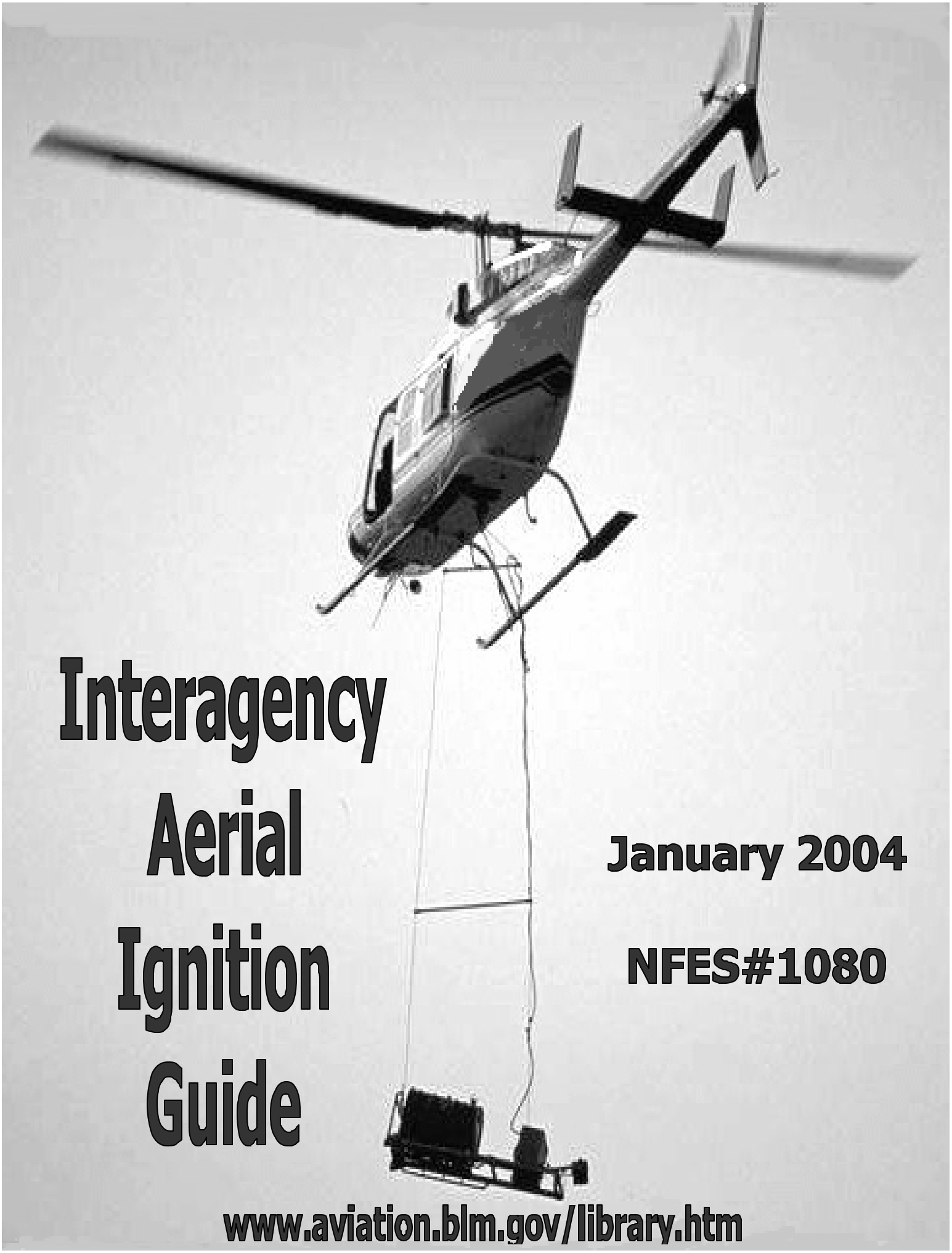

Interagency Aerial Ignition Guide

January 2004

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Chapter I – Introduction to the Interagency Aerial Ignition Guide

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Interagency
Aviation Management Council

300 E. Mallard, Suite 200
Boise, Idaho 83706-3991

To: Users of the Interagency Aerial Ignition Guide

From: Interagency Aviation Management Council

Date: March 4, 2004

Subject: Publication of the 2004 Interagency Aerial Ignition Guide

The Interagency Aerial Ignition Working Group has revised the Aerial Ignition Guide. Improvements and changes have been made in the following areas:

1. Reformatted portions of the Guide to improve flow
2. Added "Contractor Provided Aerial Ignition Services" procedures/requirements
3. Added requirement for CAF extinguishers for helitorch operations
4. Added OSHA-recommended procedures for helitorch operations (vapor recovery)
5. Added OSHA- and agency-required retrofits/inspection for helitorch equipment
6. Revised forms package
7. Revised "Prerequisites, Training, and Qualifications" matrix

Training packages for the helitorch module and plastic sphere dispenser operator have also been developed. These training packages will be placed, along with the Guide, on the Bureau of Land Management (BLM) aviation website (<http://www.aviation.blm.gov/library.htm>).

The following agencies have designated the Interagency Aerial Ignition Guide as policy: U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and National Park Service.

Publication as a cache item and placement on the BLM aviation website is authorized. Copies of this memo will be included with all paper and electronic versions of the Interagency Aerial Ignition Guide.

Michael A. Martin
Associate Director
Aviation Management Directorate
National Business Center
U.S. Department of the Interior

Tony Kern
Assistant Director, Aviation
Aviation and Fire Management
U.S. Forest Service
U.S. Department of Agriculture

Chapter I – Introduction to the Interagency Aerial Ignition Guide

I. Objectives

The objectives of the *Interagency Aerial Ignition Guide* (IAIG) are:

A. Define and standardize procedures and equipment for approved aerial ignition operations for use by all cooperating natural resource agencies.

B. Ensure that all aerial ignition operations are performed in a safe and efficient manner.

C. Provide a framework within which areas, regions, States, and local units can provide supplemental, site-specific guidance.

D. Establish a method to evaluate and approve aerial ignition systems not currently approved and outlined in this guide.

II. Scope

The IAIG contains procedures that are specific to aerial ignition operations. The procedures and equipment outlined in this guide address both incident and project aerial ignition operations.

III. Authority

Participating agency aviation manuals contain the authority for implementing this guide.

IV. Participating Agencies

The IAIG is published with the concurrence and cooperation of the United States Department of Agriculture Forest Service (USDA-FS), certain bureaus and offices within the United States Department of Interior (USDI), and various State, and local agencies.

V. Approved Aerial Ignition Systems

All aerial ignition systems must meet OSHA, DOT requirements, and NFPA standards as well as the required safety modifications outlined in this guide.

The following are the **only** aerial ignition systems **currently** approved for Interagency use by all cooperating agencies/bureaus:

A. Premo Mark III Aerial Ignition Device (PSD)
B. Simplex Helitorch Model 5400
C. Fire-Spec Systems: Spec 2000 Helitorch and Spec 2000 Modular Mix Transfer System
D. Isolair Helitorch
E. Firecon Batchmixer and Portable Mix Transfer System

Some aerial ignition devices and procedures are in use that can only be utilized by a specific bureau/agency. **The following aerial ignition devices are only approved for specific bureaus/agencies use (non-interagency)** for burning operations conducted by qualified personnel of the agency approving their use:

A. Fusee Dispenser: NPS, Yosemite National Park **only.**
B. Western Helicraft Helitorch: Alaska **only.**
C. California Division of Forestry Helitorch: CDF **only.**
D. Bureau/Agency or Vendor Mixing Systems that are in compliance with criteria in this guide, and that have been inspected by an Interagency Aerial Ignition Equipment Specialist.

VI. Agency Manufactured or Modified Devices

If agency personnel modify a commercially obtained device or construct their own devices, the agency assumes liability for the product. The USDA Forest Service strictly forbids the altering of any commercial aerial ignition device other than those approved through the Washington Office. The Department of the Interior and other agencies require their personnel to obtain bureau approval to use agency-manufactured or modified commercial devices. The bureaus/agencies are responsible for conforming to the procedures described in this guide.

VII. Manufacturer Modifications

Periodically, manufacturers of aerial ignition equipment modify or upgrade their equipment. As an example, Simplex has made several revisions of their helitorch and accessory equipment. Modifications made by the original manufacturer may require special authorization from an agency to be installed. Bureaus and agencies are not required to install new modifications unless the agency or manufacturer requires installation of the modification for safe operation of the device. All manufacturer modifications shall be accompanied by revised operating procedures if applicable.

For approved current aerial ignition components and modifications, reference Appendix D.

VIII. Aerial Ignition Systems Approval Process

An agency/bureau may wish to evaluate an aerial ignition system not covered in the IAIG. While all cooperating agencies/bureaus are strongly encouraged to use the systems and procedures prescribed in this guide, the following guidelines should be used for a proposed aerial ignition system approval:

A. The sponsoring unit must request, in writing, permission to evaluate the unapproved system. The written request shall be submitted through appropriate channels to their regional/State aviation manager.

1. The written request must include a project proposal, which describes the user needs, and justification for use of an unapproved system.

2. A written manufacturer operational manual must be submitted with the request package, describing operating procedures, training plan, and a job hazard analysis.

B. The agency/bureau Aviation Manager shall submit the proposal to the Interagency Aerial Ignition Workgroup through their representative to the group. The Interagency Aerial Ignition Workgroup will then forward the proposal to the Aerial Ignition Technical Advisors at MTDC and the BLM Equipment Shop and arrange for technical review and evaluation.

If live burn operations are required as part of the evaluation the sponsor shall submit an approved Project Aviation Safety Plan (PASP) and provide necessary personnel (and incur associated costs) that possess the aerial ignition qualifications listed in chapter II.II (table 1).

C. After the technical review the Interagency Aerial Ignition Workgroup will vote for full Interagency adoption or specific agency/bureau adoption and provide implementation procedures and policy direction.

IX. Contracted Aerial Ignition Services

Some geographic areas have private vendors who own and operate aerial ignition systems. When an agency opts to use contract provided aerial ignition personnel and/or equipment, the following guidelines shall be observed:

A. The user unit must ensure that the contractor has been awarded a contract or a modification has been done to an existing procurement document that includes provisions for contracted aerial ignition services and that the equipment and personnel have been approved. The Helicopter Manager will assure that contracted aerial ignition services will be conducted in accordance with the procurement document and this Guide.

1. The requesting agency unit will provide information to assist the Contractor in planning for equipment, personnel, supply needs, location of burn, and objectives. This information will include approximate acreage (overall/acres per day), time and dates of proposed burn, location and directions to the burn area, time and location of pre-use inspection, supplies and equipment to be provided by the agency, agency contact names and phone numbers, local support equipment sources and phone numbers (bulk fuel providers, motels, etc).

2. The Government will provide at the job-site: pad marker(s), wind indicator(s), fire shelter for pilot, crash rescue kit, evacuation kit (complete to include first aid supplies, as per (IHOG Chapter 9.VI.B/C) and 40-B:C fire extinguisher(s), (IHOG Chapter 9.VI.A).

3. As required for the project, a Government Helicopter Manager (HCWN), Helitorch Manager (HTMG) and Helitorch Parking Tender (HTPT) will be provided by the ordering agency unit (reference Chapter IV.V.A.1 for collateral duty specifics) and will be on site, for contract aerial ignition operations, to perform functions listed in the IAIG. For helitorch operations Contractor provided Helitorch Mixing Personnel will assume the duties of Helitorch Mixmaster (HTMM).

4. The Contractor shall have a written standard operating plan (SOP) outlining duties and responsibilities for Contractor personnel, qualifications and training records, and equipment use and mixing/operating procedures. The Contractor must certify that Contractor personnel meet the prerequisites and training requirements for the position they are providing (PLDO or Helitorch Mixing Personnel) as per this guide (reference Chapter II.II table 1). The SOP shall be made available for review by the Government Helicopter Manager upon arrival to the job-site and prior to the start of contract work.

5. The Helicopter Manager will inform the Contractor Helitorch Mixing Crew of gel fuel needs, in gallons, throughout the duration of the burn.

   The Helicopter Manager will inform the Contractor PLDO of glycol/sphere needs.

6. The Contractor shall be responsible for disposal of any gelled fuel deemed unacceptable. Any residual waste product shall be disposed of at an approved hazardous waste disposal site or, with the Helicopter Managers approval, by incineration within the burn area.

   Spheres with solidified potassium permanganate may not be accepted by the Helicopter Manager for use on the project.

B. Any deviation from established standard operating procedures or policy requires authorization by the regional aviation officer or state aviation manager.

C. The user unit must submit a written Project Aviation Safety Plan (PASP)/Special Use Mission Plan (reference example PASP in Appendix A and B) as outlined in the IHOG (3-25) to the appropriate region, state, or agency aviation managers.

X. Organization

The chapters of the IAIG identify the approved aerial ignition systems and procedures. The appendices provide the user with operational and administrative forms, checklists, equipment modifications and job aids.

XI. Publication

The United States Department of Agriculture -Forest Service and the Bureau of Land Management, United States Department of the Interior, jointly sponsor publication of the IAIG.

XII. Review and Revision

Users are encouraged to send recommended changes for the IAIG to their aviation program managers at the State, regional, or national level. This guide will be reviewed every three years, revisions will be made as warranted, the most current version of the guide can be found on the website as listed below.

XIII. Ordering and Distribution

This publication and related training material are available for download on the BLM National Aviation Office Web Site at **www.aviation.blm.gov/library.htm**. Hardcopies of this document (NFES #1080) may be ordered by mail or fax from the National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 S. Development Avenue, Boise, Idaho 83705. Consult the BLM website prior to ordering to assure that the current revision of the guide is in print and available.

Chapter II – Aerial Ignition Position Qualifications

I. Introduction

This chapter identifies the position prerequisites and qualifications for individuals involved in aerial ignition operations. To meet the minimum qualifications, individuals must be trained, experienced, certified, and current with that aerial ignition system. Position requirements apply to both incident and prescribed fire operations.

II. Qualifications

To be qualified in an aerial ignition position, individuals must meet all the prerequisite training and experience standards listed below.

Table 1: Aerial Ignition Training, Qualifications, and Experience Requirements

	Position	***Prerequisites***	***Training Requirements***	***Job Aids/ Currency Requirements***
PLDO	Plastic Sphere Dispenser (PSD) Operator	Project Helicopter Crewmember (Reference IHOG Chapter 2)	S-271, Interagency PLDO Training and a minimum of one successful assignment to include a minimum 1-hour in-flight machine operation and completion of the task sheet.	Annual recertification training and performance in the position once within the last 3 years. Other position that will maintain currency: **None.**
HTMG	Helitorch Manager	HCWN Helibase Manager Type 2 (T) Helitorch Mix Master	A minimum of one successful assignment and completion of the task sheet.	Annual recertification training and performance in the position once within the last 3 years. Other position that will maintain currency: **HTMM.**
HTMM	Helitorch Mixmaster	Project Helicopter Crewmember (Reference IHOG Chapter 2)	S-271, Interagency Helitorch/Mixing System Training and a minimum of three successful assignments, completion of the task sheet, and one additional assignment per model-specific equipment, each documented on the task sheet.	Annual recertification training and performance in the position once within the last 3 years. Must be current in model-specific equipment. Other position that will maintain currency: **None.**
HTPT	Helitorch Parking Tender	Project Helicopter Crewmember (Reference IHOG Chapter 2)	S-271, Interagency Helitorch/Mixing System Training and a minimum of one successful assignment and completion of the task sheet.	Annual recertification training and performance in the position once within the last 3 years. Other position that will maintain currency**: None.**
	Helitorch Mixing Personnel	None	Interagency Aviation Training (available at http://iat.nifc.gov/) A-101, A-105, A-106, A-107, A-108, A-109, and A-113 or S-271. On-The-Job Helitorch Operation Instruction (Live Burn Ops).	Attend/complete online Interagency Aviation Training every 3 years. OJT Helitorch Operations Safety Review. Other position that will maintain currency: **None.**
	Helitorch Fire Protection Group	Proficient in Class B Foam Application	On-site Helitorch Operations Safety Review.	**None.**

III. Instructor Qualifications

A. Qualified and current as a Helitorch Manager (HTMG) or Plastic Sphere Dispenser Operator (PLDO) and Helicopter Manager (HCWN)

B. Approval from Regional Helicopter Operations Specialist or State/Regional Aviation Manager.

IV. Certification

In the USDA Forest Service, certification is the responsibility of the applicable Regional Helicopter Operations Specialist, or designee. For DOI bureaus and States, certification is accomplished through bureau/agency authority at the State, regional, or area office level or as otherwise established by individual bureau/agency.

A. Initial Certification and Training

Certification and training for helitorch module members (Helitorch Manager, Mixmaster, and Parking Tender) and Plastic Sphere Dispenser Operators shall consist, at a minimum, a 1-2 day session on each type of equipment utilizing nationally approved lesson plans. The national approved PSD and Helitorch lessons plan are available at the Bureau of Land Management National Aviation Office website at aviation .blm.gov/library.htm Training will cover:

1. Organization and communication requirements.
2. Special safety procedures and concerns, including emergencies.
3. Hazardous materials shipping, storing, and handling procedures and requirements.
4. Equipment testing, bench test, troubleshooting, and maintenance.
5. Briefing and checklist requirements.
6. Manufacturer operational manual (if applicable), procedures and requirements.
7. A "live-run" exercise. For the helitorch, the live run shall consist of a briefing by the Burn Boss and all personnel, mixing, torch test procedures, pilot briefing, and dropping of gel. For the PSD operator, the live run shall consist of briefing the Pilot and Burn Boss, installing and testing the PSD in the helicopter, and dropping plastic spheres.
8. The dropping of gel or plastic spheres may be accomplished either as a training exercise or as part of an actual burn project.
9. Helitorch support personnel (mixing crew) reference bureau/agency manuals and the training and qualification chart (Chapter II.II, table 1), for requirements.
10. Initial certification and training must be documented on the Interagency PLDO/Helitorch Module Task Sheet form, IAIG appendices A and B. A copy of the form must be submitted to the appropriate agency Aviation Manager/Helicopter Operations Specialist.

Note: During the PSD OJT flight a qualified PLDO will be onboard the aircraft until the PLDO(T) completes their required OJT and is considered fully qualified.

B. Annual Approval and Recertification

1. Annual recertification is required. Once a helitorch module or PSD Operator has been trained and certified, the required annual recertification shall consist of the following:

   a. Each helitorch module member or PSD Operator shall review the applicable sections of this guide, as well as agency-specific guidance and direction.
   b. A recertification training session consisting of items 1 through 6 in chapter II, paragraph IV, section A.
   c. A system for documenting and tracking annual recertification shall be maintained by responsible agency/bureau managers. (See appendix A, for example of Annual Recertification Form.)

2. Aerial ignition personnel who transfer from one region, State, or area within an agency or who transfer from one agency to another shall show documentation that they have successfully completed the requirements outlined above for certification and training.

C. Currency Requirements

In addition to initial certification and annual recertification training, a member of a helitorch module or PSD operator must perform in the position *at least once every 3 years* to maintain currency and remain eligible for recertification training. If an individual does not meet the currency requirement, he or she must complete the initial certification and training.

V. Additional Positions in Prescribed/Wildland Fire Aerial Ignition

A. Prescribed Burn Boss (RXB 1 or 2)/Ignition Specialist (RXI 1 or 2)/Firing Boss (FIRB)

The PLDO or Helitorch Manager works directly for these positions. In Wildland fire operations the Firing Boss reports to the Operations Section Chief or Branch Director.

1. Prerequisites – See Wildland Fire Qualifications Subsystem Guide 310-1 (Part 2), FSH 5109.17, for specific requirements.

2. Qualifications – Knowledgeable of ICS organization and concepts and is familiar with helicopter aerial ignition operations.

3. Duties and responsibilities – Has complete authority for and directs the firing operation, develops firing plan(s), performs the initial briefing from the firing plan, covers the assignments of each boss/supervisor and pilot. Instructs the Pilot on the firing sequences and keeps the Pilot informed throughout the entire operation.

   For Plastic Sphere Dispenser operations, the Burn Boss/Ignition Specialist will be in the helicopter with the dispenser operator. For helitorch operations, the Pilot will be the only person onboard the aircraft.

Note: Prescribed fire positions "recommend" minimum training for Type 2 Ignition Specialist to include attendance at aerial ignition workshop, or Helitorch/PLDO training.

B. Pilot

The pilot works directly for the Helicopter Manager in conjunction with the Burn Boss/Ignition Specialist/Firing Boss.

1. Prerequisites – Both the pilot and aircraft must be carded for the intended mission by an approved Pilot Inspector. Before operations commence the pilot shall receive a briefing on the operational objectives and ground and flight procedures, familiarization with fire behavior/fire shelter and terminology used during burning. Examples of inspection criteria include:

   a. Exhibits a basic knowledge of wildland and prescribed fire operations.
   b. Exhibits knowledge of communications and coordination required with the Burn Boss and Parking Tender.
   c. Exhibits knowledge of limitation section of the flight manual regarding limitations to flight with doors off.
   d. Exhibits knowledge of helitorch/PSD operations, installation, and emergency procedures.

e. Demonstrates the ability to maintain a constant airspeed and altitude above the ground while staying within the burn area.
f. Demonstrates the ability to maintain reserve power/airspeed in the event of an emergency.
g. Explains how to set up flight patterns according to the relative winds in relation to the terrain.
h. Is aware of problems encountered with steep hillsides, and the relation of convective and radiant heat.
i. Is aware of the possibility of loss of tail rotor authority in slow descending turns or turning downwind.

Note: For initial aerial ignition helicopter pilot carding procedures contact Forest Service Regional Helicopter Inspector Pilots or DOI Helicopter Inspection Pilots.

Chapter III – Plastic Sphere Dispenser Operations

The **Premo Mark III Aerial Ignition Device** is the only Plastic Sphere Dispenser authorized. It is distributed by Aerostat, Inc., Leesburg, Florida.

I. Introduction

The Plastic Sphere Dispenser (PSD) machine was developed to provide a method of igniting ground fuels, in a short time, on large acreage without causing undue damage to the overstory. This method had to be cost effective, environmentally acceptable, and readily available.

II. Description

The sphere is made of high impact polystyrene, 32-mm (1.25 inches) in diameter and contains approximately 3.0 grams of potassium permanganate. The rate of chemical reaction is dependent on the particle size and concentration of the chemicals involved. Undiluted, ethylene glycol-based antifreeze is required. It provides a reliable ignition and a time delay of at least 20 seconds.

Note: Propylene glycol shall not be used.

III. Dispenser Function

The PSD injects glycol into the plastic sphere, initiating an exothermic reaction and then expells the primed sphere from the aircraft. Incorporated in the mainframe are the power train, water and glycol reservoirs (with separate pumps), slipper blocks, and injection mechanism. The PSD contains four slipper blocks and feed chutes. Feed chutes can alternate patterns to regulate the number of spheres being dispensed, establishing ignition patterns on the ground. Power to the PSD is supplied by the aircraft's electrical system. The standard PSD uses a 24 volt DC electrical system, a 12 volt PSD may be ordered for special applications. Refer to aircraft manual for voltage requirements.

IV. Safety Precautions

A. PSD operations require helicopter flight below 500 ft AGL and less than 50 mph. Hovering out of ground effect (HOGE) is often requested. The Pilot must keep altitude, airspeed, wind direction and aircraft capabilities and limitations in mind during all phases of flight operations. Thorough briefings prior to operations are required.

B. The PSD will not be permanently affixed to the helicopter. It will be mounted in a fashion that allows the operator to rapidly jettison the PSD in case of a malfunction.

C. The glycol tank must be filled and tightly capped at least 25 feet away from the aircraft.

D. Lead acid batteries will not be carried in the cabin to power the PSD. The PSD must be powered through the aircraft's electrical system.

E. Provide crash rescue kit and evacuation kit at helitorch base (complete with contents including first aid supplies as per IHOG Chapter 9.VI. B/C.

F. Provide one 40-B:C rated fire extinguisher (IHOG Chapter 9.VI.A) per pad.

G. The operator shall wear an approved restraining harness in the helicopter, complete with approved tether. Using an approved carabiner, the tether shall be attached to an approved tether attachment that has been properly secured to hard points during firing (reference chapter III, section VI, paragraph A).

H. Extra supplies of glycol will not be carried in the cabin during burning operations.

I. A metal container will be available during testing for containment of plastic spheres.

J. Ignition lag time should not be less than 20 seconds.

K. The maximum, PSD manufacturer, recommended helicopter speed should not exceed 50 mph during ignition operations. Slow the aircraft speed to the planned application speed when the firing operation is in progress.

L. The PSD manufacturer recommended operational flight altitude is 300' AGL.

M. Do not disassemble ANY PSD components during flight.

N. Potassium permanganate is a strong oxidizer; it should be stored in a cool, dry place and must be kept completely separate from glycol and petroleum products.

O. The area to be burned must be clear of people and equipment.

P. At least 5 gallons of water will be available on-site.

CAUTION: ***An inadequate quantity of glycol injected into the plastic sphere can induce a violent reaction that can cause the sphere to spin or roll and spray a hot mixture of potassium permanganate and glycol a considerable distance. Injected spheres will also react in a similarly violent fashion if they come in contact with water during the ignition sequence***

Table 2: Advantages and Disadvantages of the PSD compared with the Helitorch

Advantages	*Disadvantages*
Logistically less complicated--plastic spheres can be safely and easily transported in bulk quantity to the burn site. Separate helibase is not required for PSD setup and operation. Essentially a self-contained operation. PSD Operator and possibly one assistant are the only personnel required. Safety and hazardous material handling procedures are less complicated than those for the helitorch. Requires little setup time apart from installation of PSD machine in helicopter. Operator in a hands-on position, able to immediately assess and/or address minor problems without returning to helipad. Equipment costs less than helitorch unit. Operator can see how many plastic spheres are left in the hopper, and can approximate how much ignition time is left before having to return to helipad. Possible to lay very long ignition lines if necessary. Less cost in support staff, setup, and demobilization time than helitorches. Minimum damage to tree canopy resulting from ignition procedures. Narrow burning windows can be better utilized due to shorter setup time. Ignition Specialist/Firing Boss can be on board during ignition sequences. Command and control can more easily be maintained.	Plastic spheres burn for a shorter time on the ground than do gelled fuels. Even a dense drop pattern of plastic spheres cannot duplicate the characteristics of the helitorch drop pattern. Firelines generally take longer to form and interact with each other. The pilot cannot jettison the PSD. The Operator must manually jettison the PSD in the event of an emergency. PSD requires continuous attention of the Operator to watch for proper operation and keep the balls in the hopper. Possibility of fires developing in the PSD.

V. Situations Favorable for Plastic Sphere Ignition

General guidelines are offered here for PSD operations that might be preferable to the helitorch. This is by no means an exhaustive list. The fire manager must select the tool to meet the mission objectives under existing and/or forecasted burning conditions.

A. Understory Burning – Plastic sphere ignition may be used in any stand that can be burned by conventional methods. The plastic sphere ignition system is an excellent tool for hazard fuel reduction in continuous surface fuels. This system is safe, efficient, and economical.

B. Burns where a long line of fire must be laid down in a short period of time. Because a large number of plastic spheres can be carried on board the helicopter, a longer line can be laid without having to return to the helibase. Setup and support is simpler and faster.

C. Burns where, due to size, poor access, safety considerations, etc., use of PSD may result in a lower cost per acre.

VI. PSD System Organization

See the Organization Charts in appendix A for required positions to be filled for both Prescribed and Wildland fire aerial ignition.

A. PSD Operator

1. Position Responsibilities - Serves as PSD Operator to the Ignition Specialist/Firing Boss. PSD Operator may have collateral duties as the Helicopter Manager. The Helicopter Manager/PSD Operator briefs pilot, (including the use of the fire shelter) identifies safety requirements at the operations briefing, monitors overall operation and provides information on aerial safety procedures to be used by the Ignition Specialist/Firing Boss. The Operator is responsible for the preparation, installation, operation, maintenance, and care of the PSD. The Operator verifies for the Ignition Specialist/Firing Boss that prescribed spacing of ignition is occurring and makes the necessary adjustments. Determines if malfunction occurs and acts accordingly. If an onboard fire takes place, it must be determined if the fire can be extinguished, or if the unit must be jettisoned. The Operator will communicate with the pilot and Ignition Specialist/Firing Boss on all procedures associated with operation and/or emergencies occurring during the operation.

