EPA 910 9-91-017

United States
Environmental Protection
Agency

Region 10
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Seattle WA 98101

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Idaho
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Washington

Hazardous Waste Division

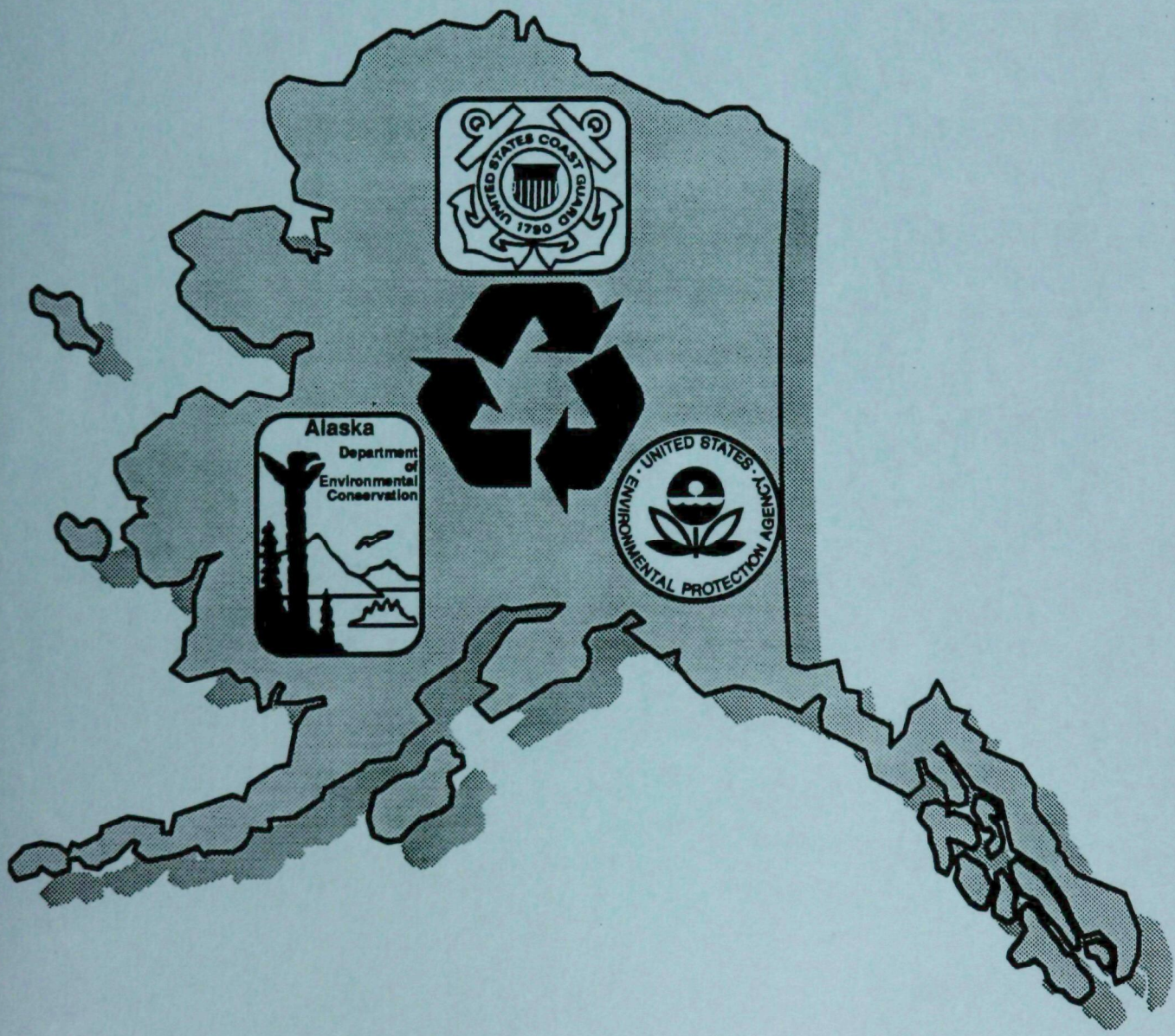
Federal Activities Program

May 1991

EPA

Waste Minimization Opportunity Assessment

U.S. Coast Guard Base
Ketchikan, Alaska



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WASTE MINIMIZATION OPPORTUNITY ASSESSMENT

U.S. COAST GUARD BASE KETCHIKAN, ALASKA

Prepared for:

U.S. Environmental Protection Agency
Region 10
Federal Activities Program
1200 Sixth Avenue
Seattle, Washington 98101

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EPA Contract No. 68-C8-0061, Work Assignment No. 2-25
SAIC Project No. 1-832-03-211-00

Final
May 1991

Acknowledgments

The preparation and publication of this report was made possible through funding from the EPA Risk Reduction Engineering Laboratory, Pollution Prevention Program, Cincinnati, Ohio, and the EPA Region 10 Federal Activities Program, Seattle, Washington. Several people have assisted in this project, and their help is gratefully acknowledged:

David Dellarco, Project Manager, EPA Region 10 Hazardous Waste Division

Jim Bridges, Pollution Prevention Program, EPA Office of Research and Development, Risk Reduction Engineering Laboratory

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EXECUTIVE SUMMARY

Through funding provided by the Environmental Protection Agency and the assistance of the Alaska Department of Environmental Conservation Pollution Prevention Program, a waste minimization opportunity assessment was conducted at Coast Guard Base Ketchikan, Alaska. The SAIC audit team collected information on the Base during a three-day site visit in October 1990, and through telephone interviews of Coast Guard personnel from October through December 1990. Based on information gathered about the waste generating processes, waste handling procedures, and quantities of waste generated at the facility, the audit team developed a number of waste minimization and waste management alternatives for the most significant waste streams. The feasibility of each option is discussed within the report and recommendations are offered for the most favorable alternatives. In addition, some general recommendations are presented for base-wide waste management and waste reduction.

The audit team found that there are significant opportunities for waste minimization at Base Ketchikan. Through the implementation of the following alternatives, the total hazardous waste stream could be reduced by as much as 85%:

- Dockside oil/water separation
- Oil recycling
- Battery recycling
- Paint waste and thinner distillation
- Antifreeze purification
- Landfilling nonhazardous blasting waste.

Implementation of these alternatives would produce an increase in sewerable wastes and landfillable solid wastes over current levels, but a significant overall reduction in waste toxicity. The total of new equipment costs for these waste minimization options is estimated at less than $45,350 (Table 1). The total net annual benefit from implementing the recommended alternatives is estimated at over $112,000. Hazardous waste disposal costs could potentially be reduced to less than $90,000 per year.

These results are dependent on a few basic changes in waste handling at Base Ketchikan. They include:

1. Segregation of waste streams
2. Determination of which wastes are hazardous

3. Refraining from disposal of nonhazardous wastes as hazardous wastes
4. Pursuing recycling options.

Segregation of waste streams will permit the recycling/reuse of some wastes and the separation of hazardous and nonhazardous constituents. Through this study, it became apparent that several wastes are being disposed of as hazardous wastes which may not be hazardous, including antifreeze solutions, bilge wastes, and used oil. If the preventive measures are taken up front to ensure that wastes are segregated, and if the proper analysis of wastes is performed to provide some certainty in waste designation, hazardous waste handling effort and disposal costs could be substantially reduced. For example, it is possible that spent blasting grit is not a hazardous waste. This can be determined through representative sampling and analysis; and if shown to be nonhazardous, blasting waste from vessel paint stripping operations could be recycled into the manufacture of asphalt or concrete.

The summary table on the following page provides an overview of the alternatives considered most favorable by the audit team for near-term implementation. Each of the preferred options is listed with its estimated capital cost, net annual benefit, and payback period. It is clear that the economics of these waste minimization opportunities are advantageous. Other indirect benefits include decreased liability for hazardous wastes, reduced effort in manifesting and recordkeeping, decreased likelihood of regulatory infractions, reduced occupational hazards, and increased community and employee good will.

Table 1

SUMMARY OF RECOMMENDED WASTE MINIMIZATION ALTERNATIVES

WASTE STREAM, LOCATION, OPERATION	WASTE MIN OPTION	TOTAL CAPITAL INVESTMENT	NET ANNUAL BENEFIT	PAYBACK PERIOD, yrs	COMMENTS
BLASTING WASTE: Marine ways, paint removal from vessels	* Retest for new designation	$6,000	~$30,000	0.2	• Cap. invest. is analytical costs for blasting waste: 20 samples @ $300/sample
PAINT WASTE: Marine ways, buoy shed, painting vessels and buoys	* High volume/low pressure paint guns	$1,300	$12,250	0.1	• Strongly recommended; used by auto body paint shops
	* Improve storage practices	Minimal	Unknown	--	• Will result in less wasted product
	* Distill paint wastes	$4,000	$6,200	0.4	• Uses same eqpt as solvent recycling option
SOLVENTS: Base-wide, cleaning and degreasing operations • Industrial and Public Works, small parts washers	* Best management practices	Minimal	Unknown	N/A	• Could reduce purchase and disposal costs significantly
	* Solvent distillation	$4,000	$6,200	0.6	• Analysis based on paint wastes; both can be distilled with same unit. Reuse solvent for cleaning operations.
BILGE WASTE: Base-wide, bilge management	* Oil/water separator on base	$26,050	$18,680	1.4	• Oil can be recycled or burned for energy recovery. Bilge must be free of emulsifying agents.
	* Eliminate use of emulsifying degreasers	Unknown	--	--	
WASTE OIL: Base-wide, lubricating and generator oils	* Offsite oil recycling	--	$25,750	N/A	• Oil must be free of halogenated solvent contamination
WASTE ANTIFREEZE/COOLANT: Base-wide, from vessels and vehicles	* Purify onsite and reuse	$8,000	$6,155	1.3	• Need to verify that system can purify Nalcool and Paxcool
BATTERIES: Base-wide, from ATON units and vehicles	* Recycle all batteries; lead-acid with payback	--	$13,560	N/A	• Use Seattle area recyclers; lead payback approx. $.03/lb
PAPER, GLASS, ALUMINUM, ETC.: Base-wide	* Take paper to USFS collection point	--	Unknown	--	• Avoids landfill disposal costs
	* Scrap eqpt and metal to local scrapper	--	Unknown	--	• Avoids landfill disposal costs and hauling

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LIST OF ACRONYMS

ATON	aid to navigation
CFR	Code of Federal Regulations
CEU	Civil Engineering Unit
DRMO	Defense Reutilization and Marketing Office
EPA	Environmental Protection Agency
FD&CC	Facility Design and Construction Center
HDPE	high density polyethylene
HVLP	high volume/low pressure
OBA	oxygen breathing apparatus
PCB	polychlorinated biphenyl
ppm	parts per million
TCA	trichloroethane
TCLP	toxicity leaching procedure
USCG	U.S. Coast Guard
USCGC	U.S. Coast Guard Cutter
VOC	volatile organic compound

1.0 PROJECT OVERVIEW

1.1 PURPOSE

The Environmental Protection Agency (EPA) Region 10 has made a regional priority of actively pursuing pollution prevention activities at federal facilities. Alaskan federal facilities generate the largest volume of hazardous wastes of all generators in Alaska. In response to Region 10's outreach activities, the U.S. Coast Guard (USCG) has requested technical assistance in exploring alternatives for the reduction of solid and hazardous wastes at the Coast Guard Base in Ketchikan, Alaska. In addition, USCG is interested in implementing a waste minimization program in Ketchikan which could be transferred to other Coast Guard facilities in Alaska and possibly elsewhere in the country.

The purpose of this project was to develop a number of waste minimization options for U.S. Coast Guard Base Ketchikan, addressing both hazardous and nonhazardous wastes. The first phase of the project, which culminated in this report, involved an onsite audit of activities at the facility which generate hazardous and nonhazardous wastes, selection of priority waste streams, and the subsequent analysis of waste minimization alternatives for each of the waste streams or processes. The second phase of the project will be the development of an implementation plan for the options selected by the Coast Guard for application at Base Ketchikan.

This project was funded by the Environmental Protection Agency and facilitated through the cooperation and participation of the Alaska Department of Environmental Conservation (DEC) Pollution Prevention Program. The Coast Guard at Base Ketchikan, Civil Engineering Unit (CEU) Juneau, and Maintenance Logistics Command (MLC) Pacific also cooperated and assisted in this effort.

1.2 PURPOSE AND BENEFITS OF WASTE MINIMIZATION

The ultimate goal of waste minimization is to reduce present and future threats to human health and the environment. Waste minimization is defined as the reduction of waste generated and subsequently treated, stored, or disposed of, including (1) reduction of total volume or quantity of waste, and (2) reduction of toxicity of the waste. Waste minimization methods can be grouped into two main categories: source reduction and recycling. Source reduction is any activity which reduces or eliminates the generation of waste at the source. One example of source reduction is the use of filtration to extend the life of solvents in a parts washer, leading to the generation of less spent solvent. Recycling includes the reuse or reclamation of used materials. In paper recycling, used paper

is used for pulp to make new paper. Spent solvents can be reclaimed through distillation, and lead can be reclaimed from lead acid batteries for reuse.

There are many ways that source reduction can be effected, including process changes, product substitution, waste stream segregation, material handling improvements, and loss prevention procedures. Furthermore, there are many ways that materials can be reused or reclaimed, however these methods are often affected by exterior influences such as market prices for recycled products and the availability of reclamation technology. Figure 1-1 depicts the categories of waste minimization techniques. EPA recommends the exploration of source reduction options first, to minimize the generation of waste, and recycling options second, to maximize the reuse of materials.

In this report, both source reduction and recycling alternatives have been considered for the waste streams selected. In addition, the audit team took a careful look at waste management practices at Base Ketchikan. Some of the options considered fall into the latter category and are not truly waste minimization techniques, though they may result in significant savings in waste disposal costs.

There are both direct benefits of waste minimization and indirect benefits. The analyses of waste minimization and waste management options in this report focus primarily on the direct benefits to the Coast Guard, i.e., savings in disposal and procurement costs. However, the indirect benefits of waste minimization may be equally important.

One indirect benefit of waste minimization is reduction in liability. Generation of less waste to be disposed of translates to a smaller legal burden for the "cradle to grave" management of hazardous waste both on- and offsite. Less hazardous waste also means less effort in manifesting and recordkeeping. Reduction in toxicity of materials or wastes and in quantity of hazardous wastes generated can decrease occupational hazards, thereby reducing the Coast Guard's liability for worker health and safety.

Finally, a waste minimization program can generate good will in the community, enhance a facility's public image, and foster a higher level of concern for the environment in individuals.

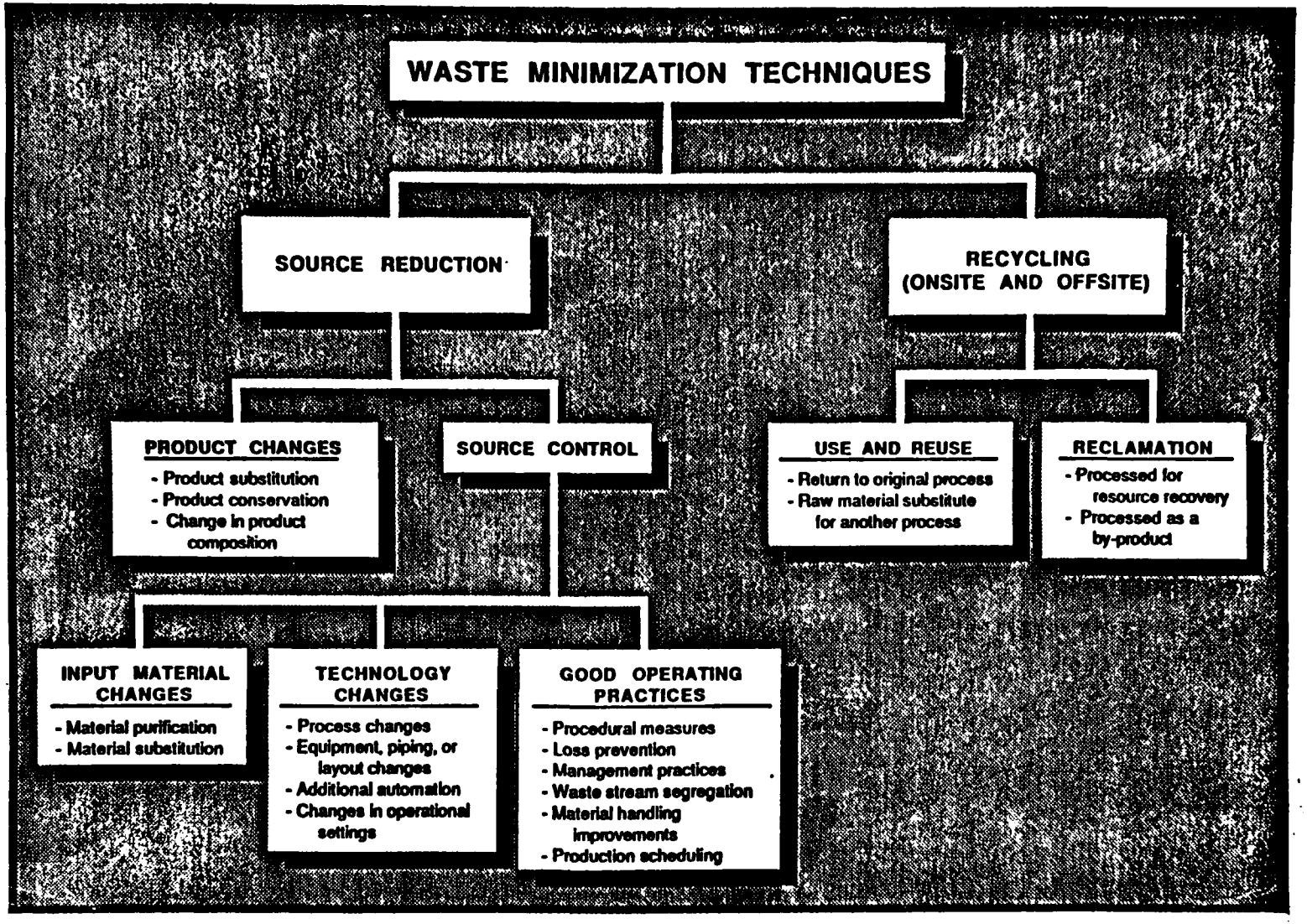

Figure 1-1

WASTE MINIMIZATION TECHNIQUES
(from EPA/625/7-88-003)

1.3 PROCEDURES

In general, this project follows the EPA procedures outlined in the Waste Minimization Opportunity Assessment Manual (EPA/625/7-88-003): 1) planning and organization, 2) assessment, 3) feasibility analysis, and 4) implementation (Figure 1-2). The project was initiated in September 1990 with a meeting at Base Ketchikan to discuss the objectives and schedule of the project and to facilitate the design of a work plan. When the audit team arrived at the Base a few weeks later (October 1990), an initial briefing was held to acquaint Coast Guard officials with the team members, discuss objectives of the site visit, and organize the onsite information gathering process.

The audit team, comprised of SAIC staff and a representative of Alaska DEC Pollution Prevention Program, spent three days at Base Ketchikan and viewed the areas where wastes are generated; collected process information; interviewed base personnel; identified waste management procedures; and gathered information concerning waste generation, disposal methods and costs, and local waste handling/reduction programs.

The audit team continued to collect information from the Coast Guard by phone after the site visit. The audit team identified the most significant waste streams based on the quantity of waste generated and associated disposal costs.

Each process that resulted in generation of a significant waste stream was analyzed. Options for waste reduction in each of those processes were identified and evaluated for their potential applicability at Base Ketchikan. In addition, several facility-wide recommendations for waste reduction and improvements in waste management were made.

During the second phase of this project, an implementation plan will be developed based on the options selected by the Coast Guard.

1.4 ORGANIZATION OF THE REPORT

The remainder of this report contains four chapters and seven appendices. Chapter 2 describes the facilities at Base Ketchikan, organization by departments, process descriptions and waste generation from each process or area, and waste management procedures. Chapter 3 presents the results of the assessment phase, including a summary of hazardous waste generation at the Base, a summary of disposal costs, and selection of priority waste streams. Chapter 4 contains the feasibility analysis of waste minimization options for each of the priority hazardous waste streams as well as for several

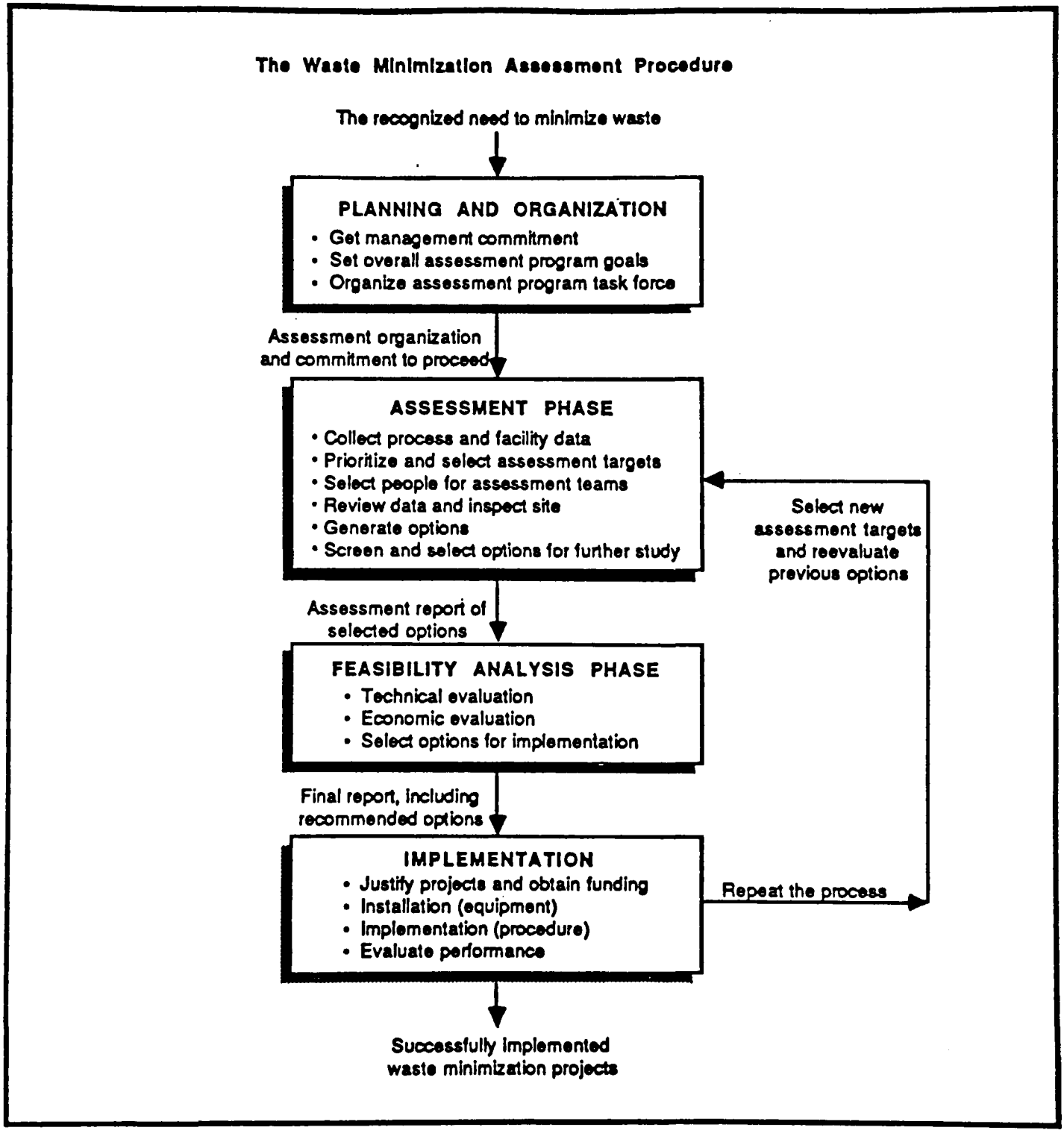

Figure 1-2

GENERALIZED WASTE MINIMIZATION ASSESSMENT PROCEDURES
(from EPA/625/7-88-003)

types of nonhazardous wastes. Chapter 5 summarizes the results of the feasibility analysis and provides recommendations.

The appendices contain background information used in the feasibility analyses, consisting primarily of product information for many of the alternatives discussed in the report. Appendix A contains product and vendor information on paint removal from buoys and hulls. Information on equipment options for minimizing paint waste is collated in Appendix B. Vendor information on solvent substitutes and distillation units are contained in Appendix C. Product information on alternatives for bilge waste management comprises Appendix D. Appendix E contains information on waste oil management options. Appendix F addresses product information on antifreeze and coolant options. Information on recyclers of batteries, paper, glass, and aluminum is provided in Appendix G. (Mention of product manufacturers, vendors, trademarks or trade names in this report does not imply EPA or SAIC endorsement of these products, manufacturers, or vendors).

2.0 FACILITY DESCRIPTION

2.1 OVERVIEW OF BASE OPERATIONS

2.1.1 Current Operations

Although a Coast Guard facility has occupied the eight-acre site at the south end of the city of Ketchikan in southeast Alaska for many years, Base Ketchikan was established organizationally in July 1989. Over 100 Coast Guard and civilian personnel work at the Base. The primary functions of Base Ketchikan are to maintain several hundred aids to navigation (ATON) in Alaskan waters, and to support and maintain several Coast Guard cutters and boats. These vessels are used for search and rescue operations, law enforcement, and ATON maintenance. The facility has several tenant commands, which are:

- Group Ketchikan
- Marine Safety Detachment (search and rescue)
- USCGC *Naushon*
- USCGC *Planetree*.

The *Planetree* is a 180-foot buoy tender with 55 personnel on board, and is the largest of the vessels supported by the Base. The *Naushon* is a 110-foot cutter employing a 16 person crew. It is one of four 110-foot vessels maintained by Base Ketchikan. Smaller vessels are home-ported and/or maintained at the Base as well, including three 41-foot aluminum-hulled cutters, two of which are based in Ketchikan, a 42-foot training vessel based in Sitka, and a steel-hulled 65-foot cutter based at Ketchikan. Coast Guard vessels are used for buoy maintenance, search and rescue operations, and enforcement duties.

Table 2-1 summarizes the departmental organization of Base Ketchikan. "Station" is the department which is responsible for Ketchikan-based boat operations. Station performs all above waterline maintenance and repair of vessels. The Industrial Department ("Industrial") is responsible for vessel maintenance and repair below the waterline. Comprised of six shops (Table 2-1), Industrial performs all of the dry blasting on both vessels and buoys. Buoys are periodically overhauled, a process in which the wiring, lighting, and bell equipment is removed, the paint is stripped off by blasting, any repairs which are needed are performed, and the unit is repainted.

The Public Works Department is responsible for maintenance of Base Ketchikan buildings, vehicles, housing, utilities, and waste management. The Medical/Dental Center on base provides out-patient health care and dental service to Coast Guard personnel. Most of the purchasing is conducted by the

Table 2-1

DEPARTMENTAL ORGANIZATION OF BASE KETCHIKAN

1. Public Works Department

    Carpenter Shop
    Vehicle Maintenance Shop & Hobby Lobby
    Utilities Shop
    Electrical Maintenance Shop
    Hazardous Waste Storage Area
    Barracks
    Gymnasium

2. Supply Department (Comptroller)

    Warehouse
    "83 Stock"
    Surf and Galley
    Mess Deck

3. Station (Boat Operations Department)

4. Non-Appropriated Funds Activities (NAFA)

    Taffrail Club
    Base Exchange (PX)

5. Medical/Dental Department

6. Industrial Department

    Carpenter Shop
    Machine Shop
    Electrical Shop
    Electronic Systems Technicians
    Telecommunications Technicians
    Metal Trades Shop
        - Sheet Metal Shop
        - Welding Shop
        - Metal Fabrication Shop
        - Painting Shop
        - Buoy Shed

Supply Department (Comptroller), which orders supplies through the federal supply system and other channels as needed. The "Surf and Galley," mess deck, and warehouse are also Supply Department responsibilities. Non-Appropriated Funds Activities (NAFA) include the Base exchange and the Taffrail Club, an all-hands club.

2.1.2 Facility Improvements

At the time of the site visit, the buoy shed was undergoing renovation. The renovation project was completed in January 1991, providing an expanded paint booth, an enclosed buoy blasting room, employing a custom-designed recyclable steel shot blasting system, and improved paint storage accommodations. Full operations in the buoy shed were resumed in January. Designs for improvements to the marine ways (dry dock for boat repair) are currently being developed by the Facility Design & Construction Center (FD&CC) in Seattle. Construction is anticipated to begin in mid- to late 1991, to be completed six to nine months later. The improvements will include completion of walls on the north, east, and west sides of the ways, and the addition of a second roof high enough to accommodate the superstructures on the 110-foot cutters which are maintained at the Base.

2.2 MAJOR WASTE-GENERATING ACTIVITIES

2.2.1 Buoy Maintenance

There are a total of 1,316 floating light units in Alaskan waters that are the responsibility of the Coast Guard, in addition to approximately 300 seasonal navigation aids statewide. One of the primary functions of Coast Guard Base Ketchikan is maintaining approximately 300 aids to navigation, most of which are steel buoys. Preventive maintenance is performed on all aids to navigation annually. This includes battery replacement, wiring repairs, maintenance of lights and bells, checking lighthouse generators, and checking anchors. A steel buoy has an expected useful life of 30 years, after which maintenance costs become unacceptably high. The buoy hulls are overhauled every five to six years, and repairs are made as needed when the buoys are damaged. Up to 150 buoys can be repaired/overhauled in a single year. At Base Ketchikan, an average of 82 buoys are overhauled per year, of various sizes and types.

The overhaul process involves the following:

- A buoy tender removes the buoy from the water;
- The buoy is pressure sprayed to remove barnacles and other marine growth;

- The buoy is brought to the Base where its wiring and bells are removed;
- The hull is blasted to remove all layers of paint and to prepare the steel surface for repainting;
- Body repairs are made;
- The hull is blown down to remove any remaining dust or grit;
- Primer coat is applied;
- Two additional layers of paint are applied;
- The buoy is prepared for replacement at a designated location.

Wastes generated in the process of buoy maintenance and overhaul include the following materials:

- Batteries
- Blasting waste (blasting media and paint dust)
- Waste paints
- Thinners
- Paint slops.

2.2.2 Vessel Maintenance

All Coast Guard vessels are routinely maintained according to a preventive maintenance schedule. This includes engine maintenance with oil changes and coolant replacement, periodic maintenance of all systems on board, and an overhaul approximately once every five years. Base Ketchikan performs repairs and maintenance on five to ten Coast Guard vessels in the marine ways each year. Paint removal from both aluminum and steel hulled vessels is accomplished by dry blasting using blasting media made from granulated smelter slag or garnet. Steel shot cannot be used for paint removal on aluminum surfaces because it damages the aluminum.

Wastes generated in the process of Coast Guard vessel maintenance and overhaul include the following:

- Waste oil
- Coolant
- Bilge
- Spent blasting media
- Paint waste
- Thinner
- Solvents.

2.3 WASTE MANAGEMENT PROCEDURES

2.3.1 Hazardous Waste Management

Base Ketchikan is a large quantity hazardous waste generator. It is also the receiving site for hazardous wastes generated by Coast Guard units in Southeast Alaska considered satellite accumulation points. [Satellite accumulation points are defined in 40 CFR 262.34(c).] Hazardous waste management policy and procedures for the Base are documented in several Coast Guard directives, including *USCG Group Ketchikan Hazardous Waste Management Plan* (Group Ketchikan Instruction 16478) and the *Hazardous Waste Management Plan* (Commandant Instruction M16478.1A).

For the past two years, hazardous materials/waste coordination has been the responsibility of a Chief Warrant Officer (Jeff Hurst) reporting to the head of the Industrial Department. This officer has carried this responsibility along with several other collateral duties. As of December 1990, this responsibility was transferred to the duties of the Chief Warrant Officer serving as the head of Public Works (John Prill).

There is an uncovered, fenced and locked concrete pad which serves as the hazardous waste storage area (HWSA) on the Base. A 5-inch concrete curb runs the perimeter of the pad, equipped with a drain at one corner. A documentation system is in place to facilitate the handling of hazardous waste which is transferred to the HWSA. For each container of waste, a "Hazardous Waste Transfer Sheet" is completed and submitted to the hazardous materials coordinator, who then moves the container of waste into the HWSA. The transfer sheets identify the source of the waste, the quantity, the type of waste, type of container, date of transfer, and provide space for comments.

The hazardous materials coordinator is responsible for the proper identification, packaging, manifesting, and shipment of hazardous waste offsite. The coordinator handles hazardous waste generated by the tenant units and satellite accumulation areas as well as from the Base itself. In addition, the coordinator is responsible for submitting the annual Generator Reports required by Alaska DEC and biennial Generator Reports required by EPA. A waste inventory report is maintained by the hazardous material coordinator on the Base mainframe computer. There is also a hazardous materials inventory report which is updated twice a year.

Liquid wastes are drummed in standard DOT open top or bung top steel containers. Batteries are stored and shipped in special plastic totes. Wastes in small containers or in damaged containers are

placed in overpack drums with absorbent filling the voids. Wastes for which there is no identifying information available are sampled and analyzed. Typically, hazardous waste shipments occur every 90 days.

Hazardous waste disposal service is obtained by contract administered by CEU Juneau. The current contract includes six pickup points at Coast Guard facilities in Alaska, of which Ketchikan is one. The contract addresses transport and delivery to one or more approved treatment/storage/disposal (TSD) facilities in the Pacific Northwest. Current disposal practices at Base Ketchikan include the containment and shipment offsite of all bilge waste, waste oils, spent batteries, used blasting grit, spent solvents, paint wastes, and miscellaneous hazardous wastes through the hazardous waste disposal contract.

2.3.2 Nonhazardous Solid Waste Management

Unusable and surplus equipment and usable scrap materials are handled through the Defense Reutilization and Marketing Office (DRMO) in Anchorage. The DRMO may find a use for the material and coordinate with Base Ketchikan for its delivery to the federal facility which needs it. The DRMO generally manages only large unused or broken down equipment, and seems reluctant to manage scraps and equipment or materials with small dollar values.

Solid waste is disposed of at the Ketchikan solid waste landfill, located about one-half mile from the Base. Three 2-1/2 cubic yard dumpsters on Base accumulate cardboard, packing materials, paper, discarded containers, food waste, nonhazardous industrial waste, and other miscellaneous trash. Tongass Sanitation collects the trash from the dumpsters and hauls it to the landfill three times per week. Additional material may warrant hauling on an unscheduled basis by the Coast Guard, which hauls discarded material and scrap equipment in a pickup truck to the landfill.

Recently, the Executive Officer installed recycling bins for aluminum cans next to the pop machines in a few locations on the Base. This is the first recycling effort to be initiated at the facility.

Contaminated medical waste is delivered to Ketchikan Hospital in special biohazard bags, where it is incinerated. Expired pharmaceuticals are disposed in one of three ways: injectibles are taken to the Ketchikan hospital and exchanged for new products; tablets are disposed of in the biohazard bags; and controlled substances and liquids are flushed into the sewer system.

2.3.3 Sanitary Waste Management

Base Ketchikan sends all of its sanitary waste into the city sewer system, for which it is charged a flat rate. Coast Guard vessels usually retain their sanitary waste and gray water in holding tanks until they return to the Base where they are pumped directly into the sewer.

2.4 WASTE GENERATION BY UNIT AND AREA

The major waste streams generated at Base Ketchikan are:

- Blasting waste
- Bilge waste
- Waste oil
- Batteries
- Paint waste
- Solvents
- Antifreeze
- OBA canisters
- Paper
- Glass, aluminum, plastic.

Contributions to several of these waste streams are made by different processes and functional units. Brief descriptions of each shop or unit's operations and significant wastes generated are presented in the following paragraphs. This information is based on interviews with shop and unit personnel and is not based on sampling or other sources.

2.4.1 USCGC *Planetree*

The *Planetree* is a 180-foot buoy tender with twin diesel engines and a single screw. It is used to haul out and replace buoys, and to do some buoy maintenance on board. Each engine uses 20 gallons of Nalcool (an engine protectant) and 480 gallons of water. The coolant mixture is changed out every two years, normally while the ship is in the shipyard for repairs or maintenance. Base Ketchikan does not normally receive this coolant waste. Bilge is run through an oil/water separator on board and the water is pumped overboard. The oil is retained in a 500-gallon holding tank, then drummed when the vessel is docked. Approximately 50 to 100 gallons of this oil/diesel/water mixture is generated per month and transferred to Base Ketchikan, where it is prepared for shipment offsite as hazardous waste.

The engines each use 80 gallons of lubricating oil. Samples are sent out periodically to a lab for testing. When the samples indicate that the oil is no longer adequate, the oil is changed. Used oil is drummed and disposed as hazardous waste by the Base, approximately once a year. The ship's generators use seven gallons of oil each. The oil is changed every 250 hours of operation, or about once per quarter. This oil is pumped into the bilge oil tank. According to the *Planetree*'s Engineering Officer, this oil could be separated from the other bilge oil and handled separately, but the current setup combines the two.

Three types of batteries are collected from the aids to navigation (ATON) and other units serviced by the *Planetree*. They are two types from ATON buoys and towers (both solar-powered), and one type of lead-acid battery which resembles a car battery. These are separated by type and placed in plastic totes, which are then disposed as hazardous waste from Ketchikan.

Currently, trash generated on board is bagged and placed in a dumpster at the Base. According to the Engineering Officer, paper trash could be separated on board from aluminum cans but currently this is not the practice.

Sewage is collected in a sewage tank, then pumped into the sanitary sewer system at Ketchikan (or another port) when the ship is docked. Gray water is held separate from the sewage, and can be pumped overboard, but ordinarily it is also sewered. The *Planetree* has the capability of making fresh water, but ordinarily does not use the system. USCG policy restricts the use of water distillation units when the ship is within 12 miles of shore.

2.4.2 USCGC *Naushon*

The *Naushon* is a twin-engined 110-foot cutter, whose primary functions are law enforcement and search and rescue. Occasionally, the *Naushon* will also perform ATON maintenance functions. The vessel's diesel engines each use 85 gallons of lubricating oil which is changed three times per year (every 500 hours of operation). Each engine uses 120 gallons of coolant, a 30 to 50% mixture of Paxcool (engine protectant) and water. The coolant is replaced every two years and disposed as hazardous waste from Ketchikan.

The *Naushon* does not have an oil/water separation unit on board. The vessel generates approximately 200 gallons of bilge per quarter, which is pumped into drums at Ketchikan and disposed as hazardous waste. The only degreasing agent currently used on board is "Simple Green," a biodegradable emulsifying cleaner.

Trash is collected on board in large plastic trash bags and disposed in a dumpster on Base. There is no separation of paper or aluminum wastes.

The *Naushon*'s sanitary waste and gray water is retained on board in separate holding tanks until they can be pumped into the sewer at Ketchikan or another port.

2.4.3 Station

Station, formerly known as the Boat Operations Department, is responsible for maintenance and repair of vessels above the waterline. The Industrial Department is responsible for all boat maintenance and repair below the waterline and all sandblasting operations. According to the Station shop head, lubricating oil on the two Ketchikan-based vessels maintained by Station is replaced every 100 hours of operation. Reduction gear oil is changed once per year. Each vessel generates approximately 14 gallons of used oil per quarter. Antifreeze or coolant solution is replaced every two years, at a minimum. Station collects roughly one drum of used antifreeze solution per quarter which is disposed as hazardous waste. Bilge waste is pumped and drummed by Station, totaling about two drums per quarter. A small parts washer located in the shop uses a Stoddard-type solvent, and generates about 10 gallons of spent solvent per year. "Simple Green" is also used as a general solvent/cleaner. Occasionally, liquid paint remover is used on the boats, resulting in paint wastes including thinner, paint sludge and solids.

2.4.4 Industrial Carpenter Shop

The Industrial Department is comprised of six shops, as outlined in Table 2-1, one of which is the Carpenter Shop, responsible for wooden structures and signs. The primary waste from the Carpenter Shop is sawdust, which is piped by vacuum from each machine to a cyclone separator, and disposed as solid waste (in the landfill). On Base, some spray paints and lacquer are used. A large vacuum heat press is located in the Carpenter Shop for the construction of sea and land-based "day boards" (navigational signs). Vapors from the press are vented to the outside. Scrap wood is left in a bin in the shop, and employees can take scraps for their home use.

The carpentry staff often travels in support of the entire 17th Coast Guard District. Several shop personnel are certified to perform asbestos removal. Any asbestos related work at Base Ketchikan is conducted by the Carpenter Shop.

2.4.5 Industrial Machine Shop

The Industrial Machine Shop is responsible for repair and maintenance of diesel engines, refilling carbon dioxide fire extinguishers, and for pipefitting activities. According to the foreman, wastes from this shop include crankcase oil (two drums per year), hydraulic fluid (three to four drums per year), antifreeze (10 gallons per year), cutting oils, grease, a small amount of paint waste, and spent solvents and sludges. The shop employs a small parts washer which generates three to four drums per year of spent solvent ("Chevron 325"). A large parts washer, aptly named the "gunk tank," uses a heated solution of carbon removing compound to clean oil, grease, and carbon deposits from diesel engine blocks. The gunk tank holds about 100 gallons of compound and is cleaned out once or twice per year, producing about 10 gallons of sludge each time. The solvent and sludge are drummed and disposed as hazardous waste.

2.4.6 Industrial Electrical Shop

The Industrial Electrical Shop services electric motors, starters, generators, and controllers for Base equipment, equipment at remote sites, and equipment on Coast Guard vessels. The shop uses a trichloroethane (TCA)-based solvent for cleaning most electrical equipment because it will not corrode wire or leave a residue. The shop uses less than 55 gallons of TCA per year. Most of this solvent is sprayed on, generating an airborne waste and not a solid waste. Other wastes generated by the Electrical Shop include aerosol spray cans, small containers, paper, packing material, styrofoam, and other miscellaneous non-hazardous wastes.

2.4.7 Electronic Systems Technicians

The Electronic Systems Technicians are responsible for repair and maintenance of radio, radar, and A/C power equipment. Because of the increasing use of circuit boards rather than individual components, very little soldering is now done in this shop. Rebuilding of radar antennas usually involves the use of TCA-based solvents (from spray cans) and paint. Small parts are cleaned in an uncovered TCA bath (a coffee can), which is drained infrequently. The shop generates one 30-gallon drum per year of waste solvents.

2.4.8 Telecommunications Technicians

The Telecommunications Technicians service communications-related electronic equipment and telephones on Base, as well as equipment at LORAN stations and on Coast Guard vessels for which the Base is responsible. Base equipment includes the switchboard, public address system, and cabling.

The shop generates little waste, including some scrap wire and cable, a small amount of TCA-based solvent, and miscellaneous trash.

2.4.9 Industrial Metal Trades Shop

The Metal Trades Shop, part of the Industrial Department, is responsible for all metalworking activities, blasting and painting. Metal Trades is subdivided into five areas: Sheet Metal Shop, Welding Shop, Metal Fabrication, Paint Shop, and the Buoy Shed. Primary activities of the Metal Trades Shop are buoy overhaul (including blasting, repair, and painting), and vessel hull blasting, repair, and painting. Scrap metal generated by the Sheet Metal Shop is saved if it appears usable. Small pieces or unusable shapes are discarded or donated to a local high school. Welding is performed inside the Industrial Building. The audit team noted that welding fumes may not be adequately exhausted based on visual observation of welding operations in progress.

When blasting operations are conducted on a vessel in the marine ways, a plastic dropcloth is first laid on the ground to help contain the paint and blasting grit/dust. The ways is partially enclosed and the roof extends only partway over the larger cutters. Some blasting grit and paint dust escapes the confines of the ways and dropcloths, and reaches the sand under the ways and probably the sediments below the waterline as well. Base personnel reported that the blasting grit is reduced to powder in a single application, preventing the recycling of it. Paint chips and dust are mixed in with the grit. The presence of lead, chromium, and other metals in the paint dust can cause the blasting waste to be designated as hazardous waste. In addition, surface pretreatment compounds have been used in the past to aid in paint removal. The presence of toxic constituents in these compounds may also cause blasting waste to be designated as hazardous. After many years of blasting at this location, blasting waste grit which had escaped retrieval had accumulated on the ground. In 1990, several thousand pounds of surface soil containing spent grit and paint dust below the ways was excavated and drummed for hazardous waste disposal.

Designs are currently underway to expand the marine ways to accommodate larger craft and provide more complete enclosure of vessels, as mentioned in Section 2.1.2.

The buoy shed was refurbished over the fall of 1990. A new blasting booth was constructed which employs a steel shot blasting and recycling system. After blasting, the shot falls into a central trough in the concrete floor and is conveyed back into the hopper automatically by a screw conveyor. As it enters the hopper, the shot is air separated (presumably by cyclone or similar device), partitioning

the paint dust, steel dust, and reusable shot. The manufacturer of this system (CAB Systems) claims the shot will endure 200 blasting cycles. Other sources[1] state typical rates of five to six cycles before steel shot breaks down to a point where it becomes too inefficient for reuse.

2.4.10 Public Works Department

Public Works includes four shops, the hazardous waste storage area, barracks, and the gym. The audit team collected information on waste generation at the Carpenter Shop, Vehicle Maintenance and the "Hobby Lobby," the Utilities Shop, and the Electrical Maintenance Shop. The operations at these shops support the Base itself: building upkeep, systems and utilities maintenance, and maintenance of shore vehicles. The Hobby Lobby provides space and tools for employees to work on their personal vehicles.

Wastes generated in the Carpenter Shop include wood scraps, sawdust, a small amount of paint waste, lacquer, adhesive, and packing materials. As in the Industrial Carpenter Shop, sawdust is pulled by vacuum into a hopper and placed in a dumpster. Almost all of the wastes from this shop appeared to be landfilled.

Wastes from the Utilities Shop and Electrical Maintenance Shop include scrap pipe and wire, unusable small metal and plastic electrical parts, and miscellaneous trash. The audit team did not find anyone in these two shops to interview.

Waste oils, spent antifreeze solutions, used batteries, and solvents are wastes generated by the Vehicle Maintenance Shop and Hobby Lobby. Accumulation drums for used oil and antifreeze were located in the shop. A small parts washer was also located in the Vehicle Maintenance area, which used a petroleum distillate solvent such as Stoddard solvent. According to the head of Vehicle Maintenance, every effort was made to keep waste oil separate from other wastes in the Vehicle Maintenance Shop. He operates a waste oil heater in the shop which runs about five months per year, supplying supplemental heat to the Vehicle Maintenance, Hobby Lobby, and Motor Pool areas in the building. The waste oil heater has been in place since late 1989. It currently has about 500 gallons of reserve oil, and cannot accommodate any additional sources of oil from other points on Base. The heater is thermostatically controlled, and burns approximately one gallon of oil per hour when it is running.

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[1]Phil Tilson, U.S. Technology, Danielson, CT, personal communication 12/5/90; SAIC, Waste Minimization Opportunity Assessment, U.S. Coast Guard Support Center New York Governor's Island, New York, August 1990.

Airless spray guns (Binks Super 1) are used for buoy and hull painting. Several different types of paint are used, depending on requirements of the painted surface. Some epoxy primers may only be applied down to 50°F, and therefore cannot be used in the marine ways for painting boats in the winter. The Paint Shop uses a methyl ethyl ketone (MEK) based thinner. Waste paints are stored in a locker with a lock (not always locked) outside the Paint Shop. Solvents and other hazardous wastes from the vessels are often deposited in the wrong drums, causing mixing of the wastes. An estimated 2 drums of paint slops and thinners are produced per month by the Paint Shop.

When the buoy surface is ready for painting, the first coat of epoxy primer is applied, usually taking about an hour. This coat dries for about eight hours before the second coat is applied. One primer is red and the other black to avoid confusion when applying the second coat. Binder coats are then applied, and finally an all gray rubber coat. Vinyl and enamel paints are used above the waterline, and antifouling paint below the waterline. With proper storage, these paints reportedly have a shelf life of 6 to 8 years. The estimated quantity of paint used per 30-foot buoy is 24-26 gallons.

Vessel bottoms are now being painted with a rubberized coating instead of the organic antifouling paint used previously. According to the head painter, approximately 100 gallons of paint are used to coat one vessel hull. Lighthouses receive three coats of epoxy paint.

Ventilation exhaust filters in the paint room are changed once a month, generating about one drum of hazardous waste per change. Intake filters are rubberized filters which are replaced every six months.

2.3.11 Medical/Dental Department

The Base medical center includes a pharmacy, out-patient clinic, and dental office and laboratory. Expired pharmaceuticals are either exchanged for fresh products or disposed of appropriately (Section 2.3.2). Waste from medical procedures are deposited in a biohazard bag, two of which (about 75% filled) are delivered to the Ketchikan Hospital every week, where they are incinerated. Sharps are placed in special sharps containers. About one quart of acetone is used per year. Live viruses (from cultures) are injected with acetone, then autoclaved. No laboratory analyses are performed on the Base other than blood cell counts, cultures, and urinalysis. Blood is sent offsite for any other additional analysis. No medical x-rays are performed at the medical center.

Dental X-rays are produced onsite. The developing machine employs an automatic replenishment system that eliminates the need to change out developer and fixer solutions. About three gallons of Kodak developer/fixer are used per week. Rinsate goes directly into the sewer drain. In addition to these chemicals, sodium hypochlorite (bleach) is used in the dental area (about one gallon per week of a 10:1 solution in water). Very small amounts of mercury amalgam and other dental compounds are disposed of as hazardous waste.

2.3.12 Galley

The Galley, operated by a contractor (currently "Big Boy") contains a kitchen and dining areas and serves all Base personnel. The Galley is under the direction of the Supply Department. Government issue caustic cleaners are no longer used in the kitchen and dining areas. Approximately one gallon of highly concentrated grease stripping product ("Grease Strip" by Ecolab) is used per year. One gallon per week of a standard kitchen degreaser is also used. The filters in the hood are cleaned three times per week with a degreaser.

"Solid Power" is used in the dishwasher (an industrial Hobart "Sanitizer"). Dishwasher operations include a prewash and post rinse. A 150 ppm chlorine additive is used for sanitary purposes. Approximately three cups per week of lime remover is used to descale the dishwasher. Floor soaps are used for scrubbing the floor. Chlorine bleach is used regularly. The floors are stripped and waxed periodically. Most cleaning is done with rags which are washed and reused. Spills are cleaned up with paper towels.

Tin cans discarded by the Galley are used by Industrial. Aluminum foil is avoided. Cardboard boxes are flattened and not reused, filling half a dumpster per week. Slop food is disposed in the trash and landfilled. The kitchen used to provide food wastes to a local pig farmer, but this is no longer an option. Apparently neither the Base nor the local landfill has pursued composting of food wastes. Stored food is rotated, and usually offered at two meals once prepared. The Galley estimates that less than 1% of prepared foods are disposed in the garbage.

Approximately six pots of coffee are made daily. Paper cups are now provided for coffee that is carried out of the dining room.

2.4.13 Administration Building

The Administration Building houses the Base administrative staff, switchboard, and radio communications facility. The major wastes generated there are white paper and miscellaneous trash. No figures were available for the base-wide consumption of paper. There are eight or nine copying machines on Base, three of which are used by Industrial. There are also about eight laserjet printers (Canon) on the Base. Laserjet cartridges are replaced at a rate of about four per machine per year. Spent cartridges are disposed of in the trash and landfilled.

2.4.14 Procurement

Supplies are purchased in several ways at Base Ketchikan. Purchase orders can be initiated by any of the functional departments. All orders go through the Base Comptroller. Most materials are ordered through the federal supply system. (The Base has no control over the brand, quality, or toxic nature of goods ordered through the government supply system.) The excess property list is first consulted to identify whether the material could be procured from another facility, and whether it could be delivered by the required date. Special orders may be placed through commercial suppliers if justified, usually because of the non-availability of government-issue equivalent, or if time constraints preclude waiting for government-issue supplies. In addition, materials may be obtained from the "83 stock" or through "SF44" authority, explained below.

The Base currently enjoys an annual $74,000 supply fund, called "83 stock," which is used to purchase items commonly used on base or for which a need can be anticipated in advance. The "83 stock" is stored in the warehouse on base and can be accessed much more quickly than ordering supplies through the federal supply system. Approximately 75% of the current inventory is paint. Coast Guard Headquarters is considering reducing this fund to $16,000 per year because the turnover rate is so low (30% per year on a cost basis). The base Comptroller believes the "83 stock" is underutilized because potential users are not acquainted with the system and may not realize what materials are in stock. An explanatory letter has been sent to all units to help inform base personnel.

"SF44" authority is provided only to large vessels to purchase items commercially rather than through government supply. This allows the unit to make purchases away from its home port or other government supply depots.

All purchased goods received by the facility are delivered to the warehouse. This includes goods purchased for other Coast Guard units and stored at Base Ketchikan until pickup is accomplished.

Goods are distributed to pallets in the warehouse marked with the shop which ordered the supplies. Material Safety Data Sheets (MSDS) are generally provided for all new materials.

In some instances, goods are available only in large quantities, resulting in the delivery of a case of paint, for example, when only one 12 ounce can was needed. This can result in excess quantities of material in storage; limited storage space or inadequate storage may lead to product degradation or exceeding the product's shelf life, resulting in the disposal of unusable goods. Shelf life problems seem to be especially critical for paints. In the past, paints have been stored in unheated lockers and ruined by freezing. This paint is disposed of as hazardous waste. The new paint storage facility will be heated.

2.5 POTENTIAL BARRIERS TO WASTE MINIMIZATION AT BASE KETCHIKAN

In any situation, there may be barriers of one sort or another that can impede the attainment of stated objectives. In attempting waste minimization, Base Ketchikan is no exception. It appears that federal facility commanders have the ultimate liability and responsibility for proper waste disposal, but this authority does not always include the authority and funding to manage a waste handling or environmental protection program effectively. Some things are simply not within the control of the Base decisionmakers, and economics are not necessarily the driving force behind change, as they often are in the private sector. It is important, nonetheless, to identify the barriers in the hopes that they may be overcome. Following is a list of potential barriers that could affect the implementation of waste minimization alternatives at Base Ketchikan.

Labor

- In some areas, Base Ketchikan is short-handed; alternatives that would require additional labor hours may not be attractive.
- Long-held practices or traditions may be resistant to change.
- Morale and time/efficiency pressures can affect general housekeeping attitudes and practices.
- Some options may be perceived as being infeasible or impractical because of former experience with an older technology; many waste minimization technologies have experienced accelerated improvements over the past two or three years.
- Lack of specific training for employees and lack of information on available waste minimization options can impede attempts at waste reduction.

- Turnover in the hazardous materials coordinator position and collateral duties assigned to that position may lead to discontinuity in a waste minimization program and a lack of emphasis on the importance of a fully integrated waste- minimization/management program.

Procurement

- There is no connection between material procurement and waste management; alternatives that reduce disposal costs may not be recognized because they may not reduce procurement costs. And vice versa, options that reduce procurement costs may not be recognized because they may not reduce disposal costs.
- Likewise, a purchase order in the federal supply system cannot necessarily specify a recycled material or a product of lower toxicity.
- Product substitutions may be difficult if they cannot be obtained through the federal supply system.

Accounting and Administration

- Costs and benefits of waste minimization options do not all accrue to the Base. CEU Juneau pays for hazardous waste disposal; Ketchikan pays for new equipment, materials, and training.
- Some alternatives may be perceived as being too expensive despite their positive fiscal benefits.
- Contractual agreements may hinder implementation of some waste reduction alternatives.
- Administrative effort, such as creating additional contracts, may hinder waste reduction options.
- Waste minimization tracking may be a difficult task, due in part to some of the issues mentioned above.
- Some decisions may lie outside the purview of the Base command or CEU Juneau.

Despite these potential constraints, because the Coast Guard at Base Ketchikan and CEU Juneau are genuinely interested in pursuing waste minimization alternatives, effective strategies can be developed to achieve pollution prevention goals. As the benefits of waste reduction become better understood, in the future some of the larger issues, such as procurement within the federal supply system, might be addressed on a Coast Guard-wide basis. A waste minimization task force has recently been established at Coast Guard Headquarters to evaluate waste minimization opportunities and plan for future waste minimization activities.

2.6 POTENTIAL AIDS TO WASTE MINIMIZATION AT BASE KETCHIKAN

Where there exist potential barriers to waste minimization at Base Ketchikan, there are also potential aids. These include current management attitudes, documentation systems in place, and specific activities or equipment already implemented that will facilitate a base-wide reduction in waste generation. The are briefly described below.

Administration

- Both the Base Commander and the Executive Officer are in favor of establishing a waste minimization program at Base Ketchikan.
- Many of the Coast Guard and civilian staff are aware of environmental issues and recognize the need for and benefits of waste minimization.
- CEU Juneau is actively pursuing waste minimization management alternatives which may benefit Base Ketchikan.

Labor

- A position of hazardous materials coordinator has already been established and filled at Base Ketchikan.
- In at least one of the shops on base, a waste coordinator has been designated to oversee the collection and handling of wastes in that particular area.
- Use of the hazardous waste transfer sheets on the Base provides for better identification of wastes, serves to heighten awareness among all personnel about handling hazardous waste, and provides a basis for tracking waste minimization progress.

Activities and Equipment

- The new blasting booth employing a steel shot blasting and recycling system is anticipated to reduce blasting waste from the buoy shed significantly over previous levels.
- Changing from toxic lead-based paints to non-toxic coatings Coast Guard-wide will help minimize paint wastes and paint removal/blasting wastes significantly. Though the overall quantity of wastes may be unchanged, the toxicity of these two waste streams will be considerably reduced.
- Replacement of ATON batteries with the new solar-rechargeable types will reduce battery wastes significantly, due to the longer life of the solar-powered batteries (five years vs. two to three years for the non-solar batteries).
- Use of products like "Simple Green" instead of chlorinated degreasers/cleaners also helps reduce the toxicity of the solvent waste stream.

- Aluminum can recycling bins have been placed near several of the pop vending machines on the Base.

- Used oil from the Vehicle Maintenance Shop and Hobby Lobby is being burned for energy recovery in a waste oil heater located in the Industrial building. Experience is being gained with a non-disposal option for used oil.

3.0 ASSESSMENT PHASE RESULTS

3.1 SUMMARY OF BASE-WIDE HAZARDOUS WASTE GENERATION

In assessing the generation of hazardous waste from Base Ketchikan, the audit team reviewed several sources of data and prepared summaries from the hazardous waste transfer sheets and delivery orders. Hazardous waste transfer sheets are available for calendar year 1989 and from January to August 1990. These transfer sheets are used internally by Base personnel to facilitate the identification, labeling, and handling of wastes generated at the various shops when they were conveyed to the hazardous materials coordinator, who subsequently prepares the hazardous waste for shipment offsite. The transfer sheets identify the source of the waste, the quantity, type of waste, type of container, date of transfer, and provide space for comments. An example hazardous waste transfer sheet is provided in Figure 3-1.

Summary and analysis of the hazardous waste transfer sheet information revealed that the data contain inherent uncertainties for the following reasons.

- Personnel completing the sheets were not uniform in their interpretation of what information was requested on the sheets.
- Personnel completing the sheets occasionally did not fully identify the type of waste and/or the quantity being transferred.
- Terms used for describing the types of waste were not uniform. For example, waste oil was described as "contaminated waste oil," "waste oil," "oil, diesel, and water," "9250," and "water-oil mixture." Oil, diesel, and water could be unseparated bilge waste, containing approximately 95% water, or it could be an oil/diesel mixture with a small amount of water in it. Therefore, summary estimates of particular waste streams required interpretation of waste descriptions which could affect the waste category in which they were included.

Although not 100% accurate, the transfer sheets were the best source of information for characterizing hazardous waste generation from each shop. The delivery orders (shipment invoices) provided no information on the source of the wastes, but provided actual quantity and disposal cost data for each of the waste categories base-wide.

Delivery orders for hazardous waste shipments were available for January through August 1990. These documents provided exact cost data for disposal of various waste categories for three shipments. Comparison of these data with those developed from the transfer sheets revealed some differences

U. S. COAST GUARD GROUP KETCHIKAN
HAZARDOUS WASTE TRANSFER SHEET

GENERATOR: _____ PHONE NR: _____

RECEIVER: _____ PHONE NR: _____

DATE: _____ LOCATION: _____ TIME: _____

DELIVERED BY: _____ _____
[Print Name & Sign] [Rate / Rank]

RECEIVED BY: _____ _____

COMMENTS: _____

CONTAINER INFORMATION: NR: _____ TYPE: _____ SIZE: _____

MATERIAL: STEEL PLASTIC GLASS OTHER: _____

LID/COVER TYPE: SCREW LID/CAP - RING TOP - BUNG - SNAP LID/CAP

OTHER: _____

GEN DESCR: COLOR: _____ MFG OF CONTAINER: _____

ORIGINAL MARKINGS: _____

SECONDARY MARKINGS: _____

CONTENTS: FULL 3/4 1/2 1/4 LESS-1/4 EMPTY

PHYSICAL DESCRIPTION OF CONTENTS: _____

ACTUAL / SUSPECTED CONTENTS: _____

HAZARDOUS CODE / INFORMATION: COMBUSTIBLE - CORROSIVE - FLAMMABLE- TOXIC
REACTIVE - ACUTE HAZARDOUS - EP TOXIC
UNCLASSIFIED----REQUIRES ANALYSIS

MATERIAL(S) ORIGINALLY USED FOR: _____

DEPT/DIV/SHOP THAT GENERATED ABOVE WASTE: _____

TO BE FILLED OUT BY GRU KTN HAZWASTEMNGR

D.O.T./PROPER SHIPPING NAME: _____

HAZARDOUS WASTE CLASSIFICATION: _____

HAZARDOUS WASTE I.D. NUMBER(S): _____

LABEL(S) : _____

E.P.A. HAZWASTE NUMBER(S) : _____

Figure 3-1

EXAMPLE HAZARDOUS WASTE TRANSFER SHEET

in total quantities and/or costs calculated for each waste category or type. These differences are attributable to possible discrepancies in categorization of waste types, missing transfer sheets for some wastes, misinterpretation of transfer sheet information, errors on the transfer sheets, incorrect assumptions as to weight or volume of particular wastes, or incomplete descriptions of some wastes. Despite these differences, both sets of data enable the identification of the significant waste streams for which minimization efforts could result in substantial cost reductions. In addition, these data are used in subsequent cost/benefit analyses of various options considered in this report for minimizing waste production within individual processes.

No attempt was made to reconcile the two data sets, except where estimates of weight and volume relationships could be revised to more accurately reflect known quantity information. Both sets of information are useful for the objectives of this report. The transfer sheets provide information as to the source of wastes (i.e., which shop or vessel generated it) from which we have developed a overview of unit- and process-specific waste generation. The delivery orders provide an accurate record of disposal costs for the various waste streams, independent of waste sources. Graphic illustrations of the overall waste production and costs at Base Ketchikan are presented on the following pages (Figures 3-2 through 3-15). Key assumptions used in summarizing the data are listed in Table 3-1. The tabular data used in constructing the graphs are included with each figure.

3.2 SOLID HAZARDOUS WASTES

Figures 3-2 and 3-3 indicate that, of the types of hazardous solid waste produced at Base Ketchikan, blasting waste represents the greatest quantity. In 1989, an estimated 29 tons of blasting waste were generated, and in the first eight months of 1990, approximately 37 tons of blasting waste were produced. Some of the 1990 blasting waste was spent grit and soil excavated from the marine ways. Spent batteries comprise the second most significant portion of the solid hazardous waste stream, followed by absorbent and oxygen breathing apparatus (OBA) canisters. Spent OBA canisters are generated primarily on CG vessels from emergency procedure drills. The canisters contain barium oxide and are disposed of as hazardous waste. Usually "Scott packs" are used on shore in lieu of OBAs for emergency drills and operations where breathing units are required. Due to space limitations on board, OBAs are used on Coast Guard boats and cutters.

Table 3-1

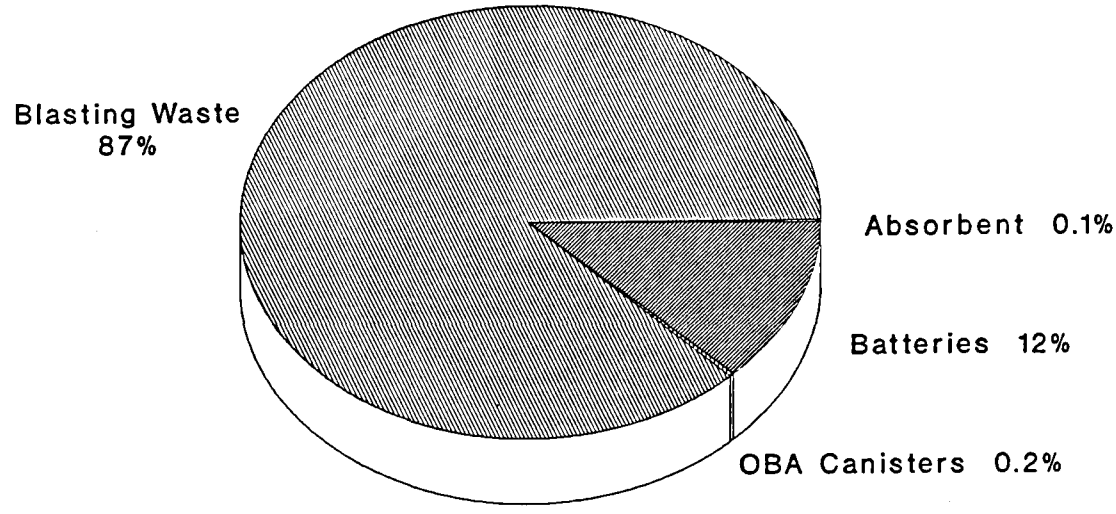
DEFINITIONS AND KEY ASSUMPTIONS FOR INTERPRETATION OF HAZARDOUS WASTE TRANSFER SHEET DATA

- "Vessels" are all boats and cutters and a light house "ANT 17." The vessels which transferred hazardous waste to Base Ketchikan in 1989 and through August 1990 are:

  CGC Naushon
  CGC Planetree
  CGC Cape Carter
  CGC Sweetbrier
  CGC Woodrush
  CGC Cape Hatteras
  CGC Firebrush
  CGC Conifer
  CGC Elderberry

- "Stations" include Station Ketchikan, Station Juneau, and Loran Station Shoal Cove.
- "Administration" includes administrative offices, medical clinic, and the galley.
- "Industrial" and "Public Works" include all shop areas per Coast Guard organizational structure (Table 2-1).
- When not specifically stated on the hazardous waste transfer sheets, contents described as a combination of water, oil, diesel (and antifreeze if present) were assigned to the "Bilge Waste" category.
- "Paint Waste" includes wasted paint, paint slops, and solvents associated with painting (i.e., thinner waste).
- "Waste Oil" consists of waste oil that is not contaminated with solvents, other fuels, antifreeze, or water. If any substances mentioned were identified, the volume of oil was categorized as "Contaminated Waste Oil."
- "Solvents" include petroleum distillate and halogenated solvents but not thinners.
- "Miscellaneous Hydrocarbons" were usually fuels (gasoline or diesel) or a hydrocarbon not assigned to other categories.
- The "Unknown" category is for drum contents that were analyzed because accompanying paperwork was not completed.
- Battery weight totals were calculated based on known weights of specific battery types. If battery types and quantities were not stated, assumptions were made consistent with known data.
- Disposal cost data do not include transportation fees, overhead, and profit unless otherwise stated.

Calendar Year 1989



Total = 67,077 pounds

All values are in pounds.

Values estimated from hazardous waste transfer sheets.

Waste Type	Weight (lbs)	Percentage
Blasting Waste	58,520	87.2
Batteries	8,309	12.4
OBA Canisters	159	0.2
Absorbents	86	0.1
Other	3	<0.1
BASE TOTAL	67,077	99.9

Data adapted from Hazardous Waste Transfer Sheets

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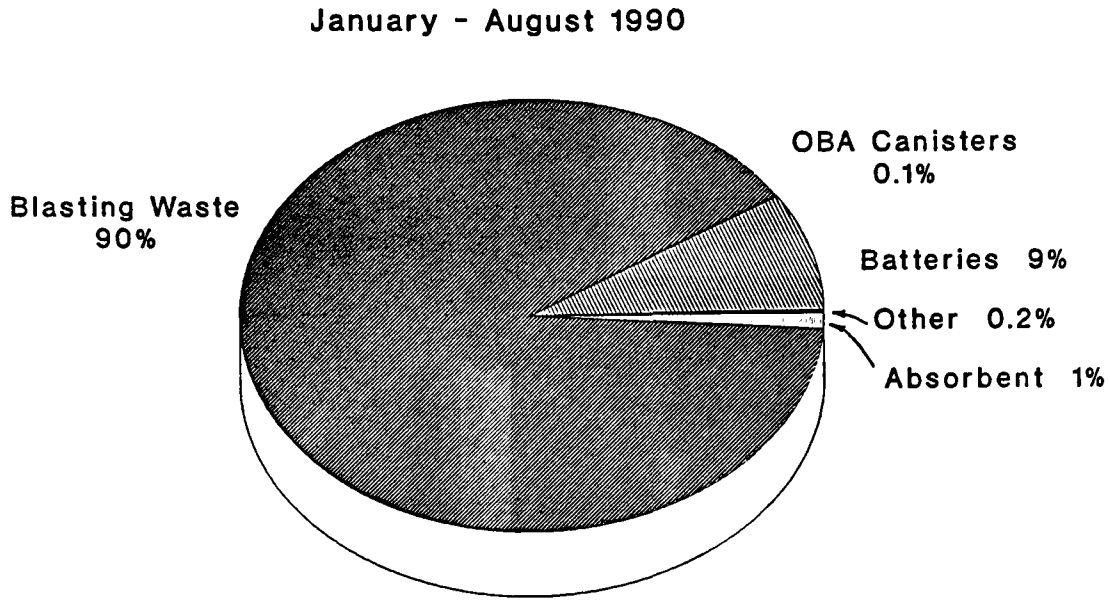
sl/ketchikan/table3-2.doc

Figure 3-2

HAZARDOUS WASTE SOLIDS BREAKDOWN BY WASTE TYPE, 1989
USCG BASE KETCHIKAN



All values are in pounds.

Values estimated from hazardous waste transfer sheets.

Waste Type	Weight (lbs)	Percentage
Blasting Waste	74,727	89.7
Batteries	7,384	8.9
Absorbents	955	1.2
Other	201	0.2
OBA Canisters	74	0.1
BASE TOTAL	83,341	100.1

Data adapted from Hazardous Waste Transfer Sheets

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sl/ketchikan/fig3-3.doc

Figure 3-3

HAZARDOUS WASTE SOLIDS BREAKDOWN BY WASTE TYPE, 1990
USCG BASE KETCHIKAN

Figures 3-4 and 3-5 indicate that Industrial is the greatest generator of hazardous solid wastes, which follows logically because all of the buoy blasting and hull paint removal is done by Industrial. Vessels represent the second largest generator of solid hazardous wastes, attributable primarily to their delivery of spent batteries for disposal by the Base.

3.3 LIQUID HAZARDOUS WASTES

Among the liquid hazardous wastes, bilge waste is estimated at 35 to 37% of the total. Miscellaneous hydrocarbon waste (off-spec diesel fuel and gasoline), contaminated waste oil, and waste oil comprise from 26 to 46% of the liquid hazardous waste stream in 1989 and 1990. Paint wastes (10-16%), antifreeze/coolants (1-10%), and solvents (1-8%) are the other significant categories of liquid hazardous waste, as depicted in Figures 3-6 and 3-7.

From Figures 3-8 and 3-9, we find that the largest generators of liquid hazardous wastes in 1989 and 1990 were:

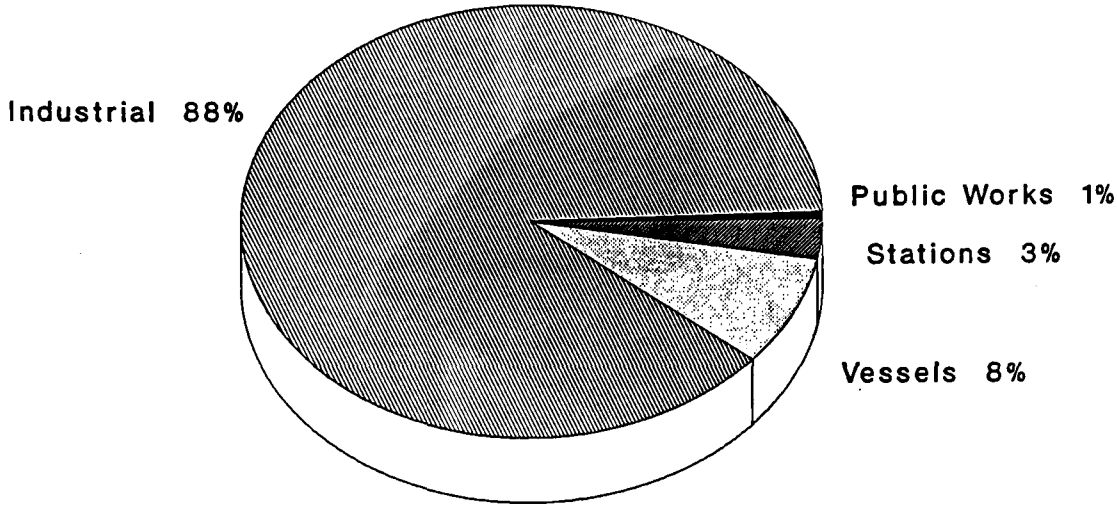
- Vessels 29-42%
- Stations 19-37%
- Public Works 10-27%
- Industrial 11-24%
- Administration 0.1-1%

3.4 DISPOSAL COSTS

Currently, the hazardous waste disposal contract is administered by CEU-Juneau for all Coast Guard facilities in Alaska. Base Ketchikan is the largest generator of hazardous waste among Alaskan CG facilities. In fiscal year 1989 (October 1988 through September 1989), the cost of hazardous waste disposal for wastes shipped from Base Ketchikan totaled $94,000. In fiscal year 1990, Ketchikan's hazardous waste disposal costs were $166,000. In fiscal year 1991, disposal costs had already reached $135,000 by December 1990. There were no clear reasons for this rising trend apparent to the audit team. However, effective waste minimization strategies could certainly help reverse the pattern.

Using the summary data developed from the hazardous waste transfer sheets and the disposal costs per unit for each waste category from the current disposal contract, we constructed an estimate of overall hazardous waste disposal costs for calendar year 1989. Figure 3-10 (and Table 3-2) indicate that in 1989, the most costly waste streams were blasting waste and bilge waste, each comprising slightly over 20% of the total disposal costs (neglecting transportation and broker's overhead and

Calendar Year 1989



Total = 67,077 pounds

All values are in pounds.

Values estimated from hazardous waste transfer sheets

Area	Weight (lbs.)	Percentage
Industrial	59,174	88.2
Vessels	5,510	8.2
Stations	2,006	3.0
Public Works	384	0.6
Administration	3	<0.1
BASE TOTAL	67,077	100.0

Data adapted from Hazardous Waste Transfer Sheets

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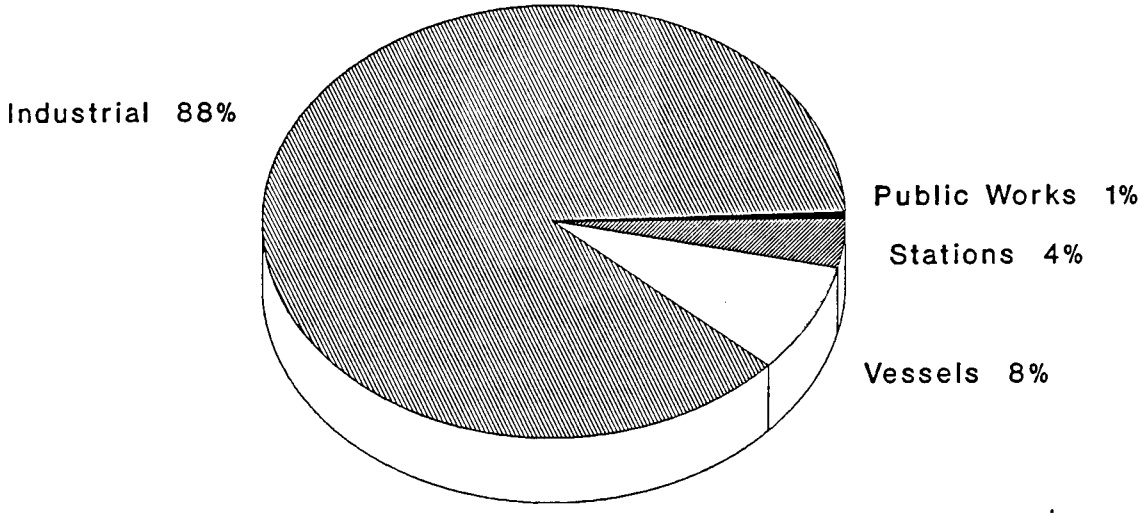
sl/ketchikan/table3-4.doc

Figure 3-4

HAZARDOUS WASTE SOLIDS BREAKDOWN BY AREA OF GENERATION, 1989
USCG KETCHIKAN

January - August 1990



Total = 83,341 pounds

All values are in pounds.

Values estimated from hazardous waste transfer sheets.

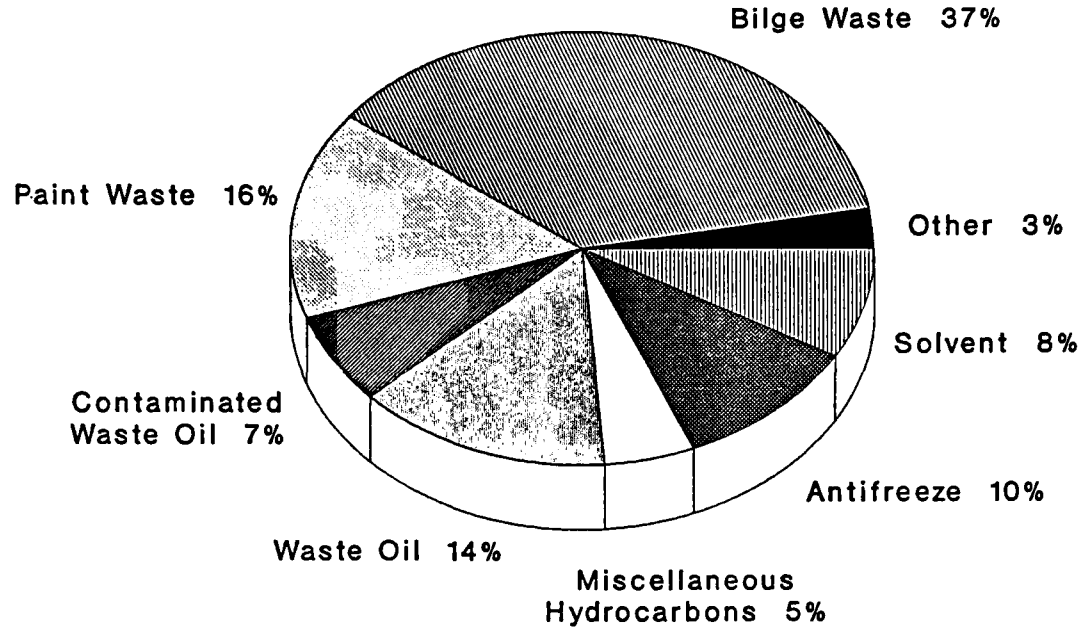
Area	Weight (lbs)	Percentage
Industrial	73,098	87.7
Vessels	6,751	8.1
Stations	3,050	3.7
Public Works	441	0.5
Administration	1	<0.1
BASE TOTAL	83,341	100.0

Data adapted from Hazardous Waste Transfer Sheets

Figure 3-5

HAZARDOUS WASTE SOLIDS BREAKDOWN BY AREA OF GENERATION, 1990
USCG BASE KETCHIKAN

Calendar Year 1989



TOTAL VOLUME = 9,536 gallons

All values are in gallons.

Values estimated from hazardous waste transfer sheets.

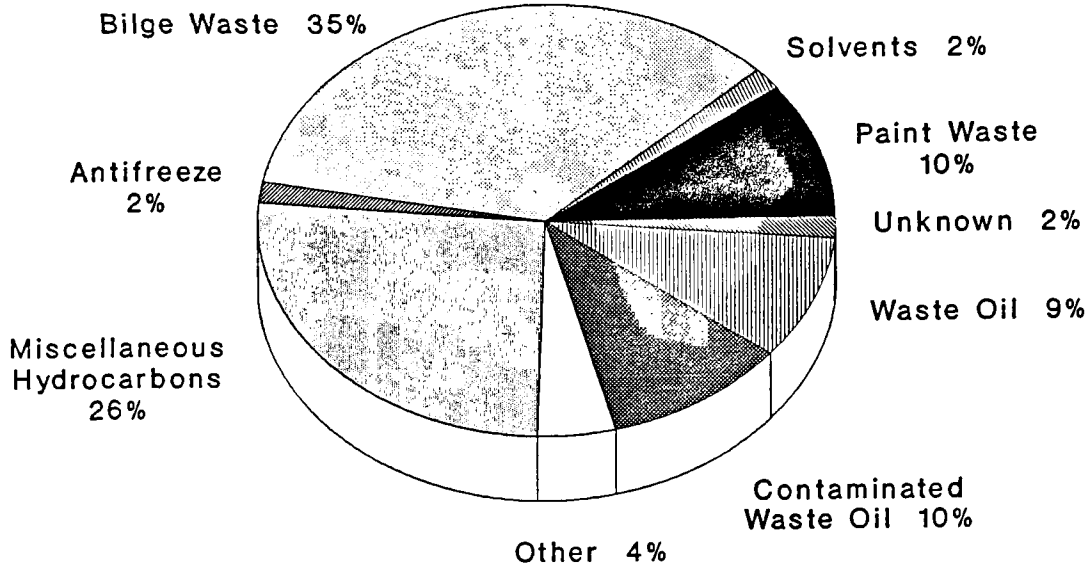
Waste Type	Volume (gal.)	Percentage
Bilge Waste	3,492	36.6
Paint Waste	1,494	15.7
Waste Oil	1,354	14.2
Antifreeze	993	10.4
Solvent	794	8.3
Contaminated Waste Oil	646	6.8
Miscellaneous Hydro-carbons	476	5.0
Other	287	3.0
BASE TOTAL	9,536	100.0

Data adapted from Hazardous Waste Transfer Sheets

Figure 3-6

HAZARDOUS WASTE LIQUIDS BREAKDOWN BY WASTE TYPE, 1989
USCG BASE KETCHIKAN

January - August 1990



TOTAL VOLUME = 6,831 gallons

All values are in gallons.

Values estimated from hazardous waste transfer sheets.

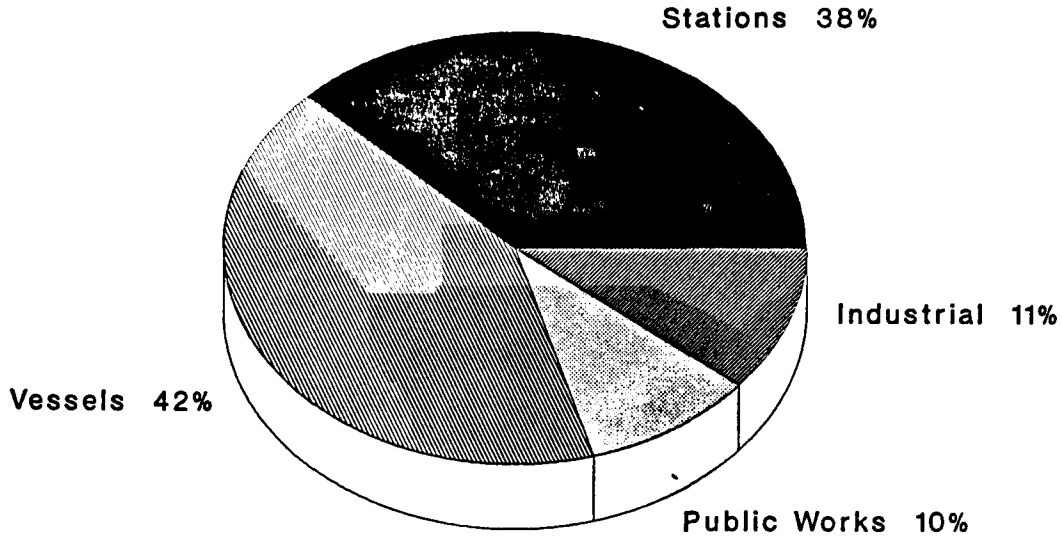
Waste Type	Volume (gal.)	Percentage
Bilge Waste	2,393	35.0
Miscellaneous Hydro-carbons	1,776	26.0
Contaminated Waste Oil	701	10.3
Paint Waste	698	10.2
Waste Oil	632	9.3
Other	299	4.4
Solvents	112	1.6
Antifreeze	110	1.6
Unknown	110	1.6
BASE TOTAL	6,831	100.0

Data adapted from Hazardous Waste Transfer Sheets

Figure 3-7

HAZARDOUS WASTE LIQUIDS BREAKDOWN BY WASTE TYPE, 1990
USCG BASE KETCHIKAN

Calendar Year 1989



TOTAL VOLUME = 9,536 gallons

All values are in gallons.

Values estimated from hazardous waste transfer sheets.

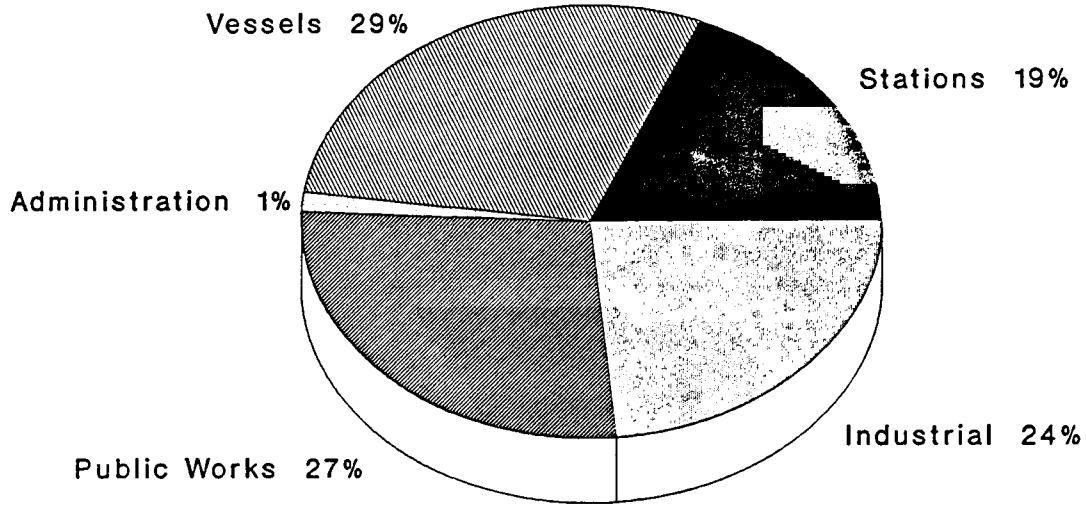
Area	Volume (gal.)	Percentage
Vessels	3,988	41.8
Stations	3,590	37.7
Industrial	1,046	11.0
Public Works	911	9.6
Administration	1	<0.1
BASE TOTAL	9,536	100.1

Data adapted from Hazardous Waste Transfer Sheets

Figure 3-8

HAZARDOUS WASTE LIQUIDS BREAKDOWN BY AREA OF GENERATION, 1989
USCG BASE KETCHIKAN

January - August 1990



TOTAL VOLUME = 6,831 gallons

All values are in gallons.

Values estimated from hazardous waste transfer sheets.

Area	Volume (gal.)	Percentage
Vessels	1,973	28.9
Stations	1,868	27.4
Industrial	1,608	23.5
Public Works	1,284	18.8
Administration	98	1.4
BASE TOTAL	6,831	100.0

Data adapted from Hazardous Waste Transfer Sheets

Figure 3-9

HAZARDOUS WASTE LIQUIDS BREAKDOWN BY AREA OF GENERATION, 1990
USCG BASE KETCHIKAN

profit). In January to August 1990 (Figure 3-11), blasting waste was somewhat more significant than bilge waste, comprising 34% of the total compared to 18% for bilge. In this year, an unusual amount of blasting waste was disposed of due to the excavation of surface soils beneath the marine ways, containing years of accumulated spent grit and paint dust.

Paint waste and waste oil are also expensive waste streams according to the summary data estimates. In 1989, paint waste represented 12% of the total disposal costs for the year. In 1990, estimated costs for this waste stream were significantly lower at 7%, explained by the fact that buoy painting was curtailed while the buoy shed was being remodeled. In 1989, waste oil comprised over 8% of the total estimated disposal expense, and 5% in 1989. Miscellaneous hydrocarbons (off-spec fuels) represented the third highest waste stream disposal costs in 1990. This was due in part to the cleanup of a fuel spill and tank removal at the Base.

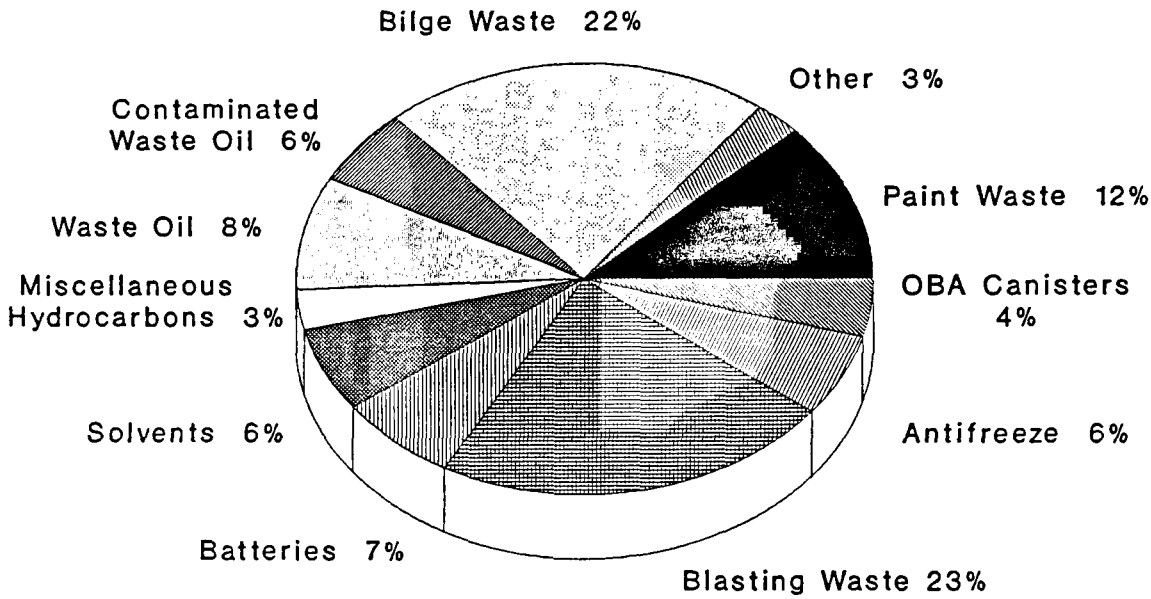
Other significant waste streams in terms of disposal costs are, in approximate order of decreasing expense:

• Batteries	7%
• Contaminated waste oil	6-7%
• Solvents	1-6%
• Antifreeze/coolant	1-6%
• OBA canisters	2-4%

The values discussed above represent estimates based on the transfer sheet data. Delivery orders for 1989 and 1990 showed significantly higher actual overall expenses for hazardous waste disposal. (Note that the transfer sheet data do not include transportation costs or broker's overhead and profit.) Four shipments of hazardous waste from Base Ketchikan in 1989 totaled $148,000. From January to August 1990, three shipments of hazardous waste from Base Ketchikan resulted in total billings of $253,000.

Figure 3-12 and Table 3-3 present the breakdown of actual disposal costs by waste category from 1989 delivery orders. The most expensive category is hazardous waste solid, comprised almost entirely of blasting waste, totaling $46,000 in disposal costs. Second to hazardous waste solid is waste

Calendar Year 1989



Total Cost = $103,958

All values are in dollars.

Values estimated from hazardous waste transfer sheets.

Figure 3-10

ESTIMATED DISPOSAL COST OF HAZARDOUS WASTE FROM TRANSFER SHEET INFORMATION, 1989

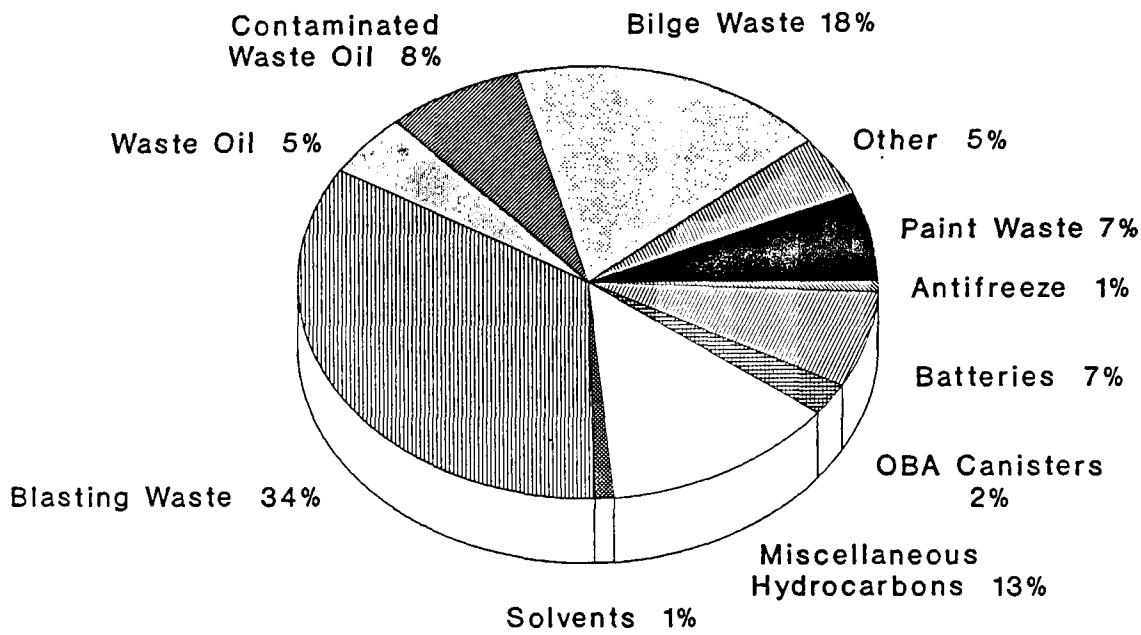
Table 3-2

ESTIMATED DISPOSAL COSTS FOR EACH HAZARDOUS WASTE TYPE AT USCG BASE KETCHIKAN

Waste Type	1989 Cost	1989 Percentage	1990 Cost	1990 Percentage
Blasting Waste	$ 23,408	22.5%	$29,891	34.1%
Bilge Waste	22,698	21.8	15,555	17.8
Paint Waste	12,475	12.0	5,828	6.7
Waste Oil	8,801	8.5	4,108	4.7
Batteries	7,063	6.8	6,276	7.2
Solvents	6,630	6.4	935	1.1
Antifreeze	6,455	6.2	715	0.8
Contaminated Waste Oil	6,092	5.9	6,610	7.6
OBA Canisters	4,500	4.3	2,100	2.4
Miscellaneous Hydro-carbons	3,094	3.0	11,544	13.2
Other	2,708	2.6	3,635	4.2
Absorbents	34	<0.1	382	0.4
BASE TOTAL	$103,958	100.0%	$87,579	100.2%

Data adapted from Hazardous Waste Transfer Sheets

January - August 1990



Total Cost = $87,579

All values are in dollars.

Values estimated from hazardous waste transfer sheets.

Figure 3-11

ESTIMATED DISPOSAL COST OF HAZARDOUS WASTE FROM TRANSFER SHEET INFORMATION, 1990

flammable liquid, including bilge waste, miscellaneous hydrocarbons, and antifreeze/coolants[3] at nearly $39,000. Paint waste and paint waste related categories follow, totaling almost $15,000. Batteries represent over $13,000 in disposal costs, followed by OBA canisters and waste oxidizing material at $10,000.

Figure 3-13 illustrates the breakdown of actual disposal costs by waste category for partial calendar year 1990 from shipping invoices. Waste flammable liquid is by far the most costly, totaling $83,000. Included in this category are bilge waste, miscellaneous hydrocarbons, and antifreeze/coolants. Hazardous waste solid, comprised almost entirely of blasting waste, followed at $39,000 for disposal. Contaminated waste oil and paint waste disposal cost $11,000 and $10,500, respectively. Disposal of batteries came to $7,400. Disposal of PCB transformers and capacitors (not documented on hazardous waste transfer sheets) totaled $7,200. Miscellaneous RCRA wastes cost about $6,000, and disposal of spent OBA canisters totaled $2,700.

The hazardous waste disposal contract is currently held by a waste broker (Oil Spill Consultants, Inc., Anchorage), who works with one or more treatment/ storage/disposal facilities in Washington, Oregon, and Idaho. Contract terms reveal that some wastes are far more costly to dispose of than others. Table 3-4 lists the per unit disposal costs for all of the waste categories in 1990. (The 1989 disposal contract employed a different broker, Glean, Inc., and different disposal rates.)

On top of disposal costs, the broker adds 10% overhead. Transportation is figured on a per trip basis, where a "trip" is defined as two Conex vans (semi-trailer loads). Each van can hold up to 40 drums. To the disposal, overhead, and transportation costs, the broker adds 10% profit. Table 3-5 summarizes the per drum (or per tote) disposal costs for common wastes generated at Base Ketchikan, including transportation costs and the broker's overhead and profit.

Figures 3-14, 3-15, and Table 3-3 illustrate the breakdown by category of actual waste disposal costs for 1989 and 1990, including transportation, overhead, and profit. Transportation costs are second only to waste flammable liquid disposal expense in 1990. Profit and overhead costs in 1990 exceed all but the two highest waste categories. Differences in the 1989 and 1990 hazardous waste disposal

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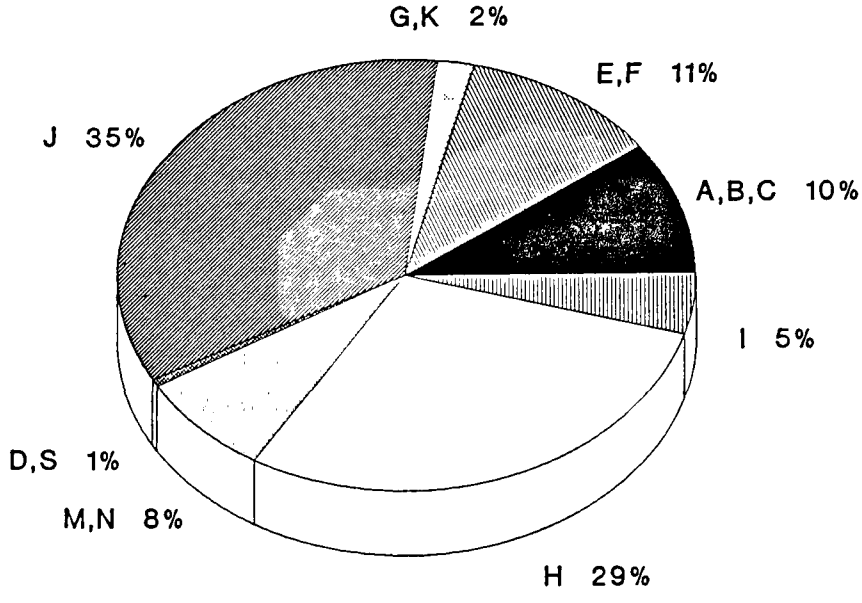
[3]Bilge waste is very likely not flammable and not necessarily a hazardous waste. Waste oil and antifreeze are also not automatically hazardous wastes. Under the new TCLP ruling, these wastes could be designated as characteristic wastes. However, used oil is readily recycled and should be viewed as a valuable resource.

Calendar Year 1989



TOTAL COST = $147,924

All values are in dollars.

Values derived from shipping records.

H	• Waste Flammable Liquid
J	• Hazardous Waste Solid
A,B,C	• Batteries (all types)
E,F	• Paint and Thinner Wastes
I	• Hazardous Waste Liquid
G,K	• Waste Corrosive Liquid and Waste ORM-A
N	• OBA Cannisters
M	• Waste Oxidizing Material
D,S	• Miscellaneous RCRA Wastes

Figure 3-12

ACTUAL DISPOSAL COSTS OF HAZARDOUS WASTE
FROM SHIPPING RECORDS, 1989
USCG BASE KETCHIKAN

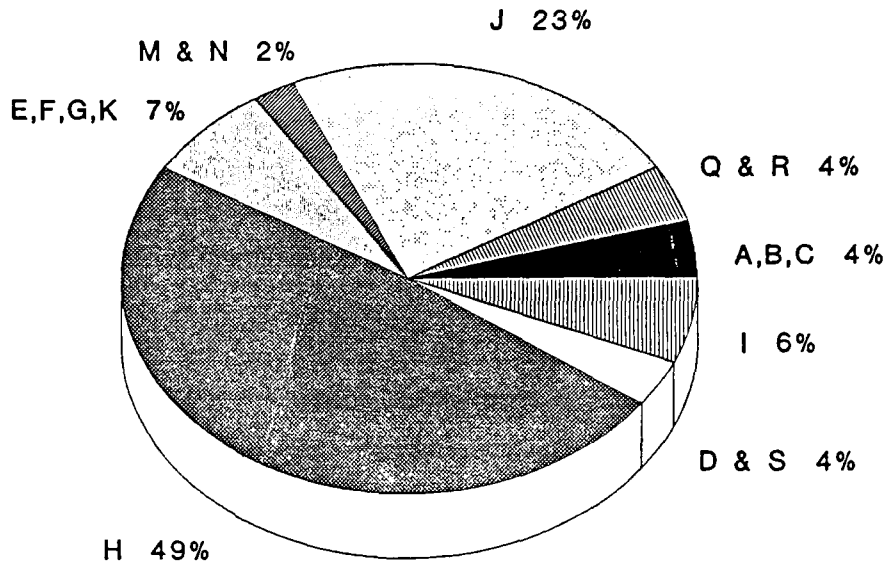
Table 3-3

ACTUAL HAZARDOUS WASTE DISPOSAL COSTS
FOR USCG BASE KETCHIKAN
Calendar Year 1989 and January-August 1990
(Data from delivery orders)

Letter Code	Classification	Waste Type(s)	1989 Quantity	1989 Cost (U.S. dollars)	1990 Quantity	1990 Cost (U.S. dollars)
A, B, C	Batteries (all types)	Batteries	8,440 lbs	$13,315	9,035 lbs	$ 7,360
E	Waste Paint	Paint Waste	483 gal	3,884	387 gal	3,231
F	Waste Paint Related	Paint Waste	1,995 gal	10,953	876 gal	7,315
G	Waste Corrosive Liquid	Solvents	335 gal	1,404	201 gal	1,678
K	Waste ORM-A		55 gal	584	--------	--------
H	Waste Flammable Liquid	Bilge, Miscellaneous Hydrocarbons, Antifreeze	7,380 gal	38,745	12,765 gal	82,973
D	Waste Battery Fluid		169 gal	722	4 gal	41
S	Misc. RCRA Wastes		110 gal 38 lbs	741	152 gal 4,631 lbs	5,918
I	Hazardous Waste Liquid	Contaminated Waste Oil	1,455 gal	6,097	1,165 gal	10,986
J	Hazardous Waste Solid	Blasting Waste	96,200 lbs	46,176	97,800 lbs	39,120
M	Waste Oxidizing Material		56 gal	781	225 gal	1,391
N	Waste Oxidizing Material	OBA Canisters	447 ea	8,940	27	2,700
Q	Waste PCB Transformers		--------	-------	385 lbs	6,661
R	Waste PCB Capacitors		--------	-------	335 lbs	603
O	Overhead		--------	-------		15,805
P	Profit		--------	-------		17,385
T	Transportation		4 trips	15,000	8 trips	49,544
	TOTAL		4 shipments	$147,924	3 shipments	$252,711

NOTE: Data used in Figures 3-12 and 3-13

January - August 1990



TOTAL COST = $252,711

All values are in dollars.

Values derived from shipping records.

H	• Waste Flammable Liquid
J	• Hazardous Waste Solid
A,B,C	• Batteries (all types)
E,F	• Paint and Thinner Wastes
I	• Hazardous Waste Liquid
G,K	• Waste Corrosive Liquid and Waste_ORM-A
N	• OBA Cannisters
M	• Waste Oxidizing Material
D,S	• Miscellaneous RCRA Wastes
Q,R	• PCB Wastes

Figure 3-13

ACTUAL DISPOSAL COSTS OF HAZARDOUS WASTE
FROM SHIPPING RECORDS, 1990
USCG BASE KETCHIKAN

contracts are evident from these graphs, as are the variations in relative magnitude of costs among waste categories.

3.5 SELECTION OF PRIORITY WASTE STREAMS

From examination of the data illustrated in Figures 3-2 through 3-15 and in the appurtenant tables, the audit team identified the priority hazardous waste streams, which are the focus of the remainder of this report. Quantity of waste generated, disposal costs, and relative toxicity were the criteria considered in the selection process. A secondary criterion was the availability of waste reduction options. In the future, the Coast Guard may find it valuable to consider other aspects such as future regulatory action in addition to waste quantity, disposal cost, toxicity, and availability of waste reduction options in prioritizing wastes for pollution prevention activities. Reduction of waste generation at its source is the preferred objective. Waste minimization options for nonhazardous solid waste streams are addressed in Section 4.8. The priority hazardous waste streams are, in approximate order of importance:

- Bilge waste
- Blasting waste
- Waste oil
- Paint waste
- Solvents
- Antifreeze/coolant
- Batteries.

In the following chapter, a variety of options for reducing waste production, improving waste management, and reducing hazardous waste disposal costs are presented for each of the waste streams listed above.

Table 3-4

CONTRACT DISPOSAL RATES PER UNIT (1990)

Category	Description	Price per Unit
A	Waste battery, wet, filled with acid	$0.80/lb
B	Waste battery, wet, filled with alkali	$0.90/lb
C	Waste battery, dry, filled with potassium hydroxide	$0.90/lb
D	Waste battery fluid, acid	$10.25/gal
E	Waste paint	$8.35/gal
F	Waste paint, related	$8.35/gal
G	Waste corrosive liquid, n.o.s.	$8.35/gal
H	Waste flammable liquid, n.o.s.	$6.50/gal
I	Hazardous waste liquid, n.o.s.	$9.43/gal
J	Hazardous waste solid, n.o.s.	$0.40/lb
K	Waste ORM-A, n.o.s.	$8.35/gal
L	Waste mercury, metallic	$0.60/lb
M	Waste oxidizing material	$6.18/lb
N	Waste oxidizing material, n.o.s., OBA canisters	$100/each
O	Waste fuel, aviation	$2.25/gal
P	Waste PCB oil (over 500 ppm)	$15.25/gal
Q	Waste PCB transformers, PCB incinerator	$17.30/lb
R	Waste PCB capacitors, PCB incinerator	$1.80/lb
S	Misellaneous RCRA type wastes	Variable

Transportation: 1 trip = 2 CONEX vans = 80 drums
Trip Cost = $6,193
$6,193/80 drums = $77.41/drum

Table 3-5

WASTE DISPOSAL COSTS PER DRUM (OR TOTE)

Item	Per Unit Disposal Cost
Batteries - Acid	$1,235/tote
Batteries - Alkali	$1,368/tote
Paint Wastes	$641/drum
Bilge (waste flamm.liquid, n.o.s.)	$518/drum
Misc. Hydro. (waste flamm. liquid, n.o.s)	$518/drum
Antifreeze (waste flamm. liquid, n.o.s.)	$518/drum
Contaminated Waste Oil (haz. waste liquid)	$713/drum
Blasting Waste (assume 1,045 lbs/drum)	$591/drum
Solvents (Waste ORM-A, n.o.s.)	$641/drum
Other - Haz. waste liquid	$681/drum
Other - haz. waste solid	variable

SAMPLE CALCULATIONS

BATTERIES, ACID:
1 tote = (1,100 lbs)($0.80/lb) = $880/tote
Transportation: 2($77.41) = $154.82 (tote occupies space of 2 drums)
Overhead: 10% (TSD Disposal Cost) = (0.1)($880) = $88/tote

TSD Disposal	$880
Broker's Overhead (10%)	$88
Transportation	$155
Subtotal	$1,123
Broker's Profit (10%)	$112
TOTAL	$1,235/tote

PAINT WASTES:
1 drum = (55 gal)($8.35/gal) = $459.25
Transportation = $77.41/drum
Overhead: 10%(TSD disposal costs) = $45.93

TSD Disposal	$459
Broker's Overhead (10%)	$46
Transportation	$77
Subtotal	$583
Broker's Profit (10%)	$58
TOTAL	$641/drum

Note: Volume equivalents, approximate weights and other physical data of various waste streams obtained by personal communication with J. Prill, USCG.

