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AUG 18 1993 (23)

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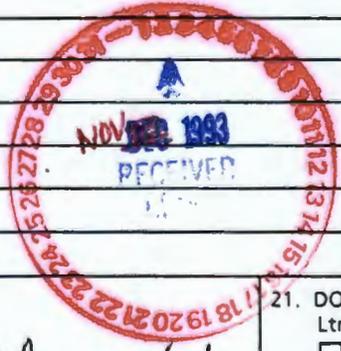
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1,2	1	Cog./Proj. Eng. Mgr.	D. J. Tolleson	7/21/93	N1-30						
		QA									
		Safety									



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B. C. Harmon

Signature

24520/FHADB

Organization/Charge Code

7. Abstract

This manual was prepared to provide detailed information for the operation and maintenance of septic tank soil absorption system 2607EQ. The system is located directly west of the 2753E building and is sized at 14,500 gallons per day. Included are procedures for both normal system operation and off-normal operation. The procedures include type and frequency of required maintenance and corrective actions to return an off-normal condition to normal operation.

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8-18-93

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DATE AUG 18 1993
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OPERATION AND MAINTENANCE MANUAL

for

SEPTIC TANK SYSTEM 2607EQ

Prepared for

Westinghouse Hanford Company

August 1993

For the U.S. Department of Energy
Contract DE-AC06-87RL10900

Prepared by

Kaiser Engineers Hanford Company
Richland, Washington

OMM-200



KAISER ENGINEERS
HANFORD

ORIGINAL

Date Received: 8-18-93 cw

INFORMATION RELEASE REQUEST

Reference: WHC-CM-3-4

Complete for all Types of Release

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Date Release Required 7/20/93				

Title	OPERATION AND MAINTENANCE MANUAL FOR SEPTIC TANK SYSTEM 2607EQ	Unclassified Category	UC- N/A	Impact Level	4
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Transmit to DOE-HQ/Office of Scientific and Technical Information <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Author/Requestor (Printed/Signature) B. C. HARMON <i>B. C. Harmon</i>		
Intended Audience <input type="checkbox"/> Internal <input type="checkbox"/> Sponsor <input checked="" type="checkbox"/> External		
Responsible Manager (Printed/Signature) Date D. J. TOLLEFSON <i>D. J. Tollefson</i> 7/21/93	Date Cancelled	Date Disapproved

APPROVAL:

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7/7/93
Date

Compliance with this document is required to meet Washington Administrative Code (WAC) 246-272 criteria. Any changes to this document must have the concurrence of the Washington State Department of Health and the Kaiser Engineers Hanford Company Project Engineer.

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INTRODUCTION

This manual was prepared to provide detailed information for the operation and maintenance of septic tank soil absorption system 2607EQ. Included are procedures for both normal system operation and off-normal operation. The procedures include type and frequency of required maintenance and corrective actions to return an off-normal condition to normal operation.

SYSTEM DESCRIPTION

The wastewater treatment facility consists of a septic tank, a dosing/pumping chamber, and three pressure distribution soil absorption fields. Each soil absorption field is designed to accept 50% of the maximum daily flow. Two of the three constructed fields are in operation at any one time. The design provides for the future construction of a fourth field if one of the constructed fields fails. The maximum daily design flow is 14,300 gal. The system location is shown on the Site Plan. (See Appendix A.)

SYSTEM OPERATION

A. NORMAL OPERATING CONDITIONS

Raw sewage enters the septic tank and departs through installed effluent filters to the dosing/pumping chamber. Each duplex alternating pump pressurizes one 50% soil absorption field. Flow is directed to the soil absorption fields through the valve vault. Pump control is through timers with float switch over-ride.

Operation Sequence

- Effluent enters the dosing chamber. Simultaneously, the dose clock commences a 6-hour cycle.
- A dose volume of 3,530 gal energizes the dose float switch.
- If the dose clock indicates a 6-hour or greater elapsed time since the last pumping cycle, the primary pump is activated and operates for a period of 3 minutes and 15 seconds. If a pump run timer malfunctions, a low-level float switch will shut off the pump before the pump runs dry.

- Upon completion of the pumping cycle, the pump alternator selects the other pump as the primary pump. The dose clock is reset to zero elapsed time.
- The cycle is repeated.
- The primary pump will not run unless both the dose clock and the dose volume float switch are activated. This ensures a uniform distribution to the two active soil absorption fields.
- The dosing chamber is sized to accept a total effluent volume of 10,850 gal prior to activating an alarm signal. This volume provides storage for peak flow periods between timed dose cycles and a power or pump failure occurrence.

B. OFF-NORMAL OPERATING CONDITIONS

An accumulation of more than 10,850 gal of effluent in the dosing/pumping chamber will activate an alarm signal. The signal is a local audible alarm and magenta strobe light. Continued filling of the dosing/pumping chamber will activate the second pump, which will then pump the contents of the dosing chamber into the soil absorption field.

Two possibilities exist for this off normal event: 1) an extreme peak flow within the 6-hour timed cycle; 2) failure of the primary pump. The second possibility is the most probable. Corrective action should commence as follows:

- Attempt to manually operate the primary pump. Successful pump operation in the manual mode would indicate a malfunction in either the floats, the dose timer, or the pump run clock.
- Failure of the pump to operate in the manual mode would indicate either an absence of power to the pump or a mechanical problem possibly necessitating the removal of the pump for repair.

In the unlikely event of the mechanical failure of both pumps, emergency pumping of the dosing chamber by pumper truck(s) must be initiated immediately and the Manager of Sanitary Systems Maintenance notified. The Manager of Maintenance Integration and

Material Support will be notified to reduce or stop all discharge to minimize pumping costs during repairs (buildings served are listed in Appendix B). Pumper truck disposal of the effluent must then be continued until at least one pump is restored to normal service. It is important to restore both pumps to normal service at the earliest possible time to minimize the overloading of one of the soil absorption fields.

Any off-normal event shall be reported immediately to the Washington State Department of Health, 924 West Sinto, Spokane, WA 99201-2595, telephone (509) 456-2490.

PERIODIC INSPECTION

Regular inspection of key system components is necessary to ensure the system integrity for the system design life. These periodic inspections are recorded on an Inspection Record Form (Figure 1). These inspection points are described as follows.

Pumps

Visual Inspection: Observe the control panel for a seal failure warning. If active, pump service is required. Remove pump and service per manufacturer's direction.

Pump Controls and Electrical Panel

Float Switch Operation: Manually rotate all four float switches to determine the contacts make and break in accordance with their design function. Recover each float switch by reaching into the dosing chamber with a hooked stick and fish each float line to the ground surface.

- The lowest float shuts off the pump(s).
- The second lowest float activates the lead pump on.

Note: The lead pump will only start if "On Delay" timer is active.

- The third lowest switch activates the alarms (both audible and the strobe light).
- The highest float switch activates the "Emergency Pump On" and bypasses the "On Delay" timer.

INSPECTION RECORD FORM

Component/Task	Frequency	Date	Date	Date
Pumps				
Visual Inspection	Monthly			
Pump Controls and Electrical Panel				
Check Float Switch Operation	Annually			
Check Timer Operation	Annually			
Manually Operate Controls	Annually			
Check for Moisture and Corrosion	Annually			
Distribution System and Drainfields				
Inspect Monitor Ports	Monthly			
Inspect Valves for Corrosion	Semi-annually			
Exercise all Valves	Annually			
Switch Fields in Operation	Semi-annually			
Septic Tank				
Check Sludge Level	Annually			
Check Floating Solids Level	Annually			
Clean Effluent Filters	Annually			
Check Inlets and Outlets	Annually			
Cycle Counters				
Record Pump Cycles				
Pump 1	Weekly			
Pump 2	Weekly			
Average Daily Flow	Weekly			

FIGURE 1

Timer Operation: Verify that both timer relays are operating as designed.

- The "Interval On" timer is to be set at 195 seconds. This relay is a Syrelec HR2 series with an "H" time range. Verify that the adjustable settings on the face of the timer are properly set.
- The "On Delay" timer is to be set at 6 hours. This relay is a Syrelec AR2 Series with an "H" time range. Verify that the adjustable settings on the face of the timer are properly set.

Manually Operate Controls: Operate each pump "Off-On-Auto" switch. Determine that the switch functions as designed, i.e., the connection is broken in the "Off" position, the pump actually starts in the "On" position, and the pump circuits are active and waiting for the other controls to start the pump in the "Auto" position.

Check for Moisture and Corrosion: Visually inspect the control panel cabinet for moisture intrusion. Visually observe all wire connection points within the control cabinet for visible corrosion. Report any evidence of moisture intrusion, electrolysis, and/or corrosion, noting specific wire connection points via wire numbers.

Distribution System and Drainfields

Soil Absorption Monitor Ports: Six monitor ports are located in each 50% soil absorption field. Follow Preventive Maintenance Procedures, "Septic Tank Inspection and Drainfield Integrity," paragraph 3.2. (See Appendix C.)

Inspect Valves for Corrosion: The valve vault contains nine valves. These valves are normally only operated semi-annually. Visually observe each valve for evidence of electrolysis, rust, and/or corrosion. Report all evidence of electrolysis, rust, and/or corrosion by valve number attached to each valve.

Note: The valve vault is defined as a confined space. Follow the requirements of WHC-CM-4-3, Standard W-13, Rev 1 and Guide W-13, "Confined Space Entry," for entry into the vault.

Exercise All Valves: The valves are lever-lock quarter-turn butterfly valves. Prior to exercising all valves, lock and tag both pumps off to prevent undue pressure accumulation during the valve exercising. Remove lock and tag when valve exercise is complete.

Switch Fields in Operation: Observe valve position at the outset of this operation. From the operations schedule in Appendix E and/or the operations schedule posted in the valve vault, determine the field cycle in service. Reset valves to the succeeding field cycle.

Septic Tank

Sludge Level and Tank Floating Solids: Follow Preventive Maintenance Procedure, "Septic Tank Inspection and Drainfield Integrity," paragraph 3.1. (See Appendix C.)

Effluent Filters: Check and clean in accordance with manufacturer's recommendation. (See Appendix D.)

Inlets and Outlets: Visually inspect the inlet and outlet device(s) within the septic tank. Ensure that the devices are in place and functioning with no visible clogging or physical damage.

Cycle Counters

Pump Cycles: Record the total number of cycles for each pump on the Inspection Record Form.

Average Daily Flow: Compute the total volume of wastewater processed during the interval to ensure that the daily design capacity has not been exceeded. The following is an example:

C = Total cycles for both pumps

Q = Average daily flow in gallons

V = 3,530 gal discharged per cycle

D = 14,300 gpd (design capacity)

$Q = C \cdot V / \text{number of days between readings}$

Example Problem:

Assume: Pump 1 cycle counter reads 125 and Pump 2 cycle counter reads 127 on a Monday morning.

The following Monday morning, Pump 1 cycle counter reads 137 and Pump 2 cycle counter reads 140.

Therefore, the total cycles for the 7-day period is 25.

$$Q = 25 \cdot 3530 / 7$$

$$Q = 12,607 \text{ gpd}$$

Conclusion: The system is operating within the daily design flow of 14,300 gpd.

Annually, submit the completed Inspection Record Form to the Washington State Department of Health, 924 West Sinto, Spokane, WA 99201-2595.

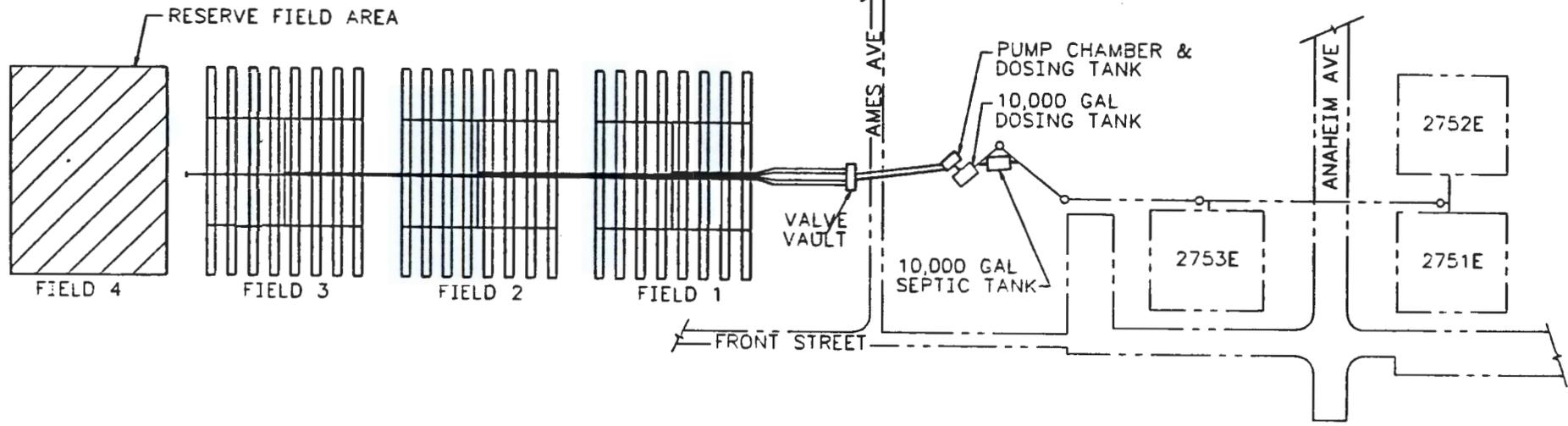
REFERENCES

1. Preventive Maintenance Procedure, "Septic Tank Pumping," prepared by Westinghouse Hanford Company Maintenance Engineering Services, Document No. 1231, Rev. 0, Change A.
2. Preventive Maintenance Procedure, "Septic Tank Inspection," prepared by Westinghouse Hanford Company Maintenance Engineering Services, Document No. 1233, Rev. 0, Change A.

Appendix A
Site Plan



A-2



SEPTIC SYSTEM
2607EQ

Appendix B

Building List

**2751-E
2752-E
2753-E
MO-276
MO-277**

Appendix C

Procedure

**MAINTENANCE ENGINEERING SERVICES
PREVENTIVE MAINTENANCE PROCEDURES
SEPTIC TANK INSPECTION AND DRAINFIELD INTEGRITY**

1.0 PURPOSE

Establish uniform criteria for septic tank inspection in order to determine tank integrity and need for pump out. Drainfield inspection shall reveal its level of performance.

2.0 GENERAL REQUIREMENTS

2.1 GENERAL SAFETY

2.1.1 A septic tank is a confined space. Follow the requirements of WHC-CM-4-3, Standard W-13, Rev 1 and Guide W-13, Confined Space Entry (KEH Procedure IS 10C) for entry into the vault.

2.2 EQUIPMENT REQUIREMENTS

2.2.1 Scum measurement device (see Attachment 1).

2.2.2 Sludge measurement device (see Attachment 2).

2.2.3 Measuring device (tape measure).

2.2.4 Illuminating device (flashlight).

2.3 REFERENCES

2.3.1 Onsite Wastewater Treatment and Disposal Systems, EPA 625/1-80-012.

2.3.3 Manual of Septic Tank Practice, U. S. Dept. of Health Education & Welfare.

3.0 PROCESS

3.1 SEPTIC TANK INSPECTION

- 3.1.1 Remove riser cover adjacent to the compartment divider (see Attachment 3). Depending on the septic tank configuration, there may be more than three risers. Perform visual inspection to determine if PVC effluent outlet (see Attachment 3) exists and is in good condition.
- 3.1.2 Insert scum measurement device with hinge closed, cord pulled taut and the flap facing toward the drainfield into the septic tank approximately 8' from the top of the riser.
- 3.1.3 Release the cord to open the flap and raise the device until resistance is felt from the bottom of the effluent outlet (see Attachment 3). Obtain measurement to the top of the riser and record the value in number 1 on the Septic Tank/Drainfield Evaluation Form (Attachment 4).
- 3.1.4 Turn scum measurement device 180 degrees and raise gently until resistance is felt by the bottom of the scum layer (see Attachment 3). Obtain a measurement to the opening of the septic tank riser and record this value in number 2 of the Septic Tank/Drainfield Evaluation Form.
- 3.1.5 Insert sludge measurement device to the bottom of the septic tank. Hold in place for a few minutes to allow sludge to absorb into the towel.
- 3.1.6 Remove device and measure the depth to which sludge absorbed into the towel. Record this value in number 4 of the Septic Tank/Drainfield Evaluation Form.
- 3.1.7 If the value for number 3 on the Septic Tank/Drainfield Evaluation Form is 3" or less or the value for number 4 is 8" or more then pump septic tank.

3.1.8 Restore site.

3.2 DRAINFIELD INSPECTION

3.2.1 Conduct walkdown to visually inspect field to ensure no saturated areas and locate monitor tubes (see Appendix A).

3.2.2 Remove cap and using a strong light source (sun directed via a mirror works best) observe the presence or absence of moisture at the bottom of the monitor tube. Through the monitor tubes, visually inspect liquid levels in the bed and record condition on the Septic Tank/Drainfield Evaluation Form.

3.2.3 If standing liquid exists, remedial action may be required. Notify Maintenance Engineering for further evaluation and an action plan.

3.3 DISPOSITION

3.3.1 Return Septic Tank/Drainfield Evaluation Form to the Maintenance Manager.

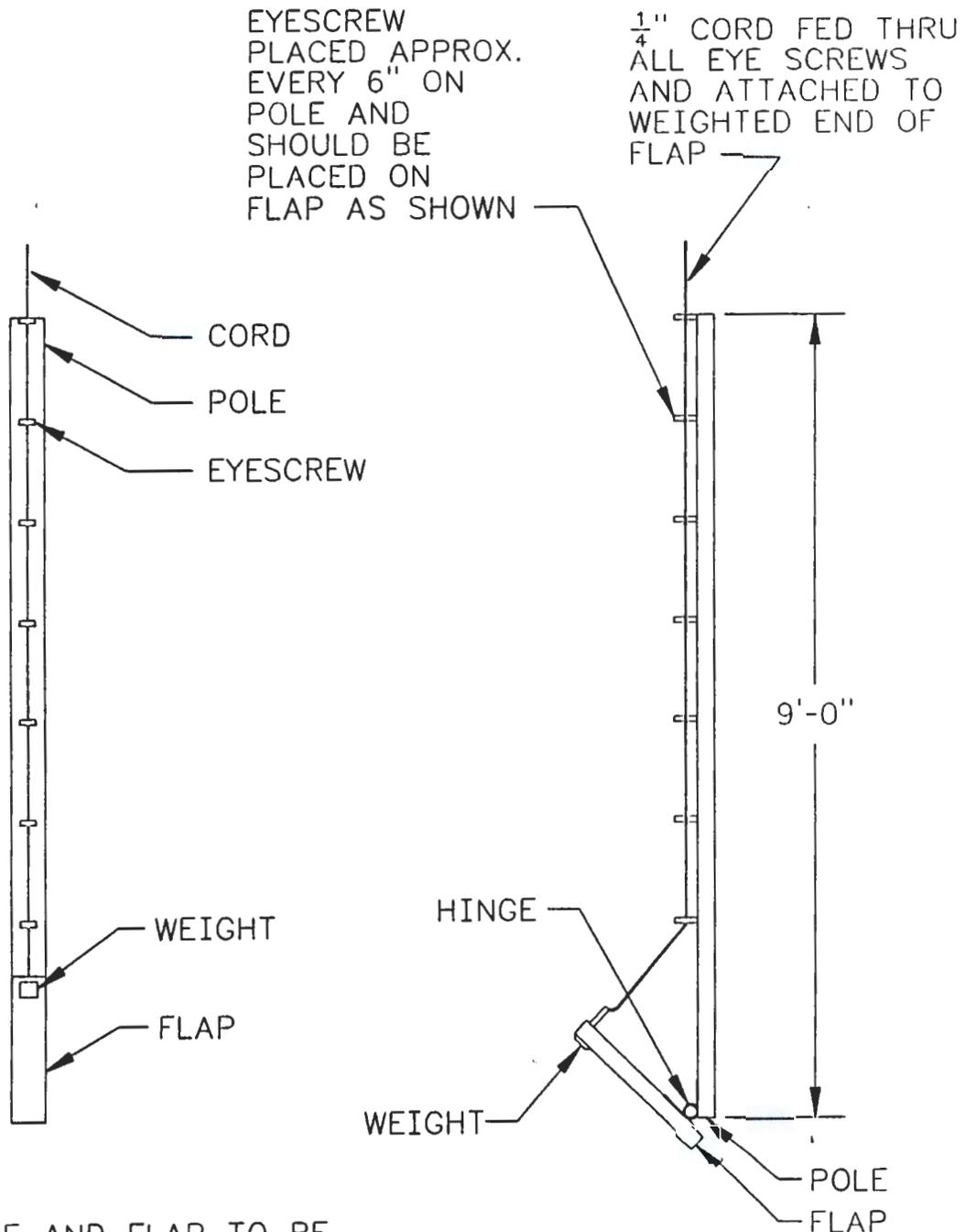
3.3.2 If septic tank pumping is required, maintenance must ensure that backflushing of the septic tank also occurs to remove all sludge and scum.

4.0 RECORDS

Document	QAR/ NQAR	Record Submittal Responsibility	Record Retention Responsibility
Septic Tank/Drainfield Evaluation Form	NQAR	Performing Organization	Environmental Engineering

5.0 ATTACHMENTS

- 1 Scum Measurement Device
- 2 Sludge Measurement Device
- 3 Septic Tank Profile
- 4 Septic Tank/Drainfield Evaluation Form



NOTES:

1. POLE AND FLAP TO BE 1" x 2" WOOD CONSTRUCTION.
2. MEASURING TAPE SHALL BE ATTACHED TO POLE WITH THE ORIGIN AT THE HINGED END.

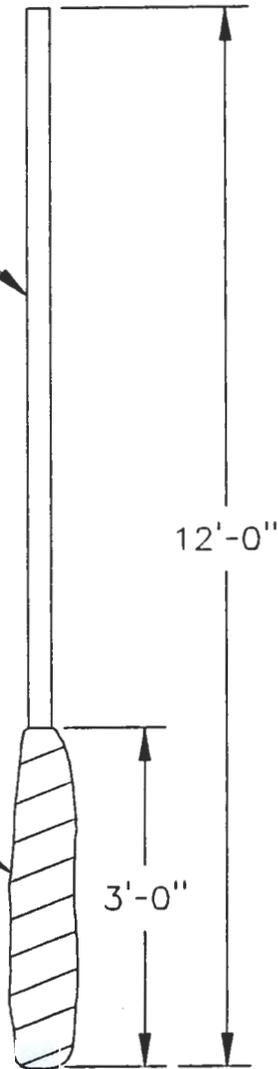
SCUM MEASUREMENT DEVICE

NTS

Attachment 1

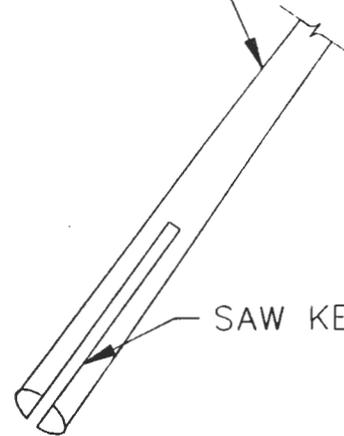
1"Ø OR LARGER
POLE (I.E. CLOSET
ROD)

ROUGH WHITE
TOWEL TO BE
ATTACHED TO
POLE TO A
HEIGHT OF
APPROX. 3'



POLE

SAW KERF



SUGGESTED ATTACHMENT

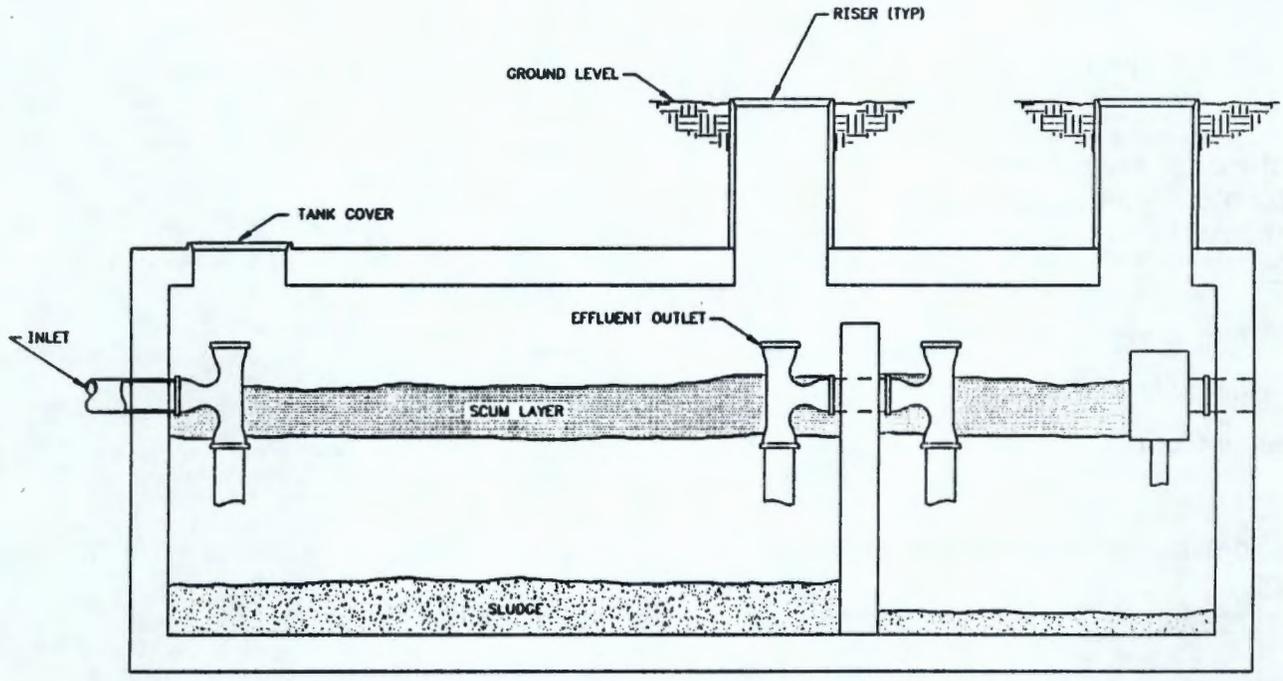
INSERT TOWEL THROUGH
KERF AND WRAP TIGHTLY
AROUND. SECURE LOOSE
END WITH ELECTRICAL
TAPE.

NOTES:

1. TOWEL TO BE REPLACED
AFTER EACH USE.

SLUDGE MEASUREMENT DEVICE
NTS

Attachment 2



SEPTIC TANK PROFILE
NTS

Attachment 3

SEPTIC TANK/DRAINFIELD EVALUATION FORM

Date _____

Location _____

Personnel performing inspection _____

1. Depth to bottom of effluent outlet _____

2. Depth to bottom of scum _____

3. Distance of scum from
bottom of baffle (subtract
#2 from #1) _____

4. Depth of sludge _____

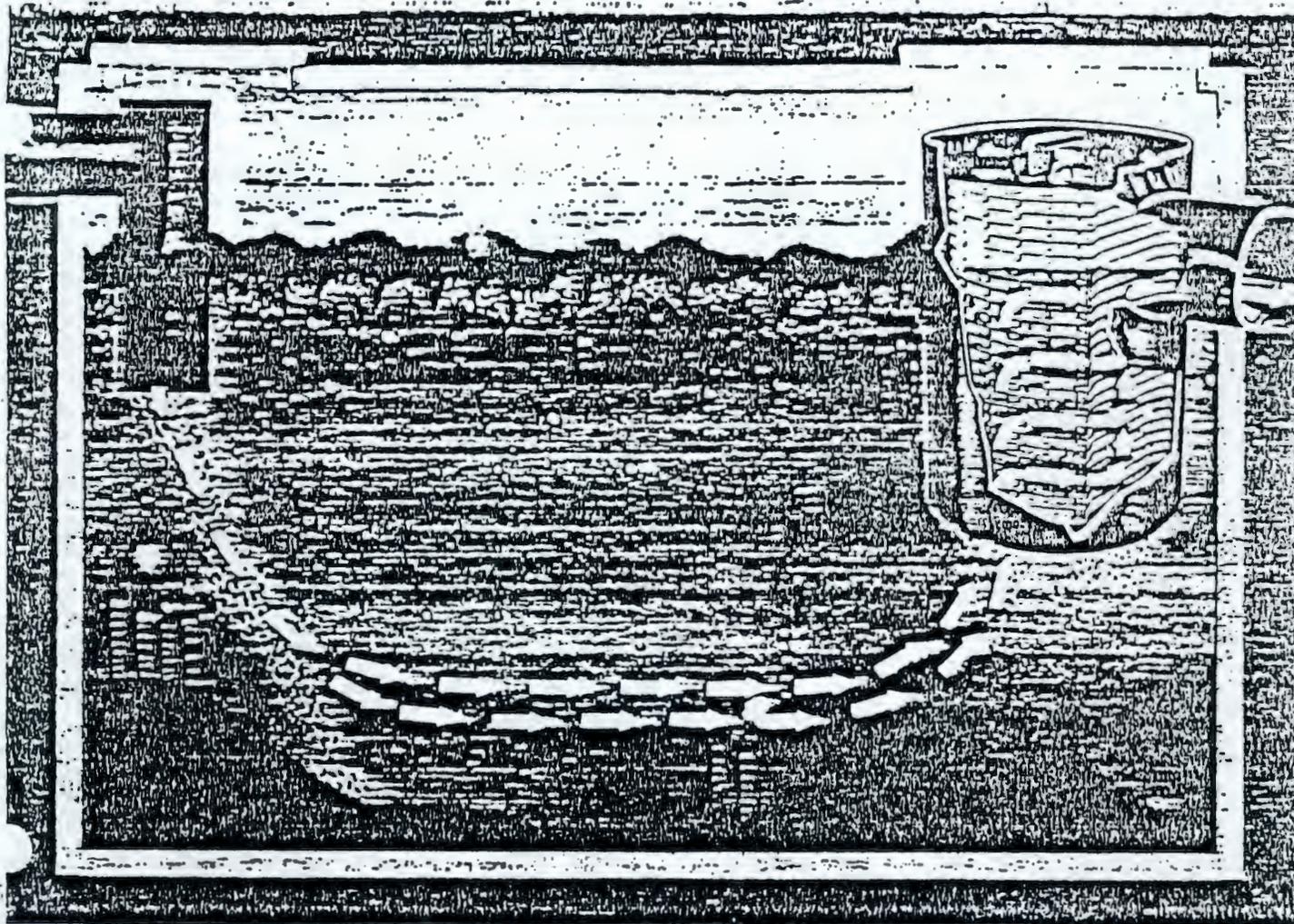
5. Vault integrity _____

6. Liquid depth in monitor tubes

Location

Condition (i.e., dry, moist, liquid depth)

Appendix D
Septic Tank Effluent Filters



Model #A100

Zabel Industries International, Ltd.

Zabel Special Purpose Filter

REMOVES SOLIDS

utilizing over 198 feet of filtering capacity

INCREASES EFFICIENCY

over 198 feet of settling capacity in a 1 foot wide space

PROTECT DRAINAGE FIELDS

solid-reduced effluents drain away faster

UTILIZES FLOW

the Zabel disc dam concept slows internal velocity but increases effectiveness.

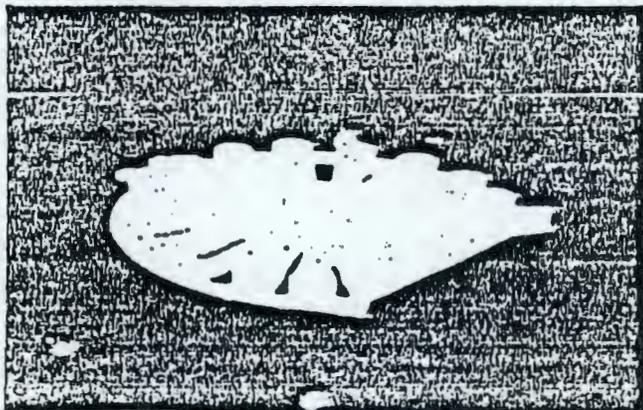
INCREASES EFFLUENT QUALITY

reducing suspended solids in the effluent discharge.

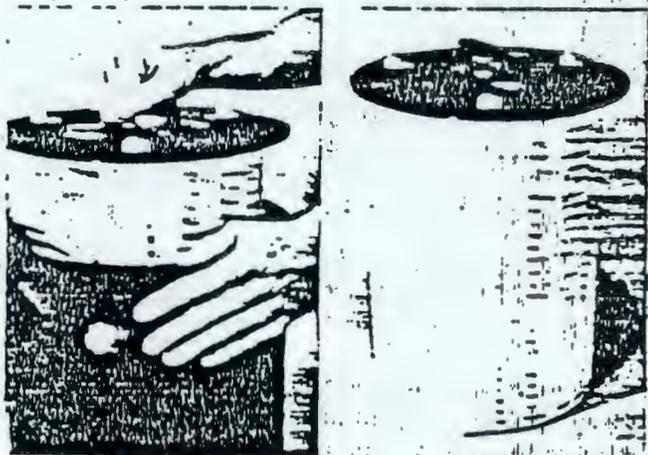
EASY INSTALLATION

just slides in any 4 1/2 inch outlet opening

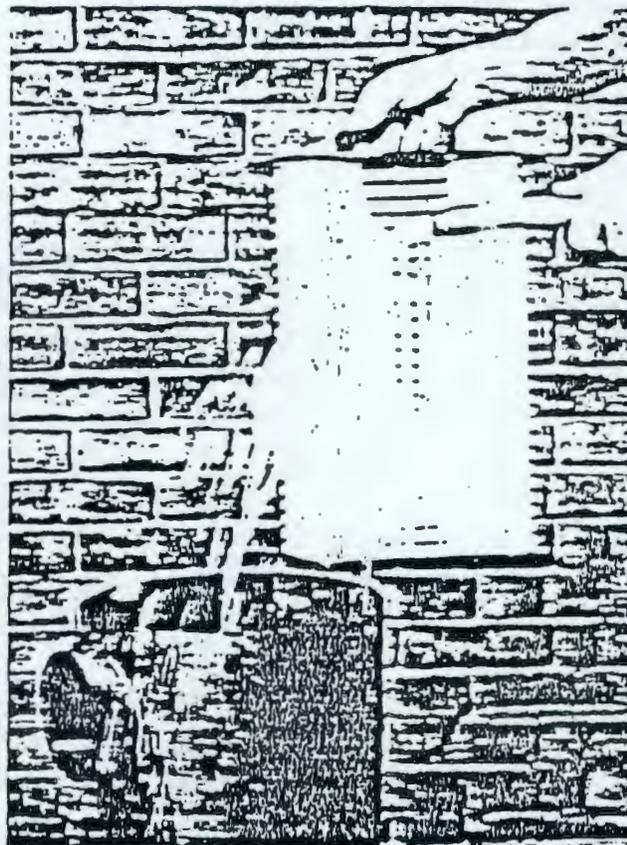
ZABEL DISC DAM FILTER PLATE



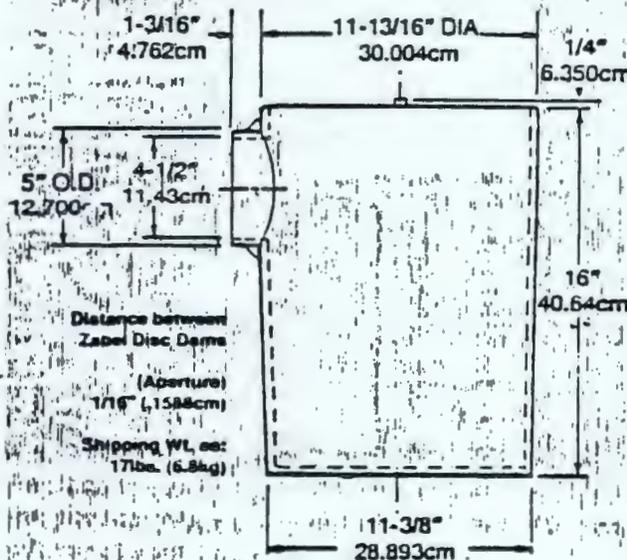
The series of Zabel disc dams are normally set with 1/16" spacing to filter out any biological sludges, water works sludges and light flocculent sludges.



The Zabel disc dam assembly easily slides in to the sturdy case. You can readily see how influent enters thru the open bottom of the case, is filtered as the liquid passes thru the Zabel disc dams, and suspended solids then fall back to the bottom of the septic tank or collection tank through the return holes. The clarified liquid flows on to the next stage (or the drainage field) through the side-wall effluent opening.



Replace the dirty cartridge with a clean one, place the dirty cartridge in a plastic bag and spray off with a hose at your shop.



For More Information
Contact:

**Zabel Industries
International, Ltd.**

3600 Chamberlain Lane, Suite 612 • Louisville, KY 40241
1-502-429-0628 or 1-800-221-5742

Patent No. 4710295

GREASE TRAP INSTALLATION FEATURES

Model A300 = 1/32" Filtration

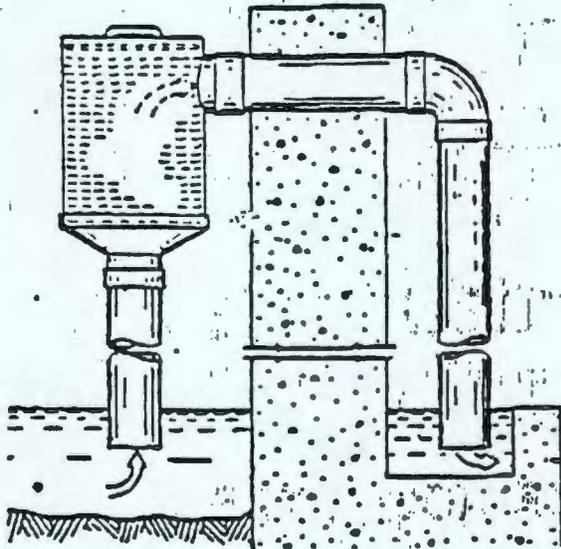
- **PROTECTS THE ENVIRONMENT.**
Prevents grease from escaping into sewer lines.
Helps meet EPA regulations.
Lowers the BOD₅ 45%.
- **IMPROVES TANK EFFICIENCY**
90%+ solids remain in tank.
Slows internal velocity.
Holds nutrients (solids) trying to exit tank.
- **EASY TO MAINTAIN**
Can be cleaned at regular tank inspection.
Removable cartridge can be replaced, pressure washed, or cleaned with degreasing solution.
- **EXTENSION REDUCER OPTION**
Increases effectiveness of the filter in grease traps.
Allows the filter to extend to the cooler liquid.
- **NO MOVING PARTS**
- **LIFETIME WARRANTY**



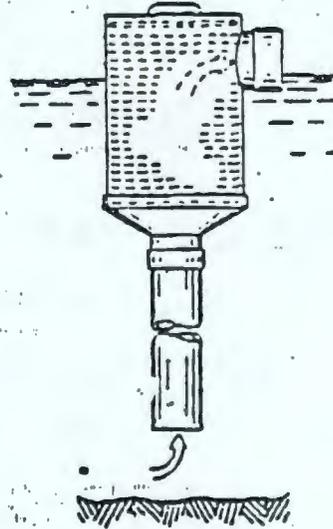
Zabel Industries Inc.

Multi-Purpose Filters

EXTENSION REDUCER OPTION



LAGOON SIPHON



**DEEP GREASE TRAP
& SEPTIC TANK**

BENEFITS:

1. The Extension Reducer allows the filter to easily meet any liquid depth requirement.
2. The Extension Reducer increases the effectiveness of the filter when it is used in grease traps.
3. The Extension Reducer forms an air tight seal, which allows the filter to be used in lagoon siphons.
(The Zabel Filter "Air Tight" lid is also required when the filter is used in the lagoon siphon application)

EASY INSTALLATION:

1. Cement the Extension Reducer onto the bottom of the filter case.
2. Cut the appropriate length of 4" pipe and cement it into the Extension Reducer.
3. Install the filter as usual.

CONTACT:



Zabel Industries Inc.

Multi-Purpose Filters

INSTALLATION AND MAINTENANCE

The Zabel multi-purpose filter is easily installed in a residential septic tank. The installation requires that the bell coupling on the side of the filter case be securely fastened by a solvent weld connection to Schedule 40 PVC plastic pipe which extends through the outlet opening of the septic tank. The filter should be suspended inside the septic tank by the bell housing on the side of the filter case. Butyl rubber mastic can be used around the outlet opening to insure a water tight seal.

The top of the tank must have an opening large enough to permit the removal of the disc dam cartridge for cleaning. A riser that is slightly larger than the opening in the top of the tank should extend to finish grade. The top of the riser should be covered with a heavy concrete cover that will allow access to the filter for cleaning.

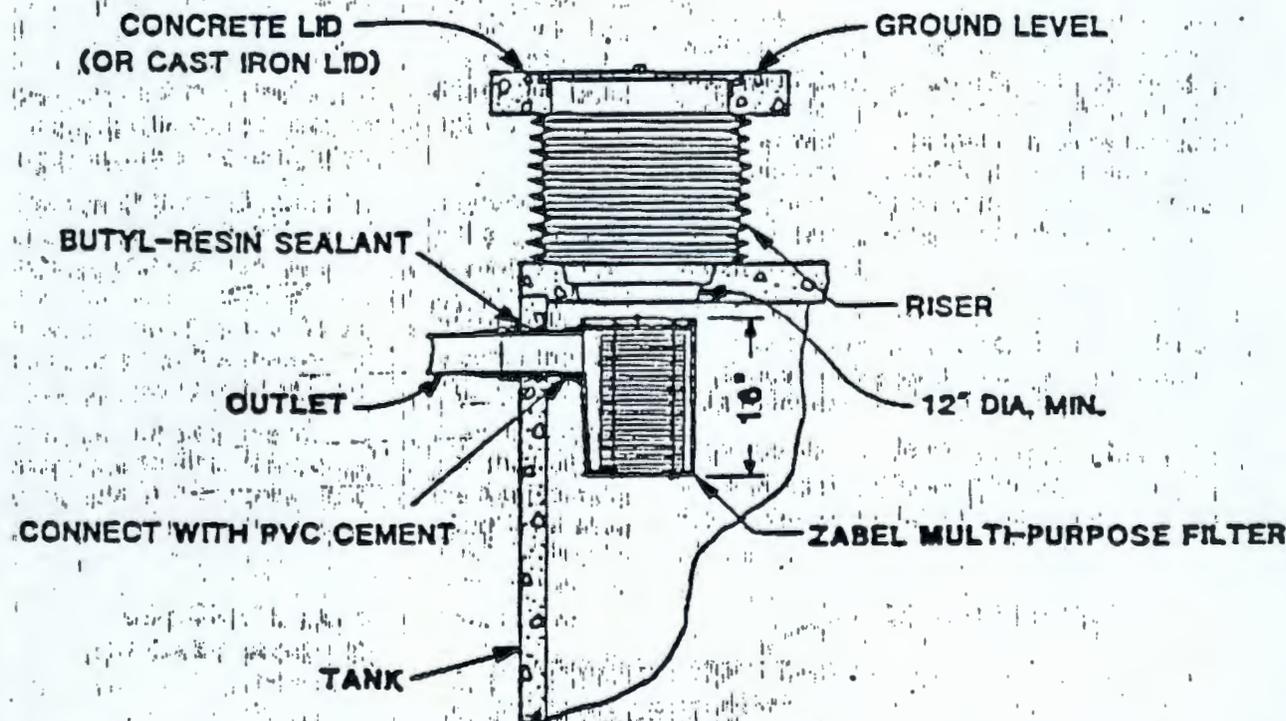
The need for cleaning the filter can vary from a few months to several years depending on the quantity of people in the home. To clean the filter, simply remove the concrete cover at ground level then

reach down and pull sharply on the handle of the lid. The disc dam cartridge will slide out of the case. The cartridge should be placed in a container for cleaning.

Cleaning can be accomplished in a number of ways: (1) rinse the filter with a garden hose that has a spray nozzle, (2) use a high pressure spray similar to one found at a car wash (3) the filter is held together with 3 bolts that can be removed to allow each disc dam to be cleaned individually. (Note: If heavy grease has been trapped by the filter it may be necessary to scrape the grease from the individual disc dams).

In handling any waste products it is advisable to wear face and hand protection. It is also necessary to dispose of the semi solid waste materials in a safe manner.

After the filter is cleaned, reassemble and replace the disc dam cartridge in the filter case. The cleaning process is complete and it takes only minutes!



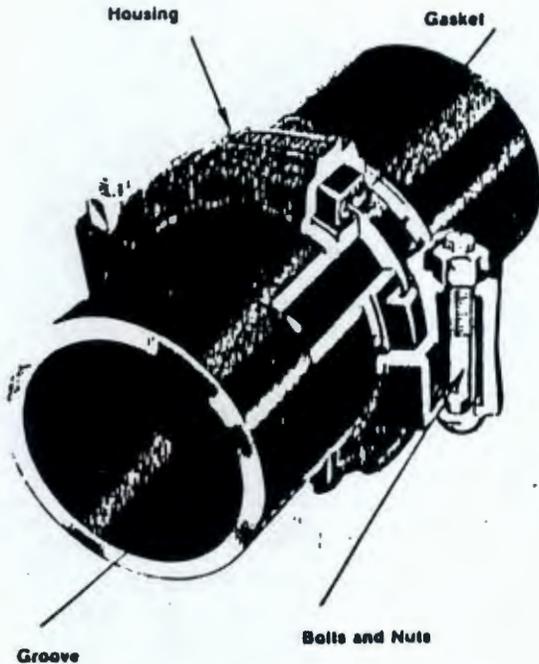
Appendix E
Valve Vault

GROOVED PIPING SYSTEM

Victaulic®

The only system that provides the option of rigidity or flexibility

FLEXIBLE



The Victaulic® grooved piping system is the most versatile, economical and reliable piping system available. It is up to three times faster to install than welding, easier and more reliable than threading or flanging, resulting in lowest total installed cost.

The system is designed for roll grooved or cut grooved standard pipe or roll grooved lightwall pipe. Pipe end preparation is fast and easy either in the shop or on the job-site with the variety of Victaulic grooving tools available.

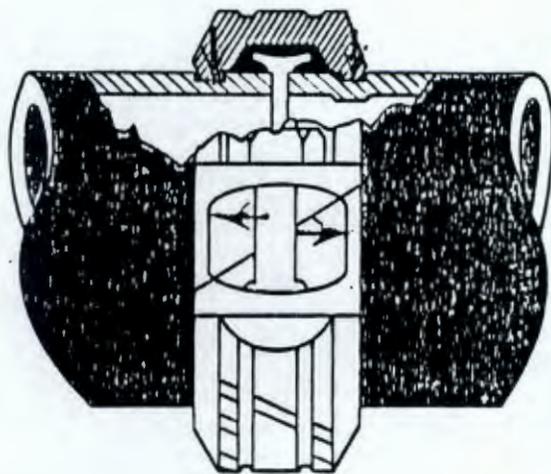
In addition to speed and ease of assembly, the Victaulic system offers varied mechanical benefits to the designer, installer and owner. With the introduction of Zero-Flex® and FireLock™ rigid couplings, the option of flexibility or rigidity adds to the design versatility. Flexible and rigid couplings can be incorporated as needed in any system to take full advantage of the characteristics of each.

Flexible

Flexible couplings (Styles 77, 75, 78, 791, 794, 750, 72 and others) provide allowance for controlled pipe movement—expansion/contraction/deflection—to absorb movement from thermal changes, settling or seismic action, as well as dampen noise and vibration.

Rigid

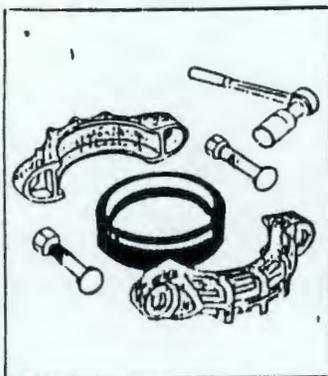
Rigid couplings (Styles 07, 005, 307, HP-70, 741 and others) create a rigid joint, useful for risers, mechanical rooms and other areas where flexibility is not desired. Zero-Flex Style 07 and FireLock Style 005 couplings are designed to provide rigidity to permit hanging to ANSI B31.1 Power Piping Code, ANSI B31.9 Building Services Piping Code and NFPA 13 Sprinkler Systems.