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Note: The following agencies require the operator to wear a restraining harness as a backup restraint, in addition to the seat belt, during doors off operation: USDA Forest Service, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, and Bureau of Indian Affairs. If your agency is not identified, refer to the approving agency official for agency/bureau-specific direction. ***Seat belts must be worn AT ALL TIMES.***

Harness information: An MTDC approved harness is required in conjunction with the approved harness tether, MTDC#-990, and tether attachment, MTDC#-946. Contact Missoula Technology and Development Center (MTDC) for current information regarding approved equipment, harness sources and hard point connections. Reference appendix G.

For information on harnesses, caribiners, tethers, and tether attachments **contact:** Rappel Equipment Specialist at MTDC (406) 329-3958.

For information on approved hard points **contact:** Rappel Accessories Specialist at MTDC (406) 329-3956

B. Helicopter Manager

1. Position Responsibilities - Duties and responsibilities are outlined in IHOG, Chapter 2. Helicopter Manager may have collateral duties as the PLDO.

C. Pilot

1. Position Responsibility - The Pilot will follow the ignition plan under the direction of the Ignition Specialist/Firing Boss. The Pilot-in-Command is responsible for all matters related to aircraft operations and safety, PSD installation oversight, and helicopter load calculation.

D. Helibase/Helispot Support (as needed, reference Appendix A Organization Chart)

1. Helibase/Helispot Fire Protection
   a. Provide one 40-B:C rated fire extinguisher (IHOG Chapter 9.VI.A) and 5 gallons of water will be positioned at the helibase/helispot.
   b. Provide crash rescue and evacuation kits at helibase/helispot (IHOG Chapter 9.VI.B/C).

2. Radio Operator
   a. Will be positioned at the helibase/helispot.
   b. Will initiate radio communications with Burn Boss and Dispatch.

3. Helibase/Helispot Manager – Depending on operational complexity, a HEB2 may be advisable in addition to the required PSD Operator.

4. Additional Operator – Based on complexity, size of burn, and weather factors, an additional PSD Operator may be advisable.

VII. Bench Testing and Cleaning

Bench tests should be performed prior to actual burn. The following outlines the steps to be performed during a bench test.

A. Review applicable portion of operations checklist.

1. Fill PSD with ethylene glycol and water.
2. Mount the PSD securely on a suitable table or bench approximately 30 inches high.
3. Connect the power cord to power supply. Two 12-volt batteries wired in series or a 24-volt power converter are the most common bench test sources.
4. Prime both pumps and plungers.

CAUTION: ***Ensure potassium permanganate does not come in contact with battery acid.***

5. Place metal bucket under chute.

CAUTION: ***Do not put water in bucket.***

6. Insert an "EMPTY" plastic sphere in one slipper block. Rotate the sphere through the machine with pump operating. The sphere should be injected with approximately ¾ to 1¼ cc full of ethylene glycol for proper ignition. Repeat for other slipper blocks.

Note: Empty plastic spheres utilized for calibration, testing and training can be obtained from – Aerostat INC, Leesburg, FL (352) 787-1348

7. Injector controls are preset by the factory and should not need to be adjusted. If adjustments are needed turn off the PSD. Adjust injector control valves by loosening lock nut and rotating valve screw. Increase amount of glycol by turning valve to left until desired volume is obtained. After adjustment, repeat step 6 to confirm injected glycol amount.
8. After adjustment has been made, using spheres with potassium permanganate, turn on the glycol pump and drive, and rotate spheres through a cycle until the spheres drop out of the chute into the bucket. A stopwatch should be used to time injection to ignition. Ignition delay should be at least 20 seconds.

Note: Temperature and humidity may affect ignition delay, causing delays to be greater than 20 seconds. Colder temperatures will cause longer ignitions, often as long as 40 to 60 seconds. This is OK if all spheres are igniting. Very small amounts of ethylene glycol (¼ cc) will give erratic ignition. Excessive amounts of ethylene glycol (2 cc or more) will not give adequate ignition.

Note: Calibration instructions are contained in manufacturer's manual.

Note: During the PSD start-up, it is normal for two of the first four spheres that pass through the machine to not be injected with sufficient glycol to promote ignition due to air in the lines.

B. Cleaning should follow the bench test. Clean with water and compressed air. Lubricate moving components with Triflow, Never Seize, or other graphite/Teflon based product. WD-40, or any petroleum based product should not be used for this purpose.

VIII. Preparation for Aerial Ignition

A. Preparation of Helicopter
1. Remove appropriate door/doors.
2. Remove all loose cushions and other loose materials.
3. Locate and assure proper electrical connections.
4. Install tether attachments to hard points per instructions on MTDC drawing #-946.
5. Have operator don harness, attach tether to tether attachment ring using approved carabiner, and adjust tether length. A properly adjusted tether shall insure that the operator is restrained inside the aircraft if the seat belt should become unbuckled during flight.

Note: Only PSD Operator will have control (electrical or manual) of the machine.

B. Preparation of Premo Mark III Aerial Ignition Device (PSD)
1. Fill glycol tank at least 25 feet from aircraft.
2. Fill water storage tank.
3. Ensure adequate supply of plastic spheres is available to complete project.
4. Ensure one-gallon container of water and seatbelt cutter is on board, secured, and is readily accessible.
5. Fire shelters for all occupants must be on board and accessible, and one or more hand tools is recommended.

C. Installation

The PSD is designed to be operated from the right rear of a Bell 206 series Jet/Long Ranger helicopter. Other types of helicopters may require an auxiliary support bracket so the exit chute clears the aircraft fuselage. Installation instructions for various helicopters are included at the end of this unit.

1. Install in doorway with exit chute attached and overhanging.
2. Attach tie-down strap.
   a. Y-end attached to PSD beside exit chute, fasten from the inside out.
   b. Pass strap under the fuselage, making sure it clears all wiring and accessories attached to the bottom of the aircraft.
   c. Return through the opposite door.

d. Fasten to buckle attached to machine.
e. Cinch tight and secure loose ends.

3. Connect power supply cord.
4. Perform electrical power check by turning on drive switch and hopper feed switch. Manual assist must rotate counter-clockwise (direction of arrow).
5. Recheck the installation.
6. Ensure a seat belt cutter is available to cut holding strap in case it is necessary to jettison the PSD.

Note: Pilot must inspect and approve installation of PSD prior to flight operations.

IX. Preflight Test Procedures

A. Sphere ignition delay time need not be checked in the Preflight Test if Bench Test has been performed.

CAUTION: ***Do not conduct this test near refueling area or in flashy ground fuels.***

B. Test procedures are as follows:

1. Place metal container under the exit chute.
2. Power on – A/C.
3. Start up the PSD (hopper off) as follows:
   a. Drive motor on.
   b. Check for proper rotation.
   c. Glycol pump on, bleed needles if necessary.
4. Deposit one sphere in a slipper block to track calibration.
5. Once the sphere has dropped into the metal container, remove it from the vicinity of the aircraft.
6. Time ignition delay by measuring time of injection to ignition.
7. Repeat for other three slipper blocks.
8. Check system for leaks.
9. Test the onboard fire extinguisher system by pushing red water button on control panel.
10. Shut down machine as follows:
    a. Drive motor off.
    b. Glycol pump off.
11. Place hopper back on mainframe and attach power cord and test hopper drive motor.
12. Fill hopper with spheres.
13. Check intercom communications and air-to-ground communications.

X. In-Flight Operations

A. Dry Run over Burn Area Procedures

1. Check burn area is clear of personnel and equipment.
2. Identify burn area boundaries.
3. Ensure communication with ground personnel.
4. Make practice run of the first firing sequence.
5. Coordinate machine speed, sphere spacing, and number of chutes to be used on first run with Burn Boss/Ignition Specialist.
6. Identify helispots and emergency landing areas.
7. After a dry run and prior to aerial firing, the Ignition Specialist/Firing Boss will confirm that all ground personnel are clear of the area and that firing may commence.

XI. In-Flight Procedures

A. Burn Boss/Ignition Specialist communicates to PSD Operator, "Prepare to fire; activate machine."

1. Operator actions:

   a. Hopper feed on.
   b. Drive pump on.
   c. Glycol motor on.
   d. PSD Operator communicates to Burn Boss/Ignition Specialist, "Ready to fire."

2. Burn Boss/Ignition Specialist communicates to PLDO to "Start firing/number of chutes/speed".
3. PSD Operator replies, "Firing/number of chutes/speed".
4. Operator monitors machine operation and refills hopper as needed.
5. When appropriate, Burn Boss/Ignition Specialist communicates, "Prepare to stop firing."
6. PSD Operator places hand on chute handles and communicates, "Ready to stop."
7. Burn Boss/Ignition Specialist gives the order "Stop firing."
8. Operator closes chute handles and responds, "Chutes closed."
9. Operator observes last sphere clear of the PSD and relays, "Machine cleared."
10. Ignition Specialist/Firing Boss gives order to PLDO to "secure machine" or "prepare to fire."
11. Operator gives appropriate response.

Note: Step 9 is important to prevent inadvertent dropping of spheres outside of burn area boundaries.

XII. Emergency Procedures

A. Operator notifies pilot of problem and gives brief description.

1. Pilot maintains a/c flight in burn area until emergency is resolved.
2. Operator closes chute feed handles.
3. If necessary, operator turns on or off drive motor.
4. If problem is a jammed machine, operator pulls manual assist wheel outward and rotates forward then backward. If obstruction clears, turn on drive motor, check circuit breaker, and notify flight crew before resuming operations.
5. If fire starts, operator pushes red button (emergency water) and holds button depressed for up to 30 seconds. If necessary, uses additional container of water to extinguish fire by pouring down feed chutes in hopper. If problem persists, land as soon as possible.
6. Notify pilot of problem status.
7. If fire proves uncontrollable during flight, the PSD must be jettisoned, unless the emergency occurs over a congested or developed area. The pilot must be made aware that a fire exists and must direct that the PSD be jettisoned.
8. To jettison the PSD, the following procedures must be performed:
   a. Cut the restraining strap between the buckle and aircraft door with seatbelt cutter.
   b. Disconnect power cord between PSD and A/C at the quick disconnect.
   c. Grasp dispenser, lift, and jettison clear of aircraft.

Note: In addition, specific emergency procedures (egress, harness tether/seat belt cutting and crash seating positions) should be discussed by the pilot with Burn Boss/Ignition Specialist and PSD operator for aircraft being used.

XIII. Ignition Operations

A. The Burn Boss/Ignition Specialist gives the directions as to how the spheres are to be placed in the burn area (firing pattern). This should be made clear during the dry run before any firing begins. It is important that all parties (Burn Boss/Ignition Specialist, Pilot, and PSD Operator) understand where the firing is to be done. This includes starting points, ending points, and desired placement and spacing.

B. PSD operations require helicopter flight below 500 ft AGL and less than 50 mph. Hovering out of ground effect (HOGE) is often requested. The Pilot must keep altitude, airspeed, wind direction and aircraft capabilities and limitations in mind during all phases of flight operations. Thorough briefings prior to operations are required. The maximum, PSD manufacturer, recommended helicopter speed should not exceed 50 mph during ignition operations. Slow the aircraft speed to the planned application speed when the firing operation is in progress. The PSD manufacturer recommended operational flight altitude is 300' AGL.

C. The Burn Boss/Ignition Specialist gives direction to the Pilot once the firing run has begun and during the dry run to assure correct placement of the injected spheres.

D. Occupants of the helicopter shall be limited to the Pilot, PSD Operator, and Burn Boss/Ignition Specialist, instructor or trainees if essential to the mission.

E. The switches on the PSD are not required to be turned off when the PSD helicopter stays within the burn area boundary or crosses a fire control line with the intent of returning for another live firing run,. The Operator's right hand must remain on the feed control levers in the closed position. If leaving the burn area the machine will be completely shut off.

Table 3: General Features of the Plastic Sphere

Material	High-impact Polystyrene
Mass empty	2.3 grams
Mass KmnO (potassium permanganate)	3.0 + 0.3 grams
Mass total	5.3 + 0.3 grams
Diameter	32 mm
1 box of 1,000 spheres	13-16 lb

Table 4: General Features for Premo Mark III Aerial Ignition Device

Specifications		
Measurement	***Metric***	***U.S.***
Main Frame Mass, Glycol Full	27.5 kg	61.0 lb
Hopper and Chutes	10 kg	23.0 lb
Emergency Water Tank (Full)	3.8 kg	8.5 lb
Hopper Capacity (450 Spheres)	2.7 kg	6.0 lb
Approximate Operational Weight	44.5 kg	98.0 lb
Glycol Tank Volume	9.0 liter	2.4 US gal
Emergency Water Tank Volume	3.2 liter	0.8 US gal
PSD Dimensions – Length	68.5 cm	27.25 in
PSD Dimensions – Width	27.0 cm	10.5 in
PSD Dimensions – Height	66.0 cm	26.0 in
Overall Dimensions – Length	83.0 cm	33.0 in
Overall Dimensions – Width	33.0 cm	13.0 in
Overall Dimensions – Height	69.0 cm	27.0 in
Total Shipping Weight	45.0 kg	98.5 lb

F. Power Requirements

1. 24-volt DC (control housing, motor, and pumps are coded red).
2. 12-volt DC (control housing, motor, and pumps are coded blue).

Note: A specially built crate with hinged top is provided with each PSD machine for maximum protection during shipping and storage of the equipment in the field.

XIV. Ignition Spacing

A. Ignition spacing is a function of, ground speed, number of operative PSD feed chutes, motor speed, and altitude.

Table 5

	Motor Shaft Sprocket - 13 Teeth					
Ground speed in MPH Camshaft speed of 27 RPM (slow)	10	20	30	40	50	60
	Approximate feet between ignition points					
USING						
1 PSD Chute	33	65	98	130	163	195
2 PSD Chutes	16	33	49	65	82	97
4 PSD Chutes	8	16	25	33	41	50
Camshaft speed of 41 RPM (fast)						
USING						
1 PSD Chute	22	43	64	86	107	129
2 PSD Chutes	11	21	32	43	54	65
4 PSD Chutes	6	11	16	23	27	33

Using one chute requires the installation of the “Spacing Kit” which allows only one chute to be loaded with plastic spheres.

CAUTION: ***To achieve continuous reliable feed when using two chutes it is imperative to only operate the center chute.***

XV. Cleaning and Preventive Maintenance

A. Suggested Tools, Supplies, and Spare Parts

1. Suggested Tools:
    a. Small 3-inch slotted screwdriver
    b. Medium 5-inch slotted screwdriver
    c. No. 2 Robertson screwdriver (square tip)
    d. Set of Allen wrenches
    e. Small, smooth file for emergency touch-up of needles
    f. Toothbrush/bottle brush
    g. Set of adjustable tubing wrenches
    h. Combination box end wrenches (5/16", 3/8", 7/16", 1/2", and 11/16")
    i. Small, adjustable (crescent) wrench
    j. Small, non-steel wire brush.
2. Suggested Supplies:
    a. Lubricant (Graphite/Teflon based product)
    b. Teflon tape
    c. Brass wool
    d. Scotch Brite pad
3. Suggested Spare Parts:
    a. Fuses 5A, 3A, 1.5A (newer PSDs have circuit breakers)
    b. Needles (set of 4)
    c. Valve springs (set of 4)
    d. "O" rings for valve stems (set of 4)
    e. Bulbs for indicator lights
    f. ¼ x 20 wing nuts (2)
    g. Electric drive motor*
    h. Electric fuel pump*
    i. Solenoid valve*

***Items are field serviceable, but may result in delays of 1 to 2 hours.**

B. Preventive Maintenance

1. Keep the needles sharp; sharpen to same angle.
2. Keep moving parts lubricated.
3. Keep clean by removing residuals from balls and potassium as soon as possible.
4. Check slipper blocks for powder buildup after approximately 6,000 spheres, 6 boxes.

C. Cleaning and Storage

1. After each use, clean as follows:
    a. Use cleaner-degreaser and brush to clean slipper block area.
    b. Dry machine.
    c. Lubricate all moving parts.
    d. Cycle by hand.
    e. Wipe off excess lubricant.
    f. Wipe down machine with cloth dampened with lubricant.
    g. Wipe down helicopter floor when PSD is removed.
2. For prolonged storage perform the following:
    a. Drain water reservoir.
    b. Drain and flush glycol reservoir.
    c. Remove and clean valve spring plugs, springs, and valves.
    d. Remove and clean needles; sharpen if needed.
    e. Lubricate all parts before reassembling.
    f. Check drive chain and lubricate.
    g. Check and clean electrical connections.

XVI. Troubleshooting the PSD

A. Spheres Do Not Move Freely in Chute
- ❑ Check the feed control handles.
- ❑ Check to assure no jam has occurred in the hopper.
- ❑ Check if only recommended chutes are used - either four, two center, or only one.

B. Drive Motor Does Not Start
- ❑ Check aircraft power supply connection, aircraft main switch circuit breaker, motor switch, PSD circuit breakers and fuses. Check quick disconnect to mainframe and control housing.
- ❑ Check wiring to motor; repair wiring or replace motor.

C. Motor Starts but PSD Jams
- ❑ Turn off motor switch, if PSD jams.
- ❑ Check for plastic sphere fragment, box staples, or other foreign objects.
- ❑ Check for damaged needle, replace using box-end wrench to prevent damage. Crushed spheres will indicate damaged or dull needles.
- ❑ Slipper blocks may seize and stop the motor, which will necessitate removal, cleaning, and lubricating.

D. Glycol Pump Does Not Start
- ❑ Bleed air from system by removing valve adjuster and operating pump.
- ❑ Check glycol pump wiring; repair wiring or replace pump.

E. Incorrect Amount of Glycol
- ❑ Check glycol level in tank and pump operation.
- ❑ Open or close adjustment valves on top of valve blocks; DO NOT OVER CLOSE. Needle should provide ¾ to 1¼ cc of glycol with each activation of valve.
- ❑ Check needles for blockage; remove, clean, and/or replace.

F. Leakage of Glycol
- ❑ If leak occurs during flight, land to make repairs.
- ❑ Check coupling for tightness.
- ❑ Check valve stems and springs for obstructions in valve block.
- ❑ Replace “O” rings on valve stems with neoprene “O” rings.

Note: Any spilled glycol must be cleaned up.

G. Plastic Spheres Do Not Ignite
- ❑ Check fluid level in glycol tank.
- ❑ Taking precautions against delayed ignition, examine spheres.
- ❑ Contents of Primed sphere appear too dry - insufficient glycol (see “E” or “F” above).
- ❑ Contents of Primed sphere are soupy (too much liquid) – excess glycol (see “E” above).
- ❑ Spheres receiving appropriate glycol - check glycol concentration or glycol quality.
- ❑ Drop boxes to loosen potassium permanganate.

H. Ignition Too Soon (Less Than 20 Seconds)
- ❑ Follow bench test procedures to adjust glycol concentration.

I. Water System Does Not Function
- ❑ Check reservoir.
- ❑ Check line for routing kinks or blockage.
- ❑ Check water ports in valve block.
- ❑ Check push button, wiring, solenoid, fuse, and pump.
- ❑ Repair and replace as necessary.
- ❑ Check for frozen lines when working in cold temperatures.

XVII. Installation Procedures (General): Premo Mark III Aerial Ignition Device

Installation of the Premo Mark III AID will be specific to individual helicopter models. Model specific procedures are outlined later in this chapter. Consult the manufacturer of Premo Mark III for specific installation procedures for those helicopters not listed below. The following apply to all PSD installations:

A. The Operator must read the Premo Mark III Operator's Manual before installation.

B. The Operator and the Pilot must read the limitations section of the flight manual and be familiar with the limitation of flight with the door(s) removed.

C. Helicopters shall be equipped with a power source for handheld Infrared Imaging Systems or Premo Mark III Aerial Ignition Device. A bulkhead mounted MS 3112E- 12-3S, 3-pin connector shall be provided. Pin B shall be airframe ground. Pin A shall be +28 V.C. for a 28-volt aircraft system. Pin C shall be +14 for a 14-volt aircraft system. The circuit shall be protected by a 5-amp circuit breaker. The mating connector for the Government-furnished Infrared or Premo device shall be an MS 3116E-12-3P wired with the same pin assignments. Reference a wiring diagram in the aircraft procurement document.

D. Helicopter load calculation/manifest unit weight is approximately 100 lb with all reservoirs and hopper filled.

E. The mounting area must be cleaned, which includes vacuuming if there is powder from broken spheres and cleaning any glycol that may have spilled on the floor from previous installation. All carpet and porous floor coverings must be removed.

F. A one-gallon container of water and a seat belt cutter must be carried on board and be within reach of the Operator.

G. Fire shelters for all occupants on helicopter.

CAUTION: ***Do not service the machine with glycol while it is installed in the helicopter.***

CAUTION: ***Under no circumstances will extra ethylene glycol (antifreeze) be carried in the same compartment with plastic spheres.***

XVIII. Installation Procedures for Specific Helicopter Types

Note: Listed below are installation procedures for some common aircraft utilized for PSD operations. Any helicopter maybe utilized if it is carded and agency approved. Obtain approval from Helicopter Operations Specialist, Helicopter Maintenance Inspector, Helicopter Inspector Pilot, or Aviation Manager for aircraft installation procedures not identified in this section.

A. Bell 206/407 Series Helicopters

Note: Consult flight manual for doors-off limitations and center of gravity.

1. Remove right rear door of helicopter.
2. Use duct tape or other means to protect the paint finish around the right rear doorsill (consult with pilot/vendor before doing this).
3. Place the PSD mainframe over the doorsill and connect the Y-end buckles of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
4. Install exit chute. Tighten and lock nuts.
5. Install hopper on the mainframe and make electrical hookup between units.
5. Slide the assembled PSD as far forward as possible to provide legroom between machine and rear seat. Some 206B3 helicopters have a cabin fire extinguisher mounted on the rear of the

pilot's seat and it may interfere with the opening of the hopper lid. The fire extinguisher must be removed from its holder and secured on the floor, or the machine must be slid far enough aft to allow the hopper lid to open. Either option must ensure enough room for access to the PSD control panel.

7. Connect and tighten the belly hold-down strap making sure the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
8. Make sure the PSD switches are in the OFF position, and connect the power supply plug from the helicopter to the PSD.
9. Turn the PSD on and watch the rotation of the hand wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
10. Proceed with ignition timing tests, briefings, etc.
11. All manufacturer's safety precautions must be adhered to during operation of the PSD.

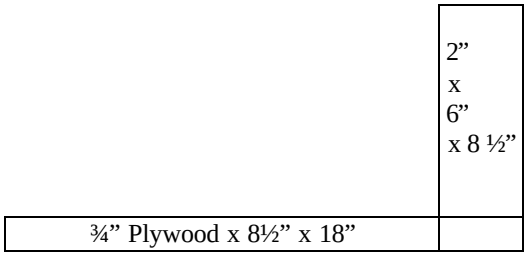
B. Hughes (McDonnell-Douglas) 500 Series

Note: Consult flight manual for doors-off limitations and center of gravity.

1. A plywood adapter board must be constructed to mount the PSD in the Hughes 500 Series helicopters (see figure 1).
2. Remove right rear door of helicopter.
3. Use duct tape or other means to protect the paint finish around the right rear doorsill.
4. Place the plywood adapter on the floor and the PSD mainframe on the adapter and connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
5. Install exit chute. Tighten and lock nuts.
6. Install the hopper on the mainframe and make electrical hookup between the two units.
7. Slide the assembled PSD as far forward as possible to provide legroom between machine and rear seat. The fire extinguisher may need to be removed from its holder and secured on the floor, or the machine must be slid far enough aft to allow the hopper lid to open. Either option must ensure enough room for access to the PSD control panel on the side of the mainframe.
8. Connect and tighten the belly hold-down strap ensuring it is not twisted and does not interfere with any external fittings, wiring, or release cables.
9. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
10. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered form the PSD during the polarity check.
11. Turn the PSD on and watch the rotation of the wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
12. Proceed with ignition timing tests, briefings, etc.
13. Manufacturer's safety precautions must be adhered to during operation of the PSD.

Auxiliary support bracket for Hughes 500; construction is of 1-inch welded aluminum on a ¾-inch plywood base.

Figure 1: Adapter Bracket



C. Aerospatiale 350-355 Series

Note: Consult flight manual for doors-off limitations and center of gravity.

1. A one-foot extension must be added to the hold-down strap when using this type of helicopter. The extension must be added to the short buckle portion that is attached to the PSD. The smooth, flat portion of the hold-down strap must pass through the doorframe without hanging up.
2. Remove right forward and right rear doors of the helicopter.
3. Use duct tape or other means to protect the paint finish around the right rear doorsill.
4. Place PSD mainframe on the floor and connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
5. Install exit chute. Tighten and lock nuts.
6. Install the hopper on the mainframe and make electrical hookup between the two units.
7. Connect and tighten the belly hold-down strap making sure the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
8. Make sure PSD switches are in the OFF position, and connect the power supply plug from the helicopter to the PSD.
9. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered form the PSD during the polarity check.
10. Turn the PSD on and watch the rotation of the hand wheel; rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
11. Proceed with ignition timing tests, briefings, etc.
12. All manufacturers' safety precautions must be adhered to during operation of the PSD.

D. SA 315B Lama

Note: Consult the flight manual for doors-off limitations and center of gravity.

1. A left passenger seat that has been modified in accordance with Heli-Support drawings and approved by the FAA must be installed. The seat has a high head restraint and is approved for aft-facing installation. The aft-facing position allows the operator ample room to operate the PSD.
2. Remove the left door.
3. Cover the forward left skid tube to prevent damage to the aircraft's finish.
4. If the floor is not covered by a ¼-inch thick piece of plywood or other material, the tie-down rings must be removed to allow the PSD to sit flat on the floor.
5. Place the PSD mainframe on the floor forward of the left cross tube.
6. Connect the Y-end clips of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down.
7. Install exit chute.
8. Install the hopper on the mainframe and make electrical hookup between the two units.
9. Connect and tighten the belly hold-down strap ensuring the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
10. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
11. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
12. Turn the PSD on and watch the rotation of the hand wheel; rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
13. Proceed with ignition timing tests, briefings, etc.
14. All manufacturers' safety precautions must be adhered to during operation of the PSD.

E. Hiller 12E Series (Three-Place)

Note: Consult flight manuals for doors-off limitation and center of gravity.

1. This series helicopter must be flown from the left seat position, and the center position cyclic control must be removed.
2. Remove the right door.
3. An adapter block must be installed on the floor on the right side of the instrument pedestal.
4. Place the adapter block on the floor on the side of the instrument pedestal.
5. Place the PSD on the floor so it is snug against the block and is as far forward as possible.
6. Connect the Y-end buckles of the hold-down strap to the slots in the mainframe. Do not tighten the hold-down strap.
7. Install exit chute. Tighten and lock nuts.
8. Install the hopper on the mainframe and make electrical hookup between the two units.
9. Connect and tighten the belly hold-down strap, ensuring the strap is not twisted and does not interfere with any external fittings, wiring, or release cables.
10. Make sure the PSD switches are in the OFF position and connect the power supply plug from the helicopter to the PSD.
11. CAUTION: A metal container shall be placed under the exit chute at this time to catch any spheres that may be triggered from the PSD during the polarity check.
12. Turn the PSD on and watch the rotation of the hand wheel. Rotation in the direction of the arrow indicates correct polarity. To change the direction of rotation, reverse the plug wiring on the PSD (black wire is positive and the white wire grounds the chassis).
13. Proceed with ignition timing tests, briefings, etc.
14. Manufacturer's safety precautions must be adhered to during operation of the PSD.

XIX. MSDS (Material Safety Data Sheets)

See Appendix C.

XX. Plastics Sphere Storage Information

Note: Manufacturer states that the spheres have an indefinite shelf life; they have tested spheres that have been in storage for 20 years with favorable results. Store spheres in a cool, dry environment. Spheres are not sealed against moisture. The main environmental effects that can cause problems are humidity, extreme temperature variations, and exposure to ultraviolet light. Discoloration of the sphere is a sign of exposure to moisture which causes the potassium permanganate to cling to the sides. This does not necessarily mean that the spheres won't function properly. For best results rotate boxes 90 degrees annually and drop boxes prior to use to eliminate clumping of potassium permanganate. Old spheres that are brittle may still be ok for use. Anticipate a dirty machine. The more brittle the spheres become the more apt the machine is to jam. Poor ignition of spheres is generally caused by over injection of glycol. Bench testing prior to use will give indications of sphere condition (brittleness).

Note: The manufacture recommends following local hazmat protocol for disposal of spheres. There is not a manufacture sponsored recycling program for spheres.