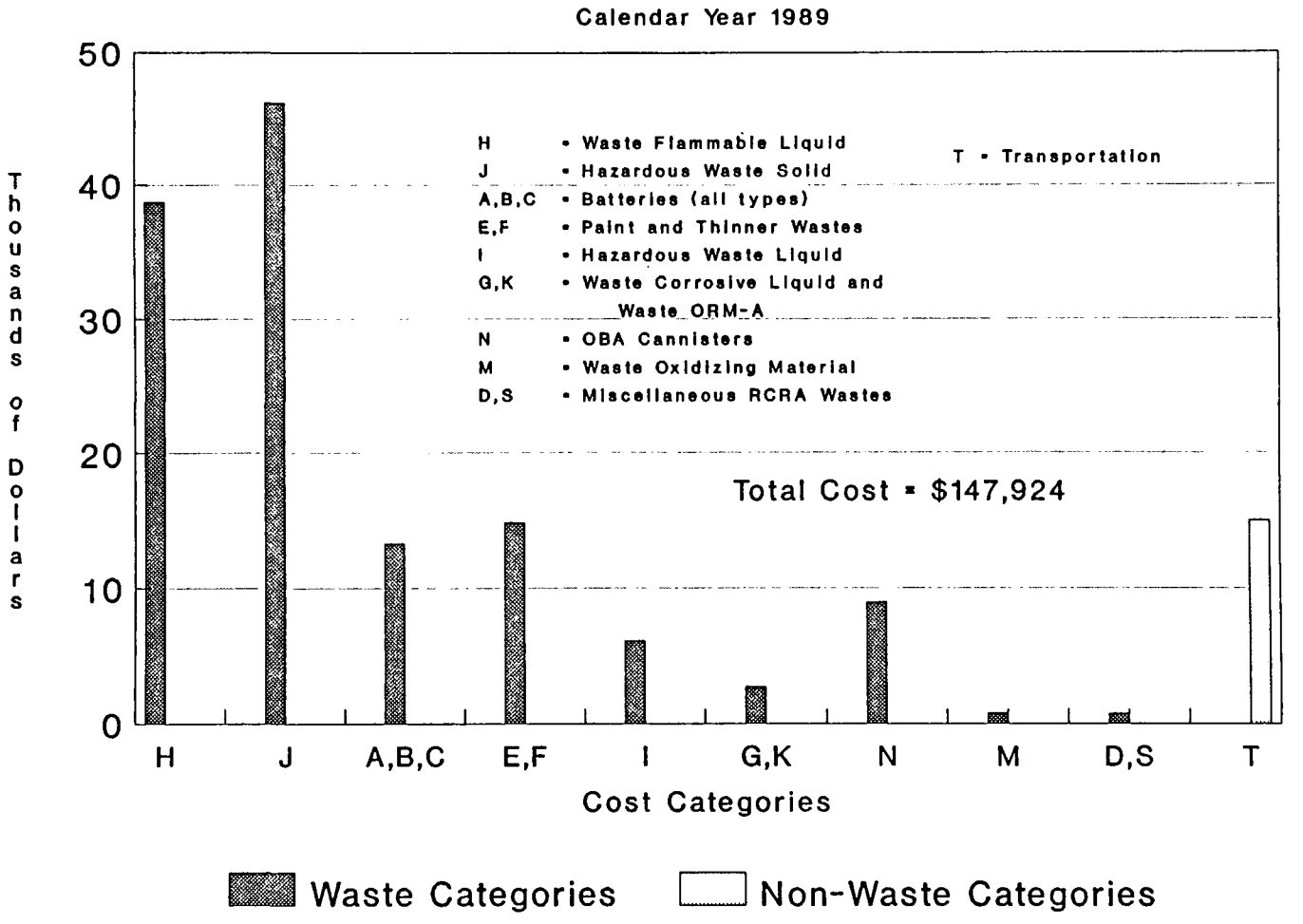


Figure 3-14

1989 HAZARDOUS WASTE DISPOSAL COSTS FROM SHIPPING RECORDS

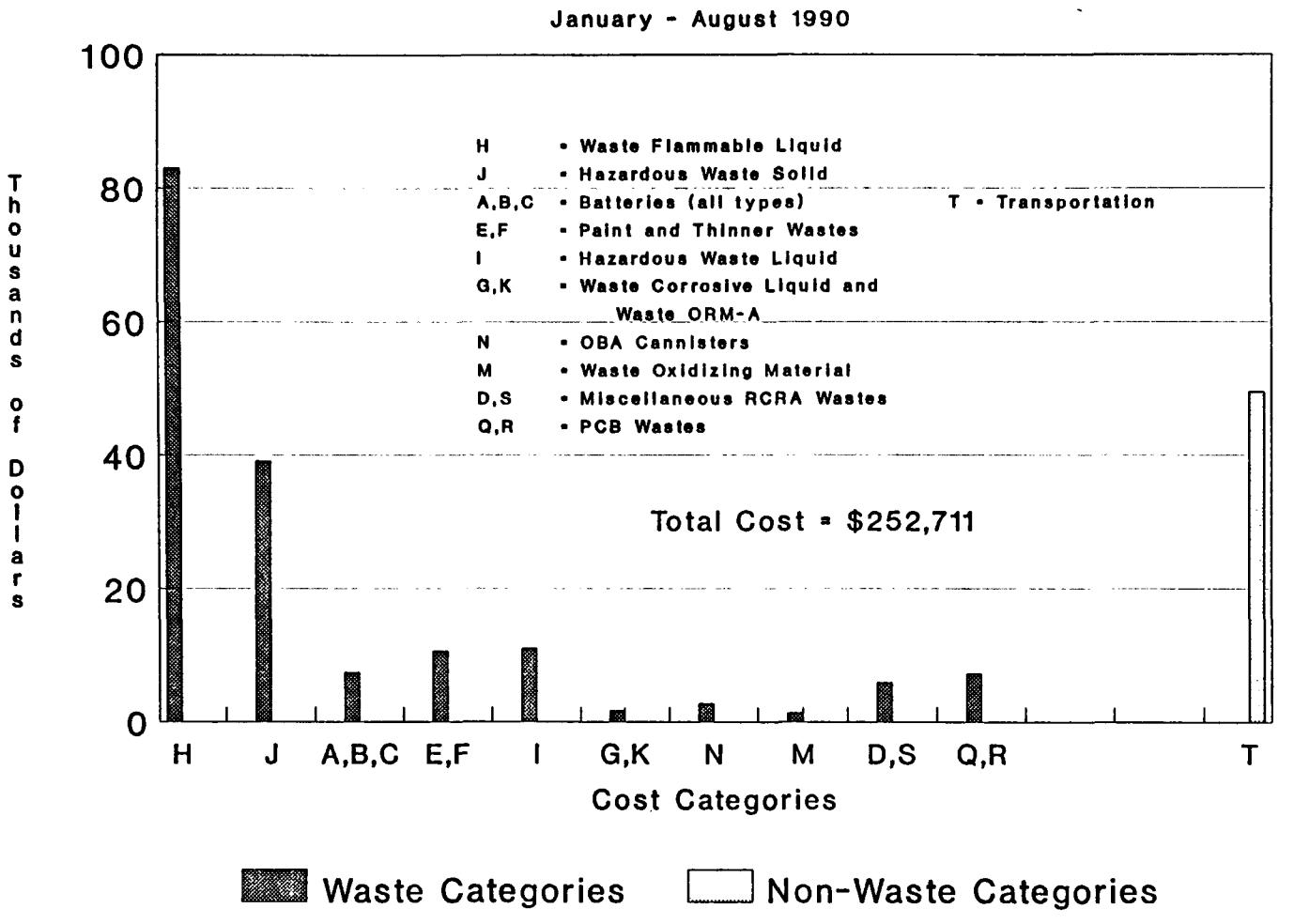


Figure 3-15

1990 HAZARDOUS WASTE DISPOSAL COSTS FROM SHIPPING RECORDS

4.0 FEASIBILITY ANALYSIS OF WASTE MINIMIZATION ALTERNATIVES

4.1 BLASTING WASTE

Dry blasting is the primary method used to remove paint from hulls of Coast Guard vessels and to remove paint and rust from buoys. Current operations are described below.

4.1.1 Paint Removal from Vessel Hulls

Base Ketchikan performs repairs and maintenance on five to ten Coast Guard vessels in the marine ways each year. Depainting of both aluminum and steel hulled vessels is accomplished by dry blasting using smelter slag media or garnet. Steel shot cannot be used for paint removal on aluminum surfaces because it damages the aluminum. When blasting operations are conducted on a vessel in the marine ways, "Visqueen" is first laid on the ground to help contain the paint and blasting grit. The ways is partially roofed and enclosed on two sides. The larger cutters (110 feet) are not fully sheltered by the marine ways structure.

Waste produced consists of powdered blasting media interspersed with paint chips and dust. The presence of lead, chromium, or other metals in the paint dust can cause the waste to designate as hazardous by TCLP[4]. (Note: Levels of arsenic, lead, zinc, and other metals present in some slag blasting media have been shown to exceed TCLP limits.) At the marine ways, what can be collected of the blasting waste is drummed for disposal.

Structural improvements of the marine ways are currently in the design stage. Walls will be completed on the north, east, and west sides, and canvas can be used to enclose the south end. A new roof will be built about 15 feet higher than the existing roofline, extending from the end of the current roof to the stern end of the ways, thereby providing a cover for the larger vessels whose superstructures prohibited entry under the original roof.

Several alternatives for minimizing or managing blasting waste from paint removal operations at the marine ways were considered, including:

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[4]TCLP: toxicity characteristic leaching procedure - an analytical method which has replaced EP toxicity for designation of wastes as hazardous based on leachable constituent concentrations.

- Use lead-free, non-toxic paints
- Construct a concrete floor for the marine ways with grit collection system
- Use a geomembrane floor for the marine ways
- Employ plastic blasting media
- Retest for hazardous waste designation
- Recycle nonhazardous blasting waste in asphalt or concrete production
- Extend maintenance schedule.

Use Lead-Free, Non-Toxic Paints

The Coast Guard is beginning to phase out lead-bearing paints and paints containing other toxic metals. However, until all Coast Guard boats (and buoys) are no longer coated with non-toxic paints, removal of paint from vessel hulls (and buoys) will continue to generate a potentially hazardous waste. Ultimately, this is the best option for reduction of this waste stream. Spent blasting grit containing non-toxic paint dust (as determined by TCLP) could be landfilled. Ketchikan Public Works stated that the landfill would accept, free of charge, nonhazardous spent blasting waste for use as daily cover material. Assuming all spent blasting material could be disposed in this manner, a savings of $30,000 to $40,000 per year could be realized.

Construct a Concrete or Geomembrane Floor

The optimum enclosure for Ketchikan's vessel depainting operations would be a fully enclosed shed with a concrete floor, capable of housing a 110-foot cutter. The floor could be constructed with a gentle slope to one central trough or sloped out to two troughs on either side of the ways to facilitate the collection and removal of blasting material and paint dust. With this type of arrangement and the use of a recyclable blasting medium, less blasting waste would be released to the environment, and the depainting waste stream would be reduced dramatically. The cost of an entirely new structure with blasting media recycling equipment could cost over $1,000,000[5]. Due to the high cost, this option was not considered further for possible short-term implementation. However, construction of only the concrete floor would be much less expensive and provide many of the same benefits as a totally enclosed structure.

[5]Author's rough estimate.

A concrete floor in the marine ways would enable the collection of the blasting material for reuse and would provide secure footing for the scaffolding equipment and hull blocks. Reusable blasting media are available, however all types require that the blasting material be relatively dry when applied. The media must not be mixed with soil, sand, or other contaminants. Construction of a concrete floor would cost $200,000 to $400,000[5]. Because the current design plans for the marine ways improvements do not include a concrete floor, the additional expenditure of this amount of capital was considered unlikely at this time.

An improvement over "Visqueen" dropcloths without the expense of a concrete floor would be the use of 30-mil (or thicker) high density polyethylene (HDPE) to cover the ground at the marine ways. This material is for more durable than lightweight "Visqueen," is less prone to flapping in the wind (especially if sandbagged), and could potentially enhance the retrieval of spent grit from blasting operations in the ways. Because it can be reused many times, a geomembrane would also reduce or eliminate the disposal of torn or shredded "Visqueen." HDPE is a recyclable plastic and, when too worn for reuse, could be recycled.

Employ Plastic Blasting Medium

Plastic blasting material is an optimal medium for paint removal on aluminum surfaces. It can be used on steel, but is not effective for heavy rust removal. On steel, more time may be required for paint removal than with other (mineral) grits. The primary advantages of plastic blasting material are its recyclability, controllability, and unique hardness characteristics. Plastic can be reused 20 times before it breaks down and is rendered ineffective[6]. Plastic can be applied with such precision that one layer of paint may be removed at a time. This could potentially eliminate or reduce the need to strip the paint down to bare metal, thus reducing both blasting waste and paint application costs. Plastic also has the advantage of lighter weight than mineral or steel particles. Therefore, disposal costs can be lower with plastic media, although actual hazardous materials content (from paint) can be higher relative to the total quantity of blasting waste due to the higher density of paint dust than of plastic.

At Base Ketchikan, without suitable means for reusing the abrasive medium at the marine ways, the substitution of plastic blasting material might not provide an advantageous alternative. However, should the use of an HDPE cover prove effective, the use of reusable plastic beads for blasting

[6]Phil Tilson, U.S. Technology, personal communication, 12/5/90.

aluminum-hulled boats and aluminum superstructures could be cost-effective. Each drum of reused plastic medium represents one drum of new grit which does not have to be purchased and disposed of.

Retest for Hazardous Waste Designation

In order to take advantage of possible recycling/reuse options, a definitive determination should be made of the hazardous designation of blasting waste from the marine ways. Should blasting waste be shown to be nonhazardous, several reuse alternatives are available. If hazardous, blasting waste will require disposal at a permitted disposal facility. Some smelter slag blasting grits contain toxic metals at levels high enough to fail the TCLP limits. This material, once a waste, would be designated as a hazardous waste even if it had never been used for paint removal. We reviewed laboratory analysis records from Base Ketchikan to determine whether its blasting waste was designated as hazardous. In 1986, 56 samples of sandblasting grit were analyzed by an environmental laboratory. Fifty-two of the samples exceeded EPA standards (presumably EP toxicity). However, there was no accompanying information indicating what kind of blasting material had been used, nor was there any analysis of unused blasting medium.

In October 1989, two samples of used grit were analyzed by Chemical & Geological Laboratories of Alaska, Inc., in Anchorage. Neither sample contained high metal levels and neither was designated as hazardous waste. Again, there was no information available as to the type of grit used. We assume these analyses were conducted to verify the designation of the waste. However, from the transfer sheets and waste shipment records, it appeared that all blasting waste was shipped offsite as hazardous waste following receipt of the test results, as had been the practice previous to the analyses.

It is quite possible that different blasting media have been used at Base Ketchikan for paint removal on both vessels and buoys over the years. The 1986 samples may have represented an abrasive which inherently contained high levels of metals before use. The 1989 samples may have represented a cleaner blasting medium such as "Kleen Blast." In Table 4-1, a chemical analysis of several different blasting grits is presented. These data show clearly that metal levels can vary significantly among abrasive media. (Note: These data represent a compositional analysis, not TCLP results.)

Two vendors, both in the field of blasting equipment and supplies, recommended "Kleen Blast" as a superior blasting grit because of its low metals content[7]. This can be an advantage in both worker safety and disposal aspects. One source[8] claimed that the metal content in the paint dust entrained in the spent blasting medium usually will not, by itself, cause the waste to designate as hazardous.

If Base Ketchikan could show through the analysis of representative samples that its blasting waste is not hazardous, this waste stream would no longer have to be handled under the hazardous waste disposal contract and it could be reused or recycled. For example, blasting waste could be used at the Ketchikan Landfill as daily cover, therefore disposed of without charge, at an approximate annual savings of $30,000 to $40,000 per year. Though this would not reduce the quantity of blasting waste produced, in effect it would reduce the toxicity of the waste stream. In the interests of proper waste handling, blasting waste should not be disposed of as hazardous waste if it is nonhazardous, and should be reused or recycled where possible.

Recycle into Asphalt or Concrete Production

Another possible use of blasting waste, should it be found to be nonhazardous, is to incorporate it in the local production of asphalt or concrete. Companies in the Tacoma, Washington area are known to use this practice, and it might be possible to arrange such an agreement with an asphalt or concrete supplier in the Ketchikan area.

Extend Maintenance Schedule

Currently, vessel hull repainting is performed every five years. With changes in paint formulations forthcoming, and the high costs of hazardous waste disposal, the Coast Guard may wish to re-evaluate its maintenance schedules. If vessels could be repainted on an every sixth year schedule instead of once every five years, 20% savings in both materials and disposal could theoretically be realized. If the schedule were extended to seven years, a 40% reduction could theoretically be achieved.

This concept could be similarly applied to buoy repainting schedules and to the replacement of lubricating oils, antifreeze, and other solutions in vessel and base vehicle engines.

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[7]Bob Olson, Caber Company, Kent, WA, personal communication, 12/7/90; Joe Schmidt, Kleen Blast Corp., Tacoma, WA, personal communication, 12/7/90.

[8]Bob Olson, Caber Company, Kent, WA, personal communication, 12/7/90.

Table 4-1

COMPOSITIONAL ANALYSIS OF BLASTING GRIT

Firearm's Fund Insurance Companies
Environmental Laboratory
Metals Content, total (mg/kg)

Manufacturer	Ag	As	Ba	Be	Cd	Co	Cr	Cu	Hg	Mo	Ni	Pb	Sb	Se	Tl	V	Zn
Military Specifications	500	500	100,000	75	100	8,000	2,500	2,500	20	3,500	2,000	1,000	500	100	700	2,400	5,000
Kleen Blast	det	det	213	det	17	37	46	1,900	<1	det	15	<4	<10	<40	<10	58	234
Copper Blast	det	102	825	<0.2	18	34	95	2,800	<1	1,198	12	304	det	<40	<10	35	843
Tru Grit Premium Navy	det	det	374	det	24	58	35	1,965	<1	det	9	21	<10	<40	40	50	3,124
Tuf Kut	2	517	445	det	25	12	17	3,114	<1	14	5	835	det	<40	<10	42	123,600
Sharp Shot N-60	<0.4	det	14	<0.2	7	14	10	1,833	<1	96	det	19	<10	<13	<10	15	176
Green Diamond	<4	<4	det	<0.2	2	10	283	4	<1	det	694	det	<10	<4	<10	4	11

det = detected but not quantitated
quantitation limit = 0.00033 - detection limit

Data provided by Kleen Blast, 1448 St. Paul Ave., Tacoma, WA 98421

Hazen Research, Inc.
Metals Content, total (mg/kg)

Manufacturer	As	Cu	Pb	Zn	Cr	Ni
Military Specifications	500	2,500	1,000	5,000	2,500	2,000
Kleen Blast	26	2,050	40	360	—	—
Copper Blast	278	5,700	920	2,100	—	—
Tru Grit Premium Navy	15	2,670	80	4,600	—	—
Tuf Kut	1,710	4,610	1,570	200,000	—	—
Sharp Shot N-60	53	4,000	70	640	—	—
Green Diamond	—	—	—	—	1,150	1,180

Sampling Methodology: A 100 pound bag of each sandblasting material was purchased from the distributor. A 1,000 gram sample of each sandblasting material was sent to the laboratory for a metals analysis.

4.1.2 Paint Removal from Buoys

As mentioned previously, a new buoy blasting booth was constructed and brought on-line in January 1991. The new booth incorporates a system for blasting and recycling steel shot and will provide significant reduction in blasting waste due to the multiple reuse of the steel blasting media. The manufacturer of this system (CAB Systems, Kent, WA) claims the steel shot can be recycled 200 times. Other sources[9] suggest that five to six reuses is typical before the steel shot breaks down. As the new system is utilized, it will be interesting for the Coast Guard to note the quantity of spent shot and paint dust which is generated from the new equipment and to compare these levels with previous buoy paint removal operations. The new equipment is likely to reduce this waste stream significantly from former levels.

Two possibilities were considered for waste minimization in buoy depainting:

- Plastic blasting media
- Magnetic separation of the paint dust from the steel shot.

Plastic Blasting Media

Our research revealed that plastic blasting media are not of sufficient hardness to effectively remove heavy rust and encrustation on steel buoys. The industry standard for this application is steel shot, and the optimum waste reduction follows from multiple recycling of the blasting media. The new system installed at the Base automates the reuse of steel shot. Actual waste production will depend on how many times the shot can be recycled before it becomes unusable or ineffective.

Magnetic Separation

Magnetic separation is one technique for segregating steel from paint dust. The CAB Systems equipment at Base Ketchikan is equipped with an air-suspension/gravity separation unit which will separate the lighter paint dust from the heavier steel dust, and segregate the reusable steel shot which is automatically returned to the hopper for blasting. Magnetic separation does not appear to have any advantages in terms of waste reduction, cost savings, or operational aspects over the newly installed CAB unit.

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[9]Phil Tilson, U.S. Technology, CT, personnel communication, 12/5/90; SAIC, Waste Minimization Opportunity Assessment, U.S. Coast Guard Support Center New York Governor's Island, new York, August 1990.

4.2 PAINTING VESSELS AND BUOYS

Various types of paints are used throughout the Base, including interior and exterior building paints, sign paints, spray paints, anti-fouling paints, and paints for vessel and buoy interiors and exteriors. The largest quantities of paints used are for painting buoys and vessel hulls. Binks "Super 1" airless spray guns are used in both of these operations. Boats are painted in the marine ways and buoys will be painted in the new paint booth in the buoy shed. Wastes from these operations include volatilized thinners and overspray, spent thinners, waste paint, and paint slops. According to the head painter, an estimated 80 to 90% of the liquid paint waste stream (excluding waste from improper storage and overspray) is generated by cleanup operations.

The following options were considered for waste minimization from the major painting operations. They are discussed in further detail below.

- Use lead-free, non-toxic paints
- Use high volume/low pressure spray guns
- Improve storage practices
- Employ best paint application practices
- Use spray gun cleaning station with recyclable solvent
- Recycle paint wastes through distillation.

4.2.1 Use Lead-Free, Non-Toxic Paints

The Coast Guard, like the Navy and other defense agencies, has begun to phase out lead-bearing paints and paints containing other toxic constituents. This change may take several years to complete. The use of non-toxic paints and non-toxic thinning agents is ultimately the best option for reduction of hazardous paint wastes. (Total volume of waste may not be affected, but non-toxic paints and thinners will reduce the toxicity of this waste stream significantly.) In the short-term, however, other means to reduce waste should be explored.

4.2.2 Use High Volume/Low Pressure Air Guns

According to several studies of paint application techniques, the estimated transfer efficiency of a Binks airless gun for painting buoys is 40 to 50%. This number reflects both the type of surface being painted and the type of applicator. With flat surfaces, a higher transfer efficiency is attainable. The significance of this number is that it indicates that 50 to 60% of the paint is not getting to the buoy. Therefore, roughly half of the paint which flows through the spray gun is wasted. Solvent in the paint evaporates as the paint dries, causing an air emission from the process estimated at about 4 pounds per gallon of paint sprayed.

A new type of paint applicator is available which employs an air compressor and high speed turbine to mobilize the paint, instead of the conventional high pressure sprayer which relies on the rapid expansion of air through the nozzle to atomize the paint. Overspray is reduced to about 15% with this high volume/low pressure (HVLP) air equipment. Therefore, more paint per gallon actually gets to the painting surface, less paint is used, less paint is wasted, and less solvent evaporates into the air. These units are being employed in auto body refinishing shops because of their environmental and economic benefits. Potential savings to the Base are approximately $12,250 per year, based on estimated paint use of 3,000 gallons per year and an average paint cost of $10 per gallon. (Both of these estimates are considered conservative. Current actual annual paint purchases may be considerably higher.) The payback period for this option, neglecting any savings in disposal costs, is less than 0.1 year, as demonstrated in the cost/benefit analysis in Table 4-2. In addition, an estimated reduction of 5,000 pounds per year of volatile organic compounds (VOCs) released to the air could be achieved through the use of HVLP equipment. Also, ventilation exhaust filters will probably require less frequent replacement, reducing another solid waste stream.

4.2.3 Improve Storage Practices

According to the hazardous materials coordinator, a significant quantity of unusable paint is disposed of annually as hazardous waste. Some paints are stored beyond their shelf life and ultimately discarded. Paints must be stored in heated space to prevent them from freezing in the winter in Ketchikan. The new paint room in the buoy shed will provide improved storage. This principle should be applied base-wide, as many shops maintain their own paint lockers.

4.2.4 Employ Best Paint Application Practices

Many studies of spray paint application have shown that operator skill can have a significant effect on the amount of waste generated from painting operations. The minimization of overspray (the paint which does not reach the painting surface) is one of the most important techniques for waste reduction. In addition, the painting of objects of the same color at the same time would reduce the amount of solvent needed to rinse the spray gun between colors. Lighter colored objects could be painted first and darker ones next, potentially reducing the need to rinse the gun between colors.

4.2.5 Spray Gun Cleaning Station

Paint solvent use and VOC emissions can be significantly reduced with the use of a spray gun cleaning station which employs an enclosed, recirculating solvent unit for the cleaning of paint spray guns.

Table 4-2

HIGH VOLUME LOW PRESSURE PAINT SYSTEM
COST BENEFIT ANALYSIS

ESTIMATED PAINT USE: 3,000 gallons/year
CURRENT PURCHASE COST: Approximate as ($10/gal) (3,000) = $30,000/year
Amount Applied = 0.5 (3,000) = 1,500 gallons/year (due to 50% overspray or "loss")

CAPITAL COST OF HVLP SYSTEM:	
MACH 1 HVLP, Model 98-1137	$1,300
OPERATING COSTS:	
Paint Purchase Costs: (1.15) (1,500 gal/yr) ($10/gal) (Assumes 15% overspray)	$17,250/yr
Replacement Parts	$500/yr
Power: Approx. equivalent to current eqpt	-----
Training (none required)	-----
Labor: Approx. equivalent to current levels	-----
TOTAL ANNUAL COSTS	$17,750/yr
AVOIDED COSTS	
Purchase Costs: $30,000 - $17,250 =	$12,250/yr
NET ANNUAL BENEFIT =	$12,250
PAYBACK PERIOD = ($1,300) / ($12,250/yr) =	0.1 yr

NOTE: Cost savings from potentially lower disposal costs are anticipated but can not be estimated at this time. Savings in disposal may result from fewer filter changes in ventilation exhaust and possibly lower amounts of paint slops and wastes generated.

ASSUMPTIONS:

- Estimated paint use is 3,000 gallons per year. Actual data not available. Values are conservative assumptions chosen to yield "worst case scenario" results.
- Average cost of paint is $10. Probably conservative. Antifouling paints and specialized coatings are typically more expensive.
- Current overspray results in 50% paint loss.

NOTE: Use of 1,275 gallons less paint results in a reduction of 5,100 lb/year of volatile organic emissions to the air.

The units are available for approximately $500. They prevent the loss of solvent through evaporation, and provide optimal reuse of solvent for equipment cleaning. When the solvent is no longer effective, it can be distilled and reused. Though exact values were not available for the amount of solvent or thinner currently used at the Base for spray gun cleaning, a system such as the Lighthall SC 1100 unit (information in Appendix B) could be economically advantageous, decrease air emissions, and reduce operator hours spent on cleanup.

4.2.6 Recycle Paint Wastes With Waste Solvents

An estimated 1500 gallons of waste paint and paint related materials were disposed as hazardous waste in 1989. Liquid paint and thinner waste can be recycled in a benchtop distillation system. A similar distillation unit can also be used for solvents such as trichloroethane (TCA) or Stoddard solvent. The equipment would provide recycled thinner adequate for cleaning use (not for thinning paint) and produce a sludge. The sludge would be a hazardous waste, but its volume would be far less than what is currently generated and disposed as paint and thinner waste. Section 4.3.4 contains further information on the distillation option, including a cost benefit analysis.

4.3 SOLVENTS

Base Ketchikan uses a variety of solvents, including Stoddard solvent (a petroleum distillate), trichloroethane-base solvents, various engine cleaners and degreasers from spray cans, and paint thinners (primarily methyl ethyl ketone (MEK) and epoxy thinners). The primary areas of solvent usage are the Industrial shops, Station, and Public Works Vehicle Maintenance. There are three small parts washers on base, and a 100-gallon hot dip tank which employs a caustic solvent. Data collected from the hazardous waste transfer sheets for calendar year 1989 indicate that nearly 800 gallons of solvent waste were disposed as hazardous waste.

Several options were considered to reduce the solvent waste stream, including:

- Solvent substitution
- Extending solvent life
- Employing best management practices
- Onsite solvent recycling and reuse.

4.3.1 Solvent Substitution

There are a multitude of products available that are being marketed as effective cleaners that replace some of the hazardous solvents commonly in use. Some areas at the Base have begun to use "Simple Green," a biodegradable industrial cleaner, instead of more toxic solvents. In most applications, a substitute solvent must be tried to determine if it is compatible with the materials being cleaned and performs its task adequately. A determination should not be made on vendor information alone. In addition, some products may be less toxic, but are still considered hazardous waste when spent.

Substitutes are available for TCA-based solvents, such as "Micro-C," "Hurri-Safe," "Ameroid OWS," "Iso-Prep," "Breakthrough," and others. Although some of these products exhibit lower toxicity characteristics, some are flammable and when spent, will be designated as hazardous waste. In addition, fire and explosion hazards may be increased.

Stoddard solvent or Chevron 325 may be replaced by solvents which have been created to meet regulatory restrictions and be classified as nonhazardous. Chemically, they may be quite different from Stoddard solvent and may vary in their effectiveness. The chemically "stronger" alternatives may be ignitable. The "weaker" products are not ignitable and are classified as cleaning oil. If these solvents are not contaminated with metals or total halogen levels in excess of regulatory requirements, they can be burned in a waste oil burner.

Nonhazardous solvent substitutes are usually more expensive to purchase than their hazardous equivalents. However, savings in disposal costs accruing from the substitution of nonhazardous solvents for hazardous products could be significant base-wide. Total solvent waste volume in 1989 was about 800 gallons. Due to the amount of solvent which evaporated during use or was spilled during transfer between containers, the total quantity of solvents purchased for the year was probably much higher than this figure.

In the machine shop, the hot "gunk tank" currently uses a carbon removing compound ("P-C-111 Am. 2, Type II," from Octagon Process, Inc.). Once or twice per year, the tank is cleaned out and the solvent and sludge are disposed as hazardous waste (2 to 4 drums per year). There are products available for this type of parts cleaning system which are nonhazardous. For example, one product called "Hurri-Safe" (information in Appendix C), when spent, produces a nonhazardous liquid and only the sludge (estimated at 10% of tank volume) must be disposed of as hazardous waste. The potential savings from this solvent substitution option are outlined in Table 4-3. It might be possible to use spent caustic solution to neutralize battery acids, as mentioned in Section 4.7.1.

4.3.2 Extending Solvent Life

The useful life of any solvent, whether hazardous or one of the nonhazardous substitutes mentioned above, can be extended through the use of fairly simple techniques. Using steam or pressure washing before applying solvent can reduce solvent use and extend its life. Solvent quality deteriorates as sludges and contaminants remain in contact with solvent solutions, and as oil builds up in the solvent. As dirt and sludge accumulate in the reservoirs of parts washers or dip tanks, solvent life shortens. Regular removal of sludge or filtration of the solvent can also extend solvent life significantly. Some sources of filtration equipment claimed that solvents could be used two to three times longer with in-line circulating filtration units. Small enclosed pressure washing systems can also be used effectively, eliminating or reducing the need for hazardous solvents. Information on such systems is contained in Appendix C.

The manufacturers of the small parts washers now in use at the Base can probably provide filtration units for very little capital investment. The filters themselves would still require disposal as hazardous waste, but less solvent would be purchased and the overall waste volume would be reduced.

4.3.3 Employ Best Management Practices

Due to their high volatility, solvents evaporate quickly and a significant waste (though untracked) is the disappearance of volatilized solvent into the air. In addition, product spillage during transfer from one container to another can be the greatest source of solvent wastes. Listed below are some simple procedures that will help minimize solvent loss through evaporation, spillage, and improper storage.

- Prevent loss of chemicals through evaporation or spillage by ensuring that container lids are replaced and tightened.
- Use spigots, pumps, or funnels when dispensing and transferring materials to reduce the possibility of spills.
- Store products in locations that will preserve their shelf life, i.e., away from temperature extremes.
- **AVOID MIXING SOLVENTS WITH ANY OTHER WASTES.** When solvents are mixed with other wastes such as oil or antifreeze, they may render that waste unfit for recycling or recovery. In addition, mixing of wastes may lead to inaccurate waste identification and improper disposal.
- Keep used chlorinated solvents (such as 1,1,1-trichloroethane and methylene chloride) separate from nonchlorinated solvents (Simple Green).

Table 4-3

ALTERNATIVE SOLVENT FOR HOT DIP TANK
ECONOMIC ANALYSIS

CURRENT COSTS	
Carbon Removing Compound Purchase (100 gal)($300/dr)(1dr/50 gal)	$600
Disposal (100 gal)(1 dr/50 gal)($641/gal)	$1,280
TOTAL ANNUAL CURRENT COST	$1,880
COSTS IF ALTERNATIVE SOLVENT WERE USED:	
Purchase Cost (2 drums)($450/drum)	$900
Disposal Cost (10 gal sludge)($13/gal)	$130
Analytical Cost	$250
TOTAL ANNUAL COST OF ALTERNATIVE SOLVENT	$1,280
NET ANNUAL BENEFIT	$600

ASSUMPTIONS:

- Exact purchase cost for current carbon removing compound was not available. A price of $300/drum was assumed.
- Ten percent of spent tank contents is sludge. Spent alternative solvent can be disposed as nonhazardous liquid. A representative sample should be analyzed to verify that spent solvent is not designated as hazardous.

- Use different funnels for used oil and solvents to reduce contamination potential.
- Minimize spray and wipe cleaning, which contribute to excess use of solvents.
- Wipe, brush off, or steam-clean parts before using solvent, to reduce solvent use and extend solvent life.
- Reuse old solvent as a pre-soak for cleaning parts.

4.3.4 Onsite Solvent Recycling and Reuse

Four types of liquid wastes are amenable to onsite recycling at Base Ketchikan: paints, thinners, Stoddard solvent, and TCA-based solvents. These materials can be recycled into cleaning grade solvents by distillation, producing a small amount of sludge which is disposed of as hazardous waste. Transfer sheet data indicate that paint and paint-related wastes total 1,300 to 1,600 gallons per year, and TCA and Stoddard solvent wastes are estimated at 200 to 500 gallons per year. Disposal costs for paint wastes and solvents are $641 per drum, or nearly $13 per gallon. Avoided disposal costs and a reduction in new product purchase costs make distillation an attractive alternative. Recycled solvent/thinner quantities could potentially meet the base-wide demand for cleaning solvent.

Small batch distillation units that handle five to 15 gallons per batch are available with or without vacuum units. A vacuum unit is required for solvents with boiling points greater than 300°F. Stoddard solvent and Chevron 325 fall into this category. Paints, thinners, MEK, and TCA have lower boiling points, for which a distillation unit would not require vacuum. Information on distillation units is provided in Appendix C. Fire code requirements apply to the installation of distillation units, and could involve additional costs.

Table 4-4 presents an economic analysis for a small batch distillation system made by Finish Engineering, model LS Jr. It does not include a vacuum unit. We assumed a conservative value of 1,300 gallons of waste distilled per year. Actual quantities may be higher. Net annual benefit is estimated at over $6,000, and the payback period is less than one year.

4.4 BILGE WASTE

Bilge waste comprises the largest volume of all the liquid waste types disposed as hazardous waste from Base Ketchikan. Our estimates of bilge quantities from transfer sheet information indicate that bilge represents 35-37% of the total liquid hazardous waste produced. In 1989, bilge totaled approximately 3,500 gallons of liquid that was drummed and shipped offsite as "Waste Flammable Liquid."

Table 4-4

COST/BENEFIT ANALYSIS OF LS-JR SOLVENT/THINNER DISTILLATION UNIT

CAPITAL COSTS:	
LS-JR Unit (GSA Schedule)	$3,700
Transport	$100
Installation:	
Labor (4 hrs @ $25/hr)	$100
Piping and Electrical	$100
TOTAL CAPITAL EXPENDITURE	$4,000
OPERATING COSTS AND MAINTENANCE COSTS	
Operating Costs:	
Heating ($0.10/gal)	$130
Water (fixed rate -- no increase)	--
LS-JR Stilbags ($19.38/doz)(22 doz/yr)	$430
Misc. Replacement Parts	$100
Labor ($25/hr)(260 hrs)	$6,500
Purchase Costs:	
MEK Thinner (50 gal)($10/gal)	$500
Epoxy Thinner (40 gal)($10/gal)	$400
Disposal Costs:	
(1,300 gals)(0.20)(1dr/50gal)($681/drum)	$3,500
TOTAL ANNUAL OPERATING AND MAINTENANCE COSTS	$11,560
AVOIDED COSTS	
Purchase Costs:	
MEK Thinner (200 gal)($10/gal)	$2,000
Epoxy Thinner (160 gal)($10/gal)	$1,600
Disposal Costs	
(1,300 gal)(0.80)(1dr/50 gal)($681/drum)	$14,160
TOTAL ANNUAL AVOIDED COSTS	$17,760
NET ANNUAL BENEFIT (NAB) = Avoided Costs - O&M Costs	$6,200/yr
PAYBACK PERIOD = Capital Costs/NAB	0.6 years

ASSUMPTIONS:

- Total volume of paint waste conservatively estimated at 1,300 gal/yr. Other solvents such as TCA are not included in this analysis; however, TCA could also be distilled with this unit.
- Annual purchase of thinners is estimated at 250 gallons of MEK thinner and 200 gallons of epoxy thinner.
- Thinner use is estimated at 80% for cleanup purposes and 20% for paint thinning.
- All reclaimed solvent from recycling is used for cleanup, eliminating the need to purchase thinners for cleanup.
- Distillation unit reclaims 80% of material. Disposal costs are reduced 80%.
- Sludge from distillation estimated at 20% of waste distilled.

Bilge, a variable mixture of water, oil, diesel, and a small amount of coolant, is generated on each of the floating units which are supported by the Base. The *Planetree*, a 180-foot buoy tender, is the only unit which treats its bilge on board. On the *Planetree*, the bilge is pumped through an oil/water separator and the water (containing supposedly less than 15 ppm oil) is pumped overboard. The remaining oily waste is pumped into a 500-gallon holding tank, then drummed for disposal. The *Planetree* generates 50 to 100 gallons per month of this oily waste.

The smaller vessels supported by Base Ketchikan are not equipped with oil/water separators. Their bilge is drummed at the Base Ketchikan dock and transferred to the hazardous waste storage area. Bilge disposal costs are estimated at $514 per drum.

The options considered for elimination or reduction of this waste stream are:

- Install oil/water separators on all vessels
- Install oil/water separation unit at the Base
- Install an ultrafiltration unit at the Base
- Recycle or recover oil onsite or offsite
- Eliminate use of detergents and emulsifying agents
- Use oil/water separator at Ketchikan shipyard.

4.4.1 Install Oil/Water Separators On All Vessels

Our research indicated that space limitations would prohibit the installation of oil/water separators on all of the smaller floating units. In addition, better performance was likely from a stationary unit at the Base. No further information was pursued for this option.

4.4.2 Install Oil/Water Separation Unit at Base Ketchikan

What makes this option so advantageous is that it enables the sewerage of approximately 95% of the waste stream, at no additional sewer expense[10]. Discussions with various sources knowledgeable about Navy and shipyard operations indicated that oil/water separation is both achievable and widely practiced by marine facilities. Several manufacturers claim that their equipment can reduce the oil content in wastewater to 15 ppm or less, well below typical municipal discharge standards (usually 50 to 100 ppm). (Note: City of Ketchikan does not have an ordinance which states such a discharge limitation. Ketchikan Public Utilities should be informed if USCG institutes oil/water separation and discharges the water to the sewer.) The water, representing 95 to 99% of the bilge volume, can be

[10]This option does not reduce the generation of bilge. However, it allows for an environmentally advantageous handling of this waste stream, effectively reducing the toxicity of the waste.

discharged to the sewer. The remaining oily waste should be tested to determine whether it is designated as hazardous waste. If it is nonhazardous, it can be burned in the waste oil burner onsite. It could also be shipped offsite for recycling or energy recovery.

The keys to successful separation of the bilge are:

- Use non-emulsifying degreasers
- Purchase the best equipment for the application
- Maintain the equipment well.

Oil emulsified by a detergent in the bilge mixture makes separation of oil from the water difficult. The substitution of non-emulsifying degreasers will permit cleaning the engine and bilge areas but will not impair the function of an oil/water separator. Even though the best equipment for this application may be expensive, there is strong economic justification for pursuing onsite bilge treatment. Avoided disposal costs will more than cover the expenses. Additional effort and expense to ensure proper installation, satisfactory operation, and reliability will also pay out favorably.

Following is a brief cost/benefit analysis for the implementation of an oil/water separator at the Base (Table 4-5). The equipment we considered for this analysis include a conical-bottom 1,000-gallon bilge holding tank (for settling out suspended solids), a Quantek CPS-3 oil/water separation unit with emulsion-breaking cartridges, a monitor which automatically recycles the effluent if it does not meet discharge specifications and shuts the unit down when the cartridges are spent, a prefabricated housing unit for the equipment, and a waste oil container (drum). Cartridges on the emulsion-breaking unit must be changed when spent. The period between cartridge changes depends entirely on the composition of the bilge entering the system. For the purposes of this analysis, we assumed the cartridges would process 5,000 gallons of bilge and cost $100.

The unit is fully automatic and would require only slightly more operator time than is currently used to pump and drum bilge directly from the vessels. The coalescing plates in the oil/water separator must be periodically cleaned, a task that takes about two hours every several thousand hours of operation, again depending upon the bilge composition. Installation costs were estimated at $5,000. These would be much less if the plumbing were performed by base personnel under the supervision of the equipment supplier.

4.4.3 Eliminate Use of Detergents and Emulsifying Agents

A potential obstacle to successful oil/water separation is the presence of detergents or other emulsifying agents at levels that prevent oil/water separation. Simple product substitution can overcome this problem. The distributor of the oil/water separation equipment cited above recommends an effective cleaning solution ("Ameroid OWS") which is compatible with the coalescing plate separator. Costs are typically much higher for non-emulsifying degreasers but the ultimate reduction in waste handling costs will more than compensate for this expense. Information on a number of these products is contained in Appendix D.

4.4.4 Install Ultrafiltration Unit at the Base

Ultrafiltration is another technique for separation of oil/water emulsions. Ultrafiltration systems usually incorporate a first stage coalescer followed by a second stage membrane separation unit. Should Ketchikan bilge emulsions be found (by prepurchase testing) to be inadequately treated in the coalescing plate separator described above, an ultrafiltration unit could be the solution for reducing the bilge waste stream. Costs of this option using a "Pace" ultrafiltration unit made by FAST Systems, Inc. are summarized in Table 4-6. Savings resulting from avoided disposal costs would be similar to those calculated in the oil/water separator analysis. These units may require much more maintenance than oil/water separators and may not operate as reliably. However, the expense will be recovered in approximately two years because of avoided hazardous waste disposal costs.

4.4.5 Recycle or Recover Oil Onsite or Offsite

The oil collected by the oil/water separator, estimated at less than one drum per quarter, should be analyzed to determine if it is designated hazardous waste. If it exhibits a hazardous characteristic, it should not be burned in the waste oil burner onsite, although it could be recycled offsite. If it is not hazardous waste, it can be burned in the waste oil burner onsite, potentially reblended for use in small diesel engines, or shipped offsite for reprocessing or blending. Section 4.5 provides more detail on these options. The Coast Guard at Base Ketchikan should become familiar with both the techniques and legal responsibilities of used oil management in pursuing these alternatives.

4.4.6 Use Oil/Water Separator at Ketchikan Shipyard

Consultation with Ketchikan Shipyard personnel indicated that this option is not currently available. The shipyard has recently installed an ultrafiltration unit which is operating at an average flow rate of 1.5 gallons per minute. Shipyard operations currently exceed the unit's capacity of 500 to 1,000

Table 4-5

BILGE WASTE OIL/WATER SEPARATOR COST/BENEFIT ANALYSIS

CAPITAL COSTS:	
CPS-3 Oil Water Separator	$8,310
MCM Housing w/Cartridge (emulsion breaking)	$650
Mark VIII Alarm (Effluent Monitor)	$5,010
Differential Pressure Switch Assembly w/Alarm	$1,480
Transportation	$1,000
On-Shore Settling Tank	$2,000
Misc. Valving, piping, wiring, switches	$2,000
Installation (Labor & Training)	$5,000
Pilot Testing	$600
Total Capital Costs	**$26,050**
OPERATING COSTS:	
Emulsion Breaking Cartridges (2 per year)	$200
Power Requirements	Data Not Available[1]
Analytical Testing	$1,000
Labor (100 hrs/year @ $25/hr)	$2,500
DISPOSAL COSTS (Scenario I):	
5% of Waste Stream Disposed as Haz. Waste (0.05)(2,400 gal)(1 drum/50 gal)($518/drum)	$1,240
TOTAL ANNUAL COSTS	$4,940
ANNUAL DISPOSAL SAVINGS (0.95)(2,400 gal)(1 drum/50 gal)($518/drum) =	$23,620
DIFFERENCE OF ANNUAL SAVINGS AND COSTS $23,620 - $4,940 = 18,680	
NET ANNUAL BENEFIT	$18,680
PAYBACK PERIOD = Capital Cost/NAB = $26,050/$18,680 =	1.4 yrs

SCENARIO II:	Assume oil stream is 2% hazardous waste and 3% reclaimable or burnable (note - does not include heat recovery value)
Disposal Costs =	(0.02)(2,400)(1 drum/50 gal)($518/drum) = $500
Payback Period =	($26,050)/($23,620 - $4,200) = 1.3 years

1 A power requirement of up to ten percent of annual costs would increase the payback period to approximately 1.5 years.

gallons per day; therefore, additional bilge to process is not being sought by the shipyard. As some of the operational problems are still being worked out by the shipyard, dependable service from this particular unit seems uncertain.

4.5 WASTE OIL

There are several significant sources of waste oil at the Base, including engine lubricating oil on Coast Guard boats, cutters, and shore vehicles, and generator oil. Hazardous waste transfer sheets indicated that waste oils were often contaminated with unknown substances and mixed with other wastes. The total volume of waste oil generated by Coast Guard vessels and Base Ketchikan is estimated at 2,000 gallons per year. In addition, a small percentage of bilge waste is oil, adding roughly another 50 gallons per year to this waste stream if the bilge is separated. In 1989, approximately 40 drums of waste oil and contaminated waste oil were shipped offsite as hazardous waste, at a cost of $518 and $713 per drum, respectively.

If halogenated solvents, in particular, and other wastes can be kept out of the used oil collected by and generated on the Base, there is no reason why all of Base Ketchikan's used oil cannot be recycled or used for building or process heat. Used oil is not automatically a hazardous waste. Oil is a valuable resource that should not be viewed as waste. Aside from a small percentage of sludge which may accumulate, essentially all of this waste stream can be eliminated from disposal as hazardous waste. If used oil is going to be recycled or burned for energy recovery, it is not subject to the 90-day storage limit nor to hazardous waste transport requirements. Familiarity with the used oil regulations (40 CFR 266 Subpart E) and federal guidance on handling used oil will provide the Coast Guard with a more complete description of legal responsibilities, testing requirements, and other aspects of waste oil management. An extensive discussion of the regulatory aspects is beyond the scope of this report.

Options evaluated for addressing used oil combine management practices with technological options. The keys to minimizing this hazardous waste stream are: 1) segregating used oils from all other waste streams, especially preventing mixture with halogenated solvents and 2) maximizing the reuse of used oils. The alternatives we considered for management of used oil are:

Table 4-6

COST BENEFIT ANALYSIS
ULTRAFILTRATION OF BILGE WASTE

CAPITAL COSTS:	
Ultrafiltration Unit (Pace)	$31,000
Oil Content Monitor (with alarm)	$6,000
Pilot Study	$1,000
Installation	$5,500
TOTAL CAPITAL COST	**$43,500**
OPERATING COSTS:	
Power ($0.10/gal) (2,400 gal)	$240
Labor (200 hrs/yr @ $25/hr)	$5,000
Detergent	$100
Membranes ($2,000/3 yr)	$670
DISPOSAL COSTS:	
(3%)(2,400 gal)(1 drum/50 gal)($518/drum)	$750
TOTAL ANNUAL OPERATING COSTS	**$6,760/yr**
ANNUAL DISPOSAL SAVINGS	
(0.97)(2,400 gal)(1 drum/50 gal)($518/drum) =	$24,120/yr
DIFFERENCE OF ANNUAL SAVINGS AND COSTS (NAB)	
$24,120 - $6,760 = $17,360	$21,330
NET ANNUAL BENEFIT =	**$17,360**
PAYBACK PERIOD = Capital Cost/NAB =	2.5 yrs

- Onsite energy recovery with waste oil heater
- Offsite energy recovery at Ketchikan pulp mill
- Offsite oil recycling
- Oil testing to extend period between oil changes
- By-pass filtration to extend oil life.

4.5.1 Onsite Energy Recovery With Waste Oil Burner

The waste oil heater located in the Vehicle Maintenance Shop is rated at 120,000 BTU per hour. According to the primary operator of this unit, the burner consumes approximately one gallon of oil per hour, and operates continuously about five months out of the year. The waste oil burner is used for supplemental heat in the Hobby Lobby, Vehicle Maintenance, and Motor Pool areas. The oil burned in the unit is generated in the Hobby Lobby, where Base personnel may perform maintenance and light repair work on their own vehicles, and in the Vehicle Maintenance shop, where maintenance and light repair is conducted on the nine shore vehicles maintained by the Base. Care is taken to avoid contamination of the oil with solvents, water, or other chemicals which would foul the waste oil heater.

There are sufficient quantities of oil generated by other sources at the Base to justify more waste oil burners for supplemental or perhaps primary heat in other buildings. Federal regulations (40 CFR 255.41(b)) allow used oil burning for energy recovery without a permit in units up to 500,000 BTU per hour. The warehouse and buoy shed are potential candidates for used oil heaters.

In Table 4-7 are presented the results of an economic analysis of using another waste oil heater on the Base. Assuming that the oil can be accumulated without contamination by water, solvents, and other materials, there would be more used oil available than a single additional unit would probably consume. Two waste oil heaters (200,000 BTU each) could probably take care of most or all of the used oil generated. Assuming that the used oil would reduce the Base purchase of heating fuel for the areas being heated, the payback on each unit is estimated at less than one year, with a net annual benefit of $10,800 per heater.

4.5.2 Offsite Energy Recovery at Ketchikan Pulp Mill

The Ketchikan shipyard accumulates used oil and trucks it to the Ketchikan pulp mill where it is used as fuel for pulp processing heat. The mill charges $.10 per gallon to accept the waste oil and the Coast Guard may be able to negotiate this down. This could be an attractive alternative for the Coast Guard, either by itself or in tandem with the usage of an additional waste oil heater. The Base would

Table 4-7

WASTE OIL HEATER COSTS/BENEFIT ANALYSIS

CAPITAL COSTS	
Lanair CA 200	$4,000
Transportation (Seattle to Ketchikan)	$100
Installation (Parts and Labor)	$1,500
Technical Assistance (installation and training	$1,000
Waste Oil Storage Tank (500 gal)	$500
TOTAL CAPITAL COST	$7,100
OPERATING COSTS	
Power ($0.10/gal)(1 gal/hr)((960 hrs)	$100
Labor (50 hrs)($25/hr)	$1,250
Replacement Parts	$200
TOTAL ANNUAL COSTS	$1,550
ANNUAL SAVINGS	
Building Heat (960 gal)($1.75/gal)	$1,680
Disposal Costs (960 gal)(1dr/50 gal)($518/dr)	$9,950
TOTAL ANNUAL SAVINGS	$11,630
NET ANNUAL BENEFIT = Annual Savings - Annual Costs	$10,080
PAYBACK PERIOD = Capital Costs/NAB	0.7 years

ASSUMPTIONS:

- Unit operates 6 months/yr, 8 hours/day, 5 days/week (960 hours per year).
- Unit burns oil at a rate of 1 gal/hr (80% capacity).
- Avoided purchase of heating fuel is assumed to be 1:1 (i.e., 1 gal burned equals 1 gal of heating fuel not purchased). Heating fuel cost assumed to be $1.75/gal.
- Labor estimates include maintenance and repairs of unit, oil transfer, and associated administrative cost.
- Capital costs are based on estimates supplied by manufacturer.

need to have a large holding tank for accumulating the waste oil. A local tank truck could be hired to transport the oil from the Base to the pulp mill. The oil would probably require regular testing to verify that it does not contain unacceptable levels of halogenated compounds.

Table 4-8 is a brief economic analysis of the offsite energy recovery option. The net annual benefit is estimated at $16,500. Payback would occur in approximately one month.

Table 4-9 illustrates a combination of onsite and offsite energy recovery options. In this scenario, the Coast Guard purchases one additional waste oil heater. The excess oil that cannot be burned in this unit is trucked to the Ketchikan pulp mill. The resulting net annual benefit is $17,700. The estimated payback period is less than six months.

4.5.3 Offsite Oil Recycling

There are several firms which reprocess oil for reuse, typically as fuel oil, in the Seattle area. Northwest Enviro Services is anticipating starting a facility in Anchorage to service Alaska generators. When that facility starts operating, it might provide a slightly less costly option than shipping used oil to Seattle.

Assuming that the used oil is free from solvent contamination, it could be shipped to Seattle either drummed or in larger containers (300 to 400 gallons). Though recycling rates may vary somewhat depending on the quality of the used oil, the current rate for "clean" oil recycling is $.50 per gallon. In Table 4-10, the costs and benefits of shipping used oil offsite to a Seattle reprocessor are calculated. The costs of handling 2,000 gallons of used oil generated annually would shrink from $24,000 per year under current practices to $2,000 using a Seattle-based oil recycler, including transportation costs.

4.5.4 Oil Testing to Extend Period Between Oil Changes

A field testing device can be used to track the "health" of lubrication oil as it wears during operation. When the instrument readings indicate that the oil is unacceptably dirty or worn, the oil should be changed. Such instruments have been used successfully to extend the period between oil changes, ensuring that the oil is fully "used" before it is replaced.

Table 4-8

SEND USED OIL TO KETCHIKAN PULP MILL FOR ENERGY RECOVERY
COST/BENEFIT ANALYSIS

CAPITAL COSTS:	
Oil Storage Tank (750 gal)	$1200
Ancillary Equipment	$200
TOTAL CAPITAL COST	$1400
ANNUAL COSTS:	
Transportation to mill:	
Labor ($45/hr, 2 hr/trip, 4 trips/yr)	$360
Truck ($75/hr, 2 hr/trip, 4 trips/yr)	$600
Disposal at Ketchikan Mill ($0.10/gal)(2000 gal/yr)	$200
Sludge Disposal (100 gal)((1 dr/50 gal)($518/drum)	$1,040
Analytical fees ($250/trip, 4 trips/yr)	$1,000
TOTAL ANNUAL COST	$3,200
AVOIDED COSTS	
Disposal (1,900 gal)(1 dr/50 gal)($518/dr)	$19,680
NET ANNUAL BENEFIT = Avoided costs - annual costs	$16,480
PAYBACK PERIOD = Capital Costs/NAB	<0.1 years

ASSUMPTIONS:

- Annual generation of acceptable waste oil is 1,800 gallons.
- Transportation rates based on figures supplied by Ketchikan Shipyard personnel.

Table 4-9

USE OF WASTE OIL HEATER AND KETCHIKAN PULP MILL
COST/BENEFIT ANALYSIS

CAPITAL COSTS:	
Lanair CA 200 Unit	$4,00
Transportation (Seattle to Ketchikan)	$100
Installation of Unit	$1,500
Technical Assistance (for installation and training)	$1,000
Waste Oil Storage Tank (750 gal)	$750
Ancillary tank Equipment	$500
TOTAL CAPITAL COST	$8,300
ANNUAL COSTS:	
Operation of Waste Oil Burner (see previous example)	
Power	$100
Labor	$1,250
Replacement Parts	$200
Transportation to Mill:	
Labor ($45/hr, 2 hr/trip, 4 trips/yr)	$180
Truck ($75/hr, 2 hr/trip, 4 trips/yr)	$300
Disposal (at Pulp Mill, $0.10/gal)(940 gal/yr)	$90
Sludge Disposal (100 gal)(1 dr/50 gal)($518/gal)	$1,040
Analytical Fees ($250/trip)(2 trips/yr)	$500
TOTAL ANNUAL COST	$3,660
AVOIDED COSTS	
Purchase of Heating Oil (see previous example)	$1,680
Disposal Costs (1,900 gal)(1 dr/50 gal)($518/dr)	$19,680
TOTAL ANNUAL AVOIDED COSTS	$21,360
NET ANNUAL BENEFIT = Avoided Costs - Annual Costs	$17,700
PAYBACK PERIOD = Capital Costs/NAB	0.5 years

Table 4-10

ECONOMIC ANALYSIS OF OFFSITE USED OIL RECYCLING
(Seattle recycler)

CURRENT DISPOSAL COSTS 1989 Costs: Waste Oil = (27 drums)($518/dr) = $13,990 Contaminated Waste Oil = (13 drums)($713/dr) = $9,270 1989 Total Cost = $13,990 + $9,270 = $23,260 1990 Costs: Waste Oil = (19 drums)($518/dr) = $9,840 Contaminated Waste Oil = (21 drums)($713/dr) = $14,970 1990 Total Cost = $9,840 + $14,970 = $24,810	
ESTIMATED ANNUAL WASTE OIL DISPOSAL COST	**$24,000**
RECYCLING COSTS Transporation Ketchikan to Port of Seattle: (0.95)(8.34 lbs/gal)(2,000 gal) = 15,850 lbs/yr ($2.75/100 lbs)(15,850 lbs/yr) = $440/yr Port of Seattle to recylcer: estunated at $310/yr TOTAL TRANSPORTATION COST = $440 + $310 = $750/yr PROCESSING COSTS (2,000 gal)($0.50/gal) = $1,000/yr	
TOTAL RECYCLING COSTS = $750 + $1,000 =	**$ 1,750**
NET ANNUAL BENEFIT = $24,000 - $1,750 =	**$25,750**

ASSUMPTIONS:

- Total annual production of waste oil is 2,000 gallons per year.
- All waste oil is free of solvent contamination.
- All waste oil is suitable for recycling.
- Coast Guard labor costs are the same for recycling as for disposal option.
- Assume specific gravity of oil is 0.95 (probably high).
- Assume oil recycler charges $0.50/gal.
- Treatment Cost: (2,000 gal)($0.50/gal) = $1,000
- Total Annual Recycling Costs: $1,000 + $1,000 = $2,000
- Total Annual Savings: $24,000 - $2,000 = $22,000

Such a unit might be practical for application on a small fleet of passenger vehicles or light duty trucks, as well as on a large cutter such as the *Planetree*. Currently, the *Planetree* sends samples of its oil to a laboratory for analysis to determine when the engine oil should be replaced. The on-board use of a field testing instrument could reduce analytical expenses and provide information much more quickly than a laboratory can.

One such unit, the Lubrisensor, costs around $500, and has been used successfully in lengthening oil changes intervals on the Municipality of Anchorage vehicle fleet and in generating substantial savings. More information on the instrument is provided in Appendix E. The use of a Lubrisensor on a daily basis and periodic laboratory analyses are recommended to track the engine oil behavior over a year or so. Once the relationship between Lubrisensor readings and lab analyses has been established, the field testing unit can be used alone to determine when the oil needs to be replaced. Potential savings in a particular application are difficult to estimate. However, if oil purchase and/or disposal costs are high, this could be an attractive alternative.

4.5.5 By-Pass Filtration to Extend Oil Life

By-pass filtration (also known as ultrafiltration) employs an after-market filter unit installed on an engine, which can remove particles down to 0.5 to 0.7 microns from the oil. Typical automotive filters remove particles 20 microns and larger, but are not effective for fine particle collection. By-pass filter units have been used successfully on automotive and marine engines to extend the useful life of lubricating oil by six to 25 times[11].

By-pass ultrafiltration units typically consist of a fiberglass or metal housing which holds a replaceable filter cartridge (a roll of paper towels in some units). The units vary in size according to crankcase volume and engine horsepower, ranging from quart jar size on an automobile to 2 feet by 6 inches on a large diesel generator. Use of by-pass filters in conjunction with laboratory analysis provides continuous cleaning of the oil and accurate verification of oil adequacy and replacement need. In addition, ultrafiltration removes water from oil and can be used to recover hydraulic oil. Additional information on by-pass filters is provided in Appendix E.

This alternative could be applied on Coast Guard vessels as well as on shore vehicles. Most engine manufacturers will maintain original warranty obligations with the use of by-pass filters. The

[11]Alaska DEC Pollution Prevention Program, unnamed article on oil waste minimization options, undated.

advantages to the Coast Guard would be reduced oil purchase costs, reduced oil disposal/recycling costs, and potentially longer engine life.

4.6 ANTIFREEZE/COOLANT

Each year, Base Ketchikan disposes of several hundred gallons of coolant and antifreeze solutions as hazardous waste, at a cost of $518 per drum or over $9 per gallon. Coolant mixtures are used in each of the engines on the vessels supported at Base Ketchikan, as well as in the nine vehicles maintained at the facility.

Two options for minimization of this waste stream were considered, as follows:

- Purify coolant onsite and reuse
- Recycle antifreeze offsite through a service contract.

4.6.1 Purify Coolant Onsite and Reuse

A number of antifreeze/coolant "recycling" units are available for commercial use. Of these, most are of the simple filtration type, providing no rebalancing of pH, ionic concentrations, or other properties significant to antifreeze performance. One unit we found did perform a more complete purification of the antifreeze mixture. Though there are no standard or military specifications for an antifreeze-plus-water mixture, the manufacturer of this unit guarantees that the purified solution will meet or exceed the performance characteristics of virgin antifreeze and water solution. The advantage of this alternative is the avoidance of both disposal costs and purchase of new antifreeze.

In the cost/benefit analysis in Table 4-11 we assumed that vessels and base vehicles generate a total of 700 gallons per year of antifreeze and coolant mixtures. The recycling unit itself costs less than $8,000, and operating costs are estimated at $3.90 per gallon. Net annual benefit is estimated at $6,880, and the payback period was calculated to be 1.2 years.

4.6.2 Recycle Antifreeze Offsite Through a Service Contract

The same type of antifreeze/coolant purification process as mentioned above, but on a larger scale, can be obtained in some areas on a service contract. Mr. Frank Madison of CEU Juneau has been investigating this option for various Coast Guard facilities using an Alaska-based service. Specific information on the availability and cost of this option was not available.

Table 4-11

ANTIFREEZE PURIFICATION SYSTEM COST BENEFIT ANALYSIS

CAPITAL COSTS:	
BG Cool'r Clean'r Coolant Purification System	$6,500
Transportation (to Ketchikan)	$100
Installation	--
Technical Assistance	$1,000
Ancillary Equipment (drums, hoses, tools)	$400
TOTAL CAPITAL COST	$8,000
OPERATING COSTS:	
Treatment: ($3.90/gal)(700 gal)	$2,370
Purchase Cost: ($10/gal) (40 gal)	$400
Disposal Cost: (.10)(700 gal)(1 drum/50 gal)($518/drum)	$725
TOTAL ANNUAL COST	$3,855
AVOIDED COSTS:	
Purchase Cost: ($8/gal)(345 gal)	$2,760
Disposal Cost: ($518/drum)(700 gal)(1dr/50 gal)	$7,250
TOTAL ANNUAL AVOIDED COSTS	$10,010
NET ANNUAL BENEFIT	$6,155
PAYBACK PERIOD	1.3 years

ASSUMPTIONS:

- Annual waste antifreeze generation is 700 gallons.
- Annual purchase requirement is 385 gallons.
- Use of system will reduce purchase by 90% (10% needed for make-up antifreeze due to leaks, evaporation, and spillage during transfer).

4.7 BATTERIES

Spent batteries represent the second largest solid hazardous waste stream from Base Ketchikan. Most of the batteries are collected from ATON units and vehicles maintained at the Base. Batteries disposed by the Base are of four basic types:

- Lead-acid batteries: used in motor vehicles and solar powered aids to navigation. They are wet, rechargeable, and usually six-celled, containing a sponge lead anode, lead dioxide cathode, and sulfuric acid electrolyte. This electrolyte is corrosive and requires disposal as a hazardous waste unless the battery is recycled or reclaimed.

- Nickel-cadmium (nicad) batteries: usually rechargeable, containing wet or dry potassium hydroxide as electrolyte. The potassium hydroxide is corrosive (pH 13.6 to 14). Therefore, nicad batteries must be disposed of as hazardous waste or recycled/reclaimed.

- Lithium batteries: used as power source for portable electronic equipment and emergency aviation equipment. All lithium batteries must be disposed of as hazardous waste or sent our for reclamation.

- Strobe light battery cells: small 14 volt strobe light battery cells used for powering hand held strobe lights (commonly used in emergency life vests). They must be returned to the manufacturer or a battery recycler for regeneration or disposed of as a hazardous waste due to mercury content.

4.7.1 Draining Wet Batteries and Neutralizing Solutions Onsite

From the shipping records, it appears that occasionally batteries have been drained and the acid placed in a container for disposal offsite as hazardous waste. Wet battery acid or alkali could be neutralized at Base Ketchikan and the resulting solutions disposed as nonhazardous liquid waste. Battery cases can be sent back to the manufacturers for reuse. This option could reduce the quantity of hazardous waste produced. However, due to the additional labor this alternative would entail and the additional risk to personnel, we do not recommend this option for Base Ketchikan. It may be an option worth further consideration in the future.

4.7.2 Recycling Batteries

Several recyclers who take batteries were contacted. Some will only accept lead-acid batteries; one we contacted will accept all types of batteries. One advantage of recycling batteries over disposing of them as hazardous waste is that they may be accumulated onsite for longer than 90 days before shipment to the recycler. Consequently, the Coast Guard could wait until a large number of batteries has accumulated in order to take advantage of lower shipping costs.

In the two cost/benefit analyses which follow (Tables 4-12 and 4-13), packing procedures and costs were assumed to be the same for recycling as for disposal. Seventy-five percent of the batteries are assumed to be lead-acid; 25% are assumed to be alkali batteries. In Option A, the recycler is Chem Pro in Seattle, who will accept all types of batteries at varying prices per pound. In Option B, Standard Batteries in Seattle is the recycler, who will pay for lead-acid batteries based on the current market price of lead. This value is currently about $.03 per pound. In either alternative, significant annual savings can be realized through recycling, and the hazardous waste stream is reduced.

4.8 PAPER, GLASS, ALUMINUM, AND OTHER SOLID WASTES

4.8.1 USFS Paper Recycling Program

Though actual purchase quantity information was not available, the use of white paper at Base Ketchikan is significant due to the amount of duplication of various communications, the use of several laserjet printers, and several photocopy machines. The city of Ketchikan estimates that up to 40% of its solid waste stream is comprised of paper, cardboard, and wood products.

Beginning in mid-1990, the U.S. Forest Service office in Ketchikan provided a collection point for used paper. (USFS contact is Ms. Jean Bartos, 225-3101.) The program had experienced enough participation by October 1990 that USFS was seeking additional temporary storage space for the used paper. The material was shipped to Bellevue, Washington where it was handled by a large recycler. This pilot project was begun with the hopes that a service organization would take it on. Due to depressed used paper prices and high shipping costs, the program did not pay for itself. Nonetheless, it enjoyed participation by local government offices and businesses in Ketchikan, and provided a reasonable alternative to landfilling the paper.

A recycling facility in Saxman, near Ketchikan, is reported to have begun collections in April 1991. Base Ketchikan could arrange with this facility for transportation of recyclable materials including paper, aluminum cans, cardboard, glass, and ferrous metals.

4.8.2 City of Ketchikan Recycling Program

The city of Ketchikan is currently considering a voluntary recycling program for paper (two or three grades), glass, plastic, and aluminum cans. The Director of Public Works (Mr. Fred Monrean) stated that the inspiration for such a program comes from a sense of limited material supply and

environmental concerns shared by the citizens of Ketchikan, rather than from limited space in the city's landfill. The program, now in the feasibility study stage, is anticipated to start in mid-1991. The city recognizes the Coast Guard Base as a major contributor to the local landfill, relative to other landfill customers in the area. It would probably welcome the Coast Guard's willingness to participate in a recycling program.

The Director of Public Works suggested that the Coast Guard could probably handle its solid wastes differently now, in advance of a city-wide recycling program. Mr. Monrean suggested that the local metal scrapper would be willing to pick up metal scrap at the Base, if the Coast Guard would call him (no name or number was provided to us). This would save Base personnel from having to haul unusable metal equipment to the landfill as well as save on landfilling costs.

4.8.3 Regional Recycling Efforts

The Southeast Conference, a coalition of Southeast Alaskan community representatives, has been meeting over the past few months to consider regional approaches for handling waste and recyclable materials in Southeast. The Alaska Ferry System is considering hauling bundled recyclables (not paper) for a very favorable rate during the off season. Coast Guard participation in both planning and implementation of a regional recycling effort could be beneficial to all involved. Contact can be initiated through David Wigglesworth, Alaska Department of Environmental Conservation.

4.8.4 Additional Solid Waste Alternatives

The Coast Guard might consider the option of hauling some of the recyclable materials from Base Ketchikan to Seattle when its larger vessels are southbound. For example, if the *Planetree* were scheduled for repairs at the Seattle or Bremerton shipyard, it might be able to transport used oil, used batteries, glass, aluminum, or other materials to the Port of Seattle for overland transport to Seattle area recyclers. This would provide savings in transport costs, although it could be disadvantageous in terms of schedule, frequency of delivery, and logistics.

Other solid wastes could be diverted from Base Ketchikan dumpsters. These include laserjet cartridges, food wastes, and lawn clippings. Spent laserjet cartridges from computer printers on the Base can be recycled. Food wastes and grass clippings could be composted, either on the Base or in a community composting project. Compost is a valuable material for agricultural or garden uses, and vegetative wastes use landfill space unnecessarily.

Table 4-12

ECONOMIC ANALYSIS OF OFFSITE BATTERY RECYCLING OPTION A
(ChemPro, Seattle)

CURRENT DISPOSAL COSTS Estimated Annual Waste Battery Production: Lead Acid Batteries: 11,580 lbs Alkaline Batteries: 1,940 lbs Estimated Hazardous Waste Disposal Costs: Lead Acid Batteries: (11,580 lbs/yr)(1 tote/1,100 lbs)($1,235/tote) = $13,000/yr Alkaline Batteries: (1,940 lbs/yr)(1 tote/1,100 lbs)($1,368/tote) = $2,410/yr	
TOTAL ANNUAL DISPOSAL COST = $13,000 + $2,410 =	$15,410
RECYCLING COSTS Transportation to Recycler: Ketchikan to Port of Seattle: (11,580 lbs/yr + 2,410 lbs/yr)($2.75/100 lbs) = $390/yr Port of Seattle to ChemPro: $360/yr (estimate) Total transporation cost = $390 + $360 = $750/yr Recycling/Reclamation: Lead Acid Batteries = (11,580 lbs/yr)($0.50/lb) = $5,970/yr Alkaline Batteries = (2,410 lbs/yr)($0.60/lb) = $1,450/yr	
TOTAL ANNUAL RECYCLING COST	$ 8,170
NET ANNUAL BENEFIT = $15,410 - $8,170 =	$ 7,240

ASSUMPTIONS:

- Annual quantities of waste batteries are constant. All batteries are assumed to be acid or alkaline.
- Current disposal costs are based on 1990 disposal data.
- Costs to Coast Guard are transport from Ketchikan to Seattle and treatment costs (paid to recycler).
- Transportation rate from Ketchikan to Seattle is $2.75/100 lbs.
- Treatment rates are $0.50/lb for lead acid batteries and $0.60/lb for alkaline batteries (information supplied by Chempro, Inc.).
- Packing material and labor costs are equivalent for current practices and recycling option.

Table 4-13

ECONOMIC ANALYSIS OF OFFSITE BATTERY RECYCLING, OPTION B
(Standard Batteries, Seattle)

CURRENT DISPOSAL COSTS: Total Annual Disposal Costs = (See Option A)	$15,410
RECYCLING PAYBACK: Payback for Lead Acid Batteries: (11,580 lb/yr)($0.03/lb) = $350/yr	
RECYLCING COSTS: Transporation (as in Option A) = $750/yr Reclamation of Alkali Batteries: (2,410 lbs/yr)($0.60/lb) = $1,450/yr	
TOTAL ANNUAL RECYCLING COST: $750 + $1,450 - $350 =	$ 1,850
NET ANNUAL BENEFIT = $15,410 - $1,850 =	$13,560

Notes:

- There are specific minimum weight shipments for some recyclers.
- Costs for additional contracts management were not considered.
- Market value of lead subject to fluctuation.

Finally, silver recovery from the dental X-ray operation at the medical center may be another option for future consideration. Due to the high value of silver, recovery operations from developer and fixer solutions have been advantageous in many situations. Feasibility at Base Ketchikan would depend on the volume of X-rays developed and the quantity of recoverable silver.

5.0 FEASIBILITY ANALYSIS SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY OF ATTRACTIVE OPTIONS AND RECOMMENDATIONS

In the previous chapter, a number of alternatives for waste minimization and handling were described. Some option combinations are complementary, for example, the application of oil/water separation and using oil for energy recovery. Others may not be. We encourage a "system view" of waste minimization alternatives to avoid the implementation of those which are not optimally compatible.

Table 5-1 summarizes the priority waste streams and the waste minimization or management alternatives described in Chapter 4. Each alternative and its associated first costs, net annual benefit, and payback period are listed. An asterisk denotes a recommended option.

From the implementation of the recommended options, the Coast Guard will be able to cut its hazardous waste stream to a fraction of the current level. Disposal costs will also decrease dramatically. With oil/water separation of bilge waste, recycling or energy recovery of used oil, distillation of paint waste and solvents, and recycling of antifreeze, the liquid hazardous waste stream could be reduced by as much as 80 to 85%. If blasting waste were found to be a nonhazardous waste, and all batteries were shipped offsite for recycling, the solid hazardous waste stream could be reduced by 90 to 99%. This reduction in hazardous waste could occur with an increase in other nonhazardous waste streams, or in further waste reduction through recycling materials such as spent blasting grit. There would be a significant reduction in the toxicity of a large portion of the waste.

The potential consequences of successful waste minimization at Base Ketchikan are significant, not just in terms of dollars saved. Other benefits are: enhanced worker safety and health, reduction of regulatory compliance effort, liability reduction, environmental benefits, and exemplary, precedent-setting operations for a federal facility. These benefits are attainable through a combination of technology, management methods, and increased awareness and understanding at all personnel levels.

5.2 SITE-WIDE RECOMMENDATIONS FOR WASTE MANAGEMENT

The following recommendations are offered to enhance the success of a waste minimization program undertaken by the Coast Guard. They are based on our knowledge of waste program management, experience in new program development, and observations of federal facility operations.

Table 5-1, Sheet 1 of 3

SUMMARY OF WASTE MINIMIZATION FEASIBILITY ANALYSIS

WASTE STREAM, LOCATION, OPERATION	WASTE MIN OPTION	TOTAL CAPITAL INVESTMENT	NET ANNUAL BENEFIT	PAYBACK PERIOD	COMMENTS
BLASTING WASTE					
Marine Ways, paint removal from vessels	• Lead-free, non-toxic paints	--	--	--	• Long-range CG goal; may take several years to realize
	• Concrete floor for marine ways	>$200,000	~$30,000	6.7	• Very expensive; w/nontoxic paints in a few yrs, may not be necessary
	• Geomembrane floor for marine ways	Unknown	Unknown	--	• Not feasible w/out improved collection system
	• Plastic blasting media	--	--	--	• Less expensive than concrete, more durable & effective than Visqueen
	* • Retest for new designation	$6,000	~$30,000	0.2	• Cap. invest. is analytical costs for blasting waste 20 samples @ $300/sample
Buoy Shed, paint removal from buoys	• Lead-free, non-toxic paints	--	--	--	• Long range CG goal; may take several years to realize
	• Plastic blasting media	--	--	--	• Not effective for rust removal
	• Magnetic separation	--	--	--	• No advantage over new steel shot recycling system
PAINT WASTE					
Marine Ways and Buoy Shed, painting vessels and buoys	• Lead-free nontoxic paints	--	--	--	• Long range CG goal; may take several years to realize
	* • High vol/low pressure paint guns	$1,300	$12,250	0.1	• Strongly recommended; used by auto body paint shops
	* • Improve storage practices	Minimal	Unknown	--	• Will result in less wasted product
	• Best application practices	Minimal	Unknown	--	• May require add. operator training
	• Spray gun cleaning station	$500	Unknown	Unknown	• May reduce solvent thinner use; solvent can be recycled
	* • Recycle paint wastes	$4,000	$6,200	0.6	• Uses same distillation unit as solvent recycling option

Table 5-1, Sheet 2 of 3

SUMMARY OF WASTE MINIMIZATION FEASIBILITY ANALYSIS

WASTE STREAM, LOCATION, OPERATION	WASTE MIN OPTION	TOTAL CAPITAL INVESTMENT	NET ANNUAL BENEFIT	PAYBACK PERIOD	COMMENTS
SOLVENTS					
Base-wide, cleaning and degreasing operations	• Solvent substitution	--	--	--	• Considered case-by-case. Test product for effectiveness and disposal options.
	* • Best management practices	Minimal	Unknown	N/A	• Could reduce purchase and disposal costs significantly.
Industrial Machine Shop, "Gunk Tank"	• Substitute "Hurri-Safe"	--	$600	--	• Sludge disposable as haz. waste
Industrial and Public Works, small parts washers	• Add filtration units	Minimal	Unknown	Unknown	• Could extend solvent life 2-3 times
	* • Solvent distillation	$4,000	$6,200	0.6	• Savings based on paint wastes; both can be distilled with same unit
BILGE WASTE					
Base-wide, bilge management	• Oil/water separators on all vessels	--	--	--	• Not feasible for smaller vessels
	* • Oil/water separator on base	$26,050	$18,680	1.4	• Oil can be recycled or burned for energy recovery
	* • Eliminate use of emulsifying detergents	--	--	--	• Necessary adjunct to use of oil/water separator
	• Ultrafiltration unit on base	$43,500	$17,360	2.5	• Oil can be recycled or burned for energy recovery
	• Use oil/water separator at Ketchikan Shipyard	--	--	--	• Not currently available

Table 5-1, Sheet 3 of 3

SUMMARY OF WASTE MINIMIZATION FEASIBILITY ANALYSIS

WASTE STREAM, LOCATION, OPERATION		WASTE MIN OPTION	TOTAL CAPITAL INVESTMENT	NET ANNUAL BENEFIT	PAYBACK PERIOD	COMMENTS
WASTE OIL						
Base-wide, lubricating and generator oils		• Waste oil heater (on-site energy recovery)	$7,100	$10,080	0.7	• Ideal for heating buoy shed or warehouse; could use two heaters
		• Off-site energy recovery-Ketchikan pulp mill	$1,400	$16,480	<0.1	• Oil must meet burning specifications
		• Combination off-site and on-site energy recovery	$8,300	$17,700	0.5	• One waste oil heater; all other oil goes to pulp mill
	*	• Off-site oil recycling	--	$25,750	N/A	• Oil must be free of halogenated solvent contamination
		• Extended oil change intervals through oil testing	Unknown	Unknown	--	• Proven successful for fleet maintenance; expense & effort occurs in first year.
		• By-pass filtration	<$200 ea	Unknown	--	• Extends life of oil, reduces purchase and disposal costs
WASTE ANTIFREEZE/COOLANT						
Base-wide, from vessels and vehicles	*	• Purify on-site and re-use	$8,000	$6,155	1.3	• Need to verify that system can purify Nalcool and Paxcool
		• Recycle off-site	--	--	--	• Being investigated by SMD Juneau
BATTERIES						
Base-wide, primarily from ATON units and vehicles		• Recycle all batteries	--	$7,240	N/A	• All types of batteries accepted
	*	• Recycle lead-acid batteries with payback	--	$13,560	N/A	• Payback for lead in lead-acid batteries; all others recycled at Chempro
PAPER, GLASS, ALUMINUM, ETC.						
Base-wide	*	• Take paper to USFS collection point	--	Unknown	--	• Avoids landfill disposal costs
		• Participate in City recycling program	--	--	--	• Program planned to start in 1991
		• Participate in regional recycling efforts	--	--	--	• In planning stages
	*•	Scrap equipment and metal to local scrapper	--	Unknown	--	• Avoids landfill disposal costs and hauling

1. Hazardous Waste Coordinator

A civilian hazardous waste coordinator, whose primary responsibility is to oversee hazardous materials and waste management activities, would be able to provide greater emphasis to the program and would avoid the discontinuity in program management which may occur from rotation of Coast Guard personnel.

2. Shop Waste Coordinators

Better participation and "quality control" would occur if one person were designated in each area where waste is generated to oversee management of waste in that area and to be responsible for its proper handling.

3. Task Force

A waste minimization task force comprised of the shop waste coordinators, the hazardous materials coordinator, and perhaps a higher ranking administrator, could be formed to provide input, new ideas, ongoing support, and base-wide participation in a waste minimization program. Often the best ideas come from within an organization at the operations level. In addition, this task force could encourage and participate in community waste reduction efforts, providing a forum for information exchange with Ketchikan Public Works, U.S. Forest Service, or other organizations.

4. Education

Every employee should understand why it is important to deal with wastes carefully, how wastes must be handled, what the proper disposal methods are, who is responsible for waste containers, and what the consequences are of mishandled wastes.

5. Specific Training

Training in specific operations can enhance waste minimization efforts. For example, skill enhancement for paint spray gun operators can help reduce paint loss due to overspray. In each process or operation conducted at Base Ketchikan, specific training could be offered to enhance personnel skills as well as to reinforce and improve waste reduction activities.

6. Segregate Waste Streams

Reduction in hazardous waste volume cannot occur without segregation of waste streams. Significant quantities of waste oil are currently being shipped offsite as hazardous waste which could potentially be recycled or burned for energy recovery if solvents and other contaminants were not mixed in with the oil.

7. Label Waste Containers

Each receptacle of waste oil, antifreeze, paint or other waste which serves as an accumulation point should be clearly labeled to indicate what may be dumped in. This will aid in waste segregation efforts.

8. Store Paints and Solvents in Heated Areas

Paint stored in outdoor paint lockers during the winter months can be ruined by freezing. Improved paint storage will reduce wasted paint.

9. Improve Small Quantity Procurements

Minimize large quantity orders when only a small quantity is needed. More sharing/trading of materials (paints, adhesives, solvents) among shops should be promoted.

The "83 stock" system could be utilized much more. Increase employee awareness of its benefits, materials stocked, and access. Avoid ordering materials for which suitable substitutes (or existing supplies) reside in "83 stock."

5.3 CONCLUSIONS

Base Ketchikan has a tremendous opportunity to initiate a waste minimization program which could have outstanding results. The potential for reduction of the hazardous waste stream is very high. Up-front capital investment to begin realization of waste reduction benefits is surprisingly small. The total of new equipment costs for oil/water separation, oil recycling, paint waste and thinner distillation, antifreeze purification is approximately $45,350. Recycling batteries and landfilling nonhazardous blasting waste would require no additional expense. The total net annual benefit from implementing the recommended options is estimated at over $112,000. If the liquid hazardous waste stream were reduced 80% and the solid hazardous waste stream reduced 90%, hazardous waste disposal costs would drop to less than $90,000 per year.

The favorable economics associated with waste minimization speaks for itself. We do well to remember that changes in dealing with waste require attitudinal and "cultural" changes, because habits are slow to die and new ways of doing things are not always quickly accepted, no matter how effective they may be. A fully integrated implementation plan which inspires participation at all levels may enhance the success of any technology and/or management alternatives selected by the Coast Guard.

APPENDIX A

BLASTING OPERATIONS

NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.

KLEEN BLAST®

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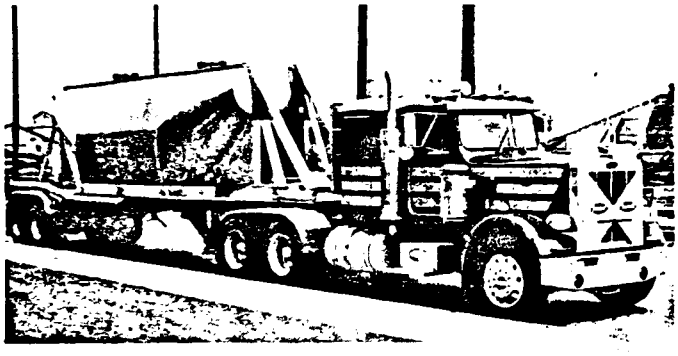

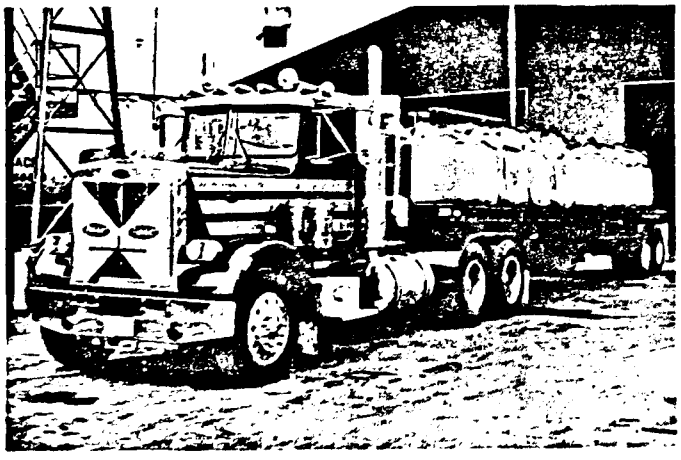

A Word About Kleen Blast®. . . .

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KLEEN BLAST® is the only abrasive manufacturer on the West Coast that distributes its own product by way of its fleet of pneumatic, bottom-dump, and flatbed trailers.

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KLEEN BLAST®

PRODUCT SIEVE ANALYSIS — ASTM-D 451-75

PRODUCT PASSING BY PERCENT ON U.S. SCREENS	30-60	35	16-30	16	8-12
#10				90-100	55-75
#12		95-100	90-100	80-95	30-50
#16	95-100	90-99	60-80	40-60	5-20
#20	90-95	75-90	40-60	10-30	2-15
#30	80-90	40-55	15-30	0-10	0-10
#50	10-35	0-10	1-5	0-2	0-5
#70	0-10	0-5	0-2		
Pan	0-Trace	0-Trace	0-Trace	0-Trace	0-Trace

KLEEN BLAST® USES BY SCREEN SIZE @80-90 psi AT THE NOZZLE:

#30-60 Light mill scale, vinyls, structural marine work. Feather edging on touch-up work. Should provide **.05-1.5** mil at 70-80 psi. Can be used on non ferrous - car bodies, light steel, and hardwoods.

#35 Mill scale, structural steel, bottom paint prep. For a light profile, will feather edge. Recommended for most light sandblast operations. **1.5-3.0** mil profile.

#16-30 Shipyard sandblasting - all types of hull and structural work. Bottom prep, shop blasting, concrete stripping, bridge blasting. **3.0-5.0** mil profile.

#8-12 For after blending, when reusing slag materials. Also used on heavy rust and mil scale. As this material is for blending, same mil profile as #16-30 is used.

KLEEN BLAST® ABRASIVE CHEMICAL ANALYSIS*

MAJOR ELEMENTS	SiO_2	45.5
	Fe_2O_3	23.3
	$A_{12}O_3$	7.2
	CaO	19.6
	MgO	3.7
TRACE METALS	Arsenic	.001
	Cadmium	.0001
	Beryllium	.0008
	Lead	.004
PHYSICAL CHARACTERISTICS	Specific gravity	2.8
	Moh hardness	7-8
	Density (lbs. per cu. ft.)	110

KLEEN BLAST® CONTAINS NO FREE SILICA

— MEETS ALL CURRENT REQUIREMENTS OF MIL. SPEC. 22262 FOR SHIPS —

— IS CERTIFIED FOR DRY UNCONFINED BLASTING BY CALIFORNIA AIR RESOURCES BOARD —

— MEETS ALL CURRENT OSHA, NIOSH & EPA CHEMICAL LIMITS —

TYPICAL LEACHATE FOR CALIFORNIA HAZARDOUS WASTE EXTRACTION TEXT 66700
TESTING DONE BY COMMERCIAL TESTING OF GOLDEN, COLORADO
Results: Reported as mg/L on an STLC basis

PARAMETER	KLEEN BLAST	SOLUBILITY THRESHOLD LIMIT
Antimony, Sb	0.030	15
Arsenic, As	0.109	5.0
Barium, Ba	3.7	100
Cadmium, Cd	< 0.02	1.0
Chromium, Total, Cr	0.366	560
Chromium, trivalent, Cr^{+3}	0.345	5
Cobalt, Co	0.38	80
Copper, Cu	0.238	25
Fluorine, F	1.5	180
Lead, Pb	0.15	5.0
Mercury, Hg	< 0.009	0.2
Molybdenum, Mo	0.052	350
Selenium, Se	< 0.002	1.0
Silver, Ag	< 0.004	5
Thallium, T1	0.2	7.0
Vanadium, V	0.11	24
Zinc, An	2.50	250

WARNING

When using Copper Slag abrasive blasting grit, the following safety precautions should be mandatory:

1. Niosh approved respiratory or breathing device should be worn, to avoid inhalation of dust which may aggravate lung condition.
2. Avoid breathing dust.
3. Wear proper abrasive resistant clothing; leather gloves, safety shoes, for protection in an abrasive environment.
4. Dispose of spent material according to all City, County, State and Federal regulations.
5. Avoid pointing abrasive blasting nozzle at any point other than the surface being worked on. Abrasive blasting grit under pressure may cause serious bodily injury from embedded abrasive particles.

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KLEEN BLAST® is a hard, durable copper slag abrasive with a bulk density of 110 lbs. per cubic foot. This slag has a low iron content giving it no magnetic properties. Its hardness and low friability factor enable it to remove paint and rust without excessive breakdown on impact, thereby causing less dust in the work area. These factors allow it to outperform other blasting abrasives while providing increased savings on cleanup and disposal.

UNIFORMITY

KLEEN BLAST® is available in five (5) industry standard sizes, giving our customers the option to choose for each particular job. Because of our State of the Art screening facility, we can provide our customers with the same uniformity in product time after time. We also have the capacity for custom blending products to meet your specific needs.

DELIVERY

KLEEN BLAST® is available , in 100 lb. bags, 2 ton metal bins and 3,000-4,000 lb. jumbo sacks. We also can deliver by direct railcar, or our own fleet of **KLEEN BLAST®** owned and operated bulk pneumatic, belly dump, or flatbed trailers. Because we haul **only KLEEN BLAST®** produced abrasives in our fleet of trucks , our product will be free of all outside sources of contamination associated with common carriers. As we are on call seven days a week, 24 hours a day, we can expedit your delivery on a moment's notice.

APPLICATIONS

KLEEN BLAST® is being used by the U.S. Navy Shipyards, civilian shipyards, painting contractors, and steel fabricators, in all aspects of the surface preparation industry, from ships to bridges to refineries, and is singled out as the product to use by many industrial users.

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If I may be of any further assistance please do not hesitate to call me on our toll free number 1-800-228-4786. Thank you for your time in this matter!

Very Truly Yours,

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Joe Schmidt
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Plant: 3650 N.W. Yeon Ave., Portland, OR 97210 • (503) 228-3965 • (800) 634-8499 • Fax (503) 228-6807

Plant: 1448 St. Paul Ave., Tacoma, WA 98421 • (206) 383-2168 • (800) 228-4786 • Fax (206) 383-2267

KLEEN BLAST®

KLEEN BLAST

A DIVISION OF LEISURE INVESTMENT CO.

LINCO HAYWARD CALIFORNIA

November 16, 1990

Dear Customer:

As of September 15, 1990 the E.P. Toxicity method for Leaching tests is no longer acceptable by the E.P.A. and the State Department of Ecology. As of that date you will need proof of Toxicity Characteristic Leaching Procedure (T.C.L.P.) test results. Please put our T.C.L.P. in your file for future reference. You will also find the E.P.A. regulations in the enclosed.

If I may provide you with any further information please do not hesitate to call.

Best Regards,

J. M. Schmidt

Joe Schmidt

JS/dgl

encolsure

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Kleen Blast Date: November 7, 1990

Report On: Analysis of Sand Blast Material Lab No.: 14377

IDENTIFICATION:
Samples Received on 11-06-90
Client ID: #16

ANALYSIS:

Sample was extracted in accordance with Toxicity Characteric Leaching Procedure (TCLP) in accordance with Federal Register, November 7, 1988.

Contaminant	Concentration (mg/l)	Max Conc., (mg/l)
Arsenic	< 0.1	5.0
Barium	< 0.1	100.0
Cadmium	< 0.1	1.0
Chromium	< 0.1	5.0
Copper	0.3	
Lead	< 0.1	5.0
Mercury	< 0.05	0.2
Nickel	< 0.1	
Selenium	< 0.1	1.0
Silver	< 0.1	5.0
Zinc	< 0.1	

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

This report is issued solely for the use of the person or company to whom it is addressed. This laboratory accepts responsibility only for the due performance of analysis in accordance with indus acceptable practice. In no event shall Sound Analytical Services, Inc. or its employees be responsible for consequential or special damages in any kind or in any amount.

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)	Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that
KLEEN BLAST	

Section I

Manufacturer's Name: KLEEN BLAST DIVISION	Emergency Telephone Number: (206) 383-2168
Address (Number, Street, City, State, and ZIP Code): 809 Podva Road	Telephone Number for Information: (415) 831-9800
Danville, California 94526	Date Prepared: March 31, 1988
	Signature of Preparer (optional):

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Iron Oxide (as % Fe203) CAS-1309-37-1		5 mg/m3		23%
Silica as S102 / 0.1% free Silica CAS7440-21-3		10 mg/m3		45%
Alumina as A1203 CAS-7429-90-5		10 mg/m3		7%
Calcium as CaO CAS-1305-78-8		2 mg/m3		19%
Other trace metals and oxides				

Section III — Physical/Chemical Characteristics

Boiling Point	2400°	Specific Gravity (H_2O = 1)	2.8
Vapor Pressure (mm Hg)	N/A	Melting Point	NONE
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	NONE

Solubility in Water: Non

Appearance and Odor: Black Angular to Sub Angular Granule with no apparent order.

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
Material is non-flammable solid	N/A	N/A	N/A

Extinguishing Media

Special Fire Fighting Procedures: N/A

Unusual Fire and Explosion Hazards: N/A

Section V — Reactivity Data

Stability			Conditions to Avoid
Inert Solid	Unstable		The material is a stable solid requiring no unusual
	Stable	X	precautions in normal use.

Incompatibility (*Materials to Avoid*) -NONE

Hazardous Decomposition or Byproducts NONE

Hazardous Polymerization			Conditions to Avoid
	May Occur		N/A
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? YES Skin? YES Ingestion? YES

Health Hazards (*Acute and Chronic*)
This material could produce respiratory problems associated with nuisance dust over long term exposure in an abrasive blast environment. NIOSH Approved particulate respirators as required.

Carcinogenicity: N/A NTP? N/A IARC Monographs? N/A OSHA Regulated? N/A

Signs and Symptoms of Exposure NONE - Since the material particulate is inert and non fibrogenic, exposure beyond TLV should be avoided.

Medical Conditions Generally Aggravated by Exposure Respiratory response due to nuisance dust.

Emergency and First Aid Procedures Avoid over exposure to airborne particulate, wear proper respiratory equipment.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled Non specific cautions, use normal housekeeping as in an abrasive blast environment.

Waste Disposal Method Follow federal, state and local regulations as a solid waste. Spent material would require further testing for disposal method.

Precautions to Be Taken in Handling and Storing Follow good housekeeping practices to reduce airborne dust. Use approved respiratory protection in abrasive blast environment.

Other Precautions Use material for the purpose intended and incorporate methods of dust control that are effective in maintaining airborne dust.

Section VIII — Control Measures

Respiratory Protection (*Specify Type*) NIOSH approved respiratory equipment for abrasive blast environment.

Ventilation			
YES	Local Exhaust	Special	
	Mechanical (*General*)	Other	As required for abrasive blast environment.

Protective Gloves Leather

Eye Protection NIOSH approved for abrasive blast environment.

Other Protective Clothing or Equipment As required in an abrasive blast environment.

Work/Hygienic Practices

• USGPO 1984-491-529/45775

Analysis and Perspective

COMPLYING WITH THE NEW RCRA TOXICITY CHARACTERISTIC AND TCLP

By Kenneth H. Kastner*

On March 5, 1990, Administrator William K. Reilly of the Environmental Protection Agency signed the new toxicity characteristic (TC) and toxicity characteristic leaching procedure (TCLP) final rule.[1] EPA estimates that the rule will nearly triple the amount of waste that is considered hazardous under the Resource Conservation and Recovery Act, and will directly impact 15,000 generators. This is because the new rule would subject to hazardous waste regulation any waste that has one or more of 25 organic constituents above the very low regulatory concentrations. Some of these constituents are common in industrial operations, such as benzene, chloroform, trichloroethylene, vinyl chloride, and carbon tetrachloride.

Companies that generate or manage hazardous wastes that exhibit this new toxicity characteristic will have only six months, or until late September, to comply with many of the requirements of the new rule. Small quantity generators will have 12 months.

The companies will first have to determine, usually by testing, whether any of their wastes exhibit the new TC. If they do, companies will quickly have to develop compliance strategies by considering complex issues regarding permits and permit exemptions, operation and design standards for units used to manage TC wastes, land disposal restrictions, corrective action measures, and other hazardous waste management requirements. Timely compliance will be a daunting challenge, especially for the hundreds of companies that have so far stayed out of the RCRA hazardous waste program.

To assist companies in their compliance efforts, the key features of the rule as well as steps companies should take to attempt to comply with the new rule by September of 1990 are described below.

Key Features

1. The rule provides that waste is a hazardous waste under the toxicity characteristic if it contains any one of the constituents on Table 1 at a concentration equal to or greater than the respective regulatory level on the Table.

Note that Table 1 includes eight metals, four insecticides, and two herbicides that are currently regulated under the Extraction Procedure toxicity characteristic test. These constituents and their regulatory levels were not changed by the new rule. Rather, EPA has added 25 organic constituents to the 14 EP toxicity characteristic constituents, resulting in a new TC covering 39 distinct constituents.[2]

2. The final rule does not contain 13 constituents that EPA proposed to regulate, although EPA says it may address them in a future, unspecified notice.

EPA deleted seven previously proposed TC constituents because they exhibit a high degree of hydrolysis (chemical reaction with water). The agency's model does not account for significant hydrolysis, and EPA does not have toxicity data for hydrolysis products. These deleted constituents are:

acrylonitrile
bis (2-chloroethyl) ether
methylene chloride
1,1,1,2-tetrachloroethane
1,1,2,2-tetrachloroethane
1,1,1-trichloroethane
1,1,2-trichloroethane

Additionally, EPA deleted six constituents it had proposed for regulation because the "steady-state" assumption in EPA's model is inappropriate for these six constituents. The constituents are:

carbon disulfide
1,2-dichlorobenzene
isobutanol
phenol
2,3,4,6-tetrachloropbenol
toluene

3. The toxicity characteristic leaching procedure must be used for all TC wastes.

In determining whether a waste stream exceeds the new TC regulatory levels, a company must compare the concentration of the liquid extract from the waste to the regulatory levels. The liquid extract must be obtained by using the TCLP.

The only exception is when the waste contains less than 0.5 percent filterable solids. In that case, the waste itself, after filtering, is considered to be the extract.

The rule also requires that the TCLP must be used on metals, insecticides, and herbicides that have been regulated under the old EP toxicity test. Because the TCLP can be a more aggressive leaching protocol than the old EP, companies may find that certain waste streams that formerly did not exhibit the EP toxicity characteristic will become TC hazardous wastes when the TCLP is applied.

4. Three TC levels were raised so they would not be below levels at which the TC constituents could normally be detected.

EPA has set the levels for 2,4-dinitrotoluene, hexachlorobenzene, and pyridine at the commonly measurable levels ("Practical Quantitation Limit") for these constituents, because their health-based regulatory levels would have been below normal detection limits.

5. The TC rule will not apply, at least for the time being, to certain wastes containing polychlorinated biphenyls and to contaminated media from petroleum underground storage tank cleanups.

Specifically, the TC rule will not apply to PCB-containing dielectric fluids removed from electrical transformers and

* Kenneth H. Kastner is Of Counsel to Newman & Holtzinger P.C. in Washington, D.C. He was formerly the Assistant General Counsel for the Chemical Manufacturers Association. The opinions and conclusions of this article are solely those of Mr. Kastner, and do not represent any editorial position of the Bureau of National Affairs, Inc.

Effective date 3/29/90

ing one of the interim status or permitting exemptions at 40 CFR 265.1(c) and 264.4(g). Consider particularly the exemptions for accumulating waste less than 90 days or for waste water treatment that is entirely in tank systems where the discharge is sent to a sewage treatment facility or under a Clean Water Act permit.

Step 6: If interim status/permits cannot be avoided, take the necessary steps to obtain or amend your facility's interim status or permit status within the attached Table 2 timeline, and meet the applicable design, operation, record-keeping, financial responsibility, and other requirements for the units that are being used for the TC wastes.

Step 7: Anticipate the land disposal restrictions, and plan for compliance or develop alternative strategies.

The statute requires EPA to issue land disposal restrictions (LDRs) no later than six months after the "identification" of the TC. It is unclear whether the TC is "identified" on the date it appears in the *Federal Register* or six months thereafter, when it is effective.

The preamble to the TC rule can be read to support both interpretations. If the *Federal Register* publication starts the LDR clock ticking, EPA should promulgate restrictions for TC wastes by late September 1990. If the effective date starts the LDR clock ticking, EPA should promulgate restrictions by late March 1991.

The timing issue is further complicated by the fact that a federal district court is currently considering whether to order EPA to issue LDRs for TC wastes by a date the court would specify.[4] Whatever the date, if EPA fails to meet it the TC wastes are not automatically prohibited from land disposal as has been the case for all wastes previously subject to the LDRs. Since there is no "hard-hammer," EPA will probably not promulgate the LDRs until it has adequate treatability and capacity data to do so.

Because the capacity data will not be available until at least early 1991, after EPA receives TC generator notifications,[5] disposal restrictions for TC wastes are not likely to be finalized before late March 1991 and possibly much later. For current planning purposes, you should probably assume LDRs for TC wastes will be in effect by late March 1991, but it is very possible that this date will change.

Just as important as the timing is the fact that in the Nov. 22, 1989, proposed "third-third" LDR rule, EPA proposed to prohibit land disposal for many EP toxicity characteristic wastes unless the wastes are first pretreated to concentrations that are often well below the EP toxicity characteristic regulatory levels. As an example, under the EP toxicity characteristic, a waste is hazardous if it has 5.0 milligrams per liter or more of chromium. Under the proposed "third-third" LDR rule, such waste water would have to be treated to 0.32 mg/l prior to land disposal, even if the waste water, through aggregation or treatment, had less than 5.0 mg/l of chromium (i.e., was not a hazardous waste) prior to it being land-disposed.

EPA may similarly require treatment to below characteristic levels for many of the new TC wastes. If so, many TC wastes would have to be incinerated prior to land disposal to meet the low levels EPA would likely propose for most of the solvent TC wastes. As such, you should be exploring options for pretreatment by incineration, or better yet, find ways to eliminate use of land disposal units for TC wastes.

Step 8: Anticipate the minimum technological requirements, and plan for compliance or develop alternative strategies.

After the effective date of the TC rule (late September 1990), any new landfill, surface impoundment, or waste pile that is used for TC waste (as well as any lateral expansion or replacement of such units) must have double-liners and a leachate collection and leak detection system. Moreover, by four years thereafter (September 1994), an existing surface impoundment that is used for TC waste must be retrofitted to meet these minimum technological requirements. EPA also will consider in its disposal restriction rule for TC wastes whether to shorten this four-year time period for retrofitting impoundments and whether to require retrofitting of landfills in situations where such units are used to manage TC waste that has been granted an LDR capacity variance.

Step 9: Anticipate closure requirements, and plan for compliance or develop alternative strategies.

Units that receive TC wastes after the effective date (late September 1990) will eventually have to close pursuant to stringent RCRA Subtitle C closure requirements. Closure will be triggered when the unit ultimately stops receiving hazardous waste unless the facility applies to delay closure, which is a limited option for certain units.

Step 10: Anticipate corrective action requirements, and plan for compliance or develop alternative strategies

If your facility will have to obtain RCRA interim status for the first time because it will manage a TC hazardous waste, the entire facility will become subject to the RCRA corrective action program. This could result in a requirement to remedy contamination throughout your plant site. On the

TABLE 2
Implementation Timeline
For Toxicity Characteristic

0 Months: Publication in the *Federal Register*

3 Months:

▸ Generators of 1000 kg/mo or more and TSDFs who have not previously notified submit 3010 Notification to EPA.

6 months:

▸ Facilities wishing to avoid entering the RCRA program cease managing newly regulated TC hazardous wastes. Units that were receiving TC hazardous wastes cease further receipt in order to avoid regulation under Subtitle C.

▸ Large quantity generators begin to comply with all applicable Subtitle C regulations for newly regulated TC wastes.

▸ Newly regulated facilities

- Submit Part A permit application.

▸ Already regulated facilities

- Interim Status Facilities: submit amended Part A permit application.
- Permitted TSDFs: submit Class 1 permit modification.

12 months:

▸ Small quantity generators begin to comply with all applicable Subtitle C regulations for newly regulated TC wastes.

▸ Already regulated facilities

- Permitted TSDFs: submit Class 2 or Class 3 permit modifications.

18 Months:

▸ Newly regulated land disposal units: submit Part B permit application and certifications to EPA — Interim Status terminates for those land disposal units that did not submit their Part B permit application and certifications by this date.

other hand, if your facility had interim status, is in interim status, or is subject to permitting for managing other non-TC hazardous wastes, it is already subject to RCRA corrective action, regardless of whether you will also manage new TC wastes.

Step 11: Anticipate the LDRs that will apply to TC wastes at remediation sites, and plan for compliance or develop alternative strategies.

When you remedy sites under the superfund law, RCRA corrective action, closure, and the underground storage tank program,[8] or when you do general plant excavation and construction, you may remove wastes, contaminated soil, debris, and ground water that exhibit the TC. After EPA prepares disposal restrictions for TC wastes, these wastes and contaminated media generally cannot be removed and placed back in a land disposal unit or on the ground unless the wastes and media have been pretreated to very low LDR treatment standards. Companies should consider trying to "beat" this LDR clock at remediation and excavation sites. Try to remedy all TC wastes and TC-contaminated media prior to EPA's promulgation of LDRs for these wastes. This will avoid significant delays and expense.

Notes

[1] The rule is titled "Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristics Revisions." Hereafter the rule will be referred to as the "TC Rule." The TC Rule has been sent to the *Federal Register* for publication and is available in the RCRA Docket Room at EPA in Washington, D.C.

[2] Although there are 40 entries on the Table, there are only 39 distinct constituents. A general cresol category is listed in addition to the distinct cresol constituents — o-cresol, m-cresol, and p-cresol.

[3] *See* 40 CFR 261.3(a)(2)(iv).

[4] *See Environmental Defense Fund v. EPA*, DC DC, No. 89-0598.

[5] Existing treatment, storage, and disposal facilities that are already subject to RCRA Subtitle C need not submit a generator's notification if they determine they are managing TC wastes. All other new generators of TC wastes must submit a generator's notification.

[6] As discussed in Section A, EPA has deferred the TC for petroleum-contaminated media that is being cleaned up under the underground storage tank program. But the TC and LDRs for TC wastes could apply to cleanups of underground storage tanks that contain hazardous substances.

CONGRESS

House Bills And Resolutions Introduced

HR 4255, March 13, to amend the Federal Water Pollution Control Act to add Morro Bay, Calif., to the national estuary program (Panetta) jointly to Public Works and Merchant Marine.

HR 4256, March 13, to provide for the funding of certain wildlife fire programs of the USDA and Interior Department (Robert F. Smith) jointly to Agriculture, Interior, and Appropriations.

EXECUTIVE BRANCH

Justice

The Department of Justice March 14 requested comments on a consent decree lodged March 2 in *U.S. v. J.Y. Arnold and Associates Inc.* (DC WKy, No. C87-0345) involving alleged violations of the Clean Air Act (55 FR 9517). Comments on D.J. 90-5-2-1-1043 should be sent by April 13 to the Assistant Attorney General, Land and Natural Resources Division, DOJ, Washington, D.C. 20530.

DOJ March 14 requested comments on a consent decree lodged Feb. 28 in *U.S. v. R.E.A.G.* (DC Conn, No. B-87-24(TFGD) involving alleged violations of the Clean Air Act (55 FR 9517). Comments on D.J. 90-5-2-1-1076 should be sent by April 13 to the above address.

DOJ March 13 requested comments on a consent decree lodged Feb. 28 in *U.S. v. Akzo Chemicals Inc.* (DC SAla, No. 90-0-162) involving compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (55 FR 9374). Comments on D.J. 90-11-2-406 should be sent by April 12 to the above address.

DOJ March 13 requested comments on a consent decree lodged March 1 in *U.S. v. NAACO Inc.* (DC RI, No. CA-90-0107) involving alleged violations of the Clean Air Act (55 FR 9375). Comments on D.J. 90-5-2-1-1318 should be sent by April 12 to the above address.

MEETINGS

April

Conference on Control of Combined Sewer Overflows, Water Pollution Control Federation, April 8-11, Boston (Libby Strickland, Water Pollution Control Federation, 601 Wythe St., Alexandria, Va. 22314; (703) 684-2417)

Seminar on The Clean Air Act Amendments: Their Impact on You, Air and Waste Management Association, April 11, Richmond, Va. (Air and Waste Management Association, P.O. Box 2861, Pittsburgh, Pa. 15230; (412) 232-3444)

Conference and Exposition on International High Level Radioactive Waste Management, American Society of Civil Engineers, April 8-12, Las Vegas, Nev. (American Society of Civil Engineers, 345 E. 47th St., N.Y. 10017; (212) 705-7543)

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0013-9211/90/$0+ $0

KLEEN BLAST

A DIVISION OF LEISURE INVESTMENT CO.

Kleen Blast All-Purpose Abrasives are available at the following authorized distrubtors in Western Washington, Canada, Alaska and Oregon.

WESTERN WASHINGTON

ANACORTES:
Concrete Nor'West
764 Marches Point Road
Anacortes, Washington 98221 (206) 293-2314
Doyle Assink

BELLINGHAM:
Cascade Building Materials, Inc.
2209 East Bakerview Spur
Bellingham, Washington 98226 (206) 676-2880
Larry Reed & Gary Little

HADLOCK:
Fred Hill Materials Inc.
4990 S.R. #20
Hadlock, Washington 98339 (206) 385-4100
Rich Wallace

BURLINGTON:
Concrete Nor'West
1912 South Burlington Blvd.
Burlington, Washington 98233 (206) 757-3121
Ron Van Dam & Wayne Beath

OAK HARBOR:
Concrete Nor'West
3199 Oak Harbor Road
Oak Harbor, Washington 98277 (206) 675-2626
Joe Short

POULSBO:
Fred Hill Materials, Inc.
16424 LeMolo Shore Drive N.E.
Poulsbo, Washington 98370 (206) 779-4431
Pete Hill & Gary Mort

CANADA

SURREY, B.C.:
O.C.L. Industrial Material, Inc.
13364 Comber Way
Surrey, B.C., Canada V3W-5V9 (604) 594-5050
Dennis Spence, John Reidl &
Alan Waddell

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Plant: 3650 N.W. Yeon Ave., Portland, OR 97210 • (503) 228-3965 • (800) 634-8499 • Fax (503) 228-6807
Plant: 1448 St. Paul Ave., Tacoma, WA 98421 • (206) 383-2168 • (800) 228-4786 • Fax (206) 383-2267

ALASKA

ANCHORAGE:	Great Western Chemical Co. 4175 Tudor Center Drive Anchorage, Alaska 99501 Jim Zimmerman & Mike Brockhoff	(907) 276-6809
FAIRBANKS:	Great Western Chemical Co. 430 West Trainor Gate Road Fairbanks, Alaska 99701 Ken Smith & Mike Curry	(907) 452-1555
KENAI:	Great Western Chemical Co. Mile 17, Kenai Spur Highway Kenai, Alaska 99611 Kathy Cruickshank & Jay Hogeland	(907) 283-4308

OREGON

TUALATIN:	Western Industrial Supply Co. 12505 Southwest Herman Road Tualatin, Oregon 97062-9998 Bruce Miller	(503) 692-9212

DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND

WASHINGTON D.C. 20362

4123 IN REPLY REFER TO
OPR: 55Z314
Ser 5523/569

01 MAR 1988

Kleen Blast, A Division of
Leisure Investment Co.
Attn: Mr. Mark Gadsby
1448 St. Paul Avenue
Tacoma, WA 98421

Gentlemen:

Results of qualification tests conducted on your "Kleen Blast" abrasive blasting media produced at your Pacific Abrasive and Supply, West Carson Road, Grand Forks, B.C., Canada, VOH 1-HO plant indicate conformance of the product with the requirements for Type I of Military Specification MIL-A-22262A(SH). A report of the required plant survey has not been received from DCASMA, Ottawa; however, they have advised this Command by phone that the survey was completed and a report is being forwarded immediately.

