CDM

Camp Dresser & McKee International Inc.

PN. ACC-076

Report

U.S. Agency for International Development

Water and Wastewater Equipment Project: Kutaisi and Tbilisi, Republic of Georgia

December 1995

Contract No. CCN-003-C-00-4086-00

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Acknowledgments

The authors would like to thank all of the people whom worked together to contribute to the success of this project. Marshall Fisher, Mike Kalinoski, and Dennis Culkin from USAID in Washington. Sherry Carlin, Paula Feeney, and Khatuna Joseliani from the USAID Mission in Georgia. Juza Shalvovich of the Tbilisi Water Supply and Canalization Services, Otar Chikhladze of the Kutaisi Water Department, Avtandil Jorbenaze at the Ministry of Health, and Tom McAloon of the International Rescue Committee.

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Water and Wastewater Equipment Project

Introduction

The Republic of Georgia is a newly independent nation undergoing profound political, economic, and environmental change. Georgia is in the process of rehabilitating their deteriorating infrastructures in the wake of these changes. Undependable energy, severely limited financial resources, and antiquated equipment have limited Georgia's ability to rehabilitate their water and wastewater resources. Although providing energy to the country's public services is given high priority, power to run pressure pumps for the water system, sewerage lift pumps, and sewerage treatment equipment is very unreliable. When power is available, low electrical frequency is often delivered to these facilities. This contributes to the rapid deterioration of the small amount of operational water and wastewater equipment. A lack of available funds have limited any rehabilitation projects started by the utilities. Meanwhile, the antiquated equipment currently in use is deteriorating at an accelerated rate.

At the request of United States Agency for International Development (USAID), an environmental engineer and a public health sanitarian from the Water and Sanitation for Health Project (WASH) performed a water and sanitation assessment of existing conditions in the cities of Tbilisi and Kutaisa in December 1993. Tbilisi is the capital of Georgia located along the Aragvi River with a population of 1,500,000. Kutaisa, a former capital, is located on the Rioni River in western Georgia and has a population of 280,000. The team assessed environmental conditions and the associated health risks to the population of the cities. An emphasis was placed on outbreaks of water born diseases attributed to the deterioration and contamination of the municipal water and sanitation infrastructure systems. In addition, they assessed the physical integrity of the municipal water supply and sanitation systems. Based on their findings specific recommendations for short and medium term interventions were identified in their WASH Field Report No. 437 *Emergency Water and Sanitation Assessment for Tbilisi and Kutaisi, Republic of Georgia,* January 1994.

Camp Dresser & McKee International Inc. (CDM) was retained by USAID to implement the recommendations outlined in the WASH field report. A contract was executed by USAID and CDM in August 1994 to proceed with the project. The project consisted of equipment evaluation, procurement, shipment, installation, and operational training. These services were carried out over a period of 18 months which included three trips to the Republic of Georgia by various CDM team members and three equipment shipments.

Equipment Evaluation, Procurement, and Shipment

Equipment Evaluation

CDM reviewed the recommendations outlined in the WASH field report. The majority of the recommendations focused on urgently needed equipment to strengthen the public works infrastructure and decrease the risks of water borne disease outbreaks. Equipment budget constraints dictated that all equipment recommendations in the WASH report would have to be prioritized with the emphasis based on prevention of water borne disease outbreaks. An evaluation was then performed regarding the mechanical, electrical, and general equipment compatibility with existing conditions in Georgia. A technical review was also conducted to insure that appropriate technology was being utilized and that it was compatible with the existing level of technology in Georgia.

The equipment emphasis focused on three key areas. First was chlorination equipment to disinfect the cities' drinking water. Second was fundamental laboratory equipment and reagent based test kits to monitor water borne disease outbreaks. Third was general equipment to assist in the operation and maintenance of the utilities. As the project progressed, recommendations were made to add various minor pieces of equipment and hand tools to the project to insure that the equipment end users would have adequate resources to properly operate and maintain the new equipment. Table 1 details all of the equipment that was procured for this project. Please see Appendix A for specific equipment catalog sheets.

Equipment Procurement

A fast track procurement procedure was used to purchase the equipment for this project. Requests for quotations were sent to a minimum of three vendors for each piece of equipment. Quotations were evaluated on compliance with technical specification, price, ability to meet project schedule, and the vendor's international experience. All equipment procured in the United States met USAID's source and origin requirements. All submersible water pumps for the project were procured in Russia to ensure compatibility with existing equipment.

Upon the awarding of the equipment contracts, Russian translation of operation and maintenance manuals commenced. Translation services consisted of summaries of key operational information for each piece of equipment. Please see Appendix B for examples of translated manuals. These summaries were provided to the end users in Georgia along with the complete English versions of the operation and maintenance manuals.

Table 1 - List of Equipment

Description	Tbilisi	Kutaisi	Total
Chlorination units	10	10	20 each
Chlorination test kits	20	20	40 each
Chlorination test kit reagents	60	60	120 boxes
Leak detectors	1	1	2 each
Pipe locators	1	1	2 each
Sewer rodding machines	2	2	4 each
Sewer bucket machines	1	1	2 each
Mechanical tool kits	1	1	2 each
Diesel generators	2	0	2 each
Submersible water pumps	15	15	30 each
Pump control panels	15	15	30 each
Pump electrical cable	1,000	2,250	3,250 meters
Water contamination test kits	50	25	75 cases
Laboratory equipment:			
Portable laboratory	2	1	3 each
Microscope	2	1	3 each
Incubator	2	1	3 each
Autoclave	2	1	3 each
Vacuum pump work station	2	1	3 each
Glassware and accessories	1	1	2 gross

Equipment Shipments

A total of three equipment shipments were carried out during the project. One major equipment shipment was conducted in June 1995 and two minor equipment shipments, consisting mainly of submersible pumps and spare parts, were completed in November and December 1995.

All U.S. vendors were directed to pack their equipment in compliance with international shipment regulations and ship it to the freight forwarder's warehouse in Virginia. At the warehouse all the equipment was inventoried and consolidated by the freight forwarder. The first equipment shipment sailed from Baltimore, Maryland to Izmir, Turkey. The containers of equipment were then trucked overland from Turkey into Georgia arriving in June.

Regional conflicts and the profound social changes ongoing in Georgia created severe transportation problems with the second and third shipments. The second shipment consisted of the submersible pumps that were purchased in Moscow. These pumps were trucked to Odessa, Ukraine and then sailed across the Black Sea to Poti, Georgia. From Poti, the pumps were trucked to Tbilisi arriving in November. The third and final equipment shipment consisted of equipment spare parts and these were air lifted into Georgia from the United States in December.

Equipment Installation and Training

A series of three trips were made by team members over a seven month period to inventory, install, and conduct operational training on the water and wastewater equipment procured for this project. The first trip was a three week assignment made in June of 1995. The team focused on three major activities. The first activity was the installation and operational training of the chlorination systems for the drinking water pump stations. The second activity consisted of laboratory equipment installation and operational training. The third activity was the assembly and operational training of general water and wastewater maintenance equipment.

Chlorination Equipment

Working in conjunction with the Tbilisi Water Supply and Canalization Services (TWSCS), a prioritized action plan was developed to install the new chlorination systems in four major pump stations of Tbilisi's water distribution system. A team of technicians from the TWSCS were chosen to accompany the team on all equipment installations. The TWSCS team consisted of electrical and mechanical technicians that would be responsible for the maintenance of the chlorination systems for the TWSCS. A total of 12 new vacuum-operated, solution fed, manually adjustable chlorination systems were installed in four pump stations in Tbilisi. These systems replaced the failing and antiquated direct pressure fed chlorination systems.

Working with the Kutaisi Water Department (KWD) a new chlorination system was installed at the Mukhnari pump station. Five additional chlorination systems were left with the KWD to be installed at their other facilities. At each installation site the pump station operators, along with the technician team, participated in the actual chlorination system installation. This facilitated the transfer of the appropriate skills that are needed to operate and maintain these systems. After each installation a classroom orientated training was conducted in which operations and maintenance manuals were reviewed, spare parts examined and labeled, and key components disassembled and reassembled.

Chlorination system spare parts and chlorine residual test kits were also key components included in the equipment for each pump station. Each pump station was equipped with chlorination system spare parts to ensure that maintenance capabilities will be as self sufficient as possible. Chlorine residual test kits were also included to ensure that proper chlorine dosages are reaching all points of the water distribution system. Sufficient chlorine residual reagents were purchased for each test kit to allow for daily testing for a two year period. Please see Appendix C for typical chlorination system installation diagrams.

Laboratory Equipment

Various pieces of laboratory equipment were procured to strengthen Georgia's water borne disease detection capabilities. The public heath laboratories are currently operating under extremely adverse conditions due to a lack of basic instruments, chemicals, supplies, and funding. In addition, the lack of electricity and heat severely hamper routine laboratory analysis. All of the laboratory equipment installation and operational training took place during CDM's June 1995 visit. The majority of the equipment was installed at the Ministry of Health's Sanitary-Epidemiology Stations in Tbilisi and Kutaisi. The remaining laboratory equipment was installed at the Water Department's laboratories. The emphasis was placed on fundamental laboratory equipment and reagent based test kits to monitor water borne disease outbreaks. Three portable laboratories were provided to the utilities. These portable laboratories utilize a spectrophometer and reagents to conduct 20 common water quality tests. The portable laboratories were also equipped with extra reagents, apparatus, and carrying cases. Basic laboratory equipment such as incubators, autoclaves, and microscopes were procured for the Sanitary-Epidemiology Stations. The majority of the remaining laboratory equipment consisted of glassware, vacuum pump apparatus, and test kits. The test kits consisted of coliform identification and chlorine residual colormetric reagent tests. All of the laboratories visited in Georgia were out of reagents to perform coliform and fecal coliform tests during training. Therefore, the arrival of the coliform test kits filled a critical void.

General Equipment

Various pieces of basic water and wastewater maintenance related equipment were procured for the TWSCS and KWD in an attempt to strengthen their infrastructure operation and maintenance capabilities. These utilities are currently operating under extremely adverse conditions where normal maintenance is not possible due to a lack of fuel, tools, supplies, and funding. The utilities are forced to take a "band-aid" approach patching together one mechanical breakdown after another. In most cases, spare parts or supplies are not available to do the repair in the proper manner. Therefore, the break is patched together utilizing whatever resources available at that time in that location.

The water and wastewater equipment was delivered to Georgia in three different shipments. Each piece of equipment was accompanied by a two year supply of spare parts. In addition, mechanical hand tools were also provided to the utilities. This was done to insure that the utilities would have sufficient capabilities to properly maintain their new equipment. The equipment handed over to the utilities included the following:

- Leak detection equipment - used to locate leaking water mains
- Pipe locators - used to locate underground pipes
- Sewer rodding machines - used to unclog blocked sewer lines
- Generators - used to power water supply pumps
- Sewer bucket machines - used to clean and maintain sewer lines
- Survey equipment - used to construct new works
- Mechanical hand tools - used to maintain equipment
- Submersible water pumps - used to pump water from municipal wells
- Pump control panels - used to operate submersible pumps
- Pump electrical cable - used to provide electricity to submersible pumps

Operational training and maintenance classes for utility personnel were provided for each piece of equipment. In may cases, such as with the sewer rodders, training was conducted while doing actual repair work on Tbilisi's sewer lines. Translated summaries of key operational information for each piece of equipment were provided to the utilities along with the complete English versions of the operation and maintenance manuals.

Certificates of acceptance were signed by the management at the various utilities for all equipment received. Please see Appendix D for these certificates.

Conclusions and Recommendations

A total of over $600,000 of critically needed water, wastewater, and laboratory equipment was provided to the infrastructures of Georgia during the 18

months of this project. This equipment has strengthened the critical infrastructures supporting Tbilisi and Kutaisi. Residents are now insured of the distribution of safer water as a result of the installation of new chlorination systems that disinfect the city's drinking water. With the equipment supplied to the laboratories water borne diseases can now be more quickly identified thereby decreasing the health risks to the general population. Follow-up visits were made in November and December to evaluate how equipment supplied in June were being used. All of the equipment supplied was in use and being properly operated and maintained. Please see Appendix E for Equipment/ System Follow-Up Evaluation Reports.

The equipment provided by this project only represents a temporary solution to a large scale problem. A full assessment of infrastructure requirements should be conducted to supplement the WASH report and the findings from this project. It is clearly evident that the skills to operate and maintain conventional water and wastewater equipment are available. The current problem area is the lack of any basic resources from funding, to fuel, to electricity, to spare parts, to tools needed to maintain these systems. The pool of existing resources is becoming smaller and smaller therefore limiting the ability to do any type of maintenance to Georgia's water and wastewater systems.

With the hardships currently facing Georgia, support of basic infrastructure services such as water, sewerage, and laboratory testing are essential. This project has only addressed a small portion of the problems currently facing these infrastructures and it is recommended that a second phase of this project be implemented to continue supporting these essential services. The second phase of the project would again focus on basic resources needed to operate and maintain the water and wastewater systems of Georgia. Equipment such as welding sets, jack hammers, test kits for the wastewater treatment plants, and process equipment for wastewater treatment plants are a few of the items recommended.

Additional laboratory equipment is also proposed for the epidemiology laboratories. Similar equipment, as provided to Tbilisi's and Kutaisi's laboratories in this project, is recommended to be provided to each regional laboratory to facilitate a cohesive water borne disease testing program. Through the use of similar equipment all operators would receive the same training, be familiar with the same technology, and this process would also facilitate the easy inter-change of spare parts.

Through the continuation of this project the basic infrastructure services required by the Georgian people would continue to be provided during this profound period of change. This continued assistance would provide the critical link needed to maintain water supplies and wastewater treatment as Georgia transitions into a self-sufficient democracy.

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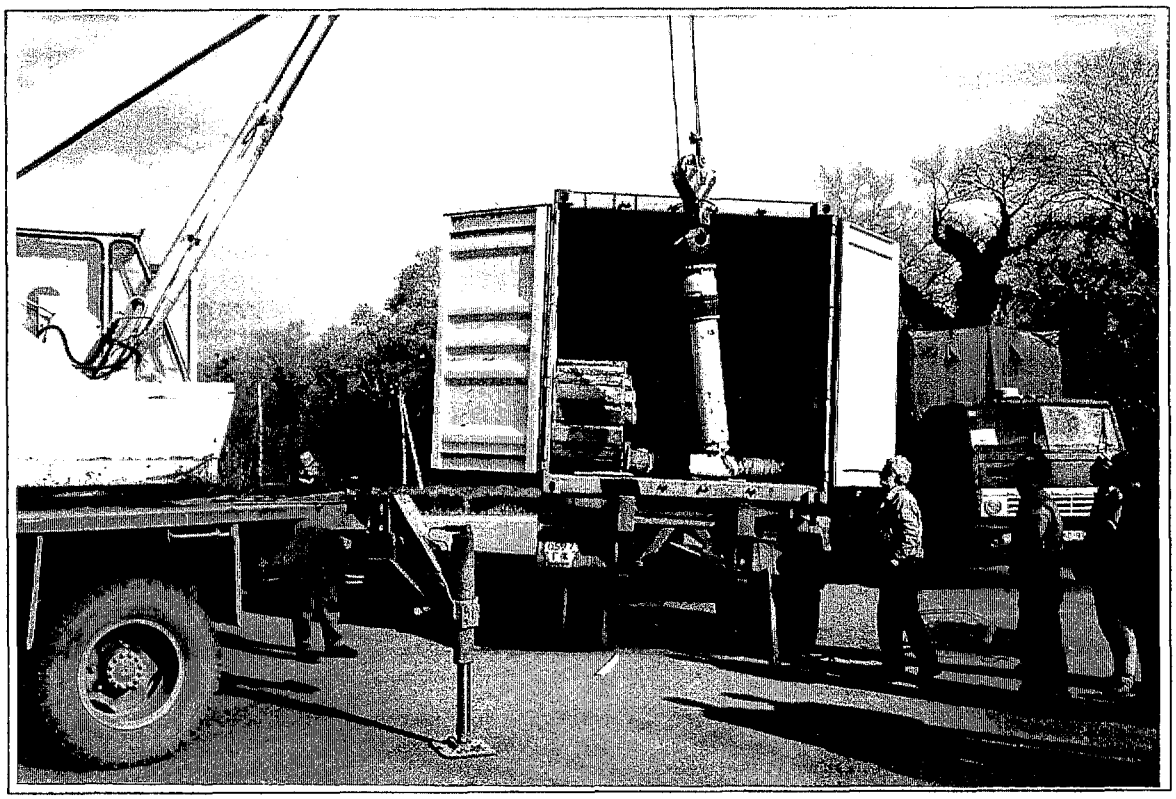
Section Two

Unpacking Equipment Shipment in Tbilisi

Unpacking Equipment Shipment in Tbilisi

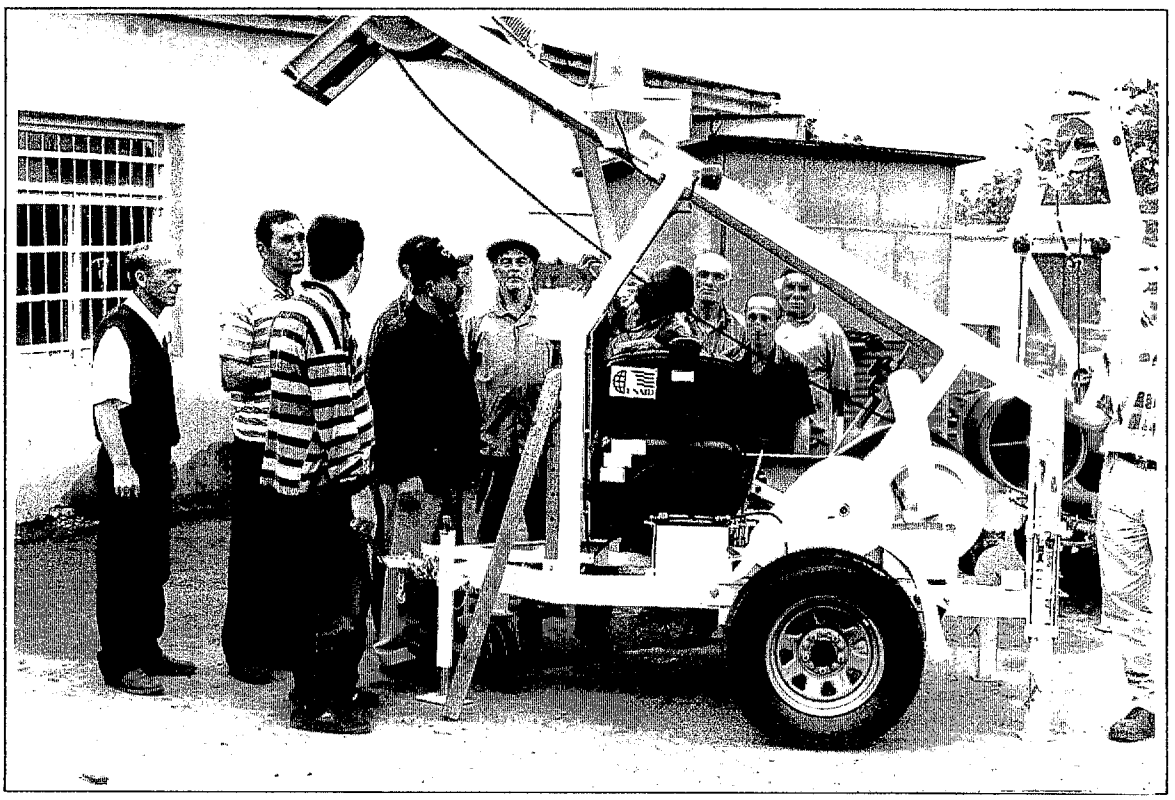


Unloading Submersible Water Pumps in Tbilisi

Inventory of Submersible Water Pumps in Tbilisi

Unloading Sewer Rodding Machines in Tbilisi

Operational Training for Sewer Rodding Machine in Tbilisi



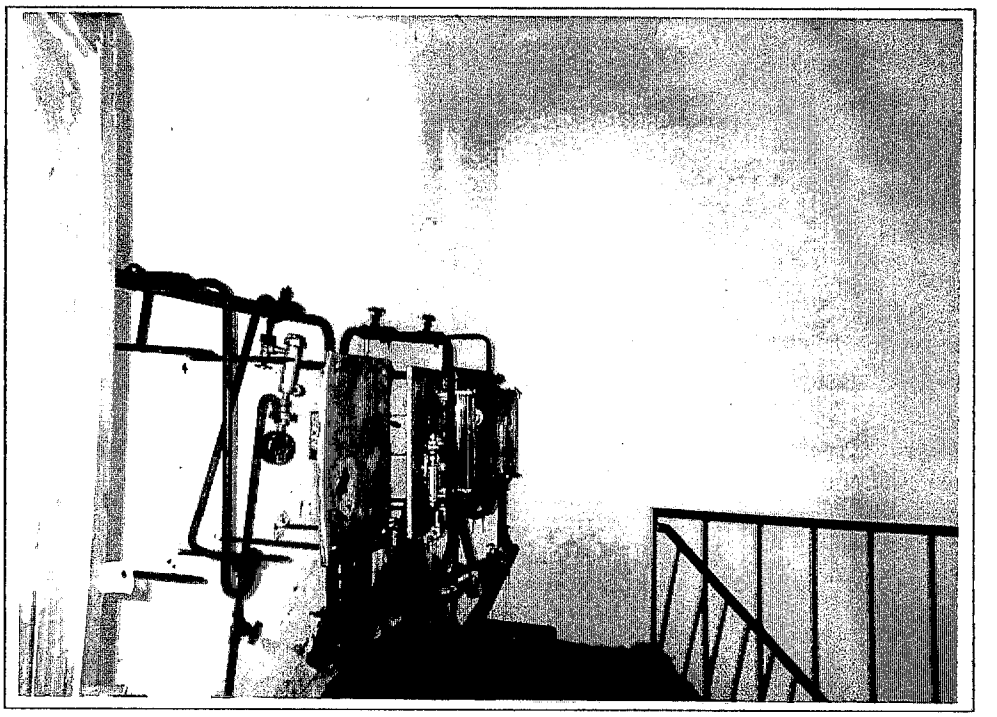
Assembly of Sewer Bucket Machines in Tbilisi

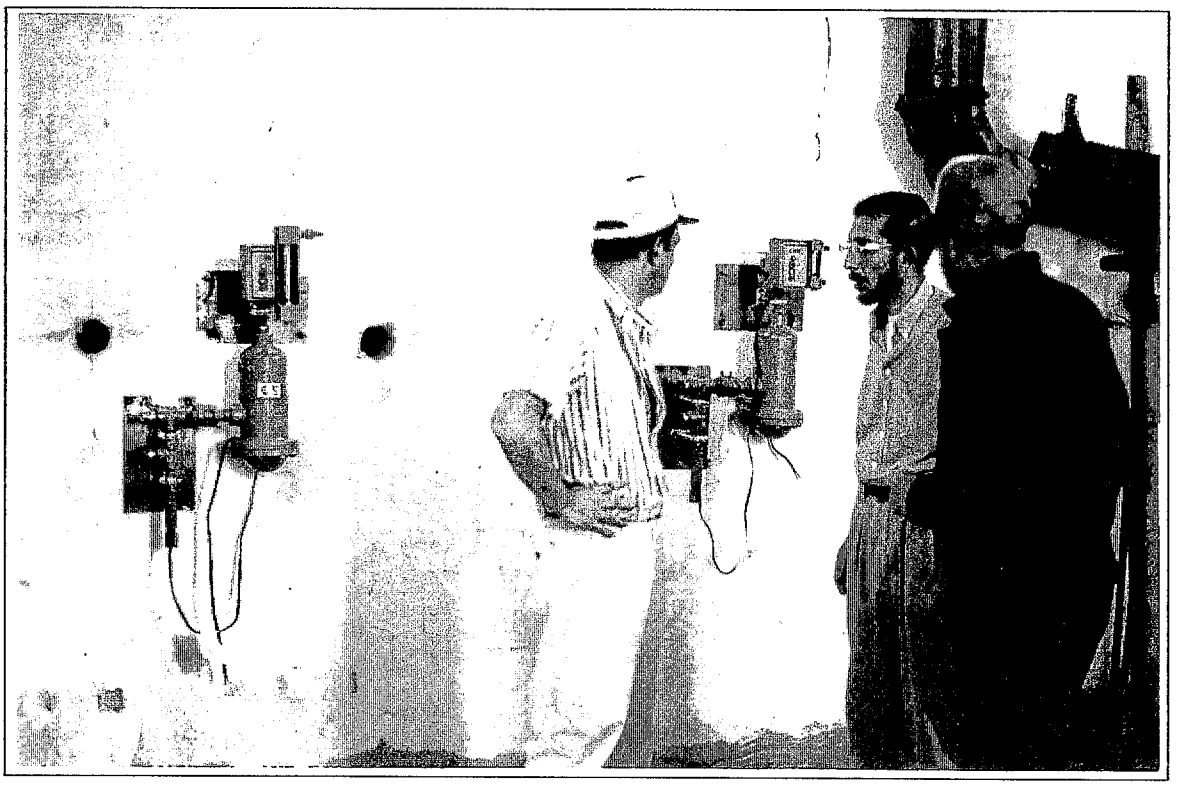
Operational Training for Sewer Bucket Machine in Tbilisi

Transporting Sewer Rodding Machine to Jobsite in Kutaisi

Transporting Sewer Bucket Machine to Jobsite in Kutaisi

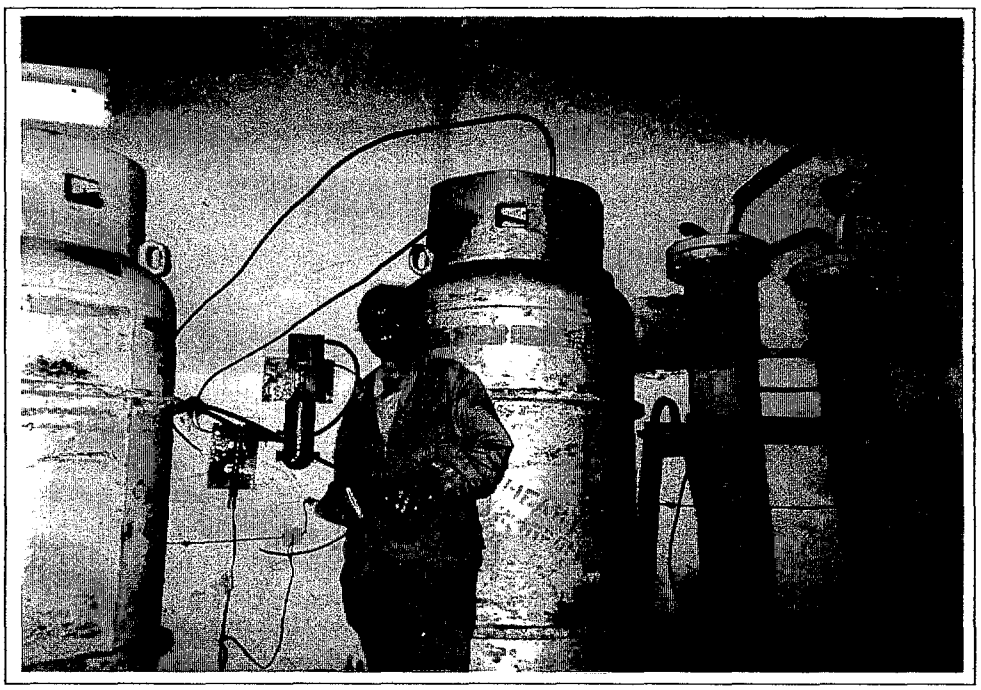
Existing Chlorination System at Grmagele Pump Station in Tbilisi





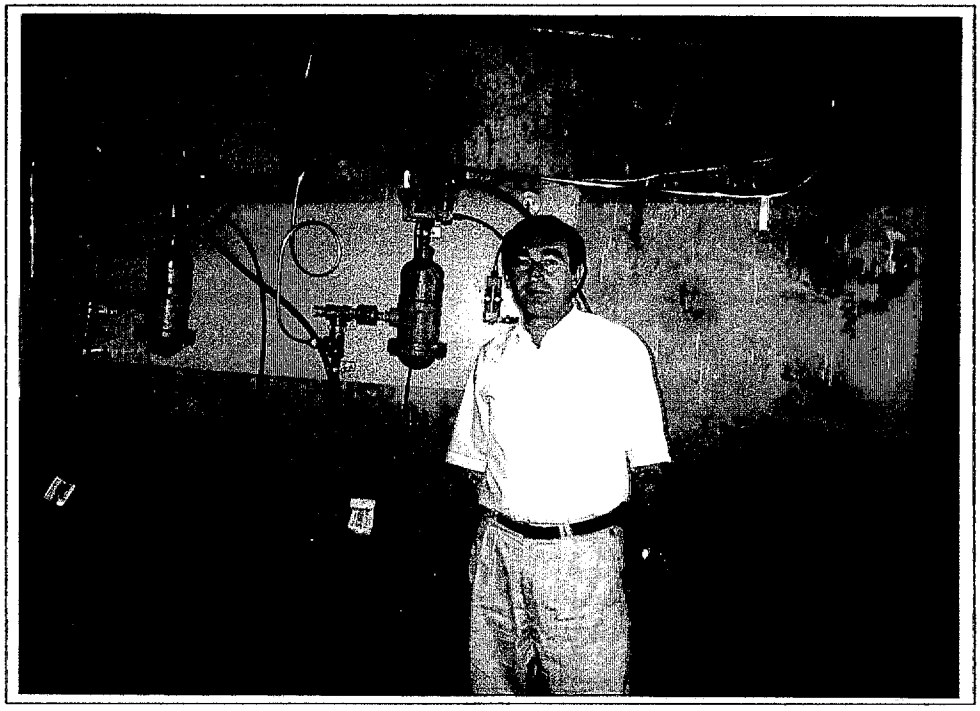
Installation of New Chlorination Equipment at Saguramo Pump Station in Tbilisi

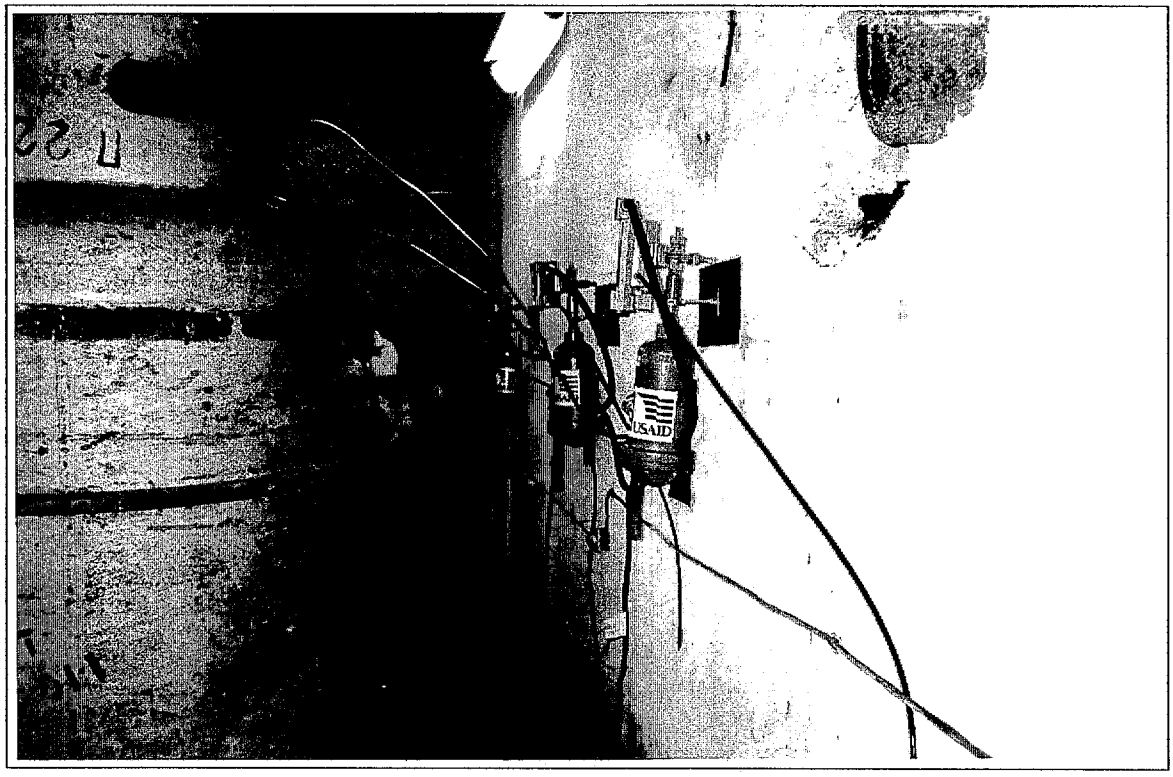
Installation of Chlorination Equipment at Samgori Pump Station in Tbilisi



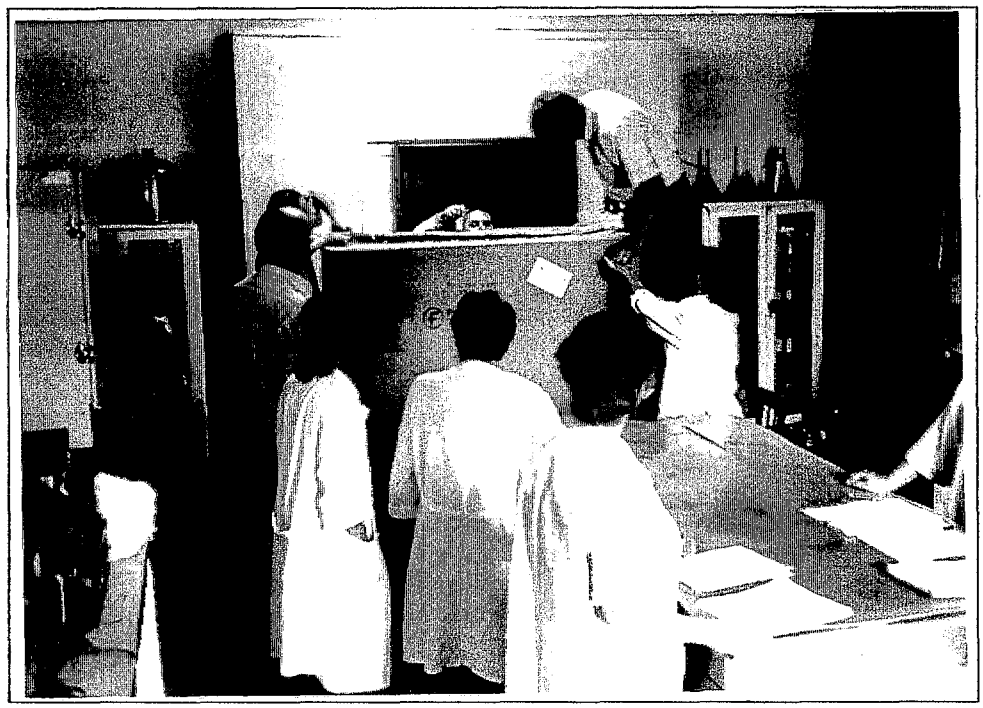
Installation of Chlorination Equipment at Natakhtari Pump Station in Tbilisi

