OPERATION AND MAINTENANCE MANUAL

Wauconda Landfill Remediation Wauconda, Illinois

ORIGINAL VERSION - APRIL 1991 LATEST REVISIONS - MARCH 1992 REF. NO. 1449-40(49)

CONESTOGA-ROVERS & ASSOCIATES

MEMO

TO:Dick Oplinger, Custodian
Mark Dierker, Village of Wauconda
Jeff Kuester, Village of Wauconda
John Mackay, Exxon
Ken Myers, CRA - Chicago
Larry Mills, CRA - ChicagoFROM:Bob Fedy/pmck/71REFERENCE NO.1449-40DATE:March 4, 1992RE:Operation and Maintenance Manual
Wauconda Landfill Remediation

Please find enclosed your revised copy of the Operation and Maintenance Manual for the Wauconda Landfill, which has been updated by CRA effective this date.

This manual covers the remedial aspects identified in the Administrative Order dated December 19, 1989.

This manual will be updated by CRA on an as-required basis.

Should there be any questions regarding the enclosed, please do not hesitate to contact us.

c.c.: Ron Frehner (w/encl) All remaining WTG Members (w/o encl.)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 5 230 SOUTH DEARBORN ST. CHICAGO, ILLINOIS 60604

Rec'd CRA

MAY 3 1991

April 29, 1991

REPLY TO ATTENTION OF: 5HS-11

Joseph S. Wright, Jr. Martin, Craig, Chester & Sonnenschein 55 W. Monroe Chicago, Illinois 60603

Re: Wauconda Sand and Gravel Site - Approval of RD/RA Work Plan, Operation and Maintenance Manual, and Health, Safety and Contingency Plan

Dear Mr. Wright:

This letter serves to notify you that the following documents, which were submitted to U.S. EPA by Conestoga-Rovers & Associates on April 25, 1991, and which are dated April 24, 1991, are hereby approved:

- RD/RA Work Plan
- Operation and Maintenance Manual
- Health, Safety and Contingency Plan

With this approval of the Work Plan, the Wauconda Task Group is hereby authorized to implement the monitoring system upgrade. According to the schedule in the Work Plan, and my letter to Mr. Ron Frehner dated April 10, 1991, which granted conditional approval of the Work Plan, the monitoring system upgrade should be completed by August 8, 1991.

The Wauconda Task Group may also continue with the design of the cap upgrade. Please be advised that the pre-final design is due by July 9, 1991.

The Quality Assurance Project Plan (QAPP), which was submitted on March 14, 1991, is still being reviewed. Comments on the QAPP will be forwarded under separate cover when we complete our review.

If you have any questions regarding this letter, please feel free to contact me at (312) 886-4760.

Sincerely yours,

Ressecca Frey

Rebecca Frey Remedial Project Manager

TABLE OF CONTENTS

<u>Page</u>

1.0	INTR	ODUCTION	.1
	1.1	HEALTH AND SAFETY REQUIREMENTS	.3
	1.2	PUBLIC RELATIONS PROCEDURE	.5
2.0	LEAC	HATE COLLECTION, TRANSFER AND STORAGE SYSTEM	.6
	2.1	PERMITS TO OPERATE THE	
		LEACHATE COLLECTION SYSTEM	.8
	2.2	LEACHATE COLLECTION GALLERY	.9
	2.3	FORCEMAIN SYSTEM	.11
	2.4	SUMP 1 - PUMPING CHAMBER	.13
	2.5	LEACHATE COLLECTION MANHOLE CHAMBERS	.17
	2.6	FORCEMAIN METER CHAMBER	. 19
	2.7	FORCEMAIN DRAIN CHAMBER	.21
	2.8	FORCEMAIN AIR RELEASE CHAMBER	.22
	2.9	VILLAGE OF WAUCONDA MANHOLE 12-24	.23
	2.10	LEACHATE STORAGE SYSTEM	.24
	2.11	ELECTRICAL SYSTEM AND CONTROLS	.30
	2.12	LEACHATE COLLECTION SYSTEM -	
		INSPECTION AND MAINTENANCE	.34
	2.12.1	Regular Inspection	.34
	2.12.2	Monthly Inspection	.36
	2.12.3	Annual Inspection	.38
	2.13	LEACHATE COLLECTION SYSTEM	.41
	2.13.1	Spare Components	.41
	2.14	LEACHATE CLASSIFICATION	.43
	2.15	TROUBLE SHOOTING PROCEDURES FOR	
		THE LEACHATE COLLECTION SYSTEM	.44
	2.15.1	No Flow or Significantly Reduced Flow in System	.45
	2.15.2	Failure of Single Pump	.47
	2.15.3	Potential for Leachate System Overflow	.48
	2.16	OPERATION CONTINGENCY PLAN	.50
	2.16.1	Mechanical Failure	.50
	2.16.2	Volumes of Collected Leachate Exceed Village	
		Limitation and CID Cannot Schedule Pick-up	.51
	2.16.3	Electrical Failure	.51

TABLE OF CONTENTS

<u>Page</u>

3.0	LANI	DFILL CAP, DRAINAGE AND PERIMETER FENCE	53
	3.1	GENERAL STATUS	53
	3.2	LANDFILL CAP, DRAINAGE AND	
		PERIMETER FENCE INSPECTION	55
	3.2.1	Landfill Cap Maintenance	56
	3.2.2	Roads and Access Maintenance	60
	3.2.3	Other Maintenance	61
	3.3	MONITORING WELLS INSPECTION	62
	3.3.1	Monitoring Well Maintenance	62
	3.4	GAS VENTS	64
4.0	INSPI	ECTION/MONITORING SCHEDULE AND REPORTING	65
	4.1	GENERAL	65
	4.2	RECORD KEEPING	66

LIST OF FIGURES

		Following <u>Page</u>
FIGURE 2.1	LEACHATE COLLECTION FORCEMAIN SYSTEM	6
FIGURE 2.2	SUMP 1 - PUMPING CHAMBER DETAIL	9
FIGURE 2.3	SUMP 2 DETAIL	10
FIGURE 2.4	SUMP 3 DETAIL	10
FIGURE 2.5	FORCEMAIN METER CHAMBER DETAIL	19
FIGURE 2.6	FORCEMAIN DRAIN CHAMBER DETAIL	21
FIGURE 2.7	FORCEMAIN AIR-RELEASE CHAMBER DETAIL	22
FIGURE 2.8	SANITARY MH12-24 DETAIL	23
FIGURE 2.9	LEACHATE STORAGE TANK - PLAN VIEW	24
FIGURE 2.10	LEACHATE STORAGE TANK - SECTIONS	24
FIGURE 2.11	ELECTRICAL CONTROL PANEL LAYOUT	30
FIGURE 2.12	ELECTRICAL CONTROL PANEL DETAIL	30
FIGURE 3.1	GENERAL SITE LAYOUT AND CONDITIONS	53

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LIST OF TABLES

		Following <u>Page</u>
TABLE 2.1	SUMMARY OF MONTHLY LEACHATE REMOVAL VOLUMES 1989-1991	7
TABLE 2.2	SCHEDULE OF MAINTENANCE	38
TABLE 4.1	OPERATION AND MAINTENANCE WAUCONDA LANDFILL	65

LIST OF APPENDICES

- APPENDIX A IEPA PERMITS FOR LEACHATE DISPOSAL
- APPENDIX B MANUFACTURER'S INFORMATION -LEACHATE COLLECTION, TRANSFER AND STORAGE SYSTEM
- APPENDIX C STANDARD REPORTING FORMS
- APPENDIX D LIST OF PROJECT CONTACTS -WAUCONDA LANDFILL REMEDIATION

1.0 INTRODUCTION

This manual has been revised effective March 1992 by Conestoga-Rovers & Associates (CRA) to update the operation, maintenance and long-term care requirements associated with each component of the final remedial measures for the Wauconda Landfill. This manual and its stated procedures have been prepared in accordance with the approved Remedial Design/Remedial Action Work Plan for the Site.* Aspects of the final remedial measures listed by category are:

- leachate management system;
- landfill cap, drainage system, security fence, access roads;
- landfill gas vents; and
- groundwater monitoring wells.

The Village of Wauconda (Village) will provide operation and maintenance (O & M) of the leachate management system, including disposal as provided by an agreement with the Wauconda Task Group (WTG).

Oplinger Consulting Services (Cary, Illinois) will provide custodial/inspection duties for the landfill (not relating to the leachate system), as provided by an agreement with the WTG.

CRA provides ongoing environmental engineering services to the WTG.

* Reference:

Remedial Design/Remedial Action Work Plan, Wauconda Landfill Remediation, Wauconda, Illinois, Conestoga-Rovers & Associates, April 1991.

This manual is organized as follows:

Section 2.0

- a general description of the components and operation of the leachate collection, transfer and storage system;
- a review of maintenance requirements for the leachate system;
- general troubleshooting procedures to be followed if a leachate system failure occurs; and
- operating contingency plans to be followed in the event of a leachate system failure.

Section 3.0

 a review of the inspection/maintenance requirements for the Site cap and drainage, monitoring wells, landfill vents, perimeter fence and access roads;

Section 4.0

• a review of inspection and maintenance schedules, and reporting for the Site.

1.1 HEALTH AND SAFETY REQUIREMENTS

All work conducted on the Site must be performed in a safe and workmanlike manner by qualified individuals. Health and safety protocols consistent with the Health and Safety and Contingency Plan for the Site, and in accordance with all applicable State, Federal and local requirements will be strictly adhered to.*

Persons working at the Site and any visitors will be required to sign the hard-cover Inspection/Maintenance/Visitor Log on a daily basis. The Log is posted in the tank enclosure building. Persons entering the Site for the first time shall be informed of the potential hazards of the Site by either the Village, Oplinger Consulting or CRA. Visitors touring the Site (i.e. not conducting work) shall be escorted at all times by a Site operator.

All personnel working on the Site where a hazard may be present, or where such persons may be exposed to the hazards of the Site, will have applicable OSHA training and medical monitoring requirements as specified in 29 CFR 1910.120. Training requirements under these standards will not apply to personnel who have no probable likelihood of being exposed to safety hazards or health hazards of the Site.

The Village, Oplinger Consulting and CRA will be responsible for providing its employees who are performing duties at the Site,

* Reference:

Health, Safety and Contingency Plan, Wauconda Landfill Remediation, Wauconda, Illinois, Conestoga-Rovers & Associates, April 1991.

with necessary personal protective equipment (PPE) and air quality monitor(s), and will further ensure proper use, cleaning and disposal of such items.

It will be assumed that all drilling equipment, excavation equipment and pumping equipment used at the Site will require decontamination. Any trucks contacting waste or leachate will also be decontaminated. Trucks used only for the purpose of delivering imported materials (clay, sand, topsoil, aggregate) will not require decontamination.

A concrete pad and sump for equipment decontamination is located adjacent to the building enclosure.

A first-aid kit and emergency eyewash are located inside the building enclosure.

Copies of pertinent Site reports, drawings and information are maintained in a filing cabinet located inside the building enclosure.

1.2 PUBLIC RELATIONS PROCEDURE

At the request of the WTG, all enquiries, questions or complaints received by a Site operator from the media, government agencies, neighbors or the general public are to be directed to Conestoga-Rovers & Associates for an official statement. All public relations are to be conducted in a courteous and professional manner. Site operators are not to express opinions or theories about the Site. Site operators may provide straightforward factual information not relating to historical operation, legal, financial or environmental matters of any kind.

2.0 <u>LEACHATE COLLECTION, TRANSFER AND STORAGE SYSTEM</u>

The leachate collection system was originally constructed in 1987 and expanded and upgraded in 1991. The combined system consists of three operational components, as follows:

- a gravity flow leachate collection gallery across the north limit of the landfill connecting to a pumping chamber at the west side of the landfill;
- a transfer forcemain from the pumping chamber along the west Site boundary connecting to the Village of Wauconda sanitary manhole 12-24 on Bonner Road; and
- a backup forcemain from the pumping chamber parallel to the gravity collection gallery connecting to an above-ground storage facility at the east boundary access gate.

The general features of the system are shown on Figure 2.1. A detailed set of record drawings and approved shop drawings depicting the above are maintained at the Site. The figures of this report are for illustration only and may not reflect all aspects of the installation.

Routine operations involve pumping collected leachate from the pumping chamber to the Village's manhole 12-24 on Bonnar Road. By agreement between the WTG and the Village, the discharge volume is limited to 28,000 gallons measured over a moving 7-day period and shall not exceed 10,000 gallons inany 24 hour (1 day) period. In the event that collected volumes would exceed either limitation, leachate will be transferred to the



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above-ground storage tank (temporarily) until it can be returned for discharge to the Village's manhole 12-24. As contingency to the above, leachate may be removed from the above-ground storage tank by a licensed liquid waste haulage vehicle for disposal to the CID Processing Center in Calumet City. Such an event must be pre-approved by CRA or the WTG and proper IEPA manifesting must be carried out.

Since 1987, leachate collection volumes have been maintained and are summarized in Table 2.1. Leachate collection volumes are known to be precipitation dependent. The flow rates shown depict the low, high and average daily volumes as calculated from monthly records. Based on Table 2.1, typical flows are likely to range from 700 gpd (dry or frozen months) to 3,000 gpd (wet or snowmelt months). On occassion, single day events following spring thaw or several days of heavy rain can generate leachate flow rates on the order of 10,000 gpm. However, the overall average daily collection rate is calculated to be on the order of 1,600 gpd and should decrease in the future due to cap upgrading and maintenance.

TABLE 2.1

SUMMARY OF MONTHLY LEACHATE REMOVAL VOLUMES 1989 - 1991 ⁽¹⁾

Month	Low Daily Volume (gpd)	High Daily Volume (gpd)	Calculated Average (gpd) ⁽²⁾
January	694	1,475	1,018
February	845	1,953	1,412
March	1,185	2,663	1,923
April	905	2,781	1,906
May	782	2,980	2,009
June	670	1,614	1,155
July	665	1,503	1,138
August	1,130	1,439	1,242
September	997	1,570	1,293
October	573	2,437	1,711
November	963	3,300	2,214
December	759	2,519	1,931
Annualized average			1,580 gpd

Notes:

(1) Source Annual Monitoring Report #3, Wauconda Landfill Remediation, CRA, January 1992.

(2) Arithmetic mean of 1989, 1990 and 1991 values.

2.1 PERMITS TO OPERATE THE LEACHATE COLLECTION SYSTEM

The WTG and Village of Wauconda have jointly obtained permits from the Illinois Environmental Protection Agency - Division of Water Pollution Control to discharge collected leachate as a special waste to the Village's sanitary sewer system via a forcemain connection or by means of a licensed liquid waste hauler. Copies of these permits are provided in Appendix A, and remain valid until August 1996.

In addition to the above, the WTG maintains an IEPA permit to dispose collected leachate as a special waste to the CID Processing Center in Calumet City, Illinois, by licensed liquid waste hauler. A copy of this permit is provided in Appendix A and remains valid until December 1995.

Should haulage of leachate be necessary to either the Village of Wauconda sewer or the CID Facility, the WTG typically contracts Mr. Frank Disposal Ltd. of Matteson, Ill., who are licensed and familiar with the Wauconda Landfill.

2.2 LEACHATE COLLECTION GALLERY

<u>General</u>

The leachate collection system is designed to intercept and remove leachate from the landfill north slope before it becomes a surface seep. A perforated pipe in a gravel bed collects leachate and conveys it by gravity flow to a pumping chamber (Sump 1). From Sump 1, leachate is pumped via a forcemain to discharge to the Village of Wauconda sanitary manhole 12-24, or alternatively is transferred by a backup forcemain to temporary on-Site storage (according to manual valve settings by the operator).

Description

The leachate collection gallery consists of a 6-inch diameter Schedule 80, perforated PVC pipe, installed in a gravel bed. The collection pipe is buried at a depth of approximately 6 feet below surface. The pipe and gravel bedding are wrapped with filter cloth to minimize sedimentation and plugging of the pipe. The length of installation is approximately 1,000 feet, nominally sloped from east to west.

Leachate collection Sump 1 (4-foot diameter concrete manhole) is located in the northwest corner of the landfill (downslope end) of the pumping chamber (see Figure 2.2).

Two 4-foot diameter concrete manhole chambers

(Sump 2, Sump 3) for inspection, monitoring and cleanout are installed at intermediate points along the collection trench (see Figures 2.3 and 2.4). The manholes are accessible to facilitate inspection and flushing of the system. A 6-inch clean-out riser pipe extending above-ground is located at the west end of the system (upslope end).



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2.3 FORCEMAIN SYSTEM

As shown on Figure 2.1 (previously referred), forcemain is constructed from:

- the pumping chamber (Sump 1) along the west Site boundary to
 Village manhole 12-24 covering 2,640 feet; and
- ii) the pumping chamber parallel to the collection gallery (north landfill boundary) to the above-ground storage tank covering 1,300 feet.

All forcemain is 2-inch diameter HDPE pipe, butt fused for continuous length and field pressure tested to 100 psi. The 2-inch forcemain is contained in an outer 4-inch diameter HDPE casing pipe at locations beyond landfilled limits in the event of a forcemain leak or break.

The west Site boundary forcemain includes a meter chamber (for flow measurement) a drain chamber (to effect maintenance) and an air release chamber (to expel entrained air). A check-valve in the clean-out/drain chamber functions to prohibit flow reversal from the forcemain into the pumping chamber during routine operational mode.

The north Site boundary forcemain connects to the above-ground 10,000-gallon tank which is air vented and includes a float level gage for volume reading. Valve operation can permit directional flow to fill the storage tank or empty it into Sump 2.

The noted forcemains should not be operated simultaneously and include isolation valves in the Sump 1 - pumping chamber for this purpose.

2.4 <u>SUMP 1 - PUMPING CHAMBER</u>

Figure 2.2 (previously referred) depicts the pumping chamber as 4-foot diameter precast concrete manhole complete with the following components:

Item	Quantity	Function
Effluent pumps	2	Operate upon demand by float level switch; function as lead and lag system.
Interior piping and fittings		Threaded and coupled for removal if required.
Slide away coupling and seal/dual vertical rail guide	2	Allow pump(s) removal from the sump without personnel entry to the sump.
Pump Check valve	2	Prevent backflow of leachate through pumps upon shut-off.
Isolation ball valve	2	routing of discharge.
Gate valve	2	allow removal of pump from operating system.
Mercury float switches	2	To start and stop pumps upon preset leachate levels and alarm at high-high level.
Access hatch cover	2	Man-entry, sampling and pump removal.

Miscellaneous components include: ladder rungs, pipe supports, pump lifting chain, 2-inch diameter, SCH. 10 steel vent pipe and pipe seals at subsurface pipe entry points.

The configuration of the discharge forcemain from Sump 1 to the Village manhole 12-24 comprises total dynamic head requirements (TDH) of approximately 100 feet. The configuration of the back-up forcemain from Sump 1 to the storage tank comprises total dynamic head requirements of approximately 120 feet.

From pump performance data supplied by the manufacturer, the Metropolitan Hydromatic SKHD150 rated capacities include:

GPM	Total Dynamic Head	Notes
26	100 ft (4 5 psi)	single pump to MH12-24
30	90 ft (41 psi)	single pump to storage tank

The SKHD150 pumps operate as a lead and lag system with provision to designate (key set) the lead pump. It is expected that the pumps will be regularly alternated by key switch settings to perform the lead pumping function. This procedure should create relatively equal pumping time for both pumps as indicated by their respective elapse time meters. The pumps are activated automatically based on the leachate level within Sump 1.

A total of four float level switches within the sump activate or deactivate the lead sequenced pump or indicate high level within the sump which functions to start the lag pump in tandem with the first. The float switches are adjustable externally at ground surface, and operate as follows:

- 1. Low Level Switch
 - disengages operating pump when low liquid level is reached and switch is in down (off) position;
 - installed above pump intakes to prevent pumps from running dry;
 - must be in the up (on) position when high level is reached to allow pump to be activated by intermediate level switch.
- 2. Intermediate Level Switch
 - activates lead pump when specified level is reached and switch is in the up (on) position. (Note: low level switch must also be in up position for pump to engage);
 - installed 3 feet above low level switch to allow sufficient pump run time and reduce pump cycling;
 - if activated by the operator during pumping to the storage tank, the high level switch in storage tank will override the starter circuit and prevent the pump from engaging.
- 3. High Level Switch
 - starts the lag (second) pump for tandem operation;
 - maintains both pumps in operation until low level switch is triggered.
 - lights the sump high-level light.

- 4. High/High Level Alarm
 - activates alarm beacon at control panel to indicate emergency leachate level in sump;
 - activates an alarm signal which is sent by dedicated phone line to the Village of Wauconda police station;
 - set at two feet below the top of the sump.

The float level switches can be overridden by the manual pump switch located in the electrical junction box adjacent to Sump 1 or at the electrical control panel to run the pump(s) in an "on" condition (see Section 2.10). The float override will only be activated if the low level switch is on and functioning to prevent the pump(s) from running dry.

Full details and manufacturer's product literature for each of the referenced components is provided in Appendix B.

2.5 LEACHATE COLLECTION MANHOLE CHAMBERS

Figures 2.3 and 2.4 (previously referred) depict the

intermediate leachate collection manhole chambers (Sump 2, Sump 3).

Sump 2 is a 4-foot diameter precast concrete chamber and

is located 180 feet east of Sump 1.

Sump 2 is complete with:

Item	Quantity	Function
Stub-end 2-inch		See ball valve.
2-inch ball valve	1	Allow manual return of leachate from the above-ground storage tank or manual pumping from the sump.
Slide-away coupling and seal/vertical dual rail guide	1	Allow auxiliary pump installation into the sump without entry to the sump.
Mercury float switches	3	To start/stop auxiliary pump upon preset leachate level and alarm at high level (normally de-energized).
Access hatch cover	2	Man-entry, sampling and pump removal.

Also included in Sump 2 are ladder rungs, steel pipe vent and pipe seals at subsurface entry points. The auxiliary pump is described in Appendix B.1.

There are no mechanical installations or piping in Sump 3, which is located 610 feet east of Sump 1. The manhole is complete with a standard 30 inch manhole frame and cover and ladder rungs.

2.6 FORCEMAIN METER CHAMBER

Figure 2.5 depicts the west boundary forcemain meter chamber as a 6-foot diameter concrete manhole which is located 20 feet south of Sump 1 and includes:

Item	Quantity	Function
Meter	1	Complete with remote read out at ground surface to record total gallons pumped and flow rate (gpm); flange bolts are stainless steel
Isolation ball valves	3	Allow meter removal and use of meter by-pass pipe
Pressure gage	1	Measures pump discharge pressure in psi
Bypass piping	-	Allow meter removal and continued pumping
Air nipple	1	Pipe stub connected to by-pass pipe to allow airline connection to blow-out forcemain
Access hatch	2	Personnel entry to chamber
Electric sump pump	1	Plug-in connection and discharge hose to pump out accumulated liquid in chamber

Metering at this location will verify the quantity of leachate which has been pumped to the Village's manhole. The flow meter utilizes an obstructionless sensor with a non-conductive ceramic flow tube and measuring transmitter (known as magnetic flow measurement) and includes remote read-out such that man-entry to the sump for routine



1449-40(49)MAR.11/92-REV.1 (D-20)

inspection is not required. Manufacturer's information for the flow meter is provided in Appendix B.

The by-pass piping is provided for contingency use in the event the flow meter is removed from service. The by-pass piping includes a 2-inch diameter galvanized steel nipple for an air-line connection to blow out the west boundary forcemain for cleaning and maintenance. A portable electric sump pump and 1/2-inch discharge hose is located in the meter chamber to allow the operator to pump out accumulated groundwater/rainwater on an as-needed basis. It is noted that the meter manufacturer recommends that the meter not be submerged.

2.7 FORCEMAIN DRAIN CHAMBER

Figure 2.6 depicts the forcemain clean-out/drain chamber as a 4-foot diameter concrete manhole which is located at a low point in the system 810 feet south of Sump 1 and includes:

Item	Quantity	Function
Ball valve (2" $Ø$)	2	Allows directional draining of leachate from forcemain (both sides of check valve) if required
Check valve	1	Prevent flow reversal from the upstream forcemain which is at higher elevation
Flange x flange pipe assembly	1	May be removed for forcemain cleaning/flushing

Forcemain flushing (cleaning) is described in Section 2.12.

The volume of leachate in the forcemain which would flow to the drain chamber is on the order of 168 gallons per 1,000 feet of length. All liquids which accumulate in the drain chamber will require management on an as-needed basis, which may include transfer to Sump 1 via portable pump/flexible hose or mobile vacuum tank should such liquids be suspected or known to contain leachate.



1449-40(49)-MAR.11/92-REV.1 (D-21)

2.8 FORCEMAIN AIR RELEASE CHAMBER

Figure 2.7 depicts the forcemain air release chamber as a 4-foot diameter concrete manhole which is located at the highest elevation in the system, 1985 feet south of Sump 1 and includes:

Item	Quantity	Function
Air release valve	1	Expel air in line during filling or air blowing or routine operation; allow air entry upon forcemain draining
1/2-inch diameter ball valve		Drain liquids from local pipe
Flange x flange pipe assembly	1	May be removed for forcemain cleaning/flushing

Air pockets in the forcemain developed by pump start-up or line filling which could potentially limit flow capacity should be expelled automatically by the universal air valve.

If the forcemain is being drained by the operator, the drain chamber check valve must be deactivated, and air will automatically enter the line through the air valve and prevent pipe collapse. Manufacturer's information for the universal air valve is provided in Appendix B. Periodic adjustment of the air valve is recommended to ensure that minimal liquids are expelled with any air during operation.



1449-40(49)-MAR.11/92-REV.1 (D-22)
The Village of Wauconda sanitary manhole 12-24 is located on the north side of Bonner Road in the landscaped portion of the right-of-way.

Bonner Road is maintained by Lake County. The Village of Wauconda has been granted a permanent easement for placement and maintenance of the sanitary manhole and gravity sewer.

The manhole is a 4-foot diameter precast concrete chamber with a standard 30-inch frame and cover and includes an 8-inch gravity sewer flowing west to Karl Court lift station No. 11 (see Figure 2.8). The manhole is the eastern termination (upstream limit) of the gravity sewer on Bonner Road tributary to the Karl Court lift station.



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2.10 LEACHATE STORAGE SYSTEM

The leachate storage system consists of an above-ground storage tank (nominal capacity 10,000 gallons), a concrete containment dike a cat-walk inspection/storage platform and weatherproof enclosure. A general truck turnaround pad and concrete spill containment pad are also included to facilitate loading of tanker vehicles from the storage tank.

All above-ground portions of piping leading into and out of the tank are electrically heat traced and insulated. Heater pads and insulation are also installed on the tank to prevent freeze-up.

The concrete containment dike has a holding capacity of 11,400 gallons. A concrete sump is provided in the northwest corner of the containment dike. A level switch in the containment sump activates an alarm light in the control panel to indicate to the operator that liquids have accumulated in the sump and a leak may have occurred. In the event of a tank leak or overflow, the floor sump grate should be removed and a pump suction placed in the sump to allow complete dewatering of the containment dike. The general layout of the storage tank and dike are illustrated on Figures 2.9 and 2.10. Further details associated with the storage tank, metering and control system and the enclosure building are provided in Appendix B.

Fittings and appurtenances provided on the tank and associated piping are as follows:



1449-40(49)-MAR.20/92-REV.1



1449-40(49)-MAR.20/92-REV.1

- 1. High Level Switch
 - mounted in nozzle installed on roof manhole;
 - is manually key set by the operator when pumping to the tank to activate alarm light in control panel and deactivate (overrides) sump pumps when high liquid level in tank is reached;
 - set 3 inches below top rim of tank to prevent overflow of tank.
- 2. Gauge Hatch
 - mounted on roof of tank;
 - used for manually gauging liquid level in tank and for collection of leachate samples.
- 3. Tank Roof Vent and Overflow
 - mounted on south side of roof;
 - vents tank during filling and discharging operations;
 - in the event of an overflow, directs leachate to rear of tank to allow operators access to tank valves.
- 4. Forcemain Inlet Piping and backflow (leachate return) system
 - 2-inch mainline piping from sumps which includes 2-inch check valve to prevent loss of tank storage in the event of an upstream malfunction;
 - tank inlet is fitted with gate value to manually isolate tank from sumps and check value to prevent loss of tank liquid in the event of a forcemain break;

- 2-inch by-pass piping tee connected on both sides of the 2-inch check valve which includes two isolation ball valves and one 1-inch ball valve for sampling (known as double block an bleed system).
- 5. Discharge Piping to tank truck loading
 - 4-inch pipe from tank to truck loading pad for gravity loading of tank trucks; including two in-line isolation gate valves.
- 6. Float Level Gage
 - tape readout in feet and inches which functions via a float level.
- 7. Man-Access Hatch

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- 36 inch diameter manway (blind flange connected) for tank access per confined space entry procedures.
- 8. Electric Activator Valve and Discharge
 - 4 inch diameter flange connection on east side of tank complete with a 4 inch isolation butterfly valve, 2 inch drilled ad tapped pipe and electric activator valve (dump valve) to sample or drain the tank into the containment dike by remote operation.

Periodically, leachate transfer to the storage tank will be necessary when previous volumes discharged to the Village of Wauconda sanitary sewer are at 4,000 gallons per day averaged over any 7-day period. Transfer periods are to be temporary and the Village of Wauconda will notify Oplinger Consulting or CRA of this situation and conduct the transfer.

The procedures for leachate transfer to the storage tank to be implemented by the Village are summarized as:

- a) Village to notify CRA or Oplinger Consulting of a need to transfer leachate to the tank and verify available tank storage,
- b) ensure tank in-flow system is open and backflow (bypass) system is closed,
- c) ensure the storage tank high level switch is activated (key switch setting at the main control panel to "normal"),
- d) ensure the ball valve at Sump 2 is closed,
- e) close ball valve at Sump 1 to terminate flow to the Village manhole,
- f) open the ball valve at Sump 1 to direct flow to the tank, and
- g) inspect the system daily while storage is required to assess when leachate can be returned to Sump 2 for discharge to the Village's manhole.
- Note: When the tank high level switch is triggered (i.e. 10,000 gallons storage), the pumps are automatically deactivated ("locked out") and will not respond to the sump level switches. To continue pumping to the Village sewer, for instance, the operator must close the tank inlet valve and turn the keyed tank level alarm switch at the main control panel from "normal" to "emergency". In this mode, pumping can continue according to the sump level switches only.

To return leachate from the tank to Sump 2, the procedures to be followed by the Village are:

- a) close the ball valve at Sump 1 to terminate flow to the tank,
- b) open the ball value at Sump 1 to direct flow to the Village's manhole,
- c) open the ball valve at Sump 2 to allow return of leachate from the holding tank,
- d) open the back-flow (bypass) system at the holding tank (2 each ball valves),
- e) observe back-flow to regulate flow and ensure pumping is initiated at
 Sump 1, and
- f) when complete, close Sump 2 ball valve and holding tank bypass,
 record finished tank volume.

In the unlikely event that disposal of leachate from the holding tank to a licensed haulage vehicle is required, the following will be implemented by Oplinger as follows:

- a) Oplinger to notify CRA or the WTG,
- b) Oplinger to provide signed manifest and arrange hauler pick-up time and confirm with Village,
- c) pump liquids collected in truck loading pad sump (if any) to truck,
- d) record liquid level in holding tank,
- e) connect truck suction to tank discharge pipe,
- f) open in-line gate valves (2 each) then pump or transfer by gravity as required,

- g) close in-line gate valves on tank then truck prior to disconnecting suction line,
- h) record liquid level in holding tank,
- pump leachate liquid collected in loading pad sump (if any) to tank truck,
- j) if tank was full prior to pumpout, ensure sump pumps are operating following removal of leachate from holding tank,
- k) complete Leachate Transfer Record and waste manifest (sample copies included in Appendix C), and
- 1) ensure gate and building is locked when leaving the Site.

The hauling contractor shall take special care to prevent spillage of leachate liquids during tank truck loading. Leachate haulage vehicles entering and operating at the Site are restricted to daylight hours Monday to Saturday unless approved otherwise by the WTG, and are not to be driven over lawns of neighboring properties.

2.11 ELECTRICAL SYSTEM AND CONTROLS

Electric power for pumping/storage operations, failure alarming, lighting and receptacle outlets at the Site comprises 120/240 Volt, 100 AMP, 3 phase service and is supplied by Commonwealth-Edison (Libertyville, Ill.).

Power is delivered to and metered at a main electrical control panel adjacent to the tank enclosure building/north gate. The electrical controls are maintained on a 4-foot by 8-foot plywood backboard and are arranged as shown on Figures 2.11 and 2.12. Further detailed schematics are provided in Appendix B.

Main Electrical Panel

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Power from the Commonwealth-Edison service pole is distributed through the control station as follows:

Item	Description	Function
1.	Commonwealth-Edison service meter Service No.: NF910338 Account No.: AS66-UW-1611D	Meter power useage
2.	Square D service entrance switch 100 amp, 3 phase	Disconnect power to the Site
3.	Square D transfer switch 200 amp, 3 phase	Activate generator plug for connection to portable generator

4.	Load center 20 circuit main breaker	Isolate individual panel circuits in use
5.	Duplex outlet receptacle	120 volt AC plug
6.	Chicago switchboard factory main control panel	Operate pumping control panel system
7.	Auxiliary portable generator plug	Operate pumping system following power failure
8.	Alarm beacon	Indicate high-high level at Sump 1
9.	Secondary control panel	Operate pipe heaters, lights, Sump 2 components, other non-pumping components
10.	Junction box	Field wiring connection

The main control panel face includes indicator lights for pump running and alarm situations. Alarming includes:

• pump overload

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- Sump 1 high-high level
- holding tank leakage

All operator controls in the main control panel face are "key switched".

Building Enclosure

Electrical power supplied to the building enclosure from the main breaker comprises 120 volt AC for:

- enclosure light (switch at building to CB6)
- holding tank high level alarm (indicator light at control panel to CB3)
- tank leakage alarm (indicator light at control panel to CB3)
- tank, pipe heater pad
- outlet receptacle (plug connection)
- two-inch diameter electric actuator valve on sample port (east side) of tank
- piping heat tapes

Field Operation

Power supplied from the main breaker includes:

- 240 volt AC for pump operation at Sump 1
- 120 volt AC for float level switches at Sump 1, Sump 2
- 120 volt AC for meter operation at meter chamber
- 120 volt AC for duplex outlet receptacle at Sump 1, Sump 2, meter chamber
- 240 volt 1 phase AC for Sump #2 pump operation
- 240 volt 1 phase AC for Sump #1 (not in use)

Pull boxes are located at intermediate locations along the alignment. Junction boxes are provided at Sump 1 and Sump 2 which include weatherproof disconnect switches for isolation purposes.

Electrical field wiring is protected in of 2 1/2-inch diameter, Schedule 40 PVC pipe, glued jointed and buried at an average depth of 18 inches.

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2.12 LEACHATE COLLECTION SYSTEM -INSPECTION AND MAINTENANCE

2.12.1 <u>Regular Inspection</u>

Regular inspections of the leachate collection system will be completed by the Village of Wauconda and Oplinger Consulting as specified herein. Inspection reporting will be completed for each inspection event as stated in Section 4.0. Regular inspections include:

A. Tank and Enclosure (a minimum of once per week by Oplinger Consulting)

- a) inspect dike and sump for accumulated liquids,
- b) inspect tank pedestal for signs of leakage from tank,
- c) inspect piping, valves and appurtenances for leakage,
- d) record liquid level in tank,
- e) inspect insulation on tank and piping to ensure it is secure,
- f) inspect heat trace and tank pad heaters to ensure they are
 operating (during cold weather), and
- g) review Village regular inspection checklist for current week.Follow up with Village on any comments noted.
- B. Truck Turn Around Area (a minimum of once per week by Oplinger Consulting)
 - a) inspect gate and lock,

- b) inspect above-grade piping for signs of leakage, to ensure valves on tank suction line are closed and to ensure insulation is secure and heat trace is operational, and
- c) inspect truck loading pad for accumulated liquids.
- C. Leachate Collection System (a minimum of three times per week by Village)
 - a) inspect electrical control panel and alarms for proper functioning,
 - switch pumps to manual to ensure that they are operational (green light on control panel will illuminate), then switch pumps back to automatic (note: only if low level float is triggered),
 - c) open sump hatches to ensure liquid level is below high level switch (liquid may be above high level switch if tank high level switch has deactivated sump pumps) and to ensure the pipe inverts and pump suctions are clear (if visible),
 - d) with hatch open and while pump operates, listen for unusual noises or vibrations from pump, and
 - e) inspect the landfill bank along Mutton Creek to check forleachate seeps.

Under no conditions should anyone enter the sump to perform the regular inspections and maintenance. If required due to detrimental weather or Site conditions, the Village and Oplinger Consulting

will perform more frequent inspections as is necessary to ensure continuing operation of the system.

The person completing the inspection shall complete a standard inspection checklist (copy to remain in the tank building). A sample copy of the checklist is included in Appendix C.

Completion of the regular inspection shall also be noted in the hard-cover Inspection/Maintenance/Visitor Log which is kept in the tank enclosure building.

2.12.2 Monthly Inspection

The monthly inspection shall consist of the same items as the regular program plus additional items as noted below. The monthly inspection shall be performed in conjunction with a regular inspection and in accordance with Section 4.0.

The monthly inspections include:

- A. <u>Tank and Enclosure (by Oplinger)</u>
 - a) conduct regular program,
 - b) inspect tank vent to ensure it is clear and open,
 - c) inspect tank top for signs of overtopping,
 - d) inspect concrete dike and tank pedestal for cracks or spalling,
 - e) inspect building for loose shingles, siding, etc.

- f) check operation of high level control, and
- g) check operation of sump liquid level indicator.

B. <u>Truck Turnaround Area (by Oplinger)</u>

- a) conduct regular program,
- b) inspect turn around surface and side slopes for erosion,
- c) inspect entrance culvert for damage, and
- d) inspect truck loading pad, sump and bollards.

C. <u>Leachate Collection System (by Village)</u>

- a) conduct regular program,
- b) inspect level switches in collection sump to ensure they are secure,
- c) inspect the sump inlets, if visible, to ensure they are free of debris. Should there be debris present within the sump which is deemed to interfere with operations, the inspector shall undertake to remove the debris using a skimmer/strainer device, held at ground surface. If unable to do so, identify blockage and contact CRA,
- d) inspect sump vents to ensure they are clean and open,
- e) inspect sumps and manhole for accumulated sludge/solids. If present, remove to 55-gallon steel drums (DOT approved) and stage at truck loading pad. If required, drum disposal shall be conducted by a qualified contractor.
- f) inspect forcemain chambers and Village manhole 12-24 to ensure they are secure, and

g) inspect the clay cover in the vicinity of the leachate collection/forcemain system to ensure that there are no cracks that would increase the amount of flow into the leachate collection system.

Under no conditions should any personnel enter the sump to perform the monthly inspection and maintenance.

The person(s) completing the inspection shall complete a standard inspection checklist. A sample copy of the checklist is included in Appendix C. Completion of the monthly inspection shall be acknowledged in the specified Maintenance/Inspection/Visitor Log.

2.12.3 <u>Annual Inspection</u>

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The annual inspection shall consist of the same items as the monthly inspection plus an assessment as to the need to conduct collection pipe and/or forcemain flushing. It is expected that cleaning/flushing would be necessary about out once every two years. To assess the leachate collection pipe, the annual inspection should state whether leachate recharge of the sumps is normal or delayed and whether the liquid elevation in Sumps 1 and 2 are similar since these sumps are hydraulically connected. To assess the forcemains, the annual inspection form should report whether the pumps operate at significantly higher pressure and/or draw more amperage than design conditions and whether solids (deposits are noted in valves, check valves, blow-out liquids).