Qualification approval is granted the "Kleen Blast" abrasive manufactured at the above plant subject to the conditions printed on the reverse side of this page and contingent upon receipt of a satisfactory plant survey report.

Your product will appear on Qualified Products List QPL-22262 as follows:

Government Designation	Manufacturer's Designation	Test or Qualification Reference	Manufacturer's Name & Address
Type I	Kleen Blast	NAVSHIPYD, MARE ISLAND Rpt.9631 Ser 134.6/34 & NEHC Rpt. 6270 Ser 42p/08213	Kleen Blast, Div. of Leisure Investment Co. 1448 St.Paul Ave. Tacoma, WA 98421 Plant: Pacific Abrasive and Supply West Carson Rd. Grand Forks, B.C. Canada VOH 1-HO

Subj: KLEEN BLAST, DIVISION OF LEISURE INVESTMENT COMPANY
QUALIFICATION APPROVAL - QPL-22262

A copy of Mare Island Naval Shipyard Report 9631, Ser 134.6/34 dated 16 February 1988 is forwarded as enclosure (1) for your information and retention. The NAVSEA point of contact for QPL-22262 is Phyllis Parker, AC 202, 692-9056/Autovon 222-9056.

Sincerely,

Encl:
(1) Cy NAVSHIPYD, MARE ISLAND Rpt. 9631, Ser 134.6/34

DAVID W. NELSON
Division Director
DOD Standardization Program
and Documents Division
By direction of Commander
Naval Sea Systems Command

Christopher L. Getchell
8455 S. 19th Suite 12A
Tacoma, WA 98465
206-565-5492

BTS

BIOASSAY TESTING SERVICES

Acute and Chronic Toxicity Testing

Joe Schmidt
Kleen Blast
1448 St. Paul Ave.
Tacoma, WA 98421

Dear Joe,

Included are the bioassay results on your samples Kleen Blast #16/30 raw and Tru-Grit heavy grade. The testing was performed following DOE 173-303, method 80-12 testing requirements designed to classify material as either dangerous waste, extremely hazardous wastes or non classified as far as bioassays are concerned. This testing is required by the Washington State Department of Ecology before material can be disposed of, either in landfills or by other means.

Please note that the testing I performed did not duplicate the testing performed by the Canadian labs that was in the information you mailed me after the tests had begun. In the testing I performed the trout were exposed to your materials at concentrations of 100 and 1000ppm(.01 and .1%). The testing performed in Canada exposed trout to concentrations ranging from 1000 to 100000ppm(.1 to 10%). If you would like to duplicate the work that was performed in Canada the tests would have to be repeated at higher concentrations of your material. Since they exposed the trout to a variety of concentrations you would need to select the concentration that would satisfy their requirements to avoid unnecessary testing and additional expense.

The results of your material showed 5 out of 30 trout mortalities in the 1000ppm exposure of the Tru-Grit heavy grade material and 1 out of 30 mortalities in the 1000ppm exposure of the Kleen Blast #16/30 raw. There were no mortalities in either of the 100ppm exposures. The results indicate that your material is unclassified as far as bioassays are concerned in Washington State. There would have had to have been 11 mortalities before the state would have imposed any restrictions.

If you have any questions about the information or you want to perform any additional testing please do not hesitate to give me a call. I appreciated the opportunity to perform this work for you.

Sincerely,

Christopher L. Getchell

Christopher L. Getchell
Oceanographer/Biologist

Kleen Blast Report

BIOASSAY TESTING SERVICES
8455 So. 19th
Tacoma, WA 98465
(206) 565-5492

STATIC ACUTE FISH TOXICITY TEST

Customer Name: Kleen Blast
Address: 1448 St. Paul Ave.
Tacoma, WA 98421

Contact: Joe Schmidt
Phone: (206)383-2168

Sample Identification:Kleen Blast #16/30 raw
Analysis Performed: Hazardous Waste Characterization

TEST METHOD:

1. **Toxicity test method used:**
   Salmonid survival test- "General Procedure for Static-Bioassay to Evaluate Industrial Effluent Toxicity," Washington Department of Ecology. Revised January 24, 1984; and Biological Testing Methods. Part A, Static Acute Fish Toxicity Test." DOE 80-12. Revised July 1981.
2. **End point(s) of test:**
   Mortality or 96 hours
3. **Deviations from reference method, if any, and the reason(s):**
   No deviations
4. **Date and time test started:**
   3/21/90, 2000hrs
5. **Date and time test terminated:**
   3/25/90, 2000hrs
6. **Type of test Chamber:**
   Glass chamber, 20"X10"X15"
7. **Volume of solution used/chamber:**
   30 litters, 13" deep.
8. **Number of organisms/test chamber:**
   10 organisms
9. **Number of replicate test chambers/treatment:**
   3 replicates
10. **Acclimation of test organisms(mean and range):**
    30 days, 10 to 90 days
11. **Test temperature (mean and range):**
    12 degrees centigrade, (11.8, 11.5-12.4)

TEST ORGANISMS:

1. Scientific name:
   Salmo gairdneri(rainbow trout)
2. Age:
   34 days
3. Life stage:
   Fingerling
4. Mean length, weight, and loading:
   2.1cm, .38gms
5. Source:
   Cascade Rainbow Trout Fish Farm
6. Food:
   Trout chow
7. Lighting:
   16 hours light, 8 hours dark, 50 to 100 foot candles
8. Diseases and treatment:
   No diseases detected, no treatment necessary
9. Dilution water used in test:
   Dechlorinated and aged municipal water

CHEMICAL ANALYSIS:

1. Physical and chemical methods used:
a. Temperature-Digital temperature probe
b. Dissolved oxygen-Membrane Electrode/Azide Modification
c. pH-Standard electrode
d. Conductivity-Conductivity meter
e. Hardness-Titrimetric/EDTA
f. Alkalinity-Titrimetric/Phenolphthalein-Sulfuric acid
g. Weight-Beam balance
h. Residual chlorine-Colorimetric/Ortho-tolidine
i. Ammonia-Colorimetric/Nesslerization
j. Nitrate-Colorimetric/Cadmium reduction

RESULTS:

1. Concentration:
a. 1000 mg/l(ppm)
b. 100 mg/l(ppm)
c. Control
2. Observed effects:
a. 1/30 mortalities
b. 0/30 mortalities
c. 0/30 mortalities
3. Raw biological data, including daily records of affected organisms in each concentration(including controls):
a. See appendix "A"
b. See appendix "A"
c. See appendix "A"
4. Summary table of physical and chemical data:
a. See appendix "A"
b. See appendix "A"
c. See appendix "A"

APPENDIX B

PAINTING OPERATIONS

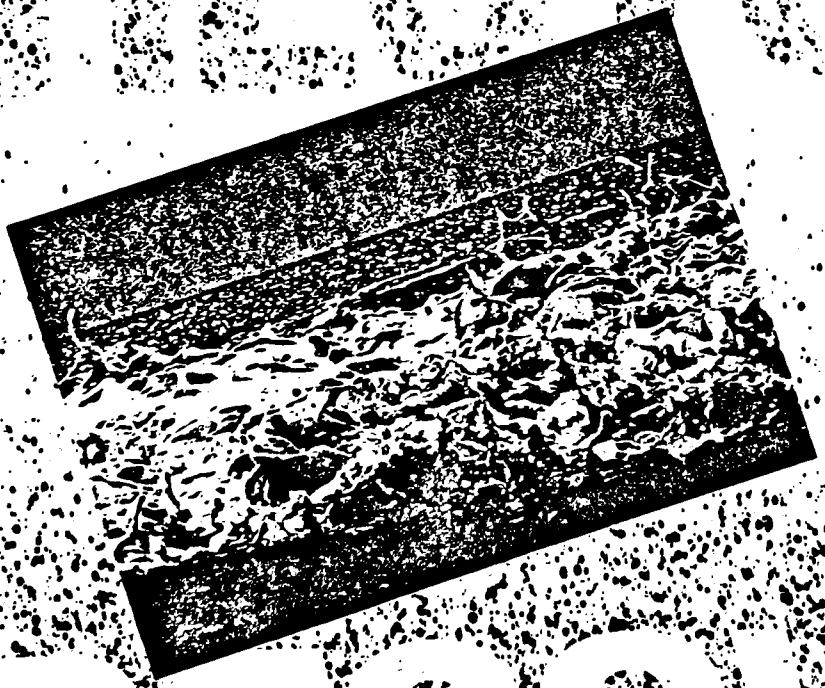
NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.

CONSERVE

Paint booth waste
minimization series

RECYCLE



RECOVER

THE SOLUTION IS CLEAR: Continuously de-water, compact, and discharge paint solids. Reuse booth water indefinitely.

THE PROBLEM

The water wash spray booth continues to be a valuable and necessary production tool for entraining oversprayed paint solids. Historically, these solids have been disposed of along with the booth liquids during routine maintenance operations. As environmental considerations have broadened, so have the costs of disposal of these materials. **It is no longer a financially or environmentally sound practice to dispose of the entire contents of a water or oil-based spray booth.** In California, some paint wastes command a disposal cost of $600 per 55 gallon drum plus pumping and trucking costs. Manpower costs to clean the remaining components of the booth are, of course, additional. **As the number of disposal sites decreases and as the classification of these wastes becomes more stringent, disposal costs will continue to escalate.** Clearly, controlling costs in this activity is of ever greater importance.

The greatest savings to be realized will come from minimizing the volume of wastes presented for disposal. State and federal regulations notwithstanding, it makes good business and social sense to recover and recycle. Adding to the volume of waste by selecting dry booth panels, various filter media, or massive dosing of clay media only adds to the disposal costs.

THE SOLUTION

The answer is remarkably simple.

Separate the waste paint solid from the liquid media without consumable elements. Dispose of the solid fraction and indefinitely reuse the liquid phase.

THE FUTURE

As the legal ramifications of waste storage transport, and disposal continue to multiply managers will focus more sharply on the absolut destruction of waste materials. Destroying thes wastes will result in even higher charges. MICROSEPARATORS will play an ever increasing role in holding down these costs and will comple ment nicely the use of further treatment technologies by minimizing the volumes to be treated

Waste paint solid from TSK 50M. Solid content appro mately 50% by weight.

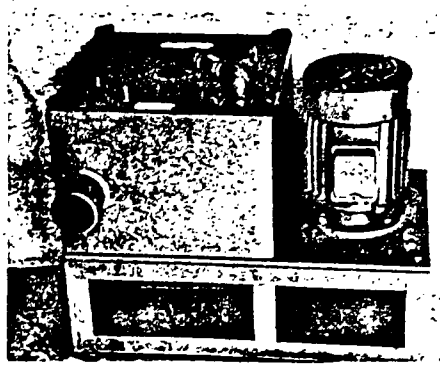
THE ANSWER IS HERE: MICROSEPARATION, a twenty year old answer to a brand new problem.

MICROSEP

ESULTS YOU CAN SEE
THE FACTORY AND ON
HE BOTTOM LINE.

- odest capital cost
- remely low maintenance
- nimal power requirements
- consumable items
- ry few moving parts
- ll factory support available
- ut disposal costs dramatically
- use booth water indefinitely
- CRA compliance
- eserve booth components
- iminate booth downtime
- ve related cleanout costs
- st justification in months—
  t years

NO OTHER centrifugal device in the world can survive harsh, industrial environments better than the MICROSEPARATOR.



TSK 50M

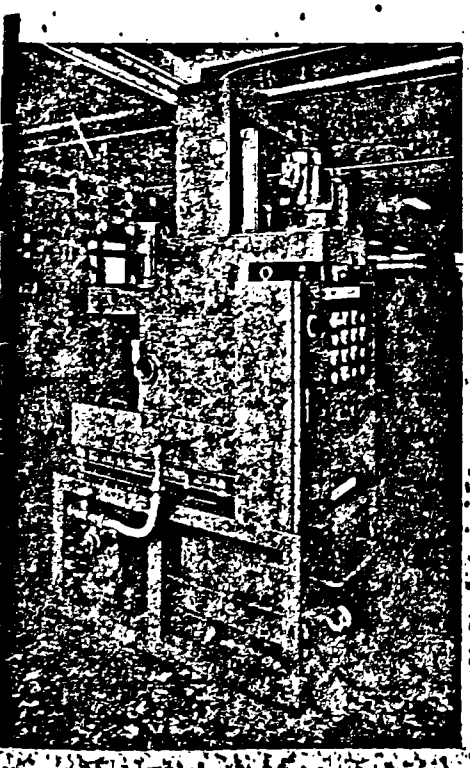
EQUIPMENT SELECTION FOR SPRAY BOOTHS OF 500–50,000+ GALLONS

Available in fully automatic or manual execution

GENERAL SPECIFICATIONS

	manually cleaned		automatic self-cleaning	
	50M	TSK 80M	TSK 100A	TSK 150A
Flow gpm	10 gpm	15 gpm	28 gpm	45 gpm
Power req	230/460V	230/460V	230/460V	230/460V
Motor HP	2 hp	3 hp	3 hp	5 hp
Dimension	26×15×20″	32×20×20″	35×20×67″	40×24×99″
Weight	176 lbs.	352 lbs.	1320 lbs.	1760 lbs.

ON SITE TESTING SERVICES AVAILABLE



SK 150A

R A T O R

General information useful for discussion of MICRO-SEPARATOR application in painting industries. Please complete this section and have available for discussions.

Booth type and mfg.

Total # and volume of booths

Current maintenance program

Chemical treatments in use

Chemical supplier

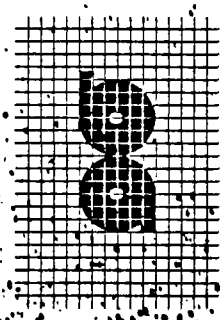
Estimated annual disposal costs

Percent solids of paint in use

Approximate transfer efficiency

Paint use in gallons/month

NOTE: It is useful to think of the solid phase of the paints you are currently using. If an average gallon of your paint is 50% solid and your transfer efficiency is 50%, then one-quarter of each gallon of paint sprayed is waste collected by the booth sump. By disposing of only this solid phase it is easy to see how the MICROSEPARATOR can reduce your disposal costs by as much as 75%.



Exclusive representation of the MICROSEPARATOR for North America and Europe by:

BAZELL ASSOCIATES, INC.
2334 Belford Drive
P.O. Box 31634
Walnut Creek, CA 94598
Phone (415) 256-0558
Fax (415) 256-7493

representing Bazell Associates:

Filtration/Treatment Systems
Design & Equipment
Post Office Box 18588
Seattle, Washington 98118
206 - 722-1330

Printed on 100% recycled paper

The New *LIGHTHALL SC 1100* TM
Spray Gun Cleaning Station
Clean Your Gun Inside And Out

Create a safer/healthier shop environment and save money

The Lighthall spray gun cleaning station is an air-driven, solvent condensing unit that is designed to sit on top of a 55 gallon drum or mounted on a work bench. The S C 1100 can be used with siphon-feed or pressure feed spray guns, draws the cleaning solvents into the durable fiberglass unit and condenses them back into liquid.Put our unit on a 55 gallon drum with a removable lid and satisfy the E.P.A.'s double wall containment rule as well.

Features:

>Minimizes evaporation of organic compounds into the atmosphere during spray gun clean up
>Cleans guns the way they were designed to be cleaned
>Saves money by reclaiming solvents
>No pumps to wear out/No filters to change
>Gun hanger and trigger lock
>Greatly reduces VOC levels
>Totally enclosed cleaning tray
>THE SOLUTION TO YOUR SHOPS COMPLIANCE

LIGHTHALL SC 1100

499.00

LIGHTHALL INDUSTRIES
934 BAY ST.
SANTA CRUZ, CA 95060
(408)429-5111

BINKS

Bulletin A93-19R

MACH 1 HVLP Spray Gun

Complies with SCAQMD Rules 1136 and 1151

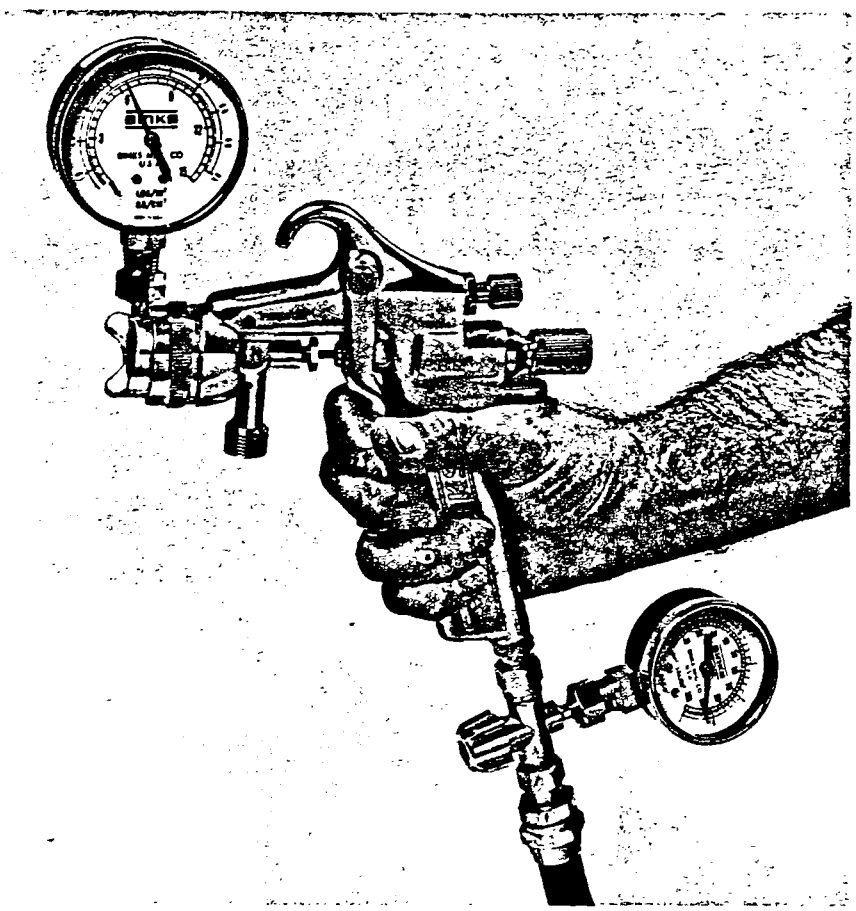
MACH-1

High Volume Low Pressure as it was meant to be.

The Binks Mach 1 High Volume Low Pressure Spray Gun is a conventional airspray with special modifications and unique nozzles that allow the gun to operate within the SCAQMD* regulations. The air passage in the gun handle incorporates a "sonic venturi" which limits air flow by creating a Mach 1 shock wave in the venturi throat. Special air and fluid nozzles allow the gun to atomize the fluid at low air pressures and velocities, creating a soft spray effect that produces high transfer efficiencies.

The sonic venturi and the gun nozzles interact to limit the air pressure to a maximum of 10 PSI at the nozzle. Normal operating pressures at the air nozzle are 3 to 5 PSI where the best transfer efficiency is obtained.

Binks Mach 1 HVLP Spray Gun operates like a conventional spray system utilizing shop compressed air. No expensive turbines...no bulky, cumbersome "vacuum cleaner" type hoses. The Binks Mach 1 sprays like our most popular air spray guns that you have become accustomed to. No new techniques to learn. Mach 1 produces a finish quality that you expect from a Binks spray gun.



Binks Mach 1 HVLP Spray Gun *Special nozzles and sonic venturi in the air passage interact to limit the air pressure at the nozzle to a maximum of 10 PSI. Complies with the SCAQMD regulations as a High Volume Low Pressure (HVLP) air spray gun.*

Benefits of the MACH 1 HVLP System:

Efficiency
Transfer efficiency as required by today's air quality regulations. Meets SCAQMD Rules 1136 and 1151.

Cost Efficient Compressed Air Consumption
Ranges from 11 to 20 SCFM depending on operating pressure. A 3 to 5 horsepower air compressor is normally sufficient to supply atomizing air.

Controllable
Total control of atomizing air pressure, fluid flow and spray pattern. Operates with ambient temperature compressed air from your shop or plant air supply. No turbine, no bulky hose, no unwanted heat in the atomizing air.

Performance
Finish quality as you expect from the world leader in spray gun technology.

Reliable
Genuine Binks quality...the name you have relied on for almost 100 years.

Rugged
Virtually indestructible drop forged gun body and stainless steel fluid passages.

Versatile
Can be used with attached one quart pressure assist cup, two quart remote pressure cup, pressure tank of any size, or low pressure pump.

Light Weight/Maneuverable
Light weight materials have been used. Sleek shape fits comfortably in the operator's hand. Small size allows maneuvering into tight corners to coat the hard to reach areas, no bulky airhose to get in the way.

Simple to Operate
No special training is required. Operates like a conventional spray gun.

*The SCAQMD (South Coast Air Quality Management District) is responsible for VOC emission regulations and enforcement in the Los Angeles basin. The current VOC regulations in Southern California are important to the coatings/finishing industry in the rest of the country, because other states tend to follow Southern California's lead in VOC rulemaking.

HVLP as it was meant to be!

MACH 1
HVLP Spray Gun

Mach 1 HVLP Cup Outfits for Vehicle Refinishing

High transfer efficiencies are obtainable when using typical automotive refinish enamels including new low V.O.C. compliant materials.

Model 98-1130
One Quart HVLP Outfit
Lightweight HVLP outfit ideal for all vehicle refinishing. Stainless steel pressure assist cup that is simple to clean and will not drip when turned vertically up or down.

Outfit consists of:
Mach 1 HVLP Spray Gun
80-272 1 Qt. S.S. Pressure Assist Cup

Model 98-1131
Remote 50 Ounce Stainless Steel Pressure Cup HVLP Outfit for refinishing larger vehicles or when less refilling is desirable.

Outfit consists of:
Mach 1 HVLP Spray Gun
80-270 S.S. 50 oz. Pressure Cup
71-1101 5' Air Hose
71-3380 5' Fluid Hose
73-125 Air Controller (optional at extra cost)

Model 98-1132
Steadi-Grip 2 Qt. Pressure Cup HVLP Outfit *(not shown)*

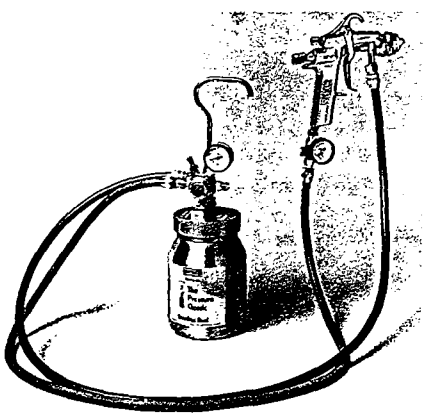
Outfit consists of:
Mach 1 HVLP Spray Gun
80-228 2 Qt. Pressure Cup
71-1101 5' Air Hose
71-3380 5' Fluid Hose
73-125 Air Controller (optional at extra cost)

Air and Fluid Nozzles

Material	Fluid Nozzle/ Orifice	For All Nozzles Air Cap 95P Inlet PSI	SCFM	Approx. Atomizing Pressure
LIGHT: stains, varnishes, thin lacquers	91 (.040)	45	11.0	3
MEDIUM: automotive refinishing materials, general industrial coatings	94 (.055)	65	15.7	6
HEAVY:	97 (.0700)	85	19.6	9
		95	22.5	10

Model 98-1130 HVLP Outfit

Model 98-1131 HVLP Outfit



Mach 1 HVLP Pressure Tank Outfits

Model 98-1133
Two Gallon Pressure Tank HVLP Outfit for refinishing large vehicles or light industrial duty.

Outfit consists of:
Mach 1 HVLP Spray Gun
83-5668 2 Gallon NON-ASME Tank
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1134
Two Gallon Pressure Tank w/Agitator HVLP Outfit *(not shown)*

Outfit consists of:
Mach 1 HVLP Spray Gun
83-5676 2 Gallon NON-ASME Tank w/Air Motor Agitator
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1135
Two Gallon Pressure Tank HVLP Outfit *(not shown)*

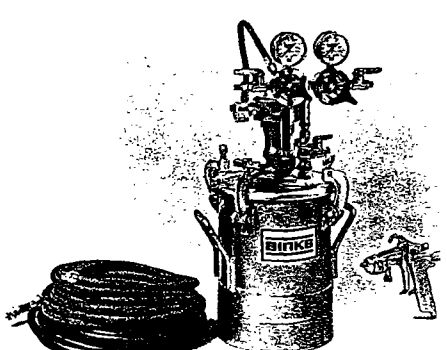
Outfit consists of:
Mach 1 HVLP Spray Gun
83-5502 2 Gallon ASME Tank
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1136
Two Gallon Pressure Tank w/Air Motor Agitator HVLP Ou

Outfit consists of:
Mach 1 HVLP Spray Gun
83-5508 2 Gallon ASME Tank w/Air Motor Agitator
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1133 HVLP Outfit

Model 98-1136 HVLP Outfit



Mach 1 HVLP Pressure Tank and Pump Outfits for Industrial Use

Model 98-1137
Five Gallon ASME Pressure Tank HVLP Outfit *(not shown)*

Outfit consists of:
Mach 1 HVLP Spray Gun
83-5402 5 Gallon ASME Tank
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1138
Five Gallon ASME Pressure Tank w/Agitator HVLP Outfit

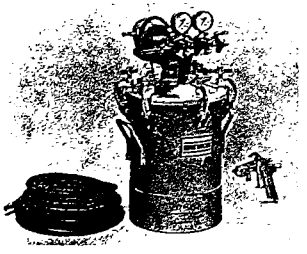
Outfit consists of:
Mach 1 HVLP Spray Gun
83-5408 5 Gallon ASME Tank w/Agitator
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1139
Pogo B 55 Gallon Pump HVLP Outfit *(not shown)*

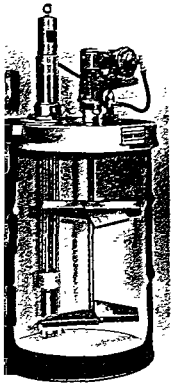
Outfit consists of:
Mach 1 HVLP Spray Gun
41-3936 Pogo B Pump Outfit
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.

Model 98-1140
Comet 55 Gallon Pump HVLP Outfit

Outfit consists of:
Mach 1 HVLP Spray Gun
41-5003 Comet Pump Outfit
71-1205 25' Air Hose, 5/16" I.D.
71-3303 25' Fluid Hose, 3/8" I.D.



▲ Model 98-1138 HVLP Outfit



Model 98-1140 HVLP Outfit ◀

Oil & Water Extractors with Regulators

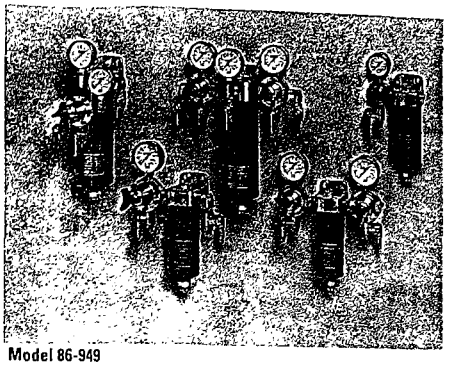
Extractors

Model 86-940
30 CFM, Filter rating 10 microns (absolute), 5 microns (nominal). Compact...single gun operation, 1/2 NPT(f) inlet, 1/4 NPS(m) outlet. Shpg. wt. 4½ lbs. Part Sheet 1958. *Order replacement filter Model 86-1017.*

Model 86-945
40 CFM, Filter rating 10 microns (absolute), 5 microns (nominal). Single or dual gun operation...dual filtration. Main line outlet for dusting gun, regulated outlet for spray gun. Air inlet 1/2 NPT(f), 2 outlets 1/4 NPS(m). Shpg. wt. 5 lbs. Part Sheet 2012.

Model 86-974
40 CFM, 2-gun operation. Same as Model 86-945 except with 2 regulated outlets.

Model 86-948
60 CFM, Filter rating 10 microns (absolute), 5 microns (nominal). Has filtered air capacity for two production guns and a dusting gun. Air inlet 3/4 NPT(f), 3 outlets 1/4 NPS(m). Main line outlet and regulator have gauges. Shpg. wt. 15 lbs. Part Sheet 1976. *Order replacement filter Model 86-1018.*



Model 86-949
100 CFM, Filter rating 10 microns (absolute), 5 microns (nominal). Has one main line and two regulated stations of filtered air for handling one dusting gun and up to 4 spray guns simultaneously. Regulators maintain pressure settings...are capable of independent regulation. Air inlet 3/4 NPT(f), 5 outlets 1/4 NPS(m). Main line and each regulator has gauge. Shpg. wt. 21 lbs. Part Sheet 1977. *Order replacement filter Model 86-1018.*

Optional Features

Model 73-125 Spray Gun Controller
For air inlet, at the gun mounting to give convenient, immediate pressure reading and correction. Anodized aluminum body is fitted with: Swivel connection, 1/4 NPS(f), for 360 degree variable position. Male thread, 1/4 NPS. Pressure adjusting knob and pressure gauge.

Model 92-1039 Compressed Air Heater
Binks air heater is used to warm the compressed air to reduce condensation of moisture. The heater includes a single 1000 watt, 120 V, single phase element.

Model 86-1001 ECD System
20 CFM. The Binks ECD System is a new triple cleaner/dryer for compressed air used for spray painting...operation of pneumatic tools, and wherever clean, dry air is essential. The system consists of an extractor, coalescer, and dryer assembled in a compact single unit for convenient installation and use.

Model 54-3935 Air Nozzle Test Gauge
For testing air pressure at the gun nozzle.

Branch Offices With Warehouse Facilities

Atlanta, GA
5575 Spalding Drive, P. O. Box 920400
Norcross, GA 30092 ..... (404) 447-5600
Chicago, IL
9201 West Belmont Avenue, Franklin Park, IL 60131-2887 . (708) 671-3000
Cleveland, OH 44142, 15401 Commerce Park Drive,
P.O. Box 42120..... (216) 362-8500
Dallas, TX
14340 Proton Road, Farmers Branch, TX 75244-3594,
P. O. Box 596-75001, Addison, TX 75001-0596 ..... (214) 233-2500
Denver, CO 80223-4015
2191 South Platte River Drive, P.O. Box 10218,
Denver, CO 80210-0128 ..... (303) 936-7226
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2553 South Garfield Avenue
P.O. Box 22147, Los Angeles, CA 90022 .... (213) 888-9955
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Pine Brook, NJ 07058-0696..... (201) 575-6660
Philadelphia, PA 19140, 4301 Rising Sun Avenue
P. O. Box 46008, Zip 19160-6008 ..... (215) 329-7800
Pittsburgh, PA 15234
Pittsburgh Spray Equipment Co., 3601 Library Road.....(412) 882-4550
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South San Francisco, CA 94080 ..... (415) 589-8477
Seattle, WA
1749 First Avenue, South
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BINKS

APPENDIX C

SOLVENTS

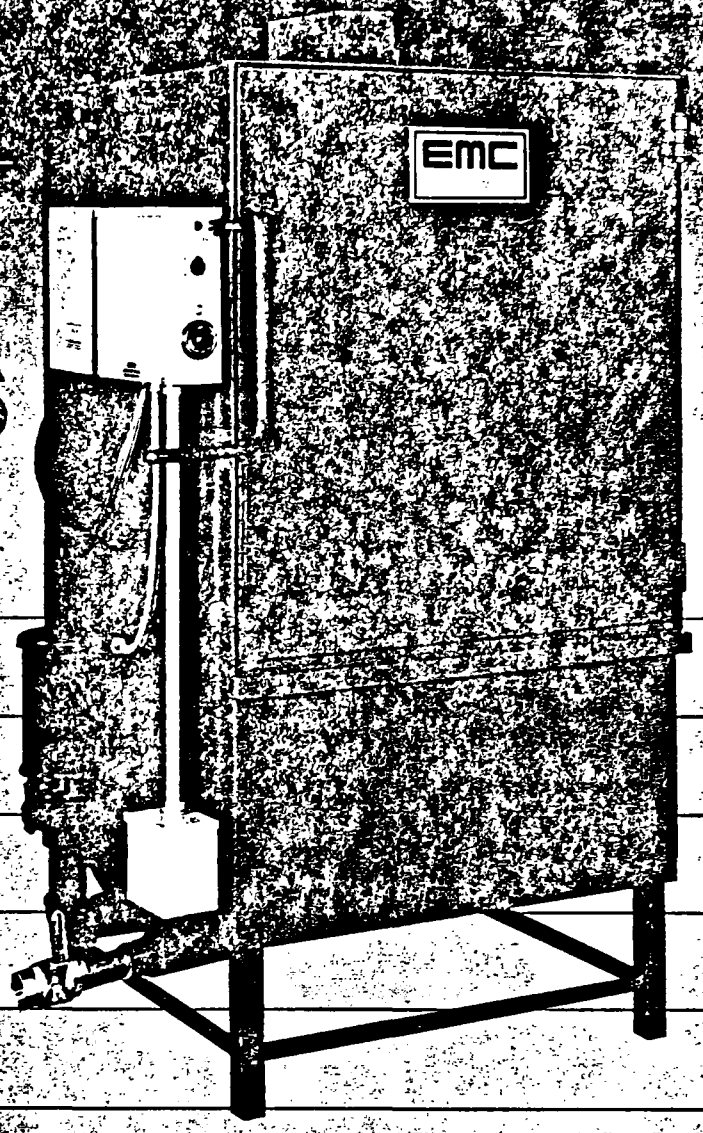
NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.

They Do The Scrubbing For You!

EMC

AUTOMATIC PARTS WASHERS



- Fast, Thorough
- Labor-Saving
- Innovative Features
- Practical Design
- Quality Construction
- Standard Components
- Versatile
- Reliable
- Economical

WESTERN EQUIPMENT
18908 HWY 99 SP 2B
LYNNWOOD, WA 98036
(206) 774-2933
1-800-888-6998 NATIONWIDE

EMC
EQUIPMENT MANUFACTURING CORPORATION

The Line That is Designe

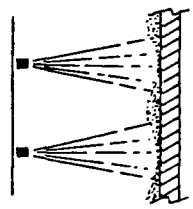
EMC AUTOMATIC PARTS WASHERS

***What's so special about* EMC Automatic Parts Washers?**

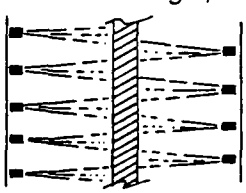
Quite simply, it's the fact that they have been designed and constructed to eliminate many of the basic operational and reliability problems inherent in other parts washers.

CLEANING ABILITY

Obviously, you expect an automatic parts washer to clean. But, how **thoroughly** it cleans can be dependent on a number of design features. For example, most parts washers have a limited number of spray jets arranged in a fan formation. The problem with this arrangement is that most of the fans strike the parts a glancing blow at an angle, losing most of their impact and cleaning ability.



Inefficient Cleaning



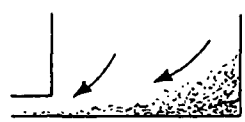
Thorough Cleaning

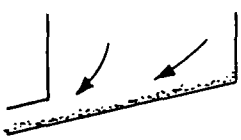
Moreover, large parts with surfaces near the jets frequently have untouched, uncleaned spaces; in turn, the fans frequently overlap on small parts, impacting on each other and losing power by the time they hit the parts.

By contrast, EMC washers employ arrays of parallel, straight jets, spaced and staggered to strike at 3/4" intervals, thus ensuring maximum impact and scrubbing ability.

MAINTENANCE REQUIREMENTS

Perhaps you enjoy the challenge, time and mess of periodically trying to shovel or hose accumulated debris from the flat floor of traditional washers. On the other hand, if you've better use for your time, you'll appreciate the deep funnel floor and drain of EMC washers. Just open the bottom drain and debris flows out for easy disposal. Typical cleanout time is just 3 to 10 minutes with EMC washers.

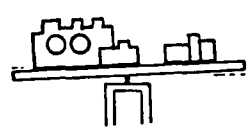


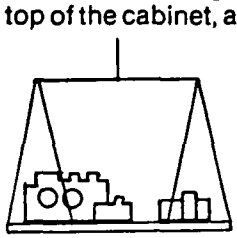


RELIABILITY

Having a machine down for repairs does nothing to enhance your operation's profitability. So, EMC Automatic Parts Washers have been designed to eliminate some of the worst troublespots.

Take the turntable drive system, for example. Other parts washers mount the drive beneath the turntable where it's subject to a constant flood of washwater as well as the grease and grime that's being removed. In addition, the weight of the parts creates a leveraged, wearing strain on the bearings, if the load is not perfectly centered and balanced. By contrast, EMC washers are designed with the drive and turntable bearing at the top of the cabinet, away from the wash fluid, and with a suspended turntable so that it is able to support weights with less strain and wear. EMC turntables rotate smoothly with the load anywhere on them.



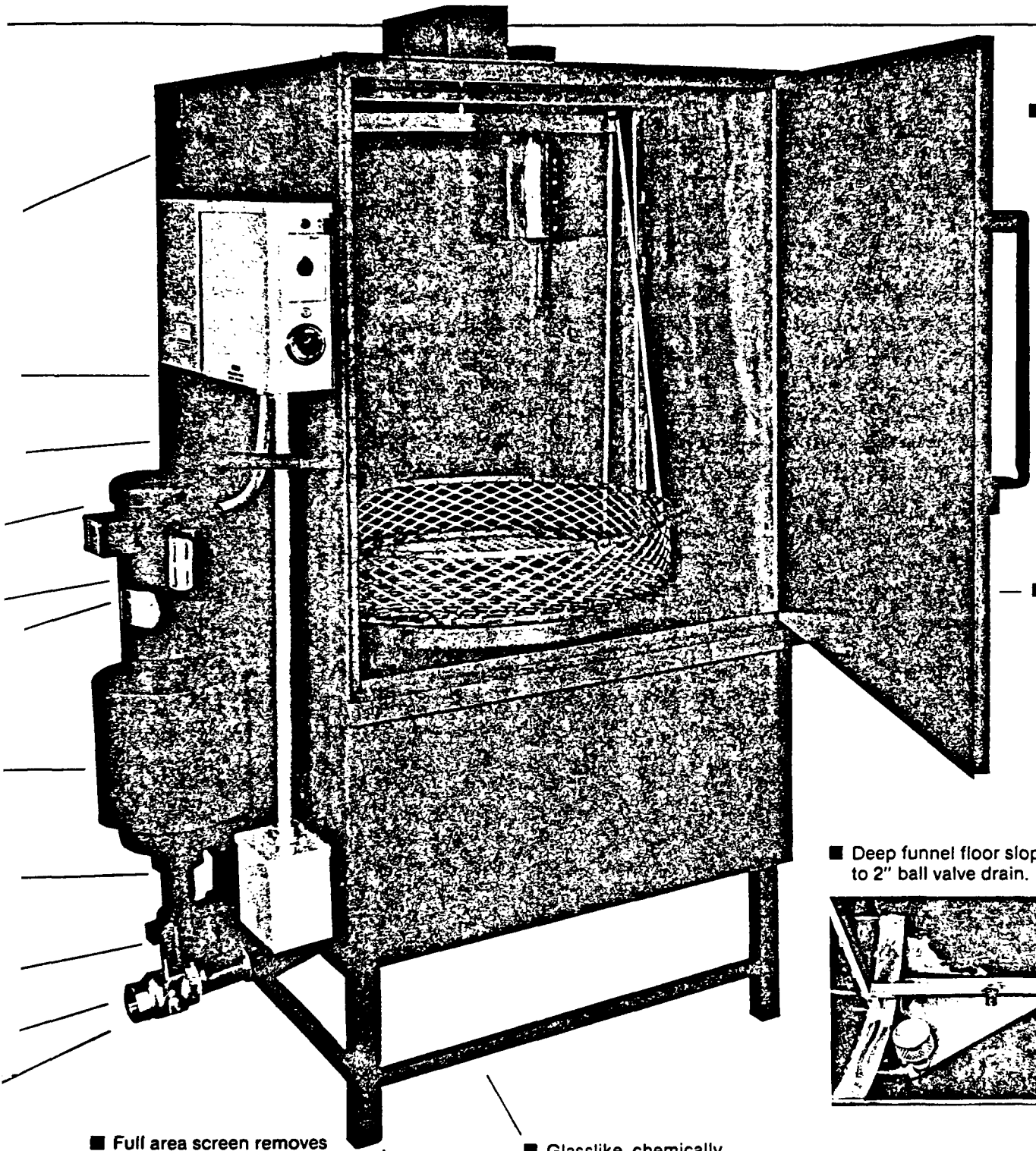


And, should repairs ever be needed, there is no waiting for special parts to be shipped from the factory. The EMC washers utilize common, industry-standardized components which are available locally, and all are readily accessible.

These are just a few examples that indicate why EMC Automatic Parts Washers are the overwhelming choice of smart buyers.

- Overhead turntable suspension using 1 RP belt drive. No bearings or lubrication points *inside cabinet.*
- 7-day heating start-up timer (optional on son *models).*
- Micro-switch door interlock.
- 30-minute wash cycle timer.
- Adjustable thermostat
- Simple in-field *conversion between* 1-phase or 3-phase source.
- Exclusive *severe-duty* pump with open well available as option on except Model 50.
- Electric heating stand optional automatic-ignition gas heat available.
- Fully heat-insulated cabinets.
- Optional basket sizes available.
- Double containment system available on a models.

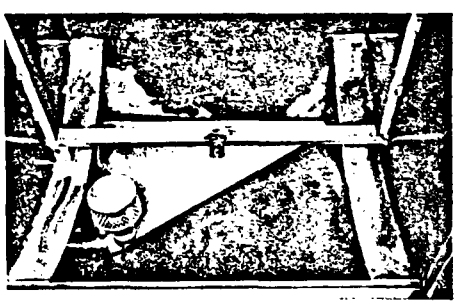
To Meet YOUR Needs...



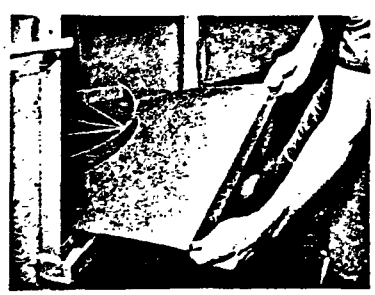
■ Single cleanout port on 360° manifold.

■ No rubber gasket to fail; metal-to-metal seal.

■ Deep funnel floor slopes to 2" ball valve drain.



■ Full area screen removes for complete access to solution tank.



■ Glasslike, chemically resistant polyurethane finish.

■ Leveling legs.

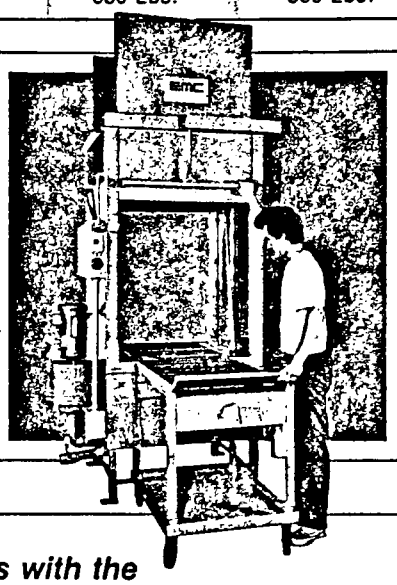
5 *STANDARD MODELS AVAILABLE*

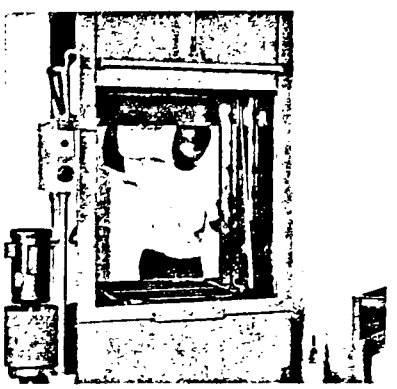
SPECIFICATIONS:

MODEL	50	80	DS80	100	T100
Max. Load Size	28" x 30" Tall	28" x 38" Tall	28" x 74" Tall	34" x 38" Tall	34" x 50" Tall
Floor Space	32" x 42" Wide	32" x 42" Wide	32" x 42" Wide	38" x 48" Wide	38" x 48" Wide
Floor to Turntable	35"	34"	34"	34"	34"
Fluid Capacity	40-50 Gal.	60-80 Gal.	60-80 Gal.	80-100 Gal.	80-100 Gal.
Pump G.P.M.	110	110	120	120	120
Approximate Ship. Wt.	500 Lbs.	650 Lbs.	800 Lbs.	800 Lbs.	900 Lbs.

PLUS
OUR UNIQUE
PASS-THROUGH PARTS WASHERS

Write or call for information.



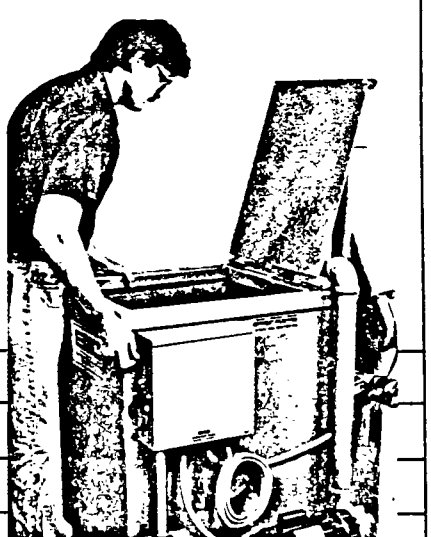


Slash Washer-fluid Disposal Costs with the

EMC WATER EATER

Why pay high disposal costs for "hazardous waste" fluids which are as much as 97% plain water? Eliminate the water first and slash your costs this safe, economical way.

- Eliminates three to eight or more gallons of water per hour.
- No drains needed; no sticky residue to dispose of.
- Thru-floor electric-heating; no gas piping or flame hazards.
- Power exhaust for easy venting.



RELIABILITY VIA QUALITY

■ **Parts Washers** ■ **Hot Tanks** ■ **Liquid Waste Elimination Systems** ■ **Small-parts Tumbler**

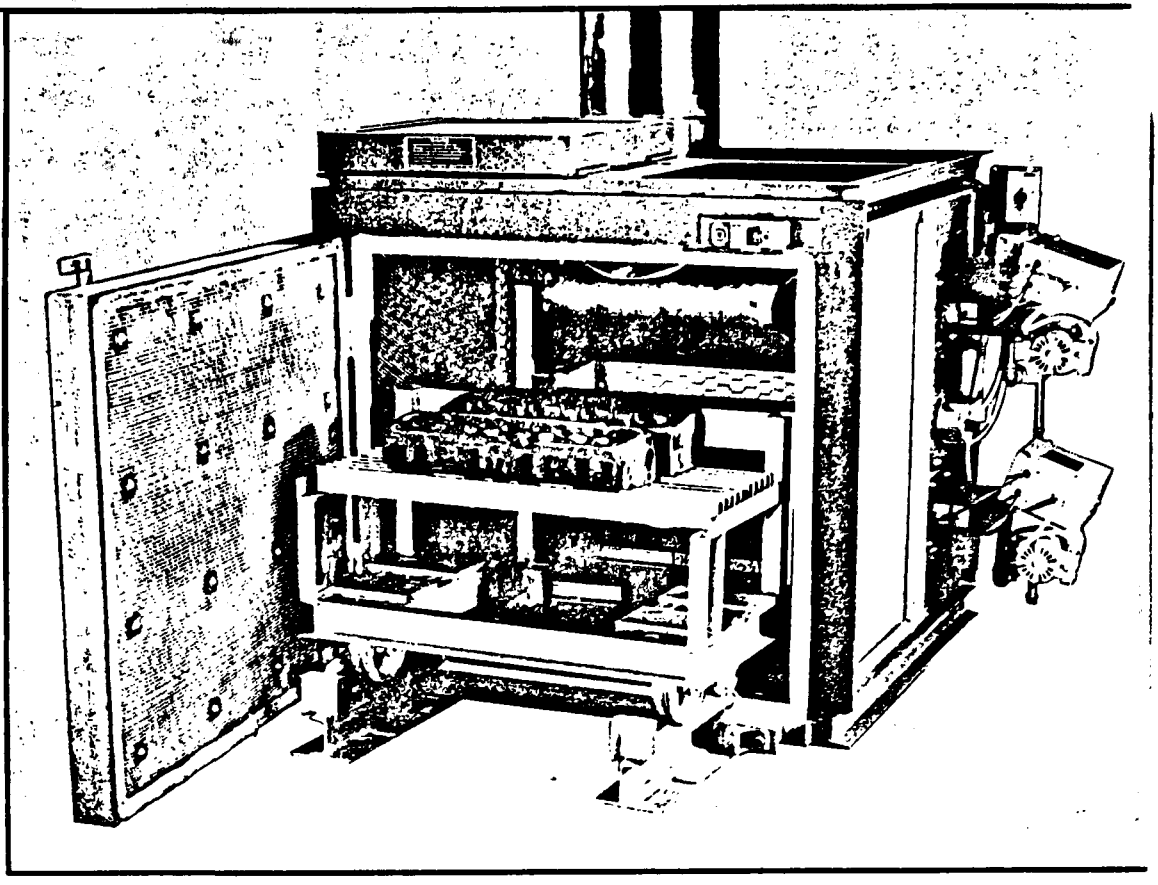
EMC
EQUIPMENT MANUFACTURING CORPORATION

1433 Lidcombe Avenue
South El Monte, California 91733
(818) 575-1644

3/89 Printed in U.S.A.

NOW

for the Automotive Jobber!



- Cycle Time 30 Minutes to 2 Hours
- RAPIDLY cleans
  - BLOCKS
  - WATER PUMPS
  - AND MORE!

POLLUTION CONTROL PRODUCTS PRESENTS THE

DRY CLEANER II

Pollution Free Short Cycle Engine Parts Cleaner

#5985.00

8 Money Saving Advantages of the Dry Cleaner II

- Short cycle reduces rebuild time.
- Parts come out of furnace dry . . . ready for shot blasting.
- Eliminates water solvent cleaning! The energy efficient "Dry Cleaner II" eliminates costly hot tank chemicals and there's no liquid chemical waste to dispose of. (Very important to the EPA).
- Controlled, even temperature protects your parts.
- Small, compact unit requires minimum floor space.
- Low operating cost: Less than one dollar per cycle, average.
- Completely automatic . . . requires no supervision!
- Easy to install yourself. Comes complete with all parts and accessories necessary for normal installation.

POLLUTION CONTROL PRODUCTS CO.

(see Specifications and Data on back)

SPECIFICATIONS and DATA

CABINET: Heavy-gauge sheet steel supported by structural steel angles and channels. All-welded construction with sealed seams to prevent air leakage gives maximum fuel economy.

FLOOR: Hard castable refractory, 3" thick, reinforced with structural steel channels. Allows easy removal of ashes.

EXPLOSION RELIEF: Required on all furnaces and ovens. Unique gravity-sealed top relief door automatically opens to relieve excess pressure, then closes, preventing air from reaching combustible material.

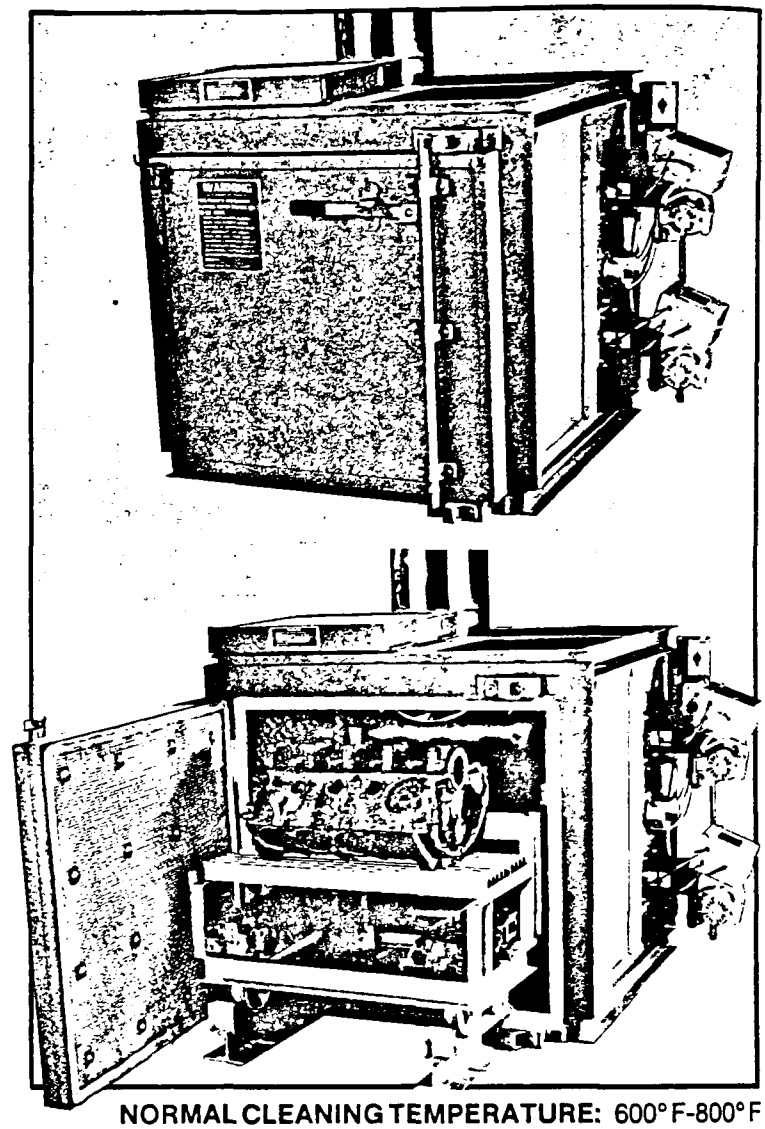
INSULATION: Walls, ceiling, and doors are covered with 3" of a two-layered light-weight ceramic fiber blanket insulation anchored on stainless steel pins, stainless wire mesh, and stainless locking washers. Contains no asbestos and has superior properties to asbestos or fiberglass. Hot face insulation rated at 2300° F (1275° C), one inch is equivalent to 9" conventional refractory or Firebrick with one-tenth the weight making these furnaces much lighter in weight and much faster to heat with less fuel.

VENT STACK: Made in 36" long light-weight sections for easy installation. Galvanized metal exterior lined with high-temperature ceramic fiber in hard form. Sections snap together. Adjustable pitch roof flashing, storm collar, and rain cap furnished with stack. Supplied with 4 sections.

FUELS: Natural gas, propane gas, or #2 fuel oil. Maximum input 300,000 BTU per hour. Gas pressure required 7 inches water column (0.18m).

ELECTRICAL SERVICE: 110-125 volts, 50-60 hertz, single-phase, 5 ampere draw. Optional transformers available for other voltages.

NORMAL CLEANING TIME: ½ to 2 hours depending on load plus cooling time. Adjustable automatic timer.



NORMAL CLEANING TEMPERATURE: 600° F-800° F (315° C-415° C).

POLLUTION STANDARDS: Meets latest E.P.A. Environmental Standards

SAFETY AND HEALTH STANDARDS: Meets latest O.S.H.A. Federal Standards.

DIMENSIONS

OUTSIDE DIMENSIONS						DOOR OPENING				INSIDE DEPTH		CART DIMENSIONS								APPROX. SHIP. WT.	
WIDTH A		DEPTH B		HEIGHT C		WIDTH		HEIGHT				WIDTH		DEPTH		HEIGHT (from bottom)		HEIGHT (from grate)			
IN.	M.	IN.	M.	IN.	M.	IN.	M.	IN.	M.	IN.	M.	IN.	M.	IN.	M	IN.	M.	IN.	M.	LBS	KGS
46	1.17	43	1.09	45½	1.16	36	.91	33	.84	21	.53	33	.84	21	.53	25½	.65	18	.46	1607	730

Manufactured by

POLLUTION CONTROL PRODUCTS CO.

Sales Offices in Principal Cities

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FACTORIES
2677 FREEWOOD DRIVE
DALLAS, TEXAS 75220
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TELEX 709610

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AUTOMOTIVE ENGINE REBUILDERS ASSOCIATION ®

Interel
Corporation
Environmental Control Systems

November 30, 1990

INTEREL QUOTATION NO. 901-195

Barrel Distiller Model B-SC 200

The Barrel Distiller consists of an insulated stainless steel vessel with cover and stainless steel condenser. The vessel is designed to accept a standard 55 gal drum. Heat transfer liquid (usually water, glycol, or polyethylene glycol 400) is required to fill the vessel around the drum.

Two thermostatically controlled electric heating elements in explosion proof housings are supplied to maintain the heat transfer liquid at the selected temperature. A separate adjustable safety temperature switch shuts off the heaters in the event of a temperature rise above the set point condition. Also provided is a direct temperature gauge. A threaded flexible pipe connection with pressure release valve is supplied to connect the 2 inch barrel opening with the externally mounted, stainless steel condenser.

Standard control instrumentation provided use intrinsically safe circuits and as such are explosion proof in accordance with NFPA Class 1, Group D, Division 1 requirements. Included are a low flow safety switch for cooling water, thermostatic and high temperature limit controls for the heating elements, low level safety switch for heat transfer liquid and vapor pressure relief valve.

An electrical panel is supplied with on-off switch and power-on light. The electric heaters are interlocked with six safety contacts (includes two spares). Standard panel is not explosion proof and is approved for use with non-flammable liquids only, or for mounting outside of the hazardous area (explosion proof panel optional).

P.O. Box 4676, Englewood, CO 80155 Telephone: 303/773-0753 Telecopier: 303/792-0931

Interel Corporation
Environmental Control Systems

Technical Data

Vessel Capacity:	55 gal drum
Nominal Distillation Rate:	8 GPH (depending on solvent and waste)
Heat Transfer Liquid Capacity:	65 gal
Heating Range:	100-450°F
Heater Capacity:	2 x 4.5 kW
Voltage:	Customer specified
Typical Cooling Water Flowrate:	1.4 GPM
Max. Cooling Water Flowrate:	4.4 GPM
Dimensions:	4'-8" H x 5' W x 4'-4" D
Weight:	550 lbs

Price

U.S. $15,225, F.O.B. Englewood, CO

Options

A. Vacuum system: Rotary vane vacuum pump, oil-less and lubricated, motor mounted and separate drive with explosion proof motor. Tubing and fittings for collection under vacuum of distillate (clean solvent) in 55 gallon drum.

Free Air Displacement:	3.75 CFM @ 0" Hg gauge S.L.
Ultimate Vacuum:	25" Hg gauge
Motor:	1/4 HP
Weight:	Approx. 50 lbs
Price:	$1,200

B. Explosion proof electrical panel in NEMA 7 enclosure: $1,490

C. Twenty-four hour adjustable timer in non-explosion proof housing for power start/stop: $ 350

D. Cooling water regulator: control system regulates condenser cooling water outlet temperature. Modulating water valve automatically conserves water consumption: $1,300

E. Barrel lifting brackets: $ 225

F. Sealless drum pump with explosion proof, pneumatic or electric, motor (10 GPM, 24 ft head). Includes stainless steel shaft: $ 950

G. 55 gallon open head drum with dish cover and bolt nut ring seal rated to withstand 15" Hg vacuum: $ 100

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Corporation
Environmental Control Systems

Terms

All prices are in U.S. dollars, F.O.B. Englewood, CO.

All prices valid for 90 days after date of issue.

Prices exclude duties and all federal, state or provincial and local taxes.

Net 30 days upon shipment, subject to credit approval.

Delivery

Allow 8-10 weeks upon order confirmation.

Warranty

See attached.

Service Policy

See attached.

Items Not Quoted

* Electrical connections between separately mounted electrical control panel and distillation equipment
* Necessary fasteners and gasketing for connection between Interel supplied equipment and equipment furnished by others
* Foundation and site preparation
* Field labor, construction supervision or start-up services
* Equipment performance testing
* Permits and documents necessary for installation and erection of quoted equipment

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Environmental Control Systems

SERVICE POLICY AND FEES

Interel Corporation will provide field supervision services at the rate of $500.00 per day plus all travel and living expenses. This fee is applied to all time, including travel time between Interel Corporation's office in Englewood, Colorado and purchaser's plant.

Service is provided during normal working hours (Monday through Friday, 8:00 a.m. through 5:00 p.m.). Work performed in excess of eight hours per day shall be charged for at the rate of $100.00 per hour.

Work performed on Saturday shall be charged for at the rate of $100.00 per hour with a minimum charge of 4 hours ($400.00). Work performed on Sunday or on any holiday shall be charged for at the rate of $125.00 per hour with a minimum charge of 4 hours ($500.00).

In order to allow for scheduling of personnel, normal response time to service requests is three to five days.

EQUIPMENT WARRANTY

Interel Corporation warrants the furnished equipment to be free of defects in material and workmanship for a period of twelve (12) months from date of start-up or eighteen (18) months from date of shipment, whichever comes first. This warranty excludes misuse of equipment and damage from fire, water, natural disasters, accidents or other events outside normal use.

Equipment purchased from others and furnished as a part of the project, such as fans, is warranted by Interel Corporation to the extent of the warranty of the original supplier.

Except as expressly provided herein, Interel Corporation makes no warranty of merchantability or fitness for a particular purpose, nor any other warranty, express or implied. Liability is limited, at Interel's option, to material or workmanship, provided notice is given to Interel within thirty (30) days after discovery of the claimed defect. All materials and repairs are supplied F.O.B. shipping point. Defective parts must be returned for repair or replacement. In no event shall Interel be liable for any amount in excess of the contract price of the item involved in any case, or for any special consequential damage, which the buyer hereby expressly waives. This warranty shall be null and void to items in which a design or functional modification is made by others after delivery.

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hterel
orporation
vironmental Control Systems

3-SC 200 Barrel Distiller

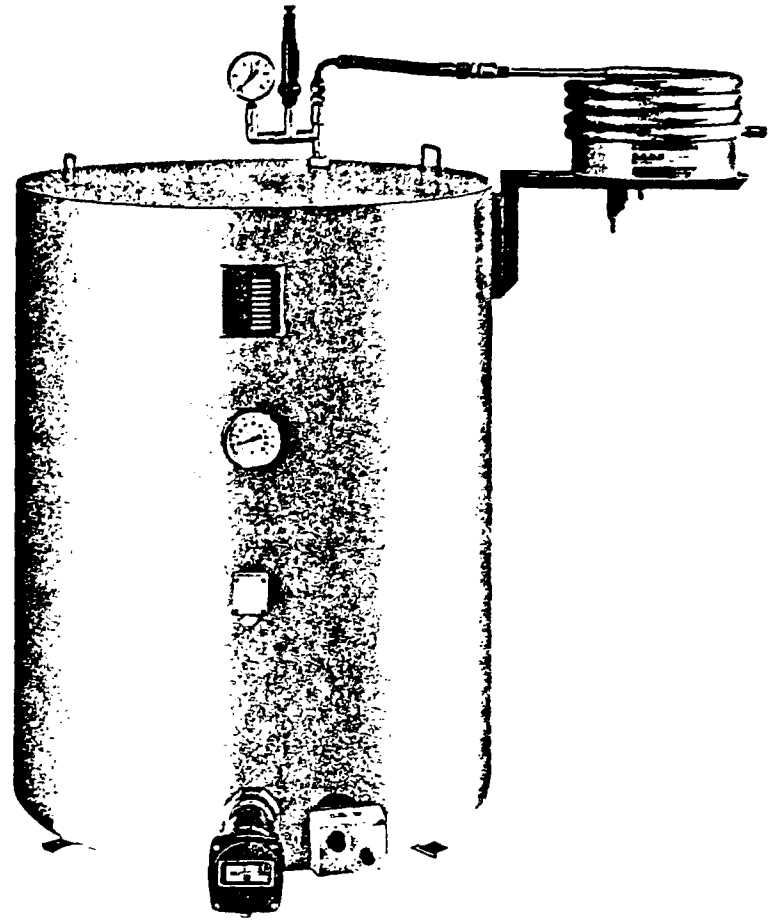
eclaimer For Highly Contaminated Solvents

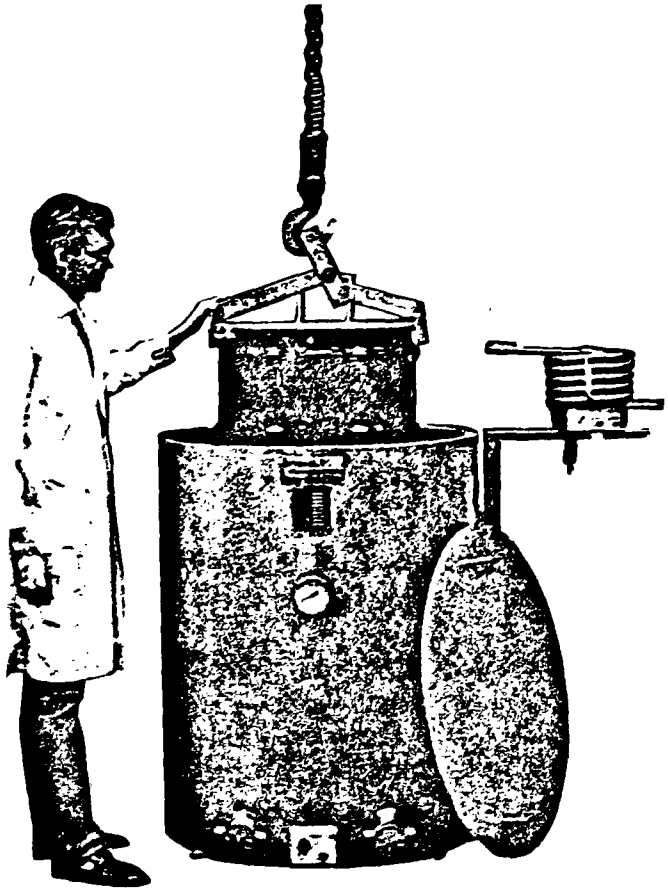
olvents contaminated by resins, adhesives, rubber, paint nd similar components which produce a hard, rubbery or cky residue generally had to be disposed of untreated. olvent reclamation was difficult or impossible.

e Barrel Distiller from Interel Corporation solves this oblem.

e equipment is surprisingly simple. A standard 55-gal um, filled with the contaminated solvent is loaded into the arrel Distiller, which is partially filled with heat transfer liquid. he transfer liquid is heated by electric immersion heaters d the solvent distilled from the drum. The concentrated esidue is disposed of with the drum.

e residue in the drum can be accumulated by repeated ings and distillation. As an alternative, the drum can be illed with other residues prior to disposal. In any case, the luable solvent is recovered.





A 55-gal drum is easily loaded with barrel clamp.

Principle Of Operation

The Barrel Distiller consists of an insulated stainless steel vessel with cover. The vessel is partially filled with heat transfer liquid — typically water, glycol or polyethylene glycol 400.

The 55-gal drum containing contaminated solvent is loaded into the Barrel Distiller. The heat transfer liquid must surround the drum to a sufficient height.

The drum opening is aligned with the opening in the cover. A pipe connection is threaded into the drum port through the opening in the cover and connected to the externally mounted water cooled condenser via a flexible hose. A safety pressure relief value is attached to the pipe connection.

Two thermostatically controlled electric heating elements heat the heat transfer liquid and the drum. The solvent vaporizes at its boiling point, liquifies in the water cooled condenser and is collected in a receiving tank of 55-gal capacity.

Shortest Investment Return

Depending on quantity and cost of the recovered solvent, the Barrel Distiller pays for itself in a few months. Savings include:

- Reduced solvent purchases
- Reduced inventory of fresh and contaminated solvents
- Reduced transportation and disposal costs
- Reduced long term liability from hazardous waste disposal

Safety Controls

The Barrel Distiller is designed for maximum safety in operation. The heating elements will shut off automatically if the cooling water flowrate falls below the set point or if the heat transfer liquid level in the Barrel Distiller falls below a minimum level. The dual thermostatic controller cycles the heaters at the selected set point and shuts off the heaters at a second high temperature safety set point. A safety pressure relief valve in the drum vapor pipe is set to open at 7 psig.

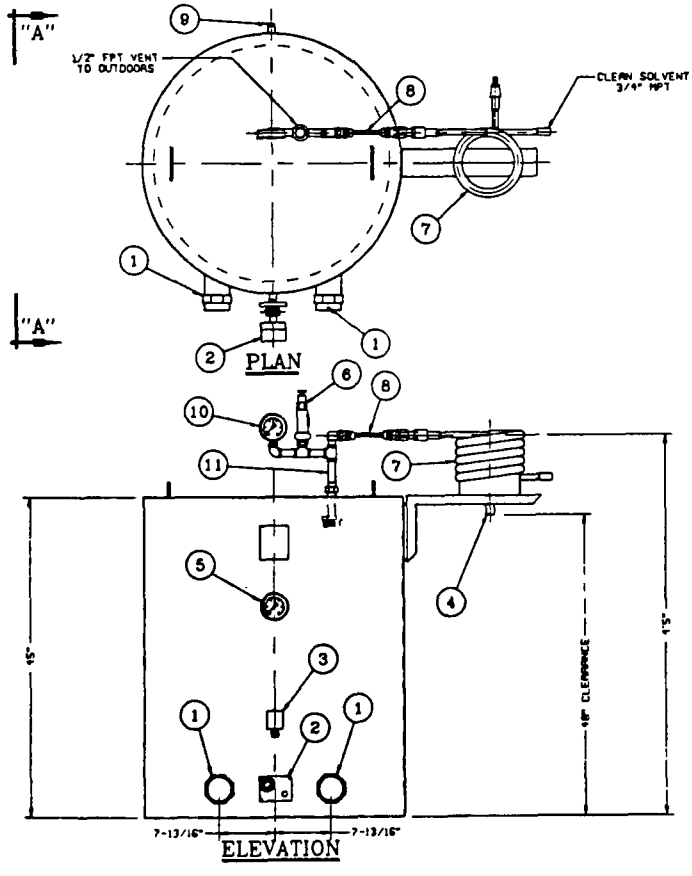
All instruments use intrinsically safe electrical circuits and therefore are rated explosion proof in accordance with NFPA Class I, Group D, Division hazardous locations. The electrical control panel with on-off pushbutton and indicator light is norma supplied non-explosion proof and is approved for use with non-flammable liquids only or for mountir outside of the hazardous area. The panel is available optionally in an explosion proof housing.

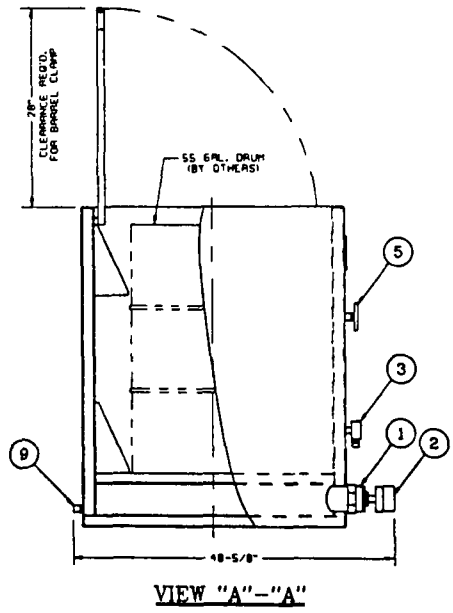
Vacuum System

Solvents which boil above 300°F require distillation under vacuum to prevent cracking of the hydrocarbon The Barrel Distiller is available with an optional vacuum system for reclamation of high boilers.

Technical Data

Evaporator Capacity:	55-gal drum
Distillation Rate:	8 GPH, varies with solve
Heat Transfer Liquid Capacity:	65 gal
Heating Range:	100-300 deg F
Heater Capacity:	2 × 4.5 kW
Voltage:	Customer specified
Cooling Water Flowrate:	2 GPM
Dimensions:	56"H × 60"W × 52"D
Weight — empty:	575 lbs
— operating:	1600 lbs





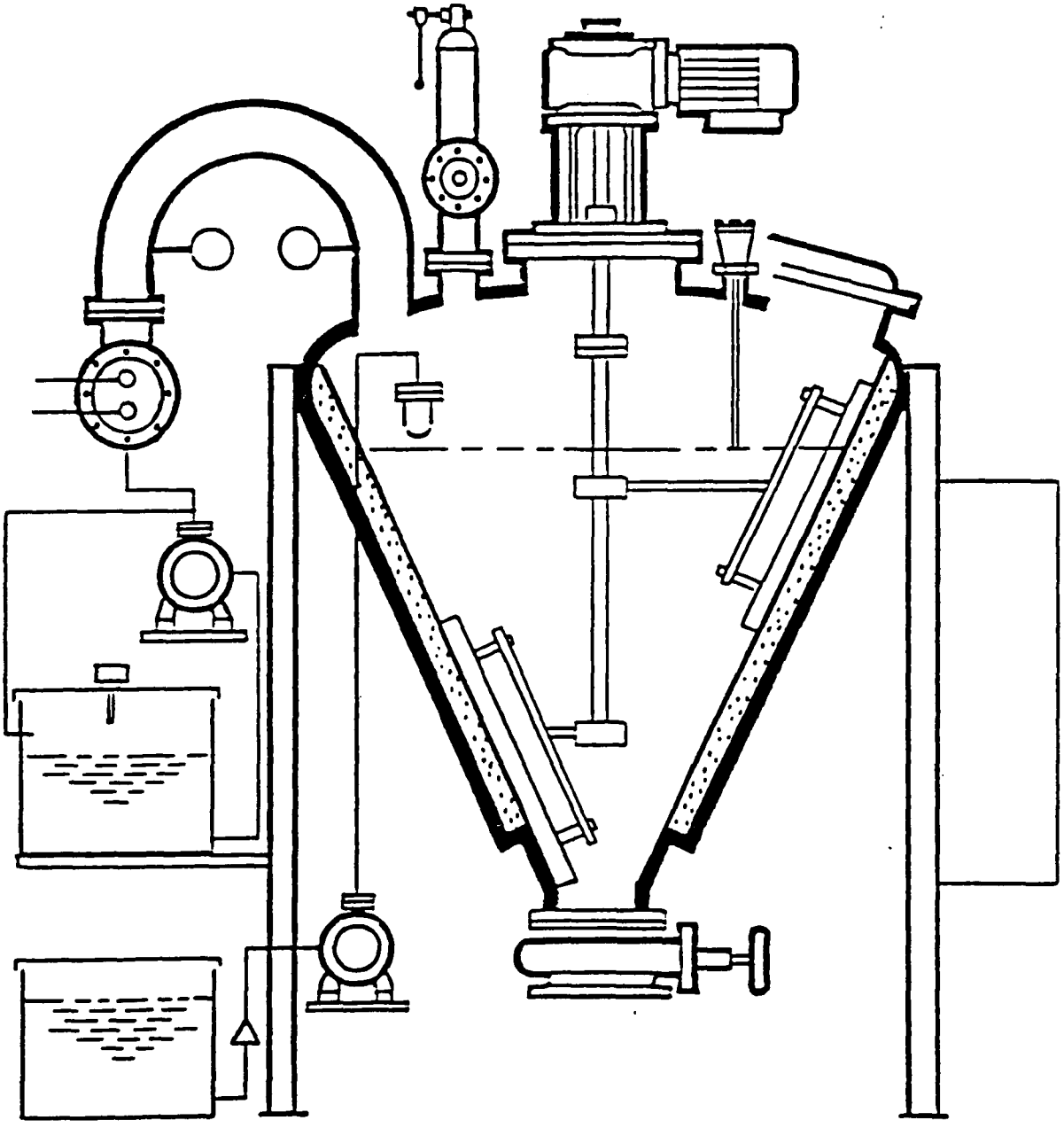
VIEW "A"—"A"

NOTE:
THIS DRAWING IS FOR INFORMATION PURPOSES ONLY.

ITEM	DESCRIPTION
11	BARREL TAP ASSEMBLY
10	PRESSURE GAUGE
9	3/4" TH'D. DRAIN VALVE
8	FLEX HOSE
7	CONDENSER - S.S.
6	PRESSURE RELIEF VALVE
5	THERMOMETER 0-200° C
4	FLOW SWITCH
3	LEVEL SWITCH, HT. TRANS. LIQ.
2	DUAL THERMOSTAT ATHS-170
1	IMMERSION HEATER, 4.5 KW

INTEREL
CORPORATION

OFRU SOLVENT DISTILLATION SYSTEMS



Interel Corporation
Environmental Control Systems

What is the Payback Period for Your Solvent Reclamation System?

A simple example demonstrates how fast your own distillation system can pay for itself.

Basis	Example	Your Estimates
Solvent Consumption:	1000 gal/month	
Solvent Cost:	$3/gal	
Disposal Cost:	$100/55 gal drum	
Reclaimer Capacity:	15 gal/hr	
Operating Time:	70 hrs/month	
Investment Cost Incl. Installation:	$25,000	
Present Cost Per Month		
Solvent Purchase 1000 gal/month:	$3,000	
Waste Disposal 1000 gal/month:	$1,820	
Total Present Cost Per Month:	$4,820	
Future Cost Per Month		
Power Requirements (18kW at 5 cents/kW):	$63	
Cooling Water (150 GPH at $1/1000 gal):	$11	
Disposal of 10% Sump Waste:	$182	
Replacement of 10% Solvent:	$300	
Service of Installation (20 man hrs/month at $20/hr):	$400	
Total Future Cost Per Month:	$956	
Cost Savings (difference between present and future costs):	$3,864/month	
Investment Cost:	$25,000	
Payback Period (investment cost divided by cost savings):	6.5 months	

Estimates do not consider:

* several different solvents can be reclaimed in sequence
* investment tax credits and depreciation tax savings
* reduced capital tied up due to less solvent inventory required
* solvent can be replenished more frequently and quality improved
* independence from solvent price increases
* avoid responsibilities for disposal or off-plant transportation of solvents

P.O. Box 4676, Englewood, CO 80155 Telephone: 303/773-0753 Telecopier: 303/792-0931

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DISTILLATION TESTS AND PRODUCT ANALYSIS

Interel Corporation offers to carry out evaluation of samples submitted for distillation tests. A number of tests including analytical work can be performed, depending on the degree of detail information required. A summary report with recommendations for distillation equipment, distillation procedure and economic return analysis will be submitted to each customer. The charges for this service are summarized below.

A. Distillation Tests

A1. Distillation at Constant Boiling Temperature

The test determines the wt-% yield of recovered solvent within the boiling temperature range. The distillation test will be performed under a preselected vacuum, if required.

The residue is characterized by its consistency, color, odor, difficulty of cleaning and other features.

Price: No Charge

A2. Distillation to Dry Residue

The residue of Test A1 is further distilled to dryness at atmospheric pressure or under vacuum, if applicable, and the wt-% yield and boiling point of additional solvent recovered is determined.

The residue is characterized by its consistency, color, odor, difficulty of cleaning and other features.

Price: No Charge

B. Analytical Tests

B1. Purity or Composition of Recovered Solvent

The solvent recovered in any of the distillation tests is analyzed by gas chromatography for composition. Major components are identified. A sample of the original solvent is tested for comparison.

Price: $ 75 per solvent sample, plus
$ 50 per ea. component identified

B2. Residue Hazardous Waste Characterization

The residue from any of the distillation tests is evaluated for hazardous waste charateristics as per EPA definition:

a. Ignitability, corrosivity and reactivity, as applicable
b. EP-Toxicity. Includes extraction procedure and tests for eight heavy metals and pesticides/herbicides, if applicable

Price:	Ignitability, corrosivity and reactivity:	$ 50
	Toxicity extraction, including metals test:	$400
	Pesticides/herbicides, add:	$325

B3. Toxicity Characteristic Leaching Procedure (TCLP)

The full procedure of hazardous waste characterization is based on the TCLP test in accordance with proposed EPA rules published in the Federal Register, June 13, 1986. The test analyzes for 20 volatile components. This is a new procedure that will be required in the future.

Price: $2,500 (estimate)

C. Distillation to Dryness and Residue Evaluation

Solvent samples are distilled to dryness under different conditions of bath temperature, vacuum and time periods. The residue of each test is analyzed for weight percent residual solvent content by gas chromatography and IR spectroscopy.

Residue is evaluated for acceptability as landfillable waste in accordance with the November 8, 1986 Hazard and Solid Waste Amendments to RCRA. The total content of F001 through F005 wastes combined must not exceed 1% by weight.

Price: $ 150 per residue sample

Prices subject to change without notice.

Interel Corporation

Environmental Control Systems

SOLVENT DATA
03/03/87

SOLVENT	DISTILLATION RANGE (F)	DELTA Hv (BTU/lb)	DENSITY (lb/gal)	AUTOIGNITION TEMP (F)	LEL (% Vol in Air)	EPA NUMBER
ALCOHOLS						
methyl alcohol	147-151	527	6.61	725	6.0	F003
ethyl alcohol, 95%	166-175	378	6.76	685	3.3	
ethyl alcohol, anhydrous	171-176	378	6.59	793	4.3	
iso-propyl alcohol	179-181	301	6.55	750	2.0	
n-propyl alcohol	207-208	338	6.74	810	2.2	
sec-butyl alcohol	208-214	260	6.73	761	1.7	
iso-butyl alcohol	225-232	266	6.72	800	1.7	F005
amyl alcohol, mixed isomers	230-293	242	6.76	572	1.2	
n-butyl alcohol	239-245	266	6.75	644	1.5	F003
n-hexyl alcohol	307-320	224	6.83		1.2	
cyclohexanol	320-324	215	7.91	572	1.2	
ALIPHATIC						
pentane	91-106	165	5.22	788	1.4	
Textile spirits	145-175		5.75			
hexane	151-160	159	5.51	502	1.2	
heptane	196-214	160	5.71	433	1.1	
VM&P naphtha	236-292		6.29		1.2	
Hi-flash VM&P naphtha	240-320		6.33			
Naphthol mineral spirits	307-340		6.34			
Mineral spirits No. 10	307-385		6.51			
Stoddard solvent	310-388		6.47			
Mineral spirits	314-390		6.58			
Varsol-1	322-336		6.58			
Hi-flash mineral spirits	325-399		6.61			
Oderless mineral spirits	352-398		6.31			
Kerosene	374-503		6.77	444	.7	
Ink solvent	512-610		6.79			
AROMATICS						
benzene	172-176	236	7.32	1044	1.3	
toluene	228-232	183	7.20	997	1.2	F005
xylene, mixed isomers	261-318	170	7.17	867	1.0	F003
ethlybenzene	277-278		7.26		1.0	F003
Hi-flash coal tar naphtha	293-392		7.12			
m-cresol	396-406	224	8.66	1038	1.1	F004
CHLORINATED						
iso-propyl chloride	94-104	157	7.17			
1,1-dichloroethylene	99	134	10.43			
methylene chloride	102-106	160	11.07	1121	none	F002
n-propyl chloride	113-117	172	7.43	968	2.0	
chloroform	142	113	12.43	none	none	

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SOLVENT DATA
03/03/87

SOLVENT	DISTILLATION RANGE (F)	DELTA Hv (BTU/lb)	DENSITY (lb/gal)	AUTOIGNITION TEMP (F)	LEL (% Vol in Air)	EPA NUMBER
1,1,1-trichloroethane	161-191	105	10.97	none	none	F002
methyl chloroform	162-190		11.03			
carbon tetrachloride	171-172	97	13.30	none	none	
ethylene dichloride	180-183	145	10.45	860	6.2	
trichloroethylene, degreasing	188-190	114	12.22	770	none	F001
trichloroethylene, extraction	188-198	114	12.22	770	none	F002
propylene dichloride	204-208	133	9.65	1034	3.2	
1,1,2-trichloroethane	230-239	124	12.04	856	none	
perchloroethylene	250-254	100	13.55	none	none	F002
tetrachloroethane, unsymmetric	264-267	106	13.25		none	
monochlorobenzene	266-273	161	9.23	1180	1.3	F002
tetrachloroethane, symmetrical	295-297	106	13.35		none	
1,2,3-trichloropropane	313-317	131	11.59			
o-dichlorobenzene	351-361	134	10.89	1198		F002
trichlorobenzene, mixed isomer	415-423	113	12.15			
ESTERS						
methyl acetate	127-136	188	7.78	850	3.1	
ethyl acetate, 85-88%	158-176	170	7.37	774	2.1	F003
ethyl acetate, 99%	169-174	170	7.51	774	2.1	F003
iso-propyl acetate	187-194	155	7.27	860	1.7	
n-propyl acetate	210-217	157	7.40	806	1.7	
sec-butyl acetate	219-239		7.27			
iso-butyl acetate	220-246	144	7.24	790	1.2	
n-butyl acetate, 99%	244-262		7.28	788	1.4	
n-butyl propionate	255-340		7.27	799		
sec-amyl acetate	259-293		7.18			
amyl acetate mixed isomers	259-311		7.21		1.1	
methyl cellosolve acetate	279-306				1.7	
cellosolve acetate	302-320		8.10	720	1.2	
glycol ether EB acetate	367-381		7.83	645	.9	
ETHERS AND ETHER ALCOHOLS						
ethyl ether	93 -95	169	5.22	356	1.8	F003
iso-propyl ether	145-158	122	6.04	830	1.4	
diethyl cellosolve	243-264		7.02			
methyl cellosolve	250-259	223	8.03	545	2.5	
cellosolve	270-279	191	7.74			
n-butyl cellosolve	331-343	158	7.51	472	1.1	
carbitol	365-401	151	8.55			
methyl carbitol	370-388	170	8.56			
butyl carbitol	428-455	132	7.95	442		
FLUOROCARBONS						
Freon TMC	97		11.85			

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SOLVENT DATA
03/03/87

SOLVENT	DISTILLATION RANGE (F)	DELTA Hv (BTU/lb)	DENSITY (lb/gal)	AUTOIGNITION TEMP (F)	LEL (% Vol in Air)	EPA NUMBER
Freon TMS	103					
Freon TA	110		11.73			
Freon TES	112		12.48			
Freon T-WD 602	112		12.47			
Freon TE	112		12.56			
Freon TF	118		13.06			F002
Freon T-DF	118					
Freon T-E-35	119		9.75			
Freon T-P-35	120		9.60			
KETONES						
acetone	132-134	237	6.58	869	2.5	F003
methyl ethyl ketone	174-177	203	6.71	759	1.8	F005
diethyl ketone	212-219	234	6.80	842	1.6	
methyl n-propyl ketone	214-225	235	6.72	840	1.5	
methyl iso-butyl ketone	234-244	210	6.68	854	1.4	F003
diisopropyl ketone	237-261		6.73			
methyl n-butyl ketone	237-279		6.83	795	1.2	
methyl cyclohexanone, mixed	237-343		7.67			
cyclohexanone	266-343	184	7.88	788	1.1	F003
diacetone	266-356		7.82			
methyl isoamyl ketone	286-298		6.78	795	1.0	
methyl n-amyl ketone	297-309		6.81	740	1.1	
acetonyl acetone	365-383		8.10	920		
n-methyl-2-pyrrolidone	395				2.1	
TERPENES						
turpentine steam distill	311-343		7.13		.8	
turpentine gum spirits	313-340		7.21		.8	
dipentene	342-374		7.10		.8	

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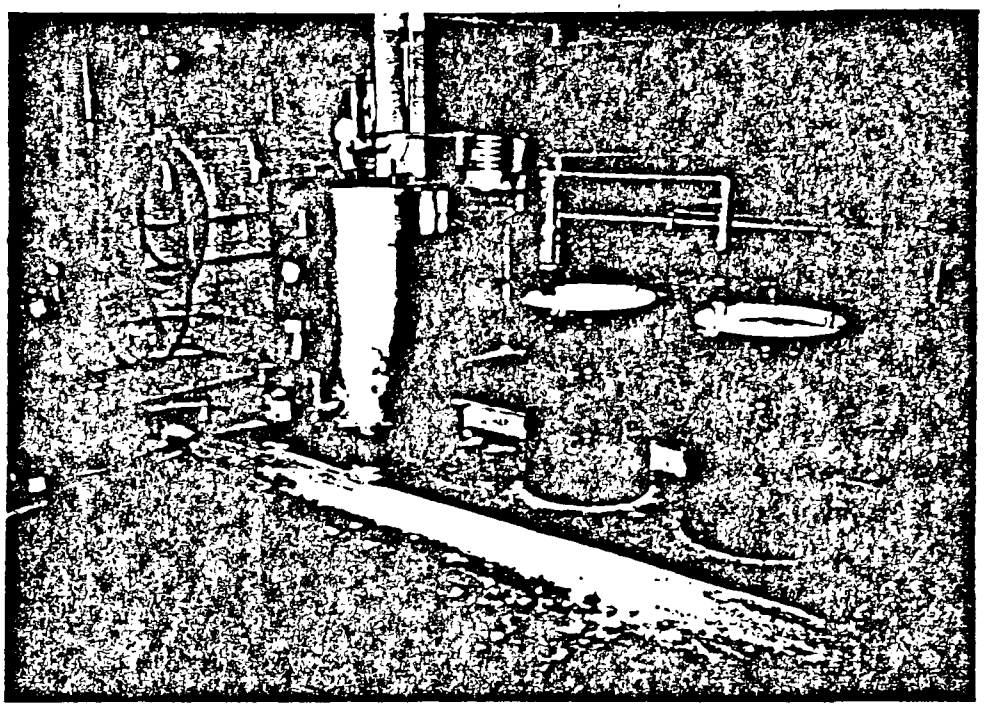
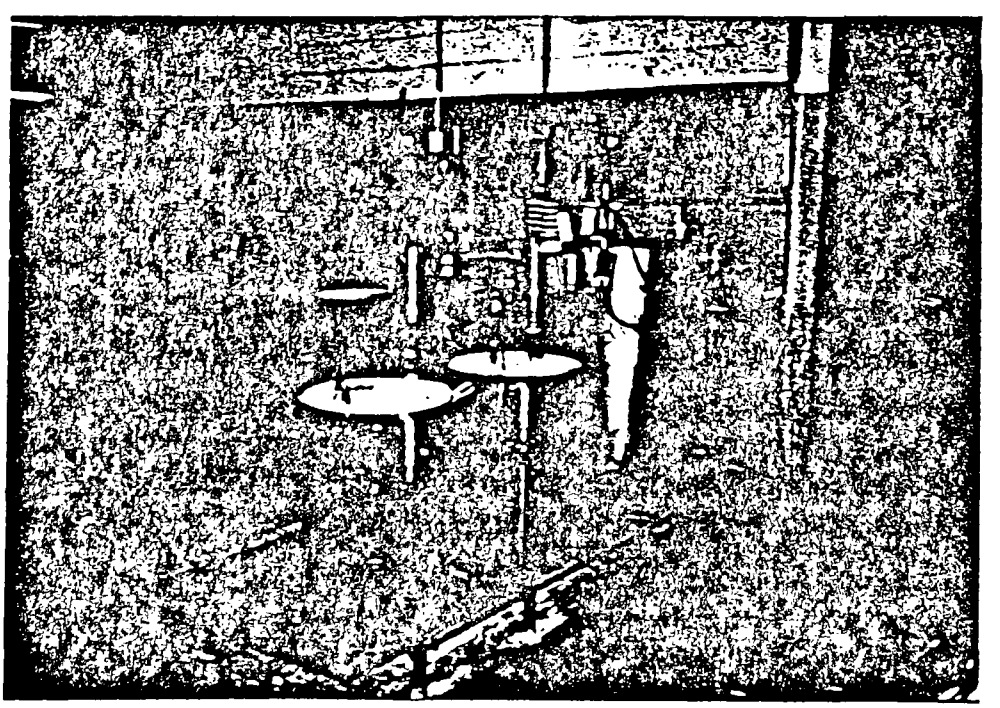


B-SC 200 Barrel Distiller
Recovering various solvents used in the
Furniture Industry
Douglas Furniture, Bedford Park, IL



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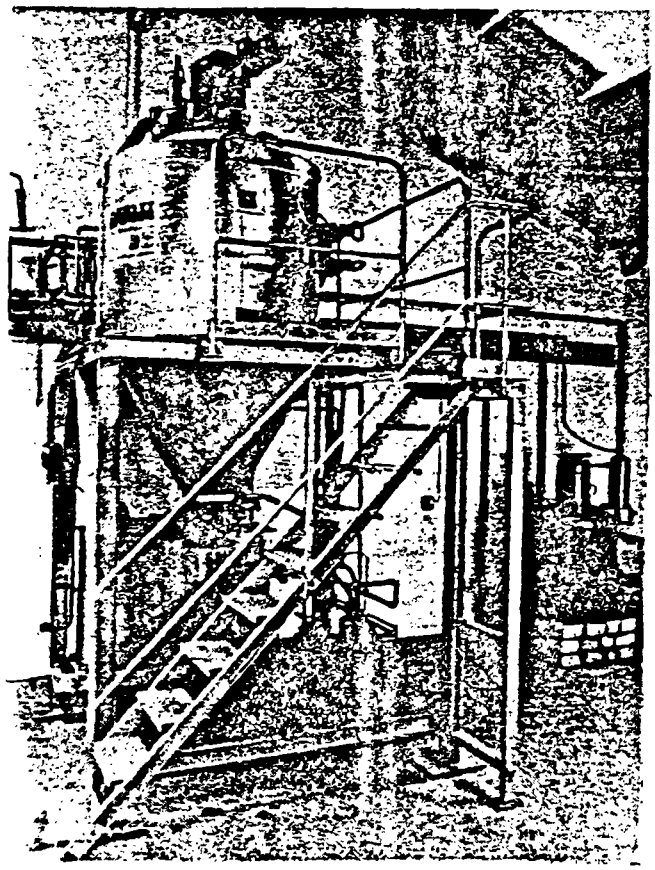

Solvent Distillation System Type A-SC 1500
and Reclaimer Type SC 100

A-SC 1500 includes Scraper for Heat Transfer Surfaces, Heating by Heat Transfer Oil Circulation with Remote Heating Station Includes Dirty Solvent Transfer Pump, Clean Solvent Transfer Pump, and Vacuum Pump

Application: Paint Manufacture

Kneho, Bad Mainberg, West Germany

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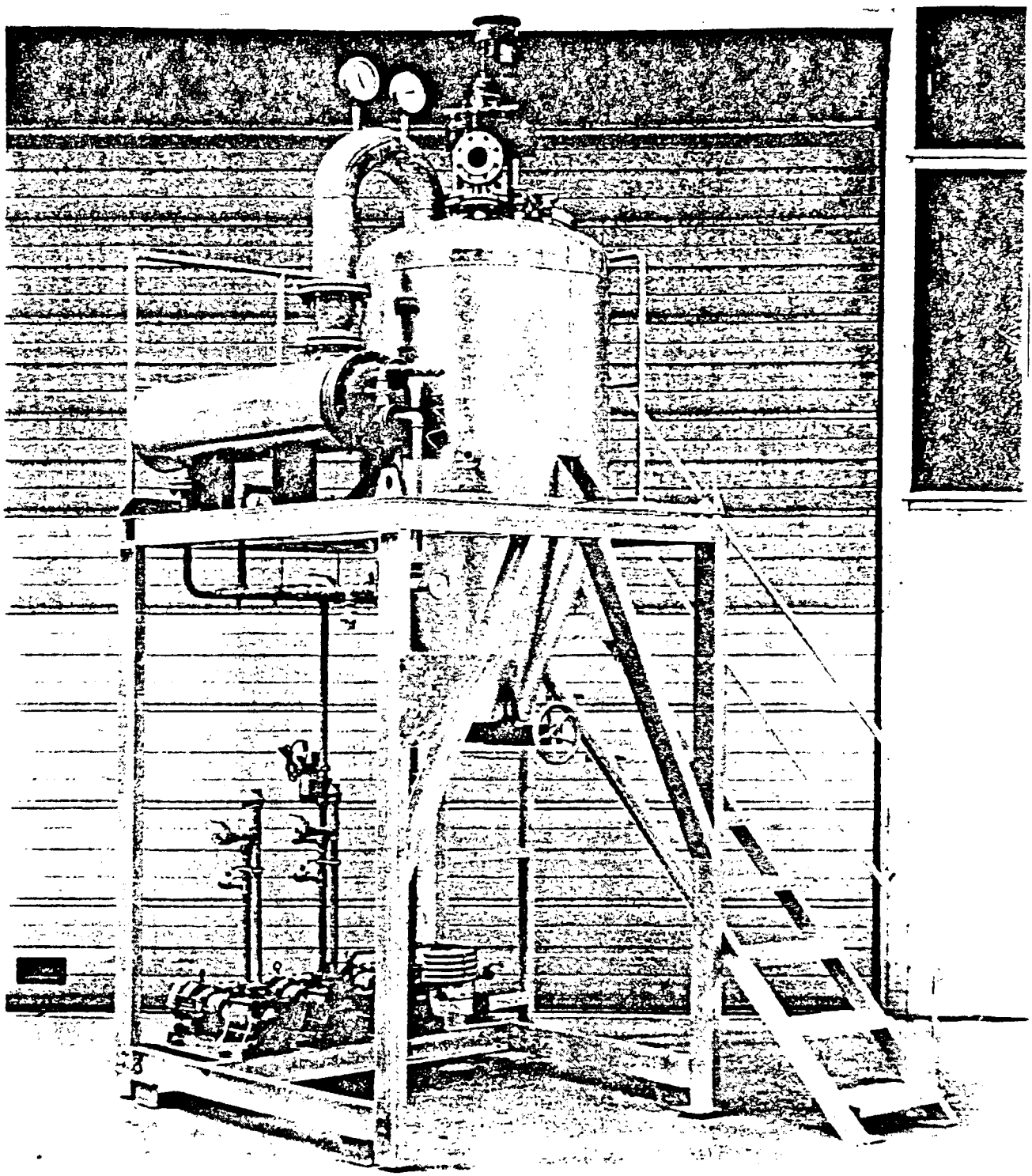

Solvent Distillation System A-SC 750

Evaporator Capacity: 100 gal, Distillation Rate: 37.5 GPH
Includes Scraper to Prevent Deposits on Heat Transfer Surfaces
Heating by Heat Transfer Oil Circulation with Remote Heating Station
Includes Dirty Solvent Transfer Pump, Vacuum Pump
and Clean Solvent Transfer Pump

DRG, Toronto

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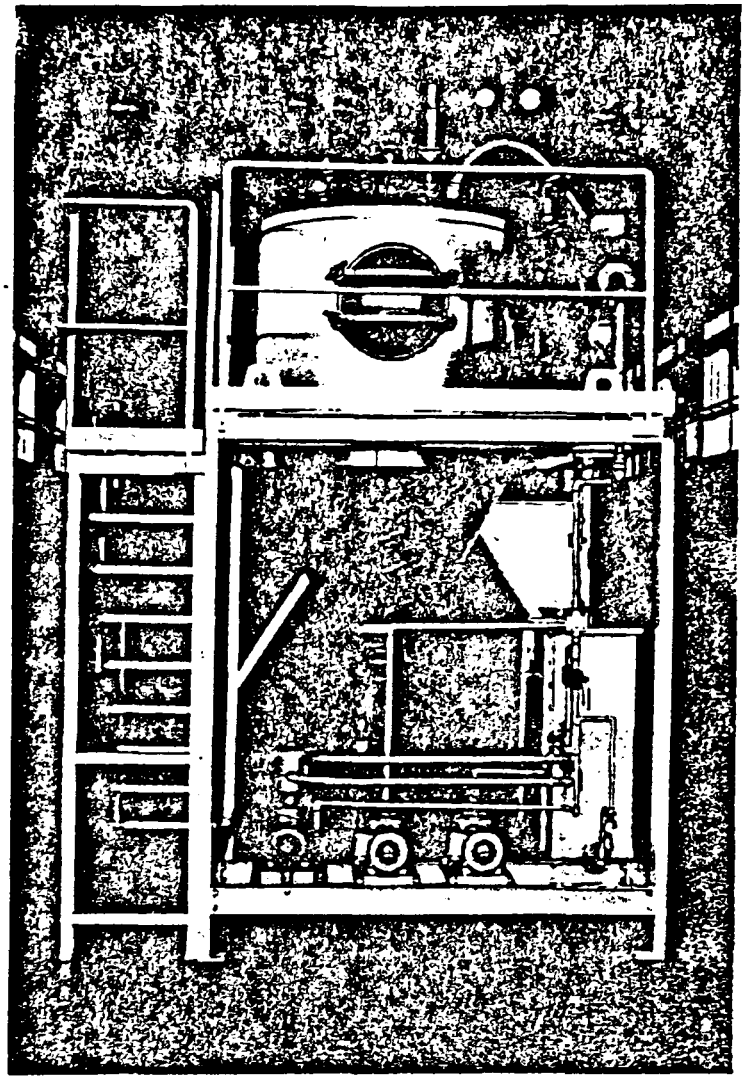
Environmental Control Systems



Solvent Distillation System Type SC 1500

Evaporator Capacity: 200 gal Distillation Rate: 90 GPH
Includes Scraper for Heat Transfer Surfaces, Heating
by Heat Transfer Oil Circulation with Remote Heating Station
Includes Dirty Solvent Transfer Pump, Clean Solvent Transfer Pump,
Vacuum Pump and Receiving Tank

ESMA GmbH, Hurth-Knapsack, West Germany

Q What is meant by land disposal?

A For purposes of the restrictions, Congress defined land disposal under RCRA section 3004(k) to include, but not be limited to, any placement of hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or salt bed formation, or underground mine or cave. As a result of the inclusion of the phrase "any placement" in the definition, the restrictions extend beyond what is often considered "land disposal." For example, under this definition the restrictions also apply to treatment and storage surface impoundments.

Q How is EPA going to implement the land disposal prohibitions?

A By each statutory deadline, EPA will promulgate treatment standards for the applicable hazardous wastes. Wastes that meet these treatment standards may be directly land disposed. Wastes that do not meet these standards must be treated before they are placed in a land disposal unit. The treatment standards are expressed as performance standards and are based on the best demonstrated available technologies (BDAT). Treatment technologies that may result in greater risk than direct land disposal of untreated wastes will not be considered in establishing the treatment standards.

Q Is there any way out of the treatment requirements?

A An applicant, usually the owner/operator of a treatment, storage, or disposal facility, may petition EPA to allow land disposal of a specific waste at a specific site. The applicant must prove that the waste can be contained safely in a particular type of disposal unit, so that no migration of any hazardous constituents occurs from the unit for as long as the waste remains hazardous. If EPA grants the petition, the waste is no longer prohibited from land disposal in that particular type of unit.

Q Will the wastes still be restricted if there is not enough alternative capacity?

A If there is insufficient capacity nationwide of alternative treatment, recovery, or disposal technologies for a particular waste or group of wastes, EPA may grant a nationwide extension to the effective date of the restriction. The purpose of the extension is to allow time for the development of capacity. This extension may not exceed two years beyond the applicable statutory deadline for the waste.

In addition, if individuals managing a restricted waste find that there is insufficient capacity for that waste, they may apply for a case-by-case extension to the effective date. Among other requirements, applicants must demonstrate that they have entered into a binding contractual commitment to construct or otherwise provide the alternative capacity. If the application is approved, EPA may allow up to a one-year extension (renewable once). During the period of the extension, the waste is not subject to the land disposal restrictions.

Q What if a waste cannot be treated to meet the standard?

A In some situations, due to unique physical and/or chemical characteristics, it may not be possible to treat a restricted waste to the levels or by the methods specified in the treatment standard. Persons managing such unique wastes can submit a rulemaking petition under 40 CFR Part 260.20 requesting a variance from the treatment standard. If the variance is granted, EPA will establish a treatment standard specific to the characteristics of that waste. Until such time, the waste may not be land disposed.

United States
Environmental Protection Agency
Washington DC 20460

November
1986

EPA/530-SW-86-057

EPA

Questions and Answers on the Land Disposal Restrictions Program

In 1976, Congress enacted the Resource Conservation and Recovery Act (RCRA) to protect human health and the environment from improper waste management practices. On November 8, 1984, the Hazardous and Solid Waste Amendments (HSWA) were signed into law, imposing substantial new responsibilities on those who manage hazardous waste. Among other things, the amendments prohibit land disposal of hazardous wastes beyond specified dates, unless a petitioner demonstrates to the Administrator of EPA that there will be no migration of hazardous constituents from the land disposal unit for as long as the waste remains hazardous. The prohibitions are intended to protect our environment from contamination by land disposal.

Concurrently with the land disposal prohibitions, HSWA directs EPA to develop treatment standards for all hazardous wastes. These treatment standards will substantially reduce the toxicity of the waste or the likelihood of migration of hazardous constituents from the waste. Wastes that meet these treatment standards are not subject to the land disposal prohibitions.

The amendments restrict the land disposal of various classes of hazardous wastes by certain dates:

November 8, 1986:
DIOXIN-CONTAINING WASTES
(EPA Hazardous Waste Numbers:
F020, F021, F022, F023, F026, F027, F028)
SPENT SOLVENTS (EPA Hazardous Waste Numbers: F001, F002, F003, F004, F005)

July 8, 1987:
SPECIFIED WASTES
(liquid hazardous wastes containing free cyanides, PCBs, corrosives, or certain metals, and hazardous wastes containing halogenated organic compounds)

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August 8, 1988:
AT LEAST ONE-THIRD OF ALL LISTED HAZARDOUS WASTES

June 8, 1989:
AT LEAST TWO-THIRDS OF ALL LISTED HAZARDOUS WASTES

May 8, 1990:
ALL REMAINING LISTED HAZARDOUS WASTES AND ALL CHARACTERISTIC HAZARDOUS WASTES

To implement the deadlines for "the thirds" in 1988, 1989, and 1990, the amendments required EPA to rank all listed hazardous wastes so that wastes with high intrinsic hazard and volume would be restricted from land disposal first, and wastes with low intrinsic hazard and volume would be dealt with last. The amendments also required the Agency to use this ranking to separate the list of wastes into a schedule of thirds. EPA published this schedule on May 28, 1986, in the Federal Register (51 FR 19300).

The prohibitions for any particular waste become effective on the applicable statutory deadline, unless there is insufficient national capacity for alternative treatment, recovery, or disposal. If EPA determines that such a shortage exists, the Agency may grant a national extension to the effective date (not to exceed two years beyond the statutory deadline). The Agency may also grant extensions to the effective date on a case-by-case basis.

EPA has promulgated a final rule which establishes a regulatory framework to implement the land disposal prohibitions. This framework includes procedures for setting treatment standards for hazardous wastes; for granting nationwide variances from the statutory effective dates; for granting case-by-case extensions to the effective dates; and for evaluating petitions that attempt to demonstrate that continued land disposal is protective of human health and the environment. In addition, the rule also establishes treatment standards and effective dates for the first class of hazardous wastes to be prohibited: certain dioxin-containing wastes and spent solvent wastes.

The following are answers to some basic questions concerning the restrictions.

Q **Are these the only new requirements that 100 to 1000 kg/mo generators must meet?**

A Not necessarily. While the items listed above briefly identify the basic new *federal* requirements for 100 to 1000 kg/mo generators, the actual requirements which go into effect on September 22, 1986 are more detailed. In addition, some states may impose more stringent requirements on small quantity generators. For example, four states (California, Louisiana, Minnesota, and Rhode Island) *now* fully regulate all generators of hazardous waste, 100 to 1000 kg/mo generators as well as larger and smaller generators. To be sure you understand all the requirements, state and federal, that you must meet, **contact your state hazardous waste management agency.**

Q **What is a U.S. EPA Identification Number, and how do I obtain one?**

A A U.S. EPA Identification Number is a unique, 12-character number that EPA assigns to generators and transporters of hazardous waste, and to owners/operators of facilities that treat, store, or dispose of hazardous waste. The identification numbers help EPA and states compile and maintain a database on hazardous waste activities.

To obtain an EPA Identification Number, you should complete EPA Form 8700-12, "Notification of Hazardous Waste Activity," or a similar form used by your particular state. To request the application form, contact your state hazardous waste management agency or EPA Regional Office. Along with the appropriate application form , you will receive instructions for completing the form and information on where you can get additional assistance.

Q **Where do I obtain the Uniform Hazardous Waste Manifest to use when I ship my hazardous waste off my plant site?**

A A hazardous waste manifest is a multi-copy form that you must fill out completely and use to accompany your hazardous waste shipments. Some states print their own versions of the Manifest with the state's name and logo and require use of the state Manifest form. These forms are available from state hazardous waste management agencies. Many transporters and facilities may also be able to provide you with the correct Manifest.

To determine which state's Manifest form you need to complete, use this system: (1) If the state to which you are shipping your waste has its own Manifest, use that Manifest form (2). If not, use the Manifest of the state in which your waste was generated. (3) If neither state requires a state-specific Manifest, you may use the "general" Uniform Hazardous Waste Manifest—EPA Form 8700-22—which you can purchase from some commercial printers, or obtain from some transporters or waste management facilities.

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Q **What information is required on the Manifest?**

A Effective September 22, 1986, federal law requires 100 to 1000 kg/mo generators to fill out all of the unshaded items on the Uniform Hazardous Waste Manifest. (The completed Manifest will also fully satisfy Department of Transportation requirements for shipping hazardous materials.) Even now, some states require generators to complete the entire Manifest, or to provide information beyond the items 3, 9, 11, 12, 13, 14, and 16 required under federal law as of August 5, 1985. To be sure you complete all necessary parts of the Manifest, contact your state hazardous waste agency, your transporter, and your receiving facility.

Q **Why are there multiple copies of the Manifest?**

A The Manifest form is designed so that shipments of hazardous waste can be tracked from their point of generation to their final destination, the so-called "cradle-to-grave" system. The Manifest is produced in a multi-copy format so that each step in the shipment process can be documented. Thus, the generator of the hazardous waste completes the Manifest, and turns the shipment and remaining copies of the Manifest over to the transporter. The transporter or hauler signs the Manifest, returns one copy to the generator, and turns the shipment and Manifest over to the facility that the generator designated to receive the waste. The facility signs the Manifest, gives one copy back to the transporter, keeps a copy, and sends the remaining copy back to the generator so the generator knows that the hazardous waste has reached its intended destination. Some states require that a copy of the Manifest also be sent to the state hazardous waste agency each time a shipment changes hands. Generators are required to keep a copy of each Manifest, signed by the designated facility, in their files for three years following the date of the shipment.

Q **What if the generator does not receive a final copy of the Manifest confirming the facility's receipt of the shipment?**

A Under the new federal regulations, 100 to 1000 kg/mo generators are not, as are larger generators, required to file "exception reports." However, while these generators are not *required* to file an exception report, EPA strongly encourages generators to use good business practice and perform the necessary follow-up to make sure their waste shipments reach the destination facility. Should a shipment be truly lost, it is in the generator's interest to notify EPA or the state in order to minimize any future lia

Q **Can a restricted waste be stored?**

A Storage is allowed for restricted wastes solely for the purpose of accumulating sufficient quantities of waste to allow for proper treatment, recovery, and disposal. EPA generally will assume that storage of less than one year is necessary for such purposes. However, an owner/operator storing for longer than one year must be prepared to demonstrate that such storage is necessary. (EPA is establishing a presumption that storage for over one year is not for the purpose of facilitating proper treatment, recovery, or disposal.) The limitation on storage applies only to restricted wastes. Therefore, wastes that meet the treatment standards, or are granted an approved petition or extension, are not subject to the storage restriction.