Completed Chlorination System Installation

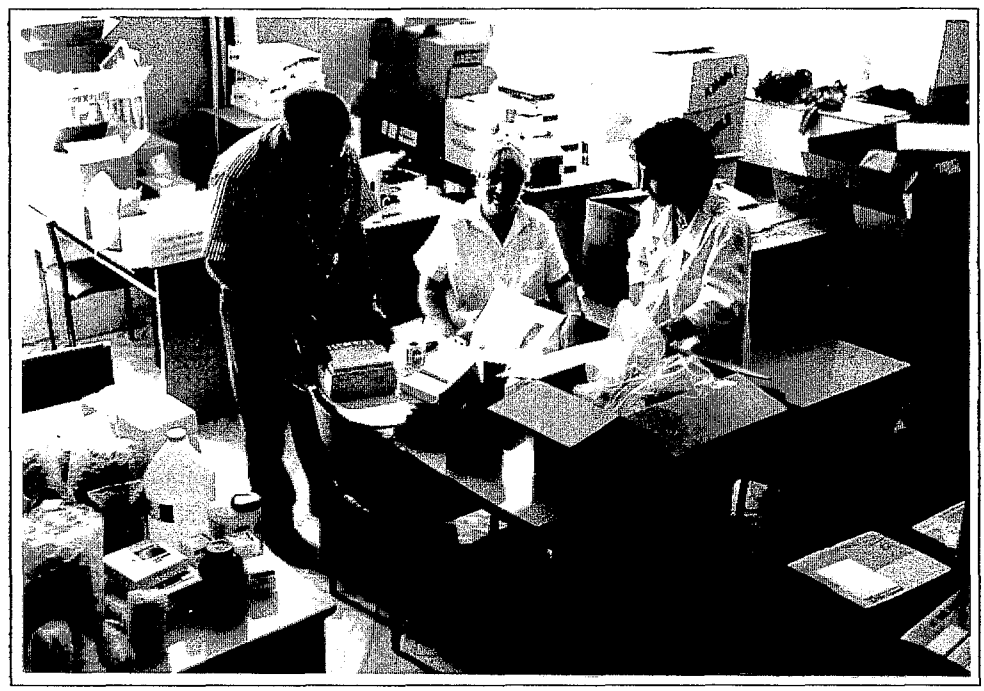




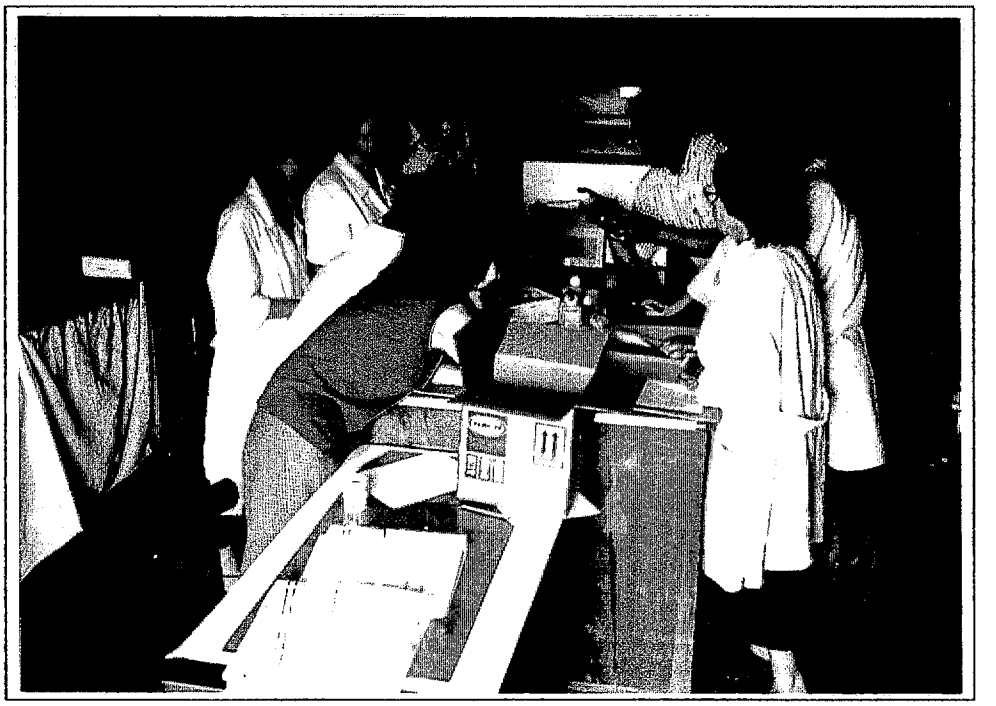
Completed Chlorination System Installation at Natakhtori Pump Station in Tbilisi



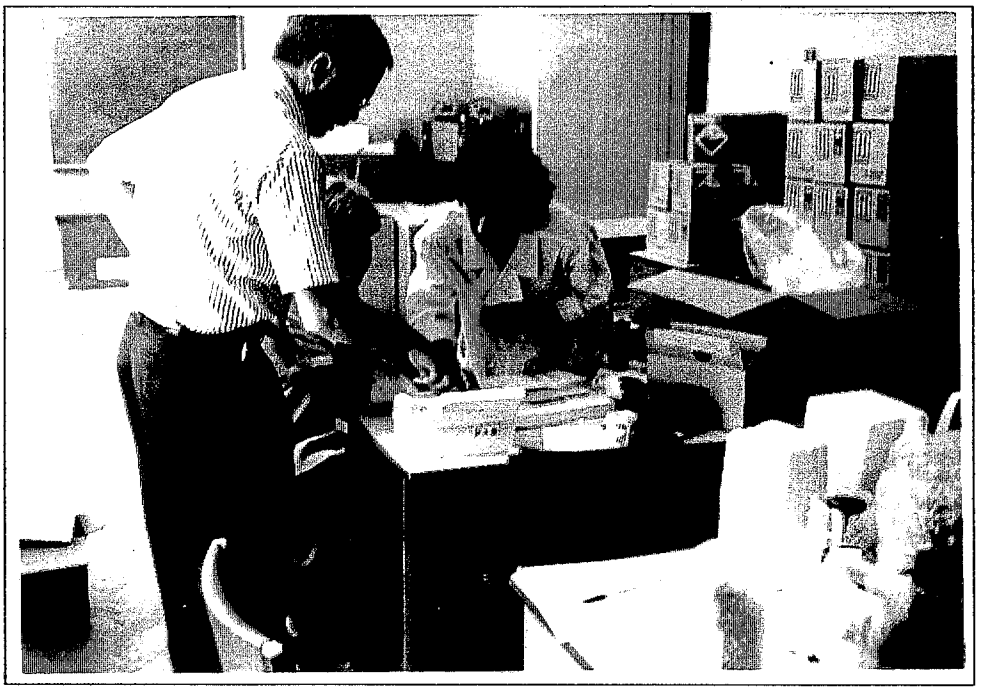
Unpacking Laboratory Equipment at the Tbilisi Epidemiology Station



Inventory of Laboratory Equipment at the Tbilisi Epidemiology Station



Operational Training for Laboratory Equipment at Tbilisi Epidemiology Station



Operational Training for Laboratory Equipment at Tbilisi Epidemiology Station

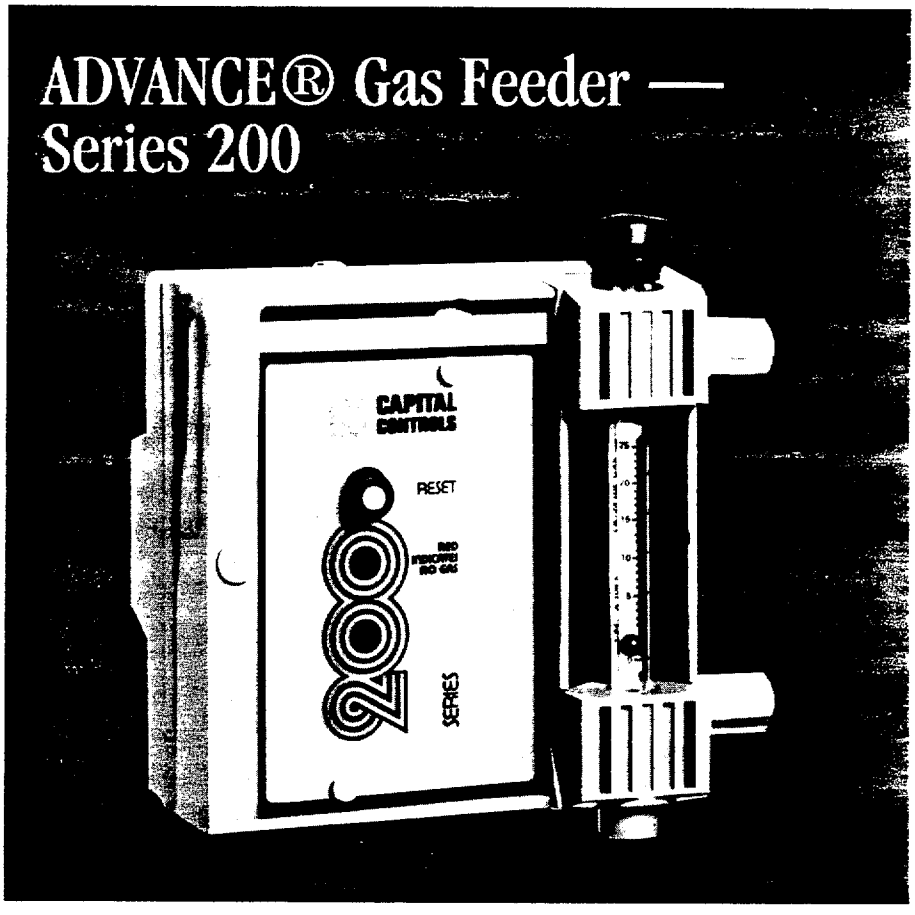
Appendix A

Appendix A

Equipment Data Sheets

Chlorination Equipment
Laboratory Equipment
Sewer Rodding Machines
Sewer Bucket Machines
Leak Detection Equipment
Diesel-Fueled Generator Set
Hand Tools

ADVANCE® Gas Feeder — Series 200



Capital Controls

ISO 9001 Certified

- **Safe and Reliable All-Vacuum Operation**
- **Lifetime Warranty on Diaphragm and Springs**
- **Worldwide Standard for Gas Feeder Technology**
- **Superior Materials of Construction for Wet or Dry Gas Service**
- **Safe Integral Venting System**
- **Capacities up to 500 PPD (10 kg/h)**
- **Solid Silver Rate and Inlet Valves**
- **Accurate Gas Metering of:**
  - **Chlorine**
  - **Sulfur Dioxide**
  - **Ammonia**
  - **Carbon Dioxide**
- **Versatile Mountings: Direct Cylinder, Manifold or Ton Container**
- **Switchover Capability with Automatic Reset for Uninterrupted Service**

Capital Controls developed the all-vacuum gas feeders which has become the worldwide standard. ADVANCE® Series 200 gas feeders are designed for manual or semi-automatic gas regulation. Automatic is a simple addition.

Easy to install, for indoor or outdoor installation, each 200 Series feeder is factory tested and needs no field adjustment prior to start-up. Ten different flowmeter capacities provide versatility in meeting gas flow requirements. Feeders mount directly on the gas valve of a cylinder, ton container or manifold utilizing a lead gasketed positive yoke clamp. Diaphragm ejectors are standard with a choice of diffuser outlets. As an option, a variety of different ejectors are available to meet your application needs.

A 200 Series gas feeder consists of a vacuum regulator, ejector and vacuum and vent tubing to make a complete system. If multiple feed points are required, remote meter panels and additional ejectors are provided. A switchover module is offered to provide for uninterrupted service.

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(Formerly A1.1200)

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Applications

For process water, waste treatment and water treatment in the municipal or industrial marketplace

- **Disinfection: potable water, municipal wastewater**
- **Chloramination: potable water**
- **Dechlorination: textiles, wastewater effluent**
- **Cooling water: control of slime and algae in piping, heat exchangers, and cooling towers**
- **Irrigation systems: slime and algae control**
- **Bleaching: textiles, pulp and paper, food**
- **Chemical/Pharmaceutical Manufacture: process and cooling water**
- **Food Processing: Washdown, canning, bleaching, taste and odor control**
- **pH neutralization**
- **Metal finishing wastes: cyanide, chromium**
- **Zebra mussel control**

Design Features

- **Sonic Flow**: Gas flows at sonic velocity maintaining constant gas flow; additional pressure regulation is not required.
- **Automatic Switchover**: A separate, independent device that does not require manual reset. Flow indication is available at both gas sources. Each gas source has a separate independent vent and an integral pressure relief device.
- **Versatility**: Cylinder, manifold or ton container mounting. Unit can be modified for semi-automatic or automatic control. Variety of ejectors available for all applications.
- **Reliable**: All vacuum operation, loss of chlorine supply indicator, integral venting system, double-thickness main regulating diaphragm, lifetime warranty on diaphragm and springs, integral gas flow indicator.
- **Ease of maintenance:** Simplicity of design and modularized components; such as the replaceable inlet capsule for minimized maintenance.
- **Superior materials of construction**: Solid silver rate valve, monel drip leg for ton mounting, corrosion resistant yoke assembly, tantalum springs

Operation

Water flowing through the ejector venturi, creates a vacuum which opens the check valve in the ejector. The vacuum is carried through the vacuum line to the vacuum regulator where the differential causes the inlet valve at the gas container to open, initiating gas flow. A spring opposed diaphragm in the vacuum regulator, regulates the vacuum. The gas passes under vacuum through the flowmeter, the rate control valve, the vacuum line and to the ejector. Here the gas is thoroughly mixed with water and applied as a solution. (Figure 1)

The system is completely under vacuum from each ejector to the gas inlet container valve. If the water supply to any ejector stops or vacuum is lost for any other reason, the spring loaded inlet valve immediately closes and isolates the gas supply. If the gas source depletes the unit seals to prevent excessive vacuum build-up and moisture from being drawn back into the gas source. When more than one feed point is desired multiple flowmeters and ejectors can be supplied.

For uninterrupted gas feeding on a round-the-clock basis, an automatic switchover system is required. Each system consists of two vacuum regulators, one vacuum type automatic switchover module, one ejector and one remote meter panel. An automatic switchover module allows gas to flow under vacuum from the regulator in service through the switchover module to the remote meter panel and the ejector, until that source is depleted. The vacuum sealing valve on the regulator then closes and the vacuum level in the system increases, initiating the spring-loaded toggle assembly switch in the switchover module. (Figure 2) The open valve on the depleted source closes while the valve on the standby source opens to permit gas flow. When a fresh gas supply replaces the depleted source it will automatically be placed in standby. The fresh supply will not be accessed until the supply in service is exhausted.

Technical Data

Capacities: Standard dual-rate indicating flowmeters are available with the following capacities 0.6, 1.5, 4, 10, 25, 50, 100, 200, 250, 500 PPD (11, 28, 75, 200 g/h, 0.5, 1, 2, 4, 5, 10 kg/h) of chlorine gas. To determine feed rates for other gases, multiply each chlorine value by:

- 0.95 for sulfur dioxide
- 0.50 for ammonia
- 0.78 for carbon dioxide

Flowmeter: The minimum feed capacity for every gas flowmeter is 1/20th of the maximum capacity. Accuracy is within ±4% of maximum flowmeter capacity.

Electrical Requirements: On ton mounted units the drip leg is provided with a 120/240 Vac, 50/60 Hz, single phase heater. Explosion-proof heaters are available upon request.

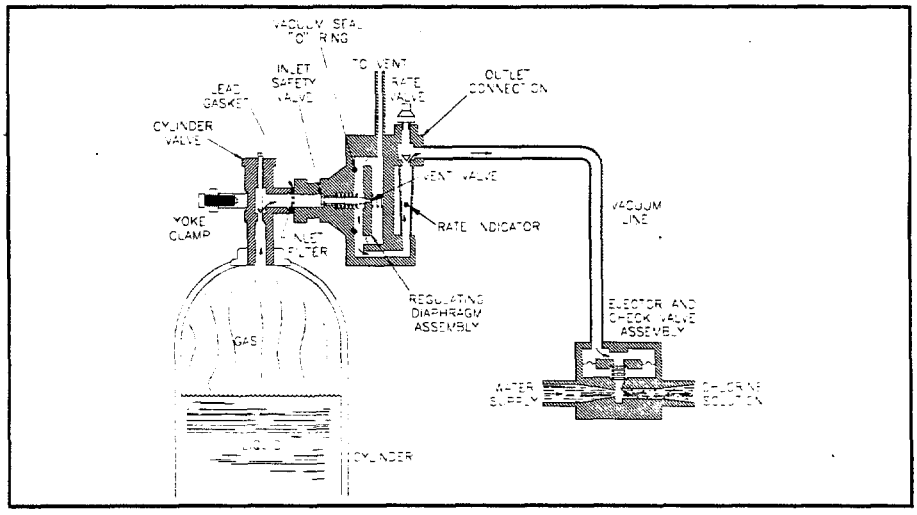

Figure 1 - Cylinder Mounted Chlorinator Flow Diagram

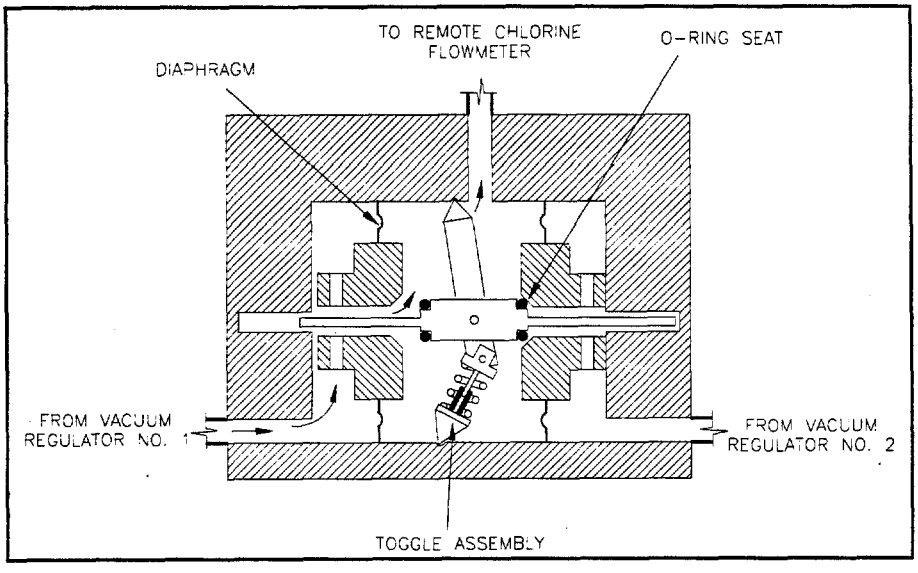

Figure 2 - Automatic Switchover Flow Diagram

Warranty and Capability

Capital Controls offers a lifetime warranty on the diaphragm and springs. There is a three (3) year limited warranty on 200 Series equipment.

Capital Controls is ISO 9001 certified to provide quality and precision materials, and specializes in disinfection technologies, water quality monitors and instrumentation for water and wastewater. Over 30 years of industrial and municipal application experience in the water and wastewater industries is incorporated into the equipment design to provide the highest quality comprehensive solutions for the global market.

Model Information Code

Model 2 0 2 C 3

Maximum Capacity
1 - 100 PPD/2 kg/h
2 - 250 PPD/5 kg/h
3 - 500 PPD/10 kg/h

Gas Handled
A - Ammonia
B - Carbon Dioxide
C - Chlorine
S- Sulfur Dioxide

Vacuum Regulator Mounting
1 - Cylinder or manifold mounted with rate valve
2 - Ton mounted with rate valve
3 - Cylinder or manifold mounted with remote meter(s) and rate valve
4 - Ton mounted with remote meter(s) and rate valve
5 - Cylinder or manifold mounted with automatic switchover
6 - Ton mounted with automatic switchover

Brief Specification

The gas feeder design shall be of the vacuum operated, solution feed type. The gas feeder shall be constructed of materials suitable for wet or dry gas service. All springs used in the vacuum regulator shall be of tantalum alloy (*stainless steel for ammonia*). The rate valve and seat shall be solid silver (*stainless steel for ammonia*). A double-thickness diaphragm shall be provided for vacuum regulation. The rate of gas feed shall be set manually and shall remain constant until manually changed. The gas shall flow at sonic velocity and a differential pressure regulator shall not be required.

The system shall be convertible to automatic control by insertion of a motorized control valve in the vacuum line to receive a signal from the appropriate control equipment.

The vacuum regulator shall mount directly on the container valve by means of a corrosion resistant yoke assembly. A spring-opposed diaphragm shall close tight upon loss of vacuum. Each vacuum regulator shall be equipped with a loss-of-gas indicator, and a gas flowmeter. A spring-loaded diaphragm actuated pressure relief valve integral to the vacuum regulator shall be provided to relieve gas pressure. The inlet capsule shall be a complete module, installed without the use of any tools.

The ejector shall be provided with a spring-loaded check valve to prevent flooding of the vacuum regulator. Automatic switchover shall be provided with automatic reset and integrally mounted vacuum regulator flow indicator.

Represented by:

EUROPEAN HEADQUARTERS
Crown Quay Lane,
Sittingbourne, Kent
ME 10 3JG U.K.
Tel: 0795-476241
Telex: 96536 CAPCO G
FAX: 0795-479052

HONG KONG

MALAYSIA

Capital Controls

Capital Controls Company, Inc.
3000 Advance Lane, P.O. Box 211
Colmar, PA 18915
Tel: 215-997-4000
Fax: 215-997-4062

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Pub. No. 681-2 7/94 6M

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(Formerly A1.1200)

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CHLORINE SPECIALTIES INC

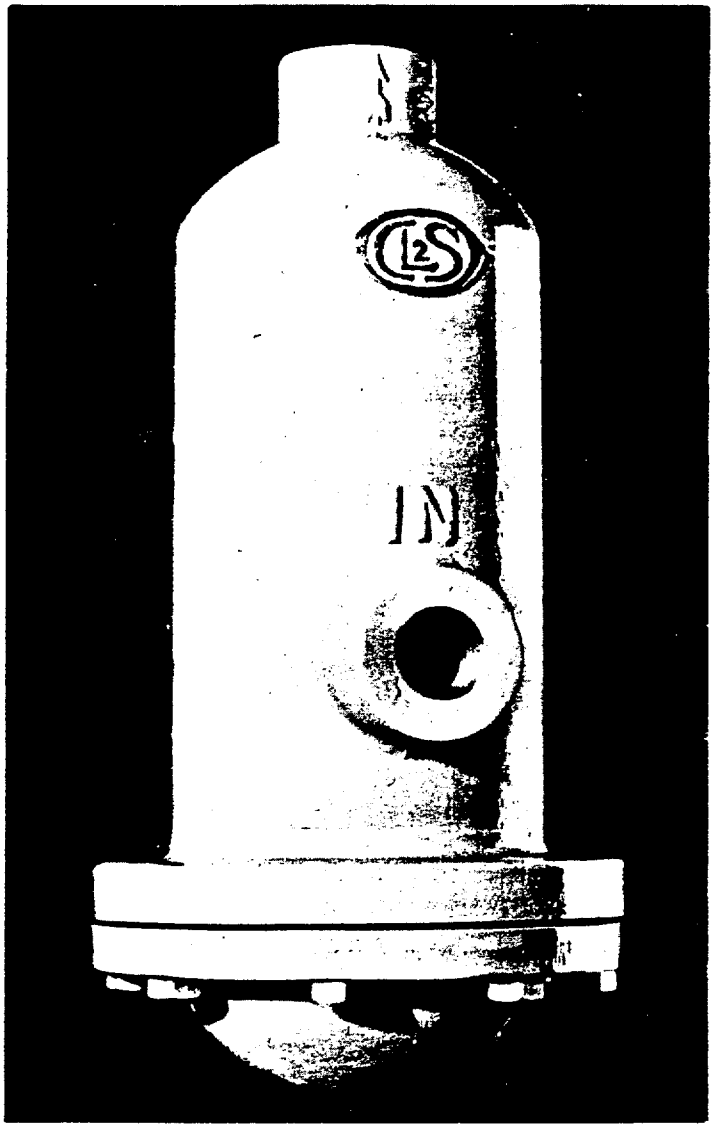
C-282 Chlorine Gas Filter

FACTS ABOUT IMPURITIES IN CHLORINE GAS

The principal impurity is FERRIC CHLORIDE. This is inherent in chlorine gas because it is packaged in steel containers.

The amount of ferric chloride that deposits out in a chlorine gas system is a function of the quantity of chlorine used.

Lesser impurities can result from use of lubricants used in valves of the packaging system.



There is no convenient way of removing impurities from liquid chlorine. Impurities will always precipitate out of gas if it reliquefies. This is a common occurence at points where there is a sudden pressure drop. Wide fluctuations in ambient temperature of chlorine storage space can cause reliquefaction.

DESIGN FEATURES OF C-282 FILTER

The C-282 Filter represents a new approach to the removal of the nuisance-causing impurities in chlorine gas. This filter has two chambers. The lower portion acts as a trap for liquid impurities (reliquefied gas and/or foam droplets from the evaporator). The sudden enlargement decreases the velocity so that gas is unable to carry entrained droplets of liquid chlorine which is high in ferric chloride. The upper portion has a removable filter cartridge. The filter element is especially impregnated so that the ferric chloride "plates out" rapidly as it passes through the element. Therefore the filter acts as both a filter and a condensate trap.

The C-282 Filter is made of 25,000 lb. tensile strength grey iron castings and is rated at 560 lbs. per square inch working pressure.

R-1256

*Trademark

CHLORINE SPECIALTIES INC

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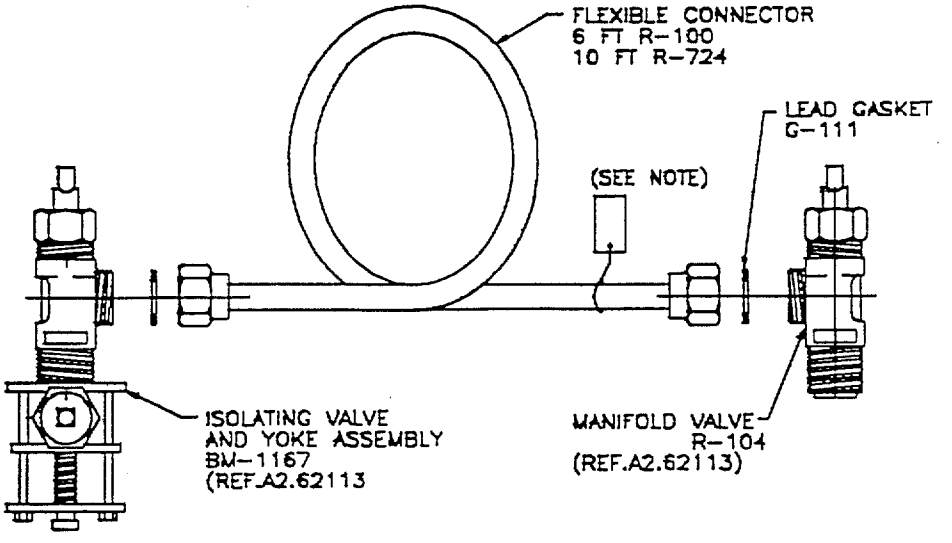
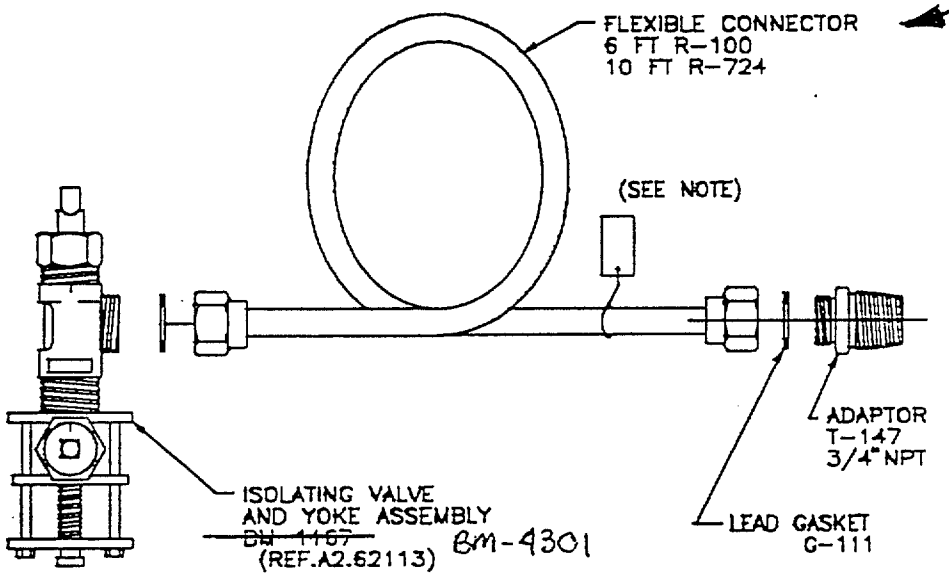
26

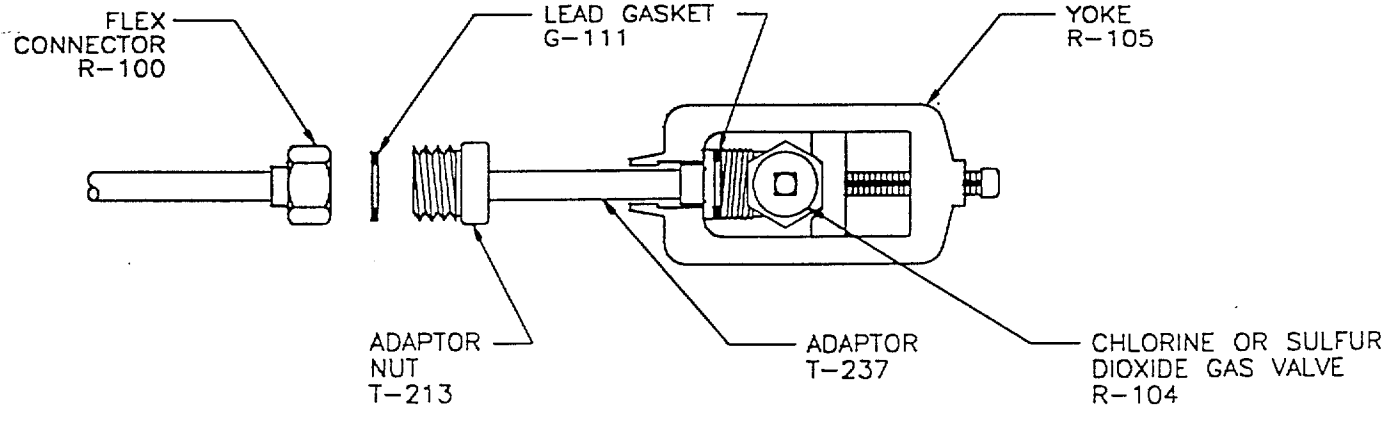
Flexible Connector with Manifold and Isolating Valves



Flexible Connector with Adaptor and Isolating Valve

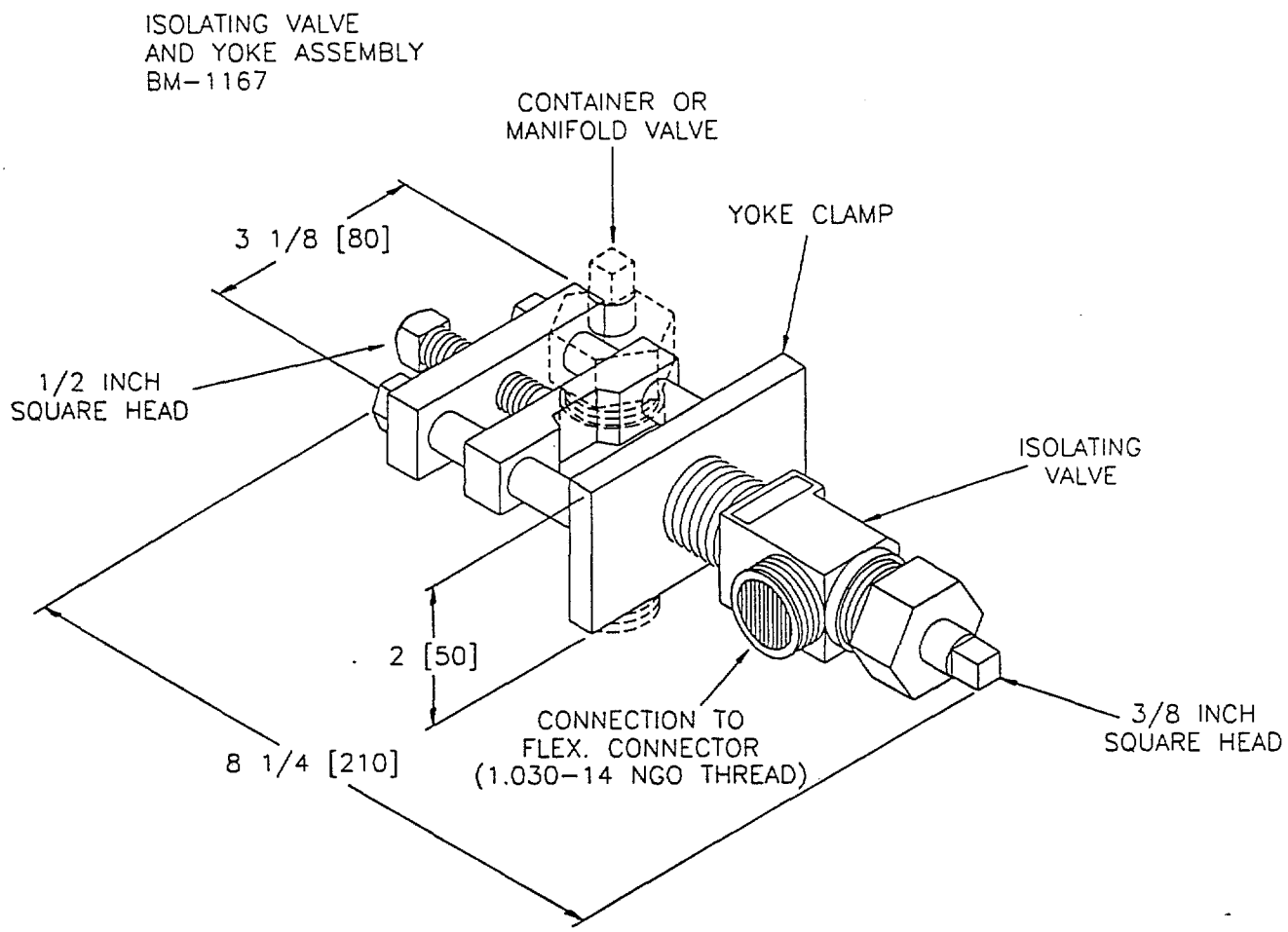


Yoke for Chlorine or Sulfur Dioxide Gas Valve



Container Isolating Valve Assembly — ~~BM-1167~~

Capital Controls



LEGEND: INCHES [MILLIMETERS]

Notes:

1. Weight: 3 lb.. (2 kg)
1. Materials of construction:
   Isolating valve: Aluminum silicon bronze
   Yoke assembly: Steel plated and epoxy coated
3. Isolating valve and yoke assembly are suitable for chlorine and sulfur dioxide gas or liquid service.