TABLE 2.2

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# SCHEDULE OF MAINTENANCE

| Item                                                       |            | Description                                                                                                                                            |   | Frequency                      |   | Notes                                                                                |
|------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------|---|--------------------------------------------------------------------------------------|
| pumps                                                      | -          | remove from service and conduct<br>overhaul of seals, impeller,<br>motor, check valve                                                                  | - | every 2 years                  | - | the pump check<br>valves are self-<br>cleaning but will<br>require grid removal      |
| access hatch                                               | -          | spray with WD/40 as<br>otherlubricant/ water repellant                                                                                                 | - | following a<br>heavy rain      | - | do not use<br>lubricants                                                             |
| locks                                                      | -          | spray with WD/40<br>as lubricant                                                                                                                       | - | weekly during<br>winter months | - | prevent freeze up                                                                    |
| electric boxes                                             | -          | remove rust then add one coat of paint                                                                                                                 | - | annually                       | - | conduct in summer                                                                    |
| sump vents and steel supports                              | -          | wire brush and add one coat of paint                                                                                                                   | - | annually                       | - | conduct in summer                                                                    |
| sump chamber<br>flushing<br>cleaning                       | -          | low volume pressure wash with<br>domestic cleaner, use long handle<br>brush to remove scum/deposits,<br>fresh water flush                              | - | annually                       | - | conduct in summer                                                                    |
| lights                                                     | -          | replace as burned out                                                                                                                                  | - | as needed                      | - | includes panel and<br>building lighting                                              |
| pipe heat<br>tape                                          | -          | replace with new                                                                                                                                       | - | annually<br>(pre-winter)       | - | remove and<br>re-install pipe<br>insulation                                          |
| tank vent                                                  | -          | replace anti-freeze in trap                                                                                                                            | - | annually                       | - | or following tank overflow if occurs                                                 |
| tank check<br>valve                                        | -          | clean and remove particles                                                                                                                             | - | every 2 months                 | - | operate on by-pass<br>if required                                                    |
| 6" ø PVC<br>collection<br>pipe                             | <b>-</b> . | American Power and Rodding,<br>Inc. (or equivalent) to pressure<br>clean pipe; working upstream<br>from sump 1 to clean-out;<br>requires 3-inch nozzle | - | every 2 years                  | - | fresh water supply<br>600 gallons per<br>1,000 feet                                  |
| 2"ø back-up<br>forcemain<br>tank to<br>Sump 2<br>(1100 ft) | -          | air blow forcemain from tank<br>inlet nipple to sump 2 using<br>maximum 90 psipressure                                                                 | - | every 2 years                  | - | may alternate<br>several sequences<br>with flushing/<br>pumping to clear<br>deposits |

# TABLE 2.2

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# SCHEDULE OF MAINTENANCE

| Item                                                                          | Description                                                                                                                                            | Frequency       | Notes                                                                           |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------|
| 2" ø back-up<br>forcemain<br>Sump 1<br>to Sump 2                              | <ul> <li>inject domestic cleaning solution<br/>to dissolve potential deposits,<br/>alternate with fresh water<br/>flushing/pump as required</li> </ul> | - every 2 years | - no current method to air blow these lines                                     |
| 2" ø west<br>boundary<br>forcemain<br>meterchamber<br>to MH12-24<br>(2620 ft) | <ul> <li>air blow forcemain from meter<br/>chamber to MH12-24 using<br/>maximum90 psi pressure</li> </ul>                                              | - every 2 years | - may conduct in<br>subsection if required                                      |
| 10,000-gallon<br>storage tank                                                 | <ul> <li>specialty contractor to access<br/>tank interior to power wash<br/>inside walls and vacuum<br/>remove sludge</li> </ul>                       | - every 5 years | <ul> <li>confined space entry;<br/>disposal to licensed<br/>facility</li> </ul> |

Maintenance comprises scheduled preventative maintenance, parts replacement due to wear and tear and unscheduled maintenance (repairs) due to malfunction or breakage.

All maintenance functions will the responsibility of the Village of Wauconda. Costs of maintenance shall be according to the terms of the agreement with the WTG. The Village will report all maintenance functions and costs to CRA as provided in Section 4.0.

Leachate is known to deposit residue on collection pipe, forcemain and sump walls with time. As such, pump performance and in-line fittings and components may be affected.

Guidelines for cleaning and maintenance are provided as shown in Table 2.2.

### 2.13.1 Spare Components

Based upon previous operating history, the following is a list of recommended spare parts/spare components to be kept on Site:

- float switch;

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- 2" ø PVC check valve for tank inlet;

- 2" ø Metropolitan Pump check valve for pumps;
- hydraulic seal set for check valve;
- bulbs for electrical panel;
- light bulbs for building;
- electric fuses;
- electric relay switch;
- heat tape;
- locks and keys to match existing;
- 2 inch PVC pipe;
- electric extension cord; and
- electric submersible sump pump (0.5 HP)

# 2.14 LEACHATE CLASSIFICATION

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A representative sample of leachate will be collected by CRA and analyzed by a qualified laboratory on a routine basis (approximately once per year). The frequency and parameters shall be determined by CRA based on the requirements of the receiving treatment facility.

Based upon sampling completed to date, Wauconda Landfill leachate is non-hazardous and considered to be a special waste for handling and manifesting purposes.

# 2.15 TROUBLE SHOOTING PROCEDURES FOR THE LEACHATE COLLECTION SYSTEM

Troubleshooting procedures presented herein apply to common or routine problems that may be encountered and are intended to isolate the cause or source of the problem. Correction of the problem will depend upon the cause of the problem and/or component(s) which failed. Operators should refer to manufacturer's instructions in Appendix B for specific components once a problem has been identified with that component.

Common problems and symptoms of problems which may be encountered include:

- 1. No flow in system
  - indicated by no volume increase in leachate in tank for given time period; or no flow measurement at the meter.
- 2. Reduced flow in system
  - indicated by significant reduction in leachate pumped in given period of time.
- 3. Failure of single pump
  - indicated by continued high level in Sump 1 and/or alarm light at the control panel.
  - may be indicated by unusual noise at Sump 1.
  - may be indicated by pump elapse time meter.

- 4. Potential for leachate system overflow
  - indicated by significant increase in leachate generated in a given period of time.
  - may also be indicated by a disruption in scheduled leachate pumping or haulage.

Procedures for identifying the cause of these problems are presented in the sections which follow.

# 2.15.1 No Flow or Significantly Reduced Flow in System

A sudden decrease or stoppage of discharge to the Village manhole or inflow of leachate into the storage tank may be caused by:

- i) an electrical failure in the system;
- ii) a solid or air blockage in the forcemain;
- iii) a leak or rupture in the forcemain; or
- iv) closed isolation valve.

Ensure all circuit breakers are turned on, pumps are set to automatic and capacity is available in tank (if directed to the tank). A power outage at the Site will provide an alarm condition via a dedicated phone line to the Village of Wauconda police station. Ensure that isolation valves at Sump 1, forcemain chambers and the tank are open. Proceed as follows:

- Switch pumps to manual "on" position and monitor the meter chamber or inflow into the tank (as proper for the direction of pumping) and pump elapse time meter on the electrical panel. Note whether pumps operate in "on" position; reset pumps to automatic (Note: when pump is on and operating properly it will register approximately 5.6 Amps on the electrical panel and 40 to 50 psi discharge pressure at the meter chamber);
- 2. Check Sump 1 to determine whether leachate level is above the high level (on) switch to both pumps;
- 3. If leachate is below high level switch, manually trigger this switch to start both pumps. If manual pump operation works and level switches do not, have electrician check level switches and control circuit. Turn on manually as needed until repaired.
- Turn pumps to "on" position using the push-botton switch at Sump 1 and listen for unusual pump noises or vibration.

If pumps operate and do not pump down sump, check forcemain for breakage/blockage (i.e. examples include open valve at Sump 2, open drain chamber, open meter bypass).

5. If no action is observed at the sumps, have electrician check control circuit, tank high level switch and relay; power supply to sumps and Site, and pump leads.

- 6. Check functioning of air release valve at forcemain chamber and/or air vent at storage tank.
- Connect an air compressor to forcemain pipe fitting(s) and blow out the full length of line or isolated segments at an air pressure not to exceed
   90 psi (alternate with task 8 below).
- Obtain approval from Village of Wauconda Public Works to inject
   20-30 gallons of a domestic cleaning solution to dissolve any potential
   blockage. Flush with fresh water.
- 9. Back-flow tank storage thru the back-up forcemain to drain to Sump 2, observe effluent for solids.
- 10. Contact qualified contractor to pressure test and/or rod-out forcemains.

# 2.15.2 Failure of Single Pump

A single pump failure in Sump 1 may cause a delay or reduction in pumping to the discharge and may be indicated by the elapse run time meter.

If a delay or reduction in leachate flow is detected:

- 1. Check operation of both sumps as follows:
  - turn pumps to manual and check operation;
  - reset to automatic and trigger the high-high level switch which would start both pumps.
- 2. Operate pumps independently and measure current draw, discharge pressure and net discharge from sump by measuring depth of liquid and recording pump down times for each 1-foot interval;
- 3. If pumps cannot pump down sump, pull pump from sump and check intake screen and impeller for blockage; check impeller for wear; clean or replace the check valve (refer to pump manufacturer's operating and maintenance instructions);
- 4. If pumps are operational and do not pump down the sump, manually pump out the sump into an on-Site tanker or storage tank. Measure inflow into sump following pump out.

### 2.15.3 Potential for Leachate System Overflow

The potential for a leachate system overflow is represented by one or more of the following:

- failure of both pumps,
- high-high level alarm,
- disruption of leachate pumping system or transport by the hauler, or

• disruption of leachate treatment by receiving facility.

At any time that the potential exists for a leachate system overflow, the Village and/or Oplinger Consulting shall immediately notify Ron Frehner (Alternates: John Mackay or Neil Everett). Appropriate action will be determined and subsequent notifications will be made by CRA or WTG as required.

#### 2.16 OPERATION CONTINGENCY PLAN

#### 2.16.1 <u>Mechanical Failure</u>

In the event of a mechanical failure in one or both pumps at Sump 1 or the forcemain breaks or becomes plugged, operation of the system will be maintained on an interim basis by manually pumping leachate from either or both Sumps 1 and 2 to the on-Site storage tank or an on-Site tanker until the necessary repairs are completed. Interim operation may be maintained as follows:

#### Option 1

A standby 2 HP Peabody Barnes electric submersible pump maintained at the Site may be connected to the forcemain at Sump 2 using the Peabody Barnes slide-away coupling assembly system. Automatic pumping may occur from Sump 2 by turning on disconnect at Sump 2 and the main panel keyed switch in Auto. Otherwise pumping may occur by manual setting. Discharge to either the Village manhole or the storage tank can be effected by valve settings.

### Option 2

A portable 0.5 HP electric sump pump complete with attached level switch are maintained at the Site. Use of this option requires flexible discharge hose. (Note: freezing conditions may restrict use of this system in cold periods. Line should be drained immediately after pump is shut off).

# 2.16.2 Volumes of Collected Leachate Exceed Village Limitation and CID Cannot Schedule Pick-up

### Option 1

Typically Mr. Frank Inc. can supply a 5,000-gallon highway tanker to be parked at the Site overnight or for a weekend for additional temporary storage.

### Option 2

If directed by CRA or the WTG, temporary additional storage of up to 4,300 gallons of leachate can be readily provided in the concrete containment dyke at the building enclosure (18 inches of storage depth). The operator shall open the 4-inch isolation valve to the east sample port and exit the building. A 2-inch diameter electric actuator valve on the sample port can be opened and closed from the keyed switch at the building entrance to effect storage. Leachate can be removed via a vacuum suction line provided by Mr. Frank licensed waste hauler. Concrete wall/floor pressure wash cleaning shall be provided to remove residual leachate/stains.

## 2.16.3 <u>Electrical Failure</u>

In the event of an electrical failure (i.e. power outage), the Village of Wauconda will supply a portable auxiliary diesel engine-generator

(120/240 VAC, 200 AMP) for stand-by power supply to the system. The generator will be connected to the 240 volt, 3 phase receptacle located at the control panel.

An operational telephone as well as a list of contractors' names, addresses and telephone numbers is to be kept at the Site for carrying out emergency and maintenance work.

## 3.0 LANDFILL CAP, DRAINAGE AND PERIMETER FENCE

### 3.1 GENERAL STATUS

Figure 3.1 depicts the general Site layout and conditions. The landfilled area of the Site consists of approximately 49 acres. It is estimated that 3.2 million cubic yards of waste were disposed into the landfill. When the landfill was closed in 1978, clay cover was placed over the waste with a typical thickness between 2 and 4 feet; however, localized areas exist where the thickness is less than 2 feet. As required by USEPA, all areas of the cap shall include a minimum of 2 feet of compacted clay and a minimum of 6 inches suitable topsoil and grass cover. Deficient areas of the cap will be upgraded in 1992.

There are four (4) existing leachate monitoring wells (LW 501, LW 502, LW 503 and LW 504) and a concrete manhole installed into the waste for measurement of leachate levels. In addition, five (5) gas vents (GV 3, 4, 5, 6 and 7) have been installed into the waste for air and methane monitoring.

Groundwater monitoring wells have been constructed about the landfill perimeter and off Site to monitor groundwater flow and quality.

The existing surface water drainage system includes four swales on the north landfill slope discharging to Mutton Creek and a swale between the permitted and unpermitted landfills at the southwest side of the

Site, which discharges to the unfilled area. All swales are currently grass-lined.

The perimeter of the landfilled area has been secured with a 6-foot industrial chain-link fence. Fence fabric comprises No. 9 gauge, galvanized steel in a 2-inch diamond pattern. Double opening vehicle access gates have been constructed at three locations: Garland Road north, Garland Road South and the south-west side of the landfill.

The Site is accessed by the main gate on Garland Road (northeast corner) for all routine operation and maintenance functions including inspections. The secondary gates located on Garland Road (southeast corner) and adjacent to the unfilled area (southwest side) are used for heavy construction equipment access.

All gates are locked. Keys are maintained by the Village of Wauconda, Oplinger Consulting, WTG, CRA and USEPA.

Interim gravel access roads have been constructed as shown on Figure 3.1 (previously referred). As a minimum, roads will be repaired and regraded once per year under the direction of Oplinger Consulting. Additional regrading and smoothing, if required, shall be conducted by the Village of Wauconda. Repairs shall be pre-approved by CRA or the WTG. Snow removal will be conducted as required by the Village and Oplinger Consulting. Snow falls exceeding 2 inches will require plowing.

# 3.2 LANDFILL CAP, DRAINAGE AND PERIMETER FENCE INSPECTION

Oplinger Consulting and CRA will complete monthly inspections of the landfill cover, drainage system and access roads except during periods of complete snow cover. Inspections of the Site fence will be conducted by Oplinger Consulting and CRA once monthly. To the extent possible, this work will be undertaken in conjunction with the monthly leachate collection system inspection by the Village.

The following shall be noted for the monthly inspection.

- (1) Evidence of unauthorized Site entry and use;
- (2) Cuts and vandalism of the fence;
- (3) Progress of growth in vegetative cover (provide written comment);
- Evidence of erosion or destruction of Site cover, areas of surface water ponding, exposed refuse or leachate seeps, evidence of animal borrows;
- (5) Locations of possible presence of landfill gas as determined by HNu meter, combustible gas meter or olfactory assessment; and
- (6) Deterioration of on-Site gravel access roads including excessive ruts, wash-outs or settlement (ponding).

The person(s) completing the inspection shall complete a standard inspection and maintenance checklist. A sample copy of the checklist is included in Appendix C. Completion of the monthly inspection shall be acknowledged in the specified Maintenance/Inspection/Visitor Log.
Annually, the landfill will be inspected by a thorough walk-over based on a 75-foot by 75-foot grid pattern to identify any deficiencies. An organic vapor analyzer capable of detecting methane will be used to assist in the detection of landfill gas emissions from the cap. Field notes and results will be attached to the inspection report.

## 3.2.1 Landfill Cap Maintenance

### <u>General</u>

Landfill cap maintenance shall be performed as required, based on the results of the monthly or annual inspection.

Maintenance shall be conducted by a qualified earth moving contractor and shall be supervised by Oplinger Consulting or CRA. Requirements may include: filling depressions due to settlement to eliminate ponding; filling gullies or eroded areas; filling and/or repairs to visible cap cracking in the vicinity of the leachate collection drain; and covering any areas of exposed refuse. Exposed refuse must be covered by at least 24 inches of clay and 6 inches of topsoil. Filled areas should be sloped to prevent ponding and erosion (minimum of 2 percent). In conjunction with the filling, some regrading may be required to meet the slope requirements or to fill areas with excessive slopes. In conjunction with cap cracking repairs, some surface preparation may be required. Disturbed areas and other areas of poor vegetative growth will be revegetated.

Existing stockpiles of clay, topsoil and general fill are provided on Site. To the extent possible, a minimum of 1,000 cy of each material type are maintained.

### <u>Performance</u>

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All field working locations will be reviewed with the Contractor. All working locations will include a minimum 2 feet extension distance to allow match grading and integration and blending with adjacent suitable clay thicknesses.

For any cap disturbance larger than 1 acre, required temporary erosion control fence and/or straw bales will be installed for the period of construction. Temporary erosion control measures are consistent with Illinois Environmental Protection Agency Standards (1987) and are designed to dissipate and filter runoff as sheet flow and preclude sediment transport from the landfill surface during active work. Straw bales and geofabric fence are proven techniques for these controls.

At all work locations (including the 2 feet extension distance), topsoil will be stripped and temporarily stockpiled along the upslope side to divert future surface flow around work areas.

Suitable clay soil will be placed and compacted in 6 to 8-inch lifts to meet required grades. Soil spreading and compaction will be undertaken with a compactor dozer with multiple passes at low speed to

reduce flexural cracking of the cover over the waste. Alternatively a steel-drum sheepsfoot compactor may be used on slopes less than 3.5H:1V.

A minimum of 6 inches of topsoil comprising replacement of existing and imported material will be placed over all disturbed surfaces and graded for seed and mulch application. A disturbed surface will be defined by removal of vegetation and topsoil layer to expose the clay surface and will not include flattened grass cover.

Seeding will be completed by a qualified seed and mulch contractor using standard equipment within the industry. Seeding will include provisions for watering until grass growth reaches 1 inch height.

## Material Selection

a) <u>Clay</u>

Imported clay shall be capable of achieving a permeability of  $1 \times 10^{-7}$  cm/sec or less, from a source approved by CRA, with less than 50% by weight of sand or gravel passing the No. 4 sieve and a minimum of 5 percent fines passing the No. 200 sieve and shall be classified as CL or ML under the Unified Soils Classification System. The clay shall be free of unsuitable materials which include and are not limited to the following:

- 1. material containing loam, roots or organic matter;
- 2. frozen material or material containing snow or ice;

- 3. clays which are classified as inorganic clays of high plasticity;
- 4. soft and/or organic clays and silts of low strength;
- 5. frost susceptible silts or clays;
- 6. swelling clays;
- rock and lumps of material with dimensions greater than specified layer thickness before compaction;
- 8. trees, stumps, branches or any other wood or lumber; and
- 9. hazardous chemical substances.
- b) <u>Topsoil</u>

Topsoil suitable for use shall be good quality, fertile loamy material free from roots, vegetation, weeds, parts of weeds, weed seeds and other debris or foreign matter. The source of topsoil shall be an area free from growth of, Japanese Clover, Horsetail, Morning Glory, and other persistent weed plants. Topsoil should be free from lumps, stones and clods over one-inch in diameter. Topsoil shall not contain excess amounts by volume of organic matter, heavy clay or sand.

Topsoil shall not be obtained from swampy areas and shall not be infested with the seeds of noxious weeds. The pH of the topsoil shall be between 5.5 and 7.0

Imported topsoil shall be inspected and approved by Oplinger Consulting or CRA prior to delivery to the Site. Topsoil stripped from the working area on-Site may be reused if suitable as determined by Oplinger Consulting or CRA.

c) <u>Grass Seed</u>

If available, grass seed mixture will include:

50% Kentucky Bluegrass
30% Creeping Red Fescue
10% Perennial Ryegrass
10% Crownvetch
The seed rate shall be approximately 135 lb/acre

## 3.2.2 Roads and Access Maintenance

As a minimum, gravel road maintenance is typically performed in late fall (end of rainy season and prior to freezing conditions) and spring (snow melt and thaw conditions). Repairs shall be conducted by a local contractor utilizing proper equipment. Requirements may include: re-grading or backdragging ruts or gullies, filling settled or ponded areas; reconstructing wash-out areas; and new road construction on the landfill cap.

Redressing existing roads can be enhanced by adding approximately 1 1/2 inches of surface aggregate as IDOT Class B, CA6 gradation (maximum diameter 1-inch) as a wearing surface. New road construction will include approximately 8-inches of base gravel compacted on a graded and

firm clay surface and 1 1/2 inches of surface aggregate as specified above. In addition, at traditionally soft or wet areas, a non-woven geotextile fabric should be placed beneath the base gravel on the prepared surface to assist support, wheel bearing and subdrainage.

## 3.2.3 Other Maintenance

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Other maintenance functions include: fence repairs and grass mowing. These activities will be conducted as determined necessary and under the direction of Oplinger Consulting or CRA.

## 3.3 MONITORING WELLS INSPECTION

The monitoring wells are to be inspected by CRA during groundwater elevation readings (a minimum of once per annum).

The following will be noted and corrections made if required:

- The casing surrounding the monitoring well is securely in place and that the locks are in place;
- (2) The bleed hole at the bottom of the casing is clear;
- (3) Nothing is left down the well;
- (4) The depth to the bottom of the well is not decreasing. A decreasing depth indicates that the well is becoming silted up and should be re-developed;
- (5) The posts surrounding the monitoring well are securely in place and visible, and
- (6) The well code is clearly visible and legible on the well casing.

## 3.3.1 Monitoring Well Maintenance

Monitoring well maintenance will be performed as required, based on the results of the inspection.

Maintenance requirements may include:

- cleaning out wells that have become silted up using water under high pressure;
- replacing a bent section in the well;
- ensuring that the locks on the monitoring wells are well oiled;
- painting of well casing; and
- repainting well code on well casing.

## 3.4 GAS VENTS

Passive gas vents do not require much inspection or maintenance. Personnel should avoid going near gas vents except when required to do so to perform inspections. This should be done by working upwind of the vents where possible or by remaining more than 20 feet from each vent.

Vents should be inspected during the cap inspection to ensure that the vents are properly labelled, that the vent is clear and not obstructed and that the cap does not leak or allow surface water ponding around the vent.

## 4.0 INSPECTION/MONITORING SCHEDULE AND REPORTING

## 4.1 GENERAL

Operation, maintenance and monitoring requirements for the Wauconda Landfill are summarized in Table 4.1. Operation and maintenance include routine system inspections, scheduled component maintenance, unscheduled maintenance in response to an observed failure, and record keeping/reporting of all such activities. All inspections and maintenance performed at the Site must be entered in the hard-cover Inspection/Maintenance/Visitor Log located in the tank enclosure building.

A list of project contacts including names, addresses and telephone numbers is provided in Appendix D and will also be maintained at the Site. A telephone and answering machine which are operational will be maintained at the Site.

## TABLE 4.1

Page 1 of 2

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## OPERATION AND MAINTENANCE WAUCONDA LANDFILL 1992 - 1995

|                                                                  | Task                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Period or Event<br>Complete By:                                                                                                                                            | Project<br>Team                                                                          |
|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| A.C                                                              | roundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                            |                                                                                          |
| 1.<br>2.<br>3.                                                   | 4th semi-annual 1992 groundwater sampling event<br>4th annual 1992 groundwater sampling event<br>5th annual 1993 groundwater sampling event                                                                                                                                                                                                                                                                                                                        | May, 1992<br>September 1, 1992<br>September 1, 1993                                                                                                                        | CRA<br>CRA<br>CRA                                                                        |
| 4.<br>5.                                                         | 6th annual 1994 groundwater sampling event<br>Reporting - See section G                                                                                                                                                                                                                                                                                                                                                                                            | September 1, 1994                                                                                                                                                          | CRA                                                                                      |
| <u>}. A</u>                                                      | ir                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                            |                                                                                          |
| 1.                                                               | Air quality monitoring during cap upgrade construction                                                                                                                                                                                                                                                                                                                                                                                                             | May 1 - September 30, 1992<br>August 1992                                                                                                                                  | CRA                                                                                      |
| 3                                                                | Install 10 new gas vents                                                                                                                                                                                                                                                                                                                                                                                                                                           | August 1992                                                                                                                                                                | CRA                                                                                      |
| 4.                                                               | Weekly methane monitoring at vents                                                                                                                                                                                                                                                                                                                                                                                                                                 | August, 1992 - August, 1993                                                                                                                                                | CRA                                                                                      |
| 5.                                                               | Semi-annual VOC monitoring at vents                                                                                                                                                                                                                                                                                                                                                                                                                                | September, 1992 and February, 1993                                                                                                                                         | CRA                                                                                      |
| 6.                                                               | Landfill gas monitoring (soil gas survey)                                                                                                                                                                                                                                                                                                                                                                                                                          | September, 1993                                                                                                                                                            | CRA                                                                                      |
|                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                            |                                                                                          |
| <u>. L</u>                                                       | eachate Management                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                            |                                                                                          |
| <u>:. L</u><br>1.                                                | eachate Management<br>Operate and maintain Leachate System                                                                                                                                                                                                                                                                                                                                                                                                         | Daily                                                                                                                                                                      | Village                                                                                  |
| <u>: L</u><br>1.<br>2.                                           | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11                                                                                                                                                                                                                                                                                                                                                  | Daily<br>If needed                                                                                                                                                         | Village<br>Village/Hauler                                                                |
| <u>. L</u><br>1.<br>2.<br>3.                                     | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility                                                                                                                                                                                                                                                                                                       | Daily<br>If needed<br>Emergency only (notify CRA)                                                                                                                          | Village<br>Village/Hauler<br>Oplinger/Hauler                                             |
| 1.<br>2.<br>3.<br>4.                                             | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility<br>Guarantee period for forcemain to Village MH 12-24<br>Juggestion Forcemain F                                                                                                                                                                                                                       | Daily<br>If needed<br>Emergency only (notify CRA)<br>January - December, 1992                                                                                              | Village<br>Village/Hauler<br>Oplinger/Hauler<br>Heritage                                 |
| <u>. L</u><br>1.<br>2.<br>3.<br>4.<br>5.                         | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility<br>Guarantee period for forcemain to Village MH 12-24<br>Inspection - See section F<br>Reporting - See section G                                                                                                                                                                                      | Daily<br>If needed<br>Emergency only (notify CRA)<br>January - December, 1992                                                                                              | Village<br>Village/Hauler<br>Oplinger/Hauler<br>Heritage                                 |
| 2.<br>1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.                     | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility<br>Guarantee period for forcemain to Village MH 12-24<br>Inspection - See section F<br>Reporting - See section G<br>Sample analysis per sump overflow                                                                                                                                                 | Daily<br>If needed<br>Emergency only (notify CRA)<br>January - December, 1992<br>If overflow to Mutton Cr.                                                                 | Village<br>Village/Hauler<br>Oplinger/Hauler<br>Heritage<br>CRA                          |
| 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.                     | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility<br>Guarantee period for forcemain to Village MH 12-24<br>Inspection - See section F<br>Reporting - See section G<br>Sample analysis per sump overflow<br>Sample analysis per IEPA permit for sewer disposal                                                                                           | Daily<br>If needed<br>Emergency only (notify CRA)<br>January - December, 1992<br>If overflow to Mutton Cr.<br>Before August, 1992                                          | Village<br>Village/Hauler<br>Oplinger/Hauler<br>Heritage<br>CRA<br>CRA                   |
| <u>. L</u><br>1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.<br>9. | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility<br>Guarantee period for forcemain to Village MH 12-24<br>Inspection - See section F<br>Reporting - See section G<br>Sample analysis per sump overflow<br>Sample analysis per IEPA permit for sewer disposal<br>Sample analysis per CID requirements                                                   | Daily<br>If needed<br>Emergency only (notify CRA)<br>January - December, 1992<br>If overflow to Mutton Cr.<br>Before August, 1992<br>By volume to CID                      | Village<br>Village/Hauler<br>Oplinger/Hauler<br>Heritage<br>CRA<br>CRA<br>CID            |
| 1.<br>2.<br>3.<br>4.<br>5.<br>6.<br>7.<br>8.<br>9.<br>10.        | eachate Management<br>Operate and maintain Leachate System<br>Stand-by truck delivery to Village lift station #11<br>Stand-by truck delivery to CID Facility<br>Guarantee period for forcemain to Village MH 12-24<br>Inspection - See section F<br>Reporting - See section G<br>Sample analysis per sump overflow<br>Sample analysis per IEPA permit for sewer disposal<br>Sample analysis per CID requirements<br>Brief summary report from STP effluent results | Daily<br>If needed<br>Emergency only (notify CRA)<br>January - December, 1992<br>If overflow to Mutton Cr.<br>Before August, 1992<br>By volume to CID<br>Summary - monthly | Village<br>Village/Hauler<br>Oplinger/Hauler<br>Heritage<br>CRA<br>CRA<br>CID<br>Village |

## D. Cap Upgrades

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| 1.<br>2. | Obtain access and permits for Mutton Creek<br>Cap upgrade bid document preparation, contractor | March 1, 1992               |
|----------|------------------------------------------------------------------------------------------------|-----------------------------|
|          | bidding, bid review and award                                                                  | February 1 - March 15, 1992 |
| 3.       | Cap upgrade and contractor demobilization                                                      | May 1 - October 1, 1992     |
| 4.       | submission                                                                                     | December 31, 1992           |

## TABLE 4.1

#### OPERATION AND MAINTENANCE WAUCONDA LANDFILL 1992 - 1995

|                                  | Task                                                                                                                                                                                                     | Period or Event<br>Complete By:                                                                                                                               | Project<br>Team                                                              |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| <u>E. R</u>                      | D/RA Work Plan                                                                                                                                                                                           |                                                                                                                                                               |                                                                              |
| 1.<br>2.<br>3.<br>4.             | Revise RD/RA per Final Remedial Design<br>Revise QAPP per lab method for air VOC<br>Revise O & M per Final Remedial Design<br>Revise H & S Plan per Final Remedial Design Project<br>Specifications Ps.6 | March 1, 1992<br>March 1, 1992<br>March 1, 1992<br>March 1, 1992                                                                                              | CRA/WTG<br>CRA/WTG<br>CRA/WTG<br>CRA/WTG                                     |
| <u>F. S</u> i                    | ite Inspections                                                                                                                                                                                          |                                                                                                                                                               |                                                                              |
| 1.<br>2.<br>3.<br>4.             | Dick Oplinger regular Site inspection<br>Village of Wauconda inspection of leachate system<br>Monthly Site inspection<br>Annual Site inspection                                                          | Once per week, minimum<br>3 times per week, minimum<br>First week of every month<br>By October 30 of each year                                                | Oplinger<br>Village<br>CRA<br>CRA                                            |
| <u>G. R</u>                      | Reporting                                                                                                                                                                                                |                                                                                                                                                               |                                                                              |
| 1.<br>2.<br>3.<br>4.<br>5.<br>6. | Routine inspection by DO and Village<br>Monthly inspection by CRA<br>Monthly leachate volumes hauled/discharged<br>Monthly report to USEPA<br>Annual monitoring report<br>Air monitoring report          | Weekly, fax to CRA<br>1st week of following month<br>1st week of following month<br>10th of following month<br>75 days after annual sampling<br>January, 1994 | Oplinger/Village<br>CRA<br>Oplinger/Village<br>CRA/WTG<br>CRA/WTG<br>CRA/WTG |
| <u>H. L</u>                      | ab/Data OAOC                                                                                                                                                                                             |                                                                                                                                                               |                                                                              |
| 1.<br>2.<br>3.<br>4.             | Leachate sampling event<br>4th semi-annual 1992 groundwater sampling event<br>4th annual 1992 groundwater sampling event<br>Landfill gas sampling analyses                                               | Before August, 1992<br>May, 1992<br>September 1, 1992<br>December, 1993                                                                                       | CRA-Chic<br>CRA-Chic<br>CRA-Chic<br>CRA-Chic                                 |
| <u>I. Er</u>                     | ngineering Survey (Contract with Lake Co. Survey)                                                                                                                                                        |                                                                                                                                                               |                                                                              |
| 1.<br>2.<br>3.                   | Leachate forcemain as-built<br>Cap upgrade grade stakes, grid, as-built<br>Survey landfill monuments                                                                                                     | March 1, 1992<br>March - October, 1992<br>Once per year                                                                                                       | CRA/Lake Co.<br>CRA/Lake Co.<br>CRA/Lake Co.                                 |

### Note:

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\* All work described herein is completed on behalf of the Wauconda Task Group (WTG) according to the effective period of the approved RD/RA Work Plan (1992 - 1995).

Page 2 of 2

#### 4.2 <u>RECORD KEEPING</u>

Record keeping requirements for operations and maintenance conducted at the Site include written documentation of the following tasks:

- i) inspections performed;
- ii) scheduled and unscheduled maintenance;
- iii) volume of leachate discharged to the Village of Wauconda Sanitary sewer;
- iv) volume, date, manifest for leachate hauled from the Site;
- v) soil volumes brought to the Site;
- vi) sub-contractor work and invoicing; and
- vii) visitors to the Site.

Standard forms for specific tasks are provided in

Appendix C, as follows:

- Weekly summary of leachate volumes discharged to Manhole 12-24;
- Monthly record and manifests for leachate transfer to haulage vehicle;
- Regular, Monthly and Annual Inspection and Maintenance Reports; and
- Monthly sub-contractor record and invoices.

Copies of all forms, once complete, shall be submitted by fax and copy mailed to:

 Mr. Neil Everett
 Dearborn Chemical Company 300 Genesee Street Lake Zurich, Illinois 60047
 Mr. John Mackay Exxon Chemical Americas Lake Zurich Film Plant 351 N. Oakwood Road Lake Zurich, Illinois 60047-1562

Fax: (708) 540-1595

Fax: (708) 540-1483

 Ron Frehner Conestoga-Rovers & Associates 382 West County Road D St. Paul, Minnesota 55112

Fax: (519) 725-1393

The monthly inspection report shall form the basis of the formal monthly report to be prepared by the Wauconda Task Group and submitted to the USEPA, IEPA and the Lake County Health Department.

or

It is to be noted that the monthly inspection shall be completed before the first day of the following month and submitted by fax the same day to CRA.

Copies of all forms will be maintained in a binder at the

Site.

APPENDIX A

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IEPA PERMITS FOR LEACHATE DISPOSAL

Illinois Environmental Protection Agency • P.O. Box 19276, Springfield, IL 62794-9276

PERMIT TO CID. 217/782-6752 DECEMBER 20, 1990 WASTE STREAM NUMBER 970235 APPLICATION RECEIVED: 11/02/90 PERMIT EXPIRES: 12/10/95 PERMIN NUMBER - - 970235-0316000056 PERMIT ISSUED TO: CHEMICAL NASTE MANAGEMENT CHEMICAL MARTE MANAGEMENT 2 NESTBROOK CTR SUITE1000 2 WESTERDOX CTR SUITEIJOU NESTCHERTER WEGTUMESTER . IL. , IL 60153 51153 WASTE NA HER LEACHATE ž HASTE CLASS 30 NON-HAZAPDOUS PERMIT TO RECEIVE THE IMDICATED WASTE IS GRADIED. UITE NAME: CID PROCEUSING 15PA SITE 40.: 0316000056 DISPOSITION OF WARTE: 28 HASTE TREATMENT WAUTE TREATMENT: 22 BTUL DGICAL TREATMENT UTUPAGE: ATTENTION: BOW FREHEFR IEPA GE (FRATOR NO.: 0971850001

NAUTE GENERSTOR: BROWITNG-FERRIS IND OF THE WATEDNDA SAND & GRAVEL \*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 1213 GAMLAND PD

P.J. 508 3151 ADUSTDE:

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60034

TY. MANCONA 77253

THIS PLRHIT IN GRANTED PUBLELT THE THE ATTACHED STALDARD CONDITIONS AND ANY SPECIAL CONDITIONS FISTED DELDA.

vrence W. Easter

LHE:RAH CC:PROWNING-FERRIS IND DF ILL PEGION: MAYABOD

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WARENCE A. FATTER, P.F. by DUC MANAGER, PERMIT PECTION DIVIDION OF LAND POLLUTION LONTHOL

## ILLINOIS ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL PERMIT

1441 FORLEMAN DISCHARG.

LOG NUMBERS: 4193-91

PERMIT NO.: 1991-EN-4193

FINAL PLANS, SPECIFICATIONS, APPLICATION AND SUPPORTING DOCUMENTS PREPARED BY: Joseph Wright, Jr., Attorney

DATE ISSUED: December 6, 1991 CORRECTION DATE: December 6, 1991

SUBJECT: VILLAGE OF WAUCONDA -- Wauconda Landfill Leachate Sewer Connection and Force Main -- Wauconda Sewage Treatment Plant

| PERMITTEE TO CONSTRUCT              | PERMITTEE TO OWN AND OPERATE  |  |  |
|-------------------------------------|-------------------------------|--|--|
| Wauconda Task Group                 | Village of Wauconda           |  |  |
| 500 West Madison Street, 40th Floor | 101 North Main Street         |  |  |
| Chicago, Illinois 60606             | Wauconda, Illinois 60084-0785 |  |  |

Permit is hereby granted to the above designated permittee(s) to construct and/or operate water pollution control facilities described as follows:

A sewer connection consisting of 180' of 6" PVC sewer pipe having one concrete manhole. A force main consisting of 2,640' of 2" high density polyethylene flexible plastic pipe inside of 4" containment pipe. All fittings and appurtenances. Total flow for this project is 2,500 GPD DAF (225 P.E.) for discharge to the Wauconda Sewage Treatment Plant.

- This Operating Permit expires on November 1, 1996.
- This Permit is issued subject to the following Special Condition(s). If such Special Condition(s) require(s) additional or revised facilities, satisfactory engineering plan documents must be submitted to this Agency for review and approval for issuance of a Supplement Permit.
- SPECIAL CONDITION 1: The issuance of this permit does not relieve the permittee of the responsibility of complying with any limitations and provisions imposed by Wauconda.

SPECIAL CONDITION 2: There shall be no arrangement or cross connection by which an unsafe substance may enter the potable portion of a public water supply. The permittee shall comply with Illinois Pollution Control Board regulations 35 Ill. Adm. Code, Subtitle F: Public Water Supplies, Section 607.104 and Illinois Environmental Protection Agency Technical Policy Statements 35 Ill. Adm. Code, Subtitle F, Chapter II, Sections 653.801 through 653.805.

Continued on Page 2

THE STANDARD CONDITIONS OF ISSUANCE INDICATED ON THE REVERSE SIDE MUST BE COMPLIED WITH IN FULL. READ ALL CONDITIONS CAREFULLY.

TGM:EK:jab/3307g/70-71 cc: EPA - Region Joseph Wright, Jr., Attorney Record Binds Richard Snyder Village of Wauconda Robert Fedy 🦯

DIVISION OF WATER POLLUTION CONTROL

fwo Thomas G. McSwiggin, P.E.

Manager, Permit Section

IL 532-0009 WPC 146 (Rev. 2/82)

## ILLINOIS ENVIRONMENTAL PROTECTION AGENCY WATER POLLUTION CONTROL PERMIT

LOG NUMBERS: 4193-91

PERMIT NO.: 1991-HB-4193

FINAL PLANS, SPECIFICATIONS, APPLICATION AND SUPPORTING DOCUMENTS PREPARED BY: Joseph Wright, Jr., Attorney DATE ISSUED: December 6, 1991 CORRECTION DATE: December 6, 1991

SUBJECT: VILLAGE OF WAUCONDA -- Wauconda Landfill Leachate Sewer Connection and Force Main -- Wauconda Sewage Treatment Plant

SPECIAL CONDITION 3: The following shall be incorporated into the project specifications if flexible pipe (PVC, ABS and others note: ASTM 2680-79a under Section 2 recommends D2321 for underground installation) is to be an alternative sewer material:

- Deflection Testing for Flexible Conduit\*
- a. The project engineer shall randomly select portions of the project to be deflection tested. Such portions shall consist of the manhole intervals in the initial 1200 feet of sewer and not less than 10% of the remainder of the sewer project.
- b. If the deflection test is to be run using a rigid ball or mandrel, it shall have a diameter equal to 95% of the base diameter of the pipe as established in proposed ASTM D-3034. The test shall be performed without mechanical pulling devices.
- c. The individual lines to be tested shall be so tested no sooner than 30 days after they have been installed.
- d. Wherever possible and practical, the testing shall initiate at the downstream lines and proceed towards the upstream lines.
- e. No pipe shall exceed a deflection of 5%.
- f. In the event that the deflection exceeds the 5% limit in 10% or more of the manhole intervals tested, the total sewer project shall be tested.
- g. Where deflection is found to be in excess of 5% of the original pipe diameter, the contractor shall excavate to the point of excess deflection and carefully compact around the point where excess deflection was found. The line shall then be retested for deflection. However, should after the initial testing the deflected pipe fail to return to the original size (inside diameter) the line shall be replaced.