Vibration Attenuation

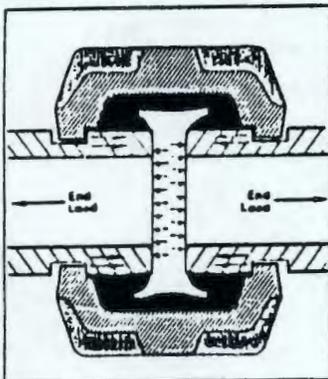
Victaulic couplings offer superior vibration attenuation characteristics to both flexible metal and elastomeric flexible arch-type connectors. Independent vibration testing data (request TS-5000 Report) verifies that three Victaulic couplings in close proximity to a vibration source (pump, equipment, etc.) provide superior vibration attenuation in piping systems.

Both type couplings offer installed cost savings from 10 to 30% and higher, plus the convenience of a union at every joint and the proven pressure-responsive "C"-shaped Victaulic gasket. Both type products fit into standard roll or cut grooved pipe and provide the security of all circumferential engagement of the coupling housing into the groove for high pressure and end load service.



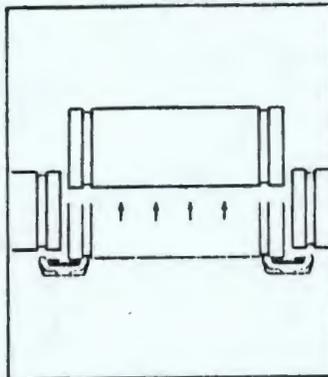
Installed cost savings from 10% to 30%

No special skills required
 • Minimal equipment investment • Fast assembly in tight places • Clean system . . . no pipe dope or welding slag to contaminate pipes • Costs are more predictable . . . estimates more accurate



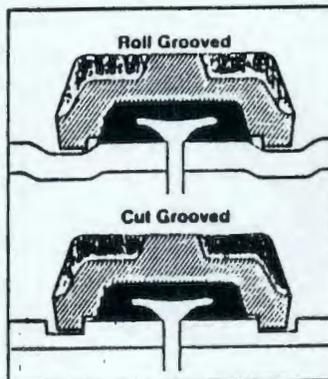
Proven joint reliability

Full circumferential engagement of housing into groove provides end pull strength
 • Couplings available for working pressures to 2,500 psi (17,235 kPa) . . . vacuum service to 29.9" Hg



Each joint is a union

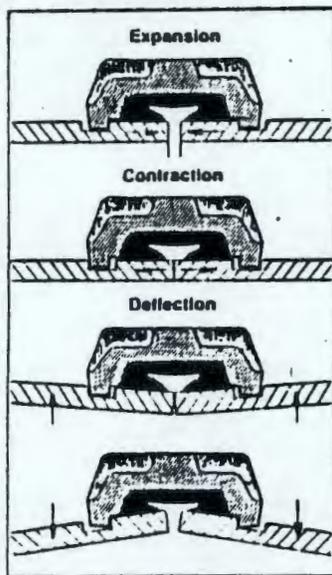
Removal of two couplings permits removal of pipe section for cleaning or servicing • Easy future addition, change or renovation of pipe to distribute internal wear from abrasives or slurries • Always depressurize and drain systems before removing couplings



For roll or cut grooved pipe

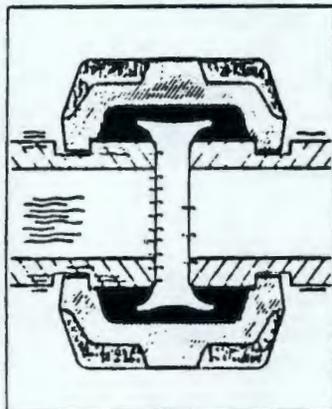
Victaulic tools permit roll grooving standard steel pipe up to 24" (600 mm) in 0.375" (9.5 mm) wall thicknesses
 • Couplings fit either roll or cut grooved pipe • Roll grooving permits use on pipe as thin as Schedule 5 • Pipe of different wall thickness and material can be connected directly and intermixed

FLEXIBILITY



Provides expansion/contraction/deflection

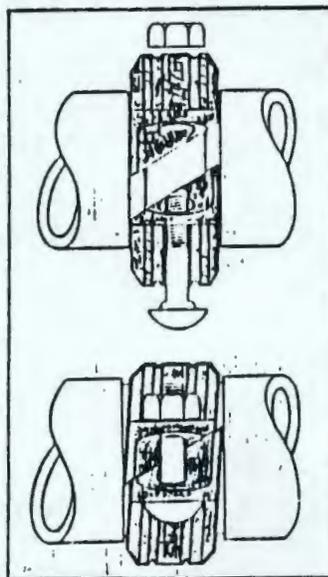
Up to 0.250" (6.35 mm) linear movement at each joint • Minimizes or eliminates costly expansion joints and loops (request TS-2000) • Flexible joints provide virtually a stress-free system (request TS-7000) • Reduces or eliminates stresses from settlement of buried pipe • Absorbs temporary stresses induced by seismic tremors (request TS-4000)



Minimizes noise and vibration transmission

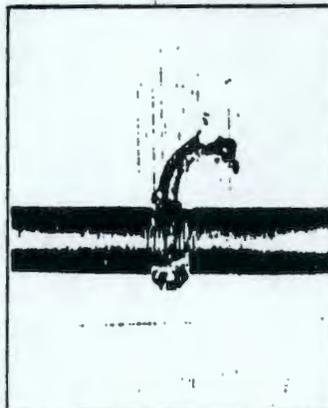
Isolates noise and vibration
 • Resilient gasket helps absorb noise and vibration
 • Permits elimination of noise suppression devices
 • Provides superior vibration attenuation better than flexible metal or elastomeric arch-type connectors. (request TS-5000)

RIGIDITY



Provides weld-like rigidity where needed

Zero-Flex Style 07 and FireLock Style 005 unique angle-pad design adjusts to standard pipe tolerances • Provides positive clamping of the pipe to resist flexural and torsional loads • Wider key section fills more of groove area.
 Provides rigidity for valve connections, machinery rooms, fire mains, long straight runs • Support and hanging requirements correspond to ANSI B31.1 Power Piping Code, ANSI B31.9 Building Services Code and NFPA 13 Sprinkler Systems



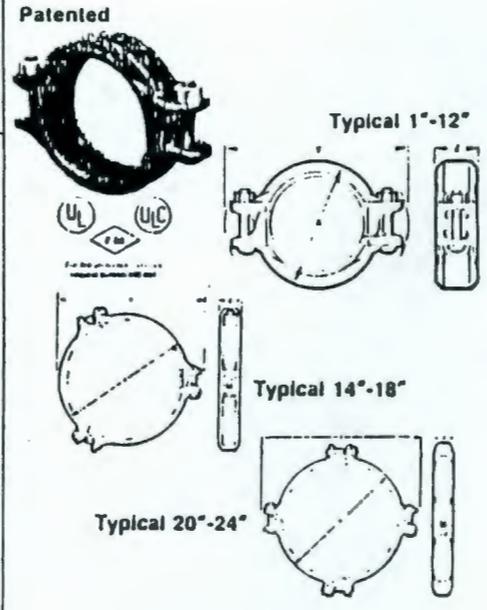
Easy swing-over assembly

Bolt-pad design permits assembly by removing one nut/bolt and scissoring housing over gasket • Reduces components to handle during assembly • Speeds and eases installation

STYLE 07 ZERO-FLEX® COUPLING

WHC-SD-L092-OMM-001, Rev. 0

Nominal Size Inches	Pipe O.D. Inches	Max. Work Press. PSI	Max. End Load Lbs.*	Allow. Pipe End † Sep. in.	Bolt/Nut No.-Size Inches	Coupling Dimensions			Approx. Weight Each Lbs.
						X	Y	Z	
						Inches			
mm	mm	MPa	kg	mm			mm	kg	
1 25	1.315 33	750 5175	650 2865	0.05 1.2	2-3/8 x 2	2.45 62	4.13 105	1.88 48	1.6 0.7
1 1/2 40	1.900 48	750 5175	2,125 9455	0.05 1.2	2-3/8 x 2	2.94 75	4.81 122	1.88 48	1.6 0.7
2 50	2.375 60	750 5175	3,320 14770	0.07 1.7	2-1/2 x 2 1/2	3.19 81	5.44 141	1.88 48	2.3 1.0
2 1/2 65	2.875 73	750 5175	4,870 21670	0.07 1.7	2-1/2 x 2 3/4	3.88 98	6.13 156	1.88 48	2.8 1.3
3 80	3.500 89	750 5175	7,215 32165	0.07 1.7	2-1/2 x 2 1/2	4.56 116	6.81 173	1.88 48	3.1 1.4
4 100	4.500 114	750 5175	11,925 53065	0.16 4.1	2-1/2 x 2 3/4	5.81 148	8.25 210	2.06 52	4.8 2.2
5 125	5.563 141	750 5175	18,230 81220	0.16 4.1	2-3/4 x 3 3/4	7.06 179	9.75 248	2.06 52	7.1 3.2
6 150	6.625 168	700 4825	24,130 107320	0.16 4.1	2-3/4 x 3 3/4	8.00 203	10.75 273	2.06 52	8.7 3.9
6 1/2 O.D. 165	6.500 165	700 4825	23,225 103305	0.16 4.1	2-3/4 x 3 3/4	8.00 203	10.75 273	2.06 52	7.2 3.2
8 200	8.625 219	600 4130	35,055 155205	0.19 4.8	2-3/4 x 4 1/4	10.25 260	13.50 343	2.50 61	14.9 6.8
10 250	10.750 273	500 3450	45,380 201945	0.13 3.3	2-1/2 x 6 1/2	12.88 327	16.75 426	2.56 65	25.0 11.3
12 300	12.750 324	400 2750	51,070 227260	0.13 3.3	2-1/2 x 6 1/2	14.88 378	18.50 470	2.56 65	28.2 12.8
14 350	14.000 356	300 2065	46,180 205400	0.125 3.2	3-1/8 x 5	16.19 411	19.75 502	2.94 75	32.8 14.9
16 400	16.000 406	300 2065	60,320 268125	0.125 3.2	3-1/8 x 5	18.38 467	21.75 553	2.94 75	41.2 18.7
18 450	18.000 457	300 2065	76,340 339715	0.125 3.2	3-1/8 x 5	20.69 526	23.88 606	3.06 78	54.2 24.6
20 500	20.000 508	300 2065	94,000 418000	0.125 3.2	4-1 x 5	23.00 584	27.38 695	3.06 78	67.2 30.5
24 600	24.000 610	250 1725	113,000 505000	0.218 5.5	4-1 x 5	27.13 693	31.50 801	3.13 79	76.2 34.6

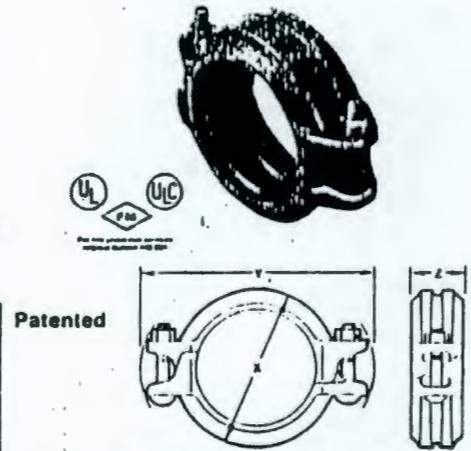


Zero-Flex® Couplings are the new rigid alternative for grooved piping systems. The unique patented angled-pad design adjusts to standard pipe and groove tolerances. This provides positive clamping of the pipe for rigidity. Zero-Flex Couplings are available in 1"-24" (25-600 mm) sizes. Zero-Flex Couplings use standard Victaulic Style 77-75-78 gaskets or Flush-Seal® gaskets. Request VS-007 for submittal.

* Refer to Notes page 22. † For field installation only. Zero-Flex Style 07 couplings are essentially rigid and do not permit expansion/contraction.

STYLE 005 FIRELOCK™ RIGID COUPLING FOR FIRE PROTECTION SERVICES

Nominal Size Inches	Pipe O.D. Inches	Max. Work Press. PSI*	Max. End Load Lbs.	Allow. Pipe End † Sep. in.	Bolt/Nut No.-Size Inches	Coupling Dimensions			Approx. Weight Each Lbs.
						X	Y	Z	
						Inches			
mm	mm	MPa	kg	mm			mm	kg	
2 50	2.375 60	175 1200	775 3450	0.07 1.7	3/8 x 2 1/2	3.41 87	4.50 114	1.86 47	1.6 0.7
2 1/2 65	2.875 73	175 1200	1,135 5050	0.07 1.7	3/8 x 2 1/2	3.91 99	5.06 129	1.86 47	1.9 0.9
3 80	3.500 89	175 1200	1,685 7450	0.07 1.7	3/8 x 2 1/2	4.54 115	5.68 144	1.86 47	2.1 1.0
4 100	4.500 114	175 1200	2,780 12350	0.16 4.1	3/8 x 2 1/2	5.71 145	6.90 175	2.07 51	3.1 1.4
5 125	5.563 141	175 1200	4,250 18970	0.16 4.1	1/2 x 2 3/4	6.85 174	8.66 220	2.07 51	4.5 2.0
6 150	6.625 168	175 1200	6,030 26810	0.16 4.1	1/2 x 2 3/4	7.91 201	9.72 247	2.07 51	5.0 2.3



FireLock™ Style 005 unique, patented angle-pad design allows the housings to offset while clamping the grooves. By permitting the housings to slide on the angled bolt pads rigidity is obtained. Style 005 is supplied with a Grade E (Type A) EPDM fire protection services gasket. Provides rigidity for valve connections, fire mains, long straight runs. Support and hanging requirements correspond to NFPA 13 Sprinkler Systems. Request VS-005 for submittal.

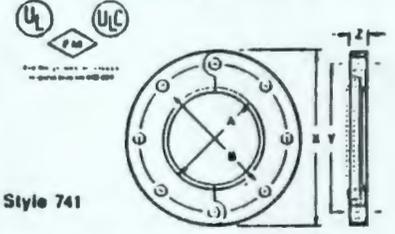
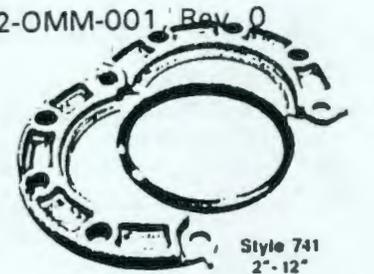
* Refer to Notes page 22. † For field installation only. FireLock Style 005 couplings are essentially rigid and do not permit expansion/contraction.

VIC-FLANGE ADAPTERS STYLE 741

Sizes 2" through 12"
ANSI Class 125 and 150 Flanges

Nominal Size Inches mm	Pipe O.D. Inches mm	Max. Work Press. PSI kPa	Max. End Load Lbs.* N	No. Bolts Req'd.	Bolt Size Inches	Sealing Surface		Coupling Dimensions				Approx. Weight Each Lbs. kg
						"A" Max.	"B" Min.	W	X	Y	Z	
						Inches millimeters		Inches millimeters				
2	2.375	300	1,330	4	3/8 x 2 3/4	2.38	3.41	6.75	6.00	4.75	0.75	3.1
50	60	2065	5920	4	3/8 x 2 3/4	60	87	172	152	121	19	1.4
2 1/2	2.875	300	1,950	4	3/8 x 3	2.88	3.91	7.88	7.00	5.50	0.88	4.7
65	73	2065	6600	4	3/8 x 3	73	99	200	178	140	22	2.1
3	3.500	300	2,885	4	3/8 x 3	3.50	4.53	8.44	7.50	6.00	0.94	5.4
80	89	2065	12610	4	3/8 x 3	89	115	214	191	152	24	2.4
4	4.500	300	4,770	8	3/8 x 3	4.50	5.53	9.94	9.00	7.50	0.94	7.7
100	114	2065	21225	8	3/8 x 3	114	141	252	229	191	24	3.5
5	5.563	300	7,290	8	3/4 x 3 1/2	5.56	6.71	11.00	10.00	8.50	0.94	9.3
125	140	2065	32110	8	3/4 x 3 1/2	140	171	279	254	216	21	1.2
6	6.625	300	10,350	8	3/4 x 3 1/2	6.63	7.78	12.00	11.00	9.50	1.00	10.3
150	168	2065	46640	8	3/4 x 3 1/2	168	198	305	279	241	25	4.7
6 1/2 O.D.	6.500	300	9,960	8	3/4 x 3 1/2	6.50	7.66	+	11.00	9.50	1.00	10.0
150	165	2065	44320	8	3/4 x 3 1/2	165	195	+	279	241	29	1.5
8	8.625	300	17,500	8	3/4 x 3 1/2	8.63	9.94	14.63	13.50	11.75	1.13	16.6
200	219	2065	77875	8	3/4 x 3 1/2	219	252	372	343	298	29	7.5
10	10.750	300	27,215	12	1/2 x 4	10.75	12.31	17.19	16.00	14.25	1.19	24.2
250	273	2065	121110	12	1/2 x 4	273	313	437	406	362	30	11.0
12	12.750	300	30,285	12	1/2 x 4	12.75	14.31	20.25	19.00	17.00	1.25	46.8
300	324	2065	140270	12	1/2 x 4	324	364	514	483	412	32	21.2

*"W" dimension does not apply. *Refer to Notes, page 22.
NOTE: Style 741 Vic-Flange adapters provide rigid joints when used on pipe with standard cut or roll groove dimensions and consequently allow no linear or angular movement at the joint.
NOTE: When used with Victaulic Style 700 butterfly valves, plastic pipe or lightweight metallic pipe, small teeth in I.D. of key section should be removed and may only be used on one side of the valve.



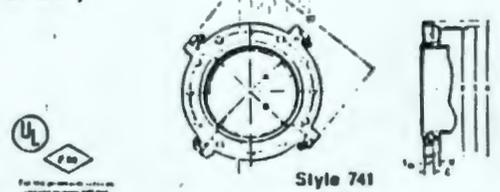
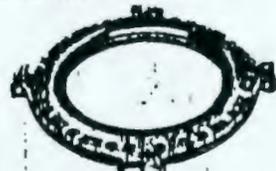
Note: Gray area of mating face must be free from gouges, undulations or deformities of any type for effective sealing.
Vic-Flange® flange-to-groove adapters permit direct connection of flanged components into a grooved system. Bolt pattern for the Style 741 conforms to ANSI Class 125 and 150 standards. Request VS-741 for submittal.

STYLE 741 Sizes 14" through 24" ANSI Class 125 and 150 Flanges

Nominal Size Inches mm	Pipe O.D. Inches mm	Max. Work Press. PSI kPa	Max. End Load Lbs.* N	Assembly Bolts†		Draw Bolts‡		Sealing Surface		Coupling Dimensions						Approx. Weight Each Lbs. kg
				No. Bolts Req'd. †	Size Inches mm	No. Bolts	Size Inches mm	"A" Max.	"B" Min.	T	V	W	X	Y	Z	
				Inches millimeters		Inches millimeters		Inches millimeters								
14	14.000	300	46,180	12	1 x 4 1/2	4	3/8 x 3 1/2	14.00	16.39	19.50	0.88	24.50	21.00	18.75	1.44	75.0
350	356	2065	205500	12	1 x 4 1/2	4	3/8 x 3 1/2	356	416	493	22	622	533	476	37	34.0
16	16.000	300	60,300	18	1 x 4 1/2	4	3/8 x 3 1/2	16.00	18.39	21.75	0.85	27.12	23.50	21.25	1.44	90.0
400	406	2065	268335	18	1 x 4 1/2	4	3/8 x 3 1/2	406	467	552	22	689	597	530	47	40.0
18	18.000	300	76,340	16	1 1/8 x 4 3/4	4	3/8 x 4 1/4	18.00	20.00	22.50	1.04	29.00	25.50	22.75	1.56	100.0
450	457	2065	339700	16	1 1/8 x 4 3/4	4	3/8 x 4 1/4	457	508	572	26	737	648	578	50	12.3
20	20.000	300	94,250	20	1 1/8 x 5 1/4	4	3/8 x 4 1/4	20.00	22.50	25.25	1.17	31.50	27.50	26.00	1.69	120.0
500	508	2065	419100	20	1 1/8 x 5 1/4	4	3/8 x 4 1/4	508	572	641	30	803	699	635	57	21.3
24	24.000	300	135,700	20	1 1/8 x 5 1/4	4	3/8 x 4 1/4	24.00	27.75	29.25	1.38	36.00	32.00	29.50	1.94	160.0
600	610	2065	611000	20	1 1/8 x 5 1/4	4	3/8 x 4 1/4	610	705	743	35	913	813	732	55	27.0

*Refer to Notes page 22.
†Total bolts required, to be supplied by installer. Bolt sizes for conventional flange-to-flange connection. Longer bolts required when Vic-Flange utilized with water-type valves.
‡Draw Bolts supplied with 14"-24" Vic-Flange adapters.

- VIC-FLANGE NOTES:**
- The Style 741 (2"-12") design incorporates small teeth inside the key shoulder I.D. to prevent rotation. These teeth should be removed when Vic-Flange is utilized with a Victaulic Series 700 grooved end butterfly valve, Schedule 5 pipe or plastic pipe. Vic-Flange Style 741 may only be used on one side of Victaulic Series 700 butterfly valve, (sizes 2"-4") fitted with standard or latch-lock handles.
 - Vic-Flange must be assembled so it does not interfere with handle operation. Because of the outside flange dimension, Vic-Flange should not be used within 90° of one another on a standard fitting. When water or lug-type valves are used adjoining a Victaulic fitting, check disc dimensions to assure proper clearance.
 - Vic-Flange adapters should not be used as anchor points for tie-rods across nonrestrained joints. Mating rubber faced flanges, valves, etc., require the use of a Vic-Flange washer.
 - Area A-B noted in the above drawing must be free from gouges, undulations or deformities of any type for effective sealing.
 - Vic-Flange gaskets must always be assembled with the color coded lip on the pipe and the other lip facing the mating flange.
 - Flange Washers: Vic-Flange adapters require a smooth hard surface at the mating flange face for effective sealing. Some applications for which the Vic-Flange is otherwise well suited do not provide an adequate mating surface. In such cases, it is recommended that a metal Flange Washer be inserted between the Vic-Flange and the mating flange to provide the necessary sealing surface. Typical applications where a Flange Washer should be used are:
 - When mating to a serrated flange: a flange gasket should be used adjacent to the serrated flange and then the Flange Washer is inserted between the Vic-Flange and the flange gasket.
 - When mating to a water valve: where typical valves are rubber lined and partially rubber faced (smooth or not), the Flange Washer is placed between the valve and the Vic-Flange.
 - When mating a rubber faced flange: the Flange Washer is placed between the Vic-Flanges and the rubber faced flange.
 - When mating AWWA cast flanges to IPS flanges: the Flange Washer is placed between two Vic-Flanges. If one flange is not a Vic-Flange (e.g., flanged valve), then a flange gasket must be placed adjacent to that flange and the Flange Washer inserted between the flange gasket and the Vic-Flange.
 - When mating to components (valves, strainers, etc.) where the component flange face has an insert: follow the same arrangement as in Application 1.





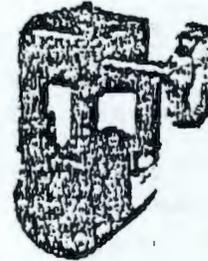
SUBMITTAL
Victaulic®
Vic-300
Butterfly Valves

PRODUCT DESCRIPTION

Victaulic Vic-300 butterfly valves are designed to provide bubble-tight shut-off to 300 psi. The valve features a double-seal disc design with a resilient elastomeric coating bonded to the ductile iron disc core. The disc drive hub is integrally cast as part of the disc and can be actuated by a manual lever or gear, pneumatic, electric or hydraulic operators.

The smooth inner body and narrow disc profile provide excellent flow characteristics. This, combined with the polyphenylene sulfide body coating provides low torque operation allowing reduced actuator sizing. A variety of body coatings and disc coatings are available to cover a wide variety of services.

Sealing and positive shut-off are accomplished by a double ring seal which is integrally molded on the disc. The disc coating also acts as the primary seal between the disc, the drive hub and the hub bearing. O-rings on the upper bearing and lower trunnion provide thread sealing.



4" with Gear Operator



6" with Lever Lock Handle



3" with 2 Position Handle



2" with Lever Lock Infinite Handle

MATERIAL SPECIFICATIONS

- Body: Ductile Iron to ASTM A-538
- Body Coating: PPS—Polyphenylene sulfide blend
- Optional: Epoxy
- Disc: Ductile Iron to ASTM A-538
- Disc Coating: (specify choice)
- Grade "E" EPDM
- EPDM (Green color code). Temperature range for continuous service up to +230°F. Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. **NOT RECOMMENDED FOR PETROLEUM SERVICES.**
- Grade "T" Nitrile
- Nitrile (Orange color code). Temperature range of continuous service up to +180°F. Recommended for petroleum products (except gasoline), mineral and vegetable oils to a maximum of +150°F. **NOT RECOMMENDED FOR WATER SERVICE OVER AMBIENT CONDITIONS.**

- Optional: Grade "O" Viton Fluoroelastomer (Blue color code). Temperature range for continuous service up to +300°F. Recommended for many oxidizing acids, petroleum oils, halogenated hydrocarbons, lubricants, hydraulic fluids, organic liquids and air with hydrocarbons to +300°F.

*Services listed are General Service Recommendations only. It should be noted that there are services for which these liners or gaskets are not recommended. Reference should always be made to the latest Victaulic Selection Guide for specific liner or gasket service recommendations and for a listing of services which are not recommended.

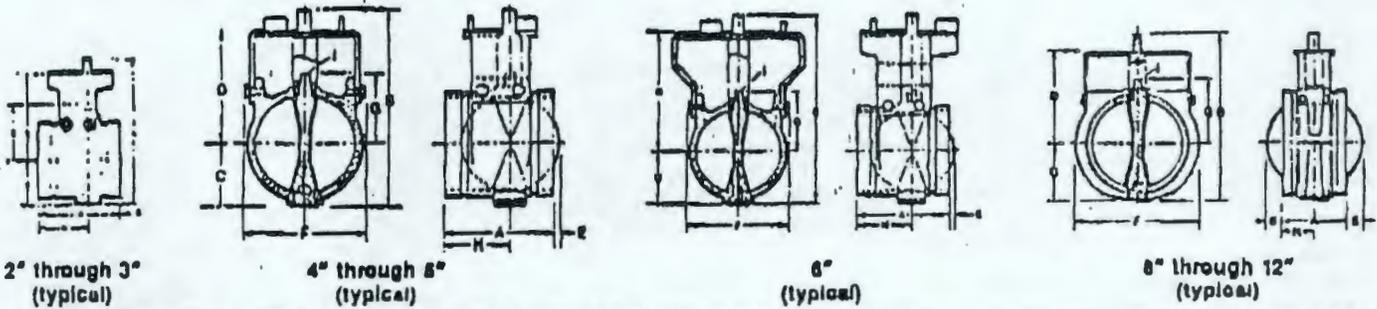
NOTE: When connecting 2, 2½ & 3" butterfly valves to Style 341 or Style 741 Vic-Flange® adapters, please contact Victaulic.
 Drive Hub Adapter: Hot rolled steel—black enamel coated
 Upper Bearing/Lower Trunnion Seals: same as Disc Coating

- Upper Bearing/Lower Trunnion: Bronze alloy
- Optional: Type 316 stainless steel
- Operator Bracket: Hot rolled steel—black enamel coated
- Bracket Bolts/Washers: Cold rolled steel—zinc plated
- Operator: (specify choice)
- 2-3" Two-position detent manual handle: Hot rolled steel—black enamel coated
- Manual lever lock/ininitely variable handle: Ductile Iron to ASTM A-538 (other parts cold rolled steel, zinc electroplated)
- Optional: Memory stop
- Manual gear operator with handwheel
- Optional: Memory stop
- Optional: Chainwheel
- Electric actuator #
- Pneumatic actuator #
- # Contact Victaulic for dimensions and other details.

This product shall be manufactured by Victaulic Company of America for the job listed below. All products to be installed in accordance with current Victaulic installation/assembly instructions. Victaulic reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligations.

JOB/OWNER	CONTRACTOR	ENGINEER
System No. _____	Submitted By _____	Spec. Sect. _____ Para. _____
Location _____	Date _____	Approved _____
		Date _____

DIMENSIONS

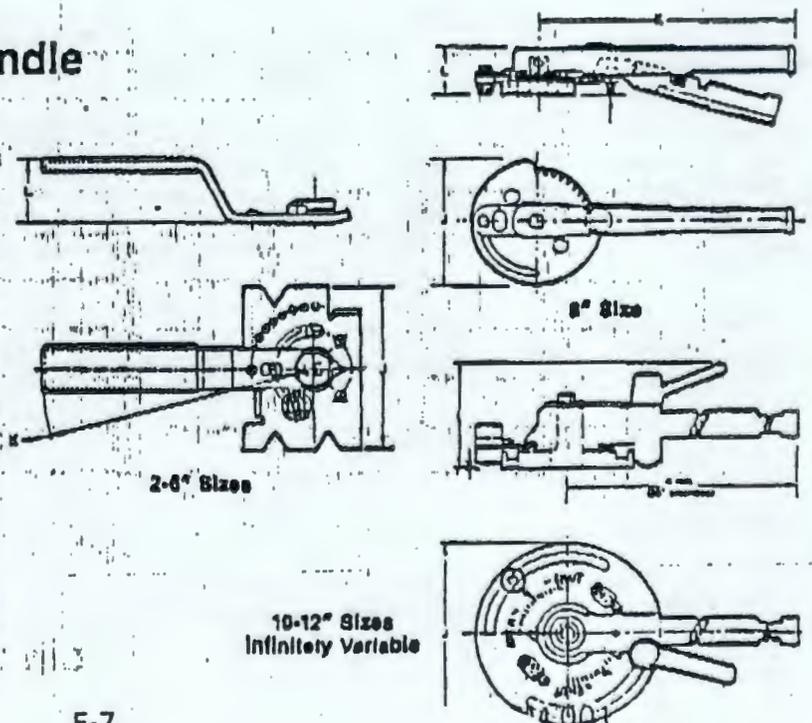


Nominal Size Inches mm	Dimensions—Inches/millimeters									Approx. Wgt. Ea. w/o Opac. Lbs./kg
	End to End A	Overall Height B	C	D	E	F	G	H		
2 80	3.21 82	4.21 107	1.50 38	2.71 69	—	2.38 60	1.89 43	1.78 45	3.7 1.7	
2 1/2 64	3.77 96	4.77 121	1.75 45	3.02 77	—	2.88 73	2.23 57	2.31 59	4.4 2.0	
3 80	3.77 96	5.39 137	2.08 52	3.33 85	0.08 2	3.50 89	2.54 65	2.31 59	6.1 2.7	
4 100	4.83 118	7.85 194	2.50 64	5.15 131	0.13 3	6.88 148	3.19 81	2.82 72	10.8 4.8	
5 125	5.88 149	8.87 220	3.00 76	6.87 144	0.60 13	6.88 148	3.76 95	4.00 102	14.0 6.4	
6 150	5.88 149	8.72 220	3.57 91	8.15 158	1.00 25	7.50 191	4.18 108	4.00 102	19.0 8.6	
8 200	5.38 137	12.20 310	4.88 124	7.32 186	1.25 32	10.19 259	6.60 140	2.69 64	41.0 18.6	
10 250	6.38 162	14.44 367	5.75 146	8.80 221	1.75 45	12.25 311	8.68 170	3.19 81	59.0 26.8	
12 300	6.60 168	17.07 434	7.07 180	10.00 254	2.83 72	14.28 362	8.00 203	3.26 83	85.0 38.6	

Lever Lock/Infinitely Variable Handle

Nominal Size Inches mm	Dimensions—Inches/millimeters				Approx. Wgt. Ea. Lbs./kg
	J	K	L	M	
2 50	4.20 107	7.08 180	1.70 43	—	1.5 0.7
2 1/2 64	4.20 107	7.08 180	1.70 43	—	1.5 0.7
3 80	4.20 107	7.08 180	1.70 43	—	1.5 0.7
4 100	7.00 178	12.00 305	2.50 64	—	1.5 0.7
6 125	7.00 178	12.00 305	2.50 64	—	1.5 0.7
8 180	7.00 178	12.00 305	2.50 64	—	1.5 0.7
8 200	6.28 133	10.50 267	1.75 45	0.50 13	4.5 2.0
10 250	7.13 181	20.00 508	4.57 118	0.15 4	12.0 5.4
12 300	7.13 181	20.00 508	4.57 118	0.15 4	12.0 5.4

NOTE: Handles for 2-8" valves come complete with hardware for both variations, 10 & 12" equipped with infinitely variable handle only.



HAMMOND

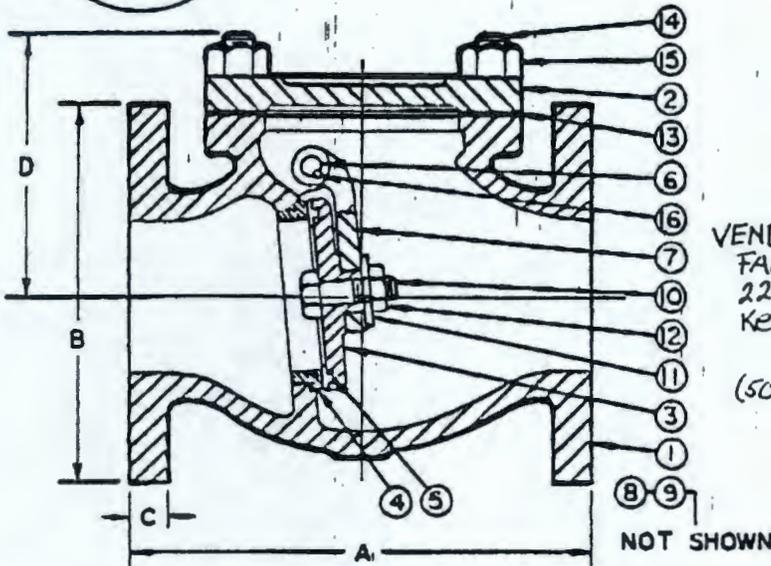
IR 1124

2" to 12"



IRON SWING CHECK VALVE

CLASS 125 - IBBM



VENDOR:
 FAMILIAN N.W.
 223 N. BENTON
 KENNEWICK, WA.
 99336
 (509) 586-2111

RATING

- 125 PSI STEAM TO 450°F
- 200 PSI NON-SHOCK COLD WATER, OIL OR GAS
- MEETS MSS SP-71

Warning: DO NOT USE for reciprocating air compressor service.

FEATURES

- IRON BODY
- BOLTED BONNET
- FLANGED ENDS
- BRONZE TRIM
- REPLACEABLE SEAT RINGS & HINGE PIN
- HORIZONTAL & VERTICAL APPLICATIONS
- 100% FACTORY TESTED

DIMENSIONS (INCHES)					WEIGHT (lbs)
SIZE	A	B	C	D	APPROX.
2	8	6	5/8	4-1/2	25
2-1/2	8-1/2	7	11/16	5-3/8	34
3	9-1/2	7-1/2	3/4	5-7/8	44
4	11-1/2	9	15/16	6-5/8	75
5	13	10	15/16	7-3/4	103
6	14	11	1	8-1/4	127
8	19-1/2	13-1/2	1-1/8	10-1/4	230
10	24-1/2	16	1-3/16	12	310
12	27-1/2	19	1-1/4	13-3/4	695

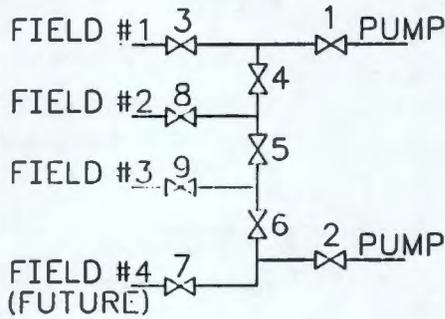
MATERIAL SPECIFICATION			
1	Body	Cast Iron	ASTM A126, Class B
2	Cap	Cast Iron	ASTM A126, Class B
3	Disc (2" to 6")	Bronze	ASTM B62, C83600
	Disc (8" to 12")	Cast Iron	ASTM A126, Class B
4	Body Seat Ring	Bronze	ASTM B62, C83600
5	Disc Seat Ring (8" to 12")	Bronze	ASTM B62, C83600
6	Hinge Pin (2" to 6")	Aluminum / Silicon Bz.	ASTM B150
	Hinge Pin (10" & 12")	Naval Brass	ASTM B21, C48200
7	Hinge	Malleable Iron	ASTM A107
8	Hinge Pin Bushing	Bronze	ASTM B62, C83600
9	Hinge Pin Plug	Brass	ASTM B16
10	Disc Stud (8")	Steel	ASTM A108
	Disc Stud Rivet (10" & 12")	Steel	ASTM A307, Grade B
11	Disc Washer (2" to 6")	Brass	ASTM B36
	Disc Washer (8" to 12")	Steel	
12	Nut For Disc (2" to 6")	Brass	ASTM B16
	Nut For Disc (8" to 12")	Steel	ASTM A563, Grade O
13	Gaskets	Non-Asbestos Sheet	
14	Cap Bolts (2" to 6")	Steel	ASTM A307, Grade B
	Cap Studs (10" & 12")	Steel	ASTM A108
15	Cap Bolt Nuts	Steel	ASTM A563, Grade O
16	Hinge Pin Key (10" & 12")	Steel	ASTM A108



OPERATIONS SCHEDULE

FIELD ROTATION SCHEDULE

VALVE DIAGRAM



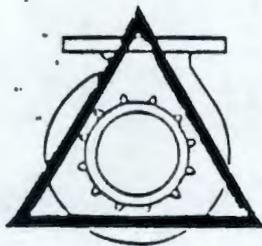
3 FIELD CYCLE	FIELDS IN SERVICE
1	1 & 2
2	1 & 3
3	2 & 3
REPEAT CYCLE	

4 FIELD CYCLE	FIELDS IN SERVICE
1	1 & 2
2	3 & 4
REPEAT CYCLE	

VALVE SCHEDULE

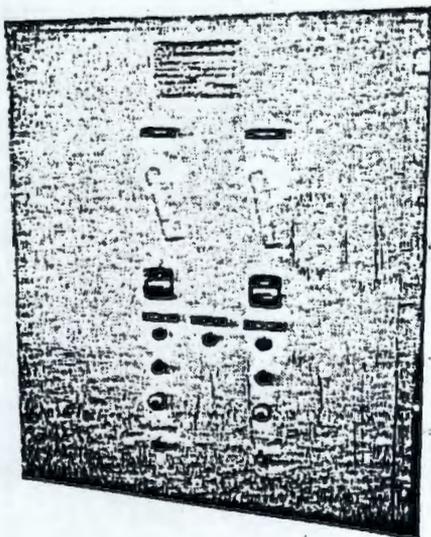
VALVE NO	FIELDS IN SERVICE			
	1 & 2	1 & 3	2 & 3	3 & 4
1	OPEN	OPEN	OPEN	OPEN
2	OPEN	OPEN	OPEN	OPEN
3	OPEN	OPEN	CLOSED	CLOSED
4	CLOSED	CLOSED	OPEN	OPEN
5	OPEN	CLOSED	CLOSED	OPEN
6	OPEN	OPEN	OPEN	CLOSED
7	CLOSED	CLOSED	CLOSED	OPEN
8	OPEN	CLOSED	OPEN	CLOSED
9	CLOSED	OPEN	OPEN	OPEN

Appendix F
Pump Controls



TRIANGLE PUMP
AND EQUIPMENT, INC.

CUSTOM BUILT MOTOR CONTROLS



Triangle Pump offers custom control panels for ~~simplex~~ duplex ~~and multiple~~ unit operation. Standard panels are available in NEMA ~~1, 2R,~~ 4 ~~8, 12~~ enclosures. Control provides short circuit, overload and undervoltage protection. Each control normally includes circuit breaker with door mounted operating handle, ~~magnetic~~ ~~contactor for single phase~~ and magnetic motor starter with ambient compensated overloads for 3 phase, H-O-A selector switches, reset buttons, electric cycle alternator where applicable, 120 VAC control circuit transformer and terminal strips.

A variety of accessories are available; some of which are run indicating lights, ~~elapsed time~~ ~~meters~~, probe relays, cycle counters, ~~strip~~ ~~boards and thermostat~~, intrinsically safe control circuits, ~~special control~~ ~~circuits~~ and a variety of both audible and visual alarms.

File No. E70758

(503) 656-1473

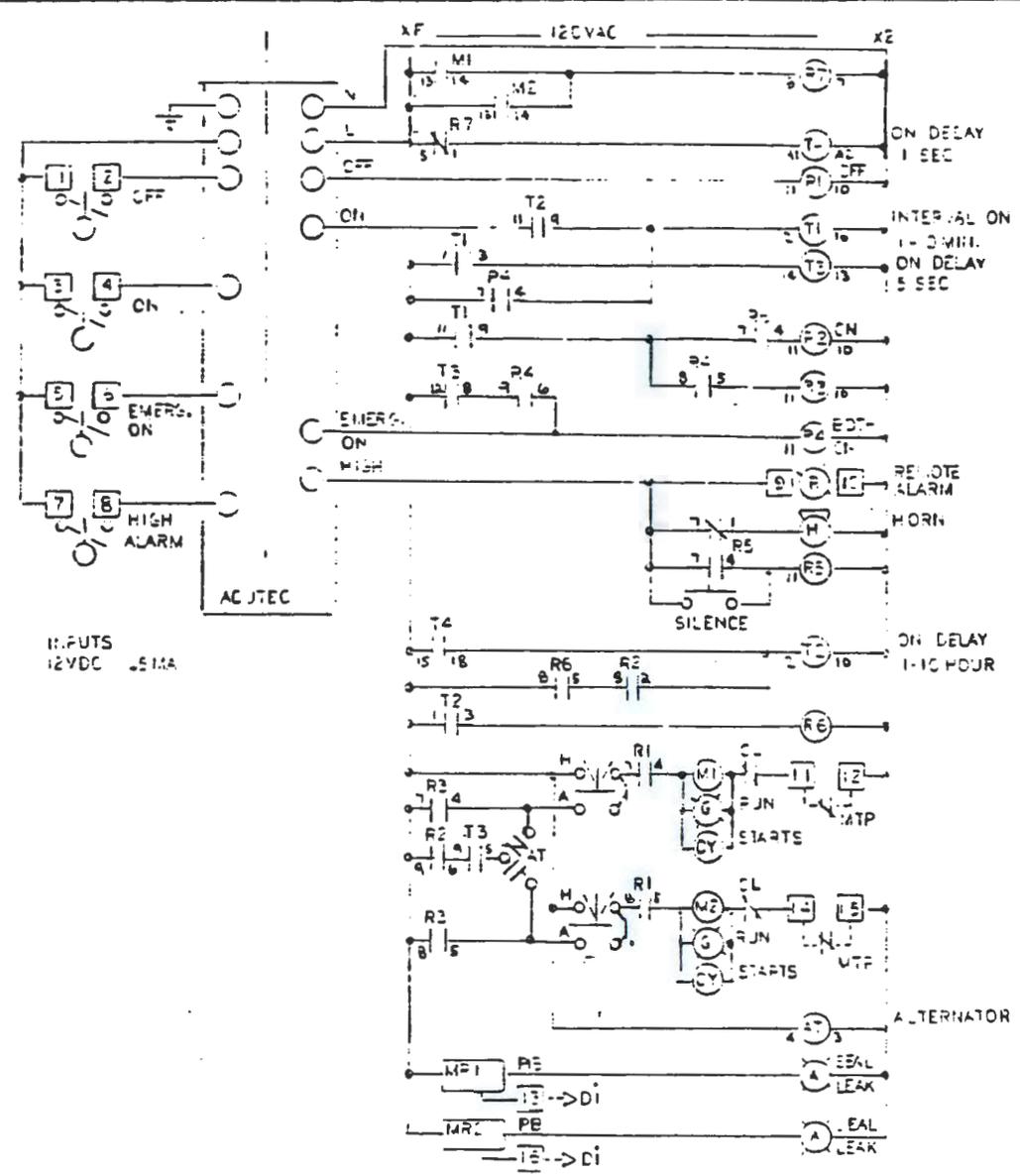
Bulletin C1-979

This Product is Listed by
UNDERWRITERS LABORATORIES INC.
and Bears the Mark:

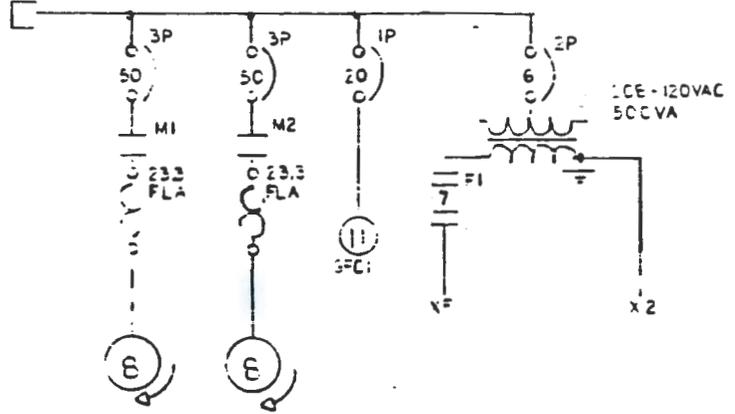


LO92001.OMM.1992

F-3



120/100VAC 3PH 4W



MOTOR TEMPERATURE SENSORS (MTP) AND MOTOR MOISTURE SENSORS (MP) ARE LOCATED IN THE PUMP. REFER TO PUMP O & M FOR SPECIFIC PARAMETERS.

TRIANGLE PUMP & EQUIPMENT, INC. Clackamas, Oregon		
SCALE: NONE	APPROVED BY:	DRAWN BY: JGE
DATE: 5-92	Project: KEH-5319	
Emergency Drainfield Replacement 200 East Area		
Customer: Thompson Mechanical	DRAWING NUMBER: 92500	

REVISED AS BUILT

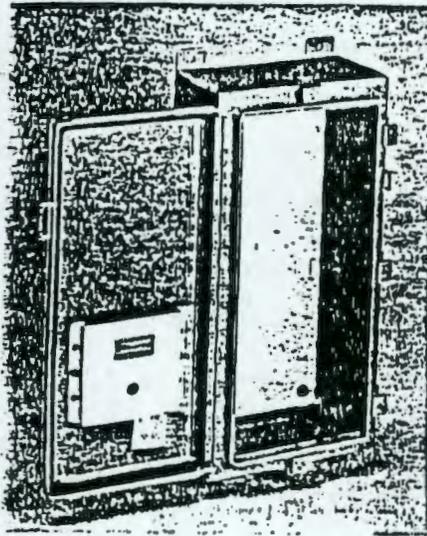
WHC-SD-LO92-OMM-001 REV.

BILL OF MATERIALS

CUSTOMER: Thompson Mechanical

PROJECT: KEH-5319
Emergency Drainfield Replacement
200 East Area

QUANT.	DESCRIPTION/CATALOG NO./MANUFACTURER	SUPPLY	STK	REMARKS
1	Enclosure A30H30BLP N-4	Hoffman		
1	Back Panel H30 $\frac{1}{2}$ 30	Hoffman		
1	Inner Door 27" X 25 $\frac{1}{2}$ X $\frac{1}{2}$ 2064	DuPont		
1	Support Frame 1" X 1 X 1/8" Aluminum	FC		
1	Input Module Model 3010	Acutec		
4	Main Terminal RWA 1205 120a	Siemens		
1	Transformer TA-2-69305	Acme		
1	Fuse Kit PL 112601	Acme		
1	Fuse MEN 7a	Littlefuse		
1	Primary CB S252-L6	ABB		
1	GFCI CB S251-L20	ABB		
2	Motor Breaker HMCP050K2	Westinghouse		
2	Starter AN16GNOA H2014-3	Cutler Hammer		
6	Control relay LY3N-120US	Omron		
1	Time relay LAR2H110VAC	Syrelec		
1	Time relay LHR2H 110VAC	Syrelec		
1	Alter Relay PJR110VAC	Syrelec		
2	Moisture relay "Seal Minder"	ABS		
2	Sel Switch E22VBG10 H-0-A	Cutler Hammer		
2	Ind Light E22H3X10 Run	Cutler Hammer		
2	Ind Light E22H9X10 Seal Leak	Cutler Hammer		
2	Pushbutton E22MRL OL reset	Cutler Hammer		
1	Pushbutton E22PB2 Silence	Cutler Hammer		
2	Event Counter R2 4904	Redington		
2	Oper Mech CBF01	Cutler Hammer		
16	Field Term 8WA1202 47A	Siemens		
1	Alarm Horn 876-NS	Edwards		
1	Alarm Horn 57R-A-1	Edwards		
1	GFCI 65991	Leviton		
1	lot wire tags	Brady		
1	lot Phenolics	FC		



Application

Designed to house electrical and electronic controls, instruments, and components in areas which may be regularly hosed down or are otherwise very wet. Suitable for use in dairies, breweries, and similar installations. Also suitable for outdoor applications (optional drip shield is recommended).