Q **When does open detonation and open burning constitute land disposal?**

A Open burning and open detonation generally are used to manage those wastes that are hazardous because they exhibit the characteristic of reactivity. The Agency believes open burning and open detonation of explosive waste generally constitutes treatment that should result in non-reactive residuals. The land disposal restrictions apply only in those instances when the residual produced continues to exhibit the characteristic of reactivity and, therefore, continues to be a hazardous waste. Treatment standards for characteristic wastes will be established by the May 1990 statutory deadline.

Q **How will the November 8, 1986, final rule affect managers of hazardous wastes?**

A It will affect them immediately in that it sets treatment standards and effective dates for the spent solvent wastes and certain dioxin-containing wastes. In addition, as noted above, it also establishes a framework for making future decisions implementing the land disposal restrictions for all hazardous wastes.

The treatment standards for solvents are based on data from the following technologies: incineration, biological treatment, steam stripping, and activated carbon adsorption. The standards range from 0.05 mg/l (milligrams per liter) to 12.7 mg/l for wastewaters containing spent solvents and from 0.05 mg/l to 5.0 mg/l for all other spent solvent wastes. The treatment standards for dioxin-containing wastes are based on data from the incineration of these wastes at 99.9999-percent destruction removal efficiency (DRE). The standards for the dioxin wastes require that the wastes be treated to a level below detection (currently one part

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All treatment standards are expressed as concentrations in the leachate of the waste. The leachate is obtained by use of the toxicity characteristic leaching procedure.

EPA is granting a nationwide two-year variance to the effective date for all dioxin wastes and for certain solvent wastes due to capacity shortfalls. The solvent wastes which have been granted the variance are:

- Solvent waste generated by a small quantity generator of 100-1000 kilograms of hazardous waste per month.
- Solvent waste generated from any remedial or response action taken under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) or any corrective action taken under the Resource Conservation and Recovery Act of 1976 (RCRA), except where the waste is contaminated soil or debris. HSWA specifies that contaminated soil and debris are not subject to the restrictions until November 8, 1988.
- Solvent waste which is a solvent-water mixture containing less than one percent total F001-F005 solvent constituents or containing less than one percent total organic carbon.
- Solvent waste which is a solvent-inorganic sludge mixture or solvent-contaminated soil (non-CERCLA or RCRA corrective action) containing less than one percent total F001-F005 solvent constituents.
- Spent solvent wastes not covered by the two-year variance are restricted from land disposal effective November 8, 1986.

Q **Where can managers of hazardous waste get further information and assistance?**

A For answers to questions on the new federal requirements or hazardous waste regulations in general, managers may wish to contact EPA's toll-free RCRA/Superfund Hotline, (800) 424-9346 (in Washington, D.C., 382-3000).

For information on specific aspects of the land disposal restrictions, managers may contact: Stephen R. Weil, Office of Solid Waste (WH-562B), U.S. Environmental Protection Agency, 401 M. Street, SW., Washington, DC 20460, (202) 382-4770.

Q **How often should generators ship hazardous waste off their premises?**

A Larger generators must ship their waste off-site at least every 90 days to avoid having to obtain a hazardous waste facility permit. The final regulations allow 100 to 1000 kg/mo generators to accumulate hazardous waste on-site for 180 days (or up to 270 days if the waste is to be shipped more than 200 miles) without the need for a permit so that generators may accumulate more economical quantities for shipment. Some states, however, allow only a 90-day accumulation period, even for 100 to 1000 kg/mo generators. Check with your state hazardous waste agency for information on the requirements that apply to you.

Q **Where can I send my waste, and who can haul it?**

A Since hazardous waste from 100 to 1000 kg/mo generators must be managed according to RCRA hazardous waste rules, only transporters and facilities which have EPA identification numbers can handle your hazardous waste. Furthermore, they must be authorized to handle your particular kind of hazardous waste. For information on hazardous waste transporters and management facilities in your area, contact your state hazardous waste agency or EPA regional office.

Q **May I recycle my hazardous waste?**

A Yes. In fact, EPA strongly encourages recycling as one of the best methods for managing hazardous waste. Waste shipped off-site for recycling may still be subject to manifesting as well as other transportation and storage requirements. These requirements, however, are not intended to discourage recycling. Contact your state hazardous waste agency, EPA regional office, or trade association for information on your specific waste recycling alternatives.

Q **Where can small quantity generators get further information and assistance?**

A Generators should contact their state hazardous waste agencies for information on the requirements they must meet. For questions on the new federal requirements or hazardous waste regulations in general, or to obtain the number for their state hazardous waste agencies, generators may wish to contact their EPA regional office (see list below); EPA's toll-free RCRA Hotline, 800-424-9346 (in Washington, DC, 382-3000); or EPA's toll-free Small Business Hotline, 800-368-5888 (in Virginia, 800-468-4561).

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Environmental Control Systems

EPA Regional Offices

EPA Region 1
JFK Federal Building
Boston, MA 02203
(617)223-7210
Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont

EPA Region 2
26 Federal Plaza
New York, NY 10278
(212)264-2525
New Jersey, New York, Puerto Rico, Virgin Islands

EPA Region 3
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-9800
Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia

EPA Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365
(404)881-4727
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee

EPA Region 5
230 South Dearborn Street
Chicago, IL 60604
(312)353-2000
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

EPA Region 6
1201 Elm Street
Dallas, TX 75270
(214)767-2600
Arkansas, Louisiana, Ne Mexico, Oklahoma, Tex

EPA Region 7
726 Minnesota Avenue
Kansas City, KS 66101
(913)236-2800
Iowa, Kansas, Missouri, Nebraska

EPA Region 8
One Denver Place
999 18th Street
Suite 1300
Denver, CO 80202-2413
(303)293-1603
Colorado, Montana, Nort Dakota, South Dakota, U Wyoming

EPA Region 9
215 Fremont Street
San Francisco, CA 9410
(415)974-8071
Arizona, California, Haw Nevada, American Samo Guam, Trust Territories Pacific

EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101
(206)442-5810
Alaska, Idaho, Oregon, Washington

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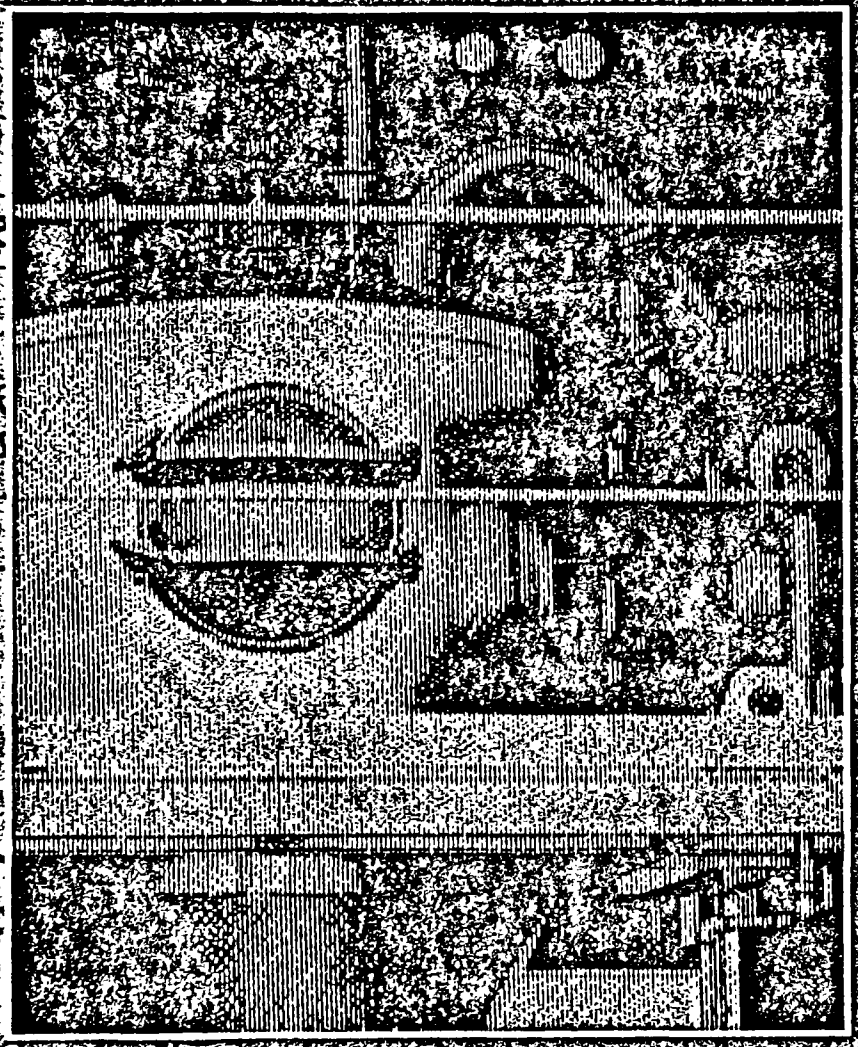


Solvent Distillation Systems

Introduction

Many industries are regularly confronted with contaminated solvents generated during equipment cleaning. Included are operations in paint manufacture, fiberglass fabrication, printing, parts degreasing and electronic parts manufacture—to mention only a few.

Many companies spend dearly for disposal, transportation or off site reclamation of spent solvents and shoulder unknown responsibilities in the process. Interel offers an economical solution for large and small quantity generators.

Simple distillation units reclaim both single and multi-component solvents. These systems have the ability to solidify residue waste for disposal at approved waste sites. When solvent costs and disposal costs are considered, payback can be less than one year—even for small operations.

Interel's solvent distillation systems may be operated manually or automatically and batchwise or continuously. These systems range in size from 8 GPH to 150 GPH of solvent recovery capacity.

B-SC 200

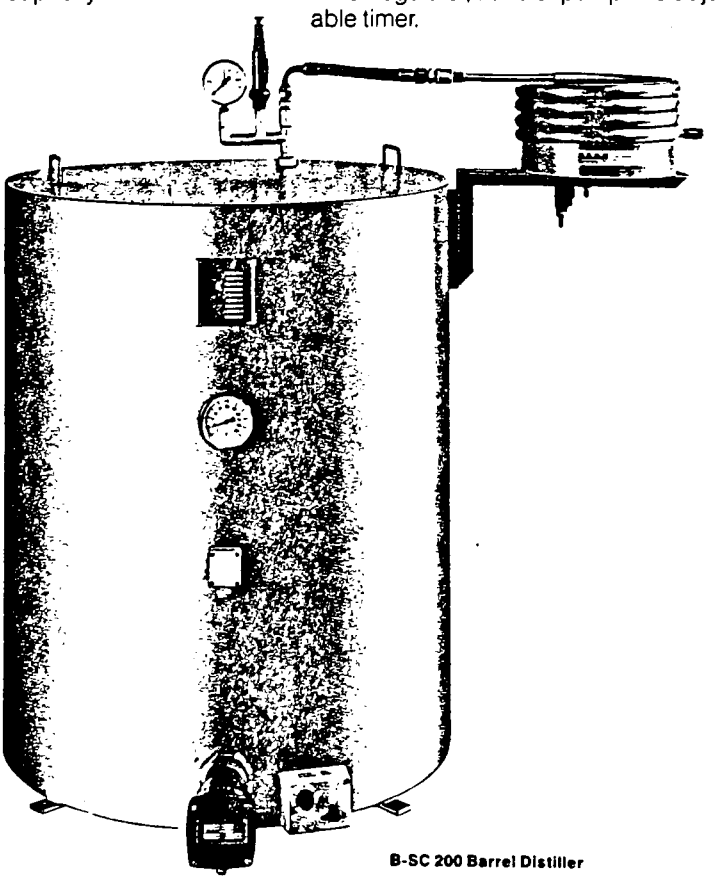
Solvents contaminated by resins, adhesives, rubber, paint or similar components which produce a hard, rubbery or sticky residue generally had to be disposed of untreated. Solvent reclamation was difficult or impossible.

The B-SC 200 Barrel Distiller solves this problem.

The Barrel Distiller is unique as it recovers spent solvent directly from a standard 55 gallon drum leaving the residue waste right in the drum for easy disposal. Successive filling of a drum consolidates residues for lower disposal costs. The drum is immersed in heat transfer liquid which is heated by electric immersion heaters.

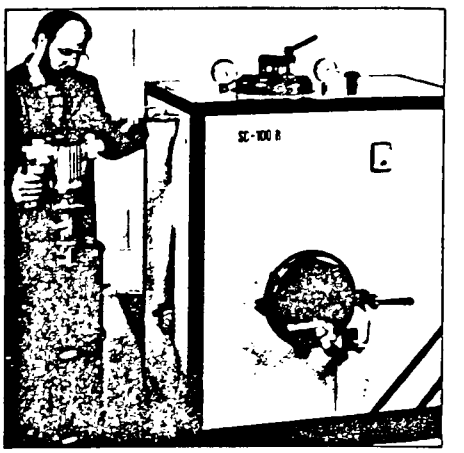
The Barrel Distiller features stainless steel construction, control panel, direct readout thermometer, pressure gauge with relief valve, liquid cooled condenser and safety controls for unsupervised operation.

Optional items include: explosion proof control panel, vacuum system, cooling water regulator, transfer pump and adjustable timer.



B-SC 200 Barrel Distiller

SC 100



SC 100 Solvent Reclaimer

The SC 100 Solvent Reclaimer consists of a heavy gauge steel vessel which is double jacketed with outer casings for heat transfer liquid and insulation. The evaporation vessel is equipped with two large, compression sealed hinged doors for access to the vapor space and to the liquid sump for manual cleanout of distillation residues. The entire system is mounted in a sturdy frame with removable side panels.

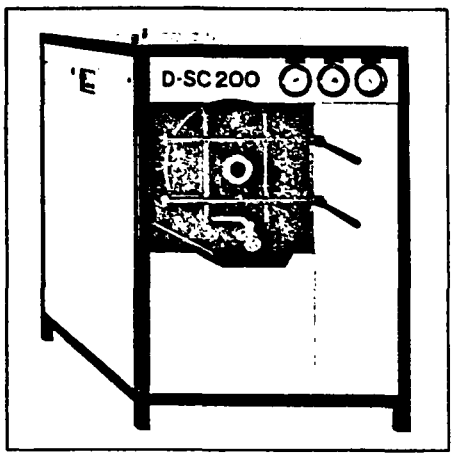
The SC 100 has a solvent capacity of 100 liters (25 gallons) and distills from 5 to 10 GPH depending on type of solvent, contamination and heat input rate.

The SC 100 includes a control panel, a direct readout thermometer, pressure gauge with relief valve, liquid cooled condenser and safety controls for unsupervised operation.

Optional items include: stainless steel construction, explosion proof control panel, vacuum system with intermediate holding tank, automatic continuous filling of dirty solvent, transfer pumps, cooling water regulator, adjustable timer and nitrocellulose safety quench system.

D-SC 200

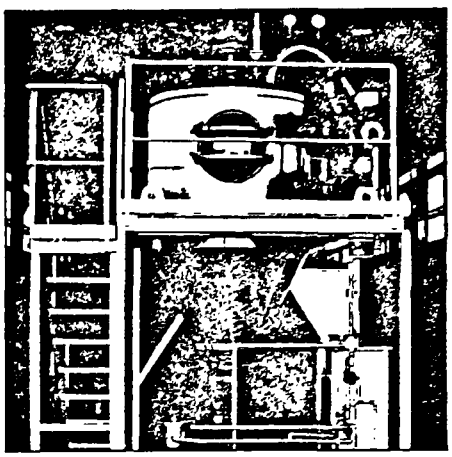
A-SC 200, 750, 1000, 1500 and 2000



D-SC 200 Solvent Reclaimer

The distillation systems Type A-SC vary in capacity from 200 to 2000 liters (50 to 525 gallons). Distillation rates of 15 to 250 GPH are a function of solvent heat of vaporization, contamination characteristics and the heat input capacity of the distillation unit.

The A-SC systems consist of a heavy gauge steel internal vessel which is double jacketed with outer casing for heat transfer liquid or steam, and insulation. The evaporation vessel is cylindrical with a conical bottom leading to a residue discharge valve. The vessel is equipped with a large compression sealed hinged access door and sight glass.



A-SC 1500 Solvent Reclaimer

The D-SC 200 Solvent Reclaimer consists of a heavy gauge steel horizontal vessel which is double jacketed with outer casings for heat transfer liquid and insulation. The evaporation vessel is equipped with a large compression sealed hinged door for manual cleanout of distillation residues. The entire system is mounted in a sturdy frame with removable side panels.

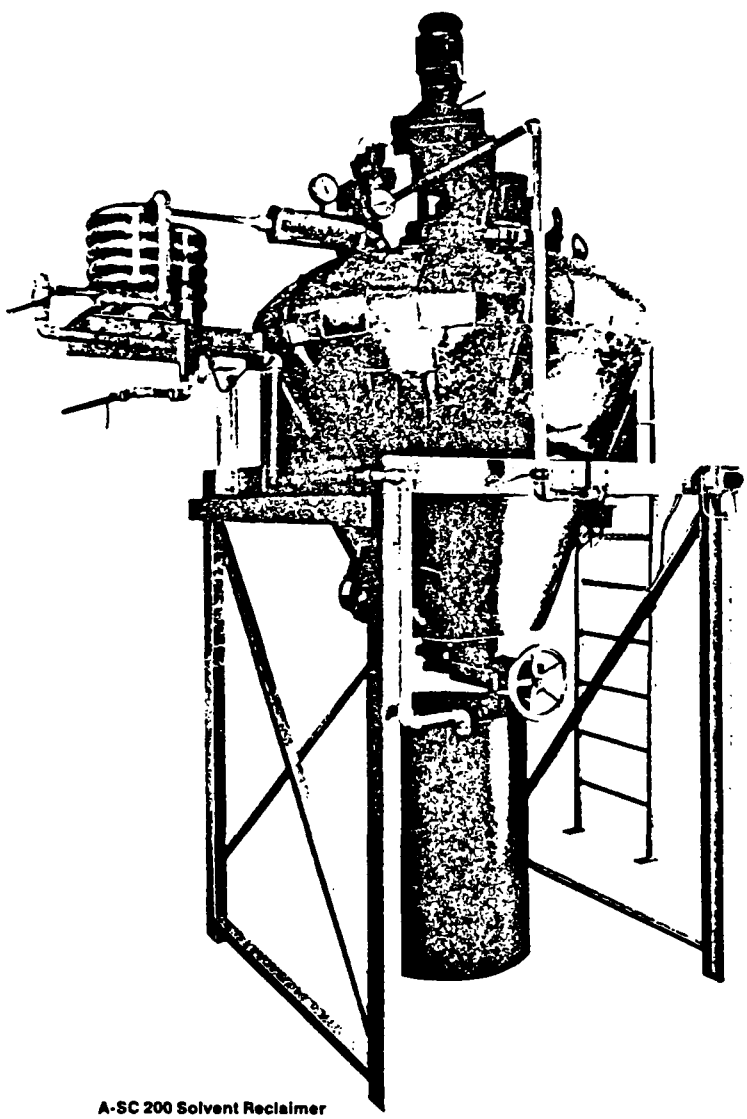
The D-SC 200 has a solvent capacity of 200 liters (50 gallons) and distills 8-20 GPH depending on type of solvent, contamination and heat input rate.

Automatic continuous filling of contaminated solvent is standard including transfer pump with explosion proof motor controlled by an induction type high/low level sensor with automatic timer shut-off and high level safety shut-off with alarm.

The standard cooling water control system regulates water consumption automatically depending on the distillation output. A modulating water valve is controlled to maintain desired set point for cooling water exit temperature.

The D-SC 200 includes a control panel, direct readout thermometer, pressure gauge with relief valve, liquid cooled condenser and safety controls for unsupervised operation.

Optional items include: stainless steel construction, explosion proof control panel, vacuum system with intermediate holding tank, internal illumination, transfer pump, adjustable timer and nitrocellulose safety quench system.



A-SC 200 Solvent Reclaimer

The vessel is designed for indirect heating by forced circulation of externally supplied thermal oil or steam and features an agitator with self-adjusting teflon scraper blades to prevent residue deposits on the heat transfer surface. Explosion proof motor with torque overload protection and shaft vacuum seal are included.

The A-SC Solvent Reclaimers feature a steel support frame with ladder, control panel, direct readout thermometer, pressure gauge with relief valve, liquid cooled condenser and safety controls for unsupervised operation.

Optional items include: stainless steel construction, explosion proof control panel, vacuum system with intermediate holding tank, thermal oil heating system, electric steam generator, internal illumination, transfer pumps, access platform with staircase, programmable controller, adjustable timer and nitrocellulose safety quench system.

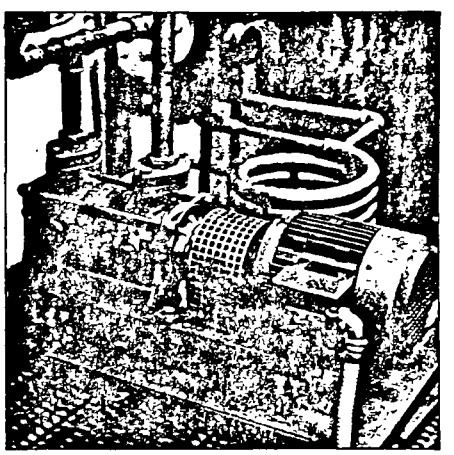
Vacuum System

A vacuum system is required for solvents with a boiling temperature which exceeds 300°F. Distillation at a lower pressure reduces the distillation temperature thus insuring a smooth distillation process without cracking of hydrocarbons.

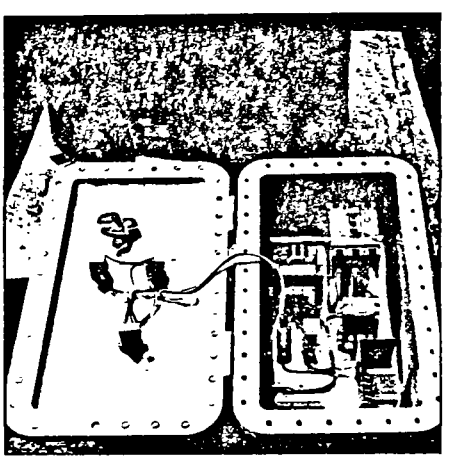
Vacuum systems feature explosion proof motors and liquid cooling to remove heat produced by the vacuum pump where required.

Safety Features

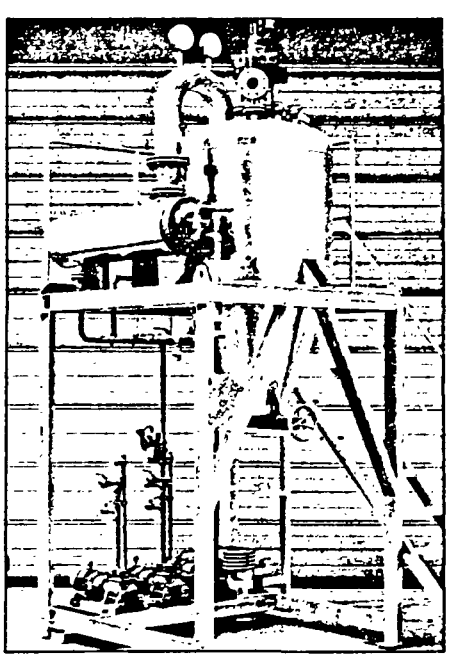
Safety features include: cooling water flow switch, vapor temperature switch, heat transfer liquid level switch and dual set point thermostat all interlocked to the heat transfer source for automatic shut-down; pressure relief valve; liquid level sensors with alarm; explosion proof motors and heating elements; intrinsically safe circuits; nitrocellulose decomposition quench; gear motor torque overload protect; and non-sparking aluminum tools for residue removal.



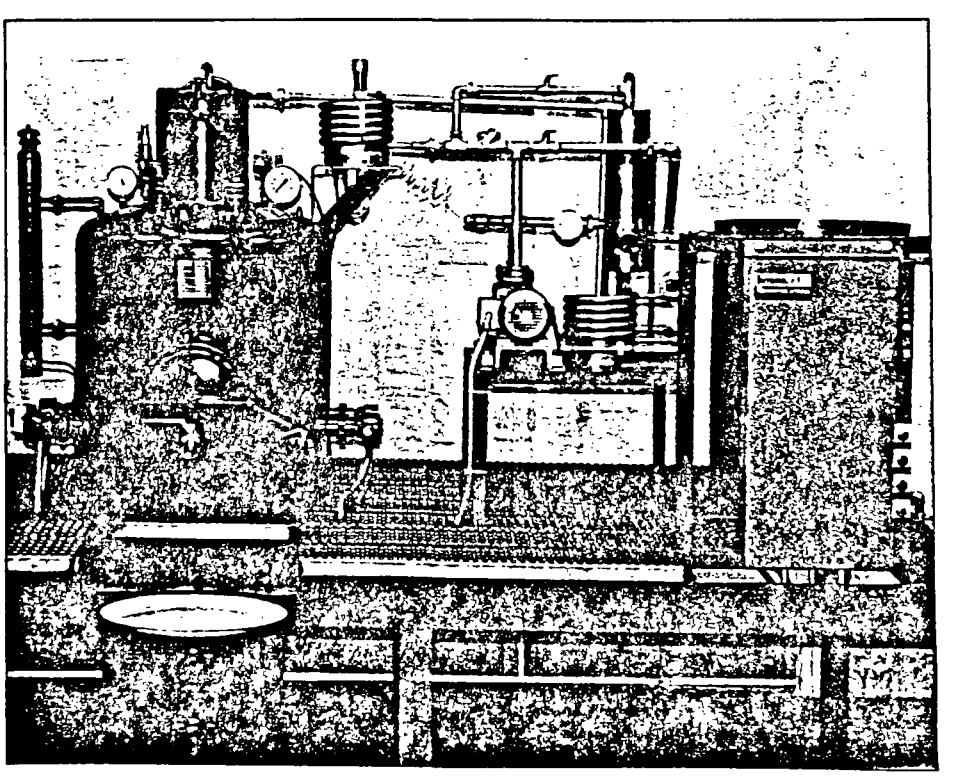
Liquid Ring Vacuum Pump



B-SC 200 Control Panel, Explosion Proof

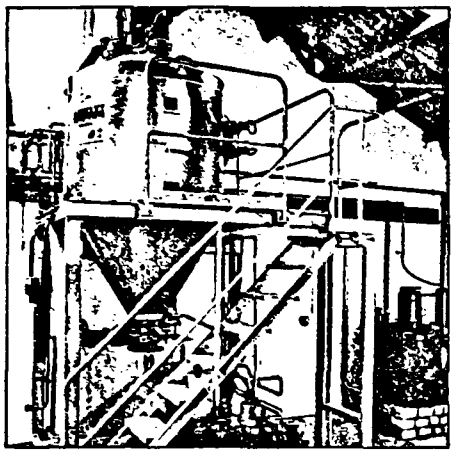


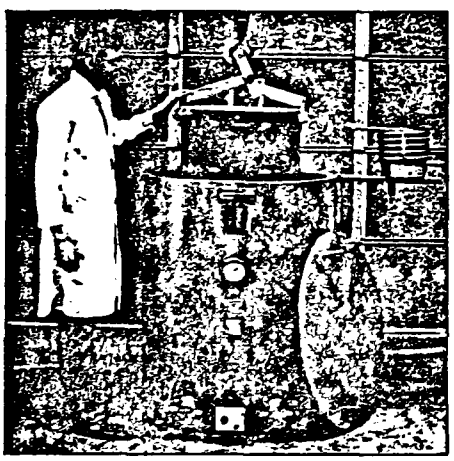
A-SC 750 Solvent Reclaimer

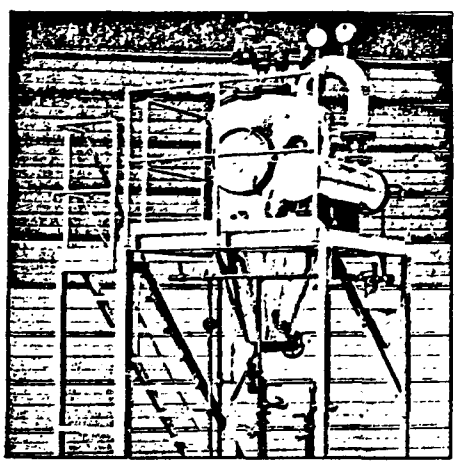


Custom Platform Mounted System

Special Benefits







Always clean solvent on demand.

Simple operation, fully automatic systems available.

Compliance with environmental standards and waste minimization requirements.

Avoid responsibility for off-site transportation of solvents.

Reduced costs and long term liability for disposal of residues only.

Avoid registration as hazardous waste generator if residues are less than 100 kg/month.

Reduced inventory of fresh and contaminated solvents—saves up to 90% of inventory capital.

Payback period for required investment typically less than one year.

Lower cost for recycled solvent than available from reclaiming companies.

Certainty of keeping your own solvents.

Interel Corporation

Environmental
Control Systems

P.O. Box 4676
Englewood, Colorado 80155
Telephone: (303) 773-0753
Fax: (303) 792-0931

Printed in U.S.A.
SDS-892-B

Interel
Corporation
Environmental Control Systems

SOLVENT RECYCLING EQUIPMENT REFERENCE LIST

National Starch and Chemical Co. 742 Grayson Street Berkeley, CA 94710 415/548-6722 Jim McManus	B-SC 200 Recycling variety of solvents
Douglas Furniture Corporation 5020 W. 73rd Street Bedford Park, IL 60499 (312)458-1505	B-SC 200 Recycling MEK
Sea Sprite Industries, Inc. Highway 24 East Crescent City, IL 60928 (815) 683-2155	B-SC 200 Recycling acetone
Marble Products 1017 E. 22nd Street Indianapolis, IN 46202 (317) 925-2433 Bill Van Huss	B-SC 200 Recycling acetone
Modine Manufacturing Co. 239 Factory Street LaPorte, IN 46350 219/362-7041, Ext. 309 Bill Burkhard	B-SC 200 Reducing hazardous waste water disposal. Recycling VM&P Naptha
Loctite Corporation 3255 Harvester Road Kansas City, KS 66115 913/621-1400 Dave Adams	B-SC 200 Recycling acetone/alcohol

P.O. Box 4676, Englewood, CO 80155 Telephone: 303/773-0753 Telecopier: 303/792-0931

Labeltape Inc. 4275 Airwest Drive S. Grand Rapids, MI 49508 616/698-8890 Chuck Piette	SC 100 Recycling perchloroethylene/ n-Butanol solvent blend
K.J. Quinn and Company, Inc. 137 Folly Mill Road Seabrook, NH 03874 603/474-5392 Bryant Winterholer	B-SC 200 Recycling MEK/methylene chloride solvent blend
National Starch and Chemical Co. 225 Belleville Avenue Bloomfield,NJ 07003 201/748-9400 Chuck Stypulkowsky	B-SC 200 Recycling variety of solvents
Gemini Lacquers,Inc. 101 S.W. 22nd El Reno, OK 73036 405/262-5710 Hersh Zarecor	D-SC 200 Recycling variety of lacquer thinners
Sharpoint, Inc. 2850 Windmill Road Reading, PA 19608 215/670-2060 Paul Kalejta	SC 200 Separating isopropyl alcohol from butyrolactone
Polymer Equipment Cleaning 109 E. Newberry Avenue Sumter, SC 29150 803/242-5192 Nicos Andreas	SC 200 Recycling triethylene glycol
Chemical Dynamics 1020 E. Columbia Weatherford, TX 76086 817/594-5464 Brian Kern	SC 100 Recycling MEK and toluene

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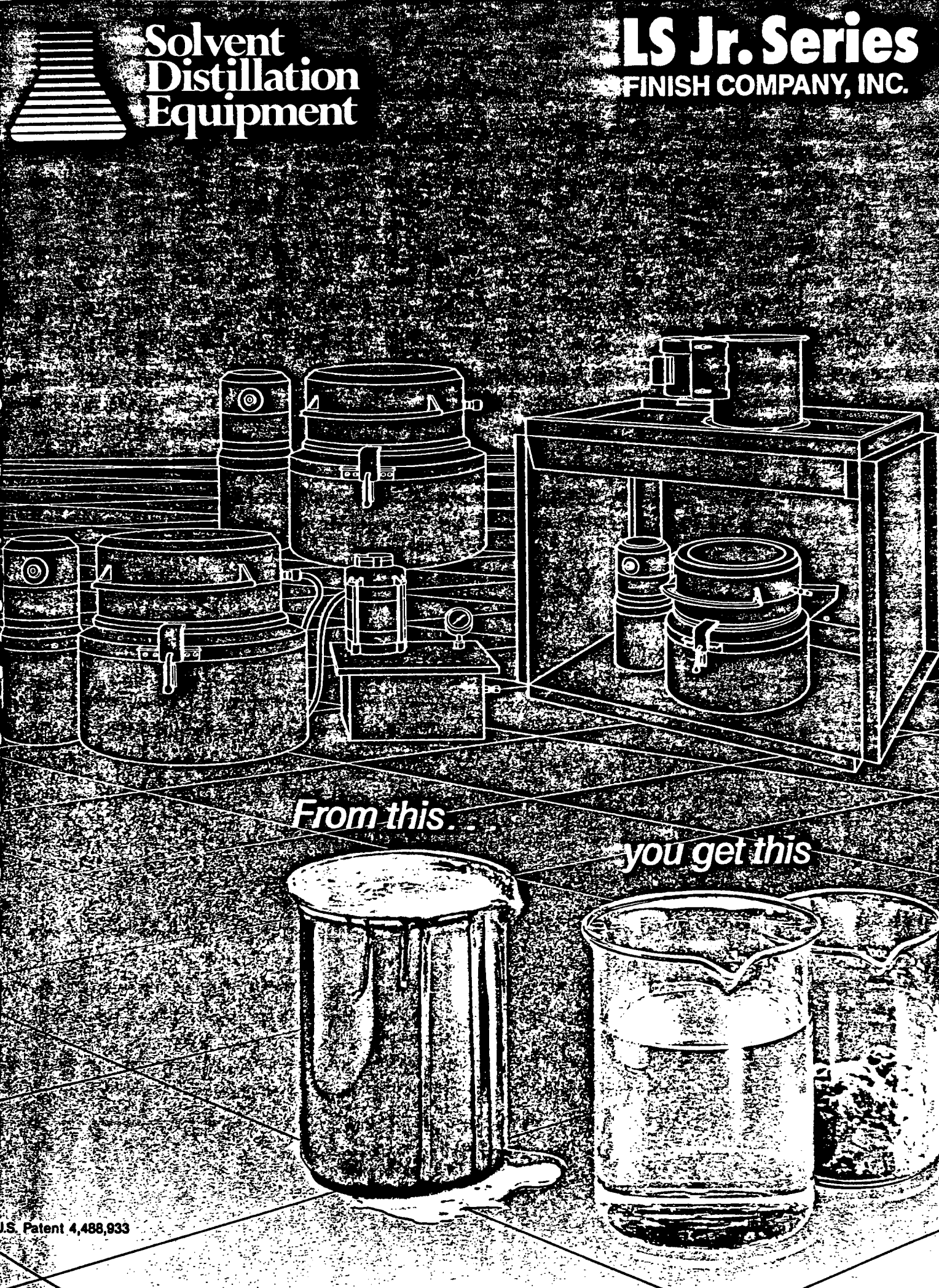
Environmental Control Systems

Lakeway Printers 100 Lakeway Place Tullahoma, TN 37388 615/455-5084 Bette Donathan	B-SC 200 Recycling toluene
American Tobacco Company 13101 N. Enon Church Road Chester, VA 23831 804/751-7500 Byron Price	2 x B-SC 200 Recycling Freon-11
Virginia Transformer Corporation 1634 Seibel Drive N.E. Roanoke, VA 24012 703/345-9892 Dave Merriam	B-SC 200 Recycling xylene and paint thinner
International Adhesives and and Resins Pty. Ltd. 14 Tullamarine Park Road Tullamarine, Melbourne Australia Wal Zawadka	B-SC 200 Recycling variety of solvents
Emhart Australia Pty. Ltd. P.O. Box 50 51-71 High Street Thomastown, Victoria 3074 Australia (03) 465-5211 Ian C. Johns	B-SC 200 Recycling variety of solvents
DRG Packaging 85 Laird Drive Toronto, Ontario M4G 3TB Canada 416/421-1700 Lou Gizzarelli	A-SC 750 Recycling ethyl acetate/ ethanol/toluene/isopropanol/ methanol solvent blend

Solvent Distillation Equipment

LS Jr. Series

FINISH COMPANY, INC.

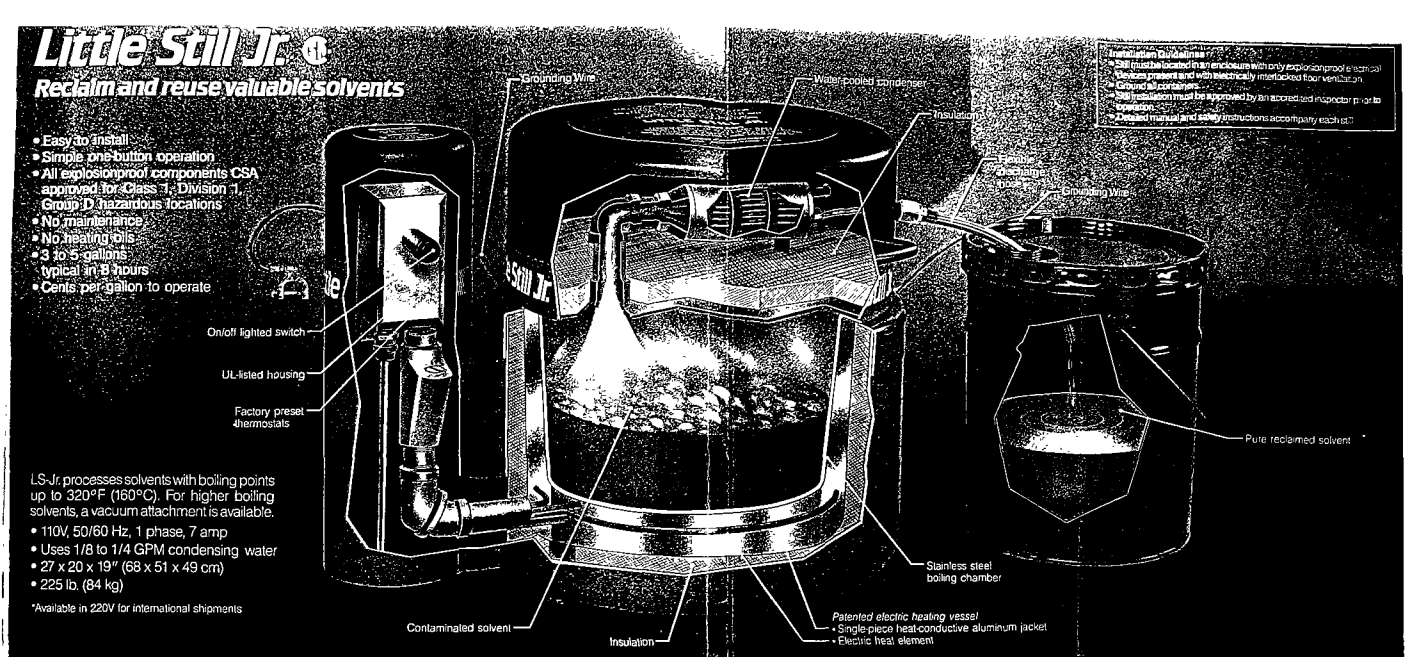


U.S. Patent 4,488,933

Little Still Jr.

Reclaim and reuse valuable solvents

- Easy to install
- Simple one-button operation
- All explosionproof components CSA approved for Class 1, Division 1, Group D hazardous locations
- No maintenance
- No heating oils
- 3 to 5 gallons typical in 8 hours
- Cents per gallon to operate

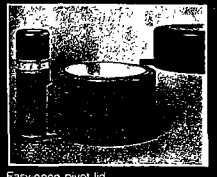


Installation Requirements
- Still must be located in an enclosure with only explosionproof electrical devices present and with electrically interlocked floor ventilation.
- Ground all containers.
- Installation must be approved by an appointed inspection agency prior to operation.
- Detailed manual and safety instructions accompany each unit.

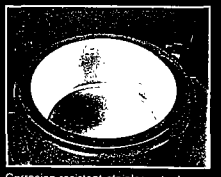
LS-Jr. processes solvents with boiling points up to 320°F (160°C). For higher boiling solvents, a vacuum attachment is available.

- 110V, 50/60 Hz, 1 phase, 7 amp
- Uses 1/8 to 1/4 GPM condensing water
- 27 x 20 x 19" (68 x 51 x 49 cm)
- 225 lb. (84 kg)

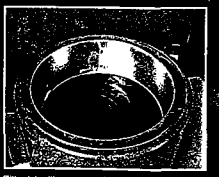
*Available in 220V for international shipments



Easy-open pivot lid



Corrosion-resistant stainless steel boiling vessel

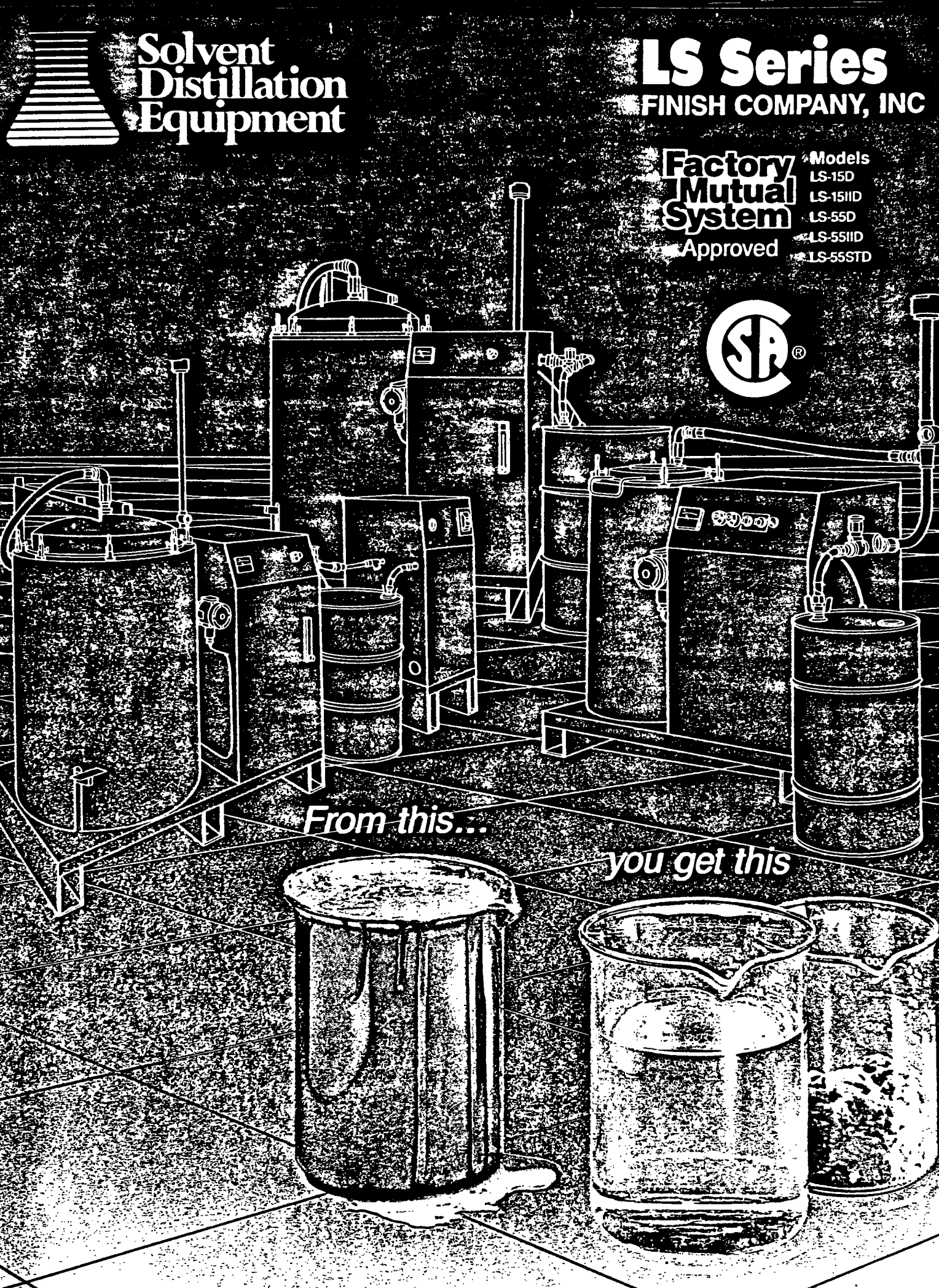


Filled boiling vessel ready for startup

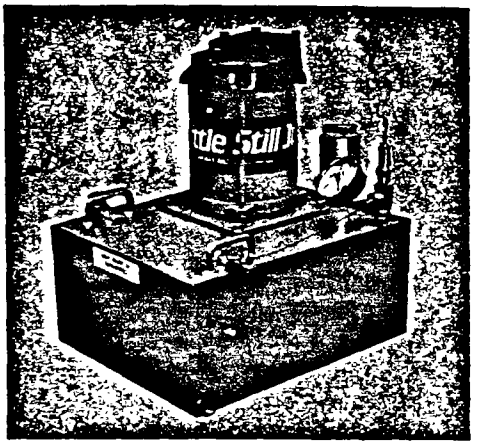
Boiling vessel fitted with optional STILBAG liner

Contaminated solvent in STILBAG-lined vessel ready for startup

STILBAG facilitates waste removal


Solvent
Distillation
Equipment
LS Series
FINISH COMPANY, INC
Factory
Mutual
System
Approved
Models
LS-15D
LS-15IID
LS-55D
LS-55IID
LS-55STD
From this...
you get this

LS-Jr. Vacuum Attachment



Specifications

Height:	17 inches	43 cm
Width:	15 inches	38 cm
Depth:	22 inches	56 cm
Weight:	80 pounds	36 kg

Capabilities

- Processes solvents with boiling points up to 500°F (260°C) such as mineral spirits, Stoddard solvent, kerosene and Varsol

Features

- Retrofitable to existing LS-Jr.
- Allows either vacuum or atmospheric distillation
- Unique JetVac pump design
- Achieves up to 28 inches (71 cm) mercury vacuum
- Explosionproof electricals CSA approved for Class 1, Division 1, Group D hazardous locations
- Distillate discharges to pail at atmospheric pressure
- One-switch operation
- Easy-to-read vacuum gauge

Utility Requirements

- 115V, single phase, 60 Hz, 4 amps
- 1/10 to 1/4 GPM cooling water

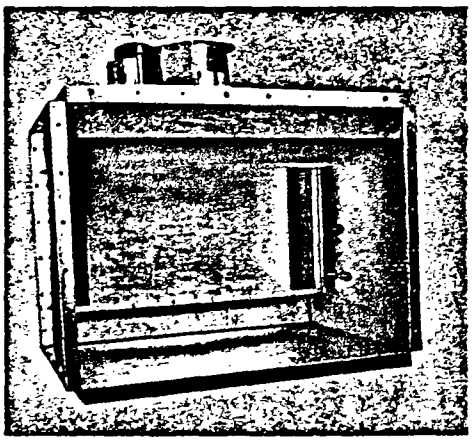
Principles

The LS-Jr. V utilizes breakthrough technology to reclaim higher-boiling solvents.

Solvent in the reservoir tank is circulated by the solvent pump through the high-velocity JetVac. This high-speed circulation produces a vacuum in the distillation unit.

As solvent is recovered and cooled, it is gravity-fed from the vacuum unit to a 5-gallon distillate pail.

LS-Jr. Ventilation Booth



Features

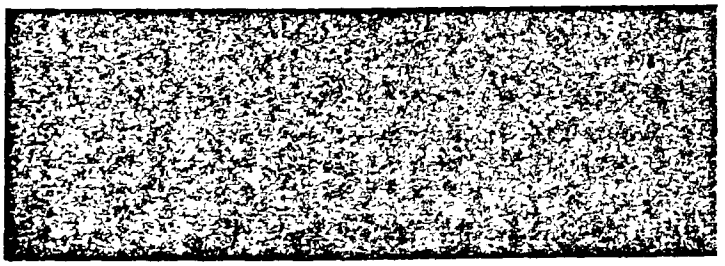
- Contains and exhausts vapor
- Available in two sizes to accommodate LS-Jr. or LS-Jr. V
- Easy to assemble
- All hardware for assembly is included
- Available with 1/4 HP TEFC motor and non-sparking ventilation fan
- Bulkhead fittings and vapor seals provided for convenient water and power hook-up

Specifications

LS-Jr. Booth	JS-Jr. V Booth
52″ wide	70″ wide
38″ tall	38″ tall
32″ deep	32″ deep

- **Motor** — 1/4 HP, 1725 RPM, 115/230 volt, 60Hz, 1 Phase, TEFC
- **Fan** — 12″ Diameter, 990 CFM Capacity @ 1/4″ SP

LARGER UNITS ARE ALSO AVAILABLE



FINISH ENGINEERING CO.™

Finish Company, Inc.
921 Greengarden Road
Erie, Pennsylvania 16501-1591 U.S.A.
Phone 814/455-4478
FAX 814/455-8518

In-House Solvent Recovery

Small Volume Batch Feed

Thousands of Installations

Turn your hazardous waste solvent into profits with Finish Company, Inc. in-house solvent recovery equipment. Manufacturing solvent handling equipment for over thirty years, Finish Company has established itself as the industry leader in in-house solvent distillation technology.

Thousands of distillation units operating successfully attest to the reliability of our equipment. Companies worldwide are reclaiming contaminated solvents on-site into clean, reusable solvent for just pennies per gallon.

Advantages

LS Series solvent recovery equipment is uniquely designed and can provide many years of safe, simple and efficient daily operation . . . virtually maintenance-free. This equipment provides typical payback in 6 to 12 months and when properly installed and operated satisfies the most stringent safety and emission standards for in-house solvent reclamation.

Compared to outside reclamation services, in-house distillation with LS equipment can return a purer product, provide a higher recovery yield and allow you to control your distillation schedule — all at exceptionally low operating costs.

In addition, liabilities for transportation and disposal of hazardous waste are substantially reduced. In recent years, the Resource Conservation Recovery Act (RCRA) has given "cradle to grave" responsibility to generators of hazardous waste for its storage, transportation and disposal.

In-house reclamation reduces the staggering cost of handling waste in compliance with EPA regulations.

Capacities

The LS Series is comprised of four basic models designed to process batches of 3-5, 15, 55 or 110 gallons of contaminated solvent per shift. The standard units are capable of handling solvents with boiling points ranging from 100° to 320°F. For solvents with boiling points from 320° to 500°F, use our standard LS Series plus optional vacuum attachment.

Safety Design

Finish Company solvent recovery equipment is unmatched in its attention to daily operator safety and environmental responsibilities. All LS Series units strictly adhere to Class I, Division I, Group D (NEMA 7) electrical code standards. Each LS unit is accompanied by a Stilmanual, which provides careful recommendations on installation and operation.

Made in the U.S.A.

LS equipment is researched, designed, produced and tested at our 50,000 square foot modern manufacturing facility located in Erie, Pennsylvania.

Meeting Your Requirements

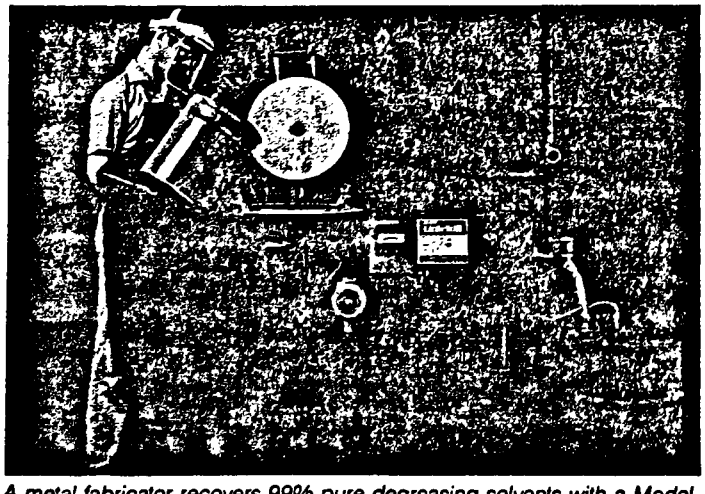
Prospective applications are evaluated by our Engineering and R & D Departments to ensure that each unit meets specific usage requirements. In our fully staffed and equipped Laboratory, we conduct daily evaluations concerning all facets of distillation technology.

Contract testing is available. You send a clearly defined sample of your contaminated solvent to be distilled, and Finish Company will provide reports and an LS equipment recommendation. Demonstrations and full scale testing can be arranged on any of the LS Series units.

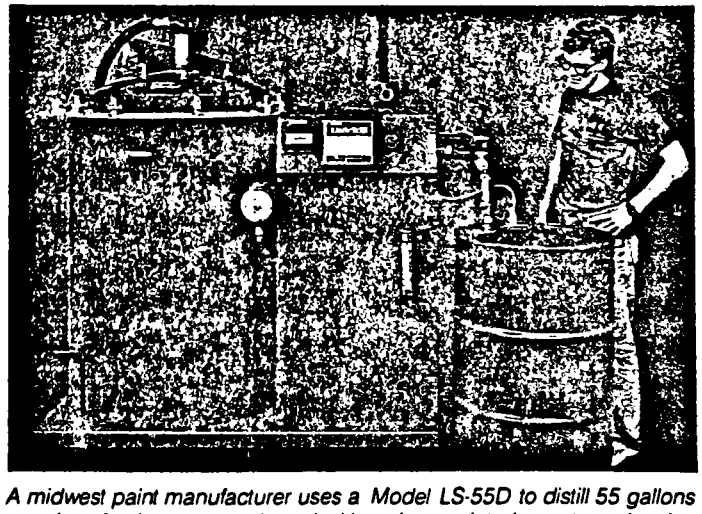
Consult Those Who Know

Finish Company sales engineers and chemists offer years of experience in solvent distillation covering diverse industrial applications and stringent military specifications. Printers, paint manufacturers and users, fiberglass molders, utility companies, government agencies and metalworking plants are just a few of those reclaiming millions of gallons of solvent on-site each year with Finish Company equipment.

A network of North American and International sales representatives offer continued support. These people have constant direct line access and contact with Finish Company, Inc.



A metal fabricator recovers 99% pure degreasing solvents with a Model LS-15D. Investment payback was realized in just a few months. This is one of thousands of successful installations in use worldwide by printers, fiberglass molders, and manufacturers of paint, adhesives, electronics, auto parts, etc.



A midwest paint manufacturer uses a Model LS-55D to distill 55 gallons per day of solvent contaminated with various paint pigments and resins. Solvents reclaimed include MEK, MIBK, xylene, methanol, and toluene. Payback was realized in a few short months.

How it Works . . .

Boiling Chamber Filled

Solvent is poured or pumped into the Teflon*-coated boiling chamber, which the operator lines with a standard Stilbag. In lieu of Stilbag, an optional Teflon-coated Stilpan may be used.

Solvent Heated

After the chamber lid is secured, power to the unit is activated. Heat is transferred from the patented encapsulated heater through the conductive walls of the chamber directly into the solvent.

Vapors Formed

As the solvent boils, vapors form and pass through the vapor tube into a water-cooled shell-and-tube condenser.

Vapors Condensed

Vapors are condensed into a liquid state. This clean, clear, 99%-pure distillate gravity flows into an approved customer-provided 15- or 55-gallon drum.

Cycle Completed

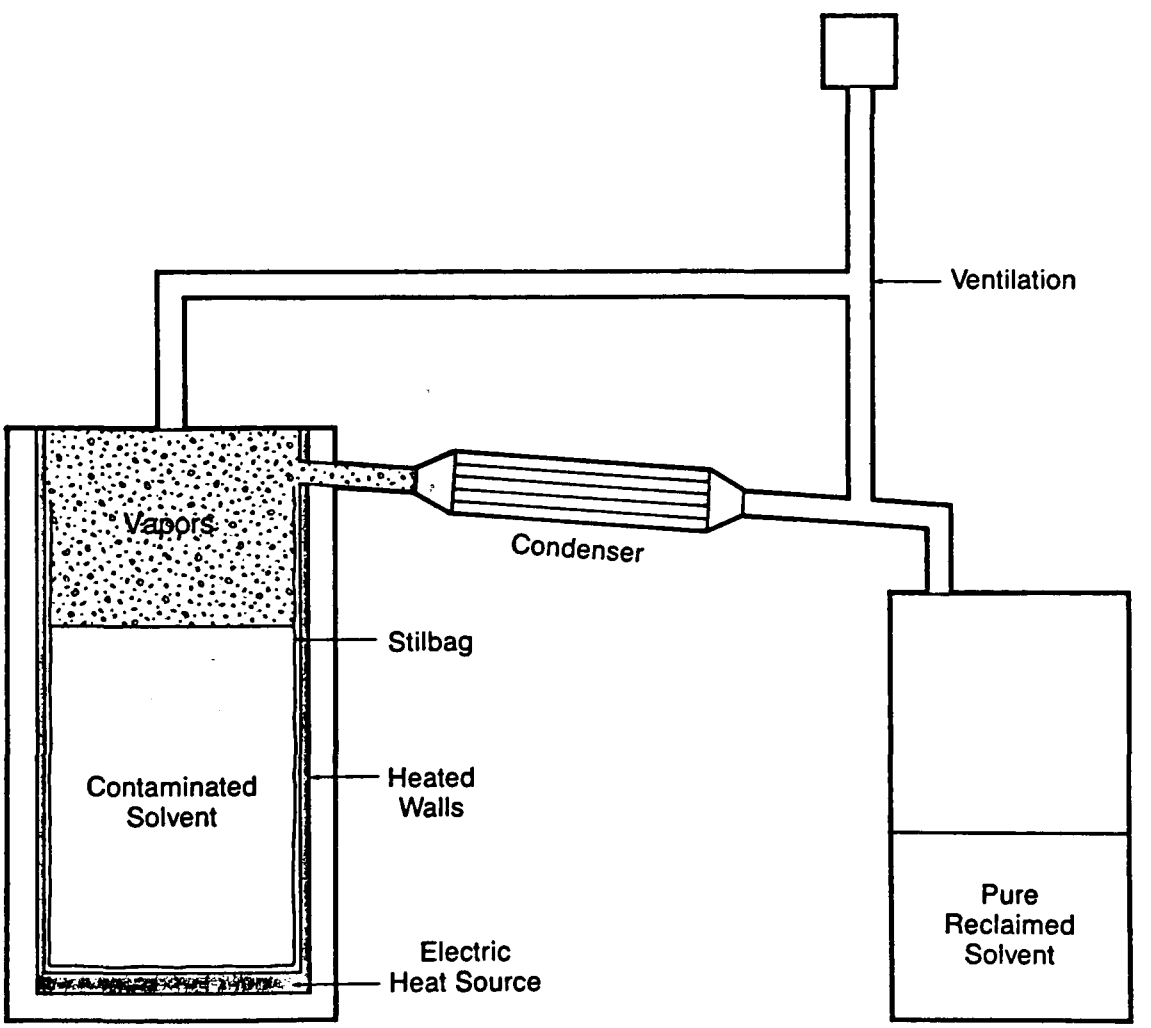
When visual check through sight glass indicates no further distillate is available, the unit is shut off and allowed to cool.

Residue Removed

After cooling, residue remaining behind in the Teflon-coated boiling chamber is then removed via the Stilbag or optional Teflon-coated Stilpan.

*DuPont registered trademark

Distillation Schematic



Design and Safety Features

Safety Design
Finish Company solvent reclaimers are built to Class I, Division I, Group D (NEMA 7) standards of the National Electrical Code.

Patented Encapsulated Heating Element
Heating element is encapsulated within the vessel bottom insuring direct heat to 100% of the vessel surfaces. This method eliminates the need for inefficient hot oil immersion heating. The encapsulated heater on all LS Series units carry a five year warranty.

Residue Removal System
Residue is contained within disposable Stilbag liner for convenient removal and handling. Teflon-coated Stilpan is optionally available. Distillation chamber is Teflon coated for ease of cleaning.

Water-Cooled Condenser
Efficient shell-and-tube design provides complete condensing of vapors, allows easy cleaning, and eliminates need for pumps or other moving parts. Solvent gravity flows into an approved customer-provided 15- or 55-gallon drum.

Push/Pull Lighted Indicator
Shows on and off positions. Light indicates sufficient water flow through condenser for operation of boiling chamber.

Condenser Water Flow Switch/Interlock
The distillation unit operates ONLY when sufficient volume of cooling water is present. Interruption of water terminates power to unit.

Adjustable Flow Meter
Console-mounted gauge with dial allows personnel to set volume and observe actual flow of cooling water to condenser for efficient usage.

Adjustable Temperature Controller
Operating temperature can be set to 350°F.

Vapor Temperature Gauge
Indicates vapor temperature throughout distillation run. Used to determine the optimum termination point.

Quick Cool Coil
Allows for fast cooling of distillation tank for multi-shift use.

Vacuum Capability
All LS Series units will accept our unique JetVac Attachment allowing recovery of solvents with boiling points up to 500°F.

Dual Thermostat Controls
Two override thermostat controls are provided so that the unit temperature does not exceed the Underwriters Laboratory's recommendation for heater temperature in a Class I, Division I, Group D environment.

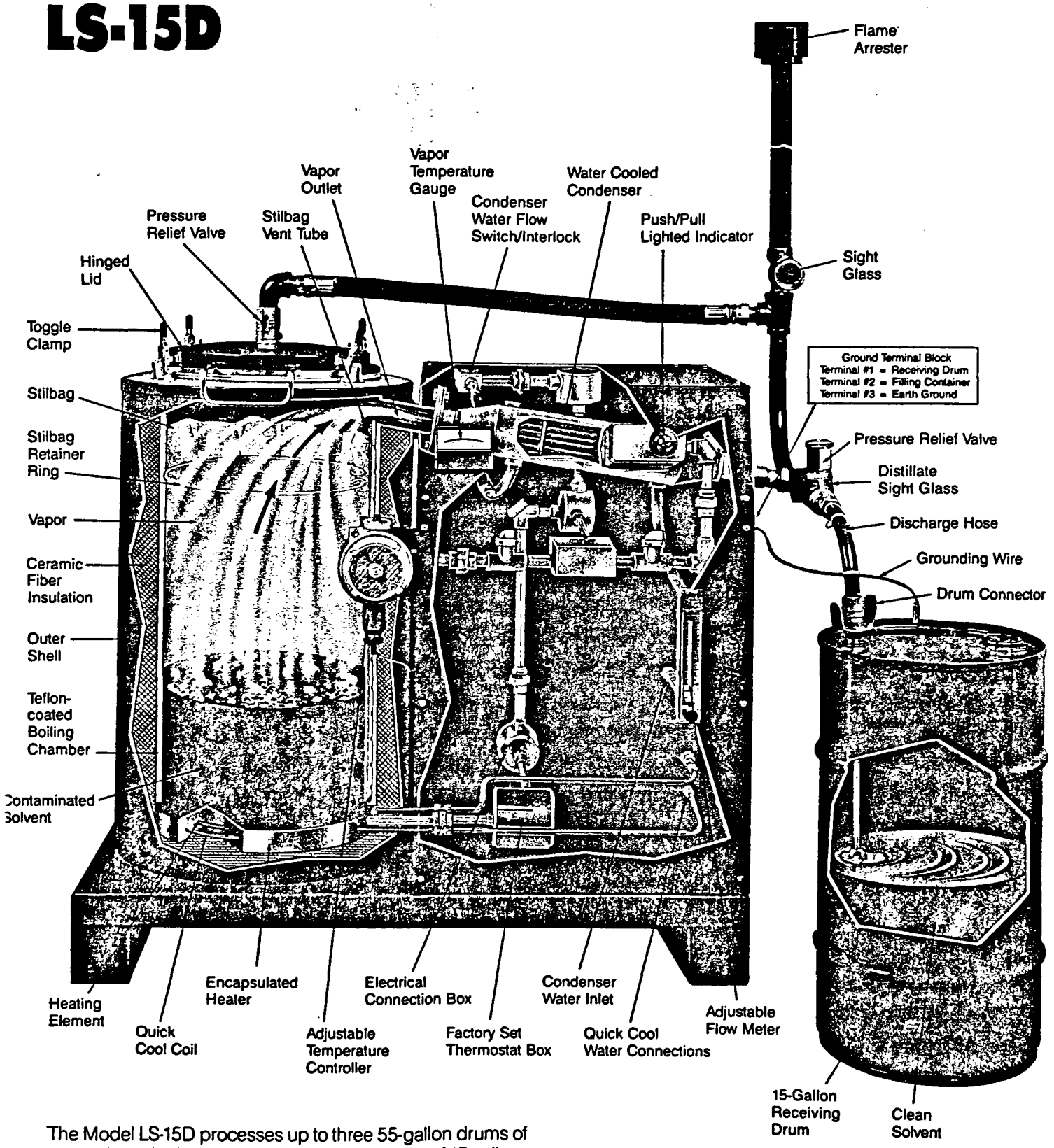
Fully Insulated
Total distillation tank including lid is insulated with ceramic fiber for heat retention to provide efficient distillation.

Dual External Venting System (DEVS)
Provides safe transmission of potential vapors away from distillation site when properly customer-installed and operated. DEVS involves:

- Pressure Relief Valves
  a) enables vapors to escape into DEVS from boiling chamber at .5 psi.
  b) prevents pressurization of distillate receiving container.
- Vacuum Attachment Port for installation of modular vacuum attachments.
- Swing Check provides for vapor exhaust under vacuum operation.
- Sight Glasses allow visual inspection of
  a) venting system
  b) reclaimed distillate flow.
- Flame Arrester conforms to NFPA requirements for the emission of vapors.

Installation Guidelines
- Still must be located in an enclosure with only explosionproof electrical devices present and with electrically interlocked floor ventilation.
- Ground all containers.
- Still installation must be approved by an accredited inspector prior to operation.
- Detailed manual and safety instructions accompany each still.

LS-15D



The Model LS-15D processes up to three 55-gallon drums of contaminated solvent per week at an average rate of 15 gallons per 6-8 hours. This standard atmospheric unit reclaims solvents with boiling points up to 320°F. Solvents with boiling points up to 500°F can be reclaimed with use of the JetVac attachment.

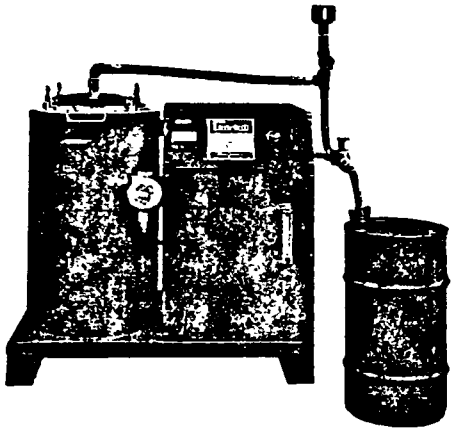
Specifications

Note: Attached to each LS Unit is a Stilmanual, which directs you to follow NFPA 30 for installation.

LS-Jr.

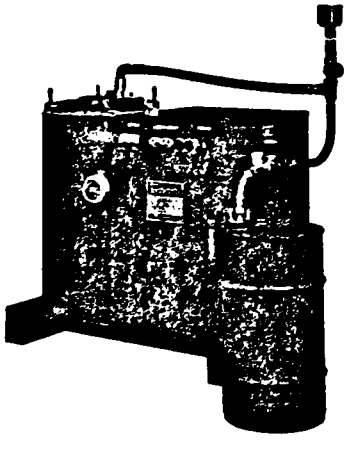
Process Rate	3-5 gal/shift	11.4-18.9 ltr/shift
Boiling Range	100 - 320°F	38 - 160°C
UTILITY REQUIREMENTS		
Condensing Water	1/8 - 1/4 gpm	.47 - .95 lpm
Cooling Water*	—	—
Electricity	115V 1Ø 50/60 Hz .82 kw	
UNIT DIMENSIONS		
Length	29 in	737 mm
Width	24 in	610 mm
Height	19 in	483 mm
Weight	220 lbs	100 kg

LS-15D



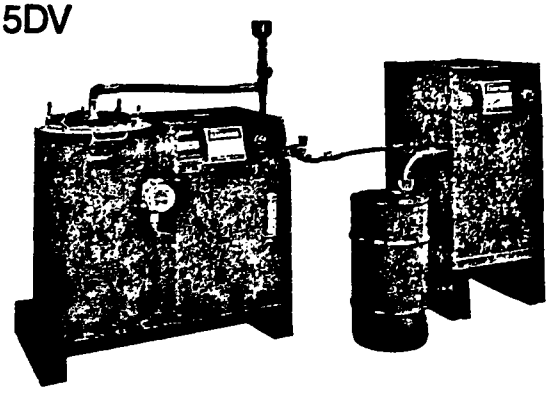
Process Rate	15 gal/shift	57 ltr/shift
Boiling Range	100 - 320°F	38 - 160°C
UTILITY REQUIREMENTS		
Condensing Water	1/4 - 1/2 gpm	.95 - 1.9 lpm
Cooling Water*	1 - 3 gpm	3.8 - 11.4 lpm
Electricity	115V 1Ø 50/60 Hz 1.65 kw	
	220V 1Ø 50/60 Hz 1.65 kw	
UNIT DIMENSIONS		
Length	51 in	1295 mm
Width	27 in	686 mm
Height	42 in	1067 mm
Weight	425 lbs	193 kg

LS-15IID



Process Rate	15 gal/shift	57 ltr/shift
Boiling Range	100 - 320°F	38 - 160°C
UTILITY REQUIREMENTS		
Condensing Water	1/4 - 1/2 gpm	.95 - 1.9 lpm
Cooling Water*	1 - 3 gpm	3.8 - 11.4 lpm
Electricity	115V 1Ø 50/60 Hz 1.65 kw	
	220V 1Ø 50/60 Hz 1.65 kw	
UNIT DIMENSIONS		
Length	51 in	1295 mm
Width	27 in	686 mm
Height	42 in	1067 mm
Weight	565 lbs	257 kg

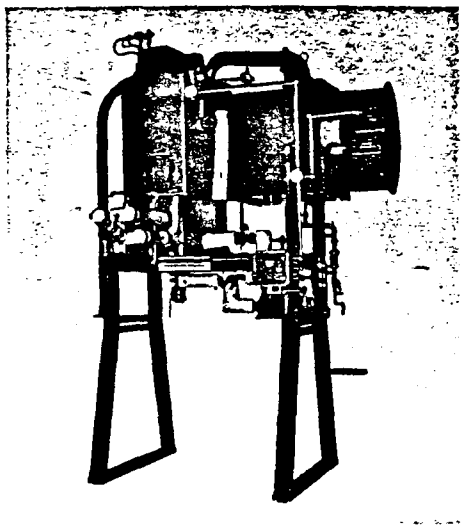
LS15DV



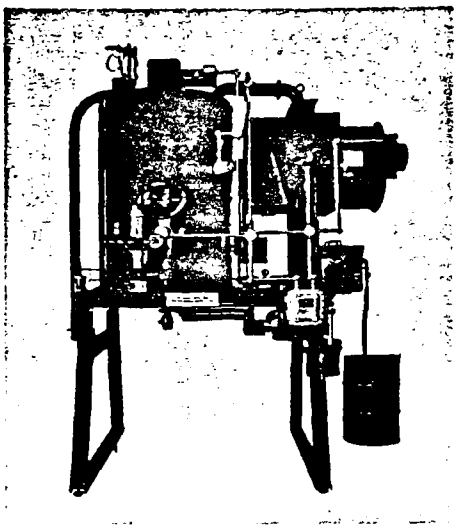
Process Rate	15 gal/shift	57 ltr/shift
Boiling Range	100 - 500°F	38 - 260°C
UTILITY REQUIREMENTS		
Condensing Water	3/4 - 1 gpm	2.8 - 3.8 lpm
Cooling Water*	1 - 3 gpm	3.8 - 11.4 lpm
Electricity	115V 1Ø 60 Hz 3.25 kw	
	220V 1Ø 60 Hz 3.25 kw	
UNIT DIMENSIONS		
Length	99 in	2515 mm
Width	27 in	686 mm
Height	48 in	1219 mm
Weight	740 lbs	336 kg

*Used for 1/2 hour to cool distillation tank (optional use)

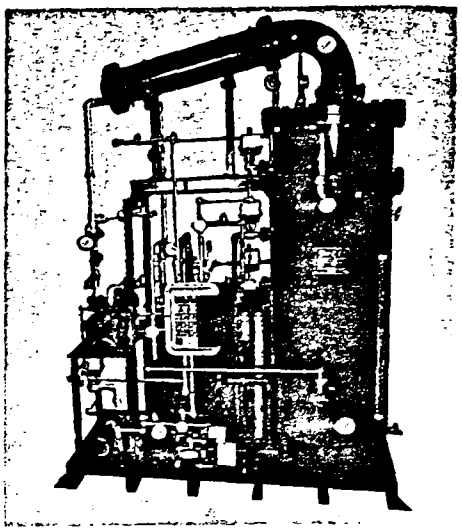
BCF-Series



BCF-380



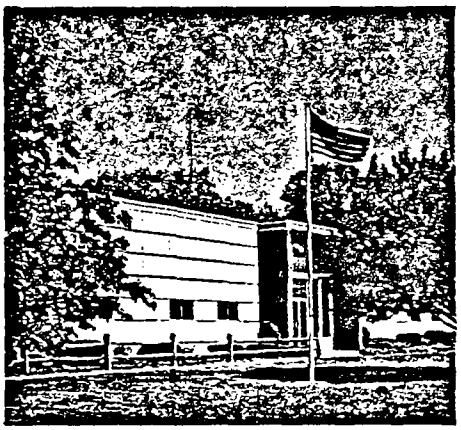
BCF-760



BCF-600

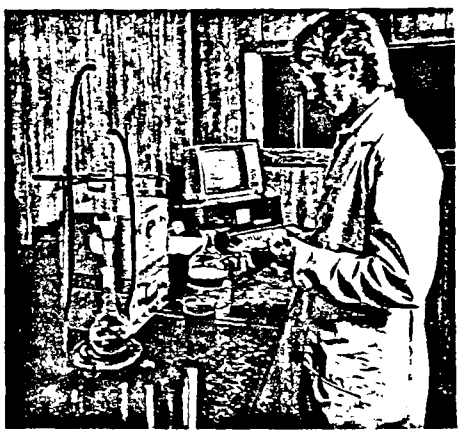
Finish Company also offers a line of large-volume solvent distillation equipment. The BCF Series is comprised of three basic models — our standard 380 and 760 units and our special 600 unit — to process from 250 to 1600 gallons per shift with single batch or continuous feed operation. Hazardous waste solvent is processed into clean, clear, reusable solvent on site.

Manufacturing Facilities



Finish Company's 50,000 square-foot modern manufacturing facility is located on 4½ acres in Erie, Pennsylvania.

All phases of manufacturing are undertaken at our main location.



Distillation of valuable solvents is evaluated daily in our fully staffed and equipped Laboratory and R & D Departments.

FINISH ENGINEERING CO.®

Finish Company, Inc.
921 Greengarden Road
Erie, Pennsylvania 16501-1591 U.S.A.
Phone 814/455-4478
FAX 814/455-8518

F89-229B-SP 10M

Solvent Distillation Equipment

Selector Guide

Follow these steps to select solvent distillation equipment.

1. Locate your solvent(s).
2. Estimate your volume of contaminated solvent.
3. Determine model code.
4. Select from Equipment Guide.

Equipment Guide

Code	Model	Gallons Per Shift	Standard 100-320°F 38-160°C boiling point	Vacuum 100-500°F 38-260°F boiling point
A	LS-JR or LS-15D	3-5 or 15	X	
B	LS-55D	55	X	
C	380	250	X	
D	760	500	X	
E	LS-JRV or LS-15DV	3-5 or 15		X
F	LS-55DV	55		X
G	380V	250		X
H	760V	500		X

ALCOHOLS	Lbs. per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model: Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
METHANOL	6.61	147-151	64-65	A	B	C	D
ETHANOL, ANHYDROUS	6.59	171-176	75-81	A	B	C	D
ETHANOL, 95%	6.76	166-175	74-79	A	B	C	D
ISOPROPANOL, 99%	6.55	179-181	80-81	A	B	C	D
n-PROPANOL	6.74	207-208	96-98	A	B	C	D
ISOBUTYL ALCOHOL	6.72	255-232	107-109	A	B	C	D
n-BUTYL ALCOHOL	6.75	239-245	116-118	A	B	C	D
sec-BUTYL ALCOHOL	6.73	208-214	97-102	A	B	C	D
AMYL ALCOHOL (Mixed Isomers)	6.76	230-293	110-145	A	B	C	D
CYCLOHEXANOL	7.91	320-324	160-163	E	F	G	H
n-HEXANOL	6.83	307-320	153-160	E	F	G	H
ETHYLENE GLYCOL	9.29	388-392	198-200	E	F	G	H

ALIPHATIC PETROLEUM	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model: Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
n-PENTANE	5.22	91-106	33-41	A	B	C	D
TEXTILE SPIRITS	5.75	145-175	63-79	A	B	C	D
n-HEXANE	5.51	151-160	65-70	A	B	C	D
n-HEPTANE	5.71	196-214	91-101	A	B	C	D
VM&P NAPHTHA	6.29 60°F	236-292	113-144	A	B	C	D
HI-FLASH VM&P NAPHTHA	6.33 60°F	240-320	116-160	A	B	C	D
NAPHTHOL MINERAL SPIRITS	6.34 60°F	307-340	153-171	E	F	G	H
MINERAL SPIRITS NO.10	6.51 60°F	307-385	153-196	E	F	G	H
STODDARD SOLVENT	6.47 60°F	310-388	154-198	E	F	G	H
MINERAL SPIRITS	6.58 60°F	314-390	157-199	E	F	G	H
VARSOL-1	6.58 60°F	322-336	161-169	E	F	G	H
HI-FLASH MINERAL SPIRITS	6.61 60°F	325-399	163-203	E	F	G	H
ODORLESS MINERAL SPIRITS	6.31 60°F	352-398	177-202	E	F	G	H
KEROSENE	6.77 60°F	374-503	190-262	E	F	G	H

AROMATICS	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model: Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
TOLUOL (Toluene)	7.20	228-232	109-111	A	B	C	D
XYLOL (Xylene) (Mixed Isomers)	7.17	261-318	127-159	A	B	C	D
HI-FLASH COAL TAR NAPHTHA	7.12 60°F	293-392	145-199	E	F	G	H
m-CRESOL	8.66	396-406	202-207	E	F	G	H

CHLORINATED HYDROCARBONS	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model: Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
n-PROPYL CHLORIDE	7.43	113-117	45-47	A	B	C	D
ISOPROPYL CHLORIDE	7.17	94-104	34-40	A	B	C	D
METHYLENE CHLORIDE	11.07	102-106	39-40	A	B	C	D
DICHLOROETHYLENE 1,1	10.43 59°F	99	37	A	B	C	D
ETHYLENE DICHLORIDE	10.45	180-183	82-84	A	B	C	D
MONOCHLOROBENZENE	9.23	266-273	131-133	A	B	C	D
PROPYLENE DICHLORIDE	9.65	204-208	95-98	A	B	C	D
CHLOROFORM	12.43	142	61	A	B	C	D
TRICHLOROETHYLENE	12.22	188-198	87-92	A	B	C	D
TRICHLOROETHANE 1,1,1 (METHYL CHLOROFORM)	12.22	165	74	A	B	C	D
TRICHLOROETHANE 1,1,2	12.04	230-239	110-115	A	B	C	D
ORTHO DICHLOROBENZENE	10.89	351-361	177-183	E	F	G	H
1,2,3 TRICHLOROPROPANE	11.59	313-317	156-158	A	B	C	D
CARBON TETRACHLORIDE	13.30	171-172	76-78	A	B	C	D
PERCHLOROETHYLENE	13.55	250-254	120-122	A	B	C	D
TETRACHLOROETHANE (Symmetrical)	13.35	295-297	146-147	A	B	C	D
TETRACHLOROETHANE (Unsymmetrical)	13.25	264-267	129-131	A	B	C	D
TRICHLOROBENZENE (Mixed Isomers)	12.15 77°F	415-423	209-217	E	F	G	H

ESTERS	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
METHYL ACETATE	7.58	127-136	53-58	A	B	C	D
ETHYL ACETATE (85-88%)	7.37	158-176	70-80	A	B	C	D
ETHYL ACETATE (99%)	7.50	169-174	76-78	A	B	C	D
ISOBUTYL ACETATE	7.24	220-246	112-119	A	B	C	D
n-BUTYL ACETATE	7.28	244-262	118-128	A	B	C	D
sec-BUTYL ACETATE	7.27	219-239	104-115	A	B	C	D
AMYL ACETATE (Mixed Isomers)	7.21	259-311	126-155	A	B	C	D
sec-AMYL ACETATE	7.18	259-293	126-145	A	B	C	D
n-BUTYL PROPIONATE	7.27	255-340	124-171	E	F	G	H

FREON*	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
TF	13.06	117.6	47.6	A	B	C	D
TA	11.73	110.5	43.6	A	B	C	D
TE	12.56	112.3	44.6	A	B	C	D
TES	12.48	111.9	44.4	A	B	C	D
TMC	11.85	97.2	36.2	A	B	C	D
T-E 35	9.75	119	48.3	A	B	C	D
T-P 35	9.6	120	48.9	A	B	C	D
T-WD 602	12.47	112	44.4	A	B	C	D

*Freon is Du Pont registered trademark for its fluorocarbon compounds

KETONES	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
ACETONE	6.58	132-134	36-57	A	B	C	D
METHYL ETHYL KETONE	6.71	174-177	78-80	A	B	C	D
DIETHYL KETONE	6.80	212-219	100-103	A	B	C	D
METHYL n-PROPYL KETONE	6.72	214-225	101-107	A	B	C	D
CYCLOHEXANONE	7.88	266-343	156-158	A	B	C	D
METHYL ISOBUTYL KETONE	6.68	234-244	114-117	A	B	C	D
METHYL n-BUTYL KETONE	6.83	237-279	115-137	A	B	C	D
METHYL CYCLOHEXANONE (Mixed Isomers)	7.67	237-343	115-173	A	B	C	D
ACETONYL ACETONE	8.10	365-383	184-195	E	F	G	H
DIISOPROPYL KETONE	6.73	237-261	114-127	A	B	C	D
METHYL n-AMYL KETONE	6.81	297-309	147-154	A	B	C	D
DIACETONE	7.82	266-356	130-180	E	F	G	H

TERPENES	Lbs. Per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
DIPENTENE	7.10	342-374	172-190	E	F	G	H
TURPENTINE GUM SPIRITS	7.21 60°F	313-340	156-171	E	F	G	H
TURPENTINE STEAM DISTILL	7.13	311-343	155-173	E	F	G	H

NEW REPLACEMENT SOLVENTS	Lbs. per Gallon at 68°F	Boiling Range °F	Boiling Range °C	Distillation Model Gallons Per 40-Hour Week 0-75	150-250	500-1000	1500+
POLYSAFE (Citrus Based)	7.00	310	154	E	F	G	H
M-PYROL (NMP)	8.56	397-401	203-205	E	F	G	H
DIBASIC ESTERS (DBE)	9.09	385-437	196-225	E	F	G	H
GAMMA-BUTYROLACTONE (GBL or BLO)	9.40	403	206	E	F	G	H

In-House Solvent Distillation Advantages

- Excellent savings
- Minimal labor involvement
- Greatly reduced residue disposal costs & responsibility

Note: Certain mixtures of chemicals that may react chemically up to 350°F must be avoided. Be sure to confer with Finish Thompson personnel regarding your particular distillation requirements.

FINISH THOMPSON INC.

921 Greengarden Road
Erie, PA 16501-1591 U.S.A
PH. 814-455-4478
FAX 814-455-8518

WASTE SOLVENT RECOVERY SYSTEMS

General Services Administration
Federal Supply Service
Authorized Federal Supply Schedule Price List (catalog)
Schedule Title: Federal Supply Schedule FSC Group 66, Part II, Section B - Instruments and Laboratory Supplies - Waste Solvent Recovery Systems
Contract Number: GS-00F-2411A
Contract Period: May 1, 1990 - April 30, 1995

FINISH COMPANY, INC.®
921 Greengarden Road
Erie, PA 16501-1591 U.S.A.
Phone: 814/455-4478; FAX: 814/455-8518
Contact: Peter B. Scantlebury, Sales Engineer
Business Size: Small

Information for Ordering Activities:

1. Special Item No. / Page / Catalog No.
   - 540-14 / 1-12 / F89-275B
   - 540-15 / 1-12 / F89-275B
2. Maximum Order Limitation: $50,000 per SIN
3. Minimum Order: One unit
4. Geographical Coverage: 50 states and Washington, DC
5. Point of Production: Erie, Erie County, Pennsylvania USA
6. Statement of Net Price: Prices shown herein are net, discount already deducted.
7. Quantity Discounts - not applicable
8. Prompt Payment Terms - Net 30 days
9. Government Commercial Credit Card - A & B -not applicable
10. Foreign Items - none
11. Time of Delivery - Standard equipment - 60 days; STD Series - 60-90 days
12. FOB Points - FOB Destination to 48 contiguous states and District of Columbia. Excludes Alaska, Hawaii and Puerto Rico.
13. Ordering Address:
    Finish Company, Inc.
    921 Greengarden Road
    Erie, Pennsylvania 16501-1591, U.S.A.
    Phone: 814/455-4478
    FAX: 814/455-8518

    Extratec Corporation
    5930 Muncaster Mill Road
    Rockville, MD 20855, U.S.A.
    Phone: 301/924-5150
    FAX: 301/924-5151
14. Payment Address:
    Finish Company, Inc.
    921 Greengarden Road
    Erie, Pennsylvania 16501-1591, U.S.A.
15. Warranty Provisions:
    Limited 360 day warranty with each model is operated strictly in accordance with Stilmanual instructions. It is guaranteed to recover solvents and is warranted 360 days from date of shipment against manufacturing defects in material and workmanship.
16. Export Packing Charges - not applicable
17. Terms and Conditions of Government commercial credit card acceptance - not applicable
18. Terms and Conditions of rental, maintenance and repair - not applicable.
19. Terms and Conditions of installation - not applicable.
20. Terms and Conditions of repair parts - 5% discount on spare parts from Spare Parts List dated June 1, 1990.
21. List of Service and Distribution Points - not applicable.
22. List of Participating Dealers - not applicable.
23. Preventive Maintenance - not applicable.

PRICING SECTION

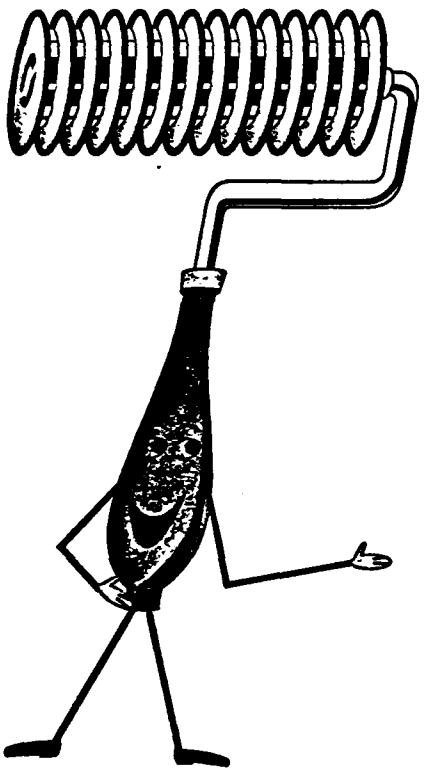
Special Item No.	Model No.	GSA Net Price
	WASTE SOLVENT DISTILLATION SYSTEMS	
540-14	LS-JR	$ 3,690.00
540-14	LS-JRV	5,295.00
540-14	LS-15D	7,807.00
540-14	LS-15DV	11,502.00
540-14	LS-15IID	11,026.00
540-14	LS-15IIDV	14,721.00
540-14	LS-55D	16,955.00
540-14	LS-55DV	21,441.00
540-14	LS-55IID	20,123.00
540-14	LS-55IIDV	24,609.00
	WATER DISTILLATION SYSTEMS	
540-14	LS-55STD-CP	$25,594.00
540-14	LS-55ST D-15B	30,034.00
540-14	LS-55STD-30B	31,052.00
540-14	LS-55STD-CPV	30,081.00
540-14	LS-55STD-15BV	34,521.00
540-14	LS-55STD-30BV	35,538.00
	OPTIONS AND ACCESSORIES	
540-15	LS-JR Vacuum Attachment only	$ 1,604.00
540-15	LS-15D Vacuum Attachment only	3,695.00
540-15	LS-55D/55IID Vacuum Attachment only	4,486.00
540-15	LS-55STD Vacuum Attachment only	4,486.00
540-15	LS-JR Stilbags	19.38/doz.
540-15	LS-JR Hi-Temp Stilbags	25.76/doz.
540-15	LS-15D Stilbags	33.72/doz.
540-15	LS-15D Hi-Temp Stilbags	44.31/doz.
540-15	LS-55D Stilbags	73.68/doz.
540-15	LS-55D Hi-Temp Stilbags	92.27/doz.
540-15	LS-55ST D Stilbags	84.73/doz.
540-15	LS-55STD Hi-Temp Stilbags	104.06/doz.
540-15	LS-JR Retainer Ring	51.20
540-15	LS-15D Retainer Ring	41.02
540-15	LS-55D Retainer Ring	61.60
540-15	LS-55STD Retainer Ring	61.60
540-15	LS-JR Stilgasket (4-50' rolls/pkg.)	18.36/pkg.
540-15	LS-15D Stilpan	254.37
540-15	LS-55D Stilpan	402.37
540-15	LS-55STD Stilpan	485.62
540-15	Temperature Shut-Off w/Timer	1,281.00
540-15	Temperature Indicator	405.15
540-15	Transfer Pump - air motor	716.87
540-15	Transfer Pump - explosion proof elec.	1,017.50
540-15	LS-JR SS Condenser	405.15
540-15	LS-15D SS Condenser	543.90
540-15	LS-55D SS Condenser	1,114.62
540-15	LS-55STD 15 kw SS Condenser	2,520.62
540-15	LS-55STD 30 kw SS Condenser	3,468.75

FINISH COMPANY, INC.®

921 Greengarden Road • Erie, Pennsylvania 16501-1591 U.S.A. • Phone 814/455-4478 • FAX 814/455-8518

TEMPLEX 853-R
RESIN CLEANER

*Templex **853-R** is a highly effective emulsion cleaner used to remove wet resins from layup tools and equipment. A versatile cleaner, **853-R** is used by boatbuilders, spa & tub makers, tank winders and others in the reinforced plastics industry to clean a wide range of resins. Iso and orthophthalic polyester, numerous epoxy, phenolic, and even vinylester resins can be cleaned with **853-R**. Clean up with acetone is no longer necessary because **853-R** can be used successfully in lamination without the hazard or environmental restrictions associated with acetone and methyline chloride.*



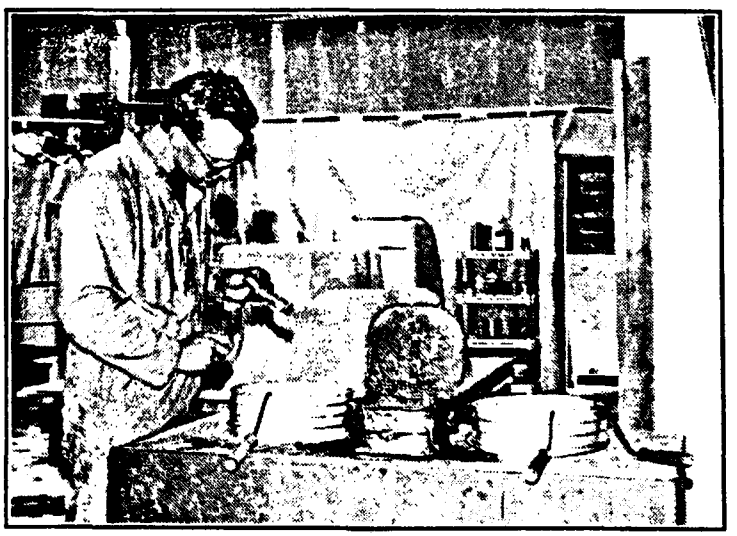
ADVANTAGES

- NON-FLAMMABLE, NON-COMBUSTABLE
- NO HEATING IS REQUIRED
- HIGHLY COST-EFFECTIVE, DILUTES WITH WATER
- LONG, USEFUL PRODUCTION LIFE
- TOOLS COME CLEAN - WITHOUT STICKY RESIDUE
- 853-R HAS BEEN ACCEPTED BY MUNICIPAL SEWAGE TREATMENT PLANTS (POTWS)
- RESINS FALL FROM SOLUTION AND HARDEN FOR EASY REMOVAL

HOW 853-R WORKS

853-R quickly penetrates and softens resins, allowing fast and thorough removal by mechanical agitation. Unlike acetone, which will dissolve resin, hold it in solution, and very quickly become sticky, *853-R* allows the majority of resin to settle from the cleaning solution to form a cake at the bottom of its container. *853-R* consists of both anionic and nonionic surfactants and a special dispersant package to break up uncured resins, temporarily prevent the cross linkage of resin molocules, and slow the action catalysts. Hardwater ions are controlled by chelation while suspension and settling of resins are modified by a propriatary organic dispersant for long working life.

For More Information Call: *1-800-554-4666*

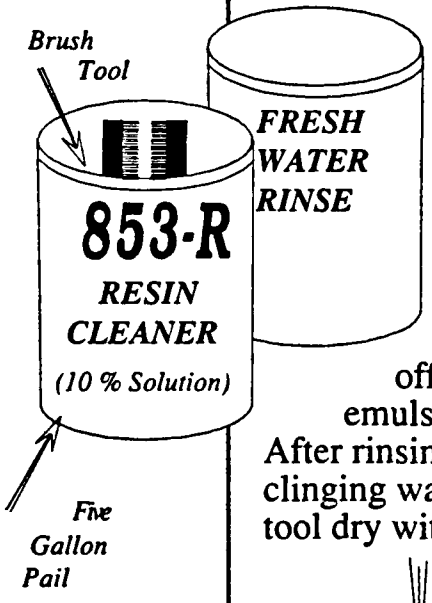


Laminator working at a three stage cleaning station with 853-R wash, water rinse, and dry dip.

TEMPLEX 853-R RESIN CLEANER

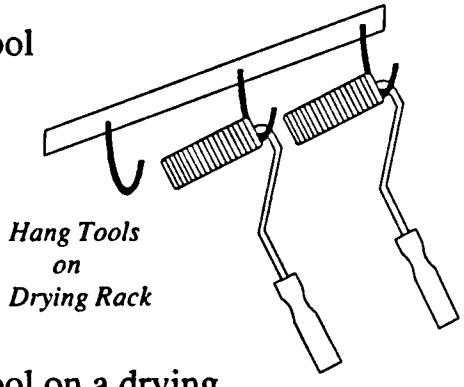
USING 853-R IN A CLEANING SYSTEM ...

Roller & Brush Cleaning

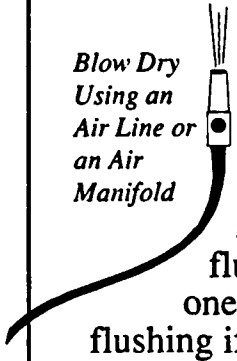


Mix one part 853-R with ten parts water at ambient shop temperature. Metal and plastic rollers are best cleaned using 853-R in conjunction with fixed brushes submerged beneath the Templex solution. Several strokes of the roller head and handle within the solution is usually enough to remove all resin. Depending on the type of resin and its gel state, further agitation may be necessary.

Once cleaned, the tool should be dipped in a clean water rinse to wash off any remaining emulsifier.



After rinsing, shake off any clinging water. Blow the tool dry with compressed air, then hang the tool on a drying rack, autoclave, or dip the tool in a water absorbing solvent.



Gun Flushing

Templex 853-R has been independently tested by Venus-Gusmer, a leading manufacturer of resin application systems, and has been found acceptable for flushing Venus spray equipment. Flush guns with a five to one 853-R solution, introducing air into the lines while flushing if possible. Rinse with water if gun is to be out of use for more than eight hours. Prior to spraying resin and chop on a part, purge the gun's tip of any remaining water with a short burst off-part.

Disposal

Since working dulutions of *853-R* are not considered dangerous waste, resin remains uncontaminated and after settling from solution, hardening and air drying, may be disposed of according to local landfill regulations. Resins that settle in the *853-R* solution but remain pasty can be mixed with catylized resin and hardened.

Discarded liquids can be disposed of by several means. If sanitary sewer systems are accessible, authorities should be contacted for approval. Generally the waste is gravity filtered through paper or cloth media to remove suspended solids before being poured into a drain.

Another disposal method is through the use of commercial evaporators, which can dispose of 50 to 1000 gallons per day cost effectively. Contact air quality regulators for permitting.

TEMPLEX **products are available through your local *TEMPLEX* salesman or distributor. Or write or call:**

TEMPLEX
4401 S.E. Johnson Creek Blvd.
Portland, OR 97222

1-800-554-4666

Ti-750

High Purity – No-odor Solvent

Ti-750 is a high purity solvent used in many manufacturing operations because of its low skin irritation, clean color, no odor and relatively fast evaporation rate. High tolerance manufacturing has made in possible to eliminate most all sulphurs, acids, chlorides and carbonyls from the formulation.

PRODUCT BENEFITS

- LOW ODOR – Ti-750 is almost odorless, making it ideal for close working conditions
- HIGH SOLVENCY – KB value 27.
- HIGH FLASH – Ti-750 does not flash until over 144°F., therefore, Ti-750 is classified as a non-listed RCRA waste.
- LOW SKIN IRRITATION – Ti-750 is so pure that many irritations associated with solvents will not occur.
- POWERFUL – Ti-750 is strong enough to penetrate such deposits as tar, asphalt, open gear compounds, and many other surface coatings and adhesives.
- SAFER THAN MOST SOLVENTS – Ti-750 can be used in certain areas of direct food contact under FDA CFR172.882 and 172.884 and certain indirect food applications under FDA CFR178.3530 and 178.3650.
- ELECTRIC MOTOR CLEANER – Ti-750 may be used on non-operating electrical equipment and is safer than chlorinated solvents. Always blow dry equipment after cleaning with compressed air.

Ti-750 is ideal for the following uses: Electric motor cleaning, parts tanks, cold soak tanks, removing grease and oil on production floors in food plants, cleaning oil field and pollution cleanup equipment, printing equipment, paint equipment, construction and marine equipment, oil and grease spills, removing many waxes and adhesives.

TYPICAL PROPERTIES

Flash	144°F.	Freeze	-76°F.
Auto ignition	640°F.	Odor	None
Gravity, °API	52.9	Odor stability	Excellent
TLV (not established)		Vapor pressure, psia @ 100°F	0.1
(recommend 300 ppm)		Vapor test method	ASTM D 2879

TEMPLEX
4401 SE Johnson Creek Blvd. Portland, OR 97222
(503) 653-9734 1-800-554-4666
A Division of ASSOCIATED CHEMISTS, INC.

MICRO-C

Production Washing Compound

Micro-C is designed to completely clean most all metal surfaces and leave them free of most oils, dirts, processing fluids, stamping compounds and other soils commonly found in a manufacturing environment.

Micro-C is safe on most metals, will not pit or darken even nonferrous metals.

Micro-C is highly concentrated and maybe diluted many times over to give maximum cost reduction.

Micro-C is very versatile: in many cases it will replace dangerous petroleum solvents in production cleaning systems.

Micro-C uses many natural and biodegradable raw materials, and is many times less costly to dispose of when compared to chlorinated or petroleum solvents.

Micro-C may be used in spray, dip, soak and other systems where heavy soils need to be removed.

When used in the following operations, Micro-C has found great success: production parts line cleaning, heavy equipment wash and degreasing, industrial floor cleaning, H.D. aircraft cleaning, auto dealers, bilge cleaning, hot water pressure washers (use solvent-resistent hose) and most other operations where fast, effective cleaning is needed.

Physical Properties

pH:	8.4
Color:	Light yellow
Weight per gallon:	8.34
Mixable in:	Water
Dilution Range:	2:1 - 25:1
Flash Point:	130 degrees Fahrenheit
Metals Safe On:	Ferrous and nonferrous
Odor:	Citrus

TEMPLEX
4901 SE Johnson Creek Blvd. Portland, OR 97222
(503) 653-9731 1-800-554-7555

TEMPLEX
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ASSOCIATED CHEMISTS, INC.
4401 S.E. Johnson Creek Blvd.
Portland, Oregon 97222
(503) 659-1708

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: TI-750 High Purity Solvent EFFECTIVE DATE: 08-08-90
PRODUCT CODE: 750

SECTION I - PRODUCT IDENTIFICATION

PRODUCT CLASS: SOLVENT BASED CLEANER
HAZARD CLASSIFICATION: Combustible liquid

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENT	CAS #	TLV	PERCENT
Isoparaffinic Solvent	64742-48-9	none estab.	99

SECTION III - PHYSICAL DATA

pH: Not applicable.
BOILING POINT: 365 °F
VAPOR PRESSURE (mm Hg): 10
SPECIFIC GRAVITY: 0.77
VAPOR DENSITY (air = 1): 5
PERCENT VOLATILES: 99
EVAPORATION RATE (n-BuAc = 1): 0.1
SOLUBILITY IN WATER: Not soluble in water.
APPEARANCE AND ODOR: Colorless solvent, negligible odor.

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (Setaflash Closed Tester): 140 °F
LOWER EXPLOSION LIMIT: Not determined.
EXTINGUISHING MEDIA: Dry chemical, chemical foam, or carbon dioxide.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide and/or carbon dioxide.
SPECIAL FIREFIGHTING PROCEDURES: Use self-contained breathing apparatus with full facepiece.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors may form an explosive mixture with air.

SECTION V - HEALTH HAZARD DATA

This product does not contain any substance(s) listed as a carcinogen by NTP, IARC, or OSHA.

TEMPLEX (a division of)
ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: TI-750 High Purity Solvent EFFECTIVE DATE: 08-08-90

SECTION V - HEALTH HAZARD DATA (conti.)

PERMISSIBLE EXPOSURE LEVEL: None established

PRIMARY ROUTES OF ENTRY: Ingestion and/or inhalation.

EFFECTS OF OVEREXPOSURE (Acute/Short Term): FOR PRODUCT

EYES: Causes slight irritation.
SKIN: No particular discomfort expected.
BREATHING: Inhalation of excessive amounts may cause impaired coordination and dizziness.
SWALLOWING: Ingestion may cause nausea, vomiting, diarrhea.

FIRST AID

IF IN EYES: Immediately flush eyes with plenty of water for at least minutes. If irritation continues, see a physician.
IF ON SKIN: Remove contaminated clothing and wash affected skin area with soap and water.
IF SWALLOWED: Do not induce vomiting. Call a physican immediately. Never give anything by mouth to an unconscious person.
NOTE TO PHYSICIAN: Ingestion of this product or subsequent vomiting can result in aspiration of light hydrocarbon liquid which can cause pneumonitis.
IF BREATHED: Remove person to fresh air. If not breathing, give artifical respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

SECTION VI - REACTIVITY DATA

HAZARDOUS POLYMERIZATION: None or won't occur.
STABILITY: Stable
INCOMPATABILITY: Acids, strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS SPILLED OR RELEASED:

SMALL SPILLS: Contain spilled material immediately. Prevent spill fr entering the sewer system.

LARGE SPILLS: Contain spilled material immediately. Prevent spill fr entering the sewer system. Use an inert material (sawdust/kitty litter/sand/etc.) to absorb spilled material.

WASTE DISPOSAL METHOD:

Product must be disposed of properly under federal/state regulations for industrial waste.

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PRODUCT NAME: TI-750 High Purity Solvent EFFECTIVE DATE: 08-08-90

SECTION VII - SPILL OR LEAK PROCEDURES (conti.)

This product when spilled or disposed of is a non-hazardous waste as defined in RCRA regulations (40 CFR 261).

SECTION VIII - PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: Use approved MSHA or NIOSH respirator for organic vapors.
VENTILATION: Use adequate ventilation to keep airbone concentrations below the exposure standard.
PROTECTIVE GLOVES: Neoprene rubber gloves recommended.
EYE PROTECTION: Wear approved splashproof chemical goggles.
OTHER PROTECTIVE EQUIPMENT: None normally required

SECTION IX - SPECIAL PRECAUTIONS - LABELING - OTHER COMMENTS

Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in this data sheet must be observed.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM LABELING:

HMIS Label	
Health	1
Flammability	2
Reactivity	0
Personal Protection	

Relative Degree of Hazard
0 - Minimal hazard
1 - Slight hazard
2 - Moderate hazard
3 - Serious hazard
4 - Severe hazard

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PRODUCT NAME: TI-750 HIGH PURITY SOLVENT EFFECTIVE DATE: 08-08-90

SECTION X - REGULATORY CONCERNS

A. EPA SARA TITLE III SECTION 313

☒ This product does not contain chemicals listed in 40 CFR 372.65

☐ This product contains a 40 CFR 372.65 reportable chemical substance or substances under SARA Title III. See Section II - Hazardous Ingredients.

B. TSCA

Ingredients for this product have been certified for inclusion or are included on the TSCA inventory of Chemical Substances.

C. USDA

☐ Registered ☒ Not Registered

D. ☒ This product does not contain materials, to the best of our knowledge, that are subject to the reporting requirements under the current Proposition 65 regulations.

☐ This material contains _____ subject to the current reporting requirements of Proposition 65.

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4401 S.E. Johnson Creek Blvd.
Portland, Oregon 97222
(503) 659-1708

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: MICRO-C
PRODUCT CODE: 3168

EFFECTIVE DATE: 06-28-90

SECTION I - PRODUCT IDENTIFICATION

PRODUCT CLASS: WATERBASE CLEANING COMPOUND
HAZARD CLASSIFICATION: Not a DOT Hazard

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENT	CAS #	TLV	PERCENT
d-Limonene	5989-27-5	none estab.	10

SECTION III - PHYSICAL DATA

pH: 8.4
BOILING POINT: 212 °F
VAPOR PRESSURE (mm Hg): Not determined.
SPECIFIC GRAVITY: 1.001
VAPOR DENSITY (air = 1): Not determined.
PERCENT VOLATILES: 10
EVAPORATION RATE (n-BuAc = 1): .5
SOLUBILITY IN WATER: SOLUBLE IN WATER
APPEARANCE AND ODOR: LIGHT YELLOW LIQ; CITRUS ODOR

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (Setaflash Closed Tester): 130 °F
LOWER EXPLOSION LIMIT: Not determined.
EXTINGUISHING MEDIA: Water spray, dry chemical, chemical foam, or carbon dioxide.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide and/or carbon dioxide.
SPECIAL FIREFIGHTING PROCEDURES: Use self-contained breathing apparatus with full facepiece.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Never use welding or cutting torch on or near drum, even empty, because product or residue can ignite explosively.

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ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: MICRO-C EFFECTIVE DATE: 06-28-90

SECTION V - HEALTH HAZARD DATA

This product does not contain any substance(s) listed as a carcinogen by NTP, IARC, or OSHA.

PERMISSIBLE EXPOSURE LEVEL: None established for product. (Current industrial experience suggests 10 mg/m^3 as a nuisance mist.)

PRIMARY ROUTES OF ENTRY: Ingestion and/or inhalation.

EFFECTS OF OVEREXPOSURE (Acute/Short Term): FOR PRODUCT

EYES: Causes severe irritation.
SKIN: Causes slight irritation.
BREATHING: Causes slight irritation to nose and throat.
SWALLOWING: Ingestion of this material might be harmful or fatal.

FIRST AID

IF IN EYES: Immediately flush eyes with plenty of water for at least 1[illegible] minutes. If irritation continues, see a physician.
IF ON SKIN: Remove contaminated clothing and wash affected skin area with soap and water.
IF SWALLOWED: Do not induce vomiting. Call a physican immediately. Give large quantities of water. Never give anything by mouth to an unconscious person.
IF BREATHED: Remove person to fresh air. If not breathing, give artifical respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

EFFECTS OF OVEREXPOSURE (Chronic/Long Term): FOR PRODUCT OR COMPONENTS

Prolonged or repeated breathing of sprays, mists, or dusts in excess of the suggested TLV may cause nasal and respiratory irritations.

SECTION VI - REACTIVITY DATA

HAZARDOUS POLYMERIZATION: None or won't occur.
STABILITY: Stable
INCOMPATABILITY: Strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS SPILLED OR RELEASED:

SMALL SPILLS: Flush small quantities to sewer.

LARGE SPILLS: Contain spilled material immediately. Prevent spill fr[illegible] entering the sewer system. Use an inert material (sawdust/kitty litter/sand/etc.) to absorb spilled material.

TEMPLEX (a division of)
ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: MICRO-C EFFECTIVE DATE: 06-28-90

SECTION VII - SPILL OR LEAK PROCEDURES (conti.)

WASTE DISPOSAL METHOD:

Product must be disposed of properly under federal/state regulations for industrial waste.
This product when spilled or disposed of has the characteristic of ignitability as defined in RCRA regulations (40 CFR 261).

SECTION VIII - PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: None normally required.
VENTILATION: Use adequate ventilation to keep airbone concentrations below the exposure standard.
PROTECTIVE GLOVES: Neoprene rubber gloves recommended.
EYE PROTECTION: Wear approved splashproof chemical goggles.
OTHER PROTECTIVE EQUIPMENT: None normally required

SECTION IX - SPECIAL PRECAUTIONS - LABELING - OTHER COMMENTS

Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in this data sheet must be observed.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM LABELING:

HMIS Label	
Health	2
Flammability	2
Reactivity	0
Personal Protection	

Relative Degree of Hazard
0 - Minimal hazard
1 - Slight hazard
2 - Moderate hazard
3 - Serious hazard
4 - Severe hazard

ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: MICRO-C EFFECTIVE DATE: 06-28-90

SECTION X - REGULATORY CONCERNS

A. EPA SARA TITLE III SECTION 313

☒ This product does not contain chemicals listed in 40 CFR 372.65.

☐ This product contains a 40 CFR 372.65 reportable chemical substance or substances under SARA Title III. See Section II - Hazardous Ingredients.

B. TSCA

Ingredients for this product have been certified for inclusion or are included on the TSCA inventory of Chemical Substances.

C. USDA

☐ Registered ☒ Not Registered

D. ☒ This product does not contain materials, to the best of our knowledge, that are subject to the reporting requirements under the current Proposition 65 regulations.

☐ This material contains _____ subject to the current reporting requirements of Proposition 65.

