

A HALON 1301 RECYCLING SYSTEM

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INTRODUCTION

In the past few years the Halon issue has very rapidly come to a head. The apparent damage of the Ozone layer by CFCs and even larger role blamed on halons has provided a great pressure to phaseout the production of Halon. It is felt that the production of 'new' halon will stop in 1994 or 1995 at the latest. Because of this and the fact that Pacific Scientific provides fire protection systems in two areas of recognized "essential use" application, namely, the aircraft industry both commercial and military and in military vehicle crew bay applications, the development of a recycling concept becomes a necessity.

There are several other drivers in this direction as well. Southern California has often been the leader in instituting rules and regulations regarding air quality and pollution of various types. In the area of Halon regulations they are once again leading the way. The South Coast Air Quality Management District (SCAQMD) has issued Rule 1418, "Halon Emissions from Fire Extinguishing Equipment" which goes into effect on July 1, 1992. The rule is summarized below:

- 1) **Purpose** - reduce Halon emissions by requiring recovery and recycling and by prohibiting the use of Halon for nonessential applications.
- 2) **Applicability** - everyone who owns, operates or services a halon fire extinguishing system halon fire extinguishing system.
- 3) **Requirements:** for portable systems there will be no release Halon without recovery/recycle with 97% efficiency. Further, there will be no sales except for buildings used for manufacturing, commerce, or government operations; or a vessel or aircraft.

For total flooding systems there will be no release of Halon without recovery/recycle with 95% efficiency. Further, there will be no discharge tests unless proved to SCAQMD to be required and tests cannot be with Halon.

THERE IS NO STATEMENT ABOUT AIRCRAFT OR **MILITARY** VEHICLES.

Any person who owns or maintains a total flooding system shall register with the District. Any person who services portable ~~or~~ total flooding systems shall register with the District. Any changes require a resubmittal of the forms.

Any discharge tests (with an agent other than Halon) requires written approval.

Any accidental discharge involving more than 10 pounds must be reported within 14 days.

Exemptions: A discharge to extinguish an actual fire (not a test ~~fire~~). Accidental Halon discharges **are** exempt, but must be reported.

It is ~~our~~ feeling that this rule may well become a model for the U.S. EPA and other regulatory agencies. The EPA already requires Halon quantities to be reported for inventory purposes. This requirement comes from Title M of the Superfund Amendments and Re-authorization Act (SARA), Section 313 Form R - The Toxic Release Inventory which requires all users with inventories over 10,000 pounds to report these inventories and includes both Halon 1301 and Halon 1211 in 1991 for the first time.

The final and possibly the most important is the U.S. Tax on 1301, which will increase to \$26.50 per pound in 1994. This tax will not be imposed on recycled Halon.

The FAA funded a study which investigated the "Feasibility of Systematic Recycling of Aircraft Halon Extinguishing Agents"(1). This study concluded a) that Halon 1301 recycling systems were feasible with Halon recovery efficiencies of 98%, b) that the purity of the recycled Halon could meet the specifications of MIL M-12218C (except for the 1.5% fixed gases in the vapor phase), and c) support of the **U.S.** civil aircraft fleet well into the next century using recycled Halon 1301 is feasible.

The general conclusion is supported by the UNEP Report of the Halons Technical Options Committee prepared for the Parties to the Montreal Protocol for their meeting in November, 1992. They conclude that there is sufficient Halon that could be "banked" and recycled to supply the "essential **uses**" for several decades.

THE HALON RECYCLING SYSTEM

In response to the ongoing requirements for Halon **1301**, Pacific Scientific has developed a system which is designed to provide Halon 1301 in a purity that can meet **MIL-M12218C**, and thereby satisfy the **needs** of the aircraft industry and military crew bay applications. This system is illustrated in Figure 1.

Figure 2 provides a flow diagram for the **Halon** through the system and indicates the main functions of the system. The overall concept of the system is straight forward. The halon passes through a series of **three** filters to remove acids, moisture, oils and particulate from the used halon. The halon is then passed through a heat exchanger into a cold separator **tank**, cooled to **-70 °F**, before venting the nitrogen.

