero to 5 or 10 Vdc scale and a minimum sensitivity of 20,000 volts/ohm is suggested.

For the R7849A,B amplifiers used with the 7800 SERIES controls, a volt-ohmmeter with a zero to 5 or 10 Vdc scale and a minimum sensitivity of one megohm/volt is recommended, (see Fig. 9c).

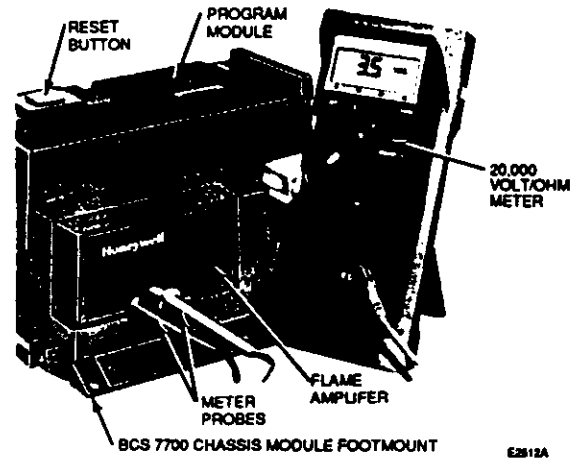
Make the flame signal voltage measurements as illustrated in Figs. 9b and 9c. Care is to be taken in that the positive meter lead is to be connected to the positive (+) amplifier jack and the negative meter lead connected to the negative (-)

amplifier jack (BCS 7700) or the (-Com) jack in the case of a 7800 SERIES control. If the BCS 7700 and SERIES 7800 controls have the optional Keyboard Display Module, a zero to five Vdc reading will be displayed on the module.

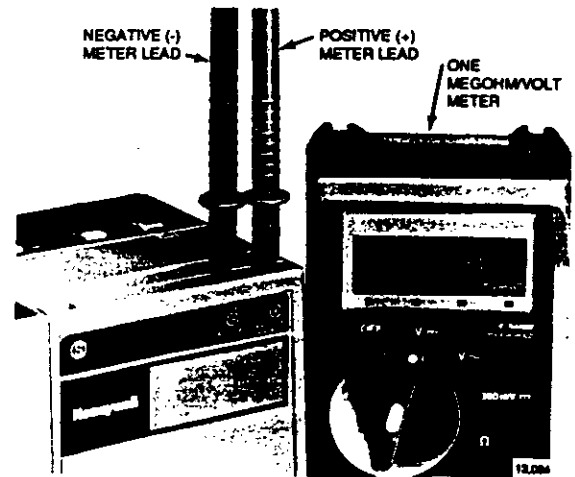
**Fig. 9a—Measuring microamp flame signal.**



**Fig. 9b—Measuring the BCS 7700 flame signal voltage.**



**Fig. 9c—Measuring flame signal voltage of 7800 SERIES controls.**



Move the flame detector and sight pipe (if not permanently attached to the burner/boiler) to view the flame from various positions. Allow a few seconds for the meter reading to stabilize. A maximum steady microamp or voltage reading is desirable. The flame signal must be above the minimum acceptable level for the flame safeguard control and associated amplifier as indicated in Table 1.

Measure the flame signal for the pilot alone, the main burner flame along, and both together (unless monitoring pilot only when using an intermittent pilot or supervising the main flame only when using direct spark ignition). Also, measure the flame signal at low and high firing rates and while modulating (if applicable).

With the flame detector in its final position, all flame signals must be steady with a current/voltage value as indicated in Table 1. If the minimum signal cannot be obtained or is unstable, refer to Troubleshooting, page 10

**PILOT TURNDOWN TEST**

If the detector is used to prove a pilot flame before the main fuel valve can be opened, perform a Pilot Turndown Test. Follow both the procedures in the Instructions for the appropriate flame safeguard control, and in the burner manufacturer's instructions.

TABLE 1—FLAME SIGNAL

Flame Detector	Plug-in Amplifier	Honeywell Flame Safeguard Control	Minimum Acceptable Steady Current (microamps)	Maximum Current Expected (microamps)	Minimum Acceptable Voltage (Vdc)	Maximum Voltage (Vdc)
	R7249A	BC7000 + PM720	3.5	7.5		
	R7749B (AMPLI-CHECK™)	BCS7700A			2.2	4.98
	R7249A	R4075C,D,E	3.5	7.5		
		R4138C,D	3.5	7.5		
		R4140G,L,M	3.5	7.5		
	R7290A	R4795A,D	1.5	2.25		
	None	R7023C,	1.5	2.25		
		R7795A,C,E,G	1.5	2.25		
	R7849A or R7849B (AMPLI-CHECK™)	RM7800E,G,L,M			1.25	5.0
		RM7823A			1.25	5.0
		RM7838A,B			1.25	5.0
		RM7840E,G,L,M			1.25	5.0
RM7885A				1.25	5.0	
RM7890A,B				1.25	5.0	
None	RA890G		1.5	2.25		5.0

**ULTRAVIOLET RESPONSE TESTS  
IGNITION SPARK RESPONSE TEST**

Test to be sure that ignition spark is not actuating the flame relay (usually 2K) in the flame safeguard control.

1. Close the pilot and main burner manual fuel shutoff valves.

2. Connect the appropriate meter to the flame safeguard control amplifier. Start the burner and run through the ignition period. Ignition spark should occur, but the flame relay must not pull in. The flame signal should not be more than 0.25 microamp.

3. If the flame relay does pull in, reposition the flame detector to increase the distance between the flame detector and the ignition spark. If the flame detector is not in the line of sight of the ignition spark but appears to respond to the spark, it may be responding to reflected spark generated UV radiation. If so, relocate the flame detector so it does not receive the reflected UV radiation. It may be necessary to construct a barrier to block the UV radiation generated by the spark from the flame detector view.

4. Continue making the adjustments until the flame signal due to ignition spark is less than 0.25 microamp or 1.25 Vdc.

5. The use of the Q624A solid-state ignition transformer may also provide a method to eliminate the C7027A, C7035A, or C7044A flame detector response to UV radiation generated by ignition spark. The Q624A prevents flame detector response to ignition spark by providing alternating periods of

spark generation and UV sensor activation.

**RESPONSE TO OTHER ULTRAVIOLET SOURCES**

Some sources of artificial light produce small amounts of ultraviolet radiation. Under certain conditions, an ultraviolet detector will respond to them as if it is sensing a flame. **DO NOT USE AN ARTIFICIAL LIGHT SOURCE TO CHECK THE RESPONSE OF AN ULTRAVIOLET DETECTOR.** To check for proper flame detector operation, test for flame failure response under all operating conditions.

**WELD THE SIGHT PIPE (or Tighten the C7044A Clamp Screw)**

When the flame signal is acceptable after all adjustments are made, remove the flame detector and weld the sight pipe in its final position. If you are using a swivel mount, the pipe may already be welded. Then reinstall the flame detector.

NOTE: If using a C7044A detector with no sight pipe, do not remove the detector; tighten the clamp screw securely.

**FINAL CHECKOUT**

Before putting the burner into service, check out the installation using the procedures in the Checkout section of the Instructions for the appropriate flame safeguard control. After completing the checkout, run the burner through at least one complete cycle to verify correct operation.

# Troubleshooting



## CAUTION

1. Be extremely careful while troubleshooting the detector; line voltage is present on some of the terminals when power is on.
2. Open the master switch to disconnect power before removing or installing the detector.

### INADEQUATE FLAME SIGNAL

If a satisfactory flame signal cannot be obtained while adjusting the sighting position of the detector, perform the procedures indicated in steps 1 through 7. If other difficulties are encountered in the system, refer to *Troubleshooting in the Instructions for the appropriate Honeywell flame safeguard control*.

1. Check for proper line voltage. Make sure the master switch is closed, connections are correct, and power supply is the correct voltage and frequency.
2. Check the detector wiring for defects, including:
  - incorrect connections.
  - wiring type or size of wire.
  - deteriorated wire.
  - open circuits.
  - short circuits.
  - leakage paths caused by moisture, soot, or dirt.

3. With the burner running, check the temperature at the detector, when it exceeds 215° F [102° C] for a C7027 or C7044, or 250° F [121° C] for a C7035:
  - use a heat block (part no. 136733) if using a C7027A Flame Detector.
  - add the additional insulation between the wall of the combustion chamber and the detector.
  - add a shield or screen to reflect radiated heat away from the detector, or
  - add cooling (refer to SIGHT PIPE VENTILATION, page 5).
4. Remove the detector and clean the viewing window with a soft, clean cloth.
5. Clean the inside of the sight pipe (if one is used) before reinstalling the detector.
6. If the flame signal continues to be too low, replace the plug-in amplifier (if the control has one).
7. If you still cannot obtain a proper flame signal, replace flame detector (C7027A, C7044A) or UV radiation sensing tube (C7035A).

**IMPORTANT:** At the completion of troubleshooting, be sure to perform the Adjustments and Checkout beginning on page 7.

# Maintenance

### PERIODIC MAINTENANCE

1. Clean the viewing window and sight pipe (if used) when necessary. Remove the detector and use a soft, clean cloth to remove accumulated contaminants from the UV radiation sensor tube glass envelope.
3. Ultraviolet sensing tubes have a life expectancy of 40,000 hours of continuous use within the ambient temperature and voltage ratings. Replace the sensing tube in the C7035, or replace the C7027 or C7044 Detector, at appropriate intervals.
3. Keep the flame detection system adjusted for the smoothest, most reliable operation as recommended by the burner manufacturer.

### CLEANING THE C7044A DETECTOR

When necessary, clean the C7044 flame detector by using the following procedure.

1. Loosen the two screws holding the C7044 mounting bracket to the blast tube. To remove, twist the bracket and detector. *Do not* loosen the clamp screw that holds the mounting bracket to the detector.
2. Clean the viewing window with a soft, clean cloth.
3. Insert the detector into the mounting hole, and to realign it, twist against the mounting screws.
4. Tighten the two mounting screws.

## Honeywell

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*Helping You Control Your World*



**FUJI**  
**ELECTRIC**

Instruction Manual

MICRO CONTROLLER E

Z SERIES

RAMP SV TYPE

TYPE: PYZ 4

5

6

7

## INTRODUCTION

You are now the owner of Fuji's Digital Temperature Controller.

Before using, be sure to check the instrument for correct specifications.

This instruction manual has been prepared for final users.

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# 1. FUNCTIONS OF THEIR KEYS AND DISPLAYS

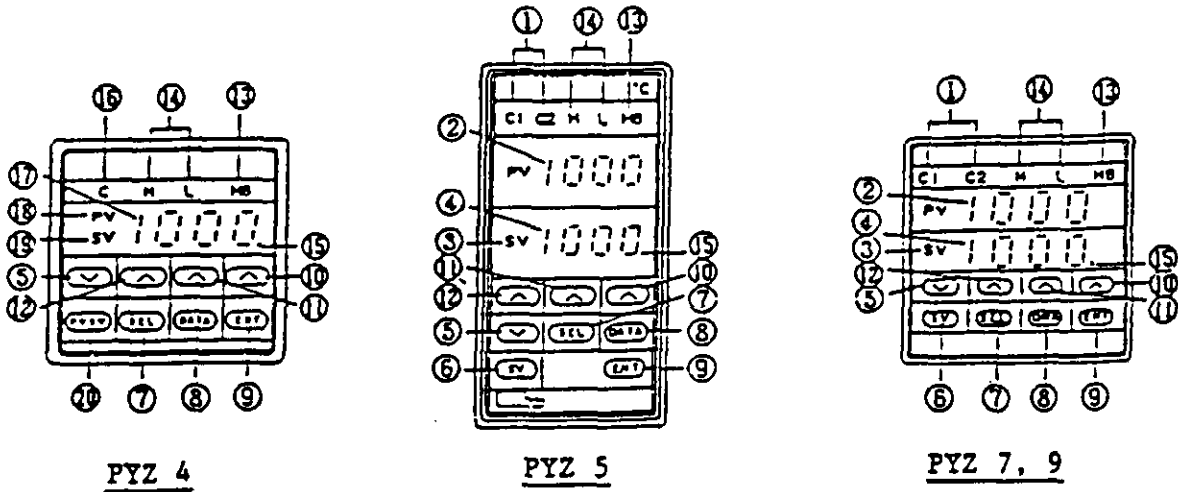


Fig. 1

Table-1

Item	Function
① Control output lamp (green)	C1: Control output "1" indication (lamp is lit at ON) C2: Control output "2" indication (lamp is lit at ON) (option)
② Measured value (PV) lamp (red)	Indication of measured value
③ Set value (SV) lamp (green)	Lamp is lit while indicating set value (SV).
④ Parameter lamp (green)	Indication of set value (SV) and various parameters (PID, high/low alarm, heater break alarm, etc.)
⑤ Down-key (common to all digits)	Numeric value of digit selected by up-key goes down.
⑥ Direct SV select key	Set value (SV) is indicated by pressing this key.
⑦ Parameter select key	Parameters are indicated in order at each press of this key.
⑧ Data key	Indication of parameter data selected by parameter select key
⑨ Data entry key	Data are registered after they have been changed. (Changed data cannot be registered unless this key is pressed.)
⑩ 1-digit up-key	Numeric value of digit flickers at a press. It goes up while repeating to press this key.
⑪ 10-digit up-key	Numeric value of 10-digit flickers at a press. It goes up while repeating to press this key.
⑫ 100-digit up-key	Numeric value of 100-digit flickers at a press. It goes up while repeating to press this key. It returns to "0" after it reaches "9" and, at the same time, the 100th digit goes up by "1".
⑬ Heater break alarm lamp (red)	Lamp is lit at ON of heater break alarm output (option)
⑭ Alarm lamp (red)	H: Lamp is ON at high alarm (option) L: Lamp is ON at low alarm (option)
⑮ Auto tuning lamp	Lamp flickers during PID auto tuning.
⑯ Control output lamp (green)	Lamp is lit at ON of control output.
⑰ Parameter indication	Indication of measured value (PV), set value (SV) and various parameters
⑱ Measured value (PV) lamp (red)	Lamp is lit at indication of measured value (PV)
⑲ Set value (SV) lamp (red)	Lamp is lit at indication of set value (SV).
⑳ PV/SV select key	Selection of measured value (PV) or set value (SV) at each press of this key

## 2. OPERATION

Turn ON the power and the measured value (PV) and set value (SV) indicators show 

.	.	.	.
---	---	---	---

, then a measured value and set value are indicated a few seconds later.

### 2.1 Preparation for operation

To ensure correct operation of the controller, it is necessary to set parameters fitted to the controlled system before operating, according to the procedures shown in the setting method. While setting parameters, be sure to turn OFF the system for the sake of safety.

For changing the ordered specifications after purchase, refer to "Setting method of second block parameters" shown on Page 6-3.

#### (1) Kinds of parameters and meaning

Table 2-1 shows a list of parameters. Note that some parameters are not indicated depending on code symbols.

Parameters are indicated in the order of SV + P + I ..... LoC + SV. To return indicating SV, with another parameter indicated, press the SV key.

#### (2) Setting method of parameters

See the Table 2-2, 2-3.

When the PID value has not been determined at the operation with PID action, the auto tuning function should be used.

When altering plus sign to minus, press the  $\ominus$  key after setting all digits to "0".

When altering minus sign to plus, press the  $\oplus$  key after setting all digits to "0".

(3) Auto tuning operation

The PID parameters can be automatically set by the controller using auto tuning function.

- (a) The auto tuning function should be used after the set value (SV), alarm setting (AL, AH) and control cycle (TC) [Reference: SSR drive output; TC=1 sec, contact output; TC=30 sec] are set up.

(b) Auto tuning startup operation

- o Press the parameter select key to indicate #1.



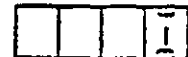
- o Press the Data key to indicated data.  
Auto tuning disable code "0" is indicated.



- o Press the 1-digit up-key for setting the code of auto turning.  
(Standard type: 1, low PV type: 2)



- o Press the 1-digit up-key to set "1". In this example, the auto tuning of the standard type is executed.



- o Press the Data entry key to start auto tuning.  
The decimal point on the 1st digit flickers during auto tuning.



- o Press the direct SV select key or PV/SV select key to indicate SV.



o At the end of auto tuning,  
flashing goes off and the auto  
tuning code is automatically  
reset to "0".

(c) Meaning of auto tuning data

0: Autotuning is disable

1: Standard type auto tuning

PV is compared with SV during auto tuning.

2: Low PV type

PV is compared with  $(SV-10\%FS)$  during auto  
tuning.

(d) When the auto tuning is completed, the PID  
parameter is saved even if the power is turned  
OFF.

(e) During auto tuning, PV may be oscillated greatly  
depending on process. If it is not desirable, do  
not use the auto tuning function.

(f) When auto tuning is not completed within 4 hours,  
it means that the auto tuning function is  
abnormal. In such a case, check the control  
system and then repeat the auto tuning once again.

(g) When the process operating condition has changed,  
carry out the auto tuning again.

(h) During auto tuning, PV and output vary as shown in  
Figs. 2-1 and 2-2.

Standard type

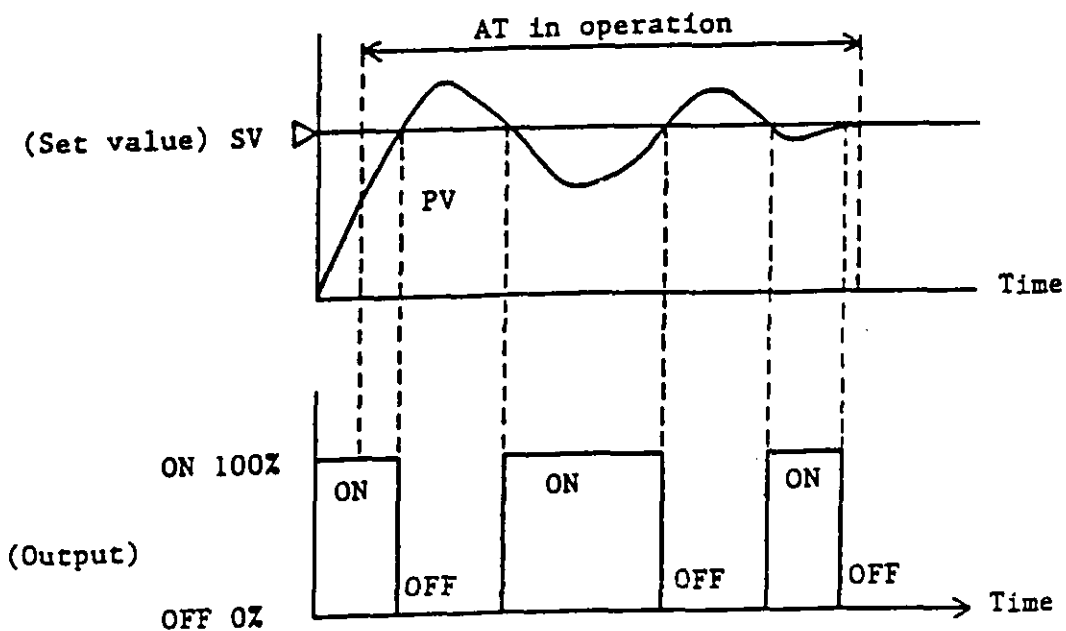


Fig. 2-1

Low PV type

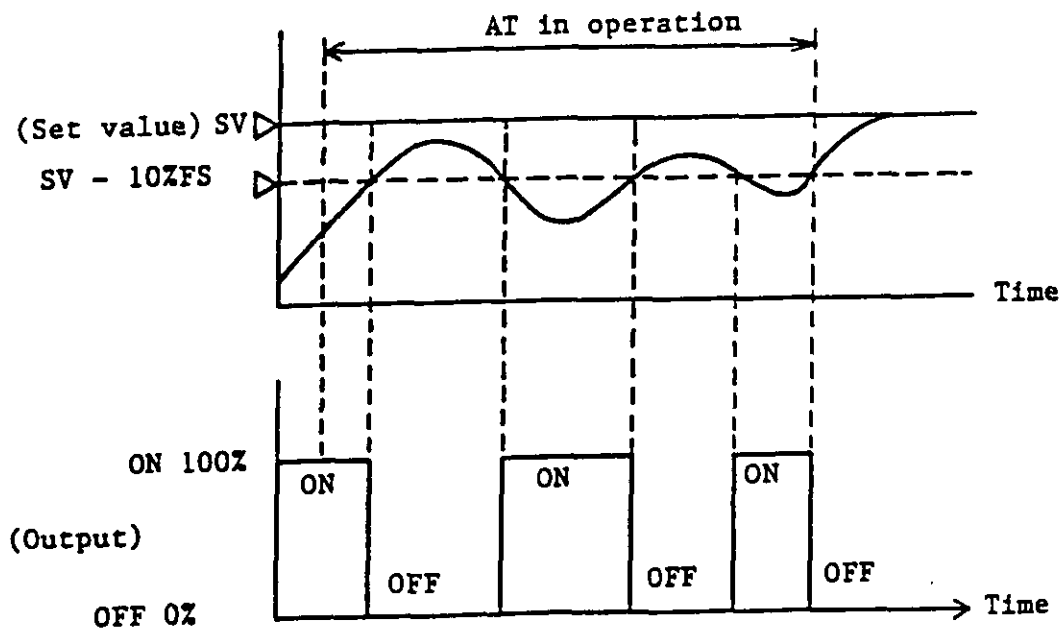


Fig. 2-2

List of parameters

Table 2-1

Parameter symbol	Item	Meaning	Description	Initial value prior to delivery
SV	SV	Set value	Settable within the input range	Ordering specification
P	P	Proportional band	Setting range: 0.0 to 999.9% 2-position action* at "0" setting (TC should also be set to "0").	3
I	I	Integral time	Setting range: 0 to 9999 sec. Integral action is OFF at "0".	0
D	D	Derivative time	Setting range: 0 to 3600 sec. Derivative action* is OFF at "0".	0
AL	AL	Low	Settable within the input range. Not indicated without alarm function.	0
AH	AH	High	Settable within the input range. Not indicated without alarm function.	0
TC	TC	Control cycle of control output 1	Setting range: 0 to 150 sec. "0" means 0.5 sec. Set to "0" at P = 0. Not indicated at current output.	Contact output : 30 SSR drive output: 1
Srr	Srr	SV ramp rate	Setting range: 1 to 999°C or °F /min. 0.1 to 99.9°C/min. Function is off when set to "0"	0
Hb	Hb	Heater break alarm	Setting range: 0 to 50.0A. See Page 5-1 for setting. Alarm function is OFF at "0.0" Not indicated without heater break alarm function.	1.0
AT	AT	Auto tuning	Used for automatic setting PID parameters. 0: Disable 1: Standard type autotuning 2: Lower PV type autotuning	0
TC2	TC2	Control cycle of control output 2	Setting range: 0 to 150 sec. "0" means 0.5 sec. Not indicated without function of control output 2 and at current output.	Contact output : 30 SSR drive output: 1
COOL	COOL	Proportional band coefficient for cooling output	Setting range: 0.1 to 100.0 Not indicated without function of control output 2	1.0
db	db	Proportional band shift for cooling output	Setting range: -50.0 to +50.0 Not indicated without function of control output 2	0.0
LoC	LoC	Key lock	Data setting inhibit 0: Release (all data settable) 1: Inhibit changing the all data 2: Inhibit changing the all data other than set value (SV)	0

\* 2-position action (ON-OFF action): Control output turns ON or OFF by comparing PV with SV

NOTE: When SV RAMP function is selected parameter Srr is displayed at the location of the parameter Hb.

## Setting of set value (SV)

Table 2-2

Contents of operation	Setting of SV to 250					
Key operation	Description	Indication				
<p><b>SV</b></p> <p>(<b>PV/SV</b>) for FY24</p>	<p>o Press the <b>SV</b> key to indicate set value.</p> <p>(This operation can be omitted when a set value is indicated.)</p>	<p>SV <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td> </td><td>0</td></tr></table></p>				0
			0			
<p><b>△</b> <b>△</b> <b>△</b></p>	<p>o Press <b>△</b> key of any digit to be set. In this example, the <b>△</b> key of 10-digit is pressed. The 10-digit indication flickers.</p>	<p>SV <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td><u>0</u></td><td>0</td></tr></table></p>			<u>0</u>	0
		<u>0</u>	0			
<p><b>△</b> <b>△</b> <b>△</b></p>	<p>o Press the <b>△</b> key (5 times) to indicate "5". (<u>0-1-2-3-4-5</u>)</p>	<p>SV <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td><u>5</u></td><td>0</td></tr></table></p>			<u>5</u>	0
		<u>5</u>	0			
<p><b>△</b> <b>△</b> <b>△</b></p>	<p>o Press <b>△</b> key of 100-digit. The 100-digit indication flickers.</p>	<p>SV <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td><u>0</u></td><td>5</td><td>0</td></tr></table></p>		<u>0</u>	5	0
	<u>0</u>	5	0			
<p><b>△</b> <b>△</b> <b>△</b></p>	<p>o Press the <b>△</b> key (2 times) to indicate "2". (<u>0-1-2</u>)</p>	<p>SV <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td><u>2</u></td><td>5</td><td>0</td></tr></table></p>		<u>2</u>	5	0
	<u>2</u>	5	0			
<p><b>EXT</b></p>	<p>o Press the <b>EXT</b> key. The indication stops flickering and the set value 250°C is indicated.</p> <p>- Operation is completed.</p>	<p>SV <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td>2</td><td>5</td><td>0</td><td> </td></tr></table></p>	2	5	0	
2	5	0				

## Setting of low alarm (AL)

Table 2-3

Contents of operation	Setting of low alarm to 100					
Key operation	Description	Indication				
<p><b>SEL</b></p>	<p>o Press the <b>SEL</b> key to indicate AL.</p>	<p>AL <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td> </td><td> </td></tr></table></p>				
<p><b>DATA</b></p>	<p>o Press the <b>DATA</b> key to indicate data. Initial value "0" is displayed.</p>	<p><table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td> </td><td>0</td></tr></table></p>				0
			0			
<p><b>△</b> <b>△</b> <b>△</b></p>	<p>o Press <b>△</b> key of any digit to be set. In this example, the indication of 100-digit flickers.</p>	<p><table border="1" style="display: inline-table; vertical-align: middle;"><tr><td><u>0</u></td><td>0</td><td>0</td><td> </td></tr></table></p>	<u>0</u>	0	0	
<u>0</u>	0	0				
<p><b>△</b> <b>△</b> <b>△</b></p>	<p>o Press the <b>△</b> key (once) to indicate "1". (<u>0-1</u>)</p>	<p><table border="1" style="display: inline-table; vertical-align: middle;"><tr><td><u>1</u></td><td>0</td><td>0</td><td> </td></tr></table></p>	<u>1</u>	0	0	
<u>1</u>	0	0				
<p><b>EXT</b></p>	<p>o Press the <b>EXT</b> Key. Indication stops flickering and the alarm set value "100" is indicated. The indication is shifted automatically to the next parameter.</p>	<p>AL <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td> </td><td> </td></tr></table></p>				

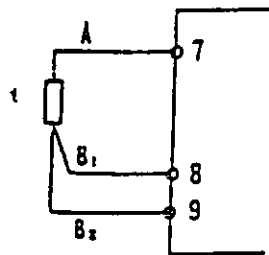
### 3. FAULT INDICATION

The controller has a fault indicating function so that the cause of fault can be removed quickly. After the cause has been removed, be sure to turn off and then turn on the power switch.

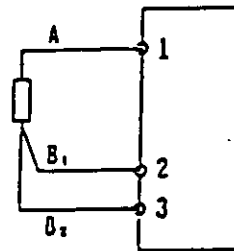
Table 3-1

Indication	Cause	Control output
UUUU	<ul style="list-style-type: none"> <li>① Burnout of thermocouple sensor (upscale burnout)</li> <li>② Burnout of resistance bulb sensor (upscale burnout)</li> </ul>	<ul style="list-style-type: none"> <li>① In case of upscale burnout OFF or less than 4 mA in reverse action ON or more than 20 mA in normal action</li> </ul>
LLLL	<ul style="list-style-type: none"> <li>① Burnout of thermocouple sensor (downscale burnout)</li> <li>② Burnout of resistance bulb sensor (downscale burnout)</li> <li>③ Short-circuit of resistance bulb sensor (between A and B) <span style="float: right;">Note)</span></li> </ul>	<ul style="list-style-type: none"> <li>② In case of downscale burnout ON or more than 20 mA in reverse action OFF or less than 4 mA in normal action</li> </ul>
UUUU	<ul style="list-style-type: none"> <li>① PV reading is more than 130% FS</li> </ul>	Goes on control
LLLL	<ul style="list-style-type: none"> <li>① PV reading is less than -30% FS</li> </ul>	
HB lamp ON	Heater burnout	Normal control

Note)



PYZ7



PYZ4  
PYZ5  
PYZ9

#### 4. USE OF DUAL OUTPUT TYPE (OPTION)

##### (1) Function description

The dual output type has 2 control outputs for one input signal and set value (SV). Control output 1 is used for heating, while control output 2 is used for cooling, respectively. Output signal is any combination with contact output, SSR drive output and DC 4-20mA output which are available according to the code symbols. The dual output type has the parameters TC2, cool, db in addition to those of the standard type.

In the dual type, the proportional band of control output 1 is  $P/2$ . The proportional band of control output 2 is described below. However, the max. value should be limited to  $P/2$ .

Example: In case of  $P = 20(\%)$  and  $\text{cool} = 0.5$   
proportional band of control output 2  
 $= 20 \times 0.5 = 10(\%)$

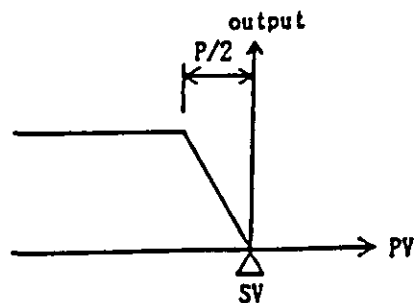


Fig. 4-1

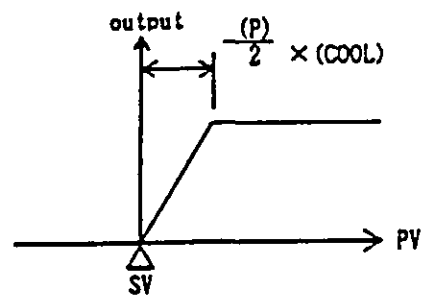


Fig. 4-2

The control output 2 value corresponding to deviation can be changed. This can be changed according to setting of parameter dB.

(When dB is plus)

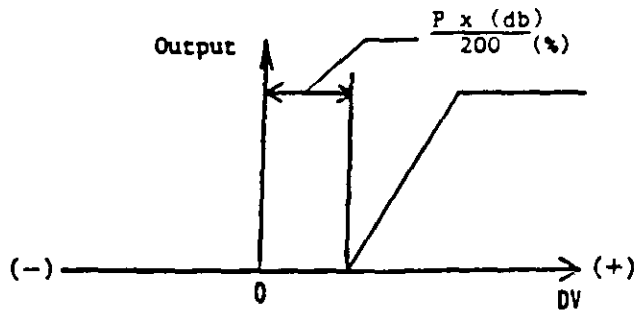


Fig. 4-3

(When dB is minus)

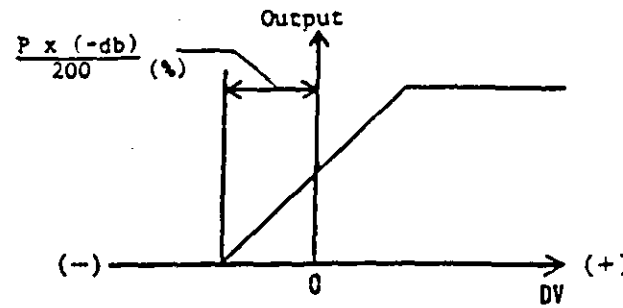


Fig. 4-4

(2) The tuning of dual output type

In the dual output type controller, the PID autotuning is not effective.

Then set PID parameters, parameter cool and parameter dB with front panel keys.

## 5. RAMP SV FUNCTION

RAMP SV is optional function. When RAMP SV function is orderd, HEATER BREAK ALARM is not available and when HEATER BREAK ALARM is orderd RAMP SV function is not available.

### PRODUCT CODING:

PYZ~~xxxx~~1-□V

- 0 no optional function
- 1 H/L alarm
- 2 Heater break alarm
- 3 H/L alarm and  
Heater break alarm
- 4 RAMP SV
- 5 H/L alarm and  
RAMP SV

### Operation of the RAMP SV function

Set proper ramp rate by the parameter Srr. Enter a new SV, then SV indicator indicates new SV. But real SV increments or decrements with ramp rate (Srr) value toward the new SV (the real SV is not indicated). When the new SV is entered, SV indicator LED goes on flashing untill real SV reaches to the new SV.

Srr is located at the next of HYS in the primary menu (tuning parameter).

Range of Srr: 1 to 999 °C/°F or  
0.1 to 99.9 °C  
and 0 or 0.0 is nonramping

It is possible to start automatically ramping SV when power on. The parameter rS determines the starting mode.

rS: 0 Initial SV starting  
1 Ramping SV start  
from initial PV

The parameter rS is located at the next of P-48 in the secondary menu (configuration parameter).

NOTE: When AUTOTUNING is done, ramping SV is inhibited.



## 6. CHANGE OF FUNCTIONS

The functions of this controller can be changed by the user, if desired. To change the functions, the second parameter should be called out.

### 6.1 Kinds of second parameter and meanings

Table 6-1 shows a list of second parameters and their meanings.

To call out of second parameter, operate the keys in the following order.

After the parameter "P" has been selected, press the SEL key for about 5 seconds. In this way, the indicator shows "P-n1" and the controller is set in the second parameter mode. To return to the first parameter mode, display "P-n1" and then press the SEL key for about 5 seconds.

### 6.2 Function setting

#### (1) Method of changing input specifications

Input can be changed shown below.

##### (a) Change of thermocouple type

Select the parameter P-n2. Set the code of desired thermocouple.

##### (b) Change from the thermocouple to resistance bulb.

Select the parameter P-n2. Set the code of resistance bulb. Change the position of internal switch to RTD position.

##### (c) Change from resistance bulb to thermocouple

Select the parameter P-n2

Set the code of desired thermocouple.

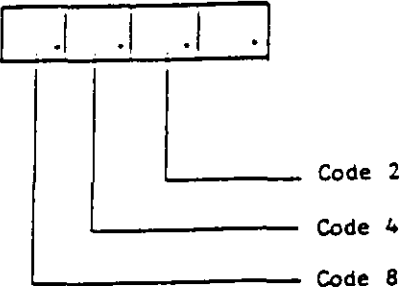
Change the position of internal switch to TC position.

- (d) Change from DC 1-5V DC input to DC 4-20 mA DC input  
Connect a resistor (250 $\Omega$ ) to input terminal. The resistor should be purchased by user.
- (e) Change from 4-20 mA DC to 1-5V DC  
Remove the resistor (250 $\Omega$ ) connected at input terminals.
- (f) Change from thermocouple or resistance bulb to 1 - 5 V DC or 4 -20 mA DC.  
In this case, changing is not usable.

For input type code, refer to table 6-2. For changeover of internal switch, refer to Fig. 6-1 through 6-4.

Second parameter list

Table 6-1

Parameter symbol	Item	Meaning	Description	Initial value
P-n1	P-n1	Control action	Setting of direct/reverse action, and setting of input direction at input burnout	Ordering specification
P-n2	P-n2	Input type		Ordering specification
P-dF	P-dF	Input filter response time	Half of data value is 63% response time (Code 0 to 201)	Code 4 (2 Sec)
P-SL	P-SL	Lower limit of input range		Ordering specification
P-SU	P-SU	Upper limit of input range		Ordering specification
P-Ab	P-Ab	Alarm type	Shown on page 6-8	Function code 79
P-An	P-An	Hysteresis of alarm	Setting range: 0-255°C/°F	1
P-dP	P-dP	Decimal point position	Selection of the position of decimal point indicated by seven segment LED 	Ordering specification
P-48	P-48		Setting need not be changed.	PYZ4 ... 3 PYZ5, 7, 9 ... 2
rS	rS	SV start mode at power-on	0:Initial SV starting 1:Ramping SV start from initial PV toward initial SV	
PVOF	PVOF	PV offset	PV indicated value is changed, however PV is unchanged. (Setting range: -1999 to +2000)	0
SVOF	SVOF	SV offset	SV value is changed, however SV indicated value is unchanged. (Setting range: -1999 to +2000)	0
P-F	P-F	°C/°F selection	°C: 0 °F: 1 $PV(^{\circ}F) = \frac{9}{5}PV(^{\circ}C) + 32$	Ordering specification

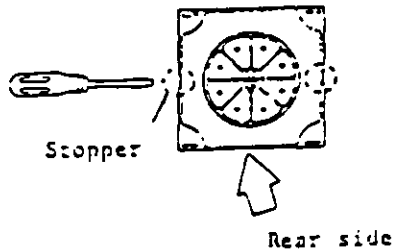
NOTE:When SV RAMP function is selected parameter rS is displayed at the location of the parameter P-CT.

# Input type and code

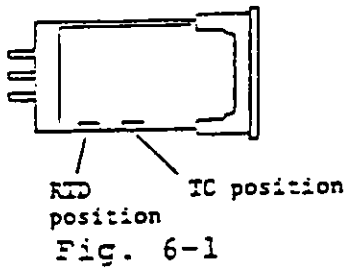
Table 6-2

Input type		Code
PT100/IEC		1
TC	J	2
	K	3
	R	4
	B	5
	S	6
	T	7
	E	8
1 to 5V DC		31
4 to 20mA DC		31

**RYZ4**  
(socket type)

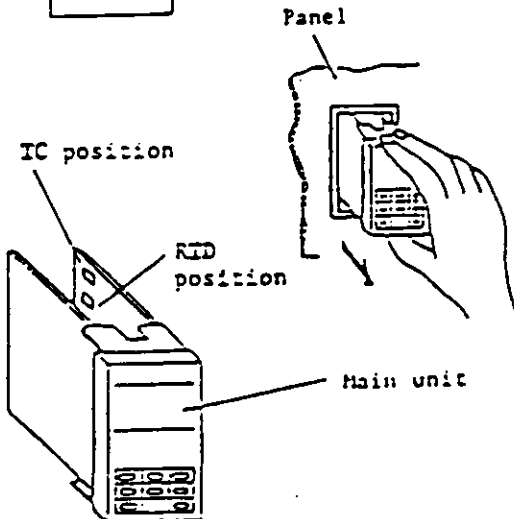


Attach a flat blade screwdriver to the hooks on the rear at the left and right sides to open the case, then push the inside of the main unit with finger tip.



Set the small socket to RTD position or IC position.

**PYZ5**

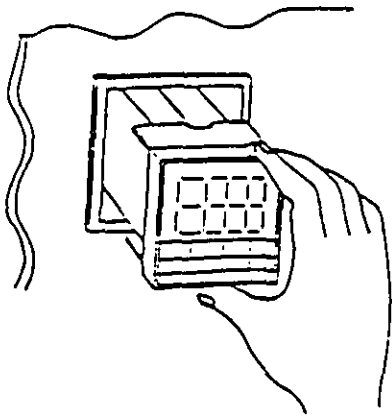


Push down until the lock is released.

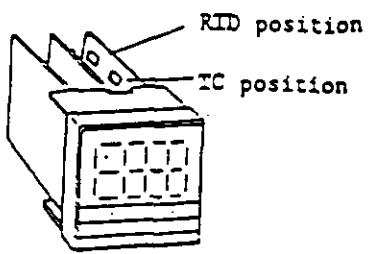
Set the small socket to RTD position or IC position.

Fig. 6-2

PYZ7



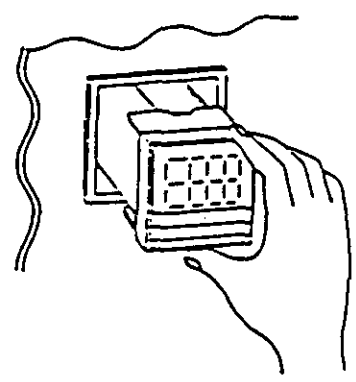
Push down until the lock is released.



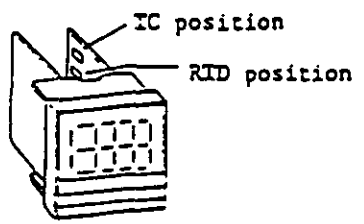
Set the small socket to RID position or TC position.

Fig. 6-3

PYZ9



Push down until the lock is released.



Set the small socket to RID position or TC position.

Fig. 6-4

(2) Change of control action

Select the second parameter "P-n1" and set the function code as shown in Tables 6-3 and 6-4.

Definition of reverse action and direct action

o Reverse action

This is used to control temperature by heating. When the temperature is higher than the set value, the controller output decreases.

o Direct action

This is used to control temperature by cooling. When the temperature is higher than the set value, the controller output increases.

For wire-break of thermocouple input and RTD input, the input value becomes the value specified by burnout direction.

As a result, when wire-break direction is set to upper limit and control output is set to reverse action, for example, the control output goes to lower limit in wire-break of input..

Table 6-3

Standard type					
Function code	Burnout direction	Control output 1	Function code	Burnout direction	Control output 1
0	Upper limit	Reverse action	1	Lower limit	Reverse action
16	Upper limit	Direct action	17	Lower limit	Direct action

Table 6-4

Dual output type							
Function code	Burnout direction	Control output 1	Control output 2	Function code	Burnout direction	Control output 1	Control output 2
2	Upper limit	Reverse action	Direct action	3	Lower limit	Reverse action	Direct action
18	Upper limit	Direct action	Direct action	19	Lower limit	Direct action	Direct action
34	Upper limit	Reverse action	Reverse action	35	Lower limit	Reverse action	Reverse action
50	Upper limit	Direct action	Reverse action	51	Lower limit	Direct action	Reverse action

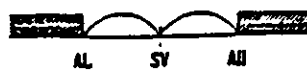

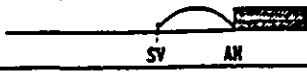
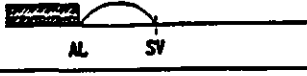

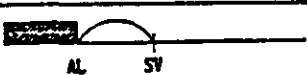


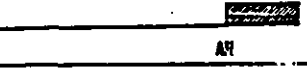
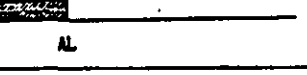
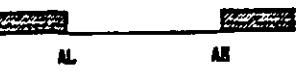
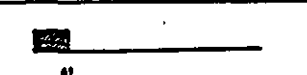
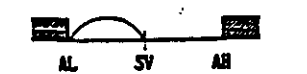
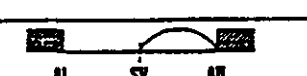
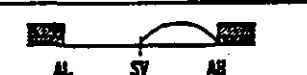
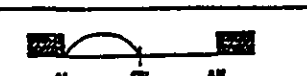
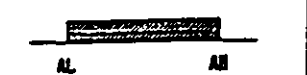

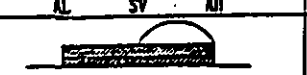

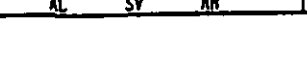
## (3) Change of alarm operation (option)

Alarm operation has 18 types of functions.

Select the second parameter "P-Ab" and set the function code as shown in Table 6-5. Then the alarm type can be changed.

The low alarm hold function inhibits the low alarm output when the power of the controller is turned on.

Table 6-5

Function		Action	Function code	Description	
Deviation alarm	High/low alarm Without low alarm hold		15	Upper limit (H) and lower limit (L) for set value (SV). Alarm output is ON in the hatched area  .	
	High alarm		10		
	Low alarm Without low alarm hold		5		
	High/low alarm With low alarm hold		79		
	Low alarm With hold		69		
Absolute value alarm	High/low alarm Without low alarm hold		3	Upper limit (H) and lower limit (L) within the range (0-100%) Alarm output is ON in the hatched area  .	
	High alarm		2		
	Low alarm Without low limit hold		1		
	High/low alarm With low alarm hold		67		
	Low alarm With low alarm hold		65		
Absolute value + Deviation alarm	Absolute value	Deviation		7	Alarm output is ON in the hatched area.
	High alarm	Low alarm		11	
	Low alarm	High alarm		75	
	Low alarm With low alarm hold	High alarm		71	
Zone alarm	Low alarm	High alarm		179	Alarm output is ON within the range between low alarm set value and high alarm set value.  Alarm is output to Alarm 2 terminal (PYZ5, PYZ7, PYZ9)
	Absolute value	Absolute value		183	
	Deviation	Absolute value		187	
	Absolute value	Deviation		191	
	Deviation	Deviation		191	



# 7. OUTLINE DIMENSIONS AND PANEL CUTOUT

(Unit: mm)

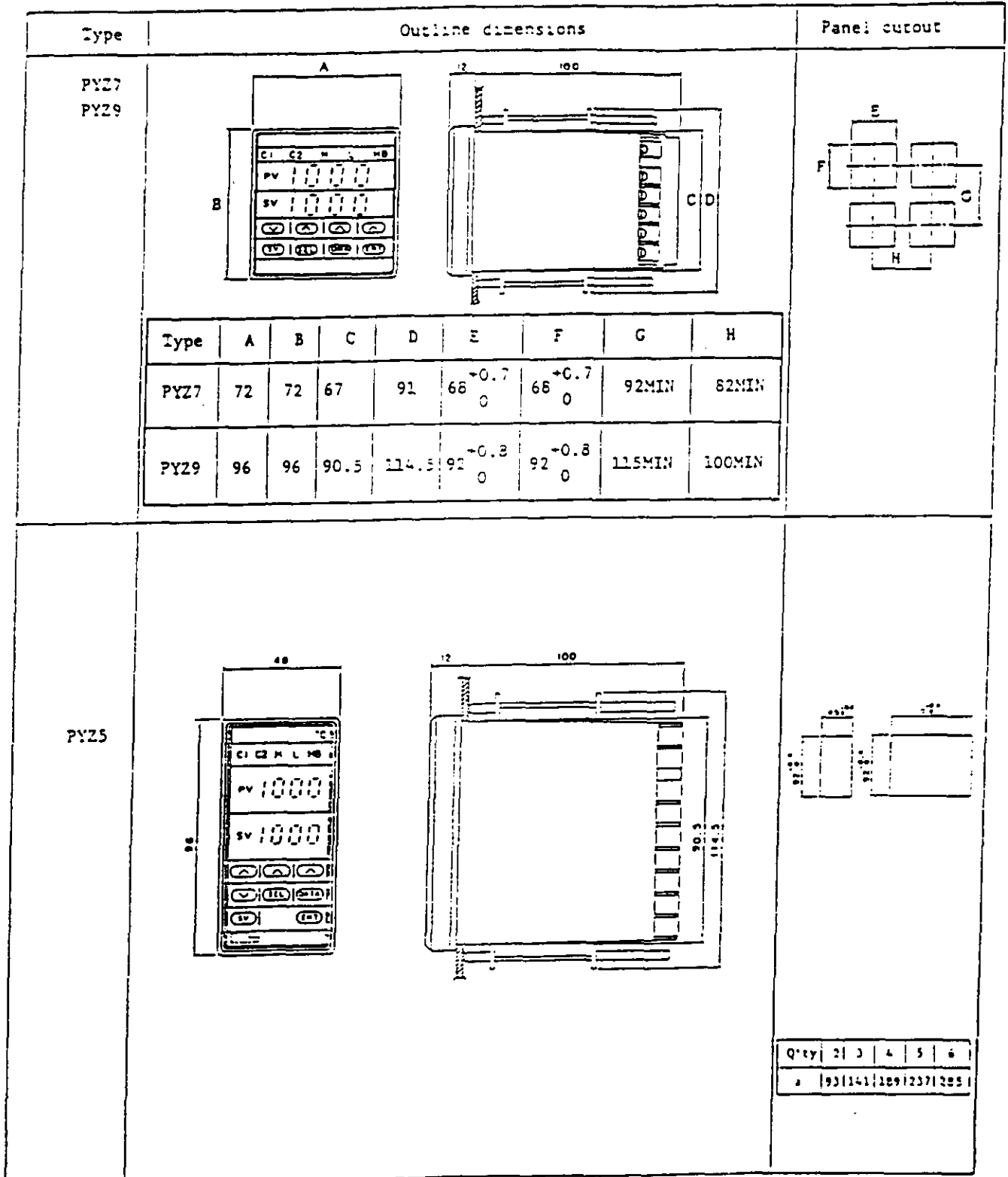


Fig. 7-1

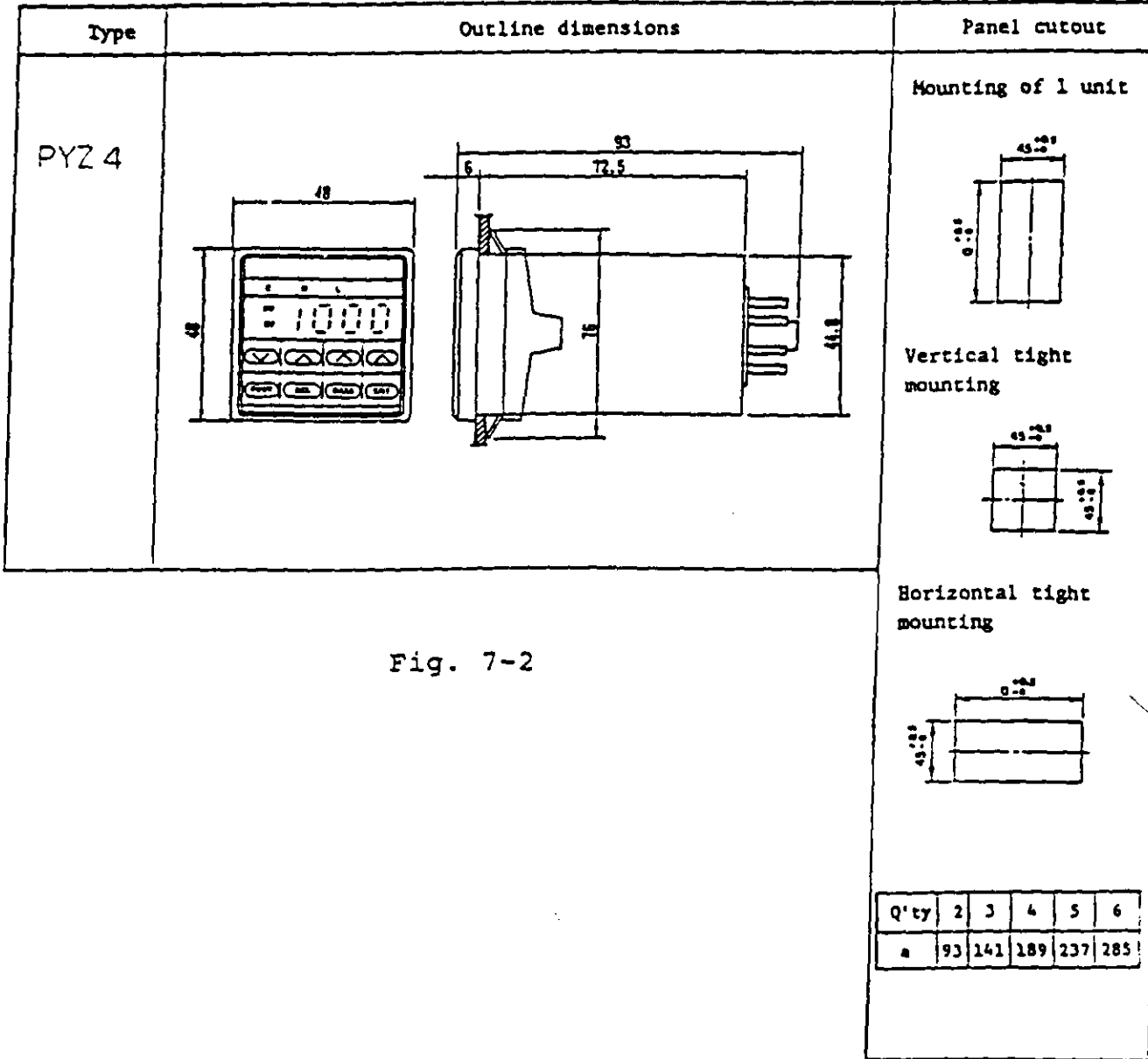


Fig. 7-2

## 8. TERMINAL CONNECTION DIAGRAM

PYZ4\*\*\*\*-0\*

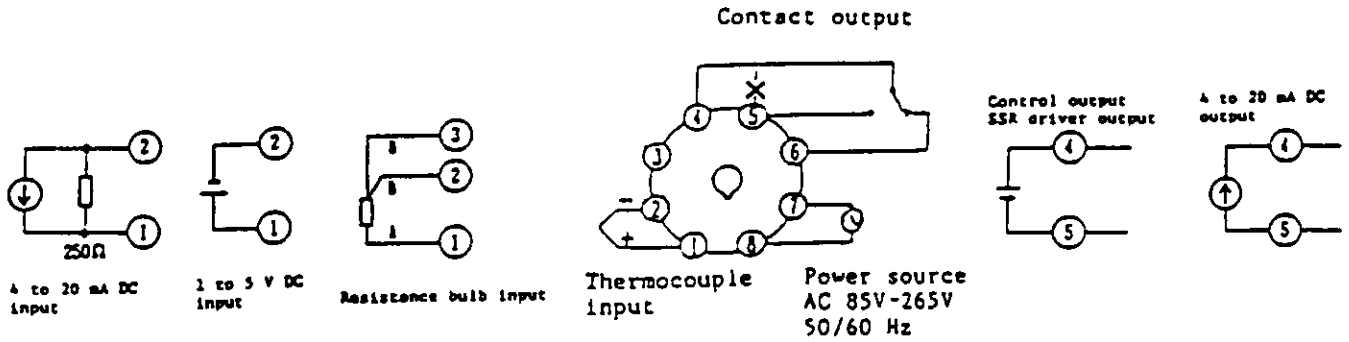


Fig. 8-1

PYZ4\*\*\*\*-1\*

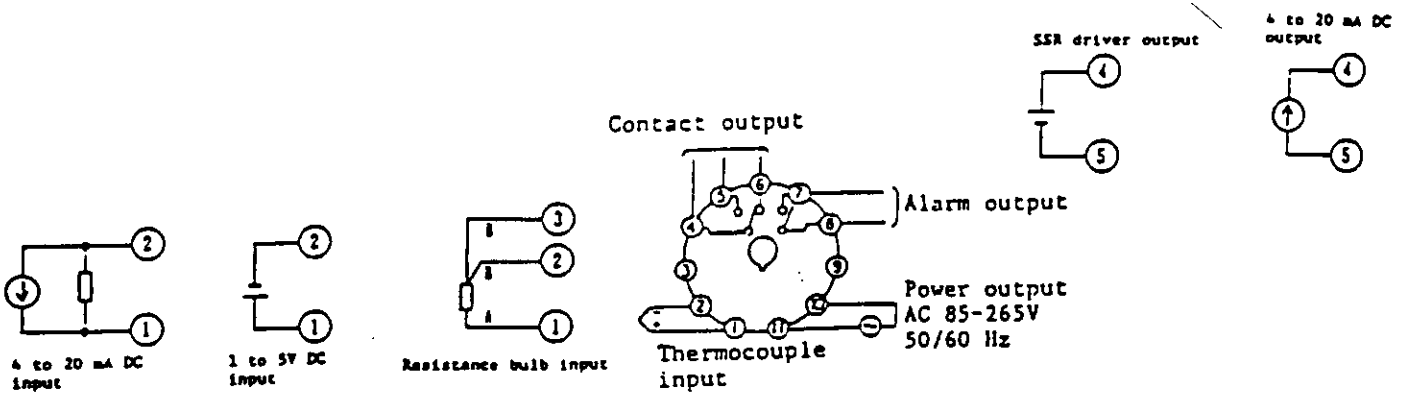


Fig. 8-2

PYZ5, 9

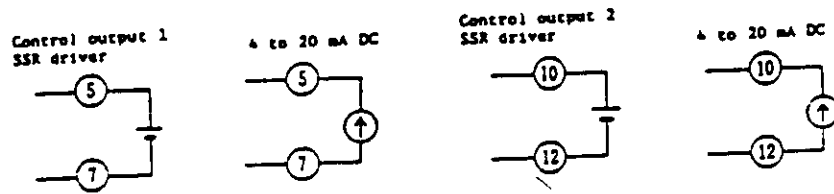
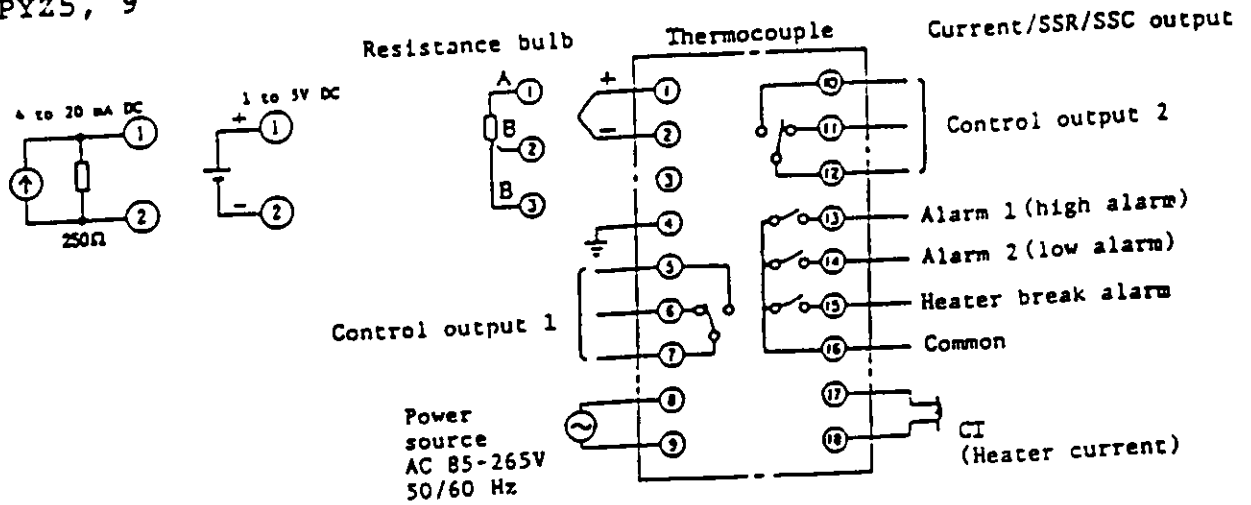


Fig. 8-4

PYZ7

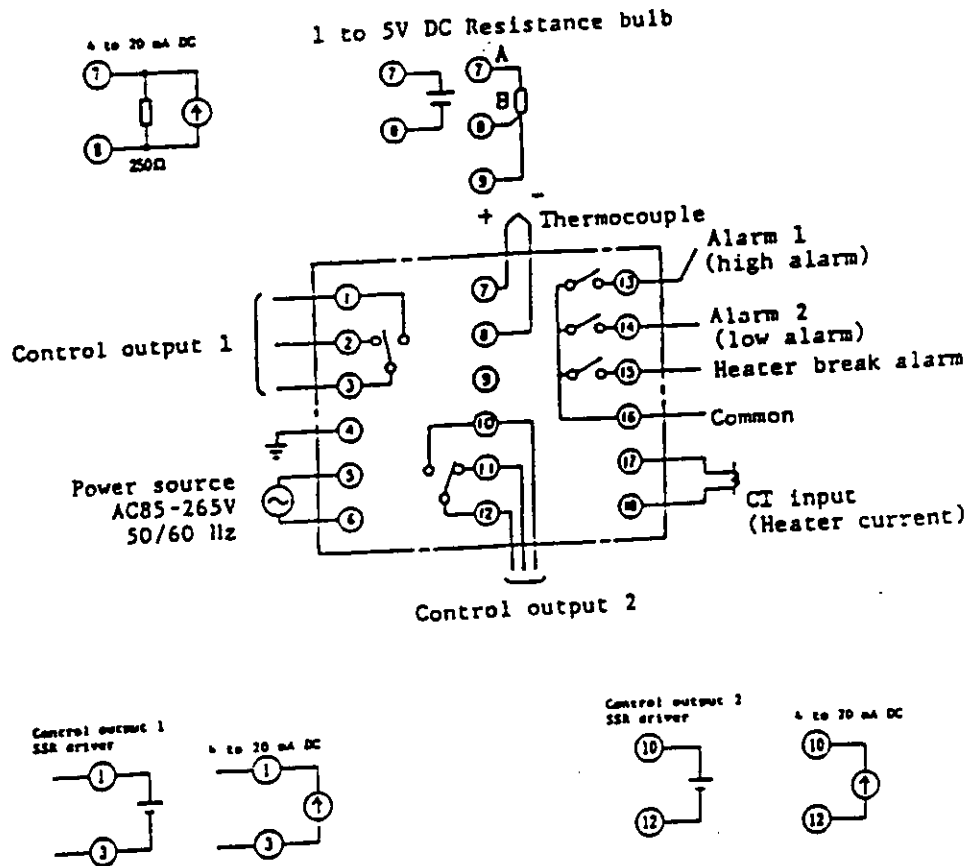


Fig. 8-5

## 9. CONTROL/ALARM OUTPUT AND INDICATING LAMP

o Output and indication during operation

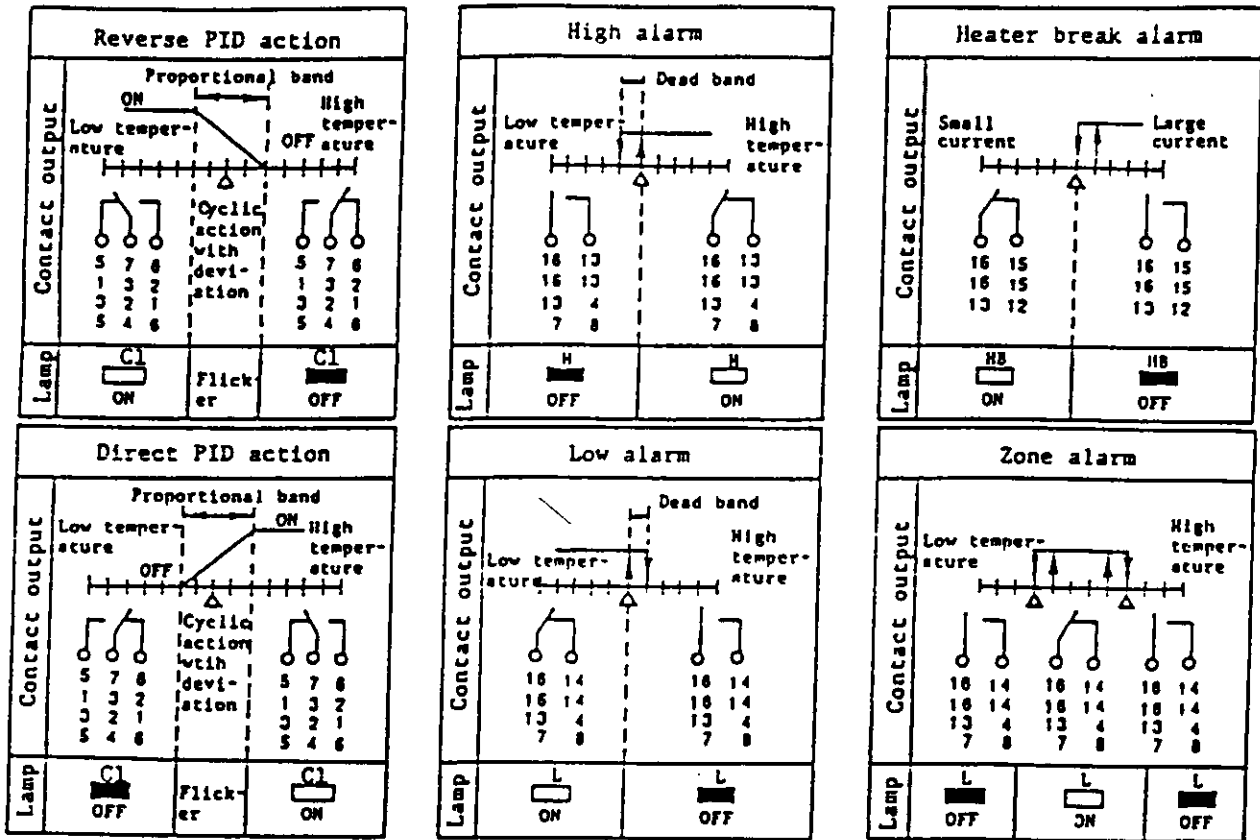


Fig. 9-1

o Output and indication at power OFF

(Note) Terminal No. varies with type of instrument.