TEMPLEX
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ASSOCIATED CHEMISTS, INC.
4401 S.E. Johnson Creek Blvd.
Portland, Oregon 97222
(503) 659-1708

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: 853-R Resin Cleaner
PRODUCT CODE: 3041

EFFECTIVE DATE: 03-26-90

SECTION I - PRODUCT IDENTIFICATION

PRODUCT CLASS: WATERBASE CLEANING COMPOUND
HAZARD CLASSIFICATION: Not a DOT Hazard

SECTION II - HAZARDOUS INGREDIENTS

INGREDIENT	CAS #	TLV	PERCENT
* 2-Butoxyethanol	111-76-2	25 ppm (skin)	10
Sodium silicate	6834-92-0	10 mg/m^3	2

*See Section X SARA Title III Substance

SECTION III - PHYSICAL DATA

pH: 11.9
BOILING POINT: 212 °F
VAPOR PRESSURE (mm Hg): Not determined.
SPECIFIC GRAVITY: 1.041
VAPOR DENSITY (air = 1): Not determined.
PERCENT VOLATILES: Not applicable.
EVAPORATION RATE (n-BuAc = 1): 0.3
SOLUBILITY IN WATER: Completely soluble.
APPEARANCE AND ODOR: Blue liquid, glycol odor.

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (Pensky-Martens Closed Cup): >212 °F
LOWER EXPLOSION LIMIT: Not determined.
EXTINGUISHING MEDIA: Water spray, dry chemical, chemical foam, or carbon dioxide.
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide and/or carbon dioxide.
SPECIAL FIREFIGHTING PROCEDURES: Use self-contained breathing apparatus with full facepiece.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Never use welding or cutting torch on or near drum, even empty, because product or residue can ignite explosively.

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ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: 853-R Resin Cleaner EFFECTIVE DATE: 03-26-90

SECTION V - HEALTH HAZARD DATA

This product does not contain any substance(s) listed as a carcinogen by NTP, IARC, or OSHA.

PERMISSIBLE EXPOSURE LEVEL: None established

PRIMARY ROUTES OF ENTRY: Ingestion, inhalation, or skin absorption.

EFFECTS OF OVEREXPOSURE (Acute/Short Term): FOR PRODUCT

EYES: Causes severe irritation.
SKIN: Causes severe irritation and is absorbed through skin.
BREATHING: Inhalation of vapors or mists could cause pulmonary irritation, dizziness, and nausea.
SWALLOWING: Ingestion of this material causes burns to the esophagus and could be fatal.

FIRST AID

IF IN EYES: Immediately flush eyes with plenty of water for at least minutes. Call a physician.
IF ON SKIN: Remove contaminated clothing and wash affected skin area with soap and water.
IF SWALLOWED: Do not induce vomiting. Call a physican immediately. Give lemon juice or vinegar in water. Never give anything by mouth to an unconscious person.
IF BREATHED: Remove person to fresh air. If not breathing, give artifical respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

EFFECTS OF OVEREXPOSURE (Chronic/Long Term): FOR PRODUCT OR COMPONENTS

Prolonged or repeated breathing of sprays, mists, or dusts in excess of the suggested TLV may cause nasal and respiratory irritations.

This product contains 2-butoxyethanol as indicated in Section II. Supplemental information on this material is given below for chronic effects observed with experimental animals and humans.
Exposure of rats by inhalation to 2-butoxyethanol caused hemolysis, hemoglobinuria (blood in the urine), and a slight increase in liver weight. Other species, including man, were less sensitive or more resistant to hemolysis. The hemolytic effect in rats was transitory and/or reversible and not considered to be relevant to human health. Inhalation exposure of pregnant rabbits caused some lethality to the dam and fetus at 200 ppm, but there were no effects at 100 ppm and below. Inhalation exposure to pregnant rats caused irritancy to the dams and related fetotoxicity at 200 and 100 ppm, but there were no effects at 50 ppm and below. 2-Butoxyethanol did not cause birth defects in either study.

TEMPLEX (a division of)
ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: 853-R Resin Cleaner EFFECTIVE DATE: 03-26-90

SECTION VI - REACTIVITY DATA

HAZARDOUS POLYMERIZATION: None or won't occur.
STABILITY: Stable
INCOMPATABILITY: Acids, strong oxidizing agents.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS SPILLED OR RELEASED:
SMALL SPILLS: Flush small quantities to sewer.

LARGE SPILLS: Contain spilled material immediately. Prevent spill from entering the sewer system. Use an inert material (sawdust/kitty litter/sand/etc.) to absorb spilled material.

WASTE DISPOSAL METHOD:
Product must be disposed of properly under federal/state regulations for industrial waste.
This product when spilled or disposed of is a non-hazardous waste as defined in RCRA regulations (40 CFR 261).

SECTION VIII - PROTECTIVE EQUIPMENT TO BE USED

RESPIRATORY PROTECTION: Use approved MSHA or NIOSH respirator for organic vapors.
VENTILATION: Use adequate ventilation to keep airbone concentrations below the exposure standard.
PROTECTIVE GLOVES: Neoprene rubber gloves recommended.
EYE PROTECTION: Wear approved splashproof chemical goggles.
OTHER PROTECTIVE EQUIPMENT: None normally required

SECTION IX - SPECIAL PRECAUTIONS - LABELING - OTHER COMMENTS

Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in this data sheet must be observed.

TEMPLEX (a division of) .
ASSOCIATED CHEMISTS INC., PORTLAND, OREGON 97222 Ph 503-659-1708

PRODUCT NAME: 853-R Resin Cleaner EFFECTIVE DATE: 03-26-90

SECTION IX - SPECIAL PRECAUTIONS - LABELING - OTHER COMMENTS (conti.)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM LABELING:

HMIS Label	
Health	2
Flammability	1
Reactivity	0
Personal Protection	

Relative Degree of Hazard
0 - Minimal hazard
1 - Slight hazard
2 - Moderate hazard
3 - Serious hazard
4 - Severe hazard

SECTION X - REGULATORY CONCERNS

A. EPA SARA TITLE III SECTION 313

☐ This product does not contain chemicals listed in 40 CFR 372.65.

☒ This product contains a 40 CFR 372.65 reportable chemical substance or substances under SARA Title III. See Section II - Hazardous Ingredients.

B. TSCA

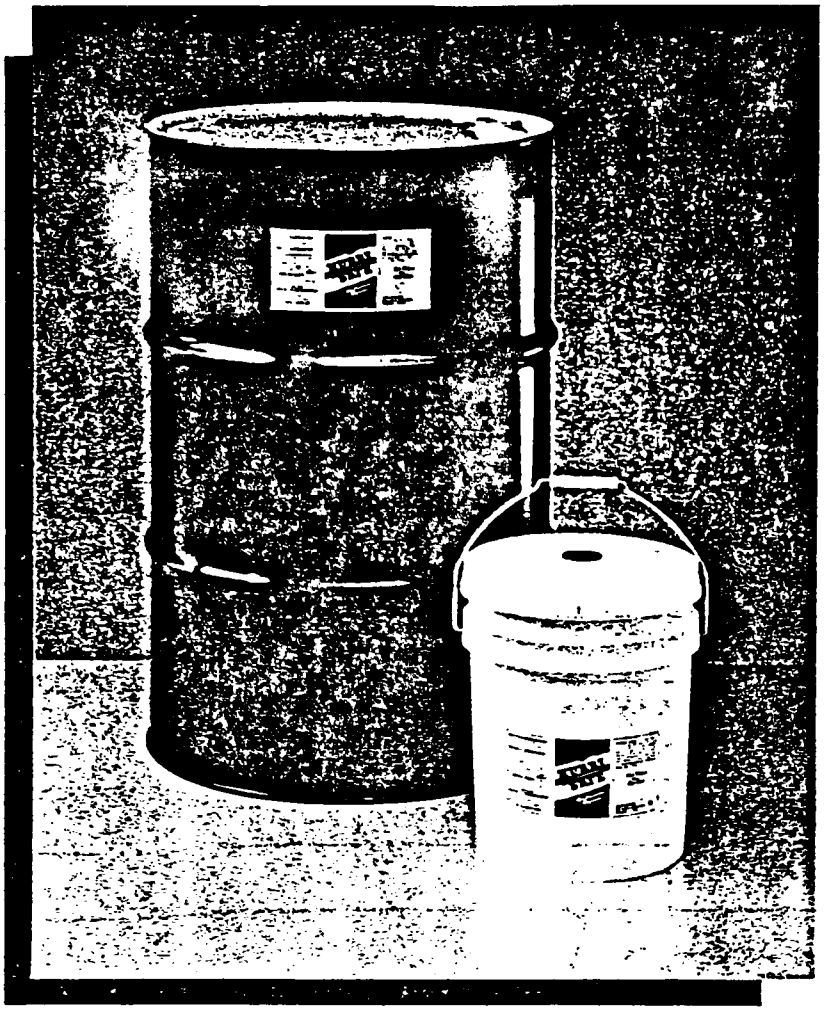
Ingredients for this product have been certified for inclusion or are included on the TSCA inventory of Chemical Substances.

C. USDA

☐ Registered ☒ Not Registered

D. ☒ This product does not contain materials, to the best of our knowledge, that are subject to the reporting requirements under the current Proposition 65 regulations.

☐ This material contains _____ subject to the current reporting requirements of Proposition 65.



HURRI-SAFE®

CRAFTED WITH PRIDE IN U.S.A.

Hot Immersion Degreaser

HURRI-SAFE HOT IMMERSION DEGREASER is designed to overcome surface tension, lift soil, emulsify and suspend a broad range of petroleum, animal or organic oils, greases, cosmolene and dirt. After being emulsified, the soiling material can easily be flushed with water. The Hot Immersion Degreaser is a safe, non-flammable, non-toxic, water-soluble, biodegradable immersion degreaser without harmful fumes.

HURRI-SAFE HOT IMMERSION DEGREASER is designed for use in high power steam pressure washers, all heated immersion tanks, dip tanks and recirculating hot washers. This degreaser is safe to use on plastic, rubber, fiber glass and all metals including steel, aluminum, brass and copper.

APPLICATIONS

HURRI-SAFE HOT IMMERSION DEGREASER should be diluted with water up to 1:10 depending upon the severity of the cleaning problem and the method of application. For high power steam pressure washers, **HURRI-SAFE HOT IMMERSION DEGREASER** may be diluted 1:10 to 1:30.

Available in: 5-gallon pails and 55-gallon drums.

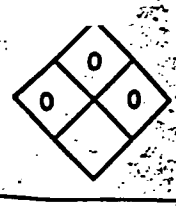
SPECIFICATIONS

Flammability	**Non-Flammable**
Solubility	**100% Soluble In Water**
Biodegradability	**100%**
Toxicity	**No Harmful Fumes, Non-Toxic**
Specific Gravity	**1.002**
Density	**8 lbs. 9 oz. per Gallon**
pH	[redacted] 12.4
Freeze/Thaw Stability	**May Be Allowed to Freeze Without Degradation**
Shelf Life	**Indefinite**

HURRI KLEEN® CORP.

SUBSIDIARY OF SELF INDUSTRIES, INC.

6000 SOUTHERN INDUSTRIAL DRIVE
BIRMINGHAM, ALABAMA 35235
TELEPHONE: 205-655-8808 • FAX: 205-655-3288



MATERIAL SAFETY DATA SHEET

I. IDENTIFICATION

PRODUCT NAME: Hurri-Safe Hot Immersion Degreaser	
CHEMICAL NAME: Alkaline Degreaser	DATE PREPARED: January 24, 1990
DEPARTMENT OF TRANSPORTATION	HAZARD CLASSIFICATION: None SHIPPING NAME: Cleaning Compound, Class 55

II. PHYSICAL DATA

BOILING POINT, (F°)	212F	VAPOR PRESSURE at 20°	Non-Volatile
SPECIFIC GRAVITY (H_2O=1)	1.01	WATER SOLUBILITY	Completely
VAPOR DENSITY (air=1)	Non-Volatile	DENSITY	8.450
PERCENT VOLATILE BY VOLUME (%)	N/A	EVAPORATION RATE WATER = 1	Non-Volatile
pH (of concentrate)	12.4	VOC'S (%)	0.005%
APPEARANCE AND ODOR Clear in color Non offensive odor			

III. INGREDIENTS

MATERIAL	%	OSHA PEL	TLV (units)	HAZARD
2-butoxyethanol	-10	25ppm	120 mg/3	N/A
" " Cas #11-76-2	N/A	N/A	TWA-25ppm	N/A
N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (test method)	None/cc	FLAMMABLE LIMITS	None	LOWER None	UPPER None
EXTINGUISHING	N/A				
SPECIAL FIRE FIGHTING PROCEDURES	N/A				
UNUSUAL FIRE AND EXPLOSION HAZARDS	N/A				

V. HEALTH HAZARD DATA

TLV AND SOURCE	Not established
ACUTE EFFECTS OF OVEREXPOSURE	LD50 (for technical 2-butoxyethanol) for skin absorption on rabbits is 200 mg/kg: Oral LD for rats is 470 mg/kg. LC50 (inhalation) for rats is 700 ppm in 7 hours
SKIN CONTACT	May cause dryness and irritation
INHALATION	None
EYE CONTACT	Flush eyes with water for 15 minutes, lifting the lower and upper lids. Obtain attention if irritation persists.
CHRONIC EFFECTS OF OVEREXPOSURE	This is relatively innocuous substance not expected to cause harm. Should treatment ever be required, it would be directed at control of symptons.
OTHER HEALTH HAZARDS	Ingestion may cause nausea and/or diarrhea.

EMERGENCY AND FIRST AID PROCEDURES

SWALLOWING	If swallowed drink warm water to dilute stomach contents, induce vomiting.
SKIN	Flush thoroughly with soap and water. Dry and apply skin lotion.
INHALATION	None
EYE	Flush eyes with water for 15 minutes, lifting the lower and upper lids Obtain attention if irritation persists.
NOTES TO PHYSICIAN	This is relatively innocuous substance not expected to cause harm. Should treatment ever be required, it would be directed at control of symptons.

VI. REACTIVITY DATA

STABILITY	STABLE: Yes	UNSTABLE: Nc	CONDITIONS TO AVOID: None
INCOMPATIBILITY:	Avoid oxidizing materials		
HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS			None
HAZARDOUS POLYMERIZATION	MAY OCCUR No	WILL NOT OCCUR Yes	CONDITIONS TO AVOID: None

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS SPILLED	Small Spills: Flush with water. Large Spills: Absord with sawdust, sand or earth.
WASTE DISPOSAL METHOD	May be disposed of in sewer system. Consult local state, county or Federal regulations for applicable laws pertaining to your areas.

VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (type)	None
VENTILATION	If desired. Local exhaust if sufficient.
PROTECTIVE GLOVES	Use if long exposure is expected
EYE PROTECTION	If splashing is expected use goggles
OTHER PROTECTIVE EQUIPMENT	Wear plastic apron if excessive splashing is expected. If clothing becomes soaked, remove, shower, and wash clothing.

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING	Store in cool dry area. Prevent freeziing, if frozen allow to thaw, stir well and re-use.
OTHER PRECAUTIONS	NONE

HURRI SAFE®

CRAFTED WITH PRIDE IN U.S.A.

Special Formula Degreaser

Hurri-Safe Special Formula Degreaser is a safe, highly concentrated cleaner that quickly cuts through both oil and grease without abrasives or grit that scratch surfaces. An exact combination of alkaline, wetting, suspension, softening and emulsifying chemical agents allows **Hurri-Safe Special Formula Degreaser** to rapidly overcome surface tension and lift soil. It also emulsifies and suspends materials such as petroleum, animal oils, organic oils, and greases. After emulsification, the solid material can be flushed with water.

Hurri-Safe Special Formula Degreaser is designed to replace hazardous and flammable cutting solvents in cold parts washing equipment as a primary cleaner in and around service stations, automotive garages, truck terminals, heavy equipment, processing plants, and any environment in which petroleum, animal or organic oils and greases are present.

APPLICATIONS

Parts Washers: Dilute **Hurri-Safe Special Formula Degreaser** 1:4 with water for cold applications.
Steam Cleaners: Dilute **Hurri-Safe Special Formula Degreaser** 1:10 to 1:40 depending on the surface to be cleaned and the degree of oil and grease build-up.
Immersion Tanks: Dilute **Hurri-Safe Special Formula Degreaser** 1:4 with water for cold immersion tanks.
Available in: Cases of six 1-gallon plastic jugs, 5 gallon plastic pails and 55 gallon drums.

SPECIFICATIONS

FLAMMABILITY	NON-FLAMMABLE
SOLUBILITY	100% SOLUBLE IN WATER
BIODEGRADABILITY	100%
TOXICITY	NO HARMFUL FUMES, NON-TOXIC
SPECIFIC GRAVITY	1.002
DENSITY	8 lbs. 9 oz. per Gallon
pH	[redacted] 12.4
FREEZE/THAW STABILITY	MAY BE ALLOWED TO FREEZE WITHOUT DEGRADATION
SHELF LIFE	INDEFINITE
TOTAL ORGANIC CARBONS	64,700

HURRI-KLEEN CORP., SUBSIDIARY OF SELF INDUSTRIES, INC., 6000 INDUSTRIAL DR., BIRMINGHAM, AL 35235 (205) 655-8808

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)
HURRI-SAFE SPECIAL FORMULA DEGREASER

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name	Emergency Telephone Number
HURRI-KLEEN CORPORATION	(205) 655-8808
Address (Number, Street, City, State, and ZIP Code)	Telephone Number for Information
	(205) 655-8808
6000 SOUTHERN INDUSTRIAL DRIVE	Date Prepared REVISED: 2-8-89
BIRMINGHAM, ALABAMA 35235	Signature of Preparer (optional) N/A

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
2 - BUTOXYETHANOL (Technical 99%)	25PPM(120MG/M^3	SAME	NONE	8.78% by wt.

The information above concerning hazardous ingredients is expressed as required by, CFR 29, Part 1910; 1000, and applies to the CONCENTRATED ingredient as it is used in the production of the product you have purchased. For safety information on how you should handle this product, see Section VIII. At end use dilution ratio, this product is comprised of 1.756% of 2-butoxyethanol.

N/A

N/A

N/A

N/A

N/A

N/A

Section III — Physical/Chemical Characteristics

Boiling Point	212°F	Specific Gravity (H_2O = 1)	1.01
Vapor Pressure (mm Hg.) NON-VOLATILE		Melting Point NOT APPLICABLE	
Vapor Density (AIR = 1) NON-VOLATILE		Evaporation Rate (Butyl Acetate = 1) NON-VOLATILE	

Solubility in Water
100%

Appearance and Odor
LIGHT GREEN COLOR WITH NON-OBJECTIONABLE ODOR

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
NON-APPLICABLE	NONE	-	-

Extinguishing Media
NON-APPLICABLE

Special Fire Fighting Procedures
NON-APPLICABLE

N/A

Unusual Fire and Explosion Hazards
NON-APPLICABLE

N/A

Section V — Reactivity Data HURRI-SAFE SPECIAL FORMULA (HSSF)

Stability			Conditions to Avoid
	Unstable		
	Stable	XX	

Incompatibility (*Materials to Avoid*): STRONG ACIDS

Hazardous Decomposition or Byproducts: NON-APPLICABLE

Hazardous Polymerization			Conditions to Avoid
	May Occur		NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? NO Skin? YES Ingestion? YES EYES(YES)

Health Hazards (*Acute and Chronic*)

FOR CONCENTRATED 2-butoxyethanol only: Oral Rats; LD-50, 480mg/kg; Inhalation Rats; LC-50 700 ppm in 7 hours, Skin Rabbits; LD-50; 220mg/kg: NO BLOOD EFFECTS OBSERVED AFTER 8 HOURS AT 200 ppm IN HUMANS, May cause hermolytic anemia. NOT A REPRODUCTIVE TOXICANT.

Carcinogenicity: NTP? NONE IARC Monographs? NONE OSHA Regulated? NONE

N/A

Signs and Symptoms of Exposure: EYES: Watering & Burning--- SKIN: Dryness--- INGESTION: May cause diarrhea ---

Medical Conditions Generally Aggravated by Exposure: SAME AS "SIGNS AND SYMPTOMS" ABOVE.

N/A

Emergency and First Aid Procedures: EYES: Flush with water and seek medical attention. SKIN: Wash with water and soap. Dry and apply lanolin lotion. INGESTION: Induce vomiting.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled: FLUSH WITH WATER. ABSORB WITH SAWDUST, SAND OR VERMICULITE.

N/A

Waste Disposal Method: FLUSH BULK LIQUID AFTER REMOVAL OF SOLID WASTE. HANDLE SOLID WASTE PER DISPOSITION IN ACCORDANCE WITH POLITICAL SUBDIVISION REGULATIONS.

Precautions to Be Taken in Handling and Storing: STORE IN COOL DRY AREA.

N/A

Other Precautions: PREVENT FREEZING. ALLOW TO LIQUIFY IF FROZEN; AND THEN USE.

N/A

Section VIII — Control Measures

Respiratory Protection (*Specify Type*): NOT REQUIRED FOR THIS PRODUCT

Ventilation		
	Local Exhaust: PREFERABLE BUT NOT REQUIRED	Special: NONE
	Mechanical (*General*): ACCEPTABLE	Other: NONE

Protective Gloves: Use neoprene gloves USE ONLY WITH LONG EXPOSURE

Eye Protection: GOGGLES IF HEAVY SPLASHING IS EXPECTED

Other Protective Clothing or Equipment: GENERAL PRACTICE

Work/Hygienic Practices: SHOWER WITH WATER AND USE AN EYE BATH

• USGPO 1988-491-529/45775

HURRI-SAFE

CRAFTED WITH PRIDE IN U.S.A.

Heavy Duty Industrial Degreaser

HURRI-SAFE HEAVY-DUTY INDUSTRIAL DEGREASER overcomes surface tension, lifts soil while both emulsifying and suspending a vast range of petroleum, animal and organic oils, greases, cosmolene and dirt. Once emulsified, the soiled material can be easily flushed with water. **HURRI-SAFE HEAVY-DUTY INDUSTRIAL DEGREASER** is non-flammable, non-toxic and biodegradable. It can be safely used on plastics, rubber and all metals including steel, aluminum, brass, copper, etc.

HURRI-SAFE HEAVY-DUTY INDUSTRIAL DEGREASER is designed for non-heated or heated; non-agitated or agitated; industrial spray wash systems, recirculating spray washers, immersion tanks, decontamination systems and various industrial plant uses for cleaning all surfaces of grease, oil, dirt and grime.

Available in: six 1-gallon jugs; 5-gallon plastic pails and 55-gallon drums.

SPECIFICATIONS

Flammability	**Non-Flammable**
Solubility	**100% Soluble In Water**
Biodegradability	**100%**
Toxicity	**No Harmful Fumes, Non-Toxic**
Specific Gravity	**1.002**
Density	**8 lbs. 9 oz. per Gallon**
pH	[redacted] 12.4
Freeze/Thaw Stability	**May Be Allowed to Freeze Without Degradation**
Shelf Life	**Indefinite**

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY *(As Used on Label and List)*
HURRI-SAFE HEAVY DUTY INDUSTRIAL DEGREASER

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name HURRI-KLEEN CORPORATION	Emergency Telephone Number (205) 655-8808
Address *(Number, Street, City, State, and ZIP Code)* 6000 SOUTHERN INDUSTRIAL DRIVE BIRMINGHAM, ALABAMA 35235	Telephone Number for Information (205) 655-8808 Date Prepared REVISED: 2-8-89 Signature of Preparer *(optional)* Alberto D. DiDario

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% *(optional)*
2 - BUTOXYETHANOL (Technical 99%)	25PPM(120MG/M^3	SAME	NONE	8.78% by wt.

The information above concerning hazardous ingredients is expressed as required by, CFR 29, Part 1910; 1000, and applies to the CONCENTRATED ingredient as it is used in the production of the product you have purchased. For safety information on how you should handle this product, see Section VIII. At end use dilution ratio, this product is comprised of 1.756% of 2-butoxyethanol.

N/A

N/A

N/A

N/A

N/A

N/A

Section III — Physical/Chemical Characteristics

Boiling Point	212°F	Specific Gravity (H_2O = 1)	1.01
Vapor Pressure (mm Hg.) NON-VOLATILE		Melting Point NOT APPLICABLE	
Vapor Density (AIR = 1) NON-VOLATILE		Evaporation Rate (Butyl Acetate = 1) NON-VOLATILE	

Solubility in Water
100%

Appearance and Odor
DARK GREEN COLOR WITH NON-OBJECTIONABLE ODOR

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) NON-APPLICABLE	Flammable Limits NONE	LEL -	UEL -

Extinguishing Media
NON-APPLICABLE

Special Fire Fighting Procedures
NON-APPLICABLE

N/A

Unusual Fire and Explosion Hazards
NON-APPLICABLE

N/A

IDENTITY (As Used on Label and List) (HEAVY DUTY) HURRI-SAFE INDUSTRIAL(HD)DEGREASER

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	XX	

Incompatibility (*Materials to Avoid*): STRONG ACIDS

Hazardous Decomposition or Byproducts: NON-APPLICABLE

Hazardous Polymerization	May Occur		Conditions to Avoid: NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? EYES(YES) NO Skin? YES Ingestion? YES

Health Hazards (*Acute and Chronic*)
FOR CONCENTRATED 2-butoxyethanol only: Oral Rats; LD-50, 480mg/kg; Inhalation Rats; LC-50 700 ppm in 7 hours, Skin Rabbits; LD-50; 220mg/kg: NO BLOOD EFFECTS OBSERVED AFTER 8 HOURS AT 200 ppm IN HUMANS, May cause hemolytic anemia. NOT A REPRODUCTIVE TOXICANT.

Carcinogenicity: NTP? NONE IARC Monographs? NONE OSHA Regulated? NONE

N/A

Signs and Symptoms of Exposure: EYES: Watering & Burning--- SKIN: Dryness--- INGESTION: May cause diarrhea ---

Medical Conditions Generally Aggravated by Exposure: SAME AS "SIGNS AND SYMPTOMS" ABOVE.

N/A

Emergency and First Aid Procedures: EYES: Flush with water and seek medical attention. SKIN: Wash with water and soap. Dry and apply lanolin lotion. INGESTION: Induce vomiting.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled: FLUSH WITH WATER. ABSORB WITH SAWDUST, SAND OR VERMICULITE.

N/A

Waste Disposal Method: FLUSH BULK LIQUID AFTER REMOVAL OF SOLID WASTE. HANDLE SOLID WASTE PER DISPOSITION IN ACCORDANCE WITH POLITICAL SUBDIVISION REGULATIONS.

Precautions to Be Taken in Handling and Storing: STORE IN COOL DRY AREA.

N/A

Other Precautions: PREVENT FREEZING. ALLOW TO LIQUIFY IF FROZEN, AND THEN USE.

N/A

Section VIII — Control Measures

Respiratory Protection (*Specify Type*): NOT REQUIRED FOR THIS PRODUCT

Ventilation	Local Exhaust: PREFERABLE BUT NOT REQUIRED	Special: NONE
	Mechanical (*General*): ACCEPTABLE	Other: NONE

Protective Gloves: Use neoprene gloves USE ONLY WITH LONG EXPOSURE

Eye Protection: GOGGLES IF HEAVY SPLASHING IS EXPECTED

Other Protective Clothing or Equipment: GENERAL PRACTICE

Work/Hygienic Practices: SHOWER WITH WATER AND USE AN EYE BATH

• USGPO 1986-491-529/45775

Facet
FLUID TECHNOLOGY GROUP

Industrial Division
Facet Enterprises, Inc.
P.O. Box 50096
Tulsa, Oklahoma 74150-0096 U.S.A.
(918) 834-2929 TELEX 49-2495

January 23, 1986

Mr. Albert R. Nolan
Drew Ameroid Marine Division
One Drew Plaza
Boonton, NJ 07005

Reference: Approval of Ameroid "OWS Quick Separating Degreaser"

Dear Mr. Nolan:

Facet has tested the Ameroid "OWS Quick Separating Degreaser" with a scaled down model of our oily-water separator. The results of our testing were:

Test #1)	Influent -	water + 5% oil, no cleaner, mixed then allowed to stand 24 hours. Effluent oil content = 35 ppm
Test #2)	Influent -	water + 5% oil + 0.17% Ameroid OWS, mixed then allowed to stand 24 hours. Effluent oil content = 8 ppm
Test #3)	Influent -	same as Test #1 but allowed to stand only 5 hours. Effluent oil content = 225 ppm
Test #4)	Influent -	same as Test #2 but allowed to stand only 5 hours. Effluent oil content = 50 ppm

Our testing shows that when used as recommended, the Ameroid OWS Degreaser has no harmful effects and actually improves the performance of the single-stage Facet Oily-Water Separator.

Very truly yours,

Ron A. McDowell
Chemist

Ralph D. Terhune
Project Manager

RAM:ase

PRODUCT DATA

AMEROID® OWS
quick separating degreaser

Drew Ameroid® Marine

Description

AMEROID® OWS quick separating degreaser is a superior solvent emulsifying detergent for general engine room degreasing and for cleaning and gas freeing of bilges. Its unique blend of surfactants, wetting agents, and solvents results in a product which has exceptional cleaning properties, breaks quickly, and does not harm the operation of oily water separators required under the MARPOL regulations.

AMEROID® OWS quick separating degreaser has been thoroughly field tested and is approved by the following separating and bilge alarm manufacturers:

Biospherics Incorporated
Butterworth Systems (UK) Ltd.
Hamworthy Engineering Ltd.
Hodge Separators Limited
Italgestra S.P.A.
National Fluid Separators, Inc.
Nelson Division, Nelson Industries
Quantek, Inc. (Facet Enterprises)
SEREP
Separation and Recovery Systems, Inc.
Sigma Treatment Systems
World Water Systems, Inc.

Features

- Does not harm functioning of oily water separators
- Quick breaking
- Solvent emulsifying cleaner
- Concentrated
- Readily disperses in water
- Does not interfere with bilge alarm sensitivity

Benefits

- Reduces the potential of oil discharge
- Does not contribute to unit operating problems
- Allows oil to separate from water
- Reduces slop disposal costs
- Reduces cleaning time
- Minimizes manual cleaning
- Low application costs
- Easy to apply
- Will not add to the number of false alarms

Application

Bilge Cleaning

To clean oil from the bilges by the rock and roll method, add AMEROID® OWS at one or more locations in the bilge at the approximate dosage level indicated in the table. Add seawater to fill approximately ⅓ of the bilge capacity and allow the natural rock and roll motion of the vessel to provide agitation for a minimum of 24 hours. At the end of 24 hours, pump the bilge in accordance with normal procedures, inspect, and if required, repeat the procedure or spot clean.

BILGE CAPACITY			AMEROID® OWS DOSAGE		
Cu. Ft.	Approx. U.S. Gallons	Approx. Tons	Liters	U.S. Gal.	Liters
2000	14,960	56	56,000	7	26
2400	17,900	68	68,000	8	30
3000	22,400	85	85,000	10	38
3600	26,900	102	102,000	12	45
4200	31,400	119	119,000	14	53
4800	35,000	136	136,000	16	60
5400	40,400	153	153,000	18	68
6000	44,880	170	170,000	20	75
6600	49,368	187	187,000	22	83
7200	53,856	204	204,000	24	90
7800	58,340	221	221,000	26	98
8400	62,832	238	238,000	28	106

Typical Physical Properties

Appearance: Clear, light amber
Specific Gravity: 0.89 - 0.91
Flash Point (PMCC): 60°C (140°F)

Important Information:

Drew maintains Material Safety Data Sheets (MSDSs) on all of its products. These sheets contain pertinent information that you may need to protect your employees and customers against any known health or safety hazards associated with our products.

We recommend that you obtain our material safety data sheet which should be read and understood by all supervisory personnel and employees before using this product in your facilities.

Precautionary Statements

General Degreasing

For general purpose cleaning and degreasing, use AMEROID® OWS neat or diluted with fresh or seawater depending on cleaning required. If spent cleaning solutions are to go through an oily water separator, ensure that the concentration does not exceed recommended levels by separator manufacturers and if possible, allow time for settling and separation to occur.

Packaging

AMEROID® OWS is normally available in 25 liter pails and 120 liter drums.

All statements, information and data presented herein are believed to be accurate and reliable but are not to be taken as a guarantee, express warranty or implied warranty of merchantability or fitness for a particular purpose, or representation, express or implied, for which seller assumes legal responsibility, and they are offered solely for your consideration, investigation and verification. Statements or suggestions concerning possible use of this product are made without representation or warranty that any such use is free of patent infringement and are not recommendations to infringe on any patent.

Drew Ameroid® Marine Division
Drew Chemical Corporation
One Drew Plaza
Boonton, New Jersey 07005 USA
Telephone: (201) 263-7600
Telex: 136444

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Printed in U.S.A.
MC-PD-31-88R

INLAND TECHNOLOGY INCORPORATED

2612 Pacific Highway East, Suite C • Tacoma, WA 98424 • (206) 922-8932

INLAND TECHNOLOGY IS AN OLD LINE CHEMICAL DESIGN AND MANUFACTURING HOUSE LOCATED IN THE TIDE FLATS OF TACOMA, WASHINGTON.

INLAND TECHNOLOGY HAS OVER 24 YEARS EXPERIENCE IN:

* CUSTOM CHEMICAL DESIGN AND MANUFACTURING.

* DESIGN OF REDUCED HAZARD ALTERNATIVES TO COMMON HAZARDOUS CHEMICALS.

* DESIGN AND MANUFACTURING OF ULTRA SAFE SOLVENTS AND SURFACE PREPARATION COMPOUNDS.

* REDUCTION OF HAZARDOUS WASTE STREAMS.

* CONSULTATION IN THE IDENTIFICATION AND ELIMINATION OF CHEMICAL HAZARDS.

INLAND TECHNOLOGY HAS JUST COMPLETED MAJOR DESIGN EFFORTS FOR BOEING AND WEYERHAEUSER AND LOOKS FORWARD TO BEING OF SERVICE TO YOUR ORGANIZATION.

INLAND TECHNOLOGY INCORPORATED

2612 Pacific Highway East, Suite C • Tacoma, WA 98424 • (206) 922-8932

PARTS WASHER RENTAL
THE WHOLE STORY

Even though you subscribe to a parts washer service that exchanges spent dirty solvent for fresh, the E.P.A. and D.O.E. regulations still consider that the solvent and resultant dangerous waste is still your "cradle-to-grave" responsibility. The following effects are the direct result of the responsibility.

* If your hazardous waste disposal never exceeds 225 lbs. in a given month, you are conditionally exempt from most of E.P.A.'s and D.O.E.'s requirements.

* Disposal or exchange of rental parts washing fluid counts as part of your site's hazardous waste disposal and can easily cause you to exceed the 225 lb. limit. If this happens you will lose your conditionally exempt status, and you will have to apply for an E.P.A. Identification number and comply with extremely complicated record keeping and procedural regulations.

* Most rental solvents contain trace amounts of the dangerous aromatic hydrocarbons and have very low threshold limit values on the Material Safety Data Sheets and these solvents can cause skin cancer.

INLAND TECHNOLOGY INCORPORATED
2612 Pacific Highway East, Suite C • Tacoma, WA 98424 • (206) 922-8932

THE EDGE TEK STORY

The Edge-Tek Filter System is a compact inexpensive ultra filter that removes particulates and other contaminants from a variety of liquids.

The Edge-Tek System Filters down to one tenth of a micron and has been particulary useful in:

* Filtering special parts washer solvents. Used in conjunction with compatible parts washing solvents (Citra Safe or Partsmaster 140), the Edge Tek Filter keeps dangerous heavy metal contamination to minimal levels and minimizes carbon and petroleum contamination. Test sites are experiencing no need for solvent disposal; they just add solvent to replace for evaporation and drag out, and replace filters as needed.

* It is estimated that the on-line use of the Edge-Tek Filter System will indefinitely postpone the need to dispose of or exchange the parts washing solvent; and will confine disposal of hazardous waste to a softball size filter that weighs about one half a pound.

INLAND TECHNOLOGY INCORPORATED

2612 Pacific Highway East, Suite C • Tacoma, WA 98424 • (206) 922-8932

PREP-TONE

PREP-TONE is a unique water based solvent formulated with no solids, that replaces Methyl Ethyl Ketone, lacquer washers, Acetone, Xylene, and Toluene for most suface preparation applications. PREP-TONE is an ultra-safe, bio-degradable surface preparation compound that replaces hazardous petroleum distillates commonly used to prepare metal, plastic, fiber-glass, and other surfaces for the acceptance of paint and other coatings.

PREP-TONE'S low toxicity, non-flamable, and biodegradable nature insure that its use will improve plant safety, decrease disposal costs, and reduce the risks of hazardous chemical spills. It's economical nature allows it to compete favorably with the traditional petroleum distillates such as M.E.K. and lacquer washes.

Surfaces to be prepared, should be sprayed then wiped with Prep-TONE or they can be wiped down with a rag dampened with PREP-TONE followed by a dry rag wipe. This removes all oils, greases, mill scale, finger prints and other surface contaminates that can interfere with proper bonding of the coating to be applied. PREP-TONE leaves no residue and leaves a paint ready surface when dry.

PREP-TONE is designed as a suface prep only and is not recommened as a thinner for paints and other coatings.

INLAND TECHNOLOGY INCORPORATED
2612 Pacific Highway East, Suite C • Tacoma, WA 98424 • (206) 922-8932

X-CALIBER

X-Caliber is a low toxicity, solvent based stripper that contains no Methylene Chloride or other Chlorinated Hydrocarbons, aromatic hydrocarbons, or petroleum distillates. Its high flash point, ease of disposal, and freedom from regulations under R.C.R.A. or C.E.R.C.L.A. or section 313, makes it the solvent stripper of choice for cleaning and removing the following contaminates: Unsaturated Polyester Resins, Gel Coat Lines, Paint Guns and Lines, Chopper Guns, Uncured Polyurethane Foam, Most Paints, Most Graffiti, and Inks.

INLAND TECHNOLOGY INCORPORATED
2612 Pacific Highway East, Suite C • Tacoma, WA 98424 • (206) 922-8932

SAFETY PREP

Replaces Methyl Ethyl Keytone (MEK), Acetone, Laquer Washes, Xylene and Toluene, when used for surface preparation.

Safety Prep is a concentrated, ultra safe, biodegradable, surface preparation compound that replaces hazardous petroleum distillates commonly used to prepare metal, plastic, fiberglass and other surfaces for acceptance of paint and other coatings. Evaporates with no residue and it's use provides superior coating for adhesives.

Safety Prep is designed to be diluted with water, but can be used straight with some applications. Average dilution is 1 part to 3 parts water. Best results are obtained with a spray and wipe application or with a wipe down with a rag moistened with Safety Prep followed by a dry rag wipe. It is not designed for use as a paint or coating thinner, and it's use for this purpose is not recommended.

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ISO-PREP

Iso-Prep is the ultimate in safety in a petroleum solvent. Iso-Prep contains no hazardous chlorinated, fluoridated or aromatic hydrocarbons, its components have been selected from only the safest petroleum distillates.

Iso-Prep removes oil, grease, glues, inks, wax, asphalt and other deposits. Its controlled evaporation makes it ideal for parts washing and cold tank cleaning. Its safety and near lack of odor makes it an ideal press cleaner for industry.

Iso-Prep is a virtually odorless, high-purity hydrocarbon that provides good wetting and a very low degree of irritancy to skin and eyes.

Iso-Prep has a low vapor pressure, 15mmHg, to control V.O.C. emissions and very low toxicity rating. Iso-Prep is exempt from S.A.R.A., Title III, section 313, is non-carcinogenic, and worker exposure is not limited by O.S.H.A.

Specifications for Iso-Prep:

Flash Point	142 F (TCC)
Vapor Pressure	5 mmHg at 60C
Volitility	100%
Solvency (KB value)	27
Boiling Point	370 F

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"Z" Strip

CHARACTERISTICS

HIGH FLASH POINT: "Z" Strip is low in flammability (Flash point 150 degrees F). Low in vapor pressure (less than 4 mm HG) and hazard free in storage.

LOW TOXICITY: "Z" Strip shows low toxicity by oral, inhalation and skin absorbtion.

EASILY DISPOSABLE: "Z" Strip may be burned and gives off approximately 9000 BTU/LB.

HIGH KB VALUE: "Z" Strip is high in solvency and may be used in cleaning such things as gel coat and paint lines, unsaturated Polyester Resin, uncured Polyurethane Resins and foams, inks, fresh paints, greases, oils, and some adhesives.

USES

SELF CLEANING: When used to clean unsaturated polyester resin "Z" Strip segregates the resin at the bottom of the container allowing "Z" Strip to be decanted and re-used. Resin continues to cure facilitating disposal.

COATINGS: "Z" Strip will remove some coatings such as some paints, resins, and adhesives.

SILK SCREEN CLEANING: "Z" Strip easily removes most silk screen inks and paints from the screens and replaces such toxic solvents as M.E.K., Toluene, and Methylene Chloride.

PAINT LINE AND GUN CLEAN UP: "Z" Strip is an ideal substitute for Methlylene Chloride in cleaning paint and gel coat lines, foam and glue lines, and various resin lines.

FIBERGLASS RESIN CLEANING: "Z" Strip quickly strips unsaturated Polyester Resins from tools and lines without the hazards and environmental problems associated with Acetone or Methylene Chloride.

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CITREX

A bio-degreadable carburetor cleaner and cold tank compound.

In order to meet a critical need in the industry, Inland Technology has developed a bio-degradable, non-toxic, easily disposable cold tank compound. Citrex has cleaning and stripping performances equal to traditional cold tank compounds without the toxicity and disposal problem associated with them.

Citrex contains no Methylene Chloride, Cresylic Acid, or Dichlorobenzene. None of its components appear on O.S.H.A's "Z" list of hazardous chemicals and none of its components are listed by Section 313, of S.A.R.A. Title III, or by Section 302, of R.C.R.A. This means that Citrex can be used with confidence regarding safety and can be disposed of with a minimum of cost and reporting. Since Citrex contains no chlorinated solvents, its use eliminates the risk of contaminating stored waste oil.

Citrex is a powerful stripping and cleaning agent that is excellent for removing paints, coatings, carbon, grease, fuel residues, resins and other tenacious contaminates from a variety of substances. Citrex is safe on both ferrous and non-ferrous metals, and is excellent for sensitive metals such as aluminum, magnesium and titanium.

CHARACTERISTICS:

Boiling point (F); 340
Vapor pressure MMHG: <2 MMHG
Vapor density (air=1): 4.5
Specific Gravity (H2O=1): .86
Volatile by volume (%): 100%
Evaporation rate (butyl acetate): <.1

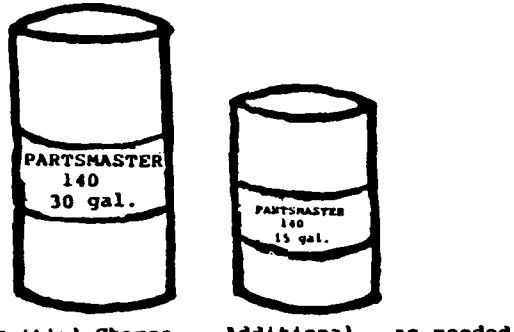
Soluability: Very slight (water)
Appearance and odor: Mild amine-like odor, clear blend.
Flash point (method used): 150F (TCC)
Flammable limits; Lel: 1% Usl: N/A
Auto ignition temperature: appox. 460 F

Stability: Stable-avoid contamination with water, as water ties up and weakens one of its ingredients.

INLAND TECHNOLOGY INCORPORATED

YOU BE THE JUDGE

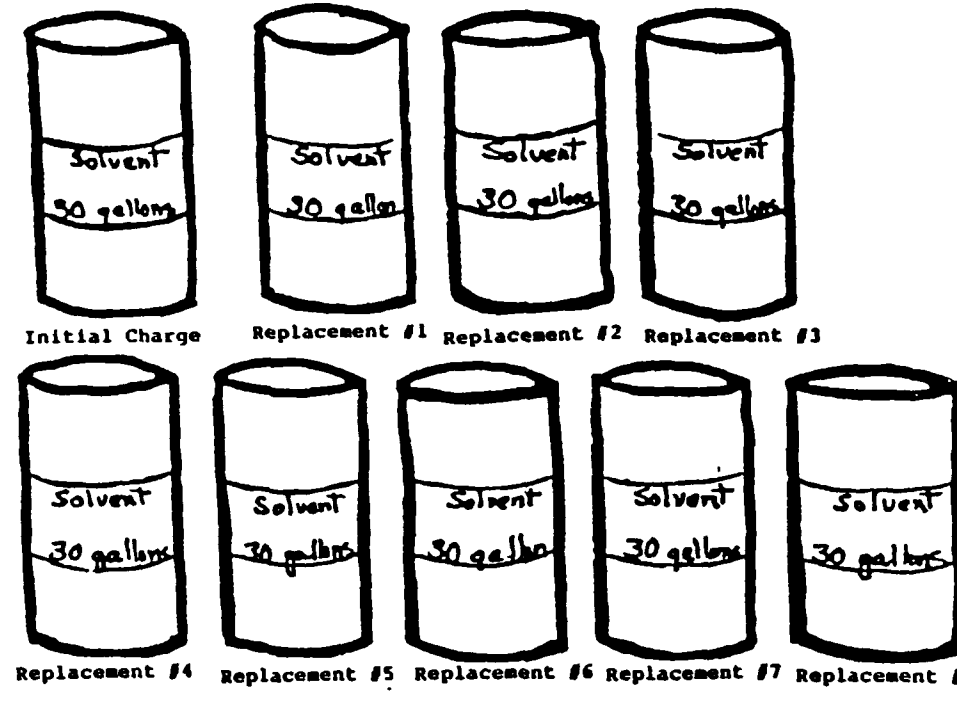
PARTSWASHER WITH INLAND'S EDGE-TEK FILTER SYSTEM



Initial Charge Additional - as needed

OR

PARTSWASHER WITHOUT SYSTEM



Initial Charge Replacement #1 Replacement #2 Replacement #3

Replacement #4 Replacement #5 Replacement #6 Replacement #7 Replacement #8

The above is based on a 30 gallon Partswasher System operating for one year, and replacing contaminated solvent every six weeks.

(206) 922-8932 WA Toll Free (800) 552-3100

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CITRA-SAFE

Citra-Safe is an ultra safe industrial solvent produced from all natural, non-petroleum distillates. Citra-Safe is far safer to work with than chlorinated petroleum solvents.

Citra-Safe exhibits no toxic properties, has no threshold limit value or P.E.L. limits imposed upon its usage in the workplace and has no carcinogenic properties. In fact Citra Safe does not contain any hazardous componets as defined in 29 CFR 1910.

Citra-Safe is literally a bio-degradable solvent replacement for mineral spirits, thinners and chlorinated solvents. The use of Citra-Safe reduces risks of hazardous chemicals spills, eliminates most hazardous waste disposal costs, and eliminates the health hazards associated with petroleum solvents. The absence of any petroleum hydrocarbons in Citra-Safe allows disposal after soil release into satisfactorily operating effluent treatment plants.

Citra-Safe removes tough greases, oils, tars and other contaminates from metals, painted surfaces, ceramic, fiber glass and many plastics. It is also effective in removing some glues, and resins, and can be used to remove oil based stains from carpets and upholstery. Its ability to evaporate totally after use makes Citra-Safe an ideal replacement for hazardous chlorinated solvents in cleaning electrical parts and apparatus. Its ability to safely clean polyethelene grease and "Icky Pic" from flooded telephone cables and semi-conductors has made Citra-Safe the solvent of choice for many telephone and power utilities.

To date, the scientists and engineers at Inland Technology Inc. have developed successful substitutes for the following problem solvents:

TOXIC SOLVENT	USAGE	SUBSTITUTES	COMMENTS
Methylene Chloride	Paint stripping, cold tank soak, resin removal.	Citrex or X-Caliber	Both products biodegradeable, not regulated by RCRA or SARA, Title III. Low VOC.
1,1,1 Trichloroethane	Electronic & electrical cleaning. Also, metal preparation.	Citra Safe Iso-Prep	Citra Safe biodegradeable. Iso-Prep low toxicity. Both low V.O.C.
Methyl Ethyl Keytone (M.E.K.)	Surface preparation prior to paint or welding.	Safety Prep Citra Safe Iso-Prep	Safety Prep & Citra Safe are biodegradeable. All low VOC.
Toluene/Xylene	Surface preparation for painting or welding.	Safety Prep Citra Safe Iso-Prep	Same as above
Acetone	Cleaning of fiberglass and expoxy resins.	Z-Strip Citrex	Low VOC & toxcity. High flash point. Citrex biodegradeable.
Stoddard Solvent/ Mineral Spirits	Parts washing and paint clean-up	Citra Safe Iso-Prep Breakthrough	Low VOC, Citra Safe biodegradeable Breakthrough free from most regs.
Trichloroethylene	Degreasing and resin removal	Citrex Iso-Prep	Biodegradeable, low VOC.
Perchloroethylene	Degreasing.	Citra Safe Iso-Prep	Non-halogenated, low VOC, easier disposal. Low toxicity.

It should be noted that performance needs vary from application to application and that none of these substitutes should be expected to be a 100% cross over for all applications.

Also, the chemical behaviors of these substitutes (vapor pressures, dry time, etc.) may differ from solvents being replaced which may require changes in work practices in order for substitutes to be successful.

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BREAKTHROUGH

Breakthrough is a state of the art solvent designed to help users break out of the tangle of regulations regarding emissions, disposal, and industrial health hazards.

Breakthrough is a virtually odorless, low toxicity, high-purity hydrocarbon and that exhibits a very low degree of irritancy to the eyes, and non irritating to the skin.

Breakthrough has low vapor pressure to control V.O.C. emissions, is non-photo-chemically reactive, non-carcinogenic and is exempt from S.A.R.A. Title III, Section 313, 302, C.E.R.L.A., and R.C.R.A. requirements, and worker exposure is not regulated by O.S.H.A. Break-through has no listed components and has no characteristics of hazardous waste per E.P.A and D.O.E. regulations.

In effect, in its uncontaminated form, the use and disposal of Break-Through is not regulated by O.S.H.A., E.P.A., R.C.R.A, S.A.R.A. Title III or the various air emmission regulations regarding volatile organic compounds and photo-chemically reactive solvents.

Breakthrough has moderate solvency and removes oil, grease, inks, wax and other deposits. Its controlled evaporation and relative freedom from regulatory restrictions make it ideal for parts washing and other metal cleaning operations.

SPECIFICATIONS:

Flash Point	142° F (TCC)
Vapor Pressure	5 mmHG
Boiling Point	370° F
Solvency (KB Value)	27
Volatility	100%

COMMON AUTOMOTIVE CHEMICALS AND THEIR HAZARDS

PRODUCT	HAZARDOUS COMPONENT	HEALTH HAZARDS	DISPOSAL
Brake Cleaner	1,1,1 Trichloroethane Perchlorethylene	Cardiac Sensitization Cancer	E.H.W.
Cold Tank Carb Cleaner	Methylene Chloride	Cancer	E.H.W.
Parts Washer Solvent	Stoddard Solvent Toluene, Xylene 1,1,1 Trichloroethane Tetra Chloroethylene	Nerve Damage, Some Carcinogenic Compounds.	D.W.
Gasket Remover	Methylene Chloride	Cancer	E.H.W.
Electrical Safety Solvent	1,1,1, Trichloroethane	Possible Carcinogenic Cardiac Sensitizer	E.H.W.
Anti-Freeze	Lead	Toxic	Possible D.W.
Hot Tank Cleaner	Sodium Hydroxide Lead, Chrome	Caustic	D.W. Possible E.H.W.
Steam Clean Soap	Sodium Hydroxide 2-Butoxyethanol	Systemic Toxin	Possible D.W.
Spot Removers	1,1,1 Trichloroethane	Possible Carcinogenic Cardiac Sensitizer	E.H.W.
Tar Remover	Toluene	Possible Carcinogen	D.W.
Lacquer Wash	M.E.K. & Toluene	Liver & Kidney Damage Possible Carcinogenic	New T.C. Listed D.W.
Prep Sol	Stoddard Solvent Toluene	Nerve Damage Possible Carcinogenic	D.W.
Paint Stripper	Methylene Chloride	Cancer	E.H.W.
Methyl Ethyl Ketone (M.E.K.)	M.E.K.	Liver & Kidney Damage	D.W.

APPENDIX D

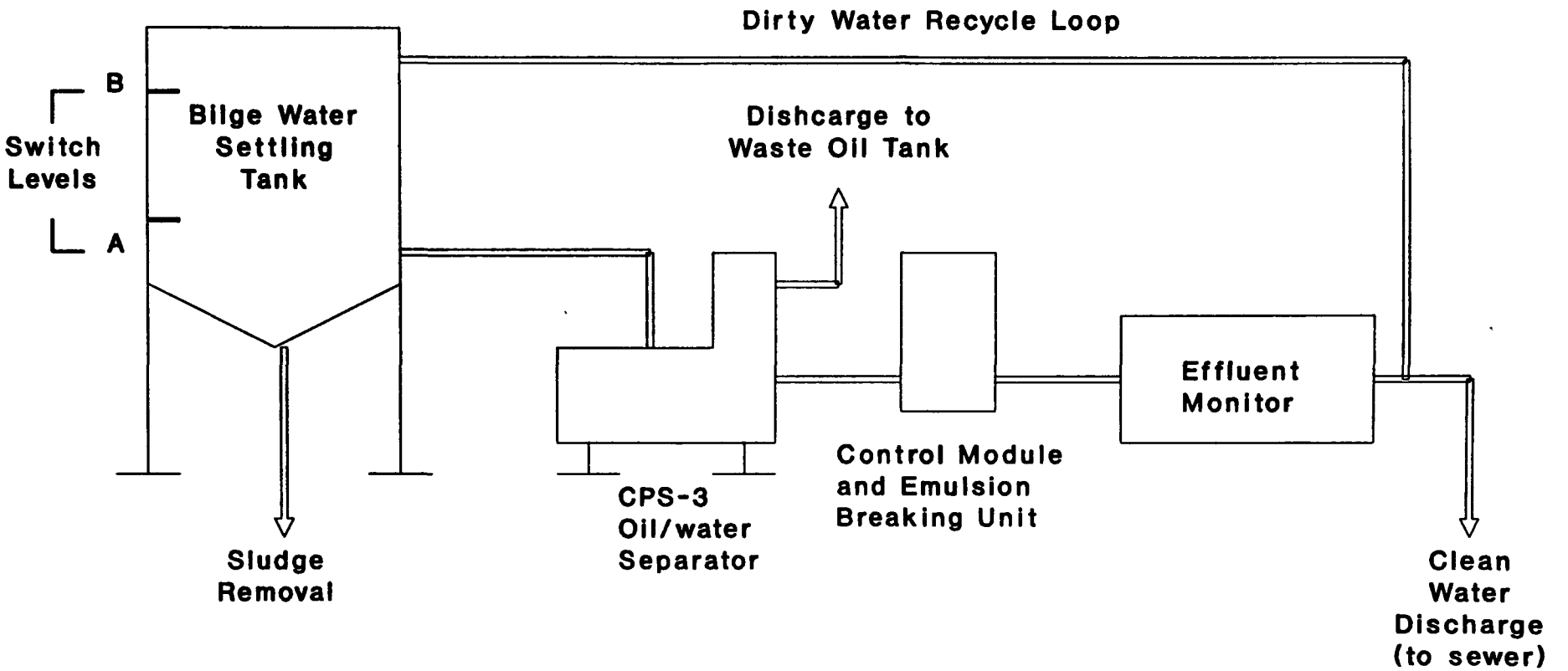
BILGE WASTE

NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.

SCHEMATIC DIAGRAM OF OIL/WATER SEPARATION SYSTEM

USCG Base Ketchikan



Basics of System:

1) Bilge/ballast water is pumped into the settling tank. When both level switches are activated, the system turns on.

2) Free oils are removed by the Quantek CPS-3 separator. When the oil dome is full the oil is automatically discharged to a remote receiver.

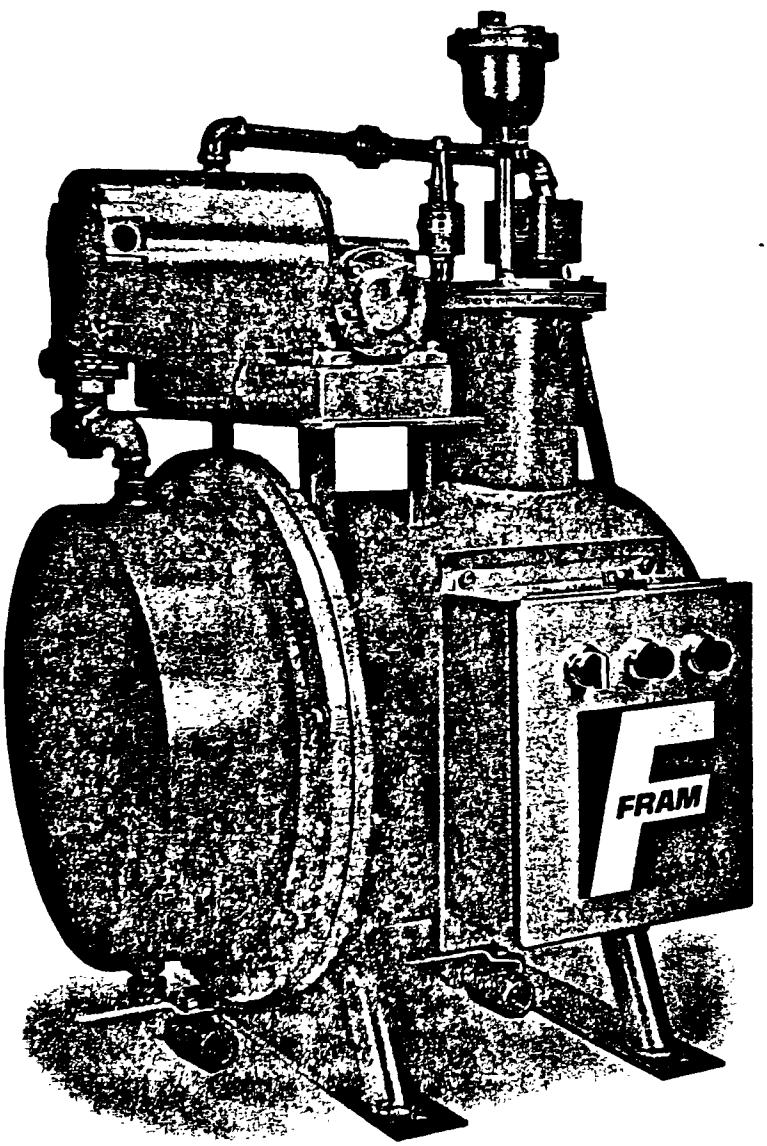
3) Process water is pumped through an emulsion breaking cartridge. When the cartridge is spent a differential pressure switch will sound an alarm.

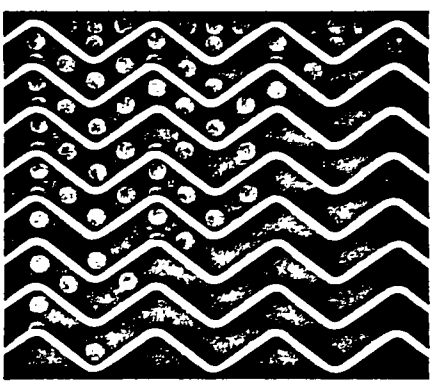
4) The monitor either discharges the process water or recycles it for additional treatment.

5) When both level switches "drop out" the system stops.

Facet | Quantek

FRAM CPS-3 MARINE SEPARATOR





The CPS-3 is designed for manual or fully automatic operation, and requires very little maintenance. Only periodic cleaning of the plate packs is required for normal operation. The unit also eliminates the need for any holding tanks, and the need for waiting in line for discharge to an on shore facility. This saves valuable time as well as cost.

The Fram CPS-3 is a cost efficient way of separating oil and solids contaminents from shipboard bilgewater.

Fram is currently installing the CPS-3 on vessels in the U.S., and all over the world. For a free consultation contact Fram Industrial in Tulsa, Oklahoma.

The Fram CPS-3 Marine Separator is a highly efficient coalescing plate separator designed especially for separation of oil and solids from shipboard bilgewater. It is ideally suited for retrofit on existing vessels due to the ultra-compact size of the unit.

The CPS-3 exceeds IMCO standard and is U.S. Coast Guard approved (#162.050/1095/0).

The unit will process 3 gallons per minute to purities of 15 ppm oil content or less, with no costly filter elements or cartridges that result in hazardous waste disposal.

CPS-3 MARINE SEPARATOR

Fram precisely engineered coalescing plate separators are utilized in liquid flows to separate hydrocarbons from water and to enhance the removal of solids from the effluent.

The CPS-3 is designed especially for marine, shipboard applications, and will process up to 3 gallons per minute, to purities of 15 ppm oil content or less.

The CPS-3 exceeds IMCO standards, and is U.S. Coast Guard approved- #162.050/ 1095/0.

Oily bilge water is conducted through the patented coalescing plates. Oil particles of 20 microns and larger adhere to the oleophilic surfaces of the plates and migrate upward, in accordance with Stokes Law. These particles are then coalesced into "sheets" of oil on the underside surfaces of the polypropylene plates. The coalesced oil rises in the form of large globules through the plate weep holes to the surface of the separator.

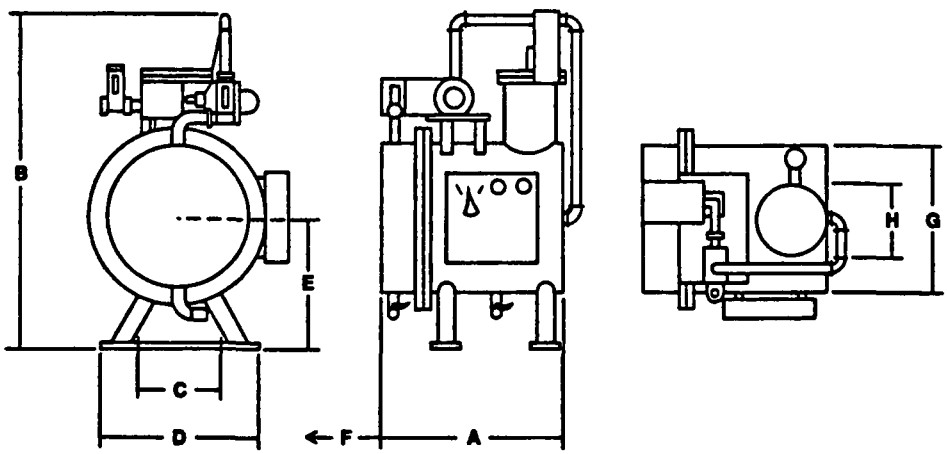
The CPS-3 is designed so that it will not be damaged or spill liquids under extreme conditions.

There is no need to change the coalescing elements in the CPS-3, only periodic cleaning of the plate pack is required. This eliminates costly cartridge storage and disposal, thus reducing operating costs dramatically.

Fram offers computerized selection and performance prediction, with standard design or custom engineering.

For effective separation of oil and solids from shipboard bilgewater contact Fram Industrial.

CONSTRUCTION MATERIALS	
Design Pressure	**20psi**
Shell	⅜" S.A.53 Steel Pipe
Flanges	S.A. 105
Plates	Polypropylene
Seals	Buna N O-Rings
Internal Pipe	S.A. 53 Steel Pipe or PVC
Internal Fastening	304 Stainless Steel Rod



DIMENSIONS	
Unit	CPS 3P
Nom Flow	3 GPM
A	24¼"
B	36⅜"
C	18⅝"
D	22"
E	14⅞"
F	12"
G	18"
H	6⅝"

U.S. Patent No. 4299706

Facet Quantek

Facet Quantek, Inc.
2929 E. Apache (74110)
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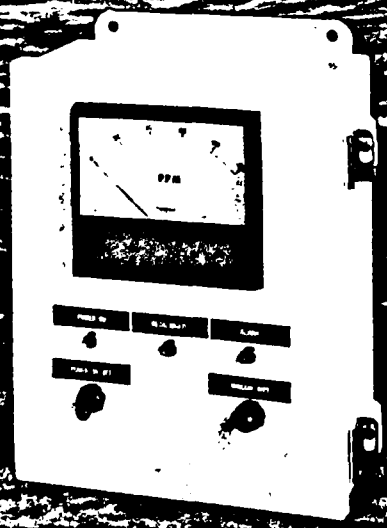
(918) 834-2929 • Telex: 201815 • Fax: 918-836-7383

Facet

FLUID TECHNOLOGY GROUP

ALARMING ACCURACY

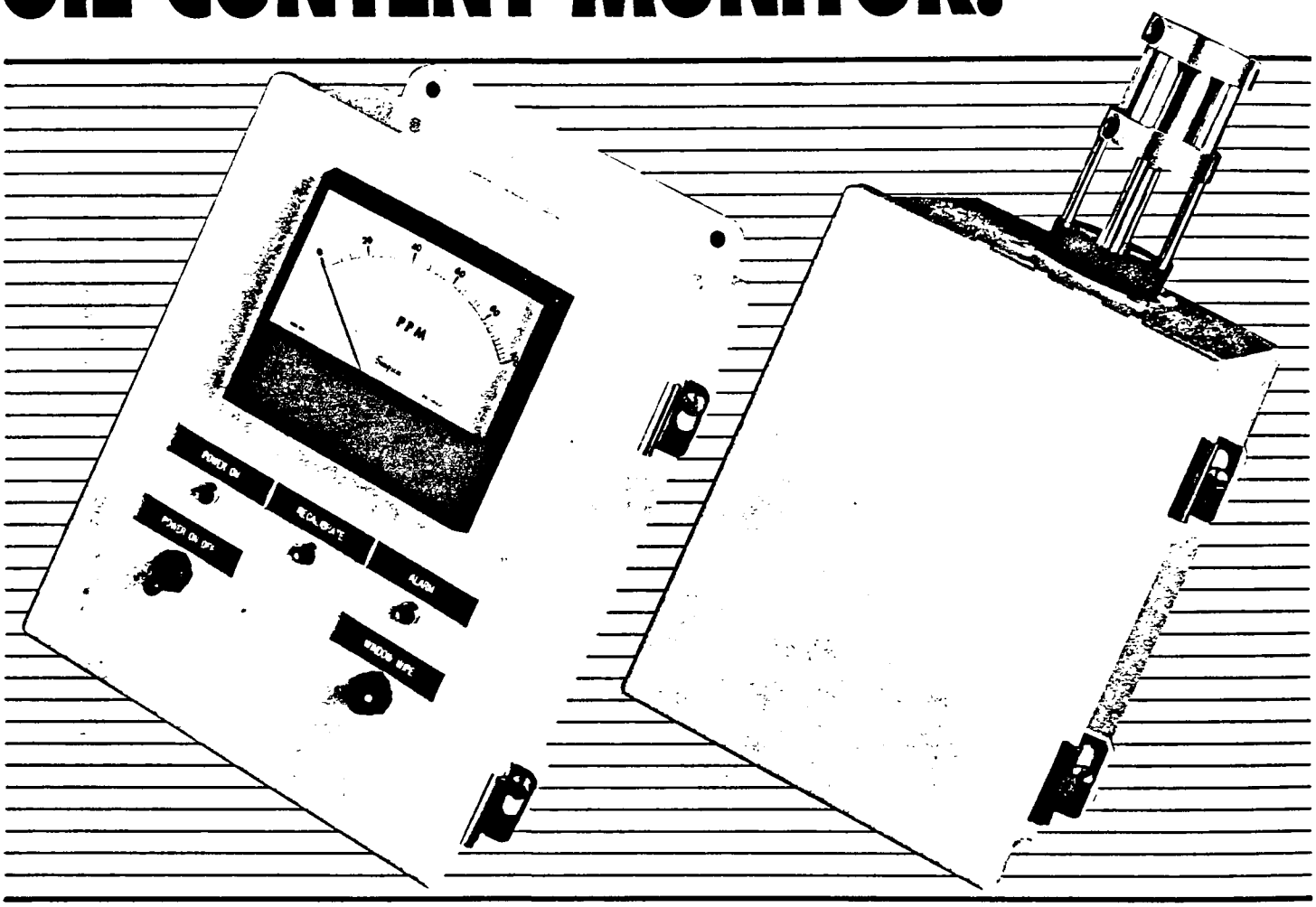
USCG CERTIFIED, 46 CFR PART 162.050, MEETING IMO RES. A. 393 (X)



Facet Mark VIII Bilge Alarm:
New Compact Design With
Exceptional Accuracy.

Facet

INTRODUCING THE NEW FACET MARK VIII BILGE ALARM OIL CONTENT MONITOR.



MARK VIII CONTROL MODULE

MARK VIII SENSING MODULE

The new Mark VIII Bilge Alarm represents the latest technology in oil content monitors from Facet. Completely tested, approved and certified to U.S. Coast Guard regulations, 46 CFR, Part 162.050 - 31, it also meets IMO Res. A. 393 (X) (Intergovernmental Maritime Organization).

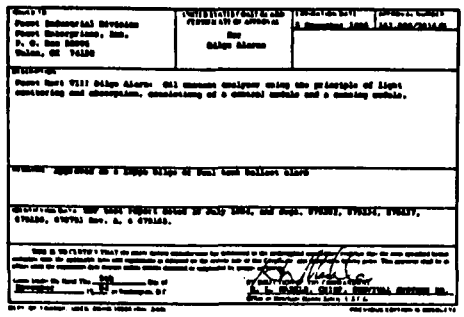
The Mark VIII continuously monitors dispersed oil in process water streams from 0 to 100 ppm. Using the principle of light scattering to detect trace amounts of oil-in-water, the Mark VIII offers a high level of accuracy in an economical, compactly designed two-module instrument. Both modules are water-tight and corrosion-resistant for in-service application in the toughest, most severe environmental conditions.

Standard Design Features:

- Continuously monitors dispersed oil-in-water from 0 to 100 ppm
- Warning lights and dry contacts designed to actuate diversion valves or remote alarms
- Compact design in watertight cabinets
- Infrared light emitting diode light source
- Silicon photo diode detector highly sensitive to light scattering
- Solid state electronics with a single printed circuit board for reliability
- Bilge alarm time delay (adjustable)
- LED indicator lights for power on, monitor recalibration and high ppm alarm
- USCG certified for demanding marine conditions

Light Scattering Detection Principle Assures Exceptional Sensitivity.

The Mark VIII bilge alarm uses a centrifugal pump to take a sample of the processed water at the rate of 5 gpm (.02 m³/H). This pump highly disperses any oil in the sample, which is then pumped through the sensing column where the sample is analyzed for oil content by the principle of light scattering. Following analysis, this sample is then returned to the process stream.



USCG CERTIFICATE NO. 162.050/3016/0

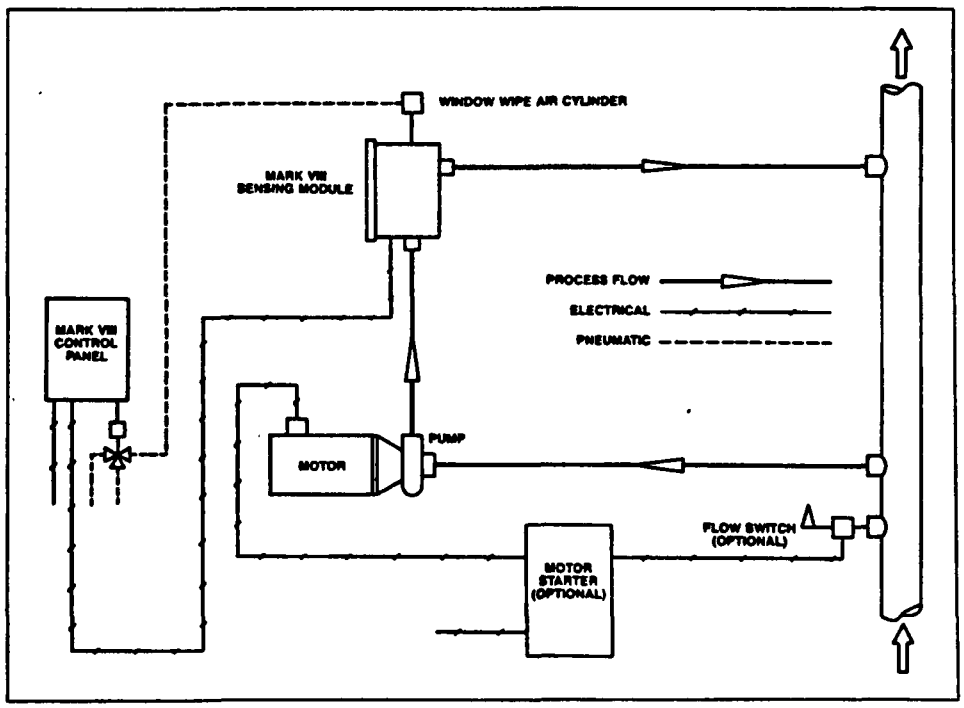
Tested, Approved And Certified To USCG Reg. 46 CFR Part. 162.050, And Meets IMO Res. A. 393 (X)

The infrared light source is a Gallium Arsenide (GaAs) diode which emits infrared light at a wavelength of 8800 angstroms. The detector is a silicon photo diode which has a peak spectral response from 8000 to 9000 angstroms — it provides exceptional sensitivity at its operational wavelength.

A built-in preamplifier in the detector boosts the signal sufficiently to provide a very high signal-to-noise ratio. This allows longer interconnecting wiring between sensing station and control module making the instrument less susceptible to external interference. The Mark VIII then conditions and amplifies this signal for a linear readout from 0 to 100 ppm which is displayed on a rugged analog meter.

Additionally, the alarm on the circuit board has been pre-set at 15 ppm. However, it is adjustable. When effluent exceeds the set point the red alarm indicating light will glow and a set of dry contacts is actuated. These contacts may also be used to actuate diversion valves or remote alarms.

Typical Flow Diagram — Mark VIII



Facet

MARK VIII BILGE ALARM

Specifications:

Range:
0-100 ppm, alarm preset at 15 ppm
Accuracy: ±5 ppm
Design
Temperature: 140°F (60° C)
Design Pressure: 100 psi (689 kPa)
Flow Rate: 5 gpm (.02 m³/H)
Detection
Wavelength: 8000 – 9000 angstroms
Light Source
Wavelength: 8800 angstroms
Storage
Temperature: 185° F max. (85° C)
Output Signals: Red alarm light with one set of dry contacts rated for 5 amps at 120 VAC for actuating diversion valves or to sound a remote alarm.
Power Supply:
Control module – 120 VAC, 60 Hz <100 VA
Pump motor – 1 HP – 230/460 VAC, 3 Ph, 60 Hz
Roll Angle: 0 to 22.5 degrees
Vibration: From 2 Hz to 13.2 Hz ±1 mm amplitude. From 13.2 Hz to 80 Hz acceleration to 0.7g
Mounting:
Control module – vertical wall mounted or skid mounted
Sensing module – vertical wall mounted or skid mounted
Pump assembly – skid mounted
Connections:
Sensing station – inlet/outlet ½" NPT
Pump – inlet/outlet ⅜" NPT

Weight:
Control module – 12.5 lbs (5.6 kg)
Sensing module – 10 lbs (4.5 kg)
Skid mounted sensing module & pump assembly – 68 lbs (30.8 kg)
Air Requirements: 100 psi nominal

Control Module:

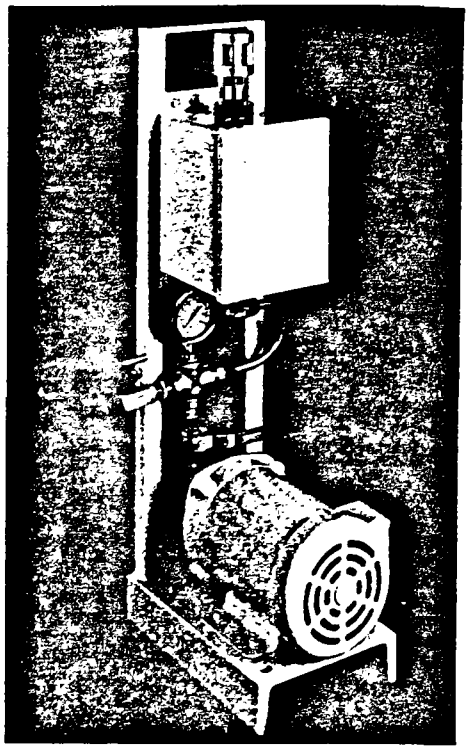
Panel – NEMA 4, 10" (254 mm) by 8" (203 mm) by 4" (102 mm), includes a gasketed hinged door cover.
Electronics – Solid-state, mounted on a single printed circuit board; water resistant and fungus proof.
Door Panel Components – Watertight panel meter, LED indicator lights, power on-off switch, and manual window wipe button.

Sensing Module:

Housing – NEMA 4, 8" (203 mm) by 6" (152 mm) by 6" (152 mm), includes gasketed hinged door cover.
Sensing Column – Vertical, tubular housing mounts inside NEMA 4 housing; includes light source, detector and associated electronics.
Window Wiping Assembly – Mounted on top of sensing housing; wiper blade attached to air cylinder shaft extending into column; cylinder controlled by built-in timer, adjusts by pre-positioning of dip switches.

Emulsifier Pump:

Centrifugal, high-speed pump driven by a ½ HP marine-duty motor; externally mounted on skidbase of sensing module support stand.



Mark VIII sensing module and pump skid-mounted for fast installation.

Optional Equipment:

Motor starter – manual or automatic
Flow switch – automatic

Pump motor – ½ HP, 110/230 VAC, 1 Ph, 60 Hz
Explosion Proof Enclosures and Motors

NOTE: European voltages available upon request.

Facet
FLUID TECHNOLOGY GROUP
Industrial Division
Facet Enterprises, Inc.
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Tulsa, Oklahoma 74150 U.S.A.
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DISTRIBUTED BY:

Bulletin 558.1
February, 1985

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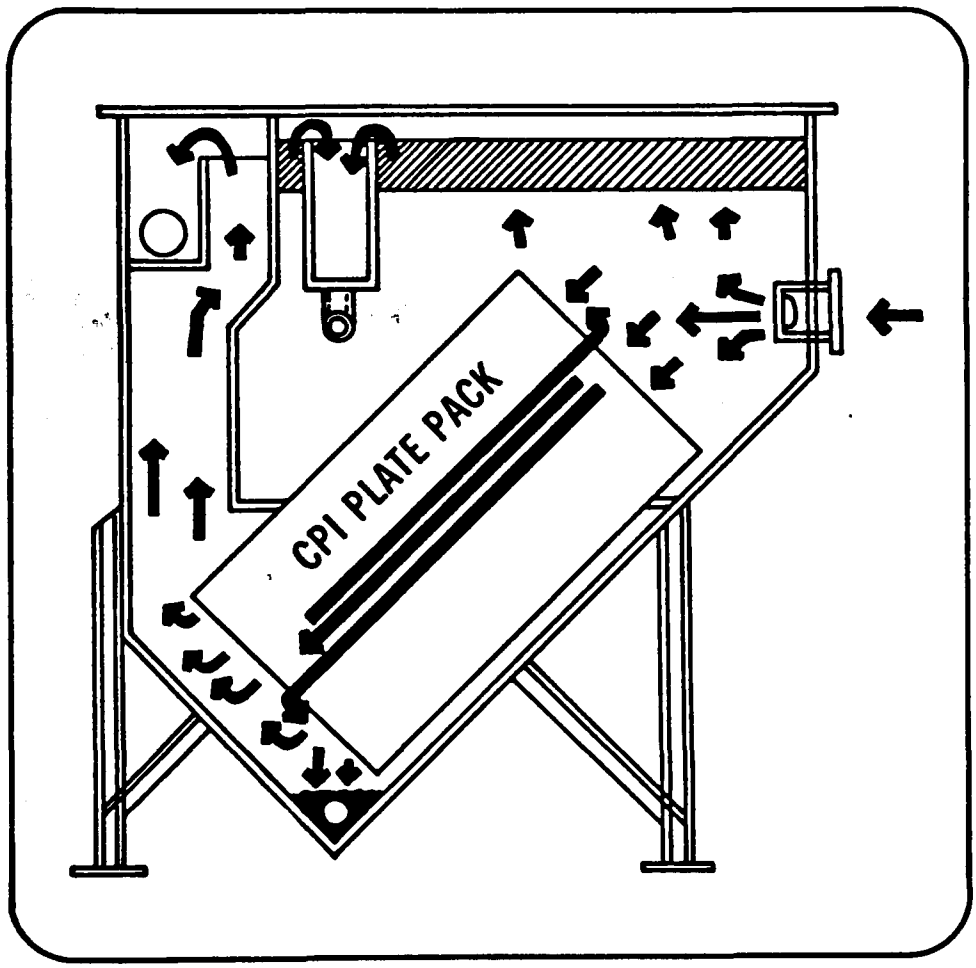
LANCY INTERNATIONAL, INC.
AN ALCOA SEPARATIONS TECHNOLOGY COMPANY

TECHNICAL BULLETIN

NUMBER 8001

LANCY CORRUGATED PLATE SEPARATOR



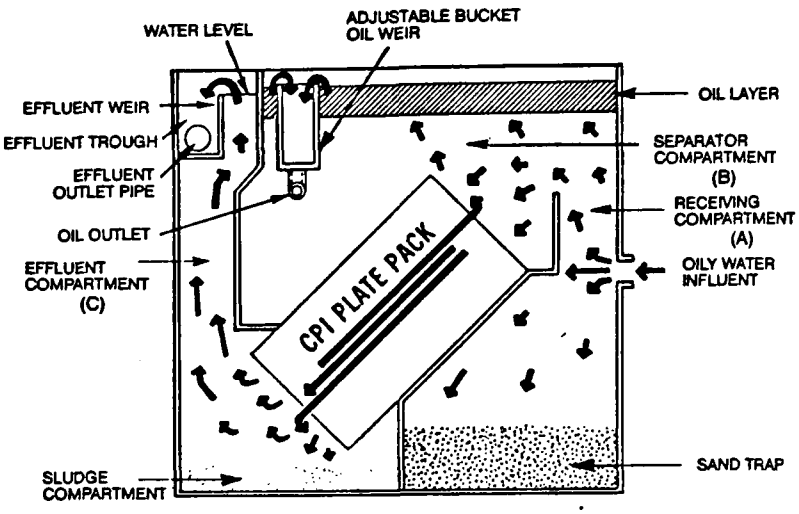
Removes Oil and Solids from Wastewater...by gravity

CORRUGATED PLATE SEPARATOR (CPS)

Basic design of the Corrugated Plate Separator for high solids load applications is illustrated at right. When wastewater enters the CPS through receiving compartment A, its velocity is slowed to less than one foot per second. This permits gross solids to settle out in the sand storage area and large oil globules to float to the surface. The influent then enters separator compartment B.

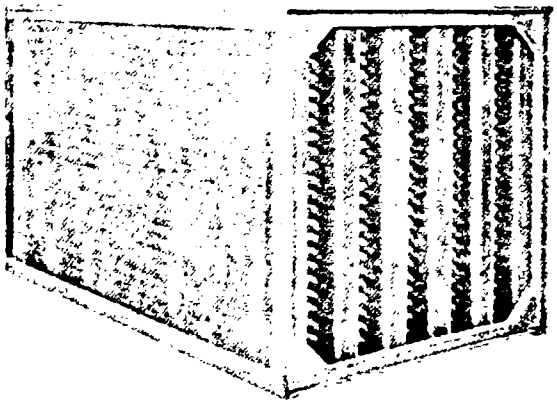
After passing through a quiescent zone, wastewater enters the Corrugated Plate Interceptor (CPI) plate pack. Here the finer oil droplets and sludge are separated by gravity. The de-oiled wastewater flows into effluent compartment C and rises toward the outlet pipe.

Both the separator compartment B and effluent compartment C are provided with a skim pipe, or weir. Height is adjusted to balance the hydraulic loads so that only oil can be skimmed off the surface. An oil layer is maintained in the interceptor, with oil discharged automatically into the skimmer due to the difference in the specific gravity of oil and water.



NOTE: General arrangement of the low solids unit is shown on the front cover of this bulletin.

CORRUGATED PLATE INTERCEPTOR (CPI)



At the heart of the Corrugated Plate Separator is the CPI plate pack. The standard plate pack consists of 47 corrugated sheets, or plates, stacked in parallel at 3/4" intervals. Overall dimensions are 38" high by 42" wide and 69" long, with a horizontally projected area of approximately 550 square feet. Both the plates and the molded housing are made from glass fiber reinforced polyester resin for corrosion resistance.

The CPI pack is installed in the tank so that the plates are at an angle of 45° to the horizontal, in the flow direction of the wastewater. Additional packs may be installed to handle the requirements of any size system.

Before water containing oil enters the pack, its velocity has been slowed in the inlet channel. As the waste stream passes through the pack, its flow rate is controlled to maintain laminar conditions. The plates are designed so that oil, as it separates from water, migrates to the underside of the next plate above. Then, by gravity, it migrates toward the inlet of the plate pack counter to the water flow. Sludge settles to the top of the next lower plate and collects in the valleys of the corrugations, sliding down by gravity toward the outlet at the bottom of the unit, in the same direction as the water flow.

The peaks of the corrugations at the inlet are connected by vertical gutters, or risers, which guide the collected oil out of the flow area of the wastewater. The same riser system is provided on the valleys of the plate pack outlet for sludge disposal. Gutters prevent the re-entrainment of oil or sludge.

CAPACITY

Because the CPI plate pack is a gravity type separator, its efficiency is determined by the rising or settling velocity of the smallest particles that will be intercepted. Capacity, then, cannot be stated as a fixed value.

The movement of particles is affected by the rising height, flow conditions, liquid flow velocity and particle size. Corrugated plates in the plate pack reduce the rising height and establish laminar flow conditions.

Flow velocity is related to the through-put. For example, with a standard plate space of 3/4" and quoted capacity of 130 GPM, the flow velocity is 1.8 ft./min. This means that all particles with a rising velocity of 0.42 in./min. (2.1 ft./hr.) will be intercepted. Particle size is determined by the difference in specific gravity between the water and oil, at a given temperature. When the water temperature is 68° F and the difference in specific gravity is 0.1, then all oil particles 55 microns or larger will be recovered.

It follows that the ppm content of the effluent depends upon the number of particles entering with the influent with a rising velocity of less than 0.42 in./min. To increase the separating efficiency of the CPI plate pack, these smaller particles must be intercepted. This can be done by reducing the flow velocity — that is, reducing the through-put per pack.

The chart below illustrates the relationship between capacity, particle size, temperature and specific gravity for the Lancy Corrugated Plate Separator.

CPS DESIGN/APPLICATION CONSIDERATIONS

To achieve a desired final concentration, the size of oil droplets that must be removed by the separator depends upon the origin of the waste-water. Normally, tank farm runoff will be less than 20 ppm if all oil globules larger than 90 microns are removed. Refinery waste streams, however, will generally be less than 20 ppm only when all oil globules larger than 60 microns are removed.

EXAMPLE: CPI Packs and Refinery Stream

How many CPI packs are required to reduce a refinery stream of 1700 GPM, containing 0.4% oil, to less than 30 ppm at a temperature of 68° F? Specific gravity, water = .995, Specific gravity, oil = .895.

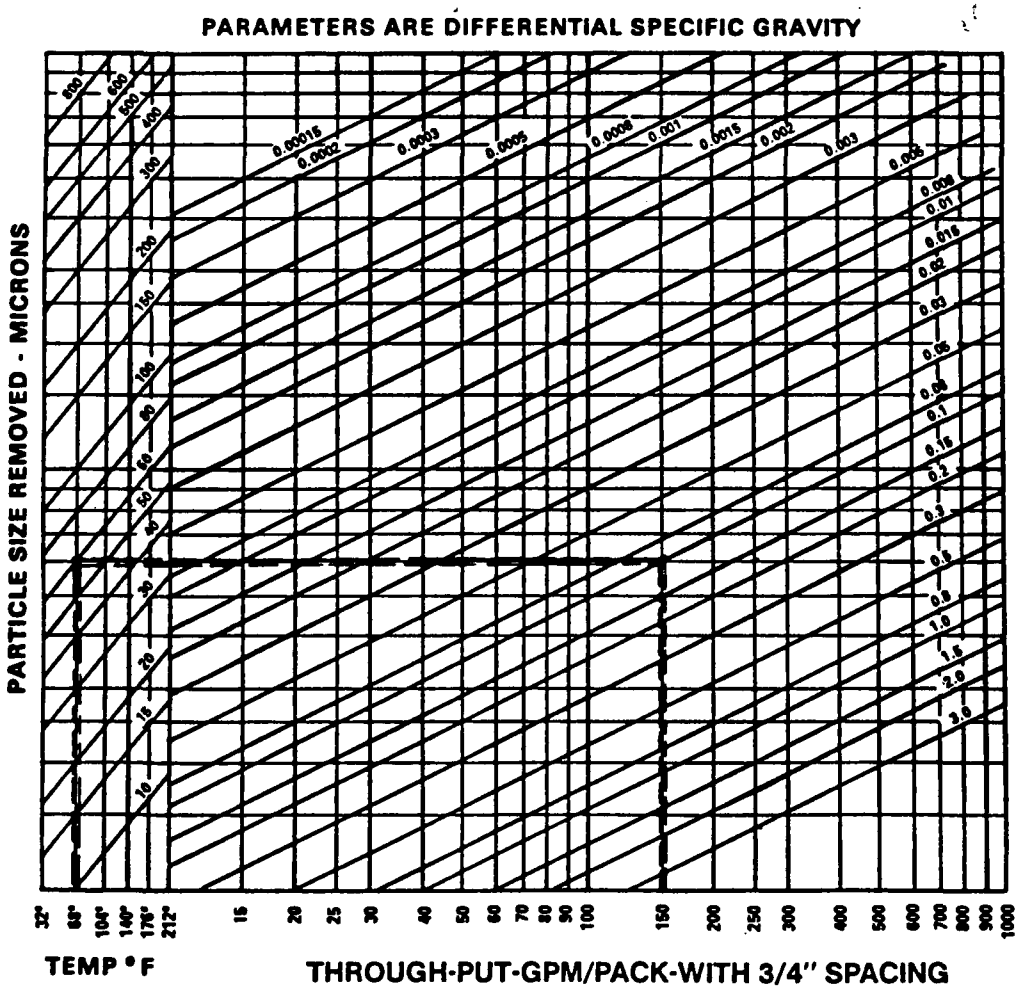
Locate 68° F on the horizontal temperature scale of the chart below. Project vertically to intercept 60 microns on the particle size scale. Next, project horizontally until crossing the differential specific gravity of 0.1 (.995 versus .895). Then, project vertically down to the through-put scale and read 150 GPM. Divide 1700 by 150 = 11.35 packs. Therefore, use twelve packs.

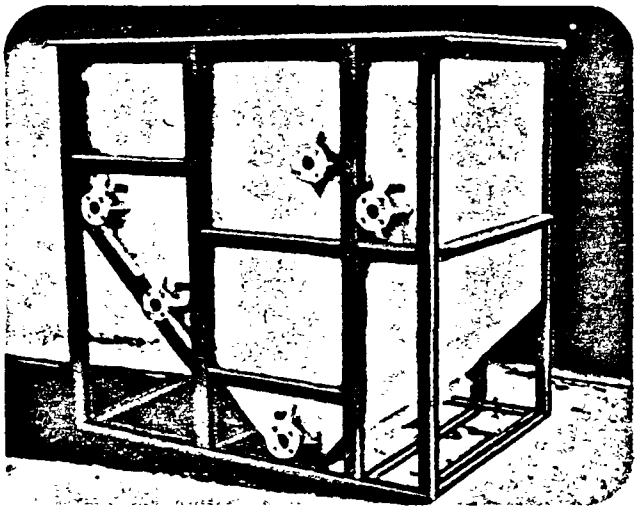
EXAMPLE: CPI Pack Load Versus Heavy Flow Conditions

What is the CPI pack load required during various rainfall intensities for a given surface area? A nominal starting point for design is to use between 1/2" and 3/4" per hour of rainfall to determine the number of packs. The oil concentration and droplet size will vary under storm conditions. At the beginning of the storm, much of the oil spilled on the platform and pads will wash into the sewer with a relatively low volume of water. Thus, while the oil concentration is high, typically 2000-3000 ppm, the oil droplets are large in size (60 microns and larger).

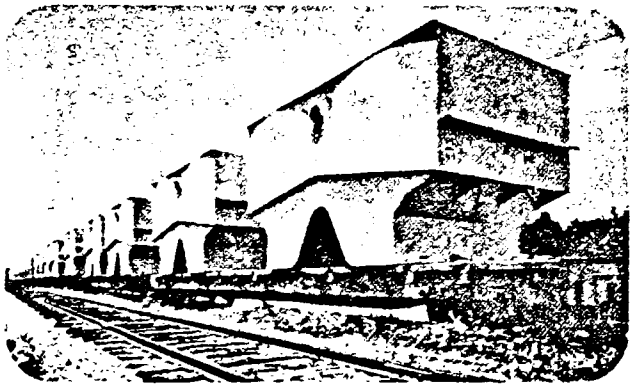
As the storm continues, the runoff rate increases while the oil concentration drops sharply. Nearly all the spilled oil has rinsed away. Because of agitation, oil droplet size is reduced, with 2 to 3% dropping below 60 microns. The concentration during this period normally is around 50 ppm.

Although theoretically the flow through a standard pack will remain laminar up to 700 GPM, at this load oil sludge particles tend to be washed from the plates into the effluent. As a result, storm water design normally is limited to 300 GPM. This is chiefly because once the separator, downstream from the plate pack, becomes coated with oil, it downgrades the effluent quality for several months.

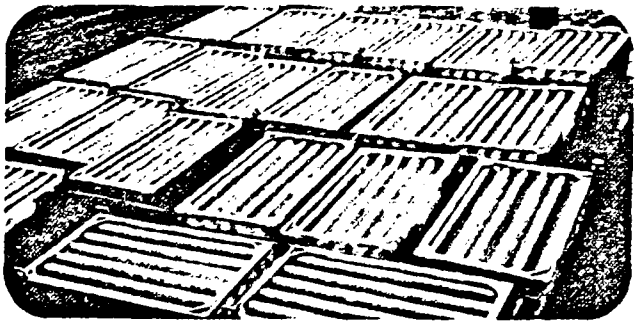




PILOT UNIT — Quarter pack pilot unit made of corrosion-resistant reinforced polyester with steel frame serves as lightweight transportable unit to determine full scale through-puts and oil and sludge removal rates.



12-PACK UNITS — This line-up of finished CPS units is part of an installation of 31 such units for a large automotive waste water treatment system. These are steel tanks with six CPI Packs on each side.



CPI PLATE PACKS — These CPI Packs are ready to be assembled into complete CPS units.

ADVANTAGES OF LANCY CORRUGATED PLATE SEPARATOR

COMPACT
Uses less space, liquid detention time is only minutes compared to hours in conventional settling devices.

NO MOVING PARTS
Simple, better separation; minimum maintenance.

LOW INSTALLATION COST
Lightweight, can be installed above ground on a concrete pad or underground; several designs available.

MOLDED FRAME CONSTRUCTION
Sturdy construction; CPI plates held in molded corrosion-resistant frame, will not become unglued in use.

LOW OPERATING COST
Gravity-design separates light from heavy materials in smooth, efficient, automatic flow.

STREAMLINED GUTTERS
Provide better collecting troughs to remove oil and sludge out of the main flow.

CONSISTENT OPERATING RESULTS
Due to our unique design features, changes in flow rate, temperature and weather do not throw operation out of equilibrium.

FLEXIBLE
Available in various materials of construction for either above or below grade installation. Can be furnished with auxiliary equipment or as an engineered system.

Special designs can also be supplied for high temperature, high pressure, vacuum or blanketed requirements.

PROVEN
Over 3,000 packs now operating.

AUTOMATIC SLUDGE REMOVAL
Sludge collects in the valleys of the corrugations of the CPI plate pack and slides down by gravity to sludge compartment at the bottom of the unit where it can easily be removed.

Alcoa Separations Technology, Inc.

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ALCOA

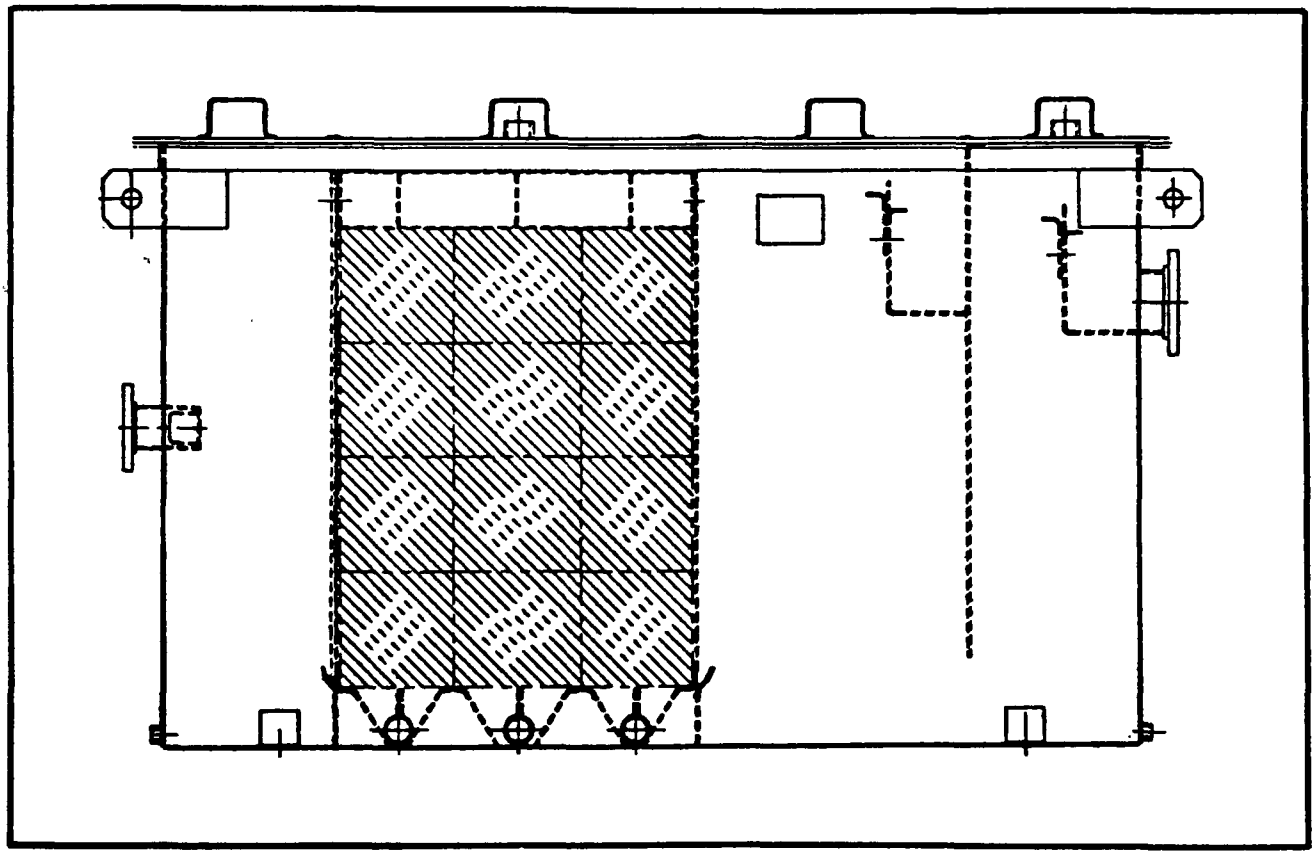
Form 8001 10/89 1M

Printed in U.S.A.

LANCY INTERNATIONAL, INC.
An Alcoa Separations Technology Company

TECHNICAL BULLETIN
NUMBER 8201

LANCY COALESCING OIL/WATER SEPARATOR



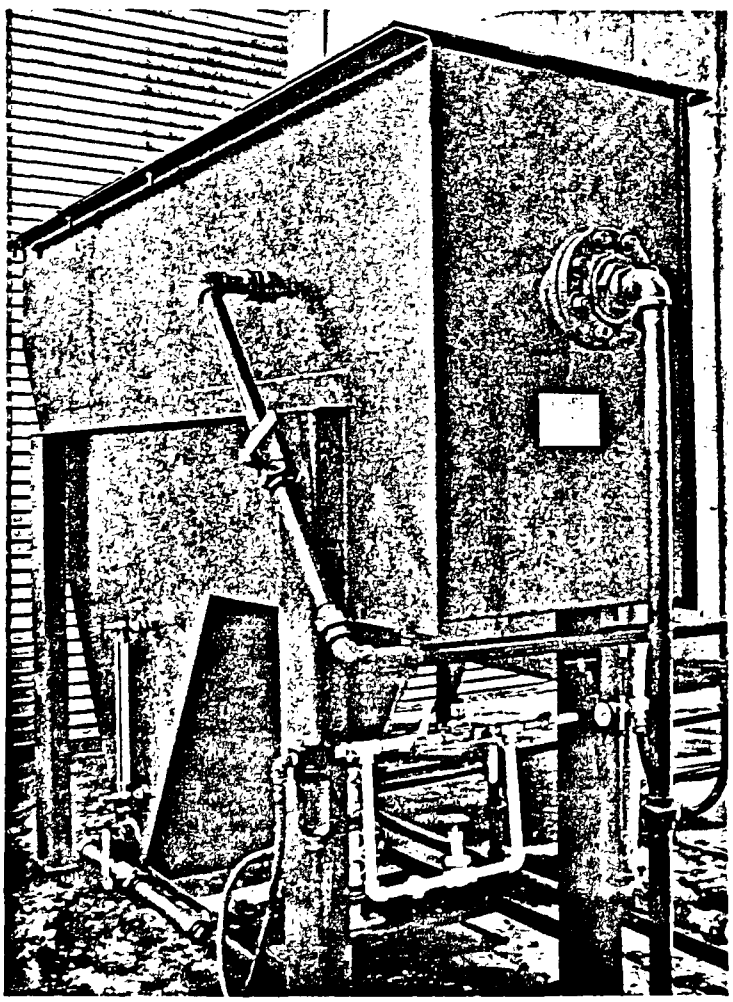
8200 Series

Separates Free & Mechanically Emulsified Oils From Wastewater

LANCY COALESCER
8200 Series

The Lancy 8200 series coalescing oil/water separator utilizes an innovative design to provide highly efficient separation of dispersed oil and settleable solids from process or waste streams. The unique coalescing medium removes oil droplets down to 20 microns in size while also tolerating moderate amounts of solids. This medium consists of multiple layers of alternating inclined corrugated plates. The design provides maximum oil/water separation capability by utilizing three mechanisms of oil droplet coalescence: gravity separation, tortuous flow path to promote collision of oil droplets, and the oleophilic (oil-attracting) nature of the medium.

The inclined corrugations of the coalescing medium permit solids to settle and collect in the sludge hopper for removal. This enables the unit to handle suspended solids in the oily water stream without plugging. The Lancy coalescer is also effective in separating heavy oils (SG > 1.0) which are then removed through the sludge hopper. Two standard designs are available. A low profile multiple hopper unit (shown on front cover) is used for low solids applications or for installations with height restrictions. The high profile single hopper model (Series 8200 S, Figure 1) is used for high solids applications (suspended solids > 300 ppm). All standard units can be provided with integral oil storage capacity up to 5,000 gallons if needed. The coalescer can be installed above or below grade. The compact design also makes it ideal for concrete vault installation.



8200 S Series, 30 GPM Unit

PERFORMANCE

Lancy coalescers are available in two configurations to accommodate either low or high solids loadings.

The standard coalescing medium is PVC. Polypropylene is also available. The coalescing medium is housed in modular packs which are installed in sections and are easily removed.

Standard units can handle influent temperatures up to 160° F and operate over a wide pH range. By using alternate materials of construction, units can be supplied to handle temperatures over 200° F, a full pH range, as well as streams containing solvents and aromatics. Surges of up to 100% oil can be accommodated.

At design flow rates, the effluent will contain 15 ppm or less free oil and grease with droplets 20 microns and larger being removed. An optional polishing pack located downstream of the main separation area can further reduce the effluent oil and grease content.

The Lancy coalescer has no moving parts and requires no electricity . . . making it easy and inexpensive to operate and maintain

OPERATION

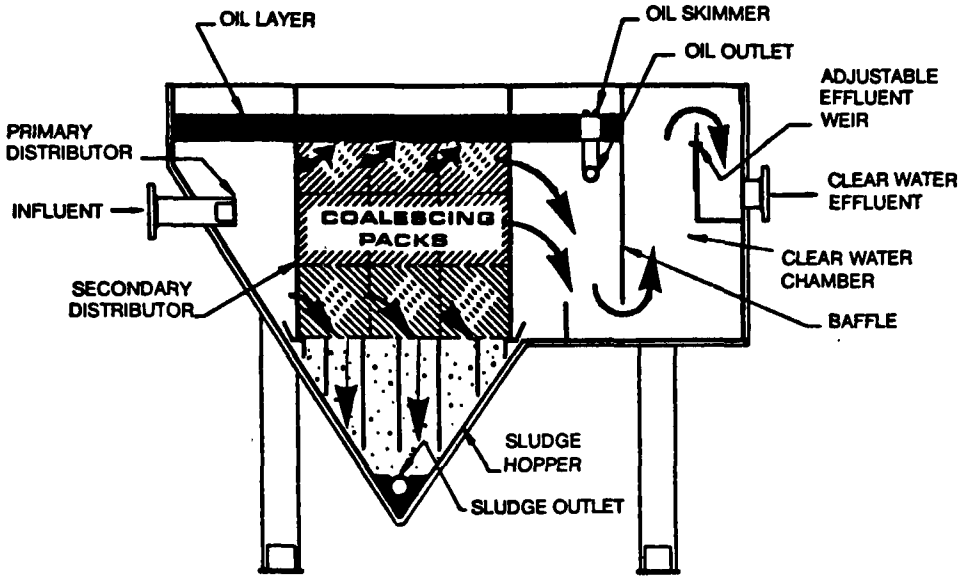


FIGURE 1 **8200 S Series**

As shown in Figure 1, oily water mixtures are introduced into the primary distribution chamber either by pumping or by gravity feed. Entering the unit through an inlet deflector pipe, the liquid stream flows through a slotted baffle to ensure even distribution across the full width and height of the coalescing packs.

In the coalescing zone, the liquid is forced to move with sharp and abrupt changes in direction. This tortuous flow promotes the collision of the small oil droplets. These droplets coalesce, grow in size, and eventually become bouyant enough to move to the top of the packs.

The recovered oil layer, floating on top of the unit, is then collected by an adjustable trough or oil skimmer from which it flows to an internal or remotely located sump. The thickness of this layer depends upon the amount of oil in the influent and the height of the adjustable oil weir. Under stable flow conditions, the coalescer should maintain a top oil layer from two to six inches in depth.

Solids and heavy oils will drop out of the medium settling to the bottom of the unit and into the sludge hopper for withdrawal.

Clean effluent, leaving the series of coalescing modules, flows under the oil retention baffle, over the adjustable weir and out of the unit.

FEATURES

- Units for flows from 15 to 2,000 GPM
- Models for low and high solids loadings
- Slotted inlet baffle for even flow distribution
- Sludge hopper for easy dirt and solids removal
- No moving parts
- Oil storage capacity up to 5,000 gallons is available as an option
- Alternate materials of construction to accommodate corrosive or high temperature fluids

BENEFITS

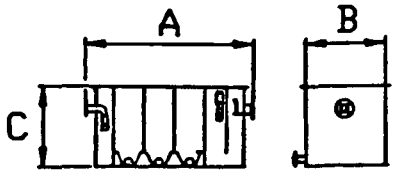
- Reduces free oil concentration to 15 ppm or better
- Coalesces and removes oil droplets as small as 20 microns
- Handles suspended solids in the flow stream
- Easy and inexpensive to operate and maintain
- Optional polishing pack available for even higher effluent quality

MAJOR APPLICATIONS

- Chemical and hydrocarbon processing plants
- Fabricated metals plants
- Bulk plants
- Utilities
- Parking lots
- Wash racks
- Machining coolants/ tramp oil

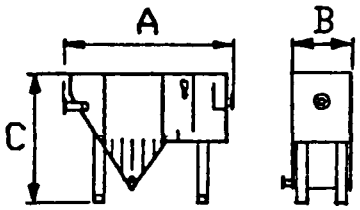
COALESCER SPECIFICATIONS

LOW SOLIDS
8200 Series



MODEL #	FLOW RATE	A	B	C	WEIGHTS (LBS) SHIPPING	WEIGHTS (LBS) OPERATING
8200.15	15 gpm	5'6"	2'9"	2'6"	900	2,600
8200.30	30 gpm	8'8"	2'9"	4'6"	1900	4,100
8201	100 gpm	9'7"	4'9"	5'6"	3100	15,400
8201.5	150 gpm	9'7"	6'9"	5'6"	3800	21,900
8202	200 gpm	9'7"	8'9"	5'6"	4500	28,300
8203	300 gpm	12'7"	6'9"	6'0"	4900	31,400
8204	400 gpm	12'7"	8'9"	6'0"	5800	40,700
8205	500 gpm	14'3"	7'9"	6'0"	7000	61,800

HIGH SOLIDS
8200 S Series



MODEL #	FLOW RATE	A	B	C	WEIGHTS (LBS) SHIPPING	WEIGHTS (LBS) OPERATING
8200.15 S	15 gpm	5'6"	2'9"	4'6"	1100	3,200
8200.30 S	30 gpm	8'8"	2'9"	7'0"	2100	4,900
8201 S	100 gpm	9'7"	4'9"	8'0"	3300	16,600
8201.5 S	150 gpm	9'7"	6'9"	8'0"	4100	23,800
8202 S	200 gpm	9'7"	8'9"	8'0"	4900	30,700
8203 S	300 gpm	12'7"	6'9"	10'8"	5500	38,300
8204 S	400 gpm	12'7"	8'9"	10'8"	6,600	49,600
8205 S	500 gpm	14'3"	7'9"	12'8"	7800	69,200

Units for flow rates up to 2000 GPM available. Consult Factory for dimensions and weights.

MATERIALS OF CONSTRUCTION

Tank

- Carbon steel (with or without coatings)*
- Polypropylene
- Stainless steel

*Standard

Coalescing Pack Material

- PVC*
- Polypropylene
- Stainless Steel

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LANCY INTERNATIONAL, INC.

TECHNICAL BULLETIN

NUMBER SP8001

CORRUGATED PLATE SEPARATOR SPECIFICATIONS

(EXPANDED VERSION: EXPLANATIONS IN ITALICS)

1.0 GENERAL

This project consists of ***(general description of oil/water separator or system, including flow rate)*** for installation at _____. The equipment is to be of proven design with at least five (5) years operational experience in similar services.

This section provides an overview of the application and service conditions. It is important to have a time-proven design because many oil/water separator designs come and go.

2.0 APPLICABLE SPECIFICATIONS

2.1 The equipment shall be designed and manufactured in accordance with the latest edition in effect at the time of the Contract of the following codes and standards:

a. American National Standard Institute (ANSI): B16.5, "Steel Pipe Flanges, Flanged Valves and Fittings".

b. American Petroleum Institute (API): Oil Water Separator Process Design.

c. American Society for Testing and Materials (ASTM):
   1. A 36, "Specification for Structural Steel"
   2. A 105, "Specification for Forgings, Carbon Steel, for Piping Components."

