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General Operation, Maintenance, and Monitoring Manual Town of New Windsor Landfill

Revision 0

Prepared for

Town of New Windsor
New Windsor, New York

Prepared by

EA Engineering, P.C.
Newburgh, New York

And Its Affiliate EA Engineering, Science, and Technology

February 1994

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Health and Safety Plan
Post-Closure Period
Town of New Windsor Landfill
New Windsor, New York

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1. INTRODUCTION

1.1 PURPOSE

The purpose of this Health and Safety Plan (HSP) is to provide personnel with protection standards and mandatory safety practices, procedures, and contingencies while performing site inspections, sample collections, and maintenance of the Town of New Windsor Landfill (NWLF). This HSP addresses the following regulations and guidance documents:

- Occupational Safety and Health Administration (OSHA) Standards for General Industry, 29 CFR 1910 (especially 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response").

- OSHA Standards for Construction Industry, 29 CFR 1926 (particularly 29 CFR 1926.652 for trenching requirements).

- National Institute of Occupational Safety and Health (NIOSH), OSHA, U.S. Environmental Protection Agency (U.S. EPA), and U.S. Coast Guard "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985.

Several sections of the HSP are not pertinent to routine activities at the site, i.e., non-invasive site inspections or general maintenance such as lawn mowing. Activities which would be classified as invasive, such as inspection of the leachate collection system piping and pump house, repair of the cap and gas vents, or repair of the leachate piping, where there is the potential for partial cap removal or waste excavation, would require compliance with all sections of the HSP.

1.2 RESPONSIBILITIES

The chain of command for health and safety-related issues during post-closure monitoring and maintenance activities at the NWLF site is delineated below.

1.2.1 All Personnel

All personnel who may perform invasive inspections, maintenance activity requiring disturbance of the cap or closure system, and sampling must follow the requirements of this HSP. Any unsafe conditions, accidents, injuries, or illnesses must be promptly reported to the Project Manager appointed by the Town.

1.2.2 Project Manager

Prior to the initiation of certain maintenance procedures, replacement, and/or construction operations, the Project Manager may assign industrial hygiene support personnel to execute

health and safety measures during project work, if required. The Project Manager will keep the Town officials informed of any substantial changes in HSP requirements.

Other Project Manager responsibilities include:

- Providing overall supervisory control for all health and safety protocols in effect for the project.
- Establishing and ensuring compliance of Town employees, subcontractor personnel, and visitors with site control areas and health and safety procedures.
- Investigating accidents and preparing any incident reports required.

1.2.3 Site Health and Safety Officer

If required, a Site Health and Safety Officer (SHSO) will be onsite during major maintenance and replacement activities and will be responsible for daily compliance with site health and safety requirements. It is not anticipated that an SHSO will be required during routine inspections, monitoring, or maintenance (e.g., lawn mowing). The SHSO will report directly to the Project Manager on all project-related health and safety matters.

Responsibilities of the SHSO include the following:

- Stopping work when unacceptable health or safety risks exist.
- Providing a health and safety briefing to all onsite personnel, including visitors.
- Conducting and documenting any necessary monitoring, including collection of air samples and heat stress monitoring.
- Supervising decontamination to ensure complete decontamination of all personnel, tools, and equipment.
- Supervising the distribution, use, maintenance, and disposal of personal protective clothing and equipment.
- Ensuring that personnel, including subcontractor personnel, assigned to the project meet the medical and training requirements for hazardous waste operations as delineated in the regulations and guidance listed in Section 1.1.
- Determine and implement any changes in personal protective clothing or respiratory protection.

2. KEY PERSONNEL

Listed below are the key personnel assigned by the Town Officials to the NWLF:

Title	Name
Project Manager	
Site Health and Safety Officer	
Current Operator	Town of New Windsor
Involved Town Employees	

3. PURPOSE AND SCOPE OF WORK

The work to be conducted during the post-closure period at the NWLF primarily includes:

- Routine site maintenance (e.g., lawn mowing)
- Groundwater well sampling
- Surface water sampling
- Leachate sampling
- Gas vent monitoring
- Site inspection (e.g., cap, fencing)
- Inspection of surface water outfall and retention pond.

During the post-closure period, operating personnel may be required to maintain and/or replace the following site components:

- The perimeter fencing
- Gas venting systems
- Vegetative cover
- Protective capping sections
- Stormwater controls (diversion trenches, swales, retention pond)
- Access roads
- Leachate collection
- Leachate pump station hardware
- Leachate force main
- Monitoring wells.

4. SITE DESCRIPTION

The NWLF is a former, sanitary landfill located in the Town of New Windsor, Orange County, New York. The site is bordered on the east by the New York State Thruway and on the west by the Stewart International Airport. The site received municipal and industrial waste from 1962 to 1976.

A Remedial Investigation/Feasibility Study was performed from 1989 to 1991 that identified an appropriate site closure remedy. Landfill closure involved waste mass consolidation and capping; with gas vent controls, leachate collection system, and surface water diversion system being installed in 1992-1993 as per the NYSDEC-approved Plans and Specifications developed by EA Engineering, P.C.

5. HAZARD ANALYSIS

Routine site inspections and maintenance are not anticipated to result in contact with site wastes. This chapter discusses the chemical and physical hazards that may be created during invasive disturbance of the cap, excavation into the waste, and sample acquisition.

5.1 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) ensembles will be assigned by work task as per Section 8 of this document to protect employees from potential exposure to contamination during the post-closure activities at the NWLF site. In addition, routine engineering controls and safe work practices will be implemented at these sites to reduce and maintain employee exposure at or below the OSHA-regulated permissible exposure limits or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for specific hazardous materials.

5.2 CHEMICAL HAZARDS

A summary of the exposure symptoms and exposure guidance for substances detected at the site is provided in Table 1. Chemical exposure to personnel is dependent upon the activities performed. Therefore, the exposure of personnel to site-related contamination is discussed below by work task.

5.2.1 Inspection

Typical site inspection includes a comprehensive evaluation of the facility's working components. In general, the infrastructure and special construction items can be approached with sensible caution adhering to the protective measures pertaining to the sampling procedures. If major problems are discovered (i.e., torn or damaged liner, damaged gas vent riser, etc.), inspection personnel shall monitor air conditions and approach the area from the upwind direction. The inspection of the leachate pump chamber only requires a visual determination. The chamber threshold should not be broken for the task.

TABLE 1 HAZARDOUS SUBSTANCES LIST - NEW WINDSOR LANDFILL

Contaminant[1]	Maximum Concentration Detected in Soil or Water	PEL/TLV[2]	Signs and Symptons of Exposure
Benzene	ND - leachate water ND - soils 546 $\mu g/m^3$ - soil vapors	10 ppm 32 mg/m^3	Eye, nose, respiratory irritant; giddiness; headache; nausea
Toluene	240,000 $\mu g/\ell$ - leachate water 280,000 $\mu g/\kappa g$ - soils 36,000 $\mu g/m^3$ - soil vapors	50 ppm 147 mg/m^3	Fatigue, confusion, dermatitis, nervousness, insomnia, dizziness, headache
Total xylenes	ND - leachate water 12,000 $\mu g/\kappa g$ - soils 3,700 $\mu g/m^3$ - soil vapors	100 ppm 434 mg/m^3	Dizziness; excitement; drowziness; eye, nose, throat, irritant; nausea
Chloroethane	74 $\mu g/\ell$ - leachate water ND - soils ND - soil vapors	1,000 ppm 2,600 mg/m^3	Uncoordination, abdominal cramps, cardiac arrhythmias, cardiac arrest, liver/kidney damage
1,2-Dichloroethane	ND - leachate water ND - soils 200 $\mu g/m^3$ - soil vapors	1 ppm 4 mg/m^3	Eye irritant, CNS depression, dermatitis, vomiting
Trichloroethene	ND - leachate water ND - soils 3,100 $\mu g/m^3$ - soil vapors	50 ppm 269 mg/m^3	Eye irritant, visual disturbance, giddiness, nausea
Tetrachloroethene	ND - leachate water ND - soils 8 $\mu g/m^3$ - soil vapors	25 ppm 170 mg/m^3	Eye, nose, throat irritant; nausea; headache; vertigo; dizziness

1. Only contaminants found to be in excess of the analytical limits are reported.
2. Permissible Exposure Limit (OSHA from 29 CFR 1910.1000) or Threshold Limit Value (ACGIH from Threshold Limit Values and Biological Exposure Indices), whichever is lower, for time-weighted average exposure for an 8-hour work day or 40-hour work week.

TABLE 1 (Continued)

Contaminant[1]	Maximum Concentration Detected in Soil or Water	PEL/TLV[2]	Signs and Symptons of Exposure
Ethylbenzene	ND - leachate water 450 µg/kg - soils ND - soil vapors	100 ppm 434 mg/m^3	Eye irritant, sensitization, dermatitis, mucous membrane irritation
Total C-PAHs	76 µg/ℓ - leachate water 63,700 µg/kg - soils ND - soil vapors		Dermatitis, bronchitis, carcinogen
Napthalene	ND - leachate water 6,400 µg/kg - soils ND - soil vapors	10 ppm 50 mg/m^3	Eye irritation, headache, confusion, malaise, nausea
Barium	6,000 µg/ℓ - leachate water ND - soils ND - soil vapors	0.5 mg/m^3	Eye irritant, skin burns, upper respiratory irritant, spasm, slow pulse
Chromium	912 µg/ℓ - leachate water ND - soils ND - soil vapors	0.5 mg/m^3	Sensitization dermatitis
Copper	2,600 µg/ℓ - leachate water ND - soils ND - soil vapors	0.1 mg/m^3	Mucous membrane/pharynx irritation, nasal perforation, eye irritation, metal taste, dermatitis
Iron	1,799,000 µg/ℓ - leachate water ND - soils ND -soil vapors	5 mg/m^3	Benign pneumoconiosis, X-ray shadows indistinguishable from fibrotic pneumoconiosis
Zinc	112,000 µg/ℓ - leachate water ND - soils ND - soil vapors	5 mg/m^3	Metal fume fever, nausea, chills, shortness of breath, chest pain
Cyanide	167 µg/ℓ - leachate water ND - soils ND - soil vapors	5 mg/m^3	Skin and eye irritant, weakness, confusion, headache, nausea, vomiting

5.2.2 Sampling

During the post-closure period, operating personnel are required to conduct periodic environmental sampling. These recurrent tasks are itemized per event in the following sections.

5.2.2.1 Leachate Collection Sampling

Leachate samples will be obtained from the leachate chamber. In reference to Table 3 of the General Operation, Maintenance, and Monitoring Manual, heavy metals and several volatile organics are expected constituents. Therefore, the pump chamber is considered a confined space and not to be entered during sampling events. Personnel should remain upwind a safe distance from the entrance port while monitoring and recording organic vapor level, and measuring explosiveness. Recorded values shall warrant a continuous sampling procedures. Direct contact and inhalation should be avoided. Adverse effects include, but are not limited to, eye and respiratory irritation along with fatigue, giddiness, nausea, and confusion. Protective measures are presented in Table 2.

5.2.2.2 Groundwater Sampling

Previous groundwater samples indicate the presence of volatile organics. An organic vapor level and combustible gas reading are required prior to sampling the well. Acceptable conditions and protective measures (Table 2) will assure safety. Direct contact and/or inhalation may cause eye and respiratory irritation, as well as nausea, dizziness, and confusion.

5.2.2.3 Surface Water Sampling

It is expected that surface water sampling will not pose a threat or result in significant exposure. Contaminant levels are expected to be nil. Precautions and protection required are presented in Table 2.

5.2.2.4 Gas Vent Monitoring

The recorded levels of explosive gases necessary for periodic reports must be obtained with an organic vapor analyzer and combustible gas indicator. In doing so, the technician should position themselves upwind of the sampling area. Protective measures are presented in Table 2.

5.2.3 Maintenance Installation and/or Replacement

Known pump station maintenance schedules, as determined by the manufacturers, will require extreme caution. The pump chamber services leachate that contain various heavy metals and volatile organic compounds. A contained condition and possible explosion hazard exists. Prior to entry, the involved personnel must comply with the confined space entry guidelines presented as Attachment A.

TABLE 2 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Work Task	Initial Level of Protection	Specific PPE
Pump chamber maintenance	C[1]	Tyvek coveralls, steel toe/shank boots, boot covers, safety glasses, latex inner gloves, nitrile outter gloves, and full-face respirators with organic vapor cartridges containing high efficiency particulate filters
Gas monitoring; site inspection; groundwater, leachate, and surface water sampling.	D[2]	Tyvek or cotton coveralls, steel toe/ shank boots with latex boot covers, latex inner gloves, nitrile outter gloves, and safety glasses
Required trench excavation and/or component replacement	C[1]	Tyvek coveralls, steel toe/shank boots, boot covers, safety glasses, latex inner gloves, nitrile outter gloves, and full-face respirators with organic vapor cartridges containing high efficiency particulate filters

1. If monitoring indicates, PPE may be upgraded to Level B by the SHSO, and personnel must then wear SCBA; Saranex coveralls, steel toe/ shank boots, latex boot covers, latex inner gloves with nitrile outer gloves, hard hat.
2. If monitoring indicates, PPE may be upgraded to Level C by the SHSO, and personnel must then wear full-face respirators with organic vapor cartridges containing high efficiency particulate filters.

During the facility's operational life, it may be necessary for personnel to replace deteriorating or damaged components. It is impossible to determine the condition or extent of unforeseen problems. Any discussion would be based on conjecture and should be resolved as they occur on a case-by-case basis.

5.3 PHYSICAL HAZARDS

Authorized Town of New Windsor personnel and/or a subcontractor performing an inspection or maintenance installation or replacement may be subject not only to the hazards of contaminant exposure, but also to dangers posed by the various task activities. In addition, heat stress caused by working in protective clothing may be encountered.

The physical hazards expected to be present at the site during sampling, maintenance, and any construction operating activities include:

- Snapping cables, slings, and rope
- Excavation equipment
- Sharp objects
- Open pits or ditches
- Excessive noise
- Fire/explosions
- Buried utility lines
- Energized overhead and underground power lines
- Heat stress
- Cold exposure
- Trench excavation
- Biological hazards (ticks, snakes)
- Sunburn and/or sun glare
- Confined space entry.

5.3.1 Abatement of Physical Hazards

Most of the physical hazards identified above will be abated through the use of good construction/excavation safety practices and common sense. Some of the hazards, however, require special precautionary procedures discussed in detail below.

5.3.2 Fire/Explosion

Whenever excavation involves exposure of fill material from the buried wastes, the potential for a fire/explosion may be present. The primary sources of flammable gases/vapors are methane, a by-product of the decay of organic material, and vapors from volatile organic compounds in the fill. If continuous monitoring of flammable gases in the area of any excavation exceed 10 percent of the lower explosive limit (LEL), work may proceed with caution. If concentrations reach 25 percent of the LEL or greater, spark-producing operations shall immediately cease and site workers shall leave the area of the excavation

until concentrations are reduced below 25 percent of the LEL. Details concerning onsite monitoring are discussed in Section 9.

Fire extinguishers will be provided to onsite personnel who will be trained in their use.

5.3.3 Buried Utility Lines

All utility companies will be contacted prior to site activities to ascertain the presence and location of underground cables, utility lines, pipes, and storage vessels at the proposed sites where drilling and excavating activities will take place if information on buried utilities is not available in existing project files. In addition, the as-built plans will be reviewed to determine the presence of underground cables, utility lines, pipes, and storage vessels. Drilling sites will also be screened for underground utilities using a pipe and cable locator prior to any drilling activities.

5.3.4 Drilling

As stated previously, selected locations for additional or replacement monitoring wells shall take into account buried utility pipes, wires, conduits, tanks, or other potentially dangerous structures. Overhead power lines and obstructions will also be surveyed. Prior to raising the rig mast, those areas overhead and surrounding the rig will be checked for clearance.

If, during drilling activities, there is any indication that underground tanks, drums, or other containers are being encountered, the drilling will be halted immediately and the Project Manager notified. Indications that a waste container may have been encountered include:

- Change in the speed or momentum of the auger
- Visual examination of auger cuttings
- Odor noted in the cuttings
- Presence of airborne total volatile organics as measured with a direct reading instrument.

5.3.5 Trench Excavation

Site health and safety procedures that must be followed during trenching must comply with OSHA standards and are discussed in detail in Attachment B.

5.3.6 Heat Stress

All personnel entering an established Exclusion Zone should be familiar with the signs and symptoms of heat stress.

These include:

- Heat Cramps - Painful contraction of voluntary muscles.
- Heat Exhaustion - Dizziness, lightheadedness, slurred speech, rapid pulse, confusion, fainting, fatigue, copious perspiration, cool skin that is sometimes pale and clammy, and nausea.
- Heat Stroke - Hot, dry, flushed skin; delirium, and coma (in some cases).

Heat stress can be prevented by resting frequently in a shaded area, and consuming large quantities of fresh, potable water and electrolyte replenishing fluids (i.e., Gatorade). If heat exhaustion symptoms are observed, the person will be required to rest in a shaded area and consume liquids. If symptoms are widespread or observed frequently, an appropriate work/rest regimen will be instituted. This may involve limiting the work period so that after one minute of rest, a person's heart rate does not exceed 110 beats per minute.

If the heart rate is higher than 110 beats per minute, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the heart rate is 110 beats per minute at the beginning of the next rest period, then the next cycle should be shortened by another 33 percent. Resting heart rate should be determined prior to starting onsite activities. A healthy individual's resting heart rate is usually 60-72 beats per minute.

If symptoms of heat stroke are observed, the victim will be transported to the nearest hospital immediately. Workers should not hesitate to seek medical attention if heat stroke is suspected.

5.3.7 Cold Exposure

Ambient temperatures at the site combined with the effects of wind and water may contribute to cold exposure. Temperatures need not be below freezing before the symptoms of cold exposure develop. Cases of hypothermia are often reported at temperatures ranging between 45 and 50 F when conditions are wet and gusty. Pain in the extremities is often the first early warning of danger to cold stress. Severe shivering indicates that the body temperature has fallen to 95 F; immediate removal to a warmer area is advised. Other symptoms indicating a need to enter a warm shelter include frostnip (the feeling of excessive fatigue, drowsiness, irritability, or euphoria).

As recommended by ACGIH, when temperatures are at or below 10 F (with wind chill considered), SHSO will be in attendance at all times, work involving heavy sweating will be avoided, and sitting or standing still in the cold temperatures will be minimized. In addition, a work-warming regimen as recommended by ACGIH in the ACGIH Threshold Limit Values and Biological Exposure Indices for 1988-1989 may be implemented by the SHSO.

5.3.8 Ticks and Lyme Disease

Lyme disease is a potentially serious disease that can affect the skin, joints, nervous system, and heart. The responsible infectious agent is a corkscrew-shaped bacteria which is transmitted to man by the deer tick (*Ixodes dammini*).

Lyme disease has been reported in 43 states. Specifically, the ticks are found in tall grass and brush and attach themselves to animals such as deer and mice, and sometimes humans. Through the biting and feeding of infected ticks, the bacteria enter man and thereby cause Lyme disease. Animal studies suggest that a tick usually needs to be attached for 24 hours or longer to transmit the disease.

Tick bites and resultant Lyme disease may occur any month; however, because of the tick's life cycle, most cases occur from May to November with the peak incidence of bites in June and July.

About 3-14 days after the tick bite, an expanding red round rash develops at the site of the bite. The rash may expand to several inches in diameter. The rash usually disappears in about four weeks. Many patients may develop flu-like symptoms with fever, headache, muscle stiffness, and joint pains.

Early generalized disease occurs several weeks to months later in untreated patients. Irregular heart beat may occur in about 8 percent of untreated patients. Approximately 15 percent of untreated patients develop neurological disturbances which may include headaches, or paralysis of facial muscles.

Months to years after the initial tick bite, late generalized disease may occur consisting of progressive arthritis, intellectual deterioration, or psychiatric disease.

The proper early diagnosis of Lyme disease is based upon recognizing the characteristic rash. Antibody blood studies are only reliable 4-6 weeks after a tick bite. The best treatment is prevention of tick bites. Antibiotics, oral penicillin, or tetracycline are effective in treating Lyme disease.

In later stages, intravenous antibiotics may be necessary.

To protect yourself from tick bites, avoid wooded or grassy areas that are inhabited by deer. When you must enter such areas, observe the following preventive measures:

- Wear long-sleeved shirts, long pants, and pull socks over the pant leg so ticks cannot attached themselves to exposed skin. Wear white or light colors and tightly woven fabrics.

- Use a repellent containing the ingredient DEET on exposed skin. Also, spray permethrin (sold as Permanone) on your clothes, particularly on pants legs and socks.

- Shower after exposure and check your body for ticks. The ticks are about the size of a pinhead; but after a meal of blood, they may increase to many times their original size. If you find any, promptly remove them with a pair of tweezers by grasping the tick as close to the mouth as possible and gently pull it away from your skin. Do not use matches or nail polish which may leave part of the tick behind.

6. TRAINING

6.1 SITE WORKERS

Site workers involved in site inspections and routine maintenance (e.g., lawn mowing) require no special training beyond general good work practices.

Personnel who may be performing invasive onsite tasks, such as sampling and site repairs, shall be trained as required by U.S. Department of Labor OSHA Standard, 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." Training will include:

- A minimum of 40 hours of initial offsite instruction.

- A minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor.

- An 8-hour "refresher" training period annually.

- Additional training which addresses any unique or special hazards.

The date of training for each site worker will be documented on the Site Worker Training and Physical Examination Record presented in Table 3.

Onsite management and supervisors who are directly responsible for or who supervise employees shall receive at least 8 additional hours of specialized training on managing such operations. The date of this training will be documented on the Site Worker Training and Physical Examination Record presented in Table 3.

6.2 PRE-ENTRY ORIENTATION SESSION

Prior to entering the site, personnel shall attend a pre-entry orientation session presented by the SHSO. All personnel shall verify attendance of this meeting by signing the HSP Review Record shown in Attachment C.

TABLE 3 SITE WORKER TRAINING AND PHYSICAL EXAMINATION RECORD

SITE: _____

Name	Date Training Completed			Date of Last Physical Examination
	Initial	Annual	(*)	

SUBCONTRACTORS:

Name	Date Training Completed			Date of Last Physical Examination
	Initial	Annual	(*)	

Visitors entering designated work areas will be subject to all applicable health and safety regulations during field operations at the site. The SHSO is responsible for briefing the personnel onsite of potential contamination that may be encountered on the site, site health and safety plans, and emergency response plans. Visitors will be under the direct supervision of the SHSO or his/her representative.

At a minimum, the pre-entry orientation session shall discuss the potential health effects and hazards associated with exposure to chemicals known or suspected to be present onsite. The physical/chemical properties and likely routes of exposure to these chemicals will also be discussed. Personnel shall be instructed in the use, care, maintenance, limitations, and fitting of PPE. Respirator training shall conform to ANSI Z88.2 (1980) and OSHA 29 CFR 1910.134. Personnel shall not be fit-tested or issued a respirator if facial hair interferes with the face-to-facepiece seal of the respirator. Qualitative fit-testing shall be performed annually. Records of the fit-testing shall be maintained.

Positive/negative fit-testing shall be performed by the user each time a respirator is donned. Other items to be discussed include decontamination procedures, safe work practices, emergency procedures, and medical and training requirements.

7. MEDICAL REQUIREMENTS

All workers who may perform invasive inspections or repairs must have satisfactorily completed a comprehensive physical examination within the past 12 months as per 29 CFR 1910.120. The protocol for medical examinations is determined by the examining physician. However, the minimum requirements for initial and interim examination are delineated in Table 2. The date of the physical examination of each site worker, including subcontractors, will be documented on the Site Worker Training and Physical Examination Record shown on Table 3.

8. PERSONAL PROTECTIVE EQUIPMENT

PPE will not be required for routine maintenance (e.g., lawn mowing) or non-invasive inspection of the site. For those activities such as invasive inspection or cap repair, the levels of personal protection and specific PPE are shown in Table 2.

All respiratory protective equipment must be approved by NIOSH/Mine Health and Safety Administration. Minimum protective equipment requirements for each area identified in Section 10 are described in Table 2. All subcontractors will be responsible for providing their own PPE and personal decontamination equipment.

8.1 PERSONAL PROTECTIVE EQUIPMENT UPGRADE/DOWNGRADE CRITERIA

The level of PPE required may be upgraded/downgraded at the discretion of the SHSO based upon the total volatile organics readings and/or visible dust emissions.

8.2 MAINTENANCE AND IN-USE INSPECTION

Effective use of protective equipment requires that the equipment be properly used, maintained, and inspected periodically throughout the day. Procedures will be presented during pre-entry training.

8.2.1 Gloves/Body Coverings

Gloves and coveralls will be regularly inspected and replaced promptly if torn. Disposable coveralls will be replaced daily as a minimum requirement. Reusable cotton coveralls will be laundered daily. Reusable gloves will be decontaminated whenever exiting the Exclusion Zone or Contamination Reduction Zone.

8.2.2 Respirators

Respirators will be inspected and checked daily for leaks both visually and with negative or positive pressure checks on the wearer. Respirator cartridges will be replaced immediately if found that they have been subjected to gross contamination or if excessive resistance develops. All respirator maintenance will be performed by the employee with assistance and periodic inspection by the SHSO.

Respirator exteriors will be wet-wiped whenever exiting work areas, as specified in Section 11.4. Respirators will be rinsed with a solution containing a sanitizer recommended by the respirator manufacturer. Respirators will then be hung to drip dry and, if not used daily, placed inside plastic bags for protection against dust.

9. ENVIRONMENTAL MONITORING

9.1 GENERAL

Environmental monitoring will not be required for routine maintenance (e.g., lawn mowing) at the site. For any inspections or invasive activities, a total volatile organics analyzer instrument (e.g., HNu system) shall be used to periodically monitor airborne concentrations of contaminants on the site. The HNu system consists of a photoionization detector used to screen excavated areas for volatile organic compound contamination, to measure employee breathing zone levels of organic vapors and gases, and to avoid measurement of normal landfill methane gas.

Monitoring for flammable/combustible gases shall be performed using a combustible gas indicator/oxygen analyzer. All onsite work tasks will be monitored as detailed in Table 4. Measurements taken for each instrument will be logged in the Environmental Monitoring Record shown in Table 5.

9.2 REAL-TIME AIR MONITORING

The Air Monitoring Program will include sufficient monitoring of air quality in work zones and other onsite areas to assess levels of employee exposure, to determine that the work zone designations are valid, and to verify that the respiratory protection being worn by personnel is adequate. The Air Monitoring Program is also designed to ensure that contaminants are not migrating offsite to minimize exposure of nearby populations and/or workers.

Monitoring must be conducted:

- When work begins on a different portion of the site
- When contaminants other than those previously identified are being handled
- When a different type of operation is initiated
- If personnel are handling leaking drums or containers, or are working in areas with obvious liquid contamination
- When a sufficient, reasonable interval (e.g., at least every 2 hours) has passed so that exposures may have significantly increased.

Instruments shall only be used by employees who have been trained in the proper operation, use limitations, and calibration of the monitoring instrument and who have demonstrated the skills necessary to operate the instrument.

9.2.1 Perimeter Monitoring

Monitoring shall be conducted during invasive activities at the site at least twice each day with a total volatile organics direct-reading instrument at locations upwind and downwind at the site perimeter. Measurements shall also be taken periodically downwind of each active task site to assess the potential for offsite migration. If airborne levels of contaminants exceed background levels for a sustained period of time (i.e., 5 minutes) at the perimeter of the Exclusion Zone, then the Exclusion Zone shall be expanded to encompass all areas subjected to the elevated levels. If airborne levels of contaminants exceed background levels at the perimeter of the site, the work will be stopped, the suspected source of contamination will be covered to eliminate emissions, and the Project Manager will be notified. A decision will then be made as to how to proceed with the work and how to more fully characterize the airborne emissions.

TABLE 4 MONITORING INSTRUMENTS AND USAGE

Instrument	Work Tasks	Frequency and Location
HNu*	All site work	At the perimeter of the site at least twice daily or whenever conditions change
	Trench excavation and replacement procedures	Continuously in the breathing zone and at drum level
	Decontamination of equipment	At the perimeter of the Decon area
CGI/OA**	Drilling	2 in. above the auger opening before each flight is added
	Trench excavation and replacement procedures	Continuously in the work area
HCN Monitor***	Trench excavation and replacement procedures	Continuously in the work area

* If levels of total organics in the breathing zone exceed background levels for a sustained period of time (>5 minutes), personnel must wear respiratory protection (Level C Protection as detailed in Chapter 8). If total organics persist at levels greater than or equal to 5 ppm in the breathing zone, personnel must leave the site and contact the Project Manager. For tasks other than test pits or drum sampling, a determination must be made to continue work at Level C.

** If the LEL ranges between 10 and 25 percent, work may continue with extreme caution. If levels of combustible gases exceed 25 percent LEL, then all spark-generating operations must cease, and personnel must evacuate the Exclusion Zone until levels subside. The monitoring program may be increased, reduced, or modified by the SHSO, based on site conditions and monitoring results.

*** If cyanide levels exceed 2.5 mg/m^3 based on direct reading, then Level B PPE must be worn for the remainder of site activities in the area until levels fall below 2.5 mg/m^3 for a sustained period of time (e.g., 15 minutes).

TABLE 5 ENVIRONMENTAL MONITORING RECORD

SITE: _____

INSTRUMENT: _____

Time	Description of Location	Reading

Calibration Information:

Comments:

Technician: Date:

9.2.2 Calibration and Maintenance

All direct-reading instruments must be calibrated on a daily basis with a known concentration of calibration gas (typically isobutylene or methane, depending on the instrument). Instructions in the manufacturer's operations manual regarding cleaning and maintenance of the instruments shall be followed.

9.2.3 Recordkeeping Requirements

The results of air monitoring readings for each instrument shall be recorded on standard air monitoring data forms as illustrated by Table 5. For measurements taken continuously, readings at the anticipated source and in the breathing zone must be recorded at least twice for each new operation. More frequent recording may be done at the discretion of the SHSO. At the end of each workday, the SHSO will document each instance of non-compliance (if any) with the corrective action specified, and whether responsible employees responded to the corrective action. All exposure monitoring records will be attached to the master copy of this HSP and submitted to the Town. A calibration and maintenance log for each monitoring instrument shall also be maintained.

9.3 HEAT STRESS MONITORING

Ambient temperatures at the site combined with the requirements for PPE use may contribute to heat stress. When ambient temperatures reach or exceed 70 F, body temperatures will be monitored using fever strips or oral thermometers, and heart rates will be monitored when heat stress conditions occur. Work-rest regimes will be adjusted accordingly (Section 5.3.7).

9.4 COLD EXPOSURE MONITORING

Ambient temperatures at the site combined with the effects of wind and water may contribute to cold exposure. Temperatures need not be below freezing before the symptoms of cold exposure are exhibited. Cases of hypothermia are often reported at temperatures ranging between 45 and 50 F when conditions are wet and gusty. When such conditions develop or when ambient temperatures fall below freezing, increased onsite medical surveillance will be performed to detect the development of signs or symptoms, including shivering, apathy or lethargy, and numbness of the extremities.

Those personnel exhibiting early signs or symptoms shall have their body temperature monitored using an oral thermometer and shall receive further monitoring and first aid as necessary.

10. SITE CONTROL

Site control measure will be required when any invasive maintenance or replacement activities is to be performed at the site. These measures will not be required for routine inspections, sampling, or maintenance (e.g., lawn mowing).

A check-in and check-out system will be used to control and record each employee and piece of equipment inside the site boundaries. Only personnel identified as "authorized" will be permitted to enter the site. A master list of authorized personnel will be available and will only include personnel who have received the appropriate training and medical certification required by this HSP and OSHA requirements.

10.1 WORK ZONES

Work zones are designed to prevent employees, visitors, and the surrounding environment from exposure to contamination during all aspects of site activities. All work zones and support areas will be established by the SHSO. Movement of personnel and equipment between zones and on and off the site will be controlled by means of designated access points. All personnel who enter any of the work zones must sign the Site Entry and Exit Log as shown by Attachment D. Minimum PPE for work in each zone is described in Section 8. The following categories are the work zones:

- The Exclusion Zone - encompasses the surface areas around the location of invasive operations within a 50-ft radius.

- The Contamination Reduction Zone - will be established as a buffer zone between the Exclusion Zone and the Support Zone of each work site. All personnel and equipment leaving the Exclusion Zone will do so through the Contamination Reduction Zone. Personnel and equipment decontamination stations, described in Section 11, will take place in this zone.

- The Support Zone - will be established near the entrance gate. No special clothing or protective equipment is required in this area. Operational direction and support facilities (supplies, equipment, storage, and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the Support Zone from the Exclusion Zone without removal of all potentially contaminated PPE.

10.2 SITE ENTRY AND EXIT

All persons entering an Exclusion Zone will be required to wear the PPE specified in Section 8.

The following protocols will be followed when leaving the Exclusion Zone and Contamination Reduction Zone:

- All personnel will exit through the designated exit points.
- All personnel will proceed through appropriate decontamination, as specified in Section 11.
- All protective equipment will be removed in the Contamination Reduction Zone.

10.3 COMMUNICATIONS

Standardized hand signals will be used to maintain communications between personnel in the various work zones throughout the duration of each specific operation when necessary. At least one person full trained in first aid and CPR must be in continuous visual and verbal contact with personnel who are working in test pits and handling drums.

10.4 "BUDDY" SYSTEM

All work in the Exclusion Zone will be scheduled so that no employee works alone in this zone at any time. Each team worker will maintain visual contact with another specified team worker at all times. The "buddy" system will ensure against an employee's becoming stressed without a co-worker being aware of his or her condition. Workers must "watch out" for each other while working close to potential chemical and physical hazards.

10.5 SAFE WORK PRACTICES

10.5.1 Site-Specific Practices

Safe work practices, which must be followed by all site workers, include:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the Exclusion and Contamination Reduction zones.
- No sitting or kneeling in areas of obvious contamination.
- Hands and face must be thoroughly washed upon leaving the work area.
- Any defective PPE must be repaired or replaced immediately.
- Prescription drugs must not be taken by personnel unless specifically approved by an occupational physician. Controlled or unauthorized drugs will not be permitted at any time.
- When respirators are required, facial hair that interferes with the face-to-facepiece fit of the respirator will not be permitted.

- Personnel onsite must use the buddy system; visual contact must be maintained between team members at all times.

10.5.2 Daily Startup and Shutdown Procedures

The following protocols will be followed daily prior to the start of work activities:

- The site SHSO will review site conditions to determine if modification of work and safety plans is needed.
- Personnel will be briefed and updated on any new safety procedures.
- All safety equipment will be checked for proper function.
- The site SHSO will ensure that first-aid equipment is readily available.
- The site SHSO will initiate appropriate monitoring.

The following protocol will be followed at the end of daily operations and before breaks:

- All personnel will proceed through appropriate decontamination procedures and facilities.
- The SHSO with this site HSP corrective action specified, and whether the responsible employee responded to the corrective action.

11. DECONTAMINATION

11.1 GENERAL

Decontamination procedures of site workers will be required when any invasive maintenance or replacement activity is to be performed at the site. These procedures will not be required for routine inspections or maintenance (e.g., lawn mowing).

Employees will be trained in decontamination procedures that will be implemented when employees or equipment enter Exclusion or Contamination Reduction zones. Decontamination will be performed to minimize potential contamination of equipment and the spread of contamination from one zone to another.

11.2 PERSONNEL

No worker, except in an emergency situation, will leave the Exclusion Zone without going through the proper decontamination sequences.

Upon leaving the Exclusion Zone, personnel will wash non-disposable boots and outer gloves at the decontamination station located at the Exclusion Zone/ Contamination Reduction Zone boundary. The wash solution will be a simple detergent/water solution. Outer disposable clothing will be removed and placed in sealed 6-mil plastic bags for disposal. Tyvek coveralls may be worn out of the Exclusion Zone if there is no evidence of gross contamination. Exterior surfaces of respirators will be wet-wiped, then respirators will be removed and placed in a plastic bag for temporary storage and cleaning.

During decontamination, personal protective clothing and equipment will be removed in the following order:

- Outer gloves
- Boot covers
- Coveralls
- Inner gloves or respirator (depending on which clothing/equipment is most heavily contaminated).

11.3 DECONTAMINATION NOTICE TO EMERGENCY PERSONNEL

Local emergency medical personnel, ambulance crews, and hospital room staff will be notified by the Town before operations begin. They will be advised and warned of the possibility of having to handle contaminated clothes and/or injured workers; they will be advised of appropriate decontamination procedures.

11.4 RESPIRATOR DECONTAMINATION

Respirators will be cleaned daily by the individuals to whom they have been assigned. Each individual will be responsible for cleaning and maintaining his/her own respirator. A wash basin or sink of a solution containing sanitizer recommended by the manufacturer must be provided by the drilling subcontractor for final rinsing of respirators at the end of the day. Respirators will then be hung to drip-dry and, if not used daily, will be placed inside plastic bags for protection against contamination. Respirator cartridges will be changed if contaminated, if sampling data indicate potential saturation concentrations exist, or if breathing resistance becomes difficult. The SHSO will also spot check respirators to ensure that all are properly cleaned, maintained, and stored.

11.5 EQUIPMENT DECONTAMINATION

Any excavation equipment, down-hole tools, and other equipment that has come in contact with the waste shall be steam-cleaned at the site's designated cleaning area prior to performing work and prior to leaving the site. Decontamination will be conducted at a centralized decontamination area. The decontamination area, at a minimum, shall consist of a pad of sufficient size to properly decontaminate all equipment anticipated to be onsite. In addition, it must be capable of containing all decontamination fluid and soil removed from

the onsite equipment and must have provisions for containerization of all decontamination fluid and soil. All decontamination fluid and soil shall be collected and stored in drums that will remain onsite in a secure area for subsequent disposal.

11.6 DISPOSAL OF WASTES GENERATED DURING REMEDIATION ACTIVITIES

Waste solids generated by the work activities (including used respirator cartridges and disposable protective coveralls) will be bagged, labeled, and stored onsite for subsequent disposal. Waste fluids will be stored for final disposal.

11.7 LAUNDERING

Non-disposable work clothing and undergarments will be laundered during the hazardous waste handling aspects of this project. All potentially contaminated articles will be washed separately from other laundry items.

12. EMERGENCY RESPONSE PLAN

Onsite emergencies will ultimately be handled by offsite emergency support personnel. Initial response and first-aid treatment, however, should be available onsite.

In case of a hazardous materials emergency, the senior supervisor on the work site will assume full control and direction of the emergency response as the Incident Commander. The Incident Commander will work with the SHSO to identify and evaluate hazards. All emergency responders and communications will be coordinated and controlled through the Incident Commander.

12.1 EMERGENCY EQUIPMENT

Emergency equipment should be provided by the Town or contractor performing site activity. Emergency equipment for the Exclusion Zone will be kept in the Contamination Reduction Zone. The equipment will include:

- Portable emergency eye wash
- Two multipurpose (ABC-rated) fire extinguishers
- An adequately stocked first-aid kit.

Another adequately stocked first-aid kit and an emergency siren will be available in the Support Zone (if present).

12.2 PRE-EMERGENCY PLANNING

Prior to the start of invasive work which may require excavation in the waste, the Town or designee should contact local authorities to inform them of the start date and anticipated scope of work.

12.3 EMERGENCY RECOGNITION AND PREVENTION

Emergency conditions that may be anticipated at the NWLF site include:

- Explosion
- Medical emergency
- Heavy equipment accident
- Discovery of unanticipated buried hazards
- Overexposure of personnel to onsite contaminants
- Heat stress
- Cold exposure.

To ensure that hazard recognition and accident prevention protocols are being maintained, personnel must follow the requirements of this site HSP particularly the hazard evaluation in Section 5, PPE requirements in Section 8, and the site control requirements described in Section 10.

12.4 OPERATIONS SHUTDOWN

Operations shutdown may be mandated by the Town, the SHSO, or by the emergency response Incident Commander. Conditions warranting work stoppage will include (but are not limited to):

- Uncontrolled fire
- Explosion
- Uncovering potentially dangerous buried material
- Any condition immediately dangerous to life and health or the environment
- Heat stress illness exhibited by the crew
- Potential for electrical storms
- Treacherous weather-related conditions
- Limited visibility
- Air contaminant concentrations in excess of the protection factors afforded by the respirators in use.

When any of these conditions exist, operations will be stopped and the work site area secured. All personnel will leave the work area until the Incident Commander has determined that operations may resume.

12.5 FIRE AND EXPLOSION RESPONSE PROCEDURES

Fires onsite can be started by natural events, work activities, or the activities of others. Personnel should be instructed in the use of multipurpose (ABC-rated) fire extinguishers which will be on hand at all times. They will be advised to attempt to control only very small fires. The procedure for using a fire extinguisher is to pull the safety pin, point the extinguisher at the base of the flames, and discharge the extinguisher by sweeping the flames from a distance of about 6 ft. The extinguisher operator should move in as the flames are being put out. The local fire district must be informed immediately in case of any fire where its help will be necessary.

12.6 EVACUATION FROM WORK ZONES

If an onsite emergency occurs, all workers will meet at an area designated during the pre-entry briefing and located in the Support Zone. An employee headcount will be performed to ensure that all workers are accounted for.

In case of emergency, evacuated employees may be decontaminated rapidly by removing exterior clothing. If a worker is critically injured in the Exclusion Zone, the worker may be removed immediately from the area--DO NOT take time to decontaminate an injured worker. Seek medical attention immediately.

12.7 REPORTING INCIDENTS

Incidents should be reported to local, state, and federal agencies in accordance with all applicable regulations. The Town representatives must be notified of all accidents and near-miss accidents.

12.8 EMERGENCY MEDICAL TREATMENT AND FIRST-AID

At least one representative employee must be trained in both first aid and CPR. Only minor injuries will be treated onsite with the first-aid kit available.

For major injuries contact (914) 565-3320. The phone numbers for the hospital, fire, police, and ambulance are provided on the form in Attachment E. If an injury is serious but not an emergency or life-threatening, the phone numbers in Attachment E may be used. The victim must be transported to the nearest hospital for an examination.

13. CONFINED SPACE

At no time will any site employee, including subcontractors, enter any confined spaces without the prior approval of the Town. Confined spaces are spaces with any of the following characteristics:

- Limited openings for entry and exit
- Unfavorable natural ventilation
- Subject to accumulation of toxic or combustible agents or oxygen deficiency
- Design prohibiting continuous worker occupancy.

Confined spaces include, but are not limited to:

- Aboveground or underground storage tanks, process vessels, and tank trailers
- Trenches >4 ft deep, test pits, bins, vaults, vats, and silos
- Ventilation or exhaust ducts, manholes, sewers, tunnels, and pipelines
- Building or room with limited means of access/egress.

EA Project No. 11160.05

General Operation, Maintenance, and Monitoring Manual Town of New Windsor Landfill

Revision 0

Prepared for

Town of New Windsor
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New Windsor, New York 12553



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John H. Samuelian, Ph.D, Project Manager — Date 2-8-94

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February 1994

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1. INTRODUCTION

The New Windsor Landfill (NWLF) is located in southeastern New York State in the Town of New Windsor, Orange County. The site, situated at the end of Square Hill Road, is 2.5 mi west of the City of Newburgh, and approximately 50 mi north of New York City (Figures 1 and 2). The NWLF is bounded on the east by the New York State Thruway, while undeveloped land occupies the areas immediately to the north, west, and south. Property of the Stewart Air National Guard Base borders the site to the northwest.

1.1 BACKGROUND

The landfill was initially closed in 1976, and prior to completing the closure per 6 NYCRR Part 360 requirements, contained grass, bushes, and small trees growing throughout most of the site; large stockpiles of gravel located in the southern portion; and piles of dirt, brush, debris, and assorted metal scattered throughout the site surface. The site perimeter was fenced with a locked entrance gate on Square Hill Road as part of the site closure.

The nearest residential area is located approximately 800 ft southwest of the site along Silver Stream Road. Although public water is available along Silver Stream Road, several residences use groundwater as a potable water supply. The nearest public water supply source, Washington Lake, is located approximately 800 ft east of the site.

1.2 OBJECTIVE

The purpose of this Manual is to provide field personnel with detailed instructions on performing environmental monitoring, reporting, and site maintenance of all the remedial facilities included in the Final Closure Plan for the NWLF. A qualified facility operator meeting New York State Department of Environmental Conservation (NYSDEC) requirements will be responsible for implementing the monitoring and maintenance program and associated reporting.

This Manual is based on, and references, the Engineer Specification Documents, the approved design plans, and 6 NYCRR Part 360. The field personnel will become familiar with all documents and objectives of the system to ensure a safe and efficient operational system. This Manual is to be finalized following construction so that specific operational equipment and final construction details can be included as a separate section. During the facility's operational life, the Manual will undergo periodical updates reflecting any changes in procedures, infrastructure, and analytical protocols. These updates will include any improvements in operational protocols. Appendixes to this Manual are as follows:

- Appendix A: Well Construction Details
- Appendix B: General Checklist Forms
- Appendix C: Town of New Windsor Wastewater Discharge Permit (15 June 1993)

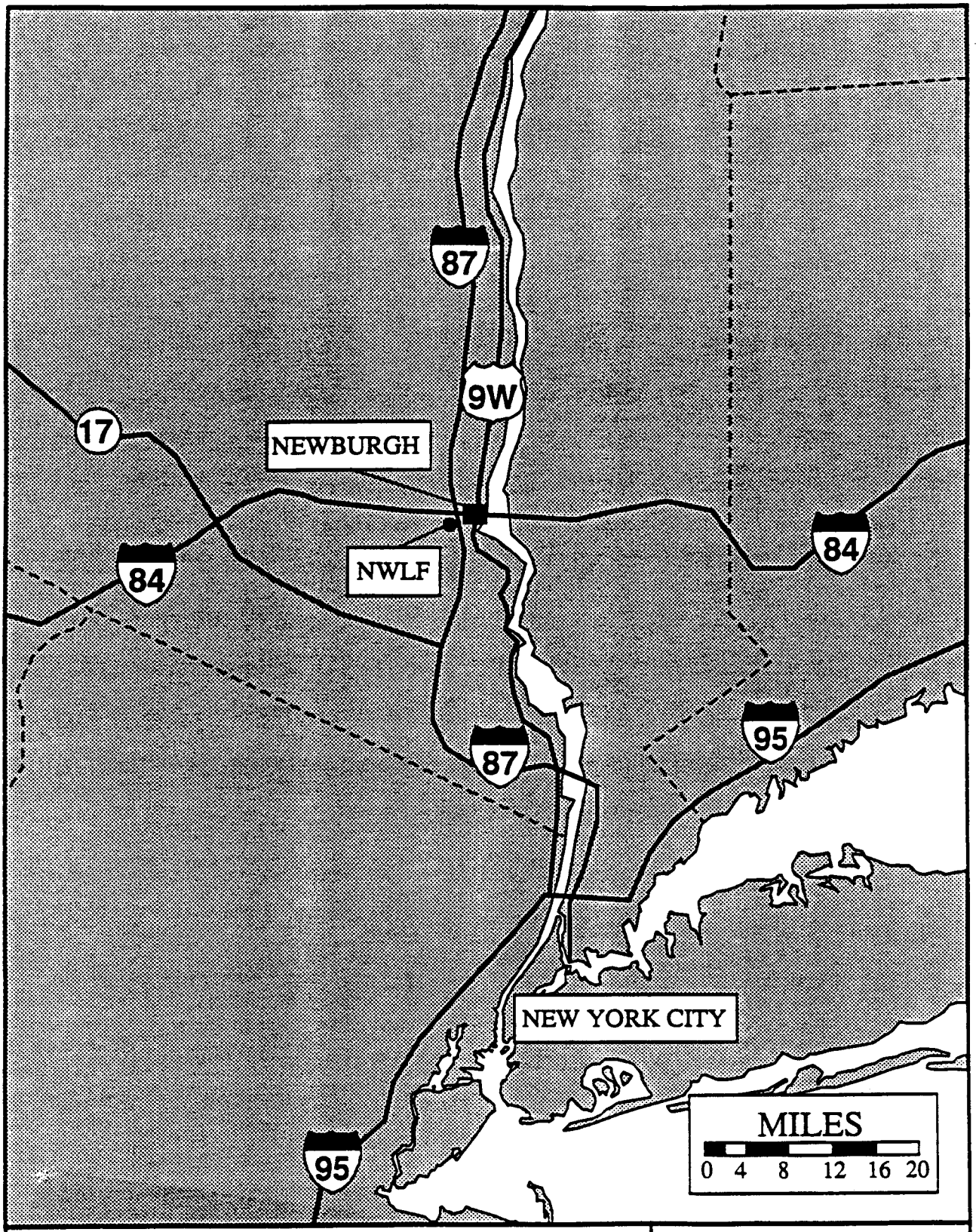


Figure 1. General location map of the Town of New Windsor Landfill.

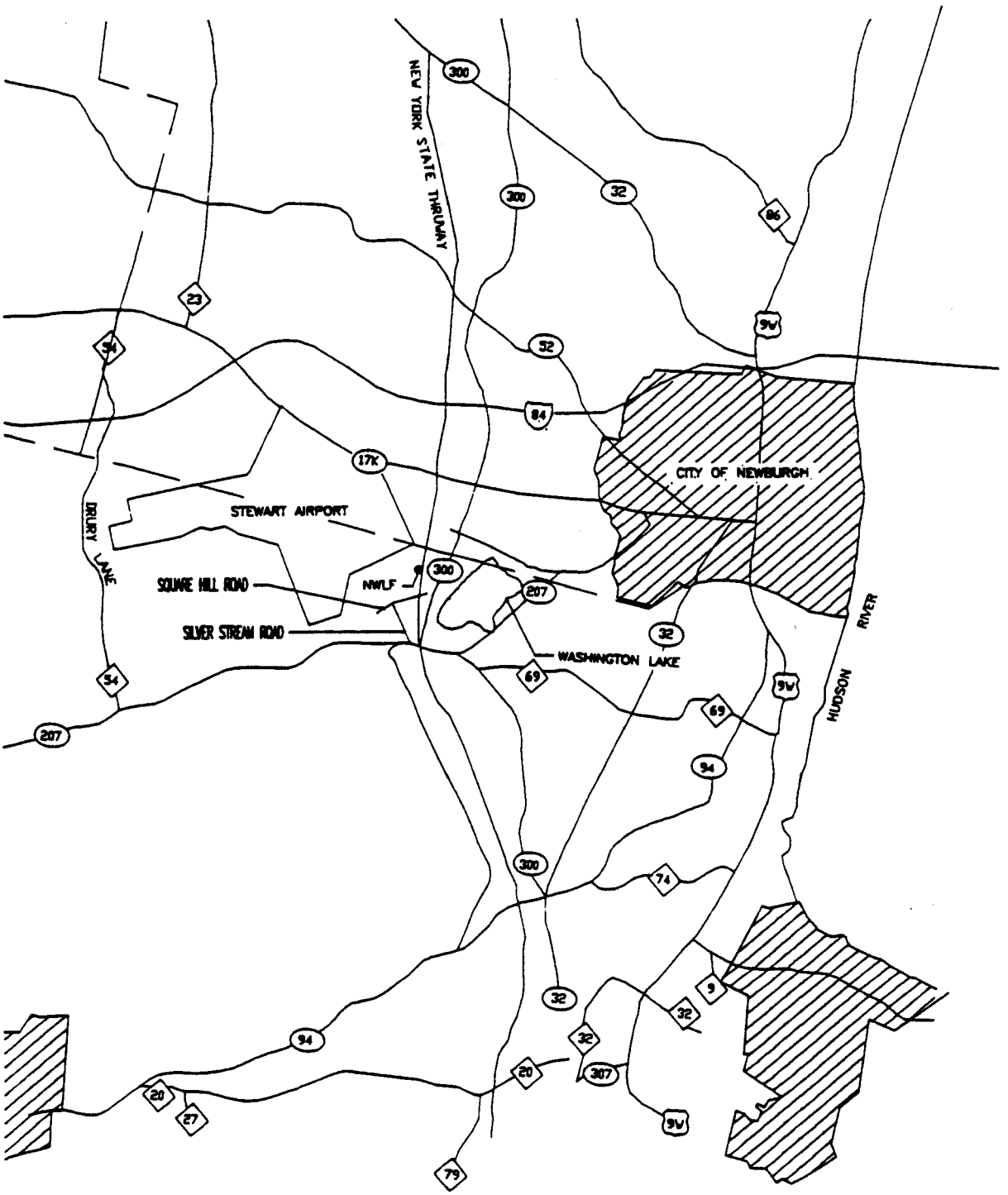


Figure 2. Site location map for the Town of New Windsor Landfill.

- Appendix D: Draft Health and Safety Plan, Post-Closure Period, Town of New Windsor Landfill, New Windsor, New York
- Appendix E: Pump Station Operation and Maintenance Manual
- Appendix F: Borrow As-Built Topography
- Appendix G: Record Details
- Appendix H: Construction Shop Drawings.

1.3 POST-CLOSURE LAND USE

The Town has proposed to utilize portions of the closed landfill as a gravel storage area and leaf composting facility. At this time, only conceptual design of these facilities has been developed. A new highway garage may be constructed off the closed landfill on an adjoining parcel once used for leaf composting, and as a staging area during the remedial action.

Since the Town has not committed to a detailed long-term use of the site, advanced notification and authorization by NYSDEC is required for any proposed change in land use or site utilization after the commencement of the post-closure period. The Town's representative will address this matter with a written correspondence to the NYSDEC Project Manager.

2. SITE REMEDIAL ACTION

In June 1991, EA submitted the Final Remedial Investigation/Feasibility Study (RI/FS) Report for the NWLF. The RI showed evidence of soil and groundwater contamination within the landfill, contamination of shallow sediments in the adjacent leachate collection area, and contamination of surface water leaving the leachate collection area. A Human Health Risk Assessment based on the RI chemical database showed that risks would exceed the NYSDEC remediation thresholds if contamination was left in place.

In response to these results, the FS Report evaluated several source area (fill) alternatives and leachate water treatment alternatives to provide protection of human health and the environment. Following completion of a detailed technical, risk, and economic analysis of these alternatives, the following remedial alternatives were selected by NYSDEC:

- Consolidate the two state-owned encroachment areas (Area Nos. 2 and 3) and Encroachment Area No. 4 with the existing fill but keep the privately-owned Encroachment Area No. 1 in place.

- Close the site in accordance with 6 NYCRR Part 360. This includes site grading, installation of a soil-geomembrane cap, a gas venting system to maintain cap integrity, and a leachate collection system.

- Construct a surface water diversion system and discharging groundwater interception system to bypass the fill mass.

- If required, pretreat the collected leachate for solids to reduce metals content and discharge to the publicly-owned treatment works (POTW) for treatment.

3. SUBMISSIONS AND RECORDS

Following closure, the Town of New Windsor will submit two copies of a monthly leachate sampling analyses and report and a quarterly report presenting surface and groundwater sampling analysis, gas sampling analysis, and field inspection observations submitted to the NYSDEC Project Engineer. These reports will include all recorded observations; analytical results and pertinent information regarding personnel involved, times, dates, and methods; and temporal trends comparing previous analysis represented in tabular and graphical format. The monthly inspection report, air monitoring report, and report of chemical analysis (monthly leachate, quarterly groundwater, and quarterly surface water) will be submitted concurrently, within 30 days of completion, to the extent possible.

After a minimum of five years, NYSDEC will formally assess the monitoring program. Any changes to the established program must be authorized by NYSDEC. The monitoring program and maintenance activities are the responsibility of the Town and must be continued for a standard period of 30 years. The submitted reports must be archived by the Town for the duration of the post-closure monitoring period.

Depending on the threat to health and/or property, NYSDEC may prescribe modifications to the analytical program and any remedial measures necessary to resolve a site-specific concern.

Personnel involved with the implementation of post-closure monitoring, reporting, and maintenance include:

Contact	Association	Telephone No./ Facsimile No.	Role
George Meyers	Town of New Windsor	(914) 565-8800 (914) 563-4693	Town Supervisor
Pat Hines	McGoey, Hauser and Edsall, P.C.	(914) 562-8640 (914) 562-1413	Overall Project Management Conduct monthly inspections Prepare monthly and quarterly reports
John Egitto	POTW Operator (CAMO)	(914) 561-2550/ (914) 561-9280	POTW Operator - Pump station operations and maintenance

Contact	Association	Telephone No./ Facsimile No.	Role
Mike Mason	NYSDEC	(518) 457-9280/ (518) 457-7743	Interim State Agency Compliance Manager
Laboratory	To be Determined		Analytical laboratory; sample acquisition
			Lawn maintenance
John Samuelian	EA Engineering, P.C.	(914) 565-8100/ (914) 565-8203	Technical Support

4. ENVIRONMENTAL MONITORING

The durability and overall effectiveness of the closure of the NWLF is determined by analyzing the surface water, groundwater, leachate, and the gas produced. The proposed monitoring points are indicated on Figure 3. Discussion and suggested guidelines are contained within this section.

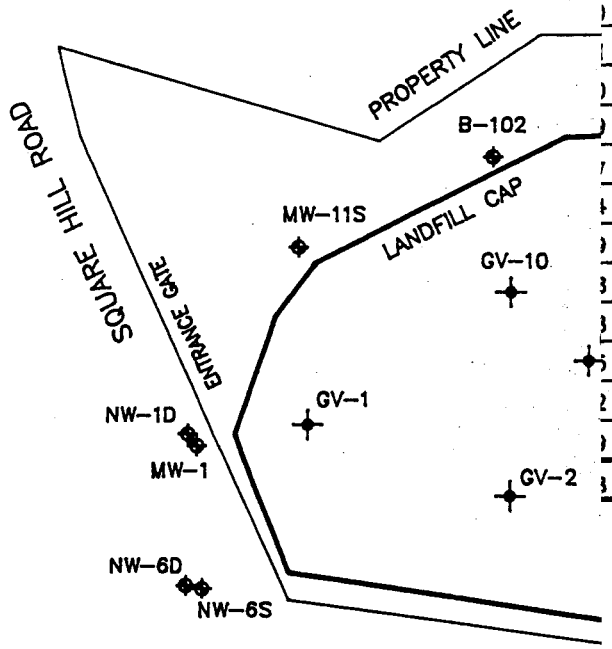
4.1 WATER SAMPLING

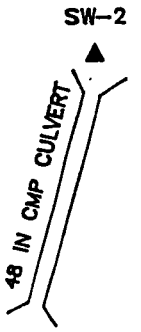
Fifteen monitoring wells located on the perimeter at the landfill site (Figure 3) are proposed to be sampled following closure and for the post-closure period. These monitoring wells include:

Overburden Wells	Bedrock Wells
MW-1	NW-1D
B-102[a]	
NW-3S, NW-3D	
NW-4S	NW-4D
NW-6S	NW-6D
	MW-7D (new)
MW-8S (new)	MW-8D (new)
MW-9S (new)	
MW-10S (new)	MW-10D (new)
MW-11S (new)	

(a) Static water level and air monitoring only.

	ELEVATION – TOP OF WELL CASING (FT)	SIZE/TYPE	DEPTH (FT)	YEAR INSTALLED
)	356.44	2 IN/PVC	21.5	NA
)	356.76	2 IN/SS	30.0	1990
)	335.97	2 IN/SS	14.5	1990
	336.29	2 IN/SS	28.0	1990
)	337.71	2 IN/SS	14.0	1990
	338.30	3 IN/SS	38.0	1990
)	357.20	2 IN/SS	23.5	1990
)	356.01	3 IN/SS	93.0	1990
)	351.23	3 IN/PVC	95.0	1993
)	340.20	2 IN/SS	15.0	1993
)	339.15	3 IN/SS	45.0	1993
)	339.29	2 IN/SS	14.5	1993
)	339.80	2 IN/SS	15.0	1993
)	339.16	3 IN/SS	60.0	1993
)	359.64	2 IN/SS	15.0	1993
)	343.44	2 IN/PVC	17.0	1989
)	352.43	2 IN/PVC	21.5	1993





MW-7D

VIRONMENTAL MONITORING PLAN
POST CLOSURE
WN OF NEW WINDSOR LANDFILL

NEW WINDSOR, NEW YORK

FIGURE 3

NOTES

1. BASE MAP DEVELOPED FROM BORROW A
2. WELL SURVEY DATA PROVIDED BY DON
3. REFER TO TEXT FOR DESCRIPTION OF S
4. ALL WELLS LABELLED "NW" WERE INSTA

EA ENGINEERING, P.C.

3 WASHINGTON CENTER
THE MAPLE BUILDING
NEWBURGH, NEW YORK 12550
(914) 565-8100

PROJECT NUMBER	11160.05
SCALE	1"=200'
FILE NAME	CAD/NWLFGOMM
DRAWING NUMBER	-
SHEET NUMBER	1 OF 1

The well construction details are included as Appendix A. The wells west of the landfill, installed for a separate investigation, may also be sampled as part of the monitoring program. In addition, there are two proposed surface water sampling points, one located at the inlet stream within the site sedimentation basin and the other immediately upstream of the 48-in. culvert crossing the New York State Thruway (approximately 1,500 ft north of the site sedimentation basin). Both points will be sampled along with the monitoring wells. The sampling program is summarized in Table 1.

The first quarterly sample (Q1) is run for the baseline and routine parameters as shown on Table 1. For the three subsequent quality samples (Q2, Q3, and Q4), those samples from Q1 which showed evidence of volatile organic chemicals must be run for baseline parameters. After the first year of sampling, this requirement may be reduced at the concurrence of NYSDEC. Table 2 is a listing of the analytes required under 6 NYCRR Part 360-2.11[C](6). Analytical methods to be used are included in Table 3. For quality assurance purposes, one trip blank and one field blank will be analyzed for volatile organic compounds only as part of the annual sampling event.

A single piezometer (PZ-1) installed within the landfill along with the monitoring wells and leachate collection manholes 2A and 4A will be gauged for water level and monitored for explosive vapor (Table 1). A summary comparing groundwater elevation will accompany the quarterly analytical reporting. These results will assist in determining the overall effectiveness of the leachate collection system as a hydraulic barrier (sink) minimizing leachate water migration outward from within the limits of the landfill.

4.1.1 Procedures

The following procedures must be observed prior to sampling the monitoring wells:

- Air present in the well riser and casing must be monitored with a calibrated HNu or organic vapor analyzer and measurements recorded prior to well sampling as summarized in Table 1.

- The static water level must be measured and recorded as summarized in Table 1.

- Wells must be observed for immiscible layers or other contaminants that are lighter or heavier than water. If found, separate samples and analyses must be performed on these immiscible layers.

- The stagnant water must be evacuated to a level not lower than the top of the sand pack. The water removed will be containerized and then discarded into a leachate collection system manhole. During the evacuation process, careful consideration must be taken to avoid excessive disturbance which may cause turbidity.

TABLE 1 ANNUAL AND QUARTERLY SAMPLING PROGRAM FOR THE NEW WINDSOR LANDFILL POST-CLOSURE MONITORING PROGRAM

Sample	Annual Sampling					Quarterly Sampling			
	Elevations	OVA/CGI	pH/eH	Baseline	Routine	Elevations	OVA/CGI	pH/Eh	Routine
MW-1	X	X	X	X		X	X	X	X
NW-1D	X	X	X		X	X	X	X	X
NW-3S	X	X	X	X		X	X	X	X
NW-3D	X	X	X		X	X	X	X	X
NW-4S	X	X	X	X		X	X	X	X
NW-4D	X	X	X		X	X	X	X	X
NW-6S	X	X	X		X	X	X	X	X
NW-6D	X	X	X	X		X	X	X	X
MW-7D	X	X	X		X	X	X	X	X
MW-8S	X	X	X		X	X	X	X	X
MW-8D	X	X	X		X	X	X	X	X
MW-9S	X	X	X	X		X	X	X	X
MW-10S	X	X	X	X		X	X	X	X
MW-10D	X	X	X	X		X	X	X	X
MW-11S	X	X	X		X	X	X	X	X
Pump Station Wet Well	X	X	X	X		X	X	X	
B-102	X	X	X			X	X	X	
PZ-1	X	X	X			X	X	X	
LCMH-1	X	X				X	X		
LCMH-2A	X	X				X	X		
LCMH-4A	X	X				X	X		
SW-1			X	X				X	X
SW-2			X	X				X	X

NOTES: Baseline and routine parameters are shown in Table 2.
Pump station wet well monitored monthly, per discharge permit requirements.
Baseline parameters will be required for the second, third, and fourth quarterly samples only in the wells and surface water samples which showed volatile organic chemicals in the first quarterly sampling round.

TABLE 2 WATER QUALITY ANALYSES FOR GROUNDWATER AND SURFACE WATER

Field Parameters	Baseline Parameters (Annual)	Routine Parameters (Quarterly)
Static water level (in wells and sumps)	X	X
Specific conductance	X	X
Temperature	X	X
Floaters or sinkers[a]	X	
pH	X	X
Eh	X	X
Dissolved oxygen[b]	X	X
Field observations[c]	X	X
Leachate Indicators		
Total Kjeldahl nitrogen	X	
Ammonia	X	X
Nitrate	X	X
Chemical oxygen demand	X	X
Biochemical oxygen demand	X	
Total organic carbon	X	X
Total dissolved solids	X	X
Sulfate	X	X

(a) Any floaters or sinkers found must be analyzed separately for baseline parameters.
(b) Surface water only.
(c) Any unusual conditions (colors, odors, surface sheens, etc.) noticed during well development, purging, or sampling must be reported.

NOTE: The samples must be unfiltered. NYSDEC may waive requirement to analyze hexavalent chromium provided that total (hexavalent plus trivalent) chromium values do not exceed 0.05 mg/L.

TABLE 2 (Continued)

Field Parameters	Baseline Parameters (Annual)	Routine Parameters (Quarterly)
Leachate Indicators (Continued)		
Alkalinity	X	X
Phenols	X	X
Chloride	X	X
Total hardness as $CaCO_3$	X	X
Turbidity	X	X
Color	X	
Boron	X	
Metals		
Potassium	X	X
Sodium	X	X
Iron	X	X
Manganese	X	X
Magnesium	X	X
Lead	X	X
Cadmium	X	X
Aluminum	X	
Calcium	X	X
Toxic metals[d] and cyanide	X	
Volatile organics[e]	X	

(d) Toxic metals include: antimony, arsenic, barium beryllium, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, silver, thallium, and zinc.

(e) Volatile organics are to be analyzed using EPA Methods 601 and 602 as described in 40 CFR Part 360 (Section 136-1.3 of this Part).

TABLE 3 ANALYTICAL METHODS

Parameter	Method Number
Specific conductance	EPA 120.1
pH	EPA 150.1
Eh	Field Measured
Dissolved oxygen	EPA 360.1
Total Kjeldahl nitrogen	EPA 351.2
Ammonia	EPA 350.1
Nitrate	EPA 353.2
Chemical oxygen demand	EPA 410.4
Biochemical oxygen demand	EPA 405.1
Total organic carbon	EPA 415.1
Total dissolved solids	EPA 160.1
Sulfate	EPA 300.0
Alkalinity	EPA 310.1
Phenols	EPA 420.1
Chloride	EPA 325.2
Total hardness as $CaCO_3$	EPA 130.1
Turbidity	EPA 180.1
Color	EPA 110.1
Boron	EPA 212.3
Metals[a]	EPA CLP (SOW 3/90)
Cyanide	EPA 335.2
Chromium, hexavalent	SM312B
Volatiles	EPA 600 Series

(a) Target analyte list metals include: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium (total), cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

TABLE 4 WATER QUALITY ANALYSES FOR LEACHATE WATER

Field Parameters	Annual Baseline Parameters	Quarterly Routine Parameters	Monthly[a] Parameters
Specific conductance	X	X	
Temperature	X	X	
Floaters or sinkers[b]	X		
pH	X	X	X
Eh	X	X	
Field observations[c]	X	X	
Leachate Indicators			
Total Kjeldahl nitrogen	X		
Ammonia	X	X	
Nitrate	X	X	
Chemical oxygen demand	X	X	
Biochemical oxygen demand	X	X	X
Total halogenated organics	X	X	X
Total organic carbon	X	X	
Settleable solids	X	X	X
Total dissolved solids	X	X	
Total suspended solids	X	X	X
Sulfate	X	X	
Sulfide	X	X	X
Alkalinity	X	X	
Phenols	X	X	
Chloride	X	X	
Total hardness as $CaCO_3$	X	X	
Turbidity	X	X	
Oil and grease	X		
Color	X		
Ignitability	X	X	X
Boron	X		
Available chlorine	X	X	X

(a) Refer to Town Wastewater Discharge Permit. Permit issued June 1993 included as Appendix C.
(b) Any floaters or sinkers found must be analyzed separately for baseline parameters.
(c) Any unusual conditions (colors, odors, surface sheens, etc.) noticed during sampling must be reported.

NOTE: NYSDEC may modify this list as needed. The samples must be unfiltered.

TABLE 4 (Continued)

Field Parameters	Annual Baseline Parameters	Quarterly Routine Parameters	Monthly[a] Parameters
Metals			
Potassium	X	X	
Sodium	X	X	
Iron	X	X	
Manganese	X	X	X
Magnesium	X	X	
Gold	X	X	X
Lead	X	X	
Cadmium	X	X	
Aluminum	X		
Calcium	X	X	
Phosphorous	X		
Cyanide	X	X	X
Antimony	X		
Arsenic	X	X	X
Barium	X	X	X
Beryllium	X		
Cadmium	X	X	X
Total Chromium	X	X	X
Hexavalent Chromium	X	X	X
Copper	X	X	X
Lead	X	X	X
Mercury	X	X	X
Nickel	X	X	X
Selenium	X		
Silver	X		
Thallium	X		
Zinc	X	X	X
Flow	X	X	X
Volatile organics[d]	X		
Appendix 33 analytes[e]			

(d) Volatile organics are to be analyzed using EPA Methods 601 and 602 as described in 40 CFR Part 360 (Section 136-1.3 of this Part).

(e) The initial sampling shall include baseline parameters and constituents listed in 6 NYCRR Subpart 373-2 Appendix 33 satisfying Part 360 and discharge permit requirements.

- Air dry
- Wrap Teflon bailers, trowels, and scoops in aluminum foil
- Place in sealed plastic bag.

Disposable bailers will not require decontamination prior to sampling. All decontamination fluids will be collected and containerized for analysis at a later date. Using disposable Teflon bailers avoids this process and is recommended.

Before and after performing a measurement (or submersible pump use) at each well and the leachate pump station, the probe of the water level indicator (e.g., QED), pH meter, or specific conductance meter (or the submersible pump and electrical wire) will be cleaned as follows:

- Wash with water (from an approved source) and laboratory-grade detergent (e.g., alconox)
- Rinse with deionized water
- Rinse with methanol
- Rinse with deionized water
- Air dry.

Methanol, as part of the decontamination procedure, will only be used where volatile organics are present or suspect.

All decontamination fluids will be collected and containerized but cannot be disposed within the existing treatment system.

4.4 SAMPLE PRESERVATION

Subsequent to sampling groundwater, surface water, and leachate, each sample will be placed in ice to maintain a sample temperature of 4 C or less. Holding times are specified for each analytical method presented in Table 3.

4.5 ANALYTICAL LABORATORY REQUIREMENTS

It is the responsibility of the laboratory to provide the date of the analysis, the individual's name who performed the analyses, analytical techniques or methods used, the results of the analyses, and a completed form indicating the chain-of-custody. In addition, the information relating to the analysis, including records of internal laboratory quality assurance and control, must be available to NYSDEC at their request. Consequently, the analytical reports submitted by the laboratory will meet or exceed the deliverable requirements of the Analytical Services Protocol.

The laboratory will be a New York State Department of Health-certified laboratory, and must be competent with the following:

- NYSDEC's Analytical Services Protocols (dated 1991 or most current)
- U.S. Environmental Protection Agency (EPA) Contract Laboratory Protocols (dated 1990 or most current).

4.6 GAS MONITORING

The landfill cover is constructed of several layers, each of which has a different function. The gas venting layer and vents are designed to control, collect, and safely vent any gas generated by the decomposition of landfill materials and vapors released from the underlying waste. The gas is typically composed of carbon dioxide, methane, and hydrogen sulfide while the vapors may include volatile organic compounds identified in the soil samples (toluene, xylene, trichloroethene, and chloroethane). There are 10 vent locations (Figure 3) at the landfill which will be tested with a properly calibrated explosimeter and organic vapor analyzer quarterly. These findings will be recorded and included within an applicable quarterly report.

If the lower explosive limit exceeds 25 percent at the vent opening, then the site perimeter will be monitored to verify that any emanating gases have diluted to acceptable levels. If perimeter measurements indicate lower explosive limit violation, the site owner will document these events and contact NYSDEC for guidance in implementing mitigative measures.

4.7 CHAIN-OF-CUSTODY

All sampling efforts must be done under a strict chain-of-custody protocol. Failure to follow this directive renders data generated on the samples collected invalid in legal proceedings. The chain-of-custody is initiated by the sampling technician and is updated each time a sample is collected, and each time a set of samples is passed from one person to another. The samples must **NEVER** be left unsecured, and they are the responsibility of the individual into whose custody they have been remanded. The chain-of custody must accompany the samples at all times. If the samples are shipped, custody must be transferred to the shipper and ultimately received by the laboratory. Appendix B includes a Standard Chain-of-Custody Record form.

5. SITE MAINTENANCE

The general objectives of the site maintenance plan are to describe those activities that will be conducted to:

- Maintain the integrity and effectiveness of the landfill cover, including making repairs to the cap as necessary to correct the effects of subsidence, erosion, or other damage
- Maintain the integrity and effectiveness of the stormwater runoff control structures (including berms, swales, the interceptor trench, the northern sedimentation pond, and 36-in. high-density polyethylene [HDPE] drain pipe)
- Maintain the integrity and effectiveness of the leachate collection system piping, pump, and force main.
- Maintain and inspect the groundwater monitoring system
- Maintain and inspect gas venting system
- Maintain vehicle access roads.

The site maintenance plan will be in effect for a 5-year period after which the plan will be re-evaluated by NYSDEC.

5.1 MAINTENANCE ACTIVITIES

Unless otherwise indicated for a specific activity below, visual site inspections will be scheduled and conducted at the site once every month for the first year after construction and quarterly or at the frequency determined to be necessary based on the first year of operation, for the duration of the post-closure period. In addition, visual site inspections will be conducted immediately following significant storm events. These inspections will be performed by individuals experienced in landfill site inspections and familiar with civil and/or soil engineering practices. Items identified during the site inspection that require routine corrective maintenance will be repaired within 30 days of the inspection report, provided weather does not restrict repair activities.

5.1.1 Site Fence Maintenance

Visual inspections of the site perimeter fence will be made on a monthly basis to ensure that all portions of the fence are intact. Any repair or replacement of the fence sections are the responsibility of the Town and will conform to the approved record design specifications

included in Appendix Figure G-1. The construction shop drawing is included in Appendix H.1. Replacement and/or reconstruction will be done in accordance with the constructed design.

5.1.2 Cover Maintenance

The vegetative cover must be maintained as a complete cover with no deep-rooted plant life. In order to ensure this, the cover will be mowed twice per month from April through October. If the grass cover is too thin to prevent erosion, the area must be reseeded and fertilized. In addition, during inspection of the vegetative cover, field personnel will identify any areas where landfill gas odors or stressed vegetation are detected. If any odors or stressed vegetation are detected, the field personnel will immediately contact the Town so that corrective measures can be taken. Unless otherwise directed, seeding, mulching, and fertilization will be in accordance with the record specifications included in Figure G-2. Until an adequate cover is established, water will be added to the cap if required to assist establishment of plant life during excessive dry periods.

Erosion of the cover system will be repaired as needed in a manner that provides a long-term solution to such damage. The activities required to repair erosive damage to the cover system will depend on the extent of the erosion into the cover. The eroded area will be stabilized and reconstructed in accordance with the record constructed detail indicated in Appendix G. In the event the perimeter toe drain or anchor trench is affected by erosion, reconstruction will be in accordance with details indicated in Figures G-2 and G-3.

The crushed stone access road, which traverses the inside perimeter of the landfill cap, is designed for use by passenger vehicles and light duty trucks. Access onto the vegetative cap cover will be avoided to prevent excessive rutting and/or destruction of the vegetative cover. Access onto the landfill cap by construction equipment (e.g., bulldozers, excavators), may occur only if there is no disturbance of the upper 30-in. soil-topsoil barrier. The Town's conceptual post-closure land use to utilize the landfill cap as a stockpiling facility must provide elements to protect the cap section.

5.1.3 Runoff Control Structures Maintenance

Maintenance of the runoff control structures consists of maintaining the integrity of surface grading (including berms and swales), inspection of the condition of rip-rap along swale alignments, inspection of the sedimentation pond, and inspection of any erosion damage to the interceptor trench and inspection of the 36-in. HDPE pipe. The activities required to repair erosive damage to the runoff control structures will depend on the extent of the damage. Replacement of rip-rap will be in accordance with New York State Department of Transportation light designation. The final grades of repaired areas will conform to the grades and slopes as constructed. Record drawing details are included in G-4. Approved shop drawings are included in Appendix H.2.

The 36-in. HDPE pipe is designed to collect stormwater runoff (25-year storm) from the southern watershed and discharge to the low-lying area to the north bypassing the landfill cap. To prevent excessive ponding to the south, the inlet and outlet structures, as well as the in-line catch basins, will be maintained free of obstructions.

The stormwater diversion channel, located immediately west of the landfill proper, originates near the site's southwestern corner and discharges directly within the northern sedimentation pond. This diversion channel collects the stormwater runoff generated by the western upland area prior to interaction with the landfill cap. Periodic maintenance will include the removal of non-living organic material (e.g., tree limbs, consolidated leaves), without disturbing the natural retarding features (cattails, high grass).

The stormwater tributary from the south and west of the landfill is conveyed northward to a naturally low-lying area. Within this northern area, a sedimentation pond with a rip rap outlet control structure exists. Periodic maintenance will include removing debris from the outlet structure allowing unobstructed passage, alleviating the potential for encroaching surface water southward.

5.1.4 Settlement and Subsidence Control Maintenance

Subsidence may occur gradually over time. Due to the age of the fill, subsidence is not expected to be a significant problem. The grades and slopes of the site are expected to be sufficient to provide positive drainage after subsidence. Should excessive settlement or damage to the cap as a result of settlement be identified during site inspections, repair of the cap will be implemented as necessary to ensure that the cover system layers remain continuous, that a positive slope be maintained, and that ponding does not occur.

The corrective action for subsidence of the drainage ditches and the cover system will consist of excavating the soil overlying the hydraulic barrier layer and adding soil material to the hydraulic barrier layer in conformance with the approved engineering specifications, design plans, and shop drawings included in Appendix H.4. This material will be brought to the slopes and grade of the hydraulic barrier layer in the surrounding area to provide uninterrupted positive drainage over the surface of the hydraulic barrier layer. Following restoration of the hydraulic barrier grade, the overlying layers will be reconstructed in accordance with the applicable specifications and the areas seeded and fertilized to re-establish a vegetative cover (Appendix H.3).

5.1.5 Flexible Membrane Liner Repairs

It may be necessary at some point to conduct repairs or replacement of portions of the flexible membrane liner. Damage may result from land subsidence, puncture from sharp objects, or other causes. When portions of the liner must be repaired or replaced, it will be necessary that the repairs are conducted by professionals familiar with placement and repairs of flexible membrane liners. Personnel and material qualifications and procedures for

conducting repairs are as outlined in the original site construction specifications, as well as the approved shop drawings and as-built drawings. These documents are bound separately on file at the Town of New Windsor Town Hall. The record details are included in Figure G-1.

5.1.6 Groundwater Monitoring System Maintenance

Monthly routine maintenance of monitoring wells will include inspection and maintenance of identification markings on each well, and inspection and replacement as necessary of caps, locks, seals, and grouting. Measurements of the static water levels in the wells are to be recorded each month and included in the monthly inspection and maintenance report. Incidents of damage to monitoring wells will be reported within 2 days of the incident to the NYSDEC Division of Hazardous Waste and Remediation (Central Office) at 518-457-9280. Repairs will be made within 30 days of the reporting.

5.1.7 Gas Venting System Maintenance

The gas venting system will be inspected for weathering effects or other damage as part of the monthly gas monitoring program. Should a vent pipe require repair or replacement, care will be taken to uncover the damaged sections and remedied in conformance with the as-built construction detail represented in Figure G-3. Replacement components will be installed from the nearest connecting union.

5.1.8 Leachate Pumping Station Maintenance

The leachate pumping station will be inspected daily by sewage treatment plant facility personnel to ensure the proper functioning of the leachate management system. Operational problems will be indicated by the control panel and system automatic dialer located at the pump station. This control panel is equipped with high and low level alarms, motor fault lights, and an externally mounted alarm light. High level alarms or other indications of serious problems with the leachate management system will be reported immediately to the Town Engineer. The manufacturer's Operation and Maintenance Manual for the submersible pumps is provided in Appendix E. Pumping station maintenance activities will be accomplished in accordance with guidelines and specifications set by the manufacturers. The POTW Operator will implement necessary operations and maintenance. In general, corrective repair maintenance rather than a strict preventive maintenance schedule for submersible pumps applies. The redundant pumping design (two pumps) allows for repair or replacement of one pump while system operation is maintained. Before maintaining any equipment within the pump vaults, refer to the Health and Safety Plan (Appendix D). A complete set of record details is included in Figures G-5, G-6, and G-7. Approved shop drawings are included in Appendix H.5.

In the event both pumps are inoperable (e.g., power failure) static groundwater level within and outside of the landfill will naturally equalize to approximately 2 ft below the top of the wet well (elevation 338 ft +/-). During equalization, perimeter groundwater will enter the limits of the landfill minimizing migration of leachate water outward. This condition can be maintained for a nominal period without considerably impacting the surrounding environment.

Leachate water flow volumes are expected to vary from season to season. The presence of iron "floc" has been observed during construction dewatering and during the first months of operation. This iron "floc" is a result of natural oxidation occurring within the leachate system primarily within the wet well. The wet well and transmission lines are expected to experience accumulation of settled flocculated iron requiring maintenance. The gravity lines, wet well and/or force main will be cleaned by a properly equipped environmental service contractor as needed and reported to NYSDEC. The development of a maintenance schedule is dependent on the future recurrence of events. If required, NYSDEC will be informed and a maintenance schedule included within the General Operation, Maintenance, and Monitoring Manual. Record details are provided on Figures G-8 and G-9. The approved shop drawings are included in Appendix H.6.

Periodic comparisons of flow rates from the pump station and the receiving gravity manhole location are recommended to identify the potential for "floc" accumulation in the 4-in. force main. If it has been determined that the force main has become restricted, appropriate maintenance actions will follow as described above.

5.1.9 Vehicle Access Road Maintenance

Monthly inspections will identify uneven settlement areas or erosive damage, and repairs will be implemented by spreading and compacting additional material where required to maintain suitable access to the landfill.

5.1.10 Vermin and Vector Observations

Evidence of disturbance of cap material, vent piping, or surface water diversion system attributable to animal activity will be noted during the monthly site inspections. Appropriate repairs for the damage incurred will be performed within 30 days of inspection. Recurring instances of damage caused by vermin and/or vector will be resolved by means of extermination or removal performed by a licensed pest control professional.

5.2 INSPECTION AND MAINTENANCE REPORTS

Complete and detailed inspection and maintenance reports are to be prepared for all site inspections. Reports will be recorded on a monthly basis for the first year and submitted to the NYSDEC Project Manager within 30 days of the inspection. Following proven

performance, NYSDEC will recommend a suitable, less frequent submission. At a minimum, these reports will include:

- Inspector's name and title
- Date and time of inspection
- Condition of cover including erosion details, areas needing regrading, settlement and subsidence, and any detection of odors or stressed vegetation
- Evidence of liner exposure
- Measurements of water levels in the monitoring wells
- Evidence of erosion of the runoff control structures (ditches, berms, and swales) and the condition of the associated rip-rap
- Any remedial actions implemented or repairs made as a result of the inspection
- Condition of the leachate management system as well as information concerning the total monthly flow volume of leachate to the sanitary sewer system
- Condition of the gas vent system including data on percent lower explosive limit
- Any maintenance recommendations and repairs, replacements, and calibrations completed.

In addition, the significant changes (equipment, grades, etc.) indicated on the periodic report must be noted on the filed as-built plans (Appendix F).

Appendix B contains an inspection and maintenance checklist.

Appendix A

Well Construction Details

WELL CONSTRUCTION OF MW-1

The following descriptions apply to the construction of MW-1, installed by others:

- 21.5 ft deep from top of casing
- Schedule 40, 2-in. diameter, threaded PVC pipe
- Factory slotted PVC screen (screened interval not available)
- Slotted screen packed with sand
- Bentonite pellet seal placed above sand pack
- Remaining annular space above bentonite pellet seal to ground surface filled with bentonite-cement grout.

TECHNOLOGY
A Division of EA Engineering, Science and Technology, Inc.

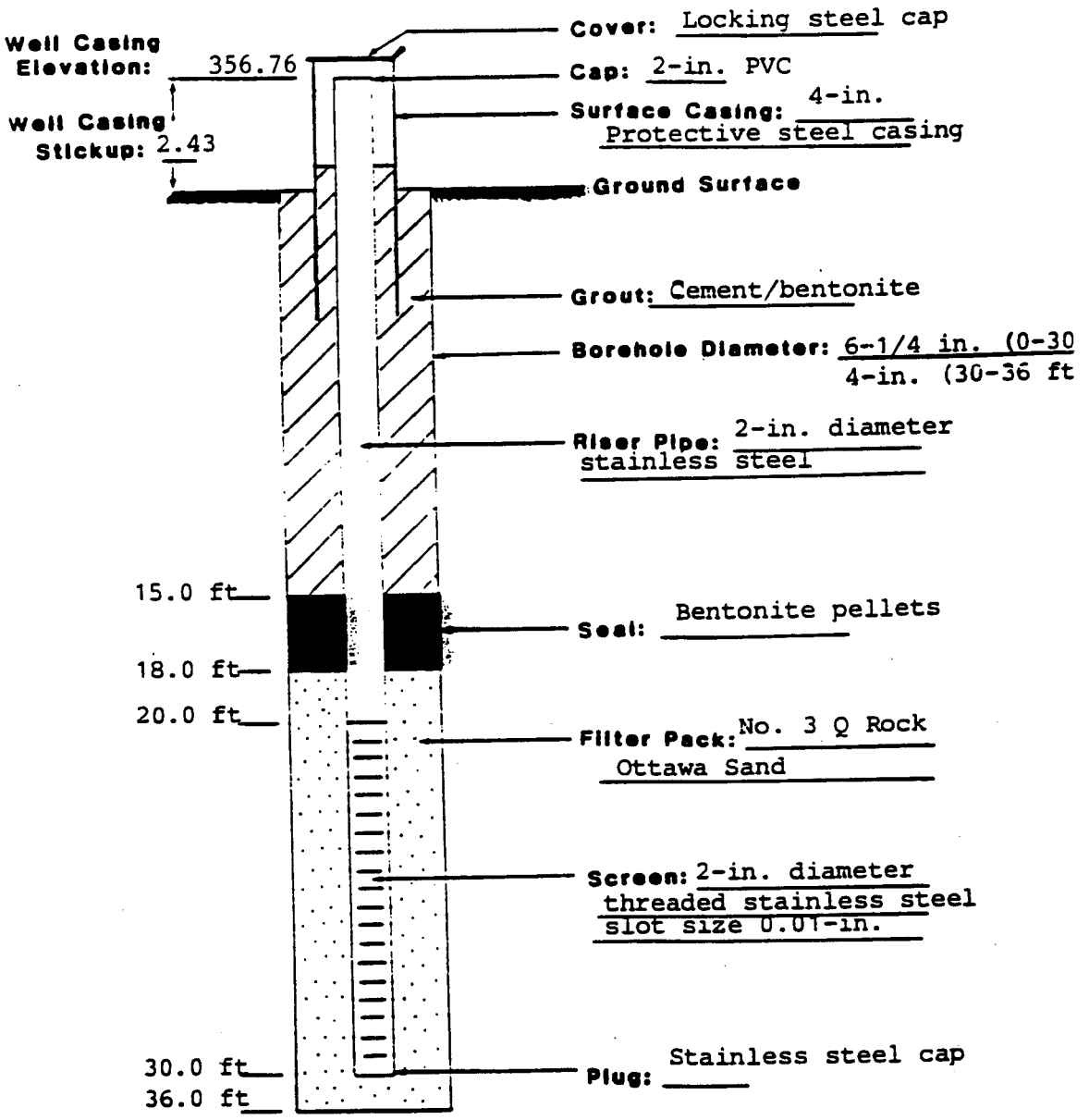
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 22 February 1990

COMPLETION DIAGRAM

WELL NW-1D



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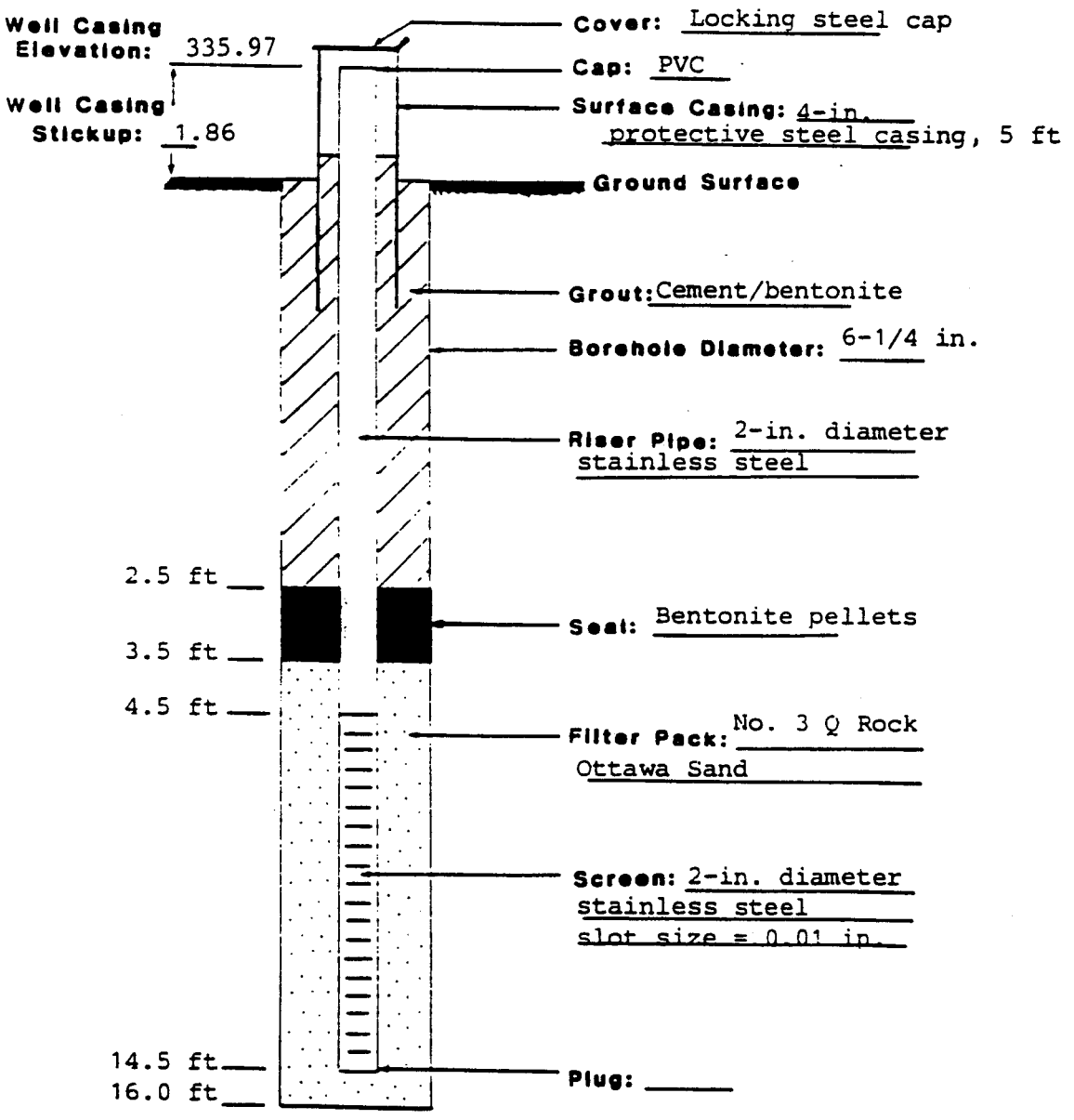
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 21 February 1990

COMPLETION DIAGRAM

WELL NW-3S



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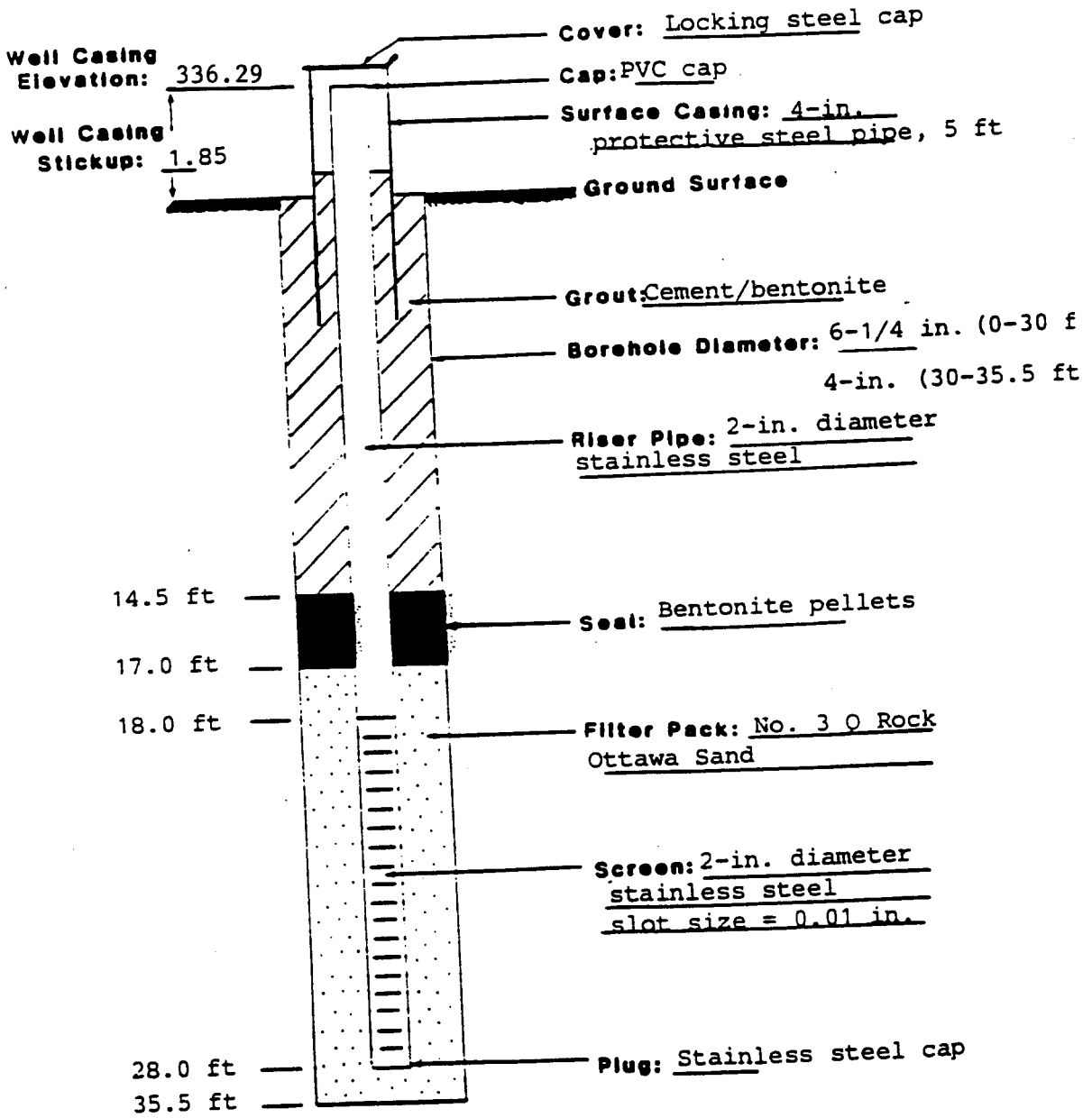
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 22 February 1990

COMPLETION DIAGRAM

WELL NW-3D



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of EA Engineering, Science and Technology, Inc.

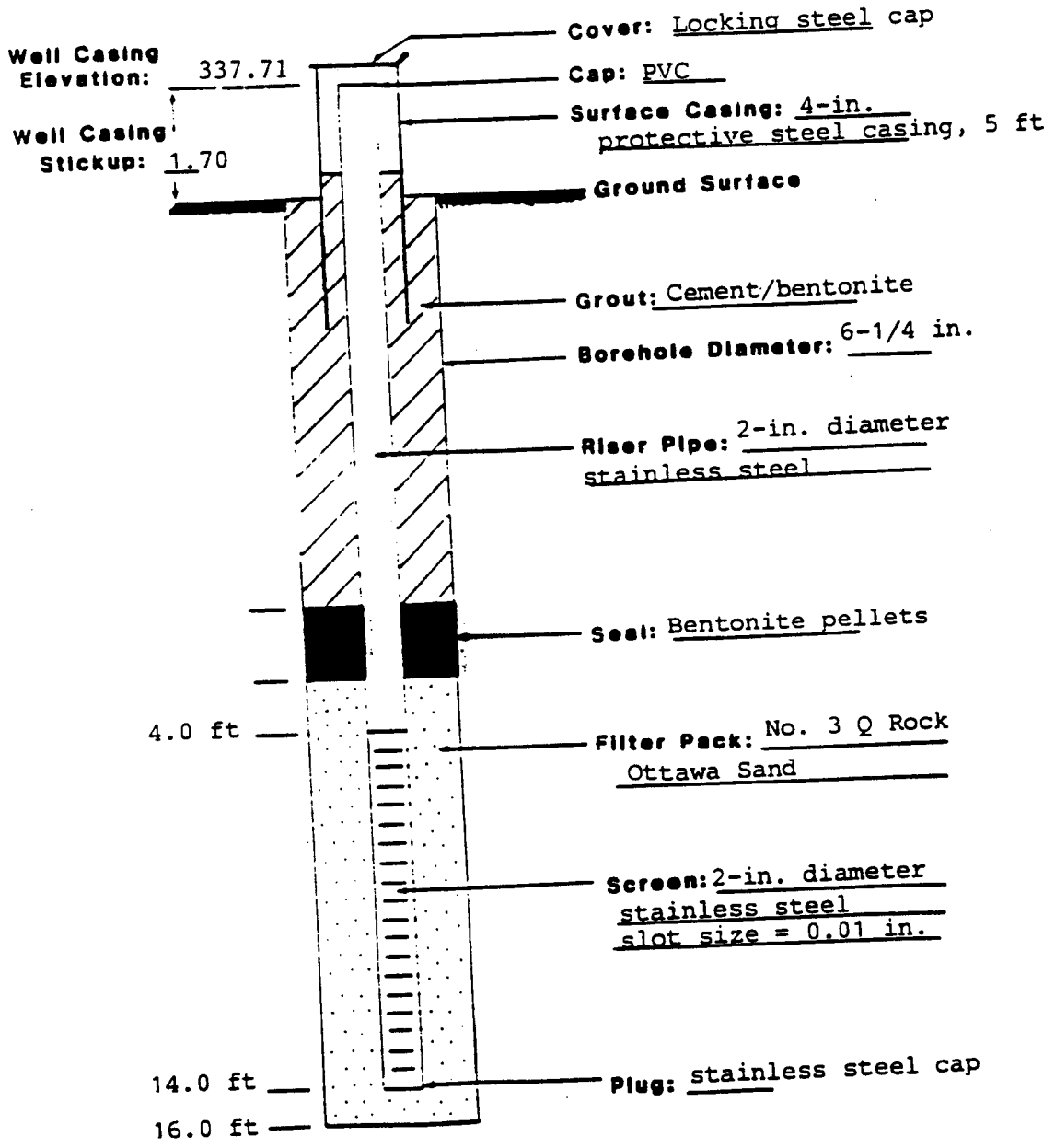
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 28 February 1990

COMPLETION DIAGRAM

WELL NW-4S



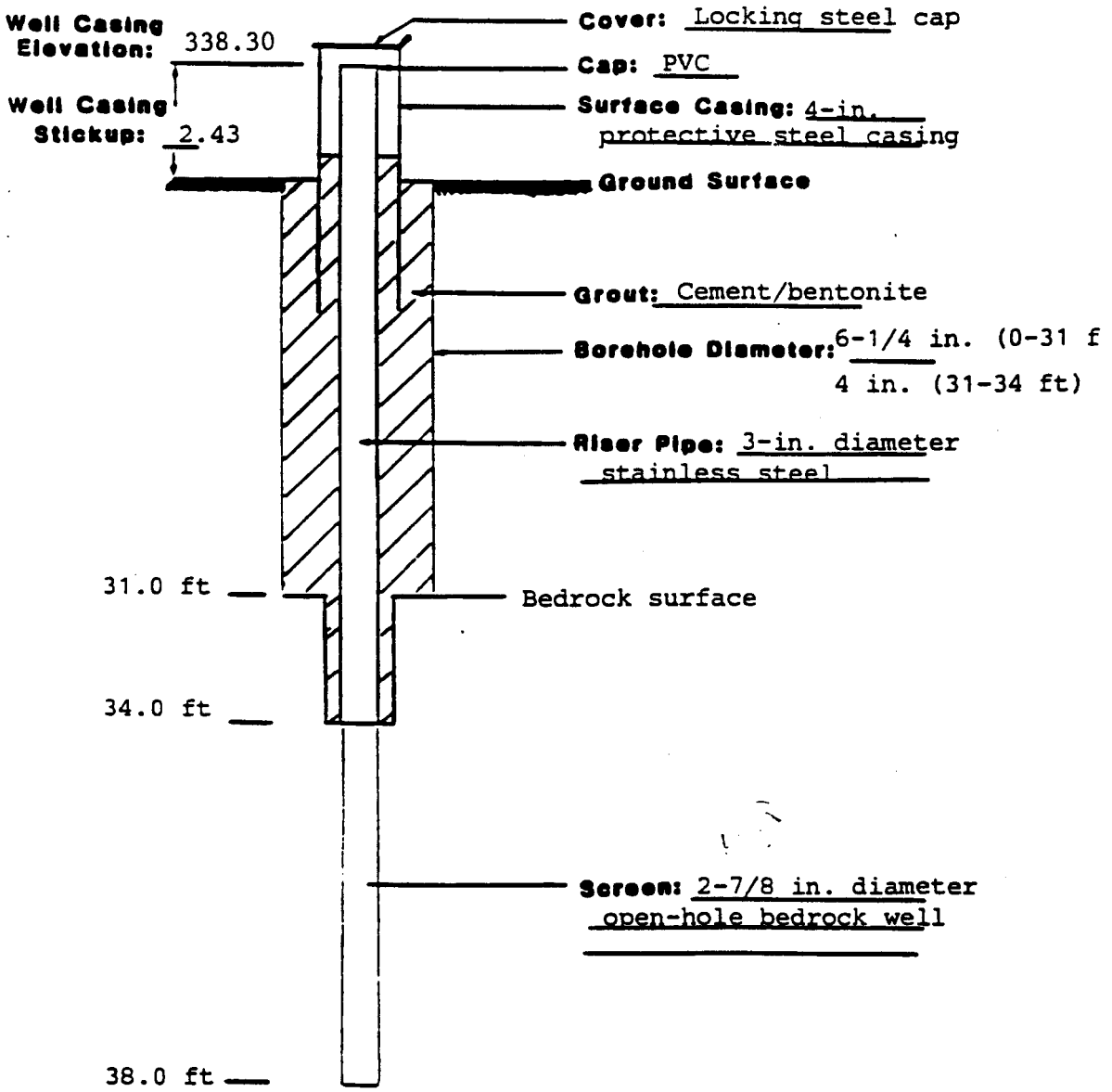
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 28 February 1990

COMPLETION DIAGRAM

WELL NW-4D



EA SCIENCE AND TECHNOLOGY

Division of EA Engineering, Science and Technology, Inc.

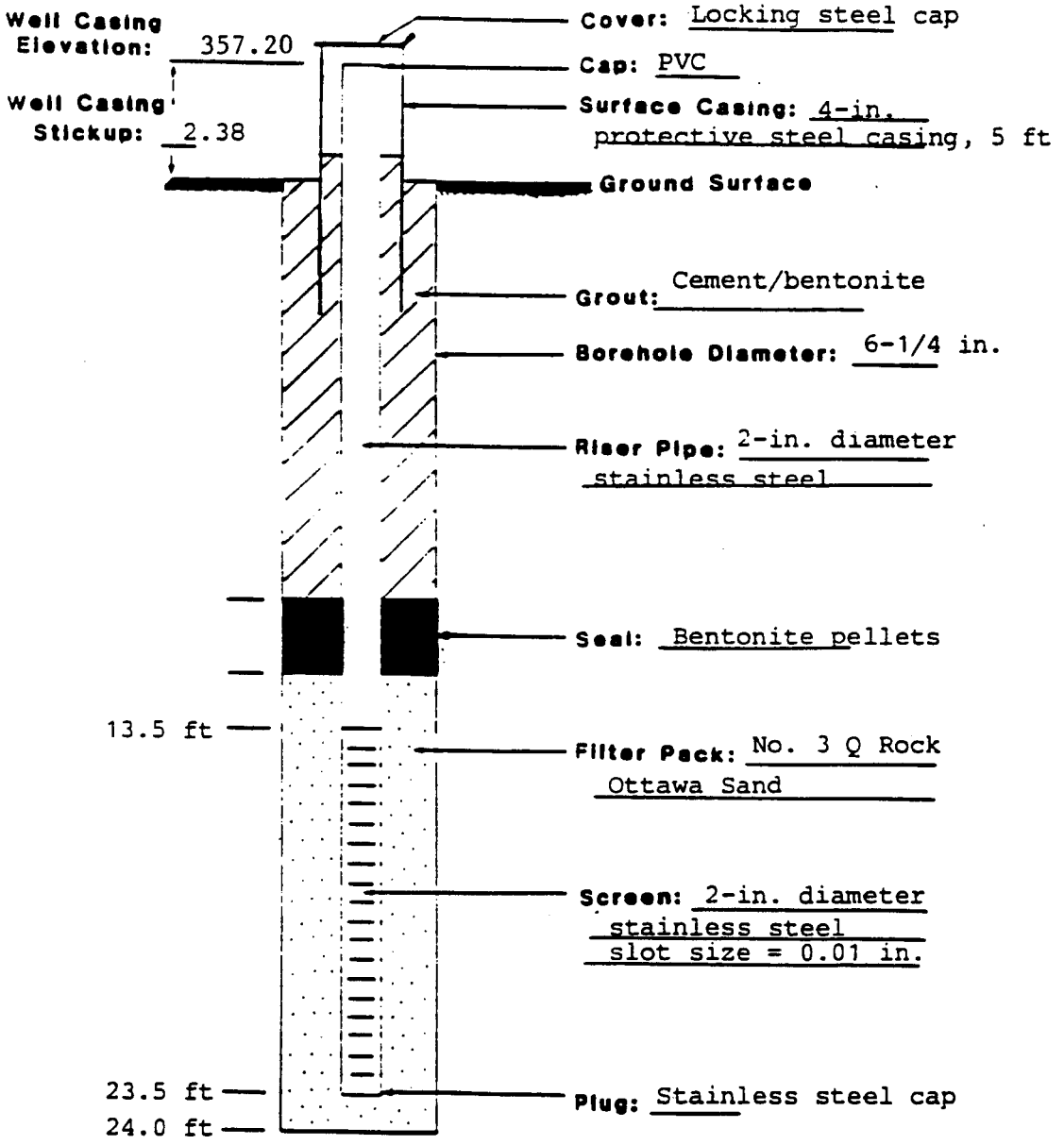
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 20 February 1990

COMPLETION DIAGRAM

WELL NW-6S



EA SCIENCE AND TECHNOLOGY

of EA Engineering, Science and Technology, Inc.

