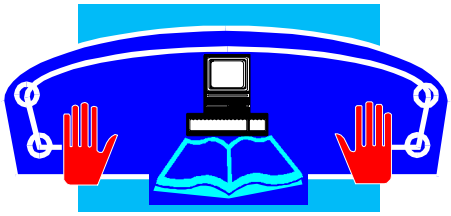

Report On Waste Diesel And Other Fuels: Options For Disposal At Remote Sites By Combustion

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REPORT ON

WASTE DIESEL AND OTHER FUELS: OPTIONS FOR DISPOSAL AT REMOTE SITES BY COMBUSTION

APRIL, 1993

Northwest Territories Renewable Resources
Pollution Control Division

FINAL REPORT

WASTE DIESEL AND OTHER FUELS: OPTIONS FOR DISPOSAL AT REMOTE SITES BY COMBUSTION

by

S.L. Ross Environmental Research Limited

Ottawa, Ontario

for

Department of Renewable Resources

GNWT

TABLE OF CONTENTS

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LIST OF FIGURES

LIST OF TABLES

SUMMARY

This report reviews several options for the disposal, by combustion, of contaminated waste fuels in the Northwest Territories. The equipment described is either heli-portable or technologically simple and easy to manufacture on-site using commonly available materials; this ensures its suitability for use in remote locations.

A literature search on the subject and a survey of over 50 potential suppliers was conducted. Eight combustion options resulting from these surveys are detailed, with particular focus on: principal of operation; ancillary equipment needed; method of ignition; combustion rate; range of wastes handled (e.g. viscosity and water content); combustion efficiency (e.g. amount of residue); cost; and pollution production. None of the systems uncovered have any certification or approvals to operate in the NWT or Canada.

Two systems are commercially available that can effectively perform the job: The SAACKE SKV series and the SWIRLFIRE series of portable, rotary cup burners,

The SAACKE SKV series have been used extensively for waste oil disposal operations and spill response in the vicinity of Tuktoyaktuk. The SAACKE SKV series requires three medium-sized helicopter lifts to be transported by air. The SWIRLFIRE is a newer self-contained design with limited use to date; it does offer lower cost and better portability than the SAACKE.

If simpler, locally-constructed technology is desired, the methods researched by Dr. P. Franken of the University of Arizona to augment the bum rate and reduce emission from small pool burns should be considered. These techniques use simple construction material (sheet metal, angle iron, culvert, etc.) and/or small compressors to induce additional air flow into a pool bum (or a "bum barrel"). It was found; however, that insufficient information was present concerning the most efficient implementation of: the vaned ducting arrangement (see section 4.2); the varied ducting with added air (see section 4.3); and, the chimney incinerator (see section 4.4). It was recommended that pilot studies be undertaken in these areas, with the aim of determining whether or not these methods are effective and reduce emissions sufficientl y, compared to the "bum barrel".

Several suppliers offered to custom-design engineered systems for specific applications.

In order to operate any of these systems they must first be evaluated and approved by regulatory agencies such as the GNWT Department of Safety and Public Services (Fire Marshals Office and Safety Division) and environmental agencies.

1. INTRODUCTION

The disposal of unwanted contaminated fuels, by the generator of the waste, is a problem common to all sites where fuel is stored. In more populated areas, the proximity to, primarily road, but also rail and water, transportation infrastructures, ensures that an accessible and economically viable path to a re-refinery or heat recovery unit will always exist. Thus, for most areas re-refining or burning with heat recovery of the contaminated fuel are the most desirable solutions, as the waste is returned to a usable state, and waste streams are properly dealt with.

The remote nature of the Northwest Territories, however, adds its own particular twist to the problem of waste disposal, that the rest of North America is often not required to face, namely, the vast distances which separate the balance of the communities from one another. These distances are often traversable only by airplane and/or water travel, and require that each town be as self sufficient as possible. This self-sufficiency extends to waste-management practices. In addition, some of the waste fuel is stored at remote sites (fuel caches, etc.) accessible only by air.

Unfortunately transporting all, or even the majority, of the waste fuel produced in the Northwest Territories to a re-refinery is not economically viable. Furthermore, the more the waste is transported, the greater the likelihood of a spill.

While disposal by combustion without heat recovery may not present the most desirable solution, it is achievable, effective and inexpensive. These factors will promote a wider participation in any waste disposal program that is mounted. This is extremely important; anyone that does not participate in the controlled disposal program, will still have to dispose of the fuel somehow, and the method they choose may be worse for the environment (i. e., straight dumping) and possibly prohibited by legislation. Thus, disposal by combustion could be the lesser of two evils.

Section 2 of this report presents the methodology used in the study. Section 3 covers the issue of burning water-contaminated fuel. Section 4 presents an overview of the selected equipment and techniques.

2. METHODS

In order to uncover as many techniques for burning waste fuel and diesel oils as possible a computerized literature search and a survey of manufacturers were conducted.

2.1 LITERATURE SEARCH

A computerized literature search was conducted using the facilities of the Canadian Institute for Scientific and Technical Information (CISTI). The six databases searched are listed below in Table 1 with the appropriate time frame for each.

TABLE 1

Computer Databases Searched

DATABASE	SPAN OF COVERAGE
Engineering Index (EI, EIM and EIPlus)	1970-present
NTIS	1964-present
ELIAS	1976-present
Energy Science and Technology	1974-present
Environmental Resources Technology Database (ERTH)	1965-present
CISTIMON	1978-present

In addition to the CISTI search a manual search of the Environmental Emergencies Technology Division (EETD) library at Environment Canada and the S.L. Ross library was conducted.

A small database was designed using DBASE IV (Ashton Tate Corp.), to organize the 209 references found and to facilitate future document selection. DBASE IV was chosen for its compatibility with industry standards, the ease with which a database can be constructed and modified, and its ability to perform complex searches on the created database.

A bibliographic list of the references is given in Appendix 1. The bulk of these references may be found in the S.L. Ross and Environment Canada, EETD libraries.

2.2 MANUFACTURERS AND ALASKAN SURVEYS

In order to determine what equipment was available, a survey was faxed to over 50 potential manufacturers, distributors or suppliers of burners in North America. The list and a sample of the fax sent may be found in Appendix 2. The majority did not manufacture, distribute or supply suitable devices. Representatives of the State of Alaska were contacted. Flaring of waste fuels is not permitted there, ail waste oils generated in Alaska must be reused, recycled or used as fuel (Hillman 1980, Hurst, 1992).

2.3 DATA ANALYSIS

The potential combustion techniques and/or equipment uncovered by the surveys were assessed, considering the following factors:

- capacity and turndown ratio";
- the wmbustion efficiency, visible airborne emission, and residual sludge or ash;
- the range of feed fuel viscosities that could be handled and debris/solids tolerance;
- approvals or certifications and safety features;
- capability to operate at remote sites in all weather conditions;
- capability to combust other waste products as fuel (e.g., turbofuel, solvents, gasoline, lubricating oils, etc.);
- purchase cost and suppliers; and
- ease and cost of assembly, transportation and operation.

Because of the above-mentioned isolation of the waste fuel locations, a successful combustion program must use equipment that is easily portable, or technologically simple and easy to construct on-

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• turndown ratio is defined as the normal maximum bum rate divided by the minimum sustainable bum rate.

site using available, local materials and expertise. Thus the two main criteria for the selection of equipment were portability and simplicity of operation.

At the very least, to be considered, the equipment had to be heli-portable by a medium-lift helicopter. Preferable was equipment that is air portable by Twin Otter and helicopter. This combination can provide cost-effective access to all sites.

Much of the commercially available portable equipment to combust waste fuels was developed for offshore applications on drilling rigs. These flare burners are used to dispose of waste crude oil from exploration or production wells and are high volume units capable of combusting waste at rates of approximately 600 litres per minute (Hillman 1980, Beach & Goldman 1981). These units, apart from being relatively non-portable and requiring literally tomes of ancillary equipment, are oversized for the application being considered. For the same reasons (capacity and size/weight) commercially available, trailer-mounted kilns for the disposal of hazardous wastes were not considered. In general, for this study, units with fuel consumption ratings higher than 1,000 litres per hour were not included.

3. BURNING WATER-CONTAMINATED FUEL

The issue of water-contamination in fuels to be disposed of does not present as large a problem as it might at first seem. In fact, with most combustion systems, some water emulsified in the fuel is beneficial in controlling smoke emissions.

Experiments have been reported where high speed photography of single water-in-oil emulsion droplets introduced into a hot chamber showed that these droplets went through a faster and more disruptive combustion process than pure fuel droplets (Kretschmer and Odgers, 1985). The theory advanced was that the rapid evaporation of the water suspended in the fuel ruptured the oil droplets (in micro-explosions). It was concluded that water in emulsified fuels did not impair but improved combustion due to the breaking of the droplets, which increased the evaporation surface and improved the mixing of fuel with air. This is true, up to a point. As the emulsion water content increases, more and more heat is needed to remove the water and, eventually the water extinguishes the flames. These water contents are generall y in the 50-80% by volume range with the higher water contents associated with more volatile oils. This phenomenon is most often used to assist the combustion of heavy residual fuels, but the benefits would still be apparent with water-contaminated diesel.

Conversely, the presence of free standing water will adversely effect combustion. Unlike the suspended water, free standing water will not assist combustion and, in many cases, will contribute to the production of more smoke. Also, some equipment will suffer flame extinction if a slug of water passes through the system. As much as possible, the fuel should be separated from any free standing water.

4. EQUIPMENT OVERVIEW

The following gives a brief narrative description of the devices deemed suitable for the combustion of contaminated fuels or diesel at remote Arctic sites. The bum-barrel is included as the first entry in order to compare the other devices to its performance and emissions. The burn-barrel is **not** recommended as a disposal option.

4.1 BURN-BARREL

The bum barrel has been used extensively in the past for the on-site disposal of waste fuel and diesel. It's continued use is **not** recommended because of the high air-emissions associated with the technique. This approach involves transferring the waste fuel to a suitable (fire resistant) container, typically open-topped 205-litre drums, where it is subsequently ignited and burned. The most appropriate ignition source will depend on the nature of the fuel. Diesel fuel, being relatively volatile, should be easy to ignite; a fuel soaked rag on a long stick will serve to initiate combustion, while maintaining minimal operator safety. Fuels with higher flash points may need a more intensive ignition source.

An approximate rate of combustion for this method is 30 L/h per drum (Buist, 1992). A wide range of fuels can be handled by the bum barrel, ranging from a light diesel fuel (anything lighter would pose an initial explosion risk), to a heavy fuel oil (No. 6). Depending on the nature of the fuel, and the amount of water contamination, there may be some residue remaining, floating atop any water not evaporated.

While this is clearly the most economical method to dispose of the waste fuel, it provides an inadequate supply of combustion air, thus generating an unacceptable amount of smoke and particulate. The flow of combustion air can be enhanced by piercing holes in the upper portions of the barrel; this will not, however, significantly reduce smoke emissions.

Although drums have been modified with the addition of propane burners, grates and compressed air for the combustion or incineration of solid fuels and waste, no modification to the bum barrel for the burning of liquid fuels were uncovered with the exception of the enhancements detailed in section 4.4. No safety certificate or approvals exist for bum barrels. Although no data on emissions from a bum barrel were uncovered in the literature search, much work has recently been conducted on air emissions

from in-sire burning of oil slicks which would be a process very similar to burning oil in a drum.

In-situ burning of oil slicks on water can be described as "stared combustion" in which not enough air (oxygen) is drawn into the fire to burn the fuel completely to carbon dioxide and water vapor. Laboratory tests (Day et al.1979, Evans et al. 1986, 1987, 1988, 1989) have indicated that the gaseous constituents of the atmospheric emissions (measured directly above the fire) from burning crude oils on water are approximately:

co*	5000 ppm
c o	200 ppm
NO	1 ppm
NO_x	2 ppm
SO_2 (if oil contains sulphur)	35 ppm for each % sulphur

The most obvious byproduct of in-situ burning is the smoke or soot plume. Laboratory and field tests (Day et al. 1979, Evans et al. 1986, 1987, 1988, 1989) have indicated that this soot amounts to about 2-15 % of the mass of oil burned (with the low end of the range associated with thinner, smaller slicks and the high end with thicker, larger slicks). This soot consists of small particles of carbon about ½ μm in diameter. These particles are generally composed of elemental carbon with about a 10% hydrocarbon content (soot from very large burns can contain unburned droplets of oil). The particles agglomerate as the smoke cools into longer chains of particles which can increase the average particle size to about 3-5 pm.

One constituent of the soot that may be of concern in polynuclear aromatic hydrocarbons (PAH's). Studies (Evans et al. 1988) have shown that the total concentration of PAH's in the smoke is virtually the same as in the original oil (about 400 ug/g). The types of PAH's in the smoke are different, however. The smoke contains more of the larger PAH species than the oil and less of the smaller PAH species. Some of these larger PAH species have been demonstrated to be carcinogenic (Benner et al. 1991). The soot can also contain metals from the original oil at concentrations on the order of 10 ppm of soot. For further information on PAH's in oil bum smoke plumes the reader is refereed to Benner et al. 1991. If the smoke is eliminated (either by introducing excess air into the bum or otherwise) the PAH's are eliminated.

There exist a number of metallic-based additives, of which one is ferrocene, that have been researched as smoke reduction agents. Applied to pools of oil as a powder or water-slurry at concentrations of a few percent by weight they can reduce soot emissions by as much as 90% (Mitchell and Moir 1992). Their most effective usage is still being researched as are cheaper substitutes. The disadvantage to these chemicals is their retention in bum residue and their high cost.

4.2 BURN POOL WITH VANES

Recently, research has been undertaken on methods to enhance in-situ combustion of oil on water (Franken et al. 1992). Some of the techniques studied may be applicable to the disposal of waste fuel and diesel using simple, locally constructed burners. Any buoyant column of heated rising air or hot combustion gases tends to have a swirl component, commonly referred to as the "Fire Whirl". This is a desirable effect as it encourages the entrainment of surrounding oxygen-rich air and thereby increases aeration at the centre of the flames. This phenomenon is present, to a limited extent, with the burn-barrel, but it is possible to increase this effect further by making some simple modifications to the combustion apparatus.

One method involves deploying sheet metal vanes about a burning pool in order to guide the in-flowing air into a cyclonic pattern (see Figures 1 and 2). Experiments performed in 0.6 m, 1.2 m, and 2.4 m diameter pools 10 cm deep indicate that the addition of vanes increased the flame height by 200 %, produced 50% less smoke and burned faster and more efficientl y than identical experiments performed without the vanes (Franken et al., 1992). Tests were also carried out with both curved (semi-circular) and straight fins; no significant difference was found. It was determined that the vanes definitely helped augment the combustion by supplying additional air to the centre of the blaze, but the configuration or shape of the vanes seemed to have little impact on the combustion rate. The effect of bum pan depth was not investigated.

For the most successful runs, each container used eight vanes, mounted on, and arranged tangentially to, the top of the containment pool, with their dimensions being 0.6 m x 0.4 m, 1.2 m x 1.2m, and 1.2 m x 1.8 m respectively (see Figure 3).

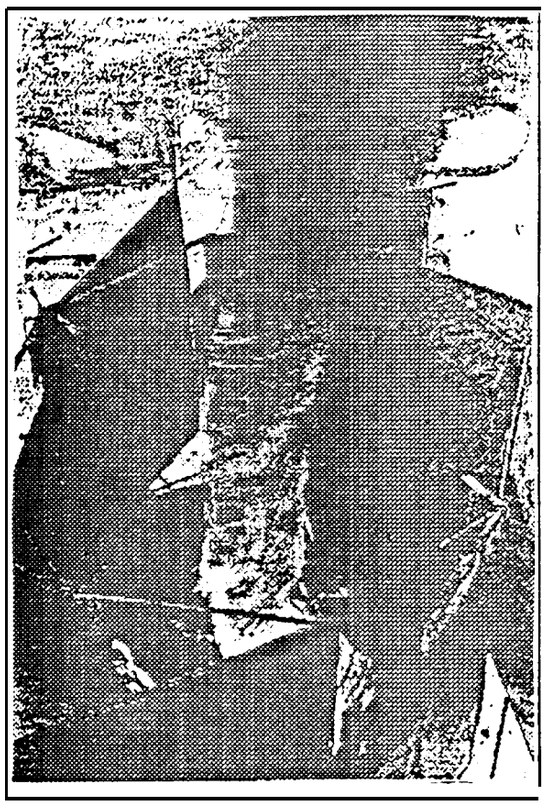


Figure 1: 1.2 m diameter pool with vane structure, showing "Fire Whirl" effect.

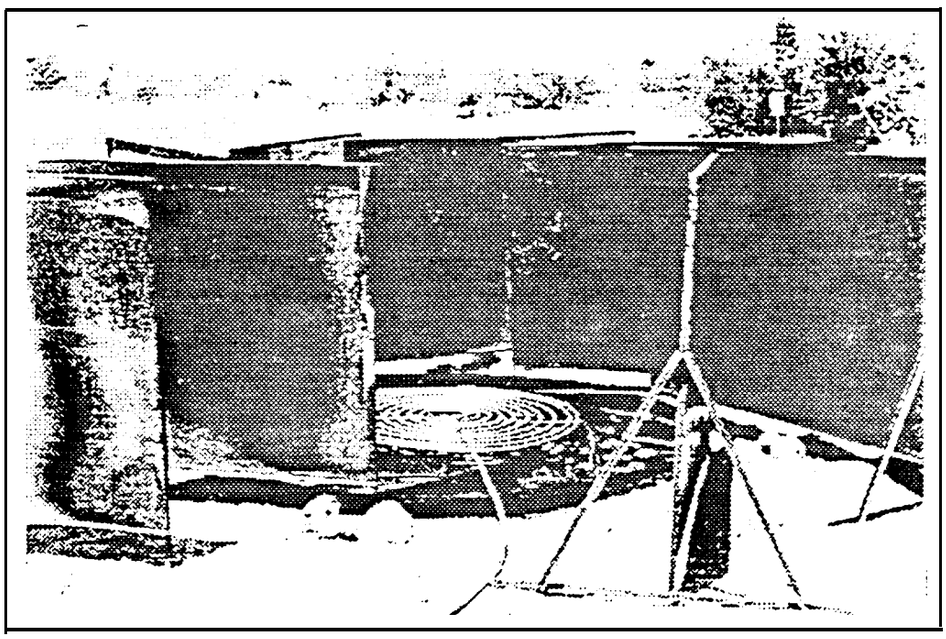


Figure 2: 2.4 m diameter pool, showing vane structure

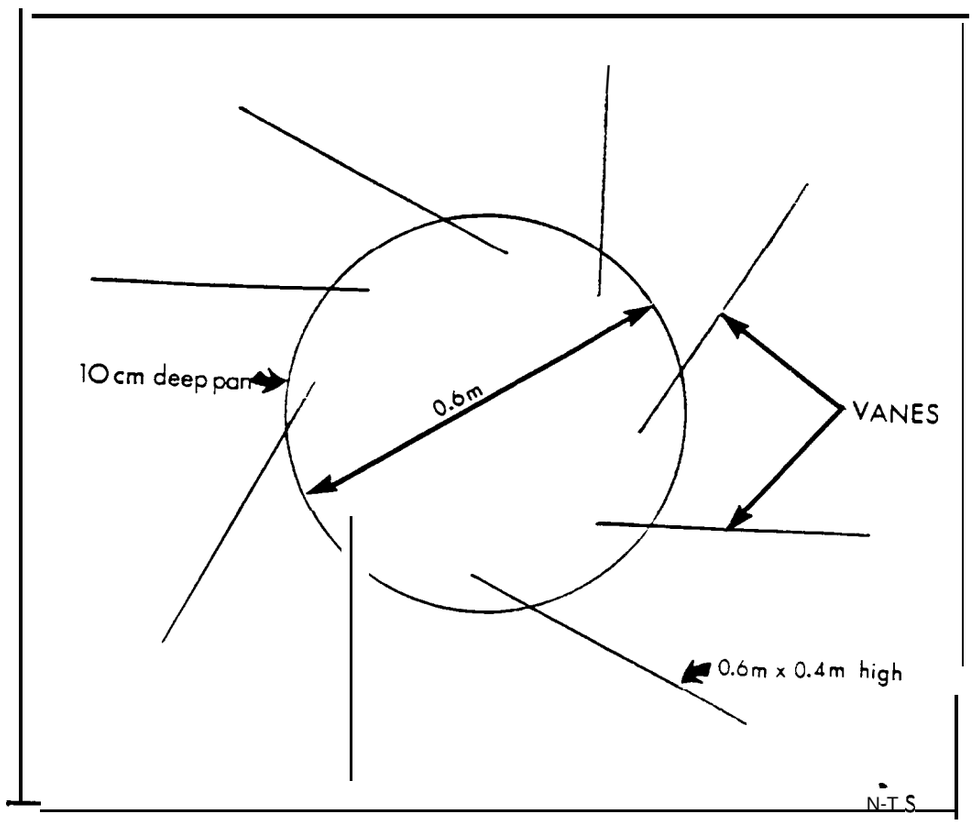


Figure 3: Plan view of ducting arrangement for 0.6 m diameter pan

The overall effect was that the use of these vanes increased the burn rate by approximately twofold. Combustion rates of approximately 60 L/h should be possible with the 0.6 m diameter pool (Franken et al., 1992). The burner could be set UP to run in a batch mode (i.e., load; burn; extinction; reload) or in a semi-continuous mode using a simple gravity-feed system. The rate of burning would not be variable. The experiments outlined used Prudhoe Bay crude oil and used crankcase oil as sources of fuel, indicating that this method is applicable to a wide range of fuels. The presence of water and/or entrained solids should not impair this technique. Fuel viscosity would not be a limiting factor either. The only weather restrains would be high winds (> 40 km/hr) or heavy rain which might extinguish the flames.

This method will generate approximately half of the smoke and soot of a similar, unducted bum,

The cost of the equipment will depend on the availability of materials, the size of the containment pool, and amount of labour required but would likely be low (c $ 1,000). It will be necessary to have the vane assembly and support structure constructed, as commercial equipment is not available. Sheet metal, welded to some angle iron would perform admirably in this application, however, the sheet metal used for the vanes should be thick enough (6 mm or more) to withstand the combustion temperatures without severe buckling. A level pad of incombustible material would be required to set up the equipment.

In summary this technique offers simplicity, ease of operation and low cost; however, it would not eliminate visible air emissions. It is recommended that pilot-scale tests be carried out to determine the optimum setup for this technique. No certificate or approval exists for this technique; this would have to be obtained prior to its use.

4.3 BURN POOL WITH DUCTING AND ADDITIONAL AIR SUPPLY

The following technique offers a further improvement over the “Bum Pool with Vanes”.

Several experiments, designed to determine an effective method of augmenting the ducting effect described above were performed by Franken, et al., from May through September 17, 1990. The conclusions from these experiments were that it was not effective in practice to supply all the stoichiometric air needed for combustion (i. e., low velocity, high volume air blowers); rather it would

be more efficient to have other processes in place which would increase the natural flow of air (the Fire Whirl) into the combustion zone. The conclusion of the report was that "the addition of a few hundred cfm of compressed air is more utilitarian than the addition of more than 50,000 cfm of low velocity air streams" (Franken, et al. 1992).

An effective arrangement for the 4 ft diameter pool with the vane ducting structure, as described above, was to employ four low volume (8 m^3/min = 300 cfm in total), high velocity (high pressure) air jets, with one placed about 1 m above the liquid surface, aimed straight up the axis of the flames, and the remaining three each placed about 0.6 m from the central axis, a few feet above the liquid and canted by some 30° from vertical (Figure 4). These jets produced a "cyclonic" or "whirling" action within the flame in the same rotational sense as produced by the external vanes. Similar layouts would be used with a 0.6 m or 2.4 m pond.

The positioning of the fourth jet, directly above the liquid surface, necessitated that some method be used to protect it from the intense heat (e.g. pipe or flexible steel tubing). If this proves to be impossible or impractical, this jet can be excluded from the system with only a small anticipated reduction in efficiency.

The addition of the high velocity air increased the burning rate by about three and one half times, over that of the ducting alone (Franken et al., 1992). Therefore, combustion rates of approximate y 210 L/h and 840 L/h would be expected for the 0.6 m and 1.2 m ponds, respectively. As with the previous entry no problems are anticipated with water, fuel viscosity or debris. The only weather constraints would be high winds or heavy rains.

Due to the air-rich environment, near-smoke free burning should be possible with proper adjustment of the air jets. A small amount of thick unburned residue may remain after each run, but it should be diluted with the fuel used in subsequent bums and re-ignited. The residue present after the final bum would have to be disposed of in another manner, although its volume will be small (2 to 3 litres at most).

The costs for this arrangement will vary with availability but will accrue to the materials (vane structure and pool), construction labour, and the rent or purchase of the air compressor. The air compressor will represent, by far, the largest expenditure and would be the heaviest component. A level pad of incombustible material would be required for set-up of this device. No certificates or approvals

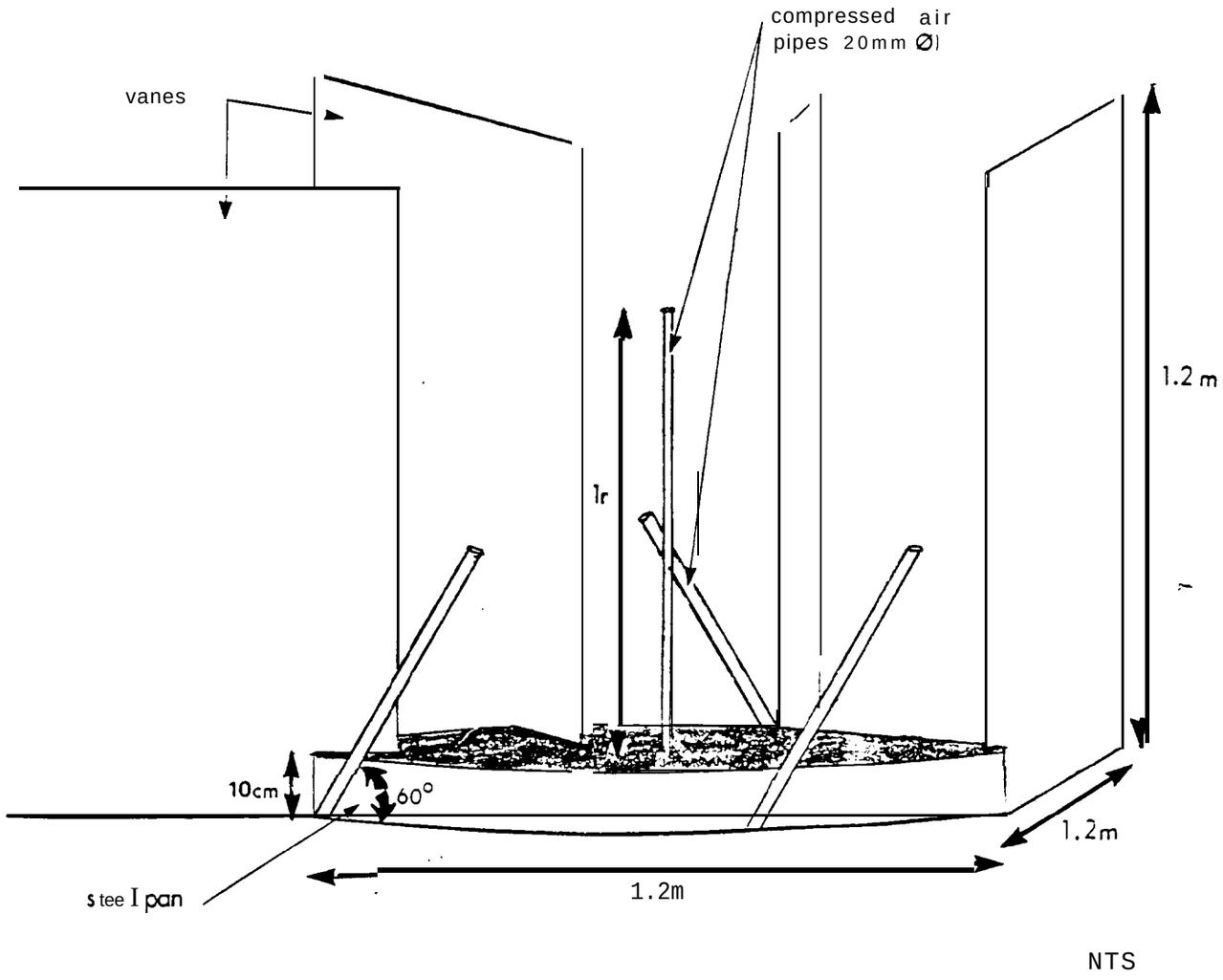


Figure 4: Sketch of bum pool with vanes and compressed air supply - front four **vanes** not shown.

exist for this approach. It is recommended that a pilot-scale unit be constructed and tested; experiments could be undertaken to identify minimum air pressure and flow requirements for minimized-smoke burning.

4.4 CHIMNEY INCINERATOR

The primary purpose of the chimney (or stack) for this application is to create an induced draft (a pressure difference below that of the surrounding atmosphere). Since the pressure of the column of hot gases emerging from the stack is atmospheric, the pressure at the stack entrance is below atmospheric, thus causing the flow of combustion-feeding air and hot gases to be increased (Perry's, 1984). A secondary benefit of the chimney is to provide a wider dispersal area for combustion products, although this does not reduce the amount of pollution generated.