Construction

- 16 gauge steel bodies and 14 gauge doors on all sizes through 24.00x24.00; remaining (larger) sizes are 14 gauge
- Seams continuously welded and ground smooth, no holes or knockouts
- Door and body stiffeners in larger enclosures for extra rigidity
- Rolled lip around three sides of door and all sides of enclosure opening excludes liquids and contaminants
- Stainless steel door clamps on three sides of door for watertight seal
- Door removed by pulling stainless steel continuous hinge pin

- Hasp and staple provided for padlocking
- Removable and reversible print pocket
- Oil-resistant door gasket attached with oil-resistant adhesive and held in place with steel retaining strips
- Collar studs provided for mounting optional panels

Finish

ANSI 61 gray polyester powder coating inside and out over phosphatized surfaces. Optional panels are white enamel. An additional protective finish may be necessary if the enclosure is located in a corrosive outdoor setting. Hoffman can supply custom finishes based upon environmental requirements. Consult factory for details.

Industry Standards

NEMA/IEEMAC Type 3, Type 4, Type 12, and Type 13
 UL 508 Type 4
 JIC standard EGP-1-1967
 CSA Enclosure 4 (Specify CSA label when ordering)
 IEC 529, IP66

Accessories	Page
Air Conditioners.....	370
Blowers.....	393
Corrosion Inhibitors	402
Door Stop Kit.....	412
Drip Shield Kit.....	416
Electrical Interlocks	422
Enclosure Stabilizer	425
Fan Cooling Products.....	390, 392
Fast Operating Clamp As'by	418
Floor Stand Kit.....	424
Heat Exchangers	380-386
Lighting Kit	410, 411
Lock Kit	417
Panel Support Kit	430
Panels (See table)	
Rack Mounting Angle Kit.....	439
Swing-Out Panel Kit.....	430
Terminal Kit Assembly	434
Window Kit.....	414
Wiring Duct.....	403

Need More Information?

Chemical Resistance Chart	pg. 459
Cross Reference to Large NEMA 3R Hinged Cover Enclosures	pg. 346
Industry Standards	pg. 451
Materials and Finishes	pg. 456
Price List	pg. 9

Modifying your Enclosure

We can modify or customize this enclosure to your specs. See page 446 for more information.



Ph: 612-421-2240
 Fax: 612-421-1556

B

Standard Sizes					Standard Sizes (Cont.)				
Single Door NEMA 4 Enclosures					Single Door NEMA 4 Enclosures				
Enclosure Catalog Number	Enclosure Size AxBxC	*Panel Catalog Number	Panel Size DxE	Center Stiffener H	Enclosure Catalog Number	Enclosure Size AxBxC	*Panel Catalog Number	Panel Size DxE	Center Stiffener H
A-16H12ALP	16.00x12.00x6.00 (406x305x152)	A-16P12	13.00x9.00 (330x229)	Not included	A-30H30BLP	30.00x30.00x8.00 (762x762x203)	A-30P30	27.00x27.00 (686x686)	Not included (178)
A-16H16ALP	16.00x16.00x6.00 (406x406x152)	A-16P16	13.00x13.00 (330x330)	Not included	A-36H24BLP	36.00x24.00x8.00 (914x610x203)	A-36P24	33.00x21.00 (838x533)	Not included
A-16H20ALP	16.00x20.00x6.00 (406x508x152)	A-20P16	17.00x13.00 (432x330)	Not included	A-36H36BLP	36.00x36.00x8.00 (914x914x203)	A-36P30	33.00x27.00 (838x686)	Not included (229)
A-20H16ALP	20.00x16.00x6.00 (508x406x152)	A-20P16	17.00x13.00 (432x330)	Not included	A-42H36BLP	42.00x36.00x8.00 (1067x914x203)	A-42P30	39.00x27.00 (991x686)	Included (251)
A-20H20ALP	20.00x20.00x6.00 (508x508x152)	A-20P20	17.00x17.00 (432x432)	Not included	A-42H48BLP	42.00x48.00x8.00 (1067x1219x203)	A-42P36	39.00x33.00 (991x838)	Included (251)
A-24H12ALP	24.00x12.00x6.00 (610x305x152)	A-12P24	9.00x21.00 (229x533)	Not included	A-48H36BLP	48.00x36.00x8.00 (1219x914x203)	A-48P36	45.00x33.00 (1143x838)	Included (289)
A-24H16ALP	24.00x16.00x6.00 (610x406x152)	A-24P16	21.00x13.00 (533x330)	Not included	A-60H36BLP	60.00x36.00x8.00 (1524x914x203)	A-60P36	57.00x33.00 (1448x838)	Included (365)
A-24H20ALP	24.00x20.00x6.00 (610x508x152)	A-24P20	21.00x17.00 (533x432)	Not included	A-20H16CLP	20.00x16.00x10.00 (508x406x254)	A-20P16	17.00x13.00 (432x330)	Not included
A-24H24ALP	24.00x24.00x6.00 (610x610x152)	A-24P24	21.00x21.00 (533x533)	Not included	A-24H30CLP	24.00x30.00x10.00 (610x762x254)	A-24P20	21.00x17.00 (533x432)	Not included
A-30H20ALP	30.00x20.00x6.00 (762x508x152)	A-30P20	27.00x17.00 (686x432)	Not included	A-30H14CLP	30.00x24.00x10.00 (762x610x254)	A-30P24	27.00x21.00 (686x533)	Not included
A-30H24ALP	30.00x24.00x6.00 (762x610x152)	A-30P24	27.00x21.00 (686x533)	Not included	A-36H10CLP	36.00x30.00x10.00 (914x762x254)	A-36P30	33.00x27.00 (838x686)	Not included (229)
A-36H24ALP	36.00x24.00x6.00 (914x610x152)	A-36P24	33.00x21.00 (838x533)	Not included	A-48H10CLP	48.00x30.00x10.00 (1219x762x254)	A-48P30	45.00x27.00 (1143x686)	Not included (330)
A-16H12BLP	16.00x12.00x8.00 (406x305x203)	A-16P12	13.00x9.00 (330x229)	Not included	A-48H16CLP	48.00x36.00x10.00 (1219x914x254)	A-48P36	45.00x33.00 (1143x838)	Included (289)
A-20H16BLP	20.00x16.00x8.00 (508x406x203)	A-20P16	17.00x13.00 (432x330)	Not included	A-60H16CLP	60.00x36.00x10.00 (1524x914x254)	A-60P36	57.00x33.00 (1448x838)	Included (365)
A-20H20BLP	20.00x20.00x8.00 (508x508x203)	A-20P20	17.00x17.00 (432x432)	Not included	A-30H14DLP	30.00x24.00x12.00 (762x610x305)	A-30P24	27.00x21.00 (686x533)	Not included
A-20H24BLP	20.00x24.00x8.00 (508x610x203)	A-24P20	21.00x17.00 (533x432)	Not included	A-36H10DLP	36.00x30.00x12.00 (914x762x305)	A-36P30	33.00x27.00 (838x686)	Not included (229)
A-24H20BLP	24.00x20.00x8.00 (610x508x203)	A-24P20	21.00x17.00 (533x432)	Not included	A-48H16DLP	48.00x36.00x12.00 (1219x914x305)	A-48P36	45.00x33.00 (1143x838)	Included (289)
A-24H24BLP	24.00x24.00x8.00 (610x610x203)	A-24P24	21.00x21.00 (533x533)	Not included	A-36H30FLP	36.00x30.00x16.00 (914x762x406)	A-36P30	33.00x27.00 (838x686)	Not included (229)
A-24H30BLP	24.00x30.00x8.00 (610x762x203)	A-30P24	27.00x21.00 (686x533)	Not included	A-48H36FLP	48.00x36.00x16.00 (1219x914x406)	A-48P36	45.00x33.00 (1143x838)	Included (289)
A-30H20BLP	30.00x20.00x8.00 (762x508x203)	A-30P20	27.00x17.00 (686x432)	Not included	A-60H36FLP	60.00x36.00x16.00 (1524x914x406)	A-60P36	57.00x33.00 (1448x838)	Included (365)
A-30H24BLP	30.00x24.00x8.00 (762x610x203)	A-30P24	27.00x21.00 (686x533)	Not included					

Millimeter dimensions () are for reference only; do not convert metric dimensions to inch.
 * Panels must be ordered separately. Optional aluminum and plywood panels also available for most sizes. See Accessories.



5485 N.W. 22nd Avenue • Ft. Lauderdale, Florida 33309-2781 • (305) 486-1588

"ACUNATOR" INTRINSICALLY SAFE CONTROLLERS

FOR CLASS I, DIV. 1, GROUPS A,B,C & D. CLASS II, GROUPS E,F & G.

 MODEL 3010 - IS A "STRAIGHT-THRU" CONTROLLER WITH 5 INPUTS AND 5 NORMALLY OPEN 120 VAC RELAY OUTPUTS. MANY OUTPUT CONFIGURATIONS ARE AVAILABLE. SUCH AS DRY CONTACTS, NORMALLY CLOSED OR A COMBINATION OF THE ABOVE. 12 TERMINALS ARE AVAILABLE WHICH CAN BE CONFIGURED TO SUIT YOUR OUTPUT NEEDS. A MAXIMUM OF 6 INTRINSICALLY SAFE INPUTS ARE AVAILABLE. NO SWITCHES OR LIGHTS ARE INCLUDED.

MODEL 3020 - IS A FULL FUNCTION DUPLEX CONTROLLER WHICH INCLUDES AUTOMATIC ALTERNATION, DELAYED START BETWEEN PUMPS ON POWER-UP, SEAL LEAK INPUTS AND 120 VAC OUTPUTS. NO SWITCHES OR LIGHTS ARE INCLUDED.

MODEL 3030 - IS A FULL FUNCTION DUPLEX CONTROLLER WHICH INCLUDES AUTOMATIC ALTERNATION, DELAYED START BETWEEN PUMPS ON POWER-UP, STANDARD SIZE TOGGLE SWITCHES FOR PUMP HAND-OFF-AUTO, ALARM TEST-AUTO-SILENCE AND 1 1/16" DIA. PUMP RUN AND ALARM LIGHTS WITH REPLACEABLE NEON LAMPS.

MODEL 3040 - IS BASICALLY THE SAME AS THE MODEL 3030 EXCEPT THAT IT IS FOR SINGLE PUMP CONTROL.

MODEL 3050 - IS THE SAME AS THE MODEL 3030 EXCEPT THAT THE SWITCHES AND LIGHTS ARE 1 1/8" DIA. HEAVY DUTY, OILTIGHT AND WATERTIGHT. (EXCEPT FOR CERTAIN OPTIONS)

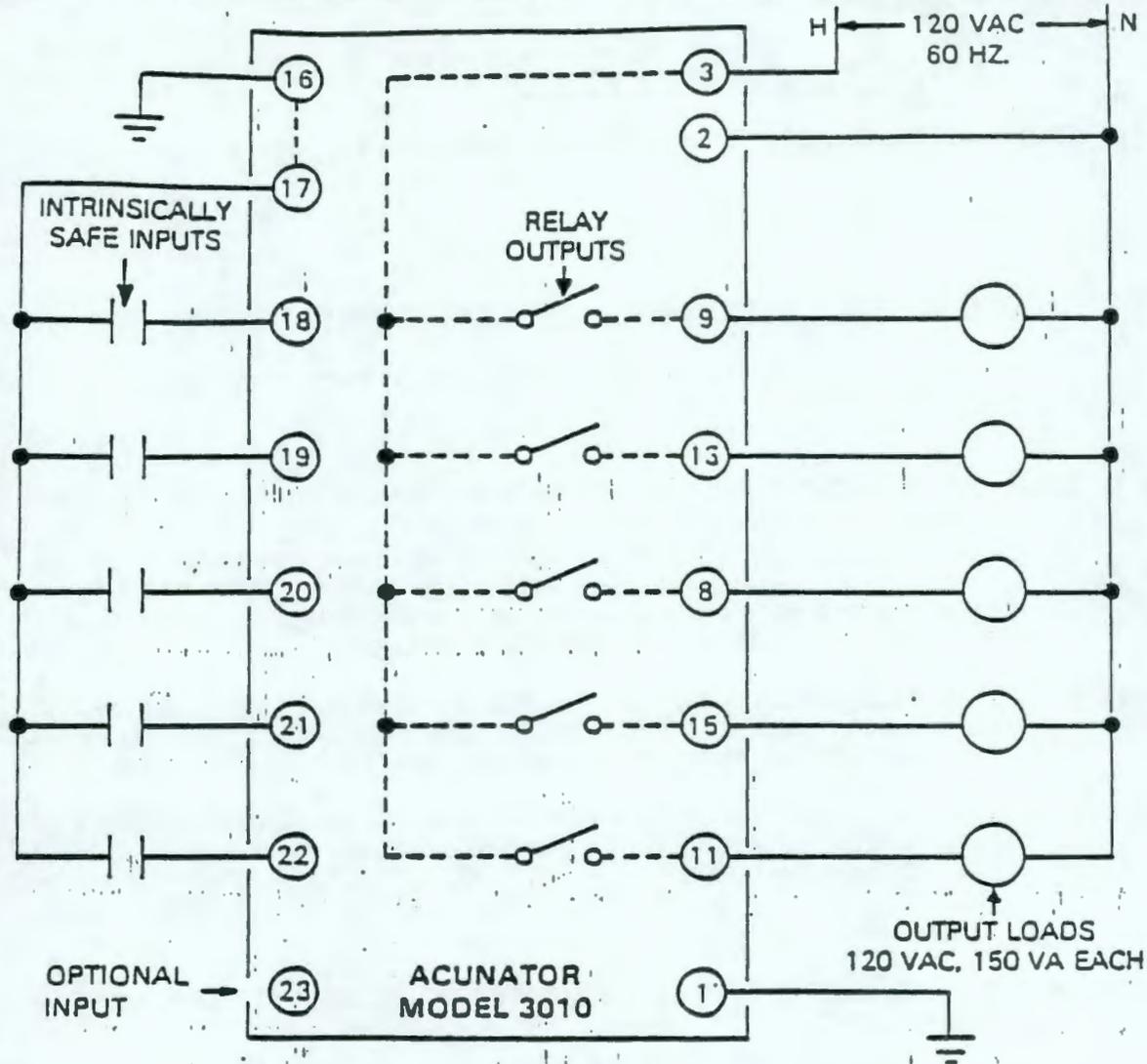
MODEL 3060 - IS BASICALLY THE SAME AS THE MODEL 3050 EXCEPT THAT IT IS FOR SINGLE PUMP CONTROL.

NOTES: - THE PUMP HAND-OFF-AUTO SWITCHES AND RUN LIGHTS ARE IN THE 120 VOLT CIRCUIT SO THAT IF THE INTERNAL LOGIC SHOULD FAIL, THE PUMPS CAN STILL BE OPERATED IN THE MANUAL MODE.

- THE CASE IS MADE OF BLACK PHENOLIC WHICH WILL NOT RUST OR CORRODE.

- CUSTOM OPTIONS ARE AVAILABLE TO SUIT YOUR REQUIREMENTS.

PUBL. NO 30002

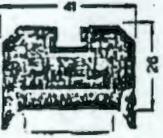
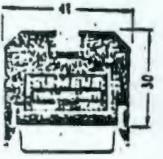
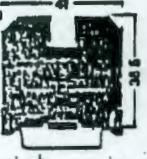
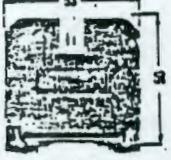


**INTRINSICALLY SAFE
"STRAIGHT-THRU" CONTROLLER
FOR CLASS I, DIV.1, GROUPS A,B,C & D. CLASS II, GROUPS E,F & G.**

- INPUTS OPERATE AT 12 VDC, 0.5 mA. RELAY OUTPUTS ARE RATED AT 150 VA., 120 VAC.
- THIS CONNECTION DRAWING SHOWS THE STANDARD INPUT/OUTPUT CONFIGURATION.
- MANY OUTPUT CONFIGURATIONS ARE AVAILABLE, SUCH AS DRY CONTACTS, NORMALLY CLOSED OR A COMBINATION OF THE ABOVE.

PUBL. NO. 301031

Acutec, inc.
5485 N.W. 22nd Avenue
Ft. Lauderdale, Florida 33309-2781
(305) 486-1588

Selection and ordering data										
Dimensions (mm)	Terminal size Conductor size	Voltage rating	Contin- uous current A		As- sembly width mm	Catalog No.	List Price Each \$	Standard pack Qty.		
Through-type terminals with insulating body of molded thermoplastic, narrow version, with screw terminals on both sides										
	Terminal size 2.5 22-12 AWG 18-12 AWG solid 0.6 to 4 mm ² finely stranded 0.5 mm ² to 2.5 mm ²	600 V AC 750 V, DC 900 V	26	Single terminal Block of three Block of ten (marked 1... 10) Single terminal, blue	5.5 16.6 55.4 5.5	8WA1 201 8WA1 301 8WA1 401 8WA1 011-1BF11	0.78 2.20 7.10 0.95	100 50 25 100		
			26	Accessories: Barrier Separator for single terminal Link rails for 2 terminals 3 terminals 10 terminals Cover with warning arrow white, for inscription Test socket 2.3 dia.	1	8WA1 820 8WA1 825 8WA1 840 8WA1 843 8WA1 800 8WA1 810 8WA1 860 8WA1 854	0.40 0.26 0.85 1.12 2.45 0.28 0.32 0.15	100 100 100 100 100 100 100 100		
			10							
	Terminal size 4 18-10 AWG 18-10 AWG solid 0.5 to 6 mm ² finely stranded 0.5 mm ² to 4 mm ²	600 V AC 750 V, DC 900 V	35	Single terminal Single terminal, blue Single terminal, green yellow	6.5 6.5 6.5	8WA1 011-1DG11 8WA1 011-1BG11 8WA1 011-1PG11	0.90 1.10 2.70	100 100 100		
			35	Accessories: Barrier Separator Link rails for 2 terminals 3 terminals 10 terminals Cover with warning arrow white, for inscription Test socket 2.3 dia.	1	8WA1 820 8WA1 825 8WA1 850 8WA1 851 8WA1 853 8WA1 811 8WA1 862 8WA1 854	0.40 0.26 1.00 1.20 3.05 0.30 0.35 0.15	100 100 100 100 100 100 100 100		
			10							
	Terminal size 6 14-8 AWG 14-8 AWG solid 0.75 mm ² to 10 mm ² finely stranded 1.5 mm ² to 6 mm ²	600 V AC 750 V, DC 900 V	47	Single terminal Block of three Single terminal, blue	7.2 21.8 7.2	8WA1 202 8WA1 302 8WA1 011-1BH11	1.20 3.30 1.46	100 50 100		
			44	Accessories: Barrier Link rails for 2 terminals 3 terminals 10 terminals Cover with warning arrow white, for inscription	1	8WA1 821 8WA1 841 8WA1 844 8WA1 801 8WA1 811 8WA1 862	0.46 1.07 1.45 3.36 0.35 0.30	100 100 100 50 100 100		
	Terminal size 18 12-4 AWG 14-6 AWG solid and stranded 1 mm ² to 25 mm ² finely stranded 2.5 mm ² to 16 mm ²	600 V AC 750 V, DC 900 V	79	Single terminal Block of three Single terminal, blue	10 30 10	8WA1 204 8WA1 304 8WA1 011-1BK11	2.00 5.70 2.37	50 50 50		
			82	Accessories: Barrier Link rails for 2 terminals 3 terminals 10 terminals Cover with warning arrow	1	8WA1 821 8WA1 842 8WA1 845 8WA1 802 8WA1 812	0.46 2.00 2.70 6.80 0.48	100 50 50 50 100		
	Terminal size 35 10-1 AWG 12-2 AWG solid and stranded 4 mm ² to 50 mm ² finely stranded 6 mm ² to 35 mm ²	600 V AC 750 V, DC 900 V	120	Single terminal Block of three Single terminal, blue	16 48 16	8WA1 205 8WA1 305 8WA1 011-1BM11	3.40 9.65 3.68	50 20 50		
			135	Accessories: Barrier Link rails for 3 terminals 10 terminals Cover with warning arrow	1.5	8WA1 823 8WA1 803 8WA1 804 8WA1 813	2.78 4.54 13.35 0.57	25 20 20 100		

For labeling accessories see page 13/11.

GROUP G

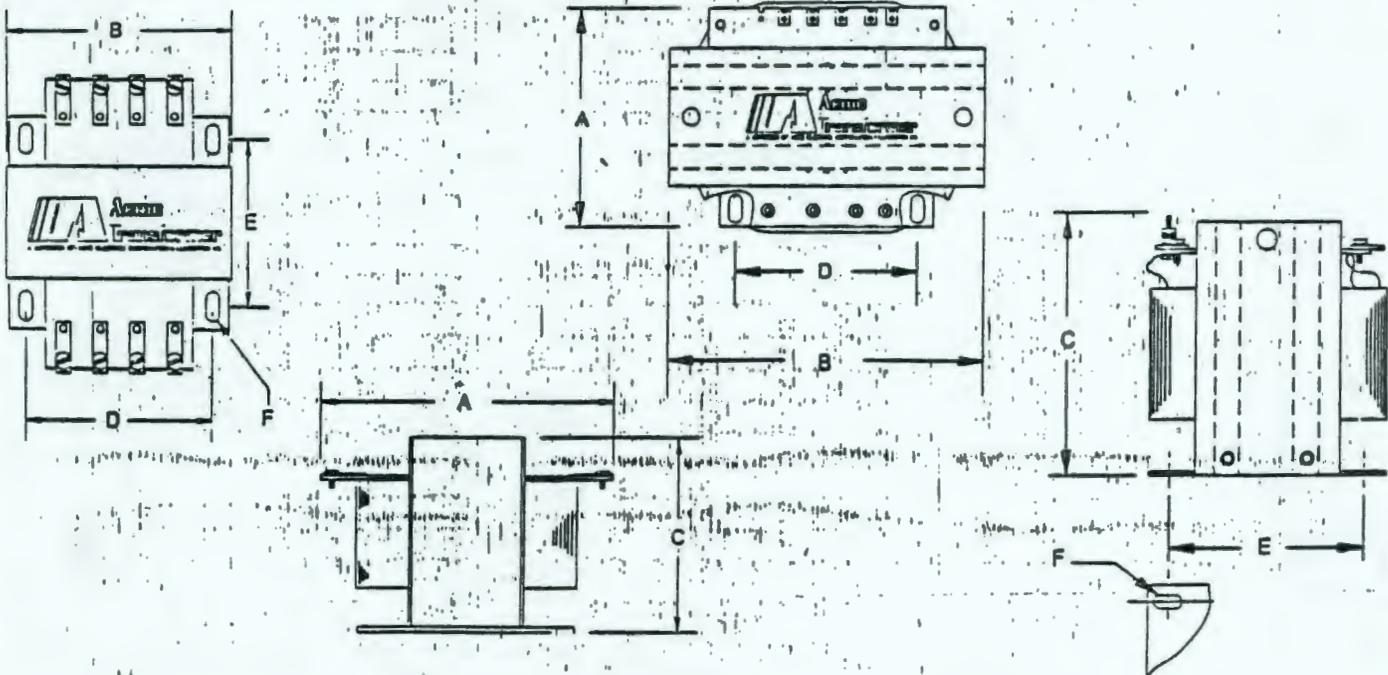
Primary Volts — 240/416/480/600; 230/400/460/575; 220/380/440/550; 208/500		Secondary Volts — 99/120/130; 95/115/125; 91/100/120; 85/100/110		50/60 Hz		Primary Fuse Block	Secondary Fuse Kit	Secondary Fuse Size				
Catalog No.	VA Rating	Output Amps	Dimensions (inches)						Weight (Lbs.)	Part No.	Part No.	130 Volts
			A	B	C	D	E	F				
TA-2-32403	50	0.38	1.18	3.75	3.21	3.125	2.31	.22 x .50	5	PL-112701	PL-112600	1/10 amp
TA-2-32404	150	1.15	4.75	4.50	3.84	3.75	3.05	.22 x .50	10	PL-112702	PL-112601	1 1/10 amps
TA-2-32405	250	1.92	5.58	4.88	4.15	4.06	4.06	.22 x .50	16	PL-112703	PL-112601	3 1/10 amps
TA-2-32669	350	2.69	6.23	4.80	4.15	4.06	5.50	.22 x .50	22	PL-112703	PL-112601	4 amps
TA-2-32406	500	3.85	5.59	6.75	5.72	5.75	3.69	.22 x .50	23	PL-112705	PL-112601	6 1/4 amps
TA-2-54523	750	5.77	6.27	6.75	5.72	5.75	4.13	.31 x .50	29	PL-112705	PL-112601	9 amps
TA-2-54524	1000	7.69	7.75	6.75	5.72	5.75	4.88	.31 x .50	35	PL-112705	PL-112601	12 amps
TA-2-54525	1500	11.54	6.75	7.50	7.75	6.50	5.42	.406 x .813	55	PL-112706	PL-112601	20 amps
TA-2-81202	2000	15.39	7.45	7.50	7.75	6.50	6.12	.406 x .813	55	PL-112706	PL-112601	25 amps
TA-1-81203	3000	23.08	8.74	11.92	8.68	6.75	5.75	.406 x .813	70	PL-112707	—	—
TA-1-81205	5000	38.46	9.24	11.92	9.34	6.75	6.25	.406 x .813	110	PL-112707	—	—

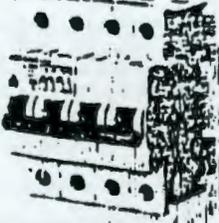
CONNECTION DETAILS FOR GROUP G

Connect To Line For Respective Voltage				Output Volts		
H1-H2	H1-H3	H1-H4	H1-H5	X1-X2	X1-X3	X1-X4
208			500	85	100	110
220	380	440	550	91	110	120
230	400	460	575	95	115	125
240	416	480	600	99	120	130

GROUP H

Primary Volts — 208/230/460		Secondary Volts — 115		50/60 Hz		Primary Fuse Block	Secondary Fuse Kit	Secondary Fuse Size				
Catalog No.	VA Rating	Output Amps	Dimensions (inches)						Weight Lbs.	Part No.	Part No.	120 Volts
			A	B	C	D	E	F				
TA-2-69300	50	0.43	4.56	3.00	2.59	2.50	2.61	.22 x .50	4	PL-112700	PL-112602	1/10 amp
TA-2-69301	100	0.87	5.32	3.00	2.59	2.50	3.26	.22 x .50	4	PL-112700	PL-112602	1 1/10 amps
TA-2-69302	150	1.30	5.20	3.75	3.21	3.125	3.06	.22 x .50	7	PL-112701	PL-112602	2 amps
TA-2-69303	250	2.17	5.38	4.50	3.84	3.75	3.50	.22 x .50	11	PL-112702	PL-112601	3 1/2 amps
TA-2-69304	350	3.04	5.90	4.88	4.15	4.06	3.81	.22 x .50	15	PL-112703	PL-112601	5 amps
TA-2-69305	500	4.35	6.23	5.25	4.47	4.38	4.56	.31 x .50	20	PL-112704	PL-112601	7 amps
TA-2-69306	750	6.52	6.23	6.75	5.72	5.75	3.69	.31 x .50	29	PL-112705	PL-112601	9 amps
TA-2-69307	1000	8.70	7.15	6.75	5.72	5.75	4.63	.31 x .50	33	PL-112705	PL-112601	12 amps



 UL 1077 VDE 0641 Cable Protection	Rated Current	Catalog Number	List Price	Delivery Class	Packing Units	Weight (oz.) 1 Piece
 SINGLE POLE	6 10 12 16 20 25 32	S251-L6 S251-L10 S251-L12 S251-L16 S251-L20 ← S251-L25 S251-L32	\$ 11.00 11.00 11.00 11.00 11.50 12.00 12.00	S S S S S S S	10	4.5
 SINGLE POLE with DISCONNECTING NEUTRAL	6 10 12 16 20 25 32	S251-L6NA S251-L10NA S251-L12NA S251-L16NA S251-L20NA S251-L25NA S251-L32NA	19.00 19.00 19.00 19.00 20.00 20.50 21.00	A A A A A A A	5	9.0
 TWO POLE	6 10 12 16 20 25 32	S252-L6 ← S252-L10 S252-L12 S252-L16 S252-L20 S252-L25 S252-L32	24.00 24.00 24.00 24.00 26.50 27.50 27.50	S S S S S S S	5	9.0
 THREE POLE	6 10 12 16 20 25 32	S253-L6 S253-L10 S253-L12 S253-L16 S253-L20 S253-L25 S253-L32	36.00 36.00 36.00 36.00 40.00 42.00 42.00	S S S S S S S	3	13.5
 THREE POLE with DISCONNECTING NEUTRAL	6 10 12 16 20 25 32	S253-L6NA S253-L10NA S253-L12NA S253-L16NA S253-L20NA S253-L25NA S253-L32NA	44.00 44.00 44.00 44.00 48.50 50.50 50.50	A A A A A A A	2	18.0



SERIES C[®] MOLDED CASE CIRCUIT BREAKERS

Type HMCP Motor Circuit Protector - F-Frame

DESCRIPTION

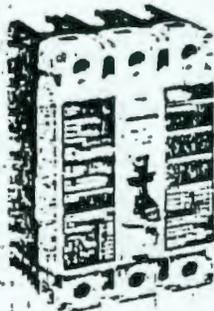
Series C Motor Circuit Protectors (MCPs)

Complementing the Series C line of molded case circuit breakers, a new line of motor circuit protectors (instantaneous-only circuit interrupters) has been developed in the 150A, 250A, and 400A frame sizes.

The primary purpose of an MCP is to provide short circuit protection as a part of a combination motor controller where other circuit protective functions are performed by other devices within the controller. MCPs are UL component recognized for this application.

Instantaneous-only trip units are supplied in the MCPs. Each MCP is uniquely engineered with the high inrush requirements of present day energy efficient motors in mind while providing the ultimate in low-level short circuit protection for the motor.

Series C motor circuit protectors are designed to be interchangeable with existing MCPs of the same continuous current rating. The same types of internally and externally mounted accessories used with the Series C molded case circuit breakers can also be used with the Series C MCPs. The F Frame MCP will replace existing MCP's to 150A as well as the FB/HFB magnetic only family of circuit interrupters.



F-Frame Series C MCP Interrupting Capacity Ratings[Ⓢ]

UL489 Interrupting Capacity Ratings:

MCP Type	Number of Poles	Interrupting Capacity (Symmetrical Amperes)			
		Volts ac (50-60 Hz)			Volts dc [Ⓢ]
HMCP	3	240	480	600	2500 [Ⓢ]
		100,000	65,000	25,000	

LIST PRICES AND CATALOG NUMBERS

Starter Size	Magnetic Trip Range (Amperes) [Ⓢ]	Continuous Amp. Rating	Catalog Numbers		List Price Dis. Sym. CB-12 [Ⓢ]
			With Standard Aluminum Alloy Terminals	With Optional Non-Aluminum Terminals	
0	9 - 30	3	HMCP003A0	HMCP003A0C	\$138.00
0	21 - 70	7	HMCP007C0	HMCP007C0C	138.00
0	45 - 150	15	HMCP015E0	HMCP015E0C	198.00
0	40 - 60	25 [Ⓢ]	HMCP02500	HMCP02500C	252.00
1	60 - 100	30	HMCP030H1	HMCP030H1C	198.00
2	150 - 500	50	HMCP050K2	HMCP050K2C	227.00
2	210 - 700	70	HMCP070M2	HMCP070M2C	302.00
3	160 - 240	100 [Ⓢ]	HMCP100LJ	HMCP100LJC	302.00
3	300 - 1000	150	HMCP100R3	HMCP100R3C	302.00
4	450 - 1500	150	HMCP150T4	HMCP150T4C	440.00
4	750 - 2500	150	HMCP150U4	HMCP150U4C	440.00

(Approx. Ship. Wt. 4 1/2 lbs.)

ACCESSORIES AND MODIFICATIONS

Current Limiter Attachment

The type ELC current limiter attachment for the Series C MCP is designed to provide increased interrupting capacity. The combination may be used for application up to 200,000A symmetrical at 600 Vac making the MCP suitable for use in network distribution systems or other applications where unusually high fault currents are available. The current limiter connects to the load end of the MCP and is provided with terminals suitable for copper or aluminum conductors.

Limiters are coordinated with the MCP so that normal fault currents are interrupted automatically by the MCP without any damage to the limiter. Only the rare very high fault is opened by the limiter. Faults that are interrupted by the limiter also magnetically trip the MCP, opening all three poles, preventing single-phase operation.

Each of the three poles of the type ELC limiter is equipped with an indicator that extends when a fault is interrupted by the limiter.

ELC Current Limiter Attachment For F-Frame Series C MCPs

MCP Rating (Amps.)	Catalog Numbers	List Price Dis. Sym. CB-12
3	ELC003R	\$ 75.00
7	ELC007R	75.00
15	ELC015R	75.00
30	ELC030R	75.00
50	ELC050R	75.00
100	ELC100R	166.00
150	ELC150R	345.00

Description List Price Dis. Sym. CB-12

Auxiliary Switches or Alarm Switch [Ⓢ]	
1A/1B or 1M/1B	\$ 50.00
2A/2B or 2M/2B	100.00
Shunt Trip	122.00
Undervoltage Release [Ⓢ]	122.00
Keeper Nut KPR1	
Package of 12	21.80 [Ⓢ]

Base Mounting Hardware:
No charge when ordered with HMCP.
Order separately when required.
Style No. 4218880G02

TERMINAL DATA

F-Frame Series C MCP Terminal Wire Sizes[Ⓢ]

MCP Max. Amp. Rating	Style No.	Wire Range	
		AWG	Metric (mm ²)
Standard Terminals - Aluminum Body			
50	6248100G10	#14-#6	2.5-18
100	6248100G21	#8-3/0	18-70
150	6248100G17	#6-4/0	25-95
Nonstandard Terminals - Steel Body			
100	6248100G02	#14-1/0	2.5-50
150	6248100G18 [Ⓢ]	#4-4/0	25-95

Type ELC Current Limiter Terminal Wire Sizes[Ⓢ]

Type ELC Current Limiter Max. Amps.	Standard Aluminum Terminals		Nonstandard Terminals (Steel)	
	Wire Range AWG	Metric (mm ²)	Wire Range AWG	Metric (mm ²)
50	#14-2	2.5-35	#14-2 [Ⓢ]	2.5-35
100	#1-4/0	50-95		
150	#1-4/0	50-95		

- Ⓢ Handle locations and travel distances on Series C MCPs differ somewhat from earlier MCP versions. This may affect their use with existing handle mechanisms. Consult Westinghouse.
- Ⓢ Interrupting capacity ratings are given for the Type HMCP devices alone. The devices provide short circuit protection only. Overload protection must be provided by other devices on the circuit.
- Ⓢ DC ratings apply to substantially noninductive loads.
- Ⓢ Trip poles of 3-pole MCP.
- Ⓢ For ac applications, trip levels are approximately 40 percent higher.
- Ⓢ Primarily used on other than motor circuits where magnetic-only circuit interrupters are required.

ACCESSORIES

For accessories such as terminal shields, handle locks, handle mechanisms and door hardware; refer to Frame Book 29-111.

FURTHER INFORMATION

Selling Policy 7000
Technical Data 29-111
L.L. 29C401
Discount CB-12

- Ⓢ Terminal wire connectors are UL listed for standard stranded wire sizes as defined in UL 488A or UL 488B.
- Ⓢ Stainless steel body. Not UL listed.
- Ⓢ Optional on special order for copper cable only.
- Ⓢ Factory installation only.
- Ⓢ Discount CB-12.

Electrical Components Division
September, 1989

CUTLER-HAMMER FREEDOM SERIES

7/1/90

NEMA Rated 3 Phase Starters — Magnetic Full Voltage Non-Reversing — 600 Volt Max.

AN16

WHEN ORDERING SPECIFY

- Catalog Number
- Heater pack number or full load current. pg 63



NEMA Size 0

WIRE SIZES

See following page.

TYPE AN16 NEMA RATED — MANUAL OR AUTOMATIC RESET OVERLOAD RELAY

NEMA SIZE	MAXIMUM HORSEPOWER ①			Magnet Coil Voltage (60 Hz)	OPEN TYPE 3 POLE		NEMA 1 General Purpose		NEMA 3R Rainproof		NEMA 4 Watertight & Dusttight Stainless Steel		NEMA 12 Dusttight Industrial External Reset (NEMA 3 & 3R) ②	
	Frame Width	Motor Voltage	Phase		Phase	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	Catalog Number	Price	Catalog Number
00 45 mm	115	1/3	---	120 ③	AN16A0A	\$ 162.	AN16A0A	\$ 174.	Select Starter from Size 0 Listing					
	200	1	1-1/2	208	AN0E		AG0E							
	230	1	1-1/2	240	AN0B		AG0B							
	460	---	2	480	AN0C		AG0C							
	575	---	2	600	AN0D		AG0D							
0 45 mm	115	1	---	120 ③	AN16B0A	204.	AN16B0A	216.	AN16B0A	\$ 288.	AN16B0A	\$ 453.	AN16B0A	\$ 288.
	200	2	3	208	B0E		B0E							
	230	2	3	240	B0B		B0B							
	460	---	5	480	B0C		B0C							
	575	---	5	600	B0D		B0D							
1 65 mm	115	2	---	120 ③	AN16D0A	234.	AN16D0A	246.	AN16D0A	318.	AN16D0A	483.	AN16D0A	318.
	200	3	7-1/2	208	D0E		D0E							
	230	3	7-1/2	240	D0B		D0B							
	460	---	10	480	D0C		D0C							
	575	---	10	600	D0D		D0D							
2 65 mm	115	3	---	120 ③	AN16G0A	426.	AN16G0A	486.	AN16G0A	618.	AN16G0A	918.	AN16G0A	618.
	200	7-1/2	10	208	G0E		G0E							
	230	7-1/2	15	240	G0B		G0B							
	460	---	25	480	G0C		G0C							
	575	---	25	600	G0D		G0D							
3 90 mm	115	7-1/2	---	120 ③	AN16K0A	690.	AN16K0A	810.	AN16K0A	966.	AN16K0A	1422.	AN16K0A	966.
	200	15	25	208	K0E		K0E							
	230	15	30	240	K0B		K0B							
	460	---	50	480	K0C		K0C							
	575	---	50	600	K0D		K0D							
4	115	---	---	120 ③	AN16N0A	1578.	AN16N0A	1830.	AN16N0A	2346.	AN16N0A	2874.	AN16N0A	2346.
	200	---	40	208	N0E		N0E							
	230	---	50	240	N0B		N0B							
	460	---	100	480	N0C		N0C							
	575	---	100	600	N0D		N0D							
5	115	---	---	120 ③	AN16S0A	3855.	AN16S0A	4317.	AN16S0A	5637.	AN16S0A	5637.	AN16S0A	5637.
	200	---	75	208	S0E		S0E							
	230	---	100	240	S0B		S0B							
	460	---	200	480	S0C		S0C							
	575	---	200	600	S0D		S0D							
6	115	---	---	120 ③	AN16T0A	8921.	AN16T0A	11841.	AN16T0A	13417.	AN16T0A	14761.	AN16T0A	13417.
	200	---	150	208	T0E		T0E							
	230	---	200	240	T0B		T0B							
	460	---	400	480	T0C		T0C							
	575	---	400	600	T0D		T0D							
7	115	---	---	120 ③	AN16U0A	12728.	AN16U0A	15736.	AN16U0A	17721.	AN16U0A	18656.	AN16U0A	17721.
	200	---	200	208	U0E		U0E							
	230	---	300	240	U0B		U0B							
	460	---	600	480	U0C		U0C							
	575	---	600	600	U0D		U0D							
8	115	---	---	120 ③	AN16V0A	19783.	AN16V0A	22703.	AN16V0A	24280.	AN16V0A	25623.	AN16V0A	24280.
	200	---	400	208	V0E		V0E							
	230	---	450	240	V0B		V0B							
	460	---	900	480	V0C		V0C							
	575	---	900	600	V0D		V0D							

Prices of starters do not include heater packs. Select 1 carton of 3 heater packs at \$27. total. Heater pack selection, Page 63.

① Maximum horsepower rating of starters for 380 V 50 Hz applications:

NEMA Size	00	0	1	2	3	4	5	6	7	8
Horsepower	1-1/2	5	10	25	50	75	150	300	600	900

② Suitable for outdoor application when properly installed — see Page 8 for details.

③ For separate 120 V control circuit. For maximum hp at listed motor voltages, use the rating of other starters of same size.

DIMENSIONS, Page 14 ACCESSORIES, Pages 58-62

DISCOUNT SCHEDULE TCD-1

Printed in U.S.A.

E.T.O.N.

CUTLER-HAMMER FREEDOM SERIES

C306

**Thermal Overload Relays
Manual or Automatic Reset**

DESCRIPTION

Type C306 Manual or Automatic Reset overload relays are designed for use with Type CE or CN non-reversing and reversing contactors. Four sizes are available for overload protection up to 144 amperes. The 32 and 75 A overload relays can be directly attached to contactors. Alternately, these relays can be DIN rail mounted — see adapter listed below. The 100 and 144 A overload relays are panel mounted only. Features include:

- Selectable Manual or Automatic Reset operation.
- Interchangeable Heater Packs adjustable $\pm 24\%$ to match motor FLA and calibrated for 1.0 and 1.15 service factor motors.
- Heater packs for 32 A overload relay will mount in 75 A overload relay — useful in derating applications such as jogging.
- Bimetallic, ambient compensated operation. Trip free mechanism.
- Electrically isolated NO — NC contacts (pull RESET button to test).
- Shrouded or "finger proof" terminals to reduce possibility of electrical shock.
- Single phase protection.

TYPE C306 THERMAL OVERLOAD RELAYS

MAXIMUM AMPERE RATING	Number of Poles	OPEN TYPE		NEMA 1 ENCLOSED	
		Catalog Number	Price	Catalog Number	Price
32	3	C306DN3	\$ 63.	C306EG3	\$ 87.
75	3	GN3	108.	GG3	156.
105	3	KN3	156.		
144	3	NN3	216.		

DIN RAIL AND PANEL MOUNTING ADAPTER

These adapters are required when component overload relays are to be separately mounted. The terminal base adapter includes line terminals and connects with the overload relays listed above.



Cat. No. C306TB1

Description	Catalog Number	Price
For 32 Ampere Overload Relay	C306TB1	\$ 9.
For 75 Ampere Overload Relay	TB2	18.

CONTACT RATINGS (Amperes)

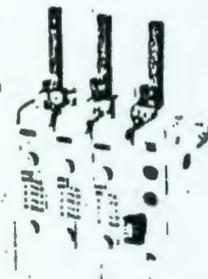
Current	Ac Volts			
	120 V	240 V	480 V	600 V
NC CONTACT (B600)				
Make & Interrupting	30	15	7.5	6
Break	3	1.5	0.75	0.6
Continuous	5	5	5	5
NO CONTACT (C600)				
Make & Interrupting	15	7.5	3.75	3
Break	1.5	0.75	0.375	0.3
Continuous	2.5	2.5	2.5	2.5

DISCOUNT SCHEDULE 1CD-1

Printed in U.S.A.



32 Ampere Overload
Cat. No. C306DN3



75 Ampere Overload Cat.
No. C306GN3

HEATER PACKS

MANUAL OR AUTOMATIC RESET

NOTE: Heater packs are shipped 3 to a carton. Catalog Numbers and prices listed below are for 3 heater packs.

Motor Full Load Ampere Rating	Dial Position	Catalog Number (Includes 3 Heater Packs)		Price (Includes 3 Heater Packs)	
		Fast Trip Class 10	Std. Trip Class 20		
A	B	C	D		
FOR USE WITH NEMA SIZES 00-2, I.E.C. SIZES A-K ONLY					
.283	.328	.374	.420	H2101-3	H2001-3
.421	.488	.556	.623	H2102-3	H2002-3
.624	.724	.824	.924	H2103-3	H2003-3
.925	1.07	1.22	1.37	H2104-3	H2004-3
1.38	1.60	1.82	2.04	H2105-3	H2005-3
2.05	2.38	2.71	3.03	H2106-3	H2006-3
2.53	2.93	3.34	3.74	H2107-3	H2007-3
3.70	4.29	4.88	5.48	H2108-3	H2008-3
5.39	6.25	7.11	7.98	H2109-3	H2009-3
7.83	9.08	10.3	11.6	H2110-3	H2010-3
10.8	12.4	14.1	16.0	H2111-3	H2011-3
16.1	18.7	21.3	23.8	H2112-3	H2012-3
21.6	25.1	28.5	32.0	H2113-3	H2013-3
FOR USE WITH NEMA SIZE 2, I.E.C. SIZES G-K ONLY					
27.0	31.3	35.6	40.0	H2114-3	H2014-3
27.4	30.7	34.0	37.3	H2115-3	H2015-3
32.5	37.7	42.9	48.2	H2116-3	H2016-3
35.5	39.0	42.5	46.0	H2117-3	H2017-3
42.1	48.8	55.6	62.3		
44.5	49.6	54.8	60.0		
50.6	58.7	66.8	74.9		
58.0	63.6	69.3	74.9		
FOR USE WITH NEMA SIZES 3-4, I.E.C. SIZES L-N ONLY					
18.0	20.2	22.3	24.5	H2018-3	H2018-3
24.6	27.6	30.5	33.4	H2019-3	H2019-3
33.5	37.5	41.5	45.6	H2020-3	H2020-3
45.7	51.2	56.7	62.1	H2021-3	H2021-3
62.2	69.7	77.1	84.6	H2022-3	H2022-3
84.7	95.0	105.0	115.0	H2023-3	H2023-3
106.0	118.0	131.0	144.0	H2024-3	H2024-3
FOR USE WITH SIZE 5 STARTERS ONLY					
55.5	64.2	73.2	82.2	H2004-3	H2004-3
82.8	96.0	109	122	H2005-3	H2005-3
123	143	163	182	H2006-3	H2006-3
152	176	200	224	H2007-3	H2007-3
222	257	293		H2008-3	H2008-3
FOR USE WITH SIZE 6 STARTERS ONLY					
165	192	218	245	H2005-3	H2005-3
246	286	325	364	H2006-3	H2006-3
304	352	401	449	H2007-3	H2007-3
444	515	585		H2008-3	H2008-3

For motor full load amperes between listed values, adjust dial clockwise for higher or counterclockwise for lower motor currents. The currents listed are for 1.0 and 1.15 service factor motors. A position adjustment is provided for 1.0 service factor motors.