Chapter IV – Helitorch Operations

I. Introduction

The Helitorch is a gelled fuel aerial ignition device that is attached to a helicopter's external cargo hook. The ignition and fuel feed are controlled by the pilot through a simple electrical connector on the belly of the helicopter, usually the water bucket plug. The complete system is jettisonable by the pilot in case of emergency.

Adding fuel-thickening compounds to the raw fuel reduces its volatility. This also increases the safety in handling the fuel, improves its drop characteristics, puts more fuel onto the ground (rather than burning off in the air), and increases residual burning time allowing the aircraft to be flown higher and faster.

II. Advantages and Disadvantages of the Helitorch in relation to the PSD

Table 6

Advantages	*Disadvantages*
Convection column can be developed quicker, increasing control over the fire. Thickened fuel provides a longer residual burning time on the ground. Helitorch has the potential of laying a more continuous line of fire. Helitorch can be easily jettisoned by the pilot in the event of an emergency. Helitorch can be more effective under marginal weather, site, or fuel conditions. Burning is possible in less accessible areas, reducing hazards to ground personnel. More acres can be burned in less time than in hand lighting. Emissions may be reduced due to widening of prescription window.	The use of gasoline is hazardous since it is highly flammable in its ungelled state. There is substantial resource outlay: three- to five-person crew, with one or two vehicle and/or trailer units for most burning operations. Crew requires extensive training and a certain degree of commitment to the program for the duration of the burning season. Bulk fuel and chemicals must be hauled to the site; the DOT and OSHA requirements must be known, understood, and complied with. Costs can be significant. Helicopter must return frequently to refill with gel. Operation requires considerable planning and setup time to organize the mixing/loading site and helipad. Rigorous safety procedures must be followed. Hazmat removal and storage may be a problem. It is easier to establish a convection column because of helitorch mass ignition; it is as easy to lose control of the column with a break in ignition. Helitorch does not lend itself to under-burning operation. The burning fuel globules can ignite tree crowns. CDL with Haz Mat endorsement required for towing batch plants.

Table 7: Advantages and Disadvantages of the Western Helicraft Helitorch

Advantages	*Disadvantages*
The small size of the torch allows it to be transported to remote areas inside any medium and most light helicopters. No need to transport large amounts of mixing equipment and supplies. Requires a smaller ground crew to mix gel, operate, and maintain.	Requires special pilot and ground crew techniques in order to operate effectively.

III. Situations Favorable for Helitorch Operations

A. Sites where burn areas have sparse or patchy fuel distribution and high fuel moisture content. The pattern of fire laid down by the torch can provide a greater chance of ignition and, under some conditions, reduce emissions.

B. The type of fire pattern laid by the torch and the fuel's residual burning time on the ground can aid in developing a continuous line of fire and achieving better consumption.

C. In ignition of aerial fuels such as standing timber, blow-down, and/or poorly compacted fuels.

D. In areas where the more intense ignition pattern of the torch can result in a more quickly established convection column.

E. Where wildland fire burnout is the best option for safety and control, the helitorch can expedite the operation without compromising personnel safety.

IV. Equipment Specifications and Design

See Appendix D and E

V. Personnel Responsibilities

See the Organization Charts in appendix B for required positions to be filled for both Prescribed and Wildland fire aerial ignition.

A. Helitorch Manager

1. Supervises and monitors the overall helitorch operations on the helibase. On operations utilizing only one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helicopter Manager as well as either (not both) the HTMM or HTPT. On operations utilizing more than one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helibase Manager providing that they do not assume duties as the HTMM or HTPT.
2. Supervises all helitorch/helibase operation and assigns qualified personnel to positions and identifies trainees.
3. Ensures Aerial Ignition Project Aviation Safety Plans (PASP) and checklists are completed, approved, posted, and followed.
4. Maintains Helitorch Maintenance log and ensures proper cleanup of equipment prior to storage (reference maintenance in appendix B).
5. Provides technical assistance to Burn Boss/Ignition Specialist on helibase location and operation.
6. Ensures all required equipment is on-site and operational.
7. Ensures communication link between helitorch base/helibase, dispatch, Burn Boss/Ignition Specialist/Operations Section Chief, and designated personnel is operational.
8. Conducts briefing and provides technical advice and information to involved parties.
9. Identifies hazards and safety requirements at operations briefing.
10. Ensures safety precautions have been completed prior to mixing.
11. Ensures that fire shelter is on board aircraft and accessible to the pilot, and that pilot is familiar with use.

B. Helicopter Manager

1. Duties and responsibilities are outlined in IHOG, Chapter 2. On operations utilizing only one helitorch helicopter, the Helicopter Manager may have collateral duties as the Helitorch Manager as well as either (not both) the HTMM or HTPT.

C. Mixmaster

1. Reports to the Helitorch Manager.
2. Attends briefings.
3. Supervises mi xing/filling operation, manages time frames to maintain availability of gel, assuring bonding procedures are followed.
4. Determines quantities of fuel, gelling agent, etc., needed and manages time frames between mixing systems mixes.
5. Oversees hookup o f helitorch to helicopter and preflight tests of helitorch with pilot.
6. Supervises the helitorch fire protection and mixing personnel.
7. Conducts drills prior to operations to ensure mixing and filling operations are coordinated between all personnel.
8. Performs preventative maintenance and cleaning of all helitorch operations equipment.
9. Places equipment and ensures it is operational; conducts drills prior to operations to ensure mixing and filling operations are coordinated between all personnel.
10. Performs maintenance and cleaning of all helitorch equipment.

D. Parking Tender

1. Reports to the Helitorch Manager.
2. Attends briefings.
3. Directs all movements of personnel and equipment around the helicopter.
4. Checks hookup of helitorch to helicopter; accomplish checkout procedures.
5. Must have a radio equipped with headset and hardhat or SPH-4/5 flight helmet with a remote transmit switch during takeoffs and landings during helitorch operations at the landing pad.
6. Has fire protection responsibility for the primary helitorch helipad (staff fire extinguisher during all fueling, reloading/filling operations, and during takeoffs and landings). Shall wear PPE as per IHOG Chapter 9, CHART 9-2.
7. Provide one 40-B:C rated fire extinguisher (IHOG Chapter 9.VI.A) per pad.
8. Attends to pilot's needs at the landing pad.
9. Ensures electrical switches are "on" prior to takeoff and "off" after landing and inspects discharge valve, propane pressure, cam lock, drum hardware, and suspension cables prior to takeoff.
10. Ensures all personnel/equipment are clear of safety circle during takeoff/landing.
11. Knows and understands helicopter crash/rescue procedures.
12. Provide crash rescue and evacuation kits at helitorch base (complete with contents including first aid supplies as per IHOG Chapter 9. VI. B/C).
13. Maintains communications with helicopter while within the area of helitorch base, turns communication over to Burn Boss/Operations Section Chief/Ignition Specialist when helicopter departs helitorch base area.

E. Helitorch Mixing Personnel

1. Report to Mixmaster. May have collateral duties as Fire Protection Personnel.
2. Attend briefings.
3. Assist Mixmaster with operation of mixing plant.
4. Assist with the filling of the helitorch.
5. Connect and disconnect vapor recovery/removal hoses as applicable.
6. Perform any other miscellaneous tasks during helitorch operation.

F. Helitorch/Helibase Fire Protection Personnel

1. Report to Helitorch Mixmaster. May have collateral duties as Helitorch Mixing Personnel.
2. Attend briefings.
3. Staff engine with Class B foam capability, or a minimum of two 3-gallon Class B portable Compressed Air Foam extinguishers on-site.
4. Are familiar with crash/rescue operations.
5. Are familiar with fire extinguisher operation.
6. Charge hoses and attend nozzles during operations.

G. Helitorch/Helibase Base Radio Operator

1. Reports to Helitorch Manager.
2. Attends briefings.
3. Receives orders from Burn Boss/Ignition Specialist and relays to Helitorch Manager.
4. Maintains communication with appropriate aircraft.
5. Provides communication between Helitorch Manager, Parking Tender, Helicopter Pilot, Burn Boss/Ignition Specialist, and dispatch and/or operations.
6. Maintains a flight following log.

H. Pilot

1. Must receive check ride from an approved Pilot Inspector.
2. Basic knowledge of wildland and prescribed fire operations.
3. Communication and coordination with Burn Boss and Parking Tender.
4. Knows limitation section of flight manual regarding limitations to flight with doors off.
5. Helitorch operation and installation procedures.
6. Maintains constant airspeed and elevation above the ground while staying within the burn area.
7. Maintains reserve power/airspeed in the event of an emergency.
8. Explains how winds and topography affect flight patterns.
9. Must be familiar with fire shelter usage.
10. **Pilot is responsible for all helicopter operations and flight safety**.
11. Slip-turns should be avoided which could result in erratic helitorch movements that may throw burning fuel across fire lines or cause inconsistent drop patterns.
12. When leaving the burned area, helitorch must be turned off well before the boundary of the burn to avoid dropping ignited fuel outside the desired burn area.
13. Residual gel may cause flaming gel to drip after the pilot has stopped ignition. The pilot must ensure that the flame on the gel nozzle is extinguished before leaving the burn area. Persistent flame can be extinguished by increasing airspeed.
14. Whenever possible, the pilot's side of the helicopter should be kept toward the previously ignited area. This way the pilot can monitor heat buildup from the ignited burn area and avoid possible heat damage to the helicopter from extreme temperatures.
15. Sufficient altitude must be maintained.
16. A safe departure path from the burn must be maintained at all times in case of erratic fire behavior.
17. When landing, the descent must be slow until the helitorch contacts the ground. Helitorch should be in front of the ship upon landing.
18. Follow emergency procedures in helicopter flight manual. Jettison helitorch by electrical or manual release. Avoid flying over personnel, vehicles, or congested areas.
19. At a minimum, the pilot's door must be removed prior to burning operations.
20. Remove external cargo racks to provide a better view of the helitorch.
21. The electrical and manual cargo hook releases must be checked and operational.
22. Helitorch tip must clear the ground before forward flight.
23. Check that sufficient reserve power is available to hover and maneuver the helitorch.
24. Do not check for helitorch ignition unless over the burn area or other designated test area.
25. Take off into the wind, allowing sufficient clearance over obstacles.
26. Airspeed must be within limits for adequate controllability of the helicopter and the helitorch combination.

27. Monitor T.O.T. when operating in burn areas, as flying through preheated air may result in erratic or high T.O.T.
28. All load calculations will be completed and posted.

I. Optional Aerial Ignition Positions (Wildland or Prescribed Fire)

1. Helitorch Mixing Personnel – Additional personnel to perform miscellaneous tasks during the helitorch operation, they are under the direction of the Helitorch Manager or Mixmaster.
2. Radio Operator – An experienced aircraft radio operator should be used on complex burns or at complex helibases.
3. Fire Protection Group – Based on the complexity of the operation, additional fire protection members, above and beyond the Helitorch Module staffing may be required. These individuals must be knowledgeable in Class B foam extinguisher capabilities and familiar with crash rescue procedures and on-site Helitorch operations.
4. For multiple helitorch aircraft or multiple helitorch bases, it is recommended to have a qualified Air Operations Branch Director or additional aviation management positions filled to provide oversight of the complex operations.

VI. Helitorch Mixing/Loading Area

CAUTION: ***All hand held electronic devices such as radios, pagers, cell phones, etc. shall be turned off within 50' of any fuel preparation/vapor removal area.***

A. Safety

The location and layout of the fuel mixing and helitorch loading site is critical to reducing the risk of accidents with flammable materials, helicopter, and mixing/loading personnel. The fuel mixing/loading area is used for the purpose of blending fuel and gelling agent, exchanging drums on helitorches, or refilling drums from the mixing units.

This helitorch base should be separated from the primary helibase and other helicopter operations. No smoking is permitted within the mixing/loading area. Precautions must be taken to eliminate sources of ignition where fuel vapors may be present.

In addition to 40-B:C extinguisher per pad, fire suppression requirements for helitorch operations will include a minimum of two 3-gallon compressed air foam system extinguishers capable of using Class B foam or an staffed foam capable engine with Class B foam on-site.

Emergency Rally Point Shall Be Identified Per OSHA 1910.38

Emergency escape route, emergency shutdown of operations, procedures to account for all employees, rescue and medical duties, and means of reporting fires and emergencies shall be covered. The alarm system to be utilized for employee notification should be outlined.

Emergency Contingency Plan

1. Establish and follow approved Crash Rescue Plan located in Aviation Safety Plan.
2. Establish and maintain a communication link to Dispatch/ICP.
3. Establish emergency contact procedure via radio notification.
4. Establish escape routes and an emergency rally point where personnel could congregate to identify everyone for accountability.
5. Identify and brief helitorch operations, suppression, fire protection, and first aid personnel.

B. Location

The helitorch mixing/loading area should meet the following criteria:

1. The helitorch site should be large enough to accommodate and provide a safe working distance between all the required pieces of equipment.

2. The site should have established a takeoff and landing corridor that has no equipment placed within that zone.
3. A safety circle shall be maintained around the landing pad.
4. There should be an alternate loading area in case the mixing/loading site becomes unusable because of changing situations.
5. The site should be located in close proximity to the burn site to minimize turnaround times.
6. Choose a site that will not be impacted by the smoke column or embers from the burn. Consider the prevailing and forecasted wind direction. Keep location upwind of the burn.
7. Helicopter flight paths must not pass over any personnel, structures, and areas of human occupancy. When over-flights of traveled roads occur, traffic control must be established.
8. The helitorch operation site should be reserved for authorized personnel only.
9. Establish alternate landing areas.
10. During wildland incidents, helitorch base operations shall be separated from the primary helibase.
11. Establish an escape route for all personnel in the event of an emergency at the work site if threatened by an escaped fire.
12. Try to choose a site that has no, or a minimum, need for dust abatement.
13. Mixing equipment must be located OUTSIDE the helicopter safety circle.

VII. Fuel Preparation

A. Safety

1. The Helitorch Manager must be aware of the procedures for safe storage, handling, and mixing of fuel according to agency or bureau policies.
2. The mixing areas should be set up with special attention to the safety equipment available and the training of the mixing crew.
3. Nonferrous mixing equipment must be used and all bonding procedures must be followed.
4. Ensure that precautions are exercised to eliminate direct exposure of skin to gelling agent or fuel.
5. Use a NIOSH-approved dust mask when dispensing or handling gelling agent (powder). Recommend use of an organic vapor respirator when conducting maintenance operations or in the event of a spill. A known source is Laboratory Safety Supplies, phone 1-800-356-0783. Refer to agency respiratory protection guidelines.
6. Personal protective equipment: Personnel must be equipped with eye protection, hardhat, fire retardant clothing labeled as non-static or 100 percent cotton coveralls, Nitrile Chemical Resistant gloves, and NIOSH-approved dust masks.
7. "NO SMOKING" signs conspicuously posted around mixing area, to include all vapor removal outlets.

B. Hazards

CAUTION: ***Hazards to the mixing personnel include vapors from gasoline, flammability of gasoline, skin contact with fuel, and dust from the gelling agent. (Review MSDS's in appendix C.)***

1. Gasoline vapors are a depressant to the nervous system and a known carcinogen; prolonged and direct exposure to these vapors must be avoided.
2. Personnel should keep their hands out of gasoline and fuel mixtures. Special care must be taken to keep fuel from the mouth, eyes, open cuts, and abrasions.
3. Dust created in fuel mixing should be avoided. Mixing can only take place when all personnel involved in the operation are adequately trained and equipped.

C. Handling Gelling Agent and Fuel

1. Bulk transportation of fuel is recommended whenever possible using a fuel truck with its own pumping system.
2. When bulk fuel transportation is unavailable, a portable refueling system may be used that complies with requirements of appendix D, E and F.
3. The gelling agent must be kept dry. The chemical is non-toxic and can be disposed of in a

landfill site; no spillage should remain on the site after the operation is completed.

4. DOT requirements (see appendix E).

CAUTION: ***Only gelling agents with a current Material Safety Data Sheet (MSDS) are approved for use.*** **Current approved brand names for thickeners are: FIRETROL® Firegel® (also known as Sure Fire) and FIRETROL® Petro Jel™.**

Portable Eyewash Station Required On-Site

OSHA 1910.151 and 1926.5 Requires that that when the eyes may be exposed to injurious corrosive materials, suitable facilities for the quick drenching or flushing of the eyes shall be provided for immediate emergency use. MINIMUM 15 MINUTE CONTINIOUS FLOW. The American National Standards Institute (ANSI) outlines what OSHA considers suitable facilities in ANSI Z358.1-1998.

Potable Water/Hand Washing Required On-Site

OSHA 1910.141 and 1926.51 Requires that potable drinking water be provided at each jobsite. In addition if the employee is consuming their lunch at the site then hand soap and water or another form of cleansing/disinfecting agent must be provided.

D. Mixing Procedures

1. Correct mixing is essential and clean fuel results in the best gelling and ignition. The optimum fuel temperature for gelling is 21 degrees Celsius or 70 degrees Fahrenheit. Colder gas takes longer to gel and requires more gelling agent for a proper mix.
2. Cleanliness of fuel, powder, and equipment must be ensured. It is desirable to set up the mixing area well ahead of the desired ignition time to ensure all components of the setup are operational.
3. Helitorch Manger checks to ensure all personnel are properly equipped and that all safety gear is in place.
4. Mixmaster ensures all mixing systems, helitorches, and bulk fuel sources are properly bonded. (Reference bonding procedures in Appendix F)
5. All drums and associated equipment must be clean.
6. Mix crew attaches the bonding cable and fuel nozzle to the mixing unit and adds fuel.
7. After fueling, the Mixmaster adds the measured amount of gelling agent to the mixing unit while the fuel is being agitated. Gelling agent must be added slowly or improper gelling may occur.
8. Mixing of fuel and gelling agent continues until required amounts have been added (reference manufacture's mixing guidelines). Agitation continues until complete mixing has occurred and the mixture shows signs of gelling (waxy surface and thickening).
9. The Mixmaster determines if the gel is of the desired consistency.
10. Gelling agent added to partially gelled fuel will not totally dissolve and will cause lumping.
11. The mixed gel should sit for 10/15 minutes or until gelling is complete. Gel color may vary with different grades and brands of fuel.

CAUTION: ***No plastic of any kind shall be used in the mixing operations. All dispensing equipment must be made of metal capable of being bonded, no plastic components. Do not pour gelling agent directly from the bag into the drum/tank (NFPA 77, 8-11).***

E. Gelled Fuel Mixing Procedure for the Western Helicraft.

1. Mixing gelled fuel for the Western Canadian helitorch can easily be done with standard fuel drums and the liquid gelling agent Petrol Gel. Two 4-liter bottles of Petrol Gel will gel a 55-gallon drum of unleaded gasoline. (With the standard helitorch ignition system, Jet A fuel did not perform well in this helitorch in either a gelled or ungelled state.)
2. Remove the large bung from the fuel drum. Watch out for spraying fuel when the drum vents.
3. Agitate the Petrol Gel bottle until the mixture is smooth and there is no powered residue left on the bottom of the bottle. Be patient – this will take several minutes.

4. Stir fuel with a non-metallic or aluminum stick in one direction, until the fuel is moving rapidly in the drum.
5. Pour one bottle of well mixed Petrol Gel in the drum into swirling fuel, then stir the fuel in the opposite direction until well blended.
6. Be sure that the entire content of the drum is being stirred. Move the stick up and down in the drum to ensure an even mix.
7. Pour the other bottle of Petrol Gel into the drum while the fuel is swirling, then stir until the fuel is completely gelled.
8. Gelled fuel will become resistant to stirring when it reaches proper consistency. The proper consistency will be reached in 6 to 15 minutes depending on the temperature of the fuel.

CAUTION: ***Fuel should not be gelled unless its use is likely. Fuel which has been gelled for more than 2 hours will begin to lose viscosity and may cause flaring during use.***

VIII. Bench Testing the Helitorch

Helitorches will be kept clean and maintained to avoid operational delays. Once the helitorch has been cleaned and reassembled, it can be tested for serviceability on the ground. A 40-B C fire extinguisher must be readily available to a trained person during helitorch testing procedure. The helitorch will not be loaded with jelled fuel for bench testing.

The following outlines the steps to be performed during a bench test:

A. Connect two 12-volt batteries in series to produce 24 volts. (See figure 2.)

B. Ensure that both pumps and ignition switches are in the off position. Attach the power cord to the battery and the 9-pin plug to the helitorch.

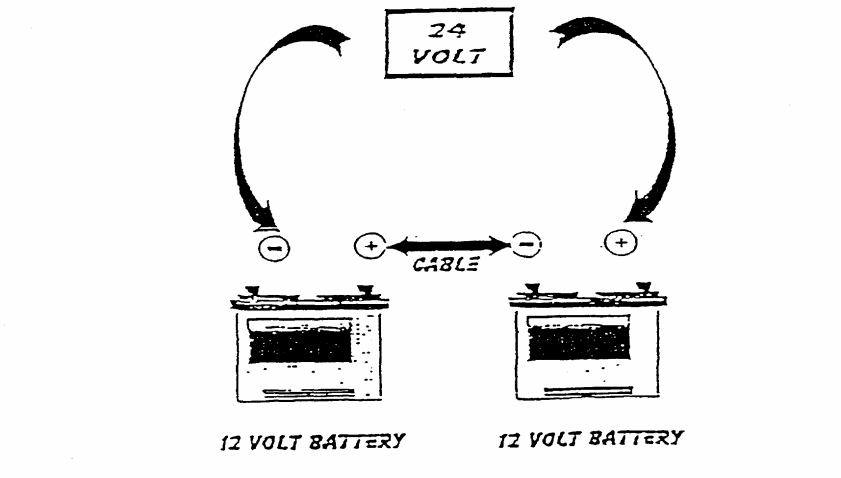
C. With the ignition switch on and the pump switch off, check to see that the igniter is producing a spark.

D. With the pump switch on and the igniter switch off, check to see that the motor and pump operate normally and the pulley rotates in the proper direction, clockwise when viewed from the control switch side of the helitorch.

E. Turn both switches off and disconnect the plug from the battery adapter cord.

F. Check all nuts, bolts, and connectors for tightness and serviceability.

Figure 2



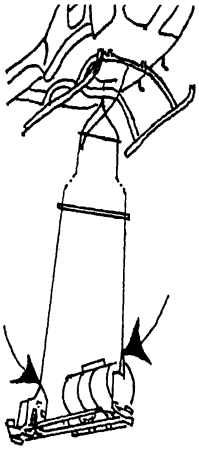
BATTERIES IN SERIES TO PRODUCE 24 VOLTS

IX. Helitorch Installation to Aircraft

A. Have the pilot door removed.

B. Ensure that the suspension cables are correctly installed to the helitorch. The long cable is attached to the housing and the short cable is attached to the bail. (See figure 3.) Inspect cables and connectors for security.

Figure 3

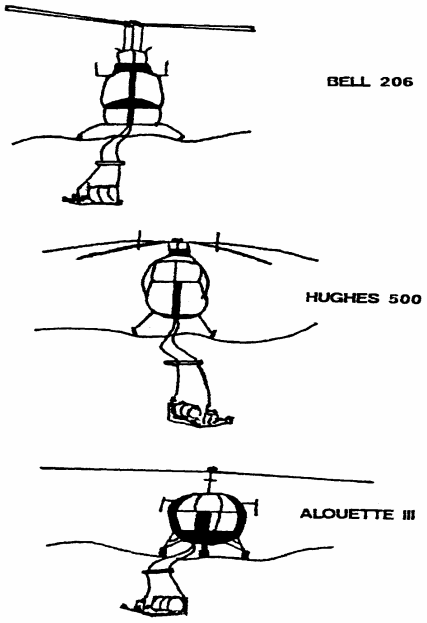


LOCATION OF ATTACHMENT POINTS OF SINGLE-POINT CABLE ASSEMBLY

Note: Single-point cable assembly attachment is the only attachment method approved for USDA Forest Service.

C. Place the helitorch on the ground in front of the helicopter with the nozzle end to the pilot's side of the aircraft and make sure the switches are off. (See figure 4.)

Figure 4



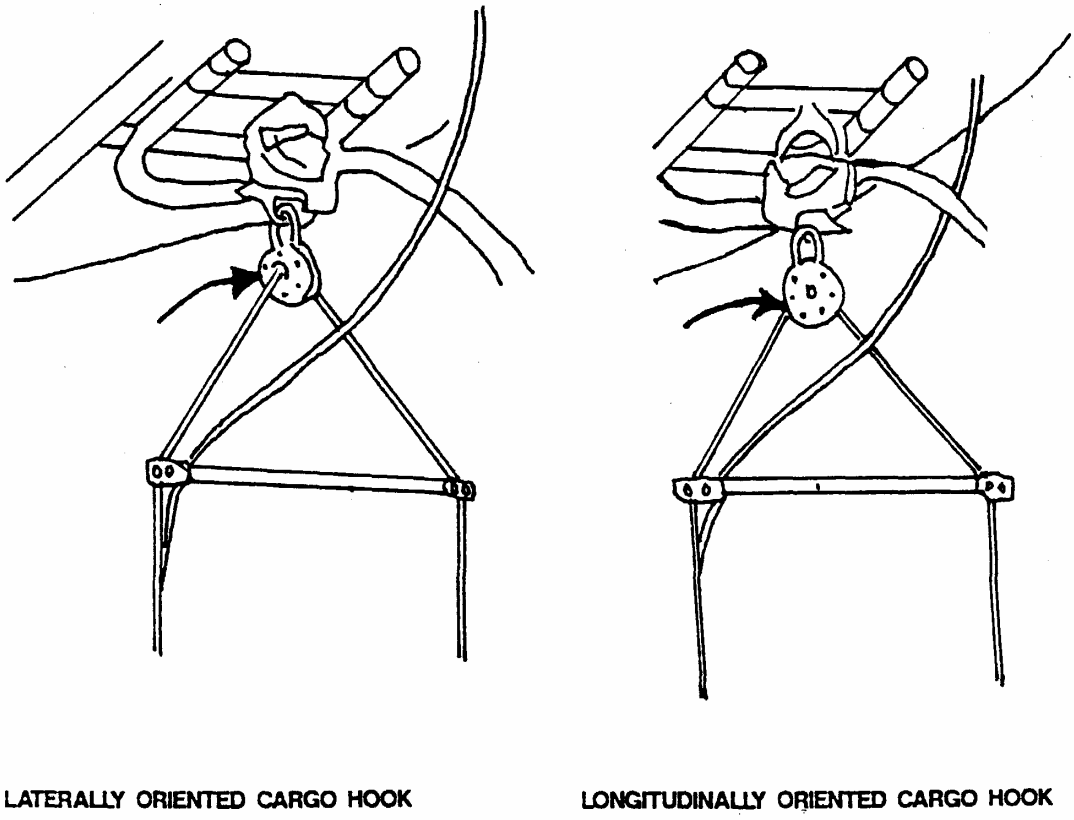
Correct helitorch orientation to above helicopter. Note position of helitorch in relationship to aircraft. (Lines are not over or under landing gear.)

D. Ensure that the pear-link adapter is correctly configured for the cargo hook on the helicopter. (See figure 5.)

CAUTION: ***Before testing helitorch with the helicopter, disconnect pear-link from the aircraft cargo hook. Failure to follow this procedure can result in damage to the helicopter wiring if polarity is incorrect.***

Make sure that the cables are between the skids and will not become entangled during takeoff. Attach the pear-link to the cargo hook. At this time conduct a safety check of the cargo hook, both manual and electrical releases. After insuring that both switches are in the off position, secure the electrical cannon plug to the plug on the helicopter.

Figure 5



CAUTION: ***The helitorch suspension system shall be hooked directly to the helicopter cargo hook. Tag/lead or long lines are prohibited. Reference App. G.***

X. Testing Helitorch with Helicopter

Even if the helitorch has been bench tested, it should be tested on the helicopter while both are on the ground. At this point it is essential that you have conducted a pre-operational briefing with the pilot and crew. This briefing must include communications, any identified hazards, and emergency procedures. Make sure you have installed the desired nozzle tip on the helitorch, that there are no cables over the skids, and have a fire extinguisher staffed with a trained person.

A. Ignition Test

1. Ensure the pump switch is off and turn the ignitor switch on.
2. Have pilot activate the helitorch control switch to test for proper ignition.
3. Have pilot release helitorch control switch and turn ignitor switch off.