120.3020.0
(Formerly A2.62113)

DREL/2000 LABORATORIES

Customized for Special Applications

DREL/2000 Water Conditioning Laboratory

Water Conditioning Laboratory

Cat. No. 45250-50

Water treatment specialists need to perform a complete water analysis before any type of system can be specified for a client. With Hach simplified methods and premeasured reagents, any specialist can, without a background in chemistry, perform analytical tests on water at the client's site or in the office. This portable laboratory includes the LeadTrak™ lead test, Hach's unique, economical method for detecting trace amounts of lead in drinking water quickly, at point-of-use.

Complete System

A DR/2000, a Digital Titrator, a Hach One Portable pH Meter, Conductivity/TDS Meter, procedures manual, step-by-step instructions and enough premeasured reagent to perform up to 100 tests of most parameters are standard equipment in this DREL/2000. **See page 187 for ranges, parameters and ordering information.**

Aquaculture Laboratory

Cat. No. 45250-40

A basic requirement for success in aquaculture is careful control of the parameters critical to fish production. Effective control begins with the analysis of the water in which fish live so as to provide a balanced environment and ultimately maximize the harvest.

When monitoring water quality with the DREL/2000 for Aquaculture, analysts can get the accurate results associated with a traditional laboratory coupled with the convenience and rapid results associated with a portable "lab in a box." Large-scale operators, research workers, educators and wildlife management personnel will appreciate the versatility and flexibility of this system, suitable for fresh- and/or salt-water analysis.

Complete System

Standard equipment includes a DR/2000, a Hach One pH Meter, Conductivity/TDS Meter, Dissolved Oxygen Sample Apparatus and Digital Titrator—all contained in two rugged carrying cases. A procedures manual, step-by-step instructions, and all necessary reagents and apparatus are at your fingertips when you use this DREL/2000. **See page 175 for ranges, parameters and ordering information.**

Surface Finishing Laboratory

Cat. No. 45250-30

The basic Surface Finisher's Laboratory includes the DR/2000, printed step-by-step procedures, a Digital Titrator and Hach's Titration End Point Adapter.

The Digital Titrator is a precision dispensing device fitted with concentrated titrants in compact, interchangeable cartridges (see pages 68-70). The Endpoint Adapter (see page 68) is a unique accessory which allows the user to determine photometrically the endpoint of titrations in which a color or turbidity change is difficult to detect visually. Other apparatus in this lab include flasks, measuring cylinders, and a portable heating device.

An expanded laboratory (Cat. No. 45250-31) combines the basic lab with two portable Hach instruments—the Hach One pH Meter and the Conductivity/TDS Meter. **See page 183 for ordering information.**

Choose the Water Analysis Lab that Suits Your Needs

For optimum convenience, select the factory-configured DREL equipped with the reagents, apparatus and instrumentation that meet your testing requirements (see Table 1). **See page 193 for additional information.**

Table 1 Customized Water Quality Laboratories

DREL/2000 Model	45250-01	45250-02	45250-03	45250-04	45250-05†	45250-10†	45250-15†	45250-17†
DR/2000	■	■	■	■	■	■	■	■
Digital Titrator					■	■	■	■
Procedures & Instrument Manual	■	■	■	■	■	■	■	■
Carrying Case	■	■	■	■	■	■	■	■
Hach One pH Meter			■	■	■			■
Conductivity/TDS Meter		■		■	■		■	
Supplies, Apparatus & Reagents					■	■	■	■
Approximate Shipping Weight	29 lbs (13 kg)	34 lbs (15 kg)	34 lbs (15 kg)	39 lbs (18 kg)	52 lbs (24 kg)	43 lbs (20 kg)	48 lbs (22 kg)	48 lbs (22 kg)
DREL/2000 Price	$1700	2195	2195	2690	3195	2200	2695	2695

†Two case configuration

DREL/2000 PORTABLE LABORATORY

Customized Testing in the Lab or in the Field

SPECTROPHOTOMETERS

We've organized the DR/2000 Spectrophotometer, instruments, apparatus and reagents into a portable lab for fast, accurate testing anywhere, anytime. Use the DR/2000 on-line power in the lab, or switch to rechargeable battery operation for convenient field use. Customize your own laboratory by adding the instruments and reagents your testing program requires, or select from 14 different equipment package options. You'll find eight variations for water analysis, two for soils analysis, two for surface finishing plus versions for water conditioning and aquaculture.

Basic Instrumentation

Each DREL/2000 comes complete with a DR/2000 Spectrophotometer, rechargeable battery, battery eliminator/charger and a comprehensive, illustrated procedures manual. The basic DREL/2000 is transported in a rugged, durable carrying case.

DREL carrying case dimensions:
Instrument module: 57 x 31 x 26 cm (22.5 x 12.25 x 10.5")
Chemistry/Apparatus module: 57 x 31 x 22 cm (22.5 x 12.25 x 8.75")

Complete DREL/2000

For optimum convenience and savings, many analysts select the fully-equipped version (Cat. No. 45250-05) already outfitted with reagents and apparatus for 29 common water quality tests. This configuration is transported in two rugged carrying cases: one module contains instruments while the other holds apparatus and chemistry.

This complete DREL/2000 includes:

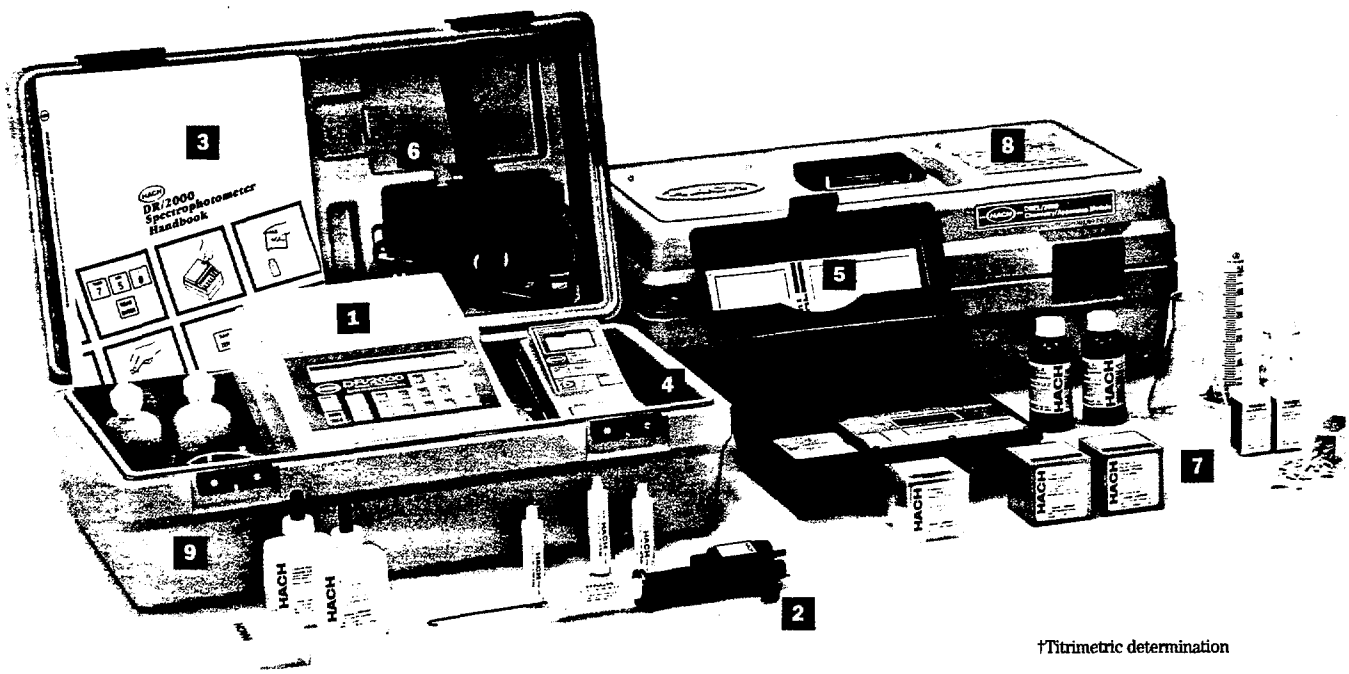
1. DR/2000 Spectrophotometer
2. Unbreakable Digital Titrator
3. Procedures and Instrument Manual
4. Portable Hach One™ pH Meter
5. Portable Conductivity/TDS (Total Dissolved Solids) Meter
6. Battery eliminator/charger
7. Reagents and apparatus
8. Apparatus/Chemistry case
9. Instrument case

Reagents for the following tests are included in the fully-equipped DREL/2000. Supplement this list with reagents for your own testing needs. Those approved by the USEPA for reporting purposes are marked with an asterisk. Sample pretreatment may be required. See page 193 for ranges.

Acidity, Methyl Orange†
Acidity, Phenolphthalein†
Alkalinity, P and T†
Bromine
Calcium†
Carbon Dioxide†
Chloride†
*Chlorine, Free and Total
*Chromium, Hexavalent
*Conductivity
*Copper
*Fluoride
Hardness, Total†
Iodine
*Iron, Total
*Manganese, High Range
*Nitrogen, Ammonia
Nitrogen, Nitrate, High and Mid Range
*Nitrogen, Nitrite, Low Range
Oxygen, Dissolved†
*pH (with meter)
*Phosphorus, Reactive, Low Range
Phosphorus, Acid Hydrolyzable
*Phosphorus, Organic and Acid (Total)
Residue, Nonfilterable
Silica, Low Range
Sodium Chromate
*Sulfate
*Sulfide
Turbidity (Absorptometric)

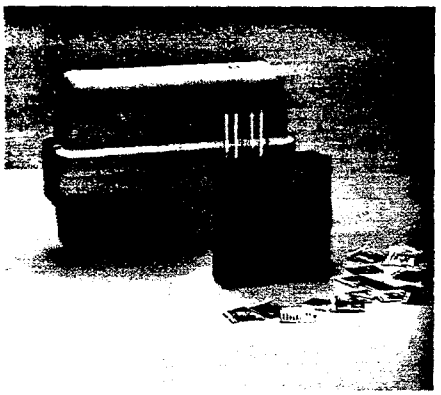
Applications Lab Researches Solutions

If you have special testing needs or difficulties in analyzing a particular sample, we may be able to help. Circle **9282** on the reply card and we'll send you a brief questionnaire to fill out and return to us. After reviewing your request, we will contact you with further information.

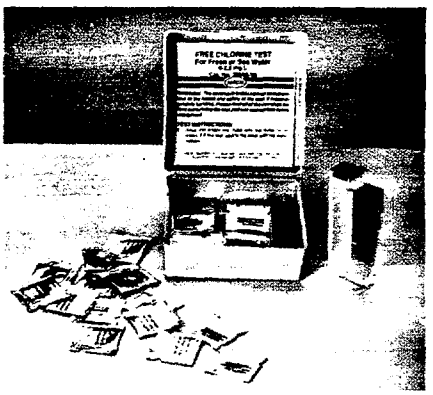


†Titrimetric determination

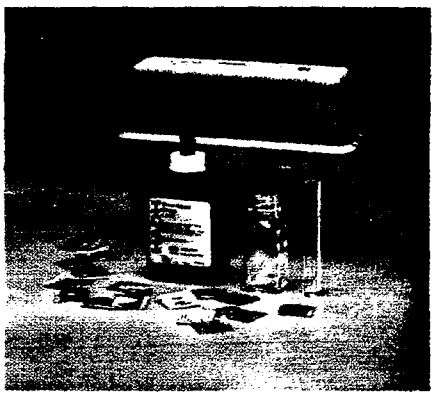
CHLORIDE, CHLORINE



Free and Total Chlorine—
Model CN-66, Cat. No. 2231-01



Low Range Chlorine—
Cube Model, Cat. No. 20603-00



Chloride—CD-51,
Cat. No. 2086-01

TEST KITS

Chloride. Found in nearly all natural waters, chloride affects human taste above 250 mg/L. High levels inhibit plant growth, and many industrial processes need to limit chloride concentration. Test kits use either silver or mercuric nitrate titrant and the Model CD-DT, a multi-range kit, is supplied with a demineralizer bottle for high-range sample dilution.

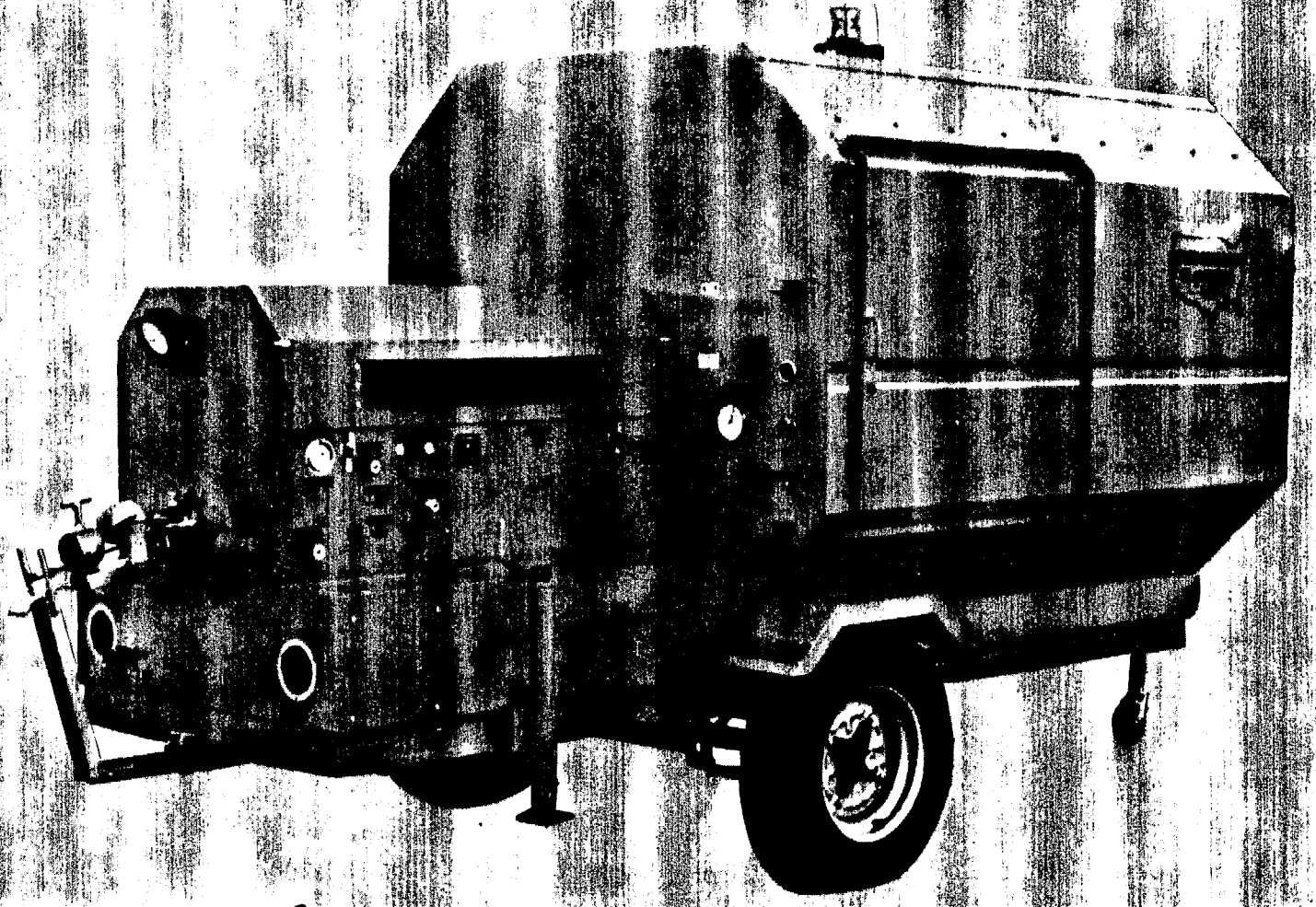
Chlorine. The most widely used disinfectant for drinking water, chlorine is also important for sanitizing swimming pools, cooling towers and other industrial equipment, and in the treatment of municipal wastewater. Its measurement and control are vital for both safety and economic reasons.

Many Hach chlorine tests have been approved by the U.S. Environmental Protection

Test	Cat. No.	Model	Range (mg/L)	Smallest Increment (mg/L)	Method/Chemistry	Approx. No. of Tests	Case Style (See p. 194)	Ship. Wt. (lb)	Price
Chloride	**1440-01**	8-P	5-100	5	Drop count titration/	100	B	1	$25.00
As Cl^-			20-400	20	Silver nitrate				
	2086-01	CD-51	500-10,000	500	Drop count titration/	100	B	1	62.50
			5000-100,000	5000	Silver nitrate				
As Cl^-	**20635-00**	CD-DT	10-8000	0.1-20	Digital Titrator/ Mercuric nitrate	100	F	4	150.15
Chlorine, low range									
As free Cl_2	**20603-00**	Cube	0-2.5	0.5	Color cube/ DPD	50 F	A	0.5	12.50
As total Cl_2	**20604-00**	Cube	0-2.5	0.5	Color cube/ DPD	50 T	A	0.25	12.50
As free Cl_2	**2231-02***	CN-66F	0-3.5	0.1	Color disc/ DPD	100 F	B	1	32.50
As total Cl_2	**2231-03***	CN-66T	0-3.5	0.1	Color disc/ DPD	100 T	B	1	32.50
As free & total Cl_2	**2231-01***	CN-66	0-3.5	0.1	Color disc/ DPD	50 F + 50 T	B	1	32.50
As free & total Cl_2	**14542-00***	CN-70	0-0.7	0.02	Color disc/	100 F	D	2	45.75
			0-3.5	0.1	DPD	+ 100 T			
As free Cl_2	**14542-01***	CN-70F	0-0.7	0.02	Color disc/	200	D	2.5	45.75
			0-3.5	0.1	DPD				
As total Cl_2	**14542-02***	CN-70T	0-3.5	0.1	Color disc/	200	D	2.5	41.45
			0-0.7	0.02	DPD				
As free & total Cl_2	**21290-00***	CN-80	0-0.7	0.02	Color disc/	100 F	D	2.5	75.50
			0-3.5	0.1	DPD	+ 100 T			
(0-10 mg/L: T only)			0-10T	0.5					
As free & total Cl_2	**41100-02†**	DR 100	0-2	0.02	Colorimeter/	100 F	F	3.5	245.00
			0-3.5	0.1	DPD	+ 100 T			
AccuVac Ampuls (as free Cl_2)	**25020-25†**	AccuVac	0-2	Pkg of 25 *free* chlorine reagent ampuls (resupply for Cat. No. 41100-02)		25			12.95
AccuVac Ampuls (as total Cl_2)	**25030-25†**	AccuVac	0-2	Pkg of 25 *total* chlorine reagent ampuls (resupply for Cat. No. 41100-02)		25			12.95
As free & total Cl_2	**46700-00†**	Pocket Colorimeter	0-2	0.01	Colorimeter/	100	D	2.5	295.00
			0-4.5	0.1	DPD				

*Approved by some states for potable water reporting under specified conditions. Check with your regulatory agency.
†USEPA-approved for analysis of wastewater and potable water.

NEW Model 444 Sectional Rodder



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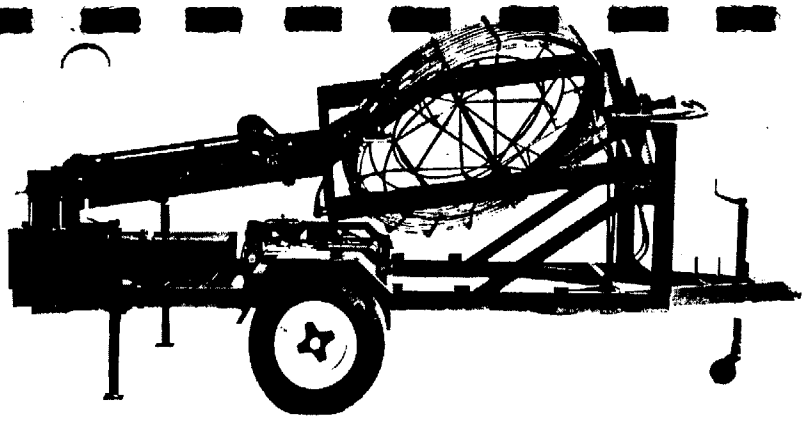
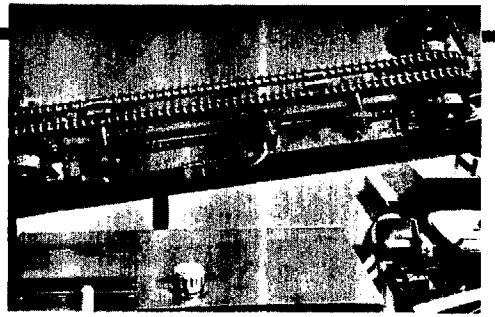
31



Model 444. The most modern answer to automated sectional rodding. Rod Reel mounted in a unitary balanced frame — rotates about its axis — powered by 18, 20, or 25 h.p. engine — PTO available with truck mounts.



Positive Rod Drive is accomplished by means of 5 hardened tool steel drive dogs spaced between endless heavy duty dual chain. Rod Drive counter balanced for concentricity.

THE MODEL 444 SECTIONAL RODDER WITH AUTO-DRIVE

The Model 444 Sectional Rodder is available as a trailer or truck mounted unit. This "easy-to-set-up" machine is available with Manual or Automatic Controls (Auto-Drive System). When the Model 444 is outfitted with Automatic Controls, the machine is designed to automatically retrieve the rod and tool when an excessive obstruction is encountered. The rod and tool reverse and Automatically stop. This type of system preserves the condition of the rods and enhances the operators abilities to clean sewer lines and open sewer stoppages. Other machines which do not have the Automatic Controls (Auto-Drive System) fail to automatically stop when trouble is encountered. The Model 444 uses 5/16" or 3/8" sectional rods.

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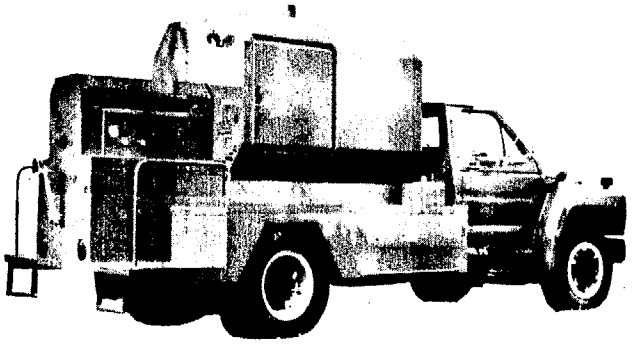
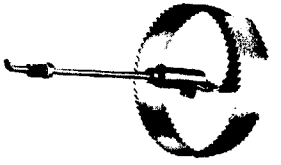


Truck-mounted rodders available with power take off or independent auxiliary engine. Deluxe skirting, platforms, and tool boxes optional.

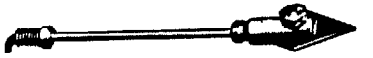
HEAVY DUTY HOSE GUIDES



HEAVY DUTY ROOT SAW

SECTIONAL STEEL RODS (5/16 and 3/8)

SQUARE BAR CORKSCREW



SPEAR HEAD

ROUND STOCK CORKSCREW

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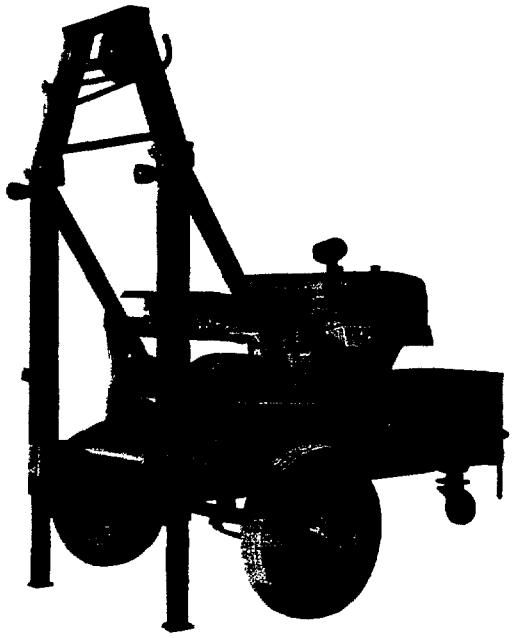
BUCKET MACHINES

The only positive way to remove all debris in larger sewer lines from manhole to manhole is with SRECO-FLEXIBLE® Bucket Machines

SRECO FLEXIBLE®

World's largest, most experienced full-line manufacturer of sewer cleaning systems and equipment

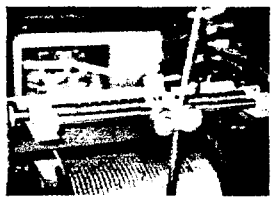


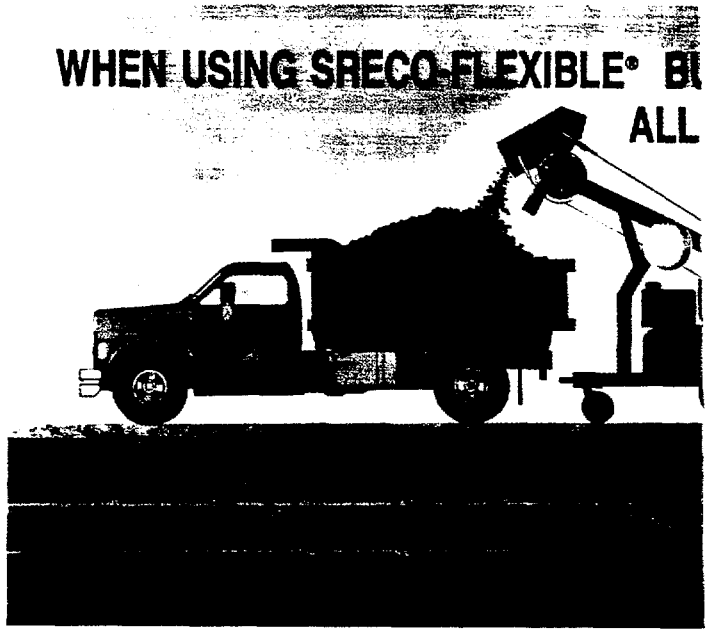
PULL-IN

STANDARD TRUCK LOADER

FLOATING SCROLL

Optional on SRECO-FLEXIBLE® Pull-In Machines, the Floating Scroll compensates for amount of cable on drum. Rolling outward it allows cable to wrap uniformly without overlap, prolongs life of level winding mechanism.





MECHANICAL PULL-

SRECO-FLEXIBLE® Mechanical Bucket Machines are designed with a variety of types and sizes to get the job done properly.

The chassis construction of both Pull-In and Truck Loader includes rugged channel base frames and I-beam uprights for strength. Each unit is equipped with a retractable swivel wheel and two leaf spring mounted wheels with pneumatic tires. Retractable leveling legs include a rack and pinion raising mechanism with positive lock.

Engines ranging from 10 to 65 horsepower are available. All engines include starters and alternators. Batteries are additional.

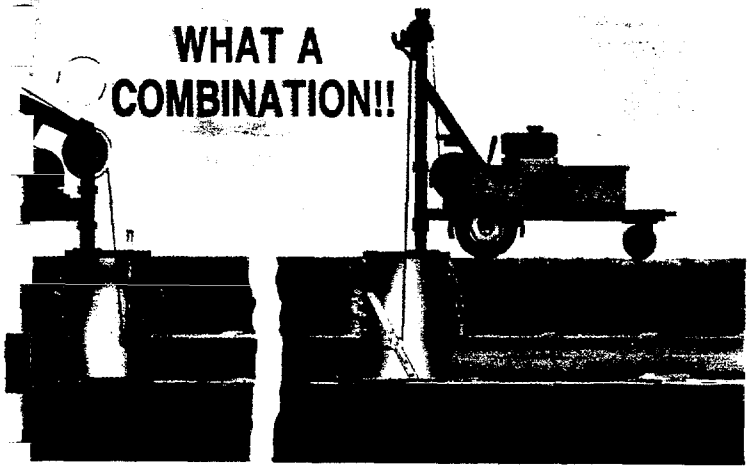
Main drum clutches are positive type, designed for manual release with center pull knob. Clutches lock in neutral position for free spooling. Disengaging not required for normal bucket operation.

Safety booster drive is belt type for smooth transfer of power. Tension is adjustable and will slip under overload conditions to protect sewer pipe and machine.

Main cable drums have a capacity of 1000 ft. of 1/2" cable. Overnight drums with a capacity of 1000 ft. of 1/4" cable, are operable from all machines.

Cable winders are automatic reel type for 1/2" cable. Standard drive train on all units is heavy-duty

ET MACHINES YOU WILL REMOVE BRIS LEAVING ONLY THE LIQUIDS...



and TRUCK LOADER

When purchasing SRECO-FLEXIBLE® Bucket Machines you receive over forty years experience in the proper set up and operation of these units which is another key to successful cleaning.

chain and sprocket for power transfer to all assemblies, including overnight drum operation. Optional transmissions include three and four speed gear box type.

Tow bars, interchangeable on Truck Loader and Pull-In Machines, permit transporting units in tandem.

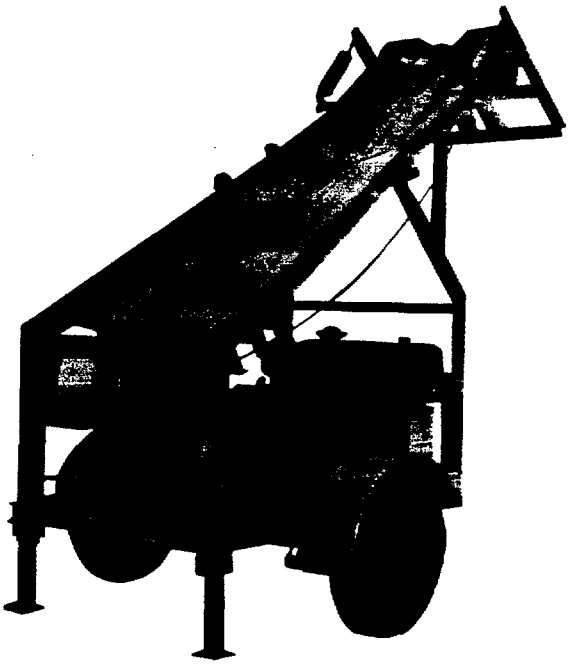
For safe operation, the main cable drum on the Pull-In is positioned in a manner that the cable itself is never more than ten degrees out of parallel with the uprights.

Conveyor chutes are constructed of I-beam with heavy steel bucket skids.

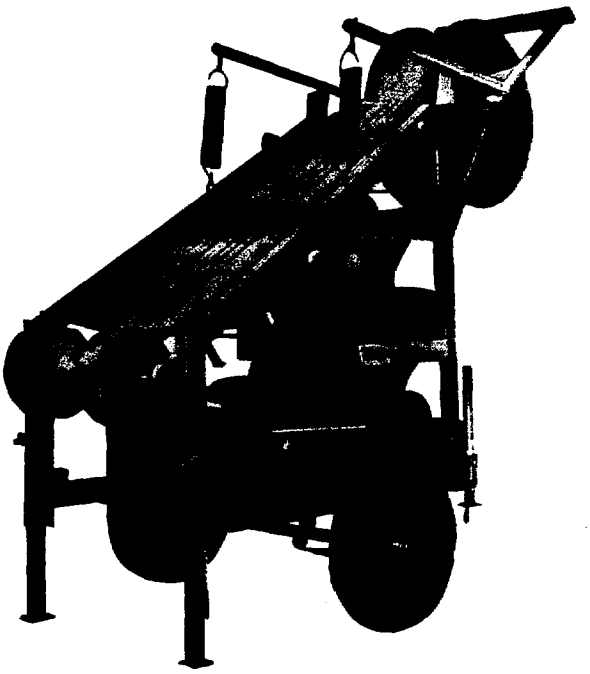
Standard Truck Loader units are designed to work with 6" to 22" pipe size buckets. The heavy duty unit handles buckets up to 24" pipe size and the extra heavy duty unit up to 30" pipe size.