\*shall include only 6-inch diameter gravity sewer.

SPECIAL CONDITION 4: <u>All high density polyethylene forcemain and carrier pipe to be</u> SDR 21 or less.

# READ ALL CONDITIONS CAREFULLY: STANDARD CONDITIONS

The Illinois Environmental Protection Act (Illinois Revised Statutes, Chapter 111-1 2, Section 1039) grants the Environmental Protection Agency authority to impose conditions on permits which it issues.

- 1 Unless the construction for which this permit is issued has been completed, this permit will expire (1) two years after the date of issuance for permits to construct sewers or wastewater:sources or (2) three years after the date of issuance for permits to construct treatment works or pretreatment works.
- 2 The construction or development of facilities covered by this permit shall be done in compliance with applicable provisions of Federal laws and regulations, the Illinois Environmental Protection Act, and Rules and Regulations adopted by the Illinois Pollution Control Board.
- 3 There shall be no deviations from the approved plans and specifications unless a written request for modification of the project, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.
- 4 The permittee shall allow any agent duly authorized by the Agency upon the presentation of credentials:
  - a. to enter at reasonable times, the permittee's premises where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit.
  - b. to have access to and copy at reasonable times any records required to be kept, under the terms and conditions of this permit.
  - c. to inspect at reasonable times, including during any hours of operation of equipment constructed or operated under this permit, such equipment or monitoring methodology or equipment required to be kept, used, operated; calibrated and maintained under this permit.
  - d. to obtain and remove at reasonable times samples of any discharge or emission of pollutants.
  - e. to enter at reasonable times and utilize any photographic;

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recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

- 5. The issuance of this permit:
  - a: shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located:
  - b. does not release the permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities;
  - c. does not release the permittee from compliance with other applicable statutes and regulations of the United States. of the State of Illinois, or with applicable local laws. ordinances and regulations;
  - does not take into consideration or attest to the structural stability of any units or parts of the project:
  - e. in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility.
- Unless a joint construction/operation permit has been issued, a permit for operating shall be obtained from the Agency before the facility or equipment covered by this permit is placed into operation.
- 7. These standard conditions shall prevail unless modified by special conditions.
- 8. The Agency may file a complaint with the Board for suspension or revocation of a permit:

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- a. upon discovery that the permit application contained misrepresentations, misinformation or take statements or that all relevant facts were not disclosed; or
- b. upon finding that any standard or special conditions have been violated; or
- c. upon any violation of the Environmental Protection Act or any Rule or Regulation effective thereunder as a result of the construction or development authorized by this permit.

WATER POLLUTION CONTROL PERMIT

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LOG NUMBERS: 3599-91

PERMIT NO.: 1991-EE-3599

DATE ISSUED: August 29, 1991

FINAL PLANS, SPECIFICATIONS, APPLICATION AND SUPPORTING DOCUMENTS PREPARED BY: Richard J. Snyder

SUBJECT: VILLAGE OF WAUCONDA -- Transport Landfill Leachate -- Wauconda Wastewater Treatment Plant

PERMITTEE TO OWN AND OPERATE Wauconda Task Group Dearborn Chemical Company 300 Genesee Street Lake Zurich, Illinois 60047

Permit is hereby granted to the above designated permittee(s) to construct and/or operate water pollution control facilities described as follows:

Transporting landfill leachate by truck from the Wauconda Landfill to a nearby lift station tributary to the Wauconda Sewage Treatment Plant, approximately 3 times per week. Total flow for this project is 2,500 GPD DAF and 5,000 GPD DMF.

This Operating Permit expires on August 1, 1996.

This Permit is issued subject to the following Special Condition(s). If such Special Condition(s) require(s) additional or revised facilities, satisfactory engineering plan documents must be submitted to this Agency for review and approval for issuance of a Supplement Permit.

SPECIAL CONDITION 1: The issuance of this permit does not relieve the permittee of the responsibility of complying with 35 Ill. Adm. Code, Part 307 and/or the General Pretreatment Regulations (40 CFR 403) and any guidelines developed pursuant to Section 301, 306, or 307 of the Federal Clean Water Act of 1977.

SPECIAL CONDITION 2: The issuance of this permit does not relieve the permittee of the responsibility of complying with any limitations and provisions imposed by Wauconda.

(Continued on Page 2)

THE STANDARD CONDITIONS OF ISSUANCE INDICATED ON THE REVERSE SIDE MUST BE COMPLIED WITH IN FULL. READ ALL CONDITIONS CAREFULLY.

TGM:ETK:rd2570q/37-38 cc: EPA - Region 2 Richard Snyder Wauconda Record Binds DIVISION OF WATER POLLUTION CONTROL

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Thomas G. McSwiggin, P.E. Manager, Permit Section

IL 532-0009 WPC 146 (Rev. 2/82) ILLINOIS ENVIRONMENTAL PROTECTION ACCASE WATER POLLUTION CONTROL P' MIT

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#### SPECIAL CONDITION 3:

A. The permittee shall sample the leachate within one year after the issuance of this permit and again within one year prior to application for renewal of this permit, and analyze for priority pollutant volatile, acid, and base/neutral compounds, and for non-priority pollutants. Samples shall be handled, prepared, and analyzed in accordance with 40 CFR 136 or other approved methods. A reasonable attempt shall be made to identify and quantify non-priority pollutant compounds. Identification shall be attempted by a laboratory whose computer data processing programs are capable of comparing the sample mass spectrum to a computerized library of mass spectra, with visual confirmation by an experienced analyst.

All sample collection, preservation, and storage times shall conform to 40 CFR 136 or other approved USEPA procedures and requirements. Detection limits for USEPA Methods, or alternative methods, shall be comparable with the method detection limit in 40 CFR 136 regulations.

- B. In addition to the monitoring required under (A), the permittee shall analyze the leachate for BOD5, ammonia nitrogen, pH, iron, manganese, zinc and oil and grease, using approved test procedures.
- C. Sampling results shall be submitted to this Agency within 60 days of each sampling. Reports shall be mailed to:

Illinois Environmental Protection Agency Division of Land Pollution Control, Permit Section 2200 Churchill Road, Post Office Box 19276 Springfield, Illinois 62794-9276

SPECIAL CONDITION 4: Each load of leachate from the Wauconda Landfill shall be transported to the Village of Wauconda STP in accordance with the procedures set forth in 35 IAC 809, Special Waste Hauling. Specifically, (1) the leachate must be transported by an IEPA licensed special waste hauler and (2) the IEPA, Division of Land Pollution Control manifest system shall be utilized for each load of leachate transported to the STP. When completing manifests: (1) "0971850001" shall be utilized as the Generator ID No. (identification number for the Wauconda Landfill), (2) "0971850006" shall be utilized as the Designated Facility's ID No. (identification number for the Village of Wauconda STP) and "911117" shall be utilized as the Authorization Number which identifies the leachate being transported from the Wauconda Landfill to the Village of Wauconda STP.

IL 532-0009 WPC 146 [Rev. 2/82]

#### READ ALL CONDITIONS CAREFULLY STANDARD CONDITIONS

The Illinois Environmental Protection Act (Illinois Revised Statutes, Unapter 111-1-2, Section 1039) grants the Environmental Protection Agency authority to impose conditions on permits which it issues

- 1 Unless the construction for which this permit is issued has been completed, this permit will expire (1) two years after the date of issuance for permits to construct sewers or wastewater sources or (2) three years after the date of issuance for permits to construct treatment works or pretreatment works.
- The construction or development of facilities covered by this permit shall be done in compliance with applicable provisions of Federal laws and regulations, the Illinois Environmental Protection Act, and Rules and Regulations adopted by the Illinois Pollution Control Board.
- 3 There shall be no deviations from the approved plans and specifications unless a written request for modification of the project, along with plans and specifications as required, shall have been submitted to the Agency and a supplemental written permit issued.
- 4 The permittee shall allow any agent duly authorized by the Agency upon the presentation of credentials
  - a to enter at reasonable times, the permittee's premises where actual or potential effluent, emission or noise sources are located or where any activity is to be conducted pursuant to this permit.
  - b to have access to and copy at reasonable times any records required to be kept under the terms and conditions of this permit.
  - c to inspect at reasonable times, including during any hours of operation of equipment constructed or operated under this permit, such equipment or monitoring methodology or equipment required to be kept, used, operated, calibrated and maintained under this permit.
  - d. to obtain and remove at reasonable times samples of any discharge or emission of pollutants.
  - e. to enter at reasonable times and utilize any pholographic,

recording, testing, monitoring or other equipment for the purpose of preserving, testing, monitoring, or recording any activity, discharge, or emission authorized by this permit.

- 5. The issuance of this permit.
  - a. shall not be considered as in any manner affecting the title of the premises upon which the permitted facilities are to be located;
  - b. does not release the permittee from any liability for damage to person or property caused by or resulting from the construction, maintenance, or operation of the proposed facilities;
  - c. does not release the permittee from compliance with other applicable statutes and regulations of the United States, of the State of Illinois, or with applicable local laws, ordinances and regulations;
  - d does not take into consideration or attest to the structura! stability of any units or parts of the project:
  - in no manner implies or suggests that the Agency (or its officers, agents or employees) assumes any liability, directly or indirectly, for any loss due to damage, installation, maintenance, or operation of the proposed equipment or facility
- 6. Unless a joint construction operation permit has been issued, a permit for operating shall be obtained from the Agency before the facility or equipment covered by this permit is placed into operation.
- These standard conditions shall prevail unless modified by special conditions
- The Agency may file a complaint with the Board for suspension or revocation of a permit:
  - a upon discovery that the permit application contained misrepresentations, misinformation or false statements or that all relevant facts were not disclosed; or
  - b. upon finding that any standard or special conditions have been violated; or
  - c. upon any violation of the Environmental Protection Act or any Rule or Regulation effective thereunder as a result of the construction or development authorized by this permit.

## APPENDIX B

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# MANUFACTURERS' INFORMATION -LEACHATE COLLECTION, TRANSFER AND STORAGE SYSTEM

Specifications, operating criteria and local suppliers for the major components and mechanical/electrical equipment are summarized herein.

Item

Component

| B.1  | Submersible Pumps              |                                   |  |  |  |  |
|------|--------------------------------|-----------------------------------|--|--|--|--|
| B.2  | Flow Meter and Remote Read-Out |                                   |  |  |  |  |
| B.3  | Float Control Switches         |                                   |  |  |  |  |
| B.4  | Slide-away Coupl               | Slide-away Coupling Devices       |  |  |  |  |
| B.5  | Air Release Valve              | Air Release Valve                 |  |  |  |  |
| B.6  | Isolation Valves               | - swing check<br>- ball<br>- gate |  |  |  |  |
| B.7  | Pressure Gage                  |                                   |  |  |  |  |
| B.8  | Sump Chambers a                | Sump Chambers and Access Covers   |  |  |  |  |
| B.9  | Storage Tank                   |                                   |  |  |  |  |
| B.10 | Tank Level Indica              | Tank Level Indicator              |  |  |  |  |
| B.11 | Heat Tracing                   | Heat Tracing                      |  |  |  |  |
| B.12 | Enclosure Buildin              | Enclosure Building Construction   |  |  |  |  |
| B.13 | Electrical                     |                                   |  |  |  |  |
| B.14 | Miscellaneous Co               | Miscellaneous Components          |  |  |  |  |

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#### APPENDIX B

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#### WAUCONDA LANDFILL LEACHATE COLLECTION AND STORAGE SYSTEM SYSTEM COMPONENTS

|            | Item                                         | Location                                            | Description                                                                                        | Function                                                                                                           | Suppliers                                                   | Notes                                                                                      |
|------------|----------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| B.1        | <ul> <li>effluent pumps</li> </ul>           | Sump 1                                              | Cast iron submersible effluent<br>pumps, Hydromatic SKHD150<br>1-1/2 Hp, 240 Volt, 3ø,<br>3450 RPM | Pump leachate to forcemain<br>upon demand.                                                                         | Metropolitan Pump Co.<br>Romeoville, IL.<br>(708) 972-9400  | Rated for 26 gpm at 100 ft.<br>total dynamic head                                          |
|            | • auxiliary pumps                            | Stored in tank<br>enclosure building,<br>and sump 2 | Cast iron submersible<br>effluent pumps Peabody<br>Barnes Model E202 2HP,<br>230 V, 1 Ø, 3450 RPM  | Contingency system to Pump<br>leachate from collection system<br>sump through forcemain, Must be<br>hand-operated. | Gasvoda & Assoc. Inc.<br>Calumet City, IL<br>(312) 891-4400 | Rated for 30 gpm at 80 ft.<br>total dynamic head                                           |
| B.2        | • flow meter                                 | Meter chamber                                       | Model 625, 2"Ø,<br>obstructionless, magnetic<br>remote read-out                                    | Record total volume and flow<br>rate of leachate discharge to<br>Village MH12-24                                   | Sparling-Tiger Mag<br>El Monte, CA                          | Stainless steel bolts,<br>flanged, 110 V DC                                                |
| B.3        | <ul> <li>sump level<br/>switches</li> </ul>  | Sumps 1, 2                                          | Roto-float normally open<br>Suspended mercury float<br>switches Model No. S30N0                    | Switch pump on or off based on<br>leachate level in sump and<br>activate high level alarm.                         | Gasvoda & Assoc. Inc.<br>Calumet City, IL<br>(312) 891-4400 | Sump 1 low level shut off,<br>intermediate as pump on,<br>high as tandem pump<br>operation |
| B.4        | <ul> <li>slide-away<br/>couplings</li> </ul> | Sump 1                                              | Metropolitan Pump Company                                                                          | Removal and installation of effluent pumps from top of sump without entering.                                      | Metropolitan Pump Co.<br>Romeoville, IL<br>(708) 972-9400   |                                                                                            |
|            | <ul> <li>slide-away<br/>couplings</li> </ul> | Sump 2                                              | Cast brass with teflon coated<br>O-ring<br>Peabody-Barnes<br>Model BAF1-1/4M                       | Removal and installation of effluent pumps from top of sump without entering.                                      | Gasvoda & Assoc. Inc.<br>Calumet City, IL<br>(312) 891-4400 | Back-up pumping location                                                                   |
| <b>B.5</b> | • air release valve                          | Air release chamber                                 | 1" threaded, universal                                                                             | Expel pumped air, allow air<br>entry while draining pipe                                                           | Crispen-Multiplex<br>Berwick, PA                            | Pumping chamber installed<br>at forcemain high point                                       |
| <b>B.6</b> | <ul> <li>check valve #1</li> </ul>           | Mounted to pumps                                    | Neoprene ball                                                                                      | Prevent backflow of leachate to sump.                                                                              | Metropolitan Pump Co.<br>Romeoville, IL                     | Horizontal mount, self<br>cleaning                                                         |
|            | <ul> <li>check valve #2</li> </ul>           | Inlet to tank,<br>drain chamber                     | 2-inch, Brass swing check                                                                          | Prevent leachate in storage tank<br>or forcemain from draining back<br>to collection sumps.                        |                                                             |                                                                                            |
|            | • ball valve                                 | Sumps 1, 2<br>Meter chamber                         | 2-inch brass ball valves                                                                           | Prevent draining of forcemain when removing components.                                                            |                                                             |                                                                                            |
|            |                                              | Drain chamber                                       |                                                                                                    |                                                                                                                    |                                                             |                                                                                            |
|            | <ul> <li>gate valves</li> </ul>              | Tank inlet, outlet<br>piping                        | 2-inch gate inlet,<br>(2) 4-inch gate outlet,                                                      | Control flow out of tank both inside building and at truck loading pad.                                            |                                                             |                                                                                            |
|            | <ul> <li>actuator valve</li> </ul>           | tank outlet                                         | 2-inch, electric                                                                                   | automatic open, close to drain tank<br>into concentration dike                                                     |                                                             | mounted with 4 inch gate valve                                                             |

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#### APPENDIX B

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#### WAUCONDA LANDFILL LEACHATE COLLECTION AND STORAGE SYSTEM SYSTEM COMPONENTS

|      | Item                                             | Location                         | Description                                               | Function                                                                                                        | Suppliers          | Notes                                             |
|------|--------------------------------------------------|----------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------|
| B.7  | • pressure gage                                  | Meter chamber                    | P500, 3 1/2" dial<br>LM, 60 psi                           | Measure pump discharge pressure                                                                                 | Amatek             | Mounted on 1/4"Ø NPT                              |
| B.8  | access hatch                                     | Sumps 1, 2, meter<br>chamber     | 24 x 36                                                   | Man-entry, pump removal                                                                                         | Halliday           | Aluminum and stainless steel                      |
| B.9  | <ul> <li>storage tank</li> </ul>                 | Enclosure building               | 10,000 gal., 17 ft. high<br>10 ft. dia.                   | Temporary leachate storage,<br>staging for haulage                                                              |                    | Steel construction, on concrete pad with concrete |
| B.10 | <ul> <li>tank level<br/>measure</li> </ul>       | Tank side                        | Moorman Bros.<br>Model 75-SS                              | Indicate volume of leachate in storage tank.                                                                    |                    | containment                                       |
|      | <ul> <li>tank high level<br/>alarm</li> </ul>    | Tank                             | Moorman Bros.<br>Model 75-SS                              | Indicate tank filled to high level<br>set point, stop pump operation to<br>prevent pump overflow.               |                    |                                                   |
|      | <ul> <li>tank leak<br/>indicator</li> </ul>      | Building sump                    | Moorman Bros.<br>Model 75–SS                              | Indicate if leachate leaks from tank to containment berm area.                                                  |                    |                                                   |
| B.11 | • heat trace                                     | Tank inlet<br>outlet piping      | Cooperheat                                                | Keep forcemain from freezing in cold weather if pumps not operating.                                            | Andcor             |                                                   |
|      | <ul> <li>tank heating<br/>panels</li> </ul>      | Tank walls                       | Cooperheat EGL-500 tank<br>heating panels 500-watt rating | Keep storage tank from freezing in cold weather                                                                 | Andcor             |                                                   |
| B.12 | <ul> <li>control panel<br/>contactors</li> </ul> | main panel                       | Square D Size 0<br>Type 509-A01                           | Indicate status of pumps and<br>leachate levels in sumps and<br>storage tanks and allow remote<br>pump control. |                    |                                                   |
|      | • pilot lamps                                    |                                  | 6 watt, 115 Volt                                          |                                                                                                                 |                    |                                                   |
|      | • control relay                                  |                                  | 120V KRPA-14AG720(5)                                      |                                                                                                                 | Potter & Brumfield |                                                   |
|      | <ul> <li>key auto switch</li> </ul>              | main panel                       | Type KS43K5<br>Class 9001                                 | Set operating components                                                                                        | Square D           |                                                   |
|      | • thermostat                                     |                                  |                                                           | Activate tank heating panels.                                                                                   |                    |                                                   |
|      | • thermostat                                     |                                  |                                                           | Activate heat trace.                                                                                            |                    |                                                   |
|      | <ul> <li>pump circuit<br/>breakers</li> </ul>    | main panel                       | 15 amp, 240V, 3Ø                                          |                                                                                                                 | Square D           |                                                   |
|      | • Fuses                                          | main panel<br>service disconnect | FRN-R-100(3)<br>little fuse FNLR - 100(3)                 |                                                                                                                 |                    |                                                   |

#### APPENDIX B

#### WAUCONDA LANDFILL LEACHATE COLLECTION AND STORAGE SYSTEM SYSTEM COMPONENTS

|             | Item                                   | Location           | Description                        | Function                                                                                                                                | Suppliers | Notes                                                 |
|-------------|----------------------------------------|--------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------------------------------------------|
| <b>B.13</b> | <ul> <li>building enclosure</li> </ul> | ~                  | wood frame and fiberglass cladding | house tank and concrete containment                                                                                                     | builder   | not heated, lockable door,<br>telephone, file storage |
| Misc.       | flexible pipe     connector            | tank inlet piping  |                                    | Prevent transmission of forcemain<br>movement to downstream joints<br>and fittings and relieve stresses<br>on upstream joints/fittings. |           |                                                       |
|             | • quick coupler                        | tank outlet piping |                                    | Connection to tanker truck hose<br>for removing leachate from<br>storage tank.                                                          |           |                                                       |

B.1 SUBMERSIBLE PUMPS

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PROJECT LEACHATE PUMP STATION

LOCATION WAUCONDA, ILLINOIS

ARCHITECT

ENGINEER CONESTOGA-ROVERS & ASSOCIATES

**REMOMBUNE CONTR. HERITAGE REMEDIATION, INC.** 

REPRESENTATIVE ROBERT L. WEDELL

DATE JANUARY 9, 1992

SUBMITTED BY



# METROPOLITAN

- PUMPS
- CONTROLS
- PUMP SYSTEMS



1400 BLUFF ROAD

**ROMEOVILLE, ILLINOIS 60441** 

PHONE: AREA 708-972-9400 FAX: 708-972-9594

## SPECIFICATIONS

JOB: LEACHATE PUMPS FOR THE LANDFILL WAUCONDA, ILLINOIS

### DUPLEX LEACHATE PUMPS

(2) SKHD150M3 pumps with 2" discharge MODEL: CAPACITY: 25 GPM @100' TDH (3/4" solids) MOTOR(S): 11 HP, 3450 RPM, 240 volt, 3 PH, 60 HZ, 1.2 service factor CONTROL: SANCE IT XDUNCKARCOSKAS DEMIK SOKAN MALAR DEMAKS BY OTHERS GODANON RADEKTONINOLOUDENTHADRORVICS STATISTICS LINES LINES (NHORE XNHOX XNHA XNH XHHAK XKSCHWARK KAKAKAK HX NEMAXX Kencicisade. BY OTHERS ALARM:

BASIN: BY OTHERS

ACCESSORIES:

20' power cord

- (2) \* Discharge piping with ball check valve 2"
- (2) \* gate valve assemblies 2"
- (2) \* pump guide kits
- (2) Pump base plates
- (2) \* 15' lengths, 3/16 galvanized lifting chains

\* Material mounted to pumps

# HYDROMATIC SKHD150 Submersible Effluent Pump

- Septic Tank Effluent
- High-Head Sump



1990 AURORA PUMP. NORTH AURORA, ILLINOIS

Bulletin 6130-2





# SKHD150 SUBMERSIBLE EFFLUENT PUMP

The Hydromatic SKHD150 submersible pump is specifically lesigned to meet the demands of -septic tank effluent and industrial sump applications that require "high-head," dual-sealed pump. The 1-1/2 inch NPT discharge pump is available with a werful 1-1/2 horsepower motor, which provides maximum starting torque.

Available in single- and threephase configurations — the sinrgle-phase, 230 volt motor feaures a start capacitor, solid-state start switch and automatic reset thermal overload protection, while the three-phase motors, 200, 230, 460, or 575 volt, require a magnetic starter with overload protection located in the accessory control panel. The SKHD150 can handle capacities up to 53 gallons per minute and heads to 130 feet.

The SKHD150 features a high-quality cast iron pump volute, motor housing and seal housing construction that help to ensure a long service life. The pump's semi-open thermoplastic impeller, which is threaded to a stainless steel shaft, is capable of handling up to 3/4 inch spherical solids — providing long life in demanding applications. In addition, the SKHD150 utilizes two carbon- and ceramic-faced mechanical shaft seals – mounted in tandem – to provide double protection against water entry.

The oil-filled motor of the SKHD150 provides superior cooling characteristics, allowing the motor to run cool and quiet for years. This oil-filled design also provides permanent lubrication of the shaft bearings, minimizing maintenance and extending the service life of the pump.

For applications requiring a seal failure alarm, the SKHD150 is available with a seal failure sensor, which is optional on single-phase models and standard on three-phase models.





demanding applications.

as an option on single phase models.



# **ENGINEERING DETAILS - SKHD150**

## Pump Characteristics

|                 | · · · · ·                                                                                                                                   |     |         |      |     |  |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|------|-----|--|
| Pump/Motor Unit | Submersible                                                                                                                                 |     |         |      |     |  |
| Manual Models   | M2                                                                                                                                          | M6  | M3      | M4   | M5  |  |
| Horsepower      |                                                                                                                                             |     | 1-1/2   | _    |     |  |
| Full Load Amps  | 12.0                                                                                                                                        | 6.1 | 5.7     | 2.9  | 2.7 |  |
| Motor Type      | Capacitor Three-Phase                                                                                                                       |     |         |      |     |  |
| R.P.M.          | 3450                                                                                                                                        |     |         |      |     |  |
| Phase Ø         | 1 3                                                                                                                                         |     |         |      |     |  |
| Voltage         | 230                                                                                                                                         | 200 | 230     | 460  | 575 |  |
| Hertz           | 60                                                                                                                                          |     |         |      |     |  |
| Operation       | Intermittent                                                                                                                                |     |         |      |     |  |
| Temperature     |                                                                                                                                             | 140 | °F Amb  | ient |     |  |
| NEMA Design     |                                                                                                                                             |     | B       | В    |     |  |
| lasulation      |                                                                                                                                             |     | Class B |      |     |  |
| Discharge Size  |                                                                                                                                             | 1-  | 1/2″ N  | PT   |     |  |
| Solids Handling |                                                                                                                                             |     | 3/4″    |      |     |  |
| Unit Weight     | 75 lbs.                                                                                                                                     |     |         |      |     |  |
| Power Cord      | 16/3, STWA, 10, 230V = 20' std.<br>16/4, STWA, 10, 230V = 20' std. (S.F.)<br>18/5, STWA, 30, 200V, 230V, 460V,<br>or 575V = 20' std. (S.F.) |     |         |      |     |  |

## **Performance** Data



## **Dimensional Data**



# Materials of Construction

| Handle                   | Steel                                                                                        |  |  |
|--------------------------|----------------------------------------------------------------------------------------------|--|--|
| Lubricating Oil          | Dielectric Oil                                                                               |  |  |
| Motor Housing            | Cast Iron                                                                                    |  |  |
| Pump Casing              | Cast Iron                                                                                    |  |  |
| Shaft                    | Stainless Steel                                                                              |  |  |
| Mechanical<br>Shaft Seal | Seal Faces: Carbon/Ceramic<br>Seal Body: Brass<br>Spring: Stainless Steel<br>Bellows: Buna-N |  |  |
| Impeller                 | Thermoplastic                                                                                |  |  |
| Upper Bearing            | Brass Sleeve Bearing                                                                         |  |  |
| Lower Bearing            | Single Row Ball Bearing                                                                      |  |  |
| Fasteners                | Stainless Steel                                                                              |  |  |

Installation and Service Manual

# HYDROMATIC SKHD150 Submersible Effluent Pump



#### NOTE!

To the installer: Please make sure you provide this manual to the owner of the pumping equipment or to the responsible party who maintains the system.





| Subject      | Page |
|--------------|------|
| Introduction | 3    |

| Installation               | 3   |
|----------------------------|-----|
| Typical<br>stallation Data | 4   |
| Service                    | 5-7 |

Trouble Shooting 8

Parts List 9

Warranty 10

Application Notes 11
# Introduction

Before operation, read the following instructions carefully. Reasonable care and safe methods should be practiced. Check local codes and requirements before installation. Servicing should be performed by knowledgeable pump service contractors or authorized service centers.

### Warning:

Read all instructions before starting any operation on pump. Always disconnect the pump and controls from its power source before handling or making any adjustments. Always wear rubber boots when there is water on the floor and unplug the pump before making any adjustments or repairs.

### Warning:

**Risk of Electrical Shock** — This pump has not been investigated for use in swimming pool areas.

# To Reduce Risk of Electrical Shock:

- Risk of Electrical Shock Connect only to a properly grounded receptacle.
- 2. Septic tank to be vented in accordance with local plumbing codes.
- Do not smoke or use sparkable electrical devices or flame in a septic (gaseous) or possible septic sump.

4. A septic sump condition may exist and if entry into sump is necessary, then (a) provide proper safety precautions per OSHA requirements and (b) do not enter sump until these precautions are strictly adhered to.

Do not install pump in location classified as hazardous per N.E.C., ANSI/NFPA 70 - 1984.

# Failure to heed above cautions could result in injury or death.



These important instructions must be followed for satisfactory performance of your pump. Before installation. check your local electrical and plumbing codes.

- 1. Provide proper basin or tank size to ensure pump operates without restriction. A two to five minute run time is recommended.
- 2. Make sure sump is free of string, cloth, nails, gravel, etc. before installing pump.
- Do not set pump directly on the bottom of sump pit if it is not solid. Raise the pump by placing bricks or concrete blocks underneath it.
- 4. Use steel or plastic pipe for all connecting lines between pump and sewer outlet.

**Note:** Some city regulations do not allow installing a pump with plastic pipe. Check local regulations.

- In applications where the pump may sit idle for months at a time, it is recommended that the pump(s) be cycled every month to insure the pumping system is working properly when needed.
- 6. A check valve should be installed in discharge pipe.
- An audible alarm system, such as the Q Alert, for high water conditions should be installed for greater protection.

**Note:** The Q Alert is for indoor use only. Contact your Hydromatic distributor for additional control and alarm panels applications.

- Use pump partially or completely submerged for pumping waterlike liquids (temperature to 140° F). The SKHD150 will pump solid materials up to ¼<sup>21</sup> (spherical) in diameter.
- Caution: Do not pump flammable liquids, strong chemicals or salt water.
- For added protection an optional seal failure probe is available as well as the control and alarm panel. Contact your Aurora/Hydromatic distributor or the factory for more information.





### **SKHD 150**

# Service

**Worning:** Before handling these pumps and controls, always disconnect the power first.

Do not smoke or use sparkable electrical devices or flames in a septic (gaseous) or possible septic sump.

Before removing the pump from its installation for repairs, check first to see if the trouble is caused by:

- 1. Miswiring of the pump into the terminal block.
- 2. Miswiring of the float level controls into the panel.
- 3. Miswiring inside the control panel.
- Tripped circuit breaker. If the breaker is manually reset and then trips off again, the problem could be:
  - a. short circuit in motor or control panel
  - b. water in the motor housing
  - insufficient amp capacity of wiring or breakers
  - d. improper panel wiring
- Tripped overload. If overload is manually reset and then trips off again, the problem could be:
  - a. pump or piping clogged
  - b. pump motor or bearings may be defective
  - c. start capacitor in motor may have failed
  - d. pump may be miswired to terminal block
  - e. head lower than rating, pumping too much liquid
- 6. Air locked pump. A sump pump is said to be air locked if air traps in the pump and it cannot get out, thus preventing pump from operating.

As a precuation, a <sup>1</sup>/<sub>4</sub>" hole should be drilled in the discharge pipe below the check valve. The check valve should be 12 to 18 inches above pump discharge. Do not install check valve directly into pump discharge opening.

**Note:** In sumps where the pump is operating daily, air locking rarely occurs.

- Wrong impeller rotation. Rotation should be counterclockwise when looking at the impeller. Correct improper rotation on three phase pumps by reversing any two line leads. Rotation check is not necessary on single phase pumps.
- 8. Closed discharge gate valve.
- 9. Plugged impeller or pipeline.
- Discharge head may be too high. Check elevation against design point of pump.
- 11. Floats not hanging free in the sump.
- 12. Malfunctioning floats.

### **Checking Power Cord**

To be sure wires are not burned off or broken in cord, use ohmmeter for check. Set ohmmeter scale pointer to R X 1 scale and attach one meter lead to white cord wire and one meter lead to black cord wire, then place a screwdriver blade across terminals of plug. If cord is O.K., meter needle will go to zero and stay there. If meter needle does not move, this will indicate an open wire and cord must be replaced.

### Repair - Motor

**Warning:** Be certain power to pump is off! Disconnect pump power cord from terminals and remove pump from sump pit.

1. Clean any dirt or trash from the outside of the pump before dismantling.

- If motor does not run when the pump is tested, the capacitor and/or stator must be checked. See Step 5. Remove plug (#9) from top of housing (#2) and pour oil into container, preferably glass, so that oil can be observed.
- If oil is clear, it will indicate motor is not burned and there has been no water leak into the motor. If oil is cloudy, it will indicate water in motor, or, if oil is black, it will indicate a burned stator. If water is in the oil, all seals should be replaced.
- 4. After draining oil, carefully loosen the power cord assembly from the motor housing. With power cord loose, remove the four screws (#6) and carefully lift off the motor housing (#2) exposing the capacitor (single phase [10] only) and the motor assembly.
- On single phase units, check capacitor (#3) using ohmmeter. With ohmmeter scale set at R X 1000, attach meter leads to capacitor. The meter needle should go to zero and come back slowly. If it does not, the capacitor should be replaced.
- 6. To check motor stator, remove power cord leads from terminal bushings on top of motor. If stator is visibly burned, motor assembly must be replaced.
- 7. Ground check on stator should be performed using ohmmeter with scale set at R X 100 and checking meter by putting both meter leads together and adjusting the needle knob until meter reads zero. If meter cannot be adjusted to zero, it will indicate that batteries in meter must be replaced. Always make this test with the meter when scale pointer is set to a new scale before making any checks on the motor. Now connect one meter lead to one terminal of stator and touch and other meter lead to motor stator shell. If needle on ohmmeter goes

### Service Continued

completely to zero, the motor probably has a wire touching the stator at some point and the motor assembly will have to be replaced.

### 8. Winding Resistance Test

should be performed if the ground test is satisfactory. Use ohmmeter with scale pointer set on R X 1 scale. On this scale, meter reads directly on ohms. Always check the meter with leads together as described above under Ground Check Test before making a reading of the winding.

Connect one motor lead to the white wire terminal and the other meter lead to the black wire terminal. This reading is for the main winding (1ø). If the readings obtained do not agree with those given below, the stator is defective and the motor assembly must be replaced.

#### Resistance

|      | le Main | 1ø Start | 3ø Bal |
|------|---------|----------|--------|
| 230V | 1.78    | 3.53     | 6.65   |
| 460V |         |          | 6.65   |
| 2007 |         | _        | 3.4    |
| 575V |         | _        | 27.97  |

- 9. For three phase pumps, remove the power cord assembly (#27) by cutting the butt connections and removing the power cord from the pump.
- 10. Twist the three leads of one end of the power cord together. Then at the other end, with an ohmmeter, check any two leads. Also check the third lead with either of the first two. If a zero reading is indicated

for any wire, the wire is broken and a new power cord assembly must be installed.

### **Seal Housing**

The pump is equipped with two mechanical seals mounted in tandem. The lower seal (#20) and the upper seal (#8) consist of a ceramic stationary seat and a carbon rotating ring.

As noted, if water is detected in the motor housing, inspect the power cord connection, pipe plug connections, Orings, the motor housing itself, and the two mechanical seals.

There are two quarts of oil in the motor housing. This is a paraffinic "SE-40" process oil. The same oil is used in the seal housing (#13) between the two mechanical seals. To check the seals, remove the lower housing pipe plug (#11) and pour the oil out into a clean, preferably glass, container. Look for the milky color as noted previously.

If the oil is clear, the lower seal is still good. If this seal is damaged, water will seep in and continue to stain the oil, changing it from clear, to slightly discolored, to cloudy, and finally to a milky white.

Except for very rare instances, the motor will continue to be protected by the upper mechanical seal. If seal probe is used the pump will not shut off when water in the oil is sensed. However, if connected to a control panel, an alarm or light will be activated. The panel alarm will show failure. The lower seal and oil must be replaced.

### Lower Seal

If water is found in the seal chamber, the lower seal must be replaced. Separate the volute by removing the three cap screws (#7) holding the volute case (#10) to the upper volute.

Insert a large screwdriver in the slotted pump shaft and strike the impeller sharply with a plastic or rubber headed hammer. The impeller should spin free. The impeller holds the rotation carbon ring of the lower mechanical seal against the stationary ceramic seat by compressing a stainless steel spring.

When the impeller is removed, the spring will relax, allowing the carbon ring to be removed. There is a rubber sleeve (bellows) inside the spring which grips the pump shaft. This often restricts the spring and must be pried or pulled loose.

With the carbon ring, spring, and rubber sleeve removed, wedge the ceramic seat out of the housing. Be sure not to scratch or mar the pump shaft.

### **Upper Seal**

- To remove and replace the upper mechanical seal (#8), the base (#10), impeller (#16), lower mechanical seal (#20), and volute must be removed first. Drain the seal oil from the housing by removing pipe plug (#11).
- 2. The rotating carbon ring and stainless steel spring are held in place by a snap ring (#21) and washer (#15). Remove these.
- 3. Remove the four hex head stator bolts(#32) and lift the stator (#5) from the seal plate (#14). A screwdriver can be inserted under the stator shell in order to remove the stator.
- 4. Bump the end of the shaft with a plastic hammer. This will push the rotating half of the mechanical seal from the shaft and also push the lower bearing from the seal plate. Now remove the shaft, rotor, and bearing assembly from the seal plate.
- 5. If water was found in the oil, the rotating and stationary halves of the mechanical seal must be replaced. Remove the stationary seal half by inserting a screwdriver into seal plate from the top and tapping lightly with a hammer.
- 6. Turning the bearing(#33, #34) by hand: if it feels rough when turned or looks rusted, it should be

# Service Continued

replaced. Obtain a bearing puller to remove the bearing. If a puller cannot be replaced over the bearing, remove the outer race by cracking in a vise. Now the outer race and balls can be removed, allowing the inner race to be pulled.

### Reassembly

- 1. Thoroughly clean the seal plate, particularly the seal and bearing pockets. All sand and dirt must be removed.
- 2. If the stationary seal half was removed, use a plastic pusher to press it into the housing. Make sure the rubber ring goes in first. Do not use any sharp objects that may damage the seal.
- 3. When installing a replacement bearing press only on the inner race and make sure the bearing is flush against the snap ring. If a press is not available, the bearing can be tapped onto the shaft using a sleeve that bears only on the inner race. Pressing on the outer race will ruin the bearing.
- 4. Push the shaft, rotor and ball bearing assembly into the seal plate, being careful not to chip the ceramic of the stationary seal half.
- Replace the stator if it is visibly burned or if the ground resistance test or the winding resistance test has failed. Note that the replacement stator must be of the same manufacture as the existing rotor, or vice versa. Replace the four stator bolts (#32).

- Remove the old O-ring (#24), regardless of condition, and replace. Place the new O-ring over the seal plate shoulder.
- Clean the motor housing (#2) thoroughly, then position it onto the seal plate.
- 8. Press the rotating seal half (#13) onto the shaft with the rubber ring facing the impeller.

**Caution:** Mixing old and new seal parts will cause immediate seal failure. When replacing seal, replace both the rotational and the stationary seal halves.

9. Reassemble the lower seal as described.

Note: If seal probe is used, go to Step 16.

- 10. Add a drop of Locktite 277\* to the impeller threads and screw the impeller (#16) on hand tight. The impeller will force the rotating seal half (#20) into position.
- 11. Set the seal housing and motor housing assembly into the volute case (#10) and secure with four hex head screws (#7).
- 12. To replace the power cord on single phase pumps, as determined on page 5, first slip the stator lead wires through the holes in the wire seal assembly. Coat the cord grip threads with pipe dope or apply teflon tape and screw the new power cord assembly into the motor housing. Referring to wiring diagrams in this manual, secure wires together.

**Note:** Do not tape leads together as the hot oil will deteriorate the tape and cause failure.

13. Before filling the motor housing with oil, an air test should be performed. Apply 7 to 8 pounds of air pressure in the ¼" NPT tap (#9) on the top of the motor cover and seal chamber. (Note: Too much pressure will damage the seal.) Then submerge the pump in water and check for leaks. If a leak occurs, isolate where it is coming from and correct the problem by replacing the sealing part. If there are no leaks, fill the motor and seal housing with high grade transformer oil, such as Factopure SE40 or equivalent, to at least one inch below top of housing.