B. Pump Test

1. Check dry-break connection and open hose valve.
2. Insure ignition switch is off and turn pump switch on.
3. Have pilot activate the helitorch control switch after having placed fuel catch vessel under fuel nozzle. Gelled fuel should flow through the nozzle tip. At this time all lines should be bled to insure fuel flow. If you hear the motor turning and no fuel flows, check for clogging, vapor lock, or polarity reversal. If the polarity is reversed, simply reverse the input wires or use a "backward-wired pigtail." When polarity is correct, reconnect pear-ring to the aircraft cargo hook.
4. Check that the positive shutoff valve does not allow fuel to leak from the nozzle and that it operates freely.
5. Make sure both switches are off.
6. The torch is ready for operation.

XI. Prior to Each Takeoff (Final Check)

A. Ensure pear-link is attached correctly to cargo hook.

B. Check helitorch structural integrity.

C. Igniter is clean.

D. Helitorch and suspension system is positioned in front of the helicopter with the nozzle end toward the pilot's side of the aircraft.

E. The Mixmaster or Parking Tender will activate the ignition and pump switches, inform the Pilot that the switches are on, and exit the area towards the Parking Tender.

F. Parking Tender directs takeoff.

CAUTION: ***If the cables become tangled over the helicopter's skids, UNDER NO CIRCUMSTANCES will any individual walk underneath the hovering helicopter to untangle the lines. The Parking Tender must direct the Pilot to place the helitorch on the ground and release it before re-hooking.***

CAUTION: ***At no time should there be anyone underneath or in close proximity of the helicopter with the helitorch attached while in flight.***

XII. Filling Helitorch from Mixing Unit

A. Ensure all mixing systems, helitorches, and bulk fuel sources are properly bonded. (Reference bonding procedures in Appendix F)

B. The helicopter returns with an empty drum. The Parking Tender directs the helicopter to its

landing position.

C. Once the helicopter is on the ground, the Pilot signals to the Mixmaster or designee to approach.

D. The Mixmaster or designee turns the switches off. Mixmaster now connects the vapor recovery and filler hoses on the helitorch drums. The Mixmaster signals the fuel mixing unit operator to pump gel. After fueling is complete, changes propane bottle if applicable.

E. When the drum is full, the Mixmaster signals the mixing unit operator to shut off the pump. Then the Mixing Unit Operator closes the valve, removes fuel and vapor hoses, turns the switches on, and exits.

F. The Parking Tender performs final checks that switches are on, cables are correct, dry-break handle is in the open position, visual check of propane gauge, and nozzle tip is clean.

XIII. Cleaning and Maintenance of Helitorch and Related Equipment

The helitorch, drums, and mixing unit must have proper care to be dependable. Thoroughly flush all equipment with diesel fuel and run through all the nozzles, hoses, etc. Keep all equipment indoors or cover well.

A. Helitorch Maintenance

It is important to properly service and store the helitorch to maintain dependability. Obtain major component service/maintenance publications from manufacturers and distributors.

The following (XIII.A.1&2) is an example specific to the Simplex 5400 Helitorch

1. Flush the helitorch plumbing with diesel fuel or Jet A after each use.

    a. Remove the wind baffle cover-hood, loosen the igniter rod support bracket, propane torch tip support bracket and offset to provide clearance to remove the discharge nozzle valve.
    b. Remove the discharge nozzle valve and connect a 3/4" to 1" reducer adaptor to the 1" discharge fuel pipe.
    c. Connect a drum with a couple of gallons of diesel to the helitorch.
    d. Remove the motor/pump housing cover and remove the coil cable.
    e. Connect the 24-volt battery system to the helitorch ninepin plug.
    f. Connect a section of 3/4" garden hose on the reducer adaptor and insert the discharge end into the drum via one of the top bungs.
    g. With the igniter switch off, turn on the pump switch. Recirculate for a few minutes.
    h. During recirculation observe the pump shaft for a fluid leak.
    i. Turn the bypass valve on to clean out the bypass line.
    j. Prior to terminating the diesel flush, turn the pump switch off and remove the garden hose from the drum.
    k. Place the garden hose into a disposal container and turn the pump switch on to remove the diesel from the drum and helitorch plumbing.

Note: Secure the garden hose when the pump is operating due to the high discharge pressure.

2. Disconnect flushing hardware and reassemble the helitorch.

    a. Remove drumhead, first being careful to relieve any built up pressure; then scrape out any remaining residue using nonferrous paddle or squeegee into a suitable container for later proper disposal.
    b. Do not store the helitorch with gel or fuel remaining in the plumbing and suction hose.
    c. Remove the propane bottle from the helitorch and depressurize the system during storage. Ensure that the system is sealed for storage.
    d. Keep the internal components and cylinder of the discharge nozzle valve free of dirt and debris. Keep the valve covered during transport. Grease the cylinder periodically during use.
    e. Grease the pillow block bearing every 10 hours of use if applicable.
    f. Replace the suction hose when no longer flexible and cracks are visible.
    g. Disassemble the propane torch tip and remove carbon from the orifice outlet and the torch tip to ensure propane flame reliability.

h. Maintain a minimum 1/4" gap between the igniter rod and propane torch tip. The igniter rod and torch tip should be offset from the discharge valve nozzle to prevent gel contamination.
i. Check the electrical cable to ensure wire ties are spaced at one per every foot along the suspension cable.
j. Service and repair the Emco Wheaton dry break coupler. Reference the J1401 Dry Break Coupler Maintenance and Repair Manual. See appendix G.
k. Twenty-four-volt motor brushes should be periodically inspected. Reference motor maintenance publication.
l. Keep all helitorch components clean and free of moisture.
m. Reference the Helitorch Inspection Checklist during maintenance inspections.
n. Store the helitorch in a sheltered, clean, dry area.
o. Apply service tag after maintenance is performed with name, date, repairs needed, etc.

B. General Mixing System Maintenance

1. Mixing systems that meet MC 306 or DOT 406 design specifications must comply with DOT regulations. This includes an annual (VK) external visual inspection (V) and leakage test (K). An (IP) internal visual inspection (I) and pressure test (P) must be performed every 5 years. The tests must be performed by a DOT licensed inspector.
2. Have equipment shop personnel or competent mechanics inspect and maintain the mixing system trailer brakes, wheel bearings, electrical system, engine oil, air filter, spark arrester, etc., and the general integrity of the unit on an annual basis. Record and log all work performed.
3. Reference maintenance publications for the major components of the mixing system (e.g., engine motor, pump, valves, etc.) to maintain the equipment and to help remedy any problems (troubleshoot).
4. Clean and purge the mixing system tank, plumbing, suction line, and discharge lines of gel/fuel when the unit is not operated for a prolonged period of time.

    a. Pump as much of the remaining gel out of the plumbing and tank. Use a nonferrous metal or wood paddle to scrape gel toward outlet valve if needed.
    b. Put several gallons of diesel into the tank and recirculate. Flush all hoses with diesel.
    c. Purge the entire system of diesel.

Note: Fuel remaining in the system can absorb moisture and could jeopardize the life span of the tank by pitting and rusting the internal walls. Also, moisture can degrade gel consistency rendering it unsafe.

5. Care must always be taken not to introduce foreign matter (i.e., rocks, grit, debris, etc.) from getting into the system and perhaps damaging the pump or valves.
6. Prevent rust from forming on the tank. Paint the unit when necessary.
7. Keep the mixing system clean and store in a dry place.

C. Drum and Associated Hardware Maintenance

1. Keep the drum purged of gel/fuel when not in use.

Note: Fuel left in the drum for a prolonged period of time (e.g., over winter) can absorb moisture resulting in the formation of internal pitting and rust pockets, which could jeopardize the drum integrity.

2. Prevent rust from forming on the drum. Paint if necessary.
3. Keep the drums clean and store in a dry environment.
4. Keep the dry breaks clean of dirt, debris, and gel residue. Clean with solvent.
5. Keep Clay & Bailey relief valve, site glasses, and vapor removal/recovery cam-lock free of gel residue. Clean with solvent.

D. Vapor Hose Maintenance

1. Store hoses in dry location away from sunlight.

2. Ensure that debris does not enter the hose by keeping the cam-lock caps on during storage.
3. Perform continuity test prior to use.
4. Replace brittle/dry cracked hoses.

XIV. MSDS (Material Safety Data Sheets)

See Appendix C.

XV. Helitorch and Mix Transfer System Required Modifications and Approved Equipment Inspection Checklists

See Appendix D and E.

XVI. Western Helicraft Helitorch Assembly and Setup

Figure 6

A. Helitorch Assembly

1. Unwind the cables for the spreader bar assembly. The short steel cable wrapped with electrical cable is the spreader bar end and attaches to the aircraft cargo hook. The longer steel cable attaches from the foot of the bent leg frame to the eyebolt on the spreader bar. (See figure 6.)
2. Straighten and check the suspension lines for damage and entanglements.
3. Check all connections to ensure that they are secure and properly safety wired.
4. Remove the two bolts from the sleeve portion of the bent leg frame.
5. Install the straight frame into the sleeve portion of the bent leg and secure it with the bolts, nuts, and safety pins.

B. Gelled Fuel Helitorch Setup Procedure

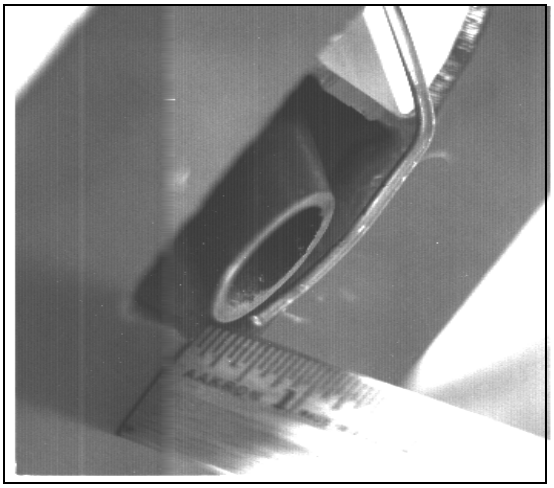
1. The pump-fin assembly is quick-pinned into place in the slot on the downfacing side of the straight leg frame, below the ignition box.
2. One end of the ¾" hose fitting is connected to the outlet of the fuel pump. The other end is connected to the fuel nozzle inlet on the bent leg frame.
3. The 1½-inch fitting will attach to the 1½-inch coupler installed on the fuel drum.
4. The cannon plug on the pump assembly presses onto the receptacle on the ignition box.

CAUTION: ***Mixing helitorch components between kits may cause compatibility problems due to differences in hose and/or nozzle length. If 1½-inch hose lengths are too long, the drum clamp may disconnect in flight.***

C. Adjusting the Igniter Tip

1. Igniter wire and nozzle terminus should be free of carbon deposits. Remove carbon deposits with sandpaper or a wire brush.
2. When properly adjusted, the igniter wire bends at the nozzle tip and parallels the nozzle terminus so that a gap of approximately 1/4- to 3/8-inch exists between the two. This will allow multiple points for arcing to occur and prevent ignition failure.

Figure 7

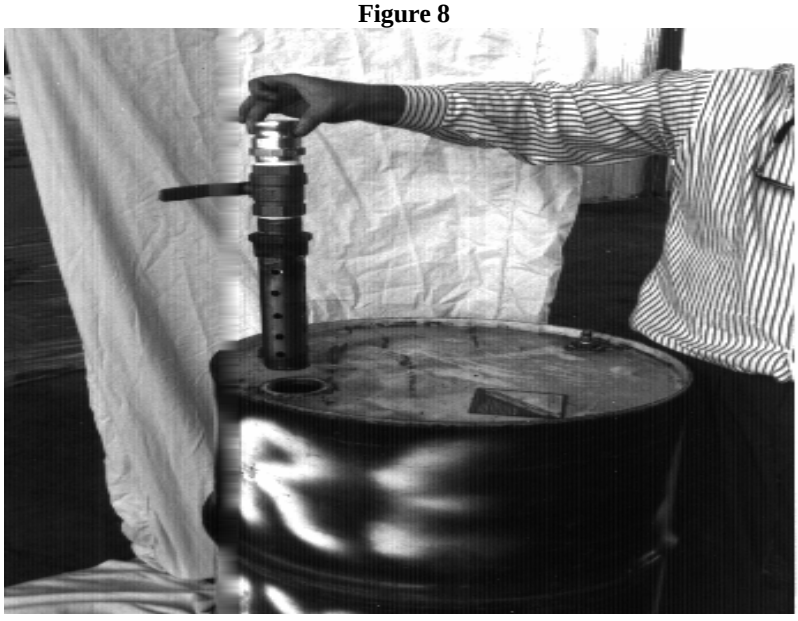


D. Fuel Drum Valve Assembly

The Western Helicraft Helitorch uses unmodified standard 55-gallon fuel drums. The ground crew must check the drums for fuel leaks and bent rims. Drums with bent rims on the vent bung side of the drum, or large dents in the side of the drum near drum rims, cannot be used since this is the area where the drum attaches to the helitorch. Any drum with damaged threads should not be used because it may leak or damage the threads of the helitorch vent or helitorch coupler.

1. Install small brass bleed-vent in the drum bung.

Figure 8

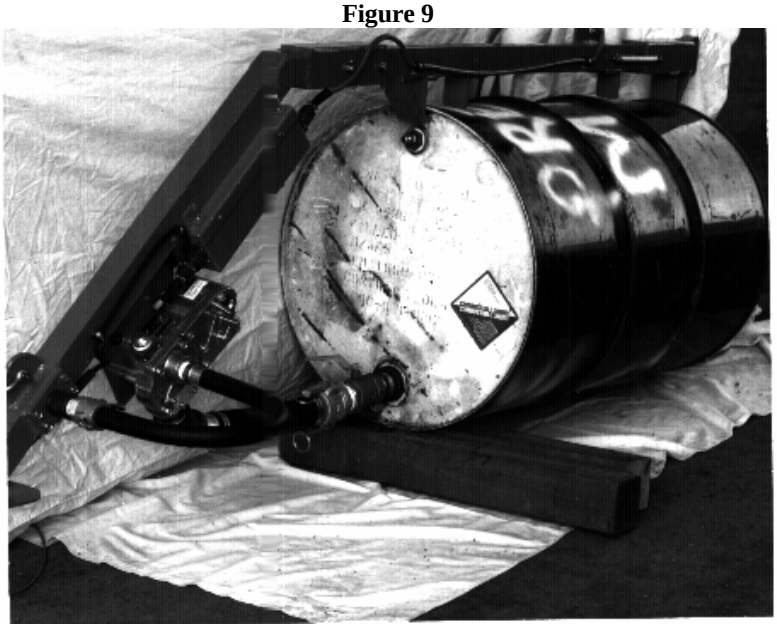


CAUTION: ***Ensure drum rim height is compatible with torch frame to maintain positive lock with torch.***

2. Check the bleed-vent for proper operation before installing by gently blowing on the brass end of the vent. If air does not go through the vent, or the vent is too loose, adjust the vent by tightening or loosening the vent's inset screw, which is located inside the vent.
3. The bleed-vent also serves as a check valve. If it is adjusted too loosely, fuel will leak from the vent during flight. Use a bung plug gasket on the air vent and finger tighten to the drum.
4. The 1½-inch coupler is used for gelled fuels.
5. Put Teflon tape on the coupling valve to seal threads. Do not use the bung gasket with the coupler.
6. Close the coupler valve before inserting into the drum.
7. Use a pipe wrench attached to large bung adapter to tighten the coupler to the drum. DO NOT USE THE COUPLER HANDLE.
8. The coupler closure handle should face up toward the center of the drum after the coupler is tightened.
9. Keep drums upright until ready for use.
10. Fuel must be gelled before inserting drum coupler.

E. Attachment of Fuel Drum to Helitorch

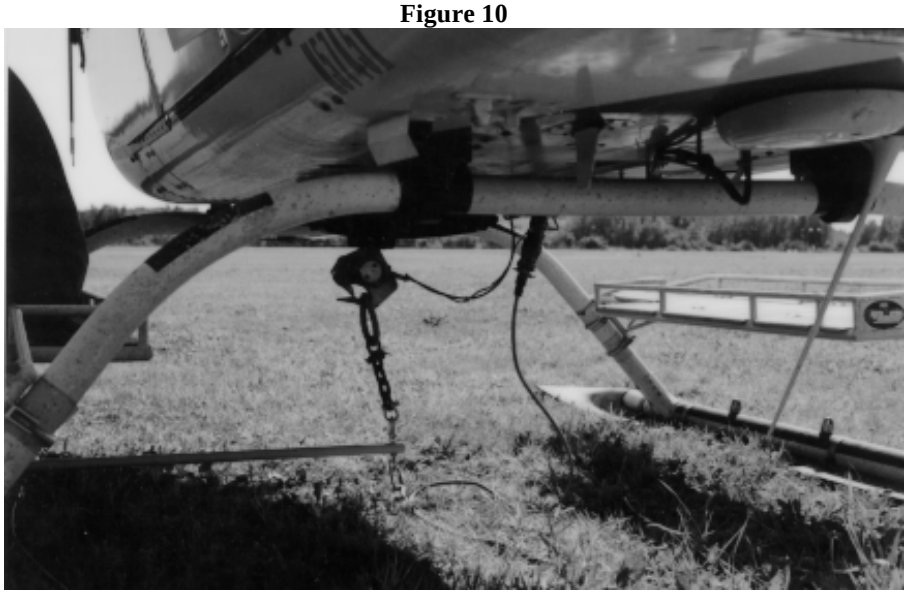
Figure 9



Ensure the fuel drum coupler valve is closed, then place the drum on its side on a 6-inch diameter log so that the small bung valve is in the upper most position and the fuel coupler is in the lowest position.

F. Helitorch Installation to Aircraft

Figure 10



G. Initial Helitorch Hookup

1. Place the helitorch on the ground in front of the helicopter.
2. Orient nozzle terminus toward the pilot's side.
3. Helitorch should be placed close enough so that it can be hooked to the aircraft by a person crawling underneath the aircraft, and far enough away as to minimize cable slack.
4. Attach the spreader bar's pear ring to the aircraft cargo hook.
5. Place the spreader bar's "crow foot" over the skid.
6. Attach the helitorch electrical connection to the helicopter's external electrical plug.
7. Check the aircraft manual and electrical hook release to ensure that the helitorch can be jettisoned during an emergency.
8. Open fuel valve on drum half open.
9. Turn on both ignition and fuel switches on the helitorch as well as the manual valves for the Mapp gas.
10. During lift-off, ensure that suspension lines do not become entangled with the helitorch and are not draped over the helicopter skid.

CAUTION: ***Never tape the spreader bar's "crow foot" to the skid because this may prevent the helitorch from being jettisoned in an emergency.***

H. Drum exchanges for Western Helicraft helitorches.

Landing is the safest way to exchange drums. This practice reduces time spent under a hovering helicopter. This also reduces the amount of residual fuel that gets blown around a by rotor wash.

1. A full fuel drum with coupler and bleed air vent attached is placed on a log so that the bung end of the drum is off the ground with the coupler on the bottom. Leave room on the downwind side of the log for the empty helitorch drum.
2. The helicopter hovers into the wind over the log with the empty helitorch. The parking tender directs the helicopter to lower the helitorch onto the downwind side of the log next to the full drum. Two helitorch crewmembers (designated as Primary and Secondary) move in under the hovering helicopter and guide the helitorch onto the log, ensuring that the helitorch tip does not touch the ground.
3. The Parking Tender signals the Pilot when to land on the downwind side of the exchange site. As the helicopter is landing, the Parking Tender will direct the Pilot back so the cables on the torch remain slack free. The Primary Crewmember turns off the ignition and pump switches,

closes the inline Mapp gas valve, and turns off the fuel valve on the 1½" drum coupler. Both crewmembers then disconnect the helitorch from the empty drum. The Primary Crewmember disconnects the fuel coupling.

4. Both helitorch crewmembers move the helitorch to the full drum. The Primary Crewmember connects the fuel coupling. Both crewmembers attach the helitorch to the drum. The Primary Crewmember turns on the fuel valve, half open for gelled fuel, turns on the pump and the two ignition switches, and opens inline Mapp gas valve.
5. The Primary and Secondary Crewmembers remain at the exchange area to ensure that the cables do not get caught on the helitorch, and the helitorch tip does not contact the ground as the helicopter lifts the helitorch.
6. The Parking Tender signals the Pilot to lift. The Primary Crewmember remains under the helicopter and double checks to make sure that the pump and ignition switches are turned on. When the helitorch begins to lift, the Primary and Secondary Crewmembers exit toward the Parking Tender.
7. The Parking Tender signals the Pilot when the helitorch crew is clear.
8. The Parking Tender signals the Pilot to exit into the wind, and observes the helitorch until it is clear of the area.
9. The Pilot avoids flying over personnel and equipment.
10. The ground crew monitors the helitorch until it is out of the helitorch base area.

I. Model Specific Hookup Considerations

1. **Bell and Hiller Model Helicopters:** The helitorch is manufactured with cable lengths suited for Bell 206 Series helicopters. The spreader bar must be perpendicular and horizontal to the skid (pilot's side) while the aircraft is on the ground to ensure the spreader bar will remain in the correct position during flight.

2. **Hughes, Aerospatiale Allouette II, and Aerospatiale Lamas:** The skids will move lower and closer to the center of the aircraft during flight. The spreader bar must be adjusted so it is in a horizontal and perpendicular position during flight.

Aerospatiale A-Star: Pilot view of helitorch may be obstructed due to seat position. This situation can be improved by adding a 20-foot cable extension to the helitorch.

XVII. MSDS (Material Safety Data Sheets)

See Appendix C.

Appendix A – Plastic Sphere Dispenser Operations

- PSD Project Aviation Safety Plan (Example Format)
  - Job Hazard Analysis
  - Job Risk Analysis

- Aerial Ignition Preplanning Checklist
- PSD Organization Chart – PSD Prescribed Fire
- PSD Organization Chart – PSD Wildland Fire
- PSD Prescribed Fire Communications Plan
- PSD Wildland Fire Communications Plan
- Helicopter Crash Rescue/Medivac Plan
- PSD Air Operations/Safety GO/NO GO Checklist (Required Format)
- Interagency PSD Operator Annual Recertification Training Form (Example Format)
- PLDO Task Sheet (Required Format)
- Aerial Ignition Annual Qualifications Update Sheet (Example Format)
- PSD Use Record (Example Format)

Job Hazard Analysis (JHA)

A required document that should outline the primary tasks, identify hazards, and describe methods to mitigate or remove risks associated with Plastic Sphere Dispenser (PSD) operations. Review of the PSD JHA with all Plastic Sphere Operations personnel prior to commencing a project is required.

Plastic Sphere Dispenser Project Aviation Safety Plan

Mission: **Aerial Ignition, PSD**	Project Name:		Unit:
Anticipated Project Date:	Start Time:	Ending Time:	
Project Plan Prepared by:	Title:		Date:
Note: Signature by the preparer verifies that all personnel have the required training for the mission. Attach map, clearly showing areas to be flown; aerial hazards must be indicated.			
Project Plan Reviewed by:	Title:		Date:
Project Plan Reviewed by:	Title:		Date:
Project Plan Reviewed by:	Title:		Date:
This Project is approved by:	Title:		Date:

Project Description:

Attachments: ☐ Map ☐ Aerial Ignition Checklist	☐ Other:	
Project Supervisor:	Phone:	Cell:
Helicopter Manager:	Phone:	Cell:
PSD Operator:	Phone:	Cell:
Participants:		

Type of Flight: Aerial Ignition, Sphere	Desired Make/Model:			Charge Code:
Type Procurement:		Method of Payment:		Projected Cost:
Vendor:		Phone:		Cell:
Aircraft N#:	Make & Model:		Aircraft Color:	
Pilot Name:		Pilot Carded: ☐ Yes ☐ No		A/C Carded: ☐ Yes ☐ No
Flight Follow:		Request or Flight #:		
Method of Resource Tracking: ☐ Phone ☐ Radio		☐ Prior to Takeoff ☐ Each Stop En Route ☐ Arrival at Dest.		
Scheduling Dispatch Phone:		Destination Dispatch Phone:		
FM Receive:	FM Transmit:		Tones:	
FM Receive:	FM Transmit:		Tones:	
FM Receive:	FM Transmit:		Tones:	
AM Air to Air:	AM Unicom:		Other:	

This form is continued on the next page.

Plastic Sphere Dispenser Project Aviation Safety Plan (continued)

Passenger Name	Weight	Departure Point	Destination Point
Cargo Weight	Cubic Feet of Cargo	Hazardous Material	Destination
		☐ Yes ☐ No	
		☐ Yes ☐ No	

Crash/Search and Rescue Procedures: Contact Dispatch, follow local/regional crash/search and rescue guide/Aircraft Incident Response Plan.

Start Location	Latitude	Longitude	Elevation	Helibase/Helispot Size
Destination Location	Latitude	Longitude	Elevation	Helibase/Helispot Size

Type of Operation – check applicable boxes	**Personal Protective Equipment Requirements**
☐ Helo Ops – ground personnel	Nomex clothing, hardhat w/chin strap, gloves, leather boots, eye protection, hearing protection, fire extinguisher
☐ Rotor Wing flights	Flight helmet, Nomex clothing, gloves, leather boots, eye protection, hearing protection, approved secondary restraint harness for doors off flights
☐ Doors off flight	Use approved secondary restraint harness attached to approved aircraft hardpoints

Justification statement for low-level flights:
Management has deemed aerial ignition as the best method of achieving Agency goals. Aerial ignition is conducted below 500' above ground level (AGL). Reference IHOG chapter 3, Operational Planning.

Special instructions:
All PSD operations will be conducted in accordance with Manual and Handbook direction as well as the Interagency Aerial Ignition Guide and Interagency Helicopter Operations Guide. A fire shelter will be available for the Pilot and trained in use. Helicopter Manager, PLDO, and Parking Tender must be carded and current for PSD operations. Helicopter Manager needs to assure that all the PSD equipment meets agency standards.

Aircraft Manager must confirm with Dispatch prior to the flight that affected routes' Schedulers contacted for Route Activity

Military Training Route (MTR) Information

MTR	Route Legs-Altitude	Activity	Time		Time Zone
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local

This form is continued on the next page.

Plastic Sphere Dispenser Project Aviation Safety Plan (continued)
PSD Job Hazard Analysis

Aircraft Manager/Pilot review with all participants as part of preflight briefing.

JOB HAZARD ANALYSIS (*JHA*) *(Instructions on next page)*	**1. WORK PROJECT/ACTIVITY** Plastic Sphere Dispenser Operations	**2. LOCATION**	**3. UNIT**
	4. PREPARED BY	**5. JOB TITLE**	**6. DATE PREPARED**

7. TASKS/HAZARDS	**8. ABATEMENT ACTIONS**
Unqualified Personnel	-Sphere Dispenser Operator shall be certified annually. Pilot and helicopter will be carded annually for PSD operations. Pilot will be knowledgeable in fire behavior and trained in use of the fire shelter.
Unknown Responsibilities	-Prior to each project, operator will review appropriate portions of IHOG and IAIG. The project briefing will cover responsibilities and emergency procedures
Aircraft Avoidance	-See and avoid. Check MTR routes in advance. Practice risk management; confirm that Dispatch has made contact with schedulers to de-conflict. Fly established airport patterns, initiate and stay in radio contact.
Weather	-Use weather advisory. Maintain VFR minimums, cancel mission if necessary.
High/Hot/Heavy	-Performance planning complete/insure accurate load calculations. Do not place the aircraft in performance related situations.
Low level obstacles	-Complete a high level recon, no unnecessary low level flight.
Doors off helicopter operations	-Use approved secondary restraint harness in addition to seat belt. Remove/secure loose items from cabin. Know VNE.
Pilot not familiar with area	-Supply hazard maps. Complete high-level recon prior to low-level work, project area identified.
Noise, rotor wash	-Wear ear and eye protection.
Unplanned aircraft events	-All personnel equipped with required PPE and trained in crash procedures. Review Crash Rescue/Medivac plan. Utilize Personnel Flotation Device when required.
Hazardous materials	-Qualified personnel will handle, review MSDS, inform pilot.
Communications	-Flight following established, checked and followed, communication plan posted. Maintain communications at all times, establish backup alternate frequencies. Take handheld radio along. Call in prior to landing. If radio contact is lost return to best suitable landing area and check-in. Parking tender outfitted with radio for takeoffs/landings.
Rotor hazards	-Pilot perform aircraft safety brief, approach/depart safely or after shutdown and rotors stop.
Multiple project aircraft	-Adequate aerial supervision. Carded managers for each aircraft. Maintain aircraft separation and positive communications.
PSD Equipment	-Use only approved equipment with current retrofits as per IAIG. Bench testing will be completed prior to any operational mission and conducted a safe distance away from aircraft.
Spheres/Gylcol	-MSDS sheets on-site and reviewed, personnel briefed on hazards, transportation of hazmat complies with agency direction.
Ignition Issues	-Conduct orientation flight with Ignition Specialist, hang fire mitigation and escaped fire contingency established, must complete all operational checklists prior to starting operations.
Aircraft Fueling	- Vendor responsibility. No agency personnel on board. Aircraft shutdown unless closed circuit, open port in accordance with NFPA 407 3-21, 4073-21.2(b). Trained personnel staff extinguisher.
Missing Aircraft, Crash/Search & Rescue	- Duties assigned for extraction, suppression and flight following. Dispatch/helibase responsible to have current Aviation Incident Response/Crash SAR Plan posted and ready to implement.
PSD Malfunctions	-Malfunctions will be addressed in project briefing. Operator will immediately notify pilot of problem and take appropriate action to correct. If malfunction cannot be corrected in the air, the helicopter will land. If fire occurs that the operator cannot extinguished, the pilot will be notified and the machine jettisoned.
Cold Weather Operations	-Utilize approved cold weather garments. This may include nomex hoods and winter weight nomex jackets, pants and flight suits.