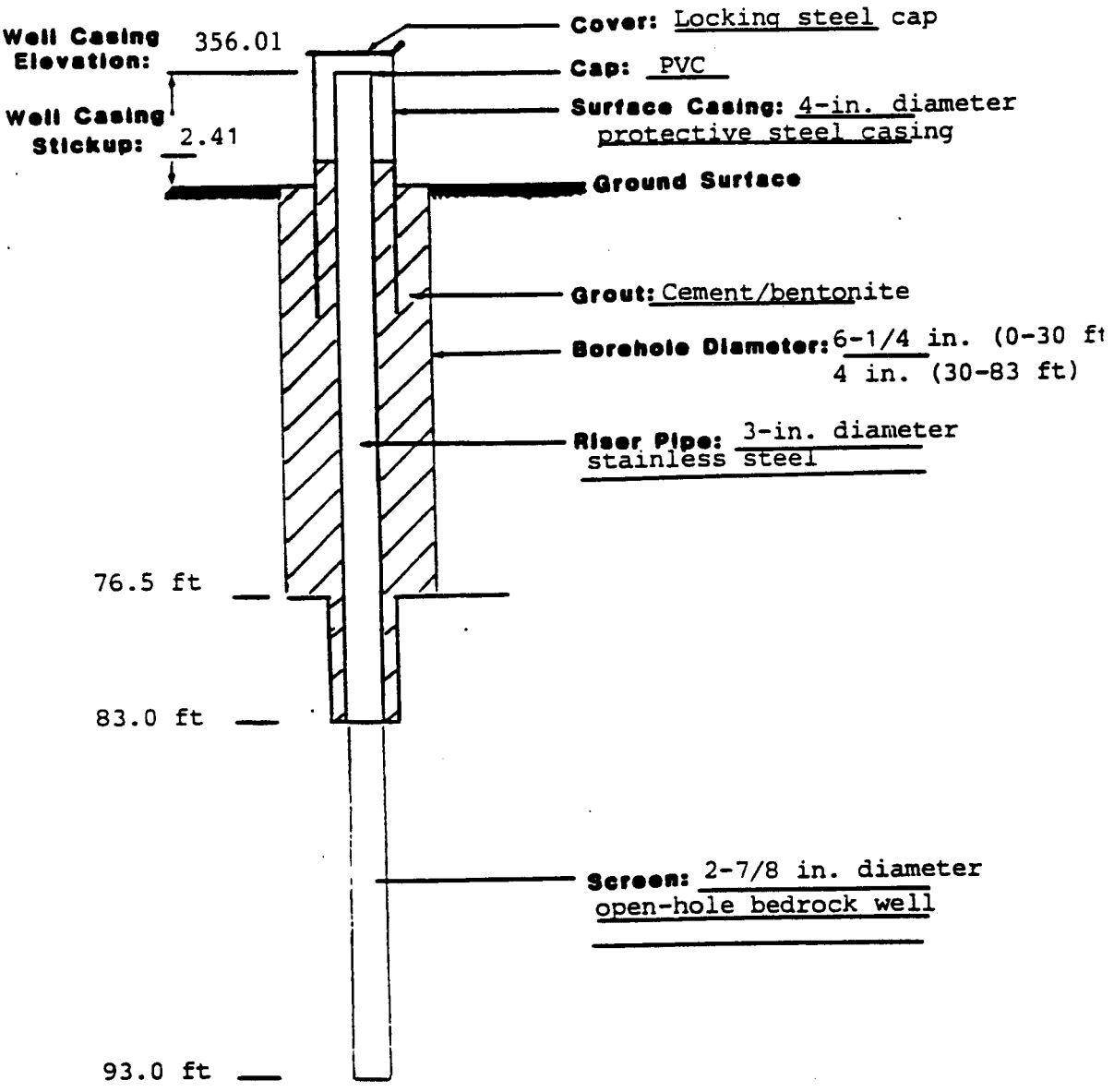
Site: New Windsor Landfill

Job No.: 11160.01

Date Installed: 5 March 1990

COMPLETION DIAGRAM

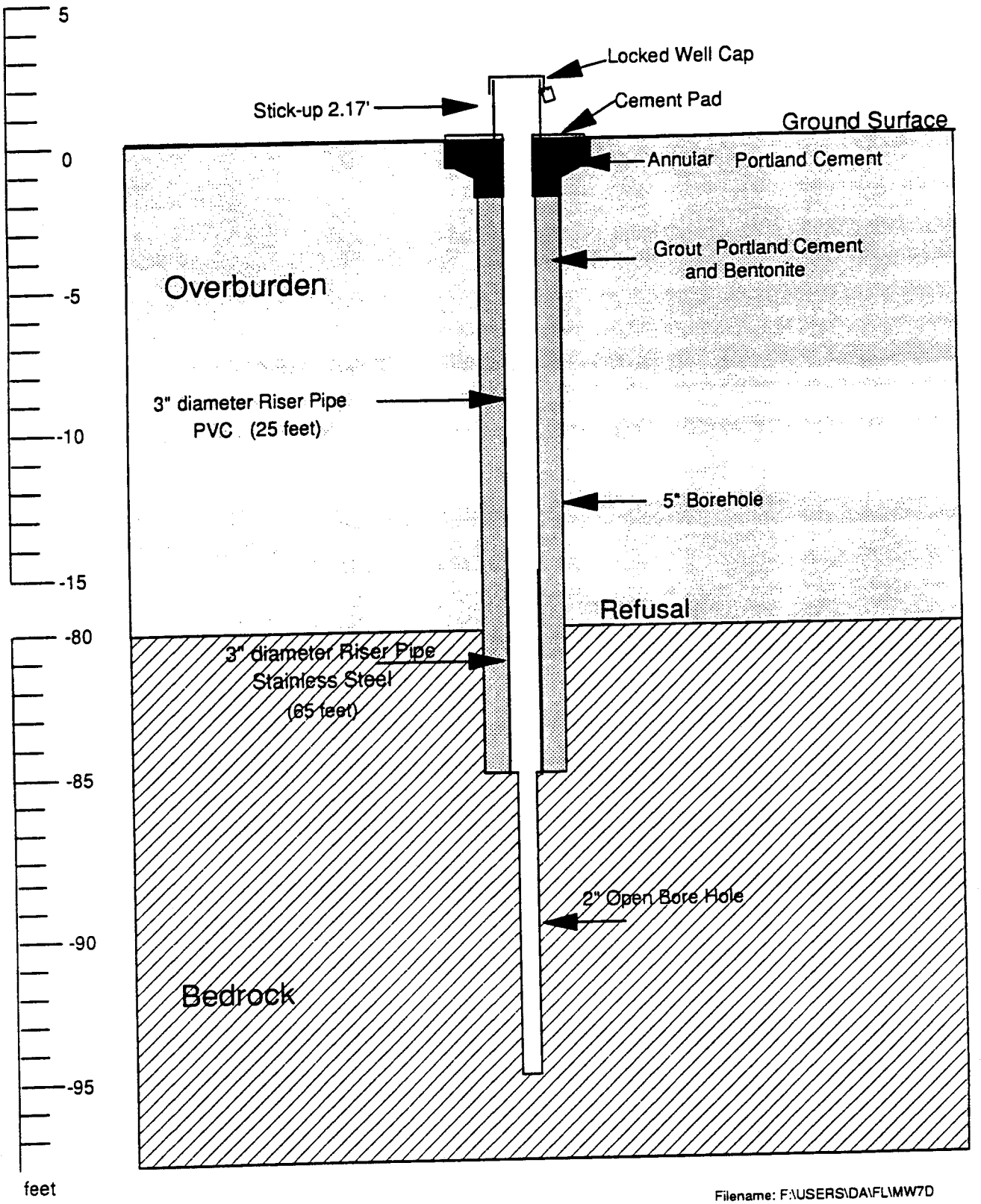
WELL NW-6D



TOWN OF NEW WINDSOR LANDFILL

Bedrock Monitoring Well MW-7D

Job No.: 11160.05
Date Installed: 26 January 1994

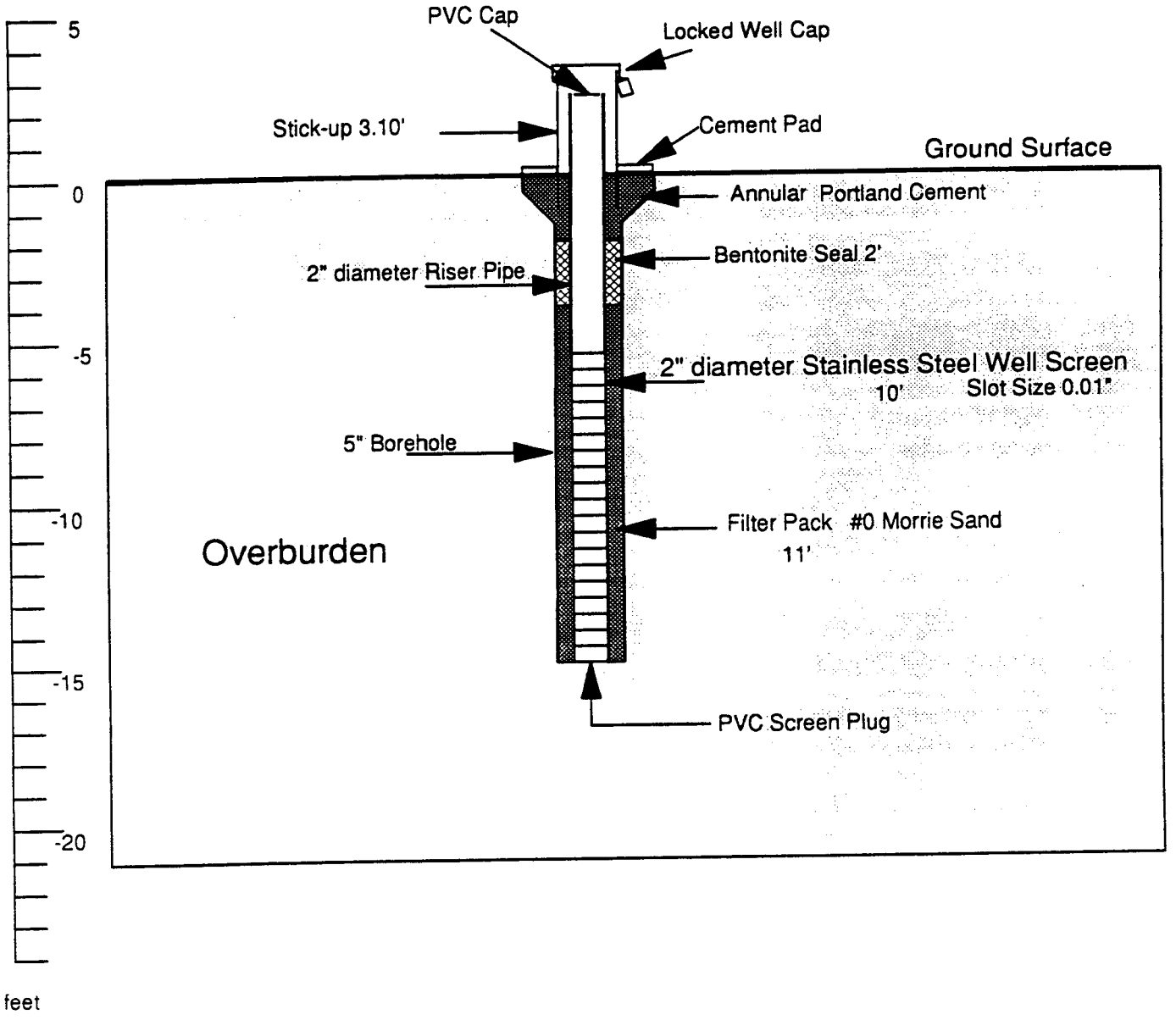


Filename: F:\USERS\DA\FL\MW7D

TOWN OF NEW WINDSOR LANDFILL

Overburden Monitoring Well MW-8S

Job No.: 11160.05
Date Installed: 2 September 1993

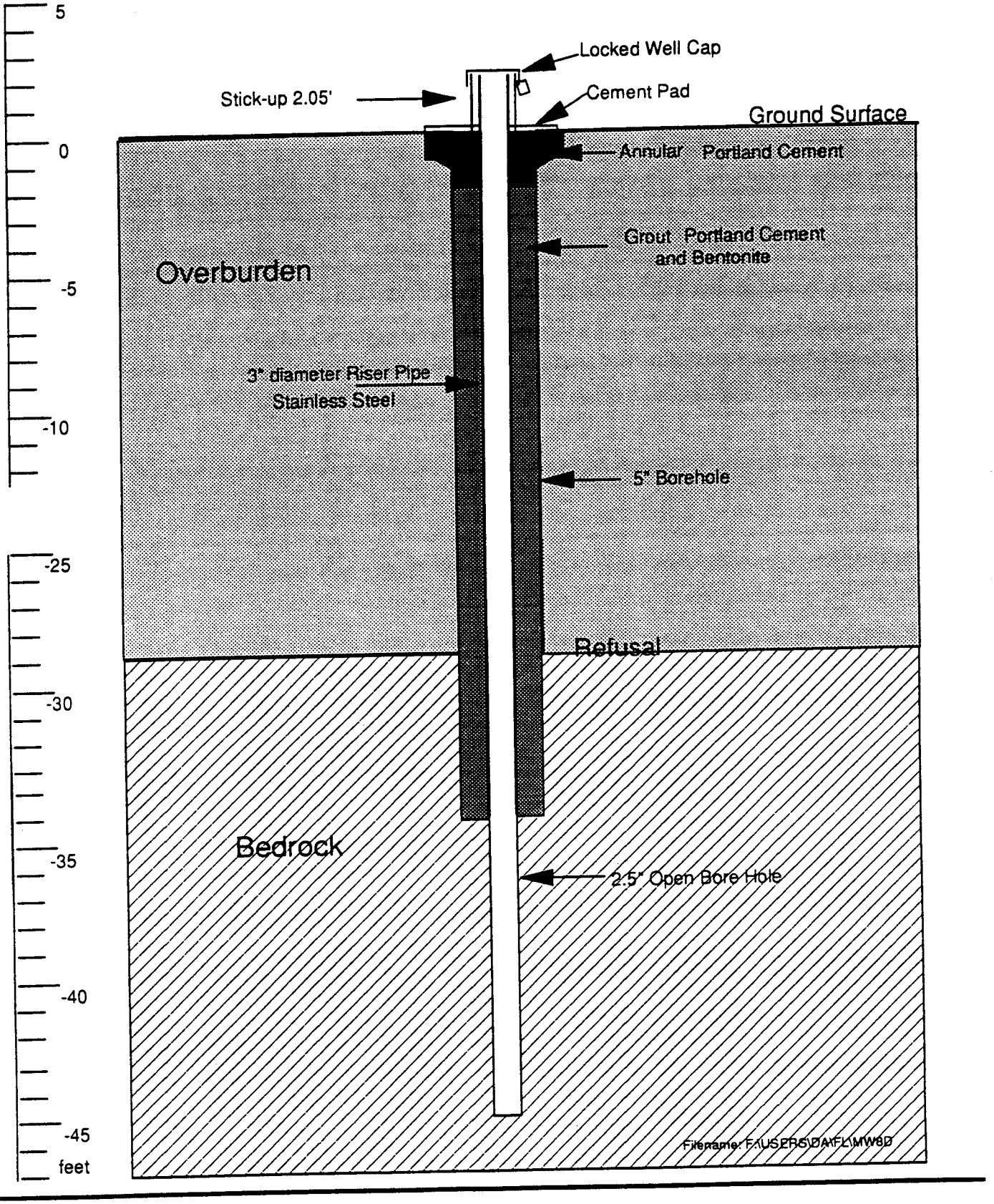


Filename F:\USERS\DA\FL\MW9S

TOWN OF NEW WINDSOR LANDFILL

Bedrock Monitoring Well MW-8D

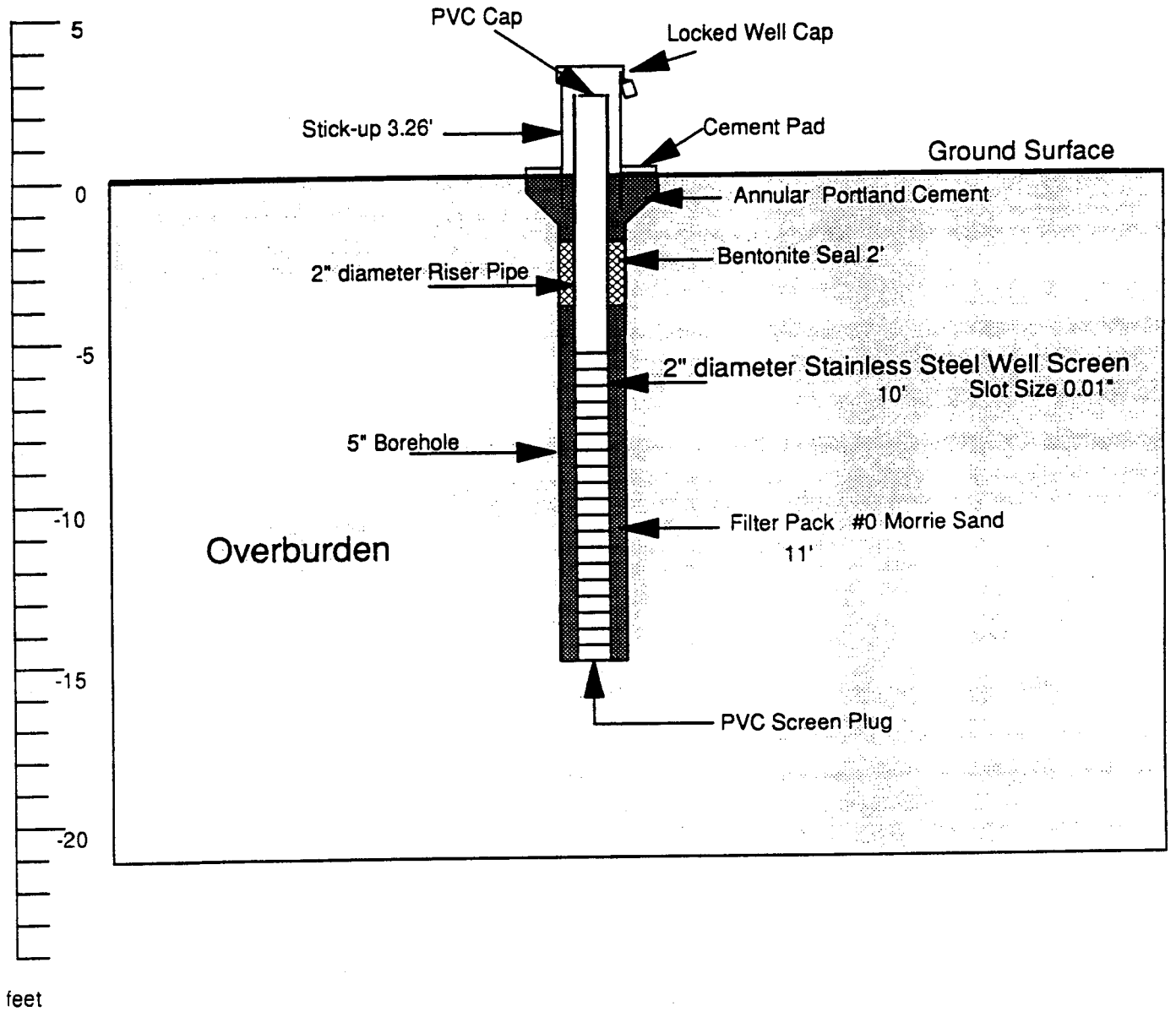
Job No.: 11160.05
Date Installed: 8 September 1993



TOWN OF NEW WINDSOR LANDFILL

Overburden Monitoring Well MW-9S

Job No.: 11160.05
Date Installed: 3 September 1993

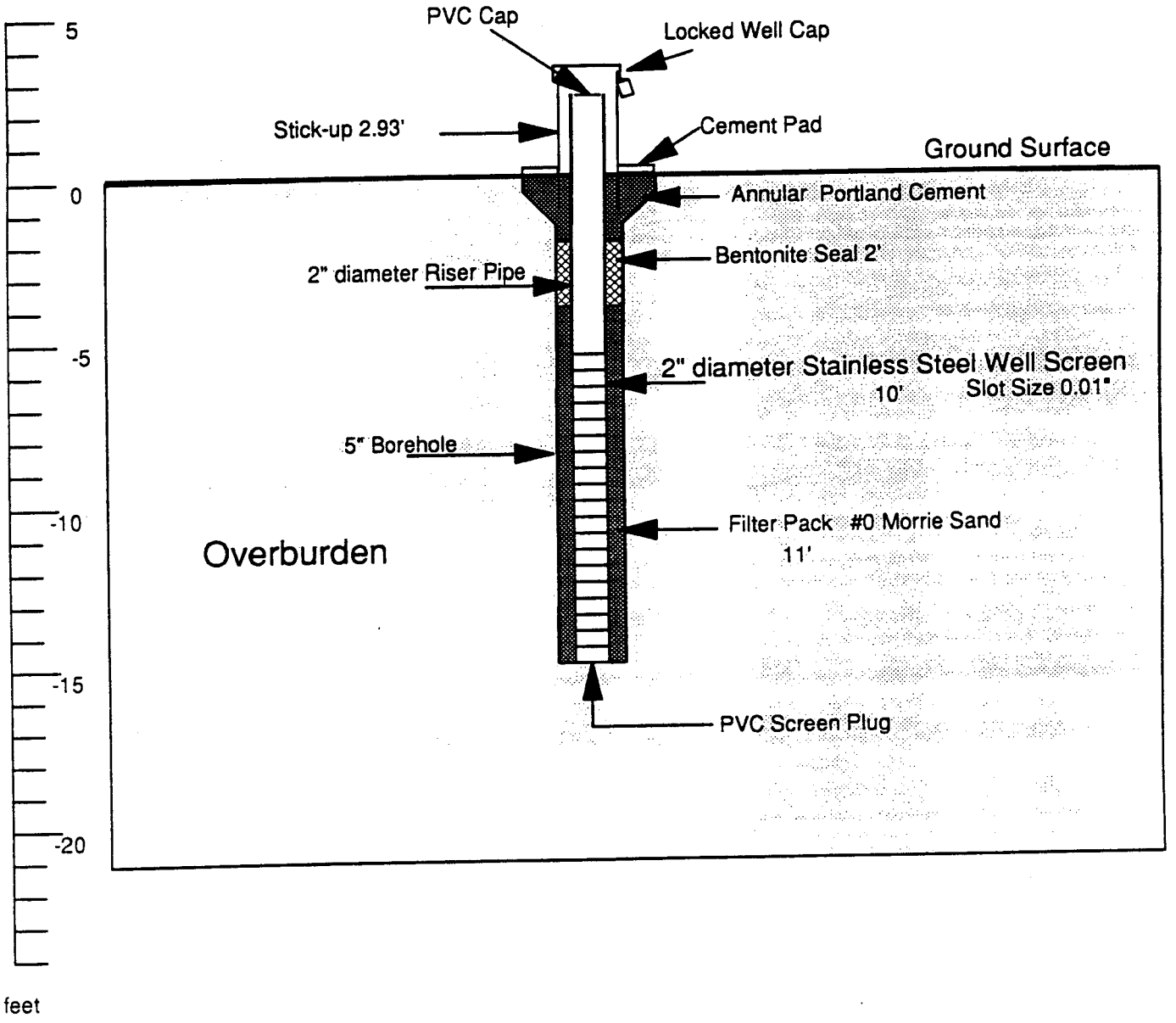


Filename F:\USERS\DA\FL\MW9S

TOWN OF NEW WINDSOR LANDFILL

Overburden Monitoring Well MW-10S

Job No.: 11160.05
Date Installed: 2 September 1993

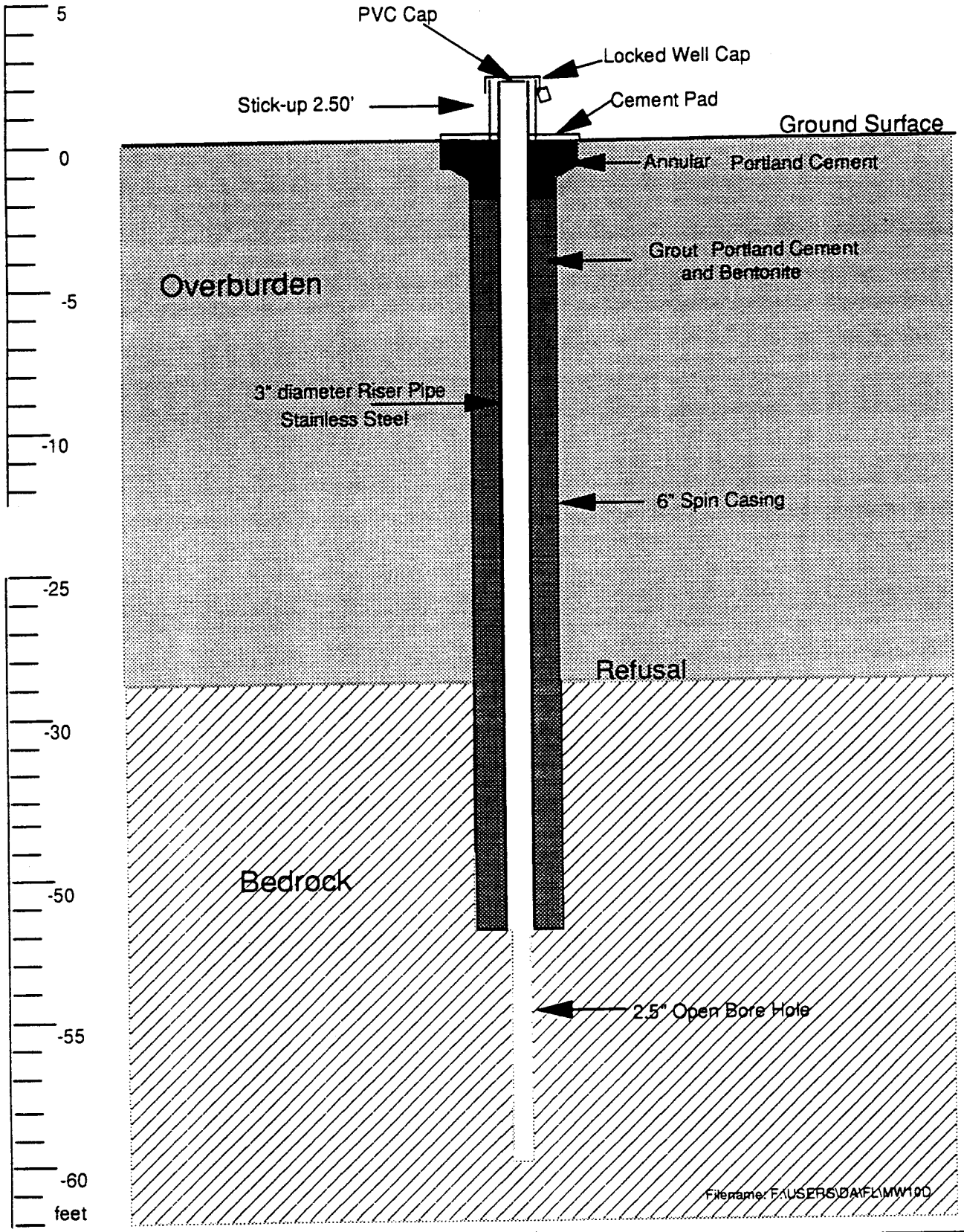


Filename F:\USERS\DA\FL\MW10S

TOWN OF NEW WINDSOR LANDFILL

Bedrock Monitoring Well MW-10D

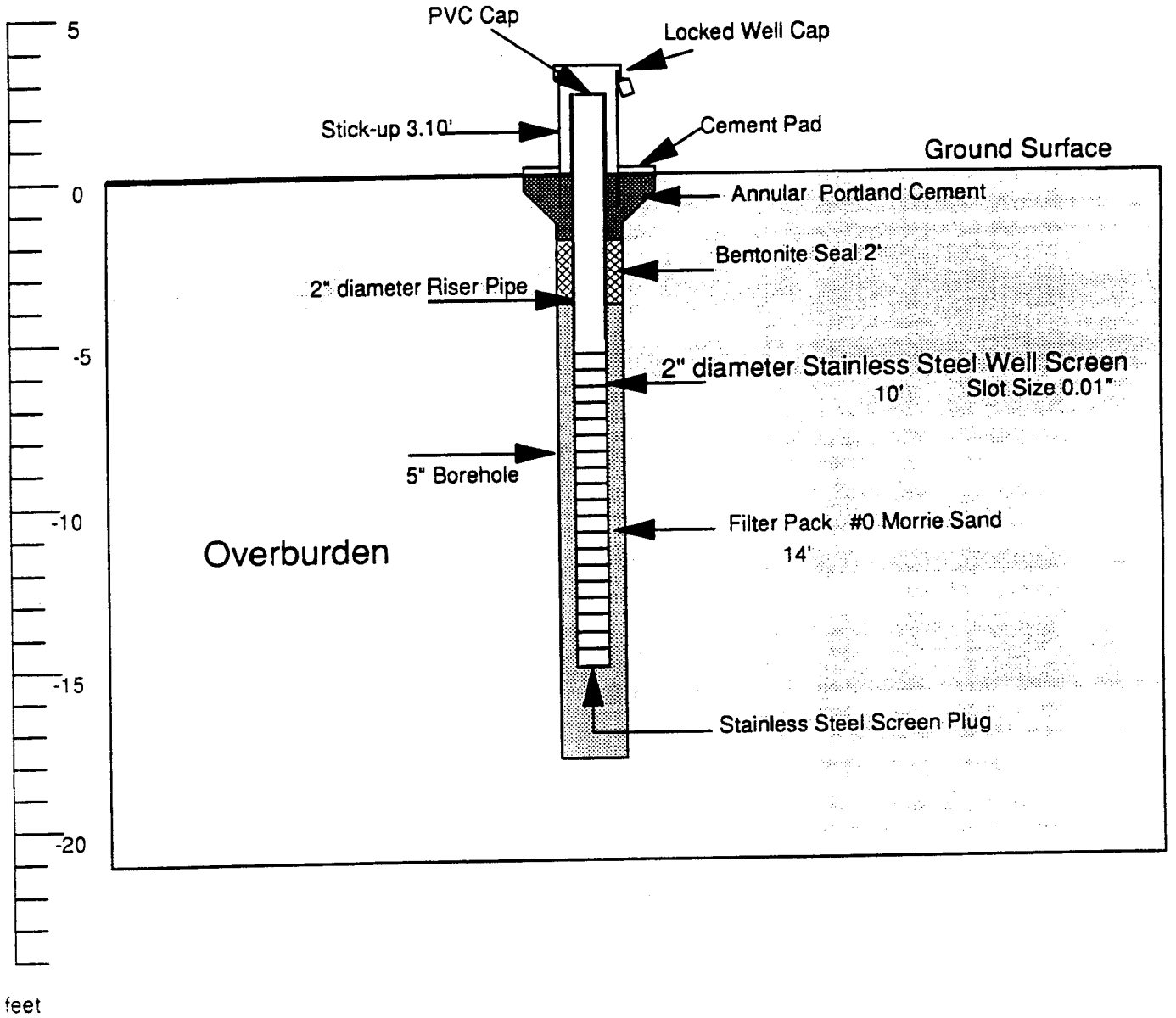
Job No.: 11160.05
Date Installed: 9 September 1993



TOWN OF NEW WINDSOR LANDFILL

Overburden Monitoring Well MW-11S

Job No.: 11160.05
Date Installed: 7 September 1993



filename F:\USERS\DA\FL\MW11S

Appendix B

General Checklist Forms

- Field Record of Groundwater Purging and Sampling
- Surface Water Sampling Checklist
- Leachate Water Sampling Checklist
- Standard Chain-of-Custody Record Form
- Inspection and Maintenance Checklist

FIELD RECORD OF GROUNDWATER PURGING AND SAMPLING

WELL I.D.: _____ SITE NAME: _____

WELL CONDITION: _____ WEATHER: _____

GAUGE DATE: _____ GAUGE TIME: _____

SOUNDING METHOD: _____ MEASUREMENT REF: _____

STICK UP / DOWN (FT): _____ WELL DIAMETER (IN): _____

PURGE DATE: _____ PURGE TIME: _____

PURGE METHOD: _____

WELL VOLUME

A. WELL DEPTH (FT): _____

B. DEPTH TO WATER (FT): _____

C. LIQUID DEPTH (FT) [A - B]: _____

D. WELL VOL / FT (SEE BACK): _____

E. WELL VOLUME (FT) [C * D]: _____

SANDPACK VOLUME

F. LIQUID SCREEN LENGTH (FT): _____

G. BOREHOLE VOL / FT (SEE BACK): _____

H. BOREHOLE VOL (GAL) [F * G]: _____

I. SAND VOLUME (GAL) [H - (D * F)]: _____

J. LIQUID SAND VOL (GAL) [I * porosity]: _____

K. LIQUID VOLUME (GAL) [E + J]: _____

L. FIVE WELL VOLUMES (GAL) [K * 5]: _____

	BEGINNING	1	2	3	END	SAMPLE
TIME (MIN)						
DEPTH TO WATER (FT)						
RATE (GPM)						
VOLUME PURGED (GAL)						
pH						
TEMPERATURE (C)						
CONDUCTIVITY						

TOTAL QUANTITY OF WATER REMOVED (GAL): _____

SAMPLERS: _____

SAMPLING DATE: _____ SAMPLING TIME: _____

SAMPLE TYPE: _____ SPLIT SAMPLE WITH: _____

COMMENTS AND OBSERVATIONS: _____

SURFACE WATER SAMPLING CHECKLIST

TECHNICIAN: _____

COMPANY: _____

DATE: _____

PREVIOUS SAMPLE DATE: _____

Item	Surface Water
Immiscible layers (Y/N)	
Floaters or sinkers (Y/N), if yes sample	
Remove water containerized and discarded (description)	
Equipment decontamination (describe)	
Sample preservation (describe)	
Specific conductance	
Temperature (F)	
pH	
Eh	
Field observations (colors, odors, etc.)	
Dissolved oxygen	

COMMENTS: _____

_____

_____

_____

_____

LEACHATE WATER SAMPLING CHECKLIST

TECHNICIAN: _____

COMPANY: _____

DATE: _____

PREVIOUS SAMPLE DATE: _____

Item	Leachate Water
OVA reading (ppm)	
Explosimeter reading	
Immiscible layers (Y/N)	
Floaters or sinkers (Y/N), if yes sample	
Equipment decontamination (describe)	
Sample preservation (describe)	
Specific conductance	
Temperature (F)	
pH	
Eh	
Field observations (colors, odors, etc.)	

COMMENTS: _____

_____

_____

_____

_____

Chain-of-Custody Record

Company Name:	Project Manager or Contact: Phone:
Project No.:	Project Name:

Sample Storage Location:

Page of

Batch ID:

Date	Time	Water	Soil	Sample Identification (ID and Matrix) 19 Characters	No. of Containers	Parameters/Method Numbers for Analysis*	EA Labs Acession Number	Remarks

Reports/Deliverables Only

Sampled by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Received by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Holding Times for VOAs	Sample Shipped by: (Circle) Fed. Ex. Puro. UPS Other: Air Bill Number:

Cooler Temp.: ____ ° | pH: ☐ Yes ☐ No | Comments:

*NOTE: Please indicate method number for analyses requested. This will help clarify any questions with laboratory technicians.

EA 0205 White — EA Laboratories Yellow — EA Laboratories Pink — Project Manager Check In Use Only

INSPECTION AND MAINTENANCE CHECKLIST FOR THE TOWN OF NEW WINDSOR LANDFILL

INSPECTOR: _____ DATE: _____

PREVIOUS INSPECTION: _____ WEATHER: _____

SIGNIFICANT RECENT EVENTS (FLOODING, DROUGHT): _____

Category	Item	Condition/Observation	Corrective Measures	Personnel (contractors, consultants, etc.)
Landfill Cap	Vegetative Cover (sparse, stressed)			
	Settlement			
	Extensive Erosion			
Monitoring Point	Groundwater Monitoring Wells (caps, locks, seals, grouting)			
	Gas Vents			
Stormwater Runoff	Swales and Berms			
	Interceptor Trench			
	Protective Rip Rap			
	36-in. HDPE Pipe, Catch Basins, End Sections, Sediment Basin, Outlet Structure			
General	Perimeter Fencing			
	Leachate Pump Station*			
	Vehicle Access Road			
	Vermin and Vector			

* The leachate pump station is in confined space. Visual inspection does not require entry. Any maintenance procedures involving installed equipment must comply with the Confined Space Entry Program included in the Health and Safety Plan (Appendix C).

Appendix C

Town of New Windsor Wastewater Discharge Permit (15 June 1993)

Town of New Windsor

Wastewater Discharge Permit

Permit No. 92-LFC/SD19

In accordance with all terms and conditions of the Town of New Windsor Local Law, No.1, Chapter 37, Section 12, et. seq., and also with any applicable provisions of Federal or State law or regulation:

Permission is hereby granted to The Town of New Windsor
555 Union Avenue
New Windsor, New York 12553

for the contribution of Waters collected from the leachate collection system, of the New Windsor Landfill into the Town of New Windsor sanitary sewer lines at Square Hill Road.

This permit is granted in accordance with the application filed May 13, 1993 in the office of the Town Engineer, Wastewater Treatment Facility, Water Department, and in conformity with plans, specifications, and other data submitted to the Town of New Windsor in support of the above application all of which are filed with and considered as part of this permit, together with the following named conditions and requirements.

Effective this fiftheenth day
June, 1993
To expire the thirtieth day of
June, 1994

John P. Egitto
Operations Engineer Camo Pollution Control
Town of New Windsor Wastewater Treatment Facility

Sampling Parameters with specific limits as per TOWN of New Windsor LOCAL LAW #3, CHAPTER 37		Sample Type	
Arsenic	0.02 mg/l	discharge unit composite[1]	
Cadmium	0.02 mg/l	discharge unit composite	
Total Chromium	2.0 mg/l	discharge unit composite	
Hexavalent Chromium	0.2 mg/l	discharge unit composite	
Copper	0.8 mg/l	discharge unit composite	
Lead	0.2 mg/l	discharge unit composite	
Mercury	0.1 mg/l	discharge unit composite	
Nickel	2.0 mg/l	discharge unit composite	
Zinc	1.2 mg/l	discharge unit composite	
Barium	4.0 mg/l	discharge unit composite	
Phenol	4.0 mg/l	discharge unit composite	
Total cyanide	0.2 mg/l	discharge unit composite	
Total Halogenated Organics (TOX)	0.1 mg/l	discharge unit composite	
Available Chlorine	50.0 mg/l	grab	
Sulfide	6.0 mg/l	discharge unit composite	
Manganese	4.0 mg/l	discharge unit composite	
Gold	0.2 mg/l	discharge unit composite	
pH	5.0-9.5 s.u.	grab	Revised 12/3/92

[1] A discharge unit is considered the period during which actual discharge from the facility takes place not to exceed 24 hours per unit.

Sampling Parameters as per POTW Operators and/or New York State DEC Requirements		Sample Type
B.O.D.	report	discharge unit composite
Total Suspended Solids	250 mg/l	discharge unit composite
Settleable Solids	50 mg/l in 1 hour	grab
Flow	Not to exceed ~~50~~ 100 GPM	daily/ report monthly
Ignitability	140° Fahrenheit closed cup	grab

APPEN

Additional Parameters:

A Baseline Monitoring Report (BMR) consisting of the above listed parameters and tests for Oil & Grease, TKN, ammonia, Phosphorus, Chlorides and all substances listed in ~~Appendix VII~~ of 40 CFR 261 will be taked during the second week of August 1993. The BMR consists of three daily composite samples and apprioerate garb samples.

Sample Location : The wet well of the onsite pumping station.

Sampling Frequency: Monthly

Reporting : A report submitted on the enclosed forms, containing the results of the Monthly Test shall be submitted no later than 30 days after test event.

Additional Sampling : Unscheduled samples will be taken by the POTW as required by Federal regulations.

PERMIT RENEWAL:

Any user who wishes to continue discharging after the permit has expired is required to submit a permit renewal application no later than 90 days prior to the expiration date of the existing permit.

Notes :

The New Windsor Wastewater Treatment Facility will immediately be notified of any spills, fires or infiltration of significant amounts of leachate which would have an adverse effect on the treatment plant's effluent.

Parameters that exceed permit limits must be resampled for with-in 30 days of original sampling event. Should the second sample show continued noncompliance a third sampling event, with-in 30 days of second sample event, must be taken. This program of resampling for parameters that exceed permit limits is the responsibility of Industrial User and must continue until the sampling results show that compliance with permit limits has been achieved.

The results from each successive sampling event must be submitted to the Control Authority along with an explanation of the reasons for and a plan of action taken to correct, each permit parameter violation.

Results of any other sampling events which provide information about the nature of the wastewaters entering the sewer system must be submitted to the Control Authority in a timely mannor.

Fees : All cost of Control Authority Sampling will be billed to the Industrial Users and is payable to the provider of services.

Appendices : Are attached, to the first permit issued to this facility. Dated August 20, 1992

A. Industrial Wastewater Permit Application

B. Industrial Chemical Survey

C. Process Block Diagram

D. Location of Tie in to Sanitary Sewer

Further Conditions relevant to all Pretreatment Permits

The following contains specific obligations for which Industrial Users are responsible.

Right of Entry

Persons or occupants of premises where wastewater is created or discharged shall allow representatives of the Control Authority, EPA or NYSDEC ready access at all reasonable times to all parts of the premises for the purposes of inspection, sampling, records examination, copying such records or in the performance of any of their duties. Also, where a user(s) has security measures in force which would require proper identification and clearance before entry into their premises, the user(s) shall make necessary arrangements with their security guards so that upon presentation of suitable identification, personnel from the Control Authority, NYSDEC and EPA will be permitted to enter, without delay, for the purposes of performing their specific responsibilities.

Penalty Provisions

If any person(s) discharge(s) sewage, industrial wastes or other wastes into the town's wastewater disposal system contrary to the provisions of Local Law #3 Chapter 37, Sewer Regulations Industrial, federal or state pretreatment requirements, or any order of the town, the Town Attorney may commence an action for appropriate legal and/or equitable relief in the Supreme Court of the county.

1. Any user(s) who is found to have violated an order of the Town Board or who willfully or negligently failed to comply with any provision of the Local Law #3 Chapter 37 and the orders, rules, regulations and permits issued thereunder, shall be fined not less than one hundred dollars ($100) nor more that one thousand dollars ($1,000) for each offense. Each day on which a violation shall occur, or continue, shall be deemed a separate and distinct offence.

2. In addition to the penalties provided herein, the town may recover reasonable attorney's fees, court costs, court reporter's fees and other expenses of litigation, by appropriate suit, at law, against the person(s) found to have violated Local Law #3 Chapter 37 or the orders, rules, regulations and permits issued hereunder.

Permit Revocation

The Control Authority may suspend the wastewater treatment service and/or sewer permit when such suspension is necessary, in the opinion of the town, in order to stop an actual, or threatened, discharge which presents or may present:

1. an imminent or substantial endangerment to
   A. the health or welfare of persons, or
   B. to the environment
2. causes interference to the treatment plant or
3. causes the town to violate any condition of its SPDES permit.

Also

Any user who violates the following conditions of Local Law #3 Chapter 37 Sewer Regulations, Industrial, or applicable state and federal regulations is subject to having its permit revoked.

A. Failure of a user to factually report the wastewater constituents and characteristics of its discharge.
B. Failure of the user to report significant changes in operations or wastewater constituents and characteristics.
C. Refusal of reasonable access to the user's premises for the purpose of inspection or monitoring.
D. Failure of the user to report occurrences of slug discharges.
E. Violation of conditions of the permit.

Records Retention

As proscribed by the New York State Education Dept. State Archives and Records Administration by Schedule MU-1
All records pertaining to the pretreatment of, or disposal of, all industrial waste are to be kept on permanent file.

Permit Non-transferability

A sewer permit shall not be reassigned, or transferred, or sold, to a new owner(s), new user(s), different premises or new changed operation, without the approval of the town, as the permits are issued to a specific user(s) for a specific operation.

Notice of Slug Loading, Accidental Discharges, or Spills

In the case of an slug discharge, accidential discharge or spill, it is the responsibility of the user(s) to **immediately** telephone and notify the town wastewater treatment plant (Control Authority) of the incident. The notification shall include:

1. location of discharge,
2. type of waste,
3. concentration of pollutants in discharge
4. volume of discharge
5. corrective actions taken to stop and prevent further discharges and shall be confirmed in writing within seventy-two (72) hours.

Written notice, shall be made within five (5) days following an accidental discharge, spill or slug discharge, the user(s) shall submit to the Superintendent (Control Authority) a detailed written report describing:

1. the cause of the discharge
2. the measures to be taken by the user(s) to prevent similar future occurrences.

Such notification shall not relieve the user(s) of any expense, loss, damage or other liability which may be incurred as a result of damage or other liability which may be incurred as a result of damage to the town treatment plant, fish kills or any other damage to person or property; nor shall such notification relieve the user(s) of any fines, civil penalties or other liability which may be imposed by this local law or other applicable law.

Appendix D

Draft Health and Safety Plan, Post-Closure Period, Town of New Windsor Landfill, New Windsor, New York

REFERENCES

American Conference of Governmental Industrial Hygienists. 1989. ACGIH Threshold Limit Values and Biological Exposure Indices for 1988-1989.

American National Standards Institute (ANSI). 1980. American National Standard Practices for Respiratory Protection Z88.2.

National Institute of Occupational Safety and Health (NIOSH), OSHA, U.S. Environmental Protection Agency (U.S. EPA), and U.S. Coast Guard. 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. October.

New York State Department of Environmental Conservation (NYSDEC). 1985. Division of Spill Response. Correspondence - analytical results.

NYSDEC Division of Spill Response. 1988. Correspondence - analytical results.

NYSDEC Division of Environment Enforcement. 1988. Correspondence - analytical results.

NYSDEC Division of Environment Enforcement. 1989. Correspondence - analytical results.

Occupational Safety and Health Administration (OSHA). 1981. Standards for Construction Industry, 29 CFR 1926.

OSHA. 1986. Respiratory Protection 29 CFR 1910.134.

OSHA. 1987. Standards for General Industry, 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response.

Attachment A

Confined Space Entry Procedures

ATTACHMENT A

CONFINED SPACE ENTRY PROCEDURES

A.1 DEFINITION

A space which is large enough and so configured that an employee can bodily enter and perform work, has limited or restricted means for entry or exit, is not designed for continuous employee occupancy, and has one or more of the following characteristics:

- Contains a potentially hazardous atmosphere due to accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.
- Contains a material with the potential for suffocation of an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor that slopes downward and tapers to a smaller cross-section.
- Contains other recognized health or safety hazard.

Confined spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 ft in depth such as pits, tubs, vaults, and vessels.

A.2 CONFINED SPACE ENTRY

No entry will be permitted into a confined space except with authorization of the Program Health and Safety Officer. The site-specific Health and Safety Plan will include a confined space entry program meeting the requirements of this Health and Safety Plan OSHA 1910.146 Permit-Required Confined Spaces, and any state standard.

A.3 PERMIT SYSTEM

Personnel required to enter a confined space will require a permit authorizing the entry. A new permit will be issued by the Site Health and Safety Officer at the start of each work shift during which confined space entry will be required. The permit will meet OSHA 1910.146.

A.4 TESTING AND MONITORING

Prior to entry, the atmosphere of the confined space will be tested for oxygen content, explosibility, and toxic chemicals. Monitoring will be continuously conducted while the confined space is occupied.

A.4.1 Qualified Person

Testing and monitoring will be conducted by a qualified person under the direction of an Industrial Hygienist.

A.4.2 Equipment

Equipment required to conduct the testing and monitoring will consist of a combination oxygen/combustible gas meter and may also include the following monitoring capabilities for toxic substances:

- Direct reading instruments for specific gases and vapors such as combination oxygen/combustible gas meter and monitoring capabilities for toxic substances.
- A photoionization detector (PID) for the monitoring of ionizable compounds.
- Detector tubes appropriate for the suspected contaminants within the confined space.

A.5 EMERGENCY RESCUE

A person trained in emergency rescue and assigned to remain on the outside of the confined space and to be in communication with those working inside will be designated as the standby person and have primary responsibility to perform emergency rescue. Rescue procedures will be specifically designed for each confined space entry and recorded on the permit.

A.6 PURGING AND VENTILATION

Purging and ventilation shall be performed to remove hazardous atmospheres whenever they are detected prior to or during a confined space entry. Ventilation, if required for entry, shall continue during entry, even if monitoring indicates a safe atmosphere. Every reasonable effort shall be made to provide sufficient ventilation for a safe atmosphere, but if ventilation is not completely effective, it shall be supplied to reduce the atmospheric hazard and entrants shall wear appropriate respiratory and other personal protective equipment.

The permit shall specify the necessary purging and ventilation procedures to be used for the confined space operation, if any. If required by the confined space entry permit, mechanical ventilation such as fans or blowers shall be provided prior to initial entry and for the duration of the permit to ensure that an atmosphere contains sufficient oxygen, is not explosive, and does not contain toxic chemical levels. When ventilation is performed, the blower controls shall be at a safe distance from the confined space. Initial testing of the atmosphere shall be performed from outside the space to determine precautions needed for purging and ventilation. Ventilation systems shall be designed to protect workers in the surrounding area from exposure to contaminated air. If flammable concentrations are present, electrical equipment shall comply with the requirements of the National Electrical Code. Permit-required continuous general ventilation shall be maintained where toxic atmospheres are produced as part of the work procedure or are likely to develop due to the nature of the confined space. When ventilation is not possible or feasible, other protective measures shall be specified in the permit.

A.7 EQUIPMENT

Minimum equipment required to perform work within a confined space will consist of the following:

- Level of protection described by Table 2 contained within the Health and Safety Plan. Real time air monitoring may dictate modification of protection required.
- A harness with attached lifeline.
- A tripod with block and tackle or winch.

A.8 TRAINING

No person will enter a confined space until they have been trained in the nature of the hazards associated with the confined space, informed of the emergency rescue procedures and equipment and necessary precautions to be taken, and trained in the use of personal protective equipment.

ATTACHMENT A

CONFINED SPACE ENTRY PROCEDURES

SITE: _____

Work Task	Entry Procedure

Project No.: _____

Effective Dates: Start _____ Expire _____

Location & Desciption of CS: _____

_____

Purpose of Entry: _____

Project Manager: _____ Site Manager: _____

SSHS: _____ CS Entrant(s): _____

CS Attendant(s): _____ _____

_____ _____

EA Subcontractors: _____ Rescue Team: _____

_____ Needed as onsite standby? Yes _____ No _____

Potential Hazards	Yes	No
Oxygen Deficiency		
Combustible Atm.		
Toxic Materials		
Type		
Heat Stress		
Pressure System		
Unstable Structures		
Electrical		
Mechanical		
_____		

Special CS Requirements	Yes	No
Lockout/Isolation		
Blank/Disconnect		
Purge-Flush & Vent		
Ventilation		
Barricade/Secure Area		
Warning Signs		
Lighting		
_____		
_____		
_____		

Personal Protective Equipment	Yes	No
Respirators		
Type _____		
Escape Air Supply		
Chem-resistant Coveralls		
Type _____		
Chem resistant Gloves		
Type _____		
Hearing Protection		
Eye/Face Protection		

Emergency Equipment	Yes	No
Tripod/Lifeline/Harness		
Fire Extinguisher		
1st Aid Kit		
Eye Wash Station		
Communication Equipment		
Type _____		
_____		
_____		
_____		

Note: Hard hat, safety glasses, and safety boots are required.

Emergency Phone Numbers:

Fire/Rescue _____ Ambulance _____

Police _____ Project Manager _____

Hospital _____ CHSO or Designer _____

Emergency Procedures: _____

_____

_____

_____

CS Communication Requirements:	Yes	No	Description
Hand Signals	____	____	_____
Audible Signals	____	____	_____
Life Line Signals	____	____	_____

Air Monitoring Requirements:*

Instrument	Yes	No	Action Level	Frequency	Action to be Taken
_____	____	____	_____	_____	_____
_____	____	____	_____	_____	_____
_____	____	____	_____	_____	_____
_____	____	____	_____	_____	_____
_____	____	____	_____	_____	_____

*Observed levels for all air monitoring must be documented on an Environmental Monitoring Record.

Vehicle Exclusion Perimeter: _____

Authorizing Signatures (Permit not active without ALL signatures):

Project Manager: _____ Date: _____

CSHO or Designated Representative: _____ Date: _____

CS Attendant (May be signed only on site): _____ Date: _____

Permit Requirements Understood: (Signed by all CS field personnel)

_____ _____

_____ _____

_____ _____

Permit Canceled by: _____ Date: _____

Copy to: Project File
HWOC

Attachment B

Trench Excavation Procedures

ATTACHMENT B

TRENCH EXCAVATION PROCEDURES

During the post-closure period, trenching may be required to replace or maintain existing piping networks (leachate collection, stormwater diversion). Acute awareness by all personnel during trench excavation is imperative due to the possible release of organic vapors and the potential fire hazard.

Entry in the Exclusion Zone will be limited to the subcontractor backhoe operator, a subcontractor employee to guide the backhoe operator, a Town employee to document what is unearthed, and the SHSO who will continuously monitor volatile organic levels and explosive conditions of the excavated materials. All workers in the Exclusion Zone, including the backhoe operator and helper, will initially be in Level D PPE, with preparation to upgrade.

It is imperative that all personnel at this task have completed the OSHA required 40-hour Safety and Health training and annual 8-hour refresher courses (if needed), be currently fit-tested for wearing respirators, and be certified in the use of SCBA and gear (Level B).

All excavations will be made in accordance with 29 CFR 1926.652 specific trenching requirements. Stable slopes must be maintained during all excavation activities to avoid collapse and to protect employees working in the area. Special attention should be paid to areas where ground material is not highly compacted but rather soft or unstable, areas where water may be encountered at a depth of less than 5 ft, areas near a railroad, highway (such as Interstate 87), or machinery operation where vibrations may induce cave-ins or slides. Attention should also be paid to the appropriations and condition of materials.

Personnel are not allowed to enter the trench excavations except in case of emergency. In an emergency situation, should it become necessary for anyone to enter a test pit, especially with a depth greater than 4 ft, an adequate means of exit, such as a ladder, must be available.

The SHSO will stop all work if this site HSP is not followed or if conditions warrant.

ATTACHMENT C

SITE HEALTH AND SAFETY PLAN REVIEW RECORD

SITE: New Windsor Landfill

I have read the Site Health and Safety Plan for this site and have been briefed on the nature, level, and degree of exposure likely as a result of participation in this project. I agree to conform to all the requirements of this Plan.

Name	Signature	Affiliation	Date

Attachment D

Site Entry and Exit Log

ATTACHMENT D

SITE ENTRY AND EXIT LOG

SITE: _____

Name	Date	Time of Entry	Time of Exit	Initials

Attachment E

Emergency Telephone Numbers

ATTACHMENT E

EMERGENCY TELEPHONE NUMBERS

SITE: New Windsor Landfill

Emergency Contact		Telephone Numbers
Police:	Town of New Windsor	(914) 565-7000
Fire:	Town of New Windsor Cornwall	(914) 561-3112 (914) 534-8100
Ambulance:	New Windsor Ambulance Corp	(914) 565-3320
Hospital:	St. Luke's Emergency	(914) 561-4400

Directions to hospital (Figure E-1):

Exit site on access road to Silver Stream Road. Turn left onto Little Britain Road (Route 207). Travel east on Little Britain Road 2.5 mi to Wisner Avenue. Turn left onto Wisner Avenue. Proceed approximately 3 blocks to Broadway (17K). Turn right onto Broadway traveling east approximately 2.25 mi. Turn left onto DuBois Street. Travel north on DuBois Street for 3 blocks to hospital.

Emergency Personnel Contact	Telephone Numbers
NOTE: Emergency personnel contacts and telephone numbers to be determined by Town of New Windsor.	

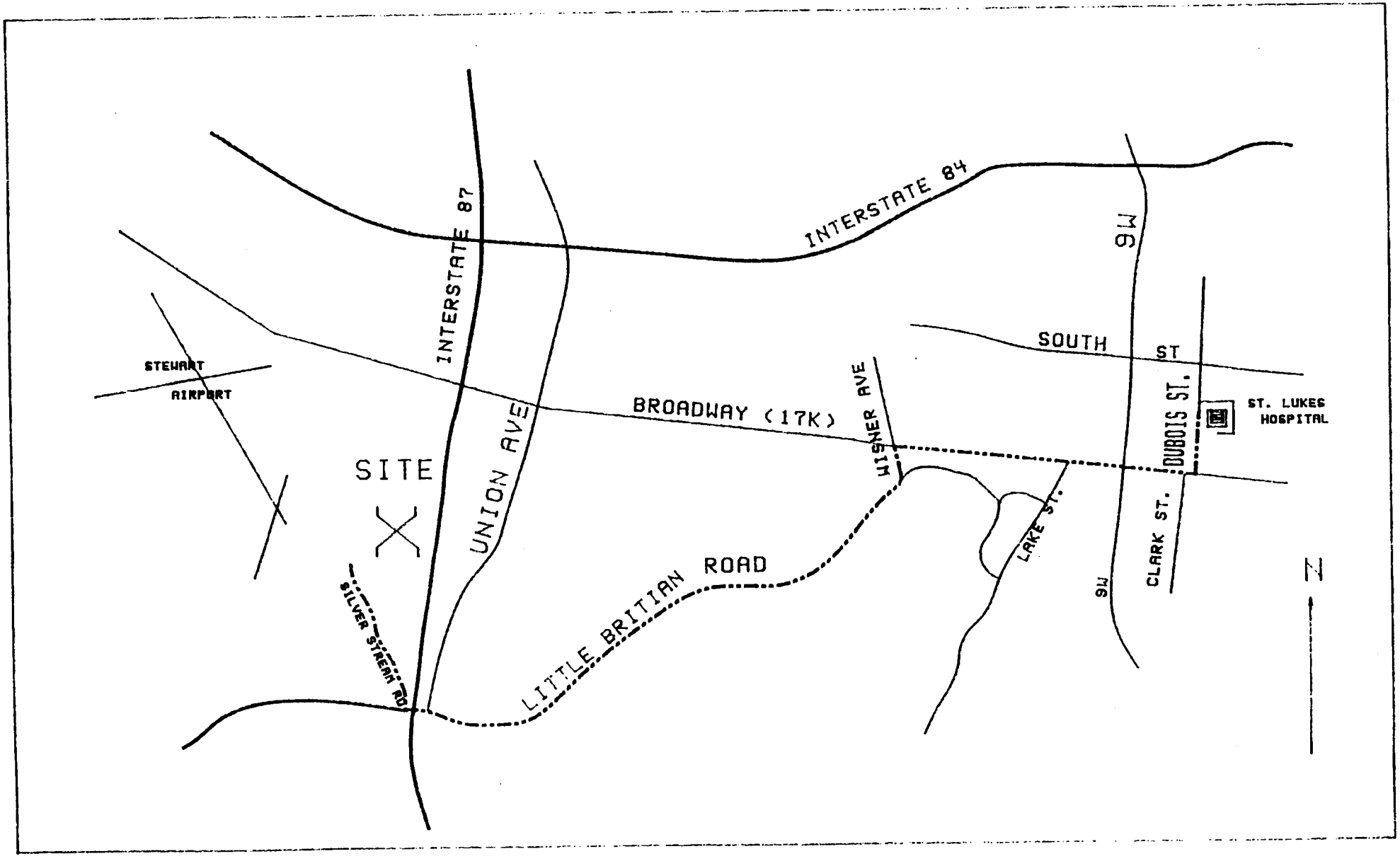


Figure E-1 Route from New Windsor Landfill to St. Luke's Hospital.

Appendix E

Pump Station Operation and Maintenance Manuals

APPENDIX E

PUMP STATION OPERATION AND MAINTENANCE MANUALS

- Operation and Maintenance Manuals for Barnes Pumps
- Instruction Bulletin for Magnetic Flowmeter Microprocessor-Based Signal Converter
- Service Manual for Magnetic Flowmeter Microprocessor-Based Signal Converter
- Magnetic Flowmeter Test Report
- Instruction Bulletin for Magnetic Flowmeter
- Operation and Maintenance Manual for THERN 2,000 lb Davit Crane/Hoist
- Civil Diagram for Control Panel
- Operation and Maintenance Manual for Microtel Automatic Dialer

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• Cut Out And Return Warranty Registration To:

BARNES PUMPS INC.
420 EAST THIRD STREET
PIQUA, OHIO 45356

Your pump is covered by the enclosed Warranty. This warranty is only effective provided the warranty registration is completed and returned to the Barnes Pumps service department. Review the form below and fill in all information.

IMPORTANT! If you have a claim under the provision of the warranty, contact your local Barnes Pumps Distributor.

WARRANTY REGISTRATION

CUSTOMER'S NAME _____ DATE INSTALLED _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

DEALER'S NAME _____

CITY _____ STATE _____ ZIP _____

PUMP MODEL NO. _____ SERIAL NO. _____ VOLTAGE _____

BUILD CODE NO. _____ PART NO. _____

Warranty

Seller warrants to its distributors and dealers, and through each of them to the first purchaser for use (Buyer) that Seller will, at its election, repair or replace any part of any product manufactured by Seller which shall, within twelve (12) months after date of installation, or eighteen (18) months after shipment (whichever first occurs) be found upon Seller's inspection to be defective in material or workmanship.

At Seller's election, Buyer, at its expense, shall return the part believed to be defective to Seller's manufacturing plant at 420 Third St., Piqua, Ohio 45356 or an authorized distributor or dealer for inspection. Seller shall not be responsible for the expense of labor or transportation; provided however, a substantiated claim for reasonable transportation expense will be reimbursed by Seller with respect to any part replaced under Seller's warranty. Warranty, repair or replacement of any part by Seller shall not extend the warranty period.

Seller incurs no liability under this warranty or otherwise for (i) items not manufactured by Seller, (Seller hereby assigns to Buyer any warranty extended by manufacturer thereof); (ii) Products of insufficient capacity for the system or service into which they are placed, or which are damaged, abused, corroded, altered or improperly maintained; (iii) Parts which are subject to wear and, while not defective, are normally replaced in accepted maintenance programs; (iv) Products subjected to other than normal use in the service for which they are designed.

This warranty is agreed by the parties to set forth Buyer's exclusive right and remedy against Seller with respect to the Product and be in lieu of all other expressed warranties and all implied warranties including implied warranties of merchantability and fitness; Seller assumes no other like or unlike liability for loss of use, or profit, or consequential damages of any kind or form whatsoever cause or thing arising, including, but not limited to claims of liability based upon tort, negligence, strict liability or breach of warranty in connection with the manufacture, sale, alteration, repair or replacement of any Product or part thereof. This warranty is not transferable by Buyer.

BARNES PUMPS, INC.
A Burks Pumps, Inc Company

1485 Lexington Ave., Mansfield, Ohio 44907
Phone 419 774 1511 Fax 419 774 1530

MADE IN THE U.S.A.

7) Barnes Pumps Control Panel Model No. _____

Number Of Pumps Operated By Control Panel _____

NOTE: At no time should holes be made in top of control panel, unless proper sealing devices are utilized.

Control Panel Manufactured By Others: _____

Company Name _____

Model No. _____

Short Circuit Protection _____ Type _____

Number and Size of Short Circuit Device(s) _____ Amp Rating _____

Overload Type _____ Size _____ Amp Rating _____

Do Protective Devices Comply With Pump Motor Amp Rating _____

Are All Connections Tight? _____

Is The Interior Of The Panel Dry? _____ If "No",The Moisture Problem Must Be Corrected.

8) Electrical Readings:

Single Phase:

Voltage Supply at Panel Line Connection,Pump Off,L1,L2 _____

Voltage Supply at Panel Line Connection,Pump On,L1,L2 _____

Amperage: Load Connection, Pump On,L1 _____ L2 _____

Three Phase:

Voltage Supply at Panel Line Connection,Pump Off,L1-L2 _____ L2-L3 _____ L3-L1 _____

Voltage Supply at Panel Line Connection,Pump On,L1-L2 _____ L2-L3 _____ L3-L1 _____

Amperage,Load Connection,Pump On,L1 _____ L2 _____ L3 _____

9) Final Check:

Is Pump Seated On Discharge Properly? _____ Check For Leaks _____

Does Check Valves Operate Properly? _____

Flow;Does Station Appear To Operate At Proper Rate _____ Pump Down Time _____

Noise Level: High _____ Medium _____ Low _____

Comments: _____

10) Equipment Difficulties During Start-Up: _____

_____

_____

_____

11) Manuals:

Has Operator Received Pump Instruction and Parts Manual? _____

Has Operator Received Electrical Control Panel Diagram? _____

Has Operator Been Briefed On Warranty? _____

Address Of Local Barnes Pumps Representative/Distributor _____

_____

_____

12) I Have Received The Above Information(Name of Operator) _____

(Name Of Company) _____

_____ Date _____

I Certify This Report To Be Accurate (Name of Start-Up Man) _____

(Employed By) _____ (Date) _____

Date And Time Of Start-Up _____

Present At Start-Up:

( ) Engineer _____ ( ) Operator _____

( ) Contractor _____ ( ) Other _____

START-UP REPORT

This report is designed to insure the customer that customer service and a quality product are the number one priority with Barnes Pumps Inc. Please answer the following questions completely and as accurately as possible. Mail this form to:

BARNES PUMPS INC
PARTS & SERVICE DEPT.
420 EAST THIRD ST.
PIQUA, OHIO 45356 USA
ATTN: SERVICE MANAGER

Reports that are not returned can delay or void warranty.

1) Pump Owner's Name _____
Address _____
Location of Installation _____
Person in Charge _____ Phone _____
Purchased From (Barnes Pumps' Representative/Distributor) _____
2) Barnes Pumps Model _____ Serial No _____
Part Number _____ Build Code _____
Voltage _____ Phase _____ Hertz _____ Horsepower _____
Rotation: Direction of Impeller Rotation (Use C/W for clockwise,CC/W for counter-clockwise) _____
Method Used to Check Rotation (viewed from bottom) _____
Does Impeller Turn Freely By Hand _____ YES _____ NO _____
3) Condition Of Equipment _____ GOOD _____ FAIR _____ POOR
Condition Of Cable Jacket _____ GOOD _____ FAIR _____ POOR
Resistance of Cable and Pump Motor (measured at pump control)
Red-Black _____ Ohms Red-White _____ Ohms White-Black _____ Ohms
Resistance Of Ground Circuit Between Control Panel And Outside Of Pump _____ Ohms
MEG Ohm Check Of Insulation:
Red to Ground _____ White to Ground _____ Black to Ground _____
4) Condition Of Equipment At Start-Up: Dry _____ Wet _____ Muddy _____
Was Equipment Stored: _____ Length Of Storage: _____
Describe Station Layout _____
5) Liquid Being Pumped _____
Debris In Bottom Of Station? _____
Was Debris Removed In Your Presence? _____
Are Guide Rails Exactly Vertical? _____
Is BAF Stationary Installed Level? _____
6) Liquid Level Controls: Model _____
Is Control Installed Away From Turbulence _____
Operation Check:
Tip lowest float (stop float), all pumps should remain off.
Tip second float (and stop float), one pump comes on
Tip third float (and stop float),both pumps on (alarm on simplex).
Tip fourth float (and stop float), high level alarm on (omit on simplex).

If not Barnes Pumps level controls, describe type of controls _____
Does liquid level ever drop below volute top? _____

Pre-Engineered Product Modifications Parts List

Feature→ Option Code ↓	5. Seal Item (31) Material	1.0 & 1.9HP P/N	1.5,2.0,2.8 & 3.7HP P/N
01	Carbon/Ceramic/Buna-N (STD)	005080	067562
02	Tungsten/Tungsten/Buna-N	005080-SB	067562-SB
03	Silicon/Silicon/Buna-N	005080-SD	067562-SD
04	Carbon/Ceramic/Viton	005080-SF	067562-SF
05	Tungsten/Tungsten/Viton	005080-SH	067562-SH
06	Silicon/Silicon/Viton	005080-SK	067562-SK
07	Silicon/Tungsten/Buna-N	005080-SM	067562-SM
08	Carbon/Ni-Resist/Buna-N	005080-SN	067562-SN
09	Carbon/Ni-Resist/Neoprene	005080-SP	067562-SP

Feature→	6. Suction		7. Testing	8. Packaging
Option Code ↓	Item (24) Description	P/N	Description	Description
01	Volute (STD)	084470	Factory (STD)	STD
02			Certified	
03			Megger	
04			Double Megger	
05			Certified & Megger	
06			Certified & Double Megger	

Pre-Engineered Product Modifications Parts List

Feature ⇒	2. CORD LENGTH		
Option Code ⇓	Power Cable Item (30) Length	1PH P/N	3 PH. P/N	Control Cable Item (32) P/N
01	15 Ft.	085399	085092	071769
02	20 Ft.	085399XA	085092XA	071769XA
03	25 Ft.	085399XB	085092XB	071769XB
04	30 Ft.	085399XC	085092XC	071769XC
05	35 Ft.	085399XD	085092XD	071769XD
06	40 Ft.	085399XE	085092XE	071769XE
07	50 Ft.	085399XF	085092XF	071769XF
08	60 Ft.	085399XG	085092XG	071769XG
09	70 Ft.	085399XH	085092XH	071769XH
10	80 Ft.	085399XJ	085092XJ	071769XJ
11	90 Ft.	085399XK	085092XK	071769XK
12	100 Ft.	085399XL	085092XL	071769XL
13	110 Ft.	085399XM	085092XM	071769XM
14	120 Ft.	085399XN	085092XN	071769XN
15	130 Ft.	085399XP	085092XP	071769XP
16	140 Ft.	085399XR	085092XR	071769XR
17	150 Ft.	085399XS	085092XS	071769XS
18	160 Ft.	085399XT	085092XT	071769XT
19	170 Ft.	085399XU	085092XU	071769XU
20	180 Ft.	085399XV	085092XV	071769XV
21	190 Ft.	085399XW	085092XW	071769XW
22	200 Ft.	085399XY	085092XY	071769XY

Feature ⇒	3. Impeller Item (29)			4.	
Option Code ⇓	Material	1.0 & 1.9HP P/N	1.5,2.0,2.8&3.7HP P/N	Sufix	Dia.
01	Cast Iron	085063	084461		4.75
02				TA	4.62
03				TB	4.50
04				TC	4.38
05				TD	4.25
06				TE	4.12
07				TF	4.00
08				TG	3.88
09				TH	3.75
10				TJ	3.62
11				TK	3.50
12				TL	3.38
13				TM	3.25
14				TN	3.12
15				TP	3.00
16				TQ	2.88
17				TR	2.75
18				TS	2.62
19					
20					
21					

Pre-Engineered Product Modifications Parts List

BUILD CODE EXAMPLE

01-05-01-12-01-01-03-01
1. 2. 3. 4. 5. 6. 7. 8.

1. Feature- **Sensor**, Option Code **01**, Sensor not supplied with this unit. Use motor housing P/N directly accross from sensor type. If Temperature sensor is supplied, also use cable from feature 2.
2. Feature- **Cord Length**, Option Code **05**, Length is 35 ft., use P/N from appropiate phase column. So part no. for 1 Phase pump at 35 ft. would be 085399XD.
3. Feature- **Impeller Material**, Option Code **01**, Material will be Cast Iron, Use P/N directly accross from material from the appropiate HP colum and add sufix from Feature 4. Example, 1.9 HP Pump = 085063 + (sufix from Feature 4).
4. Feature- **Impeller Diameter**, Option Code **12**, Diameter is 3.00. Use the P/N from Feature 3 and add the sufix that corresponds to the dia. The P/N would be 085063-TL. (Check performance curve for diameter ranges when replacing impeller with diameter other than what was supplied.)
5. Feature- **Seal**, Option Code **01**, Material will be Carbon/Ceramic use P/N from appropiate HP column. Example, 1.9HP pump = P/N 005080, for item 31.
6. Feature- **Suction**, Option Code **01**, Standard Volute construction P/N 084470 for item 24.
7. Feature- **Testing**, Option Code **03**, This Option indicates this pump had a Megger Test performed.
8. Feature- **Packaging**, Option Code **01**, Standard Factory Packaging.

Feature ⇒	1. Sensor	
Option Code ⇓	Type	Item (5) Mtr. Housing P/N
01	No Sensor (STD)	084550
02	Temp. Only	084550-HA
03		
04		

ITEM	QTY.	DESCRIPTION		PART NO.
24	1	Volute		**See PPM**
29	1	Impeller		**See PPM**
30	1	Power Cable Set		**See PPM**
30a	1	* Cable		(Not Sold Separately)
30b	1	* Gland Nut		051447
30c	2	* ◇ Friction Ring	(single phase)	066071
		* ◇ Friction Ring	(three phase)	051450
30d	1	* ◇ Grommet	(single phase)	066072
		* ◇ Grommet	(three phase)	051452
31	1	† ◇ Shaft Seal		**See PPM**
32	1	Control Cable Set	(Optional Three Phase)	**See PPM**
32a	1	‡ Cable		(Not Sold Separately)
32b	1	‡ Gland Nut		051448
32c	2	‡ Friction Ring		051449
32d	1	‡ Grommet		051451
33	1	Temperature Sensor	(Optional 3 Phase)	
			1.0 & 1.9HP	051621
			1.5,2.0,2.8,3.7HP	085615
38	1	Wire Assembly		085073-WE
40	5	◇ Connector	(Three Phase)	071363
41	1	◇ Wire Connector	(Three Phase)	019212
42	1	◇ Bearing	1.5, 2.0, 2.8 & 3.7HP ONLY	017414
43	2	Belleville Washer	1.5, 2.0, 2.8 & 3.7HP ONLY	085282
44	1	Spacer	1.5, 2.0, 2.8 & 3.7HP ONLY	085283

* Included with item number 30.
‡ Included with item number 32.

PARTS KITS

SEAL REPAIR KIT: 1.0 & 1.9HP..P/N 085439 (†) 3,10,11,12,19,31.
1.5, 2.0, 2.8 & 3.7HP..P/N 085440

OVERHAUL KITS: 1.0 & 1.9HP

SINGLE PHASE.....P/N 085437 (◇) 2,3,6,8,9,10,11,12,19,23,30c,30d,31,42.

THREE PHASE..... P/N 085438(◇) 2,3,6,8,9,10,11,12,19,23,30c,30d,31,40,41,42.

OVERHAUL KITS: 1.5, 2.0, 2.8 & 3.7HP

SINGLE PHASE.....P/N 085446 (◇) 2,3,6,8,9,10,11,12,19,23,30c,30d,31,42.

THREE PHASE..... P/N 085445(◇) 2,3,6,8,9,10,11,12,19,23,30c,30d,31,40,41,42.

SEAL TOOL KIT: 1.0 & 1.9HP...P/N 085442
1.5, 2.0, 2.8 & 3.7HP....P/N 085443

PRESSURE GAUGE KIT..... P/N 085343

PARTS LIST

ITEM	QTY.		DESCRIPTION		PART NO.
1	1		Seal Plate	1.0 & 1.9HP	084532
				1.5, 2.0, 2.8 & 3.7HP	084343
2	1	◇	Retaining Ring	1.0 & 1.9HP	085326
				1.5, 2.0, 2.8 & 3.7HP	061143
3	1	†◇	Nut 1/2-20 Stainless	1.0 & 1.9HP	030068
			5/8-18 Stainless	1.5, 2.0, 2.8 &3.7HP	038132
5	1		Motor Housing		See PPM
6	1	◇	Bearing		039734
7	1		Screw	#8-32 x 3/8" lg stainless	016660
8	1	◇	Square Ring		027269
9	2	◇	Soc. Hd Cap Screw	1/4-20 x 1-1/4" lg stainless	084948
10	1	†◇	Gasket		027344
11	4	†◇	Lockwasher	5/16 stainless	026322
12	4	†◇	Cap Screw	5/16-18 x 2" lg stainless	070278
13	1 Gal.		Oil		029034
16	1		Hex Hd. Plug		084534
17	1		Eye Bolt	3/8-16 stainless	085544
18	1		Hex Nut	3/8-16 stainless	018927
19	1	†◇	Pipe Plug	1/8 NPT	014270
20	1		Motor	3SE1022L, 1922L	084049MB
				3SE1062L, 1962L	071355MB
				3SE1042L,1032L,1942L,1932L	071355MB
				3SE1522L,2022L,2822L,3722L	084386MA
				3SE1532L,1542L,2032L,2042L, 2832L, 2842L,2862L,3732L,3742L	067572MB
21	1		Capacitor (single phase)	1 & 1.9HP	034964
				1.5, 2.0, 2.8 &3.7HP	085348
22	1	◇	Capacitor Bracket (single phase)		039860
23	3 (single phase)		Terminal Connector		079318
	6 (three phase)		Terminal Connector	(2 for Temp. Sensor)	079318

See PPM = Pre-Engineered Products Modifications parts list

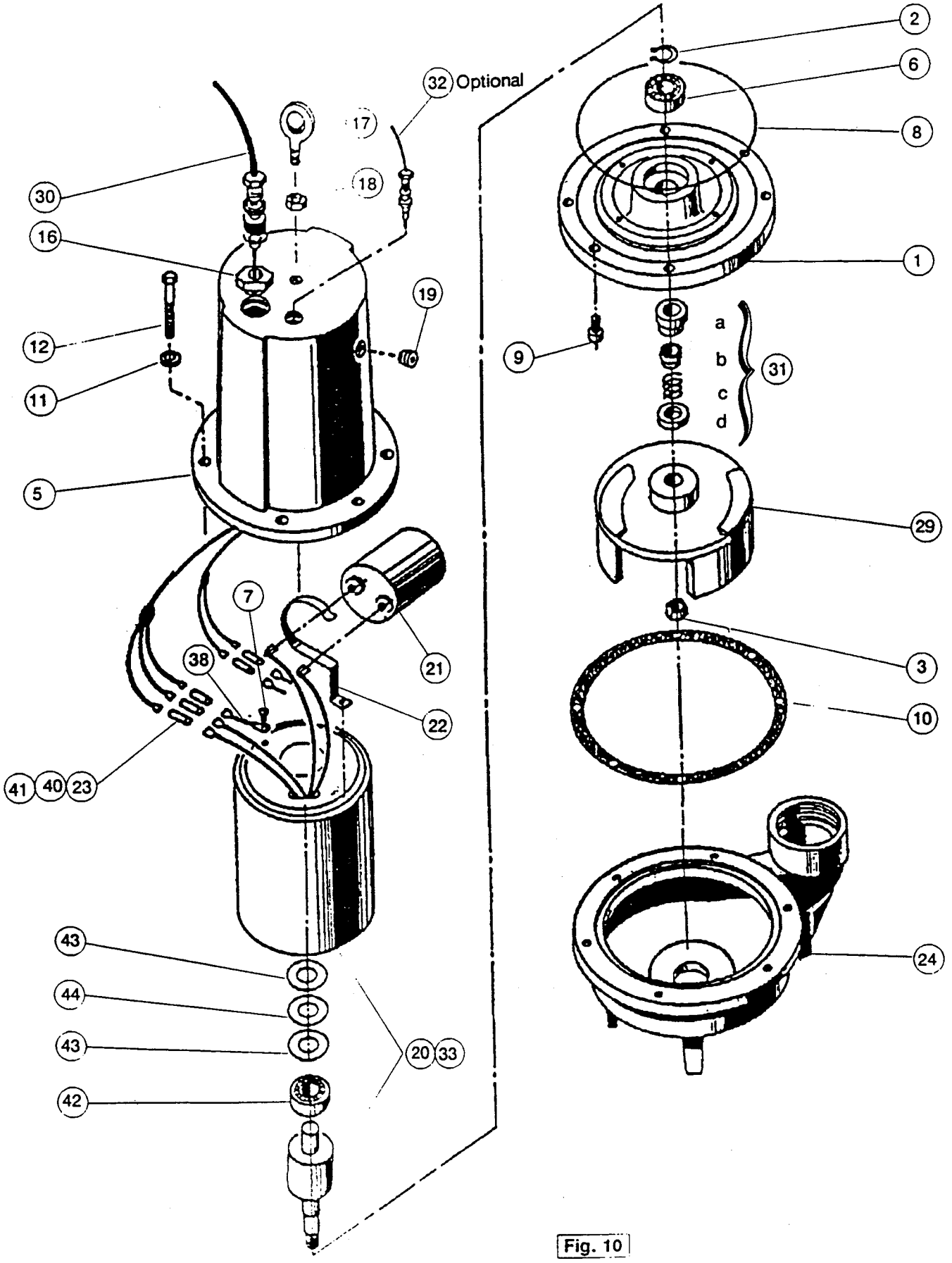

32 Optional
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Fig. 10

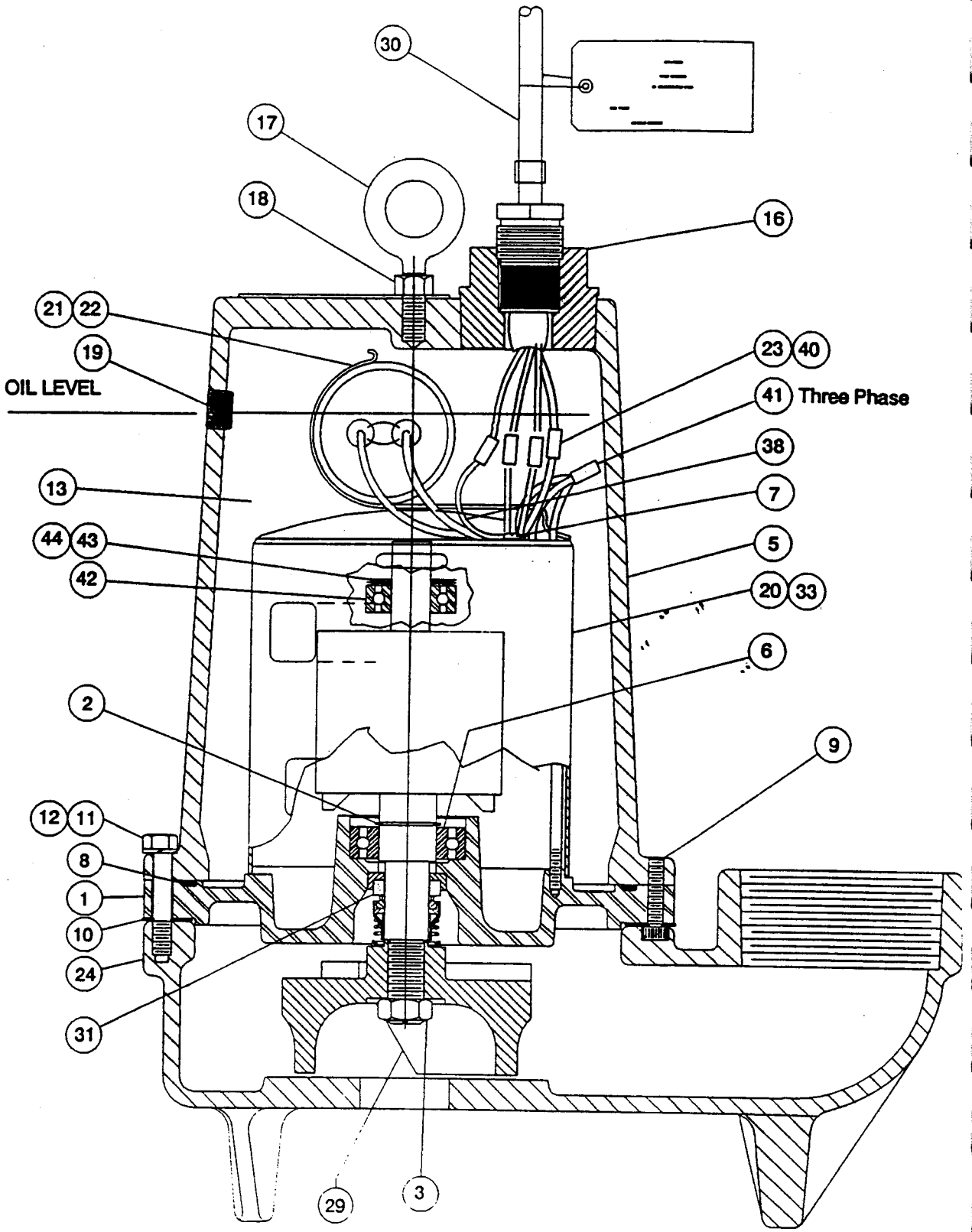

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OIL LEVEL
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Three Phase
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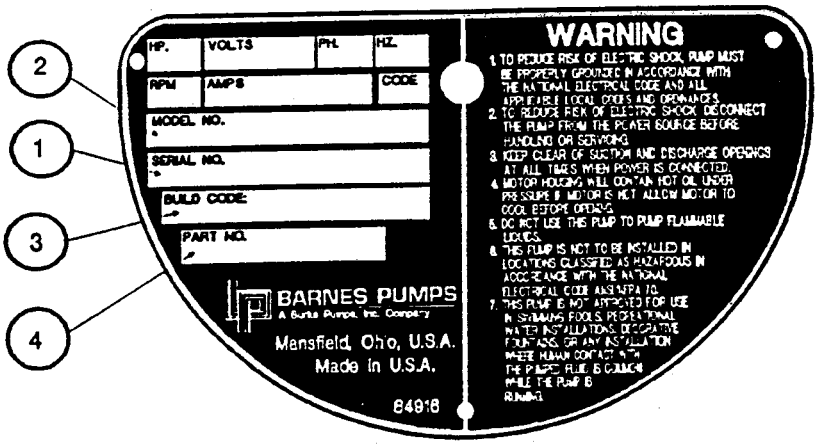
Fig. 9

SECTION: G REPLACEMENT PARTS

G-1 ORDERING REPLACEMENT PARTS:

When ordering replacement parts, ALWAYS furnish the following information:

1. Pump serial number and date code. (G-4)
2. Pump model number. (G-3)
3. Build Code number. (G-5)
4. Pump part number.(G-2)
5. Part description.
6. Item part number.
7. Quantity required.
8. Shipping instructions.
9. Billing Instructions.



G-2 PART NUMBER:

The part number consist of a five (5) digit number, which appears in the catalog. A one or two letter suffix may follow this number to designate the design configuration. This number is used for ordering and obtaining information.

G-3 MODEL NUMBER:

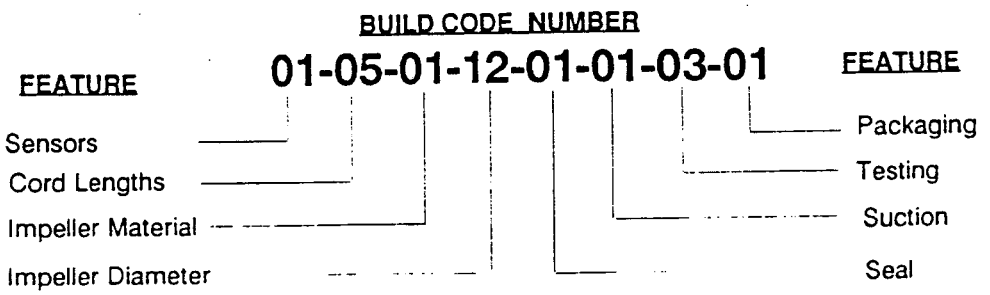
This designation consist of numbers and letters which represents the discharge size, series horsepower, motor phase and voltage, speed and pump design. This number is used for ordering and obtaining information.

G-4 SERIAL NUMBER:

The Serial Number consist of a ten digit number, which is specific to each pump. The first six digits are the pumps individual identity and the last four digits are the date the units was built. Example: 0056750490; 005675 = Identity Number, 0490 = Date Code (April of 1990).

G-5 BUILD CODE IDENTIFICATION:

Each of the eight, two digit number locations listed below represents a feature of the pump construction and the two digit number (01 to 99) represents an option of that feature. The example below identifies each of the eight Feature locations. Using the two digit number for each Feature and the Item number from the Parts List which indicates "see PPM" (in the Part No. column), turn to the PPM parts list to identify each Features' modification and part number.



TROUBLE SHOOTING

PROBLEM	CAUSE	CORRECTION
Pump cycles too frequently or runs periodically when fixtures are not in use.	6. Check valve not installed or leaking back into basin. 11. Fixtures are leaking. 15. Ground water entering basin.	6. Remove and examine check valve for proper installation and freedom of operation. 7. Open valve.
Pump shuts off and turns on independent of switch. (trips thermal overload protector). CAUTION ! Pump may start unexpectedly. Disconnect power supply.	1. Improper wiring or power supply. 4. Discharge head less than minimum. 8. Impeller jammed or rubbing. 12. Excessive water temperature (internal protection only).	8. Check impeller for freedom of operation, security and condition. Clean impeller cavity and inlet of any obstruction. 9. Loosen union slightly to allow trapped air to escape. Verify that turn-off level of switch is set so that impeller cavity is always flooded. Clean vent hole.
Pump operates noisily or vibrates excessively.	2c. Worn bearings, motor shaft bent. 8. Debris in impeller cavity or broken impeller. 10. Pump running backwards. 13. Piping attachments to building structure too rigid or too loose.	10. Check rotation. If power supply is three phase, reverse any two of three power supply leads to ensure proper impeller rotation. 11. Repair fixtures as required to eliminate leakage. 12. Check pump temperature limits & fluid temperature. 13. Replace portion of discharge pipe with flexible connector. 14. Turn to automatic position. 15. Check for leaks around basin inlet and outlets.

TROUBLE SHOOTING

CAUTION ! Always disconnect the pump from the electrical power source before handling.
If the system fails to operate properly, carefully read instructions and perform maintenance recommendations. If operating problems persist, the following chart may be of assistance in identifying and correcting them: **MATCH "CAUSE" NUMBER WITH CORRELATING "CORRECTION" NUMBER.**

PROBLEM	CAUSE	CORRECTION
Pump will not run	1. Poor electrical connection, blown fuse, tripped breaker or other interruption of power; improper power supply. 2. Motor or switch inoperative (to isolate cause, go to manual operation of pump). 2a. Float movement restricted 2b. Switch will not activate pump or is defective. 2c. Defective motor. 3. Insufficient liquid level.	1. Check all electrical connections for security. Have electrician measure current in motor leads, if current is within ±20% of locked rotor Amps, impeller is probably locked. If current is 0, overload may be tripped. Remove power, allow pump to cool, then recheck current. 2a. Reposition pump or clean basin as required to provide adequate clearance for float. 2b. Disconnect level control. Set ohmmeter for a low range, such as 100 ohms full scale and connect to level control leads. Actuate level control manually and check to see that ohmmeter shows zero ohms for closed switch and full scale for open switch. 2c. Replace per servicing instructions. 3. Make sure liquid level is at least equal to suggested turn-on point. 4. Recheck all sizing calculations to determine proper pump size. 5. Check discharge line for restrictions, including ice if line passes through or into cold areas.
Pump will not turn off	2a. Float switch movement restricted. 2b. Switch will not de-activate pump or is defective. 4. Excessive inflow or pump not properly sized for application. 9. Pump may be airlocked. 14. Switch is in "HAND" position.	
Pump hums but doesn't run	1. Incorrect voltage. 8. Impeller jammed or loose shaft, worn or damaged, impeller cavity or inlet plugged.	
Pump delivers insufficient capacity	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 5. Discharge restricted. 6. Check valve stuck closed or installed backwards. 7. Shut-off valve closed. 8. Impeller jammed, loose on shaft, worn or damaged,impeller cavity or inlet plugged. 9. Pump may be airlocked. 10. Pump running backwards.	

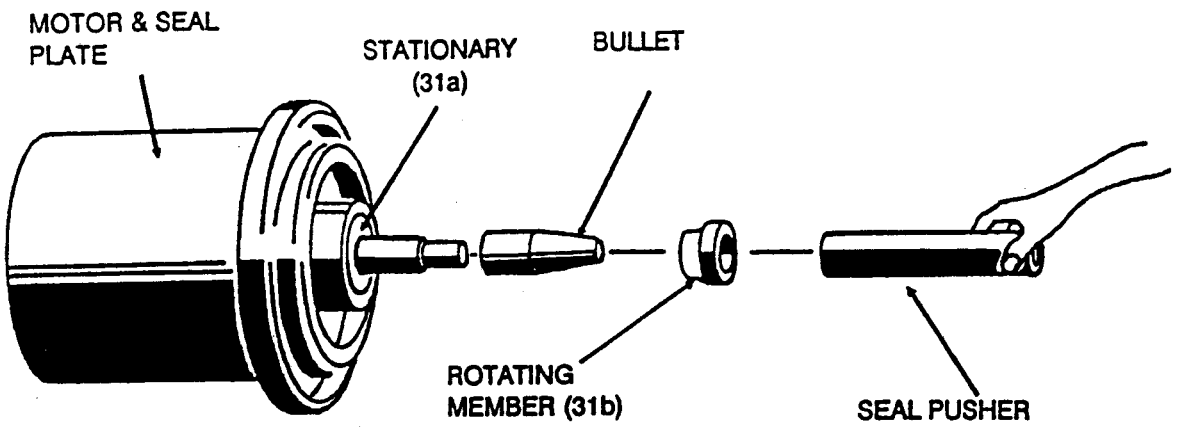


Fig. 8

It is extremely important to keep seal faces clean during assembly. Dirt particles lodged between these faces will cause the seal to leak.

Place spring (31c) over shaft and in place on rotating member (31b), making sure it is seated on retainer and not cocked or resting on bellows tail. Slide retaining ring (31d) over shaft and let rest on spring (31c). Assemble impeller and volute as outlined in paragraph F-2.2. Replace oil as outlined in paragraph F-1.3.

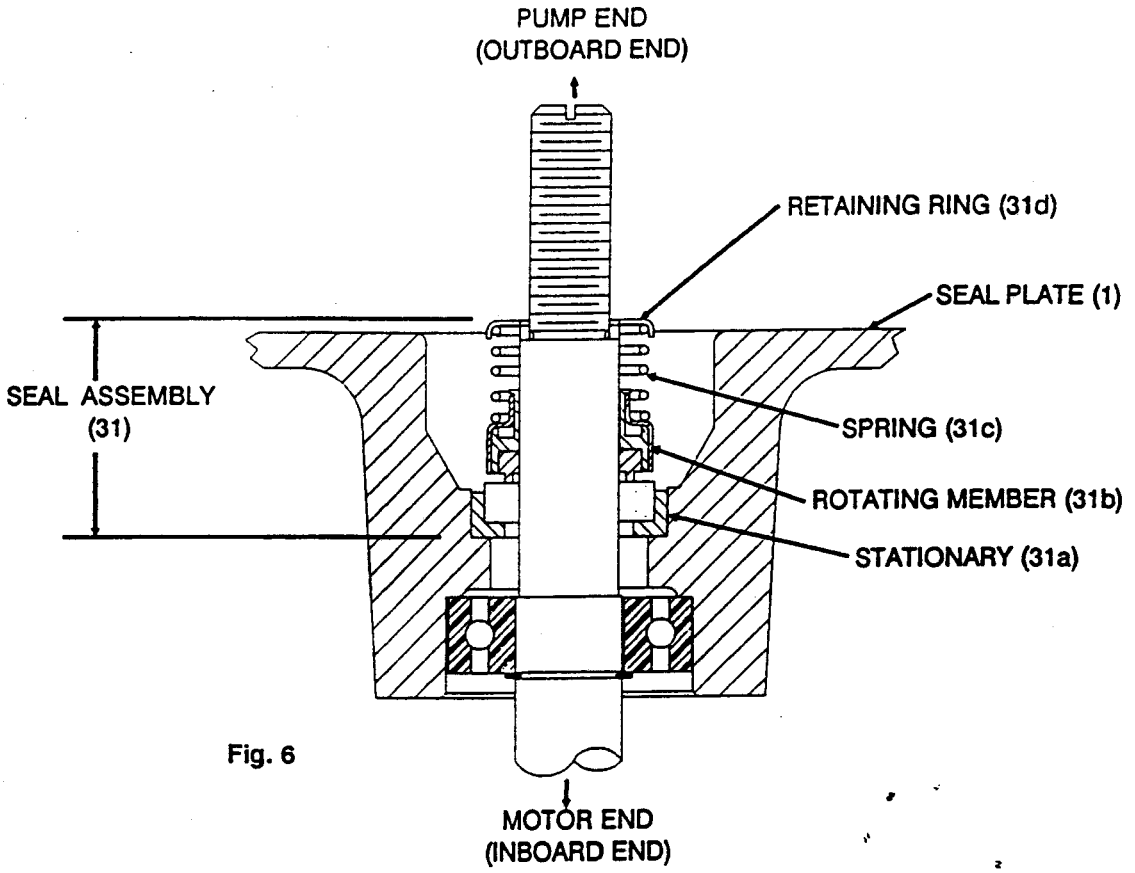


Fig. 6

IMPORTANT !
DO NOT HAMMER ON THE SEAL PUSHER- IT WILL DAMAGE THE SEAL FACE.

Make sure the stationary member is in straight. Slide a bullet (see parts list-seal tool kit) over motor shaft. Lightly oil (DO NOT use grease) shaft, bullet and inner surface of bellows on rotating member (31b) see Fig. 8. With lapped surface of rotating member (31b) facing inward toward stationary member (31a), slide rotating member (31b) over bullet and onto shaft, using seal pusher, until lapped faces of (31a) and (31b) are together (see Fig. 6).

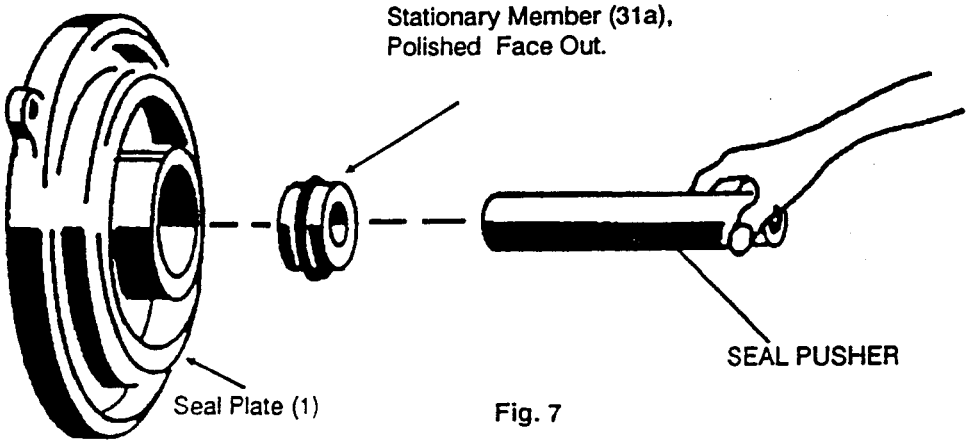


Fig. 7

F-3.3) Wiring Connections:
Check power cable (30) and control cable (32) (if used), for cracks or damage and replace if required (see Fig. 5). Place parts (30a,b&c) and hex nut (16) on power cord (30), and parts (32a,b &c) on control cable (32 if equipped). Bring cord sets (30) and (32 if equipped) through opening in top of motor housing (5), and reconnect motor leads to power cable (30) and temperature sensor leads to control cable (32 if equipped) using connectors (23), and in addition use (40) and (41) for 3 phase, as show in Fig. 4.

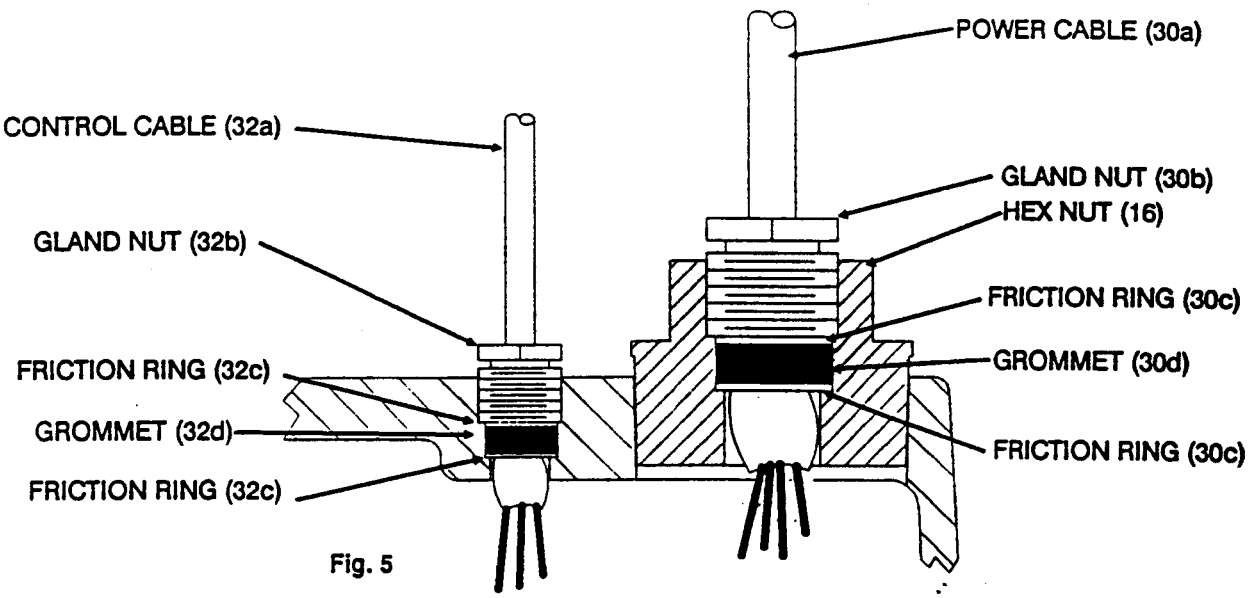


Fig. 5

F-3.4) Cable Assemblies:
Power Cable- Refill with cooling oil (if it has been drained) as outlined in paragraph F-1.3. Make wire connections as outlined in paragraph F-3.3. Apply thread locking compound to hex nut (16) and tighten into motor housing (5). Insert one friction ring (30c), grommet (30d), another fiction ring (30c) and gland nut (30b) into hex nut (16) and tighten gland nut (30b) to 15 ft. lbs. to prevent water leakage (see Fig. 5).

Control Cable (optional)- Insert one friction ring (32c), grommet (32d), one friction ring (32c) and gland nut (32b) into motor housing (5). Torque gland nut (32b) to 15 ft. lbs to prevent water leakage.

F-4) Shaft Seal Service:

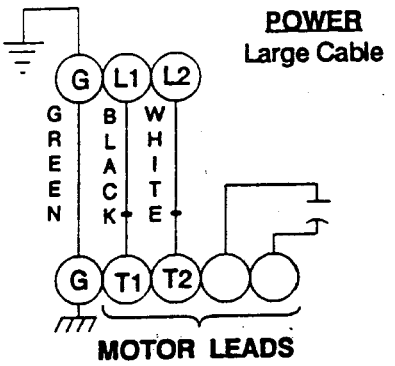
CAUTION !
HANDLE SEAL PARTS WITH EXTREME CARE. DO NOT SCRATCH OR MAR LAPPED SURFACES.

F-4.1) Disassembly and Inspection:
To expose shaft seal (31) for examination disassemble volute and impeller as outlined in paragraph F-2.1. If further repair is required remove retaining ring (31d), spring (31c) and rotating member (31b) from shaft (see Fig. 6). Examine all seal parts and especially contact faces. Inspect seal for signs of wear such as uneven wear pattern on stationary members, chips and scratches on either seal face. DO NOT interchange seal components, replace the entire shaft seal (31). If replacing seal, remove stationary (31a) by prying out with flat screw driver.

F-4.2) Reassembly:
Seal- Clean and oil seal cavities in seal plate (1). Lightly oil (DO NOT use grease) outer surface of stationary member (31a). Press stationary member (31a) firmly into seal plate (1), using a seal pusher (see parts list- seal tool kit), nothing but the seal pusher is to come in contact with seal face (see Fig. 7).

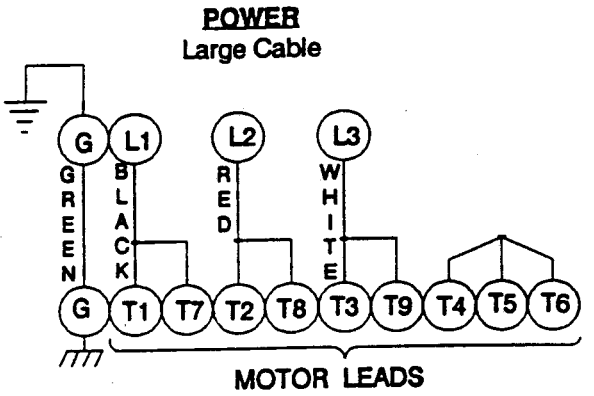
SINGLE PHASE, 115/230 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1
White	2
Flag Terminal	Capacitor
Flag Terminal	Capacitor



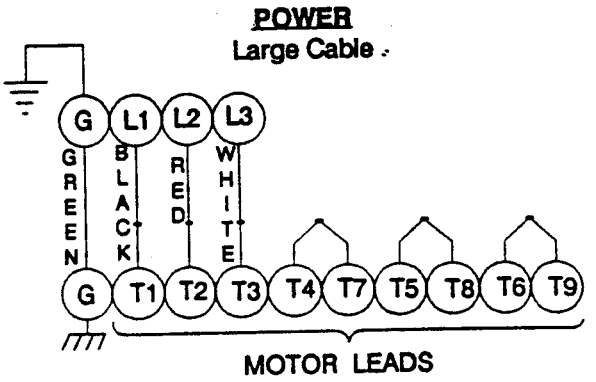
THREE PHASE, 200/230 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1 & 7
Red	2 & 8
White	3 & 9
	4, 5 & 6 Together



THREE PHASE, 460 VOLT AC

Power Cable (30)	Motor Lead Number
Green (Ground)	Green
Black	1
Red	2
White	3
	4 & 7 Together
	5 & 8 Together
	6 & 9 Together



TEMPERATURE SENSORS (Optional)

Control Cable (32)	Lead Number
Black	P1 (Thermo Sensor)
White	P2 (Thermo Sensor)

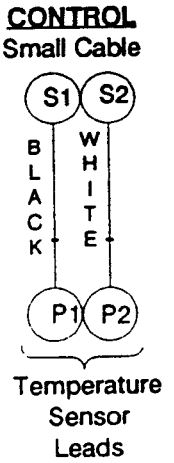


Fig. 4

F-2.2) Reassembly:

To install impeller (29), screw impeller onto the shaft hand tight. Clean the threads with Loctite cleaner. Apply thread locking compound to shaft threads and install nut (3). Torque to 40 ft. lbs. Rotate impeller to check for binding. Position gasket (10) on volute flange and position impeller and motor housing on volute (28). Position lockwasher (11) on cap screw (12) and screw into volute (28). Torque to 8 ft. lbs. Check for free rotation of motor and impeller.

F-3) Motor and Bearing Service

F-3.1) Disassembly and Inspection:

To examine or replace the motor (20) and bearings (6) and (42), disassemble volute and impeller as outlined in paragraph F-2.1 and disassemble shaft seal as outlined in paragraph F-4.1. Drain oil from motor as outlined in paragraph F-1.3.

Position unit upright, using blocks to avoid resting unit on shaft. Remove socket head cap screws (9). Vertically lift the outside motor housing (5) from seal plate (1) by lifting eye (17). Inspect square ring (8) for damage or cuts. Remove cable assembly (30) by unscrewing gland nut (30a), gland nut (32a), if equipped, and hex nut (16) from motor housing (5). Remove cable lead wires from motor lead wires and temperature sensors wires (if equipped) from control cable by disconnecting connectors (23) and (40). The unit voltage should be noted. Remove the motor bolts and lift motor (20) from seal plate (1). Examine bearing (6) and replace if required. If replacement is required, remove bearing (6) from motor shaft using a wheel puller or arbor press.

Vertically lift motor stator from rotor. On 1.5, 2.0, 2.8 and3.7HP pumps inspect bearing (42), belleville washers (43) and spacer (44) if replacement is required, remove belleville washers (43) and spacer (44) from motor shaft, remove bearing (42) from motor shaft using a wheel puller or arbor press. Inspect winding for shorts and check resistance values. To test the temperature sensor (if equipped), check for continuity between the black and white wires. If found to be defective contact a motor service station or Barnes Pumps service department. Check rotor for wear. If rotor or the stator windings are defective, the complete motor must be replaced. Check motor capacitor (21), on single phase units and replace if defective.

IMPORTANT !
ALL PARTS MUST BE CLEAN BEFORE REASSEMBLY.

F-3.2) Reassembly:

Bearings- When replacing bearings, be careful not to damage the rotor or shaft threads. Clean the shaft thoroughly. Apply adhesive compound to the shaft and press bearing (6) on the motor shaft, position squarely onto the shaft applying force to the inner race of the bearing only, until bearing seats against the retaining ring (2). On 1.5, 2.0, 2.8 and 3.7HP pumps apply adhesive compound to the other end of motor shaft and press bearing (42) on, positioning squarely on the shaft shoulder, applying force to inner race of bearing only. Position belleville washer (43), spacer (44) and another belleville washer (43), with curvatures pointing away from spacer (44), on motor shaft above bearing (42) and lower motor stator over rotor.

Motor- Slide lower bearing (6) and motor (20) squarely into the seal plate (1) until bearing seats on the bottom. Torque motor bolts to 17 inch pounds.
Make wire connections per paragraph F-3.3. Set square ring (8) in groove on seal plate (1), lower motor housing (5) down onto seal plate (1) while aligning holes. Place socket head cap screws (9) through seal plate (1) into motor housing (5) and torque to 60 inch pounds.

Table 1

COOLING OIL- Dielectric	
Supplier	Grade
BP	Enerpar SE40
CONOCO	Pale Paraffin 22
MOBIL	D.T.E. Oil Light

F-1.4) Pressure Test:

Before checking the pump for leaks around the shaft seal, square rings, and cord inlet, the oil level should be full as described in section F-1.3. Remove pipe plug (19) from motor housing (5).Apply pipe sealant to pressure gauge assembly and tighten into hole (see Fig. 3). Pressurize motor housing to 10 P.S.I. Use a soap solution around the sealed areas and inspect joints for "air bubbles". If, after five minutes, the pressure is still holding constant, and no "bubbles" are observed, slowly bleed the pressure and remove the gauge assembly. Replace the pipe plug (19) using a sealant. If the pressure does not hold, then the leak must be located and repaired.

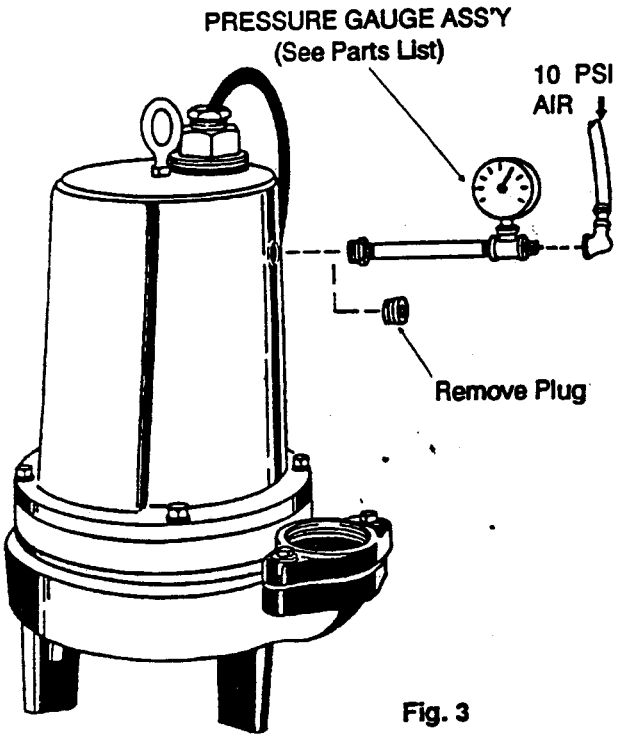


Fig. 3

CAUTION !
ALWAYS WEAR EYE PROTECTION WHEN WORKING ON PUMPS.

CAUTION !
PRESSURE BUILDS UP EXTREMELY FAST, INCREASE PRESSURE BY "TAPPING" AIR NOZZLE. TOO MUCH PRESSURE WILL DAMAGE SEAL. DO NOT EXCEED 10 P.S.I.

F-2) Impeller and Volute Service:

F-2.1) Disassembly and Inspection:

To clean out volute (24) or replace impeller (29), disconnect power, remove hex nuts(12), and lockwasher (11), vertically lift motor and seal plate assembly from body (24). Clean out body if necessary. Clean and examine impeller (29), for pitting or wear and replace if required, inspect gasket (10) and replace if cut or damaged. If the impeller (29) needs replacing, remove nut (3), place a flat screwdriver in the slot of the end of the shaft to hold the shaft stationary while unscrewing the impeller (29).

SECTION F: SERVICE AND REPAIR

NOTE: All item numbers in ( ) refer to Figures 9 & 10.

WARNING !
ELECTRICAL POWER TO THE PUMP MOTORS MUST BE DISCONNECTED AND LOCKED OUT TO PREVENT ANY DANGEROUS ELECTRICAL HAZARDS OR PERSONNEL DANGER BEFORE ANY SERVICE WORK IS DONE TO THE PUMP.

CAUTION !
OPERATING PUMP BUILDS UP HEAT AND PRESSURE; ALLOW TIME FOR PUMP TO COOL TO ROOM TEMPERATURE BEFORE HANDLING OR SERVICING.

F-1) Lubrication:
Anytime the pump is removed from operation, the cooling oil in the motor housing (5) should be checked visually for oil level and contamination.

F-1.1) Checking Oil:
Motor Housing- To check oil, set unit upright. Remove gland nut (30a) see Fig. 5, from hex nut (16). Unscrew hex nut (16) from motor housing (5). DO NOT disconnect wiring from motor leads. With a flashlight, visually inspect the oil in the motor housing (5) to make sure it is clean and clear, light amber in color and free from suspended particles. Milky white oil indicates the presence of water. Oil level should be to bottom of plug (19) Fig. 9, when pump is in vertical position.

F-1.2) Testing Oil:
1.Place pump on it's side, remove pipe plug (19), from motor housing (5) and drain oil into a clean, dry container.
2. Check oil for contamination using an oil tester with a range to 30 Kilovolts breakdown.
3. If oil is found to be clean and uncontaminated (measure above 15 KV. breakdown), refill the motor housing as per section F-1.3.
4. If oil is found to be dirty or contaminated (or measures below 15 KV. breakdown), the the pump must be carefully inspected for leaks at the shaft seal (31), cable assemblies (30) and (32 if used), and hex nut (16), O-ring (8) and pipe plug (19), before refilling with oil. To locate the leak, perform a pressure test as per section F-1.4. After leak is repaired, refill with new oil as per section F-1.3.

F-1.3) Replacing Oil:
Motor Housing- Drain all oil from motor housing and dispose of properly. Set unit upright and refill with (see parts list for amount) new cooling oil as per Table 1. Fill to pipe plug (19) level as an air space must remain in the top of the motor housing to compensate for oil expansion (see Fig. 9). Apply pipe thread compound to threads of hex nut (16) and pipe plug (19) then assemble to motor housing (5). Insert friction ring (30b), grommet (30c), another friction ring (30b), and gland nut (30a) into hex nut (16) and torque to 15 ft. lbs.

WARNING !
DO NOT OVERFILL OIL
Overfilling of motor housing with oil can create excessive and dangerous hydraulic pressure which can destroy the pump and create a hazard. Overfilling oil voids warranty.

SECTION: D START-UP OPERATION

D-1) Check Voltage and Phase:
Before operating pump, compare the voltage and phase information stamped on the pump's identification plate to the available power.

D-2) Check Pump Rotation:
Before putting pump into service for the first time, the motor rotation must be checked. Improper motor rotation can result in poor pump performance and can damage the motor and/or pump. To check the rotation, suspend the pump freely, momentarily apply power and observe the "kickback". "Kickback" should always be in a counter-clockwise direction as viewed from the top of the pump motor housing.

D-2.1) Incorrect Rotation for Three-Phase Pumps:
In the event that the rotation is incorrect for a three-phase installation, interchange any two power cable leads at the control box. DO NOT change leads in the cable housing in the motor. Recheck the "kickback" rotation again by momentarily applying power.

D-2.2) Incorrect Rotation for Single-Phase Pumps:
In the unlikely event that the rotation is incorrect for a single phase pump, contact a Barnes Pumps Service Center.

D-3) Start-Up Report:
Included at the end of this manual are two start-up report sheets, these sheets are to be completed as applicable. Return one copy to Barnes Pumps and store the second in the control panel or with the pump manual if no control panel is used. It is important to record this data at initial start-up since it will be useful to refer to should servicing the pump be required in the future.

D-3.1) Identification Plate:
Record the numbers from the pump's identification plate on both START-UP REPORTS provided at the end of the manual for future reference.

D-3.2) Insulation Test:
Before the pump is put into service, an insulation (megger) test should be performed on the motor. The resistance values (ohms) as well as the voltage (volts) and current (amps) should be recorded on the start-up report.

D-3.3) Pump-Down Test:
After the pump has been properly wired and lowered into the basin, sump or lift station, it is advisable to check the system by filling with liquid and allowing the pump to operate through it's pumping cycle. The time needed to empty the system, or pump-down time along with the volume of water, should be recorded on the start-up report.

SECTION E: PREVENTATIVE MAINTENANCE

As the motor is oil filled, no lubrication or other maintenance is required, and generally Barnes Pumps will give very reliable service and can be expected to operate for years on normal sewage pumping without failing. However as with any mechanical piece of equipment a preventive maintenance program is recommended and suggested to include the following checks:

1) Inspect motor chamber for oil level and contamination and repair as required per section F-1.
2) Inspect impeller and body for excessive build-up or clogging and repair as required per section F-2.
3) Inspect motor and bearings and replace as required per section F-3.
4) Inspect seal for wear or leakage and repair as required per section F-4.

MODEL NO.	HP	VOLT	PH	RPM (Nom)	NEMA CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD OD	WINDING RESISTANCE MAIN–START
3SE1022L	1.0	230	1	3450	C	8.5	17.0	10/3	SO	0.690	1.93—8.80
3SE1062L	1.0	200	3	3450	H	5.7	18.5	10/4	SO	0.750	4.57—
3SE1032L	1.0	230	3	3450	K	5.0	21.3	10/4	SO	0.750	4.57—
3SE1042L	1.0	460	3	3450	K	2.5	10.7	10/4	SO	0.750	17.50—
3SE1522L	1.5	230	1	3450	E	12.0	31.0	10/3	SO	0.690	2.15—12.49
3SE1562L	1.5	200	3	3450	J	9.8	3130	10/4	SO	0.750	4.22—
3SE1532L	1.5	230	3	3450	L	8.6	36.0	10/4	SO	0.750	4.22—
3SE1542L	1.5	460	3	3450	L	4.3	18.0	10/4	SO	0.750	17.00—
3SE2022L	2.0	230	1	3450	C	13.5	31.0	10/3	SO	0.690	1.26—55.34
3SE2062L	2.0	200	3	3450	F	11.5	31.3	10/4	SO	0.750	3.08—
3SE2032L	2.0	230	3	3450	J	10.0	36.0	10/4	SO	0.750	3.08—
3SE2042L	2.0	460	3	3450	J	5.0	18.0	10/4	SO	0.750	12.30—
3SE1922L	1.9	230	1	3450	A	8.5	17.0	10/3	SO	0.690	1.93—8.80
3SE1962L	1.9	200	3	3450	B	5.7	18.5	10/4	SO	0.750	4.57—
3SE1932L	1.9	230	3	3450	D	5.0	21.3	10/4	SO	0.750	4.57—
3SE1942L	1.9	460	3	3450	D	2.5	10.7	10/4	SO	0.750	17.50—
3SE2822L	2.8	230	1	3450	A	12.0	31.0	10/3	SO	0.690	2.15—12.49
3SE2862L	2.8	200	3	3450	C	9.8	31.3	10/4	SO	0.750	4.22—
3SE2832L	2.8	230	3	3450	F	8.6	36.0	10/4	SO	0.750	4.22—
3SE2842L	2.8	460	3	3450	F	4.3	18.0	10/4	SO	0.750	17.00—
3SE3722L	3.7	230	1	3450	A	13.5	31.0	10/3	SO	0.690	1.26–55.34
3SE3762L	3.7	200	3	3450	A	11.5	31.3	10/4	SO	0.750	3.08—
3SE3732L	3.7	230	3	3450	C	10.0	36.0	10/4	SO	0.750	3.08—
3SE3742L	3.7	460	3	3450	C	5.0	18.0	10/4	SO	0.750	12.30—

Temperature sensor cable for all models is 14/2 SO, 0.530 OD.

C-4.3) Overload Protection :

C-4.3-1) **Three Phase** (Optional) - The normally closed (N/C) thermal sensor is embedded in the motor windings and will detect excessive heat in the event an overload condition occurs. The thermal sensor will trip when the windings become too hot and will automatically reset itself when the pump motor cools to a save temperature. It is recommended that the thermal sensor be connected in series to an alarm device to alert the operator of an overload condition, and/or the motor starter coil to stop the pump. In the event of an overload, the source of this condition should be determined and rectified immediately.
DO NOT LET THE PUMP CYCLE OR RUN IF AN OVERLOAD CONDITION OCCURS !

C-4.3-2) **Single Phase** (Standard) - The type of in-winding overload protector used is referred to as an inherent overheating protector and operates on the combined effect of temperature and current. This means that the overload protector will trip out and shut the pump off if the windings become too hot, or the load current passing through them becomes too high. It will then automatically reset and start the pump up after the motor cools to a safe temperature. In the event of an overload, the source of this condition should be determined and rectified immediately.
DO NOT LET THE PUMP CYCLE OR RUN IF AN OVERLOAD CONDITION OCCURS !

SECTION C: INSTALLATION

C-1) Location:
These pumping units are self-contained and are recommended for use in a sump, lift station or basin. This pump is designed to pump sewage, effluent, or other nonexplosive or noncorrosive wastewater. Never install the pump in a trench, ditch or hole with a dirt bottom; the legs will sink into the dirt and the suction will become plugged.

C-2) Discharge:
Discharge piping should be as short as possible. Both a check valve and a shut-off valve are recommended for each pump being used. The check valve is used to prevent backflow into the sump.Excessive backflow can cause flooding and/or damage to the pump. The shut-off valve is used to stop system flow during pump or check valve servicing.

Barnes Pumps supplies a breakaway fitting discharge system designed to allow the submersible wastewater pump to be installed or removed without requiring personnel to enter the wet well.

Place the Break Away Fitting (BAF) in position. Temporarily secure the guide rails in the upper mounting brackets and locate the base on the bottom of the wet well. Level the base with grout and/or shims. Install the intermediate support brackets, if required. Make sure the rails are in a true vertical position so the pump will clear the access opening and will slide freely down the rails into place on the discharge stationary fitting. Once the rails are in proper alignment, bolt the base into the floor of the station and connect the discharge pipe to the elbow.

Connect the movable portion and other supplied fittings of the BAF onto the pump and lower into wet well. See the Break Away Fitting manual for more information.

C-3) Liquid Level Controls:
The level controls are to be supported by a mounting bracket that is attached to the sump wall, cover or junction box. Cord grips are used to hold the cords in place on the mounting bracket. The control level can be changed by loosening the grip and adjusting the cord length as per the plans and specifications. Be certain that the level controls cannot hang up or foul in it's swing and that the pump is completely submerged when the level control is in the "Off" mode.

C-4) Electrical Connections:

WARNING!
All model pumps and control panels must be properly grounded per the National Electric Code ,state and local codes. Improper grounding voids warranty.

C-4.1) Power Cable:
The cord assembly mounted to the pump must not be modified in any way except for shortening to a specific application. Any splice between the pump and the control panel must be made in accordance with the National Electric Code and all applicable state and local electric codes. It is recommended that a junction box, if used, be mounted outside the sump or be of at least Nema 4 construction if located within the wet well. **Do not use the power cable to lift pump.**

C-4.2) Wire Size:
Consult a qualified electrician for proper wire size if additional power cable length is required. See table for electrical information.

SECTION B: GENERAL INFORMATION

B-1) To the Purchaser:

Congratulations! You are the owner of one of the finest sewage pumps on the market today. Barnes Pumps are products engineered and manufactured of high quality components. Over ninety-five years of pump building experience along with a continuing quality assurance program combine to produce a pump which will stand up to the toughest sewage removal projects.

Through proper installation and a scheduled preventive maintenance program, this unit will provide years of dependable service.
This Barnes Pumps manual will provide helpful information concerning installation, maintenance, and proper service guidelines.

B-2) Receiving

Upon receiving the pump, it should be inspected for damage or shortages. If damage has occurred, file a claim immediately with the company that delivered the pump. If the manual is removed from the crating, do not lose or misplace.

B-3) Storage

Short Term- Barnes Pumps are manufactured for efficient performance following long inoperative periods in storage. For best results, pumps can be retained in storage, as factory assembled, in a dry atmosphere with constant temperatures for up to six (6) months.

Long Term- Any length of time exceeding six (6) months, but not more than twenty four (24) months. The units should be stored in a temperature controlled area, a roofed over walled enclosure that provides protection from the elements (rain, snow, wind blown dust, etc..), and whose temperature can be maintained between +40 deg. F and +120 deg. F.
If extended high humidity is expected to be a problem, all exposed parts should be inspected before storage and all surfaces that have the paint scratched, damaged, or worn should be recoated with a water base, air dry enamel paint. All surfaces should then be sprayed with a rust-inhibiting oil.

Pump should be stored in its original shipping container and on initial start up, rotate impeller by hand to assure seal and impeller rotate freely.

If it is required that the pump be installed and tested before the long term storage begins, such installation will be allowed provided:

1) The pump is not installed under water for more than one (1) month.

2) Immediately upon satisfactory completion of the test, the pump is removed, thoroughly dried, repacked in the original shipping container, and placed in a temperature controlled storage area.