2.2 Applicable Specifications developed by the Consulting Engineer.

Helps assure uniformity in the quality of the equipment quoted by different vendors.

3.0 UTILITIES AVAILABLE

Important on systems where pumps, controls, etc. are required. Corrugated Plate Separator has no moving parts and, therefore, requires no utilities.

4.0 PERFORMANCE REQUIREMENTS

The separator shall be capable of treating a maximum design flow of _____ gpm of oily water. The effluent from the equipment shall have a total free oil and grease concentration less than _____ mg/l and a total suspended solids concentration less than _____ mg/l at the design flow rate.

Please note that most laboratory oil determinations use an extraction method which gives total oil and grease, not free oil. Separators only remove free oil. Chemical treatment is necessary to remove dissolved or emulsified oil.

5.0 DESIGN CONDITIONS

The specified oily water separator will serve to treat ***(describe water source.)*** The oily wastes shall flow ***(by gravity or pump)*** through the separator, which will be installed ***(above or below)*** grade. Temperature of the wastewater shall range between _____ and _____. The equipment shall be capable of removing both floating and free types of oil contamination, as well as suspended solids. The effluent from the separator shall be discharged ***(by gravity or pump)*** to _____. Oil, grease and sludge recovered shall be collected and disposed of by others.

Detail of the conditions of service are as follows:

Fluid ..... _____
Fluid pH ..... _____
Specific Gravity of Carrier Fluid ... _____
Proportion of oil in fluid ..... _____
Design flow rate, gpm ..... _____
Maximum flow rate, gpm ..... _____
Normal flow rate, gpm ..... _____
Physical properties of design oil:
  Type(s) ..... _____
  Specific Gravity @ 65° F ..... _____
  Viscosity @ 122° F, SFS ..... _____
  Pour point, ° F ..... _____
Influent temperature range, ° F .... _____
Ambient air
  temperature range, ° F ..... _____
Suspended solids:
  Design concentration ..... _____

6.0 CORRUGATED PLATE OIL/WATER SEPARATOR

The separator shall be the inclined corrugated plate type. The unit will be complete and factory assembled. The separator shall be designed for installation as shown in drawing _____.

An installation drawing is the best insurance for getting what is specified.

6.1 Separator Basin

a. The basin and its steel internals shall be fabricated of A36 carbon steel plate with at least 1/4" thickness, and shall have the general configuration shown in ***Figure 1. Special materials of construction also available.***

b. Basin shall be of welded construction. All welds shall be ground smooth and all weld splatter removed.

c. All steel surfaces shall be cleaned ***(and/or sandblasted to near white metal)*** and coated ***(inside and/or outside)*** with ***(rust resistant primer, coal tar epoxy, or other).***

d. All flanges shall be 150 lbs. Nozzle size schedule is as follows:

	Number	Inch Diameter
Influent		
Effluent		
Oil Outlet		
Drain		

e. Effluent weir will be adjustable, gasketed plate type.

f. Standard oil weir will be adjustable bucket type with adjustment bolts at tank sides. ***This design is easier to level and adjust than plate type. This is important for the oil weir due to its location. Adjustment may be necessary when oil is present. The bucket weir adjustments are at the tank sides instead of all the way across the tank.***

g. The separator shall be provided with a sectionalized removable cover.

h. Optional: The separator basin shall include an inlet, presettling compartment in which heavy solids can drop out. ***(See Figure 2.)*** ***For application such as storm water runoff it is necessary to provide extra sludge settling and holding capacity. The alternative is to have a unit which clogs frequently or with an unacceptable frequency of sludge pump-out. Preceding the unit with a separate sludge sump is also possible.***

6.2 Corrugated Plate Interceptor Pack (CPI)

The separator shall have ***(number)*** Corrugated Plate pack(s) with a total effective surface area at a 45 degree angle of inclination of _____sq. ft. The CPI(s) shall be constructed of fiberglass reinforced polyester with 304 stainless steel hardware. ***Four CPI pack sizes are available. Special materials of construction also available.***

a. Each pack shall have plates at a 0.75 inch spacing between the plates. The depth of the corrugations shall be 2 inches and the crest to crest dimension shall be 7 inches. ***It is not enough to specify corrugated plates since there are an infinite number of possible configurations. A proven configuration should be specified.***

b. CPI shell thickness shall be 0.25 inches. The pack shall have the following outside dimensions:
Length:
Width:
Height:

c. Packs shall have inlet and outlet troughs to prevent the re-entrainment of separated oils and solids. ***This key design feature is graphically illustrated in Figure 3. Without the troughs the separated media must rise or fall directly through the flow which could result in carry over.***

7.0 OPTIONS

7.1 Coalescing Media

Polypropylene coalescing media shall be installed in the inlet or outlet compartment to facilitate oil removal. This oleophilic material coalesces small oil droplets into particles of sufficient size to separate. ***(See Figure 4).***

Coalescing media is only necessary when mechanically emulsified oil is present or when low effluent oil contents are required. Consult with Lancy when considering this design.

7.2 Integral Oil Tank

An integral oil tank of _____ gallon capacity shall be provided. Oil will flow from the bucket oil weir to the oil tank by gravity. Tank construction will be the same as that of the CPS. ***This feature eliminates the need to provide for continuous oil removal. Oil can be allowed to accumulate until removal is convenient or oil can be removed on a regular schedule.***

7.3 Effluent Clear Well

An integral clear well of _____ gallon capacity shall be provided. The effluent will flow by gravity over a weir into the well. Water will be pumped from an outlet at the bottom of this compartment. The clear well shall be of the same construction as the basin. ***This feature is used when the effluent must be pumped. For proper functioning, flow through the separator must be by gravity.***

7.4 Pumps

a. Influent — ***Screw pump, positive displacement, sliding shoe or other non-emulsifying pump.***

b. Sludge — ***Positive displacement preferred.***

c. Oil Transfer — ***Gear pumps acceptable.***

d. Water Transfer — ***Centrifugal.***

7.5 Level Detectors and Controls

a. Oil — ***Positioned in bucket weir or integral oil tank.***

b. Separator Compartment — ***Would sense flooding if outlet restricted.***

c. Clear Well — ***Control of water transfer pump.***

d. Oil Monitor — ***In effluent to verify performance.***

7.6 Working Platform

Separator can be supplied with a steel platform around the perimeter. Platform would be complete with ladders, handrails and toe plates. ***The cover can be made such that it can serve as the platform. The handrails and toe plates would be around the perimeter.***

7.7 Observation Hatches

Above oil and effluent weirs.

7.8 Heaters

Submersion, electric heaters or steam coils can be specified to prevent freezing as well as heating oil so it will flow. If unit is to be above ground, field installed insulation will reduce power requirements.

7.9 Basin Side-Wall Extensions

To allow for direct burial and gravity flow.

7.10 Automatic Sludge Withdrawal Module

See Technical Bulletin 6201.

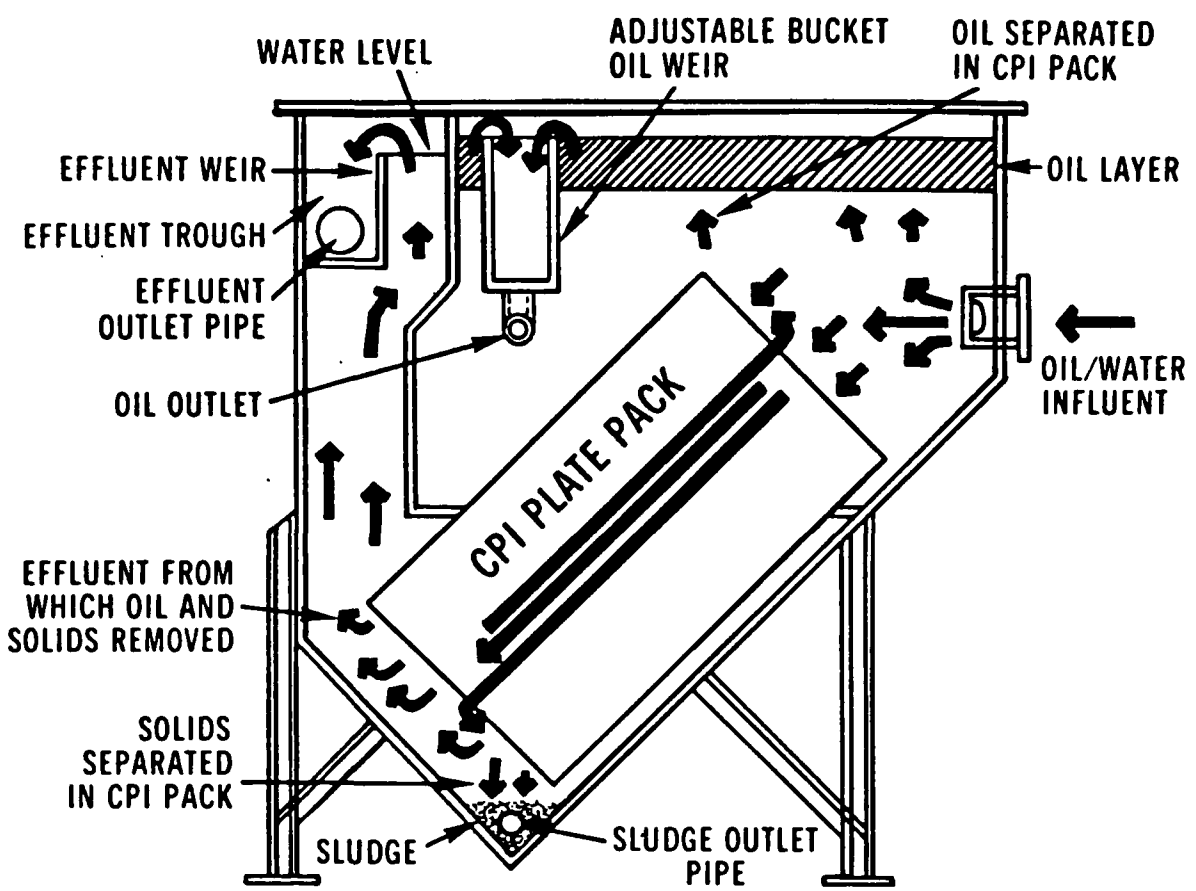

FIGURE 1

Lancy's Standard Basin

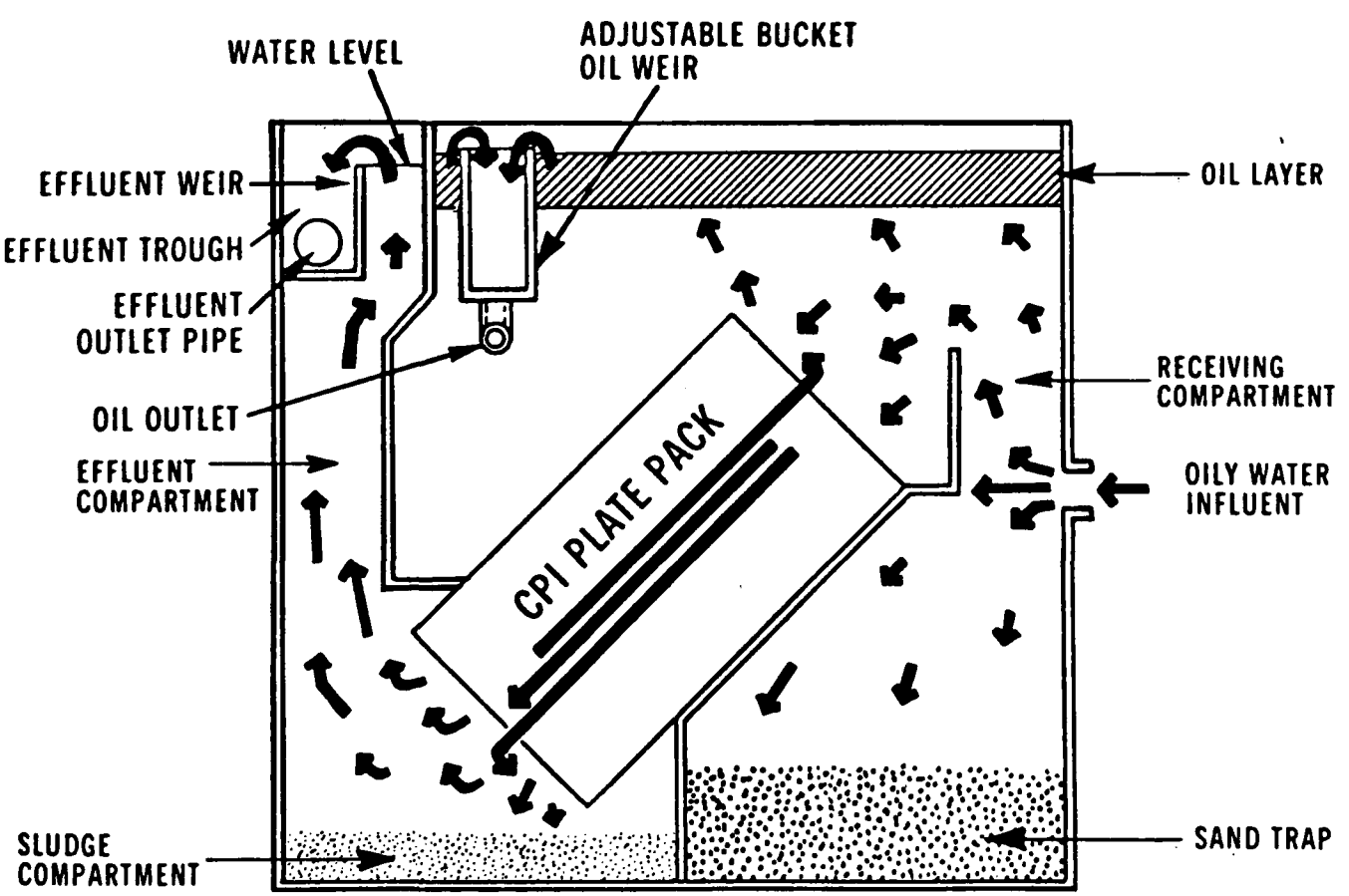

FIGURE 2

Lancy's Standard S/S Design

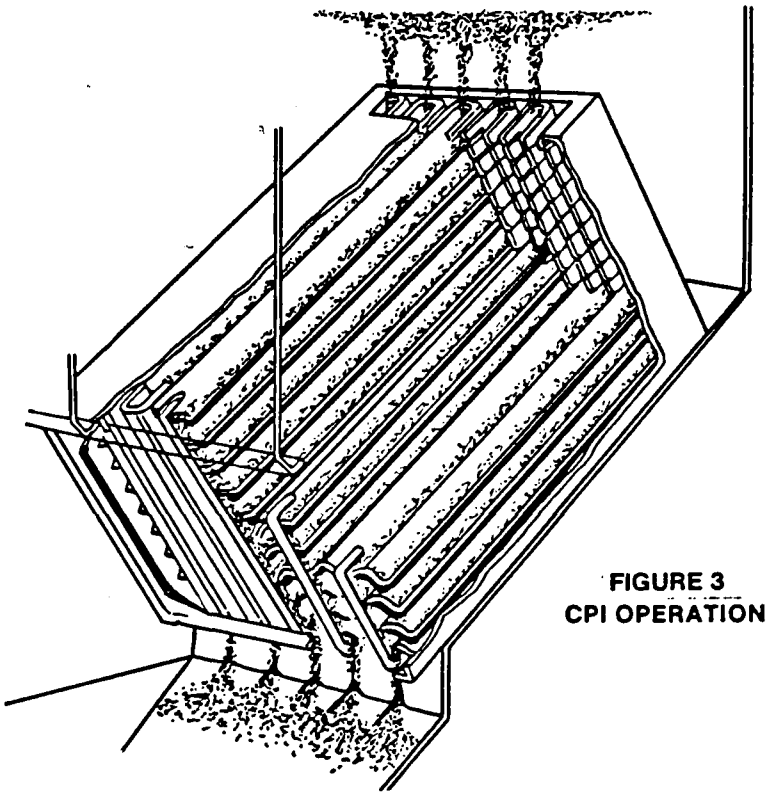

FIGURE 3
CPI OPERATION

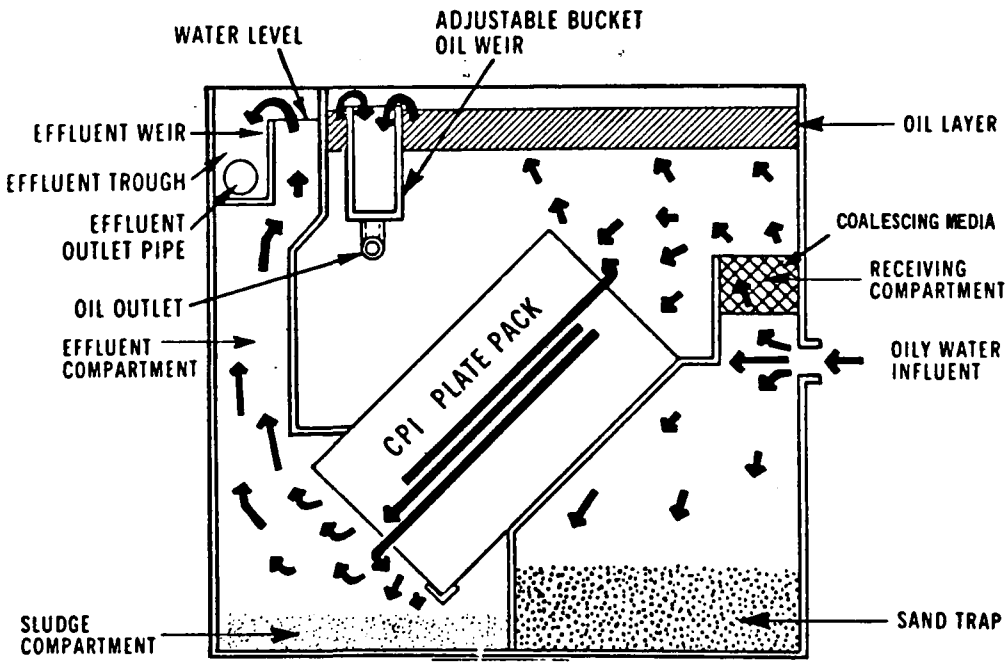

FIGURE 4
Lancy's Standard CPS w/Coalescing Media

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Form No. SP8001-1085 10M

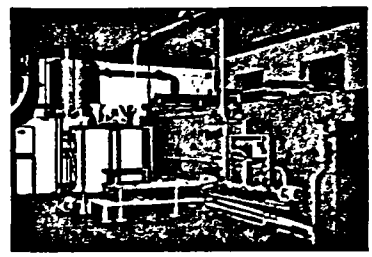
in U.S.A.

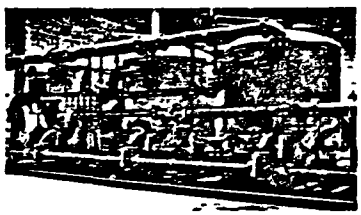
Oil/Water Separation Equipment

GRAVITY SEPARATOR — Lancy Corrugated Plate Separators provide effective high rate gravity separation of free oil and water mixtures, along with superior solids handling capability. These units have no moving parts and require much less space than conventional API Separators which are also supplied by Lancy. The patented lamella type design applies one or more inclined corrugated plate interceptor packs mounted in a modular basin. The basins are usually constructed of steel but can be supplied in FRP or concrete. Standard designs for both above and below ground installation and for pressurized applications are available. Over 2,500 Lancy oil/water separators are in continuous heavy-duty use in such diverse industries as oil production and refining, chemical and petrochemical production, fertilizer manufacture, steel production, metal forming and fabrication, food processing and electric utilities. They are ideal for processing surface run-off from commerical and industrial parking lots and for oily water generated by transportation servicing and maintenance facilities.

EMULSION BREAKING — Emulsion breaking is the most difficult and critical aspect of effective separation of oily water mixtures. Recent treatability studies and development work by Lancy have led to a better understanding of the mechanism and control of emulsion treatment methods which use polyelectrolytes. These advances show that the common techniques of heating and coagulation can be minimized or eliminated, thus simplifying the emulsion breaking step without creating a secondary contaminated stream which would require additional treatment. This improved treatment chemistry and the associated controls are readily incorporated into standard Lancy equipment and systems, and will generate separate free oil and water phases which can be easily processed by conventional gravity separators, flotation units or media filters to generate high quality effluent.

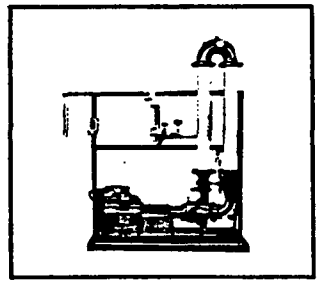
DISSOLVED AIR FLOTATION — Lancy Dissolved Air Flotation Units combine an innovative, compact equipment design with a unique, low pressure air injection device. This proprietary combination achieves a 2 to 5 times increase in rise rate over competitive systems, and optimum control of bubble size and dispersion at lower operating pressures (energy efficient) compared to the other pressure let-down devices. The Lancy DAF unit thus improves the removal of oils, fats, grease and suspended solids in less space. When used in conjunction with Lancy's enhanced emulsion breaking methods, it will produce a high quality effluent from difficult waste streams such as emulsified oils, dairy wastes and discharges from food processing, rendering or paint and varnish operations.

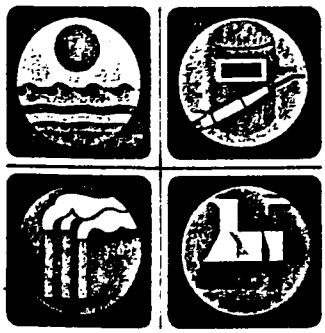




RESIDUAL OIL FILTERS — Fluids containing low concentrations of finely suspended oils, particularly the overflow from gravity or chemical/mechanical separators, can be further treated by gravity or pressure filtration to reduce oil content to levels as low as 2 ppm. To meet the need, Lancy provides a complete line of heavy duty, down-flow filters in treatment capacities ranging from 10 to 5,000 gpm complete with automatic polymer feed to enhance removal and improve backwash effectiveness. Other optional features include face piping, provision for air scour, pressure differential or time actuated backwash control and automatic valving to suit specific requirements.

ULTRAFILTERS —Ultrafiltration is a physical separation technique using pressure to drive fluid through a special membrane. This technique is effective for removing and concentrating colloidal dispersions or emulsified oils from water or other solvents. The heart of the Lancy Ultrafilter is a unique, chemically stable inorganic membrane and membrane support which permits operation over a wide range of pH and at elevated process temperatures, making solution pre-cooling unnecessary. Because it is chemically stable and resists abrasion and compaction, this inorganic membrane can be easily cleaned by strong acids, alkalis or solvents. Unit sizing is based on laboratory feasibility trials to suit specific applications. Lancy Ultrafilters are particularly effective for continuous removal of oils and greases from hot alkaline cleaners and for recovery of machining lubricants and coolants.





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Printed in U.S.A.

TECHNICAL PAPER

MR84-923

Ultrafiltration: A Turnkey System

abstract

Ultrafiltration has become an alternative to the chemical treatment of soluble oil and alkaline wash water wastes. To gain the maximum benefits of ultrafiltration a complete turnkey system is needed. This paper will discuss the basic components required for such a system and why they are needed.

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conference

Metalworking Coolants—A Practical Approach
March 27-29, 1984
Dearborn, Michigan

index terms

Ultrafiltration
Waste Treatment
Oils
Turnkey Systems

1983

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The prospects for ultrafiltration become ever increasingly inevitable with the advent of the Resource Conservation and Recovery Act (RCRA) and the 1985 zero discharge goal. There are many different applications for ultrafiltration in todays industry, but this discussion will be limited to soluble oils and alkaline wash waters wastes.

What is ultrafiltration? Ultrafiltration is a semi-permeable, pressure activated process which is capable of removing emulsified oils and suspended solids from soluble oils and alkaline wash waters. Since the membrane is semi-permeable, emulsified oil and suspended solids are retained by the membrane allowing only water and some dissolved low molecular weight materials to pass through the membrane. The emulsified oils and suspended solids retained by the membrane are referred to as concentrate and the water and dissolved solids which pass through the membrane are referred to as permeate.

The membrane itself is a thin film which acts like a filter and has a pore size less than 0.005 microns. The emulsified oils and suspended solids are much larger than the pore openings so the pores cannot become plugged. The flow of the feed stream is tangential (cross flow) to the surface of the membrane which helps prevent solids from accumulating on the membrane.

There are four basic ultrafiltration configurations, but only two of them will be discussed in this paper.

TUBULAR MEMBRANE

The membrane is cast onto the inside of the porous, fiberglass-reinforced epoxy support tube (see Fig. 1). The support tube is usually ½ to 1 inch in diameter and can vary in length. The tube fits into a permeate collection shell and is sealed at both ends of the support tube to completely isolate the permeate from the oily process water. This complete structure is known as a module.

HOLLOW FIBER MEMBRANE

The membrane is a self-supporting tube with a high density surface (membrane) formed on a continuous porous substrate (see Fig. 2). The hollow fiber usually has an inside diameter of 0.020 to 0.045 inches and can vary in length. The fibers are placed in a bundle and are bonded together on each end and inserted inside a permeate collecting shell and sealed at both ends. The fiber and shell structure is known as a module. Due to the unique structure of the hollow fiber, it is the only ultrafiltration membrane that can withstand having a back pressure applied to the membrane.

And is also capable of forward and reverse flow through the hollow fibers (see Fig. 5).

Currently, the main means of disposal of soluble oils and alkaline wash water wastes is to have them hauled away by licensed disposers which becomes more expensive day by day or by chemical treatment with such things as acids, alum, polymers and flocculants (see Fig. 3). Ultrafiltration has many advantages over todays conventional chemical treatment methods:

1) No need for technical people to do laboratory testing for every batch to be treated.

2) No hazardous chemicals to contend with.

3) Is not manpower intensive.

4) Low operating costs - no heat required, low energy consumption.

5) Easy to operate.

6) Concentrate large quantities of wastewater into smaller quantities (usually 95-99 percent reduction).

7) Allows the possibility of reusing premeate for coolant make-up or washwater make-up (Remember zero discharge).

8) Modular construction, which takes up smaller amounts of floor space and allows for easy expansion by just adding more modules.

The purpose of this paper is to give a fundamental and practical explanation of what is needed for a turnkey ultrafiltration system. It does not matter what type of ultrafiltration module you have, whether it is the hollow fiber type or the tubular modules, certain basic equipment is needed:

1) Tanks
2) Pumps
3) Piping
4) Free oil removal equipment
5) Filters
6) Oil/Water Separators
7) Instrumentation
8) Automatic Controls

Anyone can purchase this type of equipment, but great care must be taken to assure that the correct fluid dynamics, flow rates, instrumentation and control requirements are provided to assure that the maximum benefits of ultrafiltration can be realized. It is important to have qualified people design the system, so the user will not have to become an expert in ultrafiltration just to get it to run properly with his existing tankage and wastestream.

There are for basic categories to a turnkey ultrafiltration system:

1) Pretreatment
2) Processing
3) Post treatment
4) Cleaning

PRETREATMENT

The first item needed for the system is an equalization tank. This acts as a collection point and also the pretreatment tank. The tank should provide the waste stream with enough retention time to settle out solids, such as chips, grinding swarf, dirt, sludges, shop rags and other miscellaneous items which find their way into machine sumps and wash tanks. The tank should also provide retention time to allow the free floating oil time to rise to the surface.

This is the main collection tank so it is the ideal place to start to control the bacteria levels. One of the primary reasons for the disposal of soluble oils is rancidity. It is in this tank that a biocide of some type should be used to control bacteria, because if the bacteria is not controlled there is a possiblity that it will grow on and/or in the pores of the membrane thus blinding the membrane.

The type of biocide chosen must first be compatible with the membranes and second depend upon the type of post treatment that has been chosen. If a biological type post treatment has been chosen, then careful consideration must be taken in the selection of the biocide. A fast acting, little or no residual effect biocide should be used for this treatment so as not to kill the bacteria in the bio-digestion plant. If an activated carbon filter or reverse osmosis is selected for post treatment, then a biocide with some residual effect can be used. As a matter of fact, some carry over of the biocide into the carbon filter or reverse osmosis system can benefit the system by not allowing bacteria to grow in either of these systems.

A pH of the waste stream should also be monitored in this tank. With a washwater, the pH should pose no problem for the membranes, since most membranes pH range is 2 to 13. The pH of most of the waste soluble oils are within this range, but as bacteria grows the pH tends to move towards the acidic side. Again, this poses no threat to the membranes, but the soluble oils tend to separate better at a pH of 7 to 8. So if the pH is below this, it should be adjusted to the 7 to 8 range using something like caustic soda, thus giving a better, cleaner permeate.

This tank can also be equipped with liquid level controls depending upon the amount of automation desired by the user. A high level, low level control can be used to control the supply pump to prevent the tank from overflowing and to prevent the supply pump from running dry.

PROCESSING

There are several different types of processing operations in ultrafiltration. These operations are batch, topped off batch, feed and bleed batch or continuous. The two types we will discuss will be batch and topped-off batch.

The batch operation is the simplest of all operating modes. It has the least amount of instrumentation, takes up the most amount of floor space and has the most flexibility. This system is usually manually operated so it requires the greatest number of man hours. It requires the largest amount of hold-up time and thus has the biggest tanks. The large hold-up time allows for the maximum microbial growth so the wastestream must be closely monitored for microbial content.

The basic principle of operation for a batch system is very simple. The process tank is filled with the waste stream. Once filled, the ultrafiltration unit is turned on. The unit will run until the batch is completely concentrated. Ultrafiltration usually reduces the volume of the waste stream by 95 to 99 percent. The flux rate of the permeate starts out fairly high, but as the concentration of the feed increases the flux rate starts to steadily decrease.

The topped-off batch operation offers more automation and instrumentation, thus the amount of man hours required to operate the system is lower than that of the batch operation. Some of the other advantages it offers are minimum tankage and lower hold up volume which, in turn, lowers the chance of microbial growth. It has smaller tankage so it will take less floor space.

The basic principle of operation for a topped-off batch system is to feed the waste stream at a rate the same as or greater than the rate of permeate being generated or to let the system process no more than 10 percent of the volume of the process tank and top the tank off with 10 percent new feed. By constantly topping off the process tank, it keeps the concentration of the feed relatively low, thus keeping the flux rates higher than those of the batch operation.

If the hollow fiber membranes are being used, then a mode known as total recycle can be used. (see Fig. 6). Total recycle can be carried out during processing without disrupting flow to the tubes. During this mode, the permeate valve is closed which causes a back pressure in the outer shell. Since there is still flow through the hollow fiber membrane, permeate is being generated in the lower half of the shell and being forced (due to pressure in outer shell) back into the upper half of the shell forcing particles back into the feed stream where they are carried away back to the process tank. The closing of the valve also helps create a high shear condition which helps to carry particles off the membrane walls. Total recycle is characteristic of hollow fiber membranes only due to the fact that in a hollow fiber membrane the membrane is on the inside of the fiber and the outside of the fiber is the support structure. (see Fig. 2).

With either a batch system or topped-off batch system an inlet tank is needed. It is at this point that the waste stream should be filtered as it enters the tank to remove abrasive suspended solids which could harm the membrane. The free oil carried over from the collection tank should be removed. This can be accomplished by a belt or rope skimmer or by a porous media separator. The mechanically dispersed oils should also be removed so they will not collect on the membrane during processing. This can be accomplished by coalescers, centrifuges or porous media separators. By removing the free and mechanically dispersed oils, the flux rate can be improved by 5 to 10 percent.

After pretreatment in the inlet tank, the wastewater is transferred to the process tank. This can be done either by gravity or with a supply pump. From here the wastewater is ready to be processed.

The equalization, inlet and process tanks should all be fitted with liquid level controls to prevent overflowing of the tanks and to protect the supply pumps and the ultrafiltration process circulation pump from running dry.

Both systems will also need certain instrumentation and controls (see Fig. 4):

1) In-line screening device-protects membranes from solids which can fall into the tanks.

2) Control valves-regulates pressure across the membranes.

3) Pressure gauges-monitors pressure of system.

4) Pressure switch-protects membranes against over pressurization.

5) Temperature gauge-monitors temperature of system.

6) Temperature gauge-protects membranes from high temperature.

If hollow fiber membranes are being used, then additional valves must be added to the system (see Fig. 4). One valve would go on the permeate line to allow the permeate line to be closed for the total recycle process. Two valves would be needed to direct the feed stream in through the bottom of the membranes (forward flow) or in through the top of the membrane (reverse flow) (see Fig. 5). The permeate valve and the two directional valves can be operated manually or automatically depending upon the degree of automation desired by the user. For a totally automatic system, these valves could be put on timers or controlled by a microprocessor to change flow and go into total recycle at set time periods to keep the flux rates running at a higher rate for a greater length of time.

POST TREATMENT

It must be remembered that ultrafiltration is not an absolute process. Its membrane is semi-permeable so water and some dissolved organic and inorganic materials will actively pass through the membrane. It will depend on the regulations of the local sewer districts as to whether or not the permeate will be acceptable for sewer discharge. The basic parameters of the sewer district are usually based in 5 areas (see Fig. 8):

1) Total Suspended Solids
2) Oil and Grease (Freon Extractable)
3) Hydrocarbon Oil
4) Chemical Oxygen Demand
5) Biochemical Oxygen Demand
6) Heavy Metals

The permeate from soluble oil wastes usually contains such inorganics as sodium, calcium, magnesium and chloride which could be detrimental to coolants if reused. For this reason, it is usually not recommended for coolant make-up water, but rather should be disposed of.

If further treatment is necessary, there are several effective post treatment methods available:

1) Biological Treatment
2) Activated Carbon
3) Ionic Resins
4) Reverse Osmosis

The permeate of alkaline washwaters usually contains detergents, surfactants and low molecular weight wetting agents that are part of the washwaters themselves. Because of these materials passing through the membrane, the permeate is usually reused for washwater make-up. If the user chooses not to reuse the water, it may be discharged to the sewer, but it may also need some type of post treatment such as those listed above.

The concentrate from ultrafiltration must also be dealt with, but remember that the concentrate volume is only 1-5 percent of the original wastewater volume. The concentrate also ranges from 40-60 percent oil. For example, if the original volume of wastewater was 1000 gallons then the volume of concentrate is 10-50 gallons and of that it is 6-30 gallons of oil. The concentrate can be handled by several methods.

1) Contract hauler

2) Emulsion breaking

3) Incinerating in the plants boiler.

CLEANING

There are several methods used for the cleaning of the ultrafiltration systems:

1) Dispersing
2) Solubilizing
3) Mechanical (tubular only)
4) Total recycle and/or backflushing (hollow fibers only)

When using any of these methods, the system should first be completely flushed with clean water. The mixture of oily waste and water flushed from the piping can be returned to the process tank and processed with the next batch of wastewater. The water used for the flushing and cleaning of the membranes should not be hard water (60 ppm or 3.5 grains/gallon total hardness). If the available water is hard, then deionized water should be considered for the cleaning of the membranes.

1. Dispersing Cleaning

The dispersing cleaning method functions by breaking up the deposits in the membrane and dispersing them into colloidal sized particles, so they can be carried away by feed stream. The most commonly used dispersants are detergents, and detergent cleaning is the most widely used cleaning method for oil/water ultrafiltration. It is also more effective at elevated temperatures.

2) Solubilizing Cleaning

The solubilizing method functions by using weak solutions of acids to chemically dissolve the deposits that foul the membrane. Elevated temperatures are also used for this method for quicker, more effective cleaning.

3) Mechanical (tubular only)

The mechanical cleaning method functions by using a brush or sponge balls to physically scrub the deposits off the membranes. This method works most effectively when used in conjunction with the dispersant cleaning method.

4) Total Recycle and Backflush (hollow fiber only)

The Total Recycle cleaning method was explained earlier. Refer to the top of page 5.

The backflushing cleaning method functions by pumping under pressure a permeate quality cleaning solution (permeate which has been stored in a separate tank) in the permeate shell (see Fig. 7). Since there is no feed stream passing through the fiber, the pressure on the inside of the fiber is zero PSI and the permeate, which is under pressure, will enter the membrane from the outside. This action will push the deposits off the membrane and into the hollow fiber and flush them to either the process tank or the drain. Total recycle runs during the detergent cleaning may clean the membranes well enough to eliminate the need for back-flush cleaning.

The equipment needed for the dispersing and solubilizing cleaning methods are:

1) Cleaning solution holding tank.

2) Heaters to elevate temperature.

3) Connecting piping to connect the tank with the ultra-filtration circulation processing pump.

The equipment needed for mechanical cleaning:

1) Brush
2) Sponge balls
3) Holding tank for cleaning solution and sponge balls
4) Connecting piping to connect the tank with the ultrafiltration circulation pump.

The equipment needed for total recycle:

1) Valve to close off permeate line.

The equipment needed for backflushing:

1) Holding tank-collection tank to hold permeate.
2) Backflush pump-supply permeate and pressure.
3) Float control-protect pump from running dry.
4) Connecting piping-connect backflush pump to permeate shell outlet.

The RCRA and zero discharge goals have created the need for a waste treatment system that is capable of treating soluble oil and alkaline wash water wastes, and produces an effluent capable of being reused for make-up water or sewer discharge. This need can be filled by ultrafiltration. Ultrafiltration can produce an effluent whose water quality remains consistent regardless of changes in the waste stream characteristics. The effluent, in most cases, is suitable for sewer discharge, while concentrating the waste stream volume to 1-5 percent of its original volume. The concentrate is 40-60 percent oil.

To maximize the full potential of ultrafiltration, a turnkey system (complete system) approach should be considered. This provides the user with an ultrafiltration system that does not require the user to become an expert on ultrafiltration or a systems engineer to design or specify the tankage, piping, controls and instrumentation needed for a complete ultrafiltration system.

The turnkey ultrafiltration system provides many features and benefits:

1) Skid-Mounted: all tanks, pumps, pre-filters, piping and instrumentation are skid-mounted for easy installation.
2) Complete Assembly: the system (tanks, pumps and pre-filters) are pre-piped and all instrumentation is pre-wired ready for operation.

3) Controls: All controls and instrumentation for the system is wired to one panel for easy monitoring of the system.

4) Installation: to install, just set the skid in place and hook-up the waste water supply pipe, electrical power to the panel and water for the cleaning of the ultrafiltration membranes.

5) Expansion: the system is a modular design which allows for easy expansion by installing additional ultrafiltration modules to existing system or by adding additional skid-mounted systems.

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FIGURE 1
TUBULAR MEMBRANE

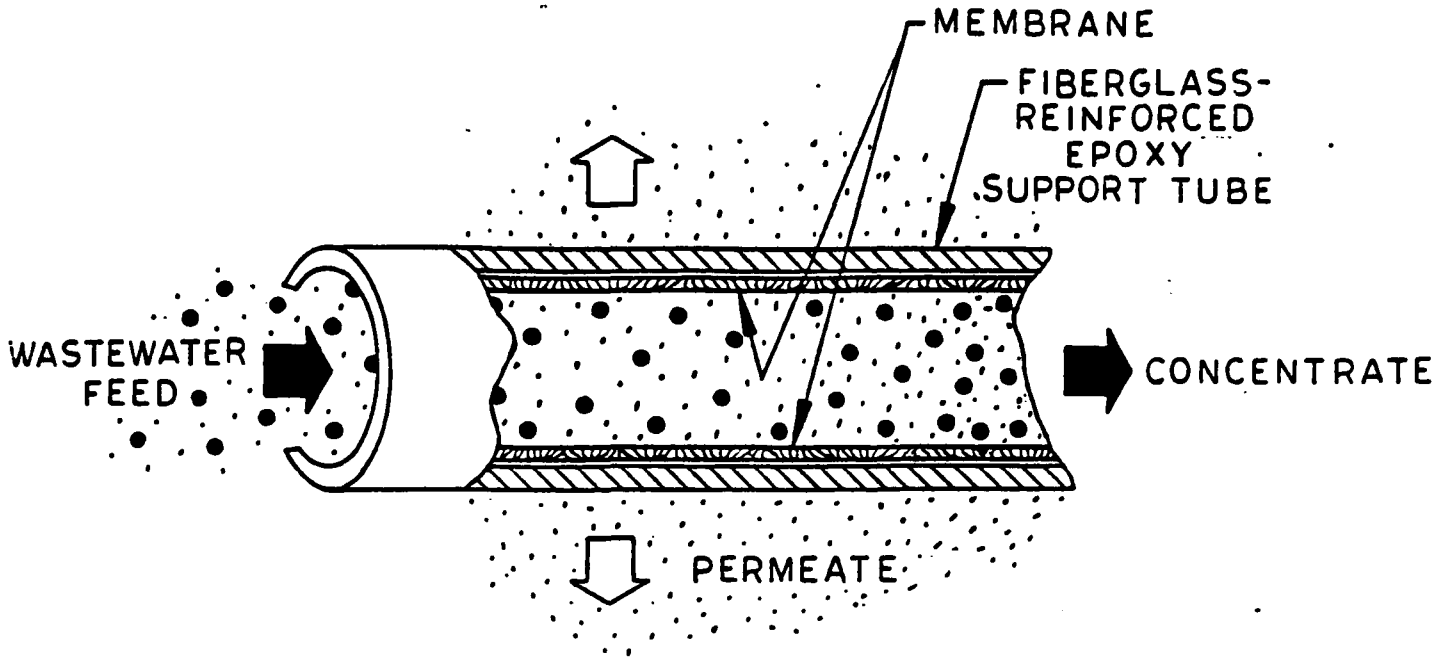
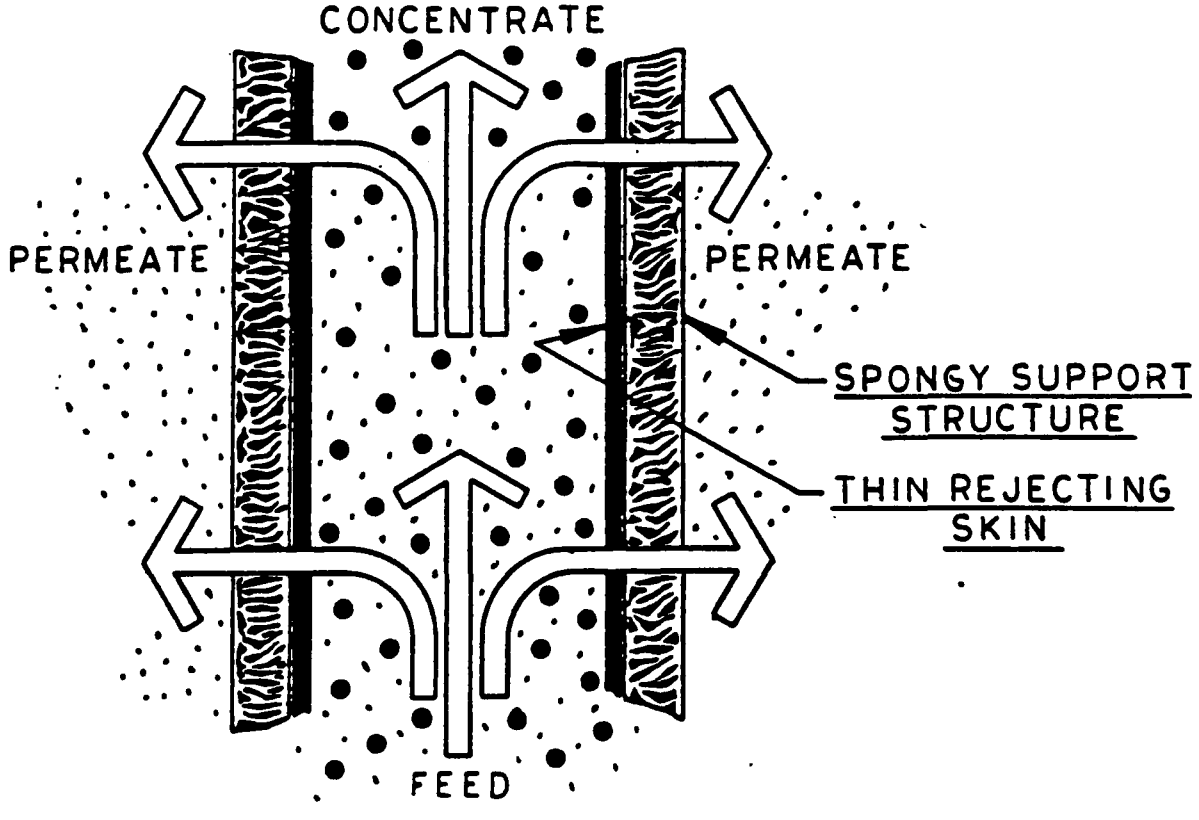


FIGURE 2
HOLLOW FIBER MEMBRANE



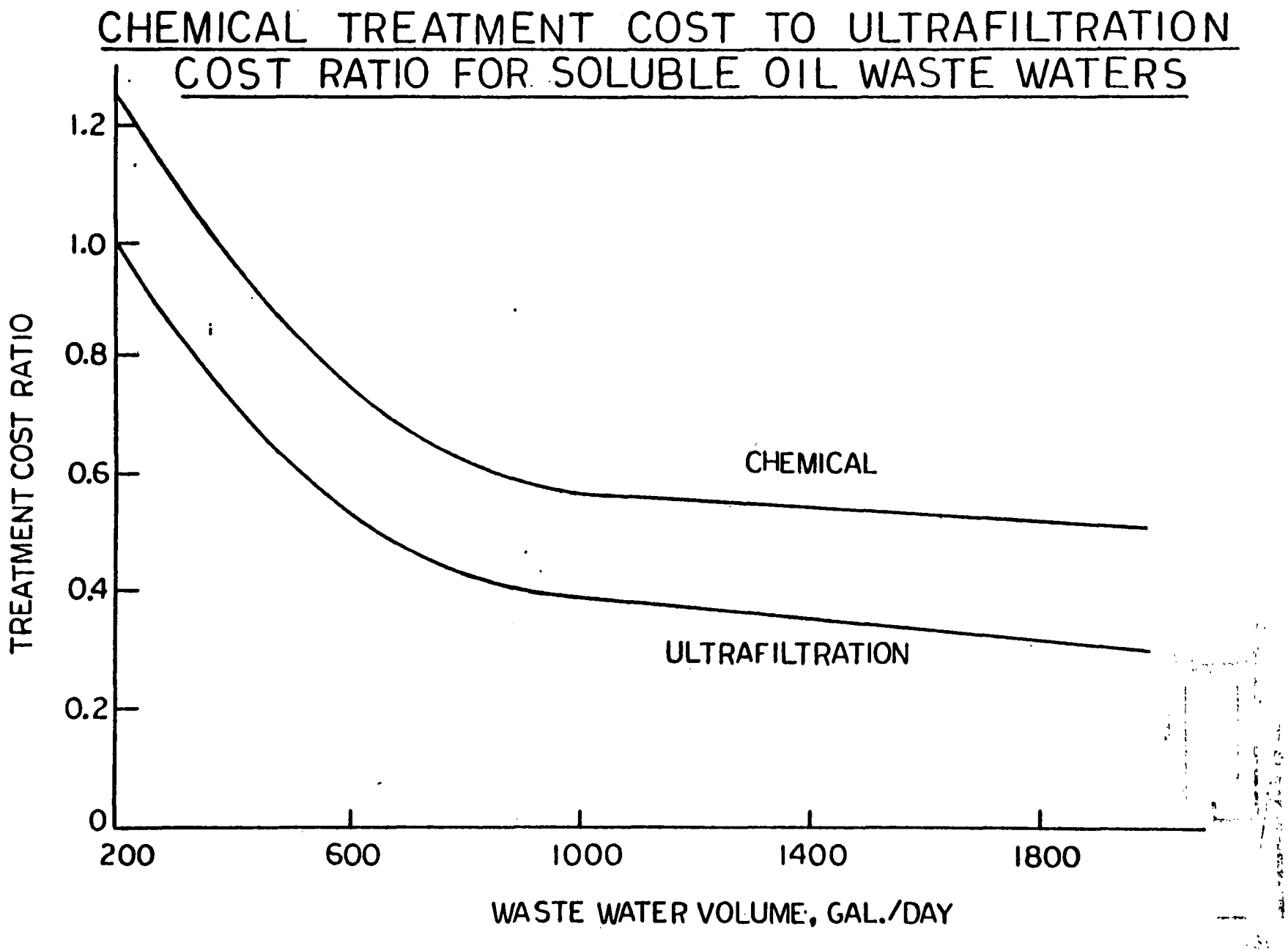
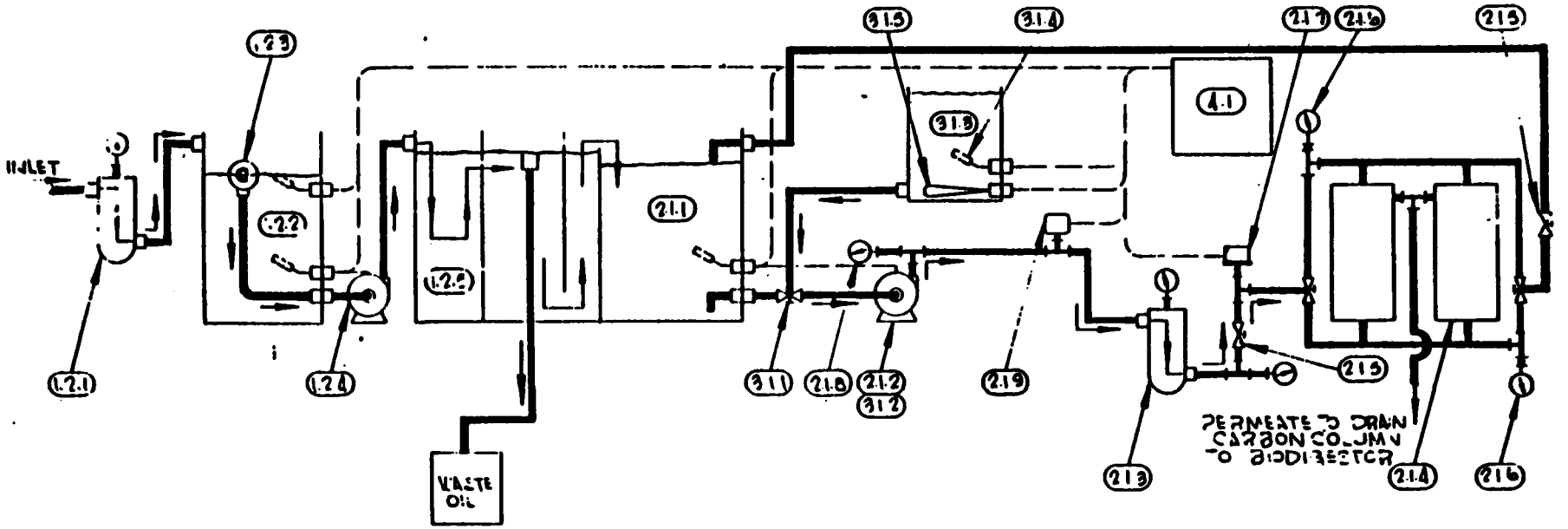

CHEMICAL TREATMENT COST TO ULTRAFILTRATION
COST RATIO FOR SOLUBLE OIL WASTE WATERS
TREATMENT COST RATIO
1.2
1.0
0.8
0.6
0.4
0.2
0
CHEMICAL
ULTRAFILTRATION
200
600
1000
1400
1800
WASTE WATER VOLUME, GAL./DAY

FIGURE 3



1.2.1 INLET BASKET STRAINER (BAG FILTER)
1.2.2 INLET TANK
1.2.3 FLOATING SKIMMER
1.2.4 SEPARATOR SUPPLY PUMP
1.2.5 TRAMP OIL SEPARATOR
2.1.1 PROCESS TANK
2.1.2 PROCESS CIRCULATION AND WASH PUMP
2.1.3 BASKET STRAINER
2.1.4 ULTRAFILTRATION CARTRIDGE
2.1.5 PROCESS CONTROL VALVES
2.1.6 PRESSURE GAUGES (2)
2.1.7 PRESSURE SWITCHES (OPTIONAL)
2.1.8 THERMOMETER
2.1.9 TEMPERATURE SWITCH
3.1.1 FLOW DIRECTIONAL VALVE
3.1.2 WASH PUMP (REF. 2.1.2)
3.1.3 WASH TANK
3.1.4 LEVEL CONTROL FLOAT
3.1.5 WASH TANK HEATER
4.1 MICRO PROCESSOR BASED PROGRAMMABLE CONTROLLER

FLOW DIAGRAM
HYDE ULTRAFILTRATION SYSTEM
(HUF 12)

FIGURE 4

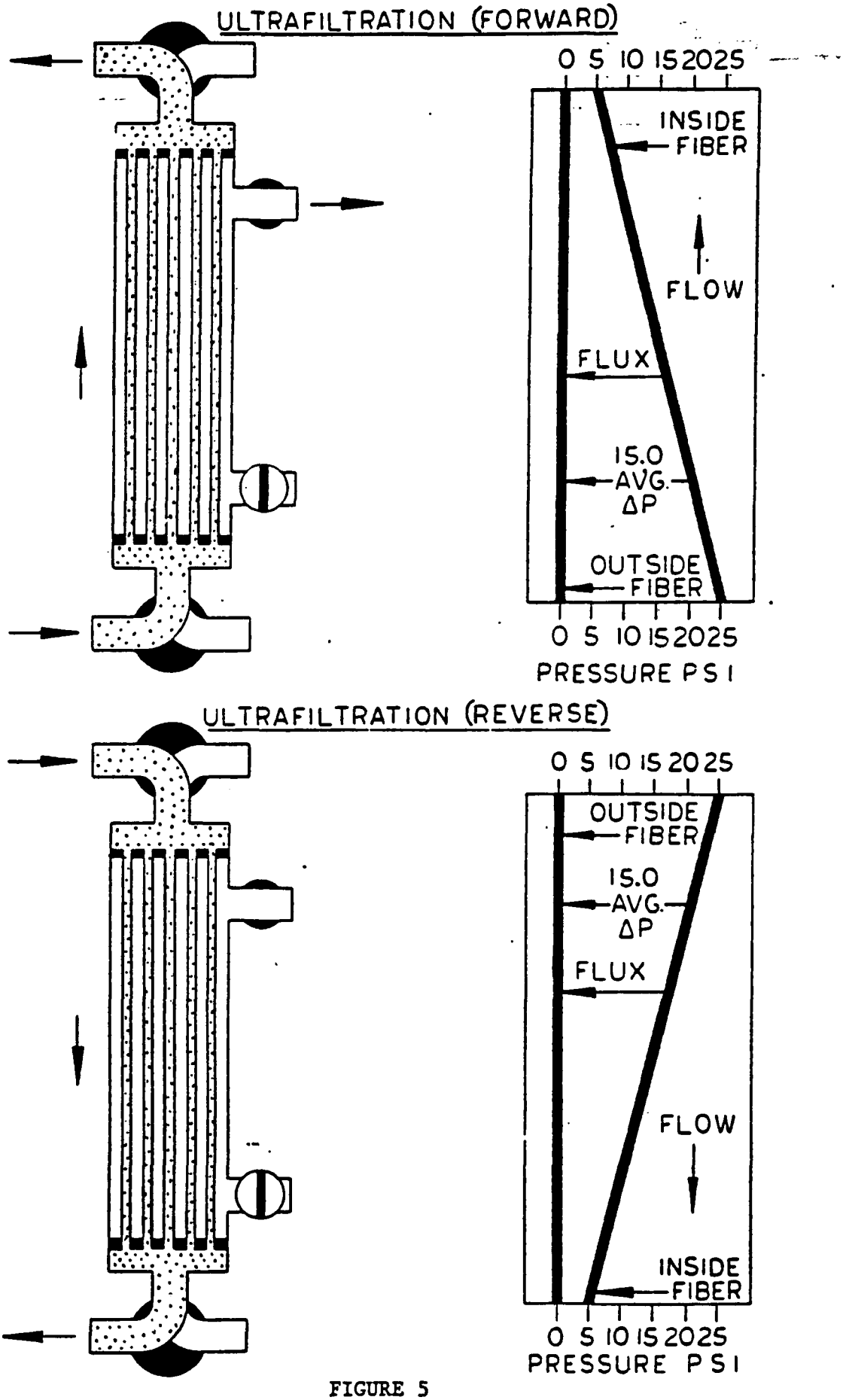
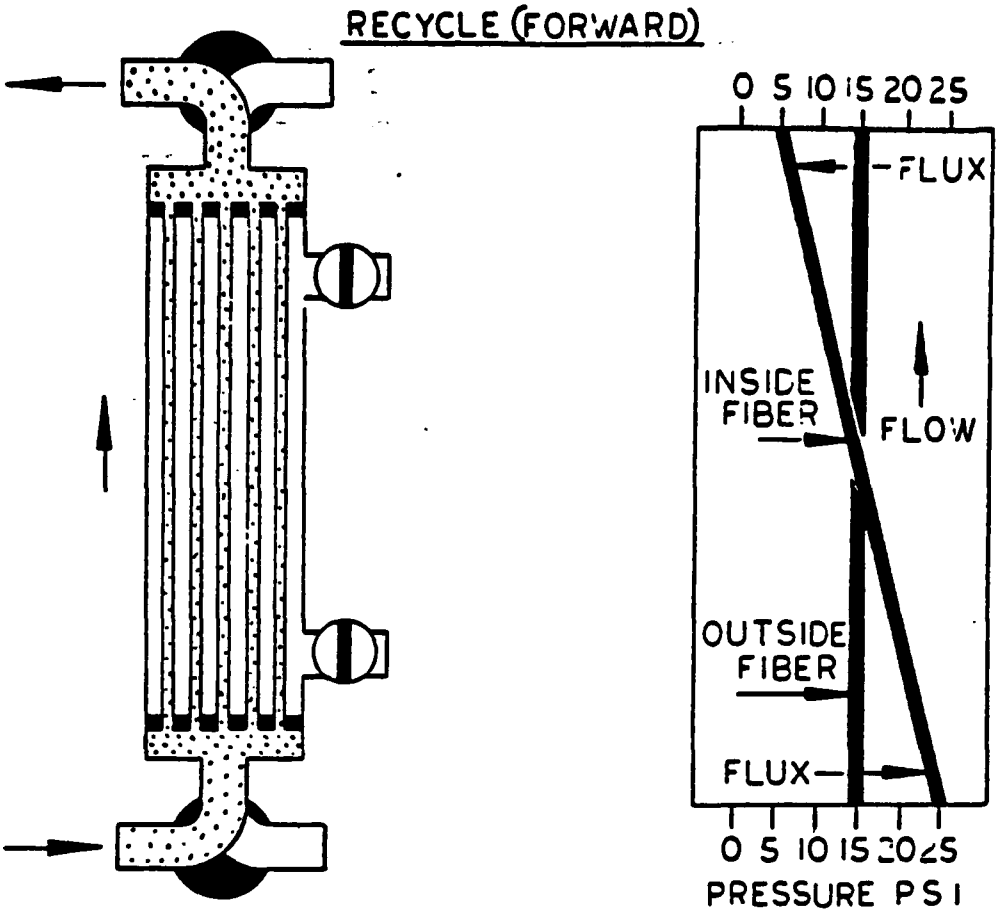

ULTRAFILTRATION (FORWARD)
0 5 10 15 20 25
INSIDE FIBER
FLOW
FLUX
15.0 AVG. ΔP
OUTSIDE FIBER
0 5 10 15 20 25
PRESSURE PSI
ULTRAFILTRATION (REVERSE)
0 5 10 15 20 25
OUTSIDE FIBER
15.0 AVG. ΔP
FLUX
FLOW
INSIDE FIBER
0 5 10 15 20 25
PRESSURE PSI

FIGURE 5

RECYCLE (FORWARD)



RECYCLE (REVERSE)

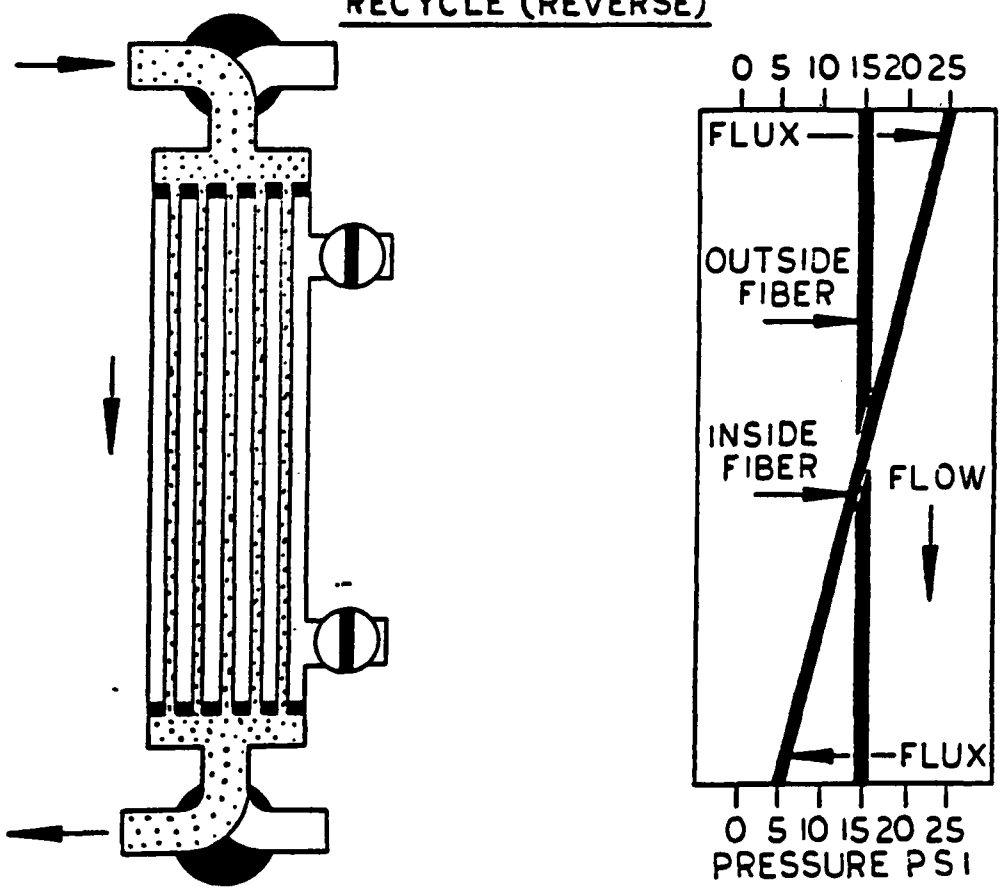


FIGURE 6

BACKFLUSH

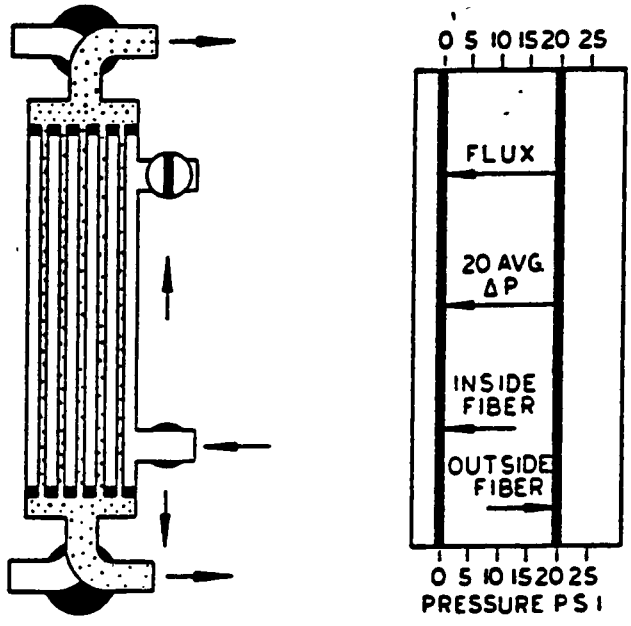


FIGURE 7

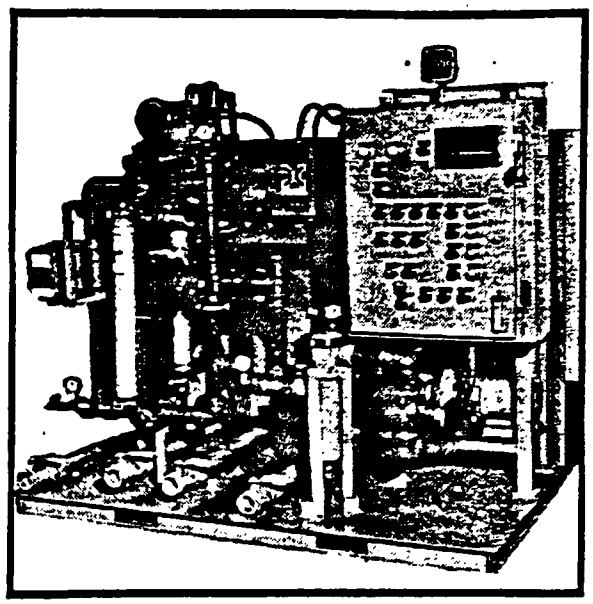
TYPICAL RESULTS OF ULTRAFILTERED OILY WASTEWATER WITH POST TREATMENT

TEST	FEED WASTEWATER	PERMEATE	POST TREATMENT	PERCENT REDUCTION
CHEMICAL OXYGEN DEMAND	88,985	18,125	58	99.9
BIOCHEMICAL OXYGEN DEMAND	68,278	6,548	17.3	99.9
TOTAL SUSPENDED SOLIDS	7,588	0	0	100
TOTAL OIL AND GREASE (FREON EXTRACTABLE)	17,944	58	28	99.8
HYDROCARBON OIL	8,318	42	13	99.8
PHENOL	922	15	8.1	99.9
pH	7.8	7.8	7.5	-------

FIGURE 8

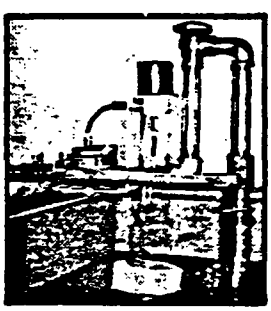
WASTEWARRIOR

A Complete Turn-Key Fluid Management System



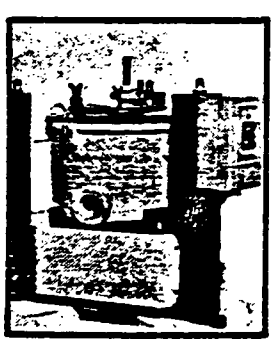
WASTEWARRIOR is the acknowledged economical, non-chemical way to significantly reduce the volume of oily wastewater for the metalworking industry. The Hyde system processes waste coolants, synthetics, alkaline washwater and other waste liquids to help meet the Resource Conservation and Recovery Act (RCRA) requirements and state and local discharge regulations.

Auxiliary Equipment

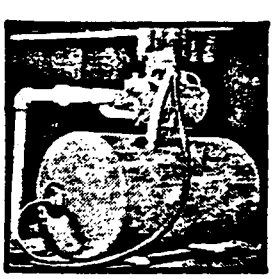


HYDE-O-MATIC™ Miscible Fluid Proportionator is an automatic device that blends miscible fluid concentrates and water into properly mixed fluids.

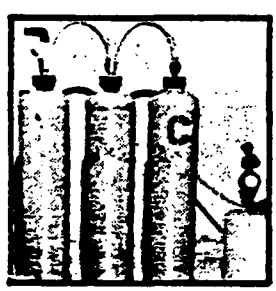
It is easily attached to existing Miscible Fluid Recycling Stations. Flow rates are available from 4 to 14 GPM. They also may be used on central systems and a number of other proven applications.



HYDE FILTRAFUGE.™ The precision-balanced vibration-free unit may be equipped to generate gravity forces from 500 to over 2000G's depending on the application. Downtime for changeouts is minimal due to simplified dumping procedures. Semi to fully automatic Filtrafuges are available if solids contamination warrants.

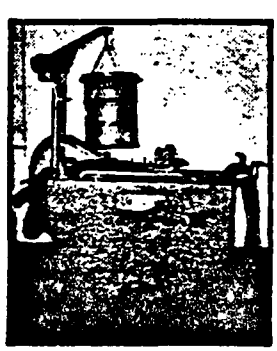


HYDE MISCIBLE FLUID RETURN PUMPS. Hyde offers a clean side return pump for operations where a convenient source of make-up fluid is required close to the machines. A full range of flow rates are available.



HYDE DEIONIZERS are recommended when the dissolved minerals in the make-up water are high enough to shorten the useful life of the miscible fluid. These products utilize the ion exchange method to yield chemically pure water for coolants, washwater and other solutions

A full range of deionizers are available from mixed bed single-cylinder rechargeable types for small requirements up to fully automatic separate bed regenerating models for larger plants.



HYDE MOBILE SUMP CLEANER is a powerful, easy to maneuver vacuum filtration device which incorporates the latest labor-saving features in one unit. It is used to quickly remove contaminated cutting fluids, chips and swarf at flow rates up to 100 GPM. A complete range of filters in various micron sizes are available to meet specific requirements. A unique option is the chip basket hoist which overcomes one of the major objections of competitive products.

Single and split tank models are available in sizes from 80 to 600 gallon capacities. The standard unit is equipped with a 5 HP electric motor. Also available are LP gas and air.

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CASE HISTORY

HYDE WASTEWARRIOR CASE HISTORY

A Pennsylvania Die Caster has found a way to reduce expensive waste disposal costs. The plant was having more than 6000 gallons of used die spray and other oily waste fluids hauled away every two or three months. Hauling and incineration costs, which had risen to more than $ 0.80/gallon, convinced managers that a better alternative was needed.

Hyde Products, Inc. worked with the company to provide a means of reducing the total volume of waste fluid hauled while complying with local discharge regulations. The Hyde WASTEWARRIOR Turn-Key Ultrafiltration system allows the company to separate water from their waste stream and reduce the total volume to be hauled by 95%. The water is then discharged to sewer through a Hyde Carbon Clarifier.

The Hyde WASTEWARRIOR system automatically feeds its inlet compartment, drawing fluid through a Hyde floating skimmer in the waste fluid holding tank. Free floating oils and solids that accumulate in the waste fluid are removed by the inlet bag filter and unique Hyde coalescing gravity separator. The system's ultrafiltration module filters out clean water from the process fluid, returning the more concentrated oily solution to the process tank. The water effluent is further clarified with activated carbon before going to sewer.

In the die casting process, the die spray, at a water dilution ratio of around 80:1, is sprayed onto the dies. Waxes in the fluid adhere to the dies to facilitate the release of the aluminum and zinc parts while excess fluid is carried off on the parts and drips from the machinery into collection troughs or directly onto the floor. Other plant oils and hydraulic fluids also end up in the waste which is vacuumed up or pumped to a waste fluid holding tank near the processing area.

The Hyde WASTEWARRIOR has run nearly continuously to process the day to day wastes of the plant as well as some waste which had built up before start up of the Hyde Equipment. Engineers responsible for operating the system say that it paid for itself in the first six months.

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HYDE
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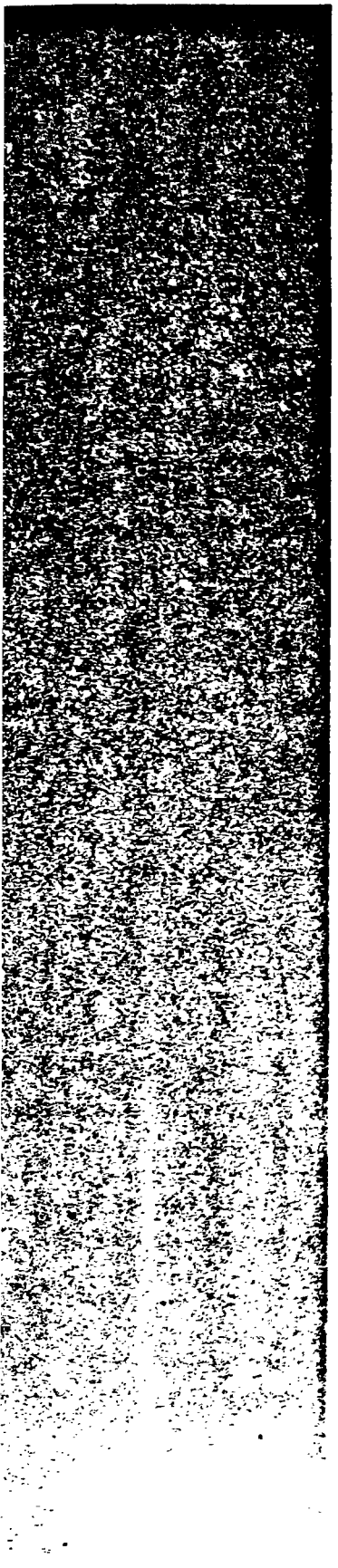


Wastewarrior™

Turnkey Fluid Management System

The Total Solution to Wastewater Problems – Extends Washwater and Rinsewater Life, Reduces Oily Wastewater up to 98%.

The Hyde Wastewarrior is a proven, economical ultrafiltration system that helps extend the life of washwaters and rinsewaters in metalworking applications. The Wastewarrior also processes waste coolants, washwaters, rinsewaters and other waste liquids to help you meet zero manifesting goals and comply with federal RCRA requirements, as well as state and local discharge regulations.

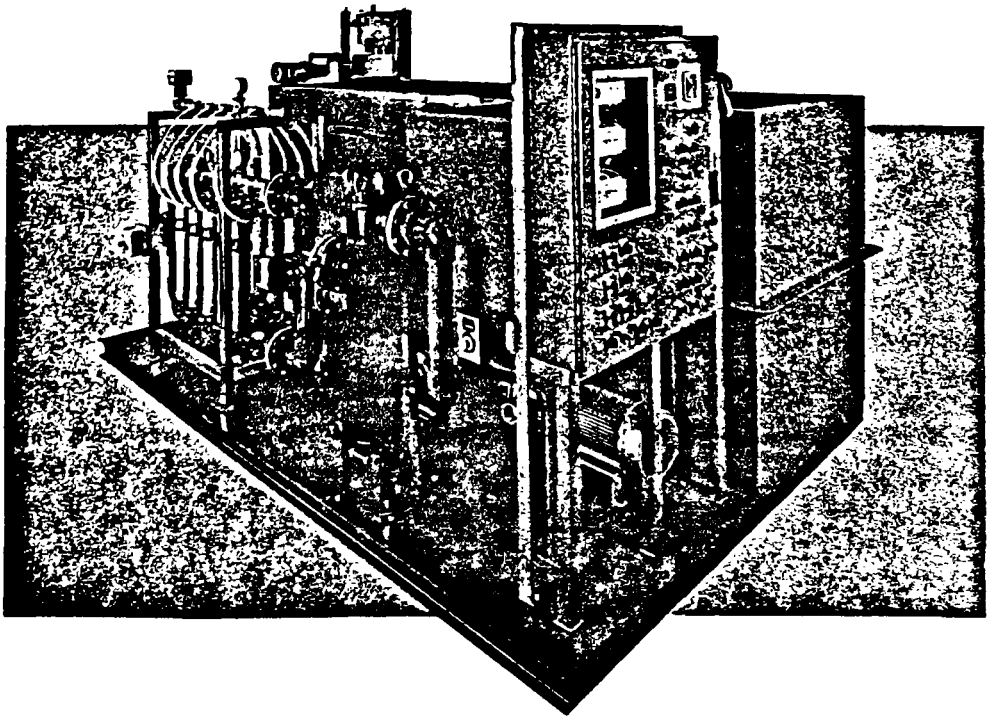
Everything you need for automatic ultrafiltration is included with the Wastewarrior. Each turnkey system is designed for easy installation, quick start-up and efficient operation. Hyde backs every Wastewarrior with single-source product responsibility, eliminating your maintenance worries.

Features

- No hazardous chemicals required
- Highly efficient membrane module
- Turnkey system – fully assembled, tested and ready to install
- Standard modular systems will process from 350 to 6000 gallons per day, larger systems are available
- "Pre-treatment" and "Post-treatment" modules included
- Automatic cleaning cycle
- Microprocessor controlled for automatic operation

Benefits

- Prolongs life of washwaters and rinsewaters and improves effectiveness by controlling oil content
- Reduces cost of washwater detergents, heating and disposal
- Oily wastewater volume is reduced 95% to 98%
- System effluent water can be discharged to sewer or reused
- May also be used for coolant recycling
- Simple automatic operation requires little attention and maintenance
- System payback typically 9 to 14 months



Wastewarrior – The Proven Ultrafiltration System

The Wastewarrior is a versatile fluid management system, proven in a variety of "in plant" applications. It is designed to separate emulsified oils from water as the fluid passes through a unique membrane module.

Wastewarrior systems are available in a range of capacities to meet most industrial requirements. They are equally effective for coolants, washing solutions and other mixtures where free and emulsified oils and suspended solids must be removed before discharge.

Simple, Efficient System Operation

The Hyde Wastewarrior includes a two compartment tank - the inlet side for the removal of solids and free oil, and the process side for holding the clarified liquid. A unique floating skimmer in the inlet side assures surface "pick up" of free floating tramp-oils and any undesireable rag or cream layer. An integral oil separator, which uses Hyde's unique gravity/coalescence principle, removes free floating and dispersed oils from the influent mixture. The separated oil is automatically discharged into a suitable container. The clarified wastewater flows from the separator by gravity into the process side.

The process supply pump discharges the clarified liquid into the membrane module, where clean water is separated from the emulsion. The water (permeate) is normally discharged by gravity through a post-treatment module to remove soluble organic materials and color before discharging to sewer.

The concentrated oily mixture is recirculated to the process side. A distinct advantage of the Wastewarrior system is that the surface layer of the process side liquid continually overflows to the inlet side for further clarification. This feature prevents the build-up of free oils.

Microprocessor Control Automates Operation and Minimizes Maintenance

The Wastewarrior includes a microprocessor controller that operates the system automatically and minimizes maintenance. The process and cleaning cycle times can be pre-programmed to your requirements.

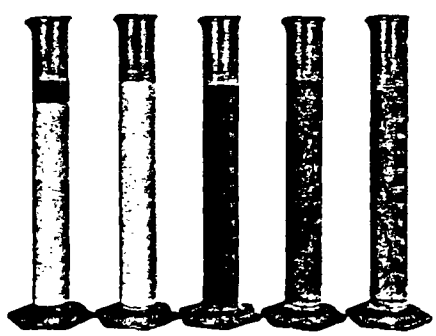
The system also includes automatic protection features, and alarm to indicate low level in the inlet and process compartments, high temperature and high pressure.

Turnkey System

The Wastewarrior is supplied as a compact, skid mounted, turnkey system and requires only electrical power, water and drain connections and a container for waste oil.

All systems are constructed of high grade materials, fully suitable for the ultrafiltration process and for hostile industrial environments. And all Wastewarrior systems are modular to allow for easy expansion by installing additional modules on the basic system.

Visible Results



The various stages of effluent produced by the Wastewarrior are graphically shown above.

1. Oily wastewater emulsion as received by the Wastewarrior
2. Free oil and suspended solids removed
3. Discharged tramp-oil
4. Permeate from the ultrafilter
5. Effluent after post-treatment suitable for sewer disposal.

Applications

MACHINING AND GRINDING - Water soluble coolant, cutting and grinding fluids, and lubricants used in machining operations.

PRIMARY METALS - Rolling and drawing fluids used as lubricants and coolants for ferrous and non-ferrous operations.

METAL FINISHING AND PLATING - Alkaline and acidic washwaters, rinse water, phosphatizing baths and other solutions containing emulsified oils.

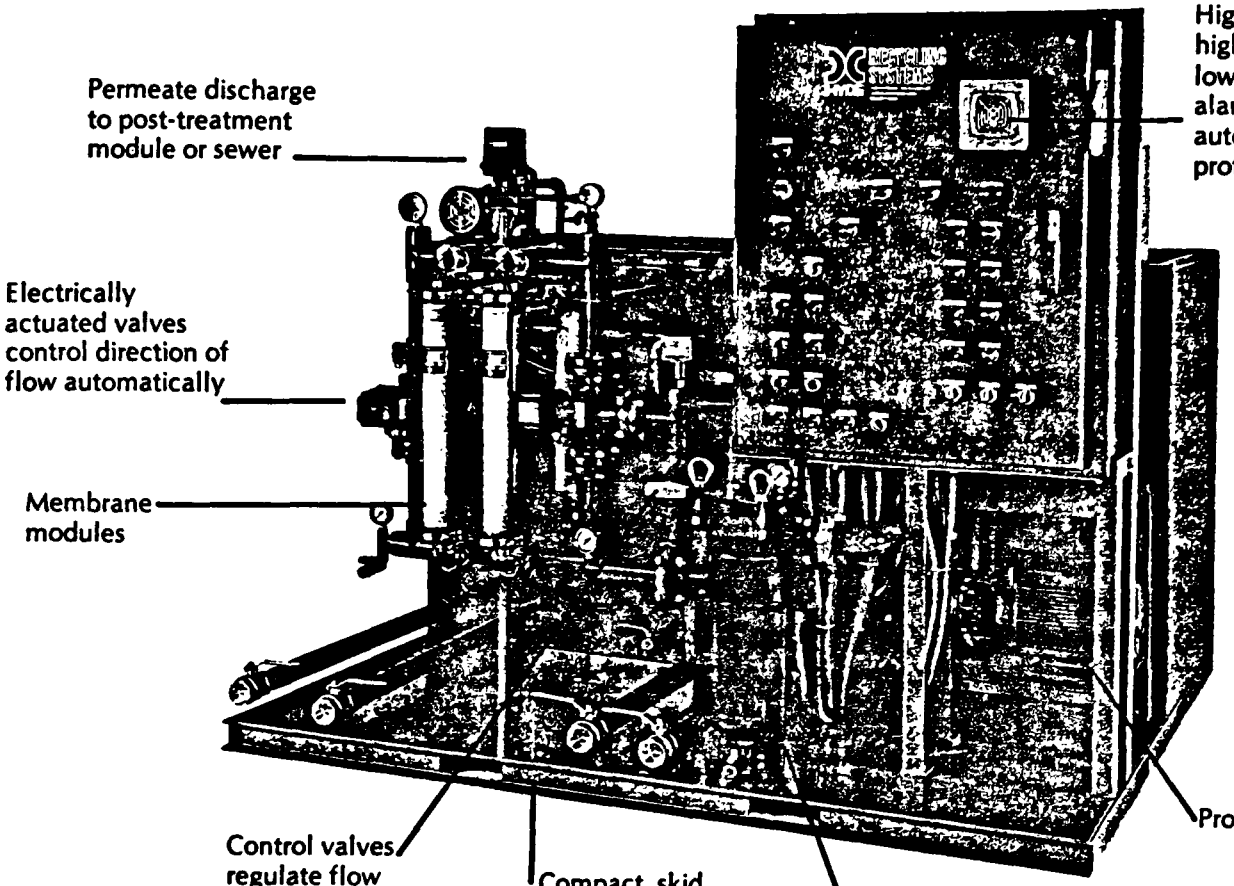
DIE CASTING - Water soluble mold release fluids and washwaters.

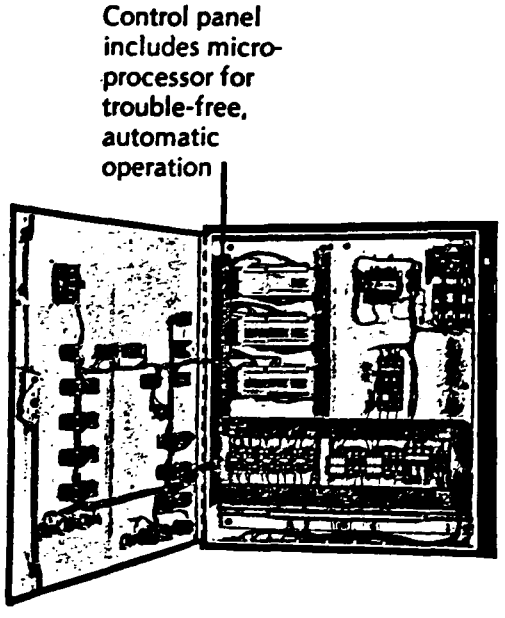
STAMPING - Water soluble stamping fluids and washwaters.

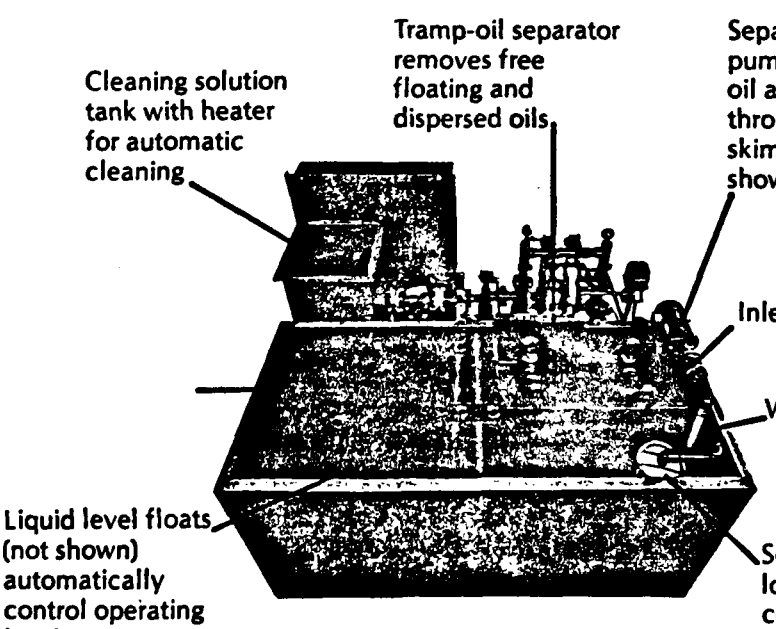
WASTE COLLECTION - Emulsified oily wastes collected by waste haulers.

TRANSPORTATION - Oily waste discharge from tank car, truck and bus cleaning operations.

GENERAL - Any process water or wastewater containing emulsified oils.


Permeate discharge to post-treatment module or sewer
High temperature/ high pressure/ low level alarm provides automatic protection
Electrically actuated valves control direction of flow automatically
Membrane modules
Process feed pump
Control valves regulate flow through membranes
Compact, skid mounted units are pre-piped and pre-wired, factory tested and shipped ready for installation
In-line solids removal device


Control panel includes micro-processor for trouble-free, automatic operation


Cleaning solution tank with heater for automatic cleaning
Tramp-oil separator removes free floating and dispersed oils
Separator supply pump picks up free oil and wastewater through floating skimmer (not shown)
Inlet compartment
Wastewater inlet
Liquid level floats (not shown) automatically control operating levels
Solids pre-filter is located within inlet compartment

Models & Specifications

Wastewarrior Systems

MODEL*	GALLONS PER DAY	LENGTH	WIDTH
HWW 1	350-600	90"	78"
HWW 2	700-1200	90"	78"
HWW 4	1400-2400	90"	78"
HWW 6	2000-3600	144"	90"
HWW 8	2800-4800	144"	90"
HWW 10	3500-6000	144"	90"

*Larger systems available

Results

SAMPLE**	BOD	COD	TOG	HYDRO CARBON OIL	PHENOL	pH	T.S.S.
WASTE	60,270	80,905	17,944	8318	75	7.8	7500
U.F.	6540	10,125	95	25	20	7.8	<10
POST-TREATMENT	17.3	50	20	10	0.1	7.5	<10

**Soluble oil metalworking coolant results shown in ppm

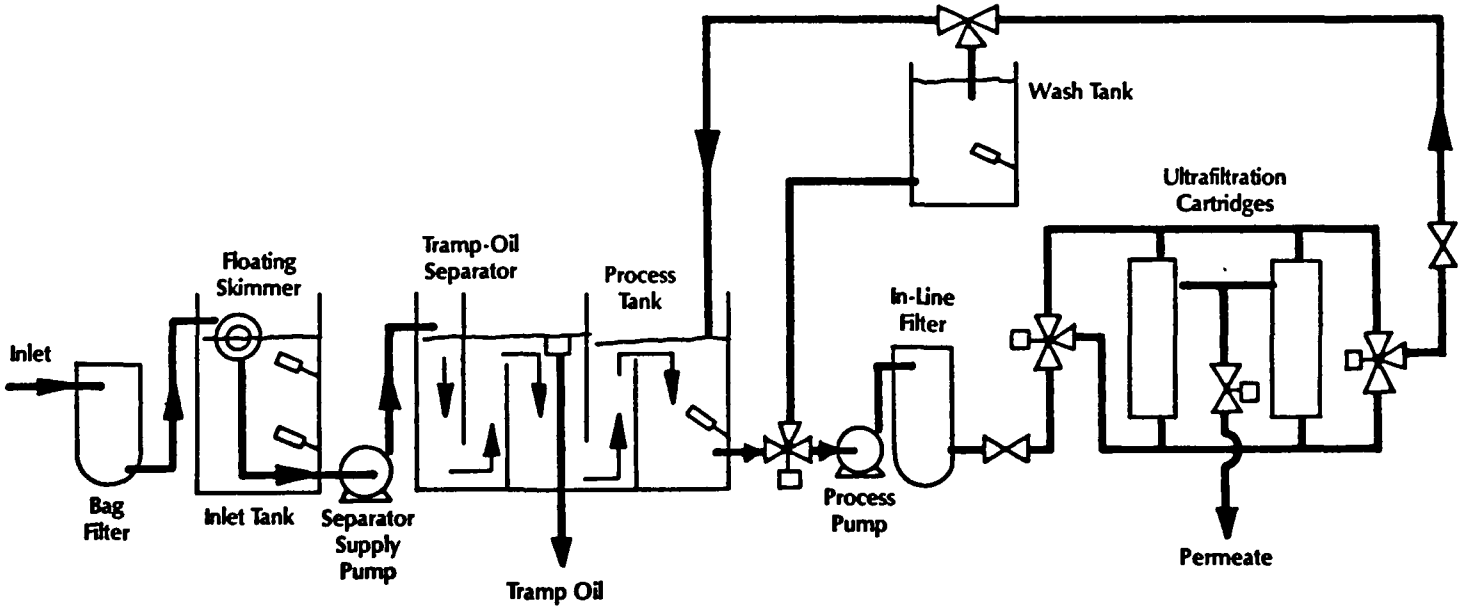
Hyde Laboratory Services

Each Hyde Wastewarrior system is designed for your particular application. Hyde offers several types of membranes and provides the laboratory services to determine their compatibility with your waste stream. Factors involved in determining your requirements are:

Compatibility Test - A bench test is conducted at the Hyde laboratory using 5 gallons of your wastewater to determine which membrane is best suited for your application. Hyde will send you a permeate (water) sample and laboratory report for your evaluation.

Recommendation - Once the compatibility test is completed, Hyde Products will provide you with a proposal for the Wastewarrior best suited for your needs.

Flow Diagram



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FAST SYSTEMS, INC.
INDUSTRIAL SALES OFFICES

COMPANY	CONTACT	TELEPHONE FAX TELEX ANSWERBACK	TERRITORY
MAGMA RESOURCES (UPS ADDRESS) 37 CHESTNUT STREET MURRAY HILL NJ 07974	ANTHONY METZNER	(201)464-2737 (201)464-2131 N/A N/A	NEW YORK, NEW JERSEY, PENNSYLVANIA
MARIX K.K. KIMURA BLDG., 6-2-1 SHIMBASHI MINATO-KU, TOKYO 105 JAPAN	SHOZO TAKEGUCHI	(03) 436-6371 011 81 3 434 8567 781-02427232 2427232 MARIX J	LICENSEE - JAPAN, KOREA
MID-STATES ENGINEERED & EQUIPMENT COMPANY 8509 MID COUNTY INDUSTRIAL DRIVE ST. LOUIS MO 63114 USA	DAVID EDMONDS	(314)423-3516 (314)427-7739 N/A N/A	MISSOURI, SOUTHERN ILLINOIS
MILLREP 3457 SOUTH 2830 EAST, P.O. BOX 9316 SALT LAKE CITY UT 84109	RICHARD S. MILLER	(801)486-8555 1(801)486-8555 N/A N/A	UTAH, SOUTHERN IDAHO, WESTERN WYOMING, NORTHEASTERN NEVADA
MODERN SUPPLY COMPANY 208 SOUTH LA SALLE STREET SUITE 683 CHICAGO IL 60604	JOHN B. BRAHAM, PAUL CORDES	(312)726-3990 (312)726-4339 N/A N/A	U.S. RAILROAD INDUSTRY
MODERN SUPPLY COMPANY P.O. BOX 12127 ROANOKE VA 24023-2127	DAN WOOLDRIGE	(703)366-1980 N/A N/A N/A	U.S. RAILROAD INDUSTRY
MODERN SUPPLY COMPANY 329 PAOLI WOODS PAOLI PA 19301 USA	MR. ED KRAEGEL	215-644-0352 N/A N/A N/A	U.S. RAILROAD INDUSTRY
MODERN SUPPLY COMPANY (UPS ADDRESS) 1919 ANDREWS NORTHWEST ROANOKE VA 24017	DAN WOOLDRIDGE	(703)366-1980 N/A N/A N/A	U.S. RAILROAD INDUSTRY
NORTHWEST POWER & PLANT EQUIPMENT COMPANY SHIPPING ADDRESS - 2366 EASTLAKE E SUITE 234 SEATTLE WA 98102-0128	JOHN LEONARD	(206)324-6880 (206)324-8331 N/A N/A	WASHINGTON, OREGON, ALASKA
NORTHWEST POWER & PLANT EQUIPMENT COMPANY MAILING ADDRESS - POST OFFICE BOX 12128 SEATTLE WA 98102-0128	JOHN LEONARD	(206)324-6880 (206)324-8331 N/A N/A	WASHINGTON, OREGON, ALASKA

SK-SERIES
OIL/WATER SEPARATOR MODULES

- Break gray emulsions into clear water and black oil
- No additives required
- Simple to install and operate
- The only moving part is a centrifugal pump

INDUSTRIAL

- Upgrade existing separators
- Dewater oil collection tanks
- Recover wash solutions for reuse

MARINE

- Extremely compact bilge separator, hang it on a bulkhead
- The only certified separator which will break emulsions
- Use detergents and emulsifiers in the engine room -no problem!
- Fully certified

INTRODUCTION

PACE® (Positive Accelerated Coalescence of Emulsions) is the most advanced and economical method of treating wastewater containing emulsified oil. PACE converts gray emulsions into black oil and clear water.

PACE® Separators provide exceptional performance at minimum cost. The patented process features state of the art effluent quality, lowest first cost and lowest cost of operation. The payback is terrific.

A complete PACE Separator incorporates a first stage coalescer plus a second stage Membrane separator. A PACE SK Module is essentially the second stage of a complete PACE Separator.

In many situations, technical and cost factors point to PACE as the ideal treatment process. Yet, a complete skid-mounted system is not required.

The answer is to use a PACE SK Module with an existing tank or separator. This provides many of PACE's exclusive benefits and at even lower cost.

APPLICATIONS

■ **Effluent Polishing.** With tightening of discharge standards, many existing separators are unable to meet the new requirements. There is no need to replace this existing equipment. Add a PACE SK Module to polish the effluent.

The water will be suitable for discharge despite the tightest regulations. The oil stripped from the emulsions will be sent back to the existing separator for collection and disposal.

The savings to the customer are considerable. The existing equipment is retained and used efficiently, and the SK Module can be added at minimum cost.

■ **Tank Dewatering.** A PACE Interface Detector can be installed in an existing collection tank, and a PACE SK Module will automatically dewater the tank.

The water can be legally discharged, and the oil stripped from the emulsions will be returned to the tank.

EXCLUSIVE BENEFITS OF THE PACE SK SEPARATOR MODULES

PACE SK Modules offer significant performance benefits over batch processes, and at no additional cost to the user. These benefits are truly exclusive, as the process itself is patented.

Batch systems direct the entire high volume feed and concentrate flows through the collection tank. Since this can be ten times the throughput, the natural separating ability of this tank is either destroyed or is compromised.

PACE maintains high cross-flow velocity through the Membrane elements, but returns oil to the first stage in a relatively small volume of liquid. This permits the first stage to remain an efficient gravity separator.

Your existing tank or separator will efficiently separate the oil which the PACE SK Module strips from the emulsion.

With PACE, and only with PACE, the oil concentration applied to the membranes is very low and is continuously regulated. This means lower fouling rates and longer periods between in-place washes of the Membrane.

There are no hidden extras. The Module is complete and ready to run as provided. The PACE Reservoir contains just the right volume of water required to wash the Membrane Element.

■ **Simple.** The only moving part is a centrifugal pump.

■ **Versatile.** Use the Module as a manual system. This is ideal for very low flows, and there is no more economical way to break emulsions. Payback is terrific.

Add automatic control at a later date if desired, or install it in the first place to eliminate the need for operator attention.

You can also add a PACE Oil Content Meter to monitor the effluent. If oil content exceeds a preset limit, this unit will energize a remote alarm or valve actuator.

■ **Economical and Compact.** The exclusive PACE process uses low cost and chemically resistant spiral Membrane elements. Look at the dimensions! These compact SK Modules take up very little of your valuable space.

Buy only what you need. Even the skid is priced separately. If you prefer, you can mount the module on a bracket or a tank bulkhead.

■ **Quality.** Low cost is achieved through knowhow and patented technology. There is no compromise in quality.

GENERAL SPECIFICATION SK-SERIES SEPARATOR MODULES

Process. PACE - Positive Accelerated Coalescence of Emulsions, a patented process available only through Smith & Loveless and its subsidiaries.

Operation. Emulsions are pumped across the surface of the Membrane at high velocity and moderate pressure. The Membrane passes water, salts and detergents, but rejects oil.

The concentrated emulsion then passes through the Reservoir, where excess oil is stripped and discharged to a primary separator or collection tank. The remainder is circulated back to the Pump suction.

The system is self regulating. There are no adjustments.

Wastewaters Treated. Any combination of mechanical emulsions and chemical emulsions following a gross oil separation. Any combination of petroleum oils up to a specific gravity of 0.94 (19 degrees API).

Certifications. U.S. Coast Guard, Canadian Department of Transport, U.K. Department of Transport, Norwegian Maritime Directorate, Danish Government Ships Inspection Service, National Swedish Administration of Shipping and Navigation, and others per IMO Resolution A.393(X), "Recommendations on International Performance and Test Specifications for Oily Water Separating Equipment and Oil Content Meters".

Tested in accordance with 46 CFR Part 162, "Engineering Equipment; Design and Approval Requirements for Oil Pollution Prevention Equipment". Copies of the Test Report are available upon request.

Electrical Equipment. As applicable, electrical equipment is in full accordance with National Electrical Code, U.S. Coast Guard Electrical Engineering Requirements and all major marine classification societies.

■ Standard voltages are 208/230/460/575 VAC 3 phase 60 Hz.

■ Standard motors are TEFC (IP55), marine or industrial duty as applicable.

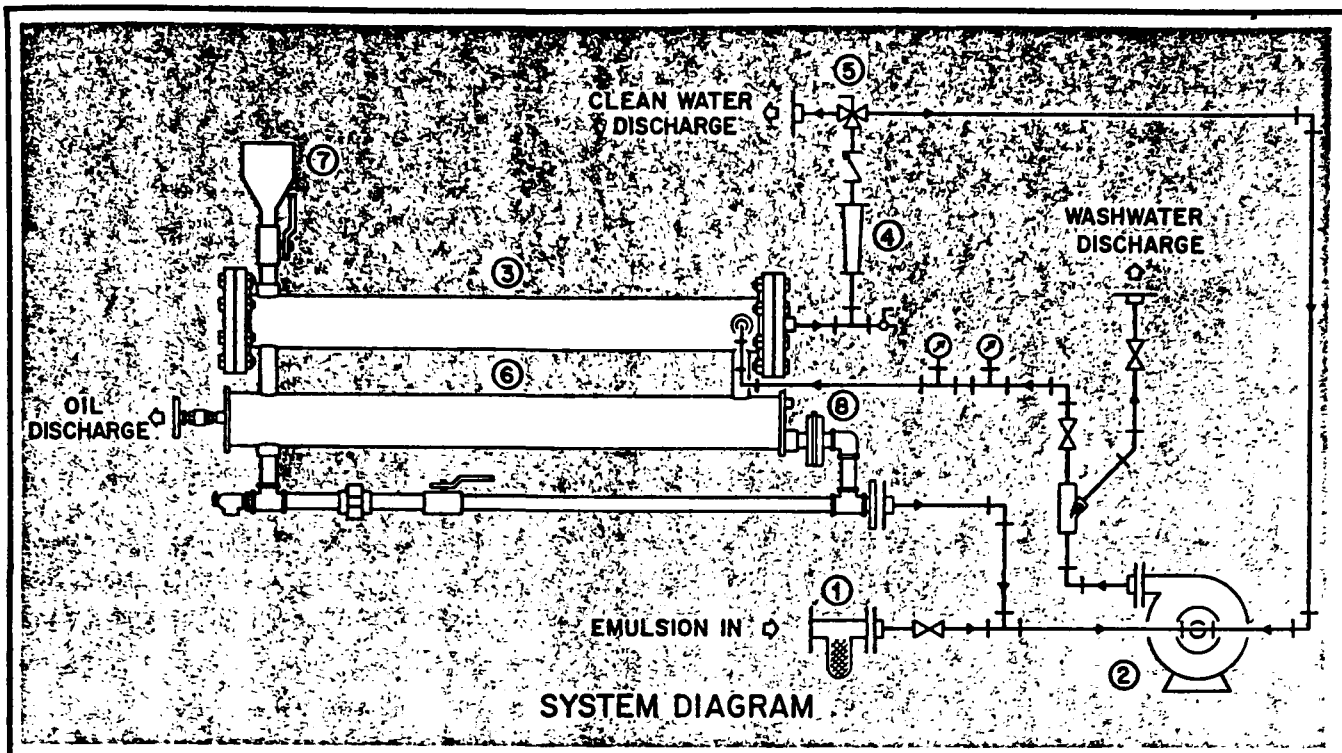
■ Standard motor starters feature across the line starting, thermal overload protection, LVP as applicable and a NEMA 4X (IP65) enclosure.

■ Standard cabling (for assembled skid mounted Modules) is stranded copper, thermoplastic insulated, protected by basket weave armor and secured to structure per the requirements of the American Bureau of Shipping. All junction boxes and cable entrance plates are watertight.

Construction. Membrane Pressure Vessel and Reservoir are welded steel construction.

Piping. All piping is steel, schedule 40 minimum, with flanges, unions or victaulic couplings provided as applicable for takedown.

Corrosion Protection. Assembly hardware and threaded tank penetrations are stainless steel. Exterior surfaces of the Pressure Vessel, Reservoir and flanged piping are grit blasted to "white metal"



SYSTEM DIAGRAM

1. **INLET STRAINER** - In many cases, your existing separator will efficiently remove solids from the oily emulsion. If not, we recommend an optional bag filter or scraper-strainer.

2. **PUMP** - Close coupled to a TEFC electric motor. The pump provides pressure to discharge clean water through the Membrane and high cross-flow velocity to minimize Membrane fouling. Up to 15 feet of suction lift is available if needed.

3. **MEMBRANE ELEMENT** - Breaks the emulsion. Passes detergents, salts and water. Will not pass oil! Several standard Membrane configurations are available to meet your special needs. Enclosed in a welded steel pressure vessel.

4. **VISUAL FLOWMETER** - A unique feature of PACE. The Flowmeter measures Membrane throughput during run and also during wash. Simple, reliable and easy to read. You can visually check the performance of the Module. You can also check the progress of your wash!

5. **THREE WAY VALVE** - Diverts effluent to drain during run, back to the pump suction during wash. Continuous forward flow of water protects the Membrane at all times.

6. **RESERVOIR** - Strips oil from the emulsion. Provides the correct volume of water required for in-place washing of the Membrane.

7. **FILL FUNNEL** - Convenient fill point for water and detergent.

8. **ORIFICE** - All flows and pressures are regulated by fixed orifices. There are no adjustments.

per SSPC 5 and coated to 8 mils DFT with polyamide epoxy resin. Threaded piping and fittings are galvanized.

Quality Control. Each Membrane is subjected to two leak tests, one before installation in the Pressure Vessel and one just before shipment. No oil leakage is permitted.

Each unit is subjected to a full power-on test prior to shipment to verify the integrity of pipe connections and seals, and proper operation of the Pump.

Maintenance.

- As required - Clean inlet and Y-strainers.
- As required - Add detergent and allow system to wash excess oil from the Membrane.
- As required - Add acid and allow system to wash accumulated mineral deposits from the Membrane.
- Semiannually-lubricate pump motor bearings.
- **No other special maintenance is required.**

STANDARD EQUIPMENT

Each PACE SK Module contains all equipment needed for operation and in-place washing of the Membrane. The equipment is preassembled into four subassemblies for ease of installation:

- **Pump Assembly.** Iron body, bronze impeller pump, with stainless steel trim, mechanical seal, close coupled to 3500 RPM electric motor.
- **Pump Discharge Assembly.** Y-strainer, associated valves, pressure and temperature gages.
- **Membrane Assembly.** Membrane element installed in pressure vessel, Reservoir, associated valves, flow regulating orifice and fill funnel.
- **Clean Water Discharge Assembly.** Visual flowmeter and associated valves.

The Inlet Strainer and Pump Motor Starter are shipped as separate items.

OPTIONAL EQUIPMENT

■ **Inlet scraper-strainer.** Where solids loading is substantial, the standard inlet basket strainer would require excessive maintenance.

■ **Bag filter.** Also suitable for higher solids loading. The finer filtration available with a bag filter can reduce the fouling rate of the Membrane and further extend the period between detergent washes of the Membrane.

■ **Automatic control.** The PACE Interface Detector and a magnetic Pump Motor Starter permit automatic dewatering of an existing tank.

■ **Oil Content Monitor.** The PACE Oil Content Meter will sense the oil content of the effluent. Oil content is displayed directly in PPM. An integral relay will energize if the preset oil content is exceeded. Fully tested and approved under IMO Resolution A. 393(X) and 46 CFR Part 162.

■ **Skid-mounting.** The Module will be assembled, wired and tested on a structural steel skid at the factory before shipment. The skid will be fully welded, grit blasted and coated with epoxy resin as specified above.

ADDITIONAL INFORMATION AVAILABLE

■ **PACE S-Series Industrial Brochure.** Contains additional technical data and service factors for industrial applications.

■ **PACE SM-Series Marine Brochure.** Contains additional technical data and service factors for marine applications.

■ **FAST Systems, Inc. Engineering Data.** Detailed engineering data covering all aspects of oil/water separation.

■ **Special Computer Analysis by Customer Request.** Technical, cost and payback analysis of emulsion disposal and washwater recovery.

FAST Systems, Inc. Formerly the Marine System Division of St. Louis Ship, we are now a subsidiary of Smith & Loveless. The FAST name is known worldwide for the performance, reliability and durability of our equipment. To date, we have delivered nearly 2,000 PACE Separators and FAST Sewage Treatment Systems for marine, offshore and industrial installations.

Smith & Loveless, Inc. The acknowledged leader in wastewater treatment technology, the most capable and experienced firm in the business.

Wastewater Specialists. The Smith & Loveless family of companies offers you the most extensive array of wastewater treatment know-how and equipment in the world. Solving your pollution problems is our only business. We can help.

Call us and find out.

FAST SYSTEMS INC.
1717 Sublette Ave.
St. Louis, Mo. 63110
Phone: (314) 781-3278
Telex: 44-7224

FAST SYSTEMS LTD.
305 Lakeshore Road East
Oakville, Ontario L6J 1J3
Phone: (416) 842-4640
Telex: 06-982422

A subsidiary of

S&L®

APPLICATION DATA

MODEL NO.			
INDUSTRIAL	SK-1	SK-2	SK-3
MARINE	SK-1M	SK-2M	SK-3M
RATED CAPACITY			
FAST SYSTEMS (GPD)[1]	200-800	1000-4000	2000-8000
USCG/IMO (GPM)[2]	1.1	5.5	11
DIMENSIONS (IN.)[3]			
MEMBRANE MODULE			
LENGTH	62	70	77
WIDTH	10	15	15
HEIGHT	34	44	69
PUMP			
LENGTH	24	26	27
WIDTH	13	15	15
HEIGHT	12	13	13
SKIDDED ASSEMBLY			
LENGTH	67	75	79
WIDTH	25	40	54
HEIGHT	47	52	72
WEIGHTS (LB)[3]			
MODULAR SYSTEM			
SHIPPING	300	550	900
OPERATING	350	750	1300
SKIDDED ASSEMBLY			
SHIPPING	600	1200	1700
OPERATING	650	1400	2050
PIPING CONNECTIONS (PIPE SIZE)			
INLET	1	1½	2
CLEAN WATER DISCHARGE	½	¾	1
OIL RETURN	½	½	¾
MAX. SUCTION LIFT (FT)[4]	15	15	15
MOTOR HORSEPOWER[5]	3	7.5	10

NOTES:

1. Capacities are identical to those of complete PACE Separators. Refer to the SERVICE FACTORS and other technical data in the PACE Industrial or Marine Brochures as applicable for actual selection of equipment.

2. USCG/IMO rated capacity is the flow at which the USCG/IMO certification test is run under laboratory conditions using clean water and idealized simulated oil.

3. Reference data only. Certified drawings are available upon request. Consult factory.

4. Flooded suction is recommended.

5. Motor horsepowers shown for 60 Hz power. Consult factory for 50 Hz motor data.

FAST® SYSTEMS, INC.