Do not fill the motor housing completely – allow air space for expansion. Replace oil plug (#9).

 Check for proper sealing of lower seal assembly by adding 7-8 lbs. air pressure at (#11) tap oil fill hole.

**Note:** Too much pressure will cause seal failure. Seal would have to be replaced.

Submerge in water. If air bubbles appear, isolate the source of the leak and correct the problem. If there are no leaks fill lower seal chamber fill with high grade transformer oil. Lay pump on side and fill to  $\frac{1}{2}$ " below fill plug. Replace plug (#11).

- 15. Connect power cord wires to terminals, connect power, and check pump running. Motor should run smoothly and be free of vibration.
- 16. To check seal probe, use an ohmmeter to measure resistance and check continuity. If meter reads zero then replace probe (#23). Check probe sensor wire (#22) for opens using the ohmmeter. If reading is zero the wire is OK. For shorts place on lead on the motor housing, making sure bare metal surface is used. Place the other lead on the bared end (#26) of the probe lead (#22). Reading should be infinity (∞). If reading is zero then replace seal probe lead. Return to Step 10.

# Trouble Shooting

**Warning:** Before handling these pumps and controls, always disconnect the power first.

Do not smoke or use sparkable electrical devices or flames in a septic (gaseous) or possible septic sump.

# Pump does not run or hum.

- 1. Check line voltage for proper power.
- 2. Line circuit breaker may be off, or fuse may be blown or loose.
- Water level in sump may be too low. Run in more water to activate switch. It will turn on when 90° has been achieved.
- 4. Pump cord plug may not be making contact in receptacle.
- 5. If pump is using the series cord plug, the two plugs may not be plugged tight together.
- 6. Float may be stuck. Be sure float operates freely in basin.
- 7. If all symptoms check OK, motor winding may be open: take pump to an authorized service center.

# Pump runs but does not deliver water.

 Check valve may be installed backwards. Arrow in valve points in direction of flow.

- 2. Discharge gate valve, if used, may be closed.
- 3. Pump may be air locked. Start and stop several times by plugging and unplugging cord. Check vent hole in pump case for plugging.
- 4. Pump head may be too high. Pump cannot deliver water over 100 ft. vertical. Horizontal distance does not affect pumping, except loss due to friction.
- Inlet in pump base may be clogged. Remove pump and clean out openings.
- Impeller or volute openings may be plugged or partially plugged. Remove pump and clean per maintenance instructions.

### Pump runs and pumps out sump but does not stop.

1. Float is stuck in up position. Be sure float operates freely in basin.

### Pump runs but delivers only small amount of water.

- 1. Pump may be air locked. Start and stop several times.
- Pump head may be too high. Pump cannot deliver water over 100 ft, vertical. Horizontal distance does not affect pumping, except loss due to friction.
- Inlet in pump base may be clogged. Remove pump and clean out openings.
- Impeller or volute openings may be plugged or partially plugged. Remove pump and clean per maintenance instructions.
- 5. Pump impeller may be partially clogged causing motor to run slow, resulting in motor overload. Clear obstruction from volute and impeller.

### Fuse blows or circuit breaker trips when pump starts.

- Inlet in pump base may be clogged. Remove pump and clean out openings.
- Impeller or volute openings may be plugged or partially plugged. Remove pump and clean per maintenance instructions.
- 3. Pump impeller may be partially clogged causing motor to run slow, resulting in motor overload. Clear obstruction from volute and impeller.
- 4. Fuse size or circuit breaker is too small.
- 5. Defective motor stator: return to Hydromatic service center for verification of failure.

### Motor runs for short time then stops. Then after short period starts again. Indicates tripping overload caused by symptom shown.

- Inlet in pump base may be clogged. Remove pump and clean out openings.
- Impeller or volute openings may be plugged or partially plugged. Remove pump and clean per maintenance instructions.
- 3. Pump impeller may be partially clogged causing motor to run slow, resulting in motor overload. Clear obstruction from volute and impeller.
- 4. Defective motor stator: return to Hydromatic service center for verification of failure.

If symptom not found call Hydromatic distributor or repair center for assistance.



| Ref.<br>No. | lø Part No. | 3ø Part No. | Description                   | Qty. | Ref.<br>No. | 1ø Part No. | 3ø Part No.         | Description                              | Qty. |
|-------------|-------------|-------------|-------------------------------|------|-------------|-------------|---------------------|------------------------------------------|------|
| 1           | 60-000-5    | 60-000-5    | Handie                        | 1    | 19          | n/a         | 111-007-1           | Screw, Impeller (3ø only)                | 1    |
| 2           | 56-006-2    | 56-007-2    | Housing, Motor                | 1    | 20          | 83-002-1    | 83-002-1            | Shaft Seal-lower                         | 1    |
| 3           | 13208-001-1 | n/a         | Capacitor (1s, 230V)          | 1    | 20          | 83-007-1    | 83-007-1            | Shaft Seal-lower                         | 1    |
| 4           | 13209-003-1 | n/o         | Solid State Switch (1#, 230V) | 1    | 21          | 975-001-1   | 975-001-1           | Snap Ring                                | 1    |
| 5           | 12690-000-1 | 12691-000-1 | Motor Assemiy                 | 1    | 22          | 6000-056-5  | 6000-056-5          | Wire Termonal Assembly                   | 1    |
| 6           | 101-008-1   | 101-008-1   | Screw, Hex Hd.                | 4    | 23          | 8472-006-5  | 8472-006-5          | Seal Failure Sensor                      | 1    |
| 7           | 101-013-1   | 101-013-1   | Screw, Hex Hd.                | 3    | 24          | 77-003-1    | 77-003-1            | 0-Ring                                   | 2    |
| 8           | 17048-000-1 | 17048-000-1 | Shaft Seal-Upper              | 1    | 25          | 12709-000-2 | 12709-000-2         | Adapter                                  | 1    |
| 9           | 119-002-1   | 119-002-1   | Pipe Plug, 1/4 NPT            | 1    | 26          | 282-001-1   | 282-001-1           | Splice Connector                         | 1    |
| 10          | 9641-000-2  | 9641-000-2  | Volute Case                   | 1    | 27          | 13216-002-5 | n/a                 | Power Cord Assembly, 20' w/plug, is only | 11.  |
| 11          | 87-004-1    | 87-004-1    | Pipe Plug, 1/8 NPT            | 1    | 27          | 11644-008-5 | 11644-018-5         | Power Cord Assembly, 20' w/S.F.          | 1    |
| 12          | 25-016-1    | 25-016-1    | Screw Rd. Hd.                 | 3    | †28         | n/a         | 73-000-1            | Connector (3em 230V/460V)                | 4    |
| 13          | 7579-001-2  | 7579-001-2  | Housing, Bearing/Seal         | 1    | 29          |             |                     | Nameplate                                | 1    |
| 14          | 6846-004-2  | 6846-004-2  | Plate, Bearing/Seal           | 1    | 30          | 4580-001-1  | 45 <b>8</b> 0-001-1 | Drive Screw                              | 2    |
| 15          | 156-052-1   | 156-052-1   | Washer                        | 1    | 31          | •           | •                   | Oil                                      | 1    |
| 16          | 9640-000-5  | 9640-000-5  | Impeller                      | 1    | 32          |             |                     | Hex Head Screw – Part of Motor Assembly  | 4    |
| 17          | •           | •           | Locktite Sealant              | 1    | 33          | 00065-001-1 | 00065-001-1         | Upper Bearing                            | 1    |
| 18          | n/a         | 518-000-1   | Washer, Impeller (3ø only)    | 1    | 34          | 00065-009-1 | 00065-009-1         | Lower Bearing                            | 1    |

†Not Shown

\* Purchase Locally



METROPOLITAN PUMP COMPANY

#### APPLICATION

- Sepuc tank effluent
- Industrial sump service

### SUBMERSIBLE HIGH HEAD EFFLUENT PUMP

### FEATURES

- Completely submersible. Heavy duty, oil-filled motors with ball bearing design in pure dielectric insulating oil for cooler running, permanent lubrication and long life. Motors are 1-1/2 HP, 3450 RPM. Single phase, 230 volt motor features start capacitor, solid state start switch and automatic reset thermal overload protection. Three phase motors, 200 volt, 230 volt or 460 volt, require magnetic starter with overload protection located in the accessory control panel.
- Dual mechanical shaft seals are standard. Seals are long life, carbon and ceramic faced. Seal failure (S.F.) sensor capability (for connection to a seal failure alarm device) available as an option on single phase units, standard on three phase units.
- Non-clogging, single vane, engineered thermoplastic impeller, 5-3/8-inch diameter, threaded to stainless steel shaft. No inlet screen to become clogged. Capable of handling 3/4-inch spherical solids.
- Pump case and motor housing are heavy cast iron for corrosion resistance. All exposed parts are high grade bronze, cast iron, steel and stainless steel.
- ✓ Field serviceable.

CAPABILITIES

# SKHD150



|                              | SKHD150                                                  |  |
|------------------------------|----------------------------------------------------------|--|
| Capacities to:               | 53 GPM                                                   |  |
| Shutoff Head:                | 130 Feet                                                 |  |
| Solids Handling:             | 3/4-                                                     |  |
| Discharge                    | 1-1/2" NPT                                               |  |
| Horsepower:                  | 1-1/2                                                    |  |
| Electrical:                  | Single phase, 60 Hz, 3450 RPM, 230V, 12.0 FLA            |  |
|                              | Three phase, 200V, 6.1 FLA; 230V, 5.7 FLA; 460V, 2.9 FLA |  |
| Controls:                    | Manual                                                   |  |
| Power Cord:                  | 16/3, STW-A, 10, 230V = 20 ft. std.                      |  |
|                              | 16/4, STW-A, 10, 230V = 20 ft. std.                      |  |
|                              | 16/5, STW-A, 30, 200V, 230V or 460V = 20 ft. std.        |  |
| * Models with seal failure s | ensor wire.                                              |  |

AS FURNISHED BY

METROPOLITAN PUMP COMPANY



SKHD150

# **Pump Characteristics**

| Pump/Motor Unit | Submersible                                                                                                                                 |     |       |       |     |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|-------|-----|
| Manual Models   | M2                                                                                                                                          | M6  | M3    | M4    | M5  |
| Horsepower      |                                                                                                                                             |     | 1-1/2 |       |     |
| Full Load Amps  | 12.0 6.1 5.7 2.9                                                                                                                            |     |       |       |     |
| Motor Type      | Cepotito:<br>Stort                                                                                                                          |     | Three | Phase |     |
| R.P.M.          | 3450                                                                                                                                        |     |       |       |     |
| Phase Ø         | 1 3                                                                                                                                         |     |       |       |     |
| Voltage         | 230                                                                                                                                         | 200 | 230   | 460   | 575 |
| Hertz           | 60                                                                                                                                          |     |       |       |     |
| Operation       | Intermittent                                                                                                                                |     |       |       |     |
| Temperature     | 140°F Ambient                                                                                                                               |     |       |       |     |
| NEMA Design     | B                                                                                                                                           |     |       |       |     |
| Insulation      | Class B                                                                                                                                     |     |       |       |     |
| Discharge Size  | 1-1/2" NPT                                                                                                                                  |     |       |       |     |
| Solids Handling | 3/4"                                                                                                                                        |     |       |       |     |
| Unit Weight     | 75 lbs.                                                                                                                                     |     |       |       |     |
| Power Cord      | 16/3, STWA, 10, 230V = 20' std.<br>16/4, STWA, 10, 230V = 20' std. (S.F.)<br>18/5, STWA, 30, 200V, 230V, 460V,<br>or 575V = 20' std. (S.F.) |     |       |       |     |



1400 BLUFF ROAD ROMEOVILLE, IL 60441 (708)972-9400 • (800)323-1665 • FAXI708)972-9594

# Installation and Operation Manual

Submersible Effluent Pumps





Mansfield, Ohio FORM NO. 60982-477

### Section A. General Information

<u>A-1</u> INTRODUCTION – This manual contains Installation, Operating and Service Instructions, plus a list of all parts for Peabody Barnes Model E202 Effluent Pump.

A-2 SPECIFICATIONS and DATA – The effluent pumps are cast iron construction with a 1-inch suction opening and a 1¼-inch discharge. The motor and seal cavity are oil-filled for lubrication and heat dissipation.

Impeller has two non-clog vanes with added back vanes to keep solids from seal area. Pump comes equipped with legs to elevate pump above bottom of sump or basin. The capacitor is easily changed through the capacitor access hole in the top of the motor housing.

### Section B. Installation

<u>B-1</u> LOCATION – The pumping unit is self-contained and is recommended for use in a sump or basin for sewage handling only.

B-2 DISCHARGE SYSTEM - Connect discharge pipe to discharge opening of pump, using a 1-inch elbow and nipple.

Ball check values are required for each pump on simplex and duplex installations to prevent back-flow into the system.

B-3 LIQUID LEVEL CONTROL (HEAD/DIAPHRAGM)

a) SIMPLEX SYSTEM (Fixed Differential) - The liquid level control can be mounted in the pasin cover (refer to Figure 1).



b) SIMPLEX SYSTEM (Adjustable Differential) – The liquid level control can be mounted to a pipe between the basin cover and bottom of basin (refer to Figure 2), or may be mounted in the basin cover (refer to Figure 3).





-2-

<u>B-4</u> LIQUID LEVEL CONTROL (Mercury Float Switch) – For simplex or duplex operation, the mercury switch should be mounted on a drop pipe which extends down through the basin cover and rests on bottom of basin (refer to Figures 8 and 9).1). NOTE: Always use one more switch than the number of pumps in the system.



### B-5 ELECTRICAL CONNECTIONS

a) SIMPLEX SYSTEM (Head/Diaphragm) — For manual cr automatic operation, both the pump and level control should be wired into the control system selected as per the instructions included with each control.

b) DUPLEX SYSTEM (Head, Diaphragm) – On all models, when used in a duplex system, the electrical connections should be made as per the instruction included with the control system selected.

c) SIMPLEX and DUPLEX SYSTEMS (Float Rod and Mercury Float) — On all models, when a float rod or mercury float level control is used, the electrical connections for both the pump and level control should be made as per the wiring instructions included with the control system selected.

|                             | ELECTRICAL INFORMATION |      |       |      |       |            |         |         |
|-----------------------------|------------------------|------|-------|------|-------|------------|---------|---------|
| MAX LOCKED WINDING BREAKERS |                        |      |       |      |       |            |         |         |
|                             |                        |      |       | RUN  | ROTOR | RESISTANCE | OR FUSE | "κ"     |
| MODEL                       | HP                     | VOLT | PHASE | AMPS | AMPS  | MAIN START | AMPS    | HEATERS |
| E202                        | 2                      | 230  | 1     | 13.5 | 34.0  | 1.26 5.53  | 30      | NONE    |

### WIRING GUIDE

To conform to the National Electric Code, all models must be wired with No. 14 AWG, or larger, wire. For runs to 250 feet from main breaker panel to pump, No. 14 AWG is sufficient. For runs greater than 250 feet, consult a qualified electrician or the factory.

Control wiring (not carrying motor current) may be No. 16 AWG.

### Section C. Operation

C-1 STARTING – After pump has been properly wired and lowered into sump or basin, it is advisable to check system by filling sump or basin with liquid and allowing pump to operate through its cycle.

C-2 MAINTENANCE - No lubrication is required as the motor is oil-filled.

If pump is idle for long periods of time, it is advisable to start pump occasionally by adding liquid to the sump or basin.

### Section D. Trouble Shooting

### TROUBLE

POSSIBLE CAUSE

.

|**9** |\_-

REMEDY

Replace capacitor.

| 1) PUMP DOES NOT RUN.                     |                                                                         |  |  |
|-------------------------------------------|-------------------------------------------------------------------------|--|--|
| Electrical power off.                     | Check power supply to control box.                                      |  |  |
| Defective relay in control box.           | Check relays and replace if required.                                   |  |  |
| Liquid level control defective.           | Switch to manual operation; if pump starts, level control is defective. |  |  |
| 2) PUMP RUNS, THEN STOP                   | PS.                                                                     |  |  |
| Locked impeller causing overload to trip. | Clean out impeller.                                                     |  |  |
| Capacitor defective - single phase only.  | If impeller is free, capacitor defective.                               |  |  |

3) PUMP RUNS AT LESS THAN CAPACITY.

| Suction opening or discharge line cloffed. | Clean out suction opening and discharge line.                                   |
|--------------------------------------------|---------------------------------------------------------------------------------|
| Impeller clogged.                          | Clean out impeller.                                                             |
| incorrect rotation.                        | Check rotation as per Paragraph B-4. If incorrect, change as per Paragraph B-4. |
| mpeller worn or damaged.                   | Check impeller and replace, if required.                                        |

### Section E. Pump Service And Repair

E-1 BODY and IMPELLER SERVICE – To clean out body (32), or to clean out, or replace, impeller (27), disconnect power and discharge piping and lift the pump from sump or basin. Remove hex nuts (34) and lockwashers (33) and pull motor, seal assembly and impeller from the body (32). Clean out the body, if necessary. Clean and examine impeller (27) and square ting (30); replace, if required.

If the impeller (27) needs replaced, remove hes nut (29) and lockwasher (28). The impeller is keyed onto the shaft and to remove, pull the impeller straight off the shaft. At re-assembly, be sure to use the required number of shims (25 and 26), to insure an impeller-to-body clearance of .010" to .030".

E-2 MOTOR HOUSING – Drain all the oil from the motor housing (5) by removing pipe plug (6). Loosen the gland nut and slide back on the cord set (7). Remove cap screws (9) and lockwashers (10) and pull the cord set assembly (7) and O-Ring (8) from the motor housing (5). Disconnect the wires to the capacitor (2). Remove body (32) as outlined in Paragraph E-1. Remove screw (23) and pull the seal plate (22), together with square ring (21), shaft seal (20) and motor (1) from the motor housing (5). Disconnect the motor (1) from the cord set (7). Flush motor housing (5) with transformer oil and discard the oil. Examine square ring (21) and cover O-Ring (8); replace, if required.

At re-assembly, connect motor (1) to cord set (7) before placing motor into housing. After reassembling motor and seal plate (22) to housing, re-connect capacitor wires and fill housing (5) with approximately two (2) gallons of transformer oil, such as Standard Oil FACTOPURE SE40, SAE No. 5W or less, or equal. Be sure to use new oil from a closed container.

E-3 MOTOR SERVICE – When the motor is to be replaced, remove body, impeller and motor housing as outlined in Paragraphs E-1 and E-2. Loosen lock nut (16) and motor screws. Pull motor (1) together with lock nut (16), retaining ring (17), washer (18), bearing (19) and rotating member (20B) of shaft seal (20) from the seal plate (22).

Carefully remove rotating member (20B), bearing (19), washer (18), retaining ring (17) and lock nut (16) from the motor shaft.

When the motor (1) or shaft (20) is being examined or replaced, replace the exclusion seal (24), also. Pry the old exclusion seal (24) from the seal plate (22), and press the new one into place using finger pressure only.

E-4 SHAFT SEAL SERVICE – The shaft seal assembly (20) is contained in the seal plate (22). To expose the seal for examination or replacement, remove body, impeller, motor housing and motor as outlined in Paragraphs E-1, E-2 and E-3. NOTE: It is recommended that any time the shaft seal (20) is removed, a complete new seal should be installed.

| CAUTION: | HANDLE SEAL PARTS W | ITH EXTREME   |
|----------|---------------------|---------------|
| CARE. DO | NOT SCRATCH OR MAR  | LAPPED FACES. |

Pull rotating member (20B) from motor shaft. When replacing stationary member (20A), press used member from seal plate (22). Lightly oil new cup of stationary member and press stationary member (20A) into seal plate (22). Lightly oil inner surface of rotating member (20B).

With lapped surface facing away from motor, slide rotating member (20B) onto motor shaft.

Re-assemble seal plate (22) onto motor (1). Tighten lock nut (16) and motor screws.

E-5 SHAFT BEARING – All of the pump parts as outlined in Paragraphs E-1. E-2, E-3 and E-4 must be disassembled in order to effect examination or replacement of the shaft bearing (19). If the bearing (19) is to be replaced, pull the old bearing from the motor shaft, then press the new bearing into place on the shaft.



PARTS LIST

| ITEM NO. | DESCRIPTION         | PART NO.      |
|----------|---------------------|---------------|
| 1        | Motor               | 53282         |
| 2        | Capacitor           | 34964         |
| 3        | Capacitor Retainer  | 33459         |
| 4        | Terminal Boot       | 34322         |
| 5        | Motor Housing       | 53154         |
| 6        | Pipe Plug           | 3201          |
| 7        | Cord Set Assembly   | 53165         |
| 8        | Square Ring         | 17026         |
| 9        | Cap Screw (4 used)  | 24418         |
| 10       | Lockwasher (4 used) | <b>223</b> 33 |
| 11       | Lifting Bail        | 36754         |
| 12       | Cap Screw (2 used)  | 2263          |
| 13       | Wire Connector      | 26880         |
| 14       | Ground Screw        | 38156         |
| 15       | Key                 | 35589         |
| 16       | Conduit Nut         | 53749         |
| 17       | Snap Ring           | 57882         |
| 18       | Washer              | 53756         |
| 19       | Bearing             | 53746         |
| 20       | Shaft Seal          | 53754         |
| 21       | Square Ring         | 33730         |
| 22       | Seal Plate          | 53755         |
| 23       | Screw               | 18923         |
| 24       | Exclusion Seal      | 53747         |
| 25       | Shim                | 8054          |
| 26       | Shim                | 8053          |
| 27       | Impeller            | 60875         |
| 28       | Lockwasher          | <b>38</b> 519 |
| 29       | Hex Nut             | 38132         |
| 30       | Square Ring         | 33730         |
| 31       | Cap Screw (4 used)  | 58547         |
| 32       | Body                | 60876         |
| 33       | Lockwasher (4 used) | 35792         |
| 34       | Hex Nut (4 used)    | 18927         |
| 35       | Pull Washer         | 62641         |

ļ

I

B.2 FLOW METER AND REMOTE READ-OUT



The Magnetic Flowmeter built to survive in harsh environments.

# The Sparling AGERMAGE: A New Breed of Cat

igermag Models 625 and 655 are technically advanced, bi-polar pulsed DC magnetic flowmeters .. the results of years of Sparling design, development, and experience in thousands of industrial and municipal plants worldwide. Our customers tell us it's the most advanced flow transmitter they've ever seen. The Tigermag will accurately measure the flow of conductive

liquids in a broad range of pipe sizes. You can consider the Tigermag for liquids with conductivities as low as 1 micromho/cm.

The performance of the Tigermag is independent of liquid density, temperature, viscosity, or pressure. Flanged and wafer style configurations offer the user optimum solutions to flow monitoring problems. You can count on Sparling's Tigermag for zero point stability and drift-free performance.

Microprocessor-based electronics, coupled with innovative software and advanced flow sensor design contribute to the Tigermag's high accuracy, dependability, and cost-effectiveness.

- SUPERIOR TECHNOLOGY
- MAXIMUM RELIABILITY
- UNEQUALED CUSTOMER SUPPORT

• Model 625 is the flangeless configuration of the Tigermag ... available for pipe sizes 1/10" to 4" diameter. The unit is designed to be mounted between ANSI, DIN, BS, or JIS flanges and carries Factory Mutual approval for hazardous environments. The rugged aluminum housings are protected by a corrosionresistant coating.



The unique flow sensor casting contains an aluminum oxide (ceramic) liner which stands up to virtually all corrosive liquids. The 625 is also highly resistant to abrasion and scale build-up. High input impedance eliminates the need for expensive electrode cleaning devices.

The construction of the 625 makes it an ideal choice for measuring flows in food processing facilities where product purity is essential. The unit is certified for use by the 3A Sanitary Council.

You can equip the 625 to handle your process by selecting the most suitable

electrodes from a range of high tech materials.

Application engineering assistance is available from our Toll-Free Hot Line.

flow tube and the same unique electronic transmitter supplied with the Model 625.

The 655 is mounted between mating ANSI, DIN, BS, or JIS flanges. You won't need grounding rings with the 655...built-in grounding electrodes do away with costly external rings and grounding straps.

You make the material choices. The 655 offers a wide selection of electrode and flow tube liner materials to

stand up to the corrosion and abrasion that can wipe out other meters. Virtually any conductive liquid can be monitored by the 655 - even up to 300°F.

As with the 625, model 655 transmitter module is completely interchangeable and field programmable with a host of value-added features at no extra cost: positive zero return, low flow cutoff, selectable engineering units, simultaneous digital and analog outputs and many other parameters configurable with MAG-COMMAND and the 16 digit display. The 655 offers top performance at low installed costs.

# MAG-COMMAND<sup>\*\*</sup>... Field Programmability At Its Simplest

The Tigermag transmitter is easily configured to your requirements by means of MAG-COMMAND." Select and change nearly every parameter from outside the explosion-proof enclosure...quickly by means of a magnetic probe and Hall effect sensors. No covers — no fasteners...it's safe and simple. (see page 4 for details)





| Full Scale Range     Accuracy | From 0-3 to 0-33 ft/sec (0-10 mps).<br>±1% of rate 1-33 fps (.3-10 mps).                        |
|-------------------------------|-------------------------------------------------------------------------------------------------|
| Reneatability                 | $\pm 0.01$ ft/sec below 1.0 ft/sec.<br>$\pm 0.1\%$ full scale                                   |
| Outputs                       | Isolated analog 4-20 mAdc into 800 ohms<br>and scaled pulse or frequency. Flow                  |
| Mag-Command <sup>**</sup>     | by magnetic probe without opening                                                               |
| • Display                     | 16 Digit alphanumeric LCD (rate and total).                                                     |
| Power Requirements            | 100. 117. 230Vac + 10% 50/60 Hz.<br>24 Vdc optional                                             |
| Power Consumption             | Less than 11 VA                                                                                 |
| • Transmitter                 | Cast aluminum with corrosion resistant<br>epoxy coating. Integral or remote mounted<br>(NEMA-7) |

Ma

| • Electrical Rating | . <b>(FN)</b> | Appr | rove | d for    | Class | I Division | 1. |
|---------------------|---------------|------|------|----------|-------|------------|----|
|                     | Groups        | BC   | D, ( | Class II | Group | s E F G.   |    |

- Ambient Temperature .....-20° to 120°F (-30° to 49°C).
- Selectable Damping .....0-99 sec.
- (others available)

### **OPTIONS**

- Remote mount transmitter.
- · Electrodes: (Titanium, Tantalum, Zirconium, Hastelloy C).

**Tigermag Model 655** 

- High temperature operation.
- $\pm 1/2\%$  rate calibration.
- 24 Vdc power supply.

# **Individual Specifications**

### 

| Sensor Housing                    | Flangeless cast aluminum with corrosion resistant epoxy coating. < > Approved for Class I & II environments. | Ranged 304 stainless steel flow tube. Carbon steel flanges and-<br>welded construction with corrosion resistant epoxy coating |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Pressure                          | Full vacuum to 740 psi @ 350°F                                                                               | 150 psi - Higher pressures optional                                                                                           |
| Flow Tube Liner                   | Aluminum oxide 99.5% (ceramic)                                                                               | Standard Polyurethane. Options include: Tetion, hard/soft rubbers                                                             |
| Standard Safety<br>Classification | Approved for Class   Div. 1 Groups B,<br>C, D Class    Groups E, F, G                                        | Designed to Class I Div. 1 Groups B, C, D; Class 2 E, F, G                                                                    |
| Electrode Seals                   | Standard seals: Ethylene Propylene and<br>Viton, Kalrez optional                                             | Not Applicable                                                                                                                |
| End Connections                   | Flangeless. Requires installation between<br>ANSI, AWWA, DIN, BS, or JIS flanges.                            | Carbon steel flanges. 150 lb. or 300 lbs. ANSI, AWWA, DIN, BS, or JIS flanges                                                 |
| x. Process Temp.                  | 350°F (176°C)<br>500°F (260°C) optional                                                                      | 180°F (82°C) Polyurethane, hard/soft rubber<br>300°F (149°C) Teflon                                                           |
|                                   |                                                                                                              |                                                                                                                               |

For further information, request product data sheet PDS 625 or PDS 655

Tigermag: The Ultimate Alternative In Electromagnetic Flowmeters



Value Added Features Models 625 & 655

> MAG-COMMAND'" Smart - Safe - Simple Programmability

### **Two Year Limited Warranty**

he Sparling Models Tigermag 625 and 655 are warranted to be free from defects in material and workmanship at the time of original shipment and for a period of two years thereafter.

Interchangeable Electronics **RFI-EMI Noise Rejection** Accidental Submergence Proof **16 Digit Display** Software Menu Changes Security Interlock Low Flow Cutoff H-Z Circuitry Auto Zero - 20 times/sec Selectable Damping Noise Suppression **Choice of Outputs** Mag-Command<sup>™</sup> Bidirectional, Positive Zero Return, **Empty Pipe Detection** 

> Every meter is wet flow calibrated and certified in Sparling's Primary Flow Lab, traceable to the National Institute of Standards and Technology.

### SPARLING ... Simplifying Flow Measurement In The Following Industries

### Municipal

Raw Sewage Primary Sludge Activated Sludge Digested Sludge Septic Sludge Aerobic Sludge Polymer Feed Wastewater

### Mining/Mineral Processing

Tailings Ore Slurnes Washer Flows Waste Water Acid Mine Drainage

### **Pulp and Paper**

Paper Stock Pulp Stock Cooling Water Refiner Flows Various Liquors Wash Water Waste Water

### Food

Food Preparations Beverages Process Water Dairy Products Juices Pulps

### Power

Cooling Water Recirculation Water Lime Slurnes Fly Ash Slurnes Coal Slurries Coal/Oil Mixtures

# Chemical and Petrochemical

Acids Caustics Wastewater Cooling Water Slurries Process Liquids Process Water

# Other Demanding Applications

Pharmaceutical and Cosmetic Preparations Inks and Dyes Cement Slurries Low Conductivity Liquids Paints Potable Water Etching Acids Fertilizers



| the set | Nominal Meter Size |             | Gallons Per Minute* |                   |               | Dimensions In Inches |      |  |
|---------|--------------------|-------------|---------------------|-------------------|---------------|----------------------|------|--|
| Nomina  |                    |             |                     |                   |               |                      |      |  |
| (MM)    | (INCHES)           | ±1% above 1 | fps Min. full scal  | e Max. tuli scale | A             | B                    | C    |  |
|         |                    | 1FPS        | 3FPS                | 33FPS             |               |                      |      |  |
| 3       | 0.10               | 0.04        | 0.12                | 1.3               | 9.00          | 2.31                 | 4.06 |  |
| 6       | 0 25               | 0.22        | 0.66                | 7.3               | 9.00          | 2.31                 | 4.06 |  |
| 12      | 0.50               | 0.55        | 1.50                | 16.5              | 9.00          | 2.31                 | 4.06 |  |
| 25      | 10                 | 1.62        | 4.86                | 53.5              | 9.62          | 2.31                 | 4.06 |  |
| 40      | 1.5                | 4.40        | 13.20               | 145.0             | 10.50         | 3.62                 | 4.06 |  |
| 50      | 2.0                | 7.00        | 21.00               | 231.0             | 11. <b>00</b> | 4.12                 | 4.06 |  |
| 80      | 3.0                | 20.60       | 61.80               | 680.0             | 12.25         | 5.25                 | 6.06 |  |
| 100     | 4.0                | 35.40       | 106.20              | 1168.0            | 13.75         | 6.75                 | 6.06 |  |





5

-----C----

"GPM calculated at actual meter ID.

|        |                                                             | Tiger       | nag Moo           | lel 655            |       |       |         |
|--------|-------------------------------------------------------------|-------------|-------------------|--------------------|-------|-------|---------|
| Nomina | Nominal Meter Size Gallons Per Minute* Dimensions in Inches |             |                   |                    |       |       |         |
| (MM)   | (INCHES)                                                    | ±1% above 1 | tps Min. tull sca | ie Max. full scale | •     | B     | C       |
|        |                                                             | 1FPS        | 3FPS              | 33FPS              |       |       |         |
| 150    | 6.0                                                         | 93          | 280               | 2800               | 13.00 | 11.75 | 18.25 · |
| 200    | 8.0                                                         | 167         | 500               | 5000               | 13.00 | 14.25 | 20.75   |
| 250    | 10.0                                                        | 260         | 790               | 7800               | 17.75 | 17.12 | 23.62   |
| 300    | •20                                                         | 367         | 1100              | 11000              | 18.87 | 20.12 | 26.62   |
| 350    | 14.0                                                        | 500         | 1500              | 15000              | 20.87 | 22.87 | 29.37   |
| 400    | 15.0                                                        | 667         | 2000              | 20 <b>00</b> 0     | 22.87 | 24.62 | 31.12   |
| 450    | 18.0                                                        | 734         | 2200              | 22000              | 26.75 | 26.12 | 32.62   |
| 500    | 20 0                                                        | 1034        | 3100              | 31000              | 27.12 | 28.62 | 35.12   |
| 600    | 24.0                                                        | 1500        | 4500              | 45000              | 32.25 | 33.12 | 39.62   |
| 750    | 30.0                                                        | 2100        | 6300              | 63000              | 43.00 | 39.87 | 46.37   |





"GPM calculated at actual meter ID.

Dimensions for 150 lb. flanges. Allow 1/8" to 1/4" for liner. DIN. BS. and JIS flanges available. Contact the factory for larger sizes.



### **Sparling Flow Experts Around The World**





SPARLING INSTRUMENTS. INC. 4097 No. Temple City Blvd., El Monte, CA 91731 Call Toll Free 800/423-4539 In California call 818/444-0571 Telex 69-1308 • FAX 818-444-2314 SRIAN CONTROLS 294 Wothing Auc Mississonge, ON+ 1416: 590 5880

389/1200

No One Knows Flow Like Sparling

# SPARLING

DATA

SHEET

### SERIES 600 METERS AND ACCESSORIES

### FM625 TIGERMAG FLANGELESS PULSED DC MAGNETIC FLOWMETER INSTALLATION, OPERATION AND MAINTENANCE

Page

### TABLE OF CONTENTS

SECTION | GENERAL 2 2 1.1 Measuring System **Operating Principal** 2 1.2 1.3 Application to Magnetic Flow Measurement 2 1.4 Interference 2 System Operation 3 1.5 Automatic Gain Control 4 1.6 1.7 Construction 4 1.8 Specifications 4 Interchangeability 5 1.9 2.0 **Application Considerations** 5 SECTION II - PRE-INSTALLATION 6 2.1 **Receiving and Inspection** 6 Storage 6 2.2 Return of Equipment 6 2.3 SECTION III - INSTALLATION 6 Site Selection 6 3.1 3.2 Rotating the Transmitter Display 6 **Pipe Connections** 3.3 7 3.4 Grounding 8 3.5 **Electrical Connections** 8 3.6 **Remote Mounted Transmitter** 9 SECTION IV - START-UP 10 SECTION V - CALIBRATION 10 SECTION VI - MAINTENANCE 10 SECTION VII - TROUBLESHOOTING 10 7.1 General 10 7.2 Troubleshooting Chart 11 7.3 Electronics Self Test 12 7.4 **Electronics Module Replacement** 12 Sensor Testing 7.5 13 7.6 Coil Continuity Testing 13 7.7 Coil Insulation Test 13 7.8 Electrode Circuit Continuity Test 13 7.9 **Electrode Circuit Insulation Test** 14 SECTION VIII REPLACEMENT PARTS LIST 14 **APPENDIX I - PROGRAMMING** A1-A8 APPENDIX II - FACTORY SET-UP A-9



### IDS-625

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| FIGU | RES                                   | Page |
|------|---------------------------------------|------|
| 1.1  | Measuring Principal                   | 2    |
| 1.2  | Noise Rejection                       | 3    |
| 1.3  | Fast Changing Flows                   | 3    |
| 1.4  | Block Diagram                         | 3    |
| 1.5  | Dimensions                            | 5    |
| 1.6  | Flowmeter Sizing Guide                | 5    |
| 3.1  | Full Pipe Required                    | 6    |
| 3.2  | Rotating the Display                  | 6    |
| 3.3  | Installation                          | 7    |
| 3.4  | Conduit Connections                   | 8    |
| 3.5  | Electrical Connections                | 8    |
| 3.6  | I/O Board Jumper Position             | 8    |
| 3.7  | Sensor Wiring - Remote Transmitter    | 9    |
| 3.8  | Remote Transmitter Mounting Bracket   | 9    |
| 7.1  | Access to Electronics                 | 12   |
| 7.2  | Electrode Cable - Simulate Position   | 12   |
| 7.3  | Removing the Electronics Module       | 12   |
| 7.4  | Coil Testing                          | 13   |
| 7.5  | Electrode Cable PCB                   | 13   |
| TABL | ES                                    |      |
| 3.1  | Flange and Bolt Specifications - ANSI | 7    |
| 3.2  | DIN Flange and Bolt Specifications    | 7    |

### SECTION 1 - GENERAL 1.1 Measuring System

The Sparling TIGERMAG<sup>™</sup> Model FM625 flowmeter is an obstructionless device for monitoring the volumetric flow of conductive liquids in full closed pipes.

The flowmeter consists of a flangeless sensor with a nonconductive ceramic flow tube and a measuring transmitter combined in a single compact unit.

### 1.2 Operating Principle

Operation is based on Faraday's Law of Magnetic Induction. An electrically conductive liquid flowing through a magnetic field induces a voltage which is perpendicular to this field and to the direction of the flow. This voltage is proportional to the average flow velocity. See figure 1.1.



Measuring Principle Figure 1.1

The mathematical formula describing Faraday's law reads:

 $E = B \times L \times V$ 

- E = Induced voltage
  - B = Magnetic field intensity (flux density)
  - L = Distance between the electrodes (pipe diameter)

V = Average flow velocity of liquid

### 1.3 Application to Magnetic Flow Measurement

In a magnetic flowmeter the liquid acts as a moving conductor as it flows through the pipe. The induced voltage in the liquid is measured by two sensing electrodes mounted opposite each other in the meter sensing head.

The length of the conductor is equal to the distance between sensing electrodes and also the internal diameter of the pipe. The flux density is proportional to the coil current, I times a constant, k. The above formula can be restated as follows:

$$V = \frac{\text{flow}}{\text{cross sectional area}} = \frac{Q}{A}$$
$$E = \frac{Q \times I \times 4 \times K}{D^2}$$

lxkxDxV

E =

Note that if I is held constant, E is proportional to Q or the induced voltage is directly proportional to the average flow rate.

### 1.4 Interference

### 1.4.1 Electrochemical Interference

The signal voltage is measured by two electrodes. Galvanic elements form on the surface areas between the ion-conducting liquid and the metal electrodes. The polarization voltages which result are dependent on temperature, pressure, and the chemical composition of the electrodes and liquid. They are direct voltages which cannot be predicted and which can be different at each electrode. The signal voltage must be separated from the interference direct voltage.

### 1.4.2 Induction Interference (Quadrature)

Electrode cables connect the electrodes with the meter electronics. Because these cables must run within the magnetic field, a voltage is induced which is proportional to the rate of change of the magnetic field strength. The meter design minimizes the length of conductor within the magnetic field in order to keep the value of this interference as low as possible.

### 1.4.3 Pulp Noise

Liquids which contain pulp such as paper stocks or food mixtures can create high levels of electrode interference voltages as the pulp contacts the electrode. The FM-625 utilizes a suppression technique by which these interference voltages are rejected if they create an electrode signal which varies excessively from the immediately preceding signal.

This feature compares each sampled flow signal to the previous signal. Signals which vary from the preceding signal by more than 0-30% (selectable) are rejected. This feature provides a stable output during the cycles when spurious signals are interfering, yet permits rapid response to true flowrate changes.



### Noise Rejection Figure 1.2

In Figure 1.2, signals at 2, 3 and 4 are outside the toleranceband. A stable output of the signal at 1 is produced until two successive signals are within the change tolerance, as occurs at 5.

In figure 1.3, signal 3 is within tolerance when compared to signal 2. The new output is displayed at 3, a delay of only two coil cycles. This rapid response permits the meter to be used on rapidly changing flows even when the noise rejection feature is used.