9. LINE OFFICER OR DESIGNEE SIGNATURE	**10. TITLE**	**11. DATE**

Continued on the next page

Plastic Sphere Dispenser Project Aviation Safety Plan (continued)

PSD Job Hazard Analysis

JHA Instructions

The JHA shall identify the location of the work project or activity, the name of employee(s) writing the JHA, the date(s) of development, and the name of the appropriate line officer approving it. The supervisor acknowledges that employees have read and understand the contents, have received the required training, and are qualified to perform the work project or activity.

Blocks 1, 2, 3, 4, 5, and 6: Self-explanatory.

Block 7: Identify all tasks and procedures associated with the work project or activity that have potential to cause injury or illness to personnel and damage to property or material. Include emergency evacuation procedures (EEP).

Identify all known or suspect hazards associated with each respective task/procedure listed in Block 7. For example:

a. Research past accidents/incidents
b. Research the Health and Safety Code, FSH 6709.11 or other appropriate literature.
c. Discuss the work project/activity with participants
d. Observe the work project/activity
e. A combination of the above

Block 8: Identify appropriate actions to reduce or eliminate the hazards identified in Block 8. Abatement measures listed below are in the order of the preferred abatement method:

a. Engineering Controls (the most desirable method of abatement). For example, ergonomically designed tools, equipment, and Furniture.
b. Substitution. For example, switching to high flash point, non-toxic solvents.
c. Administrative Controls. For example, limiting exposure by reducing the work schedule; establishing appropriate procedures and practices.
d. PPE (least desirable method of abatement). For example, using hearing protection when working with or close to portable machines (chain saws, rock drills portable water pumps)
e. A combination of the above.

Block 9: The JHA must be reviewed and approved by a line officer. Attach a copy of the JHA as justification for purchase orders when procuring PPE.

Emergency Evacuation Instructions

Project Supervisor and crew members are responsible for developing and discussing field emergency evacuation procedures *(EEP)* and alternatives in the event a person(s) becomes seriously ill or injured at the worksite.

Be prepared to provide the following information:

a. Nature of the accident or injury *(avoid using victim's name).*
b. Type of assistance needed, if any *(ground, air, or water evacuation)*
c. Location of accident or injury, best access route into the worksite *(road name/number),* identifiable ground/air landmarks.

d. Radio frequency(s).
e. Contact person.
f. Local hazards to ground vehicles or aviation.
g. Weather conditions *(wind speed & direction, visibility, temp).*
h. Topography.
i. Number of person(s) to be transported
j. Estimated weight of passengers for air/water evacuation.

The items listed above serve only as guidelines for the development of emergency evacuation procedures.

JHA and Emergency Evacuation Procedures Acknowledgment

We, the undersigned Project Supervisor and crew members, acknowledge participation in the development of this JHA *(as applicable)* and accompanying emergency evacuation procedures. We have thoroughly discussed and understand the provisions of each of these documents:

SIGNATURE DATE Project Supervisor	SIGNATURE DATE

AVIATION RISK ASSESSMENT WORKSHEET (Example)

Assess the risks involved with the proposed operation. Use additional sheets if necessary. Line Officer/Designee Signature Required. Reference IHOG Chapter 3.II.C.2

Chart 3-2: Risk Assessment Matrix			HAZARD PROBABILITY				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
EFFECT	Catastrophic	I	Extremely High(4)				Medium
	Critical	II			High(3)	Medium	
	Moderate	III	High	Medium(2)			
	Negligible	IV	Medium			Low(1)	

Assignment: Date:

Pre-Mitigation hazards rate out as: High – 3.2

Describe Hazard:	Probability (A-E)	Effect (I-IV)	Risk Level
1. PSD malfunction-fire in machine attached to aircraft	C	II	HIGH 3
2. Doors off PSD machine jettison procedures-fall risk to operator.	E	I	MED 2
3. Aircraft malfunction	D	I	HIGH 3
4. General Aviation Aircraft in Area. Military Traffic in Area. *Must be location specific*	C	I	Ex HI 4
5. Over grossed aircraft/critical wind azimuth	D	I	Ex HI 4
Mitigation Controls: **Post-Mitigation hazards rate out as: Low – 1.8**	Probability (A-E)	Effect (I-IV)	Risk Level
1. Emergency procedures covered with Pilot, Operator and Burn Boss/Ignition Specialist in pre-burn briefing. Water reservoir full in machine, pump operational. Spare gallon of water within reach of PSD operator. Machine clean.	D	II	MED 2
2. Utilize approved restraint harness and tether to approved attach point.	E	IV	LOW 1
3. Helicopter Manager ensures helicopter is carded and checks log books upon pre-use inspection. Pilot carded and trained in specific helicopter.	E	I	MED 2
4. Initiate and stay in radio contact with PSD Base. Monitor VHF. Have Dispatch check/clear MTRs in advance. Issue NOTAM if necessary. See and avoid. *MUST be completed specific to project area.*	E	I	MED 2
5. Pilot completes load calculation form properly for current and anticipated conditions. New load calculation will be completed for every 5° change (F) and 1,000' elevation change. Manager will ensure load is commensurate with allowable payload as recorded on load calculation.	E	I	MED 2

Approved By (Line Officer or Designee) Title: Date:

Plastic Sphere Dispenser Project Aviation Safety Plan (continued)

Job Risk Analysis

Helicopter Manager/Pilot review with all participants as part of preflight briefing.

Is everything approved with clear instructions, aviation plan signed and reviewed?	☐ Yes	☐ No	☐ NA
Are communications and flight following established, including repeater tones?	☐ Yes	☐ No	☐ NA
Can terrain, altitude, temperature, or weather that could have an adverse effect be mitigated?	☐ Yes	☐ No	☐ NA
Are all aerial hazards identified and known to all participants?	☐ Yes	☐ No	☐ NA
Have mitigating measures been taken to avoid conflicts with military or civilian aircraft.	☐ Yes	☐ No	☐ NA
Have adequate landing areas been identified and or improved to minimum standards.	☐ Yes	☐ No	☐ NA
Are all agency personnel qualified for the mission?	☐ Yes	☐ No	☐ NA
Is the pilot carded and experienced for the mission to be conducted?	☐ Yes	☐ No	☐ NA
Are pilot flight and duty times compromised?	☐ Yes	☐ No	☐ NA
Are there enough agency personnel to accomplish the mission safely?	☐ Yes	☐ No	☐ NA
Will adequate briefings be conducted prior to flight to include Pilot, Passengers, and Dispatch?	☐ Yes	☐ No	☐ NA
Are all involved aware that the Pilot has the final authority, but if any passenger feels uncomfortable, that they can decline the flight?	☐ Yes	☐ No	☐ NA
Is the aircraft capable of performing the mission with a margin of safety?	☐ Yes	☐ No	☐ NA
Have manifests of cargo and passengers, load calculations, and/or weight and balance completed?	☐ Yes	☐ No	☐ NA
Is the aircraft properly carded?	☐ Yes	☐ No	☐ NA
Do all personnel have the required PPE?	☐ Yes	☐ No	☐ NA
Fuel planning, adequate fuel on board, fuel truck location, availability of commercial fuel?	☐ Yes	☐ No	☐ NA
Remember maps of areas/sites, handheld radios, cell phones, day/survival packs, and sick sacks.	☐ Yes	☐ No	☐ NA
Is there an alternative method that would accomplish the mission more safely?	☐ Yes	☐ No	☐ NA
Will the mission be conducted at low levels? (Below 500' AGL). Discuss	☐ Yes	☐ No	☐ NA
Can the same objectives be achieved by flying above 500' AGL?	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA

PSD Aerial Ignition Preplanning Checklist

Prescribed Burn plan approved	☐ **yes**	☐ **no**	☐ **N.A.**
Aviation Safety Plan approved	☐ **yes**	☐ **no**	☐ **N.A.**
Burn Blocks prepped for aerial ignition	☐ **yes**	☐ **no**	☐ **N.A.**
Is there an aircraft and pilot available/carded	☐ **yes**	☐ **no**	☐ **N.A.**
Aircraft and fuel truck reserved/scheduled the week before	☐ **yes**	☐ **no**	☐ **N.A.**
PSD Equipment serviced and ready	☐ **yes**	☐ **no**	☐ **N.A.**
PPE including fire shelters for all participants	☐ **yes**	☐ **no**	☐ **N.A.**
Adapters needed/available	☐ **yes**	☐ **no**	☐ **N.A.**
Extra Spheres available/where	☐ **yes**	☐ **no**	☐ **N.A.**
Backup/spare PSD	☐ **yes**	☐ **no**	☐ **N.A.**
Crash rescue/Evacuation equipment ready	☐ **yes**	☐ **no**	☐ **N.A.**
Helispots prepared and approved	☐ **yes**	☐ **no**	☐ **N.A.**
Fire Suppression needs available (Extinguishers, foam, Engine, CAF)	☐ **yes**	☐ **no**	☐ **N.A.**
Enough qualified people available	☐ **yes**	☐ **no**	☐ **N.A.**
PSD Operator(s)	☐ **yes**	☐ **no**	☐ **N.A.**
Helicopter Manager(s)	☐ **yes**	☐ **no**	☐ **N.A.**
Helibase Manager	☐ **yes**	☐ **no**	☐ **N.A.**
Parking Tender(s)	☐ **yes**	☐ **no**	☐ **N.A.**
Fire Protection Group	☐ **yes**	☐ **no**	☐ **N.A.**

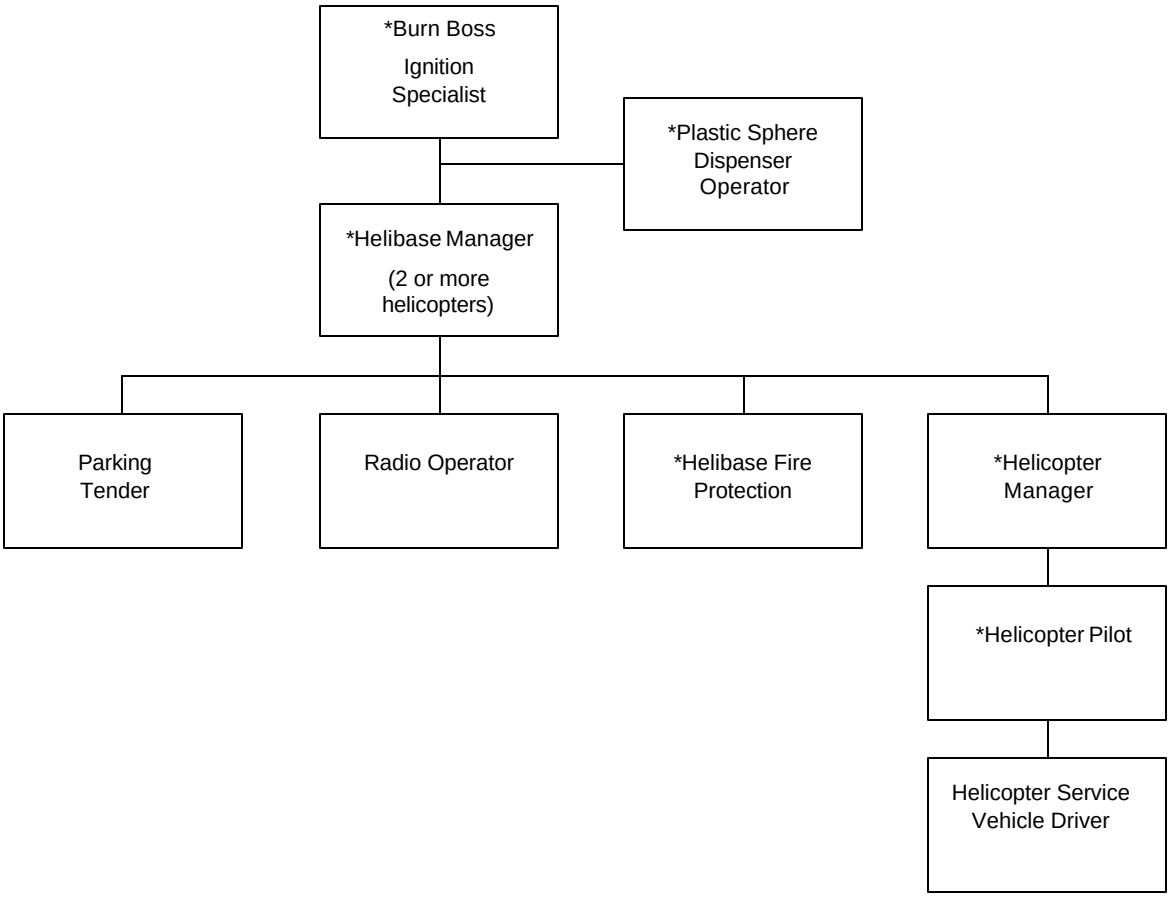
Additional reminders:

_____	☐ **yes**	☐ **no**
_____	☐ **yes**	☐ **no**
_____	☐ **yes**	☐ **no**

Estimated cost: _____

Location of aircraft: _____

Plastic Sphere Dispenser Organization – Prescribed Fire



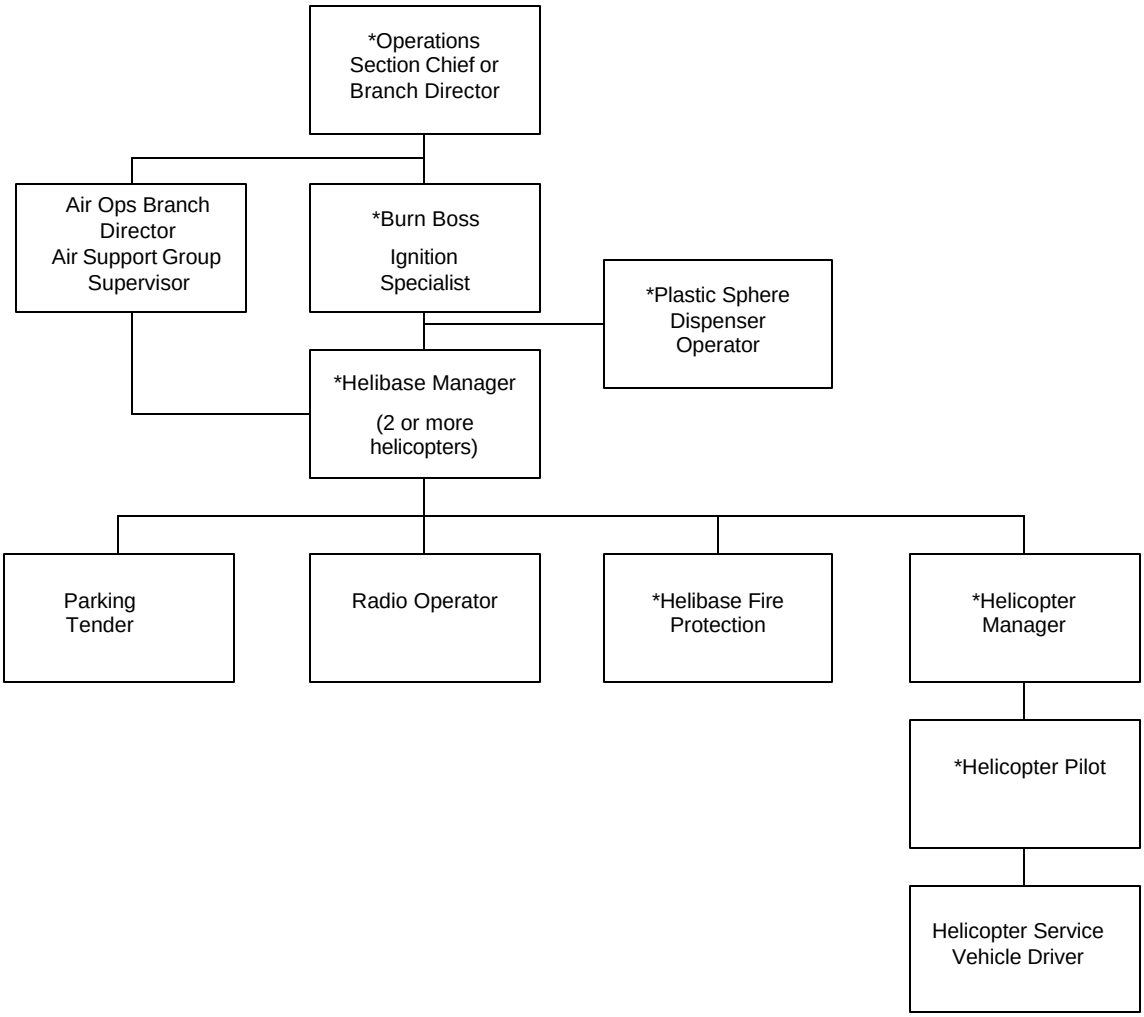
***Minimum required organization. Deviation from staffing required positions requires prior approval from Regional Helicopter Operations Specialist or State/Regional Aviation Manager. Other positions to be filled as needed to provide for a safe and efficient operation.**

Note: Helicopter Manager may serve collateral duty as PLDO.

Note: If Helibase Manager is not required then the Helicopter Manager provides supervision of helibase personnel.

Note: Identify all trainees for given positions on organization chart.

Plastic Sphere Dispenser Organization – Wildland Fire



***Minimum required organization. Deviation from staffing required positions requires prior approval from Regional Helicopter Operations Specialist or State/Regional Aviation Manager. Other positions to be filled as needed to provide for a safe and efficient operation.**

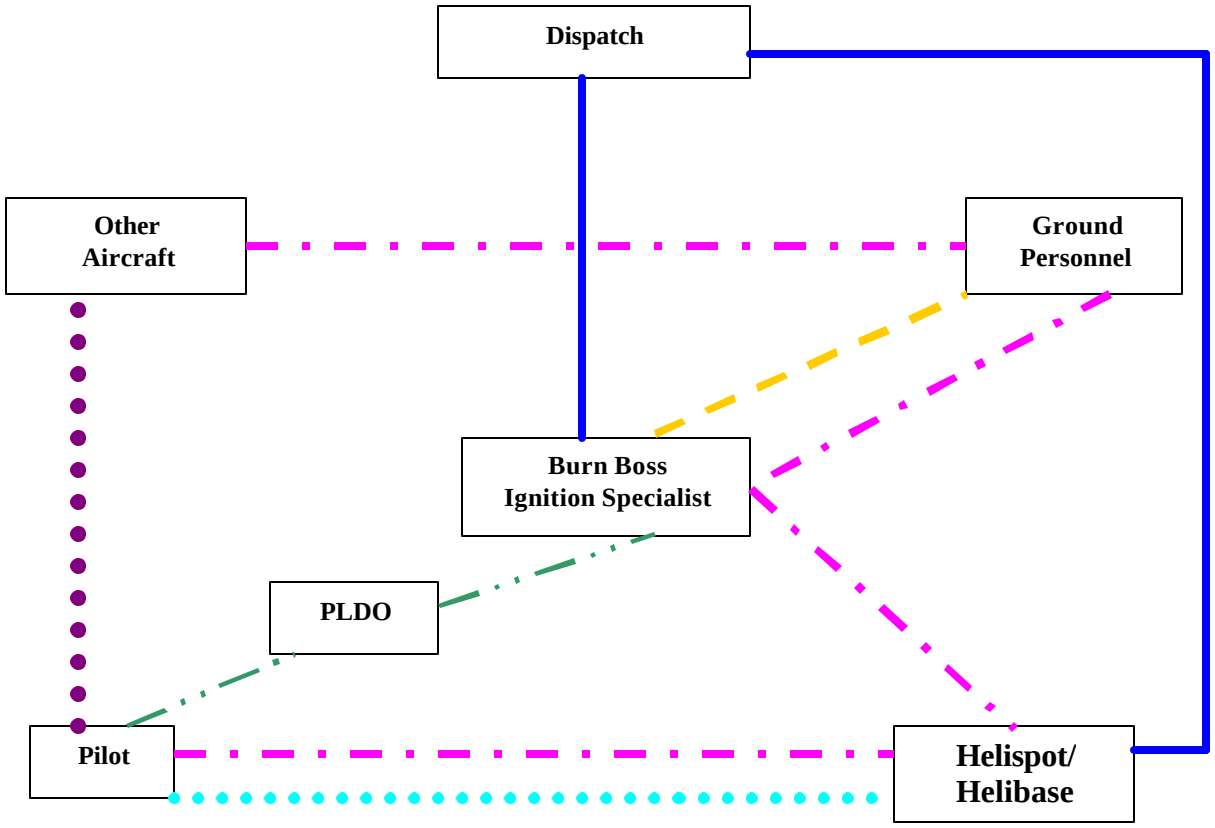
Note: Helicopter Manager may serve collateral duty as PLDO.

Note: If Helibase Manager is not required then the Helicopter Manager provides supervision of helibase personnel.

Note: Identify all trainees for given positions on organization chart.

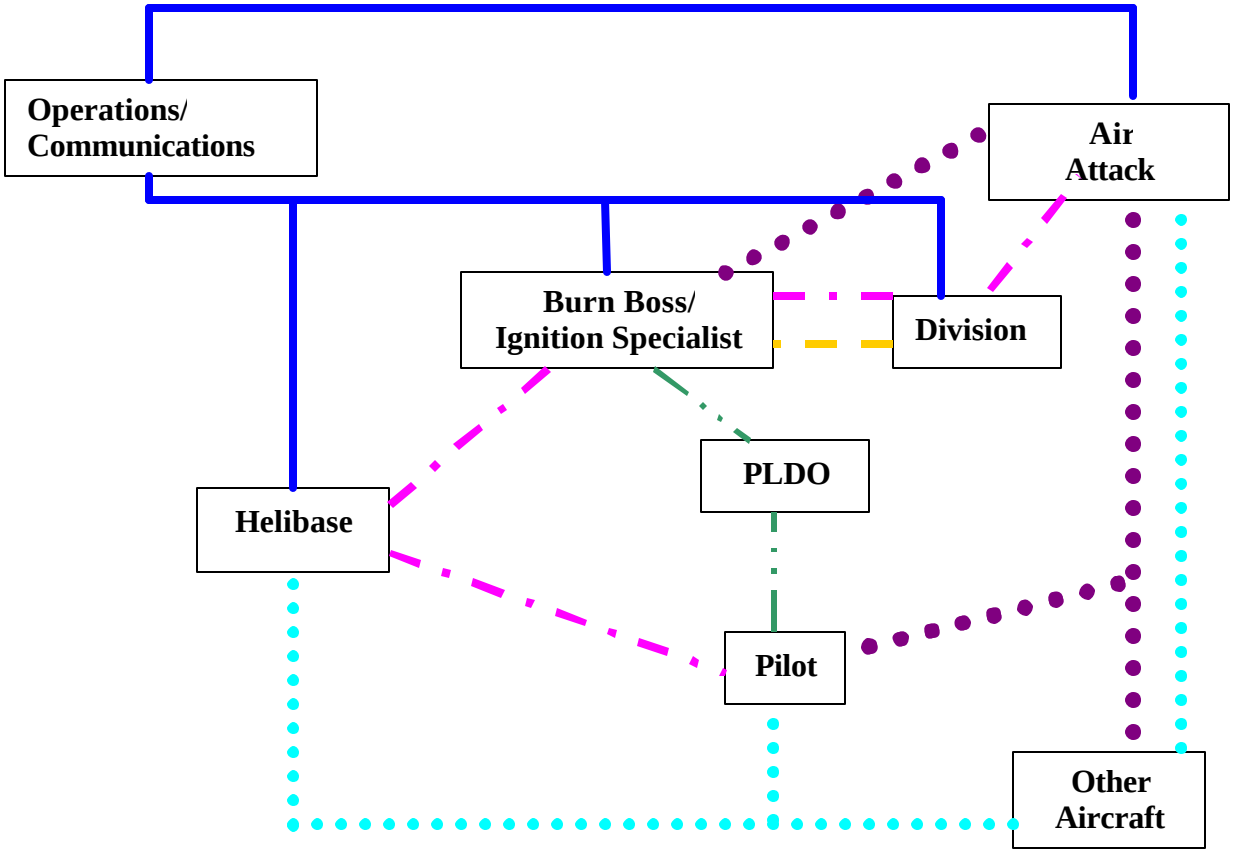
PSD Prescribed Fire Communications Plan

Legend	RX	TX	Tone
Command			
Air to Ground			
Tactical			
Flight Following			
Air to Air			
Intercom System			



PSD Wildland Fire Communications Plan

Legend	RX	TX	Tone
Command			
Air to Ground			
Tactical			
Flight Following			
Air to Air			
Intercom System			



Helicopter Crash Rescue/Medivac Plan

General Instructions			
In the event of an accident, the Helicopter/Helibase/Helitorch Manager will supervise and coordinate the crash rescue activities. Specific crash rescue duties will be assigned to helibase personnel each morning before flights of any kind. Crash rescue, evacuation and first aid equipment will be located near the helipad and equipment's location made known to all helibase personnel. Information and instructions will be sent/received through the local dispatch office or communications.			
Specific Information and Instructions (Utilize cell phone if possible. Do not use names over the radio.)			
1.	Nature of the injury(s)/illness.		
2.	Is medical help needed? If available supply vital signs!		
3.	What transportation is needed? Is patient(s) ambulatory?		
4.	Location of victim.		
5.	Route to be taken (use land marks as guide).		
6.	Equipment needed.		
7.	Name of contact on site.		
8.	Notify appropriate agency line officer.		
EMT(S) on project			
Available Medivac helicopters			
FAA #	HEMG		
Litter/rappel/extraction capable			
Remarks			
FAA #	HEMG		
Litter/rappel/extraction capable			
Remarks			
Nearest medical facility	Location		
Latitude	Longitude		Contact Freq
VOR	NM		DEG
Nearest burn center	Location		
Latitude	Longitude		Contact Freq
VOR	NM		DEG
LifeFlight		Location	
Type aircraft	Phone Number		Contact Freq
Site conditions			
Latitude	Longitude		Contact Freq
VOR	NM		DEG
Wind speed	Elevation (msl)		Temperature (F, C)
Terrain factors		Helispot size	
Proximity of helispot to injury site		Visibility/sunrise/sunset limitations	
Flight hazards			
Other aircraft in area (call signs and frequencies)			
Ground contact and frequencies			

PSD Air Operations/Safety GO/NO GO Checklist

The helicopter operations on this project require the use of this checklist. If all items are not checked as satisfactory and maintained in that state for the duration of the mission, flying operations will be suspended until the deficiency is mitigated.

Helibase Safety

- ☐ Approved Project Aviation Safety Plan.
- ☐ Qualified Helibase/Helispot Manager assigned.
- ☐ Helibase/helispot meet established standards.
- ☐ Organizational chart posted, assignments known.
- ☐ Communications chart posted. Frequency assignments known.
- ☐ Helibase/helispot fire protection meets established standards.
- ☐ Crash rescue/evacuation kits on the helibase/helispot.
- ☐ Current Aviation Incident Response Plan posted at Dispatch/Helibase and ready to implement.
- ☐ All personnel briefed. Aerial ignition personnel briefed on in-flight operations.
- ☐ Separation of aircraft (if more than one used).
- ☐ Personal protective equipment meet established standards.
- ☐ Flight hazard map posted/hazards known to pilot.

Aircraft/Pilot(s)

- ☐ Check pilot and aircraft approval cards.
- ☐ Check pilot and aircraft limitations.
- ☐ Load calculations prepared and posted.
- ☐ Check aircraft radios.
- ☐ Remove all loose articles from aircraft.
- ☐ Fire shelter on board aircraft for each person.
- ☐ Water bucket ordered with aircraft (optional).
- ☐ Approved Secondary Restraint Harness and approved aircraft hardpoint to attach to.

