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The material contained herein includes operating and maintenance instructions for the system of groundwater production wells, treatment equipment, pumping units, piping and valves, electrical, instrumentation and HVAC equipment related to the collection and treatment of the groundwater at the Old Bethpage Solid Waste Disposal Complex (OBSWDC).

The instructions and recommendations in this Manual are intended to serve as a guide for maintenance personnel in the performance of their duties in the operation and maintenance of the systems and equipment described.

This Manual should be used with, and must comply with Town of Oyster Bay Department of Public Works (TOB DPW), with Occupational Safety and Health Administration (OSHA)/National Institute of Occupational Safety and Health (NIOSH), accepted safety practices and precautions, as well as with the instructions provided by operation staff personnel.

SECTION 1

1.1 INTRODUCTION

The success of pumping and treatment facilities operation and efficiency in performing the removal of contaminants ultimately depends upon effective operation and maintenance (O&M) of the installed mechanical, electrical, instrumentation, chemical and HVAC equipment.

Regardless of how well the equipment and appurtenances have been designed or installed, a poor O&M will lead to the deterioration of its various components and a resulting decrease in the performance of these systems.

Effective O&M also affects equipment reliability, on-line availability, and continuing regulatory compliance. Lack of timely and proper O&M leads to a gradual deterioration in the equipment which in turn increases the probability of equipment failure and decreases both its reliability and on-line availability.

This Manual focuses on the operation and maintenance of the submersible pumps in the production wells, vertical pumps in the air stripper and filter pump station wet wells, air stripper and air blower, instrumentation and control equipment, HVAC and auxiliary equipment.

1.2 INTENDED USE OF MANUAL

The intent of this Manual will be to assist both maintenance personnel and control agency personnel.

The objective of this Manual is to present the elements of a sound and systematic maintenance operation, surveillance and diagnostic program that will promote the continuous satisfactory performance of the equipment.

Emphasis is on operating practices; preventive maintenance procedures; performance monitoring; record keeping; and finding, diagnosing and solving problems. Should a problem be experienced that is not covered by this Manual, it may be required to consult with equipment manufacturers, suppliers or other qualified sources.

1.3 SCOPE AND CONTENT

o Section 2 outlines a basic description of treatment procedures, a detailed description of treatment system components and diagramatic flow sheets, which will provide the background for and understanding of the Manual sections that follow. It also presents information on typical failure modes and causes for poor performances, and establishes an adequate O&M program.

o Section 3 discusses performance monitoring as a major element of O&M programs. Initial presentation centers on the key design parameters established for the influent and effluent, for the liquid side of the process as well as the parameters for the outlet air stream. This description covers what is to be monitored, where the sampling should be taken and the purpose of this sampling program. Instrumentation and control systems are described and evaluated with respect to their use as performance monitors. Performance tests, baseline assessments, and the role of parameter monitoring are briefly discussed, and the importance of good record keeping practice and procedures is stressed in regard to record keeping frequency, quality assurance, and record maintenance.

o Section 4 describes the use of performing monitoring in the evaluation of control system performance, in the discovery of real or impending problems, and in the diagnosis and correction of causes of poor performance. This section also focuses on the determination of probable causes of different operating problems, malfunction, and deteriorating performance. The final

discussion will cover miscellaneous techniques for determining the success of corrective actions.

o Section 5 presents guidelines for general O&M practices and procedures that can be used to improve and sustain control equipment performance and reliability. This section indicates good operating practices and preventive maintenance programs and addresses start-up procedures and shutdown practices, under normal and emergency conditions.

o Section 6 presents safety considerations and special precautionary measures for electrical hazards in confined areas.

o Section 7 describes procedures and techniques provided for conducting external and internal inspections, and describes portable instrumentation and safety equipment needs during inspection.

o Section 8 presents the requirements for the management and competence of the operations staff. It also presents the O&M supplied by the manufacturers of the main equipment, shop drawings for major equipment, and spare parts list for equipment.

o Laboratory operation and maintenance procedures are presented in a separate manual designed specifically for use of the laboratory staff. Copies of that manual are located in the laboratory and supervisor's office.

SECTION 2
DESIGN CONSIDERATIONS

2.1 BASIC DESCRIPTION OF GROUNDWATER RECOVERY, WATER CONVEYANCE AND TREATMENT SYSTEMS

- The overall objectives of the operation and maintenance of these systems are:

  a. Development of a hydraulic containment of the tainted groundwater plume, by operating the system of production wells. The recovery system is designed to maintain a sufficient drawdown to create a hydraulic barrier, which will prevent further migration of the landfill leachate plume.

  b. Collection and removal, through the five production wells, of the landfill leachate plume.

  c. Conveyance of the tainted groundwater to the treatment plant.

  d. Treatment of the groundwater to comply with the air and water discharge criteria set forth in the Consent Decree.

  e. Recharge of the treated water to the aquifer system.

2.1.1 Groundwater recovery system refers to the five production wells located at the leading edge of the plume within the Bethpage State Park Black Golf Course (BSPBGC).

- The production wells are designed to withdraw a total of 1.5 MGD (1050 GPM), or 0.3 MGD (210 GPM) from each well.

- Each individual well consists of a 10-inch well casing and continuous slot well screen, a 15 HP submersible pump, equipped with a check valve and discharge pipe. The control valve, pressure gauge and flowmeter are installed in an underground reinforced concrete pit.

- The design flow required to maintain hydraulic containment and its corresponding resultant water table drawdown, has been estimated from groundwater modeling studies and confirmed through pilot pump test.

- To ensure that the groundwater recovery system will maintain hydraulic containment over a range of possible operating conditions, the following operation modes have been considered:

  a. The normal mode of operation assumes all five production wells operating at 210 GPM (0.30 MGD) each for a total flow of 1050 GPM (1.5 MGD).

  b. The total maximum pumping capacity of the system is 1,200 GPM (1.76 MGD), or 240 GPM (0.36 MGD) per each production well.

  c. Production wells No. 1 and 2 pumping together can deliver 260 GPM and 270 GPM, respectively, for a total of 530 GPM. Any combination of well operations for a wide range of flow rates can be obtained by adjusting the motor operated control valves at the wells, which also can be remotely controlled from the control room at the Water Treatment Plant.

d. To account for seasonal water table fluctuations, as well as the possible lowering of the water table over the duration of the project, the submersible pumps have been located an additional approximate twenty feet below the maximum anticipated drawdown depth (see "As-Built Drawing No. 18 for the elevations).

2.1.2 Water Conveyance System

- The conveyance system through the golf course generally follows existing pathways and clearing so as to cause minimum disturbance of the existing environment and to minimize potential impact on park activities. The actual locations of the piping system and appurtenances are shown on the "as-built" drawings.

- The conveyance piping system consists of 4-inch, 6-inch, 8-inch and 10-inch diameter PVC pressure pipe, and vacuum and air release valves located in pits at high points and drain valves at the low points along piping. To be able to isolate sections of piping, shut off valves have also been provided. To accommodate for low flow rates and negative pressures in the system, a back pressure sustaining valve is provided at an adequate location.

- The main conveyance line begins at the production wells located in the BSPBGC and runs in a northwesterly direction through the Black, Course, continuing westerly along the northern top of slope of the recharge basin, east of Winding Road and enters the Old Bethpage Solid Waste Disposal Complex (OBSWDC). Once in the OBSWDC, it continues in a northerly direction along the Patrol Road to its intersection with the LILCO easement to the treatment plant.

- An important feature in operating the systems is the detection of leakage which might occur along the conveyance piping. Both the flow rates at each individual production well will be measured at the well sites as well as the total flow delivered at the treatment plant. Comparing the two flows, if the difference exceeds a predetermined limit, the wells will be automatically shut off. The actual location of the leak will be determined by maintenance crew, and pipe will be repaired.

2.1.3 Treatment of Tainted Groundwater

- The intent of treating tainted groundwater is to meet the effluent quality requirements as set forth in the Consent Order.

- The treatment process equipment chosen consists of the latest state of the art technology to treat the water.

- The process selection was made to assure the removal of volatile organic compounds (VOC's), down to the requirements of the Federal, State and local agencies.

- Air stripping is the unit process of choice for removing many different VOC's from groundwater. The required removal efficiency will be achieved by applying the air-to-water ratio, hydraulic loading rate and the packing material.

- The principal of air stripping is the transfer of VOC's from an aqueous solution into the gaseous phase, the rate of which is dependent on the mass transfer properties of the contaminants involved.

- During the operation of air stripper tower (AST), an optimum air-to-water ratio will be established to maximize the mass transfer rate and at the same time keep energy requirements within economical range.

- The air stripper power is of counter-current flow type, and has been proved to be the most effective unit for removing VOC's, to required limits before recharging the treated effluent back into the ground. The VOC removal will occur throughout the packing (media) material, and depends upon the depth of medium.

2.1.4 Discharge System

- Treated water effluent is discharged through a forced main which will carry water to diffusion wells located within the existing Recharge Basin No. 1 located at Claremont Road. The discharge forced main alignment begins at the treatment plant and continues in a westerly direction towards the landfill haul road, where it turns 90 ^{o} and continues southerly adjacent to the haul road to the discharge manhole.

- A gravity line continues from the discharge manhole to a diffusion well field located in Recharge Basin No. 1.

- A total of eight (8) diffusion wells are required beneath the bottom of the recharge basin to dispose of the 1.5 MGD flow.

- The diffusion wells are arranged along the bottom of the recharge basin in a circular formation, with a distribution well in the center. They are interconnected by perforated pipe, to maintain even distribution of the flow.

2.2 DESCRIPTION OF SYSTEMS COMPONENTS

2.2.1 Production Wells (PW)

PW #1 – has a total depth of 280 feet, from the ground elevation (at 117.44) to the bottom of the well. The 10-inch black steel well casing has been installed in an 18-inch diameter drilled hole. The gravel pack is provided for about 165 feet below bank run gravel to the bottom of the hole. The 10-inch diameter stainless steel 0.040-slot screen has been installed with some blank areas along the casing. The gravel pack has been installed 25 feet above the top slot of the screen in order to provide ample reserve to allow for any settlement.

On-off level controls for submersible pump have been established at elevations 39.0 and 98.5, respectively, for off and on levels.

PW #2 has a total depth of 290 feet from the ground elevation (at 151.77) to the bottom of the well. The well has been constructed similar to PW #1. The gravel pack is provided for about 180 feet below bank run gravel to the bottom of the hole. The same screen dimension as shown for PW #1 has been installed, providing 10 and 30 feet blank areas along the casing. The gravel pack has been installed 43.5 feet above the top slot of the screen. Calculations performed at the four steps of pumping provided a specific capacity of about 37 GPM/FT for flows varying from 170 GPM to 313 GPM.

On-off level controls for submersible pump have been located at elevations 38.5 and 58.5, for off and on levels.

PW #3 has a total depth of 275 feet from the ground elevation at (127.30) to the bottom of the well. This well has been constructed similar to the previously described two wells. The gravel pack is provided for about 150

feet below bank run gravel to the bottom of the hole. The same screen dimension as shown for PW #1 has been installed providing a total continuous length of about 90 feet. The gravel pack has been installed 40.0 feet above the top slot of the screen. Calculations performed at the four steps of pumping provided a specific capacity of about 23 GPM/FT for flows varying from 154 GPM to 319 GPM.

On-off level controls for the submersible pump have been located at elevations 39.0 and 58.5, for off and on levels.

PW #4 has a total depth of 270 feet from the ground elevation (at 151.31) to the bottom of the well. This well has also been constructed similar to three previous wells. The gravel pack is provided for about 163 feet, below bank run gravel to the bottom of the hole. The same screen dimension as shown for PW #1 has been installed providing a total continuous length of about 103 feet. The gravel pack has been installed about 48.6 feet above the top slot of the screen. Calculations performed at the four steps of pumping provide a specific capacity of about 45 to 50 GPM/FT for flows varying from 168 GPm to 328 GPM.

On-off level controls for the submersible pump have been located at elevations 39.0 and 58.5, for off and on levels.

PW #5 has a total depth of 282.0 feet from ground elevation (at 156.20) to the bottom of the well. This well has also been constructed similar to four previous wells. The gravel pack is provided for about 163 feet, below bank run gravel to the bottom of the hole. The same screen dimension as shown for PW #1 has been installed providing 22.5 feet blank area along the casing. The gravel pack has been installed 40 feet above the top slot of the screen. Calculations performed at the four steps of pumping provided a specific capacity of about 30 to 45 GPM/FT for flows varying from 162 GPM to 320 GPM.

On-off level controls for the submersible pump have been located at elevations 43.0 and 59.0 for off and on levels.

2.2.2 Submersible Pump, Level Controls, and Pressure Switches

2.2.2.1 Submersible Pumps

- The pump installed in each production well is a Grundfos Model 225 S150-6, with a flow range of 150 to 290 GPM, and variable head for typical operation of each well. The motor is a direct coupled, water lubricated, rated at 15 Hp. 460V, three phase, 3,500 RPM. The pump is equipped with a stainless steel non-clogging, non-slamming check valve, built into the top of the pump chamber to prevent backflow. Pump is also equipped with a priming inducer which provides maximum pump protection from dry-run damage during low water levels. Located inside the suction interconnector at the pump inlet, this small axial flow screw provides enough water to lubricate the pump until the well has time to recover.

- The motor starter is a Furnas, Model 15 FP34WF81, magnetic, full voltage, non-reversing 460 volt, 3 phase, 3 pole, 60 Hz, size 2, Nema 4X enclosure with hand/off/automatic switch, the starter has 2 normally open 2 pole auxiliary contacts, and 3 normally closed 2 pole auxiliary contacts.

2.2.2.2 Level Measurement System

The level measurement system, manufactured by Ametek Control Division is Model 572 Digital Meter Controller, with 2 relays, a 4 to 20mA outlet, for Model 57 SP level tranducers. The system utilizes a compact microprocessor

controlled digital meter to display and transmit level data hydrostatically measured by 2 stainless steel pressure transducers. The transducers (low and high level) are lowered into the production well with a cable, and display levels on the meter.

The microprocessor is housed in a control panel, weathertight housing, installed in the production well pit.

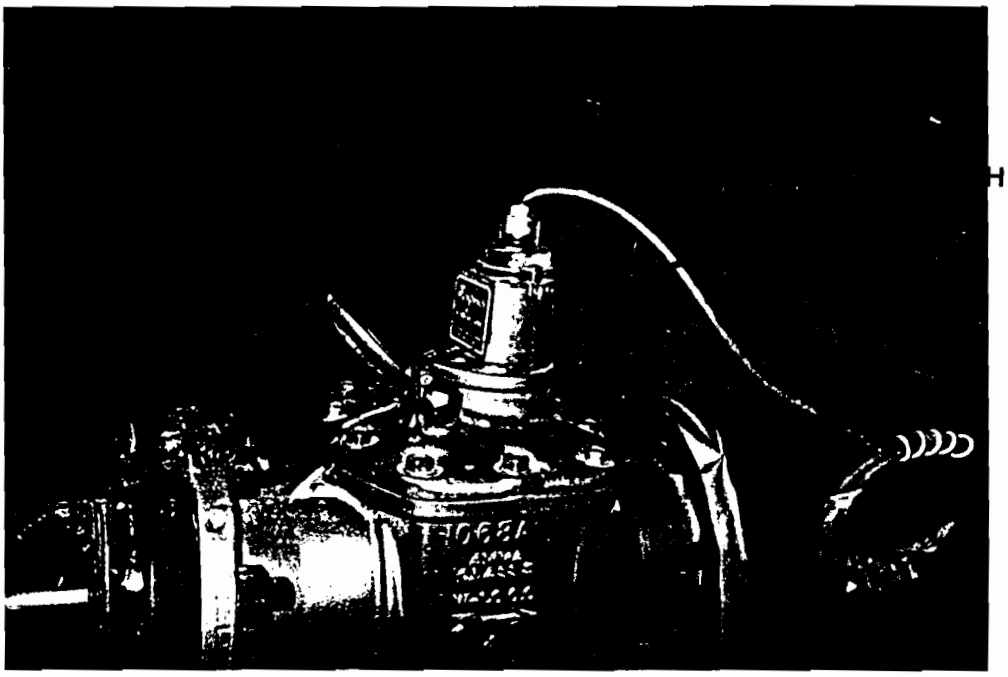
2.2.2.3 Pressure Switches

Industrial pressure switch Type "G" Class 9012, break rating 6 amp. at 120 VAC with 10 AMP D.C. rating is installed in each production well. Each switch have lock on, on rising pressure with manual reset only and is field adjusted for N.C. contact to open at 100 PSI. The N.C. contact of the pressure switch is wired in series with the starter control relay coil. The N.C. contact is located in the control circuit so that will prevent restarting of the pump locally or remotely unless the pressure switch is manually reset.

2.2.3 Production Well Pit

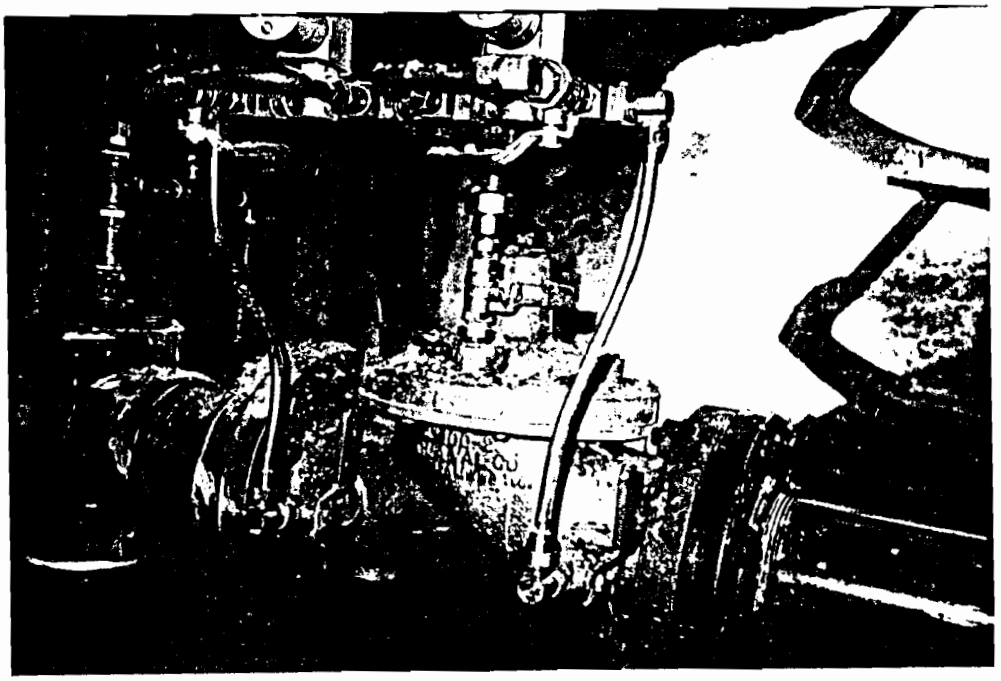
2.2.3.1 The motor starter, level controller, automatic control valve and flowmeter are located in the below ground reinforced concrete pit.

2.2.3.2 The automatic valve, is a Cla-Val Co., Model 100-20 hytrol valve. This valve is a hydraulically-operated, diaphragm-actuated, globe pattern. The valve contains a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a drop tight seal against the removable seat insert.



H SPEED PICK-UP

FLOWMETER



CLA-VAL CONTROL VALVE

FIGURE 2 - A

The diaphragm assembly containing the valve stem is fully guided at both ends by a bearing in the valve cover and by an integral bearing in the valve seat.

- o The valve is remote controlled and can be opened or closed, or made to modulate by energizing the solenoids mounted on the valve. If one solenoid is energized, the valve will open, if the other is energized, the valve will close and if they are de-energized, the valve will throttle and remain in that position until one or the other solenoid is energized.

2.2.3.3 The flowmeter is a magnetic drive turbo meter type, manufactured by Rockwell, Model W-1000 DR.

The meter is comprised of two basic assemblies, the main case and the measuring chamber. The measuring chamber includes the rotor, calibration vane and seal direct reading (DR) register.

A ring magnet in the rotor drives the follower magnet in the seal register's well through a patented flux carrier that accomplishes right angle magnetic drive. The thermoplastic rotor with graphite bearing rotates on a chrome plated stainless steel shaft.

2.2.3.4 A high speed pick up (HSP) register, manufactured by Rockwell will transmit solid state signals from the flowmeter to the control room at the Treatment Plant Building. The HSP register is fastened to the flowmeter with an internal locking nut.

A mechanical odometer and test circle are incorporated for direct readings.

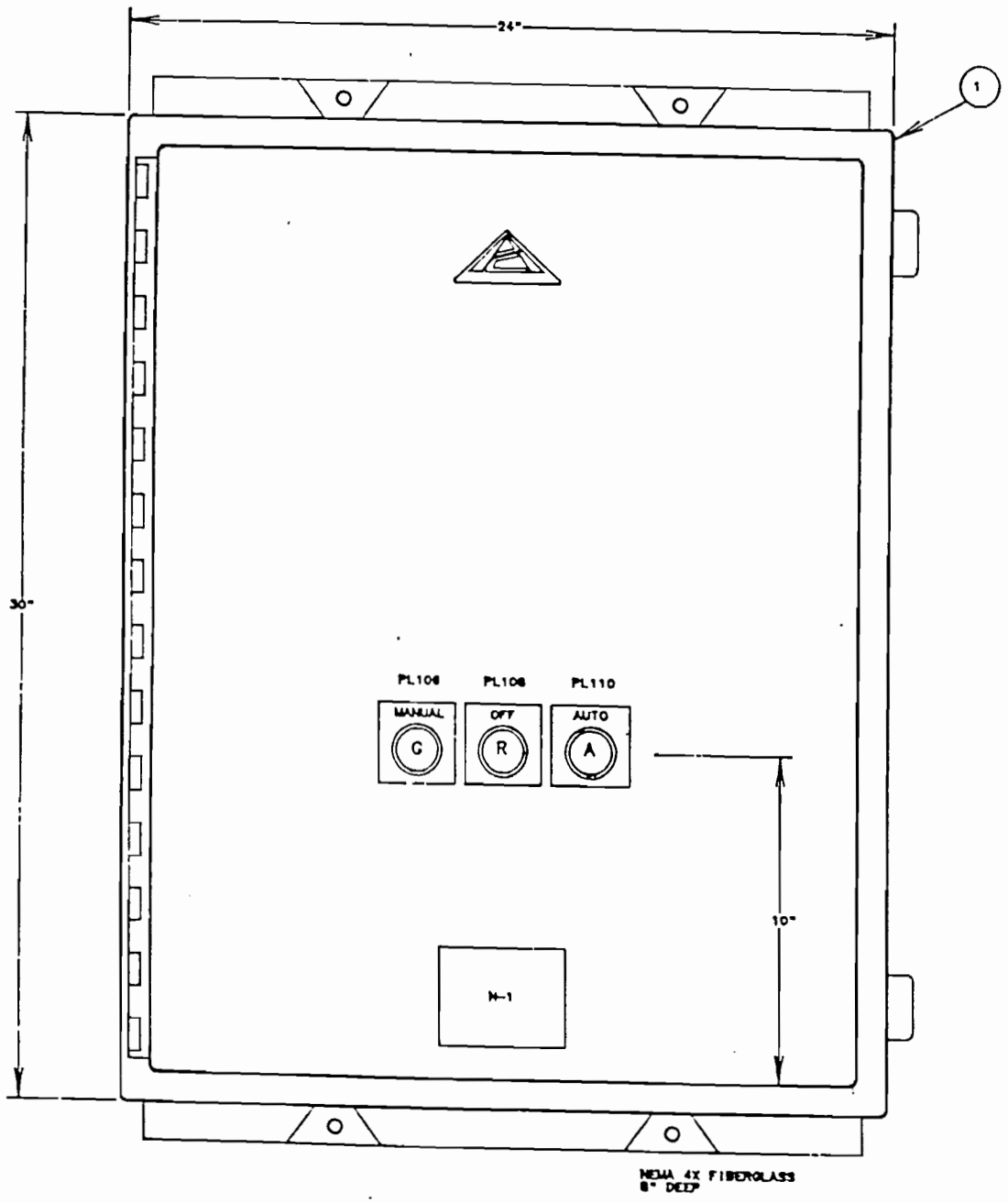
The HSP register is equipped with two (2) internally mounted trouble-shooting lights. The continuous (non-blinking) red light (located at the rear left interior of the register enclosure when facing the odometer) indicates power from the totalizer flow indicator is being received at the HSP's terminal strip.

When water is flowing through the meter, the odometer test circle is rotating, and a red light (located at the rear right interior when facing the odometer) will blink in proportion to the flow rate. If the light is not blinking, either the HSP's electronic circuit is defective or the connection is not continuous.

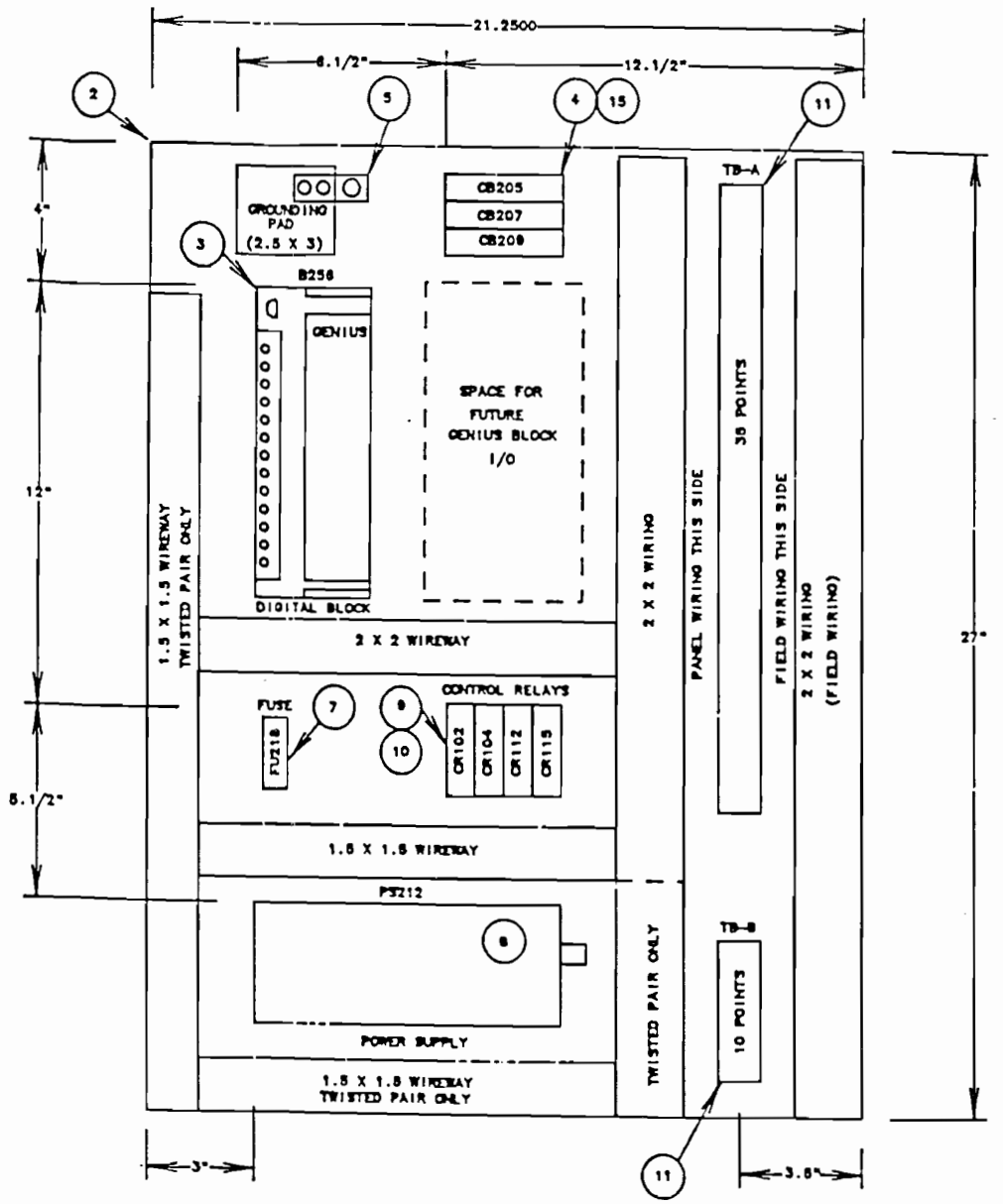
2.2.4 Water Conveyance System

2.2.4.1 The water conveyance system include the water transmission lines connecting each production well, up to the entrance of the water treatment plant. All appurtenances including sectional shut-off valves, are usually located in the vicinity of a drain valve pit or air release valve pit, and backpressure sustaining valve pit.

2.2.4.2 The water transmission line consists of 4, 6 and 8 inch and 10 inch bell and spigot type, Class 150 (DR 18) PVC pressure pipe. The pipes have been installed with ductile iron mechanical joint fittings and complete accessories as required.



FRONT



SUB-PANEL

ITEM	DESCRIPTION	MANUFACTURER
001	NEMA 4X FIBERGLASS ENCLOSURE, SIZE: 30"H X 24"W X 8"D, WALL MOUNTED TYPE	HOFFMANN
002	SUB PANEL PLATE SIZE 27" X 21"	HOFFMANN
003	GENIUS BLOCK, 24VDC, 16 POINT I/O BLOCK SELECTABLE INPUT/OUTPUT	GENERAL ELECTRI
004	CIRCUIT BREAKER, 1 POLE, 120/240VAC, 15A QP PLUG IN TYPE	ITE
005	GROUNDING PAD	RED1
006	150 OHM CARBON FILM (BULK)	RESISTOR
007	FUSE 5 AMP.	BUSS
008	POWER SUPPLY, 24V, 3.5A	ACOPIAN
009	RELAY, MINIATURE POWER, 2PDT, 24VDC CONTACTS RATED @ 10 AMPS	IDEC
010	RELAY SOCKET SNAP/SURFACE MOUNT, 8 BLADE	IDEC
011	TB 600V MD #30-14 STRAP CLAMP,CHAN. MNT.	BUCHANAN
012	TERM BLOCK END SECTION, 60GV, MED DUTY	BUCHANAN
013	TERM BLOCK CHANNEL CLAMP	BUCHANAN
014	TERM BLOCK MOUNTING CHANNEL, STEEL, 6 FT	BUCHANAN
015	MOUNTING BRACKET SHALLOW BQ TYPE 1 POLE P/N SMB6	ITE

LAYOUT
WELL PUMPS NO. 1.2.3.4.5 REMOTE CONTROL PANEL (TYP)

FIGURE 2-B

The piping within the drain and air release valves pits are of ductile iron, and are connected to the PVC pipe approximately 5'-0" on each side of the pit.

2.2.4.3 Shut-off gate valves are mechanical joint type, at 200 PSI working pressure, non-rising stem, bronze mounted, double disc, as manufactured by U.S. Pipe, Model Hydra Gate, and are installed ahead of each drain and air release valve pit.

The valve closes in two steps. In the first step, the downward travel, the two disc stops at a point where the disc and body rings coincide. In the second step, the disc actuating mechanism moves against the discs and pushes them apart so they press against the body rings, thus providing the sealing action and completing closure.

The valve is provided with a valve box for protection and easy access.

2.2.4.4 Drain valve pits are located at the low points along the transmission line. Each pit can hold 180 gallons without submersing the valve. When any kind of repairs are required, the shut-off valves located upstream or downstream, depending on the section of pipe of the drain pit, will be closed. The same for the valve located outside the drain pit. The maintenance personnel will open the 3-inch drain valve and the water that has collected in the sump will be pumped out with a portable sump pump. The water will be disposed of in a manner complying with the regulatory agency requirements. An estimated amount of water entering each pit is indicated in the following table.

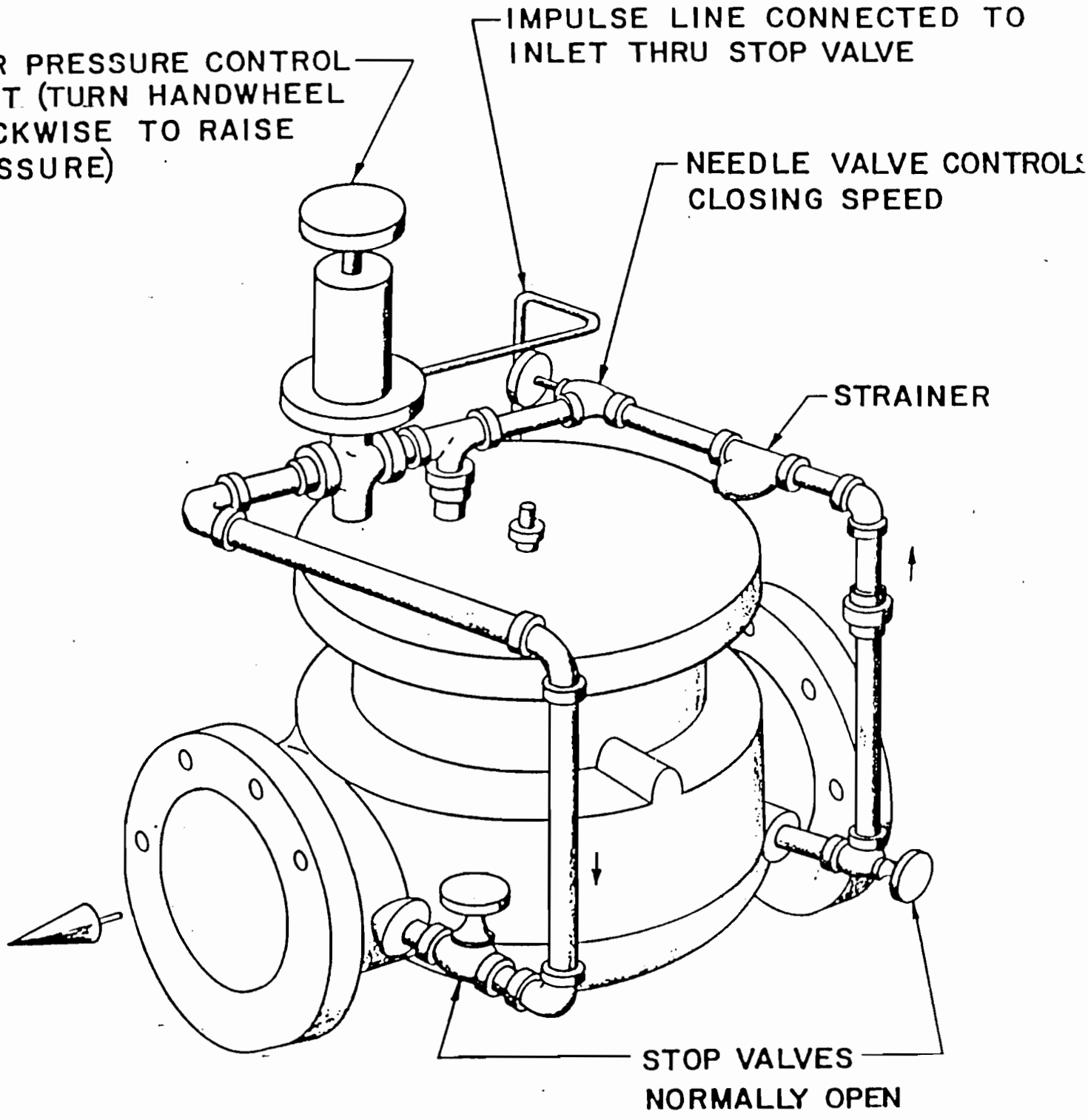
Drain Pit Station	Dia. of Pipe To Discharge in Pit (Inch)	Length of Pipe (Ft)	Volume of Water Entering Pit (CF)
12 + 45	8	950	2,660
17 + 87	10	250	1,030
20 + 80	10	480	1,970
27 + 83	10	1015	4,170
43 + 22	10	3140	12,900
0 + 38	10	750	3,080

2.2.4.5 Air release/vacuum valve pits are located at high points along transmission line.

- Air/vacuum valve is Figure No. 935, as manufactured by Golden Anderson Industries. The valve will automatically exhaust large quantities of air and gases while the water line is being filed, and allow air to re-enter during drainage or when a negative pressure exists.

- The valve is float operated and will close drip tight against a renewable rubber seat. Valve is also provided with a shut-off butterfly valve, when the air valve has to be removed for maintenance or repair.

2.2.4.6 Back pressure sustaining valve pit is located immediately downstream of the highest point on the transmission line. The valve is manufactured by Golden Anderson Industries, and is Figure No. 6700-DR.



BACKPRESSURE SUSTAINING VALVE

FIGURE 2-C

The valve is throttled to maintain a pre-set pressure of 7-40 psi on the upstream side of the valve. If upstream pressure drops below valve setting, the valve will close. Turning clockwise on the sustaining pilot handwheel will increase the setting and turning counter-clockwise will decrease the setting. Needle valve controls closing and opening of the main valve.

This valve is a differential piston type valve having the small seating end of the piston exposed to the inlet-upstream pressure, and a larger area top side of the piston which is alternately exposed to the full inlet-upstream pressure to close the valve; or exposed to the lower downstream pressure when the pilot is open, permitting draining of water from atop the piston to open the main valve.

The pilot functions in response to an impulse line from the inlet-upstream side of the valve, opening when that pressure exceeds the spring setting above the diaphragm; and closing when the impulse pressure drops below the spring setting. When the pilot opens, it permits drain of pressure from the large area top of the piston, and permits the high inlet-upstream pressure under the small end of the piston to open the valve. When the pilot closes, it traps inlet-upstream pressure above the large top area of the piston closing the main valve. Inlet-upstream pressure reaches the top of the piston through a small control line between the inlet-upstream side of the valve, and the lid of the valve. In the small control line to the top of the lid, there is a needle valve to permit regulation of the flow so that the speed of valve closing can be adjusted as to speed.

The valve is tight seating when closed, the piston being furnished with a renewable rubber, leather or composition seat ring. Pressure is controlled between the bottom and top of the piston by a rubber or leather (composition) cup on the piston, and a similar cup on the liner. The differential area between top and bottom of the piston is provided by an atmospheric vent in the valve body.

The pilot valve is set at the factory at the pressure at which the main valve is designed to open. The pressure setting may be increased by screwing down, clockwise, on the handwheel to have the valve open at a higher inlet pressure. To have the main valve open at a lower inlet pressure, simply screw up, counterclockwise, on the pilot handwheel. The pilot is a sturdy diaphragm operated, spring loaded control.

For maintenance and/or repair, two flanged shut-off gate valves on both sides of the backpressure sustaining valve and a bypass also equipped with a flanged gate valve have been provided within the pit.

2.2.5 Air Stripper Pump Station

2.2.5.1 The water pumped from all five production wells flows through the transmission line and is discharged into the air stripper pump station wet well. The total flow is registered (totalized and displayed) by the flowmeter located on the influent line to wet well) and the results are transmitted to the control room.

2.2.5.2 For normal operation, two of the vertical pumps will be on, and the third unit will be off, as a standby. Pump operations will be sequenced by the amount of flow sensed by the water level controls connected to the pump control panel.

Pump operations will be alternated on a time basis to provide equal wear on all three pumps.

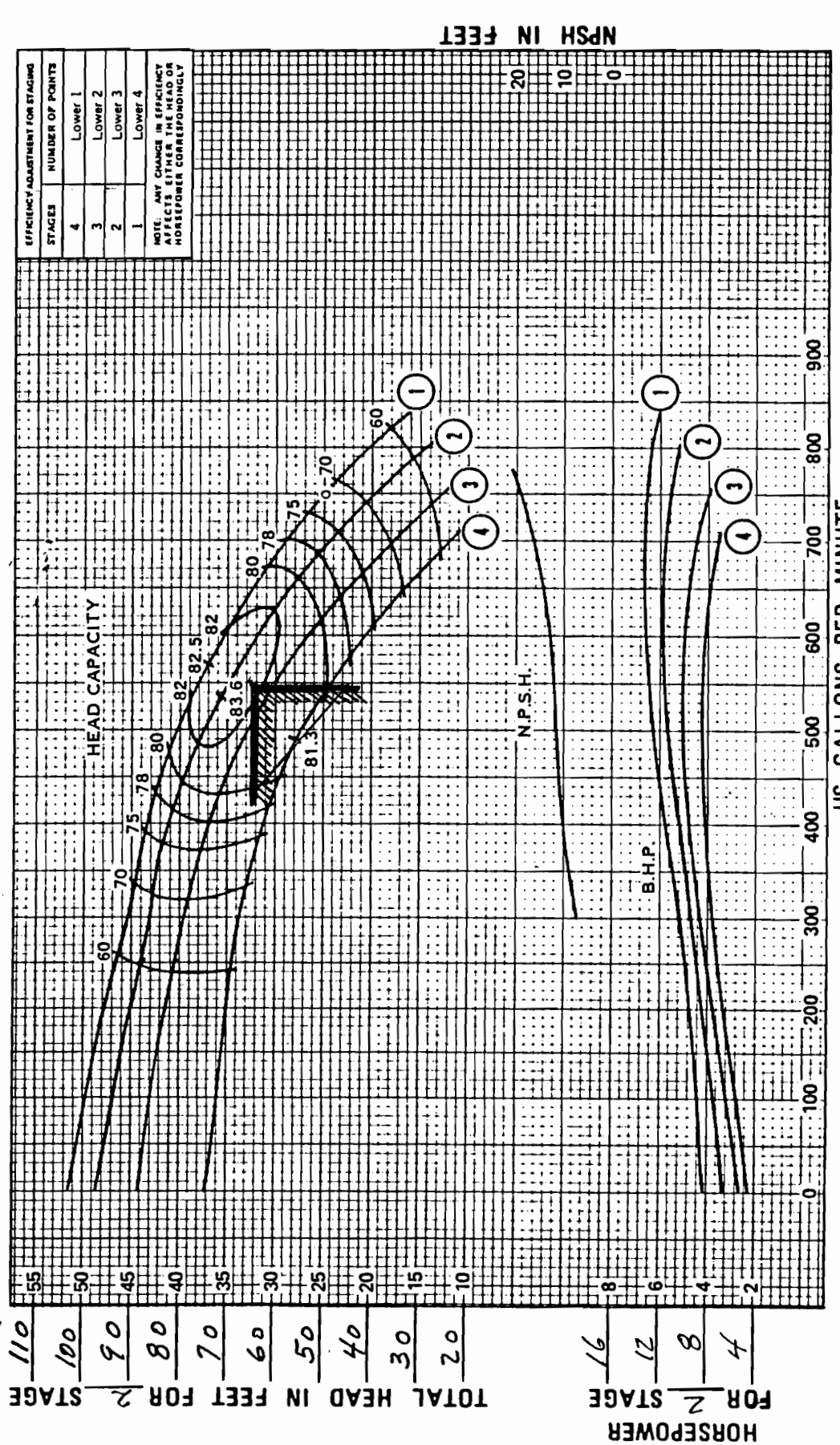
2.2.5.3 Electric motor operated shut off valves on the discharge header of each pump can be turned on/off from the control room with manual overrider at the valve. If the electric motor operated shut-off valve(s) are closed from the control room while the pump(s) are in operation, it will automatically shut down the pump(s).