This feature permits the use of the TIGERMAG<sup>™</sup> automatic zeroing pulsed DC magneter in applications which had previously required AC meters. See Noise Suppression in

#### 1.5 System Operation



Fast Changing Flows Figure 1.3 the Programming Appendix, 1.9.4.

1.4.4 Other Interference Voltages

Pipes and the liquids within them are often used as a conductor for electrical grounding. This creates a voltage potential between electrodes which can be high relative to the signal voltage. Proper grounding of the flowmeter to the liquid is necessary to achieve correct meter operation. All necessary grounding of the FM625 is accomplished by built-in grounding electrodes. Grounding rings may be required if the flowing medium has a voltage potential.



### 1.6 Automatic Gain Control

The FM625 incorporates 8 levels of automatic gain control. Electrode signals are automatically amplified to maintain proper signal levels at all flows. This makes accurate flow measurement with the display and with the pulse or frequency outputs completely independent of the settings of full scale. Rangeability of these outputs is in excess of 100:1 (from 0.3 feet per second to 33 feet per second). Rangeability at stated accuracies is 33:1 when the minimum velocity of 1 foot per second is considered.

### 1.7 Construction

#### 1.7.1 Sensor

The FM625 TIGERMAG<sup>™</sup> cast aluminum sensor housing is shrink fitted to the aluminum oxide liner to form a structurally sound waterproof assembly. This housing is Factory Mutual and CSA approved.

Electrodes in meters over 1/2" are sealed by a double O-ring seal. The primary O-ring seal is ethylene propylene. This seal is backed by a secondary seal of viton. The combina tion of seals makes the meter suitable for nearly all conduc-

- tive liquids.
- All internal cavities in the sensor housing are filled with a high temperature silicone potting compound to prevent the possibility of moisture damage and to avoid the possibility of collection of explosive gases.

When properly connected with liquid tight conduit, the meter will withstand accidental submergence.

### 1.7.2 Transmitter

The transmitter is housed in a CSA and Factory Mutual Approved, NEMA-7 instrument enclosure. The electrical connections are made in a separate section of the housing which is isolated from the electronics.

### 1.8 Specifications

| Po | ower Requirements: - See Nameplate                   |         |
|----|------------------------------------------------------|---------|
|    |                                                      | Fuse    |
|    | 100 V ac <u>+</u> 10% 50/ <b>60 Hz <u>+</u>10%</b> , | 1.0 amp |
|    | 117 V ac + 10% 50/60 Hz + 10%,                       | 1.0 amp |
|    | 230 V ac + 10% 50/60 Hz + 10%,                       | 0.5 amp |
|    | 24 V dc + 10%                                        | 2.0 amp |

### --- Fuse:

Fast-Blo, PCPI, Littelfuse Microfuse Spare fuse provided on connector PCB.

### Wire Size:

Power: 16 AWG 14 AWG Max Signal: 18 AWG

Ground Cable: Third wire ground of power cable.

DS-625 Page 4



### Standard Accuracy: Frequency Output

 $\pm$  1% of rate with flow velocity above 1 fps (0.3 mps)  $\pm$  0.1% of full scale flow below 1 fps.

**Reference Conditions:** 

25° C, 6 fps full scale Temperature effect, 0.025% Full Scale/° C Voltage effect, 0.3% Rate/10% Fluctuation Accuracy statement based on digital outputs

Repeatability: within + 0.1% FS

Power Consumption: Less than 11 VA

Output Signals: Simultaneous Isolated Analog and Digital Analog: 0 or 4-20 mA dc into 800 ohms max.
Digital: Scaled pulse or Frequency (selectable)

a. Scaled Pulse. 24 V dc square wave, 25 ms pulse
width, 0-10 Hz max. Into 150 ohm impedance min.
b. Scaled Frequency. 15 V dc square wave, 50/50 duty
cycle, 0 -1000 Hz max.
Note: Either (a) or (b) with transistor open collector to common, jumper selectable.

Fault: Open collector. Active on self test failure and during programming.

Flow Direction: Open collector. Active in reverse flow.

Input Signal: Positive zero return (PZR). Connect to remote contact to drive output to zero (0-4 mA) when an empty pipe condition can occur.

Minimum Conductivity: 1 micromho/cm

Full Scale Velocity Ranges: 0-3 to 0-33 fps (0 - 1 to 0 - 10 mps)

<u>Ambient Temperature Limits:</u> -20° to 140° F (-30° to 60° C) (Display may darken above 110° F)

Liquid Temperature Limits: -40° to 350° F (-40° to 176° C)

Temperatures above 158° F (70° C) require mounting the electronics separately (max. distance 15 feet at liquid conductivity of 1 micromho and min. velocity of 1 fps).

Storage Temperature Limits - - 20° to 140° F (-30° to 60° C)

| CONSTRUCTION<br>Metering Tube<br>Lining<br>Electrodes<br>Housing<br>Protection rating | Cast Aluminum<br>Aluminum Oxide 99.5%<br>316 SS. Others as req'd.<br>Cast Aluminum<br>Hi-build Epoxy Coated<br>NEMA-4, NEMA-7 | 2.0 Application Considerations<br>The TIGERMAG <sup>™</sup> can be used to accurately measure th<br>volumetric flow rate of liquids having a conductivity of<br>least 1 micromho/cm. |  |  |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Electrical rating                                                                     | General Purpose<br>Designed for Class I & II,<br>Division 1 & 2, Groups B, C and D                                            | will not prevent meter operation, but will produce a positive (+) error equal to the % by volume gas entrainment.                                                                    |  |  |
| (S)P                                                                                  | This equipment for use in Class 1,<br>Division 2, Groups or non-<br>bazardous locations only                                  | Full scale flow rates should be selected above 3 feet per<br>second (1 meter per second) for best accuracy. Verify<br>proper velocities from the nomogram in figure 1.6.             |  |  |



Flowmeter Sizing Guide Figure 1.6

1110

1.9 Interchangeability

sensor.

NOM

1/10

1/4

1/2

1-1/2

1

2

3

4

2.75

METER SIZE (in)

ACT

0.125

0.302

0.452

0.812

1.34

1.69

2.90

3.80

7 87 in Α mm

9.00

9.00

9.00

9.62

10.50

11.00

12.25

13.75

The FM625 Transmitter is designed to be used with any

FM625 Sensor. Electronics are completely interchange-

able. Each electronics module is software configured to the

228

228

228

244

267

279

311

349

DIMENSIONS IN INCHES/MM

59

59

59

59

92

105

145

168

in

4.06

4.06

4.06

4.06

4.06

4.06

6.06

6.06

C mm

103

103

103

103

103

103

154

154

in B mm

2.31

2.31

2.31

2.31

3.62

4.12

5.70

6.62

Dimensions Figure 1.5

### SECTION II - PRE-INSTALLATION

### 2.1 Receiving and Inspection

When the equipment is received, the outside of the package should be inspected for damage. If any damage or shortage is found, notation to that effect should be made on the carrier's delivery receipt.

Visually inspect the sensor and transmitter for damage from rough handling or faulty packaging. If concealed damage is discovered, notify the delivering carrier at once and request an inspection. Confirm telephone conversations in writing. If inspection is not made, prepare an affidavit stating that you notified the transportation company and that they failed to inspect. Save containers and packaging material.

It is essential that the carrier be notified within 15 days from the date of delivery in order to be in a position to present your claim. Make your claim promptly.

Unpacking and handling of FM625 Magnetic Flowmeters should be consistent with the procedures used to handle field instruments.

#### 2.2 Storage

This equipment should be stored in a clean, dry environment. Do not store outside in an unprotected area. Observe the storage temperature requirements. Unpowered storage should not exceed 2 years.

### 2.3 Return of Equipment

Obtain an RGA (Returned Goods Authorization) number from the factory prior to returning any materials. The RGA number should be marked on the outside of the package. Failure to obtain authorization will unnecessarily delay any work to be performed at the factory.

### SECTION III - INSTALLATION

#### 3.1 Site Selection

Select a pipe location which will always be full of liquid. The equipment should be located where the sensor will be accessible for adjustment. Provide a minimum of 18" clearance to the electronics enclosure.

The meter may be located in any position from vertical to horizontal. Flow may be in either direction through the meter. Vertical installation minimizes the possibility of slurry separation. Vertical installation with the liquid flowing upwards assures full pipe conditions.

Horizontal installation requires that the sensing electrodes be positioned in the horizontal plane and grounding electrodes be positioned at the bottom of the meter.

IDS-625 Page 6



Full Pipe Required Figure 3.1

Provide at least three pipe diameters of straight piping approach between an upstream elbow and the midpoint of the meter. In small meters this can be achieved within the meter itself. More straight approach should be provided after valves or multiple elbows. Provide at least 10 diameters after expanders or laterals which are smaller diameter than the line size.

### 3.2 Rotating the Transmitter Display

The transmitter can be rotated 90 degrees in either direction. See figure 3.2. Loosen the lock nut securing the transmitter to the standoff. Rotate the transmitter by hand in the desired direction. Tighten the lock nut to prevent further rotation and to prevent moisture entering the enclosure.

Additional rotation can be achieved by removing the meter from the line and reversing the flow through the meter. Excessive rotation of the transmitter can damage internal wiring. Do not rotate the transmitter more than 90° in either direction.



LOCK NUT & SEAL

### 3.3 Pipe Connections

The flangeless sensor is installed between two process pipe flanges. The sensor contains a non-conductive aluminum oxide liner (ceramic). The integrity of this liner must be maintained for the flowmeter to function. CARE SHOULD BE TAKEN DURING INSTALLATION TO INSURE THAT THIS LINER IS NOT DAMAGED. Depending upon meter size, four (4) or eight (8) steel bolts are furnished with the FM625.\* These bolts are for installing the meter between existing flanges. Also included are two (2) gaskets of PTFE. See Table 3.1 Install the two bolts at the bottom of the meter. Place the meter temporarily between the flanges to confirm correct positioning. The meter should rest directly on the bolts. Remove the meter. Put a small quantity of silicone grease or other tacky material on gasket to hold it temporarily to the end of the meter. Reinstall the meter taking care to keep the gasket centered. Install all bolts and tighten finger tight. Complete installation with torque wrench. It is important that the bolts be tightened alternately so that excessive force is not applied to a concentrated point. See Figure 3.3. Do not exceed the torque limits in Table 3.1

| Table 3.1 Flange and Bolt S | pecifications - ANSI and AWWA | (Bolts furnished for U.S. | shipments only) |
|-----------------------------|-------------------------------|---------------------------|-----------------|
|                             |                               |                           |                 |

| Flange | Pressure | O.D.  | Bott   | Hole    | Bolt Size       | Torque          |   |
|--------|----------|-------|--------|---------|-----------------|-----------------|---|
| Size   | Rating   | Inch  | Circle | Dia     |                 | Limits (ft-lbs) |   |
| 1/2    | 150      | 3-1/2 | 2-3/8  | 4 @ 5/8 | 7/16-14 x 6-3/4 | 17              |   |
| 1/2    | 300      | 3-3/4 | 2-5/8  | 4 @ 5/8 | 1/2-13 x 6-3/4  | 17              |   |
| 1/2    | 600      | 3-3/4 | 2-5/8  | 4 @ 5/8 | 1/2-13 x 6-3/4  | 17              |   |
| 1      | 150      | 4-1/4 | 3-1/8  | 4 @ 5/8 | 7/16-14 x 6-3/4 | 17              |   |
| 1      | 300      | 4-7/8 | 3-1/2  | 4 @ 3/4 | 5/8-11 x 7-1/2  | 17              |   |
| 1      | 600      | 4-7/8 | 3-1/2  | 4 @ 3/4 | 5/8-11 x 7-1/2  | 17              |   |
| 1-1/2  | 150      | 5     | 3-7/8  | 4 @ 5/8 | 1/2-13 x 5-3/4  | 17              |   |
| 1-1/2  | 300      | 6-1/8 | 4-1/2  | 4 @ 7/8 | 3/4-10 x 7-1/2  | 17              |   |
| 1-1/2  | 600      | 6-1/8 | 4-1/2  | 4@7/8   | 3/4-10 x 7-1/2  | 17              |   |
| 2      | 150      | 6     | 4-3/4  | 4 @ 3/4 | 5/8-11 x 7-1/2  | 17              |   |
| 2      | 300      | 6-1/2 | 5      | 8 @ 3/4 | 5/8-11 x 7-1/2  | 17              |   |
| 2      | 600      | 6-1/2 | 5      | 8 @ 3/4 | 5/8-11 x 7-1/2  | 17              | ĺ |
| 3      | 150      | 7-1/2 | 6      | 4 @ 3/4 | 5/8-11 x 9-1/2  | 24              | _ |
| 3      | 300      | 8-1/4 | 6-5/8  | 8 @ 7/8 | 3/4-10 x 10-1/2 | 24              | 1 |
| 4      | 150      | 9     | 7-1/2  | 8@3/4   | 5/8-11 x 9-1/2  | 30              | _ |
| 4      | 300      | 10    | 7-7/8  | 8 @ 7/8 | 3/4-10 x 10-1/2 | 30              |   |

### Table 3.2 DIN Flange and Bolt Specifications

| Flange | Pressure | 0.D. | Bolt   | Hole | Bolt Size | Torque        |
|--------|----------|------|--------|------|-----------|---------------|
| Size   | Rating   | mm   | Circle | Dia  |           | Limits (ka-m) |
| 15     | 10       | 95   | 65     | 4@14 | M10 x 170 | 2.3           |
| 15     | 25       | 95   | 65     | 4@14 | M12 x 170 | 2.3           |
| 25     | 10       | 115  | 85     | 4@14 | M12 x 170 | 2.3           |
| 25     | 25       | 115  | 85     | 4@14 | M12 x 170 | 2.3           |
| 40     | 10       | 150  | 110    | 4@18 | M16 x 190 | 2.3           |
| 40     | 25       | 150  | 110    | 4@18 | M16 x 190 | 2.3           |
| 50     | 10       | 165  | 125    | 4@18 | M16 x 190 | 2.3           |
| 50     | 25       | 165  | 125    | 4@18 | M16 x 190 | 2.3           |
| 80     | 10       | 200  | 160    | 8@18 | M16 x 240 | 3.3           |
| 80     | 25       | 200  | 160    | 8@18 | M16 x 240 | 3.3           |
| 100    | 10       | 220  | 180    | 8@18 | M12 x 240 | 4.0           |
| 100    | 25       | 235  | 190    | 8@22 | M20 x 260 | 40            |



#### 3.4 Grounding

The TIGERMAG<sup>™</sup> has built -in grounding electrodes. The grounding electrodes are in continuous contact with the process liquid providing a direct means for grounding electrical noise in the liquid and eliminating the need for grounding rings or straps. The grounding electrodes are connected to the meter housing and to the ac power electrical ground. The transmitter electronics operate on dc power and are isolated and floating electrically. The signal outputs therefore are isolated from process liquid and ac ground electrical noise.

The electrical noise potential in the process liquid is at a similar level to the electrical ground plane to which the ac supply ground is connected. This grounding method stabilizes the electrical field within the sensor measuring section permitting accurate flow detection. Contact our technical support group if process liquid is maintained at a potential to ground.

### 3.5 Electrical Connections

Unscrew the small blind cover of the electronics enclosure to gain access to the I / OPCB. Separate conduit entrances are provided for power and signal wiring. Conduit entrances are 3/4" NPT. Conduit connections should follow good practice and should be routed from below the meter. If conduit cannot be routed from below, provide moisture traps to prevent moisture from entering the meter enclosure. See figure 3.4.



A connection diagram is located in the cover of the connection section and infigure 3.5. Determine which of the outputs (4-20 mA, fault, flow direction, pulse or frequency) are to be used. Connect the required outputs as shown in figure 3.5. Install 1N4004 diodes when driving inductive loads.



. Figure 3.5

Connect power to the power input. If required, connect the Positive Zero Return (PZR) input. Note that meter output is forced to zero when terminals 4 and 5 are jumpered.

Check the position of the jumper on the I/O board. Place the jumper as shown below. See figure 3.6.

TOTALIZER WITH 24 VDC

The external load on the outputs must be within the limits specified. Calculate the external load by summing the input resistance, including all interconnecting cable. Signal cable of 18-22 gauge is normally adequate.

### External load limits:

Analog output: 800 ohms max impedance 150 ohms min impedance Pulse output:

Both outputs are floating and use the same isolated ground. If both outputs are used simultaneously, only one of the common legs can be grounded. If both are grounded, a ground loop will occur causing erroneous signals.



### 3.6 Remote Mounted Transmitter

Remote mounting of the electronics is required when process temperatures exceed 158° F ( 70° C) or when pipe vibration is excessive. Remote mounting should be used when high process temperatures exist at high ambient temperatures.

A bracket for wall or pipe mounting is furnished as part of the optional remote mounting kit. Interconnecting cable is supplied between the sensor and transmitter enclosure. The cable is pre-wired to the transmitter. Also supplied is a sensor mounted NEMA-7 rated junction box in which coil and electrode connections are made.

The standard interconnecting cable length is 15 feet. Shorter or longer cables should be ordered from the factory. Do not attempt to shorten the cables in the field.





**Remote Transmitter Mounting Bracket** Figure 3.8

REMOTE TRANSMITTER

TEE MOUNTING STANDOFF

OUTPUT 3/4 NPT---

POWER IN

SIGNAL WIRING

### **SECTION IV - START-UP**

Prior to applying power, the following checks should be made:

a) Check the flowmeter nameplate to insure that the power supply voltage is correct.

b) Verify that all electrical connections are correct. See figures 3.5 and 3.7.

c) Check the polarity of external loads connected to the outputs.

### **SECTION V - CALIBRATION**

All flowmeters are calibrated before leaving the factory. No field recalibration is required.

The 4 and 20 mA current level may be checked if desired by following the procedure in Appendix I DIAGNOSTICS. The meter can be used as a current calibrator to check connected equipment. See Appendix para. 2.2.2.

### **SECTION VI - MAINTENANCE**

No routine maintenance is required.

### SECTION VII -TROUBLESHOOTING 7.1 General

Each flowmeter is rigorously tested during production. The final test stage is a wet flow calibration in a Sparling precision primary flow laboratory traceable to the National Institute of Standards and Technology (NIST).

Before troubleshooting, carefully verify the operating conditions of the meter:

- 1. Verify the interconnecting wiring by using a local milliammeter connected to the current output with no other load connected.
- 2. Verify that the sensor is completely filled with liquid. An empty or partially full sensor will continue to send a flow signal even with no flow.
- 3. Verify that the flow test comparison is valid to be sure that the meter is in error.
- 4. If in doubt, verify the conductivity of the liquid to see that it exceeds 1 michromho/cm.

### 7.2 Troubleshooting Chart

The following trouble shooting chart should assist in correcting meter malfunction. For additional assistance, contact Technical Support 800/423-4539 (818/444-0571 in California).

### WARNING

(a) "WARNING - EXPLOSION HAZARD- SUBSTI-TUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2";

"AVERTISSEMENT - RISQUE D'EXPLOSION -LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE 1, DIVISION 2".

(b) "THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS 1, DIVISION 2, GROUPS (AS APPLI-CABLE) OR NON-HAZARDOUS LOCATIONS ONLY.

| SYMPTOM                                                                                                                    | POSSIBLE CAUSE AND CURE                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Meter display reads "CHECKSUM ERROR" on power-<br>up.                                                                   | 1. The meter has failed the power on self-test. Answer<br>"YES" and the meter will load default values and start<br>operating. Both factory and user setting will require<br>reprogramming. See Appendix II A-9.                                                      |
| 2. Display is blank.                                                                                                       | 2. Check the power and the fuse.<br>Turn the power off and on.<br>Call the factory for assistance.                                                                                                                                                                    |
| 3. Display is turning black around edges.                                                                                  | <ol> <li>Temperature is too high inside the enclosure. Relocate<br/>the meter or shield against the heat source. Continuing<br/>to power the meter in this condition will permanently<br/>damage the display.</li> </ol>                                              |
| 4. Display is difficult to read.                                                                                           | <ol> <li>Improve the lighting conditions if ambient light is dim<br/>Remove large cover and adjust the pot directly below the<br/>display for best contrast while viewing from the intended<br/>viewing angle.</li> </ol>                                             |
| 5. Displayed flow rate changes rapidly (jitters).                                                                          | 5. Unsteady flow. Increase display damping. See Appen<br>dix I, 1.9.1.                                                                                                                                                                                                |
| 6. Recorder trace is too wide (paints).                                                                                    | 6. Increase current damping. See Appendix I, 1.9.2.                                                                                                                                                                                                                   |
| 7. Display is correct but current output does not correctly track the flow.                                                | <ol> <li>Incorrect selection of full scale "Q" which defines the<br/>flow rate for 20 mA.</li> <li>Verify current scale selection (0 - 20 mA or 4 - 20 mA).</li> <li>Perform "CURRENT CHECK" in diagnostics.</li> </ol>                                               |
| 8. Display is correct but totalizer doesn't correctly track the flow.                                                      | <ol> <li>Incorrect selection of registration "R".</li> <li>Verify output selection (either "TOT" or "FREQ") and<br/>matching jumper placement on I/O board.</li> </ol>                                                                                                |
| 9. Display and outputs are at zero.                                                                                        | 9. Dry Sensor<br>Full pipe no flow condition.<br>PZR contact closed.                                                                                                                                                                                                  |
| 10. Display and outputs are not zero at zero flow.                                                                         | 10. Leaky valves<br>Some liquid movement. Set Low flow cutoff to keep<br>totalizer from advancing.                                                                                                                                                                    |
| 11. Display and outputs are erratic or wander.                                                                             | <ol> <li>Pipe partially full.</li> <li>Large air bubbles are present in the process liquid.</li> <li>Increase the head in the line by restricting downstream flow.</li> <li>Pipe freshly drained. If part of process cycle utilize PZR to inhibit outputs.</li> </ol> |
| 12. Internal totalizer not advancing.                                                                                      | <ul> <li>12. Meter operating in reverse flow. (Negative sign will show on display.) Change flow direction. (See Appendix I, 1.8.2.</li> <li>"R" selected too high for the actual flow.</li> </ul>                                                                     |
| If the above steps fail to correct the problem, try different<br>flow rates and disconnecting loads temporarily and see if | When does the symptom occur or repeat?                                                                                                                                                                                                                                |
| the problem persists. Perform simulator check and call the factory.                                                        | What are the flow rates, the orientation of the meter in the<br>pipeline, environmental conditions and the output loads<br>on <b>the meter?</b>                                                                                                                       |
| Please have the following information available when you                                                                   |                                                                                                                                                                                                                                                                       |

call:

Meter serial number.

Description of the problem. (Display, current output,

totalizer/frequency, all of the above.)

How did you verify the discrepancy?

Contact Technical Support 800/423-4539 (in California 818/444-0571) for additional assistance.
## 7.3 Electronics Self Test

7.4 Electronics Module Replacement

Using the MAG-COMMAND<sup>™</sup> (magnetized screwdriver), enter programming mode by holding the MAG-COMMAND to the "NO" switch for several seconds. See Appendix for detailed instructions. Answer NO to all prompts until the DI-AGNOSTICS menuappears. Answer YES to the DIAGNOS-TICS menu. Follow the menu instructions.

At this point, it will be necessary to remove the coverto gain access to the electrode cable PCB.

Remove the electrode cable PCB and rotate it 90 degrees as shown in figure 7.2. Continue to follow the instructions in the menu. The meter will self test exercising the coil timing circuits and internal electronics. If it obtains the same values as were factory stored, it will answer "PASSED".

This confirms that the electronics are functioning correctly.





Removing the electronics module Figure 7.3





Meter electronics are contained in a plug in module. <u>This</u> module contains no user serviceable parts.

WARNING: DO NOT REMOVE ELECTRONICS MODULE WHILE POWER IS APPLIED. DISCONNECT POWER BE-FORE PROCEEDING

To remove the electronics module, first unplug the electrode cable PCB and the coil cable. See figure 7.1.

Grasp the module at each side and pull firmly while rocking the boards gently from side to side. <u>Do not pull the module</u> out by the display.

When re-installing the electronics module, observe the connector in the bottom of the electronics enclosure. Line up the electronics module with the connector. Plug in the replacement module. Plug in coil and electrode PCB's. Be certain the plug wires are routed properly and will allow you to engage housing cover.

Apply power and observe display. Now, reprogram any values which were modified from factory preset levels.

# 7.5 Sensor Testing

The sensor consists of a measuring section with electrodes and coils in an aluminum enclosure. Defective sensors should be returned to the factory for repair. OBTAIN A RETURNED GOODS AUTHORIZATION PRIOR TO RE-TURNING MATERIALS TO PREVENT DELAYS.

# 7.6 Coil Continuity Testing

| CAUTION      |                        |                |  |  |  |  |
|--------------|------------------------|----------------|--|--|--|--|
| DO NOT MAKE  | OR BREAK COIL          | CONNECTION     |  |  |  |  |
| WHILE POWER  | IS APPLIED.            | DISCONNECT     |  |  |  |  |
| POWER BEFORE | <b>PROCEEDING WITH</b> | 7.4a AND 7.4b. |  |  |  |  |

Unplug coil cable PCB. Using a short test lead, connect ohmmeter between coll wires and measure resistance. See Figure 7.4b.



|        | Coll           |       |
|--------|----------------|-------|
|        | Resistance     | Power |
| Dia.   | Ohms           | Input |
| Inches | ( <u>+</u> 5%) | (VA)  |
| 0.1    | 270            | 11    |
| 0.25   | 270            | 11    |
| 0.5    | 270            | 11    |
| 1.0    | 270            | 11    |
| 1.5    | 270            | 11    |
| 2      | 270            | 11    |
| 3      | 270            | 11    |
| 4      | 270            | 11    |
|        |                |       |

If the coil resistance is too high or low (including open and short circuits) the sensor must be returned to the factory for Inspection and/or repair.

## 7.7 Coil Insulation Test

Required test equipment: Insulation tester 10<sup>10</sup> ohm

Disconnect coil wires, figure 7.4c.

Connect insulation tester between coil wire and housing ground. Test the insulation at 500 V dc. A reading below 10000 meg ohms indicates molsture in the sensor. The sensor must be returned to the factory for inspection and/ or repair.

# 7.8 Electrode Circuit Continuity Test

Remove sensor from the pipeline. Drain sensor and dry interior thoroughly.

Unplug coll and electrode cable pcbs.

Connect ohmmeter to E1 (center conductor of one electrode cable) and to the electrodes which are accessible through the open sensor. Use the sensing electrodes which are located opposite each other in the center of the sensor. Do not use the grounding electrodes which are located at the ends of the pipe (0.1" thru 2") or midway between the sensing electrodes (3" & 4").

Measure 0 ohms for one electrode and  $\infty$  ohms for the other.

Connect ohmmeter to E2 and repeat the above procedure.



Electrode Cable PCB Figure 7.5 IDS-625 Page 13

## 7.9 Electrode Circuit Insulation Test

Unplug coll and electrode cable PCB's.

Connect insulation tester three ways (see figure 7.5.):

- 1. Between E1 and housing ground.
- 2. Between E2 and housing ground.
- 3. Between E1 and E2.

A reading below 1400 meg ohms at 500 V dc indicates moisture in the sensor. Return the sensor to the factory for inspection and repair.

## SECTION VIII REPLACEMENT PARTS LIST

| 1. Electronics Mo                                                                                                                                                                     | dule, complete                                                       | Part Number<br>549993 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------|
| 2. I/O PCB                                                                                                                                                                            |                                                                      | 549347                |
| 3. Fuse, Fast-Blo,                                                                                                                                                                    | PCPI Littelfuse                                                      |                       |
| 230 Vac                                                                                                                                                                               | 0.5 amp                                                              | 116287                |
| 117 Vac                                                                                                                                                                               | 1.0 amp                                                              | 116295                |
| 24 Vdc                                                                                                                                                                                | 2.0 amp                                                              | 117102                |
| <ul> <li>4. Transmitter, remassembly incluants</li> <li>a) Mounting b</li> <li>b) Tee mounting</li> <li>c) Sensor junction</li> <li>d) 15 ft. cable</li> <li>e) Cable grip</li> </ul> | note mount<br>des:<br>racket<br>ng standoff<br>ition box<br>assembly | 550203                |
| 5. Replacement re                                                                                                                                                                     | emote mount cable, ft                                                | 143967                |

550071

~ 6. Remote mount PCB

# APPENDIX I - PROGRAMMING (Firmware Ver. 5.2)

## 1.1 General



The 16 character alpha-numeric display is located directly above two magnetically operated Hall effect switches. The left switch is labeled "YES" and the right switch is labeled "NO". THESE SWITCHES ARE THE ONLY CONTROLS YOU WILL USE TO SELECT AND CHANGE PARAME-TERS ON THE TIGERMAG.

The TIGERMAG is configured to the user's installation (programmed) using the MAG-COMMAND magnetic probe furnished with each meter. It can also be programmed with any high strength magnet. (See figure A 1.1). Either switch is activated by momentarily holding the MAG-COMMAND probe close to the switch.

# IT IS NOT NECESSARY TO OPEN THE ELECTRONICS COMPARTMENT IN ORDER TO CHANGE PROGRAM SETTINGS.

Refer to figure A 1.2 to determine how to get to each section of the program.

## 1.2 Entering alphanumeric data

Alphanumeric data is required for the password and to enter or change constants. When data is required, the cursor will be positioned under the first character. A "NO" answer will cause the next valid character to be displayed in turn. A "YES" answer accepts the displayed character or digit and moves the cursor to the next position. After answering "YES" to the last character, you will be prompted with the entire data just entered. Answer "NO" if you wish to change. Answer "YES" when it is correct.



In this manual the meter display will be shown in a box like this:



## 1.3 Select Display Mode

Answer "YES" when the meter is in operation to toggle the display modes. A "YES" will change the display from showing flow rate (the default) to showing both rate and total alternately or showing the totalizer counter only.



# 1.4 Show Meter Data

Hold the MAG-COMMAND next to the "NO" switch for approximately 3 seconds. The meter will respond:

SHOW METER DATA?

a) Answer "YES" and the meter will display the model number, firmware version, serial number, tag number, K factor (pulses/gallon) liner and electrode material. As each data line is displayed a "YES" answer will display the next item. <u>A "NO" answer at any item (or lack of response for 12</u> seconds) will return the meter to the operating display.

b) A failure to answer this prompt within a few seconds will automatically bring the PASSWORD menu. See Sec. 1.5.

c) Answer "NO" and the PASSWORD prompt appears. A failure to enter a correct password will return the meter to operation.

1.5 Enter Program Loop

PASSWORD=0000

To go beyond this point, a valid password is required. Every meter is shipped with the default password "0001". Any user with a valid password can change the password. The meter password is entered by responding to each digit of the password with a "YES" or "NO". A "YES" moves the cursor under the next digit to the right.. A "NO" scrolls to the next higher value for the underlined digit and then back to 0 again. The same 12 second time limit applies to each digit selection ie., a lack of response advances the cursor to the next position. Upon entry of a valid password, the meter enters program mode and activates the fault output to signal remotely that programming is taking place.



## 1.6.2 Set Full Scale

1.6 Rescale Rate



A "YES" answer enters the Rescale Rate loop. A "NO" answer continues to the next menu item.

A menu is presented to select the engineering units in which rate is displayed and scaled. By answering "NO" each menu selection is presented in turn. A "YES" selection selects the unit displayed and moves on to the next item.

1.6.1 Select Rate Units

# RATE UNITS = GPM

Answer "YES" if you want the rate displayed in "GPM". Otherwise answer "NO". A "NO" answer will bring the other pre-defined choices in turn ie., liters/min., cu. ft./sec., liters/sec., cubic meters/hour, million gallons/day, ft./sec., meters/sec. and ???. Answer "YES" to the predefined rate units or to "???". A "NO" to each item brings you back to the beginning of the loop. You must answer "YES" to one of the selections to leave the loop.

Select one of the presented units of measure by answering "YES" and skip to Sec. 1.6.2. If no appropriate choice is displayed, select "???" and define your own units in 1.6.1a below.

1.6.1a User defined rate units

RATE UNITS = AAA

Note the cursor under the first <u>A</u>. Select the three alphabetic or numeric characters which you want displayed for your selected rate units by answering "NO" until the correct character is displayed in the current cursor position. A "YES" answer then accepts that character and moves the cursor one position to the right. A "YES" to the last character brings the conversion factor menu.

1.6.1b Conversion Factor

1 = 1.200000 GPM?

The conversion factor is defined as U.S. GPM/user unit. This is interpreted to mean that 1 of your selected units equals 1.2 GPM. Enter the number of GPM which is equal to 1 of your selected units.

Example: To set the conversion factor for gallons per hour, enter the number of gallons per minute which is equal to 1 gallon per hour. In this case, 1/60 GPM = 1 GPH. Enter 1/60 or 0.01666666. The full scale flow rate defines only the flow rate at which the current output is set to 20 mA and at which the frequency output is set to 1000 Hz. It does not affect the display or the accuracy of the frequency or pulse output.

Q = 5.0000000 GPH?

Full scale flow is selected in the units defined in 1.6.1 above. Thus, if "GPH" were defined, full scale would be defined in GPH not GPM. By answering "YES" or "NO" to each digit, you can enter the full scale flow rate. A full scale below 1FPS or above 33 FPS will receive a warning of "OUT OF RANGE LOW" or "OUT OF RANGE HIGH".

1.6.3 Select Rate as Percent of Full Scale

DISPLAY: RATE UNITS

A "YES" answer will display flow in engineering units as defined in 1.6.2.. "NO" displays rate as a percentage of full scale. Either choice will affect only the format of the display and nothing else.



# **RESCALE TOTAL**

A "YES" answer enters the Rescale Total loop. A "NO" answer continues to the next menu item.

**RESET TOTALIZER?** 

This is a warning that any change of totalizer scaling will automatically reset the internal totalizer(s). A "NO" answer ends this loop.

1.7.0 Count Direction

The internal totalizer can be programmed to totalized in the forward direction only or to totalize separately for forward and reverse.

COUNT: FWD ONLY

Answer "YES" to count in the forward direction only (shown in the "operate" mode as "COUNT = ").

COUNT: FWD, REV

Answer "YES" to have separate internal counters for forward and reverse flow (displayed as "F CNT = " and "R CNT = " respectively.)

1.7.1 Select Total Units

A menu is presented to select the engineering units in which totalization or frequency is displayed and scaled. By answering "NO" each menu selection is presented in turn. A "YES" selection selects the unit displayed and moves on to the next item.



Answer "NO" to view the available pre-defined totalization units. Select "YES" to the preferred engineering units for totalization. One of the options will be ???. This permits the definition of any desired units. A "YES" must be selected to one of the options to exit this loop.

1.7.1a User defined totalizer units



Select the desired 3 character abbreviation as in 1.6.1a above.

Ver 5.2 Page A4

## 1.7.1b Conversion factor

1 = 1.2500000 GAL?

Enter the number of U.S. gallons which is equivalent to 1 of your selected units.

For example, the conversion factor from U.S. Gallons to Imperial Gallons is 1.25 because there are 1.25 U.S. Gallons to each 1 Imperial Gallon.

1.7.2 Set Registration



Enter the number of your engineering units of totalization which is equivalent to one count of the totalizer. This is normally an even number such as 0.1,1, 10, 100, etc. In the above case 100 gallons will produce one totalizer pulse.

1.8 Set Outputs



This permits the selection of 4-20 or 0-20 mA dc outputs. Answer yes to the output desired. Most U.S. installations will use 4-20.

1.8.1 Select Pulse or Frequency



This selects the totalizer output of 0-10 Hz 25 ms, 24 V dc. The frequency output of 0-1000 Hz, 50/50 duty cycle is selected by answering "NO" to "OUTPUT: TOT" and "YES" to "OUTPUT: FREQ".

A jumper located on the I/O board under the small cover must be correctly set in the "totalizer" or "frequency" position. Be sure that your connections are properly made for the outputs which you select. (See figure 3.6). Set the jumper in the "open collector position" if an unpowered signal is preferred.

1.8.2 Set flow direction .



This allows the user to reverse the normal flow direction. The default flow direction is from left to right as you face the display. If flow is in the opposite direction a minus sign (-) will appear in the display, the flow direction output will be active and the internal totalizer will be inhibited in the count forward direction. Apart from that, the meter will operate prroperly in either direction. Answer "NO" to reverse the normal flow direction. The meter will operate properly in either direction.

## 1.8.3 Empty Pipe Detection

Disabled on default, it must be enabled in the factory. It allows the user to set the EPD control between 0 (= off) and 9 as part of "SET OUTPUTS?" menu. Numerically, this represents approx. delay in seconds before the activation of EPD state (outputs driven to zero, totalizer on hold, message "OUTPUT INHIBITED" on display). Note that EPD setting functions like a "volume" control, with "0" serving as an 'EPD-off' click and "1" thru "9" enabling various levels of detection. Typical setting may fall between 3 and 6, for the customer to select: the lower the number, the higher the possibility of 'false' detection of a single air bubble. Factory setting is "0" (off).



## 1.9 Damping adjustments



Display and current output are damped independently. Answer "YES" to enter this loop.

1.9.1 Display Damping

DISP DAMPING = 5

A "NO" answer scrolls from 0 (no damping) through 9 (maximum damping). Answer "YES" to the desired degree of display damping. Some experimentation may be necessary to obtain optimum results.

1.9.2 Current Damping

CURRENT DAMP = 20

Current damping may be selected from 0 to 99 seconds. This corresponds approximately to the number of seconds to respond 90% of the way to a step change in input.

1.9.3 Low Flow Cutoff

% ZERO CUTOFF = 0

This is the minimum flow rate at below which meter outputs are forced to zero. The number entered corresponds to the Ver 5.2 Page A6 selected percentage of full scale. Choices range from 0 (low flow cutoff disabled) through 9%.

1.9.4 Pulp Noise Suppression



This feature provides a method of rejecting noisy signals received at the electrodes. These signals are normally associated with pulp flow such as found in paper processing or in juice processing.

Pulp noise rejection ignores any single flow signal which differs excessively from the preceding signal. As soon as two consecutive signals are received which are within the accepted range, the meter responds to the signal as being a true flow signal.

If pulp noise is encountered, select a suppression amount required to stabilize the signal. The units are the percentage change which is acceptable from one sampling cycle to the next as being a true flow signal. Zero is arbitrarily defined as disabling noise suppression. See Manual section 1.4.3.

2.0 Exit Programming



A "YES" answer stores the changes which have been made and returns the meter to operation. A "NO" goes to the next menu item.

2.1 Change Password

CHANGE PASSWORD?

ARE YOU SURE?

Answer "NO" to return to CHANGE PASSWORD. Answer "NO" again to continue to the next item.

A "YES" answer permits you to change the password by scrolling through the four available digits. Be sure to record your new password. *If you change the password and fail to record or remember it you will be unable to re-enter the program at a later date.* 

DIAGNOSTICS?



Answer "YES" to enter the diagnostics loop. A "NO" answer returns to the RESCALE RATE menu.

It is recommended that you do not perform diagnostics unless malfunction is suspected. Refer to the trouble shooting section for coil and electrode tests which can be performed.

WARNING. The meter will cease to be updated while you are in this loop. Outputs will be held at their last value.

2.2.1 Check coll current. (Perform this test last) DISCONNECT POWER BEFORE PROCEEDING

CAUTION: The coil current has been factory set using precision instrumentation. Confirm the accurate calibration of test equipment prior to making any adjustments. Improper adjustment will affect meter calibration.

STOP COIL DRIVE?

A "YES" response enters the simulation mode. the Display reads:





Coil Jumper Figure A 1.8 Remove coil jumper. See figure 1.8. Place a digital current meter in series with the colls. See figure 7.4b. BE SURE TO DISCONNECT POWER FIRST.

COIL = HIGH

Read coil current of 80.00 mA ±0.05 mA.

COIL=LOW

Read coil current of -80.00 mA ±0.05 mA. If necessary adjust pot R21 to achieve the correct current reading.

A "NO" response enters the loop current check mode.

2.2.2 Check Current Loop

LOOP CURRENT = 04

By answering "NO" the loop current can be scrolled up to 20 mA and then back to 4. Answer "YES" at the desired value. Check the 4 mA and 20 mA positions with a digital milliammeter. Each should be accurate within ±0.02 mA.