Plastic Sphere Dispenser

- ☐ Installation correct with restraints in place.
- ☐ Mechanical operation satisfactory.
- ☐ Extinguisher (water reservoir) system filled and operational.
- ☐ Glycol reservoir filled and tightly capped.
- ☐ 20-second ignition delay achieved.
- ☐ Intercom and aircraft-to-ground communications operable.
- ☐ Pilot has been briefed and agrees that all is in order.
- ☐ Sphere containers secured.
- ☐ Seat belt cutter available for emergency use.
- ☐ Additional container of water available.
- ☐ Tool kit/Premo Mark III manual on board aircraft (optional).

Burning Operations

- ☐ All persons briefed and assignments known.
- ☐ Maps/photos of project area used/posted.
- ☐ Special weather considerations known/discussed.
- ☐ Communication plan posted and frequency assignments known.
- ☐ Emergency operations plan known and discussed.
- ☐ Personal protective equipment meets established standards.
- ☐ Special safety considerations known and discussed.

Support Equipment/ Personnel

- ☐ Adequate support equipment/personnel to complete mission.
- ☐ Pump/engine operational checks.
- ☐ Radios/communications operationally checked.
- ☐ Support equipment/personnel propositioned before actual operations begin.
- ☐ Adequate supply of plastic spheres and glycol to complete project.
- ☐ PSD checklist complete.

_____ / _____ _____ / _____

PSD Operator Date Pilot Date

_____ /

Burn Boss/Ignition Specialist Date

Interagency PSD Operator
Annual Recertification Training Form

Suggested Time 2 hours.

Training Aids Premo Mark III- plastic sphere dispenser
Current Interagency Aerial Ignition Guide (IAIG).

Objectives Each PSD Operator shall review the applicable sections of the Interagency Aerial Ignition Guide as well as agency-specific guidance and direction. Complete items 1-6 in chapters II and IV.A and the PLDO will have fulfilled the annual refresher requirement.

Document annual recertification.

Student's Name _____

Date _____

Location of Training _____

Instructor _____

A. PLDO will complete the pre-use bench test.

PART I - BENCH TEST

1. ❑ Properly examine machine prior to firing
2. ❑ Check fuses
3. ❑ Check glycol level and emergency water
4. ❑ Checked needles
5. ❑ Rotated manual assist
6. ❑ Checked power and rotation of manual assist (arrow)
7. ❑ Briefed with burn boss
8. ❑ Gave proper responses
9. ❑ Clear communication (concise)
10. ❑ Remained calm
11. ❑ Handled malfunctions (comments)
12. ❑ Secured machine properly

The recertification form is continued on the next page.

Interagency PSD Operator
Annual Recertification Training
(Continued)

B. Emergency Procedures (to be memorized and relayed back to certifier)

1. ❑ Operator closes chute feed handles.
2. ❑ Operator notifies pilot of problem and gives brief explanation.
3. ❑ If machine continues to operate, operator assesses situation.
4. ❑ If problem is a jammed machine, w/NO FIRE, operator pulls manual assist wheel outward and rotates forward then backward until spheres have cleared machine. When obstruction is cleared, operator checks and or resets circuit breakers; operator continues communication with pilot.
5. ❑ If "FIRE IS PRESENT," operator pushes red button (emergency water) and holds button depressed for up to 30 seconds. If power is off, operator uses the required 1-gallon canteen to extinguish fire by pouring water into the hopper. Make sure the fire is out. Pilot is to land at nearest possible site.
6. ❑ If fire proves uncontrollable, operator notifies pilot and then jettisons the machine (unless it occurs over a congested area). If fire is present in the machine itself, operator then cuts the retaining strap between the buckle and the door, grasps dispenser, and pushes it out of the aircraft.

C. Verbal Commands – In flight (to be memorized and relayed back to certifier)

1. ❑ Burn boss/Ignition Specialist communicates to PLDO location boundaries of burn unit and states, "Prepare to fire."
2. ❑ PLDO responds, after machine is ready, "Ready to fire."
3. ❑ Burn boss communicates to PLDO to "start firing/number of chutes/machine speed."
4. ❑ PLDO responds, "Firing # of chutes and speed."
5. ❑ Burn boss states, "Prepare to stop firing." PLDO has hand on chutes and states, "Ready to stop."
6. ❑ Burn boss states, "Stop firing."
7. ❑ PLDO states, "Chutes closed." *** PLDO waits until spheres stopped dropping and states, "Machine clear."

D. Personal Protective/Emergency Equipment (certifier asks operator to recite)

1. ❑ SPH 4-5 flight helmet
2. ❑ Nomex flight suit or Nomex shirt and trousers
3. ❑ Nomex flight gloves or other approved (leather, etc.)
4. ❑ Eight-inch top leather boots (boot tops covered by Nomex)
5. ❑ Full body harness and tether (inspect harness/tether before each use)
6. ❑ Seatbelt cutter – located within reach of operator
7. ❑ One-gallon canteen – located within reach of operator

Plastic Sphere Dispenser Operator (PLDO)
Task Sheet

Trainee	
Unit	
District	
Date of classroom and bench test training	
Training location	
Instructor	
Instructor's training recommendations and comments: **(to fully qualify trainee operator)**	

Experience Record

Live firing machine operation
Minimum qualification PROJECT HECM

Date	Flight Hours	Evaluator's Name	Acres Burned	Comments

Recommended by: _____ Date _____

Reviewed by: _____ Date _____

Approved and certified by: _____ Date _____

* Aerial Ignition Annual Qualifications Update Sheet

Submitted by:

As of (date):

Name/Agency	Helitorch/PSD Annual Re-Certification** Dates:	Last Operational Assignment Dates and type of equipment:			
		HTMG	HTMM	HTPT	PLDO

*** Agency/Bureau Unit Name**

**** Reference the Interagency Aerial Ignition Guide chapter II, pg. 2, IV B. for annual re-certification requirements.**

Submit this form annually to the appropriate Agency/Bureau manager responsible for tracking qualifications and re-certification.

Plastic Sphere Dispenser Use Record

Machine # _____

****

Date: ___/___/___ Location/Project: _____

Operator: _____Acres treated: _____ Spheres used: _____

Problems encountered: _____

_____

_____

_____

Maintenance performed: _____

_____

_____

_____

Resupply needs: _____

_____

_____

_____

Order/purchase date: _____/_____/_____

Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

The record is continued on the next page.

PSD Use Record
(continued)

Date	*Spheres Used*	*Maintenance and Repairs Performed*

Appendix B – Helitorch Operations

- Helitorch Project Aviation Safety Plan (Example Format)
  - Job Hazard Analysis
  - Job Risk Analysis

- Aerial Ignition Preplanning Checklist
- Aerial Ignition Organization Chart – Helitorch Prescribed Fire
- Aerial Ignition Organization Chart – Helitorch Wildland Fire
- Helitorch Prescribed Fire Communications Plan
- Helitorch Wildland Fire Communications Plan
- Helicopter Crash Rescue/Medivac Plan
- Helitorch Inspection Checklist
- Helitorch Mix Systems Checklist
- Helitorch Air Operations GO/NO GO Checklist (Required Format)
- HTMG, HTMM, HTPT Task Sheet (Required Format)
- Aerial Ignition Annual Qualifications Update Sheet
- Helitorch Pre-Use Checklist
- Helitorch Post-Use Maintenance Checklist
- Helitorch Annual Maintenance and Winterization Checklist
- Helitorch Use Record (Example Format)

Job Hazard Analysis (JHA)

A required document that should outline the primary tasks, identify hazards, and describe methods to mitigate or remove risks associated with helitorch operations. Review of the helitorch JHA with all helitorch personnel prior to commencing a project is required.

Helitorch Project Aviation Safety Plan

Mission: **Aerial Ignition, Helitorch**	Project Name:	Unit:
Anticipated Project Date:	Start Time:	Ending Time:
Project Plan Prepared by:	Title:	Date:
Note: Signature by the preparer verifies that all personnel have the required training for the mission. Attach map, clearly showing areas to be flown; aerial hazards must be indicated.		
Project Plan Reviewed by:	Title:	Date:
Project Plan Reviewed by:	Title:	Date:
Project Plan Reviewed by:	Title:	Date:
This Project is approved by:	Title:	Date:

Project Description:

Attachments: ☐ Map ☒ Aerial Ignition Checklist	☐ Other:	
Project Supervisor:	Phone:	Cell:
Helicopter Manager:	Phone:	Cell:
Helitorch Manager:	Phone:	Cell:
Participants:		

Type of Flight: **Aerial Ignition, Helitorch**		Desired Make/Model:	Charge Code:
Type Procurement:		Method of Payment:	Projected Cost:
Vendor:		Phone:	Cell:
Aircraft N#:	Make & Model:	Aircraft Color:	
Pilot Name:		Pilot Carded: ☐ Yes ☐ No	A/C Carded: ☐ Yes ☐ No
Flight Follow:		Request or Flight #:	
Method of Resource Tracking: ☐ Phone ☐ Radio		☐ Prior to Takeoff ☐ Each Stop En Route ☐ Arrival at Dest.	
Scheduling Dispatch Phone:		Destination Dispatch Phone:	

FM Receive:	FM Transmit:	Tones:
FM Receive:	FM Transmit:	Tones:
FM Receive:	FM Transmit:	Tones:
AM Air to Air:	AM Unicom:	Other:

This form is continued on the next page.

Helitorch Project Aviation Safety Plan (continued)

Crash/Search and Rescue Procedures: Contact Dispatch, follow local/regional crash/search and rescue guide/Aircraft Incident Response Plan.

Start Location	Latitude	Longitude	Elevation	Helibase/Helispot Size
Destination Location	Latitude	Longitude	Elevation	Helibase/Helispot Size

Passenger Name	Weight	Departure Point	Destination Point
Cargo Weight	Cubic Feet of Cargo	Hazardous Material	Destination
		☐ Yes ☐ No	
		☐ Yes ☐ No	

Type of Operation – check applicable boxes	**Personal Protective Equipment Requirements**
☐ Helo Ops - ground personnel	Nomex clothing, hardhat w/chin strap, gloves, leather boots, eye protection, hearing protection, fire extinguisher.
☐ Rotor Wing flights	Flight helmet, Nomex clothing, gloves, leather boots, eye protection, hearing protection, approved secondary restraint harness for doors off flights.
☐ Doors off flight	Use approved secondary restraint harness attached to approved aircraft hardpoints.
☐ Helitorch Mix Crew	Anti-static cotton clothing, hard hat w/chin strap, ear protection, Nitrile & cotton/leather gloves, NIOSH dust mask, chemical splash goggles.

Justification statement for low-level flights:
Management has deemed aerial ignition as the best method of achieving Federal goals. Aerial ignition is conducted below 500' above ground level (AGL). Reference IHOG chapter 3, Operational Planning.

Special instructions:

All helitorch operations will be conducted in accordance with Manual and Handbook direction as well as the Interagency Aerial Ignition Guide and Interagency Helicopter Operations Guide. A fire shelter will be available for the Pilot and trained in use. Helitorch Manager, Mixmaster, and Parking Tender must be qualified and current for helitorch operations. Helitorch Manager needs to assure that all the helitorch equipment meets agency standards.

Aircraft Manager must confirm with Dispatch prior to the flight that affected routes' Schedulers contacted for Route Activity.

Military Training Route (MTR) Information

MTR	Route Legs-Altitude	Activity	Time		Time Zone
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local
		☐ Hot ☐ Cold	Start	Stop	☐ UTC ☐ Local

This form is continued on the next page.

Helitorch Project Aviation Safety Plan (continued)

Helitorch Job Hazard Analysis

Aircraft Manager/Pilot review with all participants as part of preflight briefing.

JOB HAZARD ANALYSIS (*JHA*) *(Instructions on next page)*	1. WORK PROJECT/ACTIVITY Helitorch Operations	2. LOCATION	3. UNIT
	4. Prepared By	5. JOB TITLE	6. DATE PREPARED

7. TASKS/HAZARDS	8. ABATEMENT ACTIONS
Personnel Qualifications	-Helitorch Module shall be certified annually. Pilot and helicopter will be carded annually for Helitorch operations. Pilot will be knowledgeable in fire behavior and trained in use of the fire shelter. Use of proper PPE by all. Pre- and Post Op briefings will be performed. Use of proper PPE by all. Pre- and Post Op briefings will be performed.
Unknown Responsibilities	-Prior to each project, operator will review appropriate portions of IHOG and IAIG. The project briefing will cover responsibilities and emergency procedures
Aircraft Avoidance	-See and avoid. Check MTR routes in advance. Practice risk management; confirm that Dispatch has made contact with schedulers to de-conflict. Fly established airport patterns, initiate and stay in radio contact.
Weather	-Use weather advisory. Maintain VFR minimums, cancel mission if necessary.
High/Hot/Heavy	-Performance planning complete/insure accurate load calculations. Do not place the aircraft in performance related situations for current and expected environmental conditions. Do not place the aircraft in performance related situations. Avoid Down wind runs.
Low level obstacles	-Complete a high level recon, no unnecessary low level flight.
Pilot not familiar with area	-Supply hazard maps. Complete high-level recon prior to low-level work, project area identified. Pre – Burn orientation flight.
Noise, rotor wash	-Wear ear and eye protection. 15-minute eye wash station on site.
Unplanned aircraft events	-All personnel equipped with required PPE and trained in crash procedures.
Hazardous materials	-Qualified personnel will handle, review MSDS, inform pilot. Use proper PPE. Driver of batch truck will have current Hazmat endorsement, and comply w/all applicable federal/state/local laws.
Communications	-Flight following established, checked and followed, communication plan posted. Maintain communications at all times, establish backup alternate frequencies. Take handheld radio along. Call in prior to landing. If radio contact is lost return to best suitable landing area and check-in. Parking tender outfitted with radio and headset/helmet w/remote transmit switch for takeoffs/landings. All hand held electronic devices such as radios, pagers, cell phones, etc. shall be turned off within 50’ of any fuel preparation/vapor removal area.
Rotor hazards	-Pilot perform aircraft safety brief, approach/depart safely or after shutdown and rotors stop.
Multiple project aircraft	-Adequate aerial supervision. Carded managers for each aircraft. Maintain aircraft separation and positive communications.

Continued on the next page

JOB HAZARD ANALYSIS *(JHA)* *(Instructions on next page)*	1. WORK PROJECT/ACTIVITY Helitorch Operations	2. LOCATION	3. UNIT
	4. Prepared By	5. JOB TITLE	6. DATE PREPARED

7. TASKS/HAZARDS	8. ABATEMENT ACTIONS
Helitorch Equipment	-Use only approved equipment with current retrofits as per IAIG. Equipment checks prior to operations.
Fuel/Gelling Agent	-MSDS sheets on-site and reviewed, fire protection in place, personnel briefed on hazards, emergency contingency plan reviewed and in place, transportation of hazmat complies with agency direction, No Smoking signs posted, no ignition sources. Proper bonding. Limit personnel on site to those required for operation. Eyewash station onsite.
Ignition Issues	-Conduct orientation flight with Ignition Specialist, hang fire mitigation and escaped fire contingency established, must complete all operational checklists prior to starting operations.
Aircraft Fueling	- Vendor responsibility. No agency personnel on board. Aircraft shutdown unless closed circuit, open port in accordance with NFPA 407 3-21, 4073-21.2(b) and requested by government. Trained personnel staff extinguisher.
Missing Aircraft, Crash/Search & Rescue	- Duties assigned for extraction, suppression and flight following. Dispatch/helibase responsible to have current Aviation Incident Response/Crash Search and Rescue Plan posted and ready to implement.
Malfunctions	- Malfunctions will be addressed in project briefing. Any malfunctions will immediately halt the project. Helicopter will sit down until the problem is identified and mitigated. If entanglement occurs, wait until the torch and helicopter are safely on the ground and the pilot has given approval to approach the aircraft. Designate helitorch jettison site.
Personal in Burn Area	- Perform high level recon to insure that agency personnel near burn unit maintain communication and are clear of the burn area. Insure that non-agency personnel are clear of burn area.
General Aviation Aircraft	- PIO will post maps and descriptions of activities at Local FBO's. Backcountry VHF-AM will be monitored in the aircraft and at the Helibase.
. .	**ITEMS LISTED BELOW ARE SPECIFIC TO WESTERN HELICRAFT HELITORCH**
Moving fuel barrels	- Get help moving fuel drums. Lift with legs rather than back. Ensure route is unobstructed. Hand and foot protection.
Pressure release of fuel barrels	- Remove large barrel bung slowly to provide gradual release of pressure. Use eye protection.
Barrel exchanges	- Maintain good visual and radio communication between pilot and ground crew. Ground crew is equipped with a radio headset and hardhat or SPH 4/5 flight helmet with remote transmit button/switch. Maintain visual contact with cables. Primary crewmember ensures cables do not twist as helicopter lifts. Do not attempt to make contact with the helitorch until it has made ground contact.
Component changes	- Mixing of helitorch components between kits may cause compatibility issues due to different tolerances.

9. LINE OFFICER or DESIGNEE SIGNATURE	10. TITLE	11. DATE

Continued on the next page

Helitorch Project Aviation Safety Plan (continued)

Helitorch Job Hazard Analysis

JHA Instructions

The JHA shall identify the location of the work project or activity, the name of employee(s) writing the JHA, the date(s) of development, and the name of the appropriate line officer approving it. The supervisor acknowledges that employees have read and understand the contents, have received the required training, and are qualified to perform the work project or activity.

Blocks 1, 2, 3, 4, 5, and 6: Self-explanatory.

Block 7: Identify all tasks and procedures associated with the work project or activity that have potential to cause injury or illness to personnel and damage to property or material. Include emergency evacuation procedures (EEP).

Identify all known or suspect hazards associated with each respective task/procedure listed in Block 7. For example:

a. Research past accidents/incidents
b. Research the Health and Safety Code, FSH 6709.11 or other appropriate literature.
c. Discuss the work project/activity with participants
d. Observe the work project/activity
e. A combination of the above

Block 8: Identify appropriate actions to reduce or eliminate the hazards identified in Block 8. Abatement measures listed below are in the order of the preferred abatement method:

a. Engineering Controls (the most desirable method of abatement). For example, ergonomically designed tools, equipment, and Furniture.
b. Substitution. For example, switching to high flash point, non-toxic solvents.
c. Administrative Controls. For example, limiting exposure by reducing the work schedule; establishing appropriate procedures and practices.
d. PPE (least desirable method of abatement). For example, using hearing protection when working with or close to portable machines (chain saws, rock drills portable water pumps)
e. A combination of the above.

Block 9: The JHA must be reviewed and approved by a line officer. Attach a copy of the JHA as justification for purchase orders when procuring PPE.

Emergency Evacuation Instructions

Project Supervisor and crew members are responsible for developing and discussing field emergency evacuation procedures *(EEP)* and alternatives in the event a person(s) becomes seriously ill or injured at the worksite.

Be prepared to provide the following information:

a. Nature of the accident or injury *(avoid using victim's name).*
b. Type of assistance needed, if any *(ground, air, or water evacuation)*
c. Location of accident or injury, best access route into the worksite *(road name/number),* identifiable ground/air landmarks.

d. Radio frequency(s).
e. Contact person.
f. Local hazards to ground vehicles or aviation.
g. Weather conditions *(wind speed & direction, visibility, temp).*
h. Topography.
i. Number of person(s) to be transported
j. Estimated weight of passengers for air/water evacuation.

The items listed above serve only as guidelines for the development of emergency evacuation procedures.

JHA and Emergency Evacuation Procedures Acknowledgment

We, the undersigned Project Supervisor and crew members, acknowledge participation in the development of this JHA *(as applicable)* and accompanying emergency evacuation procedures. We have thoroughly discussed and understand the provisions of each of these documents:

SIGNATURE DATE Project Supervisor	SIGNATURE DATE

AVIATION RISK ASSESSMENT WORKSHEET (Example)

Assess the risks involved with the proposed operation. Use additional sheets if necessary. Line Officer/Designee Signature Required. Reference IHOG Chapter 3.II.C.2

Chart 3-2: Risk Assessment Matrix			**HAZARD PROBABILITY**				
			Frequent	Likely	Occasional	Seldom	Unlikely
			A	B	C	D	E
EFFECT	Catastrophic	I	Extremely High(4)	High(3)			Medium
	Critical	II				Medium	
	Moderate	III	High	Medium(2)			
	Negligible	IV	Medium			Low(1)	

Assignment: Date:

Pre-Mitigation hazards rate out as: High – 3.14

Describe Hazard:	Probability (A-E)	Effect (I-IV)	Risk Level
1.General Aviation Aircraft Encroachment	B	II	H 3
2.Density Altitude- Hot, High, Heavy	C	II	H 3
3.Low level/hanging torch obstacles	C	II	H 3
4.Rotor wash/flying debris, Noise	A	II	XH 4
5.Multiple project aircraft	A	I	XH 4
6.Lost load/hang fire	C	III	H 3
7.Emergency landing	E	I	M 2
Mitigation Controls: **Post-Mitigation hazards rate out as: Low – 1.29**	Probability (A-E)	Effect (I-IV)	Risk Level
1. Place NOTAM about Firing Area and Helibase. Post Flyers at local airport with information on aircraft activity. Contact local FBO's with information.	C	II	H 3
2. Ensure pilots complete load calculations for the current and predicted conditions. Ensure torch is marked with empty and filled weight.	E	IV	L 1
3. Post and review flight hazard maps daily at briefing. Complete high and low level recon of project area.	E	IV	L 1
4. Ensure ground personal and those flying in aircraft are wearing required PPE.	D	IV	L 1
5. Ensure qualified supervision is in place and adequate spacing of aircraft is maintained. Ensure all radios are functioning properly.	E	IV	L 1
6. Ensure all equipment is in working order at beginning of shift and check at fueling breaks. Do not leave unit with hang fire.	E	IV	L 1
7. Use of high performance well maintained helicopters. Designated emergency landing site at the beginning of operations. Designate and ensure crash personnel are briefed.	E	II	L 1

Approved By (Line Officer or Designee) Title: Date:

Helitorch Project Aviation Safety Plan (continued)

Job Risk Analysis

Helicopter/helitorch Manager/Pilot review with all participants as part of preflight briefing.

Is everything approved with clear instructions, aviation plan signed and reviewed?	☐ Yes	☐ No	☐ NA
Are communications and flight following established, including repeater tones?	☐ Yes	☐ No	☐ NA
Can terrain, altitude, temperature, or weather that could have an adverse effect be mitigated?	☐ Yes	☐ No	☐ NA
Are all aerial hazards identified and known to all participants?	☐ Yes	☐ No	☐ NA
Have mitigating measures been taken to avoid conflicts with military or civilian aircraft.	☐ Yes	☐ No	☐ NA
Have adequate landing areas been identified and or improved to minimum standards.	☐ Yes	☐ No	☐ NA
Are all agency personnel qualified for the mission?	☐ Yes	☐ No	☐ NA
Is the pilot carded and experienced for the mission to be conducted?	☐ Yes	☐ No	☐ NA
Are pilot flight and duty times compromised?	☐ Yes	☐ No	☐ NA
Are there enough agency personnel to accomplish the mission safely?	☐ Yes	☐ No	☐ NA
Will adequate briefings be conducted prior to flight to include Pilot, Passengers, and Dispatch?	☐ Yes	☐ No	☐ NA
Are all involved aware that the Pilot has the final authority, but if any passenger feels uncomfortable, that they can decline the flight?	☐ Yes	☐ No	☐ NA
Is the aircraft capable of performing the mission with a margin of safety?	☐ Yes	☐ No	☐ NA
Have manifests of cargo and passengers, load calculations, and/or weight and balance completed?	☐ Yes	☐ No	☐ NA
Is the aircraft properly carded?	☐ Yes	☐ No	☐ NA
Do all personnel have the required PPE?	☐ Yes	☐ No	☐ NA
Fuel planning, adequate fuel on board, fuel truck location, availability of commercial fuel?	☐ Yes	☐ No	☐ NA
Remember maps of areas/sites, handheld radios, cell phones, day/survival packs, and sick sacks.	☐ Yes	☐ No	☐ NA
Is there an alternative method that would accomplish the mission more safely?	☐ Yes	☐ No	☐ NA
Will the mission be conducted at low levels? (Below 500’ AGL). Discuss	☐ Yes	☐ No	☐ NA
Can the same objectives be achieved by flying above 500’ AGL?	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA
	☐ Yes	☐ No	☐ NA

Helitorch Aerial Ignition Preplanning Checklist

Prescribed Burn plan approved	☐ **yes**	☐ **no**	☐ **N.A.**
Aviation Safety Plan approved	☐ **yes**	☐ **no**	☐ **N.A.**
Burn Blocks prepped for aerial ignition	☐ **yes**	☐ **no**	☐ **N.A.**
Is there an aircraft and pilot available/carded	☐ **yes**	☐ **no**	☐ **N.A.**
Aircraft and fuel truck reserved/scheduled the week before	☐ **yes**	☐ **no**	☐ **N.A.**
Helitorch Equipment serviced and ready	☐ **yes**	☐ **no**	☐ **N.A.**
PPE including fire shelters for all participants	☐ **yes**	☐ **no**	☐ **N.A.**
Adapters needed/available	☐ **yes**	☐ **no**	☐ **N.A.**
Extra Gelling Agent/Propane/Fuel available/where	☐ **yes**	☐ **no**	☐ **N.A.**
Backup/spare Helitorch	☐ **yes**	☐ **no**	☐ **N.A.**
Crash rescue/Evacuation equipment ready	☐ **yes**	☐ **no**	☐ **N.A.**
Helispots prepared and approved	☐ **yes**	☐ **no**	☐ **N.A.**
Fire Suppression needs available (extinguishers, foam, Engine, CAF)	☐ **yes**	☐ **no**	☐ **N.A.**
Enough qualified people available	☐ **yes**	☐ **no**	☐ **N.A.**
Helicopter Manager(s)	☐ **yes**	☐ **no**	☐ **N.A.**
Helibase Manager	☐ **yes**	☐ **no**	☐ **N.A.**
Helitorch Manager	☐ **yes**	☐ **no**	☐ **N.A.**
Parking Tender(s)	☐ **yes**	☐ **no**	☐ **N.A.**
Mixmaster	☐ **yes**	☐ **no**	☐ **N.A.**
Mixing Crew	☐ **yes**	☐ **no**	☐ **N.A.**
Fire Protection Group	☐ **yes**	☐ **no**	☐ **N.A.**

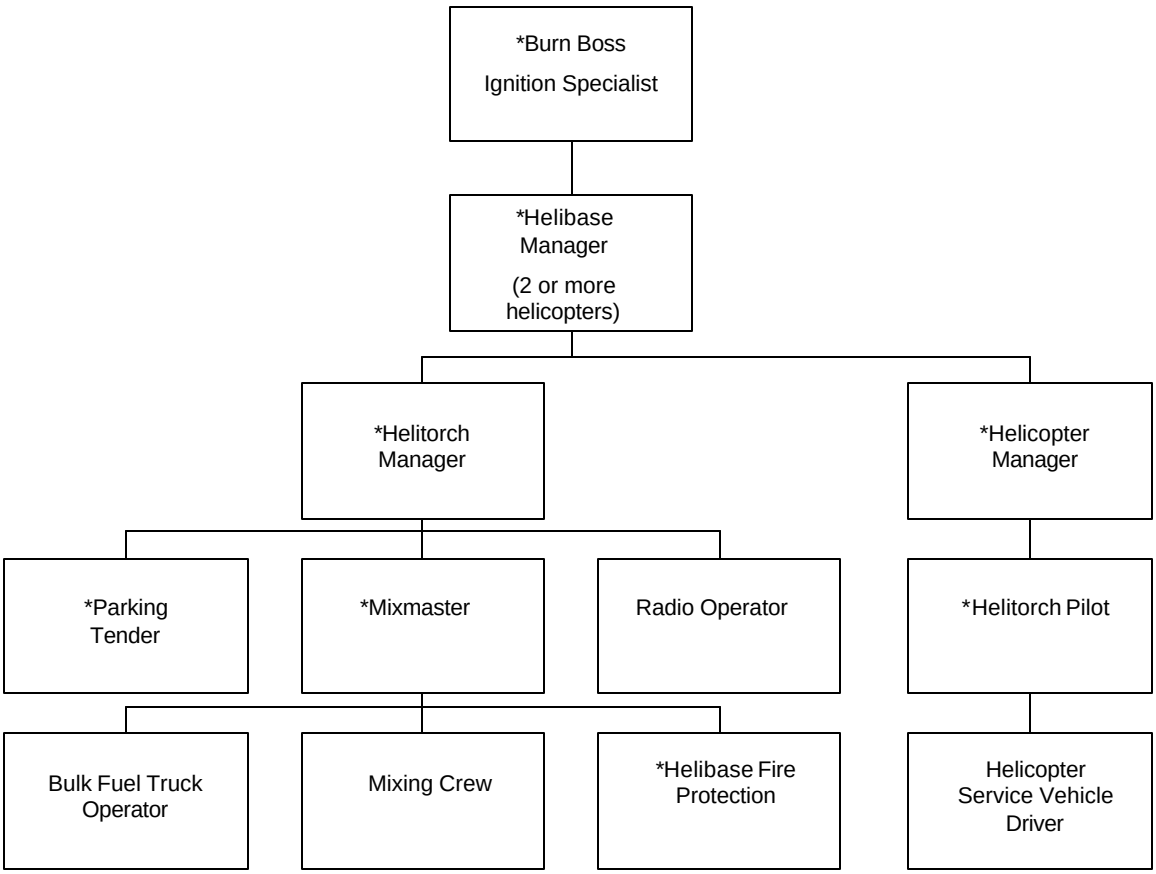
Additional reminders:

_____	☐ **yes**	☐ **no**
_____	☐ **yes**	☐ **no**
_____	☐ **yes**	☐ **no**

Estimated cost: _____

Location of aircraft: _____

Helitorch Organization Chart –Prescribed Fire



***Minimum required organization. Deviation from staffing required positions requires prior approval from Regional Helicopter Operations Specialist or State/Regional Aviation Manager. Other positions to be filled as needed to provide for a safe and efficient operation.**

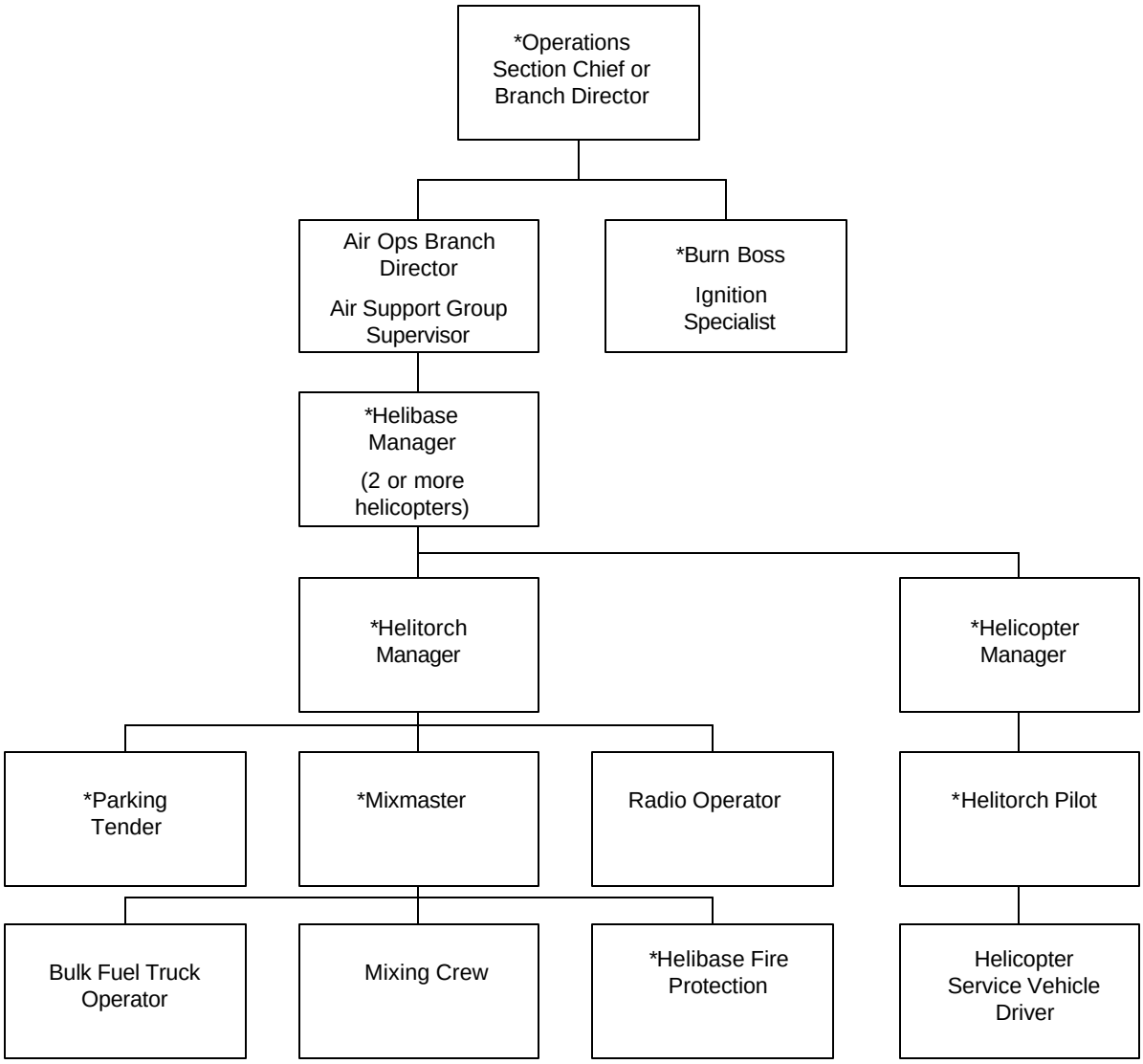
Note: On operations utilizing only one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helicopter Manager as well as either (not both) the HTMM or HTPT. On operations utilizing more than one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helibase Manager providing that they do not assume duties as the HTMM or HTPT. (Reference chapter IV for collateral duty allowances for all positions).

Note: If Helibase Manager is not required then the Helitorch Manager provides supervision of helibase personnel.

Note: Helibase Fire Protection may be staffed by members of the Mixing Crew.

Note: Identify all trainees for given positions on the organization chart.

Helitorch Organization Chart –Wildland Fire



***Minimum required organization. Deviation from staffing required positions requires prior approval from Regional Helicopter Operations Specialist or State/Regional Aviation Manager. Other positions to be filled as needed to provi de for a safe and efficient operation.**

Note: On operations utilizing only one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helicopter Manager as well as either (not both) the HTMM or HTPT. On operations utilizing more than one helitorch helicopter, the Helitorch Manager may have collateral duties as the Helibase Manager providing that they do not assume duties as the HTMM or HTPT. (Reference chapter IV for collateral duty allowances for all positions).

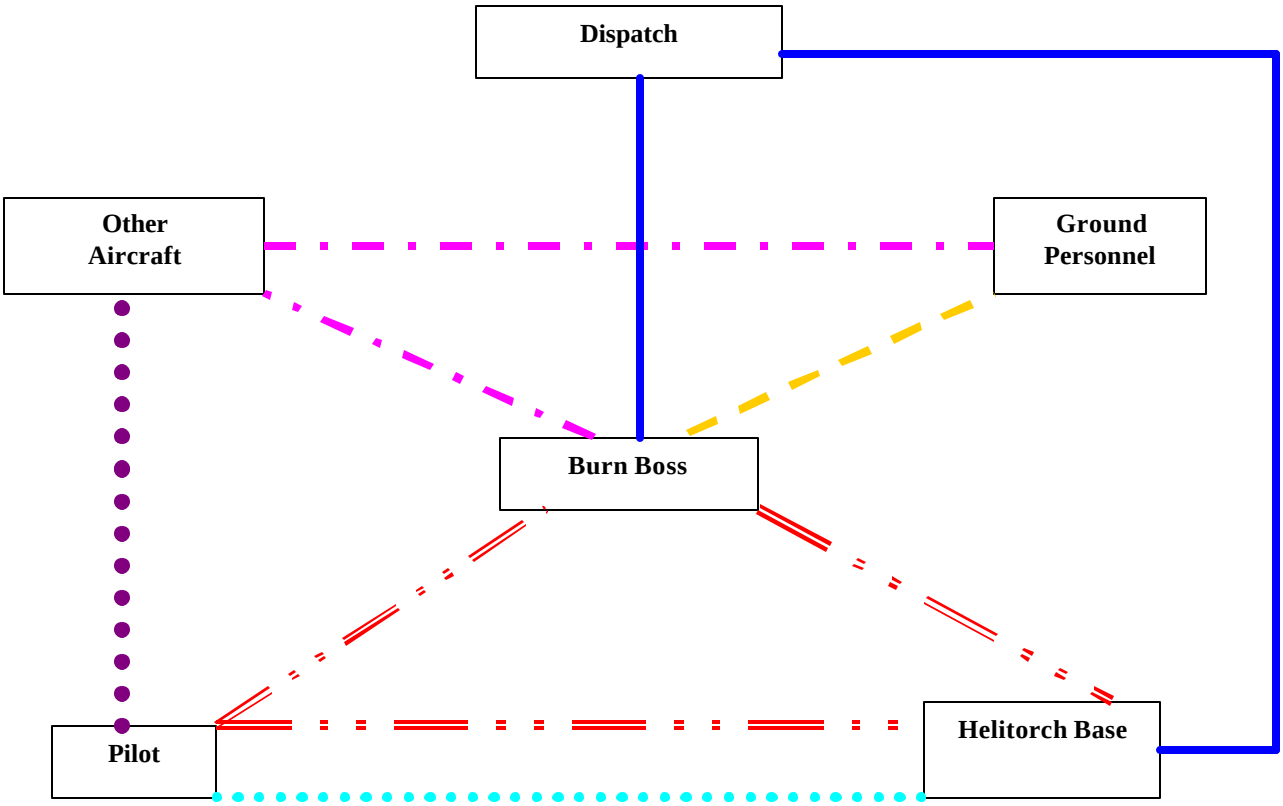
Note: If Helibase Manager is not required then the Helitorch Manager provides supervision of helibase personnel.

Note: Helibase Fire Protection may be staffed by members of the Mixing Crew.

Note: Identify all trainees for given positions on the organization chart.

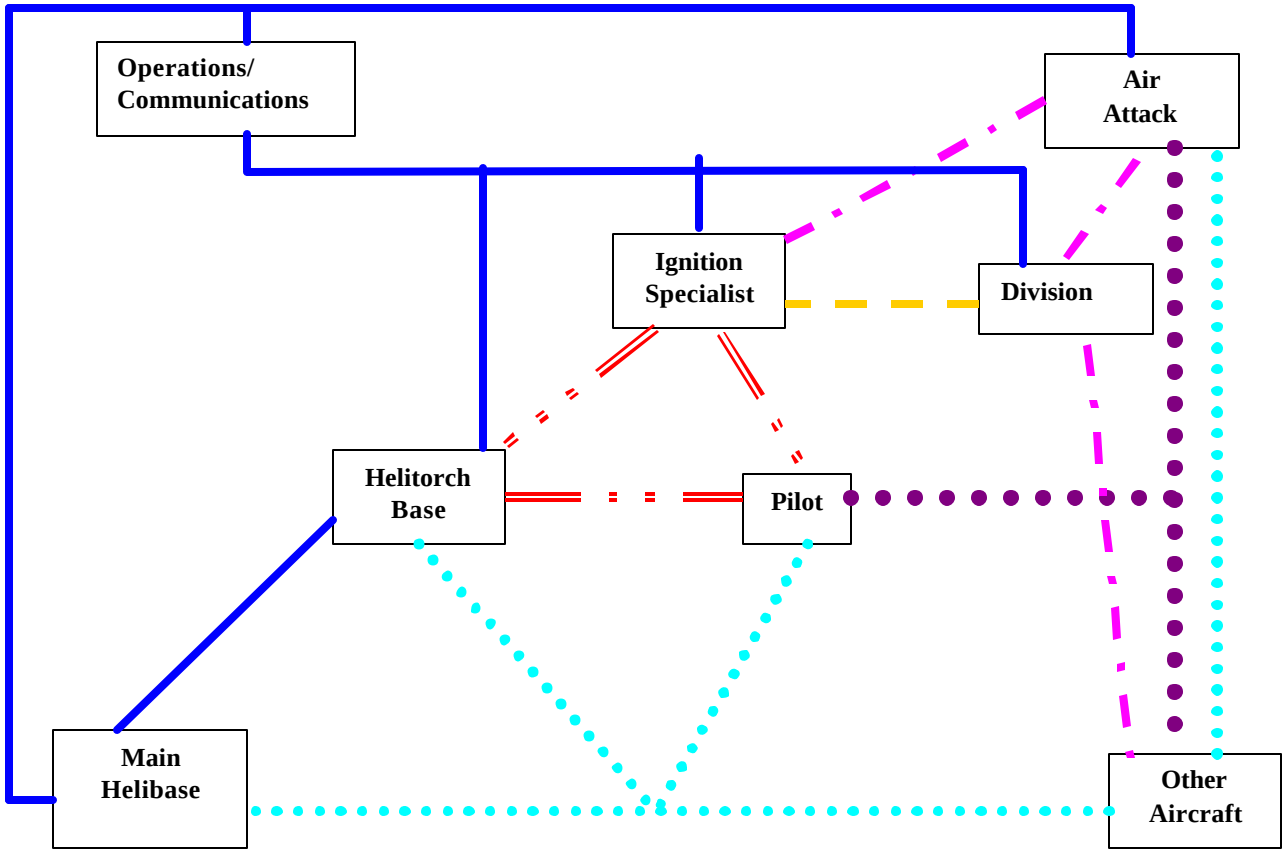
Helitorch Prescribed Fire Communications Plan

Legend			
	RX	TX	Tone
Command			
Air to Ground			
Tactical			
Flight Following			
Air to Air			
Discrete			



Helitorch Wildland Fire Communications Plan

Legend			
	RX	**TX**	**Tone**
Command			
Air to Ground			
Tactical			
Flight Following			
Air to Air			
Discrete			



Helicopter Crash Rescue/Medivac Plan

General Instructions			
In the event of an accident, the Helicopter/Helibase/Helitorch Manager will supervise and coordinate the crash rescue activities. Specific crash rescue duties will be assigned to helibase personnel each morning before flights of any kind. Crash rescue, evacuation and first aid equipment will be located near the helipad and equipment's location made known to all helibase personnel. Information and instructions will be sent/received through the local dispatch office or communications.			
Specific Information and Instructions (Utilize cell phone if possible. Do not use names over the radio.)			
1.	Nature of the injury(s)/illness.		
2.	Is medical help needed? If available supply vital signs!		
3.	What transportation is needed? Is patient(s) ambulatory?		
4.	Location of victim.		
5.	Route to be taken (use land marks as guide).		
6.	Equipment needed.		
7.	Name of contact on site.		
8.	Notify appropriate agency line officer.		
EMT(S) on project			
Available Medivac helicopters			
FAA #	HEMG		
Litter/rappel/extraction capable			
Remarks			
FAA #	HEMG		
Litter/rappel/extraction capable			
Remarks			
Nearest medical facility	Location		
Latitude	Longitude		Contact Freq
VOR	NM		DEG
Nearest burn center	Location		
Latitude	Longitude		Contact Freq
VOR	NM		DEG
Life Flight		Location	
Type aircraft	Phone Number		Contact Freq
Site conditions			
Latitude	Longitude		Contact Freq
VOR	NM		DEG
Wind speed	Elevation (msl)		Temperature (F, C)
Terrain factors		Helispot size	
Proximity of helispot to injury site		Visibility/sunrise/sunset limitations	
Flight hazards			
Other aircraft in area (call signs and frequencies)			
Ground contact and frequencies			

Helitorch Inspection Checklist

Project/Incident		Location	
Helitorch Manager			Date
Helitorch Mixmaster			Date

DAILY INSPECTION

HELITORCH DRUM/TANK	
☐	Visually inspect for damage and leaks
☐	Clean and ready for use
☐	Valves clean and working properly
☐	All fittings in place and leak free
☐	Removable drum head in place, securing band tight, and leak free
☐	All bolts/pins in place and secure
☐	Bonding cable connection paint free and clean to allow continuity
☐	Replacement drum available on-site
HELITORCH FRAME	
☐	No cracks or breaks
☐	Clean and ready for use
☐	All bolts/pins in place and secure
MOTOR AND ELECTRICAL HOUSING	
☐	Clean
☐	Motor pulley and belt in good condition
☐	Electrical wiring free from cracks, corrosion and connected properly
☐	Pump motor lubricated
☐	All screws and bolts in place and tight
☐	Pump operating (primed)
☐	Ignition system adjusted, clean and working
HOSE CONNECTIONS	
☐	Clean with clamp or compression fittings tight/leak free
☐	Dry Break Valves clean. **Caution! Do not open valve unless attached!**
☐	Swivel rotates freely
SUSPENSION SYSTEM AND HELITORCH ELECTRICAL CABLE	
☐	Clean and free of kinks, nicks, corrosion, and burrs
☐	Suspension line connectors secure and in good condition
☐	All bolts, nuts, and attachment ring meet MTDC drawing, properly secured
☐	Electrical connector clean and tight w/line properly attached to suspension system and Helitorch
☐	Separator bars not cracked or broken and properly attached between cable swedges

HELITORCH SUPPORT KIT			
☐	Windsock	☐	Dust mask
☐	Approved powder dispenser	☐	First aid kit/burn kit
☐	Two 5-gallon slop buckets	☐	Chemical splash goggles
☐	Continuity tester	☐	Spare dry break valves
☐	Fire extinguishers, one 40-B:C per aircraft, minimum of two-3 gallon class B compressed air foam, or class B capable engine	☐	100 % Cotton coveralls or Fire Retardant clothing labeled non-static (variety of sizes)
☐	Tool kit	☐	Wire brush, steel wool
☐	Spare parts kit	☐	Wire ties
☐	Hearing protection	☐	Electrical & duct tape
☐	Orange paint/fluorescent flagging/pad markers	☐	Silicon based lubricant/engine de-greaser
☐	Bonding cables	☐	Washbasin, soap, and 5 gallons of water
☐	Emery cloth and extra tip parts	☐	Hand cleaner and rags
☐	Metal funnel and coffee can	☐	Scale and scoop for measuring gelling agent
☐	Flight helmet, flight suit	☐	Fuel thermometer
☐	Approved vapor recovery/removal hose 2”	☐	Clay Bailey pressure relief valve
☐	2 extra sight glasses	☐	Nonferrous paddle/scraper
☐	5 gallons of diesel for cleanup	☐	Cleaning rags, hand cleaner, garbage bags
☐	2 extra drum head seals	☐	Nitrile, cotton, leather gloves
☐	Grease gun w/grease	☐	Single pole guarded electrical switch
☐	Extra nut and bolts	☐	Propane bottles if needed
☐	5-gallon hazmat spill kit	☐	Headset/patch cords
☐	2 nonferrous metal pipe wrenches	☐	Eyewash Station

Helitorch Mixmaster	**Signature:**	**Date**

Helitorch Mix Systems Checklist

Project/Incident		Location	
Helitorch Manager			Date
Helitorch Mixmaster			Date

DAILY INSPECTION	
DRUM/TANK	
☐	Visually inspect for damage and leaks
☐	Clean and ready for use
☐	Valves clean and working properly
☐	All fittings in place and leak free
☐	Removable drum head in place, securing band tight, and leak free
☐	All bolts/pins in place and secure
☐	Bonding cable connections paint free and clean to allow continuity throughout mixing system
☐	Drum stand on-site and in working condition
☐	Replacement drum available on-site
MIXING SYSTEM FRAME	
☐	No cracks or breaks
☐	Clean and ready for use
☐	All bolts/pins in place and secure
ENGINE AND ELECTRICAL SYSTEMS	
☐	Clean
☐	Pulleys, shafts, and belts in good condition
☐	Electrical wiring free from cracks, corrosion, and connected properly
☐	Drive shaft bearings lubricated
☐	All screws and bolts in place and tight
☐	Pump operation checked
☐	Gas tank full
☐	Oil clean and at operating level
☐	Spark plug operational and spare available
☐	Air filter clean and foam sponge lightly oiled
☐	Ignition system clean and operational
PLUMBING AND HOSES	
☐	Clean with clamp or compression fittings tight/leak free
☐	Dry Break Valves clean. **Caution! Do not open valve unless attached!**
☐	Bonding continuity tested
☐	Check for cracks, wear and serviceability
☐	Swivels rotate freely and not leaking

MIXING SYSTEM SUPPORT KIT (in addition to Helitorch support kit)			
☐	Spare tire, jack, tire lug wrench	☐	Jumper cable, tow chain
☐	Spare trailer light bulbs	☐	First aid kit
☐	1 fire extinguisher, 40-B:C	☐	Extra 2” ball
☐	Extra fuses	☐	Extra motor oil
☐	Chock blocks	☐	Safety can of gasoline
☐	Gelling agent 8 hours worth	☐	20-foot emergency shut off wire rope
☐	Copy of Aerial Ignition Guide	☐	Emergency release attachment handle
☐	Copy of MSDS	☐	Extra pressure gauge
☐	Transportation papers	☐	Terra torch wand
☐	North America Hazardous Materials Guide	☐	Barrier flagging

Helitorch Mixmaster	**Signature:**	**Date**

Helitorch Operations GO/NO GO Checklist

The helicopter operations on this project require the use of this checklist. If all items are not checked as satisfactory and maintained in that state for the duration of the mission, flying operations will be suspended until the deficiency is mitigated.

Project/Incident		Location	
Helitorch Manager			Date
Burn Boss/Ignition Specialist			Date

DAILY INSPECTION		
ORGANIZATION		
GO	NO/GO	
☐	☐	Helitorch organization chart has been prepared and posted showing responsibility for functions by name.
☐	☐	All helitorch positions are filled by qualified personnel and trainees identified.
☐	☐	Pilot and aircraft agency approved cards checked.
☐	☐	Agency Helitorch module certified by agency aviation manager/HOS and documentation checked by HTMG.
☐	☐	Vendor provided equipment and personnel approved through contracting and checked by HTMG.
HELIBASE OPERATIONS		
☐	☐	Multiple aircraft - Helibase Manager qualified and assigned.
☐	☐	Briefing: to include as a minimum all required Helitorch personnel, key-firing personnel, fire protection personnel, fuel handling personnel, and Helitorch pilot.
☐	☐	Overhead personnel responsibilities and authorities identified and discussed.
☐	☐	Area flight hazard map posted, hazards discussed and mitigated with pilot.
☐	☐	Personnel assignments/duties/responsibilities known and understood, PPE standards discussed.
☐	☐	Helibase Managers checklist reviewed.
☐	☐	Fire Shelter provided for pilot, on board and accessible and pilot familiar with use.
☐	☐	Establish rendezvous point, escape routes and safety zone for personnel and equipment accountability for Helitorch base incidents and escaped fire situation. Radio notification will be made in the event personnel need to evacuate work area.
☐	☐	All personnel will be briefed on the hazards associated with the handling of the materials.
CRASH RESCUE PLAN		
☐	☐	Aviation Safety Plan approved, and posted at helibase.
☐	☐	Helibase crash rescue personnel assigned, duties discussed and understood.
☐	☐	Aircraft Incident Response Plan/Crash Rescue Plan posted at Helitorch base and dispatch
☐	☐	Map showing flight routes, Helitorch area, flight hazards, ground access routes, and alternate landing posted on a bulletin board.
☐	☐	Emergency procedures with torch operations reviewed, duties discussed and understood.
☐	☐	Emergency fire suppression and Medivac procedures reviewed, duties discussed and understood. Location of crash rescue, evacuation and first aid equipment discussed with all.
MIXING AREA		
☐	☐	Separate from other helibase activities
☐	☐	Traffic, ground vehicles, personnel, and aircraft control measures in place.
☐	☐	Bulk fuel supply available and properly located, bonding measures properly applied, fuel handlers briefed.
☐	☐	Operational 15 minute continuous flow eye wash station that meets ANSI Z358.1-1998, OSHA 1910.141

The Helitorch Operations Go/No GO Checklist is continued on the next page.

Helitorch Operations GO/NO GO Checklist (continued)

MIXING AREA (continued)		
GO	NO GO	
☐	☐	Class B foam system on-site and operational (engine with Class B foam capabilities or minimum of two 3-gallon CAF extinguishers).
☐	☐	Post "No Smoking" signs at all vapor removal outlets and mixing areas.
☐	☐	Equipment operational, dry run/walk through with mixing personnel completed.
☐	☐	Personal protective equipment: Personnel must be equipped with eye protection, hardhat, fire retardant clothing labeled as non-static or 100 percent cotton coveralls, Nitrile Chemical Resistant gloves, and NIOSH-approved dust masks.
☐	☐	Provide briefing to all personnel to assure all hand held electronic devices such as radios, pagers, cell phones, etc. shall be turned off within 50' of any fuel preparation/vapor removal area.
☐	☐	OSHA 1910.141 and 1926.51 Requires that potable drinking water be provided at each jobsite. In addition if the employee is consuming their lunch at the site then hand soap and water or another form of cleansing/disinfecting agent must be provided.
LANDING AREA(s)		
☐	☐	Approach and departure paths adequate.
☐	☐	Landing Area/Safety Circle free from hazards.
☐	☐	Traffic, ground vehicles, personnel, and aircraft control measures in place.
☐	☐	Dust abatement measures taken.
☐	☐	Helicopter fuel truck parking area and driving route designated, located away from flight routes, landing areas, and personnel.
☐	☐	Fire extinguishers and crash rescue/extraction kit, evacuation kit (complete with contents including first aid supplies as per IHOG Chapter 9.VI.B/C) available and operational.
COMMUNICATIONS		
☐	☐	Communication Plan completed and posted at Helitorch base
☐	☐	Have established radio frequencies as designated on the Aviation Safety Plan.
☐	☐	Parking Tender is equipped with a radio with headset and hardhat or SPH 4/5 Flight Helmet with remote transmit button/switch.
☐	☐	Radio frequency assignments established to include the discrete frequency.
☐	☐	Communications tested and operational with all functions to include Dispatch/ICP.
ORIENTATION FLIGHT		
☐	☐	Flight routes include jettisoning torch considerations and alternate landing sites, identified during pilot orientation flight/briefing.
GO/NO GO CHECKLIST		
☐	☐	All checklists completed (Helitorch Inspection Checklist, Mixing Systems Checklist).
☐	☐	Helitorch Operations Go/No Go Checklist Completed. (All items must be checked GO prior to commencing operations.)

Helitorch Manager	**Signature:**	**Date**
Mixmaster	**Signature:**	**Date**
Pilot	**Signature:**	**Date**

Helitorch Task Sheet
(HTMG, HTMM, HTPT)

Trainee	
Unit	
District	
Date of classroom and bench test training	
Training location	
Instructor	

Instructor's training recommendations and comments:
(to fully qualify trainee as Parking Tender, Mixmaster, or Helitorch Manager)

Experience Record

Live firing machine operation.
Minimum (T) assignments: HTPT-1, HTMM-3, HTMG-qualified, HEMG, & HEB2 (T).

Date	*Flight Hours*	*Evaluator's Name*	*Acres Burned*	*Comments(Equipment used and qualified for)*

Recommended by: _____ Date _____

Reviewed by: _____ Date _____

Approved and certified by: _____ Date _____

* Aerial Ignition Annual Qualifications Update Sheet

Submitted by:

As of (date):

Name	Helitorch/PSD Annual Re-Certification** Dates:	Last Operational Assignment Dates:			
		HTMG	HTMM	HTPT	PSDO

*** Agency/Bureau Unit Name**

**** Reference the Interagency Aerial Ignition Guide chapter II, pg. 2, IV B. for annual re-certification requirements.**

Submit this form annually to the appropriate Agency/Bureau manager responsible for tracking qualifications and re-certification.