The degree of the naturally-induced draft depends largely upon the stack height, although the diameter also plays a role. Diameter and height are not independent variables in arriving at the net draft created by the chimney. Height primarily affects the theoretical draft, whereas diameter primarily affects the velocity (Franken et al., 1992). Also ambient temperature, which affects the pressure difference between the bottom of the chimney and surrounding air, will affect the air entrainment, with higher ambient temperatures resulting in a lower stack effect.

When the chimney effect is coupled with the addition of small amounts of high velocity air, a fairly efficient, simple incinerator for fluid fuels can be constructed.

A simple affair could be constructed by using a 205-L drum as a combustion chamber and mounting a section of steel culvert over top (Figure 5). This setup was tested using a drum fitted with a heavy sheet metal stack (of culvert), 43 cm in outer diameter and 2.4 m high (Franken et al., 1992). Four compressed air lines, all hooked to a single 5 m^3/min (185 cfm) air compressor, were used, with 3 pointed straight down, located about 10 cm above the liquid surface. This configuration produced an atomization effect, breaking the fuel surface into a froth of droplets. The fourth compressed air line was located about 60 cm above the liquid, and directed straight up the centre of the stack, in order to increase the chimney draft effect. Experiments with low pressure fans did not produce the desired effects; high pressure compressed air was required.

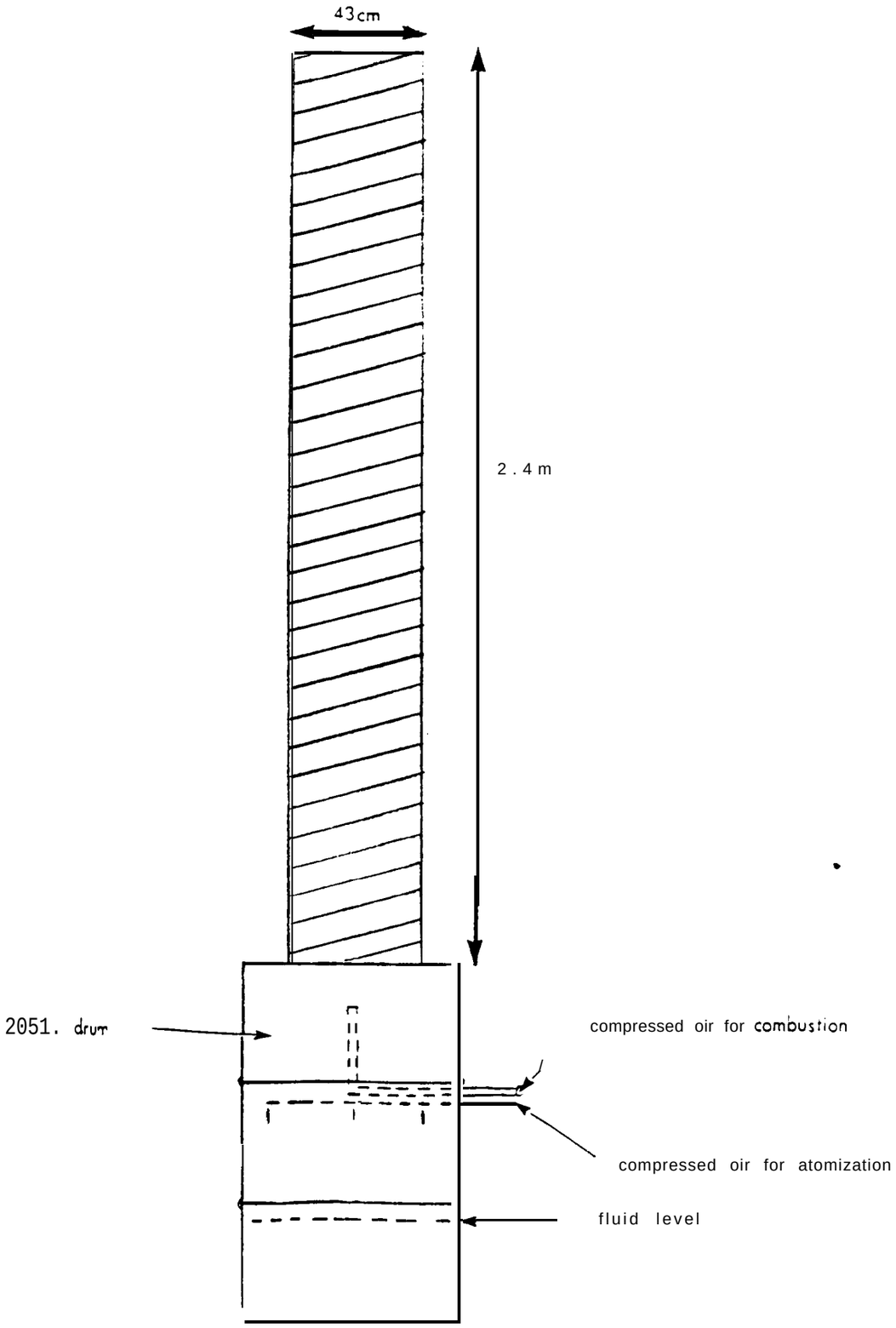


Figure **5:** Schematic of chimney incinerator NTS

When crude oil was burned in this system, it performed at 440 L/h, emitting some brownish-gray smoke from the stack. No specific information on emissions was available. No problems with fuel viscosity, debris or solids is anticipated, although higher viscosity fuels will likely generate more smoke.

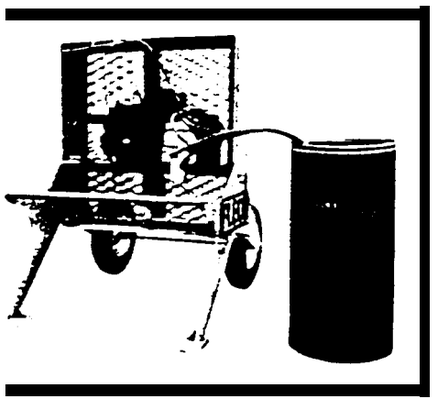
The compressed air jets cannot be engaged immediately; a short time must be allowed for the fire to develop, or extinguishment will likely result. Care should be taken when constructing the stack to ensure that the support structures can withstand the heats generated. Suitably thick steel is a necessity. No weather constraints, other than high winds or heavy rain, are envisioned.

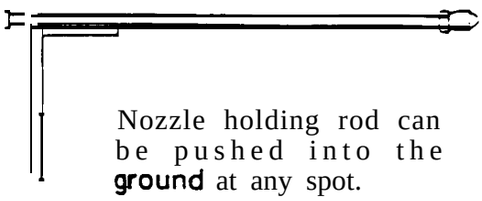
The materials used for the combustion containment structure (e.g. 205-L drum), chimney stack, and chimney support structure, will contribute the majority of the cost. This system is not characterized by a high degree of portability; its use is envisioned only where substantial quantities of waste fuel, and the necessary construction materials, are present. A suitable pad of incombustible material would be required. No certificates or approvals exist for this approach and these must be obtained prior to its use. A pilot-scale unit should be constructed and tested.

4.5 THE BRUSH BURNER

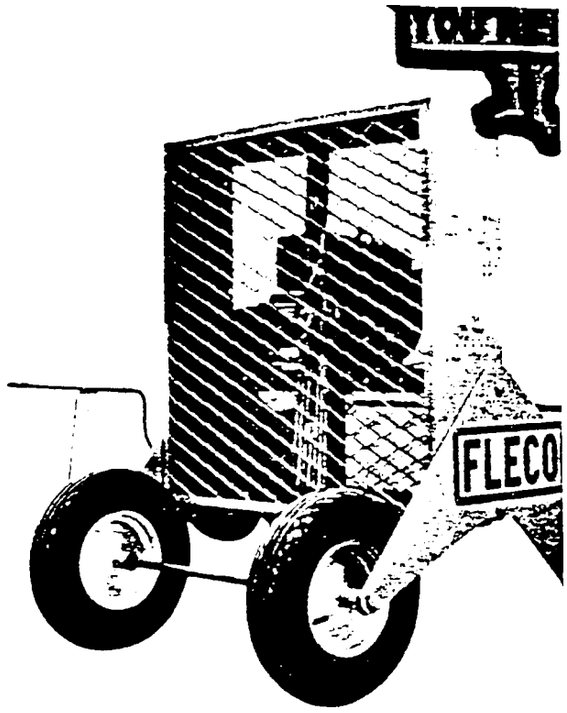
In February 1976, the cleanup of a spill in Chesapeake Bay, Maine resulted in the recovery of approximately 473,000 litres of contaminated Bunker oil (Wise, N. 1977). Due to the lack of nearby refineries, the remote location of the spill, and high water table of the area (which precluded land disposal due to oil leaching problems), disposal by combustion was chosen. To assist with the disposal, the Fleco Brush Burner was used (See Figure 6).

The Brush Burner is a relatively simple setup involving a gasoline-powered forced-draft blower hooked to a tractor to facilitate re-positioning. The device was developed to assist in the combustion of "slash" from logging and similar operations. It is powered by a 2.2 kw Briggs & Stratton, 4-cycle, air-cooled engine. The propeller has a rated capacity of 650 m^3/min (23,000 cfm) at 2,700 rpm. Included are optional pumps and two fuel nozzles which deliver 60 and 120 litres per hour of diesel fuel, respectively. It is recommended that a nozzle be used in conjunction with the fan to supply a steady ignition source for the material to be burned.





Nozzle holding rod can be pushed into the ground at any spot.



The brush burner

Burning the oil

Figure 6: Fleco Brush Burner, showing fan and fuel nozzle; smoke plume and residue remaining after bum

Experience gained from the 1976 oil spill indicated that the most effective, and efficient, means of disposal was to construct a pile of combustible debris (ideally driftwood or dry brush); the open-topped drums containing the waste fuel were then stacked upright on top of the debris. Tipping or puncturing the containers was not recommended, as it allowed the oil to flow to the ground where temperatures were not high enough for ignition.

The debris was then ignited and the fan used to supply a high volume of combustion air. The heat produced boiled the water out of the fuel and provided for a more complete burn inside the drum. Any suitable method of ignition will suffice, typically a burning fuel-soaked rag, thrust into the debris or the path of the fuel stream from the nozzle.

A precise disposal rate is not available for this method, although in 1976 it removed 2,500 L/hour (in total about 2,300 drums) of the recovered semi-solid Bunker C containing water, sand and flotsam. As the above implies, a wide range of waste types can be handled by this method. Provided that the high-temperature is maintained and the fuel is relatively free of solid contaminants. no residue will remain in the drums after the bum.

The commercial availability of the Fleco Brush Burner is unknown; it should, however, be possible to find an analogous replacement.

The major source of pollution, in 1976, arose from the old tires that were used as an underfire. These generated “tremendous clouds of black and grey smoke”. It was felt that this problem. could have been eliminated, or at least greatly reduced, had the burners integral diesel nozzle and/or dry brush and wood been used. No oil viscosity or solids problems are envisioned for this device.

The cost of the Brush Burner is unknown. The additional cost of the drums should be minimal, as most of the fuel is likely in drums already. In addition, the undamaged drums could be returned to the storage site for reuse after the bum. The cost of the fuel for the debris pile will vary with availability. The nature of the debris will dictate its rate of consumption. If one of the optional fuel nozzles is used it will consume 0.9 and 1.8 L/rein of diesel fuel, respectively. (It should be noted that use of the nozzles will limit feed fuel viscosity and solids and water contents.)

It should be noted that an adequate supply of debris is essential as this is the source of the high

temperatures necessary for the complete combustion of the waste fuel. This may eliminate this technique from consideration for use in some areas of the Arctic. As well, a large pad of incombustible material would be required as this method will not provide a very controlled burn. No approvals or certifications are available for this device.

4.6 MODIFIED HOME OIL BURNER

The oil burners used in home heating furnaces can be fairly easily modified to accept a wider range of fuels and operate with an open flame. Figure 7 shows a typical model.

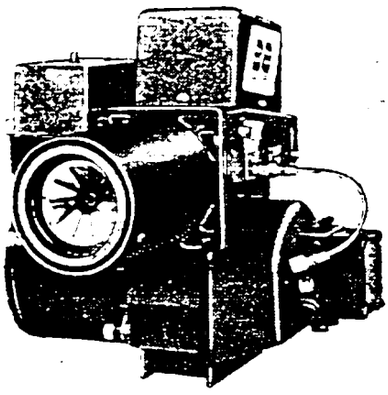
The pumps which accompany most domestic burners are rated at about 700 kPa (100 psig). Higher pressures, around 1.3 to 1.5 MPa (190-220 psig), are required to fully atomize higher viscosity waste fuels and emulsions (Kretschmer and Odgers, 1985). Any pump capable of reaching these elevated pressures, and small enough to be portable, would be a suitable replacement for the original.

For example, a standard gear pump for hydraulic applications would work well (rated at 6.9 MPa/1,000 psig).

Home furnace burners are also not designed for burning in the open, so a combustion chamber must be fitted onto the burner. The one designed by Kretschmer and Odgers (1985) was a cylindrical chamber 250 mm long and of 150 mm interior diameter. The chamber was lined with 25 mm of castable ceramic cement (outer diameter 200 mm). The end was restricted by a ring baffle with an opening of 90 mm.

Emulsions with 30 percent or less water could be ignited directly, using the standard piezo-electric igniter, incorporated in the burner, provided that fuel pressures were over 3 MPa. The pressure needed increased with increasing water content (i. e., increasing viscosity), the increase necessary for cold ignition being more than that needed to keep a constant droplet diameter and, for more than 40 percent water the pressure needed exceeded the pump capacity. Very satisfactory ignition was achieved for all emulsions by preheating the combustor (usually with diesel fuel) and then switching over to the emulsion.

Combustion rates of about 8 L/h would be typical of such a system. These lower rates may preclude the use of such burners from many disposal applications. Higher rates could be achieved with larger capacity, commercial-type burners.



EAGLE ONE

UL

- Firing range from 0.5 to 2.50 GPH with optional end cones
- Uses #1 or #2 fuel oil
- 3450 RPM, 115V, 60 Hz
- Shipped completely assembled

Figure 7: Typical home-heating oil burner

With the above-mentioned pressure limitations (i.e., 1.5 MPa), fuels with viscosities up to 3,200 cP* could be adequatel y atomized (Kretschmer and Odgers, 1985). Combustion tests using this combustion chamber showed that emulsions containing up to 60 percent water could be burned successfully after preheating the ceramic lining, either using pure diesel fuel or emulsions with lower water content. Emulsions with higher water content burned quite well initially. The low heat release, however, was insufficient to keep the ceramic lining hot and the flame rapidly deteriorated and eventually extinguished.

Emissions tests were carried out while burning a Beaufort crude oil/water emulsion. Results were that all emulsion flames were without visible smoke. Unburned hydrocarbons in the exhaust gases, were more or less constant very near the lower detection limit of the equipment used (about 30 ppm as propane), and were considered to be insignificant. Carbon monoxide levels were even more surprising since they were consistently below the detection limit (on a O to 0.5 percent scale). NO_x emissions were also very low and their emissions, per mole of oil, were found to have decreased with increasing water content of the emulsion.

Home-heating burners are certified and approved for use indoors; it is not likely that this certification would extend to this proposed use. Since the units are designed for indoor use they may need some modification. Wind, rain and cold would detract from their performance. As with all hydraulic atomization devices, suspended solids and debris in the waste fuel would clog the nozzle.

The cost of the oil burner will vary with manufacturer and the model chosen. Additional cost will also accrue to the fabrication of the combustion chamber and the purchase of the pump and the provision of a small portable electric generator.

4.7 THE SAACKE BURNER

The SAACKE burner was developed as a heli-portable device capable of dealing with the disposal of recovered fluids from an oil spill cleanup. It is based on the principle of atomization by centrifugal force. The rotary cup and primary air fan (supplying 25% of the stoichiometric air required) are

---

cP = centipoise; 1 centipoise = 1 mPas; centipoise = centistokes x density (gm/cm^3)

mounted on a common shaft, driven at high speed (5,000 to 6,300 rpm) by an electric motor. The combustible liquid is pumped at low pressure into the conical spilling cup. It is distributed evenly over the cup's inner surface by centrifugal force and thrown off the cup rim in the form of a thin film. Air. supplied by the primary fan, is blown concentrically around the cup and atomizes the oil film. The balance of the combustion air is provided by natural entrainment into the flame. To augment this the SAACKE is equipped with a shroud which captures the wind and directs it into the combustion region. The burner can be swivelled 360°, to ensure that it can always fire in the same direction as the wind.

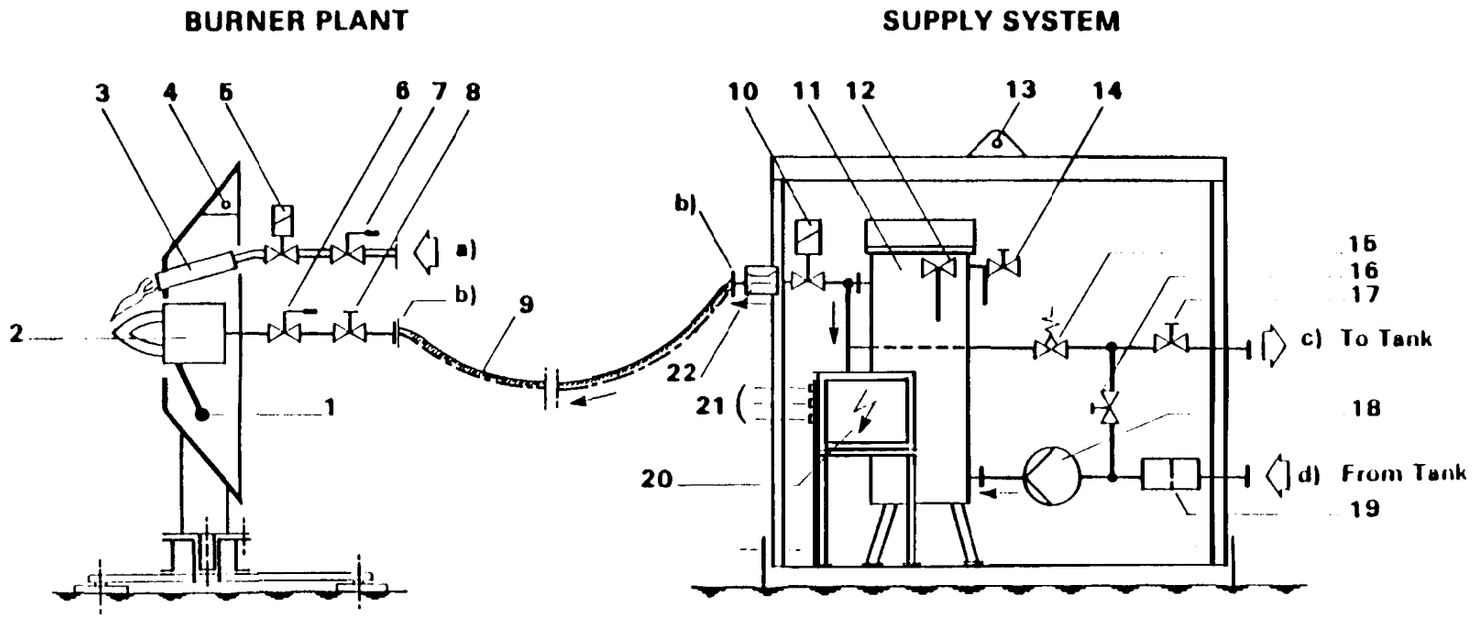
The complete package includes the burner unit (see Figure 8) and the control unit. A 20 kW 440 VAC three phase power source is also required, but not included. The control unit includes all automatic ignition and shutoff equipment, a screen filter to remove large solids, a gear pump, a 40 kW preheater (optional), and the required valving, flow meters and flow controllers. A pad of incombustible material is required for the unit to be set up on.

If the self-checking propane igniter is purchased, it eliminates the need to ensure that the fuel/water emulsion is completely mixed. Any water slugs that are pumped through the unit may temporarily extinguish the flame, but it will be quickly reignited, even if the unit is left unattended.

There are two models of the SAACKE burner available: the SKV 400 has a nominal capacity of 1,700 L/h, and has successfully burned a 40% diesel/60% water mixture at a rate of 3,400 L/h (S.L. Ross 1988); the SKV 150 is a smaller unit, nominally rated at 700 L/h, and has disposed of oil-based drill muds with 10% water and 20!% solids at rates of 1,100 L/h. The burner, generator and control unit for the SKV 150 weigh 365, 934 and 500 kg respectively. With both models of the SAACKE, greater-than-nominal combustion rates would be realised with higher water/fuel ratios. The turndown ratio on this burner is high.

Both models will handle a wide variety of fuels, with varying water contents. Over a two-year period at Canmar's base camp in Tuktoyaktuk, a SK150 (Figure 9) was used to dispose of over 1,000,000 L of waste oil, solvents, etc. The only waste products that could not be burned were grease and paint. A limit to fuel viscosity is unknown, but would likely be around 10,000 cP; emulsions with a water content up to 80% can be successfully handled (Buist and Vanderkooy, 1982). Suspended solids will generally not cause a problem, although some vibration of the unit has been experienced if the solids cake onto the rotating cup. This can be eliminated by periodic cleaning of the cup.

PORTABLE WASTE OIL BURNER

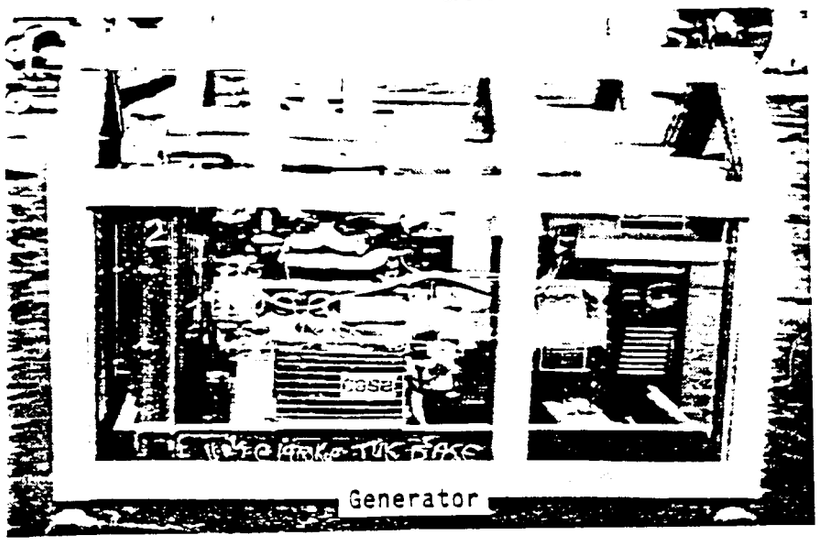


1 AIR DAMPER LEVER
2 ROTARY CUP ATOMIZER
3 SELF-CHECKING GAS IGNITER
4 LIFTING EYE
5 ELECTROMAGNETIC GAS IGNITER
6 MANUAL RAPID SHUT-OFF VALVE
7 MANUAL GAS VALVE
8 MANUAL FLOW CONTROL VALVE
9 FLEXIBLE TUBING - OIL SUPPLY
10 ELECTROMAGNETIC OIL VALVE
11 HEATER (ELECTRICALLY OPERATED)
12 PRESSURE RELEASE VALVE
13 LIFTING EYE
14 AIR VENT VALVE
15 PRESSURE CONTROL VALVE
16 INTERNAL RECIRCULATING VALVE
17 EXTERNAL RECIRCULATING VALVE
18 WASTE OIL PUMP
19 OIL FILTER
20 CONTROL BOX
21 ELECTRIC CABLES FOR CONTROL OF ELECTROMAGNETIC VALVES, GAS IGNITER AND ROTARY CUP MOTOR
22 OIL FLOW METER

CONNECTIONS
a) PROPANE GAS CONNECTION
b) OIL SUPPLY LINE
c) EXTERNAL RECIRCULATION CONNECTION
d) OIL SUCTION CONNECTION

Figure 8: SAACKE burner unit

SAACKE BURNER SK150



Generator

Bur

DESCRIPTION: Portable device for burning recovered oil and oil/water mixtures.

MAIN FEATURES : System comprises three units: burner, generator and control unit. Each unit is heli-transportable. Burner - electrically powered, uses a rotating cup to atomize oil for burning. Generator - four cylinder water cooled diesel engine, electric start, skid mounted. Control unit - includes flow and pressure control, oil supply pump and emergency shut-off valve. Lifting eyes provided on each unit - two point bridle required for burner, four point bridle for each of the other two units.

sPECIFICATIONS:

	Burner	Generator (I Suzu QD60)	Control Unit
Length dia.	2.0 m (78.7″)	2. I m (82.7″)	1.26 m (49.7″)
Width	---	0.8 m (31.5″)	1.16 m (45.7″)
Height	1.75 m (68.9″)	1.2 m (0.47″)	1.75 m (68.9″)
Wei ght	365 kg (804 lbs)	934 kg (1837 lbs)	500 kg (1101 lbs)

CAPACITY: Burner: 16 m^3/day (100 bbl/day) of oil, can burn mixtures containing up to 50% water.

Generator: 20 Kw, three phase 440 VAC
diesel fuel led, 0.68 m^3 (150 gal)fuel tank

CONNECTIONS : Control to Burner: 1 1/4 inch camlocks: hoses, fittings supplied with control unit.
Control Suction: 3 inch male camlock fitted.

SUPPLIER: Burner: H. Saacke KG
Postfack 210261
2800 Breman 21 Germany

Klaus Haubold
Tlx 024-4230
421-600-675

Figure 9: Data Sheet for SAACKE SK150 burner

The SAACKE burns with very little smoke and soot production; environmental impact would be minimal, provided a moderate bum rate was maintained. No certifications or approvals exist for the sYstem, although the burner head is a production model in Europe and likel y certified there. Cost estimates for the SAACKE burners are $200,000 for the SKV 400, and $100,000 for the SKV 150, they must be ordered from Hamburg, Germany (see data sheet - Figure 9).

4.8 THE SWIRLFIRE BURNER

The Swirlfire burner is a rotary cup burner, designed to burn a wide variety of combustible liquid waste (see Figure 10). It is similar, in principle, to the SAACKE burner, described above, but with a number of improvements. As above, the fuel is pumped into a slightly conical, rotating cup, and is spread into a thin layer by the centrifugal forces. Combustion air is delivered through a small space around the rotating cup and shears the fuel layer off and atomizes it, as it reaches the rim of the cup.

There are several features which distinguish the S wirlfire from other waste oil disposal burners. The Swirl fire delivers about 40 to 50% excess air (i.e., 140 to 150% of the stoichiometric air required for combustion), which results in a very lean bum and reduced smoke emissions. A material balance performed on the combustion system shows that to pass such a high volume of air through the gap between the rotary cup and combustion chamber, the air must be traveling at high speed. This air produces great shearing forces and contributes to the complete atomization of the fuel.

The Swirlfire burner utilizes two fuel atomization processes, the primary system being the rotary cup and the secondary system being impingement of oil on a hot plate. A steel band, placed inside the combustion chamber and raised about 2cm off the chamber wall, is located where droplets flung off the rotary cup will land (if not sheared off by the air flow). This plate glows red hot after the system has gone through a warm up stage, and any liquid that contacts it will immediately vaporize and bum.

The combustion chamber itself incorporates a unique recirculation system and swirling motion to extend retention times and encourage complete, smokeless combustion (SL Ross, 1989). The results of the above are that the Swirlfire delivers high combustion rates with very low smoke emissions.