The current output can also be used to test other equipment in the current loop such as recorders and controllers.

CABLE BOARD OPERATE POSITION ANALOG PCB

**Electrode Cable - Simulate Position** Figure 1.9

Ver 5.2 Page A8

SIMULATOR CHECK?

Answer "YES" to enter the self test mode.

PCB ROTATED?

Rotate the electrode PCB to the test position. See figure 1.9. Then answer "YES". The meter will then compare the signal level injected into the meter with the level which was set at the factory.

SELF -TEST PASSED

The electronics are working satisfactorily.

The electronics are not operating accurately. Replace the electronics module. See Section 7.3.

SELF-TEST FAILED



2.2.3 Simulator

## **APPENDIX II - FACTORY SET-UP**

#### 1.1 General

The Factory Set-up menu is available only on spare electronics modules or on recovery from "CHECK SUM ER-ROR".

Enter the programming loop as described in Appendix I, 1.1 - 1.5.

## 1.2 Factory Set-Up



In this menu, data is entered which customizes a universal set of electronics to the specific sensor. This is normally a factory function and is done in the field only when spare electronics are stocked in the field or when a "CHECK SUM ERROR" occurs. Replacement electronics from the factory are pre-programmed for your sensor serial number.

# 1.3 Setting the Calibration Constant "K".

| K = 2000.0000 ? |  |
|-----------------|--|
|-----------------|--|

Set "K" to the value stamped on the sensor nameplate.

## 1.4 Setting the off set



Set "O" (the offset in Hz) to the correct value. The correct value of "O" is located on the Nameplate (SN H - 1600000 and above) and on the meter data printout furnished with each meter. Select proper sign of the offset (+ or -) by replying "YES" to:



# 1.5 Exit

When replacing the electronics module, you can exit at this point and the meter will function correctly. *Do not proceed unless recovering from "CHECK SUM ERROR". Any errors made will affect meter accuracy.* 



## 1.6 Set Meter Data

This permits setting the model number, serial number, tag number, nominal meter size, liner, electrode material, actual diameter (see figure 1.5) and the coil frequency.

Caution: Do not change the tag number at this time. A change will prevent return to factory set-up.

## 1.7 Cal 4-20 Loop

Answer "YES" and connect an external digital current meter (DMM) to the current output in series with or in place of field wiring.. While display shows "SET 4MA OUTPUT", hold the magnet over the "NO" and watch the current increase on the DMM. As it passes the 3.9 mA mark apply brief magnet strokes to "NO" until the DMM reads  $4.00 \pm 0.05$  mA. Reply "YES" to that and to the prompt "OUTPUT=4 MA?" that follows. A "NO" answer will restart the adjustment. The 20 mA level is set in the same manner.

## 1.8 Set Sim Level

A "YES" answer resets the stored values used by the simulator to confirm proper meter operation. Answer "YES" if correcting a "CHECK SUM ERROR", otherwise answer "NO".

# 1.9 Set Gain Errors

Automatic ranging uses 8 gain levels. Each level can be individually trimmed in software to enhance interchangeability of electronics. These gain levels require resetting when recovering from a "CHECK SUM ERROR". Set the gain correction to the data supplied with-the meter. Also set "H", a slope correction factor.

When exchanging electronics, do not change these correction factors as the gain errors and "H" relate to the electronics rather than the sensor.

## 2.0 Finalizing

 The meter will return to operation as soon as "H" is set.
 Return to user programming and set full scale, damping etc. as required.

- After confirming proper operation you may disable the factory set-up menu as follows:
- Enter Factory Set-up and answer "NO" to each prompt until the display reads

SET METER DATA?

Answer "YES" to enter the SET METER DATA loop. Set through each item until the display reads:



Answer "NO" to any character to change it. Change the tag so that it no longer contains the word "SPARE."

Caution: When you exit the SET METER DATA loop, you will not have access to the Factory Set-up Menu.

# B.3 FLOAT CONTROL SWITCHES



# **TYPE S**



The ROTO-FLOAT is a direct acting float switch. Each ROTO-FLOAT contains a single pole mercury switch which actuates when the longitudinal axis of the float is horizontal, and deactuates when the liquid level falls 1" below the actuation elevation.

The float is a chemical resistant polypropylene casing with a firmly bonded electrical cable protruding. One end of the cable is permanently connected to the enclosed mercury switch and the entire assembly is encapsulated to form a completely water tight and impact resistant unit. Type S — Suspended has bullt in weight.

ROTO-FLOATS can be mounted on a support pipe (type P) or suspended from above (type S). Advantages of the ROTO-FLOAT are low cost, simplicity and reliability.

Listed
 Pilot Duty

Industrial Control Equipment

CABLE STATE

P.V.C. type STO #18 conductors (41 strand) rated 600 volts • Various lengths available • See table of models • Non-standard lengths also available on special order.

| Switch<br>Arrangement | Cable<br>Length | Suspended<br>Type S Model No. | Ship.<br>Wt. |
|-----------------------|-----------------|-------------------------------|--------------|
| Marrally              | 20              | 820NO                         | 40           |
| Normany               | 30              | SJONO                         | 41/20        |
| Open                  | 40              | S40NO                         | 51/40        |
| Normally              | 20              | S20NC                         | 40           |
|                       | 30              | SJONC                         | 41/20        |
| Closed                | 40              | S40NC                         | 51/40        |

#### GENERAL DESC

THE ROTO-FLOAT IS A DIRECT ACTING FLOAT SWITCH. EACH ROTO-FLOAT CONTAINS A SINGLE POLE MERCURY SWITCH WHICH ACTUATES WHEN THE LONGITUDINAL AXIS OF THE FLOAT IS HORIZONTAL, AND DEACTUATES WHEN THE LIQUID FALLS I" BELOW THE ACTUATION ELEVATION.

THE FLOAT IS A CHEMICAL RESISTANT POLPROPYLENE CASING WITH A FIRMLY BONDED ELECTRICAL CABLE PROTRUDING. ONE END OF THE CABLE IS PERMANENTLY CONNECTED TO THE GLASS ENCLOSED MERCURY SWITCH AND THE ENTIRE ASSEMBLY IS ENCAPSULATED TO FORM A COMPLETELY WATER TIGHT AND IMPACT RESISTANT UNIT.

ROTO-FLOATS CAN BE MOUNTED ON A SUPPORT PIPE. (TYPE P): OR SUSPENDED FROM ABOVE, (TYPE S). ACVANTAGES OF THE ROTO-FLOAT ARE LOW COST, SIMPLICITY AND RELIABILITY. VARIOUS CIRCUIT CONFIGURATIONS, OTHER THAN THE ONES LISTED BELOW. ARE AVAILABLE.

#### SPECIFICATIONS:



PVC TYPE ST0, 2 • 18 AWG 41 STRAND 600V, 60°C CONDUCTORS 20', 30', 40' LENGTHS STANDARD. OTHER LENGTHS AVAILABLE. UL & CSA LISTED.

TEMP LIMIT 50°C

- POLYPROPYLENE CASING CONTAINS HERMETICALLY SEALED MERCURY SWITCH.

> USE: N.O. FOR PUMP OUT N.C. FOR PUMP IN

- UL LISTED, IND. CONT. EQ. PILOT DUTY 4 5 AMPS 120 VAC 2 25 AMPS 240 VAC
- FLOAT COLOR
   N.O., BLACK
   N.C., RED
- MOUNTING ARRANGEMENT
   TYPE P PIPE MOUNTED MODEL INCLUDES
   POLYPROPYLENE CLAMP

TYPE'S SUSPENDED MODEL WITH STABILIZING WEIGHT

#### MODELS:

| SWITCH<br>ARRANGEMENT | CARLE          | CARLE SUSPENDED TYPE       |                    | PIPE MOUNT                     | PIPE MOUNTED TYPE P |  |
|-----------------------|----------------|----------------------------|--------------------|--------------------------------|---------------------|--|
|                       | LENGTH         | MODEL NO.                  | SHIP WT.           | MODEL NO.                      | SHIP WT.            |  |
| NORMALLY<br>OPEN      | 20<br>30<br>40 | \$20N0<br>\$30N0<br>\$40N0 | 4-<br>4 %-<br>5 %- | P20N0<br>P30N0<br>P40N0        | 2+<br>2 %+<br>3 %+  |  |
| NORMALLY<br>CLOSED    | 20<br>30<br>40 | SZONC<br>SJONC<br>S4ONC    | 4-<br>4 %-<br>5 %- | P20NC<br><b>P30NC</b><br>P40NC | 2+<br>2%=<br>3%+    |  |

#### APPLICATIONS.

FOR USE IN CONTROLLING PUMPS OR OTHER MACHINES AND MEASURING ALARM LEVELS IN WATER, SEWAGE AND MANY OTHER LIQUIDS. ROTO-FLOATS WAY BE USED FOR PUMP IN OR PUMP OUT CONTROL, FOR LOW LEVEL CUTOUT, OR FOR LOW AND HIGH LEVEL ALARMS.



# B.4 SLIDE-AWAY COUPLING DEVICES

# Slide Away Coupling

| SECTION    | 15    |
|------------|-------|
| PAGE       | 39    |
| ISSUED     | 10/85 |
| SUPERSEDES | 2/85  |

# Model

# BAF 1-1/4M

A complete system in one carton includes top brackets, moveable and stationary fittings, and bottom rail supports.

This coupling allows the submersible wastewater or effluent pumps to be installed or removed without requiring personnel to enter the wet well.

%" pipe, plastic, galvanized or stainless steel, should be used for guide rails.

The stationary portion is made of cast brass and locks to the guide rails with stainless steel set screws, and has a funnel top for easy mating with the moveable portion.

The moveable portion is made of cast brass and has a teflon coated O-ring in it to provide a positive leak-proof seal. The moveable portion is provided with a 3/8"-16 tapping for installation of a pull rod if desired.

# **Specifications**

| Overall Width                  | 7.0″  |
|--------------------------------|-------|
| Overall Height                 | 4.5"  |
| Overall Depth                  | 2.0″  |
| Guide Rails—Center to Center   | 5.18" |
| Travel to Completely Disengage | 4.0"  |
| Pressure Rating—Min. P.S.I.    | 150   |





B.5 AIR RELEASE VALVE

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# UNIVERSAL AIR VALVES

#### OPERATION

The Universal Air Valve is designed to permit automatic escape of large quantities of air from a pipeline when the line is being filled, and permit air to enter the pipeline when the line is being emptied. It will also allow accumulating air to escape while the line is in operation and under pressure.

Cutaway View A shows the valve in a wide open or empty position. As the liquid rises into the valve, air escapes through the large orifice and into the outer atmosphere. Liquid entering the valve raises the float and lever system, carrying with it the pressure plunger and the main valve. When the liquid has raised the float to its limit (View B), the stainless steel main valve rests against the seat and the pressure plunger also rests against its seat, which is the main valve. In this position, the valve is closed and no liquid can escape.

If accumulating air rises into the valve while the line is in operation and under pressure, it will displace the liquid at the top of the valve body and the float will start to go down as the liquid level drops. As this occurs, the pressure valve will open (View C), permitting the escape of the accumulated air, after which the liquid level will rise and the valve will close.

Should the pipeline be drained through natural processes or a large break develop, the float will drop all the way down as the liquid level sinks in the valve body. The valve will then stand in the full open position (View A) permitting the entrance of air and eliminating danger of pipeline collapse due to vacuum.

These cycles will repeat automatically as each condition presents itself, and the valve will function satisfactorily with hot or cold water, and in the presence of many chemicals and oil base liquids.

#### ORIFICE SIZING INFORMATION FOR 1" VALVE

|   | ORIFICE DIA. | RANGE OF WORKING PRESSURE |
|---|--------------|---------------------------|
|   | 3/16"        | 0 TO 125 LBS.             |
| • | 5/32**       | 0 TO 200 LBS.             |
|   | 1/8"         | 0 TO 250 LBS.             |
|   | 3/32'        | 0 TO 300 LBS.             |

ORIFICE SIZING INFORMATION FOR 2"-3"-4"-6" AND 8" VALVES

| ORIFICE DIA. | RANGE OF WORKING PRESSURE |
|--------------|---------------------------|
| 1/4"         | 0 TO 165 LBS.             |
| 3/16"        | 0 TO 250 LBS.             |
| 1/8''        | 0 TO 300 LBS.             |

## PERFORMANCE CHART



PARTS LIST

| Part No.     | Name                  | Material        |
|--------------|-----------------------|-----------------|
| 1P*          | Protectop             | Cast Iron       |
| 15*          | Top                   | Cast Iron       |
| 2            | Flange                | Cast Iron       |
| 3*           | Body, Screwed         | Cast Iron       |
| 3F*          | Body, 125 lb. Figd.   | Cast Iron       |
| 3FH+         | Body, 250 lb. Flgd.   | Cast Iron       |
| 4            | A & V Fulcrum         | Brass           |
| 5 & 16 Assy  |                       |                 |
| 6            | Valve Lever           | Brass           |
| 7,           | Link                  | Brass           |
| 8            | Ball Lever            | Bress           |
| 9            | Ball Floet            | Stainless Steel |
| 10           | Bell Fulcrum          | Bress           |
| 11           | Plunger               | Brass           |
| 12           | Plunger Nut           | Breas           |
| 13           | Screw                 | Stainless Steel |
| 14           | Pressure Valve        | Rubber          |
| 15           | Pressure Seat         | Stainless Steel |
| 16 & 5 Assy. | 4                     |                 |
| 17           | Seat Cage             | Brass           |
| 18           | A & V Seat            | Rubber          |
| 19           | A & V Limit Stop      | Stainless Steel |
| 20           | Limit Stop Nut        | Stainless Steel |
| 21           | Press. Limit Stop     | Brats           |
| 22           | Screw                 | Stainies Steel  |
| 23           | Beering Pin           | Brass           |
| 23A          | Bearing Pin           | Brass           |
| 24           | Beering Pin           | Brass           |
| 25           | Bearing Pin           | Brade           |
| 26           | Pin Clip              | Stainless Steel |
| 26A          | Pin Clip              | Stainless Steel |
| 27           | Screw                 | Stainless Steel |
| 27A          | Screw                 | Stainless Steel |
| 28           | Screw                 | Stainless Steel |
| 29           | Drain Plug            | Steel           |
| 30           | Fulcrum Washer        | Fibre           |
| 31           | Fulcrum Washer        | Fibre           |
| 32           | Flange Gasket         | Accopec         |
| 33           | rlange Bolt           | Steel           |
| <b>34</b>    | Plange Nut            | Steel           |
| 35           | A& V Fulcrum Nut      | Steel           |
| 30           | Ball Fulcrum Nut      | Steel           |
| ⊃ & 16 Assy. | Press. Fulcrum & Cage | Brass           |
|              |                       |                 |

\*Parts are interchangeable and optional at customer's request. When ordering repair parts state for use with Universal Air Valve. Give the size of valve, name, and part number along with quantity desired.

#### NOTE: MATERIALS AND PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

#### MODEL INFORMATION

| Size of Valve              | <u> </u> 1" | 2'' | 3.  | 4"  | 6"  | 8"  |
|----------------------------|-------------|-----|-----|-----|-----|-----|
| Model No.<br>Screwed Inlet | U10         | U20 | U30 | U40 | 1   |     |
| 125 Flanged<br>Inlet       |             | U21 | U31 | U41 | U61 | U81 |
| 250 Flanged<br>Inlet       |             | U22 | U32 | U42 | U62 | U82 |

#### 22 Rev 11 82

**MULTIPLEX** Manufacturing Co.

600 Fowler Ave., P.O. Box 427, BERWICK, PA 18603 / 717-752-45

View B

View C





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# UNIVERSAL AIR VALVES

 $\widehat{\mathbf{m}}$ 

| SIZE OF VALVE                   | 17      | 2″      | 3-       | 4*       | 67       | 8*      |
|---------------------------------|---------|---------|----------|----------|----------|---------|
| WIDTH                           | 6%-     | 8 % *   | 10%-     | 1134*    | 16"      | 16"     |
| LENGTH                          | 93/-    | 12%     | 1434-    | 16%*     | 22-      | 22"     |
| HEGHT<br>SCWD. CONNECTION       | 10%*    | 13%     | 17%*     | 20*      | -        | -       |
| HEIGHT<br>FLGD. CONNECTION      | -       | 15%*    | 20 5/1-  | 23*      | 25%*     | 28 1/2* |
| WEIGHT<br>SCWD. CONNECTION      | 27 ibs. | 66 lbs. | 111 lbs. | 163 lbs. | -        | -       |
| WEIGHT<br>FLGD. CONNECTION      | -       | 72 lb1. | 131 lbs. | 180 lbs. | 425 lbs. | 480 lbs |
| STANDARD<br>WORKING<br>PRESSURE | 125 psi | 165 psi | 165 psi  | 165 psi  | 165 ры   | 165 ps  |
| STANDARD<br>PRESSURE<br>ORIFICE | 3/4-    | ¥4*     | ¥4*      | ¥4-      | 74       | ·⁄4*    |

**(1**)



#### DIMENSION AND WEIGHT INFORMATION

PERFORMANCE CHART

# B.6 ISOLATION VALVES

- Swing Check
- Ball

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- Gate
- Actuator

# AS FURNISHED BY

# METROPOLITAN PUMP COMPANY

This is a combination ball check and hydraulic sealing diaphragm in a single housing. The assembly is mounted in a horizontal position in the pump discharge piping and is removed with the pump as a unit for inspection and service. On initial installation, the design clear-ance between the sealing diaphragm and the sealing flange is  $V_{16}$ . When the pump starts, discharge water pressure expands the sealing diaphragm, effecting an hydraulic seal between the check valve assembly and the sealing flange. The neoprene ball is non clog, self cleaning, while the pump is running, and is shown in the drawing as a solid line. This allows full flow of the ground slurry.



When the pump stops, the ball check valve will seat as shown in dotted lines, and seat down to a minimum discharge line back pressure of 1-2 psi.

When the pump stops and when the pump is not running the hydraulic sealing diaphragm will maintain contact with the sealing flange down to a minimum downstream line back pressure of 2-3 psi.

Below this pressure, and at negative discharge line pressures the sealing flange shall automatically release and act as an anti-syphon valve, venting the downstream discharge line to atmosphere.

Anti-syphoning is important with grinder pump installations as it prevents an accumulation of solids in the tank. Should this occur there is a much higher possibility of the pump clogging when the pump finally turns on.

# CHECK VALVE ASSEMBLY

AS FURNISHED BY

METROPOLITAN PUMP COMPANY



| DISCHARGEFIFING |                     |   |  |  |
|-----------------|---------------------|---|--|--|
| REF.<br>NO.     | ITEM<br>DESCRIPTION |   |  |  |
| 1               | Long Nipple         | l |  |  |
| 2               | Elbow               | ł |  |  |
| 3               | Short Nipple        |   |  |  |
| 4               | Check Valve         |   |  |  |
| 5               | Thread Protector    |   |  |  |

| CHECK VALVE (#4) |                          |  |  |  |  |
|------------------|--------------------------|--|--|--|--|
| REF.<br>NO.      | ITEM<br>DESCRIPTION      |  |  |  |  |
| 6                | Lug                      |  |  |  |  |
| 7                | Screw (Holds Lugs)       |  |  |  |  |
| В                | Lock Washer (Holds Lugs) |  |  |  |  |
| 9                | Sealing Diaphragm        |  |  |  |  |
| 10               | Ring to Hold Diaphragm   |  |  |  |  |
| 11               | Screws to Hold Ring      |  |  |  |  |
| 12               | Neoprene Ball            |  |  |  |  |

# PUMP DISCHARGE PIPING AND CHECK VALVE



# bronze and brass ball valves



1"

7/8

ANSI B.18.18 stated that the maximum operating pressure of 50/50 solder sweat connections is 200 PSI at 100°F and decreases with higher temperatures.

For Additional Information, send for ES-B6002.

23/8

49/16

2.12

41/8

For Additional Information, send for F-B6000.

# bronze and br**ass gate** valves

#### Complies with Federal Specification WW-V-54, Type I, Class A, 85-5-5 construction

# Series FGV-1

Federal Specification MSS SP-80 Inside screw bonnet, NRS, solid disc

Designed for continuous service on steam, water, oil and gas in either the open or fully-closed position. They are ideally suited for areas where space is a premium. Virgin PTFE packing and a gland follower. ASTM B62 body, stem and disc. Threaded IPS connections. Pressure rating: 200 WOG Steam rating: 125 W.S.P.



| No.            | Size  | Dime<br>A | nsions (<br>  B | Inches)<br>C | Mac<br>Qty. | ter Carton<br>  Weight (lbs.) |
|----------------|-------|-----------|-----------------|--------------|-------------|-------------------------------|
| FGV-1, FGVS-1* | 1/4"  | 1.66      | 3.05            | 1.88         | 120         | 60                            |
| FGV-1, FGVS-1* | 3/8"  | 1.66      | 3.05            | 1.88         | 120         | 60                            |
| FGV-1, FGVS-1* | 1/2"  | 1.96      | 3.29            | 2.44         | 96          | 74                            |
| FGV-1, FGVS-1* | 3/4"  | 2.05      | 3.92            | 2.75         | 48          | 62                            |
| FGV-1, FGVS-1* | 1"    | 2.48      | 4.46            | 2.75         | 42          | 74                            |
| FGV-1, FGVS-1* | 11/4" | 2.60      | 5.24            | 3.35         | 24          | 64                            |
| FGV-1, FGVS-1* | 11/2" | 2.77      | 5.59            | 3.74         | 15          | 46                            |
| FGV-1, FGVS-1* | 2"    | 2.96      | 6.38            | 4.13         | 10          | 45                            |

\*FGVS-1 solder end connections

For Additional Information, send for F-BBV, GV, CV

# Series GV, GVS Bronze Gate Valves

For Water and Steam Service

Full rating for broad application. 125 WSP, 200 psi WOG.

Series GV have IPS threaded connections in sizes 14"- 4".

- Series GVS have CxC sweat connections in sizes 3/8''- 3''.
- Screw-in bonnet
- 85-5-5-5 bronze body



|   |       | DIMENSIONS (Inches) |        |       |       |        |        |        |                    |
|---|-------|---------------------|--------|-------|-------|--------|--------|--------|--------------------|
|   |       |                     | A      |       | B     | (      | 0      | Weight | t (l <b>iss.</b> ) |
|   | Size  | GV                  | GVS    | GV    | GVS   | GV     | GVS    | GV     | GVS                |
|   | 1/4"  | 15/8                | - 1    | 3     | -     | 115/16 | -      | 0.62   | -                  |
|   | 3/8"  | 15/8                | 13/4   | 33/16 | 33/8  | 115/16 | 21/8   | 0.62   | 0.62               |
|   | 1/2″  | 13/4                | 13/4   | 33/8  | 33/B  | 23/16  | 21/8   | 0.71   | 0.62               |
|   | 3/4"  | 1 15/16             | 23/8   | 35/8  | 35/8  | 23/8   | 23/8   | 0.93   | 0.88               |
|   | 1"    | 21/8                | 213/16 | 47/16 | 47/16 | 29/16  | 29/16  | 1.2    | 1 15               |
|   | 11/4" | 23/8                | 3      | 5     | 5     | 23/4   | 23/4   | 20     | 1 72               |
|   | 11/2" | 21/2                | 33/8   | 53/8  | 57/16 | 31/8   | 31/B   | 2.7    | 1.85               |
|   | > 2"  | 27/8                | 4      | 61/2  | 61/2  | 39/16  | 31/2   | 34     | 3 53               |
| - | 21/2" | 31/2                | 41/2   | 8     | 85/16 | 45/16  | 43/8   | 64     | 5 95               |
|   | 3"    | 315/16              | 53/16  | 93/16 | 93/16 | 415/16 | 415/16 | 93     | 8 97               |
|   | 4"    | 43/4                | -      | 103/4 | -     | 53/4   | -      | 18 0   | 0.02               |
|   |       |                     |        |       |       |        | 1      |        |                    |

For Additional Information, send for F-BBV.GV.CV.

# Series FGV-UB

Federal Specification MSS SP-80 Union bonnet, rising stem, solid disc

Designed for continuous service on steam, water, oil and gas in either the open or fully-closed position. They afford free flow with minimum pressure drop. The union bonnet provides for quick valve disassembly for inspection and repair plus it reinforces the body to protect against vibration and pipeline strain. Virgin PTFE packing and a gland follower. Pressure rating: 300 WOG Steam rating: 150 W.S.P.



|                          |        | Dime     | msions (I | nches) | Master Carten |               |  |  |
|--------------------------|--------|----------|-----------|--------|---------------|---------------|--|--|
| No.                      | Size   | <b>A</b> |           | C      | Qty.          | Weight (lbs.) |  |  |
| Threaded IPS connections |        |          |           |        |               |               |  |  |
| FGV-US                   | 1/4"   | 1.75     | 4.13      | 1.88   | 120           | 60            |  |  |
| FGV-UB                   | 3/8"   | 1.75     | 4.13      | 1.88   | 120           | 60            |  |  |
| FGV-UB                   | 1/2"   | 2.13     | 5.00      | 2.44   | 96            | 74            |  |  |
| FGV-UB                   | 3/4"   | 2.24     | 6.10      | 2.75   | 48            | 62            |  |  |
| FGV-UB                   | 1″     | 2.62     | 7.56      | 2.75   | 42            | 74            |  |  |
| FGV-UB                   | 11/4'' | 2.87     | 8.62      | 3.35   | 24            | 64            |  |  |
| FGV-UB                   | 11/2"  | 3.13     | 10.04     | 3.74   | 15            | 46            |  |  |
| FGV-UB                   | 2"     | 3.52     | 12.13     | 4.13   | 10            | 45            |  |  |

For Additional Information, send for F-BBV, GV, CV

# Series WGV, WGVS

**Brass Gate Valves** 

Rating: 200 psi WOG

Series WGV have IPS threaded connections in sizes 1/2" - 4".

**Series WGVS** have CxC sweat connections in sizes 1/2''- 2''.

|           | DIMENSIONS (Inches) |        |          |      |       |      |        |          |
|-----------|---------------------|--------|----------|------|-------|------|--------|----------|
| Size      |                     | A      | <b>i</b> | B    |       |      | Weight | (ibs.)   |
| (INCIDES) | WGV                 | WGVS   | WGV      | WGYS | WGV   | WGVS | WGV    | WGVS     |
| %         | 13/4                | 115/16 | 3        | 3    | 21/8  | 21/8 | 60     | 58       |
| *         | 115/16              | 21/2   | 31/2     | 31/2 | 21/8  | 21/8 | 82     | 80       |
| 1         | 21/8                | 23/4   | 41/8     | 4    | 23/8  | 23/B | 11     | 1        |
| 1%        | 2 <sup>3/8</sup>    | 3      | 41/2     | 41/2 | 21/2  | 23/4 | 1.37   | 1.33     |
| 1%        | 2 <sup>3</sup> /8   | 31/2   | 53/8     | 51/8 | 23/4  | 23/4 | 2      | 2        |
| 2         | 2 <sup>13</sup> /16 | 41/4   | 6        | 6    | 31/4  | 31/4 | 3      | 3        |
| 2%        | 31/2                | —      | 73/4     | _    | 4     | -    | 6.25   | <u> </u> |
| 3         | 37/8                | -      | 87/s     | - 1  | 47/16 | _    | 7.75   | I _      |
| 4         | 43/4                | —      | 101/2    | _    | 51/e  | -    | 13.50  | - 1      |

For Additional Information, send for S-WGV.



# IN IERINA HUNAL REPRESENTATION

|       | والبكام والبلينية والمريين والمواد والمتعاون والم                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ونهيديها الكرافية ونوو الشهونية بوهنية فناقا ماكرينا ال                                                       | Telephone #                   | Fax #                        |          |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------|----------|
| 5.1   | Travco Sales inc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | P.O. Box 653. Lynnfield, MA 01940                                                                             | 617 334-6078                  | 617 334-2859                 |          |
|       | W P. Haney Co. Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 51 Norfolk Ave., South Easton, MA 02375                                                                       | 508 238-2030                  | 508 238-8353                 |          |
| 31    | F W Lennard Inc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ray Palmer Bd., P.D. Box 371, Moodus, CT 06469-0371                                                           | 203 873-8691                  | 203 873-8693                 |          |
|       | WMS Sales inc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 9580 County Rd., Clarence Center, NY 14032                                                                    | 716 741-9575                  | 716 632-0633                 |          |
| = 1   | WMS Sales, inc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4415 Cindy Lane, Syracuse, NY 13215                                                                           | 315 469-8083                  |                              |          |
| - 1   | WMS Sales, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4 McMillen Place, Delmar, NY 12054                                                                            | 518 475-1017                  |                              |          |
|       | Mack-Allied Sales Co. Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1012 Goffle Rd., Hawthome, NJ 07506                                                                           | 201 423-1101                  | 201 423-2641                 |          |
| 1.5   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                               | 212 594-1319                  |                              |          |
| . 1   | Mack Allied Sales Co., Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 95 J. Hoffman Lane, Central Islip, NY 11722                                                                   | 516 348-2550                  |                              |          |
|       | Vernon Bitzer Associates, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 138 Railroad Dr., Northhampton Ind. Pk., Ivyland, PA 18974                                                    | 215 953-1400                  | 215 953-1250                 |          |
|       | J. B. O'Connor Company, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 120 Union St., Bridgeville, PA 15017                                                                          | 412 221-5300                  | 412 221-4510                 |          |
| ···-: | Bearing a support of the support of  |                                                                                                               |                               |                              |          |
| •     | Walter E. Harkleroad Sales Agency Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 12213 Distribution Way, Beltsville, MD 20705                                                                  | 301 595-4495                  | 301 595-0577                 |          |
| • •   | Virginia Marketing Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | P.O. Box 29, Virginia Beach, VA 23458                                                                         | 804 428-2060                  | 804 428-8129                 |          |
|       | Virginia Marketing Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3396 Londonderry Lane S.W., Roanoke, VA 24018                                                                 | /03 989-6600                  | /03-989-8215                 |          |
| :     | Virginia Marketing Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | P.U. Box 8891, Hichmond, VA 23225                                                                             | 804 2/2-6343                  | 004-330-7099<br>704 507 0520 |          |
| Ì     | Smith & Stevenson                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4935 Chastain Ave., Chanotte, NC 28210                                                                        | /04 525-3366                  | 704 527-0539                 |          |
|       | Central Sales Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2/00 Munteesboro Rd., Antioch, IN 3/013                                                                       | 615 361-4244                  | 010 300-11/5                 |          |
|       | Central Sales Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 21/U YORK AVE., Memphis, IN 36104                                                                             | 901 278-2251                  | SUT 272-1014                 |          |
| Ξ.,   | Spotswood Parker & Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 6700 Best Friend Hd., Norcross, (Adama) GA 300/1-2919                                                         | 404 44/-122/                  | 404 203-0099                 | F        |
| •     | Distributor Sales of Florida                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0320 Join St. North, Finenas Pauk, FL J3303                                                                   | 013 327-0031                  | 013 223-2110                 | E        |
|       | Ead L Criffin Co                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2776 P.M. Monteemen St. Disminsherry AI 26200                                                                 | 304 073-4333<br>205 870 2460  | 205 970 5027                 |          |
|       | Billingslev & Associates Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2000 Clearnian Blance Suite 201 Metairia LA 20205                                                             | 203 075-3405<br>504 995 5771  | 504 985-7516                 |          |
|       | Billingslav & Associates Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ATR Chevenne Lane Madienn MS 20110                                                                            | SO1 855.7555                  | JUN 003*7310                 |          |
|       | HARASSOCIALS, INC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | P/O Gildydinie Lalid, Midulsuli, Mo 35110<br>P.O. Boy 10201 Caparra Maishte Station Bio Diadras DD 00022 0201 | 800 782 4244                  | 900 792 6576                 |          |
|       | C.T. Rao, Jr., S.E. Reg. Director                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 126 Stone Lake Ct., Tabb, VA 23602                                                                            | 804 867-9675                  | 009 /02-03/0                 |          |
| . •   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                               |                               |                              |          |
|       | Mid-Continent Marketing Services Ltd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1724 Armitage Ct. Addison II 60101                                                                            | 312 052 1211                  | 312 062.1067                 |          |
|       | Mid-Continent Marketing Services Ltd.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 11424 Miniater Dr. Indiananalie IN 46220                                                                      | 217 204 2619                  | 312 333 100/<br>217 904 2074 |          |
| •     | Advance Industrial Marketing 1 td                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 923 South Rind St. Sun Prairie WI 53590                                                                       | SIT 034-3010                  | 608 837.2368                 |          |
|       | Dave Watson Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1325 West Reacher Adrian MI 40221                                                                             | 517 263,8088                  | 517 262.2228                 |          |
|       | The Harns-Billings Co                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | P 0 Roy 41304 1920 Annanolis Lane North Plymouth MN 55441                                                     | 612 550-0300                  | 612 550,8230                 |          |
|       | Mack McClain & Associates, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1537 Ohin St. Des Moines 14 50314                                                                             | 515 288_0184                  | 515 288.5049                 |          |
|       | Mack McClain & Associates: Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1438 South 76th St Omaha NF 68124                                                                             | A02 397-3688                  |                              |          |
|       | Mack McClain & Associates, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 15090 West 116th St Olather KS 66062                                                                          | 913 339-6677                  | 913 339-9518                 | f        |
|       | R. R. Iverson & Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4141C South 68th East Ave., Tulsa, OK 74256                                                                   | 918 664-0423                  | 918 664-0425                 | Ne.      |
|       | J. W. Sullivan Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 7901 Manchester Ave., St. Louis, MO 63143                                                                     | 314 644-5454                  | 314 644-5527                 |          |
|       | Disney-McLane, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2704 Colerain Ave., Cincinnati, OH 45225                                                                      | 513 541-1682                  | 513 541-0073                 |          |
|       | Madsen-Bayer & Associates, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2510 Englewood Dr., Columbus, OH 43219                                                                        | 614 476-1833                  | 614 476-1846                 |          |
|       | Madsen-Bayer & Associates, Inc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4640 Warner Rd., Garfield Heights, OH 44125                                                                   | 216 641-5808                  | 216 641-5546                 |          |
|       | Gary S. Gilpin Sales Co.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4468 Emberson Ave., Louisville, KY 40209                                                                      | 502 367-2178                  | 502 367-9080                 |          |
|       | Don Sinsabaugh MidWest Reg. Sales Mgr.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 42 W 597 Steeple Chase, St. Charles, III. 60175                                                               | 312-377-3671                  | 312 513-5063                 |          |
|       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                               | , *.                          | Sector Du                    |          |
|       | n. U. Marthett & Associates<br>Holiabaugh Brothers & Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | JUGDZ HURTWOOD AVE., Mayward, UA 94544                                                                        | 415 471-7200                  | 415 471-4441                 |          |
|       | Holiabaugh Brothers & Associates                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1200 DIN AVE. SOUTH, SEATTLE, WA SO 134-1300                                                                  | 200 46/-0346                  | 200 46/-6366                 |          |
|       | R F Fitznatrick Sales inc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | JULU J.E. 1/11 AVE., FULUAIN, UT 9/202<br>16 East 8th Ave. Midwale IIT 9/0/7                                  | JUJ 230-UJ 13<br>801 666 7466 | JUJ 233-2024<br>901 655 4070 |          |
|       | Hudson and Lening Sales Co                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ID LOSL OUI AVE., MILVAR, UI 0909/<br>2506 W. Barbarny Diana Danwar CO 80204                                  | 2021/-000 100                 | 001 000-49/9<br>203 622 9676 |          |
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|       | HDQTRS: Watts Regulator Co./EXPORT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Rte. 114 and Chestnut St., No. Andover, MA 01845 USA                                                          | 508 688-1811                  | 508 794-1848<br>508 794-1674 |          |
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|       | watts Regulator of Nederland b.v.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | P.U. Box 98, 6960 AB Eerbeek, Holland Telex 35365 (011) ;                                                     | 31-8-338-59028                | 8-338-52073                  |          |
|       | And the second s |                                                                                                               |                               |                              |          |

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REGULATOR Mail: Box 628, Lawrence, MA 01842 • Telex: 94-7460 Watts Reg Law Hdgtrs: Rte 114 and Chestnut St., No. Andover, MA 01845



**Actuator Mounting Instructions** 

# TO MOUNT THESE ACTUATORS:

SL10, EL8, EL20, EJ20, EJX20, EJ50, EJX50, EJ90, EJX90, SERIES B AND C QUADRA-POWR®, ST20, ST50, ST13MS, ST20MS, TORQ HANDLE SERIES A AND B, MA010, PMV, FSRB AND FSRC

# ON THESE VALVES:

SERIES 2000 CLINCHER\*

Read these entire instructions carefully before installation or servicing.

| RECONNENDED TOOLS                                |                                                                                |  |  |  |  |
|--------------------------------------------------|--------------------------------------------------------------------------------|--|--|--|--|
| 2 open end wrenches for body bolts               | 7/16" for 1/4, 3/8, 1/2, 3/4 6 1"<br>1/2" for 1-1/4"<br>9/16" for 1-1/2 6 2"   |  |  |  |  |
| 1 open and wrench for stem nut                   | -1/2" for 1/4, 3/8, 1/2 & 3/4"<br>3/4" for 1 & 1-1/4"<br>15/16" for 1-1/2 & 2" |  |  |  |  |
| l open end wrench for actuator to bracket screws | - 7/16*                                                                        |  |  |  |  |
| 1 socket wrench for Series C adapter plate       | -9/16-                                                                         |  |  |  |  |
| 1 soft mandrel to fit through ball opening       |                                                                                |  |  |  |  |

# DESCRIPTION

These actuator mounting instructions describe the steps required to assemble Jamesbury valves and actuators listed above, using appropriate linkage kits that are available from Jamesbury. The  $3/4^{\circ}$  and smaller bronze valves must be equipped with stainless tria.

Linkage kits covered in this AMI are shown in Table I.

CAUTION: This table should not be used for sizing actuators to values. Refer to the Jamesbury general catalog for sizing information.

# TABLE

# LINKAGE KIT DESIGNATION ON –OFF SERVICE (MOT FOR ACTUATOR SIZING)

| ACTUATORS                 |                                                                                                                                          |                                                |  |  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--|--|
| VALVE<br>SIZE             | SL10,ST20,S.50,ST13MC,<br>ST20MS,QUADRA-POWR<br>SERIES B,<br>EL8,EL20,EJ20,EJX20,<br>EJ50,EJX50,<br>TORQ-HANDLE A & B,<br>MA010,PMV,FSRB | EJ90,EJX90<br>QUADRA-POWR<br>SERIES C,<br>FSRC |  |  |
| 1/4", 3/8", 1/2"          | LK-499                                                                                                                                   |                                                |  |  |
| 3/4"                      | LK-500                                                                                                                                   |                                                |  |  |
| 1"                        | LK-501                                                                                                                                   |                                                |  |  |
| 1-1/4"                    | LK-502                                                                                                                                   |                                                |  |  |
| 1-1/2*                    | LK-503                                                                                                                                   | LK-514                                         |  |  |
| 2*                        | LK-504                                                                                                                                   | LK-515                                         |  |  |
| *For EJ20,<br>when manual | EJX20 & EJ50, EJX50 also<br>override is required.                                                                                        | use LK-505,                                    |  |  |

\*Bronze Model C, Carbon Steel and Stainless Steel Series 2000 Clincher valves.

# WARNING

BEFORE INSTALLING THE VALVE AND ACTUATOR, BE SURE THAT THE INDICATOR POINTER ON TOP OF THE ACTUATOR IS CORRECTLY INDICATING THE VALVE'S POSITION. FAILURE TO ASSEMBLE THESE PRODUCTS TO INDICATE CORRECT VALVE POSITION COULD RESULT IN PERSONAL INJURY.

CAUTION. WHEN INSTALLING A LINKAGE OR SERVICING A VALVE/ACTUATOR ASSEMBLY THE BEST PRACTICE IS TO REMOVE THE ENTIRE ASSEMBLY FROM SERVICE.

CAUTION: AN ACTUATOR SHOULD BE REMOUNTED ON THE VALVE FROM WHICH IT WAS REMOVED. THE ACTUATOR MUST BE READJUSTED FOR PROPER OPEN CLOSE POSITION EACH TIME IT IS REMOUNTED.