Bucket shakers on discharge end of chutes are spring loaded to permit operator to empty bucket. Spring loaded shaker platform prevents bucket from falling into the truck.

Several optional features and accessories are available to help the end user select the proper unit(s) to complete their assigned cleaning tasks.



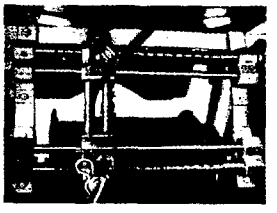
HEAVY DUTY TRUCK LOADER



EXTRA HEAVY DUTY TRUCK LOADER

DUAL SCROLL

Optional on SRECO-FLEXIBLE® Truck Loaders, the Dual Scroll is perfectly synchronized to lay cable evenly on drum under the heaviest pulls, minimizing wear of the level winding mechanism.



HYDRAULIC PULL-IN and TRUCK LOADER

Selective speed and load ranges can be obtained by use of the hydraulic system providing infinite variable settings. A preset force can be obtained avoiding potential damage to bad pipe.

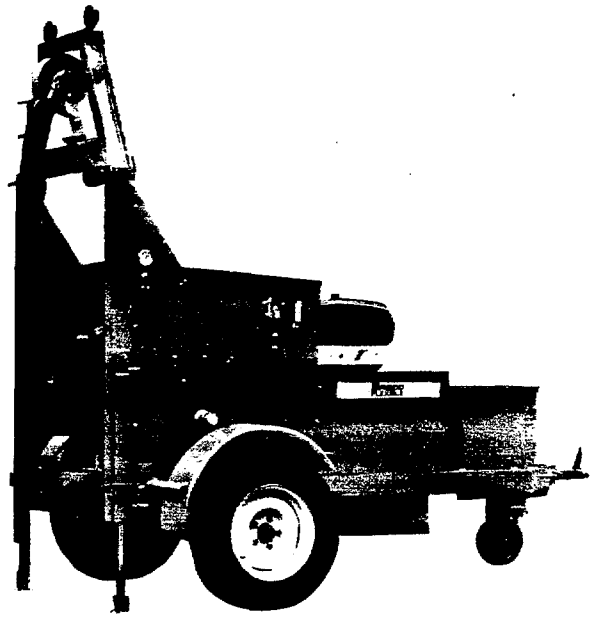
Minimum requirement for hydraulic driven units is a thirty horsepower engine. Engines range from 30 to 65 horsepower. Larger gasoline engines and various sizes of diesel engines are available upon request.

Base frames and uprights are sized proportional to engine horsepower and other pertinent features as may be selected for the assigned jobs.

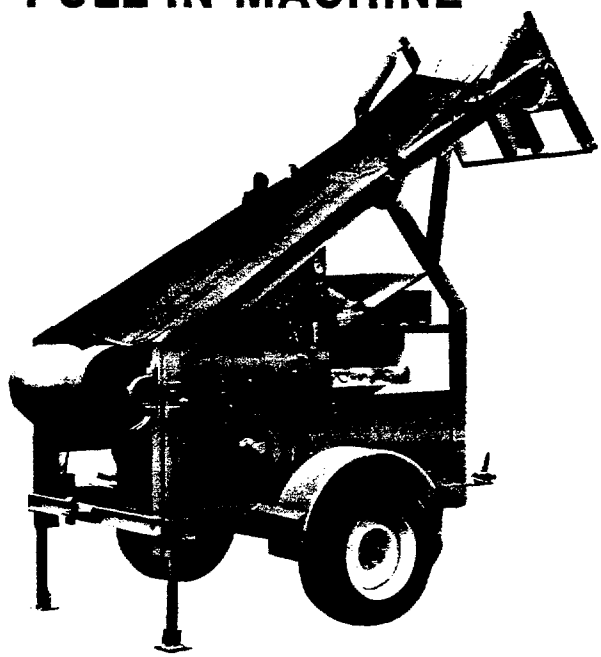
Cable winch drums, clutches and chutes are the same as described on the mechanical Pull-In and Truck Loader Bucket Machines.

Hydraulic system as a standard has one operating speed range with dual and three speed systems available as an option.

Lift legs are rack and pinion gear type with hydraulic powered lift legs available as an optional feature.



HYDRAULIC PULL-IN MACHINE



HYDRAULIC TRUCK LOADER MACHINE

SRECO FLEXIBLE®

P.O. BOX 1441 LIMA, OH 45802 U.S.A. 419/991-2065 800/537-3592 FAX 419/999-2300

P.O. BOX 2957 CULVER CITY, CA 90231 U.S.A. 213/301-9009 800/421-6536 (OUTSIDE CA) 800/852-7727 (INSIDE CA) FAX 213/301-6232

Distributed By:

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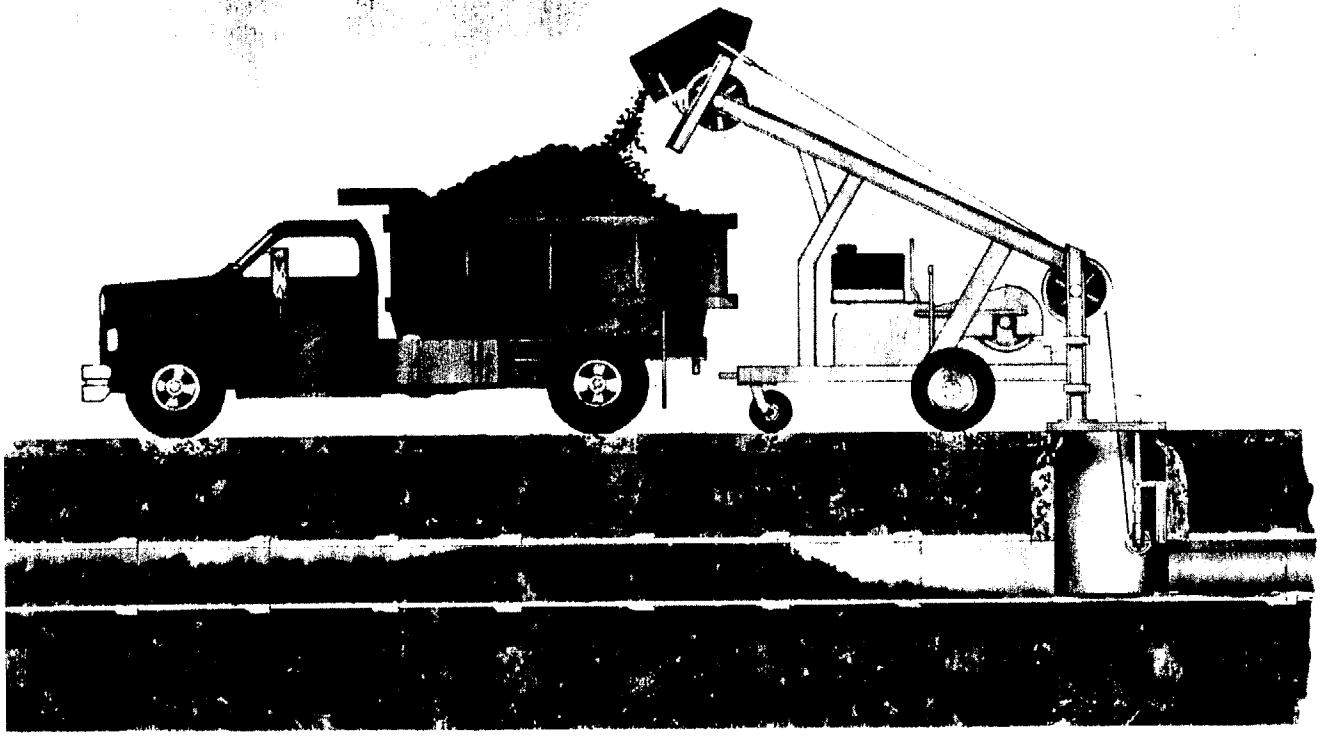

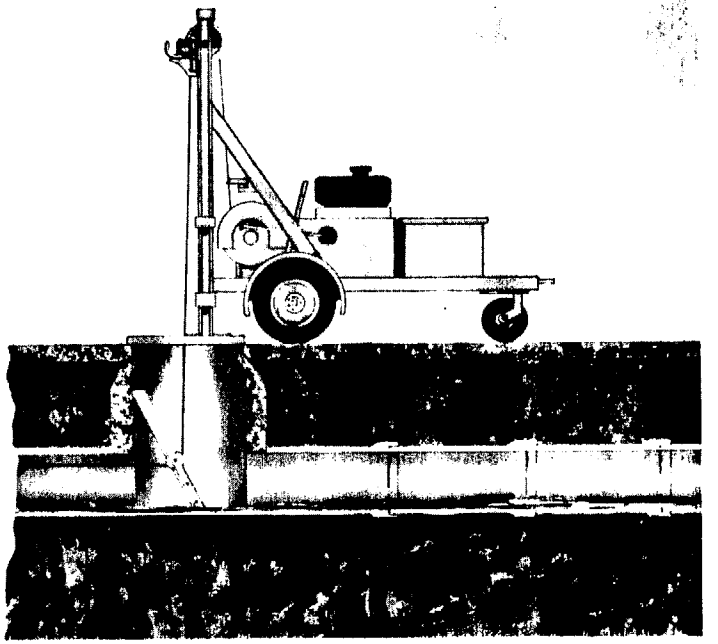

SRECO FLEXIBLE®

3434 S. DIXIE HWY. LIMA, OH 45804 U.S.A. 419/991-2065 800/537-3592 FAX 419/999-2300

P.O. BOX 2957 CULVER CITY, CA 90231 U.S.A. 310/301-9009 800/421-6536 (OUTSIDE CA)
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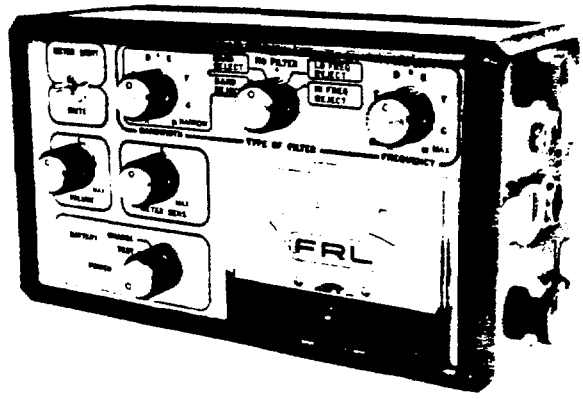
0994A

FISHER m-SCOPE® Model XLT-20



LEAK DETECTOR

CASSETTE TRAINING TAPE

This tape and an adapter cord to connect your recorder to the instrument are provided for orientation and training. A narrative followed by actual leak sounds make up this 22 minute cassette.

The Fisher Leak Detector Model XLT-20 combines advanced acoustic detection methods with electronic amplification and filtering to detect and pinpoint leak sounds.

Liquid escaping under pressure through an orifice in a pipe generates three distinct types of sound. One is produced by the friction of the escaping liquid against the edges of the orifice in the pipe. The second is caused by the liquid striking the soil. The third is caused by rock and soil particles colliding with each other and with the pipe, as they are impacted by the escaping liquid.

These sounds travel in both directions along the pipe, and radiate outward through the ground from the point of the leak. With the sensitive transducers, high amplification and selective filtering of the Fisher Model XLT-20, these sounds may be quickly identified, localized, and pinpointed.

FEATURES:

- Detects and pinpoints liquid leaks in pipes.
- Locates leaks over wide range of pipe diameters and types, internal pressures and surrounding media.
- Leaks are indicated by meter deflection and sound in the headphones.
- Acoustically shielded "Big Foot" crystal probe for non-contact detection through paved surfaces reduces distracting ambient noises.
- Direct pipe contact probe substantially reduces traffic and pedestrian noise.
- High-gain solid-state amplifier aids in detection of sound in poor sound conductors such as PVC and cement pipe.
- Headset acoustically designed to shut out outside sounds for more accurate leak detection.
- Ni-Cad rechargeable batteries may be charged without removing from the instrument by plugging in the included charger.
- Night light on meter dial for "round-the-clock" detection capability.
- Selective electronic bandwidth filter provides control over distracting ambient sounds.

Probing for leak sounds through pavement with acoustically shielded XLT-20 "Big Foot" crystal probe.

COMPLETE INSTRUMENT SET

OPERATING MODES

The XLT-20 provides two operating modes. Survey and detection without direct pipe contact is accomplished with the "Big Foot" accoustically shielded crystal probe or the Hydrophonic Cylinder Probe. Direct contact survey and detection is carried out with the Hydrophonic Cylinder Probe. With this probe and a set of Sound Rods, pipes from above surface to depths of more than six feet may be sensed.

APPLICATIONS

The XLT-20 may be used for detecting leaks in all types of pipe, including steel, cast iron, PVC, cement and asbestos. It may be used in all types of earth, such as sand, clay, gravel, and even water filled cavities. The XLT-20 also detects leaks at valves, couplings, meter boxes and tanks, through cement slab, pool decking, walls, radiant heating systems and escased pipe.

SELECTIVE SOUND SENSING

Normal sounds such as wind, traffic, liquid flow, pumps and meters, will be amplified along with leak sounds by the XLT-20's powerful amplifier. But, a sharp cutting bandwidth filter reduces the particular band of unwanted frequencies, or enhances a specific band of desired frequencies. The filter can also select or reject frequencies above or below a given sound.

5-YEAR GOLD SEAL LIMITED WARRANTY

Fisher warrants the XLT-20 to be free of defects in materials and workmanship when it is shipped from the factory. The terms of this warranty are fully explained in a warranty registration card that accompanies the device. Complete field and factory service facilities support the warranty.

The length and terms of the warranty may vary outside the USA. Check with your distributor for details.

Fisher Research Laboratory, Inc., manufactures a wide range of electronic survey and detection instruments designed to meet the needs of the utility industry. Some of these instruments include pipe and cable locators, valve and box locators, fault locators, AC potential detectors, sound and leak detectors, and water level indicators. Ever since the company began operation in 1931, high quality design and advanced production techniques have solidified the Fisher tradition of being foremost in the industry. For applications, assistance or additional information on the Model XLT-20 Leak Detector, contact the Fisher Marketing Department.

Probing for leak sounds in PVC pipe just below ground level, using Fisher's XLT-20 Hydrophonic Probe and 24" Sound Rod.

SPECIFICATIONS

Operating Frequency Range	80 Hz to 8 kHz
Gain	82 dB
Type of Filters:	
Band Reject	Band Select
Low Frequency Reject	High Frequency Reject
Meter Output Indication	
One Milliamp,	0-100 Linear Scale
Power Supply ± 9 VDC consisting of	
14AA Ni-Cad batteries	
Battery life between changes	25 hrs.
Battery recharge time	18 hrs.
Headset Impedance	150 ohms
Weight	
(in covered wooden case)	22 lbs.
Case dimensions	8¼" X 8½" X 32½"
Shipping Weight	26 lbs.
Shipping Dimensions	10" X 12½" X 34¼"

FISHER m-SCOPE

FISHER RESEARCH LABORATORY
200 W. Willmott Rd.
Los Banos, CA 93635
(209)826-3292,FAX:209-826-0416

EXPORT DEPARTMENT
P.O. Box 1896, New Haven, CT 06508
(203)288-1638,FAX:203-287-8099
TELEX: 963487

LATIN AMERICAN EXPORT (except Mexico)
MART HALLER, INC.
P.O.Box 140159, Coral Gables,FL 33134
244 San Lorenzo,Coral Gables,FL 33146
Ph.(305)444-4617,FAX:305-445-7551

FISHER m-SCOPE®

Model *TW-770* Line Tracer

Digital depth-reading line tracer offers durability and simplicity

The TW-770 instrument set consists of a transmitter, receiver, ground-plate/ground-rod assembly, operating manual, and hard carrying case. The transmitter signal is applied to the underground service in one of two ways: inductively with the transmitter placed on the ground over the line, or conductively using the included ground-plate/ground-rod assembly with the transmitter. The coupling clamp accessory can be used with the transmitter when a direct physical hook-up cannot be done with insulated pipes, and electrical or telephone lines that are in service.

The design emphasis of the TW-770 is simplicity and durability. Some line tracers are overly complicated and others are too delicate for sustained field use. The TW-770 receiver has only two controls: a knob for on/off and volume, and a push-button to read depth on the LCD display in either inches or centimeters. The transmitter's controls consist of a toggle switch for "battery test" and "on."

In the upper photo, the operator is following a water main. He is assisted by the audio and visual guidance from the receiver, as he swings the unit left and right. If left of the line, the word "RIGHT" with right arrows will appear on the LCD, and the audio tone will pulsate. If right of the line, the message is "LEFT" with left arrows and a continuous tone. When at the centerline, the message is "OVER TARGET" with a peak audio tone. At this time, the button is pushed for depth readout.

TW-770 receiver, hard carrying case, transmitter and ground-plate/ground-rod assembly. Also shown are the accessory headphones and coupling clamp.

The Fisher TW-770 traces the underground route of a water main.

FEATURES

- Digital accuracy for pipe and cable tracing and depth readout.
- Audio and visual response for left-right guidance.
- Automatic gain control.
- Digital signal strength.
- Inductive or conductive tracing.
- Easy to use.
  - Instant target response.
  - Push-button for depth readout.
  - Only one knob to turn on and adjust volume.
- Splashproof.
- Built to take a beating.
- Operates on standard batteries.

FISHER m-SCOPE®

FISHER RESEARCH LABORATORY
200 W. Willmott Rd., Los Banos, CA 93635 USA
TEL (209) 826-3292, FAX (209) 826-0416

Here is what your TW-770 will do!

INDUCTIVE TRACING

When one point is known on a linear conductor, such as a pipe or cable, the TW-770 transmitter can be placed on the ground over it, and tracing can go in either direction from that point. The operator walks the path of the line while moving the receiver left and right. At some distance from the transmitter, the signal will become faint, but the transmitter can be brought up to that point so tracing can continue indefinitely.

Note: If there is no known starting point to do an inductive or conductive trace, use a Fisher TW-6 with handle to inductively locate a starting point.

The operator traces a water main with the TW-770. The transmitter is lying out of sight on the ground behind him.

The TW-770 traces an underground line away from the conductive hookup in the background.

CONDUCTIVE TRACING

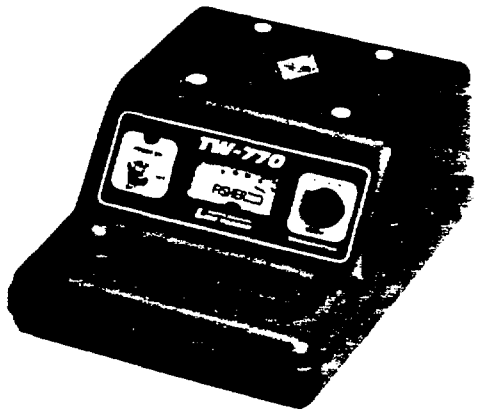
This is the preferred method for tracing because the transmitter makes a direct physical hook-up with the line to be traced. The included ground-plate/ground-rod assembly plugs into the transmitter, and one alligator clamp is attached to the pipe, non-energized cable, conduit, tracer wire or tracer tape. The other end must be well grounded. This concentrates the signal on the known line to be traced, and there is less chance of the signal being accidentally induced to a nearby or adjacent line. Tracing distances are usually increased 25-50 percent over the inductive method. Non-metallic pipes may be traced conductively if the ground-plate/ground-rod assembly is attached to a plumber's "snake" or electrician's "fish tape" running inside of the pipe.

INDUCTIVE COUPLING CLAMP

The coupling clamp takes the place of the ground-plate/ground-rod assembly when tracing telephone and electrical lines that are in service. It inductively energizes without metal-to-metal contact. Tracing distances are less than when using the ground-plate/ground-rod assembly, so there is no advantage to using the coupling clamp on pipes unless a non-conductive wrapping or insulation is preventing direct metal contact. The TW-770 frequency will not disturb voice, data-communication lines, or electrical service when the coupling clamp is used.

The coupling clamp energizes a telephone pair for tracing from the transmittter.

The TW-770 performs a conductive trace toward the instrument transmitter in the foreground. Note that one clip of the ground-rod assembly is attached to the gas line being traced and the other is attached to the ground rod.



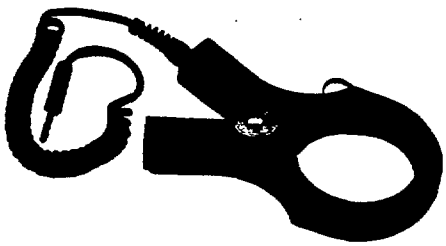
TW-770 Transmitter

The meter on the TW-770 transmitter can show two different types of information. With the toggle switch down, battery strength is indicated. With the toggle switch up, the transmitter is on. Meter readings indicate current flow of the tracing signal. This reading is only significant when performing a conductive trace.

TW-770 Receiver —

The TW-770 receiver features an LCD readout of signal strength in bar-graph form. It also gives a digital percent of signal as well as visual left/right guidance. Depth readout appears on the LCD with the push of a button.

Accessories

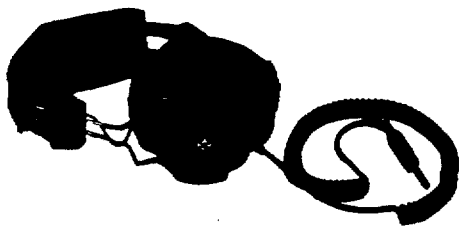


Coupling Clamp

This accessory, part No. 203400, is especially useful for in-service telephone and electric power line tracing where a metal-to-metal hook-up with a ground-plate/ground-rod assembly isn't practical.

Headphones

The standard Fisher stereo headphones, part No. 972095, when plugged into the receiver, makes easier listening in noisy construction areas. Volume is separately adjustable for each ear. Use of the headphones increases battery life by 50-100 percent.



TW-770 Specifications

Receiver

Sensitivity Control	Automatic (AGC)
Dynamic Range	110 dB
Depth Readout Range	to 16 ft. (488 cm.)
Readout Units	Optional (inches or cm)
Depth Accuracy	± 8% under normal conditions
Trace Accuracy	± 1 inch to 4 ft. deep; ± 2% over 4 ft.
Audio Output	Continuous/pulse VCO output through speaker or optional headphones
Visual Display	LCD provides left/right directional information, signal strength readout (numeric and bar graph), and depth (specify inches or cm on order)
Batteries	6 alkaline C cells
Battery Life	30 hrs. continuous
Battery Test	Automatic (low battery warning on LCD)
Weight	5.4 lbs.
Dimensions	32" L X 11.75" H X 6.5" W (81 cm L X 29.8 cm H X 16.5 cm W)

Transmitter

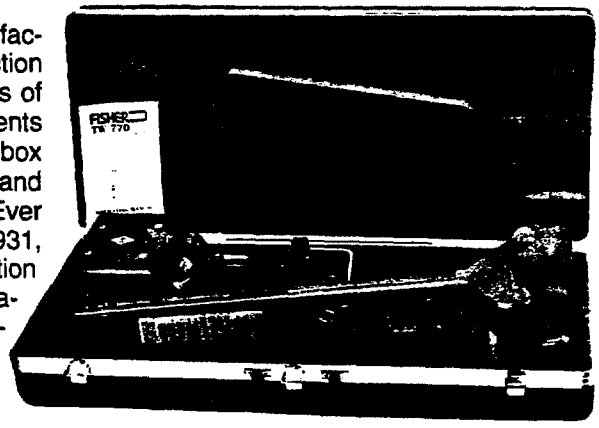
Frequency	82.175 kHz ± 0.001%
Output Power	500 mW: 10 ohms to 3 kohm load
Batteries	(2) 6-Volt lantern batteries (Eveready No. 509)
Battery Life	30 hrs. continuous
Weight	5.0 lbs.
Dimensions	12" L X 4.75" H X 8.5" W (30 cm L X 12 cm H X 21.5 cm W)

General

Operating Temperature	-4 to +140 degrees F (-20 to +60 C)
Shipping Dimensions	36 3/4" X 17 1/2" X 9 1/2" (93.3 cm X 44.4 cm X 24 cm)
Shipping Weight	26 lbs.(11.8k) without accessory head phones and accessory coupling clamp. Add 13 oz. (.37K) for each accessory.

The Fisher tradition

Fisher Research Laboratory, Inc. manufactures a wide range of electronic detection instruments designed to meet the needs of the utility industry. Some of these instruments include pipe and cable locators, valve and box locators, AC potential detectors, sound and leak detectors, and water-level indicators. Ever since the company began operation in 1931, high-quality design and advanced production techniques have solidified the Fisher tradition as foremost in the industry. For applications assistance or additional information on the TW-770 Line Tracer, contact the Fisher marketing department.



The complete TW-770 instrument set includes a hard carrying case, transmitter, receiver and ground-plate/ground-rod assembly. Also shown are the coupling clamp and headphones, which are sold as accessories and fit into the TW-770 case.

5-Year Limited Gold Seal Warranty*

Fisher warrants the TW-770 to be free of defects in materials and workmanship when it is shipped from the factory. The terms of this warranty are fully explained in a warranty registration card that accompanies the instrument. Complete field and factory service facilities support the warranty.

**Warranty may vary outside USA. See your distributor for details.*

U.S., Canadian and Mexican customers contact:	**FISHER RESEARCH LABORATORY** 200 W. Willmott Rd., Los Banos, CA 93635 USA TEL (209) 826-3292; FAX (209) 826-0416
Latin American customers contact:	**MART HALLER, INC.** 244 San Lorenzo Ave.; P.O. Box 140159; Coral Gables, FL 33114-0159 USA TEL (305) 444-4617; FAX (305) 445-7551
All other countries contact:	**EXPORT DEPARTMENT** P.O. Box 1896, New Haven, CT 06508 USA TEL (203) 288-1638; FAX (203) 287-8099; TELEX 179160 EXPORT

FISHER m-SCOPE®

Made in the USA since 1931

FRL8706999

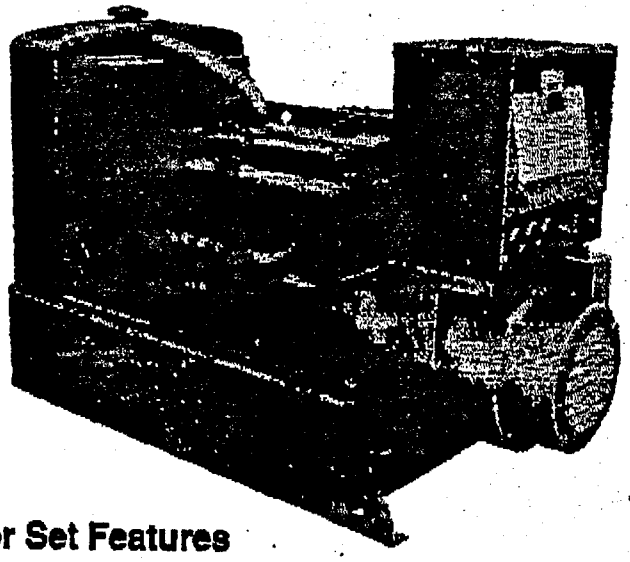
5-94 Printed in USA

43

15 RDJC 60 Hz
* → 12.5 RDJC 50 Hz
Diesel-Fueled Generator Set

Onan

	STANDBY 1-Phase	STANDBY 3-Phase
60 Hz	15 kW 15 kVA	15 kW 19 kVA
50 Hz	12.5 kW 12.5 kVA	12.5 kW 16 kVA



Generator Set Features

- Single-source design, manufacturing and testing of all set components and accessories by Onan Corporation.
- Accepts 100% of nameplate kW rating in one step, in compliance with NFPA 110, Paragraph 5-13.2.6.
- Engine torque-matched excitation system provides quick recovery from transient speed dips.
- Low reactance generator design offers low waveform distortion with non-linear loads and provides excellent motor starting capabilities.

Standard Equipment

ENGINE
Onan 4-cycle diesel engine.

ALTERNATOR
Brushless, revolving field Onan AC alternator provides broad range reconnectible output.

CONTROL PANEL
Vibration isolated control with analog instrumentation.

VOLTAGE REGULATOR
Electronic voltage regulator provides precise regulation and underfrequency compensation.

COOLING SYSTEM
High ambient 122° F (50° C) system.

SKID BASE
Supports the alternator and engine. Battery rack and cooling system mount to the skid base. Integral vibration isolation.

Generator Set Testing

The Prototype Test Support (PTS) program is our commitment to verifying the integrity of our designs and products.

Before the generator sets are put into production, prototype models are subjected to demanding tests with typical/atypical loads and transients anticipated in service.

Production models earn the PTS seal only after meeting the performance criteria established by the program.

Single-Source Warranty

All generator set components and systems are covered by a limited one-year warranty. Optional two- and five-year extended programs are available.

Standard Models are CSA certified.

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Generator Set Performance

Voltage Regulation
At constant load, from no load to 100% load will be within ±2%.
Random Voltage Variation
At constant load, from no load to 100% load will not exceed ± 1% of its mean value.
Frequency Regulation
Under varying loads from no load to 100% load: 5% maximum
Random Frequency Variation
Will not exceed ± 0.5% of its mean value for constant loads from no load to full load.
Electromagnetic Interference Attenuation
Meets requirements of most industrial and commercial applications.

AC Waveform Total Harmonic Distortion
Less than 5% total no load to full load, and less than 3% for any single harmonic
Telephone Influence Factor (TIF)
Less than 40 per NEMA MG1-22.43.
Telephone Harmonic Factor (THF) Less than 3.
Alternator Temperature Rise
At rated load is less than 105°C at standby rating, per NEMA MG1.22.40, IEEE115 and IEC 34-1.
Radio Interference
Alternator and voltage regulator meet the provisions of BS.800 and VDE Class G and N.
Ratings and Performance
The standby power rating is applicable for the duration of normal power interruption. No overload is available at this rating.

Engine: Onan 4-cylinder, in-line, diesel

Design: 4-cycle, water-cooled, natural aspiration
Bore: 3.25" (83 mm) **Stroke:** 3.625" (92 mm)
Piston Displacement: 120 cubic inches (2.0 liters)
Compression Ratio: 19.0:1
Starting: 12-volt, 2-wire, negative ground
Cranking Current: 225 amps at ambient temperature of 32° F (0° C).
Battery Charging: Adjustable, 2-5 amp.
Cast Iron Cylinder Block
Valves: Overhead
Governor: Adjustable, mechanical, flyball, pressure lubricated.

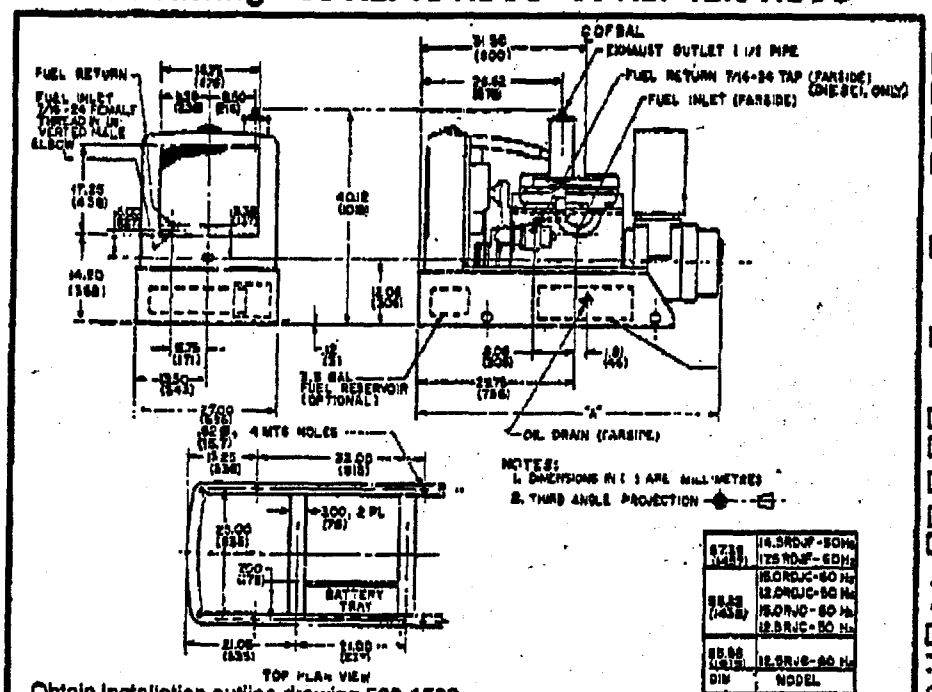
Indirect Injection Fuel System: Number 2 diesel fuel; Dual fuel filters and water separator; Mechanical fuel transfer pump with hand primer; Fuel lift 6 feet (1.8 meters); Automatic fuel shutoff; Distributor injection pump.
Oil-Wetted Element Air Cleaner with Restriction Indicator
Lube Oil Capacity: 6.5 US quarts (6 liters)
Lube Oil Filter: Single Spin-On, Full Flow
Typical Lube Oil Consumption:
3 US quarts (3 liters) – per 100 Hours
Cooling System
High Ambient 122° F (50° C) Radiator.
Coolant Capacity: 13 US quarts (12 liters)

Alternator: Onan

Design:
Revolving field, single bearing, 4-pole, brushless, drip-proof construction. Standard 105° C temperature rise at standby power rating. Class F insulation system per NEMA MG1–1.65 and BS2757. The main alternator and exciter insulation systems are suitable for typical standby applications.
Stator:
Skewed stator and 2/3 pitch windings minimize field heating and voltage harmonics.
Rotor:
Dynamically balanced assembly. Direct coupled to engine by a flexible drive disc. Complete amortisseur (damper) windings help minimize voltage deviations and heating effects under unbalanced loads. The rotor is supported by a pre-lubricated, maintenance-free ball bearing.