2.2.5.4 Vertical pumps are manufactured by Peerless Pumps, Model No. 10MA with a design flow of 550 GPM vs. 65.0 FT. TDH, 1,760 RPM, 15 HP motor, 60 Hz, 460 Volts, 3 phase.

o The pump consists of four component assembles:

1. The pumping element - bowl unit.
2. The eduction system - column assembly.
3. The discharge assembly.
4. The drive - electric motor.

The electric motor is mounted on the discharge assembly and rotates a vertical line shaft which extends downward through the column assembly, to the bowl unit. In the bowl unit are two pumping stages (each consisting of a bowl case, and an impeller which rotates at the speed of the drive).



HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Guaranteed at designated point only, and contingent on:	1	T84363	UNDERCUT 7-1/8"	58076
Proper flow to pump suction	2	T84363	STANDARD FILING 7-1/8"	58356
Proper submergence	3	T84363	7"	—
Fluid free of gas, air & abrasives	4	T84363	6-5/8"	26863
Proper lateral setting of impeller				

Customer Larry E. Tyree Co. Lee Guy Pratt Inc. Jointventure

Item Air Stripper and Pressure Filter Pump Station

Peerless Ref. No:

Laboratory Performance

SIZE	RPM	BOWL	CURVE
10MA	1760	T-84232-C.I.E.	4806183

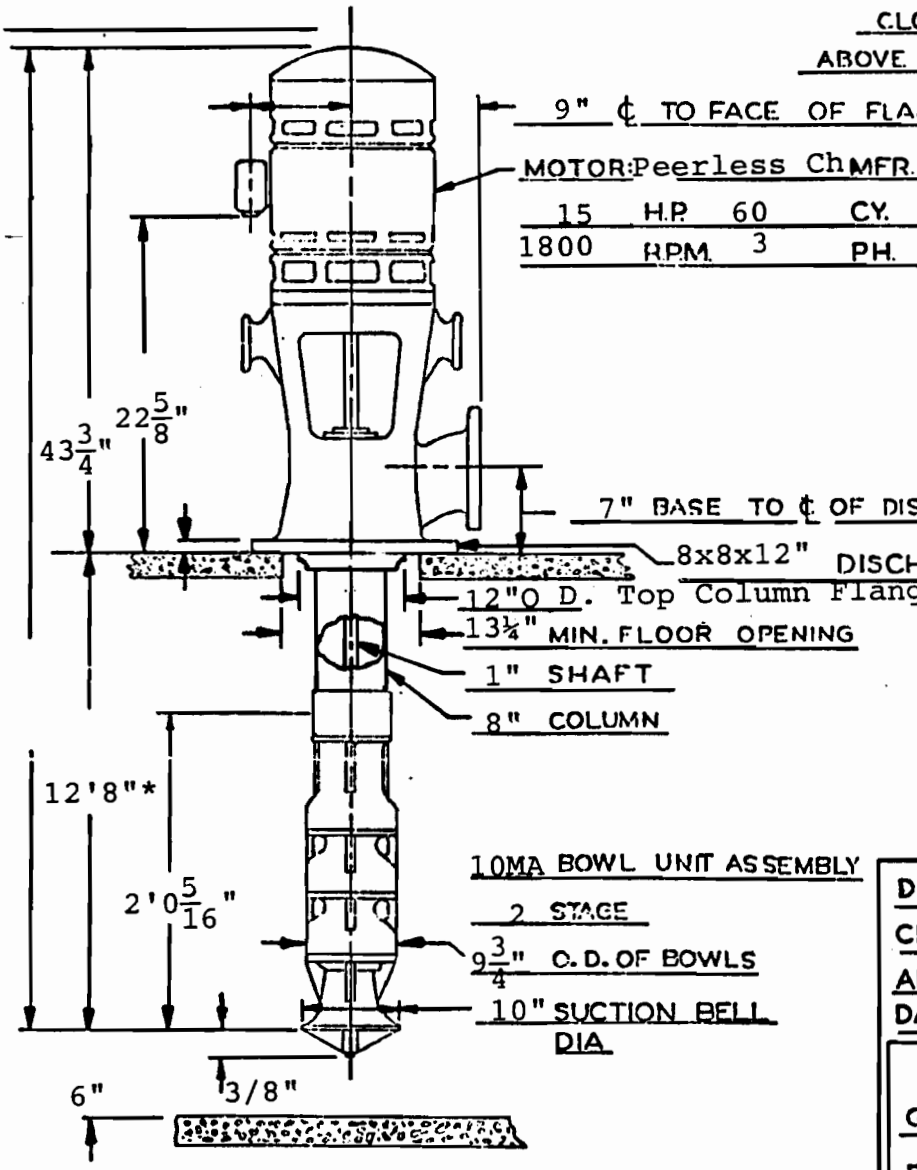
PUMP DESCRIPTION: Driver Electric Motor ; Head 8"X8"X12" ; Column 8"

GUARANTEED BOWL☒ PERFORMANCE: Capacity 550 gpm; Head 65 ft; Eff 80 %; BHP 11.3

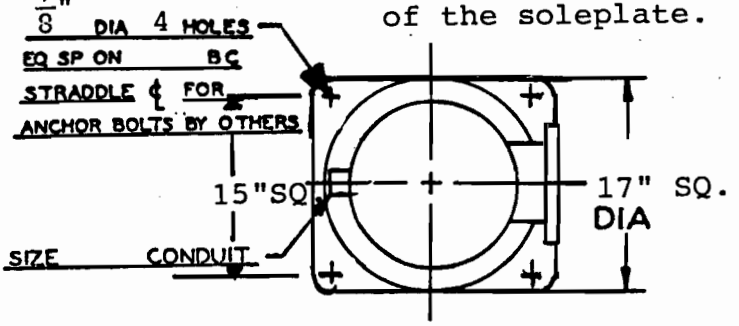
FIELD☐

FIGURE 2-D

DRAWING NO. 4805517



* This dimension includes thickness of the soleplate.



PEERLESS
horizontal and vertical centrifugal pumps

DRN. BY:
CHK'D BY:
APPROVED:
DATE:

PUMP RATING
G.P.M. 550
FT. FIELD HD. 65'

SO. NO.
SOLD TO: Larry E. Tyree Co & Guy Pratt Inc. Joint Venture
ORDER NO. 0303
USER Old Bethpage Land Fill
ITEM NO. Air Stripper &
END USE: Pressure Filter
PUMP NO. Pump Station

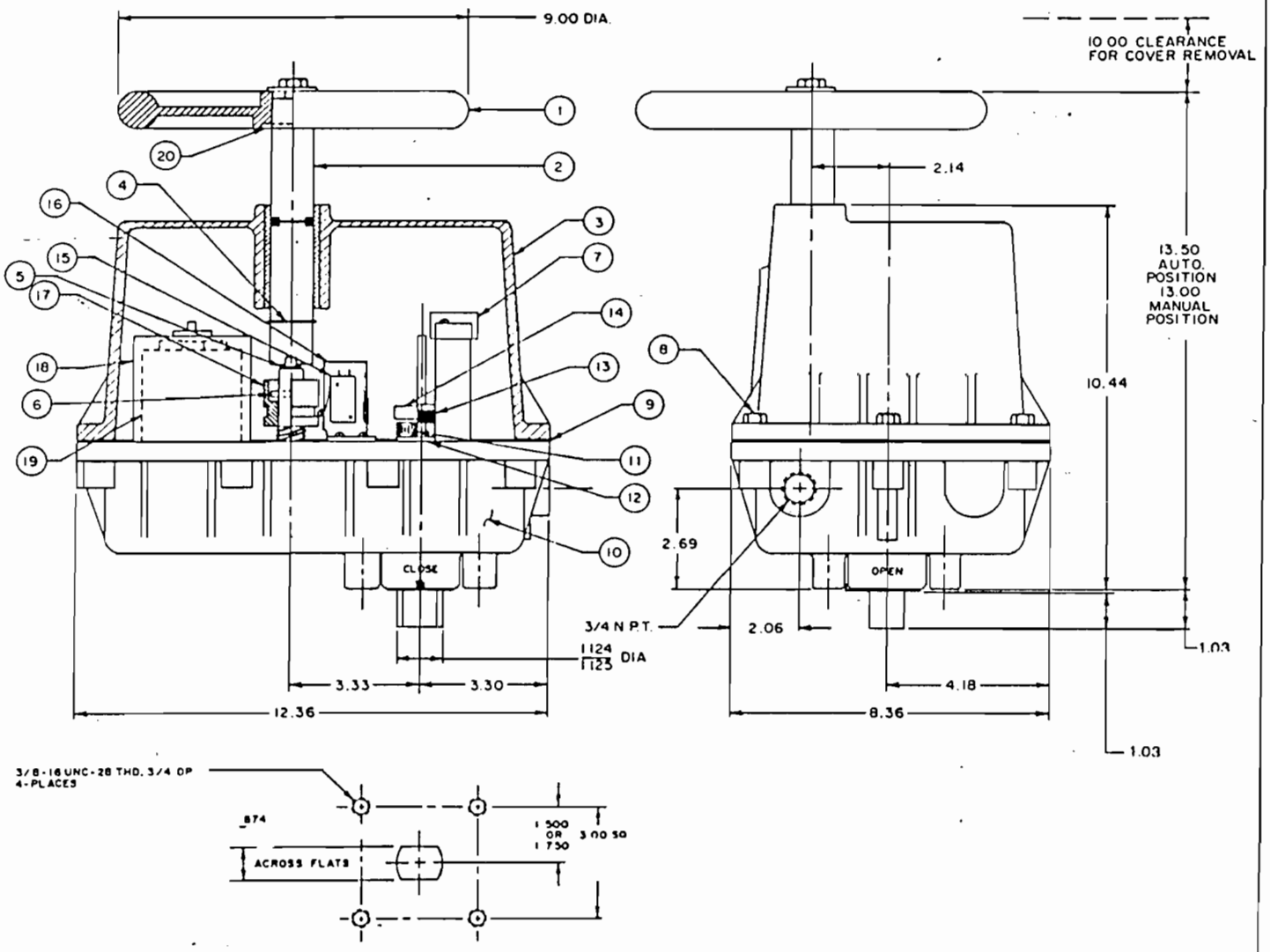
THIS CERTIFIED PRINT
☒ FOR APPROVAL
BY A.T.H. DATE 6/18/92
☐ FOR CONSTRUCTION
BY _____ DATE _____

Montebello, California 90640
Indianapolis, Indiana 46208

MAR-100

NEMA 4

PARTS LIST & DIMENSIONAL DRAWING



TECHNICAL DATA

VOLTAGE: 120 VAC 60/50 HZ., 1 PHASE — STANDARD

OPERATION: STANDARD REVERSIBLE (UNIDIRECTIONAL UPON REQUEST)

LIMIT SWITCHES: UL & CSA LISTED — 15 AMPS AND 1/3 HP, 125 OR 250 VAC; 1/2 AMP, 125 VDC; 1/4 AMP, 250 VDC; 5 AMPS, 120 VAC "L" (LAMP LOAD).

AMBIENT TEMPERATURE: MINUS 40 DEGREES F. TO PLUS 150 DEGREES F.*

LUBRICATION: HIGH TEMPERATURE GREASE FOR GEARS; SELF-LUBRICATING BEARINGS

MOUNTING POSITIONS: UNIVERSAL

WEIGHT: 34 POUNDS

* THE ADDITION OF A HEATER AND THERMOSTAT IS RECOMMENDED FOR ALL OUTDOOR INSTALLATIONS AND FOR ALL APPLICATIONS THAT ARE EXPOSED TO HIGH HUMIDITY OR TEMPERATURES BELOW 32 DEGREES F.

PARTS LIST

LOC NO.	DESCRIPTION	QTY.	PART NO.
1	HANDWHEEL	1	15-05 (9")
2	SHAFT — MANUAL	1	21-19
3	CONTROL COVER	1	10-05
4	STOP RING	1	25-03
5	SPRING — MANUAL	1	30-04
6	DRIVE PIN — MANUAL (.187 DIA. x 7/8 LG.)	1	850X24-58
7	TERMINAL STRIP	1	72-03
8	SCREWS (1/4-20 x 1 LG.)	10	128X470-4
9	GASKET	1	16-03
10	GEAR CASE ASSEMBLY	1	AS REQUIRED
11	MICRO ADJUSTMENT CAM	2	68-07
12	MICRO ADJUSTMENT PLATE	2	65-02
13	LIMIT SWITCH	2	63-01
14	CAM	2	68-38
15	ELECTRICAL LOCKOUT SWITCH	1	63-01
16	MTG. BRACKET — LOCKOUT SWITCH	1	62-09
17	CLUTCH COLLAR	1	
	(FOR MAR-100,120,160 & 250)		28-07
	(FOR MAR-800)		28-24
18	MOTOR	1	AS REQUIRED
19	CAPACITOR	1	AS REQUIRED
20	DOWEL PIN (.250 DIA x 2LG.	1	300W80-28

DATE			RAYMOND CONTROL SYSTEMS A BRUNSWICK COMPANY HOUSTON, TEXAS 77205	90-600
2-7-87				
REVISION F				

FIGURE 2-F

o Pump Characteristics:

Number of Units	:	3
Design Point - Capacity (GPM)	:	550
TDH (FT)	:	65
Efficiency (%)	:	83
2nd Req. Point-Capacity (GPM)	:	250
TDH (FT)	:	80
Efficiency (%)	:	61
3rd Req. Point-Capacity (GPM)	:	720
TDH (FT)	:	30
Efficiency (%)	:	68

Shut-off Head	
Min. - (FT)	80
Max. - (FT)	90
Number of Stages	2
Motor (HP)	15
Speed (RPM)	1760
Motor Voltage	460
Power Factor	80

See attached performance curve for the pumps indicated in the design point.

2.2.5.5 Electric motor actuator, shut-off valves are Victaulic 300 butterfly valves, a double-seal disc design with a resilent elastometric coating bonded to the ductile iron disc core. Sealing and positive shut off are accomplished by a double ring seal which is integrally molded on the disc. The disc

coating also acts as the primary seal between the disc, the drive hub and the hub bearing.

O-rings on the upper bearing and lower trunnion provide thread sealing.

- o Electric motor actuators manufactured by Raymond Control Systems, are Model No. MAR-100 120 VAC, 60 Hz, 1 Phase. Actuator is equipped with travel limit switches which are factory set for 0^{o} to 90^{o}. Actuators are in Class 1, Group "C" and "D" enclosure.

2.2.5.6 Check valves are manufactured by Victaulic, Model No. 715, Vic-Check II, are lightweight, non-slamming dual disc design. Seats are integrally bonded to the discs and are replaceable.

2.2.5.7 Pressure gauges installed on discharge side of each turbine pump, have a range of 0-100 PSIG with an accuracy of 1 percent of full range.

Gauges are manufactured by Weksler Model #AA44P.

2.2.6 Air Stripper System

2.2.6.1 Air stripper system includes an Air Stripper Tower (AST) including air blower and the packing which must be backwashed with hydrochloric acid solution, and handling of the storage of the fresh and wasted chemicals.

The Air Stripper is of countercurrent type, and works on the principle that molecules of dissolved gases can move freely between the gas and liquid phases until equilibrium is reached.

As contaminated water is pumped from the air stripper pump station wet well up to the top of the tower and distributed downwards through the packing, the air is blown in at the bottom of the tower and flows upwards, stripping the volatile compounds from the water. The air (carrying the stripped volatile organics) exits at the top of the tower and is dispersed into the atmosphere.

This process unit provides continuous and thorough contact of the liquid with the gas and minimizes the thickness of the water layer on the packing, promoting efficient mass transfer.

2.2.6.2 The column has an inside diameter of 8'-0" and an overall height of 53'-7", measured from the bottom of the column to the top of the air outlet stack. The column is constructed of FRP Atlac 400 resin and is manufactured by R.E. Wright Associates, Inc.

The tower is provided with:

1 - 12" I.D. Sump inspection manway
4 - 24" I.D. Packing inspection manway
1 - 12" I.D. Distribution inspection manway
1 - 3'-4" I.D. air outlet stack provided with 2-3" diameter-sample ports, located at 90 degrees

1 - Level control/sight tube

- Ladder and access and working platforms located at different elevation along the tower

2.2.6.3 The packing bed, within the column, has a height of 35 feet. The packing is composed of 2-inch Jaeger Tripack material, and has a surface area of approximately 43 square feet/cubic foot and 90 percent void space.

Packing support plates are provided to sustain the weight of media, and are designed to have a deflection less than one quarter inch, for maximum load.

An influent distributor tray has been installed for uniform distribution of the water flow over the surface of the packing and uniformly to collect the exhaust air.

Also, for a uniform water redistribution, rings evenly spaced throughout packing media depth have been provided, to improve the efficiency of packing media.

A mist eliminator, manufactured by Kimre Inc., has been installed to remove the water droplets reaching the exhaust air stream.

Acid rinse nozzles are provided to evenly distribute the acid wash solution over the packing media, in order to remove any iron oxides or iron bacteria buildup.

2.2.6.4 Air stripping Tower Fouling Control

The chemical and physical mechanism of fouling that occur when groundwater is treated by air stripping is primarily those of oxidation of dissolved iron and stimulation of biological activity in the indigenous microbial population. both of these processes are important when explaining how packing media within the tower becomes clogged.

The amount of fouling that will occur in an air stripping tower treating contaminated groundwater will generally be much more pronounced than fouling within the production wells, which receive the same groundwater.

Dissolved (ferrous) iron existing in groundwater is easily oxidized in the presence of oxygen to form insoluble (ferric) compounds. Continued oxidation creates hydrated ferric oxides which have extremely low water solubility. The ferric forms of iron take the forms of a rust-colored amorphus mass or rust-to-black-colored gel.

The stripping process creates adequate oxigenation to allow the continued conversion to iron hydroxide and subsequently hydrated iron oxides.

The presence of iron oxidation and deposit of the material on the tower packing, produces the fouling of the media, which in turn, reduces the efficiency of the stripping process.

Another factor in analyzing the fouling is the presence of iron bacteria, which under aerobic conditions with sufficient ferrous iron will produce the biomass and slimy sheaths having a marked clogging effect on packing media.

To control fouling, a periodic cleaning and removal of fouling buildup is provided by using hydrochloric acid backwash of the media.

2.2.6.5 Air Blower

The unit is a centrifugal fan, manufactured by New York Blower Company, for a maximum capacity of 12,000 CFM at a static pressure of 9-inches with a motor of 30 HP, 1800 RPM, 3 Phase, 60 Hz, 230/460V.

The attached flow chart (Figure 2-G) indicates the amount of air, in CFM, required to be discharged to the air stripper tower depending on the water flow running downward through the tower.

2.2.7 Filter Pump Station

2.2.7.1 The treated water passing through the air stripper is collected into the filter pump station wet well. The flow is pumped from here, through 10-inch discharge line, into the existing Recharge Basin No. 1,through the diffusion wells.

2.2.7.2 For normal operation, two of the vertical pumps will be on, and the third unit will be off, as a standby. Pump operations will be sequenced by the amount of flow sensed by the water level controls connected to the pump control panel.

Pump operation will be alternated on a time basis to provide equal wear on all three pumps.

AIR FLOW vs WATER FLOW

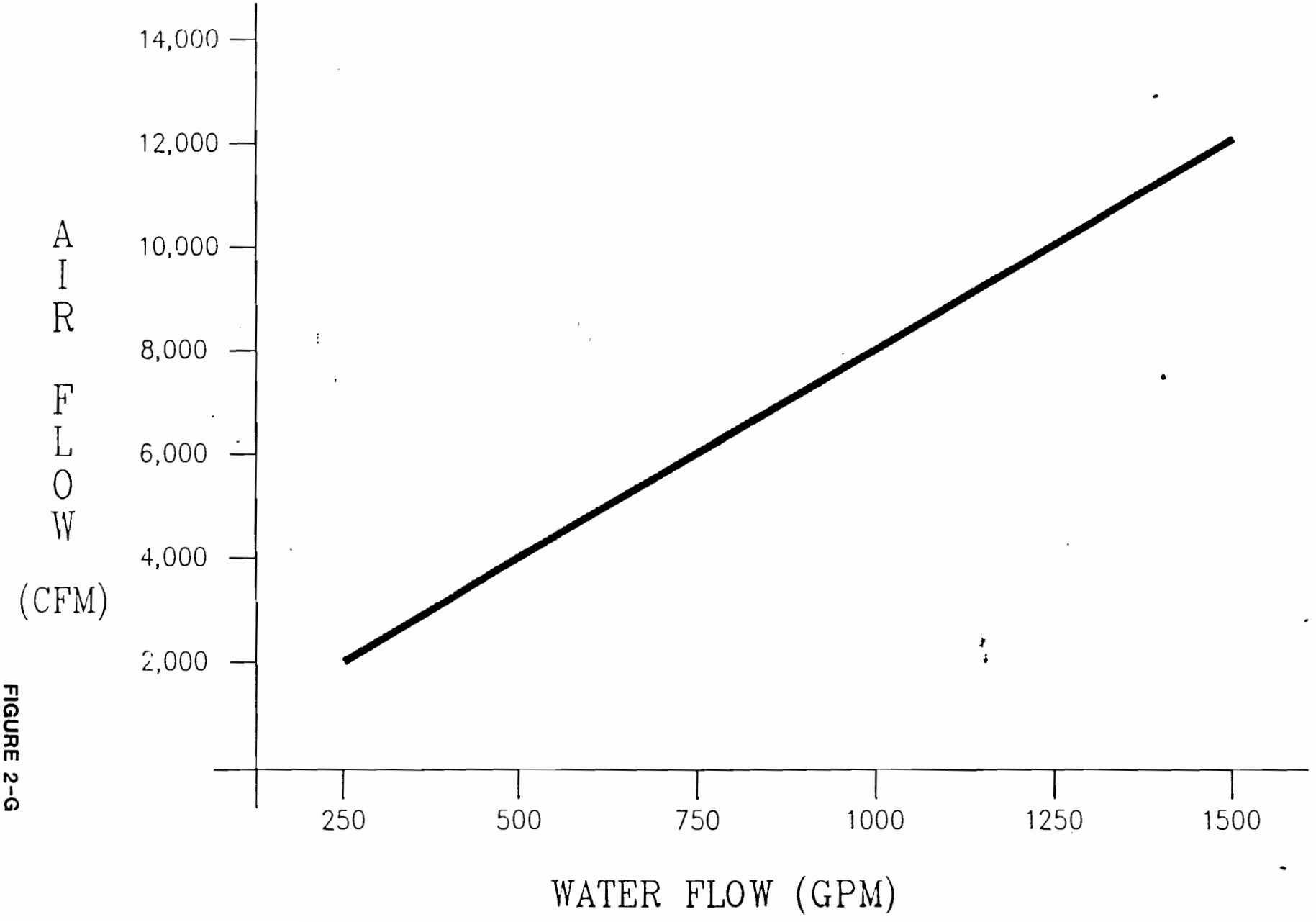


FIGURE 2-G

2.2.7.3 Electric motor operated shut off valves on the discharge pipe of each pump, can be turned on/off from control room, and manually overriden at the valve. If the electric motor operated shut-off valve(s) are closed from the control room while the pump(s) are in operation, it will automatically shut down the pump(s).

The characteristics and the description of the components of the pump, is similar to the one presented in the chapter for air stripping pump station.

The same description as shown for air stripping pump station is for valves, gauges and miscellaneous equipment.

2.3 DESCRIPTION OF HVAC SYSTEMS

2.3.1 AHU-1 - Heat Pump Heating and Cooling System

- The Heat Pump (AHU-1) serves as an air conditioning, heating and ventilating system for the control room, laboratory and bathroom.

- The heat pump unit is a split system, consisting of an indoor unit (air handling unit) and outdoor unit (heat pump unit). Both units are interconnected by liquid and suction refrigeration (charged with R-22 refrigerant) lines.

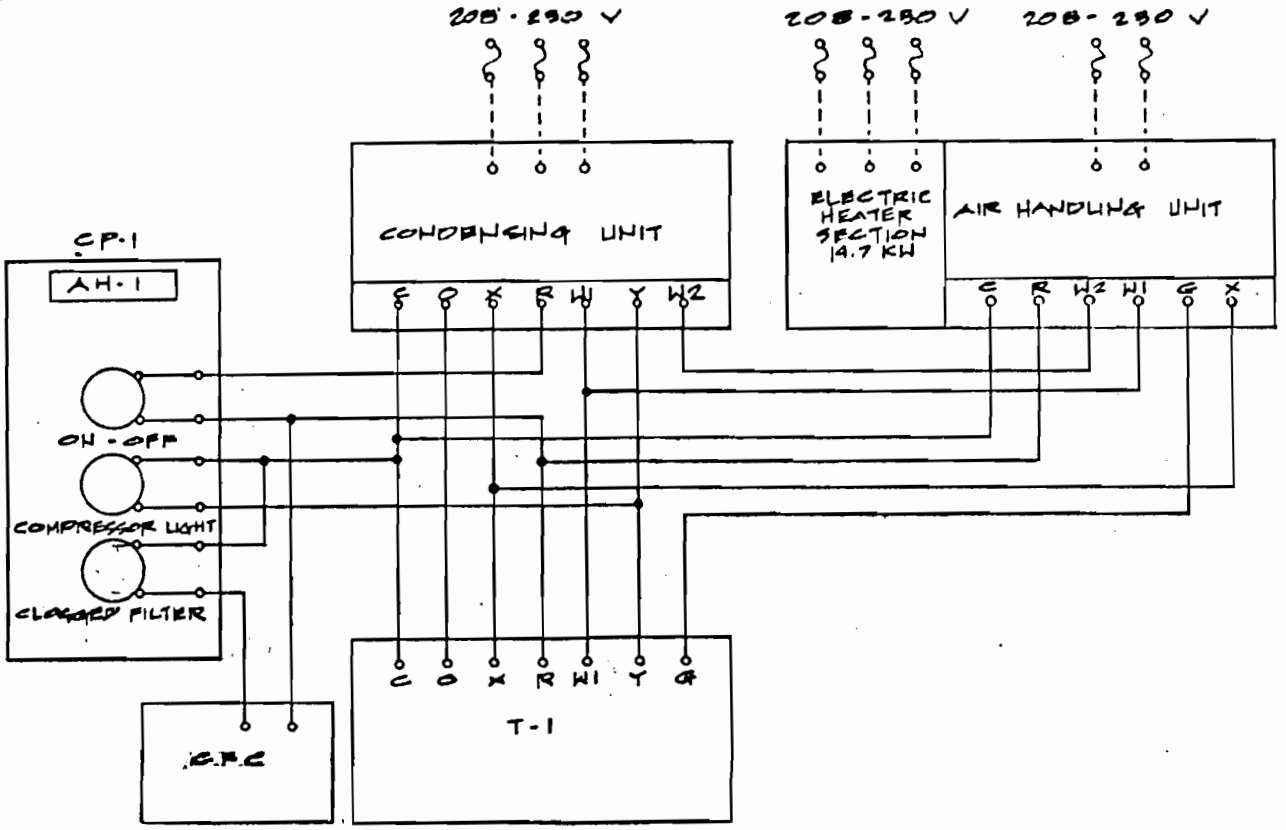
- The outdoor unit is comprised of the compressor, the outdoor coil, the outdoor fan, control panel and a reversing valve.

- The outdoor unit is rugged for outdoor operation, and its cabinet stands up to all kinds of outdoor conditions.

- The indoor unit consists of indoor coil with dual directional bi-flow drier, conditioned or heated air distribution fan (blower) with 1/2 HP motor, filter section and unit cabinet with air inlet and outlet connection flanges. The unit is equipped with supplementary 15 KW electric air heater. The conditioned or heated air distributed through ductwork terminated with air supply diffusers. Return air is provided by return registers (from lab and control room only), through air return/fresh air ductwork.

- Air from toilet room is evacuated outside by exhaust fan (TE).

AH-1



LEGEND:

LINE VOLTAGE	----------	
24 VOLTS	————	
CP-1	REMOTE CONTROL PANEL	LOCATE IN CONTROL ROOM
CFC	CLOGGED FILTER CONTROL # WHITE ROGERS 770-1	LOCATE ON AH-1
T-1	COOL-HEAT THERMOSTAT #WH-T[illegible]	

CONTROL WIRING DIAGRAM

FIGURE 2-H

- The exhaust fan (TE) is not interconnected with the AHU-1 system. See description of "TE" fan, p. 2.3.4.6.

- Main control panel for this system (AHU-1) is located on the west wall in the control room.

- To operate this system, the switch on the main control panel must be turned "ON", the switch over set position "HEAT" or "COOL", as required, then the thermostat located in the laboratory to be set to required temperature.

- The air handling unit filter change will be indicated by red light on the panel in the control room.

IMPORTANT: Under any circumstances - any portion of the charge (refrigerant R-22) CAN NOT be used for purging or leak testing.

2.3.2 AHU-2 Make-up Air Unit

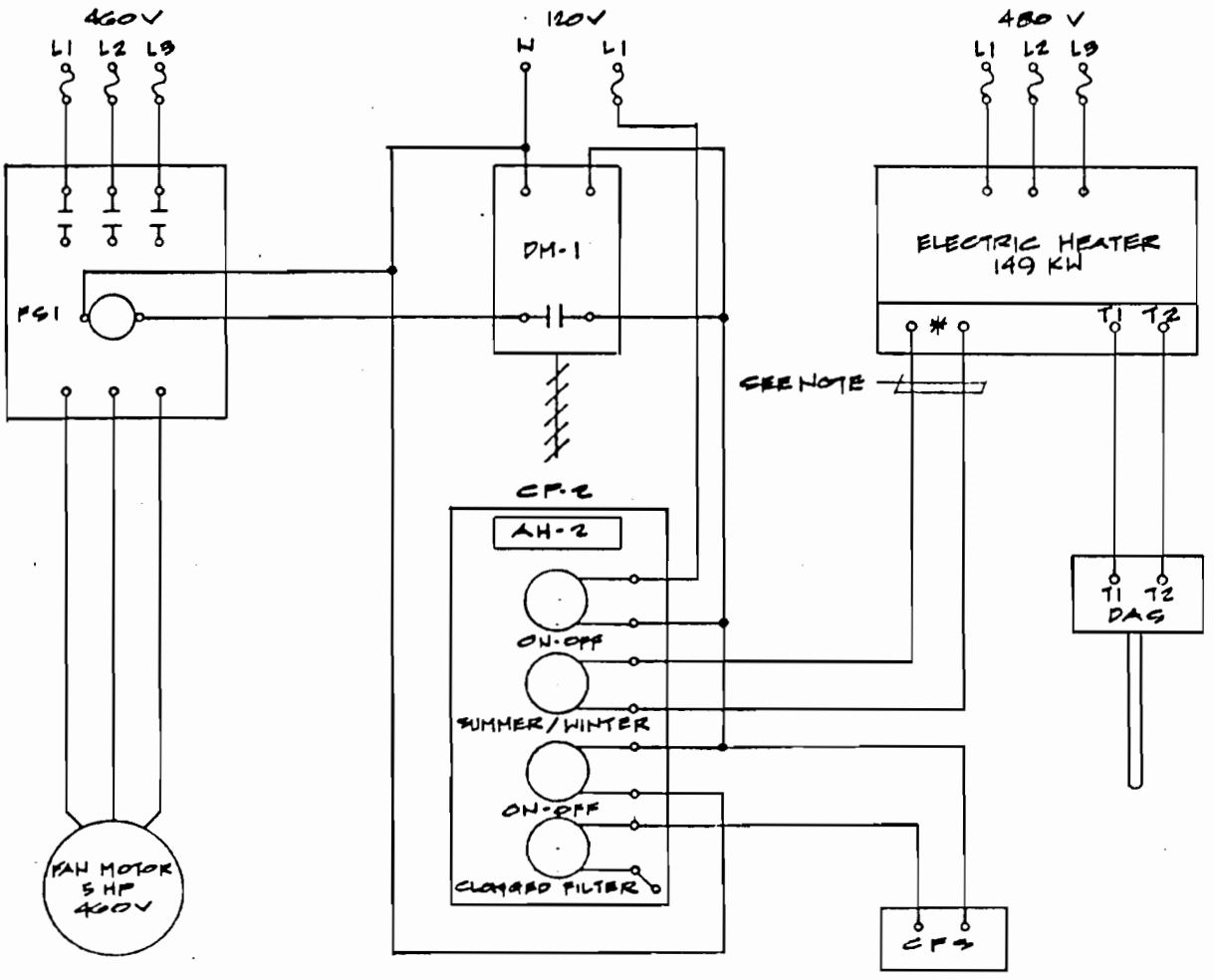
- The heating and ventilation in the form of forced air system is provided for the main pump room.

- The major components of a forced air system (AHU-2) are:

  - air handling unit with fan, cabinet, air electric heater, filter section, and connection flanges;

  - fresh air intake louver (weather proof construction);

  - motorized damper;



FS1	FAN STARTER SIZE 1	LOCATE AT AH-2
DM1	DAMPER MOTOR	LOCATE AT AH-2
DAS	DISCHARGE AIR SENSOR	LOCATE IN SUPPLY AIR DUCT
CFS	CLOGGED FILTER SWITCH	LOCATE AT AH-2 (FILTER SECTION)
CP-2	REMOTE CONTROL PANEL	LOCATE IN CONTROL ROOM
	ALL LINE VOLTAGE WIRING	

NOTE: * CONNECT IN SERIES WITH AIR FLOW SWITCH CIRCUIT.

CONTROL WIRING DIAGRAM

FIGURE 2-1

- insect screen; and

- ductwork, terminated with air supply registers.

o The unit is located on the mezzanine, and supported on steel dunnage. Air handling unit fan has 5 HP motor, 1800 RPM, 460V, 3 phase, 60 HZ. The electric air heater, is open coil, single zone type, with step controls, de-energizing contactors, thermal cutouts, pressure air flow switch, unfused disconnect switch, with total power 149 KW, 480V, 3 phase, 60 HZ, with 120V of control circuit. The filter is a heavy-duty type with hinged access door.

o Main control panel for this heating and ventilating system is located on the west wall in the control room. To operate this system, the switch on the control panel must be turned to "ON" position and selected "SUMMER" or "WINTER" operation.

o Summer Operation

When main switch is turned to "ON", motorized damper will move to full open position, fan motor will be energized, 100 percent fresh air will be supplied to the pump room. Exhaust fans will start simultaneously with air supply system (interconnected with).

o Winter Operation

With main switch turned "ON", with switch over to "WINTER" position, fresh air intake motorized damper will move to the full open position and start the fan motor, and according to temperature of the entering air, the temperature controller will trigger the electric air heater through four (4) stages to match

setting temperature in the supply air duct. Filter change will be indicated by red light on the main control panel in the control room. Exhaust fans will operate as described hereinbefore for "SUMMER" operation.

2.3.3 Electric Unit Heaters

The units described hereinafter are explosion proof (EP) forced air heaters normally used for comfort heating or freeze protection in areas classified as Class 1, Group D, Division 1 Hazardous Environment.

Each explosion proof electric unit heater has the following features:

- o Cast aluminum elements, heating bank includes three heavy-duty cast aluminum elements welded into a cast aluminum EP junction box to attain low surface operating temperature and maximum EP integrity.

- o Built-in overtemperature protection consists of three redundant thermal sensors wired in series to interrupt the control circuit voltage.

- o Non-sparking aluminum fan and heater case.

- o Heavy-duty EP motor, with built-in thermal overload protection.

- o Adjustable lowered outlet grille, to direct air flow up or down.

- o Universal mounting kit, to permit either wall or ceiling mount.

- o Integral line voltage terminal bloc,

- NEMA 7 control panel, prewired, including contactor, motor starter, transformer, disconnect switch, fusing three-way (H-O-A) selector switch, terminal connection block and time delay relay.

- Each electric unit heater is controlled by explosion proof (EP) thermostat.

- Selector switch, located on the unit control panel can be set to operate on manual mode or automatic operation (H-O-A).

- Manual operation mode will operate the electric unit heaters continuously and constantly, overriding the thermostat.

- Automatic operation mode will cycle the heaters and fan automatically through the thermostat. When the thermostat sensor is satisfied (temperature is reached), heat will be cut-out and the fan will stop on time delay.

2.3.4 Exhaust Fans

- Generally, all exhaust fans are centrifugal type, belt or direct drive, vertical (for exhaust through the roof) or horizontal (exhaust through the wall). For hazardous areas, all fans are spark-proof and driven by explosion proof motors.

2.3.4.1 Exhaust Fan "EF-1"

- Exhaust fan "EF-1" serves the lower acid tank room. The fan is designated for continuous operation, and is manually operated from the main control panel.

- If the fan should stop for any reason, air flow switch, located in the ductwork will light on the methane control panel located in the control room.

2.3.4.2 Exhaust Fans "EF-2A" and "EF-2B"

- Exhaust fans "EF-2A" and "EF-2B"serve the main pump room area. The fans (with respective two separate ductworks), are designated for continuous operation with constant air flow.

- If anyone of these two fans should stop for any reason, air flow switch located in the ductwork will light the red bulb on the methane control panel located in the control room.

2.3.4.3 Exhaust Fan "EF-3"

- Exhaust fan 'EF-3", located on the roof, is designated for an emergency mechanical ventilation for the main pump room.

- When any of the remotely mounted methane sensors detect the presence of methane gas, the fan (EF-3) will automatically and instantly be activated through the methane anunciator/control panel.

- The three (3) fresh air intake motorized louver-dampers will be open in the same time.

- In addition to the above function (emergency ventilation), the EF-3 fan can also be activated by a room thermostat, when the temperature of the pump room should rise above 95 ^{o} F.

2.3.4.4 Exhaust Fan "EF-4"

- Exhaust fan "EF-4" serves the mezzanine mechanical equipment room area.

- Exhaust fan is mounted on the north wall.

- Operation of this fan is controlled by a thermostat, set at 95 ^{o} F, and located on the west wall.

2.3.4.5 Exhaust Fan "EF-5"

- Exhaust fan "EF-5" is designated for protection of the control room against methane contaminated (hazardous) air into the control room from the pump room area.

- Exhaust fan "EF-5" is exhausting the air from vestibule entrance to the control room.

- Operation of this fan is controlled through a vestibule door switch which activates a time delay, relay located in the control room.