CAUTION: THIS LINKAGE HAS BEEN DESIGNED TO SUPPORT THE WEIGHT OF THE JAMESBURY ACTUATORS AND RECOM-MENDED ACCESSORIES. USE OF THIS LINKAGE TO SUPPORT ADDITIONAL EQUIPMENT SUCH AS PEOPLE, LADDERS, ETC. MAY RESULT IN THE FAILURE OF THE LINKAGE, VALVE OR ACTUATOR AND MAY CAUSE PERSONAL INJURY.

# VALVE PREPARATION (REFER TO FIGURE 1 & 2)

- Remove the stem nut (16), lockwasher (9), handle (15) and second stem nut (16). These parts except the handle (15) will no longer be used.
- Assemble the stem nut (4) from the linkage kit onto the valve stem until the spring washers (10) are compressed flat (use a soft mandrel through the ball to keep the stem from turning.)

NOTE: When spring washers are not used (monel trim valves) tighten the stem nut (4) until the stem seal is fully seated, then tighten the stem nut (4) an additional 1/4 turn.

 Remove the four hex nuts (19), the four lockwashers (21), if applicable, and the four body bolts (20). These parts will no longer be used. Do not discard the valve identification tag (22).



 Rotate the body cap (2) 180 degrees as shown. Be careful not to damage the valve seats and body seal. Replace the body cap (2) back on the body (1) and proceed with the assembly.



| PARTS LIST FOR FIGURE 1 |                    |      |  |
|-------------------------|--------------------|------|--|
| Item No.                | Description        | Qty. |  |
| 1                       | Body               |      |  |
| 2                       | Body Cap           |      |  |
| 4                       | Stem               |      |  |
| 9                       | Lockwasher (Stem)  | 1    |  |
| 10                      | Spring Washer      | 2    |  |
| 15                      | Handle             |      |  |
| 16                      | Stem Nut           | 2    |  |
| 18                      | Compression Ring * | 1 1  |  |
| 19                      | Hex Nut            | 4    |  |
| 20                      | Body Bolt          | 1 4  |  |
| 21                      | Lockwasher         | 4    |  |
| 22                      | l'ag               |      |  |

# ASSEMBLY

## (REFER TO FIGURE 2)

- When a spring return actuator is being mounted, the valve should be in the closed position for spring-to-close operation, or in the open position for the spring-to-open operation. When an electric or double acting pneumatic actuator is being mounted, the valve position should correspond to the actuator indicator call out. (Use the handle (15) to position the valve. Remove the handle (15) and discard.)
- Place the bracket (1) onto the body cap. The bracket (1) pilots onto the turned diameter of the body cap and may need to be snapped into place.
- 3. Install the four Grade B7 body bolts (5). Install the valve identification tag (22) that was removed on one of the lower body bolts. Place the four lockwashers (9) and the four hex Grade 2H nuts (8) on the body bolts. Be sure that the material markings on the nuts are on the outside. Snug up the four hody bolts (5) and the four hex nuts (8), but do not tighten.

- NOTE: Linkage kits are supplied only with Grade B7 body bolts and Grade 2H nuts.
- Place the coupling (2) onto the valve stem and insert the reducer (3) only if the actuator driver is 3/8 square.
- a. For mounting EJ20, EJX20, EJ50 and EJX50 ACTUA-TORS when manual override is required, LINKAGE 201-0505 (LK-505) MUST BE USED IN ADDITION TO THE STANDARD LINKAGE. Place adapter plate (14) on top of the bracket (1).
  - b. For mounting SL10, and EL8 when the coupling (2) has excessive movement up and down, place the spacer (13) on top of the coupling (2).
  - c. When mounting Series C Quadra-Powr actuators, secure the adapter plate (10) to the actuator using the four hex head cap screws (12) with the four shakeproof washers (11) (See Torque Table IV.)
- Lower the actuator onto the bracket and valve assembly, carefully inserting the actuator shaft into the coupling (2) and spacer (13) if required.
  - a. Secure the actuator to the bracket (1) using the three hex head cap screws (6) or (15) with the three lockwashers (7) (See Torque Table IV.)
- 7. Visually straighten the actuator over the valve. Using 2 ft. lb, increments, tighten the body bolts (5) alternately in a diagonal pattern, as you would the lug nuts on an auto wheel until the torgue shown in Table II is met. DO NOT TIGHTEN ONE NUT COMPLETELY, THEN PROCEED TO THE NEXT.

#### TABLE II BODY BOLT TORQUES

| SERIES 2000 CLINCHER       |                |  |  |  |
|----------------------------|----------------|--|--|--|
| Valve Size                 | Torque         |  |  |  |
| 1/4", 3/8", 1/2", 3/4", 1" | 8-10 ft; 1bs.  |  |  |  |
| 1-1/4*                     | 18-20 ft. 1bs. |  |  |  |
| 1-1/2 6 2                  | 32-35 ft. 1bs. |  |  |  |

- Refer to the appropriate actuator IMO for instructions on setting the actuator travel stops or limit switches for proper full-"pen and full-closed positions. Actuator INQ's are listed in Table III."
- For proper ball position in the open and closed valve position, use the following procedures.
  - a. Valve open position: Allowable misalignment of the ball port in relation to the body port is 1/32" misalignment and 17/16" misalignment for bronze valves.
    - NOTE: The seat I.D. should not be used to measure missalignment since, in many cases, the I.D. is larger than the ball and body ports.
  - b. Valve closed position: With the valve in the closed position against the stops, make a pencil mark on the ball as in Fig. 3. Open the valve and measure bim. "B", the measurement should day ate no more than <u>+</u> 1/32" of Dim. "B" give in Table V.

#### TABLE III

| Actuator Model           | INO- |
|--------------------------|------|
| SL10                     | 21   |
| ST20, ST50               | 22   |
| ST13MS, ST20MS           | 25   |
| Series B & C Quadra-Powr | 32   |
| PMV                      | 36   |
| EL20, EJX20              | 41   |
| EL20                     | 43   |
| EL8                      | 44   |
| EJ50, EJX50, EJ90, EJX90 | 48   |
| MAOLO                    | 63   |
| Torg-Handle              | 71   |
| FSR-B, FSR-C             | 546  |
|                          | -    |

\*For copies of any of these IMO's, contact the nearest stocking distributor or write: Jamesbury Corp., 640 Lincoln St., Worcester, Mass. 01605 U.S.A.

#### TABLE IV

#### RECOMMENDED FASTENER TORQUES\* GRADE 5 BOLTS

| Size                           | Torque                    |
|--------------------------------|---------------------------|
| 1/4" - 20 UNC<br>3/8" - 16 UNC | 9 ft. 1bs.<br>30 ft. 1bs. |
| *Does not apply to body bo     | lts or stem nuts.         |

NOTE :

The SLIO actuator will only mount with its cylinder parallel to the pipe over the body cap side.

To prevent interference between the diaphragm casing and the pipe, Series B Quadra-Powr actuators should be mounted perpendicular to the pipe on 1/4" - 1 - 1/4" valves. Series C Quadra-Powr actuators should always be mounted perpendicular to the pipe.

All other actuator/valve combinations allow for the actuator to be mounted in any 90 degree position.

# 

IN LINE WITH WATERWAY

Figure 3

#### TABLE V

| DIMENSION "B" FOR SERIES<br>2000 |          |  |
|----------------------------------|----------|--|
| VALVE SIZE                       | DIM. "B" |  |
| 1/4-1/2                          | 3/32     |  |
| 3/4                              | 1/8      |  |
| 1                                | 3/16     |  |
| 1-1/4                            | 1/4      |  |
| 1-1/2                            | 1/4      |  |
| 2                                | 9/32     |  |

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# **NELES-JAMESBURY** IMO - 43

Installation, Maintenance & Operating Instructions

**EL20** 

# **ELECTRIC ACTUATORS**

**Read** these entire instructions carefully before installation or servicing.

# WARNING

1. DISCONNECT POWER BEFORE REMOVING COVER.

#### CAUTION

WHENEVER AN ACTUATOR IS REMOVED FROM THE VALVE AND THEN REMOUNTED, THE LIMIT SWITCHES MUST BE READ-JUSTED. SEE ADJUSTMENT SECTION.

WHEN SERVICING A VALVE/ACTUATOR ASSEMBLY, THE BEST PRACTICE IS TO REMOVE THE ENTIRE ASSEMBLY FROM SERVICE.

# MOUNTING INSTRUCTIONS

For instructions for mounting the EL20 actuator on various Jamesbury ball valves, refer to the Actuator Mounting Instructions listed in Table I.

| - |   | ~ |   | -  |  |
|---|---|---|---|----|--|
|   | А | в | L | E. |  |

| ACTUATOR MOUNTING INSTRUCTIONS |            |  |
|--------------------------------|------------|--|
| VALVE SIZE AND STYLE           | AMI NUMBER |  |
| $1/4^{\circ}$ - 2° A, AF and B | 1          |  |
| 1/4" - 2" Clincher             | 2          |  |
| 1/4" - 2" HP/HT                | s          |  |
| 1/2" - 2" 5000 Series          | 8          |  |
| 3/4" - 1 1/2" 6000 Series      | 8          |  |

For copies of any of these ENO's, contact the nearest Jamesbury stocking distributor or write:

> JAMESBURY CORP. 640 Lincoln Street Worcester, Mass. 01605

# ADJUSTMENT INSTRUCTIONS

(Refer to Fig. 1)

- 1. Remove the cover.
- Close the valve by applying power to the common and either one or the other directional leads.
- Adjust the cams as follows:
  - a. Loosen set screws (12) in cams.
  - b. Turn the lower cam clockwise until switch arm clicks into low spot immediately after high spot.
  - c. Tighten the set screw in the lower cam.
  - d. Turn upper cam so that center of high spot matches lower cam center of low spot (90° phase shift) and tighten set screws.
  - e. Apply power and make fine adjustments if necessary. The lower cam should be adjusted so that the actuator closes the valve completely. The upper cam should be adjusted so that the actuator stops when the hole in the ball is centered within the hole in the valve.
- 5. Replace the gasket.
- Replace the cover and fasten with six fillister head screws.

NOTE: Whenever an actuator is removed from the valve and then remounted, the limit switch cams must be readjusted.

# INSTALLATION OF OPTIONS

- 1. Remove the cover.
- 2. Refer to Fig. 4 for wiring diagram.
- 3. ES-1 (TWO ADDITIONAL LEAD WIRES) LK-5018 (SEE FIG. 1)
  - a. Attach the orange with red stripe lead wire to the free terminal on the lower switch, S1.
  - b. Attach the orange with blue stripe lead wire to the free terminal on the upper switch, S2. Route both lead wires through the conduit.

- 4. ES-5 (ONE EXTRA SPDT SWITCH) LK-5034 (LK-5079 for DC)
  - a. Remove the two fillister head screws (7) and two lockwashers (8) holding switches 1 and 2. Refer to Fig. 1.
  - b. Place the additional switch insulator on top of switch 2 and the additional switch on top of the insulator. Refer to Fig. 3.
  - c. Fasten using the 2 original lockwashers and the 2 longer fillister head screws provided in the option kit.
  - d. Lead wires colored yellow and red may be placed on the terminals desired. Route lead wires through the conduit.
  - Place the third cam on the cam shaft and adjust for desired switch indication.
  - f. Switches S1 and S2 may have to be readjusted for proper opening and closing of the valve per ADJUST-MENT INSTRUCTIONS.
- 5. HEATER AND THERMOSWITCH LK-5060
  - a. Mount the thermoswitch on top of the limit switch using the fillister head screws (7) that hold the switches in place. Refer to Fig. 3.
  - b. Place the heater around the inside of the base so that the end of the heater with the lead wires is near the conduit hole. Refer to Fig. 2.
  - c. Route one lead wire through the conduit.
  - d. Cut the second lead wire to approximately 4" long (save the remaining wire) such that it reaches one of the terminals on the thermoswitch. Assemble a connector and insulator to it and connect it to the thermoswitch.
  - e. Assemble a connector and insulator to one end of the remaining wire from Step d and connect it to the remaining thermoswitch terminal. Route it through the conduit.
  - f. Bend the tabs on the thermoswitch to approximately 45° toward the center of the actuator to insure clearance for the cover. Refer to Fig. J.
- Readjust the switches if necessary per ADJUSTMENT IN-STRUCTIONS.

# MAINTENANCE

- The unit is permanently lubricated at the factory.
  - Under normal operating conditions the actuator requires only periodic observation to verify proper switch adjustment.
- For repair or replacement of limit switches follow the precautions listed in the WARNING Section (Fig. 1).
  - 1. Remove the cover.
- 2. Remove the lead wires from the switch to be repaired.
  - Remove the fillister head screws (7) and lockwashers (8) holding the switches and remove the affected switch.
- Reassemble in reverse order and readjust per ADJUSTMENT INSTRUCTIONS. Refer to Fig. 4 for wiring diagram.

NOTE: The unit is thermally protected. If unit will not run, allow to cool before operating.



Figure 1

| ITEM<br>NO. | NO.<br>REQD. | PART NAME                   |
|-------------|--------------|-----------------------------|
| 1           | 1            | Gear Motor Base             |
| 2           | 1            | Cover                       |
| 5           | 1            | Switch Bracket sub-assembly |
| 6           | 2            | Switch                      |
| 7           | 2            | Cap Screw                   |
| 8           | 2            | Lockwasher                  |
| 10          | 2            | Switch Insulator            |
| 11          | 2            | Cam                         |
| 12          | 4            | Set Screw                   |
| 16          | 1            | Bearing                     |
| 21          | 1            | Gasket                      |
| 22          | 2            | Lockwasher                  |
| 30          | 8            | Cap Screw                   |
| 48          | 2            | Stand off Spacer            |
| 58          | 2            | Nut (hex)                   |



Figure 4

B.7 PRESSURE GAGE

B.8 SUMP CHAMBERS AND ACCESS COVERS

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(815) 726-3351 (815) 726-7661 (815) 726-2163

# Concrete Products

# NORWALK TANK COMPANY Mechanical Sewage System

RON PIERSON

2121 MAPLE ROAD JOLIET, ILLINOIS 60432

Mechanical Sewage Systems Septic Tanks Manholes Water Vaults Adjustment Rings Ductile Iron Watermain Copper Brass Clay Pipe PVC Pipe Truss Pipe Culvert Metal Pipe Flexible Pipe Dry Mix Products All Types of Fittings





PLAN





WIS ACCESS DOOR SERIES

MISCAT 7/25/90 PAGE 13

(WATERTICHT WITH SPRING ASSIST)

# STANDARD FEATURES:

- STAINLESS STEEL COMPRESSION SPRING ASSIST
- AUTO-LOCK STAINLESS STEEL HOLD OPEN ARM WITH RELEASE HANDLE
- STAINLESS STEEL LIFTING HANDLE, HINGES AND ATTACHING HARDWARE
- STAINLESS STEEL SLAM LOCK W/REMOVABLE KEY
- CHANNEL FRAME

1/4" THOK

EXTRUCED ALUM, FRAME

1 1/2" ALUM.

COUPLING

- BUILT-IN NEOPRENE CUSHION/GASKET
- BITUMINOUS COATING •
- SINGLE LEAF CONSTRUCTION
- 300 LBS. PER SO. FT. LOAD RATING
- . 10 YEAR GUARANTEE

### SPECIFICATIONS

THE WIS SERIES (SINGLE LEAF) ACCESS FRAMES AND COVERS AS MANUFACTURED BY HALUDAY PRODUCTS, INC. OF ORLANDO, FLORIDA SHALL HAVE A 1/4" THICK ONE-PIECE, MILL FINISH, EXTRUDED ALUWINUM CHANNEL FRAME, INCORPORATING A CONTINUOUS CONCRETE ANCHOR. A 1 1/2" DRAMAGE COUPLING SHALL BE LOCATED IN THE FRONT LEFT CORNER OF THE CHANNEL FRAME A BITUMINOUS COADING SHALL BE APPLIED TO THE FRAME EXTERIOR WHERE IT WILL COME IN CONTACT WITH CONCRETE, DOOR PANEL SHALL BE 1/4" ALUMINUM DIAMOND PLATE, RENFORCED TO WITHSTAND & LIVE LOAD OF 300 LBS. PSF. DOOR SHALL OPEN TO 90' AND AUTOMATICALLY LOCK WITH A STAINLESS STEEL HOLD OPEN ARM WITH AN ALUMINUM RELEASE MANDLE. FOR EASE OF OPERATION, THE HOLD OPEN ARM SHALL INCORPORATE AN ENCLOSED STAINLESS STELL COMPRESSION SPRING ASSIST. DOOR SHALL CLOSE FLUSH WITH THE FRAME AND REST ON A BUILT-IN NEOPRENE CUSHION/GASKET, LIFTING HANDLE, HINGES AND ALL FASTENING HARDWARE SHALL BE STAINLESS STEEL. UNIT SHALL LOCK WITH A STAINLESS STEEL SLAW LOCK WITH RENOVABLE KEY, UNIT SHALL BE GUARANTEED AGAINST DEFECTS IN NATERIAL AND/OR WORKMANSHIP FOR A PERIOD OF 10 YEARS.

| MODEL    |     | UNIT    |     |         |          |
|----------|-----|---------|-----|---------|----------|
| NO.      | A   | 8       | С   | D       | WT.      |
| W1S2424  | 24* | 31 1/2" | 24* | 31 1/2  | 60 LBS.  |
| W1\$3030 | 30* | 37 1/2  | 30" | 37 1/2  | 71 LBS.  |
| W1S3636  | 36* | 43 1/2  | 36" | 43 1/2" | 87 LBS   |
| W1S3048  | 30* | 37 1/2  | 48" | 55 1/2  | 94 L85.  |
| W1S3648  | 36* | 43 1/2  | 48* | 55 1/2  | 106 LBS. |
| W1S2430  | 24" | 31 3"   | 30" | 37 🕂 "  | 65 LBS   |
| W1S2448  | 24" | 31 1"   | 48" | 55 🛉 "  | 74 LBS.  |



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SPECIFICATIONS

NEENAH quality construction castings conform to the following requirements. Use this data in your specifications to insure highest quality.

# SUGGESTED

# SPECIFICATIONS FOR CONSTRUCTION CASTINGS

GENERAL: Ferrous castings shall be as manufactured by Neenah -Foundry Company or prior approved equal. They shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. They shall be smooth and well cleaned by shotblasting.

QUALITY: Metal used in the manufacture of castings shall conform to ASTM A48-83 Class 35B for Gray Iron or ASTM A536-80 Grade 65-45-12 for Ductile Iron or in the grade you specify.

FINISH: All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.

TOLERANCES: As cast dimensions may vary one-half the maximum shrinkage possessed by the metal or +/- 1/16 inch per foot.

PAINT: Painting of castings does not provide significant added protection to cast iron, but merely changes the appearance with a colored coating. Castings are furnished unpainted. See following page for additional information.

WEIGHT: All published weights are average (and approximate) values. Deviation shall not exceed published weights by +/-5 percent.

SUBMITTALS: Manufacturer's shop drawings shall be submitted to the engineer for approval prior to manufacture or shipping of castings to job site. The engineer shall retain the right to reject castings not conforming to this specification and/or approved submittal drawings.

# Gray Iron – Best for Construction Castings

The use of gray iron offers many advantages over other materials for construction castings.

Of all the common castable ferrous materials, gray irons exhibit the best corrosion resistance and the excellent quality of high compressive strength. These are valuable qualities for load bearing street hardware.

# Strength:

Gray Iron produced by Neenah Foundry is laboratory tested from specimens to verify consistent tensile strengths of 35,000 p.s.i.

Through alloying, tensile strengths can be increased to 45,000 p.s.i. if specified.

### When to Use Ductile Iron

Ductile Iron is an ideal material for construction castings when standard Gray Iron castings do not have the load bearing capabilities or required impact resistance for a particular application.

While having the advantages of Gray Iron, Ductile Iron has greater strength characteristics than structural carbon steel without steel's inherent corrosion characteristics.

Ductile Iron is often used in areas subjected to loads greater than H 20 loadings such as:

> Industrial facilities with forklift traffic **Container Ports** Airports

Freeway traffic or hard rubber forklift tires may also necessitate use of Ductile Iron due to impact loading.

Due to the excellent compressive strength of Class 35B Gray Iron, mating Ductile Iron lids or grates with Gray Iron frames is often the cost effective approach.

There are many factors involved in choosing a grade of Ductile Iron. When there are unusual loading conditions or locations subjected to extreme heat or cold, please consult our Product Engineering Department for recommendations.

### **Casting Load Bearing Capabilities**

Specifiers must be certain the castings they have chosen are suitable for the intended loads. The U.S. Government prescribes a Proof Load Test Procedure under Federal Specification RR-F-621D. This is the same method used at Neenah. For details, please see page 5.

|              | TYPICAL SPECIFICATIONS AND MECHANICAL PROPERTIES OF GRAY IRON AND DUCTILE IRON |                               |           |                            |                          |            |                           |  |  |  |  |
|--------------|--------------------------------------------------------------------------------|-------------------------------|-----------|----------------------------|--------------------------|------------|---------------------------|--|--|--|--|
| GRAY IRON    |                                                                                |                               | •         | DUCTILE IRON               |                          |            |                           |  |  |  |  |
| Class<br>No. | Tensile Strength<br>p.s.l.'                                                    | Specifications                | Grade     | Tensile Strength<br>p.s.i. | Yield Strength<br>p.s.i. | Elongation | <b>Specifications</b>     |  |  |  |  |
| 30           | 30,000                                                                         | ASTM A48-83                   | 60-40-18  | 60,000                     | 40,000                   | 18% Min.   | ASTM A536-80<br>SAE J434C |  |  |  |  |
| 35           | 35,000                                                                         | ASTM A48-83<br>AASHTO M105-82 | 65-45-12  | 65,000                     | 45,000                   | 12 to 20%  | ASTM A536-80<br>SAE J434C |  |  |  |  |
| 40<br>45     | 40,000<br>45,000                                                               | ASTM A48-83<br>ASTM A48-83    | 100-70-03 | 100,000                    | 70,000                   | 3 to 10%   | SAE J434C<br>ASTM A536-80 |  |  |  |  |
|              |                                                                                |                               | CLASS A   | 60,000                     | 45,000                   | 15% Min.   | MIL+24137 CLASS A         |  |  |  |  |

|      |       | SPECII  | FICATIONS        | & MECHANICA | L PROPERTIES FO | OR NON-FERRO                           | OUS METALS |        |            |
|------|-------|---------|------------------|-------------|-----------------|----------------------------------------|------------|--------|------------|
|      | •••   | ALUMINU | M                |             |                 | BRONZE                                 |            |        |            |
| ASTM | Allow | Alloy   | ysical Propertie | ь р.s.i.    | ASTM            | ASTAA Allow Physical Properties p.s.i. |            |        | p.s.i.     |
| No.  | No.   | Tensile | Yield            | Elongation  | No.             | No.                                    | Tensile    | Yield  | Elongation |
| B26  | 713.0 | 32,000  | 22,000           | 3%          | 8584            | C87200-12A                             | 45,000     | 18,000 | 20%        |
| B26  | 319.0 | 23,000  | 13,000           | 1.5%        | 6584            | C86300                                 | 110,000    | 60,000 | 12%        |

Most of the costings in this catalog can be furnished in aluminum or bronze. SPECIFY BY CATALOG NUMBER

**B.9 STORAGE TANK** 



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1449-40(49)-MAR.11/92-REV.0 (D-26)

B.10 TANK LEVEL INDICATOR

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**B.11 HEAT TRACING** 

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# 'EGL' Flexi-panels for Tank & Vessel Heating



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'EGL' epoxy glass laminated heating flexipanels are 4ft x 1'6" and described in sheet HTD-32. Each panel provides 500W at 120V. (240V also available.)

The first step is to make a metal frame to go around the manway and to anchor  $\frac{1}{2}$ " stainless steel banding tape, atternatively the tape may be strapped around the manway flange as a double loop.

The flexipanels are placed in position around the tank, or on the underside of a horizontal vessel, and temporarily held in place with duct tape. Two %" SS bands then secure the panels at 12" centers, the bands being tightened down with a crimping type case banding machine.

Up to 7'6" diameter, 120V is more normally selected. From 6' to 15' diameter 240V is favored and from 12' to 30' diameter 480V is preferred. Note that EGL flexipanels are suitable for 600V operation, five in series.

For Class 1 and 2, Div. 2, panels are supplied with an attached ½" NPT hub. Screw into each hub a 6" long conduit nipple and attach a weatherproof conduit box suitable for two incoming ½" conduits from underneath.



Continued

# JUN 26 '87 12:23 COOPERHEAT SOMERSET N.J.

EGL-CC SYSTEM HAZ. -+ -> SAFE C/L Wiring to other Danels Epoxy not shown resin 1/2 'EGL 1/2 conduit S/S flexipane strap

The conduit box need not be explosion proof even if the location is hazardous. There are no arcing and sparking devices in the EGL System when solid-state CC controls are used. Use intermediate conduit instead and reduce costs.

- Select a 5 amp fuse that is suitable for the voltage and is obtainable locally, one that may be part of the wiring within the conduit box and connected with insulated wire connectors ('wire nuts'). Fit one per box, 120V; one every other box, 240V;
  one every fourth box, 480V, interwire the panels via the boxes as shown on page 1.
- The recommended control system is the Cooperheat 'CC' electronic module which has a 25A solid-state single phase contactor controlled from a temperature controller with a 1/8" diameter stainless steel tubular thermocouple with an attached polarized plug.
- Using a screwdriver to pry away the top SS band at the center of the first panel, insert the tubular thermocouple such that the tip is at the centerpoint of the panel. Using epoxy resin such as Devcon 2-ton epoxy, Duro Master-Mend or any other
- similar adhesive, securely attache the t/c to the panel over 5" of its length. The plug end to be in the conduit box where it attached to a polarized socket connect to the thermocouple extension cable.
- Note that it is very important to connect the positive (+) wire of the extension cable (colored yellow) to the small pin (+) of the plug, via the socket. Contrary to first thought, red is negative, not positive, in thermccouple circuitry. Therefore the red wire
   of the 1/c extension cable is (-) and connects to the large pin via the socket.

Do not run the t/c extension cable in the same conduit as the power wiring. Use a separate conduit as shown, it is only at the tank-position, where both power and t/c extension cable enter the box, that they may come together.

After two hours examine the epoxy around the t/c tip. Make certain it is a firm bond and is a part of the flexipanel itself. It will thus register the maximum temperature of the panel (at its midpoint). As the panel must be operated within its maximum temperature of 120°C (250°F) ensure that no unauthorized person can reset the CC temperature controller to a higher level

Thermocouple circuits fail to safety. Power is switched off if the t/c circuit is broken. Thermostats, on the other hand, call

for power when the capillary is damaged and breaks. Therefore thermostat control requires a second unit to lock out for high-limit control. Cooperheat's EGL-CC System does not require the second sensor.

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Operating personnel should be instructed that the CC temperature controller is NOT the temperature of the tank contents. It is approximately 20°C (40°F) higher but the actual deviation should be found by an accurate thermometer strapped to the outgoing piping under its insulation and the reading taken when contents are flowing.

Sensing the panel temperature and not the tank temperature is important in that it protects against over-voltage and buildup of semi-insulating lining (impurities) on the inside wall which can affect heat transfer. In addition, high-speed pulsing of the heat via the solid-state contactor and the electronic temperature controller provides absolutely constant heat as opposed to the slow on-off pulsing via thermostatic control.

Make certain therefore that the vital thermocouple circuit is installed correctly.

### EGL-CC SYSTEM (See above illustration)

- A. Incoming single-phase supply from circuit breaker.
- B 25A single pole solid-state contactor, 480V maximum
- C. Aluminum finned heat sink, external, for contactor.
- D. 1/2" conduit for wiring to flexipanels from contactor.
- E. 1/2" sealing fitting if tanks are in hazardous area.
- F Dyke around tank(s) to limit and define Div 2 area.
- G. Weatherproof, nonexplosionproof conduit box.
- H. 6" long %" NPT conduit nipple between hub and box.
- 1. 1/2" NPT conduit hub spoxy resined to flexipanel.
- J. 500W 120V 4ft x 1ft 6in EGL heating panel.
- K. ½" stainless steel band applied by case bander.
- L. 5A 120V auxiliary supply for temperature controller.
- M. Miniature type, electronic temperature controller.
- N. Outgoing thermocouple extension cable, type KX.
- O. ½" conduit to carry and protect t/c extension cable.
- P. Polarized socket at the end of the t/c extr. cable.
- Q. Matching polarized plug fitted to end of type K t/c.
- R. Conduit gland and sealing compound around t/c.
- S. 1/8" diameter stainless steel tubular thermocouple.
- T. Panel banding lifted 1/8" and t/c passed under.
- U. Base heaters provide excellent circulation in tank.

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# **Electric Surface Heating of Tanks & Vessels**





## Specification

| EGL panel size 4n x 1n bin x 5/64 (80 mou) in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power rating                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Power density                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Voltage (State either 120 or 240V)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Amoerage 42A: 21A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Maximum surface temperature of panel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Maximum tack or vessel temperature mainlenance 100°C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Making dispeter for sense length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Minimum diameter for parter length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Minimum diameter for panel width 411 bin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Heating element Etched resistance alloy foil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Dielectric Several layers of fine glass gauze                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Bonding material Epoxy resin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Bonding pressure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Dielectric strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Glass/resin ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Thermal conductivity 70% of oure class                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Waterprochase 100%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Temperature collegies point 30% higher then CBD penels                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Temperature soliening point Sole nigher men rine planets                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Sell extinguishing characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Absence of air bubbles in dielectric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Structural strength                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Noxious odor at switch-on Nil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Cold lead 6tt, Ordinary Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Cold lead                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Color of beating pagel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| And A segurit has a second sec |

EGL heating panels are constructed on similar lines to printed circuit boards used in the electronic industry. Instead of computer controlled etched wiring laminates, the computer is used to etch a pattern of resistance foil which is then sandwiched between layers of glass gauze using epoxy resin as the binder under pressure of 300psi.

Being extremely thin (5/64"), the panel is highly flexible such that it may be strapped around 3ft diameter surfaces in its 4ft length and 4ft 6in diameter surfaces in its 1ft 6in width.

The greatest use of heating panels is for tank and vessel heating to provide temperature maintenance of the product. As the product level varies inside the tank, it is more effective to apply the heating panels at the bottom of the tank in the horizontal mode rather than the vertical model. EGL's flexibility allows this to be achieved.

Case banding, polyester strapping or wire rope with toggle tightening may be used to pull down the panels to the outside surface of the tank. Thermal insulation is then applied.

With a low power density of only 64 Watts per square foot, the heating panel may be applied to fiberglass tanks (which resist the passage of heat) and not damage the tank wall. Similarly, on epoxy lined mild steel oil storage tanks, the lining remains undamaged when oil level falls below the top adge of the heating panels.

Continued







Up to five 120V panels may be connected off a 22 amp thermostat, the current in each panel being 4.2 amps. If any one of the panels is damaged, the others may still operate if a 6 amp fuse is crimped into the wiring which feeds each panel.

If 240V panels are selected, up to ten panels may be controlled by the 22 amp thermostat, the fuse being 3 amp per panel

In Division 2 hazardous locations, Cooperheat offers a lwin bulb thermostat which satisfies Article 501-3-1c of NEC-84 as being nonincendive.

A 30A double pole circuit breaker (A) with shunt trip is located in the nonhazardous area and feeds the NEMA-4 twin thermostat unit (D) which has a 25A solid-state contactor to switch the load. Conduit (B) interconnects conduit boxes (I) at each parts: position where the individual fuse (I) is located Cold lead from panels (E) pass via conduit nipple (H) to the boxes. High limit trip of the panels is via the second thermostat which has a 2% A solid-state relay for nonincendive trip of the 30A breaker, thus providing manual reset.

As the size of tanks increase and the number of heating panels also increase, consideration is given to connecting the panels in series off 480V. This reduces on-site transforming requirements

Up to twenty 120V panels may be controlled via the 25A solid-state contactor thus providing up to 10kW of heat.

Due to the fact that the on-off contacts in each thermostat make and break milliamps in the gate circuit of the solid-state relays (contactors) and do not have to make and break up to 10kW of power, life expectancy is much greater.

All thermostats call for power if the capillary or bub is broken or the bellows become punctured and most users protect against this happening by having the second high-limit thermostat, the bulb being applied by epoxy resin to the center of one of the heating panels.

The control thermocouple bulb for tank temperature is located 2" away from the edge of one of the heating panels and at the top edge level of the panels. Held on by duct tape it is preferably secured under the banding which holds on the panels.

Storage tanks and associated piping may be heated by grouping the controls in the safe area where the panel board is located and utilizing temperature controllers and thermocouples instead of thermostats. Alternatively, as Cooperheat controls are entirely solid-state and nonincendive, the controls may be placed in the hazardous area.

Cooperheat supplies 'CC' control chassis units which have 25A solid-state relay (contactor) for panel switching or 10A triac power module, also solid-state, for the control of Cooperheat's VT20 System for pipe heat tracing.

Each unit is 7 wide and takes up 9" space of a Hoffman 12  $\times$  12  $\times$  311 411 or 61t wiring trough. The 25A solid-state relay with its finned heat sink is mounted in the top face of the trough and the HC10 triac power module is similarly mounted (A). This may be field-assembly work

The facia panels are hinged such they drop down for access. They are filted with either one or two temperature controllers for tank heating (B) or with triac power control and a temperature controller for pipe heat tracing (C)  $= \frac{1}{2} = \frac{1}{2} = \frac{1}{2}$ 

As temperature controllers shut down the heating if the mocouple circuits open-circuit (as opposed to thermostats which do the reverse), it is not mandatory to have the second temperature controller for panel heating, although one is shown in the diagram. It opens one of the 30A DP circuit breakers shown in the panel board via its shunt trip

High limit protection is not required for the VT20 System due to its unique feature of the power (Watts per foot) being set on the HC 10 triac module and also its individual circuit highspend tusing. Circuit breakers are 15A rated

F. 4

**B.12** ELECTRICAL

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# ARKTITE® Heavy Duty Plug AP Series, Model 80, Styles 1 & 2, 200/400 Ampere

# IF852 Installation and Maintenance Information



### APPLICATION

AP Series ARKTITE Heavy Duty Plugs are designed to provide connection and distribution of secondary electrical power from a power source to portable or stationary electrical equipment. AP Series Plugs are compatible with Crouse-Hinds AR Series receptacles and APR Series cable connectors. Refer to Crouse-Hinds Catalog CM4000/4700 for a complete listing of compatible ARKTITE heavy duty receptacles and connectors. AP Series plugs are supplied in 3 and 4 pole designs. They are capable of carrying a maximum continuous current of 200 or 400 amperes at a rated voltage of 600 volts AC from 50 through 400 Herz, or 250 volts DC. 200A rated AP series plugs feature load breaking capability in emergency situations at or below the plugs maximum current rating.

# CAUTION

400A rated AP series plugs may only be connected or disconnected with electrical power OFF.

Two styles of plug grounding are available. Style 1 units have the grounding conductor connected to the plug sleeve with a pressure connector located on retaining cup. The plug sleeve and receptacle detent spring connection form the grounding path. Style 2 units contain an extra



Actual operation must comply with the information stipulated on the plug nameplate. AP Series plugs may be used in areas classified as nonhazardous in accordance with the National Electrical Code® (NEC). AP Series plugs should be installed, inspected, maintained, and operated only by qualified and competent personnel.

### PLUG DISASSEMBLY



 Loosen gland nut set screw two turns. Unscrew gland nut from handle body, remove slip washer and sealing bushing and set aside for later reassembly. See Figure 1.

2. Loosen handle body set screw one turn. Unscrew handle body from plug sleeve assembly and set aside.

3. Remove two %-20\_hex head retaining screws that secure the retaining cup and insulator/contact assembly in the plug sleeve. Remove insulator/ contact assembly. See Figure 2.



National Electrical Code is a Registered Trademark of the National Fire Protection Association.

grounding contact (pole) which is also connected to the plug sleeve through a factory installed grounding strap.

4. Remove the retaining cup from insulator/contact assembly by sliding it sideways off contacts. Remove front insulator.

5. Remove the contact retaining clip from all contacts, except the ground contact in Style 2 plugs, located in front of the rear insulator. To remove the clips, insert a flat blade screwdriver between the clip and contact, then rotate screwdriver to pry off the clip. Remove the contacts from the rear insulator assembly. See Figure 3.



### CABLE CONNECTION

WARNING

Electrical power must be turned OFF before and during installation and maintenance.

1. Establish a wiring pattern.

#### WARNING

Before assembling an AP Series plug, a wiring pattern must be established. The same colored wire must be put into the same numbered contact on all plugs and receptacles in a system. This will assure correct system polarity and reduce the possibility of equipment damage and/or personal injury due to misphasing or shorts.

ARKTITE plugs and receptacles are polarized so plug enters receptacles only one way. Contact recesses in insulating bodies are identified by number. This assures proper polarity of conductors through plug and receptacle or cable connector.

- To ensure uniformity of the system follow these instructions or use your own established standards. Electrical continuity testing is required to verify proper polarization.
- Connect wires, identified by color in first column of Table 1, to contacts identified by number noted in columns to the right. White wire is connected to contact identified by #2. Connect other contacts in accordance with color of wires.
- Conductors are identified by the color of insulation on each individual conductor. These colors agree with those given in Section 210-5 of N.E. Code for multi-wire branch circuits; an additional wire in the cable, uninsulated or identified green, is for grounding and complies with Sections 250-42 and 250-45 of N.E. Code. If conductors are not identified with exactly these colors, these colors may be assumed in making proper connections. If the conductors are all alike except one, that one is to be assumed to be white and the others to be in the same relative locations at the other end of same cable. If any doubt exists on identification, test them out electrically.

TABLE 1

|          | Color of Wire<br>in Cable       | Numbers On Insulator Body         |                   |  |  |  |
|----------|---------------------------------|-----------------------------------|-------------------|--|--|--|
|          | 3 Pole                          | 3 Pole Style 1                    |                   |  |  |  |
|          | White*                          | Contact #2                        | Contact #2        |  |  |  |
|          | Black                           | Unnumbered Contact                | Contact #1        |  |  |  |
|          | Red (Style 1 only)              | Contact #1                        |                   |  |  |  |
|          | Green**                         | Grounding Lug on<br>Retaining Cup | Grounding Contect |  |  |  |
|          | 4 Pole                          | Style 1                           | Style 2           |  |  |  |
|          | White*                          | Contact #2                        | Contact #2        |  |  |  |
|          | Black                           | Unnumbered Contact                | Contact #3        |  |  |  |
|          | Red                             | Contact #1                        | Contact #1        |  |  |  |
| <b>.</b> | Yellow/Russet<br>(Style 1 only) | Contact #3                        |                   |  |  |  |
|          | Green**                         | Grounding Lug on<br>Retaining Cup | Grounding Contect |  |  |  |

NOTE: All installations must be electrically tested to assure proper polarity of conductors between plugs, receptacles and connectors.