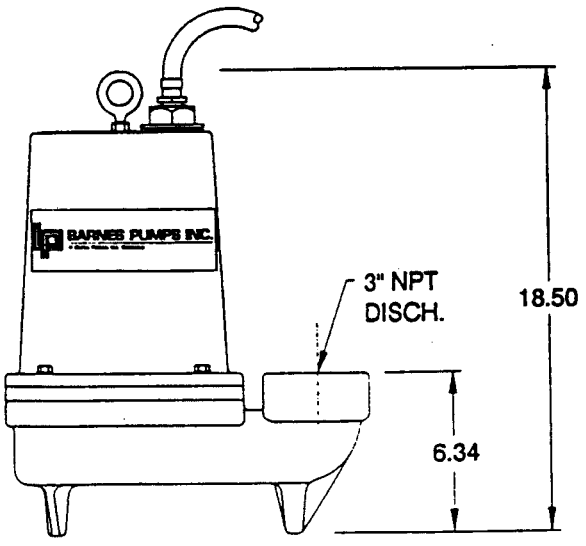
B-4) SERVICE CENTERS:

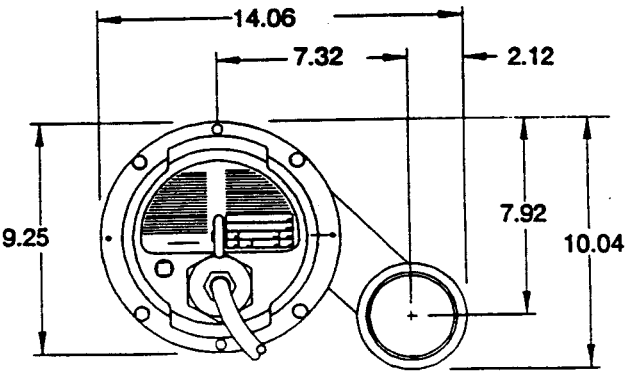
For the location of the nearest Barnes Pumps Service Center, check your catalog, your Barnes Pumps representative or Barnes Pumps Service Department in Piqua, Ohio, telephone (513) 773-2442.

SECTION: A- PUMP SPECIFICATIONS

DISCHARGE: 3" NPT, Vertical
LIQUID TEMPERATURE: 160° F intermittent.
VOLUTE: Cast Iron, ASTM A-48 Class 25 min.
MOTOR HOUSING: Cast Iron ASTM A-48, Class 25 min.
SEAL PLATE: Cast Iron ASTM A-48 Class 25 min.
IMPELLER:
Design: 2 Vane, Open, with Pump Out Vanes On Back Side. Dynamically Balanced.
Material: Cast Iron ASTM A-48 Class 25 min.
SHAFT: 416 Stainless Steel
SQUARE RINGS: Buna-N
HARDWARE: 300 Series Stainless Steel
PAINT: Air Dry Enamel
SEAL: *Design:* Single Mechanical
Material: Rotating Face - Carbon
Stationary Face - Ceramic
Elastomer - Buna-N
Hardware -300 Series Stainless
CABLE ENTRY: 25 ft. Cord,
Pressure Grommet for Sealing and Strain Relief.

SPEED: 3450 RPM (Nom.)
UPPER BEARING:
Design: Sleeve for 1.0 and 1.9 HP.
Single Row, Ball for 1.5 thru 3.7HP
Lubrication: Oil
Load: Radial
LOWER BEARING:
Design: Single Row, Ball
Lubrication: Oil
Load: Radial & Thrust
MOTOR:
Design: NEMA B;Completely Oil-Filled, Squirrel Cage Induction.
Insulation: Class A for 1.0 & 1.9HP.
Class B for 1.5 thru 3.7HP
SINGLE PHASE: Permanent Split Capacitor (PSC). Includes Overload Protection In Motor.
THREE PHASE: Tri Voltage 200-230/460; Requires External Overload Protection.
OPTIONAL EQUIPMENT: Seal Material, Impeller Trims, N/C Temperature Sensor with Cable, Additional Cable.





SAFETY FIRST!
PLEASE READ THIS BEFORE INSTALLING OR OPERATING PUMP.

GENERAL

1. Most accidents can be avoided by using COMMON SENSE.
2. Read the operation and maintenance instruction manual supplied with the pump.
3. Do not wear loose clothing that may become entangled in the impeller or other moving parts.
4. This pump is designed to handle materials which could cause illness or disease through direct exposure. Wear adequate protective clothing when working on the pump or piping.

PUMPS

5. Pump builds up heat and pressure during operation-allow time for pump to cool before handling or servicing.
6. Only qualified personnel should install, operate and repair pump.
7. Keep clear of suction and discharge openings. DO NOT insert fingers in pump with power connected.
8. Do not pump hazardous materials (flammable, caustic, etc.).
9. Do not block or restrict discharge hose-be careful of discharge hose whipping under pressure.
10. Make sure lifting handles are securely fastened each time before lifting.
11. Do not lift pump by the power cord.
12. Do not exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat.
13. Secure the pump in its operating position so it can not tip over, fall or slide.
14. Keep hands and feet away from impeller when power is connected.
15. Submersible Non-Clog Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.
16. Do not operate pump without guards or safety devices in place.
17. For hazardous locations, use pumps that are listed and classified for such locations.
18. When towing pump behind a vehicle; make sure hitch is properly attached, always attach safety chains.
19. Always replace safety devices that have been removed during service or repair.

ELECTRICAL

20. To reduce risk of electrical shock, pump must be properly grounded in accordance with the National Electric Code and all applicable state and local codes and ordinances.
21. To reduce risk of electrical shock, disconnect the pump from the power source before handling or servicing.
22. Any wiring of pumps should be performed by a qualified electrician.
23. Never operate a pump with a power cord that has frayed or brittle insulation.
24. Never allow cords or plugs lay in water.
25. Never handle connected power cords with wet hands.
26. Never operate a pump with a plug-in type power cord without a ground fault circuit interrupter.

GAS/DIESEL ENGINE POWER PUMPS

27. Never operate in a enclosed building or area where exhaust gases can accumulate.
28. Do not breath exhaust fumes when working in the area of the engine. (Exhaust gases are odorless and deadly poison.)
29. Never operate near a building where exhaust gases can seep inside.
30. Never operate in a pit or sump without making provisions for adequate ventilation.
31. Allow exhaust system to cool before touching.
32. Never add fuel to the tank while the engine is running. Stop engine and allow to cool.
33. Do not smoke while refueling the engine.
34. Do not refuel near open flame.

IMPORTANT! Barnes Pumps is not responsible for losses, injury, or death resulting from a failure to observe these safety precautions, misuse or abuse of pumps or equipment.

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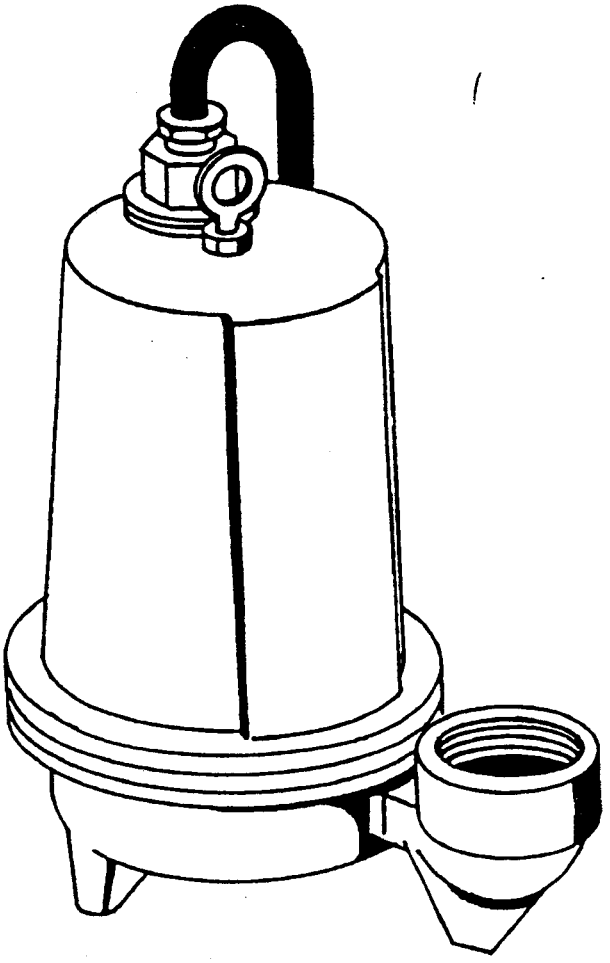
SPECIAL TOOLS AND EQUIPMENT

INSULATION TESTER (MEGGER)
DIELECTRIC TESTER
SEAL TOOL KIT (see parts list)
PRESSURE GAUGE KIT (see parts list)

INSTALLATION and OPERATION MANUAL

Submersible Sewage Ejector

SERIES: 3SE
1.0 Thru 3.7 HP
3450 RPM



Effective Serial Number:_____

IMPORTANT: Read all instructions in this manual before operating pump.
As a result of Barnes Pumps constant product improvement program, product changes may occur. As such Barnes Pumps reserves the right to change product without prior written notification.

BARNES PUMPS INC.
A Burks Pumps, Inc. Company
420 East Third Street, Piqua, Ohio 45356
Phone: 513-773-2442 Fax: 513-773-2238

MADE IN THE U.S.A.

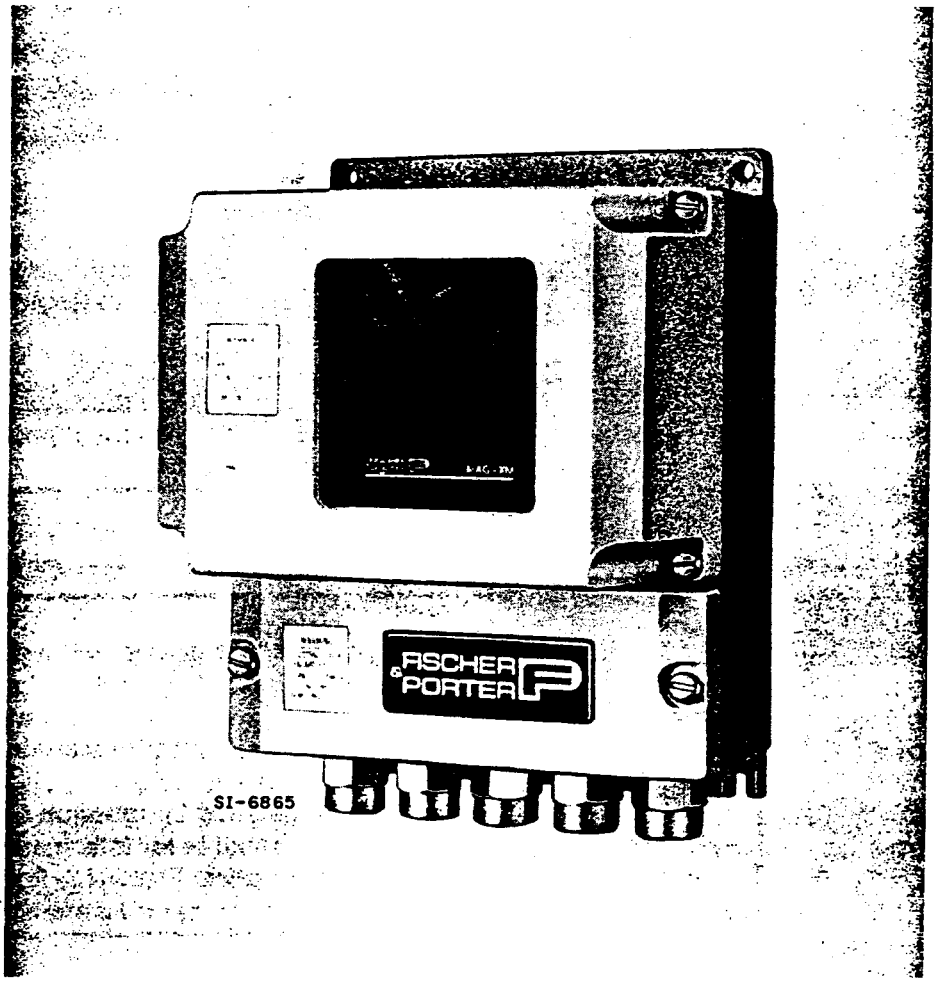
Submersible Wastewater Pump Association SWPA MEMBER

Form No. 85045-0391-16802

FISCHER & PORTER

MAGNETIC FLOWMETERS
50XM1000B

MICROPROCESSOR-BASED SIGNAL CONVERTER



Pub. 24273B

PUMPING SERVICES, INC.
368 LINCOLN BLVD.
MIDDLESEX, N.J. 08846
(908) 469-4540

Read these instructions before starting installation; save these instructions for future reference.

NOTICE

The instructions given herein cover generally the description, installation, operation and maintenance of subject equipment. Fischer & Porter reserves the right to make engineering refinements that may not be reflected in this bulletin. Should any questions arise which may not be answered specifically by these instructions, they should be directed to Fischer & Porter for further detailed information and technical assistance. The material in this manual is for informational purposes and is subject to change without notice. Fischer & Porter Company assumes no responsibility for any errors that may appear in this manual.

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1.0 INTRODUCTION

1.1 General Description

The F&P Series 50XM1000B Microprocessor-Based Signal Converter is of modular construction and utilizes the latest state-of-the-art electronic design (a mix of standard IC and surface mount technology). This design concept provides a compact, reliable, secondary instrument intended for use with MAG-X® type Magnetic Flowmeters. The 50XM1000B features firmware which has been developed especially for flow metering applications. This permits the respective Magnetic Flowmeter/Signal Converter combination to be easily customized for the particular process operating parameters.

The Signal Converter can be mounted as an integral part of the Magnetic Flowmeter or in a remote NEMA 4 rated enclosure. A remote mounted Signal Converter (with the upper housing cover removed) is shown in Figure 1-1.

NOTE

Magnetic Flowmeters manufactured to earlier design levels require an internal circuit board change to make them compatible with the integrally mounted microprocessor-based XM Converter. Consult Fischer & Porter Company for details.

As Signal Converter operations are microprocessor-based, the Converter has the capability to communicate via data link with other intelligent instruments such as F&P Series 53SU1000 SUPERVISOR, 53SU5000 SUPERVISOR-PC, or host computer. The Signal Converter will support either MICRO-DCI® Binary or ASCII protocol, permitting up to 32 instruments to be addressed via the data link. In addition, when specified at time-of-purchase, communications can be provided over the 4-20 mA current output using HART™ protocol. These features are discussed in detail in the 50XM1000B COMMUNICATIONS MANUAL.

The Signal Converter can be configured manually by use of the three pushbutton switches adjacent to the LCD readout (See Figure 1-1) or remotely by means of the data link. During configuration, the Converter remains on-line and data is updated continually. Zero is factory set and no field zero adjustments are required.

Major features of the Signal Converter include:

1) All operating parameters are configurable, e.g., totalization units, flow rate range, calibration factor, etc. Parameter values can be changed via pushbuttons on the Converter or via serial interface.
2) Microprocessor-based with digital signal processing.
3) Communication via terminal, computer or similar smart instrument using RS 485, RS 232-C or current loop. Compatible with F&P MICRO-DCI instruments permits integration into process control or monitoring systems.
4) Direct reading data display without operator calculations. Displays forward and/or reverse flow.
5) Automatic self-monitoring with error diagnostics.

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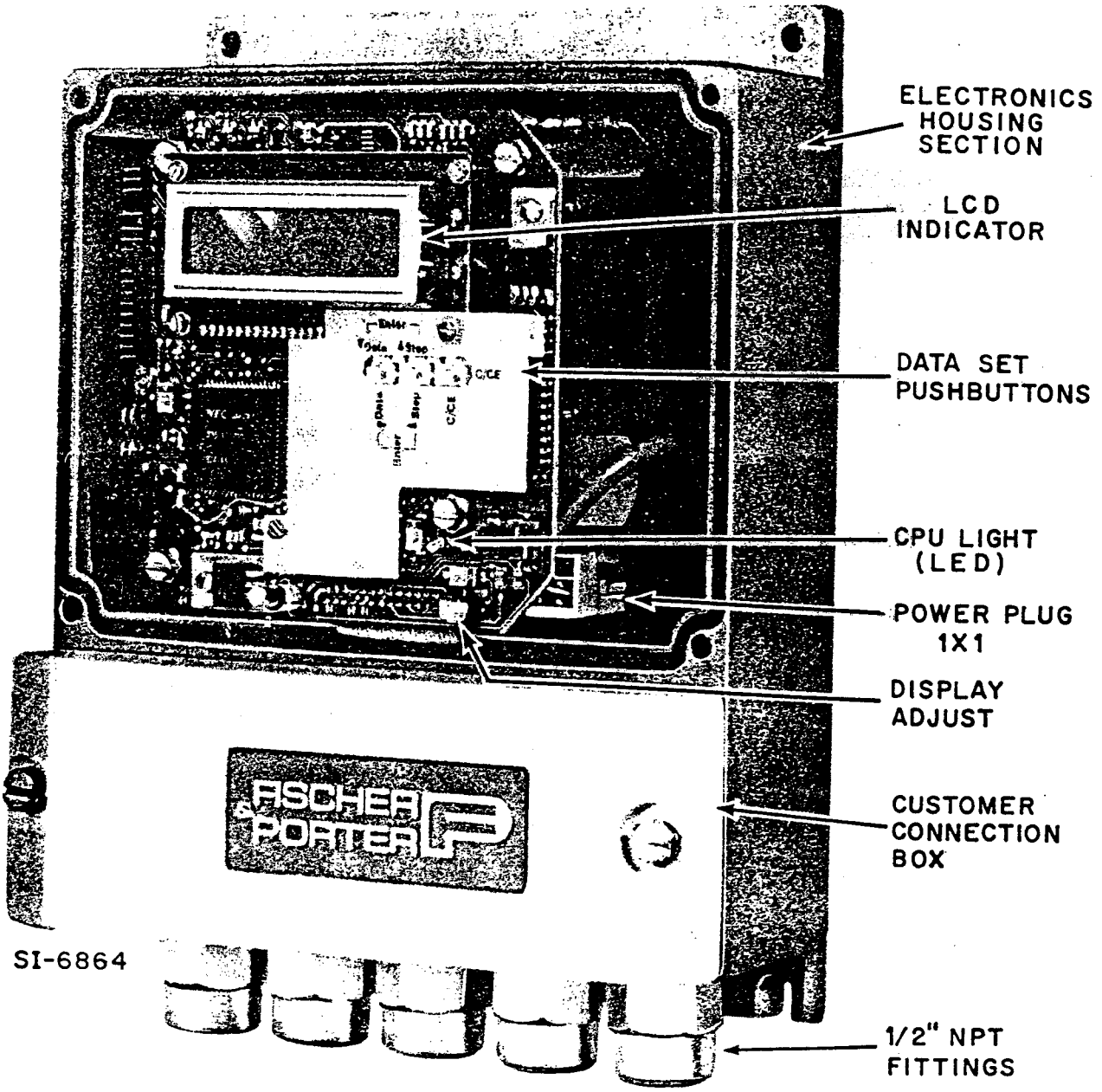
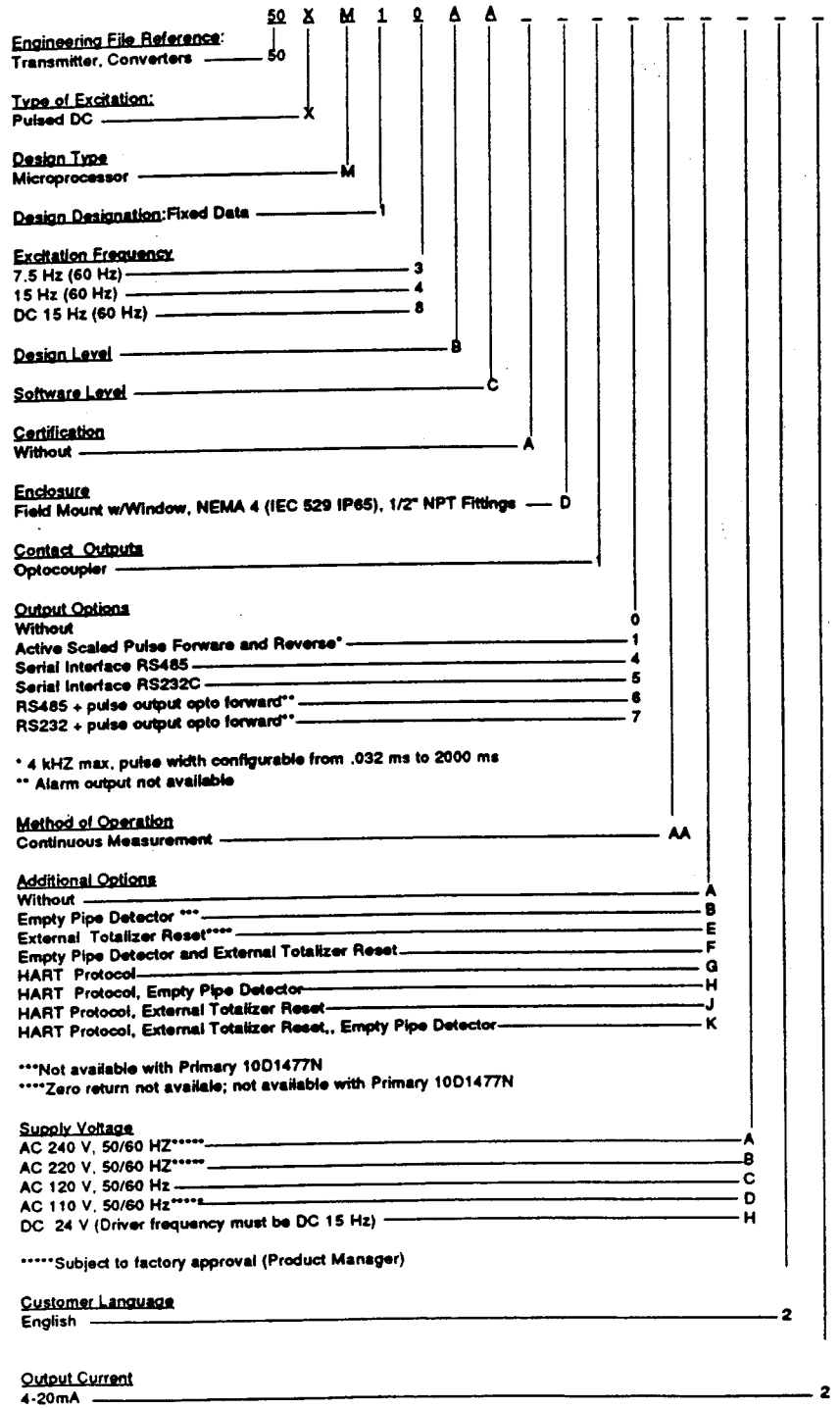


FIGURE 1-1 SERIES 50XM1000 SIGNAL CONVERTER (HOUSING COVER REMOVED)

1.2. Model Number Breakdown

The basic flow metering system consists of a primary mounted Magnetic Flowmeter and an integral or remote mounted Signal Converter. When the Signal Converter is integrally mounted with the primary, the available features are defined in the Instruction Bulletin supplied for the particular Magnetic Flowmeter and the Signal Converter is referred to as the type "XM". However, when the Signal Converter is remote mounted, the Signal Converter is assigned a separate model number (Series "50XM1000") and selectable options are as defined below.



1.3. Specifications

Power Requirements

Power Input (as specified)	120 V ac ± 10%, 50/60 Hz (standard), or 24 V dc ± 25% (110 V ac, 50/60 Hz and 220/240 V ac, 50/60 Hz available, contact factory)
Power Consumption	< 30 VA

Performance Characteristics

Primary Model Number	refer to the manufacturing specification sheet or data tag on the body of the primary
Meter Size, Cal Factor and Flow Range	see Magnetic Flowmeter Instruction Bulletin
Minimum Liquid Conductivity	5 µS/cm
Bidirectional Flow	rate indication and totalization in both forward and reverse flow direction. (Flow direction for analog output is indicated by contact closure.)
Rangeability	100:1
Accuracy	0.5% of rate from 2% to 100% of meter Cal Factor; 0.01% of Cal Factor from 0% to 2% of Cal Factor
Response Time	1 second, minimum
Damping	configurable, 1 to 100 seconds
Analog Output Current	4 to 20 mA into 0 to 750 ohm load (configurable to 0 to 20, 2 to 10, or 0 to 10 mA)

Pulse Outputs

Scaled Pulse*	24 V dc, 150 ohm min load, 0-4 kHz max, pulse width configurable from 0.032 ms to 2000 ms
Unscaled Pulse	5 V dc (TTL), 0-10 kHz max unscaled frequency, pulse width configurable from 0.032 ms to 2000 ms (15 feet maximum cable length)

* Scaled pulse output is also available with optically coupled output option when data link output option specified.

Contact Outputs	
Alarm Contact	denotes failure condition, with high or low analog output. Energy through contacts must not exceed 3 VA, 28 V or 250 mA.
Flow Direction	contact transfers when flow direction changes. Energy through contacts must not exceed 3 VA, 28 V or 250 mA.
Contact Inputs (optional)	
Zero Return or Totalizer Reset	as specified by Model Number, remote contact closure needed to initiate action, as follows: Total Reset (forward and reverse), momentary closure. Zero return, maintained closure when pump or valve stops flow through meter
Communications	
Data Link I/O	binary or ASCII communications -- via RS 232-C, 110 to 9600 Baud, 50-ft. limit, 1 instrument serial communication; -- via RS 485, 110 to 28.8 kBaud, 4000-ft. limit, up to 32 instruments in parallel
HART Interface	1200 bits/s (transmitting/receiving) using frequency shift keying (FSK) as defined by Bell 202 standard, 5000-ft. limit
Empty Pipe Detection	automatically drives the analog and digital output signals to zero when the meter electrodes become uncovered (not available with 10D1477)
Physical Characteristics	
Ambient Temperature Range (converter only)	-10°C to +50°C (14°F to 122°F)
Relative Humidity	10% to 90%
Vibration Limit	< .75 g continuous (10 to 150 Hz) < 1.5 g intermittent (10 to 150 Hz)
Enclosure Classification	NEMA 4, IEC 529 IP65 (weather-tight and dust-tight)
Housing	3-piece aluminum housing with gasketed covers, panel or wall-mounting (refer to Figure 2-1)
Cable Entrance	five 1/2" NPT conduit fittings in base

2.0 INSTALLATION

2.1 Inspection

The F&P Series 50XM1000 Signal Converter is shipped in a heavy-duty protective container that is specially designed to provide adequate protection of the equipment during transit. The packaging is certified for air shipment by the Container Testing Laboratory. An itemized list of all items included in the shipment is attached to the shipping container.

The Signal Converter can be supplied as an integrally mounted assembly of the associated Magnetic Flowmeter, or in a separate wall or panel mounted enclosure. When the XM Converter is integrally mounted with the primary meter, outline and mounting dimensions are provided in the Instruction Bulletin supplied with the Magnetic Flowmeter. Outline dimensions and clearance requirements for the remote mounted Signal Converter are provided in Figure 2-1.

The equipment should be inspected immediately upon arrival for indications of damage that may have occurred during shipment. Due to the rugged design of the Flowmeter and Signal Conditioner housings, equipment damage as a result of normal handling is unlikely. In most cases a careful visual inspection is all that is required to establish apparent damage.

All damage claims should be reported to the shipping agent involved for equipment shipped F.O.B. Warminster, PA, or to Fischer & Porter Company for equipment shipped F.O.B. job site before installation is attempted. In the event damage is such that faulty operation is likely to result, this damage should be brought to the attention of Fischer & Porter Co. Service Department. Always reference the complete instrument serial number and model number in all correspondence concerning the equipment supplied.

Following inspection of the shipment contents, it is suggested that all items be carefully replaced in the shipping container for storage and/or transit to the installation site. The use of normal care in the handling and installation of this equipment will contribute substantially toward satisfactory performance. Further, careful preplanning of piping and cable runs, placement of equipment, etc., will add significantly to system appearance as well as overall safety

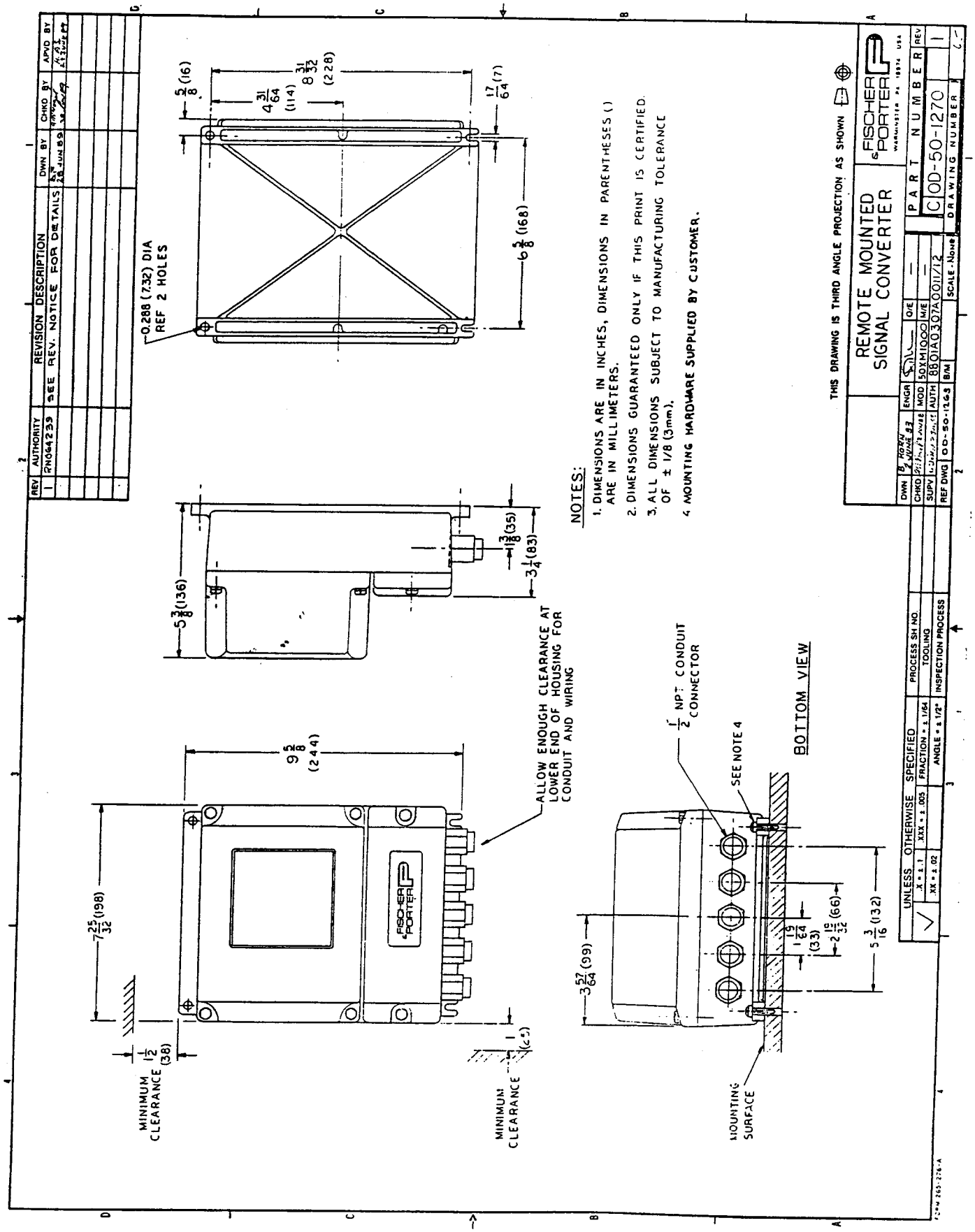


FIGURE 2-1 OUTLINE DIMENSIONS, REMOTE MOUNTED SIGNAL CONVERTER

2.2. Location and Mounting

When the Signal Converter is supplied as an integral part of the primary, refer to the INSTALLATION section of the Instruction Bulletin supplied with the Magnetic Flowmeter for location and mounting requirements.

Ideally, the installation site for the remote mounted Signal Converter should be clean, well lighted and adequately ventilated. Also, consideration should be given to access requirements for repair and maintenance of the equipment. The remote mounted enclosure is designed to meet NEMA 4 standards and is suitable for indoor or outdoor installation in an environment that is within the temperature, humidity and vibration limits as given in 1.3 Specifications of the INTRODUCTION section. Mounting dimensions for the wall (flat vertical surface) mounted enclosure are provided in Figure 2-1. Mounting hardware is to be supplied by the user.

The installation site must be provided with a convenient source of instrument power, as designated by the instrument Model Number. Either 120 V, 50/60 Hz or 24 V dc power may be specified.

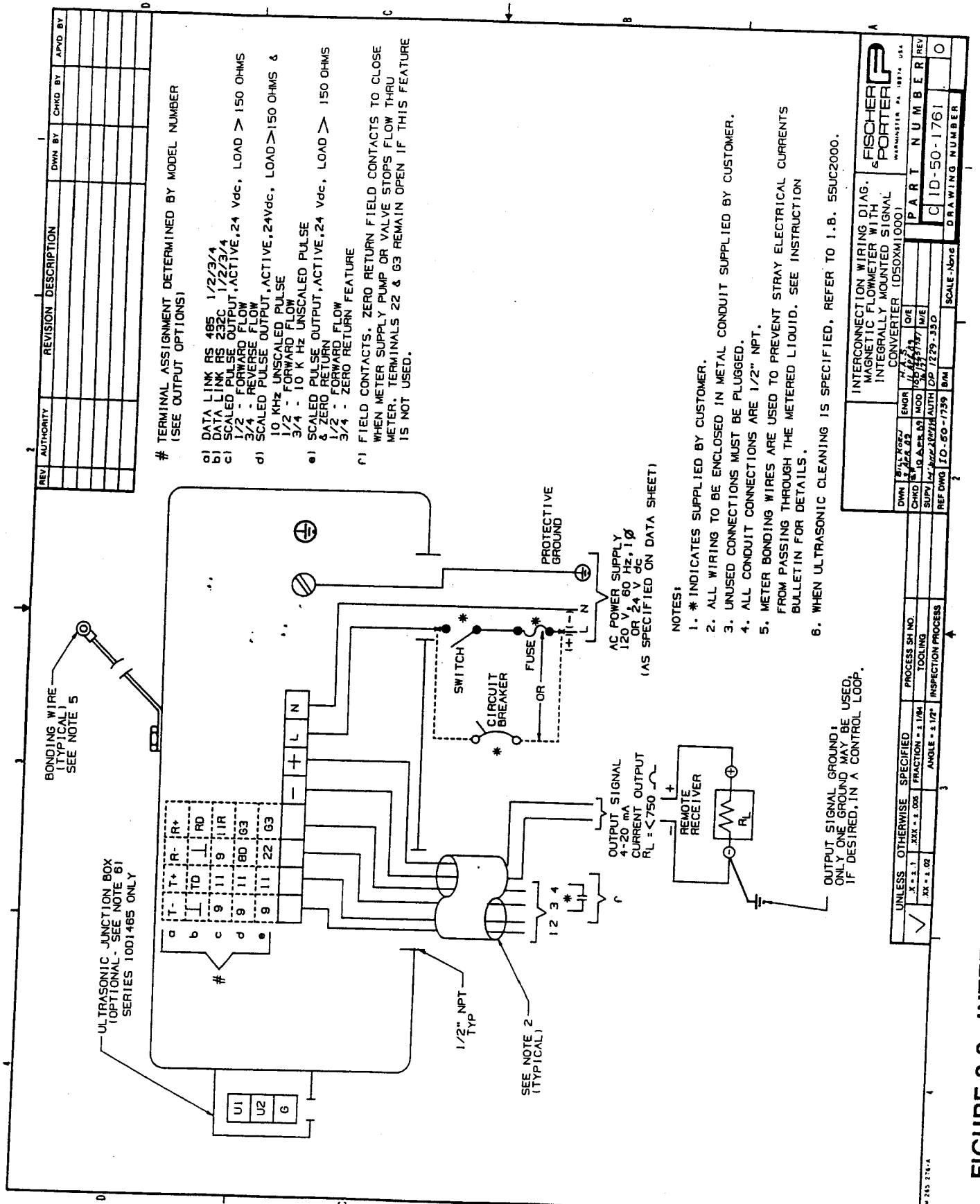


FIGURE 2-2. INTERCONNECTION WIRING FOR INTEGRALLY MOUNTED SIGNAL CONVERTER

2.3 Electrical Interconnections

2.3.1 Integrally Mounted Signal Converter

Signal and power interconnection wiring enters the junction box on the Magnetic Flowmeter housing via two 1/2" NPT conduit fittings. All wiring is to be enclosed within metal conduit, supplied by the user. Interconnection wiring is terminated to an 8-point terminal block located within the meter junction box. Terminal assignment will vary according to the options specified, as defined by the instrument model number. Interconnections for the integrally mounted 50XM Converter are identified in notes Figure 2-2. The five combinations of options available with the integrally mounted converter are identified in notes a through e on that illustration. Note that if the integrally mounted converter is used for bidirectional flow, flow direction will not be indicated for the analog output. The display WILL show flow direction for both totalization and flowrate. Additional options are available with the remote version.

2.3.2 Remote Mounted Signal Converter

The remote mounted Signal Converter housing is supplied with five 1/2" NPT conduit fittings in the junction box section of the housing base (see Figure 2-1). When all five conduit connectors are not used, the unused opening(s) should be sealed by installing a 1/2" pipe plug in the respective opening. This will maintain the NEMA 4 rating of the enclosure. All interconnection wiring is to be enclosed within metal conduit as noted on the system wiring diagram, Figure 2-3.

The Signal Converter signal and power interconnection cables are to be terminated to the 25-point terminal block located in the remote housing junction box. Certain terminal assignments vary in accordance with the model number as defined in the Terminal Assignment Table on Figure 2-3. Note that the terminals labeled V1 through V6 are used for the active pulse output as well as the data link. Consequently, only one of these can be selected as an option. If a pulse output is required as well as the data link, the output pulse must be optocoupled, and is available on terminals 55 and 56 (V5 and V6). When this combination is selected, the alarm contact on terminals V5 and V6 (39 and 40) is not available.

Unless otherwise specified, a 30-ft. length of signal and ground cable is supplied by F&P for connecting the Magnetic Flowmeter process signal (1 and 2), reference signal (16 and 3-shield) and magnet coil drive (M1 and M3-shield) to the remote mounted Signal Converter. The Flowmeter housing ground terminal is connected to the Signal Converter housing ground terminal, which is in turn connected to an external earth ground. (Refer also to the Magnetic Flowmeter grounding procedure given in the Instruction Bulletin provided for the meter.)

NOTE: MODEL 10D1477 ONLY

The signal cable leads (1 and 2) have driven shields which must be connected as follows:

line 1 shield - - - - to V+
line 2 shield - - - - to V-

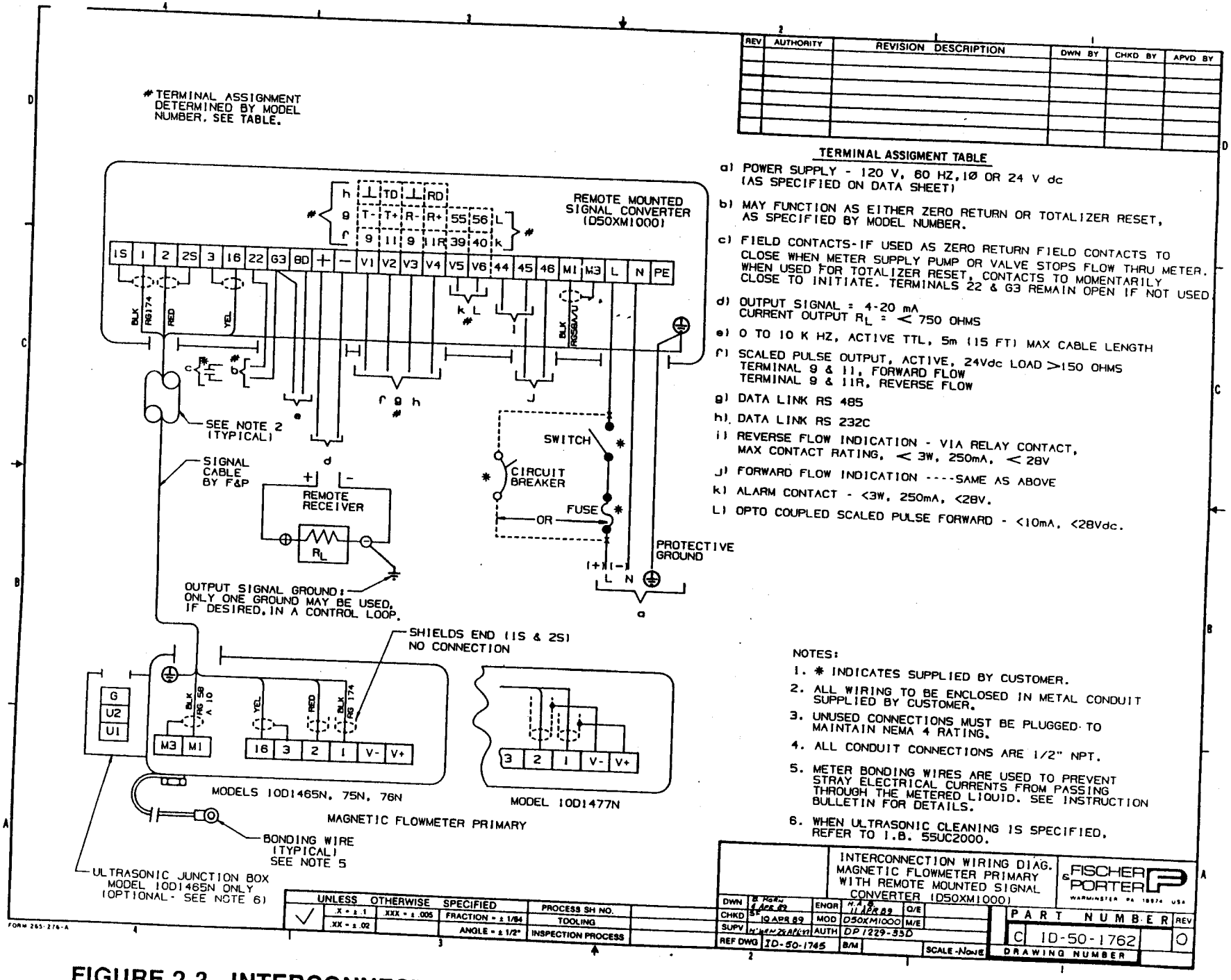


FIGURE 2-3. INTERCONNECTION WIRING FOR REMOTE MOUNTED SIGNAL CONVERTER

3.0 OPERATION

3.1 Start-Up

3.1.1 Calibration Data

The Magnetic Flowmeter and its associated Model 50XM1___B Signal Converter are a discrete flow metering system and therefore the respective Flowmeter/Converter combination must be installed and operated as a dedicated unit. Each flow metering system is precisely calibrated at the factory in accordance with customer specified flow parameters. The data recorded at calibration is listed on the tags attached to the Signal Converter. Typical data and calibration tags are shown in Figures 3-1 and 3-2.

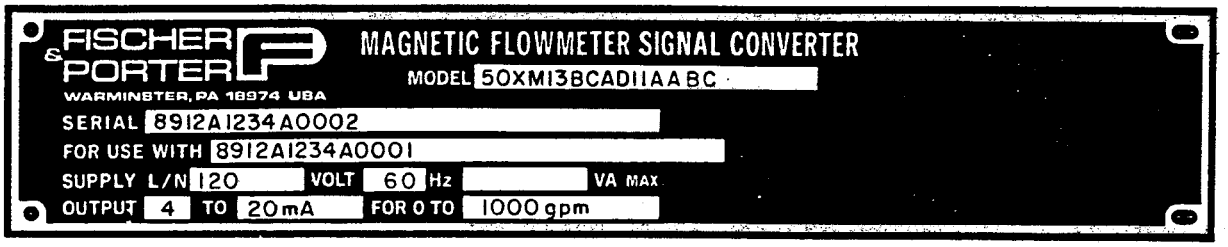


FIGURE 3-1. TYPICAL DATA TAG, REMOTE MOUNTED CONVERTER

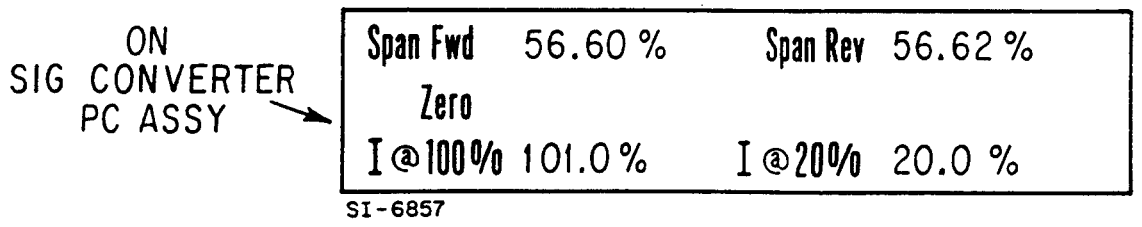


FIGURE 3-2. TYPICAL XM CALIBRATION TAG

Typically, the primary meter and its Converter will have either the same or sequential serial numbers. For example, if the Signal Converter is integrally mounted with the meter, then both the meter and the Converter would be assigned the same serial number such as 8912A1234A001. However, if the Converter is remote mounted, then the meter would be assigned 8912A1234A001 and the Converter 8912A1234A0002, with the designated serial numbers referenced on the Converter data tag as shown in Figure 3-1.

As the flow metering system is precalibrated, it is generally ready for on-line service as received. To place the flow metering system in operation, proceed as outlined in paragraph 3.1.2.

In the event that the specified system flow parameters or engineering units are to be changed, the Signal Converter must be reconfigured to agree with the revised flow values. The procedure is outlined in paragraph 3.2.

Should it be necessary to replace the Signal Converter assembly, the operator should record the operating parameters because these values must be entered in the replacement Converter. The replacement Converter will also be factory calibrated, eliminating field calibration requirements. Simply enter the noted operating parameters and the system can be returned to service.

3.1.2 Flow Measurement

To place the flow metering system on-stream, proceed as follows:

1) Verify that the Signal Converter has been properly mounted and that system interconnection wiring has been completed correctly, as discussed in the preceding INSTALLATION section. It will be necessary to remove the instrument housing covers temporarily to permit access for inspection of system wiring and to verify normal operation.

2) Check that the external power source connected to the Signal Converter is compatible with the power requirement for the particular Signal Converter at hand. The required power source is given on the instrument name tag affixed to the housing.

3) Apply power to the Signal Converter. As the Magnetic Flowmeter is driven by the Signal Converter, the meter will be energized also.

4) Using the Step, Data and C/CE keys on the front of the Signal Converter, verify that system operating parameters have been correctly entered. This data can be verified with the Signal Converter operating in the monitor mode. Refer to the flow parameter values given on the F&P manufacturing specification sheet (identified by serial number).

5) Initiate a minimal flow through the process pipeline for several minutes to purge entrapped air from the piping system. Flow rate indication should be displayed on the Signal Converter readout concurrent with flow start-up. (Accurate measurement cannot be expected until all air has been purged from the process pipeline. If desired, after the pipeline has been purged of air, the flow totalizer can be reset to zero.)

6) When system operation appears normal, stop flow measurement and replace all housing covers. Log the flow total displayed on the LCD readout or reset flow totalizers. Process measurement will commence with the initiation of flow through the meter.

3.2 Configuration Procedure

The unit has been pre-configured at the factory per the specifications given at the time the order was placed. However, before or after the Converter is connected to a Magnetic Flowmeter, any of these specifications can easily be changed using the procedure described in this section. Note that the software version described is C.10 (used with ASCII or binary communications) or version B.15 (used with HART protocol.) Other versions may show slightly different displays and options.

CAUTION

Do not power the unit with the terminals M1 and M3 connected without also connecting terminals 3 and 16. Fuse failure and possible Converter damage will result.

NOTE

Additional configuration information and a typical Test Wiring Diagram are provided in the CALIBRATION section of the 50XM1000B SERVICE MANUAL.

All data base interrogations and changes are addressed through three pushbuttons. They are identified as "Data", "Step", and "C/CE". To gain access to the data base, it is necessary to leave the normal "monitoring mode" and enter the "configuration mode". This is accomplished simply by pressing the third pushbutton on the right which is identified as the "C/CE" pushbutton. The various parameters of the data base can then be viewed by moving up or down through the menu by pressing one of the two buttons to the left of "C/CE" identified as "Data" and "Step". Data is accessed and changes entered by pressing "Data" and "Step" simultaneously. They constitute the "ENTER" button. See Figure 3-3. If no entries or changes are made the unit will revert to the monitoring mode after about 20 seconds.

When the "C/CE" button is pressed while the unit is in the monitoring mode, the flowrate and totalization in the display will be replaced by a data base parameter. The name of the parameter will appear on the top line, and the changeable value on the bottom line.

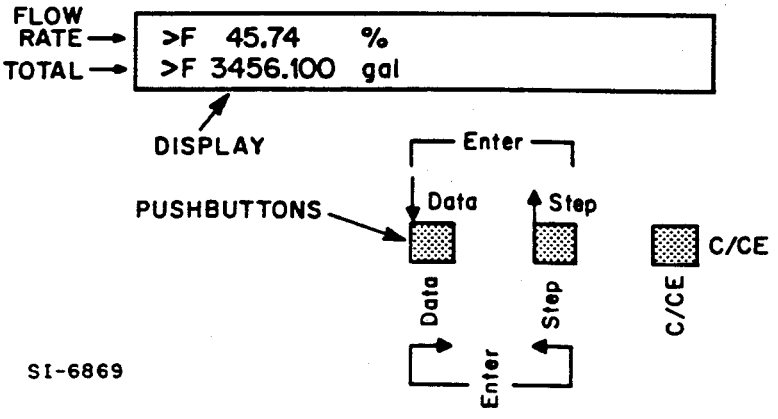


FIGURE 3 - 3. 50XM DISPLAY AND PUSHBUTTONS

will move one space to the right. A zero will again appear over the cursor, and the next desired digit can be selected. If an error is made in the selection of a number it can be corrected by pressing the "C/CE" button. The entry will be cleared, and a new entry can be made. (This functions the same as a hand calculator.)

When the desired value is reached, press the entry buttons and the value will be entered into memory. It will then be evaluated by the computer, and if it is not compatible with other selected parameters it will be rejected. An ERROR message will appear in plain language to announce why the entry is not acceptable.

3.3 Changing Parameters

The following section will be devoted to the configuration procedure for each changeable parameter. Some items are not accessible even though they appear in the menu. They are "locked out" and are indicated as such by a series of asterisks on the second line of the display. These will be pointed out in the following discussion. Each parameter will be discussed briefly to promote an understanding of that function as well as the procedure for its configuration. From this point forward, parameters will be presented in the order in which they would logically be addressed in the start up of an instrument.

3.3.1 Range Unit

There is a table of flow units in the EPROM from which the range units can be selected. A listing of available units is given in Table 3-1. Also, see Data Base section of COMMUNICATIONS MANUAL 50XM1000B (ref:data point B22). Each unit is normally available in seconds, minutes, or hours. For example, L/s, L/min, or L/h. US gallons are available in minutes, hours, or in million gallons per day. New units are added and some units removed from time to time.

```
Range unit
gpm _
```

To select the range unit from this menu, first enter the configuration mode by pressing the C/CE button. Next, use the Data or Step keys to move through the data base until Range unit appears on the top line of the display, and then press the ENTER keys. Use the Data or Step keys again to go through the Unit Menu until the desired unit appears on the bottom line of the display. Press the ENTER keys again and the selected unit is placed in memory. No further action is required. After about 20 seconds, the display will be automatically returned to the monitoring mode. Pressing the C/CE button will return the display to the monitoring mode immediately.

3.3.2 Totalizer Unit

The totalizer units available are the same as those for the range units except, of course, they do not include units of time. A listing of available units is provided in Table 3-2. Also, see Data Base (B11) in COMMUNICATIONS MANUAL 50XM1000B. Selecting the totalizer units is done by following the same procedure as for selecting the Range Units

3.3.3 CAL Factor/Range DN/Meter Size

There are two ways to establish meter capacity (calibration factor) for the computer. One is configurable and appears in the display as Range DN 33 ft/s or as Cal Fact 33 ft/s. The other is fixed and appears in the display as Meter size.

3.3.3.1 Cal Factor 33 ft/s (Range DN 33 ft/s)

Calibration factor and Range DN are synonymous. Each magnetic flowmeter is hydraulically calibrated to determine its flow capacity at a given velocity which has been established by Fischer & Porter at 33.33 ft/s for magnetic flowmeters manufactured in the U.S.

This capacity is expressed in units such as gpm, l/m, or mgd and is called the calibration factor. Calibration factors are recorded on the Magnetic Flowmeter nameplate. Some meters may have a meter factor recorded instead of the calibration factor. These can be converted to calibration factors in gpm by using the following equation:

$$\text{Cal Factor} = (\text{Meter Factor})^2 \times 81.6$$

The calibration factor is the base upon which the computer establishes maximum and minimum limits for range settings and outputs. A typical calibration factor for a size two-inch magnetic flowmeter might be 268.4 gpm. It will appear in the display as shown below.

Range DN 33 ft/s
268.400 gpm

If the units (gpm) are not the desired units step back to RANGE UNITS and change to the correct value. To enter a calibration factor, press the ENTER keys. The number 268.400 will disappear and will be replaced by the cursor. The unit "gpm" will remain. Enter the cal factor value, as it appears on the Magnetic Flowmeter nameplate, and press the ENTER keys. The new calibration factor will be entered into memory. This value will also be entered into the forward and reverse range settings. The Pulse factor (to be discussed later) will be set to one pulse per engineering unit.

3.3.3.2 Meter Size

A program has been completed to make all calibration factors identical by size for Flowmeter Models 10D1465B or N, 10D1475D or N, 10D1476B or N, and 10D1477A or N. The letters "A", "B", "D" and "N" denote design levels for which these models have constant calibration factors per size. For those meters, the meter size function should be used. For all units built to lower design levels, the meter size function will be locked out, and a message will be displayed as shown below.

Meter size
****

Typically,If the Meter size function is available the display will show the following for a size 10 inch magnetic flowmeter.A listing of available meter sizes is given in Table 3-3.

Meter size
250 mm 10 in.

Depressing the ENTER keys will cause the cursor to appear on the lower line to the right of the size. Depress either the Data or Step key to step through the menu of sizes. When the desired size is reached, press the ENTER keys again. The size will be entered into memory. At this point, the computer will enter the calibration factor for the selected size as it is recorded in the EPROM. This value will also be entered under the forward and reverse ranges.

TABLE 3-1 RATE ENGINEERING UNITS

- l/s
- l/min
- l/h
- hl/s
- hl/min
- hl/h
- m3/s
- m3/min
- m3/h
- igps
- igpm
- igph
- umgd
- umpm
- ugph
- bbl/s
- bbl/min
- bbl/h
- bls/day
- bls/min
- bls/h
- kg/s
- kg/min
- kg/h
- t/s
- t/min
- t/h
- g/s
- g/m
- g/h
- ml/s
- ml/min
- ml/h

TABLE 3-2 TOTALIZER ENGINEERING UNITS

- l (Liters)
- hl (Hectoliters)
- m3 (Cubic Meter)
- igal (Imperial Gallons)
- ugal (US Gallons)
- umg (Million US Gallons)
- bbl (Barrels)
- bls (Liquid Barrels)
- kg (Kilograms)
- t (Tons)
- g (Grams)
- ml (milliliter)

TABLE 3-3 METER SIZE

	1 mm	1/25"
*	2 mm	1/12"
	3 mm	1/10"
	4 mm	5/32"
*	5 mm	3/16"
	6 mm	1/4"
*	8 mm	5/16"
	10 mm	3/8"
	15 mm	1/2"
*	20 mm	3/4"
	25 mm	1"
*	32 mm	1-1/4"
	40 mm	1-1/2"
	50 mm	2"
*	65 mm	2-1/2"
	80 mm	3"
	100 mm	4"
*	125 mm	5"
	150 mm	6"
	200 mm	8"
	250 mm	10"
	300 mm	12"
	350 mm	14"
	400 mm	16"
	450 mm	18"
	500 mm	20"
	600 mm	24"
	700 mm	28"
*	750 mm	30"
	800 mm	32"
	900 mm	36"
	1000 mm	40"
	1100 mm	42"
	1200 mm	48"
	1300 mm	54"
	1400 mm	60"
*	1500 mm	64"
	1600 mm	66"
*	1700 mm	72"
	1800 mm	72"
	2000 mm	78"

*Not available in the US.

3.3.4 Range > F / Range < R

Entering the cal factor automatically sets both the forward and reverse ranges equal to that value. Note that this is the flow value at 33.33 ft/s (higher than what normal flows are in practical applications). Consequently, the range must be set to the actual maximum flowrate for the application. The value for the forward direction need not be the same as the value for the reverse direction. If the unit is set for unidirectional flow the reverse flow will be locked out with asterisks as discussed previously in Meter Size.

Step through the menu until Range > F appears in the display. For the cal factor setting of 268.4 gpm, it should look like the following display.

```
Range  > F
268.400 gpm
```

The actual range can now be set in the same manner as was the cal factor. Any value can be set between 5% and 100% of the cal factor. If a higher or lower setting is attempted an error message will appear in the display, and the new value will be rejected. For example, 12 gpm is below 5% of 268.4 gpm. If an attempt is made to enter 12 gpm as the range setting the following message will appear in the display.

```
Error - 11
< 0.05 Range DN
```

Range DN is the Cal Factor. The Cal Factor times 0.05 is 5% of that value. The message says that the value we attempted to enter is below 5% of the Cal Factor, and it will not be accepted. The procedure for entering the range for the reverse flow is the same as for the forward flow.

There is an additional error message related to range settings that applies to both forward and reverse ranges. That message is "FLOW> 130%, and it appears when the actual process flow exceeds the maximum range setting by 130% for any reason. This could happen because the range was set too low for the actual flow or because a valve failed or was improperly positioned. The message would appear as shown below. Between 100% and 130%, the output signal will accurately reflect the flow rate.

```
Flow > 130%
> F 6359284 gal
```

3.3.5 Flow

The upper line of the display is used to indicate flowrate in the monitoring mode. It can be expressed in % or in direct engineering units. Step through the menu until Flow appears on the upper line of the display. It might appear as shown below.

```
Flow
gpm
```

Because gpm was selected for range units in the previous example, that is the unit that appears here. The only selections available for this parameter are this engineering unit or %. Press the ENTER keys, and the cursor will appear to the right of gpm. Now press either the Data or the Step button, and the value will change from the engineering units shown to %. Press the ENTER keys again, and the change is entered into memory.

3.3.6 Pulse Width

If the pulse output option is selected the output pulse width can be adjusted between 0.032 and 2000 milliseconds. For driving an electromechanical counter, the pulse width should be about 50 milliseconds. For high speed electronic devices, a pulse width of about 50 microseconds (0.050 milliseconds) is typical.

Step through the menu until Pulse width appears in the display. The present pulse width will be displayed. Press the ENTER keys, and the value will be replaced by the cursor which will be at the left of the display. All values are in milliseconds. To enter a microsecond pulse width, place a decimal point three places to the left of the numerical value. For example, a 50 microsecond pulse width would be entered as 0.050 milliseconds, as follows:

```
Pulse  width
0.0500 ms
```

3.3.7 Pulse Factor

The pulse factor is used to select the number of pulses per engineering unit for totalization purposes. It functions whether or not the pulse output option is selected and operates equally on the internal and the external totalizer. If the unit is set for unidirectional flow the pulse factor in the reverse direction will be locked out. As an example, note what happens as the number of pulses per gallon is changed. Call up Pulse factor, and the display might look like the figure below.

```
Pulse factor > F
1.00000 / gal
```

The internal totalizer display is always direct reading so that at one pulse per gallon the totalizer will add one count for each pulse applied to it. We can select a factor of ten pulses per gallon and there will be ten pulses arriving at the totalizer for each gallon. Keep in mind that these units can be gallons, barrels, liters or whatever is selected from the units menu. Each pulse now represents 1/10 of a gallon. The totalizer will still add a count for each arriving pulse, but a decimal will be added so that the display reads in gallons and tenths of a gallon.

If we select 100 pulses per gallon then each pulse represents 1/100 of a gallon, and the decimal will appear at the proper point to show totals in hundredths of a gallon. See below for units of 1/10 gallon.

```
> F 45.75%
> F 34864.8 gal
```

NOTE

This is a seven digit counter, and as it fills up, the decimal will be continually moved to the right until it is no longer possible to read in other than units of one gallon or whatever engineering units are selected.

Although selecting multiple pulses per engineering unit is practical for low flows, it creates readability problems at high flows. The higher flows could cause the totalizer to add counts so rapidly that the last digit or two would be unreadable. What is needed to slow down the totalizer is for each pulse arriving at the counter to represent more than one gallon. For example, at one pulse per ten gallons (select factor 0.1) the totalizer will receive a pulse every ten gallons, and the last digit on the right will always be a zero. The count will change every ten gallons (10,20,30, etc.). For one pulse equal to 100 gallons, (select factor 0.01), the last two digits will be zeroes, and the totalizer will change every 100 gallons.

3.3.7.1 Allowable Pulse Factors

Pulse factors can be selected for any value between 0.01 and 100 (0.001 to 1000 for software version B.15, C.10, or later). Which factor to select is generally determined by the application requirements. However, there are two restrictions that must be considered.

First, the maximum pulse output frequency at 100% of the Converter span is 4 kHz. The internal counter operates at this frequency independent of the pulse width selection for the external readout device. The following discussion applies to the internal counter as well as to an external high frequency counter. The suggested maximum count to these devices is limited to 4,000 pulses per second. Consider a max flow of 240,000 gpm (4,000 gal/s). With this flow, the highest pulse factor that could be used would be one pulse per gallon.

$$4{,}000 \text{ gal/s} \times 1 \text{ pulse/gal} = 4{,}000 \text{ pulse/s}$$

However, the Converter will normally function properly up to 130% of the range setting. This means that for a range setting of 4,000 gal/s (and 4000 pulses/s at 100%) a proper output signal will be generated for flows up to 5,200 gal/s (4,000 X 1.3 = 5,200). The analog value at 130% of the range setting will be 24.8 mA dc. Although this condition is acceptable, it is not considered good practice.

Ideally, a pulse factor should be selected to keep the pulses to the counter within the 4,000 per second limit. For example, if we apply a pulse factor of 0.1 to the above example then each pulse will represent 10 gallons, and the pulses at the counter will be within 4,000 per second.

$$4{,}000 \text{ gal/s} \times 1.3 \times 0.1 \text{ pulse/gal} = 520 \text{ pulses/s}$$

Second, electromechanical counters typically require a pulse width of 30 milliseconds or more and are limited to about 15 counts (pulses) per second. They require time between pulses to complete the mechanical operation of moving a wheel to its next count position. If there is not sufficient time between pulses to do this the counter will jam. A high pulse factor could create a condition where an external electromechanical counter would jam while the internal counter would continue to operate. Because the ERROR message is based upon 4 kHz (operating frequency of internal counter), there would be no alert signal to this condition.

A conservative approach would assume a 50 millisecond on time and 50 milliseconds between pulses at maximum flow. This gives us 100 milliseconds total time for each pulse or ten pulses per second. Consider a flow of 750 gpm or 12.5 gal/s.

$$12.5 \text{ gal/s} \times 1 \text{ pulse/gal} = 12.5 \text{ pulses/s}$$

But remember the converter can operate up to 130% of range setting!

$$12.5 \text{ gal/s} \times 1.3 \times 1 \text{ pulse/sec} = 16.25 \text{ pulses/s}$$

This condition would not generate an ERROR message, but it could cause the electromechanical counter to jam. It would operate normally up to the max range setting, and as the flow approached 130% of the range setting, the counter could jam. The internal counter would continue to count.

3.3.7.2 Summary

The important thing to remember about pulse factor selection is that the high frequency output is limited to 4,000 counts per second and the electromechanical devices are limited to about 15 counts per second. Also, remember that the internal counter operates independently of the pulse width selection and the external counter.

To select a pulse factor, convert flowrate to units per second. Then multiply by 1.3 to determine flowrate at 130% of range setting. This cannot exceed 5200 per second for high frequency devices or 15 counts per second for electromechanical counters. Select a pulse factor that will keep the counts within these limits.

CAUTION

The sequence in which the range and pulse factor are selected are important. The range must be selected first and then the pulse factor. If the pulse factor is selected first or is not reset when a range change is made, the frequency to the totalizer could exceed the limits discussed above.

3.3.8 Density

If kg, tons, or grams is selected for the range or totalizer units a density value can be entered. The density can be entered between the values of 0.00001 and 5 g/cm^3. This is used as a factor against the range setting. For example, if the range setting is 250 kg/min a density setting of 2.00000 g/cm^3 will change the range setting to 500 kg/min. Therefore, the pulse factor must be based on 500 kg/min.

Density 1.00000 g/cm^3

Density is a numerical value. It is entered in the same manner as the range setting. If values entered are not within the limits listed above an ERROR message will result.

NOTE

It is important to make changes to the parameters discussed up to this point in the order in which they have been presented. This will simplify the task and minimize the margin of error. From this point on, the order in which parameters are addressed is less important.

3.3.9 Damping

Damping effectively controls the speed at which the signal converter responds to changes in flow. Without damping, it will show a 100% change in flow in about 1 second. By entering various values for damping, the full scale response can be slowed to as much as 99 seconds. This is not a linear function. Consequently, response will be faster in the first few seconds of the damping interval than during the last few seconds. Damping is sometimes used to smooth out pulsating flow signals that are caused by pumps and to reduce output oscillations that are created by process generated noise.

Damping 10.0000 s

Damping is a numerical value entry, and it is changed in the same manner as the range and other numerical units. Values greater than 99.9999 seconds will prompt an ERROR message.

3.3.10 Low Flow Cut-Off

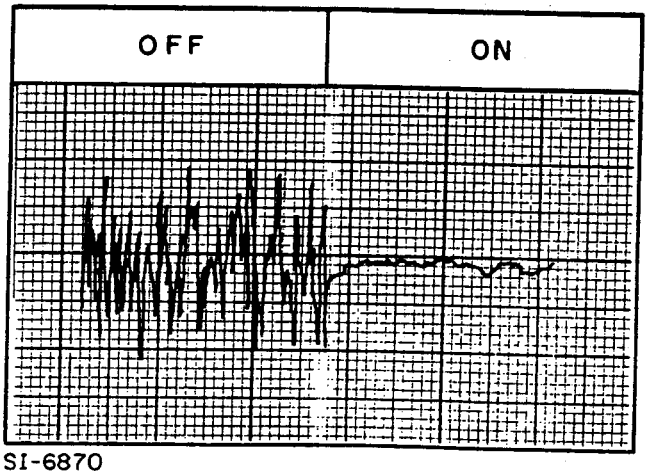
This feature allows for setting the low flow cut-off point in terms of percent of the full scale range setting. The cut-off causes the input signal to drop to a zero condition (4 mA dc for a 4-20 mA dc output) when the flow drops below the set value. This value can be set at 0 to 10% of the full scale range setting. Typical values are 1 or 2%. If a value greater than 10 is attempted it will be rejected, and an error message will appear as shown below.

Error - - 16 Input > 10

3.3.11 Noise Reduction

This function is either ON or OFF. It is activated or deactivated simply by finding it in the menu and pressing the ENTER keys. Next, press a Data or Step key to change from ON to OFF or vice versa. Press the ENTER keys again to complete the task.

The NOISE REDUCTION acts a little like the DAMPING function in that it reduces or eliminates process generated noise. However, it does not slow down the response severely as does the Damping Function. It is especially useful in dealing with slurries containing very hard particles, heavy paper stock, and some very low conductivity liquids. Figure 3 - 4 illustrates the effectiveness of the proprietary software that drives this function. The illustration shows a noise level in excess of 40% of full scale with the function turned off.With the function turned on, the level of noise has been reduced to about 2%. While the 40% oscillations are unacceptable for control purposes, the 2% oscillations are quite manageable.



SI-6870

FIGURE 3 - 4. NOISE REDUCTION

The Noise Reduction function is normally used in conjunction with the 15 Hz coil energizing frequency. To obtain optimum results, a minimum of ten seconds damping is recommended. Factory assistance should be requested when these applications are encountered.

3.3.12 Totalizer Reset

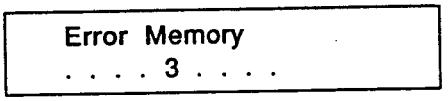
The Forward and Reverse totalizers can be reset to zero individually. Toggle through the menu until the Totalizer> F reset message appears in the display. Forward or reverse flow will be indicated by "> F" and "< R". Press the ENTER keys, and the appropriate counter will be reset to zero.

3.3.13 Totalizer Overflow

When the totalizer reaches its maximum count (9,999,999,) it "rolls over" and starts to count again at zero. When this occurs, the direction indicator (> F or < R) at the left of the register and the units (ie. gal) at the right of the register will blink, and an overflow register will record the overflow. The cumulative total can be determined by multiplying the number in the overflow register times 9,999,999 and adding the value in the totals register. The overflow message is removed by toggling through the menu using the "Data" or "Step" pushbutton until "Totalizer reset" appears. At this time, pressing the ENTER keys will reset the totalizer, clear the overflow register, and the blinking will stop.

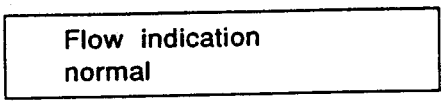
3.3.14 Error Memory

Alarm conditions may exist momentarily. For example, the flow may exceed 130% of the range setting for a short period of time and return to normal before the alarm condition is detected. The Error Memory records the code number of any alarm conditions as they occur. For flows that exceed 130% of range setting, the error code is the number 3. This number would appear in the error register along with the code numbers of any other failures that have occurred as shown below. The code numbers are cleared from the error register by pressing the ENTER keys.



3.3.15 Flow Indication

This feature makes it possible to reverse the forward and reverse flow signals. If the magnetic flowmeter is installed so that flow through it is in the opposite direction to which it is wired and calibrated the flow indications will be reversed. Forward flow will read as reverse flow and vice versa. This can be corrected by reversing the wires on terminals #1 and #2 of either the magnetic flowmeter or the Signal Converter. The change can also be made through software by selecting the Flow indication feature as shown below:



Press the ENTER keys and the cursor will appear to the right of "normal". Press Data or Step and the indication will toggle between "normal" and "inverse".

Select "inverse" and both the flowrate and totalizer indications will display in the normal direction even though the magnetic flowmeter has been installed so that the actual flow enters it from the reverse flow direction.

3.3.16 Multiplex Display

The totalizer value on the bottom line of the display shows the total for the operating flow direction. It can be made to show totals for the opposite direction either manually or automatically if the unit has been set up for bidirectional flow. If not then this feature will be locked out. Totals for the opposite flow direction can be displayed manually by pressing the Data or Step buttons. The total will be momentarily switched to show the totalized flow for the opposite flow direction. After about twenty seconds, the flow totalizer will revert to show the total for the current flow direction.

The MULTIPLEX feature automatically switches the totalizer values so that they are alternately displayed for each flow direction. A total for one direction will be displayed for about 20 seconds and then the other for about 20 seconds. This will continue for as long as the MULTIPLEX feature is turned on. It is an "ON" - "OFF" function that is selected by the Data/Step keys and entered with the ENTER keys.

Multiplex disp.
off

3.3.17 Language

Messages and data can be shown in the display in nine different languages. Changing languages affects only the text that appears in the display. It does not affect any of the engineering units. The languages are selected by pressing the Data or Step key to step through the menu and enter the desired language. In (software) design level "A" units, only English and German are available. Languages available in design levels "B" or higher are: English, Danish, Dutch, Finnish, French, German, Italian, Spanish, or Swedish.

Language
English

3.3.18 Output Current

The output current range is selectable. In addition to the 4-20 mA dc which is the normal output, 0-20, 2-10, and 0-10 are also available and selectable from the menu. In addition, the current output during an alarm condition can be set to either 0% or 130%. The display for these options appears initially as shown below.

Submenu
Current output

At this point, press the ENTER keys, and the current output menu will be accessible. Move back and forth between the submenu items of Current output and I out at alarm using the Step/Data buttons. Select either by pressing the ENTER buttons. Again, step through the submenu to select the appropriate current output or alarm output.

Current output
4-20 mA

Manual exit from any submenu is done in two steps. Pressing the C/CE button from either I out at alarm or Current output will step the menu up to Submenu. Press "Data" or "Step" to continue in the configuring mode or press the C/CE button again to exit from the configuration mode. The unit will return to the monitoring mode on its own in two steps taking about 20 seconds between each step.

I out at alarm sets the analog output to a low or high value as selected. In case of an operational failure, the computer activates an alarm, an error message is sent to the display, and the current output goes to the selected value. The selected value can be either 0% or 130% of the range setting. Examples of the error messages that result in the alarm output are shown in paragraph 4.2.10 ERROR MESSAGES. The I out at alarm menu appears as shown below:

Iout at alarm 0%

3.3.19 Data Link

If the DATA LINK option has been installed it is configured by calling up the data link submenu which appears in the display as shown below.

Submenu Data Link

Press the ENTER keys, and the COMMUNICATIONS menu will appear as shown below. If the DATA LINK option has not been installed a "NOT AVAILABLE" error will appear.

Communications uDCI Binary

Press the ENTER keys again, and select MICRO-DCI Binary or ASCII.

Press a Data or Step button, and the menu will change to the BAUDRATE menu as shown below.

Baudrate 2400 Bd

Press the ENTER key, and select one of the following baud rates: 110, 300, 600, 1200, 2400, 4800, 9600, 14400, 28800.

Press a Data or Step button, and the menu will change to the Instrument Address as shown below.

Instr. address 011

Each Converter included in the data link must be identified by a unique numeric address. These are limited to the numbers 000 to 031. An attempt to enter a number higher than 031 will result in an ERROR message. For further discussion refer to the COMMUNICATIONS MANUAL for 50XM1000B..

3.3.20 System Zero Adjust

This adjustment is required for magnetic flowmeters that are converted for use with a type XM or 50XM1000 series Signal Converter. To make the adjustment, the magnetic flowmeter must be set up in a full pipe, no flow condition. Then call up the System zero adj feature which should appear as shown below.

System zero adj. 0.0000 Hz

To access the zero adjustment, simply press the ENTER keys, and the display will show:

Adjust ? yes-----> Enter

Press ENTER and the option to adjust manually or automatically will be offered.

Adjust Automatic?

Select automatic, and press ENTER again. The zero will be adjusted. During the adjustment procedure, the display will show a count down from 255 to 0. At the end of the count down, a frequency value will appear. If the value exceeds 500 Hz an ERROR message will appear, and an adjustment to the magnetic flowmeter or Converter may be required: Record the value. If the Converter is changed, this value can be entered into the new Converter manually. It will not be necessary to set up a "full pipe no-flow" condition for this situation.

When it is necessary to replace the Converter assembly, the meter zero value must be entered in the replacement Converter. This value is noted on a sticker attached to the inside of the Converter junction box (behind the terminal block). To adjust zero manually, select MANUAL operating mode and press ENTER. Next, encode the applicable zero value (as given on the sticker in the junction box) and press ENTER to complete the procedure.

3.3.21 Software Level

The software level and the Converter model number can be shown in the display with the model number on the top line and the software level on the bottom as shown below. Changes can be made only by replacing the EPROM.

3.3.22 Empty Pipe Detector

This feature is a factory installed option. It is designed to sense that the liquid in the magnetic flowmeter has dropped below the level of the electrodes. When this happens, the outputs are locked at zero flow (4 mA dc and 0 Hz typically) or 130% of range setting depending upon which of these values has been selected for the "Iout at alarm" condition.

In order to use this option, certain adjustments must be made with the magnetic flowmeter installed in the pipeline under both full pipe and empty pipe conditions. First, call up the Empty Pipe Menu.

Submenu Detector e. Pipe

Now press ENTER and the display will show either an ERROR message if the option has not been installed or the menu as shown below.

Adjust Detector e. pipe

Press the ENTER keys and a numerical value will appear in the display. With the pipe full of the process liquid, adjust potentiometer R813 on the Empty Pipe Detector Board until the value in the display reads 100.

At this point, drain the liquid from the pipe and note the value in the display when the pipe is empty. Calculate the threshold value using the equation:

$$\text{Alignment value} = \frac{100 + \text{pipe empty value}}{2}$$

Press Step until Threshold appears in the display as shown below:

Threshold 097

Press ENTER and change the numerical value that appears on the second line of the display to the alignment value calculated above. The empty pipe detector can be turned on or off in the same manner as the noise reduction by calling up Detector e. pipe and selecting either "on" or "off".

3.3.23 Self Check

A number of self test routines are built into the Converter. Some of these are software driven checks and some are performed with a combination of software and continuity checks.

NOTE

The Converter is not "on line" during SELF CHECK. This is a maintenance procedure, and data is not updated while the Converter is in this mode.

Submenu Self check

Press ENTER and the following should appear in the display.

Self Check Iout

Press ENTER again, and I out will disappear and the % sign will appear on the right in the bottom line. A percentage of the output can now be entered, and the analog output will go to that value. For example, enter 25, and the analog output will go to 8 mA dc. To exit the I out test and any other Self Check test, press C/CE.

Iout 0%

3.3.24 Port B & Port A

Press Data, and Port B will appear. Press it again, and Port A will appear. These two checks are for factory use only. They are not field adjustable.
Press Data again, and the following should appear.

Self Check Totalizer reset

This check is for factory use only.
Press Data, and the following should appear.

Self check Zero return

This test checks the external contact operated Zero Return feature. Press ENTER. The display should read "Zero return off". Place a jumper across terminals 22 and G3, and the display will change to "Zero return on".
Press Data, and the following should appear.

Self check Display

Press ENTER, and the display will fill up with the numbers 1 through 0 and the letters A through F to show that the display is functional.
Press Data, and the following should appear.

Self check Fout

This test functions the same as the "I out" test except the output frequency is read across terminals 8D and G3.
Press Data, and the following should appear.

Self check Data link

The Data Link check requires that jumpers be installed in the wiring so that the converter can transmit and receive its own signal. For the RS 232 link, place the jumper between terminals TD and RD. For the RS 485 link, place a jumper between terminals T- and R- and another between T+ and R+. These terminals are located in the Converter customer connection box.

Now press ENTER. The computer will output 1000 characters of ASCII code 31 Hex ("1") and check the received characters. In the display, the output data count appears on the left, and the error data count appears on the right. After 1000 characters are sent, the computer ends the check on the received data and continues to transmit the value 31 Hex until the C/CE button is pressed.

Press Data, and the following should appear.

Self check Switch 206

The Switch 206 test is for factory use only

Press Data, and the following should appear.

Self check Dir. contact

This test checks the flow direction contacts for the analog signal. Place an ohmmeter across terminals 44, 45 and 46 in the remote connection box. Continuity should be present on terminals 44 and 45 for reverse flow and terminals 45 and 46 for forward flow. Press ENTER, and reverse or forward will appear in the display. Press Data to change from one to the other.

Press Data, and the following should appear.

Self check Alarm contact

This test checks the alarm contact for operation. It can be tested for continuity with the alarm on in the same manner as the flow direction contact at terminals V5 and V6 in the remote Converter.

Press ENTER, and the display will show "Alarm contact" on the top line and either "Off" or "On" on the bottom line. Press the Data key to switch from "On" to "Off". Continuity should be present when the menu reads "On".

Press Data and the EPROM check should appear as shown below.

Self check EPROM

Press ENTER and an EPROM OK or an ERROR message will appear in the display.

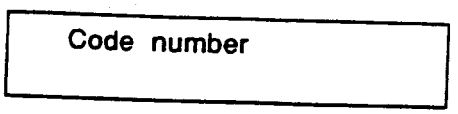
Press Data and the NVRAM check should appear as shown below.

Self check NVRAM

Press ENTER and an NVRAM OK or an ERROR message will appear in the display.

3.3.25 Code Number

The Code Number is used to gain access to internal checks and adjustments that are not normally performed by operator personnel. These are reserved for factory and maintenance personnel. Detailed instructions for these procedures are contained in SERVICE MANUAL 50XM1000B. The Code Number appears in the display below.



4.0 FUNCTIONAL DESCRIPTION

4.1 Basic Functions

The Type 50XM Microprocessor-controlled Magnetic Flowmeter Signal Converter is of the pulsed dc type, i.e., it supplies a pulsed constant current dc signal to the magnet coils of the flowmeter to establish the magnetic field. Also it receives the flow signal from the Magnetic Flowmeter and converts it into analog and digital output signals. Zero is factory set, and no field zero adjustments are required.

Two field selectable coil operating frequences are incorporated in this design. They are 7.5 Hz and 15 Hz. The standard coil drive frequency is 7.5 Hz. The 15 Hz, when used with a software noise reduction feature, is only recommended for applications in which the process generates noise signals that interfere with the flow signal.

4.2 Design Features

4.2.1 Microprocessor Controlled

The Converter is microprocessor-controlled with nonvolatile memory. All operating parameters are configurable via three pushbuttons on the Converter or via an optional data link. During configuration, the Converter remains on line, and data is updated continually. The data base is updated at the time the ENTER buttons are depressed to enter a parameter change.

4.2.2 Display

The liquid crystal display (LCD) is back lighted and contains two lines of 16 alphameric (5 X 7 dot matrix) characters. The display is used to show flow rate on the top line in either percent of flow or in direct engineering units and totalization in direct engineering units on the bottom line (see Figure 3-1). In addition, the display is used to show configuring data or error messages in English language. Both the rate indicator and the seven digit totalizer are included in every Converter as standard.

4.2.3 Rangeability

Any range from 0 to 100% can be selected provided the full scale value is between 33.33 ft/s (10 m/s) and 1.5 ft/s (0.5 m/s).

4.2.4 Bi-Directional Flow

The Converter can be either unidirectional or bidirectional. Selection of the directional mode is made through software. The standard mode is unidirectional. This can easily be changed at the factory or in the field. Instructions for this software change are contained in SERVICE MANUAL 50XM1000B. In the bidirectional mode, the Converter will automatically display rate and totalization in forward and reverse directions. A pulse output option for each direction is available for retransmission to an external totalizer. A flow direction contact is included in the 50XM1000 to indicate flow direction for the one analog output.

4.2.5 Flow Direction

The flow direction is indicated at the left side of the display as "F" for forward flow and "R" for reverse flow. Totalization is also shown in this manner. The totalizer can be switched manually from forward to reverse or vice versa by pressing the "Data" or "Step" key located just below the display. The totalizer can also be switched automatically every 20 seconds by selecting MULTIPLEX DISPLAY from the configuring menu.

A separate external totalizer for each flow direction can be driven by the 24 V dc scaled pulse if the scaled pulse option has been selected.

There is one analog output available. Flow in the reverse direction is indicated by the same analog signal as the forward. To make the distinction between forward and reverse flow, contact closures are provided in the 50XM1000. In a two pen recorder, for example, one pen could be used to record flow while the second pen could rest at zero with the contact open and could be elevated to some positive value when the contact closes. Thus, the position of the second pen would indicate the direction of flow. If the analog signal goes to a computer or CHAMELEON™ type instrument the contact closure condition is easily recognized as an indication of flow direction.

4.2.6 Output Signals

4.2.6.1 Analog Output

A 4-20 mA dc output signal into 0-750 ohms is standard and is always available regardless of which output options are selected.

4.2.6.2 Incremental Pulse

This is a 5 volt, 0-10 kHz unscaled frequency which is normally used during calibration. It can be adapted for use as an output in special applications. This output is also provided regardless of output options.

4.2.6.3 Optional Outputs

Either a scaled pulse output or a data link can be selected.

4.2.6.4 Scaled Pulse

This is a 24 V dc pulse that requires a minimum load of 150 ohms. It can be used to drive an electromechanical counter at 0-10 Hz with a 50 millisecond pulse width or a high speed electronic device at 0-4 kHz with a 50 microsecond pulse width. The pulse width can be adjusted as a part of the data base and does not require a hardware change

4.2.7 Data Link

The data link is the hardware and software by which the data base may be examined. The data base is a collection of elements in the Converter memory which may be either altered or examined through software. In addition, the data base represents the information the instrument is working with in the course of its normal computations. A few of the parameters included in the data base are calibration factor, range setting, damping value and pulse width. The data link consists of two transmitting and two receiving wires which pass serial data at 110 bits per second up to 28,800 bits per second (110 Baud to 28.8 kBaud). It does not carry the analog output signal from the Con-

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verter. The analog signal is carried over its own wires directly to the receiving device (recorder controller, indicator, computer, etc.) in the normal manner. There are two industry standard hardware arrangements for the data link option. They are RS232C and RS485.

RS232C interface is probably the most common serial data link in use today. It permits communication between two devices normally within 50 feet of each other at baud rates up to about 9600. Devices are available to convert from RS232C to RS485 to allow connection of more tha one Converter to a single computer and to transmit well beyond 50 feet.

RS485 interface is a high speed link used by F&P's MICRO-DCI™ instrument line as well as oth intelligent instruments. It permits any transmitter to be shut off or 'tri-stated' when not in use. F F&P instruments such as the SUPERVISOR™, it means that up to 32 instruments may 'talk' over one data link. This link can send data at 28.8 kBaud over lines up to 4000 feet long. Two key p selectable communication modes are available. They are MICRO-DCI Binary and ASCII.

4.2.7.1 ASCII

In the ASCII mode, a sequence of ASCII characters is sent back and forth.

4.2.7.2 MICRO-DCI BINARY

This mode is the most powerful communications scheme available. It will be recognized by the fo lowing instruments:

1) SUPERVISOR™ & SUPERVISOR-PC (53SU1000 & 53SU5000).
2) IBM PC with F&P software (53HC3300)
3) DCI system using I-COM/X and Supervisor

In the binary mode, information is compressed so that it is sent approximately twice as fast as in the ASCII mode. However, this format will not be recognized by "dumb" terminals. The binary mode interface provided by F&P permits the user to write programs which automatically extract c. change data. In each of the above cases, these programs are written in a different notation, with the IBM PC version using BASIC with customized subroutine calls. Detailed instructions on programming for the data link are contained in the COMMUNICATIONS MANUAL for the 50XM1000B..

4.2.8 HART Interface

The optional HART* protocol system, when supplied,permits simultaneous 4-20 mA and digital sig nal transmission on the same 2-wire cable. With this protocol, process parameters such as instan taneous flow rate and cumulative total flow, or operating conditions such as alarm values,can be monitored or altered by an external "smart " device - for example- a host computer. This interface allows the 50XM1000 data base to be uploaded into the host computer. Thus, operating parameters which would only be changeable at the 50XM Converter can be scanned and, if desired, remotely reconfigured.

When implementing the HART protocol, the control computer is the master and the field transmit the slave. In addition to this primary master a second master (such as the Series 50HC1000 Hand-Held Computer) can become active. Data is transmitted at 1200 baud, with the serial infor mation being encoded and detected as outlined in the Bell 202 standard. A description of HART protocol is provided in the 50XM1000B COMMUNICATIONS MANUAL.

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* Highway Addressable Remote Transducer

4.2.9 Power

The standard input power service for the Converter is either 120 V ac, 50/60 Hz or 24 V dc.

4.2.10 Error Messages

Error messages replace the flow rate indication in the top line of the display when certain failure conditions exist or when an attempt has been made to enter an unacceptable value. The various error messages are shown below. Both the message and the error code number will be displayed. During an alarm condition, the error message is displayed on the top line. The message alternates between English language text and the error code number. Only the highest priority alarm is displayed in text, whereas error codes for all conditions in alarm are displayed. In the following table, the alarm conditions are listed in their order of priority. In addition to the alarm message, an alarm contact will operate, and the output current will be held at 0% or 130%, as software selected, except error code 3 (flow greater that 130%).

ERROR #	DISPLAY	CAUSE
5	NVRAM Defect	Error in NVRAM data
4	External Switch-off	Zero Return activated
0	Empty Pipe	Empty Primary
7	REFp Too Large	Positive ref voltage too large
8	REFn Too Large	Negative ref voltage too large
2	REF Too small	Pos or Neg ref voltage too low
1	A/D Overload	A/D converter over ranged
3	Flow 130%	Flow is greater than 130%

5.0 MAINTENANCE

5.1 General Discussion

As the Type 50XM Signal Converter is a microprocessor based instrument, all computations, data manipulation and sequencing operations are software controlled. Display of flow rate and the cumulative total flow are performed automatically concurrent with flow through the associated Magnetic Flowmeter. As the Magnetic Flowmeter has no moving parts that are subject to mechanical wear and the Signal Converter has no operating controls that require field adjustment, there are no recommended periodic tests to be performed. As a result, routine system maintenance is not required.

If in the course of operation the Signal Converter does not perform as expected, it is normal for the operator to first suspect that the software configuration is faulty. Although this may occasionally be true, it should be emphasized that the EPROM and NVRAM memory devices used in the Signal Converter are highly reliable. Should a malfunction be evident, remove the Signal Converter housing cover and see if the CPU light is energized. (This LED is located on the lower right-hand corner of the Converter assembly as shown in Figure 5-1.) When the CPU light is energized steadily, it is probable that the microprocessor and associated memory devices are functional. In this case, proper operation of the Magnetic Flowmeter should be established before troubleshooting the Signal Converter. Proper operation of the Converter can be confirmed as described in the CALIBRATION section of the 50XM1000B SERVICE MANUAL.

Due to the complexity of troubleshooting microprocessor based instruments, maintenance beyond the assembly level is not recommended. If troubleshooting of the Signal Converter assembly is attempted, it should be noted that many of the CMOS type IC chips used in this assembly are static sensitive devices that can be internally damaged if not handled properly. Also, caution must be used when connecting test probes, as even a momentary accidental short may damage or destroy an integrated circuit. Further, although protection is provided against electro-static effects by built-in circuitry, the following precautions should be taken if it is necessary to handle the 50XM Converter pc assembly:

1) Ground all test equipment.

2) Technicians should use grounding-type wrist straps.

3) The surface of the service bench should be grounded to preclude static electric build-up.

4) All CMOS devices should be stored or transported in materials that are anti-static (do not use ordinary plastic wraps or bags). Typically, protection of the Converter assembly can be effected by first covering the pc assembly with aluminum foil and then providing an outer wrap of heavy paper.

When a system malfunction is evident, the first step is to determine whether the problem is hardware or software related. If the Signal Converter appears to respond normally to functional operations such as those expected to occur during the course of parameter monitoring, self test procedures, etc., and system constants can be verified as correct - but the displayed process values are wrong - then proper operation of the primary meter should be verified.

When the Signal Converter exhibits total failure (no display can be obtained on the LCD), then possible loss of the external power source or an internal hardware malfunction could be the cause. A simple volt-ohm analysis will quickly indicate whether the problem is external or internal. Use of a conventional V-O-M type multimeter is considered adequate for voltage and resistance analysis. An electronic frequency counter and oscilloscope will also be useful for verifying the output frequency rate, signal tracing, etc.

In the event of a hardware malfunction, a replacement Converter assembly can be quickly substituted for the defective assembly, thereby minimizing system downtime. F & P Company offers a factory repair/exchange program to facilitate replacement of a defective electronics module, i.e., the complete Signal Converter assembly. Under this repair/exchange program a fixed price will be charged to the account of buyer for replacement of defective equipment, with appropriate credit issued when the defective (but repairable) unit is received (shipping charges prepaid) by F&P.

When communicating with F&P in regard to a replacement Converter assembly, it is important to refer to the complete instrument serial number and model number to assure that the correct replacement assembly will be provided. The serial number and model number are given on the F&P manufacturing specification sheet and on the instrument nameplate (attached to the housing base). Should any doubt arise regarding the proper procedure for solving a service problem, it is suggested that the user contact their local F&P service facility for technical assistance.

5.2 Converter Disassembly

Should it be necessary to disassemble the Signal Converter for calibration, troubleshooting, or replacement of a defective assembly, proceed as outlined below.

5.2.I Removing Converter Module from Housing

WARNING
Equipment powered by an ac line service constitutes a potentially lethal electric shock hazard. Always de-energize system power before removing the housing cover.

1) To remove the Converter housing cover, unscrew the four hex head mounting screws located in the respective corners of the cover. These are captive-type screws and should not be removed from the housing cover. Store the housing cover for later use.

2) On top of the digital pc board (see Figure 5-1), unscrew the four screws that pass through the 1-7/8" standoffs located near the corners of the Converter module. Support the Converter Module while removing the last of the 4 mounting screws. This will prevent excessive strain on interconnection cables. Save this mounting hardware.

3) Disconnect the 20-pin ribbon-type signal cable from receptacle 1X2 (located on the lower left edge of the Analog Board). Disconnect the 3-pin power plug from receptacle 1X1 (located on the lower right edge of the Analog Board).

The Converter Module is now disconnected and can be removed from the housing.

5.2.2 Disassembly of Signal Converter Module

To obtain access to optional plug-in assemblies located on the Analog Board (see Figure 5-1), it is necessary to separate the two pc boards as outlined below.

1) Unscrew the four 5/16" hex nuts that secure the Digital Board to the 1-7/8" standoffs. Save this hardware.

The Digital Board can then be lifted slightly and tilted up (away) from the lower pc board.

2) If it is desired to separate the Analog and Digital pc boards, disconnect the 26-pin interboard cable from receptacle 1X3 on the Analog Board.

The Converter module can be reassembled by performing the above procedure in reverse order.

5.3 Troubleshooting

A series of simple tests may be performed on the Signal Converter module to determine problem areas. If proper Converter operation cannot be achieved when these steps are completed, then it should be assumed that the Converter has a failed component, most of which are not field replaceable. It is assumed that persons following this procedure are thoroughly familiar with operation of the device and that the entire magnetic flowmeter system has previously operated correctly. Servicing of the Signal Converter should only be attempted by a qualified electronics technician. Refer to the Circuit Description section of the 50XM1000B SERVICE MANUAL to supplement the following discussion.

NOTE

It is possible to place incorrect data into the Converter when using the MICRO-DCI binary interface. If this interface has been utilized to change parameters, verify that all Converter data is within proper limits before continuing troubleshooting.

5.3.1 Procedural

Typical troubleshooting procedure is outlined herewith. The appropriate response or course of action is indicated by " * ".

1. System has no output, display and CPU LED not illuminated:

* Check power fuse on Converter assembly. (Component location is shown in Figure 5-1.)

* Verify power input source is operational and that the applied voltage is correct.

2. No characters present on display:

* Check display contrast adjustment, R207, on Digital pc board.

3. Error messages appear on display instead of the normal flow rate and totalization information.

* Attempt to determine the source of any error message (some are detailed further on in this procedure). Error code numbers are also defined in section 4.0 FUNCTIONAL DESCRIPTION.

* Check system interconnection wiring for loose connections, open or shorted cable(s), etc.

4. Garbled information or missing characters appear on the display.

* Execute the display self-test. Assuming no other problems exist, the Converter can operate without a display, except that no data can be changed.

5. Converter output does not appear to be correct but display information seems OK.

* Move to the "SELF-TEST" menu and execute the I_{out} and F_{out} functions. The Frequency self-test will also produce both a 10 kHz and an active pulse output. On some units, a fuse is present on the Digital pc board in series with Iout. The integrity of the fuse should be verified if no analog output current is present.

6. Error message "U-REF too low" or "U-REF too high" present:

* Check for proper reference voltage (+/-65 to +/-75 mV). Use S204 on Digital pc board (see Figure 5-1) to place reference voltage into a dc condition (switch set to "open" for negative, toward board edge for positive). Always return S204 to the "as found" position.

* Check magnet coil wiring (in Flowmeter) for proper circuit resistance.

* Turn Converter power off and on again.

7. CPU LED is flashing (it should be on continuously):

* Turn converter power off and on again.

8. Error message "NVRAM Defect" appears on display:

* Log all process parameters (range, damping, totalizer factors, etc.) and enter the "code 1000" mode. Step to the "INITIALIZE" menu and press "ENTER". Manually load all calibration parameters back into Converter as they appear on the attached tags

NOTE

If the ininialize routine is involked, the Converter must be recalibrated as discussed in the 50XM1000B SERVICE MANUAL.

9. Error message "A to D OVERLOAD" appears in display:

* Check for incorrect range, non-full pipe, excessive flow noise, incorrect reference, improper grounding, excessive DC voltage on meter electrodes.

* Apply a short circuit between primary terminals 1, 2, and 3 (except on model 10D1477). The current output should drop to less than 1% of calibration factor (Range DN).

10. Converter does not appear to be in calibration:

* Using the 55XC2000 Flow Simulator, apply input signals representing various points along the range. If the Converter checks out properly, the problem may be in the primary, or system interconnection wiring may be defective. (Refer to SERVICE MANUAL 50XM1000B for test wiring,calibration procedure,etc.)

The following problems can only occur if the referenced options are present:

11. "Empty Pipe" message appears on display when pipe is known to be full or does not respond when pipe empties.

* Re-verify set-up of optional empty pipe detector

12. Data link communication does not take place properly.

* Invoke the data link self-test after connecting the Converter receive line(s) to the transmit line(s). This is a temporary connection for test purposes.
For the RS485 link, place a jumper between terminals T- and R-, and another jumper between T+ and R+.
For the RS232-C link, place a jumper between terminals TD and RD.

If the action in response to a given problem does not result in correct Converter operation, it may be assumed that the Converter module is defective and should be exchanged.

5.3.2 Test Point Information

5.3.2.I Analog Board

(Test point location is shown in Figure 5-1.)

TP101 = analog circuit common (same as "3" of the primary)

TP102 = reference signal (nominal +/-70 mV square wave at 1/4 or 1/8 of the power line frequency)

TP103 = multiplexed signal and reference; with signal at approx 550 times the input level observed at input terminals "1" and "2", and the reference signal selected every twentieth measurement at 30 times input level (see TP102)

TP104 = full wave rectified reference voltage used for driver pulse width modulator control.

5.3.2.2. Digital Board (all signals are 5 volt CMOS logic level)

(Test point location is shown in Figure 5-1.)

The following points are contained in a strip near the edge of the digital board:

TP1 = digital circuit common (same as "3" of primary)

TP2 = is not used

TP3 = serial communication data received by 50XM1000 CPU (RXD)

TP4 = serial communication data sent by 50XM1000 CPU (TXD)

TP5 = + 5 volts dc

The following points are contained in a second strip located at the perimeter of the Digital board. (On the latest design, these test points are actually a row of PC solder pads located along the left-hand side of the Digital board.)

41 = 1.000 MHz crystal clock oscillator

42 = 31.250 kHz (derived from 41)

43 = comparator output of analog to digital converter (activity depends on magnitude of velocity input signal)

44 = CPU master measuring interrupt (line frequency or 1/2 line frequency depending on setting of analog board S101 or dc power clock module selected)

45 = clock burst for analog to digital converter (length of pulse train depends on magnitude of velocity input)

46 = analog multiplexer control - logical "1" only when reference voltage is to be measured

47 = CPU "reset" terminal - must be low for CPU to run

48 = CPU "ale" terminal used for memory control and generally consisting of 170 ns pulses occurring every 550 ns

49 = CPU "psen" terminal generally consisting of 250 ns pulses occurring every 550 ns

50 = not used

51 = scaled pulse output into gate array (pulse width and repetition rate are the same as at the output terminals and information is present for both flow directions)

52 = watch dog timer from gate array to CPU - the line is normally high unless a system fault is present

53 = nominal 0 - 10 kHz Converter output - pulses are 32 usec wide and must be averaged for at least 100 ms due to their synthesized nature

5.3.3 Reference Literature

Technical literature that will be useful to supplement the 50XM1000B INSTRUCTION BULLETIN is listed below.

COMMUNICATIONS MANUAL 50XM1000B:
Provides coverage for MICRO-DCI Binary and ASCII data link communications. Also, the use of HART protocol for communication with smart devices is described in detail.

SERVICE MANUAL 50XM1000B;
This Manual describes initialization and calibration procedures in addition to a brief circuit description with pertinent engineering drawings.

INSTRUCTION BULLETIN 55XC2000;
This Manual describes the EMF Signal Simulator.

Instruments For Use With HART Protocol:
Hand-Held Computer .....Instruction Bulletin 50HC1000

5.4 REPLACEABLE PARTS LIST

SIGNAL CONVERTER, 50XM1000

NOTE: The circuit board layout and schematic diagrams for the respective option module(s) and the Converter Assembly are contained in the 50XM1000B SERVICE MANUAL. When specified, the Empty Pipe Detector module and HART interface module are included as part of the Converter Assembly along with the Magnet Driver and the Signal/Reference module, i.e., these modules are to be factory installed. The data link and pulse output modules are plug-in type boards and the selected assembly can be added in the field, if desired.

5.4.1 FUNCTION MODULES

DESCRIPTION	PART NUMBER
+Pulse Output Module	CD685A290U01
+RS 232-C Data Link Interface Module	CD685A287U01
+RS 485 Data Link Interface Module	CD685A290U01
*Empty Pipe Detector Module	CD685A330U01
*Signal & Reference Module	CD685A326U02
*Magnet Driver Module	CD685A329U01
*HART Interface Module (Kit)	D614L326U01
**LCD Assembly	177A118U02
# Analog Board (Design Level B)	
120 V ac, 50/60 Hz	CD685A371U08
24 V dc	CD685A371U51
Digital Board (Design Level B)	
Opto Pulse Output	CD685A372U51
Totalizer Reset	CD685A372U52
Opto Pulse & Totalizer Reset	CD685A372U53

+ Pulse output and data link options are mutally exclusive
* Factory Installed.
** Requires unsoldering of 2 wires to remove LCD subassembly from Digital Board. Polarity must be observed.
# Analog PC Assembly does not include Empty Pipe Detector Module or HART Interface Module. (See Converter Assembly in 5.4.2.)

5.4.2 CONVERTER ASSEMBLY

FEATURES	ADDITIONAL MODULE	SIGNAL CONVERTER	
		120 V ac	24 V dc
W/O Options		CD674A253U06	CD674A253U51
Empty Pipe Detector		CD674A254U51	CD674A254U61
Empty Pipe Detector and RS232-C Data Link	CD685A287U01	CD674A254U51	CD674A254U61
Empty Pipe Detector and RS485 Data Link	CD685A299U01	CD674A254U51	CD674A254U61
RS232-C Data Link	CD685A287U01	CD674A253U06	CD674A253U51
RS485 Data Link	CD685A299U01	CD674A253U06	CD674A253U51
Active Scaled Pulse	CD685A290U01	CD674A253U06	CD674A253U51
Active Scaled Pulse and Empty Pipe Detector	CD685A290U01	CD674A254U51	CD674A254U61
Opto Coupled Pulse Output		CD674A254U52	CD674A254U62
Totalizer Reset		CD674A254U54	CD674A254U64
Opto Coupled Pulse Output and Totalizer Reset		CD674A254U56	CD674A254U66
Opto Coupled Pulse Output and Empty Pipe Detector		CD674A254U53	CD674A254U63
Totalizer Reset and Empty Pipe Detector		CD674A254U55	CD674A254U65
Opto Coupled Pulse Output, Totalizer Reset and Empty Pipe Detector		CD674A254U57	CD674A254U67
HART Protocol w/o Options	D614L326U01	CD674A253U06	CD674A253U01
HART Protocol & Empty Pipe Detector	D614L326U01	CD674A254U51	CD674A254U61
HART Protocol & External Totalizer Reset	D614L326U01	CD674A254U54	CD674A254U64

5.4.2 CONVERTER ASSEMBLY (Continued)

FEATURES	ADDITIONAL MODULE	SIGNAL CONVERTER	
		120 V ac	24 V dc
HART Protocol, External Totalizer Reset & Empty Pipe Detector	D614L326U01	CD674A254U55	CD674A254U65
Hart Protocol, Empty Pipe Detector & Scaled Pulse	D614L326U01 CD685A290U01	CD674A254U51	CD674A254U61
HART Protocol & Scaled Pulse	D614L326U01 CD685A290U01	CD674A253U06	CD674A253U51

5.4.3 CONVERTER ASSEMBLY FUSE REPLACEMENT

SYMBOL	PC ASSEMBLY	DESCRIPTION	PART NUMBER
F101	Analog Board	Type 3AG,0.250A	D151B001U03
F201	Digital Board	Type 2AG,0.125A	1D151B1026

PARTS LIST ADDENDA

Compatibility Guide

1.The following printed circuit assemblies may be used with any series 50XM1000 Signal Converter without regard to design level:

Digital Board
LCD Display
Empty Pipe Detector Module
Active Pulse Output Module
RS232-C Data Link Module
RS485 Data Link Module
Magnet Driver (part of Analog Board)

2. The following modules must only be used with devices of their particular design level:

Analog Board (includes Magnet Driver & Signal/Reference Module)

Signal/Reference Assembly (part of Analog Board).

3. Design level "A" Digital Boards must use "A.xx" level software. Design level "B" Digital Boards may use "C.xx" (except some assembly types which require version "B.15" for use with HART protocol).

NOTE

Recalibration may be necessary when Analog or Digital Boards are replaced in the field. Always verify correct calibration as outlined in the CALIBRATION section of the 50XM1000B SERVICE MANUAL.

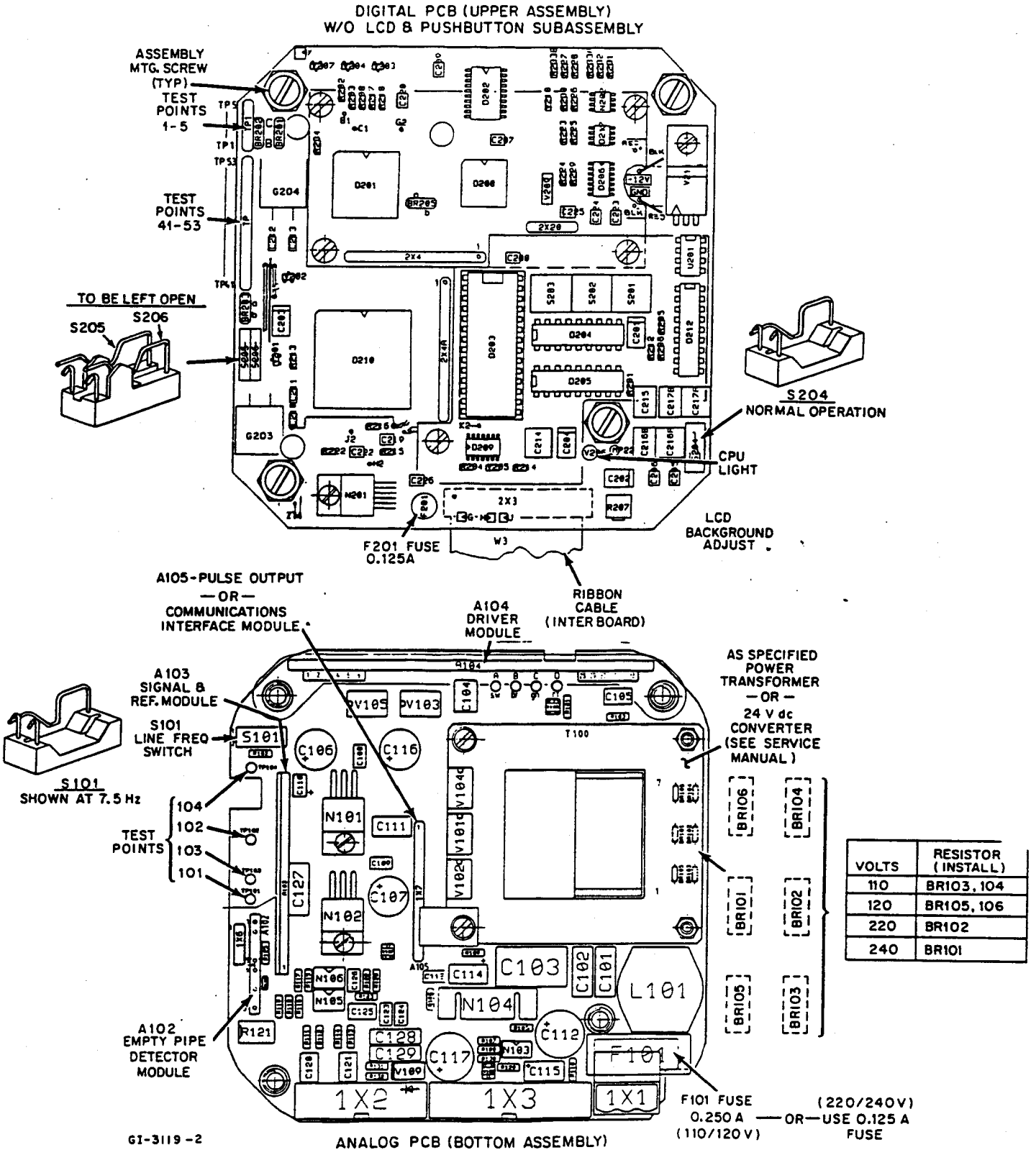
4. Identification of Analog and Digital Boards of Design Levels A and B

a) The Analog boards are most easily distinguished by the presence of a separate Input Signal module in Design Level A. This module is adjacent to the Signal/Reference assembly and nearest to the board edge. These input modules are ceramic, approximately l/2" high, and 2" long. Design Level B Analog boards contain only the Signal/Reference module in this area.

b) The most easily distinguished features of the Design Level B Digital board are the presence of the "Start in English" jumper and a plastic encased surface mounted 11.059 MHz oscillator. The jumper appears between the LM317 Voltage Regulator (N201) and the standoff along the same edge as the fuse and ribbon cable connector. Design Level A boards did not have a "Start in English" jumper and used a metal encased 11.059 MHz oscillator.

5. EPROM Replacement

This memory chip is factory programmed and installed as component D203 on the Digital Board. The EPROM is socket mounted and can be replaced in the field by an exact replacement part. The component part number is printed on the top of the EPROM. The part number may change with design level of the Digital Board and/or the applicable software requirement. Currently, for software version C.10 the EPROM part number is CD699B064U01.



VOLTS	RESISTOR (INSTALL)
110	BR103, 104
120	BR105, 106
220	BR102
240	BR101

FIGURE 5-1 LAYOUT, ANALOG & DIGITAL PC ASSEMBLIES

DETACH, FOLD, STAPLE

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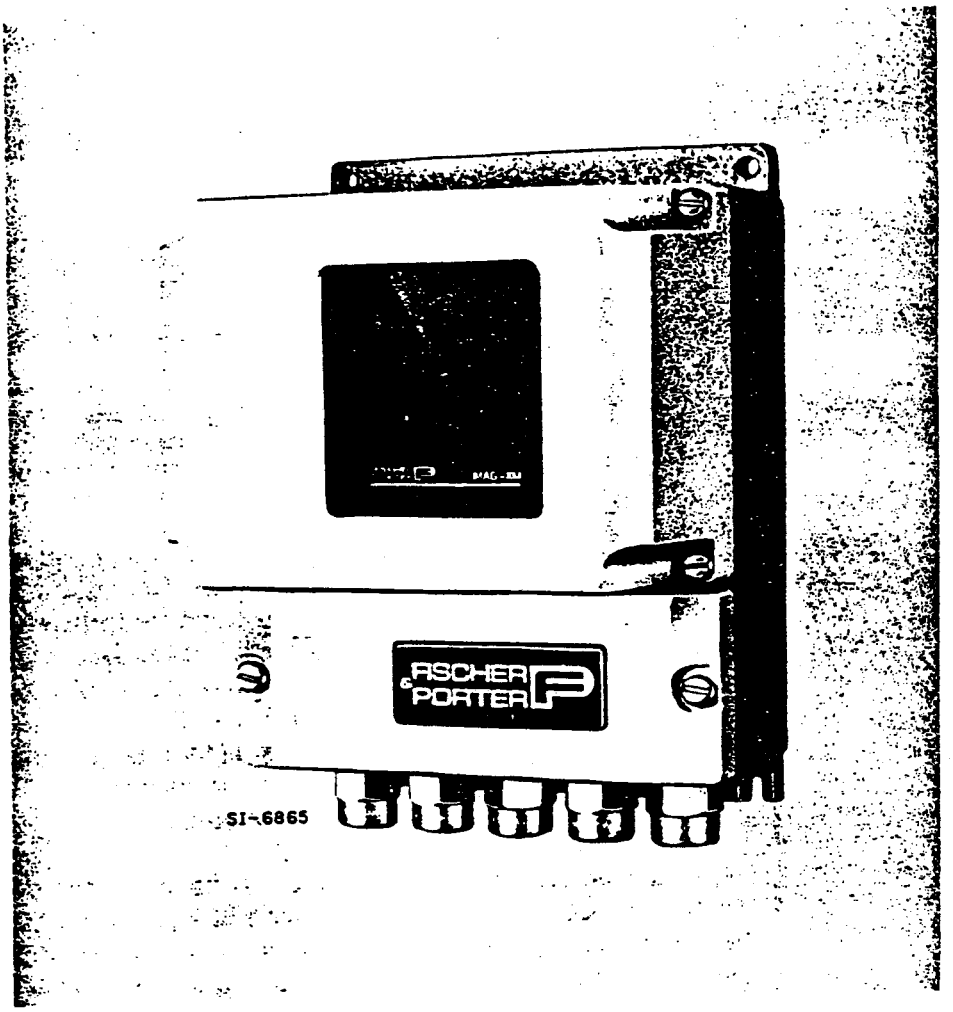


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MAGNETIC FLOWMETERS
50XM1000B

MICROPROCESSOR-BASED SIGNAL CONVERTER



Pub. 24296a

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SALES SERVICE RENTALS

Read these instructions before starting installation; save these instructions for future reference.

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1.0 INTRODUCTION

1.1 Preface

The 50XM1000B is a microprocessor-based instrument; therefore all mathematical computations, data manipulation and sequencing operations are software controlled. Each Converter is configured and precisely calibrated at the factory in accordance with customer specified flow parameters. Configuration consists of customizing the Converter for the particular process variable application: presetting all process parameters, entry of meter size, selecting alarm limits and output signal type(s), etc.

After the Signal Converter has been configured for the particular application, normal operations are controlled via the front panel pushbutton switches. Because the Converter has no internal controls that require field adjustment, routine maintenance is not normally required.

In the event that the Signal Converter does not perform as expected, refer to the maintenance procedure outlined in Instruction Bulletin 50XM1000B. This procedure is intended to enable service personnel to establish whether or not a malfunction has occurred. If a malfunction should occur, a replacement Signal Converter assembly can be quickly substituted for the defective assembly minimizing system downtime.

Because troubleshooting microprocessor-based instruments is complex, servicing beyond the printed circuit assembly level is not normally recommended. If pc board troubleshooting is attempted it should be noted that some of the integrated circuit chips used in the Converter are static sensitive devices that can be internally damaged if not properly handled. Also, caution must be used when connecting test probes: even a momentary accidental short can damage or destroy an integrated circuit. Therefore, only trained electronic technicians who are familiar with CMOS technology, have a background in microprocessor functions, and are knowledgeable with servicing technique applicable to surface-mount technology should be permitted to service this equipment.

The operations and functions performed by the particular pc board are discussed in the Circuit Description section of this manual. Should a malfunction occur, a logical analysis of the type of problem will aid in identifying whether the malfunction is hardware or software related. Troubleshooting is normally limited to the standard volt-ohm or oscilloscope analysis method followed by conventional signal tracing until the defective circuit is identified.

Due to the high density construction used in Converter packaging, it is recommended that servicing be performed in the customer's instrument service facility. When either the analog or digital pc assemblies (or components thereon) are replaced, the Converter should be recalibrated as discussed in this manual. Use of an F&P Series 55XC2000 Signal Simulator will be required for calibration. Refer to Instruction Bulletin 50XM1000B (MAINTENANCE section) to supplement this discussion.

A dynamic test of proper performance of Signal Converter operation can be made at convenient intervals; e.g., upon process shutdown, semiannually, or whenever system maintenance is scheduled. The applicable procedure is outlined in subsection 2.3 Performance Verification.

The Converter has three modes of operation:

- monitoring - normal operation
- configuration - used to display and change parameters
- calibration - used to calibrate converter and make adjustments which are only required in special cases

1.2 Monitoring Mode

When the converter is in "monitoring mode" the display normally shows flowrate and totalization in a two line display as shown in Figure 1-1. Range units and totalizer units can be changed in configuration mode.