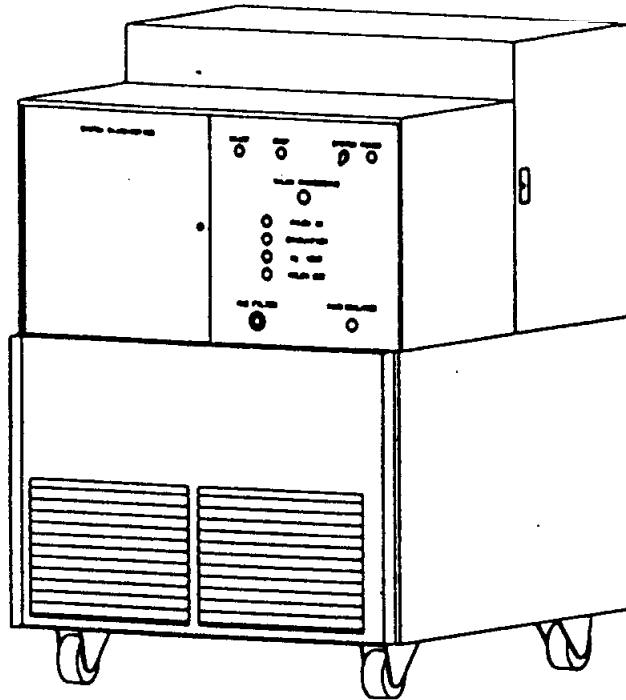
This is the key step in purification. Nitrogen is **used** at many different pressures in halon systems to provide additional force for distribution. **In aircraft** applications the nitrogen pressure in a bottle may vary from **no** nitrogen to 800 psia. **This** makes the separation of nitrogen critical to filling the subsequent bottle for a potentially different application.

Once the **halon** reaches the necessary temperature for efficient separation in the separator tank, the nitrogen is vented and the cold halon is pumped into a storage bottle for subsequent applications.

Figure 3 lists the technical specifications for the system. This system offers several unique features. The system is totally automated. Once a bottle is connected to the system at the front end and the storage container is connected to the outlet, the process is initiated with the push of a button. The operator can then **"walk away"** from the system. A light indication **on** the unit lets the operator know when the bottle is finished.

The system can pump liquid halon at the rate of **10-11** pounds per minute. However, this rate can be deceiving with processing small bottles of halon. The aircraft industry uses bottles ranging from 60 cubic inches holding only a pound or **so** to **2500** cubic inch bottles holding over **100** pounds. The military vehicle application generally uses bottles containing **5, 7.5, and 10** pounds of halon pressurized to 750 psia. Clearly, if your application centers about the smaller bottles, the processing **time** will be dictated by the time required to connect and disconnect bottles. In addition, in order to effect a high efficiency halon recovery, it is necessary to pump the "heel" out of the bottle. If the bottle is vented after pumping the liquid only, the efficiency is about 70-80% halon recovery depending **on** the size of the bottle. Pumping the heel requires a compressor **type** pump and is not a fast process. The heel