"White wire must not be used for grounding. If portable cable contains an uninsulated wire, or one identified green, this wire is for grounding the portable device. If no green or bare wire is in the portable cable, another wire may be connected through plug and receptacle connections to conduit or some other non-current-carrying conductor permanently grounded in accordance with Article 250 of the National Electrical Code. "Use the pressure type termination

2. Make sure that the diameter of the cable to be attached to the plug is compatable with the AP Series plug strain relief and bushing. Refer to Tables 2 and 3 for AP Series plug catalog numbers and the corresponding cable diameters that they will accommodate.

|                                         | TABLE 2 200 /                              | MPERE AP PLU                            | JG                                         |
|-----------------------------------------|--------------------------------------------|-----------------------------------------|--------------------------------------------|
| Catalog No.<br>(.56" Dia.<br>Wire Weil) | Cable Diameter<br>Accommodated<br>(Inches) | Catalog No.<br>(.75" Dia.<br>Wire Well) | Cable Diameter<br>Accommodated<br>(Inches) |
| AP20355                                 | .875 to 1.375                              | AP203511                                | 1.375 to 1.875                             |
| AP20357                                 | 1.375 to 1.875                             | AP203512                                | 1.875 to 2.500                             |
| AP20358                                 | 1.875 to 2.500                             | AP204511                                | 1.375 to 1.875                             |
| AP20455                                 | .875 to 1.375                              | AP204512                                | 1.875 to 2.500                             |
| AP20457                                 | 1.375 to 1.875                             | AP204513                                | 2.500 to 3.000                             |
| AP20458                                 | 1.875 to 2.500                             | AP203610                                | .875 to 1.375                              |
| AP20365                                 | .875 to 1.375                              | AP203611                                | 1.375 to 1.875                             |
| AP20367                                 | 1.375 to 1.875                             | AP203612                                | 1.875 to 2.500                             |
| AP20368                                 | 1.875 to 2.500                             | AP204611                                | 1.375 to 1.875                             |
| AP20465                                 | .875 to 1.375                              | AP204812                                | 1.875 to 2.500                             |
| AP20467                                 | 1.375 to 1.875                             |                                         |                                            |
| AP20468                                 | 1.875 to 2.500                             |                                         |                                            |

| TABLE 3 400 AMPERE AP PLUG              |                                            |                                          |                                            |  |  |  |  |  |
|-----------------------------------------|--------------------------------------------|------------------------------------------|--------------------------------------------|--|--|--|--|--|
| Catalog No.<br>(.84" Dia.<br>Wire Well) | Cable Diameter<br>Accommodated<br>(inches) | Catalog No.<br>(1.25" Dia.<br>Wire Well) | Cable Diameter<br>Accommodated<br>(Inches) |  |  |  |  |  |
| AP40357                                 | 1.375 to 1.875                             | AP403510                                 | 2.500 to 3.000                             |  |  |  |  |  |
| AP40358                                 | 1.875 to 2.500                             | AP403512                                 | 3.000 to 3.500                             |  |  |  |  |  |
| AP40457                                 | 1.375 to 1.875                             | AP404510                                 | 2.500 to 3.000                             |  |  |  |  |  |
| AP40458                                 | 1.875 to 2.500                             | AP404512                                 | 3.000 to 3.500                             |  |  |  |  |  |
| AP40367                                 | 1.375 to 1.875                             | AP403610                                 | 2.500 to 3.000                             |  |  |  |  |  |
| AP40368                                 | 1.875 to 2.500                             | AP403612                                 | · 3.000 to 3.500                           |  |  |  |  |  |
| AP40467                                 | 1.375 to 1.875                             | AP404610                                 | 2.500 to 3.000                             |  |  |  |  |  |
| AP40468                                 | 1.875 to 2.500                             | AP404612                                 | 3.000 to 3.500                             |  |  |  |  |  |

3. Loosen hex head bolts on cable clamps and slide gland nut over cable. Slide slip washer over cable with bevel towards the gland nut.



#### Figure 4 Gland Nut/Handle Body Detail

4. Slide sealing bushing (selected from bushings packed with unit) that has smallest inside diameter that will pass over the cable. Slide over cable with large end towards gland nut. Slide handle body over cable. See Figure 4.

5. Strip outer cable jacket and then conductor insulation to the dimensions shown in figure 5. These dimensions will allow the conductor cable to bottom in the contact wire well and the cable insulation to extend into the insulator tube.



### CAUTION

Do not cut into the individual conductor insulation when removing the outer cable jacket. Do not damage the conductor when removing its insulation.

6. Connect the conductors (except the grounding conductor) into each contact wire well by either crimp (preferred) or solder method, following the established system wiring pattern. Grounding conductors are not crimped or soldered but held securely with two pressure connector screws.

### **Crimp Connection:**

Proper crimp termination may require the use of a wire well reducer to ensure a complete metal fill in the crimped joint. Tables 4 and 5 list the various wire well reducers and crimping dies to be used with each wire well contact and conductor size.



Select the proper wire well reducer (supplied with AP Series plugs ordered with a "T" suffix on the catalog number), and insert into the contact wire well. See Figure 6. Insert the conductor and crimp the connection in two places using a Thomas & Betts hex crimp die recommended in Tables 4 and 5. Crimp near bottom of wire well first making sure that the reducer is fully inserted in wire well. Refer to Figure 7.



Inspect the crimp connection. The contact must securely grip the conductor without any cracks or tears in the wire well. Remove any flash raised by crimping.

| IAL | SLE | 4 | 200  | AMP  | EKE | CUN | LAC | 15   |
|-----|-----|---|------|------|-----|-----|-----|------|
| LE  |     | _ | CONC | UCTO | A   |     | AE  | DUCE |

|      | SIZE    | C     | CONSTRUCTION |      | REQUIRED |         | T & 8* |
|------|---------|-------|--------------|------|----------|---------|--------|
| I.D. | AWG/MCM | CLASS | STRANDS      | DIA. | O.D.     | 1.0.    | DIE NO |
| 56   | 1       | 8     | 19           | 332  | 555      | 489     | 54     |
|      |         | н     | 259          | 378  | 555      | 469     | 54     |
|      |         | 1     | 210          | 367  | .555     | .469    | 54     |
| .56  | 1/0     | B     | 19           | .373 | .555     | .469    | 54     |
|      | 1 1     | н     | 259          | .424 | .555     | 469     | 54     |
|      |         | 1     | 266          | 441  | 555      | .469    | 54     |
| .56  | 2/0     | 8     | 19           | .418 | .555     | .469    | 54     |
|      | } }     | н     | 259          | .477 | .555     | 500     | 54     |
|      |         | t     | 342          | 500  | I none n | beniupe | 54     |
| .56  | 3/0     | 8     | 19           | 470  | nonen    | benupe  | 54     |
|      |         | н     | 427          | .535 | none n   | benupa  | 54     |
|      | l       |       | 418          | 549  | nonen    | beniupe | 54     |
| .56  | 4/0     | 8     | 19           | .528 | none n   | benupe  | 54     |
| .75  | 4/0     | н     | 427          | .602 | .745     | .672    | 66H    |
|      | 11      | 1     | 532          | .613 | 745      | 672     | 66H    |
| 75   | 250     | 8     | 37           | .575 | .745     | 672     | 71H    |
|      | 1       | н     | 427          | .653 | 745      | 672     | 66H    |
|      | 4       | 1     | 537          | 682  | none     | benuper | 66H    |

\*Use in Thomas & Betts Crimp Tools, Catalog #13642 (Head) #13604 (Pump)

|       | TA      | BLE 5 4                              | 00 AMPERE        | CONT                 | ACTS                         |                          |                   |
|-------|---------|--------------------------------------|------------------|----------------------|------------------------------|--------------------------|-------------------|
| ITACT | CABLE   | CABLE CONDUCTOR<br>SIZE CONSTRUCTION |                  | REDUCER              |                              | T & 8"                   |                   |
|       | AWG/MCM | CLASS                                | STRANDS          | DIA.                 | 0.0.                         | I.D.                     | DIE NO.           |
| 84    | 350     | 9 H -                                | 37<br>427<br>882 | .881<br>.772<br>.800 | .830 /<br>none re<br>none re | .735<br>quired<br>quired | 87H<br>87H<br>87H |
| 84    | 400     | 8<br>H<br>!                          | 37<br>427<br>960 | .728<br>.826<br>.831 | .830 i<br>none re<br>none re | .735<br>quired<br>quired | 87H<br>87H<br>87H |
| 84    | 500     | 8                                    | 37               | .813                 | none re                      | benup                    | 87H               |
| 25    | .500    | н                                    | 427              | .923                 | 1.240                        | .950                     | 115H              |

|      |      | м<br>!           | 427                          | .631                            | Denuper enon                                                     | 87H<br>87H                   |
|------|------|------------------|------------------------------|---------------------------------|------------------------------------------------------------------|------------------------------|
| .84  | 500  | 8                | 37                           | .813                            | home required                                                    | 87H                          |
| 1.25 | .500 | I -              | 427<br>1,225                 | .923<br>.941                    | 1.240 .950<br>1.240 .950                                         | 115H<br>115H                 |
| 1.25 | 600  | 8<br>H<br>I      | 61<br>703<br>1,470           | .893<br>1.022<br>1.027          | 1.240 .950<br>1.240 1.040<br>1.240 1.040                         | 115H<br>115H<br>115H         |
| 1.25 | 700  | 8<br>H<br>I      | 61<br>703<br>1,729           | .964<br>1,106<br>1,194          | 1.240   1.040<br>none required<br>none required                  | 115H<br>115H<br>115H         |
| 1.25 | 750  | 8<br>H<br>I<br>M | 61<br>703<br>1,862<br>18,788 | .998<br>1.145<br>1.235<br>1.207 | 1.240 i 1.040<br>none required<br>none required<br>none required | 115H<br>115H<br>115H<br>115H |

\*Use in Thomas & Betts Crimp Tools, Catalog #13642 (Head) #13604 (Pump)

#### Solder Connection:

CON

Reliable solder connections require the use of proper soldering techniques.

Remove insulation from conductor as shown in Figure 5 and wire brush contact wire well.

Hold contact in insulated vise with wire well in upright position. Heat and pre-tin the wire well using a 60-40 rosin core solder. Do not fill well with solder.

NOTE: A high heat source (750° F) is required for good soldering. Use a high current resistance type. A torch may be used only if the surrounding conductor insulation is adequately protected.

Insert conductor into wire well as far as possible while applying heat to the well. Add solder by melting on conductor until well fills and a smooth concave surface of solder forms between the cable and well lip.

Remove heat but continue to hold the conductor and contact rigid until solder solidifies. A good solder connection is indicated by a bright shiny solder surface.

#### PLUG ASSEMBLY

1. Place retaining cup around rear insulator insulation tubes.

2. Following the system wiring pattern, push each contact into position in the rear insulator body. Insert the green or grounding conductor into the grounding contact wire well at the same time. Securely tighten the two pressure connector screws to 30 in. Ib. torque.

NOTE: NEC prohibits soldering of the grounding conductor in the grounding contact.

3. Install the contact retaining clips onto each contact when fully inserted into rear insulator body. See Figure 8.



4. Slide front insulator over contacts making sure that polarizing grooves are aligned. Slide plug sleeve over contact assembly with polarizing grooves sliding over alignment key until insulators seat on the inside boss.

5. Install two slotted %-20 hex head screws through holes in retaining cup into sleeve. Torque to 30 in. lb.

NOTE: The grounding strap from the grounding contact in Style 2 plugs is also attached to the sleeve with one of these screws. The strap is to be placed on top of the retaining cup. Refer to Figure 9.



- Slide handle body up cable and thread into plug sleeve until bottomed on O-ring gasket. Torque to 10 lbs. ft. minimum. Tighten set screw on handle body flange to 25 in. lbs. torque.
- 7. Slide sealing bushing and slip washer into place in handle body. Screw gland nut onto end of handle body tight enough to firmly squeeze bushing against cable. While tightening the gland nut, push in on cable to relieve strain on the wire terminals. Tighten gland nut set screw to 25 to 35 in. Ibs. torque.
- B. Tighten the cable clamp hex head bolts to 25 to 35 in. ibs. torque completing reassembly of the plug.

### SPECIAL FEATURES

AP Series plugs with special features are identified through the addition of a suffix to the Catalog Number.

Suffix T: Plug is supplied with wire well reducers for crimp termination. Suffix S4: Plug interior is rotated 22-1/2 degrees for special polarity application.

Suffix S22: Reversed contacts: Plug is assembled with recessed male contacts.



#### CAUTION

The multiple point bands and their retaining rings on the S22 reversed contacts must not be removed. Inspect and replace if broken, damaged, or missing. Plug will not operate properly without all bands and retaining rings intact. Each band is secured with two rings - one on each end.

AP Series plugs with special features such as reversed contacts (Suffix S22) and rotated interiors (Suffix S4) are compatible only with receptacles and cable connectors built with the same special feature. Always compare catalog numbers located on unit nameplates if in doubt.

#### WARNING

If any parts of the plug, receptacle, or connectors appear to be missing, broken, or show signs of damage,

DISCONTINUE USE IMMEDIATELY.

Replace with the proper replacement part(s) or properly repair the item(s) before continuing service.

### **ELECTRICAL TESTING**

Do not connect to power until the following electrical tests have been performed:

Make continuity checks of wiring to verify correct phasing and grounding connections.

 Check insulation resistance to be sure system does not have any short circuits or unwanted grounds.

NOTE: The National Electrical Manufacturers Association (NEMA) publication No. PB1.1-1979 indicates that an insulation resistance of less than 1 megohm on an open circuit is an unsafe condition that must be investigated and corrected prior to turning the power on.

### MAINTENANCE

Electrical and mechanical inspection of all components must be performed on a regular schedule determined by the environment and frequency of use. It is recommended that inspection be performed a minimum of once a year.

1. Inspect all contact terminators for tightness. Discoloration due to excessive heat is an indicator of a possible problem and should be thoroughly investigated and repaired as necessary.

2. Inspect interior insulation for surface contamination or physical damage such as cracked or broken segments. Contaminated insulators should be cleaned and broken insulators replaced.

3. Check grounding and bonding for correctness of installation and secureness of connection.

- 4. Check gaskets for deterioration and replace if necessary.
- 5. Clean exterior surfaces making sure nameplates remain legible.

6. Inspect the multiple point contact bands and retaining rings on the Suffix S22 reversed contacts. Replace if broken, damaged or missing. Do not operate without all bands and retaining rings intact.

- 7. Inspect cable clamp tightness to ensure proper cable gripping.
- 8. Check lightness of all screws before using.

9. Inspect metal housings and replace those which are cracked or broken.

In addition to these required maintenance procedures, we recommend an Electrical Preventive Maintenance program as described in the National Fire Protection Association Bulletin NFPA No. 70B.

### **ELECTRICAL RATING**

Maximum Voltages: 600 VAC @ 50-400 Hz, 250 VDC Maximum Continuous Current: 200 or 400 Amperes.

All statements, technical information and recommendations contained herein are based on information and tests we believe to be reliable. The accuracy or completeness thereof are not guaranteed. In accordance with Crouse-Hinds "Terms and Conditions of Sale", and since conditions of use are outside our control, the purchaser should determine the suitability of the product for his intended use and assumes all risk and liability whatsover in connection therewith.



Division of Cooper Industries, Inc. • Syracuse, New York 13221 • USA

1986, Cooper Industries, Inc.

WAUCONDA LANDFILL

DATE: 2-9-91



SF3 - SUMP FLOAT HIGH LEVEL, STARTS SECOND PUMR SF4 - SUMP FLOAT HIGH HIGH LEVEL, TURNS ON BERCON. BDFH - BUILDING DIKE PIDAT HIGH LEVEL. TFH - HOLDING TANK HIGH LEVEL FIORT. CRETE ILL INOIS 672-5320 DWG. NO. 2750-18

DWG. APPROVED AND ACCEPTED BY: DATE: 3/9/92 NAME: Ruhand 7. Opliger

# B & K ELECTRICAL CONTRACTING, INC.

1503 MICHAEL'S STREET ORETL, IL 60417 (708) 672-5320 or 349-6586

Wauconda Landfill Project Sump pumping system Wauconda Illinois

### SEQUENCE OF OPERATION FOR AUTOMATIC MODE

SELECT EAST OR WEST PUMP OPERATION USING THE "LEAD SELECTOR SWITCH". PLACE BOTH HAND/OFF/AUTO SWITCHES IN THE AUTOMATIC POSITION. PLACE "HOLDING TANK HIGH LEVEL OVERRIDE SWITCH" IN THE AUTOMATIC POSITION. AUTOMATIC OPERATION MODE SELECTION IS NOW CONPLETE. SYSTEM WILL NOW OPERATE AS FOLLOWS: liquid level rises in sump pit and makes SF1 float switch. liquid level continues to rise in sump pit and makes SF2 float switch. when SF2 is made, CR1 relay pulls in starting the pump which was selected by the lead switch. lead pump will continue to run until liquid levels drops below SF1 float switch. if lead pump will not keep up with liquid level and water continues to rise, SF3 will make and pull in CR2 relay, which will start the second pump. both pumps will continue to run until liquid level drops below SF1 float switch. if both pumps will not keep up with liquid level, SF4 will make, lighting the red rotating beacon light located at the control cabinet near street. if you are pumping to the holding tank, when high level is reached in the tank, the high level float switch (TFH) located on top of the holding tank will make, pulling in CR3 relay and will shut down either or both pumps. by placing the "high level override switch" in the emergency position, you will override the high level float on the holding tank and will be able to continue pumping operation. YOU MUST REMEMBER THAT WITH THE "HIGH LEVEL OVERRIDE SWITCH" IN THE EMERGENCY POSITION, THE HOLDING TANK HIGH LEVEL ALARM IS BY-PASSED AND WILL HAVE NO EFFECT ON THE PUMPS OR THE LEVEL INDICATION IN THE HOLDING TANK.

# B & K ELECTRICAL CONTRACTING, INC.

1508 MICHAEL'S STREET CRETE, IL 60417 (708) 679-6320 or 349-6586

Wauconda Landfill Project Sump pumping system Wauconda Illinois

# SEQUENCE OF OPERATION FOR MANUAL MODE

SELECT EAST OR WEST PUMP OPERATION USING THE "LEAD SELECTOR SWITCH". PLACE PUMP SELECTED BY LEAD SWITCH IN THE HAND POSITION.

PLACE SECOND PUMP IN THE OFF OR THE AUTO POSITION. if second pump is placed in the auto position, it will operate as in the auto mode and turn on when SF3 makes. if ascond pump is placed in the off position it will not operate.

PUMPS WILL ONLY OPERATE IF THERE IS LIQUID PRESENT IN THE SUMP PIT AND SF1 IS MADE.

BOTH PUMPS WILL NOT OPERATE IN THE HAND POSITION UNLESS SF3 IS MADE. CARE SHOULD STILL BE TAKEN IN REGARDS TO THE "HIGH LEVEL OVERRIDE SWITCH". NORMAL OPERATING POSITION MUST BE IN THE AUTO POSITION.

NANUAL OPERATION MODE SELECTION IS NOW COMPLETE.

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1 **INSTRUCTION SHEET** R. Y. 1991

#### CLASS 9001 TYPE KS\_\_\_K KEY OPERATED SELECTOR SWITCH OPERATOR UNDERWRITERS LABORATORIES LISTED FOR USE ON A FLAT SURFACE OF TYPE 1, 2, 3, 3R, 4, 6, 12 AND 13 ENCLOSURES



- A. Installation of Operator to Panel Using Class 9001 Type KN-2, KN-3 or KN-6 Legend Plates. See Cam Replacement Instructions Before Installing Contact Blocks.
- 1. Mount only Class 9001 Type KA Contact Block to the operator. Tighten Mounting Screws to 5-8 in. ib. CAUTION: Mount a maximum of 2 contact units to momentary (apring operated) operators, Mount a maximum of 4 centect unit, 2 in tantism and 2 side by side or maintained operators. 2. Remove the ring nul, locking thrust washer and tim washer from the operator.
- Discard the locking thrust washer and trim washer. 3.
- . Retain the required number of compensating gaskets (determined from Figure 1) on the operator.
- 5. insert the operator into the panel from the rear with the locating mark at the top.
- Install the required Legend Plate on the operator by aligning the tab with slots in the operator and panel.
- 7. Install the ring nut on the operator and tighten with a Class 9001 Type K-95 ring nut wrench. Recommended lightening torque: 6-8 pound-leet.
- B. Installation of Operator to Panel Using Class 9001 Type KN-1 and KN-7 Legend Plates.
  - Follow sleps A1, A2, A4 and A5 above.
  - 6. Install the Legend Plate on the operator.
  - 7. Install the locking thrust washer on the operator by aligning the tab with the slots in the operator, Legend Plate and panel.
- 8. Install the ring nut on the operator and tighten with a Class 9001 Type K-95 ring nut wrench. Recommended lightening torque: 6-8 pound-feet.
- C. Installation of Operator to Panel Without Legend Plate Follow steps A1, A2, A4 and A5 above.
- 6. Install the trim washer on the operator.
- 7. Install the locking thrust washer on the operator by aligning the tab with the slots in the operator, trim washer and panel, then follow step B8 above.



| Wilhout Leg<br>With Legen | Vertical<br>1.56<br>(<br>Squ | Piori<br>2<br>Consu<br>are D |   |
|---------------------------|------------------------------|------------------------------|---|
| :                         | GAI<br>BELECTH               | KET                          | ] |
|                           | Panel<br>Thk,                | Ne. of<br>Gaskets            | 1 |
|                           | 1/16                         | 4                            | 1 |
|                           | 1/8                          | 3                            | 1 |
|                           | 3/16                         | 2                            | ] |
|                           | 1/4                          | ,                            | ] |





MADE IN USA



Mounting Hole for All Type X Central Units 87

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HOLE PUNCH The 1.22 dies Koperaters -1.22 diameter hale required to me persiders may be cut with Groundes I nch No. 739-8. The metch may be al Turn h may be cut will to 720-3

Figure 1

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3007" 17J



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**B.13 BUILDING ENCLOSURE** 

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# B.14 MISCELLANEOUS COMPONENTS

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# **APPENDIX C**

# STANDARD REPORTING FORMS

- (1) WEEKLY SUMMARY OF LEACHATE VOLUME TO VILLAGE MANHOLE 12-24
- (2) MONTHLY RECORD OF LEACHATE TRANSFER TO HAULAGE VEHICLE
- (3) SAMPLE WASTE MANIFEST FORM
- (4) REGULAR, MONTHLY AND ANNUAL INSPECTION REPORT
- (5) SAMPLE MONTHLY SUB-CONTRACTOR RECORD AND INVOICES

LEACHATE TRANSFER RECORD - WAUCONDA LANDFILL SITE

MONTH OF \_\_\_\_\_, \_\_\_\_

| ·        | 1        | TANK LEVEL     | TANK LEVEL | VOLUME    | NAME OF    |
|----------|----------|----------------|------------|-----------|------------|
|          |          | BEFORE         | AFTER      | LOADED TO | CONTRACTOR |
| DATE     | TIME     | LUADING (feet) | (feet)     | (gallons) | PERSONNEL  |
|          | <u> </u> | (10007         | (1000)     | (quiiono) |            |
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Days since previous inspection:

Week Beginning: \_\_\_\_\_

# WAUCONDA LANDFILL SITE INSPECTION REPORT - PART I

| Re           | gular (R):                                                                                                                                                                                                      | Monthly (M):                                                                                                                                                                                | Annual (A):                                                                          | ······································ |     |           |                     |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------|-----|-----------|---------------------|
| Ins          | pector(s) (1)                                                                                                                                                                                                   |                                                                                                                                                                                             | Company: _                                                                           |                                        |     |           |                     |
|              | (2)                                                                                                                                                                                                             |                                                                                                                                                                                             | -                                                                                    |                                        |     |           |                     |
| Da           | te of Inspection:                                                                                                                                                                                               |                                                                                                                                                                                             | Complete<br><u>By</u>                                                                | Required<br>Frequency                  | Yes | <u>No</u> | Not<br><u>Check</u> |
| А.           | Leachate Collection                                                                                                                                                                                             | on/Forcemain and Electrical System:                                                                                                                                                         |                                                                                      |                                        |     |           |                     |
| 1.           | Electrical Control I<br>a. Is the panel fun<br>b. Any fault alarm<br>c. Hour meter Eas                                                                                                                          | Panel<br>ctioning?<br>is noted or reset made?<br>t West                                                                                                                                     | Village<br>Village<br>Village                                                        | R<br>R<br>R                            |     |           |                     |
| 2.           | Sump 1 Pumping 6<br>a. Pump E and W<br>b. Unusual noises<br>c. Valves and pipe<br>d. Sump liquid lev<br>e. Any indication<br>f. Sump covers see<br>g. Level switches<br>h. Sump free of de<br>i. Sump vent open | Chamber<br>operational? Pumping to Sewer or Tank.<br>or vibration from pumps E or W?<br>e watertight?<br>vel below high-high level?<br>of sump overflow?<br>cure?<br>secure?<br>ebris?<br>? | Village<br>Village<br>Village<br>Village<br>Village<br>Village<br>Village<br>Village | R<br>R<br>R<br>R<br>R<br>M<br>M        |     |           |                     |
| 3.           | Sump 2 Chamber<br>a. Chamber and P<br>b. Has the tank be<br>since previous i                                                                                                                                    | iping intact?<br>en backflowed to Sump 2<br>nspection?                                                                                                                                      | Village<br>Village                                                                   | R<br>R                                 |     |           |                     |
| 4.           | Meter Chamber<br>a. Chamber and p<br>b. Meter functiona<br>Meter Reading                                                                                                                                        | iping intact and pumped dry?<br>1?<br>gpm total gal                                                                                                                                         | Village<br>Village                                                                   | R<br>R                                 |     |           |                     |
| 5.           | Drain Chamber an                                                                                                                                                                                                | d components intact and dry?                                                                                                                                                                | Village                                                                              | М                                      |     |           | <u></u>             |
| 6.           | Air release chambe                                                                                                                                                                                              | er intact and dry?                                                                                                                                                                          | Village                                                                              | М                                      |     |           |                     |
| 7.           | Village MH 12-24 i                                                                                                                                                                                              | ntact?                                                                                                                                                                                      | Village                                                                              | М                                      |     |           |                     |
| 8.           | Buried pipe alignn                                                                                                                                                                                              | nent free of encumberance?                                                                                                                                                                  | Village                                                                              | М                                      |     |           |                     |
| 9.           | Is vegetative cover                                                                                                                                                                                             | intact over LC drain and FM?                                                                                                                                                                | Village                                                                              | М                                      |     |           |                     |
| 10.          | Is there leachate se                                                                                                                                                                                            | epage to Mutton Creek?                                                                                                                                                                      | Village                                                                              | М                                      |     |           |                     |
| 11.          | Has any servicing                                                                                                                                                                                               | been conducted this month?                                                                                                                                                                  | Village                                                                              | М                                      |     |           |                     |
| <b>B</b> . ( | Comments/Follow-1                                                                                                                                                                                               | ip Items To Above                                                                                                                                                                           |                                                                                      |                                        |     |           |                     |

Week Beginning: \_\_\_\_\_

Days since previous inspection: \_\_\_\_\_

# WAUCONDA LANDFILL SITE INSPECTION REPORT - PART II

| Regular (R): _     | Monthly (M):                                    | _ Annual (A): _ |                       | <u></u>  |    |              |
|--------------------|-------------------------------------------------|-----------------|-----------------------|----------|----|--------------|
| Inspector(s):      | (1)                                             | Company:        |                       |          |    |              |
|                    | (2)                                             | _               |                       |          |    |              |
| Date of Inspec     | ction:                                          |                 |                       |          |    |              |
|                    |                                                 | Complete<br>By  | Required<br>Frequency | Yes      | No | Not<br>Check |
| A. <u>Abovegr</u>  | ound Tank and Enclosure Bldg                    |                 |                       |          |    |              |
| 1. Containn        | nent floor and tank wall dry?                   | OPL             | R                     |          |    |              |
| 2. Signs of t      | 2. Signs of tank leakage?                       |                 | R                     | <u> </u> |    |              |
| 3. Signs of a      | piping/valving leakage?                         | OPL             | R                     |          |    |              |
| 4. Has tank        | been backflowed to sumps since last inspection? | OPL             | R                     |          |    |              |
| 5. Is the bac      | kflow system secure and off?                    | OPL             | R                     |          |    |              |
| 6. Has the h       | high level alarm been activated?                | OPL             | R                     |          |    |              |
| 7. Tank and        | piping insulation secure?                       | OPL             | R                     |          |    |              |
| 8. Pipe heat       | tracing operating?                              | OPL             | R                     |          |    |              |
| 9. Tank pad        | heaters operating?                              | OPL             | R                     |          |    |              |
| 10. Signs of a     | overfilling on the tank top?                    | OPL/CRA         | М                     |          |    |              |
| 11. Signs of c     | concrete damage or spalling?                    | OPL/CRA         | М                     |          |    |              |
| 12. Any dam        | age to the building structure?                  | OPL/CRA         | М                     |          |    |              |
| 13. Tank ven       | it open and clear?                              | OPL/CRA         | М                     |          |    |              |
| 14. Sump liq       | uid level indicator operational?                | OPL/CRA         | М                     |          |    |              |
| Tank leve          | el:                                             |                 |                       |          |    |              |
| Day/Tim            | ne:                                             |                 |                       |          |    |              |
| B. <u>Truck Tu</u> | urnaround                                       |                 |                       |          |    |              |
| 1. Entrance        | gate and lock secure?                           | OPL             | R                     |          |    |              |
| 2. External a      | above ground piping for truck loading           |                 |                       |          |    |              |
| a. leakage         | e?                                              | OPL             | R                     |          |    |              |
| b. suctior         | line valve closed?                              | OPL             | R                     |          |    |              |
| c. insulati        | ion secure?                                     | OPL             | R                     |          |    |              |
| d. heat tra        | acing operating?                                | OPL             | R                     |          |    |              |
| 3. Liquids o       | on the loading pad?                             | OPL             | R                     |          |    |              |
| 4. Turnarou        | und area intact?                                | OPL/CRA         | М                     |          |    |              |
| 5. Entrance        | culvert intact?                                 | OPL/CRA         | Μ                     |          |    |              |
| 6. Concrete        | sump/pad intact?                                | OPL/CRA         | М                     |          |    |              |
| C. <u>Leachate</u> | Collection System                               |                 |                       |          |    |              |
| 1. Review V        | 'illage inspection checklist?                   | OPL             | R                     |          |    |              |
| 2. Pump rui        | n times E W                                     |                 |                       |          |    |              |

| Regular (R): Monthly (M):                            | ): Annual (A):      |                       |     |          |              |
|------------------------------------------------------|---------------------|-----------------------|-----|----------|--------------|
|                                                      | Complete<br>By      | Required<br>Frequency | Yes | No       | Not<br>Check |
| D. Landfill Cap and Perimeter                        |                     |                       |     |          |              |
| 1. Cover intact and free of erosion?                 | OPL/CRA             | М                     |     |          |              |
| 2. Vegetation cover intact? (provide comment)        | OPL/CRA             | М                     |     |          |              |
| 3. Perimeter fence and gates intact?                 | OPL/CRA             | М                     |     |          |              |
| 4. Surface water ponding?                            | OPL/CRA             | М                     |     |          |              |
| 5. Exposed refuse or leachate leaks?                 | OPL/CRA             | Μ                     |     |          |              |
| 6. Animal burrows?                                   | OPL/CRA             | М                     |     |          |              |
| 7. On-Site access road to sump 1 driveable?          | OPL/CRA             | М                     |     | <u> </u> |              |
| 8. On-Site access road to permit landfill driveable? | OPL/CRA             | Μ                     |     |          |              |
| 9. Grid-pattern walk-over of cap (attach notes)      | OPL/CRA             | Α                     |     |          |              |
| E. Gas Vents and Monitoring Wells                    |                     |                       |     |          |              |
| 1 Are vents and wells properly locked and secure?    | OPL/CRA             | ۵                     |     |          |              |
| 2 Bleed hole in casing clear?                        | OPL/CRA             | Δ                     |     |          |              |
| 3 No blockage down the well?                         | OPL/CRA             | A                     |     | <u></u>  | <u> </u>     |
| 4. Depth to bottom of well decreasing?               | OPL/CRA             | A                     |     |          | ·            |
| 5. Protective posts in place and secure?             | OPL/CRA             | A                     |     |          | <u> </u>     |
| 6. Are labels legible?                               | OPL/CRA             | A                     |     |          |              |
| F. Personal Protective Equipment                     |                     |                       |     |          |              |
| 1. PPE supplies adequate and maintained              | OPL/CRA             | М                     |     |          |              |
| 2. Spent materials properly disposed                 | OPL                 | М                     |     |          |              |
| G. <u>Well Liquid Level to Top of Pipe (Monthly)</u> |                     |                       |     |          |              |
| 1. LW501 :                                           | 4. LW504 :          |                       |     |          |              |
| 2. LW502 :                                           | 5. Permit Manhole : |                       |     | -        |              |
| 3. LW303                                             |                     |                       |     |          |              |
| H. <u>Comments/Follow-up Items To Above</u>          |                     |                       |     |          |              |
|                                                      | ····                |                       |     |          |              |
|                                                      |                     |                       |     |          |              |
| Inspector(s) Signature                               |                     |                       |     |          |              |
| (1)                                                  | (2)                 |                       |     |          |              |

APPENDIX D

LIST OF PROJECT CONTACTS -WAUCONDA LANDFILL REMEDIATION Waucanda Landfill Names & Addresses

File: LANDFILL NAMES Report: BFI Names & Address COMPANY PHONE Page 1 3/15/92 CONTACT STREET CITY Wauconda, II. Palatine, II. 62560 Wauconda, II. 60084 Wauconda, II. 60084 Northbrook, II. 60084 Northbrook, II. 60062 Crete, II. 60417 Grayslake, II. 60030 Wauconda, II. 60084 McHenry, II. 60050 Calumet City, II. 60409 Ambulance, Police, Fire 911 708-358-9100 Don Zeigler Rand & Lake Cook Rds. 610 W. Liberty Street Action Fence Co. 708-526-4554 Jerry McMaster 708-526-3800 -Acre Enterprises 1000 N. Rand Road American Power Rodding 708-320-3800 -708-205-4540 Danilo Corpuz 708-672-5320 Larry 708-223-2722 -708-526-5456 Dennis Maher 815-385-1470 Bob Brauer 210 44444 Bob Brauer Army Corp of Eng. B & K Electricacal Cont. ARF Landfill 666 Dundee Rd. Suite 160 1503 Michael St. Rt. 83 1003 Washington St. 5404 W. Elm St. Berger Excavating Contrac Brauer Land Surveying 312-646-6660 John Arand C.I.D. P.D.Box 1309 C.I.D. CRA Consulting Engineers CRA Consulting (Home) 312-646-3099 Roger fuchs 312-646-3099 Roger fuchs 519-725-3313 Bob Fedy (Cindy) 519-886-9769 Bob Fedy 519-893-8070 Ron Frehner 519-578-0263 Bob Pyle 651 Colby Drive Waterloo Ontario Canada N2V1C2 CRA Consulting CRA Consulting (Home) (Home) 519-578-0263 Bob Pyle 519-886-9386 Julian Hayward 708-299-9933 Ken Myers 219-322-7554 Ken Myers 612-639-0913 Brian Sanburg 612-785-1844 Brian Sanburg 708-438-8241 Neil Everett (Ruth) 708-526-7071 Neil Everett 708-438-4111 -800-782-7860 -217-782-3637 -618-382-3511 Jim Robinson 713-870-6189 -1708-438-2111 John Mackay CRA Consulting (Home) CRA Consulting Engineers 10400 W. Higgins Rd. Sui Rosemont, 11. 60018 CRA Consulting (Home) CRA Consulting Engineers CRA Consulting (Home) Ind. St. Paul, Min. 55789 382 W. County Road D 300 Genesee St. 26730 N. Schwerman Rd. 520 D1d McHenry Rd. Lake Zurich, 11. 60047 Wauconda, 11. 60084 Lake Zurich, 11. 60047 Dearbon Chemical Co. Dearborn Chemical (Home) Elmwood Sewer & Plumbing Emergency Disaster Agency Emergency Response Unit Eastern Services (Tanks) Carmi, Il. 62821 Houston, Texas,77079 Lake Zurich, Il. 60047 Burtons Bridge, Il. Calumet City, Il. 60409 Barrington, Il.60010 Romeoville, Il. 60441 Springfield, Il. 62708 Waukegan, Il.60085 Wauconda, Il. 60084 Glenwood, Il. 60425 P.D. Box 149 PO Box 3272 351 N. Dakwood Road 3703 McCabe Exxon Exxon Chemical Co. 708-438-2111 John Mackay 815-459-9370 John Mackay 312-891-4400 -708-381-9600 -1594 Huntington Dr. 450 W.Hwy.Rt. 22 Pager 379-3801 Gasvoda & Assoc. (Pumps) Good Shepard Hospital Hertige Remediation 11.E.P.A. 708-378-1600 Larry Malik 217-782-6760 David Dollins 3010 Grand Ave. 118 S. Main St. 333 W. 195th St. Lake Co.Health Dept. Lake Co Health Dept. 708-360-6747 708-526-1125 -708-709-0333 Dennis Bennett 708-709-0333 Jerry Tatme 708-893-6400 C.H. Distributor Maecorp(manpower) (Emergency) Maecorp 1721 S. Wright Blvd. 388 Hollow Rill Dr. 221900 S. Central Ave. Schaumburg, Il. 60194 Wauconda, Il. 60084 Mattson, Il. 60443 Maloney Electric Supply Mandan Mechanical Co. Mr. Frank Hauling Mr. Frank Hauling Mr. Frank Hauling (Home) Mr. Frank Hauling (Home) Mr. Frank Hauling National Response Center 18225 Gottschalk

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Ne i ghbor Obenauf Rubish Removal Obenauf Rubish Removal Obenauf (Home) Oplinger's Consulting Pesz Snow Removal Planson Electric Poison Control Center Radian Corp Testing Radian Corp. Suburban Landscaping Tree-Landscape Service U.S.E.P.A. Wauconda Landfill Site Wauconda Public Works Wauconda Sewer Wauconda Sewer Wauconda Township Supv. Waste Management Waste Management Weather Berger Excavting (FAX) (FAX) CRA<sup>-</sup>Consulting CRA Consulting (FAX) CRA Consultino (FAX) (FAX) Dearborn Chemical

Exxon Chemical Co.

Wauconda Vill Hall

Oplinger's Consult (FAX)

Maecorp

(FAX)

(FAX) (FAX)

708-873-0400 C.H. Distributor 708-526-2930 Guy Dellaria 800-426-7549 Chris (trucks) 708-720-0700 Michael Pfeifer 708-957-2321 Thomas Grad 219-865-8641 Michael Pfeifer 708-481-5221 Terry O'Brien 708-481-5221 Terry O'Brien 800-424-8802 -708-526-5315 Harold Brown 708-566-5159 John Obenauf 708-566-5361 John Obenauf 708-639-3577 Dick Oplinger 708-639-3577 Dick Oplinger 708-639-9321 Joe Pesz 708-526-3596 Paul Planson 708-942-5969 -512-454-4797 Jane Lidsey 512-454-4797 J. Steven Gibson 708-526-8083 Gene Murdock 312-886-4740 Rebecca Fry 708-526-8083 Gene murdock 312-886-4740 Rebecca Fry 708-526-7208 -708-526-9610 Jeffery Kuester 708-526-9612 Mark Dierker 708-526-9612 Rick Burns 708-526-2531 -708-409-0700 William Schubert 708-409-0700 Den Brack 708-409-0700 Dee Brench 312-353-4684 -708-526-4204 Dennis Maher 519-725-1394 Bob Fedy 708-299-6421 Ken Myers 612-639-0923 -708-540-1595 Neil Everett 708-540-1484 John Mackay 708-526-8809 Mark Dierker 708-957-7324 Gary Hammer

708-639-3577 Dick Oplinger

Homewood, 11. 60430 Dyer, In. 46311 2416 Foliage Lane 4447 Lincoln Mall Drive Mattson, 11. 60443 28975 W. Garland Rd. Indian Creek Road Indian Creek Road Wauconda, 11.60087 Mundelein, 11. 61349 Mundelein, 11. 61349 Cary, 11. 60013 151 Sherwood Drive 4705 S. Roberts Rd. 2609 Hyde Park Ave. Island Lake, 11.60042 Holiday Hills, 111.60050 Austin, Texas 78766 Austin, Texas 78766 Mt. Prospect, 11. 60056 Wauconda, 11. 60084 Chicago 11.66604 8501 MoPac Blvd. P.D.Box 9948 1500 Barbury Lane 1013 Highland Ave. 230 S. Dearborn St. Wauconda, 11. 60084 Wauconda, 11. 60084 Pager 314-2828 Pager 440-2972 1213 Garland Road 302 Slocum Lake Road Home 708-526-1478 Home 708-526-3625 505 Bonner Road PO Box 7070, Suite 1000 Wauconda, Il. 60084 Westchester, Il. 60154

Wauconda, Il. Waterloo Dntario, Canada Rosemont, Il. St. Paul, Min. Lake Zurich, Il. Lake Zurich, Il. Wauconda II. Glenwood, Il. Cary, IL.