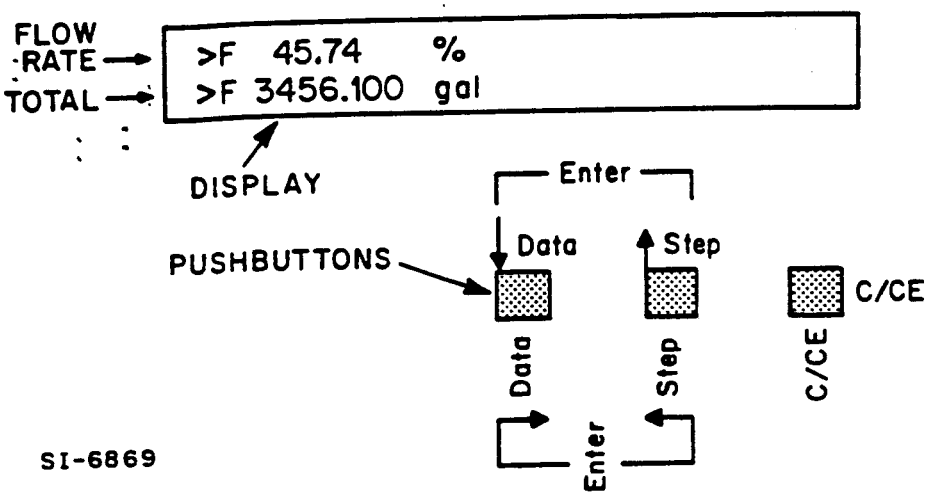


FIGURE 1-1. 50XM DISPLAY AND PUSHBUTTONS

1.3 Configuration Mode

When the "C/CE" pushbutton shown in Figure 1-1 is pressed, the display shows messages and database parameters instead of flow data. The first message displayed the first time the C/CE button is pressed after the Converter is powered up is "Prog. Protection ON". As long as program protection is on, database parameters can be displayed BUT NOT CHANGED. If program protection is turned off, the parameters may be changed using the "Data" and "Step" pushbuttons. To make a change take effect push the "Data" and Step" buttons simultaneously; this is the "ENTER" function. The parameters which can be changed in configuration mode are:

- range units
- totalizer units
- meter capacity
- forward and reverse ranges
- flow
- pulse width
- pulse factor
- density
- damping
- low flow cut-off
- noise reduction
- totalizer reset
- totalizer overflow
- error memory
- flow indication
- multiplex display
- language
- output current
- data link
- system zero adjust (for converted meters requiring zero adjust)
- empty pipe detector (option)

Note that it is also possible to display the software level and the Converter model number, and to run self checks when in configuration mode. The software level can only be changed by replacing the EPROM.

Detailed instructions for the use of configuration mode are provided in Instruction Bulletin 50XM1000B.

1.4 Calibration Mode

Calibration mode is used to calibrate the Converter and to make adjustments which are only required in special cases. Calibration requires the use of an F&P Series D55XC2000 EMF Signal Simulator as described in Section 2 of this manual. Special adjustments may require the use of test equipment as described in Section 2 of this manual.

NOTE

The 50XM Signal Converter should NEVER require recalibration in its lifetime, unless a hardware failure has occurred. If the NVRAM proves defective, calibration data must be reentered. In the event of component failure, existing calibration data may no longer be valid.

Calibration mode is used to:

- set maximum velocity
- set span adjust-forward flow
- set span adjust-reverse flow
- set zero adjust
- adjust current output
- enter range DN (cal factor)
- select flow direction to be measured
- display driver frequency
- display unique factory-installed instrument number
- display line power interruption count and reset counter
- execute a "warm" CPU hardware reset
- turn on function sending data to the data link as well as the Converter

IMPORTANT

DO NOT ATTEMPT TO CHANGE THE SPAN ADJUST-FORWARD FLOW, SPAN ADJUST-REVERSE FLOW, OR ZERO ADJUST UNLESS AN F&P EMF SIGNAL SIMULATOR IS AVAILABLE TO USE DURING THE PROCEDURE.

THE LAST ITEM IN THE CALIBRATION MENU SEQUENCE IS "INITIALIZATION". IF THIS ITEM IS SELECTED ALL PARAMETERS ARE SET TO THE DEFAULT VALUES, REPLACING THE FACTORY-INSTALLED SETTINGS. THEREFORE, EXTREME CAUTION SHOULD BE EXERCISED IN USING "INITIALIZATION".

Calibration procedures are described in Section 2 of this manual.

2.0 CALIBRATION

2.1 General Discussion

NOTE
The 50XM Signal Converter should NEVER require recalibration in its lifetime, unless a hardware failure has occurred. If the NVRAM proves defective, calibration data must be reentered. In the event of component failure, existing calibration data may no longer be valid.

One notable feature of the type 50XM Converter is that it can be configured independent of any particular primary, as long as the flowmeters are of the same size and use the constant meter factor/size design concept. Thus, the design of the microprocessor-based 50XM Converter permits configuration and calibration of the Converter prior to its installation.

Each Converter is configured and precisely calibrated at the factory in accordance with customer specified flow parameters.

Because the flow metering system is precalibrated, it is generally ready for on-line service as received. To place the flow metering system in operation, proceed as outlined in Section 3 of Instruction Bulletin 50XM1000B.

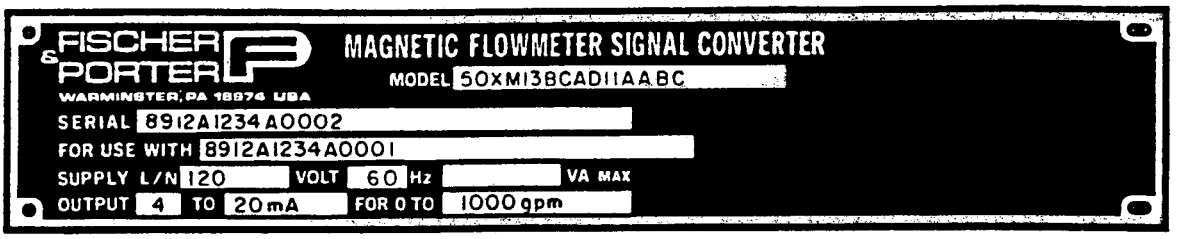
In the event that the specified system flow parameters or engineering units are to be changed, the Signal Converter must be reconfigured to agree with the revised flow values. The procedure is also described in Section 3 of Instruction Bulletin 50XM1000B.

Signal Converter performance can be verified periodically using the procedure described in Section 2.3 of this manual. If problems are experienced which MAY be originating with the Signal Processor, use the performance verification procedure FIRST. Recalibration should be done only when it has been determined that it is actually required. If calibration IS necessary, it can be done using the procedure described in subsection 2.7.

Performance verification and calibration of the Series 50XM1000 Signal Converter require the use of the F&P Model D55XC2000 EMF Signal Simulator. The Signal Simulator is supplied with an interface adaptor which includes test cables that mate with receptacles provided on the Signal Converter assembly.

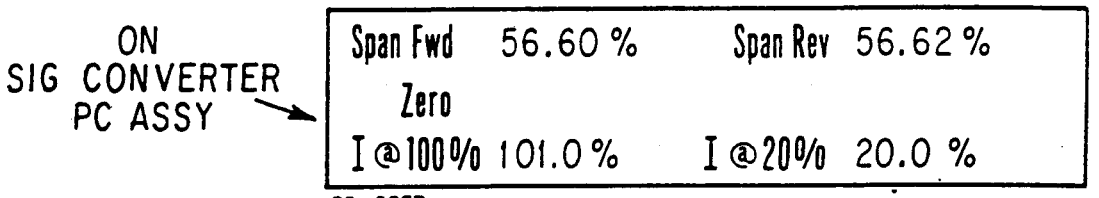
Essential calibration data is recorded and listed on a data tag that is then attached at the factory to the side of a transformer in the Signal Converter assembly. The calibration data provided can be used to restore the signal converter to a calibrated condition when data held in the NVRAM has been corrupted. (RAM corruption can result from a lightening strike or severe electrical disturbance near the installation site.) In this event, all of the calibration data can be re-entered manually. However, if the Signal Converter has malfunctioned and a defective component must be replaced, the calibration data is no longer valid; the unit must then be recalibrated as described in this section.

Typical data and calibration tags are shown in Figures 2-1 and 2-2.



SD-99-1905

FIGURE 2-1. TYPICAL DATA TAG, REMOTE MOUNTED CONVERTER



SI-6857

FIGURE 2-2. TYPICAL XM CALIBRATION TAG

Should it be necessary to replace the Signal Converter assembly, the operator should record the operating parameters because these values must be entered in the replacement Converter. The replacement Converter will also be factory calibrated, eliminating field calibration requirements. Simply enter the noted operating parameters and the system can be returned to service.

2.2 Test Equipment Requirements

2.2.1 Equipment

Test equipment needed for Signal Converter calibration includes the following:

1) F&P Series D55XC2000 EMF Signal Simulator

2) Electronic Totalizer/Frequency Counter (0-10 kHz)

3) Digital Voltmeter (typically, 0-10 V dc)

4) Electromechanical Counter or Electronic Totalizer (as applicable for 0-15 Hz* max, or 0-4 kHz)

5) 500 ohm ±0.05%, 1/2 W, precision resistor

*assumed max count rate of electromechanical counter

Typical test wiring is shown in Figure 2-3. Interconnection wiring diagrams for the 50XM Signal Converter are included in the INSTALLATION section of Instruction Bulletin 50XM1000 and should be used to supplement this discussion.

Use of an F&P Model 53SU1000 SUPERVISOR, 53SU5000 SUPERVISOR-PC, or similar intelligent data handling equipment will be needed for interfacing with the RS 232C or RS 485 I/O signals, when supplied. Signal wiring is shown on the applicable system interconnecting diagram. When communication is implemented via the HART™ Protocol, applicable interconnection diagrams are contained in the technical literature provided for the particular communicator; e.g., the Hand-Held Computer (IB 50HC1000).

2.2.2 Signal Simulator

The Series D55XC2000 EMF Signal Simulator provides an adjustable process variable flow signal suitable for on-site performance and accuracy tests of the Model 50XM1000 EMF Signal Converter.

The Signal Simulator is supplied with an interface adaptor which includes test cables that mate with receptacles provided on the Signal Converter assembly.

Typically, when these test cables are connected, power for operation of the 50XM Signal Converter is supplied by the EMF Signal Simulator.

Attachment of the test cables from the Signal Simulator to the Signal Converter is illustrated in Figure 2-3. The verification procedure is described in subsection 2.3.

HART™ Protocol is a trademark of Rosemount,Inc.

The Simulator signal range can be preset via 3 decade type (0-9) digital switches. These preset switches permit precise setting of the simulated flow signal over a range of 0.00 to 9.99 m/s in 0.01 m/s increments. Refer to Instruction Bulletin 55XC2000 for details regarding operating controls, range setting, power requirements,etc.

The Converter power supply should correspond to Simulator power supply. The ac line plug (mains plug) should be connected so that the "Phase" lamp is energized. If dc supply,observe polarity as given in Figure 2-3.

CAUTION

Applying 120 V ac power to a Converter assembly that is supplied for 24 V dc operation will result in destruction of the Signal Converter.

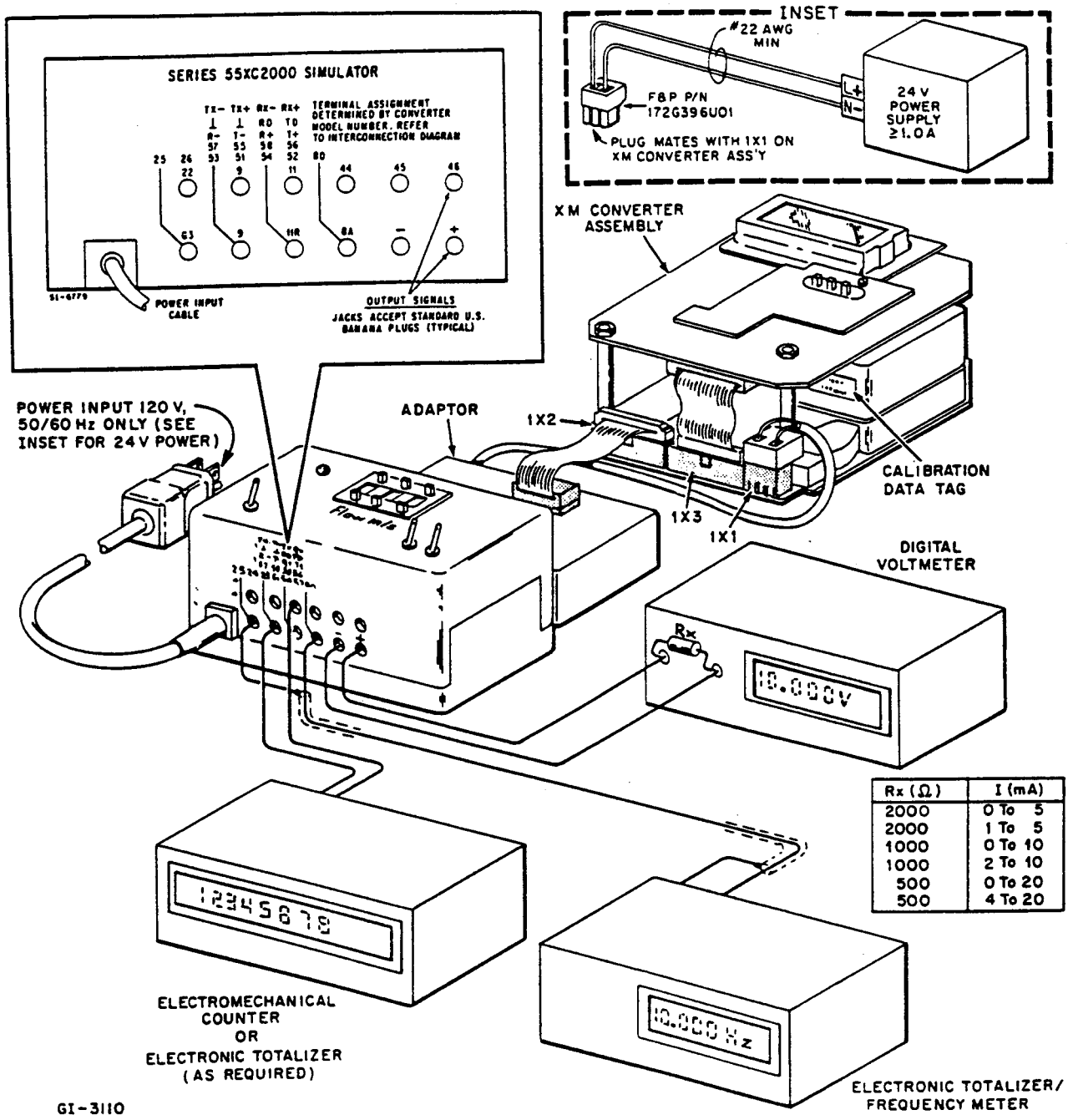


FIGURE 2-3 TEST WIRING FOR 50XM1000

2.3 Performance Verification

To verify calibration of the XM Converter,connect the 55XC2000 Simulator as shown in Figure 2-3.

When the dynamic test is to be made in the customer's instrument service shop, especially if the total volume processed is needed for inventory or billing purposes, the total volume should be logged before disrupting electrical interconnections.

Enter a range value on the 3-digit range selector and read the output on the Converter assembly liquid crystal display or metering devices connected to the Simulator output(s).

For ... Qmax DN velocity = 33.33 ft/s

The indicator reading can be calculated as follows:

$$\% \text{ Indicator Display} = \frac{\text{m/s}}{10.159} \times \frac{\text{Range DN}}{\text{Range} > \text{F or} < \text{R}} \times 100$$

where, m/s = Simulator velocity setting
Range DN = meter Cal factor (automatically corrected by the computer for either 33.33 ft/s or 10.0 m/s)

Alternatively, if the Converter is set up for max flow velocity (QmaxDN) = 10 m/s, then the % Indicator Display" calculation would be as follows:

$$\% \text{ Indicator Display} = \frac{\text{m/s}}{10.00} \times \frac{\text{Range DN}}{\text{Range} > \text{F or} < \text{R}} \times 100$$

For example, assume the primary is a 2" size meter with a Cal Factor of 268.372 gpm at 33.33 ft/s, that the Signal Simulator is set for 5.00 m/s, and Range > F is preset for 250 gpm max, then:

$$\% = \frac{5.00}{10.159} \times \frac{268.372}{250} \times 100$$

$$= 52.8$$

If the current output is preset for 0-20 mA and the load resistor (Rx) is 500 ohm (refer to Figure 2-3 Test Wiring), then the voltage reading displayed by the DVM should be:

$$E = \left(Imax \times \frac{Indicator\ \%}{100} \right) (Rx)$$

$$= \left(0.020 \times \frac{52.8}{100.0}\right)(500)$$

$$= 5.28\ V\ dc$$

The flow velocity in ft/s at the operating flow rate can be calculated as shown below.

$$ft/s = \frac{OPER(gpm) \times 33.33}{CALFACTOR(gpm)}$$

Using values given in the above example,

$$ft/s = \frac{250 \times 33.33}{268.372} = 31.0$$

To convert velocity in ft/s to m/s,

$$m/s = \frac{ft/s}{3.2808}$$

typically,

$$m/s = \frac{31.0}{3.2808} = 9.45$$

When satisfactory performance has been demonstrated, select the desired current output span (0-20/4-20/0-10/2-10 mA) before returning the Converter to service. 4-20 mA output is standard.

2.4 Initialization

The last item in the calibration menu sequence is "Initialization". If this item is selected all parameters are set to the default values, replacing the factory-installed settings. Therefore, extreme caution should be exercised in using "Initialization". In general, "Initialization" need only be performed if there has been a loss of data in NVRAM memory. If a record of the calibration data is available from the tag, the data should be re-entered following the initialization. Otherwise, the unit must be calibrated again to place it back to within specified accuracy.

2.5 Menu Sequence

The following list represents the display menu sequence of the Design Level B Series 50XM1000 Converter observed when running software version C.10 and using the Step button to move forward through the menu items. The first message displayed the first time the C/CE button is pressed after the Converter is powered up is "Prog. Protection ON". Thereafter, pressing the C/CE button while the Converter is in monitoring mode will display the parameter on display when configuration or calibration mode was last exited. There is wraparound between the last and the first items on the menu.

The menu items beginning the list are configuration mode functions. Calibration mode items are those items on the list following "code number". These items are preceded with " * " on the list; these calibration mode functions are inhibited unless "code" is selected. Submenu lists (preceded with a "+") only appear if the associated upper level is selected.

Where an item has two simple choices, the second selection is shown following a "//".

```
Prog. protection
off  //on

Language
English

Meter size    (available only for fixed range per size)
25 mm  1 in

Range unit
 gpm

Cal-fact  10m/s //33ft/s
53.6744 gpm

Range >F
53.6744 gpm

Range <R
53.6744 gpm

Totalizer unit
 gal

Pulse factor >F
1.00000 / gal

Pulse factor <R
1.00000 / gal

Pulse width
30.000 ms
```

```
Low flow cut-off
1.0000 %

Damping
6.0000 s

Density                    Note:  may only be changed
1.00000 g/cm3              when units are mass

Flow
% //-selected units-

System zero adj.
0.0000 Hz

Submenu
Current output
   +  Current output
      4 - 20 mA
   +  Iout at alarm
      0 % //130 %

Submenu
Data link
   +  Communication
      UDCI binary //ASCII
   +  Instr. address
      000
   +  Baudrate
      1200 bd

Submenu
Self check
   +  Self check
      Iout
   +  Self check
      NVRAM
   +  Self check
      EPROM
   +  Self check
      Alarm contact
   +  Self check
      Dir. contact
   +  Self check
      Switch S206
   +  Self check
      Data link
   +  Self check
      Fout
   +  Self check
      Display
```

```
   +  Self check
      Zero return
   +  Self check
      Totalizer reset
   +  Self check
      Port A
   +  Self check
      Port B

Submenu
Detector e.pipe
   +  Detector e.pipe
      on //off
   +  Threshold
      070
   +  Adjust
      Detector e.pipe

Noise reduction
off //on

Totalizer >F
reset

Overflow >F
000

Totalizer <R
reset

Overflow <R
000

Error memory                    Shown with no
. . . . . .                     errors present

Flow indication
normal//invers

Multiplex displ.
off //on

D50XM1000  04/89      Note:  Other program versions
D699B064U01  C.10            may differ somewhat

Code number
 ####

*  QmaxDN velocity
   10 m/s //33.33 ft/s

*  Span adjust >F
   56.250 %
```

* Span adjust <R
  56.250 %

* Zero adjust
  0.0000 Hz

* Adjust Iout 100%
  100.00

* Adjust Iout 20%
  20.000

* Range DN
  fixed //programmable

* Flow direction
  forward/reverse //forward

* Excitation
  7-1/2 Hz //15 Hz

Read Only. Not software selectable.

* Instrument no.
  1234

* Mains interrupt
  237

* Analog reset
  62

* ** Reset **

* output data
  fast

* Output data
  slow

* Initialization

2.6 Engineering Units

Available flow units are listed below. Entries for volumetric units followed by a "/" may use any of the units of time following the "/". Entries preceded with a "^" permit use of a density entry other than 1.000.

```
  igps igpm igph
  mgd
  gpm gph
  bbl/s /min /h
  bls/day /min /h
^ kg/s /min /h
^ t/s /min /h      where ton = 1000 kgm (not U.S. ton)
^ gram/s /mi /h
  ml/s /min /h
  l/s /min /h
  hl/s /min /h
  m3/s /min /h
```

The following are totalization units available:

```
  igal
  gal
  mgal
  bbl
  bls
^ kg
^ t
^ gram
  ml
  l
  hl
  m3
```

NOTE

Engineering units may be selected via the display menu or from a remote terminal connected to the 50XM data link. In the latter case, selection is made by use of a 3-digit code number as defined in Communications Manual 50XM1000 (refer to Data Base, data points B11 and B22).

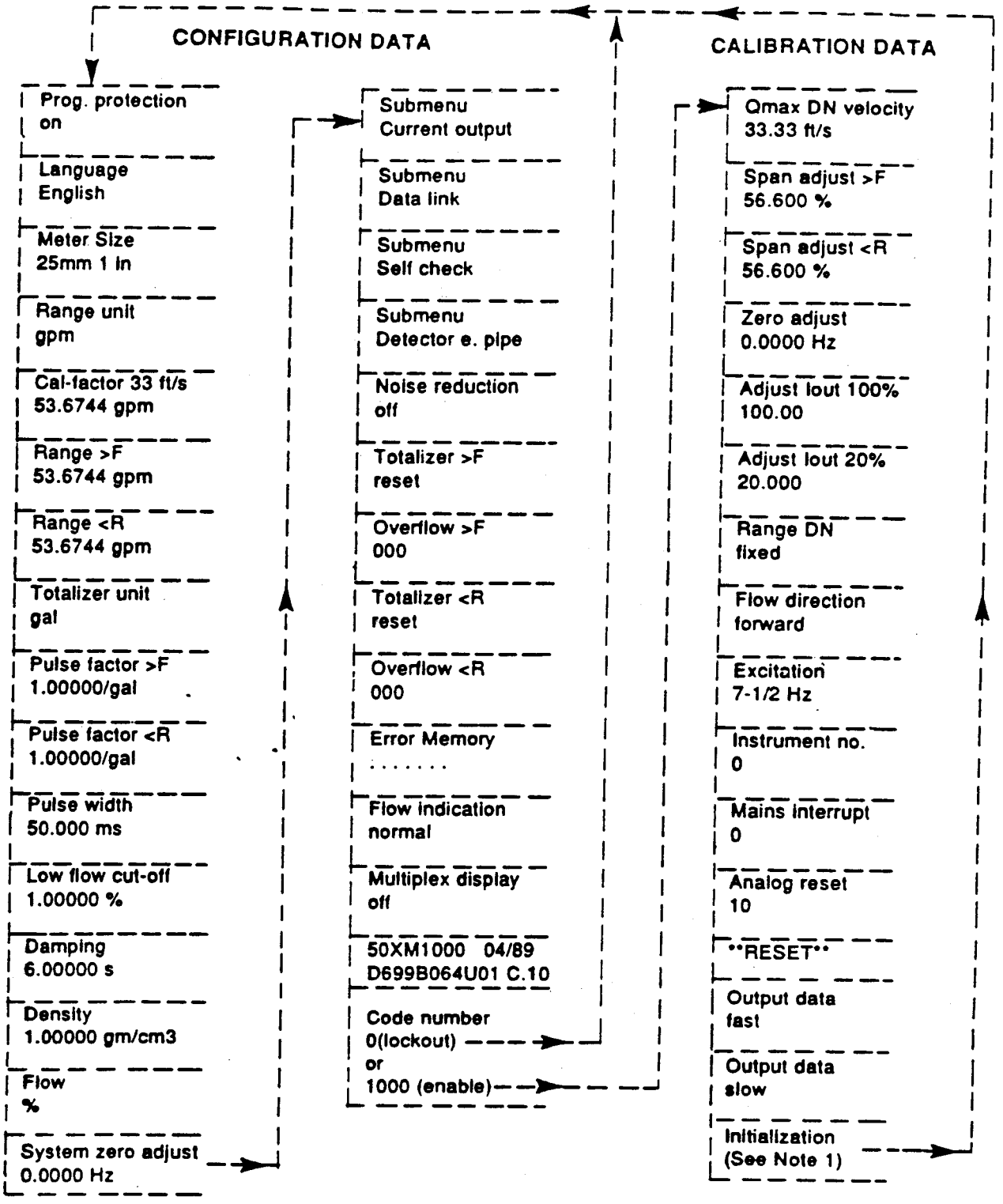


FIGURE 2-4 CONFIGURATION & CALIBRATION FLOWCHART

NOTE 1. - Preset values or conditions noted in the above flowchart are "default" values preset into the database upon selection of the INITIALIZATION subroutine.

2.7 Calibration Procedure

NOTE

The 50XM Signal Converter should NEVER require recalibration in its lifetime, unless a hardware failure has occurred. If the NVRAM proves defective, calibration data must be reentered. In the event of component failure, existing calibration data may no longer be valid.

The F&P Type 50XM Converter software includes some configuring routines whose use permits special registers specific to the calibration of the device to be set. When the calibration mode has been invoked, it is possible to access parameters normally blocked because they are either linked to options not installed or because they are not compatible with other parametric settings.

For example, the software includes an automatic module identification for the RS485 and RS232 serial interface modules. When configuring the 50XM the parameters "ADDRESS", "BAUD RATE" and "COMMUNICATION" in the "Data Link" submenu are programmable only if a serial interface module has been installed. The absence of such a module is indicated by "ERROR-NOT AVAILABLE" on the display whenever an attempt is made to call up that parameter. However, in the calibration mode, any of these menu items may be accessed and changed.

NOTE

This procedure has been prepared for use with software version B.15 or C.10 of the F&P type 50XM Signal Converter. Other versions will be similar but not necessarily identical and may have features different from those discussed in this section.

CAUTION

ONLY experienced electronic technicians should attempt to calibrate the Signal Converter. Erroneous calibration will result in unsatisfactory performance.

CAUTION

Some of the surface mounted IC devices used in the Signal Converter are static sensitive and may be damaged by improper handling. When adjusting or servicing the Signal Converter, use of a grounded wrist strap is recommended to preclude inadvertent damage to the integral solid state circuitry.

2.7.1 Code Number

Access to special functions including calibration parameters is achieved by entering the proper code number. In order to enter the factory calibration mode it is necessary to enter the number 1000. The calibration mode is locked out with the entry of a number other than 1000 or after a power-on reset. Program protection must be "OFF" in order to make this entry.

```
Enter code number 1000
```

2.7.2 Maximum Velocity

Velocity at Cal Factor

```
QmaxDN velocity      33.33 ft/s
```

This parameter is used to select either 10 m/s or 33.33 ft/s as the velocity corresponding to Cal factor. Span calibration adjustments of both frequency and current outputs are to be made with this parameter selected to 10 m/s and the display set to indicate flow in "%".

2.7.2.1 Span Adjust-Forward Flow

Span Adjust forward flow (shown below as not adjusted).

NOTE: The Converter range should be changed to correspond with "Range DN" or the "Cal Factor" value for any of the remaining steps.

```
span adjust > F
56.250%
```

This parameter determines the calibration of both the display and the 10 kHz unscaled pulse output and may be set by two different methods. First, a value may be entered manually when the following menu appears following the "Enter" operation:

```
Span adjust > F
 manual    ?
```

The proper value is that which will cause the display readout to indicate 99.90% with an input of 9.99 m/s. This number is present on the converter data tag affixed to the power transformer on the Converter assembly and will be valid unless there has been replacement of analog circuit hardware.

In order to automatically adjust the span, which is the only mode available in older software versions, a flow simulator of the type 55XC2000 must be available. Applicable test wiring is shown in Figure 2-3. The Simulator must be set to 9.99 m/s and switched to the forward flow mode. After scrolling to the "automatic" menu item and pressing "Enter", the adjustment progresses and the display will show:

```
>F>F>F>F>F
 >F>F>F>F>F
```

After a few seconds the adjustment is completed and the Converter reverts to monitoring mode; the display reading will be 99.9% (+/- 0.1%). Push the C/CE button to display the value computed such as:

```
Span adjust >F
 56.255 %
```

After approximately 20 seconds the Converter will return to monitoring mode.

2.7.2.2 Span Adjust - Reverse Flow

```
Span adjust <R
 56.273
```

This adjustment is performed in the same manner as that for the forward direction except that in the automatic mode the simulator is to be set at 9.99 m/s "Reverse". Refer to span adjust -forward flow (2.7.2.1) for instructions.

2.7.3 Zero Adjust

```
Zero adjust
 5.0 Hz
```

In order to manually set zero, enter an input of "0.10" m/s FWD, and note the reading obtained. Then enter an input of "0.10" m/s REV, and note the reading obtained. Enter a value into the "Code 1000" Zero adjust menu which ultimately causes these readings to be equal.

Example:

Enter an input of 0.10 m/s FWD = Output.98% of 10 m/s span
Enter an input of 0.10 m/s REV = Output -1.04% of 10 m/s span
Enter an input of -3 Hz as a manual zero.
Outputs will then be +/- 1.01% respectively.

See the following fold-out pages for the analog board and digital board schematics.

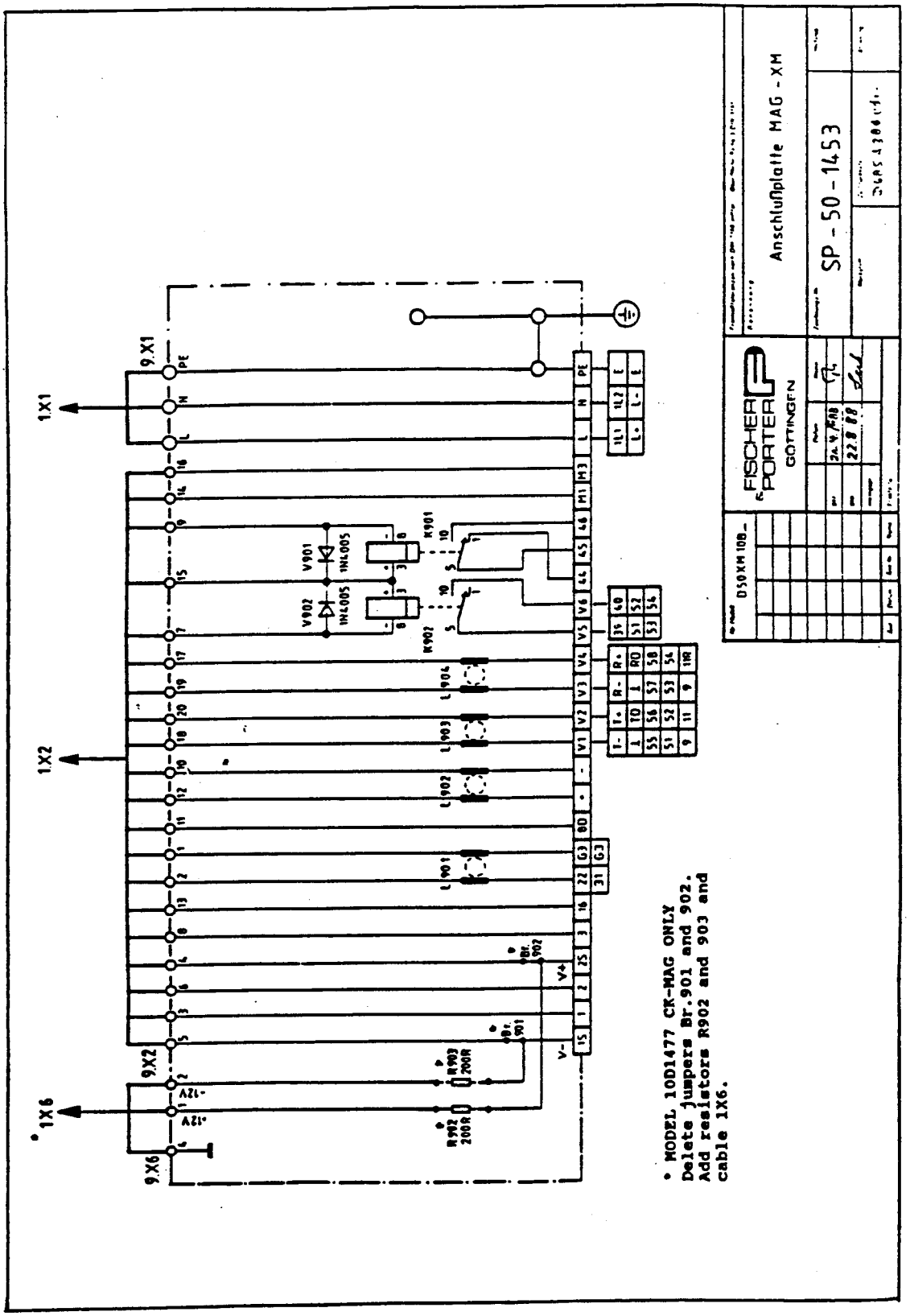


FIGURE 3-17. SCHEMATIC, CUSTOMER CONNECTION BLOCK - CONTACT OUTPUTS

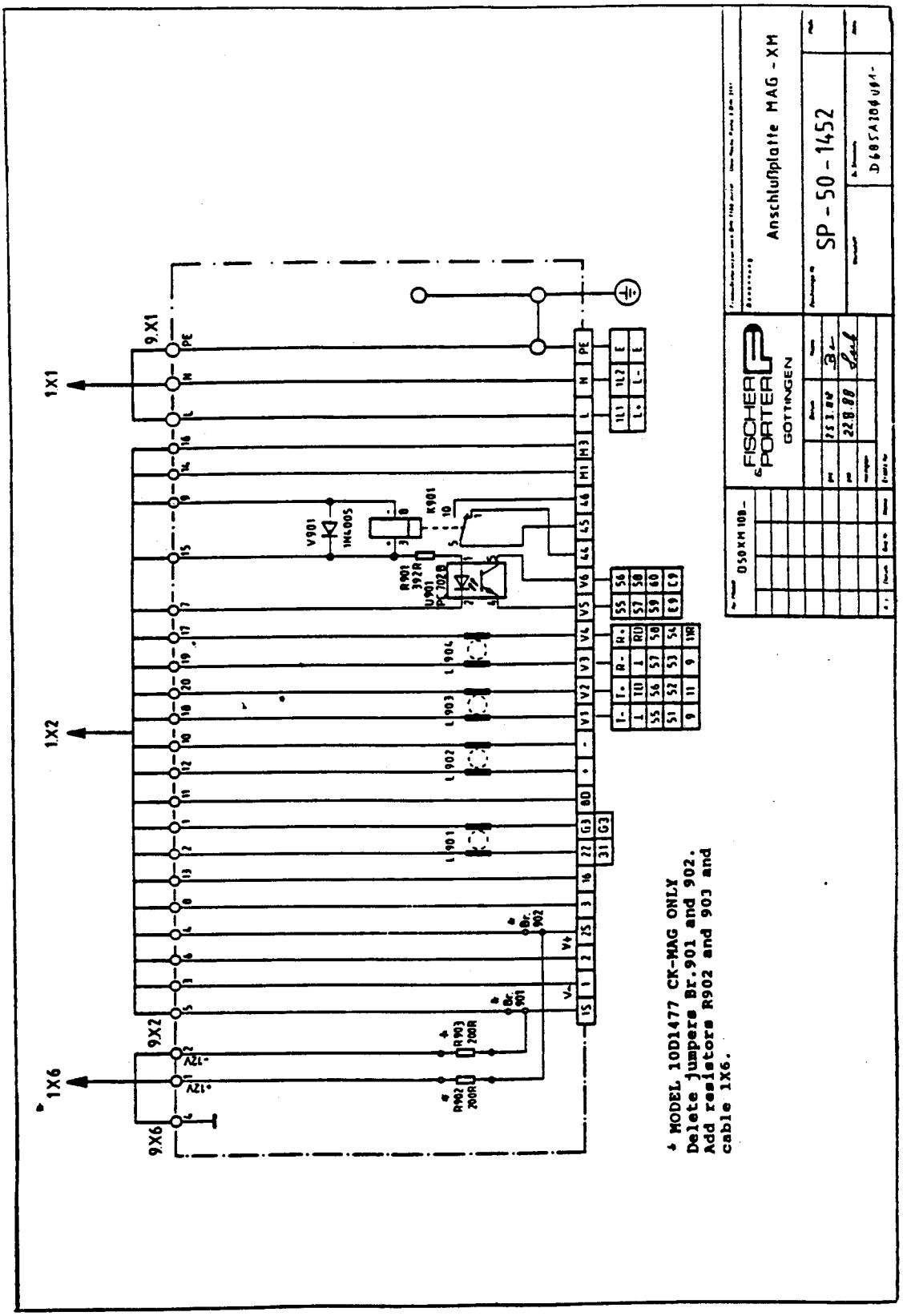


FIGURE 3-16. SCHEMATIC, CUSTOMER CONNECTION BLOCK - OPTO COUPLER & ALARM OUTPUT OPTIONS

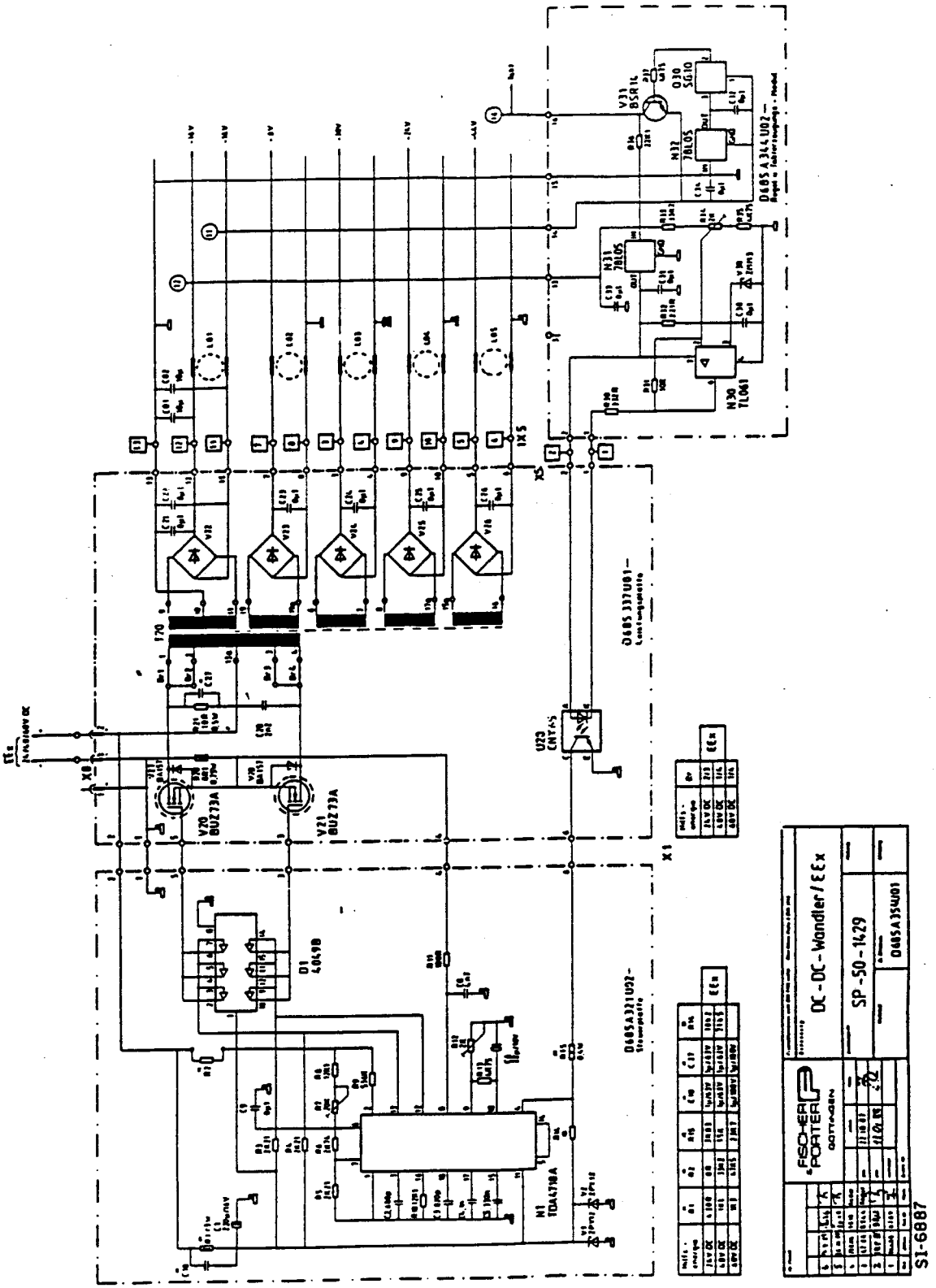


FIGURE 3-15. SCHEMATIC, DC/DC CONVERTER, 24 V

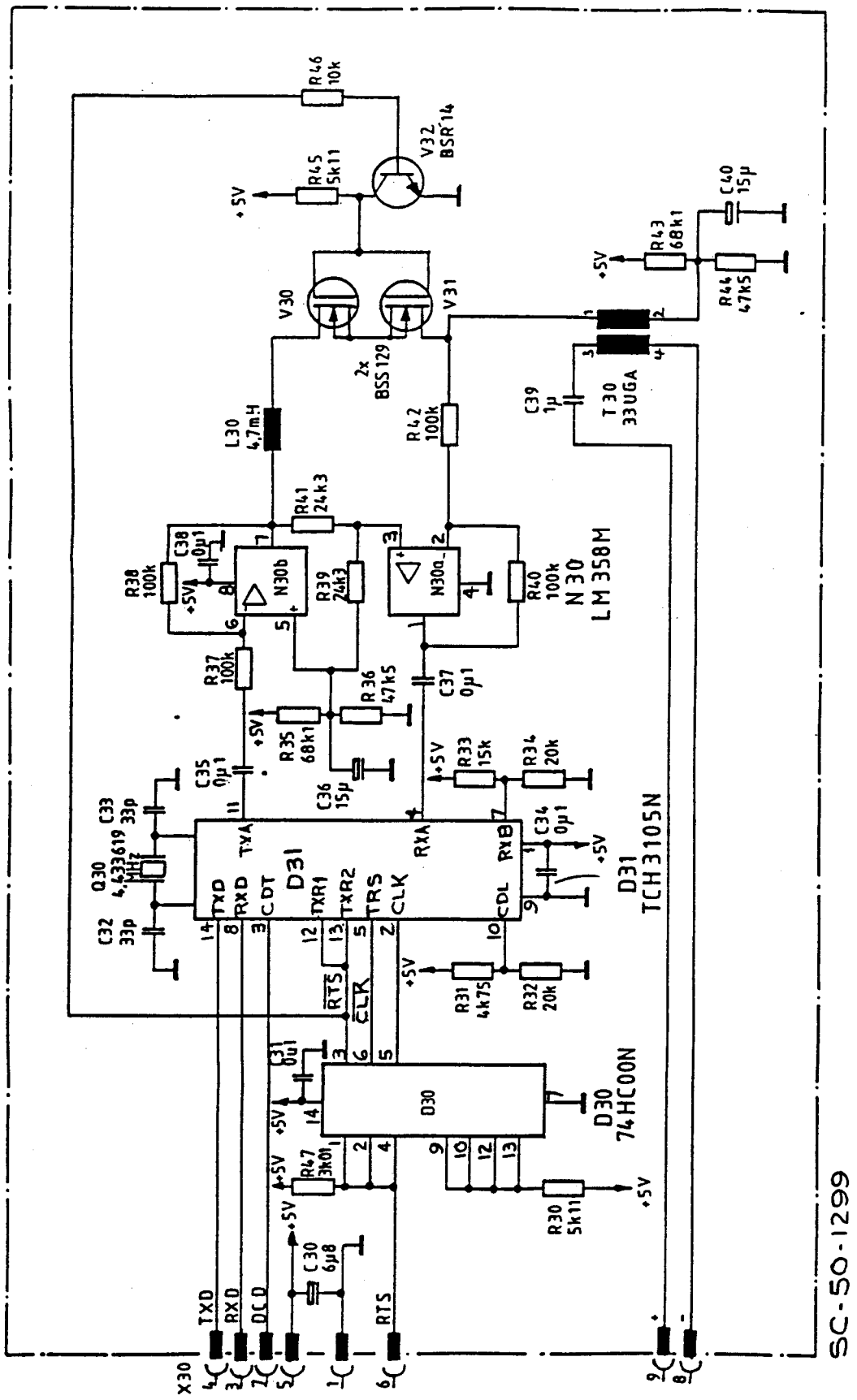
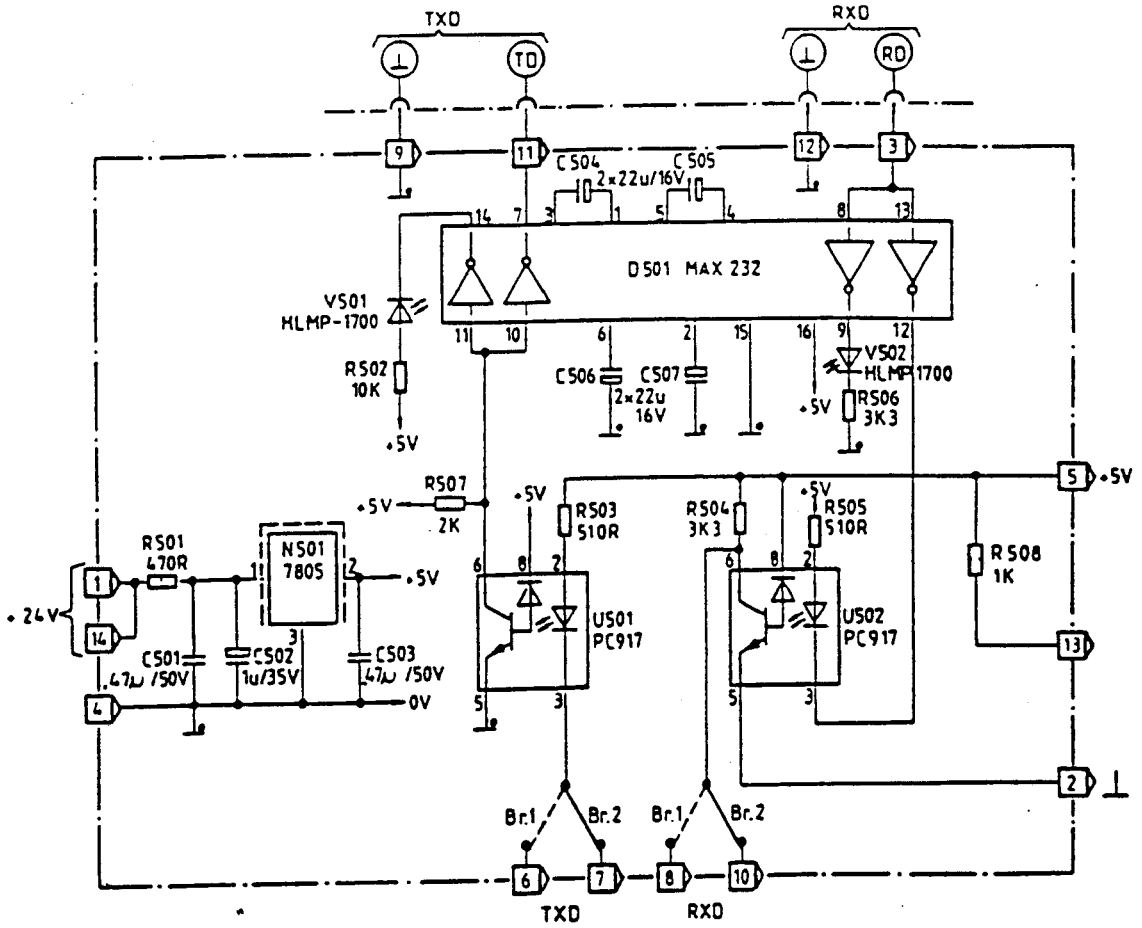


FIGURE 3-14. SCHEMATIC, HART INTERFACE MODULE



4 CONTACT X5

Br.1 - 50 DK3000
Br.2 - 50XM1000

NOTES:

1. SEE SD-50-2318 FOR COMPONENT VALUE DESIGNATION INFORMATION.
2. CIRCUIT COMMON SYMBOLS-

POWER — ANALOG INPUT

A105 MODULE

MATL		SCHEMATIC DATA LINK RS 232C V			FISCHER & PORTER WARMINSTER PA 18974 USA		
DWN	SF 5 DEC 88	ENGR	HAS 14 FEB 89	O/E	C. VAMOS 13 FEB 89	PART NUMBER	REV
CHKD	~	MOD	D50XM1000B	M/E	B. HAYWOOD 13 FEB 89	C SC-50-1277	O
SUPV	H'JOHN 14 FEB 89	AUTH	DP1229-33D				
REF DWG		B/M	CD685A287	SCALE -		DRAWING NUMBER	

SI-6886

FIGURE 3-13. SCHEMATIC, RS 232-C DATA LINK

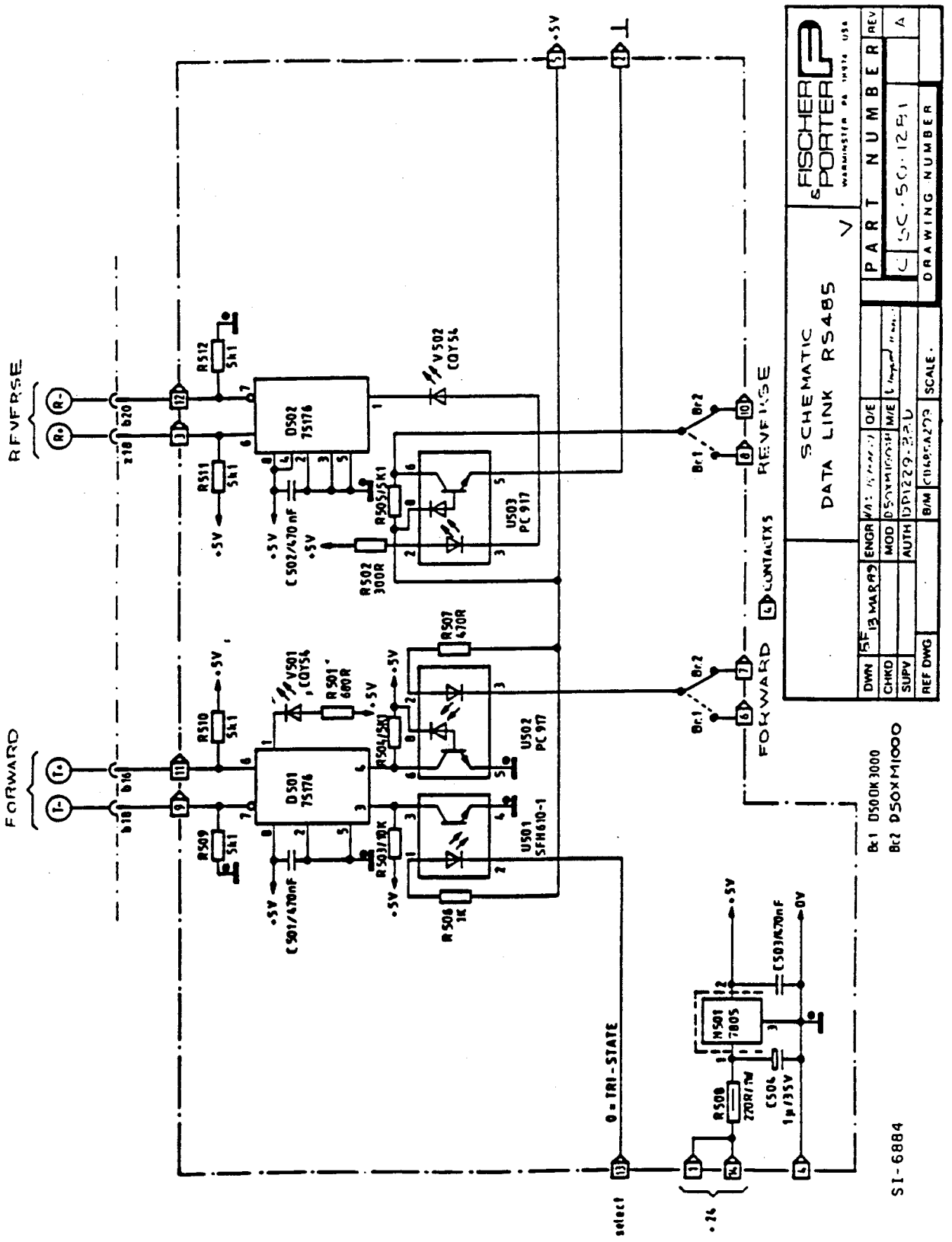
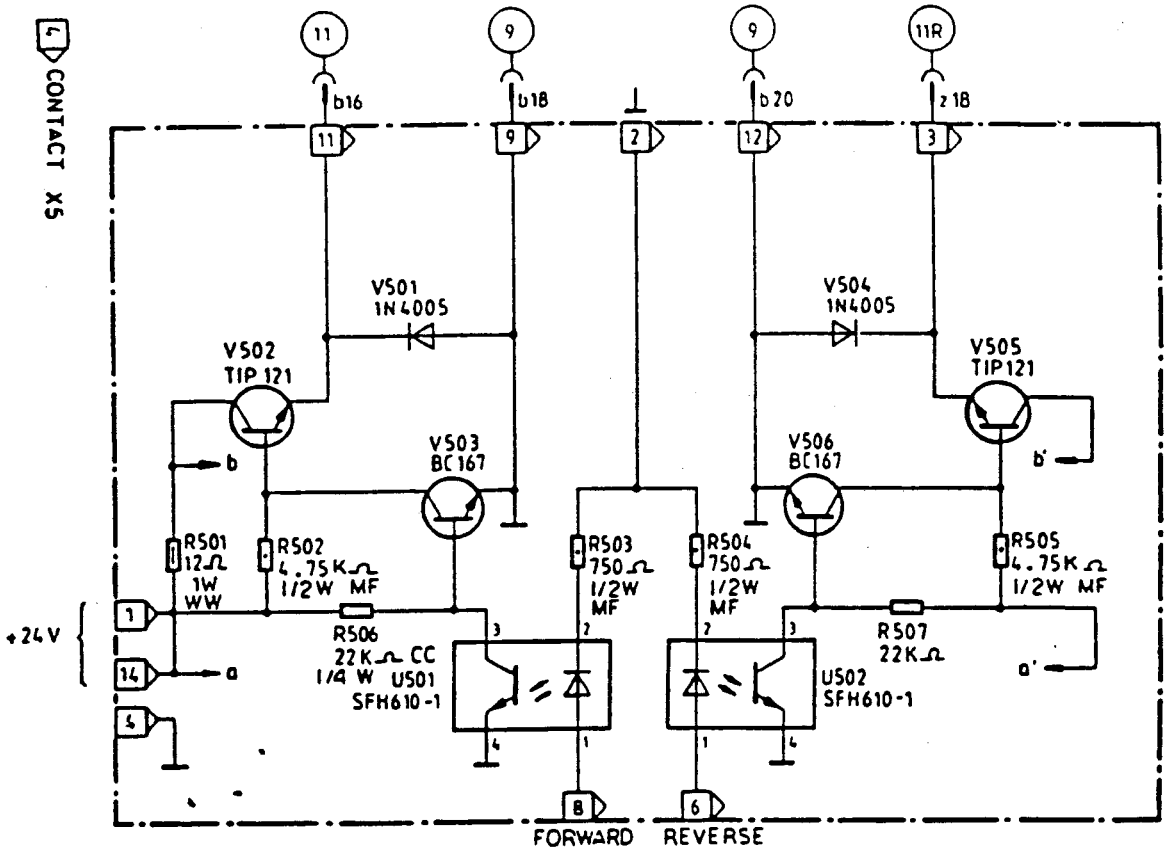


FIGURE 3-12. SCHEMATIC, RS 485 DATA LINK



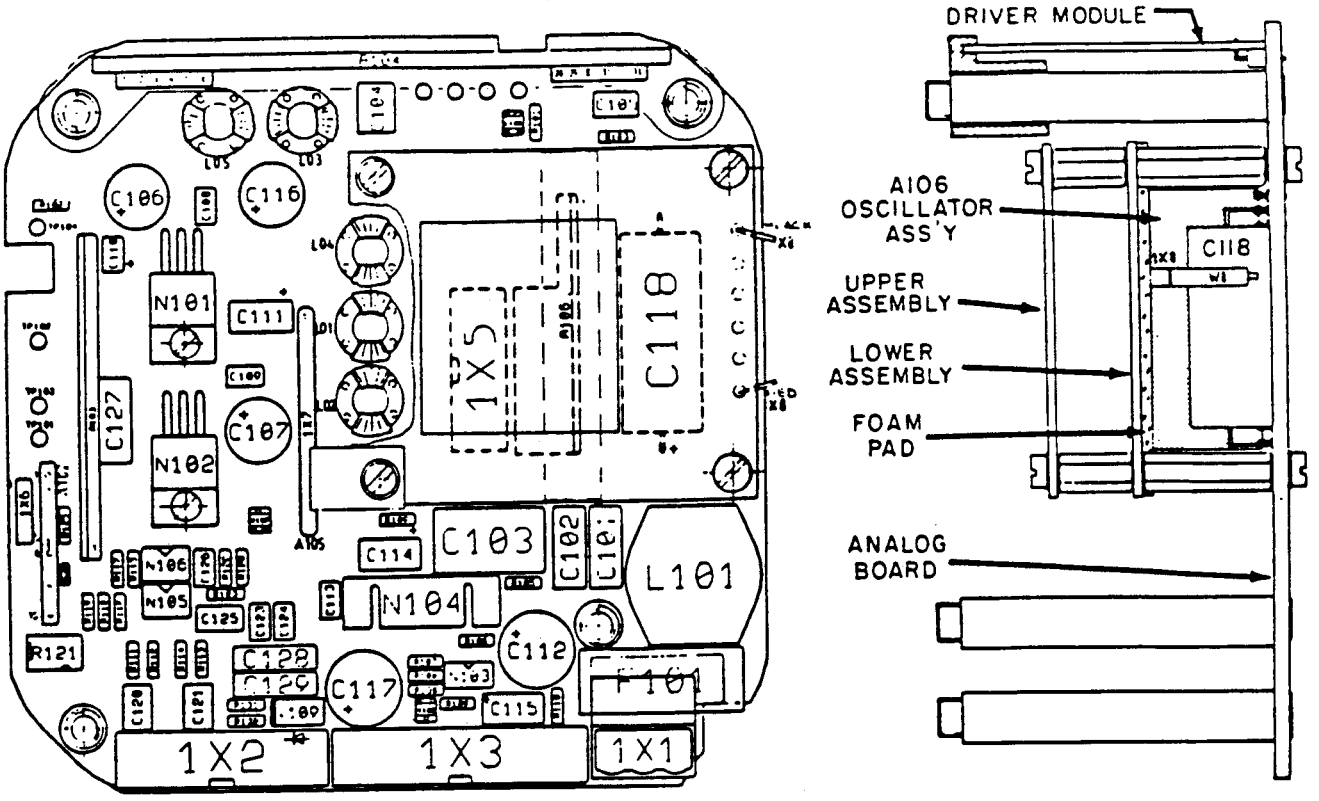
CIRCUIT COMMON SYMBOL-

SCHEMATIC PULSE OUTPUT MODULE					FISCHER & PORTER WARMINSTER PA 18974 USA	
DWN GF 8 NOV 88	ENGR		O/E		PART NUMBER	REV
CHKD	AUTH	DP1229-330	M/E		C SC-50-1273	O
SUPV	MOD	D50XM1000B			DRAWING NUMBER	
REF DWG SP-50-1407	B/M	CDG85A290U01				

FORM 263-285

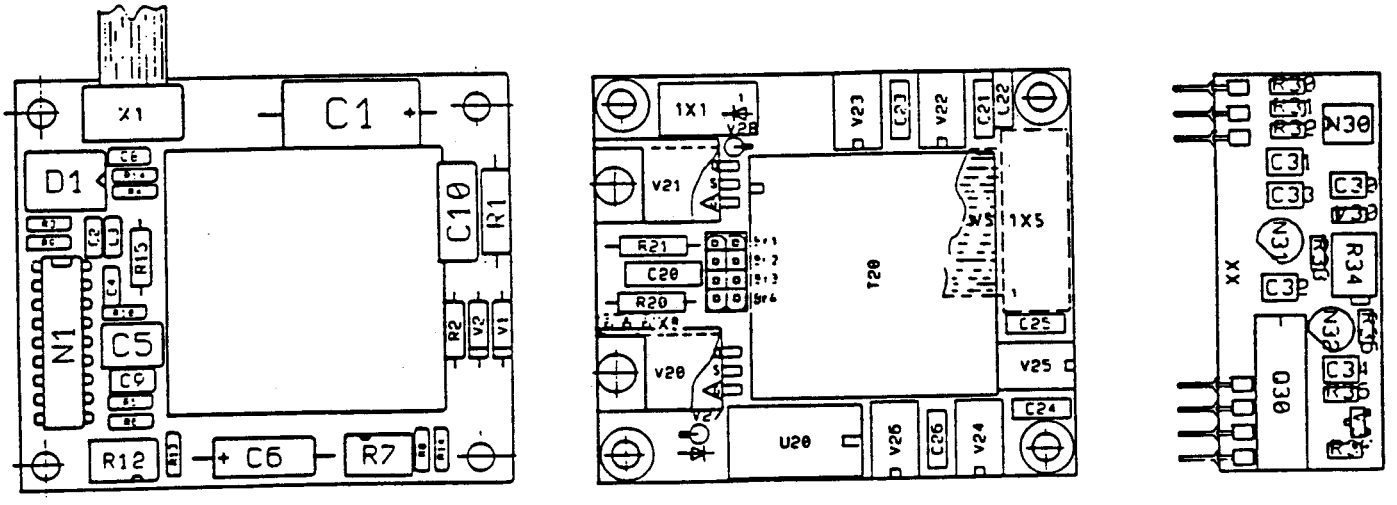
SI-6883

FIGURE 3-11. SCHEMATIC, PULSE OUTPUT MODULE



A. ANALOG BOARD W/dc CONVERTER

B. ASSEMBLY DETAIL



C. LAYOUT, DC-DC CONVERTER (UPPER PC ASSEMBLY)

D. LAYOUT DC-DC CONVERTER (LOWER PC ASSEMBLY)

E. LAYOUT OSCILLATOR ASSEMBLY

SI-6885

FIGURE 3-10. LAYOUT, DC/DC CONVERTER ASSEMBLY

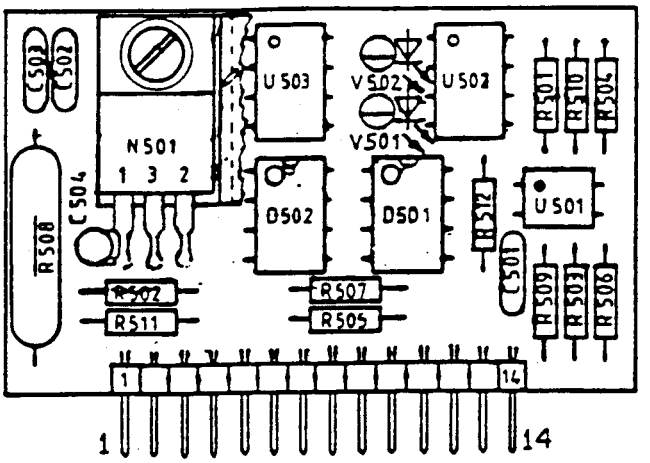


FIGURE 3-8. LAYOUT, RS 485 DATA LINK MODULE (A105)

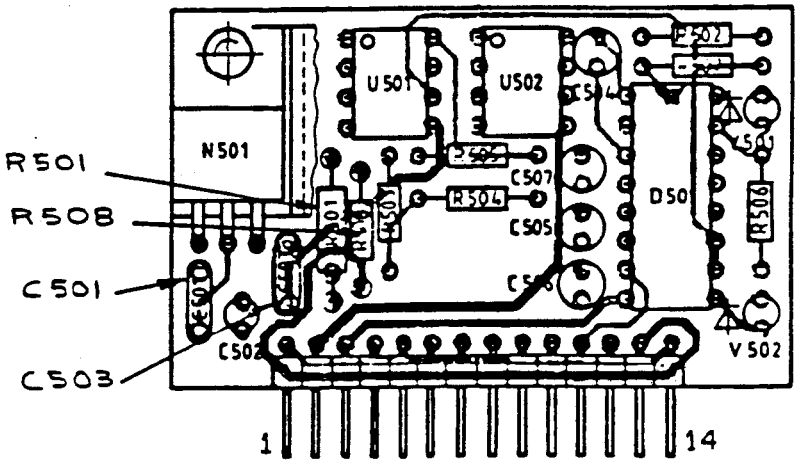
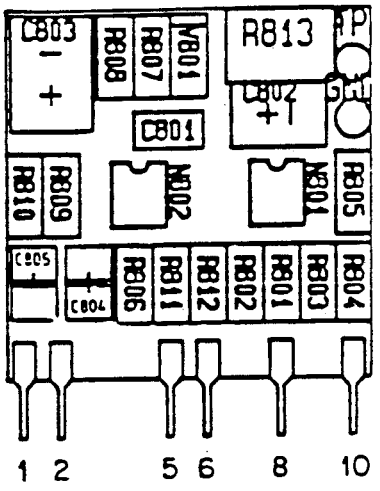


FIGURE 3-9. LAYOUT, RS 232-C DATA LINK MODULE (A105)



SI-6881

FIGURE 3-6. LAYOUT, EMPTY PIPE DETECTOR MODULE (A102)

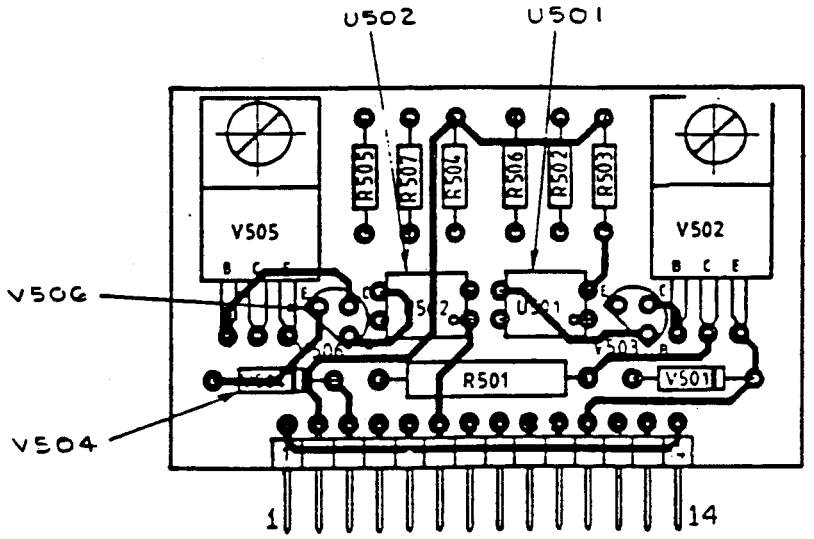


FIGURE 3-7. LAYOUT, PULSE OUTPUT MODULE (A105)

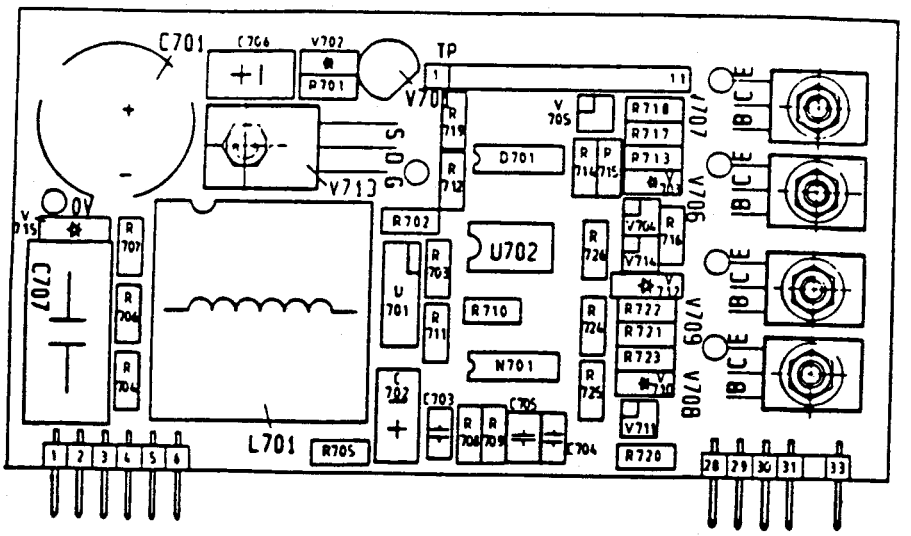
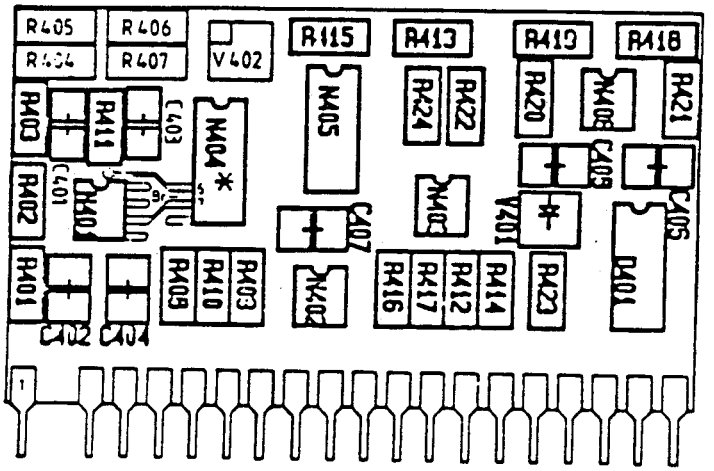


FIGURE 3-4. LAYOUT, DRIVER MODULE (A104)



*N404 NOT USED IN 50XM1000

FIGURE 3-5. LAYOUT, SIGNAL & REFERENCE MODULE (A103)

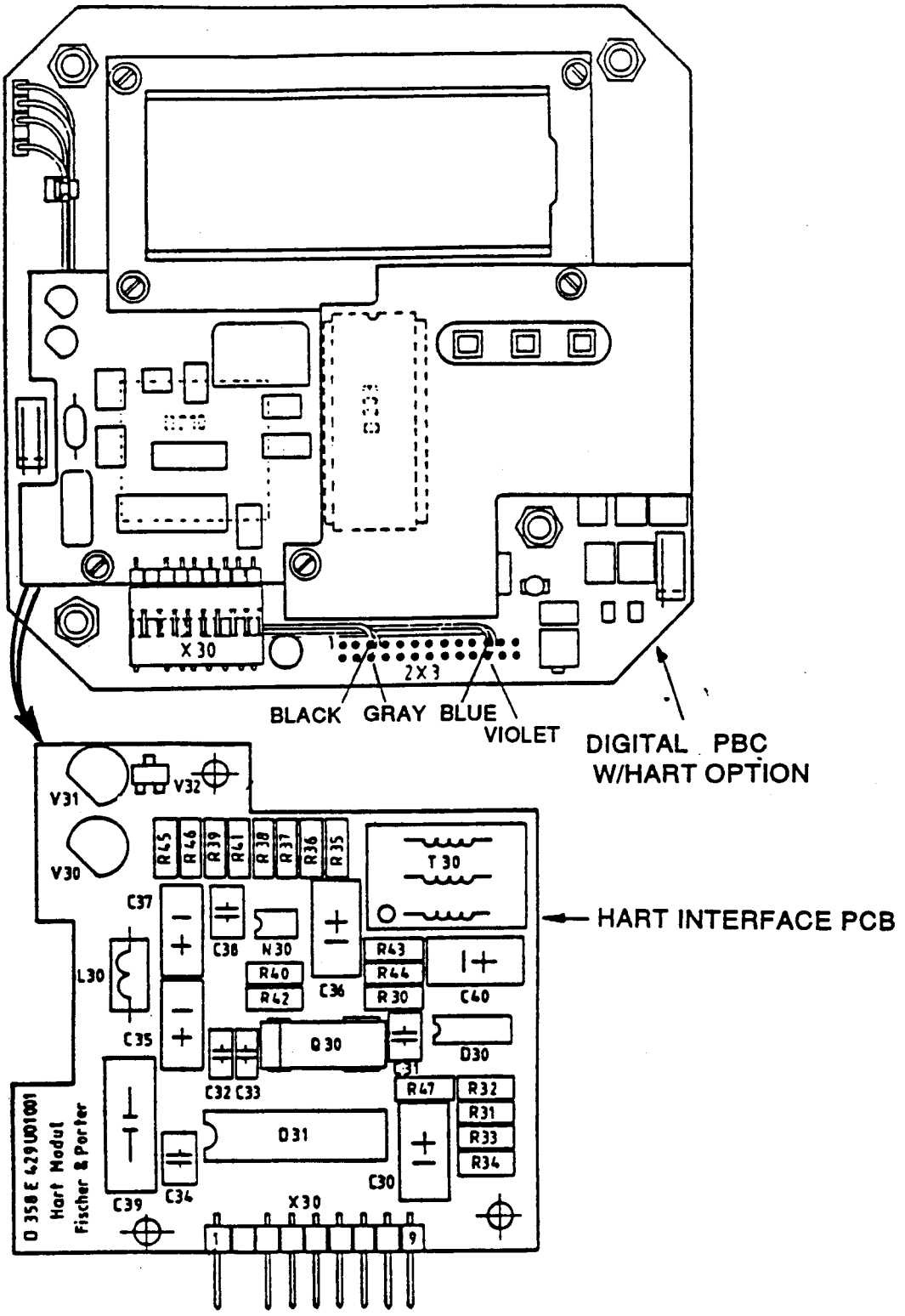


FIGURE 3-3. LAYOUT, DIGITAL PCB WITH HART INTERFACE MODULE

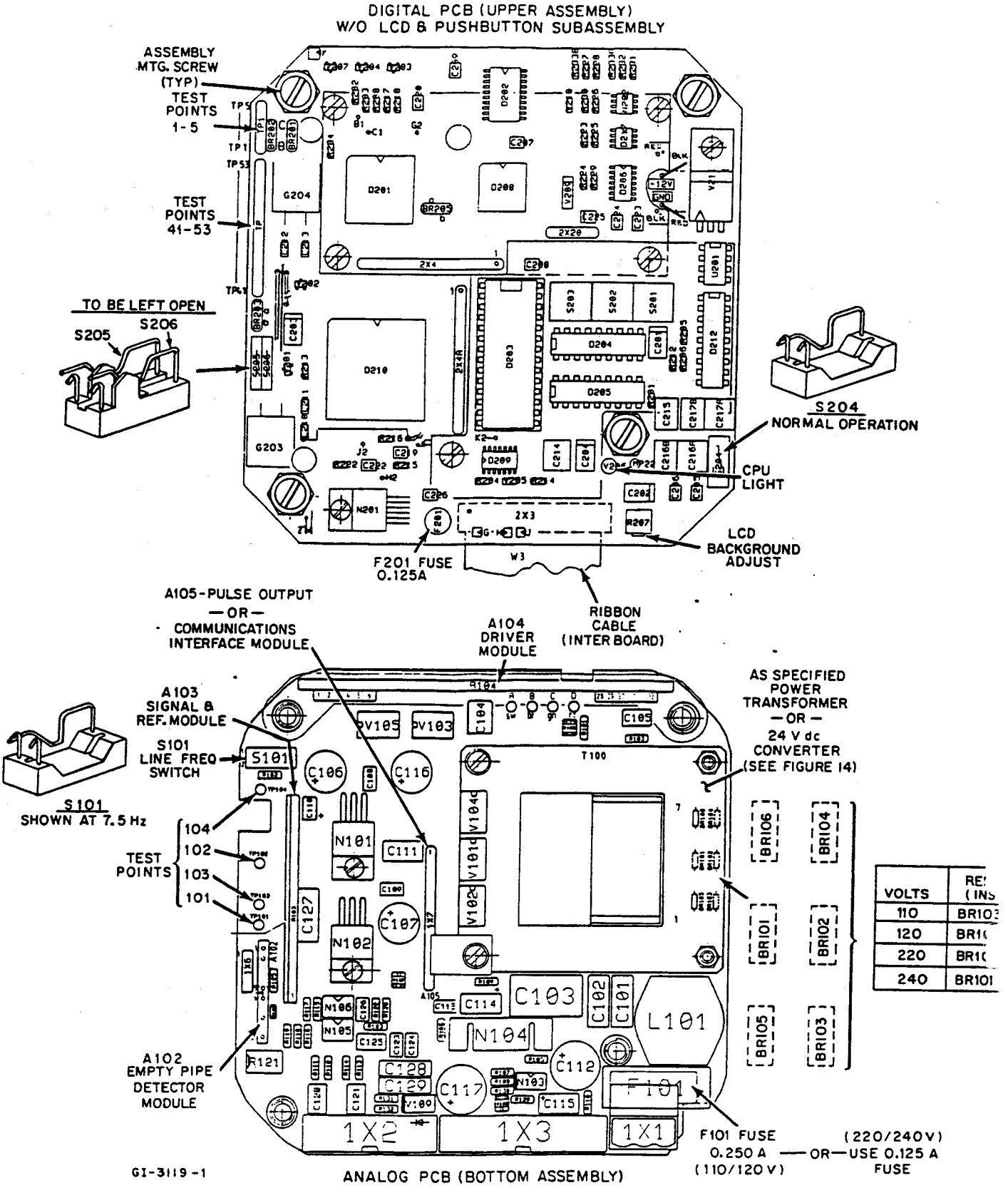


FIGURE 3-2. LAYOUT, ANALOG & DIGITAL PC ASSEMBLIES

The CPU digitally applies the proper span and bias level to the current output pulse train before it is sent to the optically isolated output section. These pulses are then shaped, switched at a precisely regulated amplitude, filtered to a dc voltage level, and finally directed to the transconductance (voltage to current) output stage.

The active pulse outputs are generated in the pulse output timer section, D208. The first two cascaded stages of this IC timer take computed flow scaled to 0 to 64 kHz and multiply that by the pulse factor to develop the basic scaled pulse output frequency. When this time out process is complete, an output pulse must be generated in a third stage of the timer. This pulse is generated by counting an appropriate number of 32 microsecond wide input pulses and holding a logic output high during that interval. This data is multiplexed with flow direction information and directed to either the optional active pulse board or the opto pulse output if so configured. The active pulse outputs will drive a 24 volt dc load of greater than 150 ohms at a rate of up to 4 kHz.

In the remote Converter, the zero return and counter reset features utilize the same input line. Counter reset is optionally obtained by jumpering on the digital board. A contact closure between inputs 22 and G3 turns on a transistor to initiate the appropriate function. This information is then polled periodically by the CPU.

The alarm output and the opto pulse outputs share terminals V5 and V6 via jumpering on the Digital board (see Figure 2-3 of IB 50XM1000B). The alarm output will cause conduction of the opto coupler to be interrupted when any error message is present on the LCD display. The opto pulse output is utilized when pulse outputs and data link are desired simultaneously. The output is configured for forward flows only and conducts during the pulse interval.

An optional Data Link module may be placed into the option socket, A105. The protocol for transferring data is a selected menu item and is under control of the CPU. The data link is serviced by the UART embedded within the microprocessor chip.

The optional HART protocol module, illustrated on Figure 3-3 and 3-14, is mounted on the Digital pc board. It includes a buffer-D30, a Bell 202 Modem-D31, Op ampl-N30 and a transistor Driver-V30/31. The Modem interfaces to the 80C31 microprocessor (D201) on the Digital PCB as shown on Figure 3-19. Modem timing is controlled by a separate crystal oscillator, Q30. The Modem operates in half duplex mode and provides all the digital functions associated with Frequency Shift Keying (FSK) transmit data modulation and receive data FSK demodulation. The modulated information is coupled directly to the 4-20 mA current output via transformer T30.

The Signal Converter package is completed with a back-lighted LCD display with two lines of 16 characters each and a key board consisting of three pushbuttons. The display is fed from the CPU data bus, while the keys are polled at each line frequency interrupt at which time the appropriate action is taken. A hardware watchdog timer is also built into the gate array. If program execution is incorrect, a reset will be issued to the CPU and the "CPU" LED (V206) will flash. If the program disruption was only momentary, program execution will resume in a normal fashion following a watchdog reset.

The optional Empty Pipe Detector module, A102 (see Figures 3-6 and 3-18), consists of an oscillator that is capacitively coupled to the meter electrodes and whose frequency depends on electrode impedance. It also contains an output stage which converts the generated frequency to a dc voltage level. A negative voltage level maintained at the output will represent normal (full pipe) operation.

The Signal-Reference module (see Figures 3-5 and 3-18) includes the multiplexer (MUX), N405, which accepts input signals from the meter electrodes, the reference amplifier and the Empty Pipe Detector (if present). The outputs of the reference amplifier and the Empty Pipe Detector are measured once for every 30 electrode signal measurements. The signal amplifier consists of a differential input section followed by additional gain stages with a net gain of 550. The reference amplifier gain is 30. Using TP101 as common, test measurements can be made as follows:

TP103 - MUX output

TP102 - unamplified reference voltage

The signals MUX and MUX1 control the analog multiplexer, N405, on the signal and reference amplifier assembly. The N405 truth table is given below.

MUX	MUX1	Signal Capture
1	0	Measuring signal
0	1	Reference signal
1	1	Empty tube detector
0	0	Reset

The MUX output is directed to the analog to digital converter, D212, on the Digital board. D212 is an integrated circuit of the dual slope type with logic control present in the gate array. Measurements are made during the last 25% of both the positive and negative excitation intervals, and the instantaneous flow is the summation of any two successive readings. The Converter output is accurate to plus or minus one part in 16,384. If the A/D measured value exceeds the device's capability, the CPU will issue a master reset, during which time the coil drive is suspended. Also during this interval, a holding capacitor establishes a new zero point for the input amplifier and the A/D integrating amplifier is set to an output of zero.

The CPU, D201, calculates instantaneous flow outputs by examining the ratio of the input signal to the reference, determining the percentage of the set range, and applying the proper damping, noise reduction and low flow cutoff values. The measurement method inherently includes flow direction information, which is available as a form "C" relay output. The results calculated by the CPU are passed to the 10kHz output, the analog current output, and the scaled pulse output sections.

The gate array, D210, incorporates 2 independent sets of hardware to take flow rate calculated by the CPU and produce variable frequency constant pulse width outputs which are fed to the 10 kHz and the current output sections, respectively. The 10 kHz output is sent directly to output terminal 8D as a 5 volt logic pulse.

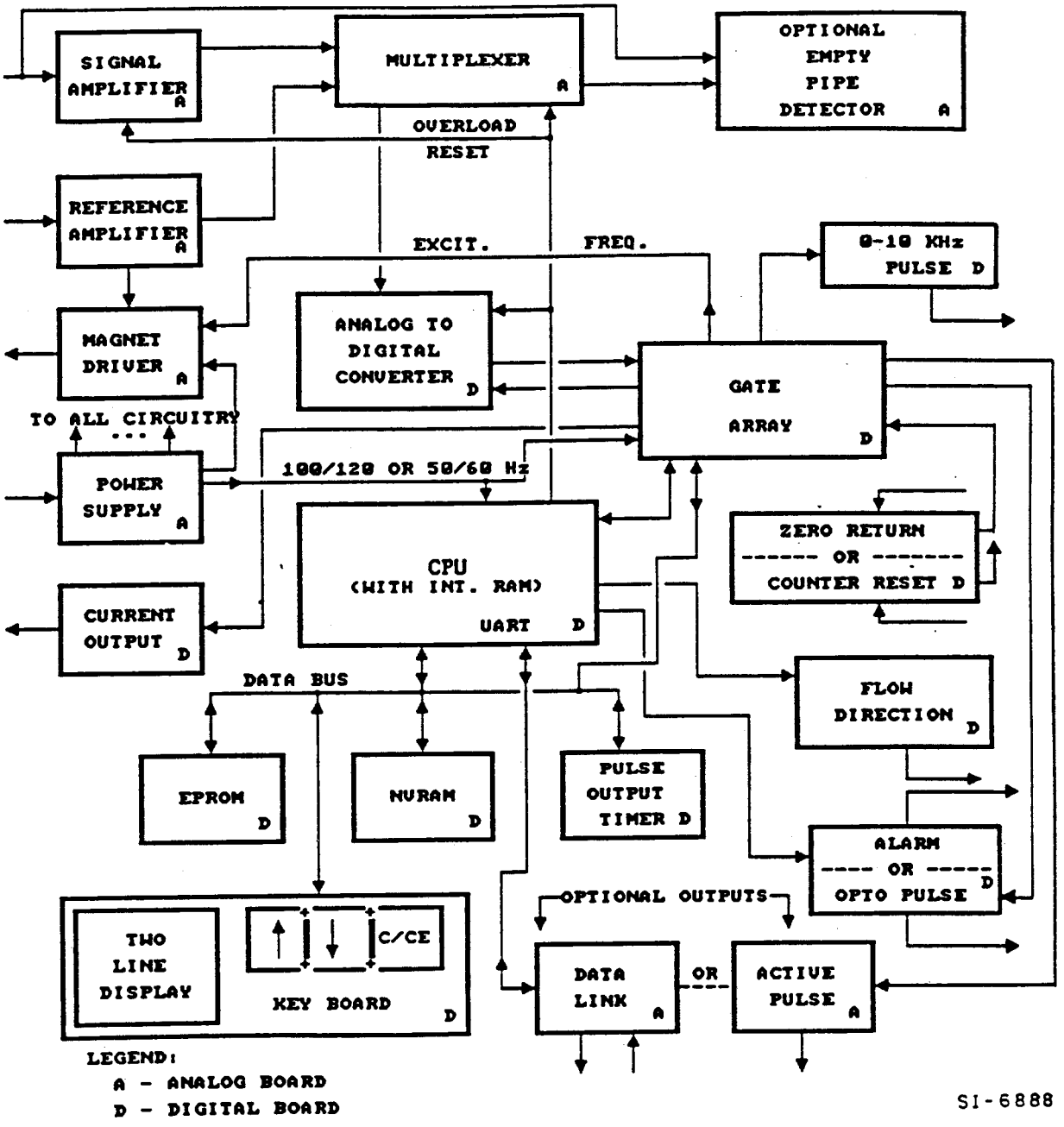


FIGURE 3-1. BLOCK DIAGRAM OF 50XM1000 SIGNAL CONVERTER

3.0 Circuit Description

To supplement the following discussion refer to the block diagram of the 50XM1000 Signal Converter, Figure 3-1. PC board layout diagrams and schematic diagrams (see Figures 3-2 through 3-19)are appended to the back of this Circuit Description for convenient reference .

The Signal Converter is constructed of a mix of "through lead" and "SMD" type components in a high density modular package. The Converter main pc board on the lower level is known as the Analog board (see Figure 3-2). The Signal/Reference module, Magnet Driver module, and option boards connect to this Analog board. The main upper level board, the Digital board, also accommodates the back-lighted LCD assembly and pushbutton switches. As shown in Figure 3-3, the optional HART interface module can be added to the Digital PCB, when specified.

Functionally, the type 50XM Converter is microprocessor-based in the true sense of the word, in that both the input signal measurement and all outputs are under control of the microprocessor (Ref: Figure 3-19, D201). The microprocessor (or CPU), for practical purposes, consists not only of the processor chip itself with some internal RAM, but also the CMOS gate array, the EPROM program memory and the non-volatile RAM (NVRAM). It should be noted that all data relevant to Signal Converter calibration is passed to the non-volatile portion of the NVRAM as instrument power is turned off. This data is replaced in working RAM immediately following a power-on reset.

The power supply section of the Analog board provides regulated voltages of +/-12 and +5 V dc as shown in Figure 3-18. Unregulated voltages of +45, +36 and +24 V dc are available for use with the Magnet Driver module, current output section and the optional output module, A105, if specified. These voltages are supplied from a transformer and rectifier configuration for models with ac power input and from a switching type isolated voltage converter when driven by a 24 V dc source.

Converter activity begins with an interrupt signal derived from the power line. The gate array, D210, shapes and divides the line frequency derived wave shape into both a CPU interrupt and a lower frequency square wave which the Magnet Driver uses as a basis for the polarity of coil excitation. When excitation at 15 Hz is required, a switch is used to select an interrupt that is double that used for 7.5 Hz. (Models driven by a dc power source have a separate oscillator used to produce an interrupt waveform. Refer to Figures 3-10 and 3-15.)

> NOTE When the coil excitation frequency is changed (from 7.5 Hz (standard) to 15 Hz, or from 15 Hz to 7.5 Hz) Converter calibration factors related to the primary are no longer valid.

The Magnet Driver module, A104 (see Figures 3-4 and 3-18), consists of a switching regulator, N701, whose output voltage is determined by the maintenance of 70 mV reference voltage level. This voltage is then directed to a full wave transistor bridge where it is converted to an alternating signal. The driver output at terminals M1/M3 is a constant alternating coil current which is sensed in the primary and fed back via the reference amplifier.

NOTE: Before initiating this function, verify that the communication mode in the data link submenu is set to "ASCII". If this is not done, the Converter will hang up and suspend all signal processing until the power is cycled off and on.

Two menu selections are available. Selection of the "slow" menu places a pause between data blocks. Thus, if a slow receiving device such as a printer is connected to the data link, sufficient time will be provided to completely capture all data. In the "fast" mode, the data stream has no dead time and is suitable for direction to an electronic data terminal.

2.7.6 Bidirectional Selection

```
Flow Direction
 forward/reverse
```

The converter offers bidirectional as well as forward only flow measurement. If the converter is in the "forward" only mode, the parameters Range R, Pulse factor R and Multiplex Display are not available.

2.7.7 Driver Frequency

```
Excitation
 7-1/2 Hz
```

The choice of coil excitation frequency is made using switch S101 on the Analog PC board of the Signal Converter assembly. (See Figure 3-2 for switch position information.) This switch position is read once upon either a power-up or a warm reset. (Refer to 2.7.10).

2.7.8 Instrument Number

```
Instrument no.
 3410
```

All converters have a factory installed sequential number, reflecting their relative time of manufacture.

2.7.9 Mains Interrupt (Line Power)

```
Mains interrupt
 12
```

All power failures which cause a power-on reset to occur are counted. This counter can only be cleared by invoking "Initialization".

CAUTION: All parameters are reset to default values upon initialization.

2.7.10 RESET

```
* *  Reset * *
```

This function executes a " warm " CPU hardware reset, after which switch positions, hardware options, etc. are polled. This function is normally completed whenever power is applied to the Converter. The power line interrupt counter is not incremented and the code number is not cleared when "Reset" is invoked.

2.7.11 Output Data

This function outputs all the Converter's configured data in plain ASCII text to both the Converter display and the data link simultaneously. This can be useful in establishing data link protocol or saving all device parameters.

```
Output data
 fast
Output data
 slow
```

2.7.4 Current Output

The current output is software adjustable as follows:

Connect a 500 ohm +/- 0.05 % shunt resistor to the +/- terminals and use a digital voltmeter to measure the output voltage across same. Set the simulator for an input of 9.99 m/s, range to either Range DN or Cal Factor value, and rate display indication in "%". Note this adjustment must be made with the 0-20 mA current output mode selected.

2.7.4.1 Adjust I Out at 100 %

Adjust Iout Value at 100% of range setting

```
Adjust Iout 100%
 100.0
```

Read the D.V.M., convert to percent of a 99.9% output and enter this value.

Example: When the above menu was selected, the value measured across the 500 ohm resistor was 10.112 volts. This value divided by the nominal value of 9.990 volts (19.98 mA x 500) yields the corrected value that must be entered, which is 101.22. In equation form, this becomes:

$$\frac{\text{Measured Value} \times 100}{\text{Nominal Value}} = \text{corrected value (in \%)}$$

2.7.4.2 Adjust I Out at 20 %

Adjust Iout value for 20% of range setting

```
Adjust Iout 20%
 20.000
```

Follow the procedure outlined in paragraph 2.7.4.1, but with an input signal of 2.00 meters/second and with a nominal value of 2.000 volts.

NOTE: When all calibration steps are completed, record the respective data and keep it with the Converter for future reference.

2.7.5 Cal Factor Mode

Range DN - fixed/programmable

```
Range DN
 fixed
```

The range DN (also referred to as "Cal factor") can be entered either through meter size selection (fixed) or by direct entry (programmable). In the programmable mode a further choice regarding the velocity at the cal factor (10 m/s or 33.33 ft/s) can be made. (Refer to paragraph 2.7.2 Maximum velocity).

If the "Fixed" mode has been chosen, Range DN and maximum velocity are automatically configured upon selection of meter size. Attempts to configure these parameters will be ignored as long as "Fixed" mode is active.

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592 WP 2M

FISCHER PORTER

SCHEMATIC

ANALOG BOARD

MATL	REVISION DESCRIPTION	AUTHORITY	REV
	ADDED CONTROL STICKER	1-HNO64194	1

DO NOT CHANGE

THIS PRODUCT IS CONTROLLED PER PRODUCT SAFETY

WITHOUT PRIOR APPROVAL BY HEREON

NOTICE OF THE CONSUMER SAFETY

PRODUCT CONSUMER DEPT 3860

USED FOR

DC/DC CONVERTER (+24V OPERATION)

+OMITTED FOR DC OPERATION

REF: SP-50-1454

TEST POINT

TEST NODE SOLDER SIDE

121- CONNECTIONS - ANALOG BD (POWER)
122- CONNECTIONS - ANALOG BD (SIGNAL)
123- ANALOG TO DIGITAL BD
124- DIGITAL BD- DISPLAY
125- ANALOG BD - DC/DC CONVERTER
126- ANALOG BD - CK HAS POWER
127- ANALOG BD - PULSE COMMUNICATIONS OUTPUTS

DRIVER MODULE BRIDGE

ANALOG OUTPUT

A105 MODULE

SIGNAL

ANALOG INPUT

CIRCUIT COMMON SYMBOLS

SEE SD-50-2318 FOR COMPONENT VALUE DESIGNATION INFORMATION. SEE SD-50-2324 FOR PERFORMANCE SPECS.

A104 DRIVER MODULE

A106 CLOCK GENERATOR MODULE

A103 SIGNAL-REFERENCE MODULE

A105 INTRINSIC SAFETY MODULE

A102 ENTRY SECTOR

PULSE OUTPUT OR COMMUNICATIONS INTERFACE

MAKE COPPER CUT FOR EMPTY PIPE DETECTOR

DO NOT PRESENT ON I/O MJS UNITS

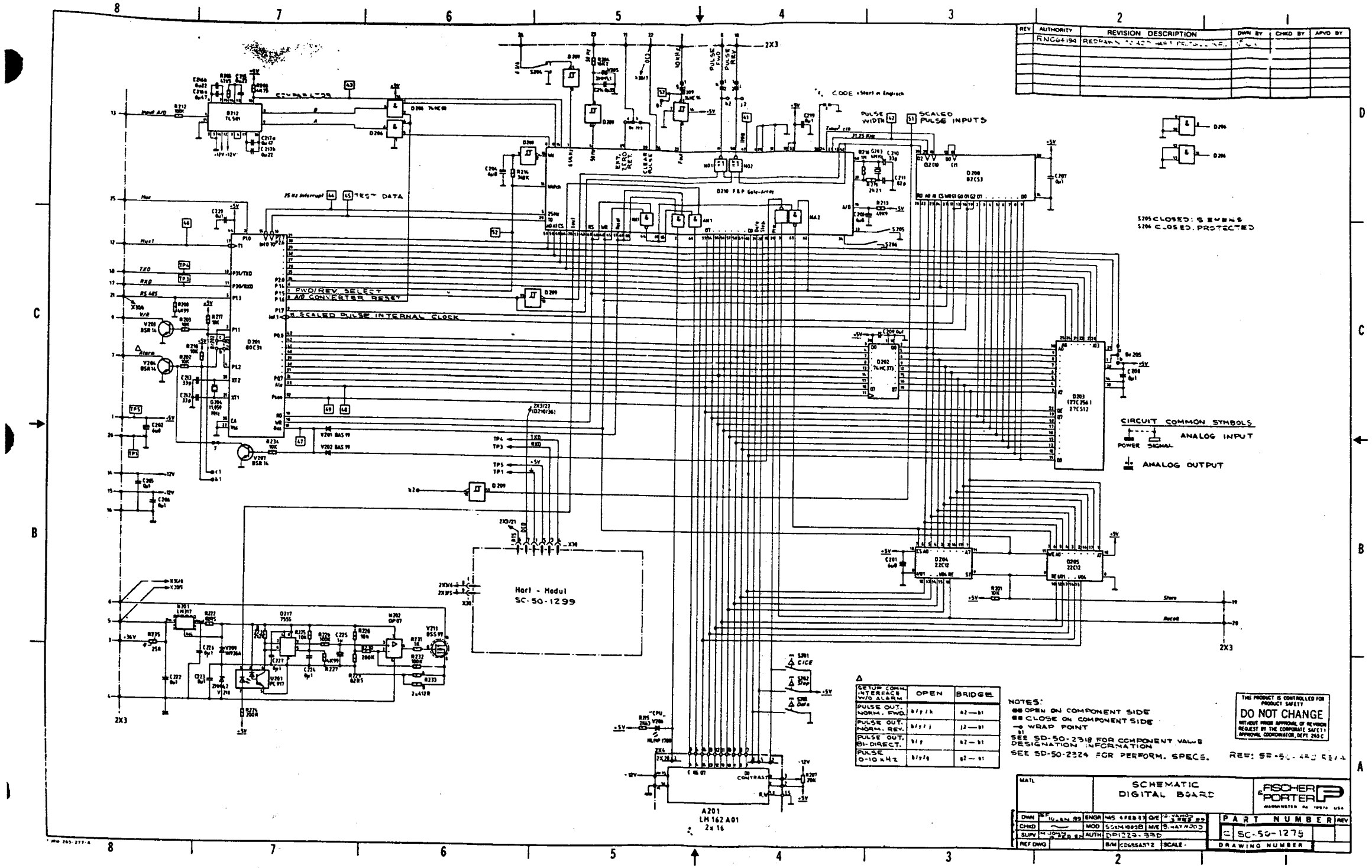


FIGURE 3-19. SCHEMATIC, DIGITAL BOARD

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ADDENDUM TO MAGNETIC FLOWMETER
AND SIGNAL CONVERTER
INSTRUCTION BULLETINS

The following information is applicable to all F&P Magnetic Flowmeters and Signal Converters supplied after March 1992. These products are provided with NEMA 4X finishes.

Read and Save this information

NEMA 4X, Corrosion Resistant Finish

The NEMA 4X rating applies to the meter body and electronics enclosure only. The following accessories (if supplied) may not meet NEMA 4X unless specifically ordered as NEMA 4X:

- meter flanges
- meter installation hardware: studs, nuts, bolts
- enclosure mounting hardware for pipe or wall mounting
- conduit hardware

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that has occurred to the finish during shipping or installation of the product. Special attention must be given to: meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continued corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and other finish damage must be repaired and promptly re-painted with approved touch-up paint. Provide the model number and size of your product to the nearest Fischer & Porter representative to obtain the correct touch-up paint.

This Addendum supplements the following Model Numbers:

10D1430	10D1465	10D1476	50CD9001	50SF2000
10D1435	10D1472	10D1477	50PZ1000	50SM1000
10D1462	10D1475	10DX3011	50SD1000	50XM1000

Pub. No. 24438

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MAGNETIC FLOW METER CALIBRATION TEST REPORT

Serial No.:93W002438 Date:12 FEB 93

Body No. :H-915

Meter Size : 2.000 inch Model No.:10DX3111

#	Actual GPM(US)	Indicated GPM(US)	DIFF % RAT
	139.041	139.013	-0.020
	70.286	70.267	-0.026
	20.551	20.563	+0.057

METER CAPACITY

	TIME UNITS			
FLOW UNITS	SEC	MIN	HR.	DAY
GALLONS(US)	4.403 GPS	264.2 GPM	15852 GPH	N A
GALLONS(IMP)	3.667 IGPS	220.0 IGPM	13200 IGPH	N A
LITERS	16.67 L/S	1000. L/M	60007 L/H	N A
CC	16669 CC/S	N A	N A	N A
CU. METER	N A	1.000 M3/M	60.01 M3/H	1440. M3/D
CUBIC FEET	.5887 CFS	35.32 CFM	2119. CFH	50867 CFD
MIL GAL(US)	N A	N A	N A	.3805 MGD
MIL GAL(IMP)	N A	N A	N A	.3168 IMGD

& P Flowmeters are hydraulically calibrated in accordance with MIL-STD-45662
d are traceable to the NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.

librated with : 50XM/7.5HZ System Zero adjust +0.00 Hz

draulic test performed by :RAY

ST EQUIPMENT USED :
*50 THERMOMETER
076 TM-C FREQ. COUNTER
077 TM-C FREQ. COUNTER
485 CONVERTER

Sender # 93W002438

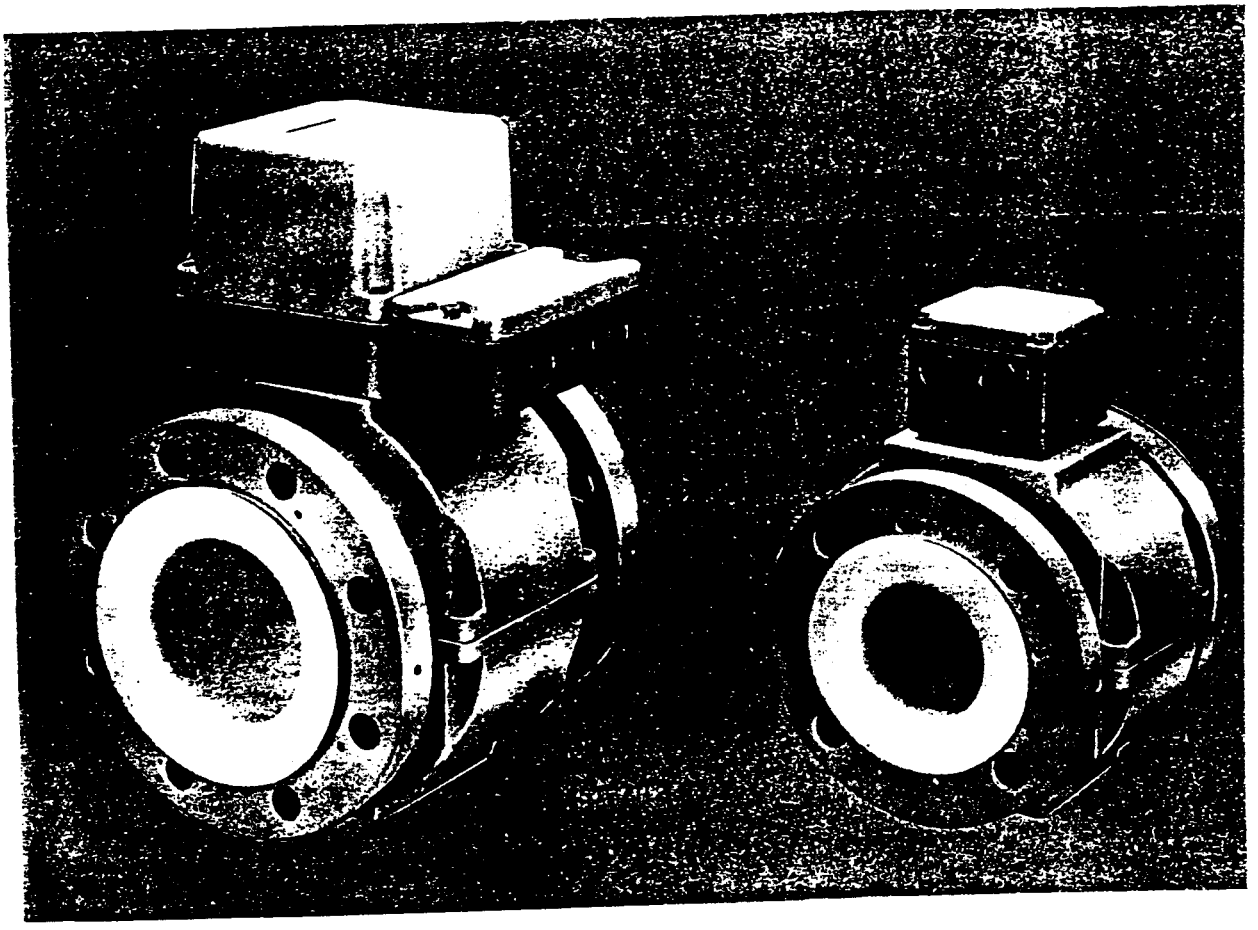
stomer's Max Flow : 50.020
stomer's Tag number : 93W002438
ual Test by : RAY DATE : 17 FEB 93
STEM 2,REV.9 R.A.M. 010992 11:20:08

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INSTRUCTION BULLETIN
MAGNETIC FLOWMETERS
10DX3011 Design Level A Rev. 2
Sizes ½" through 10"

COPA-XO, COPA-XM and MAG-X
SERIES 3000 MAGNETIC FLOWMETE



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READ FIRST

This revision of Instruction Bulletin 10DX3011 replaces Pub. No. 24398. The purpose of this revision is to document new lay lengths. Information about the NEMA 4X corrosion resistant finish has been added. A new sub-section, 2.7 Conduit Seal and Pressure Relief, has also been added.

WARNING

All Flowmeters and/or Signal Converters being returned to Fischer & Porter for repair must be free of any hazardous materials (acids, alkalis, solvents, etc.). MSDS (Material Safety Data Sheet) for all process liquids must accompany returned equipment. Contact F&P for authorization prior to returning equipment.

Read these instructions before starting installation; save these instructions for future reference.

The following information is applicable to all magnetic flowmeters supplied after March 1992. Each of these meters is provided with a corrosion resistant NEMA 4X finish.

The NEMA 4X rating applies to the meter body and electronics enclosure only. The following accessories (if supplied) may not meet NEMA 4X unless specifically ordered as NEMA 4X:

- meter flanges
- meter installation hardware: studs, nuts, bolts
- enclosure mounting hardware for pipe or wall mounting
- conduit hardware

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that has occurred to the finish during shipping or installation of the product. Special attention must be given to: meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continued corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and other finish damage must be repaired and promptly re-painted with approved touch-up paint. Provide the model number and size of your product to the nearest Fischer & Porter representative to obtain the correct touch-up paint.

1.0 INTRODUCTION

1.1 General

1.1.1 Description

The Fischer & Porter Series 3000 Magnetic Flowmeter is a compact, volumetric, liquid flow rate detector that uses as the process transducing method the characteristic of a conductive liquid to generate an induced voltage when flowing through a magnetic field. The amplitude of the voltage produced is directly proportional to the flow rate of the metered liquid.

Being a completely obstructionless metering instrument, the F&P Series 3000 Magnetic Flowmeter can be used to meter liquids without regard to heterogeneous consistency and is as independent of the tendency to plug or foul as the pipeline in which it is mounted. An inherent advantage of obstructionless construction is that pressure losses are reduced to levels occurring in equivalent lengths of equal diameter pipeline. This reduces or conserves pressure source requirements in new or existing hydraulic lines as compared to other metering methods. The compact size of the meter results in a light-weight unit which requires no additional support other than that used normally on pipe runs. Short laying lengths minimize the need for altering existing pipe runs to accommodate metering. A basic construction of corrosive resistant wetted parts and a variety of meter lining materials permit metering of most corrosive and reactant liquids.

Factors such as liquid viscosity and density require no compensation and have no effect on the measurement accuracy of the Magnetic Flowmeter. Metering limitations are confined to a minimum threshold of electrical conductivity inherent to the liquid being metered. The degree of liquid conductivity has no effect upon metering accuracy as long as it is greater than this minimum level. Liquid temperature is limited only to the extent that it may affect liquid conductivity and, like liquid pressure, to the extent that it can not exceed the meter material specification limits.

The associated electronics package is called the Signal Converter and may be either integrally or remotely mounted. Either an analog or a microprocessor signal converter may be used with the Series 3000 Magnetic Flowmeter. The Flowmeter without the electronic package is used with a remote mounted Signal Converter. A remote mounted Signal Converter is recommended for any or all of the following conditions:

- if the summation of ambient and process temperature is greater than 110° C (230° F) for COPA®-XM or 120° C (248° F) for COPA®-XO, the Signal Converter must be remotely mounted.
- vibrations above the specification given in Section 1.3

The Signal Converter also contains a magnet driver unit that is used to power the meter's magnet coils. The steady bipolar state magnetic field principle, referred to as the MAG-X® design concept, provides optimum zero point stability at an optimized drive frequency.

For information concerning the Signal Converter, refer to the Signal Converter Instruction Bulletin.

1.1.2 Construction

The F&P Series 3000 Magnetic Flowmeter consists of a flanged, stainless steel pipe spool w serves as a meter body. A pair of flat magnet coils fit on opposite sides of the meter housing i surface. Permeable iron straps and pole pieces focus the magnetic field generated by the coil provide a flux return path.

An insulating interior liner of TEFLON® (PTFE), neoprene or polyurethane is inserted into the and turned-out against the flange faces. Two cylindrical electrodes are mounted diametricall posed within the central portion of the meter body and are completely insulated from the me pipe. The end surfaces of the electrodes are virtually flush with the inner surface of the insula liner and come into contact with the liquid to be metered.

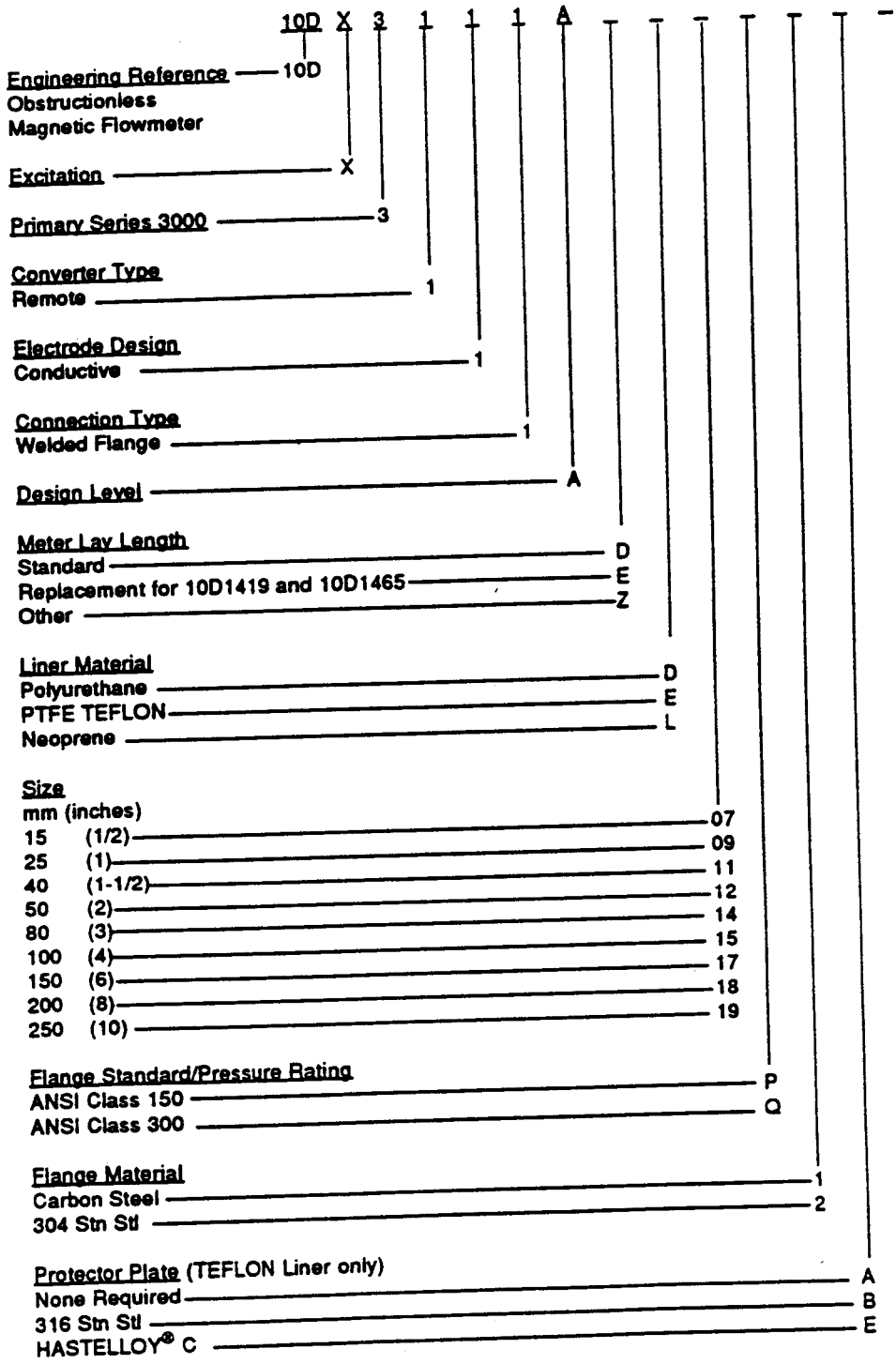
NEMA 4X, Corrosion Resistant Finish

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that may occur to the finish during shipping or installation of the product. Special attention must be given to meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continuing corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and finish damage must be repaired and promptly repainted with approved touch-up paint.

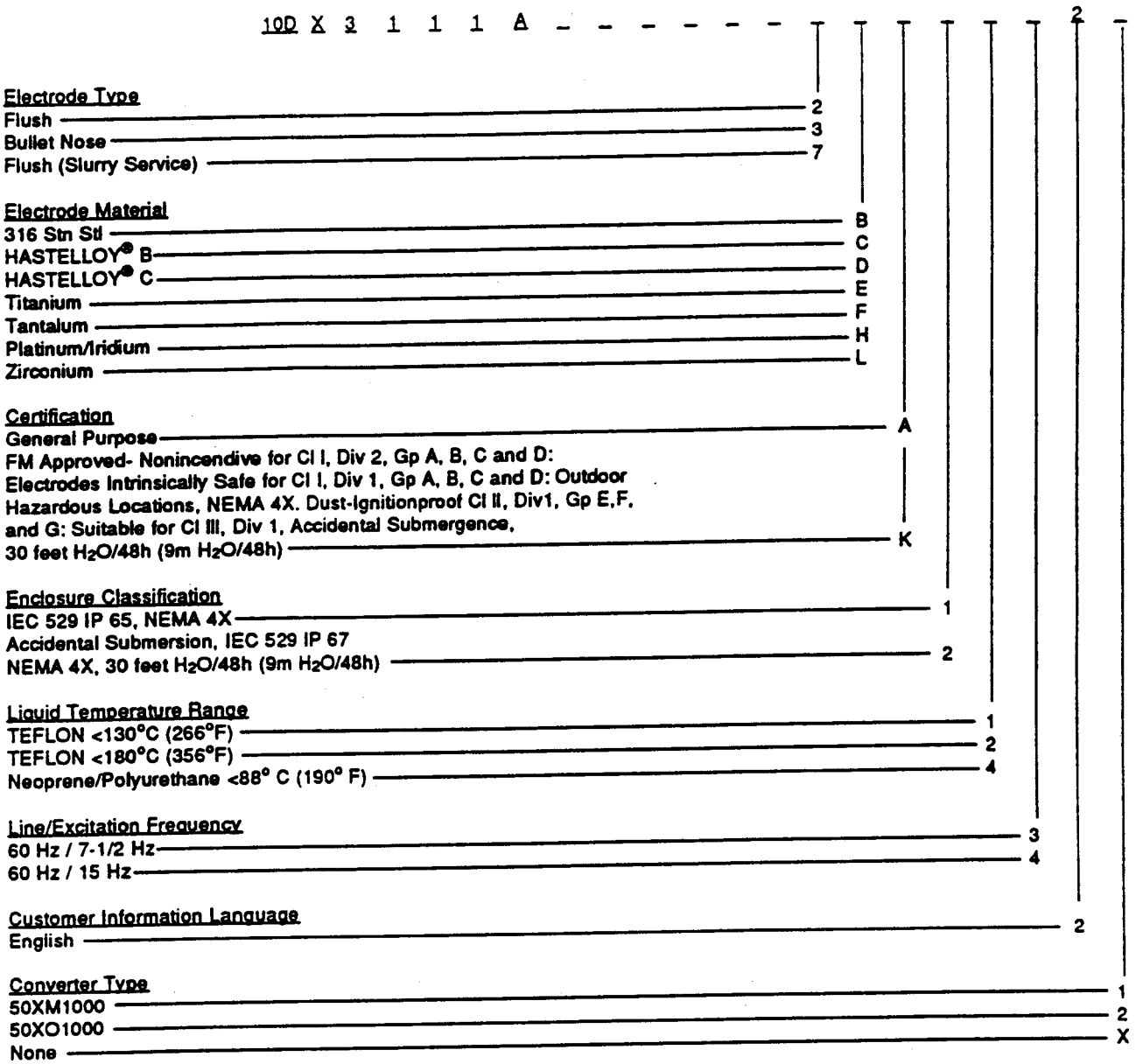
1.2 Model Number Breakdown

Refer to the F&P data sheet or data tag on the equipment for the model number of the instrument furnished. The details of a specific number are referenced on the following pages.