The Swirlfire's rotary cup operates at between 1,600 and 3,500 rpm. This is considerably slower

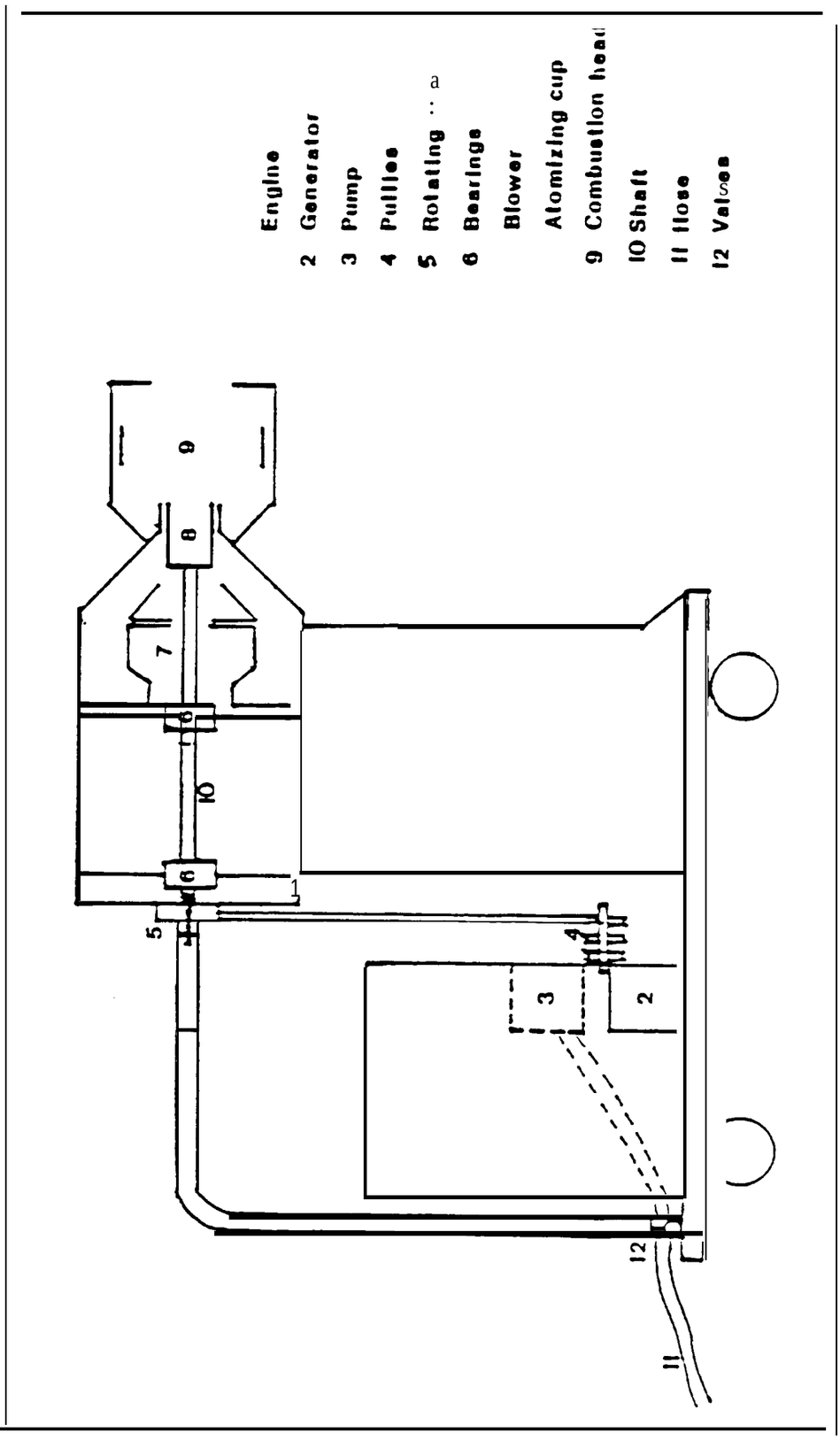


Figure 10: Schematic of the **Swirlfire** Burner

than the SAACKE burner (5,000 to 6,000 rpm), which lessens the possibility of vibration problems encountered when burning liquids with some solid contamination.

There are two sizes of Swirlfire burners in existence, the Mark I (a commercially available unit) and the Mark II (a larger prototype) (see Figures 11, 12 and 13), both consist of single units, each incorporating a diesel engine, fan, rotary cup atomizer and combustion head. They are designed to be heli-portable and incorporate pad-eyes for stable lifting. The Mark I unit weighs 590 kg and the Mark II prototype unit 1590 kg, including fuel for the diesel engine. A level pad of incombustible material is required for the unit.

A slot is cut into the side of the combustion chamber to allow the insertion of an ignition source, such as a burning rag or oxy-acetylene torch. The unit is usually started with pure diesel fuel and switched to the waste liquid after a warmup period.

The Mark I Swirlfire burner is nominally rated at 110 L/h and has burned pure diesel fuel at rates of 192 L/h (SL Ross, 1991). It has also burned preheated Bunker C (viscosity = 5,000 mPas, temperature = 49°C) at 54 L/h (SL Ross, 1990) with some smoke (less than Ringelmann no. 1). The Mark I has also burned waste lubricating oil, crude oil and emulsified crude oil. No problems are envisioned burning most combustible fuels. The Mark II prototype burner is nominally rated at 558 L/h and has burned pure diesel fuel at 715 L/h. Fuel viscosity limits are not available for either of the two models, but they are likely both near 10,000 cP.

The rate of combustion, and delivery of combustion air, can be precisely controlled with the units, so smokeless burning should be possible with most liquids.

No residue will remain after the combustion. However, care should be taken to separate the waste diesel fuel from any free standing water; any slugs of water that are picked up and pumped to the combustion chamber will most likely extinguish the flame, and necessitate re-starting the system. Small solids and debris will not likely affect the unit's operation. High winds and extreme cold (< -20°C) could hamper the unit's operation.

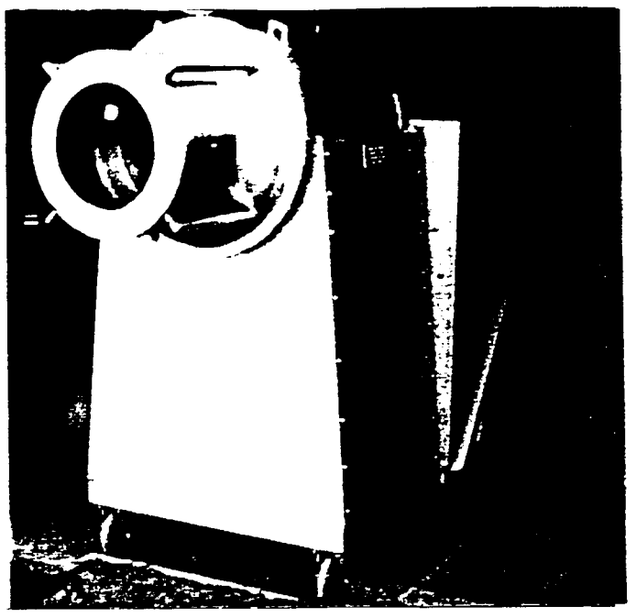


Figure 11: Mark I Swirlfire, showing combustion chamber

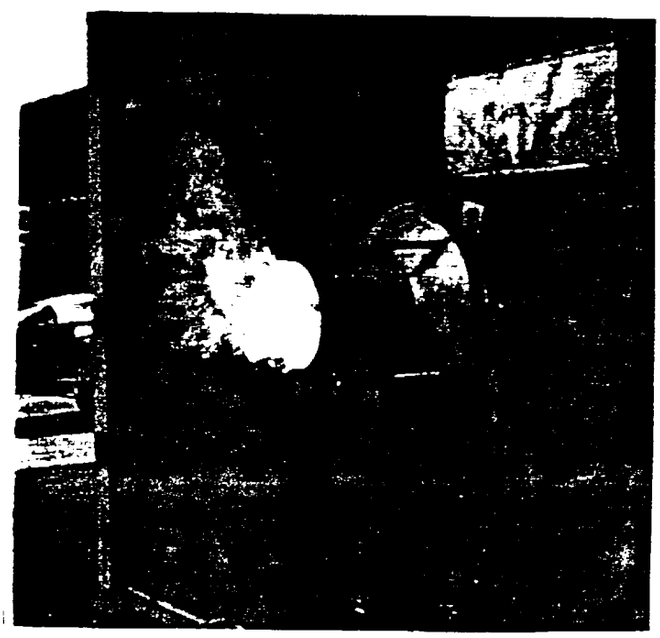


Figure 12: Mark I Swirlfire, showing clean bum of diesel fuel

Figure 13: Mark II Swirlfire burning diesel at 714 L/h

Cost estimates for the Swirlfire burners are $40,000 for the Mark I and $50,000 for the Mark II and are supplied from Waterloo, Ontario. The manufacturer is: Energetex Engineering, 505-125 Lincoln Road, Waterloo, Ontario N2J 2N9. No certificates or approvals are available for this device.

4.9 OTHER MANUFACTURERS OFFERING CUSI'OM-ENGINEERED SYSTEMS

Several manufacturers responded to the survey by saying that they would custom-design portable burners using their combustion expertise. These were:

HED Industries Inc.
P.O. Box 246, Highway 31
Ringoes, New Jersey 08551
U.S.A.
tel: (609) 466-1900
fax: (609) 466-3608
contact: John Dennis
system: ISOMAX Blue Flame Burner

HMT Thermal Systems Inc.
14615 FM 2920
Tomball, Texas 77375
U.S.A.
tel: (713) 351-7945
fax: (713) 351-6758
(Canadian office in Calgary)
contact: Richard Anderson
system: proprietary technology for waste oil burning

Preferred/W.N. Best Combustion S ystems
11 South Street
Danbury, Connecticut 06810
U.S.A.
tel: (203) 7434741
fax: (203) 798-7313
contact: Grant Bowman
system: custom-engineered rotary cup-type burners

MBB-Trecan
2150 Dunwin Drive #3
Mississauga, Ontario
L5L 5M8
tel: (416) 607-5905
fax: (416) 607-5908
contact: Frank Morrison
system: custom-engineered portable systems for waste fuel/diesel disposal

Company information on these manufacturers may be found in Appendix 3.

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table

Information on the following units were provided to the Pollution Control Division following completion of the report.

The units were not assessed and are included for information only.

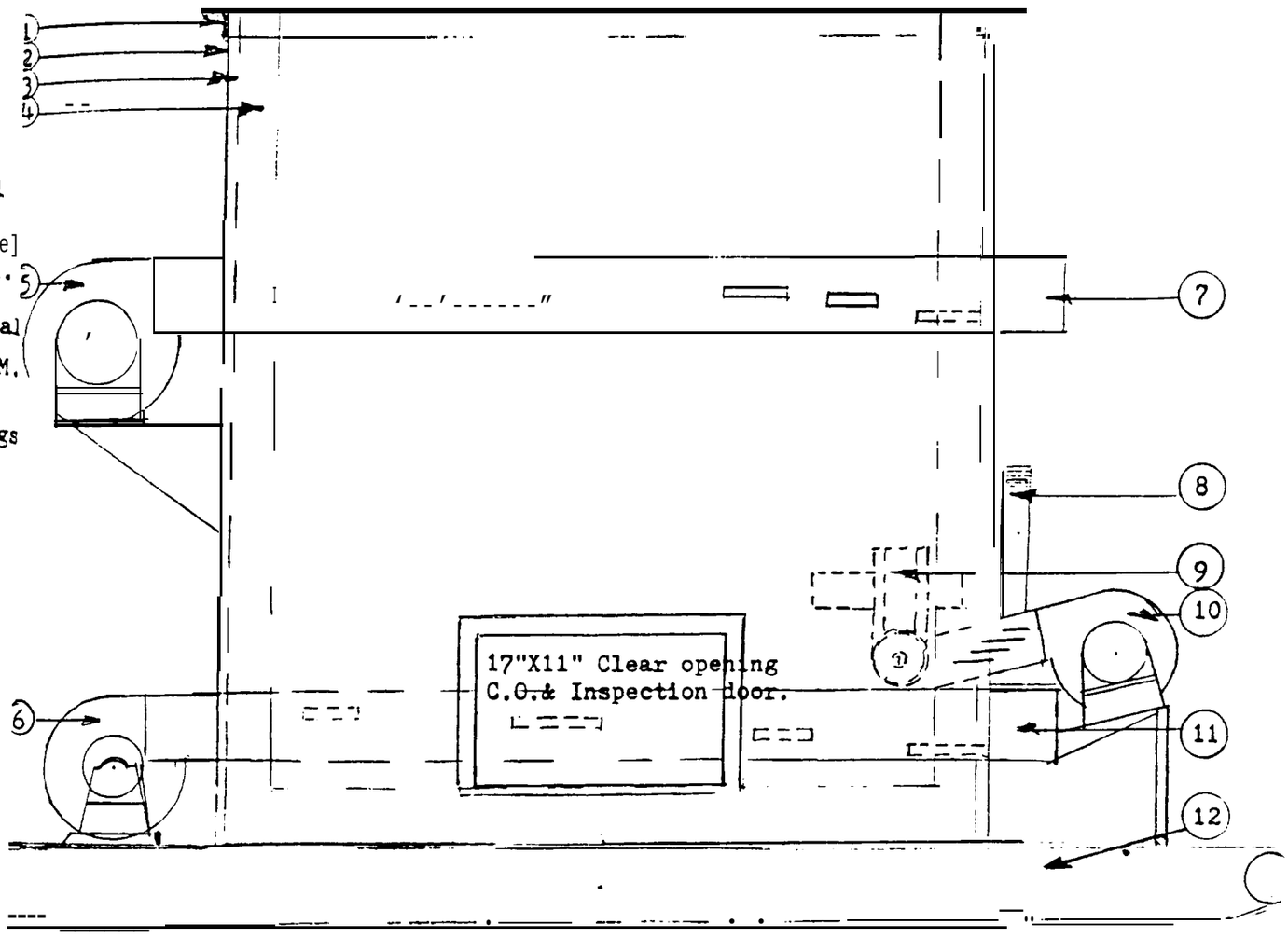
PORTABLE OIL SPILL WASTE INCINERATOR SPECIFICATION AS DESIGNED AND MANUFACTURED BY HOWELL REFRACTORIES LTD.

PHYSICAL APPEARANCE	Incinerator to be a cylinder with an outside diameter of 4'-8" and an inside diameter of 4'-0", Outside height to be 5'-0" and the inside height to be 4'-8".
OUTER CASING	Generally constructed of 10ga. steel plate with structural steel angle supports at top and around cleanout door. Floor to be 10Ga. steel plate.
CLEANOUT & OBSERVATION DOOR.	Located at hearth level and to be fabricated of ¼" steel lined with refractory, Size to be 17" wide by 11" high clear.
LINING.	Generally of 1" of 1900 F, block insulation against the steel with 3" of 3000°F. high strength castable in the walls and 4" of the same castable refractory In the hearth.
COMBUSTION AIR BLAMERS ALL TO BE HIGH PRESSURE.	1. Primary underfire air with manifold at hearth level- Lau model H.P.R.-10 1H.P./3450RPM./120V/60Hz. Cap. 482CFM@4"S.P. Or equal. 2. Secondary overfire air with manifold near top of unit. *Lau* model H.P.R.-12 2H.P./3450RPM/120V/60Hz. Cap. 900CFM@4" S.P. Or equal. 3. Waste oil injector blower just above hearth level. Lau model H.P.R.-9 3/4H.P./ 3450RPM/120V/60Hz. Cap, 235 CFM@4" S.P. Or equal
IGNITION BURNER	AERO Model HFAFC-5 electric ignition power burner 1/3 H.P./3450RFM. 120V/60Hz. Adjustable BTU input. 011 burner.
INCINERATOR BASE	Usually mounted on a 5'X6' steel skid which would have lifting lugs
CONTROL PANEL	Steel weatherproof panel enclosure to be mounted adjacent to incinerator on skid and have sheet metal outer protector shroud. Control panel to house starter switches fo all motors, magnetic starters for motors *where* required, main disconnect switch and female receptacle for incoming power.
AUXILIARY EQUIPMENT REQUIRED	Waste oil feed tank, Ignition burner fuel tank, Electric power generator set.
POWER REQUIREMENTS	Generator set capable of supplying 20KW 120-208 3PH 60Hz.
REMOVABLE LID & SPARK ARRESTER	Incinerator 1s normally fitted with a solid steel lid section for use when not under fire. A stainless steel spark arrester is available if wastes having large incombustible content are to be destroyed.
SHIPPING WEIGHT	Incinerator mounted on skid with blowers, burner & waste oil injector unit mounted Approximately 1800 KGS.
1993 APPROXIMATE COST .	Incinerator comes complete with blowers, oil burner and waste oil Injector system mounted on a skid G.S.T.N.I. $20,000.00
INCINERATOR CAPACITY PERFORMANCE WHICH CAN BE EXPECTED.	The following tests were run at our plant. 1. Simulated treater hay-- 350 Lbs./Hr. (23 Cu. Ft.) No smoke. 2, Used crankcase oil through injector- 50 G.P.H. No smoke. 3. Light Solvent (Acetone) 45 G.P. H, No smoke.

HOWELL REFRAC TORIES LIMITED
20208 - 110th. Ave.
EDMONTON, AB
T5S 1X8

SKETCH OF HOWELL REFRACTORIES LTD. CYCLONATOR OILY WASTE

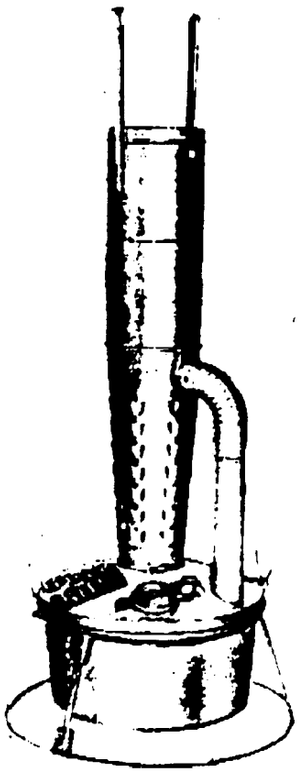
SINGLE CHAMBER FORCED AIR INCINERATOR



DETAIL DESCRIPTION

. 2"X2"X¼" Rolled angle around top of incinerator.
. 10 Ga. Steel plate casing.
. 1" of 1900°F. High temperature block insulation.
·. 3" of High heat duty high strength castable refractory, Max. 3000°F. service temperature.
i, Overfire or secondary air high pressure blower. Lau model HPR-12 or equal.
)₀ Underfire or primary air high pressure blower. Lau model HPR-10 or equal.
'. Secondary alr manifold with air jets through inner lining.
3. Wasteoil introduction pipe.
9. Ignition burner. Aero Model HFAFC-5 oil burner or equal. Input Max. 6 G.P.H.
). Waste oil injection blower system. High pressure Lau model HPR-9 or equal.
1. Primary air manifold with jets through inner lining.
2. 6"I beam with 3" pipe ends. Skid.

ASSEMBLY & OPERATING INSTRUCTIONS FOR THE OIL-BURNING CONSTRUCTION HEATER



This heater has been designed for maximum heating effectiveness and fuel economy. The intended use is primarily temporary heating or buildings under construction, alteration, or repair.

SPECIFICATIONS

Heater Type:	Radiant Oil
Burning Range:	50,000-140,000 BTU/hr
Fuel Consumption:	.35.0 Gal/hr
Maximum Fuel Capacity:	10 Gallons
Fuels:	No. 1 or No. 2 Diesel Fuel
	No. 1 or No. 2 Heating Fuel
	Kerosene
Ignition:	Manual
Size (Height x Diameter):	63" x 21"
Weight (Without Fuel):	28 lbs.

A WARNING:

IMPROPER USE OF THIS HEATER CAN RESULT IN SERIOUS BODILY INJURY OR PROPERTY DAMAGE DUE TO HAZARDS OF FIRE OR EXPLOSION, CARBON MONOXIDE POISONING, AND BURN.

DO NOT OPERATE THIS HEATER UNTIL YOU HAVE READ AND THOROUGHLY UNDERSTAND THE SAFETY AND OPERATING INSTRUCTIONS.

SAFETY PRECAUTIONS

(1) Do not operate a heater which has been damaged, modified or otherwise changed from its original condition.

(2) Operate only on a stable, noncombustible surface or floor.

(3) Use only No. 1 or 2 diesel fuel, *No. 1* or 2 fuel oil, Or kerosene. Never burn crankcase drainings, transmission fluid, gasoline, naptha, paint thinner, or other volatile fuels.

(4) WARNING: Water in the bottom of the bowl can create a hazardous condition (including, but not limited 10. an explosion of fire and boiling water from the heater). Do not allow under any circumstances water 10 ● nter the heater, Be mindful some fuel may contain water under various circumstances.

(5) Keep the stack cap (3) on the heater when not in use and keep out of the rain, Use only clean water-free fuel ● nd clean bowl and replace the fuel frequently (at *least* after every 100 hours of use.)

(6) Provide minimum clearances from normal combustible materials of 8 ft. top , 6 ft. - sides.

(7) Use only in areas free of flammable vapor Never use where gasoline, paint thinner, or other highly flammable vapors are present.

(8) Use only in well ventilated spaces, providing a minimum of 2 sq. ft. air inlet near each heater and 2 sq. ft. above ● acn neater in, *or* near, the ceiling.

(9) Do not touch the heater surface Whale it is operating or for 30 minutes after shutdown, it can cause serious burns.

(10) DO NOT MOVE, HANDLE, OR FUEL HEATER WHILE HOT OR BURNING. Wait until heater is out and the fuel has cooled. Allow at least 30 minutes after shutdown: then open the regulator one hole to be sure no combustible gas is still being generated.

(11) Always use stand supplied with heater; be sure handles (10) are locked to cover ● *nd* securely bolted.

(12) When carrying the heater with *the* handles (after out and cooli, grasp the elbow 10 provide stability. NEVER use the handles for crane hoisting or similarly transporting the heater.

(131 NEVER look down imo the stack.

(14) NEVER throw paper cups. food, lunch bags, trash or other foreign material dawn the stack.

(15) Use this heater only in accordance with Federal, State, and Local Codes or regulations governing temporary heating appliances. Safety requirements and model plate data comply with AMERICAN NATIONAL STANDARDS INSTITUTE INC. Bulletin ANSI Al O. 1 O 1970.

HOW TO ASSEMBLE THE HEATER

(Refer 10 illustration 1 for parts identification.)

(I) Place cover (9) on bowl (13)--push down firmly. Check to see that cover is seated down ● li ● rounct the bowl.

(2) Depress regulator latch (16) and lift up regulator (11] and insert down draft tube (12) until lip m the regulator opening snaps over notch in down draft tube.

(3) Place plain end of 3" pipe (7) on 3 nozzle in cover and push down.

(4) (See illus. 2) Pick up the scoop (5) with left hand, wsth thumb just covering small hole (A) near the end of the tube. Pick up the elbow (6) with right hand, with thumb cowering slotted hole (B) and fingers wrapped around tube so they grip lock formed seam *on* the opposite side.

(5) Insert the lock formed seam of the ● {bow into me end of the scoop. Squeeze elbow ● press with thumb wnile rotating the ● lbow. This will reduce the size of the elbow and allow it to slide easily into the end of the scoop.

(6) (See illus. 3A) Place louvered tower stack section upright on the floor. Holding the assembled scoop and elbow (5 & 6) in one hand, hook the end of the scoop through *the* 3" hole *in* the stack *from* me outside. Lift up and push the scoop into the 3" opening.

(7) (See illus. 3B) Reach into the stack and pull scoop and elbow inward until all holes (A, B, and C! line up inside the stack.

(8) (See thus. 3B) Start the No. 6 x 3/8" sheet metal screw at a slight angle and tighten with a No. 2 Phillips screwdriver.

(9) After assembling scoop and elbow, place louvered lower stack (4) on 6" collar of cover, aligning 3 elbow opening with top of the 3" pipe (7) and doss in lower ● nd of stack with damper rod (8) and push down firmly.

(10) Place upper stack (4) on crimped top of lower stack and push down firmly. Make sure ● ll joints are seated.

(11) Insert wire hinge prongs of cap (3) into bracket riveted to upper stack. Close *the cap* and push down on it to snap the prongs in place.

(12) Attach the diffusion hood (1) to diffusion hood arms (2); then attach the arms to the holes on side of upper stack using six 10-24 x 3/8" machine screws and six square nuts.

(13) Place heater in stand with cover lock brackets centered over handles. Pull handle (10) upward through cover lock bracket slot, insert 12-24 1¼" screw through the hole in bracket and fasten in place with the 12-24 hex locknut. Repeat this operation on the second handle.

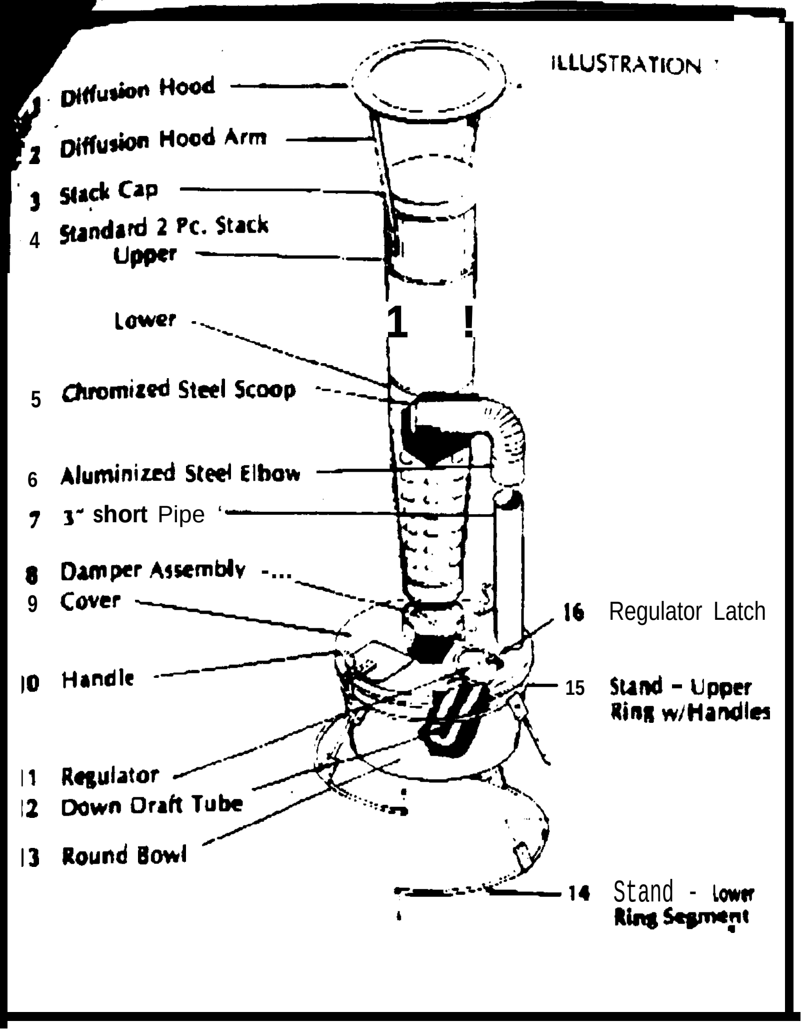


ILLUSTRATION 1

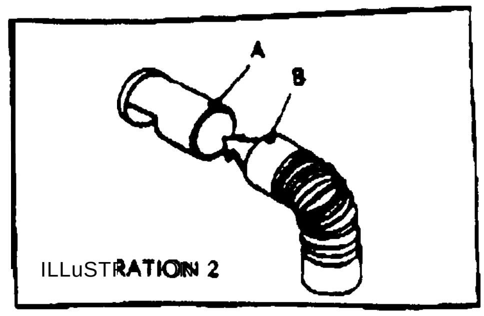


ILLUSTRATION 2

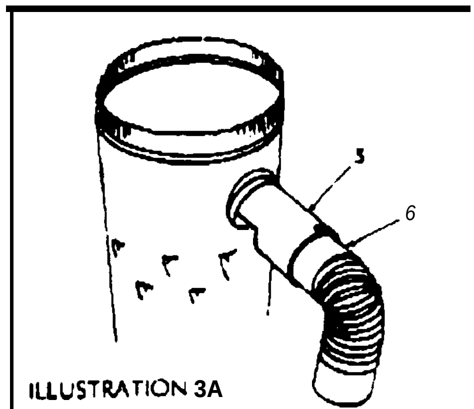


ILLUSTRATION 3A

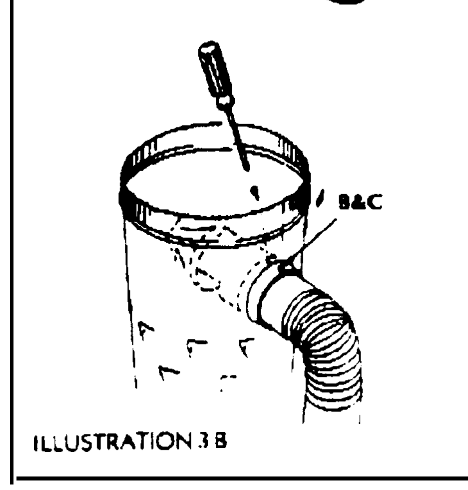


ILLUSTRATION 3 B

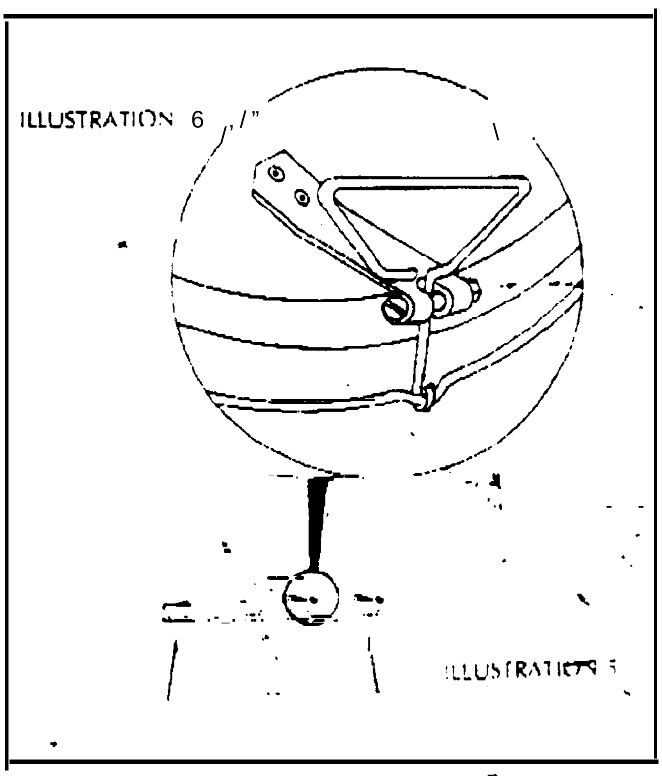


ILLUSTRATION 6

ILLUSTRATION 5

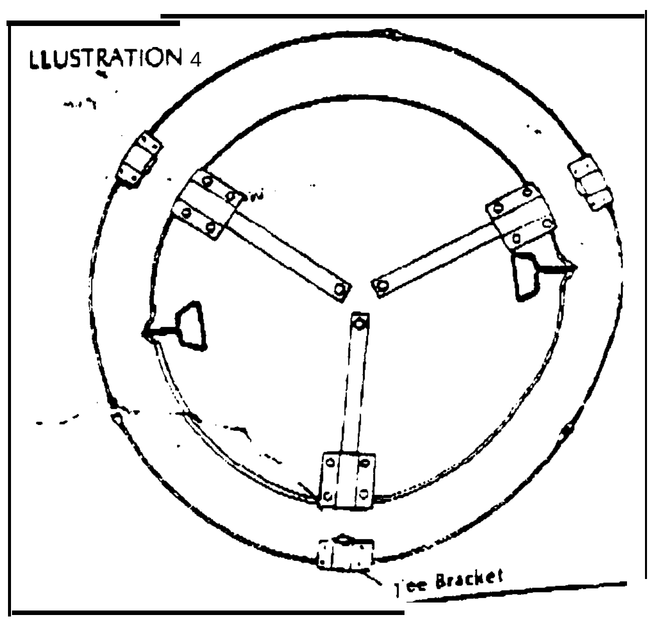


ILLUSTRATION 4

OPERATING PRINCIPLE

This is a highly efficient heater, yet the principle of burning is extremely simple. Air entering through the regulator openings feeds and maintains a small generating fire on the surface of the oil. The generating fire gasifies oil in the bowl and this gas rises into the stack where main combustion takes place. Thus, the size of the fire in the stack is dependent on the gas supplied by the generating fire and this is controlled by the openings in the regulator.