Torque-Matched Voltage Regulation:
The voltage regulator provides torque-matched underfrequency compensation to optimize motor starting performance and assist the engine during transient load conditions. The brushless exciter armature powers the main alternator field winding through shaft-mounted, three-phase, full wave silicon diode rectifiers.
Shunt Excitation:
The excitation system derives its power from the main output of the generator, eliminating the need for a separate excitation power source. This excitation system, combined with the Onan low reactance generator, comprise a system that provides sufficient short circuit current for selective clearing of instantaneous overcurrent devices
Phase Rotation: A (U), C (W), B (V)
Alternator Cooling: Direct drive centrifugal blower.

Outline Drawing 60 Hz: 15 RDJC 50 Hz: 12.5 RDJC



Obtain installation outline drawing 500-1502.

Voltage Selections

60 Hz, 1800 rpm, 3-phase, Reconnectible Broad Range

- ☐ 120/208V ☐ 220/380V
- ☐ 127/220V ☐ 240/416V
- ☐ 139/240V ☐ 254/440V
- ☐ 120/240V* ☐ 277/480V

60 Hz, 1800 rpm, 1-phase, 4-Wire Reconnectible, Broad Range

- ☐ 120V ☐ 120/240V

60 Hz, 1800 rpm, 3-phase, Specific Voltage

- ☐ 347/600V

50 Hz, 1500 rpm, 3-phase, Reconnectible, Broad Range

- ☐ 110/190V ☒ 220/380V ←
- ☐ 115/200V ☐ 230/400V
- ☐ 120/208V ☐ 240/415V
- ☐ 127/220V ☐ 254/440V
- ☐ 110/220V*

50 Hz, 1500 rpm, 1-phase, 4-Wire Reconnectible, Broad Range

- ☐ 110V ☐ 110/220V

*Single-phase power can be taken in capacities up to 2/3 of the rated 3-phase kVA with broad range alternator.

This drawing is for informational purposes only. For specific construction details, obtain installation outline drawing from your distributor.

Unhoused Weight
Dry: 940 lbs 427 kg
Wet: 979 lbs 444 kg

Housed Weight
Dry: 1090 lbs 495 kg
Wet: 1129 lbs 513 kg

OPERATING DATA	60 Hz (1800 rpm)				50 Hz (1500 rpm)			
Set Rating / Max. Surge	15.0	kW /	15.7	kW (max)	12.5	kW /	13.0	kW (max)
Motor Starting	52	kVA (Std)	108	kVA (Ext)	43	kVA (Std)	80	kVA (Ext)
Fuel Consumption (at rated load)	1.6	US gph	6	L/hr	1.4	US gph	5	L/hr
Combustion Air	53	cfm	1.5	cu m/min	44	cfm	1.2	cu m/min
Exhaust Gas Flow	155	cfm	4.4	cu m/min	140	cfm	4.0	cu m/min
Exhaust Gas Temperature	1100	°F	593	°C	1075	°F	579	°C
Radiator Cooling Air	3000	cfm	85.0	cu m/min	2500	cfm	70.8	cu m/min
Alternator Cooling Air	160	cfm	4.5	cu m/min	133	cfm	3.8	cu m/min
Heat Rejected to Coolant	1800	Btu/Min	1.9	MJ/Min	1550	Btu/Min	1.6	MJ/Min
Heat Radiated to Room	293	Btu/Min	0.3	MJ/Min	260	Btu/Min	0.3	MJ/Min
Coolant Flow	24	Gal/Min	91	L/Min	20	Gal/Min	76	L/Min
Engine Power	27	bhp	20	kW	21	bhp	16	kW
Radiator Fan Load	1.5	hp	1.1	kW	1.4	hp	1.0	kW
BMEP	89	psi	616	kPa	92	psi	634	kPa
Piston Speed	1088	ft/min	5.53	m/s	907	ft/min	4.61	m/s
Overspeed Limit	2100 ±50 rpm				1850 ±50 rpm			

FULL LOAD CURRENTS (Amps @ Standby Rating)	120/208	127/220	139/240	120/240*	110/190	115/200	120/208	110/220*
	52	49	45	52	47	45	43	47
	240/416	254/440	277/480	347/600	220/380	230/400	240/415	254/440
	26	25	23	18	24	23	22	20

INSTALLATION DATA				
Maximum Coolant Friction Head	2.0	psi	14	kPa
Maximum Coolant Static Head	10	ft	3.1	m
Maximum Air Cleaner Restriction	15	in H2O	3.7	kPa
Maximum Exhaust Back Pressure	27	in H2O	6.7	kPa
Minimum Air Opening to Room	3.0	sq ft	0.3	sq m
Minimum Discharge Opening	2.0	sq ft	0.2	sq m
Maximum Restriction at Radiator Discharge (static)	0.5	in H2O	125	Pa

Derate for each 1000 ft (305 m) as follows:

	#2 Diesel Fuel
Derate	4 %
Above (60 Hz)	2100 ft (641 m)
Above (50 Hz)	2000 ft (610 m)

Derate 1% per 10°F (2% per 11°C) for ambient temperatures above 85°F (29°C).

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Control System

- **Monitors engine performance and AC power output.**
- **Controls generator set start and shutdown.**
- **Remote start terminals.**
- **DC panel lighting.**
- **Vibration isolators protect control panel electronics and circuitry from generator set vibration.**

Standard Control Features

- Fused DC controls
- Start-stop switch, 12-volt, 2 wire
- Exciter circuit breaker, manual reset
- Oil pressure gauge
- Coolant temperature gauge
- Battery charge rate ammeter
- Preheat switch – manifold heater and glow plugs.

Generator Set Monitoring System

- Fault light (red) with alarm contact (manual reset) indicates engine shutdown for:
- High coolant temperature
- Low oil pressure

Generator Set Options

Engine

- ☐ 120-volt, 850 watt coolant heater
- ☐ 120-volt, 300 watt oil base heater
- ☐ Oil level maintainer
- ☐ Heavy duty air cleaner

Cooling Systems

- ☐ Remote radiator cooling
- ☐ Heat exchanger cooling
- ☐ Raw water cooling

Exhaust System

- ☐ Industrial-grade exhaust silencer
- ☐ Residential-grade exhaust silencer
- ☒ Critical-grade exhaust silencer

Alternator

- ☐ Anti-condensation heater
- ☐ Full single-phase output (3-phase alternator)
- ☐ Extended alternator shaft
- ☐ Severe environment insulation

Control Panel

- ☒ AC meter package
  - AC voltmeter
  - 3-phase voltage selector switch
  - Ammeter – one per phase
  - Frequency meter
  - Running time meter
- ☐ Main line circuit breakers
- ☐ SCR filter
- ☐ Switching regulator
- ☐ Anti-condensation heater
- ☐ Overspeed shutdown
- ☐ Alarm package
  - High engine temperature (with pre-warning)
  - Low oil pressure (with pre-warning)
  - Overcrank
  - Overspeed
  - Low coolant temperature
- ☐ Fault signal package
- ☐ Time delay – start
- ☐ Time delay – stop

Generator Set

- ☒ Battery charger, equalizer, float-type
- ☒ Battery
- ☒ Skid and battery rack
- ☐ Weather-protective enclosure with mounted silencer
- ☐ 2-year standby power warranty
- ☐ 5-year standby power warranty

Onan Corporation
1400 73rd Avenue N. E.
Minneapolis, MN 55432
612-574-5000
Telex: 275477
Fax: 612-574-8087

See your distributor for more information.

Onan is a registered trademark of Onan Corporation

Backfeed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is opened.

Cummins is a registered trademark of Cummins Engine Company

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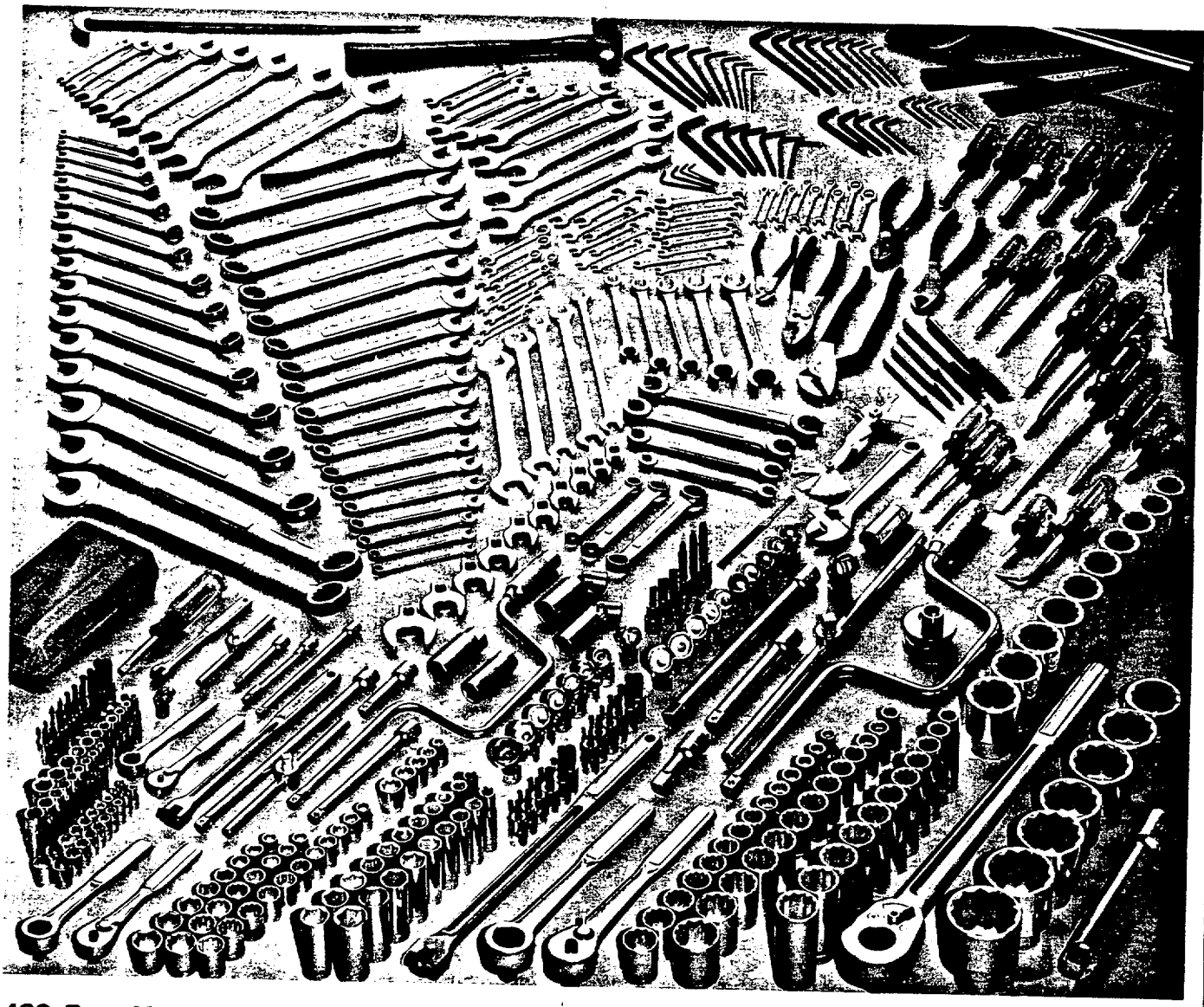
CRAFTSMAN® 430-PIECE MECHANICS' TOOL SET

GREAT VERSATILITY FOR COMPLEX JOBS



430-PIECE MECHANICS' TOOL SET INCLUDES STANDARD AND METRIC SIZES

- 196 Sockets
- 105 Wrenches
- 30 Drive Tools
- 13 Screwdrivers
- 5 Pliers
- 81 Additional Tools

MADE IN THE USA

No other hand tool brand has a stronger commitment to quality and performance than Craftsman ...Guaranteed Forever!

ENTIRE SET

$1280 $27 monthly†

430-Piece Tool Set with Standard and Metric Sizes. Set includes all the great features and individual tools from the chart on PAGE 26. Separate pieces total $1888.35. Warranted by Sears.*

46465—Wt. 75.00 lbs. **$1280.00**

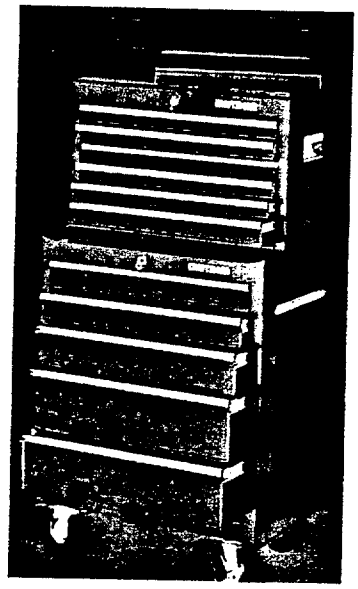
SAVE $89

when you buy Tool Set plus Chest and Roll-Away

$1535 $32 monthly†

430-Piece Mechanics' Tool Set Plus 6-Drawer Chest and 5-Drawer Roll-Away. Separate prices total $1624.98.◆

43074N—Wt. 252 lbs. **$1535.00**



Chest and Roll-Away. Together, these two storage units give you the space you need to keep your shop organized. The 5-drawer roll-away with its 750 lb. load capacity takes your tools where you need them, and when added to the heavy-duty 6-drawer chest gives you all the storage space you need. Full extension removable drawers open all the way to make your tools fully accessible. Compound action slide design allows drawers to open smoothly and easily. Tumbler locks and internal drawer lock system let you unlock all drawers at once. 6-drawer chest has handy portable tote tray. Roll-away's four 5x2-inch casters provide easy mobility. Exclusive I-FRAME® construction provides strength and rigidity. See pages 8 and 9 for dimensions.◆

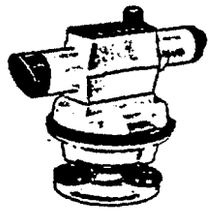
65624N—Wt. 177 lbs. ...**$344.98**

CALL TOLL-FREE: 1-800-377-7414

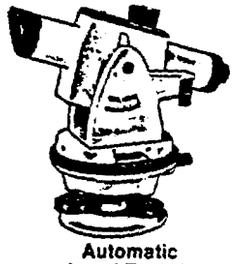
BEST AVAILABLE COPY

Levels, Transits & Laser Levels

Levels and Level-Transits



Automatic Level



Automatic Level-Transit

Built for accuracy in the field, these levels and level-transits are excellent for light construction work requiring a sighting range up to 200 feet. They're also ideal for optical tooling and machinery set ups. All instruments include a plumb bob, instructions, and a plastic carrying case.

Standard models—have 20X magnification and accuracy within ¼" at 75 feet.

Automatic models—have 18X magnification and accuracy within ¼" at 100 feet. They also have a compensator which automatically adjusts to keep the line of sight even at all times.

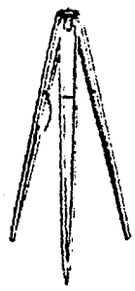
PLEASE NOTE: For standard models, use tripods with meridian head. **For automatic models,** use tripods with ⅝" × 11 thread head. **Tripods are shown in presentation below.**

LEVELS — For horizontal sighting only. The horizontal circle is graduated to 1° and is read by vernier to ¼° (15 minutes). Furnished with a built-in sunshade, easy-to-read level, and large leveling screws.

LEVEL-TRANSITS — For horizontal and vertical sighting. Horizontal circle is graduated to 1° and is read by vernier to ¼° (15 minutes). Vertical arc reads 0°-45°. Furnished with built-in sunshade, horizontal and vertical clamp, and tangent screws for precise control.

Description	Standard No.	Standard NET EACH	Automatic No.	Automatic NET EACH
Level	1924A16	$299.90	1926A11	$451.11
Level-Transit	1925A1	399.95	1926A14	585.32

Tripods



Three-legged supports for stability and vibration resistance. Tripods have die-cast aluminum heads and ¾" welded steel tubing legs, except where noted. Extensions on extension-leg models are hardwood. Tripods are orange and white.

Meridian Style Head—for any instrument that has a meridian tripod head. Stiff ht.: 61". Extended ht.: 39" to 61".

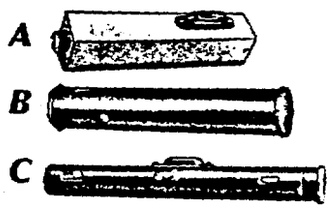
⅝" × 11 Tribrach Head—for tribrach (3 screw) instruments not requiring an optical plummet. Also for instruments with standard ⅝" × 11 thrd. center stud. Stiff ht.: 61". Extended ht.: 39" to 61".

3½" × 8 Tripod Head—for any instrument that has standard 3½" × 8 threads. Stiff ht.: 60". Extended ht.: 44" to 67".

Head Style	Stiff Legs No.	Stiff Legs NET EACH	Extension Legs No.	Extension Legs NET EACH
Meridian	8973A66	$91.73	8973A67	$133.62
Tribrach ⅝" × 11 Thread	8973A62	89.08	8973A63	129.77
3½" × 8 Thread	8973A64 ◆	134.35	8973A65 ◆	186.68

◆ Aluminum legs.

Hand Levels



No need to carry bulky surveying equipment everywhere you go. Pocket-size instruments quickly, accurately project a level line of sight for work on drains, ditches, fences, and soil erosion. The spirit level bubble appears in the viewfinder against a center line. All levels include a carrying case.

(A) SQUARE 5" LEVEL—has a calibrated scale. Aluminum level has a baked metallic enamel finish with black trim.
No. 19225A14 ..... **NET EACH $54.55**

(B) ROUND 6" LEVEL—has a fixed eyepiece and adjustable reflector. A hexagonal objective cap prevents rolling. Brass level has a black finish.
No. 19225A64 ..... **NET EACH $56.32**

(C) MAGNIFYING 8" LEVEL—provides 5X magnification of objective and 2X magnification of level bubble. Stadia lines read 1:100. Level is solid brass with a durable black finish.
No. 19225A65 ..... **NET EACH $117.28**

Professional Leveling Sets

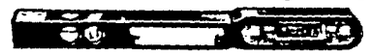
What you need is what you get! Sets have all the instruments necessary for accurate leveling and distance measuring. Sets include a level, leveling rod, tripod, carrying case, and instructions. The maple leveling rod is graduated in feet and inches to 8ths and is 8' high extended; 4' 6" high closed.

Standard Level Set–20X power magnification. Hardwood tripod is 4' 7" extended; 2' 7" folded.

Automatic Level Set—Compensator automatically maintains a level line of sight—even through on-the-job vibrations. 18X power magnification. Steel tubing tripod with hardwood extension legs adjust from 39"-61" high.

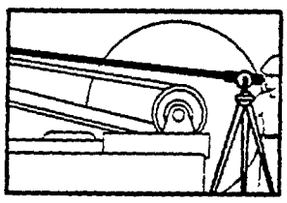
Automatic Level-Transit Set—In addition to having the compensator described above, this set can also shoot vertical angles up to 45° or plumb a vertical line. 18X power magnification. Steel tubing tripod with hardwood extension legs adjusts from 39"-61" high.

Set Description	No.	NET EACH
Standard Level	1927A11	$324.33
Automatic Level	1927A12	512.64
Automatic Level-Transit	1927A13	646.36



2153A65

Electronic Laser Levels



Forget about using string, water, torpedo, and level-transits. One person can easily take measurements directly from the laser-beam dot. Ideal for machine, pipe laying, and construction alignment. **Not just an ordinary level . . . with the flip of a switch a laser beam is projected for up to 100 feet.** Instead of just measuring level and plumb, you can also measure all the degrees in between!

Standard Level—Features 8-lb. magnets that will hold unit steady on metal surfaces. Level is accurate to ± ⅛" per 100 feet. It operates on four AA batteries (not included).

Level with Electronic Angle Indicator— In addition to the features above, unit measures angles up to 360° and percent of slope. It also calculates the rise and run of slope in inches per foot. The angle indicator operates on one 9V battery (not included). For angle indicator unit only, see series 23325A on page 1707.

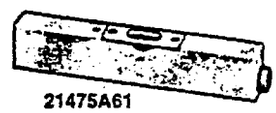
Mounting Base—Allows 360° horizontal rotation and 90° vertical elevation. Use of the base also allows laser level to be used in place of level-transits. Base has a ⅝" × 11 tripod mounting hole.

Description	No.	NET EACH
Standard Level	2153A66	$328.85
Level with Angle Indicator	2153A65	416.67
Mounting Base	2153A67	290.91
9V Battery	21105A105	2.49
AA Battery	21105A102	.92

LASER LEVEL PACKAGES—Everything you need for professional leveling and surveying. Includes laser level, mounting base, an 8" × 8" target, a 2" × 4" target, and 2 carrying cases.

Packages includes Level:	No.	NET EACH
No. 2153A66	2153A76	$525.45
No. 2153A65	2153A75	626.36

Laser Hand Levels



21475A61

These small, portable units are accurate to ±¼" over the entire range of the level. Use in place of strings, transits, and water levels.

Simply aim the level and mark the laser-beam dot. Runs on three 1.5V alkaline batteries (included). Made of aircraft aluminum with recessed, factory-set vials. The optional 90° prism lets you set up a right angle with a single beam. Leveling base provides fine leveling adjustment, 360° swivel action, ± 5° tilting action. Fits standard camera tripods with ¼"-20 threads and builders' tripods with ½"-20 threads.

Range	No. of Vials Level	No. of Vials Plumb	Dimensions, Lg. × Wd. × Dp.	No.	NET EACH
25 ft.	1	—	6¾" × ⅝" × 1¼"	21475A63	$137.46
50 ft.	1	—	6¾" × ⅝" × 1¼"	21475A62	207.23
[illegible]	1	1	9½" × 1" × 1"	21475A61 ◆	311.36

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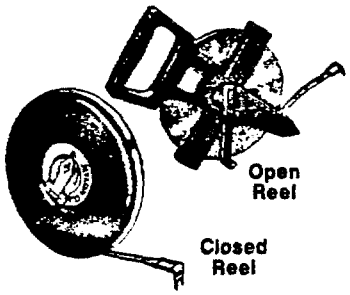
Long Tapes

Fiber Glass, Nylon-Coated Steel, and Woven Dacron Measuring Tapes



Forget about trying to read rusty tape blades—these corrosion-resistant tapes let you take clear, accurate measurements every time you use them. Tapes are white with black and red markings. Closed and open reels are available. **All tapes meet Federal Specification GGG-T-106E.**

FIBER GLASS—Nonconductive tapes are great for work around electricity. They're washable and won't stretch or shrink. Features include an end hook and a zero point at the end of the tape. Closed-reel case is vinyl-coated metal. Open-reel case is ABS plastic.

NYLON-COATED STEEL—Even if these tapes were bent, stepped on, or run over, they wouldn't break! The flexible steel core is coated with permanently bonded nylon and protected by a wear-resistant, nonglare vinyl coating. Tapes are washable and won't stretch or shrink. Except where noted, the zero point is at the end of the tape. Closed-reel case is vinyl-coated metal. Open-reel case is ABS plastic, except for the 300-ft. length, which is stainless steel.

WOVEN DACRON—Nonconductive tapes resist breakage, even when twisted and bent. They feature an end ring and a zero point at the end of the tape. The closed-reel case is vinyl-coated steel.

Blade Length	Blade Width	CLOSED REEL Tape Rule No.	CLOSED REEL Tape Rule NET EACH	CLOSED REEL Replacement Blade No.	CLOSED REEL Replacement Blade NET EACH	OPEN REEL Tape Rule No.	OPEN REEL Tape Rule NET EACH	OPEN REEL Replacement Blade No.	OPEN REEL Replacement Blade NET EACH
FIBER GLASS									
INCH: Front, inches to 8ths.									
50 ft.	½"	6806A31	$17.08	6806A51	$11.08	6806A13	$19.25	6806A51	$11.08
100 ft.	½"	6806A32	24.64	6806A52	19.08	6806A14	30.48	6806A52	19.08
200 ft.	½"	6806A33	58.80	6806A53	46.83	6806A21	63.22	6806A53	46.83
300 ft.	½"	—	—	—	—	6806A22	83.13	6806A54	70.50
INCH/METRIC: Front, inches to 8ths; Back, cm to 2mm.									
50 ft./ 15 m	½"	6806A38	18.20	6806A61	12.25	6806A11	21.16	6806A61	12.25
100 ft./ 30 m	½"	6806A39	25.72	6806A62	22.92	6806A12	35.93	6806A62	22.92
200 ft./ 60 m	½"	6806A34	71.88	6806A63	53.83	6806A23	70.24	6806A63	53.83
300 ft./100 m	½"	—	—	—	—	6806A24	89.32	6806A64	80.21
DECIMAL: Front, feet to 100ths.									
50 ft.	½"	6806A35	17.08	6806A65	11.08	6806A25	19.00	6806A65	11.08
100 ft.	½"	6806A36	24.64	6806A66	19.08	6806A26	30.08	6806A66	19.08
200 ft.	½"	6806A37	58.80	6806A67	46.83	6806A27	59.89	6806A67	46.83
300 ft.	½"	—	—	—	—	6806A28	90.50	6806A68	70.50
NYLON-COATED STEEL									
INCH: Front, inches to 8ths.									
50 ft.	⅜"	1930A17♦	$29.85	1930A61	$24.08	—	—	—	—
100 ft.	⅜"	1930A18♦	49.90	1930A62	38.04	1930A11♦	$49.90	1930A62	$38.04
200 ft.	⅜"	—	—	—	—	1930A12♦	79.75	1930A63	70.46
300 ft.	⅜"	—	—	—	—	1930A23♦	146.33	1930A64	95.63
METRIC: Front, cm to mm.									
30 m	⅜"	1930A22●	49.90	1930A71	38.04	1930A15●	49.90	1930A71	38.04
60 m	⅜"	—	—	—	—	1930A16●	79.75	1930A72	70.46
DECIMAL: Front, feet to 100ths.									
50 ft.	⅜"	1930A19●	29.85	1930A68	24.08	—	—	—	—
100 ft.	⅜"	1930A21●	49.90	1930A69	38.04	1930A13●■	49.90	1930A65	38.04
200 ft.	⅜"	—	—	—	—	1930A14●■	79.75	1930A66	70.46
300 ft.	⅜"	—	—	—	—	1930A24●■	146.33	1930A67	95.63
WOVEN DACRON									
INCH: Front, inches to 8ths.									
50 ft.	⅝"	1961A12	$48.45	1961A16	$30.88	—	—	—	—
100 ft.	⅝"	1961A14	79.34	1961A17	57.37	—	—	—	—

♦ Hook at end of tape. ● Ring at end of tape. ■ Zero point is 12" from the end of the tape.

Long Steel Tape Rules

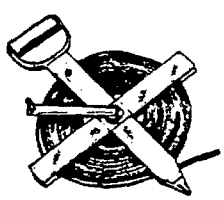
Professional-quality rules go a long way to provide accurate measurements.

All of the rules are ⅜" wide. They have a vinyl-covered steel case, an easy-to-operate manual rewind, and a folding hook ring. Rules with a yellow steel blade have black and red markings. Rules with a chrome-plated steel or stainless steel blade have black markings (♦ black markings only).

Blade Length	YELLOW STEEL BLADE Tape Rule No.	YELLOW STEEL BLADE Tape Rule NET EACH	YELLOW STEEL BLADE Replacement Blade No.	YELLOW STEEL BLADE Replacement Blade NET EACH	CHROME-PLATED STEEL BLADE Tape Rule No.	CHROME-PLATED STEEL BLADE Tape Rule NET EACH	CHROME-PLATED STEEL BLADE Replacement Blade No.	CHROME-PLATED STEEL BLADE Replacement Blade NET EACH	STAINLESS STEEL BLADE Tape Rule No.	STAINLESS STEEL BLADE Tape Rule NET EACH	STAINLESS STEEL BLADE Replacement Blade No.	STAINLESS STEEL BLADE Replacement Blade NET EACH
INCH: Inches to 8ths top and bottom.												
50 ft.	1965A2	$19.82	1965A7	$13.80	1956A2	$27.75	1956A7	$20.86	1964A1	$59.49	1964A5	$48.30
100 ft.	1965A4	30.14	1965A8	22.99	1956A4	40.14	1956A8	33.42	1964A2	96.95	1964A6	84.74
INCH: Consecutive inches and 16ths.												
50 ft.	1965A61♦	$20.33	1965A62♦	$13.35	—	—	—	—	—	—	—	—
INCH/METRIC: Inches to 8ths front; cm to mm back.												
50 ft./15-m	1965A52	$20.17	1965A54	$13.80	1956A52	$28.42	1956A56	$24.87	—	—	—	—
100 ft./30-m	1965A53	30.67	1965A55	22.99	1956A54	41.11	1956A58	37.07	—	—	—	—
DECIMAL: Feet to 100ths top and bottom.												
50 ft.	1965A56	$20.86	1965A58	$14.29	—	—	—	—	—	—	—	—
100 ft.	1965A57	31.73	1965A59	23.81	—	—	—	—	—	—	—	—

Fiber Glass Measuring Ropes

Lightweight but tough and flexible for easy handling in the field—excellent for surveying and estimating distances. Ropes are covered with nonglare, textured vinyl for abrasion resistance. Markings are red and black in inches and feet.



Steel Babbitt Tapes

Durable field-use tapes provide accurate readings, even when pulled taut. Raised babbitts are fused to tin-coated steel blades. Reels have nickel-plated steel frames. Leather tie-down thongs included.

Tapes are also available in 30-, 50-, 100-, and 150-meter lengths. Specify No. 1974A888 and length. Prices on request.

Blade — Tape Rule — Replacement Blade

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Two-Way Radios

Professional-quality, two-way hand-held radios let you communicate on FCC-designated business frequencies. They can be used up to several miles outside in the direct line-of-sight, and limited distances inside buildings. All radios come with a rechargeable battery pack, 10-hour battery charger, and FCC license application. They feature an on/off volume switch and squelch control. Radio frequencies are identified by color codes. To communicate with one another, radios must be on the same frequency. VHF frequencies offer maximum range in open terrain and wooden buildings. UHF provides better range in and around steel and concrete buildings. Use local frequencies if you operate in a set location all the time. Itinerate frequencies are for users who move around geographically. **Please specify color code when ordering one-channel radios.**

Color Code	Frequency	Type
~~Red Dot~~	~~VHF, 151.625 MHz~~	~~Itinerant~~
Blue Dot	VHF, 154.570 MHz	Local
~~Green Dot~~	~~VHF, 154.600 MHz~~	~~Local~~
Brown Dot	UHF, 464.500 MHz	Itinerant
Yellow Dot	UHF, 464.550 MHz	Itinerant
Silver Star	UHF, 467.850 MHz	Local
Gold Star	UHF, 467.875 MHz	Local
Blue Star	UHF, 467.925 MHz	Local

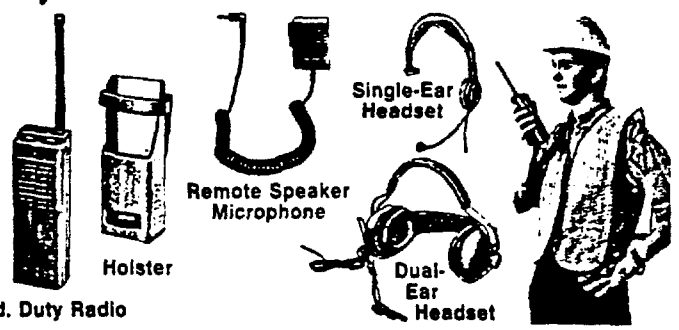
Standard-Duty Radios

Here's the easy way to immediately communicate with any job location. These radios have a tough, ABS-plastic case that measures 7.2" × 2.6" × 1.8", and a molded screw-in antenna.

Push-to-talk (PTT) models require that the transmit button be pushed in while speaking to transmit message.

Voice-activated (VOX) model enables hands-free operation. When speaking, the voice-activated headset (included) transmits your message via radio.

When ordering one-channel radios, please specify the color-code frequency in VHF or UHF levels (see chart above). Radios are also available in two-channel styles with preset frequencies.



Radio	No. of Channels	UHF RADIO No.	UHF RADIO NET EACH	UHF REPL. BATTERY No.	UHF REPL. BATTERY NET EACH	VHF RADIO No.	VHF RADIO NET EACH	VHF REPL. BATTERY No.	VHF REPL. BATTERY NET EACH
1 Watt, Push To Talk (PTT)	1	8292T45	$188.14	8292T52	$31.50	8292T1	$194.93	8292T51	$32.31
1 Watt, Voice Activated (VOX)	1	—	—	—	—	8292T2	254.98	8292T51	32.31
2 Watt, Push To Talk (PTT)	1	8292T55	247.46	8292T53	39.67	8292T35	247.46	8292T52	31.50
2 Watt, Push To Talk (PTT)	2	8292T75 ♦	245.71	8292T53	39.67	8292T65 ♦	245.71	8292T52	31.50

♦ Preset Silver Star/Blue Star frequencies. ● Preset Green Dot/Red Dot frequencies.

ACCESSORIES	No.	NET EACH
Holster with Belt Loop and Rain Shield	8292T41	$26.87
Replacement Battery Charger	8292T61	9.62
~~Remote Speaker Microphone with Lapel Clip~~	~~8292T81■~~	~~35.69~~

HEADSETS—Fit under hardhats.	No.	NET EACH
Light-Duty, Single-Ear Headset	8292T95■	$18.64
Heavy-Duty, Dual-Ear Headset	8292T85■	155.93

■ For use with 8292T2, T35, and T65 radios only.

Coded-Squelch Radios

These one-channel radios block out unwanted receptions of other conversations and interference transmissions that are common in urban areas. You can set your own code to screen out unwanted receptions and communicate only with radios of the same frequency and code. (Note: This is not a security line).

Radios have a polycarbonate, sealed-gasket housing that's weather resistant. Measures 5.3" × 2.5" × 1.2". Features include a push-to-talk (PTT) switch with battery/transmit light indicator, belt clip, and screw-in flexible rubber antenna.

Optional quick-change, three-hour battery charger and voice-activated (VOX) adapter are sold separately at right.

When ordering, please specify the color-code frequency (shown in chart above).

Frequency	Watts	No.	NET EACH
VHF	1	5893T7	$283.61
UHF	2	5893T9	313.11

ACCESSORIES		
Repl. Battery Pack	5893T81	34.86
Leather Holster	5893T83	34.43
Earpiece/Microphone	5893T32	54.10
Headset/Microphone	5893T34	63.93
VOX Adapter●	5893T36	40.98
3-Hour Battery Charger	5893T28	57.38

●Must be used with earpiece or headset.