Terminal No.:

Uppermost ... PYZ5, 9

Upper ..... PYZ7

Lower ..... PYZ4\*\*\*\*-2\*,

PYZ4\*\*\*\*-3\*

Lowermost ... PYZ4\*\*\*\*-0\*,

PYZ4\*\*\*\*-1\*

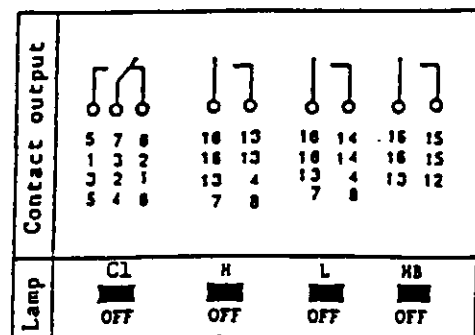
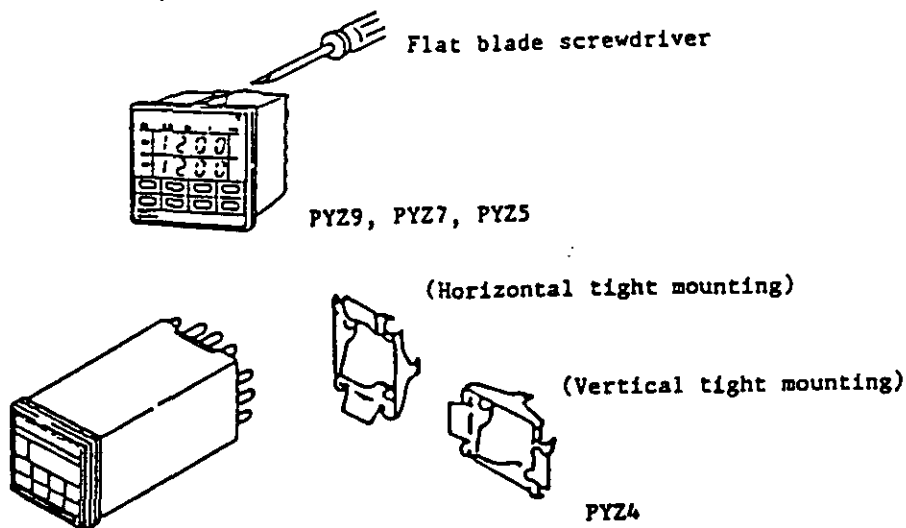


Fig. 9-2

## 10. CAUTIONS FOR INSTALLATION AND WIRING

### o Installation

- . The front panel size of the instrument and the panel mounting size conform to DIN43700 Standards.
- . Recommended panel of PYZ9, PYZ7 and PYZ5 is 1-8 mm thick and the recommended panel of PYZ4 is 1-3.2 mm thick.
- . For installation of PYZ9, PYZ7 and PYZ5, attach the mounting brackets (two) on the top and bottom and tighten with a flat blade screwdriver to the torque of about 1.5 kgcm.  
(Plastic case is used. Do not tighten excessively.)

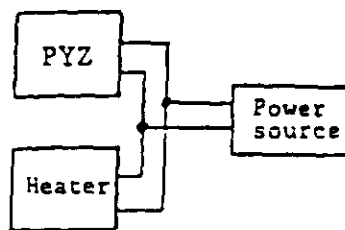


### o Environment of installation location

- . Do not install in a place with corrosive gases (sulfuric gas, ammonia, etc.)
- . Do not install in a place subject to vibration, impact, water or high temperature.
- . Do not install in a place where ambient temperature changes suddenly or radiation from furnace is present. Ambient temperature of installation location should be  $-10$  to  $+50^{\circ}\text{C}$ .

o Wiring

- . For thermocouple input, connect the specified compensating lead wire.
- . For resistance bulb input, use a lead wire having a small resistance.
- . For instrument with heater break alarm, use the same power source for the heater and the controller to minimize the variation of alarm operating point due to power voltage.



o Use of controller output for sequence circuit

- . When power is ON, it takes about 4-5 seconds until the internal relay starts operating. This should be taken into account when using the controller contact output for the sequence circuit.

o Wiring of load circuit

- . A load connected to the control output should be used within the rating. If it exceeds the rating, it should be connected through a contactor having a larger rating.

The contact output type has its own operating life so the control cycle (TC and TC2) should be extended so as not to affect the control function. In the case of the 2-position control, the hysteresis width should be increased making sure that it does not affect the control function. Also, care should be taken with regard to the alarm output and heater break alarm output when using.

Contact output life:

Mechanical ... More than  $10^7$  cycles  
(at no load)

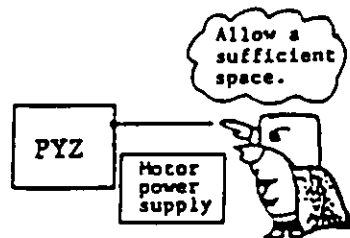
Electrical ... More than  $10^5$  cycles  
(at AC 220V/3A, resistive load)

o Current output ripple

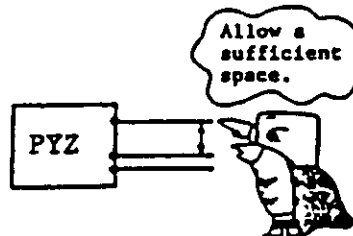
. Current output (4-20 mA DC) contains about 1.5%FS/2 Hz of ripples.

o Removal of noise

. The instrument should be installed as far as away possible from a device generating high frequency noise.



. Input signal and power cables connected to the instrument should be wired away from power line and load line to minimize inductive noise.

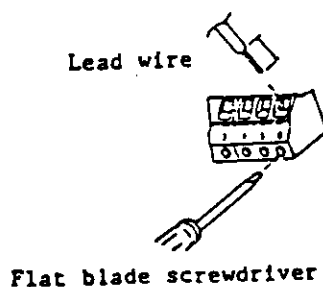


. Instrument power cable should preferably be twisted to avoid noise.





- . Use of noise filter or insulating transformer for the instrument power supply is recommended.
- o Wiring for DC 4-20 mA input
  - . When ordering instrument of DC 4-20 mA input specifications, a resistor (250Ω) will be supplied as an accessory for connection to the input terminal.
  - . When using the final control element in the non-insulated type, use the temperature sensor in non-grounding type
- o Connection of PYZ4 (with heater burnout alarm)
  - . When connecting to the terminal, remove the sheath of the cable at the end and connect it to the rod type clamping terminal as show below.

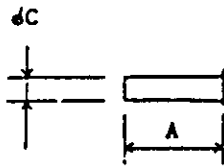


Length of lead sheath removed: 8 mm  
 Solid lead : 2.5 mm<sup>2</sup> (max)  
 Twisted lead : 1.5 mm<sup>2</sup> (max)

(AWG No. 14 or equivalent)

- . When using a twisted lead wire, care should be taken to ensure that the lead wire is not projected from the insertion hole.
- . When tightening the terminal screw, make sure that it is not tightened excessively. (Tightening torque: About 5 kg·cm)
- . When using a rod type clamping terminal, use of the following terminal is recommended.

Maker : Phenix Contact Co., Ltd.  
 Name of product: Ferrule, without insulating collar



Kind	Part No.	A (mm)	$\phi C$ (mm)
For 0.5 sq	3200218	6	1
For 0.75 sq	3200221	6	1.4
For 1 sq	3200247	6	1.6
For 1.5 sq	3200263	7	1.8

o Connection of PYZ9, PYZ7 and PYZ5

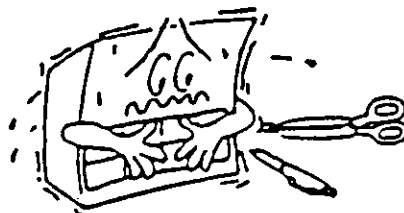
For connection, use round type or fork type M3.5 clamping terminal. The maximum outside diameter of the terminal should be less than 8 mm.

o Caution prior to use

- . To clean the front panel of the instrument, do not use benzine, thinner, etc., as it damages the panel. It should be washed with water or soapy water until the dirt and dust are removed. (The front panel of the instrument is water/dust-proof type based on IEC IP65 standards.)



- . Do not use any tool having a sharp tip when operating the keys on the front panel.



## 11. SPECIFICATIONS

Table 11-1

Input signal	Thermocouple/resistance bulb, 1 to 5V DC, 4 to 20 mA DC.
Control output signal	Contact (AC 220V, 3A, 1c contact), 4 to 20 mA DC (load resistance: less than 600Ω)  SSR drive (24V DC typ./60mA at ON, DC 0.3V max at OFF)
Control action	PID action (2-position action, proportional action possible)
Indicator accuracy	±0.5% full scale ±1 digit (better than 400°C with R, B, S thermocouple)
Operating cycle	0.5 sec
Indication system	7-segment LED, 4 digits
Effect of external resistance	About 0.5μV/Ω (Thermocouple input) Reading 0.015%/Ω (per wire), resistance bulb
Attachment	High/low alarm (PYZ4: high or low alarm)  Alarm output: AC 220V, 1A, 1a, 2 contact (PYZ4: 1 contact)  Heater break alarm (Connected to separately installed Fuji's CT)  Alarm output: AC 220V, 1A, 1a contact
Power supply	AC85-265V, 50/60 Hz
Power consumption	About 10 VA
Enclosure case	Plastic housing
Ambient temperature	-10 to +50°C
Ambient humidity	90% RH or less

Table 11-2 Input specification

Type of input	Range (°C)	Range (°F)	Remarks	
Pt 100/IEC	0 to 50 ... 400°C -150 to 200°C -100 to 50 ... 200°C	32 to 122 .... 752°F -238 to 392°F -148 to 122 ... 392°F	Accuracy at range set below the minimum range cannot be guaranteed.  $PV(^{\circ}F) = \frac{9}{5}PV(^{\circ}C) + 32$ (NBC standards)	
J	0 to 200 ... 1000°C	32 to 392, ... 1832°F		
K	0 to 200, ... 1200°C	32 to 392, ... 2192°F		
R	0 to 1000, ... 1600°C	32 to 1832, ... 2912°F		
B	0 to 1500, ... 1800°C	32 to 2732, ... 3272°F		
T	-200 to 400°C -100 to 200°C 0 to 200, ... 400°C	-328 to 752°F -148 to 392°F 32 to 392, ... 752°F		
E	0 to 200, ... 800°C	32 to 392 ... 1472°F		
S	0 to 1000, ... 1600°C	32 to 1832 ... 2912°F		
DC4 - 20mA	-1999 ... 3000 to -1999 ... 3000			Decimal point can be added.
DC1 - 5V				

# 12. ORDERING CODE

## Table 12-1

1	2	3	4	5	6	7	8	9	10	digit	Description
P	Y	Z					1	-	V		
			4								Front panel size 48 x 48 mm
			5								48 x 96 mm
			7								72 x 72 mm
			9								96 x 96 mm
	T										Input signal Thermocouple (°C)
	R										Thermocouple (°F)
	N										Resistance bulb, Pt 100, 3-wire, (IEC) (°C)
	S										Resistance bulb, Pt 100, 3-wire, (IEC) (°F)
	A										DC 1 - 5V
	B										DC 4 - 20 mA (I/V converter (250 Ω) mounted outside)
	A										Control output 1 Contact reverse PID output
	B										Contact direct PID output
	C										SSR drive reverse PID output
	D										SSR drive direct PID output
	E										DC 4-20 mA reverse PID output
	F										DC 4-20 mA direct PID output
	Y										Control output 2 (Not for PYZ4) None
	A										Contact reverse PID output
	B										Contact direct PID output
	C										SSR drive reverse PID output
	D										SSR drive direct PID output
	E										DC 4-20 mA reverse PID output
	F										DC 4-20 mA direct PID output
			0								Attachment None
			1								With high/low alarm
			2								With heater break alarm
			3								With high/low alarm + heater break alarm
			4								With ramp SV
			5								With ramp SV + high/low alarm

### Mounting socket ordering (PYZ4)

Type	Mounting	Application
ATX2PSB	Panel flush mounting	} For non alarm type
ATX1NS (US SOCKET)	Panel flush mounting	
TP28S	Wall mounting	
TP28X	Rail mounting	
TP311SB	Panel flush mounting	} For alarm type
11GB	Panel flush mounting	
TP311S	Wall mounting	
TK7A5807P9	Rail mounting	



TOTAL  
TEMPERATURE  
INSTRUMENTATION  
INCORPORATED

P.O. BOX 1073, 30 KRUPP DRIVE UNIT #1  
WILLISTON, VT 05495-1073  
PHONE: (802) 863-0085  
FAX: (802) 863-1193

Ramp to Setpoint function  
PYZ Series controllers

The ramp to setpoint function (ramp SV) is a means of controlling the rate of ascent or descent for your process. The value of this is, if properly applied, it will eliminate overshoot and undershoot problems. This is especially important with applications involving high powered heaters that tend to rise rapidly in temperature and are, thus, prone to overshooting setpoint by a considerable amount.

The heater break alarm function is not available when the ramp SV feature is ordered.

Operation of the ramp SV function

In the second menu/table of parameters you will find a parameter labeled "rs". When you have arrived at "rs", depress the data key and enter a value of 1. This will enable the ramp SV feature in your PYZ controller. If you leave this parameter set at 0 your ramp SV function will remain disabled.

In the first menu/table of parameters you will find a parameter labeled "srr". When you have arrived at "srr" you will depress the data key and enter the amount of units per minute that you wish to ramp either up or down.

For example, if you wish to go from ambient, which we will say is 70 degrees F, to a setpoint of 500 degrees F in a period of 15 minutes, you perform the following calculations:

500 - 70 = 430

430 divided by 15 minutes = 28.66 degrees rise per minute.

Thus, you would put 28 or 29 for the data entry information in "srr".

If you wish you may add a decimal point, which is reached on the second table of parameters at parameter "p-dp". By adding a decimal point you can increase the accuracy of your ramp rate. Thus, referring back to our example, you could enter 28.6 in "srr" instead of 28 or 29.

Once you have entered data in "srr" and have entered it properly into the controller, the controller must be reset (shut off then on again) in order to begin using the data.

When the ramp SV function is in operation you will note that a green LED on the right side of the "SV" display will be flashing. Once the unit has finished its ramp cycle, which will be when the controller reaches its setpoint, the green LED will cease its flashing and the controller is now out of the ramp SV mode.

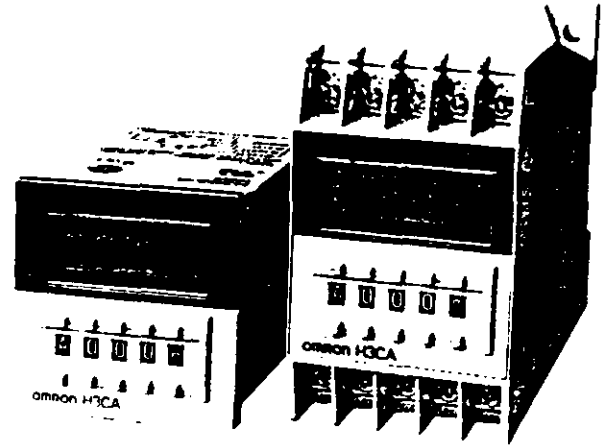
It is possible to start up in the ramp SV mode automatically by leaving the ramp SV enable function in the second table of parameters (rs) in the "1" position.

The controller will not ramp to setpoint once it has reached setpoint, as in the case of a process upset. If you are maintaining a setpoint in temperature or pressure and you suddenly have an upset and lose temperature or pressure, the controller will not ramp back to setpoint. The controller will act within the PID parameters that have been entered by the operator previously to reach its setpoint again.

**OMRON****Solid-State Timer****H3CA**

1/16 DIN, Digital-Set Timer with  
0.1 Second to 9,990 Hours Range

- 8 field-selectable operation modes
- Universal AC/DC supply voltage timers available
- Operations include ON-delay, Repeat cycle, Signal Interval/OFF-delay, Signal-OFF delay (I and II), Interval, Cycle and Signal ON-delay/OFF-delay
- Selectable no-voltage start, reset, gate and check inputs expand capabilities
- Time remaining LCD bar graph and LCD output status indicator
- Panel mounting adapters, sockets, and accessories may be ordered separately

**Ordering Information**

## ■ TIMERS

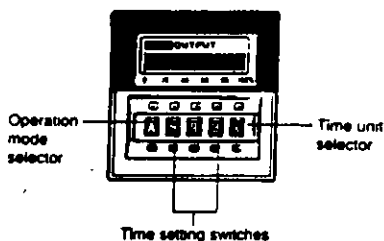
Add the supply voltage to the part number when you order ON-delay only timers H3CA-8 and H3CA-8H. For example, H3CA-8H-AC/100/110/120.

Timing function		8 field-selectable functions		ON-delay only	
Contact type	Time limit	SPDT	SPDT	SPDT	DPDT
	Instantaneous	-	-	SPDT	-
Terminal form		11-pin round socket	Front mounted screw terminals	8-pin round socket	
Part number		H3CA-A	H3CA-FA	H3CA-8H	H3CA-8
Supply voltages	AC	24 to 240 V, 50/60 Hz or		Specify 24 V, 100/110/120 V, or 200/220/240 V; 50/60 Hz	
	DC	12 to 240 V		Specify 12 V, 24 V, 48 V or 110 V	

## ■ ACCESSORIES

Description		Part number	
Sockets	H3CA-A timer	Bottom surface or track mounting, top screw terminals	P2CF-11
		Back mounting, for use with Y92F-30 mounting adapter, bottom screw terminals	P3GA-11
	H3CA-8, H3CA-8H timers	Bottom surface or track mounting, top screw terminals	P2CF-08
		Back mounting, for use with Y92F-30 mounting adapter, bottom screw terminals	P3G-08
Panel mounting adapters	Fits behind panel, ideal for side by side installation. Use P3G□-□ sockets.		Y92F-30
	Installs through panel front; timer face fits bezel, rear of timer clips to adapter. Use P3G□-□ sockets. Fits 65-66 mm (2.56 - 2.59 in) x 52-53 mm (2.04 - 2.09 in) panel cutout. Charcoal gray face plate measures 88 H x 58 W mm (3.46 x 2.28 in).		Y92F-70
	Installs through panel front; timer face fits bezel, rear of timer clips to adapter. Use P3G□-□ sockets. Fits 55 x 45 mm (2.17 x 1.77 in) panel cutout. Charcoal gray face plate measures 58 H x 50 W mm (2.28 x 1.97 in).		Y92F-71
Protective cover	Hard plastic cover; not for use with Y92F-70 or Y92F-71 panel adapters.		Y92A-48B
	Soft plastic cover; not for use with Y92F-70 or Y92F-71 panel adapters.		Y92A-48D
Mounting track	DIN rail, 50 cm (1.64 ft) length		PFP-50N
	DIN rail, 1 m (3.28 ft) length		PFP-100N
	End plate		PFP-M
	Spacer		PFP-S

## ■ RANGE AND OPERATION MODE SELECTION



Time unit	Timing range
0.1 s	0.1 to 99.9 seconds
s	1 to 999 seconds
0.1 m	0.1 to 99.9 minutes
m	1 to 999 minutes
0.1 h	0.1 to 99.9 hours
h	1 to 999 hours
10 h	10 to 9990 hours

Mode	Operation
A	ON-delay
B	Repeat cycle
C	Signal Interval/OFF-delay
D	Signal OFF-delay I
E	Interval
F	Cycle
G	Signal ON-delay/OFF-delay
H	Signal OFF-delay II

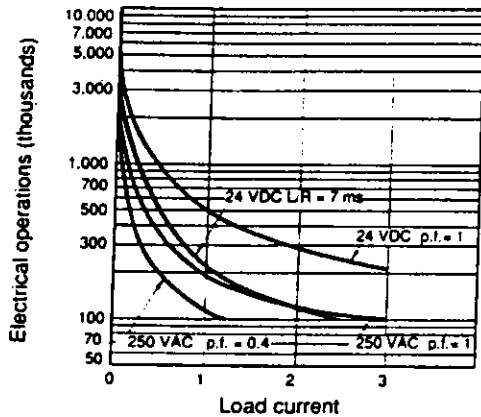
## Specifications

Part number		H3CA-A	H3CA-FA	H3CA-8H	H3CA-8
Supply voltage	AC	24 to 240 V, 50/60 Hz		24 V, 100/110/120 V, 200/220/240 V; 50/60 Hz	
	DC	12 to 240 V		12 V, 24 V, 48 V, 110 V, (permissible ripple factor: 20% max. using single-phase, full-wave rectified power sources)	
Operating voltage		90 to 110% of rated voltage			
Power consumption	AC	3 VA		10 VA	
	DC	3 W		2W	
Timing functions		8 field-selectable modes: ON-delay, Repeat cycle, Signal Interval/OFF-delay, Signal ON/OFF-delay, Signal OFF-delay (I and II), Interval and Cycle		ON-delay only	
Start, reset, gate inputs		No voltage	No voltage	-	-
Control output	Type	Time limit	SPDT	SPDT	DPDT
		Instantaneous	-	SPDT	-
	Max. load	3 A, 250 VAC (p.f. = 1)			
	Min. load	10 mA, 5 VDC			
Repeat accuracy		±0.3%, ±0.05 sec (includes variation due to voltage and temperature changes)			
Setting error		±0.5%, ±0.05 sec			
Resetting system		Power-OFF, external and self-reset		Power-OFF	
Resetting time		0.5 sec max.		0.1 sec max.	
Indicators		Time Remaining (LCD bar graph), Output Status (LCD message)			
Materials		Plastic case			
Mounting		Panel, track, surface			
Connections		11-pin round socket	Terminal screws	8-pin round socket	
Weight		110 g (3.9 oz)	190 g (6.7 oz)	110 g (3.9 oz)	
Approvals	UL	Recognized, File No. E41515			
	CSA	Certified, File No. LR22310			
	Others	SEV, File No. 1021			
Operating ambient temperature		-10° to 55°C (14° to 131°F)			
Humidity		35 to 85% RH			
Vibration	Mechanical durability	10 to 55 Hz; 0.75 mm (0.03 in) double amplitude			
	Malfunction durability	10 to 55 Hz; 0.5 mm (0.02 in) double amplitude			
Shock	Mechanical durability	100 G			
	Malfunction durability	10 G			
Variation due to voltage change		See "Repeat Accuracy"			
Variation due to temperature change		See "Repeat Accuracy"			
Insulation resistance		100 MΩ min. at 500 VDC			
Dielectric strength		2,000 VAC, 50/60 Hz for 1 minute between current-carrying and non-current-carrying parts and between contact and control circuit 1,000 VAC, 50/60 Hz for 1 minute between non-continuous contacts			
Service life	Mechanical	10 million operations minimum (under no load, at 1,800 operations/hour)			
	Electrical	100,000 operations minimum at maximum ratings			



# Engineering Data

## ■ ELECTRICAL SERVICE LIFE



## Timing Charts

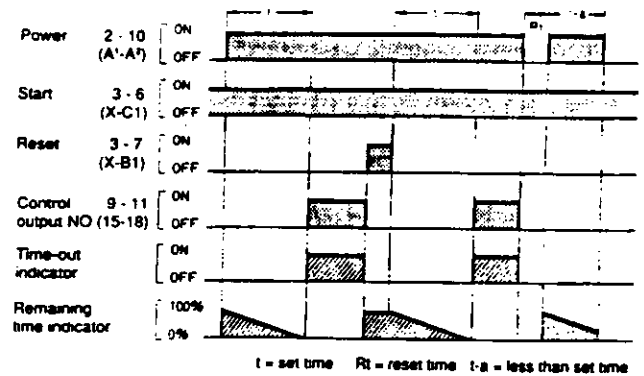
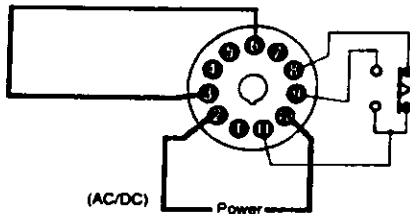
In the schematic diagrams, each thick line indicates the external wiring necessary for the selected operation.

### ■ (H3CA-A, H3CA-FA)

#### Mode A ON-Delay

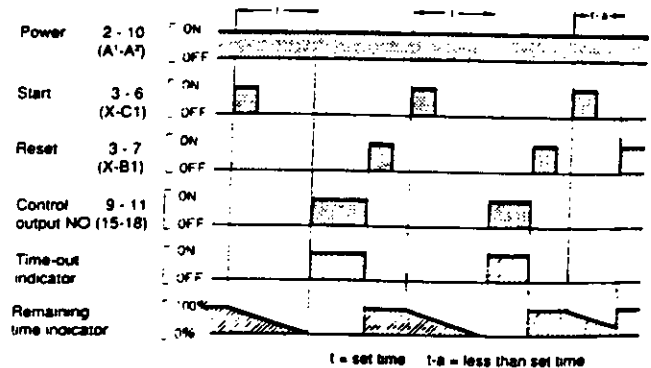
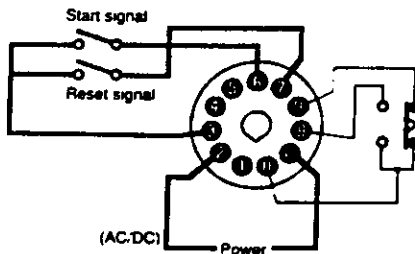
##### Power-ON Start/Power-OFF Reset

The start terminals are connected. Timing starts when power is applied. The output is energized when the accumulated time equals the set time. The output remains energized until power is disconnected or a reset input is applied.



#### Signal Start

Power is applied continuously. Timing starts at the leading edge of the start input. The output is energized when the accumulated time equals the set time. Subsequent start signals during or after timing will not be accepted. The output relay will remain energized until a reset input is applied or power is interrupted.

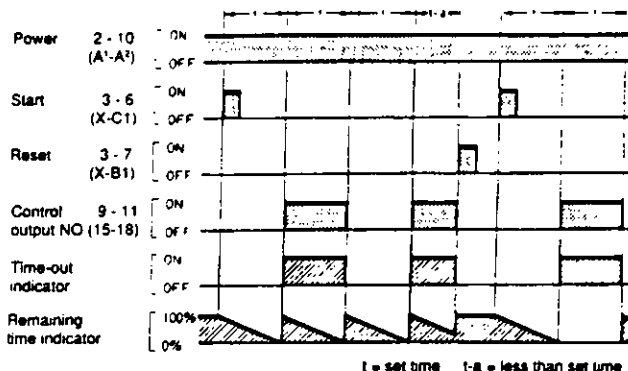
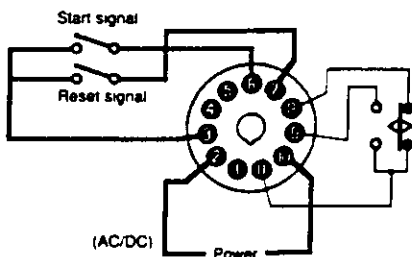


In the schematic diagrams, each thick line indicates the external wiring necessary for the selected operation.

### Mode B Repeat Cycle

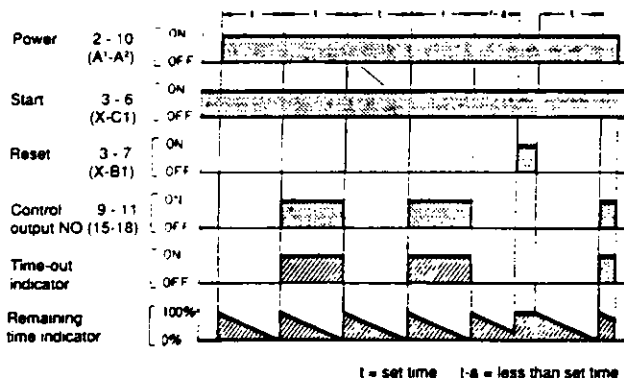
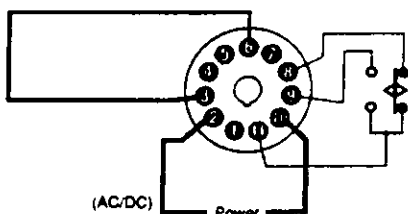
#### Signal Start

Power is continuously applied. The OFF/ON cycle is initiated at the leading edge of the start input. The output relay will be OFF for the set time and then ON for the set time. This cycle will be repeated until a reset input is applied or power is disconnected.



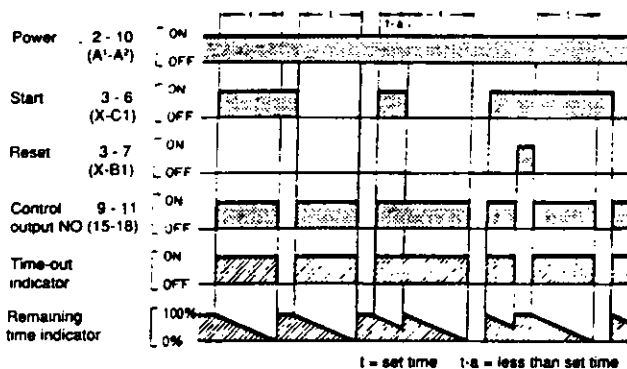
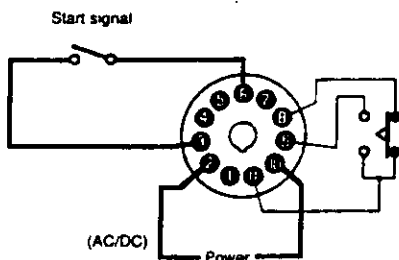
#### Power-ON Start/Power-OFF Reset

The start terminals are connected. Timing starts when power is applied. The output relay will be OFF for the set time and then ON for the set time. This cycle will be repeated until a reset input is applied or power is disconnected.



### Mode C Signal Interval/OFF-Delay

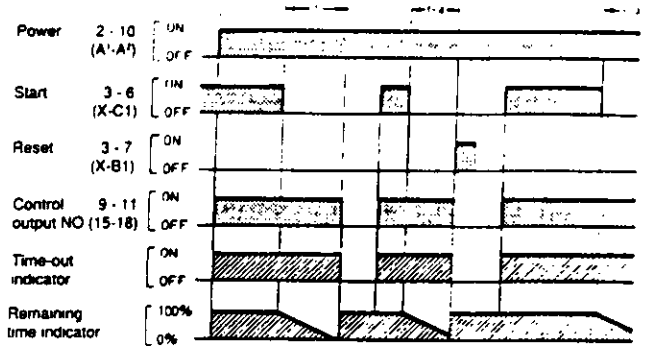
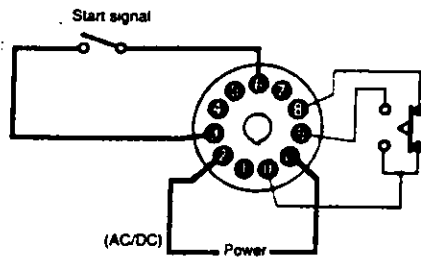
Power is continuously applied. Timing begins on both the leading and trailing edges of the start input. The output relay is energized during timing. Once the timer has timed out from the trailing edge, it resets and is ready for subsequent start inputs.



In the schematic diagrams, each thick line indicates the external wiring necessary for the selected operation.

### Mode D Signal OFF-Delay (I)

Power is continuously applied. The output relay is energized at the leading edge of the start input. Timing starts at the trailing edge of the start input. The output relay is de-energized when the accumulated time equals the set time.

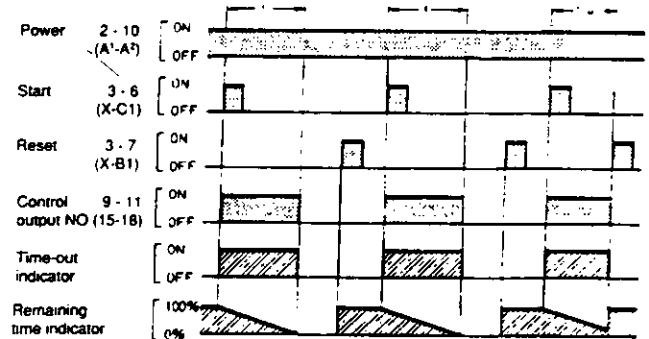
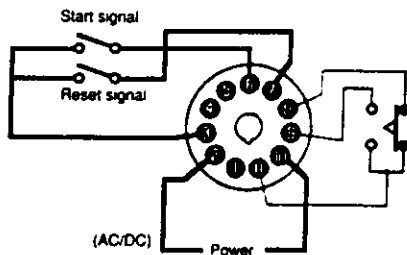


t = set time t-a = less than set time

### Mode E Interval

#### Signal Start

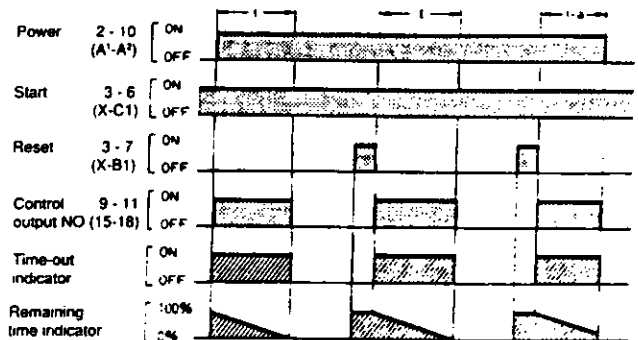
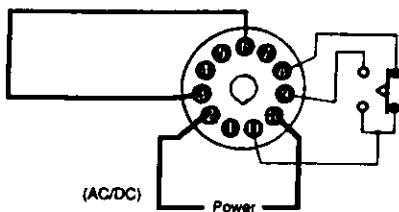
Power is applied continuously. Timing starts at the leading edge of the start input. The output relay is only energized during timing. The timer is reset when power is disconnected or a reset input is applied.



t = set time t-a = less than set time

#### Power-ON Start/Power-OFF reset

The start terminals are connected. Timing starts when power is applied. The output relay is only energized during timing. The timer is reset when power is disconnected or a reset input is applied.



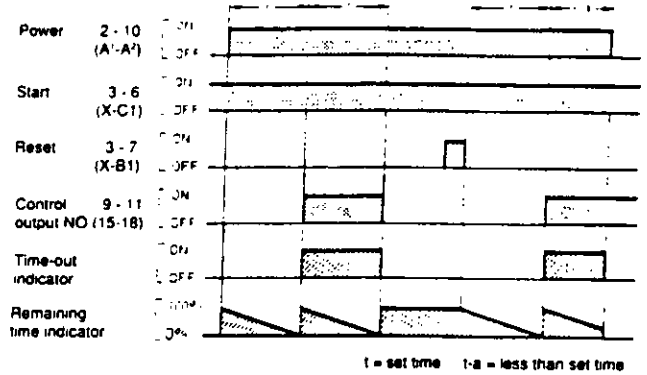
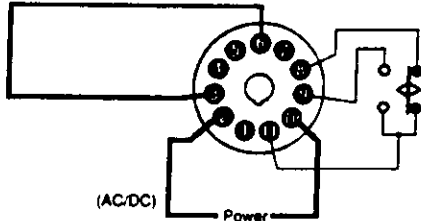
t = set time t-a = less than set time

In the schematic diagrams, each thick line indicates the external wiring necessary for the selected operation.

### Mode F Cycle One-Shot

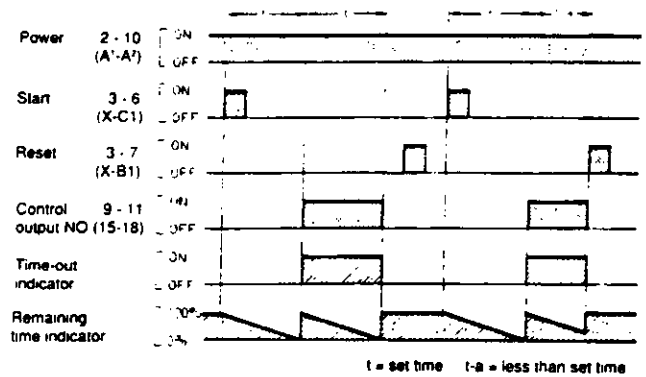
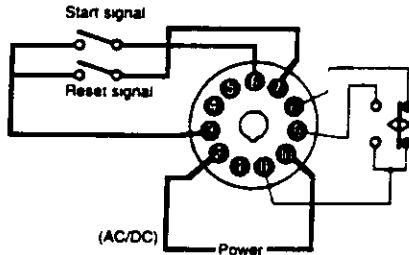
#### Power-ON Short/Power-OFF Reset

The start terminals are connected. Timing starts when power is applied. The output relay will be OFF for the set time and then ON for the set time. The timer is reset when power is disconnected or a reset input is applied.



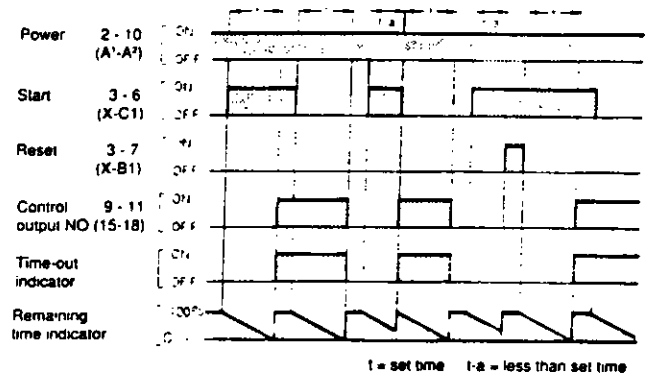
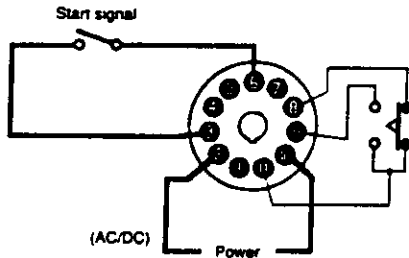
#### Signal Start

Power is applied continuously. The OFF/ON cycle is initiated at the leading edge of the start input. The output relay will be OFF for the set time and then ON for the set time. The timer is reset when power is disconnected or a reset input is applied.



### Mode G Signal ON-delay/OFF-delay

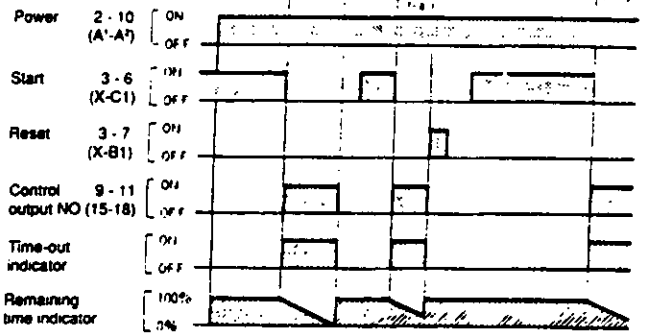
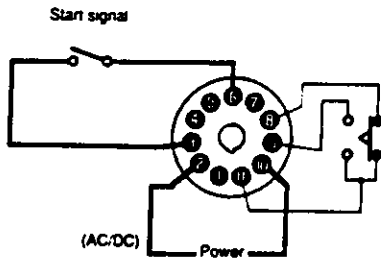
Power is continuously applied. Timing begins on both the leading and trailing edges of the start input. The output relay is energized when the accumulated time from the leading edge equals the set time. It is also energized for the set amount of time from the trailing edge of the start input.



In the schematic diagrams, each thick line indicates the external wiring necessary for the selected operation.

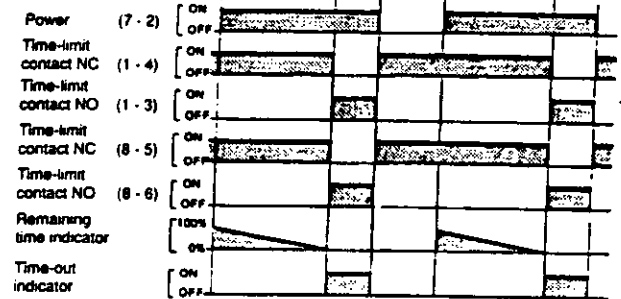
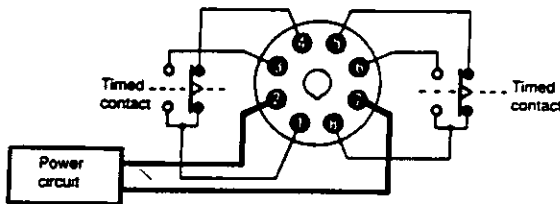
**Mode H Signal OFF-Delay (II)**

Power is continuously applied. Timing starts at the trailing edge of the start input. The output relay is energized during timing.



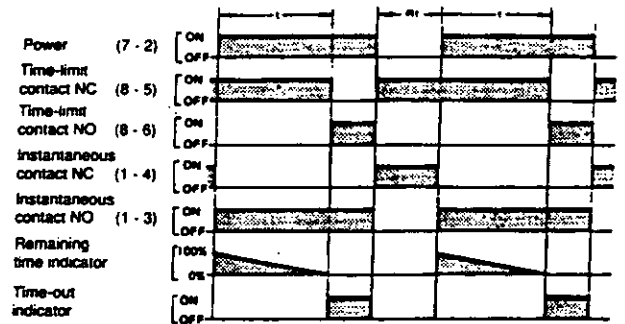
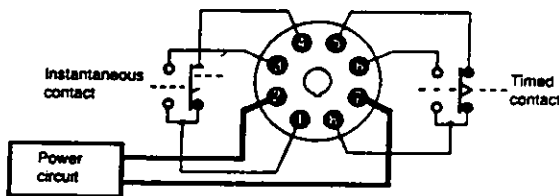
t = set time t-a = less than set time

**H3CA-8**



t = set time Rt = reset time

**H3CA-8H**



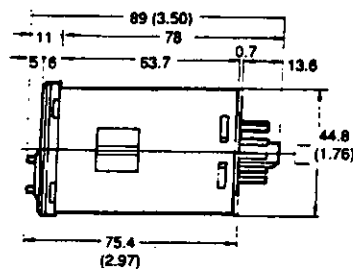
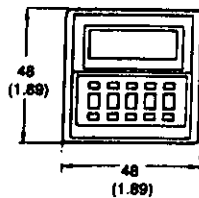
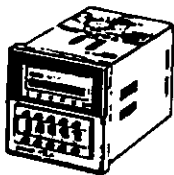
t = set time Rt = reset time

**Dimensions**

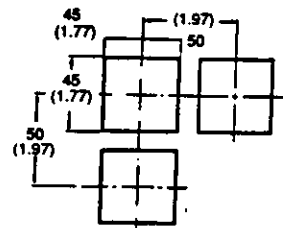
Unit: mm (inch)

**TIMERS**

**H3CA-A**



**Panel cutout**

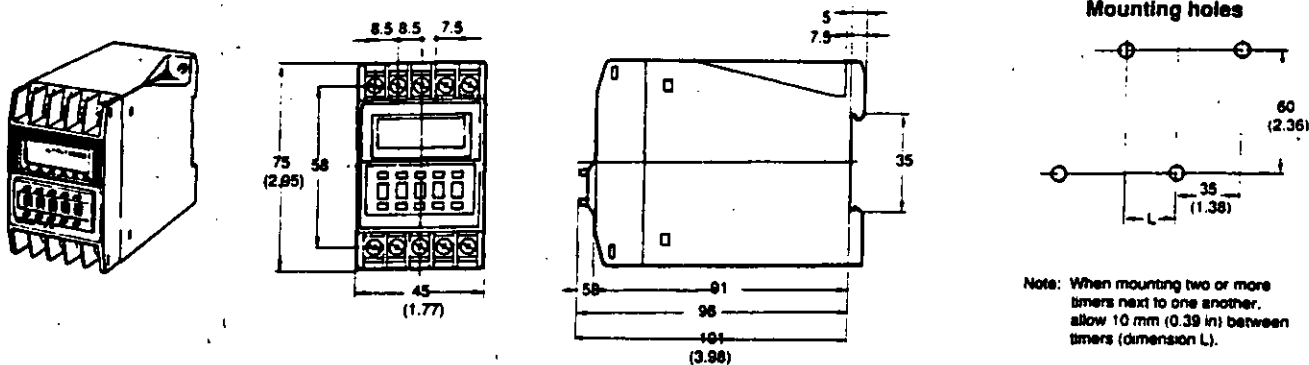


Note: Recommended panel thickness is 1 to 3.2 mm.

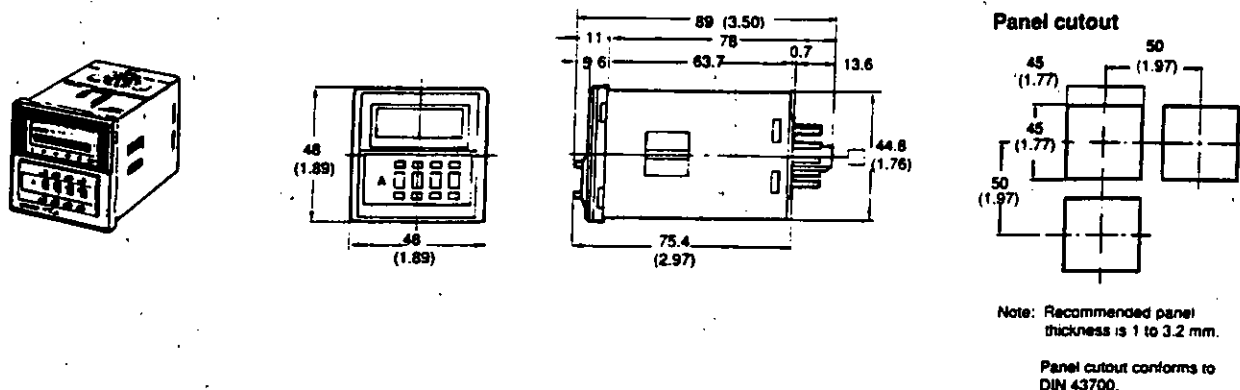
Panel cutout conforms to DIN 43700.

In the schematic diagrams, each thick line indicates the external wiring necessary for the selected operation.

■ H3CA-FA



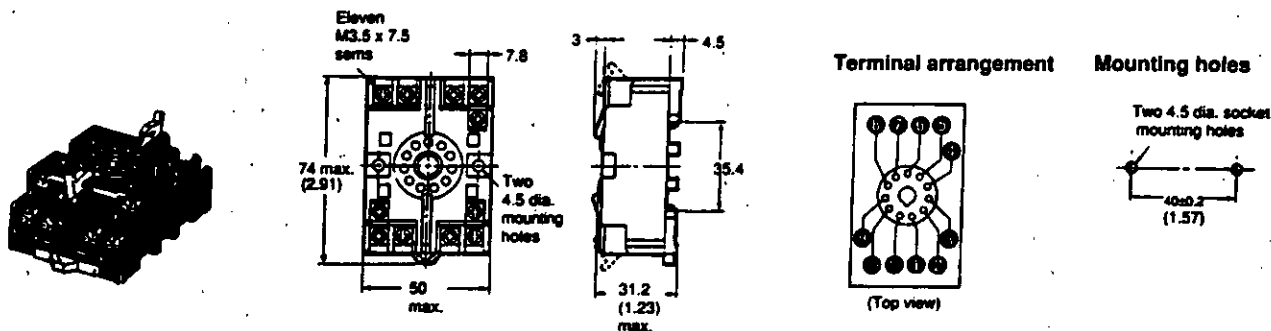
■ H3CA-8, H3CA-8H



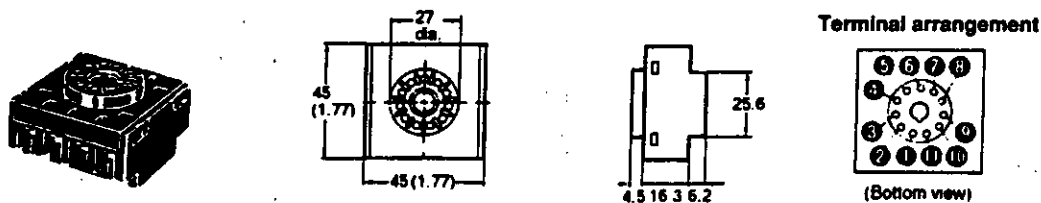
■ SOCKETS

11-Pin Sockets for H3CA-A

P2CF-11 Bottom surface or track mounting socket

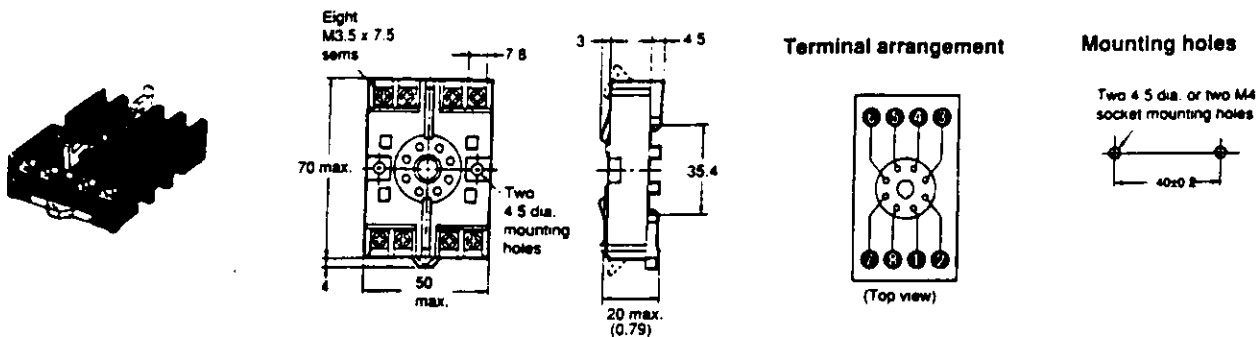


P3GA-11 Back Mounting Socket

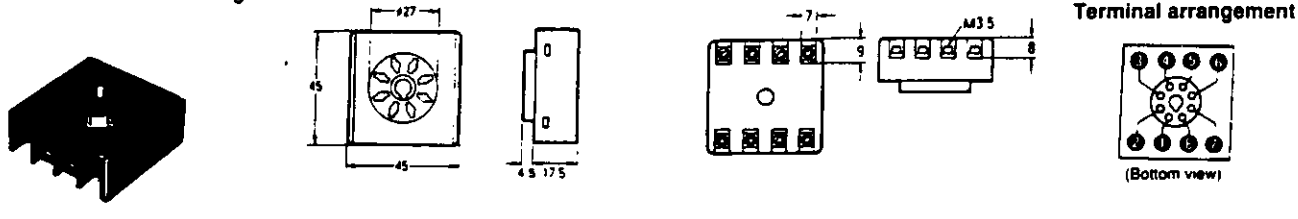


**8-Pin Sockets for H3CA-8, H3CA-8H**

P2CF-08 Bottom surface or track mounting



**P3G-08 Back mounting socket**

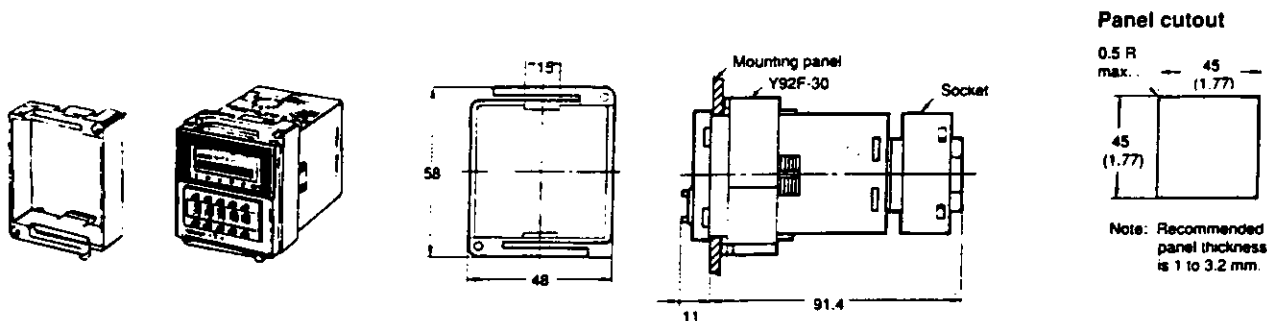


**■ PANEL MOUNTING ADAPTERS**

For H3CA, H3CA-8, H3CA-8H

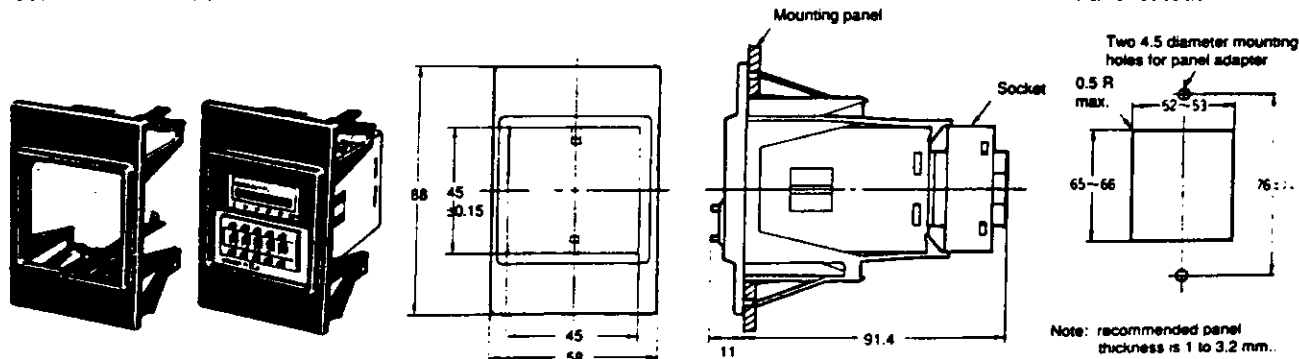
**Y92F-30 Mounting Adapter**

Adapter installs behind the panel. It is ideal for side by side installation. Use P3GA-11 or P3G-08 sockets.