2.3.4.6 Exhaust Fan "TE"

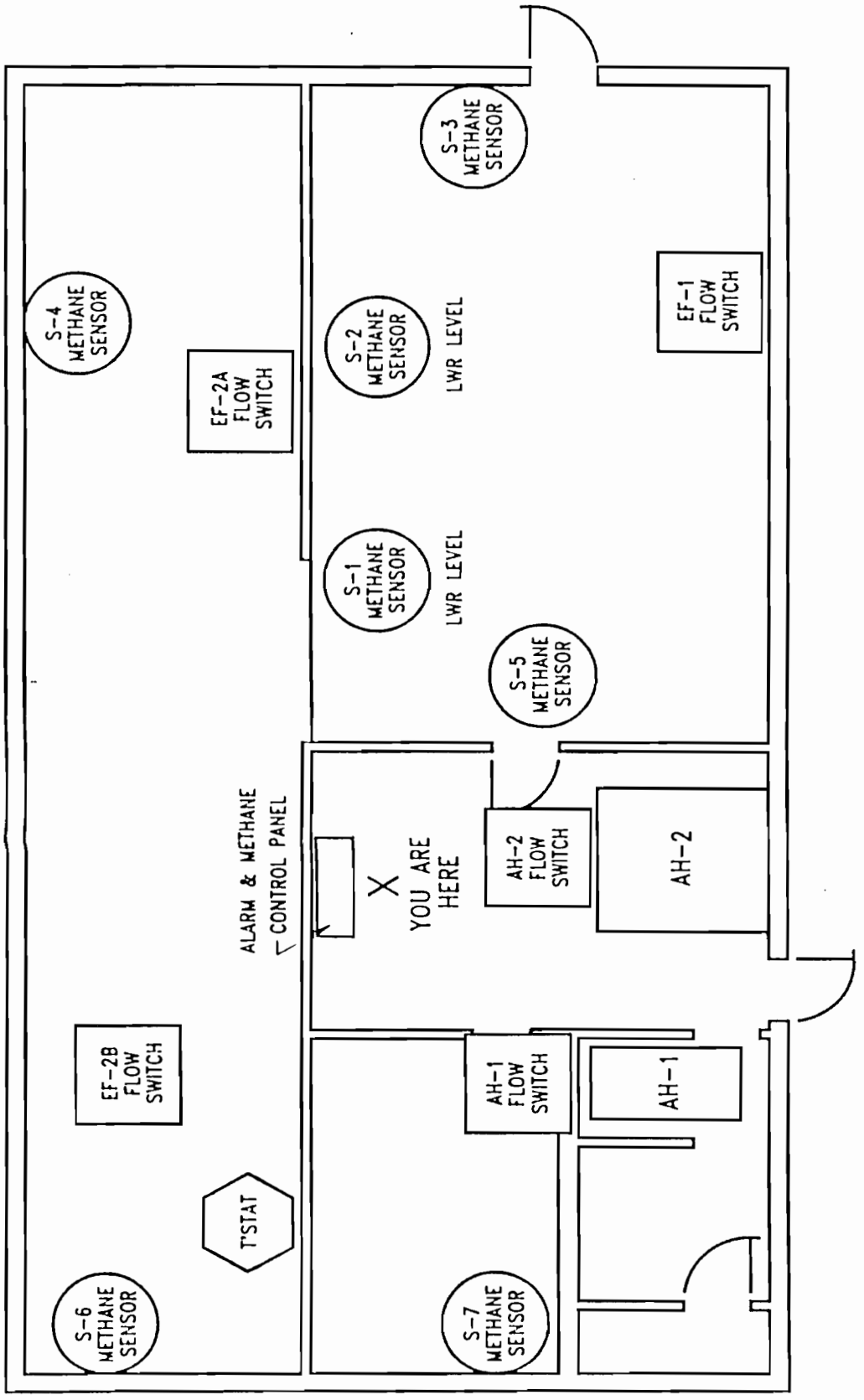
- Exhaust fan "TE" serves as an air exhaust for the toilet room. Fan is activated by manual switch, and always should be turned on, when heat pump system is operating (either on cooling or heating mode), to provide negative pressure for the toilet room.

2.3.5 Methane Control System

The methane control system consists of:

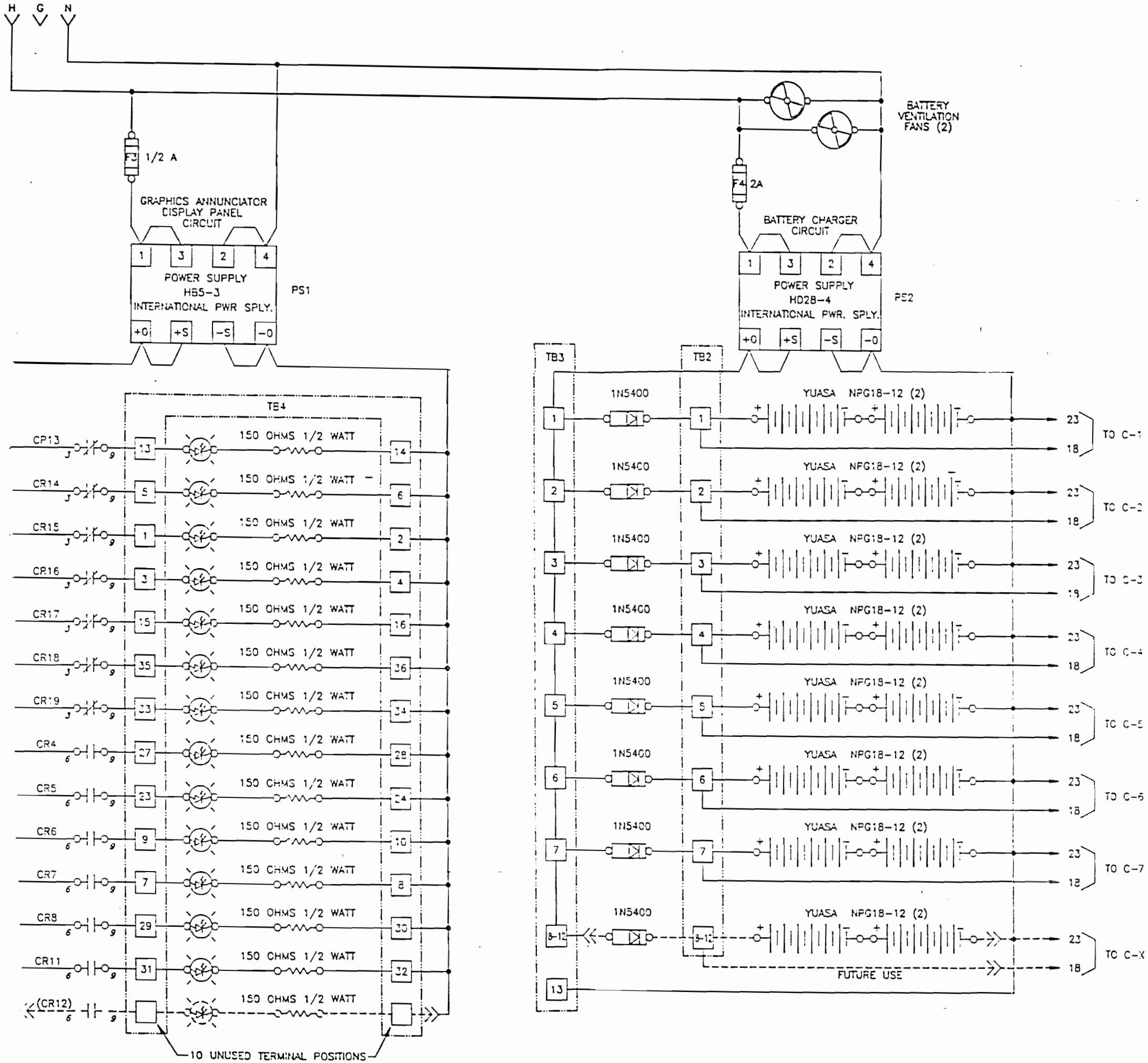
- the methane anunciator/control panel;
- seven (7) strategically located methane gas sensors (S-1 through S-7);
- two (2) control modules;
- one emergency exhaust fan "EF-3"; and
- three (3) motorized louver-dampers.

When presence of methane gas is detected by one or more of the remotely mounted sensors, emergency exhaust fan is activated, and three (3) motorized louver-dampers are in fully opened position.



GRAPHIC ANNUNCIATOR DISPLAY PANEL

FIGURE 2-J

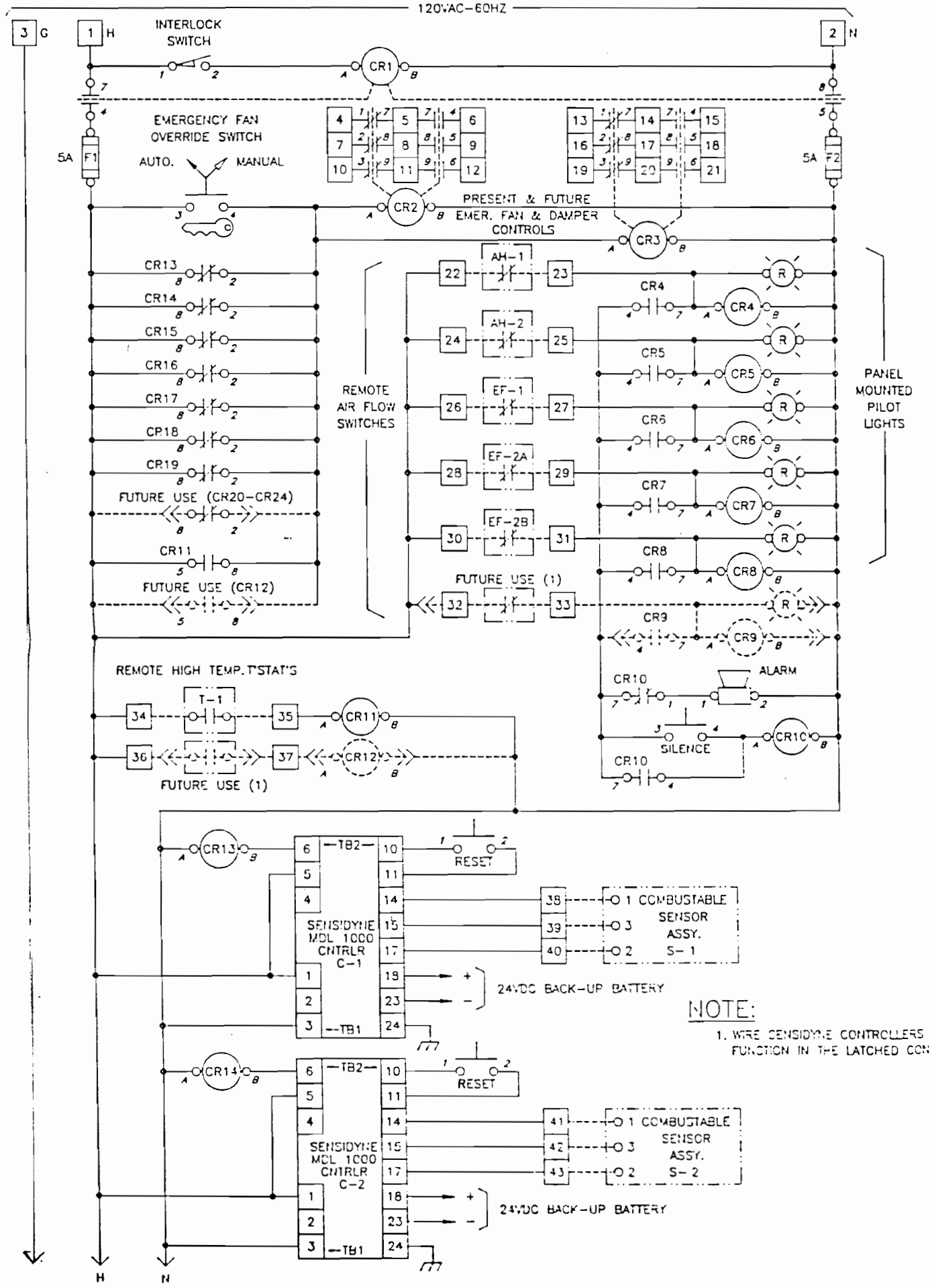


SCHEMATIC

MAIN CONTROL

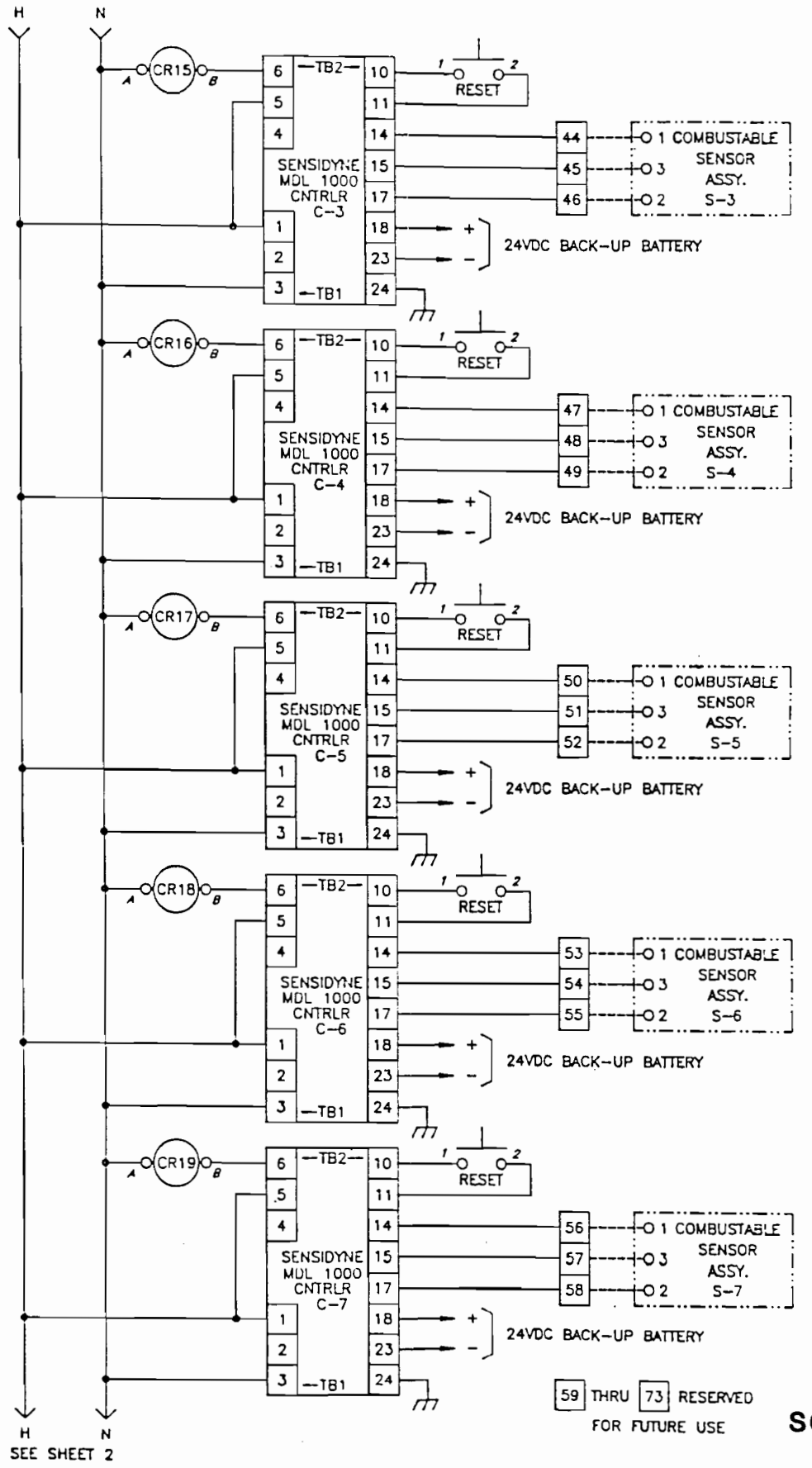
PANEL

FIGURE 2-K



NOTE:

1. WIRE SENSIDYNE CONTROLLERS TO FUNCTION IN THE LATCHED CONDITION.

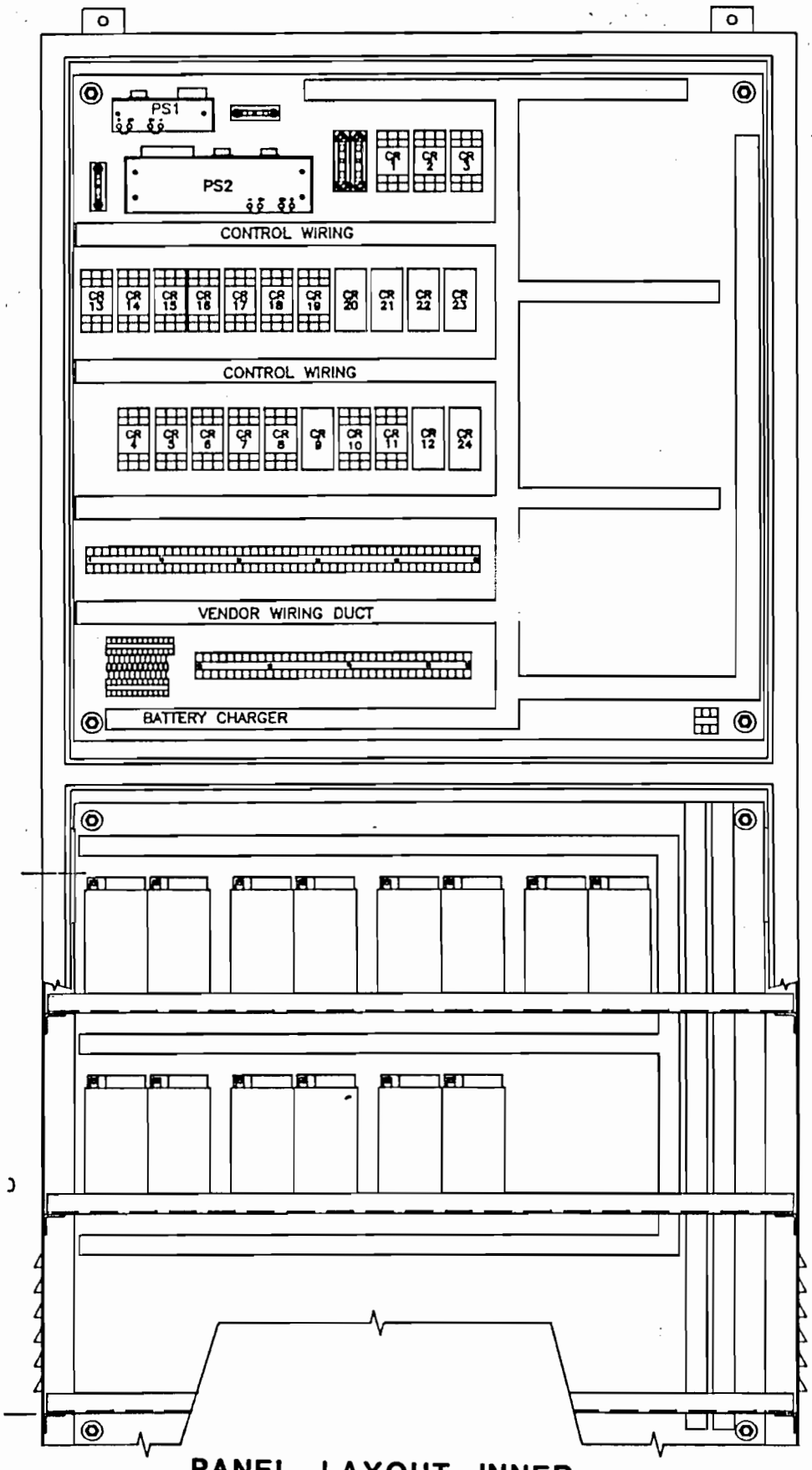


SCHEMATIC

MAIN CONTROL

PANEL

FIGURE 2-L



PANEL LAYOUT INNER

FIGURE 2-M

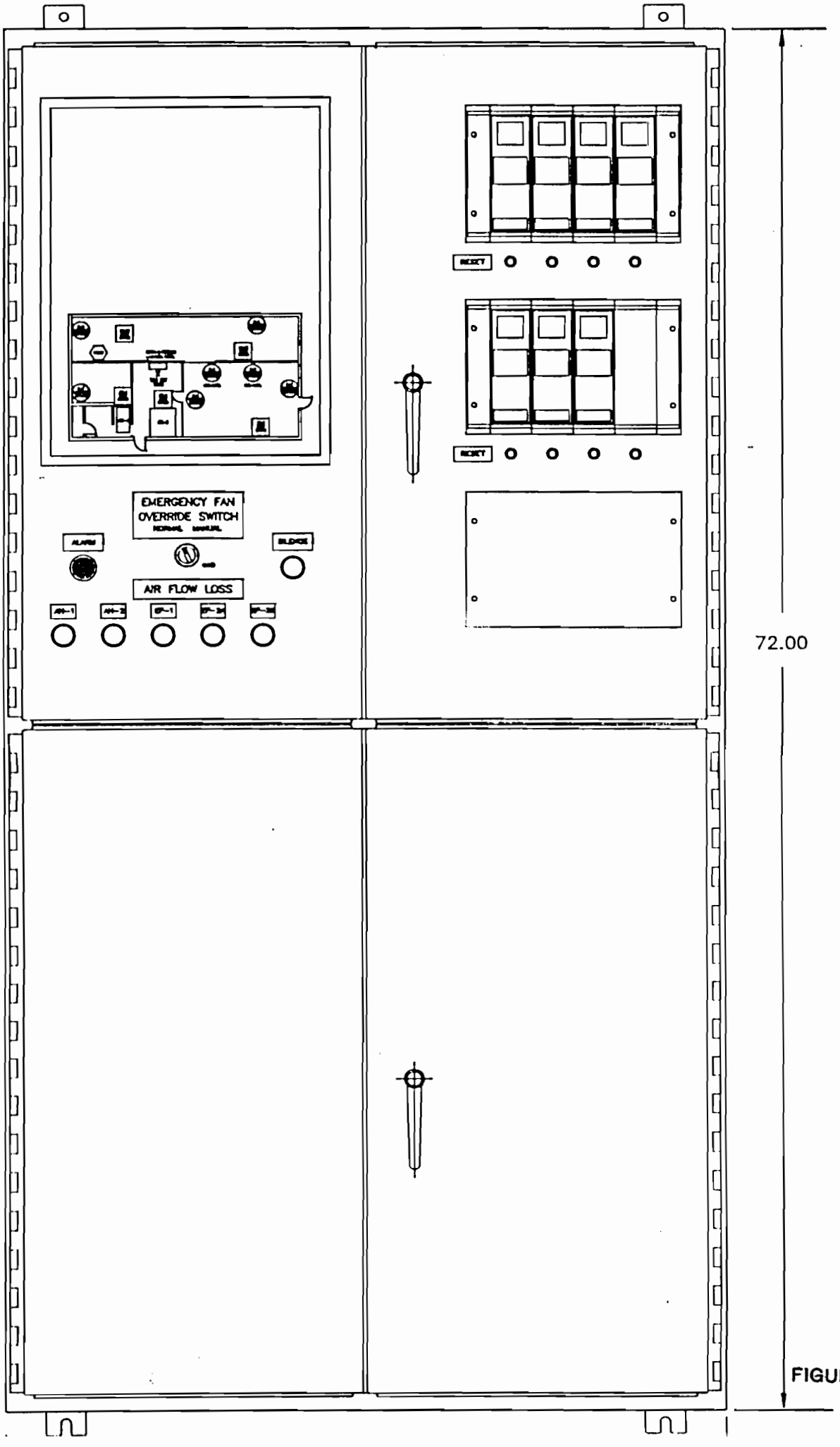
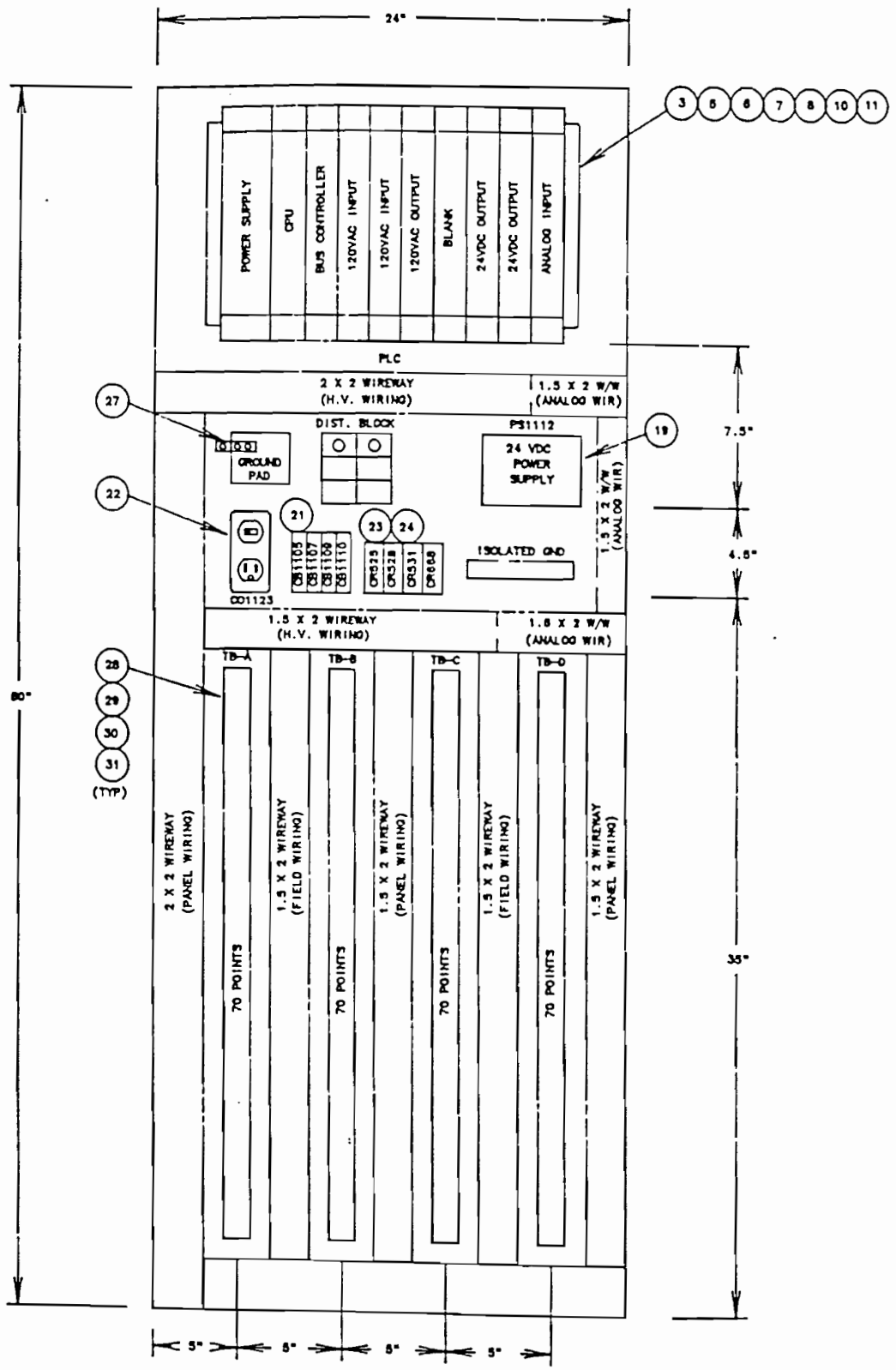
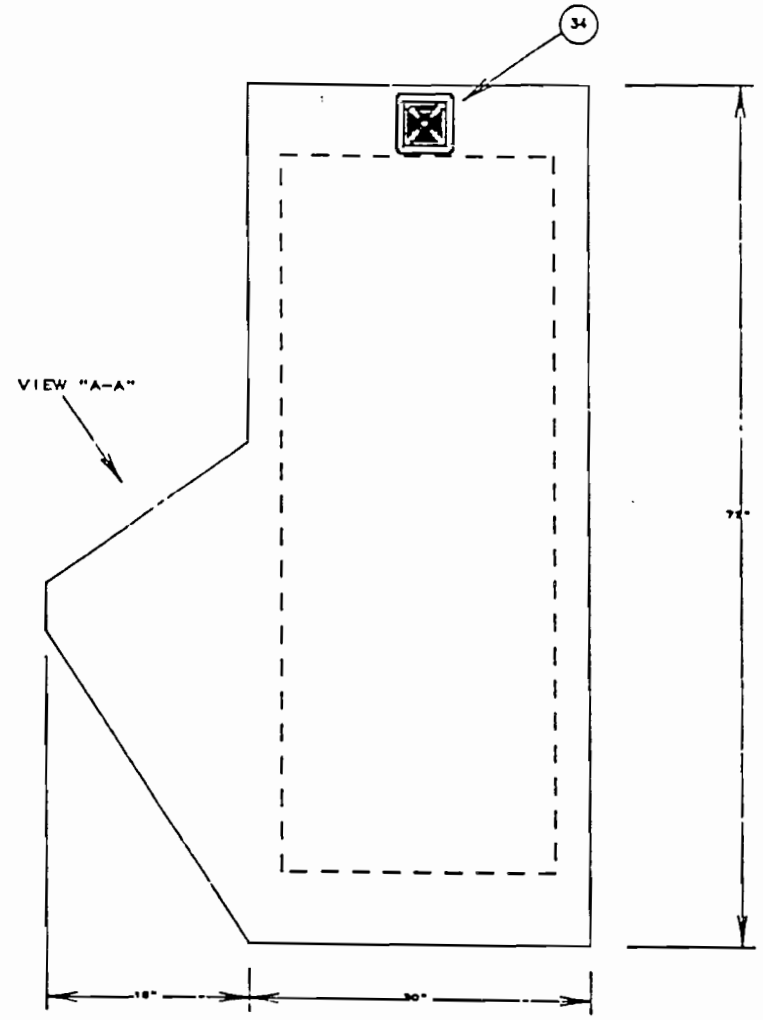


FIGURE 2-N



LEFT SIDE PANEL
(2" = 1 FT.)

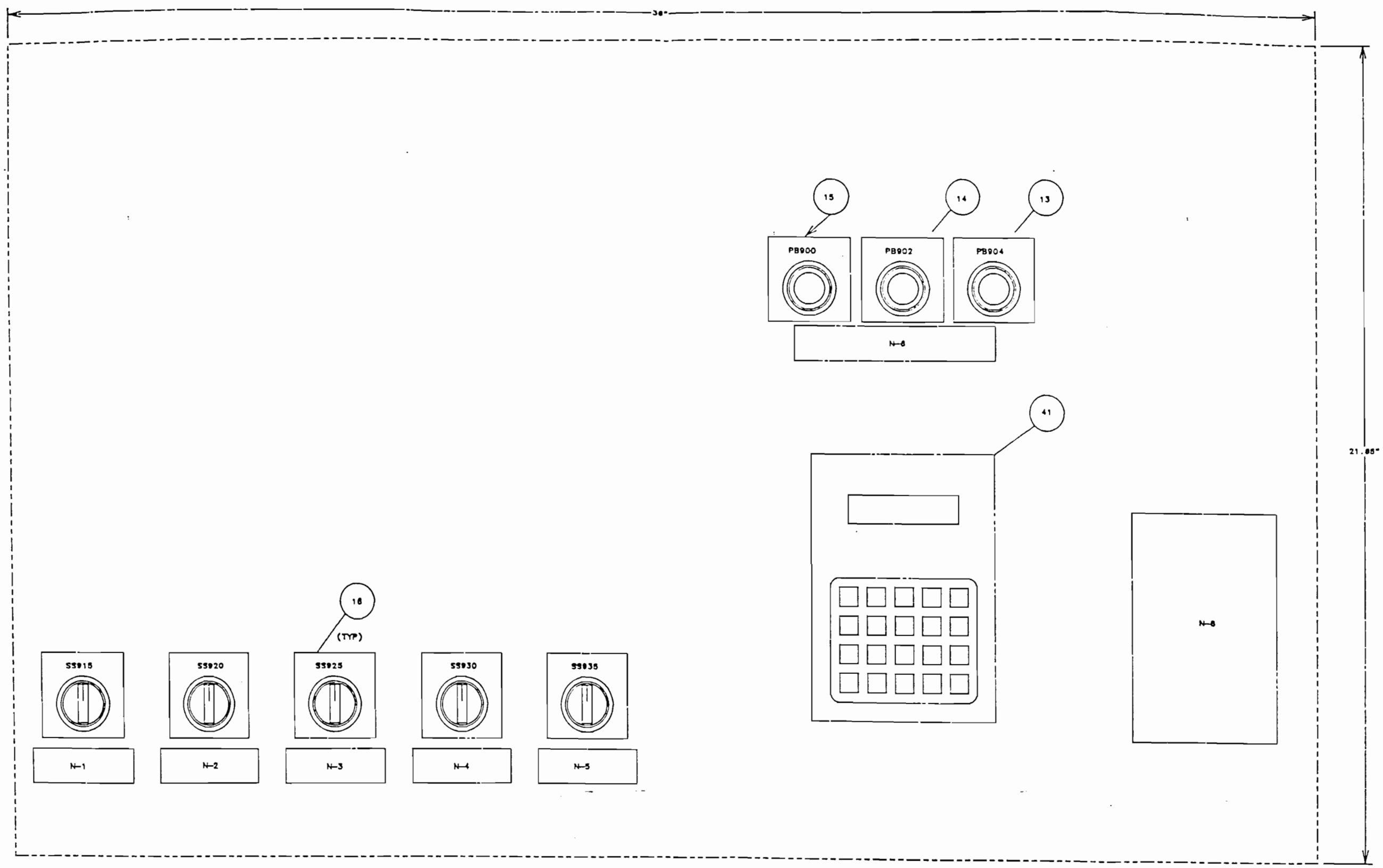


SIDE VIEW

LAYOUT
MAIN CONTROL CONSOLE

ITEM	DESCRIPTION	MANUFACTURER
001	CONTROL CONSOLE COMPLETLY FABRICATED AND PAINTED AS PER PCI DRAWINGS, D2607-4315-1 AND D2607-4315-2 AND SPECIFICATION, A2017-4315-1	SELCO
002	MOSAIC GRAPHIC PANEL DISPLAY COMPLETELY FABRICATED AND WIRED AS PER DRAWING D2607-4315-3	AMERICAN MODULAR
003	PROGRAMMABLE CONTROLLER 90/70 CPU	GENERAL ELECTRIC
004	PLC SERIES 90/70 9-SLOT RACK UNIT	GENERAL ELECTRIC
005	PLC SERIES 90/70 POWER SUPPLY, 115/230 VAC, 55 WATTS	GENERAL ELECTRIC
006	PLC SERIES 90/70 120 VAC INPUT MODULE, 32 POINTS	GENERAL ELECTRIC
007	PLC SERIES 90/70 120 VAC OUTPUT MODULE, 32 POINTS	GENERAL ELECTRIC
008	PLC SERIES 90/70 24VDC OUTPUT MODULE, 32 POINTS	GENERAL ELECTRIC
010	PLC SERIES 90/70 ANALOG INPUT MODULE, 8 POINTS	GENERAL ELECTRIC
011	PLC SERIES 90/70 GENIUS BUS CONTROLLER 32 NODES	GENERAL ELECTRIC
013	PUSHBUTTON, BLACK, 120VAC, 1 NO/1 NC CONTACTS.	MICROSWITCH
014	PUSHBUTTON, BLUE, 120VAC, 1 NO/1 NC CONTACTS.	MICROSWITCH
015	PUSHBUTTON, YELLOW, 120VAC, 1 NO/1 NC CONTACTS.	MICROSWITCH
016	SELECTOR SWITCH, 2 POS. MAINTAINED 1 NO/1NC CONTACTS.	MICROSWITCH
017	PILOT LIGHT, RED, TRANSFORMER TYPE 120VAC	MICROSWITCH
018	PILOT LIGHT, GREEN, TRANSFORMER TYPE 120VAC	MICROSWITCH
019	POWER SUPPLY, 120VAC INPUT, 24VDC OUTPUT AT 5.5 AMPS	ACOPIAN
020	DISPLAY, 4 DIGIT LED WITH BCD INPUTS	CINCINNATI ELECTRO.
021	CIRCUIT BREAKER, 15AMP, 1-POLE	ITE
022	SWITCH & GRND. OUTLET 120 VAC RECEPTACLE WITH SPST SWITCH.	LEVITON
023	RELAY, DPDT, 10 AMP RATED CONTACTS	IDEC
024	SOCKET, RELAY	IDEC
025	FUSE, 1/8 AMP, 250 VOLTS	BUSSMAN
026	FUSEBLOCK, 9-POLE, 600V	BUSSMAN
027	GROUNDING PAD, MACHINED BY PCI	RED1
028	TERMINAL BLOCK, 600V	BUCHANAN
029	END SECTION, TERMINAL BLOCK	BUCHANAN
030	END CLAMP, TERMINAL BLOCK	BUCHANAN
031	MOUNTING CHANNEL, TERMINAL BLOCK	BUCHANAN
032	MOUNTING RAIL, RELAY	IDEC
033	END CLIP, MOUNTING RAIL, RELAY	IDEC
034	ALARM BELL, 24VDC, 4" X 4" BOX	FEDERAL SIGNAL
035	MOUNTING BRACKET FOR 1-POLE CIRCUIT BREAKER (ITEM 21)	ITE
036	FUSE 10 AMP. (FU4-6)	BUSS
037	RIBBON CABLE ADAPTER, CONVERTS 16 CONDUCTORS TO A RIBBON CABLE	CINCINNATI ELECTRO
038	ADAPTER FOR 4161 BCD DISPLAY, HAS TWO 16 DIP SOCKETS TO ALLOW BUSSING OF DATA LINES, POWER STROBES AND DECIMAL POINT SELECTION ARE MADE THRU A TERM. STRIP	CINCINNATI ELECTRO
039	RIBBON CABLE 16 CONDUCTOR FOR MULTIPLEXING 4161 DISPLAYS 1 FOOT LONG	CINCINNATI ELECTRO
040	RIBBON CABLE 16 CONDUCTOR FOR MULTIPLEXING 4161 DISPLAYS 4 FEET LONG	CINCINNATI ELECTRO
041	OPERATOR INTERFACE UNIT FOR GE 90/70 PROGRAMMABLE CONTROLLER, USES PROGRAM PORT, 100 MESSAGE CALL UP, REGISTER ACCESS	BORNER ELECTRIC

FIGURE 2-O



COMPONENT LAYOUT
MAIN CONTROL CONSOLE

FIGURE 2-P

2.4. DESCRIPTION OF ELECTRICAL SYSTEMS

The intent of this manual is to outline the principle of operation which will form the basis of the electrical work necessary to maintain the Groundwater Treatment Plant and Pump Station No. 3 located in Nassau County of New York State.

2.4.1 Groundwater Treatment Plant

2.4.1.1 Power Source

Electrical power to the Groundwater Treatment Plant is provided by the Long Island Lighting Company - LILCO.

Electrical service is supplied at 13.2KV from a LILCO service pole via 3-2/C #2 - 15KV direct burial shielded cable to a pad mounted 13.2KV - 480/277 volt 750KVA transformer.

Secondary voltage to the Groundwater Treatment Plant is supplied via 3-500 MCM per phase and 1-3/0 neutral wire at 480/277 volt to a 1200 amp main service switch. A LILCO KWH and Demand Meter is installed on the south wall of the Control Room. It is connected to CT'S owned by LILCO. The secondary feeder is installed in 4-4" PVC conduits in a duct bank.

2.4.1.2 Power Distribution

The 1200 Amp Main Service Switch is located in the 480/277 volt service entrance section of the MCC, which feeds the Motor Control section of the MCC.

The MCC is located on the first floor of the Ground Water Treatment Plant in the Control Room.

The service entrance section of the MCC consists of three (3) vertical subsections (an incoming, a main switch and metering subsection and a transition section). The transition section is provided for power cable connections from the service entrance section to the Motor Control section of the MCC.

The incoming service entrance conductors from the 750KVA outdoor transformer enter the incoming section at the bottom. The LILCO company CTS, voltmeter, ammeter and selector switches are located in the same section.

The main service switch is a fusible bolted pressure switch 1200 ampere, 3 pole, 480 volt with compression lugs.

The MCC operates at 277/480 volt, 60 Hz, 3 phase, 4 wire and is supplied from the main service switch.

The main service switch is equipped with a class L (XXX) amp current limiting fuses, with integrally mounted zero sequence type Ground Fault Protection (GFP) and blown fuse protective system.

Low level grounds faults are sensed by the GFP system and cleared by switch opening. High magnitude ground faults and short circuits are cleared by the class L current limiting fuses.

The ground fault system components are mounted and wired onto the switch and factory tested. The ground fault relay is field adjustable with pick up setting from 100 amps to 1200 amps (set at 600A) and a trip signal time from 0.1 seconds to 0.5 seconds.

A GFP monitor and test panel is an integral part of the switch. The panel is equipped with control power indicating light, ground fault trip indicating target, target reset and means of testing the GFP relay and trip circuit - with and without tripping the switch.

Manual closing is accomplished by a two stroke sequence whereby the opening spring is charged and latched before - and independent of - compression of the closing spring.

Opening of the switch is accomplished electrically by solenoid or manually by mechanical pushbutton with no movement of the handle. The operating handle is mechanically interlocked with fuse access door and has provisions for padlocking in "Open" position.

The integrally mounted blown fuse protective system provides tripping of the switch upon blowing of any main fuse.

In the Motor Control section are located the magnetic starters for acid rinse pump, caustic sump pump, exhaust fan, air stripper blower and acid sump pump as well as circuit breakers for heaters, air stripper panel, filter pump panel and 112.5KVA transformer that feeds panel "LP".

Spare starters are provided in the first and second section, spare CB's are provided in the third section of the MCC.

All starters are mounted on the front of the vertical sections and have provisions for removal.

Bolt holes in the base channels are provided in all sections for the bolting of the MCC to the floor. The MCC is arranged in such a manner that additional sections may be readily added.

Full voltage across the line combination magnetic motor starters with thermal magnetic type circuit breakers overload protection provide overcurrent and running protection for the motors.

"Start-Stop" pushbuttons or "Hand-Off-Auto" selector switches with maintained contact are provided on the compartment door.

A red pilot light for each starter is mounted on the compartment door to indicate motor is "running".

Each starter is capable of being locked in the open position and has manual reset on the overload relay.

The starters have 2 N.O. and 2 N.C. extra auxiliary contacts in the addition to the "seal-in" contacts. A 480/120 volt, 180VA control transformer with fuses on primary side is furnished in each starter.

LILCO is responsible for the maintenance of the 750KVA transformer. The County is responsible for the primary connections and secondary service from transformer to the main 1200 amp bolted Pressure Service Switch.

2.4.1.3 Grounding

The grounding system consists of the following:

1. An outdoor loop of 1-4/0 buried copper conductor connected to a triad electrode system consisting of ground rods of 10' x 5/8".

2. MCC ground bus is connected to the outdoor loop and to the cold water pipe with 4/0 bare copper conductor.

3. Building steel and foundation reinforcement bars are separately connected to the MCC ground bus and to the outdoor grounding loop.