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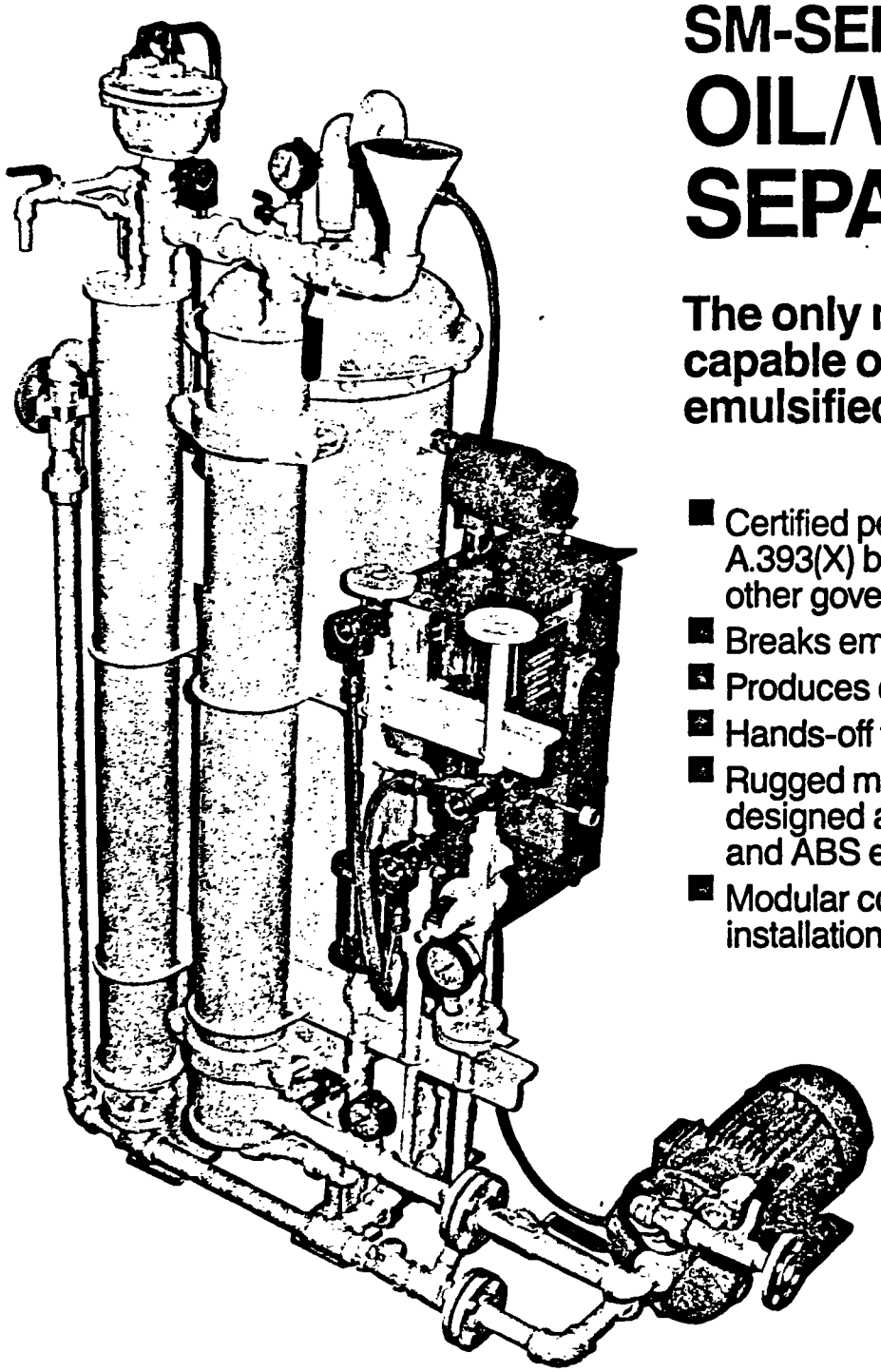
pace®

SM-SERIES OIL/WATER SEPARATORS



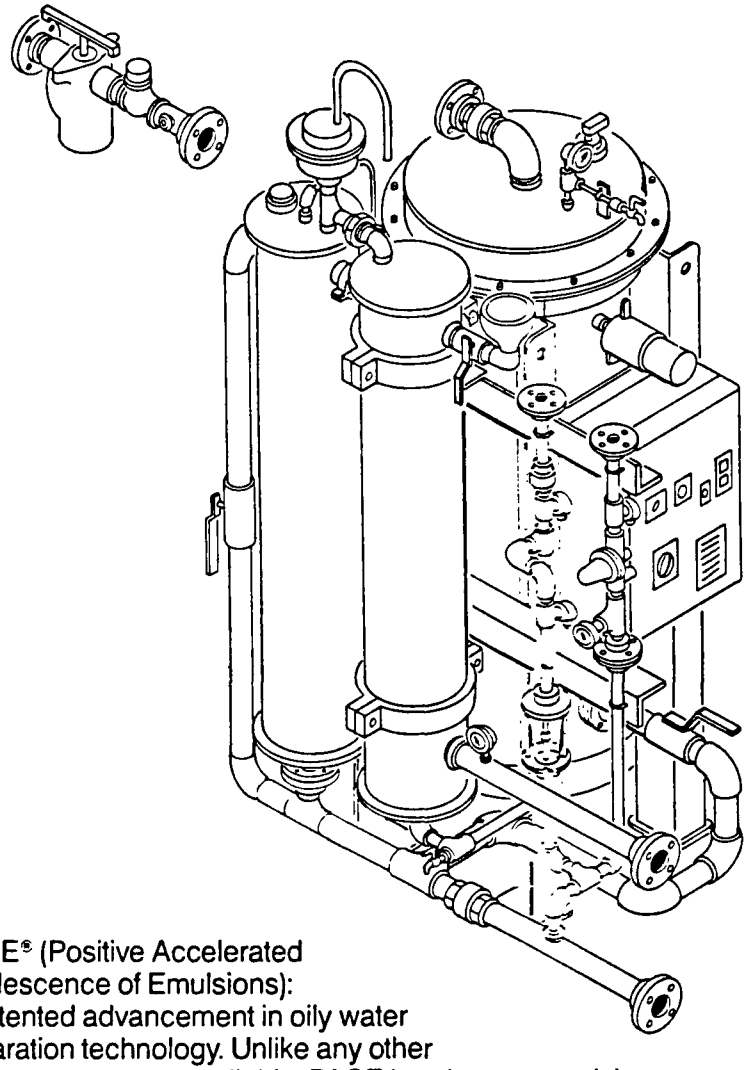
The only marine separator capable of treating emulsified bilge slops

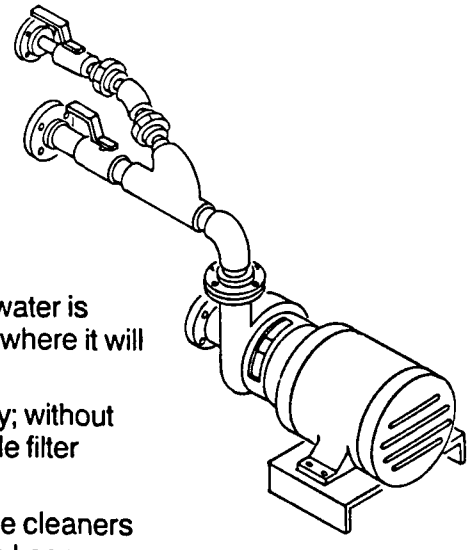
- Certified per IMO resolution A.393(X) by U.S.C.G, D.O.T. and other government agencies.
- Breaks emulsions
- Produces oil-free water
- Hands-off failsafe operation
- Rugged marine equipment designed and built per U.S.C.G. and ABS engineering standards.
- Modular construction for ease of installation.

pace®

SM-SERIES

OIL/WATER SEPARATORS





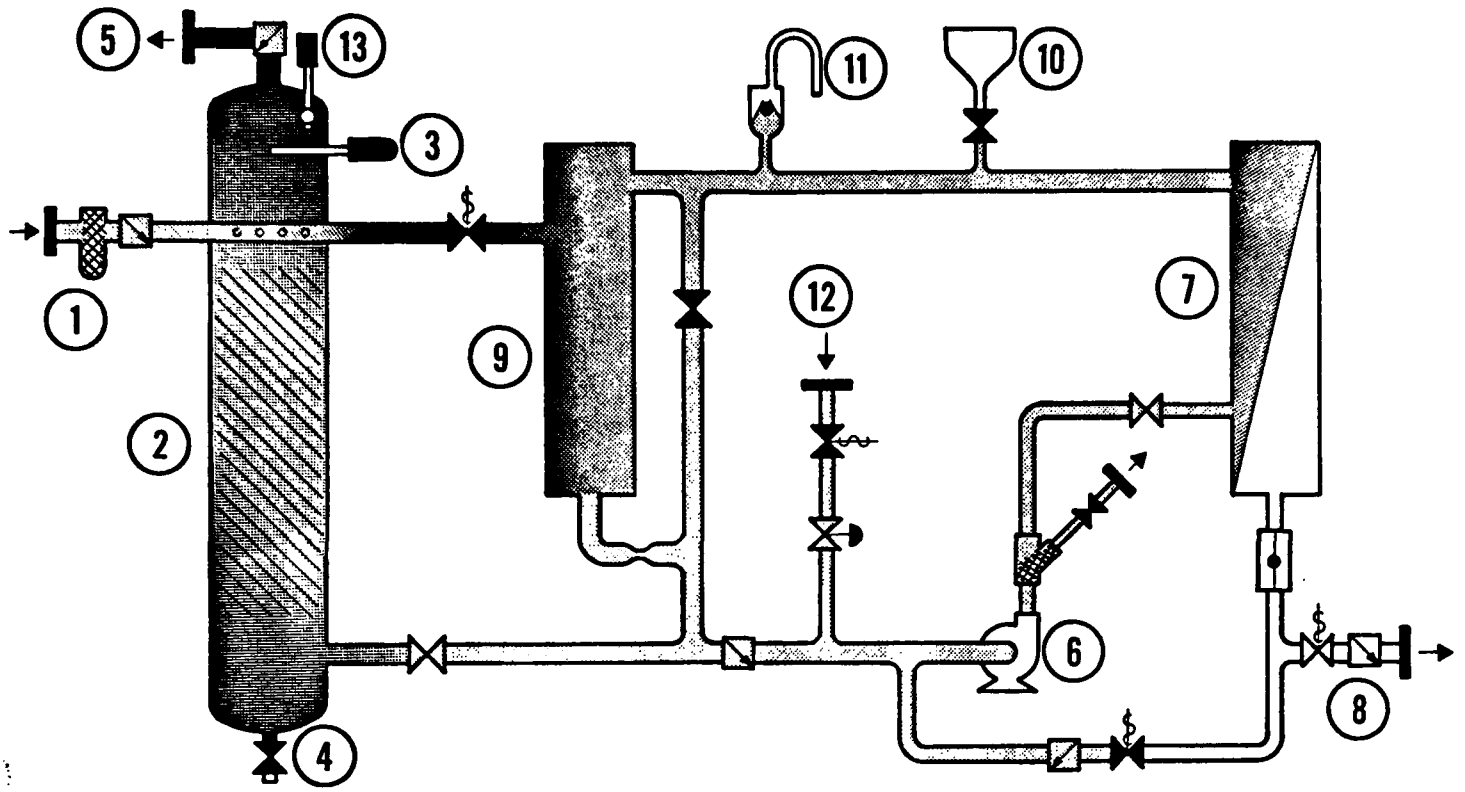
PACE® (Positive Accelerated Coalescence of Emulsions): a patented advancement in oily water separation technology. Unlike any other oil/water separator available, PACE breaks true emulsions.

PACE converts grey emulsions into clear water and black oil. The water is suitable for legal discharge, and the oil is concentrated to the point where it will support combustion.

Fail-safe, PACE cannot discharge oil. PACE operates automatically; without operator intervention, adjustments, chemical additives or disposable filter elements.

PACE allows you to continue using high-efficiency emulsifying bilge cleaners without the liability of violating worldwide oil-pollution laws. You can keep machinery, bilges, work platforms and ladders clean, and reduce the risk of bilge fires and injuries.

PACE was developed by the same organization responsible for thousands of FAST® Marine Sewage Treatment Systems. PACE meets the same exacting standards of reliability and performance in shipboard service. This patented system is the best oil/water separator in the world.



FLOW DIAGRAM

1. INLET — Fitted with oversized basket strainer to keep solids out of system. Check valve prevents backflow to bilge collection tank when oil is ejected. Piping is oversized to handle heavy oils.

2. PRIMARY SEPARATOR — An efficient gravity separator itself. Incorporates coalescing media to separate free oil. Accumulates both free oil and oil broken out of emulsions for automatic ejection.

3. INTERFACE SENSOR — Automatically controls ejection of accumulated oil.

4. DRAIN — Drain Valve and flanged access hatch are provided for washdown and desludging, if ever required.

5. OIL DISCHARGE — Flanged connection for piping either to a separate slop oil tank or back to the bilge collection tank. Check valve prevents backflow when system is drawing in wastewater. Piping is oversized to handle heavy oils.

6. PUMP — Marine-duty centrifugal provides suction to draw slops from the bilge collection tank, and pressure to discharge clean water.

7. MEMBRANE — Breaks the emulsion. Passes detergents, salts and water. **Will not pass oil.**

8. OVERBOARD DISCHARGE — Flowmeter allows visual measurement of water being discharged. Solenoid and Check Valves provide automatic operation without backflow.

9. RESERVOIR — Recovers oil stripped from the emulsion and returns it to the Primary Separator. Provides the water volume required for periodic in-place washing of the Membrane.

10. FUNNEL — Convenient fill point for addition of detergent during in-place washing of the Membrane.

11. AIR VENT — Automatically bleeds air during draining and filling associated with in-place washing.

12. WATER INLET — Solenoid Valve and Pressure Reducing Valve control ejection of oil accumulated in Primary Separator.

13. ENTRAINED AIR SENSOR — Liquid level sensor detects vacuum leaks in piping. Indicator lamp on Control Panel alerts personnel.

CONTROL PANEL — Marine-duty motor control panel is mounted on Primary Separator tank.

GENERAL SPECIFICATIONS: PACE MARINE OIL/WATER SEPARATORS

General. Each system includes all machinery, valves and controls necessary for automatic operation, in-place washing of the Membrane, filling and draining, and is comprised of three sub-assemblies:

Inlet Sub-Assembly, including

- Simplex Basket Strainer, and
- Check valve.

Separator Sub-Assembly, including

- Primary Separator tank fitted with lifting lugs, structural mounting pads and inspection hatch,
- Membrane and Reservoir modules,
- Oil/water interface sensor,
- Entrained Air Alarm
- Oil discharge Check, Pump isolation and Drain Valves,
- Water inlet Pressure Reducing and Solenoid Valves,
- Clean water discharge Solenoid and Check Valves, Visual Flowmeter, and
- Motor control panel.
- All of the above fully piped, wired and mounted on the Primary Separator tank.

Pump Sub-Assembly, including

- Iron body bronze fitted pump, with mechanical seal, close-coupled to a marine-duty 3500 RPM electric motor,
- Y-Strainer,
- Valved pumpout connection.

Wastewaters Treated. Any combination of salt water, fresh water, free oils, mechanically-induced emulsions and chemically-induced emulsions. Any combination of petroleum oils up to a specific gravity of 0.94 (19 degrees API), any viscosity which will flow through the piping.

Certifications. U.S. Coast Guard, U.K. Department of Transport, Norwegian Maritime Directorate, Danish Government Ships Inspection Service, National Swedish Administration of Shipping and Navigation and others per IMO Resolution A.393(X), "Recommendations on International Performance and Test Specifications for Oily Water Separating Equipment and Oil Content Meters".

Design Standards. Equipment is designed and constructed in accordance with the U.S. Code of Federal Regulations (CFR), Title 46 Shipping, Subchapter F (Mechanical Engineering) and Subchapter J (Electrical Engineering).

Certification Test Results. Testing in accordance with 46 CFR Part 162 "Engineering Equipment; Design and Approval Requirements for Oil Pollution Prevention Equipment", conducted by a U.S. Coast Guard Designated Testing Facility and witnessed by representatives of the U.S. Coast Guard and the Canadian Water Pollution Directorate resulted in the following oil concentrations being measured in the water discharge:

All numerical values listed in parts per million (PPM).

Condition	Max.Oil Content	Avg.Oil Content	USCG/ IMO Limits
Treating Heavy Fuel Oil	ND*	ND*	15.0
Treating Light Fuel Oil	ND*	ND*	15.0
Treating Chemical Emulsion	6.50	1.00	15.0

* **ND** means **"Not Detected."**

Copies of the Test Report are available upon request.

Rated Capacity. Several standard models are available. Please refer to the Data Table for capacities and physical dimensions.

Operation. Suction generated by the Pump draws fresh wastewater into the Primary Separator where free oil is separated and accumulated. Emulsions are unaffected by gravity separation and pass on to the second stage of treatment.

These emulsions are pumped across the surface of the Membrane at high velocity and moderate pressure. The Membrane passes water, salts and detergents, but rejects oil. The concentrated emulsion then passes through the Reservoir, where excess oil is stripped and returned to the Primary Separator. The remainder is recirculated back to the Pump suction.

The Primary Separator is full of liquid at all times. As oil accumulates, the oil/water interface moves lower. When this interface reaches the Interface Sensor it triggers the oil-ejection cycle: the Pump is turned off, the Overboard Discharge Solenoid Valve closes and the Water Inlet Solenoid Valve opens. Water under regulated line pressure ejects the accumulated oil through the Oil Discharge Check Valve fitted on the Primary Separator.

Once a preset quantity of oil has been ejected, the system resets for normal operation: the Pump starts, the Water Inlet Solenoid Valve closes and the Clean Water Discharge Solenoid Valve opens.

The system operates automatically and is self-regulating. There are no adjustments.

Electrical Equipment. Electrical equipment is in full accordance with the requirements of major classification societies.

- Standard voltages are 208, 230/460/575 VAC, 3 phase, 60 Hz.
- Standard motors are TEFC (IP55), marine duty, 50 deg. C. ambient, with Class F insulation.
- Standard Controls feature across the line starting, overload protection for all three phases, line disconnect, 110 Volt control transformer and transformer type indicating lamps, all housed in an oil tight, dust tight, NEMA 4X (IP65) enclosure. A terminal strip and removable stainless steel cable entrance plate are provided for installation connections.
- Standard cabling is stranded copper, thermoplastic insulated, protected by basket weave armor and secured to the structure per ABS requirements. All junction boxes and cable entrance plates are watertight.
- Electrical Service Required — Please refer to Data Table for the motor horsepower rating for each model.

Construction. All welded steel construction, ASTM A-36 steel with 1/4 inch minimum thickness. Tank penetrations are fully welded both sides.

Piping. All steel piping is ASTM A-53 Gr. B minimum, with flanges or unions provided for takedown. All installation connections are 150 lb. rated raised face flanges per ASTM A-105.

Corrosion Protection. Assembly hardware and threaded tank nozzles are stainless steel. Primary Separator interior and all exterior surfaces are grit blasted to "white metal" per SSPC 5 and coated to 10 mils DFT with polyamide epoxy resin.

Quality Control. Membrane elements and tanks are separately tested for leaks. Coatings are tested for holidays and pinholes. Each unit is subjected to a full power-on test prior to shipment to verify the integrity of pipe connections and seals, proper operation of all machinery and controls, and Membrane oil rejection.

Modes of Operation. Each standard PACE unit is fully configured to operate automatically in any of three modes:

- **Manual:** The operator manually starts and stops the system to pump down the bilges, or preferably a bilge collection tank. The system automatically produces clean water and ejects oil removed from the water to a separate slop oil tank.

- **Liquid Level Control:** A liquid level sensor in the bilge collection tank automatically starts and stops the system to control the liquid level in the tank. The system automatically produces clean water and ejects oil removed from the water to a separate slop oil tank.
- **Interface Control:** An oil/water interface sensor in the bilge collection tank automatically starts and stops the system to dewater the tank. The system automatically produces clean water and ejects oil removed from the water to the same oil collection tank.

If oil with little or no water is collected, or if the contents of the collection tank have already been dewatered by the PACE system, the system will not start.

Maintenance.

- As required — Clean Inlet and Y-Strainers.
- Monthly (or as experience dictates) — Add detergent and allow system to wash excess oil off the Membrane. Eject the accumulated paraffin, soap scum, etc. from the Primary Separator.
- Semiannually — Lubricate pump motor bearings.
- **No other special maintenance is required.**

OPTIONAL EQUIPMENT

- Bilge collection tank sensing probes for either liquid level or interface control.
- Machinery rated to operate at non standard voltages.
- Explosion-proof electrical equipment.
- Duplex basket and self-cleaning scraper-type Inlet Strainers.
- Remote Status Indicating Panel with press-to-test, transformer-type indicator lamps for power on, pump on, water on and entrained air.
- U.S.C.G./IMO approved bilge alarm.

Consult your authorized PACE Representative or FAST Systems for further details.

PACE is the result of five years of research, development and field testing by:

FAST Systems, Inc. (formerly the Marine Systems Division of St. Louis Ship) — responsible for nearly 2,000 Marine and Offshore installations of its FAST sewage treatment systems, and our new corporate parent:

Smith & Loveless, Inc. the most capable and experienced firm in the business, the acknowledged leader in wastewater treatment technology.

Together, FAST Systems and Smith & Loveless have produced:

THE ONLY COMMERCIALLY AVAILABLE SEPARATOR CAPABLE OF SUCH PERFORMANCE, SIMPLICITY AND RELIABILITY IN REAL WORLD APPLICATIONS.

Together, FAST Systems and Smith & Loveless offer you the most extensive array of wastewater treatment technology, expertise, experience, knowhow and equipment in the world.

In addition to Marine installations, PACE systems are in everyday use for industrial wastewater cleanup in the automotive, metals processing, petrochemical, and railroad industries and in utilities.

Request our PACE Industrial Brochure, and contact us for further details.

PACE APPLICATION DATA
STANDARD MARINE UNIT DIMENSIONS AND DATA

MODEL NO.	S-1M	S-2M	S-3M	S-4M
FAST SYSTEMS RATED CAPACITY[2]				
M3/DAY	23	113	224	453
GAL/DAY	800	4000	7900	16000
USCG/IMO RATED CAPACITY[1]				
M3/HOUR	0.25	1.25	2.5	5
GPM	1.1	5.5	11	22
DIMENSIONS (FT-IN)[3]				
SEPARATOR ASSEMBLY				
LENGTH	2'-6"	3'-2"	4'-2"	9'-4"
WIDTH	1'-10"	3'-6"	4'-6"	5'-5"
HEIGHT	5'-10"	6'-0"	6'-0"	6'-7"
PUMP ASSEMBLY				
LENGTH	2'-10"	3'-2"	3'-7"	N/A[4]
WIDTH	0'-9"	0'-9"	1'-0"	N/A
HEIGHT	1'-8"	1'-11"	2'-0"	N/A
WEIGHTS (LB)[3]				
SHIPPING	900	1700	3000	4600
OPERATING	1100	2500	4900	8200
PIPING CONNECTIONS (ANSI FLANGE SIZES)				
WASTEWATER INLET	1"	1-1/2"	2"	2-1/2"
OIL DISCHARGE	1"	1-1/2"	2"	2-1/2"
EJECTION WATER INLET	1/2"	3/4"	1"	1-1/4"
CLEAN WATER DISCHARGE	1/2"	3/4"	1"	1-1/4"
MAX SUCTION LIFT (FT)[5]	15'	15'	15'	15'
MAX OIL DISCHARGE HEAD (FT)[6]	30'	30'	30'	30'
PUMP MOTOR HORSEPOWER[7]	3	7-1/2	10	15

NOTES:

1. USCG/IMO rated capacity is the flow at which the USCG/IMO certification test is run under laboratory conditions using clean water and an idealized simulated oil.

2. Ideal laboratory conditions are not likely to be found aboard ship. FAST Systems rated capacities are based upon real bilge water, containing real fuel and lubricating oils, grease, bilge cleaners, bacterial growths, paint, dirt and trash.

   FAST Systems rated capacities should provide reasonable equipment selection in most applications. For extreme conditions of water temperature, suction lift and discharge lift, use the Service Factors listed on the reverse side of this page.

3. Reference data only. Certified drawings are available upon request. Consult factory.

4. PACE Model S-4 incorporates Separator Assembly and Pump Assembly on common steel skid.

5. Flooded suction is recommended wherever possible. Under shipboard vibration, piping leaks are always a problem, and vacuum leaks are hard to find and repair.

6. For oil discharge heads greater than 30 FT, consult factory.

7. Motor horsepowers shown for 60 Hz power only. Consult factory for 50 Hz motor data.

SERVICE FACTORS

PACE is a variable flow device. The throughput to be expected in service will depend upon two major factors:

1. the total dynamic head the system must overcome (TDH SERVICE FACTOR), and
2. the temperature of the wastewater (TEMPERATURE SERVICE FACTOR), and

In order to select a unit for a specific application, you must first determine a value for each of these service factors using the tables provided below.

TDH SERVICE FACTOR. As the total dynamic head (TDH) which the unit must overcome increases, the differential pressure available to force water through the Membrane decreases, and flow decreases accordingly. The total dynamic head (TDH) includes suction lift, discharge head and friction losses. To be conservative, the TDH should be calculated using the USCG/IMO rated capacity as the design flow.

TDH (FT)	TDH SERVICE FACTOR
0	1.00
10	1.09
20	1.21
30	1.35
40	1.53
50	1.76

TEMPERATURE SERVICE FACTOR. The viscosity of water decreases as its temperature increases. The pores of the Membrane are so tiny that a decrease in the water's viscosity reduces the Membrane's resistance to flow.

TEMPERATURE °C.	TEMPERATURE °F.	SERVICE FACTOR
90	194	0.53
80	176	0.58
70	158	0.65
60	140	0.73
50	122	0.83
40	104	0.97
30	86	1.18
20	68	1.48
10	50	1.99

Multiply the required flow in GPD times the TDH SERVICE FACTOR times the WATER TEMPERATURE SERVICE FACTOR to get the corresponding nominal rating. Select the next largest unit.

EXAMPLE: Vessel in arctic service; required flow 350 GPD, 10 FT TDH, water temperature approximately 68 degrees F. Size a standard unit based upon the GPD calculated as follows:

350 X 1.09 X 1.48 565 GPD

Select a PACE S-1 with nominal rated capacity of 800 GPD.

EXAMPLE: Same case, but vessel has deep molded draft requiring a total lift of 50 FT TDH:

350 X 1.76 X 1.48 912 GPD

which would exceed the capacity of a PACE S-1 and require a PACE S-2. In this case, it may be more practical to select the smaller separator, and reduce the effective head by installing a small booster pump for overboard discharge of the clean water.

FAST® SYSTEMS LTD.
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A Subsidiary of S&D®

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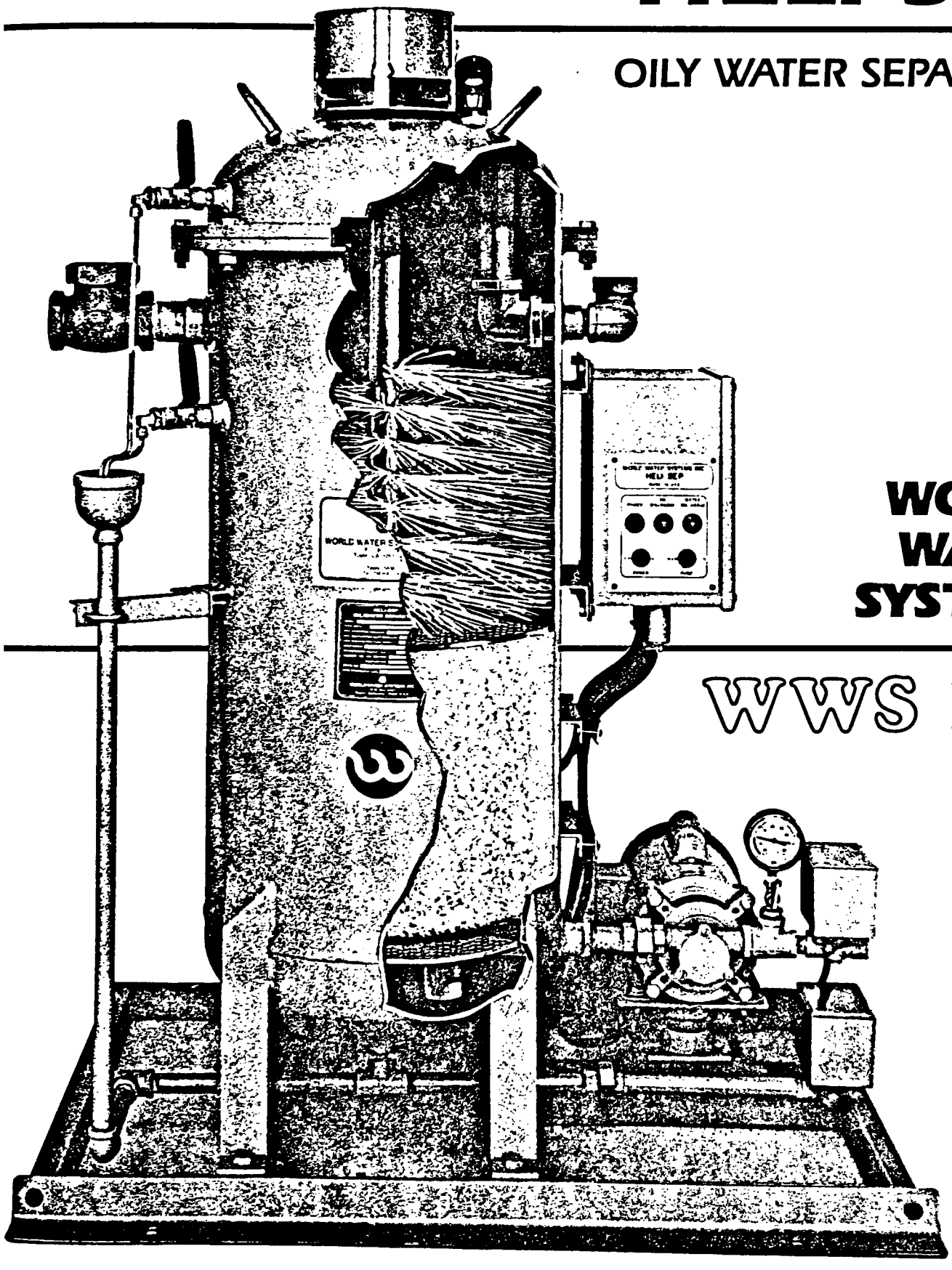
HELI-SEP®

OILY WATER SEPARATOR



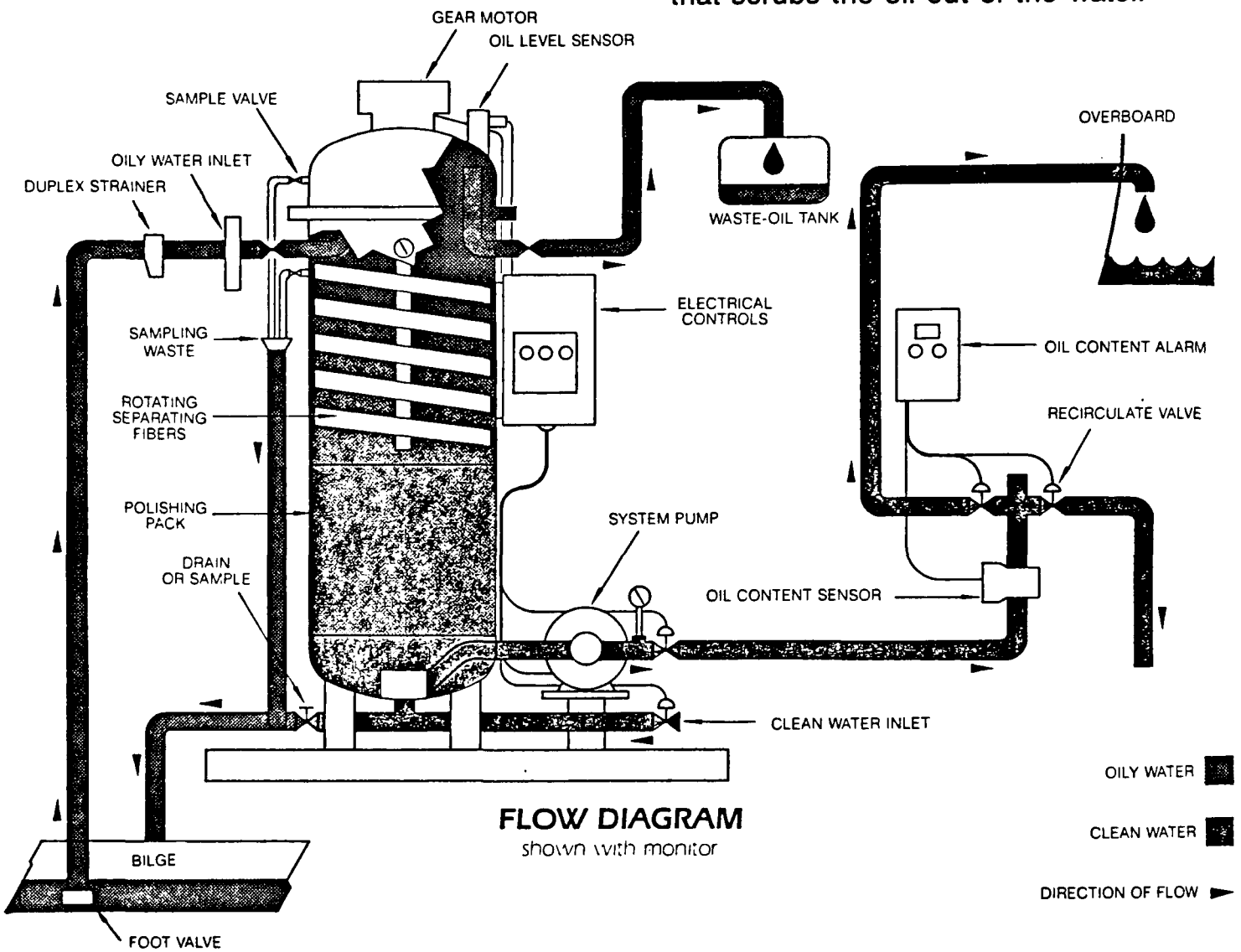
WORLD WATER SYSTEMS

WWS Inc.

UNIQUE CONCEPT SAVES MONEY

World Water Systems has combined state of the art technology with decades of practical experience in the design and manufacture of marine equipment. The result is the most effective, efficient oily water separator available.

We have employed a unique concept called *gravity assist separation* that completely eliminates expensive filters and coalescers. This exclusive design incorporates mechanical, rotating, coalescing fibers and a stationary polishing pack that scrubs the oil out of the water.



FLOW DIAGRAM
shown with monitor

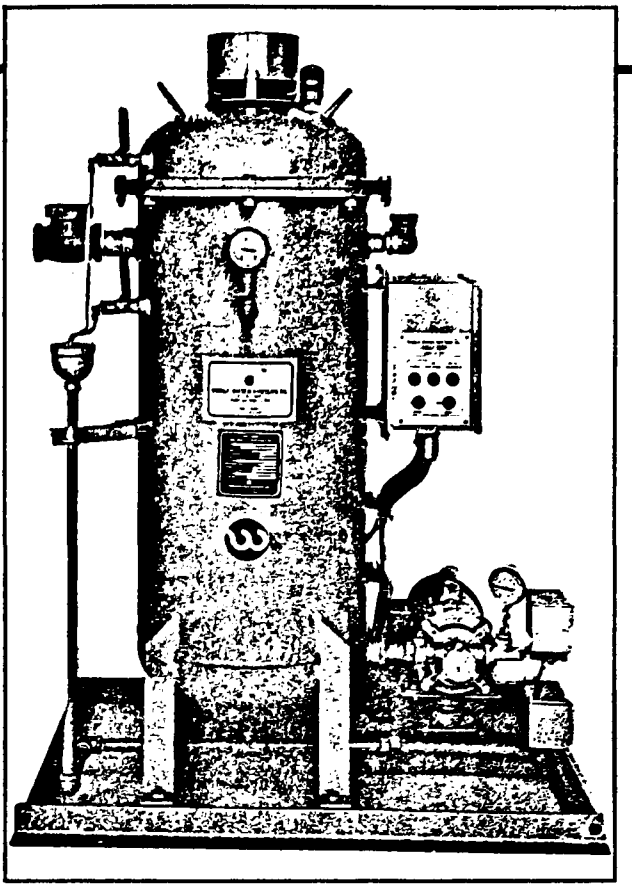
PRINCIPLE OF OPERATION: Oily bilge water is drawn into the separator by the automatic self-priming pump. This pump is located on the outlet of the separator to prevent the formation of a mechanical emulsion. When the oily bilge water enters the separator, it is directed toward the top of the vessel. Some oil separates immediately due to the difference in specific gravity and the reduced velocity.

As the oily water is directed downward in the *helical flow path* toward the pump suction, the oil impinges on the slowly rotating oleophylic separating fibers. The oil is forced to gravitate to the top of the separator. Any oil that escapes the separation fibers is removed by the permanent polishing pack.

After the separated oil accumulates to a predetermined level, the oil sensor initiates the oil discharge and cleaning cycle by stopping the pump, closing the water discharge valve and opening the sea water inlet valve. This allows clean sea water to flow in the reverse direction, up through the polishing pack and the separating fibers to clean them and displace the accumulated oil.

FEATURES OF THE HELI-SEP

- No expensive, messy filters to change and store
- Self-cleaning polishing pack never needs replacing
- All automatic operation
- Simple to operate
- Compact and easy to install
- Suction direct from bilge, no holding tank required
- All separation accomplished in one stage
- Reliable, rugged marine-duty components
- Lowest maintenance cost of any system



World Water Systems also offers an internationally-approved 15 PPM oil content alarm, with overboard and recirculation valves installed on the pre-wired sensor.

The Heli-Sep has been thoroughly tested and approved by the United States Coast Guard under the authority of 46 CFR 162.050-7 and according to IMO Resolution A. 393 (X) by Dept. of Transport (United Kingdom), Norwegian Maritime Directorate, and the Netherlands Shipping Institute.

Manufacturing facilities located in the United States and Europe.

DIMENSIONS

MODEL	CAPACITY	LENGTH	WIDTH	HEIGHT	WEIGHT	INTERFACE CONNECTIONS				
						OILY WATER IN	OIL OUT	SEA WATER IN	WATER OUT	MOTOR
	M^3HR / GPM	MM / IN	MM / IN	MM / IN	KG / LBS	MM / IN	MM / IN	MM / IN	MM / IN	HP
500	.5 / 2.2	775 / 30.5	476 / 18.75	1168 / 46	89 / 196	38 / 1.5	25 / 1	13 / .5	13 / .5	1 / 4
1000	1 / 4.4	902 / 35.5	521 / 20.5	1270 / 50	119.5 / 263	38 / 1.5	25 / 1	13 / .5	13 / .5	1 / 4
2000	2 / 8.8	1168 / 46	762 / 30	1575 / 62	218 / 480	38 / 1.5	25 / 1	13 / .5	25 / 1	1 / 2
2500	2.5 / 11	1219 / 48	864 / 34	1651 / 65	288 / 635	51 / 2	25 / 1	13 / .5	25 / 1	3 / 4
5000	5 / 22	1422 / 56	1092 / 43	1829 / 72	431 / 950	51 / 2	25 / 1	13 / .5	25 / 1	1
10000	10 / 44	1828 / 72	1270 / 50	1956 / 77	731 / 1610	76 / 3	51 / 2	13 / .5	31 / 1.25	2

WORLD WATER SYSTEMS

Designers and manufacturers of equipment for the marine industry

WWS Inc.
World Water Systems, Inc.
P.O. Box 3427
Tustin, CA 92681 U.S.A.
Telephone: (714) 641-2968 **Telex: 551424** **Fax: (714) 641-1215**

WWS Inc.

Your Representative:

ANTHONY'S INDUSTRIAL & MARINE SERVICES

(206) 783-0650
4360 LEARY WAY N.W. 24 Hr. Ans. (206) 546-2174
SEATTLE, WA 98107 FAX: 784-5492

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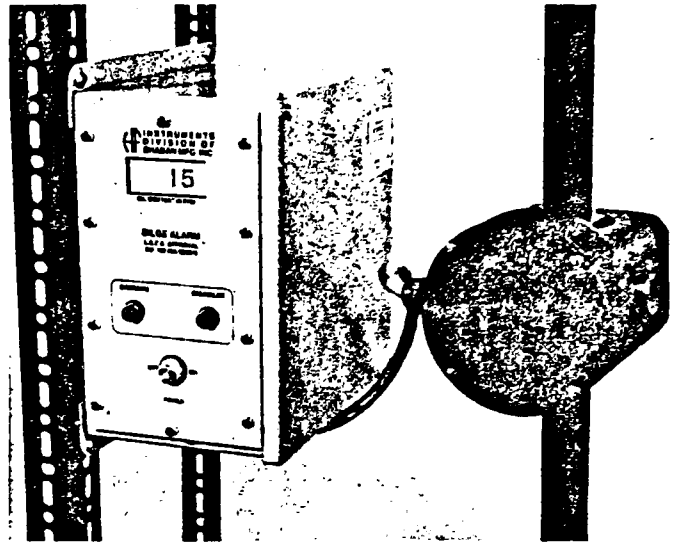
INSTRUMENTS
Product Data Sheet

NOW. . . A SIMPLE, INEXPENSIVE AND EASY-TO-USE OIL CONTENT BILGE ALARM



The Oil Content Bilge Alarm measures and displays the amount of dispersed oil over a range of 0 to 100 p.p.m. in the flowing stream of cleaned water. The instrument consists of a Sensing Module and an Indicating/Control Module. Oil content of the cleaned bilge water is continuously shown on a digital display on the Indicating/Control Module. An adjustable alarm set-point function, on which the allowable oil content level is set, is located inside the Indicating/Control Module. When the Sensing Module determines that the oil content exceeds the set-point value, a relay activates the lights on the display panel of the Indicating/Control Module. Green for "Overboard" changes to red for "Recirculate." Simultaneously, two sets of relay contacts activate independent alarm and control circuits. When the oil content in the effluent water is once more below the set-point value, the above conditions are automatically restored to normal.

Piping for the Sensing Module may be arranged in the outlet line of an Oil/Water Separator. Cleaned bilge water flows through the module, past optical pressure windows where the measurement is made. A prefocussed incandescent light source provides a light beam which passes through the bilge water. A detector, placed at an angle to the incident light beam, measures light scattered by the dispersed oil in the bilge water. An electrical output from the detector is transmitted through a cable to the Indicating/Control Module where it is processed and the measurement displayed on the panel in p.p.m.

The 2½-digit display on the panel can indicate readings up to 199; however, readings beyond 100 may not be within specified accuracy. The "On/Off" switch for input power to the Oil Content Bilge Alarm is also located on the panel.

This easy-to-install, easy-to-clean Oil Content Bilge Alarm is already highly proven in worldwide marine use. Fully tested, and approved by the U.S. Coast Guard, the instrument provides control signals to recirculating valves when a preset oil content in bilge water is met.

Meets requirements of
IMO Resolution A (393) (X)

Quality products for science, medicine and industry.

instruments

Division of
Shaban Manufacturing, Inc.
3052 Metro Parkway S.E.
Fort Myers, FL 33901-7539
Telephone: (813) 337-2116
Telex: (EASY LINK) #703-862

CONSTRUCTION MATERIALS

Sensing Module — Body: Cast Aluminum, Neoprene O-Ring Seals, Borosilicate Pressure Windows
— Internal Components: Incandescent Lamp, Acetal Mount, Threaded Terminal Connections, Photo Diode Detector

Indicating/Control Module — Digital Display, Indicating Lights, Solid State Electronics in Oil Tight J.I.C. (Joint Industrial Council) enclosure with holes for ½" conduit

Interconnecting Cable — 15 ft., Multiconductor Shielded

SPECIFICATIONS

Range: 0-100 p.p.m.

Recorder Output: 0-10 VDC Minimum impedance 500 ohms

Alarm Relay: Adjustable set point, N.C. and N.O. contacts. Loss of power causes relay coil to de-energize and close alarm contacts (failsafe)

Digital Display: 2½-digit. Shows set-point value when "Alarm Set" switch is energized

Alarm Relay: Activates upon light source burnout, or when optical windows become fouled

Calibration: Check switch provided

Sensing Module: Threaded for 1" N.P.T. pipe (customer supplied)

Alarm Relay: 5 amps, 110 volts/2.5 amps, 220 volts, 28 VDC, Resistive

Power: 110/220 volt, 50/60 Hz, 25 watts

Response Time: 5 seconds or less

Measured Material Flow Rate: 40 g.p.m. maximum

Measured Material Pressure Range: 0-60 p.s.i.

Operating Temperature: 0-50°C

Operating Humidity: To 95%

Vibration: From 2 Hz to 13.2 Hz ± 1 mm amplitude. From 13.2 Hz to 80 Hz, with acceleration to 7 G

Rolling Angle: To 22.5°

Fused on both primary lines for short circuit protection

Voltage Regulator: Accommodates ± 15% voltage variation

Amplifier P.C. Board: Has a plug-in connector and is fastened to the chassis for rigidity. It includes trim pots, and Alarm Set and Calibration check switches

Power Supply P.C. Board: Includes test points, a plug-in connector, and is also fastened to the chassis

Weight — Sensing Module: 6 lbs., 11 oz.
— Indicating Control Module: 19 lbs.

Dimensions — Sensing Module: 6" length x 5" diameter
— Indicating/Control Module: 11½" high x 6" wide x 10" deep

Meets requirements of IMO Resolution A (393) (X)
U.S. Coast Guard Approval No. 162.050/3009/0
Approved By Canadian Coast Guard
Approved By Danish Government Ships Inspection Service
Approved By United Kingdom D.O.T.
Approved by Norwegian Maritime Directorate

instruments

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Shaban Manufacturing, Inc.
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ANTHONY'S INDUSTRIAL & MARINE SERVICES

(206) 783-0650
4360 LEARY WAY N.W. 24 Hr. Ans. (206) 546-2174
SEATTLE, WA 98107 FAX: 784-5492

APPENDIX E

WASTE OIL

NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.

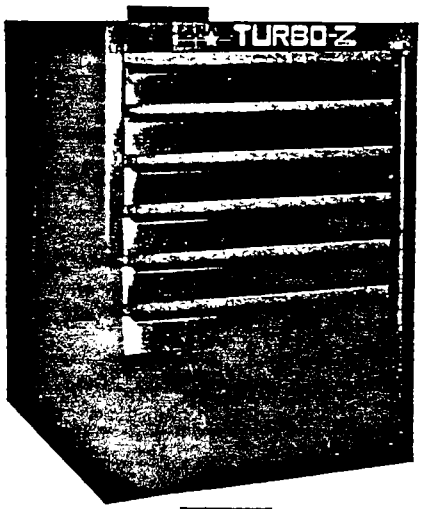
WASTE OIL DISPOSAL SOLUTIONS

LANAIR

Waste Oil Fired Heaters

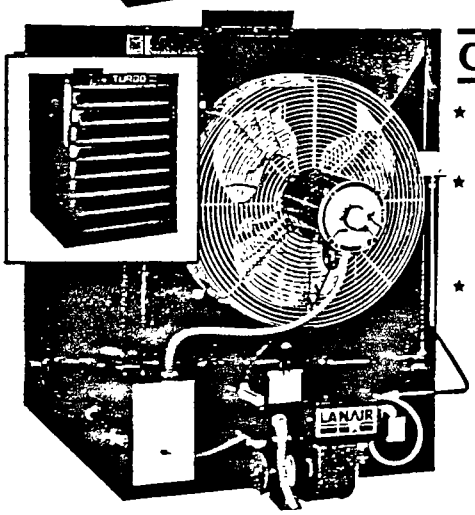
LANAIR Heat With Waste Oil

Turbo Z Series Free Air Applications



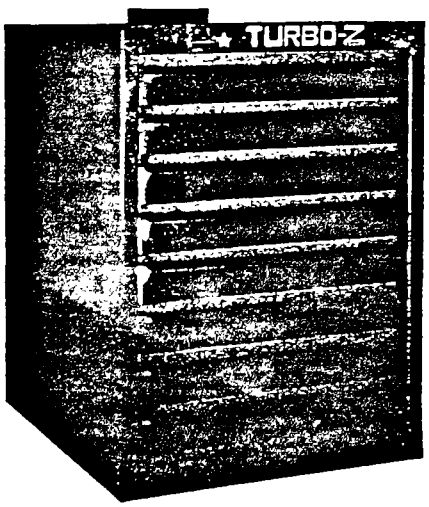
CA 120

- ★ Heat disbursement range 120,000 Btuh[1]
- ★ Recommended for areas up to 4,000 sq. ft.[2]
- ★ Removable high temp combustion board



CA 200

- ★ Heat disbursement range 190,000 Btuh[1]
- ★ Recommended for areas up to 8,000 sq. ft.[2]
- ★ Removable high temp combustion board and refractory



CA 260

- ★ Heat disbursement range 260,000 Btuh[1]
- ★ Recommended for areas up to 12,000 sq. ft.[2]
- ★ Removable high temp combustion board and refractory

For Your Service Area

The Industry Leader

Since 1976, Lenan has been affiliated with the pioneers in research and development of Waste Oil Heating and Waste Disposal technology. More Lanair Heaters are in use in the United States than any other brand.

Lanair Free Air Atomizing Space Heaters were introduced in 1982. They were the first ceiling hung, fully automatic, thermostatically controlled Waste Oil Heaters available to the automotive and industrial market place.

A Valuable Heating Fuel

Waste oil is more valuable as a heating fuel than in any other recyclable form. This virtually free fuel has an average rating of 150,000 Btuh's per gallon. This allows a Lanair Heater to pay for itself in a surprisingly short period of time.

Profit Center

Studies show that employees who are comfortable work more efficiently. Your service department is a profit center. Using waste oil as an energy source provides you with the opportunity to save thousands of dollars in heat bills, waste disposal costs and improved employee efficiency.

Lanair Versatility

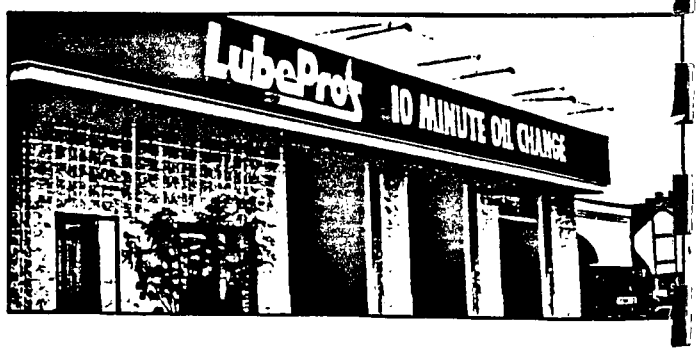
Lanair Heaters burn used automotive oils as primary fuels, providing supplemental heat for work areas and reducing waste disposal costs.

UL®

LISTED WASTE OIL BURNING APPLIANCE

10 YEAR LIMITED WARRANTY

	CA 120	CA 200	CA 260
Fuel consumption (GPH)	.95	1.28	1.83
Electric (AC 60 Hz)	120V	120V	120V
Electric draw (max amps)	14.0	14.0	14.8
Dimensions (H-W-L)	40 x 30 x 46	40 x 30 x 46	40 x 30 x 65
Weight lbs.	280	340	415
Flue pipe I.D. (Class A)	6"	8"	8"
Axial fan output CFM	2800	2800	2800



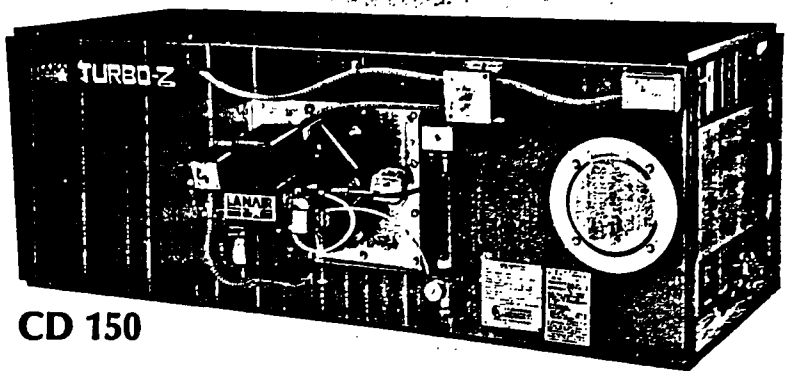
Save Money On Heating Costs

Turbo Z Series Ductable Applications

For Your Office Area

Lanair Ductable Heaters provide you with the opportunity to also heat offices and other ductable areas with inexpensive waste oil heat. CD models will easily fit into your existing ductwork. All heaters can be installed by any licensed heating contractor.

Lanair Free Air and Ductable models can be installed as individual heating units or with a used oil/workbench tank. All models are compatible with all Lenan accessories. Standard accessories supplied with each heater are a fuel supply pump, filters, barometric damper and manometer.



CD 150

LANAIR

UL LISTED

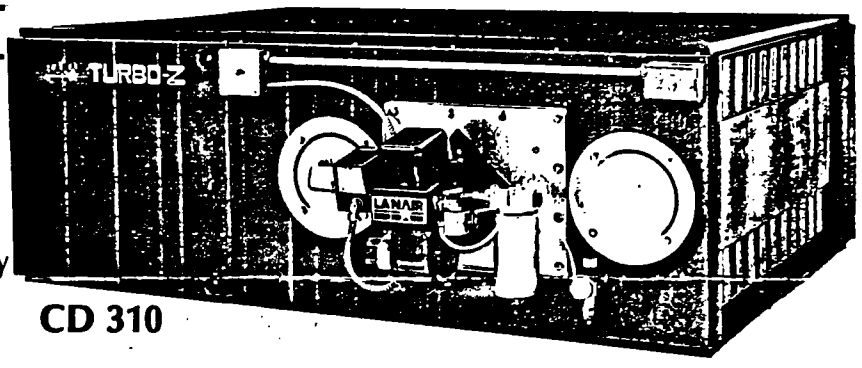
10 YEAR LIMITED Warranty

CD 150

- Heat disbursement range 150,000 Btuh[1]
- Ductable or free air
- Corrogated heavy duty heat exchanger
- Optional flue pipe vent ports

CD 310

- Heat disbursement range 310,000 Btuh[1]
- Ductable or free air
- Horizontal or vertical installation
- Corrogated heavy duty heat exchanger
- Optional flue pipe vent ports



CD 310

Multi Fueled Central Furnace

Heat with: Wood, Coal, Used Oil & Fuel Oil

The perfect unit for solid fuel applications when there is a limited supply of used automotive oil for use as a primary fuel.

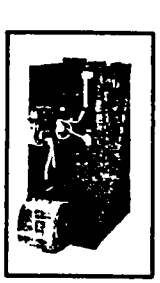
This self-contained furnace can be installed in a furnace room and easily connects to existing ductwork. The unit automatically switches from solid to liquid fuels with dual thermostats.

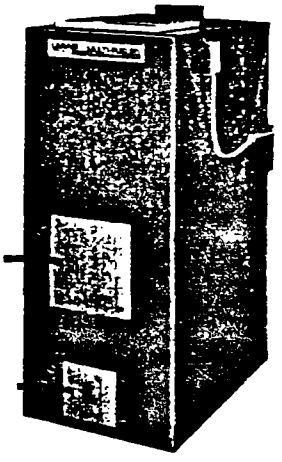
An auxiliary supply tank is provided in addition to standard Lanair accessories.

Safety tested and listed by P.F.S. Corp.

MF 150

- Heat disbursement range 150,000 Btuh[1][3]
- Ductable or free air
- Lanair w.o. burner for commercial use
- Len Cor 150 with Becket fuel oil burner for residential use

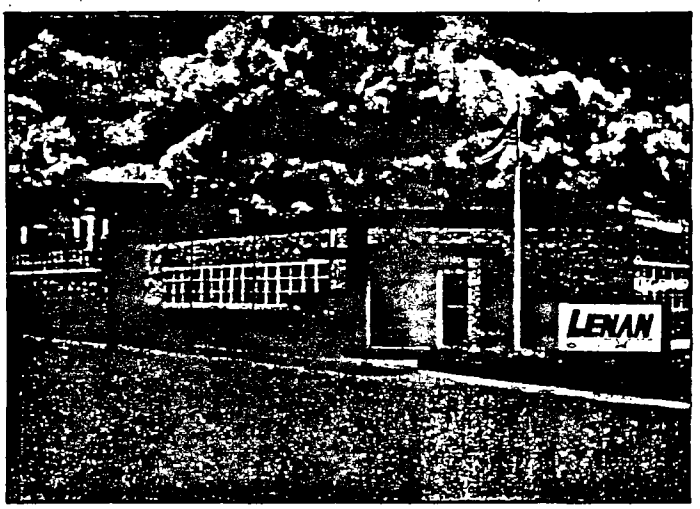




	CD 150	CD 310	MF 150
Fuel consumption (GPH)	1.07	2.21	1.07
Electric (AC 60 Hz)	120V	120V	120V
Electric draw (max amps)	17.5	19.5	14.0
Dimensions (H-W-L)	26 x 26 x 72	26 x 63 x 72	58 x 25 x 53
Weight lbs.	290	825	650
Flue pipe I.D. (Class A)	8"	8"	8"
Blower output CFM	1570	3140	1450

Decrease Your Disposal Liability

On-Site Waste Oil Disposal Solution



Lenan Corporation Has The Solution To Your Waste Oil Disposal Problems

Strict EPA Regulations and recent court decisions make you responsible for proper handling of your Waste Oil. This "cradle to grave" liability can not be assigned to your waste hauler. A Lanair System will greatly reduce the costs and liabilities associated with Waste Oil Disposal.

An EPA Solution

All Lanair Heaters meet the EPA's Regulation 40 CFR #266.41 of Nov. 29, 1985, allowing the burning of on-site generated used automotive oil, for energy recovery, in used oil fired space heaters.

A Code Solution

Lanair Heaters meet N.F.P.A. #31 Sec. 1-10 & 1-11 requirements regarding the use of crankcase oil as fuel.

A Safe Solution

Lanair Heaters are safety tested and listed by Underwriters Laboratory or PFS Corporation.

A Lenan Solution

Lanair Heaters carry a one year limited warranty on all replacement parts. CA and CD models carry an extended 10 year limited warranty on the combustion chamber/heat exchanger. All Lenan products must be installed in accordance with state and local codes.

On-Site Disposal Solution

Lenan's total system concept makes it cost effective to collect, store and heat with used oil.

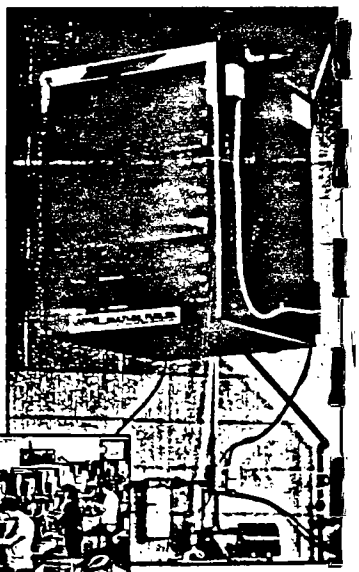
To Our Customers

As we focus on environmental concerns for the 90's, Lenan Corp. has dedicated itself to providing the automotive and industrial community with products which satisfy environmental concerns and provide waste disposal solutions.

Lenan has over 13 years experience in waste oil heating technology and waste recycling products. Our commitment to you our customer is to provide the highest technology, quality products and a commitment to customer service for the 90's.

Les Marzahl
President Lenan Corp.

People & Experience Make The Difference



Committment to the Future

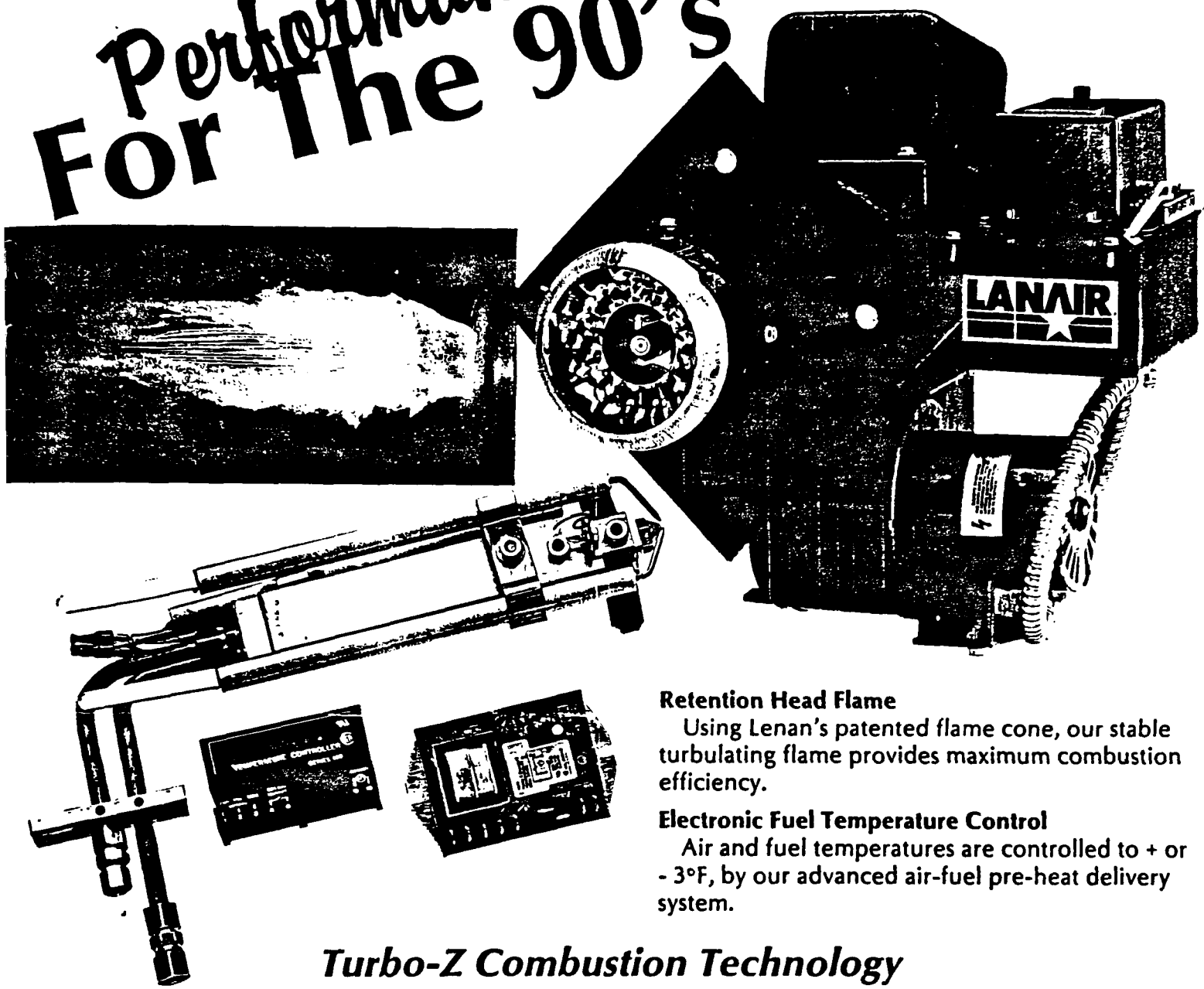
Dedicated to engineering and technological leadership for the 90's.

National Distribution Network

Dedicated to customer service, our distributors have made Lanair the #1 Name in the Waste Oil Heating Industry.

(1)Lanair Heaters are multi oil fueled and listed to burn used crankcase oil, used automatic transmission fluid, #1 & 2 fuel oil. Btuh and consumption varies with type of fuel.
(2)Varies with location, R-value and heat loss. Btu requirements for your facility should be established by a licensed heating contractor.
(3)Btuh varies with type of fuel burned. Operation with wood varies with type and moisture content.

Performance For The 90's



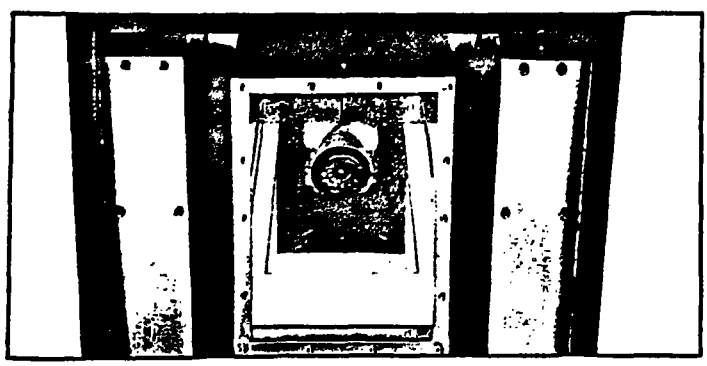
Retention Head Flame
Using Lenan's patented flame cone, our stable turbulating flame provides maximum combustion efficiency.

Electronic Fuel Temperature Control
Air and fuel temperatures are controlled to + or - 3°F, by our advanced air-fuel pre-heat delivery system.

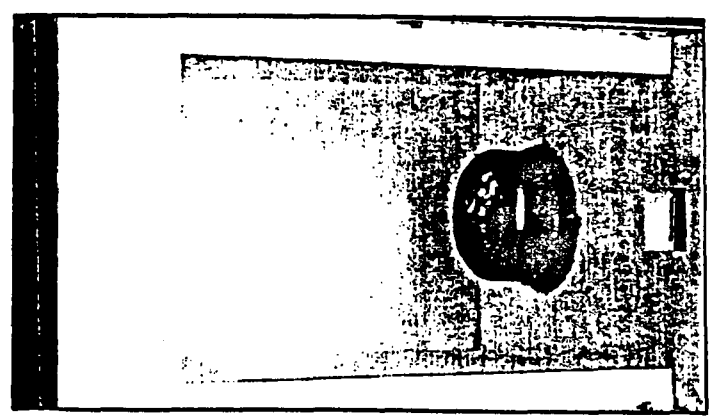
Turbo-Z Combustion Technology

Produces the Hottest Cleanest Burning, Most Efficient Air Atomization Flame on the Market.

Two Stage Combustion Chamber
Hi-temp refractory materials provide radiant reflection for second stage afterburn.



Dual side flow heat exchanger with removable access covers for easy maintenance.



Combustion Chamber Components
Hi-Temp, Hi-Density materials, with stainless steel rails, for maximum retention time and combustion efficiency.

Disposal Technologies For The 90's

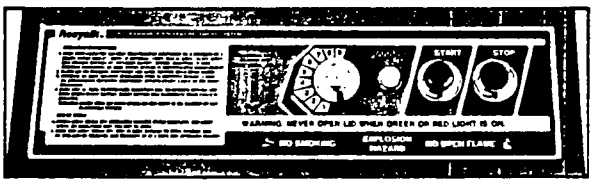
On-Site Waste Solvent Recycling

Hazardous Waste Problem? Your On-Site Solution!

Lenan Recyclit™ products are the answer to your hazardous waste disposal problems. Used paint thinners and solvents are classified as hazardous waste...but, they are also recyclable. The EPA encourages on-site recycling and that's what Recyclit™ does for economical and environmental benefits.

It couldn't be easier to use! Simply pour in the waste and turn Recyclit on. In just a few hours, gallons of liquid waste are recycled into reusable material. No other similar product can match the SR 80's combination of safety, reliability, versatility and technology.

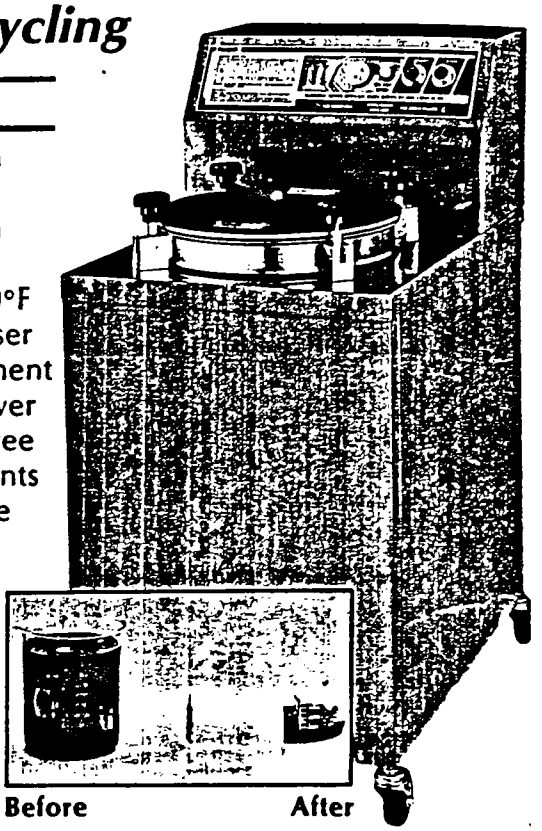
Recyclit™



For a product brochure on Recyclit™ call Lenan or contact your Lenan dealer.

SR 80

- ★ Two step operation
- ★ 1-8 gallon capacity
- ★ 5-8 hours full batch recycling time
- ★ Temp ranges to 370°F
- ★ Air cooled condenser
- ★ Direct heating element
- ★ 120 VAC 60 HZ power
- ★ All enclosed dust free electrical components
- ★ Optional disposable tank liner
- ★ Heavy duty casters



Before After

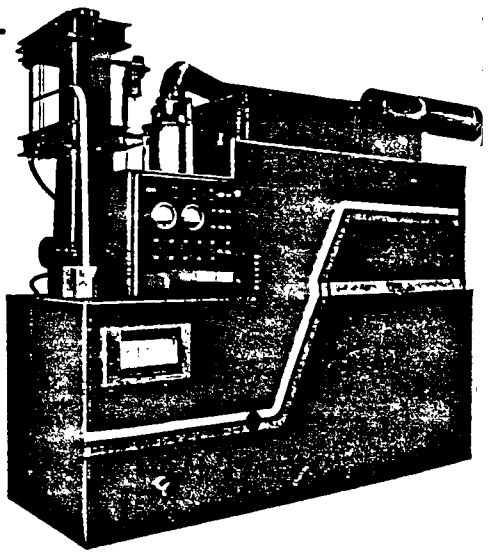
TecSon Scrap Tire Disposal

TecSon Corporation, a sister company designs and markets waste recycling equipment manufactured by Lenan Corp.

PMR Module 2000 recycles up to 550,000 scrap tires per year. The destructive distillation process converts properly sized rubber into synthetic fuels for generating electricity or boiler fuels. The rubber being processed does not come in direct contact with the flame. The process is smokeless and meets environmental air quality concerns.

PMR 2000

- ★ Processes 100 automobile tires per hour
- ★ Produces synthetic fuels
  Oil 140,000 Btu/gal.
  Gas 1,080 Btu/cu. ft.
  Carbon 13,500 Btu per lb.
- ★ Continuous feed/clean process
- ★ Industrial computer controlled



For more information, contact TecSon toll free 800-356-9460, (WI) 608-752-2176

LENAN CORPORATION

Call: 800-356-9424 • In Wisconsin 608-752-1601 • FAX 608-752-9994

Lenan Products Are Distributed By:

615 North Parker
Janesville, Wisconsin 53545

Made in USA. Patent applied for.
Copyright Lenan Corp.
7/17/89 Design and specifications subject to change without notice.

Waste Oils & Fuels Recovery

We cut our teeth on this piece of the business. We collect and recycle waste oils, lubricants and fuels. Radio-dispatched trucks respond to every emergency request promptly. Whether it's an emergency or a scheduled pickup, you will get the same great service.

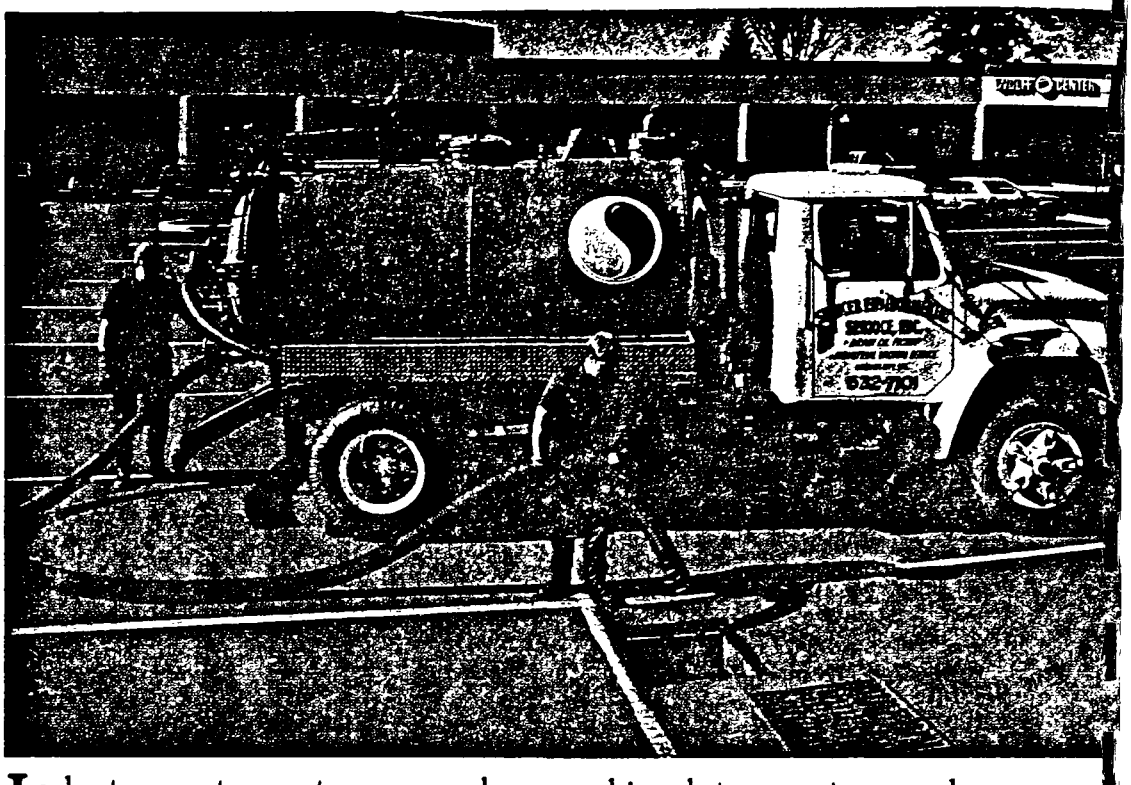
- Vacuum trucks with fast recovery pumps for efficient service
- Service for underground and above-ground tanks and reservoirs
- Vacuum trucks from 650-gallon to 5,000-gallon capacity
- Removal of oils, solids and sludges
- Tank cleaning and sludge buildup removal
- Salvaged fuels transported to EPA-approved reprocessors and refiners, or to recognized and approved TS&D facilities

Spencer Environmental Services, Inc.

Expertise at Work

15770 South Beaver Glen Drive Oregon City, Oregon 97045 (503) 632-7101

Industrial Sump & Drain Basin Service



Industry, restaurants, car washes, parking lot operators and apartment managers rely on Spencer Environmental Services for routine and emergency cleaning of sumps and drain basins. Radio-dispatched vacuum trucks with fast-recovery pumps get the job done right. Our equipment can work in hard-to-reach locations inside your plant or warehouse.

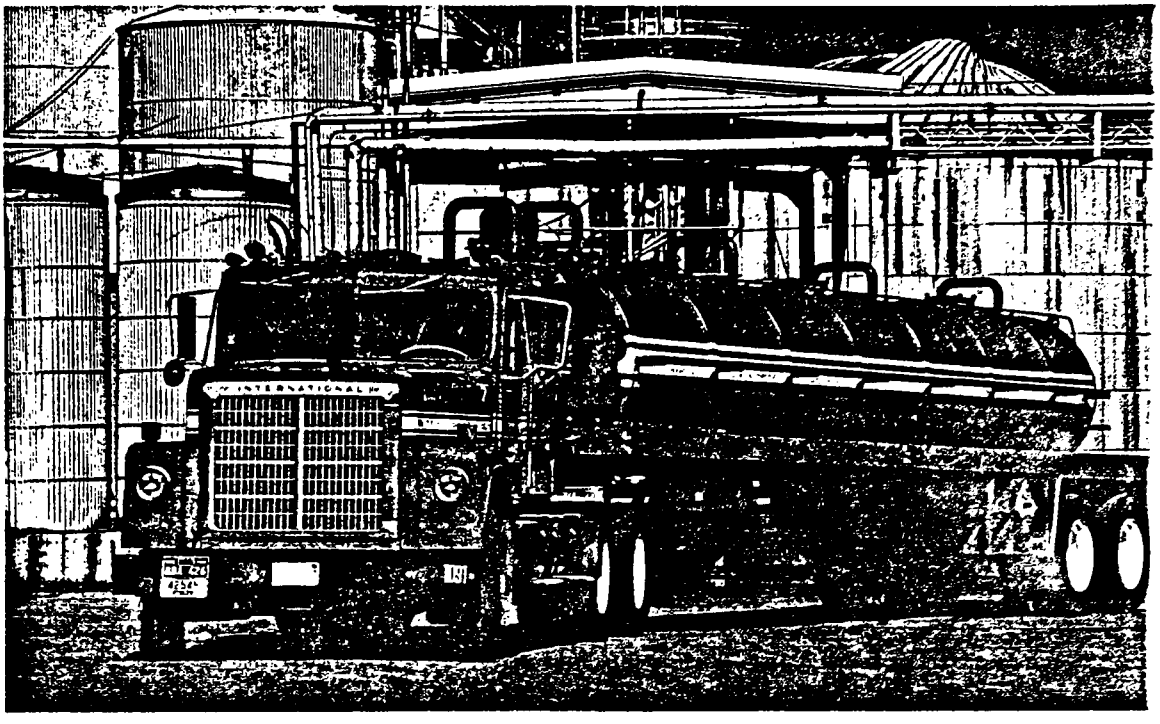
- Vacuum tanker trucks in 650-gallon, 1,500-gallon, 2,000-gallon and 2,500-gallon capacities
- Hoist-mounted vacuum tanks
- Semi-solids, high-viscosity sludges and residues removed
- Service for oil and water separators, tri-accelerator tanks, settling ponds, water recycling pits and treatment plants
- Truck-mounted heavy-duty pressure water-wash for basins, piping and components

Spencer Environmental Services, Inc.

Reliability

15770 South Beaver Glen Drive Oregon City, Oregon 97045 (503) 632-7101

Hazardous Waste Specialists



Society must dispose of hazardous wastes in a safe and responsible manner. At Spencer Environmental, we deliver hazardous wastes only to treatment, storage or disposal facilities approved by the U.S. Environmental Protection Agency. U.S. Department of Transportation tank inspection certificates are on file for review, upon request.

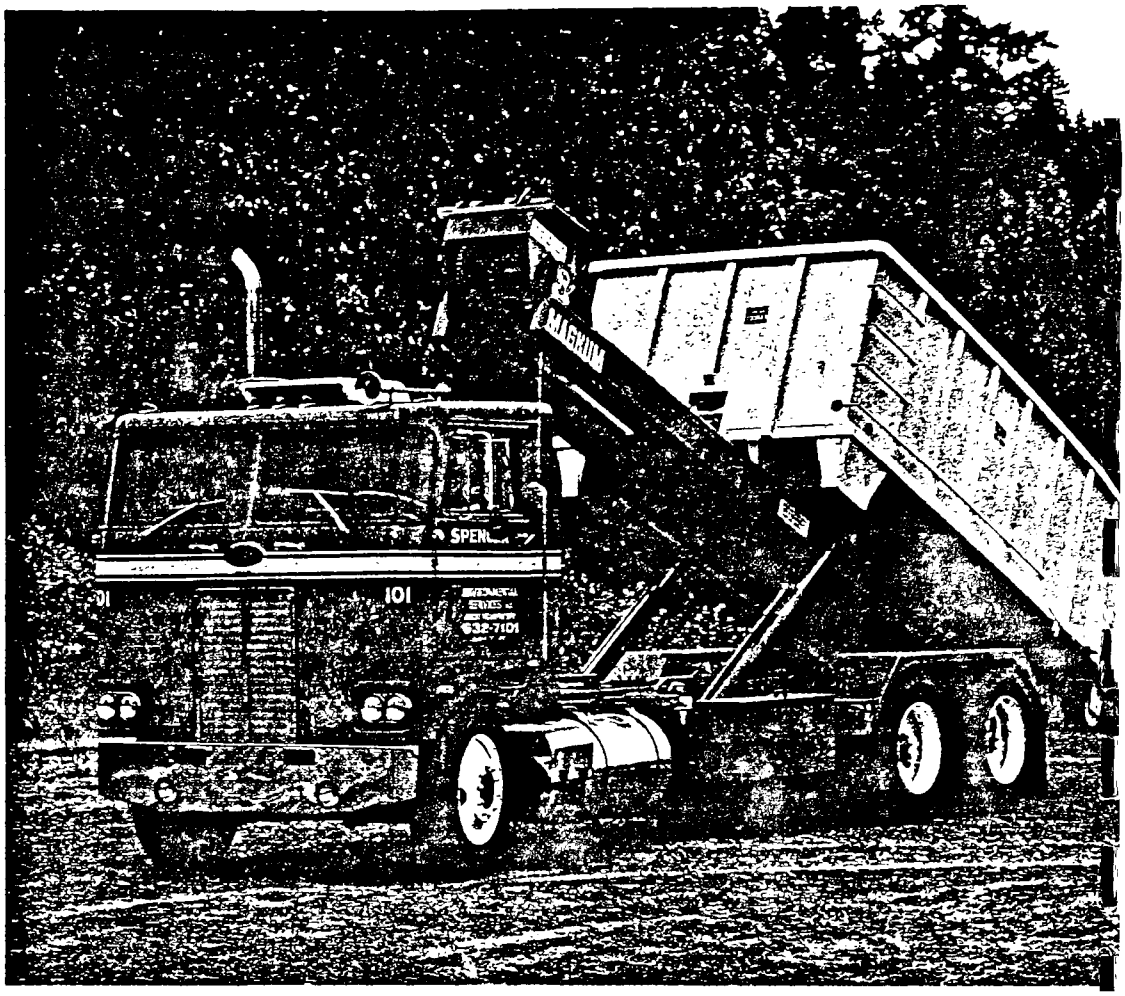
- All waste-handling equipment built to DOT Transportation Specification MC 307 and MC 312 standards
- Regulatory compliance and environmental safety ensured
- Lined vacuum tanker-trailers for hazardous waste transport
- Delivery *only* to EPA-approved TS&D facilities
- Oregon P.U.C. No. FMC 4267 (Hazardous Wastes)
- EPA Certification ORD-980836415
- California Hazardous Waste Hauler No. 1154

Spencer Environmental Services, Inc.

Versatility and Compliance

15770 South Beaver Glen Drive Oregon City, Oregon 97045 (503) 632-7101

Bulk Waste Collection & Transport



State of the art roll-on roll-off containers are used to safely move your bulk solid wastes to landfills or approved TS&D facilities. We are also certified by the Oregon Public Utility Commission to transport bulk liquid wastes, asbestos, solids and sludges.

- Roll-on/Roll-off technology
- 5,000-gallon tanker for hauling bulk liquid wastes
- Oregon PUC Certification No. FMC 4267 for hazardous waste
- Approved for asbestos transport and disposal

Spencer Environmental Services, Inc.

Stabilization and Compliance

15770 South Beaver Glen Drive Oregon City, Oregon 97045 (503) 632-7101

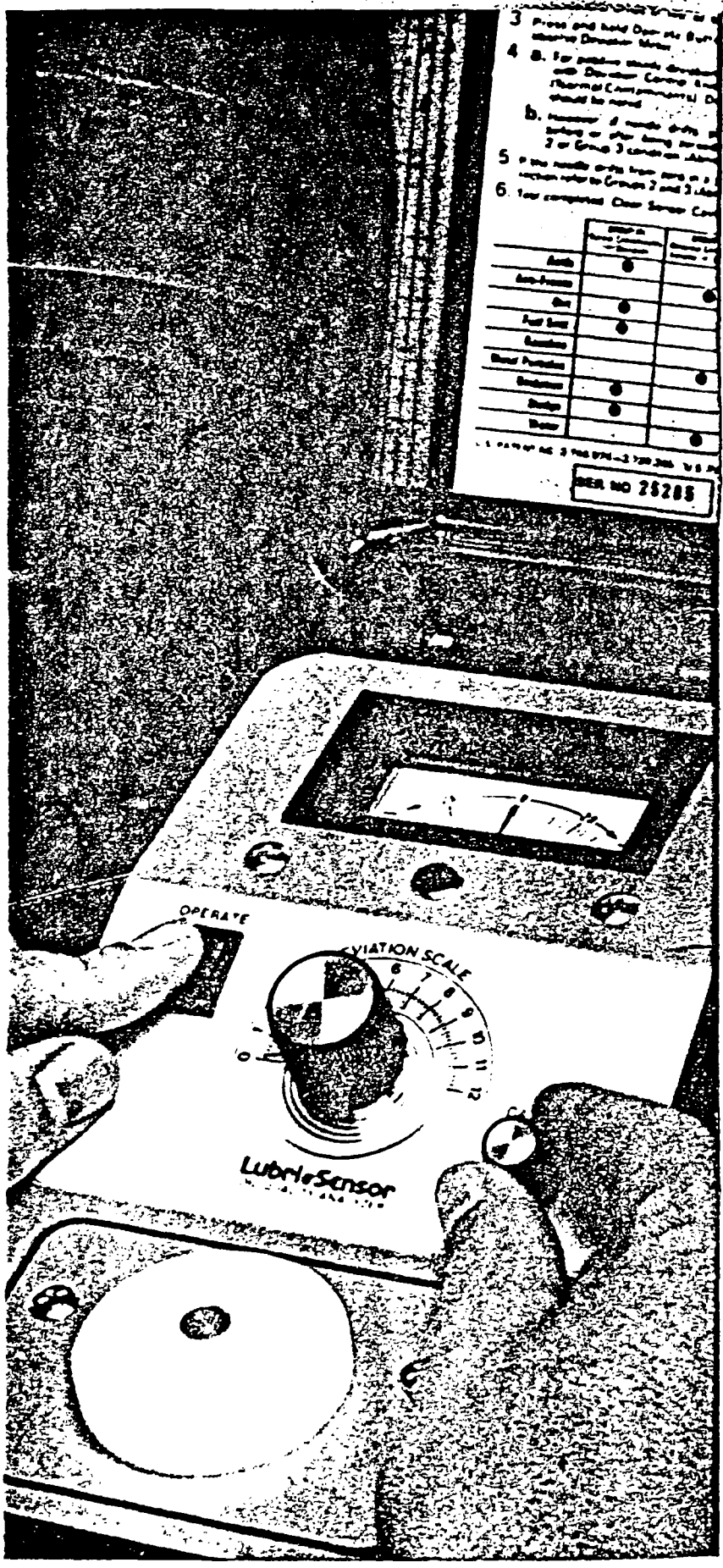
Operating Manual

LubriSensor

OIL QUALITY ANALYZER

NORTHERN INSTRUMENTS CORP.

6680 N. HIGHWAY 49, LINO LAKES, MINNESOTA 55014
PHONE 612/784-1250 TELEX 290-431



Foreword

Northern Instruments Corporation is a manufacturer of unique, proprietary sensing instruments which have evolved from the Corporation's efforts to develop useful products from the chemistry of organic materials. The sensor in the LUBRI-SENSOR owes its accuracy and sensitivity to this developmental work.

Oil is subjected to high temperature and extreme pressures during engine operation. An atmosphere conducive to oxidation is usually present in the crankcase. A variety of contaminants enter the oil system. While some contaminants are inert, others are chemically active or cause undesirable chemical reactions. The physical and electro-chemical properties of the oil change during use and it is this change that is important and affects the lubricating capability of the oil. For this reason an analysis of the new (unused) and used oil should be conducted frequently to determine their relative conditions. This is ascertained by evaluating the changes in physical and electro-chemical properties. The interpretation of these changes, as they affect engine performance, is of fundamental significance. One important and primary electro-chemical property of oil is its DIELECTRIC CONSTANT.

LUBRI-SENSOR detects, measures and indicates the TOTAL EFFECT of contamination on the DIELECTRIC CONSTANT of oil. Contamination is usually caused by oil oxidation, water, acids, antifreeze, metal particles or fuel. Thus, LUBRI-SENSOR makes it possible to determine when oil is still usable permitting longer intervals between changes. Even more importantly, overhauls can be postponed by detection of impending lubrication or mechanical failure.

Further, the sensor and operating range of the LUBRI-SENSOR has been designed to deal specifically with the current move to longer drain intervals, resulting from engine and filter refinements, and the increasing use of synthetic oils.

General Information

1. There are hundreds of oils on the market processed for specific lubrication purposes. The dielectric constant of these oils can vary between brands and types. This need not have anything to do with the quality of a particular oil processed for a specific purpose—it simply means that different types of oil additives, or their lack, will result in dielectric constant variations in oil.

   For this reason leading users of oil recommend that the interpretation of an analysis is, in part, a comparison between the properties of the unused oil and the properties of the used oil. To accommodate this, LUBRI-SENSOR has been designed to be calibrated quickly and easily to a zero reference with the same brand and type of oil in an unused state as the used oil to be tested.

2. As the sensor is sensitive to moisture, do not operate LUBRI-SENSOR in rain, snow or fog.

3. If LUBRI-SENSOR is subjected to significant temperature changes (for example, from 45°F. to 75°F.) then recalibrate the instrument as close as possible to the extremes of the range.

4. Always clean the sensor cavity thoroughly. Ideally the cleaned sensor will be dry to the touch. However, synthetic oils often leave a tenacious film behind. We recommend using SENSOR KLEEN for best results.

5. The electronic circuit in LUBRI-SENSOR will cease operation when the battery voltage falls to 5.0 volts. While voltage fall-off will not affect the instrument's relative accuracy (readings will still be directly proportional to the change in the oil's dielectric constant), the pointer on the Deviation Meter will deflect less and less as this happens. We suggest battery replacement after approximately 1,000 tests.

6. LUBRI-SENSOR is as ruggedly constructed as it can be and remain the sensitive instrument it is; however, please treat it with reasonable care.

Principles of Operation

This section has been included for those interested in the design theory of LUBRI-SENSOF It is not necessary to completely understand this section to operate the instrument.

THE OIL SENSOR

If you look at the bottom of the sensor cavity under magnification you will see two metal leads spiraling in from the outer edge to the center of the sensor. Each lead acts as a capacitor plat with the oil sample acting as the capacitor dielectric. This planar design maximizes skin capacitance measurements as opposed to only bulk capacitance, thereby providing for greater sensitivity to contaminants.

THE CIRCUIT

LUBRI-SENSOR's circuit is a specially adapted capacitance bridge operating at a frequency of 5 Megahertz. It contains two parallel resonating legs; the sensor leg and the measuring leg. When the meter is at zero, the legs are neutralizing one another. A meter deviation means that a capacitance value has changed and one leg is overpowering the other.

DIELECTRIC CONSTANT OF OIL

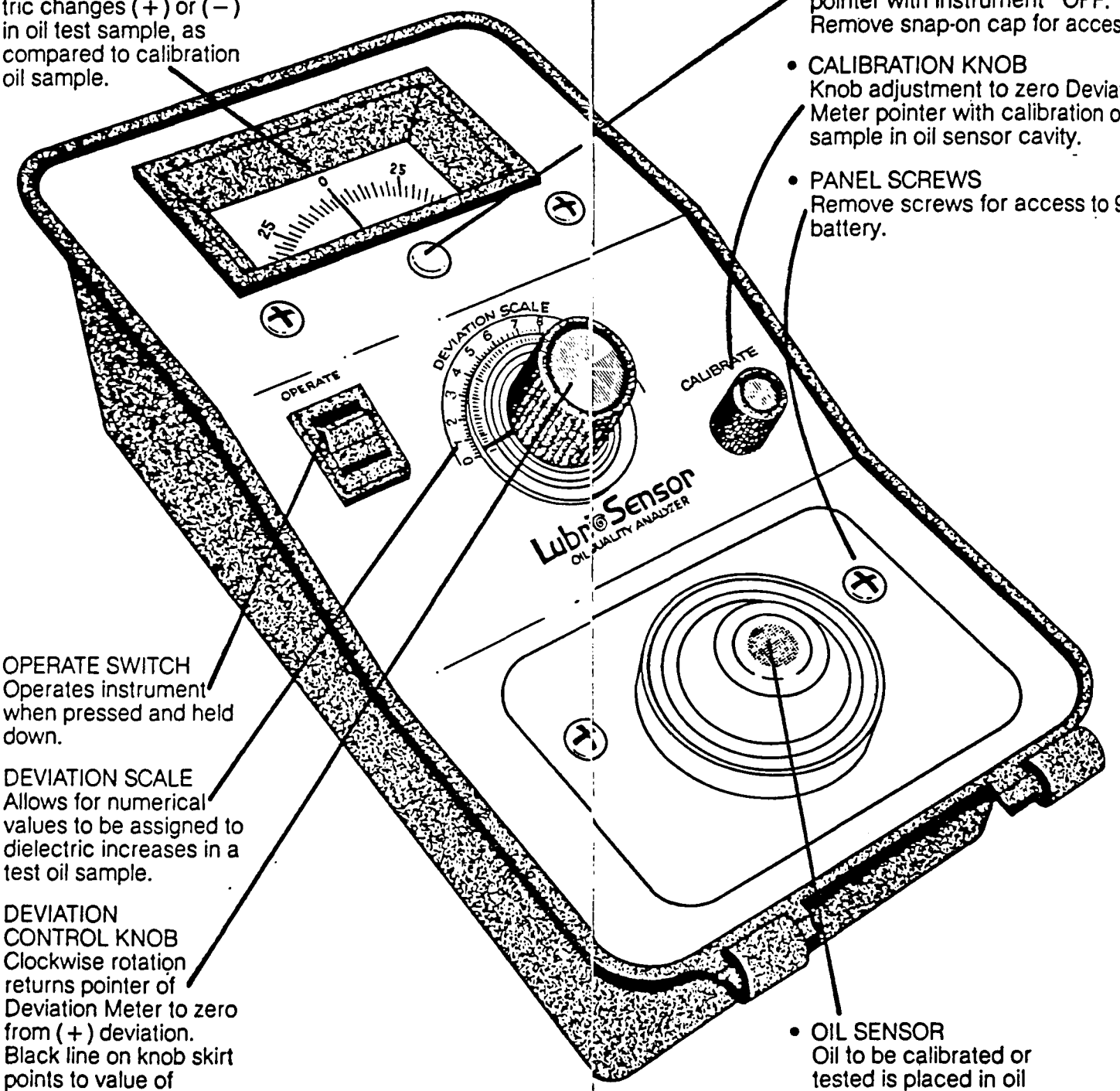
The dielectric constant of a substance is its abilit to transfer electrical energy as compared with a vacuum. In oil systems this value is dependent upon the base oil plus additives or contaminants present.

As oil breaks down, peroxides, acids and other radicals are formed on the oil molecule. These cause the molecule to become somewhat polar (positively charged on one end, negative or the other). As the number of polarized molecules increases, the dielectric constant of the oil mixture increases. At the same time, the lubricating quality of the oil decreases in the same proportions.

Metal particles and other highly conductive contaminants change the plate area to gap widtl ratio of the sensor, thereby causing a dramatic increase in the capacitance value. They have an extreme effect on LUBRI-SENSOR's readings when they are present.

Operating Features

- DEVIATION METER
  Visually indicates dielectric changes (+) or (−) in oil test sample, as compared to calibration oil sample.



- METER ADJUSTMENT
  Screwdriver adjustment to zero me pointer with instrument "OFF." Remove snap-on cap for access.
- CALIBRATION KNOB
  Knob adjustment to zero Deviatio Meter pointer with calibration oil sample in oil sensor cavity.
- PANEL SCREWS
  Remove screws for access to 9 vo battery.
- OPERATE SWITCH
  Operates instrument when pressed and held down.
- DEVIATION SCALE
  Allows for numerical values to be assigned to dielectric increases in a test oil sample.
- DEVIATION CONTROL KNOB
  Clockwise rotation returns pointer of Deviation Meter to zero from (+) deviation. Black line on knob skirt points to value of dielectric increase.
- OIL SENSOR
  Oil to be calibrated or tested is placed in oil sensor cavity.

Operating Instructions

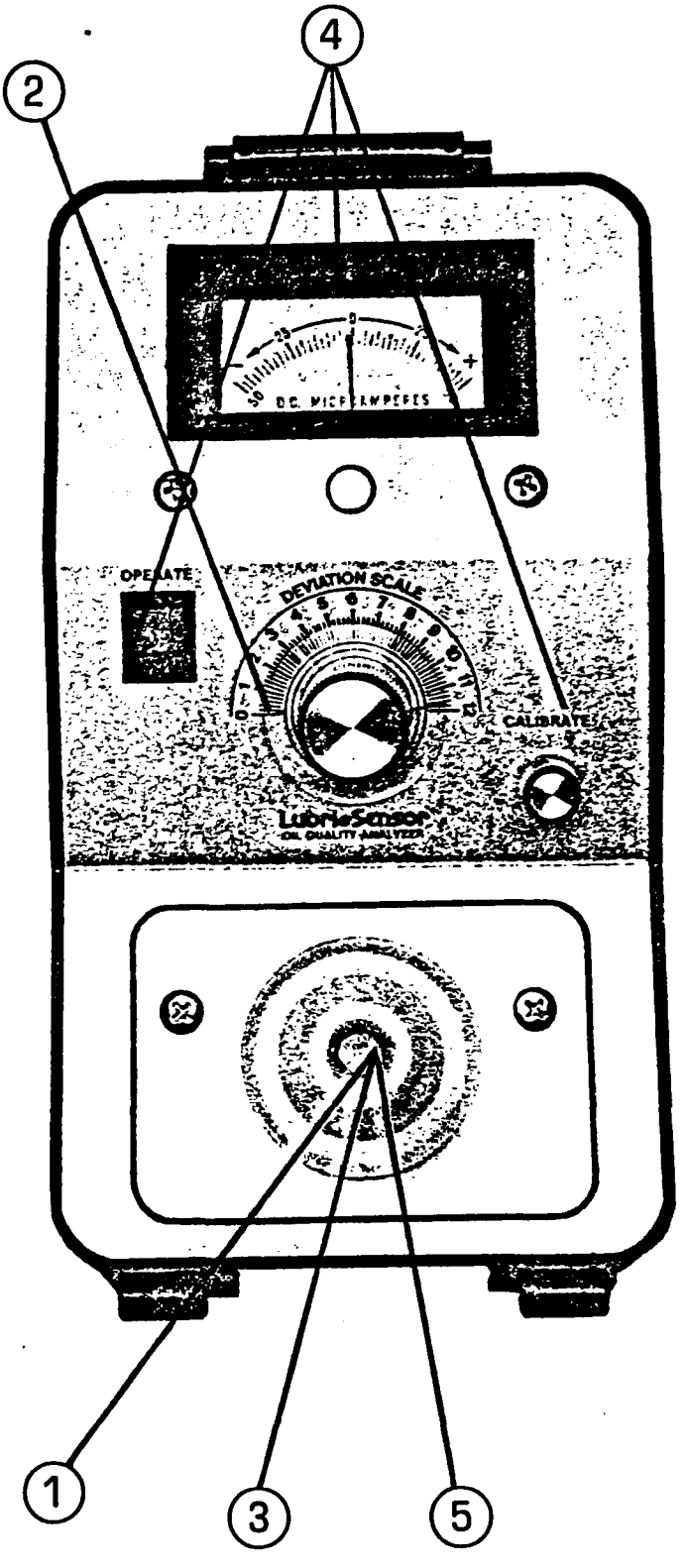
As with any sensitive instrument, LUBRI-SENSOR's accuracy is a function of the operator's technique. Careful and continued adherence to the few simple directions below will provide the operator with the technique necessary to insure dependable operation and accuracy.

The instructions are broken down into categories; CALIBRATION, setting the unit to a zero reference with the same brand and type of oil in an unused state as the used oil to be tested, and TESTING, measuring and assigning a numerical value to the change in the used oil's dielectric.

Calibration

1. Wipe Oil Sensor cavity carefully and thoroughly with clean, dry tissue. Preferably use SENSOR KLEEN.
2. Set black line on Deviation Control Knob skirt to "0" on Deviation Scale.
3. Fill oil sensor cavity with new oil of the same make and grade as the oil to be tested.
4. Press and hold down the Operate Switch and zero the Deviation Meter by turning the Calibration Knob either a clockwise or counter-clockwise direction. Release the Operating Button.
5. Again thoroughly clean the Oil Sensor cavity.

   The instrument is now calibrated and ready for testing used oil. It is good practice to recheck calibration daily and to periodically recheck during extensive testing.

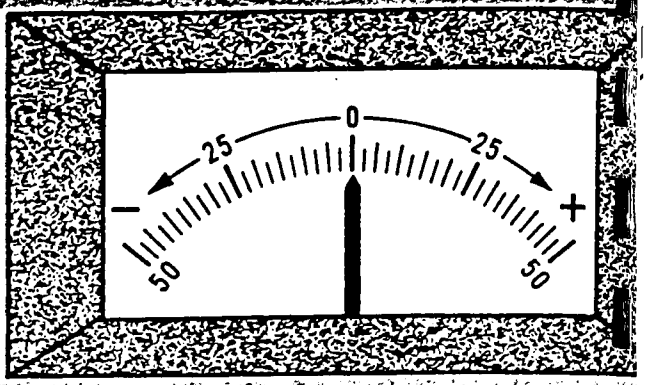


Operating Instructions

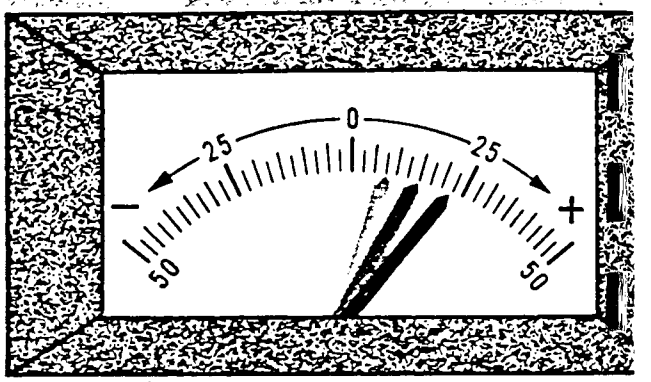
Testing

1. Always start with a clean Oil Sensor cavity and the black line on the Deviation Control Knob at "0" on Deviation Scale.
2. Fill Oil Sensor cavity with test oil sample. For best results obtain sample with "SAMPULLER" from warm engine that has been operated within the last 5 minutes.
3. Press and hold down the Operate Switch for approximately 15 seconds and observe the Deviation Meter pointer.
   a. If the pointer comes to rest in the positive (+) zone of the Deviation Meter, turn the Deviation Control Knob and rezero the meter. The oil is in a Group 1 condition and the reading on the Deviation Scale should be noted.
   b. If the pointer cannot be rezeroed with the Deviation Control Knob the oil can be considered to be severely contaminated.
4. Repush the Operate Switch after 30 seconds to detect abnormal contaminants.
   a. If the pointer has drifted off zero and continues to drift positively after being zeroed once again, the oil is in a Group 2 condition.
   b. For a negative deviation the meter cannot be zeroed and the oil is in a Group 3 condition.
5. Clean the Oil Sensor cavity and proceed to the next test sample. If the test indicated the oil was in a Group 2 or 3 condition extra care should be taken in cleaning the sensor before further testing. (Use SENSOR KLEEN.)

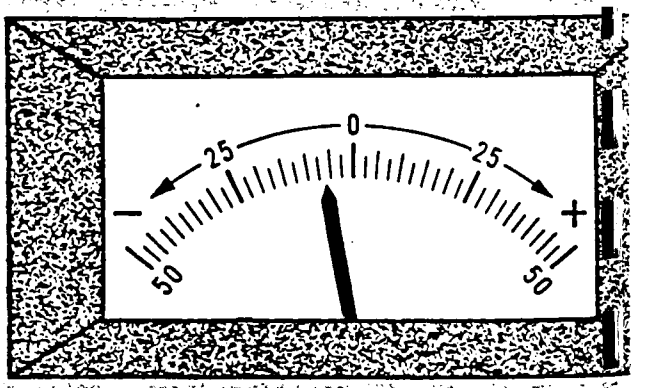
   See the following section, Interpretation Of Test Results to determine and understand the type of contamination present.



GROUP 1—"NORMAL CONTAMINANTS"
The meter can be zeroed from a positive deviation shown) and, the pointer then remains steadily at zero



GROUP 2—"ABNORMAL CONTAMINANTS"
The meter pointer can be rezeroed momentarily from a positive deviation but then drifts in a positive direction again. The meter can also peg positively scale immediately.



GROUP 3—"ABNORMAL CONTAMINANTS"
The meter pointer will move negatively a distance which is directly related to the strength of the dilu in the sample.

Interpretation Of Test Results

The LUBRI-SENSOR measures oil quality by sensing a property of the oil called the dielectric constant. The dielectric constant increases or decreases in proportion to the relative concentrations of the contaminants present in the oil system. The following table lists the typical lubricating oil contaminants and their effect upon the dielectric constant.

	GROUP 1 (Normal Contaminants) (+) DEVIATION	GROUP 2 (Abnormal Contaminants) EXTREME (+) DEVIATION	GROUP 3 (Abnormal Contaminants) (−) DEVIATION
Oxidation	●		
Sludge	●		
Dirt	●		
Fuel Soot	●		
Acids	●		
Water		●	
Antifreeze		●	
Metal Particles		●	
Gasoline			●

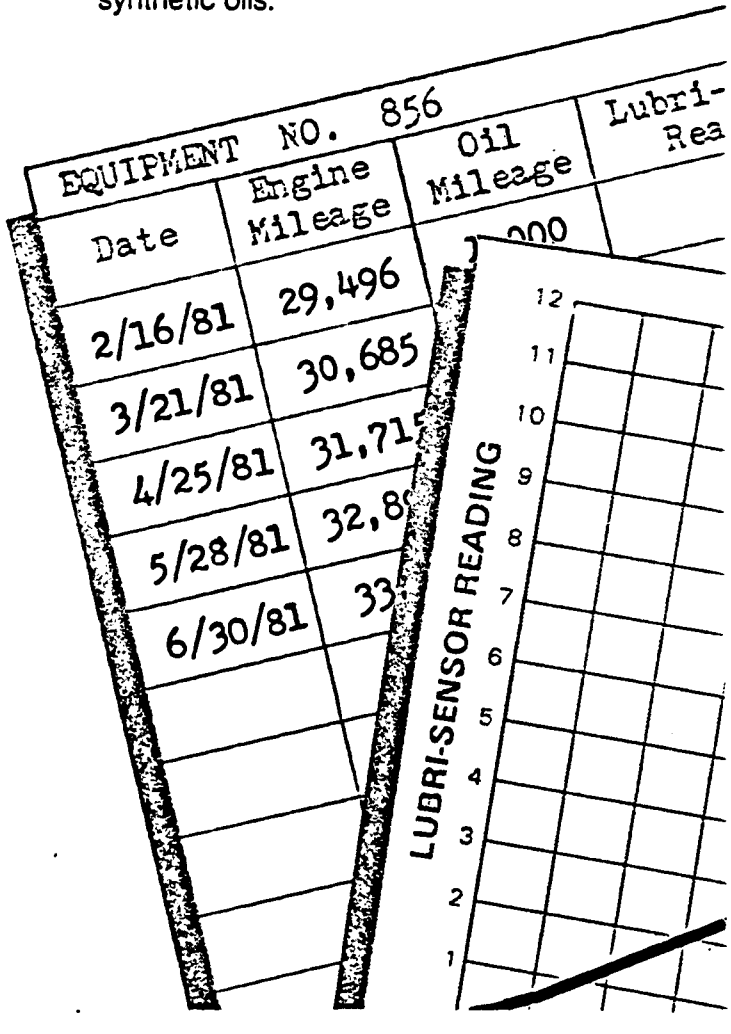
GROUP 1 contaminants cause the dielectric constant to increase moderately. Oxidation and acids build up with engine running time and are the primary degradation products in engine lubricating oils and thus are considered as Normal Contaminants. The other Group 1 contaminants are or are not present depending on the lubricating system.

GROUP 2 contaminants cause an extreme dielectric constant increase as compared with GROUP 1 contaminants. These contaminants are readily identified as their effects overpower moderate dielectric increases and/or decreases.

Water and antifreeze traces cause the needle of the Deviation Meter to drift persistently off "zero." In some instances the entire Deviation Scale can be used up. When present in greater than trace amounts the needle will peg immediately.

Metal particles can cause LUBRI-SENSOR to react somewhat as with water or antifreeze although the needle movement can be more erratic and "jerky" as the particles settle to the bottom of the Oil Sensor cavity. It is in order to observe these types or reactions that we request the Operate Switch to be held down a second time after 30 seconds into the test.

GROUP 3 contaminant causes a decrease in the dielectric constant. This effect is caused by the dilution of oil by gasoline, and because it is opposite from the other group, makes the contaminant identifiable from those of the other two groups. The deviation is slight with petroleur oils and pronounced with synthetic or para-synthetic oils.



Recording of Results

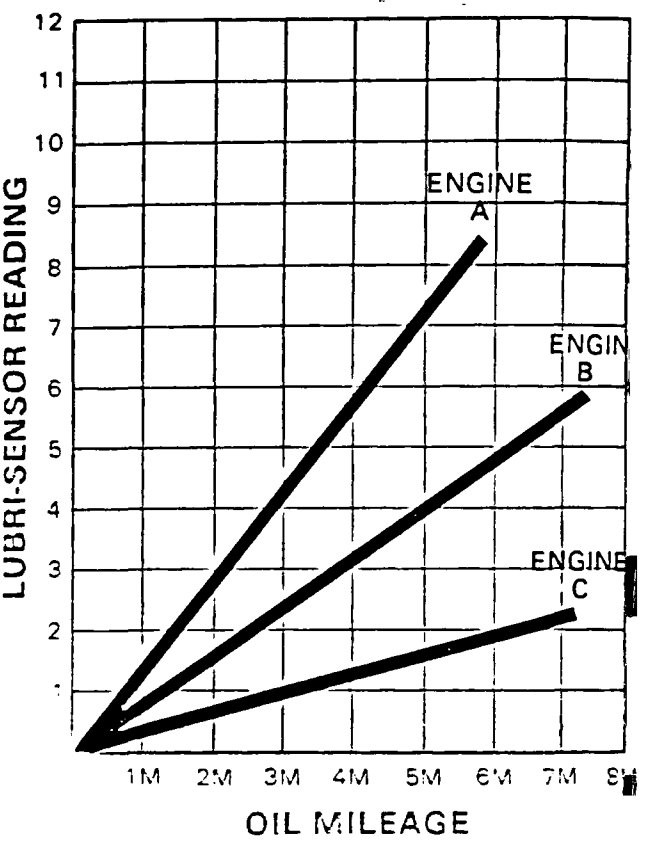
A systematic recording system for LUBRI-SENSOR data allows the user to take maximum advantage of the instrument. We recommend the use of a log and/or graph system of the type depicted below:

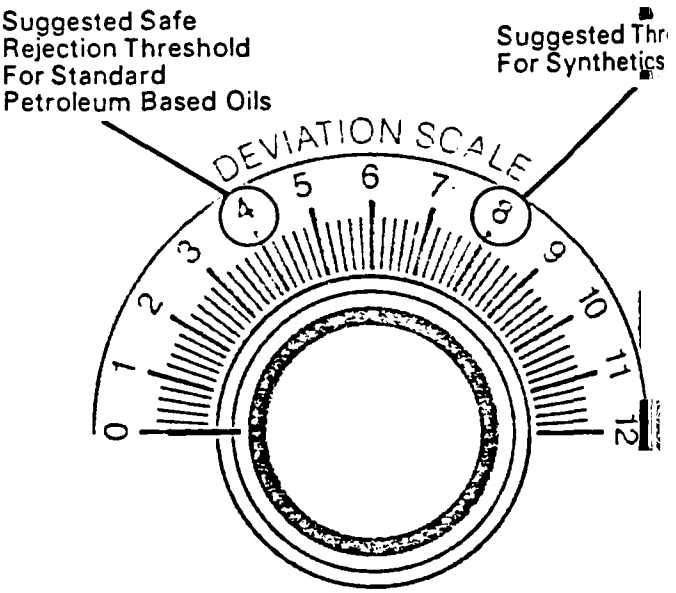
The graph system is particularly valuable in that it highlights minor variations in engine oil performance.

A. Most lubricating applications will show a straight line correlation between mileage (or running hours) and the LUBRI-SENSOR reading, although the slope of the line will not always be the same when an engine uses different makes of the same type of oil. This can be attributed to better grades of oil which oxidize more slowly than lesser grades because of the additives and inhibitors present. On the other hand, a bank of similar engines might treat the same make and grade of lubricating oil differently depending on the particular "health" of each engine.