OPERATING THE HEATER

TO FILL

Depress the regulator latch (16) open hinged regulator (11) and fill through down draft tube (12) to within 2 inches of top of the bowl. Put in 8 to 9 gallons of diesel oil, or grade No. 1 or 2 fuel oil, or kerosene. Use only clean fuel from enclosed storage vessels. Fuel from open containers may contain contaminants and is not recommended.

TO LIGHT

Throw back the hinged stack cap (3). Move damper (8) to upright open position. Depress the regulator latch (16) and open the hinged regulator (11). Place a crumpled paper in down draft tube (12) on surface of oil and ignite. Watch that heater continuously and when fire starts up through stack (4), close regulator (11) and rotate its cap to one or more holes to maintain fire in stack (4). Be sure the regulator (11) is securely fastened under the regulator latch (16). Allow several minutes for surface oil to become uniformly heated before making final regulator setting; otherwise, fire will increase. As fire in stack increases, close the regulator cap to one hole or less.

TO REGULATE

The best combination of heating and heater life will occur when only a flicker of flame is seen at top of the stack. Control fire size by rotating the regulator cap to cover or uncover holes. Covering the holes reduces the burn rate and uncovering the holes increases the burn rate. NEVER allow over 6 inches of flame to appear at top of the stack. Overfiring can be hazardous and voids warranty. To maintain even burning rate, regulator can gradually be opened as fuel is consumed.

TO EXTINGUISH

CAUTION: Follow steps "A", "B", and "C" in exact order.

A. 15 minutes before extinguishing, rotate regulator cap closed so no holes are visible.

B. 15 minutes later, close damper (8) by rotating arm 10 the right until tip touches cover (9).

C. Place cap (3) on top of stack (4) and secure.

Check in 15 minutes after shutdown. The cover (9) should be cool to the touch. Slide regulator (11) open to see there is no fire in bowl. If no fire is visible, heater is out. If fire is visible, close regulator (11), wait 15 minutes and repeat observations until no fire is evident.

MAINTENANCE

Clean heater after every 100 hours of use. Remove retainer nuts and bolts; then lift heater out of stand. Using a small wooden block and hammer, tats the underside of the rolled rim on the cover progressing around the bowl to loosen the seal. Remove cover from bowl. Clean off any accumulated soot in down draft tube under fire cover, or around six-inch neck and damper. Dispose of remaining fuel, sludge and any accumulated waste in the bottom of the bowl. Maintain heater in original operating condition.

At the beginning of each heating season, clean the heater, flush the bowl with trash fuel, then fill with clean fresh fuel.

LIMITED WARRANTY

The Company warrants this product to be free from defects in material or workmanship, under normal and proper use in accordance with instructions of The Company, for a period of ninety days from the date of delivery to the buyer. The Company, at its option, will repair or replace (f.o.b. Factory. California) products returned by the buyer to the factory, California, transportation prepaid within said ninety day period and found by the Company to have been thus defective in material or workmanship.

Address any Warranty Claims to the Customer Service Department, Scheu Products Company, Incorporated P O Box 250, Upland, 091766. Include your name, address, and telephone number and include details concerning the claim. Also, supply us with the purchase date and the name and address of the dealer from whom you purchased our product.

The foregoing is the full extent of the responsibility of the Company. There are no other warranties, express or implied. Specifically there is no warranty of fitness for a particular purpose and there is no warranty of merchantibility. In no event shall the Company be liable for delay caused by defects, for consequential damages, or for any charges of the expense of any nature incurred without its written consent. The only repair or replacement shall be the exclusive remedy for any breach of warranty. There is no warranty against infringement or the like and no implied warranty arising from course of dealing or usage of trade. This warranty will not apply to any product which has been repaired or altered outside of the California factory in any respect which, in our judgement, affects its condition or operation.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific legal rights, and you may have other rights which vary from state to state.

5394713

C.J.S. COMBUSTION PRODUCTS
SALES & SERVICE LTD.

March 8, 1993.

NORTHWEST TERRITORIES POWER CORP.
HAY RIVER, N.W.T.

Attention: Mr. Stephen Kerr

Dear: Stephen:

As per our telephone conversation of today we are pleased to quote you as follows:

(1) Only Model CJS-50 incinerator and stack as per the following specifications and drawing.

INCINERATOR - 10 Gauge steel plate casing c/w structural angle and channel iron supports.

- Refractory lining would be 4½" of 2600°F high abrasion castable refractory backed by 1½" thick 1900°F high temp block insulation. Refractory would be anchored back to the steel sheel using stainless steel "V" type anchors.

STACK - 10 Gauge steel casing c/w companion flanges, base plate and gussets for a total height of 20 feet.

- Refractory lining would be 3" of 2800°F lightweight insulating castable refractory backed by 1" thick 1900°F high temp block insulation. Refractory would be anchored back to the steel sheel by stainless steel "V" type anchors.

CONTROL PANEL - Would include indicating temperature controller c/w thermocouple which would be mounted in stack, temperature controller and thermocouple which would be mounted in primary chamber, timers, lights and on/off switch.

COMBUSTION AIR BLOWER - For supply of combustion air to primary chamber and reactor section of the stack.

BURNERS - (3) Only Incinomite Model J Series natural gas burners. Each burner has a maximum capacity of 800,000 btu/hr. (2) Burners would be mounted in the primary chamber and (1) burner would be mounted in the reactor section of the stack.

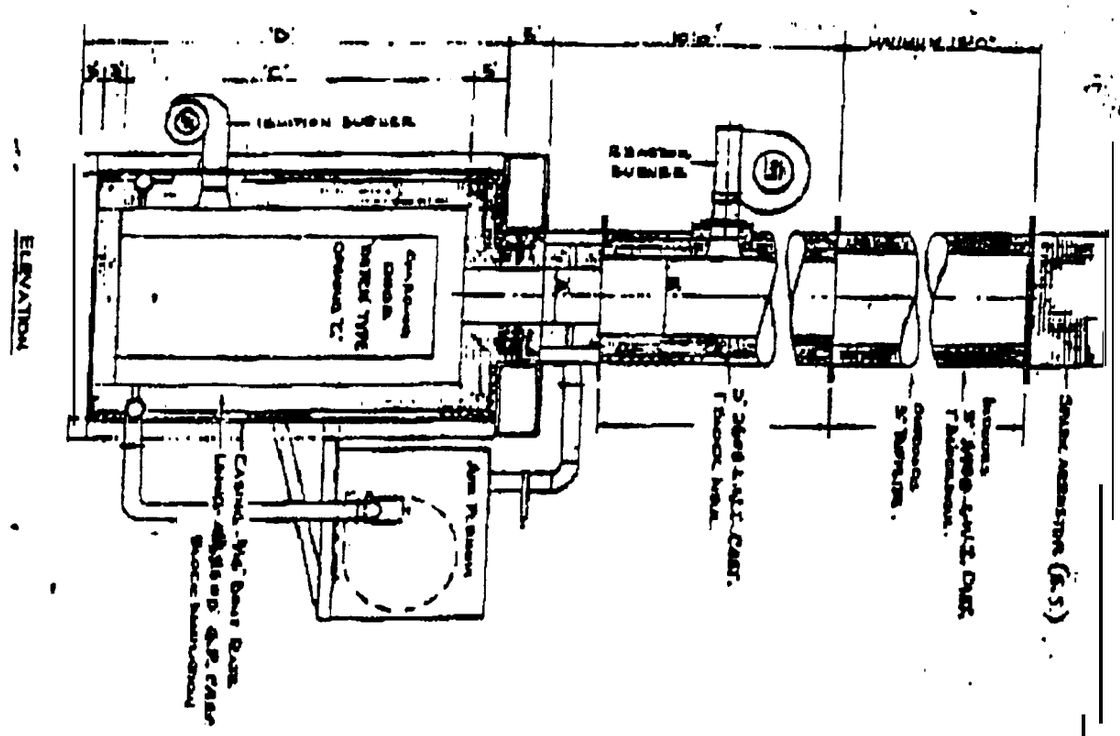
Total Cost for the (REBUILT) incinerator and stack. . . . . $ 19,991.00
F.O.B. Edmonton, Taxes Extra.

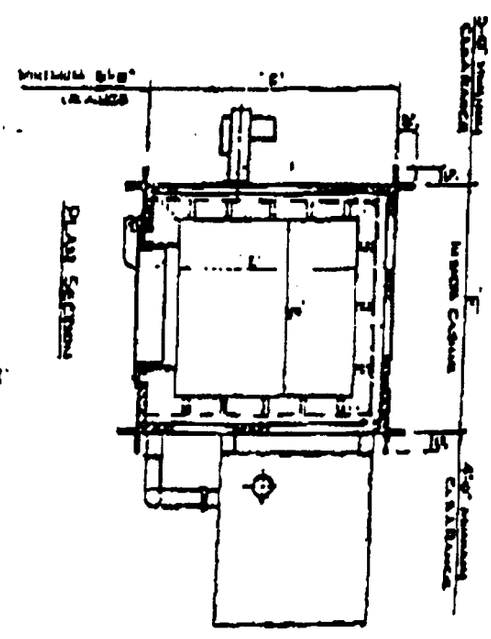
If you have any questions please do *not* hesitate *to* contact me.

Kindest Regards,

C. J. (Vic) small

BAY 5, 13826 - 112 AVENUE
Edmonton, Alberta
Phone: 452=3651





MODEL	A	B	C	D	E	F	G	CAPACITY(KW/HR)
								90

MODEL	

CJS COMBUSTION PRODUCTS
SALES & SERVICE LTD.

REFERENCES

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APPENDIX 2

Manufacturers Survey Form and **List**

S.L. Ross Environmental Research Ltd.
717 Belfast Road, Suite 200, Ottawa, Ontario, Canada, KIG OZ4
phone: 613-232-1564 **fax: 613-232-6660**

FAX

Destination: _____

Fax **No.:** _____ **Attention:** Sales Manager

Date: 11/12/92 **Number of pages, including this page: 1**

If any problems, please contact James McCourt **at (613)232-1564.**

original: **Held on file ⊗** **To follow by mail ❑** **To follow by courier •l**

)ear Sales Manager:

Ve have been contracted by the Government of the Northwest Territories (GNWT) to conduct a study of: portable :quipment for the smokeless combustion of water-contaminated diesel fuel; and, furnaces, boilers, and space waters capable of accepting used lubricating oil as **a fuel. The water-contaminated diesel fuel will, typically, be removed from the bottom layers of fuel storage tanks. The sources of used lubricating oil include gasoline and diesel-powered-automobile crankcases, and diesel-powered electric generators. The GNWT contract manager for this study is Neil] Thompson who may be contacted at (403)873-7654. Your company has come to our attention as a potential supplier of these products.**

If **your company does in fact produce equipment that could be used for either of these applications, please send us two good copies of all sales and, particularity, technical literature pertaining to your products. With regards to the diesel fuel combustors, of particular importance are copies of reports or data about your products** fuel consumption rate, particulate emissions, weight, and range of fuels handled. For the used oil **or** multi fuel furnaces, we **are most** interested **in air quality/feedstock emissions results, heating capacity, fuel consumption rate, maintenance requirements, and status of certification. Also, please include the cost associated with the relevant** equipment. **Good, color copies,** of brochures are requested **as** we will be putting together a binder of material for the **GNWT staff** for whom we are conducting the study.

If **you** have **any questions or comments, please feel free to contact me at the number listed above.**

Yours sincere] y,

James L. McCourt

AEROTECH INTERNATIONAL, INC.
1OO-T Eagle Drive
Winnipeg, MB
tel: (204)633-1999
fax: (204)694-1612

AKI SYSTEMS, INC.
14615-T F.M. 2920
Tomball, TX
77375
tel: (713)351-7945
fax: (713)351-6578

ALZETA CORPORATION
2343-Z Calle Del Mundo
Santa Clara, CA
95054
tel: (408)727-8242
fax: (408)727-9740

AMERICAN HEATING CO., INC.
1200-T Route 46
Clifton, NJ
07013
tel: (201)777-0100
fax: (201)777-4693

BABCOCK & WILCOX
POWER GENERATION GROUP
CUSTOMER PARTS & SERVICE DEPARTMENT'
P.O. Box 351
Barberton, OH
44203
tel: (216)753-4511
fax: (216)860-1886

BELTRAN ASSOCIATES, INC.
1133-T East 35th Street
Brooklyn, NY
11210
tel: (718)338-3311
fax: (718)253-9028

BLASDEL ENTERPRISES, INC.
P.O. Box 260-T
Greensburg, IN
tel: (812)663-3213
fax: (8 12)663-4968

BURNER AND ENERGY SYSTEMS, INc.
901 Via Rodeo
Building No. 22
Placentia, CA
92670
tel: (714)572-8290
fax: (714)572-8296

BURNER SYSTEMS INTERNATIONAL, INC.
P.O. Box 1227
Chattanooga, TN
37401
tel: (800)251-6318; (615)867-5787
fax: (615)867-5965

COMPU-HEAT, INC.
7589 Race Road
Oleria, OH
tel: (216)353-0650
fax: (216)327-1047

CORBETT INDUSTRIES, INC.
39-T Hewson Avenue
Waldwick, NJ
07463-1819
tel: (201)445-6311
fax: (201)445-6316

COWAN, FREDERICK & COMPANY, INc.
48-T Kroemer Avenue
Riverhead, NY
11901-3108
tel: (516)369-0360
fax: (516)369-0637

DORR-OLIVER, INC.
77 **Havemeyer Lane**
Stamford, CT
06904
tel: (203)876-5400
fax: (203)876-5444

EASTERN ENERGY SERVICES, INC.
605 **Saltaire** Way
P.O. Box 1019-T
Mattituck, NY
11952
tel: (516)298-3841
fax: (516)298-3842

ECLIPSE COMBUSTION
Rockford IL
61103
tel: (815)877-3031
fax: (815)877-3336

ENARDO MANUFACTURING CO.
P.O. Box 266
Tulsa, OK
74101
tel: (918)835-6974
fax: (918)835-0044

ENERGETEX ENGINEERING
505-125 Lincoln Road
Waterloo, Ontario
N2J 2N9
tel: (519)886-2672
fax: (519)885-2738

ENGINEERED. COMBUSTION SYSTEMS, INC.
600-A Washington Avenue
Bridgeville, PA
15017
tel: (412)257-3274
fax: (412)221-5054

ENVIRO-CARE MANUFACTURING LTD.
Waterloo, Ontario, Canada
tel: (5 19)725-9285
fax: (519)725-9288

EVERHOT ALL-COPPER, INC.
191 Arlington Street
Watertown, MA
tel: (617)924-3877
fax: (617)924-7271

FORD PRODUCT CORP.
Ford Products Road
Valley Cottage, NY
tel: (914)358-8282
fax: (914)358-8717

W.W. GRAINGER, INC.
333 Knightsbridge Parkway
North Suburban, **IL**
Dept. TR24
tel: (708)982-9000
fax: (708)913-7463

GSW HEATING PRODUCTS CO.
281-T Birch Avenue
Hamilton, ON
tel: (416)529-8191
fax: (416)529-4514 "

HAGUE INTERNATIONAL
3-T Adams Street
South Portland, ME
04106
tel: (207)799-7346
fax: (207)799-6743

URING

HAUCK MANUFACTURING CO.
P.O. Box 90
Lebanon, PA
17042
tel: (800)3947543
tlx: 671-1457
fax: (717)273-9882

HEAT TRANSFER PRODUCTS, INC.
120-T Braley Road
East Freetown, MA
tel: (508)763-8071
fax: (508)763-3769

HED INDUSTRIES, INC.
UNIQUE/PERNEY BLUE FLAME DIV.
P.O. Box 246-T
Ringoes, NJ
08551
tel: (609)466-1900
fax: (609)466-3608

HY-WAY HEAT SYSTEMS, INC.
P.O. Box 2443
Youngstown, OH
tel: (216)747-1931
fax: (216)747-4323

JOSEPH A. HENDEL, INC.
97-15 95th Avenue
Ozone Park, NY
tel: (718)845-3000
fax: (718)738-0180

HIRT COMBUSTION ENGINEERS
931 South Maple Avenue
Montebello, CA
90640
tel: (213)728-9164
fax: (213)727-1829

INDUSTRIAL AIRSYSTEMS, INC.
2475-T Doswell Avenue
St. Paul, MN
tel: (612)646-9631
fax: (612)646-5867

IN-PROCESS TECHNOLOGY
1294 Hammerwood Avenue
Sunnyvale, CA
94089
tel: (408)745-1066
fax: (408)944-0292

IT-MCGILL POLLUTION CONTROL SYSTEMS, INC.
P.O. Box 9667-T
74157
tel: (918)748-0700
fax: (918)748-0739

KALDAIR, INC.
15835 Park 10 Place
Suite 115
Houston, TX
15835
tel: (800)525-3247
fax: (713)492-2399

KEL-GOR LTD.
P.O. Box 2253
Sarnia, ON
tel: (519)336-9312
fax: (519)336-9582

KEWANEE MANUFACTURING CO., INC.
101 Franklin Street
Kewanee, IL
61443
tel: (309)853-3541
fax: (309)852-3953

KLEENAIR PRODUCTS CO., INC.
P.O. BOX 1669
Clackamas, OR
97015
tel: (503)653-6925
fax: (503)659-0941

LANAIR, INC.
1312-T Barberry Drive
P.O. Box 1017
Jamesville, WI
53547
tel: (608)752-1601
fax: (608)757-7878

MAXON CORPORATION
201 East 18th Street
P.O. Box 2068
Muncie, IN
47302
tel: (317)284-3304
fax: (317)286-8394

MOCO THERMAL INDUSTRIES
2 Oven Place
Romulus, MI
48174
tel: (313)728-6800
fax: (313)728-1927

NAO, INC.
East Sedgley Avenue
Philadelphia, PA
19134
tel: (215)743-5300; (800)523-3495 ext. 103
tlx: WU 84-5403-
fax: (215)743-3018; (215)743-3020

NATIONAL COMBUSTION & CONTROL
P.O. Box 8627
Oakland, CA
94608
tel: (510)652-6000
fax: (510)652-4302

OAL ASSOCIATES, INC.
16744 West Bernard Drive
Rancho Bemardo, CA
92127-1904
tel: (619)451-1799
fax: (619)451-2799

ORIGO USA, INC.
1121-T Lewis Avenue
Sarasota, FL
tel: (813)265-3660
fax: (813)955-2598

POWER FLAME, INC.
2001 South 21st Street
Parsons, KS
67357
tel: (316)421-0480
fax: (3 16)421-0948

POWRMATIC ELTRON, INC.
2906-T Baltimore Blvd.
Finksburg, MD
tel: (410)833-9100
fax: (410)833-7971

pREFERRED UTILITIES MANUFACTURING CORP.
WN Best Combustion Equipment Division
11 South Street
P.O. Box 1280
Danbury, CT
06810
Mr. Grant Bowman
tel: (203)743-6741
fax: (203)798-7313

PROCESS COMBUSTION CORPORATION
Horning & Curry Road
Pittsburgh, PA
15236
tel: (412)655-0955
tlx: 81-2389
fax: (412)655-0961

SAACKE KG
Postfack 210261
2800 Bremen 21
Germany
tel: 421-600-675
fax: 024-4230

SAGE HEATER CO.
40-T North Prospect Avenue
Lynbrook, NY
tel: (516)887-1426
fax: (516)887-1619

G E A RAINEY CORP.
5202 West Channel Road
Catoosa, OK
tel: (918)266-3060
fax: (918)266-2464

RANSOME MANUFACTURING
3495 South Maple Avenue
Fresno, CA
93725-2494
tel: (209)485-0979
fax: (209)485-8869

SELAS CORPORATION OF AMERICA
2034 Limekiln Pike
Dresher, PA
19025
tel: (800)523-6500; (215)646-6600
fax: (215)646-3536

SMIDTH F L & CO., INC.
300 Knickerbocker Road
Cresskill, NJ
07626
fax: (201)871-3300

STACKMATCH FLARE IGNITION, INc.
620 Haggard
Suite 610
Piano, TX
75074
tel: (800)523-9260
fax: (214)881-9324

SUR-LITE CORPORATION
8124-T Allport Avenue
Santa Fe Springs, CA
90670
tel: (310)693-0796 ext. 7; (310)698-9432 ext. 7;
tel: (800)432-8818 ext 7
fax: (3 10)693-7564

TAMPELLA POWER CORPORATION
P.O. Box 3308, Dept. HG
2500 Reach Road
Williamsport, PA
17701-0308
tel: (800)394-5643
fax: (717)327-3 141

THARRINGTON INDUSTRIES, INC.
Station Square Mall
Rocky Mount, NC
tel: (919)977-7775
fax: (919)977-9442

TIOGA AIR HEATERS, INC.
P.O. Drawer 11
Waconia, MN
tel: (612)937-9000
fax: (612)442-5517

TODD COMBUSTION, INC.
61 Taylor Reed Place
Stamfort, CT
06906
tel: (203)359-1320
tlx: 643174
fax: (203)359-9317

TRECAN COMBUSTION, LTD.
6685 Mill Creek Drive
Unit 6
L5N 5M5
tel: (416)826-8631
fax: (416)607-5908

TRANE THERMAL - THE TRANE CO.
101 Brook Road
Conshohocken, PA
19428
tel: (215)828-5400
tlx: 84-6484
fax: (215)825-4877

VAPOUR CORP.
VA Power Products Group
6420 West Howard Street
Chicago, IL
60648
tel: (708)967-8300
fax: (708)470-7800

WEATHER-RITE, HEATING AND VENTILATION, INC.
616-T North 5th Street
Minneapolis, MN
55401
tel: (612)338-1401
fax: (612)338-6783

WELLMAN THERMAL SYSTEMS CORP.
1 Progress Road
Shelbyville, IN
tel: (317)398-4411
fax: (317)392-5275

ZEECO, INC.
P.O.Box 52165-T
Tulsa, OK
74157
tel: (918)258-8551
fax: (918)251-5519

JOHN ZINC CO.
4401 South Peoria
P.O.Box 702220
Tulsa, OK
74170
tel: (918)747-1371
fax: (918)234-1989

APPENDIX 3

Manufacturer Information Sheets

PREFERRED UTILITIES MANUFACTURING CORP.

11 SOUTH STREET, P.O. BOX 1280, DANBURY. CONN. 06813
TEL: (203) 743-6741 ● FAX: (203) 798-7313

December 21, 1992

Mr. James McCourt
S.L. Ross Environmental Research LTD
717 Belfast Road - Suite 200
Ottawa, Canada, K1GOZ4

Dear James:

Thank you for your interest in Preferred Utilities. I have enclosed some brochures on our burners. Our burner is a **rotary** cup burner, and it commonly used to burn waste fuels. Please contact me if you have any questions.

Sincerely,

Grant F. Bowman

Grant F. Bowman
District Manager

A packaged combustion ***system*** engineered for fuel **economy.**

INJECT-AIRE®

CAPACITY **25-120 GPH** / 3,500-17,000 **CFH**

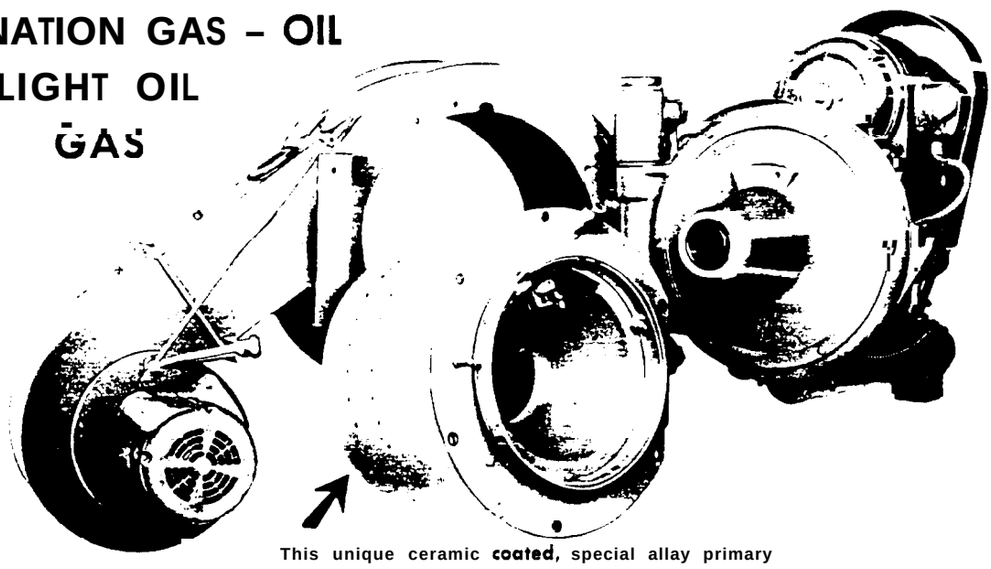
for

HEAVY OIL

COMBINATION GAS – OIL

LIGHT OIL

GAS



This unique ceramic coated, special allay primary combustion chamber which replaces the "conventional burner refractory block is the heart of the Inject-Aire. It is unconditionally guaranteed for two years.

The unique INJECT-AIRE Thermopak has been engineered to obtain all the energy available from each drop of **fuel.** On job after job, when installed in existing boilers as a replacement for obsolete natural draft burners, the INJECT-AIRE has effected fuel savings in the range of ten to twenty-five percent. Frequently the reduction in the fuel bill has been sufficient to amortize the cost of the INJECT-AIRE in less than two years.

The INJECT-AIRE has -been used to upgrade existing Scotch Marine, Sectional Cast iron, Steel Firebox, Water Tube and H. R. T. boilers. It is frequently specified for use with new boilers of all types to operate against either positive or **negative** furnace pressures. Each INJECT-AIRE is custom engineered at the factory to suit the boiler dimensions and th operating parameters at the point of installation.

Fuel economy can only be evaluated by day-to-day operation under the conditions prevailing in the typical boiler room. Test data taken by laboratory technicians on finely tuned burners operating under ideal conditions is not indicative of burner performance. The rugged, cast-iron construction of the Preferred burner combined with the rigid control linkage, time-proven in thousands of boiler rooms. permits the maintenance of optimum fuel/air ratios under all load conditions. The unique ceramic coated, special alloy primary combustion chamber provides higher flame temperatures throughout the firing cycle, reduces soot deposits within the boiler and thereby minimizes stack losses.

A low stack temperature combined with a high CO_2 reading in the flue gases is the best indication of the efficient, fuel saving performance of combustion equipment.

Bulletin No. 190D

PREFERRED UTILITIES MANUFACTURING CORPORATION

11 South Street. P.O. Box 1280, Danbury, **Corm. U.S.A.** 06810-1280

(203) 743-6741 • (212) 682.2322 • (617) 489-2230

● OPTIMUM FUEL/AIR RATIO

The INJECT-AIRE replaces the large mass of refractor surrounding the burner nozzle wth a primary combustion chamber constructed of the same alloy as is used in airplane jet engines. Ultra high velocity jets of secondary air converge on the flame through a carefully calculated pattern of perforations in the peripheral metal wall. The number. size and location of these secondarv air jets provide *in the flame* the exact volume of air required for complete combustion. This arrangement. interlocked bv rigid linkage with the precision fuel metering Voluvalve control in the burner reservoir. permits efficient operation with a high CO_2 at all firing rates.