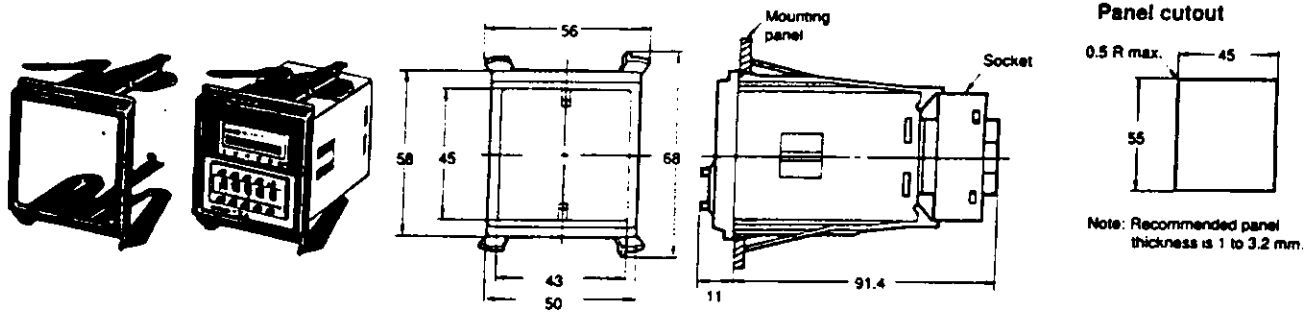
**Y92F-70 Mounting Adapter**

Charcoal gray panel adapter installs through panel front. Timer fits bezel, rear of timer clips to adapter. Use P3GA-11 or P3G-08 sockets.



**Y92F-71 Mounting Adapter**

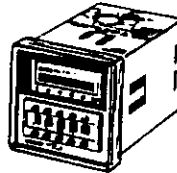
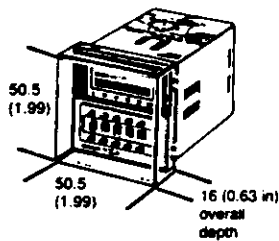
Charcoal gray panel adapter installs through panel front. Timer face fits bezel, rear of timer clips to adapter. Use P3GA-11 or P3G-08.



**PROTECTIVE COVERS**

**Y92A-48B Hard Plastic Cover**

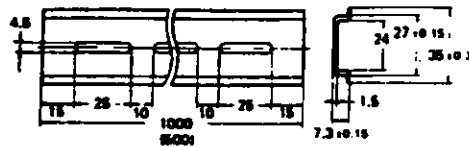
**Y92A-48D Soft Plastic Cover**



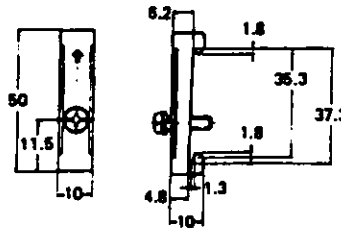
Hard plastic cover Y92A-48B and soft plastic cover Y92A-48D snap onto the front of the timer to protect against dust and water. The Y92A-48B hard plastic cover prevents accidental resetting. Y92A-48D soft plastic cover fits snugly over the front and allows settings to be changed. These covers are intended for use in areas where unusual service conditions do not exist.

**MOUNTING TRACK AND ACCESSORIES**

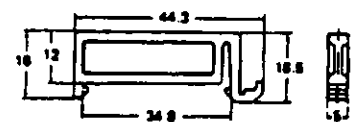
**PPF-100N/PPF-50N DIN Rail**



**PPF-M End Plate**



**PPF-S Spacer**



**Connections**

Part number	Input terminal numbers (no-voltage only)					Power supply terminal numbers		Output terminal numbers			
	Gate	Start	Reset	Check	COM	AC (common), DC-	AC (hot), DC+	Type	COM	NC	NO
H3CA-A	5	6	7	4	3	2	10	Timed contact	11	8	9
H3CA-FA	D1	C1	B1	E1	X	A2	A1	Timed contact	15	16	18
H3CA-8H	-	-	-	-	-	2	7	Instantaneous	1	4	3
								Timed contact	8	5	6
H3CA-8	-	-	-	-	-	2	7	Timed contact	1	4	3
								Timed contact	8	5	6



CONTACT SIGNAL INPUTS

Input Signal Requirements

Resistance	1 KΩ max.
Residual voltage	1 V max. when the contact makes
Contact material	Gold-plated contacts recommended

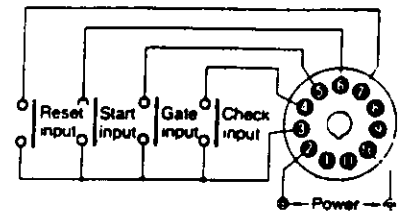
H3CA-A

- Start input contact between terminals 3 and 6.
- Reset input contact between terminals 3 and 7.
- Gate input contact between terminals 3 and 5.
- Check input contact between terminals 3 and 4.

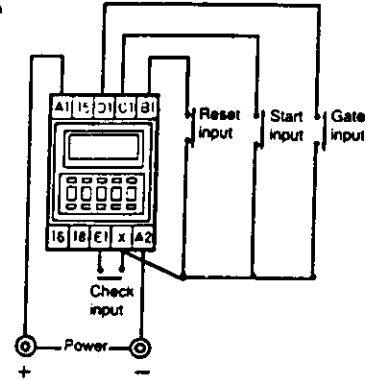
H3CA-FA

- Start input contact between terminals X and C1.
- Reset input contact between terminals X and B1.
- Gate input contact between terminals X and D1.
- Check input contact between terminals X and E1.

H3CA-A



H3CA-FA



SOLID-STATE SIGNAL INPUTS

Input Signal Requirements

Input type	Open collector transistor
Voltage when collector is OFF	20 V min.
Saturated voltage when transistor is ON	1 V max.
Collector current	50 mA max.
Input current between collector and base	0.5 μA max.
Resistance when transistor is ON	1 KΩ max.
Residual voltage when transistor is ON	1 V max.
Resistance when transistor is OFF	200 KΩ min.

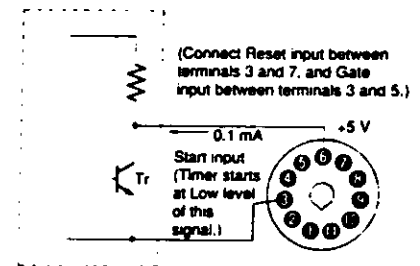
H3CA-A and H3CA-FA

Solid-state input terminal connections are the same as those for contact signal inputs.

Solid-State Inputs (Not Open Collector Type)

Proximity and photoelectric sensors often have NPN or PNP type solid-state output circuits and rated supply voltages ranging from 6 to 30 VDC. These signals are applied to the timer according to the diagram below.

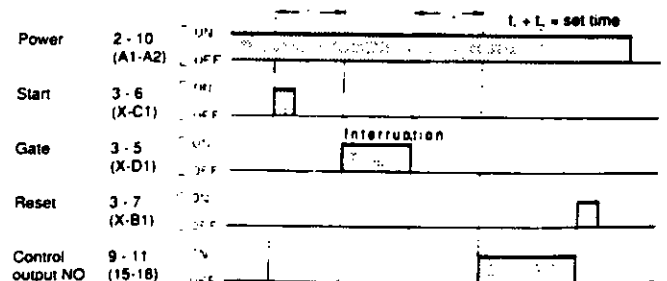
Solid-state circuit (proximity sensor, proximity sensor, etc.)



CUMULATIVE TIMING

Using the Gate Input with ON-Delay

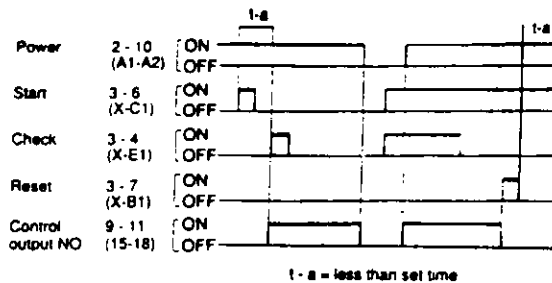
When the gate signal is closed, timing is temporarily stopped. When the gate signal opens, timing resumes at the point of interruption. The gate input terminal permits the timer to sum up times  $t_1$  and  $t_2$  as shown in the timing chart.



■ CHECK INPUT

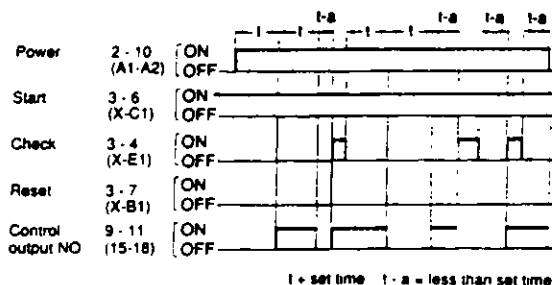
ON-Delay Operation

When a no-voltage input signal is applied to the timer during the lapse of a set time, the remaining set time will become 0 and the timer will enter the next control state. Also, while the Check Signal is applied, the elapsed time measurement of the set time is not performed. The Check input is especially useful where ON-delay override may be desirable.



Repeat Cycle Operation

The Check input signal in Repeat cycle mode allows the timer to be used like a binary flip-flop or alternating relay. Set an unattainable time, such as 999 hours. Apply the no-voltage Check input to shift output status from ON to OFF, or vice-versa. Jumper terminals 3 and 6 (X and C1) to short the start function. The Check input then controls the output relay like a flip-flop or alternating relay. This may be used to alternate wear on main and secondary equipment such as pumps.



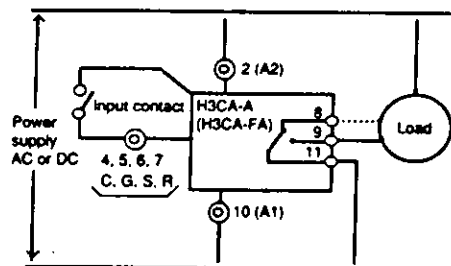
# Installation

■ PROPER INPUT CONNECTIONS (H3CA-A, H3CA-FA)

The neutral or common of the power supply is connected to terminal 2 (A2) of the timer. Terminal 10 (A1) should be connected to the "hot" or positive of the power supply. Do not apply voltage to Check, Gate, Start and Reset inputs. These are no-voltage type inputs.

■ PROPER OUTPUT CONNECTIONS

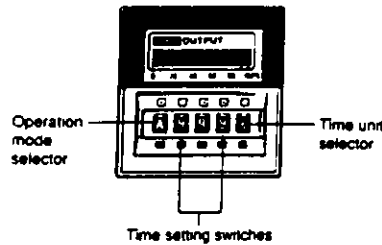
Design your control circuit using the output relay contacts to switch the load. **Never switch a load with the contact that is being used as an input signal.** The timer's circuitry may be damaged.



## Operation

### ■ SELECTING TIME RANGE

Use the rightmost pushwheel switch to select the time range. Use the three center pushwheel switches to select the time setting between 000 and 999. For ranges with 0.1 time units, the decimal point is assumed to be between middle and right digits.



Time unit	Timing range
0.1 s s	0.1 to 99.9 seconds 1 to 999 seconds
0.1 m m	0.1 to 99.9 minutes 1 to 999 minutes
0.1 h h 10 h	0.1 to 99.9 hours 1 to 999 hours 10 to 9990 hours

### ■ SELECTING OPERATION MODES (H3CA-A, H3CA-FA)

The operation mode is selected by the leftmost pushwheel switch.

Mode	Operation
A	ON-delay
B	Repeat cycle
C	Signal Interval/OFF-delay
D	Signal OFF-delay I
E	Interval
F	Cycle
G	Signal ON-delay/OFF-delay
H	Signal OFF-delay II

### ■ CAUTIONS

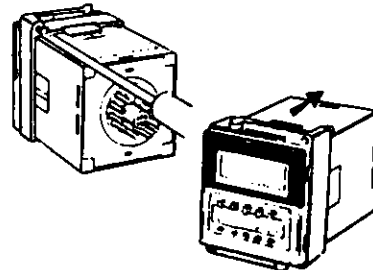
Do not change the time unit or time range while the timer is in operation. Otherwise, the timer may malfunction or be damaged. Be sure to turn off the power supply to the timer before changing any of the selections.

## Mounting

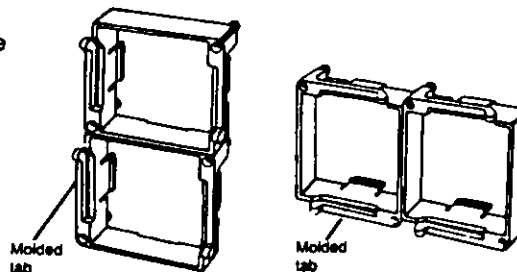
### ■ PANEL MOUNTING

#### Using Y92F-30 Adapter

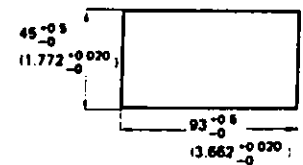
Insert the timer through the panel cutout. Push the Y92F-30 adapter from the rear of the timer as far forward toward the panel as possible. Wire the P3G□-□□ socket, then push it onto the rear of the timer. Then, tighten the two retaining screws. To release the adapter, lift the tab at the rear of the adapter.



Several timers may be mounted close together using Y92F-30 adapter as shown here. When mounting two or more timers in a vertical line, arrange the adapters so that their molded tabs are positioned on the right and left sides. When mounting two or more timers in a horizontal line, arrange the adapters so that their molded tabs are positioned on the top and bottom sides.



#### Panel cutout for side-by-side mounting of two timers

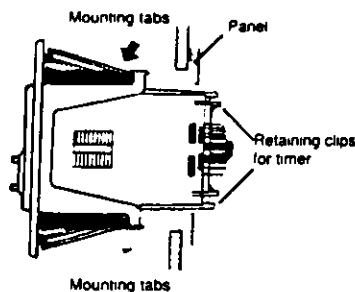


### Using Y92F-70 and Y92F-71 Adapters

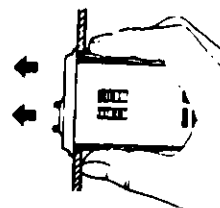
Install the H3CA timer, face first, into the back side of the Y92F-70 or Y92F-71 adapter so the bezel fits snugly. Be sure the retaining clips at the back of the adapter fit into the slots on either side of the timer. Compress the top and bottom tabs of the adapter then push the adapter through the front side of the panel cutout. Be sure the tabs extend after installation for a secure fit.

To remove the timer from the adapter, unclip the two retaining clips at the back of the adapter. To remove the adapter and timer from the panel as a unit, compress the tabs behind the panel and push the unit out the front of the panel.

#### Installation



#### Removal

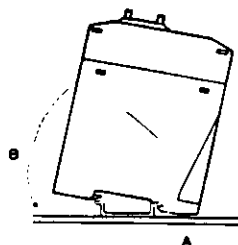


## ■ TRACK MOUNTING

### H3CA-FA with Built-In Track Adapter

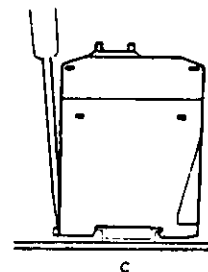
#### Mounting

First hook part "A" on the rear of the timer onto an edge of the track. Then, press the timer in direction "B" until the latch on the bottom rear of the timer locks securely.



#### Removal

Pull the latch "C" with a flat-blade screwdriver and remove the timer from the mounting track.

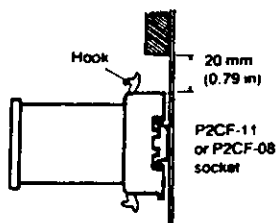


### P2CF-□□ Socket

For H3CA-A, H3CA-8 and H3CA-8H

#### Mounting

The P2CF-□□ socket has two hooks that secure the timer to the socket. Be sure to allow at least 20 mm (0.79 in) clearance above and below the socket to gain access and to release the hooks for servicing and maintenance. Insert timer into the socket. Latch hooks. Then clip rear of the socket to the track. Push the bottom onto the track until the latch hooks securely.



#### Removal

Pull the latch on the socket with a flat-blade screwdriver and remove the timer and socket as one unit.

**NOTE: ALL DIMENSIONS ARE IN MILLIMETERS. To convert millimeters into inches divide by 25.4.**

Down Timer

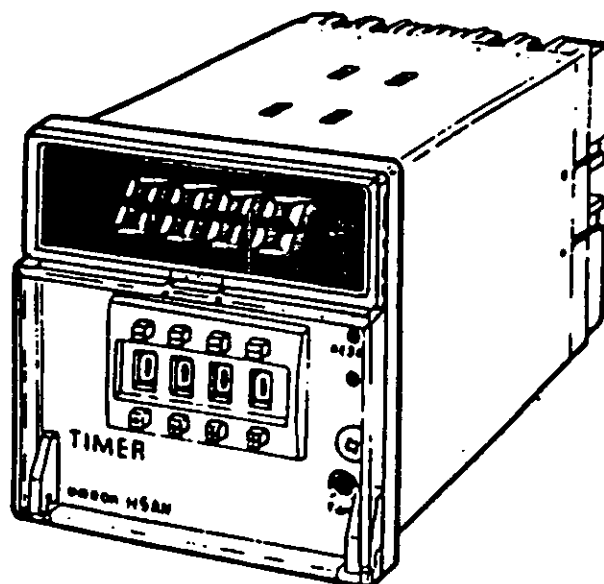
**OMRON**

Model **H5AN** QUARTZ  
TIMER

## INSTRUCTION MANUAL

Model H5AN QUARTZ TIMER

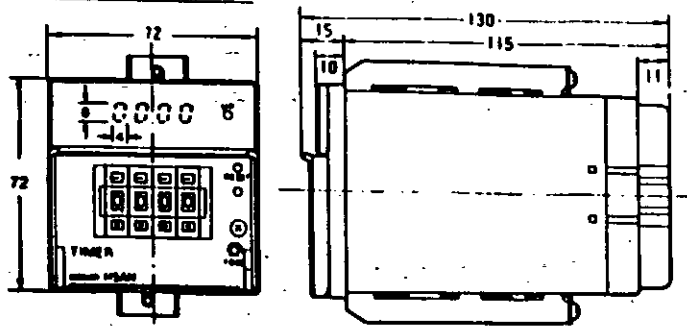
This manual primarily describes precautions required in installing and wiring the timer. When using the timer, please refer to the pertinent catalog for detailed information.



**OMRON TATEISI ELECTRONICS CO.**

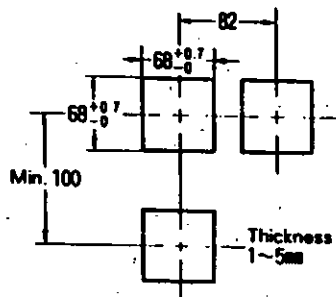
**0613404-6D**

## ■ DIMENSIONS

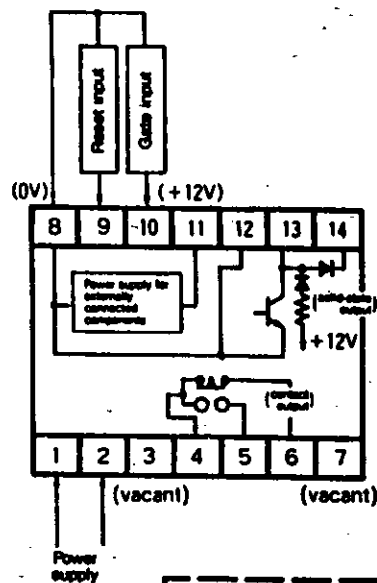


## ■ PANEL CUTOUT

(Panel cutout conforms to DIN 43700.)



## ■ CONNECTIONS



### NOTE:

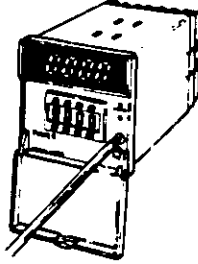
1. For the DC-operated version, connect (-) polarity of power supply to terminal 1 and (+) polarity to terminal 2.
2. Power specifications are individual for each of DC-operated versions: 12 to 24, 48, and 100 VDC types.
3. Never use the vacant terminal for any purpose.
4. Connections of gate and reset input give an example of using a contact.

Model H5AN timer can supply 448 specifications by selecting UP or DOWN display, rated time, operation mode, enable or disable of manual reset, and output level of the solid-state output with internal rotary DIP switches and slide switches.

## PROGRAMMING OF SPECIFICATIONS

### STEP 1 TAKING OFF THE CASE

Open the transparent front cover and loosen the screw as in the right hand picture. And then, draw out the body of the timer from the case. (When putting it back into the case after programming, insert the body straightly into the case until it stops. Then, tighten the screw until it is mounted completely.)



### STEP 2 SELECTION OF SPECIFICATIONS

By changing the position of the rotary switches and the slide switches on the board, various functional specifications as shown in the figure below can be selected. As to memory protection type (-M type), however, the changeover becomes effective only when the timer is reset (external reset or manual reset). Without reset, the timer operates according to the previous specification.

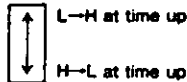
SW1		SW2	
No.	Time range	No.	Mode
0	99.99s	0	N B N
1	999.9s	1	F 9 F
2	9999s	2	C A C
3	99m59s	3	R B R
4	999.9m	4	K C K
5	99h59m	5	P D P
6	999.9h	6	Q E Q
7	9999h	7	N F N
8	99.99s		
9	999.9s	Decre- ment	Incre- ment



SW4 (Manual reset)

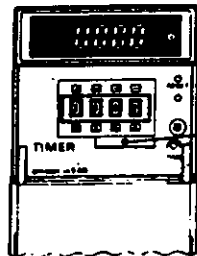


SW6 (Voltage level in solid-state output operation)



### STEP 3 INDICATIONS OF SPECIFICATION ITEMS

Select the appropriate rating label from the rating sheet supplied as an accessory and attach it below the switches on the front panel.



0.01s to 99.99s
0.1s to 999.9s
1s to 9999s
1s to 99m59s
0.1m to 999.9m
1m to 99h59m
0.1h to 999.9h
1h to 9999h

### STEP 4 TIME SET

The rated time is determined by the digital switches in the center of the front panel. When the rated time of 99min59s or 99h59min is selected, any value set to 9 or more (i.e., 6-9) in the order of x10s or x10min, respectively, will be read as 5. Note that unit, decimal point, and colon are not shown on the digital display. (The set value of the time can be changed during operation.)

## HINTS ON CORRECT USE

#### MEMORY PROTECTION TYPE

1. Since the power reset function is not provided for this version, care must be exercised as to the following points.

The specification set at the delivery time from the factory is as follows. When power is to be applied to the timer for the first time after delivery, the timer must be reset by applying external or manual input.

## STANDARD FACTORY-SET SPECIFICATION ITEMS

Direction of digital display	UP
Time specification	0.01s-99 99s
Operation mode	M mode
Manual reset	Available
Voltage level of the solid-state output at time up	L-H

If the specification is changed during a power failure, the timer must be reset externally or manually after the power recovery.

Failure to apply this reset input will cause the timer to operate with the previous memory data.

2. The Type -M is capable of retaining memory for approximately 10 years after power failure. The battery cannot be replaced.

• When the power voltage is momentarily released (i.e., momentary power failure) at certain fixed intervals, the condition of the H5AN-4D becomes as follows depending on the length of the release time (length of the momentary power failure).

1. Power failure for 0.5s or more:

The timer is reset when power recovers and power reset is executed.

2. Power failure for 0.01s or less:

Status before the power failure is held.

3. Power failure for between 0.01s and 0.5s:

Operation is unstable and the timer will function according to either above item 1 or 2.

To hold the previous status in the case of a power failure of 0.01s or more, use the Type H5AN-4DM.

• The timer has been tested for the external impulse voltages across the power supply terminals with the standard waveform of 6KV,  $\pm(1 \times 40)\mu$ s conforming to JEC-187 and for the external noises with a noise simulator at 2KV, 100ns pulse width and 1ns leading time. In case the impulse voltages and noise voltages exceed the above values, it is recommended to connect 0.1 to 1 $\mu$ F MP capacitor or oil capacitor for AC across the the supply terminals.

• Install the input signal source equipment, the wiring for input signal source, and the timer itself apart from noise generating sources and wiring for high power to cause noise.

• Never apply any voltages to the terminals 8, 9, and 10 from an external circuit.

• Never fasten the terminal screws too much when clamping them.

• Avoid using the timer in the following conditions:

- Location subject to corrosive gas.

- Location where vibrations and shocks are too big or constantly occur.

- Location where the timer might be splashed with water or oil.

- Location where there is much dust.

- Location where the timer might be exposed to the direct ray of the sun.

- Location when the timer can be exposed to organic solvents (thinner or benzene), strong alkali and strong acidic.

• The residual voltage between the short-circuited terminals when the reset input and the gate input are turned on, is to be 3V Max.


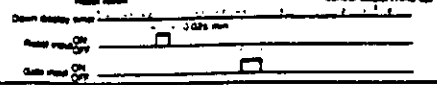

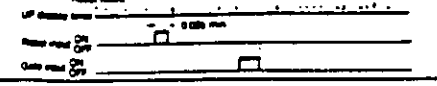



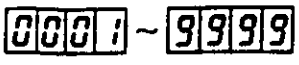

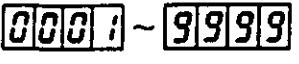

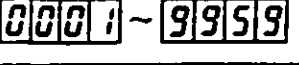

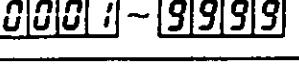

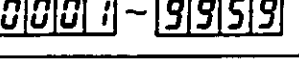

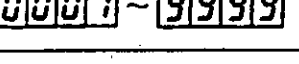

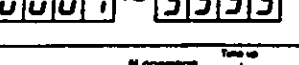

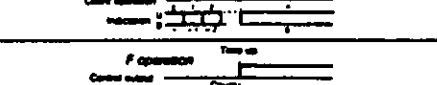

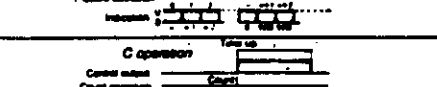

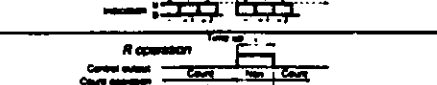

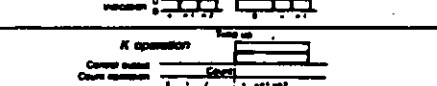

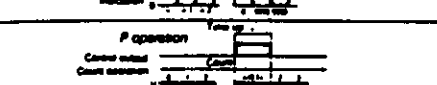

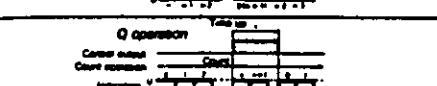

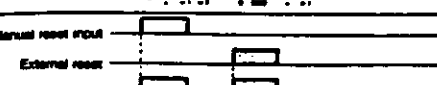

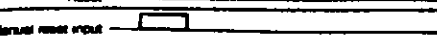

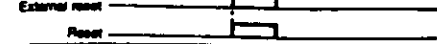

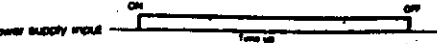

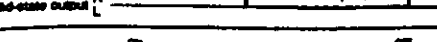
• When using the timer in the condition subject to much static electricity, (which is caused by transportation of molding materials and liquid materials with pipes), keep the timer from the generating source of the static electricity.

• In the case of impulse voltage test or insulation resistance test with the timer mounted on the board, remove the timer body to separate the timer circuit. This is to prevent degradation and damage to the internal circuit of the timer due to sneaking test voltage into the input terminals when damage caused by transient voltage or insulation fault occurs in some devices of the control board.

• Since the timer is provided with a switching regulator in its internal power supply circuit, inrush current will be carried when turning on the power. If the capacity of the power for the timer is insufficient, the timer cannot start. So, use the power which has sufficient capacity.

• About built-in battery. The type with memory back up function has a built-in lithium battery. Do not throw the exhausted lithium battery in fire. Be sure to dispose of

# SWITCH OPERATION AND TIMING CHARTS

		Switch position		Timing charts	
Direction of digital display	DOWN	SW2 : 0-7			
	UP	SW2 : 8-F			
Time specifications	99.99s	SW1 : 0 or 8			0.01s - 99.99s
	999.9s	SW1 : 1 or 9			0.1s - 999.9s
	9999s	SW1 : 2			1s - 9999s
	99m59s	SW1 : 3			1s - 99m59s
	999.9m	SW1 : 4			0.1m - 999.9m
	99h59m	SW1 : 5			1m - 99h59m
	999.9h	SW1 : 6			0.1h - 999.9h
	9999h	SW1 : 7			1h - 9999h
Operation mode	N	SW2 : 0 or 7 (DOWN) 8 or F (UP)			
	F	SW2 : 1 (DOWN) 9 (UP)			
	C	SW2 : 2 (DOWN) A (UP)			
	R	SW2 : 3 (DOWN) B (UP)			
	K	SW2 : 4 (DOWN) C (UP)			
	P	SW2 : 5 (DOWN) D (UP)			
	Q	SW2 : 6 (DOWN) E (UP)			
Manual reset	Available	SW4			
	Non-available	SW4			
Voltage level in solid-state output	L → H at count up	SW6			
	H → L at count up	SW6			

U - UP display timer    D - DOWN display timer



# AB QUALITY BULLETIN 800H/800T BULLETIN

## SELECTOR SWITCH INSTALLATION AND MOUNTING INSTRUCTIONS INSTRUCTIONS DE MONTAGE ET D'INSTALLATION DU SELECTEUR WAHLSCHALTER, EINBAU- UND MONTAGEANLEITUNG INSTRUCCIONES DE INSTALACION Y MONTAJE DEL CONMUTADOR SELECTOR INSTRUÇÕES DE INSTALAÇÃO E MONTAGEM DO COMUTADOR SELECTOR

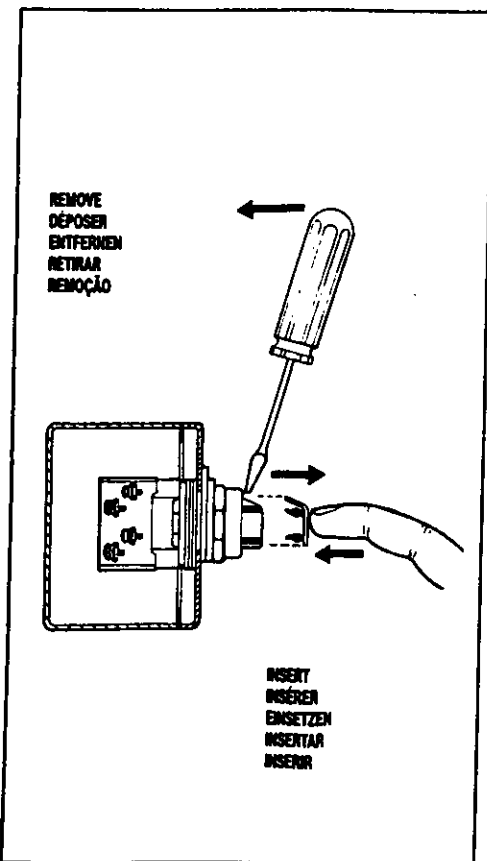
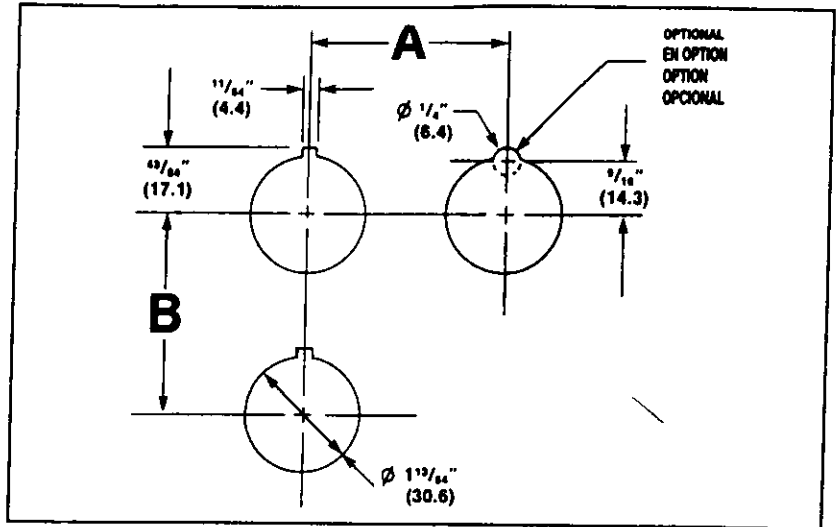
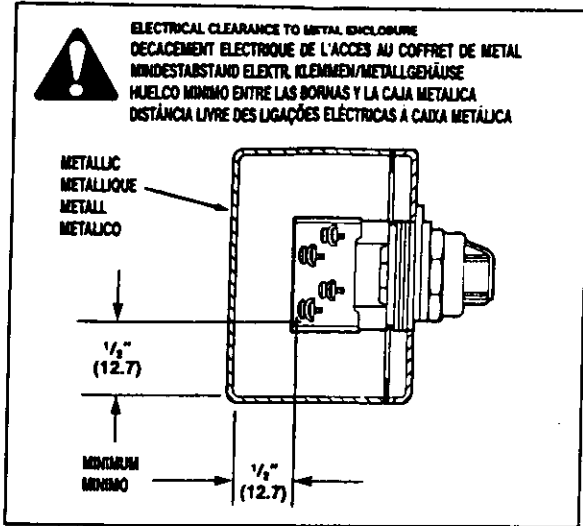
**WARNING:** Isolate before servicing. Install in suitable enclosure. Keep free from contaminants.

**ATTENTION:** Toujours couper toutes sources d'alimentation avant de commencer l'entretien. Installer dans une boîte appropriée. Protéger le relais contre les contaminants.

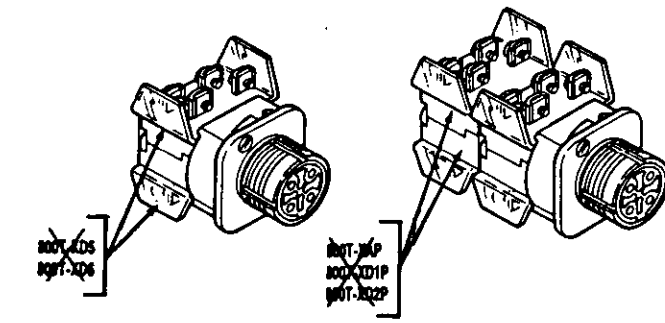
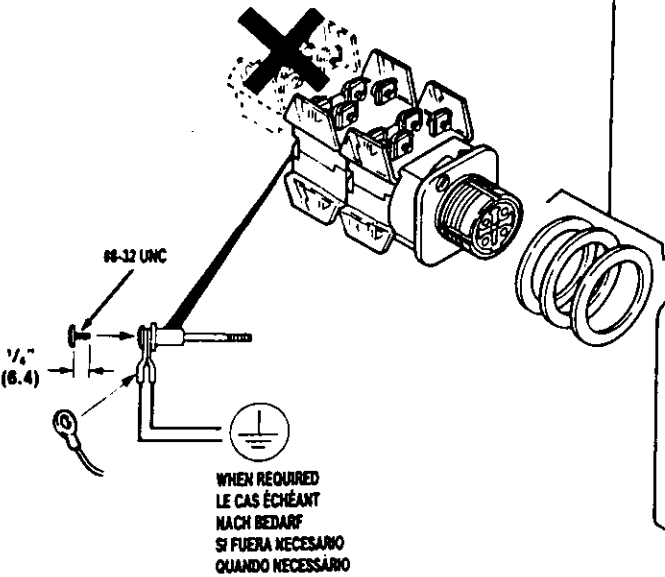
**WARNING:** Vor Wartungsarbeiten Anlage abschalten. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden.

**PRECAUCION:** Desconéctelo antes de servirlo. Instálelo en una caja apropiada. Manténgalo libre de contaminantes.

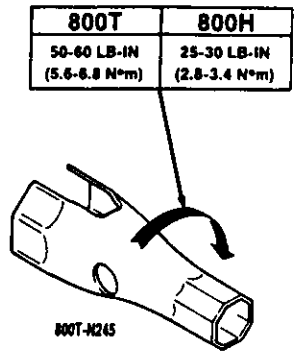
**CUIDADO:** Desconectar antes de usar. Instalar em caixa apropriada. Manter livre de contaminantes.



TYPE TYP TIPO TIPO	POSITIONS STELLUNGEN POSICIONES POSIÇÕES	Ø 1 1/2" (38.1)		1 13/16" (46.4)		2 7/16" (61.9)	
		1 13/16" (46.4)	1 13/16" (46.4)	2 7/16" (61.9)	2 7/16" (61.9)	A	B
 (800T) (800T) (800H)	∨	2 1/2" (57.2)	1 7/8" (46.8)	2 1/2" (57.2)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)
	∨	2 1/2" (57.2)	1 7/8" (46.8)	2 1/2" (57.2)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)
	∨	2 1/2" (57.2)	1 7/8" (46.8)	2 1/2" (57.2)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)
 (800T)	∨	2 1/2" (57.2)	1 7/8" (46.8)	2 1/2" (57.2)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)
	∨	2 1/2" (57.2)	1 7/8" (46.8)	2 1/2" (57.2)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)
	∨	2 1/2" (63.5)	1 7/8" (46.8)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)	2 1/2" (63.5)
 (800T)	∨	3 1/2" (82.6)	3" (76.2)	3 1/2" (82.6)	3" (76.2)	3 1/2" (82.6)	3" (76.2)
	∨	3 1/2" (82.6)	3" (76.2)	3 1/2" (82.6)	3" (76.2)	3 1/2" (82.6)	3" (76.2)
	∨	4" (101.6)	3" (76.2)	4" (101.6)	3" (76.2)	4" (101.6)	3" (76.2)

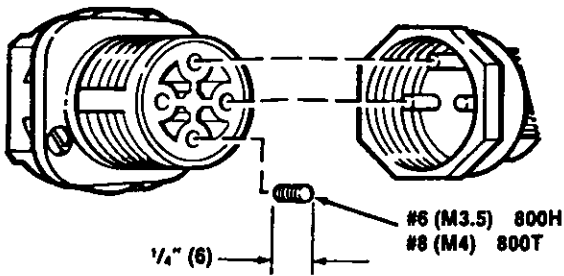


PANEL THICKNESS ÉPAISSEUR DE PANNEAU STÄRKE DER TAFEL GROSOR DEL PANEL ESPESSURA DO PAINEL	NUMBER OF GASKETS NOMBRE DE JOINTS D'ÉTANCHÉITÉ ANZAHL DER DICHTUNGEN NUMERO DE JUNTAS NUMERO DE JUNTAS VEDANTES
16 Gage - 1/16" (1.6)	3
12 Gage - 1/16" (2.8) 10 Gage - 1/16" (3.8)	2
1/16" (4.8)	1
> 1/16" (4.8)	└ (COUNTERBORE)



FLAT, SMOOTH SURFACE  
SURFACE PLATE ET LISSE  
FLACHE, EBENE OBERFLÄCHE  
SUPERFICIE LISA Y PLANA  
SUPERFICIE PLANA E LISA

**KNOB KEYING OPTION  
OPTION DE DÉTROMPAGE DU BOUTON  
WAHLWEISE KEILVERBINDUNG  
OPCIÓN DE CODIFICACIÓN DEL MANDO  
OPÇÃO DE ENCAIXE DO BOTÃO**


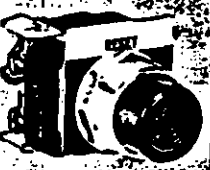


PLUG (CUSTOMER SUPPLIED)  
FICHE (FOURNIE PAR LE CLIENT)  
STECKER (KUNDENSEITIGE LIEFERUNG)  
CLAVIJA (SUMINISTRADA POR EL CLIENTE)  
FICHA (FORNECIDA PELO CLIENTE)

DEVICE RATING PUISSANCE NOMINALE DU DISPOSITIF BEMESSUNG DER VORRICHTUNG RÉGIMEN DEL DISPOSITIVO GRADUAÇÃO DO INSTRUMENTO	ENCLOSURE RATING VALEUR NOMINALE DU COFFRET GEHÄUSESCHUTZGRAD REGIMEN DE LA CAJA CAPACIDADE DO COMPARTIMENTO	STATION RATING VALEUR NOMINALE DE LA STATION STATIONSLESTUNG REGIMEN DE ESTACION CAPACIDADE DA ESTAÇÃO
<b>800T</b> UL LISTED: NEMA 4, 13 IP66	NEMA 1	NEMA 1
	NEMA 4	NEMA 4
	NEMA 4, 4X	NEMA 4
	NEMA 13	NEMA 13
	NEMA 4, 13	NEMA 4, 13
	IP66	IP66
<b>800H</b> UL LISTED: NEMA 4, 4X, 13 IP66	NEMA 4, IP66	NEMA 4, IP66
	NEMA 13, IP66	NEMA 13, IP66
	NEMA 1	NEMA 1
	NEMA 4	NEMA 4
	NEMA 4, 4X	NEMA 4, 4X
	NEMA 4, 13	NEMA 4, 13
IP66	IP66	
NEMA 4X, IP66	NEMA 4X, IP66	
NEMA 13, IP66	NEMA 13, IP66	

**PILOT LIGHT UNITS**

**LEGEND PLATE** — Price includes a standard legend plate selected from Page 483. Deduct \$1.80 if legend plate is not required.

	Complete Units				Lamp Only			Color Caps Only		
	Type	Volts	Catalog Number	Price	ANSI Designation	Catalog Number	Price	Color	Catalog Number	Price
 <p>Transformer Type Pilot Light Catalog Number 800T-P26R</p>	Transformer 50/60 Hz	120	800T-P16R	\$66	#755 or #1866 (6.3V)	800T-N65	\$ 3	Red Green Amber Blue White Clear	800T-N26R N26G N26A N26B N26W N26C	\$4.20
		240	P26R			800T-N65				
		480	P46R			800T-N65				
		600	P56R			800T-N65				
	Full Voltage AC/DC	6	800T-Q06R	54	#755 or #1866 (6.3V) #756 (14V) #757 (28V) #120MB (120V) #120MB (120V)	800T-N65	3			
		12	Q12R			N141				
		24	Q24R			N157				
		120	Q10R			N169				
		240	Q20R			N169				
	Resistor AC/DC	120	800T-Q11R	54	#120MB (120V)	800T-N169	3			
LED Transformer 50/60 Hz	120	800T-PL16R	75	Red Green Amber	800T-N77R	12				
	240	PL26R			N77G					
	480	PL46R			N77A					
	600	PL56R								
LED Full Voltage AC/DC	24	800T-QL24R	63	Red Green Amber	800T-N78R	12				
	32	QL32R			N78G					
	120	QL10R			N78A					
Dual-Input Diode Type AC	24	800T-PD24R	84	#24MB (24V) #90MB (90V)	800T-N180	6				
	120	PD16R			N261					
Dual-Input Transformer AC	120	800T-PD116R	96	#755 or #1866 (6.3V)	800T-N65	3				
Neon AC/DC	120	800T-R10A	54	#B2A (120V)	609-N5	6				
	240	R20A								
 <p>Push-To-Test Pilot Light Catalog Number 800T-PT26R</p>	Push-to-Test Transformer 50/60 Hz	120	800T-PT16R	94	#755 or #1866 (6.3V)	800T-N65	3	Red Green Amber Blue White Clear	800T-N40 N41 N42 N43 N44 N45	4.20
		240	PT26R							
		480	PT46R							
		600	PT56R							
	Push-to-Test Full Voltage AC/DC	6	800T-OT06R	72	#755 or #1866 (6.3V) #756 (14V) #757 (28V) #120MB (120V) #120MB (120V)	800T-N65	3			
12		OT12R	N141							
	24	OT24R			N157					
	120	OT10R			N169					
	240	OT20R			N169					
Push-to-Test Resistor AC/DC	120	800T-OT11R	72	#120MB (120V)	800T-N169	3				
Push-to-Test LED Full Voltage AC/DC	24	800T-OTL24R	81	Red Green Amber	800T-N78R	12				
	32	OTL32R			N78G					
	120	OTL10R			N78A					
Push-to-Test LED Transformer 50/60 Hz	120	800T-PTL16R	93	Red Green Amber	800T-N77R	12				
	240	PTL26R			N77G					
	480	PTL46R			N77A					
	600	PTL56R								

- A full voltage unit is not recommended when a unit is subject to appreciable shock or vibration. A transformer, neon or LED unit will provide longer lamp life under these applications.
- See typical wiring diagram on Page 479.
- The full voltage devices are available in 24, 32 and 120 volts AC/DC and transformer construction in 120, 240, 480 and 600 volts AC. The LED transformer type lamps are the only devices that can directly replace incandescent type ANSI #1866 or #755 lamps in most applications. Full voltage LED lamps require the use of a dedicated power module and do not directly replace existing full voltage lamps. LED lamps provide an added degree of protection against shock and vibration.
- Use Discount Schedule A1.

**SPECIAL COLOR CAPS** — The pilot lights listed are supplied with a red color cap, except the neon type which is supplied with an amber color cap. The following colors are also available at no additional charge:

Color	Green	Amber	Blue	White	Clear
Transformer, Full Voltage, Resistor	G	A	B	W	C
LED	G	A	—	—	—
Neon	—	A	—	—	C

To order, change the last letter of the listed catalog number to the first letter of the color desired.

**LED PILOT LIGHTS** — The Allen-Bradley line of high density LED (Light Emitting Diode) indicator pilot lights is designed for industrial environments to provide long life, plus improved resistance to shock and vibration. These devices are available in amber, green, and red lamps and utilize a standard bayonet style T-3/4 lamp base. ■

**FLASHING LAMP** — Available only for transformer type illuminated devices and for 6 Volt full voltage type pilot lights. The flashing lamp is compatible with devices using 6.3 Volt #755 or #1866 miniature bayonet bulbs only. To order a device with flashing lamp, add the letter "F" before the first number in the listed catalog number. Example: Catalog Number 800T-PF16R. Add \$3 to the price. For the flashing lamp only, order Catalog Number 800T-N212 (ANSI #267) at \$8 each.

\*Order Bulletin 800T, Series "T" Devices for NEMA Type 4/13 Applications.





## IGNITOR/PILOT SYSTEM

The LFG Specialties ignitor/pilot system is designed for the reliable ignition of landfill gas flares. When coupled with the Flame-Trol controller, it provides a fully integrated automatic starter and monitoring flare ignition and control system.

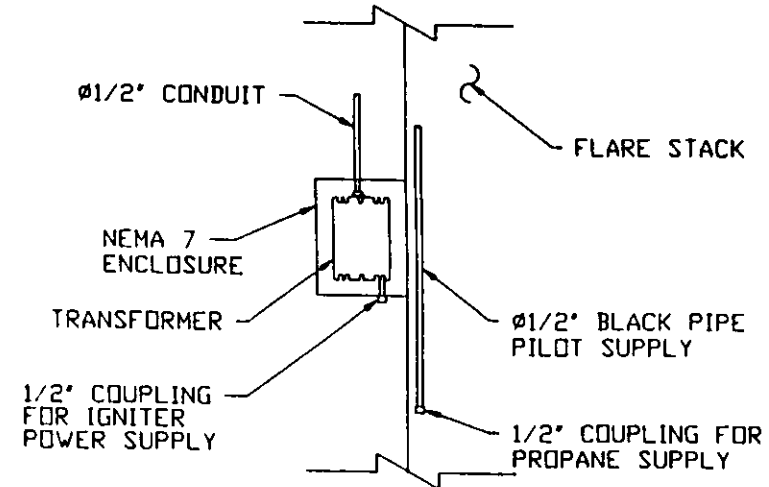
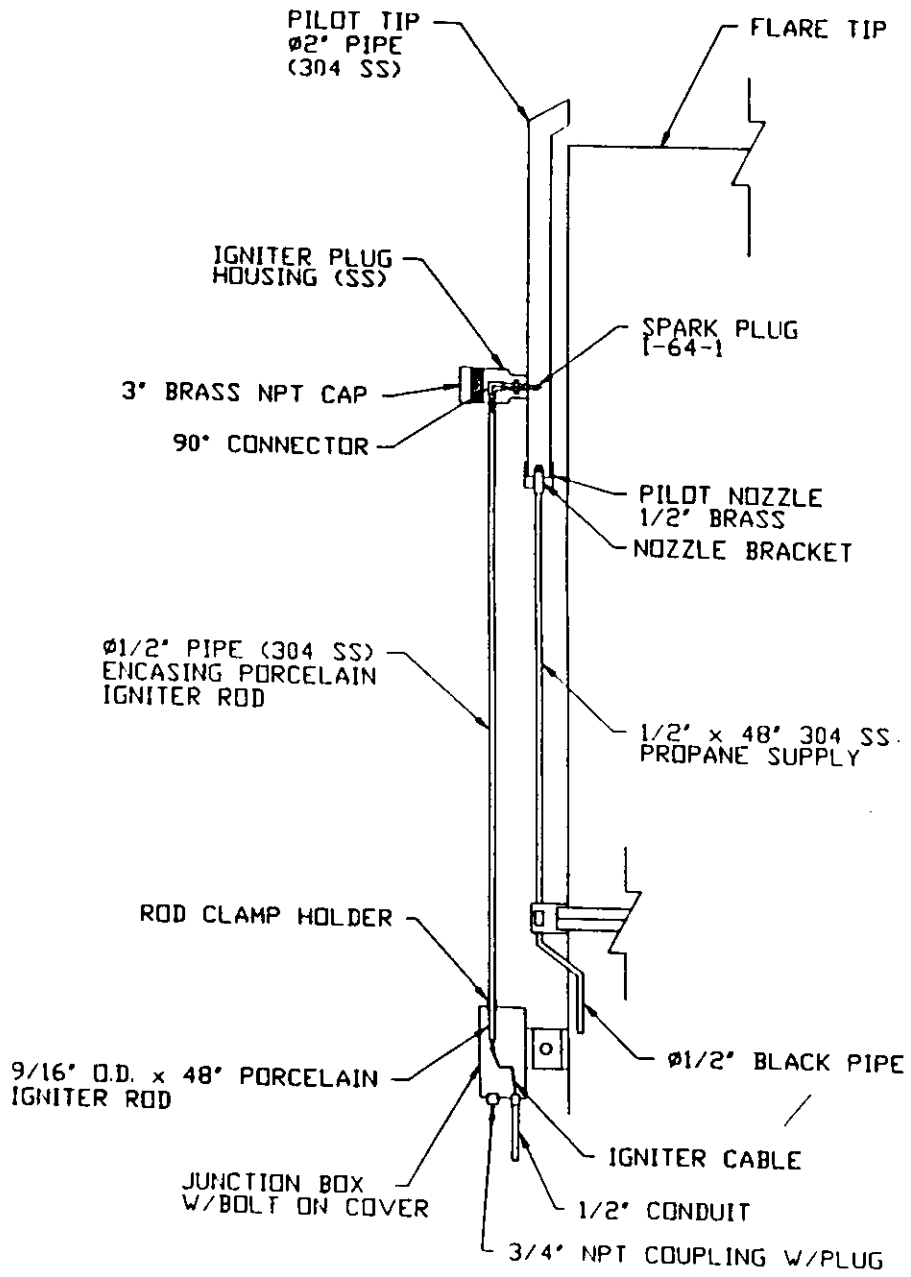
The ignitor/pilot system includes the following standard equipment:

### IGNITOR ASSEMBLY

- \*\*\* 2 in. diameter 304 stainless steel pilot tip with integral spark plug connection/housing
- \*\*\* Spark plug ignitor, eliminates gap problems often incurred with straight rod type ignitors
- \*\*\* 110/5,000V single pole transformer mounted in NEMA 7 enclosure
- \*\*\* High temperature ignitor leads in  $\frac{1}{2}$  in. conduit
- \*\*\* Pilot nozzle in  $\frac{1}{2}$  in. stainless steel pipe
- \*\*\* Chromel-Alumel (type k) thermocouple in stainless steel thermal well to give pilot confirmation

### PILOT GAS CONTROLS

- \*\*\* Pressure control regulator
- \*\*\* Pressure gauge with isolation valve
- \*\*\* Fail-close solenoid valve
- \*\*\* Bypass around solenoid valve with manual block valve
- \*\*\* Main manual shut-off valve



REV.	DESCRIPTION	DATE	BY

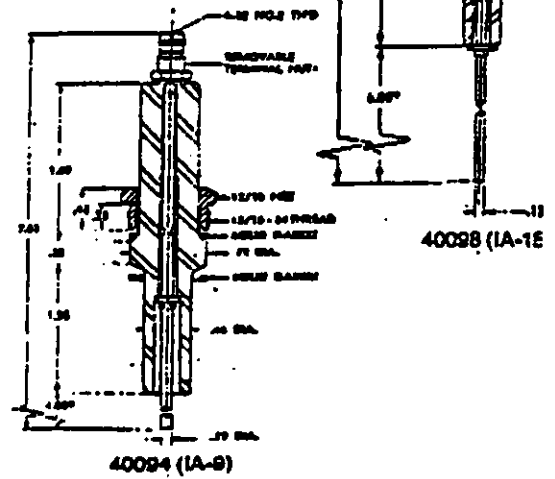
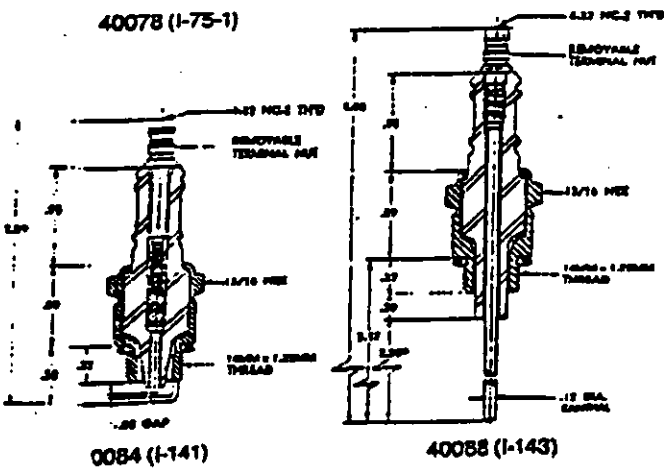
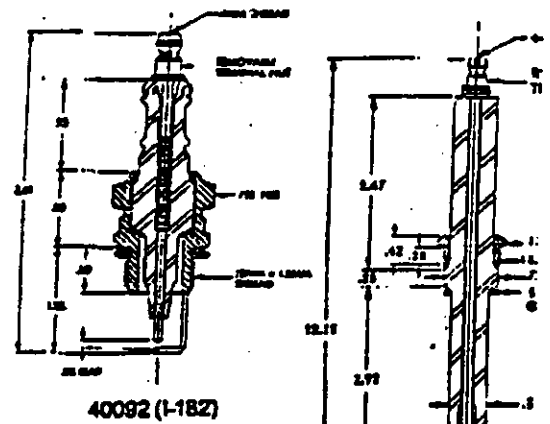
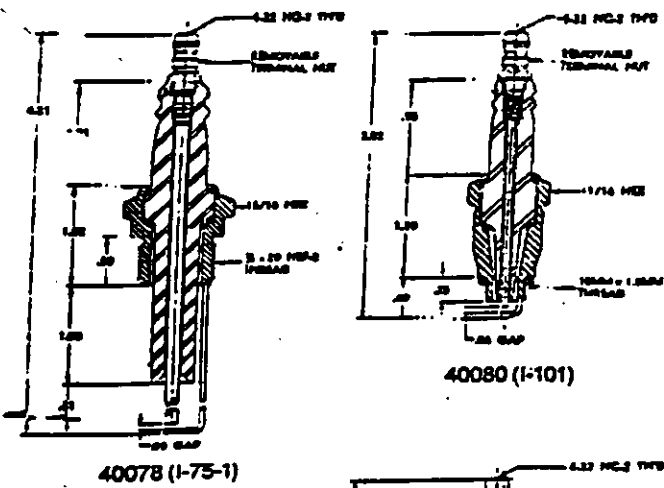
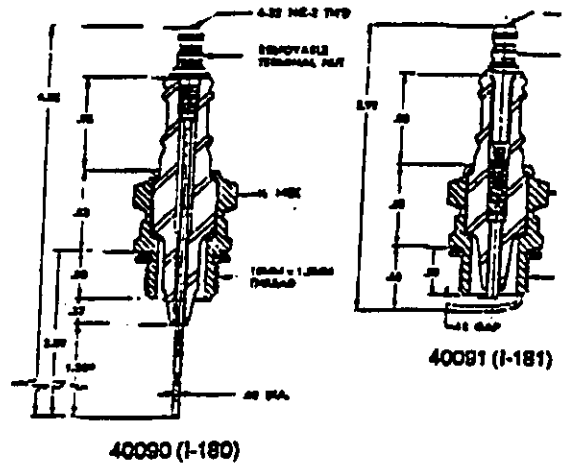
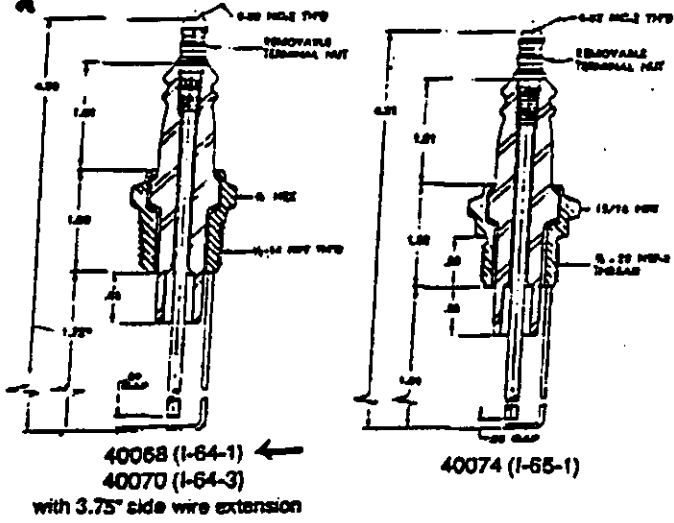
**LFG SPECIALTIES, INC.**  
 PLANT 753 FREDERICK DRIVE  
 CLEVELAND, OHIO 44126  
 TEL. (216) 431-1100

REV.	DESCRIPTION	DATE	BY

# Spark Plug

## Auburn Ignition Assemblies

## Auburn Ignition Assemb



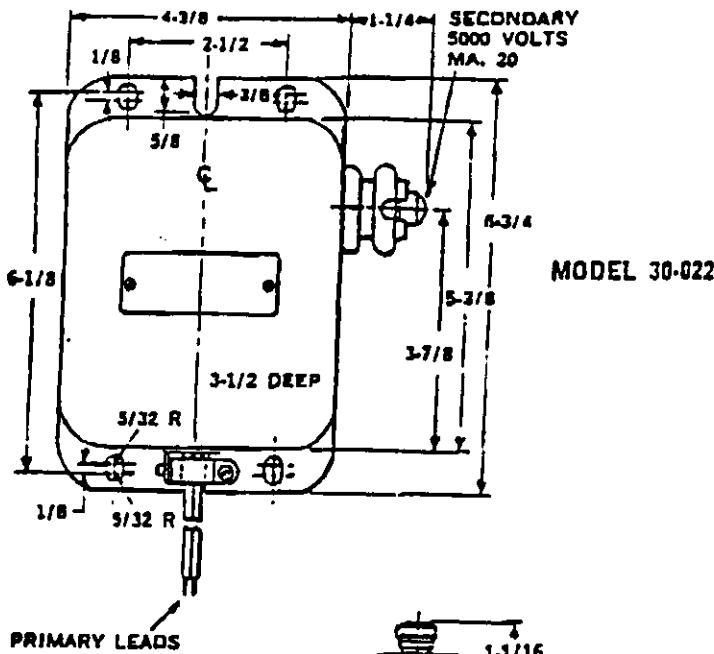
Standard—Other lengths available upon request.