B. The selection of a safe rejection point is a function of operating conditions and oil type. It has been our customer experience with correlated laboratory tests that a safe rejection threshold for the standard petroleum based multi-viscosity engine oils is "4" on LUBRI-SENSOR's Deviation Scale. However, to determine if this point best fits your particular operating condition and oil type, we recommend coordination with laboratory tests of samples tested on LUBRI-SENSOR.

User tests on synthetic oils have indicated that one can expect a safe rejection threshold between 7.5 to 8.5 on the Deviation Scale.





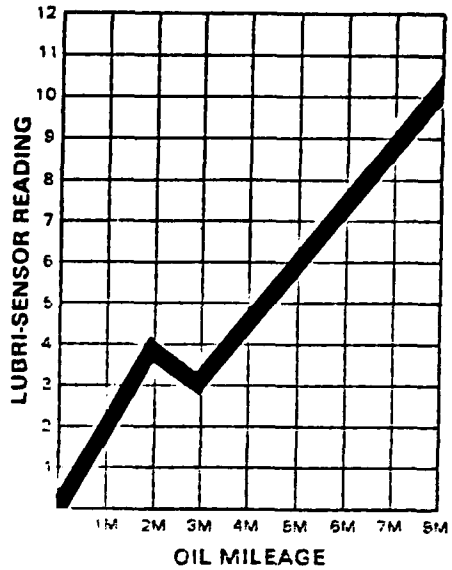
Recording of Results

C. Remember that each time new oil is added, the Deviation Scale reading will show a lower, improved reading in proportion to the amount of oil added. Thus the amount of new oil added between readings should be known and considered in LUBRI-SENSOR readings.

D. Slope changes, either (+) or (−) indicate something unexpected has taken place in the lubrication system and should be investigated by chemical analysis. For example, if new oil was not added between readings and LUBRI-SENSOR shows an unexpected low reading, fuel dilution is to be suspected.

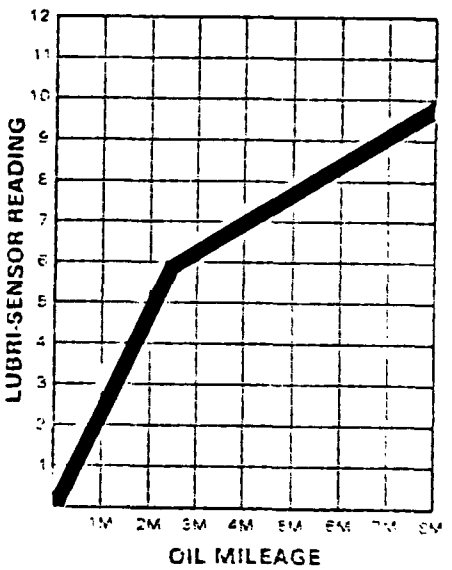
Or, oil filter or air cleaner clogging can result in rapid increases in the dielectric.

Following an oil change, especially with detergent oils, LUBRI-SENSOR readings may be slightly negative for the first approximately 500 miles. Thereafter they will begin to climb in a positive direction. This can be attributed to action of the additives in the new oil.



Other Uses

While the most visible application for LUBRI-SENSOR is engine lubricating oils, there are a number of other applications where the unit could be a help in determining oil quality. Other lubricating applications are: Industrial Machinery, Refrigeration Systems, Transmission and Gear Cases. LUBRI-SENSOR is also effective for non-lubricating applications such as cooling oils and quenching oils.

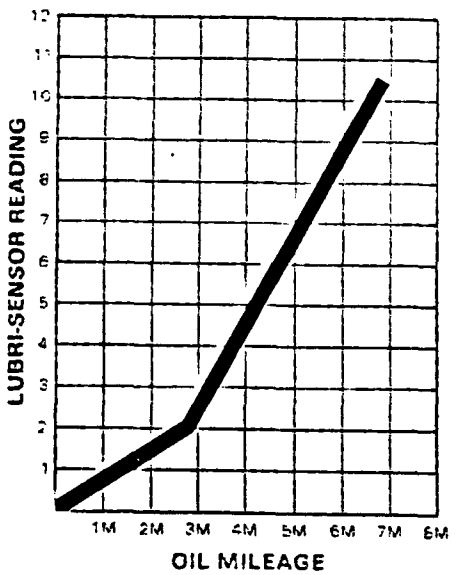


Maintenance

LUBRI-SENSOR requires very little maintenance. Thorough cleaning of the sensor after testing is, of course, a must. If oil is spilled on the instrument's face, it should be wiped off promptly. Should the instrument be dropped or bumped hard, it is advisable to re-check the calibration.

Warranty and Service

LUBRI-SENSOR is warranted against defects in materials and workmanship for a period of one year from date of purchase. All service on LUBRI-SENSOR will be performed at the factory.



LIMITED WARRANTY

NORTHERN INSTRUMENTS CORPORATION, hereafter referred to as NORTHERN, warrants that LUBRISENSOR will be free from defects in parts and workmanship for a period of one year from date of purchase—when used as instructed in the manual furnished with the instrument. This warranty does not extend to instruments which have been subjected to misuse, neglect, or accident. Any attempt to make any adjustments not covered in the manual will void the warranty.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE, ANTICIPATED PROFITS, LOSS OF TIME, CONSEQUENTIAL DAMAGES OR OTHER LOSSES INCURRED BY THE USER IN CONNECTION WITH THE USE OF THIS INSTRUMENT.

NORTHERN's liability under this warranty shall be limited to the repair or replacement of any part or parts thereof which proves, upon NORTHERN's examination, to be defective within the one year warranty period from date of purchase.

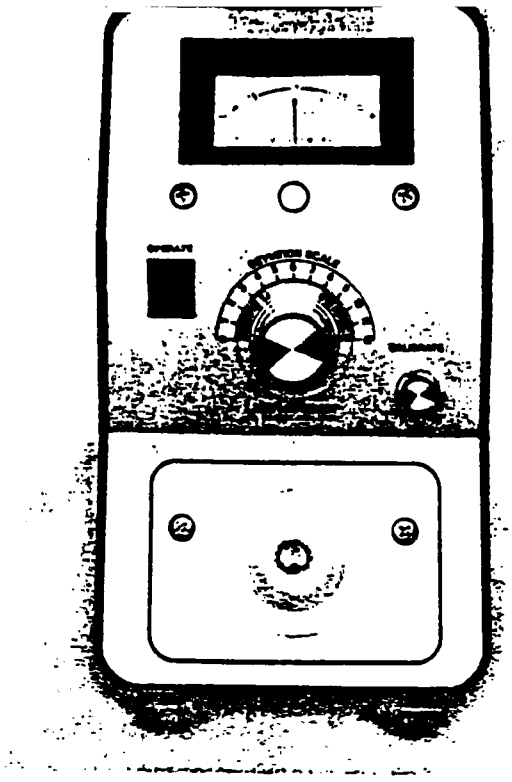
After the one year warranty period, any repairs to the instrument will be charged to the user on the basis of the cost of components and labor required. Repairs are warranted for a 30 day period.

NORTHERN reserves the right to make changes in the design or construction of this instrument at anytime, without incurring any obligation to make any change whatever to units previously sold or delivered.

All service will be performed at the factory. Instruments requiring service must be carefully packed and shipped prepaid to the address noted on back cover.

NORTHERN INSTRUMENTS CORP.
6680 NORTH HIGHWAY 49
LINO LAKES, MINNESOTA 55014

Stamp Here



As oil is used, its physical and electrochemical properties change in direct proportion to the type and amount of contamination present. A property change indicates a **change** in the lubricating capability of the oil. For this reason, it is important to analyze frequently the properties of used oil in relation to unused oil of the same type. One important electrochemical property of oil is its dielectric constant.

"LUBRI-SENSOR" Oil Quality Analyzer, is a portable, low-cost, battery operated electronic instrument, which accurately detects, measures and indicates the total effect of contamination on the dielectric constant of oil. Contamination is usually caused by oil oxidation, water, acids, etc.

Thus, "LUBRI-SENSOR" makes it possible to determine when oil is still usable, permitting longer intervals between changes. Both oil and labor costs can be controlled more easily. Even more important, costly overhauls can be postponed by detection of impending lubrication or mechanical failure.

All this information is available in seconds, without sending samples elsewhere for analysis. And "LUBRI-SENSOR" gives top performance, even with new synthetic oils.

SIMPLE, FAST, PORTABLE

"LUBRI-SENSOR"

TESTS TRUE OIL QUALITY

Now... an instrument to analyze the true quality of lubricating oils, quickly, on-site! Helps you get maximum use from lubricants, engines and equipment... safely extend intervals between oil drains... improve preventive maintenance programs... immediate detection of impending major mechanical failure.

"LUBRI-SENSOR" BENEFITS

■ Helps get maximum use or mileage out of oil. ■ Provides advance warning of potential lubrication failure by detecting excessive oxidation buildup or fuel dilution. ■ Provides advance warning of potential mechanical failure. ■ Cuts "down time" by suggesting action that postpones the need for costly overhauls. ■ Used as screening test limits number of oil samples requiring lab analysis.

"LUBRI-SENSOR" APPLICATIONS

- GASOLINE/DIESEL ENGINES
  Heavy Equipment, Motorized Equipment, Trucks, Aircraft, Boats, Buses.
- TRANSMISSIONS
  Trains, Boats, Manufacturing Equipment, Earth Movers, Bulldozers.
- COMPRESSOR SYSTEMS
  Compressor Lubricants, Commercial Refrigerator and Freezer Units, Air Conditioners.
- HYDRAULIC SYSTEMS
  Detection of Low Levels of Water Contamination in Hydraulic Systems.

ORDERING INFORMATION

MODEL NUMBER	DESCRIPTION
NI-2B	"LUBRI-SENSOR" Oil Quality Analyzer
ACCESSORIES	
Sampuller	Oil Sampler 6 ft. long x 5/32 in. diameter. Teflon tube, suction type.
Sensor Kleen	Non Flammable, No Residue Cleaner for Sensor. Removes all traces of severely contaminated oil samples from Sensor. 3 oz. & 16 oz. sizes.
Carrying Case	Case with Foam Inserts. Holds NI-2B, Sensor Kleen, Oil Sample Bottles and Sampuller.

LubricSensor
OIL QUALITY ANALYZER
MODEL NI-2B

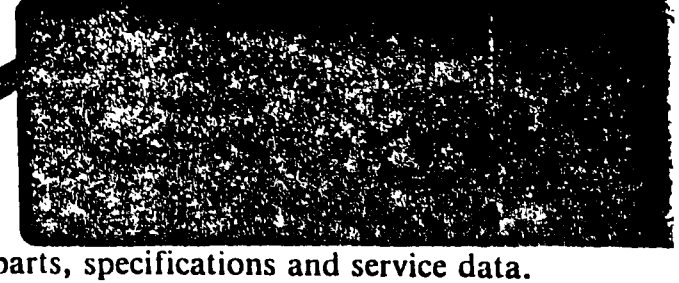
PETROLEUM/HAZARDOUS WASTE MINIMIZATION THROUGH SUPERIOR FILTRATION

SOLVENT/FUEL/ANTIFREEZE
MODEL A-D
HYDRAULIC/OIL MODEL A-H-O
ACID/THINNER MODEL C-P
MOBILE FILTRATION SYSTEMS

Applications

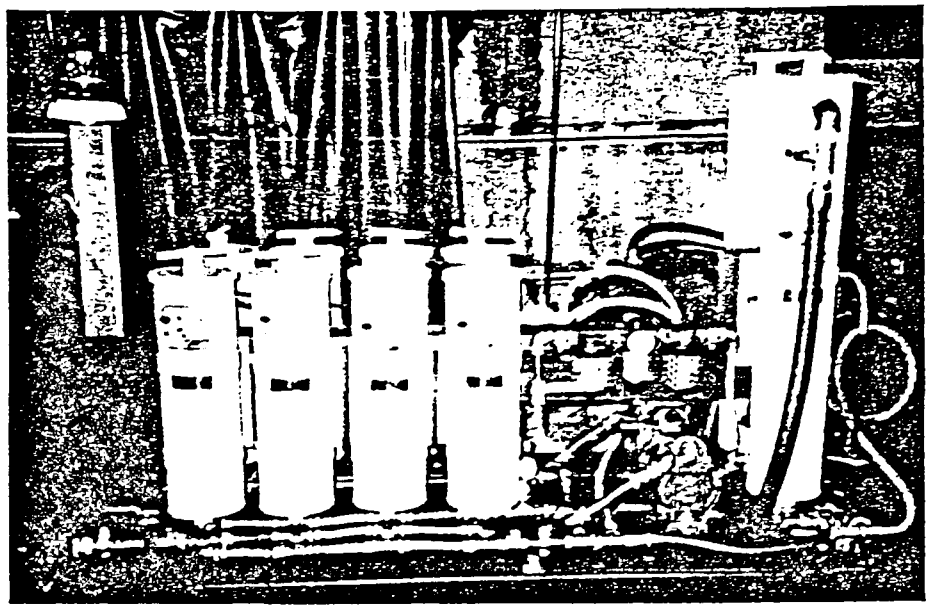
GASOLINE
KEROSENE
DEISEL FUEL
SOLVENT
ACID/THINNER
ANTIFREEZE
MOTOR OIL
HYDRAULIC OIL
INSULATING OIL
TRANSFORMER OIL
TURBINE LUBE OIL
SYNTHETIC OIL
GEAR OIL
CUTTING OIL
MINERAL OIL
WATER

MODEL A-1 & B-1
OIL FILTERS
MODEL A&B
FUEL FILTERS
MODEL D
AIR FILTERS
MODEL E HP
OIL FILTERS
MODEL N1-2B
LUBRI-SENSOR

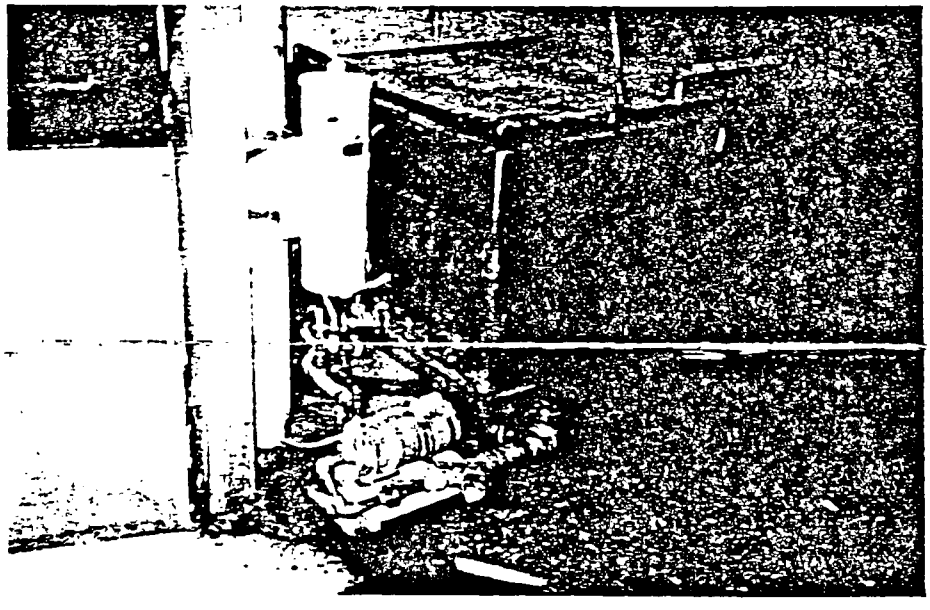


Operation, parts, specifications and service data.

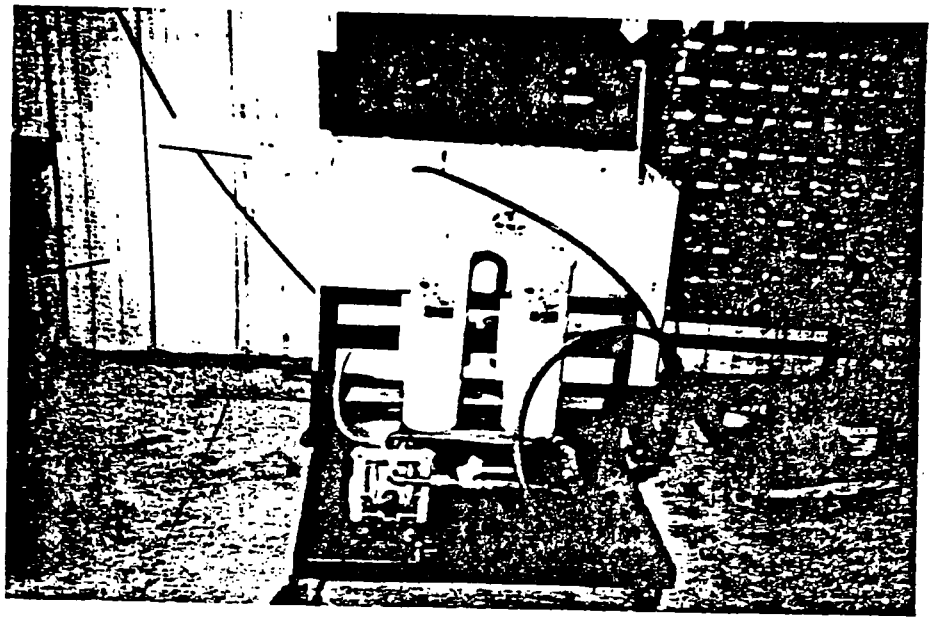
CASH'S FILTRATION TECHNOLOGY
340 EAST 76th AVE.
ANCHORAGE, ALASKA 99518
(907) 349-7649



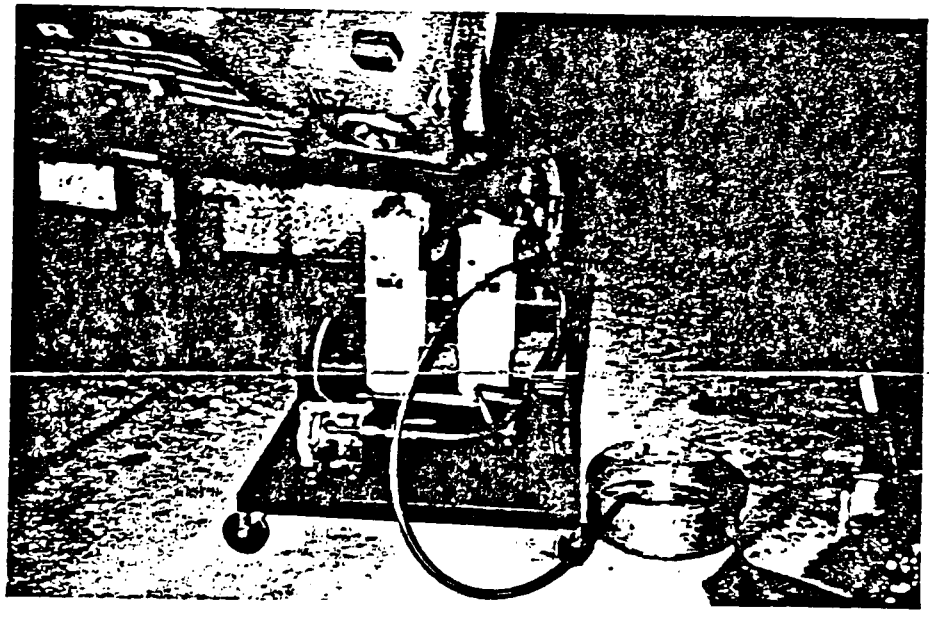
MODEL B1-10
FUELS/OILS



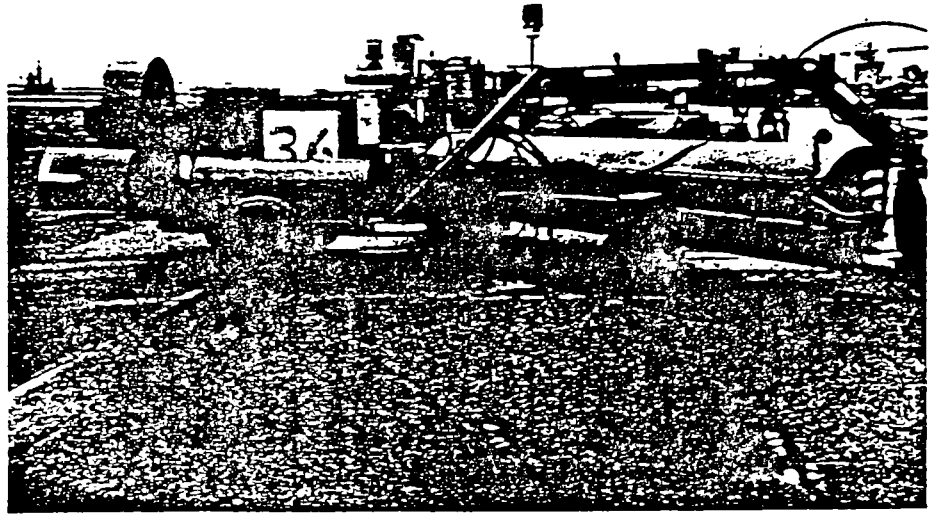
MODEL A
FILTER ON GUNK TANK



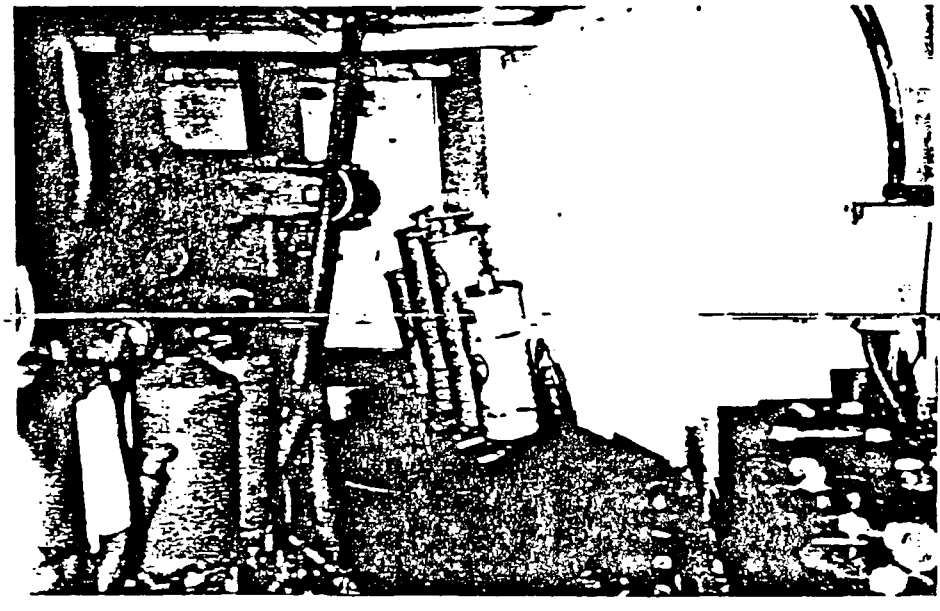
MODEL A-D
SOLVENT/FUEL/ANTIFREEZE



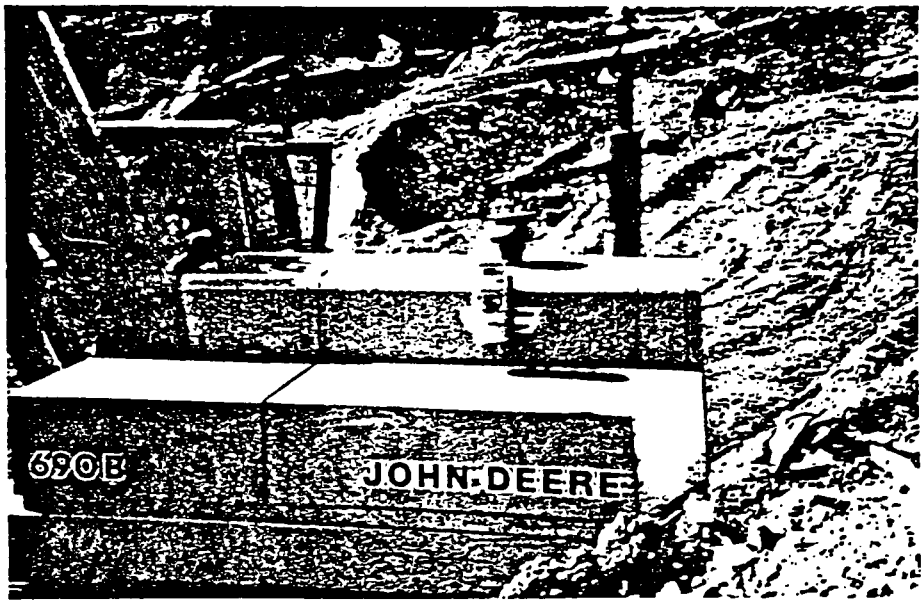
MODEL A-H-O
HYDRAULIC/OIL



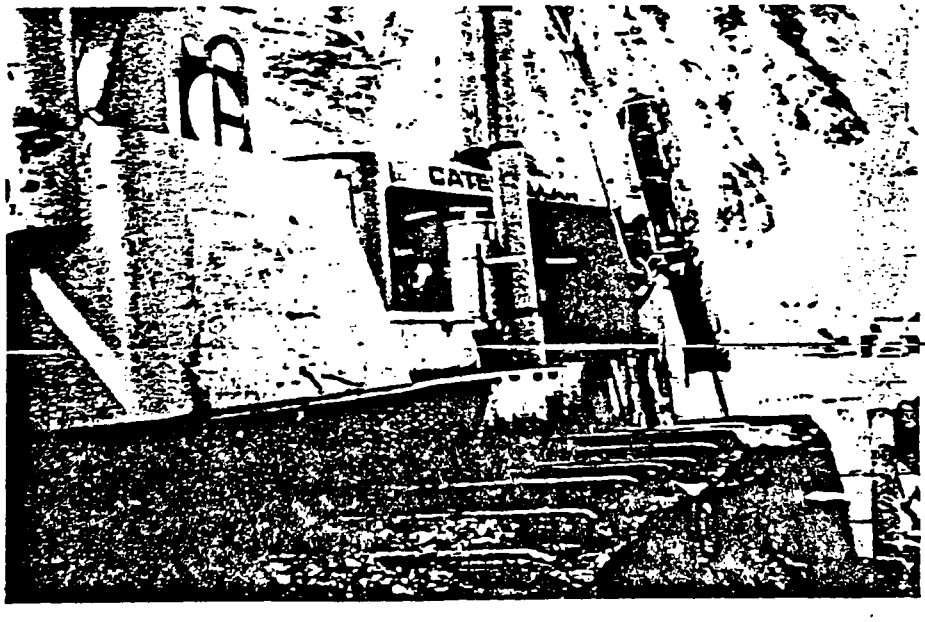
MODEL A-1
ON SNOW BROOM



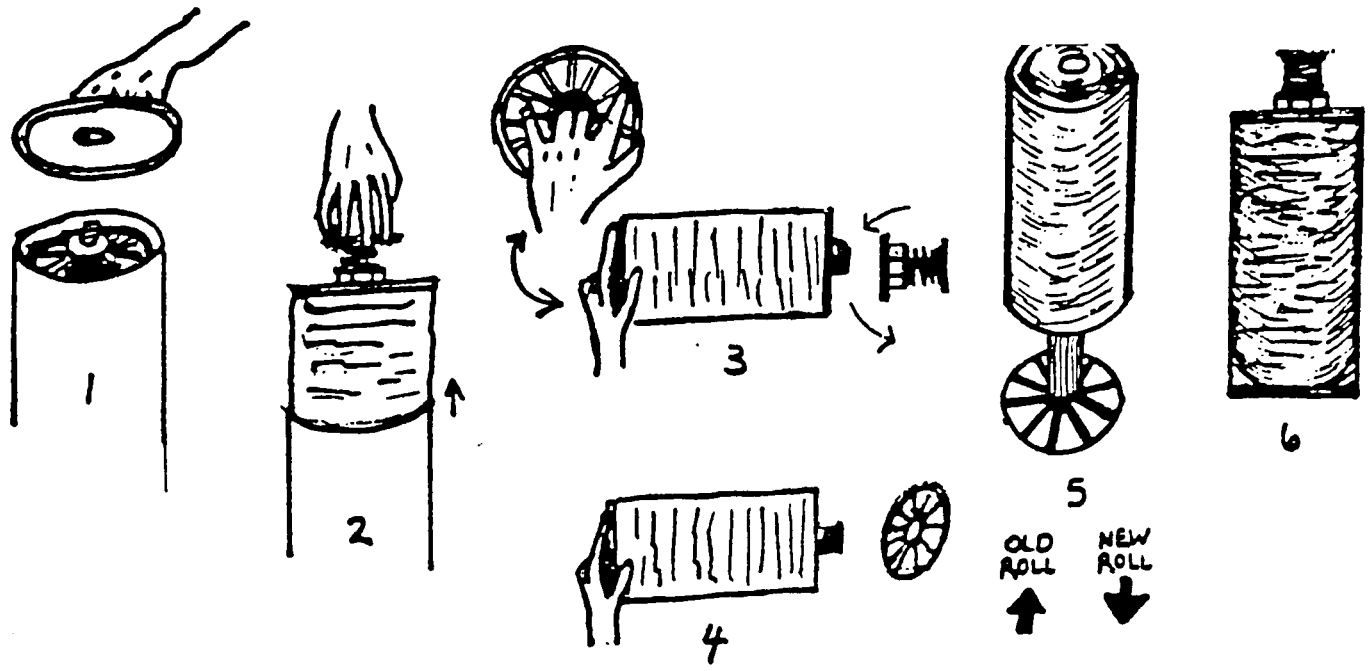
MODEL A-1 AND
MODEL A
ON DREDGE



MODEL A-1
ON 690 B
JOHN DEERE



MODEL A-1
ON D-7 CATERPILLAR



CHANGE INSTRUCTIONS (Fuel)

1. CLOSE Input & Output valves
2. Remove lid (pic. 1)
3. Grasp washer (handle) and slowly lift element assembly from filter.
4. Hold guide positioning plate with two middle fingers inserted into center tube (pic. 3)
5. Grasp washer (handle) and remove Holddown assembly (pic. 3)
6. Remove top guide positioning plate (pic. 4).
7. Remove old roll (pic. 5).
8. Replace new roll (pic. 5).
   NOTE! New roll must be quality 6" OD papertowel such as Bounty.
9. Press top guide positioning plate in place and replace holddown assembly (pic. 6).
10. Slide element assembly back into filter housing.
11. Open draincock and drain contamiants.
12. Close draincock.
13. Slowly fill with clean fuel.
    NOTE! Depending on amount drained from draincock, refill will be 1½ to 2 gallons. It takes 5 to 7 minutes for *all* air bubbles to escape new roll.
14. Replace lid and hand tighten only.
15. Open Input & Output valves.
16. Start engine and insure operation.
    NOTE! If vacuum guage still has a high reading check condition of engine filters and/or remove and clean baffle assembly in bottom of filter housing.

TO REMOVE BAFFLE ASSEMBLY:

Repeat Steps 1, 2 and 3.

Reach down into filter housing and grasp baffle assembly washer under rubber washer. Slowly lift out of filter housing. Clean with air or conventional shop solvents. Insure rubber sealing washer is replaced on top of baffle assembly in filter housing.

Repeat steps 10 thru 16.

CHANGE INSTRUCTIONS (Oil)

1. CLOSE Input valve (if engine running).
2. Remove lid (pic. 1).
3. OPEN draincock on bottom.
4. Grasp washer (handle) and slowly lift element assembly from filter.
5. CLOSE draincock.
6. Hold guide positioning plate with two middle fingers inserted into center tube (pic. 3).
7. Grasp washer (handle) and remove holddown assembly (pic. 3).
8. Remove top positioning guide plate (pic. 4).
9. Remove old roll (pic. 5).
10. Replace new roll (pic. 5).
    NOTE! New roll must be quality 6" OD papertowel such as Bounty.
11. Press top guide positioning plate in place and replace holddown assembly (pic. 6).
12. Slide element assembly back into filter housing.
13. Replace lid and handtighten only.
14. Start engine. OPEN Input valve (if closed). After approximately 5 minutes (if oil is hot) filter will be full.
15. Add approximately 1 gallon make-up oil for filter change.

Most Model A-1 & Model B-1 parts are the same.

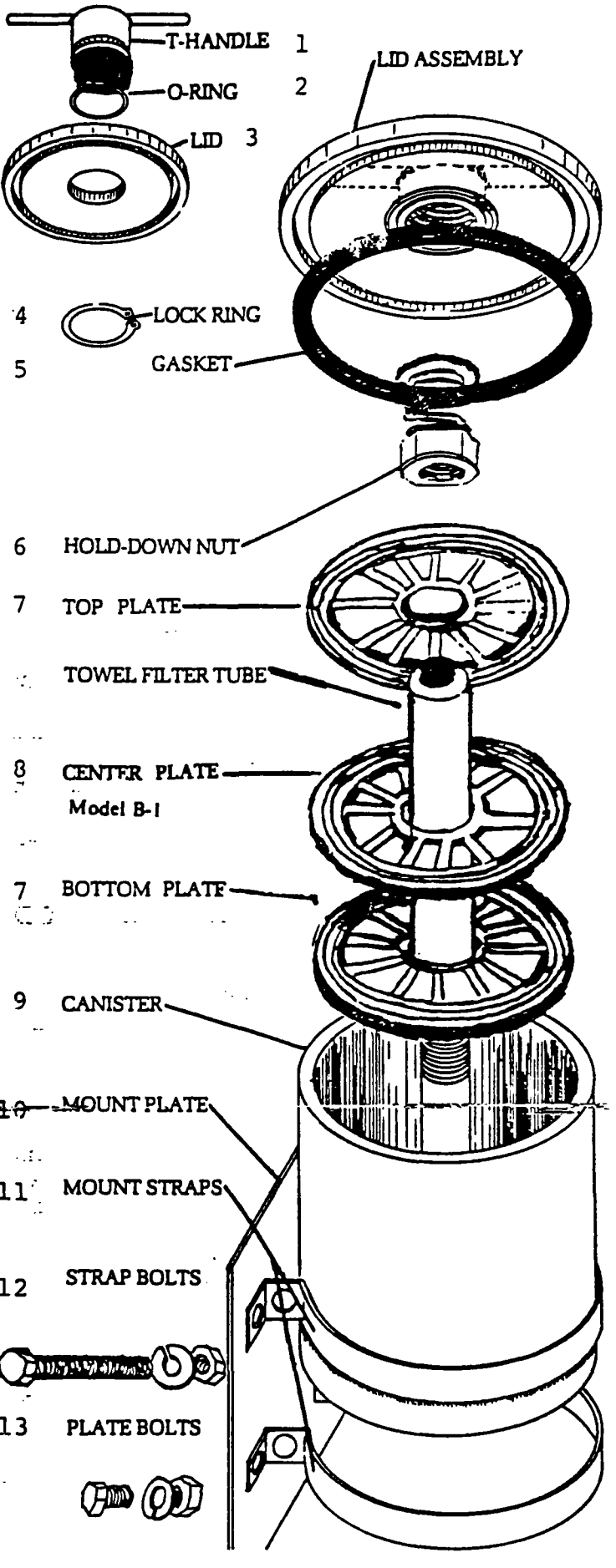
NOTE: Hose and fittings must be purchased separately due to wide variety in mounting possibilities.

PARTS LIST A-1 & B-1

A & B

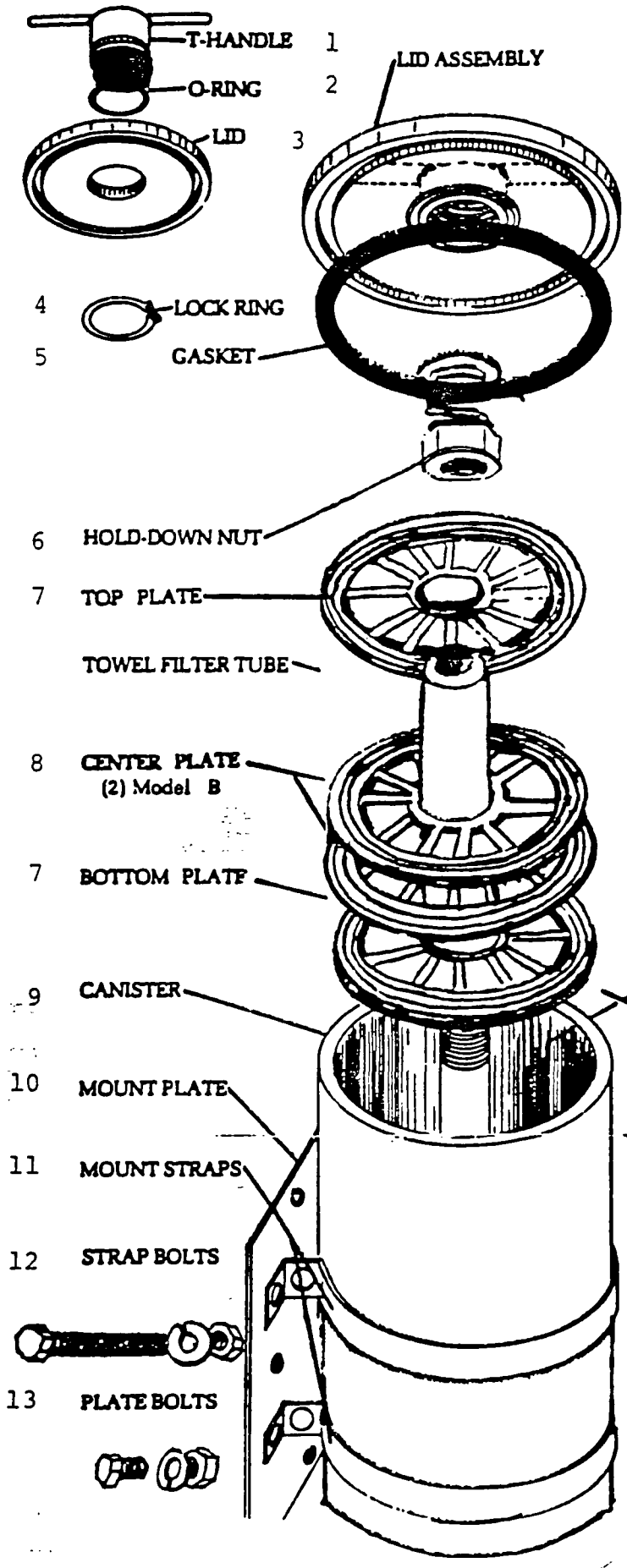
PARTS #	ITEM	QTY	DESCRIPTION
GC1405	1	1	T-Handle
GC1406	2	1	O-Ring
GC1407	3	1	Lid
GC1408	4	1	Lock Ring
GC1409	5	1	Gasket
GC1410	6	1	Hold Down Nut
GC1411	7	2	Plate
GC1412	8	1	Plate Model B-1 & B
GC1413	9	1	Canister
GC1414	10	1	Mount Plate
GC1415	11	2	Mount Straps
GC1416	12	2	Strap Bolts
GC1417	13	4	Plate Bolts
GC1418	14	1	Baffle Model A&B
GC1419	15	1	Baffle Tool
GC1420	16	2	Sealing Washer
GC1421	17	1	Plate & Screws

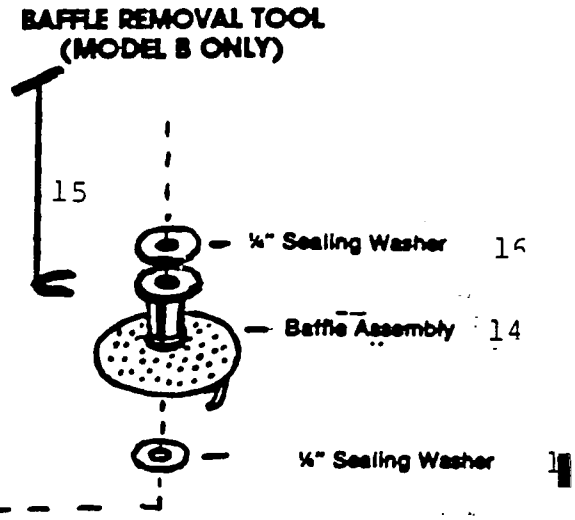
NOTE: ALL PARTS ARE INTERCHANGEABLE FROM THE OIL MODEL A-1 & B-1 TO THE FUEL MODELS A&B EXCEPT THE BAFFLE ASSY.

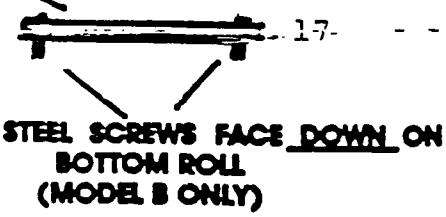


Most Model A & Model B parts are the same.

NOTE: Hose and fittings must be purchased separately due to wide variety in mounting possibilities.







FUEL

WHY SPEND YOUR DOLLARS ON FILTERS THAT WERE DESIGNED FOR THE PROBLEMS OF THE PAST? INSTALL A GCF PAPER TOWEL FUEL FILTER/WATER SEPARATOR AND VIRTUALLY ELIMINATE DOWNTIME AND INJECTOR PROBLEMS DUE TO TODAY'S HEAVILY CONTAMINATED FUEL.

The Problem:
Contaminated FUEL (Diesel or Gasoline)

The Causes:
Storage, condensation, transfer operations, sloppy maintenance procedures, chemical reactions, and other causes.

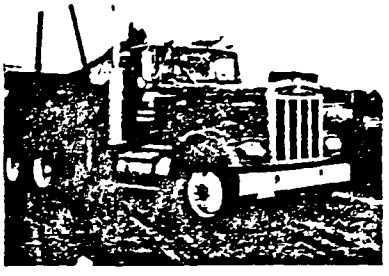
The Result:
Damaged storage tanks, fuel tanks, filters, injector pumps, injectors, and finally, DOWNTIME.

The Solution:
Install a GCF Fuel Filter (single, double, or in banks or 2 or more singles or doubles, depending on volume desired.)

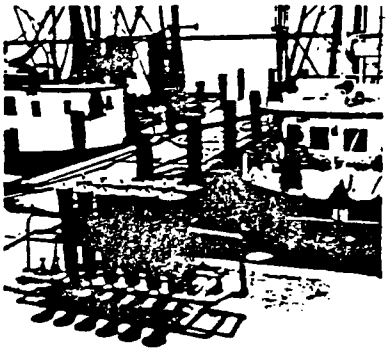
Advantages:

1. First, and foremost, IT WORKS. The GCF Fuel Filter is positively the best buy on the market today. It is simple to install, even more simple to service.
2. The elements are available at more locations than all other Fuel Filter elements combined.* (How many times have you run out of filter elements after the parts houses have closed?)
3. Conventional filter elements (Primary and/or secondary filters presently on your engine) will last indefinitely when the GCF Fuel Filter element is serviced at necessary intervals (at the first loss of RPM or an increase of 3-5" above clean filter reading on vacuum gauge). Clean filter reading on vacuum gauge ideally should be 0" but never over 7" under maximum load. Higher reading than 7" indicates additional filter(s) needed in parallel.
4. Inventory costs are drastically lowered since conventional elements are seldom replaced and since the GCF Fuel Filter element is the same for all engines.
5. Contrary to popular belief, water is not the primary cause of downtime in a diesel engine...it is all of the other contaminants combined. Water can be effectively removed with simple water-traps. The element used in GCF's Fuel Filter not only cleans but "drys" the fuel. Compare any conventional filter element with the element recommended for GCF's Fuel Filter. And there the comparison ends.

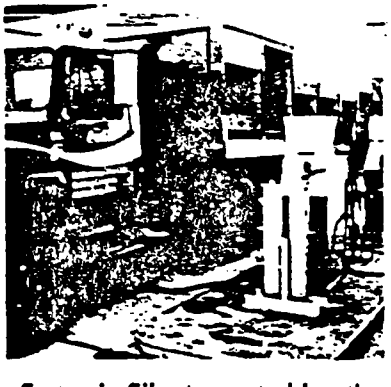
*The element recommended for the GCF Fuel Filter is a large roll of Quality paper towels, available at the nearest supermarket.



Keeping the right amount of products available is of utmost importance to keep customers from turning to other products that did arrive on time. Clean fuel keeps the engine purring at peak efficiency with no injector or pump failures. Its CAT 3406 engine also runs on clean oil thru a GCF paper towel oil filter.



Dennis Dauro, owner of this $140,000 shrimp boat, does not worry about where he buys fuel...he has used paper towel oil and fuel filters for several years. But, when at home, he always fills up at James Murray's Fuel Dock thru this bank of 12 GCF Model "B" double-element fuel filters at 48 gpm at 45 psi. Dennis likes to kid, "Getting clean fuel from James saves my paper towels on the boat."



When your fleet only fills at a central location, it is oftentimes much more cost-effective to place the fuel filters at the pump instead of on each individual piece of equipment. Also is outstanding for service trucks delivering your fuel to remote operating locations. A GCF by-pass oil filter on the tractor insures clean oil and long engine life.

OIL

We can eliminate oil changes and increase engine life

WITH A BY-PASS GCF PAPER TOWEL FILTER AND LABORATORY OIL ANALYSIS.

WHY ADD A BY-PASS OIL FILTER?

To answer this question it is important to review the **full-flow** and **by-pass** filter systems.

In the **full-flow** system, all the oil that lubricates the engine is first pumped through the full-flow filter. Since this amount of oil is quite large, 10 to 20 quarts in a V8 car engine and much more in a large diesel engine, the full-flow must be porous (somewhat like a sieve) so that it will not restrict this large volume of oil.

The advantages of the **full-flow** system are: It protects the bearings and all other moving parts of the engine since the oil has to go through it first. It is especially useful during break-in when close tolerance parts are "wearing-in". By filtering all the oil used in lubricating the precision parts, the larger particles that could seriously damage the engine are removed. EXCEPT: during start-up, if the oil is too cold or thick to readily flow through the filter, the pressure relief valve opens and allows unfiltered oil to lubricate the engine. Also, this valve opens when the full-flow filter becomes clogged. The reason for this is that dirty oil is better than no oil.

In the **by-pass** system, the oil is regulated through the filter in a very small amount and then returns directly to the oil pan. This filtering system filters a small percentage of the oil and refreshes the engine with oil that has passed slowly through a much denser element than the full-flow element. Since it filters at a very slow rate, and it is not responsible for supplying oil for lubrication, it is possible to insert a very dense element that will trap the microscopic particles that grind away the precision moving parts of the engine. With the proper element, it also can remove sluge producing contaminants (mostly water and carbon particles). The disadvantage, of course, is that only a small portion of the oil is filtered at a time. An interesting note is that many industrial engines still come factory equipped with **only** the by-pass filter system.

SO WHAT IS THE ANSWER?

Both! If your engine is equipped with a full-flow filter system leave it intact to do its designed function of protecting the moving parts of the engine. Add a quality GCF by-pass filter to keep the oil CLEAN!

Trucks

Highway Use-Change filter element every 10,000 miles.*
Stop & Go Use-Change filter element every 5,000 miles.*

Stationary or Boat Use

Engine Size (HP)	No. of Filters Required	Change Interval (Hours)
Up to 300.....	1 single.....	100-200
300 to 600	1 double + ...	100-200
600 to 1200	2 doubles +.....	100-200
1200 to 1800	3 doubles +.....	100-200
1800 to 2400	4 doubles +.....	100-200

+ Indicates Model B-1

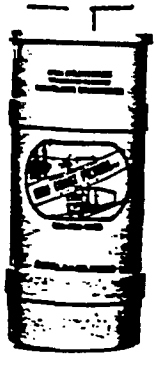
**Routine operation. Other than normal driving conditions require more frequent service. Rule of thumb: large engines require more service than small engines.*

Nov. 9, 1985, INDAL ALUMINUM'S #407 had run 117,275 miles without a single expensive oil change!! Oil analysis confirms the excellent condition of the 400HP CUMMINS engine and the 15W-40 oil. Each 12,000 miles it costs about $14.00 for 2 rolls of Bounty and make-up oil plus 10 min. labor to service the GCF B-1 Oil Filter. (Marvin Matheny, Truck Mgr. (601)863-2852, Gpt., MS)

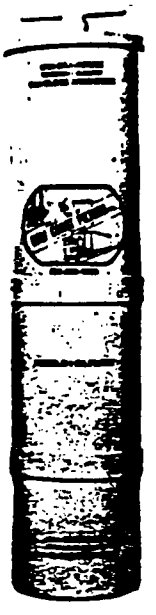
Ed Douglas, Maint. Supt. over 575 engines for John E. Graham & Sons, Morgan City, LA (504) 395-9557, personally inspected this 12V71 Detroit Diesel in the oilfield workboat "CORA G" when one cylinder suffered a hydrostatic lock and bent a connecting rod. The engine was in "new" condition with no visible wear. Only the one cylinder and rod assembly was replaced and the engine put back in service. The oil had not been changed in over 8,000 hours! (August 18, 1983 to February 20, 1985).

Two Mack trucks operated by Pepsi-Cola of Gulfport, Mississippi. Mr. Cleve Allen, owner, calls for a new filter to be installed as soon as a new piece of equipment arrives. He has used paper towel filters since 1976.

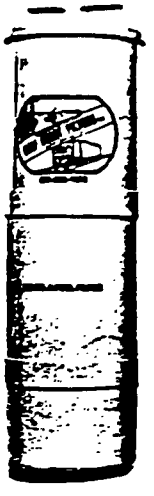
GULF COAST FILTERS, INC. IS LEADING THE FIELD OF FILTRATION TECHNOLOGY.



Model A-1 Single Roll Oil for engines up to 300 Hp.



Model B-1 Double Roll Oil for engines up to 600 Hp.



Model A Fuel Filter/Water Separator, Two GPM Flow Rate.

Preventive Maintenacne through Superior Filtration

The Most Cost Effective Way to Take Care of Your Fleet

CASH'S FILTRATION TECNOLOGY LIMITED WARRANTIES STATEMENT

All products manufactured or distributed by Cash's Filtration are subject to the following, and only the following limited express warranties.

For a period of five (5) years from and after the date of purchase of a new Gulf Coast Filter, Cash's Filtration warrants each GCF filter to be free from defects in workmanship and materials. During this time Cash's Filtration will repair or replace any CGF Filter part(s) proven to be defective in either workmanship or materials. The warranty period for pumps is specifically limited to one (1) year from date of purchase to be free from defects of materials and workmanship in the manufacturing process. A product claimed to be defective must be returned to Cash's Filtration. It is the sole option to either replace the defective product with a comparable new product or repair the defective product. This express warranty shall be inapplicable to any product not properly used, damaged, or impaired by external forces. Cash's Filtration shall have no liability whatsoever for consequential damages flowing from the use of any defective product or by reason of the failure of any product and disavows all warranties and liabilities if the product is not operated in accordance with each product's maintenance and operating instructions.

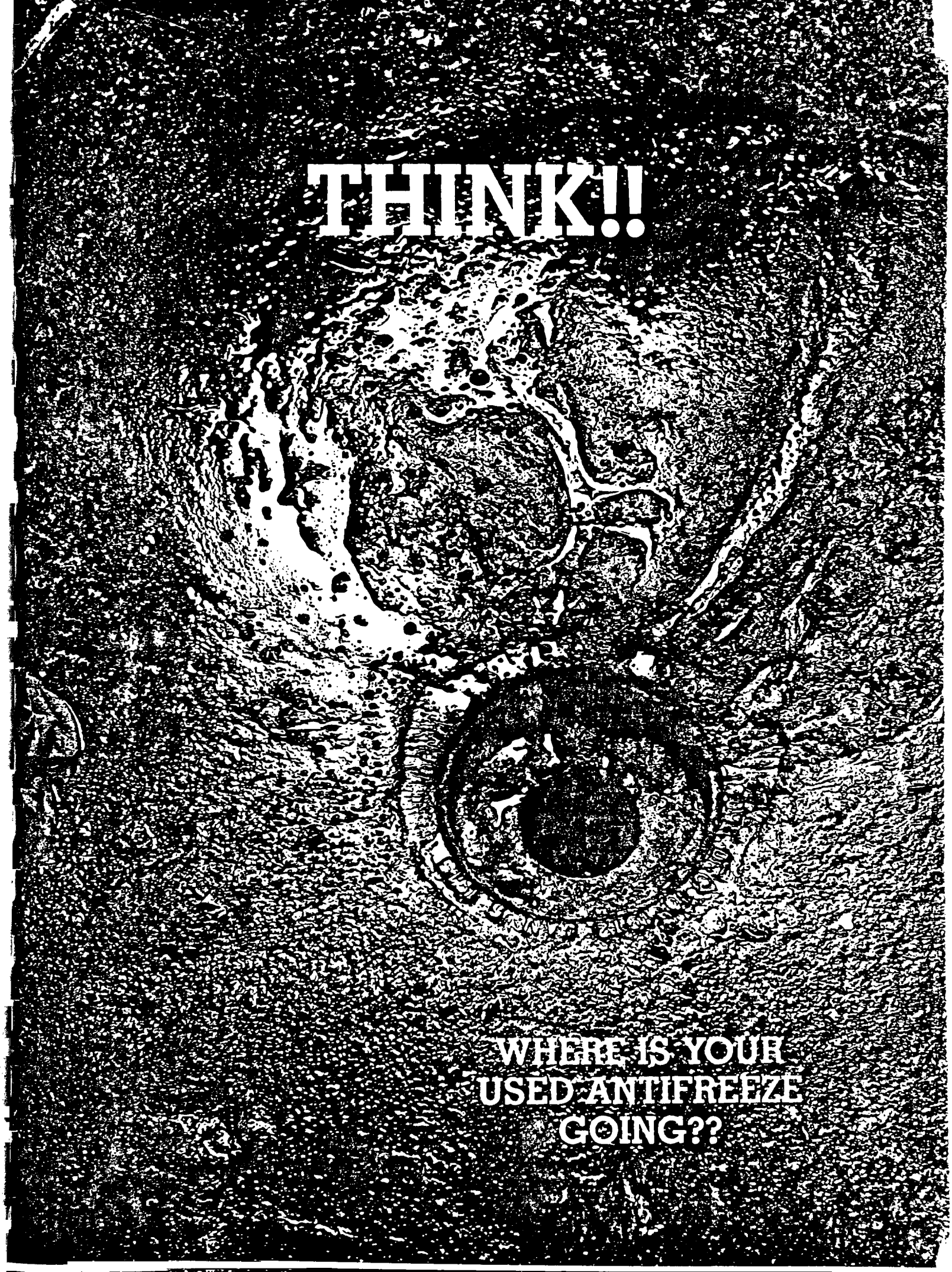
Cash's Filtration Technology
340 E. 76th Ave.
Anchorage, Alaska 99518

APPENDIX F

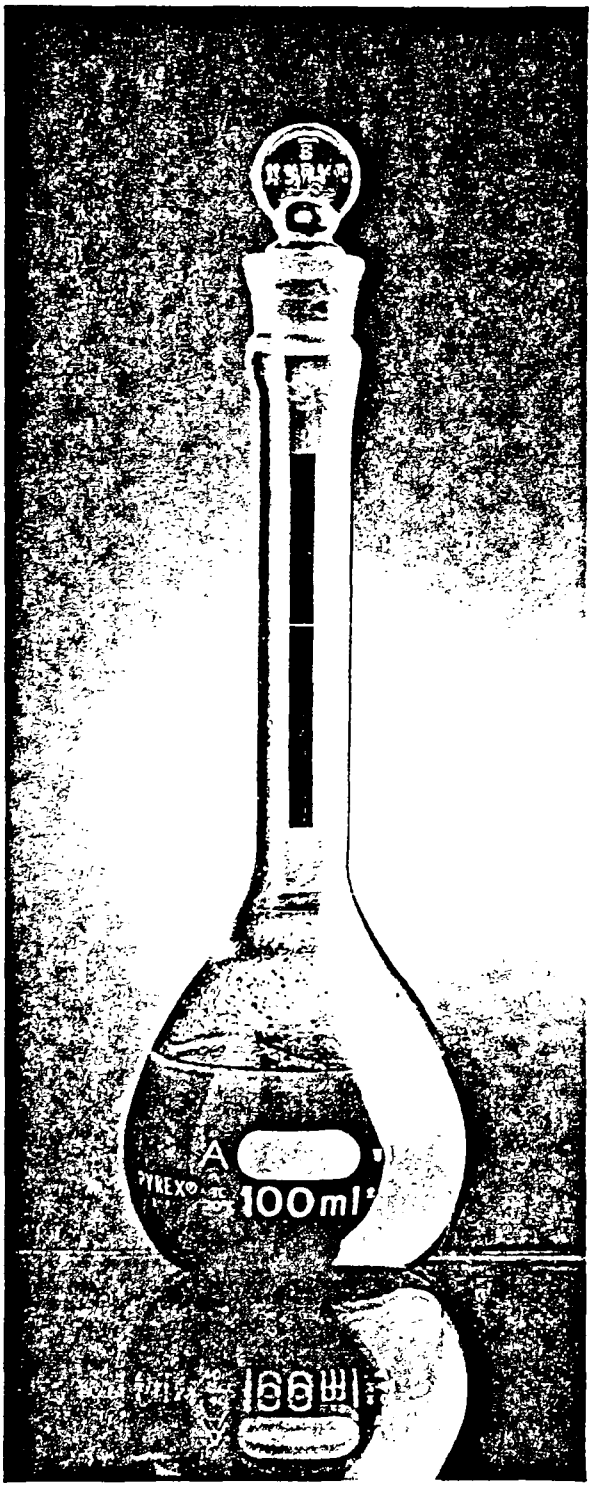
ANTIFREEZE/COOLANT

NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.


THINK!!
WHERE IS YOUR USED ANTIFREEZE GOING??

Environmental damage and the threat of heavy fines create a dilemma...



WHAT CAN THE AUTOMOTIVE REPAIR FACILITY OR THE FLEET OPERATOR DO WITH USED ANTIFREEZE?

Used antifreeze is highly contaminated...

As antifreeze accumulates miles or hours in a vehicle cooling system, it accumulates many different types of contaminants. The most hazardous of these contaminants is lead. However, iron, copper, aluminum, chlorides, sulfates, acids and oils may also be present in used antifreeze. All of these are potentially harmful to people and our environment when disposed of improperly.

Used antifreeze is considered dangerous...

Many state and local governments have labeled used antifreeze as a pollutant or a hazardous waste which cannot be discharged into a sewer or dumped on the ground. These agencies now have regulatory requirements in place which define disposal procedures for pollutants and hazardous waste materials.

Non-compliance can be expensive...

The threat of heavy fines and imprisonment make the disposal problem even more frightening. Improper disposal of contaminated antifreeze can result in fines as high as $25,000.00 per day.

High disposal costs add to the problem...

- Choosing to have your used antifreeze taken to an outside firm for recycling or disposal costs as high as $12.00 per gallon.

Environmental groups add to the pressure...

Environmental groups are becoming a stronger power and demanding government action on environmental issues.

IT'S A CHALLENGE FOR ALL OF US!!

BG Cool'r Clean'r™ Coolant Purification System purifies contaminated coolant...Makes it crystal clear!!

Revolutionary new coolant purification system solves the problem.

The BG Cool'r Clean'r™ Coolant Purification System not only cleans the entire cooling system, it also cleanses the used antifreeze, removes contaminates, and leaves only pure water and ethylene glycol.

BG Cool'r Clean'r™ Coolant Purification System eliminates the need to drain coolant from the vehicle.

Utilizing a closed loop system, the used antifreeze is circulated from the engine through a five step purification process, then returned to the vehicle cooling system.

The system removes impurities, yet retains ethylene glycol...like magic!!

After processing, the fluid which is retained consists only of de-ionized water that is more pure than ordinary tap water, and the purified ethylene glycol that was originally in the coolant.

Conditioners are added as part of the process.

The BG Cool'r Clean'r™ Complet'r Kit adds the necessary conditioners back to the system to inhibit corrosion, prevent foaming, and neutralize acidic contaminants. It protects all cooling system metals including copper, solder, brass, steel, cast iron and aluminum. It is suitable for use in engines utilizing aluminum cylinder heads and water pumps, and it also protects against high lead solder corrosion.

Big benefits for your shop.

- *Reduces the worry, cost and liability of disposal.
- *Provides an easy way to help comply with regulations, and, at the same time, take responsible action to help clean up the environment.
- *Makes cooling systems more efficient and cuts required maintenance.
- *Offers new profit opportunities for service shops; new cost savings for fleet maintenance shops.

BG Cool'r Clean'r™ Coolant Purification System... Complete Cooling System Clean-up Made Easy!!

Designed for durability, maximum efficiency, and ease of operation...

The BG Cool'r Clean'r™ Coolant Purification System is a compact, portable unit which needs minimal training to operate. It is mounted on rubber swivel casters for easy movement between vehicles. It features one switch operation, quick connect and disconnect, and reinforced hoses. Best of all, it is environmentally safe. Even servicing of the BG Cool'r Clean'r™ Coolant Purification System is smooth and uncomplicated.

BG Cool'r Clean'r™ chemicals assure a clean, well-balanced cooling system...

BG Cool'r Clean'r™ Flush (Part #541) is formulated to remove rust, scale, and corrosion by-products from the cooling system. It may be used in both gasoline and diesel engines and is harmless to all cooling system components. It contains no harsh chemicals nor does it require neutralization after using.

BG Cool'r Clean'r™ Complet'r Kit
Automotive: (BG Parts #5502A & 5502B) When used as recommended, this product yields a coolant containing the proper level of inhibitors to protect against rust and corrosion, foaming, and acidic contamination. It protects all cooling system metals including copper, solder (both high and low lead), brass, steel, cast iron, and aluminum. It also protects aluminum cylinder heads from heat transfer corrosion and water pumps from rust and cavitation.

Heavy Duty (BG Parts #5702A & 5702B)
Yields a modern, low-silicate heavy duty coolant, precharged with supplemental coolant additives. Because of the severe operating cycle, long expected engine life, and the use of wet sleeve cylinders, the demands placed on a heavy duty engine coolant are much greater than those placed on an automotive engine coolant. This package addresses the needs of a heavy duty engine by providing complete protection against liner cavitation, erosion, deposit control and foaming.

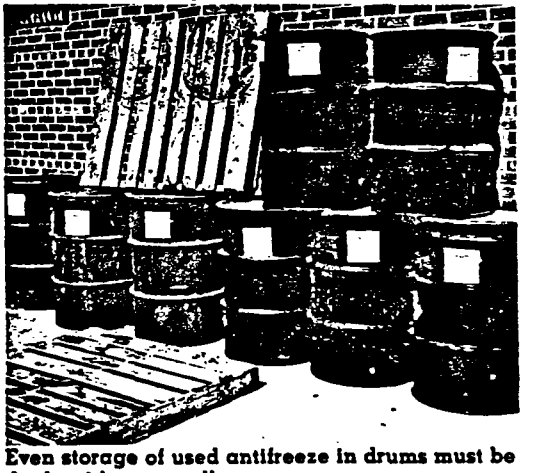
BG Cool'r Clean'r™ Ethylene Glycol (BG Part #556)
This Ethylene Glycol conforms to ASTM E1177, the specification for antifreeze grade ethylene glycol.

YOU CAN'T JUST "THROW IT AWAY" ANYMORE!!

Fleet operators must manage hundreds of gallons of used antifreeze each year...

Pouring contaminated antifreeze down the drain can result in stiff penalties...

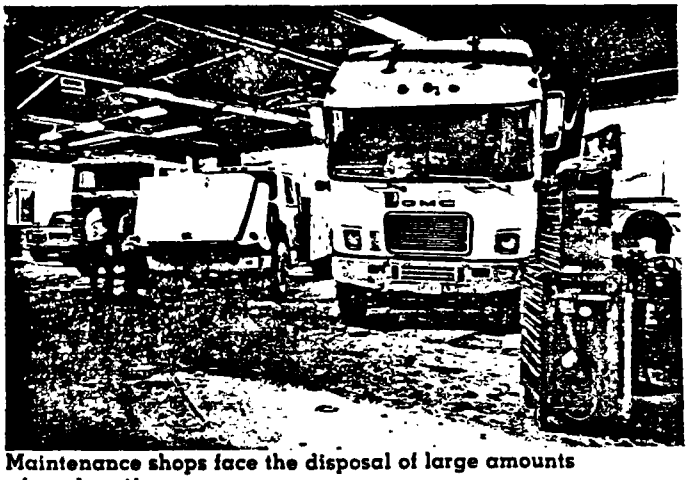
Putting contaminated antifreeze in the trash is strictly prohibited...



Even storage of used antifreeze in drums must be dealt with eventually...

COMPLETE
OOLING SYSTEM
SERVICES

Service shops are especially vulnerable to enforcement of hazardous waste laws. . .



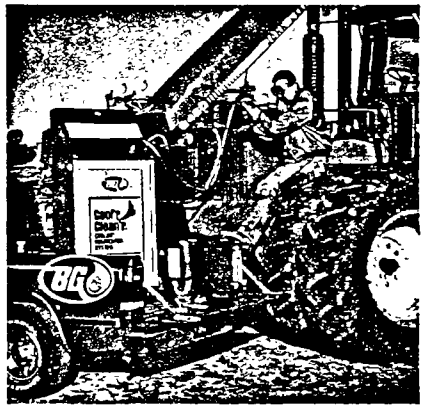
Maintenance shops face the disposal of large amounts of used antifreeze...

BG Cool'r Clean'r™ Coolant Purification System provides top performance in a variety of applications...

Portability and rugged construction allow the BG Cool'r Clean'r™ Coolant Purification System to work as well in the field as it does in the shop.

Service shops can use the system with complete confidence knowing that they are providing the best service available.

Fleet maintenance is made simple with the use of the system. Portability allows it to move easily from vehicle to vehicle.



Field Service can be provided easily and quickly from the back of a service vehicle.

Bulk purifying can also be accomplished. Simply place the inlet hose of the system into the drum or tank of used antifreeze and the outlet hose into the clean drum or tank. Then purify following the same easy instructions.

Laboratory and field tested to assure reliable performance...

This unique system has been tested extensively, both in the laboratory to prove its capabilities, and in the field to ensure performance under "real world" conditions. The system has been found to be capable of:

1. Removing spent additives and oil.
2. Removing corrosion by-products such as iron and lead.
3. Removing contaminants from water such as hardness (calcium and magnesium), chlorides, and sulphates.
4. Removing glycol oxidation products (low molecular weight organic acids).
5. Removing dissolved solids down to extremely low levels (< 150 mg/l).
6. Producing antifreeze meeting the general/performance requirements of ASTM D3306.
7. Providing balanced pH and freeze protection.

BG No.1810

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Litho in U.S.A.

9165

DRAVIS DISTRIBUTING INC.
6924 WEST 27th ST. 564-1020
TACOMA, WA 98466

BG Products, Inc.
MAILING ADDRESS - P.O.BOX 1282 • WICHITA, KS 67201
SHIPPING ADDRESS - 701 S. WICHITA • WICHITA, KS 67213
Phone: (316) 265-2686
Fax No.: (316) 265-1082

From the BG Products Laboratory

Total Dissolved Solids

By Rob Richardson, Lab Manager

Total Dissolved Solids (TDS) is a term of importance concerning the issue of recycling antifreeze. TDS is a measure (usually in parts per million, or ppm) of the amount of dissolved or ionic species in coolants. The greatest contributor to TDS is the additives dissolved in the coolant to protect against corrosion.

Normal levels in new coolants range from 5,000 to 20,000 ppm. Normal levels in used coolants range from 5,000 to 30,000. TDS levels beyond 30,000 have been known to aggravate water pump failure through face seal leakage. Additives can also come out of solution to clog cooling systems and plate out on internal components, thus reducing heat transfer.

There will likely be a TDS limit set for recycled coolants when an ASTM specification is drafted. That spells "good news" for our patent-pending BG Cool'r Clean'r ™ Coolant Purification System because it reduces TDS levels below 150 ppm each and every time the coolant is processed. Other systems actually increase TDS with the addition of concentrated inhibitor packages after recycling and may reach the TDS limit after only one or two services.

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SHIPPING ADDRESS - 701 S. WICHITA • WICHITA, KS 67213
Phone: (316) 265-2686
Fax No.: (316) 265-1082

RECYCLING vs PURIFYING ANTIFREEZE

COMPARATIVE TEST DATA

Five Types of Processing

	Simple Filtration BEFORE	(AFTER)	Filtration Through Celite BEFORE	(AFTER)	Flash Distillation BEFORE	(AFTER)	Simple Distillation BEFORE	(AFTER)	BG Cool'r Clean'r ™ Coola Purification Syst BEFORE	(AFTER)
Contaminants, ppm:										
Iron	10	(3)	0	(0)	0	(0)	0	(0)	13	(1)
Lead	4	(0)	0	(0)	12	(1)	12	(0)	7	(0)
Copper	2	(0)	0	(0)	21	(2)	21	(0)	7	(0)
Aluminum	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
Additives, % WT.:										
Sodium	.22	(.22)	.04	(.03)	.25	(.08)	.25	(.01)	.50	(.00)
" Metasilicate	.07	(.07)	.02	(.01)	.03	(.01)	.03	(.00)	.04	(.00)
" Tetraborate	.84	(.84)	.74	(.50)	1.85	(.29)	1.85	(.06)	.50	(.00)
" O-Phosphate	1.35	(1.35)	.15	(.10)	1.63	(.23)	1.63	(.02)	2.61	(.00)
" Molybdate	.00	(.00)	.00	(.00)	.00	(.00)	.00	(.00)	.00	(.00)
" Nitrite	.00	(.00)	.00	(.00)	.00	(.00)	.00	(.00)	.00	(.00)
Potassium	.00	(.00)	.00	(.00)	.07	(.00)	.07	(.00)	.13	(.00)
Other Properties:										
PH	10.2	(9.8)	2.8	(3.0)	7.8	(7.9)	7.8	(7.5)	8.2	(6.2)
Reserve Alkalinity	6.0	(6.0)	0.0	(0.0)	5.0	(0.0)	5.0	(0.0)	9.0	(0.0)
Glycols, %WT.	49.0	(47.0)	56.0	(49.0)	54.0	(45.0)	54.0	(45.0)	65.0	(65.0)

HYDE
Since 1865 PRODUCTS INC.

Guardian™

Coolant Recycling System

The Effective Solution to Coolant Maintenance Problems – Reduces Coolant Waste Up to 90%.

The Hyde Guardian is the acknowledged, economical solution to the high costs associated with maintaining water based coolants and washwaters in the metalworking industry. The Hyde system recycles used coolants and washwaters, reducing waste fluids by 50% to 90% and eliminating concerns about manifesting and compliance with federal RCRA requirements and state and local discharge regulations.

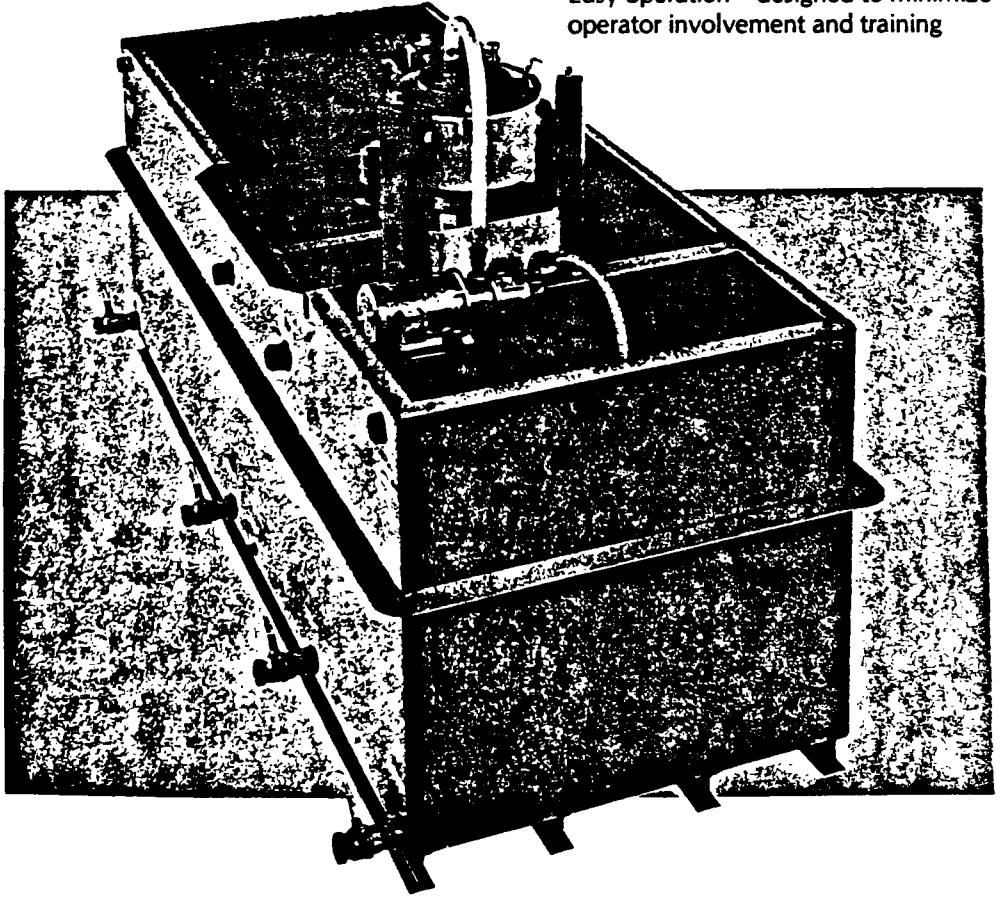
Everything you need for coolant recycling is included with the Guardian. Each turnkey system is designed for easy installation, quick start-up and simple, efficient operation. Hyde backs every Guardian with single-source product responsibility.

Features

- Removes free floating, dispersed and mechanically emulsified tramp-oils to ⅒% or less
- Integrated coolant make-up system replaces coolant lost due to evaporation or drag out with properly proportioned coolant mix
- Removes majority of suspended solids
- Separated tramp-oils can be sold or recycled
- Standard systems will process up to 600 gallons per hour. Larger and custom designed systems are available

Benefits

- Reduces new fluid purchase cost by 45% to 75%
- Reduces hazardous waste disposal cost by 50% to 90%
- System pay back is typically 6-9 months
- Easy operation - designed to minimize operator involvement and training

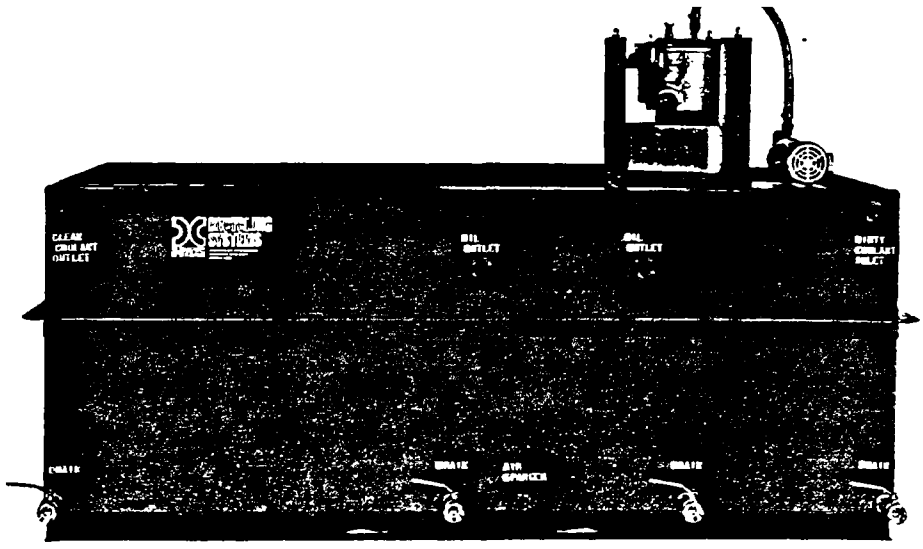


Guardian – The Proven Coolant Recycling System

The Hyde Guardian Coolant Recycling System is a proven fluid management tool for plants with individual coolant or wastewater reservoirs.

The Guardian uses a topped-off batch type process to recondition metalworking coolants commonly used in individual machine tools. It is equally effective for washing compounds and other water soluble mixtures where tramp-oils and suspended solids detract from performance. This highly versatile product incorporates Hyde's proven tramp-oil separator, which has provided years of trouble free performance to hundreds of metalworking plants.

The Guardian provides a central fluid collection point for tramp-oil and suspended solids removal, bacteria control and fluid concentration adjustment. A divided tank is used to process the used coolant. The inlet (dirty coolant) compartment allows settling and removal of suspended solids and the second (clean coolant) compartment holds the clarified coolant. Three principles - gravity settling, filtration and coalescence - are used to attain exceptional clarification of the coolant. A floating skimmer in the inlet compartment assures surface "pick-up" of free floating tramp-oils and any undesirable rag or cream layer. A bag filter assembly is used to remove suspended solids and the integral tramp-oil separator, using Hyde's unique gravity coalescence principle, removes free floating, dispersed and loosely emulsified tramp-oils from the coolant to as little as 1/10% by volume.

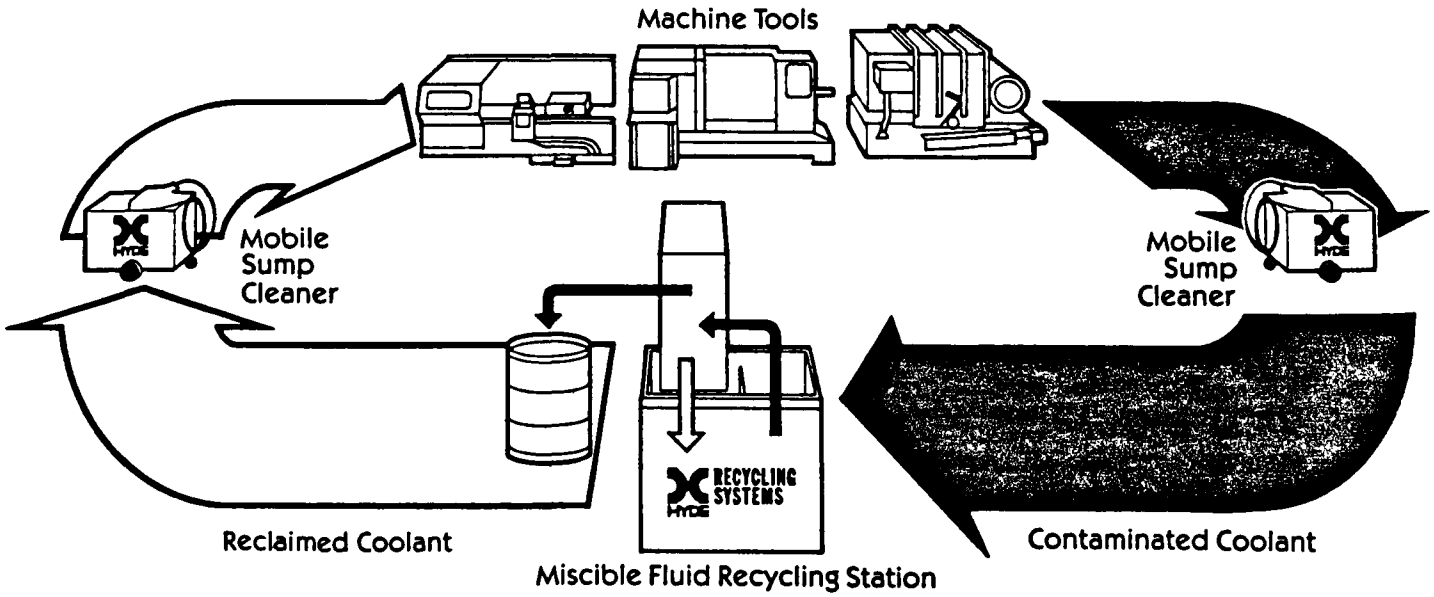


The separated tramp-oil is discharged automatically directly into a drum, while the clarified coolant flows by gravity from the separator into the clean compartment. A unique advantage of the Guardian recycling system is that the clarified and refortified coolant continually overflows to the inlet compartment for further clarification. This feature provides continuous mixing of the clarified coolant, prevents rancidity and assures a continuous volume of clean coolant ready for use on your machines.

The Hyde Guardian recycling system is supplied in start-up condition, needing only electrical power, make-up water for the coolant proportionator, and a ¾" plant air supply connection. All Guardian units are constructed of coated steel and other high grade materials, fully suitable for rugged industrial applications.

Custom Engineering

Hyde also provides custom engineering including: tailored capacities, additional tankage, pre- and post-filtration, and temperature control.



Miscible Fluid Recycling Station

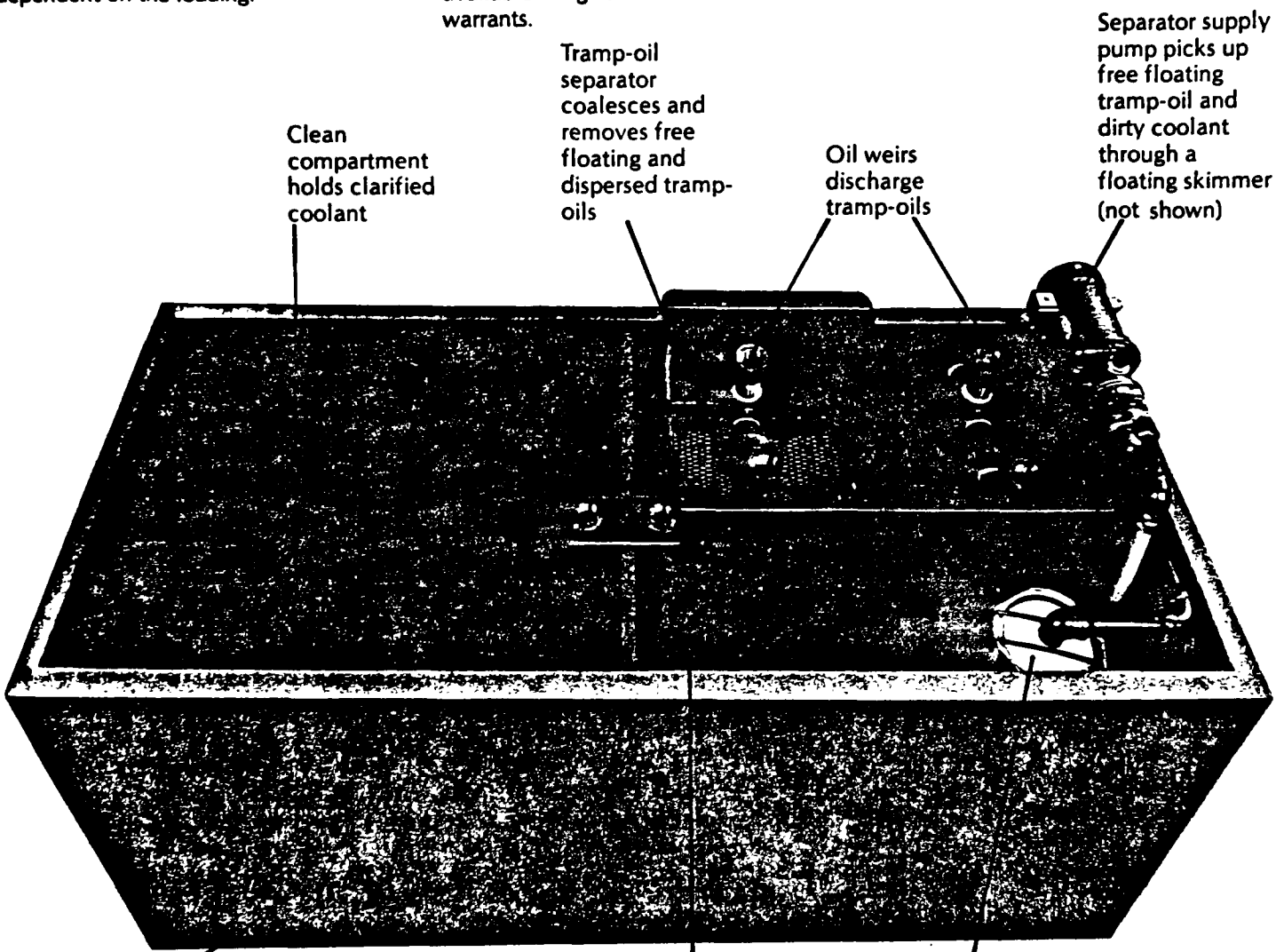
Simple to Maintain

The Guardian is furnished with an air sparger to remove settleable sludges from the tramp-oil separator. 2 SCFM of plant air at 5 PSIG is all that is required to purge the unit of solids and sludges. The cleaning cycle takes about 10 minutes once every 90 to 120 days. Replacement of the solids removal unit element is required only infrequently dependent on the loading.

Featured Options

A **Hyde Filtrafuge™** is recommended when cast iron or other metallic fines from grinding and other sources contaminate miscible fluids. High clarity (2 micron, if required) is attained by the Filtrafuge's diffuser action design. Downtime for change outs is minimal due to the simplified dumping feature. Semi to fully automatic Filtrafuges are available if high solids contamination warrants.

The **Hyde Miscible Fluid Return System** is available when a convenient source of make-up fluid is required closer to the machines. Systems include a ½ HP jet pump mounted on a horizontal 30 gallon coolant tank, air volume control, pressure gauge, ejector and foot valve.



Models & Specifications

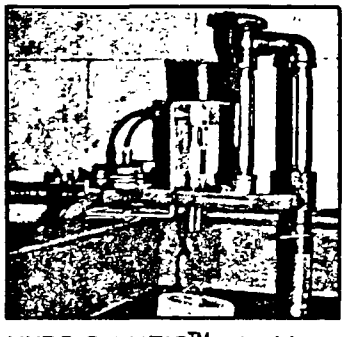
Model	Processing Rate Gallons Per Hour	Dirty/Clean Tank Capacity (Gallons)	Length	Width	Height
HG400	300	200/200	81	44	48
HG400F	300	200/200	81	44	72
HG400CRS	300	200/200	81	44	78
HG400FCRS	300	200/200	81	44	78
HG800	600	400/400	120	48	48
HG800F	600	400/400	120	48	72
HG800CRS	600	400/400	120	48	78
HG800FCRS	600	400/400	120	48	78

F = Filtrafuge CRS = Coolant Return System

Sample	Tramp Oil %	T.S.S. PPM	Coolant Ratio
From Machine Sump	8%-18%	High	1:8-1:15
Sump Cleaner Discharge	8%-18%	3000-7200	1:8-1:15
Guardian Inlet Tank	8%-18%	3000-7200	1:8-1:15
Guardian Clean Tank	<0.10%	60-176	1:20*

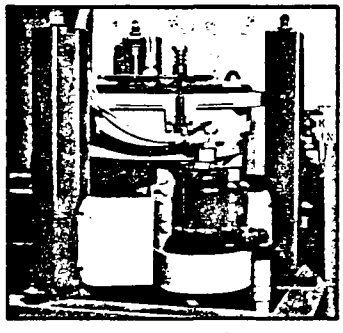
The results are from typical Hyde "GUARDIAN" Systems installed on cast iron grinding and high grade steel machining application.
*Desired coolant concentration - 1:20.

Auxiliary Equipment

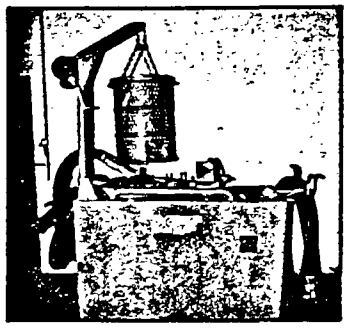


HYDE-O-MATIC™ Miscible Fluid Proportionator is an automatic device that blends miscible fluid concentrates and water into properly mixed fluids.

It is easily attached to existing Miscible Fluid Recycling Stations. Flow rates are available from 4 to 14 GPM. They also may be used on central systems and a number of other proven applications.



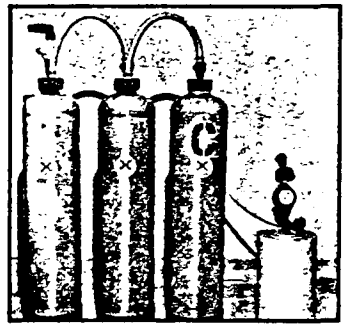
HYDE FILTRAFUGE™ The precision-balanced, vibration-free unit may be equipped to generate gravity forces from 500 to over 2000G's depending on the application. Downtime for changeouts is minimal due to simplified dumping procedures. Semi and fully automatic Filtrafuges are available if solids contamination warrants.



HYDE MOBILE SUMP CLEANER is a powerful, easy to maneuver vacuum filtration unit which incorporates the latest labor-saving features. It quickly removes contaminated cutting fluids, chips and swarf at flow rates up to 100 GPM. A complete range of filters is available to meet specific requirements.

A unique and useful option is the chip basket hoist.

Single and split tank units are available in 80 to 600 gallon capacities. Units are available with electric, LP gas or air power.

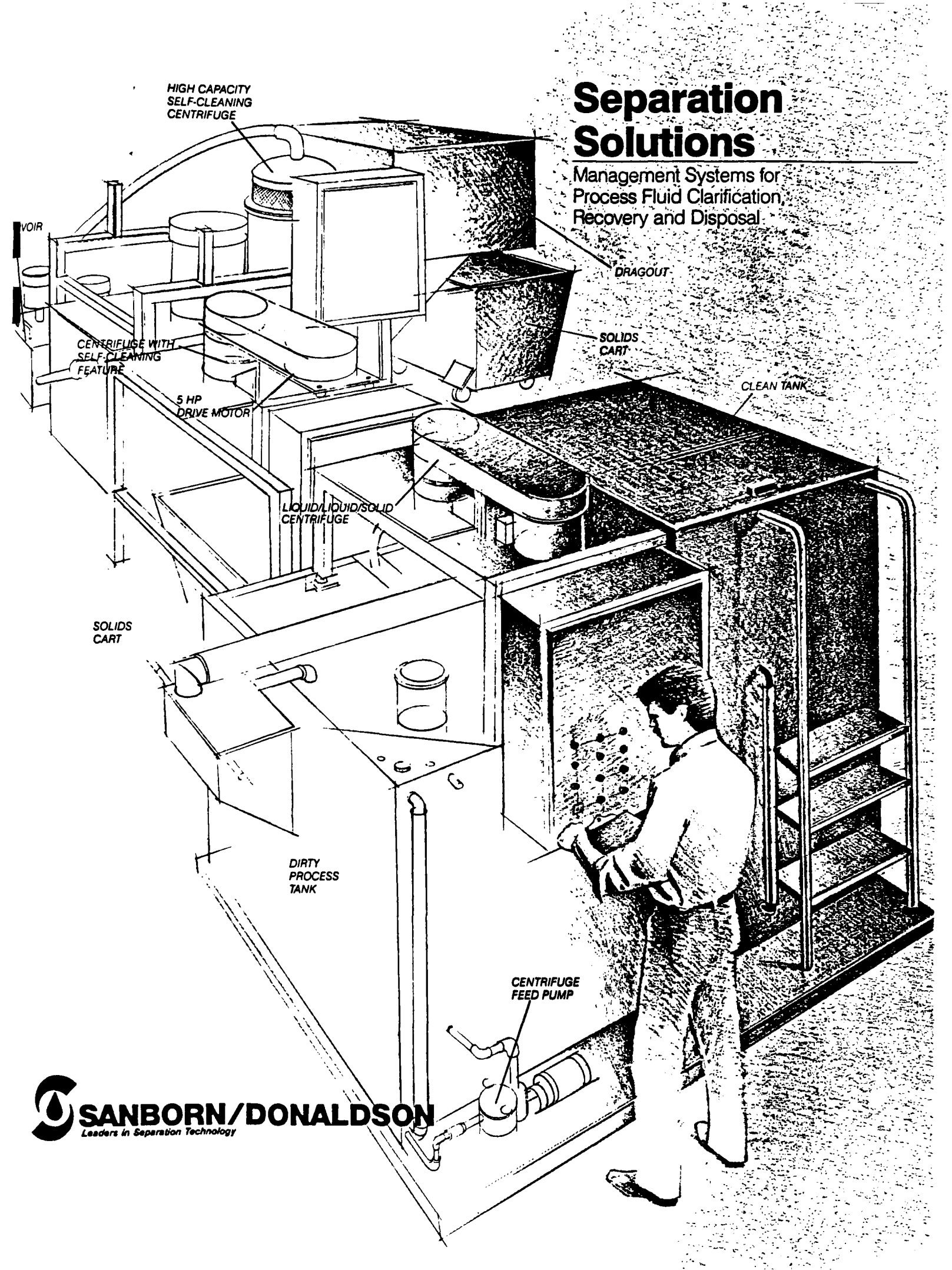


HYDE DEIONIZERS are recommended when the dissolved minerals in the make-up water are high enough to shorten the useful life of the miscible fluid. These products utilize the ion exchange method to yield chemically pure water for coolants, washwater and other solutions.

A full range of deionizers are available from mixed-bed single-cylinder rechargeable types for small requirements, up to fully automatic separate bed regenerating models for larger plants.

HYDE PRODUCTS INC.
Since 1865

HYDE PRODUCTS, INC.
28045 Ranney Parkway
Cleveland, Ohio 44145
(216) 871-4885
TLX 212568
FAX (216) 871-1143



Separation Solutions

Management Systems for Process Fluid Clarification, Recovery and Disposal

SANBORN/DONALDSON

Leaders in Separation Technology

Coolant Recovery and Disposal Systems

CAR 100

Coolant Recovery Disposal System

Utilizing the patented LLSC Centrifuge, this system is totally automatic. It can be used for continuous or "topped-off" batch processing and has all the features that you would expect to find in a state of the art product.

Features of the CAR 100 Include:

- New Self-Cleaning LLSC Centrifuge
- Continuous or Batch Operation
- Removes Tramp Oil as well as Solids
- Can be used with Membrane System for Coolant Disposal
- Programmable Logic Controller
- Positive Displacement Proportional Mixer for Automatic Makeup

Options:

- Solids Dragout
- Venturi/Siphon Type Proportional Mixers
- Pasteurizer
- De-Ionizer Stand
- Biocide Metering Pump
- Air Compressor
- Surface Skimming Devices
- Plus custom designed options for individual systems

CAR 50

Coolant Recovery System

The CAR 50 is a downsized version of the CAR 100. It utilizes the smaller LLSC JR self-cleaning centrifuge for lower volume operations. It has many of the features of the CAR 100.

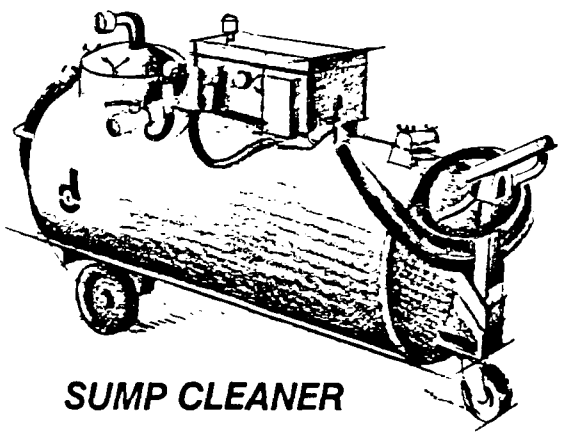
CAR 10

Self-Cleaning Liquid/Solid Coolant Filtration System

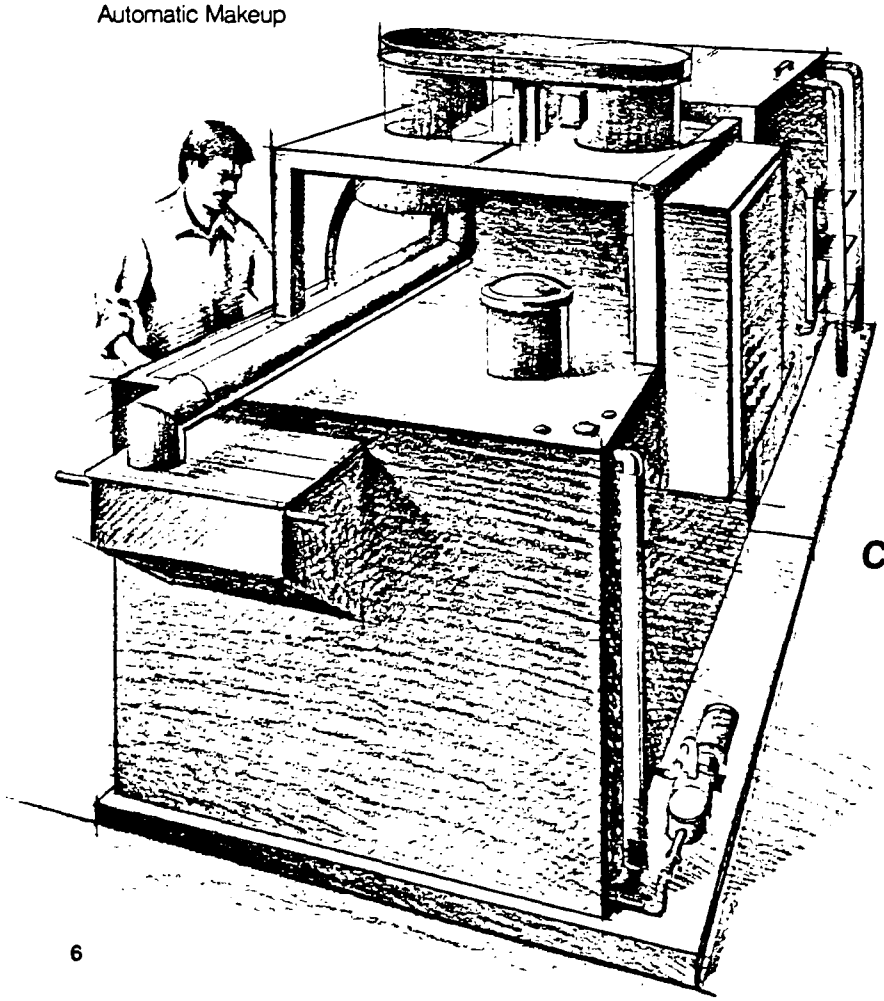
The CAR 10 is the smallest of the CAR family. It is a setting system with a solids dragout and oil skimmer designed for low volume batch type coolant recovery.

Portable Sump Cleaners

Sanborn/Donaldson Sump Cleaners can be configured for any operation. They are available with electric, air or L.P. gas power. High suction and flow rates are available in machines from 90 gallon single compartment, up to 200 gallon dual compartment models. The Sump Cleaners' sludge/chip baskets have a 1, 2, 3, and 5 cubic foot capacity. Sanborn/Donaldson Sump Cleaners can be truck or motorized pallet mounted. A Drum Tank Sump Cleaner is available for smaller operations.



SUMP CLEANER



CAR 100

CEN/MEM™

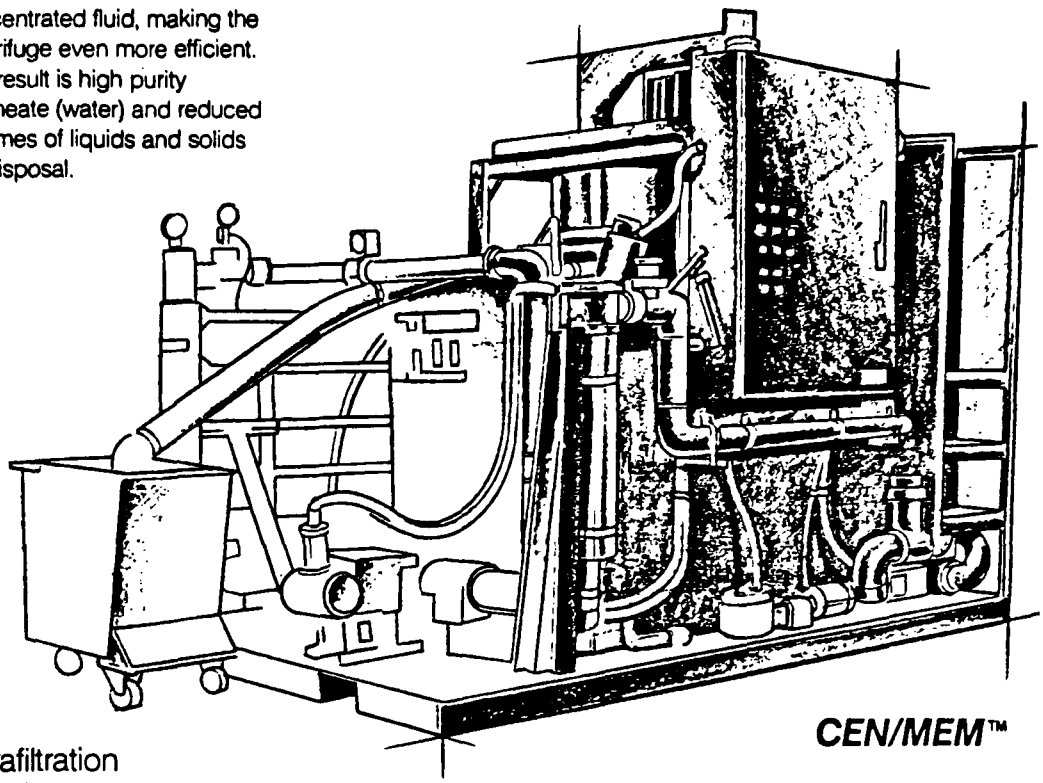
Centrifuge/Membrane Recovery/Disposal Systems

Sanborn/Donaldson CEN/MEM™ systems are designed to handle recovery and/or disposal of metalworking fluids in a single economical unit. For recovery operations, our patented self-cleaning centrifuge is the primary fluid separator. For disposal, it acts as the first clarification stage.

CEN/MEM™ recovery features removal of solids and tramp oils. It has automatic fluid make-up, water de-ionization and offers biological control. CEN/MEM™ has multiple fluid recovery capabilities.

In disposal service, CEN/MEM™ provides continuous or batch processing to 7200 GPD (larger on request) with optimized membrane performance and longer membrane life. It produces permeate with an oil content less than 100 PPM. The centrifuge removes high grade oil, suspended solids, and continually breaks down the ultrafiltration concentrate. Pre-clarification gives higher continuous flux rates while reducing both by-product build-up and the frequency of membrane cleaning.

The centrifuge works in concert with the membrane-concentrated fluid, making the centrifuge even more efficient. The result is high purity permeate (water) and reduced volumes of liquids and solids for disposal.



CEN/MEM™

Ultrafiltration Membrane

Our membrane is a versatile polyolefin filtration membrane ideal for high fouling feeds. It is ideal for clarification of oily waste waters from sources such as machine coolants, floor cleaning and parts washers. It has excellent PH characteristics, operating in the range of 2–12, and is resistant to most solvents. This anti-fouling hydrophillic membrane features steady flux rates and is available in modules that easily retrofit existing cabinets and racks.

Filtration/Treatment Systems
Design & Equipment
Post Office Box 18588
Seattle, Washington 98118
206 - 722-1330

SANBORN/DONALDSON
Leaders in Separation Technology

25 Commercial Drive • Wrentham • MA • 02093
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FAX 617/384-5346
TELEX 910-380-9466

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APPENDIX G

RECYCLABLE MATERIALS

NOTE

Mention of product manufacturers, vendors, trademarks, or trade names in this report does not in any way imply EPA or SAIC endorsement of these products, manufacturers, or vendors.

ALASKA RECYCLING CENTERS

Note: This list may not include every recycling center in the state. Market conditions change and recycling centers may alter the list of materials they accept. Contact names, addresses, and phone numbers are also subject to change without notice. (List provided by Alaska Department of Environmental Conservation Pollution Prevention Program.)

LOCATION	ORGANIZATION/BUSINESS	SERVICES PROVIDED	COLLECTION LOCATION	CONTACT	PHONE
Anchorage	Alaska Metals Recycling	steel, non-ferrous metals, appliances, car bodies	97th & King	Leo or Linda	349-4833
	Alaskans for For Litter Prevention and Recycling (ALPAR)	recycling information and resources	P.O. Box 231231 Anchorage, 99523	Audrey Lee	272-9326
	Alaska Pollution Control POB 110374, Anchorage 99511	used oil recycling	10620 Old Seward Hwy.		344-5036
	Anchorage Recycling Center (ARC) (call regarding other services and programs offered)	aluminum cans, newspaper, office paper, cardboard, glass, plastic milk jugs, copper, brass, scrap aluminum	6161 Rosewood St.	Tom Turner	800-478-2267
	ARC Satellite	aluminum cans, newspaper, glass, plastic jugs	54th and Juneau	Tom Turner	800-478-2267
	Asset Recovery	Full Service Recycling	3237 Mountain View Drive	Jim Myers	279-1446
	Mobile Metals	non-ferrous metals	pick up		277-7777
	Standard Steel & Metals Co.	non-ferrous metals, aluminum cans	2400 Railroad Avenue		272-8558
Barrow	Ipalook Elementary School	aluminum cans	Ipalook Elementary School	Lori Lamoreaux	852-4711

LOCATION	ORGANIZATION/BUSINESS	SERVICES PROVIDED	COLLECTION LOCATION	CONTACT	PHONE
Bethel	Allen Auxier "Can Man"	aluminum cans	Box 1054 Bethel, AK 99559	Allen Auxier	543-2273
Clam Gulch	Box 148, Clam Gulch, 99568 Recycling Co.	non-ferrous metals	Mile 115 & Sterling Hwy.	Bud Hatten	262-5767
Coopers Landing	Anchorage Recycling Center	aluminum cans, glass, newspaper	Old Fire Station	Tom Turner	800-478-2267
Deering	City	aluminum cans, styrofoam packing	call for information	Michael Moore	363-2136
Eagle River	Anchorage Recycling Center	aluminum cans, newspaper	Easy Street/behind Chepo's 10:00-2:00 Sat.	Tom Turner	800-478-2267
Fairbanks	Fairbanks North Star Borough	cardboard recycling information	call for information	Shaune Grose	459-1321
	Good Sense Recycling Group	general recycling information	218 Driveway	Deborah Koons	455-6024
	Alaska Solid Waste	cardboard, aluminum, paper, glass, plastic jugs	400 Sanduri Road	Ralph Bartlett	452-1372 451-1517
	K & K Recycling	ferrous, non-ferrous	8.6 Old Richardson Hwy.		488-1409
Gustasvus	Community	aluminum, glass, steel cans	Bins near small boat harbor	Rita Wilson	697-2245
Homer	Kenai Peninsula Borough	newspaper, cardboard, glass, aluminum	Eagle Quality Center/Landfill	Bob Pollard Kathy Mayer	235-6678 262-9657
Juneau	Auke Bay Cans	aluminum cans	14 Mile Glacier Hwy.		789-9407
	E&L Auto	car batteries, appliances, non-ferrous scrap iron, cardboard (no wax)	1005 Crazy Horse Drive	Ralph Burkhardt	790-CANS

LOCATION	ORGANIZATION/BUSINESS	SERVICES PROVIDED	COLLECTION LOCATION	CONTACT	PHONE
Juneau (cont'd)	Channel Sanitation	glass, large home items, car batteries	(Lemon Creek) 5600 Tongass Ct.		780-4288
	Buzzel's Economy Printing	toner cartridges, print ribbons,	pick up		789-2230
	Juneau Empire	newspaper	3100 Channel Drive		
	Jaws II/A Student Enterprise Juneau 2000 Foundation	aluminum cans	Price Plus 5165 Glacier Hwy.	Bill Lynn and Devin Jones	789-1062
	Mendenhall Flying Lions Club	white paper	Fred Meyers	Neil Atkinson	789-9179
	North Tongass Salvage	aluminum, metal, steel cans	variety of drop-off locations		789-7340
	Paper Chase Recycling Co.	paper	call for information	Michael Butler	780-4400
	Pay-n-Save	plastic bags	Nugget Mall		789-2111
	Southwest Copy Supply	toner cartridges/will refurbish for reuse	9538 Taku Blvd.	Joan Harvey	789-3758
Kenai	Central Peninsula Community Recycling	glass, cardboard, newspaper, office paper	Borough Building	Peggy Mullen	262-7715
	Kenai Peninsula Borough	aluminum, glass, paper, cardboard	Soldotna Landfill	Kathy Mayer	262-9657
	Kenai Peninsula Recycling	all metals	Kalifonsky Road		283-4312
Ketchikan	Revilla Recycling	paper, cans, glass, plastics, Terminal	Saxman Seaport	Dick Allen	225-3101 247-9454
Kodiak	Kodiak Island Borough 710 Mill Bay Rd, Kodiak 99615	aluminum cans, glass, baler at landfill	Bins located Bayside Grocers, Safeway; City Library; Bell Flats	Ray Camardella	486-5736

LOCATION	ORGANIZATION/BUSINESS	SERVICES PROVIDED	COLLECTION LOCATION	CONTACT	PHONE
Mat-Su	Valley Refuse and Recycling	aluminum cans, all recyclable paper, cardboard, glass, plastic milk jugs, copper, brass, scrap aluminum	49 Mile Parks Hwy., behind Seven/Eleven	Dorothy Attwood	376-3663
Moose Pass	Katie Toth-Stauble Box 564, Moose Pass 99631	aluminum cans	Mile 29 Seward Hwy.	Katie Toth-Stauble	288-3631
Palmer	Chevron Alaska Box 110374, Anchorage 99511	used oil	Hamman St.		746-0399
Petersburg	Boy Scouts Box 371, Petersburg 99833	aluminum cans, scrap aluminum	Main and Gjoa ballfield	Ken Elmore	772-3841
Seldovia	Kenai Peninsula Borough	cardboard, glass, aluminum, paper	S.O.S. Office		234-7400
Seward	Seward Community Recycling Action Program (SCRAP)	aluminum cans, other scrap metals, all paper, cardboard, newspaper	Bib's Market mile 2/aluminum can bins in many locations	Carol Griswald	224-5620
Sitka	City & Borough of Sitka	aluminum cans, glass, plastics, other aluminum	Bins at: Sea Mart, Blatchley Middle School, rec. area at Granite Creek General Store	Larry Harmon	747-3294
Skagway	Gary Hansen	aluminum cans, non-ferrous metals	call for information	Gary Hansen	983-2609 983-2944
Soldotna	Central Peninsula Community Recycling	glass, cardboard, newspaper, office paper	Fred Meyers	Peggy Mullen	262-7715
	Kenai Peninsula Borough	aluminum cans, glass, all paper, cardboard	Soldotna Landfill-cardboard & drop-off locations	Kathy Mayer	262-9647

LOCATION	ORGANIZATION/BUSINESS	SERVICES PROVIDED	COLLECTION LOCATION	CONTACT	PHONE
Statewide	Pay-n-Save Stores	plastic bag recycling	all stores	contact nearest Pay-n-Save	
Thorne Bay	Community	aluminum cans	call for information	Don Hadlock or Coy Lester	828-3340 828-3973
Valdez	Alyeska Pipeline Service Co./ PW Sound Conservation Alliance	call for information	call for information	Gary Moore	835-6035
Wasilla	Anchorage Recycling Center	aluminum cans, newspaper	Carr's parking lot 10:00-2:00 Sat.	Tom Turner	800-478-2267
Western Alaska	"Flying Cans Program"	aluminum cans	40 communities	Tom Turner	800-478-2267
	"Can Do Kids Program"	aluminum cans		Tom Turner	800-478-2267
Yakutat	Community	aluminum cans		Skip Johnson	784-3323