● INCREASES BOILER CAPACITY

The INJECT-AIRE principle, by injecting all required combustion air directly into the flame. provides a much more compact fire. Flame clearance requirements are so radically reduced that the ability of the boiler to absorb heat and the ability of refractor (when used) to withstand heat become. in most instances. the limiting factors. Where these considerations permit. boiler outputs can be increased up *to* 50%, therefore providing greater capacity with *no* additional cost.

● DRAFT IS NO PROBLEM

The INJECT-AIRE Therrnopak can be used on all jobs where a stack or induced draft fan maintains a negative fur. nace draft, or with a properly sealed boiler, it can be used with positive furnace pressures. The primary and secondary air fans built into the INJECT-AIRE Thermopak provide all air required for complete combustion. When desired, draft programming controls and an actuator can be furnished to automatically position the boiler outlet damper to maintain a constant overfire draft during firing cycles and to close the damper and conserve boiler heat during standby periods.

● LOWER STACK TEMPERATURES

Almost all burners utilize a refractory block to reflect heat into the base of the flame and thereby stabilize combustion. On each start. while this refractory is cold the flame is chilled and unburned carbon enters the boiler in the form of soot. During hundreds of such starts this soot gradually accumulates in the boiler. insulates the heat transfer surfaces and thereby raises the temperature of the stack gases. This increase in the stack temperature is a positive sign of wasted fuel. The INJECT-AIRE replaces this refractorv with a thin metal primary combustion chamber which has little mass and therefore comes up to temperature almost instantly. Soot formation is reduced. heat transfer surfaces remain clean and the stack temperature remains low. It is not unusual to find boilers when opened for the annual inspection with only a light deposit of brownish material on the heating surfaces. Laboratory analysis has shown this to be unburnable fuel ash with only a trace of unburned carbon.

● LESS DOWN TIME

The special alloy lining of the combustor cone can be quickly replaced. It is not necessary to disconnect anv burner piping connections and. since the change is made from outside the boiler, it is not necessary to cool the boiler before starting: work. The replacement can be readily made by maintenance personnel. It is not necessary, as is the case with refractory, to call in a skilled specialist when repairs are required.

● LOWER MAINTENANCE COSTS

Refractory repairs have always been a major item of boiler: maintenance. The areas subject to hardest usage requiring most frequent renewal are the checkerwork hearth or, on windbox jobs. the burner block or tile. The INJECT-AIRE Thermopak eliminates checkerwork floors (thev are prohibited by many Air Pollution Codes) and replaces the burner refractory block with a liner of a special alloy metal. Tbe initial cost of this liner is much less than the refractory. More important. however. it is not subject *to* the rapid wear, erosion, spalling. etc. associated with refractor and lasts indefinitely. All INJECT-AIRE liners are unconditionally warranted.

A CORRECTION

Many uninformed individuals have attributed the improved performance available from modern oil burners solely to the use of compressors and air atomizing nozzles. ***This statement is absolutely false!*** Improved burner performance is due to the incorporation of combustion air fans in the burner assembly thereby eliminating reliance upon variable natural draft or induced draft fans, to the use of flame retention combustor heads which provide better mixing of air: and atomized oil, to improved oil handling and metering systems and to the elimination of crude, job built checker work refractory floors. All of these features, plus several unique innovations are provided by the INJECT-AIRE Thermopak.

The Office of Research and Development, U. S. Environmental Protection Agency, recently published a report entitled; ***Field Testing; Application of Combustion Modifications to Control Pollutant Emissions from Industrial Boilers (EPA-600/2-76-086a).*** The summary of this report, on page 16 states: – "Atomization Method: The total nitrogen oxides emissions were found to be relatively independent of the fuel oil atomization method, i.e., steam, air, pressure or rotary cup, and dependent upon the characteristics of the individual burner. The boiler efficiency was unaffected to any significant degree by the type of atomization employed. " This finding verifies the results of previous, privately sponsored, field and laboratory testing.

The Preferred INJECT-AIRE Thermopak

BHE - BE - BHER - BER

Application Engineering Data for 0. 0"w. C. *or* **Negative** Furnace Pressures

There is no "standard" INJECT-AIRE Thermopak. Each is factory engineered fur a specific boiler using components best suited for that application. The information on this sheet is published to permit planning of projected installations . We reserve the right to make changes and substitutions.

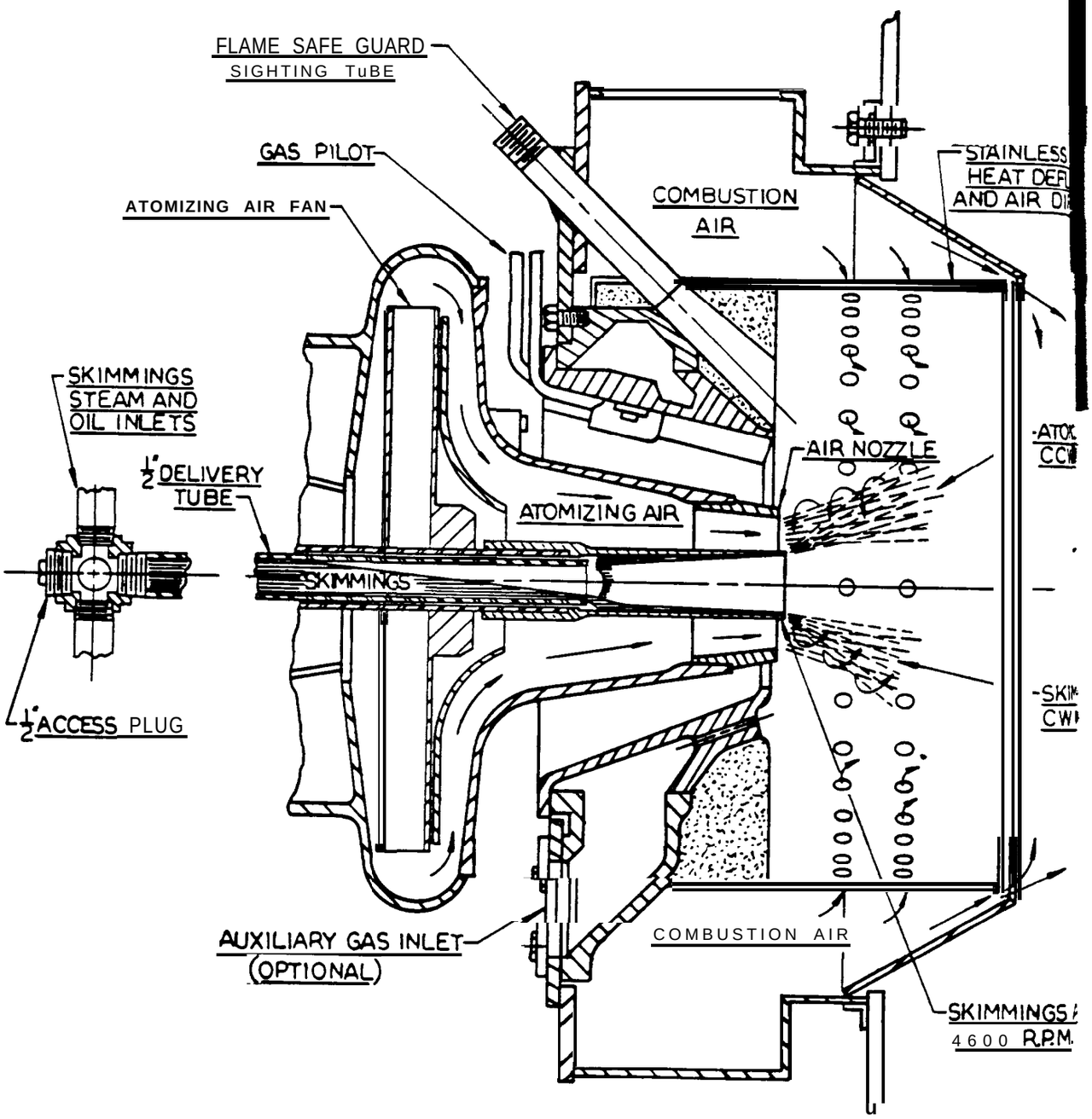
DESIGN CAPACITY			SIZE	FAN MOTOR H.P.	BURNER MOTOR H.P.	RESERVOIR HEATER ** WATTS	NOZZLE LINE ** HTR. KW	PRIMARY PUMP G.P.H.*
OIL G. P. H.	GAS C.F.H.	INPUT M.B.H.*						
25	3,575	3,750	A	1.5	3	150	2	115
30	4,275	4,500						
35	5,000	5.250					3	
40	5,700	6,000		2	3			
45	6,425	6,750						
50	7,150	7,500					4	
55	7,850	8,250						
60	8,575	9,000		5	5		5	1 2
65	9,275	9,750						
70	10,000	10,500	B					
75	10,700	11,250						
80	11,425	12,000						
85	12,150	12,750						
90	12,850	13,500			7.5			
95	13,575	14,250		7.5			7	
100	14,275	15,000						230
105	15,000	15,750						
110	15,700	16,500	C		10		8	
115	16,425	17,250		10				
120	17,125	18,000		1				
125	17,850	18,750		15	15		9	

* Based upon **fuel** oil **averaging 150,000** BTU per gallon and natural gas having a heating-value of 1050 BTU per cubic foot.

** Electric heaters not furnished on Model BE.

SKIMMINGS DISPOSAL SYSTEM

COMBUSTION HEAD

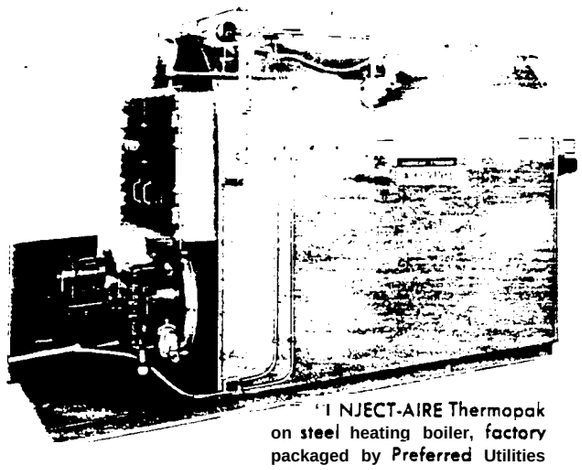


PREFERRED

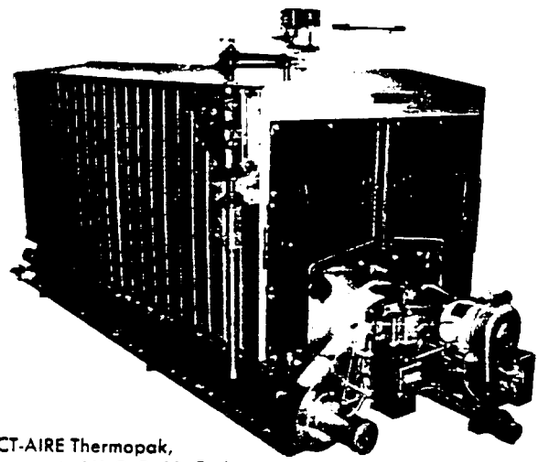
UTILITIES MANUFACTURING CORPORATION

DANBURY, CONN. 06810

Form 242



"I NJECT-AIRE Thermopak on steel heating boiler, factory packaged by Preferred Utilities Mfg. Corp.



INJECT-AIRE Thermopak, a component of H. S. Smith Co.'s Series 4500 boiler-burner package

NEW CONCEPTS IN BOILER - BURNER COORDINATION

The INJECT-AIRE introduces a completely new approach to the integration of boiler and combustion equip. ment. Just as the factory designed automobile has replaced the horse and buggy, the factory built INJECT-AIRE Thermopak replaces the old-style job assembled combusion system.

● FACTORY ENGINEERED

Each INJECT-AI RE is factory-engineered to fire a specific make and model of boiler to produce a required output under conditions prevailing at the point of installation. After establishing such criteria as boiler rating, heating surface, furnace volume and draft loss, type of fuel. electrical characteristics and control requirements, Preferred engineers select the various components best able to achieve the desired result. The user is thus assured of a fully coordinated combustion system designed and constructed for his own job by factory experts.

● CAPACITY TO MATCH LOAD

The INJECT-AIRE Thermopak is available with de. signed firing rates in 5 gallon increments from 25 to 125 gallons per hour. This permits the combustion system to be sized precisely to the load requirements rather than "'cutting down" an oversized burner. A unique advantage is the abi'ity of the Voluvalve oil metering system to limit the fuel delivered to the atomizer. *regardless of improper field adjustments.* This provides positive protection against smoking fires or boiler damage resulting from attempts to force the svstem bevond its design rating.

● DIMENS1ONS COORDINATED

Physically, as well as functionally, the INJECT-AIRE Thermopak is coordinated with a specific boiler. Application drawings are furnished with each order. The small size of the primary combustion chamber plus the ability to rotate the position of the combustion air fan permit installation with limited clearances and frequently eliminate the need for costly pitting or expensive boiler bases.

● STANDARD CONSTRUCTION

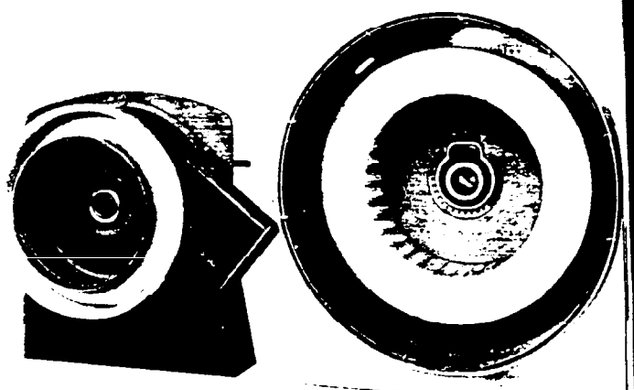
Several boiler manufacturers have arranged to provide boilers with firing ports specially constructed to accomodate the INJECT-AIRE. Not only does this arrangement substantially reduce the overall job cost but it also permits the use of stock size pre-formed refractory tiles to protect the boiler water leg. These are readily installed by one man from outside the boiler and eliminate the need of skilled refractory masons for future maintenance.

● UNDIVIDED RESPONSIBILITY

There is no divided responsibility with the INJECT-AIRE Thermopak. Everything on the water side of the boiler is a functional component of the heat absorption and distribution system and as such has no direct affect upon the performance of the combustion svstem. Everything on the fire side of the heat transfer surfaces including burner, control system. refractory (when used). draft and air distribution is a functional component of the combustion system and is thus considered in the engineering application design of the INJECT-AIRE.

● MINIMUM SPACE REQUIREMENT

By replacing the burner refractor block with relatively thin special alloy metals there is a substantial reduction in the overall size of the opening required for insertion of the burner in the front of the boiler furnace. This is especially important where boiler setting heights are limited and on larger boilers where multiple burners are to be used. The small size and the elimination of heavy refractory greatly simplifies the rigging of INJECT-AIRE Thermopaks when they are to be installed in existing boiler rooms.



Size comparison: Inject-Aire and refractory lined windbox with identical firing rates.

STANDARD EQUIPMENT SPECIFICATIONS

BURNER — Model BE or SHE including duel fuel pumps submerged in on oil reservoir, Voluvalve for precision oil metering, pressure relief valve, oil pressure gouge, four-stage oil atomization system with high static atomizing oir, precision oir control, double oil shutoff valves, self-cleaning atomizer, self-cleaning premix gas-electric ignition system ond standard N. E.M.A. frame motor with double v-belt drive. Also full capacity combustion air fan with standard N. E.M.A. frame motor, stainless steel primary combustion chamber and flange-mounted windbox assembly, all combined into one factory-tested package. Model BHE, furnished for heated oils, also includes electrical heater in reservoir, ail thermometer, cold ail interlock switch and nozzle line oil heater with thermostatic control and indicator light, having capacity to heat full burning rate aver a rise of 40° F.

FIRING RATE CONTROL - Automatic firing rate central is provided to vary delivery of fuel, atomizing air and cam bustion air in carefully synchronized proportions by a system of rigid linkage between oil metering Voluvalve, fan dampers and a low voltage positioning motor. System is governed by a potentiometer controller sensing bailer heat demand and is arranged to permit starts only in the low fire position. A knob is provided to manually reduce the maximum firing rate without disturbing linkage settings. A painter an a easy to read 2¼" diameter dial provides automatic indication of the precise firing rate.

BURNER MOUNTED CONTROLS – In addition to the components of the firing rate control system, burner mounted devices in. elude air flow interlock switch, - ignition transformer, modutrol motor transformer, solenoid oil valve, solenoid pilot gas valve and pilot gas pressure regulator. All electrical components of the burner are factory mounted and wired to numbered terminal strips for external connections.

BOILER MOUNTED CONTROLS — Standard controls furnished loose for boiler mounting include operating switch (burner on potentiometer switch (firing rate control), back-up high limit s (manual reset). Provision is made for connection of a low water c (not normally furnished with the burner).

STANDARD CONTROL CABINET - A specially designe JECT-AIRE control cabinet provides the simplest installation, gre assurance of dependable operation and many exclusive fern Available either as a built-in component of the burner or for re wall mounting, it includes a manual burner on-off switch, a co circuit fuse, circuit breakers and mater starters far both burner combustion air fans and either Honeywell or Fireye burner sequ ing and flame safeguard control. Cabinet is of heavy gauge s with piano-hinged door and handle latch. All components mounted on a special sub-base and wired to a numbered terminals

GAS FIRING — When ordered for combination oil/gas firing,; INJECT-AIRE includes a special gas manifold ring and an atomi air interlock switch on the burner PIUS a fuel selector switch on control cabinet. The gas train components are shipped loose for, site incorporation into the gas piping. A manual ail pump disco clutch is provided to permit discontinuance of oil circulation du extended periods of gas firing.

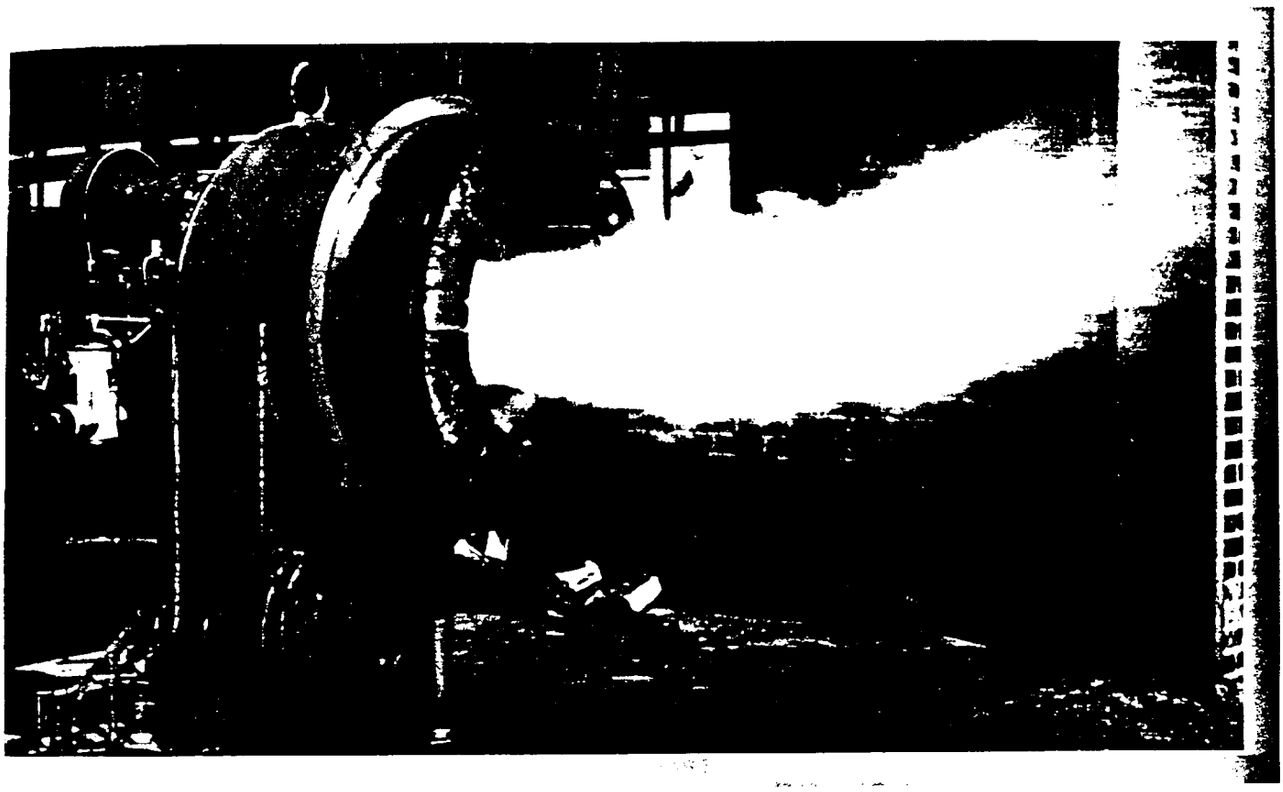
OPTIONAL EQUIPMENT - Although the standard INJECT-A Thermopaks were developed to best till normal requirements, a w range of optional and alternate control equipment is available meet special requirements of the owner, his insurance company or engineering consultants. These include additional gas train co ponents far gas-fired jobs, bailer lead-lag control systems, lar wall or floor mounted central cabinets incorporating over-fire di control systems, flue temperature indicators, draft gauges, smo indicators and alarms, alarm bells and alternate models of flo safeguard centrals,

WARRANTY

The special alloy metal liner band of the combustor cone of the Preferred INJECT-AIRE Thermopak is unconditionally warranted against failure for a period of two years. This includes failures resulting from warping. overheating, flame impingement. moisture. or the effects of Vanadium. Sulphur and other chemicals in the fuel and is in addition to our standard warranty against defects in material or workmanship. Any liner band which is returned to us within two years from date of shipment will be exchanged for a new band at no charge. This warranty covers exchange of material only and does not include shipping charges or labor for replacing material on job.

Printed in U.S.A.

PREFERRED / W.N. BEST COMBUSTION SYSTEMS



FOR THE DESTRUCTION & RECYCLING OF ."

PREFERRED/W. N. BEST COMBUSTION EQUIPMENT
11 SOUTH STREET, DANBURY, CONN. 06810
NINE HEAT SPECIALISTS IN COMBUSTION SYSTEMS
A DIVISION OF PREFERRED UTILITIES MANUFACTURING CORPORATION

The time provel

Example: Refinery Acid Sludge

The Problem:

A by-product of petroleum refinery operations is acid sludge, a black mixture of asphaltic hydrocarbons, sulphuric acid and water. This material is highly corrosive and would cause disastrous contamination in any disposal area.

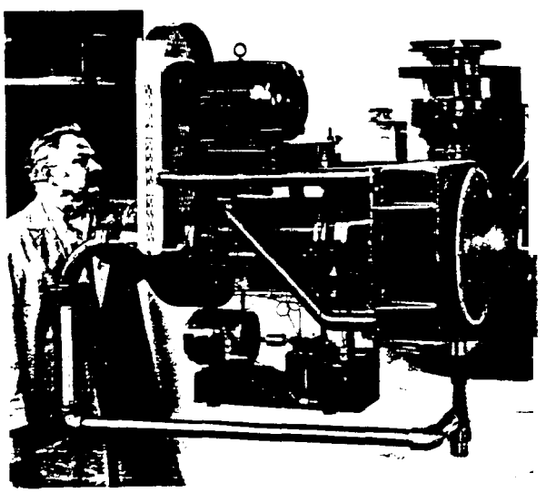
The Preferred/W. N. Best Solution:

Long before ecology became a national concern, Preferred/W. N. Best developed equipment for a process designed to recycle this waste. Not only does this process eliminate a critical disposal problem, it pays important dividends in the form of fresh, white, 99% sulphuric acid.

The heart of this regeneration process is the Preferred/W. N. Best acid sludge atomizer which was designed specifically for this application. Built of acid-resisting materials and alloys, it has a range of sizes to handle from 100 to 7,000 gallons of sludge per hour. This unique atomizer utilizes centrifugal force combined with a blast of compressed air to break the sludge into a mist of minute droplets which is blown into a refractory-lined furnace.

This atomized waste is burned in suspension. In most instances supplementary fuel is used to augment the hydrocarbons in the sludge to maintain the required 2200° F. furnace temperature When the waste has an adequate hydrocarbon content the firing of the supplementary fuel is discontinued and the combustion of the sludge becomes self-supporting.

The hot gas is drawn from the furnace through a series of stills, scrubbers, heat exchangers and other apparatus which reclaims the sulphur and otherwise cleans and cools the gas before it is released to atmosphere.



Let us demonstrate ho

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Example: Sewage Plant Skimmings

The Problem:

ous con

Skimmings, or floatable wastes composed principally of oils, fats and greases containing a high percentage of water together with rags, plastics and rubber present a vexing problem in the operation of sewage treatment plants. They upset biological processes. Open pit burning creates serious air pollution problems. Lagooning and land-fill contribute to ground water contamination.

The Preferred /W. N. Best Solution:

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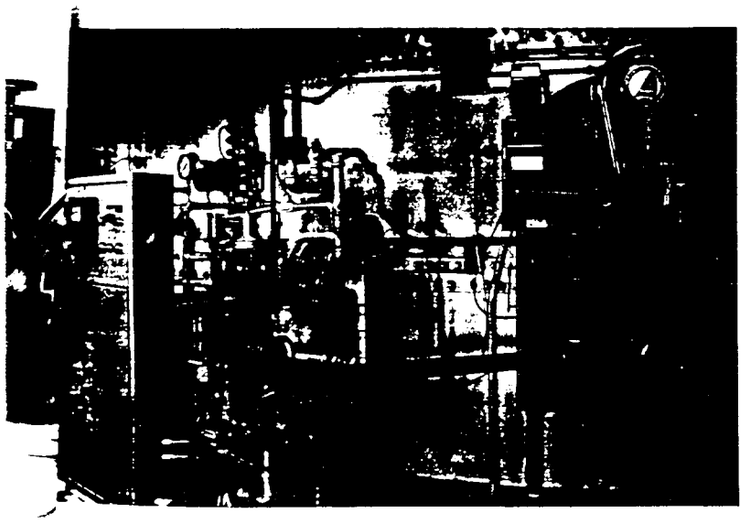
Skimmings are burned as a fuel rather than as a waste material.

Utilizing experience acquired during the past fifty years Preferred/W. N. Best developed a special clog-free **combustor** capable of handling solids as large as



3/8" in diameter. Incorporating a unique continuous purge cleaning system this **combustor** uses centrifugal force to achieve micron-size particulate distribution. Counterflowing air, furnished by built-in fans, produces high turbulence and mixing so that combustion proceeds smoothly and completely.

This skimmings **combustor** may be mounted directly on either a new or existing multiple hearth incinerator to provide clean combustion and a controlled input of supplemental heat. The versatile design makes it adaptable to its own incinerator, with or without waste heat recovery capability. Normally there is no need for supplementary fuel. Once the incinerator has reached operating temperature, the **heat** in the waste sustains combustion.

A packaged preparation set is furnished as a part of the overall system. This set automatically functions to pump, preheat and meter the flow of the waste to the atomizer and to deliver supplementary fuel if and as it may be required. A factory fabricated control center, complete with first-out annunicator display, automatically programs the operation and provides constant safety monitoring.

ur experience and equipment

ns approach...

Example: Molten Sulphur

The Problem:

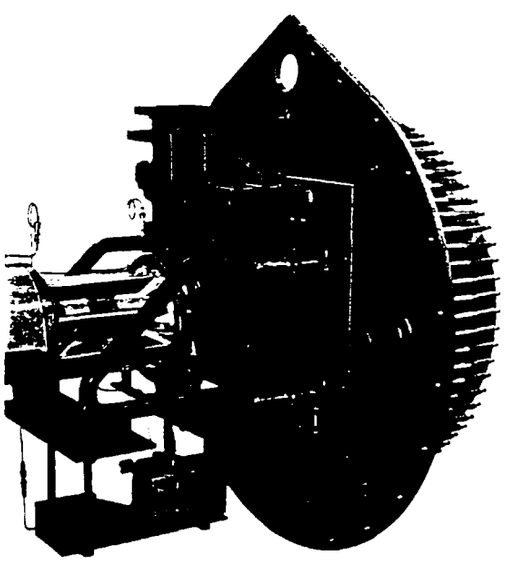
The burning of sulphur in air to make sulphuric acid from the resulting sulphur dioxide is an old process. Controlling the combustion at a uniform burning rate and a constant gas strength are highly desirable. The key to uniform, high-quality product and lower production costs is the burning equipment.

The Preferred /W. N. Best Solution

Sulphur is preheated and delivered to the burner as a liquid at a carefully maintained temperature of 270°F. The Preferred/W. N. Best atomizer breaks this liquid into microscopic droplets which burn in suspension in a refractory lined furnace. Aside from a controlled supply of clean *dry* air, combustion is entirely self-supporting; no supplementary fuel is required.