OMRON

WHC-SD-L092-OMM-001, Rev. 0

GENERAL-PURPOSE RELAY

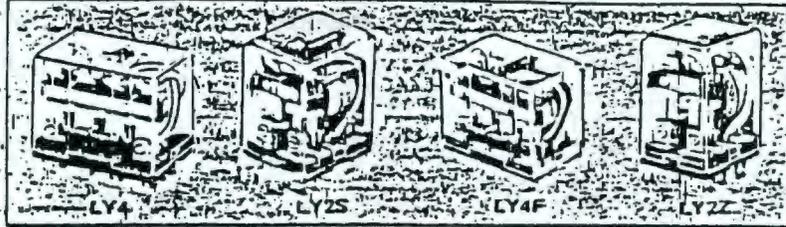
Cat. No. J02-E33

Model LY

Small, General-purpose 10A Relay For Various Applications

FEATURES

- High shock and vibration resistance
- Arc barrier equipped
- High dielectric strength (2,000 VAC)



AVAILABLE TYPES

Type	Type	Single contact			Two contact		
		SPDT	3PDT	4PDT	SPDT	3PDT	4PDT
Standard	Plug-in socket	SPDT	LY1-US	LY1F-US	LY1S-US	LY1Z-US	LY1ZS-US
		3PDT	LY2-US	LY2F-US	LY2S-US	LY2Z-US	LY2ZS-US
	PCB	SPDT	LY10-US	LY10F-US	LY10S-US	LY10Z-US	LY10ZS-US
		3PDT	LY20-US	LY20F-US	LY20S-US	LY20Z-US	LY20ZS-US
Over-current protector and surge protector	Plug-in socket	SPDT	LY11-US	LY11F-US	LY11S-US	LY11Z-US	LY11ZS-US
		3PDT	LY21-US	LY21F-US	LY21S-US	LY21Z-US	LY21ZS-US
	PCB	SPDT	LY110-US	LY110F-US	LY110S-US	LY110Z-US	LY110ZS-US
		3PDT	LY210-US	LY210F-US	LY210S-US	LY210Z-US	LY210ZS-US
Over-current protector and surge protector	Plug-in socket	SPDT	LY12-US	LY12F-US	LY12S-US	LY12Z-US	LY12ZS-US
		3PDT	LY22-US	LY22F-US	LY22S-US	LY22Z-US	LY22ZS-US
	PCB	SPDT	LY120-US	LY120F-US	LY120S-US	LY120Z-US	LY120ZS-US
		3PDT	LY220-US	LY220F-US	LY220S-US	LY220Z-US	LY220ZS-US
Time delay and latching	Plug-in socket	SPDT	LY13-US	LY13F-US	LY13S-US	LY13Z-US	LY13ZS-US
		3PDT	LY23-US	LY23F-US	LY23S-US	LY23Z-US	LY23ZS-US
	PCB	SPDT	LY130-US	LY130F-US	LY130S-US	LY130Z-US	LY130ZS-US
		3PDT	LY230-US	LY230F-US	LY230S-US	LY230Z-US	LY230ZS-US

When placing your order, add the desired coil voltage rating listed in "SPECIFICATIONS" to the part number as shown below.

LY1-US-DC5
 ↳ Coil rating

OMRON

STANDARD TYPE

SPECIFICATIONS

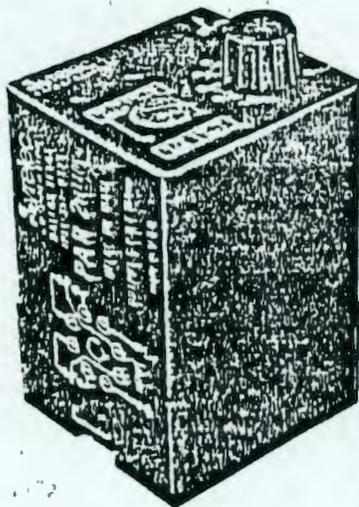
COIL RATINGS

Rated voltage (V)	Rated current (mA)						Coil resistance (Ω)			Coil inductance (ref. value) (mH)						Max. operate voltage (% of rated voltage)	Must dropout voltage (% of rated voltage)	Max. surge voltage (% of rated voltage)	Power consumption (VA, W)			
	SPDT, DPDT		3PDT		4PDT		SPDT, DPDT	3PDT	4PDT	SPDT, DPDT	3PDT	4PDT	SPDT, DPDT	3PDT	4PDT							
	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	SPDT, DPDT	3PDT	4PDT	Armature OFF	Armature ON	Armature OFF	Armature ON	Armature OFF	Armature ON							
AC	6	214	183	310	270	386	330	12.2	6.7	5	0.04	0.08	0.03	0.05	0.02	0.04	85 max.	30 min.	110	Approx. 1.0 to 1.2	Approx. 1.6 to 2.0	Approx. 1.95 to 2.5
	12	106.5	91	159	134	199	170	6	24	20	0.17	0.33	0.12	0.21	0.10	0.17						
	24	53.2	45	80	67	93.6	80	180	100	78	0.69	1.30	0.44	0.79	0.38	0.67						
	50	23.7	22	38	33	46.8	40	788	410	350	3.22	6.64	2.24	3.87	1.74	2.88						
	120	10.8	9.2	17.3	14.8	19.0	16.4	4,430	2,300	2,200	19.00	32.40	11	20.1	9.3	19						
240	5.4	4.6	9.4	8.1	11.0	9.5	18,790	10,400	9,000	78.70	128.7	43.6	74.6	33.2	63.4							
DC	6	150	124	240	200	40	25.7	15	15	0.16	0.33	0.11	0.21	0.09	0.21	10 min.	110	Approx. 0.9	Approx. 1.4	Approx. 1.3		
	12	75	62	120	100	160	107	100	73	0.73	1.37	0.46	0.98	0.39	0.84							
	24	36.9	31.2	58.6	49	650	410	350	10.30	15.72	1.89	3.87	1.41	2.91								
	48	18.5	15.6	28.2	23	2,600	1,700	1,600	10.6	21.0	4.53	10.9	4.09	13.6								
	110	10	8.5	15.9	13.3	11,000	8,500	8,900	45.8	88.2	29.6	54.3	37	63.7								

NOTE: The rated current, coil resistance and inductance are measured at coil temperature of 23°C with tolerance of ±15%, -20% for AC rated current, ±15% for DC rated current, and ±15% for rated coil resistance.

CONTACT RATINGS

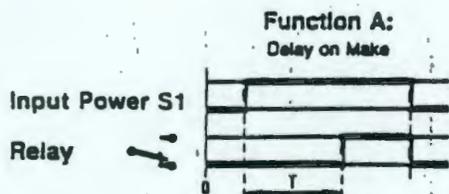
Item	Type	SPDT, DPDT, 3PDT, 4PDT	
		Resistive load (p.f.=1) [L/R=7ms.]	Inductive load (p.f.=0.4) [L/R=7ms.]
Rated load		110 VAC 15A 24 VDC 15A	110 VAC 10A 24 VDC 7A
Carry current		10A	
Max. operating voltage		250 VAC 125 VDC	
Max. operating current		15A	
Max. switching capacity		1,700VA 360W	1,100VA 170W
Minimum permissible load (ref. value)		5 VDC 100mA	



AR2 SERIES DELAY ON MAKE ELECTRONIC TIMING RELAY

UL-E80750 CSA-56339

- CMOS Technology
- 10 Amp DPDT Relay
- LED Relay Status Indicator
- Two Timing Ranges

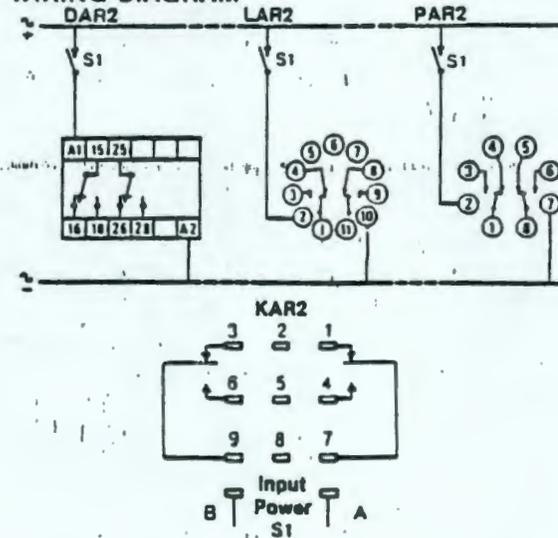


When input power (S1) is applied, the relay delays the preset time (T) period prior to energizing. Interrupt power to unmatch the relay. Timer is supplied with a red LED relay status indicator.

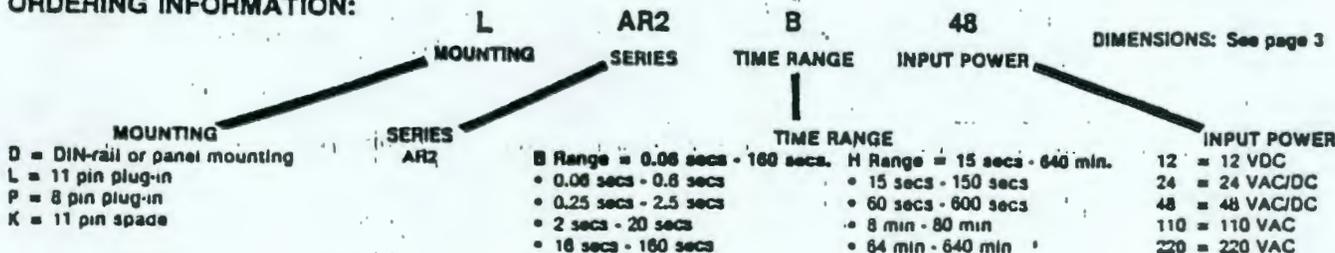
SPECIFICATIONS:

Input power	12 VDC, 24 VAC/DC, 48 VAC/DC, 110 VAC, 220 VAC, ± 15% (50/60 Hz)
Maximum power consumption	24 VAC: 1.5VA 12 VDC: 0.5W 48 VAC: 2 VA 24 VDC: 0.8W 110 VAC: 5 VA 48 VDC: 1.8W 220 VAC: 11 VA
Output	DPDT Relay
Contact material	Ag Cdo
Maximum loading	10A AC resistive 1A DC inductive
Maximum switching voltage	240 VAC 30 VDC
Relay maximum power rating	2400 VA 30W
Transient protection	2500 volts
Mechanical life of relay	30 x 10 ⁶ operations
Electrical life of relay	2 x 10 ⁶ at 2400 VA resistive load
Repetition Accuracy	± 0.5% at a constant ambient
Reset time	25ms after timing 100ms during timing
Operating and storage Temperature	-4°F to +140°F -20°C to +60°C
Weight	3.5 oz. (100 grams)

WIRING DIAGRAM



ORDERING INFORMATION:

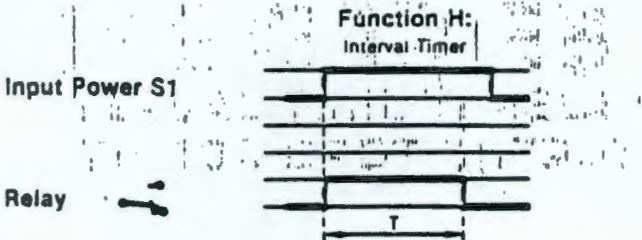
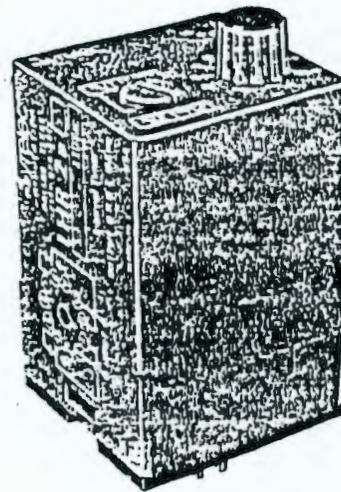


HR2 SERIES

INTERVAL TIMING RELAY WITH 10A DPDT OUTPUT

UL-E80750

- High Repeatability
- Two Time Ranges
- Four Time Subranges
- Four Mounting Choices

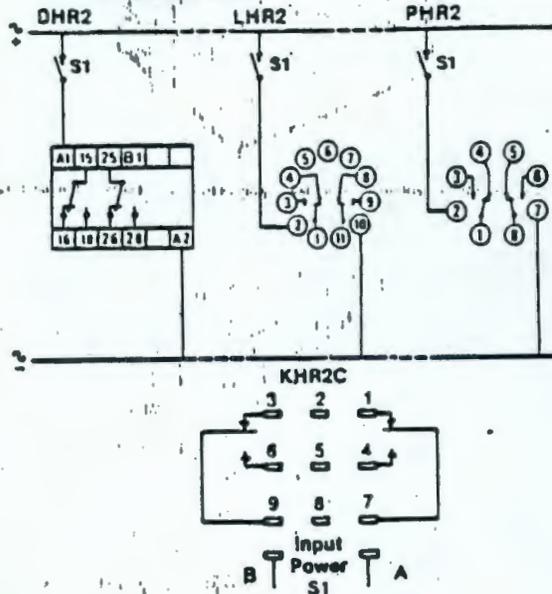


Function H: The output relay is energized when the input power (S1) is applied. At the end of the delay time (T), the output relay is de-energized. The timer is reset when the input power is removed.

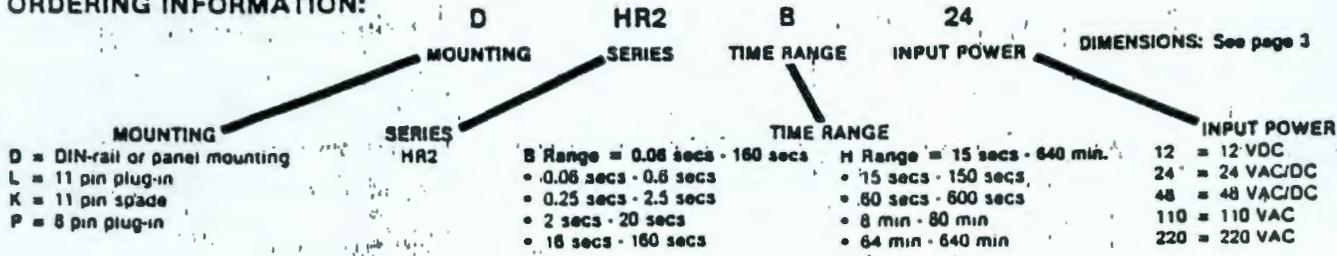
SPECIFICATIONS:

Input power	12 VDC, 24 VAC/DC, 48 VAC/DC 110 VAC, 220 VAC, ± 15%, 50/60 Hz
Maximum power consumption	24 VAC: 1.5 VA 12 VDC: 0.5W 48 VAC: 2 VA 24 VDC: 0.8W 110 VAC: 5 VA 48 VDC: 1.8W 220 VAC: 11 VA
Output	DPDT Relay
Contact material	Ag Cdo
Maximum loading	10A AC resistive 1A DC Inductive
Maximum switching voltage	240 VAC 30VDC
Relay maximum power rating	2400 VA 30W
Transient protection	2500 volts
Mechanical life of relay	30 x 10 ⁶ operation
Electrical life of relay	± 0.5% at a constant ambient
Reset time	Function H: 200ms during timing or 50ms after.
Operating temp	-4°F to +140°F -20°C to +60°C
Weight	3.5 oz. (100 grams)

WIRING DIAGRAM



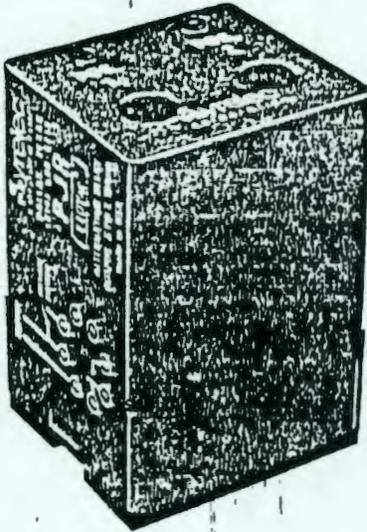
ORDERING INFORMATION:



JR SERIES

Alternating Relay

UL-E80750 CSA-56339



- Duplex Alternating Control
- SPDT or DPDT Control Relay
- 10 Amp Rated
- Externally Controlled

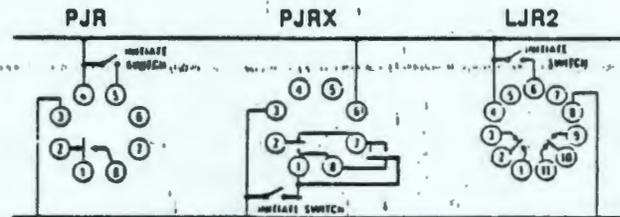
The electronic alternating relay is designed to replace mechanical style devices used in control applications requiring a duplexing or alternating action of the control circuit to operate pumps, compressors, etc. This is achieved by activating a control switch which is common to one side of the input control voltage. The output contact of the relay(s) change state when this switch is opened (on

de-energization of the control circuit). When the control initiate switch is actuated and released or opened, the relay will change state. The next time the initiate switch is actuated, it will change back to its original state. Two red LED's located on the top of the dust resistant enclosure provide the status of the relay.

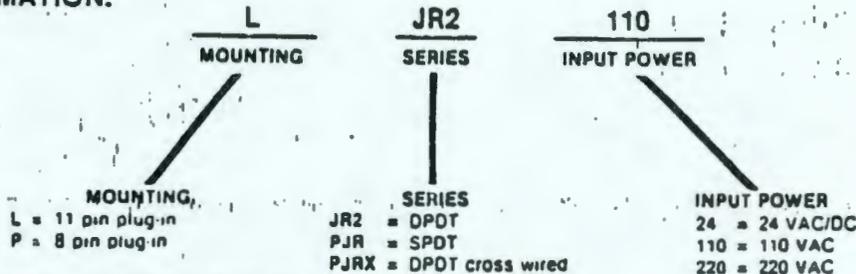
SPECIFICATIONS:

Input Power	24 VAC/DC, 110, 220 VAC. ± 15% (50/60 Hz)	
Power Consumption	24 VAC: 1.5VA 110 VAC: 5VA 220 VAC: 11VA	24VDC: .8W
Output	SPOT 10A resistive DPDT, 10A resistive DPDT 10A crosswired	
Minimum Pulse	30ms	
Contact Material	AgCdO	
Maximum Loading	10A AC Resistive	1A DC inductive
Maximum Switching Voltage	250 VAC	30VDC
Maximum Power Rating	2200 VA	30W
Mechanical Life of Relay	30 x 10 ⁶ operation	
Electrical Life of Relay	2 x 10 ⁶ at 2200 VA resistive load	
Operating Temperature	14 °F to 140 °F	10 °C to + 60 °C
Weight	2.8 oz. (100 grams)	

WIRING DIAGRAM

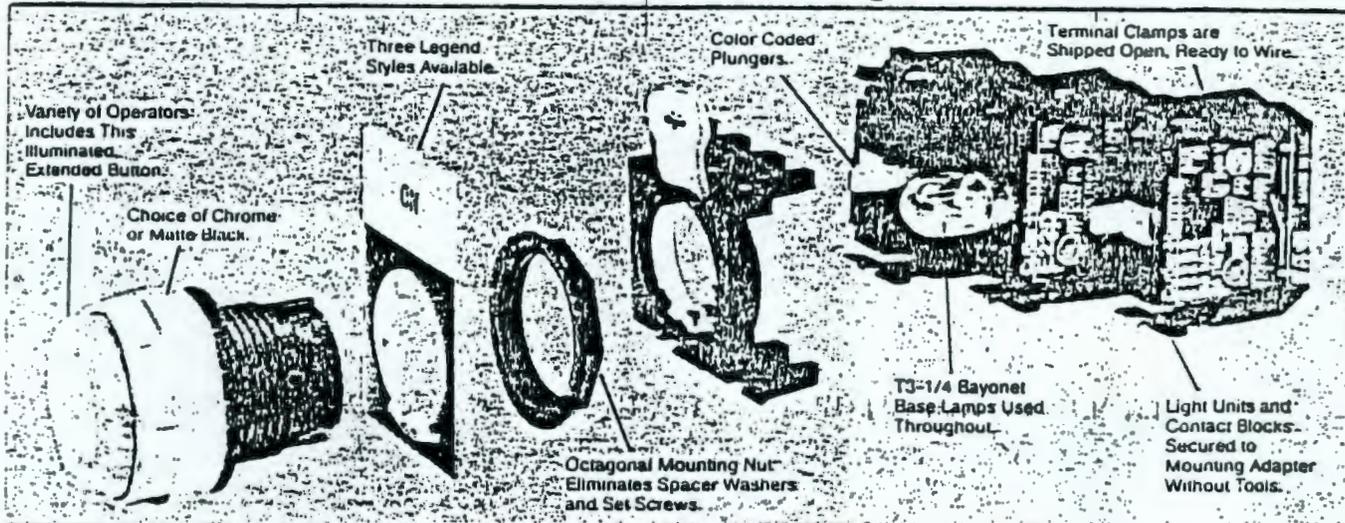


ORDERING INFORMATION:



Note: DPDT relay available only with 11-pin plug-in (L).

Part by part no other Industrial Pushbutton comes together with as much class!



SPECIFICATIONS

International Standards and Approval

- UL listed — File #E131568, Guide #NKCR.
- CSA Certified — Class #3211 03, 352C, 54094.
- UL508, I.E.C. 337 (BS4794), VDE0660, MTTA, NEMA.

Environmental and Operating Conditions

- UL listed (NEMA) Type 1, 2, 3, 3R, 4, 4X, 12, 13 when mounted in enclosure rated for those same applications.
- I.E.C. 529 — All operators IP65.
- Ambient Temperature Range:
Operating: -20°C to 60°C (-4°F to 140°F)
Storage: -40°C to 80°C (-40°F to 176°F)

Contact Block Specifications

- I.E.C. 337-1 — AC11/DC11.
- UL486E — Terminal secureness test.
- IP20 — Fingerproof protected (shrouded) terminals.
- Positive drive operation on NC contacts.
- 1 NO, 1 NC, 1 NO Early Make, 1 NC Late Break, 2 NO, 1 NO-1 NC
- Solid or stranded wires, single or in pairs, between AWG 12-22.



CONTACT BLOCK RATINGS

	Ac — UL Type A600				Dc — UL Type Q600			
	120	240	480	600	125	250	440	600
Make and emergency interrupting capacity	60	30	15	12	0.55	0.27	0.1	0.1
Normal Load Break	6	3	1.5	1.2	0.55	0.27	0.1	0.1
Continuous Current	10	10	10	10	2.5	2.5	2.5	2.5

GENERAL DESCRIPTION

Cutler-Hammer's 22.5 mm Industrial Heavy Duty Pushbutton line offers functional, smartly styled illuminated and non-illuminated pushbuttons, selector switches, indicating lights, mushrooms, twist-to-release operators, enclosures and wobble sticks. Complete line also includes transformer, full voltage and LED light units, a wide selection of contact blocks, aluminum and plastic legend plates and accessories. The operators are available with either a traditional chrome or new matte black front-of-panel appearance. The space saving design and modular construction of the E22 line makes on-the-job assembly fast, and simplifies the stocking of both components or complete devices.

These devices are 600 V heavy duty industrially rated — watertight, piltight and corrosion resistant, and meet international standards and approvals for easy exporting.

The operators mount from the front-of-panel in an unnotched 22.5 mm (7/8") diameter hole, and are secured from the rear by an octagonal mounting nut.

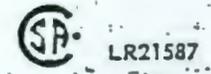
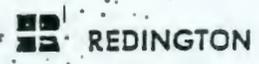
PAGE GUIDE

Catalog Number	Page Number	Catalog Number	Page Number
E22A	244, 259-260	E22LL	243, 252
B	243, 245, 258-259	M	242, 252, 259
C	257-258	ML	243
D	245, 259	N	244, 254, 256
E	242, 252	P	242, 252, 254, 258-259
E22ED	246, 252	E22R	245, 251, 259
F	244	S	249
FD	246	T	244, 253
G	243	TL	245, 259
GD	246	V	247, 253, 258
E22H	244	E22W	249, 259
HD	246	X	247, 253
J	242-243, 252	Y	250
K	248, 260		
L	242, 252, 258		

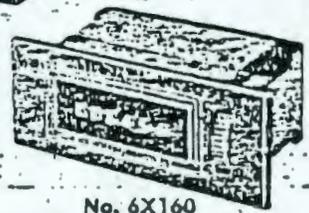


ELECTRICAL AND ELECTRONIC RESETTABLE COUNTERS

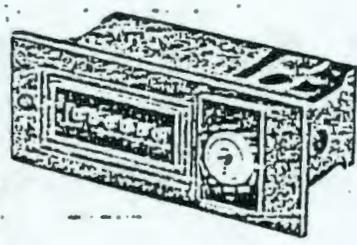
ELECTRICAL RESETTABLE COUNTERS



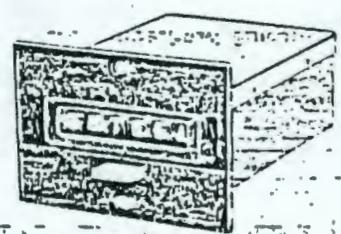
No. 6X159
Diecast
Frame



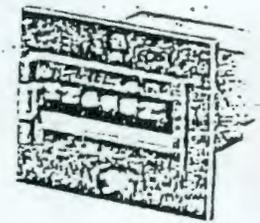
No. 6X160
Universal
Replacement



No. 6X161
Flush
Mounting



Nos. 1A124 & 6X594
Front or Rear
Panel Mounting



No. 6X595
Designed for
Quick Connect Wiring

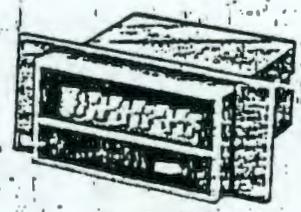
COUNTER SPECIFICATIONS AND ORDERING DATA

Reset Type	No. of Digits	Counts Per Minute	Life. No. of Counts	60 Hz Input Volts	60 Hz Input Power	Minimum Pulse Timing, mSec.-ON/mSec.-OFF	Mounting	Redington Model -T15AC	Stock No.	List	Each
Knob	6	1000	50x10 ⁶	115VAC	7.8VA	30/30	Base	2-1006	6X159	\$76.20	\$69.73
							Panel	P2-1006	6X160	82.75	75.77
Key	6	1000	50x10 ⁶	115	7.8	30/30	Panel	P32-1026	6X161	111.50	101.95
Pushbtn	6	600	10x10 ⁶	115	3.0	50/50	Panel	P2-4906	1A124	38.45	36.50
Pushbtn	4	600	10x10 ⁶	115	3.0	50/50	Panel	P2-4904	6X594	31.00	29.45
Pushbtn	6	960	200x10 ⁶	115	1.8	30/30	Panel	R2-3106	6X595	76.45	69.98

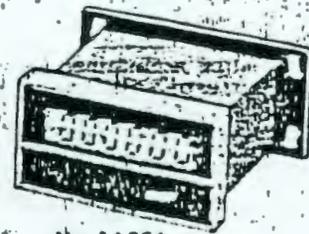
ELECTRONIC RESETTABLE COUNTERS

9415 SERIES

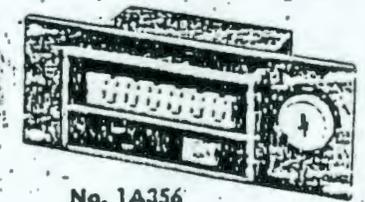
- Provides high speed counting
- 4 year battery life
- Epoxy coated zinc housings
- Dimensions: 3.15W x 2.9L x 1.65"H, excluding mounting plate



No. 1A365
Panel Mount



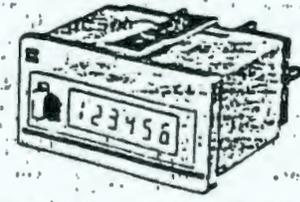
No. 1A354
Base Mount



No. 1A356
Panel Mount

7600 SERIES

- No power supply needed. Connect to switch or contact device to operate
- 7 year battery life
- Molded plastic housing
- Dimensions: 1.9W x 2.0L x 0.95"H



No. 2A540
Panel Mount

COUNTER SPECIFICATIONS AND ORDERING DATA

Reset Type	No. of Digits	60 Hz Input Volts	Power	Counts/Minute Switch-Sensor	Minimum Pulse Timing Msec.-ON/Msec.-OFF	Redington Model	Stock No.	List	Each
Pushbutton	6	6 to 240 Volts AC or DC	1.1VA	1200-2400	25/25 (Switch) 12.5/12.5 (Sensor)	9415-003	1A355	\$114.80	\$169.18
Pushbutton						9415-001	1A354	172.15	157.59
Key						9415-005	1A356	197.75	181.01
Pushbutton or Remote	6	Not Required		1900-60,000	12/12	7600-030	2A540	143.60	41.79

Thru-The-Door Operators & Circuit Breakers

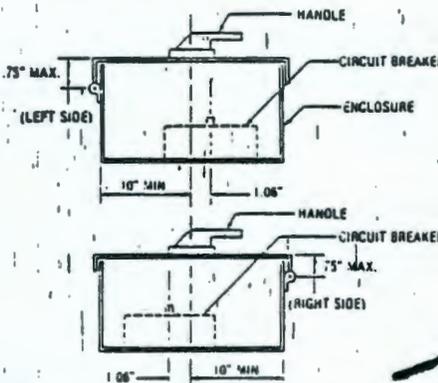
WHEN ORDERING SPECIFY

- Catalog Number of Kit
- Catalog Number of Long Shaft if required.

DESCRIPTION

Rotary, door mounted handles are gasketed to be suitable for NEMA 3R/12 or NEMA 4 enclosures. Standard Kit consists of a door mounted handle, a short threaded shaft for cutting to proper panel depth, and a breaker mounted operating mechanism. The optional long shaft is ordered separately to provide for greater panel depths. Panel depth is the distance from the inside of the enclosure door to the mounting surface of the circuit breaker.

The handle may be padlocked in the OFF position. It is interlocked to the operating mechanism so that the door cannot be opened in the ON position without using a hidden defeater. The handle, when locked in the OFF position, also locks the enclosure door closed so that the defeater cannot be utilized.



ROTARY CIRCUIT BREAKER OPERATING MECHANISM KITS

Circuit Breaker		Handle and Mechanism with Standard Shaft				Separate Long Shaft			
Maximum Amperes	Type	Panel Depth in Inches	NEMA 3R/12 Kit		NEMA 4 Kit		Panel Depth in Inches	Catalog Number	Price
			Cat. No.	Price	Cat. No.	Price			
150A	3 Pole FS, FH	5.00 — 10.25	CBF01	\$ 80.	CBF01W	\$122.	10.25 — 14.00	CBSL1	\$14.80
225A	JS, JH, JL	5.88 — 11.12	CBJ02	99.	CBJ02W	151.	11.12 — 14.88		
400A	KS, KH	5.88 — 11.12	CBK040	99.	CBK040W	151.	11.12 — 14.88		
600A	LS, LH	6.12 — 11.25	CL06	133.	CL06W	204.	11.25 — 15.00		
800A	MS, MH	6.68 — 11.81	CBM08	133.	CBM08W	204.	11.81 — 15.56		
1200A	NS, NH	7.94 — 13.25	CBN12	133.	CBN12W	204.	12.94 — 16.94		

CIRCUIT BREAKER SELECTION BY HORSEPOWER • TYPE FS-MS

Thermal Magnetic Trip — 600.V ac.Max. — Full Selection and Prices On Following Pages

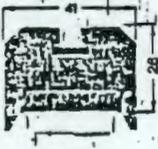
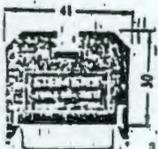
NEMA Size	Maximum Horsepower 3 Phase			240 V ac			480 V ac			600 V ac		
	230 V	460 V	575 V	Frame Size	Ampere Rating	Catalog Number	Frame Size	Ampere Rating	Catalog Number	Frame Size	Ampere Rating	Catalog Number
	0	3/4 2 3	1-1/2 5	2 5	FS FS FS	15 15 20	FS320015A FS320015A FS320020A	FS FS FS	15 15 15	FS340015A FS340015A FS340015A	FS FS FS	15 15 15
1	5 7-1/2	7-1/2 10 15	7-1/2 10 15	FS FS	25 30 50	FS320025A FS320030A FS320050A	FS FS	20 35	FS340020A FS340035A	FS FS	20 25	FS360020A FS360025A
2	10 15	20 25 30	20 25 30	FS FS	60 90	FS320060A FS320090A	FS FS	60 70	FS340060A FS340070A	FS FS	50 60	FS360050A FS360060A FS360060A
3	25 30	30 40 50	— — 50	FS JS	125 125	FS340125B JS360125A	FS FS FS	80 100 125	FS340080A FS340100A FS340125B	— — FS FS	— — 80 100	— — FS360080A FS360100A
4	— 40 50	60 75 100	60 75 100	— JS JS	— 150 200	— JS360150A JS360200A	FS JS JS	125 150 175	FS340125B JS360150A JS360175A	FS JS JS	125 125 175	FS360125A JS360125A JS360175A
5	— 60 75 100	— 125 150 200	125 150 200	— JS KS KS	— 225 300 400	— JS360225A KS3603000 KS3604000	— KS KS KS	— 225 250 350	— KS3602250 KS3602500 KS3603500	— JS KS KS	— 200 225 300	— JS360200A KS3602250 KS3603000
6	— 125 150 200	— 250 300 400	250 300 400	— LS LS MS	— 500 600 700	— LS360500A LS360600A MS360700A	— LS LS MS	— 450 600 800	— LS360450A LS360600A MS360800A	— LS LS MS	— 350 400 600	— LS360350A LS360400A MS360600A

Selections are based on NEC Table 430-152. Some applications may require selection in accordance with exceptions noted in NEC paragraph 430-52.

For Discount, See Distribution Equipment Price and Availability Digest (DE PAD)



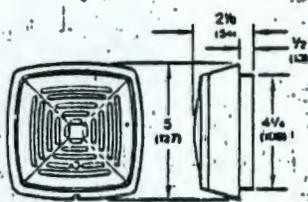
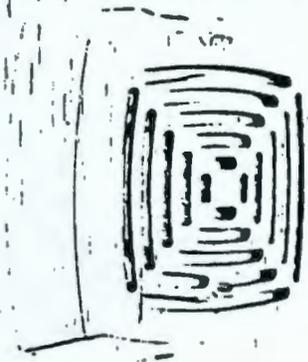
Through-Type Terminals

Selection and ordering data								
Dimensions (mm)	Terminal size Copper size	Voltage rating	Continuous current A		As-sembly w/CR mm	Catalog No.	List Price Each \$	Standard pack Qty.
Through-type terminals with insulating body of molded thermoplastic, narrow version, with screw terminals on both sides								
	Terminal size 2.5 18-12 AWG solid 0.5 mm ² to 4 mm ² finely stranded 0.5 mm ² to 2.5 mm ²	600 V AC 750 V, DC 900 V	26 26 10	Single terminal Block of three Block of ten (marked) Single terminal, blue	5.5 16.6 55.4 5.5	#WA1 201 #WA1 301 #WA1 401 #WA1 011-1BF11	0.78 2.20 4.10 0.95	100 50 25 100
				Accessories: Barrier Separator for single terminal Link rails for: 2 terminals 3 terminals 10 terminals Cover with warning arrow white, for inscription Test socket 2.0 dia.	1 1 1 1 1 1 1	#WA1 820 #WA1 825 #WA1 840 #WA1 843 #WA1 800 #WA1 810 #WA1 860 #WA1 854	0.40 0.26 0.85 1.12 2.45 0.28 0.32 0.15	100 100 100 100 100 100 100
	Terminal size 4 18-10 AWG @ 18-10 AWG solid 0.5 to 6 mm ² finely stranded 0.5 mm ² to 4 mm ²	600 V AC 750 V, DC 900 V	35 35 10	Single terminal Single terminal, blue Single terminal, green yellow	6.5 6.5 6.5	#WA1 011-1DG11 #WA1 011-1BG11 #WA1 011-1PG11	0.90 1.10 2.70	100 100 100
				Accessories: Barrier Separator Link rails for: 2 terminals 3 terminals 10 terminals Cover with warning arrow white, for inscription Test socket 2.3 dia.	1 1 1 1 1 1 1	#WA1 820 #WA1 825 #WA1 850 #WA1 851 #WA1 853 #WA1 811 #WA1 862 #WA1 854	0.40 0.26 1.00 1.20 3.05 0.30 0.35 0.15	100 100 100 100 100 100 100
	Terminal size 6 14-8 AWG @ 14-8 AWG solid 0.75 mm ² to 10 mm ² finely stranded 1.5 mm ² to 6 mm ²	600 V AC 750 V, DC 900 V	47 44	Single terminal Block of three Single terminal, blue	7.2 21.8 7.2	#WA1 202 #WA1 302 #WA1 011-1BH11	1.20 3.30 1.46	100 50 100
				Accessories: Barrier Link rails for: 2 terminals 3 terminals 10 terminals Cover with warning arrow white, for inscription	1 1 1 1 1	#WA1 821 #WA1 841 #WA1 844 #WA1 801 #WA1 811 #WA1 862	0.46 1.07 1.45 3.36 0.35 0.20	100 100 100 50 100 100
	Terminal size 16 12-4 AWG @ 14-6 AWG solid and stranded 1 mm ² to 25 mm ² finely stranded 2.5 mm ² to 16 mm ²	600 V AC 750 V, DC 900 V	79 82	Single terminal Block of three Single terminal, blue	10 30 10	#WA1 204 #WA1 304 #WA1 011-1BK11	2.00 5.70 2.27	50 50 50
				Accessories: Barrier Link rails for: 2 terminals 3 terminals 10 terminals Cover with warning arrow	1 1 1 1 1	#WA1 821 #WA1 842 #WA1 846 #WA1 802 #WA1 812	0.46 2.00 2.70 6.80 0.48	100 50 50 50 100
	Terminal size 35 10-1 AWG @ 12-2 AWG solid and stranded 4 mm ² to 50 mm ² finely stranded 6 mm ² to 35 mm ²	600 V AC 750 V, DC 900 V	120 135	Single terminal Block of three Single terminal, blue	16 48 16	#WA1 205 #WA1 305 #WA1 011-1BM11	3.40 9.65 3.68	50 20 50
				Accessories: Barrier Link rails for: 3 terminals 10 terminals Cover with warning arrow	1.5 1 1	#WA1 823 #WA1 803 #WA1 804 #WA1 813	2.76 4.54 13.35 0.57	25 20 20 100

For labeling accessories see page 13/11.

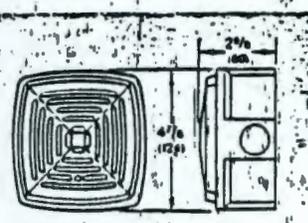
GRILLE TYPE

For general broadcast coverage. Convenient, simple Adaptaplate mounting. Projects only 2" from mounting surface. Mounts on any single gang box or 3 1/4", 3 1/2" or 4" octagon box or 4" square box.



WEATHERPROOF TYPE

For outdoor applications. Die-cast weatherproof box with bonderized sage gray finish. Mounts on conduit or any flat surface using 3" (76.2) diameter bolt circle. Drilled and tapped 1/4", 14 NPT on top, bottom and rear and has knockouts bottom and rear.



STANDARD AC SERIES

Cat. No.	Type	Volt. AC 50/60 Hz	Amps	VA	DC Coil Res. (Ohms)	dB at 10 Ft.
870-G5	Flush	24	.63	15	52	103
870-N5		120	.13	15	150	
870-R5		240	.06	15	580	
872-G5	Projector	24	.63	15	52	
872-N5		120	.13	15	150	
872-R5		240	.06	15	580	
874-G5	Grille	24	.63	15	52	
874-N5		120	.13	15	150	
874-R5		240	.06	15	580	
876-G5	Weather- Proof	24	.63	15	52	
876-N5		120	.13	15	150	
876-R5		240	.06	15	580	

UL Listed and FM approved.

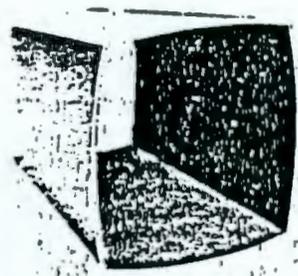
For Hazardous Location Models See Page A20.

STANDARD DC SERIES

Cat. No.	Type	Volts DC	Amps	VA	DC Coil Res. (Ohms)	dB at 10 Ft.
871-G1	Flush	24	.16	3.5	24	101
871-P1		125	.025	3.5	600	
873-G1	Projector	24	.16	3.5	24	
873-P1		125	.025	3.5	600	
875-E1	Grille	12	.27	3.5	6	
875-G1		24	.16	3.5	24	
875-J1		32	.11	3.5	40	
875-P1		125	.025	3.5	600	
875-S1		250	.014	3.5	2400	
877-G1	Weather- Proof	24	.16	3.5	24	
877-P1		125	.025	3.5	600	

UL Listed.

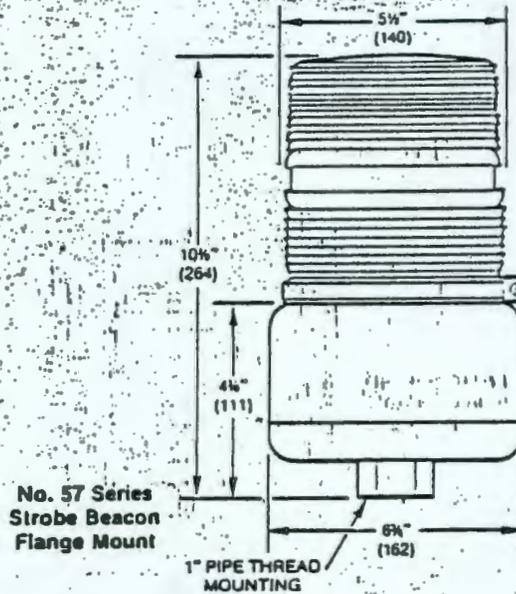
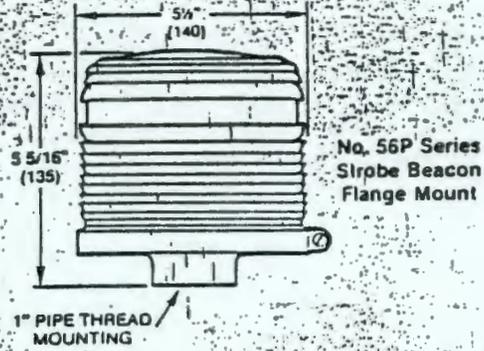
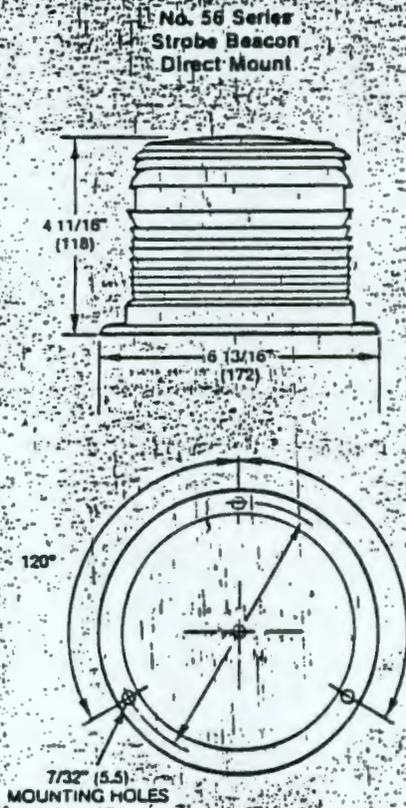
For Hazardous Location Models See Page A20.



PLASTIC PROJECTOR

Cat. No.	Type	Description
872-P0	Projector Only	Plastic Projector from 872/873 is available as separate item. Snaps onto any Adaptahorn.

AdaptaBeacon Strobe Lights SPECIFICATIONS

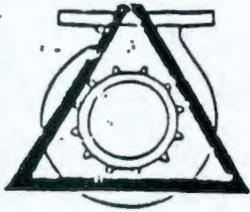


Description	Lens Cat. No.	Col. No. Color	Replacement Lens	Flash Rate	Voltage	Mounting	Lamp
Strobe Beacon Direct Mounting	56R-E1	Red	P-047549-0013	80 FPM	12V DC 2 amps	Direct 3 holes 120° apart on 5.937" bolt circle	Xenon Type Cat. No. 56-ST
	56A-E1	Amber	P-047549-0011				
	56B-E1	Blue	P-047549-0012				
	56C-E1	Clear	P-047549-0014				
Strobe Beacon Pipe Flange Mounting	56PR-E1	Red	P-047549-0013	80 FPM	12V DC 2 amps	Flange Type for mounting on 1" pipe	Xenon Type Cat. No. 56-ST
	56PA-E1	Amber	P-047549-0011				
	56PB-E1	Blue	P-047549-0012				
	56PC-E1	Clear	P-047549-0014				
AC Only Strobe Beacon Pipe Flange Mounting	57R-AY	Red	P-047549-0009	80 FPM	120V AC 40 amps	Flange Type for mounting on 1" pipe	Xenon Type Cat. No. 57-ST
	57A-AY	Amber	P-047549-0007				
	57B-AY	Blue	P-047549-0008				
	57C-AY	Clear	P-047549-0010	80 FPM	240V AC 20 amps	Flange Type for mounting on 1" pipe	Xenon Type Cat. No. 57-ST
	57R-AZ	Red	P-047549-0009				
	57A-AZ	Amber	P-047549-0007				
	57B-AZ	Blue	P-047549-0008				
57C-AZ	Clear	P-047549-0010					

NOTE: Dimensions are in inches and millimeters. Specifications subject to change without notice.

Appendix G

Pumps



TRIANGLE PUMP AND EQUIPMENT INC.

Equipment Approval Data

Date 5/26/92

Project KEH-5319/Emergency Drainfield Replacement, 200 East Area Hanford Site, Richland, WA

Customer Thompson Mechanical Order No _____

Engineer Kaiser Engineers Hanford

Equipment Ref 02745 2.2.4 Sewage Effluent Pumps

We request your approval to supply the following described equipment for the above referenced project:

Two (2) ABS model AF-60(EX)-4-6", 8 HP, 1750 RPM, 3/60/208 VAC submersible sewage pumps.

Two (2) ABS quick lift assemblies with base elbows, sealing flanges, rail support brackets & 15' stainless steel lift cables.

Four (4) float switches with hanger bracket.

One (1) Triangle Pump, UL Listed, NEMA 4 enclosed duplex pump control panel.

One (1) start up service.

May we have your approval?

Cordially,

Harold R Clayton
President

attachments

/lc

- APPROVED SDC/200
- APPROVED WITH EXCEPTION
- NOT APPROVED, REVISE AND RESUBMIT
- RESUBMIT

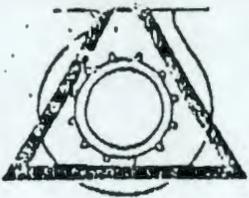
THE ACTION NOTED ABOVE IS SUBJECT TO THE TERMS OF THE CONTRACT/PURCHASE ORDER AND DOES NOT RELIEVE CONTRACTOR/SELLER FROM ANY OF HIS OBLIGATIONS UNDER THE CONTRACT/PURCHASE ORDER, INCLUDING DESIGN AND DETAILING.

REVIEWED BY KAISER ENGINEERS HANFORD CO. FOR THE DEPARTMENT OF ENERGY

JOB NO. 6092/5/20
REVIEWED BY CS/Pickermer/DJ
DATE 5-17-92

16189 S.E. 106th St./PO Box 950
Clackamas, Oregon 97015
(503) 656-1473
FAX (503) 656-2037

225 S.W. 41st St.
Renton, Washington 98056
(206) 251-9666
FAX (206) 251-9667



TRIANGLE PUMP AND EQUIPMENT INC.

Supplemental
Equipment Approval Data

Date 6/19/92

Project KEH-5319/Emergency Drainfield Replacement, 200 East Area
Hanford Site, Richland, WA

Customer Thompson Mechanical Order No _____

Engineer Kaiser Engineers Hanford

Equipment Ref Q2745 2.2.4 Sewage Effluent Pumps

We request your approval to supply the following described equipment for the above referenced project:

- 1)2.2.4.2.a-Contractor to furnish guide rails.
- 2)2.2.4.2.b-Quick lift sealing flange is by Buna N profile gasket compressed to mating face of base elbow by the weight of the pump which is superior to metal to metal.
- 3)2.2.4.3.e-Stator is heat shrunk fit.
- 4)2.2.4.3.h-Motor is capable of 10 starts per hour.
- 5)2.2.4.3.i-Upper seal faces offered do not need to be hard surface material as the seal chamber is provided with a moisture sensor probe and control circuitry to warn of lower seal failure. This allows for repair of the unit before the upper seal fails and causes motor damage. Silicon carbide versus silicon carbide on the lower seal faces offer superior wear and cold shock protection.
This sealing system is superior to that specified and offer by competition.
- 6)2.2.4.3.l-The industry standard for these pumps is cast iron impellers. We assume that this specification reference is in error.
- 7)2.2.4.3.m-Impeller does not utilize coating to improve performance.
- 8)2.2.4.4-Pump warranty attached.
- 9)16400 2,2.3.10-We will provide a Federal Signal, or equal, model 27S with magenta globe.

May we have your approval?