4. Provisions are made for extension of the ground loop for future connection of the grounding system for equipment to be installed in phase II construction.

2.4.1.4 Telephone System

Telephone service is provided to the Groundwater Treatment Plant with a telephone line entering the building through the east wall in one (1) 4" PVC conduit.

The telephone cable is installed in the same trench with the 15KV shielded power cable and terminates at the terminal strip located in the Control Room.

Telephone service is provided in the Control Room only.

2.4.1.5 Lighting Panel "LP"

The "LP" panel located in the control room on the 1st floor of the Groundwater Treatment Plant. It is supplied from a 3 pole, 70 amp trip, 100 amp frame circuit breaker located in the Section No. 3 of the Motor Control Center.

The panel is rated for 480/277VAC, 65,000 AIC, 3 phase, 4 wire, with 225 amp main lugs and ground bar and has 42 circuits. Circuit breakers are 1 pole 20 amp trip, 100 amp frame type FS13A rated for 65,000 AIC. Lock in "On" position is provided for five (5) circuit breakers serving emergency lighting, battery packs, lighting of lower floor and outside lighting. A timer is provided to control the outside lighting circuits.

The panel is surface wall mounted in NEMA I enclosure with the main entering at the top. Spare breakers are provided for future use.

2.4.1.6 Low Voltage System Transformer

A floor mounted 112.5KVA, 3 phase, 4 wire, 480-208/120V transformer is installed on the mezzanine level above the Control Room. The transformer has a delta connected primary supplied from a 3 pole, 150 amp circuit breaker located in the Section No. 3 of the MCC.

The secondary WYE connected windings supply the power to the Utility Panel "UP".

2.4.1.7 Utility Panel "UP"

The "UP" panel is located in the Control Room on the 1st floor of the Ground Water Treatment Plant. It is circuit breaker type, 208/120 volt, 3 phase, 4 wire with the main breaker rated for 225 amp frame/225 amp trip. The panel has 36 single pole, 100 amp frame, 20 amp trip, one 3 pole, 100 amp frame, 80 amp trip and one 3 pole, 100 amp frame, 100 amp trip circuit breakers. The panel provides 208/120 VAC required for the operation of the fans, motorized dampers, heaters, HVAC units, indoor lighting and receptacles. It is surface wall mounted in NEMA 1 enclosure with power feeder entering at the top.

2.4.1.8 Laboratory Panel "RP-L"

The RP-L panel is located on the East wall of the Laboratory Room in the Ground Water Treatment Plant building.

It receives power from a 3 pole, 100 amp trip, 100 amp frame circuit breaker located in the Utility Panel "UP-1".

The panel is circuit breaker type, 208/120 volt, 3 phase, 4 wire with 100 amp main lugs and ground bar and has 18 single pole 100 amp frame, breakers.

Two circuit breakers are 15 amp, one is 30 amp and 15 breakers are 20 amp trip.

Dedicated neutral is provided for four (4) circuits.

The panel provides 120 VAC required for the operation of the electrical laboratory equipment.

2.4.1.9 Fire Alarm System

The Fire Alarm System consists of one main microprocessor based Fire Alarm Control panel, a smoke control panel, thirteen (13) ionization type sensors, three (3) explosion proof horns, two (2) duct smoke detectors, four (4) non-coded fire manual stations, two (2) visual audible combination units, three (3) explosion proof strobe lights and one automatic telephone dialer.

The sensors are arranged in three zones with two signal circuits provided throughout the Groundwater Treatment Plant.

The Central Processing Unit (CPU) integral part of the Fire/Alarm Control Panel continuously scans each module of the Fire Alarm Control Panel for status changes.

CPU also provides supervision of the system wiring, module placement and normal switch position.

A continuous alarm signal is maintained until the initiating detector is restored to its normal condition or until the alarm is manually silenced. Operation of the "Alarm Silence Switch" or the "Trouble Silence Switch" silences the tone-alert, but the alarm or trouble LEDs remain illuminated until condition return to normal.

Activation of any smoke detector will cause the FACP to begin its Alarm Verification Cycle. The control panel will retard the activation of the alarm for approximately 30 seconds. If during this alarm retard period any smoke detector from another zone or any manual station activates, the alarm will be confirmed.

If a second device does not activate during this period the control panel will reset and begin a 120 second confirmation cycle. During this cycle should any device activate on any zone, the alarm will activate. Should the verification cycle end without incident, the panel will return to its normal state.

Upon activation any area smoke detector, duct detector or manual station control panel will shut down HVAC systems, exhaust fans and operate dampers.

Automatic Telephone Dialer has two sending channels. One channel can be used to transmit any emergency call upon operation of any electrical or mechanical device capable of tripping a switch. Second channel is used to dispatch a fire alarm message. In the event of simultaneous alarms priority takeover by channel 2 is provided. Test switches provided for

either channel. The telephone dialer allows an authorized person to abort the dialer message in case of accidental false alarms so that the fire department or central station is not disturbed unnecessarily. If this feature is not desired, it can be easily eliminated by switching a wire lug on the dialer's terminal strip.

The Fire Alarm Control Panel and Automatic Dialer located in the Control Room.

Power to Fire Alarm Control Panel (FACP) is provided by tapping to line side of the Panel "UP" through 30 amp fuse cutout. The FACP provides power for the detectors, audible and visual alarms devices such as strobe lights and bells. Low voltage batteries provide 24 hour power back up for the system in the event of normal LILCO power failure.

A variable rate battery charger provides recharging of the batteries to 70% in 12 hours.

2.4.2 Existing Pump Station #3

2.4.2.1 Power Source

Electrical service for the production pumps is provided by the Long Island Lighting Company - LILCO. It is furnished from LILCO pole via 3-2/C #2 - 15KV shielded direct burial feeder to a pad mounted 150KVA 13.2KV-480/277 volt transformer to a 200 amp metering cabinet located on the exterior North wall of the station.

Primary voltage from LILCO is 13.2KV. Secondary voltage entering the pump station is 480/277 volt, 3 phase, 4 wire, 60 Hz.

The capacity of the feeder is 175 amperes. The Long Island Lighting Company - LILCO - is responsible for the 150KVA transformer and for the 200 amp demand KWH meter, located in the metering cabinet.

The County is responsible for both the primary and the secondary connections to the 150KVA transformer.

2.4.2.2 Power Distribution

The secondary of the 150KVA 480V/227V transformer is connected with 4 #2/0 and 1 #4 grd. to the 200 amp demand meter with bypass feature. The cable is installed in 2" PVC conduit.

From the meter 4 #2/0 and 1 #4 grd - in a 2" conduit feed the 200 amp service switch located on the internal North wall of the pump station with 175 amp fuses.

From the service switch 4 #2/0 and 1 #4 grd - 2" wires feed floor mounted on pad 150 KVA, 3 phase, 4 wire, 480/277 volts voltage regulator, which comprises a motor-driven variable auto transformer, a buck-boost fixed ratio transformer and solid state control unit that automatically positions the auto transformer to hold the output voltage constant.

Built-in Control Circuit Switch provides either automatic control of the output voltage or manual control.

Manual Control switch allows manual control of the output voltage.

Outcoming wires 4 #2/0 and 1 #4 grd - 2" C from the voltage regulator feed the Main Distribution Panel (MDP) located on the North wall in the Pump Station No. 3.

System grounding is provided by connection of a 1 #4 grounding electrode conductor - 3/4" C to a 10' grounding rod, to the grounded service conductor at the service disconnect and to a ground bar within the building.

2.4.2.3 Main Distribution Panel (MDP)

The panelboard located at the existing well and pump station building No. 3 receives power from the voltage regulator.

The 30 circuit panelboard is circuit breaker type, rated for 277/480 VAC, 3 phase, 4 wire, 60 Hz, 65,000 AIC, with 225 amp main lugs and ground bar, manufactured by Cutler Hammer Company.

It contains six (6) 3 pole, 50 amp trip, 100 amp frame circuit breakers with 14.000 AIC and two (2) 1 pole - 15 amp trip, 100 amp circuit breakers with 22,000 AIC. The five (5) active breakers supply power to the production/recovery pumps and associated control equipment located at recovery well #1, 2, 3, 4 and 5.

The panel is surface wall mounted in NEMA 1 enclosure with main feed entering at the top. Blank spaces and four (4) spare 1 pole circuit breakers are available for future equipment connection.

2.4.3 Production Wells

2.4.3.1 Power Distribution

Electrical service to production wells No. 1, 2, 3, 4 and 5 is provided at 480/277 volt, 3 phase, 4 wire, 60 Hz, with grounded neutral from the Main Distribution Panel (MDP) located in the existing Pump Station No. 3.

Feeders to wells No. 1 thru 5, 4 #4 and grd., 4 #2 and grd, 4 #1 and grd., 4 #2/0 and grd. and 4 #4/0 and grd. respectively are direct burial cables type USE which provide 3 phase, 4 wire, 480 volts for well pump motor and 277 volts single phase for well control panel.

Outgoing feeder to the production well pump run to pump motor starter via junction box installed in well pit. A full voltage across-the-line combination magnetic motor starter with circuit breaker overload protection provides overcurrent and running protection for each pump motor. The starter also includes a momentary contact stop and reset push-buttons, a pilot light and "Hand-Off-Automatic" switch built into the cover.

Hand position on "H-O-A" switch permits local starting of the motor by shunting all automatic controls.

The starter is capable of being locked in the open position and has manual reset on the overload relay.

A 1000 VA, 480-240/120 volt, 3 phase, 3 wire stepdown transformer is supplied by tapping 3 #10 and 1 #10 grd. - 1" C to the line side of the incoming feeder in the junction box. Protection of the primary winding is provided with 30 amp, fused disconnect switch in weatherproof enclosure.

A ground fault receptacle in weatherpoof enclosure is provided for portable lighting and miscellaneous power equipment.

Grounding of the electrical equipment is provided with 1 #8 bare ground conductor connected to a buried 10' grounding rod.

All five feeders for the wells are direct burial cables run to well #1.

From well #1 to well #5 the cables are run in a common trench with the telemetry cables and the ground water transmission line.

2.5 BASIC DESCRIPTION OF THE INSTRUMENTATION AND CONTROL SYSTEM

a. The system is designed to provide status reporting and control of the groundwater recovery water conveyance and treatment systems.

b. A detailed description of all component parts and control will be found in the Operation and Maintenance Manual prepared by PCI Ozone and Control Systems Inc., One Fairfield Crescent, West Caldwell, NJ 07006.

2.5.1 Groundwater Recovery Production Wells located within the Bethpage State Park Black Golf Course.

- The Main Control Console (MCC) in the treatment plant is provided with a graphic display panel. The graphic display indicates flow in gallons per minute (GPM), well pump status and valve status for each of the five production wells.

2.5.2 A graphic display on the MCC indicates total flow from all five (5) production wells to the Treatment Plant.

- Valve status for the valves directing influent from the production wells to either the Air Stripper Pump Station or the Pressure Filter Pump Station is displayed on the console.

- The graphic display indicates pump status for the triplexed pumps in the Air Stripper Pump Station along with water level control and alarms.

- Valve status for the effluent from the Air Stripper Pump Station is indicated for each of the three motor operated valves for the pump discharge.

- A graphic display on the MCC indicates the flow in GPM from the Air Stripper Pump Station to the Air Stripper Tower, and also indicates high water in the tower.

2.5.3 Acid Rinse System

- The Acid Rinse System for the Air Stripper tower is a manual operation.

- Status of the manually operated valves used to direct the flow of acid to the air stripper tower and return re-usable acid to the storage tank is graphically represented.

- On-off status of the Acid Pump and low level indication with safety shut down protect the acid pump.

- Valve status for the transfer of spent acid to the acid waste tank and high level status along with safety shut down is graphically represented.

2.5.4 Pressure Filter Pump Station

- Valving is provided to direct the effluent from the Air Stripper Tower to the Pressure Filter Pump Station and for future extension of the process. Status of these manual valves is displayed on the graphic.

- The graphic display indicates pump status for the triplexed pumps in the pressure filter pump station along with water level control and alarm (same as Air Stripper Pump Station).

- Valve status for the effluent from the Pressure Filter Pump Station is indicated for each of the three motor operated valves for the pump discharge.

- Effluent from the Pressure Filter Pump Station is directed to two manually operated valves. One valve is normally closed (status is indicated on graphic) and is intended for future expansion of the process. The second valve is normally open (status is indicated on graphic) and controls the flow of effluent to the diffusion wells.

- A flow meter in the discharge piping from the Pressure Filter Pump Station located in the manhole outside the building, to the south side provides a graphic display of the total effluent discharge.

- The graphic display also indicates alarm conditions for the plant operation both visually and audibly (with silencing switch).

2.6 EMERGENCY OPERATION AND RESPONSE PROGRAM

2.6.1 General

This section covers the emergency operation and response program which outlines various procedures to effectively deal with emergency conditions.

Emergency conditions which can jeopardize the normal operation of the systems include personnel absence, equipment failure, transmission line failure, power loss, natural disasters, strikes, explosion, fire, etc.

Effective emergency planning will require considerable coordination and forethought by the operating staff so as to be able to identify the major considerations and the vulnerability of the facility in each type of emergency. The objectives of the Emergency Response Plan are as follows:

- Eliminate or minimize adverse effects from emergency situations affecting the normal operation of the production wells, transmission line, treatment plant and discharge to diffusion wells.

- Develop procedures for properly responding to emergencies.

- Provide instruction for system personnel to ensure they understand their responsibilities during emergency situations.

- Provide inventories of available emergency equipment and outline existing mutual aid agreements and contracts with outside organizations for specialized assistance.

2.6.2 Vulnerability of the Systems

1. Vulnerability Analysis Methods to Reduce Vulnerability

a. Areas of Vulnerability

These systems are vulnerable to a number of natural disasters which can potentially inflict such damage as to disrupt its normal functions. Natural disasters which are most likely to affect the normal operation of this facility include the following:

- o Flood
- o Blizzard
- o Ice Storm
- o Wind Storm
- o Thunderstorm, Lightning
- o Extreme Cold

These systems are also vulnerable to faulty maintenance; negligent operation; failures in production well pumps, transmission line, air stripper and accessories and air stripper and filter pumps.

The equipment in this facility will have to be properly maintained or it could cease to perform the tasks for which it was intended. Faulty maintenance will shorten the expected life of the equipment. Unexpected breakdowns due to faulty maintenance can greatly affect the continued operation of these facilities. The effect of such equipment breakdown on continued satisfactory operation of this station can lead to an emergency condition.

The operation of the equipment will have to follow certain procedures to obtain satisfactory performance. To operate the facility without due regard to established procedures could constitute negligent operation. Negligent operation may not be as readily noticeable as faulty maintenance, but the emergency condition resulting from it could possibly be just as severe.

Accidents can result in either or both, personal injury and property damage; both of which have a direct bearing on the station's operation.

b. Vulnerability Analyses

A vulnerability analysis of the system is an estimation of the degree to which the system is adversely affected, in relation to the function it must perform, by an emergency condition.

The following steps have been followed in making a vulnerability analysis:

- o List components of system.
- o Select condition to be investigated.
- o Estimate effects of emergency condition on each component of system, using vulnerability worksheet.
- o Estimate system's ability to perform its intended function during the emergency.
- o If system(s) fails to perform, identify key system components responsible for the failure.

The following methods can be employed to reduce the systems' vulnerability:

- o An optimum preventive maintenance and testing program.
- o Training of regular and auxiliary personnel in emergency operations and procedures. Training should be a combination of class room instruction and on-the-job training.
- o Conducting emergency operation exercises periodically.
- o Provide proper tools in adequate supply and in the proper location.

c. Vulnerability of Facility

The vulnerability of these facilities, as determined through a vulnerability analysis, is listed below along with description of the impact on the operation of this facility.

Power Failures

The electric power is supplied by LILCO. If power is lost, life safety system is first priority:

- Fire alarm system provided with low voltage batteries for 24 hour power pack.
- Methane gas detection systems, which each has battery backup.
- Emergency batteries are provided for lighting units and exit signs for emergency egress out of the building.

Fire

Fire can be caused by faulty maintenance, negligent operation, lighting and accidents. Although fire can cause property damage, personnel injury and loss of life, it is unlikely that a fire of any significance will occur because there is a limited amount of combustible material used in the construction of the treatment facility.

Failure in Pumping Equipment, Air Stripper and Appurtenances, and Piping

An emergency condition can be caused due to failure of the following equipment and piping:

- Failure of submersible pump in production wells.
- Failure of pumping equipment and/or air blower.
- Failure of ventilation system.
- Failure of alarm and telemetering system.
- Failure of discharge piping or valves.
- Transmission line failure.

Many possible combination of conditions can occur which can lead to the above failures. A preventive maintenance program will help in reducing the chances of these failures.

Failure in Transmission Line

An emergency condition can be caused due to a failure in the transmission line. Although the transmission line has been designed to withstand the anticipated discharge pressures, a break can occur due to a variety of reasons along the route of the pipeline.

2.6.3 Emergency Procedures

1. Emergency Equipment Inventory

The Operations' Supervisor and his operators should be aware of which materials, equipment and spare parts would be critical during emergencies. He should know if these items are on hand or how to get them at a moment's notice. Items which are considered critical and are not available locally should be stocked.

A list of spare parts and tools is included in the Equipment Operation and Maintenance Manual. This list will have to be maintained by the personnel to prepare for proper operation during an emergency. Additional emergency equipment and supplies required may be purchased and stockpiled and/or arrangements can be made to obtain these items through mutual aid agreements or outside contracts.

2. Methods of Preserving Treatment Plant Records

The essential treatment plant records should be preserved in the event of an emergency situation. These records should be placed in an area that is both safe and convenient.

The following is a partial listing of documents to be protected:

- "As-built" drawings
- Monthly operating records
- Manufacturers' Operation and Maintenance Manuals.

3. Coordination Between Police and Fire Departments

Emergency procedures and response procedures should be coordinated with both the local police and fire departments.

Local police officials should be asked to provide input on security measures. A decision will have to be made as to whether to request the police department to make routine checks at this facility. The police department officials should be briefed on the role that their department may be asked to play during emergencies.

The local fire department should be asked to check the adequacy of the existing fire fighting equipment within this facility. They can be asked to provide first-aid instruction for all personnel with an upgrade training periodically. Coordination between fire and police department and the operations personnel should be coordinated during an emergency.

4. Emergency Responsibilities for Personnel

The Operations Supervisor should have the overall responsibility for the emergency program.

All employees will have to familiarize themselves with their responsibilities during an emergency condition. The Operations Supervisor will be responsible for assigning these emergency assignments. He can establish an Emergency Response Card for each employee delineating specific assignments for various types of emergencies. These cards, once prepared, can become a permanent part of this O & M Manual. A sample Emergency Response Card is presented in Exhibit 2.3-1.

The Operations Supervisor, upon notification of emergency conditions, should initiate the appropriate portion of the emergency operations plan. He will contact the key personnel and representatives from organizations providing assistance.

The Shift Supervisor will be responsible to mobilize the maintenance crews as dictated by the nature of the emergency, and all emergency actions involving operators until all normal operations are restored. He will have to provide the Operations Supervisor with input concerning all operational actions made necessary by the emergency to minimize the impact on public health and the environment.

5. Telephone Numbers for Emergency Response

POLICE DEPARTMENT - 911

FIRE - Dial Operator, ask for Old Bethpage Fire Department Emergency

HEALTH DEPARTMENT

9:00 AM TO 5:00 PM - (516) 535-3410
5:00 PM TO 9:00 PM - (516) 795-0880

LONG ISLAND LIGHTING COMPANY - (516) 931-5800

2.6.4 Mechanism for Updating Emergency Response Program

The response in an emergency, as previously discussed, should be appraised and re-evaluated each year. It is important for the operations personnel to critique both the emergency response program and the prevention methods. Key operations personnel should constantly strive to improve the emergency response program by discussing and updating procedures to be used during emergency situations. New personnel should be acquainted with all emergency response procedures and responsibilities.

EXHIBIT 2.6-1

SAMPLE
EMERGENCY RESPONSE CARD

NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS
EMERGENCY RESPONSE CARD

NAME: John (FIRST) J. (MIDDLE) Jones (LAST)

NORMAL DUTY ASSIGNMENT: Mechanic's Helper

EMERGENCY SITUATION:	EMERGENCY ASSIGNMENT:
Power Failure	Report to Maintenance Foreman and stand by to serve on emergency crew.
Mechanical Equipment Failure	Report to Maintenance Foreman (Give Name) in treatment plant building for assignment.
Natural Disaster	Try to contact Emergency Response to determine if conditions require you to report to maintenance shop. If you are told to report for duty, your supervisor is (Give Name).

SECTION 3

MONITORING PLANT OPERATIONS AND PERFORMANCE

CAUTIONARY NOTE: All reference to computer generated forms or programs, whether proprietary or designed by Lockwood, Kessler & Bartlett, Inc., require the use of **Microsoft's Windows 3.1, Excel 3.0 and Perkin Elmer's Turbochrom 3.2** to operate correctly. Use of other versions may cause program failure and/or loss of data. Please refer to the appropriate user manuals for specific instructions related to the features available and their operation.

3.1 GENERAL

As part of the OBSWDC Consent Decree, the Town is required to submit to the appropriate regulatory agencies quarterly reports detailing the facility's hydraulic and treatment operations. This Section introduces the staff to the type of data required for reporting purposes, as well as associated record keeping requirements. The data collected will also be utilized to assess the integrity of equipment and its servicing requirements, the treatment efficiency of the air stripping tower and its need for process control adjustments or servicing, and will further assist in developing additional information on the groundwater plume, should modification to the treatment process be required.

Two computers have been supplied with this facility to gather, store, manipulate and report hydraulic and analytical self-monitoring data. The main facility computer, located in the supervisor's office, receives, stores and processes all hydraulic and analytical data. This computer will also be utilized to print monitoring data in a readable format for

reporting purposes. The laboratory computer receives data from the Town's gas chromatograph (GC), as well as hand-entered data from various analytical tests performed in the Town's laboratory. At appropriate intervals, data from this computer is transferred to the facility computer.

3.1.1 Hydraulic Monitoring

This facility is designed to pump, treat and discharge up to 1.5 MGD of groundwater from a series of five wells, each delivering approximately 300,000 GPD (0.3 MGD). The flow from each well is independently operated from the control room in response to the water levels recorded in the wells and/or data from chemical analyses performed in the facility laboratory. Air flow to the air stripper may also be varied in response to the concentration of volatile organic compounds (VOCs) contained in the combined flow from the production wells.

Hydraulic monitoring will also alert the operator to equipment faults, and assists in establishing a sound inspection and maintenance program. Table 3.1 lists the major facility pumps and their design flows. Hourly hydraulic data from each shift will be entered into the facility computer from worksheets and printed, as required, in a format previously inserted in the computer memory. This format and specimen reporting forms are presented more fully in Section 3.4, "Recordkeeping."

3.1.2 Treatment Performance Monitoring

Treatment success at this facility is measured by the ability of the air stripping process to remove VOCs to below the current regulatory discharge requirements. These requirements, which were current in August, 1991, are reproduced in Tables 3.2 and 3.3 and are somewhat more restrictive than the

TABLE 3.1

NOMINAL FLOW RATES - MAJOR FACILITY PUMPS

Pump Designation	Nominal Flow		
	GPM	GPD	MGD
Well Pump No. 1	210	300,000	0.30
Well Pump No. 2	210	300,000	0.30
Well Pump No. 3	210	300,000	0.30
Well Pump No. 4	210	300,000	0.30
Well Pump No. 5	210	300,000	0.30
* Air Stripper Pump No. 1	520	750,000	0.75
Air Stripper Pump No. 2	520	750,000	0.75
Air Stripper Pump No. 3	520	750,000	0.75
* Effluent Pump No. 1	520	750,000	0.75
Effluent Pump No. 2	520	750,000	0.75
Effluent Pump No. 3	520	750,000	0.75

* Only two pumps are to be on line at any one time; the third pump is on standby.

TABLE 3.2

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS
GROUNDWATER TREATMENT FACILITY

EFFLUENT LIMITATIONS*
INORGANICS

CHEMICAL CONSTITUENT	ALLOWABLE EFFLUENT CONCENTRATION (mg/l)
BARIUM	1
CADMIUM	0.01
CHLORIDE	250
CHROMIUM (hex)	0.05
COPPER	1
CYANIDE	0.2
IRON	0.3
LEAD	0.025
MAGNESIUM	35
MANGANESE	0.3
MERCURY	0.002
SILVER	0.05
ZINC	5
TOTAL DISSOLVED SOLIDS	500
NITRATE	10
SULFATE	250
PHENOLS (total)	0.001

* REGULATORY EFFLUENT DISCHARGE STANDARDS AS SPECIFIED IN THE CONSENT DECREE AND AS MODIFIED BY 11/10/88 LETTER TO THE TOWN.

TABLE 3.3

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS
GROUNDWATER TREATMENT FACILITY

EFFLUENT LIMITATIONS*
VOLATILE ORGANIC COMPOUNDS

CHEMICAL CONSTITUENT	ALLOWABLE EFFLUENT CONCENTRATION (ug/l)
TOTAL VOCs	100
BENZENE	ND
BROMODICHLOROMETHANE	50 **
BROMOFORM	50 **
CARBON TETRACHLORIDE	5
CHLOROBENZENE	5
CHLORODIBROMOMETHANE	50 **
CHLOROETHANE	5
CHLOROFORM	100 **
DICHLOROBENZENE o&p	4.7
DICHLORBENZENE o,m&p	50
1,1 DICHLOROETHANE	5
1,2 DICHLOROETHANE	5
1,1 DICHLOROETHENE	0.07
1,2 DICHLOROETHENE cis	5
1,2 DICHLOROETHENE trans	5
1,2 DICHLOROPROPANE	5
ETHYLBENZENE	50
METHYLENE CHLORIDE	5
TETRACHLOROETHENE	0.7
TOLUENE	5
1,1,1 TRICHLOROETHANE	5
TRICHLOROETHYLENE	5
VINYL CHLORIDE	2
XYLENE o	5
XYLENE m	5
XYLENE p	5
XYLENE o,m&p	50

* REGULATORY EFFLUENT DISCHARGE STANDARDS AS SPECIFIED IN THE CONSENT DECREE AND AS MODIFIED BY 11/10/88 LETTER TO THE TOWN.

** TOTAL CONCENTRATION OF THESE FOUR TRIHALOMETHANES SHALL NOT EXCEED 100 ug/l.

original discharge requirements contained in the OBSWDC Consent Decree. Primary control of the treatment process is exerted via gas chromatographic analyses performed on the various process streams. Table 3.4 summarizes the purpose and use of gathering VOC data on each process stream during plant operation. Primarily, however, this data will assist in establishing water and/or air flow rates to the air stripping tower and aid in determining whether discharge requirements are being met. An air/water ratio sufficient to achieve greater than 99 percent removals of VOCs from the groundwater was set at plant start-up (April 1, 1992). Continued monitoring data (as of September 1992) has shown that no adjustment to the air/water ratio is required at this time.

Secondary control of the treatment process is exerted via various "wet chemical" tests for inorganic parameters known and/or suspected to be present in the groundwater plume. Table 3.5 summarizes the purpose and use of gathering data of this type on each process stream. Depending on treatment plant performance, parameters may be deleted or added to this list.

3.2 RECORDKEEPING

3.2.1 General

Daily activities will be recorded by hand on worksheets, as reproduced in this section. The worksheet format may be modified by the facility supervisor, as required, and is contained in the memory of the facility computer. All completed worksheets will be entered directly onto this computer at the end of the shift by the facility supervisor or his designee, and stored on the computer hard drive in specially designed Excel based data files.

TABLE 3.4

ORGANICS (VOCS) MONITORING OF PROCESS STREAMS

Process Stream(s)	Data Utilization
1) Production Wellfield (5 Wells)	1) Provides data related to the concentration and direction of the groundwater plume. 2) In conjunction with water level measurements, will provide data to determine if entire groundwater plume is being captured. 3) Provides data required to determine if an individual well should be throttled or shut down.
2) Air Stripper Influent	1) Provides averaged concentration data from the entire wellfield which, with flow rate data, will assist in determining air flow rates to the air stripper. 2) Provides necessary data to determine air stripper efficiency and will assist in determining the acid rinse cycle in the air stripping tower.
2) Air Stripper Effluent	1) Provides necessary data to determine if regulatory discharge requirements are being maintained. 2) Provides necessary data to determine air stripper efficiency and will assist in determining the acid rinse cycle in the air stripping tower.

TABLE 3.5

INORGANICS MONITORING OF PROCESS STREAMS

Process Stream(s)	Data Utilization
1) Production Wellfield	1) Provides data related to the concentration and direction of the groundwater plume. 2) In conjunction with water level measurements, will provide data to determine if entire groundwater plume is being captured. 3) Provides data required to determine if an individual well should be throttled or shut down. 4) Provides data related to frequency of inspection and/or maintenance required at the well heads, due to scaling.
2) Air Stripper Influent	1) Provides averaged concentration data from the entire wellfield, which sets the influent conditions to the air stripper and will assist in determining the acid rinse cycle in the air stripping tower.
3) Air Stripper Effluent	1) Provides necessary data to determine if regulatory discharge requirements are being maintained for pH, iron and manganese. 2) Provides necessary data to assist in determining the acid rinse cycle in the air stripping tower.

Analytical results generated by the gas chromatograph (GC) will be stored automatically on the laboratory computer hard drive by the Turbochrom software package supplied by the GC manufacturer, Perkin-Elmer. Other analytical results will be entered on this computer by the laboratory staff at the end of the day shift. To protect against the possible loss of data, all raw data files should be backed up daily on 3.5 inch diskettes. These backup diskettes will be utilized to copy the raw data into the previously mentioned, specially designed data files in the facility computer for further processing and will be reused.

Additionally, all data files will be copied quarterly from the facility computer memory onto 3.5" diskettes for distribution. Initially, distribution of data will be performed by the Town's consultant. One set of data will be copied onto computer generated forms for report purposes and eventual storage at the GTF. After all data has been successfully backed up, copied, printed and distributed, all data files in the facility computer will be erased to free computer memory for the next quarter's data. Backup diskettes should be saved for archival purposes.

3.2.2 Worksheet Formats

The blank worksheets utilized at this facility for hand entering hydraulic and some analytical data are stored on the computer hard drive and can be retrieved and printed for use by entering the appropriate commands. Specimen worksheets for recording daily shift data and the results of inorganic analytical testing are presented in Figures 3-A, 3-B, 3-C and 3-D, respectively. Each worksheet format is protected in computer memory from accidental erasure or editing. The worksheets have been designed for ease

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS
GROUNDWATER TREATMENT FACILITY

DAILY OPERATIONS WORKSHEET
NIGHT SHIFT

FILE ID:	
DATE:	

	WELLFIELD OPERATION GALLONS PER MINUTE						AIR STRIPPER OPERATING PARAMETERS					
TIME	WELL 1 FLOW	WELL 2 FLOW	WELL 3 FLOW	WELL 4 FLOW	WELL 5 FLOW	SYSTEM FLOW	STRIPPER FLOW GPM	PRESS FIL FLOW GPM	BLOWER AIR FLOW CFM	AIR PRESSURE INCHES WC	EFFLUENT FLOW M GALS	SUPERVISOR/ OPERATOR INITIALS
11 PM											ZERO	
12 AM												
1 AM												
2 AM												
3 AM												
4 AM												
5 AM												
6 AM												
7 AM												
AVERAGE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

REMARKS

NOTES

1- THE SYSTEM FLOW, STRIPPER FLOW AND PRESSURE FILTER FLOW MUST BE EQUAL WITHIN 5%.

2- EFFLUENT FLOW MEASURES THE TOTAL FLOW THROUGH THE FACILITY. OPERATOR SHALL RESET THE GAUGE TO ZERO AT THE BEGINNING OF EACH SHIFT.

FIGURE 3-A

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS
GROUNDWATER TREATMENT FACILITY

DAILY OPERATIONS WORKSHEET
DAY SHIFT

FILE ID:	
DATE:	

	WELLFIELD OPERATION GALLONS PER MINUTE						AIR STRIPPER OPERATING PARAMETERS					
TIME	WELL 1 FLOW	WELL 2 FLOW	WELL 3 FLOW	WELL 4 FLOW	WELL 5 FLOW	SYSTEM FLOW	STRIPPER FLOW GPM	PRESS FIL FLOW GPM	BLOWER AIR FLOW CFM	AIR PRESSURE INCHES WC	EFFLUENT FLOW M.GALS	SUPERVISOR/ OPERATOR INITIALS
7 AM											ZERO	
8 AM												
9 AM												
10 AM												
11 AM												
12 PM												
1 PM												
2 PM												
3 PM												
AVERAGE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

REMARKS

NOTES

1- THE SYSTEM FLOW, STRIPPER FLOW AND PRESSURE FILTER FLOW MUST BE EQUAL WITHIN 5%.
2- EFFLUENT FLOW MEASURES THE TOTAL FLOW THROUGH THE FACILITY. OPERATOR SHALL RESET THE GAUGE TO ZERO AT THE BEGINNING OF EACH SHIFT.

FIGURE 3-B

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS
GROUNDWATER TREATMENT FACILITY

DAILY OPERATIONS WORKSHEET
EVENING SHIFT

FILE ID:	
DATE:	

	WELLFIELD OPERATION GALLONS PER MINUTE						AIR STRIPPER OPERATING PARAMETERS					
TIME	WELL 1 FLOW	WELL 2 FLOW	WELL 3 FLOW	WELL 4 FLOW	WELL 5 FLOW	SYSTEM FLOW	STRIPPER FLOW GPM	PRESS FIL FLOW GPM	BLOWER AIR FLOW CFM	AIR PRESSURE INCHES WC	EFFLUENT FLOW M.GALS	SUPERVISOR/ OPERATOR INITIALS
3 PM											ZERO	
4 PM												
5 PM												
6 PM												
7 PM												
8 PM												
9 PM												
10 PM												
11 PM												
AVERAGE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

REMARKS

NOTES

1- THE SYSTEM FLOW, STRIPPER FLOW AND PRESSURE FILTER FLOW MUST BE EQUAL WITHIN 5%.
2- EFFLUENT FLOW MEASURES THE TOTAL FLOW THROUGH THE FACILITY. OPERATOR SHALL RESET THE GAUGE TO ZERO AT THE BEGINNING OF EACH SHIFT.

FIGURE 3-C

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS
GROUNDWATER TREATMENT FACILITY

INORGANICS ANALYSIS WORKSHEET

SAMPLE ID:		SAMPLER:	
LOCATION:		ANALYST:	
DATE:		TIME:	

CHEMICAL CONSTITUENT	ALLOWABLE EFFLUENT CONCENTRATION* (mg/l)**	MEASURED CONCENTRATION*** (mg/l)
pH (units)	6.5 - 8.5	
ORP (mv)	NO REQUIREMENT	
IRON, TOTAL	0.3	
MANGANESE, TOTAL	0.3	
DISSOLVED OXYGEN	NO REQUIREMENT	
AMMONIA	10	

* REGULATORY EFFLUENT DISCHARGE STANDARDS AS SPECIFIED IN THE CONSENT DECREE AND AS MODIFIED BY 11/10/88 LETTER TO THE TOWN.

** ALL CONCENTRATIONS EXPRESSED IN MG/L EXCEPT pH AND ORP.

*** HIGHLIGHTED COMPOUNDS IN EXCESS OF REQUIRED EFFLUENT CONCENTRATIONS.

of operator use, while displaying the information required in the most readable format. Data from these forms is manually entered onto the facility computer. Data from the gas chromatograph is automatically transferred into the proper format and does not require prior hand entering onto a worksheet.

3.2.3 Report Identification

All reports generated by the facility operations require unique identification for retrieval purposes, since they are stored in the facility computer as components of spreadsheets or as individual files. Therefore, having a unique identification allows any individual prior daily operations report or analytical test to be called up from a diskette or the hard drive for examination on the monitor and/or printout. When specifying a date and shift for which data has not yet been recorded, a blank worksheet is presented for data entry.

3.2.3a Daily Operation Reports (DOR)

To utilize this program to enter, edit or view data, call up the Excel based template, "DOR.XLM" from the "RAPRPRTS" subdirectory. Identification is provided by simply specifying the date and shift required.

3.2.3b Inorganic Analyses Reports (IAR)

To utilize this program to enter, edit or view data, call up the Excel based template, "IAR.XLM" from the "RAPRPRTS" subdirectory. Identification is provided by simply specifying the date required and the location sampled.

3.2.3c Organic Analyses Reports (OAR)

To utilize this program to view data, call up the Excel based template, "OAR.XLM" from the "RAPRPRTS" subdirectory. Identification is provided by simply specifying the date and time (a.m./p.m.) required and the location sampled. Data entry is accomplished automatically by this program from the appropriate Turbochrom files discussed in Section 3.2.3d. Editing data must also be performed in Turbochrom program.

3.2.3d Gas Chromatograph Files *

Data gathering, processing and storage into the "Organic Analyses Report" format (Section 3.2.3c) is largely automatic once the gas chromatopgraph begins analyses. After the analyses have been completed, data is automatically stored in a sample raw data file (**.RAW). After batch reprocessing, the file is renamed as a result file (**.RST). When converting the file to an ASCII format, suitable for storage in an Excel based spreadsheet, the file is again renamed as a text file (**.TX1). Files with the TX1 file extension are utilized as input data to the organic analyses report program previously mentioned.

* Refer to the laboratory operating and maintenance manual for this facility, the Turbochrom manual, and the manuals for Microsoft Windows and Excel for detailed instructions related to this section.

3.2.4 Daily Operations Report (DOR)

The mechanical operations of the facility will be monitored through the use of the "Daily Operations Report". During the start-up and shake-down phases of operation, a reporting format requiring hourly readings will be utilized. These hourly readings are entered onto the "Daily Operations Worksheet," previously reproduced as Figure 3.1.

Due to the large amounts of data collected, a computer program has been designed to assist in managing and displaying the data in a meaningful manner. This program ("Daily Operations Reports", Version 1.0) incorporates a number of useful functions designed to minimize computer memory requirements, preserve data integrity and facilitate the production of daily printouts and graphical displays. For reference, these functions are tabulated in Table 3.6.

This program has been designed for use with specially designed spread sheet files (one spread sheet file for each column of data). A computer-generated worksheet template for recording the data required is reproduced as Figure 3.E. This figure also represents the format used for report purposes. As discussed previously, each worksheet will have individual identification for retrieval purposes. In this case, the identification is provided by simply specifying the date and shift required.

After data entry for a particular date/shift on the worksheet template, the program automatically stores each column of data in the appropriate spread sheet file when the completed template is archived. This method of data storage minimizes the amount of computer memory required, and facilitates retrieval of data for printout.

Daily Operations Report

TOWN OF OYSTER BAY

DEPARTMENT OF PUBLIC WORKS

GROUNDWATER TREATMENT FACILITY

DAILY OPERATIONS REPORT

DAY SHIFT

Well Field Operation (GPM) / Air Stripper Operation

	Well 1	Well 2	Well 3	Well 4	Well 5	System Flow	Stripper Flow	Pressure Filtr Flow	Blower Air Flow	Air Pres	Effluent Flow	Op Init
7 AM:												
8 AM:												
9 AM:												
10 AM:												
11 AM:												
Noon:												
1 PM:												
2 PM:												
AVG.:												

Note: All flows are in GPM except Blower (CFM) and Effluent (Millions of gallons).

Cumulative Effluent flow is periodically reset; other flows are instantaneous rates.

UKB

Operator remarks:

"DAILY OPERATIONS REPORT"
WORKSHEET TEMPLATE AND REPORT FORMAT

FIGURE 3-E

TABLE 3.6

Function	Enabling Feature
1. Minimization of Memory Requirements and Facilitation of Printouts	- Construction of individual data files (Well 1OP, Well 2OP, etc.) in a spreadsheet format in conjunction with the computer program designed permits the archieving and retrieval for printout of all shift data.
2. Graphical Display	- Quarterly & monthly graphical displays are preconstructed in each data file for simplified viewing. - All graphical displays are automatically updated when data is archieved to the data file. - Up to date, graphical displays can be viewed on the monitor or printed (utilzing preselected parameters) at will.
3. Preservation of Data Integrity	- Hourly data entry requires the initials of operator to be accepted into the worksheet template. - Data can only be entered for the current or a previous day*. Data entry into a future date is not accepted. - Data can only be entered for a shift for which data has already been recorded if the operator records the reason for the edited update and his initials. - Program provides for archieving data to the computer hard drive and/or diskette. - Program and spread sheet data files are password protected.**

* Data cannot be entered for a date prior to April 1, 1992, the official startup date of this facility.

** Password protection must be removed from the data files in order to print quarterly or monthly graphs.

In addition, monthly and quarterly graphical displays have been preconstructed in each spread sheet file. Each spread sheet file and associated graphical display are automatically updated when the completed worksheet template is archived. Therefore, up-to-date data, presented in a graphical format, can be reviewed and/or printed when required for reporting purposes. The operator may also find graphical illustration of historical data useful when assessing the operation of individually monitored equipment, such as the production well pumps and the air stripper blower.

This program has been designed to assist in correlating data with the "Inorganic Analyses Report", discussed in Section3.2.5 and the "Organic Analyses Report", discussed in Section 3.2.6, both of which are currently in development (September 1992).