\*Standard—Other lengths available upon request.



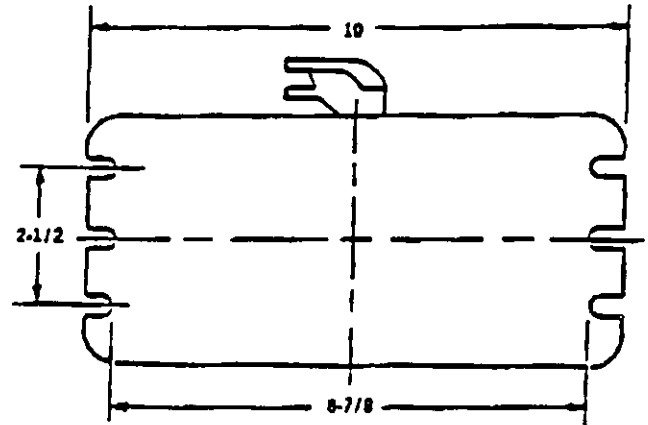
IGNITION TRANSFORMERS

SINGLE IGNITION GROUNDED TYPES



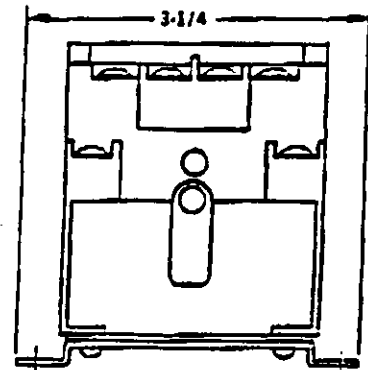
DUAL IGNITION MIDPOINT GROUNDED TYPES

MODEL 30-028

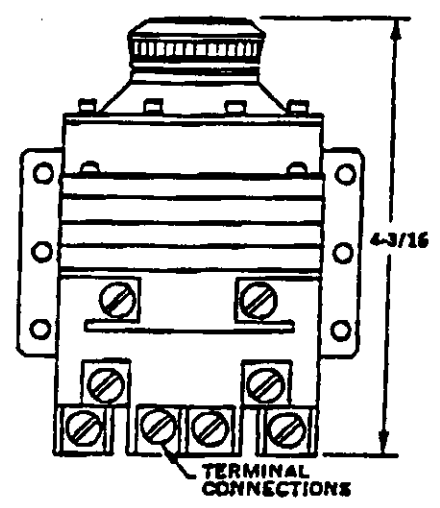
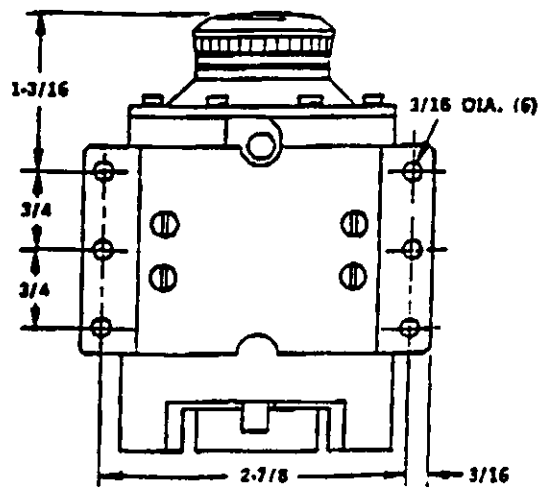
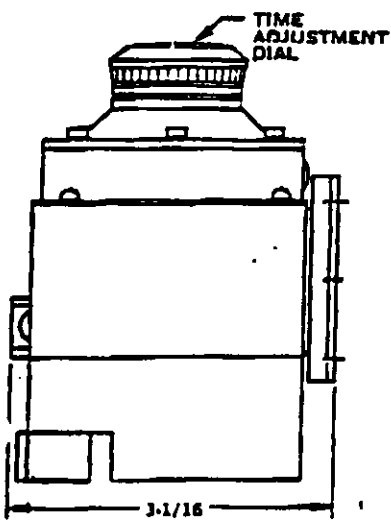
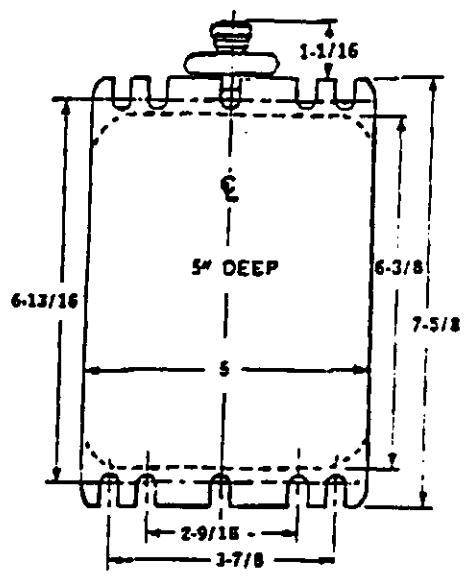


RESET TIMER FOR PRE-VENTILATION

38-159-1 AGASTAT  
(With Calibrated Dial Adjustment)

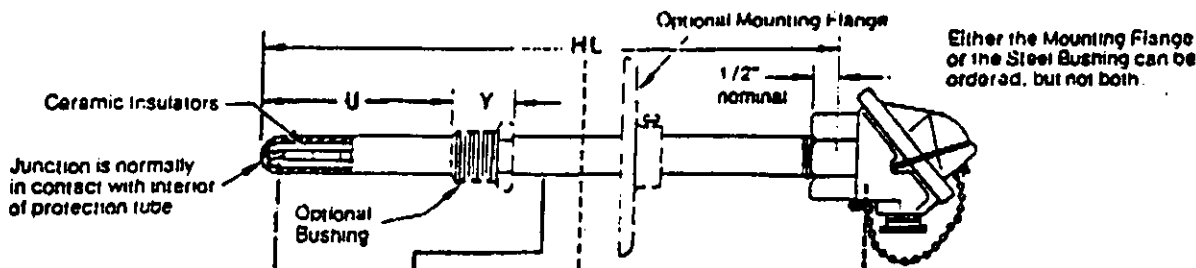


MODEL 30-079



# Thermocouples

## Straight Metal Pipe or Tube Protection — Closed or Open End



### ORDERING NUMBER

X XX X — XX X HL — X00 — X — XX

#### THERMOCOUPLE TYPE

- J — Iron-Constantan
- K — Chromel-Alumel
- T — Copper-Constantan (20 ga. only)
- E — Chromel-Constantan

#### THERMOCOUPLE WIRE

See Compatibility Table

#### AWG and Limits of Error

- 08 — 8—Standard
- 09 — 8—Special Limits
- 14 — 14—Standard
- 15 — 14—Special Limits
- 20 — 20—Standard
- 21 — 20—Special Limits

#### NUMBER OF ELEMENTS

See Compatibility Table

- 0 — One
- 1 — Two
- 2 — Single twisted, ungrounded
- 3 — Butt-welded, grounded
- 4 — Single butt-welded, ungrounded
- 5 — Butt-welded, ungrounded, dual common
- 6 — Butt-welded, ungrounded, isolated dual

#### PROTECTION TUBE OR PIPE

See Compatibility Table

- | Tube | OD (In.) | Material  |
|------|----------|---|
| 01   | 1-5/8    | Coated cast iron  |
| 09   | 1-5/8    | Cast iron   |
| *41  | 1-1/4    | Ceramic coated steel; immersion depth is nom. HL-2"                             |
| **42 | 1-1/4    | Ceramic coated steel with spring; immersion depth is nom. HL-2" (HL = 18" min.) |
| 45   | 1-1/8    | Meehanite (n/a in 42" and 48" length)   |

\*Only with additional fitting code 0; for replacement element specify A-11711-XXX-X-XX

\*\*Only with additional fitting code 0; for replacement element specify A-11000-XXX-X-XX

Pipe	Nom. Size (In.)	Material (See Table for ID and head mounting NPT)
03	1/2	Low carbon black steel
05	1XH	Low carbon black steel
06	1/8	Steel, SAE 1020
07	1/4	Steel, SAE 1026
08	1XH	Steel, SAE 1025
1	3/4	446 SS
1.	1/2	446 SS
13	1	446 SS
16	1/2	Inconel 601
17	3/4	Inconel 601
18	1/4	304 SS
19	1/2	304 SS

Either the Mounting Flange or the Steel Bushing can be ordered, but not both.

**U DIMENSION**  
Specify in whole inches. Applicable only when additional fitting code is 8, or A thru N. Otherwise insert 00. Maximum U dimension is HL minus 2".

#### ADDITIONAL FITTINGS

- 0 — None
- 2 — Adjustable flange (not with prot. tube codes 41 or 42)
- 8 — Standard welded bushing:

#### NPT

(Thrd Size)	Material	Available with Pipe Code
1/2"	Black steel	06
1/2"	Black steel	07,17
3/4"	Black steel	03,12,16,19,44
1"	Black steel	11,17
1-1/2"	Black steel	05,08,13

#### Optional welded bushings:

A — 1/2"	Black steel	06,07,18
E — 1/2"	316 SS	06,07,18
B — 3/4"	Black steel	03,06,07,12,16,18,19,44
F — 3/4"	316 SS	03,06,07,12,16,18,19,44
G — 1"	316 SS	03,06,07,11,12,16,17,18,19
M — 1-1/4"	Black steel	03,05,08,11,12,13,16,17,19,44
N — 1-1/4"	316 SS	03,05,08,11,12,13,16,17,19,44
H — 1-1/2"	316 SS	03,05,08,11,12,13,16,17,19,44

#### HOT END

- 0 — Closed
- 8 — Open

#### HOT LENGTH, HL

Specify in whole inches 12" minimum and increments of 6". Maximum standard length is 48"

#### COLD END TERMINATION

- 1 — General purpose head, cast iron
- 2 — Weatherproof head, internal threads, cast iron
- 3 — General purpose head, aluminum
- 8 — Explosion proof head, cast iron body, aluminum cover

ATTACHMENT 3

United Ins (Medley) 2/11/11 18 1990

James  
to A. Benard  
G. Salinas  
D. Moore  
J. Smith



# Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406 • 407-964-9668

Bob Martinez, Governor

Dale Twachtmann, Secretary

John Shearer, Assistant Secretary  
Scott Benyon, Deputy Assistant Secretary

## NOTICE OF PERMIT

JUL 16 1990

Dade County  
SW - Medley Landfill  
Permit File

Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West  
Suite 300  
Fort Lauderdale, FL 33309

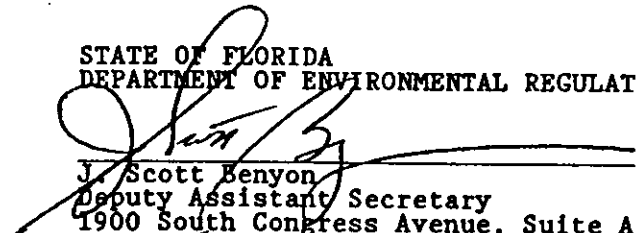
Dear Mr. O'Connor:

Enclosed is Permit Number SC 13-179974 to construct/operate a Solid Waste Resource Recovery and Management Facility issued pursuant to Section 403.707, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

  
J. Scott Benyon  
Deputy Assistant Secretary  
1900 South Congress Avenue, Suite A  
West Palm Beach, FL 33406  
407/964-9668

JSB:jlh/23

Copies furnished to:

- cc: Chris McGuire, OGC/Tlh.
- John Reese, SW/Tlh.
- Fred Wick, SW/Tlh.
- Mike Graham, DERM (w/out Encl.)
- Neal Williams, GoeServices

## CERTIFICATE OF SERVICE

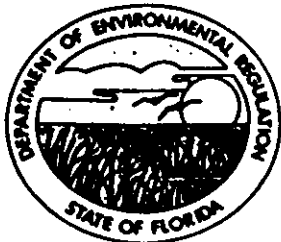
This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on JUL 16 1990 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to §120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

  
Clerk

JUL 16 1990  
Date



# Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406 • 407-964-9668

Bob Martinez, Governor

Dale Twachtmann, Secretary

John Shearer, Assistant Secretary  
Scott Benyon, Deputy Assistant Secretary

**PERMITTEE:**

Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West  
Suite 300  
Fort Lauderdale, FL 33309

I.D. NUMBER: 5013P13040

PERMIT/CERTIFICATION NUMBER: SC 13-179974 \*

DATE OF ISSUE:

EXPIRATION DATE: JUL 16 1990

COUNTY: Dade

LATITUDE/LONGITUDE: 25° 52' 31" N / 80° 21' 03" W

SECTION/TOWNSHIP/RANGE: S4/T53/R40

PROJECT: Medley Landfill

This permit is issued under the provisions of Chapters 403, Florida Statutes, and Florida Administrative Code Rule 17-701. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

**To Construct:** A 43.5 acre bottom and side slope lined landfill system. The bottom liners consist of two (2) layers of 60 mil HDPE (primary and secondary) underlain by six (6) inches of rocks tailings with a permeability of  $1 \times 10^{-5}$  cm/sec and associated leachate collection and detection systems. The side slope liner is a nominal 60 mil HDPE roughened geomembrane with a geotextile filter, geonet drainage layer and one foot of protective subbase soils.

**To Operate:** A Class I Sanitary Landfill consisting of two (2) separate bottom lined landfills (6 and 10 acres respectively totaling sixteen (16) acres collectively). The bottom liners consist of a 60 mil H.D.P.E. liner, leachate collection system and an approved surface water management system. The total disposal acreage of this site is 157.6 acres.

**IN ACCORDANCE WITH:** An application to construct/operate a Solid Waste Resource Recovery and Management Facility dated May 3, 1990 along with certified engineering plans, drawings, Notice of Application published May 31, 1990, and additional information received on May 31, 1990, respectively.

**LOCATED AT:** 9350 Northwest 89 Avenue, Medley, Dade County, Florida.

**TO SERVE:** Dade County

**SUBJECT TO:** General Conditions 1-15 and Specific Conditions 1- 21.

\* This permit supercedes Permit S0 13-148518 issued November 28, 1988. This permit does not relieve the permittee from compliance with the terms of Consent Order OGC Case No. 82-0187.

**PERMITTEE:**  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

**I.D. NUMBER:** 5013P13040  
**PERMIT/CERTIFICATION NUMBER:** SC 13-179974  
**DATE OF ISSUE:** JUL 1 6 1990  
**EXPIRATION DATE:** JUL 1 6 1995

JUL 1 6 1995

**GENERAL CONDITIONS:**

1. The terms, conditions, requirements, limitations, and restrictions set forth herein are "Permit Conditions" and as such are binding upon the permittee and enforceable pursuant to the authority of Sections 403.161, Florida Statutes. The permittee is hereby placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the "Permit Conditions" by the permittee, its agents, employees, servants or representatives.
2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.
3. As provided in Subsections 403.087(6), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit does not constitute a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.
4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the state. Only the Trustees of the Internal Improvement Trust Fund may express state opinion as to title.
5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, plant or aquatic life or property and penalties therefor caused by the construction or operation of this permitted source, nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.
6. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules.
7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law, access to the premises, at reasonable times, where the permitted activity is located or conducted for the purpose of:
  - a. Having access to and copying any records that must be kept under the conditions of the permit;
  - b. Inspecting the facility, equipment, practices, or operations regulated or required under this permit; and
  - c. Sampling or monitoring any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.Reasonable time may depend on the nature of the concern being investigated.
8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, the permittee shall immediately notify and provide the Department with the following information:
  - a. a description of and cause of non-compliance; and
  - b. the period of non-compliance, including exact dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.

PERMITTEE:  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
PERMIT/CERTIFICATION NUMBER: SC 13-179974  
DATE OF ISSUE: JUL 16 1990  
EXPIRATION DATE: JUL 16 1995

JUL 16 1995

GENERAL CONDITIONS Cont'd:

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case arising under the Florida Statutes or Department rules, except where such use is proscribed by Sections 403.73 and 403.111, Florida Statutes.
10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.
11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-730.300, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.
12. This permit is required to be kept at the work site of the permitted activity during the entire period of construction or operation.
13. This permit also constitutes:
  - ( ) Determination of Best Available Control Technology (BACT)
  - ( ) Determination of Prevention of Significant Deterioration (PSD)
  - ( ) Certification of Compliance with State Water Quality Standards (Section 401, PL 92-500)
  - ( ) Compliance with New Source Performance Standards
14. The permittee shall comply with the following monitoring and record keeping requirements:
  - a. Upon request, the permittee shall furnish all records and plans required under Department rules. The retention period for all records will be extended automatically, unless otherwise stipulated by the Department, during the course of any unresolved enforcement action.
  - b. The permittee shall retain at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation), copies of all reports required by this permit, and records of all data used to complete the application for this permit. The time period of retention shall be at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.
  - c. Records of monitoring information shall include:
    - the date, exact place, and time of sampling or measurements;
    - the person responsible for performing the sampling or measurements
    - the date(s) analyses were performed;
    - the person responsible for performing the analyses;
    - analytical techniques or methods used; and
    - results of such analyses.
15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

PERMITTEE:  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
PERMIT/CERTIFICATION NUMBER: SC 13-179974  
DATE OF ISSUE: JUL 1 6 1990  
EXPIRATION DATE: JUL 1 6 1995

**SPECIFIC CONDITIONS:**

1. Prior to liner installation, the subgrade shall be prepared to provide a firm unyielding foundation. The base shall be brought up to grade by placement and compaction of limerock. The upper portion of the base shall be of select materials of one-quarter inch maximum size not containing shells, angulars or other materials which could damage the liner.
2. The permittee is responsible for obtaining the services of a registered land surveyor who shall provide a minimum second order of accuracy on: triangulation, traverse, leveling and base-line measurements of the base grade as shown on the approved drawings. The base grade shall be certified in writing by the liner contractor and installer prior to liner placement.
3. A documented control program shall be established for the lined expansion phases as follows:
  - a. A map of each sector showing panel layouts as installed.
  - b. A letter of certification signed by the liner manufacturer or manufacturer's representative and the sanitary landfill inspector stating that all weld test results and vacuum or pressure testing of all welded seams were visually observed by both.
  - c. The professional engineer registered in the State of Florida shall review the inspections and test records for each sector as certified by the liner manufacturer or manufacturer's representative and the sanitary landfill inspector. The professional engineer shall certify in writing that the bottom liner and leachate collection system have been installed in accordance with the plans as approved by the Department. Such certification shall be submitted to the Department and the Metro Dade County Department of Environmental Resources Management (DERM) after construction completion.
4. Installation of the liner shall be performed by an experienced installer who has installed a minimum of 500,000 square feet of similar type liners or shall be performed under the supervision of the manufacturer. An experienced sanitary landfill inspector responsible to the engineer of record shall observe liner installation and grade elevations. The permittee shall notify the Department five (5) days prior to any liner installation work.
5. In order to protect the primary liner, a minimum of two (2) feet of clean soil fill shall be placed over the liner. The sand fill shall provide a lateral zone to hydraulically connect the entire leachate collection system.
6. The leachate collection system shall be installed according to the approved plans and drawings.
7. No solid waste shall be disposed of into the new sector(s) of the lined expansion phase until a professional engineer certifies completion of construction on DER Form 17-7.130(2) and contacts the Department to arrange for an inspection of each new sector with the engineer and on-site facility operator.
8. The permittee is responsible to retain a professional engineer registered in the State of Florida for the supervision of the construction of this project, and upon completion, the engineer shall submit a summary report to the Department as to the complete conformity to the plans and specifications as approved. This summary report shall include a documented control program of the liner installation, liner inspections and the quality assurance/quality control testing procedures, laboratory analyses and engineer's certification of construction.



PERMITTEE:  
Mr. Harvey H. Bush, Jr., P.E.  
Waste Management, Inc. of Florida

I.D. NUMBER: 5006C06029  
PERMIT/CERTIFICATION NUMBER: SC 06-184761  
DATE OF ISSUE: NOV 21 1990  
EXPIRATION DATE: NOV 21 1995

**SPECIFIC CONDITIONS CON'T.:**

8. The permittee shall submit a monthly operating report (MOR) by the fifteenth (15) day of the succeeding month to:

Florida Department of Environmental Regulation  
Solid Waste Administrator  
Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400; and a copy to:

Florida Department of Environmental Regulation  
S.E. Florida District Office  
Solid Waste Section  
1900 South Congress Avenue, Suite A  
West Palm Beach, FL 33406

Reports shall include the following information:

- a) types of solid waste received;
  - b) quantities of solid wastes received; and
  - c) quantities of leachate (gallons) pumped to the sanitary sewer system.
9. Stormwater that comes in contact with leachate shall be treated as leachate.
10. Stormwater shall meet the water quality standards as established in Chapters 17-3 and 17-4, Florida Administrative Codes at the point of discharge at the property boundaries.
11. The groundwater monitoring plan is approved pursuant to Section 17-28.700, Florida Administrative Code for this site as shown on Exhibit I attached. This monitoring plan is subject to change based upon the results of the CAP/RAP in Specific Condition 20.

Groundwater Sample Locations - Exhibit I

- (a) Monitoring well clusters 1, 5, 11, 12, 13 and 14 shall be sampled quarterly (January, April, July, October) and semi-annually (April and October) for the following parameters.
- (b) Quarterly Groundwater Parameters

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
· Ammonia Nitrogen	000610	mg/l
· Chemical Oxygen Demand	000340	mg/l
· Chloride	000940	mg/l
· Total Coliform	031505	#/100
· Fecal Coliform	031616	#/100
· Total Copper	001042	ug/l
· Total Iron	001045	ug/l
· Total Lead	001051	ug/l
· Total Manganese	001055	ug/l
· Nitrate	000620	mg/l
· pH	000400	S.U.
· Sulfate	000946	mg/l
· Specific Conductance	000095	umhos/cm
· Total Dissolved Solids	000515	mg/l
· Total Zinc	001092	ug/l
· Water levels	082545	Feet (MSL)
· Nitrite	000615	mg/l

PERMITTEE:  
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Waste Management, Inc. of Florida

I.D. NUMBER: 5006C06029  
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EXPIRATION DATE:

NOV 21 1995

**SPECIFIC CONDITIONS:**

(b) Quarterly Groundwater Parameters Cont'd

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
· Arsenic	001002	ug/l
· Barium	001007	ug/l
· Cadmium	001027	ug/l
· Mercury	071900	ug/l
· Selenium	001147	ug/l
· Silver	001077	ug/l
· Sodium	000929	mg/l

(c) Semi Annual Groundwater Parameters (April, October)

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
· Bromodichloromethane	032101	ug/l
· Bromoform	032104	ug/l
· Bromomethane	034413	ug/l
· Carbon Tetrachloride	032102	ug/l
· Chloroethane	034311	ug/l
· 2-Chloroethylvinyl ether	034576	ug/l
· Chloroform	032106	ug/l
· Chloromethane	034418	ug/l
· Dibromochloromethane	032105	ug/l
· 1,2-Dichlorobenzene	034536	ug/l
· 1,3-Dichlorobenzene	034566	ug/l
· 1,4-Dichlorobenzene	034571	ug/l
· Dichlorodifluormethane	034668	ug/l
· 1,1-Dichloroethane	034496	ug/l
· 1,2-Dichloroethane	034531	ug/l
· 1,1-Dichloroethene	034501	ug/l
· trans-1,2-Dichloroethene	034546	ug/l
· 1,2-Dichloropropane	034541	ug/l
· cis-1,2-Dichloropropene	034704	ug/l
· trans-1,3-Dichloropropene	034699	ug/l
· Methylene chloride	034423	ug/l
· 1,1,2,2-Tetrachloroethane	034516	ug/l
· Tetrachloroethene	034475	ug/l
· 1,1,1-Trichloroethane	034506	ug/l
· 1,1,2-Trichloroethane	034511	ug/l
· Trichloroethene	039180	ug/l
· Trichlorofluoromethane	034488	ug/l
· Vinyl chloride	039175	ug/l
· Benzene	034030	ug/l
· Ethylbenzene	034371	ug/l
· Toluene	034010	ug/l

(d) The permittee shall maintain reasonable access to all the monitoring stations (owned by the permittee) required by this permit. In order to assure that representative samples are obtained, it shall be the responsibility of the permittee to maintain the integrity of the monitoring stations and protect them from destruction or vandalism. Should any of these stations be destroyed, the permittee shall notify the Department immediately. The notification shall include pertinent information as to the cause, and what steps are being taken to replace the monitoring station and prevent the recurrence of such problems in the future. A Well Completion Report shall be sent to the department on DER Form 17-1.216(2) within thirty (30) days of any new well construction.

12. Leachate shall be sampled quarterly (January, April, July, October) as follows:

(a) Leachate Sample Locations

Composite samples from the manholes of the lined expansion phase.

PERMITTEE:  
 Mr. Harvey H. Bush, Jr., P.E.  
 Waste Management, Inc. of Florida

I.D. NUMBER: 5006C06029  
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 DATE OF ISSUE: NOV 21 1990  
 EXPIRATION DATE:

NOV 21 1995

**SPECIFIC CONDITIONS:**

**(b) Leachate Parameters**

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
Total phosphorus	000665	mg/l
Total Kjeldahl Nitrogen	000625	mg/l
Total Dissolved Solids	000515	mg/l
Total phenols	032730	ug/l
Nitrate as N	000620	mg/l
Ammonia as N	000610	mg/l
Lead	001051	ug/l
Arsenic	001002	ug/l
Sodium	000929	ug/l
Barium	001007	ug/l
Selenium	001147	ug/l
Silver	001077	ug/l
Fluoride	000951	mg/l
Zinc	001092	ug/l
Chromium	001034	ug/l
Cadmium	001027	ug/l
Mercury	071900	ug/l
Trichlorethene	039180	ug/l
Tetrachloroethene	034475	ug/l
Carbon Tetrachloride	032102	ug/l
Vinyl Chloride	039175	ug/l
1,1,1-Trichloroethane	034506	ug/l
1,2-Dichloroethane	034531	ug/l
Benzene	034030	ug/l
Ethylene Dibromide	900222	ug/l
Chlorides	000940	mg/l
Color	000080	PCU
Turbidity	082079	NTU
Odor	000085	Threshold #
pH	000400	S.U.
Conductance	000094	umhos/cm
Temperature	000010	°C
Sulfate	000946	mg/l
Chemical Oxygen Demand	000340	mg/l
Biological Oxygen Demand	050080	mg/l
Nitrite	000615	mg/l

13. All ground water and leachate analyses shall be submitted to the Department within ninety (90) days of sampling on DER Form 17-1.216(2), copy enclosed as Exhibit II.
14. The zone of discharge for this site shall be in accordance with FAC Rule 17-28.700 and extend to the property boundaries horizontally and vertically to the first confining layer.
15. The maximum height of this landfill shall be 186 feet above mean sea level in accordance with the Engineering Report of the Application.
16. On or before January 31 of each year the permittee shall submit an annual elevation survey of the site as prepared by a land surveyor registered in the State of Florida. This survey shall clearly show the horizontal and vertical dimensions of the landfilled area.
17. Prior to the deposition of solid waste into the lined ash monofill the permittee shall receive written approval from the Department by demonstrating compliance with the Financial Responsibility requirements of Rule 17-701.076, FAC.
19. The permittee shall obtain a permit from South Florida Water Management District prior to the construction of the lined expansion phases.

PERMITTEE:  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
PERMIT/CERTIFICATION NUMBER: SC 13-179974  
DATE OF ISSUE: JUL 1 6 1990  
EXPIRATION DATE: JUL 1 6 1995

JUL 1 6 1995

**SPECIFIC CONDITIONS:**

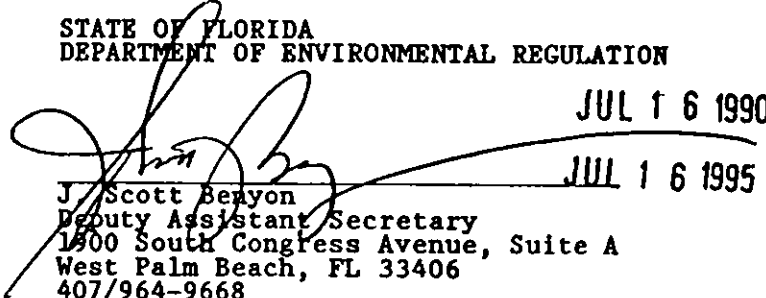
20. The permittee shall obtain a permit from South Florida Water Management District prior to the construction of the lined expansion phases.
21. The permittee shall continue to implement the "Corrective Actions for Ground Water Contamination Cases (CAFGWCC)" in accordance with the Department's March 28, 1990 letter of approval. All subsequent actions/reports required in the CAFGWCC shall be submitted in quadruplicate to the Department within the time frames specified in the CAFGWCC.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

JUL 1 6 1990

JUL 1 6 1995

  
J. Scott Benyon  
Deputy Assistant Secretary  
1900 South Congress Avenue, Suite A  
West Palm Beach, FL 33406  
407/964-9668

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA  
DISTRICT

3301 GUN CLUB ROAD  
P.O. BOX 3858  
WEST PALM BEACH, FLORIDA 33402



BOB GRAHAM  
GOVERNOR  
VICTORIA J. TSCHINKEL  
SECRETARY  
ROY DUKE  
DISTRICT MANAGER

QUARTERLY REPORT ON GROUND WATER MONITORING  
Rule 17-4.245(6)(k)2.

GMS # \_\_\_\_\_ DATE \_\_\_\_\_

DER PERMIT # \_\_\_\_\_

Installation Name \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_ State Zip \_\_\_\_\_ County \_\_\_\_\_

Owner or Authorized Representative's Name \_\_\_\_\_ Title \_\_\_\_\_

Method of Discharge \_\_\_\_\_

Type of Industry \_\_\_\_\_

Report for Period \_\_\_\_\_ date \_\_\_\_\_ to \_\_\_\_\_ date \_\_\_\_\_

Attach monitoring data as approved in monitoring plan using parameter monitoring report forms. When applicable, attach additional sheets describing any changes in the background water quality and the discharge plume since the last reported description. Include any changes in size, direction of movement, rate of movement, and concentration changes of plume constituents in violation of the applicable standards.

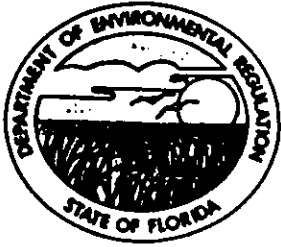
NOTE: Pursuant to Rule 17-4.245(6)(k)3., at any time there is a change in the permitted volume, location or chemical, physical or microbiological composition of the discharge plume, the permittee shall notify the department and, if required by the department, submit a new report stating the volume and chemical, physical and microbiological compositions of the discharge at the point of release or contact with the ground water at the site boundary.

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Owner or Authorized Representative's Signature \_\_\_\_\_ Date \_\_\_\_\_

EXHIBIT II



*Forward to Albert G. Sales & Moore*

# Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406 • 407-964-9668

Bob Martinez, Governor

Dale Twachtmann, Secretary

John Shearer, Assistant Secretary  
Scott Benyon, Deputy Assistant Secretary

## NOTICE OF PERMIT

JUL 16 1990

Dade County  
SW - Medley Landfill  
Permit File

Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West  
Suite 300  
Fort Lauderdale, FL 33309

Dear Mr. O'Connor:

Enclosed is Permit Number SC 13-179974 to construct/operate a Solid Waste Resource Recovery and Management Facility issued pursuant to Section 403.707, Florida Statutes.

Any party to this Order (permit) has the right to seek judicial review of the permit pursuant to Section 120.58, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 2600 Blair Stone Road, Tallahassee, Florida 32301; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this Notice is filed with the Clerk of the Department.

Executed in West Palm Beach, Florida.

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

*[Signature]*  
J. Scott Benyon  
Deputy Assistant Secretary  
1900 South Congress Avenue, Suite A  
West Palm Beach, FL 33406  
407/964-9668

JSB:jlh/23

Copies furnished to:

cc: Chris McGuire, OGC/Tlh.  
John Reese, SW/Tlh.  
Fred Wick, SW/Tlh.  
Mike Graham, DERM (w/out Encl.)  
Neal Williams, GoeServices

## CERTIFICATE OF SERVICE

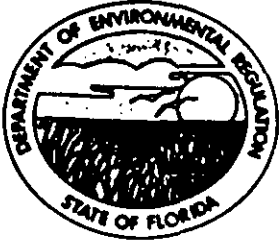
This is to certify that this NOTICE OF PERMIT and all copies were mailed before the close of business on JUL 16 1990 to the listed persons.

Clerk Stamp

FILING AND ACKNOWLEDGEMENT FILED, on this date, pursuant to §120.52(10), Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

*[Signature]*  
Clerk

JUL 16 1990  
Date



# Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406 • 407-964-9668

Bob Martinez, Governor

Dale Twachtmann, Secretary

John Shearer, Assistant Secretary  
Scott Benyon, Deputy Assistant Secretary

**PERMITTEE:**

Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West  
Suite 300  
Fort Lauderdale, FL 33309

I.D. NUMBER: 5013P13040

PERMIT/CERTIFICATION NUMBER: SC 13-179974 \*

DATE OF ISSUE:

EXPIRATION DATE: JUL 16 1990

COUNTY: Dade

LATITUDE/LONGITUDE: 25°58'31"N/80°21'03"W

SECTION/TOWNSHIP/RANGE: S4/T53/R40

PROJECT: Medley Landfill

This permit is issued under the provisions of Chapters 403, Florida Statutes, and Florida Administrative Code Rule 17-701. The above named permittee is hereby authorized to perform the work or operate the facility shown on the application and approved drawing(s), plans, and other documents attached hereto or on file with the Department and made a part hereof and specifically described as follows:

**To Construct:** A 43.5 acre bottom and side slope lined landfill system. The bottom liners consist of two (2) layers of 60 mil HDPE (primary and secondary) underlain by six (6) inches of rocks tailings with a permeability of  $1 \times 10^{-5}$  cm/sec and associated leachate collection and detection systems. The side slope liner is a nominal 60 mil HDPE roughened geomembrane with a geotextile filter, geonet drainage layer and one foot of protective subbase soils.

**To Operate:** A Class I Sanitary Landfill consisting of two (2) separate bottom lined landfills (6 and 10 acres respectively totaling sixteen (16) acres collectively. The bottom liners consist of a 60 mil H.D.P.E. liner, leachate collection system and an approved surface water management system. The total disposal acreage of this site is 157.6 acres.

**IN ACCORDANCE WITH:** An application to construct/operate a Solid Waste Resource Recovery and Management Facility dated May 3, 1990 along with certified engineering plans, drawings, Notice of Application published May 31, 1990, and additional information received on May 31, 1990, respectively.

**LOCATED AT:** 9350 Northwest 89 Avenue, Medley, Dade County, Florida.

**TO SERVE:** Dade County

**SUBJECT TO:** General Conditions 1-15 and Specific Conditions 1- 21.

\* This permit supercedes Permit SO 13-148518 issued November 28, 1988. This permit does not relieve the permittee from compliance with the terms of Consent Order OGC Case No. 82-0187.

**PERMITTEE:**  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

**I.D. NUMBER:** 5013P13040  
**PERMIT/CERTIFICATION NUMBER:** SC 13-179974  
**DATE OF ISSUE:**  
**EXPIRATION DATE:** JUL 1 6 1990

**JUL 1 6 1995**

**GENERAL CONDITIONS:**

1. The terms, conditions, requirements, limitations, and restrictions set forth herein are "Permit Conditions" and as such are binding upon the permittee and enforceable pursuant to the authority of Sections 403.161, Florida Statutes. The permittee is hereby placed on notice that the Department will review this permit periodically and may initiate enforcement action for any violation of the "Permit Conditions" by the permittee, its agents, employees, servants or representatives.
2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviation from the approved drawings, exhibits, specifications, or conditions of this permit may constitute grounds for revocation and enforcement action by the Department.
3. As provided in Subsections 403.087(6), Florida Statutes, the issuance of this permit does not convey any vested rights or any exclusive privileges. Nor does it authorize any injury to public or private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations. This permit does not constitute a waiver of or approval of any other Department permit that may be required for other aspects of the total project which are not addressed in the permit.
4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgement of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the state. Only the Trustees of the Internal Improvement Trust Fund may express state opinion as to title.
5. This permit does not relieve the permittee from liability for harm or injury to human health or welfare, animal, plant or aquatic life or property and penalties therefor caused by the construction or operation of this permitted source, nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department.
6. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit, as required by Department rules.
7. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, upon presentation of credentials or other documents as may be required by law, access to the premises, at reasonable times, where the permitted activity is located or conducted for the purpose of:
  - a. Having access to and copying any records that must be kept under the conditions of the permit;
  - b. Inspecting the facility, equipment, practices, or operations regulated or required under this permit; and
  - c. Sampling or monitoring any substances or parameters at any location reasonably necessary to assure compliance with this permit or Department rules.Reasonable time may depend on the nature of the concern being investigated.
8. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in the permit, the permittee shall immediately notify and provide the Department with the following information:
  - a. a description of and cause of non-compliance; and
  - b. the period of non-compliance, including exact dates and times; or, if not corrected, the anticipated time the non-compliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the non-compliance.



**PERMITTEE:**  
Mr. James E. O'Connor, Regional Manager  
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**I.D. NUMBER:** 5013P13040  
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**DATE OF ISSUE:** JUL 16 1990  
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**GENERAL CONDITIONS Cont'd:**

The permittee shall be responsible for any and all damages which may result and may be subject to enforcement action by the Department for penalties or revocation of this permit.

9. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data and other information relating to the construction or operation of this permitted source, which are submitted to the Department, may be used by the Department as evidence in any enforcement case arising under the Florida Statutes or Department rules, except where such use is proscribed by Sections 403.73 and 403.111, Florida Statutes.
10. The permittee agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance, provided however, the permittee does not waive any other rights granted by Florida Statutes or Department rules.
11. This permit is transferable only upon Department approval in accordance with Florida Administrative Code Rules 17-4.120 and 17-730.300, as applicable. The permittee shall be liable for any non-compliance of the permitted activity until the transfer is approved by the Department.
12. This permit is required to be kept at the work site of the permitted activity during the entire period of construction or operation.
13. This permit also constitutes:
  - ( ) Determination of Best Available Control Technology (BACT)
  - ( ) Determination of Prevention of Significant Deterioration (PSD)
  - ( ) Certification of Compliance with State Water Quality Standards (Section 401, PL 92-500)
  - ( ) Compliance with New Source Performance Standards
14. The permittee shall comply with the following monitoring and record keeping requirements:
  - a. Upon request, the permittee shall furnish all records and plans required under Department rules. The retention period for all records will be extended automatically, unless otherwise stipulated by the Department, during the course of any unresolved enforcement action.
  - b. The permittee shall retain at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation), copies of all reports required by this permit, and records of all data used to complete the application for this permit. The time period of retention shall be at least three years from the date of the sample, measurement, report or application unless otherwise specified by Department rule.
  - c. Records of monitoring information shall include:
    - the date, exact place, and time of sampling or measurements;
    - the person responsible for performing the sampling or measurements
    - the date(s) analyses were performed;
    - the person responsible for performing the analyses;
    - analytical techniques or methods used; and
    - results of such analyses.
15. When requested by the Department, the permittee shall within a reasonable time furnish any information required by law which is needed to determine compliance with the permit. If the permittee becomes aware that relevant facts were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be submitted or corrected promptly.

**PERMITTEE:**  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

**I.D. NUMBER:** 5013P13040  
**PERMIT/CERTIFICATION NUMBER:** SC 13-179974  
**DATE OF ISSUE:** JUL 16 1990  
**EXPIRATION DATE:** JUL 16 1995

**SPECIFIC CONDITIONS:**

1. Prior to liner installation, the subgrade shall be prepared to provide a firm unyielding foundation. The base shall be brought up to grade by placement and compaction of limerock. The upper portion of the base shall be of select materials of one-quarter inch maximum size not containing shells, angulars or other materials which could damage the liner.
2. The permittee is responsible for obtaining the services of a registered land surveyor who shall provide a minimum second order of accuracy on: triangulation, traverse, leveling and base-line measurements of the base grade as shown on the approved drawings. The base grade shall be certified in writing by the liner contractor and installer prior to liner placement.
3. A documented control program shall be established for the lined expansion phases as follows:
  - a. A map of each sector showing panel layouts as installed.
  - b. A letter of certification signed by the liner manufacturer or manufacturer's representative and the sanitary landfill inspector stating that all weld test results and vacuum or pressure testing of all welded seams were visually observed by both.
  - c. The professional engineer registered in the State of Florida shall review the inspections and test records for each sector as certified by the liner manufacturer or manufacturer's representative and the sanitary landfill inspector. The professional engineer shall certify in writing that the bottom liner and leachate collection system have been installed in accordance with the plans as approved by the Department. Such certification shall be submitted to the Department and the Metro Dade County Department of Environmental Resources Management (DERM) after construction completion.
4. Installation of the liner shall be performed by an experienced installer who has installed a minimum of 500,000 square feet of similar type liners or shall be performed under the supervision of the manufacturer. An experienced sanitary landfill inspector responsible to the engineer of record shall observe liner installation and grade elevations. The permittee shall notify the Department five (5) days prior to any liner installation work.
5. In order to protect the primary liner, a minimum of two (2) feet of clean soil fill shall be placed over the liner. The sand fill shall provide a lateral zone to hydraulically connect the entire leachate collection system.
6. The leachate collection system shall be installed according to the approved plans and drawings.
7. No solid waste shall be disposed of into the new sector(s) of the lined expansion phase until a professional engineer certifies completion of construction on DER Form 17-7.130(2) and contacts the Department to arrange for an inspection of each new sector with the engineer and on-site facility operator.
8. The permittee is responsible to retain a professional engineer registered in the State of Florida for the supervision of the construction of this project, and upon completion, the engineer shall submit a summary report to the Department as to the complete conformity to the plans and specifications as approved. This summary report shall include a documented control program of the liner installation, liner inspections and the quality assurance/quality control testing procedures, laboratory analyses and engineer's certification of construction.

PERMITTEE:  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
PERMIT/CERTIFICATION NUMBER: SC 13-179974  
DATE OF ISSUE:  
EXPIRATION DATE: JUL 16 1990

JUL 16 1995

**SPECIFIC CONDITIONS CON'T.:**

9. The permittee shall submit a monthly operating report (MOR) by the fifteenth (15) day of the succeeding month to:

Florida Department of Environmental Regulation  
Solid Waste Administrator  
Twin Towers Office Building  
2600 Blair Stone Road  
Tallahassee, Florida 32399-2400; and a copy to:

Florida Department of Environmental Regulation  
S.E. Florida District Office  
Solid Waste Section  
1900 South Congress Avenue, Suite A  
West Palm Beach, FL 33406

Reports shall include the following information:

- a) type of solid waste received (i.e. trash, yard trash and garbage);
  - b) quantities of solid wastes received; and
  - c) quantities of leachate (gallons) pumped to the POTW.
10. Stormwater that comes in contact with leachate shall be treated as leachate.
11. Stormwater shall meet the water quality standards as established in Chapters 17-3 and 17-4, Florida Administrative Codes at the point of discharge at the property boundaries.
12. The groundwater monitoring plan is approved pursuant to Section 17-28.700, Florida Administrative Code for this site as shown on Exhibit I attached.

Groundwater Sample Locations - Exhibit I

- (a) Monitoring well clusters 1, 1D, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14 shall be sampled quarterly (January, April, July, October) and semi-annually (April and October) for the following parameters.
- (b) Quarterly Groundwater Parameters

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
Ammonia Nitrogen	000610	mg/l
Chemical Oxygen Demand	000340	mg/l
Chloride	000940	mg/l
Total Coliform	031505	#/100
Fecal Coliform	031616	#/100
Total Copper	001042	ug/l
Total Iron	001045	ug/l
Total Lead	001051	ug/l
Total Manganese	001055	ug/l
Nitrate	000620	mg/l
pH	000400	S.U.
Sulfate	000946	mg/l
Specific Conductance	000095	umhos/cm
Total Dissolved Solids	000515	mg/l
Total Zinc	001092	ug/l
Water levels	082545	Feet (MSL)
Nitrite	000615	mg/l

PERMITTEE:  
 Mr. James E. O'Connor, Regional Manager  
 Waste Management, Inc. of Florida  
 500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
 PERMIT/CERTIFICATION NUMBER: SC 13-179974  
 DATE OF ISSUE: JUL 1 6 1990  
 EXPIRATION DATE: JUL 1 6 1995

JUL 1 6 1995

SPECIFIC CONDITIONS:

(c) Semi Annual Groundwater Parameters

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
Acrolein	34210	ug/l
Acrylonitrile	34215	ug/l
Benzene	34030	ug/l
Bis (chloromethyl) ether	34268	ug/l
Bromoform	32104	ug/l
Carbon Tetrachloride	32102	ug/l
Chlorobenzene	34301	ug/l
Chlorodibromomethane	32105	ug/l
Chloroethane	34311	ug/l
2 - Chloroethylvinyl ether	34576	ug/l
Chloroform	32106	ug/l
Dichlorobromomethane	32101	ug/l
Dichlorodifluoromethane	34668	ug/l
1, 1 Dichloroethane	34496	ug/l
1, 2 Dichloroethane	34531	ug/l
1, 1 Dichloroethene	34501	ug/l
1, 2 Dichloropropane	34541	ug/l
cis - 1,3 - Dichloropropene	34561	ug/l
Ethylbenzene	34371	ug/l
Bromomethane	34413	ug/l
Chloromethane	34418	ug/l
Methylene Chloride	34423	ug/l
1, 1, 2, 2 - Tetrachloroethane	34516	ug/l
1, 1, 1 - Trichloroethane	34506	ug/l
1, 1, 2 - Trichloroethane	34511	ug/l
Trichloroethene	39180	ug/l
Trichlorofluoromethane	34488	ug/l
Vinyl Chloride	39175	ug/l
trans -1, 3- Dichloropropene	34699	ug/l

12. The permittee shall maintain reasonable access to all the monitoring stations (owned by the permittee) required by this permit. In order to assure that representative samples are obtained, it shall be the responsibility of the permittee to maintain the integrity of the monitoring stations and protect them from destruction or vandalism. Should any of these stations be destroyed, the permittee shall notify the Department immediately. The notification shall include pertinent information as to the cause, and what steps are being taken to replace the monitoring station and prevent the recurrence of such problems in the future. A Well Completion Report shall be sent to the department on DER Form 17-1.216(2) within thirty (30) days of any new well construction.

13. Leachate shall be sampled semi-annually (April and October) as follows:

(a) Leachate Sample Locations

Composite samples from the manholes of the lined expansion phase.

(b) Leachate Parameters

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
Total phosphorus	000665	mg/l
Total Kjeldahl Nitrogen	000625	mg/l
Total Dissolved Solids	000515	mg/l
Total phenols	032730	ug/l
Nitrate as N	000620	mg/l
Ammonia as N	000610	mg/l
Lead	001051	ug/l
Arsenic	001002	ug/l

PERMITTEE:  
 Mr. James E. O'Connor, Regional Manager  
 Waste Management, Inc. of Florida  
 500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
 PERMIT/CERTIFICATION NUMBER: SC 13-179974  
 DATE OF ISSUE: JUL 16 1990  
 EXPIRATION DATE: JUL 16 1995

JUL 16 1995

**SPECIFIC CONDITIONS:**

<u>Parameters</u>	<u>Storet Codes</u>	<u>Units</u>
Barium	001007	ug/l
Selenium	001147	ug/l
Silver	001077	ug/l
Fluoride	000951	mg/l
Zinc	001092	ug/l
Chromium	001034	ug/l
Cadmium	001027	ug/l
Mercury	071900	ug/l
Trichlorethene	039180	ug/l
Tetrachloroethene	034475	ug/l
Carbon Tetrachloride	032102	ug/l
Vinyl Chloride	039175	ug/l
1,1,1-Trichloroethane	034506	ug/l
1,2-Dichloroethane	034531	ug/l
Benzene	034030	ug/l
Ethylene Dibromide	900222	ug/l
Chlorides	000940	mg/l
Color	000080	PCU
Turbidity	082079	NTU
Odor	000085	Threshold #
pH	000400	S.U.
Conductance	000094	umhos/cm
Temperature	000010	°C
Sulfate	000946	mg/l
Chemical Oxygen Demand	000340	mg/l
Biological Oxygen Demand	050080	mg/l
Nitrite	000615	mg/l

14. A Base Monitoring Report (BMR) shall be conducted in accordance with DERM's and 40 CFR 403 General Pretreatment Regulations. This BMR shall be completed and submitted to the Department within 365 days after operations in the 43.5 acres lined areas commence. If the BMR determines pretreatment is required prior to discharge into the POTW, a compliance schedule is to be attached to the BMR. Maximum time allowed on the schedule for a pretreatment system to be on-line shall be within 365 days of approval of the BMR.
15. All ground water and leachate analyses shall be submitted to the Department within ninety (90) days of sampling on DER Form 17-1.216(2), copy enclosed as Exhibit B.
16. The zone of discharge for this site shall be in accordance with FAC Rule 17-28.700 and extend to the property boundaries.
17. The maximum height of this landfill shall be 200 feet above mean sea level in accordance with the Closure Plan.
18. On or before January 31 of each year the permittee shall submit an annual elevation survey of the site as prepared by a land surveyor registered in the State of Florida. This survey shall clearly show the horizontal and vertical dimensions of the landfilled area.
19. Prior to the deposition of solid waste into the lined expansion phases of the landfill the permittee shall receive approval from the Department by demonstrating compliance with the Financial Responsibility requirements revised May 23, 1990.

PERMITTEE:  
Mr. James E. O'Connor, Regional Manager  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West

I.D. NUMBER: 5013P13040  
PERMIT/CERTIFICATION NUMBER: SC 13-179974  
DATE OF ISSUE: JUL 1 6 1990  
EXPIRATION DATE: JUL 1 6 1995

JUL 1 6 1995

**SPECIFIC CONDITIONS:**

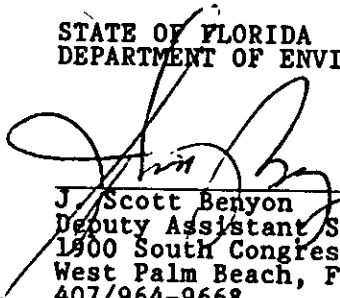
20. The permittee shall obtain a permit from South Florida Water Management District prior to the construction of the lined expansion phases.
21. The permittee shall continue to implement the "Corrective Actions for Ground Water Contamination Cases (CAFGWCC)" in accordance with the Department's March 28, 1990 letter of approval. All subsequent actions/reports required in the CAFGWCC shall be submitted in quadruplicate to the Department within the time frames specified in the CAFGWCC.

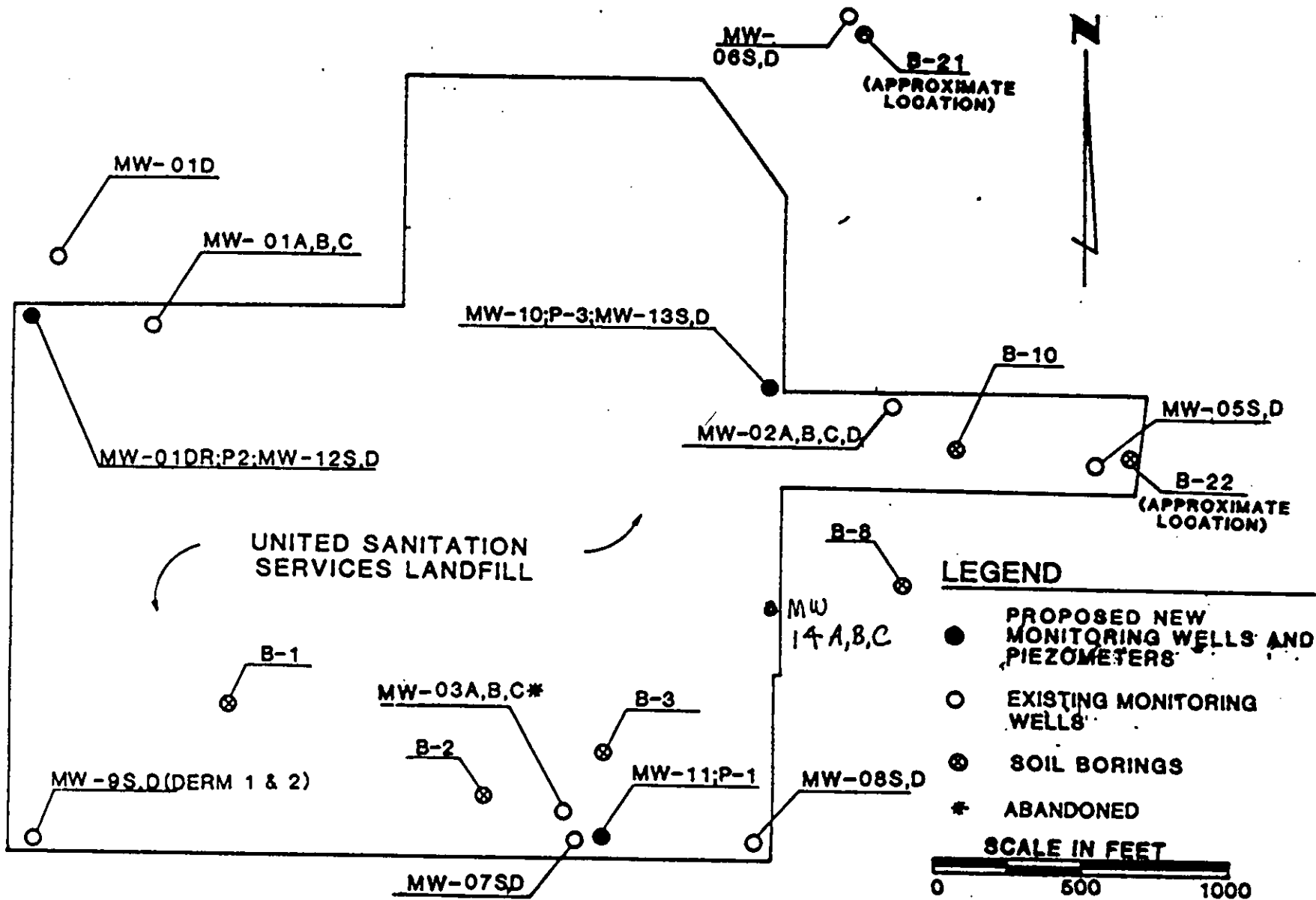
Executed in West Palm Beach, Florida.