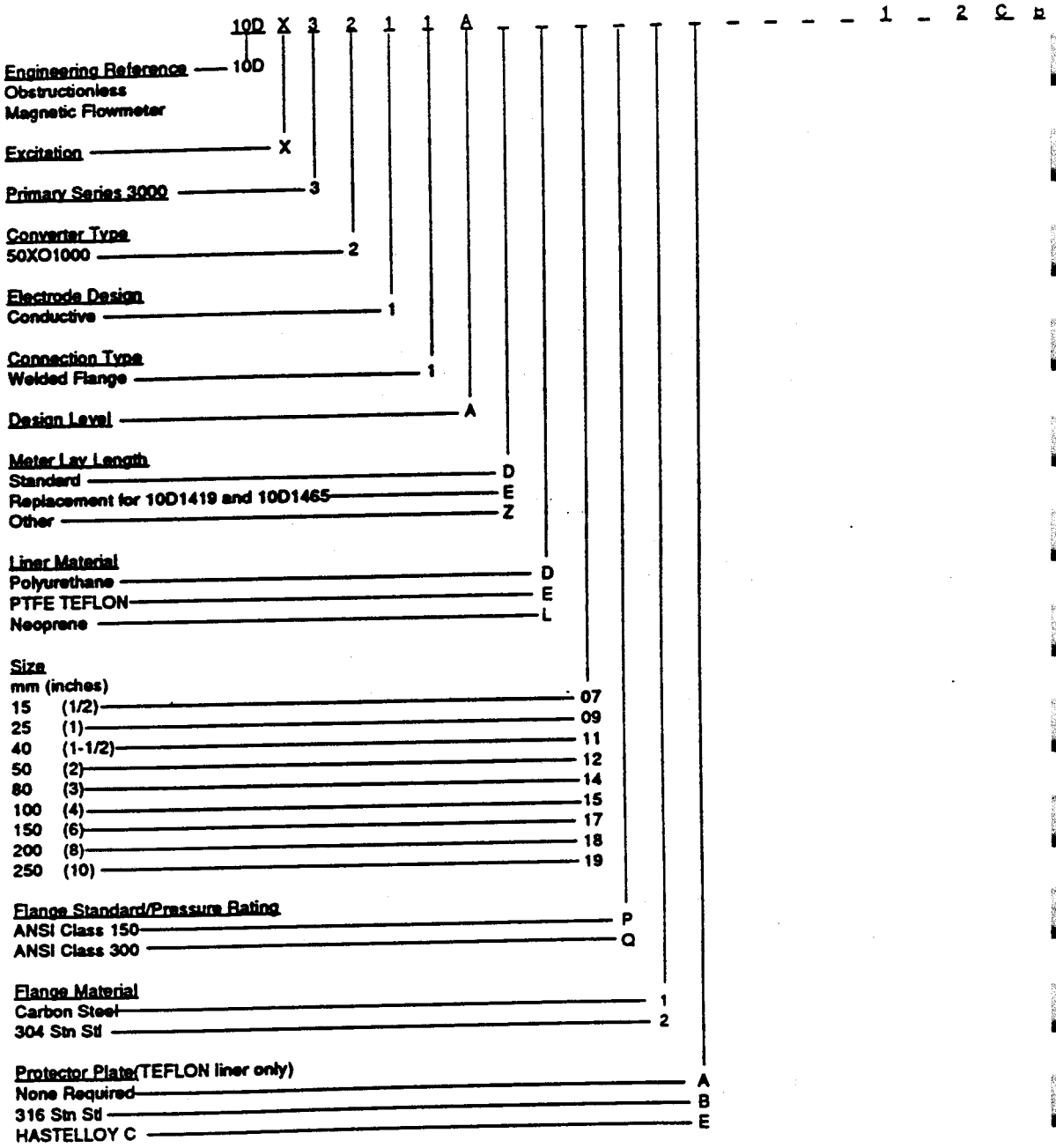
1.2.1 Model 10DX3111



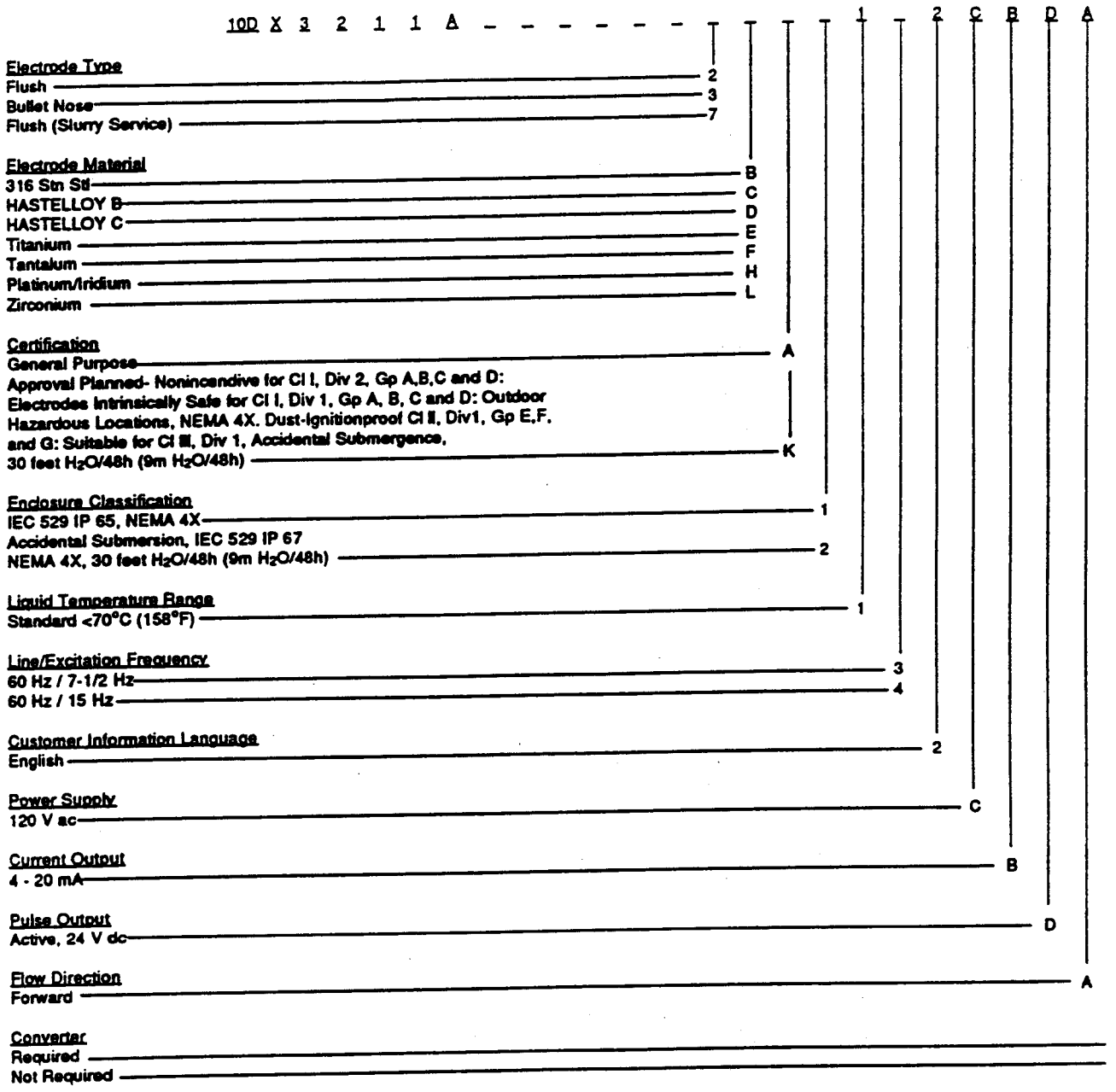
1.2.1 Model 10DX3111 (continued)



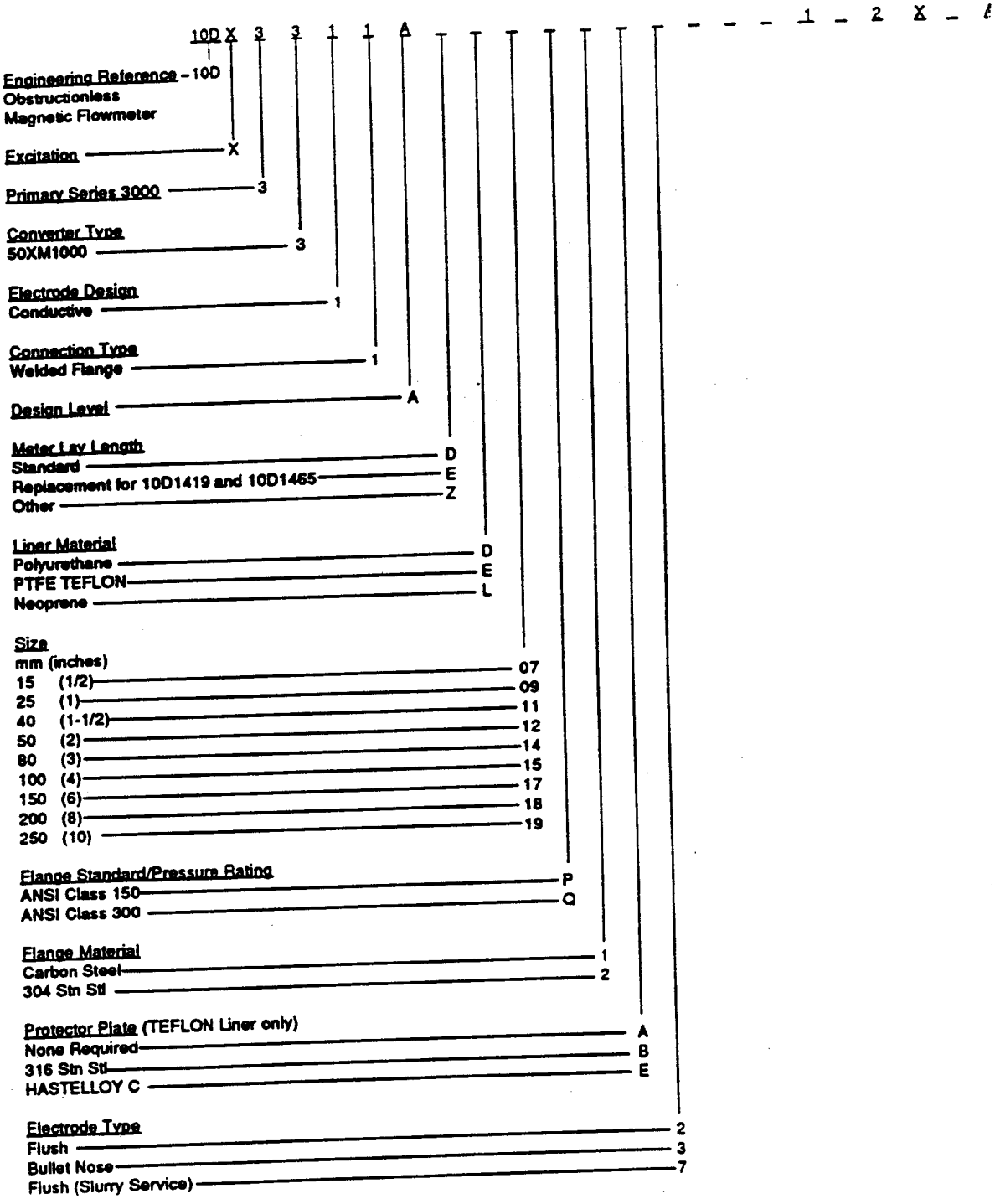
1.2.2 Model 10DX3211



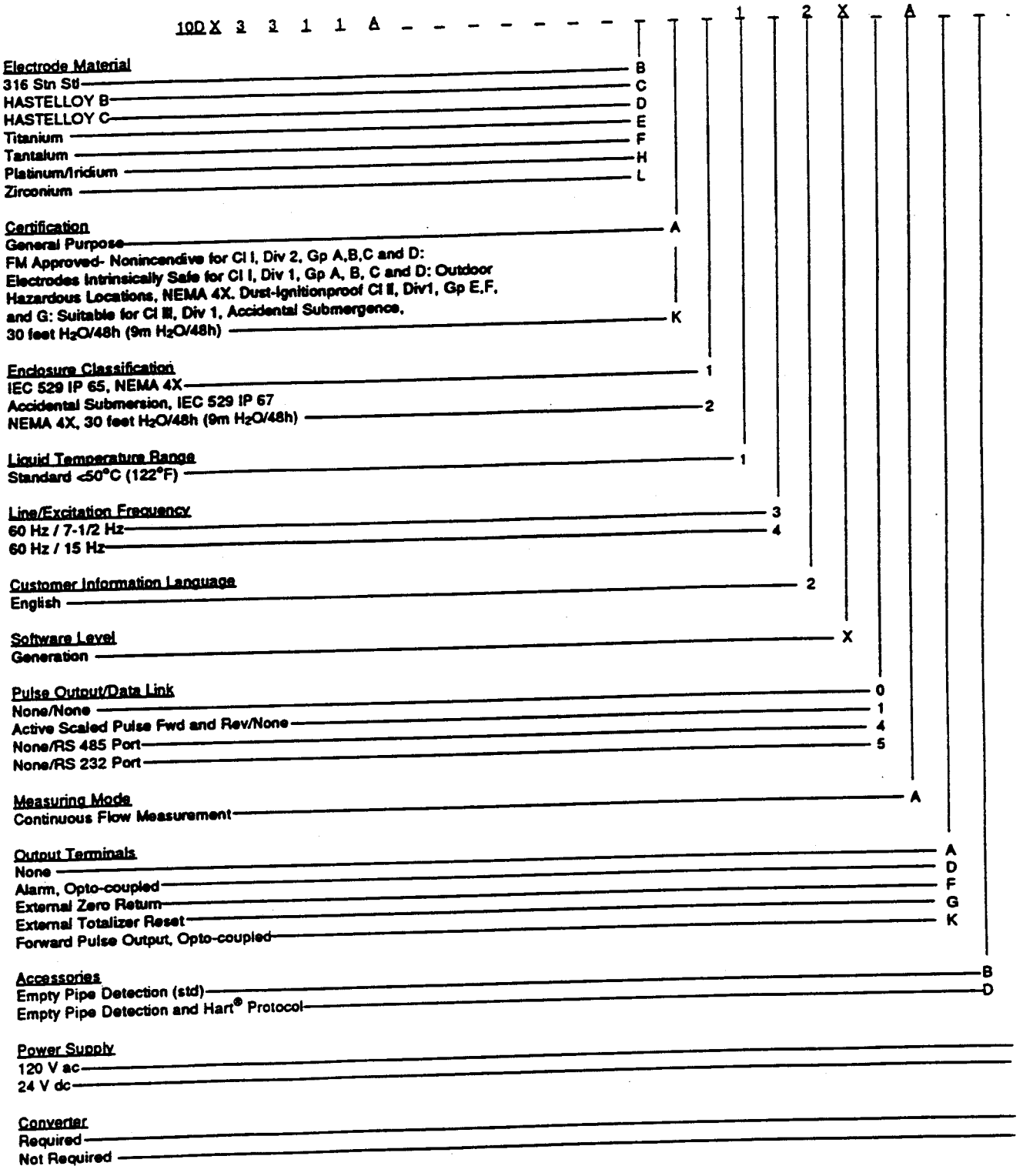
1.2.2 Model 10DX3211 (continued)



1.2.3 Model 10DX3311



1.2.3 Model 10DX3311 (continued)



1.3 Specifications

Power Requirements — See Section 1.2 Model Number Breakdown.

Power Consumption — Refer to Signal Converter Instruction Bulletin.

Flowmeter Characteristics

- **Meter Size/Flow Capacity** — See Table 1-2.
- **Span** — Factory set at specified range between extremes listed in Table 1-2; can be field adjusted.
- **Rangeability** — 100:1
- **Minimum Liquid Conductivity** — 5 µS/cm
- **System Accuracy** — Refer to Signal Converter Instruction Bulletin.
- **Meter Capacity** — Specified on primary data tag (equal to max flow capacity engineering units). Refer to Table 1-2.

Environmental Limits

- **Enclosure Classification (with integral or remote Signal Converter)** — See Section 1.2 Model Number Breakdown.
- **Relative Humidity** — 10% to 90%

Vacuum Operating Limits — Neoprene and Polyurethane lined meters can be subjec full vacuum over their entire temperature range.

TABLE 1-1. TEFLON Lined Meters

Meter Size	ANSI Flange Class	Temperature	Vacuum
15 - 100 mm (½ - 4 inches)	150	130° C (266° F)	full
150 - 250 mm (6 - 10 inches)	150 300 300	20° C (68° F) 100° C (212° F) 130° C (266° F)	3.9 psia 5.8 psia 6.7 psia

TABLE 1-2. METER CAPACITY VALUES

Meter Size		Meter Capacity*	Flow Ranges 0 to Value Tabulated			
			Minimum		Maximum	
mm	Inches	gpm	gpm	L/min	gpm	L/min
15	½	26.4172	2.65	10.0	26.4	100.0
25	1	52.8344	5.29	20.0	52.8	200.0
40	1½	158.503	15.9	60.0	158.0	600.0
				m^3/h		m^3/h
50	2	264.372	26.5	6.0	264.0	60.0
80	3	792.516	79.3	18.0	792.0	180.0
100	4	1056.68	106.0	24.0	1056.0	240.0
150	6	2641.72	265.0	60.0	2641.0	600.0
200	8	4755.09	476.0	108.0	4755.0	1080.0
250	10	7925.16	793.0	180.0	7925.0	1800.0

* Each Flowmeter is calibrated to determine its flow capacity at a given velocity, which has been established by F&P as 32.808 ft/s (10m/s) for the Meter Capacity. The Meter Capacity expressed in gpm is recorded on the Flowmeter nameplate.

Series 3000 Magnetic Flowmeter primaries are calibrated at 32.808 ft/s (10 m/s). Note that the display on the Signal Converter supplied may read "Cal Factor" even when configured for 32.808 ft/s (10 m/s).

The Meter Capacity is the base upon which maximum and minimum limits for range settings and outputs are established.

Flow Velocity can be determined as follows:

Meter Capacity:

Flow Velocity (ft/s) = (Operating gpm x 32.808)/Meter Capacity

NOTE

The maximum meter flow range is a function of the Signal Converter used. The maximum flow range may exceed the meter capacity to allow for overrange.

Physical Characteristics

Outline Dimensions	See Figures 2-1 and 2-2
Vibration Limit - with integral Converter	5 to 14 Hz, 0.10"; 14 to 200 Hz, 1 g

> **NOTE**
> A remote mounted Signal Converter must be used when vibration limit is exceeded.

Signal Cable for remote Converter (supplied by F&P, when applicable)

Standard Length	30 feet (9 m)
Optional Length	Up to 300 feet (90 m) in 10 feet increments, as specified.

Materials of Construction

Meter Liner	see Section 1.2 Model Number Breakdown
Electrode Assembly	see Section 1.2 Model Number Breakdown
Meter Body	304 sst, epoxy finish
Flanges	carbon steel or 304 sst, as specified
Meter Housing	aluminum, epoxy finish
Electronics Housing	cast aluminum, epoxy finish, 316 sst attachment screws, gasketed covers

Primary Enclosure Ratings

Watertight Housing (standard)	IEC 529 IP65 (NEMA 4X)
Accidental Submergence	IEC 529 IP67, 30 feet H_2O/48 h (9 m H_2O/48 h)
Conduit Connections	(2) 1/2" NPT internally threaded entrances - remote conv
	(3) 1/2" NPT internally threaded entrances - integral con

NOTE
Enclosures are suitable for indoor or outdoor installation. Enclosure ratings apply to the Magnetic Flowmeter with or without an integral Signal Converter.

Safety Classification refer to Section 1.2, Model Number Breakdown

TABLE 1-3. PRESSURE RATING vs TEMPERATURE - MPa (psi)

Sizes 15-250 mm (½ - 10 Inches)

ANSI CLASS	FLANGE MATERIAL	NEOPRENE/POLYURETHANE 38° C (100° F)	88° C (190° F)	TEFLON 38°C (100° F)	180° C (356° F)
150	Carbon st	1.90 (275)	1.66 (240)	1.90 (275)	1.41 (205)
150	304/316 sst	1.90 (275)	1.66 (240)	1.90 (275)	1.31 (190)
300	Carbon st	4.97 (720)	4.66 (675)	4.97 (720)	4.35 (630)
300	304/316 sst	4.97 (720)	4.21 (610)	4.97 (720)	3.42 (495)

2.0 INSTALLATION

2.1 Inspection

All F&P Series 3000 Magnetic Flowmeters are shipped in heavy duty containers which are specially designed to provide adequate protection during transit. Since the Magnetic Flowmeter will be operated in conjunction with an electronic Signal Converter, both instruments may be in the same shipping container. An itemized list of all items included in the shipment is attached to the shipping container. Refer to the Instruction Bulletin supplied with the associated Signal Converter for operation and maintenance procedures for the particular Converter.

If the specified Magnetic Flowmeter is supplied with a remote Signal Converter, thirty feet of interconnection cable(standard) and conduit seals will be included in the shipment.

Inspect all items included in the shipment immediately for indications of damage which may have occurred during shipment. All damage claims should be reported to the shipping agent involved before attempting to install or operate this equipment. If the damage is such that faulty operation is likely to result, the damage should be brought to the attention of the Fischer & Porter Service Department.

2.2 Meter Handling

The liner of the flowmeter may be damaged if it comes in contact with a sharp object and must protected at all times.

When a TEFLON lined meter is specified, two liner protector plates (one on each flange face) factory installed (when specified at time of order). These plates serve to contain the flared en the liner, and to prevent damage to the liner during installation and handling. These protecto plates are attached to the meter with flat head screws that securely hold the liner in place. If .. pressure on the liner is relieved, the TEFLON will tend to curl away from the flange. These pro tor plates must remain in place when the meter is installed. Refer to Figure 2-1.

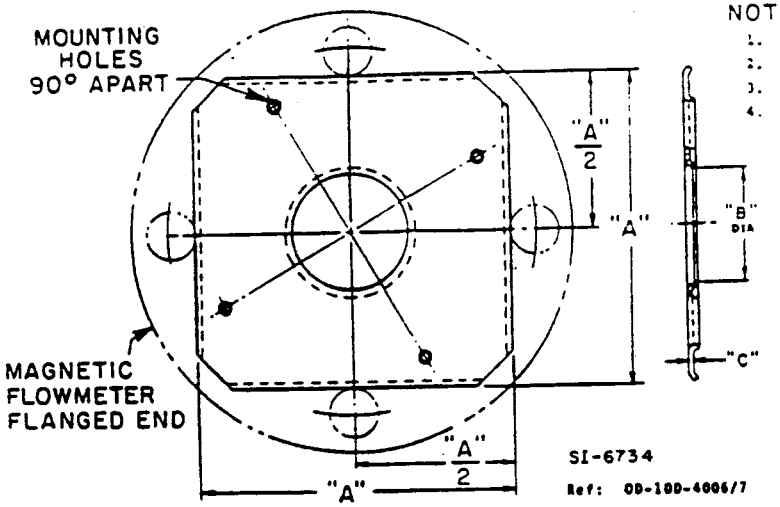
During shipment, the liner is protected by wood or composition protectors as shown in Figure : (standard); these are removed before the meter is installed; leave them in position while mo the meter to the installation site

To place the meter in the pipeline a sling and hoist may be necessary. Do not pass any rope wire sling through the meter; the liner will be damaged if the meter is supported by the liner. the meter as shown in Figure 2-2.

Table 2-1 lists the weights of the meters by size and flange classification. Weights shown ar proximate and should be used only as a guide when installing the meter.

TABLE 2-1. METER WEIGHTS

Meter Size		ANSI Class 150		ANSI Class 300	
mm	Inches	lbs	kg	lbs	kg
15	½	24	11	34	15
25	1	25	12	36	16
40	1½	32	15	43	20
50	2	32	15	43	20
80	3	43	20	53	24
100	4	45	21	59	27
150	6	105	47	140	64
200	8	155	70	210	95
250	10	220	100	295	134

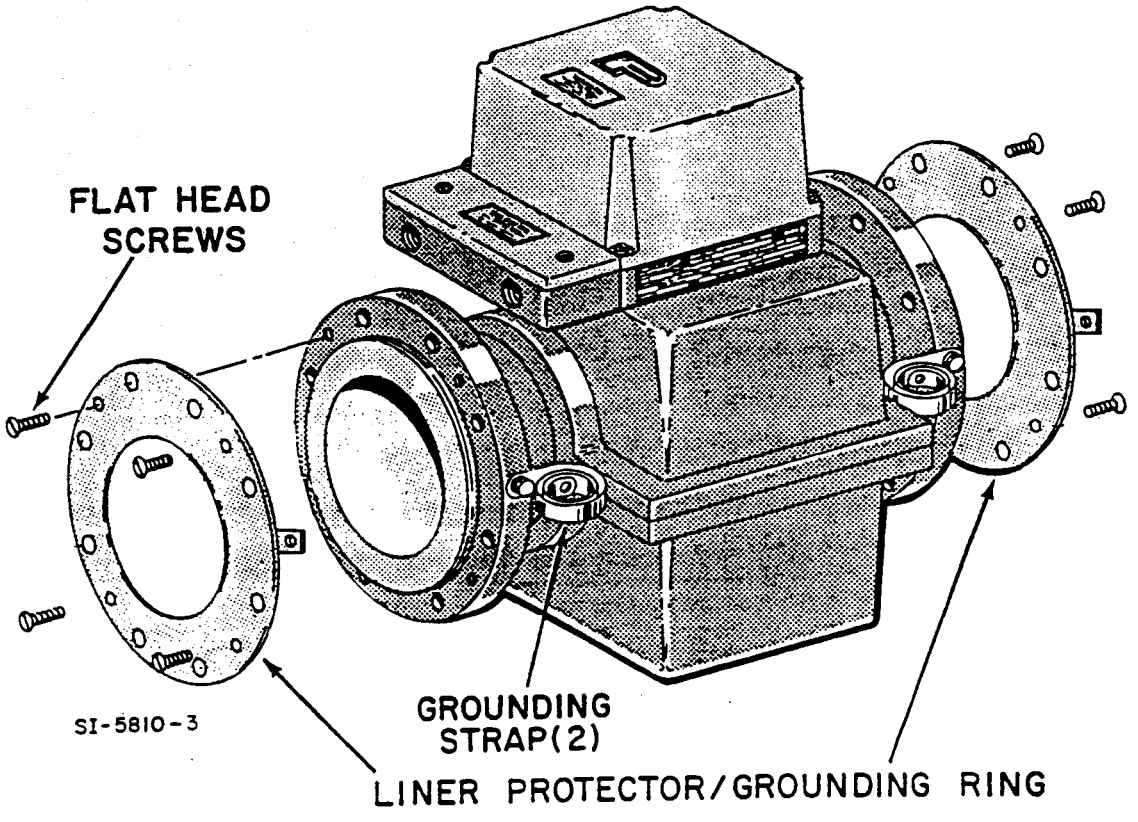


NOTES:

1. ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE ±1/16.
3. DIMENSIONS GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
4. THIS DRAWING IS THIRD ANGLE PROJECTION AS SHOWN.

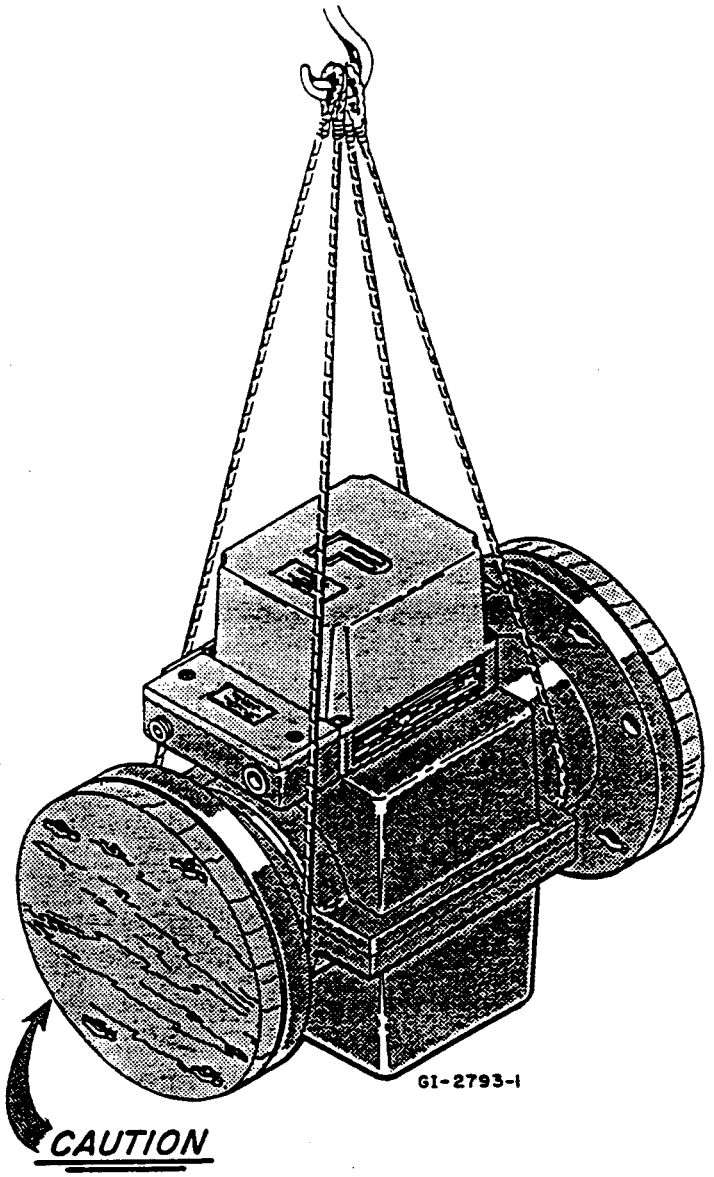
METER SIZE	A		B		C	
	INCH	mm	INCH	mm	INCH	mm
1/2	1-7/8	48	1/2	13	5/64	2
1	2-1/2	64	25/32	20	1/16	2
1-1/2	3-5/16	84	1-3/8	35	1/16	2
2	4	102	1-27/32	47	1/16	2
3	5-3/8	137	2-15/16	75	1/16	2
4	6-5/8	168	3-25/32	96	1/16	2

LINER PROTECTOR PLATES, SIZES 1/2 through 4 INCH



LINER PROTECTOR/GROUNDING RINGS, SIZES 6 THROUGH 10 INCH

FIGURE 2-1. PROTECTOR PLATES for TEFLON LINERS



CAUTION

DO NOT PUT SLING THRU METER LINER.

DO NOT REMOVE METAL LINER PROTECTOR AT ANYTIME.

REMOVE WOOD SHIPPING PROTECTOR (SHOWN) AT THE TIME OF ACTUAL INSTALLATION IN THE PIPELINE.

FIGURE 2-2. PROPER HOISTING TECHNIQUE

Note that the flowmeter shown in this illustration is not the meter described in tl instruction bulletin.

2.3 Location

The Flowmeter is suitable for either indoor or outdoor installation. When selecting the installation site, consideration should be given to the ambient and process temperature limits, as stated in the Specifications section. The Standard meter is rated NEMA 4 (IEC 529 IP65), watertight, and will withstand rain and hose down. If periodical flooding may occur, an optional IEC 529 IP67 accidental submergence flowmeter is available.

It is recommended that the meter not be installed within the immediate proximity of heavy induction equipment.

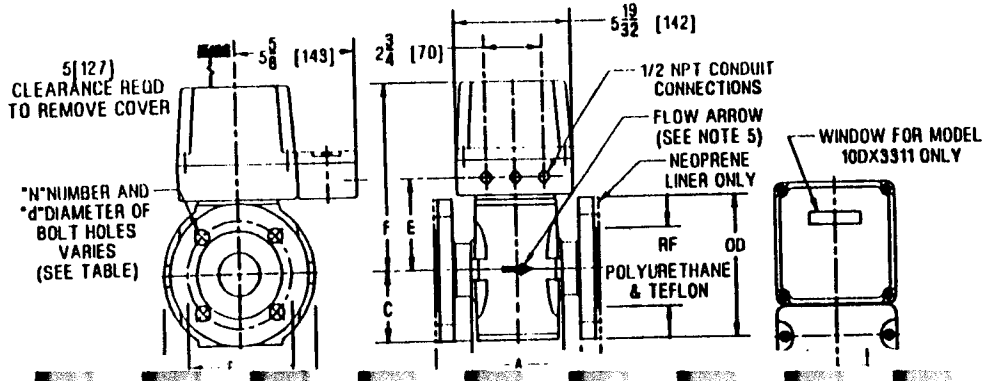
Access for wiring interconnections and servicing of the integrally mounted Signal Converter should be considered when installing the meter. A minimum of five inches of overhead clearance is required for cover removal. Outline dimensions of the Flowmeter are given in Figures 2-3 and 2-4.

Outline dimensions of the optional remotely mounted Signal Converter are given in the Instruction Bulletin supplied with the Signal Converter.

The installation site must be provided with a convenient source of power as specified for the Signal Converter. The power line should have a disconnect switch, and suitable fuse or circuit breaker as shown on the applicable interconnection diagram provided in the Instruction Bulletin supplied with the Signal Converter.

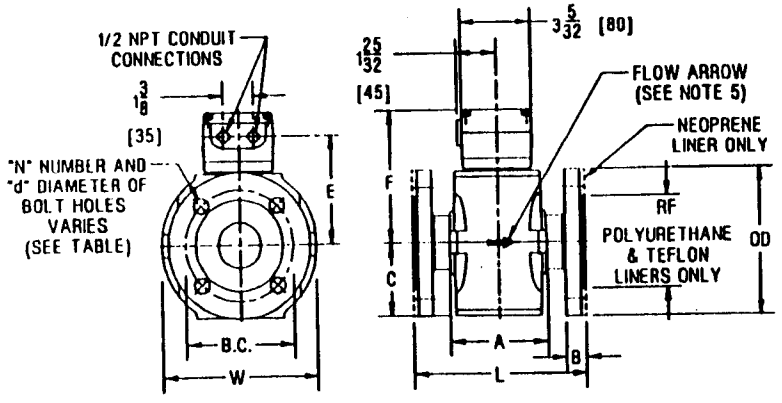
OUTLINE DIMENSIONS Inches (mm)

DIM	SIZE	1/2 (15)		1 (25)		1-1/2(40)		2 (50)		3 (80)		4 (100)		6 (150)		8 (200)		10 (250)	
	ANSI FLG CL	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300
	MODEL NO.																		
L	10DX$^{32}_{33}$11AD	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	9-7/8 (250)	11 (280)	11-13/16 (300)		13-25/32 (350)		17-23/32 (450)	
L	10DX$^{32}_{33}$11AE	14 (356)		14 (356)		16 (406)		16 (406)		12 (305)		12 (305)		17-23/32 (450)		19-11/16 (500)		21-21/32 (550)	
RI	LINER NEOPRENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RF	OTHERS	1-3/8 (35)		2 (51)		2-7/8 (73)		3-5/8 (92)		5 (127)		6-3/16 (157)		8-1/2 (216)		10-5/8 (270)		12-3/4 (324)	
B	POLY/NEOP	NA	NA	NA	NA	NA	NA	15/16 (24)	1-1/16 (27)	1-1/8 (29)	1-5/16 (33)	1-1/8 (29)	1-7/16 (36)	1-3/16 (30)	1-5/8 (41)	1-5/16 (33)	1-13/16 (48)	1-3/8 (35)	2-1/16 (52)
B	TEFL/TEFZ	5/8 (16)	3/4 (19)	13/16 (21)	15/16 (24)	15/16 (24)	1-1/16 (27)	1 (25)	1-3/32 (28)	1-3/16 (30)	1-3/8 (35)	1-3/16 (30)	1-1/2 (38)	1-1/8 (29)	1-9/16 (40)	1-9/32 (32)	1-25/32 (44)	1-3/8 (35)	2-1/16 (52)
d		5/8 (16)		5/8 (16)	3/4 (19)	5/8 (16)	7/8 (22)	3/4 (19)	3/4 (19)	3/4 (19)	7/8 (22)	3/4 (19)	7/8 (22)	7/8 (22)	7/8 (22)	7/8 (22)	1 (25)	1 (25)	1-1/8 (29)
N		4	4	4	4	4	4	4	8	4	8	8	8	8	12	8	12	12	16
BC		2-3/8 (60)	2-5/8 (67)	3-1/8 (79)	3-1/2 (89)	3-7/8 (98)	4-1/2 (114)	4-3/4 (121)	5 (127)	6 (152)	6-5/8 (168)	7-1/2 (191)	7-7/8 (200)	9-1/2 (241)	10-5/8 (270)	11-3/4 (298)	13 (330)	14-1/4 (362)	15-1/4 (387)
OD		3-1/2 (89)	3-3/4 (95)	4-1/4 (108)	4-7/8 (124)	5 (127)	6-1/8 (156)	6 (152)	6-1/2 (165)	7-1/2 (190)	8-1/4 (210)	9 (229)	10 (254)	11 (279)	12-1/2 (318)	13-1/2 (343)	15 (381)	16 (406)	17-1/2 (445)
A		4-13/16 (122)		4-13/16 (122)		4-13/16 (122)		4-13/32 (112)		4-13/32 (112)		5-1/8 (130)		6-11/16 (170)		7-11/16 (195)		9-27/32 (250)	
C		2-27/32 (73)		2-27/32 (73)		2-27/32 (73)		3-7/32 (82)		3-7/8 (98)		4-21/32 (118)		5-25/32 (147)		7-1/16 (179)		8-5/32 (207)	
E		3-27/32 (98)		3-27/32 (98)		3-27/32 (98)		4-7/32 (107)		4-27/32 (123)		5-5/8 (143)		4-13/32 (173)		8-3/32 (205)		9-3/16 (233)	
F		7-29/32 (201)		7-29/32 (201)		7-29/32 (201)		8-1/2 (216)		9-1/8 (232)		9-29/32 (252)		10-7/8 (276)		12-1/8 (308)		13-1/4 (336)	
W		6-17/32 (166)		6-17/32 (166)		6-17/32 (166)		7-3/32 (180)		7-7/8 (200)		9-7/16 (240)		12-3/16 (310)		14-3/8 (365)		16-25/32 (426)	



NOTES
1) ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESIS [ ] ARE IN MILLIMETERS [mm].
2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3) THIS DRAWING IS A THIRD ANGLE PROJECTION AS SHOWN.
4) FLANGE BOLT HOLES STRADDLE CENTERLINES
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/-1/8 [3].

OUTLINE DIMENSIONS inches (mm)																					
DIM	SIZE	1/2 (15)		1 (25)		1-1/2(40)		2 (50)		3 (80)		4 (100)		6 (150)		8 (200)		10 (250)	
	ANSI FLG CL	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300
	MODEL NO.																		
L	10DX3111AD	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	7-7/8 (200)	9 (229)	9-7/8 (250)	11 (280)	11-13/16 (300)		13-25/32 (350)		17-23/32 (450)	
L	10DX3111AE	14 (356)		14 (356)		16 (406)		16 (406)		12 (305)		12 (305)		17-23/32 (450)		19-11/16 (500)		21-21/32 (550)	
	LINER																		
RF	NEOPRENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RF	OTHERS	1-3/8 (35)		2 (51)		2-7/8 (73)		3-5/8 (92)		5 (127)		6-3/16 (157)		8-1/2 (216)		10-5/8 (270)		12-3/4 (324)	
B	POLY/NEOP	NA	NA	NA	NA	NA	NA	15/16 (24)	1-1/16 (27)	1-1/8 (29)	1-5/16 (33)	1-1/8 (29)	1-7/16 (36)	1-3/16 (30)	1-5/8 (41)	1-5/16 (33)	1-13/16 (46)	1-3/8 (35)	2-1/16 (52)
B	TEFL/TEFZ	5/8 (16)	3/4 (19)	13/16 (21)	15/16 (24)	15/16 (24)	1-1/16 (27)	1 (25)	1-3/32 (28)	1-3/16 (30)	1-3/8 (35)	1-3/16 (30)	1-1/2 (38)	1-1/8 (29)	1-9/16 (40)	1-9/32 (32)	1-25/32 (44)	1-3/8 (35)	2-1/16 (52)
d		5/8 (16)		5/8 (16)	3/4 (19)	5/8 (16)	7/8 (22)	3/4 (19)	3/4 (19)	3/4 (19)	7/8 (22)	3/4 (19)	7/8 (22)	7/8 (22)	7/8 (22)	7/8 (22)	1 (25)	1 (25)	1-1/8 (29)
N		4	4	4	4	4	4	4	8	4	8	8	8	8	12	8	12	12	16
BC		2-3/8 (60)	2-5/8 (67)	3-1/8 (79)	3-1/2 (89)	3-7/8 (98)	4-1/2 (114)	4-3/4 (121)	5 (127)	6 (152)	6-5/8 (168)	7-1/2 (191)	7-7/8 (200)	9-1/2 (241)	10-5/8 (270)	11-3/4 (298)	13 (330)	14-1/4 (362)	15-1/4 (387)
OD		3-1/2 (89)	3-3/4 (95)	4-1/4 (108)	4-7/8 (124)	5 (127)	6-1/8 (156)	6 (152)	6-1/2 (165)	7-1/2 (190)	8-1/4 (210)	9 (229)	10 (254)	11 (279)	12-1/2 (318)	13-1/2 (343)	15 (381)	16 (406)	17-1/2 (445)
A		4-13/16 (122)		4-13/16 (122)		4-13/16 (122)		4-13/32 (112)		4-13/32 (112)		5-1/8 (130)		6-11/16 (170)		7-11/16 (195)		9-27/32 (250)	
C		2-27/32 (73)		2-27/32 (73)		2-27/32 (73)		3-7/32 (82)		3-7/8 (98)		4-21/32 (118)		5-25/32 (147)		7-1/16 (179)		8-5/32 (207)	
E		4-17/32 (115)		4-17/32 (115)		4-17/32 (115)		4-7/8 (124)		5-1/2 (140)		6-9/32 (160)		7-1/2 (190)		8-3/4 (222)		9-27/32 (250)	
F		5-19/32 (142)		5-19/32 (142)		5-19/32 (142)		5-15/16 (150)		6-17/32 (166)		7-5/16 (186)		8-1/2 (216)		9-3/4 (248)		10-7/8 (276)	
W		6-17/32 (166)		6-17/32 (166)		6-17/32 (166)		7-3/32 (180)		7-7/8 (200)		9-7/16 (240)		12-3/16 (310)		14-3/8 (365)		16-25/32 (426)	



NOTES
1) ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESIS [ ] ARE IN MILLIMETERS [mm].
2) DIMENSIONS ARE GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3) THIS DRAWING IS A THIRD ANGLE PROJECTION AS SHOWN.
4) FLANGE BOLT HOLES STRADDLE CENTERLINES
5) FLOW MUST BE IN SAME DIRECTION AS FLOW ARROW.
6) METER MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
7) ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES OF +/- 1/8 [3].

FIGURE 2-4. OUTLINE DIMENSIONS, Remotely Mounted Converter (OD-10D-4123 R0)

2.4 Mounting

2.4.1 Orientation

The F&P Series 3000 Magnetic Flowmeter may be installed in horizontal, vertical or sloping runs. However, precautions must be taken to assure that the metering tube is filled at all times during measurement. A vertical installation, with the pipe line carrying liquid upwards assures filled hydraulic line under low flow rate conditions and also minimizes wear on the meter lini abrasive grit. Horizontal installations should be made with the meter in the lower section of pipeline to assure a filled meter condition.

For horizontal or sloping installations the meter should be placed so that the electronic hou the meter is on top. This will align the meter electrodes in a lateral plane. Positioning the met this way eliminates the possibility of entrained air acting as an electrode insulator.

The Magnetic Flowmeter must be oriented in accordance with the direction of process flow, c cated by the FLOW arrow on the meter body. For accurate metering, a straight pipe run equi to a minimum of three straight pipe diameters are required upstream of the magmeter for e and tees, measured from the center of the meter (refer to Figure 2-6).

If a control valve is required, it is recommended that it be placed downstream of the meter. Upstream valves can create turbulence that result in air pockets and may affect the meter's racy or cause its output to be noisy. A minimum of ten pipe diameters of straight pipe are rec upstream between the magmeter and a control valve or pump (refer to Figure 2-6).

2.4.2 Pipe Connections

The TEFLON and polyurethane lined meters have ANSI raised faced flanges rated as Clas 300, as specified. The neoprene lined meters have ANSI full faced flanges rated as Class 300, as specified. Two flange gaskets are supplied per meter; the mounting studs and nuts nished by the user.

Flange nuts should be tightened in an alternate pattern (e.g., 1-3, 2-4) to produce equal pres distribution around the flange face. Bolt torque should be limited to that which will produce tive seal for the application.

Refer to Figure 2-5 for proper gasket locations and Figure 2-6 for recommended piping arra ment.

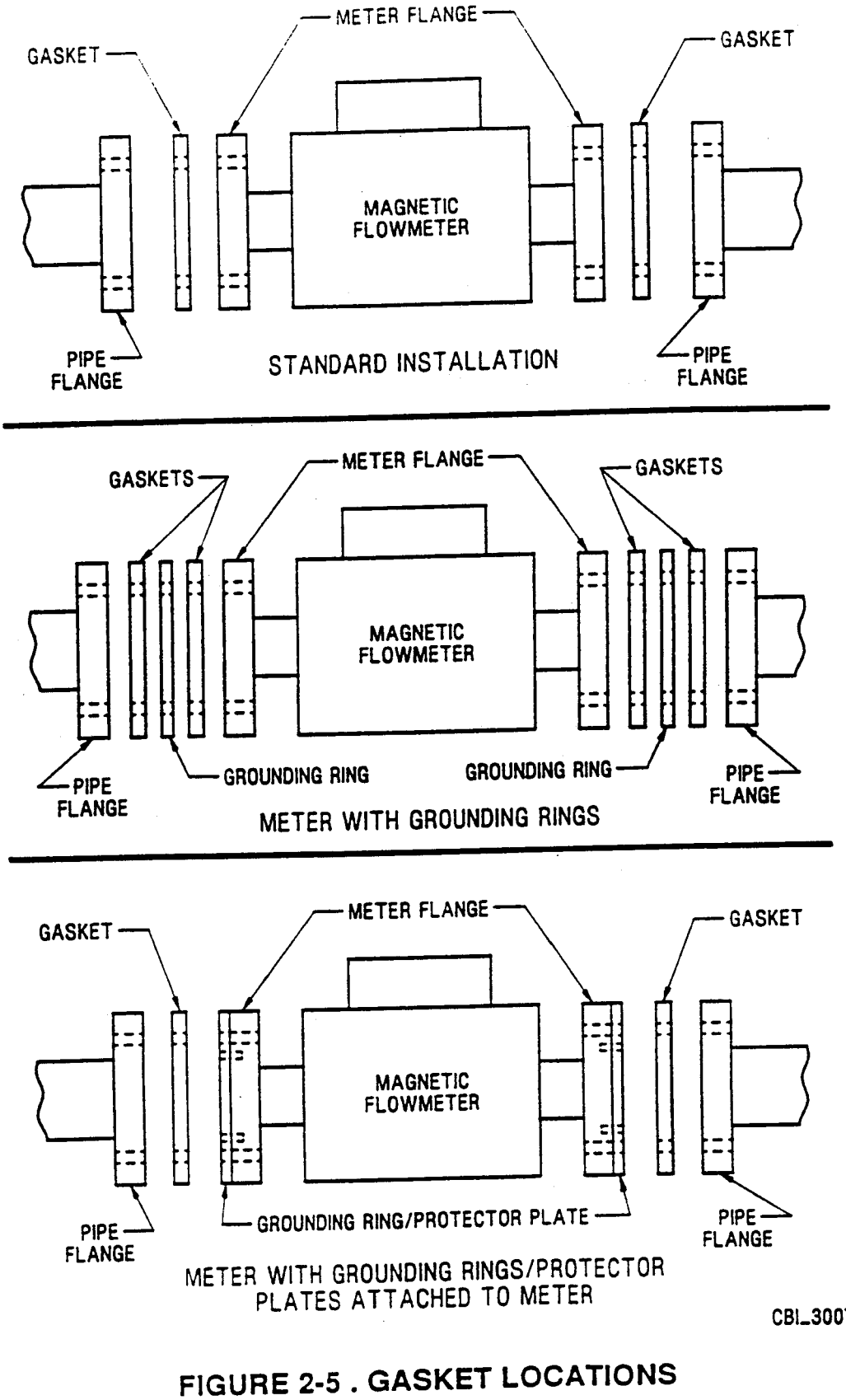
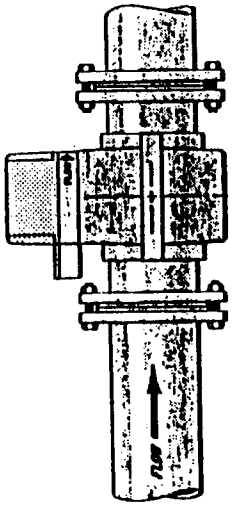
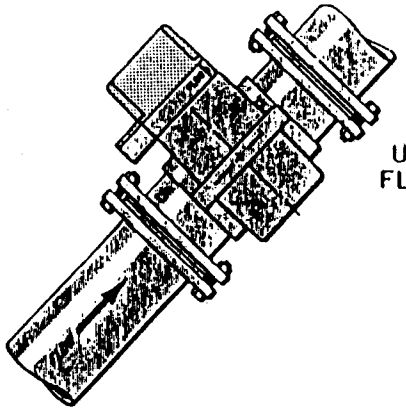


FIGURE 2-5 . GASKET LOCATIONS

PREFERRED INSTALLATION



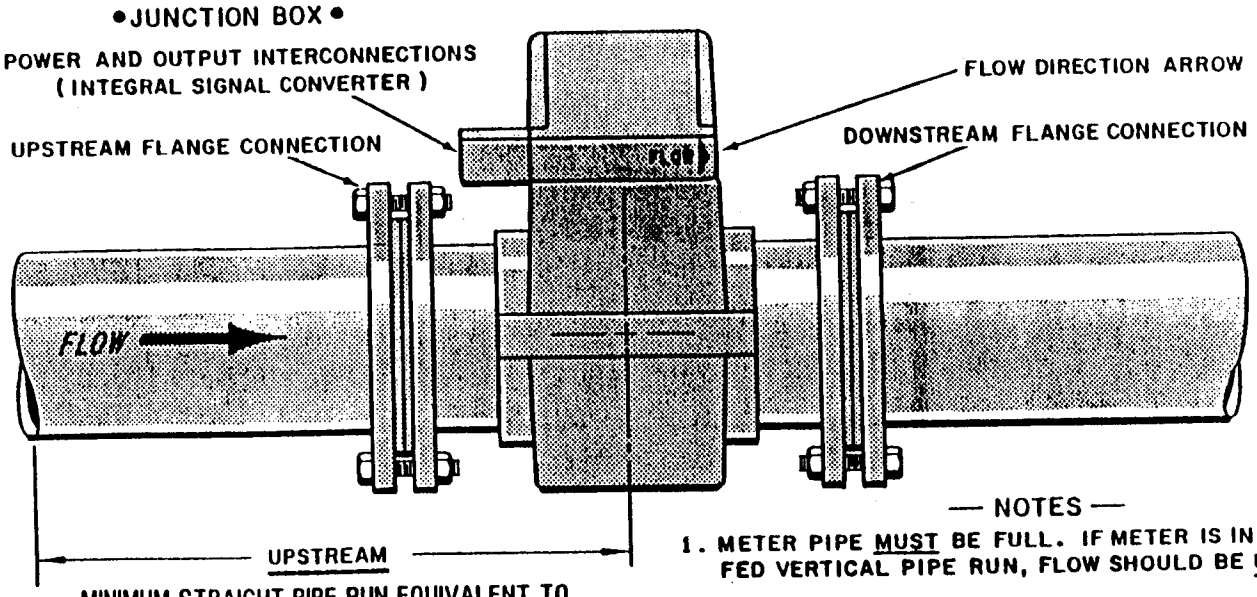
VERTICAL UPWARD FLOW



SLOPING UPWARD FLOW

ACCEPTABLE INSTALLATION WITH LIMITATIONS

HORIZONTAL FLOW TO LEFT OR RIGHT



GI-2916-I

MINIMUM STRAIGHT PIPE RUN EQUIVALENT TO 3 TIMES METER SIZE FOR ELBOWS AND TEES; 10 TIMES METER SIZE FOR CONTROL VALVES AND PUMPS.

— NOTES —

1. METER PIPE MUST BE FULL. IF METER IS IN GRAVITY FED VERTICAL PIPE RUN, FLOW SHOULD BE UPWARD.
2. METER MUST BE ORIENTED IN ACCORDANCE WITH FLOW DIRECTION.

2.5 Grounding Procedure

2.5.1 General

Satisfactory operation of Fischer & Porter Magnetic Flowmeter Systems requires that careful attention be paid to proper grounding techniques. A good ground is one that is in contact with the earth over a large conductive area. An excellent example of this is a cold water pipe which is buried in the earth and travels many miles in its distribution system. A great number of pipe branches form a large conductive area of contact which provides a low resistance connection to earth. A hot water or steam pipe must first return to a boiler before it becomes a cold water pipe, and therefore, its greater length of ungrounded path offers a less desirable ground bus. A metallic structural member of a building, such as a supporting "I" beam, may be a good earth ground, but it is a second choice to a cold water pipe.

Meter grounding requirements are really a combination of standard grounding methods and a bonding of the meter body to the process liquid. The most important of these is the process bonding, which is nothing more than ensuring that the meter body is in contact with the process liquid at both ends of the meter body. Basically, the bonding procedure places an electrical short circuit across the meter, thereby routing any stray current around the liquid in tne meter (rather than through it).

From the point of view of grounding there are two basic types of piping systems:

- electrically conductive pipeline: the process liquid comes in contact with conductive pipe. This piping requires that each meter flange be connected with a bonding wire to the adjacent pipeline flange. The grounding procedure to use with conductive pipeline is described in 2.5.2.
- non-conductive or electrically insulated pipeline: the pipeline may be made of an electrically non-conductive material (plastic, concrete, etc.) or lined with a non-conductive material (rubber, TEFLON, etc). These non-conductive pipelines require the use of metal grounding rings to bond the process liquid to ground. The grounding procedure to use with nonconductive pipeline is described in 2.5.3.

Proper grounding of the Magnetic Flowmeter is required for optimum system performance.

2.5.2 Conductive Pipeline

If the flowmeter is included as part of a conductive pipeline that is not electrically insulated from the liquid to be metered, the following grounding procedure should be followed.
Refer to Figure 2-7 to supplement the following text.

1) Drill and tap both pipeline flanges adjacent to the bonding connections on the flowmeter. The lugs on the bonding cables are sized for metric M6 fasteners (a 1/4" bolt).

2) Obtain a bright metal surface around the edges of the tapped hole with a file or burnishing tool.

3) Attach the bonding wire and another length of ground wire to the flanges as shown. Use internal tooth lockwasners as shown in the detail. The wire to the good external ground should be #12 AWG. or heavier. copper wire.

2.5.3 Non-Conductive or Electrically Insulated Pipeline

If the flowmeter is included as part of a non-conductive or liquid insulated pipeline (such as tot plastic pipe, ceramic lined iron pipe, or cast pipe with internal bitumastic coating), the followi grounding procedures apply. Refer to Figure 2-8 to supplement the following text.

1) For this service, the meter requires the use of grounding rings. The grounding ring should be installed between the meter flanges and the mating flanges of the pipeline shown in Figure 2-8. A gasket is required on both sides of the grounding ring. If the me is supplied with a grounding ring/protector plate fastened to the meter flange,only on ket is required between the grounding ring/protector plate and the pipeline flange. Pr gasket locations are shown in Figure 2-5.

2) Attach the bonding wire and ground wire to the tab of the grounding ring. Use inte tooth lockwashers and hex head nut and bolts as shown in Figure 2-8. The ground w should be #12 AWG, or heavier, copper wire.

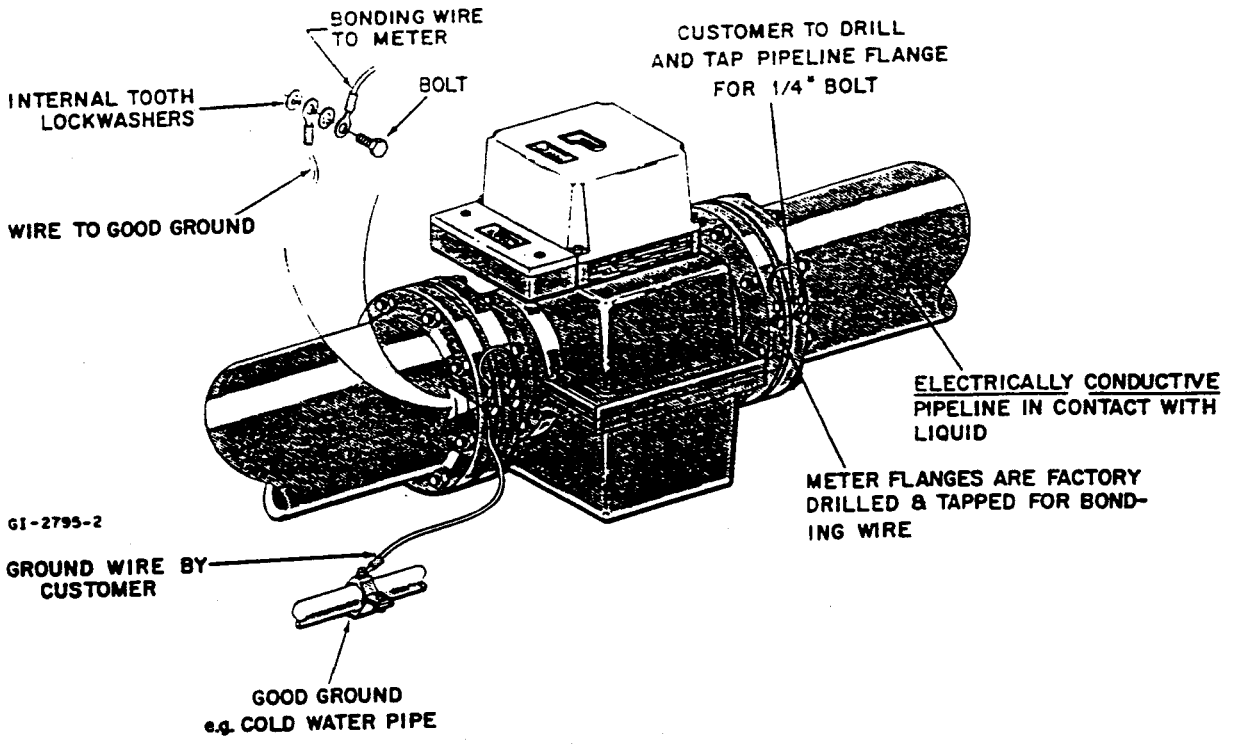


FIGURE 2-7. GROUNDING PROCEDURE; CONDUCTIVE PIPELINE

Note that the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

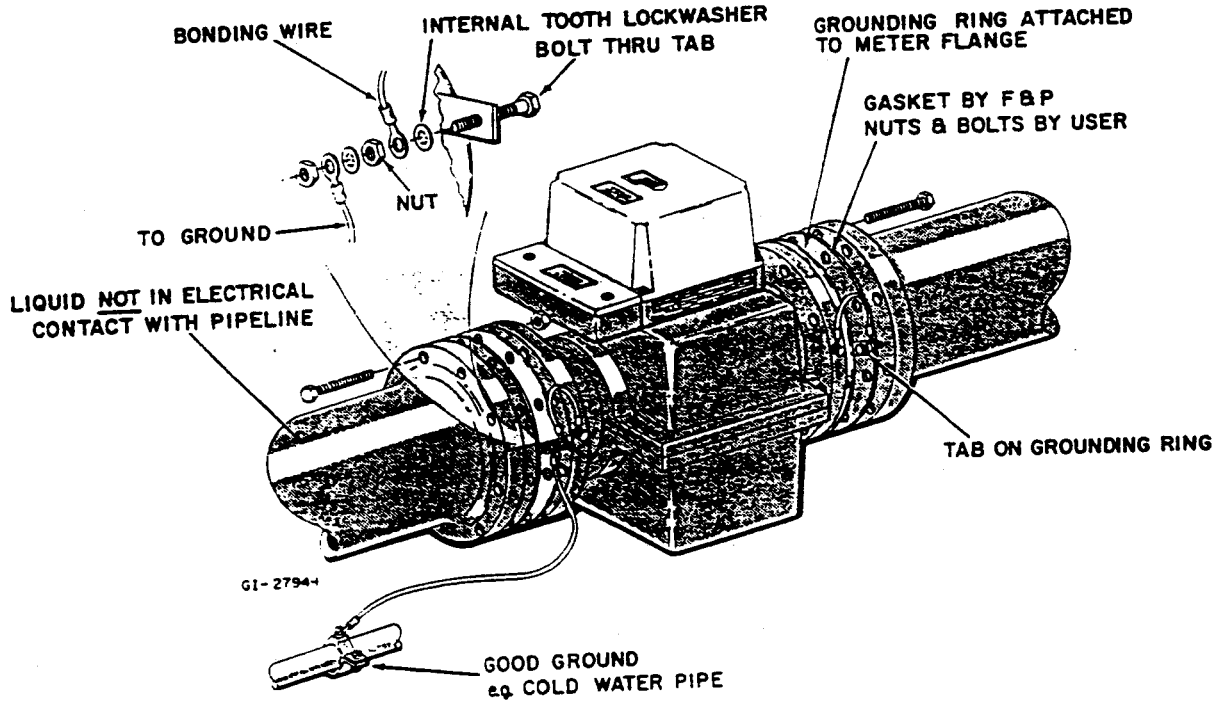


FIGURE 2-8. GROUNDING PROCEDURE; NON-CONDUCTIVE PIPELINE

Note that the flowmeter shown in this illustration is not the meter described in this instruction bulletin.

2.6 Electrical Interconnection

The Series 3000 Magnetic Flowmeter may be furnished with either an integrally or remotely mounted (optional) Signal Converter. Interconnection wiring is arranged differently for the two tems. Interconnection details are provided in the Instruction Bulletin provided with the Signal verter.

WARNING
Equipment powered by ac line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power input leads are disconnected from the operating branch circuit before attempting electrical interconnections.

Regardless of the interconnection procedure used, the grounding procedures given in Sectic must be followed.

2.7 Conduit Seal and Pressure Relief

In accordance with the National Electrical Code (NEC) ANSI/NFPA 70, Article 501-5(f)(3), th meters include a conduit entry seal and pressure relief to prevent the process fluid from ent the electrical conduit system. This safety feature considers the remote possibility of a primar failure, in which case, the secondary seal will prevent the process from entering the electric duit system. The secondary seal consists of the following:

Integral Converter - Feed-through's between the electronics housing and field wiring (customer connection) junction box.

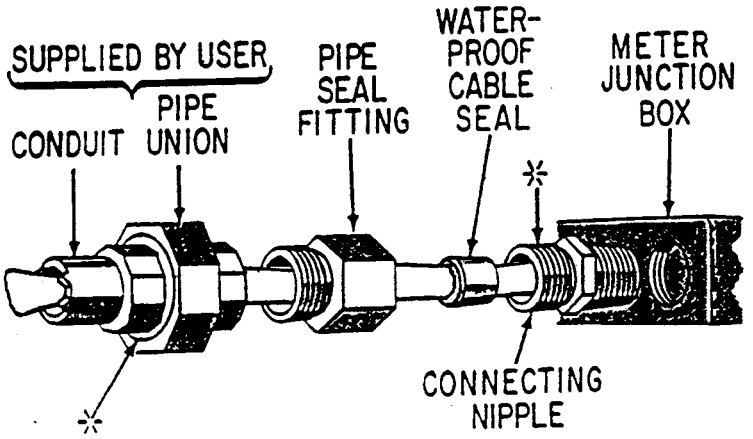
Remote Primary - Conduit entry cable seal on meter customer connection box.

It is the user's responsibility to properly install the conduit entry cable seal fitting supplied w signal cable provided with the remote mounted signal converter. This will ensure proper per mance of this safety feature. See Figure 2-9.

A pressure relief is provided in the electronics housing for the integrally mounted signal conv and in the customer connection box on the remote mounted flowmeter primary. In both hou the pressure relief is located in the center of the cover joint on the side opposite from the cc connection. If the primary seal should fail, the pressure relief will vent the process preventin over pressurization and potentially dangerous failure of the electronics housing.

It is the user's responsibility to be aware of this safety feature and to consider the unlikely e its functioning. Based on knowledge of the process and meter application, the user should c the installation orientation of the meter and possible use of deflectors to safely direct the ve process.

THE CONDUIT ENTRY SEAL FITTING PROVIDED WITH THIS METER SHALL BE INSTALLED AS SHOWN.



* CONDUCTIVE THREAD SEALANT TO BE USED ON ALL EXCEPT THESE STRAIGHT THREADS.

Figure 2-9. Conduit Entry Seal Installation

3.0 START-UP and OPERATION

The F&P Series 10DX3011 Magnetic Flowmeter (which includes the integral or remote Signal Converter) is precision calibrated at the factory. Each Flowmeter is calibrated to determine its meter capacity at a given velocity. Refer to Table 1-2.

There are no operating controls that require field adjustment unless the full scale range setting was not specified. If a change in the full scale range setting is required, refer to the Instruction Bulletin supplied with the Signal Converter. If no change is required, the equipment is ready for operation as received.

Prior to initial system start up, verify that the meter is properly installed; check flow direction, wiring interconnection and grounding as discussed in Section 2.0 Installation. Particular attention should be given to the meter grounding procedures; improper grounding may result in unsatisfactory performance. Refer to the Signal Converter Instruction Bulletin for interconection grounding.

Start flow through the process piping system that includes the meter. Allow a nominal flow through the pipeline for several minutes to purge entrapped air. The pipeline must be full for accurate flow measurement.

Apply the appropriate power for the 10DX3011 Magnetic Flowmeter by closing the external switch or circuit breaker; there are no switches inside of the equipment. Also energize any auxiliary equipment associated with the flow metering system, such as remote analog recorders, controllers or rate indicators.

Initiate process flow through the pipeline. Flow measurement and concurrent output signal transmission will commence with flow through the meter. Information concerning operation of the Signal Converter is provided in the Instruction Bulletin supplied with the Converter.

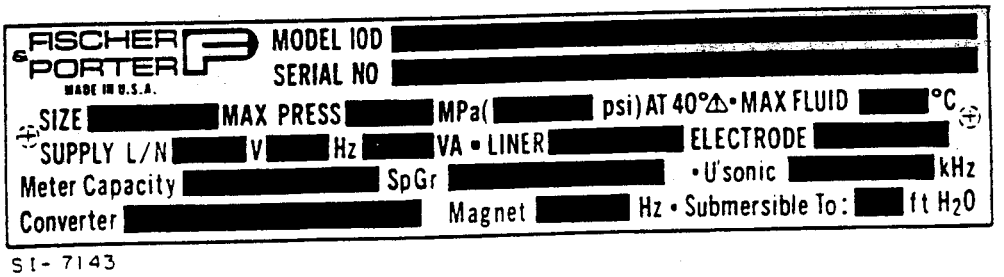


FIGURE 3-1. TYPICAL INSTRUMENT TAG

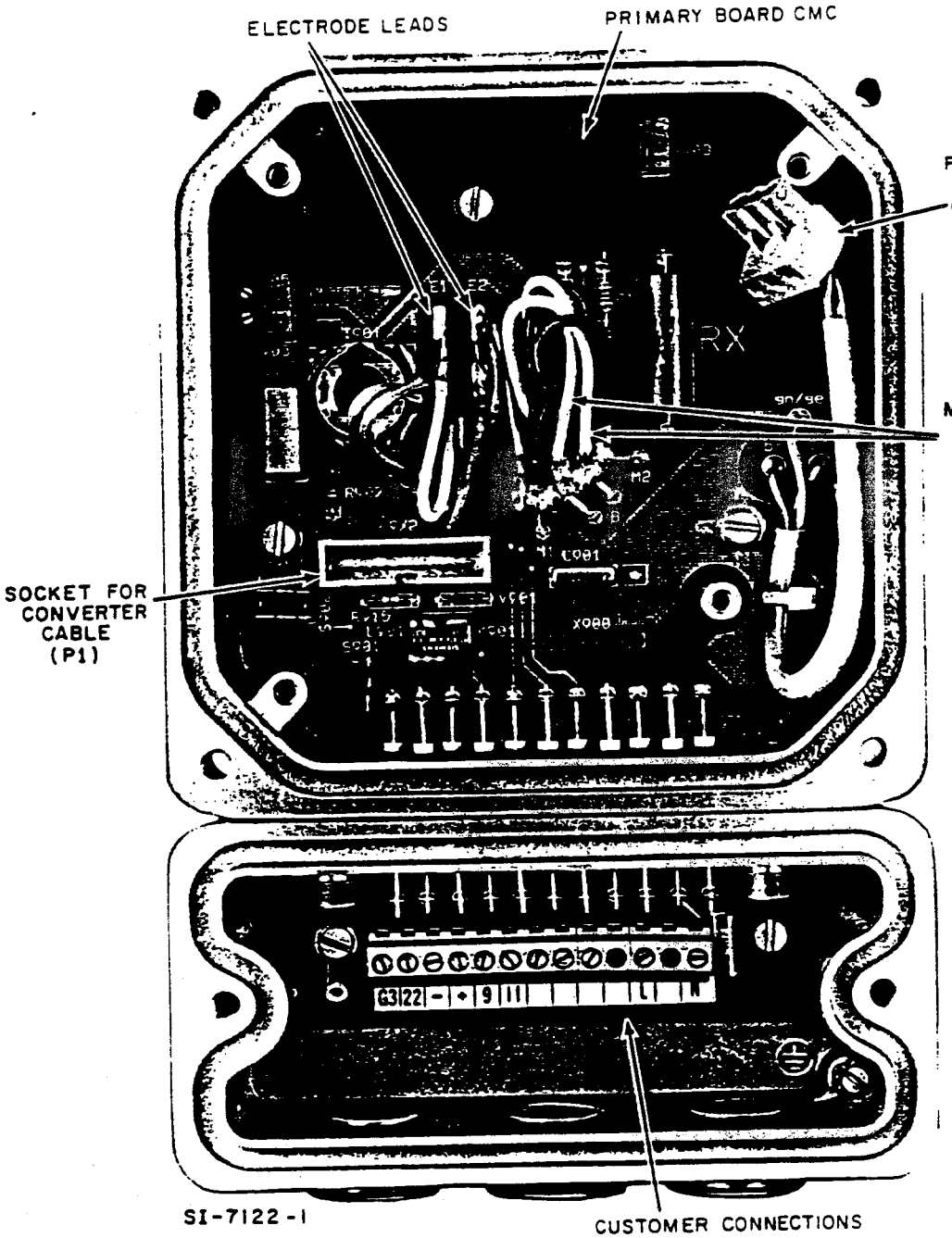


FIGURE 3-2 . PRIMARY MOUNTED PC ASSEMBLIES

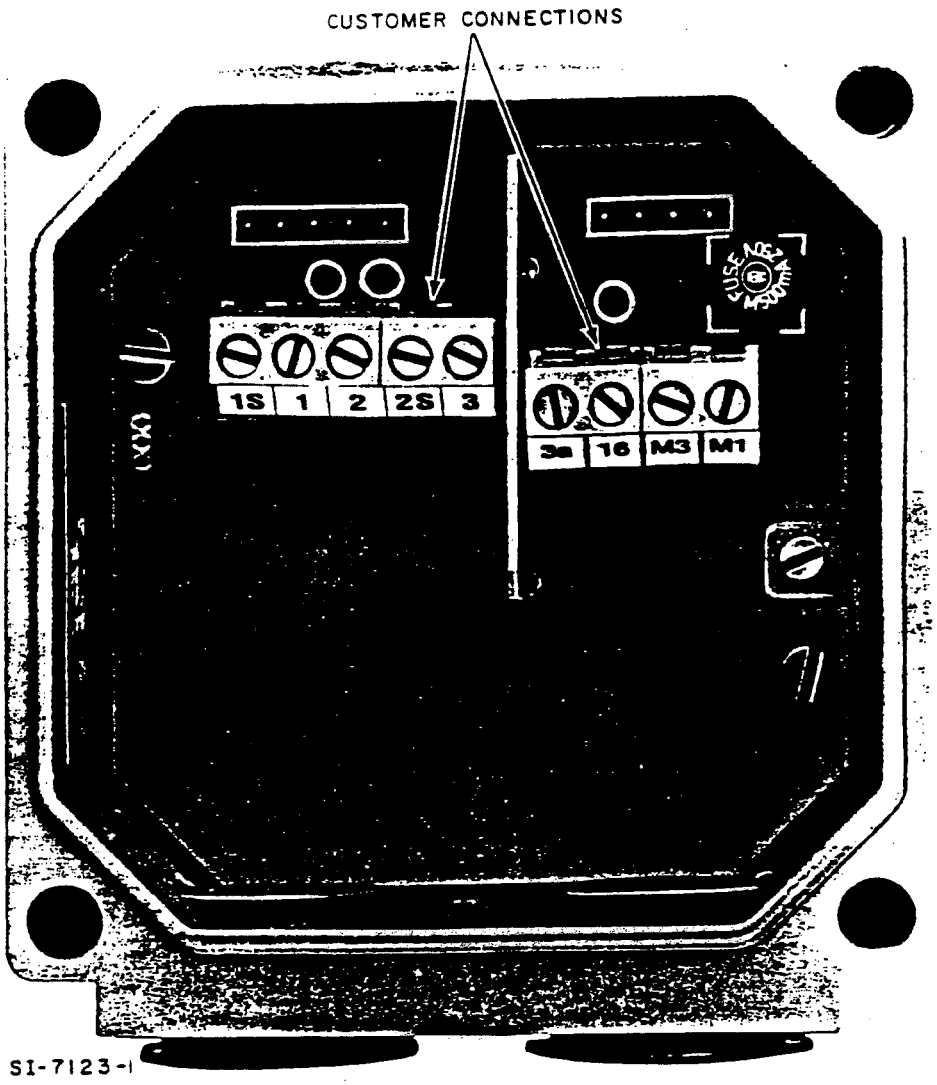


FIGURE 3-3. PRIMARY CONNECTIONS FOR REMOTE MOUNTED SIGNAL CONVERTER

4.0 FUNCTIONAL DESCRIPTION

The Magnetic Flowmeter body houses two signal electrodes and two flux producing magnet coils, as shown schematically in Figure 4-1. All primary intraconnection wiring is terminated at a printed circuit assembly located in the base mounted on the meter housing.

The primary provides two output signals to the associated Signal Converter:

- an electrode signal that contains the flow rate information
- the reference signal which is proportional to the magnet excitation current (theoretically, this reference signal is proportional to the flux density in the metering section).

The reference voltage is derived across a precision constant meter capacity (CMC) resistance network that is connected in series with the magnet coils. Changes in magnet drive voltage, which cause a variation of flow signal, will simultaneously cause a proportional variation of the reference voltage. The circuitry will provide an exact ratio and thereby provide immunity to power supply variation. The magnet coil drive circuitry is contained in the Signal Converter.

4.1 Basic Operating Principle

4.1.1 Signal Voltage Generation

The operating principle of the Fischer & Porter Series 3000 Magnetic Flowmeter is based upon Faraday's Law of Induction which states that the voltage induced across any conductor as it moves at right angles through a magnetic field will be proportional to the velocity of that conductor. This principle finds common application in direct and alternating current generators. Essentially, the F&P Magnetic Flowmeter constitutes a modified form of a generator.

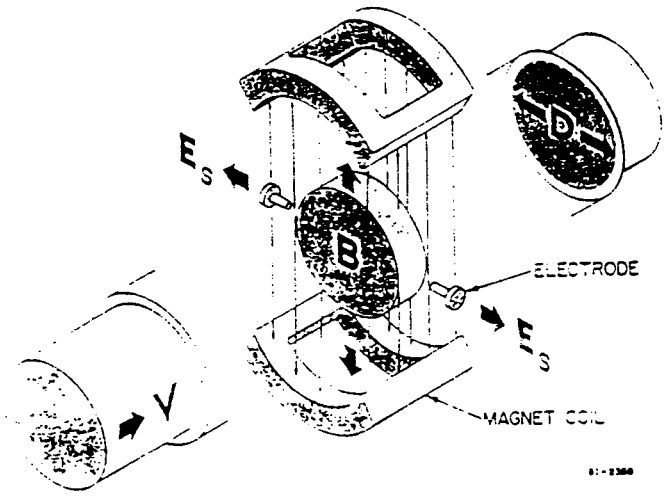


FIGURE 4-1. BASIC OPERATING PRINCIPLE

Figure 4-1 graphically illustrates the basic operating principle. A magnetic field, "B", being generated in planes which are perpendicular to the axis of the meter pipe. A disk of the metered liquid can be considered as a conductor. The transverse length "D" is equal to the meter pipe diameter. Since the velocity "V" of the liquid disk is directed along the axis of the meter pipe, a voltage, signal "E_S", will be induced within this liquid which is mutually perpendicular to the direction of the liquid velocity and the flux linkages of the magnetic field; i.e., in the axial direction of the meter electrodes. This electrode voltage is the summation of all incremental voltages developed within each liquid particle that passes under the influence of the magnetic field.

This may be expressed mathematically as:

(Equation #1)

$$E_S = \frac{1}{\alpha} BDV$$

where:

E_s = induced electrode voltage
B = magnetic field strength
D = meter pipe diameter
α = dimensionless constant
V = liquid velocity

The metered liquid constitutes a continuous series of conductive liquid disks moving through a netic field. The more rapid the rate of liquid flow, the greater the instantaneous value of signa age as monitored at the meter electrodes.

4.1.2 Magnet Coil Drive Circuits

In older conventional Magnetic Flowmeters the integral magnet coils are driven directly by the customer's 50/60 Hz power service. Notably, however, the design of the F&P Series 3000 Ma netic Flowmeter uses magnet drive circuits which are alternately energized bi-directionally at frequency rate as commanded by the associated Converter/Driver assembly. This provides n mum zero stability.

4.1.3 Volumetric Flow Rate Measurement

The F&P Magnetic Flowmeter is a volumetric flow rate measuring instrument. This can be sho by substituting the physical equivalent of liquid velocity into equation #1 as follows:

(Equation #2)

$$V = \frac{Q}{A} = \frac{4Q}{\pi D^2}$$

Substituting for V in equation #1

$$E_S = \frac{1}{\alpha} BD \frac{4Q}{\pi D^2}$$

and solving for Q:

$$\therefore Q = \frac{\pi \alpha D}{4} \cdot \frac{E_S}{B}$$

Since $B = \beta E_r$

and since α, D and β are constant:

Equation #3)

$$Q = \gamma \frac{E_s}{E_r}$$

where:

Q = volumetric flow rate
A = cross-sectional area
D = pipe section diameter
E_s = induced signal voltage
E_r = reference voltage
B = magnetic flux density
α = dimensionless constant
β & γ = dimensional constant
V = liquid velocity

Therefore, volumetric flow rate is directly proportional to the ratio of the induced signal voltage to the reference voltage as measured by the F&P Magnetic Flowmeter.

4.2 Operating Characteristics

4.2.1 Liquid Variables

4.2.1.1 Liquid Conductivity

The Series 3000 Magnetic Flowmeter requires a liquid conductivity of 5 microsiemens per centimeter or higher for operation. This minimum liquid conductivity requirement is not affected by the length of the signal interconnection cable when remote mounting of the Signal Converter is required, as long as the F&P supplied or F&P approved interconnection cable (with driven shields) is used. The nominal maximum transmission distance is limited to 30 meters (100 feet); however longer distances can be accommodated (contact F&P for details). Thirty feet of cable is supplied as standard for remotely mounted Signal Converters.

The conductivity of a given liquid, σ, may be determined experimentally under a filled meter condition, as follows:

1) Turn off power to the Signal converter. Remove the Converter housing cover. Disconnect and identify the electrode signal interconnection leads from terminals "1" and "2" of the Signal Converter.

2) Measure the resistance between signal leads "1" and "2" with an ac ohmmeter.

CAUTION
Do not use a dc ohmmeter for this measurement as polarization effects will produce completely erroneous data.

The conductivity of the process liquid (in microsiemens/cm) may be determined from the elec ac resistance measurement (in megohms) by substitution of values in the following equation.

$$\sigma = \frac{1}{R_{ac} - 0.072) \times \text{Electrode Dia. in cm}}$$

where,

0.072 is the electrode barrier resistance in megohms; i.e., 36 kΩ x $2/10^6$

and,

typical electrode diameter is 0.3" (0.76 cm)

For example, assuming the measured ac electrode resistance (full pipe) is 192,000 ohms and electrode diameter is 0.76 cm, then

$$\sigma = \frac{1}{(0.192 - 0.072) \times 0.76} = 7.65\ \mu S/cm$$

This is above the threshold for specified measurement accuracy for the particular liquid, met and Signal Converter combination. Liquid conductivities at the operating temperature may als determined from standard references for many pure liquids. F&P Field Engineers are equippe determine the conductivities of special liquids at the user's site as an engineering service.

Electrode diameters vary with meter size and type of liner, the values given in Table 4-1 are t electrode diameters.

TABLE 4-1. ELECTRODE DIAMETERS

Meter Size	Electrode Diameters	
	TEFLON Lined Meter	Neo/Poly Lined Meter
15 mm (½)"	.549 cm (.216 inch)	----------
25-40 mm (1 - 1½")	.770 cm (.303 inch)	----------
50-100 mm (2 - 4")	.820 cm (.323 inch)	.635 cm (.250 inch)
150-250 mm (6 - 10")	1.200 cm (.472 inch)	.635 cm (.250 inch)

4.2.1.2 Liquid Temperature

Having established the minimum liquid conductivity requirements for a given application, any liquid which exhibits equal or higher conductivity may be metered without concern for any system compensating adjustments. However, the effect of the liquid conductivity versus temperature should be considered.

Most liquids exhibit a positive temperature coefficient of conductivity. It is possible for certain marginal liquids to become sufficiently non-conductive at lower temperatures so as to hamper accurate metering; whereas, the same liquid at higher or normal environmental temperatures may be metered with optimum results. The possibility of an adverse temperature conductivity characteristic should be investigated before attempting to meter such a liquid. Process or ambient temperatures are limited by the meter materials specification.

Other normal effects of temperature, such as influence upon liquid viscosity and density, the size of the metering area, and the flux density of the magnetic field, have negligible or no effect upon metering accuracy.

4.2.1.3 Other Liquid Variables

Other liquid variables such as viscosity, density and liquid pressure have no direct influence on metering accuracy. Liquid density has no effect on volumetric flow rate since only the area of the meter pipe and liquid velocity are required to determine the rate of flow. Viscosity and metering pressure are restricted to physical limitations alone, such as the leakage pressure of the meter pipe flange connections.

4.2.2 Metering Characteristics

The metering pipe must be completely filled at all times for accurate results. Where there is a possibility of operation with a partially filled horizontal pipeline, it is recommended that the Magnetic Flowmeter be installed in a vertical section of that pipeline such that liquid flow moves upward. A vertical installation also offers the advantage of an even distribution of liner wear in the event that solid abrasives are being carried along in the liquid stream.

The magnetic flowmeter must be full at all times for accurate measurement.

The F&P Magnetic Flowmeter will measure the total amount of material passing in the liquid stream. The meter will not, for instance, differentiate between the amount of liquid and the amount of entrained gases. Also, in the case of a slurry, it will not differentiate the amount of liquid from solids. If the liquid to mixant ratio is of importance to process control, then separate measurements of the concentration of the desired medium must be made and appropriate correction factors must be applied to the Magnetic Flowmeter output.

In applications involving variable quantities of uniformly dispersed, non-conductive mixing agents, it must be ascertained that the higher concentrations of mixant will not drive the average conductivity of the liquid mixture below the minimum conductivity level for the given installation.

5.0 CIRCUIT DESCRIPTION

5.1 Primary Signals

The Magnetic Flowmeter body houses two signal electrodes and two flux producing magnet coils. All Flowmeter intraconnection wiring is terminated at the CMC/ZERO PC board located in the base of the meter housing.

The Flowmeter provides two output signals to the associated Signal Converter; one, an electrode signal that contains the flow rate information, and two, the reference signal which is proportional to the magnet excitation current (theoretically, this reference signal is proportional to the flux density in the metering section). The reference voltage is derived across a precision "constant meter factor" resistance network that is connected in series with the magnet coils. Changes in magnet drive voltage, which cause a variation of flow signal, will simultaneously cause a proportional variation of the reference voltage. The circuitry will provide an exact ratio and thereby provide immunity to power supply variation. The magnet coil drive circuitry is contained in the Signal Converter.

The (gated) magnet driver operates at a frequency that permits magnetic flux in the primary to reach a steady state level during the last 25% of each half period of magnet excitation. By using sampling techniques, the flow (differential mode) signal is measured only during the intervals that magnetic flux is constant $\frac{d\phi}{dt} = 0$.

Therefore, zero instability due to changing flux is eliminated by use of the MAG-X design concept (sampling technique), providing a meter totally free of zero drift. A thorough discussion of Signal Converter operation is provided in the Instruction Bulletin supplied with the particular Signal Converter.

5.2 Constant Meter Capacity (CMC) PC Assembly

The CMC PC Assembly provides several functions. These include:

1. Establishes interconnections between the Flowmeter internal wiring and the Signal Converter.

2. Permits factory adjustment of meter capacity values to a fixed value for each nominal size Flowmeter.

3. Permits factory adjustment of Flowmeter zero.

4. Establishes proper wiring connections for integrally or remotely mounted Signal Converters.

For integrally mounted Converters, zero return and options associated with the 50XM1000 Sign Converter are established by the position of Switches S901, S902 and S903 located on the low- left corner of the primary board. The following table and diagram correlate the zero return and options with the Switch positions.

Option	Converter type	Terminal ID	Switch/Position		
			S901	S902	S903
Zero return (input)	50XM1000, 50XO1000	G3, 22	*	2	2
External totalizer reset (input)	50XM1000	G3, 31	*	2	2
Alarm (output)	50XM1000	E9, C9	1	1	1
Opto-Coupled scaled pulse forward (output)	50XM1000	55, 56	1	1	1
Flow direction indicator (output)	50XM1000	E9, C9	2	1	1

* Switch position does not matter.

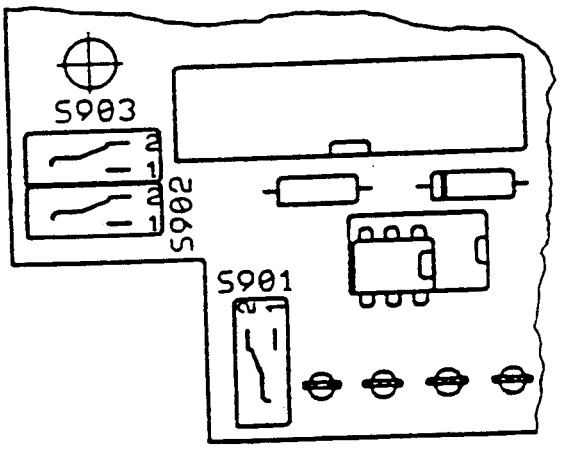


FIGURE 5-1. LOCATION OF OPTION SWITCHES

6.0 MAINTENANCE

6.1 General

Except for an occasional performance verification check, there is no required routine maintenance for the Series 3000 Magnetic Flowmeter. For practical reasons it is suggested that the meter body not be disassembled. If disassembled, complete waterproof sealing is required for satisfactory operation and is best done at the factory. Replacement of faulty magnet drive coils and electrode replacement is a factory operation. Factory calibration after this type of repair is the only way to guarantee meter accuracy.

F&P offers a Repair/Exchange Program to facilitate replacement of a defective meter or Converter. If the equipment is beyond the warranty limit, under this program a fixed price will be charged for replacement of defective equipment, with appropriate credit issued when the repairable unit is received by F&P (charges prepaid). The equipment available under this program is as follows:

- the complete meter with integrally mounted Signal Converter
- the meter and associated primary board; that is, the hydraulic portion without the Signal Converter
- the Signal Converter

WARNING

All Flowmeters and/or Signal Converters being returned to Fischer & Porter for repair must be free of any hazardous materials (acids, alkalis, solvents, etc.). MSDS (Material Safety Data Sheet) for all process liquids must accompany returned equipment. Contact F&P for authorization prior to returning equipment.

NOTE

Operation and maintenance procedures for the Signal Converter are provided in the Instruction Bulletin supplied with the Signal Converter.

When communicating with F&P in regard to replacement of a complete meter (with integrally mounted Converter), the meter body, or the Signal Converter, it is important to refer to the complete instrument serial number to assure that the correct replacement will be supplied. This information is provided on the manufacturing specification sheet supplied with the Magnetic Flowmeter, and on the instrument data tag.

6.2 System Troubleshooting

In the event that faulty operation of the Magnetic Flowmeter is evident, the following procedur be used as a guide to isolate the malfunctioning device to either the primary meter or the Sig Converter. A standard multimeter and an oscilloscope are suitable for making most of the te measurements.

To supplement the following discussion refer to:

Section 5.0 Circuit Description

Signal Converter ... refer to applicable Instruction Bulletin

NOTE
The Series 3000 Magnetic Flowmeter housing is supplied as a sealed unit. Therefore, customer field repairs to these meters are not recommended. In the event of a malfunction, repairs should only be performed by an F&P field service engineer, or the complete meter returned (shipping charges prepaid) to F&P for service.

WARNING
Equipment powered by an ac line voltage presents a potential electric shock hazard. Servicing of the Magnetic Flowmeter or Signal Converter should only be attempted by a qualified electronics technician.

1. If meter operation is suspected, proceed as follows:

a) Remove access covers from the junction box and the Converter housing (remote integral).
b) Inspect for evidence of water entry in the junction box and Converter housing.

If water is present, de-energize system at power source. Inspect conduit seals and cover g for possible source of water entry. Replace the seals and/or gaskets as required. Allow inter junction box and Converter housing to dry completely before restoring system power. Refe Table 7-6 for gasket part numbers. Seals are supplied by user.

2. Since signal wiring and operating procedures are dependent upon the type of Converter mounting option selected, the user should refer to the instruction bulletin supplied with the associated Signal Converter for system troubleshooting procedures. A static performance te the primary mounted components is discussed in Section 6.3.

The Signal Converter options available for use with the Magnetic Flowmeter are:

- integrally or remotely mounted Analog Signal Converter
- integrally or remotely mounted Microprocessor Signal Converter

3. Possible causes of erroneous flow rate indication are:

- incorrect grounding
- excessive noise due to a heavy slurry process or a non-homogeneous process
- loose or intermittent wiring
- non-full or empty meter pipe
- excess air entrained in process liquid

6.3 Static Test

If improper operation of the Magnetic Flowmeter is suspected, the following resistance meas ments can be made to establish whether an electrical malfunction has occurred. An analog n meter is required for checking the electrodes. Either an analog or digital multimeter can be checking the coils. These measurements can be made at the flowmeter PC board.

WARNING
Equipment that operates from ac line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power is disconnected before making the following ohmmeter checks.

6.3.1 Magnet Coil Check

6.3.1.1 Integrally Mounted Signal Converter

There are two magnet coils in the meter that are wired in series and brought up to terminal and M2/M3 of the flowmeter PC board in the electronics base.

Verify that the system power service has been de-energized. For a meter with an integrally mounted Converter, loosen and remove the four screws that hold the Signal Converter to t Disconnect the connector from signal (P1) on the CMC PC board and the power (P3) conne the Converter and set the Converter aside. Read the resistance of the magnet coils by conn the ohmmeter between M1 and M2/M3. The value displayed should correspond to that indi Table 6-1. If the value is incorrect, read the resistance of each coil by measuring between .. B, and M2 and B. Verify that it is in accordance with the value given in Table 6-1.

Verify that the resistance of each coil lead to the meter case is infinite. This requires unsol and identifying each coil wire on the CMC PC board. If coils are defective, meter must be re to the factory for service.

6.3.1.2 Remotely Mounted Signal Converter

Verify that the system power service has been de-energized. For a meter with a remotely m Signal Converter, turn off the power to the Signal Converter to de-energize the meter. Ren cable leads M1 and M2/M3 from the customer terminal block. Measure magnet coil series re tance by connecting the ohmmeter between M1 and M2/M3. The value displayed should co respond to that indicated in Table 6-1. A reading of infinity or a short circuit between leads indicates defective coil(s). If proper coil resistance is verified, reconnect cable leads to ter M1 and M2/M3. If coil(s) is defective, meter must be return to the factory for service.

TABLE 6 -1. METER COIL RESISTANCE

METER SIZE		COIL RESISTANCE Nominal, ohms ±10%	
mm	inches	Each Coil*	Series Resistance**
15	½	61	122
25	1	38	76
40	1½	61.5	123
50	2	37	74
80	3	37	74
100	4	16.5	33
150	6	17.7	35.4
200	8	9.8	19.6
250	10	7.4	14.8

* M1 to B or M2/M3 to B
** M1 to M2/M3

6.3.2 Electrode Check

The electrode check is essentially a resistance measurement that can be made to establish t short (or high resistance leakage path) does not exist between one, or both, electrodes and t meter body. Verify that the system power service has been de-energized.

To perform this test, the meter must be removed from the pipeline and the meter liner "wipec When the meter liner has been thoroughly dried, proceed as follows:

1) If a integral Signal Converter is supplied, begin with step a), below. If a remote Sig Converter is supplied, begin with step b).

a) Remove meter housing cover from electronics compartment. Loosen the fc mounting screws that secure the integral Signal Converter to the meter base. connect the connector from signal (P1) on the CMC PC board and the power (connector to the Converter, and set the Converter aside. Proceed to step 2.

b) Disconnect and identify(tag) the electrode signal leads, 1 and 2, from the te minal board in the remote Signal Converter (or from the terminal board in the of the meter housing).

2) Place Ohmmeter on highest available range (for example: R x 100,000).

3) Connect the Ohmmeter "minus" lead to the meter ground stud and the "plus" lead electrode line 1. This reading should be infinite. If any resistance can be measured, th meter is defective and must be replaced.

4) Check the other electrode by connecting the Ohmmeter "plus" lead to line 2. This re ing must also be infinite. If any resistance can be measured, the meter is defective a must be replaced.

5) If measurement of both electrodes indicate an infinite resistance reading, the meter then be returned to on-stream operation. LINES 1 AND 2 FROM THE RESPECTIVE ELECTRODES MUST BE RECONNECTED TO TERMINALS 1 AND 2 OF THE TERM BOARD. DO NOT INTERCHANGE THESE PROCESS SIGNAL CONNECTIONS.

7.0 PARTS LIST

TABLE 7-1. FLANGE GASKETS FOR METER BODY

NOTE
Polyurethane and neoprene lined meters use neoprene gaskets.
TEFLON lined meters use TEFLON gaskets.

Two gaskets are required for each meter. If the meter has grounding rings, two additional gaskets are required for each meter.

Meter Size (Inches)	ANSI Flange Class	Liner Material		
		TEFLON	Polyurethane	Neoprene
½"	150	333N123P30	----------	----------
	300	333N240P30	----------	----------
1"	150	333N239P30	----------	----------
	300	333N205P30	----------	----------
1½"	150	333C526U20	----------	----------
	300	333N314P30	----------	----------
2"	150	333N415P30	333N415Q10	333C376Q10
	300	333N416P30	333N416Q10	333C373Q10
3"	150	333N509P30	333N509Q10	333C377Q10
	300	333N510P30	333N510Q10	333C374Q10
4"	150	333N604P30	333N604Q10	333C370Q10
	300	333N702P30	333N702Q10	333C375Q10
6"	150	333N811P30	333N811Q10	333C371Q10
	300	333N801P30	333N801Q10	333C378Q10
8"	150	333N812P30	333N812Q10	333C372Q10
	300	333N802P30	333N802Q10	333C379Q10
10"	150	333N807P30	333N807Q10	333C382Q10
	300	333N821P30	333N821Q10	333C514Q10

TABLE 7-2. PROTECTOR PLATES FOR TEFLON LINED METERS

Order number consists of two protector plates and mounting screws. Grounding rings are no
able for this application.
When ordering, specify 614B452___ and suffix from table below.

Protector Plate Material	Flange Rating = Size(Inches) =	ANSI Class 150					
		½"	1"	1½"	2"	3"	4"
316 sst	Suffix =	02	03	04	05	06	07
HAST "C"	Suffix =	16	17	18	19	20	21

Protector Plate Material	Flange Rating = Size(Inches) =	ANSI Class 300
		4"
316 sst	Suffix =	40
HAST "C"	Suffix =	47

TABLE 7-3. LINER PROTECTOR/GROUNDING RINGS FOR TEFLON LINED METERS

Order number consists of two protector plates and mounting screws. Grounding rings are no
able for this application.
When ordering, specify 614B384___ and suffix from table below.

Protector Plate Material	Flange Rating = Size(Inches) =	ANSI Class 150			ANSI Class 300		
		6"	8"	10"	6"	8"	10"
316 sst	Suffix =	01	07	13	04	10	16
HAST "C"	Suffix =	02	08	14	05	11	17

TABLE 7-4. GROUNDING RINGS - SIZES 1/2 THROUGH 4 INCH

Order number consists of two grounding rings and mounting screws.
When ordering, add suffix to BM number.

Meter Size (Inches)	Material =	Flange ANSI Class 150		Flange ANSI Class 300	
		316 sst	HAST "C"	316 sst	
	BM No.	Suffix		BM No.	Suffix
½"	800D508	U01	U09	800D708	U02
1"	800D508	U02	U10	800D708	U03
1½"	800D508	U03	U11	----------	
2"	800D508	U04	U12	800D708	U04
3"	800D508	U05	U13	800D708	U05
4"	800D508	U06	U14	800D708	U06

TABLE 7-5. GROUNDING RINGS - SIZES 6 THROUGH 10 INCH

NOTE
Polyurethane and neoprene lined meters use neoprene gaskets.
TEFLON lined meters use TEFLON gaskets.

Order number consists of one grounding ring and mounting screws. Order a quantity of two for each meter.
Order by the referenced part number.

Meter size (Inches)	Flange ANSI Class 150	Flange ANSI Class 300
	304 sst with neoprene gasket	304 sst with neoprene gasket
	Part Number	Part Number
6"	644B009U01	644B009U23
8"	644B009U03	644B009U25
10"	644B009U69	644B009U71

Meter size (Inches)	Flange ANSI Class 150	Flange ANSI Class 300
	304 sst with TEFLON gasket	304 sst with TEFLON gasket
	Part Number	Part Number
6"	644B009U02	644B009U24
8"	644B009U04	644B009U26
10"	644B009U06	644B009U28

TABLE 7-6. CONVERTER BASE AND JUNCTION BOX GASKETS

Integrally mounted Converter	
Converter base gasket	D101A009U01
Junction box gasket	D333F004U01

Remotely mounted Converter	
Meter junction box cover gasket	D333F008U01

DOCUMENTATION QUESTIONNAIRE

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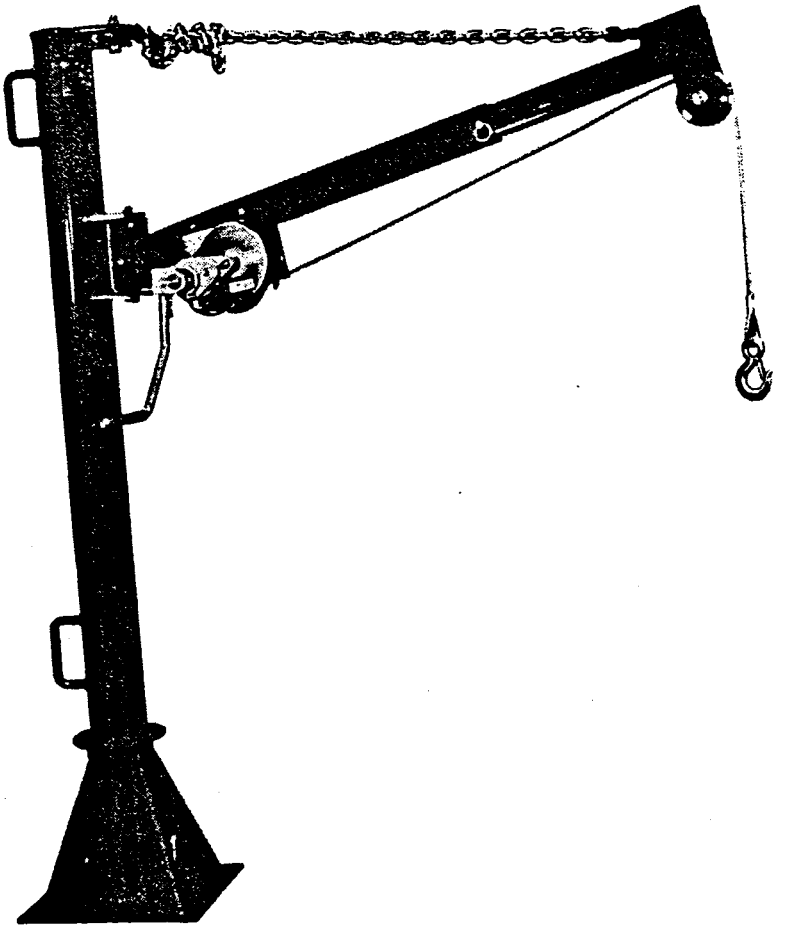
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WARMINSTER, PA 18974

FOLD 2

STAPLE HERE

THERN INCORPORATED

Read this Owner's Manual thoroughly before operating the crane. This manual tells you how to install, operate, and maintain the crane. Keep it with the crane at all times. Replacements are available from Thern, Inc., PO Box 347, Winona, MN 55987, 507-454-2996.



Owner's Manual

For Transportable Davit Crane Model 5334M1

form O-C534-0493

Limited Warranty

Thern, Inc. warrants its products against defects in material or workmanship for one year from the date of purchase by the original using buyer, or if this date cannot be established, the date the product was sold by Thern, Inc. to the dealer. To make a claim under this warranty, the product must be returned, prepaid, directly to Thern, Inc., 5712 Industrial Park Road, Winona, Minnesota 55987. The following information must accompany the product: the date of purchase, the description of the claimed defect, and a complete explanation of the circumstances involved. If the product is found to be defective, it will be repaired or replaced free of charge, and Thern, Inc. will reimburse the shipping cost.

This warranty does not cover any damage due to accident, misuse, abuse, or negligence. Any unauthorized alteration, repair or modification of the product outside the Thern, Inc. factory shall void this warranty. Factory authorization must be in writing from Thern, Inc.

FACTORY AUTHORIZED REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY TO THE CONSUMER. THERN, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS PRODUCT IS LIMITED IN DURATION TO THE DURATION OF THIS WARRANTY.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or allow limitations on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Note: Thern, Inc. reserves the right to change the design or discontinue the production of any product without prior notice.

About This Manual

The Occupational Safety and Health Act of 1970 states that it is the employer's responsibility to provide a work-place free of hazard. To this end, all equipment should be installed, operated, and maintained in compliance with applicable trade, industrial, federal, state, and local regulations. It is the equipment owner's responsibility to obtain copies of these regulations and to determine the suitability of the equipment to its intended use.

This Owner's Manual, and warning labels attached to the equipment, are to serve as guidelines for hazard-free installation, operation, and maintenance. They should not be understood to prepare you for every possible situation.

The information contained in this manual is applicable only to the Thern Model 5334M1 Transportable Davit Crane. Do not use this manual as a source of information for any other equipment.

The following symbols are used for emphasis throughout this manual:

⚠WARNING

Failure to follow 'WARNING!' instructions may result in equipment damage, property damage, and/or serious personal injury.

⚠CAUTION

Failure to follow 'CAUTION!' instructions may result in equipment damage, property damage, and/or minor personal injury.

Important!

Failure to follow 'important!' instructions may result in poor performance of the equipment.

1.1 Installing the Crane

Important!

- A licensed professional should inspect or design the foundation to insure that it will provide adequate support.
- Locate the crane so it will be visible during the entire operation.
- Keep a type ABC fire extinguisher near the operation area.

⚠WARNING

Do not install the crane in an area defined as hazardous by the National Electric Code, unless installation in such an area has been thoroughly approved.

Do not install the crane near corrosive chemicals, flammable materials, explosives, or other elements that may damage the crane or injure the operator. Adequately protect the crane and the operator from such elements.

Position the crane so the operator can stand clear of the load, and out of the path of a broken wire rope that could snap back and cause injury.

Attach the crane to a rigid and level foundation that will support the crane and its load under all load conditions, including shock loading.

1.1.1 CONSULT APPLICABLE CODES AND REGULATIONS for specific rules on installing the equipment.

1.1.2 LOCATE THE CRANE in an area clear of traffic and obstacles that could interfere with operation. Make sure the crane is accessible for maintenance and operation.

1.1.3 INSTALL THE CRANE on a level surface. **An unlevel surface will cause the boom to swerve.**

1.1.4 FASTEN THE BASE securely to the foundation.

CONTACT A QUALIFIED PROFESSIONAL FOR MOUNTING INSTRUCTIONS.

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Figure 2 – Boom Swivel

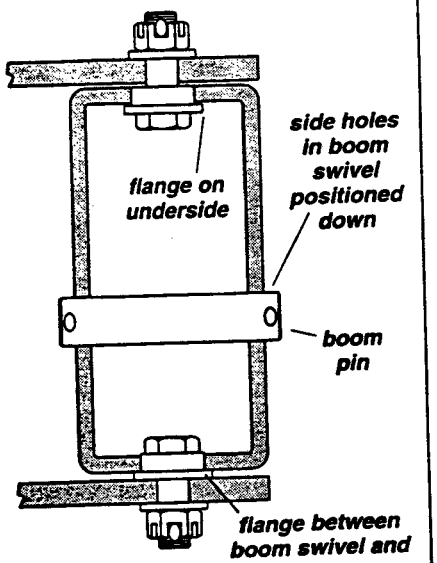
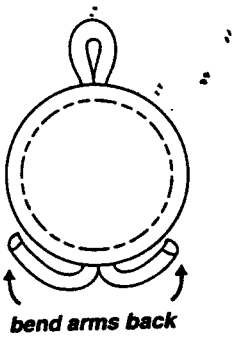


Figure 3 – Cotter Pins



1.2.6 ATTACH THE LOAD CHAIN.

a ATTACH THE LOAD CHAIN (**item 7**) to one end of the double clevis link (**item 21**), and attach the other end of the clevis link to the boom extension.

b ATTACH THE OTHER END of the load chain to the grab hook by turning a link sideways and inserting it in the hook. **Avoid twisting the load chain, and make sure the chain link is seated in the saddle of the hook. See figure 1.**

1.2.7 POSITION THE SHEAVE (**item 9**) between the chain plates on the boom extension, insert the clevis pin (**item 8**), and secure in place with a cotter pin (**item 3**).

1.2.8 FASTEN THE WINCH ASSEMBLY (**item 20**) to the boom, using four cap-screws with lock washers and hex nuts (**items 16, 18, and 17**). **Make sure the drum is positioned toward the mast.**

1.2.9 COMPLETE ASSEMBLY.

a MAKE SURE ALL FASTENERS are tightened, and cotter pins properly bent to secure them in place, see figure 3.

b LUBRICATE THE ENTIRE CRANE.

c INSTALL THE WINCH HANDLE according to the instructions in the Winch Owner's Manual.

d INSTALL THE WIRE ROPE according to the instructions in the Winch Owner's Manual.

2.1 General Theory of Operation

Important!

- Limit nonuniform winding by keeping tension on the wire rope.
- It is your responsibility to detect and account for different factors affecting the condition and performance of the equipment.

2.1.1 THE PULL REQUIRED to move the load must not exceed the load rating of the crane. Consider the total force required to move the load, not the weight of the load.

2.1.2 THIS EQUIPMENT CAN develop forces that will exceed the load rating. It is the responsibility of the equipment user to limit the size of the load. Inspect the equipment regularly for damage according to the instructions contained in this manual.

2.1.3 PERFORMANCE RATINGS of the equipment are affected by the position of the boom, and the amount of wire rope you use.

a LOAD RATING represents the maximum pull that can be placed on new equipment. Load ratings are assigned values for specific boom positions and wire rope lengths. **The load rating decreases as you increase boom length.**

b LIFT varies with the height of the boom and the length of the wire rope.

c REACH varies with the length of the boom.

2.1.4 DUTY RATINGS refer to the type of use the equipment is subject to. Consider the following when determining duty rating.

a ENVIRONMENT: harsh environments include hot, cold, dirty, wet, corrosive, or explosive surroundings. **Protect the equipment from harsh environments when possible.**

b MAINTENANCE: poor maintenance, meaning poor cleaning, lubrication, or inspection, leads to poor operation and possible damage of the equipment. **Minimize poor maintenance by carefully following the instructions contained in this manual.**

c LOADING: severe loading includes shock loading and moving loads that exceed the load rating of the equipment. **Avoid shock loads, and do not exceed the load rating of the equipment.**

d FREQUENCY OF OPERATION: frequent operation increases wear and shortens the life span of the winch and other components. **Increase maintenance of the equipment if used in frequent operations.**

CONTACT THE FACTORY FOR MORE INFORMATION.

2.2 Suggestions for Safe Operation

⚠WARNING

DO the following:

Keep at least 4 wraps of wire rope wound on the drum at all times, to serve as anchor wraps. With less than 4 wraps on the drum the wire rope could come loose, causing the load to fall.

Keep hands away from sheaves, gears, wire rope, and other moving parts of the equipment.

Keep all people, including operators and yourself, away from the crane. Keep out of the path of the load, and out of the path of a broken wire rope that might snap back and cause injury.

DO NOT do the following:

Do not lift people, or things over people. Do not walk or work under a load or in the line of force of any load.

Do not exceed the load rating of the crane or any other component in the system. To do so could result in failure of the equipment.

Do not use more than one crane to move a load that exceeds the load rating of a single crane. A shift in load weight could overload the equipment.

Do not use damaged or malfunctioning equipment. To do so could result in failure of the equipment.

Do not modify the equipment in any way. To do so could cause equipment failure.

Do not operate the crane with winch guards removed or improperly installed.

Do not divert your attention from the operation. Stay alert to the possibility of accidents, and try to prevent them from happening.

Do not jerk or swing the load. Avoid shock loads by starting and stopping the load smoothly. Shock loads overload the equipment and may cause damage.

Do not use the crane to drag or pull loads. This will create side pulls which could damage the equipment or cause the load to tip.

Do not leave a suspended load unattended. Place the load on the ground before leaving it unattended.

2.3 Preparing for Operation

mportant!

When determining whether the load will exceed the load rating, consider the total force required to move the load.

2.3.1 CONSIDER THE OPERATION. Do not begin until you are sure you can perform the entire operation without hazard.

2.3.2 INSPECT ALL COMPONENTS of the system.

a INSPECT THE CRANE and other equipment according to the Instructions for Frequent Inspection.

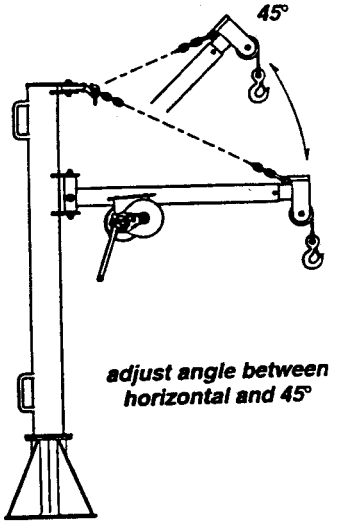
b OPERATORS must be in good health, alert, thoroughly trained in operating the equipment, and properly clothed (hard hat, safety shoes and safety glasses, no loose clothing).

c THE LOAD must be clear of other objects and free to move. Make sure the load will not tip, spin, roll away, or in any way move uncontrollably.

2.3.3 KNOW YOUR LOAD and make sure you do not exceed the load rating of the crane or any other equipment in the system.

2.4 Positioning the Boom

Figure 4 – Boom Angle



2.4.1 POSITION THE BOOM so the load hook is centered over the load, by adjusting boom length and height. **Avoid side pulls which could damage the crane or cause the load to tip. See figure 5.**

2.4.2 ADJUST BOOM LENGTH.

a RAISE THE BOOM and remove the load chain from the grab hook.

b REMOVE THE QUICK RELEASE PIN, MOVE the boom extension in or out to the desired length, and line up the holes in the boom and boom extension. **The load rating decreases as you lengthen the boom.**

c INSERT THE QUICK RELEASE PIN and push it through until it locks in place.

d ATTACH THE LOAD CHAIN by adjusting the boom height as described below.

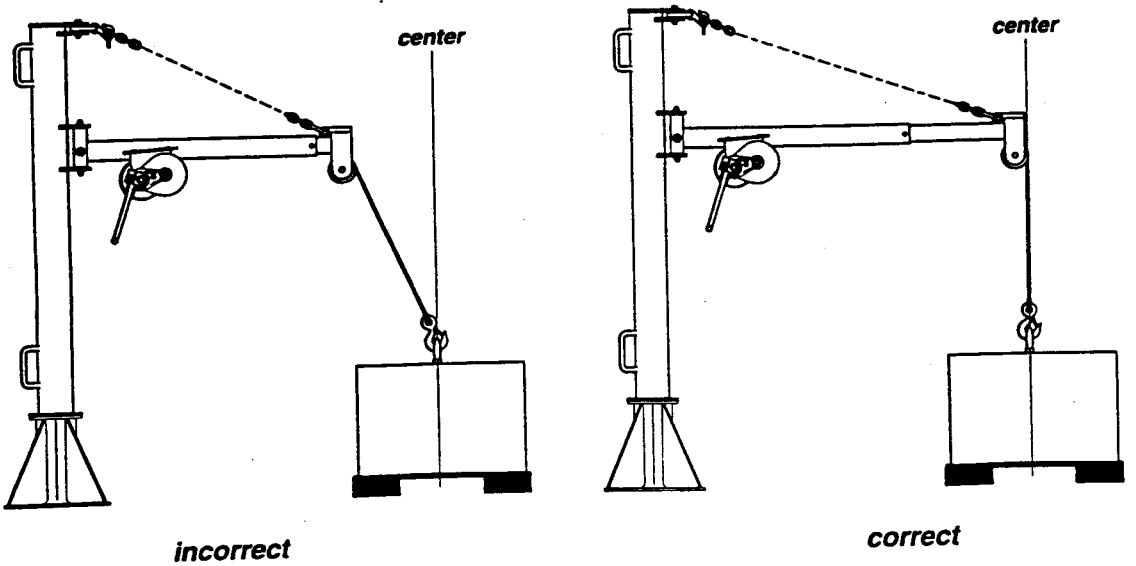
2.4.3 ADJUST BOOM HEIGHT.

a RAISE THE BOOM and remove the load chain from the grab hook.

b RAISE OR LOWER THE BOOM to the desired height, then raise it approximately 2" more. **Do not position the boom below horizontal or at an angle greater than 45°. See figure 4.**

c ATTACH THE LOAD CHAIN to the grab hook by turning a link sideways and inserting it in the hook. **Avoid twisting the load chain, and make sure the chain link is seated in the saddle of the hook. See figure 1.**

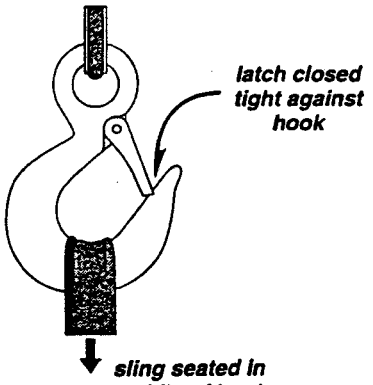
Figure 5 – Positioning the Boom



Note: the load rating decreases as you lengthen the boom.

2.5 Attaching the Load

Figure 6 – Attaching Load



⚠WARNING

Do not wrap the wire rope around the load. This damages the wire rope and could cause the load to fall. Use a sling or other approved lifting device.

2.5.1 CLEAR OBJECTS from the path of the load so you can move it freely and observe it at all times during the operation.

2.5.2 MAKE SURE THE WIRE ROPE is not twisted. A twisted wire rope could cause the load to spin when it is raised off the ground.

2.5.3 ATTACH THE LOAD using a nylon sling, or other approved lifting device. Follow the recommendations of the sling manufacturer.

a SEAT THE SLING in the saddle of the hook with the hook latch completely closed. See figure 6.

b CENTER THE LOAD on the hook so it will remain balanced and not tip or rotate to one side.

2.6 Moving the Load

Important!

- Obey a stop signal from anyone!
- Maintain tension on the wire rope to keep it tightly and evenly wound on the drum.
- If the crane and load are not visible during the entire operation, get help from another person.
- Appoint a supervisor if more than one person is involved in the operation. This will reduce confusion and increase safety.
- When lifting a load, use a metal rod, wooden stick, or rope to keep the load from swinging or twisting, while keeping yourself away from the load.

2.6.1 MOVE THE LOAD slowly and smoothly, only a small distance at first. Make sure the load is balanced and securely attached before continuing.