3.2.5 Inorganic Analyses Report (IAR)

Although the function of this facility is to remove volatile organic compounds from the groundwater, other inorganic parameters will be monitored regularly. Some of these parameters, such as iron, may adversely affect the removal efficiency of the air stripping tower by inducing clogging through the formation of iron deposits or by providing a favorable environment for bacterial growth. Regular monitoring will assist in establishing the frequency of the acid rinse cycle discussed in Section 2. Other parameters (such as chloride), in conjunction with groundwater monitoring well data, will assist in determining the overall strength and direction of the groundwater plume. This information will be useful if design modifications become necessary in future years.

Laboratory data will be hand-entered on the "Inorganic Analyses Worksheet," reproduced as Figure 3.D, immediately after each individual analytical test is performed. The information from the worksheet will be transcribed onto

the computer after a full day's data has been taken. Initially, it is anticipated that the laboratory will be operating during the hours of 8:00 a.m. to 5:00 p.m., and the supervisor may find it convenient to enter the previous day's data, after his review, during the next day shift.

Due to the large amounts of data collected, a computer program will be developed to assist in managing and displaying the data in a meaningful manner. This program ("Inorganic Analyses Report," Version 1.0 (not completed)) will incorporate a number of useful functions designed to minimize computer memory requirements, preserve data integrity and facilitate the production of daily printouts and graphical displays.

This program will be designed for use with specially designed spread sheet files (one spread sheet file for each column of data). After data entry for a particular date/shift on the worksheet template, the program will automatically store each column of in the appropriate spread sheet file when the template data is archived. This method of data storage minimizes the amount of computer memory required.

In addition, monthly and quarterly graphical displays will be preconstructed in each spread sheet file. Each spread sheet file and graphical display will be automatically updated when the completed worksheet template is archived. Therefore, up-to-date data, presented in a graphical format, can be reviewed and/or printed when required for reporting purposes. the operator may also find graphical illustration of the data useful when assessing the effect of individually monitored parameters, such as iron, on air stripping efficiency.

The program will be designed to assist in correlating data with the "Daily Operations Report" discussed in Section 3.2.3 and the "Organic Analysis Report" discussed in Section 3.2.5. Regulatory discharge requirements

(current in August 1991), applicable to this effluent will also be tabulated for quick comparison and operator action, if indicated.

3.2.6 Organic Analysis Report

Overall treatment performance at this facility is measured by the amount of volatile organic compounds (VOCs) removed during the air stripping process. Regular monitoring for VOCs of the effluent stream from the air stripper will assist in determining whether regulatory discharge requirements are being satisfied. Comparison of effluent testing data to additional data from the influent side of the air stripping tower will indicate the VOC removal efficiency of the air stripper, and will assist in establishing air/water ratios and the frequency of the acid rinse cycle.

Control of the gas chromatograph operation and data management is maintained by Turbochrom 3, a proprietary software package offered by Perkin Elmer with their equipment.

As discussed in Section 3.2.3d, each report will have an individual identification number for retrieval purposes. Aside from entering this basic informational data, the Turbochrom 3 based report will be processed and stored automatically by the laboratory computer, as it receives the VOC analyses directly from the gas chromatograph.

Due to the large amounts of data collected, a computer program will be developed to assist in managing and displaying the data in a meaningful manner. This program ("Organic Analyses Report," Version 1.0 (not complete)) will incorporate a number of useful functions designed to minimize computer memory requirements, preserve data integrity and facilitate the production of daily printouts and graphical displays.

This program will be designed for use with specially designed spread sheet files (one spread sheet file for each parameter of interest). After automatic data entry for a particular date/sample on the worksheet template, the program will also automatically store each parameter in the appropriate spread sheet file when the template data is archived. This method of data storage minimizes the amount of computer memory required and facilitates retrieval of data for printout. Figure 3.F illustrates the format used for reporting purposes.

In addition, monthly and quarterly graphical displays will be preconstructed in each spread sheet file. Each spread sheet file and graphical display will be automatically updated when data is archived. Therefore, up-to-date data, presented in a graphical format can be reviewed and/or printed when required for reporting purposes. the operator may also find graphical illustration of the data useful when assessing the efficiency of the air stripper in removing individual VOCs of interest.

The program will be designed to assist in correlating data with the "Daily Operations Report" discussed in Section 3.2.3 and the "Inorganic Analysis Report" discussed in Section 3.2.4. Regulatory discharge requirements (current in August 1991), applicable to this effluent will also be tabulated on the report form for quick comparison and operator action, if indicated.

TOWN OF OYSTER BAY

Department of Public Works
Groundwater Treatment Facility
ORGANICS ANALYSIS REPORT

Chemical Constituent	Concentration Allowed	Measured
Total VOCs	100	
Benzene – ND	0	
Bromodichloromethane	50***	
Bromoform	50***	
Carbon Tetrachloride	5	
Chlorobenzene	5	
Chlorodibromomethane	50***	
Chloroethane	5	
Chloroform	100***	
Dichlorobenzene o&p		
Dichlorobenzene o,m&p	50	
1,1 Dichloroethane	5	
1,2 Dichloroethane	5	
1,1 Dichloroethene	0.07	

Chemical Constituent	Concentration Allowed	Measured
1,2 Dichloroethene cis	5	
1,2 Dichloroethene trans	5	
1,2 Dichloropropane	5	
Ethylbenzene	5	
Methylene Chloride	5	
Tetrachloroethene	0.7	
Toluene	5	
1,1,1 Trichloroethane	5	
Trichloroethylene	5	
Vinyl Chloride	1	
Xylene o	5	
Xylene, m&p	5	
Xylene, o,m&p	50	

FIGURE 3-F

3.3 SAMPLING SCHEDULES AND ANALYTICAL PROCEDURES

3.3.1 Sampling Schedules

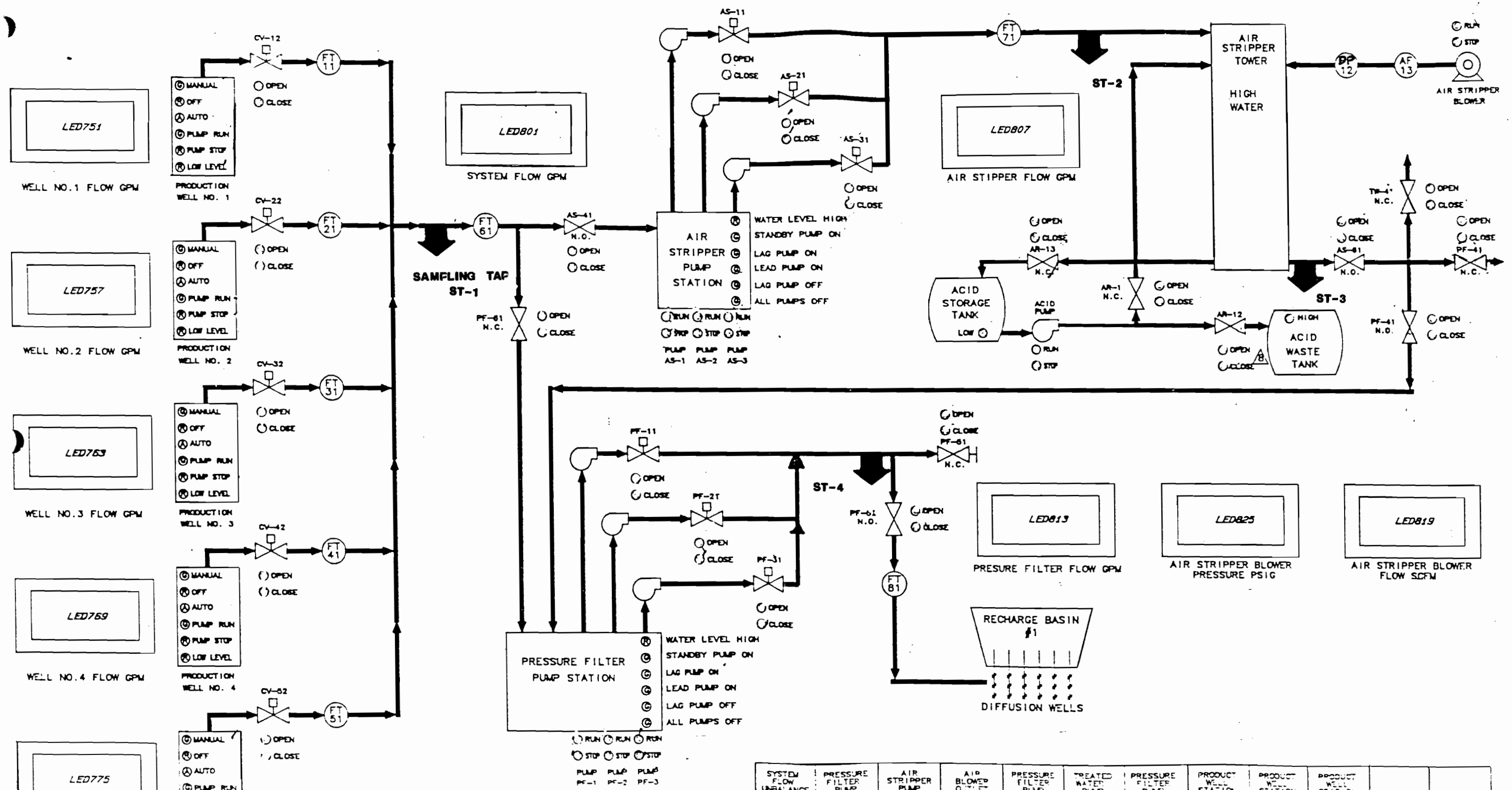
During normal operation, the following basic sampling and inspection schedule is recommended:

Sampling Location	No.	Recommended Sampling Parameters	Sampling Frequency
Plant Influent	ST-1	Not utilized at this time.	
Air Stripper (Influent)	ST-2	VOC's, Fe, Mn, pH, DO, NH -N	Daily for VOC's, twice weekly for other parameters
Air Stripper (Effluent)	ST-3	VOC's, Fe, Mn, pH, DO, NH -N	Daily for VOC's, twice weekly for other parameters
Plant Effluent	ST-4	pH, DO	Daily for pH, twice weekly for DO
Production Wells	PW1-4	VOC's, Fe, Mn, pH, ORP, NH -N	Weekly (N4 -N when air stripper effluent exceeds 10.0 ug/l)
Air Stripper		One representative piece of packing for inspection	Weekly (when influent ion influent concentration exceeds 0.5 ug/l)

This schedule may be modified to fit the facility schedule. It may be reduced by about half during periods when the analytical data shows little sample to sample variation. Sampling locations can be readily determined using Figure 3.G.

FIGURE 3-G

SAMPLING POINTS



SYSTEM FLOW UNBALANCE	PRESSURE FILTER PUMP STATION BYPASS VALVE OPEN	AIR STRIPPER PUMP STATION LEVEL HI HI	AIR BLOWER OUTLET PRESSURE HIGH	PRESSURE FILTER PUMP STATION INFLUENT VALVE CLOSED	TREATED WATER PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HI HI	PRODUCT WELL STATION NO. 1 LEVEL LOW	PRODUCT WELL STATION NO. 3 LEVEL LOW	PRODUCT WELL STATION NO. 4 LEVEL LOW		
AIR STRIPPER INFLUENT VALVE CLOSED	AIR STRIPPER PUMP STATION LEVEL HIGH	AIR STRIPPER LEVEL HIGH	AIR BLOWER SHUTDOWN	ACTIVATED CARBON PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HIGH	TREATED WATER VALVE CLOSED	PRODUCT WELL STATION NO. 1 LEVEL LOW	PRODUCT WELL STATION NO. 4 LEVEL LOW			

(2)

3.3.2 Analytical Procedures

At the time of start-up, the laboratory was equipped to perform the following analytical procedures for the constituents listed:

Constituent	Method
pH	Electrometric
Oxidation Reduction Potential (ORP)	Potentiometric
Iron, total soluble (Fe)	Colorimetry
Manganese, total (Mn)	Colorimetry
Ammonia (as N)	Colorimetry
Chloride (Cl)	Potentiometric
Dissolved Oxygen (DO)	Potentiometric
Aromatic Hydrocarbons (BTX)	Gas Chromotography (GC)
Volatile Halogenated Hydrocarbons	Gas Chromotography (GC)

The above constituents may be modified in the future by the need for additional operating data or by increased or decreased monitoring requirements imposed by the regulatory agencies.

Basic analytical procedures for all the inorganic testing performed in this facility are contained in the latest edition of "Standard Methods for the Examination of Water and Wastewater," (currently the 17th edition, 1989), APHA-AWWA-WPCF. When using test kits, more specific procedures will be contained in the manufacturers instructions, packaged with their equipment.

Additional basic analytical procedures for all organic testing are contained in the laboratory manual developed by Lockwood, Kessler & Bartlett, Inc. More complete information will be found in the Turbochrom user's manual supplied with the gas chromatograph.

SECTION 4
PERFORMANCE EVALUATION, PROBLEM DIAGNOSIS

4.1 PERFORMANCE EVALUATION

- The Treatment Plant performance evaluation will be actually the performance of the air stripper tower which is the only process unit which provides the actual removal of the contaminants existing in the groundwater. Although the air stripper tower performance is complex and sensitive to a number of variables associated with the process, it can usually be related to its internals, mainly the packing media, the uniformity of the distribution of the water and the air-to-water ratio.

- The efficiency of the VOCs removals which are usually monitored, will serve as a basis for performance evaluation. Thus it is important for personnel responsible for evaluating or maintaining air stripper performance to keep good records and to understand the significance of these recorded values.

- Proper evaluation of the data may have a significant effect on both short- and long-term performance as well as maintenance requirements.

- Difficulties often arise in the interpretation of the data because Treatment Plant personnel may not realize what is "Normal" for an air stripper, or because they do not understand the importance of the values for air stripper performance.

- Establishing what is "Normal, Good Performance" through good recordkeeping practices helps to provide a data base against which responsible personnel may compare daily operating values. This "Baseline" condition serves as a benchmark against which to

compare changes in operating conditions and to help decide what effect, if any, these changes have had on the performance.

- A further complication in the evaluation of performance is that a change in operating characteristics (i.e. change in water or air flows, which also will change the air-to-water ratio) may be a symptom of not just one problem, but several unrelated problems. This sometimes makes it difficult to decide what the initial failure was and what corrective action is needed.

- Uses of available data in evaluating the performance and diagnosing the more common problems and the corrective actions available for both long- and short-term improvement of performance will be described in this section. Much of the long-term improvement relies on good record keeping practices (both operation and maintenance records).

- Part of the evaluation of performance will result in comparing the removals of the VOCs that were predicted, in order to comply with Consent Decree requirements, and with those obtained during Tower operation under various conditions: i.e. changes in air-to-water ratio, status of the packing media, mist eliminator, etc.

- Special attention should be given to precipitation of iron on the packing media, which will be a concern because of clogging conditions which might occur. To obtain this status, a close watch should be kept on the results of the analysis for iron in the influent and effluent.

A simple calculation like:

[mg/l iron (influent)-mg/l iron (effluent)] X 0.012 X GPM (water flow)

will indicate the amount of LBS/DAY of iron which remains in the packing media. As an example: assume: Iron in influent = 1.0 mg/l; Iron in effluent = 0.5 mg/l, and 1,000 GPM. The formula will indicate (1.0-0.5) x 0.012 X 1,000 = 6.0 lbs/day.

- While observing the effect of iron deposited on the packing media, the differential pressure should be carefully monitored, knowing that at about 8.5 to 9 inches of water, the Tower should be acid rinsed.

- Most of the performance changes that occur are reflected in the quality of the effluent which is monitored and controlled by periodic testing. These changes can be caused, as it was mentioned before, by internal conditions related to the packing media, air-to-water ratio, and air flow which is blown into the tower. Monitoring and recording the pertinent operating parameters are important aspects of a performance operation.

- No single parameter should be used to evaluate performance; a combination of factors is more likely to be reliable. Although some parameters are more important and have greater effect than others, it is usually the combination of the parameters, that determine performance of this air stripper.

Section 3 of this Manual, indicates the effluent limitations for Volatile Organic Compounds (VOCs) and organics.

Performance should be evaluated by comparing the actual test results for the influent and effluent versus the required effluent concentrations, as shown in Section 3.

4.2 TROUBLESHOOTING

In general, the supplier's O&M's will indicate some of the most outstanding problems which might be found for each piece of equipment. However, the following procedures can be used for any kind of problem evaluation.

The first step in troubleshooting will be to determine if the facility is meeting design performance standards. This will be done by comparing the plant effluent quality and overall efficiency with that listed on the Design and/or Consent Decree. If the Facility does not always operate correctly, the problem usually falls under one of the following causes:

- o incorrect air-to-water ratio;
- o iron deposits on the packing media;
- o poor laboratory control;
- o mechanical/electrical/instrumentation failure; and
- o poor operation and maintenance procedures.

Once the problem area has been defined, the cause of the problem should be identified. For example, incorrect air-to-water ratio may be caused by a lower amount of air supplied to a high water flow.

The troubleshooting information found in each supplier's O&M manual, which are part of this Manual will help to identify and solve common problems with each piece of equipment.

For problems not covered in the above mentioned references, and if the maintenance personnel cannot solve the problem, further inquiry should be made with the actual equipment supplier, whose telephone numbers are indicated in this Manual.

4.3 CORRECTIVE ACTIONS

Corrective actions can be defined as work required for repairs and non routine activities. The maintenance personnel must always be ready to handle these work tasks as equipment failures occur and emergency conditions arise. A review of equipment will aid in determining what failures may occur.

A review of these potential failures will aid in determining spare parts and equipment required to correct these problems, should they arise.

Procedures for performing corrective actions should follow the manufacturers' recommendations for disassembling and assembling their items of equipment. Manufacturers frequently provide troubleshooting checklists for use with their equipment. These troubleshooting guides should be readily available to persons performing corrective actions.

Also, when data collected indicates that a problem exists, plant personnel must decide what action should be taken. Sometimes the initial cause of the problem is hard to define, even though results and symptoms clearly indicate their existence. In other cases, the problem is easily identifiable, but more than one choice for corrective action is available. The options available to plant personnel for the various problem areas will arise during the operation of the plant. This part of corrective actions should be expended by the plant personnel, who will indicate in detail, describing the cause of the problem and what actions they took to correct the situation.

SECTION 5
O&M PRACTICES

5.1 OPERATING PRACTICES

Operating practices can significantly affect daily and long-term systems performance. Only the most general of practices can be presented here, and their characteristics must be considered in the establishment of operating practices and procedures.

These practices should cover most of the situations expected to be encountered, and personnel should be trained so that these practices become routine.

Part of the operating practices is the start up procedure. Start up can greatly affect the subsequent operation of the systems and it is as important to performance, as daily operating checks and maintenance practice.

Start up is not part of this manual, but has been presented in a separate book and put together by the General Contractor. Based on the Contract Documents Requirements, the General Contractor should operate the systems in its entirety for a period of fourteen (14) days, and place all equipment installed by him into successful operation.

The following operating practices will be fully described under subchapters; normal operation (which is actually similar to the start up procedure), low flow operation, air stripper fouling control operation, and shutdown practices under normal and emergency conditions.

5.1.1 Normal Operation (Routine)

Normal operation will include the plant operation when all five production wells are pumping the design flow to the treatment building, where the air

NORMAL OPERATION

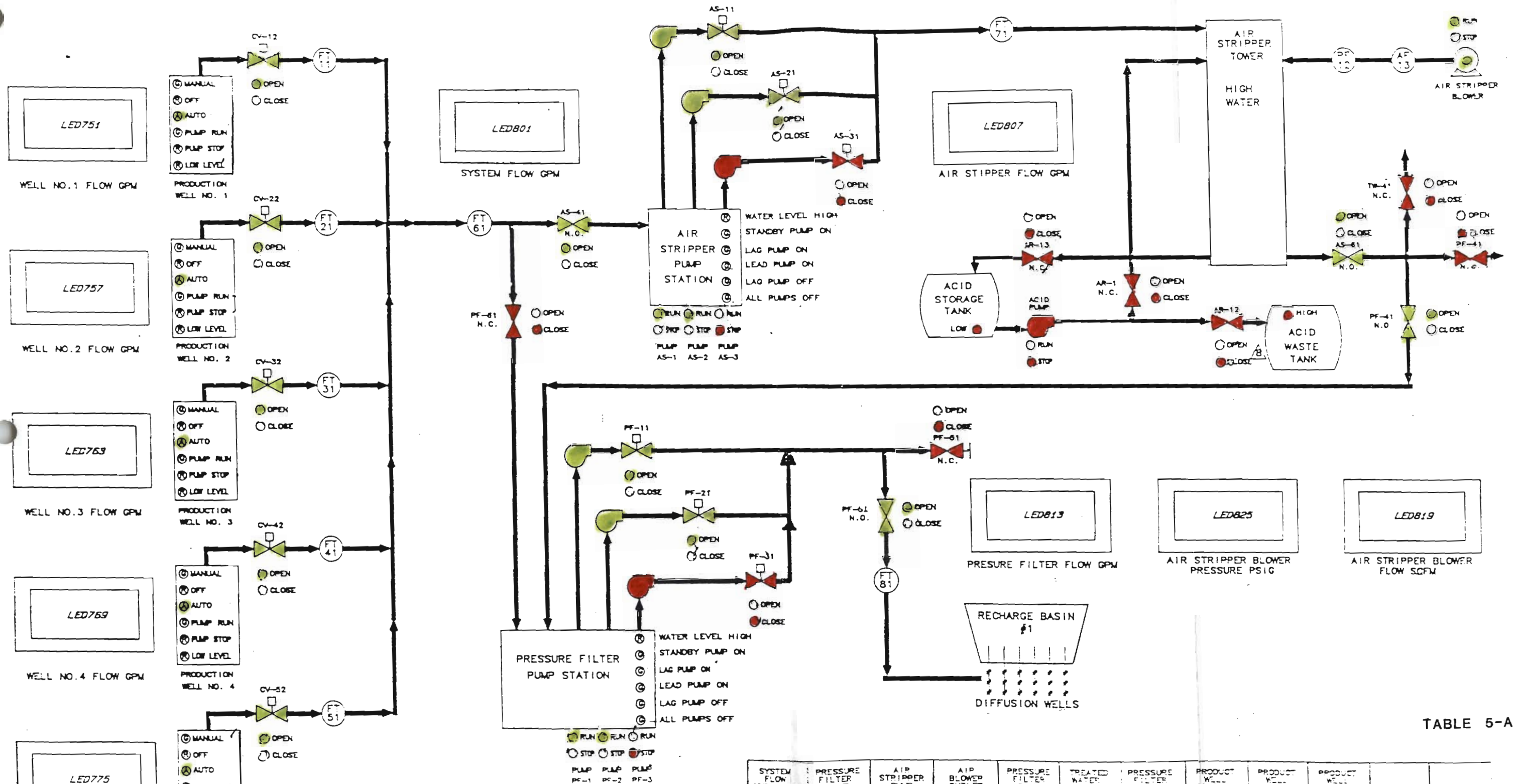


TABLE 5-A

SYSTEM FLOW UNBALANCE	PRESSURE FILTER PUMP STATION BYPASS VALVE OPEN	AIR STRIPPER PUMP STATION LEVEL HI HI	AIR BLOWER OUTLET PRESSURE HIGH	PRESSURE FILTER PUMP STATION INFLUENT VALVE CLOSED	TREATED WATER PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HI HI	PRODUCT WELL STATION NO. 1 LEVEL LOW	PRODUCT WELL STATION NO. 4 LEVEL LOW	PRODUCT WELL STATION NO. 5 LEVEL LOW		
AIR STRIPPER INFLUENT VALVE CLOSED	AIR STRIPPER PUMP STATION LEVEL HIGH	AIR STRIPPER LEVEL HIGH	AIR BLOWER SHUTDOWN	ACTIVATED CARBON PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HIGH	TREATED WATER VALVE CLOSED	PRODUCT WELL STATION NO. 1 LEVEL LOW	PRODUCT WELL STATION NO. 4 LEVEL LOW			

stripper pumps will pump the flow toward the air stripper. The treated effluent is collected into the filter pump wet well and discharged back into the ground through the diffusion wells.

Step by step operation will be as follows:

1. All the valves should be positioned in open or closed position, as shown in the attached schematic. The actual position for each valve will be indicated in the graphic display at the console in the control room.

2. Air stripper and filter pumps should be positioned on automatic.

3. Air blower should be on automatic position too.

4. If the water level for each production well is as indicated in the following table, the pump will be started manually. At the same time, the operation of bringing in line each well will be monitored from the control console located in the treatment plant. The recommended pump protector settings for the production wells, are as follows:

Production Well No.	Elevation of Pump Protector Off Setting (ft. msl)	Elevation of Pump Protector on Setting (ft. msl)
1	39.0	58.5
2	38.5	58.5
3	39.0	58.5
4	43.0	58.5
5	43.0	59.0

ft. msl - feet above mean sea level.

The control valve at each well CV/12, CV/22, CV/32, CV/42 and CV/52) should be automatically controlled from the treatment plant. The automatic control, will use the capability of throttling the valve, in order to obtain the design flow, as indicated on the display.

5. Each well has a flow meter and transmitter, which is sending information to the control panel. At this time, a check of the flow coming from each well should be performed. Check and compare the flow recorded from each transmitter (FT/11, FT/21, FT/31, FT/41 and FT/51) with the reading at the plant influent flow meter FT/61.

   An audible and visual alarm will be energized if the plant influent flow is less than the total flow pumped from the five production wells (within a predetermined allowable difference, established to be $\pm$ 5 percent of the design flow, or about 52.5 GPM for the design flow of 1,050 GPM.

6. Check the position of the influent valve to air stripper pump station (AS/41). It is a manually operated, normally open valve. If this valve is closed, the operation of the production well pumps are overridden, and audible and visual alarms activated at the control console.

7. Check the position of the valve to the filter pump station (PF/41). It is a manually operated, normally open valve. If this valve is closed, the operation of the production well pumps are overridden, and audible and visual alarms, activated at the control console.

8. At air stripper pump station for normal operation, two pumps (AS/1 and AS/2) will be on, and one pump (AS/3) will be off. Individual pump operation will be automatically alternated on a timed basis from the pump control panel to provide even wear on all three pumps.

WARNING:

DO NOT START THE PUMPS BEFORE AIR BLOWER IS ON

Pumps operation will be as follows:

- At high water level (HL 1/61), pump AS/1 is turned on, after air blower has been operating for minimum 30 to 60 seconds.

- At high water level (HL2/61), pump AS/2 is turned on, when flow increased over the capacity of pump AS/1.

- At high water alarm (HW/61), pump AS/3, the standby unit is turned on, and activates an audible and visual alarm at console board.

- At high water alarm #2 (HH61), the five production well pumps will be shut down and activates an audible and visual alarm at the console board.

- At low water level (LL/61), pumps AS/1 and AS/2 and air blower turn off. An override will allow air blower to be turned off manually.

- At low water level (LL1/61), pump AS/3 turns off.

While the air stripper pumps are operating, the motor operated valves AS/11, AS/21 and AS/31, located on the discharge pipe of each pump can be opened or closed from the control room.

When the air stripper pumps are off, the air blower will be turned off manually.

9. High water alarm (AS/51) installed at the air stripper will activate visual and audible alarm in control room and shut down the following:

   - production well pumps
   - air stripper pumps (AS/1, AS/2 and AS/3)
   - air stripper blower (AB/14)

10. Air Blower Operation:

10.1 The air blower is a direct-drive unit and will always operate at 1,700 RPM. The volume of the air moved by the air blower is a function of the total static pressure which this blower must overcome in order to deliver the desired volume of air.

10.2 To determine the required amount of air versus the water flow passing through the air stripper, the following steps should be followed:

1. From Figure 1, determine the air flow requirements (CFM) for the selected flow of water (GPM). For example, for a water

AIR FLOW vs WATER FLOW

FIGURE 1

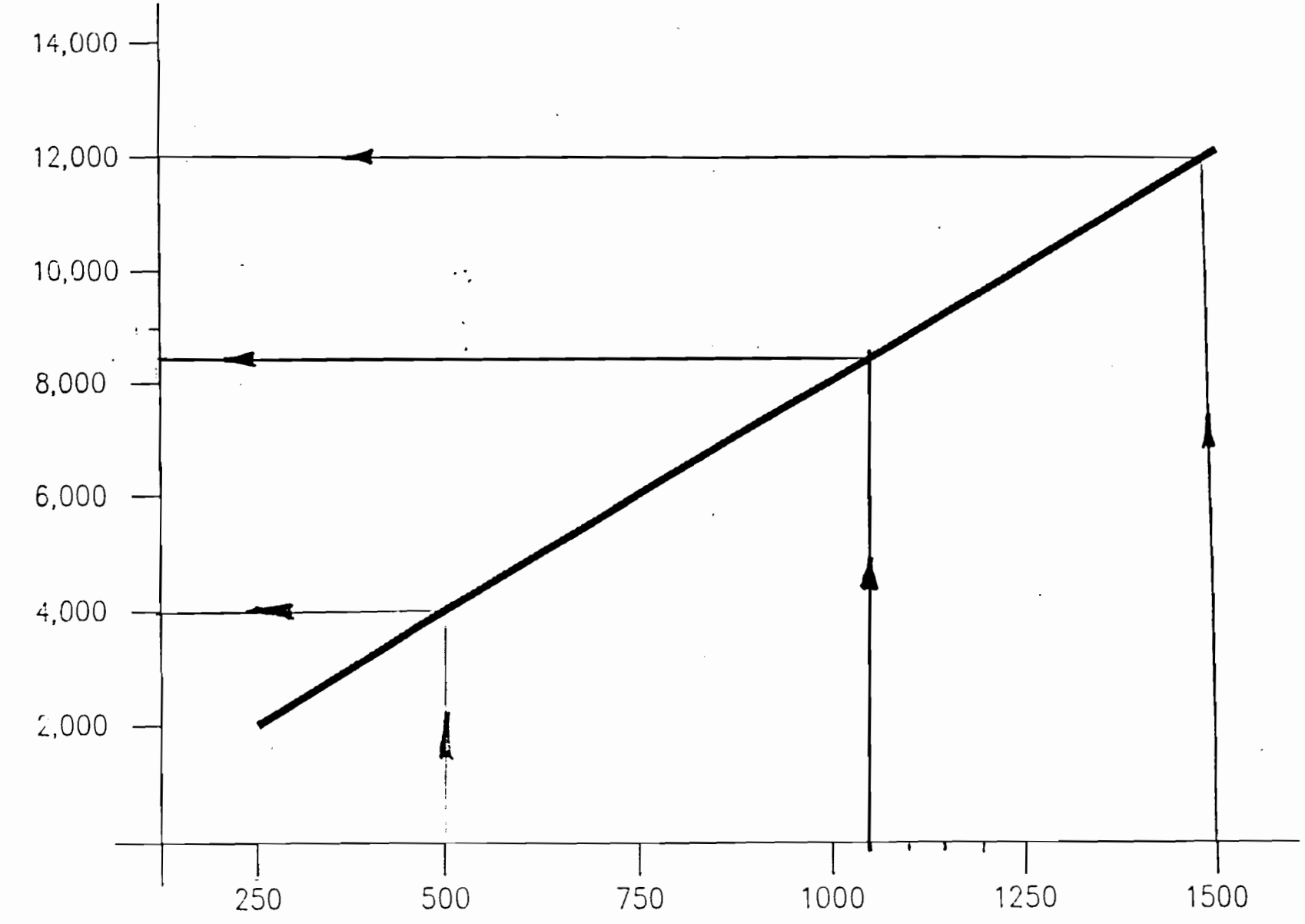


FIGURE 5-B

nyb | The New York Blower Company

PERFORMANCE CURVE

FIGURE 2

TO DETERMINE PERFORMANCE AT ANOTHER RPM MULTIPLY:

1 - CFM x K
2 - SP x K^2
3 - BHP x K^3

WHERE K IS NEW RPM DIVIDED BY RPM SHOWN AT RIGHT.

CUSTOMER'S NO. _____
CUSTOMER WRIGHT
TAGGING _____
SIZE 30 85%HW TYPE ACF SW WHEEL
12000 CFM AT 9 SP AT .075 Dens.
AT 1770 RPM AT 21.5 BHP
FILE NO. _____ DATE 10-17-1990

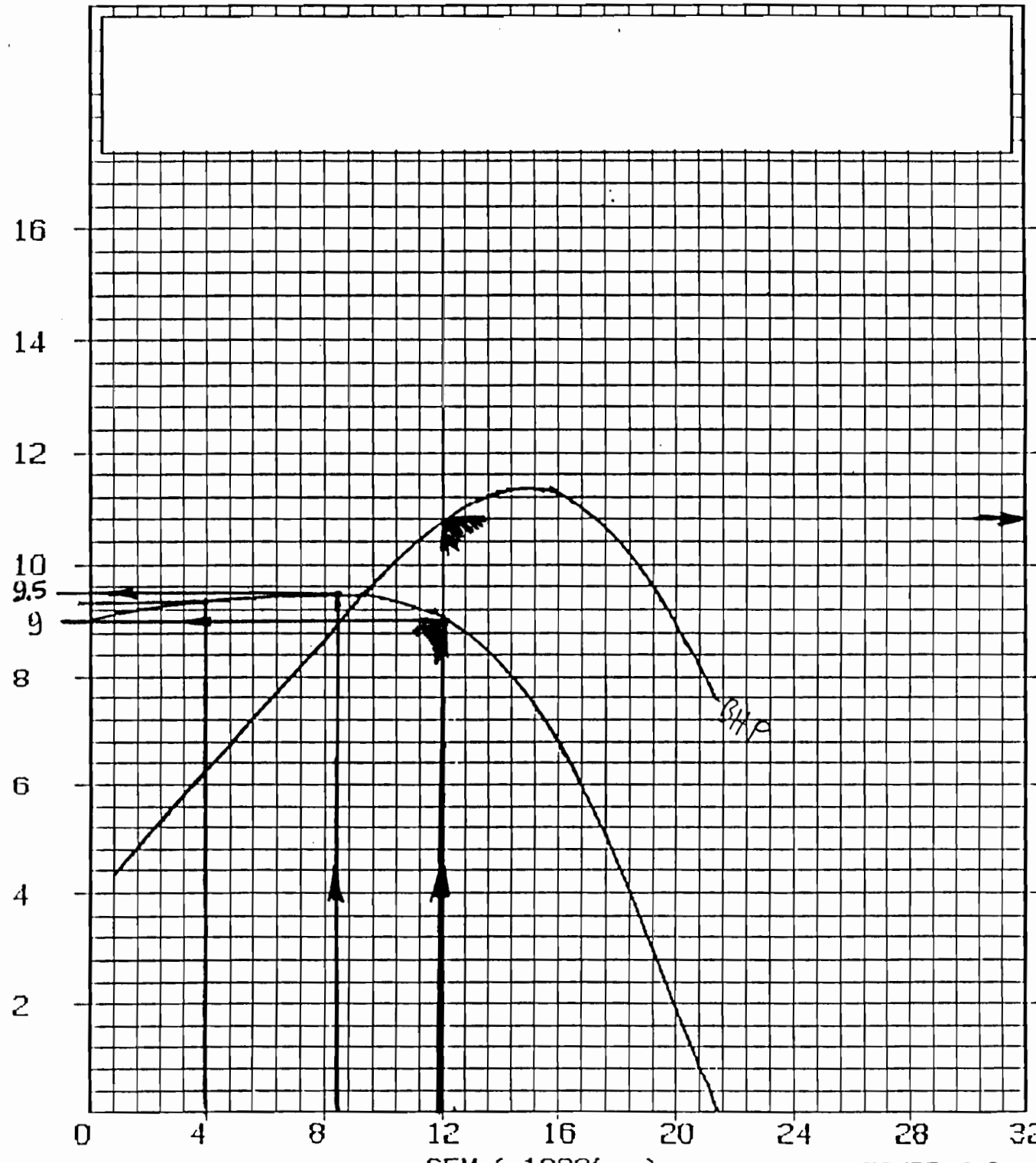


FIGURE 5-C

flow rate of 500 GPM, the required amount of air flow will be 4,000 CFM.

2. From Figure 2, air blower performance curve for the air flow, the static pressure at the duct inlet will be obtained. For example at 12,000 CFM, the static pressure will be 9.0-inch of water.

10.3 To obtain the proper air flow which will be provided in the air stripper, the inlet vane damper should be opened or closed. The air blower performance curve will be altered by the opening or closing of the inlet damper. The blower curve will be correct only for an entirely open inlet damper. As the damper is closed, the performance curve will not only be shifted to the left of the chart, but will actually change shape. The magnetic pressure gauge provided on the outlet side of the air blower is intended as a visual check for excessive increase in static pressure.

10.4 The air blower, as designed, is suitable for full range of water flow (500 to 1,050 GPM). Differential pressure gauge DP/12 with a range of 0-20 inches of water is located in the air blower intake with reading at the instrument.

Air blower shut down should activate an audible and visual alarm at the control panel, and turn off the production well pumps and air stripper pumps (AS/1, AS/2 and AS/3).

11. Operation of Filter Pumps:

Effluent discharging from the air stripper will reach filter pump station through the following steps:

11.1 Check the position of valve (AS/61) on air stripper effluent pipe. It is manually operated and normally open. If the valve is closed, a limit switch will override the operation of the air stripper pumps and production well pumps.

11.2 Check the position of influent valve (PF/41) to filter pump station wet well. It is manually operated and normally open. If the valve is closed, an audible and visual alarm should be activated at the control panel.

11.3 Check the position of valve (AC/41) to the future activated carbon pump station. It is manually operated and normally closed. If the valve is open, audible and visual alarms should be activated at the control panel, and the operation of the production well pumps and air stripper pump station pumps will be overridden.

11.4 Check the position of valve (TW/41) to the future treated water pump station. It is manually operated and normally closed. If this valve is open, an audible and visual alarm should be activated at the control panel, and the operation of the production well pumps and air stripper pump station pumps will be overridden.

With all these valves in the normal operating positions as described above, treated water effluent will reach the filter pump station wet well.

11.5 At filter pump station for normal operation, two pumps (PF/1 and PF/2) will be on, and one pump (PF/3) will be off. Individual pump operation will be alternated on a timed basis to

provide even wear on all three pumps. Pump operation is controlled by level control (LC/71) with manual override from control panel.

11.6 Pumps operation will be as follows:

- At high water level (HL 1/71), pump PF/1 is turned on.

- At high water level (HL 2/71), pump PF/2 is turned on when flow increased over the capacity of pump PF/1.

- At high water alarm (HW/71 pump PF/3, the stand by unit is turned on, and activates an audible and visual alarm at the control panel.

- At high water alarm #2 (HH/71), shuts down the air stripper pump station pumps (AS/1, AS/2 and AS/3) and production well pumps and activates an audible and visual alarm at the control panel.

- At low water level (LL/71), plumps PF/1 and PF/2 are turned off.

- At low water level (LL 1/71), pump PF/3 turns off.

- During pumps operation, valve (PF/52) is manually operated and normally open. If the valve is closed, the operation of

the production wells, air stripper pumps and filter pumps should be overridden, and an audible and visual alarm should be activated at the control panel.

- Valve (PF/51) is manually operated and normally closed. If the valve is open, an audible and visual alarm should be activated at the control panel, and the operation of the production well pumps, air stripper pumps and filter pumps should be overridden.

- Check flow meter readings for: FT/11, FT/21, FT/31, FT/41, FT/51. Total for these meters should be within $\pm$ 5 percent reading from FT/61. Check flow reading for FT/71 and FT/81. Indicate reading in GPM, except FT/81, which will be in gallons. During normal operation of the filter pumps, visual observation at the recharge basin where diffusion wells are located, should be maintained periodically to establish if diffusion wells are working and treated water is infiltrating back into the ground.

- As mentioned previously in this manual, continuously monitoring the flow and also the efficiency of the treatment is the most important tasks of the maintenance staff. The two elements: flow and performance will decide if the normal operation, known also as routine operation, can be maintained throughout the daily operation without any changes in the way the equipment operates.

5.1.2 Low Flow Operation

Low flow operation is referred to in the plant operation when only two to three production wells are pumping low flow, usually requiring either only one pump operation in the air stripper and filter pump stations, or operating two pumps with throttling valve PF-52, on the main header.

Step by step operation will be similar to the one described under "normal operation" with a few adjustments:

1. Check that the correct control valves at the operating pumps in the air stripper and filter pump station are positioned to allow pumping the amount of water required.

2. Check the opening of the inlet vane damper, which is supposed to handle a smaller amount of air flow toward the air stripper.

3. Check the two Figures 1 and 2, indicating the air flow versus water flow, and air flow versus static pressure in inches of water.