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

JUL 1 6 1990

JUL 1 6 1995

  
J. Scott Benyon  
Deputy Assistant Secretary  
1800 South Congress Avenue, Suite A  
West Palm Beach, FL 33406  
407/964-9668



CLIENT/PROJECT  
 WASTE MANAGEMENT INC. OF FLORIDA  
 UNITED SANITATION SERVICES  
 LANDFILL



**Golder Associates**  
 Atlanta, Georgia

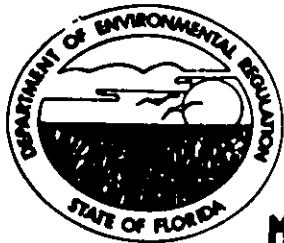
TITLE  
 SITE BORING AND MONITORING  
 WELL LOCATION MAP

DATE	REVIEWED	CHECKED	SCA
		KBK	

EXHIBIT I

E NO. 883-3712.6	DWG NO / REV NO 22	FIGURE 3
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Medley LIF  
APR 2 1992



# Florida Department of Environmental Regulation

Southeast District • 1900 S. Congress Ave., Suite A • West Palm Beach, Florida 33406

Lawton Chiles, Governor

Telephone: 407/433-2650

Carol M. Browner, Secretary

**MAR 31 1992**

Fax: 407/433-2666

Mr. Harvey Bush, P.E.  
Waste Management, Inc. of Florida  
500 Cypress Creek Road, West  
Suite 300  
Fort Lauderdale, FL 33309

Dade County  
SW -Medley Landfill  
Permit File

**Re: Modification of Conditions, Permit Number SC 13-179974**

Dear Mr. Bush:

We are in receipt of your request for a modification of the permit conditions. The new specific condition is as follows:

**Condition #22**

**TO:**

The permittee shall construct a Landfill Gas Management System which will collect, transport and dispose of extracted landfill gasses. The system will consist of forty-eight (48) gas extraction wells which has an estimated flow rate of 1026 cubic feet per minute and 1113 gallons per day of condensate production during operation.

This gas management system shall be constructed in accordance with documents for minor modification to permit # SC 13-799974 dated December 17, 1991 along with certified engineering documents received March 19, 1992.

This letter must be attached to the original permit and becomes part of that permit.

A person whose substantial interests are affected by this modification may petition for an administrative proceeding (hearing) in accordance with Section 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received) in the Office of General Counsel of the Department at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400, within 14 days of receipt of this Modification. Petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. Failure to file a petition within this time period shall constitute a waiver of any right such person may have to request an administrative determination (hearing) under Section 120.57, Florida Statutes.

The Petition shall contain the following information;

- (a) The name, address, and telephone number of each petitioner, the applicant's name and address, the Department Permit File Number and the county in which the project is proposed;
- (b) A statement of how and when each petitioner received notice of the Department's action or proposed action;
- (c) A statement of how each petitioner's substantial interests are affected by the Department's action or proposed action;
- (d) A statement of the material facts disputed by Petitioner, if any;
- (e) A statement of facts which petitioner contends warrant reversal or modification of the Department's action or proposed action;



- (f) A statement of which rules or statutes petitioner contends require reversal or modification of the Department's action or proposed action; and
- (g) A statement of the relief sought by petitioner, stating precisely the action petitioner wants the Department to take with respect to the Department's action or proposed action.

If a petition is filed, the administrative hearing process is designed to formulate agency action. Accordingly, the Department's final action may be different from the position taken by it in this modification. Persons whose substantial interests will be affected by any decision of the Department with regard to the application have the right to petition to become a party to the proceeding. The petition must conform to the requirements specified above and be filed (received) within 14 days of receipt of this notice in the Office of General Counsel at the above address of the department. Failure to petition within the allowed time frame constitutes a waiver of any right such person has to request a hearing under Section 120.57, F.S., and to participate as a party to this proceeding. Any subsequent intervention will only be at the approval of the presiding officer upon motion filed pursuant to Rule 28-5.207, F.A.C.

This modification is final and effective on the date filed with the Clerk of the Department unless a petition is filed in accordance with the above paragraphs or unless a request for extension of time in a petition and conforms to Rule 17-103.070, F.A.C. Upon timely filing of a petition or a request for an extension of time this modification will not be effective until further Order of the Department.

When the Order (Modification) is final, any party to the Order has the right to seek judicial review of the Order pursuant to Section 120.68, Florida Statutes, by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of Tallahassee, Florida 32399-2400; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date the Final Order is filed with the Clerk of the Department.

Should you have any questions, please contact Mr. Joe Lurix of this office, telephone 407/433-2650.

Executed in West Palm Beach, Florida.

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT MODIFICATION and all copies were mailed before the close of business on \_\_\_\_\_ to the listed persons.

FILING AND ACKNOWLEDGEMENT  
FILED, on this date, pursuant to §120.52, Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Florida L. L. L. MAR 31 1992  
Clerk Date

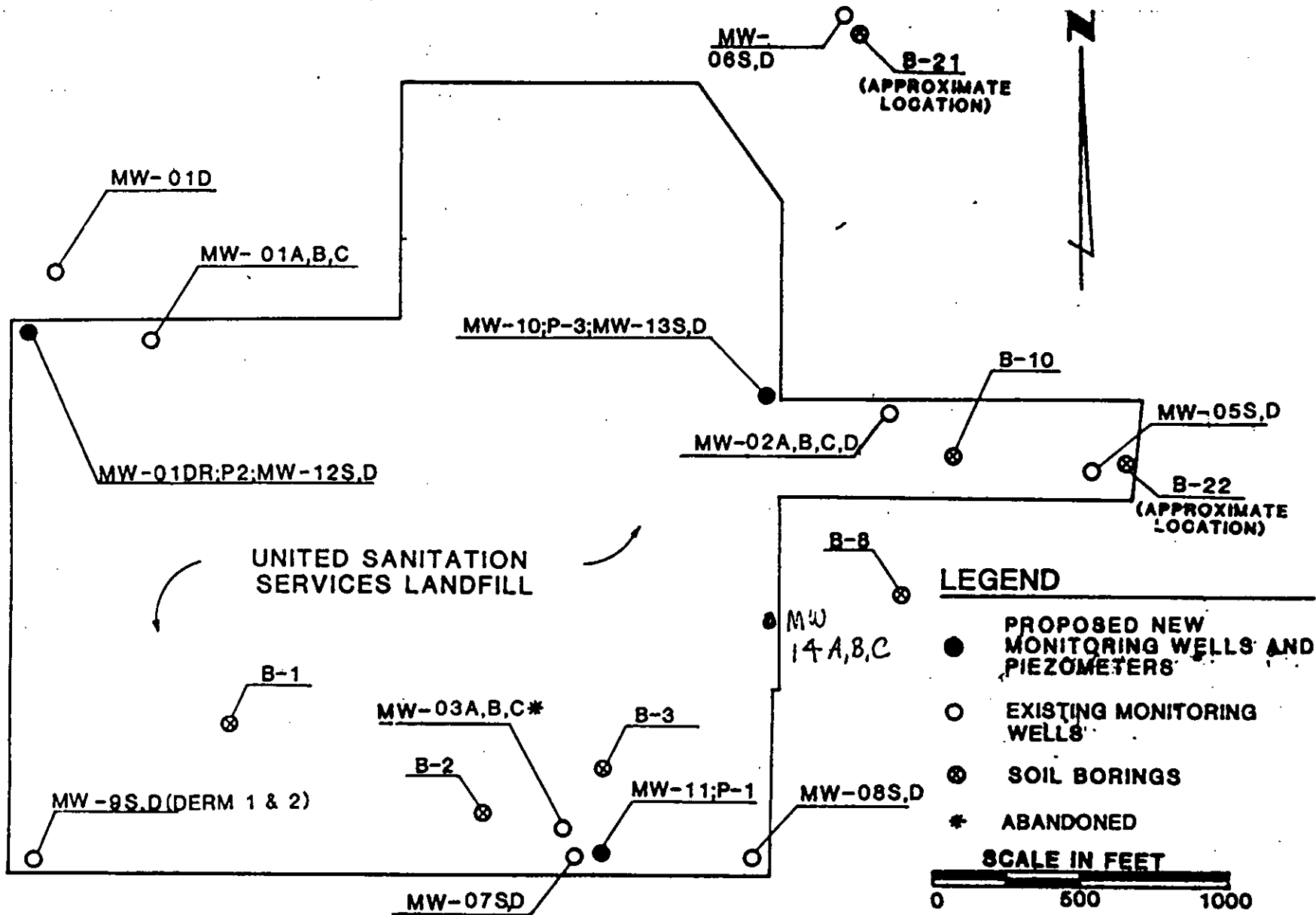
STATE OF FLORIDA DEPARTMENT  
OF ENVIRONMENTAL REGULATION

Donald B. White  
Donald B. White, P.E.  
Acting Director of District  
Management  
1900 South Congress Avenue, Suite A  
West Palm Beach, FL 33406  
407/433-2650

DBW:an:gml/986.132

cc: Patricia E. Comer, OGC/Tlh.  
Fred Wick, SW/Tlh.  
Mary Jean Yon, SW/Tlh.

Chris McGuire, OGC/Tlh.  
Laurie Cunniff, DERM



CLIENT/PROJECT  
**WASTE MANAGEMENT INC. OF FLORIDA**  
**UNITED SANITATION SERVICES**  
**LANDFILL**



**Golder Associates**  
 Atlanta, Georgia

TITLE  
**SITE BORING AND MONITORING**  
**WELL LOCATION MAP**

DESIGNED BY: SCA  
 CHECKED: KBK  
 REVIEWED:  
 DATE:

*EXHIBIT I*

E NO: 883-3712.6  
 DWG NO / REV NO: 22  
 FIGURE: 3

STATE OF FLORIDA  
DEPARTMENT OF ENVIRONMENTAL REGULATION

SOUTHEAST FLORIDA  
DISTRICT

3301 GUN CLUB ROAD  
P.O. BOX 3858  
WEST PALM BEACH, FLORIDA 33402



BOB GRAHAM  
GOVERNOR  
VICTORIA J. TSCHINKEL  
SECRETARY  
ROY DUKE  
DISTRICT MANAGER

QUARTERLY REPORT ON GROUND WATER MONITORING  
Rule 17-4.245(6)(k)2.

GMS # \_\_\_\_\_ DATE \_\_\_\_\_

DER PERMIT # \_\_\_\_\_

Installation Name \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ County \_\_\_\_\_

Owner or Authorized Representative's Name \_\_\_\_\_ Title \_\_\_\_\_

Method of Discharge \_\_\_\_\_

Type of Industry \_\_\_\_\_

Report for Period \_\_\_\_\_ date \_\_\_\_\_ to \_\_\_\_\_ date \_\_\_\_\_

Attach monitoring data as approved in monitoring plan using parameter monitoring report forms. When applicable, attach additional sheets describing any changes in the background water quality and the discharge plume since the last reported description. Include any changes in size, direction of movement, rate of movement, and concentration changes of plume constituents in violation of the applicable standards.

NOTE: Pursuant to Rule 17-4.245(6)(k)3., at any time there is a change in the permitted volume, location or chemical, physical or microbiological composition of the discharge plume, the permittee shall notify the department and, if required by the department, submit a new report stating the volume and chemical, physical and microbiological compositions of the discharge at the point of release or contact with the ground water at the site boundary.

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Owner or Authorized Representative's Signature \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_

EXHIBIT II



**LANDFILL GAS MANAGEMENT SYSTEM  
ENGINEERING REPORT  
MEDLEY LANDFILL AND RECYCLING CENTER  
DADE COUNTY, FLORIDA  
Project No. 19377**

**Prepared by**

**SEC DONOHUE  
Oak Brook Division  
3003 Butterfield Road  
Oak Brook, Illinois 60521  
March 1992**

*Martin A. DeLuca*  
3/17/92

**LANDFILL GAS MANAGEMENT SYSTEM  
ENGINEERING REPORT  
MEDLEY LANDFILL AND RECYCLING CENTER  
DADE COUNTY, FLORIDA  
Project No. 19377**

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**LANDFILL GAS MANAGEMENT SYSTEM  
ENGINEERING REPORT  
MEDLEY LANDFILL AND RECYCLING CENTER  
DADE COUNTY, FLORIDA  
Project No. 19377**

**LIST OF TABLES**

TABLE NO. 1	GAS RECOVERY TEST SUMMARY FOR UNITED SANITATION (MEDLEY) LANDFILL (February 1987)
TABLE NO. 2	GAS PRODUCTION DATA SHEET FOR MEDLEY LANDFILL (January 1992)

**LIST OF APPENDICES**

APPENDIX A	EXTRACTION VOLUMES
APPENDIX B	HEADER COLLECTION SYSTEM
APPENDIX C	VACUUM APPLICATION
APPENDIX D	BLOWER SELECTION
APPENDIX E	FLARE SELECTION
APPENDIX F	CONDENSATE MANAGEMENT
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APPENDIX J	WEEKLY CONSTRUCTION STATUS REPORT
APPENDIX K	PE PIPE PRESSURE TEST REPORT
APPENDIX L	DESIGN DRAWINGS

**LANDFILL GAS MANAGEMENT SYSTEM  
ENGINEERING REPORT  
MEDLEY LANDFILL AND RECYCLING CENTER  
DADE COUNTY, FLORIDA  
Project No. 19377**

**1.0 INTRODUCTION**

The following Engineering Report document outlines the engineering practices which were used in the systematic approach for the design of a Landfill Gas Management System which will collect, transport, and dispose of extracted landfill gasses at the Medley Landfill and Recycling Center.

**2.0 MEDLEY LANDFILL AND RECYCLING CENTER  
GAS MANAGEMENT SYSTEM**

The following section describes the perimeter gas extraction well and collection header system at Medley Landfill and Recycling Center. Additional interior gas extraction wells may be installed in the future based on the final grades and gas production anticipated for the estimated closure date in the year 2003.

**2.1 System Description**

The primary objective of this gas management system is to extract, transport, and dispose of potentially harmful landfill gas. The following narrative is a general description of the gas management system components for the Medley Landfill and Recycling Center Landfill Gas Management System (LGMS). For a more detailed description of construction procedures, refer to Appendices G and H.

The Perimeter Gas Management system will consist of 48 gas extraction wells varying from depths of 30 ft to 71 ft below the landfill surface.



There are a total of 7 engineered low points in the collection header system for the collection of condensate, which is generated by the cooling of the methane gas that occurs between the gas extraction well and blower flare station. The condensate that is removed from the collection system will be pumped directly to existing leachate collection manholes or to the leachate force main system and disposed of along with the landfill leachate.

Each gas extraction well is located and spaced according to a calculated zone of influence (ZOI). The ZOI defines an area from which gas can be extracted without inducing excessive air intrusion into the landfill. Each gas extraction well is connected via a lateral pipe to a main collection header.

The collection header is designed as a looped network to provide continuous removal of landfill gas in the event that a section of header becomes inoperative. Control valves are located throughout the collection header to allow for isolation of sections for monitoring and maintenance. The header is sloped to provide for gravity collection of condensate and prevent blockages caused by differential settlement. All anticipated current and future extracted gas volumes, velocities, and collection header pressure drops are accounted for in the sizing of the collection header.

The vacuum required to extract and transport the landfill gas is provided by a centrifugal blower. From the blower, the gas is delivered to the flare for thermal destruction.

## **2.2 Construction Phases**

The Perimeter Well System will consist of a total of 48 gas extraction wells. The calculated flow rate from this system is estimated to be 1026 cfm. The anticipated condensate production during operation of the perimeter system is 1113 gal. per day. The anticipated closure date for Medley Landfill and Recycling Center is in the year 2003. Additional interior gas extraction wells may be installed in the future based on the anticipated final grades and gas production at closure. The anticipated gas extraction rate for the future landfill conditions is estimated to be 3194 cfm. This value was based on a gas production model (data sheet) developed with an

anticipated closure date of 2003 (See Table 2). The calculated condensate production rate for this future system is estimated to be 3463 gal. per day.

### **2.3 System Monitoring**

A monitoring plan will be implemented to evaluate the performance of the gas management system. This monitoring plan will include surface and subsurface monitoring around the perimeter of the landfill and evaluating the extracted gas quality and quantity at each extraction well.

## **3.0 LANDFILL GAS MANAGEMENT SYSTEMS ENGINEERING DESIGN PROCEDURES**

The following section describes the methods and procedures used to design an effective Landfill Gas Management System. Example calculations and tabulated results for Medley Landfill and Recycling Center are included in the Appendices.

### **3.1 Design Assumptions**

- Refuse constituency is uniform throughout the landfill.
- Landfill cover material density and permeability is uniform for type and thickness of material.
- Landfill gas constituency is uniform throughout the facility.
- Landfill gas temperature is uniform throughout the landfill.
- Landfill gas is 100% saturated.
- Medley Landfill and Recycling Center design parameters are interpolated from United Sanitation/Medley Landfill Gas Recovery Test data (See Tables 1 and 2).

### **3.2 Collection Headers**

A flexible, high density polyethylene (HDPE), extruded pipe material made of 3408 type resin will be used for the collection header system. Collection headers must withstand internal and external forces developed by non-uniform settlement of decomposing refuse. HDPE is flexible

and will conform to changing strata configurations by bending and bowing and thus develop much lower material stress conditions.

### 3.3 Gas Extraction Wells

The three parameters which must be considered in the design of gas extraction well core pipe material are 1) buckling of vertical pipe during installation, 2) temperature of the environment in which the core pipe is being placed, and 3) ground surface shear forces due to cover material/refuse interface slippage (when gas extraction wells are installed on side slopes). At the time of completion of a well installation, there is very little stress developed in the core pipe.

- (1) Buckling - PVC pipe Type 1, SCH 80 (6" or 8" diameter) is chosen for its rigidity and lack of measurable bowing under its own weight (in the vertical position) to lengths of 120 feet.
- (2) Temperature of Environment - The average gas temperatures are 126°F which is well below the maximum recommended operating temperature for PVC pipe, Type 1, Sch 80 (140° F). (Reference from Plastic Piping Systems Vol. 1, 1980, Table 1-B, page 5.)
- (3) Ground Surface Shear - With 3 feet of cover material and the estimated internal angle of friction (33°) of the cover material, the forces developed by cover material slippage on side slopes of minimum 3:1 will be insufficient to cause well pipe failure.

During construction compacted muck is placed above and below a bentonite mat (Claymax) to reduce air intrusion into the landfill at the gas extraction well pipe and at the existing cover/backfill interface. At the existing cover/backfill interface, the bentonite will migrate into the void spaces of both the soils, tying the two together into one continuous barrier. At the gas extraction well pipe, the bentonite will migrate into any void spaces around the pipe and the compacted muck, preventing air intrusion at the muck/pipe interface.

### **3.4 Well Placement**

Well placement is based on the following criteria:

- Zone of Influence
- Drill rig accessibility

The Zone of Influence (ZOI) for an individual well is estimated by an equation developed by the Waste Management of North America, Inc. Gas Recovery Group. The design parameters used in this Engineering Report were obtained from the United Sanitation/Medley Landfill Gas Recovery Test data (see Tables 1 and 2). A typical calculation for the ZOI can be seen in Appendix A, Section 2.

Since well zones of influence are theoretically circular in shape, overlap of ZOI's is necessary to obtain the maximum influenced area. Therefore, the wells are spaced to maximize the landfill coverage and minimize the overlap of the ZOIs.

The accessibility of the drill rig which is to perform the boring is limited to slopes of no more than 6 horizontal to 1 vertical. If ground surface slope exceeds this maximum, the creation of a bench and bench access will be necessary to facilitate leveling of the drill rig. Benches will be removed following completion of construction so that the final contours are not changed.

### **3.5 Extraction Volumes**

The landfill gas extraction volume for each well is determined by multiplying the volume of influenced refuse by the field test determined gas generation rate. This volume is reduced by the appropriate reduction factor due to ZOI overlap. The generation rate is an average value of recoverable gas volumes. The actual generation rate may vary slightly.

Extraction volume calculations and tabulation are included in Appendix A. These extraction volumes are used to design the header collection system.

### 3.6 Header Collection System

The header collection system design is based on the following criteria:

- 1) Maximum gas velocity is 50 feet per second in headers which exhibit concurrent flow conditions (flow of gas and condensate in the same direction.)
- 2) Maximum gas velocity is 30 feet per second in header which exhibits countercurrent flow conditions (flow of gas and condensate in opposite direction).
- 3) The following factors of safety will be applied:
  - 1.2 for concurrent conditions
  - 1.4 for countercurrent conditions
- 4) Headloss shall not exceed one inch water column per 100 feet of header pipe.
- 5) Minimum acceptable slope is 2.0% for header located in refuse, and 0.5% for header out of refuse.
- 6) The Spitzglass equation for low pressure flow of compressible fluids will be used for headloss calculations.
- 7) All calculations performed assumes Phillips Driscopipe Series 6400 SDR 17.0 pipe is used for collection system construction.
- 8) Exceptions to these criteria are acceptable if the effect on the system is minimal.

Headloss and velocity calculations are included in Appendix B.

### **3.7 Vacuum Application**

Vacuum application is the anticipated permissible negative pressure which can be applied to the well and maintain less than 1% air intrusion. Operation, testing and monitoring at over 30 existing landfill gas management facilities has determined that air intrusion can be controlled by adjusting the applied vacuum. The vacuum application factor (inches water column per foot depth to slot) is derived from field test data and then applied to the design dimensions of each extraction well. An example calculation and tabulated results are included in Appendix C.

### **3.8 Blower Selection**

The requirements of the blower are as follows:

- 1) Supply sufficient negative pressure for distribution throughout the collection system and sufficient positive pressure for delivery of collected gas to the flare for combustion.
- 2) Supply sufficient flow volume capacity for anticipated extraction rates.

The blower selection procedure begins with calculation of minimum and maximum differential pressure and volume capacity requirements. Then several blowers meeting the requirements are analyzed for economic longterm operation (minimal future modifications) and the most efficient is selected. Calculation of blower requirements and blower selection criteria are included in Appendix D.

### **3.9 Flare Selection**

Selection of the flare is based on short-term peak and long-term flow volumes. Since it is not desirable to sacrifice combustion efficiency, the flare must be effective over a wide range of flow volumes. Through years of testing and infield monitoring of operating flares, Waste Management of North America, Inc. has developed standard state-of-the-art utility flare specifications. The flare is designed specifically for efficient thermal disposal of landfill gas.

Along with the development of the flare, design basis parameters have been created so that cross-referencing of infield test data with the design basis parameters is sufficient to determine

if any special flaring techniques or processes are needed. After this determination, the flare size is selected by use of specially developed nomographs.

Parameter comparisons and flare selection are included in Appendix E.

### **3.10 Condensate Management**

Condensate management calculations include determination of condensate volumes produced within the collection system and the anticipated distribution of these volumes.

The design assumptions that are used in calculating the condensate production rate and distribution are listed below.

- 1) Landfill gas is 100% saturated at the time of extraction.
- 2) All liquid is knocked out prior to flaring .
- 3) Operational pressure is 14.6 psia.

The procedure for condensate calculations begins with determination of the volume of condensate formed per cubic foot of extracted landfill gas. Combining this value with the gas extraction rate provides the condensate production rate.

The preceding calculations and tabulated results are included in Appendix F.

**TABLE 1**

**GAS RECOVERY TEST SUMMARY**

**(February 1987)**



**TABLE 1**  
**GAS RECOVERY TEST SUMMARY**  
**UNITED SANITATION/MEDLEY LANDFILL**  
**FEBRUARY 1987**

WELL	A	B	C	D	E	SITE AVERAGE
Well Depth (feet)	45	40	40	40	40	41
Amount Slotted (feet)	24	20	20	20	20	21
Cover Depth (feet)	6	5	5	5	5	5
Static Pressure (in w.c.)	0.22	0.35	0.44	0.19	1.14	0.47
Gas Temperature (°F)	116	123	133	114	144	126
Free Flow (cfm)	10	5	10	5	10	8
Max Flow (cfm)	42	--	17	10	15	21
Max ZOI (feet)	134	--	118	195	114	140
Max Vacuum (in w.c.)	0.0	--	0.6	0.2	1.1	0.5
Gas Generation (ft <sup>3</sup> /lb-yr)	0.290	--	0.191	0.040	0.175	0.174
Stabilized Flow (cfm)	--	--	15	3	10	9.3
Vacuum (in w.c.)	0.0	--	0.6	0.2	1.1	0.5
Composition (Stabilized Flow):						
% CH <sub>4</sub>			54.0	54.4	54.4	54.3
% CO <sub>2</sub>			44.4	43.2	43.3	43.3
% N <sub>2</sub> /O <sub>2</sub>			1.6	0.4	2.3	1.4

Note: Data obtained from: Landfill Gas Recovery Test Program: performed by Waste Management of North America, Inc., Gas Recovery Group.

**TABLE 2**  
**GAS PRODUCTION DATA SHEET**  
**(January 1992)**

# LANDFILL GAS PRODUCTION DATA SHEET

Ref#-GAS19D

DATE OF ENTRY: January 13, 1992

SITE: Medley Landfill	
SITE CLOSURE DATE:	2003
GAS GENERATION RATE:	0.170 CU FT/LB-YR
GAS PRODUCTION:	4.5 CU FT/LB
REFUSE DENSITY:	500 LB/CU GATE YD
RECOVERABLE GAS:	55 %
METHANE CONCENTRATION:	54 %
SITE CAPACITY:	8,126,127 TONS OF REFUSE IN PLACE

YEAR	ANNUAL REFUSE (tons)	GAS PRODUCED (cfd)	RECOVERABLE AS PRODUCED (cfd)	FUEL EQUIVALENT (mmBTU/hr)	ESTIMATED MSDS INVENTORY (lbs/day)
1975	191136	0	0	0.0	0
1976	194292	0	0	0.0	0
1977	195324	178044	97924	2.0	13924
1978	201804	352303	193766	4.0	27553
1979	202320	520939	286517	5.9	40741
1980	305088	689241	379083	7.8	53903
1981	342120	851665	468416	9.6	66606
1982	368904	1103683	607026	12.4	86316
1983	366552	1380675	759371	15.5	107978
1984	371424	1672153	919684	18.8	130774
1985	329100	1950429	1072736	21.9	152537
1986	343000	2222730	1222501	25.0	173833
1987	343000	2445319	1344925	27.5	191241
1988	235007	2672447	1469846	30.1	209004
1989	350095	2890995	1590047	32.5	226096
1990	341606	3000690	1650380	33.8	234675
1991	265355	3213447	1787396	36.2	251314
1992	265000	3410258	1875642	38.4	266706
1993	265000	3528606	1940733	39.7	275962
1994	265000	3642152	2003184	41.0	284842
1995	265000	3751409	2063275	42.2	293386
1996	265000	3856539	2121096	43.4	301608
1997	265000	3957697	2178733	44.5	309520
1998	265000	4055033	2230268	45.6	317132
1999	265000	4148692	2281781	46.7	324457
2000	265000	4238813	2331347	47.7	331505
2001	265000	4325529	2379041	48.7	338287
2002	265000	4408970	2424933	49.6	344812
2003	265000	4489258	2469092	50.5	351091
2004	0	4566513	2511582	51.4	357133
2005	0	4640850	2552467	52.2	362947
2006	0	4685529	2458041	50.2	349236
2007	0	4296831	2363257	48.3	336042
2008	0	4134506	2273978	46.5	323347
2009	0	3978314	2188073	44.8	311132

# LANDFILL GAS PRODUCTION DATA SHEET

Ref#-GAS19D

DATE OF ENTRY: January 13, 1992

SITE:	Medley Landfill
SITE CLOSURE DATE:	2003
GAS GENERATION RATE:	0.170 CU FT/LB-YR
GAS PRODUCTION:	4.5 CU FT/LB
REFUSE DENSITY:	500 LB/CU GATE YD
RECOVERABLE GAS:	55 %
METHANE CONCENTRATION:	54 %
SITE CAPACITY:	8,126,127 TONS OF REFUSE IN PLACE

YEAR	ANNUAL REFUSE (tons)	GAS PRODUCED (cfd)	RECOVERABLE AS PRODUCED (cfd)	FUEL EQUIVALENT (mmBTU/hr)	ESTIMATED MSDS INVENTORY (lbs/day)
2010	0	3828022	2105412	43.1	299378
2011	0	3683408	2025874	41.4	288068
2012	0	3544257	1949341	39.9	277186
2013	0	3410363	1875700	38.4	266714
2014	0	3281527	1804840	36.9	256838
2015	0	3157558	1736657	35.5	246943
2016	0	3038272	1671050	34.2	237814
2017	0	2923493	1607921	32.9	228838
2018	0	2813050	1547178	31.6	220000
2019	0	2708779	1488729	30.5	211689
2020	0	2604523	1432488	29.3	203692
2021	0	2508130	1378372	28.2	195997
2022	0	2411454	1326300	27.1	188593
2023	0	2320355	1276195	26.1	181468
2024	0	2232697	1227983	25.1	174813
2025	0	2148351	1181593	24.2	168016
2026	0	2067191	1136955	23.3	161669
2027	0	1989097	1094003	22.4	155561
2028	0	1913953	1052674	21.5	149685
2029	0	1841648	1012907	20.7	144030
2030	0	1772075	974641	19.9	138589
2031	0	1705130	937821	19.2	133353
2032	0	1640714	902393	18.5	128315
2033	0	1578731	868302	17.8	123468
2034	0	1519090	835500	17.1	118804
2035	0	1461703	803936	16.4	114315
2036	0	1406483	773565	15.8	109997
2037	0	1353349	744342	15.2	105841
2038	0	1302222	716222	14.7	101843
2039	0	1253027	689165	14.1	97996
2040	0	1205691	663130	13.6	94293
2041	0	1160142	638078	13.1	90731
2042	0	1116315	613973	12.6	87304
2043	0	1074143	590779	12.1	84005
2044	0	1033564	568460	11.6	80832

# LANDFILL GAS PRODUCTION DATA SHEET

Ref#-GAS19D

DATE OF ENTRY: January 13, 1992

SITE:		Medley Landfill				
SITE CLOSURE DATE:	2003					
GAS GENERATION RATE :	0.170 CU FT/LB-YR					
GAS PRODUCTION :	4.5 CU FT/LB					
REFUSE DENSITY :	500 LB/CU GATE YD					
RECOVERABLE GAS:	55 %					
METHANE CONCENTRATION:	54 %					
SITE CAPACITY:	8,126,127 TONS OF REFUSE IN PLACE					
					ESTIMATED	
YEAR	ANNUAL REFUSE (tons)	GAS PRODUCED (cfd)	RECOVERABLE AS PRODUCED (cfd)	FUEL EQUIVALENT (mmBTU/hr)	MSDS INVENTORY (lbs/day)	

2045	0	994518	546985	11.2	77778
2046	0	956948	526321	10.8	74840
2047	0	920796	506438	10.4	72013
2048	0	886011	487306	10.0	69292
2049	0	852539	468897	9.8	66675
2050	0	820332	451183	9.2	64156

Data obtained from , "Landfill Gas Production Data Sheet", prepared by Waste Management of North America, Inc., Gas Recovery Group, January 1992.

**APPENDIX A**  
**EXTRACTION VOLUMES**

<u>SECTION</u>	<u>TITLE</u>
1.0	EXTRACTION FLOW RATE SUMMARY
2.0	ZONE OF INFLUENCE
3.0	EXTRACTION FLOW RATES
4.0	REDUCTION FACTORS

**APPENDIX A**

**SECTION 1.0**

**EXTRACTION FLOW RATE SUMMARY**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

<b>EXTRACTION FLOWRATE SUMMARY (Perimeter System Layout)</b>			
WELL	FLOW RATE $Q_u$ (CFM)	REDUCTION FACTOR $R_r$ (%)	REDUCED FLOW RATE $Q_A$ (CFM)
W-1	23.3	13	20.3
W-2	30.2	23	23.2
W-3	29.6	24	22.5
W-4	30.2	22	23.6
W-5	33.9	24	25.8
W-6	26.7	58	11.2
W-7	51.1	34	33.7
W-8	20.5	39	12.5
W-9	56.4	39	34.4
W-10	23.9	43	13.6
W-11	52.0	35	33.8
W-12	10.4	39	6.3
W-13	33.3	38	20.6
W-14	25.0	26	18.5
W-15	14.4	13	12.5
W-16	23.9	30	16.7
W-17	81.2	32	55.2
W-18	69.2	53	32.5
W-19	14.0	55	6.3
W-20	121.2	49	61.8
W-21	113.4	30	79.4
W-22	22.2	59	9.1
W-23	26.5	10	23.8
W-24	22.7	11	20.2
W-25	20.5	4	19.7
W-26	21.0	19	17.0



**EXTRACTION FLOWRATE SUMMARY**  
(Perimeter System Layout)

WELL	FLOW RATE $Q_v$ (CFM)	REDUCTION FACTOR $R_r$ (%)	REDUCED FLOW RATE $Q_A$ (CFM)
W-27	21.6	13	18.8
W-28	21.0	22	16.4
W-29	21.0	19	17.0
W-30	22.7	9	20.6
W-31	22.7	22	17.7
W-32	22.7	20	18.2
W-33	23.9	22	18.6
W-34	23.9	24	18.2
W-35	22.7	17	18.8
W-36	13.1	4	12.6
W-37	22.7	10	20.4
W-38	22.7	21	17.9
W-39	22.2	21	17.5
W-40	22.2	21	17.5
W-41	21.6	23	16.6
W-42	22.2	18	18.2
W-43	22.7	20	18.2
W-44	23.7	22	17.7
W-45	23.3	21	18.4
W-46	21.0	21	16.6
W-47	21.6	21	17.1
W-48	22.2	11	19.8
<b>TOTAL</b>			<b>1026.4</b>

**APPENDIX A**  
**SECTION 2.0**  
**ZONE OF INFLUENCE**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**ZONE OF INFLUENCE**

**Purpose:** To determine the refuse permeability factor ( $F_r$ )

**Given:** The following parameters obtained from the United Sanitation/Medley Gas Recovery Test data (Table 1)

Average Zone of Influence (ZOI) = 140 ft  
Average length of solid pipe ( $S_p$ ) = 20 ft  
Cover depth ( $C_d$ ) = 5.0 ft  
Relative cover permeability ( $m_c$ ) = 1.5

**Equation:**

Zone of Influence:  $ZOI = F_r(S_p + m_c C_d)$

Refuse permeability factor:  $F_r = ZOI / (S_p + m_c C_d)$

Evaluating equation:

$$F_r = \left( \frac{140 \text{ ft}}{20 \text{ ft} + (1.5)(5.0 \text{ ft})} \right) = 5.09$$

Factor of Safety = (Reduce by 10%) =  $5.09 - 10\% = 4.58$

**ZONE OF INFLUENCE CALCULATION**

**Purpose:** To determine the area affected by an individual gas extraction well. (using W-1).

**Given:** Length of solid pipe ( $S_p$ ) = 20 ft  
Refuse permeability factor ( $F_r$ ) = 4.58  
Cover depth ( $C_d$ ) = 3.0 ft  
Relative cover permeability ( $m_c$ ) = 1.5

Equation:

$$\text{Zone of Influence: } ZOI = F_s(S_p + m_s C_d)$$

Evaluating the equation for well (W-1)

$$\begin{aligned} ZOI &= 4.58[20 + (1.5)(3.0 \text{ ft})] \\ &= 112.2 \text{ ft} \end{aligned}$$

DES: TAD DATE: 3-12-92

CHK: AKC DATE: 3-12-92

**APPENDIX A**  
**SECTION 3.0**  
**EXTRACTION FLOW RATES**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**EXTRACTION FLOW RATES**

**Purpose:** To determine the extraction rate of landfill gas from individual gas extraction wells (using well W-1).

**Given:**

Zone of Influence (ZOI)	= 112.2 ft.
Ground Surface Elevation	= 44 ft. MSL
Base Grade Elevation	= 0 ft. MSL
Gas Generation Rate ( $G_p$ )	= 0.17 ft <sup>3</sup> /lb-yr
Density of Refuse ( $\rho$ )	= 1200 lb/yd <sup>3</sup>
Cover Depth ( $C_d$ )	= 3.0 ft

**Assumptions:** Gas extraction well influences a cylindrical volume of refuse

**Equations:**

Volume of a cylinder:  $V = \pi r^2 h$  (1.0)

Where:  $r$  = radius of cylinder  
 $h$  = height of cylinder

Extraction rate:  $Q = G_p \rho V$  (2.0)

Where:  $G_p$  = gas generation rate  
 $\rho$  = refuse density  
 $V$  = volume

**Sample calculation using well 1:**

Volume influenced:  $V = \pi (112.2 \text{ ft})^2 (44 \text{ ft} - 0 \text{ ft} - 3.0 \text{ ft})$   
 $= 1,621,509 \text{ ft}^3$   
 $= 60,056 \text{ cy}$

Gas extraction rate:  $Q = (0.17 \text{ ft}^3/\text{lb-yr})(1200 \text{ lb/yd}^3)(60,056 \text{ yd}^3)$   
 $= 12,251,424 \text{ ft}^3/\text{yr}$   
 $= 23.3 \text{ cfm}$

DES: TAD DATE: 3-12-92

CHK: A/K DATE: 3-12-92

WELL NO.		COORDINATES	GROUND ELEV. (MSL)	BASE GRADE OF REFUSE (MSL)	LIQUID ELEV. (MSL)	WELL DEPTH (FT)	SOLID* PIPE (FT)	SLOTTED PIPE (FT)	DESIGN FACTORS				ZOI (FT)	FLOW (CFM)	NOTES
NEW	OLD								F <sub>s</sub>	C <sub>b</sub>	m <sub>s</sub>	G <sub>r</sub>			
1		N 554863; E 713044	44	0		39	20	19	4.58	3.0	1.5	0.17	112.2	23.3	
2		N 554826; E 712900	52	0		42	21	21					116.8	30.2	
3		N 554798; E 712752	51	0		41	21	20					116.8	29.6	
4		N 554781; E 712602	52	0		42	21	21					116.8	30.2	
5		N 554773; E 712430	54	0		44	22	22					121.4	33.9	
6		N 554670; E 712376	50	0		40	20	20					112.2	26.7	
7		N 554570; E 712434	61	0		51	26	25					139.7	51.1	
8		N 554500; E 712317	39	0		34	20	14					112.2	20.5	
9		N 554394; E 712429	63	0		53	27	26					144.3	56.4	
10		N 554270; E 712348	45	0		40	20	20					112.2	23.9	
11		N 554258; E 712497	62	0		52	26	26					139.7	52.0	
12		N 554136; E 712306	32	0		27	15	12					89.3	10.4	
13		N 554125; E 712426	53	0		43	22	21					121.4	33.3	
14		N 553989; E 712366	47	0		40	20	20					112.2	25.0	
15		N 553863; E 712310	36	0		31	17	14					98.5	14.4	
16		N 553663; E 712575	45	0		40	20	20					112.2	23.9	
17		N 553761; E 712690	71	0		61	31	30					162.6	81.2	
18		N 553733; E 712832	61	0		51	31	20					162.6	69.2	
19		N 553641; E 712999	35	0		30	17	13					98.5	14.0	

\*Does not include 3' stick-up as shown in detail

(1) Assume Base Grade @ 0 MSL; min 5 ft separation between bottom of gas well and base grade.

WELL NO.		COORDINATES	GROUND ELEV. (MSL)	BASE GRADE OF REFUSE (MSL)	LIQUID ELEV. (MSL)	WELL DEPTH (FT)	SOLID PIPE (FT)	SLOTTED PIPE (FT)	DESIGN FACTORS				ZOI (FT)	FLOW (CFM)	NOTES
NEW	OLD								F <sub>s</sub>	C <sub>D</sub>	m <sub>s</sub>	G <sub>r</sub>			
20		N 553768; E 712979	81	0		71	36	35	4.58	3.0	1.5	0.17	185.5	121.2	
21		N 553750; E 713131	76	0		66	36	30					185.5	113.4	
22		N 553653; E 713219	42	0		37	20	17					112.2	22.2	
23		N 553639; E 713775	46	0		41	21	20					116.8	26.5	
24		N 553640; E 713924	43	0		38	20	18					112.2	22.7	
25		N 553677; E 714227	39	0		34	20	14					112.2	20.5	
26		N 553682; E 714396	40	0		35	20	15					112.2	21.0	
27		N 553692; E 714535	41	0		36	20	16					112.2	21.6	
28		N 553884; E 714585	40	0		35	20	15					112.2	21.0	
29		N 553993; E 714588	40	0		35	20	15					112.2	21.0	
30		N 554782; E 713674	43	0		38	20	18					112.2	22.7	
31		N 554796; E 713820	43	0		38	20	18					112.2	22.7	
32		N 554820; E 713968	43	0		38	20	18					112.2	22.7	
33		N 554837; E 714119	45	0		40	20	20					112.2	23.9	
34		N 554846; E 714269	45	0		40	20	20					112.2	23.9	
35		N 554854; E 714402	43	0		38	20	18					112.2	22.7	
36		N 554765; E 714546	36	0		31	16	15					93.9	13.1	
37		N 555298; E 714533	43	0		38	20	18					112.2	22.7	
38		N 555449; E 714552	43	0		38	20	18					112.2	22.7	



WELL NO.		COORDINATES	GROUND ELEV. (MSL)	BASE GRADE OF REFUSE (MSL)	LIQUID ELEV. (MSL)	WELL DEPTH (FT)	SOLID PIPE (FT)	SLOTTED PIPE (FT)	DESIGN FACTORS				ZOI (FT)	FLOW (CFM)	NOTES
NEW	OLD								F <sub>1</sub>	C <sub>D</sub>	m <sub>1</sub>	G <sub>1</sub>			
39		N 555597; E 714553	42	0		37	20	17	4.58	3.0	1.5	0.17	112.2	22.2	
40		N 555732; E 714471	42	0		37	20	17					112.2	22.2	
41		N 555798; E 714338	41	0		36	20	16					112.2	21.6	
42		N 555823; E 714191	42	0		37	20	17					112.2	22.2	
43		N 555821; E 714029	43	0		38	20	18					112.2	22.7	
44		N 555812; E 713889	43	0		38	20	18					112.2	22.7	
45		N 555743; E 713753	44	0		39	20	19					112.2	23.3	
46		N 555616; E 713676	40	0		35	20	15					112.2	21.0	
47		N 555466; E 713661	41	0		36	20	16					112.2	21.6	
48		N 555313; E 713657	42	0		37	20	17					112.2	22.2	

**APPENDIX A**  
**SECTION 4.0**  
**REDUCTION FACTORS**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**REDUCTION FACTORS**

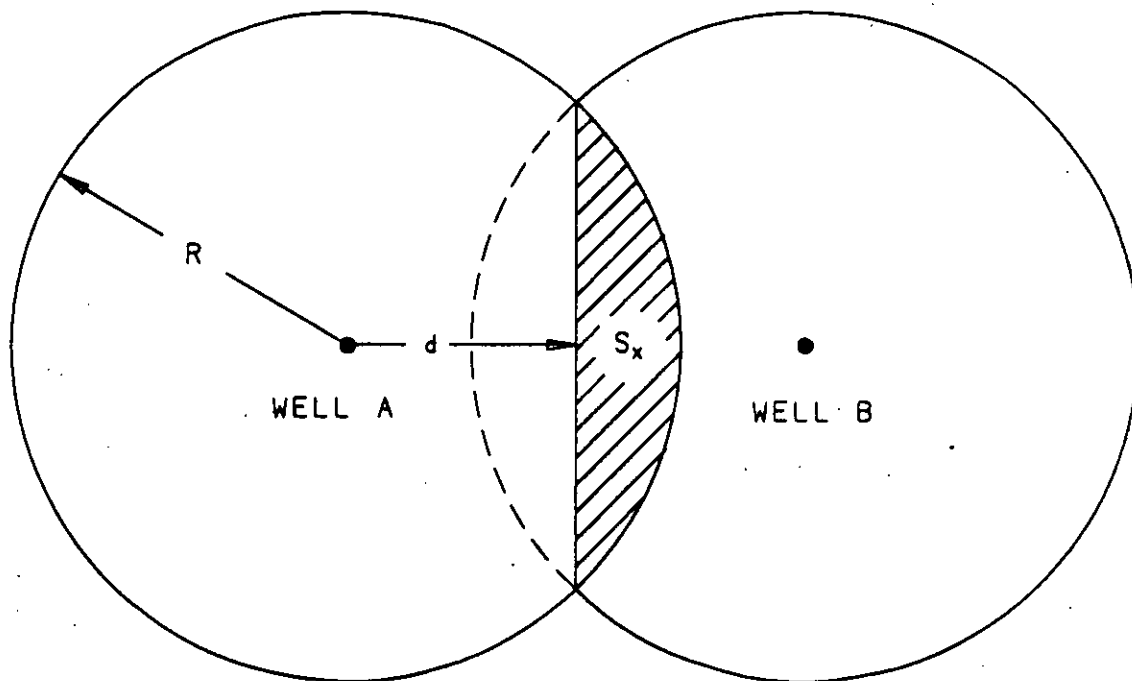
**Purpose:** To determine the percentage of the Zone of Influence which overlaps adjacent Zones of Influence (using W-1)

**Method:** Use a planimeter to measure area of the Zone of Influence which is not overlapped by adjacent Zones of Influence.

**Given:** Zone of Influence (R) = 112.2 ft.  
Area of Zone of Influence not overlapped ( $A_{NO}$ ) = 34,255 ft<sup>2</sup>

**Assumptions:** Gas produced on the left side of the chord is collected by well A.

**Diagram:**



**d** = distance to chord  
**s<sub>x</sub>** = area not influenced by Well A

Equations:

$$R_y = \left( 1 - \frac{A_{NO}}{A_T} \right) 100\%$$

Where:  $R_y$  = Reduction Factor (%)  
 $A_{NO}$  = Area of the Zone of Influence which is not overlapped by adjacent Zones of Influence (ft<sup>2</sup>)  
 $A_T$  = Area of Total Zone of Influence (ft<sup>2</sup>) =  $\pi(ZOI)^2$

Sample calculation using well 1:

Reduction Factor:

$$R_y = \left( 1 - \frac{34,255 \text{ ft}^2}{\pi(112.2)^2} \right) 100\% = 13.4\%$$

DES: TBD DATE: 3-13-92

CHK: AKC DATE: 3-12-92

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

REDUCTION FACTORS				
WELL NO.	A <sub>NO</sub> (ft <sup>2</sup> )	ZOI (ft <sup>2</sup> )	A <sub>T</sub> (ft <sup>2</sup> )	R <sub>r</sub> (%)
1	34,255	112.2	39,549	13
2	32,860	116.8	42,858	23
3	32,705	116.8	42,858	24
4	33,325	116.8	42,858	22
5	35,418	121.4	46,301	24
6	16,662	112.2	39,549	58
7	40,145	139.7	61,312	34
8	24,102	112.2	39,549	39
9	39,835	144.3	65,416	39
10	22,630	112.2	39,549	43
11	39,835	139.7	61,312	35
12	15,190	89.3	25,052	39
13	28,675	121.4	46,301	38
14	29,295	112.2	39,549	26
15	26,505	98.5	30,481	13
16	27,590	112.2	39,549	30
17	56,575	162.6	83,060	32
18	39,215	162.6	83,060	53
19	13,795	98.5	30,481	55
20	55,490	185.5	108,103	49
21	75,175	185.5	108,103	30
22	16,275	112.2	39,549	59
23	38,440	116.8	42,858	10
24	35,340	112.2	39,549	11

DES: TED DATE: 3-12-92

CHK: Akc DATE: 3-12-92

REDUCTION FACTORS				
WELL NO.	A <sub>NO</sub> (ft <sup>2</sup> )	ZOI (ft <sup>2</sup> )	A <sub>r</sub> (ft <sup>2</sup> )	R <sub>r</sub> (%)
25	37,975	112.2	39,549	4
26	32,085	112.2	39,549	19
27	34,332	112.2	39,549	13
28	31,000	112.2	39,549	22
29	31,930	112.2	39,549	19
30	35,908	112.2	39,549	9
31	31,000	112.2	39,549	22
32	31,775	112.2	39,549	20
33	30,690	112.2	39,549	22
34	30,070	112.2	39,549	24
35	32,705	112.2	39,549	17
36	26,660	93.9	27,700	4
37	35,495	112.2	39,549	10
38	31,388	112.2	39,549	21
39	31,310	112.2	39,549	21
40	31,078	112.2	39,549	21
41	30,535	112.2	39,549	23
42	32,472	112.2	39,549	18
43	31,465	112.2	39,549	20
44	30,845	112.2	39,549	22
45	31,155	112.2	39,549	21
46	31,155	112.2	39,549	21
47	31,233	112.2	39,549	21
48	35,030	112.2	39,549	11

DES: TAD DATE: 3-12-92

CHK: Akc DATE: 3-12-92

**APPENDIX B**  
**HEADER COLLECTION SYSTEM**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER  
PRESSURE DROP AND VELOCITY CALCULATIONS**

**Purpose:** To determine the pressure drops and velocities experienced in the gas collection header

**Example Calculation:**

**Given:** Gas flow rate (Q) = 130.0 cfm  
Pipe length (L) = 25 ft  
Internal pipe diameter (d) = 11.205 in  
Specific gravity of landfill gas (G) = .98

**Assumptions:** Pressure drop is approximated by the Spitzglass Equation for relatively low pressure flow

**Equations:**

**Spitzglass Equation:**

$$Q = 59.167 K \left( \frac{P}{GL} \right)^{1/4}$$

**Where:** Q = volumetric flow rate (CFM)  
K = Spitzglass constant  
P = pressure drop (in wc)  
G = specific gravity of gas  
L = length of pipe (ft)

**Rearrange Spitzglass Equation:**

$$P = GL \left( \frac{Q}{59.167 K} \right)^2$$

**Spitzglass constant:**

$$K = \left( \frac{d^5}{1 + \frac{3.6}{d} + 0.03d} \right)^{1/4}$$

**Where:** d = internal diameter of pipe (in.)



Velocity:  $V = Q/A$

Where:  $Q$  = volumetric flow rate (CFM)  
 $A$  = cross sectional area of pipe ( $\text{ft}^2$ )

Sample calculation using pipe section I (see Figure 1 for pipe sections):

Spitzglass constant:

$$K = \left( \frac{11.205^3}{1 + \frac{3.6}{11.205} + 0.03(11.205)} \right)^{1/4} = 326.45$$

Pressure drop:

$$P = (.98)(25\text{ft}) \left( \frac{130.0 \text{ ft}^3/\text{m}}{(59.167)(326.45)} \right)^2 = 0.0011 \text{ in wc}$$

Multiply by safety factor:

$$P = 1.2 ( 0.0011 \text{ in wc} ) \\ = 0.0013 \text{ in wc}$$

Velocity:

$$V = \left( \frac{130.0 \text{ ft}^3/\text{m}}{\pi(11.205 \text{ in}/2)^2} \right) \left( \frac{1\text{m}/60\text{s}}{1 \text{ ft}^2/144 \text{ in}^2} \right) = 3.16 \text{ ft/s}$$

\*Gas flows shown account for future system expansion based on an anticipated closure date in the year 2003, and an estimated gas generation rate of  $4.6 \times 10^6$  scfd.