2.6.2 OPERATE THE WINCH to raise and lower the load. Refer to the Winch Owner's Manual for instructions.

2.6.3 OBSERVE THE WIRE ROPE as it winds onto the drum. If it becomes loose, uneven, or overlapped, stop the operation and rewind the wire rope before continuing. **Continued operation with overlapped or uneven wire rope can damage the wire rope and shorten its life.**

2.6.4 ROTATE THE BOOM to move the load up to 240° side-to-side.

a ROTATE THE BOOM slowly and smoothly to avoid swinging the load or causing shock loads. **Do not jam the boom against the mast or other objects.**

b PUSH AGAINST THE BOOM just in front of the winch to rotate the boom. **Do not push or pull the load, wire rope, or any other part of the crane other than the boom.**

3.1 Cleaning the Crane

Important!

Increase the frequency of maintenance procedures if the crane is:

- Operated for long periods.
- Used to lift heavy loads.
- Operated in wet, dirty, hot, or cold surroundings.

Clean the crane to remove dirt and help prevent rust and corrosion.

3.1.1 CLEAN THE CRANE every six months or whenever it is dirty.

a WIPE ALL EQUIPMENT with an oily rag to remove dirt and grease.

b LEAVE A LIGHT FILM of oil on all surfaces to protect them against rust and corrosion.

c WIPE OFF excessive amounts of oil to avoid the accumulation of dirt.

3.1.2 REMOVE ALL UNNECESSARY OBJECTS from the area surrounding the crane.

3.2 Lubricating the Crane

Important!

- Make sure lubricant has a temperature rating appropriate for the ambient temperatures of the operation.

Lubricate the crane properly to help protect it from wear and rust. Read the following instructions carefully.

3.2.1 LUBRICATE THE GRAB HOOK at least every 6 months. Use a grease gun to apply an NLGI #2 grease to the grease fitting until excess lubricant comes out the sides.

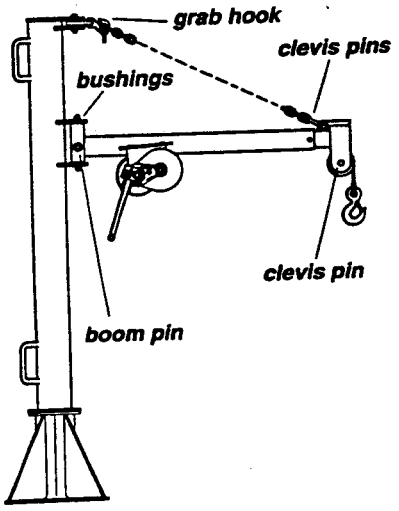
3.2.2 LUBRICATE THE BOOM SWIVEL BUSHINGS at least every 6 months. Apply 2 to 3 drops of 150 grade gear oil to the bushings. Rotate the boom to allow oil to penetrate, and wipe off excess oil to avoid accumulation of dirt.

3.2.3 LUBRICATE THE BOOM AND CLEVIS PINS at least every 6 months. Use a grease brush to apply a light film of NLGI #2 grease to the boom pin, and all clevis pins. See figure 7.

3.2.4 LUBRICATE THE WINCH at least every 6 months. Refer to the Winch Owner's Manual for instructions.

3.2.5 LUBRICATE THE WIRE ROPE at least every 6 months, by wiping a thin coat of oil onto the wire rope using an oily rag.

Figure 7 – Lubrication



3.3 Inspecting the Equipment

)ortant!

Start an inspection program as oon as you put the crane into use.

Appoint a qualified person to be esponsible for regularly inspecting he equipment.

Keep written records of inspection. This allows comparison with omments from previous inspec-ons so you can see changes in ondition or performance.

⚠WARNING

Do not use damaged or malfunctioning equipment. Place an "OUT OF ORDER" sign on the crane. Do not use the crane until the sign is removed by a qualified maintenance person who has completely corrected the problem.

Inspect the crane to detect signs of damage or poor operation before they become hazardous.

3.3.1 CONSULT APPLICABLE CODES AND REGULATIONS for specific rules on inspecting the crane and other equipment.

Form frequent inspections:

Before each operation.

Every 3 hours during operation.

Whenever you notice signs of damage or poor operation.

3.3.2 **Instructions for Frequent Inspection**

a VISUALLY INSPECT the entire crane and all other equipment involved in the operation.

- Check all equipment for cracks, dents, bending, rust, wear, corrosion and other damage.
- Make sure the wire rope is installed correctly and anchored securely to the drum.
- Make sure the crane is properly lubricated.
- Make sure the load chain is not twisted and is securely fastened to the boom and grab hook.
- Make sure all fasteners are tight and secure.
- Make sure mounting fasteners are tightened securely.
- Make sure the foundation is in good condition, and capable of supporting the crane and its load under all load conditions.

b TEST CRANE PERFORMANCE by moving a test load of 100 pounds.

- Listen for unusual noises, and look for signs of damage as you operate the crane.
- Make sure the wire rope winds evenly and tightly onto the drum. If it is loose or uneven, rewind it before continuing.
- Make sure the load moves smoothly, without hesitation or strain, and that the winch handle rotates freely in both directions.
- Make sure the boom rotates freely when you push it, and remains stationary when you release it.
- Check the brake. Raise the load, then lower it and stop it a few feet off the ground. If the load continues to coast or creep, the friction discs may be worn and in need of replacement.

Completely correct all problems before continuing. Use the Troubleshooting Chart to help determine the cause of certain problems. See table 2.

Table 1 – Inspection Checklist

checked boxes indicate damage or problem in need of repair

	damages	problems
general	☐ finish weathered, flaking, otherwise damaged ☐ parts cracked, bent, rusted, worn, otherwise damaged	☐ equipment not properly lubricated ☐ unusual noises, other signs of malfunction
foundation **fasteners**	☐ loose, unstable, otherwise damaged ☐ stripped threads, bent, worn, otherwise damaged	☐ not level - boom swerves ☐ loose, not tightened to the proper torque
grab hook	☐ twisted, bent, worn, otherwise damaged, see figure 11 replace if twist is 10 degrees or more replace if throat width is 15% larger than nominal replace if thickness is 10% less than nominal	☐ grease fitting is clogged or dirty twist = throat width = thickness =
boom assembly **load chain**	☐ holes worn, distorted, or otherwise damaged ☐ corroded, worn, or otherwise damaged, see figure 10 replace if any 10 link length is more than nominal replace if any link diameter is reduced 20%	☐ does not rotate freely ☐ twisted or improperly installed 10 link length = link diameter =
winch assembly	☐ gears, bearings, and other parts worn, otherwise damaged ☐ brake corroded, cracked, worn, otherwise damaged	☐ winch jerks or hesitates under load ☐ brake does not operate properly
sheave	☐ holes worn, distorted, or otherwise damaged	☐ does not rotate freely
wire rope	☐ bent, crushed, otherwise damaged ☐ broken wires, see figure 8 replace if more than 6 wires in one lay, or 3 wires in one strand in one lay, are broken ☐ diameter reduced, see figure 9 replace if diameter is excessively worn	☐ wire rope loosely or unevenly wound number per strand = number per lay = diameter =
end connections	☐ corroded, rusted, worn, otherwise damaged	☐ not securely attached
load hook	☐ twisted, bent, worn, otherwise damaged, see figure 12 replace if twist is 10 degrees or more replace if throat width is 15% larger than nominal replace if thickness is 10% less than nominal	☐ hook latch fails to close when released twist = throat width = thickness =
labels and plates	☐ dirty, illegible, otherwise damaged	☐ loosely attached or missing

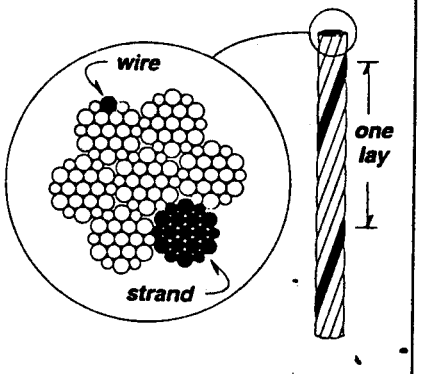
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Perform periodic inspections:

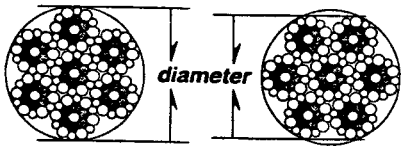
- Every 6 months.
- Whenever you return the crane to service from storage.
- Whenever you notice damage or poor operation in a frequent inspection.
- Whenever you have, or think you may have, overloaded or shock loaded the crane.

Figure 8 – Broken Wires



Wire rope assembly must be replaced if more than 6 wires are broken in one lay, or if more than 3 wires are broken in one strand in one lay.

Figure 9 – Rope Diameter



correct *incorrect*

The wire rope assembly must be replaced if the diameter measures less than the minimum diameter at any point.

Wire rope diameter	minimum diameter
1/4 in	15/64 in (.2344 in)

3.3.3 Instructions for Periodic Inspection

a VISUALLY INSPECT the crane and all other equipment.

- Check the finish for wear, flaking, or other damage.
- Check all equipment for cracks, dents, bending, rust, wear, corrosion and other damage. If the crane was overloaded, or if you notice cracks and other signs of overloading, check for damage using magnetic or chemical crack detecting procedures.
- Check all fasteners for stripped threads, wear, bending, and other damage.
- Make sure all labels and plates are readable, firmly attached, free of damage and clean. Replacements are available from the factory.

b REMOVE THE WIRE ROPE entirely from the crane.

- Check the entire length of wire rope for bent wires, crushed areas, broken or cut wires, corrosion, and other damage. Carefully inspect areas that pass over sheaves or through roller guides.
- Note the location and concentration of broken wires. Replace wire rope if more than 6 wires are broken in one lay, or more than 3 wires are broken in one strand in one lay. See figure 8.
- Make sure the load hook or other device is securely attached to the wire rope, and the wire rope where it is attached is not frayed, corroded, broken, or otherwise damaged.
- Measure the throat opening, thickness, and twist of the hook. Replace the hook if it shows signs of damage. See figure 12.
- Make sure hook latch opens without binding and closes when released.
- Check the anchor holes in the drum and the surrounding area for signs of wear or distortion.

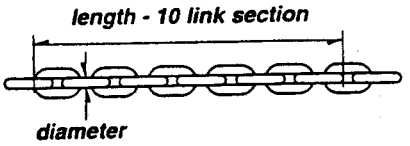
c PLACE 100 POUNDS of tension on the wire rope.

- Measure the diameter of the wire rope, especially in areas where wear is noticeable. Replace the wire rope if the diameter measures below the minimum diameter at any point. See figure 9.

d REMOVE THE WINCH and inspect it by following the instructions in the Winch Owner's Manual.

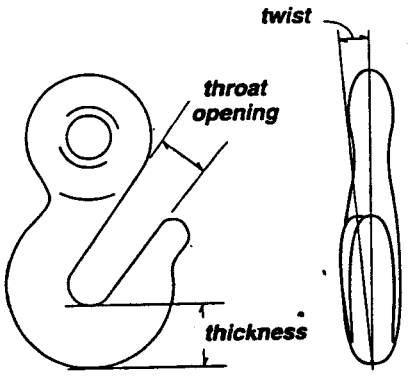
e DISASSEMBLE THE CRANE, and inspect each part for damage. Refer to instructions under Disassembling the Crane.

Figure 10 – Load Chain Inspection



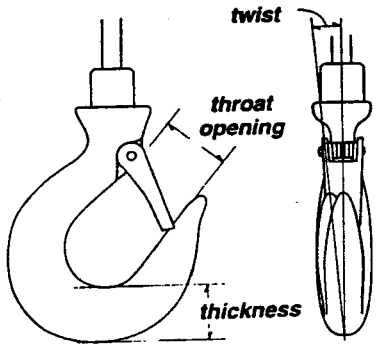
The load chain must be replaced if the length of any 10 link section exceeds maximum allowable length, or if the diameter of any link measures 20% less than nominal.

Figure 11 – Grab Hook Inspection



The hook must be replaced if the throat opening is 15% wider than nominal, if the thickness is 10% less than nominal, or if the hook is twisted 10° or more.

Figure 12 – Load Hook Inspection



The wire rope assembly must be replaced if the throat opening is 15% wider than nominal, if the thickness is 10% less than nominal, or if the hook is twisted 10° or more.

f PLACE 50 POUNDS OF TENSION on the load chain. Measure the length of several 10 link sections of chain, and measure the diameter at several points on each link. Replace the load chain if it shows signs of wear, stretching, or other damage. See figure 10.

g REMOVE THE GRAB HOOK, and measure the throat opening, thickness, and twist of the hook. Replace the hook if it shows signs of damage. See figure 11.

h REMOVE THE CRANE BASE from the foundation.

- Check fasteners for stripped threads, wear, bending, and other damage.
- Check the foundation for cracks, corrosion, and other damage.

i FASTEN THE CRANE BASE securely to the foundation.

j REASSEMBLE THE CRANE by following the instructions under Assembling the Crane.

k TEST CRANE PERFORMANCE by operating the crane with a test load equal to the load rating.

- Listen for unusual noises, and look for signs of damage as you operate the crane.
- Make sure the wire rope winds evenly and tightly onto the drum. If it is loose or uneven, rewind it before continuing.
- Make sure the load moves smoothly, without hesitation or strain, and that the winch handle rotates freely in both directions.
- Make sure the boom rotates freely when you push it, and remains stationary when you release it.
- Check the brake. Raise the load, then lower it and stop it a few feet off the ground. If the load continues to coast or creep, the friction discs may be worn and in need of replacement.

Completely correct all problems before continuing. Use the Troubleshooting Chart to help determine the cause of certain problems. See table 2.

able 2 – Troubleshooting Chart

roblem	cause	correction
andle turns, drum doesn't turn	• loose or broken spring pins	inspect winch and brake, repair as necessary
	• loose, stripped or broken gears	inspect gears and repair as necessary
andle turns hard or not at all	• ratchet on winch engaged	disengage winch ratchet
	• load too heavy	lighten load
	• spring pins loose or broken on winch or brake	inspect winch and brake, repair as necessary
	• disc brake damaged or locked	inspect brake, repair as necessary
	• gears or bearings broken or locked	inspect and repair as necessary
	• crane sheave damaged or locked	inspect and replace as necessary
rake does not operate properly	• friction discs worn or damaged	inspect and replace as necessary
	• friction discs damaged from over lubrication	inspect and replace as necessary
	• disc brake ratchet pawl damaged	inspect and repair as necessary
verheating	• operated too long without rest	allow to cool
	• load too heavy	lighten load
	• poor lubrication	inspect and lubricate as necessary
	• bearing seized up	inspect and replace as necessary
oom bounces up and down	• load too heavy	lighten load
	• mounting bolts loose	tighten mounting bolts to proper torque
	• sheave worn or damaged	inspect and replace as necessary
	• foundation loose or unlevel	inspect and repair as necessary
	• winch gears worn or damaged	inspect and repair as necessary
oom does not rotate	• rotation points contaminated or worn	inspect and repair as necessary
	• boom swivel bushings broken or seized	inspect and replace as necessary
	• grab hook spacer broken or seized	inspect and replace as necessary
oom swerves	• foundation loose or unlevel	inspect and repair as necessary
	• mast bent, distorted, or leaning	inspect and repair as necessary
nusual noises		
high pitched squeak	• poor lubrication	lubricate entire crane properly
grinding noise	• contaminated lubricant at rotation points	clean and lubricate rotation points
	• dirt in brake or winch gears	inspect and clean as necessary
	• broken gears or bearings	inspect and replace as necessary
rattling noise	• loose bolts, set screws or other fasteners	tighten all bolts and other fasteners
uneven clicking noise in brake	• broken gear tooth in brake	inspect and repair as necessary
weak clicking noise in brake	• spring or ratchet pawl dirty or damaged	inspect and clean or repair as necessary
	• worn brake ratchet pawl, gear, or spring	inspect and replace as necessary
no clicking noise in brake	• ratchet incorrectly installed	disassemble and install correctly
	• ratchet pawl damaged or worn excessively	inspect and replace as necessary

3.4 Repairing the Crane

Important!

- It is your responsibility to determine when to replace parts. When considering whether to continue using a part or to replace it, remember that replacing it is the best way to avoid further equipment damage.
- Appoint a qualified person to be responsible for all repairs to the equipment.

3.4.1 GET FACTORY AUTHORIZATION for all repairs. Unauthorized repairs will void the warranty, and may lead to damage or failure of the crane.

3.4.2 REPLACE DAMAGED OR POORLY OPERATING PARTS with Therm repair parts.

3.4.3 REFINISH AREAS where the paint is worn or flaking. A good finish helps to protect against corrosion and weather damage.

a REMOVE THE FINISH from damaged areas, down to the bare metal.

b CLEAN THE AREA thoroughly.

c REPAINT with a high quality primer and finishing coat.

3.4.4 TO ORDER REPAIR PARTS, contact your local dealer. Include the following information when ordering:

- model number
- serial number (or code number)
- part number
- date purchased, and from whom
- description of what happened, or what is wrong
- your name and return address

3.5 Disassembling the Crane

Disassemble the crane to inspect or repair gears, bearings, and other parts.

3.5.1 DISASSEMBLE THE CRANE in the following order.

a REMOVE THE WIRE ROPE from the winch drum.

b REMOVE THE WINCH from the boom.

c REMOVE THE SHEAVE from the end of the boom by removing the cotter pin from the clevis pin.

d REMOVE THE LOAD CHAIN from the grab hook, and remove the other end from the boom, by removing the cotter pins and unfastening the clevis link.

e REMOVE THE BOOM by removing the cotter pins from the boom pin.

f REMOVE THE BOOM SWIVEL by removing the cotter pins from both slotted hex nuts, and unfastening the swivel pins.

g REMOVE THE GRAB HOOK by removing the capscrew and spacer.

3.5.2 DISASSEMBLE THE WINCH if necessary for repair or inspection. Refer to the Winch Owner's Manual.

4.1 Transporting the Crane

Important!

- Keep a record of what you ship, and when you send it.

4.1.1 PARTIALLY DISASSEMBLE THE CRANE into parts that can be easily transported.

a REMOVE THE WIRE ROPE from the crane.

b REMOVE THE LOAD CHAIN from the grab hook, remove the boom pin, and remove the boom assembly.

c REMOVE THE MAST from the base by lifting up on the carrying handles.

4.1.2 PACK THE CRANE for transport, using the original packaging materials, if appropriate.

4.1.3 REASSEMBLE THE CRANE at its new location following the instructions under Assembling the Crane.

4.1.4 INSPECT THE CRANE according to the Instructions for Frequent Inspection before operating it.

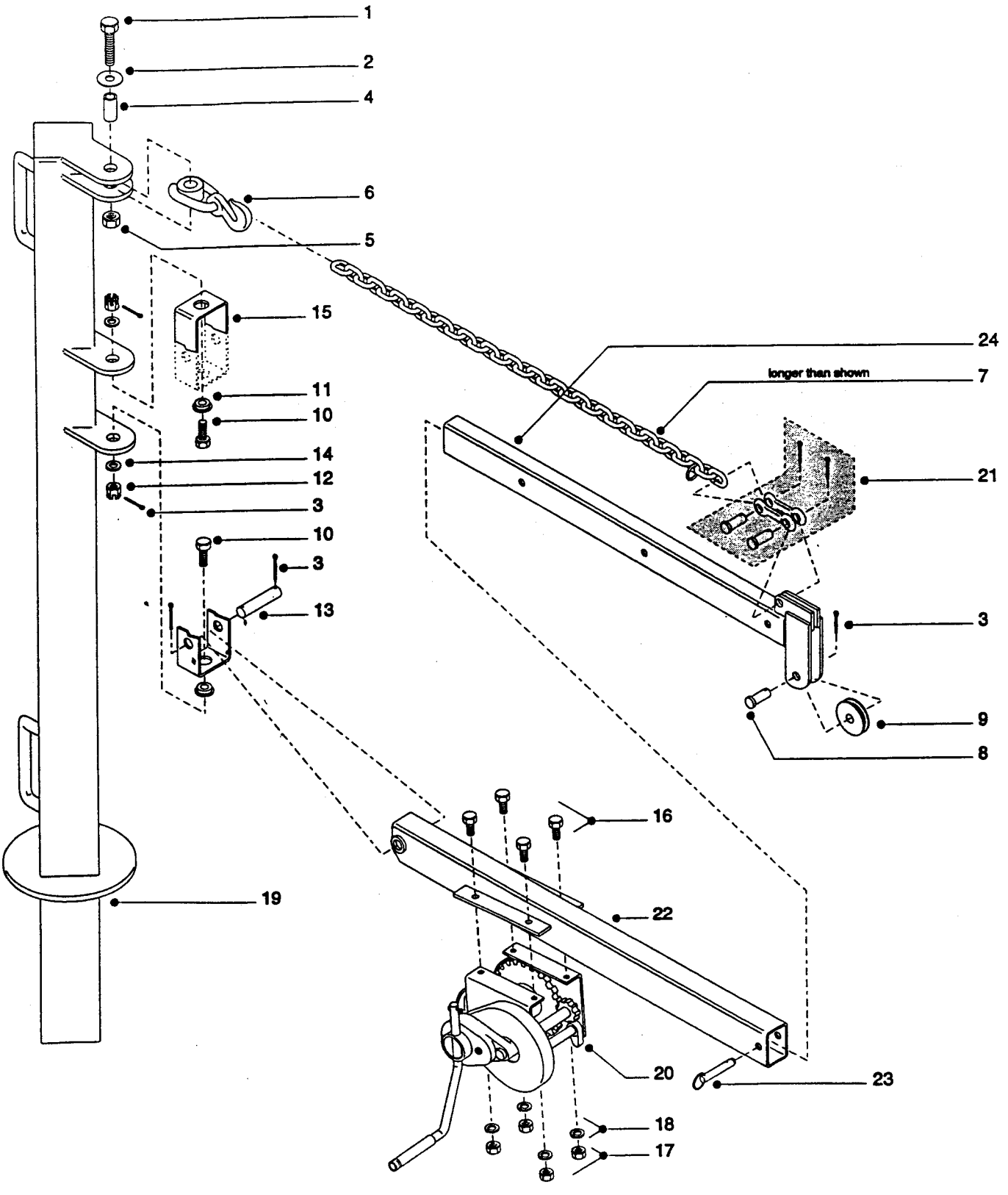
4.2 Storing the Crane

4.2.1 DISASSEMBLE THE CRANE and store all parts in a cool clean place away from corrosive chemicals and moisture.

4.2.2 SEAL THE CRANE in plastic with a desiccant to help protect it from rust, corrosion, and other damage.

4.2.3 INSPECT THE CRANE according to the Instructions for Periodic Inspection before installing it for operation.

334M1 Transportable Davit Crane			
em	description	part number	qty.
	capscrew .625-11UNC x 2.750	A3347	1
	flat washer .625 x 1.312	A3348	1
	cotter pin .125 x 1.250	A4305	5
	spacer	A1382	1
	hex jam nut .625-11UNC	A4331	1
	hook weldment	B1778	1
	chain	A2723	1
	clevis pin .75 x 2.750	A4438	1
	sheave assembly	SA4642	1
0	boom swivel pin	A3263	2
1	bushing	A2808	2
2	slotted hex nut .500-13UNC	A3265	2
3	boom pin	A2462	1
4	flat washer .516	A3266	2
5	boom swivel	B1776	1
6	capscrew .375-16UNC x 1.000	A3355	4
7	hex nut .375-16UNC	A3356	4
8	lock washer .375	A3357	4
9	mast weldment	C1416	1
0	winch assembly	M4311PB	1
1	double clevis link	A4581	1
2	boom weldment	B1757	1
3	quick release pin	A2463	1
4	boom extension weldment	C2599	1


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THERN
INCORPORATED

Therm

Keep this Supplement Manual readable and available with the Owner's Manual at all times. Replacements are available from Therm, Inc., PO Box 347, Winona, MN 55987, 507-454-2996.

Owner's Manual Supplement

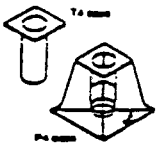
supplement to the Portacrane Owner's Manual for the Model 5334 Wastewater Pump Hoist

Most of the instructions for the Model 533, contained in the Portacrane Owner's Manual, are applicable to the Model 5334. There are several exceptions to this, which are noted below.

Section 2.0, pages 6 through 9

Replace the crane base model numbers with the new numbers shown below:

Old Number	New Number
Model SA2 Base	Model P4 Base.
Model SA4 Base	Model T4 Base



Packing List, page 10

Omit the Packing List contained in the Owner's Manual and replace it with the following. Note that bases are sold separately, and shipped separately as well.

Packing List

Package No. 1

- mast weldment, item 1

Package No. 2

- hook weldment, item 2
- two spacers, items 3 and 4
- one 5/8" x 2-3/4" capscrew with 5/8" flat washer and 5/8" nyloc hex nut, items 5, 6 and 7
- boom swivel, item 8
- two bushings, item 9
- two 1/2" x 1-1/2" cap screws with 1/2" lock washers and 1/2" hex nuts, items 10, 13 and 14
- boom weldment, item 15
- boom pin, item 16
- two 1/8" x 1-1/2" cotter pins, item 17
- boom extension weldment, item 18
- assembly pin, item 19

Package No. 2 – continued

- load chain assembly, item 20
- one 3/8" x 1-1/4" shoulder screw with 5/16" lock nut, items 21 and 24
- clevis pin, item 26
- one 1/8" x 1-1/4" cotter pin, item 27
- four 3/8" x 1" capscrews with 3/8" lock washers and 3/8" hex nuts, items 29, 30 and 31
- Portacrane Owner's Manual

Package No. 3

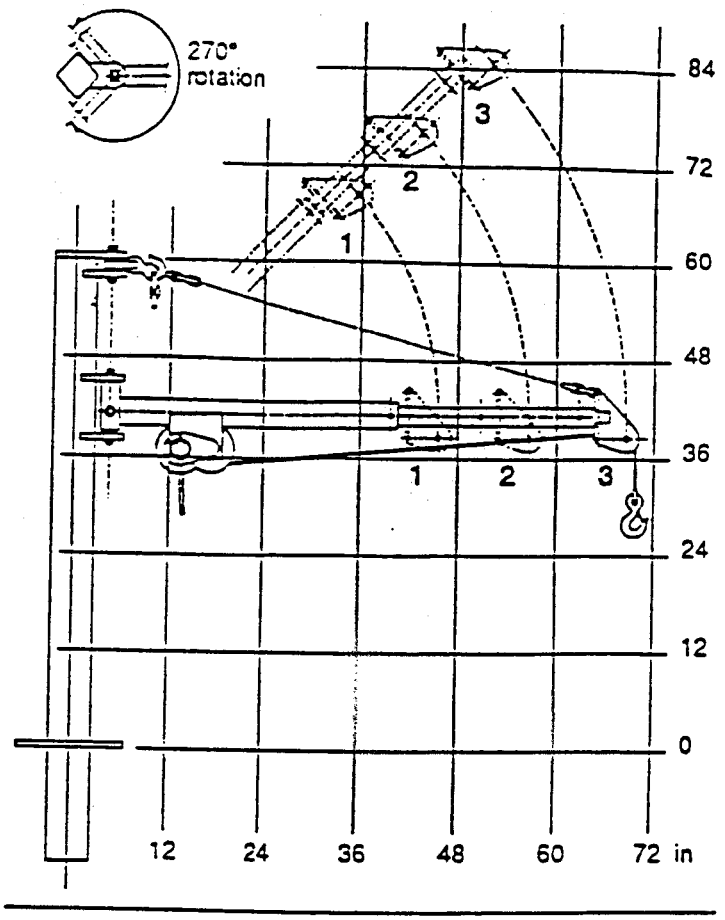
- sheave, item 25
- Model 5334 hand winch, item 28a
- brake assembly, item 32
- wire rope assembly, item 33a
- spring retainer with one 1/4" x 3/8" machine screw and 1/4" lock washer, items 34, 35, and 36.
- Winch Owner's Manual

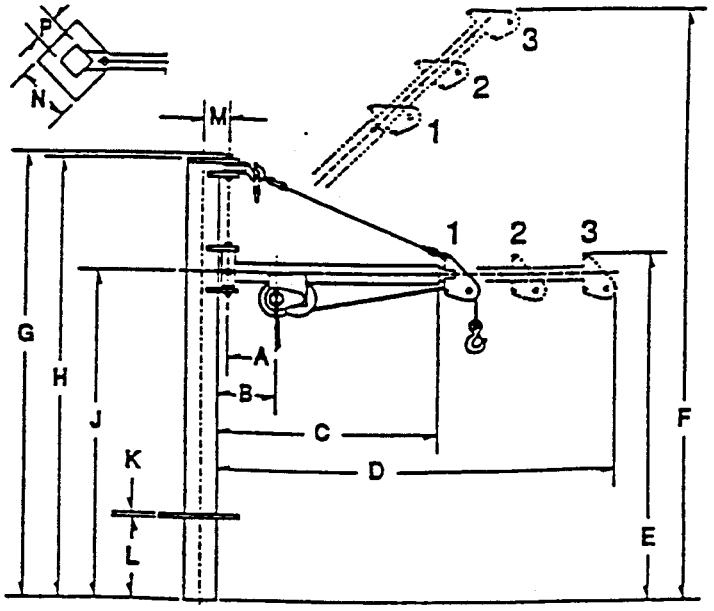
Sweep Drawing and Table 4, page 18 Omit the Sweep Drawing and Table 4, and replace with the following:

cable size		30 ft	*9.14 m*
cable diameter		1/4 in	*6.4 mm*
	position 1	position 2	position 3
load rating	2000 lbs *907.2 kg*	1500 lbs *680.4 kg*	1000 lbs *453.6 kg*
maximum lift †	59 in *1.50 m*	68 in *1.73 m*	76 in *1.93 m*
maximum reach	46 in *1.17 m*	58 in *1.47 m*	70 in *1.78 m*
crane dimensions			
A	2.00 in	*50.8 mm*	
B	10.50 in	*266.7 mm*	
C	38.00 in	*965.2 mm*	
D	68.25 in	*1733.6 mm*	
E	57.50 in	*1460.5 mm*	
F	100.00 in	*2540.0 mm*	
G	74.88 in	*1889.3 mm*	
H	74.38 in	*1889.3 mm*	
J	54.50 in	*1384.3 mm*	
K	.38 in	*9.7 mm*	
L	14.00 in	*355.6 mm*	
M	4.63 in	*117.6 mm*	
N	9.00 in	*228.6 mm*	
P	4.00 in	*101.6 mm*	
approximate shipping weight			
5334 crane		179 lbs	*81.2 kg*
T4 base		24 lbs	*10.9 kg*
P4 base		70 lbs	*31.8 kg*

Dimensions are for reference only and are subject to change without notice.
Contact the factory for certified drawings.

† Maximum lift will vary with the size of the load.





Parts List, page 43

Omit the Parts List in the Owner's Manual and replace it with the following:

Model 5334 Parts List

item	description	part number	qty.
1	mast weldment	C1416	1
grab hook assembly			
2	hook weldment	B1778	1
3	spacer	A1611	1
4	spacer	A1382	1
5	capscrew	CS625-2750NCSS	1
6	flat washer	FW625SS	1
7	lock nut	79NTE5811	1
boom swivel assembly			
8	boom swivel	B1776	1
9	bushing	A1626	2
10	cap screw	CS500-1500NCSS	2
13	lock washer	LW500SS	2
14	hex nut	HN500NCSS	2
boom assembly			
15	boom weldment	B1757	1
16	boom pin	A2462	1
17	cotter pin	CP125-1500SS	2
18	boom extension weldment	C1415	1
19	assembly pin	A2463	1
load chain assembly			
20	load chain assembly	A2723	1
21	shoulder screw – grade 8	SH375-1250NCSKN	1
24	lock nut	79NE51618	1
sheave assembly			
25	sheave	B1765	1
26	clevis pin	A2722	1
27	cotter pin	CP125-1250SS	1
winch assembly			
28a	Model 5334 winch assembly	D1424	1
29	capscrew	CS375-1000NCSS	4
30	lock washer	LW375SS	4
31	hex nut	HN375NCSS	4
32	brake assembly	C1422	1
cable assembly			
33a	wire rope assembly	B1841	1
spring retainer assembly			
34	spring retainer	A2718	1
35	machine screw	MS250-375PHSSS	1
36	lock washer	LW250SS	1

I. INTRODUCTION

A. GENERAL INFORMATION

The purpose of this manual is to completely explain the function, installation, and operation of the MCS Model 250/Real Voice Communication System. This automatic dialing, synthesized speech, telephone based monitoring system represents a new generation of computer controlled telemetry devices, with features and capabilities not found in any other telephone oriented monitoring system. The device is designed specifically for industrial based equipment monitoring needs, by the engineering staff which invented the concept of synthesized speech dialers. The Real Voice System allows the user to actually train the system to place alarm calls, and precisely inform the called individual of the location and nature of the alarm condition, using a digitized sample of the user's voice.

The System is configured to accept four channels of normally open or normally closed fault state switches (contacts), such as float switches, pressure switches, temperature switches and similar devices that contain an unpowered contact that changes state whenever a preset condition changes. Fault recognition can be set as fast as 1 second or as long as ninety-nine seconds, programmable on a channel-by-channel basis. Internally, the system monitors its own power supply and will respond to any power outage which persists longer than a user programmable time period.

When an alarm occurs, as recognized by the system by the opening or closing of an external contact, it begins to place a series of telephone calls, dialing up to eight different telephone numbers, one at a time, in an attempt to make contact with a qualified person to whom it can deliver a combination of digitally stored voice messages, describing the location and type of alarm condition. These messages are originally programmed by the user at the time of system installation.

The system will continue to call from the list of up to 8 telephone numbers, insisting that its message be heard. Also, if desired, the system can be called at any time to check or verify the monitored conditions.

The following instructions generally describe the installation, operation and maintenance of the equipment. Microtel reserves the right to make engineering refinements that may not be described herein.

B. UNPACKING AND INCOMING INSPECTION

Microtel takes all possible precautions in packaging each item to prevent shipping damage. Carefully inspect each package at the time of receipt for signs of physical damage. Report damage claims to the shipping agent involved immediately. Do not install damaged equipment.

All instructions given on any attached labels or tags should be followed. Carefully inspect all packing material before discarding it to prevent the loss of accessories, mounting hardware, spare parts, or instructions.

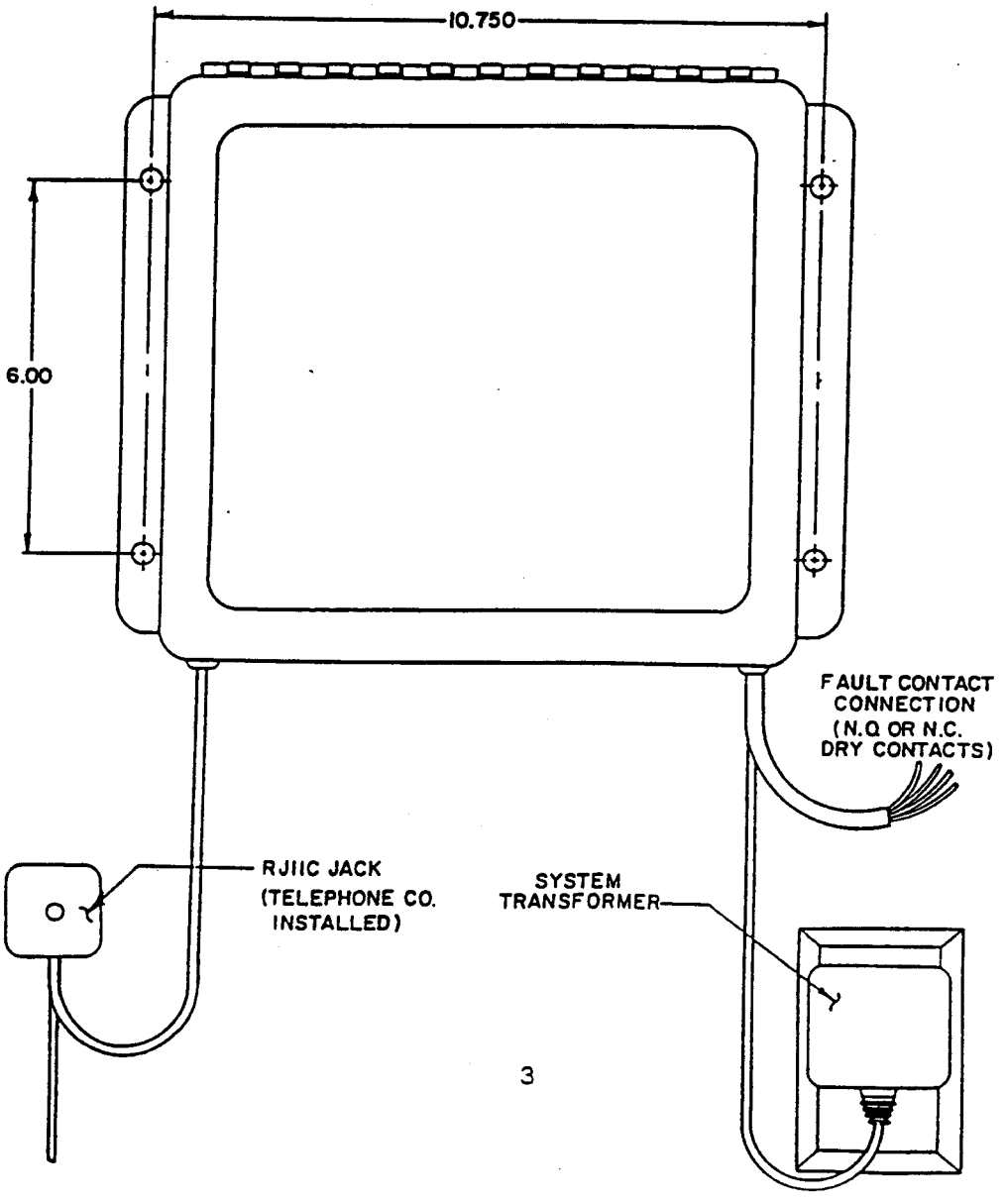
If the unit is not to be installed immediately, repack it in the shipping carton to protect it while in storage.

C. PHYSICAL SYSTEM INSTALLATION

Mount the system on a wall or other vertical surface, away from and protected from harsh weather extremes. It is also recommended that the unit not be placed in close proximity to high voltage (480 V and higher) electrical equipment. Four mounting holes on the left and right side enclosure flanges are to be used for system mounting. It is recommended that the system be mounted at eye level to facilitate ease of programming and operation.

There are three access holes on the bottom of the unit. The left side port is for the system's telephone line connection. The large hole on the right side of the unit is intended for routing of the system's fault sensing leads, while the smaller hole on the right side of the unit is for the system's power supply transformer.

The following figure shows the recommended dimensions to be used in the physical installation of the system.



D. BATTERY INSTALLATION

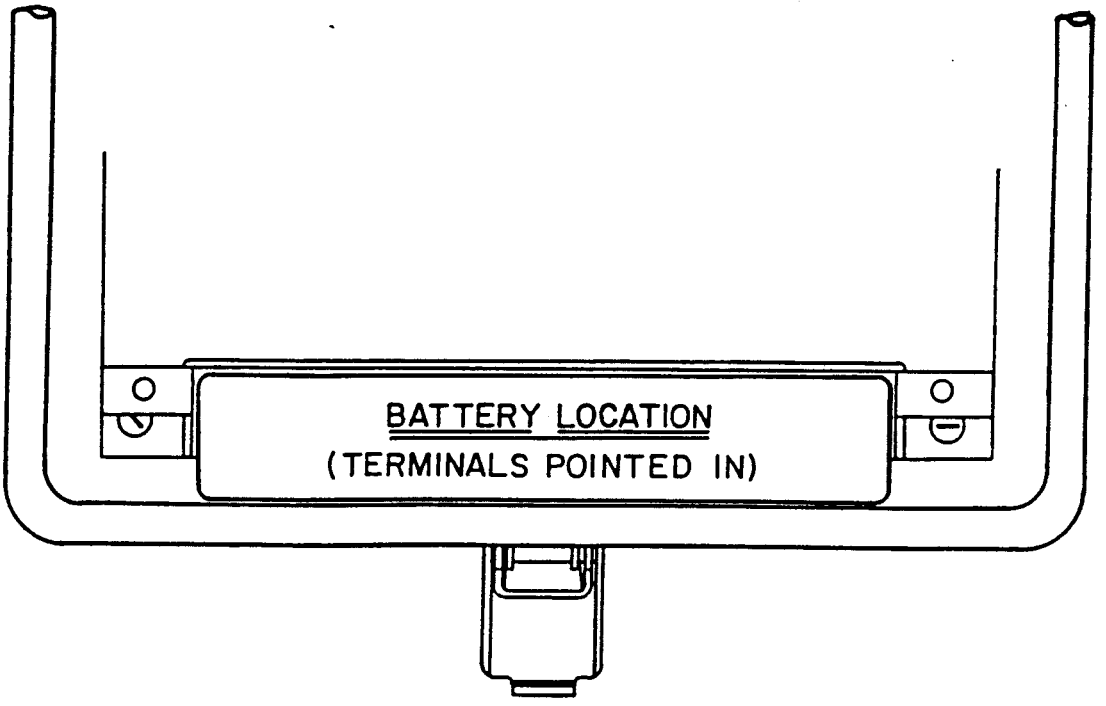
The battery is installed at the bottom of the system, in the battery tray provided as part of the interior chassis assembly.

IMPORTANT!
Before installing the system battery, be certain the power supply transformer is not plugged into an electrical outlet.

Remove the four phillips head screws which secure the system's front panel and remove it to expose the system's interior. Note that the panel is still connected to the system's main circuit board, so care must be exercised while the panel is hanging on this "tether". Retrieve the red and black battery leads from within the battery tray. Push the battery lead terminals on to the new battery, BEING CERTAIN that the red lead connects to the positive (+) battery terminal, and the black lead connects to the negative (-) battery terminal.

Slide (do not force) the battery completely into the battery tray with the terminals pointed DOWN into the system. If the battery is not completely seated in the battery tray, the front panel will be obstructed and will not fit properly onto its mounting area.

A new battery will take no longer than 24 hours to gain a full charge, capable of powering the system through any power outage up to four hours in length. It should be noted that the LOW BATTERY indicator is only valid when the 120 vac power is on. If the LOW BATTERY indicator stays on for more than eight hours, the battery is in need of replacement.



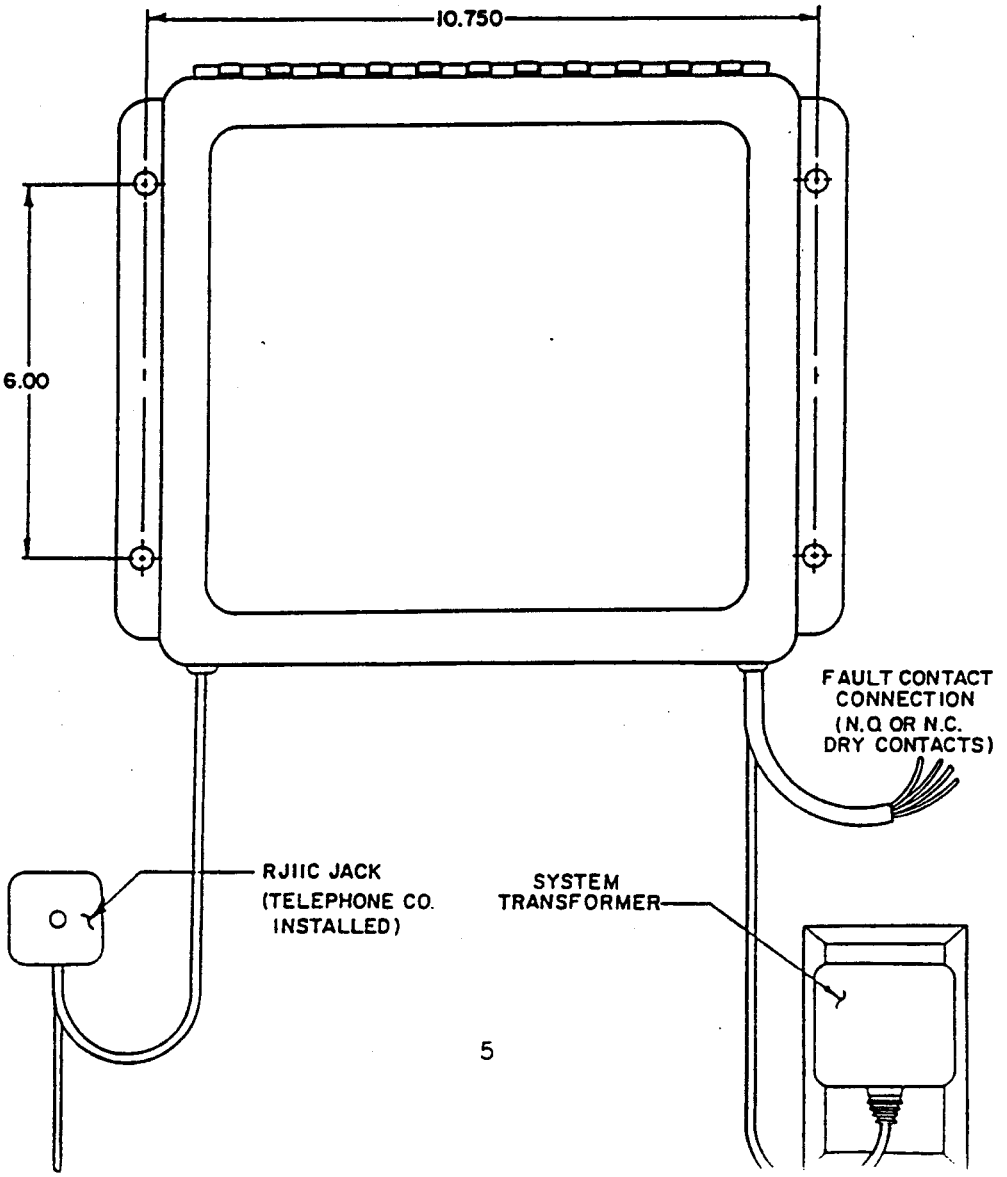
E. ELECTRICAL POWER INSTALLATION

Electrical power may be applied by simply plugging the system transformer into a nearby electrical outlet. If the system's environment has a history of, or has known electrical power line disturbances, then use of a transient protection module, available as an option from Microtel, is highly recommended.

If the unit is to be installed in a location where large or high voltage motors are in use, a power line transient suppressor is also recommended to insure that the unit is not affected by surges and spikes in the 120 VAC power to the unit.

It is recommended that a separate circuit breaker be used with the system. Remember that when the breaker is on, and the unit is plugged in, 12 vac is contained within the system even though the system Power switch may be turned off. This is to allow continued charging of the system's backup battery, and retention of the system's message data, even with the system in a powered down state.

The internal system fuse is a 1 amp fuse (Littlefuse #312.001), or equivalent. WHEN INSPECTING OR REPLACING THE FUSE, UNPLUG THE SYSTEM OR THROW THE CIRCUIT BREAKER SUPPLYING POWER TO THE UNIT.



F. TELEPHONE LINE INSTALLATION

The connection to the telephone network is a matter of simply plugging the modular jack cable into the telephone line termination provided by the telephone utility (RJ11C or equivalent).

This section contains important information regarding the installation of the telephone line to be used by the system, and pertinent information for notifying the telephone company of what type of line is to be installed.

The MCS is registered for direct connection to the telephone network by the FCC, which places three restrictions on its use:

1. The system cannot connect to a party line or a pay telephone line.

2. The telephone company must be notified that an FCC registered device is being installed.

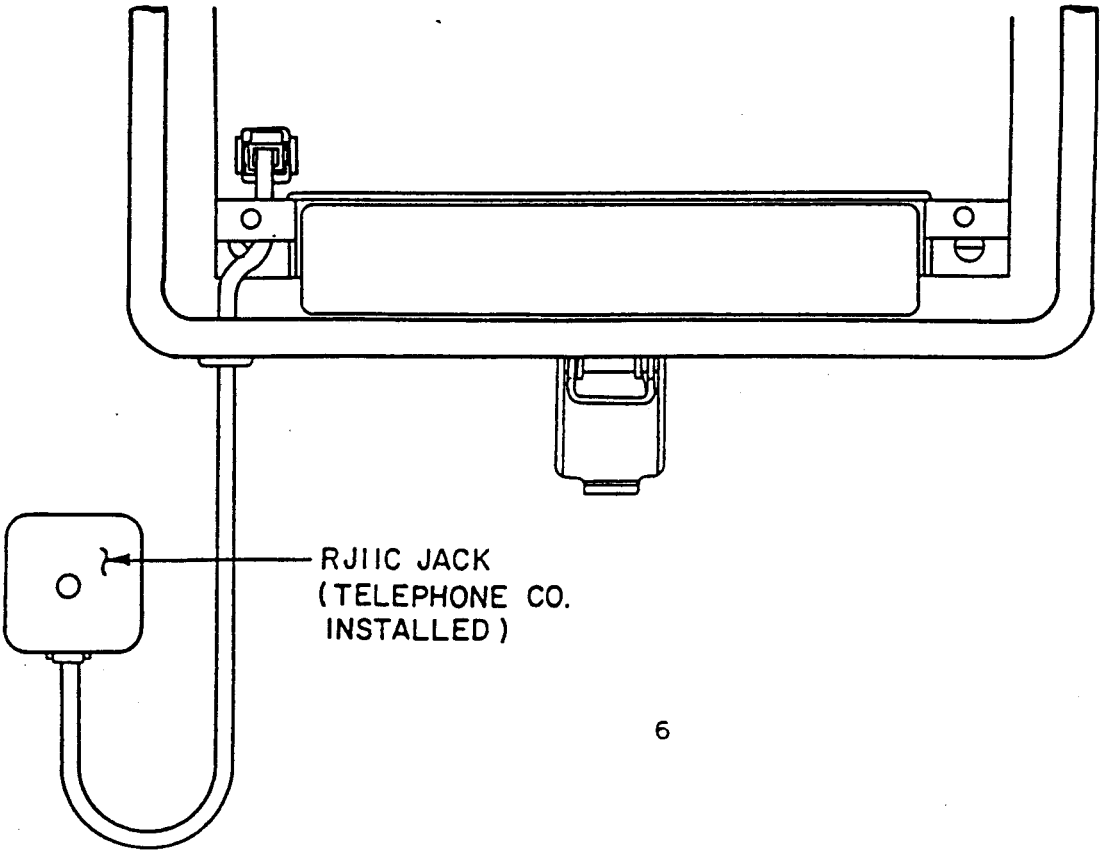
3. If trouble is experienced with the device, it must be immediately disconnected from the telephone network. Microtel must make any repairs which may be necessary in order to maintain the FCC registration status of the device.

THE FOLLOWING INFORMATION WILL BE REQUIRED BY THE TELEPHONE UTILITY WHICH INSTALLS THE TELEPHONE LINE FOR THE SYSTEM:

1. The FCC Registration Number, which is, D4J6M6-13598-AL-E.

2. The Ringer Equivalence, which is, 0.2B.

3. The system needs to be connected to an RJ11C telephone jack.



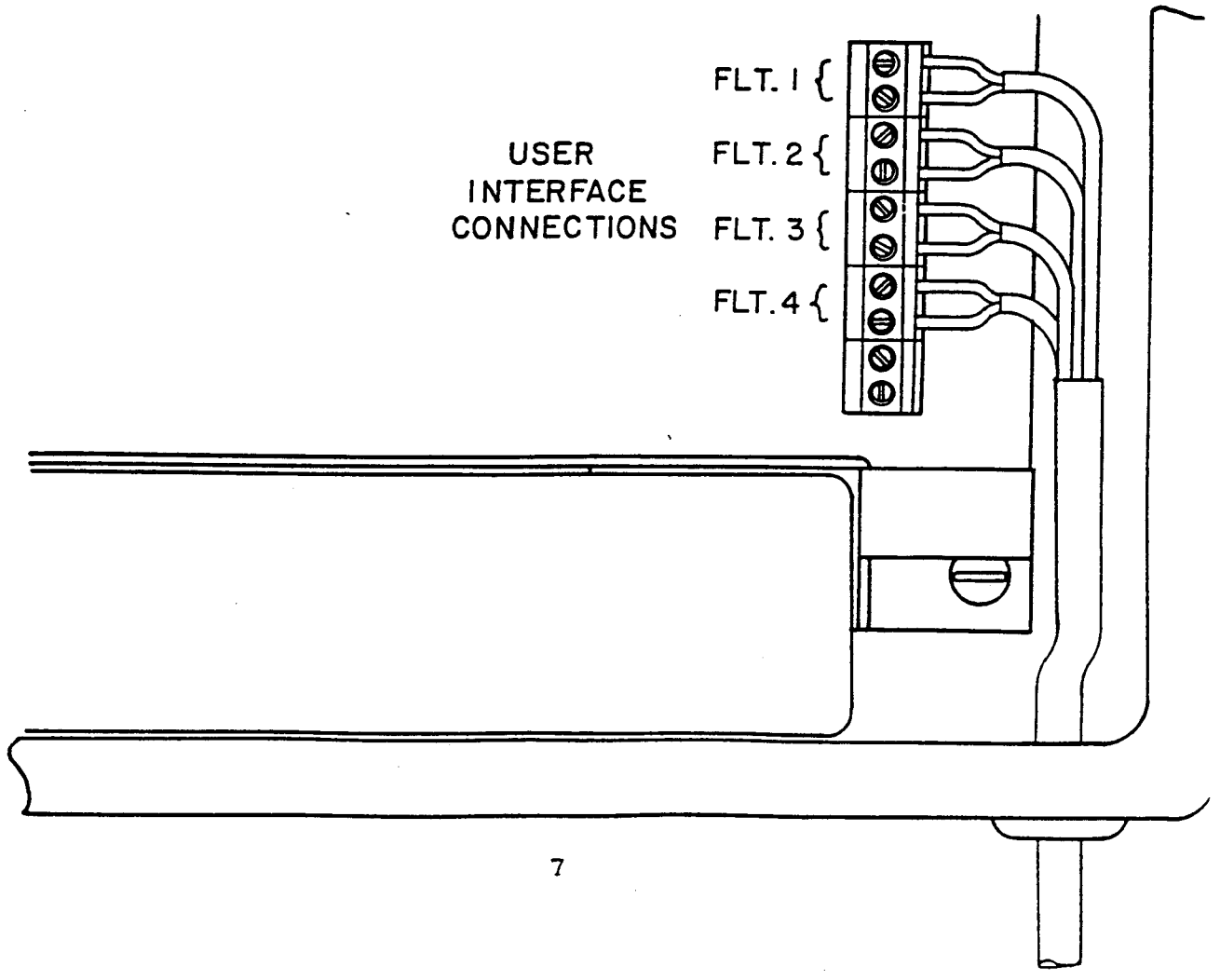
G. FAULT MONITORING INTERFACE CONNECTIONS

The MCS system is designed to accept up to four channels of dry (unpowered), normally open or normally closed signal lines. The system provides a small, pulsed sampling current to determine if the contact is open or closed. Leads from normally open or normally closed switches may be routed through the conduit port at the lower right side of the system. Connect each wire pair to its appropriate channel input terminal pair on the Fault Input Terminal Strip. Shielded, twisted pair, #20 or #22 wire (Belden 8205 or equivalent) is recommended. If shielded cable is used, ground the shield at the sensor and leave the shield floating (unconnected) at the MCS system.

Each channel may be configured to be either normally open or normally closed. A channel should be normally open if the "no fault" (Green) condition is that condition which consists of an open circuit on that channel's wire pair. A channel is normally closed if the "no fault" (Green) condition is that condition which consists of an closed circuit on that channel's wire pair.

The programming section of this manual will provide details on how to program the Mode (normally open or normally closed) of each channel as well as setting the Fault Delay time for each channel.

Any unused channel should be left unconnected and programmed to a normally open mode.



H. POWERING UP THE SYSTEM

NOTE: IF THE UNIT ABOUT TO BE POWERED UP FOR THE FIRST TIME CONTAINS HARDWARE FOR OPTIONAL FEATURES, READ THE SUPPLEMENTARY INSTRUCTION MANUAL FOR THOSE FEATURES BEFORE POWERING THE UNIT UP FOR THE FIRST TIME.

After the system has been mounted in a suitable area, the battery installed and power, telephone and fault sensing lines connected, it may be powered up by switching the POWER switch to the ON position. This switch is on the system's front panel. When the unit is powered up, the front panel indicators will flash in sequence [reset flash] for a few moments. If this does not happen, turn the switch to the OFF position and disconnect power and the telephone line from the unit. Contact qualified service personnel or Microtel for instructions.

II. PROGRAMMING THE SYSTEM

For this section, be advised that the key stroke entries are CAPITALIZED and the system's response whether visual or audible, are enclosed with in [brackets].

The system must be in the Halt mode to accept programming information. If it is not in the Halt mode, depress the HALT key to force that condition. [reset flash]

A. FAULT MODE PROGRAMMING

The fault status of each of the five channels is shown as a fault (RED) or no-fault (GREEN) condition on the corresponding front panel indicator. The system allows the user to specify whether an open contact condition should be regarded as a GREEN (no-fault), or as a RED (fault) state. To program each channel, first apply a known fault contact state to each input. This means shorting the input if a normally closed contact mode is to be used, or opening the input connections if a normally open contact mode is to be used. The 250 Real Voice system allows you to train the input for the proper mode choice.

For each fault input channel, perform the following programming steps:

1. ENTER, MODE, N(1,2,3, or 4)
   [indicator N will flash verifying selection]

2. The selected indicator will alternate between RED and GREEN at one second intervals. When the indicator for the channel being programmed is in the proper state (RED or GREEN) for the applied input, depressing ENTER again will select that mode.

To verify the proper mode, simulate the opening or closing of the fault input contacts and view the proper state indication (RED or GREEN) on the system front panel.

B. FAULT DELAY TIME PROGRAMMING

Each channel may be programmed for its own fault delay time response, from 1 to ninety-nine seconds. This means that the system will neither display or respond to a fault channel changing from a no fault to a fault condition for this time period. Changes from a fault to a no fault condition are, however, instantly detected by the system.

The 250/Real Voice system allows the user to train the fault detection sequence to set the desired fault detection delay.

To program the Delay Time for each fault channel (Channels 1,2,3, and 4) and the Power Fault channel (Channel 5), perform the following programming steps:

1. ENTER, DELAY, N(1,2,3,4, OR 5)
   [indicator N will flash verifying selection]

2. Indicator will flash once each second. When the desired delay time has passed, depressing ENTER again will set that time period for that fault channel.

To verify the proper delay time, simulate the opening or closing of the fault input contacts and view the proper state indication (RED or GREEN) on the system front panel. The fault channel will change from a GREEN to a RED state after the programmed delay. It will change from a RED to a GREEN state almost immediately upon detection of a no-fault state.

To read the Fault Delay for each channel, the following steps should be performed:

1. READ, DELAY, N(1,2,3,4, or 5)
   [fault N indicator will flash, once each second, the programmed number of seconds]

C. FAULT MESSAGES

The system allows the user to program messages for each event which the system must respond. The unit is shipped with no speech programmed and must be loaded with messages after installation. Voice data is retained using the system battery installed in section 1D, above. The following messages must be entered by the user:

Location	Purpose
0	The message indication system or station location
1	The message for fault channel 1
2	The message for fault channel 2
3	The message for fault channel 3
4	The message for fault channel 4
5	The message for fault channel 5 (AC Power Failure)
6	The message for Status Normal--No faults
7	The message used after proper acknowledgement, before entering intercall delay

The system reserves 4 or 8 seconds of message time for each message. The programming sequence used determines the amount of time allotted. Additionally, fault messages may be programmed as "Status Only" channel as described below.

The following programming steps should be performed for the creation of fault channel messages:

1. ENTER, MESSAGE, N (0,1,2,3,4,5,6, or 7)
   [indicator or combination of indicators will flash verifying selection]

2. Depress ENTER for a normal 4 second message, or
   depress # for an extended length (8 seconds) message, or
   depress * for a "Status Only" assignment message.

   [Message In Process Indicator will turn on, indicating recording is in process].
   Begin speaking message when so prompted. It is necessary to speak directly at the microphone, at a distance of approximately 8 inches. This will minimize background noise which would be picked up by the microphone as part of the message. It is also necessary to turn off loud equipment in the vicinity of the system while recording messages, to maximize clarity.

3. After the expiration of the message time limit, Message In Process Indicator will go out, and the message just programmed will be played back for verification.

To read or verify the message for each channel,

1. READ, MESSAGE, N(0,1,2,3,4,5,6, or 7)
   [message N will be spoken by the system]

A sample of messages is located in Section IV. D.

Status Only Channel Programming

Any fault channel may be programmed as a "status only" channel as shown above (i.e. it will not cause call-outs to begin, but will be reported in any status messages). When the status of a channel so programmed is announced over the telephone connection, it will be preceeded by a single tone.

D. PROGRAMMING TELEPHONE NUMBERS

The system can be programmed with up to eight telephone numbers, which will be called sequentially when an abnormal condition is detected by the system on any fault channel not programmed as a "status only" channel. The following programming procedure should be performed to enter telephone numbers into the system. Note that there must be at least one telephone number programmed into the system for it to operate at all. All eight telephone number data locations need not be programmed. Telephone numbers may be deleted by entering a "0" into the data location for that number in the list.

1. ENTER,N (1,2,...8)
   [indicator or combination of indicators will flash verifying selection]

2. Enter the desired phone number by depressing the numbers on the keypad.

3. Terminate the entry with a second depression of ENTER

To read this data for verification,

1. READ, N (1,2,...8)
   [telephone number N will be dialed by the system. Test call may be terminated by depressing HALT]

Up to 16 digits may be entered for each phone number position. If any of the numbers the unit is to call require a pause for a second dial tone, enter the pause by using the DELAY key in place of a digit.

To clear a phone number out of the unit, enter a 0 (zero) as the phone number. The unit ignores any phone number that starts with a 0. If you wish to have the unit call the Operator, enter the phone number as DELAY, 0.

E. OPERATIONAL PARAMETERS

This section describes the procedure for setting 4 operational parameters. All of these parameters are entered into the system using the system's programming keypad.

1. Setting the Ring Count

The ring count is the number of rings the unit will wait before answering a call placed to it. This may be set to any number of incoming rings from 1 to 99.

1. ENTER, *
   [indicator flash]
2. enter a two digit number from 01 to 99 representing the desired ring count

To check the ring count programmed into the system, it is best to arrange for someone to call the system's telephone number.

2. Tone or Pulse Dial Selection

The system needs to be set for pulse or tone type dialing. Perform this selection by following these programming steps. Before programming the unit to function in a tone dialing mode, confirm with the telephone company that services the installation that the line to which the unit is connected to will accept tone dialing.

1. ENTER, MODE, 0
   [indicator flash]
2. enter "0" for pulse type dialing, or "1" for tone type dialing

To verify the dialing mode, cause the system to test dial by selecting

1. READ, N(1,2,3,4,5,6,7 or 8)
   [telephone number will be dialed]

3. Message Repetitions

The system will repeat its fault status message a number of times in the course of any telephone call which it places. The system is shipped programmed to repeat the message 8 times during each call. If it is necessary to change this number, perform the following programming steps.

1. ENTER, #
   [indicator flash]

2. Enter a two digit number corresponding to the desired number of message repetitions (01 to 99)

To verify this data, test dial a number and listen to the number of message repetitions before the system terminates the call attempt.

4. Intercall Delay

When a call placed by the system is acknowleged (see section III.C. for the acknowlegement procedure) it will delay further calls for a programmable period to allow time for the condition to be corrected. This time delay period following an acknowledged call is called the intercall delay. The unit is shipped with this delay set to 1 hour. It may be from one to 99 hours and is programmed at the system keyboard as follows.

1. ENTER, DELAY, 0
   [indicator flash]

2. Enter a two digit number corresponding to the desired number of hours of delay

(Numbers less than 10 must be entered with a leading 0, as in 01, 05, etc.)

5. Delay Run Programming

The Run Mode may be entered after a programmable delay. To do so,

1. Depress DELAY, RUN
   [indicator flash]

2. Enter the desired two digit delay in minutes (01 to 99 minutes)
   (Values less than 10 minutes must be entered with a preceding 0, i.e. 01, 07...)

The flashing Run indicator verifies that the system is in the delayed run mode. After the delay is completed, the system will enter the Run Mode and the Run indicator will stay on.

III. OPERATION

A. SYSTEM FAMILIARIZATION AND KEY FUNCTION SUMMARY

The power switch for the system is located on the Front Panel of the system. It is important to note that when 12 vac power is connected to the system, this switch does not remove 12 vac power from the unit--it is always present unless the circuit breaker, which the INSTALLER must supply, is turned off, or the transformer is removed from the power outlet.

There are six indicators across the top side of the keyboard assembly on the front panel. These LEDs will indicate the state of the fault channels which the system is intended to monitor, indicating RED for a fault condition and GREEN for a no-fault condition, along with a system status indicator which display RED for the HALT mode and GREEN for the RUN mode.

On the left side of the system front panel, is the system speaker. This speaker allows words the system synthesizes to be heard, as well as telephone line sounds when the system is on the telephone line placing an alarm call or during a status call placed to the system.

A description of each of the system's keys and their functions now follows:

HALT
The HALT key will abort any operation in process, and return the system to the Halt mode as indicated by the RUN STATUS indicator. In this mode, fault conditions will not be acted upon by the system. However, it is still possible to call the system. The system will answer the call and deliver the appropriate fault status message.

RUN
The RUN key will place the system in a run mode as indicated by the RUN STATUS indicator. If fault conditions exist, the system will begin placing telephone calls (if valid telephone numbers have been programmed into the system). Use of the Delay key in conjunction with the RUN key will cause the system to execute a delayed entry into the Run mode--which may be programmed to be up to 99 minutes (see the section entitled "Putting the System in Run" later in this section for more information on this feature).

MODE
The MODE key is used in conjunction with other keys to effect certain features in system programming including fault modes and tone/dial selection.

SEQUENCE
The SEQUENCE key is a preface key which allows some of the advanced operation features of the system to be activated. Until the purpose and use of this key is explained later in this manual, it is advisable to leave it alone. If this key is

randomly operated with others, an unintentional yet valid keystroke combination could occur, wiping out portions of telephone numbers and other data.

ENTER
The ENTER key is used to enter data which the system must use in performing its monitoring and alarming functions. Included in this data are telephone numbers, fault messages, the system identification message, the message count, and the intercall delay.

MESSAGE
The MESSAGE key is used in conjuction with others to program the message for each fault channel, and the system identification message. Additionally, depression of the MESSAGE key alone when the system is in the Halt mode, will cause the current ID and status messages to be articulated by the system.

READ
The READ key is used to recall any of the programmed information.

DELAY
The DELAY key has four functions:

When used in telephone number programming, it inserts a short pause between digits in a telephone number.

When used with the ENTER key,(i.e. ENTER, DELAY,0) it sets the intercall delay time; that is, the time the system will wait after its callout message has been acknowledged before it begins placing regular calls again (see section II of this manual for additional information).

When the DELAY key is used with the RUN key, (DELAY, RUN) it allows delayed, automatic entry into the Run mode.

When the DELAY key is used for fault delay time programming, it allows the entry of integration or delay times for the detection of each fault condition.

DIGITS 1 THROUGH 0
The digits keys are used for numeric entry of data values and data locations.

* KEY
The * key is used as an entry location for ring count programming. The ring count is the number of incoming telephone rings which the system will count before answering and servicing the incoming call. (see Section II of this manual for more information)

Additionally, the * key is the key used over the telephone for acknowledgement of the system callout message. It is also useable locally (on the system keyboard) for acknowledgement right at the system.

KEY
The # key is used as an entry location for the message count. This is the number of times that the entire fault status message is repeated in the course of each telephone call placed by the system. (see Section II of this manual for more information).

B. PUTTING THE SYSTEM IN RUN

After all operational data has been entered into the system, the unit is ready to enter the run mode, from which any fault channels will be acted upon--causing calls to be placed to the programmed telephone numbers.

To place the system in the Run Mode, depress the RUN key on the system front panel. The Run indicator will verify successful entry into the Run Mode.

Delayed Entry into the Run Mode

The Run Mode may be entered after a programmable delay. To do so,

1. depress DELAY, RUN
   [indicator flash]

2. enter the desired two digit delay in minutes (01 to 99 minutes)
   (values less than 10 minutes must be entered with a preceeding 0, i.e. 01, 07...)

The flashing Run indicator verifies that the system is in the delayed run mode. After the delay is completed, the system will enter the Run Mode and the Run indicator will stay GREEN.

C. RECEIVING AN ALARM

When a valid alarm condition is recognized by the system, it will be indicated locally on the system front panel. If the system is in the Run Mode, it will immediately begin placing telephone calls to the telephone numbers which have been programmed by the user.

Upon the receipt of an alarm call, the answering party will hear the station identification, followed by the current status messages. This entire message will be repeated the number of times programmed. If the entire message sequence is completed without an acknowledgement being returned over the telephone link, the system will terminate the call, wait 70 seconds for a call back acknowledgement, and then place a call to the next telephone number in the list. If an acknowlegement is not received from the next call, after the 70 second wait, a 3rd call will be placed, and so on. The unit will continue to call repeatedly from the user's programmed list of telephone numbers until it receives an acknowlegement or the fault condition is removed.

If the system is acknowledged during the call, it will not place any further calls for a time programmed as the Intercall Delay. If a new fault condition occurs during that period, the Intercall Delay will abort and calls will begin again. If the entire Intercall Delay expires and the fault conditions still persist, the system will again begin to place telephone calls.

To Acknowledge a Call From the System

Acknowledgement may be accomplished by depressing the * key on the called telephone between message repeats during the alarm call. The * key must be depressed for at least 1 second but no longer than five seconds. The system will verify that the acknowledgement has been accepted by saying, [sign off message, in location number 7, as programmed above, will be recited].

If acknowledgement must be returned from a telephone without tone capability, the system may be acknowledged by placing an immediate call back to the system, within 60 seconds after it has completed its call. Again, the system will verify that the acknowledgement has been accepted by saying, [sign off message, in location number 7, as programmed above, will be recited].

D. TEST AND ADVANCED KEYSTROKE SEQUENCES

A number of sequence commands are possible on the system front panel keyboard. These are as follows:

SYSTEM LEVEL TEST SEQUENCES

SEQUENCE 50 [all messages are recited]

SEQUENCE 52 flash test all front panel indicators (HALT to terminate this sequence)

SEQUENCE 55 Acknowledge tone adjustment self test

PRESET ALL DATA VALUES TO DEFAULT

NOTE: Do not use these sequences unless you are thoroughly aware of the results which will occur--that is, the resetting of operational data to default values, and destroying any numbers or delays which may have been entered by the user.

SEQUENCE 60 Preset system variables such as delays, message count,ring count, amd fault channel modes.

SEQUENCE 61 preset telephone numbers only (all become 0)

IV MAINTENANCE AND TROUBLESHOOTING

In the unlikely event that trouble is suspected with the system, it must be promptly disconnected from the telephone network, and referred to Microtel or its authorized service representatives. A service manual detailing troubleshooting procedures is available to qualified personnel.

Periodically inspect the system internally for any evidence of moisture, blown fuses, or battery failure as instructed herein.

A. MAINTENANCE

1. Battery Care

Battery life is dependant upon a number of factors, and will vary depending on the number of outages, and the age of the battery. A new battery will take no longer than 24 hours to gain a full charge, capable of powering the system through any power outage up to four hours in length. It should be noted that the LOW BATTERY indicator is only valid when the 120 vac power is on. If the LOW BATTERY indicator stays on for more than eight hours, the battery is in need of replacement.

2. Battery Replacement

The battery is installed at the top of the system, in the battery tray provided as part of the interior chassis assembly.

It is necessary to remove power from the system by throwing the supply circuit breaker or removing the power transformer from the power outlet before replacing the battery.

Refer to Section I.C - Battery Installation for instructions on installing a new battery.

3. Volume Adjustment

The volume of the system's speech messages delivered to the telephone network is fixed. The volume of the speech heard through the system speaker is, however, adjustable by varying the setting of potentiometer R21, located on the main circuit card in the unit.

4. Acknowledge Tone Adjustment

R33, located on the system's main board, is the adjustment for the frequency detected during the acknowledgement of an alarm call. By activating SEQUENCE 55 (see previous section) the system will deliver a continuous acknowledge tone (* key) to itself, during which the potentiometer R33 may be set. Center the adjustment by varying the setting until the Acknowledge LED

on the front panel turns on. There is some amount of hysteresis associated with this detection so the centering of the component must take into account approaches from each direction. The continuous tone used for adjustment may be halted by depressing the HALT key after the adjustment is completed.

B. SYSTEM SPECIFICATIONS

ENVIRONMENTAL	
Temperature	-10F to +130F
Humidity	90% RH, Non-condensing
Surge	2500 V, Per ANSI C37-90A-1974, common and differential mode
EMI/RFI	per FCC part 15C
ELECTRICAL	
Power requirements	120 VAC, 50/60 Hz, 7 watts
Fault sensing current	10 mA per channel
Battery Backup	4 hours typical
Power outage detection time	1-99 seconds
PHYSICAL	
Dimensions	11 5/8 x 9 7/16 x 4 inches
Weight	10 lbs.
Mounting method	Flange mount, 4 points
Enclosure	NEMA 12 std., others optional
TELEPHONE SYSTEM	
FCC registered for direct interconnect	FCC Registration Number: D4J6M6-13598-AL-E
Dialing capacity	8 numbers, 16 digits each, maximum
Dialing format	Loop disconnect, 10 pps nominal; or tone, 100ms/100ms;user selectable
Answer delay	Programmable, 1 to 99 rings
Acknowledged intercall delay	1 to 99 hours, programmable
Call acknowledgement method	Tone or callback
Unacknowledged intercall delay	One minute
Surge and environmental protection	Per FCC part 68
OPERATIONAL	
Fault detection method	Normally open or closed, selectable
Fault integration time constant	One to 99 seconds
Station identification	Name or number, user selectable
Message selection	Synthesized voice, user programmable messages
Message repetitions	One to 99, user programmable
Data retention	Nonvolatile EEPROM
Message retention	Battery Backed DRAM, 1 MBit
Programming	Local keyboard entry

SYSTEM DIAGNOSTICS

Audible indicators	Line monitor Vocal status of all data, fault conditions and parameters
Visual indicators	Fault channels Run status Off hook Incoming call Power on Battery condition Intercall delay in progress Successful acknowledgement

C. PRODUCT WARRANTY

We warrant to the original purchaser the Microtel unit manufactured by us to be free from defects in material and workmanship under normal use and service. Our obligation under this warranty shall be limited to the repair or exchange of any part or parts which may thus prove defective under normal use and service within one year from date of installation by the original purchaser, in no event shall this warranty apply to equipment after the expiration of eighteen (18) months from date of shipping to the original purchaser whether or not the equipment is installed and which our examination shall disclose to our satisfaction to be defective. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INLCUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON OUR PART, AND WE NEITHER ASSUME, NOR AUTHORIZE ANY OTHER PERSON TO ASSUME FOR US, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS MICROTEL UNIT OR ANY PART THEREOF WHICH HAS BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. WE MAKE NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY US. THE TERM "ORIGINAL PURCHASER", AS USED IN THIS WARRANTY, SHALL BE DEEMED TO MEAN THAT PERSON FOR WHOM THE MICROTEL UNIT IS ORIGINALLY INSTALLED.

D. Sample Messages

System Identification, location 0

"This is the West Side Treatment Plant, 91st and Oak"
"This is an automatic alarm from Microtel Corporation"
"This is station 51"

Fault Messages, locations 1,2,3,4 and 5

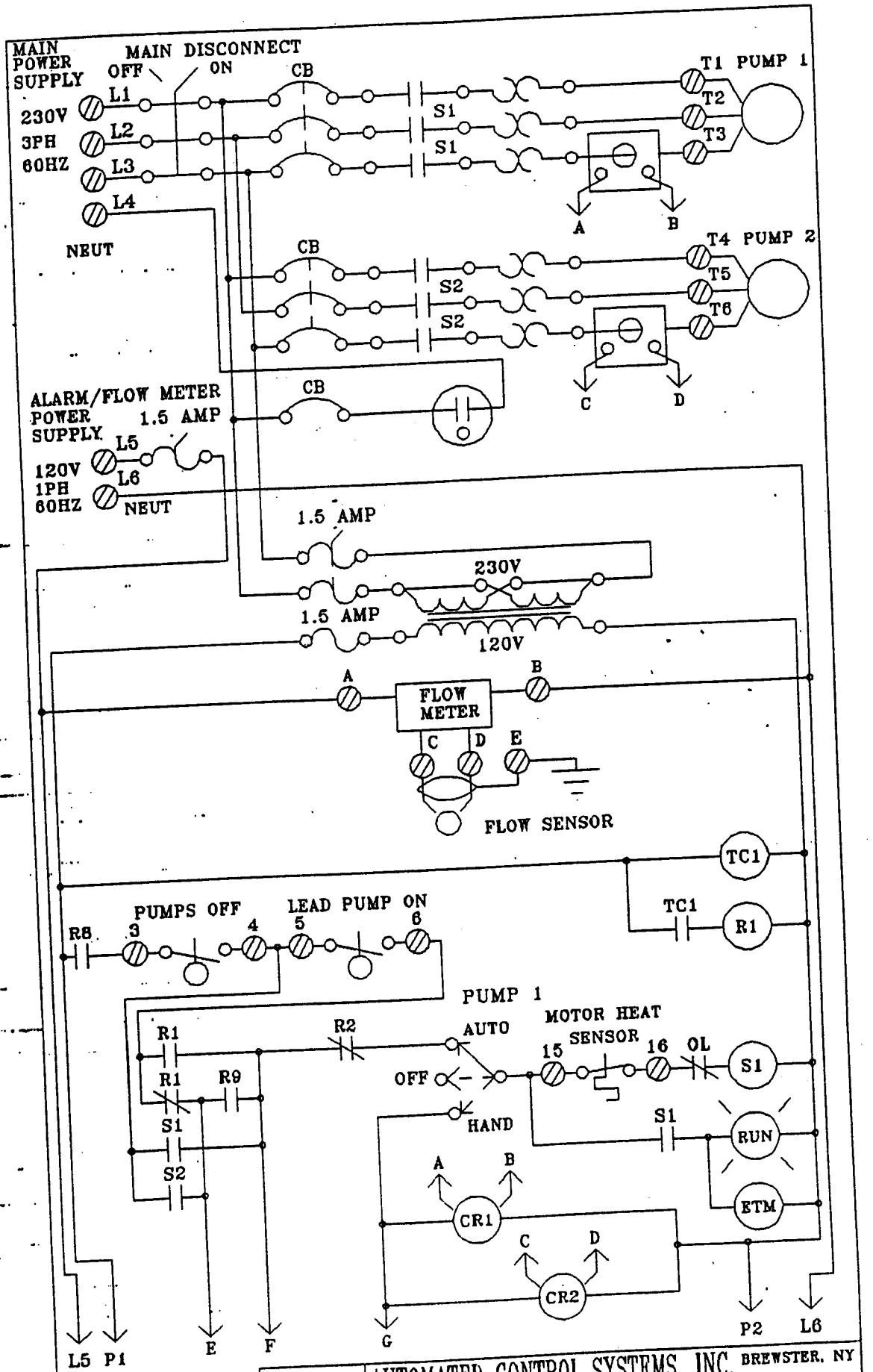
"High well Level"
"AC Power failure, dispatch crew at once"
"Fire Alarm, activate fire emergency plan"
"Intrusion, call the supervisor and the police"

Status Normal Message, location 6

"Status Normal"
"No fault conditions exist at this time"

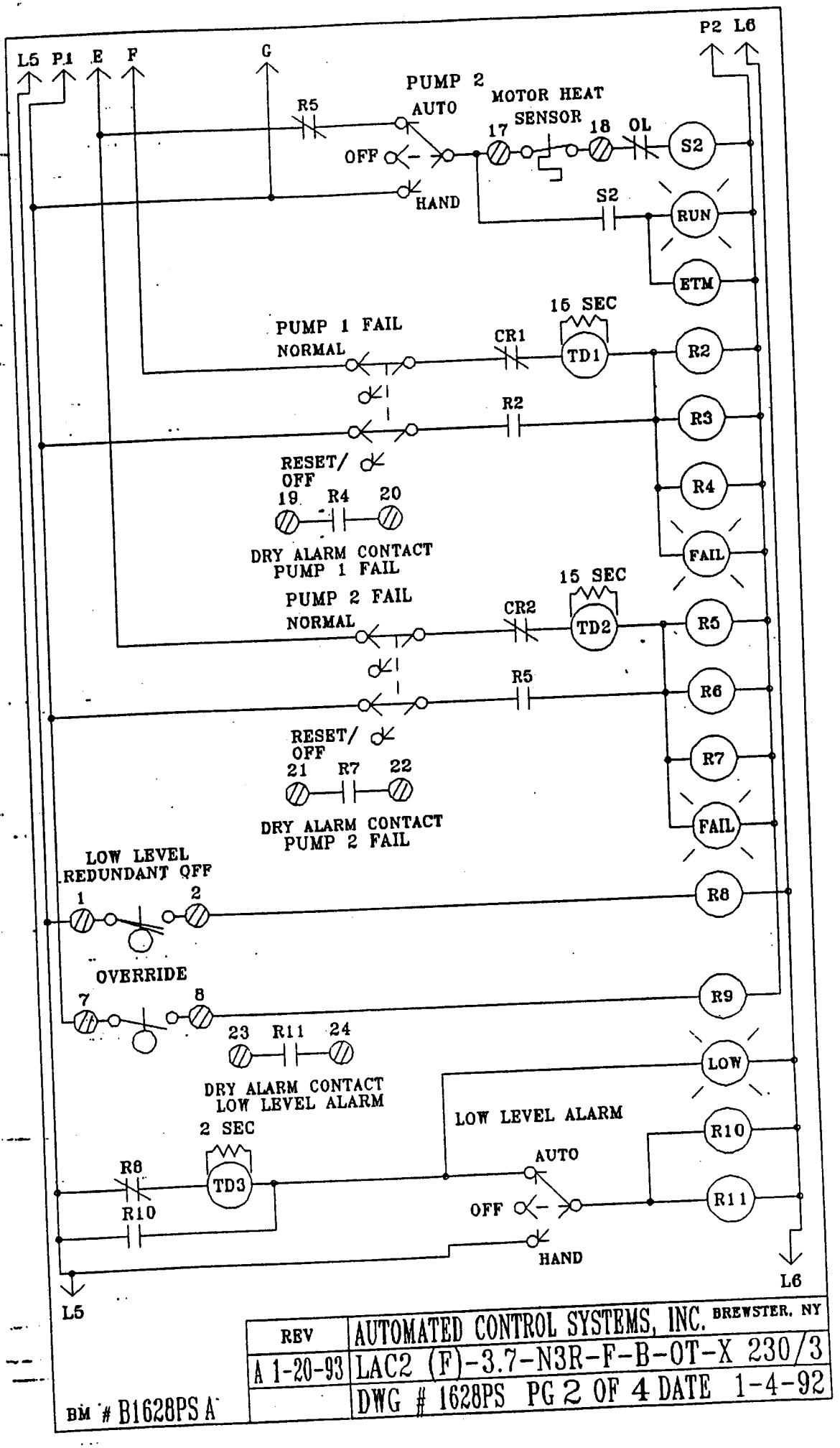
Signoff Message, location 7

"Acknowledge accepted, now entering the intercall delay"
"Acknowledgement detected, further calls will be delayed for t... intercall delay period"



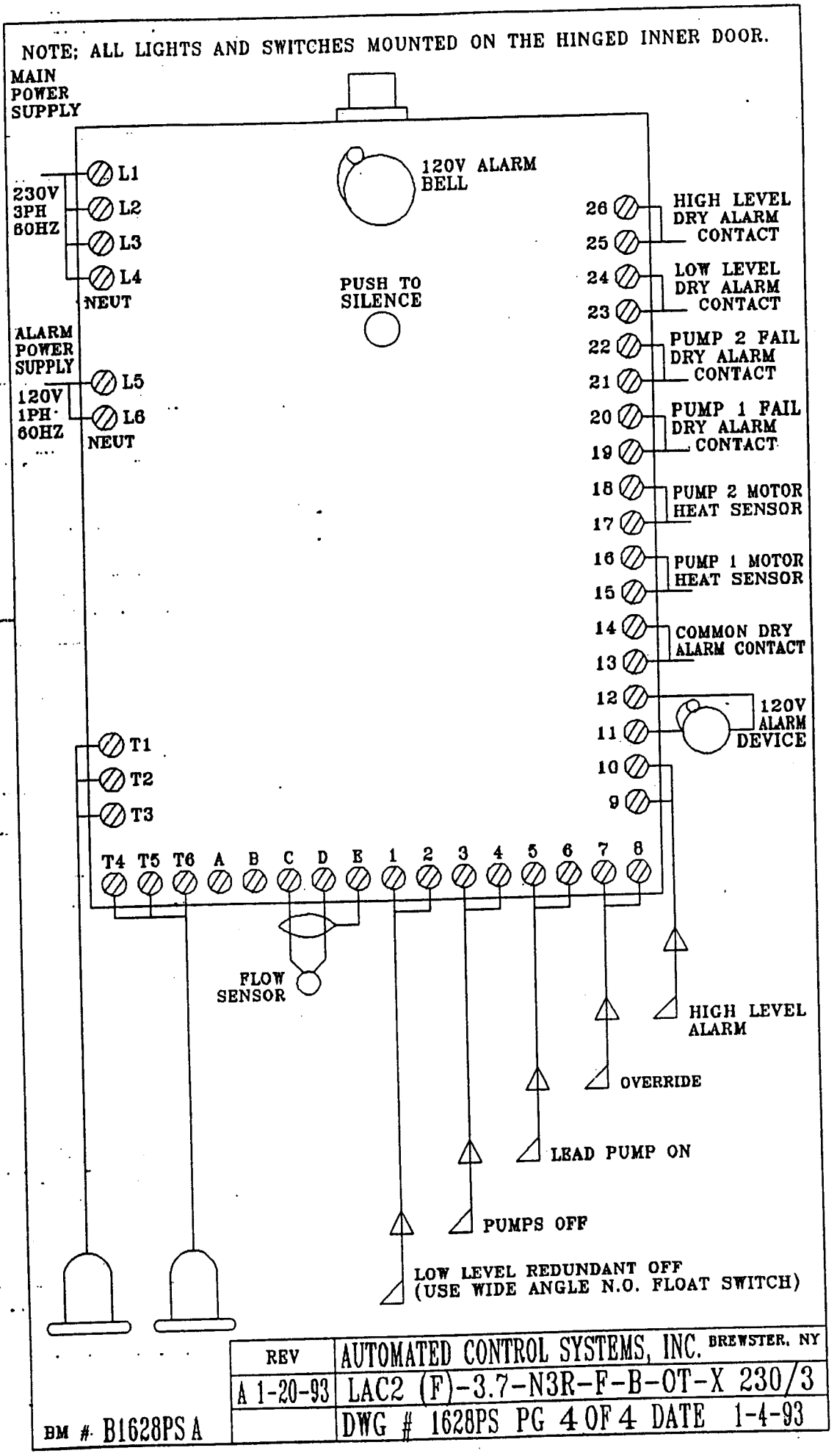
REV	AUTOMATED CONTROL SYSTEMS, INC. BREWSTER, NY
A 1-20-93	LAC2 (F)-3.7-N3R-F-B-0T-X 230/3
	DWG # 1628PS PG 1 OF 4 DATE 1-4-92

BM # B1628PSA



REV	AUTOMATED CONTROL SYSTEMS, INC. BREWSTER, NY
A 1-20-93	LAC2 (F)-3.7-N3R-F-B-0T-X 230/3
	DWG # 1628PS PG 2 OF 4 DATE 1-4-92

BM # B1628PS A


NOTE; ALL LIGHTS AND SWITCHES MOUNTED ON THE HINGED INNER DOOR.
MAIN POWER SUPPLY
230V 3PH 60HZ
L1
L2
L3
L4
NEUT
ALARM POWER SUPPLY
120V 1PH 60HZ
L5
L6
NEUT
120V ALARM BELL
PUSH TO SILENCE
26
25
HIGH LEVEL DRY ALARM CONTACT
24
23
LOW LEVEL DRY ALARM CONTACT
22
21
PUMP 2 FAIL DRY ALARM CONTACT
20
19
PUMP 1 FAIL DRY ALARM CONTACT
18
17
PUMP 2 MOTOR HEAT SENSOR
16
15
PUMP 1 MOTOR HEAT SENSOR
14
13
COMMON DRY ALARM CONTACT
12
11
120V ALARM DEVICE
10
9
T1
T2
T3
T4 T5 T6 A B C D E 1 2 3 4 5 6 7 8
FLOW SENSOR
HIGH LEVEL ALARM
OVERRIDE
LEAD PUMP ON
PUMPS OFF
LOW LEVEL REDUNDANT OFF
(USE WIDE ANGLE N.O. FLOAT SWITCH)
REV
AUTOMATED CONTROL SYSTEMS, INC. BREWSTER, NY
A 1-20-93
LAC2 (F)-3.7-N3R-F-B-OT-X 230/3
DWG # 1628PS PG 4 OF 4 DATE 1-4-93
BM # B1628PS A

ELAPSED TIME METER, GRASSLIN JMZ5-E	2
CURRENT RELAY, SYRELEC, L1AR1 120	2
11 PIN BASE, CUSTOM CONNECTOR, RB	2
TIME DELAY, SSAC, KSD1422	3
RELAY, POTTER & BRUMFIELD, 120V K10P	15
RELAY MOUNT, ACS, RM-2	7
RELAY MOUNT, ACS, RM-1	1
IDEC PB FLUSH/E ABW100	1
IDEC PB BLACK CAP	0
IDEC PB RED CAP	1
SWITCH CONTACTOR, NORMAL OPEN	1
ALARM BELL, FARDAY, 4434B-4-15-120-60	1
ALARM LIGHT, AC/DC BL5R	1
FLASHER, SSAC, FS126RC	1
TERMINAL STRIP, MARATHON, 330012-WSC	1
TERMINAL STRIP, MARCO, 33006-WSC	1
TERMINAL STRIP, MARCO, 33008-WSC	6
TERMINAL STRIP, KULKA, 0987-1	6
TERMINAL STRIP, KULKA, 0987-1	1
TELEPHONE DIALER, MICROTEL, CUSTOMER SUPPLIED	

General Specifications

Environmental	
Temperature	-10°F to +130°F
Humidity	90% RH, Non-condensing
Surge	2500 V, Per ANSI C37-90A-1974, common and differential mode
EMI/RFI	per FCC part 15C
Electrical	
Power requirements	120 VAC, 50/60 Hz, 15 Watts
Fault sensing current	10mA per channel
Battery backup	4 hours typical
Power outage detection time	1-99 seconds
Physical	
Dimensions	11" x 9" x 5"
Weight	10 lbs.
Mounting method	Flange mount, 4 points
Enclosure	NEMA 12 std., others optional
Telephone System	
FCC registered for direct interconnect	FCC Registration Number EJF6M6-14699-AL-E
Dialing capacity	8 numbers, 16 digits each, maximum
Dialing format	Loop disconnect, 10 pps nominal, or tone, user selectable
Answer delay	Programmable, 1 to 99 rings
Acknowledge intercall delay	One to 99 hours, programmable
Call acknowledgement method	Tone or callback
Acknowledged intercall delay	One minute
Surge and environmental protection	Per FCC part 68
Operational	
Fault detection method	Normally opened or closed, selectable, keyboard programmable
Fault integration time constant	One to 99 seconds
Station identification	4 or 8 seconds, user selectable
Message selection	4 or 8 seconds, user selectable
Message repetitions	One to 99, user programmable
Data retention	Nonvolatile EEPROM
Programming	Local keyboard entry
System Diagnostics	
Line monitor	Vocal status of all fault conditions, station identification, and acknowledge response
Audible indicators	
Visual indicators	Fault channels Run status Incoming call Power on Battery condition Off hook Intercall delay in progress Successful acknowledgement

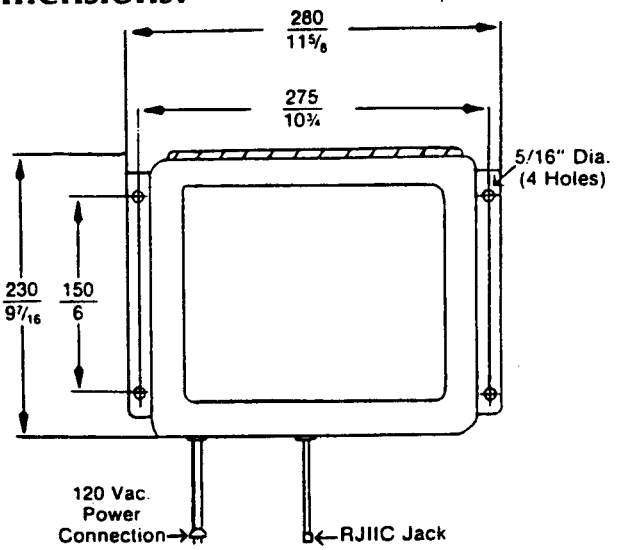
Options

Tone generator (screw-on or hand-held)
Additional power and telephone line surge protection
24 hour battery backup

Typical Applications:

Remote pump stations
Unmanned oil fields
Greenhouses
Refrigerated storage areas
Level control
Pressure
Temperature
Vacuum
Leak detection
pH Monitoring
Fire
Equipment malfunction
Flow
Residual
Weight
Power-unmanned substations

Dimensions:



DIMENSIONS = MILLIMETERS / INCHES

Contact Aquatrol or your nearest authorized representative for a complete set of engineering specifications.

Represented by

AQUATROL CORPORATION

The first name in digital telemetry and control systems
4480 West Round Lake Road • Arden Hills, MN 55112
612 / 636-3950 • FAX: 612 / 636-5509

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039010M

SAMPLE SPEC FOR MCS-250 - REAL VOICE/DIGITIZED SPEED

AUTOMATIC DIALING ALARM MONITOR
Four (4) Digital Inputs Plus Power Fault

Furnish one (1) automatic dialing alarm monitor. The monitor shall be a microprocessor based system that shall sense four alarm conditions at the site. In addition, power failure shall be sensed internally and shall not require using one of the fault channels. upon detection of any of the fault conditions or power failure the unit shall commence dialing the first of eight (8) user selected phone numbers and deliver a message describing the actual alarm condition. This message shall be delivered in an electronic digitized voice, utilizing the user's own digitally recorded voice. Message programming shall be accomplished by speaking into the system and shall not be limited to internal synthesized speech vocabulary. Messages will include actual system location and alarm conditions. The unit will continue to call the phone numbers in succession until acknowledged by calling the unit back or by depressing a touch-tone key. Once acknowledged, the unit shall enter a programmable intercall delay to allow the alarm condition to be attended to before beginning notification again. Additionally, the system shall have the capability of answering incoming calls. Upon receipt of a call, the system shall report the station status to the caller. All communications shall utilize standard telephone lines; no leased or dedicated lines shall be required. The unit shall be a Microtel MCS-250/Real Voice as manufactured by Aquatrol Corporation, Arden Hills, Minnesota.

The alarm monitor unit shall possess the following physical and functional characteristics:

- Fiberglass NEMA 12 enclosure, with clear polycarbonate gasketed cover and external mounting holes and lockable stainless steel clasps.
- Built-in maintenance free battery back-up, 4 hours.
- Sealed mylar keyboard to preclude contamination.
- Tubular screw-clamp terminals for fault leads, not requiring lugs or connectors, for up to 12 AWG wire.
- Optically isolated fault input channels.
- Individually selectable fault delay times - keyboard programmable.
- Tone or loop-disconnect dialing capability.
- Visual indications of the following conditions, even when the cover is closed:

  All fault channels
  Power on
  Call in progress
  Battery condition
  Intercall delay in progress
  Successful acknowledgment
  Message in progress

The unit shall utilize non-volatile ROM circuitry such that the unit's operating system, programmed phone numbers and all other functions and values stored in memory shall be retained without any power requirement.

Additionally, each unit shall include the following standard features:

- Individually selectable intercall delay from the keyboard.
- Individually selectable open and closed contacts for alarm sensing from the keyboard.
- Dual color, red/green indicators for each channel.
- U.L. listed power source.

Manufacturers warranty shall be a minimum of one year parts and labor, at the factory, on all parts and workmanship - excluding lightning, flood, vandalism and other acts of God.

MCS-250 INSTALLATION AND OPERATION MANUAL

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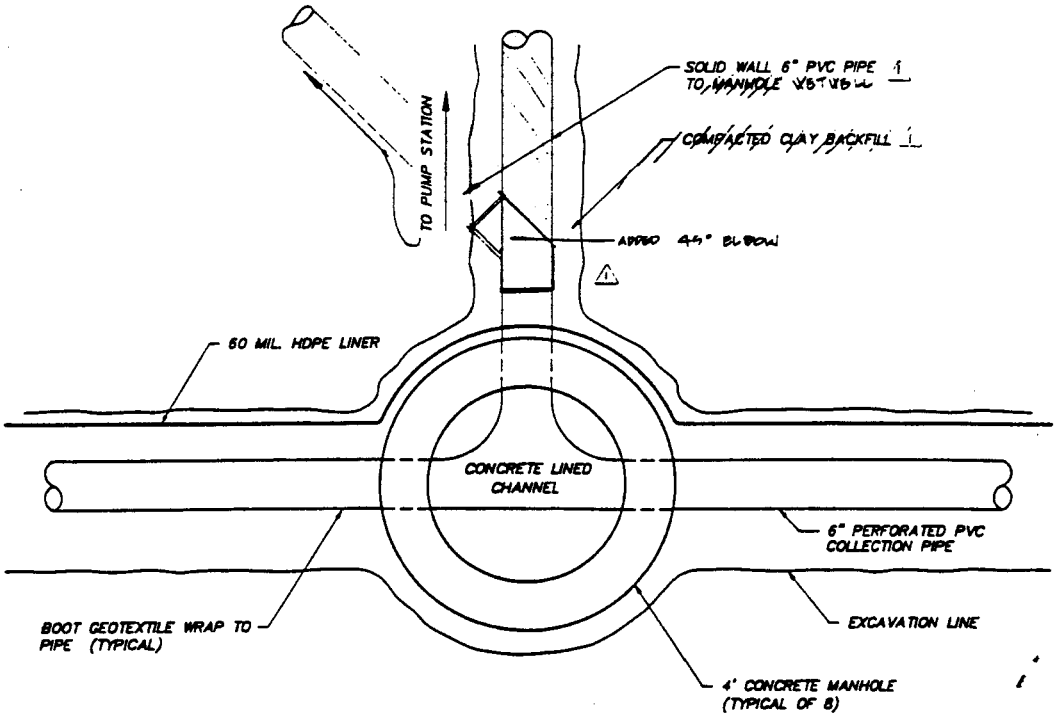
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Appendix F

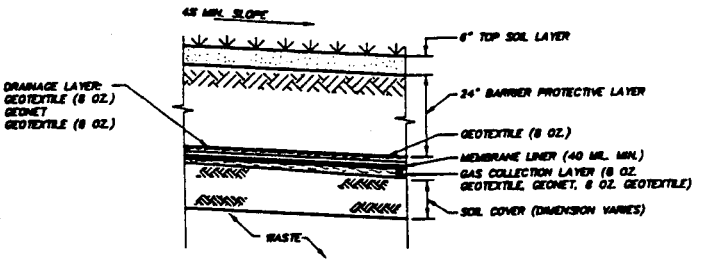
Borrow As-Built Topography

Appendix G

Record Details

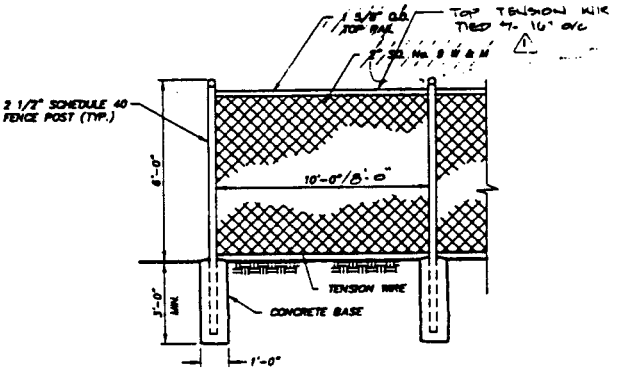


PLAN VIEW AT MANHOLE STATION 0+00



CLOSURE CAP DETAIL

SCALE : NONE



CHAIN LINK FENCE DETAIL

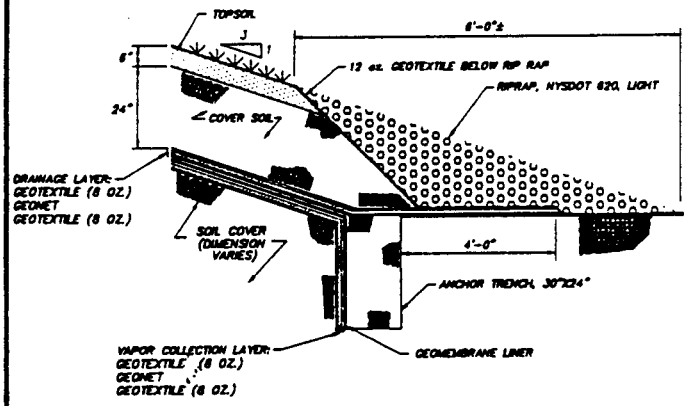
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REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

EA ENGINEERING, P.C.

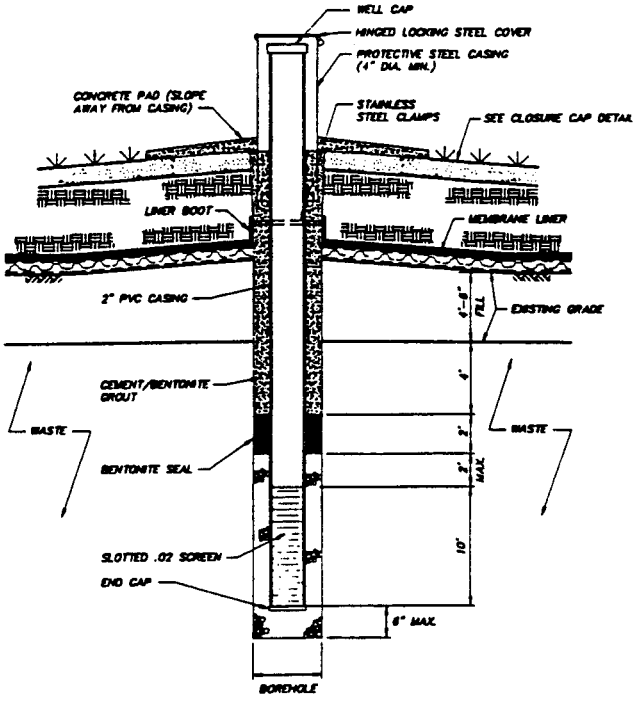
DRAWN BY: TMM	PROJECT NO: 11160.05
PROJECT MGR. JHS	DATE: 12-30-93
SHEET NO. 1 OF 9	SCALE: NONE

FIGURE G-1
STANDARD DETAILS
TOWN OF NEW WINDSOR LANDFILL
GENERAL OPERATIONS MONITORING AI
MAINTENANCE MANUAL



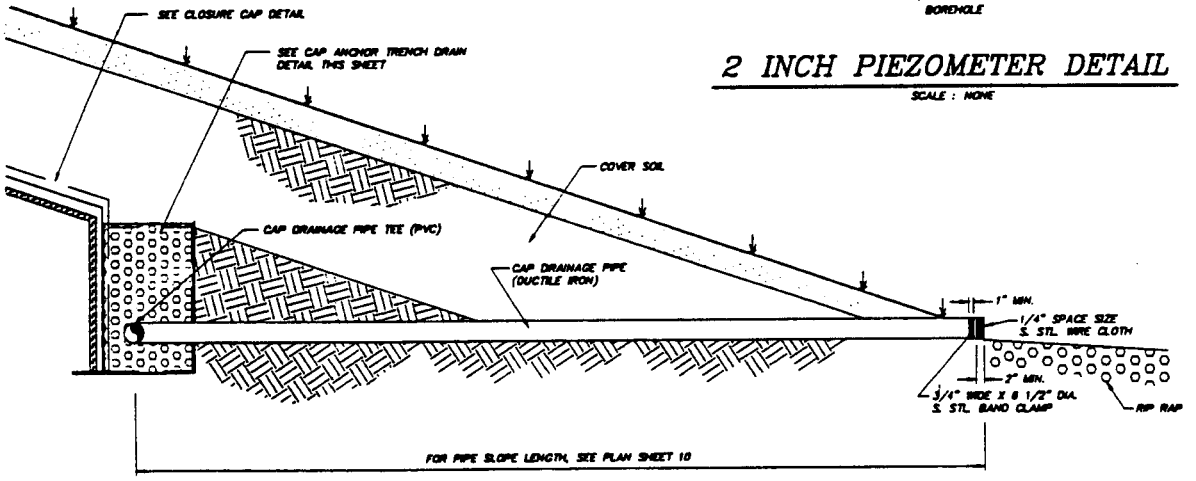
CAP TOE DRAIN DETAIL

SCALE : 1/2" = 1'-0"



2 INCH PIEZOMETER DETAIL

SCALE : NONE

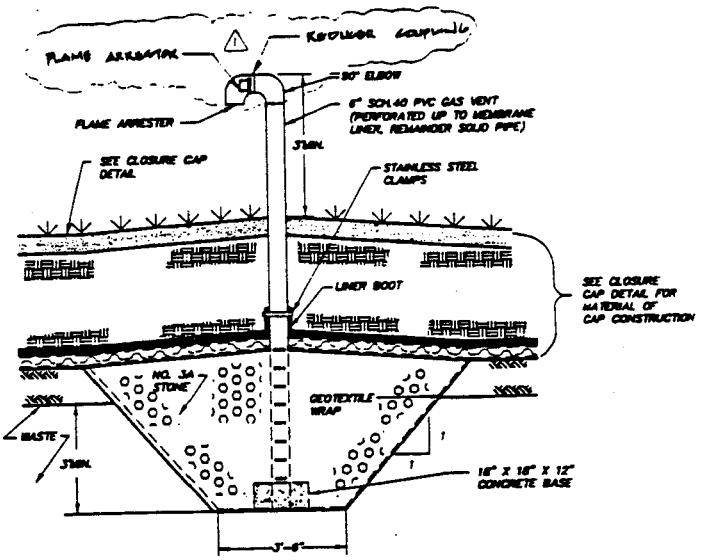


CAP DRAINAGE OUTLET DETAIL (TYP. AT 2 LOCATIONS)

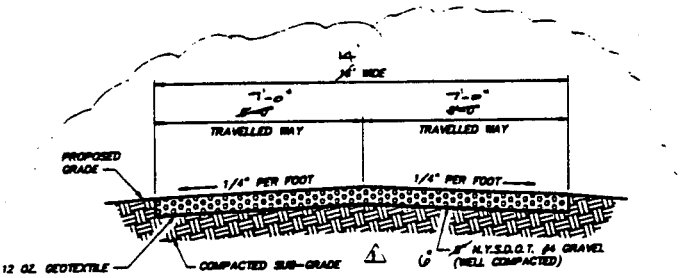
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REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

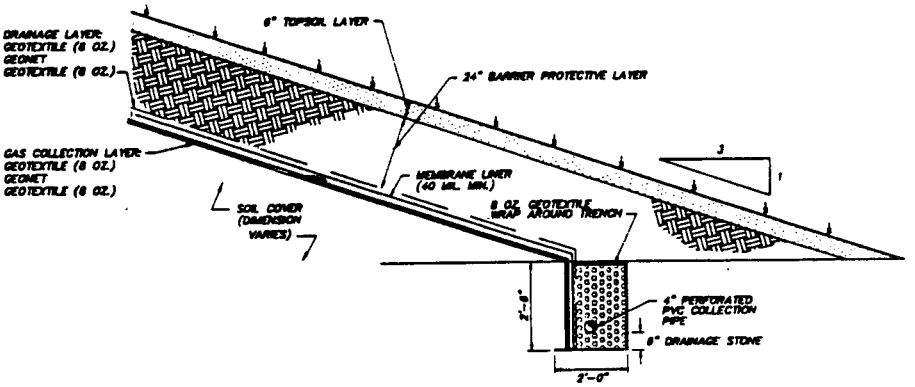
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	PROJECT MGR. JHS	DATE: 12-30-93	
	SHEET NO. 2 OF 9	SCALE: NONE	



GAS VENT RISER DETAIL (TYP. OF 10)



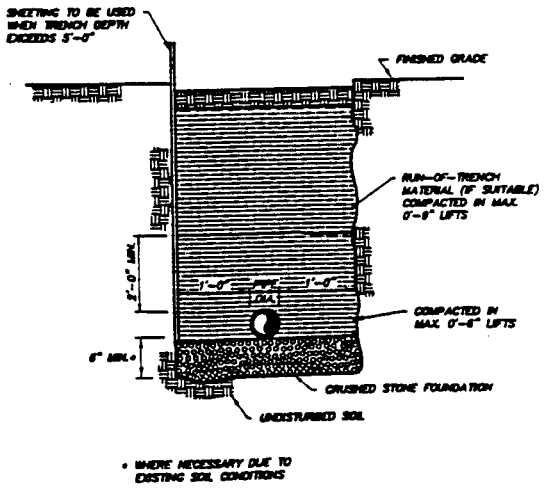
TYPICAL GRAVEL ACCESS ROAD DETAIL



CAP ANCHOR TRENCH DRAIN DETAIL

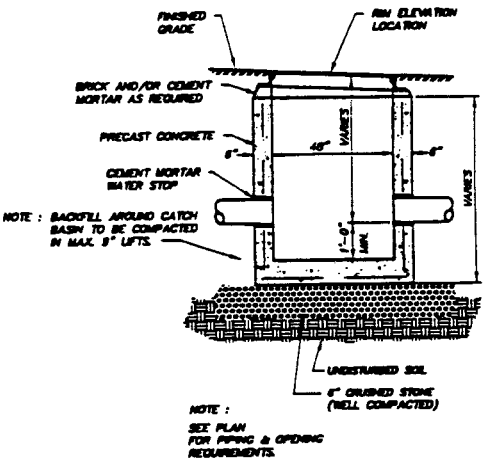
REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

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	PROJECT MGR. JHS	DATE: 12-30-93	
	SHEET NO. 3 OF 9	SCALE: NONE	



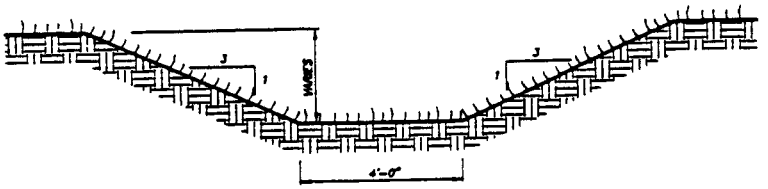
STORM DRAINAGE TRENCH DETAIL

SCALE : NONE



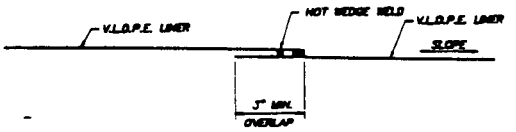
TYPE "A" CATCH BASIN

SCALE : NONE



TYPICAL GRASSED SWALE DETAIL

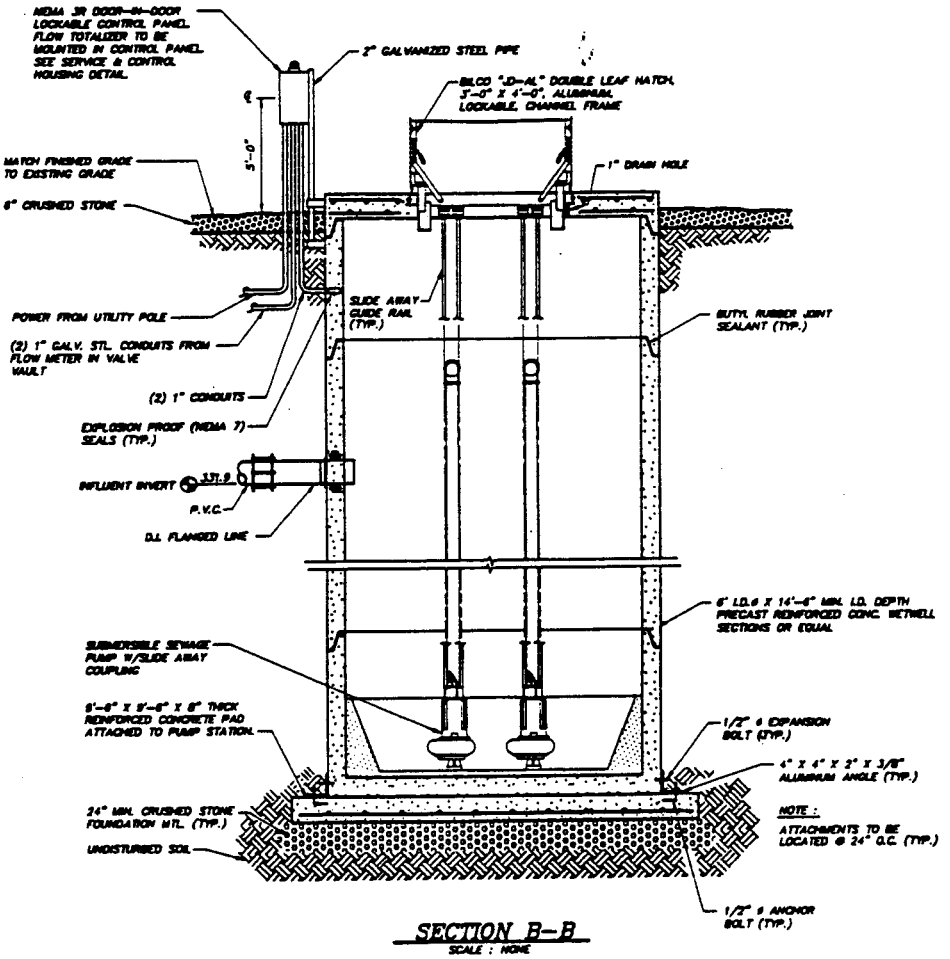
SCALE : NONE



TYPICAL V.L.D.P.E. LINER SEAM

REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

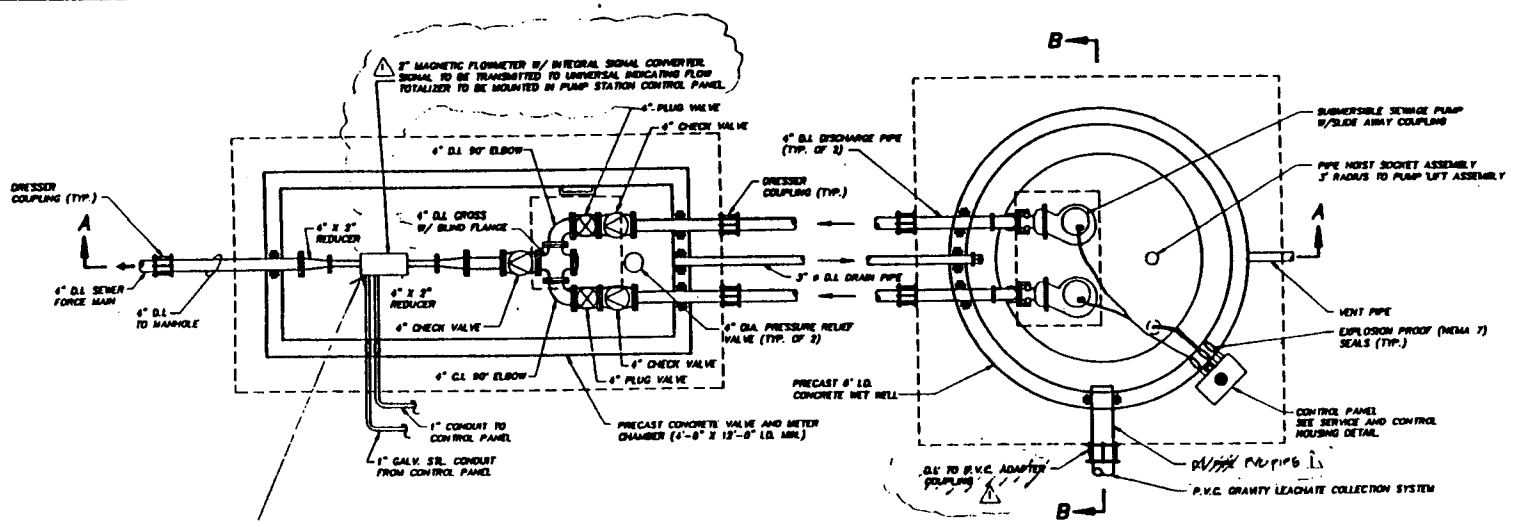
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	REVIEWED BY: TMM	DATE: 12-27-93	
	APPROVED BY: DSS	SCALE: NONE	



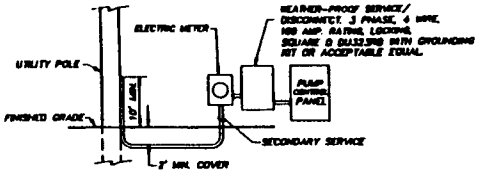
SECTION B-B
SCALE : NONE

REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

EA ENGINEERING, P.C.	DRAWN BY: TMM	PROJECT NO: 11160.05	FIGURE G-5 STANDARD DETAILS TOWN OF NEW WINDSOR LANDFILL GENERAL OPERATIONS MONITORING AND MAINTENANCE MANUAL
	PROJECT MGR. JHS	DATE: 12-30-93	
	SHEET NO. 5 OF 9	SCALE: NONE	

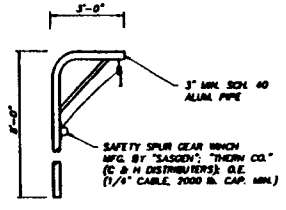


PLAN



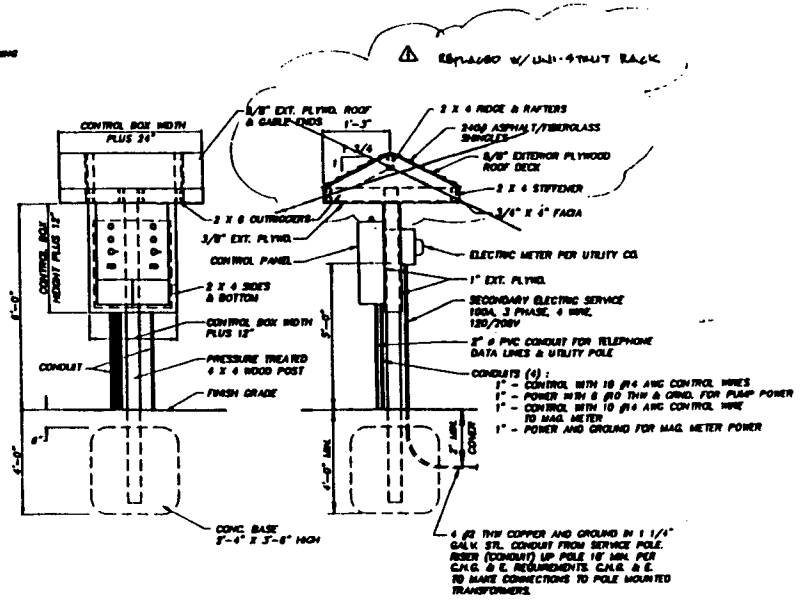
ELECTRICAL SCHEMATIC

SCALE : NONE



PIPE HOIST ASSEMBLY

SCALE : NONE

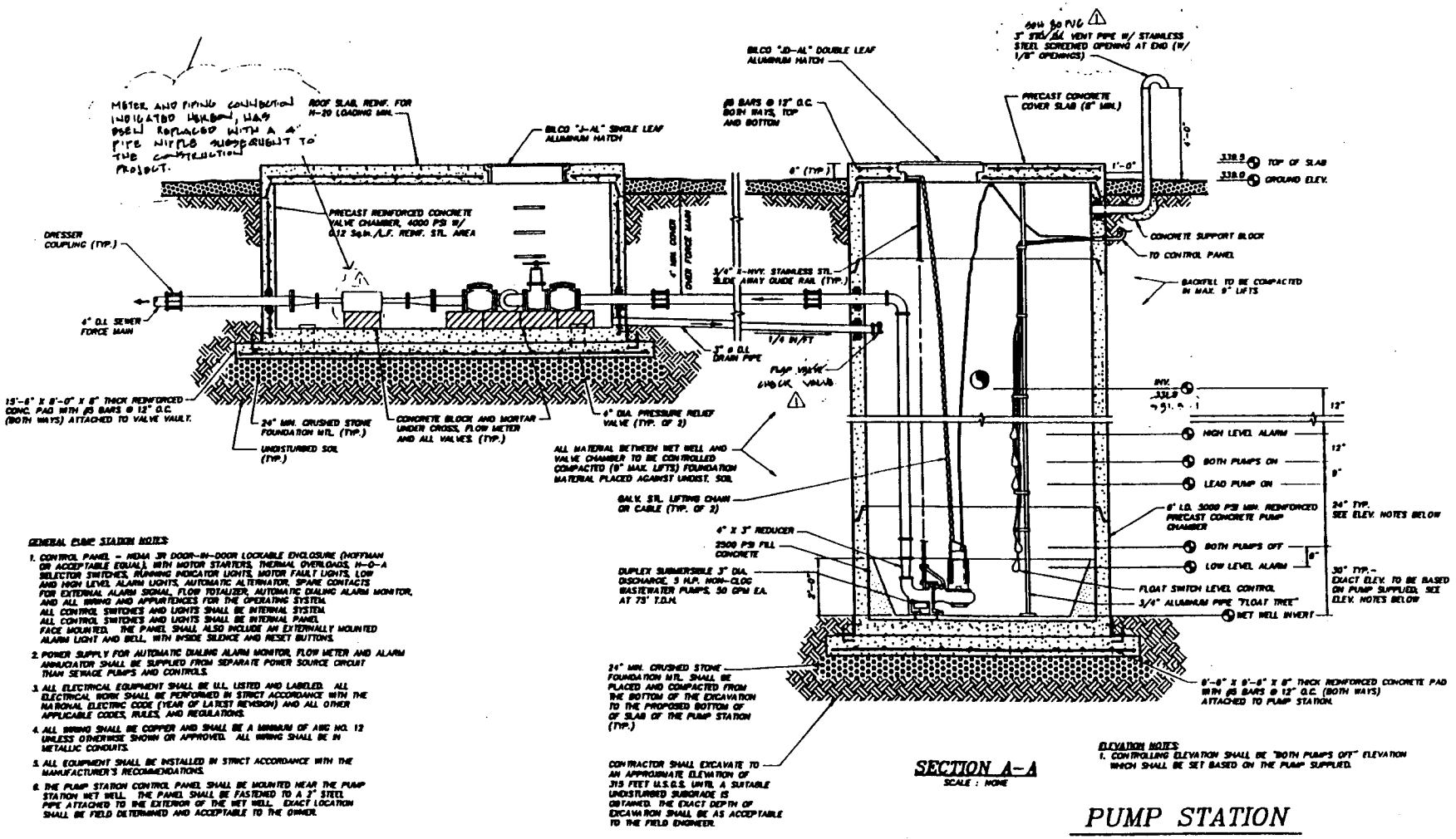


SERVICE & CONTROL HOUSING

EA ENGINEERING, P.C.