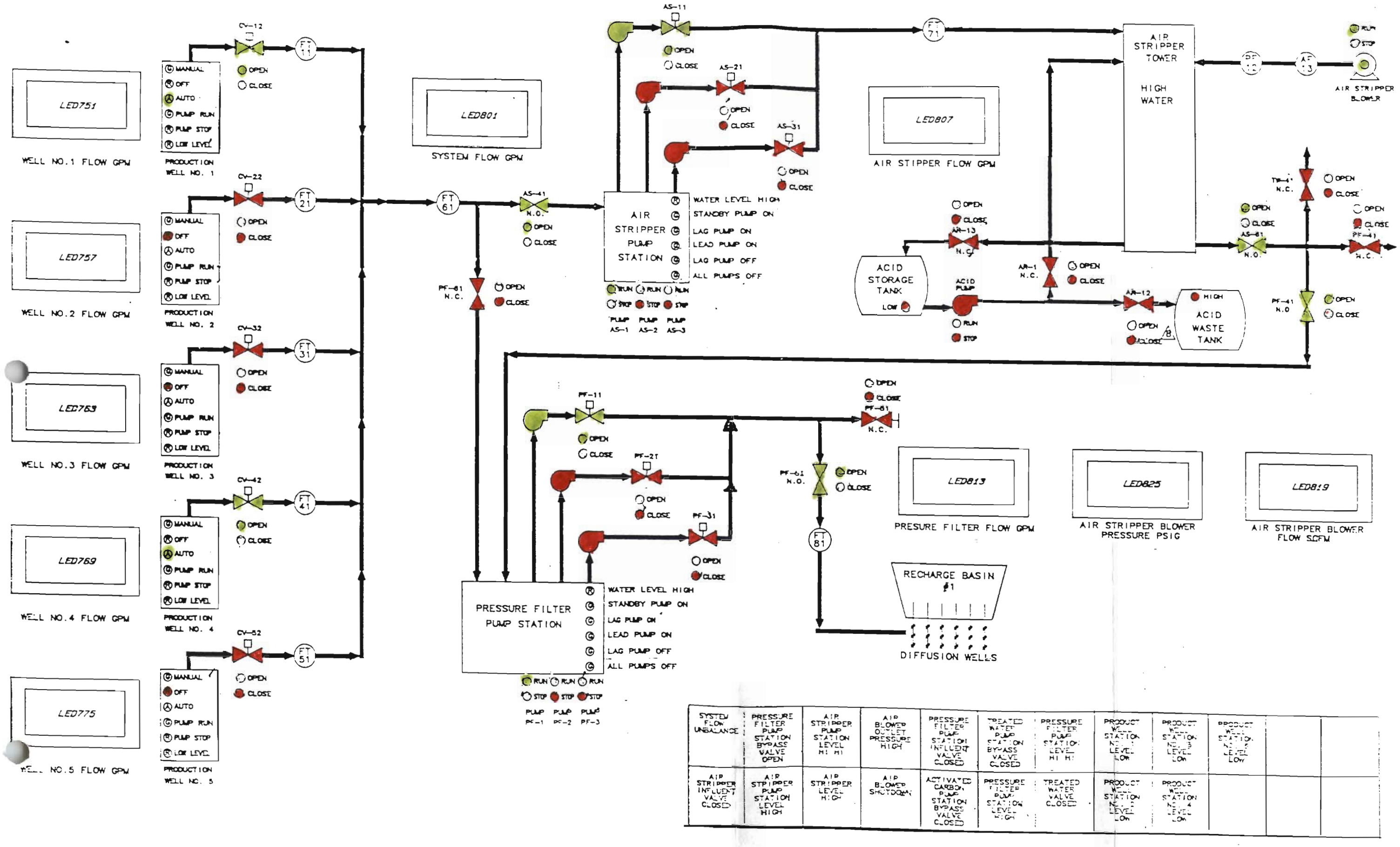
4. Check the air differential pressure gauge DP/12, for the actual pressure.

5. Check the status of the valves on the discharge piping from the pumps in air stripper and filter pumping stations.

All the operations will be conducted in the same way as described under "normal operation" subchapter.

TABLE 5-D

LOW FLOW OPERATION



SYSTEM FLOW UNBALANCE	PRESSURE FILTER PUMP STATION BYPASS VALVE OPEN	AIR STRIPPER PUMP STATION LEVEL HI HI	AIR BLOWER OUTLET PRESSURE HIGH	PRESSURE FILTER PUMP STATION INFLUENT VALVE CLOSED	TREATED WATER PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HI HI	PRODUCT WELL STATION NO. 1 LEVEL LOW	PRODUCT WELL STATION NO. 3 LEVEL LOW	PRODUCT WELL STATION NO. 5 LEVEL LOW		
AIR STRIPPER INFLUENT VALVE CLOSED	AIR STRIPPER PUMP STATION LEVEL HIGH	AIR STRIPPER LEVEL HIGH	AIR BLOWER SHUTDOWN	ACTIVATED CARBON PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HIGH	TREATED WATER VALVE CLOSED	PRODUCT WELL STATION NO. 2 LEVEL LOW	PRODUCT WELL STATION NO. 4 LEVEL LOW			

5.1.3 Air Stripper - Fouling Control

The air stripper contains no moving mechanical parts or electronics, and therefore requires minimal maintenance. However, fouling of the air stripper internals can occur under the operating conditions of the facility. The need for maintenance to control fouling is based on physical observations and to some extent on the analyses performed in the onsite laboratory.

Fouling in this facility is caused by the formation of iron oxides and bacterial colonies. An acid rinse system has been incorporated into the operation, and is designed to control fouling by dissolving chemical deposits and destroying bacterial growth.

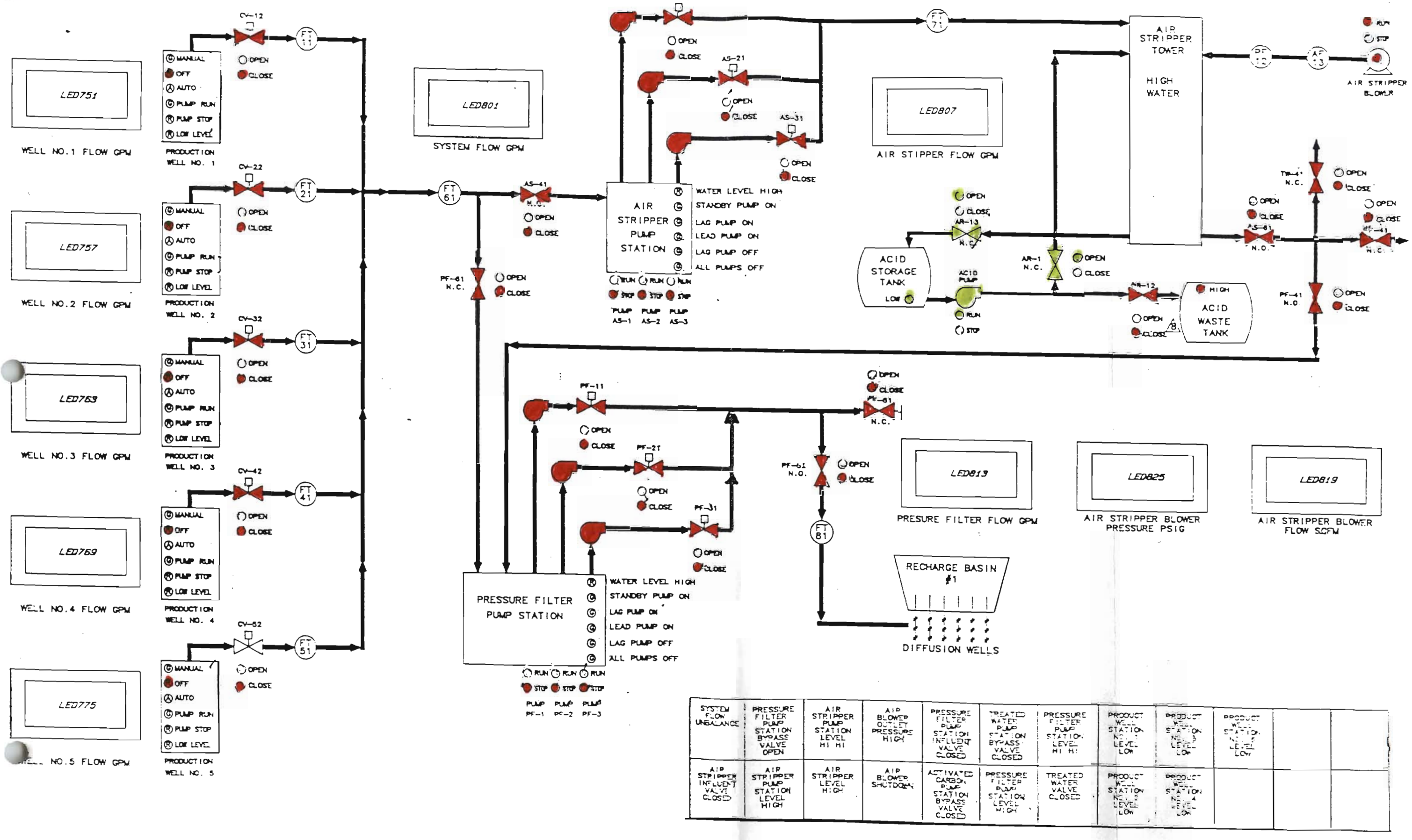
5.1.3.1 Inspection Procedure

The influent to the air stripper overflows weirs and at the top of the stripper tower. Inspect the weirs for level, checking that flow does not preferentially spill over one side or one end. Check that no buildup of grit or slime is occurring inside the weir. Much material can be removed with a long handled mop. It is normal for some rust-like staining to appear and is related to the iron content in the groundwater.

The packing used in this air stripper are open spheres. The packing is formulated from a polypropylene resin and is not degraded by the groundwater or most inorganic chemicals. However, the packing will collect a rust-like coating related to the oxidation of the dissolved iron in the groundwater as it passes through the tower. Since the reaction, in this instance, is not oxygen limiting, the rate of iron buildup will be related to the concentration of iron in the groundwater. In addition, the iron coating in the packing will support bacterial growth. If the iron coating with or without bacteria attached is not removed regularly, the packing media will

AIR STRIPPER FOULING CONTROL

TABLE 5-E



SYSTEM FLOW UNBALANCE	PRESSURE FILTER PUMP STATION BYPASS VALVE OPEN	AIR STRIPPER PUMP STATION LEVEL HI HI	AIR BLOWER OUTLET PRESSURE HIGH	PRESSURE FILTER PUMP STATION INFLUENT VALVE CLOSED	TREATED WATER PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HI HI	PRODUCT WELL STATION NO. 1 LEVEL LOW	PRODUCT WELL STATION NO. 3 LEVEL LOW	PRODUCT WELL STATION NO. 5 LEVEL LOW		
AIR STRIPPER INFLUENT VALVE CLOSED	AIR STRIPPER PUMP STATION LEVEL HIGH	AIR STRIPPER LEVEL HIGH	AIR BLOWER SHUTDOWN	ACTIVATED CARBON PUMP STATION BYPASS VALVE CLOSED	PRESSURE FILTER PUMP STATION LEVEL HIGH	TREATED WATER VALVE CLOSED	PRODUCT WELL STATION NO. 2 LEVEL LOW	PRODUCT WELL STATION NO. 4 LEVEL LOW			

begin to clog, resulting in a drop-off of air stripper efficiency and the ultimate cessation of flow. The packing is ready to be acid washed when a representative piece of packing shows a continuous brown iron oxide coating with little or none of the original translucent white color showing through.

The acid solution is directed to the top of the stripper tower through spray nozzles mounted above the overflow weirs. These nozzles are manufactured from PVC and are impervious to the effects of hydrochloric acid. However, all spray nozzles are prone to clogging, which in this case will be noticeable as an uneven cleaning pattern in the tower. The service conditions of pumping hydrochloric acid under pressure helps to prevent clogging When a nozzle clogs, it is usually best replaced, unless the particulates are readily accessible with a pin and can be removed.

The following discussion concerns the operation of the acid rinse system.

5.1.3.2 Acid Rinse Procedure

CAUTION

This procedure involves the handling and pumping of high strength hydrochloric acid (HCl). Material Safety Data Sheets have been previously supplied to plant personnel and should be posted for easy access. Adequate first aid equipment suitable for the treatment of chemical burns should be available nearby. Each individual involved in the procedure must wear acid proof footwear, aprons and gloves. In addition, wrap-around goggles or full face shields, should be worn for eye protection.

The acid washing of the media is a manual operation. The hydrochloric acid working solution, stored in the 2,000 gallon storage tank, will be

recirculated through the air stripper tower, by the use of the acid rinse pump. This pump is manually (ON/OFF) operated.

The operation of the acid rinse pump will be overridden by either a low level indicator in the acid storage tank (AR/21), a high water level indicator in the acid waste tank (AR/22), or if valve AS/61 is open.

The acid rinse procedure is accomplished as follows:

Remove the facility from operation by shutting down:

A. All production wells, air blower, and all air stripper and filter pumps, air blower, and all air stripper and filter pumps. All the related valves should be in the position as indicated below and in Table 5-E.

B. Verify that the following valves are closed:

AR/12 - Located on the supply pipe to acid waste tank.

AR/61 - Located on the air stripper effluent pipe.

AR/41 - Located on the line to future activated carbon pump station.

TW/41 - Located on the line to future treated water pump station.

PF/41 - Located on the line to filter pump station.

C. Verify that the following valves are open:

AR/11 - Located on the acid rinse pump discharge line to air stripper tower.

AR/13 - Located on the effluent line from air stripper tower, discharging back to acid storage tank. This valve should be open only after all water collected at the bottom of the air stripper has been drained out through the valve AR-14. After the water is drained, valve AR-14 should be closed, and valve AR-13 opened.

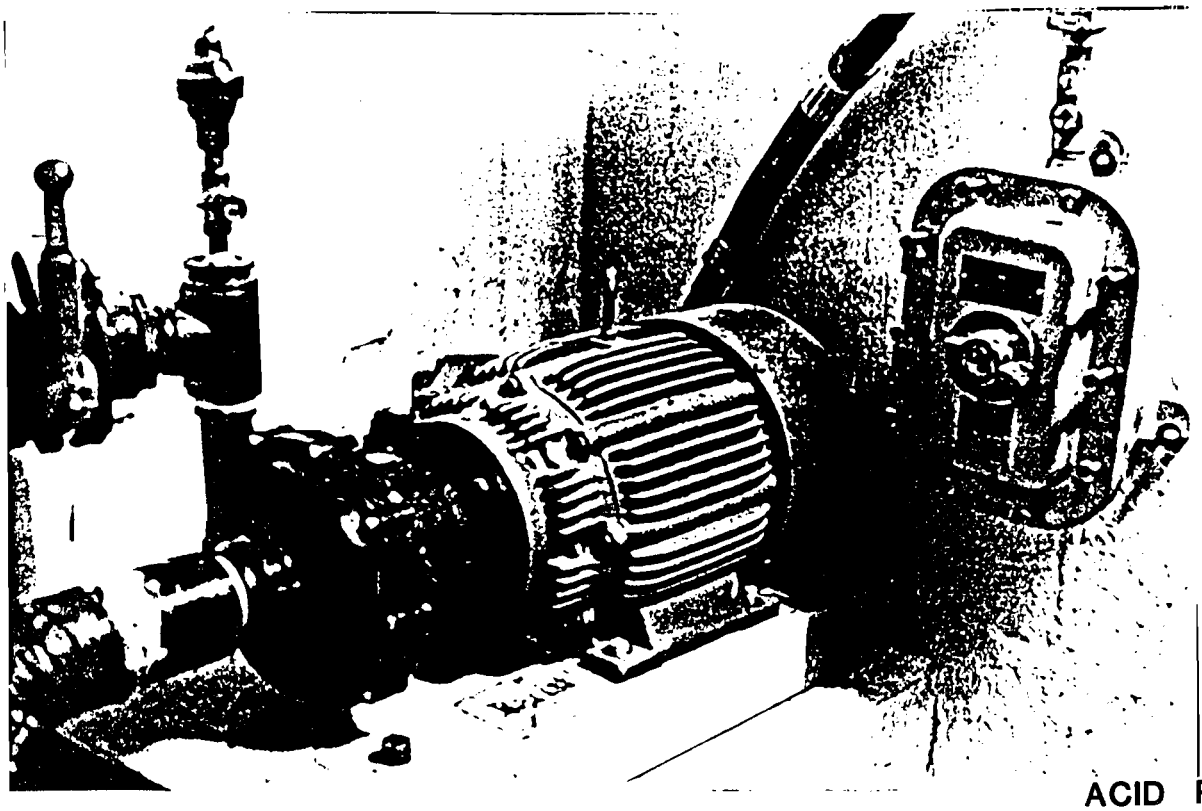
D. As the tower drains, make up a 1,500 gallon acid rinse (working) solution of 3 percent hydrochloric in water using the following technique:

1. to the empty acid tank, add water to the 1,275 gallon mark as registered by the appropriate level indicator.

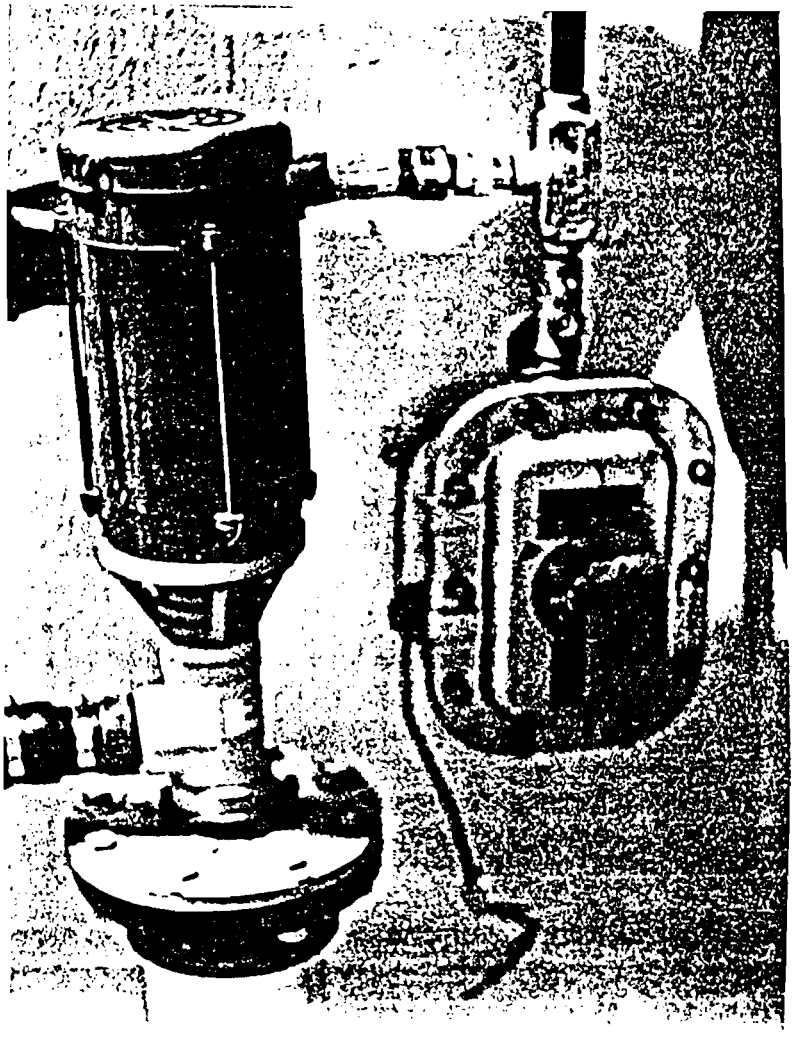
2. slowly pump the contents of four (4) drums (225 gallons) of 20 percent hydrochloric acid into the acid tank fill pipe. Always add acid to water, not the reverse.

If other acid concentrations are desired, utilize the following formula for various acid strengths, volume of working solution or new acid. Do not use greater than a 5 percent solution as recommended by the air stripper manufacturer.

$$\% \text{ Acid (Working Solution)} = \frac{\text{Gallons of Drum Acid to add}}{\text{Gallons of Working Solution Desired}} \times \% \text{ Acid (Drum Acid)}$$

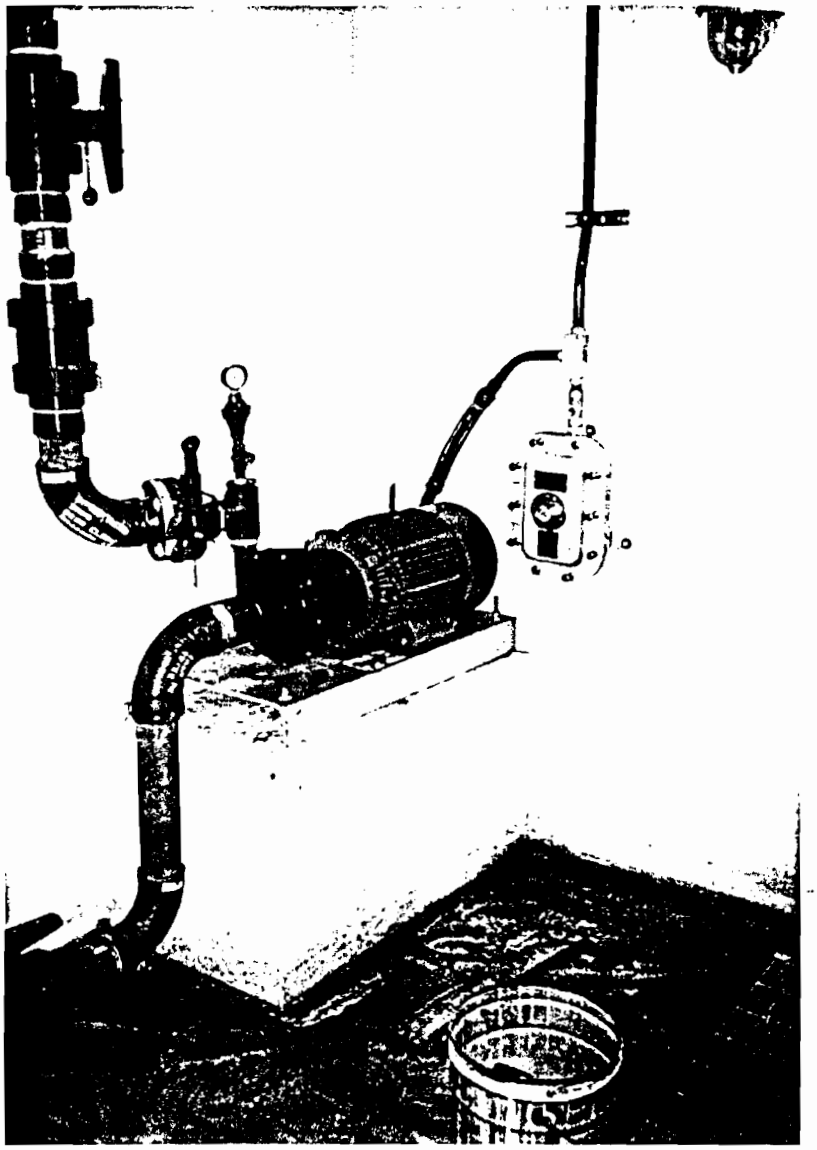


ACID PUMP



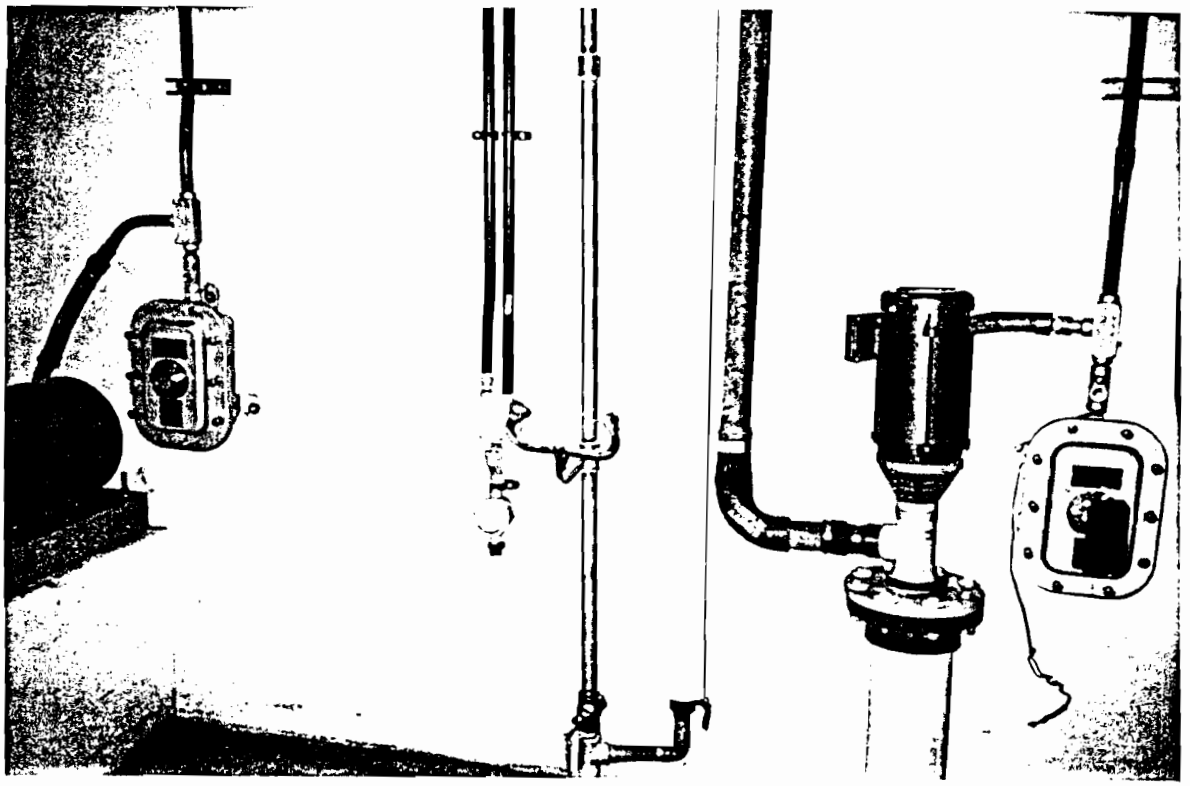
SUMP PUMP

FIGURE 5-F



ACID PUMP

FIGURE 5-G



ACID PUMP EMERGENCY SHOWER SUMP PUMP LOCATION

FIGURE 5-H

Before the acid rinse pump is started, verify that valve AR-14 is closed and valve AR-13 open.

E. Start the acid rinse pump. Observe from the floor grates above the tank that all piping is tight. About two minutes after the initiation of pumping, flow will begin to recirculate back to the tank from the stripper tower.

1. If the operator is removing samples from the tank for iron analyses (so that the progress of acid rinsing may be monitored), the following collection schedule may be helpful.

   1st hour - every ten minutes starting at t=0
   2nd hour - every fifteen minutes
   3rd, 4th, etc. hour - every thirty minutes.

2. continue the acid rinse cycle until the iron analysis have remained unchanged for one hour or the packing is the original color. The acid rinse should be continued for at least three hours, however.

3. if the top of the liquid surface begins to show a foam, the operator may add an acid resistant defoaming agent to the tank. This foam is caused by the breakup of bacterial cells.

F. when the acid rinse cycle is complete, turn off the acid rinse pump, and allow the acid to drain from the tower for thirty minutes.

1. after the acid has thoroughly drained, reverse the position of the valves set in Sections 5.1.3.2B and C.

G. Place the facility back into operation.

It is not known, at this time, what the ultimate soluble iron concentration in 3 percent hydrochloric acid will be in this operation. Therefore, the number of acid rinse cycles that can be performed in a reasonable period of time before acid depletion can not currently be predicted. In this facility, acid depletion for the purposes of acid rinsing the packing, will be considered to occur when adequate rinsing cannot be accomplished within a four hour cycle. When the initial working solution of acid provided at plant startup is exhausted, these questions will be resolved.

5.1.3.3 Waste Acid Transfer

The working acid solution can be reused until it is exhausted. When no longer effective, the solution is transferred to a 4,000 gallon holding tank for disposal by a licensed waste hauler. The procedure for transferring this solution to the "Acid Waste" Tank is as follows. Follow the cautionary notes discussed in Section 5.1.3.2.

A. The following valve(s) are open

AR/12

B. The following valve(s) are closed

AR/11

C. Start the acid rinse pump, which will begin transferring the acid from the storage tank into the acid waste tank. During this operation, both level indicators (low level in acid storage tank - AR/21 and high level in acid waste tank - AR/22) will be checked. These level indicators will override the manual operation mode and shut down the acid rinse pump, when a setpoint liquid level condition occurs in either tank.

D. Push the "OFF" button on the pump control box.

E. Reverse the position of the valves set in Section 5.1.3.3A and B.

5.1.4 Shutdown Practices Under Normal and Emergency Conditions

5.1.4.1 Under Normal Conditions

The process should be essentially similar to start-up procedures. To cut the flow coming to the Treatment Plant, the production well will be shut down one by one. The air stripper pumps should be shut down followed by the air blower. The filter pumps will be shut down last in order to make sure that the amount of water in the wet well is reduced. Shut down procedures can have a bearing on both the maintenance required during the stoppage and on the success of the next start up. In general, shutdowns are better controlled and present less problems than startups do, primarily because the equipment is warm and has been under relatively stable operation.

5.1.4.2 Under Emergency Conditions

Emergency conditions may include anything from a defective pump, or malfunction of a control valve in the production well, defective pump or

pumps in the air stripper or filter pump stations, defective air blower, or failure of the telemetering system, to an overall outage or thunderstorm, that takes the entire system off line.

The emergency conditions created by equipment failure can be controlled by the maintenance personnel. The emergency conditions due to power loss or caused by natural disaster, are out of control, and the personnel should deal with these conditions.

Under Section 2.6, Emergency Operating and Response Program, indicate various procedures to effectively deal with these conditions.

Bsed on the emergency problems created during severe thunderstorms, an emergency response plan has been proposed. This plan includes, but is not limited, to the following:

1. Installation of a lightning and surge protection on the main service at the well house.

2. Installation of lightning and surge protection on production wells.

3. Installation of lightning and surge protection on the main service at the Treatment Plant Building.

4. Installation of surge protection on the genius network.

5. Provide a semi-automatic system to isolate each communication cable for the production wells.

6. Provide five (5) Nema 4X Flowmeters at each R.T.U.

With all these measures in place, it is expected to allevaite the consequences of any thunderstorm, on the overall operation of the facility.

5.2 PREVENTIVE MAINTENANCE

- Preventive maintenance can be defined as work done to prevent breakdown, reduce wear, improve efficiency, and extend the life of equipment and structures.

- The greatest reliability and dependability of equipment are experienced only when a well-planned and organized preventive maintenance program is carried out.

- Another reason for setting up a preventive maintenance program is that emergency repair costs are much higher than the routine repairs that are required to prevent breakdowns.

- The main goal of preventive maintenance is to maintain the long-term performance of the facility and to reduce or minimize the failure of various components that affect facility performance.

- An important aspect of preventive maintenance are inspections, including daily or shift inspections, weekly inspections, monthly or quarterly inspections and outage inspections (annual).

- Daily and weekly inspections may require checks of operating parameters and general operating conditions. Whereas monthly or quarterly inspections require specific actions regardless of performance of the facility.

5.2.1 Daily Inspection and Maintenance

Most often the daily inspection or shift inspection is aimed to identify the existence of any operating problems before they develop into more serious and possibly more damaging failures. The fact that the majority of the equipment is equipped with alarms allows the maintenance personnel to respond to these alarms immediately. The instrumentation system available for the entire facility provides the first indicator of operation problems.

Process operating data, water flows and daily analyses should be recorded and compared against the regulatory discharge requirements. Any changes in the values, either from previous normal reading or baseline conditions, are important because they may indicate the need for maintenance work or even additional process units, in order to meet the requirements.

Once the reading has been obtained and checked for any apparent changes, some simple external checks are in order. If the operating valves, like analyses results, indicate considerable change, the remainder of the inspection should concentrate on attempting to identify the cause of the observed changes. The chemical analyses should identify the potential causes for the change. The operation of air blower and status of the air stripper media should be checked. Other checks of the production wells operation as well as the air stripper and pressure filter pumps, should be performed.

Although the problems which will affect the performance are corrected in a timely manner, the effect will not be long-term.

The following is "the daily inspection checklist which should be the operator concern:

- Check the piping and valves leaks throughout the treatment plant and production wells.

- o Listen for any unusual noises, try to locate and repair the cause.

- o Record all the pressure gauges, flow meter reading.

- o Record all the chemical tests and correlate those results with flow readings, to note trends in the performance of each piece of equipment.

- o Check the operation of the air stripper and filter pumps, and listen for any unusual noises.

- o Record anything that is going wrong with the facility, and explain the causes.

5.2.2 Weekly Inspection and Maintenance

The best way to start a weekly inspection is with a brief review of the daily or shift inspection data. This review should attempt to identify any apparent trends in the key operating parameters and determine whether a change is needed in some operating practice or maintenance procedure. In addition, this review should confirm that all requested or required maintenance has been completed satisfactorily or has been scheduled in a timely manner.

After reviewing the previous week's operating data and comparing it against normal and baseline values, the inspector should make a physical check of the equipment within the production wells.

One of the most important weekly inspection should be the packing inspection.

The presence of chemical or biological contaminants in the water or air supply may result in the development or growth of encrustations on the packing material over a period of time which will interfere with the efficiency of the air stripping process and may result in the discharge of effluent, which may exceed the effluent VOC concentration limits.

Remove all packing inspection covers and visually examine the packing. If the packing is discolored or encrusted with biological or chemical deposits, an analysis of a sample must be run to determine the exact cause of the fouling. Remove several samples of contaminated packing at different levels in the packing bed for analysis.

The weekly inspection should include a visual inspection of the mist eliminators for possible foul-up or bacterial growth. The air flow rate should be checked to ensure that it meets recommended operation parameters.

The following is the "weekly inspection checklist":

- Check and inspect the packing and eventually remove some samples for analysis. Record what has been observed and points of sampling.
- Check the status of mist eliminator, and record if any changes took place.
- Check the air blower operation.
- Check the control valve operation in each production well.
- Check if flowmeters and remote transmitter unit are operating.
- Check the level control (in each well) operation.

5.2.3 Monthly or Quarterly Inspections and Maintenance

Whether a monthly or quarterly inspection is required depends on the manufacturer's recommendations. All of the recommended procedures should be followed at least quarterly. The valves located along the transmission line, air release, drain and backpressure sustained should be visually inspected for leakage or rust. Accumulated dust and dirt inside the vaults should be cleaned. The exterior of the vault should be checked for proper seal. All pumps in the treatment plant should be checked for proper operations, and the piping and valves should be checked for leakage and motor operated valves for proper operation. All production wells vaults should be checked and dirt should be removed. Check all the panel controls and the heaters inside the vaults. Check for the damage of exposed wiring within the vaults, and eventual need of repair. Check the chemical storage tanks and look for leakage of the tanks or interconnecting piping. Check the operation of ventilating equipment and the panel control.

The following is a summary of the "monthly or quarterly inspection checklist":

- Inspect all valves and piping within the air release, drain and backpressure sustaining vaults. Record any unusual condition and the status of each valve and operator.

- Inspect all production well vaults and look for leakage operation of the heater, and record if any special conditions have been encountered during the inspections.

- Provide lubrication, as per manufacturer's requirements of each piece of equipment which need it.

- Inspect and clean the outside side tube, at the base of the air stripper.

- Inspect fuses throughout the treatment plant and replace the defective ones.

- Test each alarm within the facility, and record anything unusual.

- Inspect and check the operation of each pump within the treatment plant building. Check and visually inspect the status of all valves serving the pumping stations.

5.2.4 Semi-annual Inspection and Maintenance

Depending on the operation, the semi-annual inspection may correspond with a maintenance shutdown or outage, and internal inspections are conducted during such outages.

In addition to the recommended procedures, for weekly and quarterly inspection and maintenance, semi-annual procedures should include the lubrication of all door hinges and closure mechanism, the cleaning and lubrication of key interlocks.

5.2.5 Annual Inspection (Outage) and Maintenance

The facility generally should be shut down at least once a year for a more complete inspection, including a check of internal conditions. During the inspection more attention may be focused on certain pieces of equipment which have out several times for repairs or detailed maintenance work.

In order that a thorough internal inspection takes place, which will include visual inspection of the wet wells, the remaining water should be pumped out in accordance with the recommendation of NYSDEC. After the wet wells are emptied, the inspector will check if any deposits have been found at the bottom. Any settled residuals should also be removed. During this operation, the level controls within each wet well will be checked and located at the right elevations.

The vertical pumps should be checked and the inlet of each pump should be cleaned. The motors and all electrical wiring should be checked.

The piping and valve systems should be checked for leakage.

The electrical and instrumentation panel controls and all wiring should be checked.

The air stripper should be checked. Perhaps additional packing should be replacing the amount taken for sampling. At that point, all the covers from the manways should be re-attached and the gaskets checked for proper seal.

An "annual inspection checklist" will include the following:

- Check and inspect all production wells, secure sealing of the covers to avoid any infiltration in the vaults.

- Check all panel controls within the vaults and check the wiring from each panel to each piece of equipment.

- Check the level control system, switches, control valve and flowmeter.

- Check and clean the floor in the vaults and remove debris which might clog the floor draining holes.

- Check and inspect all the valves and vaults for drains, air release and backpressure sustaining. Look for any debris in each vault, and secure all the covers. Each valve and fitting should be inspected for corrosion or defects.

- Check and inspect the entire air stripper/air blower system. Check manways for leakage proof. Check the valves on the inlet and outlet of the air stripper.

- Check and inspect air stripper and pressure filter pumps and motors. Check all piping and valves pertinent to the pumping system.

- Check and inspect chemical rinsing system including pump and storage tanks.

- Check and inspect instrumentation system and electrical system.

The entire inspection schedule should be expended based on actual day by day experience gained by the maintenance personnel. A good recordkeeping system will help the periodical inspections to reach the goal of securing a proper operation of the facility.

5.2.6 Lubrication

Those responsible for preventive maintenance should also be responsible for lubrication. Their duties should include the following:

1. Apply lubrication for each piece of equipment in accordance with the preventive maintenance schedule.

2. Standardize application methods.

3. Maintain consumption and inventory records.

4. Establish proper handling and storage of lubricants.

5. Investigate new lubricants; evaluate and revise specifications where necessary.

6. Standardize lubricants whenever possible to eliminate stocks of identical material under various trade names.

7. Each manufacturer of equipment will very likely specify one or more trade name lubricants by the producers number or by an SAE (Society of Automotive Engineers) number or some other designation. This may result in numerous trade named lubricants being designated for various pieces of equipment.

A working schedule for lubrication should be established.

As an example, the following is the "air blower lubrication", which should serve as a model, to prepare similar schedules for equipment which need it.

5.2.6.1 Air Blower Lubrication

- Bearing should be lubricated with a good quality lithium-base grease conforming to NLGI Grade 2 consistency. The recommended lubricants are:

Mobil	-	Mobilith 22
Texaco	-	Premium RB
Standard Oil	-	Amolith #2
Gulf Oil	-	Gulf Crown #2
Shell	-	Alvania #2

- o Add grease to the bearing while running the fan or rotating the shaft by hand. Be sure all guards are in place, if lubrication is performed while the fan is operating.

- o Add just enough grease to cause a slight purging at the seals. Do not over-lubricate.

- o Lubrication should be scheduled between 4 to 6 months.

5.3 Equipment Recordkeeping System

- o The initial step in the development of an equipment recordkeeping system is the one-time accomplishment of a complete inventory of facility mechanical and electrical equipment.

- o Table 5.3.1 is the list of mechanical and instrumentation (pertinent to mechanical equipment) equipment. This list includes: description of equipment, model number, manufacturer, distributor and the actual location of the equipment.

- o Table 5.3.2 is the functional numbering system. The first digit identifies one of the major system in the facility, the second identifies parts of the system, and the third identifies particular function, which for now, is marked "0".

  For example, referring to Table 5.3.2, "2.3.1" refers to the part in the transmission line system. The digit 2 refers to transmission line; the digit 3 refers to backpressure sustaining valve system and digit 1, refers to valve itself.

- Table 5.3.3 is the equipment data list. This table used the ID for each piece of equipment, from Table 5.3.2 for each item, which is part of an equipment 4 digit ID number is used. Table indicates manufacturer name, part no. and serial no.

- This table identifies the main equipment, but the maintenance personnel is supposed to complete all the required information, based on a detailed survey performed throughout the facility.

- The recordkeeping system for the maintenance procedures the following three forms should be kept up to date.

- Form M-1, the "Equipment Reference Data", is the permanent record for each item of equipment, containing reference data and cumulative maintenance data.

- Form M-2, the "Equipment Malfunction Report", is intended for the use by maintenance personnel while performing preventive maintenance. Completed forms M-2 should, of course, be promptly delivered to the maintenance supervisor. These forms should be in convenient locations throughout the facility.

- Form M-3, the "Corrective Maintenance Work Order", is prepared with cost and downtime estimates when analysis indicates that corrective action is required.