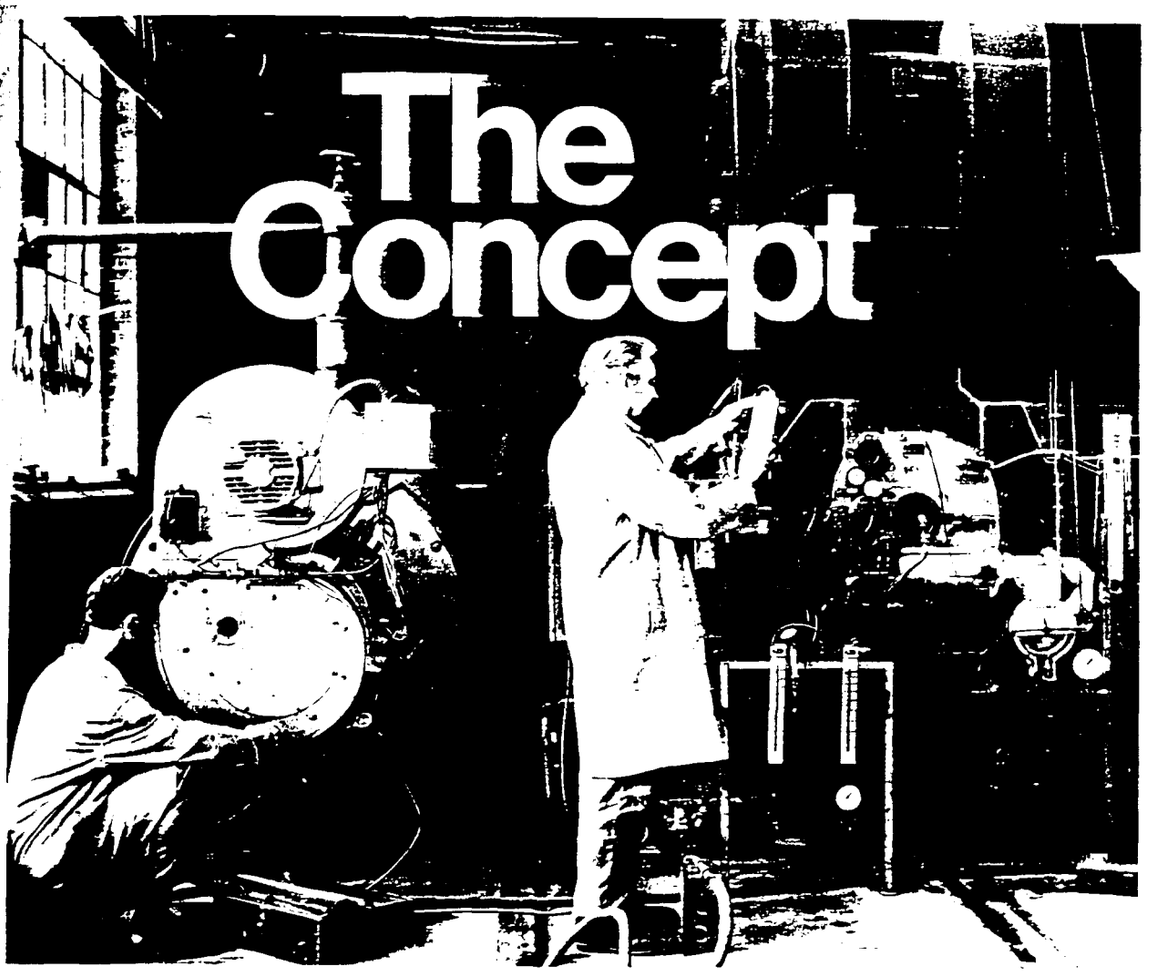
The process generates an appreciable amount of heat which in turn is recovered by passing the hot gas through a waste heat boiler to supply plant steam.

The Preferred/W. N. Best sulphur atomizer has several advantages for this application. Unlike other atomizers it has no small orifices in the nozzle and is thus less susceptible to clogging. Because no steam is required, moisture is kept out of the furnace and the possibility of sulphuric acid formation on the heat transfer surfaces of the waste heat boiler is minimized. Most important, the atomizer combines high capacity with a compact flame which permits reductions in furnace size with resultant savings in both initial cost and in furnace maintenance expense.



an solve your problem.

The Concept



The Preferred/W. N. Best approach to incineration and/or recycling of liquid wastes is based upon the premise that all wastes are not alike and there. fore there is no single process or piece of equipment which is ideal for all applications.

Each proposed installation is handled as an individual problem, After carefully weighing all factors applicable to a specific situation, recommendations are presented for the o wrier's considers tion. Frequently alternative solutions will be offered for evaluation. After. tentative processes have been established, our in-house test facilities permit us to set up a pilet operation before the owner is commit. ted to extensive construction. The photograph on the front of this bulletin illustrates such a rest firing of a liquid waste burning system.

A paramount concern, which is carefully weighed ear/y in the conceptual stage, is the potential for salvaging various components of the waste. In many instances this involves the reclaiming of the energy from the waste for use in the generation of plant steam. /n other instances the combustion process removes impurities, leaving a usable residue which can be easily recovered.

The increasing cost of energy in all forms mandates full consideration of operating expense. Rather than depend solely upon the burning of gas to create a suitable destructive environment the Preferred/W. N. Best approach whenever possible treats the waste as a fuel, atomizing and burning it in suspension, When the calorific value is too low for self-sustaining combustion oil may be blended into the liquid stream before it is fed to the burner or gas may be used to assist in attaining the de sired temperature in the furnace.

An inherent weakness in many types of waste burners is the use of small orifices which continually clog. Although strainers or filters may be used to remove the impurities many liquids are so badly contaminated with solids that the necessary frequent cleaning of strainers is unacceptable. The Preferred/W. N. Best burner design eliminates the small orifices and handles the solids contained in the liquid without difficulty, even when they are as large as %" diameter,

Experience

The priceless contribution to problem solving . . . .

The Preferred/W. N. Best organization brings to each problem not only technical proficiency but also the benefits of over 90 years of experience devoted to **the design, fabrication, installation and servicing of literally tens of thousands of industrial combustion systems. These systems, which may burn residual oil, gas tar or distillate oil, embrace not** only the burner but frequently the combustion air supply system, the flame safeguard **system, the fuel handling system, the combustion control system and even the heat receiver.**

Our interest in the thermal destruction and/or recycling of liquid wastes comes from working with industrial users in designing systems to reduce their plant discharges. Our long years of experience in solving their problems is now used to design similar systems to attain discharge levels required by environmental regulations. Our products have thoroughly demonstrated their ability to handle a variety of wastes. Our engineers have the skills to adapt these products and incorporate them into innovative systems. The combination provides the customer with maximum assurance of obtaining desired results.

The Preferred/W. N. Best claim to experience is solidly based upon the operation in our customer's plants of our waste incineration systems. These various systems, some in use for upwards of twenty years, have a combined capacity to burn over two *million gallons* of contaminated waste each day.

PREFERRED/W. N. BEST COMBUSTION EQUIPMENT

11 SOUTH STREET, DANBURY, CONN. 06810

SINCE 1890 SPECIALISTS IN COMBUSTION SYSTEMS

A DIVISION OF PREFERRED UTILITIES MANUFACTURING CORPORATION

THERMAL SYSTEMS, INC.

December 13, 1992

Mr. James C. McCourt
S. L. Ross Environmental Research, Ltd.
717 Belfast Road, Suite 200
Ottawa, Ontario, Canada K1G-074

Dear Mr. McCourt:

Thank you for your follow-up phone call from this afternoon. We will work up some budgetary capital and operating costs for you to present to your client for a 2 gpm unit to burn the contaminated diesel fuel mixture.

We will include a trailer, telemetry system, and complete winterizing package in our outline proposal.

Thank You for your interest in HMT Thermal Systems. We look forward to the opportunity to work with you and your client or. this project.

Sincerely,

HMT Thermal Systems, Inc.

Richard F. Anderson
Marketing Manager

cc: HMT Canada, Shairole Henchall

14615 FM 2920 • TOMBALL, TEXAS 77375 • (713)351-79450 FAX (713)351-6758

THERMAL SYSTEMS, INC.

RECEIVED DEC 1 8 1992

December 10, 1992

Mr. James C. McCourt
S. L. Ross Environmental Research, LTD.
717 Belfast Road, Suite 200
Ottawa, Ontario, Canada K1G-0Z4

Dear Mr. McCourt:

You had sent an inquiry fax to AKI Systems,Inc. Please be advised that our company is ncw operating under the name HMT Thermal Systems, Inc. , recognizing that the company was acquired by HMT, Inc. about two years ago.

It should be noted that HMT, Inc. maintains an office in Calgary, Alberta - under the name HMT Canada Ltd.

In response to your inquiry, HMT Thermal Systems, Inc. is particularly interested in the problem of destruction of hydrocarbon contaminated water - such as is presented in your fax. No other company is as aggressively involved in this particular challenge, we are working on development projects with several major U.S. companies involving clean ups of contaminated process water and contaminated groundwater.

For your reference, I have assembled some introductory materials.. including a general discussion of the subject of oxidation of contaminated water. We do not revealour proprietary technology in this type of communications, however, we would be glad to meet with your company and/or representatives of the GNWT to further explore several methods for destroying contaminated water that are utterly reliable, and quite cost effective.

Please call me after you've received the materials.

Thank you,

HMT Thermal Systems, Inc.

Richard F. Anderson
Marketing Manager

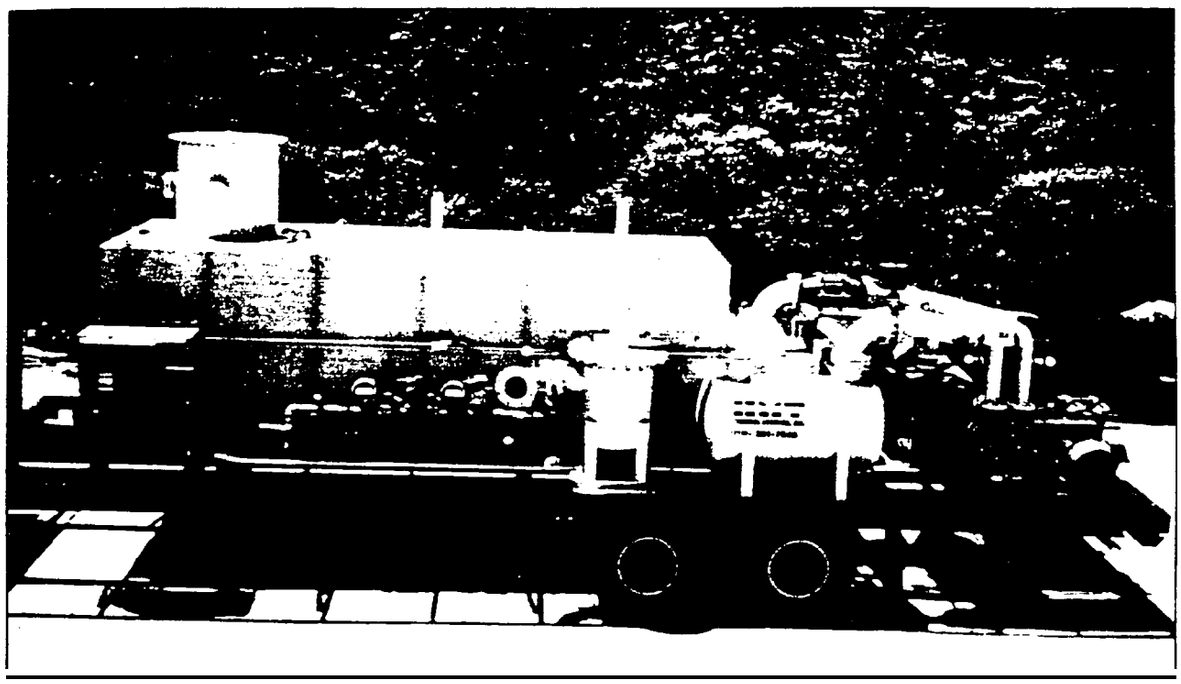
RFA:al

14615FM 2920 • TOMBALL, TEXAS 77375 .(71 3)351-79450 FAX (713)351-6758

THERMAL SYSTEMS, INC.

THERMAL AND CATALYTIC OXIDATION SYSTEMS

FOR HIGH DESTRUCTION EFFICIENCY OF FUME, VAPOR AND/OR LIQUID WASTE



LIQUID/VAPOR THERMAL OXIDATION UNIT

HMT **Thermal Systems, Inc., a leader** in applying combustion technology to eliminate unwanted fumes, vapors and/or liquid waste, offers a broad range of thermal and catalytic oxidizers to meet virtually any need.

Benefiting from years of experience HMT has developed standard vapor systems in the 50 SCFM to 20,000 SCFM flow range and liquid systems from 2 GPM to 20 GPM. Additionally, HMT provides specialized design and construction for projects up to ***70,000*** SCFM. Each of these systems maybe equipped with air to air **preheat exchangers to minimize fuel useage, as well as, secondary heat** recovery for use in process or for comfort heating.

THERMAL SYSTEMS, INC.

Specializing in high destruction efficiencies (up to 99.99$40) HMT has a proven record of exceeding federal, state and local regulatory agency requirements.

Tank Degassing Unit Currently Operating in Southern California

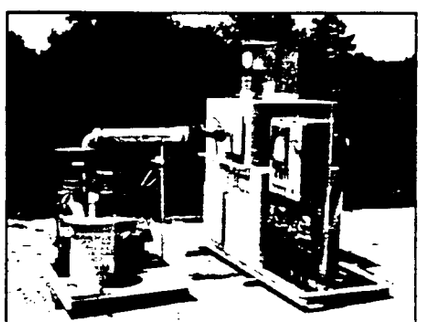
- Fully Automated Operation
- Lo-Nox Burners
- High Destruction Efficiency
- Compact Design
- Safety System Conform to IRI, FM, CSA, NEMA, NFPA
- **Automatic Safety Shut** Down
- Propane, Natural Gas, Butane or Oil Fired
- No Visible Flame
- Heat Recovery Systems
- Unitized Construction
- Pre Assembled and Fully Tested

APPLICATIONS - Permanent or Mobile

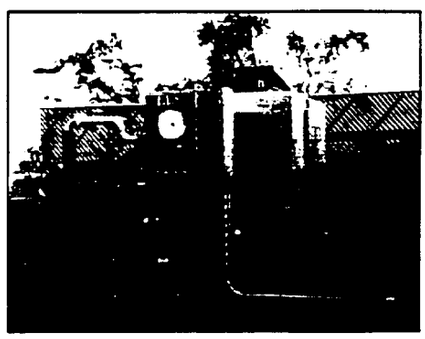
- Hydrocarbon Contaminated Water/Liquid Waste
- Truck Loading Facilities
- Barge and Ship Terminals
- Process Off Gas Destruction
- Paint Spray Booth Exhaust
- Coating Applications
- Distillation Tower Degassing
- Tank Degassing
- Pipeline Blowdown
- Soil Remediation
- Odor Control
- Hazardous Waste Destruction "

HMT Thermal Systems is also a recognized leader in providing soil remediation systems. *Call today for a free brochure.*

THERMAL/CATALYTIC CONVERTABLE SYSTEMS



***HMT 500S-M** currently operating in Southern California*



***HMT 1000S-M** currently operating in Mesa, Arizona*

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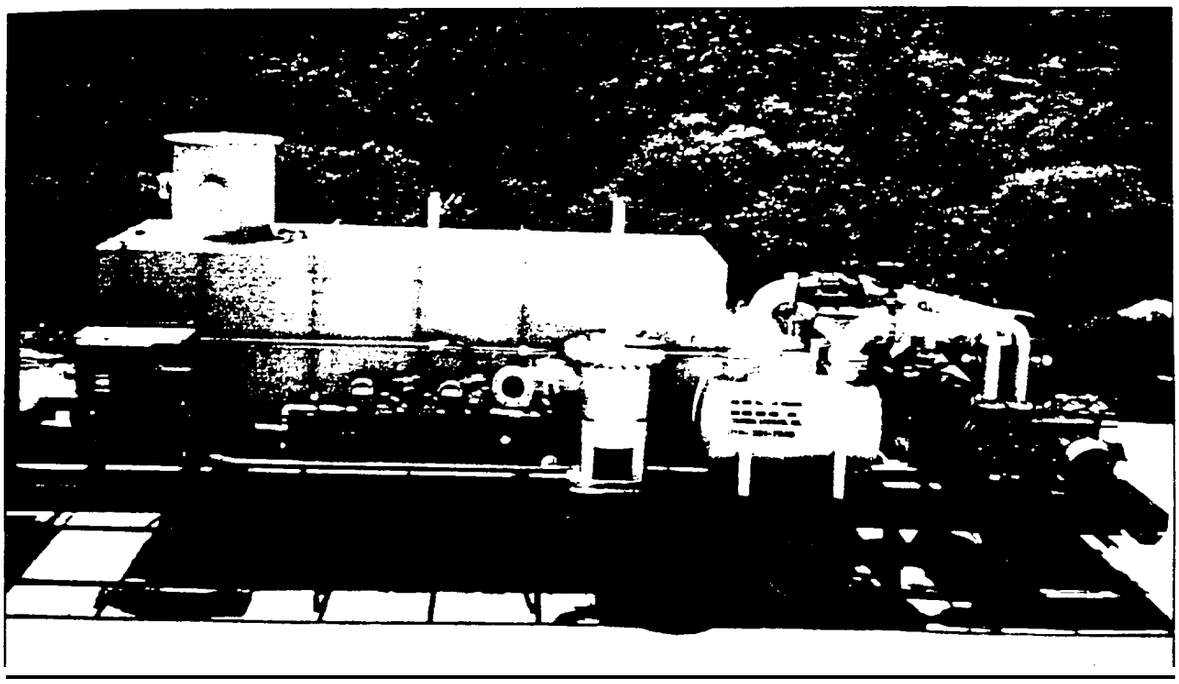
THERMAL SYSTEMS, INC.

THERMAL AND CATALYTIC OXIDATION SYSTEMS

FOR HIGH DESTRUCTION EFFICIENCY OF FUME, VAPOR AND/OR LIQUID WASTE



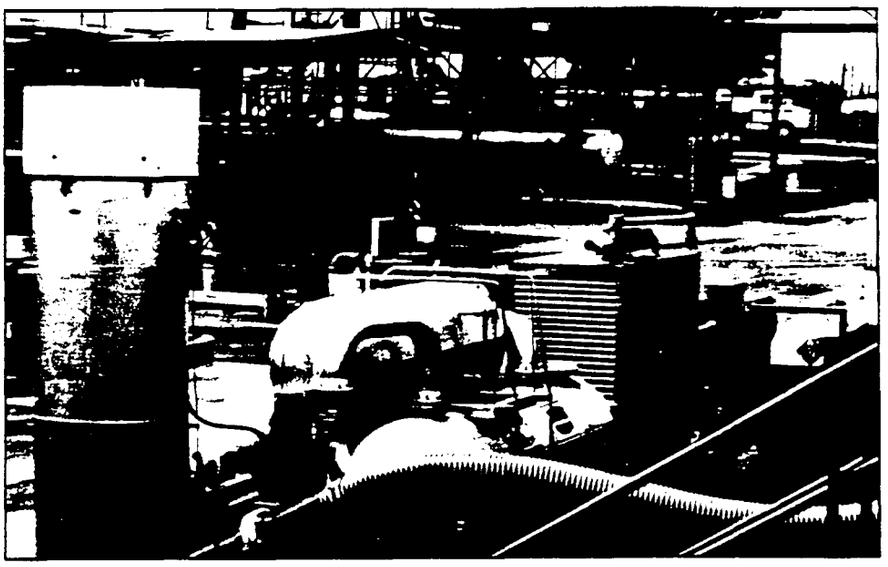
LIQUID/VAPOR THERMAL OXIDATION UNIT

HMT Thermal Systems, Inc., a leader in applying combustion technology to eliminate unwanted fumes, vapors and/or liquid waste, offers a broad range of thermal and catalytic oxidizers to meet virtually any need.

Benefiting from years of experience HMT has developed standard vapor systems in the 50 SCFM to 20,000 SCFM flow range and liquid systems from 2 GPM to 20 GPM. Additionally, HMT provides specialized design and construction for projects up to 70,000 SCFM. Each of these systems maybe equipped with air to air preheat exchangers to minimize fuel useage, as well as, secondary heat recovery for use in process or for comfort heating.

THERMAL SYSTEMS, INC.

Specializing in high destruction efficiencies (up to 99.99%) HMT has a proven tr[ad]
record of exceeding federal, state and local regulatory agency requirements.



Tank Degassing Unit Currently Operating in Southern California

FEATURES

- Fully Automated **Operation**
- **Lo-Nox Burners**
- **High** Destruction Efficiency
- Compact Design
- Safety System Conform to IRI, FM, CSA, NEMA, NFPA
- Automatic Safety Shut Down
- Propane, Natural Gas, Butane or Oil Fired
- No Visible Flame
- Heat Recovery Systems
- Unitized Construction
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APPLICATIONS - Permanent or Mobile

- **Hydrocarbon Contaminated Water/Liquid Waste**
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- **Barge and Ship Terminals**
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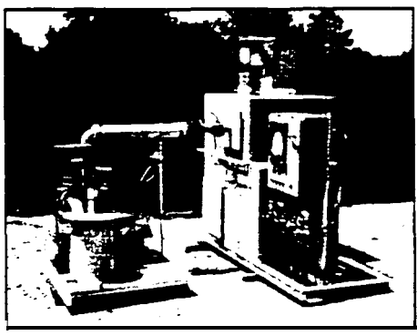
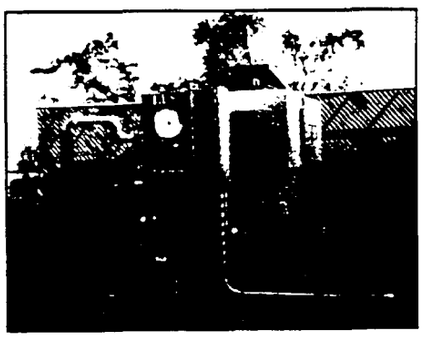
THERMAL/CATALYTIC *CONVERTABLE SYSTEMS*



HMT 500S-M currently *operating in Southern* ***California***



HMT 1000S-M currently operating in Mesa, Arizona

14615 FM 2920 TOMBALL TEXAS 77375 (713) 351-7945 FAX (71 3) 351-6758

HMT Thermal Systems is a wholly owned subsidiary of HMT, Inc., an Astrotech International Company. HMT is well known as a storage tank service company, with engineered products and maintenance capabilities that are in demand worldwide. Because of our ties to HMT, the mission at Thermal Systems is to bring state of the art vapor and liquid waste destruction technology to the petroleum storage market.

By focusing our resources to serve that market we have developed turnkey solutions from concept through start up and operations in:

* Soil Remediation - Treating both Soil and Vapor
* Tank Degassing
* Loading Rack Emission Destruction
* Liquid Waste Destruction

Our standard systems include Thermal , Catalytic-and Dual Mode Oxidizer Systems, Liquid Waste Oxidation systems , Enclosed Flare Vapor Combustors and Thermal Resorption Systems.

No other Company can equal the range of engineered products backed up by reliable *service* that HMT Thermal Systems offers to the petroleum storage market.

The following data sheets, drawings and specifications give an overview of HMT Thermal Systems" technologies, products and services.

We look forward to the opportunity to work with you.

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EMT THERMAL SYSTEMS, INC.
(713) 351-7945

QUESTIONNAIRE FOR DESIGN OF OXIDIZER SYSTEM:
(Air and Liquid Waste)

This questionnaire will give us the necessary information to design and select the system that meets your requirements.

DATE: _____

Company: _____

Contact: _____

Address: _____

City: _____ State: _____ zip: _____

Phone: _____ Pax: _____

Process Description: _____

Flow: _____ (SCFM) _____ (GPM)* Temperature: _____ °F

Voc Content: _____ #/hr _____ (PPM_v) Composition: _____

Destruction Eff. Reqd.: ____ 95% ____ 98% 99% Other

Operating Time: _____ hrs / day _____ days/yr _____ hrs/yr

Type of Pollution Control Equipment Desired:

[ ] Thermal Oxidizer
[ ] Catalytic Oxidizer
[ ] Combination of Thermal and Catalytic Oxidizer (Dual) System
[ ] Soil Vent Extraction and Oxidizer System
[ ] Liquid Waste Oxidizer

Type of Heat Recovery Desired:

[ ] Air to Air Heat Exchanger to Preheat the Incoming Gases
[ ] Air to Air Heat Exchanger to Provide Hot Air to Process
[ ] Waste Heat Boiler
[ ] Hot Water Generator
[ ] Building Comfort Heat

Location: Indoor Outdoor Ground ____ Roof
Other _____

Configuration: ____ Skid Mounted Trailer Mounted

Available Electric Power: ____ V – phase – Hz

Auxiliary Fuel Available: ____ Natural Gas *Propane* ____ Other

Process Schematic or Other Information:
(use separate sheet if necessary)

* For Liquid Waste

Oxidation

of

Liquid Wastes

Destruction of hydrocarbon containing liquids, such as contaminated water, in a thermal oxidizer is an economical alternative to other methods, such as land and deep well disposal. The concept is to use the available heat content from the hydrocarbon wastes with auxiliary fuel as needed, to oxidize the total liquid waste stream. The result is complete destruction of the waste stream, and elimination of the problem, in contrast to those alternatives which can be viewed as deferral methods.

HMT's liquid oxidizer systems will destroy combustible, non-combustible and aqueous based wastes. Because the composition of a liquid waste stream can be quite variable, with the heat content dependent upon VOC concentration, a control logic is incorporated which reacts to variations in the burner behavior and modulates the rate at which liquid waste is injected into the combustion chamber. The injection systemis designed for standard capacities from 2 gpm to 20 gpm. Capacities outside this range are achievable, but have not been standardized.

A complete liquid oxidation system typically includes the following basic components:

Liquid Supply Unit
Injector System
Large Capacity Combustion Chamber

Each application must be carefully evaluated so the capital equipment costs, long term operating costs, and the rate at which the liquid stream can be destroyed are known. In addition, the costs and liabilities associated with other approaches must be weighed.

HMT Thermal Systems , Inc. believes that oxidation is a means for dealing with liquid waste streams that compares favorably to other approaches, because it eliminates the problem, rather than simply moving it to another location, to be resolved at some later date.

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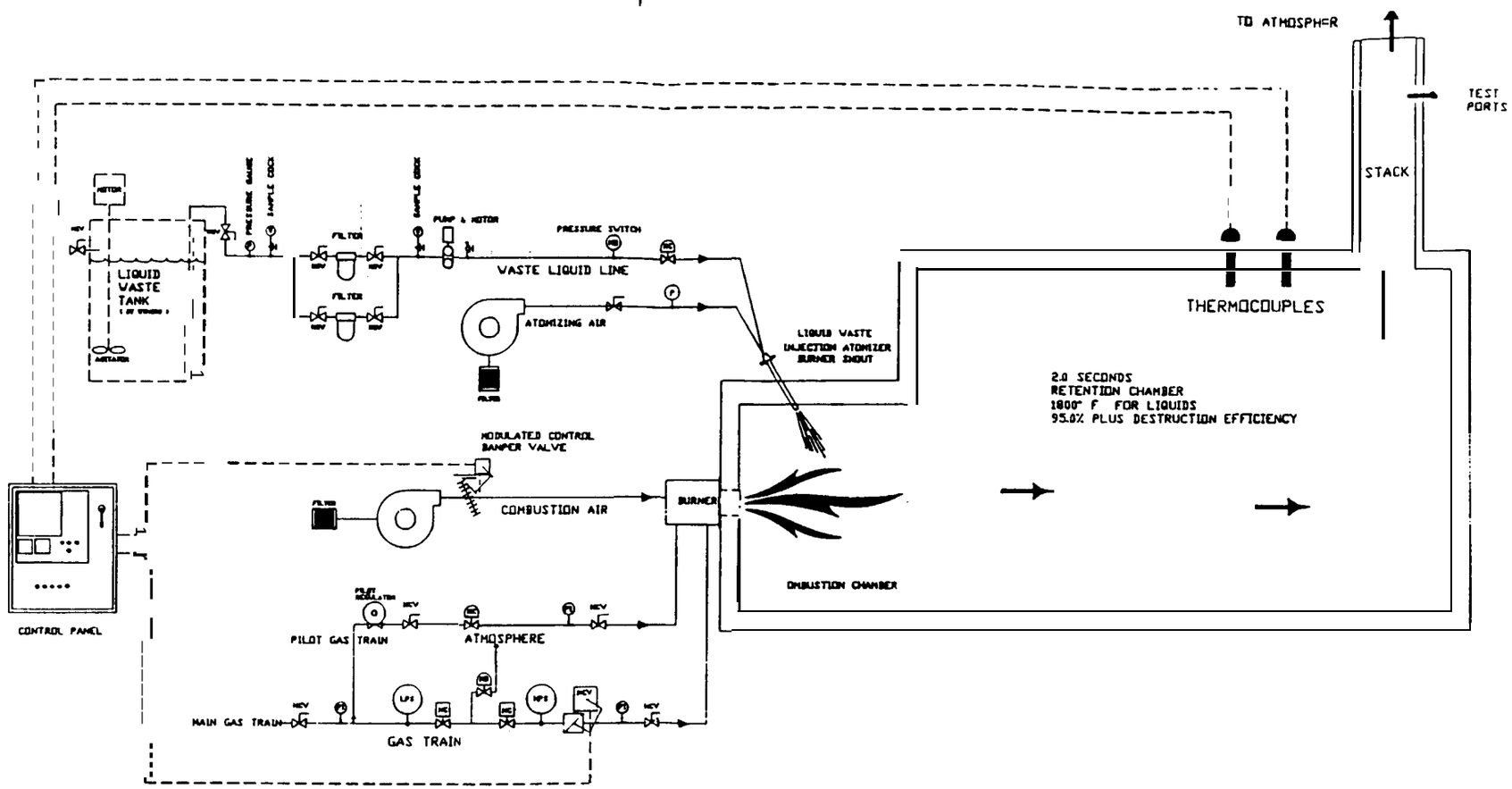


LIQUID WASTE OXIDIZER SYSTEM

BILL OF MATERIALS

APPROVALS DATE

R.LOPEZ, JR.