FIGURE G-6
STANDARD DETAILS
TOWN OF NEW WINDSOR LANDFILL
GENERAL OPERATIONS MONITORING AND MAINTENANCE MANUAL

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.
	TMM	12-30-93	11160.05
CHECKED BY	PROJECT MGR.	SCALE	SHEET NO.
DSS	JHS	NONE	4 OF 9



GENERAL PUMP STATION NOTES:

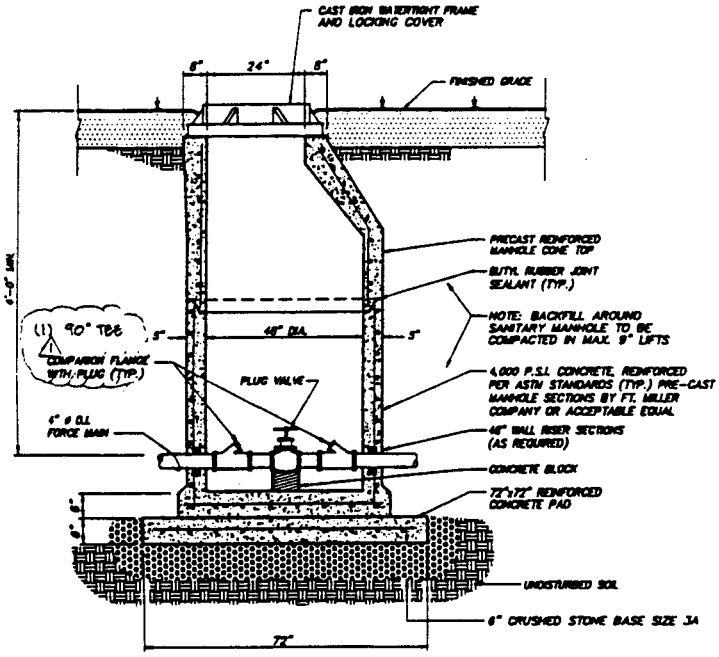
1. CONTROL PANEL - NEMA 3R DOOR-IN-DOOR LOCKABLE ENCLOSURE (HOFFMAN OR ACCEPTABLE EQUAL), WITH MOTOR STARTERS, THERMAL OVERLOADS, H-O-A SELECTOR SWITCHES, RUNNING INDICATOR LIGHTS, MOTOR FAULT LIGHTS, LOW AND HIGH LEVEL ALARM LIGHTS, AUTOMATIC ALTERNATOR, SPARE CONTACTS FOR EXTERNAL ALARM SIGNAL, FLOW TOTALIZER, AUTOMATIC DIALING ALARM MONITOR, AND ALL WIRING AND APPURTENCES FOR THE OPERATING SYSTEM. ALL CONTROL SWITCHES AND LIGHTS SHALL BE INTERNAL SYSTEM. ALL CONTROL SWITCHES AND LIGHTS SHALL BE INTERNAL PANEL FACE MOUNTED. THE PANEL SHALL ALSO INCLUDE AN EXTERNALLY MOUNTED ALARM LIGHT AND BELL, WITH INSIDE SILENCE AND RESET BUTTONS.
2. POWER SUPPLY FOR AUTOMATIC DIALING ALARM MONITOR, FLOW METER AND ALARM ANNUCIATOR SHALL BE SUPPLIED FROM SEPARATE POWER SOURCE CIRCUIT THAN SEWAGE PUMPS AND CONTROLS.
3. ALL ELECTRICAL EQUIPMENT SHALL BE U.L. LISTED AND LABELED. ALL ELECTRICAL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (YEAR OF LATEST REVISION) AND ALL OTHER APPLICABLE CODES, RULES, AND REGULATIONS.
4. ALL WIRING SHALL BE COPPER AND SHALL BE A MINIMUM OF AWG NO. 12 UNLESS OTHERWISE SHOWN OR APPROVED. ALL WIRING SHALL BE IN METALLIC CONDUITS.
5. ALL EQUIPMENT SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
6. THE PUMP STATION CONTROL PANEL SHALL BE MOUNTED NEAR THE PUMP STATION WET WELL. THE PANEL SHALL BE FASTENED TO A 2" STEEL PIPE ATTACHED TO THE EXTERIOR OF THE WET WELL. EXACT LOCATION SHALL BE FIELD DETERMINED AND ACCEPTABLE TO THE OWNER.

SECTION A-A
SCALE : NONE

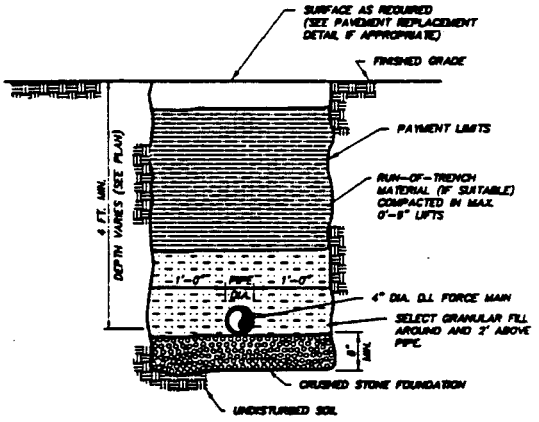
ELEVATION NOTES:
1. CONTROLLING ELEVATION SHALL BE "BOTH PUMPS OFF" ELEVATION WHICH SHALL BE SET BASED ON THE PUMP SUPPLIED.

PUMP STATION
SCALE : AS SHOWN

EA ENGINEERING, P.C.	FIGURE G-7 STANDARD DETAILS TOWN OF NEW WINDSOR LANDFILL GENERAL OPERATIONS MONITORING AND MAINTENANCE MANUAL	DESIGNED BY	DRAWN BY: TMM
		DATE: 12-30-93	PROJECT NO.: 11160.05
		CHECKED BY: DSS	PROJECT MGR.: JHS
		SCALE: NONE	SHEET NO.: 7 OF 9



TYPICAL FORCE MAIN MANHOLE CLEANOUT DETAIL (TYP. OF 3)

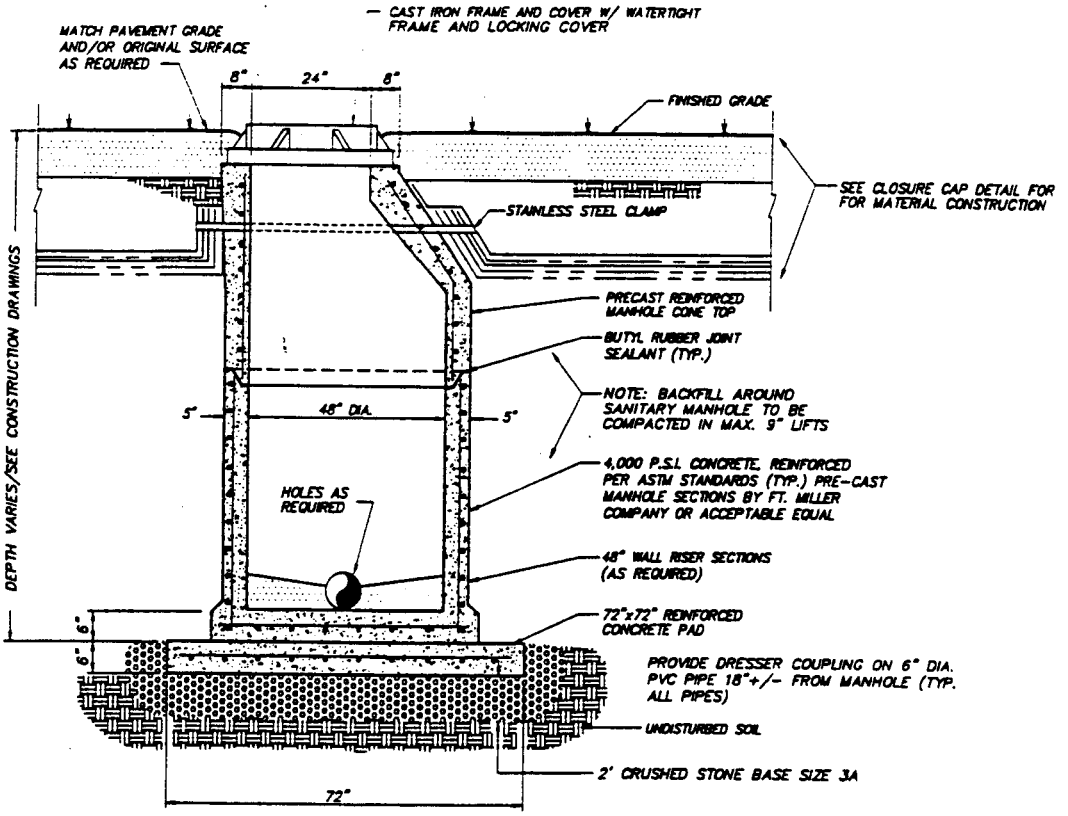


FORCE MAIN TRENCH DETAIL

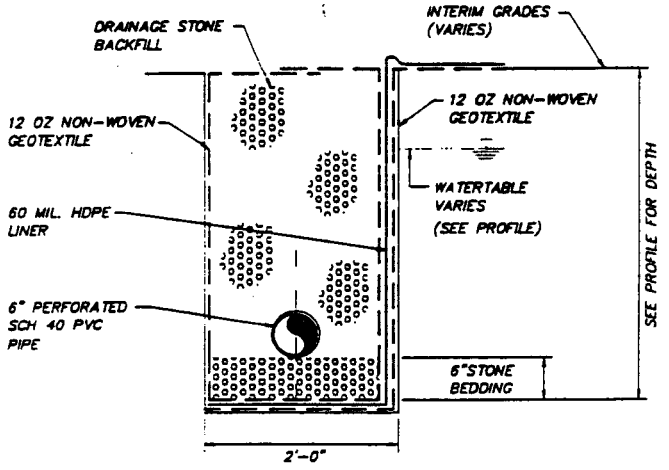
REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

EA ENGINEERING,P.C.	DRAWN BY: TMM	PROJECT NO: 11160.05
	PROJECT MGR. JHS	DATE: 12-30-93
	SHEET NO. 8 OF 9	SCALE: NONE

FIGURE G-8
STANDARD DETAILS
TOWN OF NEW WINDSOR LANDFILL
GENERAL OPERATIONS MONITORING AN
MAINTENANCE MANUAL



LEACHATE COLLECTION MANHOLE DETAIL



TYPICAL LEACHATE COLLECTION TRENCH

REFERENCE RECORD DRAWING REVISIONS DATED NOVEMBER 1993

EA ENGINEERING, P.C.	DRAWN BY: TMM	PROJECT NO: 11160.05	FIGURE G-9 STANDARD DETAILS TOWN OF NEW WINDSOR LANDFILL GENERAL OPERATIONS MONITORING AN MAINTENANCE MANUAL
	PROJECT MGR. JHS	DATE: 12-30-93	
	SHEET NO. 7 OF 9	SCALE: NONE	

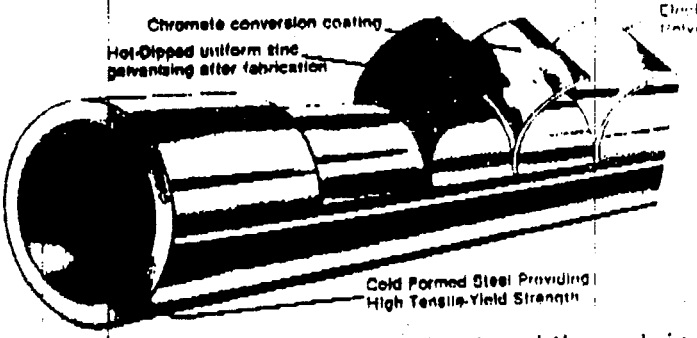
Appendix H

Construction Shop Drawings

Appendix H.1

Triple-coated for Longevity, Cold-formed for Strength...

SS-40 OUT-PERFORMS SCHEDULE 40



Allied has developed an engineering breakthrough in corrosion resistance for lasting durability in all climates and atmospheric conditions. The formula is a uniform triple coating of zinc, chromate, and acrylic/polyurethane formula which are applied in one continuous operation by Allied's in-line patented Flo-Coat® process.

- Electrostatic Applied Clear Polyurethane Finish
- Chromate Conversion Coating
- Hot-dipped Uniform Zinc Galvanizing After Pipe is Fabricated
- Cold-rolled Steel Providing High Tensile-Yield Strength

(MR) MANUFACTURER

Founded in 1960 by the inventor of the patented Flo-Coat® process, Allied Tube & Conduit has emerged as a potent factor in the pipe and tube industry. In the two decades since its inception, production has reached the rate of 300,000 tons annually. Fence pipe, a mainstay of its worldwide sales, has propelled Allied to its position as Number One Supplier to the fencing industry.

Facilities

SS-40 is manufactured in two locations: Harvey, Illinois, and Philadelphia, Pennsylvania. The headquarters complex in Harvey has more than 1,250,000 sq. ft. The Philadelphia production plant and warehouse facilities have an additional 250,000 sq. ft. Eight electric-weld cold forming pipe mills, incorporating the in-line galvanizing process, enable Al to minimize shipping costs while providing unmatched service to the industry. Allied employs more than 1,500 people and devotes a large staff research, development and quality control. It is an engineering-oriented company. The in-line process provides the optimum situation for constantly monitoring the entire production process.

(USES, APPLICATIONS

SS-40 fence pipe is one of the newest products developed by the research and engineering department of Allied. Its specifications and characteristi are based on the concept that performance is the only true criteria. SS-40 will give superior performance wherever Schedule 40 is presently used.

"Acceptance of SS-40 has grown rapidly and is increasingly widespread. We have gained acceptanc by State Highway Departments throughout the U.S including most of the seaboard states, which have the most corrosive environments."

Federal agencies which have approved SS-40 incl the following:

- (AASHTO) American Association of State Highw and Transportation Officials M 181-77
- Federal Specification RR-F-191/2b (Chain Link Fence Gates)
- Federal Specification RR-F-191/3b (Chain Link Fence Posts, Braces, Top Rails)
- Department of the Army CEGS-02711
- Department of the Navy TS-02711
- Department of Transportation Federal Aeronautics Administration Brief 24020

ASTM specification F-669-81 Standard Specificati for Strength.

THE PATENTED FLO-COAT® PROCESS



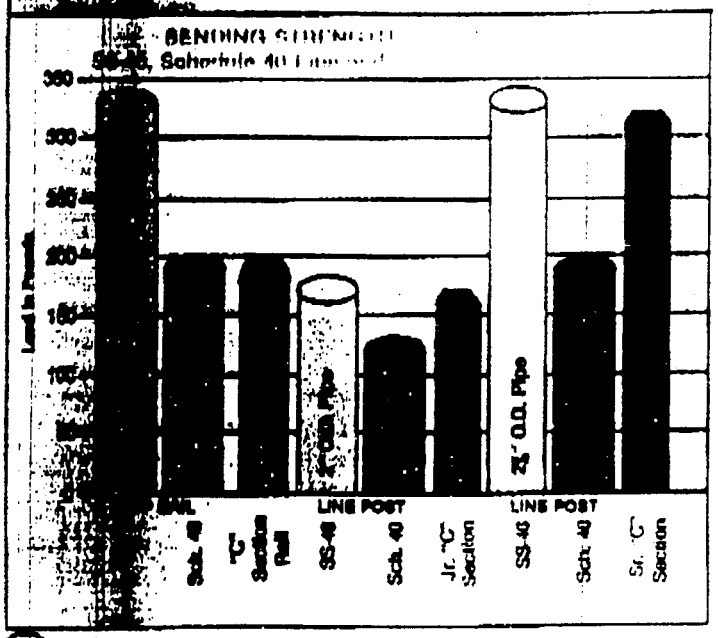


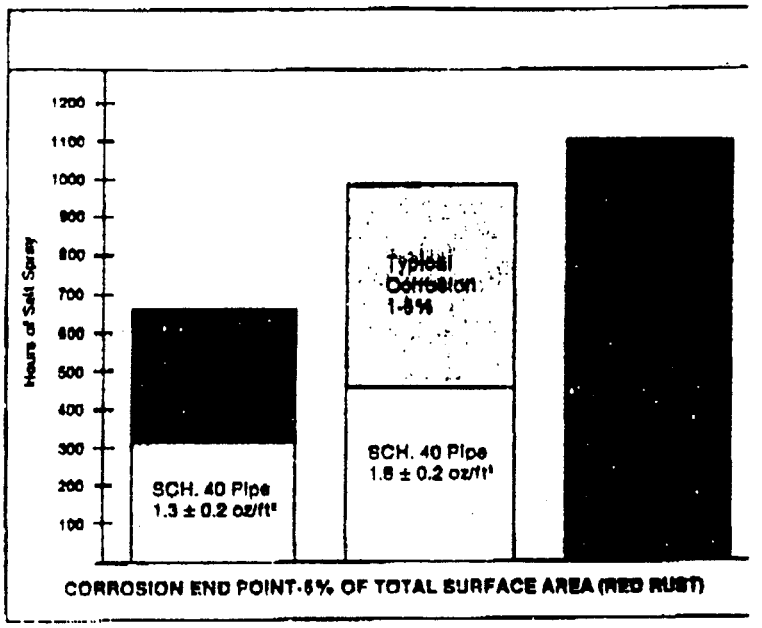


TABLE I
PHYSICAL DIMENSIONS AND STRENGTH PERFORMANCE

Nominal Pipe Size I.D.	Decimal Equiv.	Pipe Wall Thickness Minimum	Wt./Ft. Minimum	Section Modulus (1)	x	Yield Strength Minimum	=	Max. Bending Moment in. lb.	Calculated (Actual) Load (lbs) 10' Free Supported	Cantilever 4'	Cantilever 6'
1"	1.315	.104	1.345	.1111	x	50000	=	5555	185 (230)	116	70
1-1/4"	1.660	.111	1.836	.1961	x	50000	=	9805	327 (390)	204	135
1-1/2"	1.900	.120	2.281	.2810	x	50000	=	14050	468	293	195
2"	2.375	.130	3.117	.4881	x	50000	=	24405	814	508	330
2-1/2"	2.875	.160	4.640	.8778	x	50000	=	43890	1463	914	610
3"	3.500	.160	5.706	1.3408	x	48000	=	64350	2145	1340	890

Testing Laboratory, 1973.
& Cornbelt, 1976.
Minimum Wall Thickness.





OVERALL PRODUCT IN PLACE

Characteristics/Performance

SS-40 out-performs Schedule 40 in both strength and corrosion resistance. SS-40 produced under the patented Flo-Coat® process has made obsolete the concept that weight means strength. SS-40 is as much as 33% stronger than Schedule 40, yet is 20% lighter in gauge and weight.

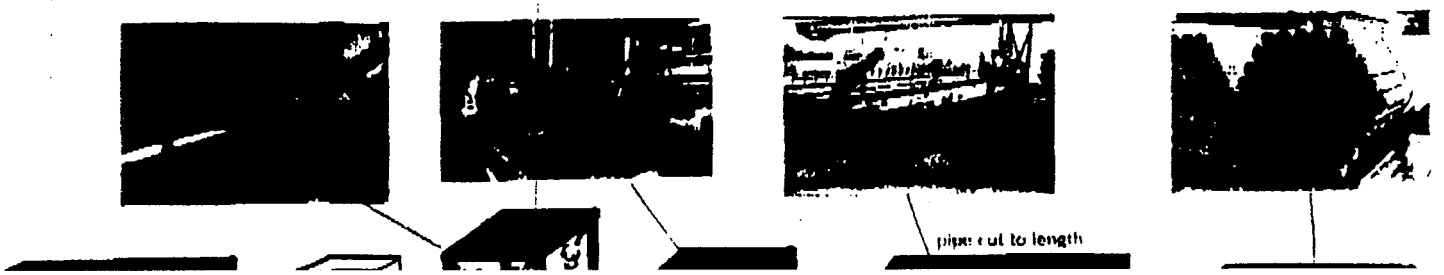
The key to its superior strength is due to two factors. First, the steel is cold rolled into the tubular shape, resulting in a yield strength in excess of 50,000 psi. Second, the cold water quenching following the hot-dip galvanizing has a tempering effect.

The greater corrosion resistance is achieved through the patented Flo-Coat® process in which the pipe is hot-dip galvanized and chromated by total immersion. This is followed by electrostatic spraying of a clear polyurethane finish. The polyurethane minimizes oxidation preserving the bright, shiny appearance.

The combined coatings of zinc, zinc chromate and clear polyurethane produce a "synergistic" effect tha has greater corrosion resistance than the sum of the individual coatings.

It all adds up to superior protection.

These three carefully metered 360° coatings applie during the Flo-Coat® process give SS-40 a highly lustrous and uniform coat which fabricates without flaking. SS-40 remains maintenance-free, attractive and durable, year after year.



TECHNICAL SUPPORT

Scope

This specification covers galvanized/clear coated steel fence pipe products manufactured by the Allied Tube & Conduit patented flo-coat process.

Materials

1 **Base Metal.** Base metal shall be steel of such quality that the fabricated product will meet the performance criteria set forth in this standard. The steel strip used in the manufacture of the pipe shall conform to ASTM A-569.

2 **Zinc.** The zinc used in the manufacture of Allied's flo-coat pipe conforms with ASTM B-6 High Grade and Special High Grade Zinc.

3 **Clear Coating.** The clear coating is manufactured from high grade raw materials which produce a crosslinked acrylic polyurethane coating.

4 **Internal Coating.** The internal zinc rich based coating shall have a minimum zinc powder loading of 87% by weight and be capable of providing galvanic protection.

5 **Chromate.** A specialty developed chromate conversion coating is deposited on the surface of the zinc to improve the corrosion resistance.

3. Weight of Zinc Coatings

3.1 The weight of zinc shall be 1.0 oz/ft² ± 0.1 oz/ft².

3.2 The weight of zinc coatings shall be determined by the method contained in ASTM A-90.

4. Chromate Conversion Coating

4.1 The chromate coating weight shall be 30 micrograms/sq. in., ± 15 micrograms/sq. in.

4.2 The coating weight shall be determined by a strip and weigh method utilizing an atomic absorption spectrophotometer.

5. Thickness of Clear Coatings

5.1 THe thickness of the clear coating shall be a nominal 0.0005 in. ± 0.0002 in.

5.2 The thickness of this coating shall be determined by measurement with a suitable magnetic or eddy current coating thickness tester. The thickness of the clear coating is the difference between the thickness of the zinc and the total thickness of the clear coating and zinc.

5.3 The coating thickness tester shall be standardized on the steel surface after removing the zinc prior to making the measurements.

6. Performance Properties of the Product

6.1 **Strength.** Pipe products manufactured in accordance with this standard shall meet the minimum strength requirements described in Table 1.

6.2 **Bending Tests.** The strength of line, end, corner and pull posts shall be determined by using a 4- or 6-foot cantilever beam test. The strength of top rail shall be determined by using a 10-foot free-supported beam test. At the buyer's option, 4- or 6-foot cantilever tests can be used to test all framework components.

6.3 **Alternative—Calculation of Bending Moment.** As an alternative to the beam tests described above, conformance with the specification can be demonstrated by measurement of the tensile yield strength of a randomly selected piece from each lot, and calculation of the section modulus according to the established formula for this purpose. The tensile yield strength shall be determined according to the methods outlined in ASTM E-8. For materials manufactured under this specification the 0.2 offset method shall be used to determine the yield strength.

7. Corrosion Performance of the Coated Surfaces

7.1 Salt Spray Resistance

7.2 **Exterior Surface.** The exterior clear coated surface of the pipe shall have a demonstrated ability to resist 1000 hours of exposure to salt fog with a maximum of 5% red rust when conducted in accordance with ASTM B-117.

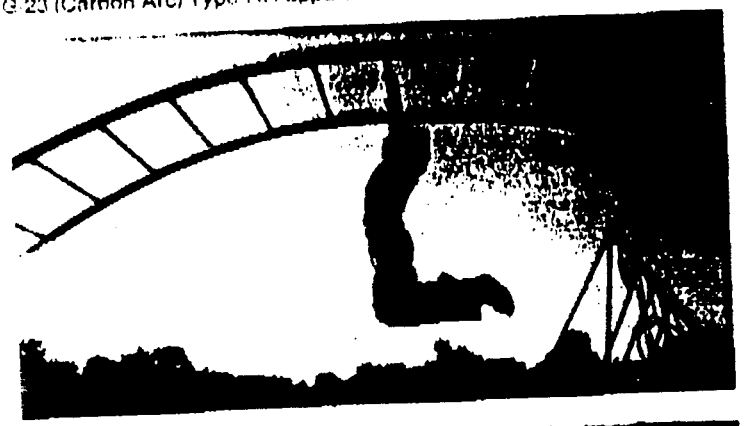
7.3 **Interior Surface.** The interior zinc rich coated surface shall have a demonstrated ability to withstand 300 hours of exposure to salt fog, with a maximum of 5% red rust when conducted in accordance with ASTM B 117.

7.4 Humidity Resistance

7.5 **Exterior Surface.** The clear coated exterior surface of the pipe shall have a demonstrated ability to resist 500 hours of exposure to 100% relative humidity without blistering and peeling when conducted in accordance with ASTM D-2247.

7.6 Weatherometer Resistance

7.7 **Exterior Surface.** The clear exterior coating shall have a demonstrated ability to withstand exposure for 500 hours without failure at a black panel temperature of 145°F. (63°C.) when tested in accordance with ASTM D-1499 (ASTM G-26) Xenon Type BH apparatus or ASTM G-23 (Carbon Arc) Type HH apparatus.





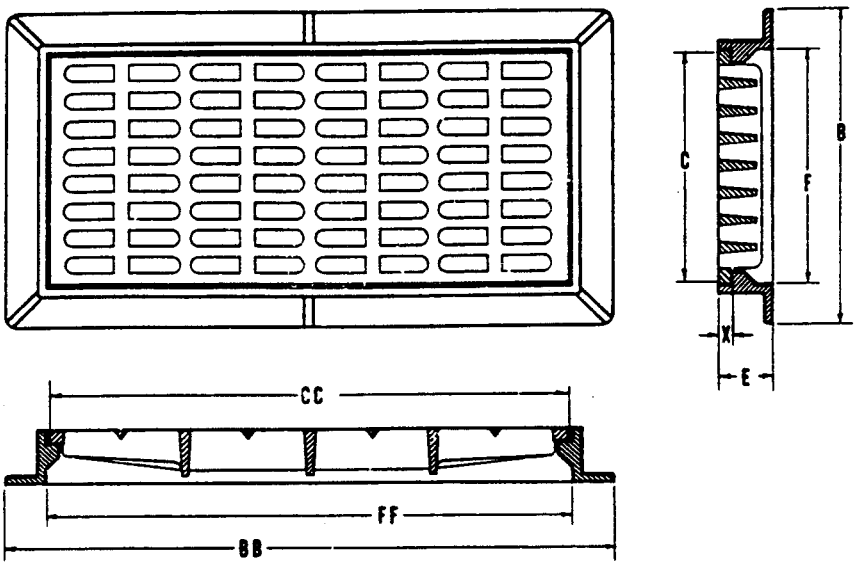


Allied
TUBE & CONDUIT CORPORATION
16100 SOUTH LATHROP • HARVEY, ILLINOIS 60426
(312) 339-1610 OR 955-6000

Call the Toll-Free numbers below for engineering or design assistance:
1-800-323-7031
Ind., Iowa, Kan., Ky., Mich., Minn., Mo., Miss., N. Car.,

Appendix H.2

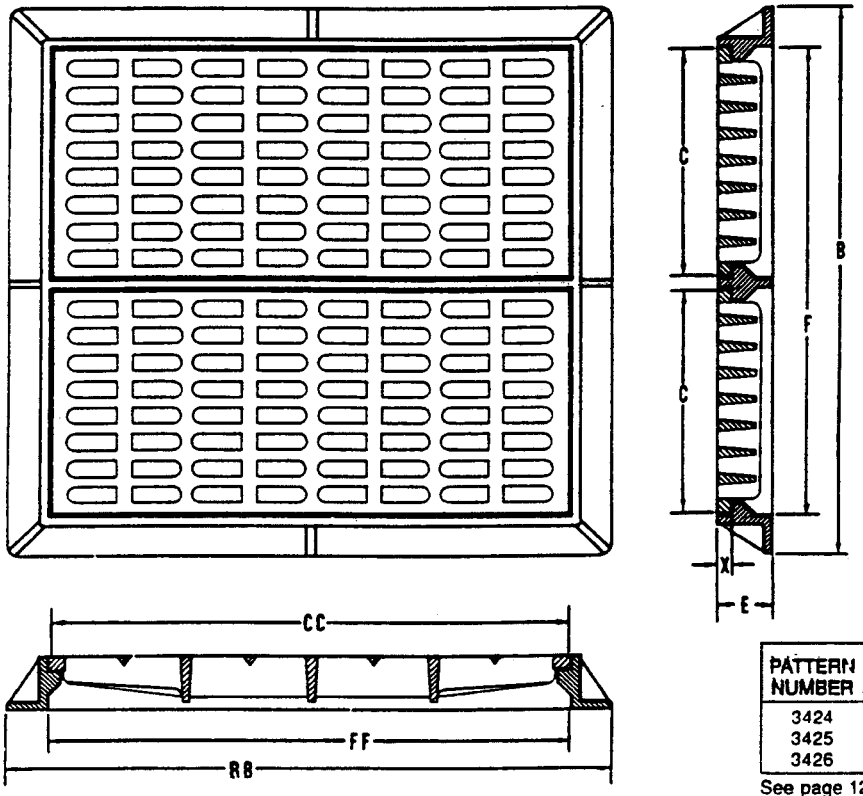
Heavy Duty Inlet Frames and Bicycle Type Grates



PATTERN NUMBER 3405

PATTERN NUMBER	DIMENSIONS IN INCHES							
	B	BB	C	CC	E	F	FF	X
3404	31	43	24	38	4½	24½	38½	1½
3405	28	54	21¾	47¾	5	22	48	1¼
3406	28	42	21¾	35¾	5	22	36	1¼
3407	32	54	25¾	47¾	5	26	48	1¼
3408	36	55½	30	49¾	5	30½	49½	1¼

See page 123 for Rate of Flow Chart



PATTERN NUMBER 3425

PROPOSED INLET FRAME AND GRATE

PATTERN # 3425
Class 30 B
ASTM A48-83
GRAY IRON

PATTERN NUMBER	DIMENSIONS IN INCHES							
	B	BB	C	CC	E	F	FF	X
3424	51	42	21¾	35¾	5	44¾	36	1¼
3425	51	54	21¾	47¾	5	45	48	1¼
3426	59	54	25¾	47¾	5	53	48	1¼

See page 123 for Rate of Flow Chart

RATE OF FLOW CHARTS

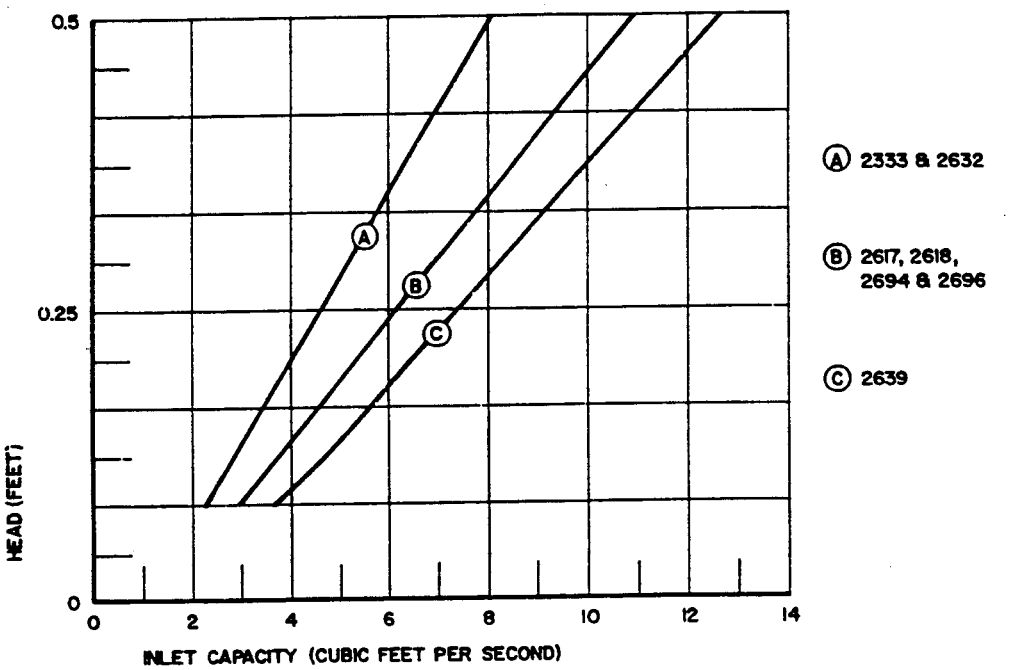


FIGURE 5. RATE OF FLOW FOR CURB TYPE CATCH BASINS WITH BICYCLE GRATES

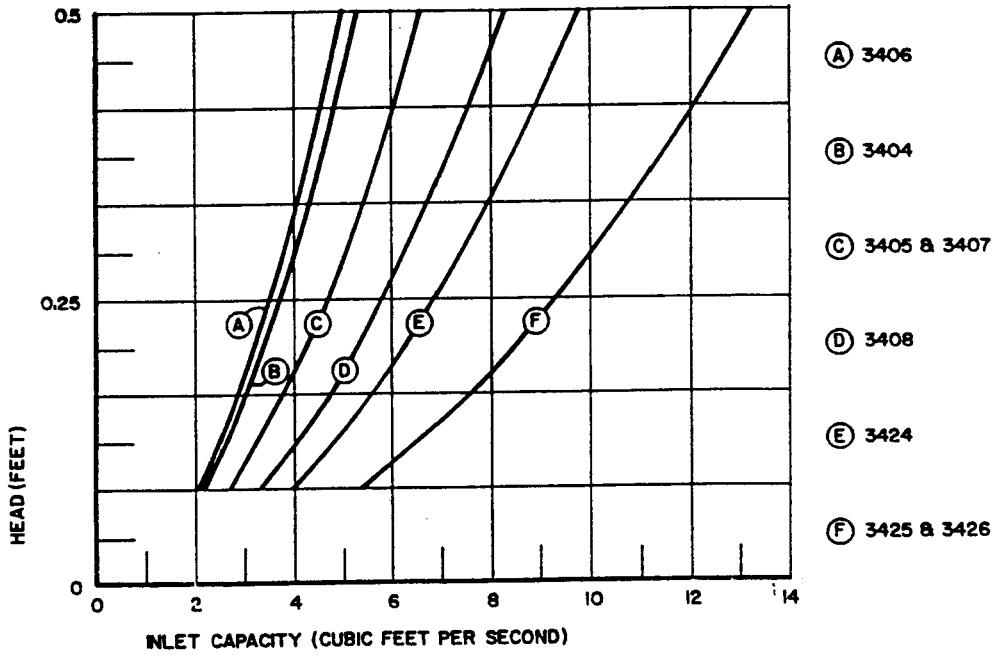
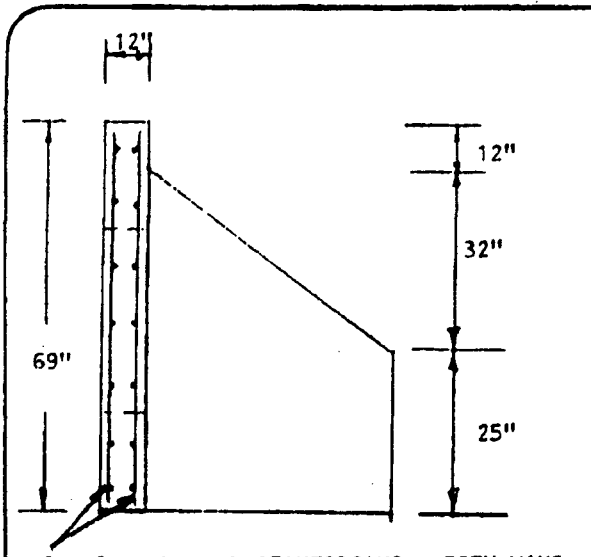
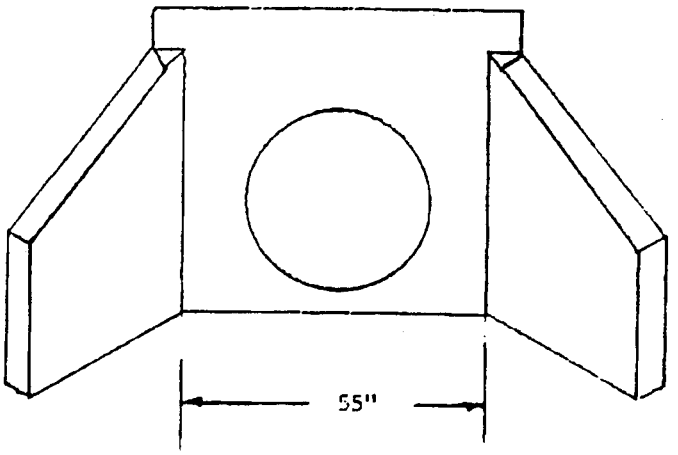


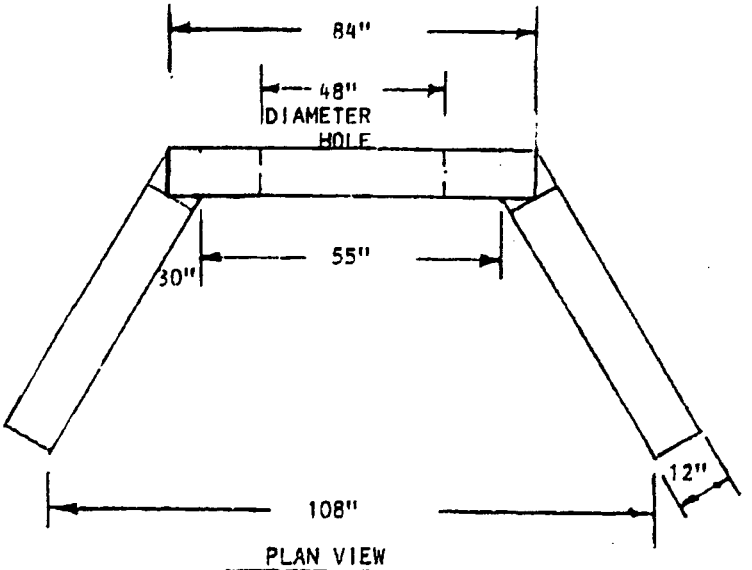
FIGURE 6. RATE OF FLOW FOR FLAT DROP INLETS WITH BICYCLE GRATES



SIDE VIEW



FRONT VIEW



PLAN VIEW

NOTES:

1. 4000 PSI CONCRETE AT 28 DAYS
2. 60 GRADE REINFORCING , 6 x 6 - W4 x W4 REINFORCING - BOTH WAYS-BOTH FACED

REQ'D 2 PCS.

DATE: 10/19/92

M&M CUSTOM CONCRETE, INC.
187 Stryker Road, Lopatcong Township
Phillipsburg, New Jersey 08865
Manufacturers of Precast Concrete Products

CUSTOMER: BET, INC.
WHITEHOUSE STATION, NJ

JOB: NEW WINDSOR LANDFILL

36" DIAMETER HDPE HW

92-1204-3

Appendix H.3

M E M O R A N D U M

Received 7/13/93

To : Tom Miller

From : Carl Dannenberger CRD

Date : July 14, 1993

Re : New Windsor Landfill Remedial Action
Items No. 20.1, 20.2 - Seeding (fertilizer and lime)

Below please find data pertaining to the fertilizer and limestone that CWM placed as part of the "seeding" of the landfill.

o Lime - Baker's Pelletized Dolomite Limestone

- $CaCo_3$ - 53.5%
- CaO - 30.0%
- $MgCO_3$ - 42.0%
- MgO - 20.0%
- Calcium Carbonate Equivalent - 103.5%
- Effective Neutralizing Power - 92.9%
- Effective Neutralizing Value - 95.0%
- Mg (elemental) - 12.1%
- Ca (elemental) - 21.4%

o Fertilizer - Prolawn Fertilizer

- Nitrogen (N) - 20.0%
- Phosphorus (P_2O_5) - 5.0%
- Potassium (K_2O) - 10.0%
- Controlled Release Nitrogen - 50.0%

If you have any questions, please contact me at (914) 567-3970 or (908) 938-7541.

CRD/cgm

CC: George Green (TNW)
Mike Mason (NYSDEC)
John Samuelian (EA)

Printed on recycled paper

Appendix H.4

September 21, 1992 Letter #NWL-020

Ms. Susan Erickson
Project Oversight Manager
EA Engineering, Science and Technology
The Maple Building
3 Washington Center
Newburgh, New York 12553

RE: New Windsor Landfill Remediation Action
New Windsor, New York 12553
CWM-RSE Project #67295

Dear Ms. Erickson:

In accordance with Specification Section 02230, B(3), CWM-RSE is submitting the name and location of the Borrow source, as well as a laboratory analysis of the material, for your review and approval.

Borrow Supplier:	REDI Materials, Inc. 661 Rt 9W Newburgh, New York 12553 (914) 794-6832 Attn. William Yuengling
Borrow Source:	Rt 17K Montgomery, New York 12549
Delivery:	Local 445 Teamsters
Testing Laboratory:	Advanced Testing Company, Inc. 7 Ruscitti Road New Windsor, New York 12553 Advanced Testing will be utilized for all required soil testing and field compaction testing.

Sincerely,

CWM-Remedial Services East, Inc.

CRD

Carl R. Dannenberger
Project Manager

cc. Town of New Windsor
J. Samuelian (EA)
T. Miller (EA)

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 4

To SUSAN E. cc: SAM	From T MILLER
Co. EA	Co. EA.
Dept. ENG.	Phone # 567-3909
Fax # 565-8203	Fax # 567-3906

A T C

Advance Testing Company, Inc.

7 Ruscitti Road • New Windsor, New York 12553-6298 • (914) 562-1616

September 17, 1992

Chemical Waste Management
Box 19A Silver Stream Road
New Windsor, NY 12553

PROJECT: New Windsor Landfill
ITEM: Borrow/General Fill
SPEC.: Section 02230

SUMMARY OF LABORATORY TEST RESULTS

SAMPLED: 09/14/92 BY CLIENT

TESTED: 09/15-16/92 BY D KENNEDY AND K PATTON

TEST PROCEDURE – RESULTS

		SPECIFICATION
AASHTO SOIL CLASSIFICATION = A-1-a		A-1,A-2,A-3
ATTERBURG LIMITS: LIQUID LIMIT	= 21	
PLASTIC LIMIT	= 18	
PLASTICITY INDEX	= 3	MAX. 5
% PASSING #200 MESH:	= 11.8%	MAX. 35%
MAX. DRY DENSITY: (AASHTO T99)	= >100 LB/FT^3	MIN. 100 PCF

DENSITY CURVE AND MAXIMUM DRY DENSITY REPORTS TO FOLLOW UPON COMPLETION.

VISUAL DESCRIPTION: BROWN SAND AND GRAVEL WITH SOME SILT; GRAVEL CONSISTS OF SUBANGULAR TO SUBROUNDED PARTICLES.

THE SUBMITTED MATERIAL IS ACCEPTABLE FOR BORROW AND GENERAL FILL HOWEVER THE AMOUNT OF MATERIAL GREATER THAN ONE INCH IN DIAMETER [illegible] LAYER DIRECTLY ABOVE AND BELOW THE

A T C

Advance Testing Company, Inc.

■ 7 Ruscitti Road • New Windsor, New York 12553-6298 • (914) 562-1616

GRADATION ANALYSIS

CLIENT:	CHEM WASTE MGMT	ATC Lab #:	92-558
PROJECT:	NEW WINDSOR LANDFILL	Sample #:	
SOURCE:	BORROW	Sample Type:	BORROW/FILL
Contractor:		Sample Location:	DEL BY CLIENT
WEATHER:	SUNNY 75	Specification:	AASHTO M145 A-1-a
Sampled:	09/14/92	Tested:	09/15/92
	BY CLIENT		BY DK

Lab# 92-558

SIEVE SIZE	% Retain	% Passing	SPEC Passing
	0.0	100.0	
2"	3.2	96.8	
1½"	8.4	88.4	
1"	7.3	81.1	
¾"	5.9	75.2	
½"	7.8	67.4	
⅜"	12.2	55.2	
#4	4.9	50.3	
#10	15.5	34.8	
#20	12.4	22.4	
#30	2.8	19.6	
#40	2.2	17.4	
#50	3.2	14.2	
#200	2.4	11.8	
PAN	11.8		

Comments:
*** 200 Sieve By Wash*

A T C

Advance Testing Company, Inc.

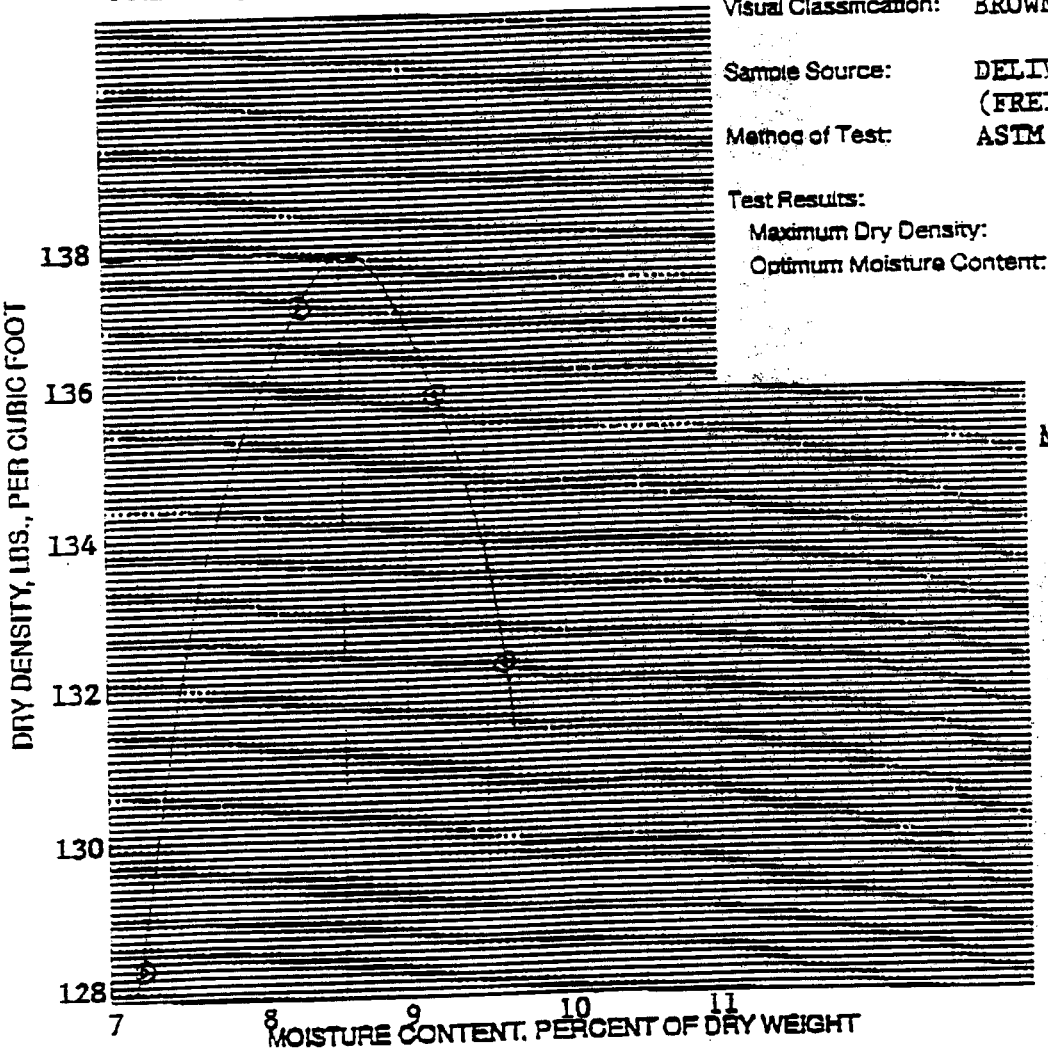
■ Ruscitti Road • Newburgh, New York 12550 • (914) 562-1616

REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL

TESTED FOR: CHEMICAL WASTE MANAGEMENT PROJECT: NEW WINDSOR LANDFILL

DATE: 09/17/92 OUR REPORT NO.:

SOIL ID# 1 LAB # 92-558



TEST DATA

Visual Classification: BROWN SAND AND GRAVEL SOME S

Sample Source: DELIVERED BY CLIENT (FREIGHTLINER SAND AND GRAVE

Method of Test: ASTM D698-AASHTO T99 METHOD

Test Results:

Maximum Dry Density: 137.9 lbs/ft³

Optimum Moisture Content: 8.6 %

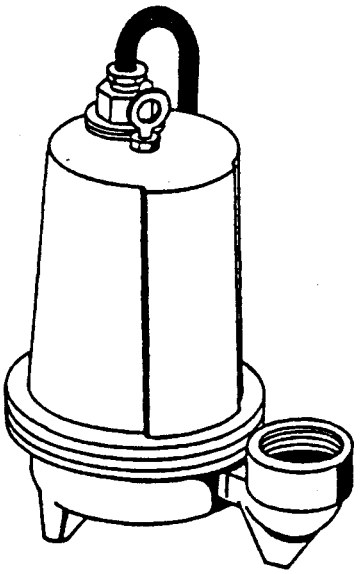
INDIVIDUAL TEST POINTS

MOISTURE CONTENT	DRY DE
7.2	128
8.3	137
9.2	136
9.6	132

Appendix H.5

SUBMERSIBLE WASTWATER PUMPS
3" Non-Clogs
1-1/2" Spherical Solids Handling

SECTION	4B
PAGE	9
ISSUED	7/9
SUPERSEDES	7/9



Series: 3SE ~~1.9, 2.8 &~~ 3.7H
3450 RPM

CRD 1/4/93

PUMP SPECIFICATIONS

DISCHARGE: 3" NPT, Vertical
LIQUID TEMPERATURE: 160° F Intermittent.
VOLUTE: Cast Iron, ASTM A-48 Class 30.
MOTOR HOUSING: Cast Iron ASTM A-48, Class 30.
SEAL PLATE: Cast Iron ASTM A-48 Class 30.
IMPELLER:
Design: 2 Vane, Open, With Pump Out Vanes On Back Side. Dynamically Balanced.
Material: Cast Iron ASTM A-48 Class 30.
SHAFT: 416 Stainless Steel
SQUARE RINGS: Buna-N
HARDWARE: 300 Series Stainless Steel
PAINT: Air Dry Enamel
SEAL: *Design:* Single Mechanical
Material: Rotating Faces - Carbon
Stationary Faces - Ceramic
Elastomer- Buna-N
Hardware -300 Series Stainless
CABLE ENTRY: ~~25 ft.~~ 30 FT. Cord Pressure Grommet for Sealing and Strain Relief.

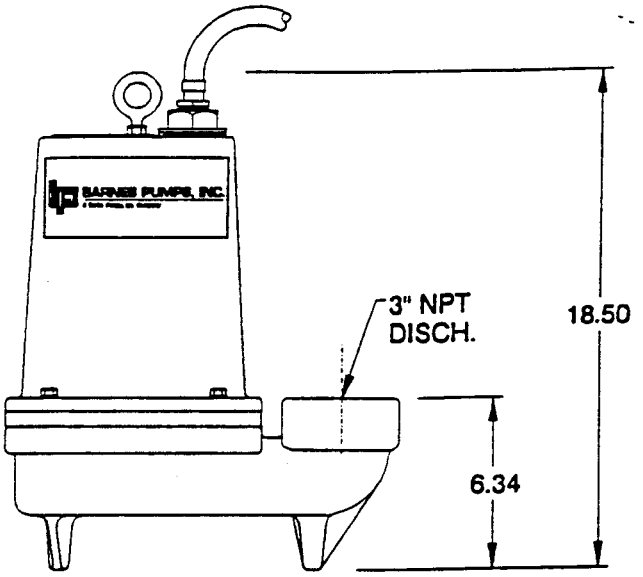
SPEED: 3450 RPM (Nom.)
UPPER BEARING:
Design: ~~Sleeve for 1.9 HP~~.
Single Row, Ball for 2.8 & 3.7 HP.
Lubrication: Oil
Load: Radial
LOWER BEARING:
Design: Single Row, Ball
Lubrication: Oil
Load: Radial & Thrust
MOTOR:
Design: NEMA B;Completely Oil-Filled, Squirrel Cage Induction
Insulation: ~~Class A for 1.9HP~~.
Class B for 2.8 & 3.7HP.
~~**SINGLE PHASE: Permanent Split Capacitor (PSC). Includes Overload Protection In Motor.**~~
THREE PHASE: Tri Voltage 200-230/460; Requires External Overload Protection.
OPTIONAL EQUIPMENT: ~~Seal Material~~, Impeller Trims, ~~N/C Temperature Sensor with cable for 3 phase pumps~~, Additional Cable.

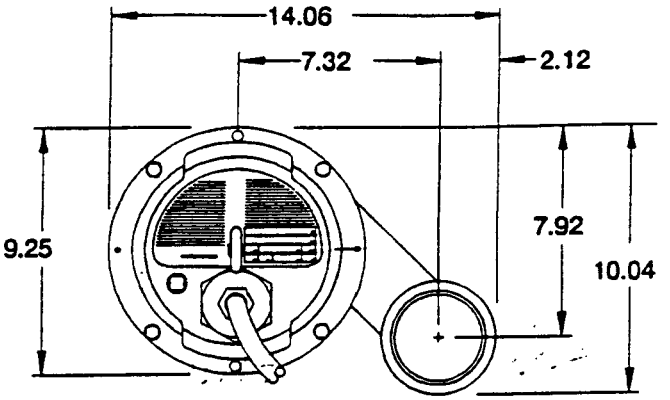
BARNES PUMPS, INC.
A Burks Pumps, Inc. Company
Distributor Sales & Service Dept.
420 Third Street/PO Box 603
Piqua, Ohio 45356-0603
Ph: (513) 773-2442
Fax: (513) 773-2239

Special Bids & Project Sales
1485 Lexington Ave.
Mansfield, ohio 44906-2674
Ph: (419) 774-1511
Fax: (419) 774-1520

PUMPING SERVICES, II
368 LINCOLN BLVD.
MIDDLESEX, N.J. 08846
(908) 469-4540

SECTION	4B
PAGE	10
ISSUED	7/92
SUPERSEDES	7/91





MODEL NO.	PART NO.	HP	VOLT	PH	RPM (Nom)	NEMA CODE	FULL LOAD AMPS	LOCKED ROTOR AMPS	CORD SIZE	CORD TYPE	CORD OD
3SE1922L	084468	1.9	230	1	3450	A	8.5	17.0	10/3	SO	0.690
3SE1962L	084482	1.9	200	3	3450	B	5.7	18.5	10/4	SO	0.750
3SE1932L	084491	1.9	230	3	3450	D	5.0	21.3	10/4	SO	0.750
3SE1942L	084488	1.9	460	3	3450	D	2.5	10.7	10/4	SO	0.750
3SE2822L	084484	2.8	230	1	3450	A	12.0	31.0	10/3	SO	0.690
3SE2862L	084480	2.8	200	3	3450	C	9.8	31.3	10/4	SO	0.750
3SE2832L	084486	2.8	230	3	3450	F	8.6	36.0	10/4	SO	0.750
3SE2842L	084476	2.8	460	3	3450	F	4.3	18.0	10/4	SO	0.750
3SE3722L	084473	3.7	230	1	3450	A	13.5	31.0	10/3	SO	0.690
→ 3SE3732L	084474	3.7	230	3	3450	C	10.0	36.0	10/4	SO	0.750
3SE3762L	084479	3.7	200	3	3450	A	11.5	31.3	10/4	SO	0.750
3SE3742L	084475	3.7	460	3	3450	C	5.0	18.0	10/4	SO	0.750

(Optional Temperature sensor cable for 3 phase models is 14/2 SO, 0.530 OD.)

IMPORTANT !

1.) DO NOT USE THIS PUMP TO PUMP FLAMMABLE LIQUIDS.

2.) THIS PUMP IS NOT RECOMMENDED FOR USE IN LOCATIONS SPECIFIED AS HAZARDOUS.

3.) THIS PUMP IS NOT APPROVED FOR USE IN SWIMMING POOLS, RECREATIONAL WATER INSTALLATIONS,DECORATIVE FOUNTAINS OR ANY INSTALLATION WHERE HUMAN CONTACT WITH THE PUMPED FLUID IS COMMON WHILE THE PUMP IS RUNNING.

4.) PUMP CAN BE OPERATED DRY FOR EXTENDED PERIODS WITHOUT DAMAGE TO MOTOR AND/OR SEALS.

BARNES PUMPS, INC.

A Burke Pumps, Inc. Company

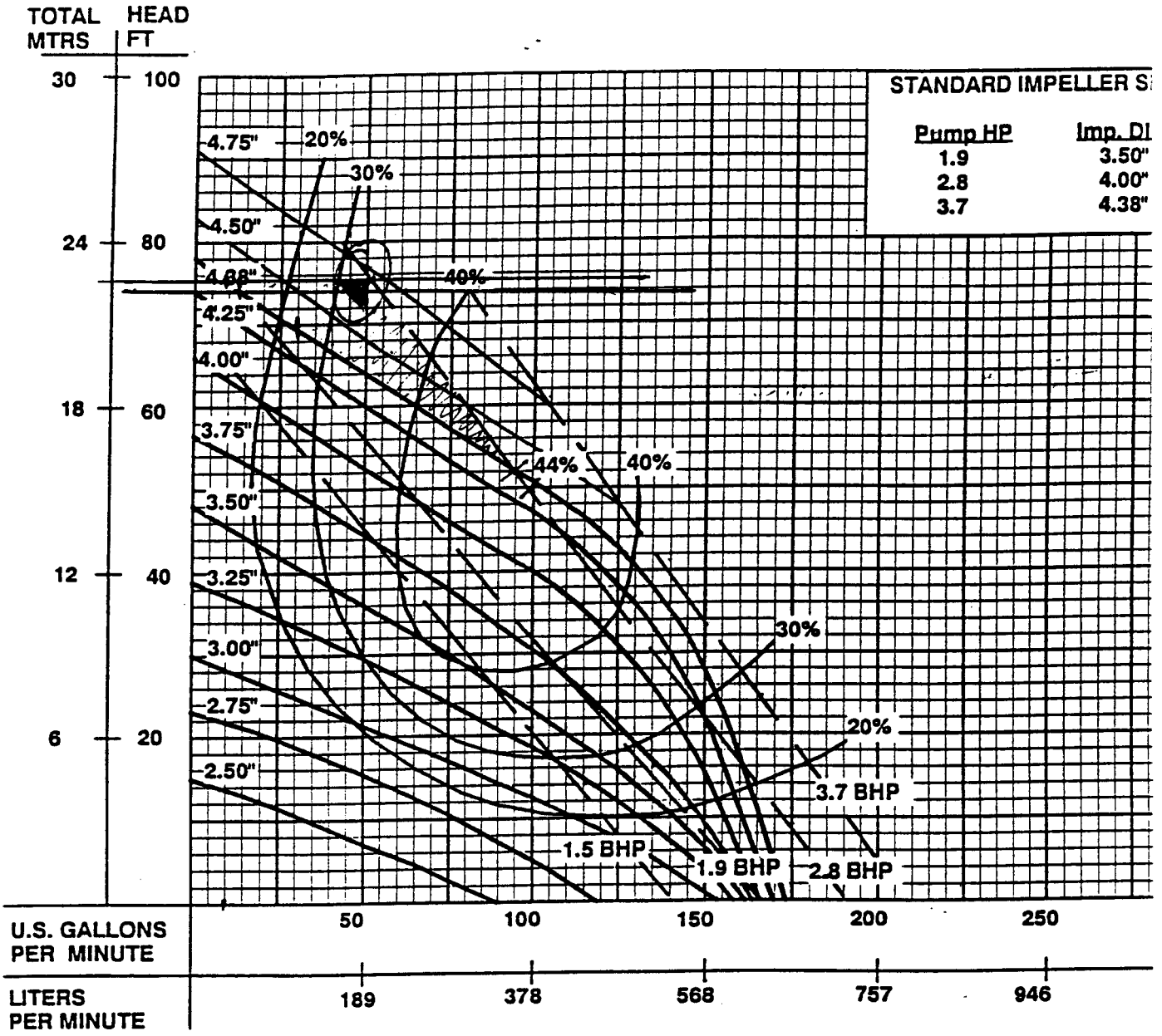
Distributor Sales & Service Dept.
420 Third Street/PO Box 603
Piqua, Ohio 45356-0603

Special Bids & Project Sales
1485 Lexington Ave.
Mansfield, ohio 44906-2674

MADE IN THE U.S.A.

PERFORMANCE CURVE
SERIES: 3SE ,1.9, 2.8, & 3.7 HP, 3450RPM

SECTION	4B
PAGE	11
ISSUED	7/92
SUPERSEDES	7/9(



Testing is performed with water, specific gravity of 1.0 @ 68° F, other fluids may vary performance.

DUTY POINT: 50 GPM @ 15 FT. T.D.H.

CAUTION: DO NOT OPERATE PUMP IF HEAD FALLS BELOW 60 FT

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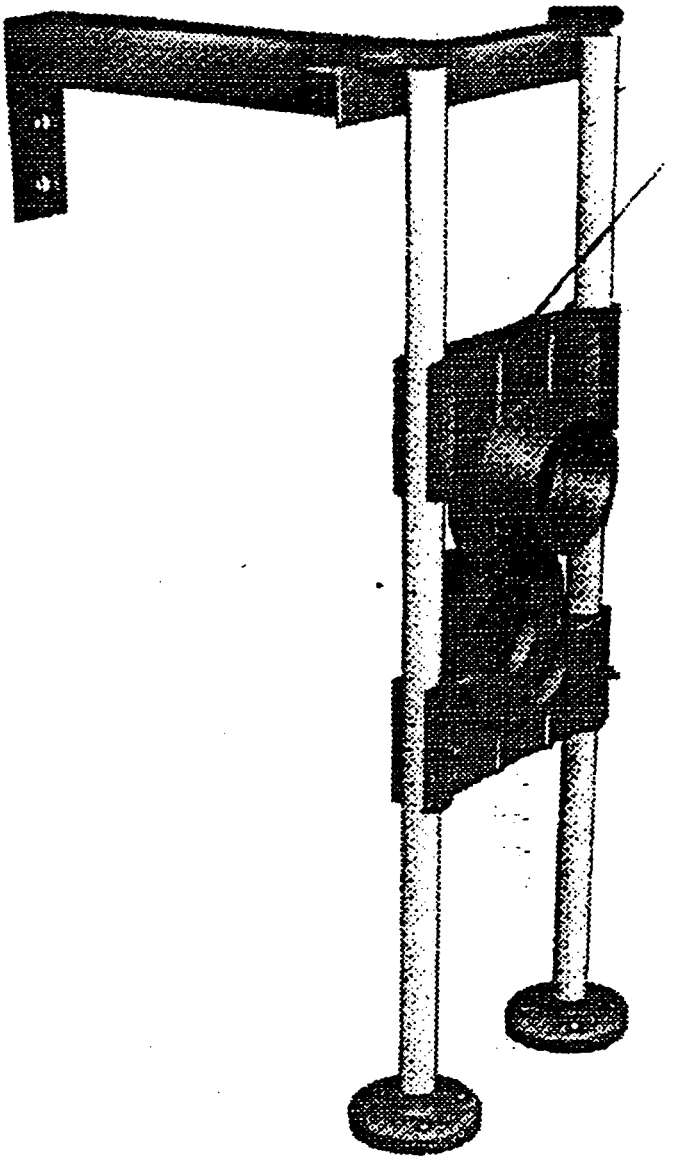
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MADE IN THE U.S.A.

SWPA MEMBER

BREAK AWAY FITTING
3"

SECTION	17
PAGE	46C
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SUPERSEDES	7/91



Model: BAF 3M
P/N: 077765

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

3/4" pipe, stainless steel, galvanized or schedule 80 PVC should be used for guide rails. PVC companion flanges are provided for mounting the guide rails to the sump floor. A guide rail bracket and stand-off bracket of steel are included to support the upper end of the guide rail pipes.

The stationary portion is made of injection molded schedule 80 PVC, and can be mounted to the guide rails by drilling and bolting, stainless steel hose clamps or solvent welding. A short length of stainless steel cable is attached to the removeable portion and is to be attached to the pump pull cable or chain to provide a balanced pull to the pump and disconnect.

The moveable portion is made of injection molded schedule 80 PVC and has a teflon coated O-Ring in it to provide a positive leakproof seal.

The coupling can be used with either horizontal or vertical discharge pumps. The sealing surfaces are self-cleaning with cleaning slots and mating pushers when re-engaging pump.

SPECIFICATIONS:

Overall Width:	9.0"
Overall Height:	8.25"
Overall Depth:	4.8"
Guide Rails- Center to Center	7.75"
Travel to Completely Disengage	6.0"
Shipping Weight:	10 lbs.

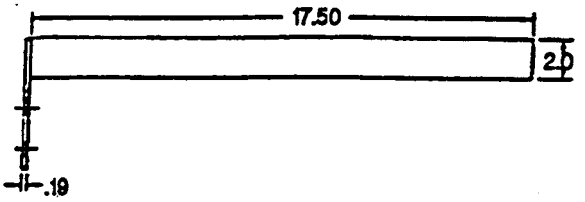
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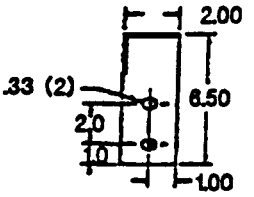
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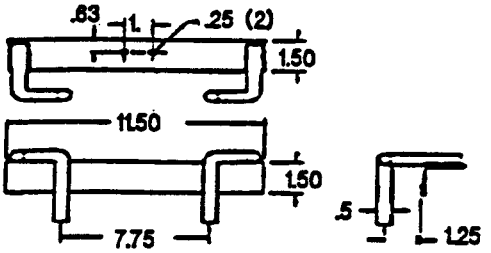
SECTION	17
PAGE	46D
ISSUED	7/92
SUPERSEDES	7/91

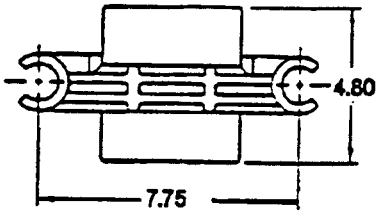
STAND-OFF BRACKET



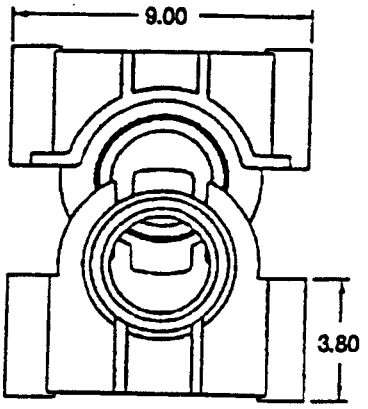


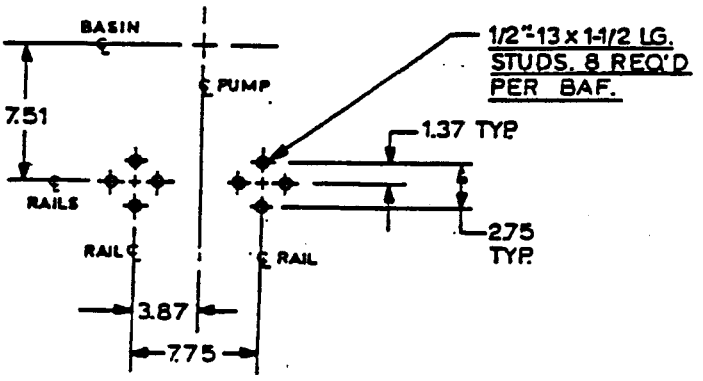
UPPER GUIDE RAIL BRACKET





SOCKET DEPTH - 1.9





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Fax: (513) 773-2238

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1485 Lexington Ave.
Mansfield, Ohio 44907
Ph: (419) 774-1511
Fax: (419) 774-1530

MADE IN THE U.S.A.

MV CONTROLS, INC.
Manufacturers Representative
111 Canfield Avenue • Randolph, NJ 07869-3007 • (201) 927-9090 • Fax (201) 927-1414

December 28, 1992

PO #: J912

BILL OF MATERIALS

QTY.	DESCRIPTION
1	Fischer & Porter Model # 10DX3111AAD12P1A2BA11321, 2" series 3000 magnetic flowmeter with polyurethane liner, 316 SST electrodes and 150 lb. carbon steel flanges.
1	Fischer & Porter Model # 50XM13BXAD10AAAC229 microprocessor based signal converter.

Flow: 50 GPM of water at 35 PSIG, ambient temperature.

PUMPING SERVICES, INC.
368 LINCOLN BLVD.
MIDDLESEX, N.J. 08846
(908) 469-4540
SALES SERVICE RENTA

FISCHER & PORTER

MAGNETIC FLOWMETERS
Series 10DX3111

Series 3000 Magnetic Flowmeter MAG-X ®

The Fischer and Porter Series 10DX3000 Magnetic Flowmeter is a pulsed DC type volumetric liquid flow rate detector. It utilizes, as the process transducing method, the characteristics of a conductive liquid to generate an induced voltage when flowing through a magnetic field. The amplitude of the voltage thus produced is directly proportional to the flowrate of the metered liquid. A characterized non-uniform magnetic field design significantly reduces sensitivity to flow profile effects as compared with magnetic flowmeters having uniform fields.

The meter's magnet coils are powered by a magnet driver unit. This method of magnet coil drive, as utilized in the Series 10DX3111, provides total zero stability. The flowmeter is designed to work with any of the Series 3000 converters: 50XO1000 or the 50XM1000. This version is available with remote converter mounting only. For an integral mounted converter, see the 10DX3211 and the 10DX3311 specification sheets.

Design Features

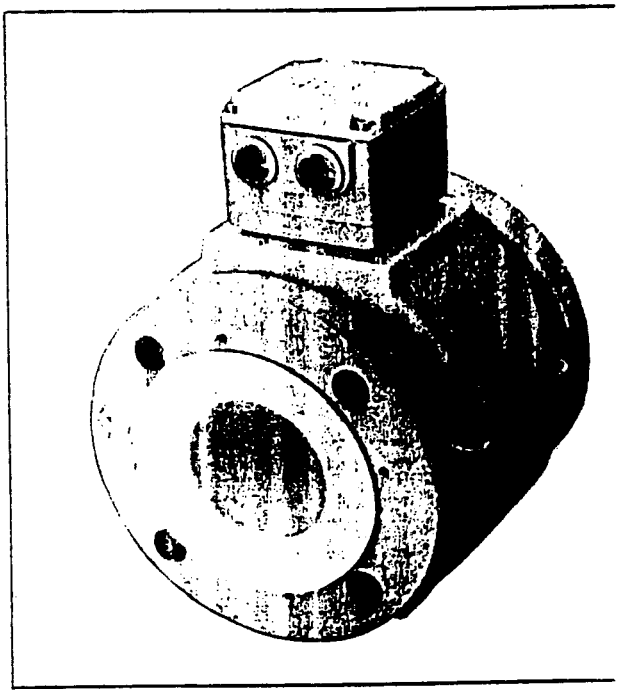
- The magnetic flowmeter is linear and accurate. The measurement is insensitive to flow profile due to the use of a characterized non-homogeneous magnetic field.

- The lay length of this meter is the shortest ever offered for a Fischer & Porter flanged magnetic flowmeter. Meter tubes of different lengths are available to match our older meters as well as competitive meters.

- This magnetic flowmeter does not violate the 1.5 length to diameter ratio required for good accuracy.

- The typical flow rate measurement is independent of viscosity, density, and temperature.

- The magnetic flowmeter is obstructionless. There is no additional pressure loss when the meter tube and pipe are the same diameter.



Engineering Specifications

Minimum Liquid Conductivity: 5uS/cm.

Pressure Limits: All liners
@ 40°C (100° F) 5.10 MPa (720 psi.)

Vacuum Limits:
Full Vacuum: for TEFLON® PTFE1/2" to 4", Neoprene, and Polyurethane liners.
For TEFLON® PTFE 6" to 10"
3.9 psia @ 20°C (68°F)
6.7 psia @ 130°C (266°F)

Temperature Limits:
Process: 180°C (356°F) for TEFLON® PTFE
88°C (190°F) for Neoprene & Polyurethane.
Ambient: -25°C (-13°F) to 60°C (140°F)for all lir
Cleaning: for TEFLON® PTFE only
Steam@ 150°C (302°F) for 60 min. max.
Liquid@ 140°C (284°F) for 60 min. max.

Accuracy: for system accuracy information, se specification sheet of Series 3000 signal conve

Enclosure Classification:
Standard: NEMA 4X
Optional: Accidential submergence in water up meters (30 feet) for up to 48 hours.

Certification: Pending: Nonincendive for Cl. I, Div. 2, Gr. A, B, C, & D. Electrodes intrinsically safe for Cl I, Div. 1, Gr. A, B, C, & D. Dust-Ignitionproof Cl. II, Div. 1, Gr. E, F, & G. Suitable for Cl. III, Div. 1 Outdoor Hazardous Locations, NEMA 4.

Connections:
Process Piping: ANSI Class 150 or 300
Electrical Connection: 1/2" NPT

Vibration Immunity: 1.5G @ 10 - 150 Hz.

Radio Frequency Interference (RFI): Equivalent to SAMA Class 2 - abc - 0.1% (10V/m - 20 to 1000 MHz).

CAPACITY TABLE

Size		Meter Capacity	Minimum Range		Maximum Range	
mm	in	gpm	gpm	L/min	gpm	L/min
15	1/2	26.41	2.65	10	26.4	100
25	1	52.83	5.29	20	52.8	200
40	1.5	158.5	15.9	60	158	600
			gpm	m3/h	gpm	m3/h
50	2	264.1	26.5	6	264	60
80	3	792.5	79.3	18	792	180
100	4	1056	106	24	1056	240
150	6	2641	265	60	2641	600
200	8	4755	476	108	4755	1080
250	10	7925	793	180	7925	1800

* Meter Capacity=Volumetric flowrate @ 32.81ft/sec.

Materials of Construction

Meter spool: 304 Stainless Steel

Liners:
TEFLON® PTFE: Available in sizes 1/2" to 10"
Neoprene: Available in sizes 2" to 10" Polyurethane: Available in sizes 2" to 10"

Electrode Material: 316 SST, Hastelloy® B, Hastelloy® C, Titanium, Tantalum, Platinum/Iridium, Zirconium.

Housing & Connection Box: Cast Aluminum

Hastelloy® is a registered trademark of Haynes International, Inc.

Equipment Description

The magnetic flowmeter shall be of the low frequency electromagnetic induction type and shall produce a DC pulse signal directly proportional and linear to the liquid flowrate. The meter shall be designed for operation on 120 Vac ±10% 60 Hz ±5% with a power consumption of less than 30VA. The magnetic flowmeter shall be Fischer & Porter series D10DX3111. Complete zero stability shall be an inherent characteristic of the meter system. There shall be no need for on-site zero adjustments.

The metering tube shall be stainless steel. The metering tube and magnet coils shall be housed within a cast aluminum housing. The meter body shall be of the flanged design suitable for mounting between either ANSI Class 150 or ANSI Class 300 flanges. The liner shall be TEFLON® PTFE, Neoprene or Polyurethane depending on the application. The electrode shall be solid 316 sst, zirconium, tantalum, Hastelloy® C, or platinum-iridium, depending on application..

The meter shall be hydraulically calibrated in a facility traceable to the National Institute of Standards and Technology. The accuracy of the magmeter system shall be ±1% or 1/2% of rate, depending on the signal converter used.

The meter housing shall be NEMA 4X as standard with an option for accidental submergence in up to 30 feet of water for up to 48 hours.

Weight Table

Size		ANSI Cl 150		ANSI Cl 300	
mm	in	lb	kg	lb	kg
15	1/2	24	11	34	15
25	1	25	12	36	16
40	1.5	32	15	43	20
50	2	32	15	43	20
80	3	43	20	53	24
100	4	45	21	59	27
150	6	105	47	140	64
200	8	155	70	210	95
250	10	220	100	295	134

TEFLON® is a registered trademark of the E. I. du Pont de Nemoures & Co. (Inc.)
MAG-X® is a registered trademark of Fischer & Porter Co.

Model Number Designation for the D10DX3111

Model Number D10DX3111 A A D 12 P 1 A 2 B A J 1 3 2 1

Design Level (A)

Meter Lay Length

Standard	(A)
10D1419 & 10D1465	E
10D1430 & 10D1435	F
Other	Z

Liner

Polyurethane	(D)
TEFLON® PTFE	E
Neoprene	L

Size

15 mm*	(1/2")	07
25 mm*	(1")	09
40 mm*	(1-1/2")	11
50 mm	(2")	(12)
80 mm	(3")	14
100 mm	(4")	15
150 mm	(6")	17
200 mm	(8")	18
250 mm	(10")	19

Flange Pressure Rating

ANSI 150	(P)
ANSI 300	Q

Flange Material

Carbon Steel	(1)
304 Stainless Steel	2

Protector Plate

None Required	(A)
316 Stainless Steel	B
Hastelloy® C	E

Electrode Design

Flush	(2)
Bullet Nose	3
Slurry Service (Liner options D & L only)	7

Electrode Material

316 Stainless Steel	(B)
Hastelloy® B	C
Hastelloy® C	D
Titanium	E
Tantalum*	F
Platinum - Iridium*	H
Zirconium	L

Certification - None (A)

Enclosure Classification

NEMA 4X	(1)
Accidential Submergence	2

Process Temperature Range

TEFLON® PTFE < 130°C (266°F)	(1)
TEFLON® PTFE < 180°C (356°F)	2
Neoprene or Polyurethane < 88°C (190°F)	4

Line/Excitation Frequency

60 Hz. / 7-1/2 Hz	(3)
60 Hz. / 15 Hz	4

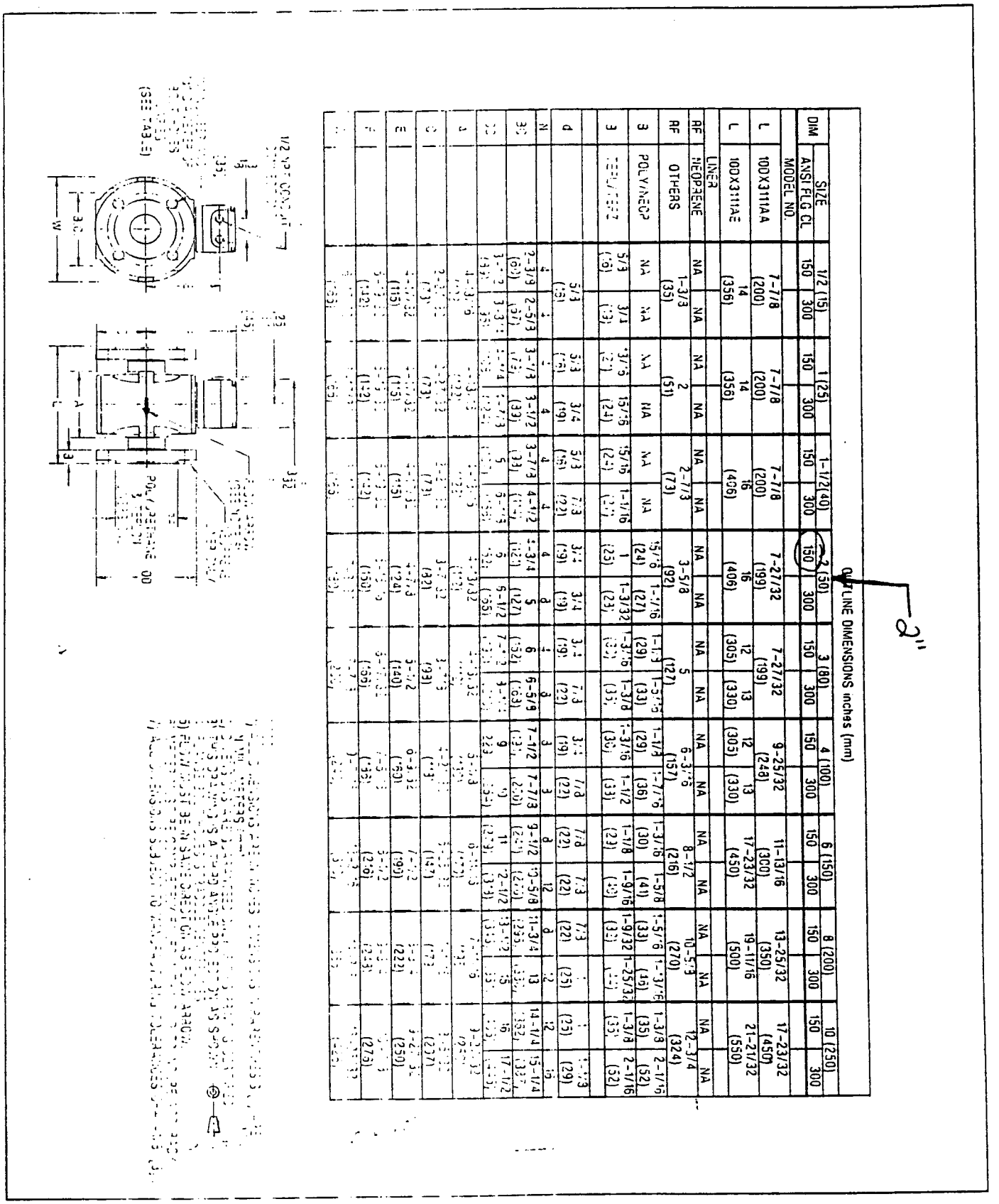
Customer Information Language - English (2)

Remote Converter Type

50XM1000	(1)
50XO1000	2
Not specified.	X

* TEFLON® PTFE liner is required.

Figure 1. Outline Dimensions of Remote Mounted Signal Converter



DIM	SIZE	1/2 (15)		1 (25)		1-1/2 (40)		2 (50)		3 (80)		4 (100)		6 (150)		8 (200)		10 (250)	
	ANSI FLG CL	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300	150	300
	MODEL NO.																		
L	10DX3111AA	7-7/8 (200)		7-7/8 (200)		7-7/8 (200)		7-27/32 (199)		7-27/32 (199)		9-25/32 (248)		11-13/16 (300)		13-25/32 (350)		17-23/32 (450)	
L	10DX3111AE	14 (356)		14 (356)		16 (406)		16 (406)		12 (305)	13 (330)	12 (305)	13 (330)	17-23/32 (450)		19-11/16 (500)		21-21/32 (550)	
	LINER																		
RF	NEOPRENE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RF	OTHERS	1-3/3 (35)		2 (51)		2-7/3 (73)		3-5/8 (92)		5 (127)		6-3/16 (157)		8-1/2 (216)		10-5/8 (270)		12-3/4 (324)	
B	POLYNEOP	NA	NA	NA	NA	NA	NA	1-5/16 (24)	1-5/16 (27)	1-5/16 (29)	1-5/16 (33)	1-7/16 (29)	1-7/16 (36)	1-3/8 (30)	1-5/8 (41)	1-5/8 (33)	1-5/8 (46)	1-3/8 (35)	2-1/16 (52)
B	[illegible]	5/3 (8)	3/4 (13)	15/16 (24)	1-1/16 (27)	1-1/16 (27)	1-1/16 (27)	1 (25)	1-1/32 (27)	1-3/16 (30)	1-3/8 (35)	1-3/16 (30)	1-1/2 (38)	1-1/8 (28)	1-9/16 (40)	1-9/32 (33)	1-25/32 (45)	1-3/8 (35)	2-1/16 (52)
d		5/3 (8)	3/4 (19)	3/4 (19)	1 (25)	1-1/16 (27)	1-1/16 (27)	1-1/16 (27)	1-1/32 (27)	1-3/16 (30)	1-3/8 (35)	1-3/16 (30)	1-1/2 (38)	1-1/8 (28)	1-9/16 (40)	1-9/32 (33)	1-25/32 (45)	1-3/8 (35)	2-1/16 (52)
N		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3[illegible]		2-3/8 (60)	2-5/3 (67)	3-1/3 (83)	3-1/2 (89)	3-7/3 (93)	4-1/2 (114)	5 (127)	5 (127)	6 (152)	6-5/8 (168)	7-1/2 (191)	7-7/3 (200)	9-1/2 (241)	10-5/8 (270)	11-3/4 (298)	13 (330)	14-1/4 (362)	15-1/4 (387)
3		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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Note: Specifications are subject to change without notice
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FISCHER & PORTER CO
Warminster, Pennsylvania 1897
Phone: (215) 67

FISCHER & PORTER

MAGNETIC FLOWMETERS
Series 50XM1000

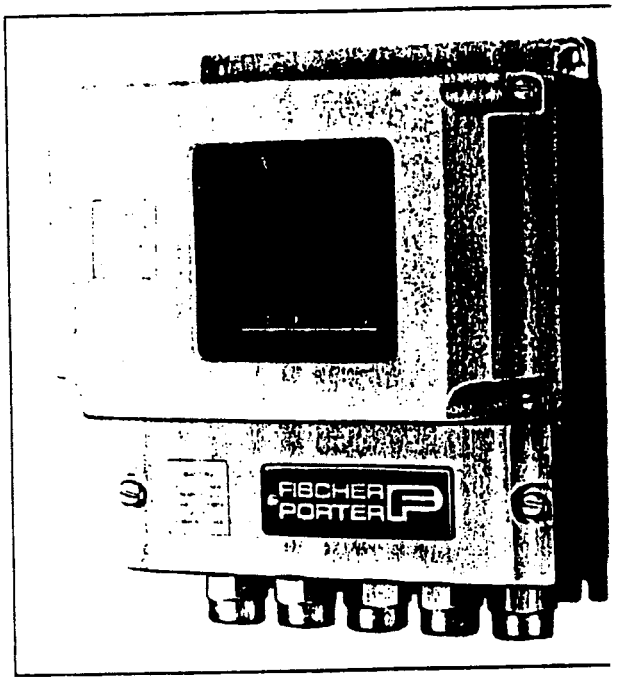
MICROPROCESSOR BASED SIGNAL CONVERTER

The Fischer and Porter Series 50XM1000 Magnetic Flowmeter Signal Converter is a MAG-X® (pulsed DC) type converter. It supplies pulsed DC current to the magnet coils of the magnetic flowmeter in order to establish the magnetic field. As a conductive liquid passes through this magnetic field, an electrical voltage is induced in the liquid which is directly proportional to its velocity. This induced voltage is sensed by the electrodes and sent to the converter which digitally manipulates and transforms these signals into analog and digital output signals.

The converter is a modular type design using state-of-the-art surface mounted technology resulting in increased reliability even under extreme operating conditions.

The converter can be mounted either integrally on top of the flowmeter or remotely on a pipe or wall. When the remote configuration is selected, 100 ft. of interconnecting cable is supplied. As an option, the converter can be mounted 350 ft. from the primary.

The remote converter is housed in a cast, three piece aluminum housing for field mounting which is designed to meet NEMA 4 standards.



Design Features

- **Back Lit LCD Display** - Indicates both rate and total on a 2 line x 16 character lighted liquid crystal display. This allows easy viewing of the display regardless of the installation location in the plant.
- **Compact Design** - Allows installation of the microprocessor based converter on top of the flowmeter or remotely with pipe or wall mounting. Integral mounting reduces conduit costs and simplifies installation.
- **High Accuracy** - Long-term accuracy of ≤0.5% of rate under reference conditions aided by microprocessor controlled, digital signal processing with automatic zero correction.
- **Self Diagnostics** - Internal tests are performed alarmed when failure conditions occur. The fail is indicated in plain English on the LCD displa saving troubleshooting time for maintenance personnel and therefore improving plant uptim
- **Remote Communications** - Via RS232C or RS two way communications with a smart termina or F & P Micro DCI™ system. This allows fast access to field instruments from a control roon a maintenance shop.
- **Noise Reduction Algorithm** - Complex mathm algorithm separates noise from signal to allow meters to be used on noise generating proce: This gives the stable zero benefits of a dc flowmeter with the noise rejecting and quick response benefits of an ac flowmeter.
- **Empty Pipe Detection** - This standard feature automatically drives both the analog and digi output signals to zero when the pipe empties
- **Self Test Mode** - Allows the converter to be as a 4-20 mA current generator by driving th outputs to any value between 0% and 100% check out any other device in the loop.

- **Memory Storage** - All data is stored in non-volatile memory for 10 years *without* battery backup.
- **Configuration** - Converter is online during configuration. Data is updated and output is current during parameter changes.

Engineering Specifications

Range - Configurable from 0.5 to 10 m/s (1.5 to 33.3 ft/s).

Rangeability - 100:1

Display - Back lighted liquid crystal display, 2 lines, each with 16 alphanumeric characters 5 × 7 dot matrix. Rate of flow in % or engineering units on top line with seven-digit cumulative total on bottom line.

Data Entry - Input of configuration data is by means of three push-buttons.

Language - Configuration data can be entered in English, Danish, Dutch, Finnish, French, German, Italian, Spanish, or Swedish.

Program Protection - Software and/or hardware protection to restrict unauthorized adjustments of configuration data.

Bi Directional Flow - Indication and totalization in both forward and reverse direction. Flow direction for analog output is indicated by contact closure. The active pulse output option provides an output for each flow direction.

Output Signal - Analog current 4-20 mA, 0-20 mA, 2-10 mA or 0-10 mA DC user defined into 0-750 ohm load.

Accuracy - At reference conditions
0.5% of rate from 2% to 100% of meter cal factor.
0.01% of cal factor from 0% to 2% of cal factor.
Effect of 10% supply voltage change 0.2% of rate
Effect of 10°C (18°F) temperature change 0.1% of rate +0.01% of range setting.

Optional System Accuracy - Valid for flow velocities of 3 to 33 feet per second. Velocities below 3 feet per second revert to standard system accuracies. Consult factory for details.

Power Supply - 24 V dc ± 30%
110/120/220/240 V ac +10%/-15%
50/60 Hz ± 6%. Standard power supply is 120 V ac, 50/60 Hz.

Pulse Output - All pulse widths for the outputs listed below are configurable from 0.032 ms to 2000 ms.
- active 24 V dc load of ≥ 150 ohms
- passive, via opto coupler: ≤25 V dc, 1 ≤7.5 mA.

Standard pulse output is active 24 V dc. When both pulse output and serial interface options are selected, the pulse must be passive.

Serial Interface - for remote communications.
- via RS232 @ 110 to 9600 Baud @ 50 ft.
- via RS485 @ 110 to 28.8 K Baud @ 4000 ft.
- Protocol: binary or ACSII.

Power Consumption: ≤ 30 VA

Damping - 1 to 100 sec configurable.

Low Flow Cut-Off - 0 to 10% configurable.

Response Time - 1 sec min. (Consult factory for faster response times.)

Minimum Liquid Conductivity - 5 uS/cm

Fail Safe Mode - Configurable by user to fail high (130%) or low (0%).

Zero Return - Provides constant zero output signal during conditions when false flow signals are possible. Activated by external non-powered contact.

Empty Pipe Detection - This feature automatically drives both the analog and digital output signals to zero when the electrodes become uncovered. This option is not available with primary Model 10D1477.

Remote totalizer reset - Resets both forward and reverse totalizer from a remote location. Zero return feature not available with this option. This option is not available with primary Model 10D1477.

Alarms - Output contact automatically announces failure of magmeter. Output current goes to 0% or 130% as configured.

Ambient Temperature: -10°C to +50°C (14°F to 122°F)

Enclosure Classification: NEMA 4

Vibration: ≤1.5 g, 10 to 150 Hz

Weight: 9.5 lbs.

Model Number Designation for the 50XM1000 Microprocessor Converter

Model Number 50XM1 3 B X A D 1 0 AA A C 2 2 9 1 1

Excitation Frequency
- 7.5 Hz — 3
- +15 Hz — 4
- +15 Hz (24 V dc pwr) — 8

Design Level — B

Software Level — X

Certification — A

Enclosure NEMA 4
- Standard, with window — D

Contact Outputs
- Optocoupler — 1

Output Options
- Without — 0
- # Active Scaled Pulse, Forward and Reverse — 1
- RS 485 — 4
- RS 232C — 5
- ** RS 485 & Pulse Output Opto Fwd — 6
- ** RS 232C & Pulse Output Opto Fwd — 7

Operational Mode
- Continuous Operation — AA

Additional Options
- ** Without (Includes Empty Pipe Detector) — A
- ## External Totalizer Reset — E
- + + Hart Protocol — G
- + +## Hart Protocol and External Totalizer Reset — J

Electrical Requirements
- 120 V ac, 60 Hz — C
- + + 24 V dc (Excitation Frequency must be 15 Hz Code 8) — H

Customer Language
- English — 2

Output Current
- 4-20 mA — 2

Primary Model Number
- 10D1465N ½" to 4" — 1
- 10D1465N 6" to 12" — 2
- 10D1465N 14" to 24" (Standard) — 3
- 10D1475N — 4
- 10D1476N — 5
- 10D1477N — 6
- No Primary Specified — 7
- 10D1465N 14" to 24" (With continuous submergence option) — 8
- SERIES 3000 (10D3111) — 9

Range Setting Mode
- CAL Factor @ 33.33 ft/s — A
- Range Set by Meter Size (Constant Meter Factor) — B

Flow Direction
- Uni-Directional — A
- * Bi-Directional — B

Communication Mode
- Not Available — 1
- ASCII — 2
- uDCI Binary — 3
- Hart Protocol — 4

Calibration Class 0.5% of Rate — 1

* Requires Product Manager Approval.

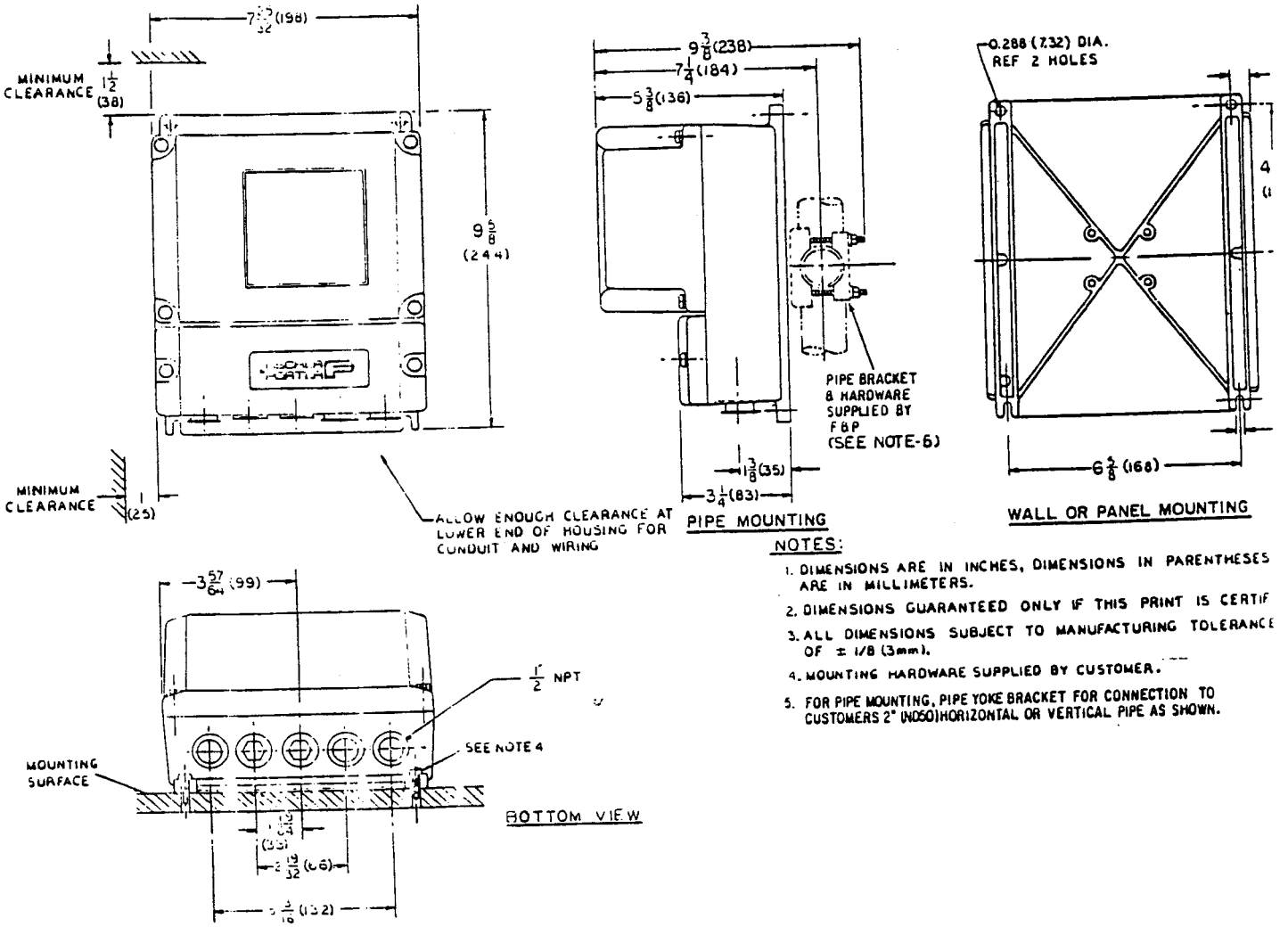
\# 4 kHz max configurable from 0.032 ms to 2000 ms.

+ + Not available with RS232C or RS485.

\+ Output Alarm not available with this option.

** Empty Pipe Detector must be turned off wh
used with Model 10D1477 or with ultrasoni

FISCHER & PORTER



NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.
2. DIMENSIONS GUARANTEED ONLY IF THIS PRINT IS CERTIF
3. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE OF ± 1/8 (3mm).
4. MOUNTING HARDWARE SUPPLIED BY CUSTOMER.
5. FOR PIPE MOUNTING, PIPE YOKE BRACKET FOR CONNECTION TO CUSTOMERS 2" (NOSO)HORIZONTAL OR VERTICAL PIPE AS SHOWN.

Figure 1. Outline Dimensions of Remote Mounted Signal Converter

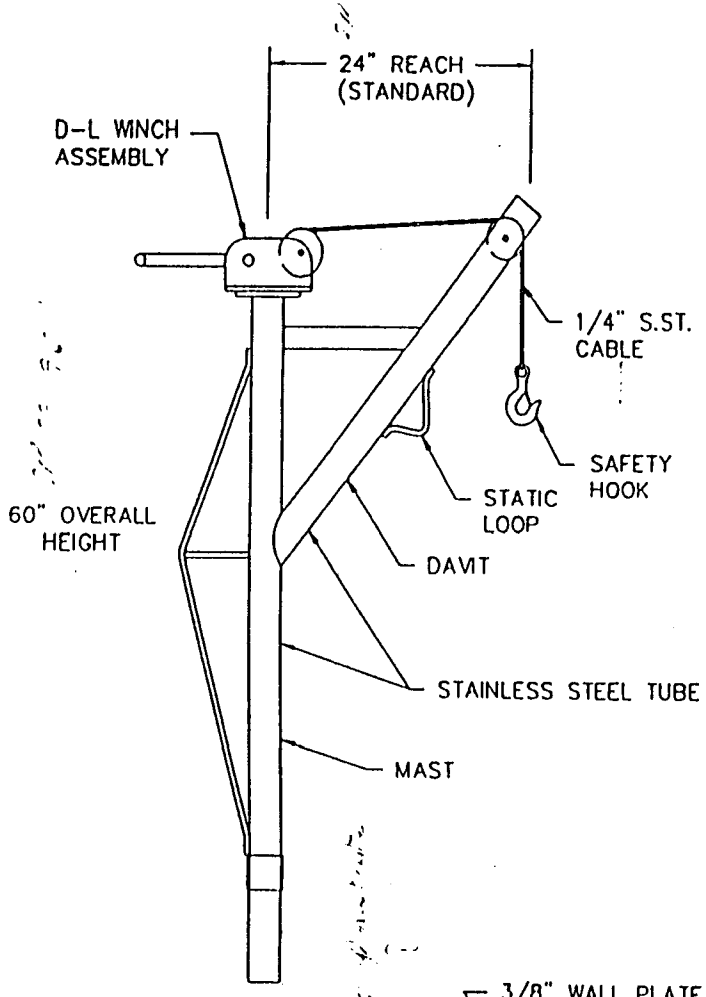
Note: Specifications are subject to change without notice.
Copyright 1991 Fischer & Porter Company
491 LA 7.5M 5

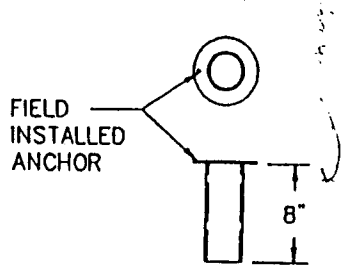
FISCHER & PORTER COMP
Warminster, Pennsylvania 1
Phone (215) 674-

STAINLESS STEEL PORTABLE HOIST

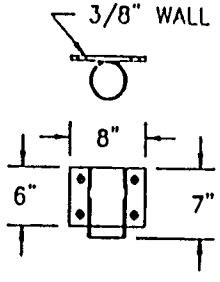
HALLIDAY PRODUCTS

SERIES D
(STAINLESS STEEL PORTABLE HOIST)

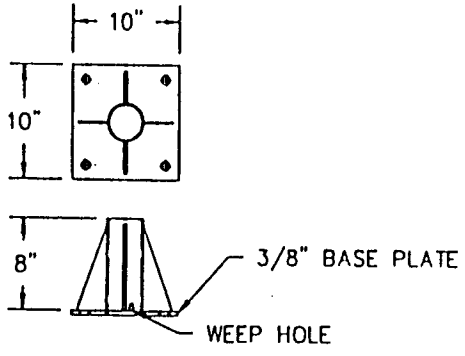




STAINLESS STEEL
EMBED SOCKET



ALTERNATE
WALL MOUNTED
STAINLESS STEEL
SOCKET
①



ALTERNATE
FLOOR MOUNTED
STAINLESS STEEL
SOCKET
①

STANDARD FEATURES:

- STAINLESS STEEL CONSTRUCTION
- STAINLESS STEEL EMBED SOCKET
- 30 FEET OF STAINLESS STEEL CABLE AND SAFETY HOOK
- DUTTON-LAINSON HAND WINCH

OPTIONS:

- H.P. T316 STAINLESS STEEL WINCH
- ELECTRIC WINCH
- ADDITIONAL CABLE AVAILABLE (SPECIFY LENGTH)
- FLOOR MOUNT OR WALL MOUNT SOCKET
- OTHER REACHES AVAILABLE ON REQUEST CONSULT FACTORY

NOTE:

① MOUNTING HOLES ARE 3/4"ø

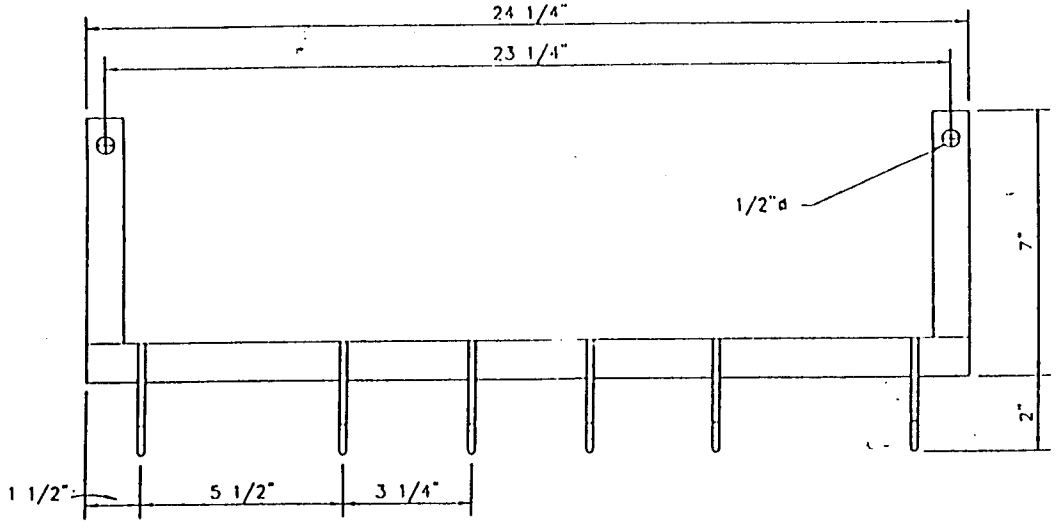
PUMPING SERVICES, INC.
368 LINCOLN BLVD.
MIDDLESEX, N.J. 08846
(908) 469-4540
SALES SERVICE RENTALS

MODEL NO.	MAST DIA.	LOAD (MAX.)
D1A24B	2 3/8"	500 LBS.

HALLIDAY PRODUCTS

PUMPING SERVICES, INC.
368 LINCOLN BLVD.
MIDDLESEX, N.J. 08846
(908) 469-4540
SALES SERVICE RENTALS

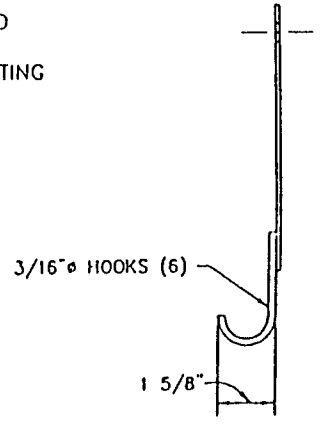
STAINLESS STEEL CABLE HOLDER



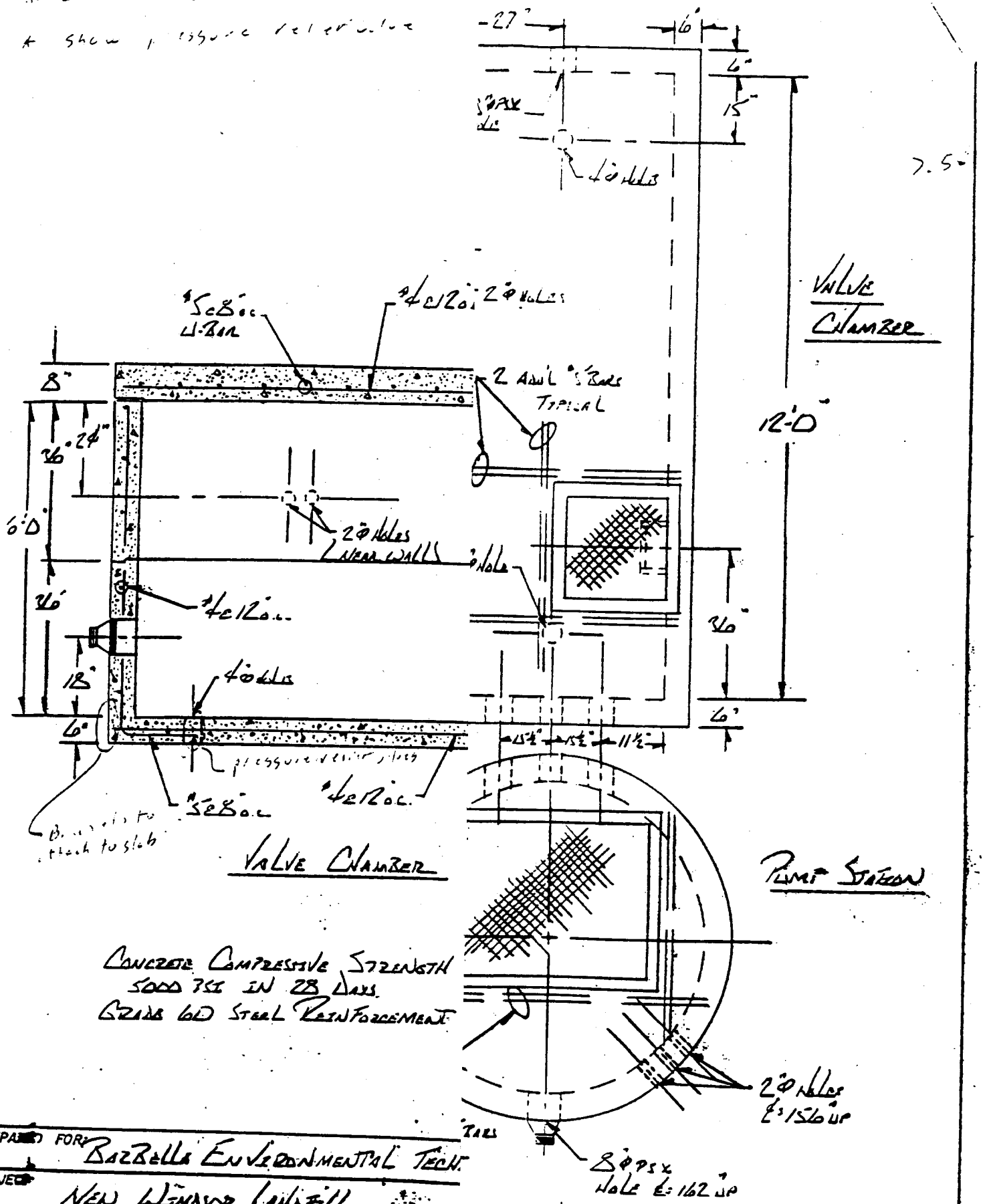
SERIES J
(STAINLESS STEEL CABLE HOLDER)

STANDARD FEATURES:

- STAINLESS STEEL, TYPE 304
- 6 HOOKS STANDARD
- USED FOR FLOAT SWITCHES AND LIFTING CABLES
- WALL OR ACCESS FRAME MOUNTING
- IN-STOCK PRODUCT



* CERTIFY AS BUILT
* SHOW PRESSURE RELIEF VALVE



PREPARED FOR: BATTELLE ENVIRONMENTAL TECH.