TABLE 5.3.3

EQUIPMENT DATA LIST

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
100	**PRODUCTION WELLS**			
110	SUBMERSIBLE PUMPS			
1111	PUMP #1	GRUNDFOS		
1112	PUMP #2	GRUNDFOS		
1113	PUMP #3	GRUNDFOS		
1114	PUMP #4	GRUNDFOS		
1115	PUMP #5	GRUNDFOS		
1121	MOTOR #1	FRANKLIN		
1122	MOTOR #2	FRANKLIN		
1123	MOTOR #3	FRANKLIN		
1124	MOTOR #4	FRANKLIN		
1125	MOTOR #5	FRANKLIN		
1131	CHECK VALVE #1	GRUNDFOS		
1132	CHECK VALVE #2	GRUNDFOS		
1133	CHECK VALVE #3	GRUNDFOS		
1134	CHECK VALVE #4	GRUNDFOS		
1135	CHECK VALVE #5	GRUNDFOS		
120	MOTOR STARTER			
1211	MOTOR STARTER #1	FURNAS		
1212	MOTOR STARTER #2	FURNAS		
1213	MOTOR STARTER #3	FURNAS		
1214	MOTOR STARTER #4	FURNAS		
1215	MOTOR STARTER #5	FURNAS		
130	LEVEL SYSTEM			
1311	LEVEL CONTROLLER #1	AMTEK		
1312	LEVEL CONTROLLER #2	AMTEK		
1313	LEVEL CONTROLLER #3	AMTEK		
1314	LEVEL CONTROLLER #4	AMTEK		
1315	LEVEL CONTROLLER #5	AMTEK		
1321	LEVEL SENSOR #1	AMTEK		
1322	LEVEL SENSOR #2	AMTEK		
1323	LEVEL SENSOR #3	AMTEK		
1324	LEVEL SENSOR #4	AMTEK		
1325	LEVEL SENSOR #5	AMTEK		
140	CONTROL VALVE			

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
1411	MAIN VALVE #1	CLA-VAL		
1412	MAIN VALVE #2	CLA-VAL		
1413	MAIN VALVE #3	CLA-VAL		
1414	MAIN VALVE #4	CLA-VAL		
1415	MAIN VALVE #5	CLA-VAL		
1421	SOLENOID CONTROL #1	CLA-VAL		
1422	SOLENOID CONTROL #2	CLA-VAL		
1423	SOLENOID CONTROL #3	CLA-VAL		
1424	SOLENOID CONTROL #4	CLA-VAL		
1425	SOLENOID CONTROL #5	CLA-VAL		
150	METERING SYSTEM			
1511	FLOW METER #1	SENSUS TECHNOLOGIES		
1512	FLOW METER #2	SENSUS TECHNOLOGIES		
1513	FLOW METER #3	SENSUS TECHNOLOGIES		
1514	FLOW METER #4	SENSUS TECHNOLOGIES		
1515	FLOW METER #5	SENSUS TECHNOLOGIES		
1521	HIGH SPEED P/U #1	ROCKWELL		
1522	HIGH SPEED P/U #2	ROCKWELL		
1523	HIGH SPEED P/U #3	ROCKWELL		
1524	HIGH SPEED P/U #4	ROCKWELL		
1525	HIGH SPEED P/U #5	ROCKWELL		
160	PRESSURE GAUGE			
1611	PRESSURE GAUGE #1			
1612	PRESSURE GAUGE #2			
1613	PRESSURE GAUGE #3			
1614	PRESSURE GAUGE #4			
1615	PRESSURE GAUGE #5			
170	SAMPLING TAP (ST)			
1711	ST-1	NA	NA	
1712	ST-2	NA	NA	
1713	ST-3	NA	NA	
1714	ST-4	NA	NA	
1715	ST-5	NA	NA	
200	**TRANSMISSION LINE**			
210	AIR/VACUUM VALVE W/PIT			
2111	AIR/VACUUM (7+05)	GOLDEN ANDERSON		
2112	AIR VACUUM (16+57)	GOLDEN ANDERSON		

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
2113	AIR VACUUM (19+04)	GOLDEN ANDERSON		
2114	AIR VACUUM (23+83)	GOLDEN ANDERSON		
2115	AIR VACUUM (33+96)	GOLDEN ANDERSON		
2116	AIR VACUUM (5+78)	GOLDEN ANDERSON		
220	DRAIN VALVE W/PIT			
2211	DRAIN VALVE (12+45)			
2212	DRAIN VALVE (17+87)			
2213	DRAIN VALVE (20+80)			
2214	DRAIN VALVE (27+83)			
2215	DRAIN VALVE (43+22)			
2216	DRAIN VALVE (0+38)			
230	BACKPRESSURE SUSTAINING VALVE (BPSV)			
2311	BPSV (34+42)	GOLDEN ANDERSON		
240	SHUT OFF VALVES (SOV)/W BOX			
2411	SOV (6+95)	MUELLER		
2412	SOV (12+35)	MUELLER		
2413	SOV (16+47)	MUELLER		
2414	SOV (A2+63)	MUELLER		
2415	SOV (17+77)	MUELLER		
2416	SOV (18+98)	MUELLER		
2417	SOV (20+70)	MUELLER		
2418	SOV (23+77)	MUELLER		
2419	SOV (B4+85)	MUELLER		
2420	SOV (27+76)	MUELLER		
2421	SOV (33+89)	MUELLER		
2422	SOV (43+31)	MUELLER		
2423	SOV (0+30)	MUELLER		
300	**AIR STRIPPER PUMPS**			
3111	VERTICAL TURBINE #1	PEERLES PUMP		EI063298-6
3112	VERTICAL TURBINE #2	PEERLESS PUMP		EI063298-5
3113	VERTICAL TURBINE #3	PEERLESS PUMP		EI063298-1
3121	VERTICAL MOTOR #1	U.S. MOTORS		T09T1920329F
3122	VERTICAL MOTOR #2	U.S. MOTORS		T09T1920329F
3123	VERTICAL MOTOR #3	U.S. MOTORS		T09T1920329F
3131	BREAKER #1	G.S. GEDNEY		T012491-01
3132	BREAKER #2	G.S. GEDNEY		T012491-06
3133	BREAKER #3	G.S. GEDNEY		T012491-09
3211	ELEC. MOTOR VALVE #1	VICTAULIC		
3212	ELEC. MOTOR VALVE #2	VICTAULIC		
3213	ELEC. MOTOR VALVE #3	VICTAULIC		

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
3221	ELEC. ACTUATOR #1	RAYMOND CONTROL SYST.		AR10057
3222	ELEC. ACTUATOR #2	RAYMOND CONTROL SYST.		AR10058
3223	ELEC. ACTUATOR #3	RAYMOND CONTROL SYST.		AR10056
3311	CHECK VALVE #1	VICTAULIC		
3312	CHECK VALVE #2	VICTAULIC		
3313	CHECK VALVE #3	VICTAULIC		
3411	PRESSURE GAUGE #1	MARSHALL TOWN		91254
3412	PRESSURE GAUGE #2	MARSHALL TOWN		91254
3413	PRESSURE GAUGE #3	MARSHALL TOWN		91254
350	BALL VALVE, DRAIN	VICTAULIC		
360	FLOAT SWITCHES	ANCHOR SCIENTIFIC		
400	**AIR STRIPPER TOWER**			
410	TOWER	R.E. WRIGHT		
411	MEDIA PACKING	JAEGER PRODUCTS		
420	AIR BLOWER	NEW YORK BLOWER		
421	MOTOR	GENERAL ELECTRIC		5K286CS225P
422	STARTER	G.S. GEDNEY		T051691-57
430	CONTROLS			
4311	AIR VANE OPER. FLOW SWITCH	DWYER INSTRUMENTS		
4312	DIFF. PRESSURE GAUGE	DWYER INSTRUMENTS		
4313	AIR FLOW METER GAUGE	DWYER INSTRUMENTS		
500	**PRESSURE FILTER PUMPS**			
5111	VERT. TURBINE PUMP #1	PEERLESS PUMP		EI063298-3
5112	VERT. TURBINE PUMP #2	PEERLESS PUMP		EI063298-4
5113	VERT. TURBINE PUMP #3	PEERLESS PUMP		EI063298-2
5121	VERT. MOTOR #1	U.S. MOTORS		T09T1920329-F
5122	VERT. MOTOR #2	U.S. MOTORS		T09T1920329-F
5123	VERT. MOTOR #3	U.S. MOTORS		T09T1920329-F
5211	ELEC. MOTOR VALVE #1	VICTAULIC		
5212	ELEC. MOTOR VALVE #2	VICTAULIC		
5213	ELEC. MOTOR VALVE #3	VICTAULIC		
5221	ELEC. ACTUATOR #1	RAYMOND CONTROL SYST.		AR10053
5222	ELECT. AUCTATOR #2	RAYMOND CONTROL SYST.		AR10054
5223	ELECT. ACTUATOR #3	RAYMOND CONTROL SYST.		AR10055
5311	CHECK VALVE #1	VICTAULIC		
5312	CHECK VALVE #2	VICTAULIC		
5313	CHECK VALVE #3	VICTAULIC		
5411	PRESSURE GAUGE #1	MARSHALL TOWN		91254
5412	PRESSURE GAUGE #2	MARSHALL TOWN		91254
5413	PRESSURE GAUGE #3	MARSHALL TOWN		91254

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
5131	BREAKER #1	G.S. GEDNEY		T012491-01
5132	BREAKER #2	G.S. GEDNEY		T012491-04
5133	BREAKER #3	G.S. GEDNEY		T012491-03
550	BALL VALVE DRAIN	VICTAULIC		
560	FLOAT SWITCHES	ANCHOR SCIENTIFIC		
600	**ACID RINSE SYSTEM**			
610	ACID PUMP			
611	MOTOR			
620	SHUT OFF VALVE			
630	CHECK VALVE			
640	CONTROLS			
641	PRESSURE GAUGE			
642	UNDERCURRENT RELAY			
650	ACID STORAGE TANK			
660	ACID WASTE TANK			
700	**UTILITES AND SERVICES**			
710	FLOWMETERS			
7111	INFLUENT (FT-61)			
7112	A/S EFFLEUTN (FT-71)			
7113	PLANT EFFLUENT (FT-81)			
720	MISCELLANEOUS VALVES			
7211	INFLUENT A/S (AS-41)			
7212	INFLUENT P/F (PF-61)			
7213	EFFLUENT A/S (AS-61)			
7214	FUTURE (TW-41)			
7415	FUTURE (AC-41)			
7216	INFL. P/F-A/S (PF-41)			
7217	EFFL. PANT (PF-52)			
7218	FUTURE (PF-51)			
7219	ACID EFFLUENT (AR-13)			
7220	WASTE ACID (AR-12)			
7221	INFLUENT A/S (AR-11)			
730	SUMP PUMPS			
7311	SUMP PUMP #1-ACID	FLUX PUMPS CORP.		
7312	SUMP PUMP #2-CAUSTIC	FLUX PUMPS CORP.		
7313	MOTOR #1-ACID	FLUX PUMPS CORP.		

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
7314	MOTOR #2-CAUSTIC	FLUX PUMPS CORP.		
740	DRUM PUMP ASSEMBLY			
7411	DRUM PUMP	FLUX PUMPS CORP.		
7412	MOTOR	FLUX PUMPS CORP.		
750	LABORATORY EQUIPMENT			
760	BACKFLOW PREVENTER			
770	SAMPLING TAPS (ST)			
7711	INFL. FROM WELLS ST-1	NA	NA	NA
7712	INFL. A/S ST-2	NA	NA	NA
7713	EFFL. A/S ST-3	NA	NA	NA
7714	EFFL. PLANT ST-4	NA	NA	NA
800	**ELECTRIC EQUIPMENT**			
810	MAIN INCOMING SERVICE MCC			
820	LIGHTING PANEL			
830	UTILITY PANEL			
840	MAIN DIST. PANEL			
850	LOW VOLT. TRANSFORMER			
860	FIRE ALARM SYSTEM			
870	LABORATORY PANEL			
900	**HVAC EQUIPMENT**			
910	AIR HANDLING UNITS			
9111	HEAT PUMP AHU-1			
9112	MAKEUP AIR AHU-2			
920	ELECTRIC HEATER UNITS			
9211	UH-1			
9212	UH-2			
9213	UH-3			
9214	FFH-1			
9215	FFH-2			
9311	EF-1			
9312	EF-24			
9313	EF-2B			
9314	EF-3			
9315	EF-4			
9316	EF-5			
9317	TE			

ID	EQUIPMENT	MANUFACTURER	PART NO.	SERIAL NO.
940	METHANE CONTROL SYSTEM			
9411	ANNUNCIATOR/CONTROL PANEL			
9421	GAS SENSOR S-1			
9422	GAS SENSOR S-2			
9423	GAS SENSOR 2-3			
9424	GAS SENSOR S-4			
9425	GAS SENSOR S-5			
9426	GAS SENSOR S-6			
9427	GAS SENSOR S-7			
9431	CONTROL MUDULE #1			
9432	CONTROL MODULE #2			
9441	MOTORIZED LOUVER-DAMPER #1			
9442	MOTORIZED LOUVER-DAMPER #2			
9442	MOTIRIZED LOUVER-DAMPER #3			
950	THERMOSTAT			
9511	THERMOSTAT T-1-PUMP ROOM			
9512	THERMOSTAT T-2-LAB. AREA			
9513	THERMOSTAT T-3-			

FORM M-1

EQUIPMENT REFERENCE DATA

Equipment Name and Number	Type No.	ID. No.	Plant Area	Level	Location Area	Ref. Location

Manufacturer	Local Representative	Part or Model Number	Serial Number

Reference Drawing	Reference Catalog	Instruction Book	Date Put in Service

ELECTRIC MOTOR			PUMP			DRIVE OR REDUCER		
HP	Frame	R.P.M.	Capacity	T.D.H.	R.P.M.	HP	R.P.M. In	R.P.M. Out

Volts	Amps	Phase	Impeller	Packing	Ratio

Type	Specification	Type	Installation	Type
☐ Series	☐ Open	☐ Centrifugal	☐ Horizontal	☐ Gear
☐ Shunt	☐ Exp. proof	☐ Plunger	☐ Vertical	☐ V. Belt
☐ Synchronous	☐ Drip proof	☐ Diaphragm	☐ Submerged	☐ Chain
☐ Induction	☐ Totally enclosed	☐ Gear	Lubrication	☐ Varidrive
☐ _____	☐ _____	☐ Screw	☐ Water	
		☐ _____	☐ Oil	
			☐ Grease	

Bearings	Bearings	Bearings
☐ Sleeve ☐ Ball ☐ Roller	☐ Sleeve ☐ Ball ☐ Roller	☐ Sleeve ☐ Ball ☐ Roller
Lubricant	Lubricant	Lubricant

OTHER EQUIPMENT

Type. Speed. Size. Capacity. Range
Bearings. Lubricant
Other Features

FORM M - 2

EQUIPMENT MALFUNCTION REPORT

Equipment Name	I.D. No.	Serial No.	Location

Date of Trouble	Time	Reported by	Foreman

Indication of Trouble

- ☐ Broken part
- ☐ Worn part
- ☐ Heat
- ☐ Noise
- ☐ Smell
- ☐ Vibration
- ☐ Leaking
- ☐ Dirty
- ☐ Voltage
- ☐ Current
- ☐ Resistance
- ☐ Flow rate
- ☐ Pressure
- ☐ Speed
- ☐ Other _____

When Discovered

- ☐ Starting
- ☐ Stopping
- ☐ During operation
- ☐ During PM - Preventive Maintenance
- ☐ During CM - Corrective Maintenance
- ☐ During OH - Over Haul
- ☐ Other _____

Cause of Trouble

- ☐ Heat / cold / weather
- ☐ Humidity / moisture
- ☐ Foreign object
- ☐ Shock / vibration
- ☐ Wear
- ☐ Equipment defect
- ☐ Improper installation
- ☐ Improper Lubrication
- ☐ Improper operation
- ☐ Other _____

Remarks and Recommendations _____

Check if equipment was tagged out of service ☐

*

FORM M-3

CORRECTIVE MAINTENANCE WORK ORDER

Date	Required Completion date

Equipment Name	I. D. NO.	Serial No.	Location

Indication of Trouble

- ☐ Broken part
- ☐ Worn part
- ☐ Heat
- ☐ Noise
- ☐ Smell
- ☐ Vibration
- ☐ Leaking
- ☐ Dirty
- ☐ Voltage
- ☐ Current
- ☐ Resistance
- ☐ Flow rate
- ☐ Pressure
- ☐ Speed
- ☐ Other _____

When Discovered

- ☐ Starting
- ☐ Stopping
- ☐ During operation
- ☐ During PM - Preventive Maintenance
- ☐ During CM - Corrective Maintenance
- ☐ During OH - Over Haul
- ☐ Other _____

Cause of Trouble

- ☐ Heat / cold / weather
- ☐ Humidity / moisture
- ☐ Foreign object
- ☐ Shock / vibration
- ☐ Wear
- ☐ Equipment defect
- ☐ Improper installation
- ☐ Improper Lubrication
- ☐ Improper operation
- ☐ Other _____

Corrective Work Requested _____

Estimated Cost

Labor _____

Parts _____

Contractors _____

Total _____

Estimated Down - Time

Approved by :	Date:	Job No.

TABLE 5.3.1

List of Mechanical and Instrumentation Equipment

EQUIPMENT	MODEL NO.	MANUFACTURER	DISTRIBUTOR	LOCATION OF EQUIPMENT
Submersible Pumps	225S150-6	Grundfos	Quimby Equipment 349-5959	Production Well Vaults
Motor Starter		Furnas	Knickerbocker Electric 567-5411	Production Well Vaults
Level Controller & Pressure Transducers	572 57SN	Ametek Ametek	Ametek (215) 35-6900	Production Well Vaults
Control Valve	100-20 & 631-01	CLA-VAL	CLA-VAL 588-3900	Production Well Vaults
4" Flow Meter	W-1000 DR	Sensus Technologies		Production Well Vaults
High Speed Pick-up Register		Rockwell	Eagle Control 924-1315	Production Well Vaults
ACT-PAK		Rockwell	Eagle Control 924-1315	Control Room PCI Panel
Shut-off Valves	A-2393-20 A-2393-23	Mueller	Pollard (203) 620-0611	Transmission Line Valve Box
Air/Vacuum Valves	Fig. 935	Golden Anderson	Golden Anderson (412) 625-3541	Transmission Line Vault
Backpressure Sustaining Valve & Pilot	G-1041 B-1030	Golden Anderson	Golden Anderson (412) 625-3541	Transmission Line Vault
Vertical Turbine Pumps	10 MA	Peerless Pumps	Peerless Pumps (908) 964-8090	A/S & PF Wet Wells
Vertical Motors		U.S. Motors		A/S & PF Wet Wells
Electric Motor Valves Actuator	VIC 300 MAR 100	Victaulic Raymond Control System		Discharge Lines from A/S & P/F Pumps
Check Valves	VIC 714	Victaulic		Discharge Lines from A/S& P/F Pumps
Manual Gate Valves & Monitor	# 2007X	Accutrak 2000		On Effluent Lines - A/S & P/F
Pressure Gauges				A/S & P/F Pumps
6" Flowmeter	W-3500 DR	Sensus Technologies	Pollard (203) 620-0611	Infl. Pipe to Treatment Plant

EQUIPMENT	MODEL NO.	MANUFACTURER	DISTRIBUTOR	LOCATION OF EQUIPMENT
8" Flowmeter	W-3500 DR	Sensus Technologies	Pollard (203) 620-0611	A/S Discharge Pipe to A.S.T.
10" Flowmeter	W-5500 DR	Sensus Technologies	Pollard (203) 620-0611	P/F Discharge Pipe, Outdoor In Vault
Air Blower	30ACF Class II	New York Blower Comp.	New York Blower Comp. (708) 655-4881	Treatment Building
Flow Switch				On Discharge Duct, Building
Pressure Diff. Gauge				On Discharge Duct, Building
Air Stripper	Serial No. 90-AST-938	R.E. Wright	R.E. Wright (717) 944-5501	Outdoor the Building
Acid Rinse Pump	TE-10K MD	March	March Mfg. Co. (312) 729-5300	Building Basement
Drum Pump	F424 PT/ F410 EXUL	Flux	Loc. Pump Equipment	Building Basement
Sump Pumps	F630K-30	Flux	Loc. Pump Equipment	Building Basement
Fiberglass Tanks				Building Basement
Emergency Eye Wash	G-1932-T0	Guardian Equipment		Main Floor & Basement
Backflow Preventor	909S-Q	Watts Regulator		Building Main Floor
Ball Valve		Hayward		Acid Piping Basement
True Union Type Check Valve		Hayward		Acid Piping Basement
Ball Valve (Drainage)	Series 721	Victaulic		On A/S & P/F Headers
Electric Water Heater	64-6S	Rheem Manuf. Comp.		Building Rest Room

TABLE 5.3.2

Functional Number System

100 **PRODUCTION WELLS**

- 110 SUBMERSIBLE PUMP
  - 111 PUMP
  - 112 MOTOR
  - 113 CHECK VALVE
- 120 MOTOR STARTER
- 130 LEVEL SYSTEM
  - 131 LEVEL CONTROLLER
  - 132 LEVEL SENSOR
- 140 CONTROL VALVE
  - 141 MAIN VALVE
  - 142 SOLENOID CONTROL
- 150 METERING SYSTEM
  - 151 FLOW METER
  - 152 HIGH SPEED PICK/UP REGISTER
- 160 PRESSURE GAUGE
- 170 SAMPLING TAP

200 **TRANSMISSION LINE SYSTEM**

- 210 AIR/VACUUM VALVE PIT
  - 211 AIR/VACUUM VALVE
  - 212 BUTTERFLY VALVE
- 220 DRAIN VALVE PIT
  - 221 DRAIN VALVE
- 230 BACKPRESSURE SUSTAINING VALVE PIT
  - 231 BACKPRESSURE VALVE
  - 232 SHUT-OFF VALVES
  - 233 GATE VALVE ON BYPASS
- 240 SECTIONAL SHUT-OFF VALVES
  - 241 VALVE BOX

300 **AIR STRIPPER PUMPING STATION**

- 310 VERTICAL TURBINE PUMPS
  - 311 PUMP
  - 312 MOTOR
- 320 ELECTRIC MOTOR OPERATED SHUT-OFF VALVES
  - 321 BUTTERFLY VALVE
  - 322 ELECTRIC MOTOR

330 CHECK VALVE

340 PRESSURE GAUGE

350 BALL VALVE, DRAIN

360 FLOAT SWITCHES CONTROLS

400 AIR STRIPPER TOWER SYSTEM

410 TOWER
- 411 MEDIA
- 412 EFFLUENT VALVE
- 413 EFFLUENT ACID VALVE
- 414 HIGH WATER ALARM

420 AIR BLOWER SYSTEM
- 421 AIR BLOWER
- 422 MOTOR
- 423 AIR FLOW SWITCH
- 424 DIFFERENTIAL PRESSURE GAUGE
- 425 AIR FLOW METER GAUGE

500 PRESSURE FILTER PUMPING STATION

510 VERTICAL TURBINE PUMPS
- 511 PUMP
- 512 MOTOR

520 ELECTRIC MOTOR OPERATED SHUT-OFF VALVES
- 521 BUTTERFLY VALVE
- 522 ELECTRIC MOTOR

530 CHECK VALVE

540 PRESSURE GAUGE

550 BALL VALVE, DRAIN

560 FLOAT SWITCHES CONTROLS

600 ACID RINSE SYSTEM

610 ACID RINSE PUMP
- 611 PUMP
- 612 MOTOR
- 613 SHUT-OFF VALVE
- 614 CHECK VALVE
- 615 UNDERCURRENT DEVICE
- 616 MOTOR STARTER

620 ACID STORAGE TANK

630 ACID WASTE TANK

640 LEVEL INDICATORS

700 UTILITIES AND SERVICES

710 FLOW METER INFLUENT LINE TO PLANT
720 FLOW METER INFLUENT LINE TO A/S
730 FLOW METER EFFLUENT PLANT
740 MISCELLANEOUS VALVES
750 SUMP PUMP
751 SUMP PUMP - ACID
752 JUMP PUMP - HYPOCHLORITE

760 DRUM PUMP ASSEMBLY

770 BACKFLOW PREVENTOR

780 SAMPLING TAPS (ST)
781 ST-1
782 ST-2
783 ST-3
784 ST-4

800 ELECTRICAL EQUIPMENT

810 MAIN INCOMING SERVICE MOTOR CONTROL CENTER

820 LIGHTING PANEL

830 UTILITY PANEL

840 MAIN DISTRIBUTION PANEL

850 LOW VOLTAGE TRANSFORMER

860 FIRE ALARM SYSTEM

870 LABORATORY PANEL

900 HVAC EQUIPMENT

910 AIR HANDLING UNITS
911 AH-1
912 AH-2

920 ELECTRIC HEATER UNITS
921 UH-1
922 UH-2
923 UH-3
924 FFH-1
925 FFH-2

930 EXHAUST FAN UNITS
931 EF-1
932 EF-2A
933 EF-2B
934 EF-3

935 TE
936 EF-4
937 EF-5

940 METHANE CONTROL SYSTEM

941 PANEL CONTROL
942 METHANE SENSOR S-1
943 METHANE SENSOR S-2
944 METHANE SENSOR S-3
945 METHANE SENSOR S-4
946 METHANE SENSOR S-5
947 METHANE SENSOR S-6
948 METHANE SENSOR S-7

950 THERMOSTATS

1000 INSTRUMENTATION

1010 MAIN CONTROL CONSOLE

1100 LABORTORY EQUIPMENT

SECTION 6

INSPECTION METHODS AND PROCEDURES

6.1 GENERAL

This section presents detailed techniques and procedures for conducting the following inspections of the systems and associated components: preoperational inspection and testing; external inspections; internal inspections; special inspections and observations that should be made with respect to the actual performance of each system.

The purpose of any inspection is to determine the current operating status and to detect deviations that may reduce performing or cause failure at some future date. For this reason, inspection programs must be designed to derive maximum benefit from the information gathered during the inspection.

A properly designed inspection program can be used for three purposes: record keeping, preventative maintenance, and diagnostic analysis. Depending on its purpose, the inspection may be conducted by maintenance staff, outside consultants, or vendor representatives.

The external inspection (on-line) usually is limited in scope to critical components. Checks of the operating status of the systems are limited to general operating characteristics (contaminants removal, electrical readings, operation of controls).

The internal inspection provides information on fouling conditions in the air stripper, distribution of water flow over packing media during normal operation, distribution and efficiency of acid rinse operation, checking the degree of settling within wet wells in both air stripper and filter pumping stations, etc.

Internal and external inspections provide continuous information to aid in the operation and maintenance of the system.

6.2 PREOPERATIONAL INSPECTION AND TESTING

Acceptance of the groundwater recovery, water conveyance and treatment systems, after installation involves a series of predetermined steps including: preoperational planning, acceptance testing, and systems transfer.

Preoperational planning involves the transfer of technical information from the vendor and contractors to plant operator and maintenance staff. This can include a work order system, record keeping requirements, and trouble shooting procedures. It should also include vendor training of the staff at a time when the components of the system are new, clean, and cold.

A schedule and procedure should be set up to verify "as-built" versus the "as specified" with regard to each system components, material of construction, "approved equal" equipment, etc.

Several preoperational tests also can be conducted before the systems are transferred to maintenance staff. The following are examples:

- **Functional Tests** - Functional tests may be performed on an individual component to determine initial acceptance before a full water-load evacuation. Functional tests include continuity checks of electrical controls, alarms, and motor circuits; verification of the rotation of motors, and checks on the operation of major components such as: pumps, motor operated valves, etc.

- **Tests for Water Leakage** - The water conveyance, transmission line should be checked for potential water leakage, along the pipeline,

fittings, valves, by comparing individual readings of flow in each production well with the cumulative flow at the entrance in the building. All points of leakage should be located, and repaired before further acceptance tests are made.

- **Tests for Electrical Continuity and Grounds** - Physical inspection of the electrical distribution system should be made, and continuity of electrical connections should be verified. The electrical systems should also be inspected to determine the possible presence of unintentional grounds.

- **Uniform Water Distribution in Air Stripper** - Visual evaluation of the way the water is distributed over the packing bed should be very closely monitored. If not uniform the water will be creating the "channeling effect" which eventually will reduce the efficiency of removals.

6.3 SYSTEMS TRANSFER

An orderly transfer of the operation and maintenance should be made from the vendor and contractors to the maintenance staff. This transfer should occur over a short period of time, as operators and maintenance staff become trained.

6.4 EXTERNAL INSPECTION

The external inspection involves checking major system components and determine their impact on electrical readings and indirectly on facility efficiency.

The normal inspection procedure involves the production well areas, treatment building area and discharge back in ground area (recharge basin).

Each inspection is performed under different conditions to acquire specific information.

The following describes the areas that should be inspected, the method of inspection, possible malfunctions, and the effect these deficiencies may have on the overall system operation.

6.4.1 Production Wells

The inspector should check the location of the on/off level controls, and the operation of the pump related to these controls.

Since most of the problems with submersible pumps are electrical, the following tests should be performed:

- Measure the voltage at the starter, if the voltage remains high or low, the motor should be changed to the correct supply voltage.

- Measure the current (which pump is operating with motor fully loaded) on each power lead at the starter.

- Measure the winding resistance, by turning off power and disconnect the drop cable leads in the starter. Measure insulation resistance by turning off power.

- Check the operation of the Cla-Val control valve by following these procedures:

  - Check the voltage to solenoid control;
  - clean the solenoid valve;
  - check the electrical system by energizing the solenoid;
  - check valve pressure which should be within the range

indicated on the name plate; and

- disassemble valve and clean all parts.

For the setting of the valve, see attached schematic.

6.4.2 Air Release Valves

The status of these valves, along the transmission line should be inspected periodically to see if it needs to be flashed out. The valves will allow air to escape during the filling of the transmission line.

To inspect each valve (see Figure 6-A), the following steps are required:

1. Move isolating valve "A" to the closed position.

2. Open the 1 inch blow-off valve "B". If fluid flows out rapidly, the valve is okay. Skip to step 12. If fluid flows out slowly or not at all, continue.

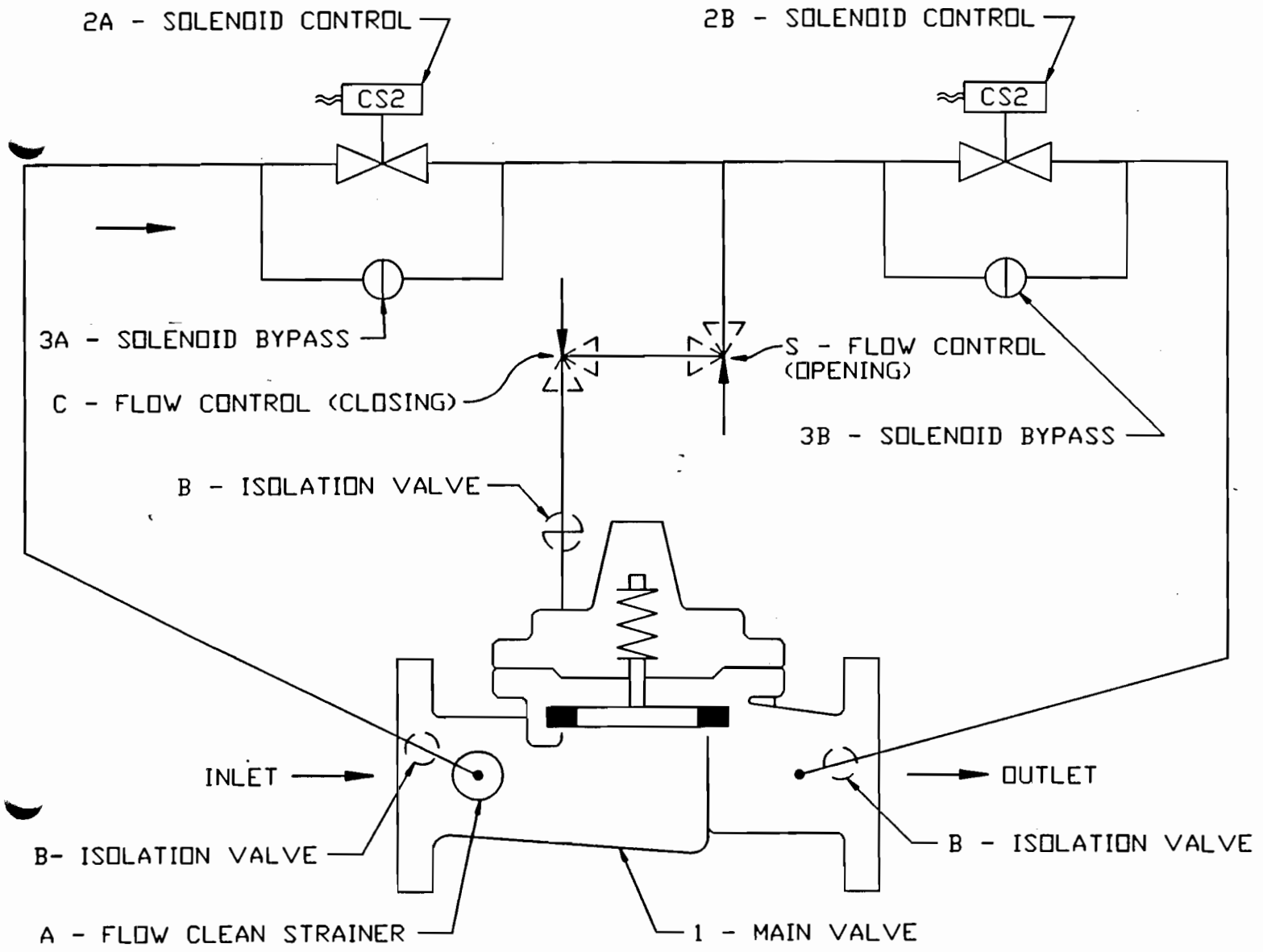
3. Connect a high-pressure (30-125 PSI) fresh water hose to the 1/2 inch NPT shut-off valve "C".

4. Move the 1/2 inch shut-off valve "C" to the open position.

5. Turn the hose on and let it run for 25-30 seconds.

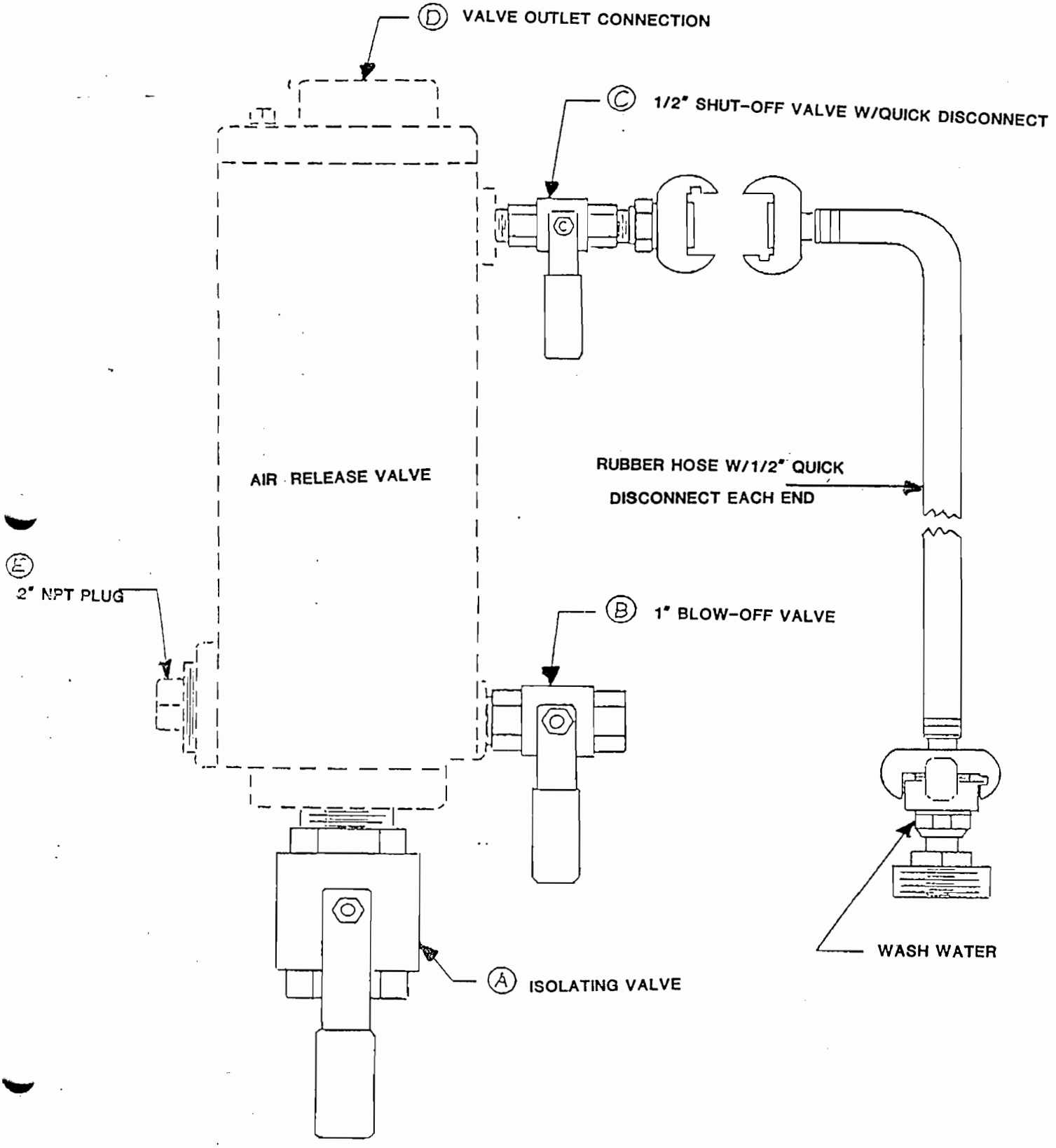
6. Take the NPT busning and quick disconnect coupling supplied when the valve was purchased, and screw it into the outlet at "D".

7. Disconnect the hose from the shut-off valve "C" and connect it to the coupling in the bushing.



SETTING OF THE CONTROL VALVE - CLA VAL

- SOLENOID BYPASS COCK "3A" AND "3B" SHOULD ALWAYS REMAIN IN THE CLOSE POSITION.
- ISOLATION VALVE COCK "B" AT TOP OF VALVE AND ON OUTLET SIDE OF VALVE "B" SHOULD ALWAYS REMAIN IN OPEN POSITION.
- TO ADJUST THE FLOW RATE OF THE VALVE, START WHEN VALVE IS IN THE FULL OPEN POSITION. THEN BY CRACKING THE ISOLATION VALVE "B" ON THE INLET SIDE EVER SO SLOWLY, WHILE WATCHING THE GPM READOUT ON THE CONTROL PANEL IN WELL.



AIR RELEASE VALVE - CLEANING OPERATION

FIGURE 6-A

8. Move the shut-off valve "C" to the closed position.

9. Turn on the hose and let it run until clear water is flowing through the blow-off valve "B".

10. If necessary, using 1/2" x 1" NPT and 1"x2" NPT bushing provided, can flush at 2 inch NPT connection "E" or can remove pipe plug "E" and clean out any remaining debris through this large opening.

11. Remove hose, bushing and coupling from the orifice, and store the bushing and couplings in a safe place for the next time.

12. Move the blow-off valve "B" to the closed position.

13. Move the isolating valve "A" to the open position, and the valve is now back in service.

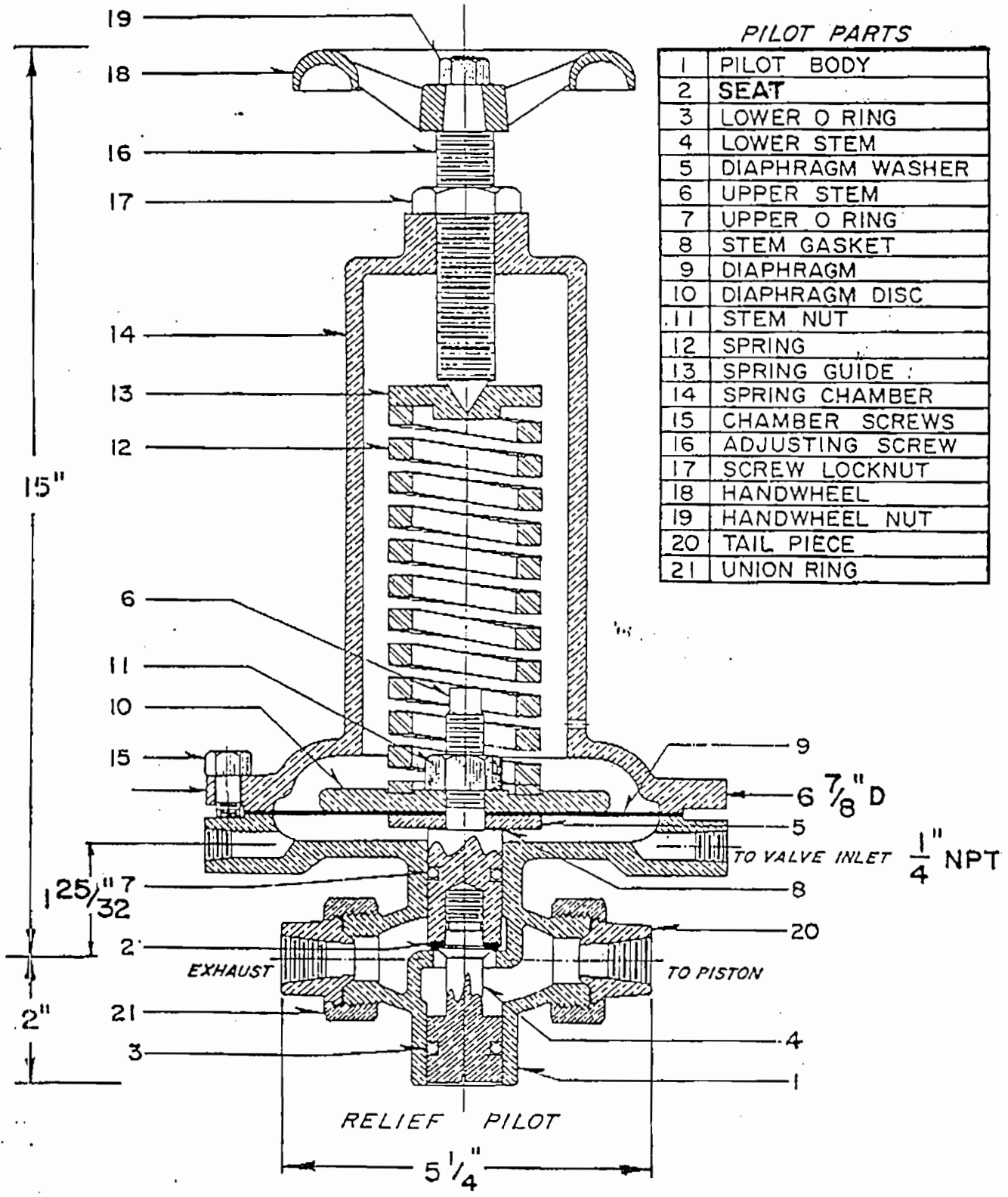
6.4.3 Backpressure Sustaining Valve

A maintenance program should be initiated to see that the valve is periodically cleaned.