Cordially,

Harold R Clayton
Harold R Clayton
President

18189 S.E. 106th St./PO Box 880
Clackamas, Oregon 97016
(503) 868-1473
FAX (503) 868-2037

226 S.W. 41st St.
Renton, Washington 98056
(206) 251-9666
FAX (206) 251-9667

AF-1 Product Range

The overall hydraulic coverage of the AF-1 series is shown on the Extensive Performance Range chart on page 7 of this brochure. The following pump motors and wet end designs are used to accomplish this performance.

PUMP MOTORS

- Standard Construction
 - 1750 RPM 1½ HP to 3¾ HP 1 Phase
 - 1750 RPM 2 HP to 12 HP 3 Phase
 - 1150 RPM 1½ HP to 4 HP 3 Phase
- Explosion Proof Construction
 - FM Approved Class 1 Division 1 Groups C&D
 - 1750 RPM 1½ to 3¾ HP 1 Phase
 - 1750 RPM 2 HP to 8 HP 3 Phase
 - 1150 RPM 1½ HP to 4 HP 3 Phase

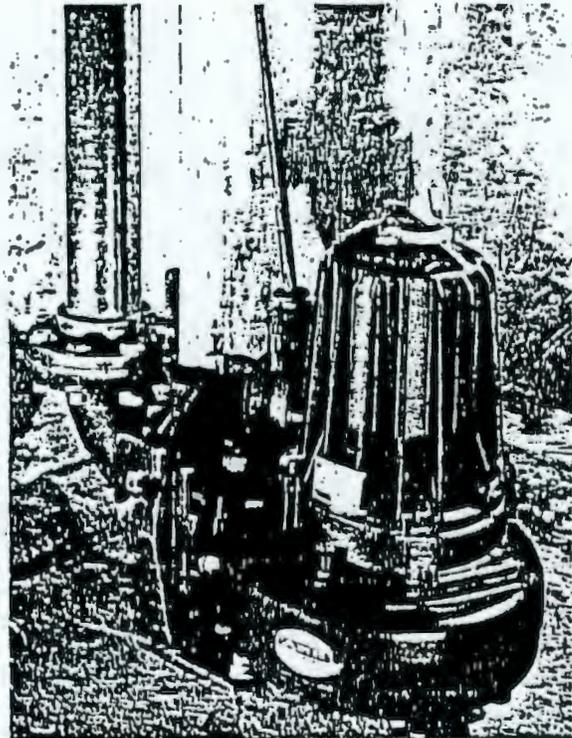
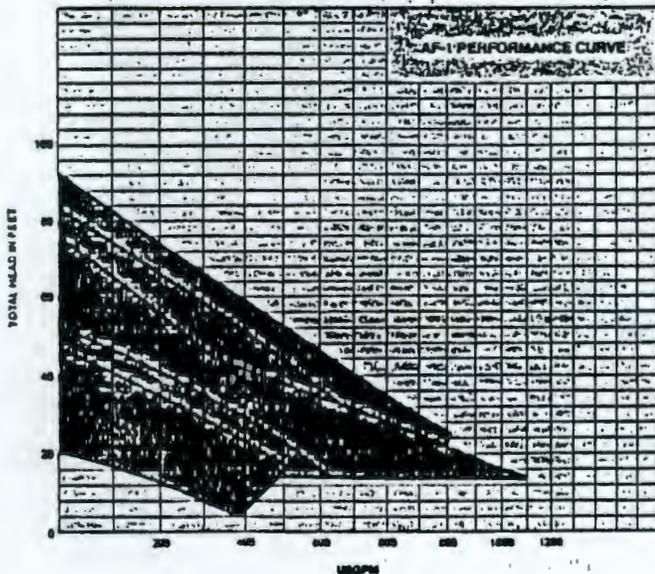
PUMP HYDRAULICS

- Contra Block construction standard on all models
- Discharge sizes 3", 4" and 6"
- Vortex impellers available on 4" up through 8 HP 1750 RPM



The following curve illustrates the specific model to be used for a particular duty point. (Note: Some models may not be shown. See individual performance curves in catalog).

AF-1 Performance Curve



AF-1 Features

Upper rotor shaft ball bearing with permanent lubrication; maintenance-free

Air-filled motor

Cast-on lifting lug

Pump housing with large size cooling fins for motor heat dissipation

Bimetallic thermal overload protectors incorporated in each phase of motor

Rotor and shaft assembly dynamically balanced

Watertight cable entry with cable gland and strain relief

Stator, insulated against heat and moisture to Class "F" (155°C.)

Upper mechanical shaft seal

Oversized double row ball bearing, maintenance-free and with permanent lubrication

Sealed junction chamber with terminal board

Lower mechanical seal; silicon carbide

"Sealminder" electronic seal monitor probe

All "O" Ring static stealing

Oil chamber

Adjustable spiral bottom plate with waved cutting edge

Adjustment screw for spiral bottom plate

ASA flange for guide rail horizontal or vertical mounting

Open non-clog impeller, with chamfered edge, dynamically balanced

PUMP SPECIFICATIONS
AF PUMPS
~~STANDARDS &~~
EXPLOSION PROOF

WHC-SD-L092-OMM-001, Rev. 0
SECT. 200 TAB 6" 1750 RPM 30 PG. 102
MODEL: AF60, 60-4-6"

GENERAL

Furnish and install 2 model AF60 ABS Submersible Pump(s) to deliver 830 USGPM against a total head of 47 feet. The motor shall be 3 HP 1750 RPM connected for operation on a 208 volt 60 Hz 3 phase service. The motor shall be an integral part of the pumping unit. The pump discharge size shall be 6.

PUMP DESIGN

The pump(s) shall be capable of handling raw unscreened sewage, storm water, and other similar solids-laden fluids without clogging. The suction inlet shall have a wave form with the leading edge of the impeller overlapping the wave form. Should a textile or plastic sheet plug the inlet, the shearing action of the leading edge of the impeller against the wave form of the inlet will cut away enough of the material to clear the inlet.

There shall be no need for personnel to enter the wet well in order to remove or reinstall the pump(s). The pump(s) shall be automatically connected to the discharge piping when lowered into place on a guide rail system, requiring no bolts, nuts or fasteners to effect sealing to the discharge connection.

PUMP CONSTRUCTION

Impeller: The impeller shall be made of erosion resistant chilled gray cast iron and shall be of the semi-open, non-clogging, dynamically balanced single vane design capable of passing a minimum of 4 diameter spherical solids. The impeller shall have a slip fit onto the motor shaft and drive key and shall be fastened to the shaft by a stainless steel bolt.

Pump Volute: The pump volute shall be made of gray cast iron with smooth internal surfaces free of rough spots or flashing. The volute shall have a centerline discharge.

Self-Cleaning Front Plate: The pump shall be equipped with a gray cast iron front plate, mounted to the volute with four stainless steel adjusting screws to permit close tolerance adjustment between the front plate and impeller for maximum pump efficiency. The front plate shall be designed with a wave shaped inlet and an outward spiraling V-shaped groove on the side facing the impeller, to shred and force stringy solids outward from the impeller and through the pump discharge.

Mechanical Seals: Each pump shall be equipped with a tandem double mechanical seal. The oil chamber shall separate the pump from the motor and shall provide lubrication for the seals. The lower stationary seal face shall be made of silicone carbide and the rotating seal face shall be made of tungsten carbide while the upper stationary seal shall be made of carbon and the rotating seal face of stainless steel. Each stationary seal face shall be sealed with an O-ring. The positively driven seal faces shall be held in place by individual independent springs. The seals shall require neither routine maintenance nor adjustment and shall not be damaged when pump is run dry. When required, seal oil inspection can be achieved without disassembly of the pump. The seal shall not require the pumped liquid as a lubricant.

Seal Failure Warning System: An electrical probe shall be provided in the oil chamber for detecting the presence of water. A solid state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber, the probe shall close an electrical circuit and energize a warning light on the face of the control panel. AF-KK: Probe in motor housing.

Shaft and Bearings: The pump shaft shall be made of stainless steel supported by a heavy duty lower double row ball bearings and an upper sealed single row ball bearing.

Motor and Cable: The pump motor shall be housed in an air filled watertight housing to provide good heat transfer. The motor shall be a NEMA design 3 suitable for continuous duty with moisture resistant Class F insulation rated for 155 degrees C. Oil filled motors shall not be considered equal to the dry air filled type nor acceptable. Each phase of motor shall contain a bimetallic electro-mechanical temperature monitor embedded in the motor windings. The monitors shall be connected in series and coupled to the control circuit of the pump control panel so as to shut the pump down should any one of the monitors select high temperature. The temperature setting of the temperature monitors shall be 140 degrees C plus or minus 5 degrees C and shall automatically reset once the stator temperature returns to normal. AF-KK: FM approved Class 1 Division 1 cad.

Power cables shall be 30 feet long of the Osflex or 30 type construction suitable for submersion in sewage. Strain reliefs shall be provided at each cable entry. AF-KK: N33HOEU cable.

O-Rings and Fasteners: All mating surfaces of the pump and motor shall be machined and fitted with Buna N O-Rings where watertight sealing is required. Sealing shall be accomplished by the proper fitting of the parts and not by compression or special torque requirements. All external screws and fasteners shall be made of stainless steel. All surfaces coming into contact with the liquid media, other than stainless steel, shall be protected by a corrosion resistant coating.

INSTALLATION

The pump(s) shall automatically connect to discharge connection(s) when lowered into place on single guide rail system, requiring no bolts, nuts or fasteners to effect proper sealing. Each system shall consist of no more than one guide rail supported at the top by an upper guide bracket and at the bottom by the discharge connection. The guide rail base shall be equipped with a vertical straightening vane which properly aligns the slot in the pump bracket and centers the pump prior to final seating. Ease and quick removal of pumps from other than the vertical direction over the center of the pump shall be a requirement of the system. Sealing of the discharge connection elbow to the pump bracket shall be by means of a metal-to-metal contact.



TECHNICAL DATA

~~STANDARD~~ EXPLOSION PROOF

MODEL: AF4, 60-4-6"

APPLICATION DATA

MODEL	40 60						
SOLID SIZE - IN.	4 4						
MINIMUM FLOW - GPM	75 75						
MAXIMUM SUBMERGENCE - FT.	65 65						

PUMP WEIGHT - lbs.

STANDARD	13 233						
EXPLOSION PROOF	233 244						

PHYSICAL DATA

POWER CABLE - TYPE	AF: HO7RN Ozoflex or Type SO AF-EX: NSSHOEU	
CONTROL CABLE - TYPE	Included in Power Cable	
CABLE, STANDARD LENGTH	30'	
MATERIALS	MOTOR HOUSING	Cast Iron - ASTM A-48, Class 30
	PUMP CAP	N/A
	OIL CHAMBER	Cast Iron - ASTM A-48, Class 30
	VOLUTE	Cast Iron - ASTM A-48, Class 30
	IMPELLER	Cast Iron - ASTM A-48, Class 30
	CUTTER DISC	Cast Iron - ASTM A-48, Class 30
	MOTOR SHAFT	420 SS
	EXTERNAL HARDWARE	304 SS
"O" RINGS	Buna N	
MECHANICAL SEAL - TYPE	Tandem Seal, Silicone Carbide, Lower; Tool Steel/Carbon, Upper	
UPPER BEARING	Single Row Ball	
LOWER BEARING	Double Row Angular Contact Ball - Heavy Duty	
DISCHARGE SIZE	6"	
IMPELLER TYPE	Open Single Vane	

Rev. 4-1-88

ABS Pumps Inc.
140 Pond View Drive
Menden, Connecticut 06450
(203) 238-2700





anchor scientific inc.
Box 378, Long Lake, NY 55256 / 612-472-7115

mini-float

Form 2500 - C

mini-float

DESCRIPTION

Mini-floats are pilot duty devices designed for small diameter sumps and places where space is a determining factor in the selection of a level control device. Mini-floats control the function of motor load devices, such as contactors, motor starters, and power relays. It automatically cycles a pump or pumps. They can also be used for alarm signaling devices. Two Mini-floats are needed for a one-pump operation, three for a two-pump operation.

SPECIFICATIONS

Cable 18-2 SJO W/A 34 x 41 strand 90°C
Housing Polypropylene
Clamp Adjustable 1"-4"
(Only on Type P models)
Temperature Rating 80° C.

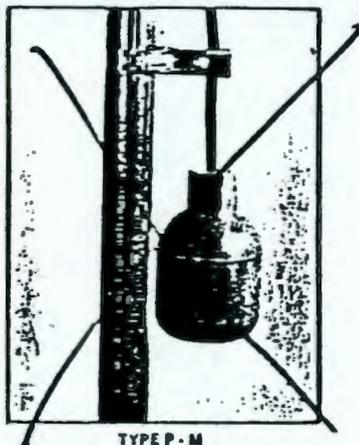
MODELS

Mini-floats are available in a combination of mounting styles, cable lengths, and circuit configurations. Mounting styles are shown at right: pipe mounted (Type P), and suspended (Type S). 10, 15, and 25-foot cable lengths are standard, but other lengths can be special ordered. Electrical configurations must be specified, normally open (NO), for pump out applications and normally closed (NC), for pump in applications.

EXAMPLE:

P Mounting Style	M Mini- Float	10 Cable Length	NO Electrical Configuration
ELECTRICAL CONFIGURATION	CABLE LENGTH	SUSPENDED TYPE S MODEL NO	PIPE MOUNTED TYPE P MODEL NO
			NORMALLY OPEN
			NORMALLY CLOSED

MOUNTING STYLES



TYPICAL INSTALLATION

General Comments

- 1) Never work in the sump with the power on.
- 2) Attach the Type P Mini-floats to the mounting pipe or the pump discharge pipe. The 'off' float should be below the 'on' float in a 'pump out' application.
- 3) Arrange the Mini-floats so they do not tangle or hang up.
- 4) Thread the cable strap through the buckle with the ratchet pawl, cinch up tight, thread excess strapping through outer buckle slot.
- 5) Measuring the difference between mounting points gives the 'pump down' differential.

Typical Simplex Wiring Schematic

Typical Alarm Wiring Schematic

Specifications

Cable - 18-2 SJO W/A 34 x 41 strand 90°C, DIAMETER .30

Float - Polypropylene.

Clamp - Stainless Steel, Ind Con Eq, 125 VA @ 115 VAC

Component 4.5A @ 120V, Res.
Switch Rating 2.2A @ 230V, Res.

Temperature Rating - 60 C.

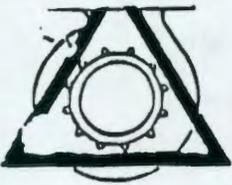
Normally Open - Blue Housing
Normally Closed - Red Housing

Float Dimensions

ELECTRICAL CONFIGURATION	CABLE LENGTH	SUSPENDED TYPE S MODEL NO	PIPE MOUNTED TYPE P MODEL NO
NORMALLY OPEN	10	S M 10 NO	P M 10 NO
	15	S M 15 NO	P M 15 NO
	20	S M 20 NO	P M 20 NO
	25	S M 25 NO	P M 25 NO
NORMALLY CLOSED	10	S M 10 NC	P M 10 NC
	15	S M 15 NC	P M 15 NC
	20	S M 20 NC	P M 20 NC
	25	S M 25 NC	P M 25 NC

Important Note: Mini-floats are pilot duty devices. They cannot be used to directly power pump motors. Also, do not use Mini-floats in gasoline or other combustible areas. These devices can be used with intrinsically safe relays for some hazardous locations. See Sec 500 of NEC.

Drawn BY PD	DATE 7-17-80		anchor scientific inc. Box 378 Long Lake, NY 55256 612-472-7115
Checked BY JTP	DATE 7-20-80		
Approved BY JTP	DATE 7-20	Typical installation and specification data for Mini-floats	
PROJECT NAME Anchor-float	DWG NO 2510-A		



TRIANGLE PUMP AND EQUIPMENT INC.

TYPICAL MAINTENANCE SUMMARY FORM

EQUIPMENT ITEM 02745 2.2.4 Sewage Effluent Pumps

MANUFACTURER ABS

EQUIPMENT ID NUMBER(S) P1 & 2

WEIGHT OF INDIVIDUAL COMPONENTS (Over 100 lbs) 250 lbs

NAMEPLATE DATA (hp, voltage, speed, etc.) 8 HP, 1750 RPM, 3/60/208 VAC

MANUFACTURER'S LOCAL REPRESENTATIVE

Name Triangle Pump & Equipment Inc

Address 16169 SE 106th/PO Box 950 Clackamas OR 97015

Phone No 503 656-1473 Fax No 503 656-2037

MAINTENANCE REQUIREMENTS

Maintenance Operation	Frequency	Lubricant (If applicable)	Comments
List briefly each maintenance operation required & refer to specific information in mfr's standard maintenance manual, if applicable.	List required frequency of each maintenance operation.	Refer by Number to lubricant list required	

Wash Down Pumps/Floats 3-6 months none

Check/Change Seal Oil annually 1

LUBRICANT LIST

Reference Symbol Shell Std Oil Gulf Arco Or Equal

List lubricant numbers as used above. List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.

1 any 10W HD motor oil

SPARE PARTS Include recommendations regarding what spare parts, if any, should be kept on the job.

None

16169 S.E. 106th St/PO Box 950
Clackamas, Oregon 97015
(503) 656-1473
FAX (503) 656-2037

225 S.W. 41st St.
Renton, Washington 98056
(206) 251-9666
FAX (206) 251-9667

Installation Operating & Maintenance Manual

SUBMERSIBLE SOLIDS & INDUSTRIAL WASTES PUMPS

ABS PUMP MODELS:

F 13 to 90

AF 60 (EX) -4-6"

ABS Pumps Inc.
140 Pond View Drive
Meriden, Connecticut 06450
(203) 238-2700



SECTION I

2-1 INTRODUCTION

This manual was prepared to assist you in the correct installation, operation, maintenance and repair of your ABS pump.

Please read it through carefully and make certain that you are familiar with the contents, and that the recommendations in the chapter on installation and operation are fully understood before running the pump.

ABS pumps have been designed to minimize maintenance. However, regular checks will ensure longer life and greater operating reliability.

WARRANTY: No repair work should be carried out during the guarantee period without prior factory approval. To do so may render the guarantee void.

PUMP SERIAL NO.: In all correspondence and reports, make certain that the pump serial number is given.

2-2 DESIGN OF PUMP

The ABS AF type submersible pumps are designed to operate in installations handling raw sewage, industrial waste or other liquids and sludge where suspended solids are found within the medium being pumped.

The motor and pump form a close coupled, fully submersible, watertight unit.

The squirrel cage induction motor is insulated against heat and moisture in accordance with Class "F" (155°C) regulations.

Thermal overload protectors (one per phase) are imbedded in the stator windings. These are connected in series and wired to the control panel so they shut down the pump if overheating occurs.

The motor is protected against damage from water entry by an oil chamber and mechanical seal located between the volute and the motor chamber. A di-electrode seal probe located in the oil chamber which, when coupled to the ABS Seal-minder control, senses the water content in the oil chamber and provides a signal which gives a visual or audible warning that water is in the oil chamber and that an inspection is necessary.

On explosion proof models, the di-electrode is located at a low point in the motor chamber to give early warning of water entry into the motor chamber.

The bearings are prelubricated and maintenance free.

The impellers are of the single channel type with the well-proven CB (contra-bloc) system. The system consists of a spiral bottom plate with wave shaped ridges. Rags, fibers, etc., are torn or cut by the shearing edge of the suction inlet and clogging is prevented. The AF pump can also be supplied with vortex impellers which are especially suitable for 4% and 5% sludge applications.

SECTION II

2-1 INSPECTION ON RECEIPT OF PUMP

The shipping container shall be immediately inspected for damage that may have occurred in shipment. Exercise care in opening the shipping container to avoid damage to the pump. Remove any blocking and cushioning from within the container. Check all cushioning for spare parts before discarding. Visually check the pump and any spare parts for damage. Check for damaged inlet and outlet port threads and flanges, and electrical wires—especially where they exit the pump housing. Report any damage or shortage of parts to your supervisor or directly to the carrier.

2-2 STORAGE BEFORE USE

ABS pumps are shipped from the factory ready for installation and use. They should be held in storage if the pump station is not complete. If storage is necessary, the pump should remain in its shipping container. It should be stored in a warehouse or storage shed that has a clean, dry, temperature-stable area where the pump and its container should be covered to protect it from water, dirt, dust, etc. The ends of the cables must be protected against moisture.

CAUTION!

AT NO TIME SHALL THE PUMP BE STORED WITHIN AN INCOMPLETE WET PIT. THE PUMP SHALL NOT BE PLACED INTO THE PIT UNTIL IT CAN BE FULLY INSTALLED AND OPERATED.

LONG TERM STORAGE

1. If it is necessary to store a pump for a long period of time, it should be stored indoors in a clean, dry temperature-stable environment. The pump should be covered to protect it from dust, dirt and water. The ends of the cable must be protected against moisture.
2. Do not allow the pump to freeze. Water trapped during quality testing may expand and cause damage. If the pump must be stored in a sub-freezing environment, consult the factory for specific recommendations and precautions.
3. During storage, the motor should be rotated a few turns once a month. This can be accomplished by turning the impeller by hand. Spinning the motor will lubricate the mechanical seals and prevent their seizing.
4. Prior to installation, the pump motor should be rotated by hand to ensure the mechanical seals are free-spinning.
5. Installed pumps which are idle for long periods of time should be jogged once a month to lubricate the mechanical seals.

The AFP & AF Series Five Year Warranty is contingent on proper start-up. Please read this manual carefully. The Product Start-up Report form must be completed and returned to ABS Pumps Inc. In the event the Product Start-up form has not been received with the pump, please contact your supplier or the factory.

Warranty

FIVE YEAR WARRANTY - STANDARD & EXPLOSION PROOF AFP & AF SERIES PUMPS PERMANENT TYPE INSTALLATION

ABS Pumps Inc. warrants its AFP & AF Series of Submersible Pumps to be free from defects in workmanship and materials for a period of five (5) years after date of shipment to end customer, with approval of installation and start-up of the equipment by the Company's authorized on-site representative and, upon payment of the applicable percentage of the list price of the following parts in effect at time of replacement.

Part Description	Months After Shipment			
	0-18	19-31	32-45	46-60
Rotor & Stator*	0%	25%	50%	75%
Mechanical Seal	0%	25%	50%	75%
Impeller	0%	25%	50%	75%
Cutter Disc	0%	25%	50%	75%
Pump Housing	0%	25%	50%	75%
Ball Bearings	0%	40%	80%	90%

*Stator guarantee effective only if Company's authorized control panels are used.

All other ABS manufactured equipment or other uses of AFP or AF series pumps will carry a one (1) year warranty from date of shipment to end customer, but in no event, longer than eighteen (18) months from date of shipment from the Company.

Start-up reports and electrical system schematics may be required to support Warranty claims and will be required for claims on pumps of 30 horsepower and greater.

The Company's sole obligation under this warranty shall be to make repairs and replace parts when necessary on products that have been returned to it or to an authorized service facility and found to be defective by the Company. Explosion Proof pumps (EX) must be serviced at a facility approved by ABS Pumps Inc. The Company shall not be liable for any special, indirect, or consequential damages of any kind. Major components not manufactured by the Company are covered by the original manufacturer's warranty in lieu of this warranty. The Company will not be held responsible for travel expenses, rented equipment, outside contractors fees, or unauthorized repair shop expenses. The Company neither assumes nor authorizes any person or other company to assume for it, any other obligation in connection with the sale of its equipment. Any enlargement or modification of this Warranty by a Representative or other Sales Agent is their exclusive responsibility. Transportation charges shall be borne by the Buyer. Labor charges for warranty repairs shall not be assumed by the Company for repairs made after one (1) year from date of shipment to end customer. Returns must have prior written authorization from the Company.

This warranty shall extend only to the original Owner, and shall not apply to any products that have been repaired or altered without the Company's consent or have been subject to misuse, accident or neglect, or have been used for pumping other than raw sewage or similar non-corrosive liquids.

NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WILL APPLY.

2-3 MOUNTING BASE CONSTRUCTION

ABS AF pumps may be either guide rail mounted or pedestal base mounted. The foundation for both must be rigid enough to absorb any induced vibrations and stress normally generated during pump operation. A pedestal pump will simply sit on this, therefore the foundation must be absolutely level. The guide rail mounted pump will have the guide rail base bolted to the foundation. The mounting bolts will be imbedded in the foundation with size and location defined by the particular job specification and engineering drawings.

CAUTION!

PRIOR TO INSTALLING THE PUMP IN THE WET WELL, REFER TO PARAGRAPH 3-4 ENTITLED "INITIAL START-UP". BE SURE THE PUMP IS RUNNING WITH THE CORRECT IMPELLER ROTATION.

2-4 GUIDE RAIL INSTALLATION AND ASSEMBLY OF AUTOMATIC COUPLING SYSTEM

Normally, ABS will be supplying the access cover for the pump installation wet well. This access cover should be cast either into the concrete roof of the wet well or be mounted on top of an ABS or contractor supplied steel or fiberglass basin in the position shown on the particular job specification engineering drawings and ABS installation drawings. At the same time, the guide rail base anchor bolts should be cast in the bottom of the wet well, again per the job specification engineering drawings and ABS installation drawings.

NOTE

The foundation bolts must be suitably grouted with a good commercial grade grout. The grout should be properly installed to prevent air bubble inclusion and completely encase and seal the area around the bolt.

To assemble the Automatic Coupling System and to install the Guide Rail Assembly, follow these instructions (See Figure 2-1):

1. Mount the straightening vane (6) to the guide rail base (19) with screws (8) and spring washer (7).
2. Install the guide rail base in the bottom of the wet well by means of cast-in anchor bolts (22). Check that the base is level. Add grout beneath base to level. Recheck base after grout dries. Finally, secure in place with hex nuts and washers (20 and 21).
3. Position the upper guide bracket to the access cover or to the wall of the opening to determine length of guide rail. The guide rail, which shall be customer supplied, will be 2" schedule 40 galvanized pipe. After positioning, cut pipe to the required length.
4. Install the guide rail pipe over the tapered plug of the guide rail base.

5. Insert the upper guide bracket tapered plug into the upper end of the guide rail and locate so the guide rail is plumb. Secure upper guide bracket to the access cover or opening wall and recheck for plumbness. Check that the guide rail base (19), the guide rail (15), and the upper guide bracket (1) are on the same center line with the discharge connection and vertically aligned. This is necessary to assure that the pump will seal itself correctly. Press upper guide bracket (1) into the guide rail pipe (15) so that no play remains and finally secure the upper guide rail bracket by tightening the screws (13).
6. The molded gasket (4) is placed in the pump bracket (3) so that the tapered face points towards the guide rail base and the sealing lips make proper contact all around on both sides. The pump bracket is fastened to the discharge of the pump with socket head screws (5), washer (18), hex nuts (16), and spring washers (17). The hex nuts (16) should be equally tightened in a cross-wise manner to prevent leakage of the seal.
7. The discharge elbow (10), with the flat gasket in place, is attached to the guide rail base with hex head screws (12) and spring washers (11).
8. No welding or building of the guide rail is required.

CAUTION!

NEVER RAISE, LOWER, OR MOVE THE PUMP BY LIFTING WITH, OR PULLING ON, THE POWER CABLES. THE PUMP IS PROVIDED WITH A LIFTING EYE AND CHAIN. THE CHAIN SHALL BE USED AT ALL TIMES WHEN MOVING THE PUMP.

Referring to Figure 4-1 and using the pump support chain, follow the procedural steps, (a through d) when lowering the pump down the guide rail until it seats against the guide rail base. The pump should be lowered at an angle to ensure that the top of the discharge connection makes contact first with the base. Continue lowering until pump is completely seated. Slack off the chain, as noted in Step "d" of Figure 4-1, and fasten the upper end of the chain to the hook of the upper guide bracket. Check to make sure that the electrical cables are supporting no weight.

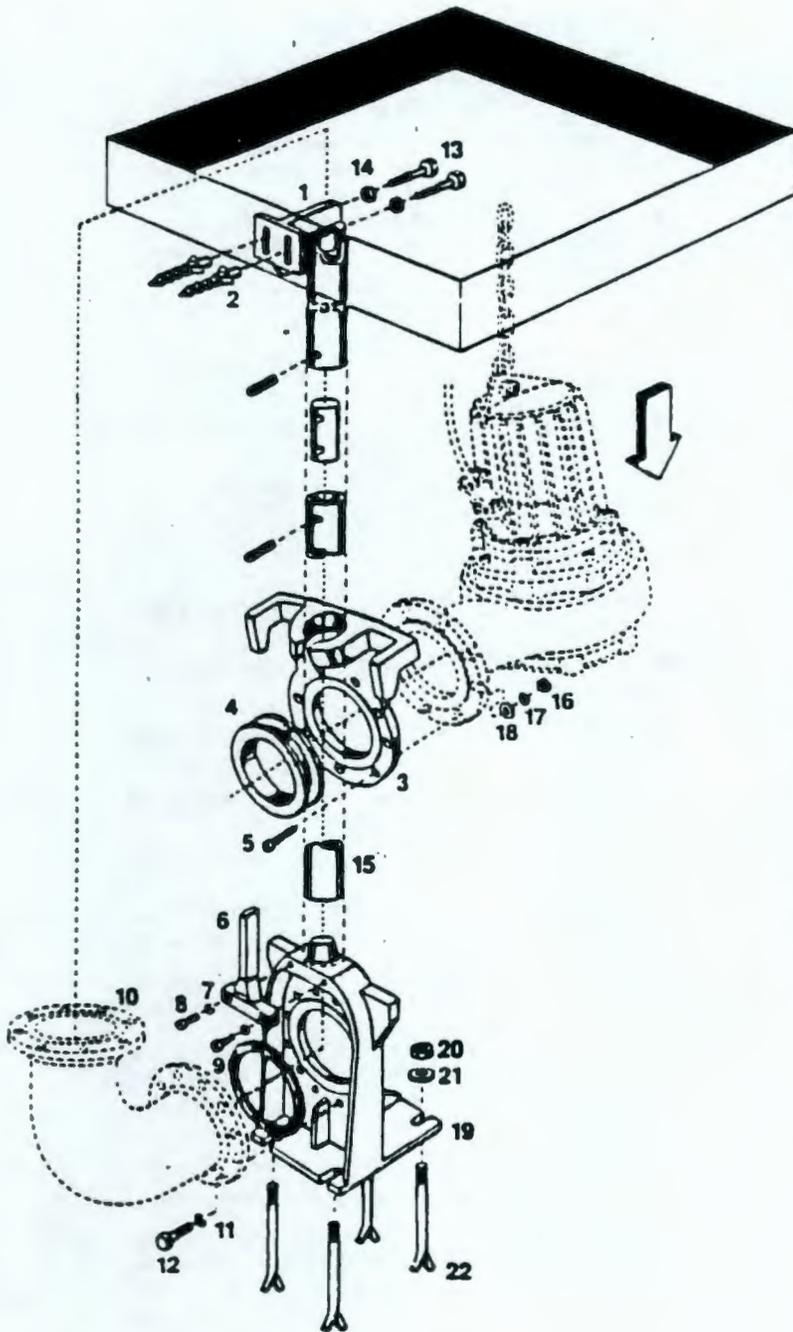
**AUTOMATIC COUPLING
WITH
SINGLE GUIDE RAIL**

The ABS guide rail with the automatic coupling system ensures rapid and economical installation and allows connection of the pump to the discharge pipe by gravity.

The guide rail base is securely mounted together with the discharge line on the bottom of the wet well.

The submersible pump is lowered by chain down the guide rail; when it reaches the proper operating position, it seals off the discharge outlet automatically by means of its own weight.

The automatic coupling can be repeated as often as necessary. For routine inspection, the pump can be easily lifted by the chain, checked or repaired, and lowered again.



1. Upper guide bracket
2. Anchor bolts
3. Pump bracket
4. Specially shaped gasket
5. Socket head screw
6. Straightening vane
7. Spring washer
8. Socket head screw
9. Flat gasket
10. Flanged discharge elbow
11. Spring washer
12. Hexagon head screw
13. Screw with hex head
14. Washer
15. Guide rail
16. Hex nut
17. Spring washer
18. Washer
19. Guide rail base
20. Hexagon nut
21. Washer
22. Anchor bolts

Automatic Coupling
FIGURE 2-1

CAUTION!

ALL DISCHARGE PIPING AND VALVES SHOULD BE SUPPORTED IN SUCH A MANNER THAT NO LOAD IS CARRIED BY THE PUMP DISCHARGE ELBOW.

2-5 PEDESTAL MOUNTING

The pedestal mounted pump is used for portable service. The pump, as supplied by ABS, contains a fully assembled pedestal base and discharge elbow. Either rigidly mounted permanent piping or hoses with quick disconnect couplings may be installed. Refer to the preceding CAUTION note.

2-6 FLOAT SWITCHES & FLOAT SEQUENCES

The fluid levels at which the pumps start or stop are normally controlled by mercury float switches. The float switches are free hanging into the wet well. The cables are held by special brackets mounted to the access cover frame. The clamps are designed to hold the cables without pinching or damaging them.

NOTE

The float switches shall never be mounted in direct line of the influent flow.

The float switch consists of a mercury switch within an air filled housing. The cable is permanently sealed to form a watertight unit (Figure 2-2). A mounting bracket is available with three or four float positions (Figure 2-3A). An alternate mounting method is shown in Figure 2-3B.

Make sure that the float switches do not tangle with each other, catch on pipes, ladders, or brackets, which may cause erroneous ON and OFF signals.

2-6-1 FLOAT SEQUENCE, SIMPLEX STATION

As the level of influent rises, "PUMP OFF" float is tilted - nothing is activated. As influent continues to rise inside the basin, "PUMP ON" float is activated. This starts the pump. It will pump until "PUMP OFF" float deactivates the pump. Should the liquid level continue to rise above the "PUMP ON" float, the "ALARM" float is activated and energizes the high level alarm light at the control panel.

2-6-2 FLOAT SEQUENCE, DUPLEX STATION

As level of influent rises, "PUMP OFF" float is tilted - nothing is activated. As influent continues to rise inside the basin, the "LEAD PUMP ON" float is activated and starts the lead pump. It will pump until "PUMP OFF" float deactivates the pump.

On the next start, the opposite pump will be activated by the "LEAD PUMP ON" float. The pumps will then continue to alternate on each start. Should the fluid level continue to rise above the "LEAD PUMP ON" float, the "LAG PUMP ON" float will activate the lag (non-operating) pump and run both pumps until the "PUMP OFF" float deactivates both pumps.

Should the liquid level continue to rise above the "LAG PUMP ON" float, the "ALARM" float is activated and energizes the high level alarm light on the bottom of the control panel.

The engineering drawings will normally specify the levels at which the pump, or pumps, shall turn ON, turn OFF and the point of high level alarm if required. If the various levels are not specified, the following guidelines should be adhered to in determining float switch locations.

SIMPLEX STATION

Pump OFF - minimum level at top of pump motor housing.

Pump ON - minimum level of 1 1/2' above pump OFF level.

Pump High Level Alarm - minimum level of 1' above pump ON, but below influent pipe.

DUPLEX STATION

Pump OFF - minimum level at top of pump motor housing.

Pump ON - minimum level of 1 1/2' above pump OFF level.

Lag Pump ON - minimum level of 1' above lead pump ON.

High Level Alarm - minimum level of 1' above lag pump ON, but below influent pipe.

NOTE

No pump ON/OFF float switch differential should be set that will exceed 12 starts per hour per pump.

2-6-3 FLOAT SEQUENCE, CALCULATED METHOD

This is a more precise method of determining the distance between the PUMP ON and PUMP OFF float switches. It takes into consideration the number of pump starts per hour.

1. Determine the diameter of the wet well.
2. Determine the design capacity of the pump in GPM.
3. Using the table on page 6, determine which graph to use, Figure 2-4A, or Figure 2-4B. Determine the Switch Differential Multiplier according to the desired number of starts per hour.
4. Using the appropriate graph, follow the vertical line from the design capacity of the pump to the well diameter line. A horizontal line from this point will indicate the float switch differential distance. Multiply this distance by the Switch Differential Multiplier from the table on page 6.

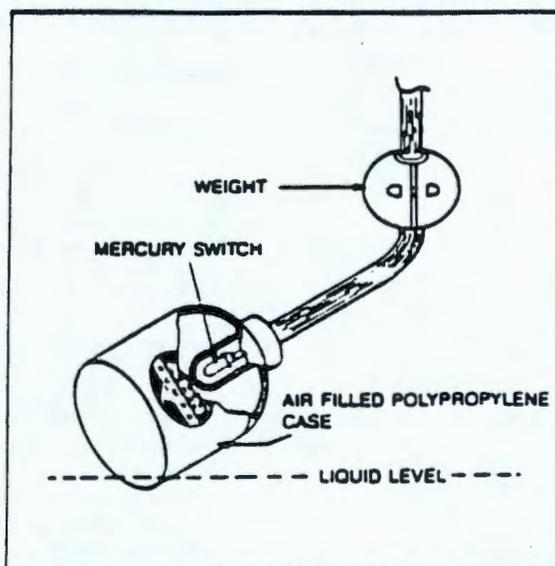


FIGURE 2-2 Float Switches

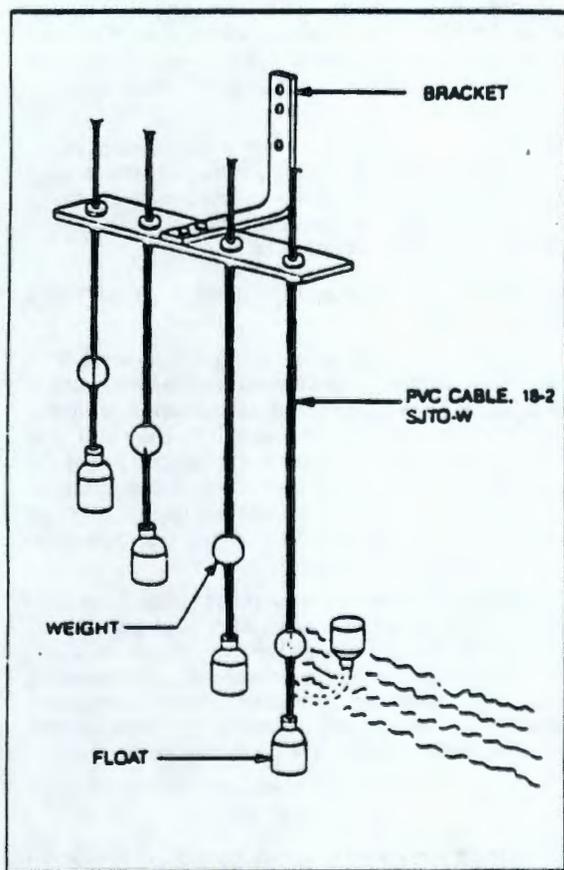
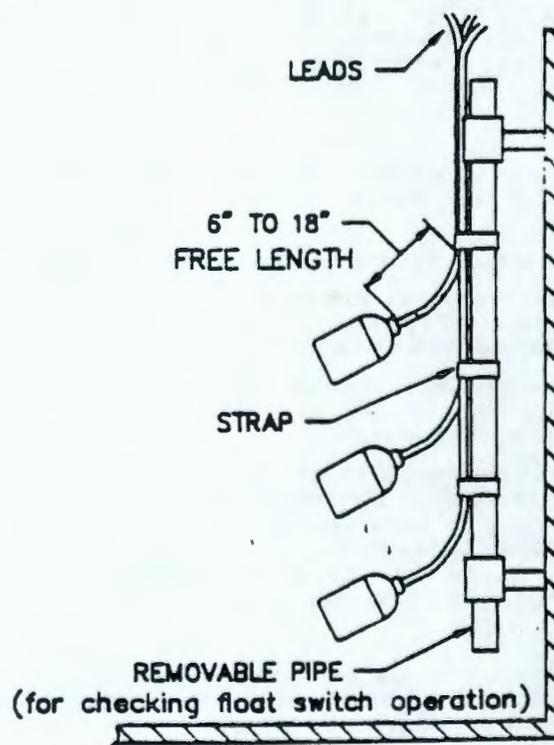


FIGURE 2-3A



(ALL HARDWARE CUSTOMER SUPPLIED)

FIGURE 2-3B

Float Mounting Methods
FIGURES 2-2, 2-3A & 2-3B

Starts Per Hour	SIMPLEX		DUPLEX	
	Maximum Use Diagram	Multiplier to Switch Differential	Maximum Use Diagram	Multiplier to Switch Differential
4	B	2	B	1
6	A	2	A	1
8	B	1	B	1/2
12	A	1	A	1/2

Example 1

1. Diameter of your wet well is 6 feet and you have determined that you want 6 starts per hour.
2. Design capacity of your pump is 300 GPM.
3. You have a Duplex station, therefore from the table you use Diagram "A" and your switch height differential multiplier is 1.
4. Enter Diagram "A" at 300 GPM and draw a vertical line to intersect the 6 foot diameter wet well curve (the dotted line for this example).
5. Draw a horizontal line to the left of the curve to determine the ON/OFF differential of 1.75 feet. Your switch differential is 1, therefore your differential remains at 1.75 feet for 6 starts per hour. Note in the table that if this were a Simplex station, the pump would start 12 times per hour (the maximum).

Example 2

1. Diameter of your wet well is 6 feet and you have determined that you want 8 starts per hour.
2. Design capacity of your pump is still 300 GPM.
3. You have the Duplex station, and from the table you use Diagram "B" and multiply the switch ON/OFF height differential by one half.
4. Enter Diagram "B" at your 300 GPM design capacity, move vertically up to the 6 foot diameter wet well curve.
5. Proceed horizontally to the left and determine that the new ON/OFF switch differential is 2.5 feet. Multiply 2.5 feet differential by the one half multiplier, (reference step 3), and the product is 1.25 feet. Note again in the table that this is half of the 2.5 feet required for 8 starts per hour Simplex.

Using both charts with a multiplier to the switch differential, it is possible to use all the starts per hour shown for either Simplex or Duplex installations.

CAUTION!

NO PUMP STATION SHOULD BE DESIGNED TO EXCEED 12 STARTS PER HOUR PER PUMP!

SECTION III

3-1 CONTROL PANELS, GENERAL

Electrical control panels are usually supplied with the pumps, although pumps may be connected to customer supplied panels. If a control panel other than that supplied by ABS is used, the panel must be wired so that the built-in SAFETY FEATURES of the AF pumps are utilized. These safety features are the Sealminder probe in the oil chamber and thermal overload connections.

There are many variations of control panels and it is impractical to include instructions for each and every variation. The standard panel supplied by ABS is equivalent to a NEMA 3R enclosure. All connections to this panel are made at the terminal strips. When control panels other than ABS are used, refer to that manufacturer's wiring diagrams and instruction manuals for proper wiring connections.

Mounted on the inside of the ABS control panel door is a complete wiring diagram and terminal strip diagram. The terminal strip diagram indicates where to connect the float switches, water warning electrode lead and pump leads.

3-2 ELECTRICAL CONNECTIONS, PUMP TO CONTROL PANEL

The pumps are supplied with free cable ends. The connection of the pump cable should be carried out by a licensed electrician in accordance with the identification on the individual leads and the corresponding connections in the control panel. On dual voltage pumps, be certain that the motor is properly wired for your supply voltage. See the wiring diagrams Figure 3-1 through 3-9 and terminal strip diagram inside the control panel.

The electrical controls and plugs should be protected from dampness and never laid directly on moist or muddy ground. If there is danger of flooding, they should be mounted above possible flood level. The Sealminder control and thermal overload switches (Klixons) are installed to protect the motor--make sure they are correctly connected.

CAUTION!

UNDER NO CIRCUMSTANCES SHALL ANY MOTOR LEAD BE SPLICED AT A SUBMERGED POINT OR IN ANY WET LOCATION THAT WILL ALLOW WICKING ALONG THE CABLE.

"A" DIAGRAM FOR: 12 Starts per Hour, Simplex
6 Starts per Hour, Duplex

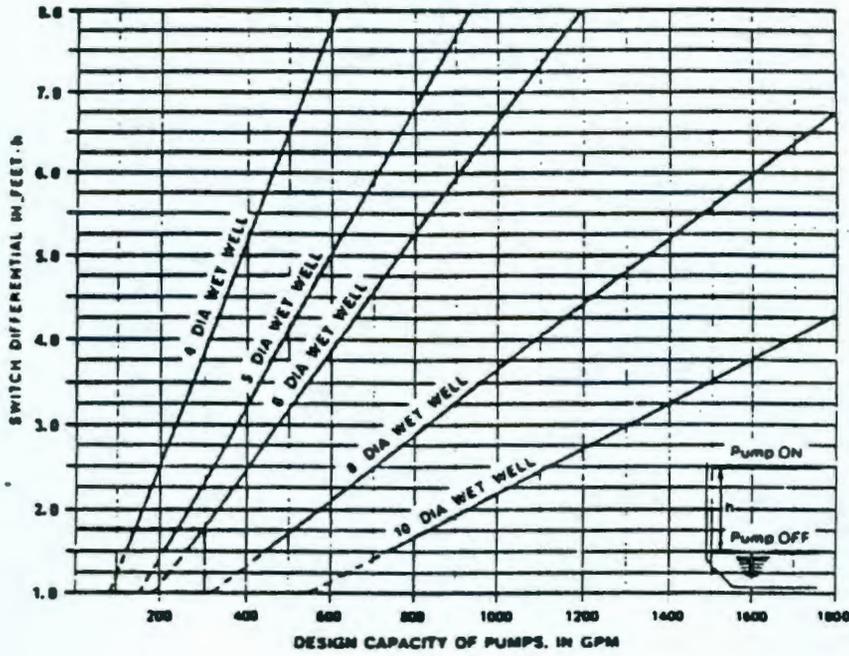


FIGURE 2-4A

"B" DIAGRAM FOR: 8 Starts per Hour, Simplex
4 Starts per Hour, Duplex

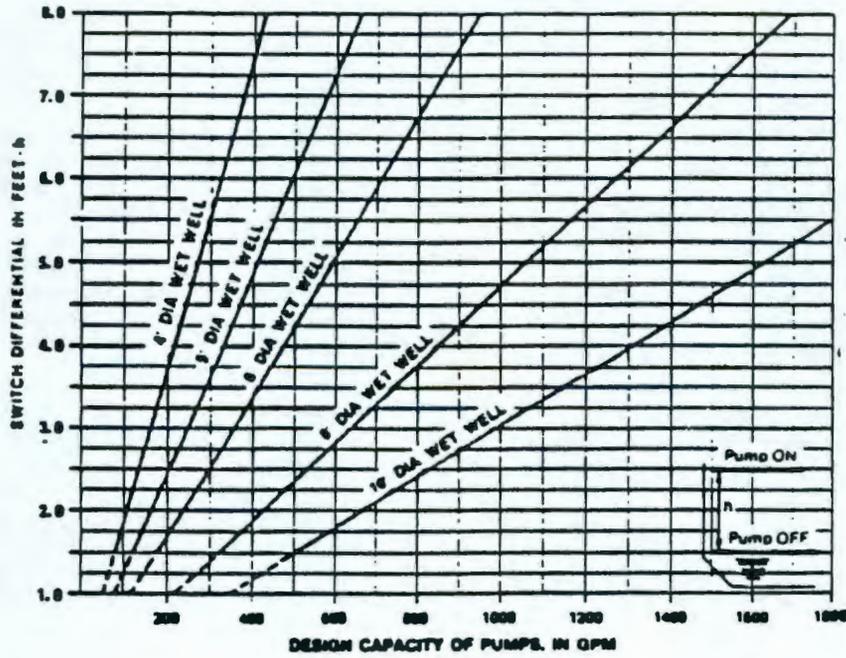


FIGURE 2-4B

"ON-OFF" Float Switch Differentials
FIGURES 2-4

INSTALLATION OF THE CONTROL PANEL

Refer to the wiring diagrams supplied with the control panel for connection and location of actual components.

1. Follow the current edition of the National Electrical Code, as well as local electrical codes and ordinances.
2. When wall-mounting the enclosure, do not depend on wooden plugs driven into masonry, concrete, plaster or similar materials.
3. Power and control terminals are located at the bottom of the panel. Locate conduit stubs and position control panel accordingly.
4. Conduits should be installed to prevent moisture or water from entering and accumulating within the enclosure. All conduits should be located in areas which will avoid cable interference with structured members and live components.
5. The control panel terminals are suitable for copper wire only. **DO NOT USE ALUMINUM WIRE!**
6. Care should be exercised in stripping insulation from the conductors so as not to nick or ring the conductors. All lugs should be tightened to approximately 15 inch-pounds of torque for wire sizes #14AWG thru #10AWG.
7. Provision should be made to locate conductors in the enclosure so that they will be free from physical damage and to avoid overheating. The conductors should be supported and braced properly.
8. All incoming and outgoing control and power connections should be made in accordance with the wiring diagram supplied with the panel.