Figure 1 & 2



SCHEMATIC DIAGRAM FOR RECYCLE SYSTEM

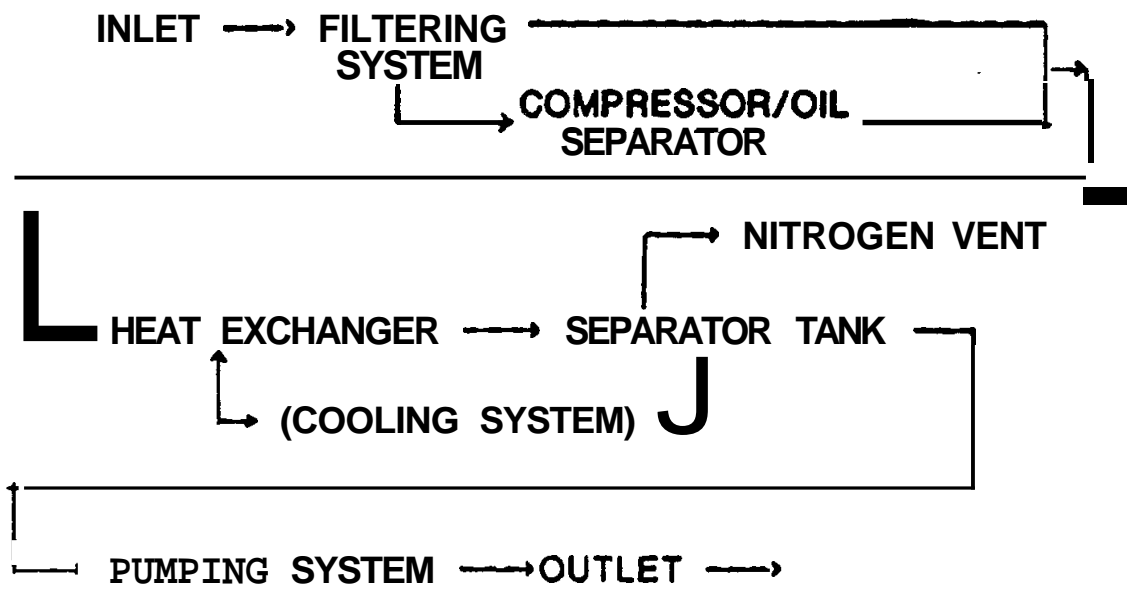


Figure 3

SPECIFICATIONS FOR RECYCLE SYSTEM

- RECYCLED HALON REQUIREMENTS
 - ✓ MEETS MIL-M-12218C SPECIFICATIONS
 - ✓ 98+% PURITY
 - ✓ 98+% RECOVERY EFFICIENCY
- SYSTEM REQUIREMENTS
 - ✓ **DIMENSIONS** -- 40' x 56' FOOTPRINT - 60' HIGH
 - ✓ **WEIGHT** -- ABOUT 1000 POUNDS
 - ✓ **INTERNAL CAPACITY** -- 120 POUNDS
- INTERFACES
 - ✓ INPUTS ANY HALON FIREX BOTTLE
 - ✓ OUTPUTS TO OPTIONAL STORAGE BOTTLES 160 - 2000 POUNDS
 - ✓ INTERFACES TO HTL FILLING STATION
- POWER REQUIREMENTS
 - ✓ 206 - 266 VOLTS AC, SINGLE PHASE, 60 HZ
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 - ✓ 90 KILOWATTS MAXIMUM POWER
- FILTRATION SYSTEM
 - ✓ ACID FILTER (0.3 POUND CAPACITY)
 - ✓ MOISTURE FILTER (332 CUBIC INCH) ACTIVATED ALUMINA/MOLECULAR SEIVE
 - ✓ PARTICULATE RETENTION
 - 98% OF 1 MICRON (LIQUID)
 - 98% OF 04 MICRON (GAS)
- NITROGEN REMOVAL
 - COLD VENTING PROCESS AT -70 F REMOVES 98+%

generally requires 5 to 10 minutes to pump depending on the size of the bottle. What this is leading to is that the process time depends on many variables, including the size of the bottle and the nitrogen pressure. This was a driving force in the decision to automate the system.

Figure 4 provides a sketch of the operating panel for the Unit. This has been kept very simple with the issues of human factors in mind. There is a "System Power" switch, an indication that the power is "on," a system "Start" switch, and a system "Stop" switch. There is an indication that the process is "on," and an indication as to which step in the process is currently being operated in the following modes: Halon In, Evacuation, Nitrogen Vent, and Halon Out.