DO NOT SCALE DRAWING

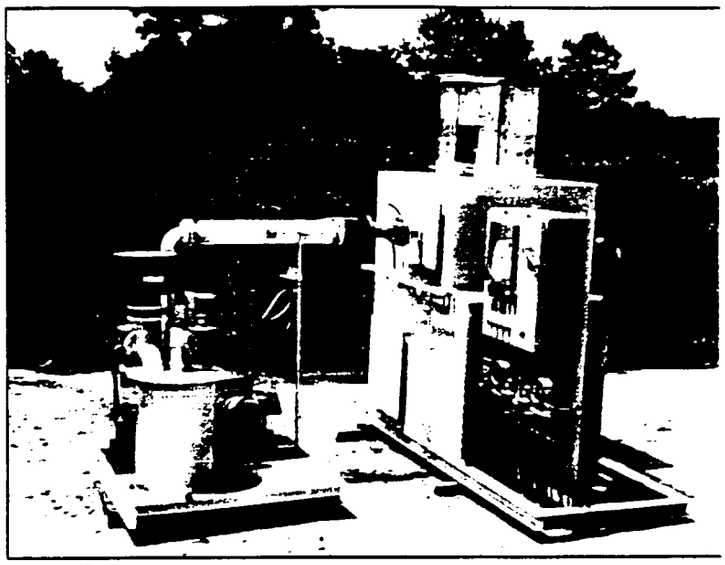
P & I DIAGRAM
LIQUID WASTE
THERMAL OXIDIZER

SIZE B IN-5063 REV 0

THERMAL SYSTEMS, INC.

SOIL REMEDIATION MADE SIMPLE

■ *Thermal/Catalytic Convertible Oxidizers* ■ *Therms/ Oxidizers* ■ *Catalytic Oxidizers*



HMT 500S-M (Currently Operating in Los Angeles, California)

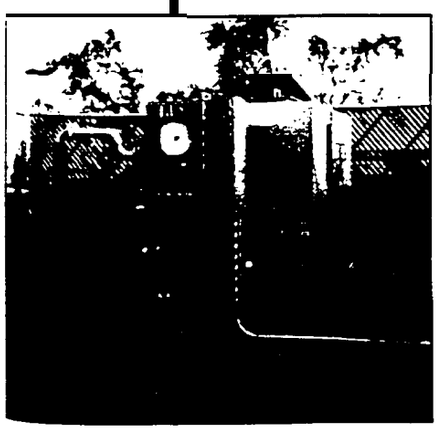
As the leader in providing state of the art soii remediation equipment, HMT Thermal Systems, Inc. (HMT) has a proven track record of successfully eliminating unwanted waste while exceeding federal, state and local agency requirements. HMT provides systems with destruction efficiencies up to 99.99"/..

Benefiting from years of experience, HMT has developed the HMT S-M series of convertible oxidizer systems capable of operating in thermal or catalytic mode. Additionally, HMT offers straight thermal (HMT-ST series) and straight catalytic (H MT-SC series) oxidizers in a wide range of sizes. Each of our systems may be equipped with an air to air preheat exchanger to minimize operating costs.

Another innovative feature of the HMT S-M series, to ensure maximum operating efficiencies are realized throughout the remediation project, is HMT's Automatic Dilution Feature (ADF). This feature provides automatic dilution of the incoming waste stream when concentrations are above design operating conditions which permits use of these systems on a wide variety of sites. As concentrations are reduced HMTs ADF reduces the dilution flow until such time as dilution is no longer required providing optimum control of supplemental fuel usage.

These systems are completely packaged units which are prewired and fully tested in the factory prior to shipment. HMT has carefully designed each model to require minimal space and because each is available in your choice of skid or trailer mounting, they are extremely mobile.

HMT also offers custom designed systems utilizing Best Available Control Technology (BACT) to meet the most stringent conditions in soil or process applications.



HMT 1OOOS-M
(Currently Operating in Mesa. Arizona/

THERMAL SYSTEMS, INC.

HMT S-M SERIES

Thermal/Catalytic Convertible Oxidizers with Built-In **Preheat Exchanger** *and* **Vapor Extraction System** - *Skid or Trailer* **Mounted**

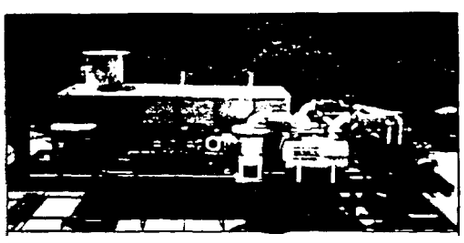
MODEL NO.	HMT 200S-M	HMT 500S-M	HMT 1000S-M	HMT 2000S-M
Soil Vent Capacity	200 SCFM	500 SCFM	1000 SCFM	2000 SCFM
Vacuum Rating*	-40" H_2O (Other blower ratings are available upon request)			
Motor HP	5 Hp	10HP	30 HP	125 HP
Retention Time	1.0 second	1.0 second	1.0 second	1,0 second
Burner Capacity	300,000 BTUH	800,000 BTUH	1.5 MM BTUH	3.0 MM BTUH
Destruction Efficiency	99% +	99% +	99%+	99% +
Thermal Mode Temp.	1400°F mm.	1400°F mm.	1400°F mm.	1400°F min.
Catalytic Mode Temp.	750°F min./1200°F max.	750°F min./1200°F max.	750°F mm.11200"F max.	750°F min./1200°F max.
Catalyst Type Volume	Platinum Based Honey comb Modules 0.83 ft³	1.66 ft³	2.5 ft³	5.0 ft³
Exterior Shell	3/16" Steel plate, primed and painted			
	High temperature (2300°F) ceramic insulation			
ntro	Honeywell digital controllers			
IRI Gas Train	314"	1"	1-1/4"	1-1/2"
Burner Management	Continuous UV scanner flame monitoring system			
UTILITIES Natural Gas" Elec. Power*	300 CFH 480V/3Ph/30 Amps	600 CFH 480V/3Ph/45 Amps	1500 CFH 480V/3Ph/60 Amps	3000 CFH 480V/3Ph/120 Amps
DIMENSIONS Oxidizer Skid Extraction Skid Recommended Pad Approx. Weight	9'6"L x 4'W x 8'H 5'6"L x 5'W 16'L x 16W 5400 lbs.	9'6"L x 4'6"W x 10'H 5'6"L x 5'W 16'L x 16W 6250 lbs.	11'Lx5'6WVX1O'H 6'6"L x 6W 18'L x 16'W 7700 lbs.	14'L x 6'6"W x 10'H 7'L x 6'W 20'L x 20'W 11,100 lbs.

. Vacuum blower rating; input voltages and available fuel vary from site to site.HMT's systems are designed to handle virtually an y variations of the above when required.

***HMT THERMAL SYSTEMS** provides specialty engineering services on a broad range of projects. Don't **hesitate** to contact us with your toughest requirements.*

*In addition to Soil Remediation Systems, HMT Thermal Systems is a leader in applying combustion technology for **the** destruction of vapor and/or liquid waste. A partial list of applications for HMT's products include:. .*

- **Tank Degassing**
- Barge/Ship Loading
- . Liquid Oxidation
- Tank Vents
- . Truck Loading Terminals
- . Process Waste Gas Vent
- Land Fill Vents
- . Rail Car Loading



LIQUID/VAPOR OXIDIZER

TANK DEGASSING UNIT (Operating in Southern California)

14615 FM 2920 TOMBALL, TEXAS 77375 (713) 351-7945 FAX (71 3) 351-6758

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SOIL REMEDIATION MADE SIMPLE

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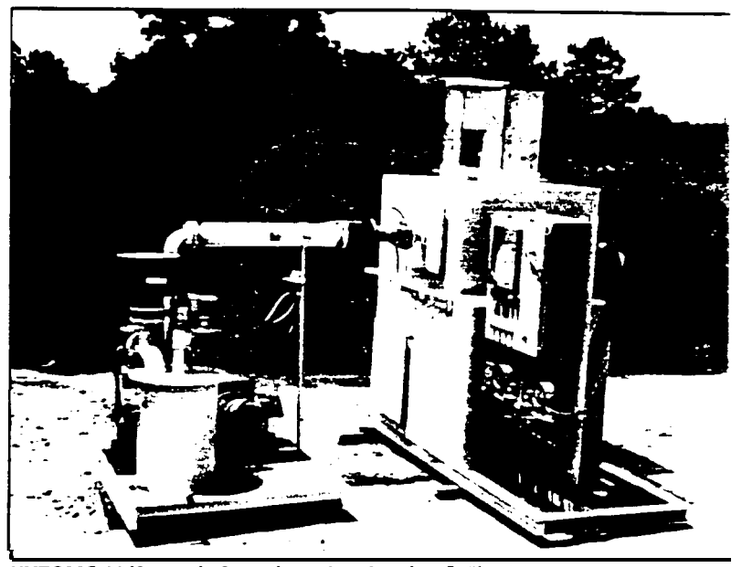

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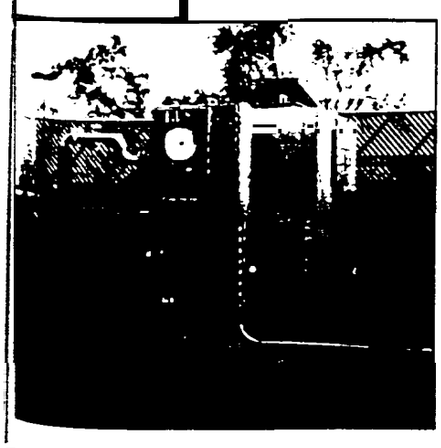

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- Truck Loading Terminals
- Process Waste Gas Vent
- Land Fill Vents
- Rail Car Loading

LIQUID/VAPOR OXIDIZER

TANK DEGASSING UN/T (Operating in Southern California)

14615 FM 2920 TOMBALL, TEXAS 77375 (713) 351-7945 FAX (713) 351-6758

HED INDUSTRIES, INC.
HEAT ENGINEERED DEVICES

P O. BOX 246 HIGHWAY31
RI NGOES. NEW JERSEY 08551
TEL.: 609/466. 1900 • TELEX: 855582

December 29, 1992

Mr. James L. McCourt
S L Ross Environmental Research Ltd.
717 Belfast Road * Suite 200
Ottawa, Ontario K1G OZ4
CANADA

Dear Mr. McCourt:

Many thanks for your letter of December 11 concerning your interest in combustion of contaminated diesel fuel. Attached is literature describing our ISOMAX Blue Flame Burner for your consideration.

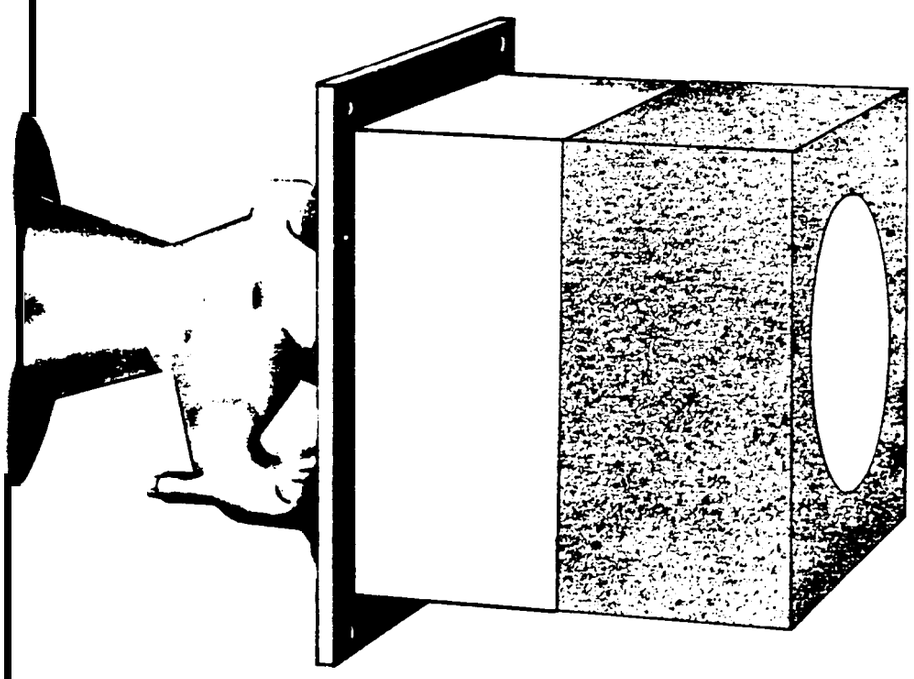
If additional product information is needed to more clearly define this versatile, multi-fuel burner for your purposes, please let me know . Blue Flame and UE Corporation are subsidiaries of HED, so you should be able to reach me easily, whenever you wish to do so.

I look forward to hearing favorably from you soon. Best regards.

Sincerely yours,

HED INDUSTRIES INC.

John S. Dennis



MULTI-FUEL BURNER

Performance Proven in Industrial Applications

SL
U.E. CORPORATION • RINGOES, NEW JERSEY

BLUEFLAME a gas flame from liquid fue

THE ULTIMATE IN COMBUSTIBILITY

The BLUEFLAME Burner is an exclusively patented combustion system which converts liquid fuel to gas immediately prior to ignition.

MULTI-FUEL CAPACITY

Permits selection from a wide range of fuels, depending on price and availability. Burns #2 fuel oil, diesel fuel, kerosene and natural and LP Gases. No longer is it necessary to curtail production because of temporary shortage of any fuel.

CLEAN BLUE FLAME

The BLUEFLAME Burner produces the same clean blue flame when operating on distillate petroleum as when operating on gas.

SHORTER, HOTTER FLAME

Combustion is essentially completed within the burner. The flame length, and therefore the clearances required, are much less than those required for most other burners. The completeness of combustion also leads to higher temperature flames and therefore higher heat transfer rates.

Operating at high combustion intensity, BLUEFLAME Burners bring the furnace up to temperatures faster, using an air-to-fuel ratio that can be maintained precisely to eliminate smoke and soot.

SWITCH FUELS INSTANTLY

The BLUEFLAME Burner switches from one fuel to another without interruption of the flame or without modification of combustion equipment.

The BLUEFLAME system requires no compromise with furnace design to achieve peak efficiency on either gaseous or liquid fuels. Combustion space remains the same with either fuel.

CONTROLLABLE ATMOSPHERE

The BLUEFLAME Burner can maintain a ,'urnace at sphere of perfect balance (stoichiometric). It can also adjusted to maintain a reducing atmosphere, holding dc oxidation to avoid scale on metal. And it may also adjustedto oxidizing atmosphere with a slight amoun free oxygen.

REDUCES AIR POLLUTION

Complete combustion leaves no soot, ash or carbon res to contaminate the air, or foul the burner, furnace or i Flue gas is free of smoke and carbon monoxide.

SIMPLE TO OPERATE

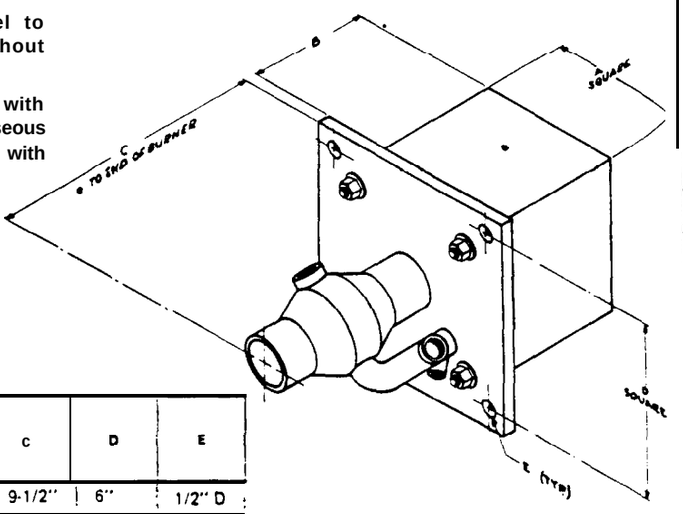
Users say that BLUEFLAME Burners are easier to op than conventional oil or gas fired systems.

MINIMUM MAINTENANCE

Users repart drastically reduced maintenance costs on t burners and furnaces. The clean blue flame means 10 life for furnace linings and crucibles.

COST SAVINGS

Gasifying the liquid fuels, preheating the combustior and being able to fire stoichiometrically, optimizes burn ing process, extending fuel allocations and lowe per unit *cost* of heating.



DIMENSIONS and RATINGS

BURNER MODEL	MAX. FIRING CAPACITY		A	B	C	D	E
	OIL. GPH	GAS MBH					
6 0 0 2	2.25	315	5"	5-1/2"	9-1/2"	6"	1/2" D
8005	6.5	910	7"	9"	15"	8-1/2"	1/2'0
8010	17	2.380	9"	9'	19"	10"	9/16" O
B030	50	7,000	12.3/4'.	12-1/8"	16"	14.1/4"	5/8" O
13090	110	15,4W	22112"	16.1/2"		27" "	3/4" D

" See certified drawings for details and exact dimensions of air and 011 inlets, and mounting details.

burner description and operation

When starting from a cold Condition, start-up oil enters the Oil Start-up Nozzle through Valve "A" and ignition is accomplished either directly by an air cooled spark plug directly by a gas pilot which is ignited by a spark plug. ndard ignition transformer is employed in either system.

ıe same time air from a blower entering the Injector le and Venturi Mixing Tee creates a negative pressure ting recirculation of combustion gases from the Flame el, through the Hot Gas Return Tube.

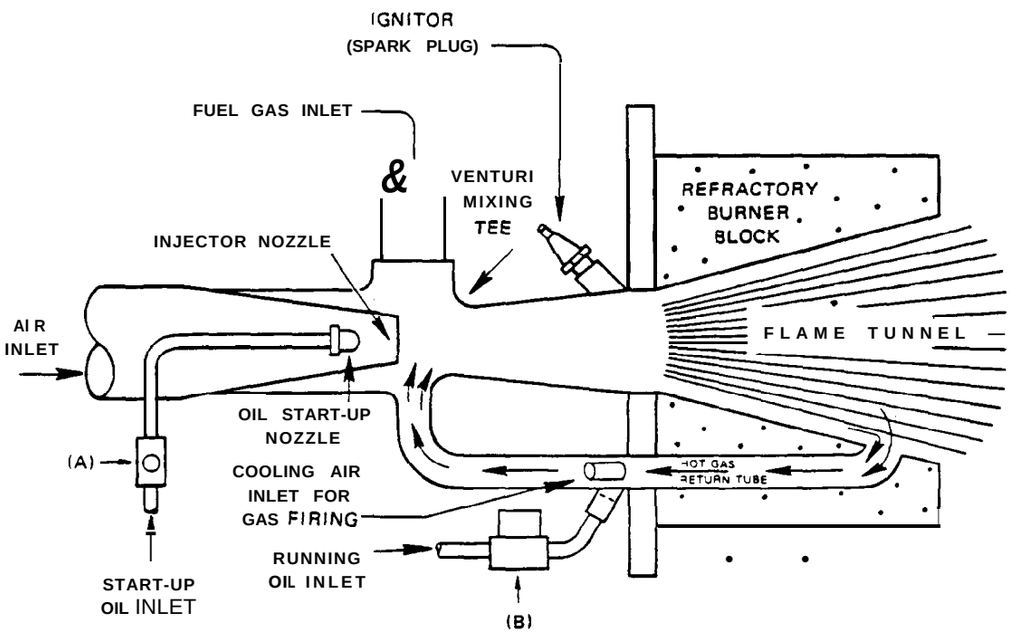
approximately 45 seconds of operation, Valve "B" ened permitting Run Oil to flow into the Hot Gas n Tube where it is mixed with the recirculating com- ın gases, immediately *becoming* gasified and trans- d to the mixing chamber. These recirculated combustion gases mix with and preheat the incoming combustion air, increasing combustion efficiency greatly.

The mixture of air, fuel and recirculated combustion gases passes to the Flame Tunnel where it is burned.

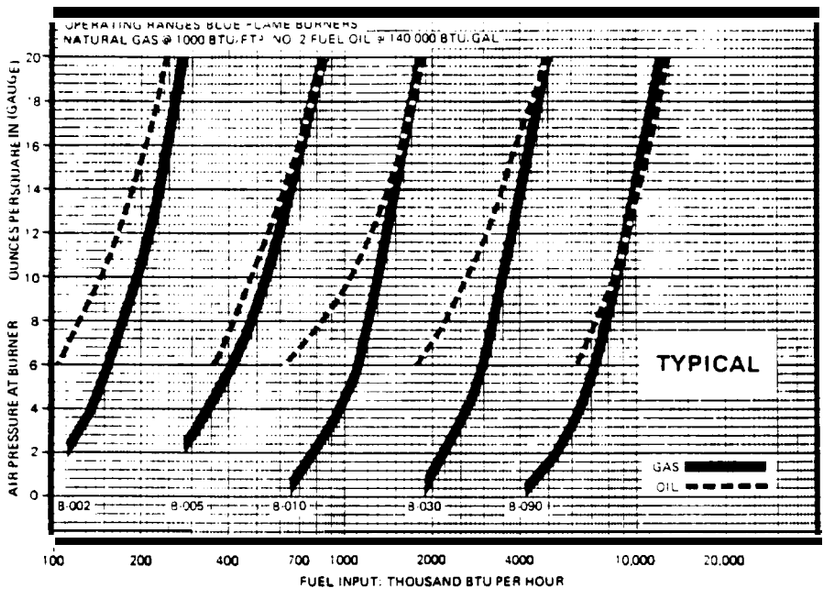
Valve "A" is then closed and burner is operating on gasified running oil.

The normal operating cycle is continuous until the flow of oil to the burner is interrupted.

Alternately the burner can be fired with gas, in which case the Return Tube is cooled by air from the blower. The BLUEFLAME Burner can also operate with any proportion of gas and oil simultaneously.

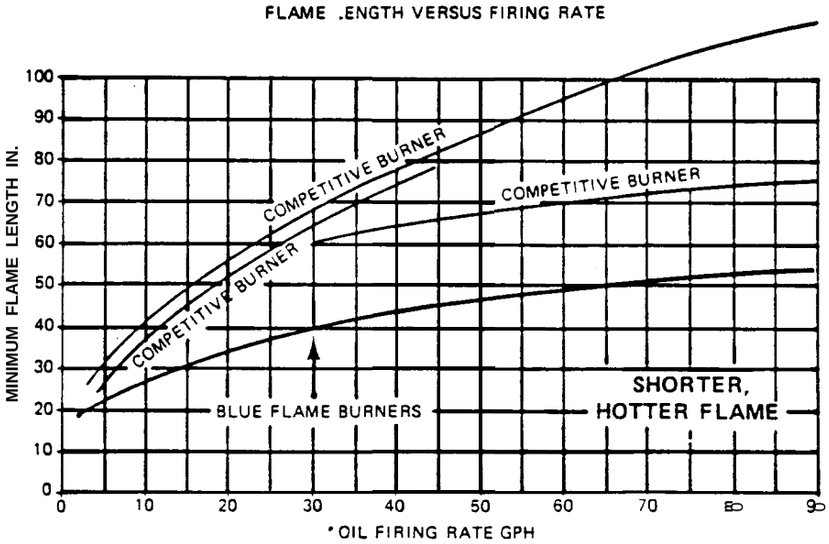


The" BLUEFLAME Burner due to its unique capability of vaporizing its oil and preheating its combustion air, burns with a clean blue flame. This is accomplished with no moving burner parts. It was first introduced to the non-ferrous foundry industry and proved to be an instantaneous success. Today it is recognized that the BLUEFLAME Burner offers many advantages for an almost unlimited variety of industrial applications.



heat treating furnace
forging furnace
crucible melting furnace
reverberatory furnace
salt bath hardening furnace
annealing furnace
billet heating furnace
vitreous enameling furnace
glass melting furnace
ceramic kiln
boilers
rotary kiln
paint oven
coal dryer
aggregate dryer
incinerators
ladle heaters
after burners
air heaters

FLAME LENGTH VERSUS FIRING RATE



The BLUE FLAME Burner is protected by existing as well as pending patents. For more details on just what the BLUE FLAME concept of fuel combustion can mean to you, write or call us.

U.E. CORPORATION
Route 31, Ringoes, N.J. 08551
609—466-1900

Bulletin 578

MBB-TRECAN

December 16, 1992

S.L. Ross Environmental Research
717 Belfast Road
Suite 200
OTTAWA, Ontario
KIG 024

ATTENTION: James McCourt

SUBJECT: ***GNWT* Study**

Dear Mr McCourt:

This letter is in response to your fax of December 10, 1992, requesting information on equipment for the combustion of contaminated diesel fuel and lubricating oil.

Trecan provides custom engineered systems for the incineration of liquids, gases and solids. We therefore do not have standard catalogue items available.

We would be interested in bidding on the portable unit for the water contaminated diesel fuel once the parameters and requirements have been set.

Enclosed for your information is our general capabilities brochure and a partial reference list for liquid waste incinerators.

Please do not hesitate contacting us should you require further information.

Regards,

Frank G Morrison
Sales Manager

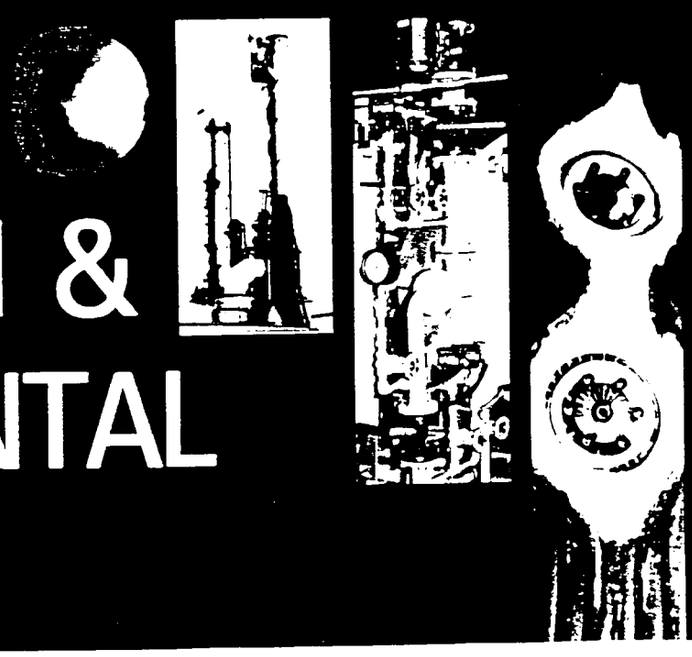
Encl.

MBB-TRECAN INC.

2150 Dunwin Drive, #3
Mississauga, Ontario,
Canada L5L 5M8
Tel.: (416) 607-5905 .Fax: (416) 607-5908

Head Office:
Lakeside, Nova Scotia (902) 876-8213
Sales Offices:
Montreal, Quebec (514) 336-1558
Calgary, Alberta (403) 243-5570

TRECAN



COMBUSTION & ENVIRONMENTAL EQUIPMENT

TOTAL SYSTEM DESIGN CAPABILITY FOR THE '90S!

As an industry **leader** in **combustion technology for over 25** years, **Trecan has built** a solid **reputation** for premium, **state-of -the-art combustion equipment and systems.**

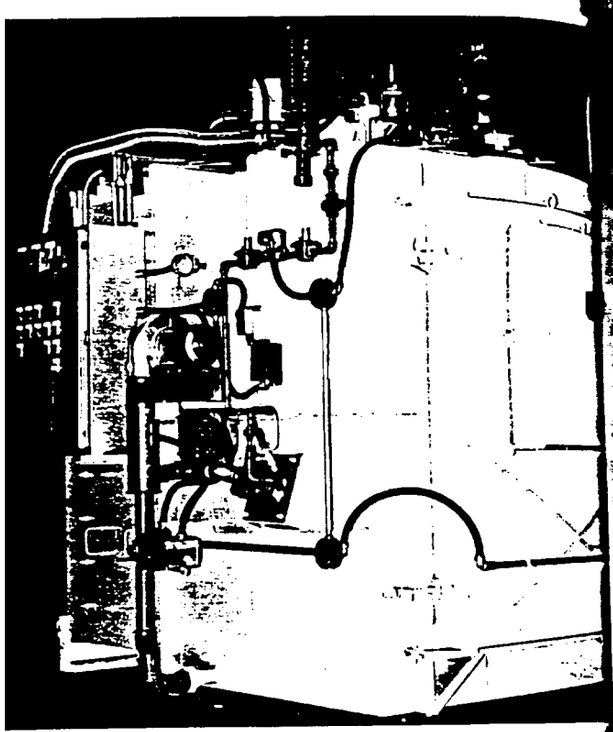
Our diverse product range includes incinerators **for solid, liquid and gaseous wastes: industrial burners: snow melters:** air **heaters and submerged exhaust** (sub-X) combustion equipment.