STEPS TO BE TAKEN BEFORE ENERGIZING

1. Retighten all field-made connections, as well as factory-made connections (which may have loosened due to snipping and handling vibrations).
2. Check the security of all mounting hardware.
3. Check the enclosure to see that it has not been damaged in such a manner as to reduce electrical spacings.
4. Manually turn on and off all switches, motor protectors and contactors to make certain that they are properly aligned and operate freely.
5. Conduct an electrical insulation resistance test to make sure that the control panel is free from short circuits and ground faults. This should be done both phase-to-phase and phase-to-ground.

NOTE

Disconnect control circuit during this testing by removing the control circuit protection fuse. Failure to do so may cause damage to control circuit components.

6. **MOTOR OVERLOAD PROTECTION:** The pump motor is protected from locked-rotor and running overloads by a circuit breaker. This device may contain adjustable thermal tripping elements. To adjust the thermal tripping function (for motor overload/locked rotor) use a small screwdriver and rotate the dial (located just under "AMP" and just above the "STOP" button) until the full load current of the pump motor is next to the "AMP" marking. The full load current rating is found on the pump nameplate.
7. Check to determine that all grounding connections are made properly.
8. Remove all debris, scrap wire etc., from the control panel interior.
9. Install covers, close doors and make certain that no wires are pinched and that all enclosure parts are properly aligned and tightened.
10. Energizing a control panel for the first time is potentially dangerous. Licensed electrical personnel should be present when the panel is energized for the first time. If faults caused by damage or poor installation practices have not been detected, serious damage can result when power is applied.

3-3-1 ENERGIZING SIMPLEX CONTROL PANELS

1. Temporarily disconnect, mark and secure motor leads before applying power. Temporarily jump or close the contacts of the pump circuit breaker.
2. With the panel H-O-A switch in the "OFF" position, turn "ON" the main disconnect switch ahead of the panel.
3. Turn the H-O-A switch to "HAND" position. The motor contactor should energize and the run lamp should light. Turn the H-O-A switch to "OFF".
4. With all float switches in the open position, turn the H-O-A switch to "AUTO". No contactors or lights should energize. Simulate closure of the ON and OFF float switches. The motor contactor should energize and the run lamp should light. Open the contacts of the ON float switch. The motor contactor should remain energized and the run lamp on. Open the contacts of the OFF float switch. The motor contactor should de-energize and the run lamp should go out.
5. Simulate closure of the HIGH LEVEL ALARM float switch. The alarm lamp should flash on and off.
6. Turn "OFF" the main disconnect switch ahead of the panel. Remove jumper from the contacts of the motor overload protection breaker, 1MCP. Reconnect motor leads. Check for proper rotation. Re-test panel, making sure that actual motor and float switches operate properly.
7. If control panel components do not perform properly, refer to the troubleshooting chart.

3-3 CONTROL PANELS

The successful and safe operation of the control panel is dependent upon proper handling, installation, operation and maintenance, as well as proper design and manufacture. Neglecting certain fundamental installation and maintenance requirements may lead to personal injury and the failure and loss of the control panel as well as damage to other property.

HANDLING OF THE CONTROL PANEL

1. Handle the control panel with care to avoid damage to components and to the enclosure.
2. Move and store the control panel on its back or base.
3. When the control panel is received, unpack it sufficiently to inspect it for concealed damage and to determine that the shipment is complete and correct.
4. If the panel is to be stored for any length of time prior to installation, restore the packing for protection during that period. Where conditions permit, leave the packing intact until the panel is at its final installation position.

STORAGE OF THE CONTROL PANEL

A non-energized outdoor type panel (NEMA 3R or NEMA 4) should, if at all possible, be stored in a clean, dry space having a constant temperature to prevent condensation. Preferably, it should be stored in a heated building having adequate air circulation and protected from dirt and water. If the panel must be stored outdoors, temporary electrical heating should be installed to prevent condensation. Approximately 5 watts (from a light bulb or equivalent) per cubic foot of enclosure volume is adequate for the average environment.

CAUTION!

ELECTRICAL CONTROL PANELS SHOULD BE SERVICED ONLY BY A LICENSED ELECTRICIAN.

CARE AND MAINTENANCE OF THE CONTROL PANEL

CAUTION!

TURN "OFF" POWER AHEAD OF CONTROL PANEL BEFORE PERFORMING ANY MAINTENANCE ON THE PANEL. CHECK INCOMING LINE TERMINALS WITH A VOLTMETER TO BE SURE THAT THE EQUIPMENT IS TOTALLY DE-ENERGIZED. MAIN SWITCHES SHOULD BE TAGGED AND LOCKED "OFF". THIS ALSO APPLIES WHENEVER WORK IS BEING DONE ON THE MOTORS AND/OR FLOAT SWITCHES.

Power should be turned off by switching "OFF" the main disconnect switch ahead of the control panel.

NOTE

~~On single phase panels the main disconnect switch is interlocked with the panel inner door. The inner door cannot be opened unless the main switch is in the "OFF" position.~~

1. Inspect the control panel at least once a year or after any electrical fault to ensure correct operation.
2. Do not use any flammable cleaning agents within the control panel.
3. Look for moisture or signs of previous wetness or dripping inside the control panel. Condensation in conduits or dripping from outside sources is a common cause of control panel failure.
 - a. Seal off any conduits which have dripped condensate and provide an alternate means for the conduit to drain.
 - b. Seal off any cracks or openings which have allowed water to enter the enclosure. Eliminate the source of any dripping.
 - c. Replace or thoroughly dry any insulating material which is damp or wet or shows evidence of previous wetting.
 - d. If the control panel is subject to large temperature variations, causing condensation within the panel, it is recommended that space heaters be installed (approx. 5 watts per cubic foot of space).
4. If there is a significant amount of dust or dirt within the panel, it should be cleaned using a brush, vacuum cleaner or lint-free rags. Make sure the main power is turned "OFF" ahead of the panel. Do not use a blower or compressed air for cleaning.
5. Before energizing the control panel, tighten all connections on all components within the panel.
6. Check the operation of all switches. Look for missing or broken parts, free movement, rusting or corrosion, dirt and excessive heat. DO NOT LUBRICATE SWITCHES OR CONTACTORS. Door hinges and interlocks may be lubricated with a light, clean grease. Wipe off excessive lubrication to avoid attracting dirt.

CAUTION!

IF THE ABS SEALMINDER RELAY AND THERMAL OVERLOAD MOTOR PROTECTION FEATURES ARE NOT CONNECTED, THE WARRANTY WILL BE VOID.

~~3-2 ENERGIZING DUPLEX CONTROL PANELS~~

1. Temporarily disconnect, mark and secure motor leads before applying power. Temporarily jump or close the contacts of the pump circuit breakers.
2. With the two panel H-O-A switches in the "OFF" position, turn "ON" the main disconnect switch ahead of the panel.
3. Turn the PUMP NO. 1 H-O-A switch to "HAND" position. The PUMP NO. 1 motor contactor should energize and the PUMP NO. 1 run lamp should light. Turn the H-O-A switch to "OFF".
4. Turn the PUMP NO. 2 H-O-A switch to "HAND" position. The PUMP NO. 2 motor contactor should energize and the PUMP NO. 2 run lamp should light. Turn the H-O-A switch to "OFF".
5. With all float switches in the open position, turn the PUMP NO. 1 H-O-A switch to "AUTO". No contactors or lights should energize. Simulate closure of OFF and LEAD float switches. The PUMP NO. 1 motor contactor should energize and the PUMP NO. 1 run lamp should light. Open the contacts of the LEAD PUMP float switch. The motor contactor should remain energized and the run lamp on. Open the contacts of both float switches. The motor contactor should de-energize and the run lamp should go out. Turn the H-O-A switch to "OFF".
6. With all float switches in the open position, turn the PUMP NO. 2 H-O-A switch to "AUTO". No contactors or lights should energize. Simulate closure of OFF and LEAD PUMP float switches. The PUMP NO. 2 motor contactor should energize and the PUMP NO. 2 run lamp should light. Open the contacts of the LEAD PUMP float switch. The motor contactor should remain energized and the run lamp on. Turn the PUMP NO. 1 H-O-A switch to "AUTO". Close the contacts of the LEAD PUMP float switch. PUMP NO. 1 motor contactor should energize and the PUMP NO. 1 run lamp should light. Open the contacts of all float switches. Both motor contactors should de-energize and both run lamps should go out.
7. With both H-O-A switches in the "AUTO" position, close the contacts of the OFF and LEAD PUMP float switches. PUMP NO. 1 motor contactor should energize and the PUMP NO. 1 run lamp should light. Open the contacts of both float switches. The motor contactor should de-energize and the run lamp should go out. Close the contacts of the OFF and LEAD PUMP float switches. PUMP NO. 2 motor contactor should energize and the PUMP NO. 2 run lamp should light. This confirms the operation of the pump alternator relay.
8. Simulate closure of the HIGH LEVEL ALARM float switch. The alarm lamp should flash on and off.
9. Turn "OFF" the main disconnect switch ahead of the panel. Remove jumper from the contacts of the pump circuit breakers. Reconnect motor leads. Check for proper rotation. Re-test panel, making sure that actual motor and float switches operate properly.
10. If control panel components do not perform properly, refer to the troubleshooting chart.

~~3-3 MAJOR REPAIRS OF THE CONTROL PANEL~~

~~Should major repairs to the control panel become necessary, consult the ABS Product Service Department.~~

3-4 INITIAL START-UP

3-4-1 CHECKING THE IMPELLER ROTATION



After completion of the electrical service power connections to the pump, the direction of rotation should be checked when the pump is first used (also if moved to a new location). Incorrect direction of rotation will result in reduced discharge and can damage the pump.

The top portion of the pump motor housing contains a cast-in arrow and the words "START REACTION" which indicates the direction in which the pump should kick when it is started. This is the starting reaction. The impeller rotates in the opposite direction, indicated by a second arrow "ROTOR ROTATION".

To carry out this test, suspend the pump by the lifting chain and jog the motor. In the case of a fixed installation, this should be done before the pump is fixed in position. The electrical connection of the pump and the rotor rotation (direction of the rotation of the impeller) are correct if the pump (when starting and looking from above) makes an anti-clockwise start reaction (in the direction of the arrow "START REACTION").

If the pump should twist in the opposite direction of the arrow, the pump is now running backwards. Remove the main power to the control panel. Interchange two pump power leads at the terminal strip. In a duplex station, be sure to check both pumps.

CAUTION!

DO NOT SWITCH INCOMING POWER SUPPLY LINE LEADS AS THIS WILL AFFECT ALL PUMPS IN A MULTIPLE INSTALLATION.

NOTE

~~If a single phase pump should run backwards, consult the ABS Product Service Department immediately. Do not operate the pump.~~

4-2 CURRENT UNBALANCE, (THREE PHASE PUMPS ONLY)

Upon ascertaining that the pump is rotating in the correct direction, the amount of current unbalance between phases must be calculated. Run the pump under water, checking that all the valves are open in the discharge lines to simulate normal operating load conditions.

CAUTION!

CURRENT UNBALANCE BETWEEN PHASES SHALL NOT EXCEED 4%. CONSULT THE FACTORY WHEN CURRENT UNBALANCE EXCEEDS 4%. THE PERCENT OF CURRENT UNBALANCE IS DEFINED AND CALCULATED PER THE FOLLOWING EXAMPLE:

$$\% \text{ of current unbalance} = \frac{\text{max. current difference from average} \times 100}{\text{average current}}$$

Example

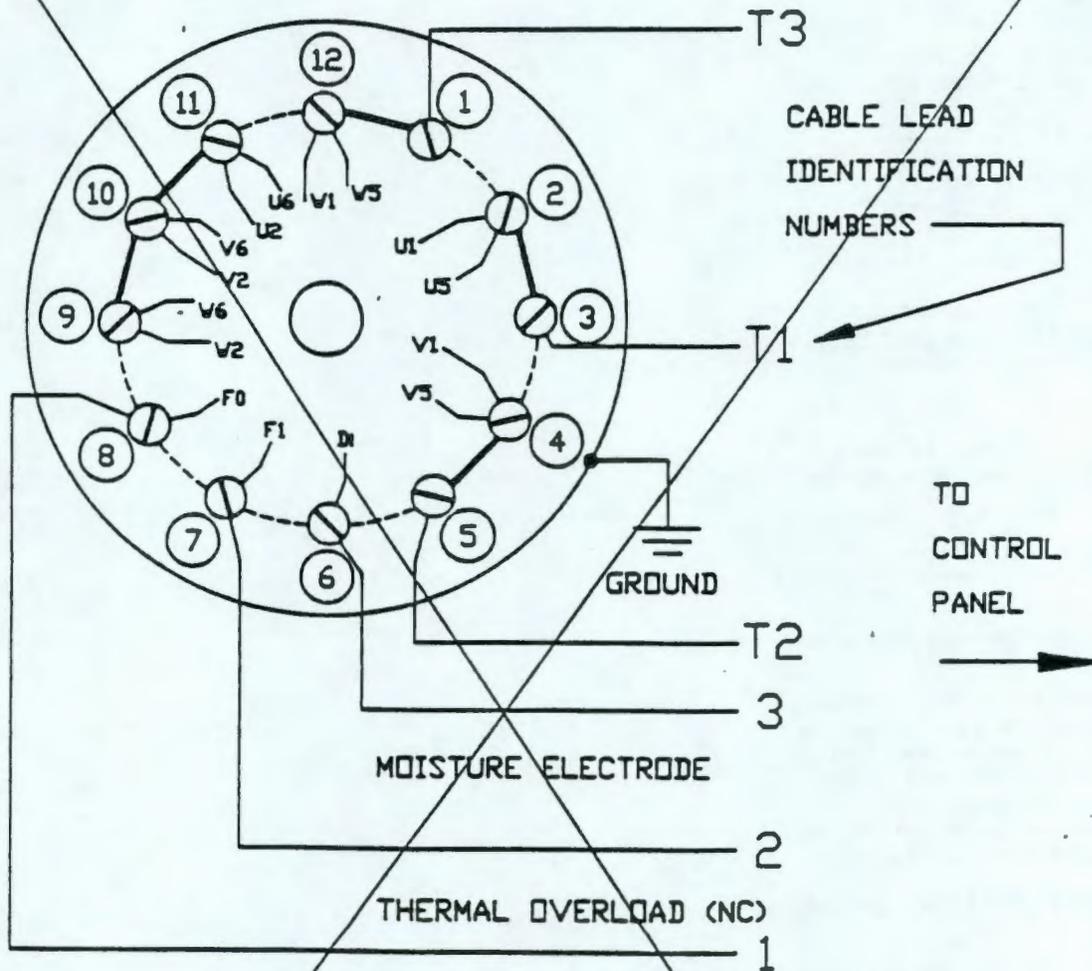
1. Current readings in amps shall be taken on each phase at the control panel terminal strip:
 $T_1 = 10 \text{ amps}, T_2 = 10.5 \text{ amps}, T_3 = 10.5 \text{ amps}$
2. The average current =

$$\frac{10 + 10.5 + 10.5}{3} = 10.33 \text{ amps}$$
3. The maximum current difference from average = .33 amps
4. The current unbalance for this particular three-phase hookup is 3.2%. If your unbalance between phases should exceed 4%, consult ABS Product Service Department immediately. Do not operate the pump. The results of this current unbalance calculation shall be entered on the "Product Start-Up Report".

4-3 INITIAL CURRENT CHECK, (SINGLE PUMPS)

~~Run the pump under water, checking that all valves are open in the discharge lines to simulate normal operating load conditions. Take current readings on the control panel terminal strip on the motor leads. The current drawn should never exceed the value given on the nameplate of the pump as "F.L. Amps". If the measured value is higher than the rated "F.L. Amps" value, consult factory immediately.~~

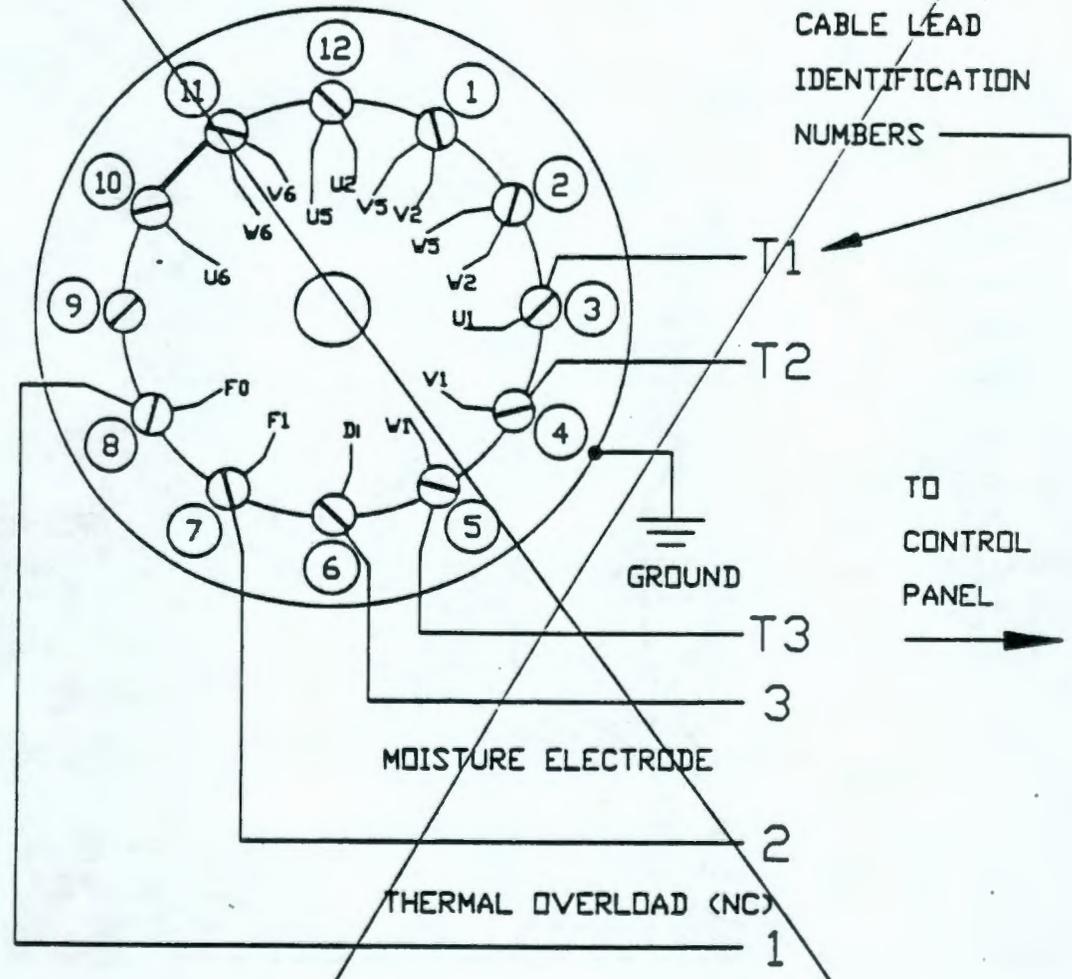
SECTION 3 PUMP WIRING DIAGRAM



PUMP WIRING DIAGRAM
AF13-6, AF15-4, AF30-4
WITH TERMINAL CHAMBER
230V 60HZ 3 PHASE

FIGURE 3-2

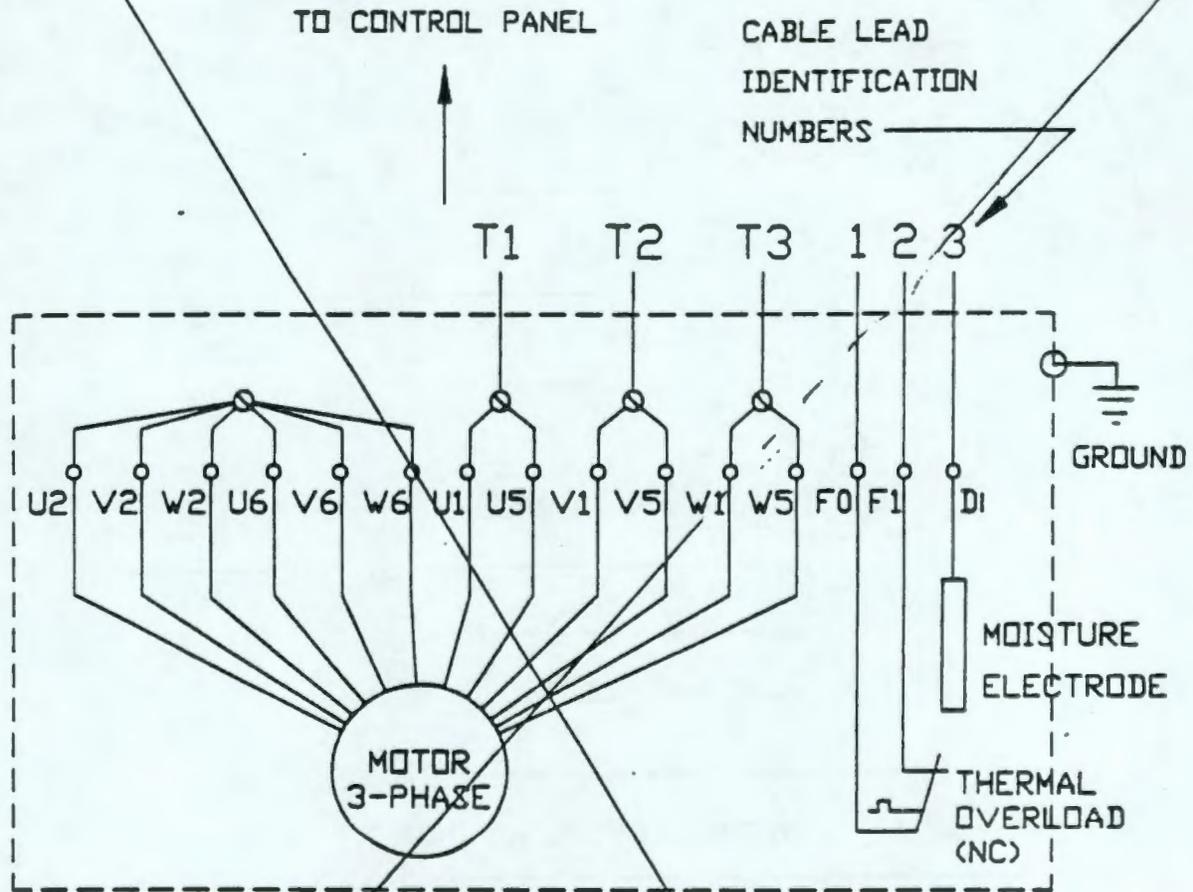
SECTION 3 PUMP WIRING DIAGRAM



PUMP WIRING DIAGRAM
AF13-6, AF15-4, AF30-4
WITH TERMINAL CHAMBER
460V 60HZ 3 PHASE

FIGURE 3-3

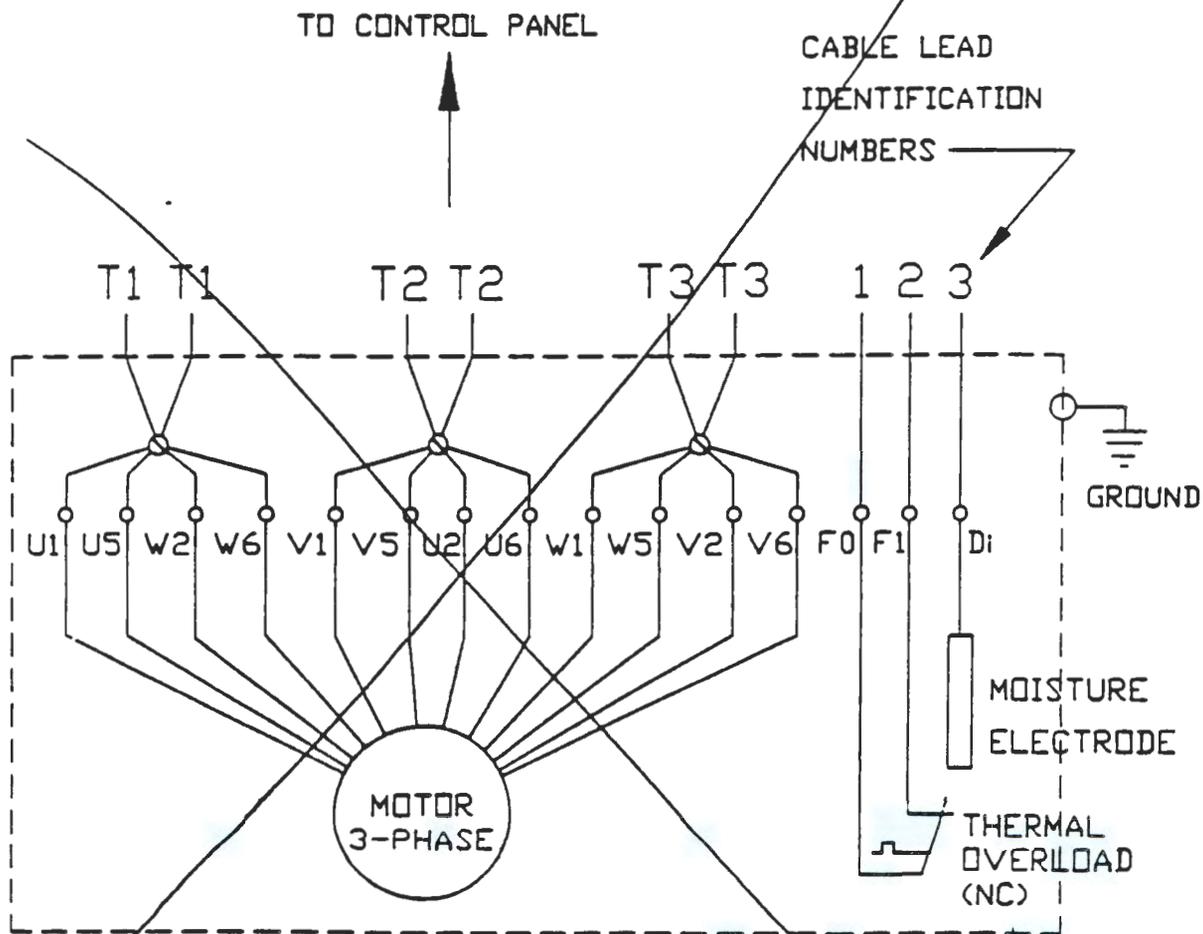
SECTION 3 PUMP WIRING DIAGRAM



PUMP WIRING DIAGRAM
AF13-6, AF15-4, AF22-4, AF30-4
WITHOUT TERMINAL CHAMBER
230V 60HZ 3 PHASE

FIGURE 3-6

SECTION 3 PUMP WIRING DIAGRAM



PUMP WIRING DIAGRAM

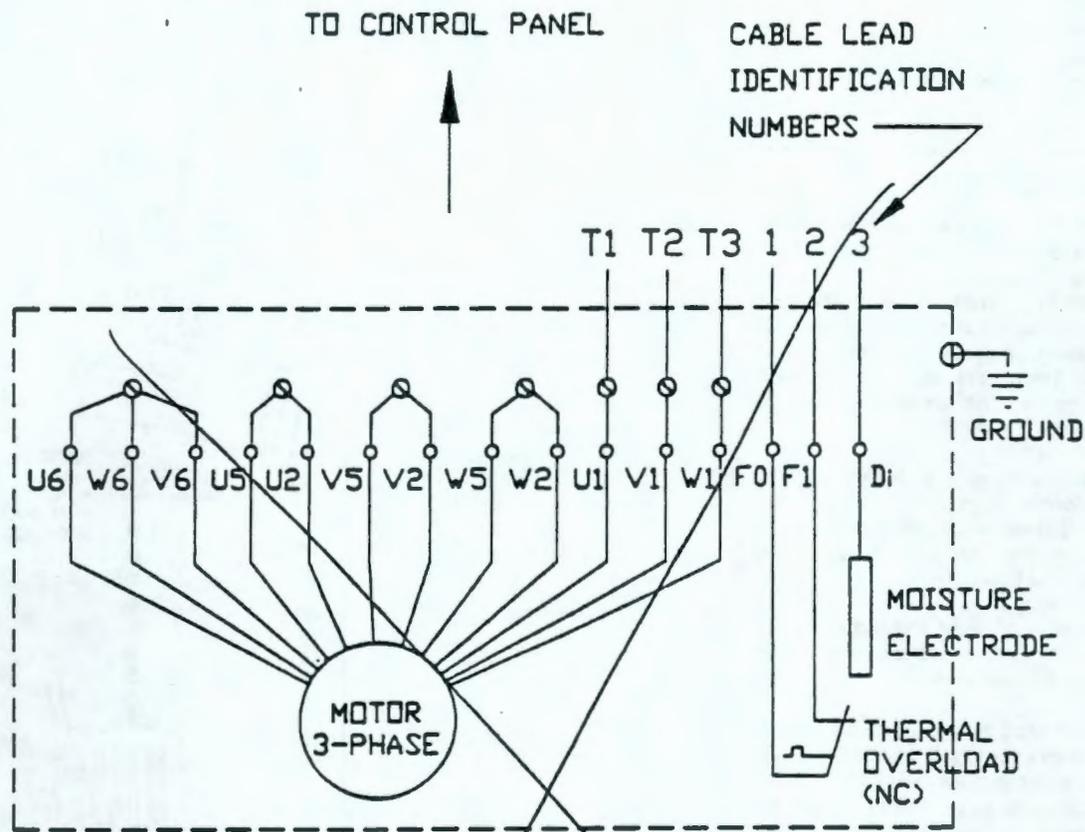
AF30-6, AF40-4, AF60-4, AF90-4

WITHOUT TERMINAL CHAMBER

230V 60HZ 3 PHASE

FIGURE 3-8

SECTION 3 PUMP WIRING DIAGRAM



PUMP WIRING DIAGRAM
AF13-6, AF15-4, AF22-4, AF30-4
WITHOUT TERMINAL CHAMBER
460V 60HZ 3 PHASE

FIGURE 3-7

SECTION IV

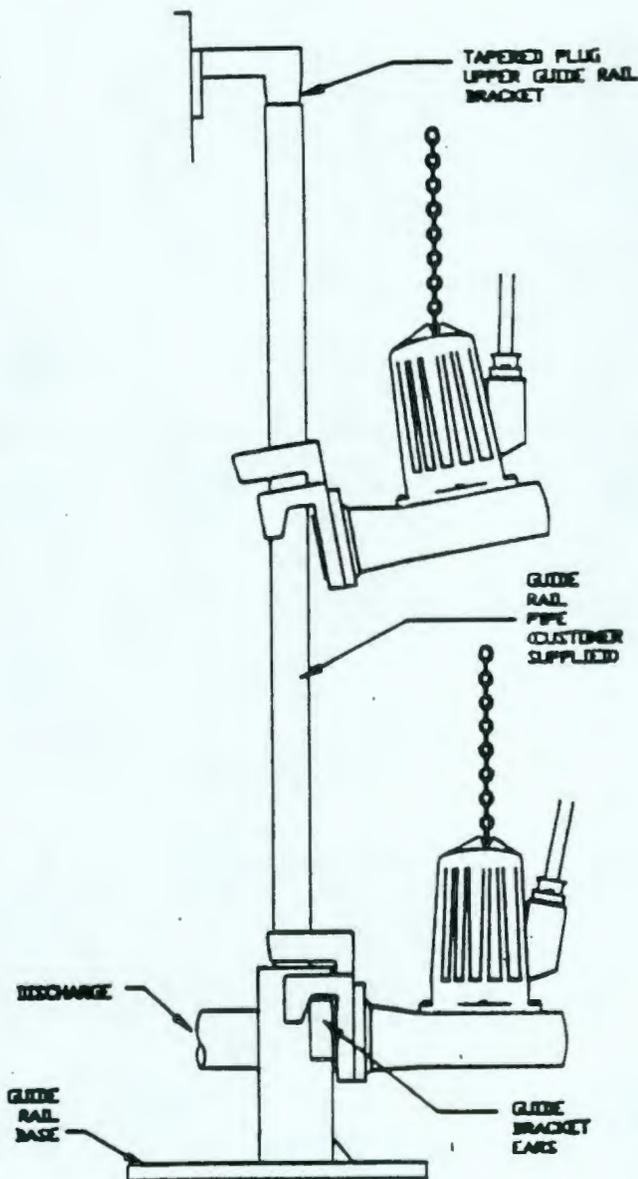
CAUTION!

PRIOR TO PLACING THE PUMP INTO OPERATION, A PRODUCT START-UP PROCEDURE SHALL BE ACCOMPLISHED BY AUTHORIZED PERSONNEL. FAILURE TO COMPLETE AND RETURN THE "PRODUCT START-UP REPORT" TO THE FACTORY WILL VOID THE WARRANTY. A COPY OF THIS REPORT IS FURNISHED WITH EACH PUMP.

4-1 GUIDE RAIL INSTALLATION

When the electrical service has been properly connected, the initial Start-Up Procedure completed, all control switches checked, and the pump mechanically mounted in position, the operation of the pump is completely automatic. No operational procedures are required except to apply rated power to the pump. There are also no specific shut-down procedures beyond disconnecting the electrical power supply.

- a. ABS submersible pumps are fitted with a bracket which forms an integral part of the pump. A molded gasket is locked into position between the back of the bracket and the discharge face of the pump.
- b. The pump bracket slips over the upper guide rail bracket and the unit is lowered down the two inch guide rail into the wet well.
- c. As the pump is lowered into position an angled slot in the pump bracket hits a straightening vane which squares the pump with the mating flange of the guide rail base. Pump should be lowered at an angle until bracket ears engage as shown.
- d. When the pump is in position, the chain is slacked off. The weight of the pump is suspended by the two pump bracket ears which seat on the pedestal base. The ears also distribute the pump weight for compression of gasket against the mating flange of the guide rail base.



Guide Rail Installation
FIGURE 4-1

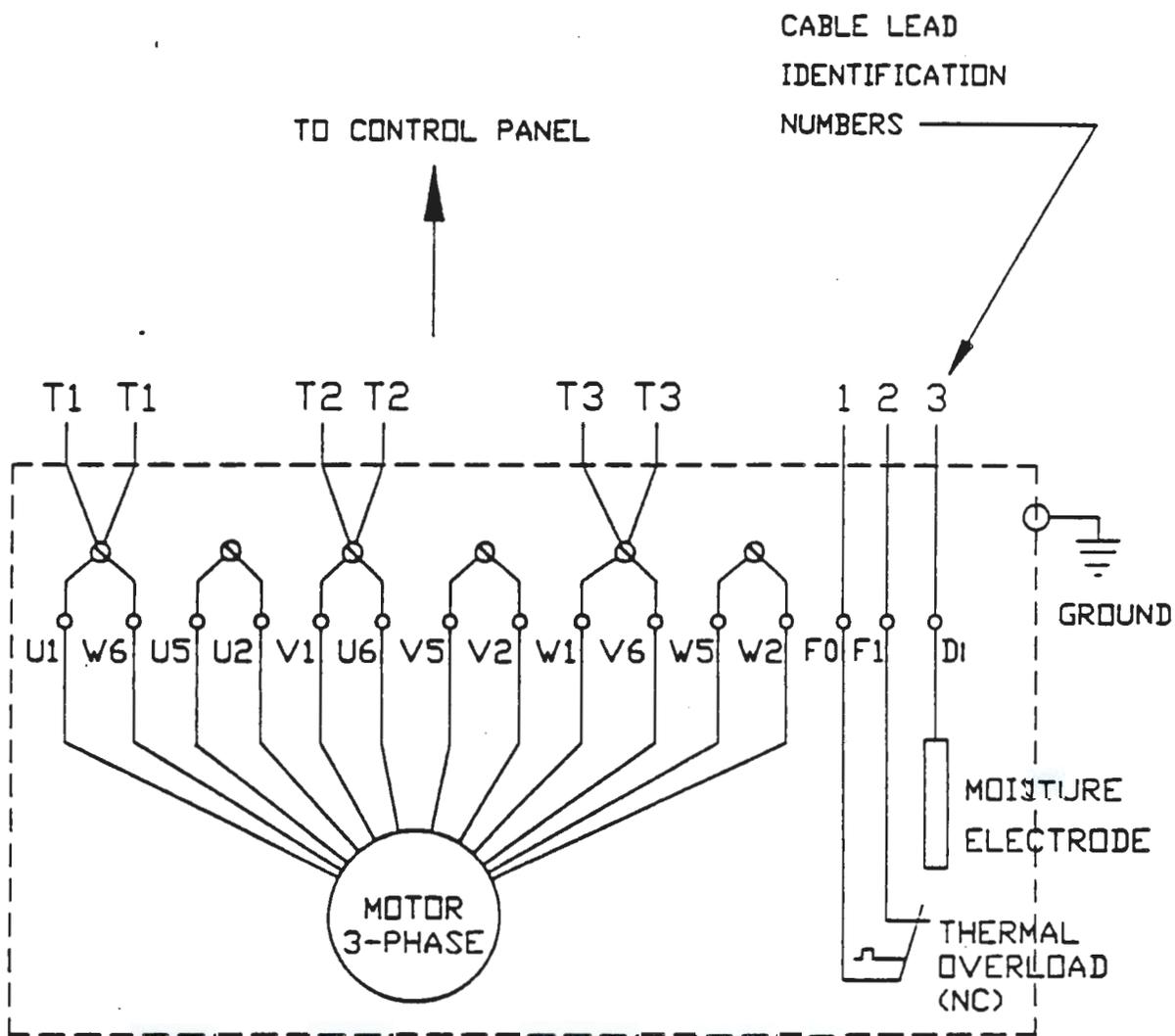
~~4-2 PORTABLE USAGE~~

~~When using the ABS AF pump for portable service, care must be taken to prevent undue wear or damage. When using the pump on a soft muddy bottom, place a flat plate beneath the pedestal base to prevent the pump from burrowing itself into the mud or sand.~~

CAUTION!

NEVER RAISE, LOWER, OR MOVE THE PUMP BY LIFTING WITH, OR PULLING ON, THE POWER CABLES. THE PUMP IS PROVIDED WITH A LIFTING EYE AND A CHAIN. THE LIFTING EYE SHALL BE USED AT ALL TIMES WHEN MOVING THE PUMP.

SECTION 3 PUMP WIRING DIAGRAM



PUMP WIRING DIAGRAM

~~AF30-6, AF40-4, AF60-4, AF90-4~~

WITHOUT TERMINAL CHAMBER

460V 60HZ 3 PHASE.

FIGURE 3-9

SECTION V MAINTENANCE

ABS pumps are designed for long lasting, efficient and reliable service with a minimum number of preventative maintenance checks. These checks are few but will add years of satisfactory service to the life of the pump. Maintenance checks should be performed at approximately the intervals stated (the actual time interval will depend on the operating environment).

5-1 MAINTENANCE NOT REQUIRING REMOVAL OF THE PUMP

5-1-1 PUMP WASH-DOWN

The build-up of sludge on the pump body and cooling fins prevent the efficient dissipation of heat from the motor. This internal heat rise can lead to a shortening of the motor life. It is recommended, therefore, that at six month intervals the pump be washed down with a pressure hose.

5-1-2 FLOAT SWITCH CLEANING

The build-up of the same fats, grease, and sludge on the float switches may cause them to function improperly. The float switches should be checked for sludge build-up at three month intervals. They may be lifted from the pit and cleaned, or cleaned in place if they are anchored to structural parts of the station. After cleaning, they should be visually inspected and worked in sequence to check pump operation. See Paragraph 2-6.

5-2 MAINTENANCE REQUIRING REMOVAL OF THE PUMP

CAUTION!

NO REPAIRS SHALL BE MADE TO PUMP DURING WARRANTY PERIOD WITHOUT PRIOR FACTORY APPROVAL. TO DO SO MAY VOID THE WARRANTY. ANY REPAIRS SHALL BE MADE BY AN AUTHORIZED SERVICE REPRESENTATIVE.

To accomplish pump removal for periodic maintenance, the following procedures are recommended:

To remove the pump assembly from the sump basin, first close the discharge gate valve. Then, using the lifting chain, raise the pump along the guide rail out of the well. If the pump is checked right outside the tank, it is not necessary to disconnect the cable. If the pump is to be moved away from the wet well, the cable must be disconnected.

CAUTION!

IT IS EXTREMELY IMPORTANT THAT UNDER NO CIRCUMSTANCES THE PUMP BE LIFTED USING THE CABLE.

UNDER NO CIRCUMSTANCES SHOULD TOOLS BE APPLIED TO THE PUMP AND MOTOR WITHOUT THE POWER TO THE CONTROL BOX BEING DISCONNECTED AND LOCKED OUT.

5-2-1 SEAL OIL CHECK

The seal oil in the oil chamber should be checked at yearly intervals or when the seal alarm signal is given.

1. Lay the pump in a horizontal position with the oil fill plug upwards. Clean around the pump (2010).
2. Remove the plug and fiber washer (2010 and 4600). The oil level should be approximately 20mm (3/4 inch) below the counterbore.
3. Drain off a small quantity of oil (7400). If the oil is in a clean condition, no further checks are necessary. Replenish the oil and replace the plug using a new fiber washer (4600).
4. If the oil has become discolored or emulsified, i.e., milky looking, drain off all the oil and refill with the correct quantity of new 10W High Detergent oil (7400). Multi-viscosity oil is not suitable.
5. A further check must be made after an interval of three weeks. If the oil has again become discolored, the lower mechanical seal and possibly the upper mechanical seal should be replaced. The motor housing should be removed to inspect for water entry (see Paragraph 5-2-2).

5-2-2 MOTOR HOUSING REMOVAL AND MOTOR INSPECTION

If contaminated oil is found in the oil chamber, check for possible water in the motor housing as follows:

1. With the pump upright, remove 4 Allen screws (1040) holding the motor housing to the oil chamber (0040).
2. Lift the pump vertically about 2 inches above the bench.
3. Tap gently to free the O-Ring (4410) compressed between oil chamber and motor housing until the pump drops down from the motor housing (0010).
4. Disconnect the seal probe (di-electrode) (0510) wire from the bearing lid (0760) using longnosed pliers and remove the motor housing.
5. Visually inspect for water or oil.
6. If the stator (0020) is wet, take action as required or call factory.

5-2-3 LOWER MECHANICAL SEAL REMOVAL

1. Drain off the oil (see Paragraph 5-2-1).
2. Remove the volute (0200) by taking out the 4 Allen screws (1040) securing it to the oil chamber. If the volute does not release easily, lift the pump a short distance off the bench and tap the volute all around until it releases. Lay the pump on its side. The impeller (0160) is now removed by withdrawing the Allen screw (right hand thread) (1000 or 1002) and washer (0480) from the center.
3. Remove the impeller key (4800).
4. The mechanical seal (3800) can now be dismantled; refer to Figure 5-1.

5-2-4 OIL CHAMBER REMOVAL

1. Remove the motor housing per Paragraph 5-2-2 and the lower mechanical seal per Paragraph 5-2-3.
2. Tap off the oil chamber (0040).

NOTE

See Paragraph 5-2-14 for proper oil quantities and assembly procedure.

5-2-5 REMOVAL OF UPPER MECHANICAL SEAL AND TRANSITION PIECE

1. Remove circlip (5410).
2. Remove the rotating metal seal ring, together with its O-Ring, discard O-Ring (3900). Never reuse a removed or exposed O-Ring; replace with new.
3. Remove the transition piece (0050) by taking the 4 Allen screws (1020) out. Discard the transition piece O-Ring (4420).
4. Pry out the stationary seal (rubber boot and ceramic/carbon seal) with a screwdriver, and discard (see Figure 5-1).

5-2-6 INSTALLATION OF UPPER MECHANICAL SEAL AND TRANSITION PIECE

1. Using soapy water, lubricate the outside of the rubber boot of the stationary seal assembly (3900). Do not touch the ceramic/carbon seal face. Insert seal into the transition piece (0050).
2. Install new transition piece O-Ring (4420), and place the transition piece into the bearing lid (0760). Secure with the 4 Allen screws (1020) and spring washer (3300); apply pressure evenly.
3. Apply water/soap solution on the seal rubber skirt and install the new rotating seal ring on the shaft so that the polished face mates with the ceramic/carbon face of the stationary seal. Take care not to cut the rubber skirt on the circlip groove.
4. Install the compression spring and support washer. Insert circlip, compress the mechanical seal assembly in order to properly seat the circlip (5410).

5-2-7 BEARING LID AND LOWER BEARING REMOVAL

1. Remove the motor housing per Paragraph 5-2-2, the lower mechanical seal per Paragraph 5-2-3, the oil chamber per Paragraph 5-2-4, the upper mechanical seal per Paragraph 5-2-5, and the transition piece per Paragraph 5-2-5.
2. Remove the shaft circlip (5400).
3. Support the bearing lid (0760) and press out the motor shaft.
4. Press the double row ball bearing (5100) out of the transition piece (0050) opening.
5. Remove the safety ring (5200) from behind the bearing (5100). It can be cleaned and re-used after inspection.

5-2-8 CABLE REPLACEMENT (STANDARD)

1. If a connection chamber (0350) is fitted, remove four Allen screws (1004) and spring washers (3300). Remove chamber lid (0410).
2. Disconnect ground wire from body. Disconnect cable wires from terminal board (9030) by removing nuts (2500).
3. If a connection chamber is not fitted, remove motor housing per 5-2-2. Disconnect ground wire from housing. Clip other wires close to crimp connectors.
4. Remove two Allen screws (1010 or 1020) and spring washers (3300 or 3310) from cable clamp (0150) on the side of the cable cap (0320). Take out the clamp. Remove two Allen screws (1030) and spring washers (3310, 3320 or 3301) securing the cable cap (0320) to the housing.
5. Pull out the cable cap (0320), cable seal (0400), washer (0340) if present, and cable (9120).

5-2-9 CABLE REPLACEMENT (EXPLOSION PROOF)

Cables for explosion proof pumps are of a special type using a potted cable entry (0320).

If the cable has been damaged, a factory replacement assembly (9120-EX) must be obtained. Do NOT attempt to make repairs to the assembly as safety regulations could be violated and the installation become hazardous. Replacement MUST be performed by a factory authorized service representative.

1. Remove motor housing per 5-2-2.
2. Disconnect ground wire from housing body. Clip stator leads close to crimp connectors.
3. Remove four Allen screws (1010) and spring washers (3301). Pull out cable assembly (9120-EX).
4. To replace cable, thoroughly clean cable cap. Install a new O-Ring (4430). Brush O-Ring with oil, push cable cap into housing. Secure with four Allen screws (1010) and spring washers (3301). Connect wires per wiring diagram.

5-2-10 STATOR REPLACEMENT

1. Clip stator leads close to crimp connections. Remove connector chamber (if required) per Paragraph 5-2-12.
2. Remove the securing screws (1000 or 1002) and washers (4610) from the side of the housing (0010). Measure the depth of the tapped holes.
3. Stand the housing upright and heat the housing externally to a temperature of approximately 100° C all around. Wearing asbestos gloves, tap the housing bottom on a piece of wood until the stator (0020) drops out.

NOTE

The securing screws on EX Models are covered in a special compound and with a steel cap.

4. To refit a new stator, locate the housing securely on the press. The stator leads should be 90° to the cable entry hole and the V-slots in the stator body should not line up with the securing holes in the housing.
5. Press the stator home using a suitable tool on the outside flange of the stator body. Never put pressure on the stator windings or use hand tools on them.
6. This may also be accomplished by heating the motor housing to 100°C to slide stator in freely.
7. Tuck/tie all leads in neatly. Tap new screw holes into the stator to the depth previously measured. Apply a non-hardening thread sealer. Insert securing screw(s) (1000 or 1002) and washer(s) (4610).

CAUTION I

REPAIR OR REPLACEMENT OF EXPLOSION PROOF STATORS MUST BE PERFORMED BY A FACTORY AUTHORIZED SERVICE REPRESENTATIVE.