DES: TSD DATE: 3-12-92

CHK: Akc DATE: 3-12-92

LANDFILL GAS MANAGEMENT SYSTEM  
 MEDLEY LANDFILL  
 HEADLOSS AND VELOCITY - YR 2003 SYSTEM  
 (THESE VALUES USED TO ESTIMATE CONDENSATE PRODUCTION)

SECTION I

Pipe Segment	Pipe Length (ft)	Pipe Size (nom)	Pipe ID (in)	Gas Flow (cfm)	Segment Flow (cfm)	Safety Factor	Segment Head (in wc)	Total Head (in wc)	Gas Velocity (ft/sec)
PPP	385.0	10.00	9.448	150.0	150.0	1.4	0.077	0.077	5.13
OOO	155.0	10.00	9.448	19.8	169.8	1.4	0.040	0.116	5.81
NNN	158.0	10.00	9.448	17.1	186.9	1.4	0.049	0.165	6.40
MMM	198.0	10.00	9.448	16.6	203.5	1.4	0.073	0.237	6.97
LLL	244.0	10.00	9.448	18.4	221.9	1.4	0.106	0.344	7.60
KKK	140.0	10.00	9.448	17.7	239.6	1.4	0.071	0.415	8.20
JJJ	15.0	10.00	9.448	18.2	257.8	1.4	0.009	0.424	8.83
III	150.0	10.00	9.448	0.0	257.8	1.2	0.076	0.499	8.83
HHH	167.0	10.00	9.448	18.2	276.0	1.2	0.096	0.595	9.45
GGG	197.0	10.00	9.448	16.6	292.6	1.2	0.128	0.723	10.02
FFF	204.0	10.00	9.448	17.5	310.1	1.2	0.149	0.872	10.62
EEE	156.0	10.00	9.448	17.5	327.6	1.2	0.127	0.999	11.21
DDD	150.0	10.00	9.448	17.9	345.5	1.2	0.136	1.135	11.83
CCC	205.0	10.00	9.448	20.4	365.9	1.2	0.208	1.343	12.53
BBB	180.0	10.00	9.448	0.0	365.9	1.4	0.213	1.556	12.53
AAA	105.0	10.00	9.448	0.0	365.9	1.4	0.124	1.680	12.53
XX	75.0	16.00	14.061	1426.3	1792.2	1.2	0.252	1.932	27.70
YY	417.0	18.00	15.819	1402.2	3194.4	1.2	2.506	4.438	39.01
ZZ	100.0	18.00	15.819	0.0	3194.4	1.4	0.701	5.140	39.01

SECTION II

Pipe Segment	Pipe Length (ft)	Pipe Size (nom)	Pipe ID (in)	Gas Flow (cfm)	Segment Flow (cfm)	Safety Factor	Segment Head (in wc)	Total Head (in wc)	Gas Velocity (ft/sec)
LLL	244.0	10.00	9.448	0.0	0.0	1.4	0.000	0.000	0.00
MMM	198.0	10.00	9.448	0.0	0.0	1.4	0.000	0.000	0.00
NNN	158.0	10.00	9.448	0.0	0.0	1.4	0.000	0.000	0.00
OOO	155.0	10.00	9.448	0.0	0.0	1.4	0.000	0.000	0.00
PPP	385.0	10.00	9.448	0.0	0.0	1.2	0.000	0.000	0.00
K	35.0	16.00	14.061	868.0	868.0	1.2	0.028	0.028	13.42
J	130.0	16.00	14.061	0.0	868.0	1.4	0.120	0.147	13.42
I	46.0	18.00	15.819	433.6	1301.6	1.4	0.054	0.201	15.89
H	153.0	18.00	15.819	20.6	1322.2	1.4	0.184	0.385	16.15
G	154.0	18.00	15.819	17.7	1339.9	1.4	0.190	0.575	16.36
F	156.0	18.00	15.819	18.2	1358.1	1.4	0.198	0.772	16.58
E	155.0	18.00	15.819	18.6	1376.7	1.4	0.202	0.974	16.81
D	135.0	18.00	15.819	18.2	1394.9	1.4	0.181	1.155	17.03
C	20.0	18.00	15.819	18.8	1413.7	1.4	0.027	1.182	17.26
B	160.0	16.00	14.061	0.0	1413.7	1.2	0.335	1.517	21.85

A	160.0	16.00	14.061	12.6	1426.3	1.2	0.341	1.857	22.04
XX	75.0	16.00	14.061	365.9	1792.2	1.2	0.252	2.109	27.70
YY	417.0	18.00	15.819	1402.2	3194.4	1.2	2.506	4.616	39.01
ZZ	100.0	18.00	15.819	0.0	3194.4	1.4	0.701	5.317	39.01

### SECTION III

Pipe Segment	Pipe Length (ft)	Pipe Size (nom)	Pipe ID (in)	Gas Flow (cfm)	Segment Flow (cfm)	Safety Factor	Segment Head (in wc)	Total Head (in wc)	Gas Velocity (ft/sec)
EE	25.0	12.00	11.205	200.0	200.0	1.2	0.003	0.003	4.87
DD	140.0	12.00	11.205	0.0	200.0	1.4	0.021	0.024	4.87
CC	133.0	12.00	11.205	55.2	255.2	1.4	0.033	0.057	6.21
BB	142.0	12.00	11.205	16.7	271.9	1.4	0.039	0.096	6.62
AA	210.0	12.00	11.205	0.0	271.9	1.2	0.050	0.146	6.62
Z	130.0	12.00	11.205	12.5	284.4	1.2	0.034	0.180	6.92
Y	130.0	12.00	11.205	18.5	302.9	1.2	0.038	0.218	7.37
X	120.0	12.00	11.205	26.9	329.8	1.2	0.042	0.260	8.03
W	15.0	12.00	11.205	481.0	810.8	1.2	0.032	0.292	19.73
V	145.0	12.00	11.205	0.0	810.8	1.4	0.358	0.650	19.73
U	125.0	16.00	14.061	34.4	845.2	1.4	0.109	0.759	13.06
T	65.0	16.00	14.061	12.5	857.7	1.4	0.058	0.817	13.26
S	115.0	16.00	14.061	33.7	891.4	1.4	0.112	0.929	13.78
R	80.0	16.00	14.061	11.2	902.6	1.4	0.080	1.008	13.95
Q	50.0	12.00	11.205	0.0	902.6	1.2	0.131	1.139	21.97
P	177.0	12.00	11.205	25.8	928.4	1.2	0.491	1.630	22.60
O	153.0	12.00	11.205	23.6	952.0	1.2	0.446	2.076	23.17
N	150.0	12.00	11.205	22.5	974.5	1.2	0.458	2.534	23.72
M	148.0	12.00	11.205	23.2	997.7	1.2	0.474	3.008	24.28
L	430.0	12.00	11.205	20.3	1018.0	1.2	1.433	4.441	24.78
K	35.0	16.00	14.061	0.0	868.0	1.2	0.028	4.469	13.42
J	130.0	16.00	14.061	0.0	868.0	1.4	0.120	4.589	13.42
I	46.0	18.00	15.819	433.6	1301.6	1.4	0.054	4.642	15.89
H	153.0	18.00	15.819	20.6	1322.2	1.4	0.184	4.826	16.15
G	154.0	18.00	15.819	17.7	1339.9	1.4	0.190	5.016	16.36
F	156.0	18.00	15.819	18.2	1358.1	1.4	0.198	5.214	16.58
E	155.0	18.00	15.819	18.6	1376.7	1.4	0.202	5.416	16.81
D	135.0	18.00	15.819	18.2	1394.9	1.4	0.181	5.596	17.03
C	20.0	18.00	15.819	18.8	1413.7	1.4	0.027	5.624	17.26
B	160.0	16.00	14.061	0.0	1413.7	1.2	0.335	5.958	21.85
A	160.0	16.00	14.061	12.6	1426.3	1.2	0.341	6.299	22.04
XX	75.0	16.00	14.061	365.9	1792.2	1.2	0.252	6.551	27.70
YY	417.0	18.00	15.819	1402.2	3194.4	1.2	2.506	9.057	39.01
ZZ	100.0	18.00	15.819	0.0	3194.4	1.4	0.701	9.758	39.01

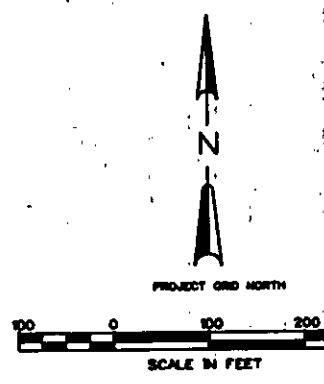
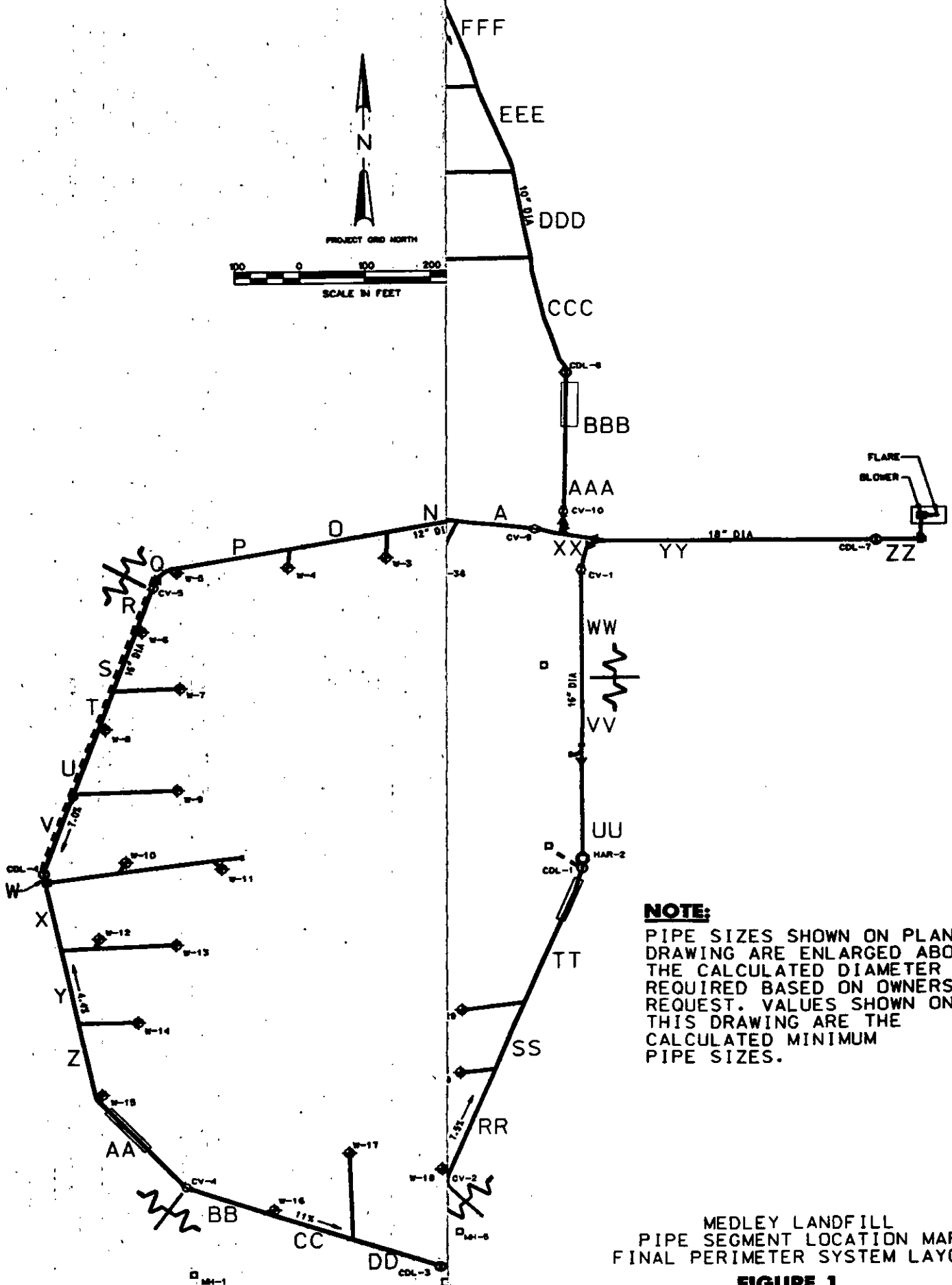
### SECTION IV

Pipe Segment	Pipe Length (ft)	Pipe Size (nom)	Pipe ID (in)	Gas Flow (cfm)	Segment Flow (cfm)	Safety Factor	Segment Head (in wc)	Total Head (in wc)	Gas Velocity (ft/sec)
--------------	------------------	-----------------	--------------	----------------	--------------------	---------------	----------------------	--------------------	-----------------------

X	120.0	12.00	11.205	0.0	0.0	1.2	0.000	0.000	0.00
Y	130.0	12.00	11.205	0.0	0.0	1.2	0.000	0.000	0.00
Z	130.0	12.00	11.205	0.0	0.0	1.2	0.000	0.000	0.00
AA	210.0	12.00	11.205	0.0	0.0	1.2	0.000	0.000	0.00
BB	142.0	12.00	11.205	0.0	0.0	1.2	0.000	0.000	0.00
CC	133.0	12.00	11.205	0.0	0.0	1.4	0.000	0.000	0.00
DD	140.0	12.00	11.205	0.0	0.0	1.4	0.000	0.000	0.00
EE	25.0	12.00	11.205	0.0	0.0	1.4	0.000	0.000	0.00
FF	140.0	12.00	11.205	245.5	245.5	1.4	0.032	0.032	5.98
GG	153.0	12.00	11.205	68.1	313.6	1.4	0.056	0.088	7.63
HH	87.0	12.00	11.205	79.4	393.0	1.4	0.050	0.139	9.57
II	20.0	12.00	11.205	9.1	402.1	1.4	0.012	0.151	9.79
JJ	448.0	12.00	11.205	0.0	402.1	1.2	0.233	0.384	9.79
KK	97.0	12.00	11.205	433.6	835.7	1.2	0.218	0.602	20.34
LL	150.0	12.00	11.205	23.8	859.5	1.2	0.356	0.958	20.92
MM	138.0	12.00	11.205	20.2	879.7	1.2	0.344	1.302	21.41
NN	167.0	12.00	11.205	0.0	879.7	1.4	0.485	1.787	21.41
OO	178.0	12.00	11.205	19.7	899.4	1.4	0.540	2.327	21.89
PP	148.0	12.00	11.205	17.0	916.4	1.4	0.466	2.793	22.30
QQ	25.0	12.00	11.205	18.8	935.2	1.4	0.082	2.875	22.76
RR	213.0	12.00	11.205	0.0	935.2	1.2	0.599	3.475	22.76
SS	122.0	12.00	11.205	16.4	951.6	1.2	0.355	3.830	23.16
TT	250.0	12.00	11.205	17.0	968.6	1.2	0.754	4.584	23.57
UU	216.0	12.00	11.205	0.0	968.6	1.4	0.760	5.345	23.57
VV	117.0	16.00	14.061	433.6	1402.2	1.4	0.281	5.626	21.67
WW	265.0	16.00	14.061	0.0	1402.2	1.2	0.545	6.171	21.67
YY	417.0	18.00	15.819	1792.2	3194.4	1.2	2.506	8.677	39.01
ZZ	100.0	18.00	15.819	0.0	3194.4	1.4	0.701	9.379	39.01

SEGMENT I	5.140
SEGMENT II	5.317
DIFFERENCE:	-0.177

SEGMENT III	9.758
SEGMENT IV	9.379
DIFFERENCE:	0.380



**NOTE:**  
 PIPE SIZES SHOWN ON PLAN DRAWING ARE ENLARGED ABOVE THE CALCULATED DIAMETER REQUIRED BASED ON OWNERS REQUEST. VALUES SHOWN ON THIS DRAWING ARE THE CALCULATED MINIMUM PIPE SIZES.

MEDLEY LANDFILL  
 PIPE SEGMENT LOCATION MAP  
 FINAL PERIMETER SYSTEM LAYOUT  
**FIGURE 1**

**APPENDIX C**  
**VACUUM APPLICATION**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**VACUUM APPLICATION**

**Purpose:** To determine the Vacuum Application Factor ( $F_A$ ) .

**Given:\*** Average Vacuum Applied ( $V_{avc}$ ) = 0.5 in w.c.  
Average Depth to Slot ( $S_p$ ) = 20.0 ft

$$\begin{aligned}F_A &= V_{avc}/S_p \\F_A &= 0.5 \text{ in W.C.}/20.0 \text{ ft} \\&= 0.025 \text{ in. W.C./ft}\end{aligned}$$

**INITIAL VACUUM APPLICATION**

**Purpose:** To determine the initial vacuum to be applied to each gas extraction well.

**Given:** Depth to Slot ( $S_p$ ) for Well (W-1) = 20 ft  
Vacuum Application Factor ( $F_A$ ) = 0.025 in W.C./ft

$$\begin{aligned}V &= S_p F_A \\&= 20 \text{ ft} (0.025 \text{ in wc/ft}) \\&= 0.5 \text{ in w.c.}\end{aligned}$$

\* Values are from the United Sanitation/Medley Landfill Test Summary, Table 1.

DES: TAD DATE: 3-12-92

CHK: AKC DATE: 3-12-92

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

VACUUM APPLICATION SUMMARY			
WELL	DEPTH TO SLOT (Sp) (ft)	VACUUM APPLICATION FACTOR (Fa) (in wc/ft)	VACUUM APPLIED (in w.c.)
W-1	20	0.025	0.5
W-2	21	0.025	0.5
W-3	21	0.025	0.5
W-4	21	0.025	0.5
W-5	22	0.025	0.6
W-6	20	0.025	0.5
W-7	26	0.025	0.6
W-8	20	0.025	0.5
W-9	27	0.025	0.7
W-10	20	0.025	0.5
W-11	26	0.025	0.6
W-12	15	0.025	0.4
W-13	22	0.025	0.6
W-14	20	0.025	0.5
W-15	17	0.025	0.4
W-16	20	0.025	0.5
W-17	31	0.025	0.8
W-18	31	0.025	0.8
W-19	17	0.025	0.4
W-20	36	0.025	0.9
W-21	36	0.025	0.9
W-22	20	0.025	0.5
W-23	21	0.025	0.5

DES: TAD DATE: 3-12-92

CHK: AKC DATE: 3-12-92



VACUUM APPLICATION SUMMARY			
WELL	DEPTH TO SLOT (Sp) (ft)	VACUUM APPLICATION FACTOR (Fa) (in wc/ft)	VACUUM APPLIED (in w.c.)
W-24	20	0.025	0.5
W-25	20	0.025	0.5
W-26	20	0.025	0.5
W-27	20	0.025	0.5
W-28	20	0.025	0.5
W-29	20	0.025	0.5
W-30	20	0.025	0.5
W-31	20	0.025	0.5
W-32	20	0.025	0.5
W-33	20	0.025	0.5
W-34	20	0.025	0.5
W-35	20	0.025	0.5
W-36	16	0.025	0.4
W-37	20	0.025	0.5
W-38	20	0.025	0.5
W-39	20	0.025	0.5
W-40	20	0.025	0.5
W-41	20	0.025	0.5
W-42	20	0.025	0.5
W-43	20	0.025	0.5
W-44	20	0.025	0.5
W-45	20	0.025	0.5
W-46	20	0.025	0.5
W-47	20	0.025	0.5
W-48	20	0.025	0.5

DES: TDD DATE: 3-12-92

CHK: A/c DATE: 3-12-92

**APPENDIX D**  
**BLOWER SELECTION**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**BLOWER SELECTION**

**Purpose:** Determine the total pressure differential which must be provided by the centrifugal blower.

**Given:** Pressure drop in Year 2003 System Header ( $P_h$ ) = 10.4 w.c.  
Pressure drop in flare ( $P_f$ ) = 12.0 in w.c.  
Applied vacuum at well ( $A_v$ ) = 0.9 in w.c.

**Assumptions:** A minimum of 5.0" water column vacuum will be available at all gas extraction wells to provide for additional vacuum application if necessary.

**Required Pressure differential for final system:**

$$P = P_h + A_v + P_f + 5.0$$
$$= 10.4 + 0.9 + 12.0 + 5.0$$
$$= 28.3 \text{ in w.c.}$$

say 29 in w.c.

**Required flow rate for proposed system:** 3194.4 cfm for Year 2003 System

\* Select blower that is capable of 110% of the flow rate for the year 2003 system. This would ensure adequate capacity to control the gas at the anticipated closure date in the year 2003.

Aerovent Model	Motor Specification (hp)	Flow Range (cfm)	Differential Pressure (in w.c.)
W580-300	40 hp	0 to 4400	27.0" to 37.0"

Blower Specification: W580-300-40 for Final System Layout

Note: The blower specified is sufficient to handle interim maintenance conditions and flow conditions anticipated for the year 2003 system. Other manufacturers' blowers meeting the preceding operating parameters are acceptable.

DES: TND DATE: 3-12-92

CHK: AKC DATE: 3-12-92

**APPENDIX E**  
**FLARE SELECTION**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**FLARE DESIGN BASIS**

Gas Composition (Vol %)

CH <sub>4</sub>	60% max	30% min
CO <sub>2</sub> , Air, Inerts	40% min	70% max
LHV	545 Btu/SCF	275 Btu/SCF
Temperature	126° F	

Flare Gas

Type	Landfill gas
Max Flow Rate	4400 (Year 2003 System, max. blower capacity)
Waste Heat Release	126 MM Btu/hr
Min Flow Rate	365 scfm
Pressure Drop	12" w.c.

Unit Design

Operating Temperature            1100 - 1600 °F

Utilities

Pilot Gas (15 psig)            22 scfh propane (intermittent)

Electricity            460 V/3 Phase/60 Hz.  
Flare manufacturer will step down to 110 V for control usage

Turndown

The utility flare has a minimum turndown ratio of 12:1 to maintain an operating temperature.

## Flame Stability

The utility flare has a Flame Stability turndown of 20:1. The flame will remain stable as long as the methane content in the landfill gas exceeds 30%.

**APPENDIX F**

**CONDENSATE MANAGEMENT**

<u>SECTION</u>	<u>TITLE</u>
1.0	CONDENSATE PRODUCTION RATE
2.0	CONDENSATE DISTRIBUTION
3.0	PUMP SELECTION FOR CONDENSATE PUMP STATIONS



**APPENDIX F**

**SECTION 1.0**

**CONDENSATE PRODUCTION RATE**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**CONDENSATE PRODUCTION RATE**

**Purpose:** To determine the amount of condensate which is produced by extracting landfill gas.

**Given:** \*Gas Flowrate ( $F_G$ ) (Year 2003 System) = 3194.4 ft<sup>3</sup>/min  
Average maximum gas temperature ( $T_{MAX}$ ) = 126° F

**Assumptions:** Minimum gas temperature ( $T_{MIN}$ ) = 35° F

Water Vapor Content of Natural Gas (Love Process Engineering, Inc.)

Vapor Content at 126° F = 6600 lb/mmcf

Vapor Content at 35° F = 320 lb/mmcf

Mass of condensate ( $M_c$ )

$$M_c = 6600 \text{ lb/mmcf} - 320 \text{ lb/mmcf} = 6280 \text{ lb/mmcf}$$

Volume of condensate ( $V_c$ )

$$V_c = 6280 \text{ lb/mmcf} \left( \frac{7.48 \text{ gal}}{6.24 \text{ lb}} \right) = 752.8 \text{ gal/mmcf}$$

Condensate Production Rate ( $Q_c$ ) (Year 2003 System)

$$\begin{aligned} Q_c &= V_c F_g \\ &= 752.8 \text{ gal/mmcf} (3194.4 \text{ cfm}) \left( \frac{MM}{1 \times 10^6} \right) = 2.405 \text{ gal/min} \\ &= 3463.2 \text{ gal/day} \end{aligned}$$

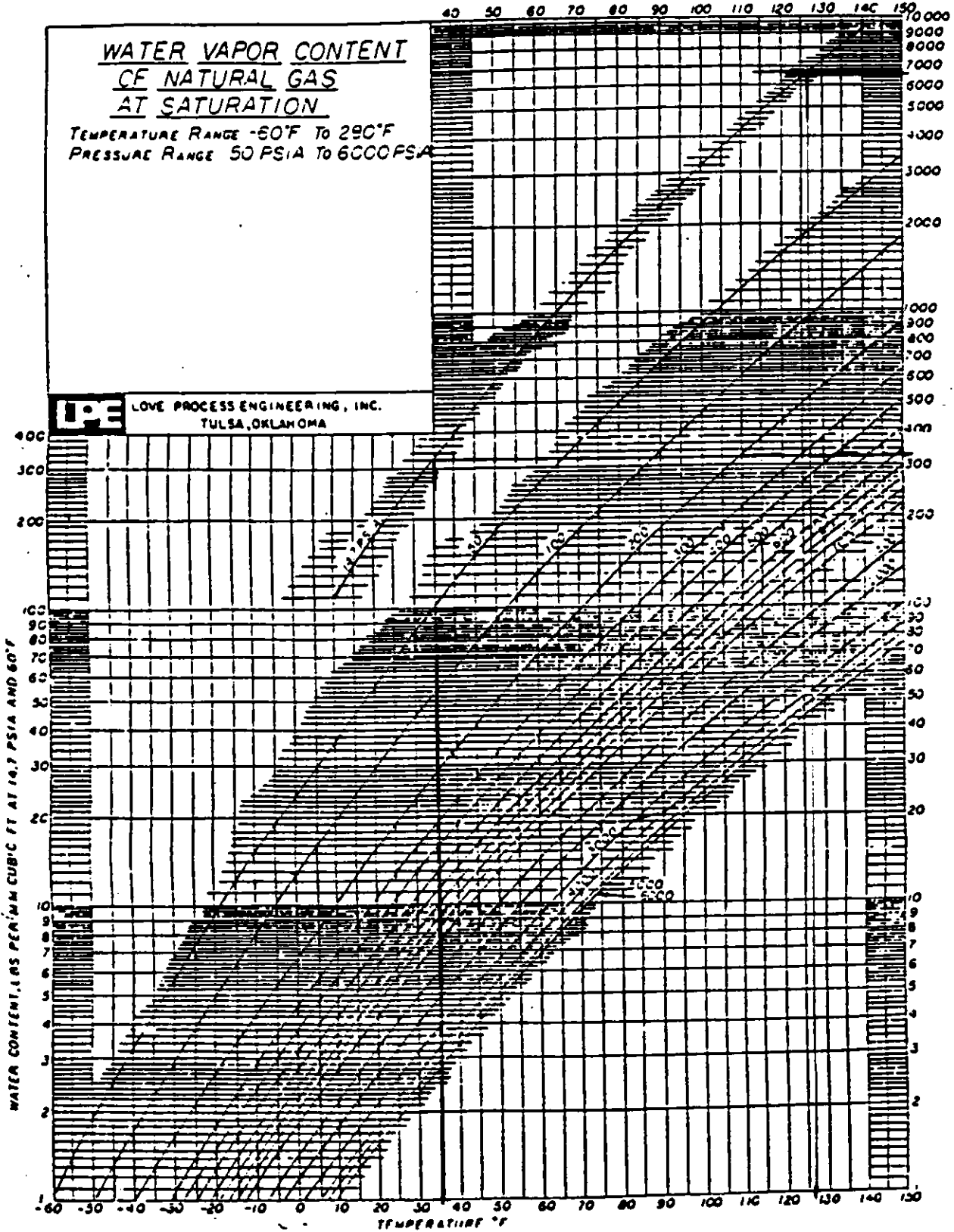
\*Gas flow rate shown accounts for future system expansion based on an anticipated closure date in the year 2003, and an estimated gas generation rate of  $4.6 \times 10^6$  scfd.

WATER VAPOR CONTENT  
OF NATURAL GAS  
AT SATURATION

TEMPERATURE RANGE -50°F TO 290°F  
PRESSURE RANGE 50 PSIA TO 6000 PSIA



LOVE PROCESS ENGINEERING, INC.  
TULSA, OKLAHOMA



**APPENDIX F**  
**SECTION 2.0**  
**CONDENSATE DISTRIBUTION**

**LANDFILL GAS MANAGEMENT SYSTEM  
MEDLEY LANDFILL AND RECYCLING CENTER**

**CONDENSATE DISTRIBUTION**

Below is a breakdown of the condensate collected within each condensate pump station when entire system is in operation.

<b>CONDENSATE DISTRIBUTION SUMMARY</b>	
Condensate Drain No.	Condensate Collection (gpd)
CDL-1	409.6
CDL-2	407.7
CDL-3	144.5
CDL-4	231.1
CDL-5	973.7
CDL-6	225.4
CDL-7	1071.7

Note: The summation of the condensate expected at each removal location is within 0.01% of the estimated total value. This variance is due to mathematical rounding to one decimal place.

DES: TAD DATE: 3-12-92

CHK: Alc DATE: 3-12-92

LANDFILL GAS MANAGEMENT SYSTEM  
 CONDENSATE PER REMOVAL LOCATION  
 CDL - 1 (GAL/DAY)

SECTION	VV	UU	TT	SS	RR	TOTAL (GAL/DAY)
WELL						
W-18,*	6.37	11.77	13.63	6.77	12.02	50.56
W-19,20	1.99	3.68	4.26	2.12	3.76	15.81
W-21	2.61	4.82	5.58	2.77	4.92	20.7
W-22	0.32	0.58	0.68	0.34	0.60	2.52
*	21.82	40.29	46.67	23.18	41.17	173.13
W-23	1.25	2.31	2.68	1.33	2.37	9.94
W-24	1.14	2.11	2.45	1.22	2.16	9.08
W-25	1.31	2.42	2.81	1.39	2.48	10.41
W-26	1.26	2.33	2.69	1.34	2.38	10.00
W-27	1.53	2.83	3.28	1.63	2.89	12.16
W-28	1.59	2.94	3.40	1.69	0.00	9.62
W-29	1.82	3.36	3.89	0.00	0.00	9.07
*	76.58	0.00	0.00	0.00	0.00	76.58
* FLOW FROM FUTURE 2003 SYSTEM					TOTAL	409.58

LANDFILL GAS MANAGEMENT SYSTEM  
 CONDENSATE PER REMOVAL LOCATION  
 CDL - 2 (GAL/DAY)

SECTION	QQ	PP	OO	NN	MM	LL	KK	JJ	TOTAL (GAL/DAY)
WELL									
W-18,*	1.41	8.53	10.44	10.02	8.28	9.21	6.13	58.78	112.80
W-19,20	0.44	2.67	3.27	3.13	2.59	2.88	1.92	18.38	35.28
W-21	0.58	3.49	4.27	4.10	3.39	3.77	2.51	24.05	46.16
W-22	0.07	0.42	0.52	0.50	0.41	0.46	0.30	2.92	5.60
*	4.84	29.21	35.76	34.31	28.37	31.54	20.98	0.00	185.01
W-23	0.28	1.68	2.05	1.97	1.63	1.81	0.00	0.00	9.42
W-24	0.25	1.53	1.87	1.80	1.49	0.00	0.00	0.00	6.94
W-25	0.29	1.76	2.15	0.00	0.00	0.00	0.00	0.00	4.20
W-26	0.28	1.69	0.00	0.00	0.00	0.00	0.00	0.00	1.97
W-27	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34

\* FLOW FROM FUTURE 2003 SYSTEM

TOTAL 407.72

LANDFILL GAS MANAGEMENT SYSTEM  
 CONDENSATE PER REMOVAL LOCATION  
 CDL - 3 (GAL/DAY)

SECTION	II	HH	GG	FF	EE	DD	CC	BB	TOTAL (GAL/DAY)
-----									
WELL									
W-16(15X)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12
W-17(15X)	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.37	0.74
W-18(15X)	0.00	0.00	0.00	0.00	0.30	1.67	1.25	1.25	4.47
W-16(85X)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18	1.18
W-17(85X)	0.00	0.00	0.00	0.00	0.00	0.00	3.61	3.62	7.23
W-18(85X)	0.00	0.00	0.00	0.00	2.82	15.80	11.77	11.79	42.18
W-18,*	2.62	11.68	25.75	30.07	0.00	0.00	0.00	0.00	70.12
W-19,20	0.82	3.65	8.05	0.00	0.00	0.00	0.00	0.00	12.52
W-21	1.07	4.78	0.00	0.00	0.00	0.00	0.00	0.00	5.85
W-22	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
-----									

\* FLOW FROM FUTURE 2003 SYSTEM

TOTAL 144.54



LANDFILL GAS MANAGEMENT SYSTEM  
CONDENSATE PER REMOVAL LOCATION  
COL - 4 (GAL/DAY)

SECTION	AA	Z	Y	X	W	V	U	T	S	R	TOTAL (GAL/DAY)
WELL											
W-18(15%),*	1.84	1.09	1.03	0.87	0.04	0.43	0.56	0.28	0.49	0.33	6.96
W-17(15%)	0.54	0.32	0.30	0.26	0.01	0.13	0.16	0.08	0.14	0.10	2.04
W-16(15%)	0.17	0.10	0.09	0.08	0.00	0.04	0.05	0.03	0.04	0.03	0.63
W-15(15%)	0.00	0.09	0.08	0.07	0.00	0.03	0.04	0.02	0.04	0.03	0.40
W-14(15%)	0.00	0.00	0.12	0.11	0.01	0.05	0.07	0.03	0.06	0.04	0.49
W-12,13(15%)	0.00	0.00	0.00	0.16	0.01	0.08	0.10	0.05	0.09	0.06	0.55
W-10,11(15%),*	0.00	0.00	0.00	0.00	0.15	1.44	1.87	0.96	1.64	1.12	7.18
W-9(15%)	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.07	0.12	0.08	0.41
W-8(15%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.03	0.11
W-7(15%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.08	0.20
W-6(15%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03
W-18(85%),*	17.44	10.33	9.70	8.21	0.42	4.04	5.26	2.69	4.59	3.15	65.83
W-17(85%)	5.35	3.17	2.98	2.52	0.13	1.24	1.61	0.83	1.41	0.97	20.21
W-16(85%)	1.74	1.03	0.97	0.82	0.04	0.40	0.53	0.27	0.46	0.32	6.58
W-15(85%)	0.00	0.95	0.89	0.76	0.04	0.37	0.48	0.25	0.42	0.29	4.45
W-14(85%)	0.00	0.00	1.44	1.22	0.06	0.60	0.78	0.40	0.68	0.47	5.65
W-12,13(85%)	0.00	0.00	0.00	1.95	0.10	0.96	1.25	0.64	1.09	0.75	6.74
W-10,11(85%),*	0.00	0.00	0.00	0.00	1.92	18.57	24.17	12.38	21.09	14.47	92.60
W-9(85%)	0.00	0.00	0.00	0.00	0.00	0.00	1.81	0.93	1.58	1.08	5.40
W-8(85%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.61	0.42	1.39
W-7(85%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.69	1.16	2.85
W-6(85%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.41

\* FLOW FROM FUTURE 2003 SYSTEM

TOTAL 231.11

LANDFILL GAS MANAGEMENT SYSTEM  
CONDENSATE PER REMOVAL LOCATION  
CDL - 5 (GAL/DAY)  
1 OF 2

SECTION	Q	P	O	N	M	L	K	J	I	H	G	TOTAL (GAL/DAY)
WELL												
W-18(15%),*	0.13	0.46	0.38	0.37	0.35	1.01	0.00	0.00	0.00	0.00	0.00	2.70
W-17(15%)	0.04	0.13	0.11	0.10	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.98
W-16(15%)	0.01	0.04	0.04	0.03	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.24
W-15(15%)	0.01	0.04	0.03	0.03	0.03	0.08	0.00	0.00	0.00	0.00	0.00	0.22
W-14(15%)	0.02	0.06	0.05	0.04	0.04	0.12	0.00	0.00	0.00	0.00	0.00	0.33
W-12,13(15%)	0.02	0.08	0.07	0.07	0.06	0.18	0.00	0.00	0.00	0.00	0.00	0.48
W-10,11(15%),*	0.45	1.53	1.29	1.24	1.19	3.40	0.00	0.00	0.00	0.00	0.00	9.10
W-9(15%)	0.03	0.11	0.10	0.09	0.09	0.25	0.00	0.00	0.00	0.00	0.00	0.67
W-8(15%)	0.01	0.04	0.04	0.03	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.24
W-7(15%)	0.03	0.11	0.10	0.09	0.09	0.25	0.00	0.00	0.00	0.00	0.00	0.67
W-6(15%)	0.01	0.04	0.03	0.03	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.23
W-5(15%)	0.00	0.09	0.08	0.07	0.07	0.20	0.00	0.00	0.00	0.00	0.00	0.51
W-4(15%)	0.00	0.00	0.07	0.07	0.07	0.19	0.00	0.00	0.00	0.00	0.00	0.40
W-3(15%)	0.00	0.00	0.00	0.07	0.06	0.18	0.00	0.00	0.00	0.00	0.00	0.31
W-2(15%)	0.00	0.00	0.00	0.00	0.07	0.19	0.00	0.00	0.00	0.00	0.00	0.26
W-1(15%)	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.17
W-18(85%),*	1.25	4.30	3.63	3.47	3.35	9.54	1.43	5.33	1.59	5.21	5.17	44.27
W-17(85%)	0.38	1.32	1.11	1.07	1.03	2.93	0.44	1.63	0.49	1.60	1.59	13.59
W-16(85%)	0.13	0.43	0.36	0.35	0.34	0.95	0.14	0.53	0.16	0.52	0.52	4.43
W-15(85%)	0.12	0.40	0.33	0.32	0.31	0.88	0.13	0.49	0.15	0.48	0.48	4.09
W-14(85%)	0.19	0.64	0.54	0.52	0.50	1.42	0.21	0.79	0.24	0.77	0.77	6.59
W-12,13(85%)	0.30	1.02	0.86	0.82	0.80	2.26	0.34	1.26	0.38	1.23	1.23	10.50
W-10,11(85%),*	5.76	19.78	16.67	15.96	15.41	43.83	6.59	24.48	7.30	23.92	23.77	203.47
W-9(85%)	0.43	1.48	1.25	1.20	1.15	3.28	0.49	1.83	0.55	1.79	1.78	15.23
W-8(85%)	0.17	0.57	0.48	0.46	0.44	1.26	0.19	0.71	0.21	0.69	0.69	5.87
W-7(85%)	0.46	1.59	1.34	1.28	1.24	3.52	0.53	1.97	0.59	1.92	1.91	16.35
W-6(85%)	0.16	0.56	0.47	0.45	0.43	1.24	0.19	0.69	0.21	0.67	0.67	5.74
W-5(85%)	0.00	1.36	1.15	1.10	1.06	3.02	0.45	1.69	0.50	1.65	1.64	13.62
W-4(85%)	0.00	0.00	1.12	1.07	1.03	2.94	0.44	1.64	0.49	1.60	1.59	11.92
W-3(85%)	0.00	0.00	0.00	1.07	1.03	2.94	0.44	1.64	0.49	1.61	1.60	10.82
W-2(85%)	0.00	0.00	0.00	0.00	1.13	3.20	0.48	1.79	0.53	1.75	1.74	10.62
W-1(85%)	0.00	0.00	0.00	0.00	0.00	2.97	0.45	1.66	0.49	1.62	1.61	8.80
*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.98	55.63	55.27	127.88
W-30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.74	2.72	5.46
W-31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.67	2.67
W-32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W-48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

\* FLOW FROM FUTURE 2003 SYSTEM

SUBTOTAL 539.43

LANDFILL GAS MANAGEMENT SYSTEM  
CONDENSATE PER REMOVAL LOCATION  
CDL - 5 (GAL/DAY)  
2 OF 2

SECTION	F	E	D	C	JJJ	KKK	LLL	MMM	NNN	OOO	PPP	TOTAL (GAL/DAY)
WELL												
W-18(15%),*	0.00	0.00	0.00	0.00	0.11	1.07	2.04	1.80	1.58	1.76	1.03	9.39
W-17(15%)	0.00	0.00	0.00	0.00	0.03	0.32	0.60	0.53	0.47	0.52	0.30	2.77
W-16(15%)	0.00	0.00	0.00	0.00	0.01	0.10	0.19	0.17	0.15	0.16	0.10	0.88
W-15(15%)	0.00	0.00	0.00	0.00	0.01	0.08	0.16	0.14	0.12	0.14	0.08	0.73
W-14(15%)	0.00	0.00	0.00	0.00	0.01	0.13	0.25	0.22	0.19	0.21	0.12	1.13
W-12,13(15%)	0.00	0.00	0.00	0.00	0.02	0.19	0.37	0.32	0.28	0.32	0.19	1.69
W-10,11(15%),*	0.00	0.00	0.00	0.00	0.36	3.61	6.86	6.06	5.33	5.92	3.48	31.62
W-9(15%)	0.00	0.00	0.00	0.00	0.03	0.27	0.50	0.45	0.39	0.44	0.26	2.34
W-8(15%)	0.00	0.00	0.00	0.00	0.01	0.10	0.19	0.17	0.15	0.16	0.10	0.88
W-7(15%)	0.00	0.00	0.00	0.00	0.03	0.27	0.51	0.45	0.40	0.44	0.26	2.36
W-6(15%)	0.00	0.00	0.00	0.00	0.01	0.09	0.17	0.15	0.14	0.15	0.09	0.80
W-5(15%)	0.00	0.00	0.00	0.00	0.02	0.22	0.41	0.36	0.32	0.35	0.21	1.89
W-4(15%)	0.00	0.00	0.00	0.00	0.02	0.20	0.38	0.33	0.29	0.33	0.19	1.74
W-3(15%)	0.00	0.00	0.00	0.00	0.02	0.20	0.37	0.33	0.29	0.32	0.19	1.72
W-2(15%)	0.00	0.00	0.00	0.00	0.02	0.21	0.39	0.35	0.30	0.34	0.20	1.81
W-1(15%)	0.00	0.00	0.00	0.00	0.02	0.18	0.34	0.30	0.26	0.29	0.17	1.56
W-18(85%),*	5.17	5.07	4.36	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.24
W-17(85%)	1.59	1.56	1.34	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.69
W-16(85%)	0.52	0.51	0.44	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.53
W-15(85%)	0.48	0.47	0.40	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41
W-14(85%)	0.77	0.75	0.65	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.26
W-12,13(85%)	1.23	1.20	1.03	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.61
W-10,11(85%),*	23.77	23.29	20.03	2.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.02
W-9(85%)	1.78	1.74	1.50	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.24
W-8(85%)	0.69	0.67	0.58	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.02
W-7(85%)	1.91	1.87	1.61	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.63
W-6(85%)	0.67	0.66	0.57	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.98
W-5(85%)	1.64	1.60	1.38	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.82
W-4(85%)	1.59	1.56	1.34	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.69
W-3(85%)	1.60	1.56	1.34	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.70
W-2(85%)	1.74	1.70	1.46	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.11
W-1(85%)	1.61	1.58	1.36	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.75
*	55.27	54.16	46.58	6.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	162.82
W-30	2.72	2.67	2.30	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.03
W-31	2.67	2.61	2.25	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.91
W-32	3.19	3.12	2.69	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.39
W-33	0.00	3.81	3.27	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.56
W-34	0.00	0.00	3.95	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.53
W-35	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75
W-43	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.23
W-44	0.00	0.00	0.00	0.00	0.20	2.01	0.00	0.00	0.00	0.00	0.00	2.21
W-45	0.00	0.00	0.00	0.00	0.17	1.75	3.32	0.00	0.00	0.00	0.00	5.24
W-46	0.00	0.00	0.00	0.00	0.14	1.37	2.61	2.31	0.00	0.00	0.00	6.43
W-47	0.00	0.00	0.00	0.00	0.13	1.27	2.42	2.14	1.88	0.00	0.00	7.84
W-48	0.00	0.00	0.00	0.00	0.13	1.32	2.52	2.22	1.95	2.17	0.00	10.31

\* FLOW FROM FUTURE 2003 SYSTEM

SUBTOTAL 434.26

TOTAL 973.69

LANDFILL GAS MANAGEMENT SYSTEM  
CONDENSATE PER REMOVAL LOCATION  
CDL - 6 (GAL/DAY)

SECTION	III	HMM	GGG	FFF	EEE	DDD	CCC	BBB	AAA	TOTAL (GAL/DAY)
-----										
WELL										
W-18(15%),*	0.99	1.03	1.14	1.12	0.81	0.74	0.95	0.84	0.49	8.11
W-17(15%)	0.29	0.30	0.34	0.33	0.24	0.22	0.28	0.25	0.14	2.39
W-16(15%)	0.09	0.09	0.11	0.10	0.07	0.07	0.09	0.08	0.05	0.75
W-15(15%)	0.08	0.08	0.09	0.09	0.06	0.06	0.07	0.07	0.04	0.64
W-14(15%)	0.12	0.12	0.14	0.14	0.10	0.09	0.12	0.10	0.06	0.99
W-12,13(15%)	0.18	0.18	0.21	0.20	0.15	0.13	0.17	0.15	0.09	1.46
W-10,11(15%),*	3.33	3.46	3.85	3.76	2.73	2.48	3.20	2.81	1.64	27.26
W-9(15%)	0.24	0.25	0.28	0.28	0.20	0.18	0.24	0.21	0.12	2.00
W-8(15%)	0.09	0.10	0.11	0.10	0.08	0.07	0.09	0.08	0.05	0.77
W-7(15%)	0.25	0.26	0.29	0.28	0.20	0.19	0.24	0.21	0.12	2.04
W-6(15%)	0.08	0.09	0.10	0.10	0.07	0.06	0.08	0.07	0.04	0.69
W-5(15%)	0.20	0.21	0.23	0.23	0.16	0.15	0.19	0.17	0.10	1.64
W-4(15%)	0.18	0.19	0.21	0.21	0.15	0.14	0.18	0.15	0.09	1.50
W-3(15%)	0.18	0.19	0.21	0.20	0.15	0.14	0.17	0.15	0.09	1.48
W-2(15%)	0.19	0.20	0.22	0.21	0.16	0.14	0.18	0.16	0.09	1.55
W-1(15%)	0.17	0.17	0.19	0.19	0.14	0.12	0.16	0.14	0.08	1.36
W-37	0.00	0.00	0.00	0.00	0.00	0.00	6.57	5.77	3.37	15.71
W-38	0.00	0.00	0.00	0.00	0.00	3.63	4.69	4.12	2.40	14.84
W-39	0.00	0.00	0.00	0.00	3.24	2.95	3.80	3.34	1.95	15.28
W-40	0.00	0.00	0.00	3.61	2.62	2.39	3.08	2.70	1.58	15.98
W-41	0.00	0.00	2.94	2.87	2.08	1.89	2.44	2.15	1.25	15.62
W-42	0.00	2.52	2.81	2.74	1.99	1.81	2.34	2.05	1.20	17.46
W-43	2.13	2.22	2.47	2.41	1.75	1.59	2.06	1.81	1.05	17.49
W-44	1.86	1.93	2.15	2.10	1.52	1.39	1.79	1.57	0.92	15.23
W-45	1.61	1.68	1.86	1.82	1.32	1.20	1.55	1.36	0.79	13.19
W-46	1.27	1.32	1.47	1.43	1.04	0.95	1.22	1.07	0.62	10.39
W-47	1.17	1.22	1.36	1.33	0.96	0.88	1.13	0.99	0.58	9.62
W-48	1.22	1.27	1.41	1.38	1.00	0.91	1.18	1.03	0.60	10.00
-----										

\* FLOW FROM FUTURE 2003 SYSTEM

TOTAL 225.44✓

LANDFILL GAS MANAGEMENT SYSTEM  
CONDENSATE PER REMOVAL LOCATION  
CDL - 7 (GAL/DAY)  
1 OF 2

SECTION	B	A	WW	XX	YY	ZZ	TOTAL (GAL/DAY)
WELL							
W-18(15%),*	0.00	0.00	0.00	0.16	0.62	0.15	0.93
W-17(15%)	0.00	0.00	0.00	0.05	0.18	0.04	0.27
W-16(15%)	0.00	0.00	0.00	0.01	0.06	0.01	0.08
W-15(15%)	0.00	0.00	0.00	0.01	0.05	0.01	0.07
W-14(15%)	0.00	0.00	0.00	0.02	0.08	0.02	0.12
W-12,13(15%)	0.00	0.00	0.00	0.03	0.11	0.03	0.17
W-10,11(15%),*	0.00	0.00	0.00	0.53	2.09	0.50	3.12
W-9(15%)	0.00	0.00	0.00	0.04	0.15	0.04	0.23
W-8(15%)	0.00	0.00	0.00	0.01	0.06	0.01	0.08
W-7(15%)	0.00	0.00	0.00	0.04	0.16	0.04	0.24
W-6(15%)	0.00	0.00	0.00	0.01	0.05	0.01	0.07
W-5(15%)	0.00	0.00	0.00	0.03	0.13	0.03	0.19
W-4(15%)	0.00	0.00	0.00	0.03	0.12	0.03	0.18
W-3(15%)	0.00	0.00	0.00	0.03	0.11	0.03	0.17
W-2(15%)	0.00	0.00	0.00	0.03	0.12	0.03	0.18
W-1(15%)	0.00	0.00	0.00	0.03	0.10	0.02	0.15
W-18(85%),*	4.02	3.99	0.00	1.49	5.88	1.41	16.79
W-17(85%)	1.23	1.22	0.00	0.46	1.80	0.43	5.14
W-16(85%)	0.40	0.40	0.00	0.15	0.59	0.14	1.68
W-15(85%)	0.37	0.37	0.00	0.14	0.54	0.13	1.55
W-14(85%)	0.60	0.59	0.00	0.22	0.87	0.21	2.49
W-12,13(85%)	0.95	0.95	0.00	0.35	1.39	0.33	3.97
W-10,11(85%),*	18.49	18.34	0.00	6.85	27.00	6.47	77.15
W-9(85%)	1.38	1.37	0.00	0.51	2.02	0.48	5.76
W-8(85%)	0.53	0.53	0.00	0.20	0.78	0.19	2.23
W-7(85%)	1.48	1.47	0.00	0.55	2.17	0.52	6.19
W-6(85%)	0.52	0.52	0.00	0.19	0.76	0.18	2.17
W-5(85%)	1.27	1.26	0.00	0.47	1.86	0.45	5.31
W-4(85%)	1.24	1.23	0.00	0.46	1.81	0.43	5.17
W-3(85%)	1.24	1.23	0.00	0.46	1.81	0.43	5.17
W-2(85%)	1.35	1.34	0.00	0.50	1.97	0.47	5.63
W-1(85%)	1.25	1.24	0.00	0.46	1.83	0.44	5.22
W-18,*	0.00	0.00	15.71	13.73	3.29	0.00	32.73
W-19,20	0.00	0.00	4.91	4.29	1.03	0.00	10.23
W-21	0.00	0.00	6.43	5.62	1.35	0.00	13.40
W-22	0.00	0.00	0.78	0.68	0.16	0.00	1.62
*	0.00	0.00	53.79	47.02	11.26	0.00	112.07
W-23	0.00	0.00	3.09	2.70	0.65	0.00	6.44
W-24	0.00	0.00	2.82	2.47	0.59	0.00	5.88
W-25	0.00	0.00	3.24	2.83	0.68	0.00	6.75
W-26	0.00	0.00	3.11	2.71	0.65	0.00	6.47
W-27	0.00	0.00	3.78	3.31	0.79	0.00	7.88
W-28	0.00	0.00	3.92	3.43	0.82	0.00	8.17
W-29	0.00	0.00	4.49	3.92	0.94	0.00	9.35
*	0.00	0.00	188.84	165.06	39.53	0.00	393.43

\* FLOW FROM FUTURE 2003 SYSTEM

SUBTOTAL 772.29

LANDFILL GAS MANAGEMENT SYSTEM  
CONDENSATE PER REMOVAL LOCATION  
CDL - 7 (GAL/DAY)  
2 OF 2

SECTION	B	A	WW	XX	YY	ZZ	TOTAL (GAL/DAY)
WELL							
* (LOOP II)	43.00	42.65	0.00	15.92	62.79	15.04	179.40
W-30	2.12	2.10	0.00	0.78	3.10	0.74	8.84
W-31	2.08	2.06	0.00	0.77	3.03	0.73	8.67
W-32	2.48	2.46	0.00	0.92	3.62	0.87	10.35
W-33	3.02	3.00	0.00	1.12	4.41	1.06	12.61
W-34	3.64	3.61	0.00	1.35	5.32	1.27	15.19
W-35	4.71	4.67	0.00	1.74	6.88	1.65	19.65
W-36	0.00	4.27	0.00	1.59	6.29	1.51	13.66
W-37	0.00	0.00	0.00	1.09	4.29	1.03	6.41
W-38	0.00	0.00	0.00	0.78	3.06	0.73	4.57
W-39	0.00	0.00	0.00	0.63	2.48	0.60	3.71
W-40	0.00	0.00	0.00	0.51	2.01	0.48	3.00
W-41	0.00	0.00	0.00	0.40	1.60	0.38	2.38
W-42	0.00	0.00	0.00	0.39	1.53	0.37	2.29
W-43	0.00	0.00	0.00	0.34	1.34	0.32	2.00
W-44	0.00	0.00	0.00	0.30	1.17	0.28	1.75
W-45	0.00	0.00	0.00	0.26	1.01	0.24	1.51
W-46	0.00	0.00	0.00	0.20	0.80	0.19	1.19
W-47	0.00	0.00	0.00	0.19	0.74	0.18	1.11
W-48	0.00	0.00	0.00	0.19	0.77	0.18	1.14
* FLOW FROM FUTURE 2003 SYSTEM							
						SUBTOTAL	299.43
						TOTAL	1071.72

**APPENDIX F**

**SECTION 3.0**

**PUMP SELECTION FOR CONDENSATE PUMP STATIONS**

**LANDFILL GAS MANAGEMENT CENTER  
MEDLEY LANDFILL AND RECYCLING CENTER**

**PUMP SELECTION FOR CONDENSATE PUMP STATIONS**

<b>PUMP SELECTION SUMMARY</b>				
CPS	FLOW, GPM		HEAD, FT.	
	MIN.	MAX.	MIN.	MAX.
1	10	30	11.6	21.2
2	10	30	20.8	50.3
3	10	30	7.8	12.5
4	10	30	55.9	124.0
5	10	30	11.1	21.1
6	10	30	11.9	26.6
7	10	30	19.3	72.2

**NOTE:** Any manufacturers' pump meeting the preceding operating parameters are acceptable.



**APPENDIX G**  
**CONSTRUCTION NOTES**

**APPENDIX G**  
**CONSTRUCTION NOTES**  
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## CONSTRUCTION NOTES

### 1.0 INTRODUCTION

These notes have been prepared to assist the contractor in the proper installation methods of gas management systems.

### 2.0 GENERAL REQUIREMENTS

- A. Contractor shall make himself aware of the present topographic conditions of the project site and of all installation requirements for the landfill gas management system presented and specified in the design plans prior to performing any work.
- B. Contractor shall make himself aware of the dangers involved with working in the confined space of an excavation and must take appropriate safety measures and adhere to all safety requirements.
- C. Contractor shall coordinate with the site manager the construction of collection headers near and across access roads.

### 3.0 RECORD DRAWINGS

- A. During project construction, the Contractor will document all as-built dimensions, elevations, changes in grade and details referenced in these construction plans. Upon completion of project, contractor will furnish owner with a legible set of appropriately marked construction "record drawings".

### 4.0 SYSTEM START UP

- A. Contractor will be available during initial start-up and tuning of the Landfill Gas Management System to ensure operation of the system.

### 5.0 PIPE FITTINGS

- A. Prior to construction of the high density polyethylene (HDPE) header collection system, Technical Specification GCS-101 (Appendix H) should be consulted for codes and procedures.
- B. All high density polyethylene (HDPE) pipe shall meet ASTM D 3350-84 and cell classification PE 345434C requirements with a minimum rated SDR of seventeen (17). All HDPE pipe fittings shall have a minimum rated SDR of fifteen and one-half (15.5).

- C. All polyvinyl chloride (PVC) pipe and pipe fittings shall be Schedule 80. The PVC pipe shall meet ASTM D-1785 classification and all PVC fittings shall meet ASTM D-2467 classification.
- D. All threaded well head fitting connections are to be teflon taped and not solvent cemented.
- E. All flanges to meet the American National Standards Institute (A.N.S.I.) 150 pound bolt hole circle diameter, number of bolts and bolt sizing requirements.
- F. In making flanged joints, the following precautions should be observed:
  - 1. When a PVC flange is installed, make sure pipe ends are cut square and fully bottomed out in the flange socket.
  - 2. Insert the appropriate size neoprene flange gasket between the flanges or flange/valve/flange spacer connection.
  - 3. Use U.S. Standard round washers on plastic flanges (trimming of washers may be required on some flanges). Bolts should be well lubricated per manufacturer's recommendations.
  - 4. Tighten the flange bolts with a torque wrench in the following 180° sequence:  
CAUTION: Do not over-torque bolts.

- BOLT NO.    1- 12 o'clock  
                   2- 6 o'clock  
                   3- 9 o'clock  
                   4- 3 o'clock  
                   5- 10:30 o'clock  
                   6- 4:30 o'clock  
                   7- 7:30 o'clock  
                   8- 1:30 o'clock

- 5. To prevent leaky gaskets, all bolts should be pulled down by degrees to a uniform torque.

- 4" Flange - 20 to 30 ft/lbs
- 6" Flange - 33 to 50 ft/lbs
- 8" Flange - 33 to 50 ft/lbs
- 10" Flange - 53 to 75 ft/lbs
- 12" Flange - 80 to 110 ft/lbs
- 14" Flange - 80 to 110 ft/lbs

- G. All below grade steel pipe and bolts to be corrosion protected with Tapecoat Mastic and Tape, or equal. All above ground exposed steel pipe to be painted with a corrosion resistant paint.
- H. All high density polyethylene (HDPE) pipe to be butt fused and flanged per manufacturer's specifications.
- I. Contractor will need to use compatibility fusion techniques when polyethylene of different melt indexes are fused together. Manufacturer's specifications shall be strictly adhered to.
- J. To reduce branch saddle stress, saddles will be installed at a slope equal to and continuous with the lateral piping.
- K. Consult the manufacturer's specifications for minimum bend radius when field bending of pipe is required.
- L. All header trenches shall provide sand bedding and cover for header pipe.
- M. The header trench shall provide continuous support and be smooth and free of rocks, foreign material and water.
- N. Minimum acceptable collection header pipe slope is two percent when located in refuse fill areas.
- O. Minimum cover depth over any polyethylene pipe is 24 inches.
- P. Gas pipeline signs should be placed above and along the pipeline route at critical points, i.e., tees, lateral connections, changes in lateral directions, breaks in grade and buried flanged or capped ends. The gas pipeline signs will consist of a metal sign connected to a steel fence post with two U-bolts.

## **6.0 BLOWER/FLARE STATION**

- A. Before construction of concrete blower and flare pad, bolt hole and flange center dimensions are to be verified by the contractor with the respective manufacturer.
- B. Concrete pad for blower to be constructed with two layers of six inch mesh wire reinforcing (.252 inch diameter) and bent steel anchor bolts set to specified depth into concrete as suggested by the manufacturer.
- C. Concrete pad for flare to be constructed as in Item B above.

- D. Blower to be mounted on 1/2 inch thick rubber bushings for vibration control.

## 6.1 Electrical

- A. Electrical components shall consist of the following:

1. 230/460 volt, three-phase 60 Hz electrical service to flare station location, sized by electrical contractor for equipment to be installed i.e., minimum 40 Hp blower motor for the final system layout.
2. All blower and flare ignition controls will be provided by the flare manufacturer in a central control panel. This system will, as a minimum, include:
  - a. All transformers needed to supply correct utility and blower power requirements. Power quick disconnects.
  - b. 110 volt service outlet.
  - c. Ammeter mounted on control panel to monitor the start-up and running amperage of the blower motor. Scale range of the meter should be approximately twice the motor running amperage.
  - d. Electric eye operated mercury vapor light mounted on top of electrical service breaker box; light to have manual override on/off switch.
3. Explosion proof or TEFC blower motor (furnished with blower)

- B. The control system will operate in the following manner:

1. If a power failure occurs or if power is interrupted at the breaker panel during system operation, the electrically actuated control valve will fail in the close position, and the system will shut down.
2. Once the power is restored, with the system in the automatic mode, (1) the thermocouple within the pilot (sensing a low temperature) will alert the control panel to initiate relight procedures, (2) the pilot gas control valve will open, (3) the pilot will start, (4) the pilot thermocouple will sense temperature increase, (5) the landfill gas control valve will open, (6) the blower will start and, (7) landfill gas will be delivered to the flare tip.
3. Once the flare is lit, another thermocouple located in the flare tip, will indicate the flare is lit and disengage the ignition system.

4. If after ten minutes, the thermocouple within the flare does not indicate a higher temperature, the entire system will shut down.
- C. Electrical power lines from power pole to blower junction box are to be underground. There should be no power poles, overhead wiring or other obstructions in excess of ten feet in height within 100 feet of the flare stack.
  - D. Due to close proximity to refuse, all underground wiring between electrical enclosure and the items listed below to be of vapor/water-tight construction to prevent gas migration into electrical components.
    1. Power service pole and electrical service breaker box
    2. Electrical service breaker box and control panel
    3. Control panel and blower motor
    4. Control panel and the flame front generator relight system
    5. The landfill gas control valve and the control panel.
  - E. All electrical work to be designed and installed in accordance with national, state, and local electrical codes, and any other board having jurisdiction over the electrical installation. Electrical shop drawings shall be prepared and provided by the electrical contractor for review by the Site Engineer prior to construction. The electrical contractor shall provide, at the time of project completion, a complete "record drawing" of the same.
  - F. Flare manufacturer to provide upon placement of flare order, details of flare equipment, flame monitoring and relight controls. Details to include but not be limited to:

Equipment dimensions and specifications including electrical and piping for the utility flare with flame front generator relight system, flame monitoring, and flare control panel.
  - G. To maintain gravel pack stability and for vegetation growth control, a geotextile will be installed in the blower/flare station prior to the four inches of compacted gravel.

## 7.0 EXTRACTION WELL

- A. All gas extraction well locations shall be surveyed prior to installation.

- B. No extraction well boring shall extend into undisturbed native soils or landfill base liner. If a well boring cannot be completed to the specified depth, due to liquids or any other obstruction the Contractor shall immediately notify the Site Engineer.
- C. All field changes regarding extraction well locations and construction dimensions specified in the gas extraction well schedule shall be properly recorded and documented in the "record drawings" by the Contractor.
- D. The backfill material used between the washed gravel and bentonite seal will consist of a clean granular material.
- E. The gas extraction well bentonite mat installation procedure will consist of:
  - 1. Replace existing cover thickness with compacted muck to within 18 inches of ground surface.
  - 2. Wrap bentonite mat (1 ft. min. width) around gas well assembly PVC and HDPE pipes centered at 18 inches below ground surface.
  - 3. Lay bentonite mat in excavation (cut holes the size of the PVC and HDPE pipe to allow the well head assembly pipes to pass through) 18 inches below ground surface.
  - 4. Place compacted muck above the bentonite mat to ground surface. Compacted muck shall be placed below and above the bentonite mat to equal the existing cover thickness.
- F. To minimize air intrusion around the extraction well, no PVC coupling shall be used within five feet of the existing ground elevation.
- G. The washed stone pack will extend 18 inches above the top of the slotted pipe.
- H. All below grade PVC slip coupling joints (for well construction) to be solvent cemented as per manufacturer's specifications and lag bolted at 120° intervals about circumference of pipe socket.