1. Look for the wear of the piston cup, liner cup and seat ring, and replace them if they become worn.

2. Look for leakage of water from the vent in the side of the valve body with the valve closed. If leakage, this will indicate the piston cup needs replacement.

3. When the leakage of water from the vent, with the valve open, indicates the liner cup should be replaced.



PILOT PARTS

1	PILOT BODY
2	SEAT
3	LOWER O RING
4	LOWER STEM
5	DIAPHRAGM WASHER
6	UPPER STEM
7	UPPER O RING
8	STEM GASKET
9	DIAPHRAGM
10	DIAPHRAGM DISC
11	STEM NUT
12	SPRING
13	SPRING GUIDE
14	SPRING CHAMBER
15	CHAMBER SCREWS
16	ADJUSTING SCREW
17	SCREW LOCKNUT
18	HANDWHEEL
19	HANDWHEEL NUT
20	TAIL PIECE
21	UNION RING

BACKPRESSURE SUSTAINING VALVE

FIGURE 6-B

4. Leakage past the main valve usually indicates need to replace the seat ring.

5. Check the strainer in the control line from the inlet-upstream side of the valve to the valve lid. This strainer is intended to remove dirt and foreign matter and prevent it from reaching the working parts of the valve. The strainer should be flushed and cleaned to assure that dirt, grit, and foreign matter does not come into contact with the valve working parts and pilot.

6. Check the pilot parts, as indicated in Figure 6-B.

7. Check if the pressure setting can be adjusted by screwing up or down, clockwise or counterclockwise, on the hand wheel to have the valve open or closed for a higher or lower inlet pressure.

6.4.4 Air Stripper and Air Blower

The efficiency of the air stripper is checked by analyzing the influent and effluent water samples. Even before the contaminant levels in the effluent samples will indicate a non-conformance to the discharge requirements, some inspections will emphasize the status of packing and mist eliminator.

- Visual inspection of the packing will indicate if clogging has occurred, and the discoloration of the packing will also provide information which will eventually require a rinsing operation (see Figure 6-C and 6-D).

- Visual inspection will also show if channeling took place. An important factor effecting plugging is the degree of wetting the flow dynamics of the water over the packing surfaces. Surfaces

that wet poorly or are alternately wet and dry tend to have precipitates form on their surfaces more readily.

Water moving constantly and evenly over a surface leaves less opportunity for the solid crystal nuclei of the precipitate to form. The plugging problem should be permanently under scrutiny, this will eliminate eventually completely shut down of the air stripper.

- o Inspection of the air blower will mainly be directed to the following:

  a. Excessive vibration, which can be caused by several conditions:

     1. Loose mounting bolts, set screws, bearings or couplings.

     2. Misalignment or excessive wear of couplings or bearings.

     3. Misaligned or unbalanced motor.

     4. Bent shaft due to mishandling or material impact.

     5. Accumulation of foreign material on the wheel.

     6. Excessive wear or erosion of the wheel.

     7. Excessive system pressure or restriction of air flow due to closed dampers.

     8. Inadequate structural support, mounting procedures or materials.

     9. Externally transmitted vibration.

b. Inadequate Performance.

1. Incorrect testing procedures.

2. Fan running too slowly.

3. Fan wheel rotating in wrong direction or installed backwards on shaft.

4. Wheel not properly centered relative to inlet cone.

5. Damaged or incorrectly installed cut off sheet or diverter.

6. Obstructions or sharp elbows near inlet.

7. Sharp deflection of airstream at fan outlet.

c. Excessive Noise.

1. Fan operating near "stall" due to incorrect system installation.

2. Vibration originating elsewhere in the system.

3. System resonance or pulsation.

4. Improper location or orientation of fan intake and discharge.

5. Loose accessories or components.

6. Worn bearings.

d. Premature Component Failure.

1. Prolonged or major vibration.

2. Inadequate or improper maintenance.

3. Abrasive or corrosive elements in the surrounding environment.

4. Misalignment or physical damage to rotating components or bearings.

5. Bearing failure from incorrect and contaminated lubricant or grounding through the bearings while arc welding.

6. Improper tightening of wheel set screws.

6.4.5 Flowmeters-High Speed Pick up Register-and Act-Pack Instruments

- Measuring the flows, and the accuracy with which this operation is made, will indicate if something unwanted is happening. If there is an important difference in readings between the flow meter indicating total flow from the wells and the total flow obtained by cumulating the individual wells, it will mean that there is an important leakage along the transmission line.

- Checking thoroughly these readings, and paying attention when the flows are recorded, will be the first indication of a good and effective inspection.

- Maintenance personnel should be instructed how to read and record the flows from all the flowmeters throughout the facility. Any difference from the normal, should be in detail, described on the forms.

- If the flowmeter is not recording the flow, the measuring chamber assembly which includes the bronze measuring chamber, rotor, adjusting vane (for calibration) and permanent hermetically sealed direct reading register should be removed and repaired without disturbing the main case in the line. A spare chamber can be utilized to keep the line in service during the measuring chamber maintenance.

- The high speed pickup register (HSP) is equipped with two (2) internally mounted trouble-shooting lights. The inspection should refer to these lights.

- The continuous (non-blinking) red light (located at the rear left interior of the register enclosure when facing the odometer) indicates power from the ACT-PAK instrument is being received at the high speed pickup's terminal strip.

- With water flowing through the meter (indicated) when the odometer test circle is rotating), a red light (located at the rear right interior when facing odometer) will blink in proportion to flow rate. This indicates electronic pulses are being generated and the three (3) conductor cable is continuous to the ACT-PACK instrument.

  If the light is not blinking, either the HSP's electronic circuit is defective or the connecting cable is not continuous.

- o ACT-PAK (Automatic Control Translator Package) is a line of electronic instruments for recording, totalizing, and controlling other devices based on meter thruput. The instrument displays rate of flow.

- o Visual inspection of input pulse indicator will indicate the most external problems. Malfunction of this indicator implies many possible failure modes and the procedure varies depending on the initial condition (i.e. failed ON or failed OFF). See Figure 6-E and 6-F.

- o To use these figures, start at the top and follow the arrows. Each time a diamond figure is encountered, observe the device noted in the diamond and follow the appropriate arrow from the diamond. Do not proceed from one section to another before correcting the previous problem.

- o When disconnecting wires or components, insure that all power is disconnected.

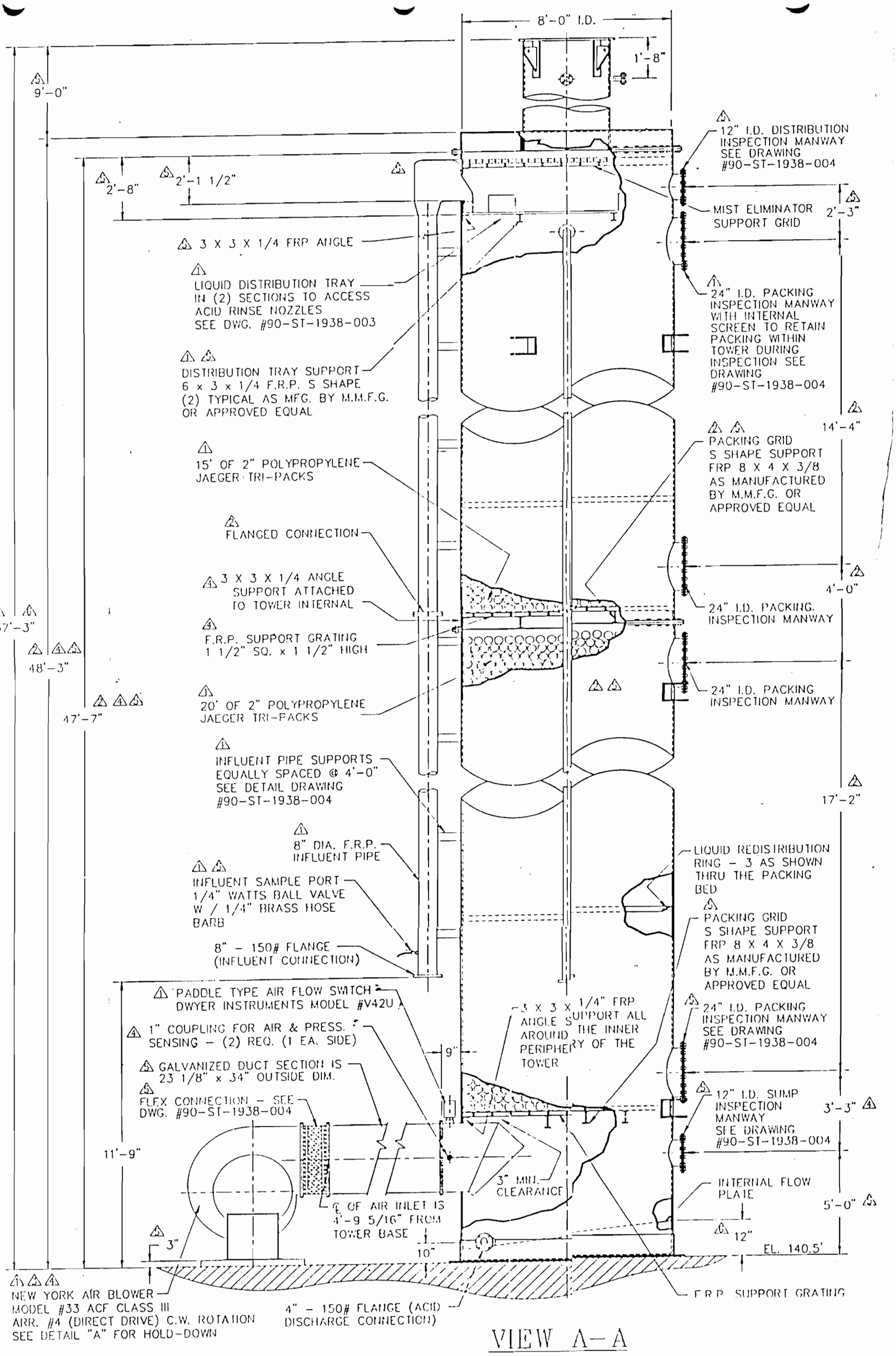
- o Consider the following components:

  A. Power indicator - if not lit:

     1. Check power source (circuit breakers, rceptacles, line cord, etc.).

     2. If an appropriate instrument is available, measure voltage on terminals #15 and #16 (117 VAC +10%).

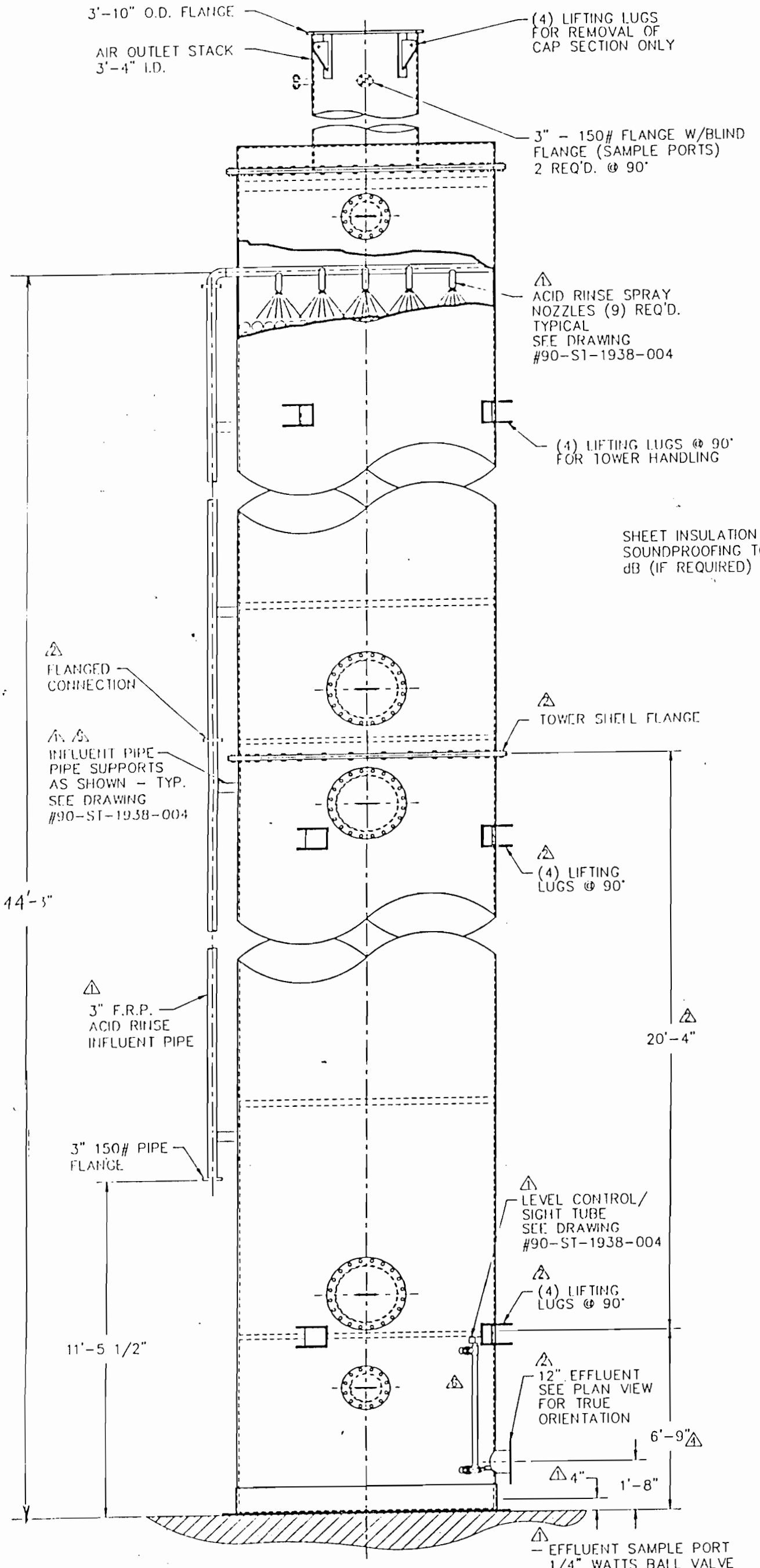
     3. If replacement of the 1/2 AMP fuse restores power for a short interval of time and the fuse again blows, remove



VIEW A-A

AIR STRIPPER

FIGURE 6-C

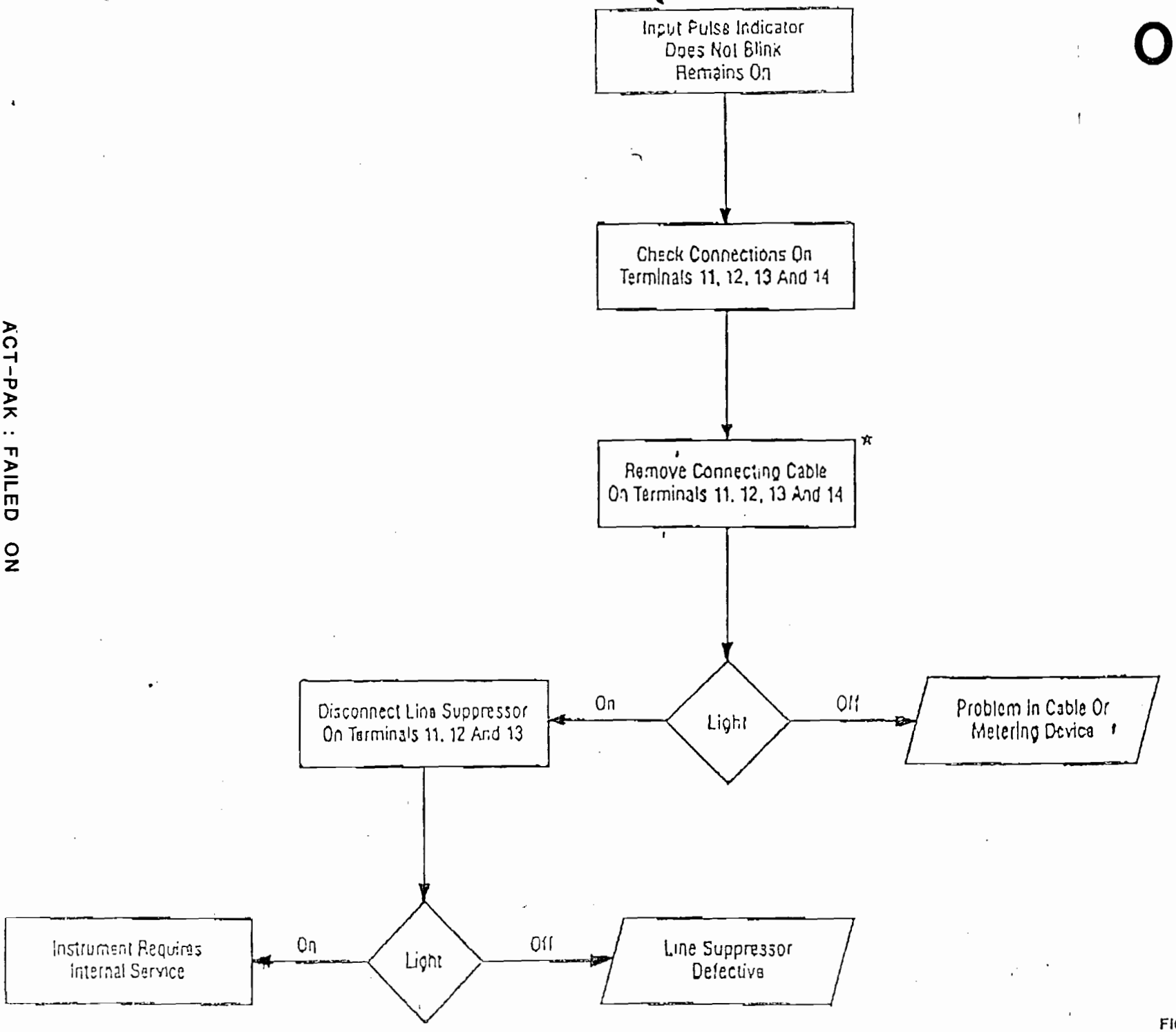


VIEW B-B

AIR STRIPPER

FIGURE 6-D

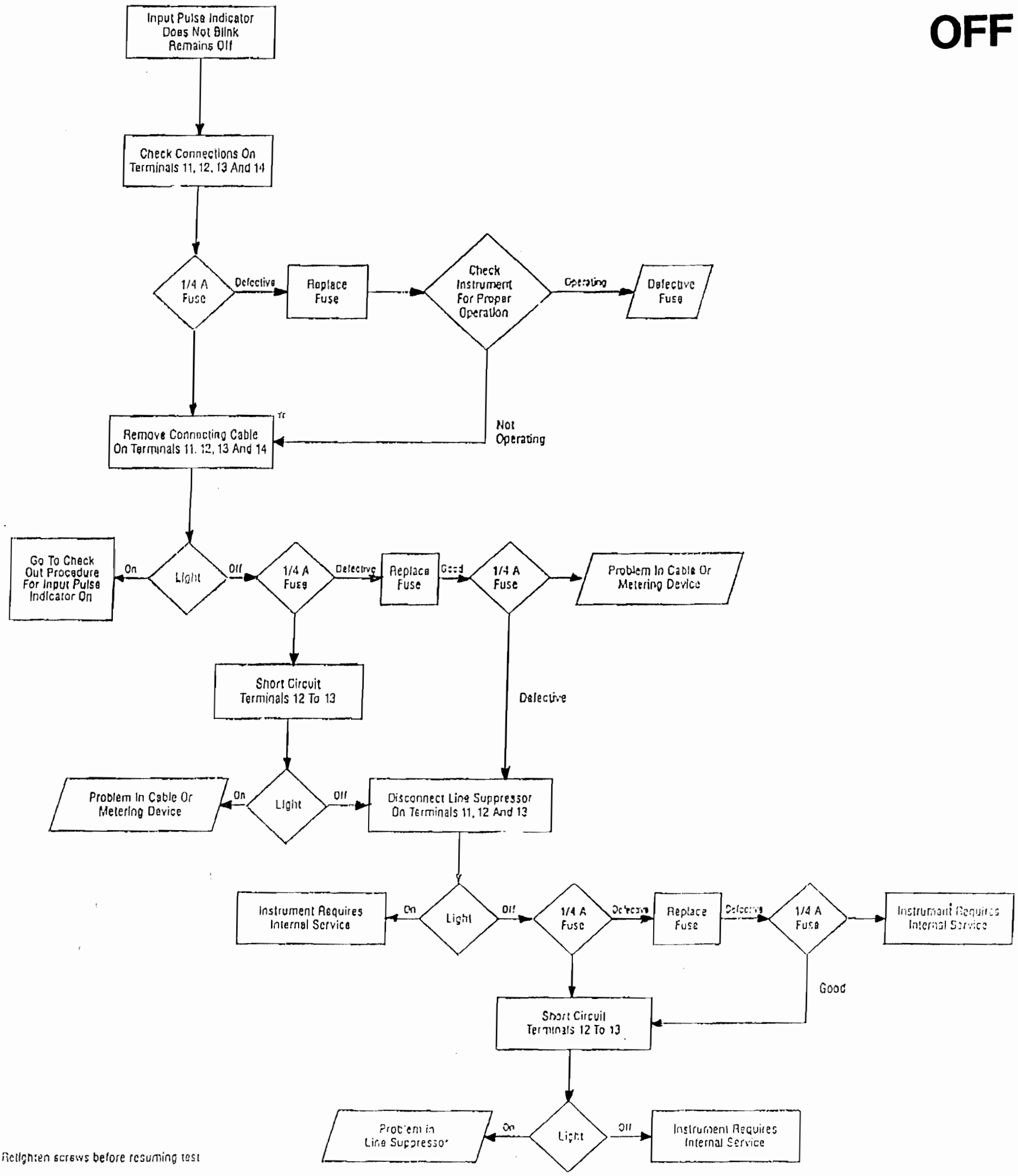
ON



ACT-PAK : FAILED ON

FIGURE 6 -E

OFF



*Retighten screws before resuming test

ACT-PAK : FAILED OFF

FIGURE 6-F

the AC line suppressor connected across the terminals #2 and #3 and replace the fuse. If the fuse does not again blow, indications are that the line suppressor is damaged and should be replaced.

Although instruments may be operated in an emergency without this device, there is the possibility of permanent damage if a power surge should occur.

o If based on the instructions above, the power indicator can not be restored, the instrument should be returned to the factory for service.

B. Flow Rate Recorder

1. Indicator consistently reads above or below the actual flow rate:

a. Remove the input signal by shutting off metering device or disconnecting signal line to insure no flow.

b. Check zero setting of indicator and adjust, if necessary, with the lever located immediately below the clear plastic lens on the front of the indicator.

c. If the indicator cannot be zeroed, it is defective.

d. If the indicator continues to read improperly after being zeroed, follow the calibration instructions or return the instrument for service.

2. Indicator binds - This condition is caused by dirt,

corrosion, or mechanical damage to the meter movement and requires replacement of the indicator.

3. Indicator reads zero - other functions confirm input signal is present.

   a. Check to insure terminals #7 and #8 are shorted.

   b. Remove instrument module from cabinet.

   c. Check to insure that the connector is properly seated on the back of the recorder.

With these instructions, the ACT-PAK can be put in normal service, or requires to be sent back for service. The inspector should not depart from the above procedures.

6.5 INTERNAL INSPECTION

Internal condition of each piece of equipment are reflected in the electrical information received in the control room. Internal inspection will include submersible pumps in the production wells, air stripper tower, pumps in the air stripper and filter pump station wet wells, acid rinse system including pump and storage tanks and all equipment (panel controls) located in the control room.

Periodic internal inspections are usually part of routine preventive maintenance activities or part of troubleshooting evaluation. The data obtained must be combined with on-line evaluations to assess each equipment adequately and to define needed maintenance or changes in the equipment. Before an internal inspection is begun, the reason for and scope of the inspection should be defined. The detail and scope of any internal

inspection may be limited by time availability, resources, personnel, and accessibility.

Annual internal inspections are generally necessary to determine hidden problems, to conduct scheduled repairs, or to make some adjustments.

The following sections describe the areas that should be inspected, the method of inspection, possible malfunctions, and the effect these deficiencies may have on facility operation.

6.5.1 Submersible Pumps in Production Wells

The inspection should include the check of each of the submersible pump. The pump should be removed from the well, and a thorough visual inspection about the status of each component of the pump, including the cable, should be performed. The inspection should include the checking of the check valve operation. If the check valve is defective, the water in the drop pipe can flow back down when the pump stops. This backflow can keep thrust on the motor while it comes to a stop which can cause excessive thrust bearing wear.

If the check valve leaks, the pump starts each time at no head. The pump can exert an upward thrust on the impeller stack at low heads which can lift the rotor until the developing water column causes down thrust Repeated up thrust at each start can cause wear and failure.

During inspection of the pump assembly, make sure the joints are adequately tightened in order to resist the tendency of the motor to loosen the joints when stopping and starting. Check that the electrical cables are not cut or damaged in any way, mainly due to the lowering of the pump back in the well.

6.5.2 Air Stripper Tower

As an internal inspection, the packing inspection is the most important activity. All the inspection covers should be removed and visually the packing should be examined. Several samples of contaminated packing should be removed at different levels in the packing bed and analyzed. If the results indicate that the packing can be cleaned, a rinsing operation should be performed. If the composition of the fouling is such that it is determined the packing can not be cleaned, replacement packing must be installed.

During the internal inspection, special attention should be given to the mist eliminator for possible foul-up or iron deposits. This will affect the uniform distribution of the air over the packing. Any clogging of the mist eliminator will affect the static air pressure.

Inspection should provide a visual checking of the level control/sight tube, outside the tower. A cleaning of the tube might be required.

6.5.3 Air Stripper and Filter Pumps

The internal inspection of the pumps, will mean, that the pump bowl should be pulled out from the wet well. At this time, the following should be checked:

a. Lateral adjustment. Performance can be greatly improved if impellers are located correctly.

b. Check the impeller for foreign substances such as solids or materials which have been caught during impeller operation.

c. Carefully inspection of all parts of the bowl assembly.

d. Check the war rings for excessive wear. If the vanes or walls are not in satisfactory condition, the parts should be replaced.

Motors should be thoroughly inspected and cleaned. The motors have been subjected to vibration, they must be disassembled and each bearing inspected for damage.

6.5.4 Inspections for HVAC Equipment

6.5.4.1 AH-1 Air Handling Unit and Heat Pump

- Inspection should start with filter, which should be cleaned periodically, and be replaced when necessary.

- The direct drive motor, being prelubricated, should also be checked periodically. Check also the tightness of the screws or rubber plugs from the oil holes at the front and back of the motor. Check also if it does need lubrication.

- The balancing of the system should be performed to provide equal comfort in every area. To perform this balancing, the following steps should be done:

  1. Open wide the dampers in all runs to each area.

  2. The thermostat in each area should be left at one setting for several hours before any attempt is done for balancing.

  3. Measure the temperature in each area.

  4. In the area which is too warm, the register damper should be

partially closed.

5. Several tests should pass until the room balances out at this new setting and then the temperature should be rechecked.

6.5.4.2 AH-2 Air Handling Unit

- Inspection should begin with checking of the filter. Filters should be inspected every three to four months under normal operating conditions and be replaced when necessary.

- Inspect the condensate drain which can pick up lint or dirt, especially with dirty filters. Inspect twice a year to avoid the possibility of overflow.

- Inspect the coil, which must be clean to obtain maximum performance. The coil should be inspected once a year under normal operating conditions and, if dirty, should be cleaned.

- Inspect every six months all the moving parts for wear.

- Inspect every six months bearing collar, sheave and wheel hub set screws, sheave cap screws, and bearing hold down bolts for tightness.

6.5.4.3 Electrical Unit Heater

- Inspection and cleaning of the units should be performed at regular intervals.

- Any accumulation of dust, grease and oil should be cleaned off. Conductive build up could lead to arching in the high voltage sections.

- Inspection of terminal connections and tighten if loose.

- Inspection of moving parts, and see if they move freely, and do not stick.

- Inspection of fuses for correct ratings, and replace as needed.

6.5.4.4 Exhaust Fans

- Inspection of the ventilators and periodic motors check should consist of spinning the motor shaft with the power off to be sure the motor turns freely and the bearings run smoothly.

- Inspection of the belt and belt driven units for radial cracks, ply separation or irregular wear.

- Inspection of the belt alignment, and make sure the belt is running perpendicular to the rotating shafts. Motor and drive shafts must be parallel. Excessive belt wear is the result of improper alignment.

- Inspection of the set screws to ensure tightness.

- Inspection of the centrifugal fan wheel for removing foreign materials that may accumulate on the blades.

Section 7

SECTION 7

SAFETY PROCEDURES

7.1 SCOPE

This chapter will describe the basic safety needs for this project. It is not all-inclusive and does not cover all situations that may be encountered. It does identify the basic need and emphasize the necessity of proper management.

The basis for any safety program is OSHA, which establishes occupational safety and health rules and regulations for the areas of operation and maintenance.

The regulations require protective equipment when operation demands it, tools and equipment to perform maintenance and instructions and rules to personnel in the proper and safe manner in conducting operation and maintenance of the systems.

The safety of the plant personnel during all aspects of the systems operation and maintenance, and during inspections by agencies personnel is of ultimate importance.

Areas of concern include electrical hazards, laboratory safety, and below surface work areas.

Many of the potential hazards and proper procedures for addressing them are discussed in the following subsections.

Further information on specific safety procedures can be found in the manufacturers' O&M, which are part of the manual. Also, any publications dealing with safety procedures, should also be researched and eventually become part of this manual.

7.1.1 Electrical Safety

The maintenance of the electrical equipment requires exposure to electrical hazards that may result in shock or death unless safe practices are strictly observed.

The following list of general safe practices should be considered as a start in establishing complete electrical safety rules and procedures at the site.

1. Allow only qualified authorized personnel to work on electrical equipment and wiring, or to perform electrical maintenance.

2. Provide and use lock-out switches and tags at all remote locations from the equipment.

3. Electrical equipment and lines always should be considered as energized unless they are positively proven to be de-energized and properly grounded. If it is not grounded, it is not dead.

4. Two workers should work as a team on energized equipment.

5. Use approved rubber gloves on voltages above 300 V.

6. An electrical control panel should never be opened unless the job requires it.

7. Before work is performed on a line or bus that operates at 440 V or above, it should be de-energized, locked out, and grounded in an approved manner.

8. No part of the body should be used to test a circuit.

9. Personnel should avoid grounding themselves in water or on pipes, drains, or metal objects when working on electrical equipment or wiring.

10. No electrical safety device should be made inoperative or by-passed.

11. When working in close quarters, all energized circuits should be covered with insulating blankets.

12. All tools should have insulated handles.

13. Metal-cased flashlights should never be used.

14. All electric tools should be grounded or double insulated.

15. Rubber mats should be used at control centers and electrical plates.

16. All electric motors, switches, and control boxes should be kept clean at all times.

7.1.2 Laboratory Safety

Safety in the laboratory being an important factor, the following practices are recommended:

1. Only authorized personnel are allowed in the laboratory, as determined by the laboratory supervisor. These personnel should be fluent with basic laboratory safety practices. Untrained visitors to the laboratory should be accompanied by laboratory personnel.

2. Eating, drinking and smoking are not permitted in the laboratory at any time.

3. Personnel protection consisting of lab coats, chemically-resistant eyeware and latex rubber gloves should be available for use.

4. The emergency eye/face wash located and shown near the fume hood in the laboratory should be checked to be in operation, when needed.

5. A "Spill Kit" of absorbent inert material, i.e. sand, should be available for use in acid and base spills.

6. Appropriately rated fire extinguishers should be readily available in the laboratory.

7. All chemicals should be labeled clearly.

8. Chemicals should be stored in their original container. Incompatible chemicals should be segregated. At this time, chemicals have been segregated in the following manner:

- o Acids are stored under the fume hood.

- o Solvents are stored in an under counter metal cabinet suitable for the storage of flammable liquids.

- o Alkaline and cyanide based compounds are to be stored in a separate shelf in the chemical cabinet.

- o Buffers, indicators, general chemicals and specialty items are stored in the chemical cabinet.

- o Solutions of stock chemicals can be stored in containers resistant to the chemical on the counter top backsplash.

9. Gloves, eyeware and lab coats shall be worn when handling chemicals, mixing solutions or performing tests.

10. All operations requiring the use of stock acids, bases, solvents or toxic chemicals shall be performed in the lighted hood with the blower activated and the face shield lowered.

11. Suction bulbs should be used on all pipettes.

12. Tongs and gloves should be used to remove samples from hot plates, ovens or furnaces.

13. All chipped or cracked glassware should be discarded in a specific container marked for disposal of broken glass.

14. Waste chemicals shall be discarded in containers marked for the waste type (acid, bases/cyanides, solvents).

15. Glassware shall be rinsed at the sink using plenty of water prior to washing with "Alconox".

16. The laboratory floor drain is not be used for disposal purposes.

17. Electrical equipment should be properly grounded.

Refer to the laboratory operating and maintenance for additional safety related information.

7.1.3 Below Surface Work Areas

The below surface work areas are the chemical storage and wet well for the air stripper and filter pumping stations.

These areas may have poor ventilation and considered a hazard, for which reason should be thoroughly inspected, maintained and cleaned.

The following operations are recommended if work is performed in these areas:

1. Before entering this area, tests should be made for the presence of dangerous gas (methane), or any gases produced by the acid used in backwashing the air stripper tower.

2. In an emergency, if it becomes necessary for an employee to enter when gas is present, a hose mask should be worn.

3. Extreme care should be taken to avoid all sources of ignition if flammable gas is present. Non spark tools and shoes with rubber soles should be used along with safety lights.

4. Each worker should wear proper protective clothing such as hard hat, rubber gloves, and rubber boots.

5. On first entering, a careful inspection for unsafe conditions should be made.

6. While work is in progress in the below surface, standby workers should be present outside this area.

Section 8

SECTION 8

O & M MANAGEMENT

8.1 MAINTENANCE PERSONNEL AND ORGANIZATION

- Responsibility for the operation and maintenance of this facility rests with the Town of Oyster Bay Department of Public Works. The operating personnel should become thoroughly familiar with the operation of each piece of equipment in the facility. They must expect trouble and must know the remedy. A preventive maintenance program that is carefully planned and executed will help to reduce major breakdown of equipment. It is extremely important to keep equipment clean and to practice good housekeeping at the facility.

- Proper maintenance will be difficult without qualified personnel and an efficient organization. Only properly trained people can be expected to perform satisfactory inspections, repairs, and preventive maintenance tasks. Each of the maintenance personnel should possess a thorough knowledge of the functions and operations of the equipment and the procedures for servicing them.

- The Plant Supervisor is responsible for the administration program and the review of all maintenance functions.

8.2 MAINTENANCE PERSONNEL TRAINING

- To perform the corrective and preventive maintenance tasks, the maintenance personnel must be trained and upgraded to handle these problems. An effective maintenance staff is always improving its ability to handle present tasks.

- Maintenance training can be considered to perform two basic functions. First, it can be used as a cure for existing deficiencies. Second, it can be used as a preventive measure to help eliminate potential future problems. For any maintenance training program to be successful, it should be aimed at meeting the plant maintenance needs and should become an essential part of the overall facility maintenance effort.

- Before initiating a maintenance training program to correct deficiencies in certain maintenance jobs, the specific job should be thoroughly analyzed. The job should be broken down step by step to determine if, in fact, training and not some other factor is the ingredient that must be improved to achieve the desired efficiency.

- On-the-job training approach through individual instruction should be part of a normal daily routine. The principal reasons for training and more particularly, for on-the-job training include:

  - To transfer ideas from the Design Engineer to the plant staff;

  - To provide information on the specific unit process - air stripping tower; and

  - To increase operator confidence through "hands-on" experience.

8.3 HOUSEKEEPING

- It is important that the production well vaults and treatment plant buildings has a clean and neat appearance. Housekeeping includes

such items as cleaning and painting of equipment and building as required, janitorial duties, snow removal and grounds keeping.

- Regular housekeeping schedules will have to be maintained. The housekeeping functions will be shared by the regular operating personnel, the maintenance staff, plus outside subcontractors. Proper records should be maintained and kept available for budget planning, scheduling and manpower expenses.

8.4 SPECIAL TOOLS

- The electrical and mechanical equipment operating in this facility will require many special tools for a complete maintenance program. The tools must be kept in good working order and used only for their intended purpose.

- The maintenance personnel should conduct routine inspections of all special tools and replace or repair any found to be worn out or broken.

- The maintenance staff should maintain a list of special tools required, their location and availability. Where some items may be required in more than one location, this should be taken into account. These tools should be kept in a specific tool storage area when not in use. A tool board is probably the most convenient method of storing most of the tools. All tools should be returned to appropriate board or storage area immediately after the operator has finished using them.

8.5 EQUIPMENT INFORMATION

- A well organized file should be established containing shop drawings, manufacturer's operation and maintenance manuals and any other pertinent information furnished by the manufacturer of each piece of equipment. In conjunction with this file, a complete set of Record drawings should be available for maintenance and troubleshooting.

- A list of manufacturer's Operation and Maintenance Manuals is provided in the Appendix of this Manual. Maintenance and operating personnel should review this material before working on equipment. These manuals are divided into the following sections where applicable.

  - Specification
  - Installation
  - Operating Instructions
  - Complete Parts List
  - Recommended Spare Parts List
  - Maintenance
  - Troubleshooting
  - Shop Drawings
  - Nameplate Information
  - Certification of Proper Installation and Start-up
  - Guarantee

- The maintenance section provides instructions from the manufacturer concerning lubricants, operating parts, special control components, motor drive assemblies, special points of wear, special tools or equipment needed for maintenance, and other important points of attention. This section gives the preventive maintenance schedule which is essential to proper operation.

- The instructions for ordering spare parts when used with the parts list guide is extremely important in minimizing downtime of the equipment. The operator should check with the manufacturer to determine the closest parts distributor to the station. A tabulation of the distributors with addresses and telephone numbers should be kept up to date.

8.6 SPARE PARTS

The amount and type of spare parts and materials in inventory will initially be determined by what has been supplied under the Construction Contract. The proper inventory should be developed by periodic review of the maintenance records. The delivery time of specific replacement items should be considered when deciding what items are to be included in the inventory.

A spare parts list is shown indicating the most needed parts or complete equipment, based on a very preliminary evaluation should be available to replace failed parts as needed. Because all pieces of equipment cannot be stocked, a rational system must be developed that establishes a reasonable inventory of spare parts. This judgment and decision regarding which components to be included in the spare parts inventory should be made by the Mainenance personnel, based on the experience gained by the Maintenance personnel during the operation of the facility. Also, the following criteria should be considered:

8.6.1 Probability of Failure. This can be established based on vendor recommendations and a history of the specific equipment. Also, the maintenance staff should be consulted for recommendations concerning some items that should be stocked and the number required. Adjustment will be made as operating experience is gained.

TABLE 8–1

SPARE PARTS LIST

ITEM No.	NAME OF PART	SUPPLIER	CATALOG No.	UNIT COST	QTY
1	PLC 90/70 CPU	ELDOR	IC697CPU731	1760.00	1
2	PLC RACK	ELDOR	IC697CH8790	462.00	1
3	PLC POWER SUPPLY	ELDOR	IC697PWR710	660.00	1
4	120 VAC IMPUT MODULE (32 POINTS)	ELDOR	IC697MDL250	770.00	1
5	120 VAC OUTPUT MODULE (32 POINTS)	ELDOR	IC697MDL350	946.00	1
6	ANALOG IMPUT MODULE (8 POINTS)	ELDOR	IC697ALG230	1375.00	1
7	GENIUS BUS CONTROLLER	ELDOR	IC6978EM731	1925.00	1
8	24 VDC GENIUS I/O BLOCK	ELDOR	IC6608BDO22	803.00	5
9	SUBMERSIBLE PUMP	GRUNDFOS	225 S150–6 (15HP)	2500.00	1
10	TURBINE VERTICAL PUMP	PEERLESS	EA063298 10MA 2 STAGE	9300.00	1
11	4" CONTROL VALVE	CLAVAL	631 G 01ACSKHXHI	2179.40	5

8.6.2 Cost of Spare Parts. It is not justified to maintain an extensive inventory of high-cost items that have low probability.

8.6.3 Replacement Time. Required to receive the part from the vendor and the time required to replace the part on the piece of equipment also influences whether an item should be stocked.

8.6.4 In-House technical repair or rebuild capabilities can greatly reduce the need to maintain spare parts in high numbers.

8.6.5 The most important element in the decision making for stocking of spare parts will be the availability of space.

8.7 CONTRACT MAINTENANCE

As part of the Management Plan, the Plant Supervisor and the Maintenance Foreman will have to evaluate the limitations of their maintenance personnel and will have to determine when it is necessary to consider using specialized contractors to perform certain maintenance tasks.

Routine jobs, such as inspections, lubrications, or minor parts replacement should not be contracted. Plant personnel should evelop their maintenance capabilities in order to perform all but the most complex tasks.