5-2-11 CABLE INSTALLATION

1. Cable installation is a direct reversal of the removal sequence. There should be about 15mm of the outer jacket projecting inside the housing after tightening the cap securing screws (1030). Always use a new cable seal (0400).
2. If a connection chamber is not fitted, the leads are crimped in the correct order with insulated connectors, checking each crimp for security.
3. The ground is attached to the tapped hole provided on the housing side, using special washers and a slotted screw (1800).
4. The di-electrode wire is left loose for the present.
5. If a connection chamber is fitted, connect wires to terminal board (4030) according to wiring diagram.

5-2-12 CONNECTION CHAMBER REPLACEMENT

1. Remove four Allen screws (1004) and spring washers (3300). Remove chamber lid (0410).
2. Disconnect wires from terminal board (9030) by removing hex nuts (2500).
3. Remove four Allen screws (1000) and washers (3020). Remove terminal board (9030).
4. Remove two Allen screws (1035) and sealing washers (4605).
5. Remove connection chamber (0350).
6. Slice around silicone seal (if present) with a sharp knife and remove grommet (0401).
7. Thoroughly clean surfaces of connection chamber (0350), inspect and replace O-Ring (4425) if damaged.
8. Feed wires through grommet (0401). Position grommet on chamber (0350).
9. Install two new sealing washers (0402). Brush O-Ring (4425) with oil and insert chamber (0350) into motor housing (0010).
10. Place two new sealing washers (4605) onto Allen screws (1035) and secure chamber to motor housing.
11. Install terminal board (9030) using four Allen screws (1000) and washers (3020).
12. Fill cavity around wires between terminal board and grommet with silicone seal to assure a water-tight seal.
13. Connect wires to hex terminal board according to wiring diagram with nuts (2500) and jumpers (0950). Connect ground wire to housing with round head screw (1800) and lock washer (3200).
14. Inspect O-Ring (4415), replace if damaged. Brush O-Ring with oil and install chamber lid (0410) with four Allen screws (1004) and spring washers (3300).

CAUTION I

REPAIR OR REPLACEMENT OF EXPLOSION PROOF CABLES MUST BE PERFORMED BY A FACTORY AUTHORIZED SERVICE REPRESENTATIVE.

5-2-13 BEARING LID INSTALLATION

1. Thoroughly clean the bearing lid (0760) having first removed the old O-Ring (4400).
2. Ensure that the dowel pin (6100) is in position.
3. Oil and loop a new O-Ring (4400) into the bearing lid groove.
4. Place the lid on the press table. Insert the safety ring (5200), position the bearing (5100) and press home.
5. Turn the lid over, place the support washer (5600) in position on the bearing, note that the lid must be mounted on a special tool supporting the bearing (5100) so that it is not pushed out as the shaft is pushed in.
6. Oil the rotor shaft (0030) and place it in the bearing (5100) and support washer (5600). Press the shaft home.
7. Remove the assembly from the press, turn it upside down and rest it on the bench. Insert the shaft circlip (5400).
8. Clean the transition piece (0050) thoroughly, oil and insert a new O-Ring (4420).
9. Push the transition piece into the bore, lining up the holes.
10. Insert and tighten evenly 4 Allen screws (102) and spring washers (3300).

5-2-14 OIL CHAMBER INSTALLATION

1. Thoroughly clean the oil chamber (0040) shaft and transition piece (0050) bores and rotor shaft.

NOTE

A new O-Ring (4400) must be used.

2. Place the oil chamber (0040) on the press table. Brush oil around the inside diameter to facilitate fitting the lid.
3. Position the lid/rotor assembly and press home.
4. Oil Chamber Capacity

Use Only 10W High Detergent Oil

AF 15-4,22-4,30-4	1.5 Ql. STD
AF 13,18,28-4W	1.3 Ql. EX
AF 13-6	
AF 30-6,40-4	3.0 Ql. STD
AF 60-4,90-4	3.0 Ql. EX

5-2-15 MOTOR HOUSING INSTALLATION

1. Loop a new O-Ring (4410) over the bearing lid diameter. Brush oil around same.
2. Suspend the motor housing/stator assembly over the oil chamber/shaft assembly.
3. Line up the location marks on the housing and oil chamber.
4. Line up the dowel pin in the bearing lid with the fork slot in the housing. The bearing lid may have to be turned to do this.
5. Lower the housing to within about 2 inches of the oil chamber.
6. Insert the seal probe (di-electrode) wire using long nosed pliers.
7. Lower the housing the rest of the way, ensuring that:
 - a. The dowel locates in the motor housing fork slot,
 - b. the location marks line up,
 - c. the O-Ring is not pinched and,
 - d. no wires are pinched.
8. Insert and tighten the 4 securing Allen screws (1040) and spring washers (3320).

5-2-16 LOWER MECHANICAL SEAL INSTALLATION

1. Dip the stationary part of the mechanical seal (3800) in soapy water.
2. Press into position using a clean, lint-free rag and both thumbs. Do not use hard or sharp tools on a mechanical seal.
3. Slide the rotating part of the seal into position after dipping in soapy water.
4. When the complete seal assembly is in place, insert the securing circlip (5410).

5-2-17 REPLACING THE IMPELLER

1. Place the impeller key (4800) in slot on shaft (0030).
2. Tap the impeller (0160) into position.
3. Insert the impeller securing washer (0480) and the Allen screw (1000), tighten.

5-2-18 REPLACING THE VOLUTE

For Vortex models, oil and loop a new O-Ring (4470) over the oil chamber end. Push the volute (0200) onto the oil chamber with the discharge in the proper position. Install the hammer screws (1100) and hex nuts (2540).

For CB models, push the volute onto the oil chamber with the discharge in the proper position. Install the Allen screws (1000) and lock washers (3320). Install the bottom plate (0230) into the volute per Paragraph 5-2-19.

5-2-19 BOTTOM PLATE ADJUSTMENT

1. Push the bottom plate (0230) into position on the volute (0200).
2. Hold it in position with one hand, check the gap between the impeller blade and bottom plate shearing with a feeler gauge. The correct gap is 0.4--1.0mm (.010" --.025").
3. The gap is adjusted by turning the brass adjusting screws (0290), one half turn at a time until the gap is even all around.
4. Insert and tighten the four Allen screws (1001) through the brass screws (0290). Re-check the gap and adjust if necessary.

5-3 HELPFUL HINTS FOR ON-SITE INSPECTION AND SERVICING OF PUMPS

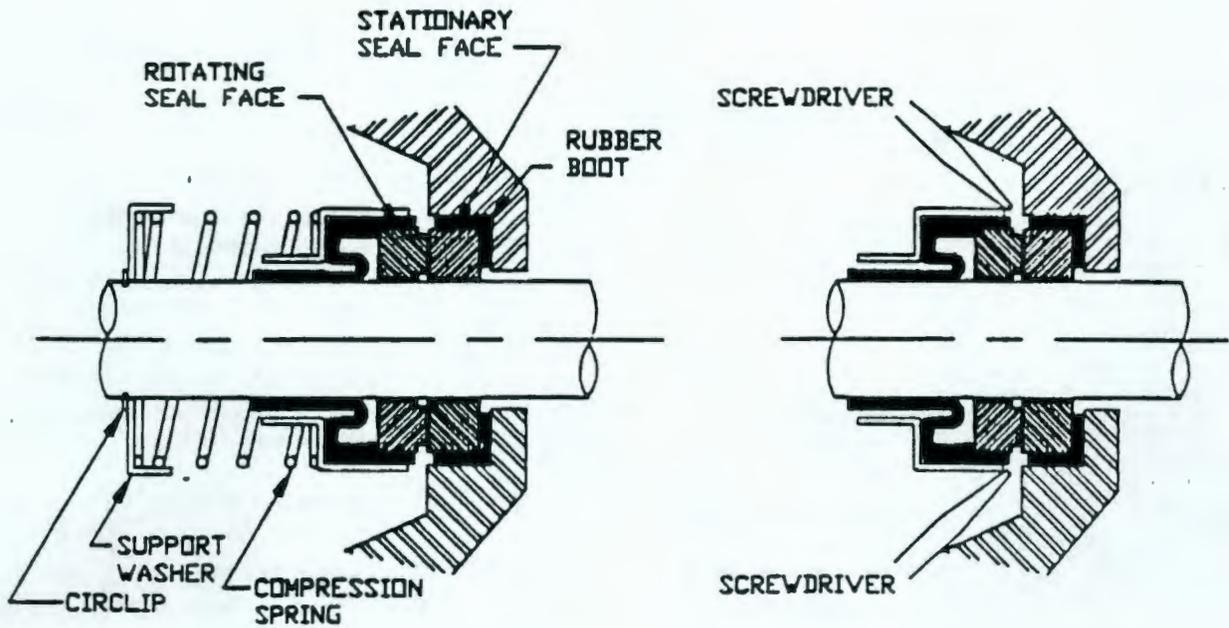
There are many checks which can be carried out on site without the necessity of transporting the pump to a workshop. They are listed below to aid the service technician.

1. Check direction of rotation - see Paragraph 3-4-1.
2. When pump is fully submerged and running under normal conditions, check the current draw. Compare with nameplate or technical data and check setting of overload in control panel.
3. Check the function of the seal probe (di-electrode). Is the warning signal on? Is the probe functioning? This can be checked by placing a jumper lead between the #3 control lead from the pump and ground. This simulates water in the oil chamber.
4. Check float switches and cable for accumulations of dirt, grease, etc. Carefully wash off floats. Check operation as indicated in Paragraph 2-6 of maintenance manual.
5. Check cables for damage.
6. Sump/Well cleaning: When cleaning the pump, the opportunity to remove any build-up of sediment/sludge in the sump bottom should be taken. Loosen the sediment with a spade and shovel it towards the pump. Add water and pump loose sediments away, repeating until well is clean.
7. Check control panel for functioning. Note any faults and check also for moisture or corrosion.
8. Check function of check valves - especially in duplex stations.

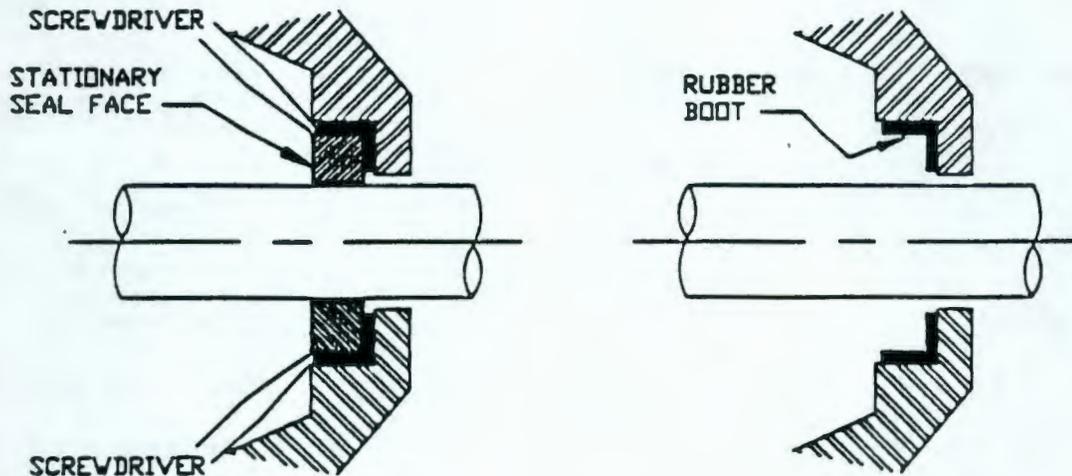
9. Stator Check: The stator windings can be checked for continuity via the cable ends.
10. Meg-Ohm resistance test: This is done between pump body or ground connection and power leads. The resistance should be in the meg-ohm range.
11. After raising and cleaning the pump, it is recommended that the impeller be inspected and the gap measured - see Paragraph 5-2-19 for adjustment method.
12. Seal Oil Check - see Paragraph 5-2-1. If the oil is good, simply replenish the amount taken out (within 20mm or 3/4 inch of the plug screw). Use a new fiber washer when replacing plug. (Do not overfill with oil as an air pocket is needed to compensate for heat expansion).
13. Head and Flow Check: In certain cases, pressure gauges are installed which measure pressure in the pump discharge line. These are mainly used to indicate fall-off in head pressure. Direct comparison to the pump performance curve is difficult as:
 - a. The head will vary as water level falls.
 - b. the discharge may vary depending on valve settings. However, regular recording of the head will indicate that impeller/bottom plate adjustment may be needed or that a check valve is allowing back flow in a duplex station.

Regular recording of the pressure readings will help in determining the condition of the pump unit and piping system.

* For dry pit models, loop a new O-Ring (4450) onto the bottom plate.



1. Remove the circlip (5410) underneath the support washer.
2. Remove the support washer and compression spring. Clean the shaft thoroughly and coat with seal oil.
3. Using two screwdrivers 180° apart, pry the rotating seal face away from the stationary seal face.
4. With a continuous twisting motion, pull the seal face along the shaft.
5. Using two screwdrivers 180° apart, pry the stationary seal face out from the rubber boot.
6. Remove the rubber boot from the housing.



Mechanical Seal Dismantling Sequence
FIGURE 5-1

5-4 TROUBLESHOOTING CHART AF 13-90

SYMPTOM	POSSIBLE CAUSE	REMEDY
1. PUMP WILL NOT START	<p>A. Power supply failure</p> <p>B. Burned-out fuse or tripped circuit breaker.</p> <p>C. Damaged power cable.</p> <p>D. Level switch failure</p> <p>E. Jammed impeller.</p> <p>F. Water inside motor.</p> <p>G. Foreign matter build-up.</p>	<p>A. Check power supply Check out electrical system for loose connections. Check operating voltage between any two power lines, three phase. Check operating voltage between terminals L1 and L2, single phase.</p> <p>B. Check circuit protectors, reset circuit breakers.</p> <p>C. Check external cable for damage-repair.</p> <p>D. Check level switches.</p> <p>E. Inspect and remove jamming object.</p> <p>F. Refer to Symptom 8 and 9.</p> <p>G. Clean floats carefully.</p>
2. REPEATED TRIPPING	<p>A. Circuit protection underrated.</p> <p>B. Phase current unbalance.</p> <p>C. Pump connected to incorrect voltage.</p> <p>D. Wet or damaged wiring.</p> <p>E. Obstruction in pump.</p> <p>F. Incorrect rotation.</p>	<p>A. Check rating and replace with proper size.</p> <p>B. Check amp draw.</p> <p>C. Verify connections. See wiring diagram.</p> <p>D. Inspect external cable and replace if worn or damaged.</p> <p>E. Remove obstruction.</p> <p>F. Check rotation per Paragraph 3-4-1.</p>
IF SYMPTOMS CONTINUE, CONSULT ABS PRODUCT SERVICE DEPARTMENT.		
3. PUMP RUNS IN "HAND" BUT NOT IN AUTOMATIC MODE	<p>A. Bad "OFF" float</p> <p>B. Bad "ON" float switch.</p>	<p>A. Install wire jumper between OFF switch terminals. If pump starts to run, replace the "OFF" float switch.</p> <p>B. Install wire jumper between ON float terminals. If pump starts to run replace the ON float switch.</p>
4. PUMPS RUN SEPARATELY BUT NOT TOGETHER (DUPLEX OPERATION)	<p>A. Faulty lead pump float switch.</p> <p>B. Faulty lag pump float switch.</p> <p>C. Foreign mater build-up on floats.</p>	<p>A. With power off, invert each float switch. Check leads for continuity. Replace failed switch.</p> <p>B. Same as Remedy A.</p> <p>C. Clean floats.</p>

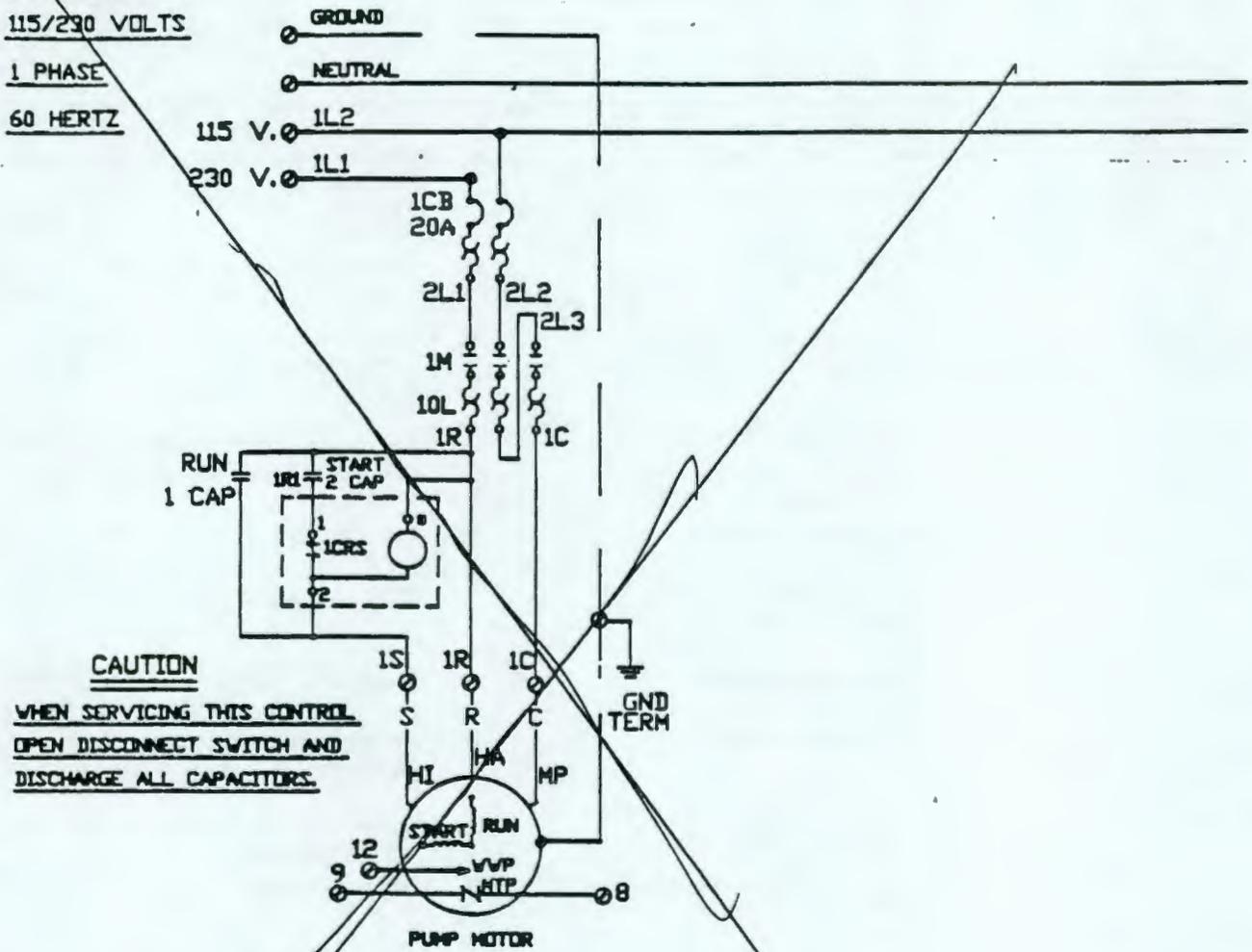
5-4 TROUBLESHOOTING CHART

AF 13-90

SYMPTOM	POSSIBLE CAUSE	REMEDY
PUMP WILL NOT SHUT OFF.	<ul style="list-style-type: none"> A. Float switch failure. B. Control panel failure. 	<ul style="list-style-type: none"> A. With power off, check float switches for continuity. B. Check control panel schematic drawing.
HIGH LEVEL ALARM DOES NOT COME ON.	<ul style="list-style-type: none"> A. Faulty high level alarm switch. 	<ul style="list-style-type: none"> A. Install wire jumper between alarm terminals. Replace high level alarm float switch.
LOW FLOW.	<ul style="list-style-type: none"> A. Incorrect rotation. B. Liquid level in pit too low, air bound. C. Obstruction in pump or piping. D. Partially closed valve(s). 	<ul style="list-style-type: none"> A. Check rotation per Paragraph 3-4-1. B. Check liquid level and location of level switches. C. Remove obstruction. D. Check and adjust valve.
WATER IN OIL CHAMBER	<ul style="list-style-type: none"> A. Loose or damaged oil plug. B. Mechanical seal failure. 	<ul style="list-style-type: none"> A. Check plug - replace. B. Replace mechanical seal per Paragraph 5-2-3.
WATER INSIDE MOTOR CASING.	<ul style="list-style-type: none"> A. Damaged upper lip seal or mechanical seal. B. Damaged O-Ring between oil chamber and motor casing. 	<ul style="list-style-type: none"> A. Replace seal per Paragraph 5-2-5. and Paragraph 5-2-6. B. Replace O-Ring.

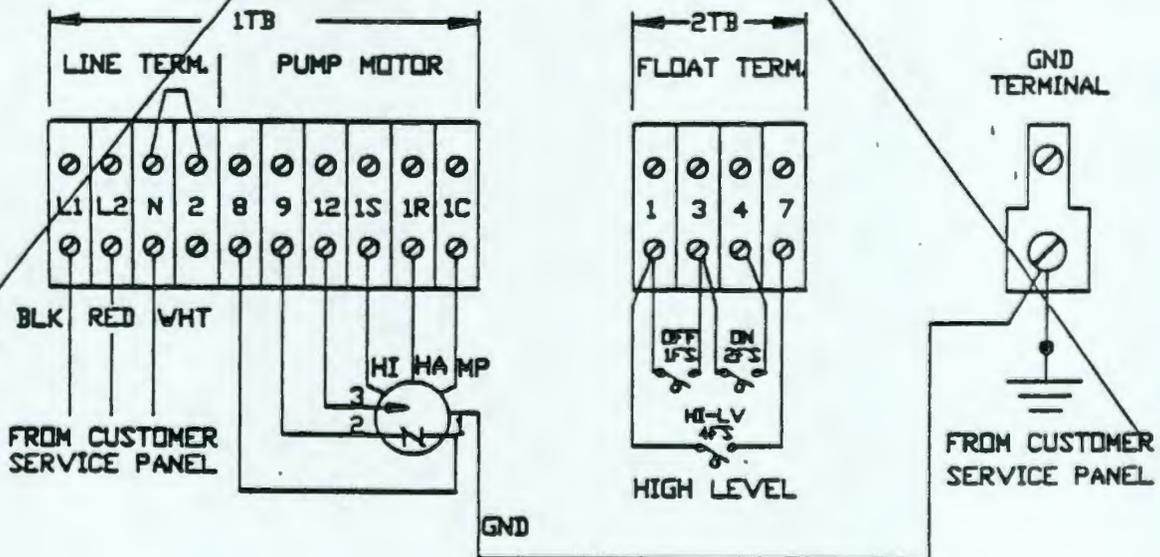
POWER SUPPLY

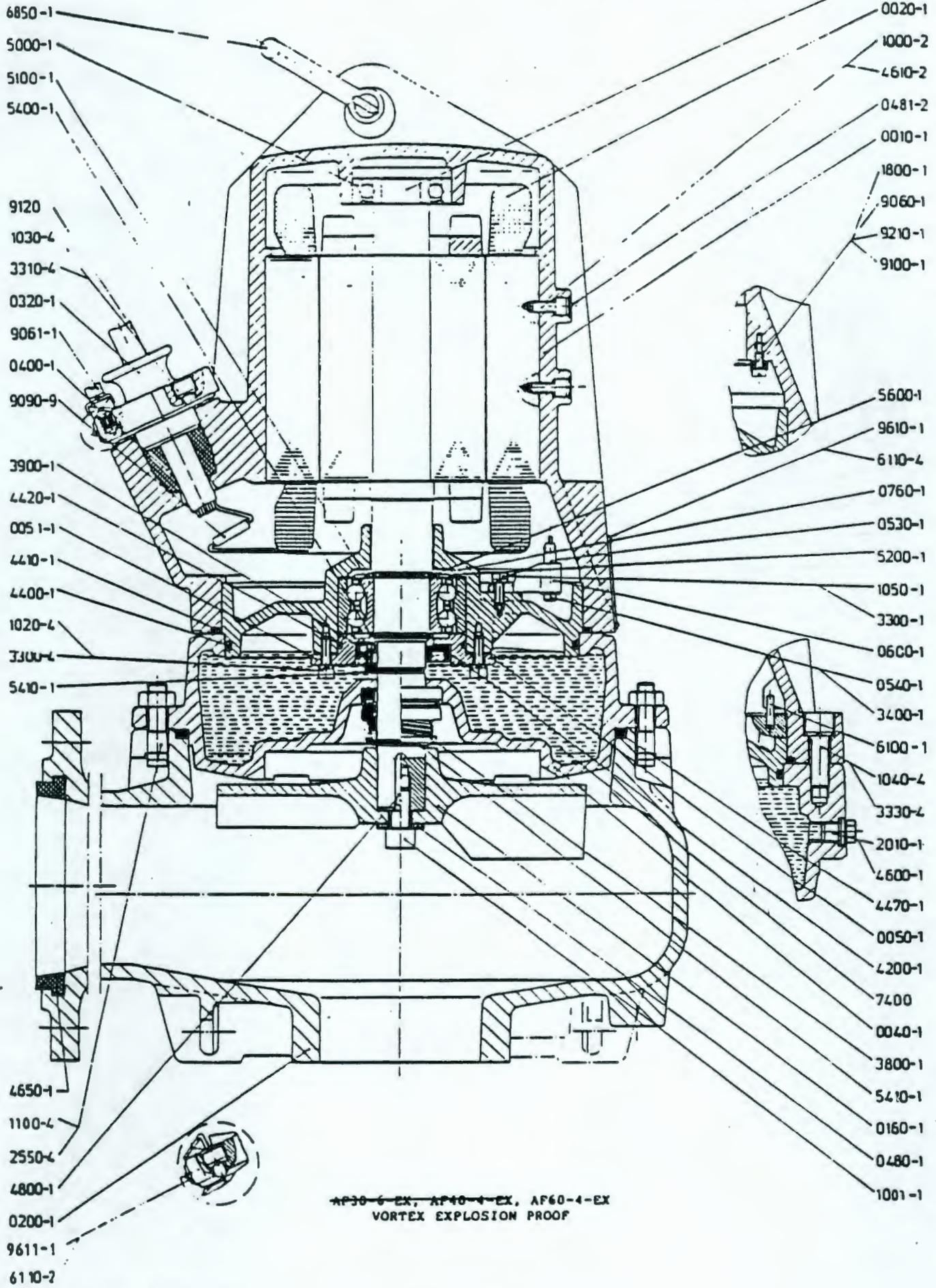
115/230 VOLTS
1 PHASE
60 HERTZ



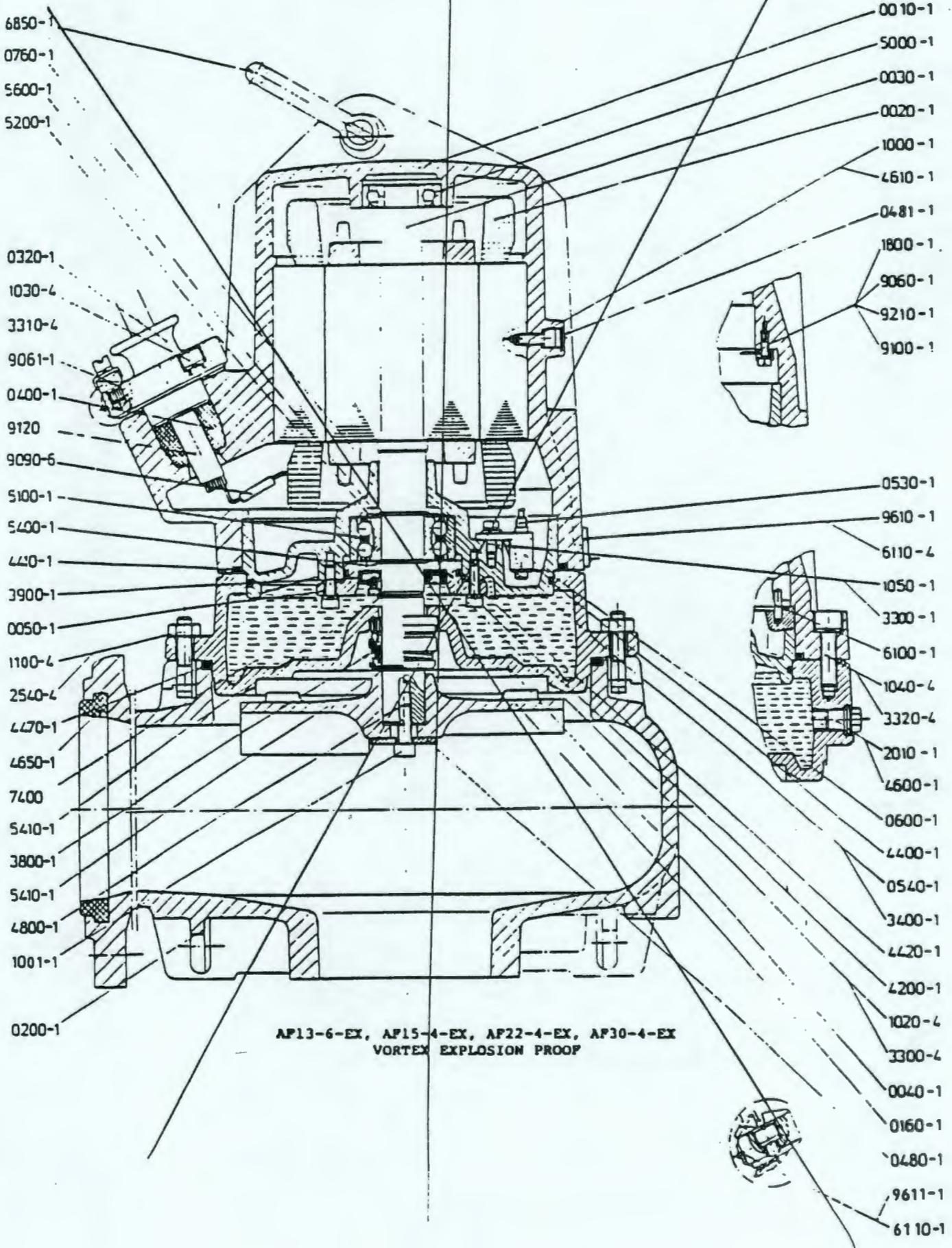
CAUTION
WHEN SERVICING THIS CONTROL
OPEN DISCONNECT SWITCH AND
DISCHARGE ALL CAPACITORS.

FIELD CONNECTIONS





AP30-6-EX, AP40-4-EX, AP60-4-EX
VORTEX EXPLOSION PROOF



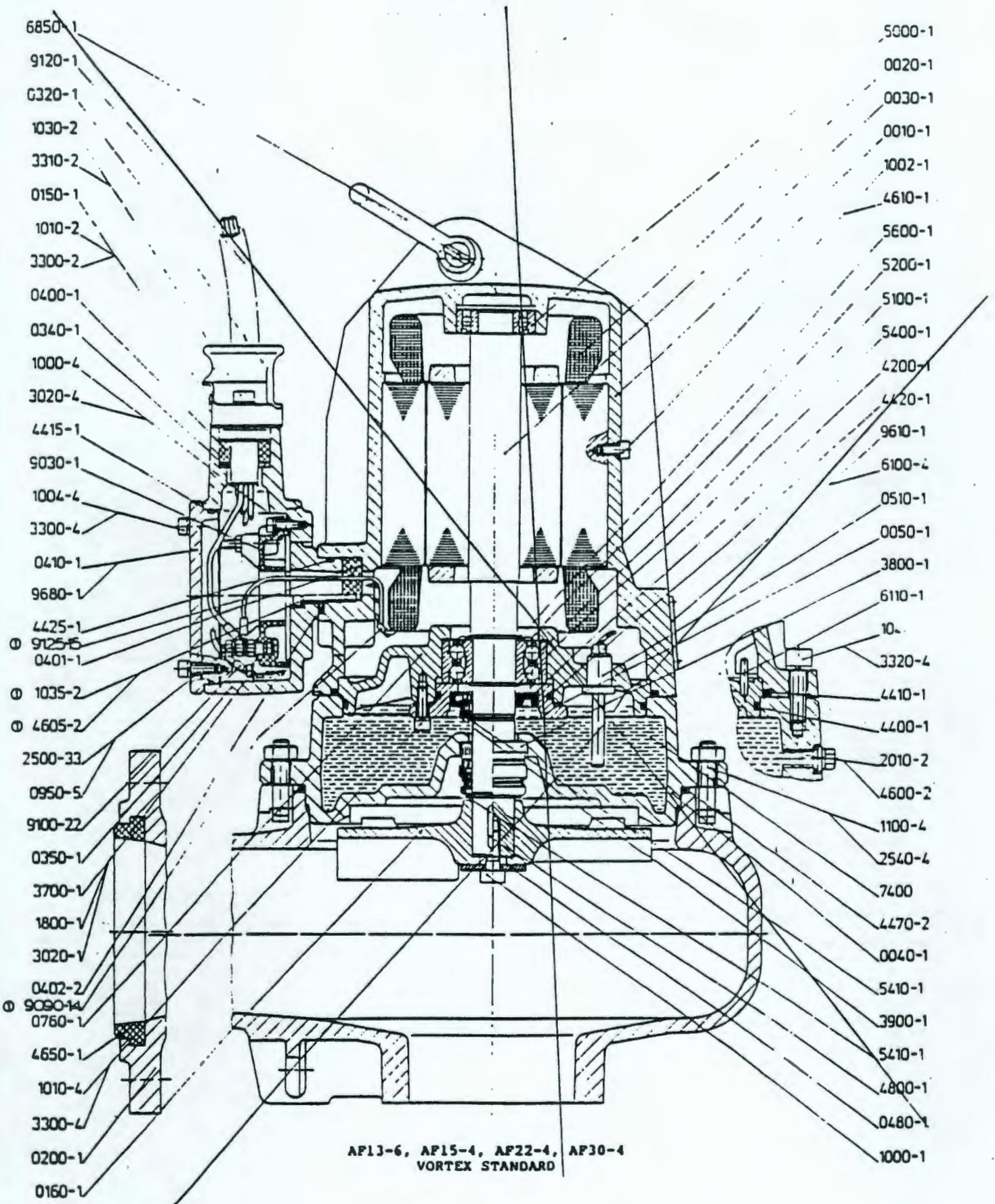
6850-1
0760-1
5600-1
5200-1

0320-1
1030-4
3310-4
9061-1
0400-1
9120
9090-6
5100-1
5400-1
4400-1
3900-1
0050-1
1100-4
2540-4
4470-1
4650-1
7400
5410-1
3800-1
5410-1
4800-1
1001-1
0200-1

0010-1
5000-1
0030-1
0020-1
1000-1
4610-1
0481-1
1800-1
9060-1
9210-1
9100-1

0530-1
9610-1
6110-4
1050-1
3300-1
6100-1
1040-4
3320-4
2010-1
4600-1
0600-1
4400-1
0540-1
3400-1
4420-1
4200-1
1020-4
3300-4
0040-1
0160-1
0480-1
9611-1
6110-1

AP13-6-EX, AP15-4-EX, AP22-4-EX, AP30-4-EX
VORTEX EXPLOSION PROOF



6850-1
9120-1
G320-1
1030-2
3310-2
0150-1
1010-2
3300-2
0400-1
0340-1
1000-4
3020-4
4415-1
9030-1
1004-4
3300-4
0410-1
9680-1
4425-1
9125-5
0401-1
1035-2
4605-2
2500-33
0950-5
9100-22
0350-1
3700-1
1800-1
3020-1
0402-2
9090-14
0760-1
4650-1
1010-4
3300-4
0200-1
0160-1

5000-1
0020-1
0030-1
0010-1
1002-1
4610-1
5600-1
5200-1
5100-1
5400-1
4200-1
4420-1
9610-1
6100-4
0510-1
0050-1
3800-1
6110-1
10-
3320-4
4410-1
4400-1
2010-2
4600-2
1100-4
2540-4
7400
4470-2
0040-1
5410-1
3900-1
5410-1
4800-1
0480-1
1000-1

AP13-6, AP15-4, AP22-4, AP30-4
VORTEX STANDARD

**INSTALLATION DIMENSIONS
STANDARD AND EXPLOSION PROOF MODELS**

(Refer to Illustrations on Preceding Page)

~~MODELS: AF 13-4, AF 18-4W, AF 15-4, AF 22-4, AF 13-6 CB 2 4"
AF 28-4W, AF 30-4, AF 13-6 CB 3 4"~~

A	B	C	D	E	F	G	H	I	J	K	L
13.19	12.50	•	26.00	**	***	8.00	6.50	1.00	21.25	4.75	7.69

M	N	O	P	Q	R	S	T	U	V	AA	BB
1.63	30.00	24.00	12.00	3.00	14.50	24.00	48.00	30.00	4.00	9.50	11.50

~~CB 2 • 12.84 ** 2.75 *** 20.19~~

~~CB 3 • 14.32 ** 4.00 *** 19.50~~

~~MODELS: AF 40-4, AF 60-4, AF 30-6 CB 6 4"~~

A	B	C	D	E	F	G	H	I	J	K	L
13.19	12.50	14.76	26.00	6.25	24.50	8.00	6.50	1.00	21.25	4.75	7.69

M	N	O	P	Q	R	S	T	U	V	AA	BB
1.63	30.00	24.00	12.00	3.00	14.50	24.00	48.00	30.00	4.00	9.50	11.50

~~MODELS: AF 13-4, AF 15-4, AF 18-4W, AF 22-4, AF 28-4W, AF 30-4 CB 1 3"~~

A	B	C	D	E	F	G	H	I	J	K	L
11.25	11.50	12.20	26.00	2.75	20.63	6.00	6.50	1.25	21.62	4.38	6.63

M	N	O	P	Q	R	S	T	U	V	AA	BB
1.50	30.00	24.00	12.00	4.25	11.50	24.00	48.00	30.00	3.00	9.88	12.88

~~MODELS: AF 22-4, AF 28-4W, AF 30-4 CB 4 6"
AF 40-4, AF 60-4 CB 5 6"~~

A	B	C	D	E	F	G	H	I	J	K	L
16.56	•	**	26.00	6.00	***	9.88	8.50	1.00	19.25	6.69	11.00

M	N	O	P	Q	R	S	T	U	V	AA	BB
2.69	30.00	24.00	12.00	3.00	22.50	24.00	48.00	30.00	6.00	10.38	12.38

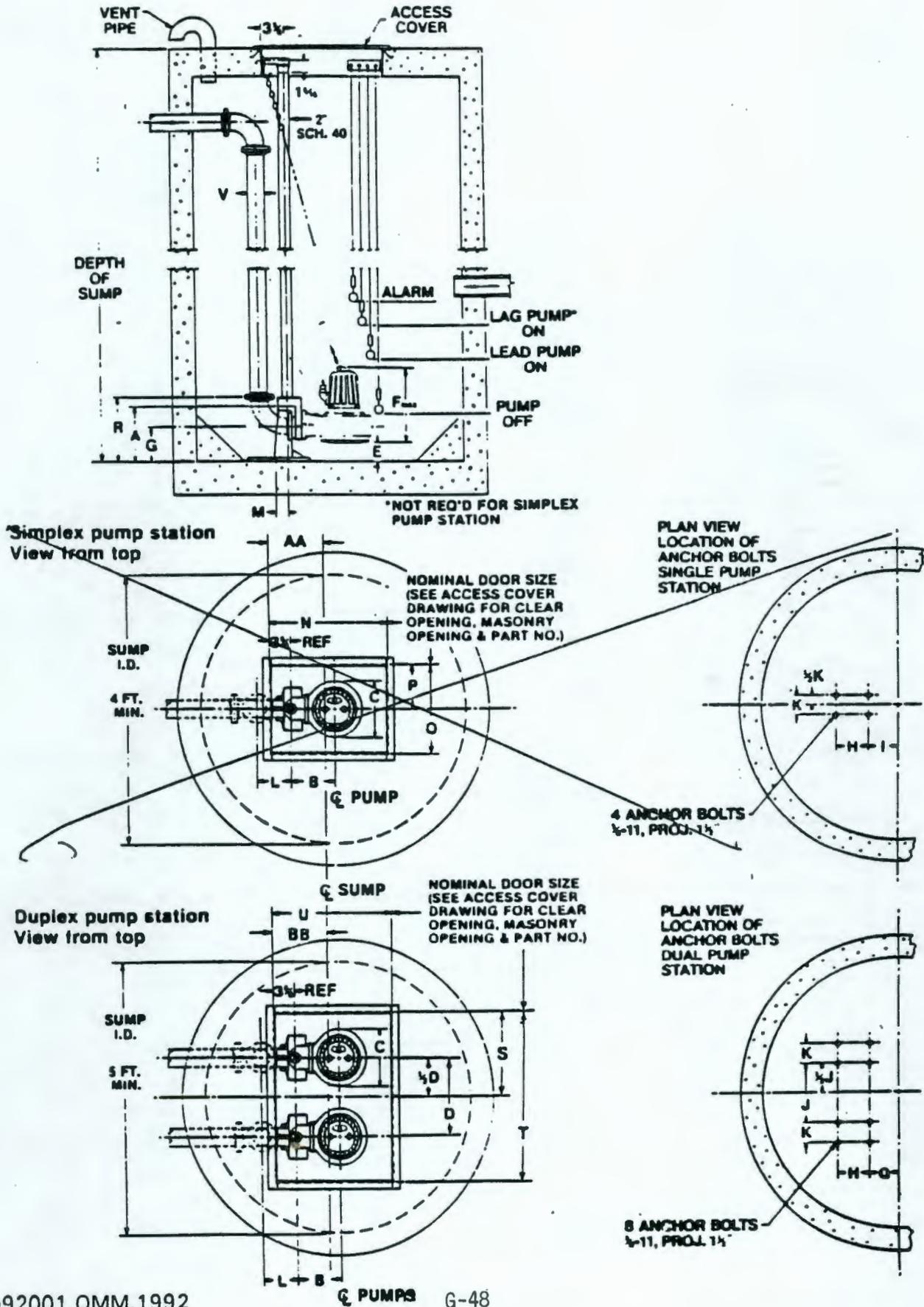
~~CB 4 • 13.68 ** 15.19 *** 20.56~~

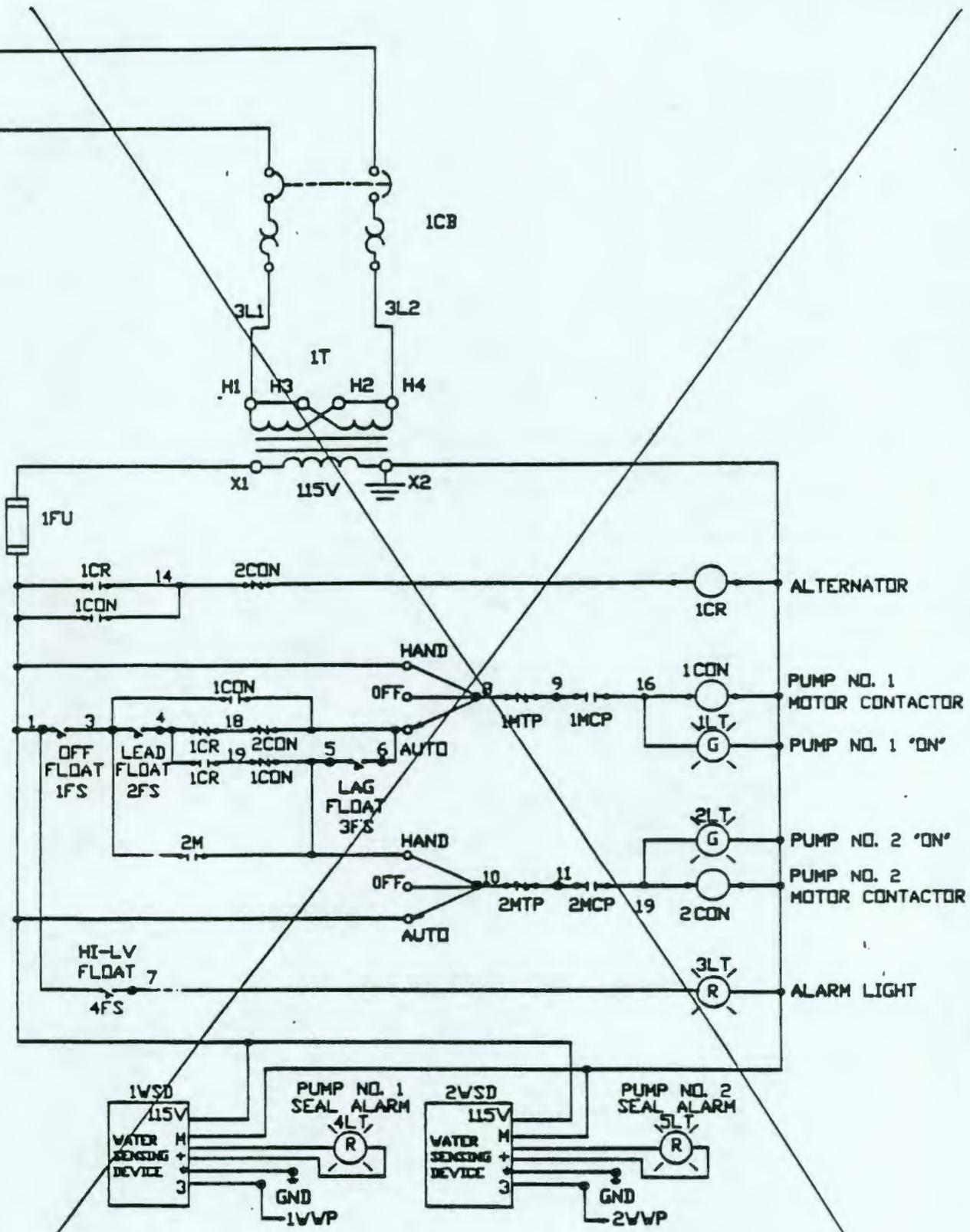
~~CB 5 • 14.69 ** 17.50 *** 24.50~~

ALL DIMENSIONS ARE IN INCHES

PUMP STATION DIMENSIONS

TYPICAL DRAWING ONLY. NOT FOR CONSTRUCTION PURPOSES.
CONTACT FACTORY FOR CERTIFIED DRAWINGS.