PROJECT: NEW WINDSOR LANDFILL

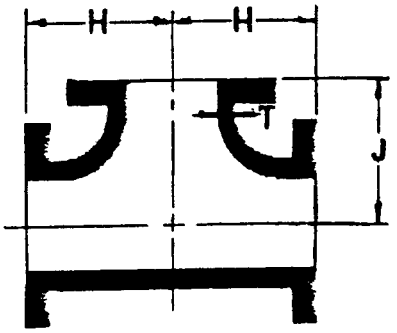
PRECAST PRODUCTS CORPORATION
EAST BRUNSWICK, NEW JERSEY

TITLE: Valve Chamber & Pump Station	DATE: 11-16-92	SO# 3621

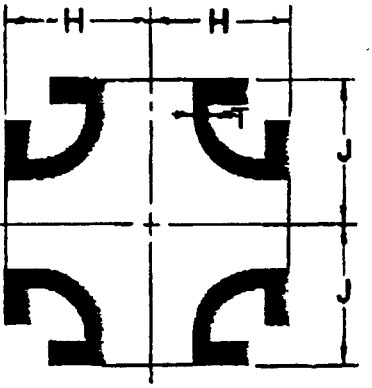
should be Ductile iron only

TEES & CROSSES

SERIES 20



SERIES 35

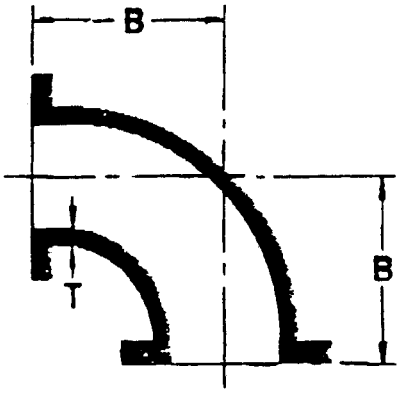


SIZE	H	J	T	PRESSURE RATING CLASS GREY CAST IRON	PRESSURE RATING CLASS DUCTILE IRON	WEIGHT TEE	WEIGHT CROSS
2 50	4.5 114	4.5 114	.31 7	250	250	29 13	30 13
3 80	5.5 140	5.5 140	.46 12	250	250	40 18	50 23
4 100	6.5 165	6.5 165	.52 13	250	250	55 25	80 36
5 130	7.5 190	7.5 190	.52 13	250	250	85 38	105 47
6 150	8.0 203	8.0 203	.55 14	250	250	95 43	120 54
8 200	9.0 228	9.0 229	.60 15	250	250	155 70	195 88
10 250	11.0 279	11.0 279	.80 20	250	250	270 122	330 150
12 300	12.0 305	12.0 305	.87 22	250	250	385 175	460 209
14 350	14.0 356	14.0 356	.86 17	150	250	435 197	530 240
16 400	15.0 381	15.0 381	.70 18	150	250	550 249	665 302
18 450	16.5 419	16.5 419	.75 19	150	250	665 302	795 361
20 500	18.0 457	18.0 457	.80 20	150	250	855 388	1015 460
24 600	22.0 559	22.0 559	.89 23	150	250	1330 603	1570 712
30 750	25.0 635	25.0 635	1.03 26	150	250	2150 975	2500 1134
36 900	28.0 711	28.0 711	1.15 29	150	250	3180 1433	3620 1642
42 1000	31.0 787	31.0 787	1.28 32	N/A	150	4470 2027	5065 2297
48 1200	34.0 864	34.0 864	1.42 36	N/A	150	6000 2676	6570 2980

Weights in pounds / kilograms.
Dimensions in inches / millimeters.
Metric conversions rounded off to nearest kilogram / millimeter.
Refer to flange details on page 5.

90° LONG RADIUS BEND

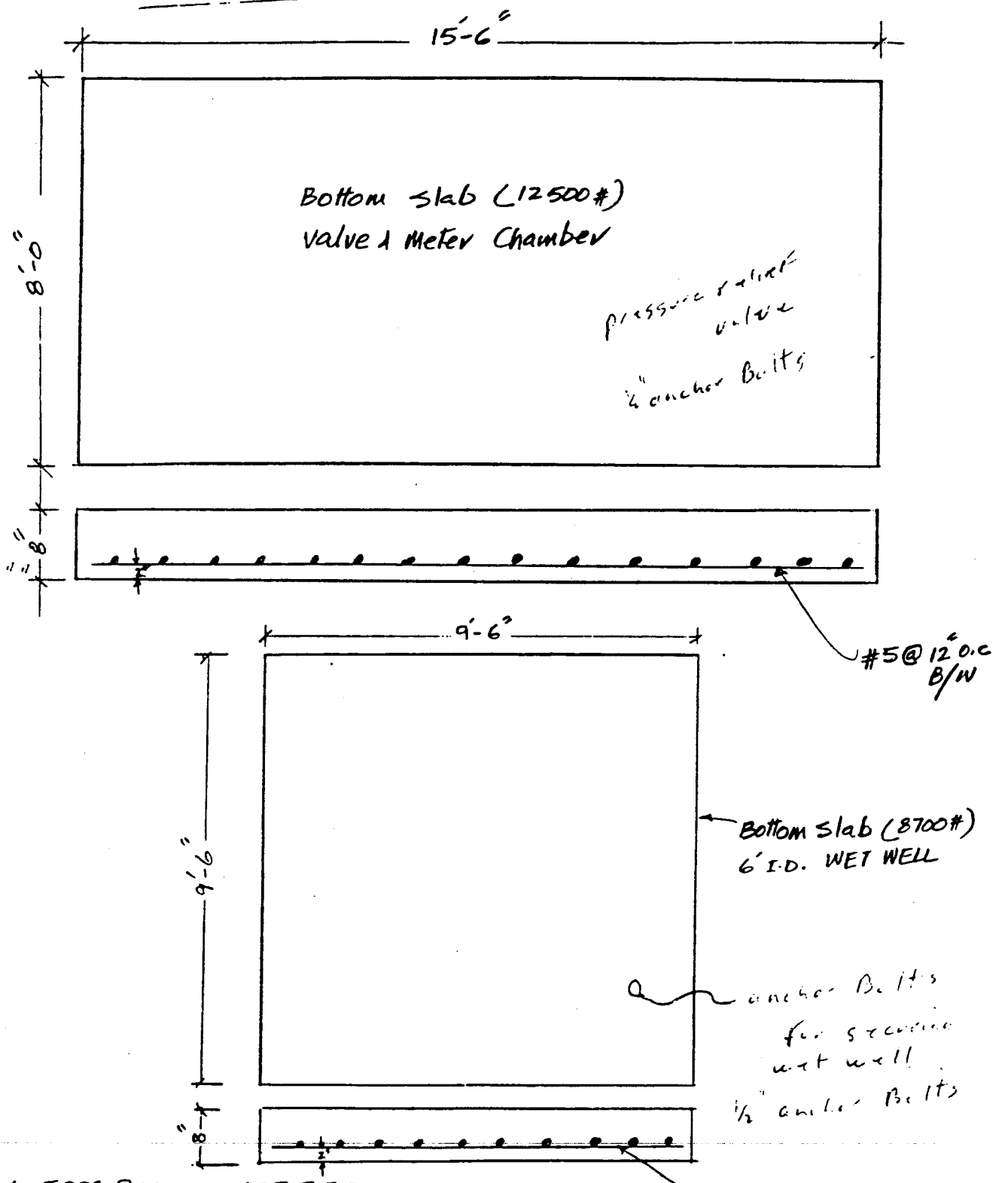
SERIES 15



SIZE	B	T	PRESSURE RATING CLASS GREY CAST IRON	DUCTILE IRON	WEIGHT
2 50	950 165	.81			
3 80	7.75 197	.48 12	250	250	30 14
4 100	9.00 229	.52			
5 130	10.25 260	.52 13	250	250	65 29
6 150	11.50 292	.56 14			
8 200	14.00 356	.60 15	250	250	140 63
10 250	16.50 419	.66 17			
12 300	19.00 483	.76 19	250	250	328 147
14 350	21.50 546	.86 22			
16 400	24.00 610	.70 18	150	250	505 229
18 450	26.50 673	.75 19			
20 500	29.00 737	.80 20	150	250	810 367
24 600	34.00 864	.88 23			
30 750	41.50 1054	1.03 26	150	250	2105 955
36 900	49.00 1245	1.16 29	150	250	
42 1000	56.50 1435	1.28 32	150	250	4865 2207
48 1200	64.00 1626	1.42 36	150	250	

Weights in pounds / kilograms.
Dimensions in inches / millimeters.
Metric conversions rounded off to nearest kilogram / millimeter.
Refer to flange details on page 5.

Should show
Bolts for connection
to chamber cast
in pl



1. 5000 PSI CONCRETE
2. Grade 60 REINFORCING

DATE: 11/16/92

M&M CUSTOM CONCRETE, INC.
181 Shylott Road, Lebanon Township
Phillipsburg, New Jersey 08865
Manufacturer of Precast Concrete Products

CUSTOMER: B.E.T., INC.

PROJECT: NEW WINDSOR LANDFILL

JOB #: 92-1204-1

JustSet Aluminum Access Doors
-PEDESTRIAN LOADING -6" EXTRUDED FRAME
-SINGLE LEAF CONSTRUCTION

SPECIFICATION: Access door shall be a light duty door as manufactured by Pennsylvanis Insert Corporation, Spring City, PA. Frame shall be 6" deep aluminum extrusion with integral anchor flanges, hinge, drain channel, and neoprene gasket. Hinge pin shall be stainless steel and run full length of door. Door leaf shall be 1/4" diamond plate built for a live load of 150 lbs./sq. ft. Access door shall be equipped with a stainless steel snap lock and removable key. All other hardware shall be brass or stainless steel. The access door shall be equipped with a flush mounted aluminum lifting handle and an easy lift hold open arm which locks the door in the 90 degree open position. Access door shall have a mill finish with bituminous coating on exterior of frame. Water shall drain through a 1 1/4" pipe.

STANDARD FEATURES:

- -EVERY JUST SET PRODUCT IS DESIGNED TO OPERATE TO THE CUSTOMER'S SATISFACTION AND TO PROVIDE LONG, TROUBLE-FREE SERVICE. SHOULD A PART FAIL TO FUNCTION IN NORMAL USE WITHIN A PERIOD OF FIVE YEARS FROM THE DATE OF PURCHASE, A NEW PART WILL BE FURNISHED AT NO CHARGE.
- -BITUMINOUS PAINT WHERE CONCRETE MEETS ALUMINUM
- -STAINLESS STEEL TORSION SPRINGS WHERE REQUIRED
- -WATERTIGHT CONSTRUCTION/DRAIN CHANNEL FRAME
- -STAINLESS STEEL SNAP LOCK
- -STAINLESS STEEL HARDWARE THROUGHOUT

OPTIONAL FEATURES:

- ☐ -SAFETY CHAINS AND POSTS
- ☐ -FIBERGLASS INSULATION WITH METAL LINER
- ☐ -STAINLESS STEEL HOLD OPEN ARM
- ☐ -CUSTOM SIZES
- ☐ -PENTAHEAD BOLT LOCK
- ☐ -PADLOCK HASP
- ☐ -RECESSED PADLOCK HASP

STANDARD DIMENSIONS		WEIGHTS
A	B	LIGHT DUTY
24"	24"	
30"	24"	
36"	24"	
42"	24"	
30"	30"	
36"	30"	
48"	30"	
36"	36"	
48"	36"	
42"	42"	
48"	48"	

x does not meet live load

11/09/92 15:58 ☎1 908 454 0512 N&M CUSTOM CONCR

JustSet Aluminum Access Doors

-PEDESTRIAN LOADING -6" EXTRUDED FRAME

DOUBLE LEAF CONSTRUCTION

SPECIFICATION: Access door shall be a standard duty door as manufactured by Pennsylvania Insert Corporation, Spring City, PA. Frame shall be 6" deep aluminum extrusion with integral anchor flanges, hinge, drain channel, and neoprene gasket. Hinge pin shall be stainless steel and run full length of door. Door leaf shall be 1/4" diamond plate built for a live load of 300 lbs./sq. ft. Access door shall be equipped with a stainless steel snap lock and removable key. All other hardware shall be brass or stainless steel. The access door shall be equipped with a flush mounted aluminum lifting handle and an easy lift hold open arm which locks the door in the 90 degree open position. Access door shall have a mill finish with bituminous coating on exterior of frame. Water shall drain through a 1 1/4" pipe.

STANDARD FEATURES:

- -EVERY JUST SET PRODUCT IS DESIGNED TO OPERATE TO THE CUSTOMER'S SATISFACTION AND TO PROVIDE LONG, TROUBLE-FREE SERVICE. SHOULD A PART FAIL TO FUNCTION IN NORMAL USE WITHIN A PERIOD OF FIVE YEARS FROM THE DATE OF PURCHASE, A NEW PART WILL BE FURNISHED AT NO CHARGE.
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- -STAINLESS STEEL TORSION SPRINGS WHERE REQUIRED
- -WATERTIGHT CONSTRUCTION/DRAIN CHANNEL FRAME
- -STAINLESS STEEL SNAP LOCK
- -STAINLESS STEEL HARDWARE THROUGHOUT

OPTIONAL FEATURES:

- ☐ -SAFETY CHAINS AND POSTS
- ☐ -FIBERGLASS INSULATION WITH METAL LINER
- ☐ -STAINLESS STEEL HOLD OPEN ARM
- ☐ -CUSTOM SIZES
- ☐ -PENTAHEAD BOLT LOCK
- ☐ -PADLOCK HASP
- ☐ -RECESSED PADLOCK HASP

STANDARD DIMENSIONS		WEIGHTS
A	B	STD. DUTY
36"	48"	
48"	48"	
48"	72"	
60"	60"	
72"	96"	

JustSet Aluminum Access Doors

-PEDESTRIAN LOADING -6" EXTRUDED FRAME

DOUBLE LEAF CONSTRUCTION

SPECIFICATION: Access door shall be a standard duty door as manufactured by Pennsylvania Insert Corporation, Spring City, PA. Frame shall be 6" deep aluminum extrusion with integral anchor flanges, hinge, drain channel, and neoprene gasket. Hinge pin shall be stainless steel and run full length of door. Door leaf shall be 1/4" diamond plate built for a live load of 300 lbs./sq. ft. Access door shall be equipped with a stainless steel snap lock and removable key. All other hardware shall be brass or stainless steel. The access door shall be equipped with a flush mounted aluminum lifting handle and an easy lift hold open arm which locks the door in the 90 degree open position. Access door shall have a mill finish with bituminous coating on exterior of frame. Water shall drain through a 1 1/4" pipe.

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-WATERTIGHT CONSTRUCTION/DRAIN CHANNEL FRAME
-STAINLESS STEEL SNAP LOCK
-STAINLESS STEEL HARDWARE THROUGHOUT

OPTIONAL FEATURES:

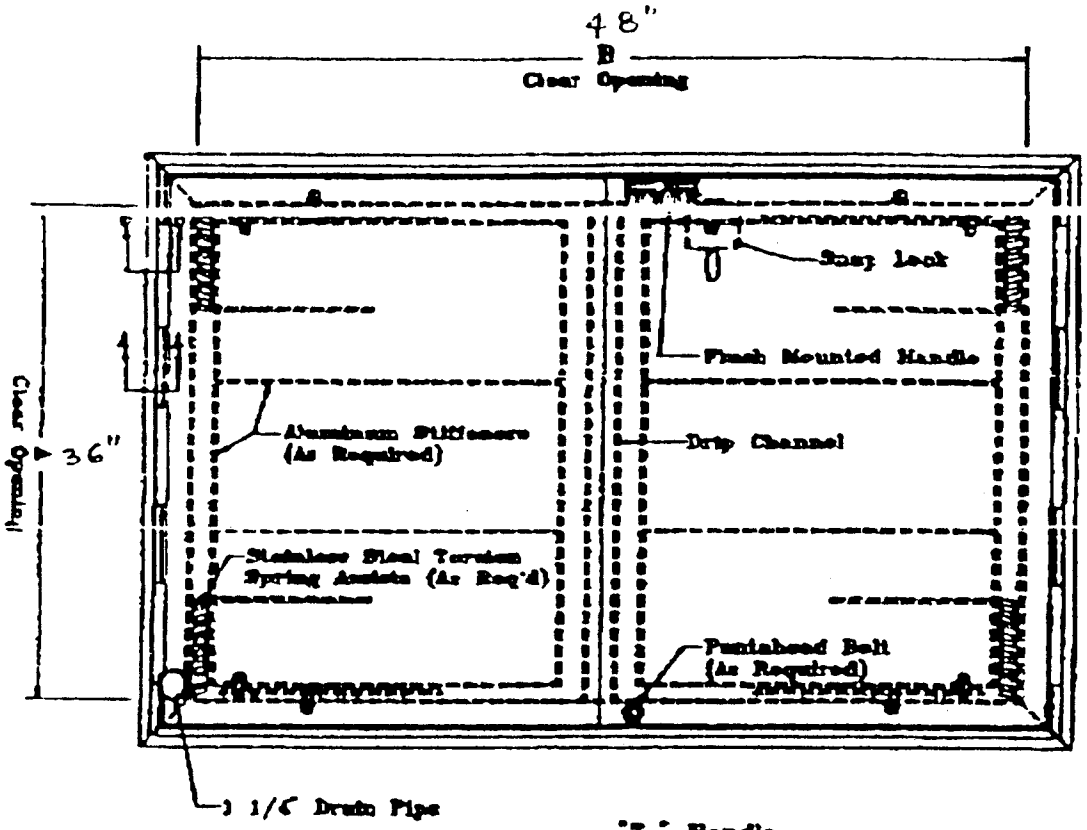
- ☐ -SAFETY CHAINS AND POSTS
- ☐ -FIBERGLASS INSULATION WITH METAL LINER
- ☐ -STAINLESS STEEL HOLD OPEN ARM
- ☐ -CUSTOM SIZES
- ☐ -PENTAHEAD BOLT LOCK
- ☐ -PADLOCK HASP
- ☐ -RECESSED PADLOCK HASP

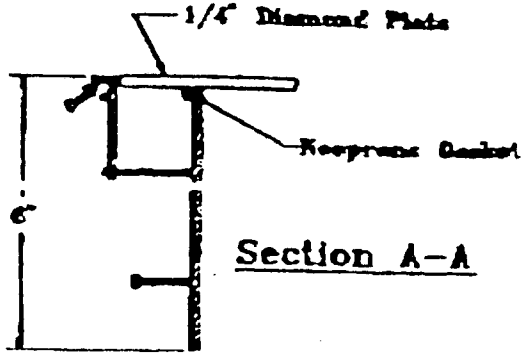
STANDARD DIMENSIONS		WEIGHTS
A	B	STD. DUTY
36"	48"	
48"	48"	
48"	72"	
60"	60"	
72"	96"	

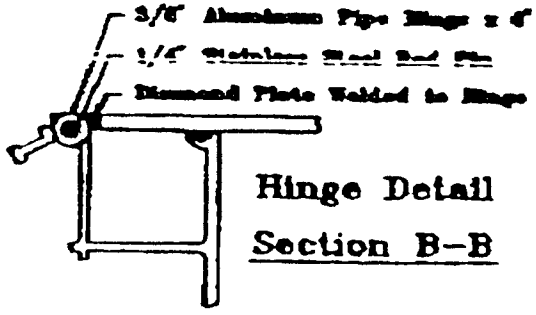
Customer

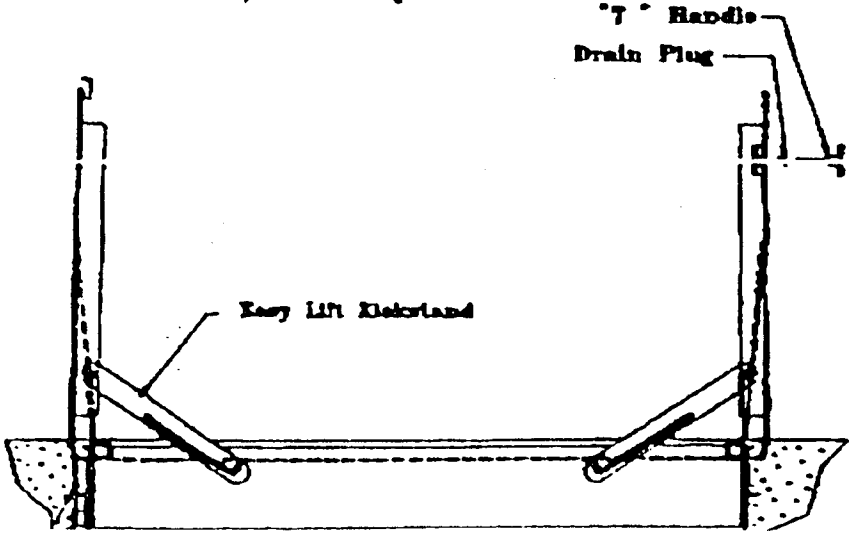
Project

Standard Duty
Aluminum Door
6" Frame
Double Leaf









-MATERIAL: MILL FINISH ALUMINUM WITH STAINLESS STEEL HINGE PIN AND SPRINGS; STAINLESS STEEL [illegible] LOCK

-LOADING: STANDARD DUTY (300 LBS./SQ. FT.)

-COATING: BITUMINOUS PAINT ON EXTERIOR OF FRAME.

-GASKETS: NEOPRENE GASKET FOR WATERTIGHTNESS

-FRAME: 6" EXTRUDED FRAME FOR EASY INSTALLATION.

KOR-N-SEAL® II

FLEXIBLE PIPE-TO-MANHOLE CONNECTOR

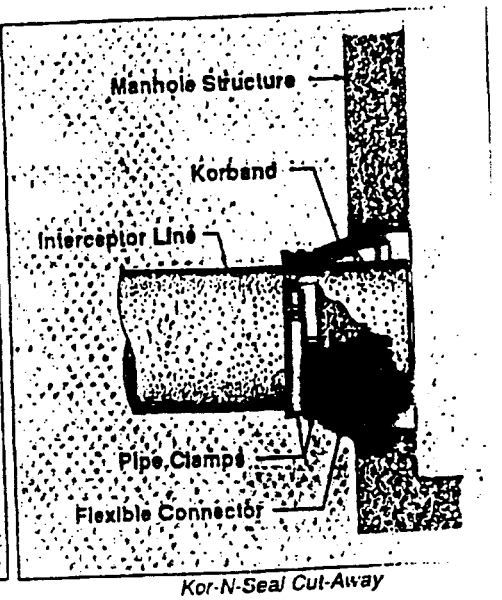
DATA SHEET



Korband Installation



Pipe Clamp Installation



Kor-N-Seal Cut-Away

The heavy-duty KOR-N-SEAL II Connector is ideally suited for large diameter pipe-to-manhole connections. It provides a flexible, watertight, environmentally safe joint that exceeds ASTM C923 specifications. A specially formulated EPDM rubber compound offers superior resistance to weather, ozone, oils, acids, alkalis, and animal and vegetable fats. Both the Korband and the Pipe Clamps are non-magnetic series 304 stainless steel to achieve maximum corrosion resistance.

Kor-N-Seal installation is simple and can be completed in minutes. A standard torque wrench is all that is required to tighten the Korband Wedge Expander. Detailed recommended installation procedures are included with every shipment.

ADVANTAGES OF KOR-N-SEAL:

- Ensures a positive, watertight seal.
- Can be installed in either a cored or formed hole.
- Installs easily in the plant or in the field.
- Accommodates both angular and lateral misalignment.
- Provides a flexible, vibration absorbing joint
- Allows for variations in pipe diameter tolerances.
- Allows for changes in pipe material.
- Can be easily replaced if necessary.
- Ensures trouble-free, efficient installations.
- Conforms to ASTM C923 specifications.
- Accommodates ground movement & prevents shear.

. . . for the Engineer

Kor-N-Seal eliminates the problems normally encountered when unforeseen, adverse field conditions necessitate a change. With Kor-N-Seal, the Engineer can easily make grade adjustments, location changes, and pipe size modifications to accommodate new requirements.

. . . for the Producer

From the standpoint of the Producer, the Kor-N-Seal system offers a way to substantially reduce time and cost factors involved in manufacturing a manhole. A diamond core drill is used to core holes into the manhole at specific locations shown on the engineering drawing. This technique allows the Producer to stock blank manhole sections. The completed unit, with holes positioned according to specifications and Kor N-Seal Connectors installed, can be ready for delivery within an hour after receiving an order.

. . . for the Contractor

The Kor-N-Seal system was developed to help the Contractor cope with wet trenches, extreme weather conditions, close tolerances, precise grade alignments, and immediate backfilling requirements. With Kor-N-Seal's flexibility, the Contractor can quickly adjust the lateral to the exact degree required to establish correct grade. Kor-N-Seal's simple, efficient installation procedures save the Contractor both man hours and equipment costs.

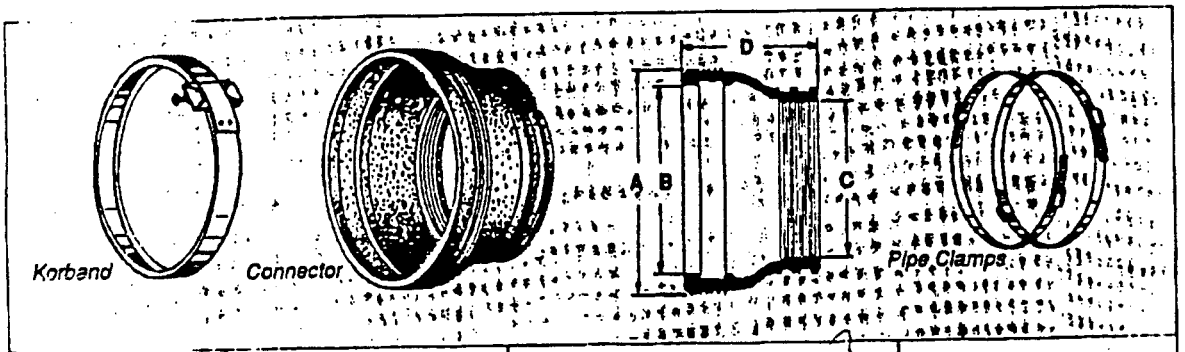
NPC INC.

250 Elm Street, P.O. Box 301, Milford, NH 03055, U.S.A. Fax: (603) 673-7271

KOR-N-SEAL

Form 2[illegible]

KOR-N-SEAL® II
DATA SHEET



Connector P/N	Suggested Pipe O.D. Range (In Inches)	Hole/Connector Dimensions (In Inches)				Pipe Clamp	
		A	B	C	D	QTY	P/N
S206-22 S206-22L	18.00 – 18.99 19.00 – 19.99	22	20.25	19 20	10.50	4	M-180
*S206-24A	18.00 – 19.50	24	22.25	18.75	12.00	4	M-180
S206-24 S206-24L	20.00 – 20.99 21.00 – 21.99	24	22.25	21 22	10.50	4	M-180
S206-26 S206-26L	22.00 – 22.99 23.00 – 23.99	26	24.25	23 24	10.50	2 2	M-180 M-240
S206-28 S206-28L	24.00 – 24.99 25.00 – 25.99	28	26.25	25 26	10.50	4	M-240
S206-30 S206-30L	26.00 – 26.99 27.00 – 27.99	30	28.25	27 28	10.50	4	M-240
S206-32 S206-32L	28.00 – 28.99 29.00 – 29.99	32	30.25	29 30	10.50	2 2	M-180 M-304
S206-34 S206-34L	30.00 – 30.99 31.00 – 31.99	34	32.25	31 32	10.50	2 2	M-240 M-304
S206-36 S206-36L	32.00 – 32.99 33.00 – 33.99	36	34.25	33 34	10.50	4	M-304
S206-38 S206-38L	34.00 – 34.99 35.00 – 35.99	38	36.25	35 36	10.50	4	M-304
S206-40 S206-40L	36.00 – 36.99 37.00 – 37.99	40	38.25	37 38	10.50	4	M-304
S206-42 S206-42L	38.00 – 38.99 39.00 – 39.99	42	40.25	39 40	10.50	2 2	M-304 M-368
S206-44 S206-44L	40.00 – 40.99 41.00 – 41.99	44	42.25	41 42	10.50	2 2	M-304 M-368
S206-46 S206-46L	42.00 – 42.99 43.00 – 43.99	46	44.25	43 44	10.50	4	M-368
S206-48 S206-48L	44.00 – 44.99 45.00 – 45.99	48	46.25	45 46	10.50	4	M-368

*Molded

CAUTION

- *All stubs awaiting pipe installation at a later date must be restrained.*
- *Assure that a proper backfill material is used in adverse conditions.*
- *Prior to any critical usage, contact NPC Customer Service (603) 673-8680.*

NPC INC.

KOR-N-SEAL

250 Elm Street, P.O. Box 301, Milford, NH 03055, U.S.A. Fax: (603) 673-7271

Tel: (800) 626-2160 (603) 673-8680

Manufactured under the following Patents: U.S.: 3,958,313 CAN: 1,035,181 U.K. 1,52

KOR-N-SEAL® II FLEXIBLE CONNECTOR

Recommended Installation Procedure

Refer to Kor-N-Seal II Flexible Pipe-to-Manhole Connector Data Sheet for Hole/Connector Diameter and Suggested Pipe O.D. Range.

KORBAND INSTALLATION:

1. Install Korband into Connector by first fitting Wedge Expander into center of cutout provided, then installing remainder of Korband. Ensure that head of bolt on Wedge Expander is located to the outside of Connector.
2. Check to be sure Korband is properly located in Connector groove.
3. Using pipe lubricant, lightly lube at least four sections of Korband by bending back rubber one section at a time. (Fig. 1)

CONNECTOR INSTALLATION:

1. Insert Kor-N-Seal II assembly into hole with Wedge Expander up. (Fig. 2)
2. Position assembly so it is flush with inner wall of manhole at top and bottom of hole. (Fig. 3)
3. Tighten Wedge Expander with torque wrench to 75 foot pounds.
4. After 15 minutes, recheck torque and retighten if necessary.
5. Place plastic protective cap over end of bolt. (Fig. 2)
6. Retorque Wedge Expander to 75 foot pounds prior to shipment.

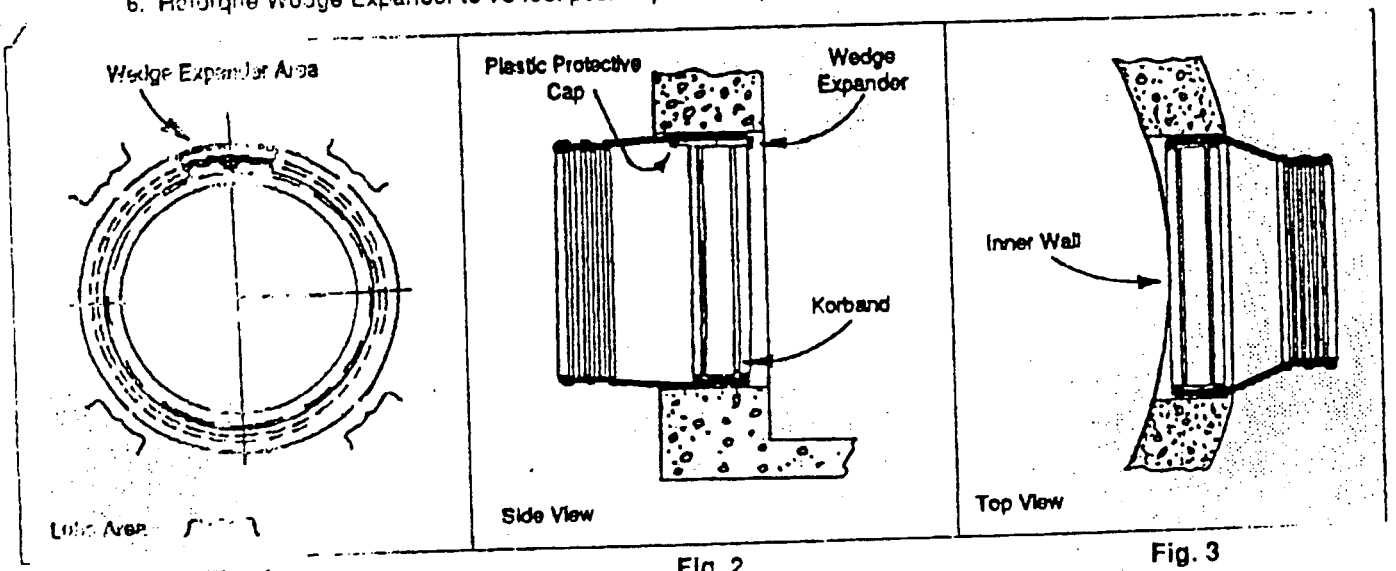


Fig. 1 Fig. 2 Fig. 3

PIPE INSTALLATION:

Center pipe in Connector opening.

When more than one size pipe clamp is specified, use one of each size for each complete clamp. Position clamp takeups 90° apart. Using T-handle Torque Wrench (P/N 60090), tighten the two sets of clamps down alternately to 60 in. lbs.

Inspect Connector to ensure that take-up is uniform and rubber is evenly compressed around pipe.

NPC INC.

KOR-N-SEAL®

Elm Street, P.O. Box 301, Milford, N.H. 03055, U.S.A. Telephone: (603) 673-8680
Fax: (603) 673-7271

Figure No. 6300A 125# Iron Swing Check Valve 2"-12"

Iron Body, Bronze Trim
125 PSI Saturated Steam, 200 PSI Cold Water, Oil, or Gas

Figure No. 6300AI

All Iron

125 PSI Fluid Pressure to 450° F
200 PSI Non-Shock W.O.G.

- **Bolted Bonnet**
- **Horizontal Swing**
- **Renewable Seat and Disc ***

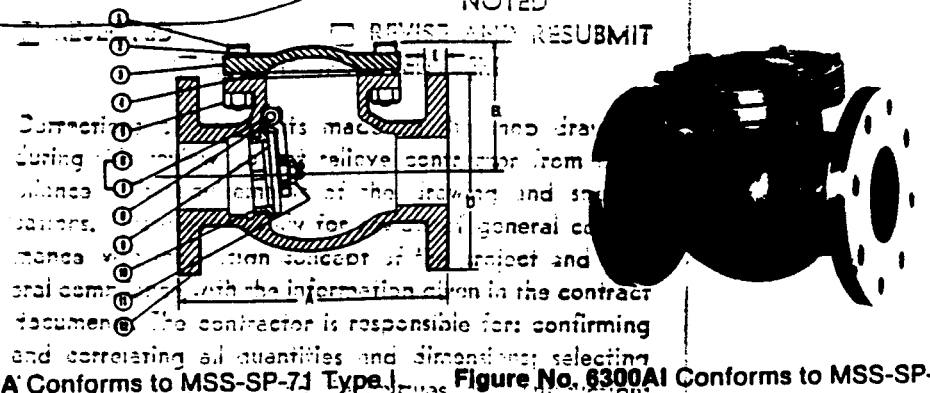


Figure No. 6300A Conforms to MSS-SP-71 Type I **Figure No. 6300AI** Conforms to MSS-SP-7

Material List Fig. No. 6300A

Part	Specification
1. [1]Body Bolt	Steel ASTM A-307
2. Identification Plate	Aluminum
3. Bonnet	Cast Iron ASTM A-126 Class B
4. Body Gasket	Non-Asbestos/Graphite/ Aramid Fiber
5. [1]Body Nut	Steel ASTM A-307
6. Side Plug	Brass ASTM B-16 Alloy C36000
7. Hanger Pin	Brass ASTM B-16 Alloy C36000
8. [3]Hanger	Cast Bronze ASTM B-584 Alloy C84400
9. [2]Disc	Bronze ASTM B-584 Alloy C84400
10. Seat Ring	Cast Bronze ASTM B-584 Alloy C84400
11. Disc Nut	Bronze ASTM B-16 Alloy C36000
12. Body	Cast Iron ASTM A-126 Class B
13. Disc Bolt 5" thru 12"	Brass ASTM B-16 Alloy C-36000

[1] 8" has hex head steel capscrews.
[2] 5" thru 12" have iron Disc with Bronze Disc Face Rings. 2" thru 4" have Bronze ASTM B-62 Disc.
[3] 10" is Cast Iron ASTM A-126 Class B.

Figure No. 6300A1 — Not Available in 5" size.

2½"-12" available with lever & weight or lever & spring.

WARNING — Do Not Use For Reciprocating Air Compressor Service. Check valves may be installed in both *horizontal* and *vertical* lines with upward flow or in any intermediate position.

Material List Fig. No. 6300AI

Not Recommended For Steam Service

Part	Specification
1. [1]Bolt	Steel ASTM A-307
2. Identification Plate	Aluminum
3. Bonnet	Cast Iron ASTM A-126 Class B
4. Body Gasket	Non-Asbestos/Graphite/ Aramid Fiber
5. [1]Nut	Steel ASTM A-307
6. Side Plug	Steel ASTM A-307
7. Hanger Pin	Steel ASTM A-108 1214L
8. Hanger	Ductile Iron ASTM A-395
9. Disc	Cast Iron ASTM A-126 Class B
10. Seat Ring	Cast Iron ASTM A-126 Class B
11. Disc Nut	Steel ASTM A-307
12. Body	Cast Iron ASTM A-126 Class B
13. Disc Bolt 5" thru 12"	Cold Roll Steel

[1] 8" has hex head steel capscrews.

Dimensions — Weights

Nominal Size	Dimensions				Approx. Net Weight
	A	B	D	E	
2	8	3 15/16	6	5/8	24.0
2½	8½	4½	7	1 11/16	35.0
3	9½	5⅛	7½	¾	47.0
4	11½	6⅛	9	15/16	71.0
5	13	6 13/16	10	15/16	100.0
6	14	8	11	1	146.0
8	19½	9 7/16	13½	1⅛	255.0
10	24½	12 1/16	16	1 3/16	426.0
12	27½	16⅛	19	1¼	655.0

* With proper machining facilities available.

MILLIKEN

MILLCENTRIC

ECCENTRIC PLUG VALVE

The Milliken criteria of quality, reliability, safety and value are embodied in the MILLCENTRIC Eccentric valve, setting higher standards for dependable performance with excellent features achieved by the utilization of the very latest design and manufacturing techniques.

- Computer Aided Design
- High integrity casting
- CNC manufacturing delivers consistent sizes on all components

All complemented by rigorous Quality Control System

BODY

Conforming to AWWA C504 wall thickness, the Millcentric valve body casting is in ASTM A126 CLB iron using high pressure molding techniques for consistent quality and precision.
Alternative flanged or mechanical joint ends are available.
Flange diameter, thickness and drilling conform to ANSI B16.1 Class 125.
Mechanical joints to AWWA C111 (ANSI A21.11).

SEAT

The MILLCENTRIC valve incorporates as standard, on 3" and larger, a welded nickel seat for corrosion and erosion resistance specially profiled for low torque and extended seat life.
An alternative corrosion resistant epoxy seat is available for general duties.

STEM SEAL

High integrity sealing by combining the advantages of a resilient and abrasion resistant U-Cup seal. From vacuum to high pressure, the self-adjusting sealing system (per AWWA C504) gives positive, trouble-free service and is retained independently of the plug stem or external torque device.

BEARINGS

The plug rotates in permanently lubricated 316 grade stainless steel bearings located in the body and bonnet, along with two PTFE thrust washers, which ensure consistently low operating torque.

PLUG

Supported on integral trunnions, the plug is encapsulated in an elastomeric polymer injection molded to the casting providing tight shut-off in either direction even under vacuum conditions. High integrity corrosion-free sealing is achieved by a variety of abrasion resistant elastomers which protect the plug right up to the trunnions. When assembled, the light compression of the elastomer onto PTFE thrust washers, prevents entry of abrasive materials into the bearings.

BONNET

Superior 'O' ring sealing with metal/metal contact means lower bolting stresses compared with compression gaskets.

FLOW

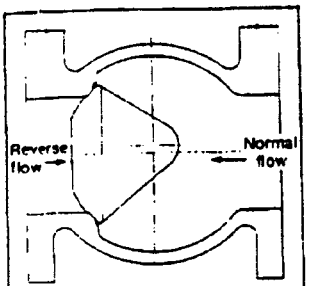
Round port design with streamlined internal contours gives high capacity straight through flow in the full open position, reducing turbulence and pressure drop and the effect of erosive media. Handling of sludges and slurries is therefore enhanced.

INTERCHANGEABLE

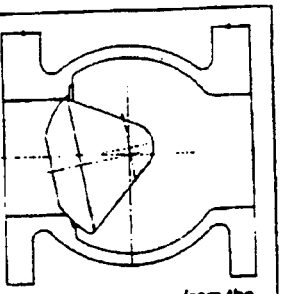
Because of common face to face dimensions with wedge gate valves, fitting the tight shut-off, rotary MILLCENTRIC valve into existing systems is accomplished without pipeline modifications.

POSITION INDICATION

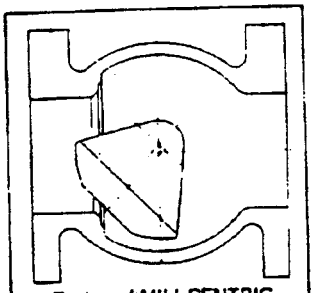
Open and closed travel stops are fitted as standard with intermediate position indication. A directional pointer is included on the end of the valve stem to confirm plug position.



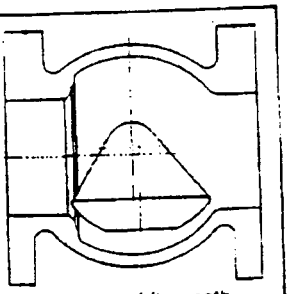
- Valve in closed position for bubble tight shut-off
- Normal flow direction gives pressure assisted sealing
- Torques are low even in reverse flow.



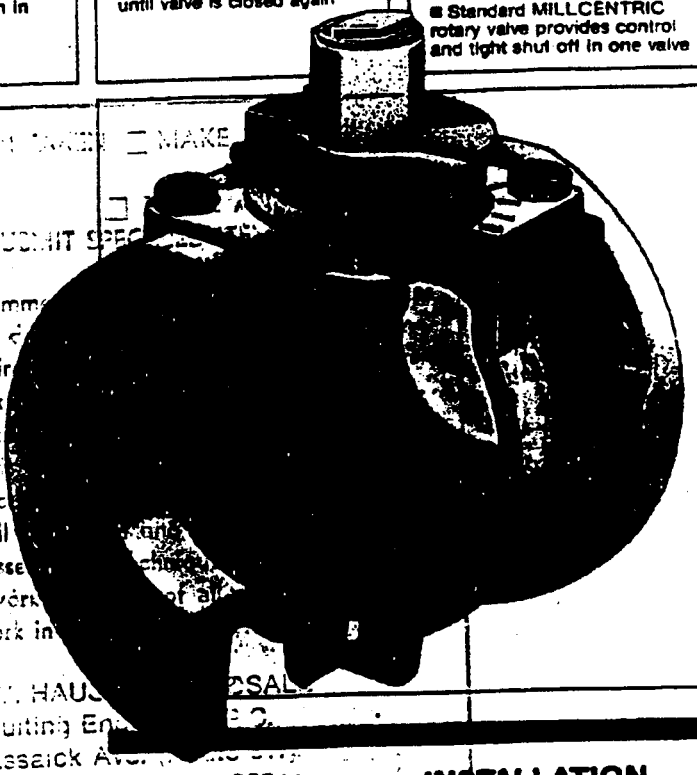
- Plug rotates away from the seat for instant opening
- Seat wear and operating torque reduced
- No further seat contact until valve is closed again



- Design of MILLCENTRIC valve allows modulating control over the full 90° travel
- Ideally suited for balancing service
- Standard MILLCENTRIC rotary valve provides control and tight shut off in one valve



- Plug is out of flow path when fully open
- Straight through, uninterrupted smooth flow
- Round port reduces turbulence and erosion, lowers pumping costs and can be "pigged" to clean the pipeline



HOW TO SPECIFY MILLIKEN NON-LUBRICATED ECCENTRIC VALVES

Valves shall be of the non-lubricated eccentric type with the plug completely resilient rubber covered. Flanged valves shall fully comply with ANSI 125/150 standards. Ports shall be round, and with minimum solids passage equal to 81% of the corresponding pipe area on sizes 2" through 12" to facilitate "pigging".

Valve bodies shall be ASTM A126 Class B with 90% nickel welded seats. No other seats will be allowed. Plugs shall be Ductile Iron to ASTM A536. Plugs shall be of one piece construction with PTFE thrust washers on the top and bottom journals. Valves shall be furnished with self-adjusting "U" cup packing and shall have bearings top and bottom of sintered oil impregnated 316 stainless steel. Each valve shall be given hydrostatic and seat tests and be rated at 175 psi per ANSI 125.

INSTALLATION

The MILLCENTRIC valve is suitable for flow and shut-off in either direction. Seat end downstream is the preferred orientation and any reverse flow requirement should be stated at the time of order. For use on fluids with suspended solids, installation with the seat upstream and the valve stem horizontal may be preferable; plug rotation to the top of the valve will ensure smooth operation.

IN-LINE MAINTENANCE

In the unlikely event of gland leakage, the stem seals can be easily replaced without removing the bonnet. Access to the body for cleaning or inspection does not require removal from the line.

201-826-7400
FAX-826-7928

Telex ITT: 4754103
ANSBK: CENTJERSI

CENTRAL JERSEY Supply Company

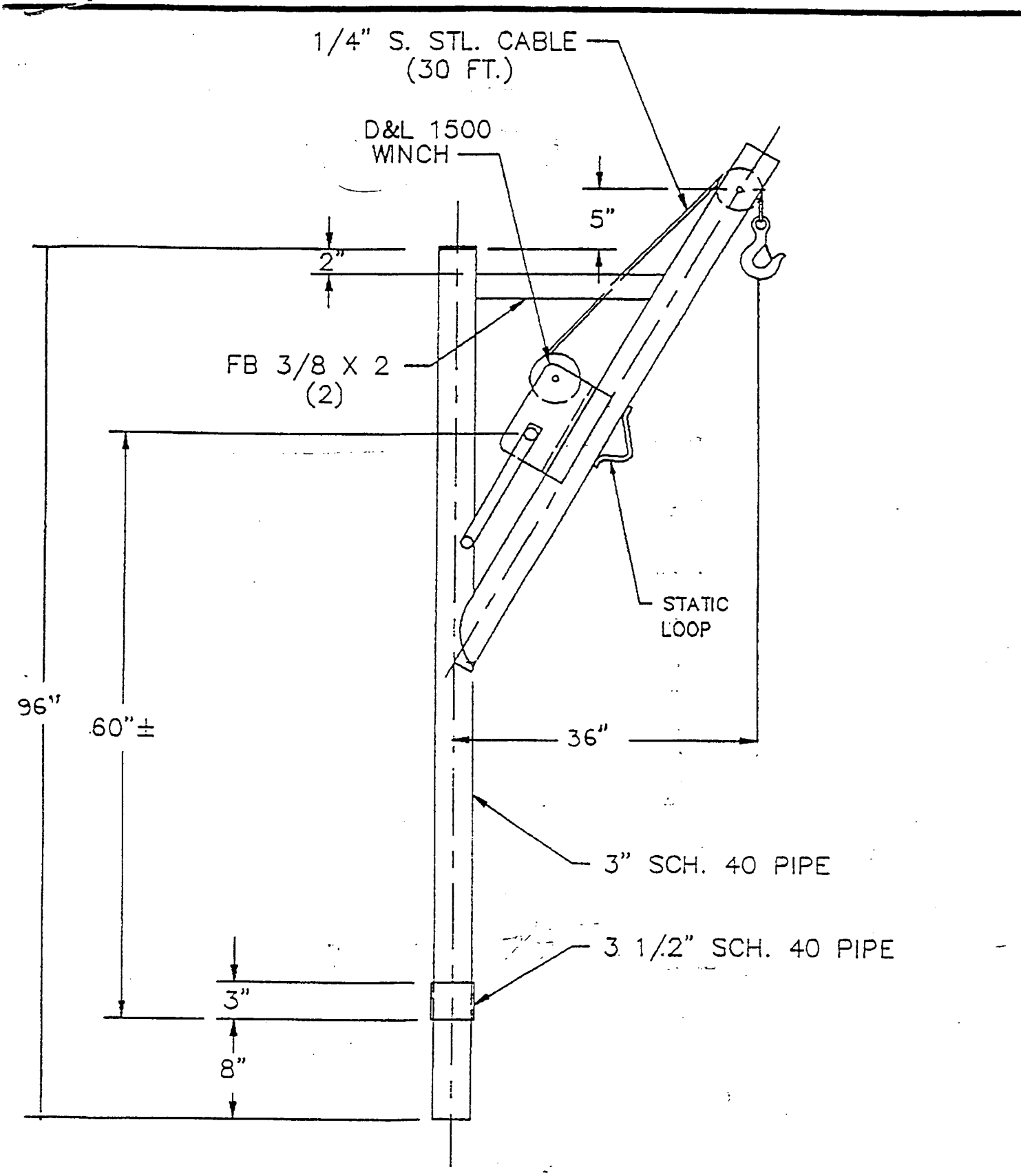
201 Second Street P.O. Box 549
Perth Amboy, New Jersey 08862

GUIDE RAILS
STAINLESS STEEL
3/4" SCH 40 PIPE

A.S.A. PIPE SCHEDULES

PIPE SIZES	O.D. In Inches	5	10	20	30	40	Std.	60	80	E.H.	100	120	140	160	D E
1/8	.405	.035	.049			.068	.068		.095	.095					
		.1383	.1863			.2447	.2447		.3145	.3145					
1/4	.540	.049	.065			.088	.088		.119	.119					
		.2570	.3297			.4248	.4248		.5351	.5351					
3/8	.675	.049	.065			.091	.091		.126	.126					
		.3276	.4235			.5676	.5676		.7388	.7388					
1/2	.840	.065	.083			.109	.109		.147	.147				.187	
		.5383	.6710			.8510	.8510		1.088	1.088				1.304	1
3/4	1.050	.065	.083			.113	.113		.154	.154				.218	
		.6838	.8572			1.131	1.131		1.474	1.474				1.937	2
1	1.315	.065	.109			.133	.133		.179	.179				.250	
		.8678	1.404			1.679	1.679		2.172	2.172				2.844	3
1 1/4	1.660	.065	.109			.140	.140		.191	.191				.250	
		1.107	1.806			2.273	2.273		2.997	2.997				3.765	5
1 1/2	1.900	.065	.109			.145	.145		.200	.200				.281	
		1.274	2.085			2.718	2.718		3.631	3.631				4.859	6
2	2.375	.065	.109			.154	.154		.218	.218				.343	
		1.604	2.638			3.653	3.653		5.022	5.022				7.444	9
2 1/2	2.875	.083	.120			.203	.203		.276	.276				.375	
		2.475	3.531			5.793	5.793		7.661	7.661				10.01	
3	3.5	.083	.120			.216	.216		.300	.300				.437	
		3.029	4.332			7.576	7.576		10.25	10.25				14.32	
3 1/2	4.0	.083	.120			.226	.226		.318	.318					
		3.472	4.973			9.109	9.109		12.51	12.51					
4	4.50	.083	.120			.237	.237	.281	.337	.337		.437		.531	
		3.915	5.613			10.79	10.79	12.66	14.98	14.98		19.01		22.51	
5	5.563	.109	.134			.258	.258		.375	.375		.500		.625	
		6.349	7.770			14.62	14.62		20.78	20.78		27.04		32.96	
6	6.625	.109	.134			.280	.280		.432	.432		.562		.718	
		7.585	9.289			18.97	18.97		28.57	28.57		36.39		45.30	
8	8.625	.109	.148	.250	.277	.322	.322	.406	.500	.500	.593	.718	.812	.906	
		9.914	13.40	22.36	24.70	28.55	28.55	35.64	43.39	43.39	50.87	60.93	67.76	74.69	
10	10.75	.134	.165	.250	.307	.365	.365	.500	.593	.500	.718	.843	1.000	1.125	
		15.19	18.70	28.04	34.24	40.48	40.48	54.74	64.33	54.74	76.93	89.20	104.1	115.7	
12	12.75	.165	.180	.250	.330	.406	.375	.562	.687	.500	.843	1.000	1.125	1.312	
		22.18	24.20	33.38	43.77	53.53	49.56	73.16	88.51	65.42	107.2	125.5	139.7	160.3	
14	14.0		.250	.312	.375	.437	.375	.593	.750	.500	.937	1.093	1.250	1.406	
			36.71	45.68	54.57	63.37	54.57	84.91	106.1	72.09	130.7	150.7	170.2	189.1	
16	16.0		.250	.312	.375	.500	.375	.656	.843	.500	1.031	1.218	1.437	1.593	
			42.05	52.36	62.58	82.77	62.58	107.5	136.5	82.77	164.8	192.3	223.5	245.1	
18	18.0		.250	.312	.437	.562	.375	.750	.937	.500	1.156	1.375	1.562	1.781	
			47.39	59.03	82.06	104.8	70.59	138.2	170.8	93.45	208.0	244.1	274.2	308.5	
20	20.0		.250	.375	.500	.593	.375	.812	1.031	.500	1.280	1.500	1.750	1.968	
			52.73	78.60	104.1	122.9	78.60	166.4	208.9	104.1	256.1	296.4	341.1	379.0	
24	24.0		.250	.375	.562	.687	.375	.968	1.218	.500	1.531	1.812	2.062	2.343	
			63.41	94.62	140.8	171.2	94.62	238.1	296.4	125.5	367.4	429.4	483.1	541.9	

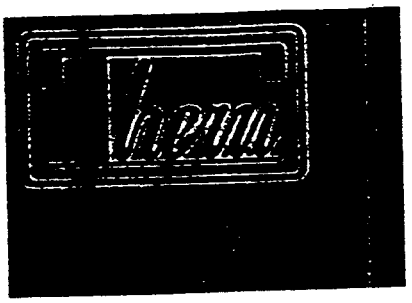
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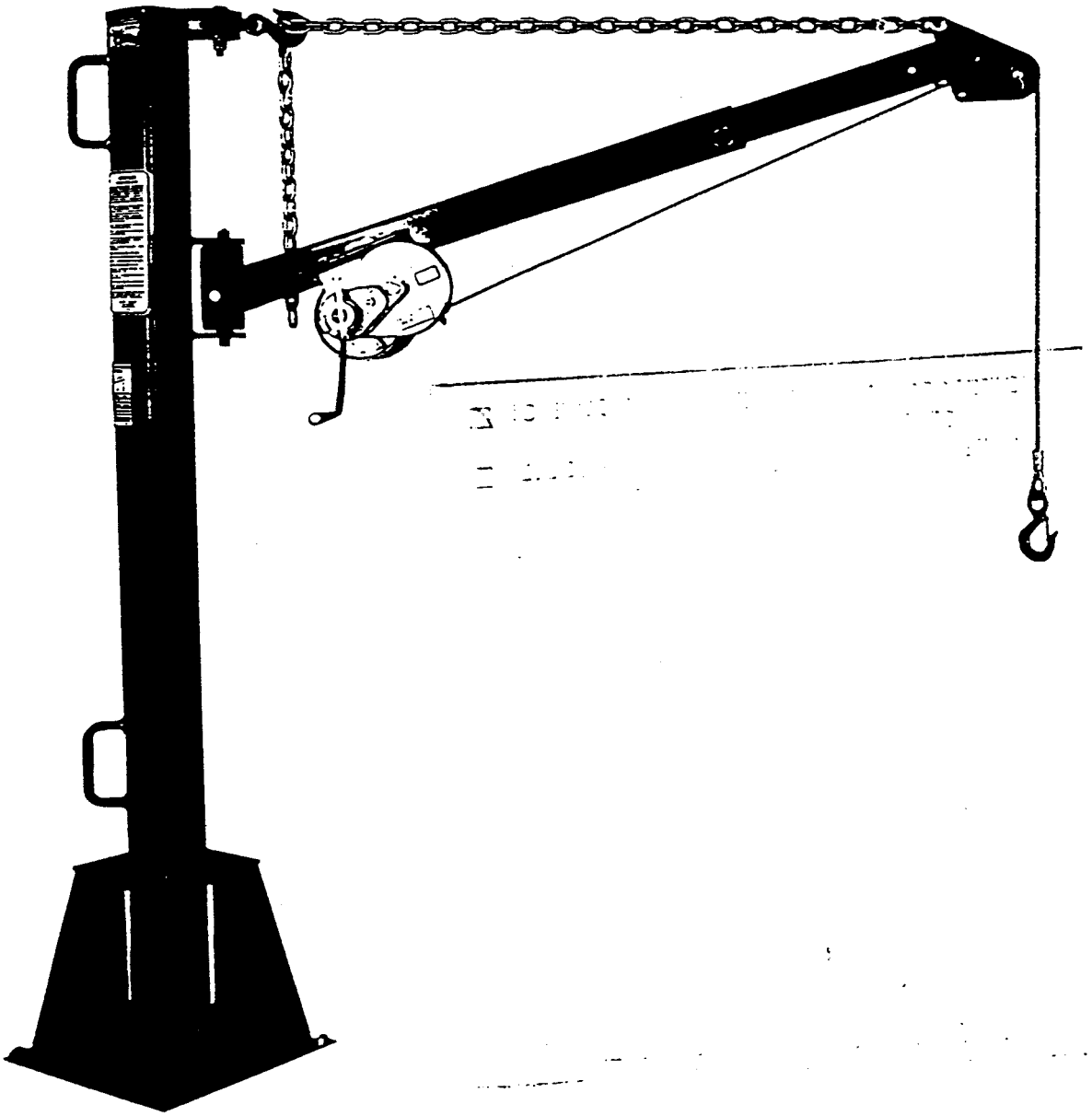


SAFE LOAD: 500+ LB.

HALLIDAY PRODUCTS
ORLANDO FL.

SCALE NONE	PORTABLE HOIST (H1000) (SPECIAL)	
DATE 2/24/92		APPROVED BY
REVISED	MATERIAL STAINLESS STEEL	DWG. NO. D2AHBMWX





FEATURES AND BENEFITS

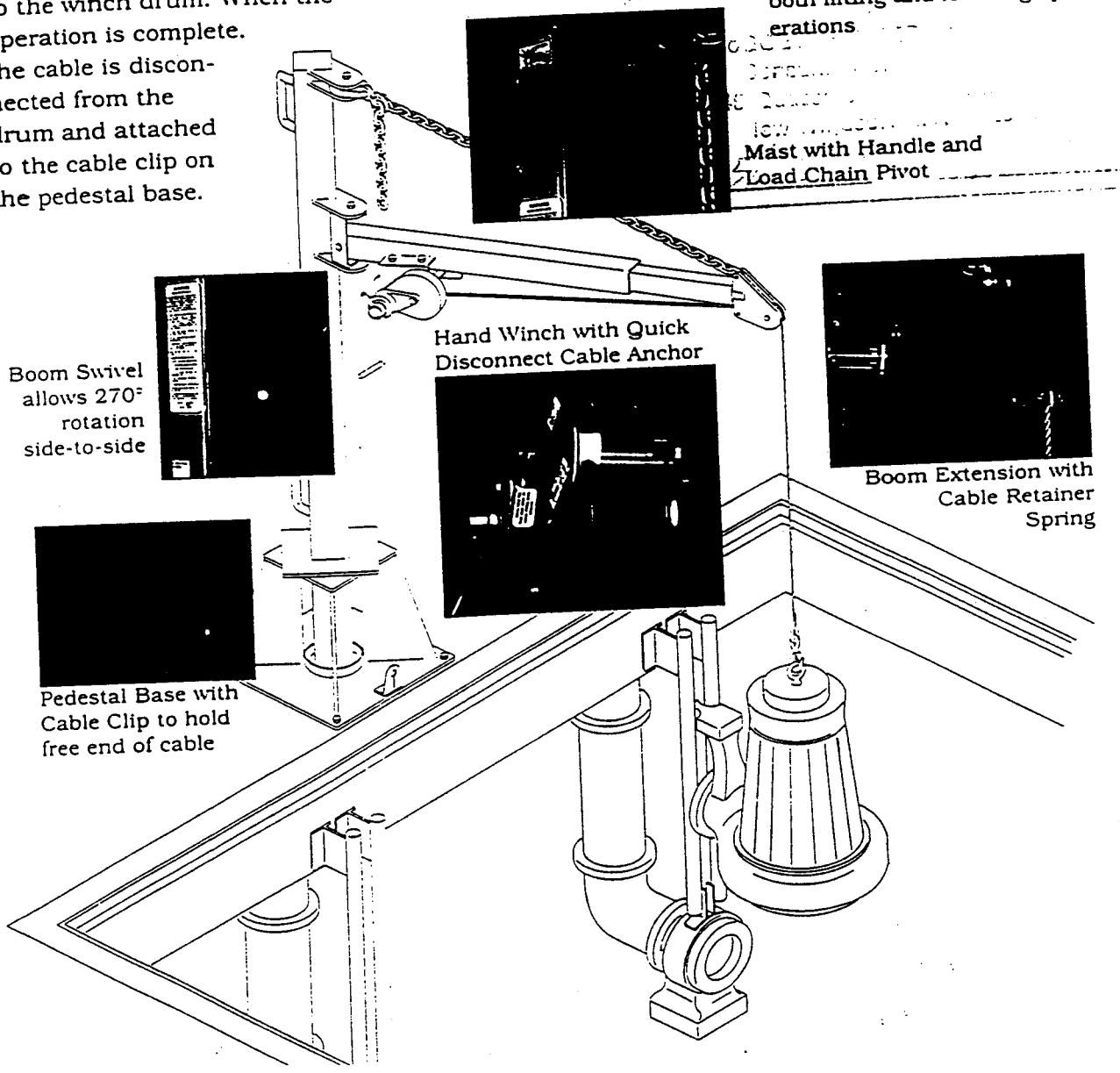
The Model 5334 Wastewater Pump Hoist is designed to be moved from pump station to pump station, to raise and lower submersible pumps. In a typical application, one pedestal base is installed at each pump station, and one stainless steel cable assembly is left permanently attached to each pump. For operation, the Wastewater Pump Hoist is placed in the pedestal base, and the cable is connected to the winch drum. When the operation is complete, the cable is disconnected from the drum and attached to the cable clip on the pedestal base.

Note the following important features:

Quick Disconnect Cable Anchor – allows operator to attach or remove cable in less than 30 seconds.

Corrosion Resistant Components – all components are either stainless steel, iridescent dichromate plated, or coated with a fusibond electrostatic finish.

Disc Brake Handle – attached to the winch, gives control of the load for both lifting and lowering operations

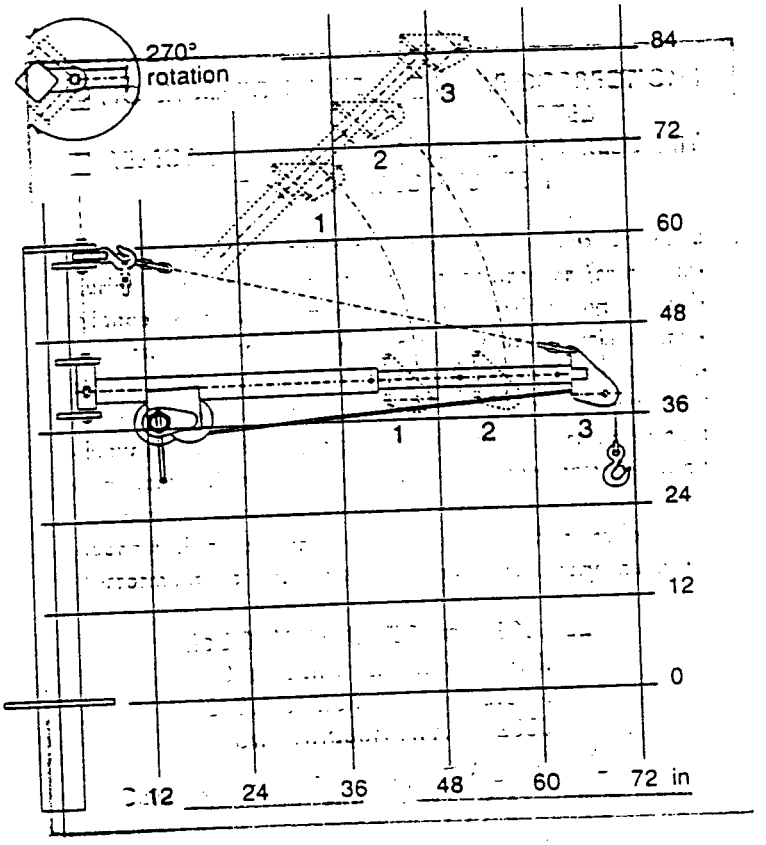


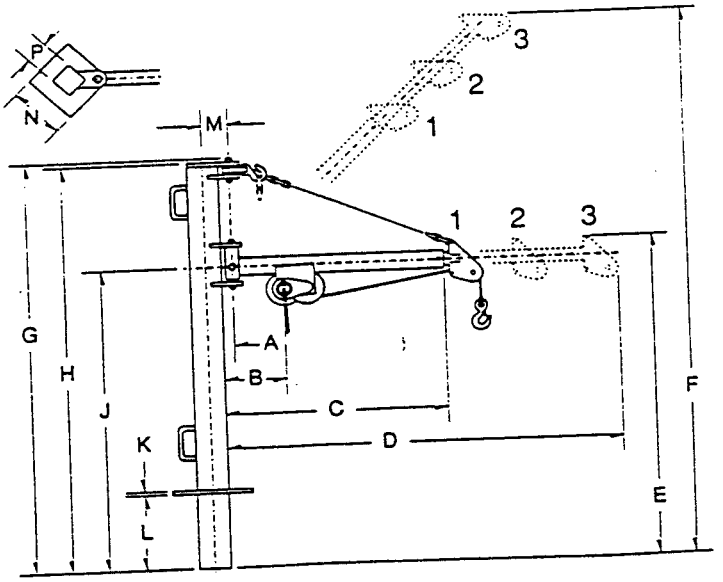
SPECIFICATIONS

winch model	M43-1B
pump lift height	30 ft
cable diameter	1/4 in
load rating	
position 1	2000 lbs
position 2	1500 lbs
position 3	1000 lbs
maximum lift †	
position 1	59 in
position 2	68 in
position 3	76 in
maximum reach	
position 1	46 in
position 2	58 in
position 3	70 in
crane dimensions	
A	2.00 in
B	10.50 in
C	38.00 in
D	68.25 in
E	57.50 in
F	88.00 in
G	74.88 in
H	74.38 in
J	54.50 in
K	.38 in
L	14.00 in
M	4.63 in
N	9.00 in
P	3.75 in
approx. shipping weight	
Model 5834	195 lbs
T4 base	26 lbs
P4 base	80 lbs

† Maximum lift is measured from base to hook and will vary with the size of the load.

Dimensions are for reference only and are subject to change without notice. Contact the factory for certified drawings.



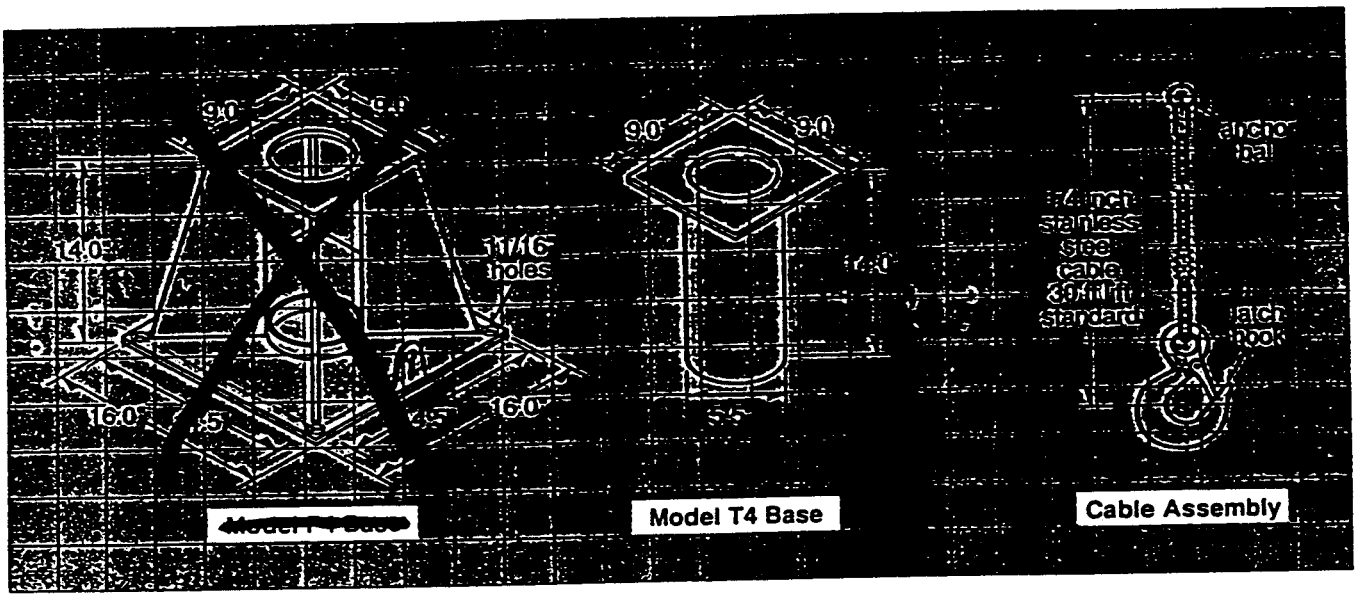


Important!

It is the owner's or operator's responsibility to determine the suitability of the equipment to its intended use. Study all applicable codes, manuals and regulations. Be sure to read the Owner's Manual supplied with the crane before operating it.

Therm products should not be used to lift people, or things over people.

OPTIONS AND ACCESSORIES



Additional Bases

The Model 5334 Wastewater Pump Hoist can be purchased with either the Model P4 or Model T4 Base. The P4 Base bolts to the floor and is equipped with a Cable Clip. The T4 Base is designed for installation in floors or truck beds. Additional bases may be purchased individually.

Stainless Steel Cable Assemblies

The Model 5334 includes a 36 foot, 1/4 inch, Stainless Steel Hook and Cable Assembly, for 30 feet of lift. Optional hook and cable assemblies for up to 40 feet of lift are available. Additional hook and cable assemblies may be purchased individually, through Therm, Inc.

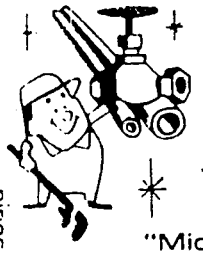
For More Information

If you are interested in learning more about the Therm Model 5334 Wastewater Pump Hoist, call or write the factory. We'll be glad to help you, or we can refer you to a distributor in your area.

Distributed By:

PUMPING SERVICES, INC.
368 LINCOLN BLVD.
MIDDLESEX, N.J. 08846
(908) 469-4540
SALES SERVICE RENTALS

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form P-C534-0790
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R.I.M.

Plumbing & Heating Supply

INCORPORATED

"Mid Hudson's Fastest Growing Supply House"

1-800-227-4321

Toll Free Out Of New York State

pipes ✲ valves

✲ plate ✲ JE



Back Water Valves

- Palmer type
- Bolt down cast iron cover
- Brass flapper



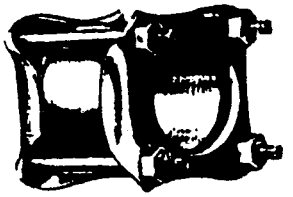
No Hub

Order No.	Description	Wt/100 Pcs.	List Price
SE2A 2	2" x 2"	1200 lbs.	46.20*
SE2A 3	3" x 3"	1600 lbs.	56.95*
SE2A 4	4" x 4"	2325 lbs.	64.21*
SE2A 6	6" x 6"	3500 lbs.	127.36*

W-R

DRESSER STYLE 39 INSULATED COUPLING
RED SHOP COAT INSULATED FOR GAS SERVICE

W-R #	SIZE
2803002	2-1/2" Style 39 Ins.
2803004	3" Style 39 Ins.
2803006	4" Style 39 Ins.
2803008	6" Style 39 Ins.
2803010	8" Style 39 Ins.



See Pete

To: Pat Hines

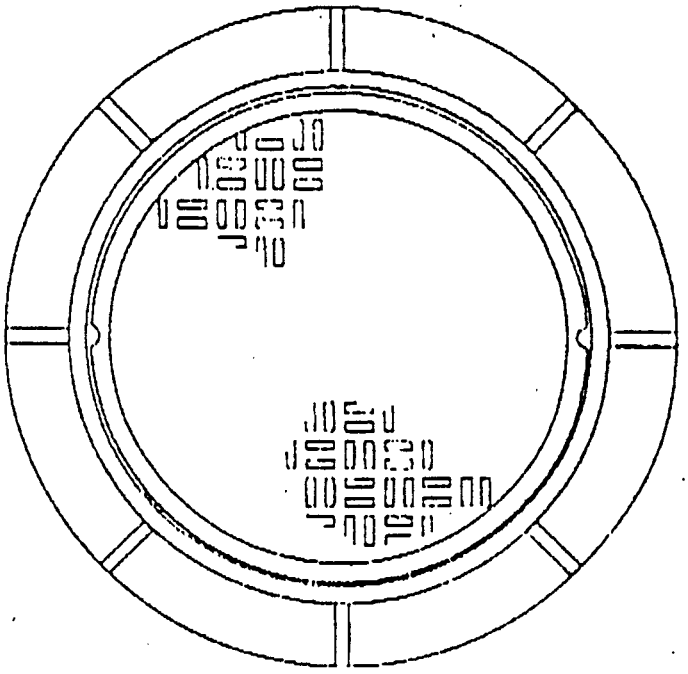
From: T. Miller

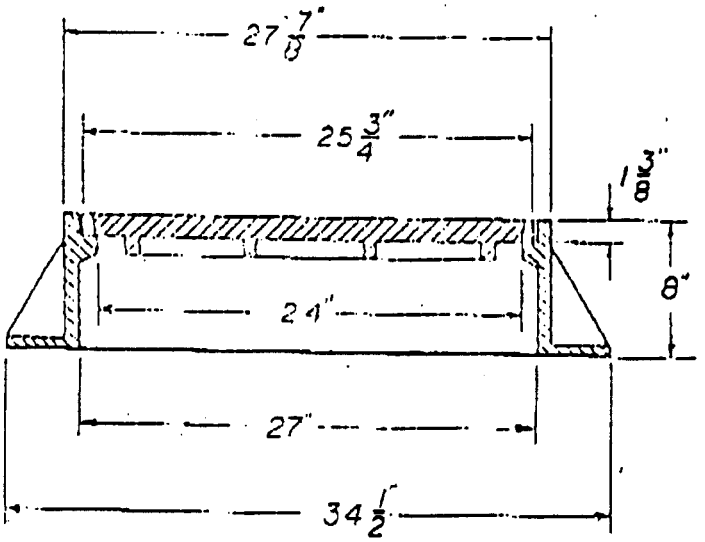
Appendix H.6

PATTERN NO. 1009

HEAVY DUTY-WILL SAFELY WITHSTAND A.A.S.H.T.O. H20-S16 HIGHWAY LOADING AND WILL SUPPORT THE HEAVIEST WHEEL LOAD PERMITTED BY STATE GOVERNMENTS.

9/25/92





Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 3

To Tom Travis	From T. Mullaney
Co. EDA	Co. EDA
Dept.	Phone # 914 592-2500
Fax #	Fax # 914 592-2593

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 3

To J. Eric Kesson	From T. Mullaney
Co. EDA	Co. EDA
Dept.	Phone # 201-483-5486
Fax # 201-7-	Fax #

GRAY IRON		
SPECIFICATION	TENSILE STRENGTH	CLASS
ASTM A 48 83	30,000 psi	30B

CAMPBELL FOUNDRY
HARRISON, NJ 07029-
NJ TEL: (201) 483-548
NY TEL: (212) 732-97
FAX: (201) 483-1843

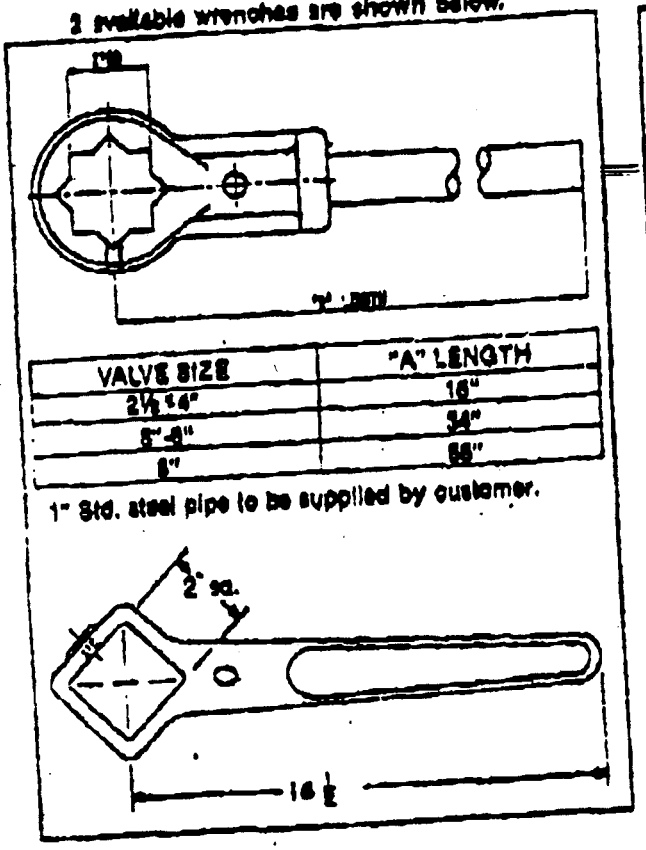
Quality Construction Castings

OPERATION

WRENCH

All valves 2½" through 8" have a 2" square nut to accommodate standard wrenches.
An adjustable Torque Collar retains the plug in any open position against hydrodynamic forces and allows the plug to be closed smoothly even under high velocity conditions.

2 available wrenches are shown below.

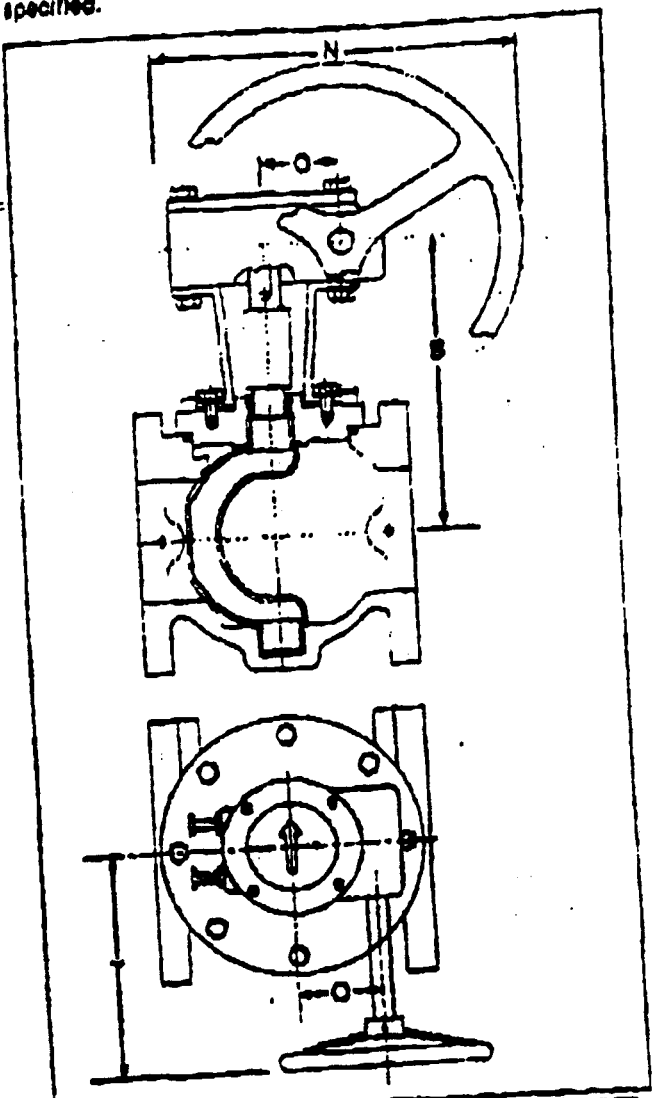


VALVE SIZE	"A" LENGTH
2½"-4"	16"
5"-8"	24"
8"	36"

1" Std. steel pipe to be supplied by customer.

GEAR

Totally enclosed worm gear reduction operators are fitted as standard on sizes above 8" and are optional on smaller sizes. Meeting the requirements of AWWA C504-80, Section 3.8.3, the standard gear operator position is shown below but alternative positions at 90° intervals are available when specified.



Nominal Size		2½	3	4	5	6	8	10	12
S	in	5⅞	5⅞	5 11/16	11	11	15	11¼	15
N (Dia)	in	12	12	16	12	12	16	16	16
T	in	5½	5½	5½	5½	5½	11¼	11¼	11¼
O	in	5 9/16	5 9/16	5 9/16	5 9/16	5 9/16	5 9/16	5 9/16	5 9/16
Flanged Weight (approx)	lb	64	74	101	116	128	225	234	491
MJ Weight (approx)	lb	N/A	66	106	N/A	141	291	301	488

POWER OPERATION

Pneumatic, electric or hydraulic operation is available, complete with accessories such as limit switches, solenoid valves and positioners when required.

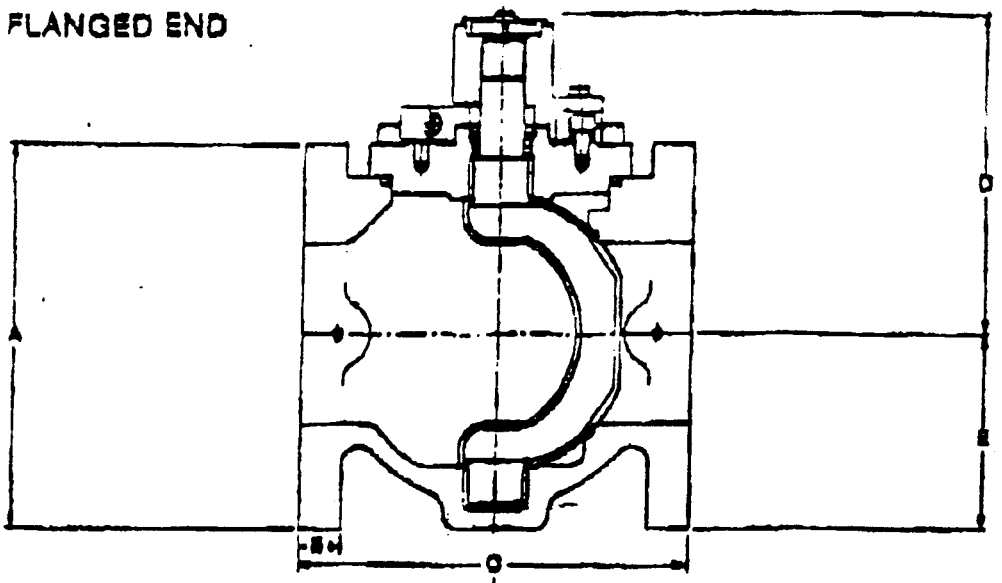
ADAPTATION

A range of extended stems and floor mounted stands for remote operation, particularly in buried service, are available.
Chainwheel operation and locking devices are readily incorporated onto the MILLCENTRIC valve.

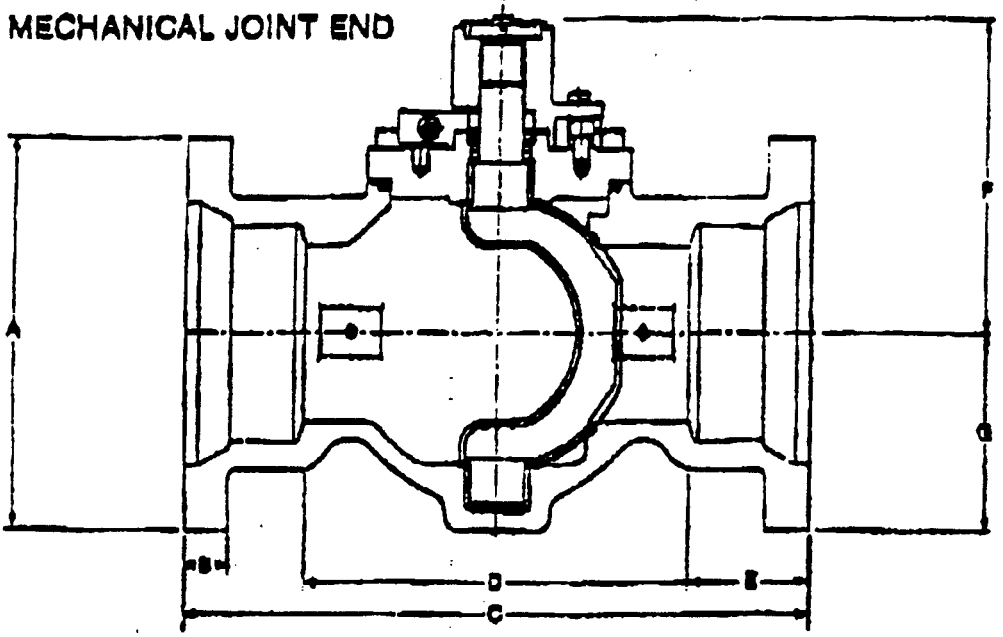
MODULAR CONSTRUCTION

Design of the bonnet and stem allows for on-site adaptation of gear operators, power actuators, or extension devices on to standard valves.
Conversion can be easily undertaken without removing the valve bonnet, thereby minimizing downtime.

FLANGED END



MECHANICAL JOINT END



FLANGED END - ANSI 125								
Size	2½	3	4	5	6	8	10*	12*
A	7	7½	9	10	11	13½	16	19
B	11/16	¾	15/16	15/16	1	1 1/16	1 3/16	1 1/4
C	7½	8	9	10	10½	11½	15	14
D	6 3/16	6 3/16	7¼	8 3/16	9 3/16	10 11/16	—	—
E	3½	3¾	4½	5½	5⅝	7 5/16	8 5/16	10
Weight (approx.)	28	39	66	81	94	160	284	361

*10" & above have gear operators as standard.

MECHANICAL JOINT END						
Size	3	4	6	8	10*	12*
A	7 11/16	9	11 1/16	13 3/16	16 3/16	19 1 3/16
B	15/16	1	1 1/16	1 1/16	1 1/16	1 1/4
C	11½	14½	15⅝	17 7/16	19 3/16	20⅝
D	6½	9½	10⅝	12 5/16	14 3/16	15⅝
E	2½	2½	2½	2½	2½	2½
F	6 3/16	7¼	8 3/16	10 11/16	—	—
G	3 7/16	4½	5⅝	7 5/16	8 5/16	10
Weight	55	71	105	218	321	416

Mechanical joint dimensions conform to ANSI A21.11 (AWWA C111). Top two bolt holes in each flange are furnished as slots.

S 85'30'20 W
395.64'
NO EXCEPTIONS TAKEN CORRECTIONS NOTED
REJECTED SUBMIT SPECIFIED ITEMS
SEP 24 '92 14:12 FR MELB FHC
SEP-17-'92 17:34 DITHMERS SUPPLY CO
SEP 17 '92 15:27
PAGE.002

MILLIKEN

MILLCENTRIC

ECCENTRIC PLUG VALVE

Corrections or comments made on the drawings during this review do not relieve the vendor from compliance with contract requirements, drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for dimensions, confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

MANGER and EDSALL
Consulting Engineers, P.C.
Executive Drive (Route 9W)
New Windsor, N.Y. 12550

The Milliken criteria of quality, reliability, safety and value are embodied in the MILLCENTRIC Eccentric valve, setting higher standards for dependable performance with excellent features achieved by the utilization of the very latest design and manufacturing techniques.

BODY

Conforming to AWWA C504 wall thickness, the Millcentric valve body casting is in ASTM A126 CLB iron using high pressure molding techniques for consistent quality and precision.
Alternative flanged or mechanical joint ends are available.
Flange diameter, thickness and drilling conform to ANSI B16.1 Class 125.
Mechanical joints to AWWA C111 (ANSI A21.11).

SEAT

The MILLCENTRIC valve incorporates as standard, on 8" and larger, a welded nickel seat for corrosion and erosion resistance specially profiled for low torque and extended seat life.
An alternative corrosion resistant epoxy seat is available for general duties.

STEM SEAL

High integrity sealing by combining the advantages of a resilient and abrasion resistant U-Cup seal. From vacuum to high pressure, the self-adjusting sealing system (per AWWA C504) gives positive, trouble-free service and is retained independently of the plug stem or external torque device.

BEARINGS

The plug rotates in permanently lubricated 316 grade stainless steel bearings located in the body and bonnet, along with two PTFE thrust washers, which ensure consistently low operating torque.

- Computer Aided Design
- High integrity casting
- CNC manufacturing delivers consistent sizes on all components

All complemented by rigorous Quality Control System

PLUG

Supported on integral trunnions, the plug is encapsulated in an elastomeric polymer injection molded to the casting providing tight shut-off in either direction even under vacuum conditions. High integrity corrosion-free sealing is achieved by a variety of abrasion resistant elastomers which protect the plug right up to the trunnions. When assembled, the light compression of the elastomer onto PTFE thrust washers, prevents entry of abrasive materials into the bearings.

BONNET

Superior 'O' ring sealing with metal/metal contact means lower bolting stresses compared with compression gaskets.

FLOW

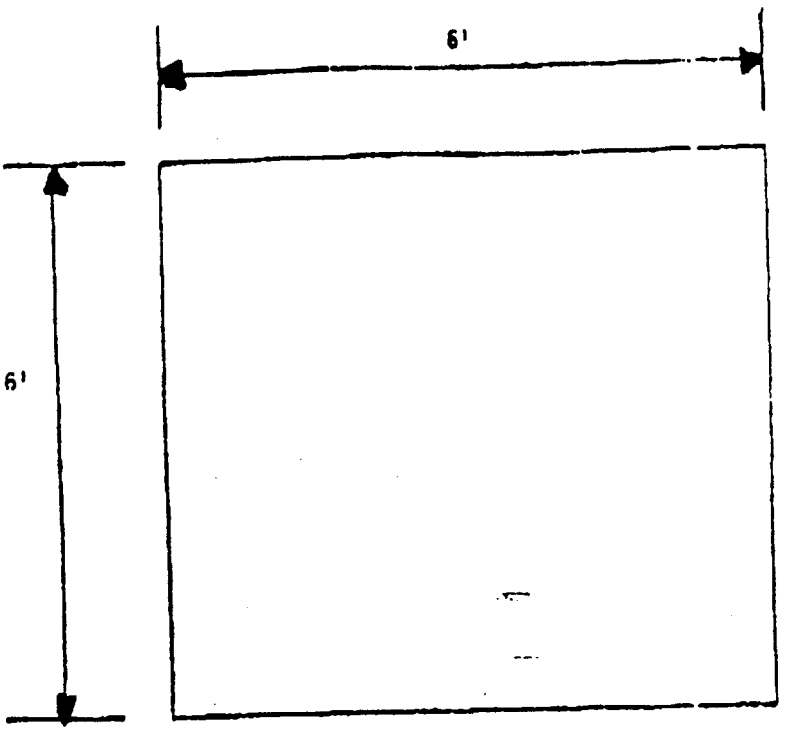
Round port design with streamlined internal contours gives high capacity straight through flow in the full open position, reducing turbulence and pressure drop and the effect of erosive media. Handling of sludges and slurries is therefore enhanced.

INTERCHANGEABLE

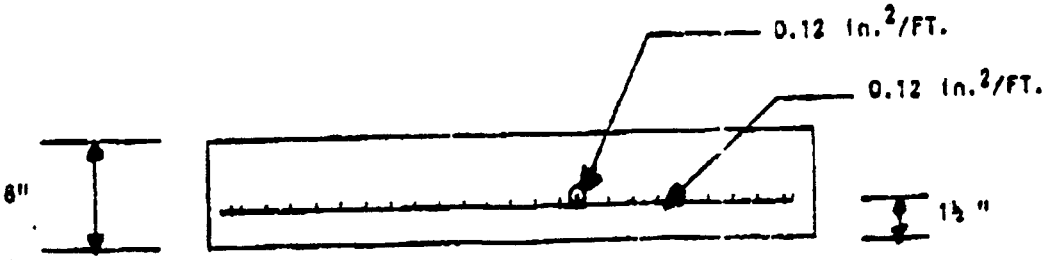
Because of common face to face dimensions with wedge gate valves, fitting the tight shut-off, rotary MILLCENTRIC valve into existing systems is accomplished without pipeline modifications.

POSITION INDICATION

Open and closed travel stops are fitted as standard with intermediate position indication. A directional pointer is included on the end of the valve stem to confirm plug position.



PLAN



SECTION

NOTES:

1. 4000 PSI CONCRETE
2. 60 GRADE REINFORCING

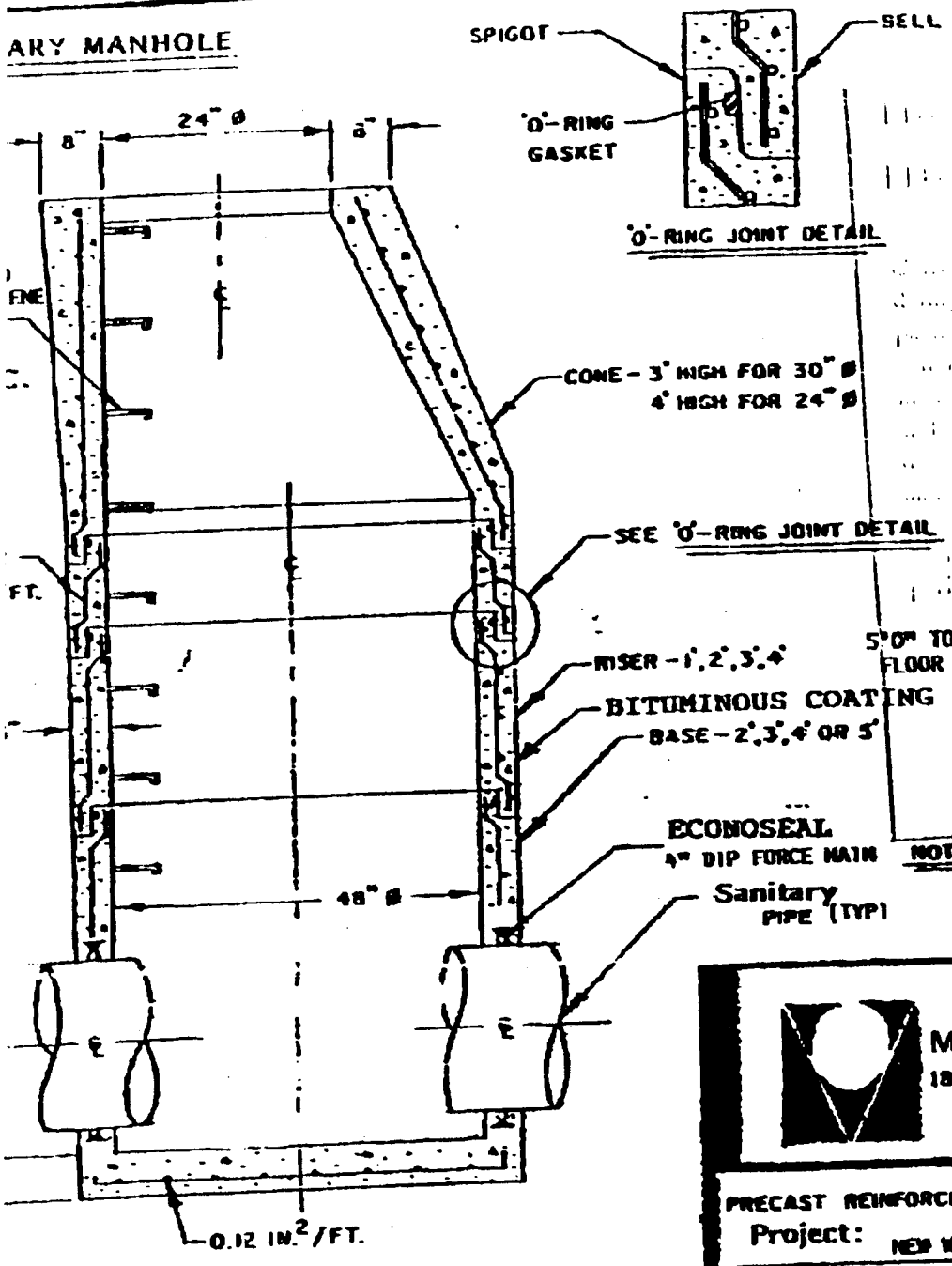
DATE: September 16, 1992

M&M CUSTOM CONCRETE, INC.
197 Stryker Road, Lagrangeville, New York

CUSTOMER: B.E.T.

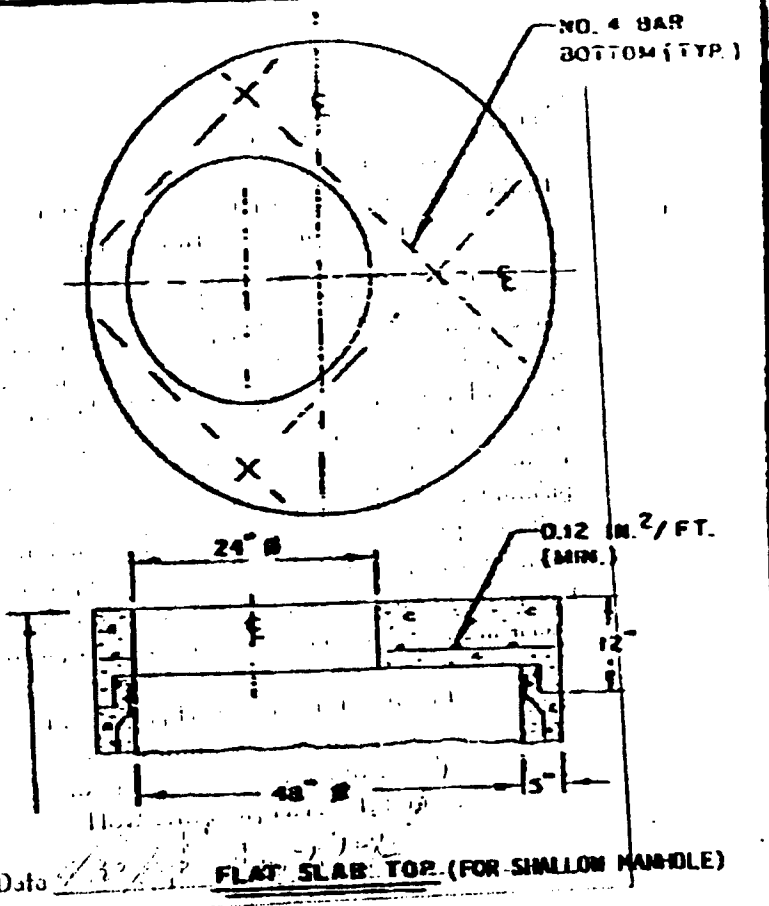
PROJECT: NEW WINDSOR LANDFILL

ARY MANHOLE



PRECAST MANHOLE ASSEMBLY

'O'-RING JOINT DETAIL



FLAT SLAB TOP (FOR SHALLOW MANHOLE)

5'0" TO FLOOR

ECONOSEAL

4" DIP FORCE MAIN

NOTES:
1. ABSORBTION NOT TO EXCEED 8%.
2. RISERS, CONES & SLABS IN ACCORD. WITH A.S.T.M. C-478.
3. LIFTING HOLES IN RISERS & CONES FOR INSTALLATION.
4. LIFTING HOOKS IN SLABS FOR INSTALLATION.

M&M CUSTOM CONCRETE, INC.
187 Strykers Rd., Lopatcong Township
Phillipsburg, New Jersey 08865

9-16-92

Drawn by C

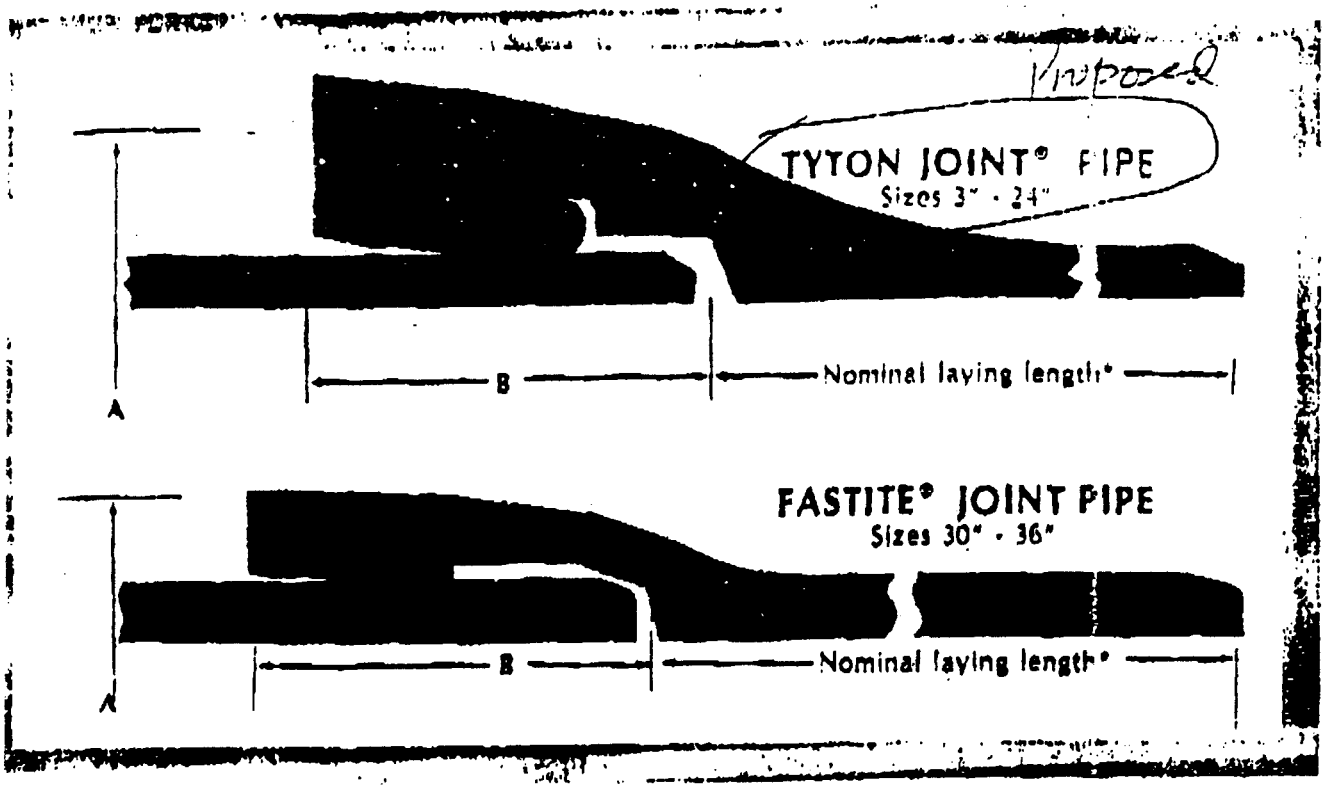
Revised

PRECAST REINFORCED CONCRETE MANHOLE ASSEMBLY - 48" O-RING JOINT

Project: NEW WINDSOR LANDFILL SITE OFFICE

Customer: B.E.T. INC., WHITEHOUSE, NJ

DRAWING NUMBER
92-1



Size Inches	Pipe Thickness Inches From	To	Outside Diameter Inches	Dimensions In Inches A	B
3	.25	.40	3.96	5.80	3.00
4	.26	.41	4.80	6.86	3.15
6	.25	.43	6.90	8.75	3.38
8	.27	.45	9.05	11.05	3.69
10	.29	.47	11.10	13.15	3.75
12	.31	.49	13.20	15.30	3.75
14	.33	.51	15.30	17.85	5.00
16	.34	.52	17.40	20.00	5.00
18	.35	.53	19.50	22.10	5.00
20	.36	.54	21.60	24.25	5.00
24	.38	.56	25.80	28.50	5.00
30	.39	.63	32.00	34.95	6.50
36	.43	.73	38.30	41.37	6.50

* 3" - 4" Nominal 20' laying length.

THICKNESS, DIMENSIONS AND WEIGHTS OF TYTON JOINT AND MECHANICAL JOINT DUCTILE IRON PIPE BY SIZE FOR EACH THICKNESS CLASS

Pipe manufactured in accordance with ANSI/AWWA C151/A21.51 under method of design outlined in ANSI/AWWA C150/A21.50.

Proposed

Size In.	Thickness Class	Thickness In.	OD* In.	Tyton Joint Wt. of Barrel Per Ft. Lb.	Tyton Joint Wt. of Bell Lb.	Tyton Joint Wt. Per Lgth.† Lb.	Tyton Joint Avg. Wt. Per Ft.‡ Lb.	Mechanical Joint Wt. of Bell Lb.	Mechanical Joint Wt. Per Lgth.† Lb.	Mechanical Joint Avg. Wt. Per Ft.‡ Lb.
3	51	.25	3.96	8.9	9	185	9.4	11	190	9.4
3	52	.28	3.96	9.9	9	205	10.4	11	210	10.4
3	53	.31	3.96	10.9	9	225	11.4	11	230	11.4
3	54	.34	3.96	11.8	9	245	12.2	11	245	12.4
3	55	.37	3.96	12.8	9	265	13.2	11	265	13.4
3	56	.40	3.96	13.7	9	285	14.2	11	285	14.2
4	51	.26	4.80	11.3	11	235	11.8	16	240	12.1
4	52	.29	4.80	12.6	11	265	13.2	16	270	13.4
4	53	.32	4.80	13.8	11	285	14.4	16	290	14.6
4	54	.35	4.80	15.0	11	310	15.6	16	315	15.8
4	55	.38	4.80	16.1	11	335	16.6	16	340	16.9
4	56	.41	4.80	17.3	11	355	17.8	16	360	18.1
6	50	.25	6.90	16.0	15	305	16.8	18	305	17.0
6	51	.28	6.90	17.8	15	335	18.6	18	340	18.8
6	52	.31	6.90	19.6	15	370	20.4	18	370	20.6
6	53	.34	6.90	21.4	15	400	22.2	18	405	22.4
6	54	.37	6.90	23.2	15	435	24.0	18	435	24.2
6	55	.40	6.90	25.0	15	465	25.8	18	470	26.0
6	56	.43	6.90	26.7	15	495	27.5	18	500	27.7
8	50	.27	9.05	22.8	22	430	24.0	24	435	24.1
8	51	.30	9.05	25.2	22	475	26.4	24	480	26.5
8	52	.33	9.05	27.7	22	520	28.9	24	525	29.0
8	53	.36	9.05	30.1	22	565	31.3	24	565	31.4
8	54	.39	9.05	32.5	22	605	33.7	24	610	33.8
8	55	.42	9.05	34.8	22	650	36.0	24	650	36.1
8	56	.45	9.05	37.2	22	690	38.4	24	695	38.5
10	50	.29	11.10	30.1	29	570	31.7	31	575	31.8
10	51	.32	11.10	33.2	29	625	34.8	31	630	34.9
10	52	.35	11.10	36.2	29	680	37.8	31	685	37.9
10	53	.38	11.10	39.2	29	735	40.8	31	735	40.9
10	54	.41	11.10	42.1	29	785	43.7	31	790	43.8
10	55	.44	11.10	45.1	29	840	46.7	31	845	46.8
10	56	.47	11.10	48.0	29	895	49.6	31	895	49.7
12	50	.31	13.20	38.4	35	725	40.3	37	730	40.5
12	51	.34	13.20	42.0	35	790	43.9	37	795	44.1
12	52	.37	13.20	45.6	35	855	47.5	37	860	47.7
12	53	.40	13.20	49.2	35	920	51.1	37	925	51.3
12	54	.43	13.20	52.8	35	985	54.7	37	985	54.9
12	55	.46	13.20	56.3	35	1050	58.2	37	1050	58.4
12	56	.49	13.20	59.9	35	1115	61.8	37	1115	62.0

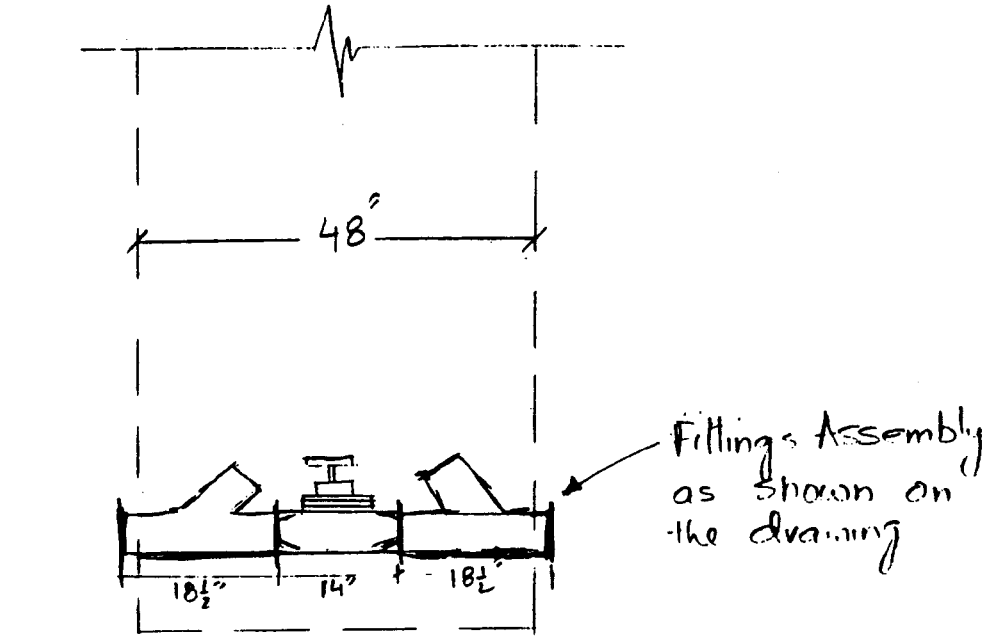
Including bell; calculated weight of pipe rounded off to nearest 5 lbs.

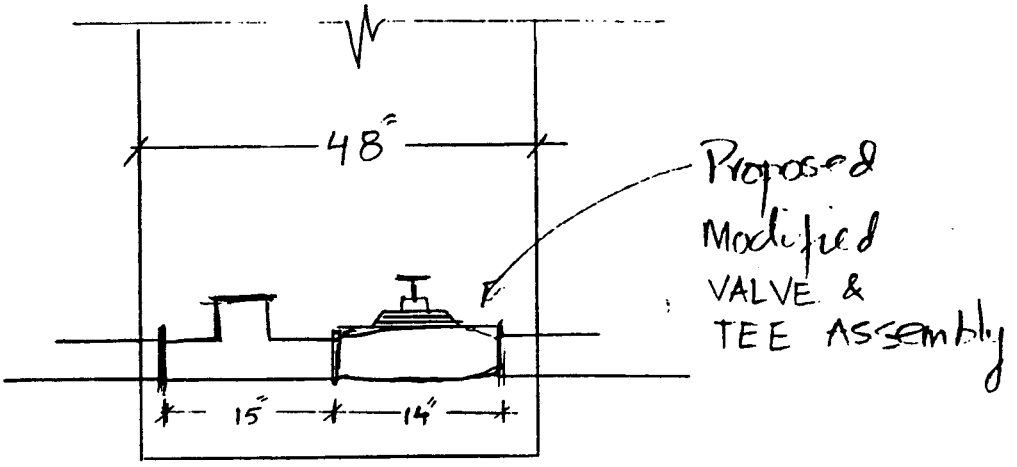
Including bell; average weight per foot, based on calculated weight of pipe before rounding.

3" - 4" Nominal 20' laying length.
6" - 36" Nominal 18' laying length

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

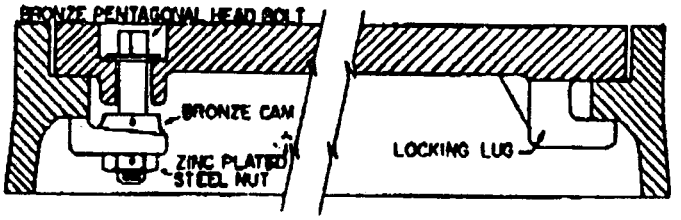
Forcemain Cleanout Manholes

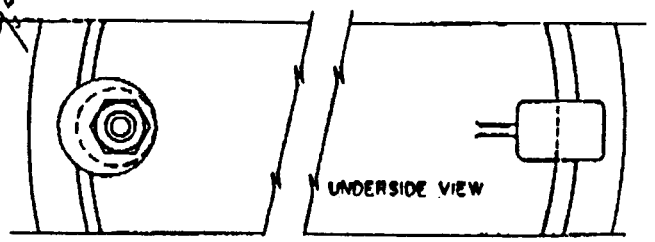




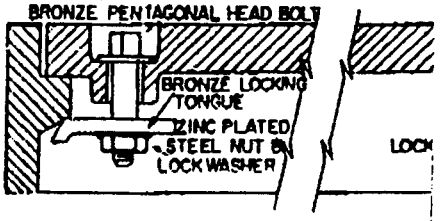
Locking Devices

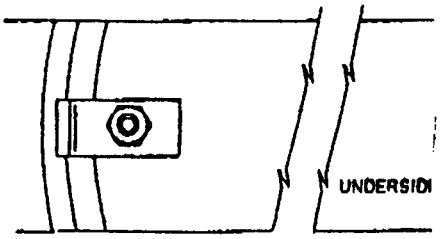
Covers and grates can be secured
detailed can be adapted to the maj
specified, Type A Camlock will be s
Sales or Engineering Department if
locking devices are not suitable for



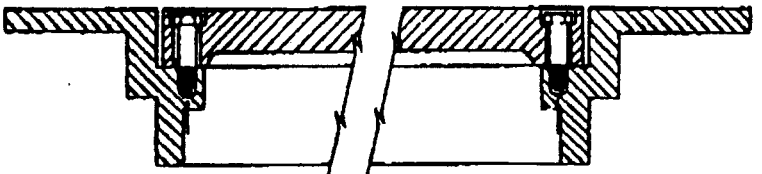


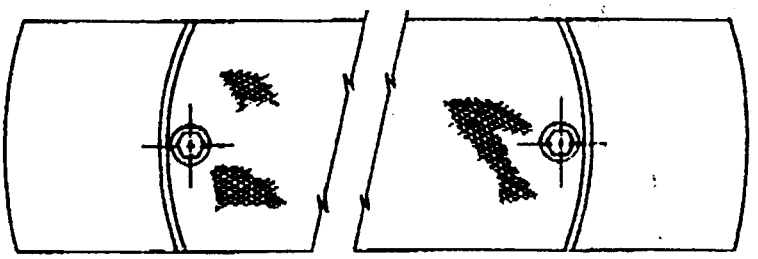
TYPE A - CAMLOCK





TYPE B - BRONZ

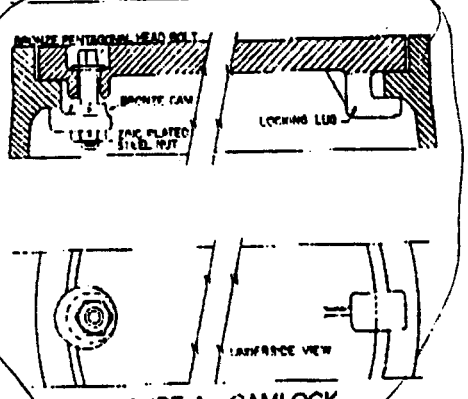




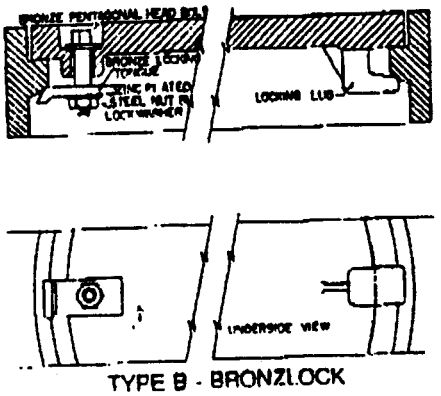
TYPE D - COUNTERSUNK BOLTS

Locking Devices

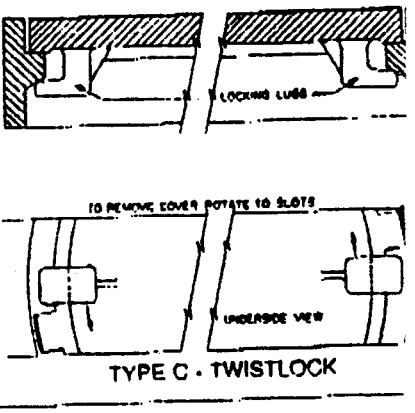
Covers and grates can be secured to frames by various methods. Standard type locking device detailed can be adapted to the majority of frames shown in this catalog. Unless otherwise specified, Type A Camlock will be supplied for locking type covers or grates. Please contact ou Sales or Engineering Department if your requirement is of a special nature and the standard locking devices are not suitable for your application.



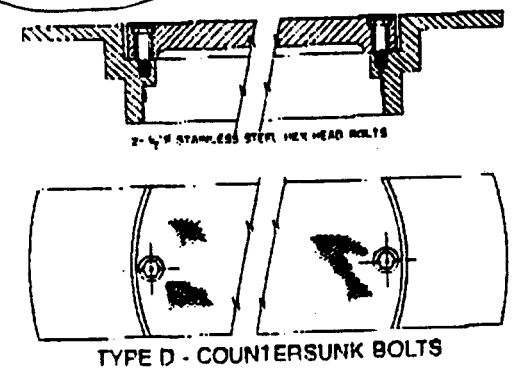
TYPE A - CAMLOCK



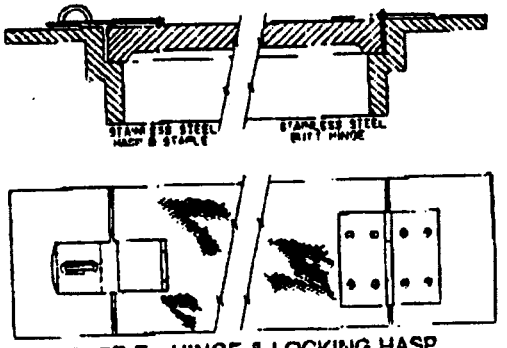
TYPE B - BRONZLOCK



TYPE C - TWISTLOCK



TYPE D - COUNTERSUNK BOLTS



TYPE E - HINGE & LOCKING HASP

Proposed Lock Type