Coded-Squelch Radio

Dual-Power Radio

Powerful 5-watt radio can be switched to 1-watt to conserve battery power. Radio has 4-channel selectable capability. Other features include push-to-talk (PTT) switch, high-impact ABS-plastic case that measures 5.2" × 2.4" × 1.5", and flexible rubber antenna.

Installed frequency is crystallized to VHF Red Dot (151.625 MHZ) in channel one. **For other frequencies, please order No. 56545T999 and specify frequencies (see chart above).**

Description	No.	NET EACH
Radio	56545T61	$262.13
Leather Holster w/Swivel Belt Loop	56545T63	25.09
Replacement Battery Pack	56545T62	42.22
3-Hour Quick-Charge Battery Charger	56545T64	45.08

Dual-Power Radio

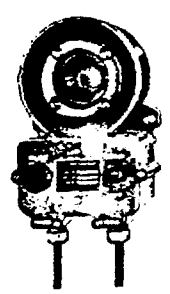
Intercoms

All-Weather Industrial Intercoms

Rain? Sleet? Snow? Heat? Even under these conditions you can count on dependable, efficient performance from these heavy-duty intercoms. Construction features sealed, cast-aluminum cases. Each self-contained station receives, amplifies, and transmits signals. All models have a press-to-talk lever and volume control. Any number of stations may be connected in series on a common line. Stations connect using 2-conductor electric wire.

The ambient temperature range for standard units is: 0° F to 150° F; for severe-Duty units: −50° F to +150° F. All of these intercoms use 117 VAC and come with a 7-ft. cord and a 7-ft. 2-conductor audio cable.

Description	No.	NET EACH
Standard	5656T25	$520.16
Standard w/Call Tone	5656T27	562.50
Severe Duty	5656T26	550.40
Severe Duty w/Call Tone	5656T28	592.74

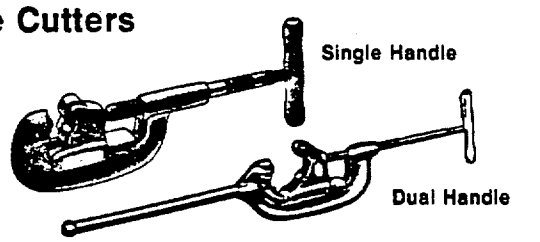


Wall-Plug Intercom Systems

1-Channel System—One talk path. **2-Channel System**—Two si-

Pipe Cutters & Wire Nippers

Ridgid Heavy-Duty Pipe Cutters



When exceptional durability and top performance are a must, you can't beat genuine Ridgid pipe cutters. They're great for hand and power-drive cutting. All have tough steel cutter wheels and balanced iron frame. Two-handle models lend a helping hand when cutting large pipe; second handle is removable for tight spots.

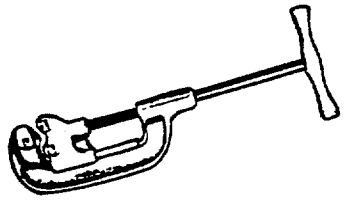
SINGLE-WHEEL CUTTERS— Use where a complete turn can be made. When a complete turn is not possible, these cutters may be converted to three-wheel style by replacing rollers with cutting wheels. No. 2679A65 has extra-wide rollers that resist wobbling for super-straight tracking . . . ideal for use with power drives.

FOUR-WHEEL CUTTER—For use where a complete turn is impossible. No. 2679A7 has an extra-short handle for use in tight spots where no more than a 130° turn can be made.

Pipe Cap., OD	Closed Lg.	Open Lg.	Wt., Lbs.	Description	Ridgid No.	PIPE CUTTERS No.	PIPE CUTTERS NET EACH	REPL. CUTTER WHEELS For Schedule 5 and 10 Steel Pipe No.	NET EACH	For Schedule 40 and 80 Steel Pipe No.	NET EACH	For Stainless Steel Pipe No.	NET EACH
⅛"-1¼"	15¼"	17"	6½	1 Wheel; 1 Handle	1-A	2679A1	$81.10	2680A13 ♦	$4.84	2680A16	$5.37	2680A19	$7.01
⅛"-2"	16¾"	19¼"	7	1 Wheel; 1 Handle	2-A	2679A2	95.35	2680A13 ♦	4.84	2680A16	5.37	2680A19	7.01
⅛"-2"	16¾"	19¼"	8	1 Wheel; 1 Handle	202	2679A65	104.30	2680A13 ♦	4.84	2680A16	5.37	2680A19	7.01
1"-3"	23"	26½"	15	1 Wheel; 2 Handle	3-S	2679A4	162.75	2680A23 ♦	6.96	2680A26	8.96	2680A29	11.84
2"-4"	23½"	28"	18	1 Wheel; 2 Handle	4-S	2679A3	246.42	2680A23 ♦	6.96	2680A26	8.96	2680A29	11.84
4"-6"	26"	30¾"	22	1 Wheel; 2 Handle	6-S	2679A5	354.10	———	——	2680A33 ♦	9.66	2680A36	15.38
¾"-2"	14¼"	17"	6¾	4 Wheel; 1 Handle	42-A	2679A7	107.00	———	——	2680A16 ♦	5.37	2680A19	7.01
2½"-4"	24¼"	28¾"	20	4 Wheel; 2 Handle	44-S	2679A8	281.10	2680A23	6.96	2680A26 ♦	8.96	2680A29	11.84

♦ This wheel style furnished with the pipe cutter.

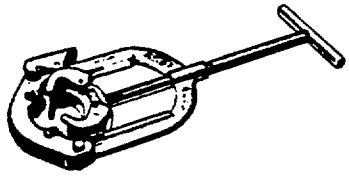
Pipe-Pro Pipe Cutters



Economical, yet tough and durable. Perfect for cutting Schedule 40 steel pipe. Cutters have a strong ductile-iron frame and one handle—excellent for hand as well as power-drive use. They're furnished with one drop-forged alloy-steel cutting wheel that's precision machined and heat treated.

Pipe Cap., OD	Closed Lg.	Open Lg.	Wt., Lbs.	PIPE CUTTERS No.	PIPE CUTTERS NET EACH	REPL. CUTTER WHEELS No.	REPL. CUTTER WHEELS NET EACH
⅛"-1¼"	13"	15"	3	2758A11	$63.36	2758A15	$8.02
⅛"-2"	17½"	20½"	5½"	2758A12	79.62	2758A15	8.02
½"-3"	19"	22"	8½"	2758A13	129.73	2758A16	10.79
2"-4"	23"	28"	14½"	2758A17	205.73	2758A18	10.42

Hinged 4-Wheel Pipe Cutters



Hinged frame swings open to fit around pipe, so cutters are easy to maneuver in tight spots. They require just 90° to 110° handle swing and only 4" clearance around pipe. Frame is made of ductile iron; handle is steel. Tough guide fingers provide perfect alignment for clean, square cuts.

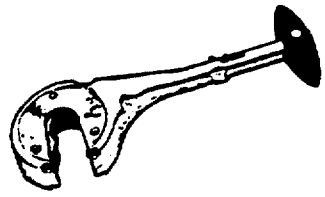
These tools will cut through ductile iron, cast iron, and Schedule 40 steel pipe with little setup time and minimum site preparation.

Cutters are furnished with four wheels to cut steel pipe. Wheels are made from heat-treated tool steel.

Pipe Cap., OD	Closed Lg.	Open Lg.	Wt., Lbs.	PIPE CUTTERS No.	PIPE CUTTERS NET EACH	REPL. CUTTER WHEELS For Schedule 40 Steel Pipe No.	For Cast- and Ductile-Iron Pipe No.	NET EACH
1"-2½"	17"	20"	8	2683A16	$271.00	2683A31●	2683A21	$9.23
2"-4"	22"	26¼"	14	2683A17	398.10	2683A32■	2683A22	17.18
4"-6"	28¼"	33½"	22	2683A18	499.60	2683A33	2683A23	19.65
6"-8"	32¼"	38¼"	28	2683A19	660.10	2683A34	2683A23	19.65
8"-12"	34½"	43¼"	39	2683A2	820.40	2683A34	2683A23	19.65

●Can be used on Schedule 80 extra-strong steel. ■Can be used on Schedule 40 extra-strong steel.

Ratchet Pipe Cutter



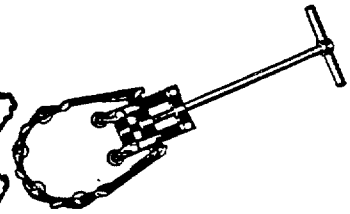
Use this ratchet-action cutter under sinks, inside walls, near machinery, and wherever space is limited. It requires only 10° of arc to complete a 360° cut, yet swings 360° if desired.

Cutter can be used on copper, brass, aluminum, Schedule 40 and 80 steel, and galvanized-steel tubing sizes ¼"-1" OD, plus rigid and semirigid plastic pipe sizes ¼" -1" ID.

Cutter is made of cast aluminum. Cutter wheel is hardened tool steel. Length is 13". Weighs 2½ lbs.

No. 2710A76—Pipe Cutter.....**NET EACH $127.14**
No. 2710A86—Repl. Cutter Wheel.....**NET EACH $7.70**

Heavy-Duty Pipe Cutters



A great choice for cutting steel and cast-iron pipe in tight places—like trenches, between rafters, and in corners. Cutter wheels are spaced only a few inches apart, so a rotation of just 60° results in a straight, accurate cut completely around the pipe with 2" of clearance. Tools will cut within ¾" of the pipe end. Frame and links are drop-forged steel for extra strength. All cutter wheels are tool steel. The wheels that are included with cutters are for cast-iron pipe.

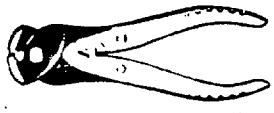
PIPE CUTTERS

Pipe Cap., OD	No. of Cutter Wheels	Lg.	Wt., Lbs.	No.	NET EACH
4"-8"	6	42"	50	2672A1	$696.43
~~4"-12"~~	~~6~~	~~46"~~	~~55~~	~~2672A2~~	~~687.01~~
4"-16"	11	50"	62	2672A6	746.36

REPLACEMENT CUTTER WHEELS

Description	No.	NET EACH
For Cast-Iron Pipe	2672A3	$13.02
~~For Schedule 40 Steel Pipe~~	~~2672A5~~	~~13.02~~
Wheel Pin	2672A7	1.26

Compound-Leverage Wire Nippers



Compound leverage makes slicing through heavy stock easy. Nippers make close cuts on wire, nails, and small rivets. They cut hard wire to .203" and piano wire to .078".

Drop-forged steel jaws are hardened and ground. Nippers have self-opening, nickel-plated steel handles. Overall length is 6½".

No. 3737A11.....**NET EACH $40.55**

Replaceable-Blade Wire Nippers

These nippers have extra-long handles for maximum leverage and cutting power. Their blades can be replaced when they become dull. Nippers cut spring/music wire to .10" and softer material such as iron wire. Made of steel with a black-oxide finish. Jaw width is 1". Length is 9".

No. 3579A77—Nippers.....**NET EACH $68.00**
No. 3579A79—Replacement Blade.....**NET EACH $30.22**

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Appendix B

Appendix B

Translated Operations and Maintenance Manuals

Leak Detection Equipment
Sewer Bucket Machine

CDM International Inc.

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FISHER m-SCOPE®

КАБЕЛЕИСКАТЕЛЬ

Комплект прибора TW-770 состоит из передатчика, приемника, блока заземляющей пластины/заземляющего стержня, руководства по эксплуатации и жесткого футляра для транспортировки. Сигнал передатчика подается на подземную коммуникацию одним из двух способов: индуктивно, когда передатчик кладется на землю над линией, или путем непосредственного контакта, когда передатчик используется совместно с блоком заземляющей пластины/заземляющего стержня. Когда непосредственный физический контакт невозможен, передатчик может использоваться со вспомогательным соединительным зажимом.

Приемник прибора TW-770 имеет всего два органа управления: ручку для включения/выключения и регулировки величины сигнала, а также кнопку для определения глубины пролегания на светодиодном табло в дюймах или сантиметрах. Органы управления передатчика состоят из тумблерного переключателя с положениями "включено" и "контроль батареи".

На верхнем фото, оператор прослеживает водопроводную магистраль. Он руководствуется звуковыми и визуальными сигналами приемника при перемещении устройства влево и вправо. При нахождении слева от магистрали, на светодиодном табло появляются слово "RIGHT" (НАПРАВО) и направленная вправо стрелка, а звуковой сигнал становится прерывистым. При нахождении справа от магистрали, на светодиодном табло появляются слово "LEFT" (НАЛЕВО) и направленная влево стрелка, а звуковой сигнал становится непрерывным. При нахождении непосредственно над магистралью, на табло высвечивается сообщение "OVER TARGET" (НАД ОБЪЕКТОМ), которое сопровождается звуковым сигналом максимальной частоты. В этот момент можно нажать кнопку для определения глубины пролегания.

Приемник, жесткий футляр для транспортировки, передатчик и блок заземляющего стержня/заземляющей пластины прибора TW-770. Также показаны вспомогательные наушники и соединительный зажим.

ОТЛИЧИТЕЛЬНЫЕ ОСОБЕННОСТИ

- Цифровая точность при поиске и определении глубины пролегания труб и кабелей.
- Звуковая и визуальная индикация для ориентировки влево/вправо.
- Простота использования.
  - Мгновенная реакция на объект.
  - Кнопка для определения глубины.
  - Одна ручка для включения и регулировки сигнала.

ИНДУКТИВНЫЙ ПОИСК

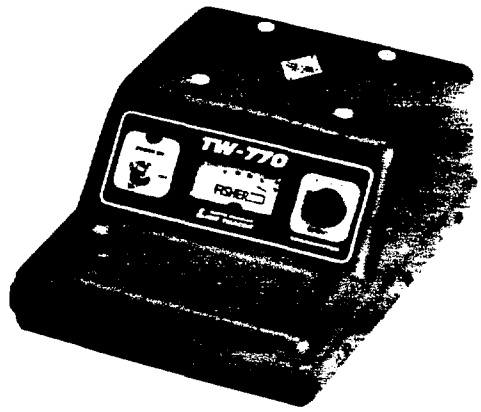
Если положение одной из точек магистрали (трубы или кабеля) известно, передатчик прибора TW-770 может быть помещен на землю над этой точкой, и поиск может осуществляться от нее в любом направлении. Оператор двигается вдоль магистрали, слегка перемещая приемник влево и вправо. На определенном расстоянии от передатчика сигнал становится слабым; в этом случае передатчик можно переставить в это место, так что поиск можно продолжать бесконечно.

ПОИСК ПРИ НЕПОСРЕДСТВЕННОМ КОНТАКТЕ

Этот метод поиска является предпочтительным, так как обеспечивается непосредственный физический контакт передатчика с отслеживаемой магистралью. Входящий в комплект прибора блок заземляющей пластины/заземляющего стержня подключается к передатчику, а одна из клемм типа "крокодил" подсоединяется к трубе, находящемуся не под напряжением кабелю, кабелепроводу, трассировочному проводу или трассировочной ленте. Второй конец должен быть надежно заземлен. При этом передаваемый сигнал концентрируется в заданной магистрали, что уменьшает вероятность попадания его в соседнюю или проходящую рядом магистраль. Дальность поиска в этом случае увеличивается на 25-50 процентов по сравнению с индуктивным методом. Неметаллические трубы могут быть отслежены методом непосредственного контакта путем подключения блока заземляющей пластины/заземляющего стержня к сантехническому тросу или проволоке для протаскивания электропроводов, пропущенной внутри трубы.

ИНДУКТИВНЫЙ СОЕДИНИТЕЛЬНЫЙ ЗАЖИМ

Соединительный зажим используется вместо блока заземляющей пластины/заземляющего стержня при отслеживании действующих электрических линий. Он обеспечивает индуктивную передачу сигнала без непосредственного электрического контакта. При использовании соединительного зажима, частота, на которой работает прибор TW-770, не вносит помехи в работу электрических коммуникаций.



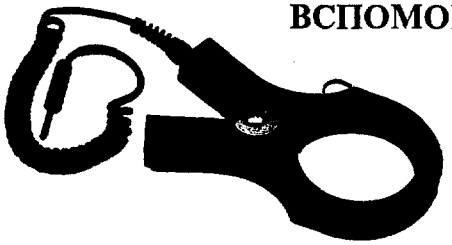
ПЕРЕДАТЧИК

Измерительный прибор передатчика TW-770 способен показывать информацию двух видов. Когда тумблер находится в нижнем положении, измеряется степень зарядки батареи. В верхнем положении тумблера передатчик включен. Прибор показывает силу трассирующего сигнала. Это показание имеет значение только при выполнении поиска методом непосредственного контакта.

ПРИЕМНИК

Приемник прибора TW-770 показывает силу сигнала в виде столбиковой диаграммы. Он показывает также силу сигнала в форме процента, а также визуальные указания для перемещения влево или вправо. При нажатии кнопки высвечивается глубина пролегания.

ВСПОМОГАТЕЛЬНЫЕ ПРИСПОСОБЛЕНИЯ



Соединительный Зажим

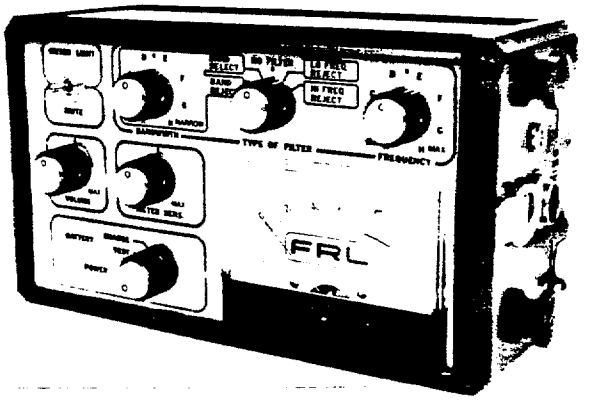
Это приспособление полезно при поиске электрических линий, когда непосредственный электрический контакт с помощью блока заземляющей пластины/заземляющего стержня не представляется возможным.

Наушники

Подключение наушников к приемнику облегчает работу с прибором в шумных условиях. Сила сигнала регулируется отдельно для каждого уха. Использование наушников увеличивает срок работы батареи на 50-100 процентов.

Контакт: Экспортный отдел, почтовый ящик 1896, г.Нью Хэйвен, шт.Коннектикут, 06508, США. Телефон: (203)288-1638. Факсимиле: (203)287-8099. Телекс: 179160 EXPORT.

FISHER m-SCOPE® Model XLT-20



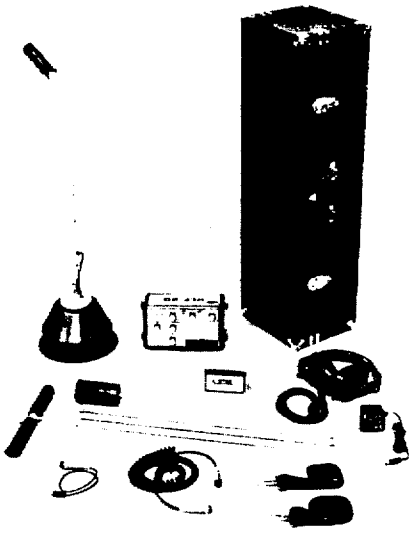
ИНДИКАТОР УТЕЧКИ

Жидкость, вытекающая под давлением через отверстие в трубе, издает три характерных звука. Первый звук возникает за счет трения вытекающей жидкости о края имеющегося в трубе отверстия. Второй звук возникает в результате контакта жидкости с почвой. Третий звук является следствием соударения камней и частиц почвы под действием вытекающей жидкости между собой, а также с поверхностью трубы.

Возникая в месте утечки, эти звуки передаются по трубе в обоих направлениях, а также распространяются через почву. С помощью чувствительных датчиков, высокого коэффициента усиления и избирательной фильтрации прибора "Фишер" XLT-20, эти звуки могут быть быстро распознаны и локализированы.

ОТЛИЧИТЕЛЬНЫЕ ОСОБЕННОСТИ:

- Обнаружение и определение мест утечки жидкости в трубах.
- Утечка определяется по отклонению стрелки прибора и звуку в наушниках.
- Акустический щуп для обнаружения утечки через дорожное покрытие без непосредственного контакта.
- Щуп для осуществления непосредственного контакта с трубой существенно уменьшает шум, возникающий вследствие движения транспорта и пешеходов.
- Полупроводниковый усилитель с высоким коэффициентом усиления помогает обнаруживать слабые звуки при использовании труб из поливинилхлорида или цемента.
- Батарея никель-кадмиевых аккумуляторов позволяет выполнять подзарядку путем подключения к входящему в комплект зарядному устройству без необходимости разборки инструмента.
- Избирательный электронный полосовой фильтр обеспечивает подавление посторонних окружающих шумов.



ПОЛНЫЙ КОМПЛЕКТ ИНСТРУМЕНТА

РЕЖИМЫ РАБОТЫ

Прибор XLT-20 обеспечивает работу в двух режимах. Обследование и обнаружение без непосредственного контакта с трубой выполняется с помощью акустически экранированного кристаллического щупа или гидрофонического цилиндрического щупа. Обследование и обнаружение при непосредственном контакте с трубой выполняется с помощью гидрофонического цилиндрического щупа. С помощью этого щупа и набора акустических трубок можно прослушивать трубы, находящиеся как на поверхности, так и на глубине более 1,8 м.

ОБЛАСТИ ПРИМЕНЕНИЯ

Прибор XLT-20 может использоваться для обнаружения утечки во всех типах труб. Он может использоваться на любой почве, даже в заполненных водой полостях. Прибор XLT-20 обнаруживает также течи в кранах, соединениях, измерительных устройствах и резервуарах через бетонное покрытие.

ИЗБИРАТЕЛЬНОЕ РАСПОЗНАВАНИЕ ЗВУКА

Мощный усилитель прибора XLT-20 усиливает как звуки, возникающие в результате утечки, так и обычные звуки, вызываемые ветром, движением транспорта, потоком жидкости, насосами и измерительными устройствами. Однако, используемый в приборе полосовой фильтр с прямоугольной характеристикой подавляет нежелательные частотные диапазоны и улучшает прохождение сигналов желаемой частоты. Фильтр способен также выбирать или подавлять частоты выше или ниже частоты определенного звука.

Контакт: Экспортный отдел, почтовый ящик 1896
г. Нью Хэйвен, шт. Коннектикут, 06508, США
Телефон: (203)288-1638. Факсимиле: (203)287-8099
Телекс: 963487

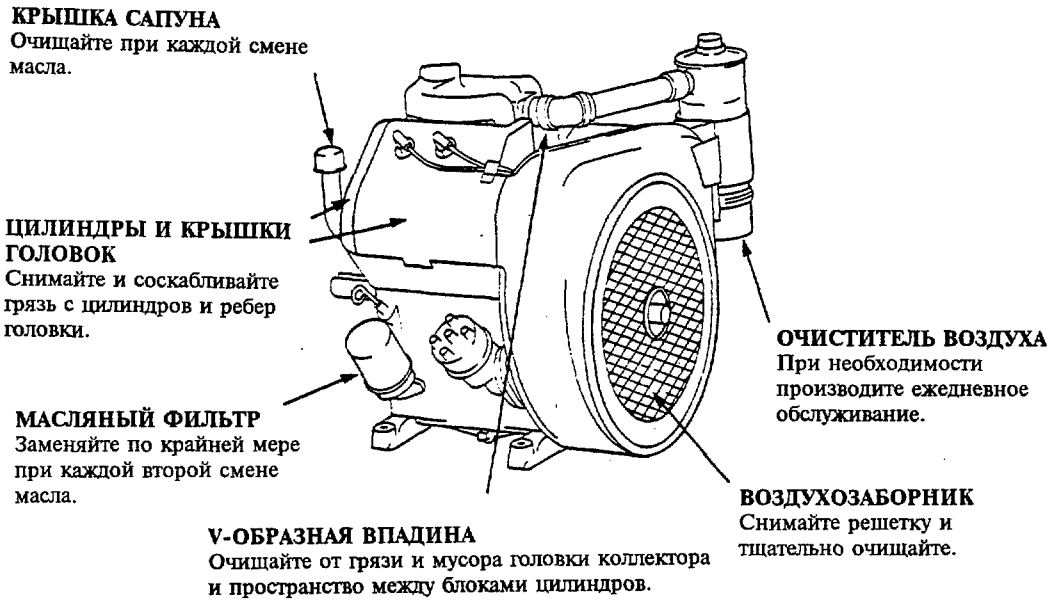
ДВИГАТЕЛЬ ДЛЯ КАНАЛИЗАЦИОННО-ОЧИСТНЫХ МАШИН

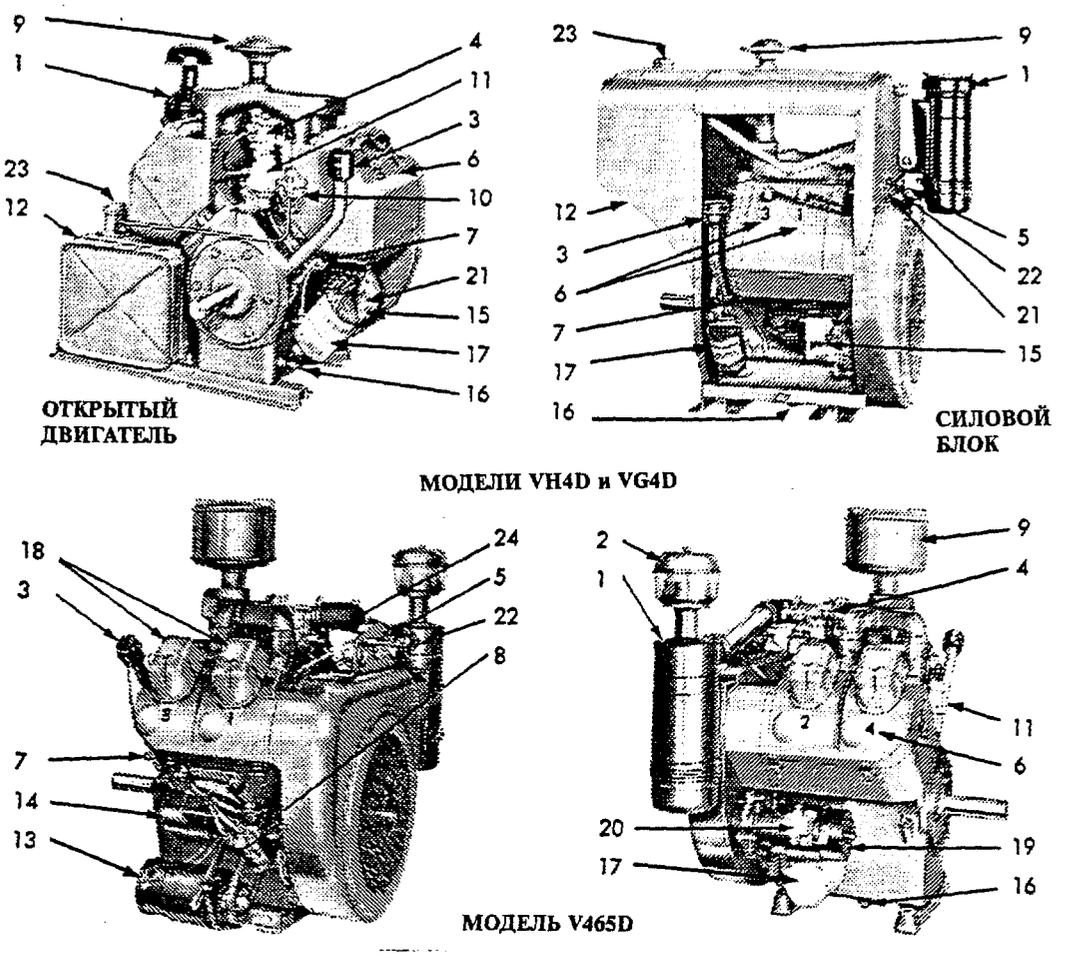
МОДЕЛЬ № VH4D

РУКОВОДСТВО ПО ЗАПУСКУ И ЭКСПЛУАТАЦИИ

ИНСТРУКЦИИ К НОВОМУ ДВИГАТЕЛЮ

- ОЧИСТИТЕЛЬ ВОЗДУХА: в двигателе используется очиститель воздуха инерционно-масляного типа. Заливайте в него такое же масло, какое используется в картере двигателя, до уровня отметки в чашке очистителя. Поддерживайте необходимый уровень масла, чтобы предотвратить попадание грязи и повреждение двигателя.
- ТОПЛИВО: используйте бензин стандартного качества.
- СОДЕРЖИТЕ ДВИГАТЕЛЬ В ЧИСТОТЕ: грязь, присутствующая снаружи, препятствует охлаждению двигателя, а внутри - вызывает повышенный износ.





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3	КРЫШКА САПУНА И МАСЛЯНЫЙ ФИЛЬТР
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24	КЛАПАН ДЛЯ УСТРАНЕНИЯ ДИЗЕЛЬНОГО ЭФФЕКТА

Рис. 1. Виды для справок

Проверяйте уровень масла в картере двигателя через каждые 8 часов; производите смену масла через каждые 50 часов работы.

Для смены масла отвинтите сливную пробку в поддоне картера.

Модель VH4D (см. рис. 2 и рис. 3):

Заполните коробку сцепления и коробку передач маслом до уровня пробок. Используйте масло той же марки, что и в картере двигателя. Добавляйте достаточное количество масла между сменами масла, чтобы поддерживать его уровень на уровне пробок.

Производите смену масла в коробках сцепления и передач по крайней мере через каждые 500 часов работы.

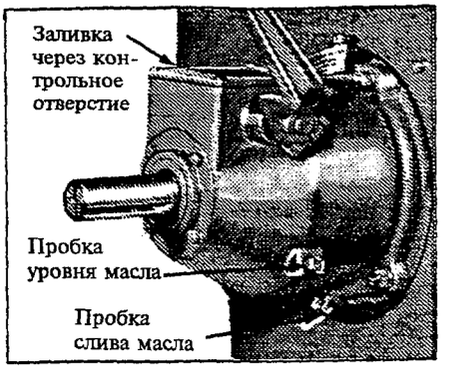

Рис.2. Смазка сцепления в модели VH4D

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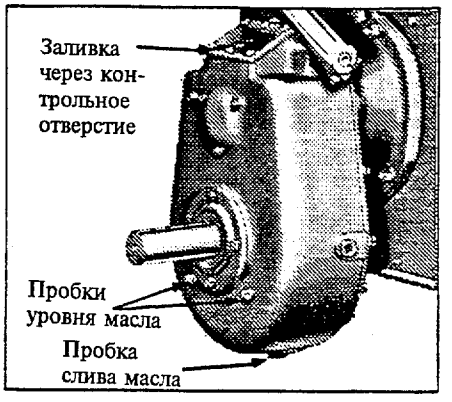

Рис.3. Смазка коробки передач в модели VH4D.

Рис. 4. Панель управления моделей VH4D и VG4D

ПУСК

Процедура пуска (см. рис. 4):

1. Проверьте уровень масла в картере двигателя и наличие бензина. Откройте запорный вентиль подачи топлива в топливном фильтре или баке.
2. Если двигатель оборудован сцеплением, отключите его.
3. Вытяните примерно на половину Т-образную ручку переменного регулятора скорости и зафиксируйте ее. При использовании двухрежимного регулятора скорости произведите пуск в положении полной нагрузки, а после запуска двигателя переведите его на холостые обороты.
4. Закройте воздушную заслонку, вытянув ручку управления воздушной заслонкой до упора.
5. Вытяните кнопку выключателя зажигания с табличкой "Нажмите для остановки".
6. Для пуска двигателя нажмите кнопку стартера.
   ВНИМАНИЕ! Не пользуйтесь стартером более 30 секунд, если двигатель не запускается. Выдерживайте паузу примерно в 2 минуты между попытками запуска, чтобы предотвратить перегрев стартера.
7. После пуска двигателя постепенно утопите кнопку управления воздушной заслонкой, поддерживая плавную работу двигателя. После прогрева двигателя воздушная заслонка должна быть полностью открыта (ручка находится в утопленном положении).

ПРОГРЕВ ДВИГАТЕЛЯ

Если все в порядке, двигатель заводится без труда в результате одной-двух попыток. После пуска дайте двигателю прогреться в течение нескольких минут перед подачей нагрузки. Не газуйте и не увеличивайте обороты двигателя с целью ускорения прогрева.

ОСТАНОВКА ДВИГАТЕЛЯ

Система зажигания с помощью магнето (двигатели с нераздельной камерой сгорания) оборудована рычажковым выключателем массы, который расположен сбоку магнето. НАЖМИТЕ ЕГО И УДЕРЖИВАЙТЕ В НАЖАТОМ ПОЛОЖЕНИИ ДО ТЕХ ПОР, ПОКА ДВИГАТЕЛЬ НЕ ОСТАНОВИТСЯ.

ТЕХНИЧЕСКОЕ ОБСЛУЖИВАНИЕ

ОЧИСТИТЕЛИ ВОЗДУХА

Частота обслуживания очистителя воздуха зависит от степени запыленности среды, в которой производится эксплуатация двигателя. Производите проверку шланговых соединений на наличие повреждений или неплотностей и заменяйте вышедшие из строя хомуты.

Увеличение количества дыма и потеря мощности являются характерными признаками того, что очиститель воздуха нуждается в обслуживании.

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ОЧИСТИТЕЛЬ ВОЗДУХА ИНЕРЦИОННО-МАСЛЯНОГО ТИПА (СМ. РИС. 5)

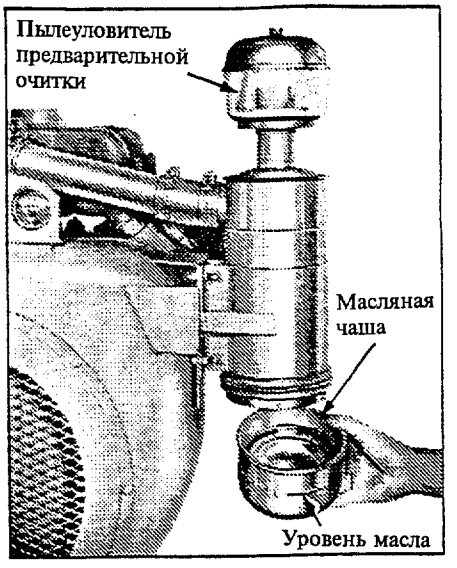

Рис. 5. Очиститель воздуха инерционно-масляного типа

Производите обслуживание ежедневно или два раза в день, если двигатель эксплуатируется в особо пыльных условиях. В относительно чистой обстановке производите обслуживание еженедельно.