TYPICAL WIRING DIAGRAM
 230V 3PHASE 60HZ
 DUPLEX PUMP CONTROL

SMALL FRAME MOTOR LEGEND

AF 13-6, 15-4, 18-4W, 22-4, 28-4W, 30-4 STANDARD
 AF 13-6EX, 15-4EX, 22-4EX, 30-4EX EXPLOSION PROOF

REF NO.	QUAN.	DESCRIPTION	REF NO.	QUAN.	DESCRIPTION
0010	1	Motor Housing	1800	1 STD	Round Head Screw
0020	1	Stator Assembly			M5x 10mm
0030	1	Rotor Assembly	2010	2 STD	Oil Plug Screw R1/4
0040	1	Oil Chamber		1 EX	Oil Plug Screw R1/4
0050	1	Transition Piece	2500	3 STD	Hex Lock Nut M5
0150	1 STD	Cable Clamp	3020	4 STD	Washer M5
0320	1	Cable Cap			Lock Washer
		(included in 9120-EX)			
0340	1 STD	Washer	3200	1 STD	M5
0350	1 STD	Connection Chamber	3300	10 STD	M6
0400	1 STD	Cable Seal		4 EX	M6
0401	1 STD	Seal	3301	4 EX	M6
0402	1 STD	Seal Ring	3310	2 STD	M8
0410	1 STD	Terminal Chamber Lid	3320	4	M10
0480	1 EX	Sealing Washer			
0510	1	Seal Probe Assembly	3800	1	Lower Mechanical Seal
		(included in 9120-EX)	3900	1	Upper Mechanical Seal
0760	1	Bearing Lid			
0950	5 STD	Jumper			
		Socket Head Screw			
1000	4 STD	M6x12mm			
	1 EX	M6x16mm			
1002	1 STD	M5x16mm			
1004	4 STD	M6x16mm			
1010	2 STD	M6x25mm			
	4 EX	M6x25mm			
1020	4	M6x20mm			
1030	2 STD	M8x30mm			
1035	2 STD	M10x25mm			
1040	4	M10x35mm			

For Part Numbers See Particular Pump Parts List

HYDRAULICS LEGEND

AF 13 - 90

REF. NO.	QUAN.	DESCRIPTION	REF. NO.	QUAN.	DESCRIPTION
CONTRA BLOCK			VORTEX		
0160	1	Impeller	0160	1	Impeller
0200	1	Volute	0200	1	Volute
0230	1	Bottom Plate	0480	1	Impeller Washer
		Adjusting Screw			Allen Screw
0290	4	M18x30mm AF 13 - 30	1000	1	M10x30mm AF 13 - 30
	4	M18x35mm AF 40 - 90		1	M12x25mm AF 40 - 90
0480	1	Impeller Washer			Hammer Screw
		Allen Screw	1100	4	M10x40mm AF 13 - 30
1000	1	M10x35mm AF 13 - 30		4	M12x45mm AF 40 - 90
	4	M12x25mm AF 30-6/40 - 90			Hex Nut
1001	4	M10x45mm AF 13 - 30	2540	4	M10 AF 13 - 30
	4	M10x50mm AF 13 - 30		4	M12 AF 40 - 90
1002	1	M10x35mm AF 13 - 30			O-Ring
	1	M12x30mm AF 30-6/40 - 90	4470	1	221x5.3mm AF 15 - 30
		Lock washer		1	260x7mm AF 40 - 90
3320	4	M10 AF 13 - 30	4650	1	Gasket
	4	M12 AF 30-6/40 - 90			
		Nord-Lock washer			
3455	2	M10 AF 13 - 30			
	2	M12 AF 30-6/40 - 90			
		O-Ring			
4450	1	185x5mm CB 1			
	1	194x5mm CB 2			
	1	210x5mm CB 3,4			
	1	248x5mm CB 5,6			

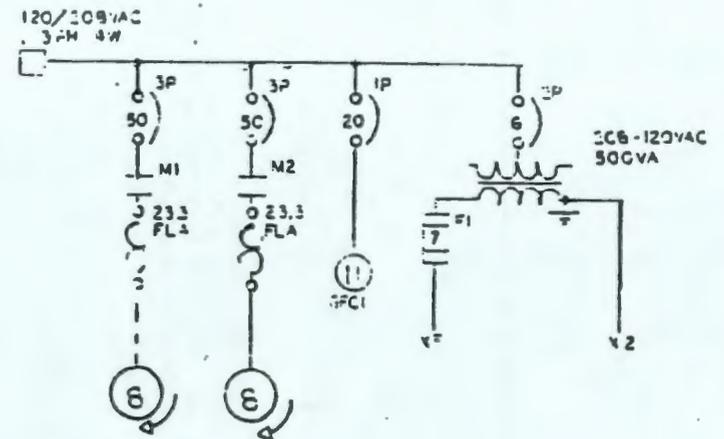
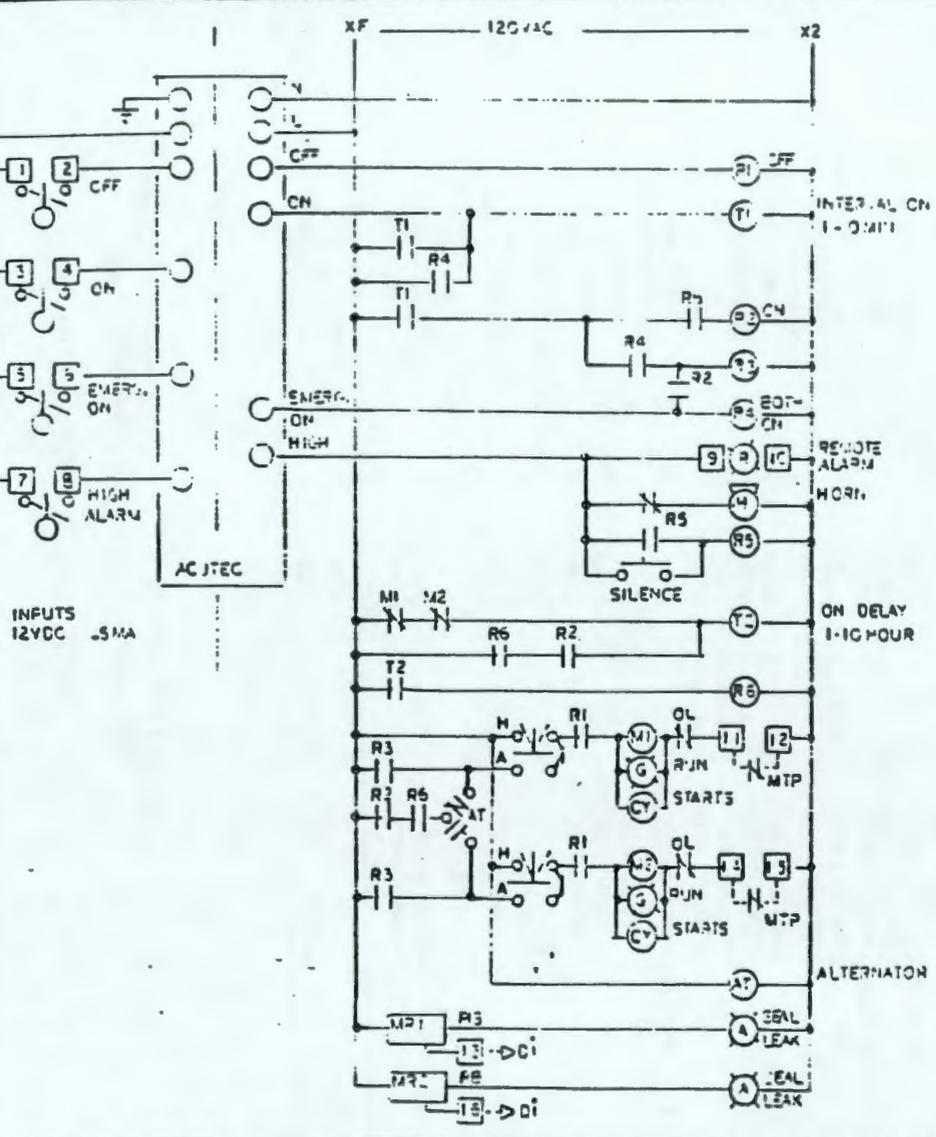
For Part Numbers See Particular Pump Parts List

LARGE FRAME MOTOR LEGEND

~~AF 30-6, 40-4, 60-4, 90-4 STANDARD~~
 AF 30-6EX, 40-4EX, 60-4EX EXPLOSION PROOF

REF NO.	QUAN.	DESCRIPTION	REF NO.	QUAN.	DESCRIPTION
0010	1	Motor Housing	3800	1	Lower Mechanical Seal
0020	1	Stator Assembly	3900	1	Upper Mechanical Seal
0030	1	Rotor Assembly			O-Ring
0040	1	Oil Chamber			
0051	1	Transition Piece	4400	1	205x5mm
0150	1 STD	Cable Clamp	4410	1	220x5mm
0135	2	Socket Hd. Screw M10x25mm	4415	1 STD	101x3mm
0320	1	Cable Cap	4420	1	70x3.5mm
		(included in 9120-EX)	4425	1 STD	42x3mm
0340	1 STD	Washer 20x28x3mm	4430	1 EX	52x5mm
0350	1 STD	Connection Chamber			Fiber Sealing Washer
0400	1 STD	Cable Seal			
0401	1 STD	Seal	4600	2 STD	18x13x2mm
0402	1 STD	Seal Ring		1 EX	18x13x2mm
0410	1 STD	Terminal Chamber Lid	4605	2 STD	16x10.7x1.5mm
0480	1 EX	Sealing Washer	4610	2	10x6x1.5mm
0510	1	Seal Probe Assembly	4800	1	Impeller Key
		(included in 9120-EX)	5000	1	Ball Bearing
0760	1	Bearing Lid	5100	1	Double Row Ball Bearing
0950	6 STD	Jumper	5200	1	Safety Ring
		Socket Head Screw	5400	1	Circlip (Ext) 35x1.5mm
1000	4 STD	M6x12mm	5410	2	Circlip (Ext) 30x1.5mm
	2 EX	M6x16mm	5600	1	Support Washer
1002	2 STD	M5x16mm	6100	1	Dowel Pin 5X20mm
1004	4 STD	M6x16mm	6110	4	Rivet
1010	4 EX	M6x25mm	6850	1	Shackle
1020	6 STD	M6x20mm	7400	3 QL	10W High Detergent Oil
	4 EX	M6x20mm	9030	1 STD	Terminal Board Assembly
1030	2 STD	M10x35mm	9060	1 STD	Clamping Strap
1040	4	M12x35mm	9090	8 EX	Crimp Connectors
1800	2 STD	Round Head Screw M5x10mm	9100	23 STD	Cable Shoe
2010	2 STD	Oil Plug Screw R 1/4	9120	1 STD	Cable
	1 EX	Oil Plug Screw R 1/4		1 EX	Cable Assembly
2500	33 STD	Hex Lock Nut M5	9210	1 STD	Lock Washer
3020	4 STD	Washer M5	9610	1	Nameplate
		Lock Washer	9680	1 STD	Label
3200	1 STD	M5			
3300	10 STD	M6			
	4 EX	M6			
3301	4 EX	M6			
3320	2 STD	M10			
3330	4	M12			

For Part Numbers See Particular Pump Parts List



MOTOR TEMPERATURE SENSORS (MTP) AND MOTOR MOISTURE SENSORS (MS) ARE LOCATED IN THE PUMP. REFER TO PUMP S & N FOR SPECIFIC PARAMETERS.

TRIANGLE PUMP & EQUIPMENT, INC. Clackamas, Oregon		
SCALE: NONE	APPROVED BY	DRAWN BY
DATE: 5-92		JGE
Project: RE-5319 Emergency Drainfield Replacement 200 East Area		
Customer: Thompson Mechanical	DRAWING NUMBER 92300	



Warranty

FIVE YEAR WARRANTY - STANDARD & EXPLOSION PROOF AFP & AF SERIES PUMPS PERMANENT TYPE INSTALLATION

ABS Pumps Inc. warrants its AFP & AF Series of Submersible Pumps to be free from defects in workmanship and materials for a period of five (5) years after date of shipment to end customer, with approval of installation and start-up of the equipment by the Company's authorized on-site representative and, upon payment of the applicable percentage of the list price of the following parts in effect, at time of replacement.

Part Description	Months After Shipment			
	0-18	18-31	32-45	48-80
Rotor & Stator*	0%	25%	50%	75%
Mechanical Seal	0%	25%	50%	75%
Impeller	0%	25%	50%	75%
Cutter Disc	0%	25%	50%	75%
Pump Housing	0%	25%	50%	75%
Ball Bearings	0%	40%	80%	90%

*Stator guarantee effective only if Company's authorized control panels are used.

All other ABS manufactured equipment or other uses of AFP or AF series pumps will carry a one (1) year warranty from date of shipment to end customer, but in no event, longer than eighteen (18) months from date of shipment from the Company.

Start-up reports and electrical system schematics may be required to support Warranty claims and will be required for claims on pumps of 30 horsepower and greater.

The Company's sole obligation under this warranty shall be to make repairs and replace parts when necessary on products that have been returned to it or to an authorized service facility and found to be defective by the Company. Explosion Proof pumps (EX) must be serviced at a facility approved by ABS Pumps Inc. The Company shall not be liable for any special, indirect, or consequential damages of any kind. Major components not manufactured by the Company are covered by the original manufacturer's warranty in lieu of this warranty. The Company will not be held responsible for travel expenses, rented equipment, outside contractors fees, or unauthorized repair shop expenses. The Company neither assumes nor authorizes any person or other company to assume for it, any other obligation in connection with the sale of its equipment. Any enlargement or modification of this Warranty by a Representative or other Sales Agent is their exclusive responsibility. Transportation charges shall be borne by the Buyer. Labor charges for warranty repairs shall not be assumed by the Company for repairs made after one (1) year from date of shipment to end customer. Returns must have prior written authorization from the Company.

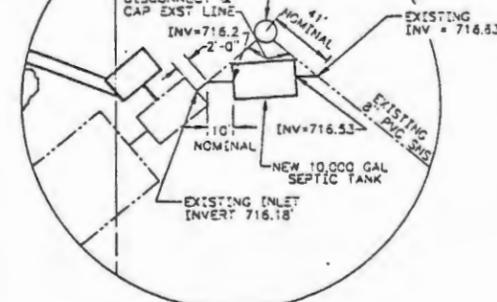
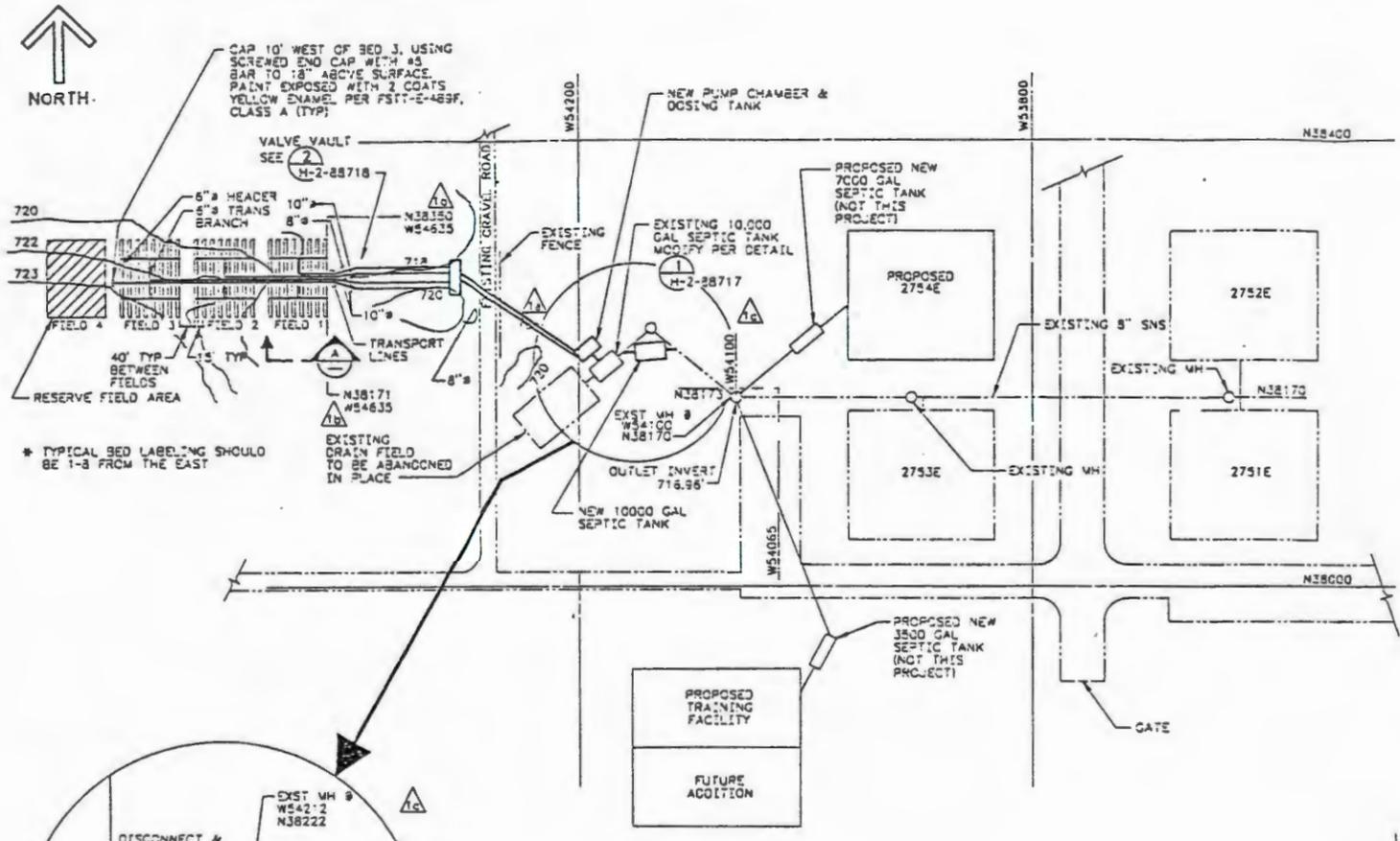
This warranty shall extend only to the original Owner, and shall not apply to any products that have been repaired or altered without the Company's consent or have been subject to misuse, accident or neglect, or have been used for pumping other than raw sewage or similar non-corrosive liquids.

NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WILL APPLY.

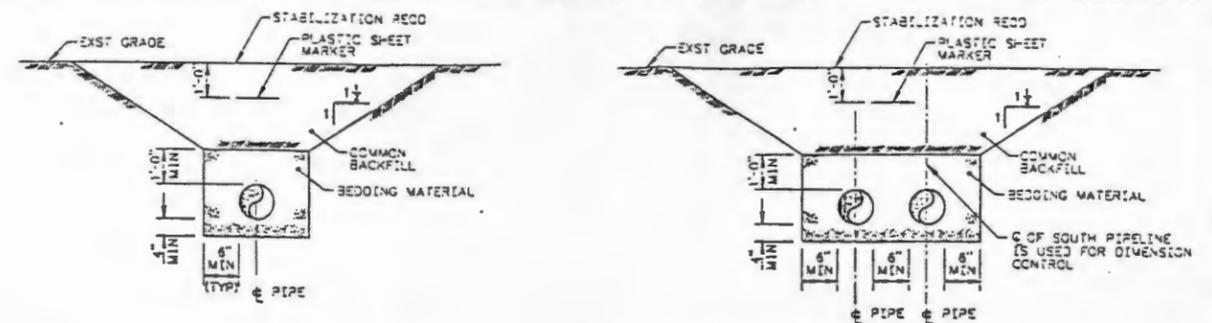
Appendix H

Drawings

H-2-88716, Sh 1, Rev 1	Civil/Dwg List - Sewage Disposal System Plan & Details
H-2-88717, Sh 1, Rev 1	Civil - Sewage Disposal System Details
H-2-88718, Sh 1, Rev 1	Civil - Sewage Disposal System Profile
H-2-88719, Sh 1, Rev 1	Electrical - Sewage Disposal System One Line Diag, Plan & Detail

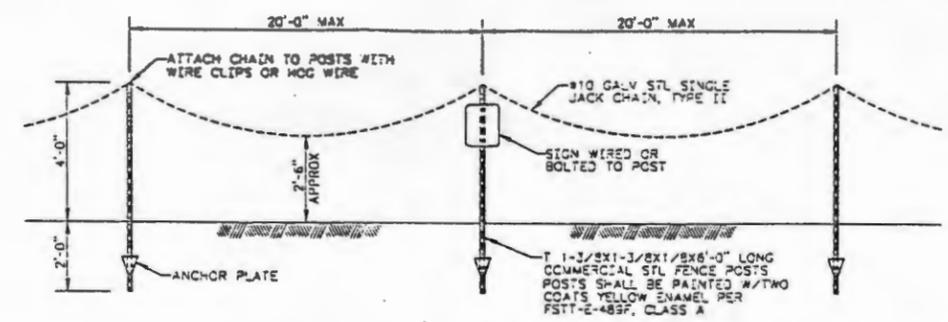


SITE PLAN
SCALE: NONE

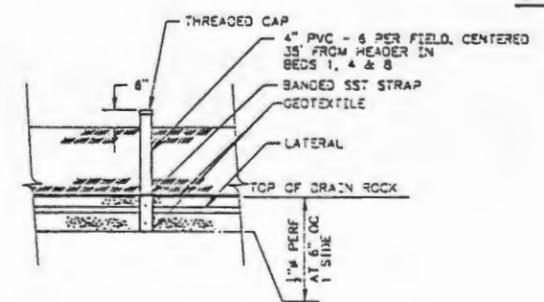


TYP PIPE TRENCH SECT
SCALE: NONE

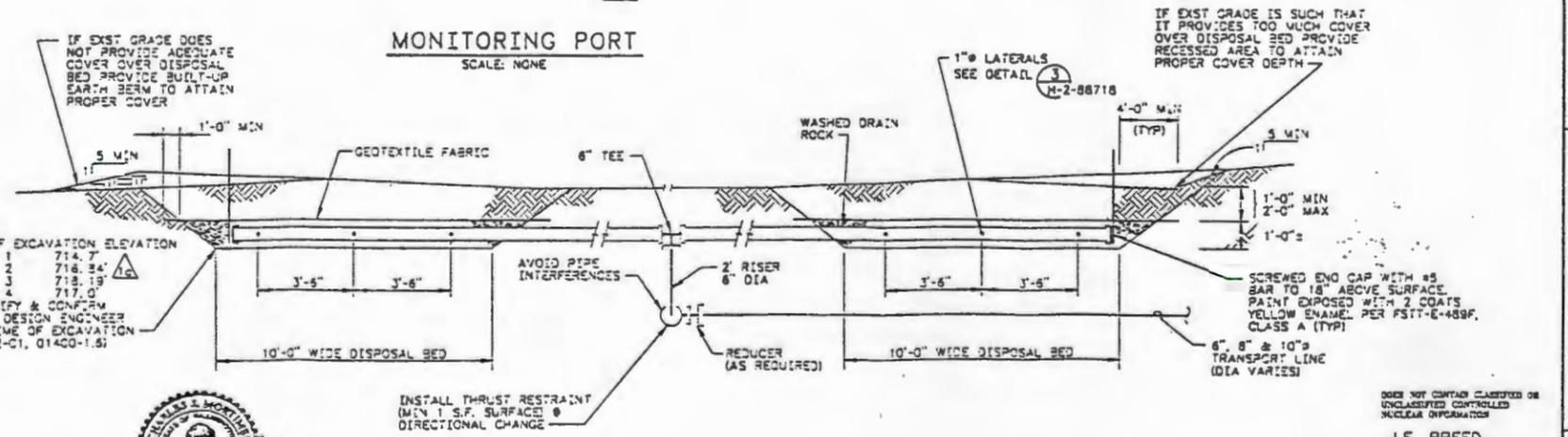
TYP MULTIPLE PIPE TRENCH SECT
SCALE: NONE



BARRICADE MARKER FENCE
SCALE: NONE



MONITORING PORT
SCALE: NONE



SECTION A-A
SCALE: NONE

- LEGEND**
- EXISTING FACILITIES
 - NEW CONSTRUCTION (THIS PROJECT)
 - PROPOSED CONSTRUCTION (NOT THIS PROJECT)

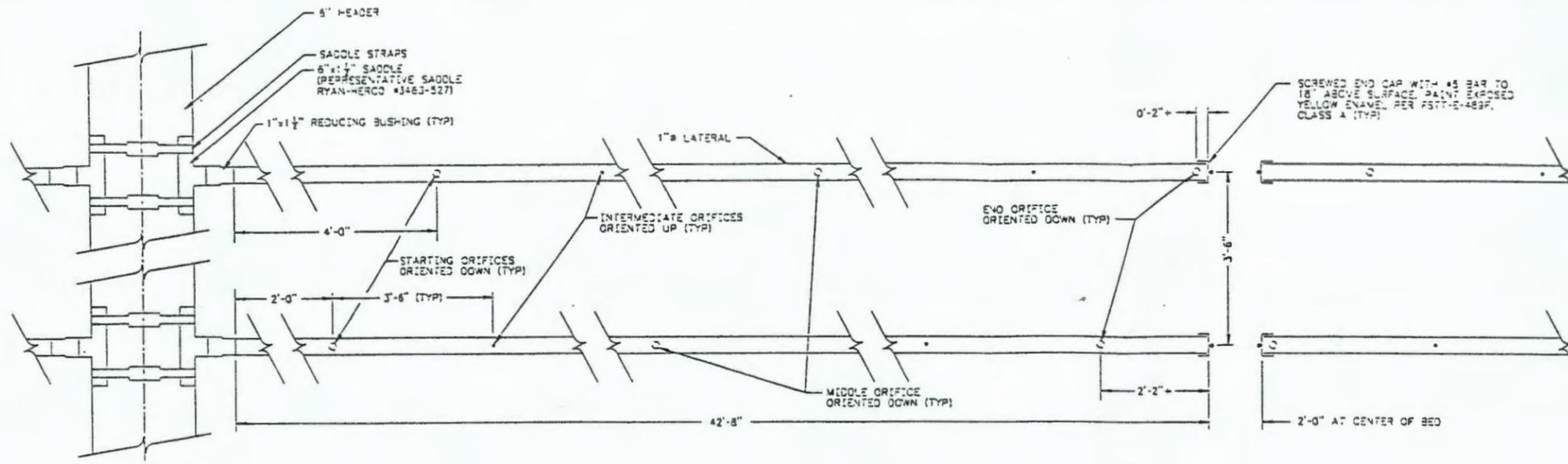
DRAWING LIST

CIVIL	DRAWING NO.	INDEX	TITLE
	H-2-88716	0400	CIVIL/DWG LIST SEWAGE DISPOSAL SYSTEM PLAN & DETAILS
	H-2-88717	0400	CIVIL SEWAGE DISPOSAL SYSTEM PLAN & SECTIONS
	H-2-88718	0400	CIVIL SEWAGE DISPOSAL SYSTEM PROFILE, SECTIONS & DETAILS

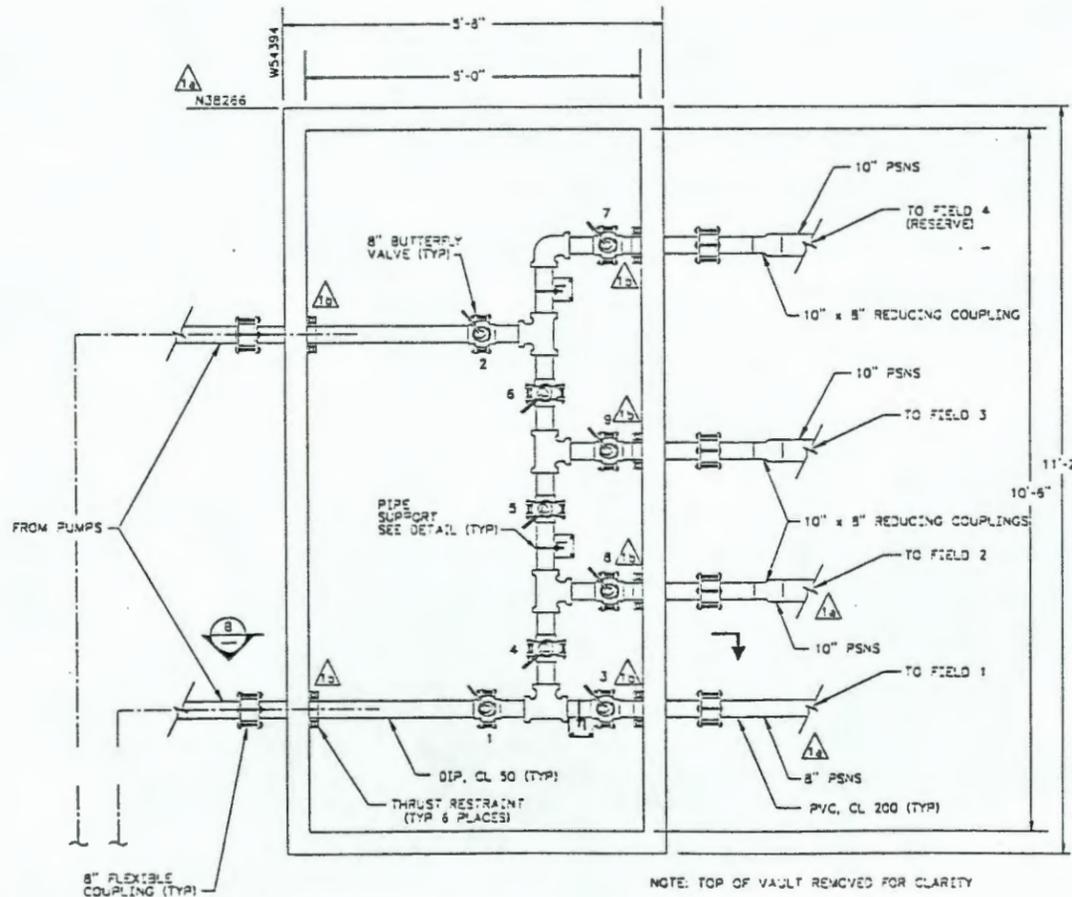
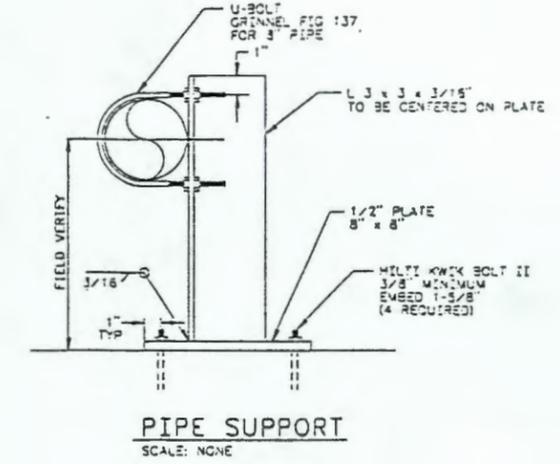
ELECTRICAL	DRAWING NO.	INDEX	TITLE
	H-2-88712	0400	ELECTRICAL SEWAGE DISPOSAL SYSTEM ONE-LINE DIAGRAM, PLAN & DETAILS

I CERTIFY THIS DOCUMENT TO GENERALLY REPRESENT THE CONSTRUCTED PROJECT. ALL DESIGN CHANGES MADE THROUGH EGM'S HAVE BEEN INCORPORATED.

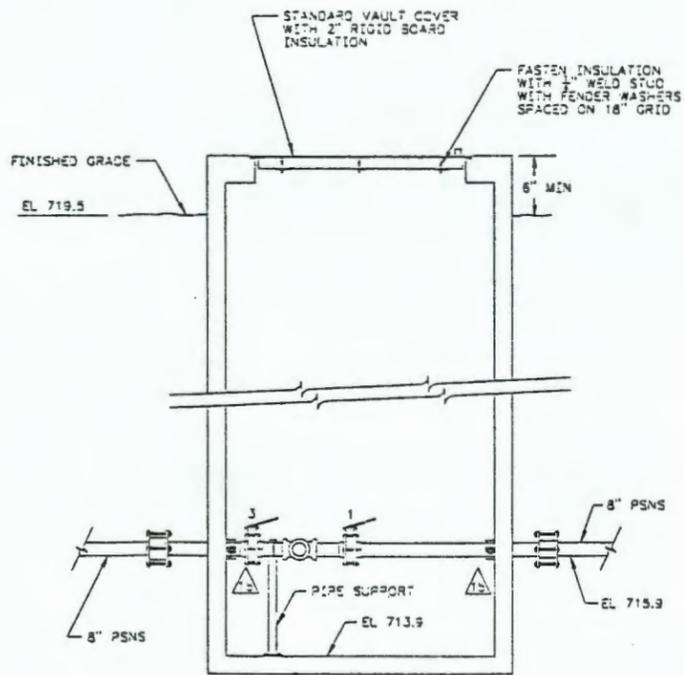
<p>AS-BUILT FOR PROJ. L-092</p> <p>REV 1: 8/27/88</p> <p>REV 2: 10/27/88</p> <p>REV 3: 11/27/88</p>	<p>DESIGNER: J. ARCHIBALD</p> <p>CHECKER: J. ARCHIBALD</p> <p>DATE: 11/27/88</p>	<p>PROJECT NO. 157434</p> <p>U.S. DEPARTMENT OF ENERGY</p> <p>RICHLAND OPERATIONS OFFICE</p> <p>KAISER ENGINEERS - MANFORD COMPANY</p> <p>CIVIL/DWG LIST</p> <p>SEWAGE DISPOSAL SYSTEM</p> <p>PLAN & DETAILS</p>
-----------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------



LATERAL & ORIFICE LAYOUT DETAIL
SCALE: NONE



VALVE VAULT PLAN
SCALE: NONE



SECTION
SCALE: NONE

- NOTES:
- TOP OF MANHOLE ELEVATIONS ARE APPROXIMATE. ADJUST TOP OF MANHOLE SUCH THAT COVER IS 3: INCHES ABOVE SURROUNDING GRADE.
 - VERIFY EXISTING INVERT ELEVATIONS PRIOR TO CONSTRUCTING NEW ITEMS. ELEVATIONS THAT VARY GREATER THAN 0.05 FEET SHALL BE EVALUATED BY DESIGN PRIOR TO CONTINUANCE OF CONSTRUCTION.
 - ALL PIPE & FITTINGS BETWEEN FLEXIBLE COUPLINGS SHALL BE DIP, CL 50.
 - PHYSICAL ARRANGEMENT WITHIN THE VAULT MAY BE MODIFIED TO ACHIEVE IMPROVED CONSTRUCTIBILITY AND/OR ACCESS, INCLUDING THE SIZE OF THE VAULT.
 - LAYOUT IS BASED ON THE USE OF A PRECAST VAULT BY PIPE, INC. #S10600 WITH A #S10634 COVER.
 - FLEXIBLE COUPLINGS SHALL BE INSTALLED AS SHOWN WITHIN 1'-6" OF THE VAULT WALL.
 - FASTEN METAL TAGS TO EACH VALVE WITH THE VALVE NUMBER ENGRAVED ON THE TAG.
 - VALVE VAULT ELEVATIONS ARE BASED ON AERIAL PHOTOGRAPHY CONTOUR MAPS. FINAL ELEVATIONS TO BE CONFIRMED AT THE TIME OF CONSTRUCTION.



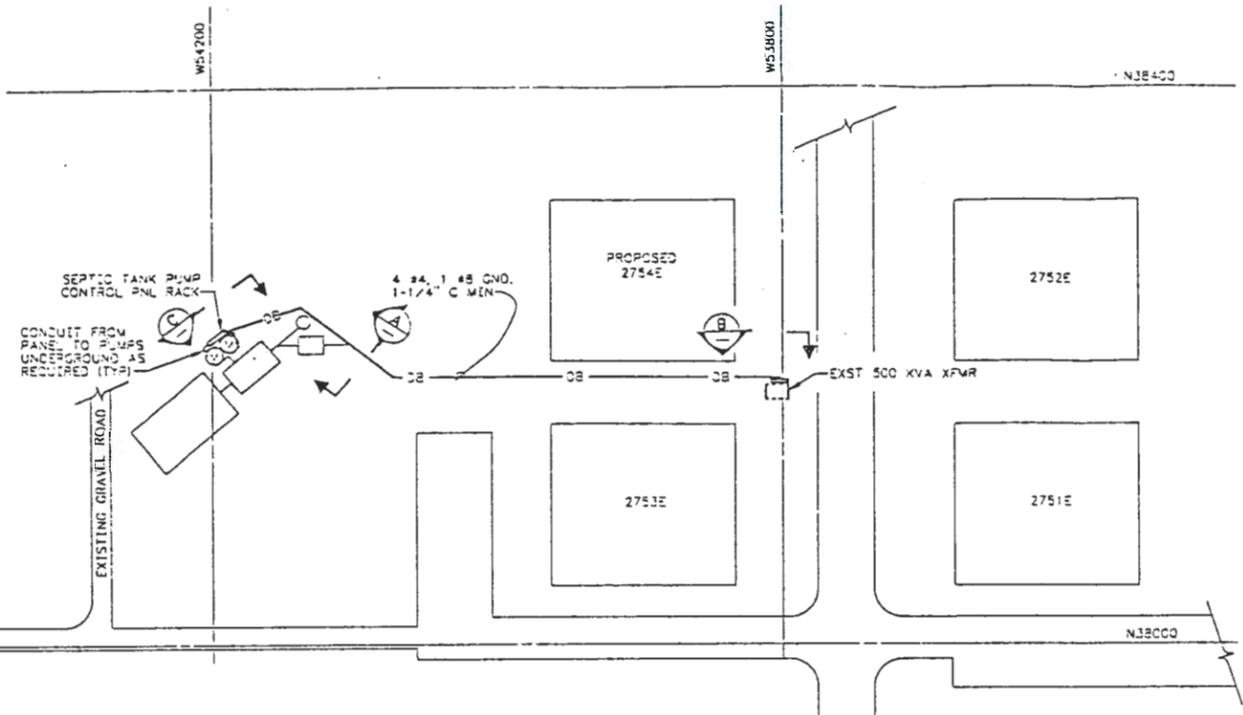
I CERTIFY THIS DOCUMENT TO GENERALLY REPRESENT THE CONSTRUCTED PROJECT. ALL DESIGN CHANGES MADE THROUGH ECR'S HAVE BEEN INCORPORATED.

J.E. BREED
 Licensed Professional Engineer
 State of California
 License No. 12522
 Date: 2/5/92

DRAWING TRACEABILITY LIST		NUMBER TITLE NEXT USED ON		REFERENCES M-2-94-56: SP. 1 R.1 CIVIL PROFILE AND DEVELOPMENT SITE PLAN M-2-94-53: SP. 1 R.1 CIVIL 2750E LAND M-2-88716: CIVIL/DWG LIST SEWAGE DISPOSAL SYS		REVISIONS NO. DATE DESCRIPTION 1 10/2/92 AS-BUILT FOR PROJ. L-092 2 11/1/92 M. J. ARCHIBALD		APPROVALS J. J. AXFORD J. E. BREED		PROJECT NO. 2751E.2752E.2753E - SEW. DISPOS. SYS SHEET 1 OF 1 DATE 2-10-92 SCALE SP-OWN KEHCAD	
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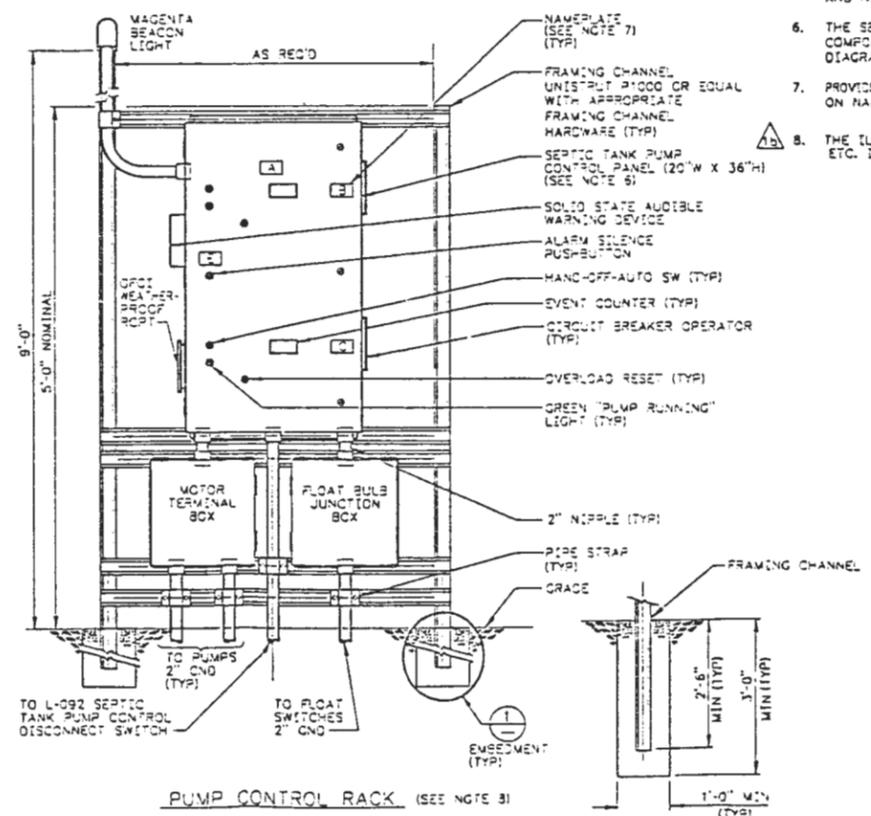
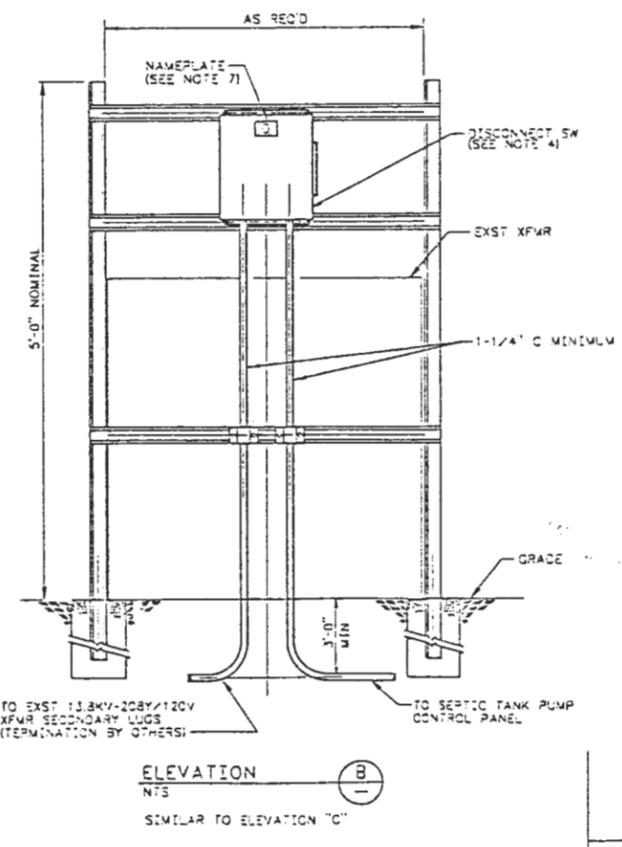
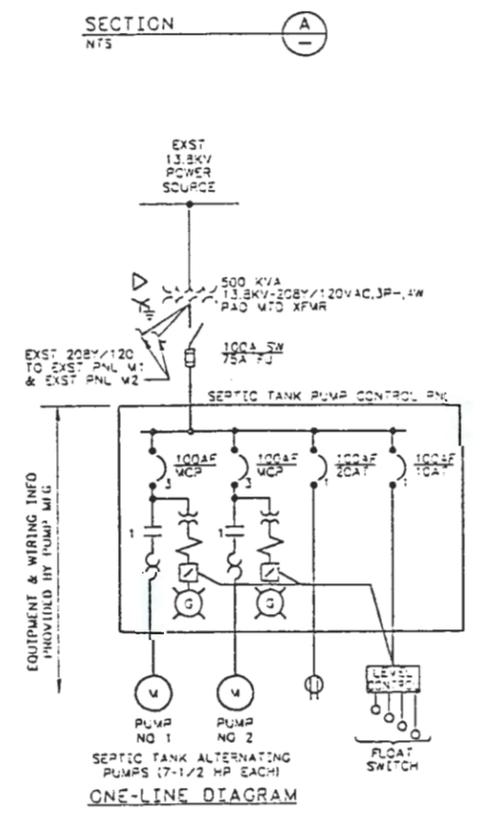
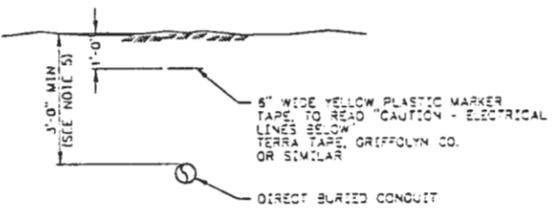


SYMBOL LIST	
SYMBOL	DESCRIPTION
--CB--	DIRECT BURIED CONDUIT
Ⓜ	120V GFCI WEATHERPROOF DUPLEX CONVENIENCE RECEPTACLE
Ⓜ	PUMP MOTOR



NAMEPLATE LEGEND	
NAMEPLATE	ENGRAVING
A	"SEPTIC TANK PUMP CONTROL PANEL (208 V PWR FROM PAD MTD XFMR AT BLDG 2753-E)"
B	"PUMP NO 1"
C	"PUMP NO 2"
D	"SEPTIC TANK PUMP CONTROL DISCONNECT"
E	"IF BEACON IS FLASHING AND AUDIBLE WARNING DEVICE IS SOUNDING, CALL MAINTENANCE ENGINEERING"

- NOTES:**
- SEE CONSTRUCTION SPECIFICATION L-092-C FOR MATERIAL DESCRIPTION AND INSTALLATION INSTRUCTIONS UNLESS OTHERWISE NOTED.
 - SEE DWG H-7-1275 FOR ELECTRICAL SYMBOLS UNLESS OTHERWISE NOTED.
 - ABBREVIATIONS ARE PER ASME Y1.1.
 - PROVIDE AND INSTALL (1) 240 VAC, 100A SWITCH, 75A FUSES, 3 POLE, FUSIBLE, LOCKABLE, NEMA TYPE 3 SAFETY SWITCH, SIMILAR TO CROUSE-HINDS TYPE WST 1003
 - FIELD ROUTE BURIED CONDUIT TO AVOID LANDSCAPING AND SPRINKLER SYSTEM AND NEW SEPTIC TANK.
 - THE SEPTIC TANK PUMP CONTROL PANEL, INCLUDING CONTROLS AND LOCAL ALARM COMPONENTS, AND NEW PUMPS, INCLUDING POWER CABLE, AND SYSTEM WIRING DIAGRAMS ARE PROVIDED BY PUMP EQUIPMENT SUPPLIER.
 - PROVIDE AND INSTALL NAMEPLATES, SIZE AS REQUIRED, ENGRAVED WITH 1/4" MIN HIGH LETTERS AS SHOWN ON NAMEPLATE LEGEND.
 - THE ILLUSTRATED LOCATION OF CONTROL SWITCHES, ALARMS, INDICATOR LIGHTS, RECEPTACLES, ETC. IS REPRESENTATIVE AND NOT INTENDED TO BE ABSOLUTE.



I CERTIFY THIS DOCUMENT TO GENERALLY REPRESENT THE CONTRACTED PROJECT. ALL DESIGN CHANGES MADE THROUGH ECR'S HAVE BEEN INCORPORATED.

DOES NOT CONTAIN CLASSIFIED OR UNCLASSIFIED CONTROLLED NUCLEAR INFORMATION
 JE BREED
 Registering Officer/ADC
 Kaiser Engineers/Manford Company
 2-5-92
 Date

NUMBER	TITLE	DATE	BY	CHKD	APP'D																				
AS-BUILT FOR PROJ. L-092	2006 OFFICE COMPLEX BLDG 2753-E	08/23/06	SM 1.3																						
<table border="1"> <tr> <td>REVISIONS</td> <td>DESCRIPTION</td> <td>DATE</td> <td>BY</td> <td>CHKD</td> <td>APP'D</td> </tr> <tr> <td>1</td> <td>AS-BUILT FOR PROJ. L-092</td> <td>08/23/06</td> <td>SM 1.3</td> <td></td> <td></td> </tr> </table>						REVISIONS	DESCRIPTION	DATE	BY	CHKD	APP'D	1	AS-BUILT FOR PROJ. L-092	08/23/06	SM 1.3										
REVISIONS	DESCRIPTION	DATE	BY	CHKD	APP'D																				
1	AS-BUILT FOR PROJ. L-092	08/23/06	SM 1.3																						
<table border="1"> <tr> <td>PROJECT</td> <td>WHC-SD-L092-OMM-001</td> <td>DATE</td> <td>08/23/06</td> </tr> <tr> <td>PROJECT</td> <td>2006 OFFICE COMPLEX BLDG 2753-E</td> <td>DATE</td> <td>08/23/06</td> </tr> <tr> <td>PROJECT</td> <td>SEWAGE DISPOSAL SYSTEM</td> <td>DATE</td> <td>08/23/06</td> </tr> <tr> <td>PROJECT</td> <td>ONE-LINE DIAG. PLAN & DET</td> <td>DATE</td> <td>08/23/06</td> </tr> <tr> <td>PROJECT</td> <td>(L-092) 2751E, 2752E, 2753E - SEW DSPL SYS</td> <td>DATE</td> <td>08/23/06</td> </tr> </table>						PROJECT	WHC-SD-L092-OMM-001	DATE	08/23/06	PROJECT	2006 OFFICE COMPLEX BLDG 2753-E	DATE	08/23/06	PROJECT	SEWAGE DISPOSAL SYSTEM	DATE	08/23/06	PROJECT	ONE-LINE DIAG. PLAN & DET	DATE	08/23/06	PROJECT	(L-092) 2751E, 2752E, 2753E - SEW DSPL SYS	DATE	08/23/06
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PROJECT	ONE-LINE DIAG. PLAN & DET	DATE	08/23/06																						
PROJECT	(L-092) 2751E, 2752E, 2753E - SEW DSPL SYS	DATE	08/23/06																						

DISTRIBUTION SHEET

To DISTRIBUTION	From B. C. HARMON	Page 1 of 1
		Date 7/20/93
Project Title/Work Order L-092, 2751-3E EMERGENCY DRAINFIELD REPLACEMENT		EDT No. 121594
		ECN No. N/A

Name	MSIN	Text With All Attach.	Text Only	Attach./Appendix Only	EDT/ECN Only
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D. A. DANCH	B4-40	X			
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