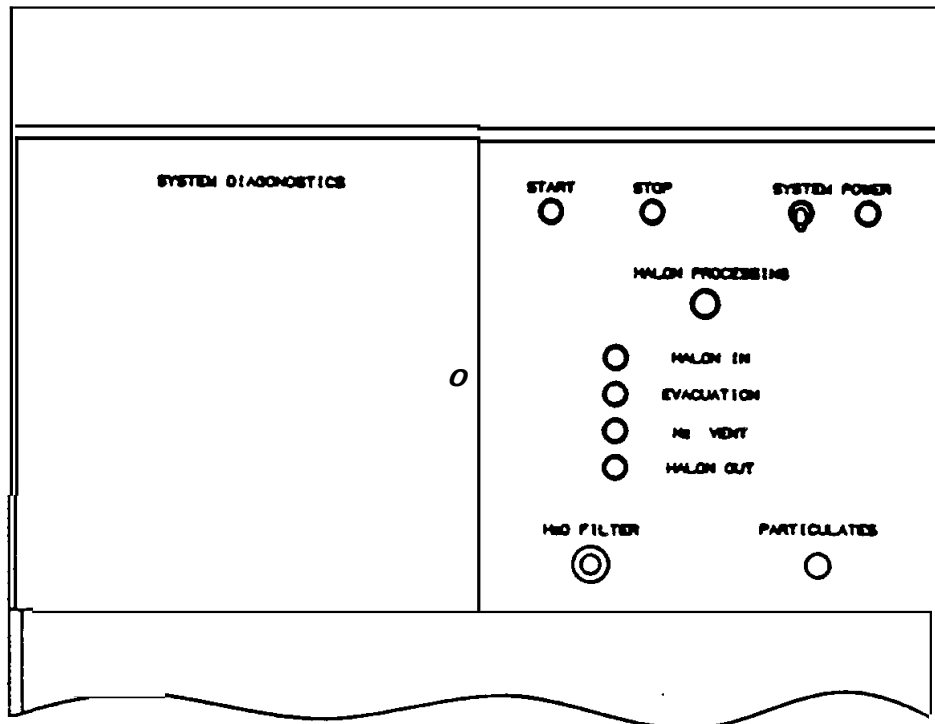


Figure 4

Further, there is a visual indication of the moisture in the halon after filtration. A change of color notifies the operator that the moisture/acid filters **need** changing. There is also a visual indication that the particulate filter requires changing. All maintenance items including the filters and any manual control systems **are** behind a locked panel.

Pacific Scientific has the ability **to** supply a complete Halon recovery / recycle / storage / recharge system. We can provide fixtures to hold and connect to any halon bottle, storage bottles, recovery systems **to** empty small bottles into a large storage tank, the recycle **station** described in this document, and a complete recharge **station** including fixtures for any **type** of fire extinguisher bottle refill. Any of these items can be obtained separately or a complete turn-key system can be **provided**.

Two optional features **are** in development and testing. One is a digital moisture indicator which read directly in parts per million and the other is a Halon 1301 sensor, which will interlock with the system and when it senses that the inlet does not contain Halon 1301, it **will** not let the system begin operation. This sensor will be able to distinguish Halon 1301 from 1211 or 1201 **or** a **freon** refrigerant gas.

PACIFIC SCIENTIFIC'S **ROLE** IN THE **FUTURE** OF **HALON**

It is clear that there will be a future market for recycled halon. The *aircraft* industry **will** use Halon 1301 **until** the current aircraft fleet is retired or until a "drop-in" replacement is found. The military crew bay application will continue until a people safe replacement is found.

The **U.S.EPA** **has been** developing a plan to create a "banking" system for recycled halon. Pacific Scientific will undoubtedly be a member of that bank. Procedures and equipment **are** being placed in **our** service facilities in the **U.S.**, England, and Singapore. These activities **are** also taking place at **our** authorized Service centers throughout the world. We are being proactive **in** ensuring that the aircraft and military requirements of Halon 1301 **are** met in the future.

REFERENCE

- I. "Feasibility **of** Systematic Recycling of Aircraft Halon Extinguishing Agents," DOT/FAA/CT-91/21, 1991.