**APPENDIX H**

**TECHNICAL SPECIFICATION GCS-101**

**POLYETHYLENE PIPE COLLECTION SYSTEM**

**TECHNICAL SPECIFICATION GCS-101**  
**POLYETHYLENE PIPE COLLECTION SYSTEM**

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**TECHNICAL SPECIFICATION GCS-101  
POLYETHYLENE PIPE COLLECTION SYSTEM**

**1.0 INTRODUCTION**

This specification has been prepared to assist the contractor in the proper handling, installation and pressure testing of polyethylene pipe and equipment requirements.

**2.0 GENERAL INFORMATION**

Work shall comply with the following aspects of the landfill's safety policy:

1. Equipment fire protection
2. Personal protective equipment
3. Accident reporting
4. Fires
5. Smoking
6. Confined space entry
7. Code of conduct

Work shall comply with appropriate codes and standards of the following organizations for the handling, heat fusion and underground installation of high density polyethylene pipe.

1. American Society for Testing and Materials (ASTM)
2. American National Standards Institute (ANSI)
3. American Gas Association (AGA)
4. Plastic Piping Institute (PPI)

All equipment, accessories and procedures shall meet the safety standards of the Local, State and Federal Agencies, including but not limited to:

- Occupational Safety and Health Act of 1970 (OSHA)
- Local Board of Health

### **3.0 POLYETHYLENE PIPE HANDLING AND FUSION**

#### **3.1 Pipe Requirements**

- A. All high density polyethylene pipe and necessary fittings will be furnished by contractor.
- B. All high density polyethylene pipe used will be made of a 3408 type resin meeting PE 345434C cell classification.
- C. Appendix I, "HDPE Pipe Vendors Installation Specification", shall be adhered to when "manufacturer's recommendations" are specified.

#### **3.2 Pipe Storage**

- A. High density Polyethylene pipe shall be stored or stacked so as to prevent damage by marring, crushing or puncture. Maximum stacking height shall be limited to six feet.
- B. For storage over 30 days, a location shall be chosen out of direct sunlight.

#### **3.3 Pipe Handling**

- A. Care shall be taken to protect the pipe from excessive heat or harmful chemicals.
- B. Cleaning solutions, detergents, or solvents, when required, shall be used in accordance with the manufacturer's recommendations.
- C. Pipe shall not be bent under the minimum radius recommended by the manufacturer for type and grade.
- D. Care shall be taken to avoid imposing strains that will overstress or buckle the piping or impose excessive stress on the joints.

#### **3.4 Heat Fusion of Pipe**

- A. All fusion equipment operators shall have been certified by the HDPE manufacturer within the last 12 months.
- B. Butt fusions shall be made in accordance with manufacturer's recommendations and procedures. Fusion equipment and a qualified operator will be provided by contractor. (See Section 4.6)

- C. Branch saddle fusions shall be made in accordance with manufacturer's recommendations and procedures. Branch saddle fusion equipment will be of the size to facilitate saddle fusion within the trench. (See Section 4.6)
- D. Before butt fusing pipe, each length shall be inspected for the presence of dirt, sand, mud, shavings and other debris or animals. If discovered, complete removal is required.
- E. At the end of each day, all open ends of fused pipe shall be capped or covered to prevent entry by animals or debris.

#### **4.0 EQUIPMENT REQUIREMENTS**

##### **4.1 General**

- A. Equipment and accessories shall be kept in a well maintained and safe condition.
- B. Each piece of heavy equipment shall carry at least one, five 5 pound dry chemical fire extinguisher.

##### **4.2 Trenching Equipment**

- A. Trenching equipment shall be of the size and nature to adequately excavate a 24 inch wide trench to maximum depth of 16 feet.

##### **4.3 Pipe Handling Equipment**

- A. Pipe handling equipment shall be of the size and nature to adequately hoist a three ton weight to a vertical height of ten feet above ground.
- B. A sling with a minimum width of 2 inches is required for handling high density polyethylene pipe.

##### **4.4 Backfilling Equipment**

- A. Backfilling equipment shall be of the size and nature to adequately backfill the trench and grade surface to original contour.

#### **4.5 Bedding and Compaction Equipment**

- A. Hand tools (shovels, rakes, hand tampers, etc.) and mechanical equipment necessary for bedding and compaction as specified in the design drawings shall be furnished by contractor.

#### **4.6 Pipe Fusion Equipment**

- A. Pipe fusion equipment shall be of the size and nature to adequately weld all pipe sizes and fittings and will be furnished by contractor.

#### **4.7 Grade Control Equipment**

- A. Grade control equipment shall be of the type to accurately control elevations during installation of high density polyethylene pipe. It is suggested a laser level be used for pipe grade control. Grade control shall be documented by the contractor. (See Section 5.1.D)

#### **4.8 Dewatering Equipment**

- A. Dewatering equipment shall be of the size and nature to maintain a dry condition in the trench before installation of the system components.

### **5.0 TRENCHING AND INSTALLATION**

#### **5.1 Piping**

- A. Maximum lengths of fused pipe to be handled as one section will be field determined by contractor according to pipe size, SDR and topography, as not to cause any excessive gauging or surface abrasion; but not to exceed 1,000 feet.
- B. Any pipe section longer than a single joint (usually 40 feet) shall be capped on both ends during placement.
- C. The owner shall be notified prior to any pipe being installed in the trench. The owner or authorized representative will inspect the following items at the time of installation.
  - 1. Butt and saddle fusions
  - 2. Pipe integrity
  - 3. Trench excavation for rocks, foreign material and bedding

4. Proper trench slope
5. Trench contour to ensure the pipe will have uniform and continuous support

Any irregularities found by owner or representative during this inspection must be corrected before lowering-in activities.

- D. A laser level or equivalent method shall be used to maintain grades of ten percent or less during installation of high density polyethylene piping. Grade settings utilized for each pipe section shall be noted accordingly on "Record Drawings".
- E. Tie-ins shall be made out of the trench whenever possible. When tie-ins can only be made in the trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.
- F. All branch saddle connections will be made within the trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.
- G. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins and/or backfilling activity.

## 5.2 Header Trench Excavation

- A. The trench shall be continuous, smooth and free of water, rocks and foreign material.
- B. The trench shall be excavated to a width of not less than 1-1/2 times the pipe diameter to be installed but not less than 18 inches.
- C. The trench shall be excavated to the depth as shown on the design plans, but not to exceed ten feet. This depth will be based on:
  1. Loading pressure
  2. Frost line
  3. A pre-determined minimum slope
- D. Excavated cover material shall be separated from excavated refuse. Any materials not suitable for backfill will be removed by contractor and disposed at a location determined by the owner and according to the design plan.

### **5.3 Header Pipe Bedding**

- A. Clean, coarse sand (No. 10 to 40 sieve size) shall be used for bedding purposes. A minimum six inch sand bed shall be placed to control trench contour and protect the pipe when installed in refuse. When the trench is not in refuse, a minimum of three inch bedding shall be maintained. The contractor shall furnish the sand bedding material unless otherwise specified.

### **5.4 Header Trench Backfilling**

- A. Loose sand backfill shall be placed in the trench and compacted with hand tools in two to four inch thick lifts under the haunches of the pipe until compacted firm to the spring line. (center-line of pipe)
- B. Initial backfill sand shall be compacted using mechanical compaction device in lifts not to exceed nine inches to a height six inches above the top of the pipe.
- C. Initial backfill shall be compacted to a density where subsequent passes with a mechanical compaction device will not reduce the surface elevation of the backfill by more than three-quarters of an inch.
- D. Excavated material will be used as backfill provided it is free of refuse, frozen earth, rocks and foreign material.
- E. Final cover backfill shall be compacted to a density and thickness consistent with the existing landfill cover material.
- F. Backfilled areas shall be graded to original grade unless specified in the design drawings.
- G. Untested segment tie-ins shall remain unbackfilled or clearly marked for easy access and inspection until the system final pressure test (Section 6.3) is complete.

### **5.5 Status Report**

- A. A weekly construction status report (Appendix J) shall be submitted to the owner. This report shall contain, but not be limited to, the following information:
  - 1. Project name and number.
  - 2. Percent of project completed as of that date and costs incurred.



3. Description of work performed.
4. Labor and Equipment used during that week and the total project.
5. Description of any problems or delays encountered during the week.
6. Description of upcoming activities and updated schedule.

## **6.0 PRESSURE TESTING**

Contractor shall furnish compressors, gauges, and all related equipment to perform segment and final pressure test.

### **6.1 Segment Testing: Pre-Installation**

- A. Similar sizes of polyethylene piping shall be butt welded together into testing segments not to exceed 1000 feet. Segments shall be fitted with a temporary cap on one end and testing apparatus on the other. (See 6.1.G for testing apparatus)
- B. The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test.
- C. The pressure test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This procedure will minimize the pressure changes which will occur during temperature fluctuations.
- D. The test pressure shall be at ten psig.
  1. Pressure testing gauge shall have minimum increments of 0.1 psig.
  2. Contractor shall submit verification and results of gauge calibration prior to (no more than 60 days) and after completion of the project.
- E. The allowable pressure drop observed during the test shall not exceed one percent of the testing gauge pressure over a period of one hour. This pressure drop shall be corrected for temperature changes before determining pass or failure. (See Section 6.2 for test failures.)

- F. Owner shall be notified before testing procedure and shall have the option of being present during the test.
- G. Equipment for this testing procedure shall be furnished by contractor. This shall consist of a polyethylene flange adaptor with a polyvinyl chloride blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge zero to one-hundred degrees centigrade, a pressure gauge zero to fifteen psig, a "tire-valve" to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested.

## **6.2 Test Failure**

- A. The following steps shall be performed when a pipe segment fails the one percent - one hour test.
  - 1. The pipe and all fusions shall be inspected for cracks, pinholes or perforations.
  - 2. All blocked risers and capped ends shall be inspected for leaks.
  - 3. Leaks shall be verified by applying a soapwater solution and observing soap bubble formation.
- B. All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.
- C. After all leaks are repaired, a retest shall be performed in accordance with Section 6.1.

## **6.3. Final Test**

- A. A final test shall be made on the completed pipeline in accordance with Sections 6.1.C-G and 6.2.
- B. To facilitate the system final pressure test all open pipe ends will be temporarily capped with a fused polyethylene cap or be fitted with a blind flange and gasket.
- C. The completed system should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test.

- D. Testing apparatus can be placed at location of the valve inlet before the blower.

#### 6.4 Test Reporting

- A. - All testing shall be reported in writing (Appendix K) to the owner and shall include the following information:

1. Date and time
2. Person performing test
3. Name of owner's representative
4. Pipe length, size(s) and location
5. Test pressure measurements at ten (10) minute intervals
6. Ambient temperature at ten (10) minute intervals (measured in trench for final test)

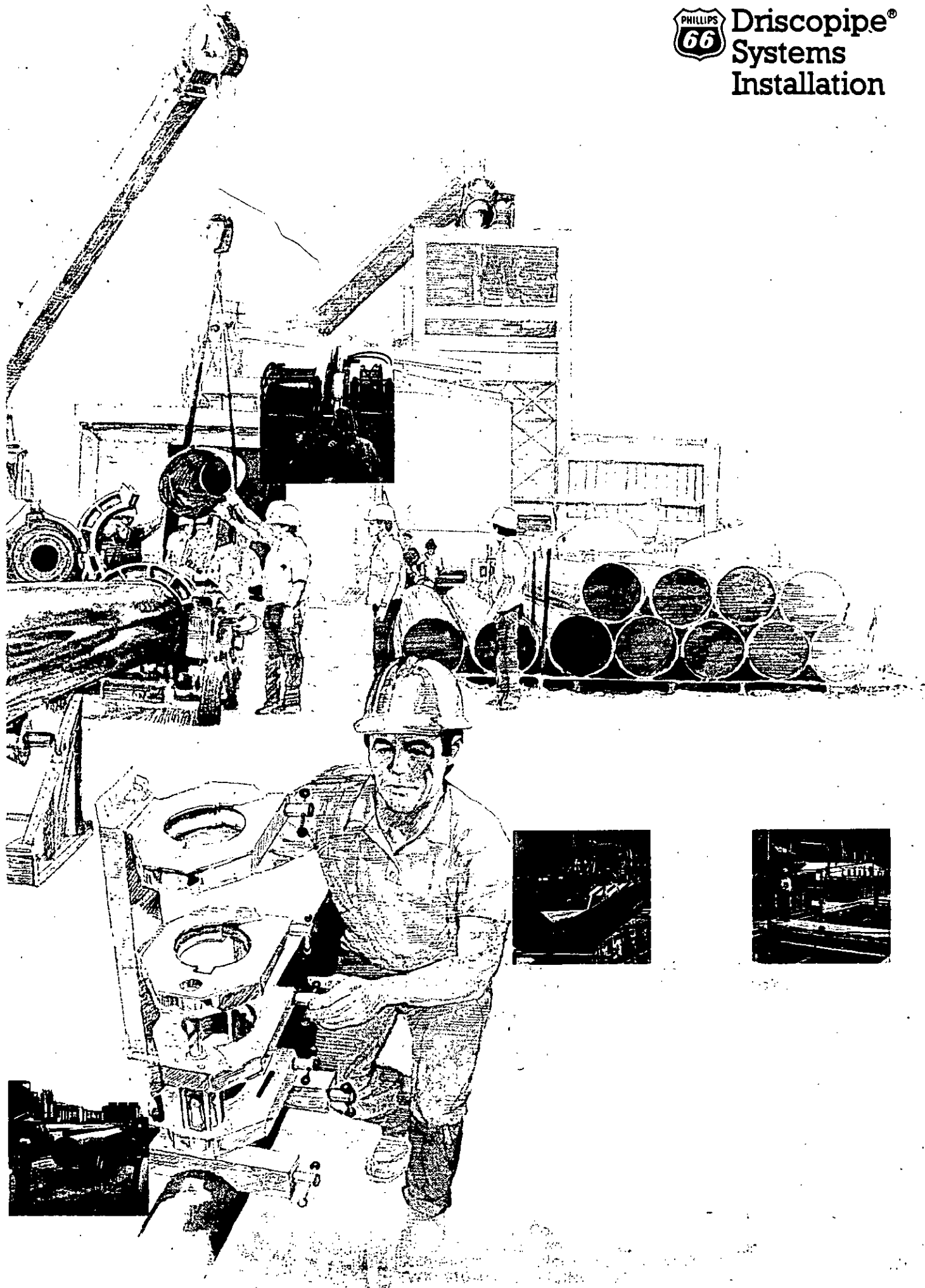
- B. The following information shall be reported in writing if a failure occurs:

1. Nature of all leaks found
2. Details of repair
3. Retest results

**APPENDIX I**  
**HDPE PIPE VENDORS**  
**INSTALLATION SPECIFICATION**



# Driscopipe® Systems Installation



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THIS DOCUMENT REPORTS ACCURATE AND RELIABLE INFORMATION TO THE BEST OF OUR KNOWLEDGE, BUT OUR SUGGESTIONS AND RECOMMENDATIONS CANNOT BE GUARANTEED BECAUSE THE CONDITIONS OF USE ARE BEYOND OUR CONTROL. THE USER OF SUCH INFORMATION ASSUMES ALL RISK CONNECTED WITH THE USE THEREOF. PHILLIPS PETROLEUM COMPANY AND ITS SUBSIDIARIES ASSUME NO RESPONSIBILITY FOR THE USE OF INFORMATION PRESENTED HEREIN AND HEREBY EXPRESSLY DISCLAIMS ALL LIABILITY IN REGARD TO SUCH USE.

Photographs shown are typical Driscopipe installations.

## Shipping

Driscopipe is easy to ship, handle and store, due to its lightweight yet rugged characteristics. The normal method of shipment is by truck. Standard packaging for Driscopipe is shown in Chart 1. When hauling Driscopipe, care should be taken that it is not damaged nor surface cut by sharp projections from other equipment or from the truckbed itself.

Chart 1.

### STANDARD PACKAGING FOR DRISCOPIPE INDUSTRIAL PIPE

PIPE DESCRIPTION		BUNDLE		TRUCK LOAD BUNDLED		40 FT. FLOAT TRUCKLOAD - LOOSE	
NOMINAL SIZE	OD. (INCHES)	NUMBER OF JOINTS	LINEAR FEET	NUMBER OF BUNDLES	LINEAR FEET	NUMBER OF JOINTS	LINEAR FEET
2"	2.375	88	3,344	14	46,816		
3"	3.500	48	1,824	14	25,536		
4"	4.500	27	1,026	14	14,364		
5"	5.563	15	570	14	7,980		
6"	6.625	11	418	14	5,852		
7"	7.125	11	418	12	5,852		
8"	8.625	8	304	12	3,648		
10"	10.750					80	3,040
12"	12.750					59	2,242
14"	14.000					48	1,824
16"	16.000					35	1,330
18"	18.000					28	1,026
20"	20.000					20	760
22"	21.500					18	608
24"	24.000					16	608
28"	27.953					10	380
32"	31.496					9	342
36"	36.000					6	228
42"	42.000					4	152
48"	47.244					4	152

NOTE: OBTAIN TRUCK LOAD WEIGHT BY MULTIPLYING LINEAR FEET TIMES PIPE WEIGHT PER FOOT.

## Handling

Driscopipe can be easily handled with fork lifts or cherrypickers. The joints should be handled *near the middle with wide web slings and spreader bars*. Rope slings also work well with straight lengths. Coils can be handled in a similar manner. The use of chains, end hooks or cable slings that may scar the pipe are not recommended. The following procedures should be observed when handling Driscopipe:

- Always stack the heaviest series of pipe at the bottom.
- Protect the pipe from sharp edges when overhanging the bed of a truck or trailer by placing a smooth rounded protecting strip on the edge of the bed.

- Driscopipe has a very smooth inner and outer surface. The load should be anchored securely to prevent slippage.

Lengths of small-diameter, lightweight pipe can be unloaded manually.

Driscopipe applications are normally handled by:

- Unloading the pipe from the truck in a row along the side of the installation area and moving the fusion unit along the row of joints.
- Stacking the pipe beside the fusion unit and trailing the pipe out after fusion, then dragging the long length of pipe into place for installation. It is suggested that as the pipe is fused and moved through the fusion machine, additional joints of pipe should be placed in the moveable jaw side of the machine for each subsequent fusion. This prevents the hydraulic system of the machine from having to pull the previously fused long length.

Dragging the pipe into place can be an economical method of installation, provided the pipe isn't damaged from sharp rocks or excessive abrasion created by pulling the pipe great distances.

## Storage

If the pipe must be stacked for storage, avoid excessive stacking heights. Out-of-roundness can be created in the lower rows of pipe, due to excessive stacking heights. The limitation on storage height is based on the weight on the bottom layer of pipe and will vary depending on the storage facilities, size and wall thickness of the pipe, and the temperature. General recommendations for stacking heights developed by the Plastic Pipe Institute for polyolefin pipe are shown below:

Chart 2.

**ALLOWABLE STACKING HEIGHTS FOR STORAGE OF POLYOLEFIN PIPE**

Nominal Pipe Size (in.)	Number of Rows High		
	for SDR's* 18 and under	for SDR's* over 18, up to 26	for SDR's* over 26, up to 32.5
4	45	26	14
6	31	17	10
8	24	13	8
10	17	10	6
12	13	8	5
14	12	7	4
16	11	6	4
18	10	6	4
20	9	6	3
22	8	5	3
24	7	4	3
28	6	4	3
32	—	3	2
36	—	3	2
40	—	—	2
48	—	—	2

\*NOTE: SDR = Standard Dimension Ratio =  $\frac{\text{Pipe Diameter}}{\text{Min. Wall Thickness}}$



Care should be taken that the pipe is stacked in straight rows. It is satisfactory to store black Driscopipe either inside or outside in direct sunlight as it will not be damaged in any way by long exposure to direct sunlight. However, the expansion and contraction caused by uneven heating by the sunlight may cause the pipe to bow if not restrained by racks. This does not damage the pipe but does reduce convenience of handling the pipe when taken out of storage for installation.

When the pipe is laid directly on the ground, care should be taken to place the pipe on an area free of loose stones or sharp objects. This will avoid scarring or gouging the pipe.

## **J**oining Procedure

The butt fusion method is a highly efficient, economical method for joining Driscopipe. The butt fusion method of joining high density polyethylene pipe began shortly after the first commercial production of high density polyethylene in the mid-1950's by Phillips Petroleum Company.

The modern day butt fusion joint is the same as the joint that was made on the first crude butt fusion equipment in 1956 . . . only the fusion equipment has evolved to gain efficiency, reliability, and convenience. The many principles learned on that early equipment for making a successful joint are still in use today. Phillips Petroleum Company designed, developed and built many new models of butt fusion equipment from 1956 until the early 1970's. Since that time, Driscopipe personnel have guided this development by others. The extensive line of fusion equipment offered by McElroy Manufacturing, Inc., Tulsa, Oklahoma is one of the results of this long history of development. Phillips pioneered the idea and development of the butt fusion joining system . . . and has used it exclusively in every high density polyethylene piping system sold by Phillips since 1956 . . . there are millions of these joints in service today.

The butt fusion method is an uncomplicated, visual procedure with straight-forward instructions. No "timing cycles" are necessary. The visual procedure allows the operator to concentrate on his work, rather than a clock . . . visually he knows when the butt ends have melted to the degree required to fuse them together. Visually he observes and controls fusion pressure by observing the amount and configuration of the fusion bead as it is formed.

The principle of heat fusion is to heat two surfaces to a fusion temperature, then make contact between the two surfaces and allow the two surfaces to fuse together by application of pressure. The pressure causes flow of the melted materials which effects mixing and thus fusion. On cooling, the original interfaces are gone and the two parts are united. Nothing is added to, or changed chemically, between the two pieces being joined. The picture on page 4 shows a cross section of butt fused Driscopipe.

Molten high density high molecular weight Driscopipe 8600 is very viscous and tough. During butt fusion of this material, the operator can apply relatively high pressure to form the butt fusion joint . . . with no danger of forcing the molten material from between the two ends of the joint. Lower fusion pressures are necessary with the softer, less viscous, high and medium density materials. When high pressure is applied to the higher melt flow material most of the molten material can be forced from the fusion joint. This produces a "cold joint" or poor fusion. Pressure control can be difficult, unless the fusion equipment is designed to compensate for the melt strength of the pipe being fused. The equipment discussed in this section can be regulated for the different melt strength materials. Compatibility fusion techniques should be used when polyethylenes of different melt indexes are fused together.

Butt fusion joints may easily be cut out and re-done. This fact has a bearing on the quantity and quality of training necessary and favorably affects operator attitude toward quality in the field. These joints can be easily cut out and destructively tested in the field to check joining proficiency and equipment condition . . . and at very little cost, since there is no coupling to destroy and throw away.

In the course of butt fusion joining, the fusion operator is faced with a wide variety of job conditions. Changes in air temperature, material temperature, wind velocity, sun exposure, humidity, as well as condition of the terrain and the equipment . . . all influence the joining requirements. Estimating pre-heat timing cycles under different conditions, can become extremely confusing. Quality work under field conditions is more consistent with a straight-forward visual procedure offered by Driscopipe. Thus, the operator can consistently produce high quality joints.

Butt fusion has successfully been accomplished in the rain with a canopy covering the fusion machine and operator, as well as in below freezing conditions.

Fusion equipment is available for piping systems that range from 1/2 inch diameter tubing to 48-inch diameter pipe. Although the size range is great, the procedure and principle remain the same. You just heat Driscopipe, pressure it together, let it cool and forget it.

### **Butt Fusion**

Butt fusion for Driscopipe Systems was pioneered and developed by Phillips Petroleum Company. Butt fusion techniques are recognized in the industry as cost effective joining systems of very high integrity and reliability. They do not require couplings, and joints are stronger than the pipe itself – in both tension and pressure conditions. There are seven joining steps – simple, visual procedures with straight-forward, uncomplicated instructions.





1. Clean pipe ends inside and outside with a clean rag to remove dirt, water, grease and other foreign materials.



2. Square (face) the pipe ends using facing tool of the fusion machine.



3. Check line-up of pipe-ends in fusion machine to see that pipe ends meet squarely and completely over the entire surface to be fused. This is commonly referred to as "adjusting high-low." It is advisable at this point to make sure the clamps are tight so that the pipe does not slip during the fusion process.

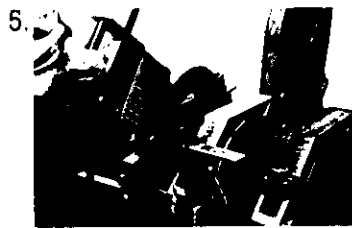
DRISCOPIPE	THERMOMETER READINGS		SURFACE TEMPERATURE	
	COATED PLATES	UNCOATED PLATES	COATED PLATES	UNCOATED PLATES
8600	500°F-525°F	475°F-500°F	475°F-500°F	475°F-500°F
1000	400°F-425°F	375°F-400°F	375°F-400°F	375°F-400°F

Note: It is most important to maintain the proper temperature of the heater plate. Check it with a tempilstik or pyrometer for correct surface temperature.



4. Insert *clean* heater plate between aligned ends, and bring ends firmly in contact with plate, but **DO NOT APPLY PRESSURE** while achieving melt pattern. Allow pipe ends to heat and soften. Approximate softening depths are as follows:

SIZE	APPROXIMATE MELT BEAD
2" and below	1/16"
3"-5"	1/8"
6" and larger	3/16"



5. Carefully move the pipe ends away from the heater plate and remove the plate. (If the softened material sticks to the heater plate, discontinue the joint. Clean heater plate, resquare pipe ends and start over.)

Note: One pipe end usually moves away from the heater plate first. It is good practice to "bump" the plate away from the other side and then lift it out. Never drag or slide it over the melted pipe end.



6. Bring melted ends together rapidly. **DO NOT SLAM.** Apply enough pressure to form a double roll-back to the body of the pipe bead around the entire circumference of the pipe about 1/8" to 3/16" wide. Pressure is necessary to cause the heated material to flow together.



7. Allow the joint to cool and solidify properly. This occurs when the bead feels hard and your finger can remain comfortably on the bead. Remove the pipe from the clamps and inspect the joint appearance.

## Sidewall Fusion

Side fusion procedure for Driscopipe can be accomplished in the field using 2" through 8" McElroy fusion units and proper heater plate adapters. Where branch outlets are larger than 8" outside diameter, sidewall fusions must be accomplished in a fitting fabrication shop. Size, availability and pricing can be obtained through Phillips Driscopipe representatives.

The following nine steps should be observed during the sidewall fusion procedure:

1. Install fusion machine on the pipe (main).
2. Clean the pipe with a rag. Prepare surface of pipe (main) by roughing with 60 grit or coarser utility cloth.
3. Prepare the base of the branch by roughing with 60 grit or coarser utility cloth.
4. Align branch on the main and tighten clamp.
5. Check branch saddle for square alignment on main.
6. Retract moveable clamp, roll in and center heater plate with adapter between base of branch and main.
7. For all sizes, apply a strong firm continuous pressure until complete melt bead can be seen on main. Release pressure to light pressure. Continue heat soak cycle on branch and main. Watch base of branch for:

MAIN SIZES	HEAT SOAK CYCLE FITTING BASE BEAD
1 1/4"	1/16" Melt Bead
2"	1/8" Melt Bead
3" and larger	1/8"-3/16" Melt Bead

8. Retract moveable clamp and cleanly remove heater plate.
9. Bring melted surfaces together rapidly. **DO NOT SLAM.** Apply continuous progressive pressure until proper fusion bead is formed. Maintain pressure until joint has cooled. (Until finger can remain comfortably on bead.)

## Compatibility Fusion

Driscopipe 8600 and Driscopipe 1000 materials can be compatibly fused together and still maintain fusion joint integrity. Although the two materials have different melt characteristics, they can be properly fused using the procedure outlined below. Phillips Driscopipe sales and technical personnel are available to instruct and demonstrate the fusion procedure for joining Driscopipe.

Compatibility butt fusion and sidewall fusion should be accomplished in the same manner as described before with the following exceptions:

- To achieve proper melt pattern insert the heater plate and place a compatibility insulator between the heater plate and



the Driscopipe 1000 material. After the Driscopipe 8600 achieves proper melt, then remove the insulator and bring the heater plate in contact with the Driscopipe 1000 material for proper melt. Continue heating both surfaces until proper melt develops. For manually operated fusion equipment, form a double roll-back bead as previously described in the fusion procedures.

- The fusion pressures for compatibility fusion of Driscopipe 1000 and 8600 on hydraulically operated equipment should be set at approximately 50% of the 8600 fusion pressures, or 75 psi. The fusion pressure will depend on the fusion conditions involved to achieve the proper roll-back bead.
- The fusion temperature for compatibility fusion should be the one that is normally used to fuse Driscopipe 8600, 475°F-500°F surface temperature.

Note: The fabricated fittings furnished by Phillips Driscopipe are made (with few exceptions) from Driscopipe 8600 pipe material. Through the use of compatibility fusion these fittings can be fused into Driscopipe 1000 pipe installations. This same fusion method must be used with Driscopipe 8600 molded stub ends and Driscopipe 1000 pipe.

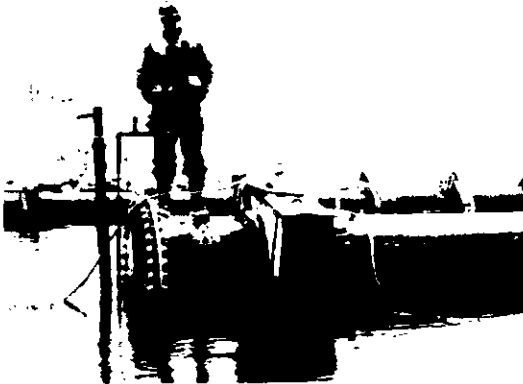
## **Stub End Fusion**

There are several manufacturers of butt fusion equipment. The operating procedure for the machine should be furnished by the equipment supplier.

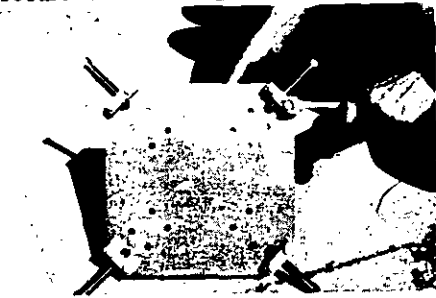
There are two procedures for butt fusing Driscopipe 8600 Stub Ends using McElroy fusion equipment. The type of procedure is governed by the McElroy fusion unit and whether a Stub End Holder attachment or a Clamping Insert attachment is used. Both procedures are outlined as follows.

### **Stub End Fusion with Holder**

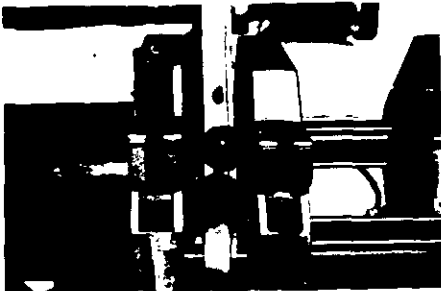
There is a specific stub end holder with four moveable blocks and clamping screws to accommodate the full range of pipe sizes for each fusion unit. The stub end holder can be used in the moveable clamp or the fixed clamp. (Note: The entire fusion procedure can be simplified in most cases if the holder is clamped in the fixed jaw.)



1. Position the four moveable blocks on face of holder so that clamping screws will secure stub end flange O.D.

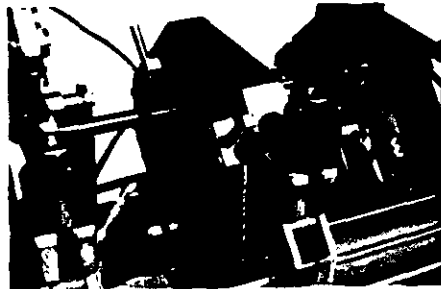


2. Determine whether the stub end will be clamped in the moveable or fixed jaws. Clamp pipe in the appropriate set of jaws and face off until jaws and facer stops bottom out.

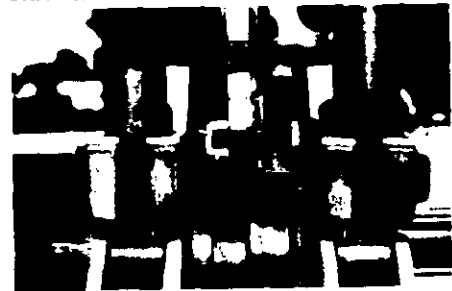


3. Remove facer.

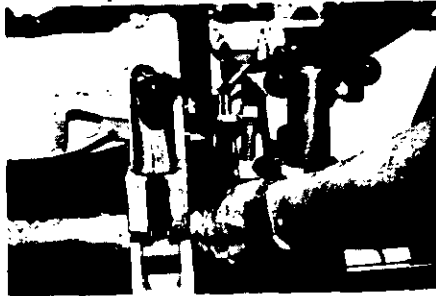
4. Clamp stub end holder in opposite set of jaws.



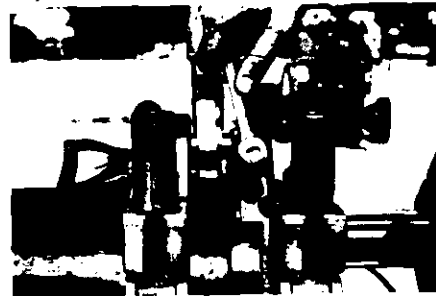
5. Place stub end in holder (loosely) and bring pipe end to within 1/16" to 1/8" of stub end.



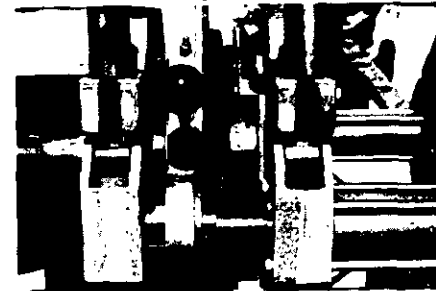
6. Hold stub end in alignment with pipe and bring pipe into contact with stub end to hold in place.



7. Adjust clamping screws to hold stub end in aligned position and make minor adjustments as necessary.



8. Bring facer into position and face stub end until two or three revolutions of material have been faced off. Bring the directional control valve to neutral and turn facer off. It is not possible to face stub end until facer stops bottom out.



9. Double check and adjust alignment if necessary.

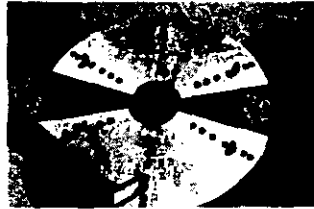
10. Complete the operation by using standard butt fusion procedures.

## Stub End Fusion with Clamping Insert

Each size machine has a specific set of clamping inserts that can be installed in the fixed jaw or the moveable jaw. The pins must be screwed into the correct holes to adjust for each size stub end. These holes are stamped for each pipe size. The aluminum clamping inserts are made in two pieces and are installed in the machine as are pipe size inserts. The high/low adjustment is made in the same manner as used for straight pipe.

Note: because the clamping inserts are an evolutionary development, certain machines must be slightly modified. A kit for such modification has been furnished with the new clamping inserts and must be installed on the machine. Please refer to instructions that were shipped with the clamping inserts.

1. Screw the pins tightly into the series of holes marked for pipe size to be fused

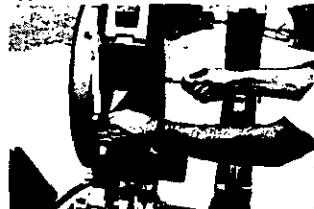


2. Determine whether the stub end will be clamped in the moveable or fixed jaws. Clamp pipe in the appropriate set of jaws and face off until jaws and facer stops bottom out.



3. Remove facer.

4. Install clamping inserts into the opposite set of jaws



5. Place stub end into inserts, insuring that fitting is seated squarely against the face of the inserts



6. Clamp fitting snugly and bring pipe end to fitting for checking alignment. It may be necessary to rotate the fitting to obtain a better high/low fit. Align pipe to fitting by tightening the appropriate clamps



7. Bring facer into position and face stub end until two or three revolutions of material have been faced off. Bring the directional control valve to neutral and turn facer off. It is not possible to face stub end until facer stops bottom out.



8. Double check and adjust alignment if necessary.



9. Complete the operation by using standard butt fusion procedures

\*When facing the stub end in the moveable clamp with the 18-Inch Fusion Unit, the pivot shaft spacer must be moved to the left side of the facer.

a. Loosen and remove facer locking hook



b. Lift up facer and slide spacer to left side of facer



c. Lower facer and secure locking hook. (Note. Spacer must be returned to right side position for normal facing operations)

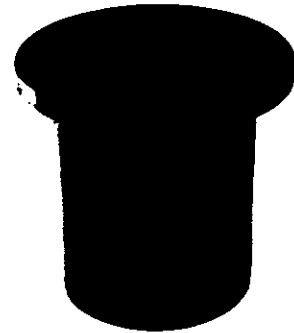


## Mechanical Joining

Mechanical joining to other piping materials – fittings, valves, tanks, pumps, etc. – may be accomplished with Driscopipe flange adapters or stub ends and metal back-up flanges. Flanges are also used to connect lengths of Driscopipe together when butt fusion is impractical.

Flange Adapters and Stub Ends are pressure rated the same as the pipe. Flange adapters can be butt fused to the pipe as outlined in the butt fusion section. Stub Ends may be butt fused to pipe, utilizing either stub end holders or clamping inserts depending on the type fusion unit used. Detailed butt fusion instructions were outlined earlier.

Figure 1 illustrates the flanged method for joining polyethylene pipe to itself or to steel pipe. Although steel is commonly used for the slip-on flanges, other materials are available from your local supplier. Gaskets may be used between the polyethylene flange adapters or stub ends, but it is not generally necessary. Sufficient torque should be applied evenly to the bolts to prevent leaks. After initial installation and tightening of flanged connections, it is a good practice to allow the connections to set for a period of time (usually a few hours). Then conduct a final tightening of the bolts. Please note the fabricated flange adapter and the molded stub end shown at right. Both types function equally well. The fabricated flange adapter is heat and pressure formed from Driscopipe 8600 pipe. It is longer than the stub end. The stub end is post machined from a molded part, thus providing smooth bore diameter flow characteristics. Both parts can be butt fused to Driscopipe 1000 or 8600 pipe. When calculating bolt length, please remember the flange face thickness of the fabricated flange adapter and the molded stub end are different. Consult the Driscopipe 8600 Fittings brochure for dimensions.

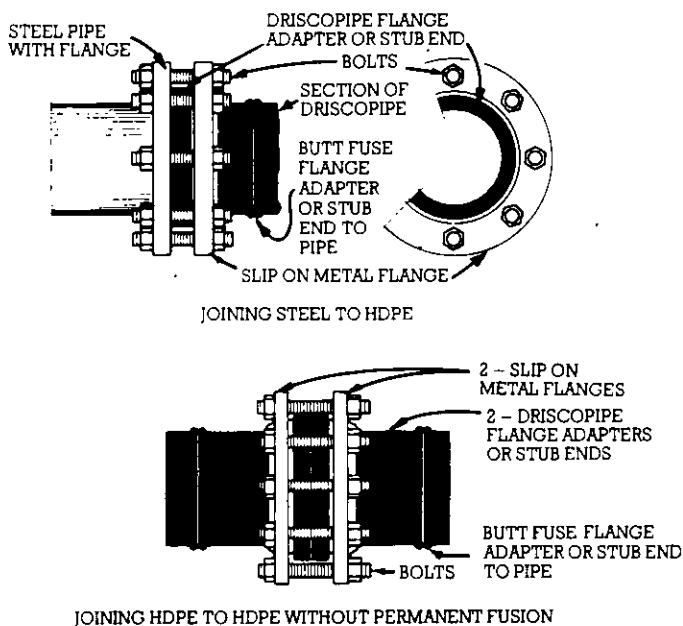


**FLANGE ADAPTER**



**MOLDED STUB END**

Figure 1.





## Other Joining Methods

Hot gas fusion welding has been used with some success with Driscopipe 1000 material for special fabrications, non-pressure applications, and for very low pressure repairs. It is not recommended for general use in joining Driscopipe 1000 nor for any use with Driscopipe 8600.

Threading is not recommended for polyethylene materials. Solvent or epoxy cementing are unsatisfactory methods of joining Driscopipe. There is no known solvent cement available for proper joining of HDPE.

Mechanical joining with bolt on wrap-around clamps is generally not recommended as a permanent long-term method of joining polyethylene unless the connection is stabilized in some manner. Due to the magnitude of thermal expansion and contraction of polyethylene materials and its creep characteristics under load, it can be difficult to maintain a permanent leak-proof seal with certain mechanical wrap-around clamps.

However, in certain low pressure, or non-pressure, non-critical applications they have been used when it is not feasible to flange or fuse the sections together. Compression type couplings with internal stiffeners are available in some sizes and are generally satisfactory where temperature changes within the system are small. Heat shrinkable polyethylene sleeves may be used for non-pressure applications to achieve effective seals but are also subject to tension pull-out with thermal contraction of the pipe.

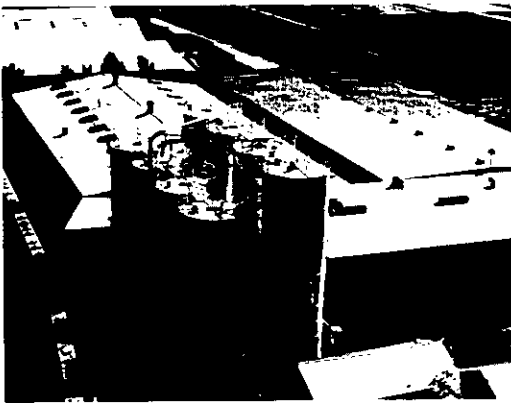
Consideration must be given to pull-out forces caused by circumferential as well as longitudinal thermal contraction when certain mechanical joints are used. If necessary, provisions must be made for sealing as well as restraining to compensate for the axial loading due to expansion or contraction and/or pipe settlement.

## Bending Driscopipe

Driscopipe may be cold-bent to a minimum radius of 20-40 times the pipe diameter as it is installed, thus eliminating the need for elbows for slight bends. The minimum bending radius that can be applied to the pipe without kinking it varies with the diameter and wall thickness ratio of the pipe. If adequate space is not available for the required radius, a fitting of the desired angle may be fused into the piping system to obtain the necessary change in direction.

## Installation Below Ground

This section sets out the general installation considerations and recommendations for below ground pipe. Although the



requirements for installing plastic pipe are similar to that for rigid piping, there are some important differences. These differences arise due to the difference in basic physical properties, differences in joining techniques, differences in the effect of environmental conditions during installation, and differences in experience of installation. Recognition of these differences in piping design and installation procedures is essential to obtain the desired objective of a piping system that will provide long-term service.

Information contained in this section along with the recommendations of the Plastics Pipe Institute (PPI), American Society for Testing and Materials (ASTM), and other Standards organizations provide pertinent facts relating to the installation of Driscopipe. We want to provide the engineer, purchaser, and contractor with essential information about the properties, advantages and cost saving benefits of polyethylene pipe.

### **Trenching and Bed Preparation**

Since Driscopipe can be butt fused above ground in long lengths, narrow trench widths can be used to save on installation costs. Due to the ease of handling Driscopipe, it may be readily placed in the trench, thus necessitating a minimum amount of open trench. The length of open trench required should be such that bending and lowering of the pipe into the ditch does not exceed the minimum recommended bend radius, and result in kinking.

The trench width will vary depending on its depth and type of soil. The bed width should be great enough to allow for adequate compaction around the pipe. Generally, a bed width one foot wider than the nominal pipe diameter is adequate. However, to reduce trenching costs, narrow trench and/or bed widths are possible for small diameter pipe. Normally the excavated material, if it is rock free and well broken up by the ditcher, will provide a suitable bedding material.

The trench bottom should be relatively smooth and free of rock. When rocks, boulders, or large stones are encountered which may cause point loading on the pipe, they should be removed and the trench bottom padded using 4-6 inches of tamped bedding material below and on all sides of the pipe and fittings. The bedding should consist of a free flowing material such as gravel, sand, silty sand, or clayey sand that is free of stones or hard particles larger than  $\frac{1}{4}$  inch. For most pressurized systems, accurate levelling of trench bottoms is not necessary unless specified. For gravity flow systems the slope should be graded evenly as is done for other piping materials.

If an unstable soil condition exists, such as mucky or sandy soils with poor bearing strength, the trench bottom should be undercut and filled to proper trench depth with a selected material of gravel or small crushed stone.

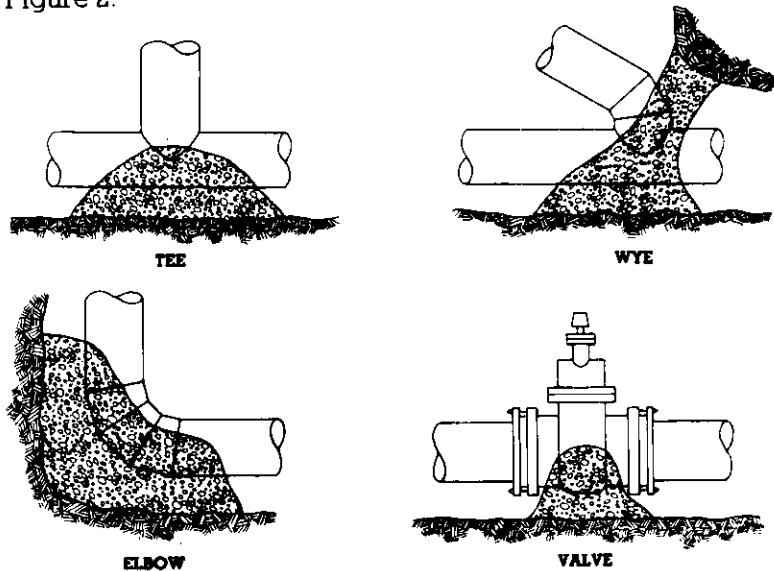


Consider all precautions necessary to prevent trench cave-ins. No part of the country is immune to cave-ins. Trench failure is influenced by the presence of construction equipment near the edge of an excavation or adverse climatic conditions. OSHA and other regulatory agencies specify the maximum vertical height of unbraced trench which is permitted (usually 4 to 5 ft.) and the suggested angle of repose for the soil type involved.

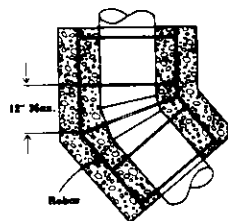
To protect the pipe from traffic loading and/or frost penetration, consideration should be given to establishing minimum earth cover requirements. Refer to the Driscopipe "Systems Design" brochure for load bearing capabilities.

Generally, slight changes in direction of the pipe can be accommodated by field sweeping of the pipe in the ditch. If proper compaction is obtained, field sweeps do not require thrust blocks. Good soil compaction around fittings such as elbows or tees is usually sufficient. If thrust blocks are required, concrete encasement or concrete bearing surfaces set in undisturbed soil will provide adequate protection. The encasement or thrust block should be constructed of reinforced concrete and act as an anchor between pipe or fitting and the solid trench wall. Figure 2 illustrates various types of concrete blocking and encasement of fittings.

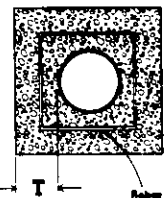
Figure 2.



### Thrust Blocks and Bearing Surfaces



Pipe Pressure psi	Concrete* Thick (T)	Reber Thick.
50 to 110	9"	3/8"
over 110	12"	1/2"



\*concrete strength to  
be 3000 psi

### Fitting Encasement

## Pipe Laying

Driscopipe can be joined at ground level and lowered into the ditch. Care should be taken not to drop the pipe. Avoid excess stress or strain conditions during installation. Flanged connections should be used as necessary to facilitate handling pipe and fittings in and out of the fusion machine and installation in the ditch. This is particularly important at fabricated fitting junctures.

The length of Driscopipe which can be pulled into position alongside the trench depends on the pipe size and field conditions. Generally, the maximum pulling length for smaller sizes is approximately 1,000 feet; for larger pipe about 500 feet.

The maximum pulling force that can be applied to a pipe on level ground can be estimated using the following formula:

$$F = SA$$

Where: F = maximum pulling force (lbs)  
S = maximum allowable stress (1000-1500 psi)  
A = cross-sectional area of pipe wall (square inches)

Cross-sectional area of pipe wall is:

$$A = \pi(D - t)t$$

Where: D = outside diameter (inches)  
t = minimum wall thickness (inches)

When pulling pipe, either a pulling head or a suitable wraparound sleeve with rubber protective cover should be used to prevent the pulling cables from damaging the pipe. Never pull the pipe by the flanged end.

## Thermal Expansion and Contraction

It is important that the expansion and contraction characteristics of Driscopipe be considered in the design and installation of most systems. Driscopipe expands and contracts at a rate higher than that for rigid metal piping. The rate and resulting amount of stress is discussed in detail in the Driscopipe "Systems Design" brochure. Although the coefficient of thermal expansion and contraction for polyethylene is approximately 10 times greater than for steel or concrete, this material has the advantage of viscoelastic properties which make it quite adaptable to relaxing or adjusting with time to stresses imposed by thermal changes.



Direct buried Driscopipe applications will generally have ample soil friction and interference to restrain movement of the pipe caused by the normal application temperature changes. Stresses induced by temperature change and resisted by soil containment do not damage the pipe. It is a good idea to make final tie-ins on a system at a temperature that is as close to operating temperature as possible. This is particularly true for insert renewal liner systems where there is no soil restraint.

For summer time installations with two fixed connection points, a slightly longer length of Driscopipe may be required to compensate for contraction of the pipe in the cooler trench bottom. The snaking in the trench which naturally occurs with pipe diameters 4" and below is normally sufficient to compensate for any anticipated thermal contraction. This snaking is desirable but not absolutely necessary. Pipe above 4" generally has sufficient soil friction to resist movement. During a winter installation the exact length of pipe should be used. Pipe which is too short or not aligned must not be drawn up by the bolts of a flanged connection because of overstressing the stub end, flange adapter, and ultimately the valve, tank, etc. to which it is connected.

When the backfill is soft or becomes fluid as in marshes or river bottoms the pipe may not be restrained by the backfill from movement caused by thermal expansion and contraction. Also, the stress induced in the pipe is transmitted to the end terminations. This can damage weak connections. If this possibility exists, adequate anchors should be installed just ahead of the termination to isolate and protect these connections.

The calculated force induced by thermal change is the product of the stress in the pipe wall and the cross sectional area of the pipe wall. The length of pipe required to anchor the pipeline against this calculated force depends on the circumference of the pipe, the average contact pressure between the soil and the pipe and the coefficient of friction between the soil backfill and the pipe.

The stress and the corresponding force developed by temperature change in a restrained pipeline are independent of the length and the burial conditions of the pipe. If pipe movement at the end sections cannot be tolerated, the pipe must be anchored mechanically to resist the thermal forces. Concrete blocks or other special anchors designed to fit the situation are usually used to transfer the thermal force into the soil adjacent to the pipe lay trench. Adequate frictional resistance must also be provided to transfer the force from the pipe into the concrete block.

If the pipe is not anchored at the ends to resist movement, the end sections will expand or contract as the temperature changes. This change in length will extend into the burial trench to a point at which the frictional resistance of the backfill is equal to the thermal force. These movements must be considered in the design of such physical features as connections to pumps, catch basins, sewer manholes, etc.



Once a line is installed and in service the temperature variation is usually small, occurring over an extended period of time, and is not likely to induce any significant stress into the pipe.

### Fitting Installation

Driscopipe polyethylene flanged connections with metal back up flanges should be used to connect Driscopipe to metal fittings, valves, pumps or other piping materials. Where pipe or fittings are connected to rigid structures, movement or bending at that point should be prevented. Either well compacted fill should provide full support or a support pad should be constructed beneath the pipe and fitting. This pad, usually of reinforced concrete, should be fixed to a rigid structure and extend one pipe diameter or a minimum of 12" from the flanged joint. See figure 3 for suggested methods.

It is recommended that the bolts in the flanged connection as well as the clamps in a support pad undergo one final retightening. This should be done after initial installation just before final backfill if it is a buried application. Surface connections can be observed while in operation. Particular attention should be given to the compaction achieved around the fittings, and extending several pipe diameters beyond the ends of the fitting. Compaction of 90% Proctor density or greater in these areas is recommended.

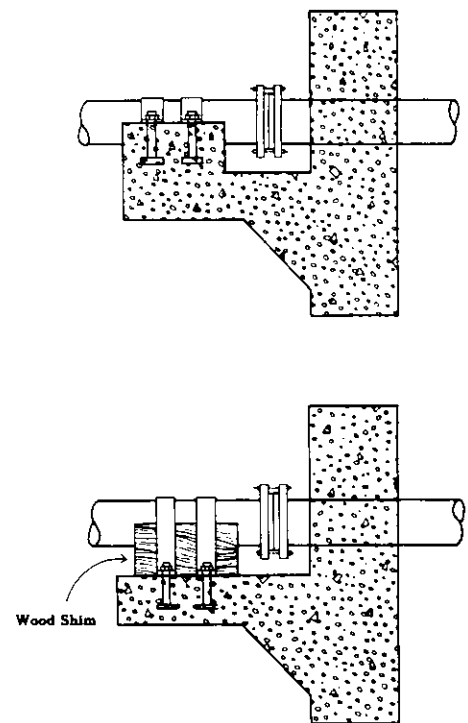
Polyethylene pipe or fittings may be totally enclosed in concrete if required in the design. Reinforced concrete encasement can be used to raise pressure rating of fittings, stabilize heavy valves or fittings, and control thermal expansion or contraction.

### Grouting

Pipe running through a manhole wall can be anchored by attaching a collar or side fused branch saddles to the pipe and encasing them in the wall of the manhole. Expandable rubber seals and grouting have proven successful in sealing an annulus between a casing pipe and polyethylene pipe when it enters a manhole.

Grouting the annulus between the inner Driscopipe and an outer pipe is often done for several reasons. Continuous grouting, with *NO VOIDS*, can provide structural strength to the liner pipe both in the form of external hydrostatic collapse pressure and internal pressure capability. However, please realize that not a single void in the grouted annulus is allowed, or the higher pressure capability of the piping system is lost. In actual grouting procedures, it is extremely difficult to achieve a void free annulus.

Figure 3.



Localized grouting can also be used at connections to manholes, and to stabilize movement of the liner pipe where break outs for laterals exist. Caution must be exercised during the grouting process to not exceed the collapse pressure of the polyethylene pipe.

Careful consideration should be given to these two key points, especially in slip lining installations: (a) anchoring the polyethylene pipe within the casing pipe to eliminate expansion and contraction if this constitutes a problem and (b) sealing the annulus to prevent infiltration and/or contamination.

### **Backfilling and Tamping**

The purpose of backfilling the trench is to provide firm, continuous support around the pipe. Achieving this proper soil backfill around the pipe is probably the most important aspect of a successful buried application.

As stated in the bedding section, the material excavated from the trench can usually be used as the initial backfill if it is smooth, free of rocks, crumbles and breaks up easily. Economics usually dictate maximum reuse of the excavated material. Where trenches are located within roadways and are subject to vehicular traffic, cohesionless granular soils are generally specified. The best initial backfill material is sand. When loading conditions are severe, such as road crossings, sand should be used where the pipe is laid in low quality soils such as heavy gumbo or muck. Coarse sand will usually reach the required density during placement without compaction. Initial backfill should be placed in two phases. The first is up to or slightly above the spring line of the pipe. Then compact or flush with water to assure that the lower part of the pipe (haunches) is supported.

Compaction of the soil around the pipe is accomplished by applying an external force to the individual layers of backfill as they are placed in the trench. Compacting brings the soil particles closer together and thus increases their density and shear strength. Compaction depends upon soil properties, moisture content, layer thickness, compactive effort and other factors. Compaction is usually applied by a mechanical tamper, vibrating plate or water flushing.

Care should be used while flushing to prevent the pipe from floating out of position in the trench. To keep the pipeline from floating or shifting, it can be internally filled with water prior to flushing until initial backfilling procedures are complete. This also assures that the horizontal diameter does not shorten excessively during compaction to the springline. The water flushing method of achieving compaction should only be used with "free draining" granular materials and a positive drainage outlet provided.

In the second phase of initial backfill additional fill in 8"-10" layers should be added and well compacted until about 6"-12"

above the top of the pipe. Larger diameter pipe requires the higher initial backfill. At this point the on-site material excavated from the trench can be used for final backfill to ground level. In a heavy traffic area, this excavated backfill of granular material should be compacted to a minimum of 90% to 95% density.

Standard tests are available to determine the density of the compacted soil such as Standard Proctor Laboratory Test Procedure, ASTM D 698. Compaction is measured in terms of the dry density achieved in the field compared to the laboratory dry density determined on a sample of the same soil type when compacted under a given effort.

The optimum moisture content (usually about 20%) at which maximum density is obtained can be estimated in the field by squeezing it in your hand. If it just holds together, it is near optimum moisture. Similarly a corner heel impression while walking probably indicates a soil density of 90%. A full heel print may indicate a density of 80%. And a full footprint may indicate a density of 70%.

Tests conducted on Driscopipe at Utah State University by Dr. Reynold K. Watkins show that Driscopipe will not buckle under ordinary conditions if the backfill is compacted and if it is in full contact with the pipe. A virtual failsafe installation can be assured if soil density is generally over 85% of Standard Proctor (AASHTO T-99) density. Additional information on Underground Installation is given in ASTM D 2321, Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe, ASTM D 2774, Underground Installation of Thermoplastic Pressure Piping, Plastic Pipe Institute Technical Report TR-31/9-79, and the Driscopipe "Systems Design" brochure.

In order to locate the underground polyethylene pipe in the future, a copper or galvanized tracer wire should be laid next to the pipe during installation to later permit use of locating devices. The metal wire should not touch the pipe in case of lightning.

## **Inspection and Testing**

After installation or a portion thereof is complete, the pipeline should be pressure tested in accordance with recommended practice. Refer to the "Testing Polyethylene Pipelines" section of this brochure for detailed testing recommendations.