Снимите масляную чашу в нижней части очистителя воздуха и тщательно очистите ее. Добавьте масло той же марки, что используется в картере двигателя.

Эксплуатация двигателя в пыльных условиях без масла или с грязным маслом в очистителе воздуха может всего в течение нескольких дней привести к износу цилиндров, поршней, колец и подшипников.

Раз в год или чаще, если эксплуатация производится в особо неблагоприятных условиях, следует снимать очиститель воздуха с двигателя и промывать в растворителе фильтрующий элемент, который является несъемным, чтобы удалить скопившуюся пыль и грязь.

КРЫШКА САПУНА (СМ. РИС. 1, ПОЗ. 3)

Вентиляция картера двигателя осуществляется через крышку сапуна, установленную на конце маслозаливной трубки. При каждой смене масла рекомендуется промывать эту крышку в керосине.

ТОПЛИВНЫЙ ФИЛЬТР (СМ. РИС. 6)

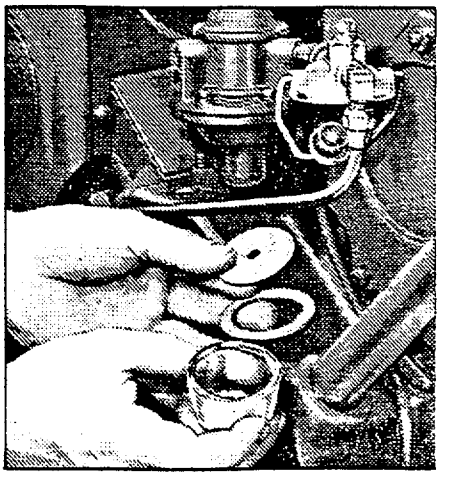

Рис. 6. Топливный фильтр

Очень важно производить фильтрование топлива, чтобы не допустить попадания осадка, грязи и воды в карбюратор, что может вызвать нарушение работы и даже полную остановку двигателя. Следует часто осматривать стеклянную чашу фильтра и очищать ее при наличии грязи или воды.

Для снятия чаши отстойника ослабьте винт под чашей, отведите в сторону скобу и, поворачивая, снимите чашу. Тщательно очистите сетку и чашу, а также замените прокладку, если она повреждена или потеряла упругость.

СВЕЧИ ЗАЖИГАНИЯ

Неправильные зазоры, а также загрязненные или сработанные электроды в свечах зажигания оказывают отрицательное влияние на работу двигателя. Периодически отворачивайте свечи зажигания и производите их очистку, калибровку зазора или, при необходимости, замену.

КОНТАКТЫ ПРЕРЫВАТЕЛЯ МАГНЕТО (СМ. РИС. 7)

По крайней мере ежесезонно, а также при ослаблении искры зажигания, снимите крышку с магнето и проверьте состояние контактов и величину зазора. При наличии признаков обгорания поверхности контактов, вызывающих необходимость их зачистки или замены, следует также отрегулировать величину зазора. ЗАЗОР В КОНТАКТАХ ПРЕРЫВАТЕЛЯ при максимальном размыкании контактов должен составлять 0,38 мм.

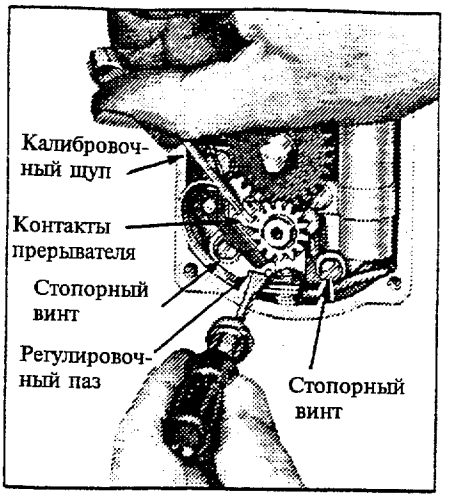

Рис. 7

РЕГУЛИРОВКА СЦЕПЛЕНИЯ

В случае пробуксовки сцепления следует выполнить его регулировку, чтобы не допустить перегрева и выхода сцепления из строя. Для этого необходимо снять крышку смотрового люка, открывающего доступ к регулировочному кольцу. Отключите сцепление, переведя рычаг переключения в направлении двигателя.

СЦЕПЛЕНИЕ МОДЕЛИ VH4D (СМ. РИС. 8)

Рис. 8. Регулировка сцепления модели VH4D

Проверните вал двигателя с помощью пусковой рукоятки таким образом, чтобы в смотровом люке показался регулировочный механизм. Отверните стопорный винт на один полный оборот. Зафиксируйте коленчатый вал со стороны пусковой рукоятки, чтобы предотвратить возможность проворачивания сцепления. Используя отвертку, постепенно поворачивайте регулировочное кольцо по часовой стрелке каждый раз на одну засечку до тех пор, пока для перевода сцепления во включенное положение потребуется прикладывать достаточное усилие к рычагу переключения. После этого надежно затяните стопорный винт.

ПОИСК НЕИСПРАВНОСТЕЙ

Для обеспечения запуска и поддержания нормальной работы двигателей внутреннего сгорания необходимо выполнение трех основных условий:

1. Подача соответствующей топливной смеси в цилиндры.
2. Достаточная компрессия в цилиндрах.
3. Надежная и своевременная искра для воспламенения топливной смеси.

При невыполнении одного из этих условий двигатель запустить невозможно.
Ниже описаны причины, которые могут затруднить пуск двигателя. Они объединены в три основные категории: топливная смесь, компрессия и зажигание.

ТОПЛИВНАЯ СМЕСЬ

Отсутствует топливо в баке или перекрыт топливный кран.

Засорено вентиляционное отверстие в крышке топливного бака.

Засорена топливная магистраль.

Изношена или порвана диафрагма топливного насоса.

Неисправен противодизельный электромагнитный клапан карбюратора (модель V465D).

Убедитесь в отсутствии отсоединенных, свободно висящих или порванных проводов.

Недостаточно прикрыта воздушная заслонка карбюратора, особенно при холодном двигателе.

Присутствующая в бензине вода, грязь или смола препятствуют свободному попаданию топлива в карбюратор.

Бензин низкого качества, несвежий или не по сезону.

Перелив карбюратора, вызванный чрезмерным закрытием воздушной заслонки, особенно при горячем двигателе.

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Игла поплавковой камеры карбюратора зависла в открытом положении. При наличии этой неисправности топливо продолжает капать из карбюратора при неработающем двигателе.

КОМПРЕССИЯ

Пересохли цилиндры вследствие длительного простоя двигателя. Залейте около 30 мл моторного масла через отверстия для свечей зажигания.

Плохо завинчена или повреждена свеча зажигания. При проворачивании коленчатого вала будет слышен шипящий звук, вызванный утечкой топливной смеси во время цикла сжатия.

Повреждена прокладка головки цилиндров или неплотно привинчена головка цилиндров. Эта неисправность также сопровождается шипящим звуком во время цикла сжатия.

Зависание клапана в открытом положении. Потеря подвижности или износ поршневых колец.

При регулировке клапанов был установлен недостаточный зазор.

ЗАЖИГАНИЕ

Проверьте наличие искры, вывернув свечи зажигания и наблюдая за образованием искры в искровом промежутке при проворачивании коленчатого вала двигателя. Отсутствие или недостаточная мощность искры может быть вызвана следующими причинами:

Повреждены или изношены провода зажигания.

Поврежден изолятор свечи зажигания.

Влажные или грязные свечи зажигания.

Неправильно установлен зазор в свечах зажигания.

Конденсация влаги на электродах свечей зажигания.

Неправильно установлен зазор между контактами прерывателя.

Обгорели или приварились друг к другу контакты прерывателя.

Заедает рычаг прерывателя.

Пробит конденсатор.

Неправильно установлен момент зажигания.

Разряжена аккумуляторная батарея. Повреждена катушка зажигания.

ПЕРЕБОИ В РАБОТЕ ДВИГАТЕЛЯ

Неправильно установлен зазор в свечах зажигания.

Износ, пробой или неплотное крепление проводов зажигания.

Слабая искра. См. процедуру проверки искры в разделе “Зажигание”.

Обгорели или изношены контакты прерывателя.

Присутствие воды в бензине.

Недостаточная компрессия, см. раздел “Компрессия”.

Заедают клапана.

ГЛОХНЕТ ДВИГАТЕЛЬ

Пуст топливный бак.

В бензине присутствует вода, грязь или смола.

Топливная магистраль заполнена парами бензина в результате слишком высокой температуры в зоне двигателя (“паровая пробка”). См. раздел “Остановка двигателя”.

Образование паровой пробки в топливной магистрали, вызванное использованием зимнего бензина (с повышенной испаряемостью) в жаркую погоду.

Неисправна система зажигания (см. “Зажигание”).

ПЕРЕГРЕВ ДВИГАТЕЛЯ

Недостаточный уровень масла в картере двигателя.

Неправильно установлен момент зажигания.

Используется бензин низкого качества.

Перегрузка двигателя.

Недостаточное охлаждение из-за нарушения циркуляции воздуха.

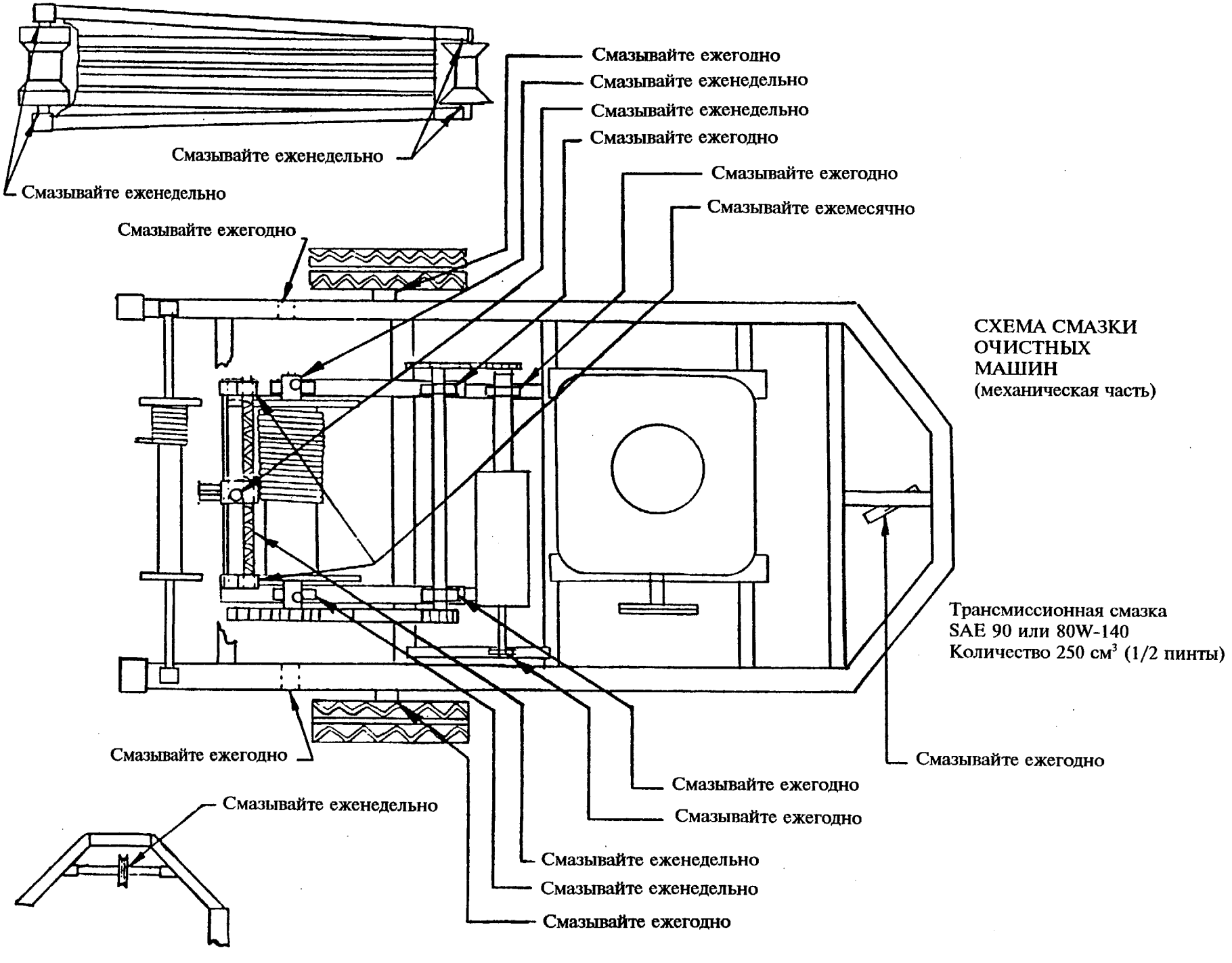
Воздухозаборная или вращающаяся сетка забиты грязью.

С двигателя сняты элементы системы обдува.

Затруднен отвод выхлопных газов.

Грязь между охлаждающими пластинами.

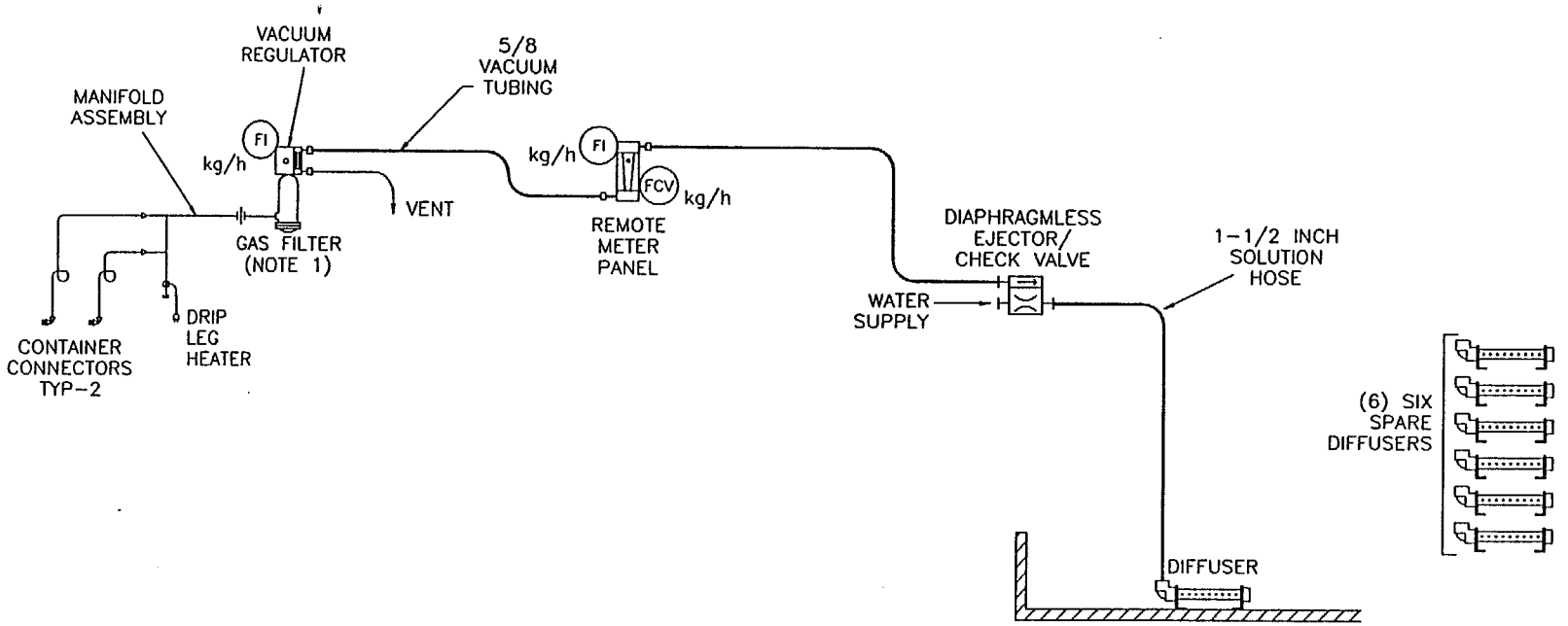
ТАБЛИЦА ТЕХНИЧЕСКОГО ОБСЛУЖИВАНИЯ	Еже-дневно	Ежене-дельно или каждые 50 часов	Каждые 100 часов	Каждые 250 часов	Ежесе-зонно или каждые 500 часов
ПРОВЕРЬТЕ УРОВЕНЬ МАСЛА. Долейте до соответствующей отметки. Не превышайте нужный уровень масла.	●				
ПРОВЕРЬТЕ ОЧИСТИТЕЛЬ ВОЗДУХА. Вытряхните скопившийся мусор из отделения сухой очистки. Поддерживайте необходимый уровень масла в очистителях инерционно-масляного типа.	●				
ОЧИСТИТЕ СЕТКУ ВОЗДУХОЗАБОРА. При необходимости очистите охлаждающие пластины.	●				
СМАЖЬТЕ ПОДШИПНИК ВЫКЛЮЧЕНИЯ СЦЕПЛЕНИЯ (модели VG4D, V465D).	●				
СМЕНИТЕ МАСЛО В КАРТЕРЕ ДВИГАТЕЛЯ.		●			
ОЧИСТИТЕ ЭЛЕМЕНТ ВОЗДУШНОГО ФИЛЬТРА (как СУХИЕ, так и ИНЕРЦИОННО-МАСЛЯНЫЕ элементы).		●			
ОЧИСТИТЕ КРЫШКУ ВЕНТИЛЯЦИИ КАРТЕРА.		●			
СМАЖЬТЕ ПОДШИПНИК КОРПУСА СЦЕПЛЕНИЯ (модели VG4D, V465D).		●			
ЗАМЕНИТЕ МАСЛЯНЫЙ ФИЛЬТР. При работе в неблагоприятных условиях производите замену фильтра при каждой смене масла.			●		
ОТРЕГУЛИРУЙТЕ ЗАЗОРЫ ПРИВОДА КЛАПАНОВ.				●	
ПРОВЕРЬТЕ КОМПРЕССИЮ. Разница давления в цилиндрах не должна превышать 10 psi (0,7 кг/см^2 - прим.перев.). Снимите головку цилиндров и удалите нагар. При необходимости произведите притирку клапанов.				●	
ПРОВЕРЬТЕ СВЕЧИ ЗАЖИГАНИЯ и КОНТАКТЫ ПРЕРЫВАТЕЛЯ (если используется контактный прерыватель). При необходимости произведите замену и установите соответствующий зазор.				●	
ПРОВЕРЬТЕ ТОПЛИВНЫЙ ФИЛЬТР. Очистите сеточку фильтра и стеклянную чашу.				●	
ПРОВЕРЬТЕ СИСТЕМУ ОХЛАЖДЕНИЯ. Снимите кожух и очистите от грязи пластины, область вокруг цилиндров и кожух.				●	
ПРОВЕРЬТЕ СТАРТЕР. Убедитесь в надежном креплении стартера и соединительных кабелей.				●	
СМЕНИТЕ МАСЛО В КОРОБКЕ СЦЕПЛЕНИЯ и КОРОБКЕ ПЕРЕДАЧ.					●


Смазывайте ежегодно
Смазывайте еженедельно
Смазывайте еженедельно
Смазывайте ежегодно
Смазывайте ежегодно
Смазывайте ежемесячно
Смазывайте еженедельно
Смазывайте еженедельно
Смазывайте ежегодно
СХЕМА СМАЗКИ ОЧИСТНЫХ МАШИН (механическая часть)
Трансмиссионная смазка SAE 90 или 80W-140 Количество 250 см³ (1/2 пинты)
Смазывайте ежегодно
Смазывайте ежегодно
Смазывайте ежегодно
Смазывайте ежегодно
Смазывайте еженедельно
Смазывайте еженедельно
Смазывайте еженедельно
Смазывайте ежегодно

Appendix C

Appendix C

Chlorination System Installation Diagrams



ACCESSORIES FOR CHLORINATION SYSTEM

(4)	1-1/2 ELBOW, 90 DEGREE
(4)	1-1/2 X 4 INCH LONG NIPPLE
(4)	1-1/2 TEE
(6)	1-1/2 NPT X 1-1/2 HOSE ADAPTOR
(10)	TEFLON TAPE
(20)	HOSE CLAMPS
(100)	CYLINDER LEAD WASHERS
(2)	5/8 VACUUM TUBING CONNECTOR
(1)	3/8 VACUUM TUBING CONNECTOR
(2)	1-1/2 COUPLING

NOTES:
1. FILTER AND MANIFOLD ASSEMBLY SHALL BE HEAT TRACED.
2. WALL ANCHORS/ANCHOR BOLTS ARE INCLUDED FOR INSTALLATION.

KIT B
EMERGENCY KIT

SITE NO.1 SAMGORI

054330-21,22,24 10 kg/hr
054330-2,5 4 kg/hr

300 kg/day CL2

5600 l/sec ≈ 127 mgd

Ps = 8 atm ≈ 120 psi

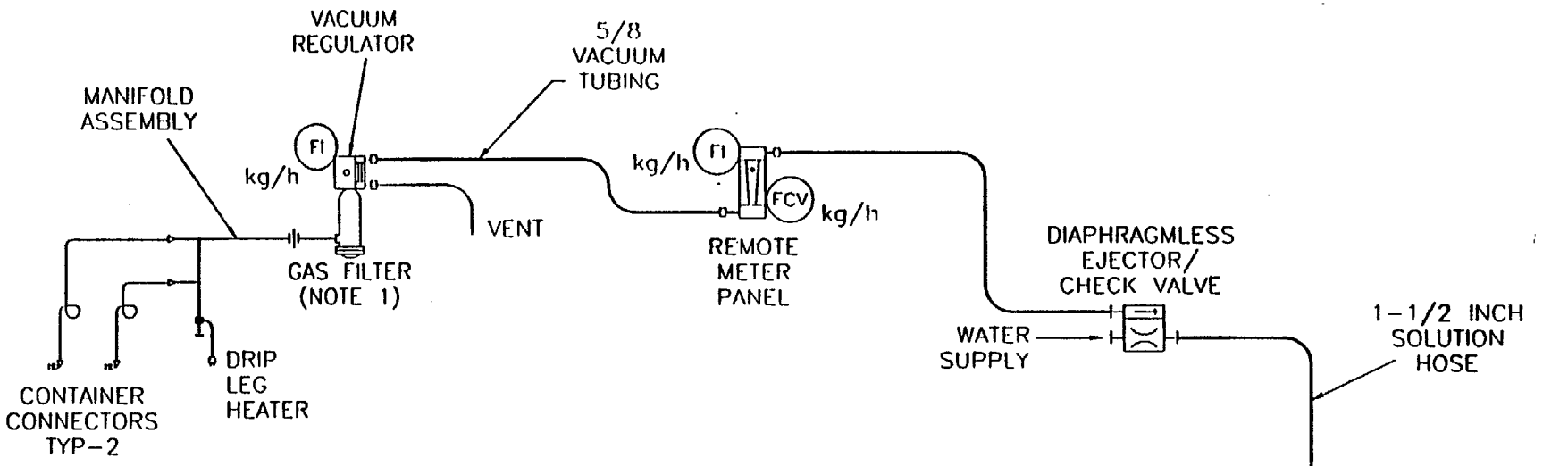
Pb = UNKNOWN

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801	Capital Controls Co., Inc. A Severn Trent Company
DRAWN BY & DATE JTG 7/6/95	TYPICAL INSTALLATION DIAGRAM
CHECKED BY & DATE JW 7/6/95	
APPROVED BY & DATE TG 7/6/95	SCALE ----- SHEET 1 OF 1
TOLERANCES Unless Noted -----	DWG NO: C-5656-1

REV	DESCRIPTION	APPD / DATE

C-5656



KIT B

EMERGENCY KIT

ACCESSORIES FOR CHLORINATION SYSTEM

(4)		1-1/2 ELBOW, 90 DEGREE
(4)		1-1/2 X 4 INCH LONG NIPPLE
(4)		1-1/2 TEE
(6)		1-1/2 NPT X 1-1/2 HOSE ADAPTOR
(10)		TEFLON TAPE
(20)		HOSE CLAMPS
(100)		CYLINDER LEAD WASHERS
(2)		5/8 VACUUM TUBING CONNECTOR
(1)		3/8 VACUUM TUBING CONNECTOR
(2)		1-1/2 COUPLING

NOTES:
1. FILTER AND MANIFOLD ASSEMBLY SHALL BE HEAT TRACED.
2. WALL ANCHORS/ANCHOR BOLTS ARE INCLUDED FOR INSTALLATION.

REV	DESCRIPTION	APPD DATE
0		

CODE: MC, OC, UK

CCC JOB NO. 054330

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801

DRAWN BY & DATE JTG 2/1/95

CHECKED BY & DATE

APPROVED BY & DATE

TOLERANCES Unless Noted -----

Capital Controls Co., Inc.
A Severn Trent Company

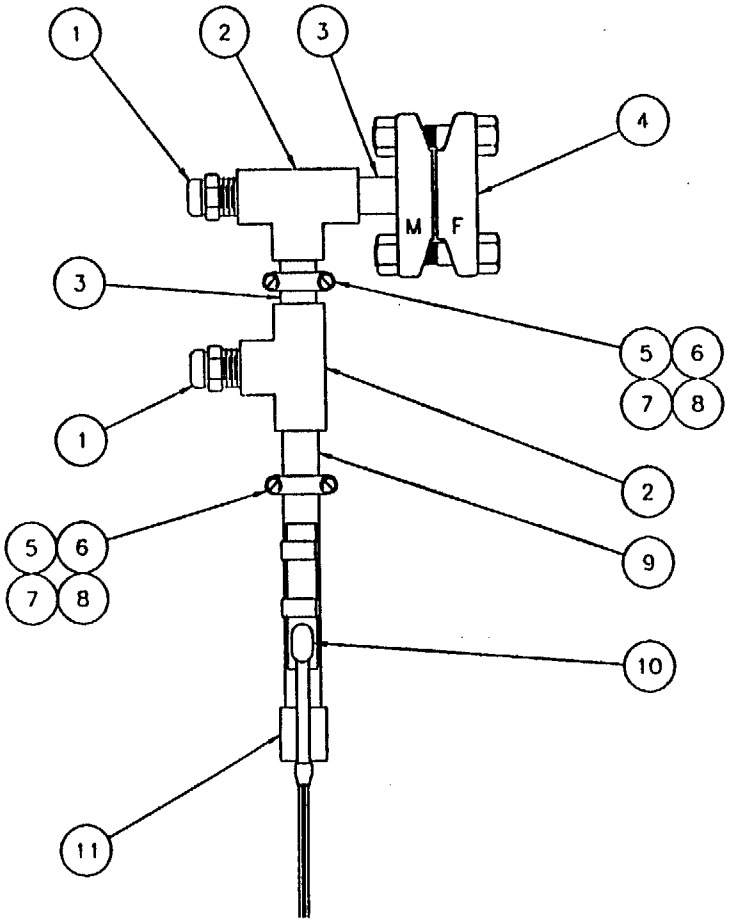
TYPICAL INSTALLATION DIAGRAM

SCALE -----

SHEET 1 OF 1

DWG NO: C-5656

CA-2345



ITEM	QTY	DESCRIPTION	PART NO.
1	2	FLEX CONNECTOR ADAPTOR	T-147
2	2	3/4 INCH NPT TEE	R-166
3	2	NIPPLE, 3/4 INCH NPT X 2 INCH LONG	R-170
4	1	FLANGED UNION, 3/4 INCH NPT	A-1461
5	4	3/8-16 HEX NUT	N-106
6	2	3/8-16 X 3-3/4 LG STUD	N-245
7	2	MANIFOLD PIPE HANGER	R-101
8	2	3/8 INCH FLANGE	R-786
9	1	NIPPLE, 3/4 INCH NPT X 8 INCH LG	R-174
10	1	MANIFOLD HEATER (240 VAC)	R-260
11	1	3/4 INCH PIPE CAP	R-902-2

NOTE: UNION ORIENTATION "M" DENOTES MALE, "F" DENOTES FEMALE.

CCC JOB NO. 054330
UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES

CODE	
	MC
	QC
	UK

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801

Capital Controls Co., Inc.
A Severn Trent Company

DRAWN BY & DATE MS 1/23/95
CHECKED BY & DATE CLS 1/25/95
APPROVED BY & DATE
TOLERANCES Unless Noted ~

ASSEMBLY, MANIFOLD
TWO-CONNECTION
240 VAC

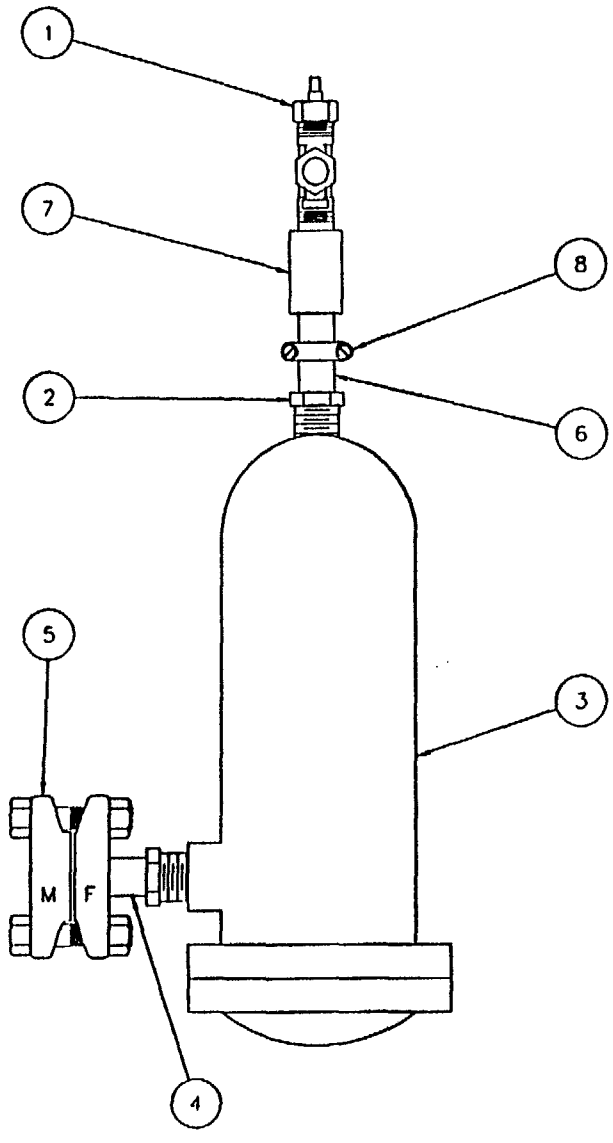
SCALE 5/16 | SHEET 1 OF 1
DWG NO: CA-2345

REV	DESCRIPTION	APPD / DATE
0		

B
A

23

CA-2346



ITEM	QTY	DESCRIPTION	PART NO.
1	1	HEADER VALVE	R-104
2	2	1 INCH NPT X 3/4 INCH NPT REDUCING BUSHING, STEEL	R-178
3	1	CHLORINE GAS FILTER	R-1256
4	1	NIPPLE, 3/4 INCH NPT X 2 INCH LONG	R-170
5	1	FLANGED UNION, 3/4 INCH NPT	A-1461
6	1	NIPPLE, 3/4 INCH NPT X 3 INCH LONG	R-171
7	1	COUPLING, 3/4 INCH NPT	R-285
8	1	PIPE HANGER ASSEMBLY	A-557-2-8

NOTE: UNION ORIENTATION "M" DENOTES MALE, "F" DENOTES FEMALE.

CCC JOB NO. 054330

UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS ARE IN INCHES

CODE: MC / QC / UK

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801

Capital Controls Co., Inc.
A Severn Trent Company

DRAWN BY & DATE: MS 1/23/95

CHECKED BY & DATE: CCC 1/25/95

APPROVED BY & DATE:

TOLERANCES Unless Noted: ------

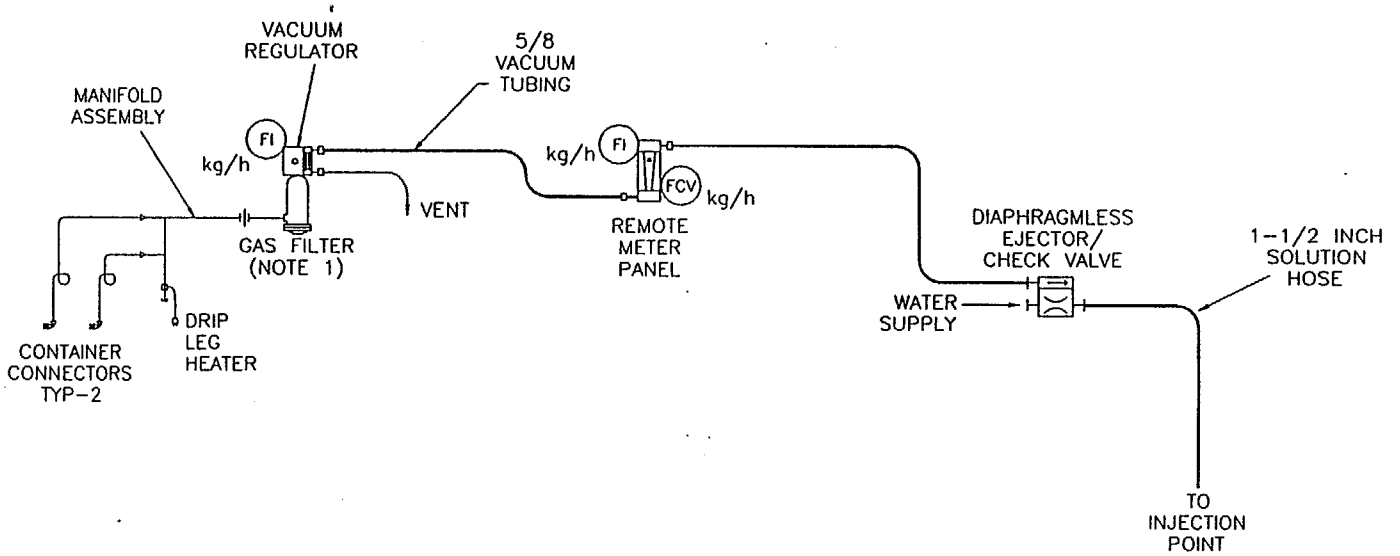
ASSEMBLY, CHLORINE GAS FILTER W/ UNION

SCALE 5/16 | SHEET 1 OF 1

DWG NO: CA-2346

REV	DESCRIPTION	APPD / DATE
0		

C-5656-2



ACCESSORIES FOR CHLORINATION SYSTEM

(4)	1-1/2 ELBOW, 90 DEGREE
(4)	1-1/2 X 4 INCH LONG NIPPLE
(4)	1-1/2 TEE
(6)	1-1/2 NPT X 1-1/2 HOSE ADAPTOR
(10)	TEFLON TAPE
(20)	HOSE CLAMPS
(100)	CYLINDER LEAD WASHERS
(2)	5/8 VACUUM TUBING CONNECTOR
(1)	3/8 VACUUM TUBING CONNECTOR
(2)	1-1/2 COUPLING

NOTES:
1. FILTER AND MANIFOLD ASSEMBLY SHALL BE HEAT TRACED.
2. WALL ANCHORS/ANCHOR BOLTS ARE INCLUDED FOR INSTALLATION.