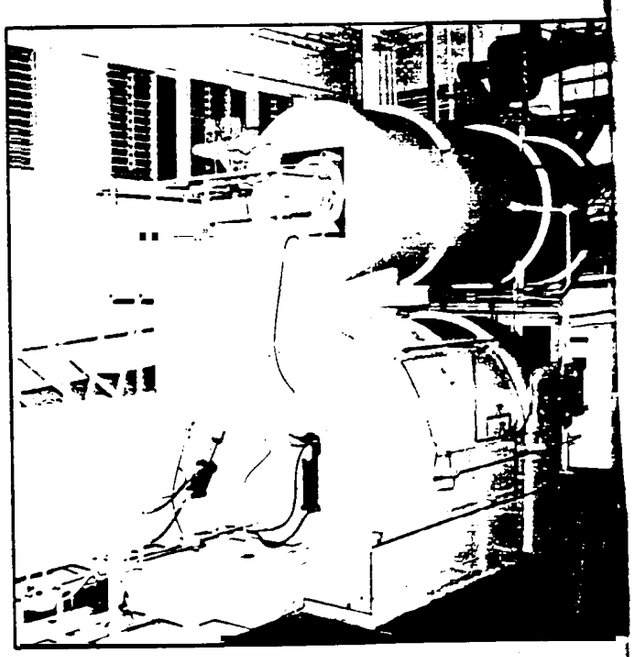
Trecan offers the complete efficiency package of service from start to finish! We provide the initial design and manufacturing . . . then follow through with expert installation backed by commissioning and service from our staff of qualified specialists.

Our extensive experience, along with our association with a number of prestigious international companies *(Hamworthy Combustion Systems, UK; BP International, UK; and T-Therms/ Inc., USA to name a few),* gives **Trecan** a level of capability that's unrivaled in this field.

Trecan is **dedicated to the pursuit** of excellence in its product design, customer service and concern for the environment.

This publication is designed to briefly introduce our product range and capabilities.





INCINERATION

As the predominant Canadian manufacturer of industrial and institutional incineration equipment, Trecan's experience is as varied as the disposal of biomedical waste, low level radioactive waste, chlorinated liquids, acid gases and VOC-contaminated exhaust streams.

Our total system design capability includes heat recovery, air pollution control, fuel and waste handling and all associated controls.

Solid Waste

Trecaire® two stage controlled air incinerators are suitable for a wide range of solid wastes including:

Biomedical / Pathological Waste
Industrial Waste
Low Level Radioactive Waste
Precious Metal Recovery
Municipal Waste

Capacities are 50 to 500 ft^3 (1.4 to 14m^3) for batch operation and 200 to 2200 lb/h (90 -1000 kg/h) for ram feed operation. Ancillary equipment includes hydraulically operated ram feeders, on-line ash removal (wet or dry type), heat recovery and gas scrubbers.

Waste Gases

A wide range of waste gases can be accommodated in our custom designed incineration systems, which are available in thermal capacities **up to 100 x 10^6 Btu/h (105,500** MJ/h). Air pollution control equipment and heat recovery will form part of the total system based on the prevailing process conditions.

VOC Fume

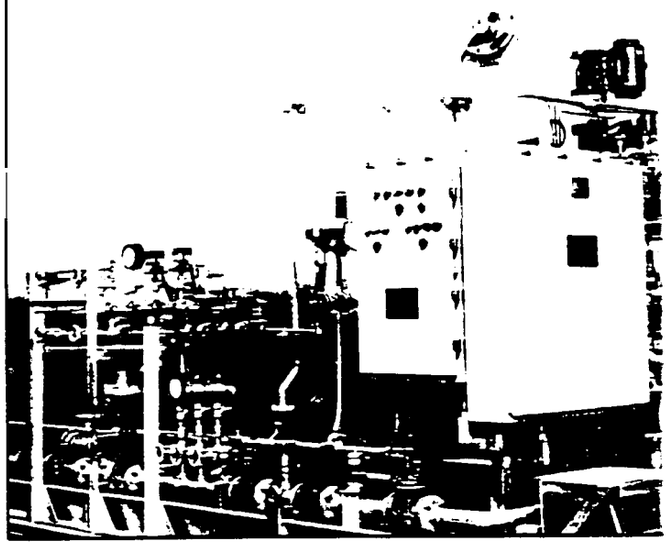
Large volume exhaust streams with low levels of organic contamination (usually **in the form of solvents) can be cost-effectively incinerated by preheating the in-**coming fume **with the** incinerator exhaust in a recuperator and by adding **secondary** heat **recovery** downstream of the recuperator. In **many instances, the exhaust fume will** contain **sufficient** oxygen to allow it to be the source of combustion air for the incinerator burner, thus further reducing auxiliary fuel usage.

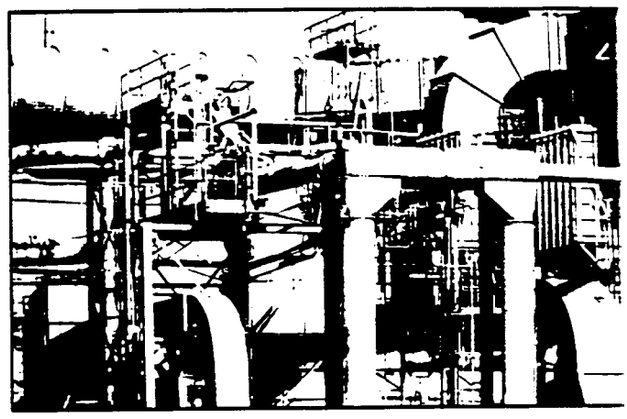
Liquid Waste

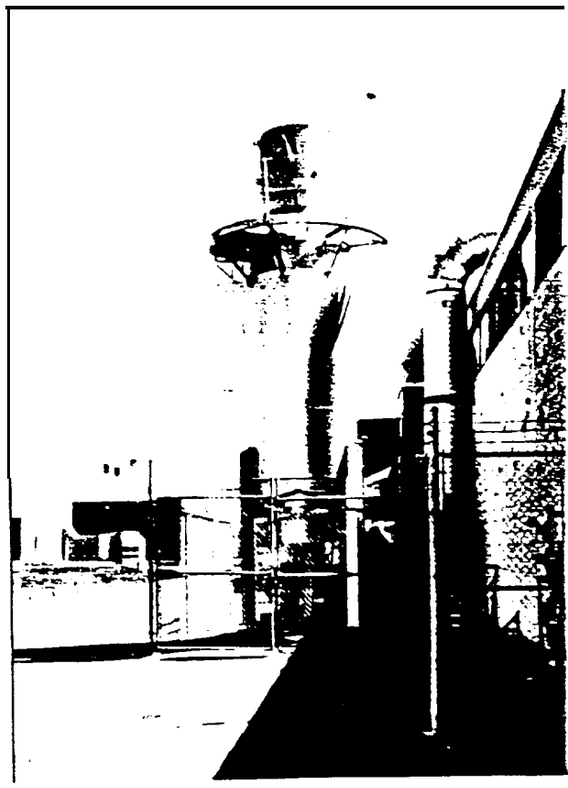
The **Trecan LV** high intensity vortex burner forms the **basis** of our liquid **waste** incineration systems. This burner ensures the highest possible destruction efficiencies and operational **flexibility.**

The ability to handle waste liquids with high solids loading is just one of the key features of the LV burner.

Thermal capacities up to 100 x 10^6 Btu/h (105,500 MJ/h) are available.







BURNERS

The diverse nature of our industrial burners enables them to be used on a wide range of applications, including steam generators, fired-heaters, reformers, air-heaters and incinerators.

Through our association with Hamworthy Combustion Systems and T-Thermal Inc., we are also able to offer unrivalled world-class burner test facilities.

T-Thermal High Intensity Burners

Thermal burners form the heart of many of Trecan's combustion systems and are also suitable for many other wide-ranging applications. These high-intensity burners, HV and LV types, are manufactured under a long-standing agreement with T-Thermal Inc.

HV (High Velocity) BURNERS

HV burners are suitable for use with either gas or distillate fuels, singly or in combination with capacities of 1.5 to 12 x 10^6 Btu/h. High discharge velocities (300 -500 ft/see) and high heat release rates, 10 x 10^6 Btu/h per ft^3 of combustion space, enables these burners to be used extensively on our Sub-X combustion systems.

LV (Vortex) BURNERS

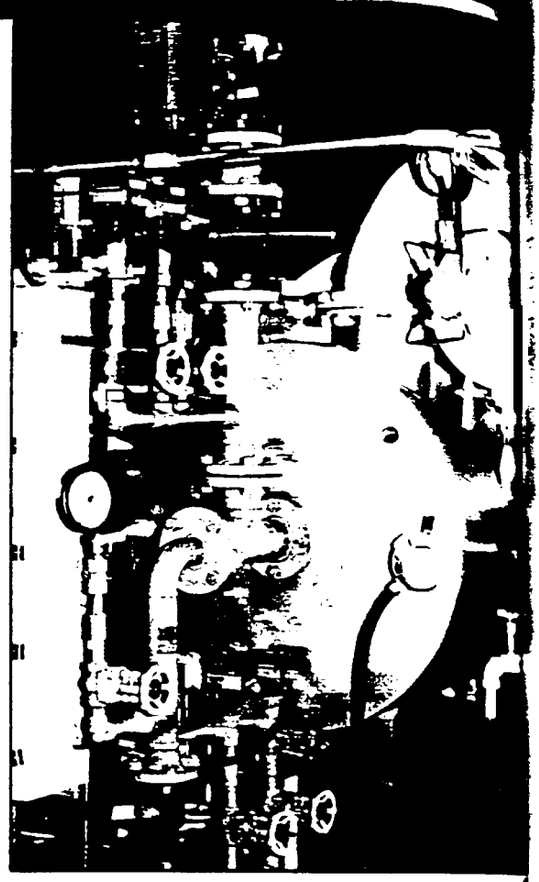
The LV burner is capable of operation with a wide range of liquid and gaseous fuels as well as many liquid and gaseous wastes in the capacity range 1 to 100 x 10^6 Btu/h. The LV burner is used extensively in Trecan incineration systems and other process applications where high heat release rates and short flame configuration are required.

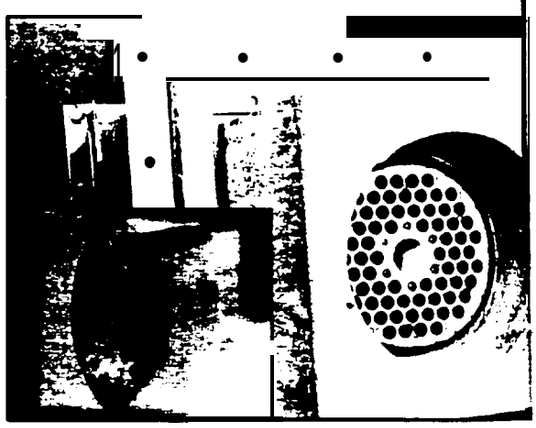
Hamworthy LU/DF Burners

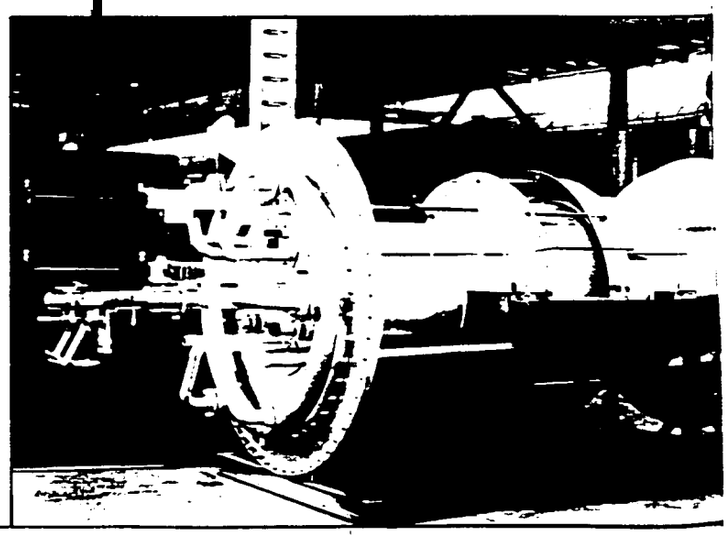
Developed to meet the demands of the power generation, petrochemical, process and heavy industrial markets for optimum combustion performance, DF and LU burners are available in capacities up to 300 x 10^6 Btu/h and are suitable for use with any grade of liquid fuel and a wide range of gases. The burner is of a fixed geometry type using the concept of multiple concentric annular flow division and axial swirl flame stabilization. This divided flow (DF) concept permits operation at low excess air levels with minimum NOX emission.

Trecan Matrix Gas Burners

Developed in conjunction with and manufactured under license from BP International, the matrix burner employs a unique patented burner head design. With capacities up to 20 x 10^6 Btu/h, the matrix burner offers unrivaled operational flexibility in terms of gas composition, fuel pressure and turn down ratio, which can be as high as 30 to 1. The burner is particularly suitable for use with reformers and fired-heaters and has been successfully applied with many other processes.







SUB-X SYSTEMS

The **Trecan Sub-X (submerged combustion) System** is a highly **efficient means of heating** liquid process materials by direct contact with products of combustion. In many cases this system can achieve heat transfer efficiencies of 98%. In this process. **combustion takes place above the liquid level while hot gases are exhausted through a submerged downcomer tube transferring heat to the liquid under condition of high** turbulance. **There are no heat transfer** surfaces to foul and this simple construction allows for responsive operation. A number of Sub-X applications are described below.

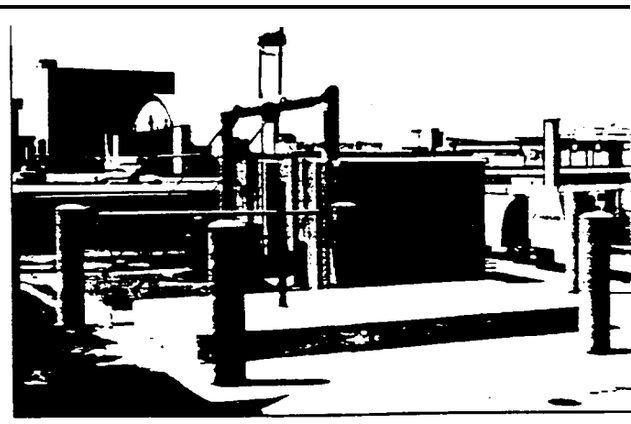
Snowmelters

Trecan oil and gas-fired snowmelters have been successfully employed on many wide-ranging applications, including airports, shopping malls, parking garages, and municipal roads. Stationary melters are available in two basic sizes, 20 and 40 ton/hr or any multiple thereof. Mobile (towed) melters, which are oil-fired only, have capacities of 40 or 80 ton/hr. This range is further complimented by a self-propelled, self-loading oil-fired snowmelter with a capacity of 150 ton/hr.

Vaporizers

This variation on the Sub-X system is used in the vaporization of cryogenic fluids. It combines the safety of steam heating with the high response characteristics of a direct fired-heater, providing efficiency and temperature uniformity superior to these two systems.

Some of the fluids handled by Sub-X cryogenic vaporization include oxygen, nitrogen, ethylene, LNG, ammonia and propane.



Liquid Heating

There is virtually no limit to Sub-X applications for heating (and concentrating) of liquids, provided that the process liquid is not reactive with the products of combustion. Sub-X technology provides a simple, cost-effective means of heating process liquids, particularly as there are no heat transfer tubes to foul or corrode and efficiencies of up to 98% can be hieved.

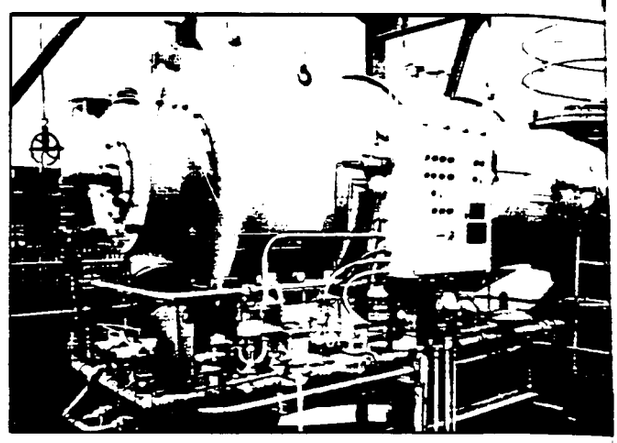
Inert Gas Generators

Our inert gas generators are available in 8 standard models, with capacities from 2,000 to 60,000 scfh. Fired on either distillate fuel or gas and using the Sub-X process, the system is reliable and extremely responsive capable of producing an inert atmosphere in just 30 seconds.

DIRECT FIRED AIR HEATERS

Trecan direct fired air **heaters** arrive **as a custom designed package, Incorporating** our high heat-release burners. This feature. coupled with dilution zone design. ensures excellent temperature profile across the heater exit for accurate **process control.**

Capacities up to 100 x 10^6 Btu/hr **are available in** vertical **or horizontal format.**

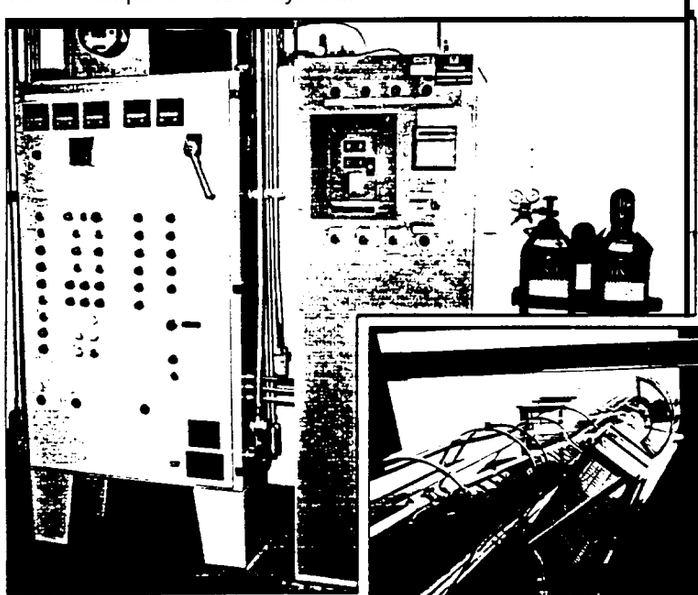


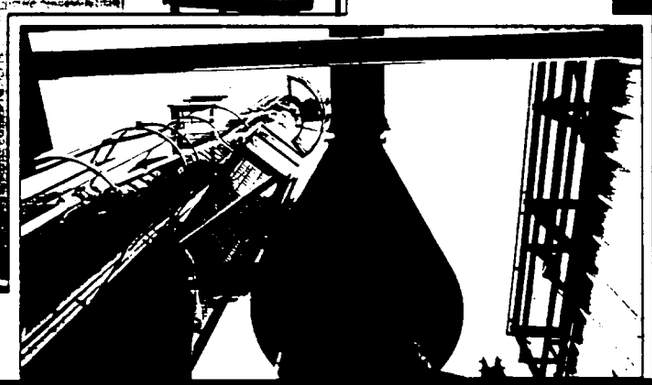
FIRED HEAT EXCHANGERS

For indirect heating of air. vapour. **superheated steam and a wide range** of process gases, **Trecan's fired heat exchangers have heat transfer ratings of 0.5** to **x** 10^6 Btu/h **with pressure** rationgs **up to** 1500 psig

ANCILLARY EQUIPMENT

The correct design, selection and integration of the many components necessary to ensure a complete operational system is a key element **in** our claim to provide total system capability. Illustrated are examples of ancillary equipment typically incorporated into a complete **Trecan** system.





TRECAN

MBB-TRECAN INC.
2150 Dunwin Drive, #3
Mississauga, Ontario
Canada L5L 5M8
Tel.: (416) 607-5905
Fax:(416) 607-5908

ULLETIN DS-15-6-90

Designed and produced by
SG & Associates Mississauga Ont

TRECAN LIQUID WASTE INCINERATORS

‘ PARTIAL REFERENCE LIST

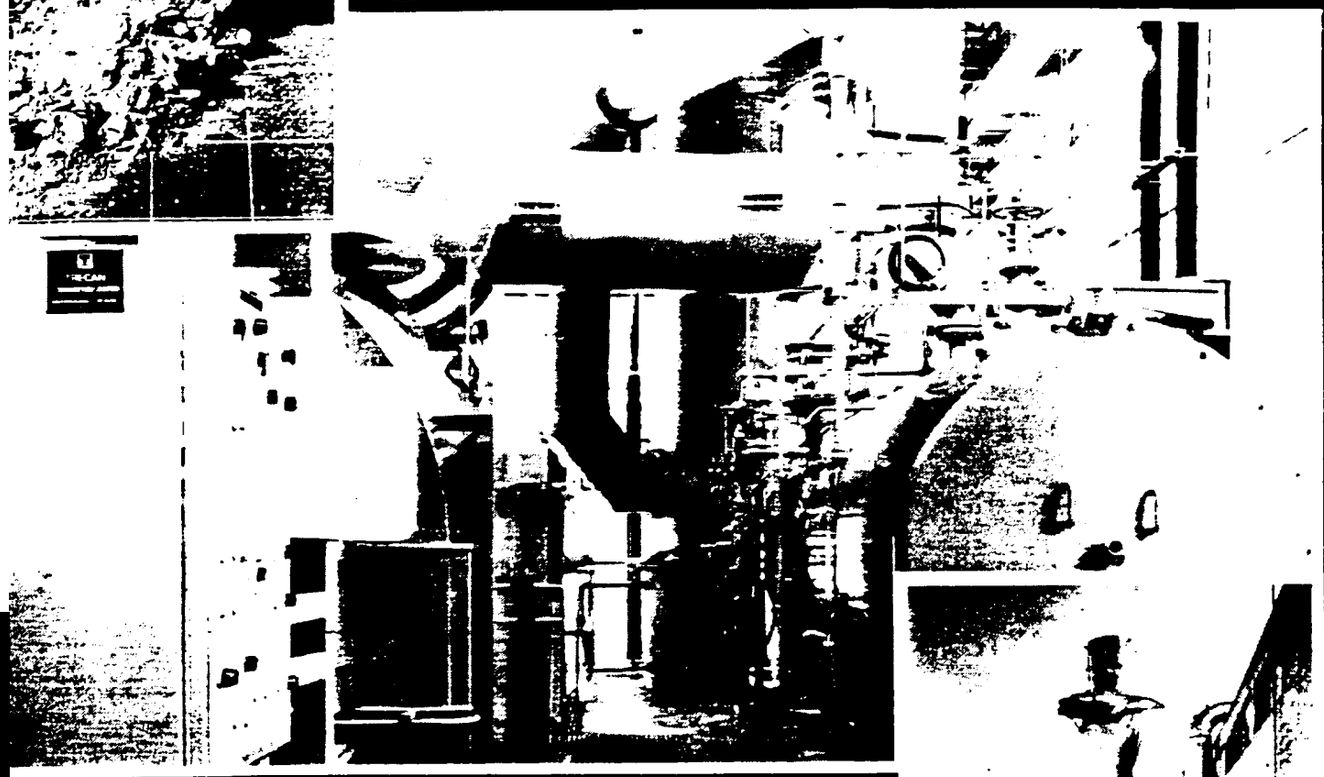
CUSTOMER	EQUIPMENT/WASTE TYPE
Polysar Sarnia, Ontario	LV-7 Vortex Burned spent oils
Atomic Energy of Canada Pinawa, Manitoba	LV-30 Vortex Burned Mixture of oil and water
Reichhold Chemical Ltd St. Therese, Quebec	Vertical Incinerator/ Phenol Water, 100 GPH
University of B.C. Vancouver, B.C.	Sub-X Incinerator/ Chlorinated Liquid Hydrocarbons
Stelco Hamilton, Ontario	Incinerator/ Ammonia Fumes and Liquids
Goodfellow Int. Mercier, Quebec	Central Disposal Plant for waste liquids and sludges
C P Rail Cote St. Luc, Quebec	Incinerator/ Waste Oil
Union Carbide Belleville, Ontario	Vertical Incinerator/ Phenol Water
Dow chemical Sarnia, Ontario	Incin. Burner for Chlorinated Hydrocarbons (liq.) and *@
DuPont of Kingston, Ontario	Incinerated 3-5% oil in water
Wilputte Canada Algoma Phosam Plant	Ammonia Destructor/ Fumes and Liquids

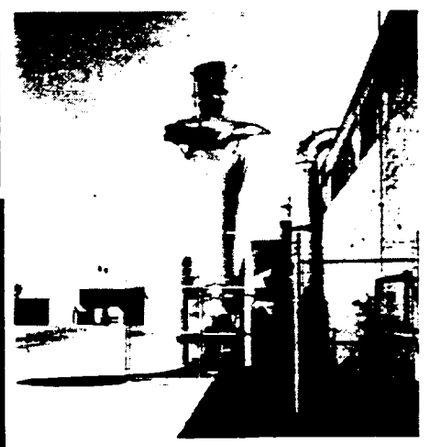
MBB-TRECAN

2150 Dunwin Drive #3 Mississauga, Ontario, Canada L5L 5M8
Telephone: (41 6) 607-5905. Fax: (416) 607-5908

Procor Ltd Edmonton, N -	Liquid Waste Incinerator for tank car cleaings, with water heating
BASF Cornwall, Ontario	Incinerator with Vortex Burner/ Liquid Organic Waste
Stelco, LED Nanticoke, Ontario	Ammonia Destructor/ Fumes and Liquids
Celanese Canada Edmonton, Alberta	Incinerator, 3300 lbs/hr, c/w quench chamber, baghouse, fans, ducting and incl. installation/ Process liquids
Diagnostic Chemicals Charlottetown, PEI	Incinerator c/w waste heat boiler, gas scrubber, stacks and controlls/ Organic liquid waste -260 lbs/hr.

INCINERATION SOLUTIONS





COMPLETE SYSTEMS
SOLIDS • LIQUIDS • GASES

Complete incineration systems incorporating air pollution control equipment to meet todays stringent emission standards. Designed, manufactured, installed and serviced by **TRECAN**. More than 200 systems supplied covering 30 years of experience.

Applications include:

- **Biomedical Waste**
- **Pharmaceutical Waste**
- **Low level radioactive waste**
- **Process off gases**
- **Industrial process fumes**
- **Liquid Waste**

TRECAN
COMBUSTION LIMITED

MBB-TRECAN INC.
2150 Dunwin Drive, #3
Mississauga, Ontario
Canada L5L 5M8
Tel.: (416) 607-5905
Fax: (416) 607-5908

TRECAN COMBUSTION LIMITED

LIQUID WASTE INCINERATOR SURVEY FORM

COMPANY: _____ DATE: _____

_____ MADE BY: _____

PHONE: _____ COPIES TO: _____

TELEX _____ FAX: _____

CONTACTS: _____ TITLE: _____

_____ _____

1) Main **Product:** _____

2) Main Raw **Material:** _____

LIQUID WASTE **SPECIFICATION**

3) Flow Rate: _____ **kg/h (lbs/hr)** 4) Temp.: _____ "c("F) 5) **pH:**

6) Heating Value: _____ **kJ/kg(BTU/lb)** **7) S.G.** _____

8) Flesh Point: _____ ● c("F) 9) **Viscosity:** _____

COMPOSITION

10) **Water Content:** _____ **WT%** 11) Total **Solid:** _____ **WT%**

Solid Size _____ **WT%**

12) **Organic Composition:** _____ **WT%**

_____ **WT%**

_____ **WT%**

13) Inorganic **Composition:** _____ **WT%**

_____ **WT%**

_____ **WT%**

14) Brief description of process

_____

_____

LIQUID WASTE INCINERATOR SURVEY FORM - Cent'd . . . . .

AVAILABLE UTILITIES

15) Steam: Yes/No Pressure: _ kPa (psi) Spare Capacity: _ kg/hr (lbs/hr)

16) Air: Instrument Yes/No Pressure _ kPa (psi)

Compressed Yes/No Pressure: _ kPa (psi)

17) Water: Yes/No Temp.: °C(°F) Pressure kPa (psi)

18) Electricity i) _ Volts, _ Hz, _ phase

ii) _ Volts, _ Hz, _ phase

19) Auxiliary Fuel (Specify): Type: _____ Pressure _____

20) Approximate Space Available: _____

_____

21) Site Location: _____ Area Classification: _____

Ambient Temp.: _____ °C(°F) Humidity _ % R.H. Alt.: m(ft)

22) Period of Operations _____

EMISSION STANDARDS: (Air/Water/Noise)

_____

_____

_____

CONSIDERATION FOR HEAT RECOVERY (Steam/Water/Other)

_____

_____

HEIGHT OF TALLEST BUILDINGS WITHIN 100M RADIUS OF PROPOSED INCINERATOR LOCATION

_____

_____