## **I** nstallation Above Ground

Generally Driscopipe is installed below ground. However, there are many situations in which above ground piping has advantages. Some advantages are:

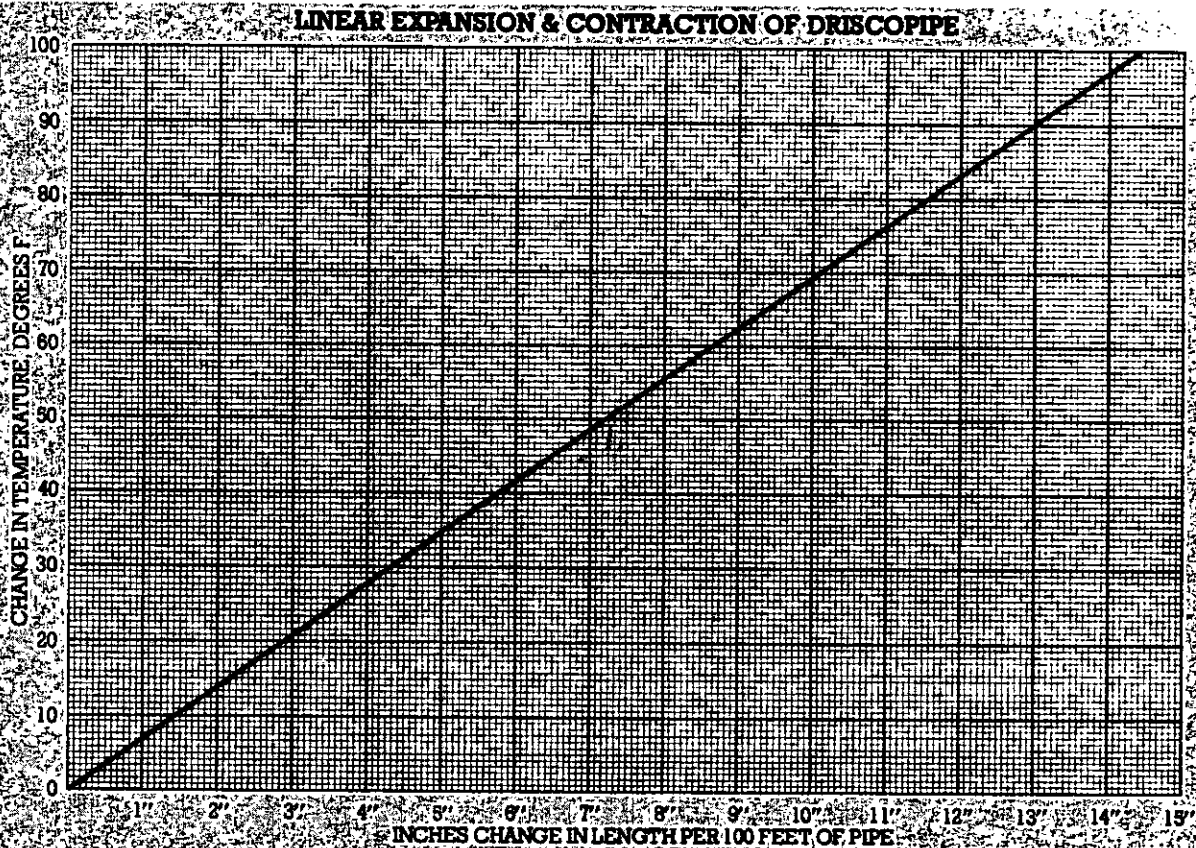


- Slurry or mine tailing lines which are often relocated and can be rotated to distribute wear in the pipe.
- Environmental conditions: The toughness and flexibility of Driscopipe often allows installation through marshes and bogs as well as over frozen areas.
- Installations over solid rock or across water are sometimes the most economical methods of installation.
- Its lightweight and ease of assembly results in immediate availability of a temporary above ground pipe line.

### Thermal Expansion and Contraction

Temperature changes both externally and internally should be considered in the design of an above ground Driscopipe application. Temperature changes cause all types of pipe to expand and contract. Chart 3 illustrates the amount of expansion and contraction to anticipate for Driscopipe during design and construction stages. These values are based on an empty pipe which is free to move. Generally, pipe laid over relatively smooth terrain and allowed to move freely in every direction will perform adequately. However, if large changes in temperature take place in short periods of time, movement of the pipe can concentrate in one area, and kinking can occur. By using proper anchors or restraints, the possibility of this occurrence can be minimized.

Chart 3.



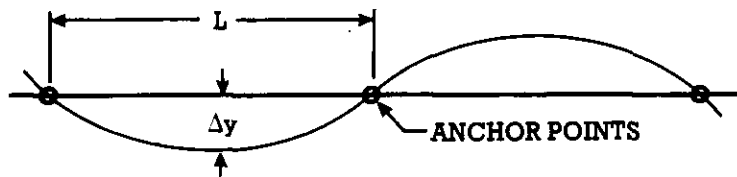
NOTE: EXPANSION OR CONTRACTION IS NOT A FUNCTION OF DIAMETER OR WALL THICKNESS

Normally if fluid flow is continuous, expansion and contraction of the line will be minimal after operating conditions are established.

Driscopipe contains 2½% carbon black which protects it from the ultra-violet rays of the sun. Although the sun will not damage Driscopipe, the heat absorbed from the sun will greatly increase the amount of expansion and contraction that will take place. The sun alone can raise the surface temperature of an empty pipe 40-50° F. Protection from the sun is generally accomplished by covering with a foot of fill dirt on buried installations. For above ground installations, there is generally no economical means to protect large diameter pipe from the sun. The effect of daily and seasonal temperature changes should be anticipated for installation and operation conditions.

One very good method of limiting expansion and contraction is to properly anchor the pipe at given intervals along its length. When expansion occurs it will, depending on the spacing, deflect laterally. Adequate space must be available to accommodate this curvature. When contraction occurs the pipe will tend to become taut between the anchor points. This does not damage the pipe because of polyethylene's unique ability to stress relieve and relax with time.

An approximation of the amount of lateral deflection as shown in the sketch below (neglecting soil-pipe friction) can be calculated as follows:



$$\Delta y = L \sqrt{.50 \alpha \Delta T}$$

- Where:  $\Delta y$  = lateral deflection, inches  
 $L$  = length of pipe between anchors, inches  
 $\alpha$  = coefficient of thermal expansion, in/in/°F  
 $\Delta T$  = change in temperature, °F

**FOR EXAMPLE:**

A pipeline installed on top of the ground in a straight condition and anchored at 50-foot intervals undergoes an increase in temperature of 50°F.

$$\Delta y = 50 \text{ ft.} \times 12 \text{ in./ft.} \sqrt{.50 \times .00012 \times 50^\circ\text{F}}$$

$$\Delta y = 34 \text{ in.}$$

If installed in a straight condition, and the operating temperature decreases, the stresses produced by the temperature change will be absorbed by the pipe. Remember these calculations are only theoretical. Actual thermal movement will be less than the theoretical because of the pipe's ability to undergo stress relaxation. As stated in the

"Systems Design" brochure, the actual measured stress has been estimated to be approximately one-half that of the calculated stress. The bending strain for the fixed end condition will be maximum at the anchor points. The distance between anchors can be related to the desired maximum strain by:

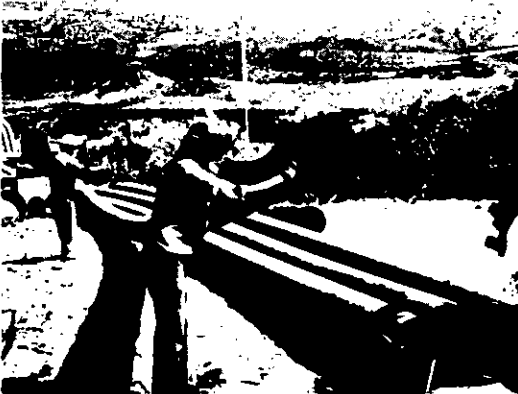
$$\epsilon = \frac{D \sqrt{96 \alpha \Delta T}}{L} \quad \text{or} \quad L = \frac{D \sqrt{96 \alpha \Delta T}}{\epsilon}$$

Where:  $\epsilon$  = strain. (usually 1% or less)

D = pipe outside diameter, inches.

$\alpha$ ,  $\Delta T$  and L are noted on page 20.

As temperature decreases, Driscopipe becomes stronger. However, even at temperatures below freezing, Driscopipe is flexible. Should water inside Driscopipe freeze, the pipe does not burst and will resume its function upon thawing. Of course, the pipe should not be pressurized while it is frozen, nor heated externally with an open flame. Thawing should be allowed to occur naturally, by the use of chemicals, or by a heat source that will not damage the pipe, such as warm air or warm water (not steam). Low thermal conductivity values for Driscopipe slows the heat transfer and inhibits freezing.



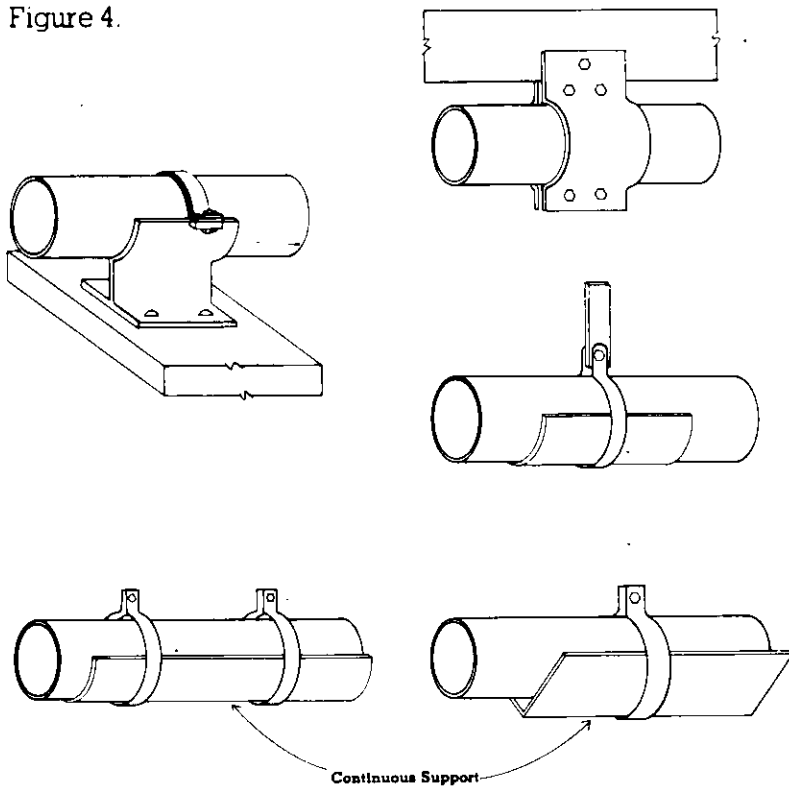
### Pipe Support

Following are recommendations for proper support of all types of above ground piping.

- If temperature or weights of the pipe and fluid are excessive, continuous support is recommended. Installation above 100°F should have continuous support or shorter support spacing. For temperatures over 150°F continuous support is required.
- Supports which run underneath the pipe and do not grip it should cradle the pipe for a length equivalent to approximately  $\frac{1}{2}$ -1 pipe diameter and not less than 120° of the pipe diameter. The supports should be free of sharp edges.
- The support should be capable of restraining the pipe from lateral or longitudinal movement if so designed. If the pipeline is designed to move during expansion, the sliding supports should provide a guide without restraint in the direction of movement.
- Pipe lines across bridges may require insulation to minimize thermal movement.
- Heavy fittings and metal flanged connections should be supported on either side.

Refer to the "Systems Design" brochure for proper spacing of pipe supports. Figure 4 illustrates some typical pipe hangers and supports for plastic piping.

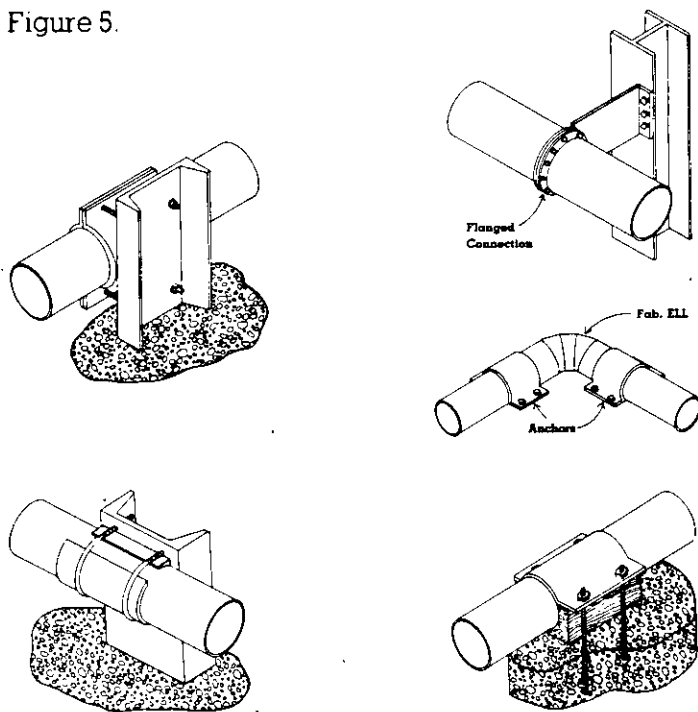
Figure 4.

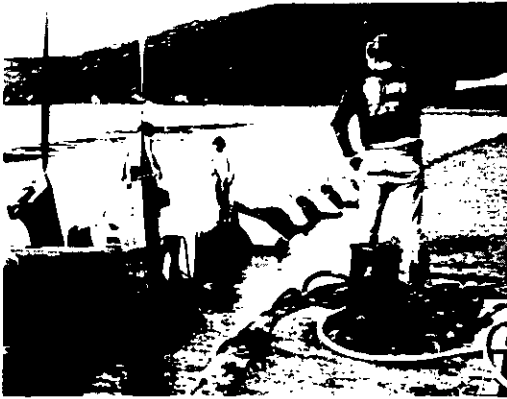


### Anchoring

Proper anchoring should be considered to prevent lateral displacement and movement at fittings. Anchors should be placed as close to an elbow as possible. If flanged connections are required, anchors can be attached to these flanges. However, it is important that bending does not occur between the pipe and the flange. Some typical anchors for polyethylene pipe are illustrated in Figure 5.

Figure 5.





## Slurry Applications

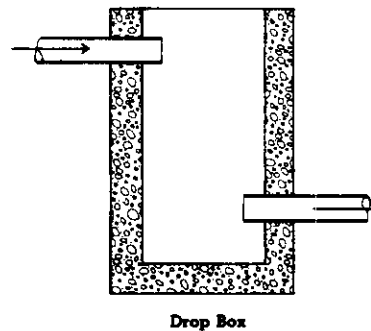
The toughness qualities and smooth inner surface that is resistant to abrasion make Driscopipe an excellent candidate for transporting slurries of all types. Typical slurry applications are dredging lines, coal or limestone slurry, wood chips, sand, mine tailings, and many others.

Installation of slurry pipelines is generally above ground. This provides easy access to the lines if plugging occurs, and also permits rotation to distribute wear evenly around the inside diameter of the pipe. In order to rotate the slurry lines, they are often flanged every 3-4 pipe lengths. Evaluation of pipe wear over the first few months of use will determine when to rotate.

Grade changes in slurry pipelines should be gradual. Exercise caution when slopes become excessive. Turbulence often increases abrasion. Drop boxes are often used to reduce turbulence. They are also used to relieve pressure buildup caused by surface gradients. Generally drop boxes are used on gravity lines, however, pressure lines can also empty into drop boxes.

Design of the drop box should either allow the slurry to fall freely into the fluid in the bottom of the box or utilize a rubber liner on the wall opposite the inlet pipe. A typical drop box is shown below.

Figure 6.



It is difficult to predict wear characteristics that will be experienced using Driscopipe to transport slurries. Every application has somewhat different parameters, whether it be flow velocity, solid concentration, particle size, and/or temperature.

When transporting slurries with Driscopipe, minimum wear will be realized if velocity is minimized yet keep the solids suspended. A maximum of 12-15 feet per second is preferred. It is generally recommended that very sharp – abrasive solids such as bottom ash should not exceed 10 feet per second. A solid concentration below 25% by volume with particle size of  $\frac{1}{4}$ " or less is generally recommended. Temperatures as close to ambient as possible are preferred. Maximum wear and flow properties will be obtained if long radius elbows, sweep elbows, and molded stub ends are used in the installation.

Driscopipe, with its smooth inner surface, will withstand some sliding action of abrasive particles along the inside of the pipe. However, where the solids are in turbulence and the angle of impingement of the solid with the inner wall of the pipe is sharp or direct, polyethylene pipe will not wear well. For instance, in a dredging operation, the section of pipe directly off the pump may experience very high turbulence and vibration; hence excessive wear.

## **I**nstallation Underwater

This section discusses some of the different aspects to be considered in marine pipeline installations. Design engineering phases, such as selecting the proper size and wall thickness as well as critical buckling pressures are discussed in the "Systems Design" brochure. Concrete weight determinations will be discussed in this section.

Driscopipe can be buried, rest on the bottom, or floated on the surface of lakes, rivers, marshes, or oceans. Its characteristics of flexibility, lightweight, inertness to salt water and chemicals, continuous pipeline due to butt fusion, and the ability to float even when full of water give polyethylene many advantages.

## **Joining and Assembly**

Proper planning of all assembly and installation phases will help alleviate problems.

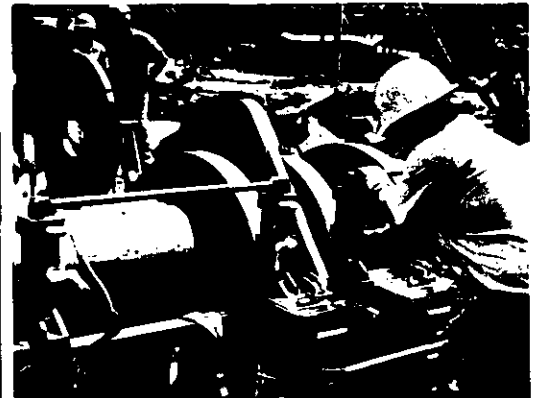
Depending on site conditions, various procedures have been used to assemble the pipeline. Some common ones are:

- Fuse the pipe together on shore into continuous lengths, assemble the ballast weights to the pipe on shore after fusion and before the pipe is launched into the water.
- Fuse the pipe together on shore and pull or push the pipe into the water as in the previous procedure, except assemble the weights to the pipe at some later time from a barge.
- All pipe can be fused on land in pre-determined lengths with flanged connections added to each end. The flanged ends are capped and the sections are launched onto the water to be later assembled on the water. Such floating lines are often used in dredging operations.

Any pipe which is temporarily stored on a body of water should be protected from all forms of marine traffic as well as preventing wave actions from pushing the pipe against rocks or sharp objects that could damage the pipe.

## **Anchoring and Weighting**

Since polyethylene pipe floats just under the surface even when full of water, it is necessary to add ballast weights in



order to sink the pipe and hold it on bottom. The most common form of weight is steel reinforced concrete, although other forms have been used. There are many companies that make the concrete weights whether in the factory or at the job site. These weights are generally round, rectangular, or square, and are clamped to the pipe using non-corrosive bolts, clamps, or straps. A compressible protective wrap around the pipe is advisable between the concrete weights and the pipe. It will protect the pipe surface and prevent the weights from sliding on the pipe. This protective wrapping of 1/8" rubber sheet or similar material should extend beyond both edges of the concrete block weights.

A cylindrical weight is commonly used on small diameter pipe; however, this configuration could allow the pipeline to roll on the bottom if subjected to currents. The rectangular or square weight is the most common type used. They are reinforced collars constructed in two halves to fit the pipe outside diameter, and usually incorporate lifting lugs built into the weights.

In determining a pipe system's specific gravity or sink factor, the engineer should consider all variables to sufficiently provide the required stability under water. Items such as tides, condition of the bottom material and the possibility of air in the pipeline should be considered.

Normally the weighted pipe is buried in a trench under water. However, it can lay on the bottom or be suspended (float) above the bottom with anchored tie lines. Under most conditions the pipe and weights will embed themselves in the soil or muck on the bottom. Driscopipe works well in extremely soft bottoms, in which little or no support is achieved, by adjusting the anchoring required.

For operating conditions where the pipe will not always be liquid full, or where the product is lighter than water, check to determine whether or not the empty pipe (air inside) with attached weights will float during installation. If the pipe will not float, attach floats at each concrete weight before towing onto the surface of the water.

Concrete weight requirements may be calculated by the following equation:

$$W_c = \frac{K D_w V_o - (W_D + W_P)}{1 - K D_w / D_c}$$

Where  $W_c$  = concrete weight, lbs/ft.

$K$  = pipe system specific gravity. (sink factor)

$D_w$  = water density, lbs/cu. ft.

$V_o$  = pipe outside volume (water displaced), cu. ft./ft.

$W_D$  = pipe weight, lbs/ft.

$W_P$  = product weight (pipe contents), lbs/ft.

$D_c$  = concrete density, lbs/cu. ft.



Chart 4 contains the concrete weights required for Driscopipe pipelines in fresh water for K=1.1, 1.2 and 1.3 and specific gravity of flowing product of 0.00 (gas), 1.00 (water), 1.10 and 1.20 (fluids heavier than water). To calculate neutral buoyancy use K = 1.

Chart 4.

**CONCRETE WEIGHTS\***  
(Dry weight in pounds per foot of pipeline)

NOM. SIZE	SDR	SPECIFIC GRAVITY OF FLOWING PRODUCT															
		0.00				1.00				1.10				1.20			
		K = 1.1				K = 1.2				K = 1.3							
<b>LOW PRESSURE</b>																	
3	35	76	08	01	- 06	01	17	09	02	108	27	19	11				
4	30	124	13	02	- 09	148	28	16	04	176	45	32	19				
5	32.5	170	18	02	- 13	203	38	21	05	242	62	44	26				
6	32.5	271	28	04	- 21	323	60	34	08	385	98	70	41				
7	32.5	313	33	05	- 24	374	69	39	09	445	114	81	47				
8	32.5	459	48	07	- 35	547	102	58	13	652	167	118	69				
10	29.5	704	74	11	- 52	841	159	91	22	100	259	185	110				
12	31.5	998	104	15	- 75	119	223	126	30	142	364	258	153				
14	32.5	121	126	17	- 91	144	269	152	35	172	439	311	183				
16	32.0	158	164	23	- 118	188	352	199	46	224	573	406	240				
18	32.5	200	207	29	- 151	238	445	251	57	284	725	514	302				
20	33.5	248	256	34	- 188	295	549	309	68	352	895	633	371				
22	32.5	285	296	41	- 215	340	635	358	82	405	103	733	431				
24	32.5	358	368	47	- 274	427	790	442	95	508	129	909	530				
28	32.5	482	500	69	- 363	575	107	605	138	685	175	124	729				
32	32.5	612	635	87	- 461	730	136	768	175	870	222	157	926				
36	32.5	806	829	106	- 617	961	178	100	213	1144	290	205	119				
42	32.5	1088	113	155	- 820	1298	242	137	311	1546	395	280	165				
48	32.5	1376	143	196	-1040	1642	306	173	393	1957	500	354	208				
<b>SDR 25.3</b>																	
6	23.5	25.9	28	09	- 18	31.0	6.1	3.6	1.1	37.1	9.9	7.1	4.4				
8	27	44.8	4.8	08	- 32	53.5	10.2	5.9	1.6	63.9	16.7	12.0	7.2				
10	25.3	68.9	7.4	13	- 4.9	82.5	15.9	9.3	2.6	98.6	25.9	18.7	11.4				
20	25.3	239	25.8	4.5	- 16.8	286	55.1	32.0	9.0	341	89.7	64.6	39.4				
24	25.3	344	37.1	6.5	- 24.2	411	79.3	46.1	12.9	491	129	93.0	56.8				
<b>SDR 15.5</b>																	
2	15.5	3.1	0.4	0.1	- 0.2	3.7	0.8	0.5	0.2	4.4	1.3	1.0	0.6				
3	16	6.7	0.8	0.2	- 0.4	8.1	1.7	1.1	0.4	9.7	2.8	2.1	1.4				
4	15.5	11.0	1.3	0.4	- 0.6	13.3	2.8	1.8	0.7	16.0	4.6	3.4	2.3				
6	15.5	23.8	2.9	0.8	- 1.3	28.7	6.1	3.8	1.6	34.6	9.9	7.4	5.0				
8	15.5	40.3	4.9	1.3	- 2.2	48.7	10.3	6.5	2.7	58.6	16.8	12.6	8.4				
10	15.5	62.6	7.6	2.1	- 3.4	75.6	16.1	10.1	4.1	91.0	26.1	19.6	13.1				
12	15.5	83.0	10.7	2.9	- 4.8	106	22.6	14.2	5.8	128	36.7	27.5	18.4				
14	15.5	106	12.8	3.5	- 5.8	128	27.2	17.1	7.0	154	44.2	33.2	22.2				
16	15.5	139	16.8	4.6	- 7.6	168	35.6	22.4	9.2	202	57.8	43.4	29.0				
18	15.5	175	21.2	5.8	- 9.6	212	45.0	28.3	11.6	255	73.1	54.9	36.7				
22	15.5	250	30.3	8.3	- 13.7	303	64.2	40.4	16.6	364	104	78.3	52.3				
24	15.5	312	37.7	10.3	- 17.1	377	80.0	50.3	20.6	454	130	97.6	65.2				
<b>SDR 11</b>																	
1/4	11	1.3	0.2	0.1	- 0.1	1.6	0.4	0.3	0.1	2.0	0.7	0.5	0.4				
1/2	11	1.8	0.2	0.1	- 0.1	2.2	0.5	0.3	0.2	2.6	0.8	0.6	0.5				
2	11	2.8	0.4	0.1	- 0.1	3.4	0.8	0.5	0.3	4.1	1.3	1.0	0.7				
3	11	6.0	0.8	0.3	- 0.2	7.3	1.7	1.2	0.6	8.9	2.8	2.1	1.6				
4	11	9.9	1.4	0.5	- 0.4	12.1	2.8	1.9	1.0	14.6	4.6	3.6	2.6				
5	11	15.1	2.1	0.8	- 0.5	18.4	4.3	2.9	1.5	22.4	7.0	5.5	4.0				
6	11	21.4	2.9	1.1	- 0.8	26.1	6.2	4.2	2.2	31.7	10.0	7.8	5.6				
8	11	36.2	5.0	1.8	- 1.3	44.9	10.4	7.1	3.7	53.8	16.9	13.2	9.5				
10	11	56.3	7.7	2.9	- 2.0	68.8	16.2	11.0	5.7	83.6	26.2	20.5	14.8				
12	11	79.1	10.9	4.3	- 2.8	96.7	22.8	15.4	8.0	118	36.9	28.9	20.8				
14	11	95.0	12.7	4.5	- 3.8	116	27.1	18.2	9.2	141	44.0	34.3	24.5				
16	11	125	17.1	6.3	- 4.5	152	35.9	24.2	12.6	185	58.1	45.4	32.7				
18	11	158	21.6	8.0	- 5.8	193	45.4	30.7	16.0	234	73.8	57.5	41.4				
<b>SDR 9.33</b>																	
1/4	9.3	0.5	0.1	0.0	0.0	0.6	0.2	0.1	0.1	0.8	0.3	0.2	0.2				
1	10	0.8	0.1	0.1	0.0	1.0	0.2	0.2	0.1	1.2	0.4	0.3	0.2				
1/2	9.3	1.3	0.2	0.1	0.0	1.5	0.4	0.3	0.2	1.9	0.6	0.5	0.4				
2	9.3	2.6	0.4	0.2	- 0.1	3.2	0.8	0.6	0.3	3.9	1.3	1.0	0.8				
3	9.3	5.6	0.8	0.4	- 0.1	6.9	1.7	1.2	0.7	8.4	2.8	2.2	1.7				
4	9.3	9.2	1.4	0.6	- 0.2	11.4	2.9	2.0	1.2	13.9	4.6	3.7	2.8				
6	9.3	20.0	3.0	1.3	- 0.4	24.6	6.2	4.4	2.5	30.1	10.0	8.0	6.0				
<b>SDR 8.3</b>																	
8	8.3	32.0	5.1	2.4	- 0.3	39.7	10.5	7.6	4.7	48.8	17.0	13.8	10.7				

NOTE: Where the concrete weight requirements is shown as a negative number, no weights are required for that operating condition, e.g. specific gravity of the flowing product is 1.2 and K = 1.1. However, in order to sink the line into position, it must be filled with the heavier operating fluid, or weights must be added.

\*Calculations of weights are based on density of fresh water,  $D_w = 62.4 \text{ lb/ft}^3$ , and density of concrete,  $D_c = 150 \text{ lb/ft}^3$ .



The spacing of the concrete weights will depend on the size of the weight, and is normally limited to 10 to 15 feet apart. A conservative *maximum* spacing between weights may be obtained from Chart 5. This spacing is based on a maximum of one percent strain in the wall of the pipe due to deflection between weights and a maximum deflection of no more than 5% of the spacing.

**EXAMPLE:**

Install a 16" SDR 15.5 line across a fresh water lake to carry a brine solution with a density of 72.9 lbs/cu. ft. Weights shall be fabricated from 150 lbs/cu. ft. concrete.

$$K = 1.3, D_w = 62.4, D_c = 150$$

$$V_o = (\pi/4) (16)^2/144 = 1.396 \text{ cu. ft./ft.}$$

$$W_D = 20.64 \text{ lbs./ft.}$$

$$\text{Pipe inside diameter} = 16 - 2 (1.032) = 13.936 \text{ in.}$$

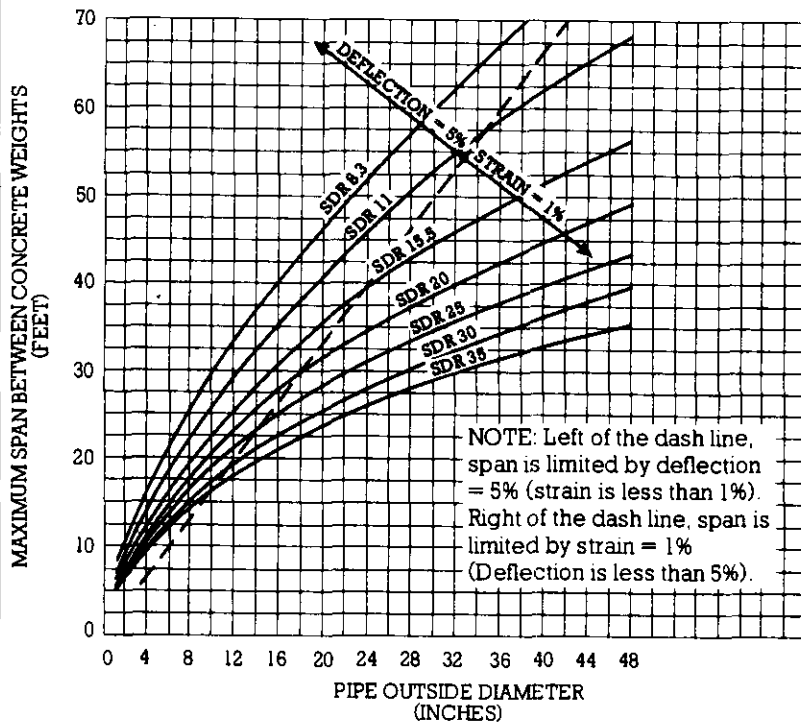
$$W_P = (\pi/4) (13.936)^2 (72.9)/144 = 77.22 \text{ lbs/ft.}$$

$$W_C = \frac{(1.3) (62.4) (1.396) - (20.64 + 77.22)}{1 - (1.3) (62.4)/150} = 33.5 \text{ lbs./ft.}$$

Maximum spacing of weights is 30.5' (See Chart 5).

Chart 5.

**MAXIMUM SPAN BETWEEN CONCRETE WEIGHTS FOR UNDERWATER DRISCOPIPE PIPELINES**



With weights 10 feet apart, each will weigh  $10 \times 33.5 = 335$  lbs. If 400 lb. weights are available, spacing will be  $400 \div 33.5 = 11.94$  ft. = 12 ft.

If it is possible that air can get into the pipe, extra weight should be allowed, and the weight spacing shortened. Gas pipelines (specific gravity = 0.00) must be designed for underwater stability when full of gas at zero pressure and thus have a design K greater than 1.00. Therefore, the pipeline, with weights attached, will sink. In this situation, floats will always be required to float the pipeline onto the water.

In general the pipe can deflect considerably between weights, with only a small resulting strain value which is well within the strength of the pipe. If a current is present, movement of the pipe itself is not harmful, however, any sharp rocks or objects it might contact may damage it. If waves or currents present a problem, the best solution is to trench and bury the weighted pipeline.

Installation of the ballast weights to the pipe is usually accomplished on shore. Several weights can be installed at one time depending on manpower and work space. To minimize drag and aid movement of the weighted pipe into the water, a wooden or steel ramp can be fabricated at waters edge.

Ballast weights may also be installed from a barge or raft to the pre-assembled pipe stored on the water. The pipe is lifted from the water onto the raft to install the weights.

### **Launching and Sinking**

To allow the pipeline to float in the water until the sinking operation, it is necessary to install a bulkhead on each end of the pipeline to prevent water from entering the pipe. This is done with a flange assembly and metal blind flange. This provides an airtight seal, thus allowing the line to float. The pipeline is then moved into position for sinking by marine craft.

The transition of the pipeline from land to water should be done in a trench before the sinking operation begins. It is important that this trench be adequate enough to protect the pipeline from damage by debris, ice, boat traffic, or wave action.

The sinking operation is controlled by the addition of water to one end and the evacuation of the enclosed air through the opposite end. The addition of water to the pipeline at a controlled rate will ensure that the pipe lays in the trench or adjusts to the profile of the bottom. The rate of sinking should also be controlled to prevent an excessive bending radius.

During the sinking, water must be prevented from running the full length of the pipe. This can be done by inducing a water pocket at the shore end, by lifting the off shore pipe above the



water. Water is introduced into the pipeline closest to shore allowing it to sink. Once the pipe seeks an equilibrium, additional water can be added gradually to complete sinking the line.

After the pipeline is installed on bottom or in the trench, a thorough inspection should be made of the pipe installation. All weights should be properly positioned, with the pipe positioned in the center of the trench, or within the right-of-way. As stated before, the trenched area where the pipe leaves the shore and enters the water, should be adequate to protect the pipe from damage. And where backfill is used, inspect for proper installation and required depth.

It is better for a marine pipeline to be too long than too short. Never attempt to flange up a pipeline that is too short by drawing the bolts together, thus stretching the line. This places the flanged connection in severe tension and could cause eventual problems. Extra length can often be accommodated by snaking the pipe.

### **Intake and Outfall Diffusers**

Phillips Driscopipe has the capability of providing special diffuser assemblies used in terminating outfall pipelines. Special sinking provisions are sometimes required, so that the vertical diffuser is exposed, yet is subject to as little damage from navigational hazards as possible. Your Phillips Driscopipe representative will be very glad to assist with diffuser design capability.



### **I**nsert Renewal Installations

Insert renewal, or slip lining, is an effective and economical method for rehabilitating a deteriorated pipeline. Installation is simple and fast with a minimum of interruption to the pipeline operation.

The pipeline to be relined is cleaned of obstructions and debris. A closed circuit TV survey of the clean pipeline is recommended to locate connections and reveal existing defects. After a test run with the pulling head, the liner may be attached, pulled into place, and secured. The pulling head may be either a flexible, field fabricated type, or a rigid type made of steel that is bolted to the end of the pipe.

Installation procedures for insert renewal are found in ASTM F585 "Insertion of Flexible Polyethylene Pipe into Existing Sewers" and PPI bulletin, "Renewing Sewers with Polyolefin Pipe". Refer to "Systems Design" brochure for proper insert renewal design.

## **T**esting Polyethylene Pipelines

Driscopipe piping systems should be hydrostatically pressure tested before being put into service. Water is the preferred test medium. After all free air is removed from the test section, raise the pressure at a steady rate to the required pressure. The pressure in the section shall be measured as close as possible to the lowest point of the test section.

### **Pressure Piping Systems**

The initial pressure test can be conducted before or after the line is backfilled. However, it is advisable to cover the pipe at intervals or particularly at curves to hold the pipe in place during pressure tests. Flanged connections may be left exposed for visual leak inspection.

Test pressure should not exceed 1.5 times the rated operating pressure of the pipe or the lowest rated component in the system. The initial pressure test shall be applied and allowed to stand without makeup pressure for a sufficient time to allow for diametric expansion or pipe stretching to stabilize. This usually occurs within 2-3 hours. After this equilibrium period, the test section can be returned to the 1.5 times operating pressure, the pump turned off, and a final test pressure held for 1-3 hours.

Remember that pressure drop will not only occur due to pressure expansion, but also due to fluctuations in temperature during the test. As the temperature increases, the gauge pressure will decrease. Allowable amounts of makeup water for expansion during pressure test is shown in Chart 6, taken from PPI Technical Report TR 31/9-79. If there are no visual leaks or significant pressure drops during the final test period, the pipeline passes the test.

Chart 6.

**ALLOWANCE FOR EXPANSION UNDER TEST PRESSURE\***

Nominal Pipe Size (in.)	Allowance for Expansion (U.S. Gals./100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

\*These allowances only apply to the test period and not to the initial expansion phase.

**Non-Pressure Piping Systems**

Testing of non-pressure, gravity flow pipes whether above or below ground may be accomplished by closing all openings below the top of the section to be tested. For test purposes, provide a means to raise the water level to a height of at least 3-5 feet above the highest point in the line being tested. The water level only need be maintained long enough to determine there are no leaks. If impractical to raise water level as suggested, the line can be pressurized with low pressure water or air. Pressure normally should not exceed 5-10 psi over a time period of 5-10 minutes.

**Repairing Damaged Polyethylene Pipe**

Hauling, unloading, stringing and installing Driscopipe should be done with the care necessary to prevent damage to the pipe. Since all plastics are softer than steel, poor handling can result in abrasions, cuts, gouges, punctures, etc.

All pipe should be carefully examined before installation and damaged pipe removed. Damage that results in reduction of the wall thickness by more than approximately 10% should be cut out and discarded as it may impair long-term service life. Minor scuffing or scratching will have no adverse affect on the serviceability of Driscopipe.

Damaged pipe may be repaired by any of the joining methods previously discussed. *Butt fusion is preferable for all applications where conditions permit.* Some of the joining methods are not satisfactory for continuous pressure systems.

**Kinks** – Normally kinks do not impair the serviceability in low pressure applications. For high pressure applications, severe kinks should be cut out and the pipe re-joined by fusing.

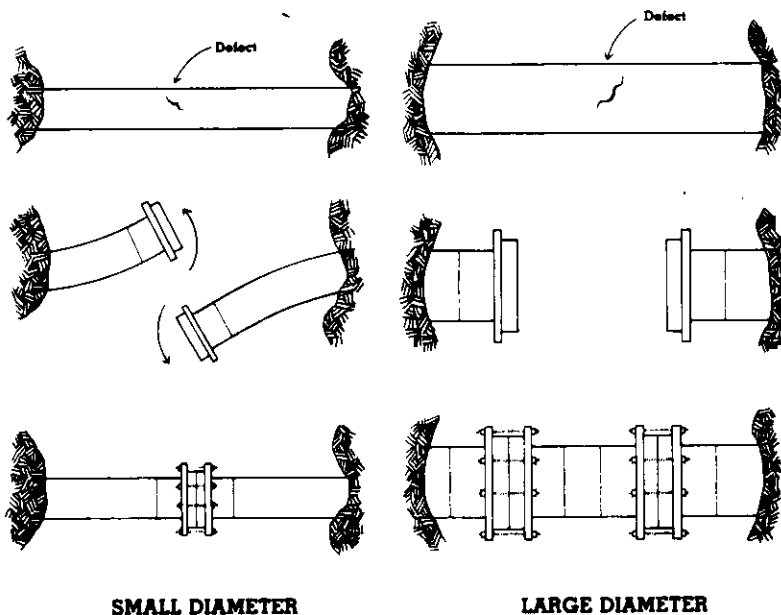
**Ovality** – Out-of-roundness due to excess loading during shipment or storage will not hinder the serviceability of the pipe. The pipe should not be considered damaged unless the fusion machine clamps cannot successfully round out the section for a good fusion joint. Occasionally the pipe can be placed in an unstressed condition so that it will relax and gradually round out.

### Permanent Repair

Repair after installation can be accomplished on small diameter pipe by removing a minimal amount of backfill, cutting out the defect, move the pipe ends to one side and fuse flanged connections to each end. The flanges are then bolted together. It is preferable that the flanged connection be under a slight compression when reconnected. The bolts should never be used to pull up a flanged joint.

Repairing large diameter pipe which is not as flexible as smaller pipe can be accomplished with a flanged spool piece. The damaged section is removed, the butt fusion machine is lowered into the ditch to fuse flanged connections to each open end, and the flanged spool assembly is bolted into place. The flanged spool must be precisely made to fit the resulting gap in the pipeline.

Figure 7 illustrates these methods.





### **Mechanical Repair**

A wrap-around-type repair clamp with integral gasket can be used but is not as permanent as a flanged or fused repair. This type of repair is principally used in buried applications because the compacted soil restrains the pipe from thermal movement and pull-out forces caused by internal pressure. A longer repair clamp generally provides greater sealing capability on the thermoplastic pipe.

A clamp length of  $1\frac{1}{2}$ -2 times the nominal pipe diameter works best. Tighten the clamp evenly around the pipe which has been wiped clean of all foreign material. Afterwards, properly backfill and compact around and over the pipe before it is pressurized.

### **Fitting Repair**

Repairing an installed fitting is normally accomplished by replacement with a new flanged fitting. Various attempts have been made to repair or join ultra high molecular weight Driscopipe using a common hot air melt welding gun. Driscopipe 8600 material does not lend itself to this form of repair, especially in trying to achieve a pressure tight repair or joint.

### **Underwater Repair**

To accomplish underwater repair on a pipeline, the pipe ends must be floated or raised above the water so that a flange assembly can be fused to each end. The ends are then lowered into position on the bottom and bolted together underwater.

Appropriate lifting equipment must be used to insure that the pipe does not kink and that the minimum bend radius is not exceeded. Normally it is not necessary to remove the weights before lifting, but extreme care should be exercised when lifting the pipe above the water level with weights attached.

### **Miscellaneous Repair Methods**

Under certain situations, a thermofit heat shrink sleeve can be used to seal a puncture or leaking joint. Many types of sleeves are available, such as those fabricated by Raychem Corporation out of crosslinked polyethylene. The sleeves are coated on the inside with a special thixotropic sealant which when heated is forced into a puncture or joint to seal and encapsulate.

## **S** tatic **E** lectricity

Static electricity charges are generated on polyethylene pipe by friction, particularly during the handling of pipe in storage, shipping and installation. The flow of air or gas containing dust or scale will also build up significant static charges, as will the flow of dry materials through the pipe such as in the case of gravity flow grain chutes. These charges are a safety hazard, particularly in areas where there is leaking gas, or an explosive atmosphere.

Plastic pipe is a non-conductor of electricity, and the static charge will remain in place until some grounding device comes close enough to allow it to discharge.

The discharge of these static electric charges generally happens when workmen touch the pipe themselves, or upon application of mechanical tools to the pipe. The result of the discharge will vary from an insignificant physical shock to possible ignition of a flammable gas-air mixture. The most effective and simple method to minimize the hazard of the discharge is to apply a film of water to the work surface, to drain away the static electricity. A ground wire on the plastic pipe will only discharge from that point, since the plastic is a non-conductor.

When workmen must enter a bellhole to hot tap a line or make emergency repairs to a damaged or leaking line, it is important that all safety precautions be observed. The exposed working surface of the polyethylene line should be doused with water before entering the area, and a wet cloth should be kept on the pipe to drain off static charge build up while working on the line.

## **I** nstallation **P** recautions **F** or Fabricated Fittings

Driscopipe 8600 fabricated tees, elbows and wyes are made by butt fusing or sidewall fusing together special cut segments of Driscopipe 8600 pipe to obtain the desired fitting. The configuration of these fittings, and the fact that they are fabricated rather than molded, requires that certain precautions be taken when installing them into a piping system.

There have been a few instances where fabricated fittings, after being fused to the pipe, have been damaged due to excessive strain imposed by improper handling. Driscopipe 8600 pipe and fittings are generally very tough and forgiving of mishandling due to the flexible nature of the material itself. However, the tensile strength of a polyethylene material is much less than steel and it will not support the excessive lifting and pulling forces that can be exerted by powered installation equipment.



For example, if, when installing a tee in the line, long lengths of pipe are fused to each of the three sides of the tee and it is then lifted up and out of the butt fusion unit without supporting the excess weight of the pipe hanging and being lifted at the same time, the tee might be torn apart. If the assembly of the tee into the piping system is done in the manner described, then precautions must be taken to lift and support the pipe on all sides of the tee as it is removed from the fusion unit and lowered to the ground or into the ditch. The fabricated tee (or elbow or wye) must not be allowed to carry the weight of the pipe that is butt fused to it.

The installation procedures should provide the least possible amount of lifting and moving of the assembled pipe and fabricated fittings. If it becomes necessary to pull the assembly along side the ditch to properly position it, the fabricated fitting should never be used as the point of attachment for the pulling line.

The fusion joining of a fabricated tee and wye into a system becomes complicated because of the third side. It is not too difficult to keep strain off the fitting when fusing pipe to the running side of the tee and lifting and lowering this much of the assembly into position in a ditch. It is when sufficient pipe is added to the third (branch) side to permit the laying of pipe in this direction, that the assembly becomes very difficult to handle. Final handling and positioning of these assemblies requires extra handling equipment and additional precautions to prevent damage to the fabricated fitting.

*Recommended Alternate Method:* The need for extra equipment and much of the possibility of damage can be eliminated by altering the method of installing the fabricated tee and wye to include the use of a flanged connection on the branch side. This will allow final positioning to take place before the branch side is connected. There will be some instances where it will prove very advantageous from an installation viewpoint to use flanged connections on two sides of a tee or wye and also on one side of the elbow. This allows the pipe to be laid from either direction, pushed or pulled into tight locations, rolled into the ditch, and generally handled much easier and faster . . . before the final connection is made at the tee, wye or elbow. From the standpoint of economy, speed and ease of installation, and to eliminate the occurrence of excessive installation stresses on fabricated fittings, it is recommended that flanged connections always be used on the branch side of tees and wyes and on one end of elbows.



USA AND CANADA



OTHER COUNTRIES

## PHILLIPS DRISCOPIPE, INC.

A SUBSIDIARY OF PHILLIPS PETROLEUM COMPANY

To Request Additional Product Literature Only:

Phone : (214) 783-2690

To Contact Your Driscopipe Representative:

Mail: Attn: Customer Service Department

P.O. Box 83-3866

2929 N. Central Expressway

Suite 100

Richardson, TX 75083

Phone: U.S. Domestic Toll Free 800 527-0662

Texas Toll Free 800 442-3802

TWX: 910-867-4818

Telecopier: (214) 783-2617

### PLANT LOCATIONS:

Watsonville, CA • Pryor, OK •

Williamstown, KY • Brownwood,

TX • Startex, SC

**APPENDIX J**

**WEEKLY CONSTRUCTION STATUS REPORT**

**FORM 1**  
**WEEKLY STATUS REPORT**

DATE: \_\_\_\_\_

PROJECT NAME/NO: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

SUPERINTENDENT: \_\_\_\_\_

PROJECT START DATE: \_\_\_\_\_

PROJECT STATUS: THIS REPORT PERIOD \_\_\_\_\_ % COMPLETED

TOTAL PROJECT \_\_\_\_\_ % COMPLETED

DESCRIPTION OF WORK PERFORMED: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

LABOR TYPE	QUANTITY	MANHOURS THIS REPORT	MANHOURS TOTAL
Supervisory			
Operator			
Labor			
Other (Specify)			

HEAVY EQUIPMENT DESCRIPTION	HOURS THIS REPORT	HOURS TOTAL

**COST STATUS**

COST INCURRED TO DATE \$ \_\_\_\_\_

TOTAL PROJECT \$ \_\_\_\_\_

DESCRIPTION OF PROBLEMS/DELAYS AND COST OVERRUNS (ATTACH ADDITIONAL SHEET IF NECESSARY). ALSO, PLEASE SUPPLY A SCHEDULE OF ACTIVITIES COMPLETED AND TO BE COMPLETED.

\_\_\_\_\_  
Contractor Field Representative Signature

**APPENDIX K**

**PE PIPE PRESSURE TEST REPORT**

**FORM II**  
**PE PIPE PRESSURE TEST REPORT**

PROJECT NAME/NO. \_\_\_\_\_ DATE: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_ TIME: \_\_\_\_\_

PERSON PERFORMING TEST: \_\_\_\_\_

DESCRIPTION/LOCATION OF TEST SEGMENT: (Pipe diameter, Length and SDR's)

- $T_i$  = Initial temperature in °C = \_\_\_\_\_ °C
- $P_i$  = Initial test pressure in psig = \_\_\_\_\_ psig
- $P_c$  = Initial pressure in psig corrected for temperature  
( $T_i$ ) at time 't'
- t = Time in minutes from initiation of test
- $T_t$  = Temperature in °C at time 't'
- $P_t$  = Test pressure in psig at time 't'
- $P_o$  =

$$\frac{(P_i + 14.7)(T_t + 273)}{(T_i + 273)} - 14.7$$

Percent Pressure Drop =

$$\frac{P_c - P_t}{P_c} \times 100$$

NOTE: °C = (°F-32)/1.8

TIME	$T_t$ TEMP READING	$P_t$ GAUGE READING	$P_c$ CORRECTED PRESSURE	PERCENT PRESSURE DROP
10				
20				
30				
40				
50				
60				< 1%

PASS/FAILURE \_\_\_\_\_ RETEST (yes/no): \_\_\_\_\_

DESCRIPTION/NATURE OF LEAKS AND REPAIRS OF RETEST SEGMENT:

**ATTACHMENT TO FORM II**  
**EXAMPLE CALCULATION SHEET**

**GIVEN:**

$$P_i = 10 \text{ psig}$$
$$T_i = 21.1^\circ \text{C} = 70^\circ \text{F}$$

**and at time t = minutes**

$$P_t = 10.05 \text{ psig}$$
$$T_t = 23.0^\circ \text{C} = 73^\circ \text{F}$$

**Calculate Corrected Initial Pressure**

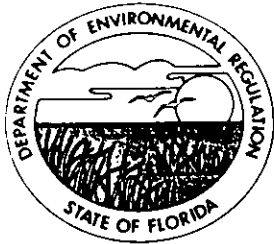
$$P_c = \frac{(10.0 + 14.7)(23.0 + 273)}{(21.1 + 273)} - 14.7$$
$$P_c = 24.85 - 14.7 = 10.15 \text{ psig}$$

**Calculate Percent Pressure Loss**

$$\% \text{ Pressure Loss} = \frac{10.15 - 10.05}{10.15} \times 100 = 0.98\% < 1\% \text{ ok}$$

**NOTE:** The difference between the corrected pressure reading ( $P_c$ ) and the gauge reading ( $P_t$ ) cannot differ by more than 1% of the corrected pressure reading ( $P_c$ ) (i.e., .105 @ 10.5 psig) over a time interval of 60 minutes.

**APPENDIX L**  
**DESIGN DRAWINGS**



# Florida Department of Environmental Regulation

Twin Towers Office Bldg. • 2600 Blair Stone Road • Tallahassee, Florida 32399-2400

Lawton Chiles, Governor

Carol M. Browner, Secretary

September 30, 1992

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. James A. Waters, Group Vice President  
Waste Management of North America  
500 Cypress Creek Road, Suite 300  
Ft. Lauderdale, Florida 33309

Dear Mr. Waters:

Re: File No. AC13-218495, Medley Landfill Flare

The Department has made a preliminary review of your application for permit to construct a flare at the Medley Sanitary Landfill and Recycling Center in Dade County. Before this application can be processed, we need the following information:

1. How many gas wells will be at the landfill?
2. What is the maximum/average gas flow per well?
3. How will the gas flow from each well and to the flare be monitored?
4. To complete Section V of the application, please provide: a map showing the location of the landfill; a plot plan of the landfill showing the wells, gas collection system, and flare; a process flow diagram of the collection and flare system; and a drawing with the specifications (brochure and warranties) for the LFG "Candle Stick", including the operating temperature of the flare.
5. Please provide a copy of solid waste permit No. SC13-179974.
6. In the gas flow and exit velocity calculations, what is the reference for the 22.1 ft<sup>3</sup>/min actual flue gas flow per cubic foot of methane? How was the other 40% of the gas (mostly CO<sub>2</sub>) accounted for in determining the flue gas velocity from the flare?
7. Is the flare 14 or 16 inches in diameter?

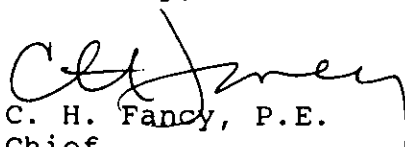


Mr. James A. Waters  
September 30, 1992  
Page 2 of 2  
Request for Additional Information

8. Will the proposed flare comply with the criteria listed in 40 CFR 60.18(b); specifically: Will there be no visible emissions from the flare except for 5 minutes in any 2 consecutive hour period? Will the flare have a flame present at all times? Will the exit velocity of the flue gas be within the limits specified? Is the flare steam, air, or non-assisted? What fuel is used for the pilot light and how is its flame monitored?

We will resume processing your application after we receive the requested information. If you have any questions on this matter, please write to me or call Preston Lewis at (904) 488-1344.

Sincerely,



C. H. Fancy, P.E.  
Chief  
Bureau of Air Regulation

CHF/WH/plm

cc: S. Brooks, SED  
E. Anderson, DERM  
H. Bush, Jr., P.E.

PS Form 3811, July 1983, 47, 945  
DOMESTIC RETURN RECEIPT

**SENDER: Complete items 1, 2, 3 and 4.**

Put your address in the "RETURN TO" space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for service(s) requested.

1.  Show to whom, date and address of delivery.

2.  Restricted Delivery.

3. Article Addressed to:  
*Mr. James A. Waters -  
 Waste Mgmt. of N. America  
 500 Cypress Creek Rd - Suite 300  
 Ft Lauderdale, FL 33309*

Type of Service:	Article Number
<input type="checkbox"/> Registered <input type="checkbox"/> Insured <input checked="" type="checkbox"/> Certified <input type="checkbox"/> COD <input type="checkbox"/> Express Mail	<i>062 921 889</i>

Always obtain signature of addressee or agent and **DATE DELIVERED.**

5. Signature - Addressee *FA L Com DL*

6. Signature - Agent *X*

7. Date of Delivery *10/30/92*

8. Addressee's Address (ONLY if requested and fee paid)

P 062 921 889



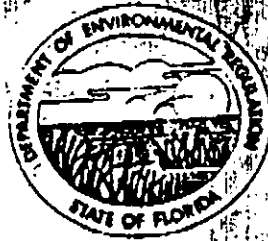
### Receipt for Certified Mail

No Insurance Coverage Provided  
Do not use for International Mail  
(See Reverse)

Sent to <i>James A. Waters</i>	
State and City <i>Waste Mgmt Inc</i>	
P.O. State and ZIP Code <i>Ft. Lauderdale, FL</i>	
Postage	\$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, and Addressee's Address	
TOTAL Postage & Fees	\$
Postmark or Date	<i>9-30-92</i>

*AC 13-218495*

PS Form 3800, June 1991



Florida Department of Environmental Regulation

Southeast District

1900 S. Congress Ave., Suite A

West Palm Beach, Florida 33406

Lawton Chiles, Governor

Telephone: 407/433-2650

Fax: 407/433-2666

Carol M. Browner, Secretary

FAX TRANSMITTAL LETTER

DATE: 9-17-92 NUMBER OF PAGES: 1.5  
(Including this Page)

TO: FAX TELEPHONE NUMBER: 904-922-6979

NAME: Patty Adams

AGENCY: DER

FROM: S. Brooks

TRANSMITTAL ON A HITACHI HIFAX #35:  
Number: 407/433-2666

IF ANY OF THE PAGES ARE NOT CLEARLY  
RECEIVED, PLEASE CALL: 407/433-2650.

SENDERS NAME: S. Brooks

COMMENTS:

Millard

Stephanie wants you  
to give her a call about  
this application  
Patty

9-16



Department of Environmental Regulation  
**Routing and Transmittal Slip**

To: (Name, Office, Location)

- 1. Preston Willard
- 2. I agree - you handle
- 3. CK with NE District
- 4. on a methane source

Remarks:

the SE District Preston  
9/21  
asked that BAR  
process this application,  
I think there work  
level is high. Suggest  
you assign it to me  
or Indya

From

lind

Date

9-17-92

Phone

METROPOLITAN DADE COUNTY, FLORIDA



RECEIVED

SEP 16 1992

DEPT. OF ENVIRONMENTAL REG.  
WEST PALM BEACH



METRO-DADE CENTER

ENVIRONMENTAL RESOURCES MANAGEMENT  
SUITE 1310  
111 N.W. 1st STREET  
MIAMI, FLORIDA 33128-1971  
(305) 375-3376

September 11, 1992

Stephanie Brooks, P.E.  
Florida Department of Environmental Regulation  
1900 South Congress Avenue  
West Palm Beach, Florida 33406

RE: Application for Permit to Construct an  
Air Pollution Source

APPLICANT: Waste Management North America  
P-1010 - AC 13-218495

LOCATION: 9350 NW 89th Street, Medley

POLLUTION SOURCE: Landfill Gas Flare

POLLUTION CONTROL DEVICE:

Dear Ms. Brooks:

The referenced application has been reviewed and has been disapproved for being incomplete. [redacted] and [redacted] [redacted] are required.

Sincerely,

Ewart Anderson, P.E.  
Air Permitting Engineer  
Environmental Monitoring Division