KIT B
EMERGENCY KIT

SITE NO.2 GRMAGELE

054330-25 & 26 10 kg/hr
054330-4 4 kg/hr

300 kg/day CL2

5600 l/sec ≈ 115 mgd

Ps ≈ 6 atm ≈ 90 psi

Pb = UNKNOWN, BUT VERY LOW

UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS ARE IN INCHES

REV	DESCRIPTION	APPD / DATE

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801

DRAWN BY & DATE JTG 7/6/95
CHECKED BY & DATE JW 7/6/95
APPROVED BY & DATE TG 7/6/95
TOLERANCES Unless Noted -----

Capital Controls Co., Inc.
A Severn Trent Company

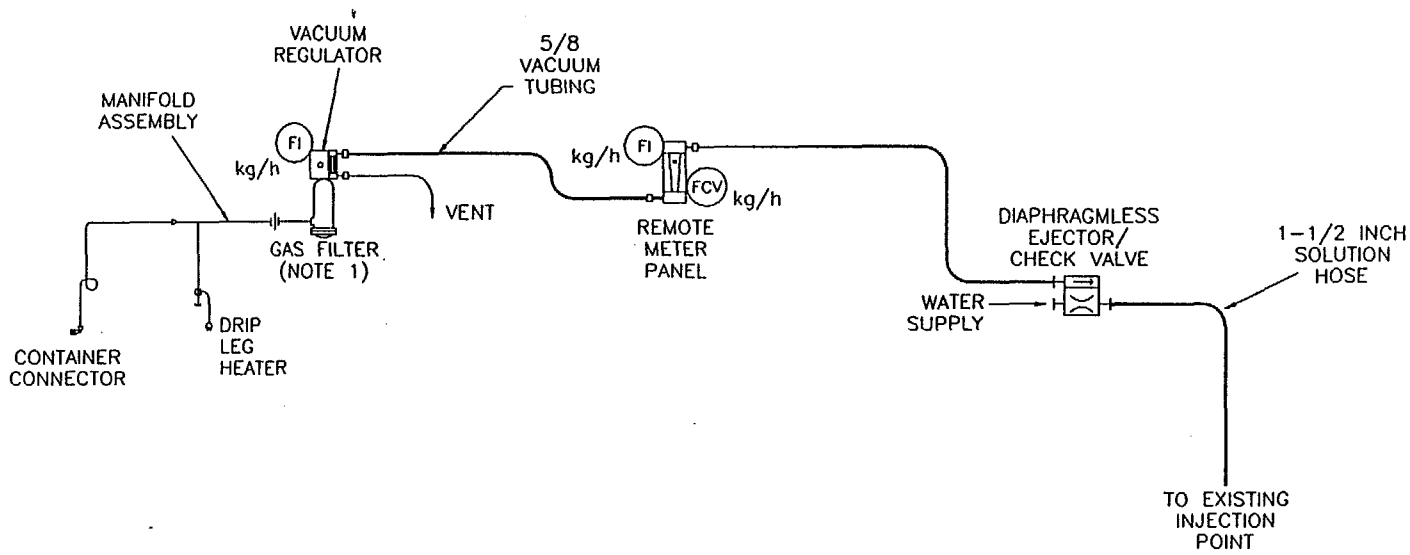
TYPICAL INSTALLATION DIAGRAM

SCALE ----- SHEET 1 OF 1

DWG NO: C-5656-2

054330

C-5656-3



ACCESSORIES FOR CHLORINATION SYSTEM

(4)	1-1/2 ELBOW, 90 DEGREE
(4)	1-1/2 X 4 INCH LONG NIPPLE
(4)	1-1/2 TEE
(6)	1-1/2 NPT X 1-1/2 HOSE ADAPTOR
(10)	TEFLON TAPE
(20)	HOSE CLAMPS
(100)	CYLINDER LEAD WASHERS
(2)	5/8 VACUUM TUBING CONNECTOR
(1)	3/8 VACUUM TUBING CONNECTOR
(2)	1-1/2 COUPLING

NOTES:
1. FILTER AND MANIFOLD ASSEMBLY SHALL BE HEAT TRACED.
2. WALL ANCHORS/ANCHOR BOLTS ARE INCLUDED FOR INSTALLATION.

KIT B
EMERGENCY KIT

SITE NO.3 NATAKHTARI

054330-1 & 2 BOTH 4 kg/hr

300 kg/day CL2

Ps = 8 to 12 atm ≈ 117/176 psi

Pb = UNKNOWN, BUT VERY LOW

UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS ARE IN INCHES

REV	DESCRIPTION	APPD / DATE

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801

DRAWN BY & DATE JTG 7/6/95

CHECKED BY & DATE JW 7/6/95

APPROVED BY & DATE TG 7/6/95

TOLERANCES Unless Noted -----

Capital Controls Co., Inc.
A Severn Trent Company

TYPICAL INSTALLATION DIAGRAM

SCALE -----

SHEET 1 OF 1

DWG NO: C-5656-3

054330

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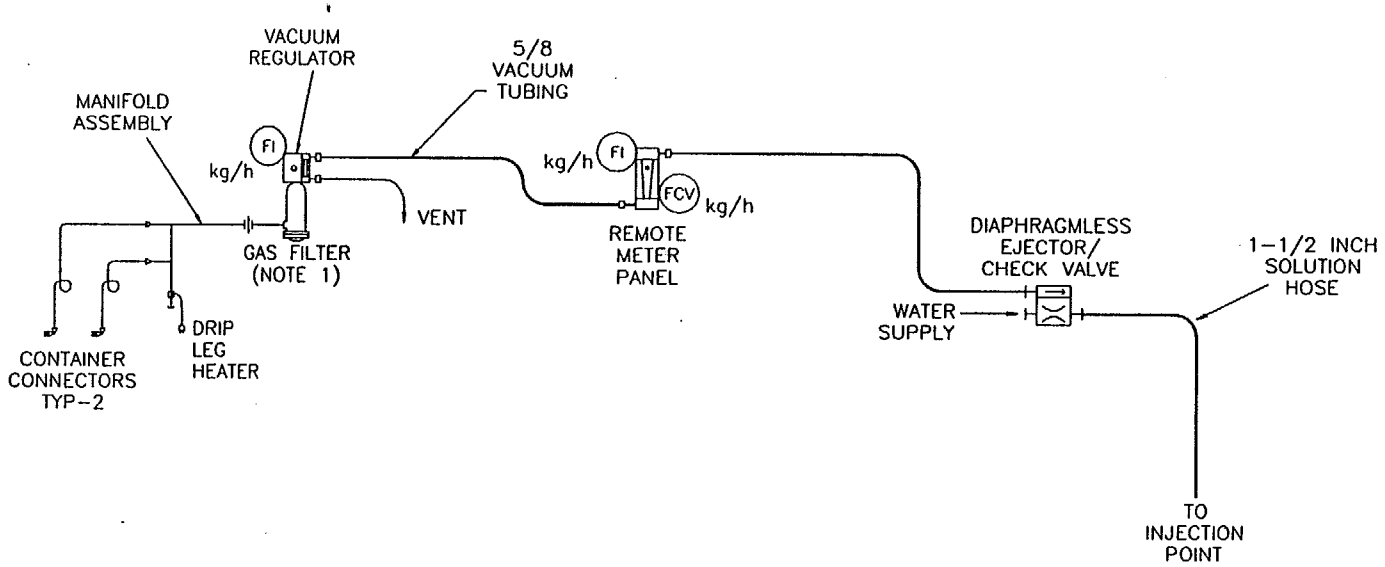
C-5656-4



ACCESSORIES FOR CHLORINATION SYSTEM

(4)		1-1/2 ELBOW, 90 DEGREE
(4)		1-1/2 X 4 INCH LONG NIPPLE
(4)		1-1/2 TEE
(6)		1-1/2 NPT X 1-1/2 HOSE ADAPTOR
(10)		TEFLON TAPE
(20)		HOSE CLAMPS
(100)		CYLINDER LEAD WASHERS
(2)		5/8 VACUUM TUBING CONNECTOR
(1)		3/8 VACUUM TUBING CONNECTOR
(2)		1-1/2 COUPLING

NOTES:
1. FILTER AND MANIFOLD ASSEMBLY SHALL BE HEAT TRACED.
2. WALL ANCHORS/ANCHOR BOLTS ARE INCLUDED FOR INSTALLATION.

KIT B
EMERGENCY KIT

SITE NO.4 SAGURAMO

054330-6 4 kg/hr
054330-23 10 kg/hr

TYP FEED RATE = 40/45 kg/day

Ps = 8 to 12 atm ≈ 117/176 psi

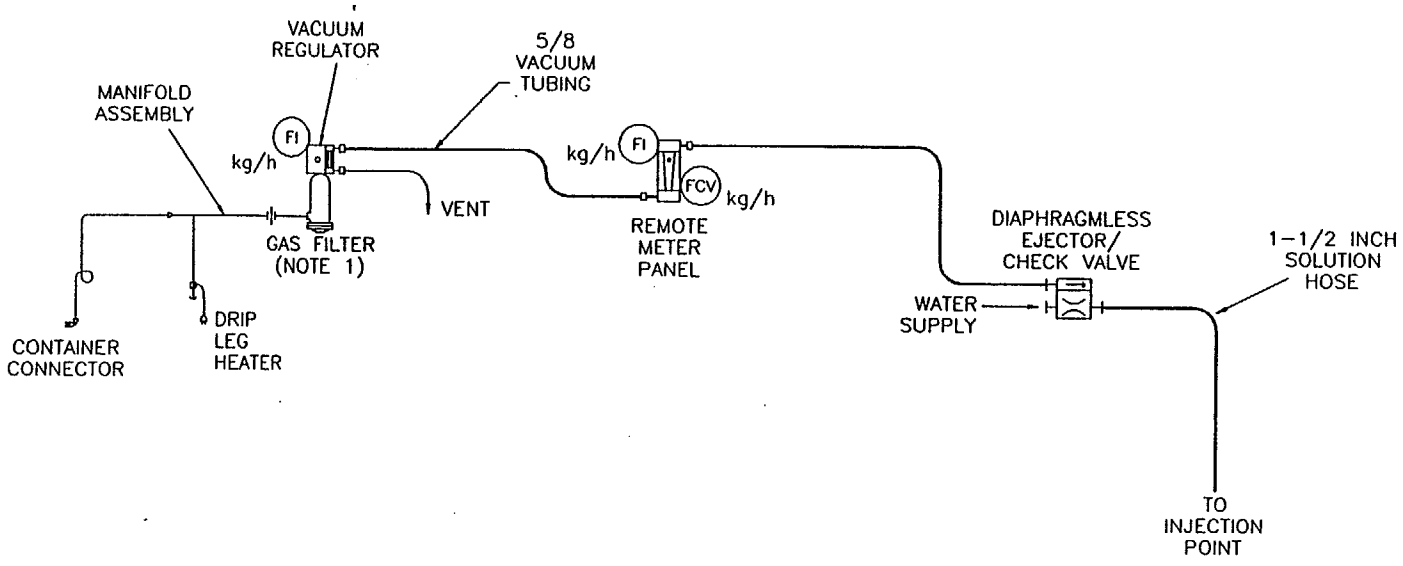
Pb = UNKNOWN, SUSPECT 2 atm

UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS ARE IN INCHES

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801	Capital Controls Co., Inc. A Severn Trent Company
DRAWN BY & DATE JTG 7/6/95	TYPICAL INSTALLATION DIAGRAM
CHECKED BY & DATE JW 7/6/95	
APPROVED BY & DATE TG 7/6/95	SCALE ----- / SHEET 1 OF 1
TOLERANCES Unless Noted -----	DWG NO: C-5656-4

REV	DESCRIPTION	APPD / DATE

054330



ACCESSORIES FOR CHLORINATION SYSTEM

(4)	1-1/2 ELBOW, 90 DEGREE
(4)	1-1/2 X 4 INCH LONG NIPPLE
(4)	1-1/2 TEE
(6)	1-1/2 NPT X 1-1/2 HOSE ADAPTOR
(10)	TEFLON TAPE
(20)	HOSE CLAMPS
(100)	CYLINDER LEAD WASHERS
(2)	5/8 VACUUM TUBING CONNECTOR
(1)	3/8 VACUUM TUBING CONNECTOR
(2)	1-1/2 COUPLING

KIT B
EMERGENCY KIT

SITE NO.5 MUKHNARI-KUTAISI

054330-8 4 kg/hr

Q = UNKNOWN, BUT 2 BASINS EACH 10,000 m^3

Ps = 8 to 18 atms

Pb = UNKNOWN

NOTES:
1. FILTER AND MANIFOLD ASSEMBLY SHALL BE HEAT TRACED.
2. WALL ANCHORS/ANCHOR BOLTS ARE INCLUDED FOR INSTALLATION.

UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS ARE IN INCHES

FOR SUPPLEMENTARY INFORMATION SEE ENGINEERING STANDARD NUMBER 801	Capital Controls Co., Inc. A Severn Trent Company
DRAWN BY & DATE JTG 7/6/95	TYPICAL INSTALLATION DIAGRAM
CHECKED BY & DATE JW 7/6/95	
APPROVED BY & DATE TG 7/6/95	SCALE ----- SHEET 1 OF 1
TOLERANCES Unless Noted -----	DWG NO: C-5656-5

REV	DESCRIPTION	APPD / DATE

054330

Appendix D

Appendix D

Certificates of Acceptance

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

IDEXX COLILERT TESTS (~~800~~ 1000 QTY)

— SEE ATTACHED —

This equipment has been accepted by: SULIKO KIZTADZE

Title: HEAD PHYSICIAN SANITARY INSPECTOR OF REP. EPIDEMIOLOGY STATION

Agency/Ministry: MINISTRY OF HEALTH

Location: TBILISI

Date: 06-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

FISHER SCIENTIFIC

1- INCUBATOR LC 5.1 CU FT 240 V

1- AUTOCLAVE W/ DRYER 220 V 50 HZ

-SEE ATTACHED -

This equipment has been accepted by: SOPIKO MAMULASHVILY

Title: HEAD OF CHEMICAL & MICROBIOLOGICAL LABORATORY

Agency/Ministry: DEPT OF WATER

Location: TBILISI, REPUBLIC OF GEORGIA

Date: 08-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

IDEXX SUPPLIES
COLILERT EXPRESS METHOD
COMPARATOR MPN
— REST AS ATTACHED —

This equipment has been accepted by: Sopiko Mamulashvily

Title: Head of Chemical & Microbiological Laboratory

Agency/Ministry: Department of Water

Location: Tbilisi, Republic of Georgia

Date: 08-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

HACH COMPANY

DREL/2000 PORTABLE LABORATORY

DR/2000 SPECTROPHOTOMETER

– SEE ATTACHED FOR REST –

This equipment has been accepted by: SOPHO MAMULASHVILY

Title: HEAD OF CHEMICAL & MICROBIOLOGICAL LABORATORY

Agency/Ministry: DEPARTMENT OF WATER

Location: TBILISI, REPUBLIC OF GEORGIA

Date: 09-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

84

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

HACH CO.

1 - DREL 2000 PORTABLE LABORATORY

1 - AMMONIUM HYDROXIDE, ACS 200 ML

- SEE ATTACHED -

* 1 ITEMS MISSING

This equipment has been accepted by: SULIKO KITADZE

Title: HEAD PHYSICIAN SANITARY INSPECTOR OF REPUBLIC EPIDIMILOGICAL STATION

Agency/Ministry: MINISTRY OF HEALTH

Location: TBILISI

Date: 13-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

85

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

FISHER SCIENTIFIC INV. # M50669195

1 - INCUBATOR LC 5.1 CUFT 240 V

1 - AUTOCLAVE W/DRYER 220 V 50 HZ

- SEE ATTACHED -

* MISSING MICROSCOPE EYE BASE

This equipment has been accepted by: SULIKO KITADZE

Title: HEAD PHYSICIAN SANITARY INSPECTOR OF REPUBLIC EPIDIMOLOGY STATION

Agency/Ministry: MINISTRY OF HEALTH

Location: TBILISI

Date: 14-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Two (2) Model 444 Sewer Rodding Machines as per the attached inventory list and invoice. Hydraulic oil filters and pre-cleaner missing.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hilliness
CDM INTERNATIONAL INC.

Signature of Consignee

87

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1- Fisher M-Scope XLT-20 Liquid Leak Detector complete with spare parts as noted on the attached invoice. Multiple factory manuals were provided.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

88

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

24 ctn. Emergency kit, 6 ctn vacuum regulators (4kg/hr) 2 ctns manifold assembly, 4 spools 1½" hose (total 400m), 1 ctn isolation valves (total 24), 6 ctns vacuum regulators (10 kg/hr), 6 ctn filter assembly (total 12),
(over)

This equipment has been accepted by: _____

Title: Head of Industrial Management of Tbilisi Water Supply & Canalization Services

Agency/Ministry: _____

Location: Tbilisi, Georgia

Date: 16 June 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

89

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Two (2) 125 KW RDJC Diesel Engine driven Generator sets, skid mounted, with accessories listed on the attached invoice and packing list.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Heltunen
CDM INTERNATIONAL INC.

Signature of Consignee

90

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1- Fisher M-Scope TW-770 Line Tracer with Stereo Headphones, ground rod and plate assembly. Multiple factory manuals provided.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl D Hultunen
CDM INTERNATIONAL INC.

Signature of Consignee

91

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Two (2) 40-ft long and One (1) 20-ft long steel shipping containers with serial numbers 435024-5, 2090632 and 270967-2 respectively.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Helltuner
CDM INTERNATIONAL INC.

Signature of Consignee

9V

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1 - Sewer Bucket Machine(s), (pull-in machine and bucket loader) complete with spare parts as noted on the attached invoice. Multiple sets of instruction and parts manuals were provided. 1 Set of belts and 2 spark plugs were missing.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellmer
CDM INTERNATIONAL INC.

Signature of Consignee

93

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1- TOOL CHEST WITH TOOLS as listed on the attached invoice and sheets.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Tbilisi

Date: June 16, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellmuren
CDM INTERNATIONAL INC.

Signature of Consignee

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

HACH COMPANY INV# 7/029-SE & 7/031
DREL/2000 W/ CONDUCTIVITY METER, W/PH METER,
REAGENTS, & SPECTROPHOTOMETER.
-SEE ATTACHED FOR DETAILS-

This equipment has been accepted by: TARIEL SVANADZE / Chatiqe Chovidze

Title: CHIEF SANITARY DOCTOR / Head of Sanitary Laboratory

Agency/Ministry: SAN / EPIDIMIOLOGY LAB

Location: KUTAISI

Date: 18-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

95

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

FISHER SCIENTIFIC

MISSING → 13-651-10A - (1) 1ml PIPET

12-070-22 - missing OPTICS FOR EYE BASE.

STARTING WITH SN# 0395 005 (1) INCUBATOR

-SEE FOLLOWING LIST FOR DETAILS-

This equipment has been accepted by: TARIEL SVANADZE / Chatige Choridze

Title: CHIEF SANITARY DOCTOR / Head of Sanitary Laboratory

Agency/Ministry: SAN/EPIDIMIOLOGY LAB

Location: KUTAISI

Date: 18·06·95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

96

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

IDEXX INV # 234880

W200, ECONOMY PREDISPENSE, MPN 25 ea

W102, COMPARATOR MPN 50 ea

WL200B, POCKET UV FLUOR LAMP 10 ea

WL201, 4 WATT UV TUBE 6" 20 ea

This equipment has been accepted by: TARIEL SVANADZE / Chatiqe Chorridze

Title: CHIEF SANITARY DOCTOR / Head of Sanitary Laboratory

Agency/Ministry: SAN/EPIDIMIOLOGY LAB

Location: KUTAISI SAN/EPIDIMIOLOGY LAB

Date: 18.06.95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

97

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

HACH COMPANY INVOICE # 63178E

TEST KIT CN-70, CHLORINE F&T QTY 20

DPD FREE CHLORINE 25 ML PK/100 QTY 60

This equipment has been accepted by: KVIRIKASRVILI PERIDA

Title: HEAD OF WATER SUPPLY LAB

Agency/Ministry: WATER DEPARTMENT

Location: KUTAISI

Date: 21-06-95

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

98

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Two (2) 40-ft long steel shipping containers @ serial numbers 434504-4 and 436598-0 respectively.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Kutaisi

Date: June 21, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

One Fisher Model XLT-20 Leak Detector complete with accessories.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia Kutaisi

Date: June 21, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl D Hettinger
CDM INTERNATIONAL INC.

Signature of Consignee

100

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

One Fisher TW-770 line tracer instrument set with coupling clamp and stereo headphones.

This equipment has been accepted by: [signature] / [illegible] /

Title:

Agency/Ministry:

Location: Republic of Georgia, Kutaisi

Date: June 21, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hiltunen

CDM INTERNATIONAL INC.

Signature of Consignee

101

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

16 ctns Emergency kit, ctns Vacuum Regulators (4kg/hr), 1 ctn manifold assemblies, 3 spools 1½" hose (800ft.), 1 ctn isolation valves, ctns Vacuum Regulators (10kg/hr), 3 ctns filter assembly, 1 ctn vacuum tubing, 1 ctn diffuser assemblies, 2 ctns spare parts & accessories

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Kuteisi, Republic of Georgia

Date: 21 June, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl D. Hettner

CDM INTERNATIONAL INC.

Signature of Consignee

102

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

One tool set @ rollaway cabinet and tool chest @ 15 drawers, 430 piece craftsman tool set and additional tools and accessories as listed on attached sheets.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia Kutaisi

Date: June 21, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellerstedt
CDM INTERNATIONAL INC.

Signature of Consignee

103

GDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Two (2) Model 444, trailer mounted hydraulic powered sewer sodders with accessories and spare parts as listed on attached sheets. Missing pre-cleaner @ both machines. One machine missing tire lug nuts

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia, Kutaisi

Date: June 21, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellmann

CDM INTERNATIONAL INC.

Signature of Consignee

104

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

One Sreco trailer mounted Pull In and Truck Loader Bucket Machines including spare parts and accessories as listed on attached sheets.

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Republic of Georgia Kutaisi

Date: June 21, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hillmer
CDM INTERNATIONAL INC.

Signature of Consignee

105

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Equipment transferred from Kutaisi to Tbilisi
2 chlorinators - 10 kg/hr, 2 each filters & manifolds, 8 pcs BM-3453, 8 pcs BM-3295-1, 100 pcs R-100, 108 pcs BM-918, 10 pcs R-260, 12 pcs R-794, 2 pcs R-1398, 24 pcs BM-1165, 14 pcs BM5666, 4 pcs isolating values

This equipment has been accepted by: _____

Title: _____

Agency/Ministry: _____

Location: Tbilisi, Republic of Georgia

Date: 23 June 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

CDM INTERNATIONAL INC.

Signature of Consignee

106

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

15 Model ECV 12-255-30 pumps equipped with 15 Model Kaskad 32-KW control stations and 1,000 m of VPP-16 cable. Spare parts: 5 electric motors, 15 impellers & 10 pump bearings.

This equipment has been accepted by: Mr Juza Tsartsidze

Title: Head of Industrial Management of Tbilisi Water

Agency/Ministry: Supply and Canalization Services

Location: Tbilisi, Republic of Georgia

Date: November 23, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

107

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

4 Model 1927A13 auto-level transit sets (includes transit-level, tripod, rod, and case). Miscellaneous survey equipment includes 4 model 1930A15, 30-m metric steel tapes and reels.

This equipment has been accepted by: Juza Tsastsidze

Title: Head of Industrial Management of Tbilisi Water

Agency/Ministry: Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G. Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

108

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

2 Model 2672A6 heavy-duty pipe cutters with 4-16 in OD Capacity, including 60 replacement cutter wheels

This equipment has been accepted by: Juza Tsartsidze

Title: Head of Industrial Management of Tbilisi Water

Agency/Ministry: Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 29, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hattunen
CDM INTERNATIONAL INC.

Signature of Consignee

109

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

4 Model 8292T352 VHF Radios complete with 4 spare batteries, 4 vinyl holsters, 2 spare battery chargers, 2 power converters and 2 sets of plug adapters.

This equipment has been accepted by: Juza Tsartsedze

Title: Head of Industrial Management of Tbilisi

Agency/Ministry: Water Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hettiner
CDM INTERNATIONAL INC.

Signature of Consignee

110

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1 Model 2788A14 drill set plus 8 miscellaneous drill bits (13.50, 14.00, 14.50, 15.00, 15.50, 16.00, 16.50 and 17.50 mm diameters)

This equipment has been accepted by: Juza Tsartsidze

Title: Head of Industrial Management of Tbilisi

Agency/Ministry: Water Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G. Hettmer
CDM INTERNATIONAL INC.

Signature of Consignee

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Miscellaneous supplies including (1200) ft of ½-in diameter polypropylene rope, (5) clevis pins, 1 roll duct tape, 1 plastic ball, 2 solar calculators

Cost $ 150.00

This equipment has been accepted by: Inga Tsartsedze

Title: Head of Industrial Management of Tbilisi

Agency/Ministry: Water Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellmer

CDM INTERNATIONAL INC.

Signature of Consignee

112

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

15 Model ECV-12-160-65 submersible pumps equipped with 15 Model Kasked-45 kw control panels and 2,250 m of VPP-25 cable. Spare parts include 5 spare motors, 10 thrust bearings, 15 impellers with rings, 10 pump bearings, ~~[illegible]~~ and 5 pump shafts

This equipment has been accepted by: Mr Otar Chekhladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi, Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Heltunen
CDM INTERNATIONAL INC.

Signature of Consignee

113

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Miscellaneous supplies including 1200 ft of 1/4 in diameter polypropylene rope, 5 clevis pins, 1 roll duct tape, 5 lug nuts for sewer rodder, 1 solar calculator.

This equipment has been accepted by: Otar Churkladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G. Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

114

CDM International Inc.

USAID

REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

2 Model 1927A13 auto-level transit sets (includes transit-level, tripod, rod and case), Miscellaneous survey equipment including 2 Model 1930A15, 30 m metric steel tapes/reels.

This equipment has been accepted by: Otar Churkladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

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REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1 Model 2672A6 heavy-duty pipe cutter with 4-16 in OD capacity, including 30 replacement cutter wheels.

This equipment has been accepted by: Otar Churkladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Heltunen
CDM INTERNATIONAL INC.

Signature of Consignee

116

CDM International Inc.

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REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

1 Model 2788A14 drill set plus 8 misc drills (13.50, 14.00, 14.50, 15.00, 15.50, 16.00, 16.50 and 17.50 mm diameter).

This equipment has been accepted by: Otar Chishladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hettunen
CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

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REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

4 Model 8292T352 VHF radios complete with 4 spare batteries, 4 vinyl holsters, 2 spare battery chargers, 2 power converters and 2 sets of miscellaneous plug adapters.

This equipment has been accepted by: Otar Churhladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hultunen
CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

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REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Spare parts for Model 422400 sewer bucket machine as listed on attached sheet

This equipment has been accepted by: Otar Churkladze

Title: General Director

Agency/Ministry: Kutaisi Water Supply System

Location: Kutaisi Republic of Georgia

Date: November 24 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellmer

CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

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REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Spare parts for chlorinators as listed on the attached sheet

This equipment has been accepted by: Juza Tsartsidze

Title: Head of Industrial Management of Tbilisi Water

Agency/Ministry: Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hellmers
CDM INTERNATIONAL INC.

Signature of Consignee

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CDM International Inc.

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REPUBLIC OF GEORGIA

SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

CERTIFICATE OF ACCEPTANCE

Under United States Agency for International Development Contract Number CCN-0003-C-00-4086-00 the following water and/or sanitation related equipment has been provided to the citizens of the Republic of Georgia:

Spare parts for sewer sodding machine as listed on attached sheet

This equipment has been accepted by: Juza Tsartsidze

Title: Head of Industrial Management of Tbilisi Water

Agency/Ministry: Supply and Canalization Services

Location: Tbilisi Republic of Georgia

Date: November 24, 1995

This certificate verifies the receipt of, and the basic instruction on the use of, the above equipment from CDM International Inc. and that this equipment is new and in good working order.

Carl G Hiltunen
CDM INTERNATIONAL INC.

Signature of Consignee

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Appendix E

Appendix E

Equipment / System Follow-Up Evaluation Reports

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi - Water Dept Laboratory

Date: Nov 20, 1995 **Time:**

Date System Installed: June 8-14th, 1995

System Status After Installation: All equipment (vacuum pump, incubator, spectophotometer, etc) set up and operating.

System Status During Follow-up Visit: All equipment in full use. The laboratory staff had translated all of the test procedures & Terry Rahe's instructions from Russian and English into Georgian. The staff is very competent with the equipment.

System Current Status: All equipment functioning except the vacuum pump which had been shut off (to protect it from burnout) because of low frequency in the power supply.

Comments: Lab needs additional reagents for the spectophotometer.

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi, Republic of Georgia - Samgouri WTP

Date: November 21, 1995 **Time:** 10:30 AM

Date System Installed: June 7-9, 1995

System Status After Installation: Chlorination equipment is working. All components on-line and are working very well - no leakage & no chlorine smell. No signs of leakage (ie no corrosion). Staff very happy w/ equipment. Staff comfortable with operation and maintenance of equip.

System Status During Follow-up Visit: the system has been in operation for 5-6 months and has been very well received by staff. Operation and maintenance has been going extremely well. Local staff is very knowledgable.

System Current Status: equipment was installed and training was adequate to prepare local staff to operate/maintain. Local staff have checked filters and found no reason to change filters yet. See other side of sheet.

Comments: Capital Controls/Jesse Wolff did a tremendous job of teaching locals to install/operate equipment. Two more chlorinators will be installed to increase the total to seven, the new chlorinators arriving in the expected air shipment.

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi - Sewer Dept

Date: Dec 15, 1995 **Time:**

Date System Installed: June 8-9, 1995

System Status After Installation: Sewer rodding machines had been assembled, operated by local staff to clear blocked sewers

System Status During Follow-up Visit: Equipment looks in excellent shape and is being used on a daily basis.

System Current Status: Went with crew to site of blocked sewer to observe equip use. Crew very knowledgable of equipment operation - equipment operating well.

Comments: The dept. needs additional lengths of the sewer rod. There are many problems associated with rocks in the sewers that are difficult for this machine's operation.

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi, Republic of Georgia, Natakhtari WTP

Date: November 23, 1995 **Time:** 2:45 pm

Date System Installed: June 8-14th, 1995

System Status After Installation: Chlorination equip installd but awaiting local water supply for ejectors.

System Status During Follow-up Visit: System in full, continuous operation w/o problems. Local staff ~~[illegible]~~ pleased with equipment.

System Current Status: No leaks or other problems observed. Local chlorine of very poor quality. System is in full operation w/o leaks, etc.

Comments:

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi - Sewer Dept

Date: Dec 15, 1995 Time:

Date System Installed: June 8-9, 1995

System Status After Installation: Sewer Bucket Machine assembled and training conducted in the street.

System Status During Follow-up Visit: Bucket machine in good condition and signs of obvious use.

System Current Status: The equipment is functional, however the sewer crews are busy trying to unblock sewers. Cleaning conducted more during warmer months.

Comments:

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilis - Samgouri WTP

Date: Nov 21, 1995 Time:

Date System Installed: June 6-7

System Status After Installation: Maintenance tools given to Water Dept

System Status During Follow-up Visit: The tools look to be complete and are kept under lock and key when not in use.

System Current Status: No breakage or loss reported

Comments:

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi - Water Dept

Date: November 23, 1995 Time:

Date System Installed: June 7-8, 1995

System Status After Installation: Pipe locator and leak detector given to Water Dept

System Status During Follow-up Visit: Equipment operating but not in immediate use due to winter weather.

System Current Status:

Comments:

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REPULBIC OF GEORGIA
SEWERAGE SYSTEMS IN TBILISI AND KUTAISI

EQUIPMENT/SYSTEM FOLLOW-UP EVALUATION

Location: Tbilisi

Date: November 14, 1995 **Time:**

Date System Installed: June 12-13, 1995

System Status After Installation: Two generators checked and started and left a Samgoari WTP for installation/use by Water Dept.

System Status During Follow-up Visit: One generator reportedly in storage, the second installed in a small water booster station on the mountain "resort area" outside Tbilisi.

System Current Status: One generator used to operate a small booster station serving a resort area filled with refugees. System operating nearly full time due to low frequency of the normal power supply.

Comments:

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