Helitorch Pre-Use Checklist

Batch Mixer

Pump:

___ Gas
___ Oil
___ Air filter
___ Zerk greased
  ___ Hose reel
  ___ Pump
___ Start and warmup

Fuel Drum

___ All welds
___ Interior clean
___ Cover and latch working
___ Properly labeled

Helitorch

___ Grease zerks on drum
___ Dry-breaks tight and functioning
___ Inspect
  ___ Hoses
  ___ Switches
  ___ Cables
  ___ Electrical lines
  ___ Bell ring properly configured for specific helicopter
___ Install spreader bars
___ Inspect drum for cleanliness
___ Replace propane bottle for new, full one
___ Inspect hose clamps
___ Ensure U-bolts for paddles are tight
___ Inspect lid on drum
___ Ensure correct polarity
___ Inspect drive belt
___ Check ignitor distance from propane nozzle (1/2")
___ Check plunger on tip, ensure complete springback
___ Inspect sled for cracks, welds, etc.
___ Flush 50-foot line of remnant diesel prior to inserting into torch
___ Perform pre-operational checks
  ___ Hook check
  ___ Pump
  ___ Ignition
  ___ Propane
___ Complete checklist from burn plan (**daily**)

Helitorch Post-Use Maintenance Checklist

Date: ___/___/___ **Inspector**: _____

_____ Flush batch mixer and helitorch(s) with diesel; remove residual gel.
_____ Ensure pump switches are turned off.
_____ Cover helitorch tips with rags/plastic bags.
_____ Cover batch mixer dry break with rags/plastic bags.
_____ Remove spreader bars.
_____ Tape up cables.
_____ Cover torches and pump with canvas covers.
_____ Grease trailer axles.
_____ Ensure all lights, electrical connections on trailer functioning.
_____ Properly secure all items on trailer.

Helitorch Annual Maintenance and Winterization Checklist

Date: ___/___/___ **Inspector**: _____

_____ Completely clean and drain batch mixer and drums.
_____ Remove all gas from pump.
_____ Grease all zerk fittings on batch mixer.
_____ Disassemble and clean all helitorch tips.
_____ Inspect all items and store trailer in covered area.
_____ Ensure all items on inventory are present and functioning.
_____ Reorder/purchase any needed items

Helitorch Use Record

Date: ___/___/___ Location: _____

Agency: _____Management Code: _____

Burn Boss: _____

Helitorch Base Manager: _____

Mixmaster: _____

Parking Tender: _____

Driver (Batch Mixer): _____

Torch #: _____ Fuel Used (gal): _____ Powder Used (lb): _____

Bottles of Propane Used: _____ Acres Treated: _____

Fuel Vendor: _____

Helicopter Make//Model: _____ N#: _____

Helicopter Company: _____Pilot: _____

Weather: _____

Problems Encountered: _____

_____

_____

Maintenance Performed/Needed: _____

_____

_____

Comments: _____

_____

_____

_____

_____

_____

_____

_____

Appendix C – Material Safety Data Sheets

DISCLAIMER: ***Due to the three year hardcopy print cycle for this document, users should consult the BLM National Aviation Office Web Site (aviation.blm.gov/library.htm) to assure the current versions of specific MSDS sheets are utilized.***

- Bernzomatic -- Mapp Gas - Methylacetylene Propadiene
- H&H Gas -- Liquefied Petroleum Gas Or Propane
- Amoco Oil -- Amoco Regular Lead-Free Gasoline - Gasoline, Unleaded
- Air Bp Bp Oil Ltd -- Jet A-1 - Turbine Fuel, Aviation
- Amoco Oil -- Jet Fuel Jp-4 - Turbine Fuel, Aviation
- Amoco Oil -- Ls No. 2 Diesel Fuel - Diesel Fuel
- Aldrich Chemical Sub of Sigma-Aldrich -- 22346-8 Potassium Permanganate 99%
- Inhibited Ethylene Glycol, Antifreeze

DISCLAIMER: ***The use of trade, firm, or corporation names listed above and contained in specific MSDS sheets is for information and convenience of the reader and does not constitute an endorsement by the Interagency Aerial Ignition Work Group of any product or service to the exclusion of others that may be suitable.***

- Petrol Jel™ Liquid Fuel Gelling Agent
- Fire-Trol® Firegel (also known as Sure Fire), Chemonics Industries, Inc.

Hazardous Material Safety Data Sheets (MSDS)

- **ALL EMPLOYEES SHALL receive information regarding hazardous substances/materials to which they may be exposed to, and receive appropriate MSDS.**
- **MSDS - designed to help us understand how to work safely with hazardous material (chemicals) that are used during the helitorch operation.**
- **MSDS explains proper ways to use, handle, and store chemicals, health hazards, precautionary measures to follow, and emergency procedures for spills, fire, and first aid.**

BERNZOMATIC -- MAPP GAS - METHYLACETYLENE PROPADIENE

MATERIAL SAFETY DATA SHEET
NSN: 683000D020183
Manufacturer's CAGE: 70785
Part No. Indicator: A
Part Number/Trade Name: MAPP GAS

==========

General Information

==========

Item Name: METHYLACETYLENE PROPADIENE
Company's Name: BERNZOMATIC CORP
Company's Street: ONE BERNZOMATIC DRIVE
Company's City: MEDINA
Company's State: NY
Company's Country: US
Company's Zip Code: 14103-1648
Company's Emerg Ph #: 716-798-4949
Company's Info Ph #: 716-798-4949
Distributor/Vendor # 1: BALKAMP INC (317-248-0760)
Distributor/Vendor # 1 Cage: 70842
Distributor/Vendor # 2: NAPA
Distributor/Vendor # 2 Cage: 050Q3
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SM
Date MSDS Prepared: 30MAY90
Safety Data Review Date: 22DEC96
Supply Item Manager: CX
MSDS Serial Number: CCHPV
Specification Number: UNKNOWN
Spec Type, Grade, Class: UNKNOWN
Hazard Characteristic Code: G2
NRC/State License Number: NONE
Net Propellant Weight-Ammo: NONE

==========

Ingredients/Identity Information

==========

Proprietary: NO
Ingredient: METHYL ACETYLENE (PROPYNE)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: UK4250000
CAS Number: 74-99-7
OSHA PEL: 1000 PPM
ACGIH TLV: 1000 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

==========

Physical/Chemical Characteristics

==========

Appearance And Odor: COLORLESS, UNPLEASANT ODOR AT APPROX. 100 PPM
Boiling Point: -36F,-38C
Melting Point: NOT GIVEN
Vapor Pressure (MM Hg/70 F): 109 PSIG
Vapor Density (Air=1): 1.48
Specific Gravity: .571

Decomposition Temperature: NOT GIVEN
Evaporation Rate And Ref: NOT GIVEN
Solubility In Water: SLIGHT
Corrosion Rate (IPY): UNKNOWN

==========

Fire and Explosion Hazard Data

==========

Flash Point: -99F,-73C
Flash Point Method: CC
Lower Explosive Limit: 3.0
Upper Explosive Limit: 11.0
Extinguishing Media: ELIMINATE OXYGEN SOURCE OR STOP FLOW OF GAS. USEWATER TO COOL CYLINDER. DRY CHEMICAL OR CARBON DIOXIDE TO REDUCE OXYGEN
Special Fire Fighting Proc: COOL CYLINDERS WITH WATER. KEEP PERSONNEL AWAY.
Unusual Fire And Explosion Hazards: VAPOR IS FLAMMABLE AND HEAVIER THAN AIR AND MAY TRAVEL TO SOURCE OF IGNITION AND FLASHBACK. USE WATER TO KEEP FIRE EXPOSED CONTAINERS COOL TO REDUCE PRESSURE.

==========

Reactivity Data

==========

Stability: YES
Cond To Avoid (Stability): DO NOT EXPOSE TO TEMPERATURES ABOVE 125F.
Materials To Avoid: EXTREMELY FLAMMABLE. AVOID UNCONTROLLED CONTACT WITH OXIDIZERS
Hazardous Decomp Products: NORMAL BY-PRODUCTS OF COMBUSTION.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): WILL NOT OCCUR.

==========

Health Hazard Data

==========

LD50-LC50 Mixture: LD50 (ORAL RAT) IS UNKNOWN
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ASPHYXIANT. MAY REDUCE OXYGEN REQUIRED FOR BREATHING. LIQUID GAS MAY FREEZE SKIN.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF 0.1% OR GREATER THAT ARE CARCINOGENS OR SUSPECT CARCINOGENS.
Signs/Symptoms Of Overexp: DIZZINESS TO UNCONSCIOUSNESS IF HIGH CONCENTRATIUONS OF GAS REPLACE OXYGEN FOR BREATHING.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: REMOVE EXPOSED PERSON TO FRESH AIR. IF UNCONSCIOUS, SEEK MEDICAL ATTENTION.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: REMOVE IGNITION SOURCES AND VENTILATE AREA.
Neutralizing Agent: NO INFORMATION GIVEN BY MFR ON MSDS.
Waste Disposal Method: VENT TO ATMOSPHERE IN OUTDOOR AREA FREE OF ALL SOURCES OF IGNITION.

Precautions-Handling/Storing: STORE IN WELL VENTILATED AREA AWAY ROM ALL IGNITION SOURCES. STORE AT TEMPERATURES BELOW 125F. STORE OUT OF DIRECT SUNLIGHT.

Other Precautions: NONE SPECIFIED BY MANUFACTURER.

Control Measures

Respiratory Protection: NOT REQUIRED WITH NORMAL USE.
Ventilation: LOCAL EXHAUST ADVISABLE WHEN WELDING, OTHERWISE "N/A".
Protective Gloves: ADVISABLE WHEN WELDING.
Eye Protection: FILTER SHADE #4 OR DARKER FOR WELDING
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: WASH HANDS THOROUGHLY WITH SOAP AND WATER BEFORE EATING, DRINKING, SMOKING OR USING TOILET FACILITIES.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

Transportation Data

Trans Data Review Date: 96327
DOT PSN Code: LLG
DOT Proper Shipping Name: PETROLEUM GASES, LIQUEFIED OR LIQUEFIED PETROLEUM GAS
DOT Class: 2.1
DOT ID Number: UN1075
DOT Label: FLAMMABLE GAS
IMO PSN Code: LMX
IMO Proper Shipping Name: PETROLEUM GASES, LIQUEFIED o
IMO Regulations Page Number: 2147
IMO UN Number: 1075
IMO UN Class: 2(2.1)
IMO Subsidiary Risk Label: -
IATA PSN Code: TJL
IATA UN ID Number: 1075
IATA Proper Shipping Name: PETROLEUM GASES, LIQUEFIED
IATA UN Class: 2.1
IATA Label: FLAMMABLE GAS
AFI PSN Code: TJL
AFI Symbols: 0
AFI Prop. Shipping Name: PETROLEUM GASES, LIQUEFIED OR LIQUEFIED PETROLIUM GAS
AFI Class: 2.1
AFI ID Number: UN1075
AFI Basic Pac Ref: A6.3,A6.5
N.O.S. Shipping Name: METHYLACETYLENE (PROPYNE)

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 22NOV96
MFR Label Number: NONE
Label Status: F
Common Name: MAPP GAS

Chronic Hazard: NO
Signal Word: CAUTION!
Acute Health Hazard-Slight: X

Contact Hazard-Slight: X

Fire Hazard-Slight: X
Reactivity Hazard-None: X
Special Hazard Precautions: STORE IN WELL VENTILATED AREA AWAY ROM ALL IGNITION SOURCES. STORE AT TEMPERATURES BELOW 125F. STORE OUT OF DIRECT SUNLIGHT. FIRST AID: REMOVE EXPOSED PERSON TO FRESH AIR. UF UNCONSCIOUS, SEEK MEDICAL ATTENTION.
Protect Eye: Y
Protect Skin: Y
Label Name: BERNZOMATIC CORP
Label Street: ONE BERNZOMATIC DRIVE
Label City: MEDINA
Label State: NY
Label Zip Code: 14103-1648
Label Country: US
Label Emergency Number: 716-798-4949

H&H GAS -- LIQUEFIED PETROLEUM GAS OR PROPANE

MATERIAL SAFETY DATA SHEET
NSN: 683000N068823
Manufacturer's CAGE: HHGAS
Part No. Indicator: A
Part Number/Trade Name: LIQUEFIED PETROLEUM GAS OR PROPANE

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General Information

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Company's Name: H&H GAS CORP
Company's P. O. Box: 208
Company's City: HIGHTSTOWN
Company's State: NJ
Company's Country: US
Company's Zip Code: 08520
Company's Emerg Ph #: 609-448-3232
Company's Info Ph #: 609-448-3232
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 27JUL95
Safety Data Review Date: 29FEB96
Preparer's Company: NATIONAL PROPANE GAS ASSOC
Preparer's St Or P. O. Box: 1600 EISENHOWER LN STE 100
Preparer's City: LISLE
Preparer's State: IL
Preparer's Zip Code: 60532
MSDS Serial Number: CBJMY

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: PROPANE % WT: 2.15-9.60
Ingredient Sequence Number: 01
Percent: <9.60
NIOSH (RTECS) Number: TX2275000
CAS Number: 74-98-6
OSHA PEL: 1000 PPM
ACGIH TLV: ASPHYXIANT

Proprietary: NO
Ingredient: AIR, COMPRESSED
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: 1004033AC
CAS Number: 25635-88-5
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: SUPDAT: TO CLEAN SINCE RESIDUE IS DFCLT TO REMOVE. ALL CNTNRS SHOULD BE DISPOSED OF IN ENVIRONMENTALLY SAFE (ING 4)
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: ING 3: MANNER & IN ACCORDANCE WITH GOVERNMENTAL REGULATIONS.
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: HAZ DECOMP PRODS: OR WHEN USED AS AN ENGINE FUEL.
Ingredient Sequence Number: 05
NIOSH (RTECS) Number: 9999999ZZ
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE
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Physical/Chemical Characteristics

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Appearance And Odor: VAPOR AND LIQUID ARE COLORLESS. PRODUCT CONTAINS AN ODORANT (UNPLEASANT ODOR).
Boiling Point: -44F,-42C
Vapor Pressure (MM Hg/70 F): 205 PSIG
Vapor Density (Air=1): 1.52
Specific Gravity: 0.51 (H*2O=1)
Evaporation Rate And Ref: GAS AT NORM AMBIENT TEMPS
Solubility In Water: SLIGHTLY
Percent Volatiles By Volume: 100
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Fire and Explosion Hazard Data

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Flash Point: -156F,-104C
Flash Point Method: CC
Lower Explosive Limit: 2.15%
Upper Explosive Limit: 9.60%
Extinguishing Media: WATER SPRAY - CLASS A-B-C OR BC FIRE EXTINGUISHER.
Special Fire Fighting Proc: USE NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). STOP FLOW OF GAS. USE WATER TO KEEP FIRE EXPOS CNTNRS COOL. USEWATER SPRAY TO DISPERSE UNIGNITED (SUPDAT)
Unusual Fire And Expl Hazrds: EMPTY CNTNRS RETAIN RESIDUE (LIQ &/OR VAP) & CAN BE DANGEROUS. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CNTNRS TO HEAT, (SUPDAT)
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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: MIXING WITH OXYGEN OR AIR, EXCEPT AT BURNER.
Hazardous Decomp Products: UNDER FIRE CNDTNS:FUMES, SMOKE, CARBON MONOXIDE, ALDEHYDES & OTHER DECOMP PRODS IN CASE OF INCOMPLETE COMBUST (ING5)
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT
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Health Hazard Data

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LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: INHALATION: CONCENTRATIONS CAN LEAD TO MODERATE IRRITATION. CONTACT WITH LIQUID CAUSES BURNS SIMILAR TO FROSTBITE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER. IMMEDIATELY FLUSH W/POTABLE WATER FOR A MINIMUM OF 15 MINUTES, SEEK ASSISTANCE FROM MD (FP N). SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD(FP N). INHAL: REMOVE TO FRESH AIR. GUARD AGAINST SELF INJURY. APPLY ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: KEEP PUBLIC AWAY. SHUT OFF SUPPLY OF GAS. ELIMINATE SOURCES OF IGNITION. VENTILATE THE AREA. DISPERSE WITH WATER SPRAY. CONTACT BETWEEN SKIN AND THESE GASES IN LIQUID FORM CAN CAUSE FREEZING OF TISSUE CAUSING INJURY SIMILAR TO THERMAL BURN.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSAL MUST BE IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS (FP N). CONTROLLED BURNING. CONTACT SUPPLIER.
Precautions-Handling/Storing: KEEP CONTAINERS AWAY FROM HEAT SOURCES AND STORE IN UPRIGHT POSITION. CONTAINERS SHOULD NOT BE DROPPED. KEEP CONTAINER VALVE CLOSED WHEN NOT IN USE.
Other Precautions: INSTALL PROTECTIVE CAPS AND PLUG CONTAINER SERVICE VALVE WHEN NOT CONNECTED FOR USE.

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Control Measures

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Respiratory Protection: STAY OUT OF GAS OR VAPOR (BECAUSE OF FIRE HAZARD). USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FPN).
Ventilation: EXPLOSION-PROOF MOTORS AND KEEP SOURCES OF IGNITION AT SAFE DISTANCES.
Protective Gloves: RESISTANT TO ACTIONS OF LP-GASES.
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).
Other Protective Equipment: ANSI APPROVED EYE WASH & DELUGE SHOWER (FP N).
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: FIRE FIGHT PROC: GAS/VAP. IF IGNIT HAS OCCURRED & NO WATER AVAIL, TANK METAL MAY WEAKEN FROM OVERHEATING. EVACUATE AREA. IF GAS HAS NOT IGNITED, LP-GAS LIQ OR VAP MAY BE DISPERSED BY WATER SPRAY OR FLOODING. EXPLO HAZ: FLAME, SPKS OR OTHER SOURCES OF IGNIT; THEY MAY EXPLODE & CAUSE INJURY/DEATH. DO NOT ATTEMPT (ING 3)

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Transportation Data

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 29FEB96

Label Date: 17JAN96

Label Status: G
Common Name: LIQUEFIED PETROLEUM GAS OR PROPANE
Chronic Hazard: NO
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Severe: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
CONCENTRATIONS CAN LEAD TO SYMPTOMS RANGING FROM DIZZINESS TO ANESTHESIA AND RESPIRATORY ARREST. EYES: MODERATE IRRITATION. CONTACT WITH LIQUID CAUSES BURNS SIMILAR TO FROSTBITE. CHRONIC: NONE LISTED BY MANUFACTURER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: H&H GAS CORP
Label P.O. Box: 208
Label City: HIGHTSTOWN
Label State: NJ
Label Zip Code: 08520
Label Country: US
Label Emergency Number: 609-448-3232

AMOCO OIL -- AMOCO REGULAR LEAD-FREE GASOLINE - GASOLINE,UNLEADED

MATERIAL SAFETY DATA SHEET
NSN: 9130012084172
Manufacturer's CAGE: 15958
Part No. Indicator: B
Part Number/Trade Name: AMOCO REGULAR LEAD-FREE GASOLINE

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General Information

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Item Name: GASOLINE,UNLEADED
Company's Name: AMOCO OIL COMPANY
Company's Street: 200 EAST RANDOLPH DRIVE
Company's City: CHICAGO
Company's State: IL
Company's Country: US
Company's Zip Code: 60601
Company's Emerg Ph #: 800-447-8735 (HEALTH)
Company's Info Ph #: 312-856-3907
Record No. For Safety Entry: 022
Tot Safety Entries This Stk#: 064
Status: FE
Date MSDS Prepared: 24SEP93
Safety Data Review Date: 20OCT94
Supply Item Manager: KY
MSDS Preparer's Name: DONALD M. BARKER, DIR
Preparer's Company: PRODUCT STEWARDSHIP & TOXICOLOY
Preparer's St Or P. O. Box: (MSDS#:02003992)
MSDS Serial Number: BVHJH
Specification Number: VV-G-1690
Spec Type, Grade, Class: CIVGAS
Hazard Characteristic Code: F2
Unit Of Issue: DR
Unit Of Issue Container Qty: 55 GALLONS
Type Of Container: DRUM, 18 GAGE
Net Unit Weight: 343.5 LBS

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: GASOLINE
Ingredient Sequence Number: 01
Percent: N/GIVEN
NIOSH (RTECS) Number: LX3300000
CAS Number: 8006-61-9
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM/500STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 02
Percent: 4
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2

OSHA PEL: SEE 1910.1028
ACGIH TLV: 10 PPM; A2; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 03
Percent: 2
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/125STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 04
Percent: 22
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM; Z-2
ACGIH TLV: S, 50 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 05
Percent: 5
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 06
Percent: 10
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/150STEL;9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 07
Percent: 15
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO

Ingredient: BUTANE
Ingredient Sequence Number: 08
Percent: N/GIVEN
NIOSH (RTECS) Number: EJ4200000
CAS Number: 106-97-8
OSHA PEL: 800 PPM
ACGIH TLV: 800 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: N-HEPTANE
Ingredient Sequence Number: 09
Percent: N/GIVEN
NIOSH (RTECS) Number: MI7700000
CAS Number: 142-82-5
OSHA PEL: 500 PPM
ACGIH TLV: 400 PPM/500STEL; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: HEXANE (N-HEXANE)
Ingredient Sequence Number: 10
Percent: N/GIVEN
NIOSH (RTECS) Number: MN9275000
CAS Number: 110-54-3
OSHA PEL: 500 PPM
ACGIH TLV: 50 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: PENTANE
Ingredient Sequence Number: 11
Percent: N/GIVEN
NIOSH (RTECS) Number: RZ9450000
CAS Number: 109-66-0
OSHA PEL: 1000 PPM
ACGIH TLV: 600 PPM/750STEL; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: TRIMETHYL BENZENE (SARA III)
Ingredient Sequence Number: 12
Percent: N/GIVEN
NIOSH (RTECS) Number: DC3220000
CAS Number: 25551-13-7
OSHA PEL: 25 PPM
ACGIH TLV: 25 PPM; 9394
Other Recommended Limit: NONE RECOMMENDED
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Physical/Chemical Characteristics

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Appearance And Odor: CLEAR, BRIGHT LIQUID, CHARACTERISTIC ODOR.
Boiling Point: 80.0F,26.7C
Vapor Pressure (MM Hg/70 F): 7-15LBS
Vapor Density (Air=1): 3-4

Specific Gravity: 0.75

Solubility In Water: NEGLIGIBLE, <0.1%
Autoignition Temperature: 495F
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Fire and Explosion Hazard Data
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Flash Point: -45F,-43C
Lower Explosive Limit: 1.3
Upper Explosive Limit: 7.6
Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS (E.G. DRY CHEMICAL, CARBON DIOXIDE, HALOGENATED AGENTS, FOAM, STEAM) OR WATER FOG.
Special Fire Fighting Proc: NONE SPECIFIED BY MFG. HOWEVER WEAR SELF-CONTAINED BREATHING APPARATUS & PROTECTIVE EQPMT IF SITUATION WARRENTS.
Unusual Fire And Expl Hazrds: EXTREMELY FLAMM VAP/AIR MIXTURES FORM. EXTINGUISHMENT OF FIRE BEFORE SURCE OF VAP IS SHUT OFF CAN CREATE AN EXPLOSIVE MIXTURE IN AIR.
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Reactivity Data
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Stability: YES
Cond To Avoid (Stability): BURNING CAN BE STARTED EASILY. KEEP AWAY FROM IGNITION SOURCES (D.G. HEAT/SPARKS/OPEN FLAMES).
Materials To Avoid: AVOID CHLORINE, FLUORINE AND OTHER STRONG OXIDIZERS.
Hazardous Decomp Products: BURNING CAN PRODUCE CARBON MONOXIDE &/OR CARBON DIOXIDE AND OTHER HARMFUL PRODUCTS.
Conditions To Avoid (Poly): NONE SPECIFIED BY MFG.
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Health Hazard Data
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LD50-LC50 Mixture: LD50 (ORAL, RATS) = 18.8ML/KG.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: EYE:HIGH CONCEN OF VAP/MIST MAY CAUSE DISCOMFORT. SKIN:PRLONG/REPEAT CONTACT CAN DEFAT & LEAD TO IRRIT &/OR DERM. INHAL:VAPOUR HARMFUL. HIGH VAP CONCEN CAN CAUSE HEADACHES, DIZZINESS, DROWSINESS, NAUSEA. INGEST:LOW VISCOSITY PRODUCT. HARMFUL/FATAL IF ASPIRATED INTO LUNGS CAUSING CHEM PNEUMONIA/FATAL.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: CONTAINS BENZENE WHICH IS KNOWN TO CAUSE CANCER.
Signs/Symptoms Of Overexp: MAY PRODUCE HEADACHES, DIZZ, NAU, DROWSINESS, IRRIT OF EYE/NOSE/THROAT/CNS DEPRESSION.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MFG.
Emergency/First Aid Proc: EYE:FLUSH W/PLENTY OF WATER. GET MED ATTN IF IRRIT PERSISTS. SKIN:WASH W/SOAP & WATER. REMOVE CONTAMIN CLOTHING/SHOES. GET MED ATTN IF IRRIT DEVELOPS. INHAL:REMOVE TO UNCONTAMINATED AREA. GIVE ARTIFICIAL RESP IF NOT BREATHING. GET MED ATTN. INGEST:DO NOT INDUCE VOMIT. GET IMMED MED ATTN.
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Precautions for Safe Handling and Use
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Steps If Matl Released/Spill: REMOVE/SHUT OFF ALL IGN SOURCES.USE WATER SPRAY TO DISPERSE VAP.INCREASE VENTILATION IF POSSIBLE.CONTAIN ON ABSORBENT MATL (SAND/SAWDUST/DIRT/CLAY).KEEP OUT OF SEWERS & WATERWAYS.REPORT SPILLS TO APPROPRIATE AUTHORITIES.

Neutralizing Agent: NONE SPECIFIED BY MFG.

Waste Disposal Method: RESIDUES/SPILLED MATL ARE HAZ WASTE DUE TO IGNITABILITY. DISPOSAL MUST BE IAW APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS. ENCLOSED CONTROLLED INCINERATION IS RECOMMENDED UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDINANCES.
Precautions-Handling/Storing: STORE IN FLAMM LIQ STORAGE AREA. KEEP CNTNR CLOSED. STORE AWAY FROM HEAT/ING SOURCES/OPEN FLAME IAW APPLICABLE FED/STATE/LOC REGS.
Other Precautions: KEEP AWAY FROM IGNITION SOURCES. KEEP CONTAINER CLOSED. USE W/ADEQUATE VENTILATION. ABOID BREATHING VAPOR &/OR MIST. USE AS MOTOR FUEL ONLY. AVOID STRONG OXIDIZERS.

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Control Measures

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Respiratory Protection: IF VENTILATION IS INADEQUATE USE NIOSH/MSHA CERTIFIED RESP WHICH WILL PROTECT AGAINST ORGANIC VAP/MIST.
Ventilation: USE WITH ADEQUATE VENTILATION.
Protective Gloves: RECOMMENDED-PVC.
Eye Protection: RECOMMENDED-SAFETY GLASSES/GOGGLES.
Other Protective Equipment: WEAR PROTECTIVE CLOTHING IF PRLONGED/REPEATED CONTACT IS LIKELY.
Work Hygienic Practices: THOROUGHLY CLEAN/DRY CONTAMIN CLOTHING BEFORE REUSE. WASH HANDS AFTER HANDLING & BEFORE EAT/SMOKE/DRINK.
Suppl. Safety & Health Data: LONG-TERM INHAL STUDY OF WHOLE UNLEADED GASOLINE VAP EXPOSURE-RELATED KIDNEY DAMAGE/TUMORS WERE OBSERVED IN MALE RATS & NOT SEEN IN FEMALES.CHRONIC EXPOSURE TO BENZENE CAUSES LEUKEMIA IN HUMAND & OTHER ADVERSE BLOOD EFFECTS (ANEMIA).

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Transportation Data

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Trans Data Review Date: 94293
DOT PSN Code: GTN
DOT Proper Shipping Name: GASOLINE
DOT Class: 3
DOT ID Number: UN1203
DOT Pack Group: II
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: HRV
IMO Proper Shipping Name: GASOLINE
IMO Regulations Page Number: 3141
IMO UN Number: 1203
IMO UN Class: 3.1
IMO Subsidiary Risk Label: -
IATA PSN Code: MUC
IATA UN ID Number: 1203
IATA Proper Shipping Name: GASOLINE
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: MUC
AFI Prop. Shipping Name: GASOLINE
AFI Class: 3
AFI ID Number: UN1203
AFI Pack Group: II
AFI Basic Pac Ref: 7-7
Additional Trans Data: PER MSDS: DOT SHIPPING DESCRIPTION:GASOLINE, 3, UN1203, II.

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Disposal Data

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Label Data
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Label Required: YES
Technical Review Date: 20OCT94
Label Status: F
Common Name: AMOCO REGULAR LEAD-FREE GASOLINE
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: EYE:HIGH CONCEN OF VAP/MIST MAY CAUSE DISCOMFORT. SKIN:PROLONG/REPEAT CONTACT CAN DEFAT & LEAD TO IRRIT &/OR DERM. INHAL: VAPOUR HARMFUL. HIGH VAP CONCEN CAN CAUSE HEADACHES, DIZZINESS, DROWSINESS, NAUSEA. INGEST:LOW VISCOSITY PRODUCT. HARMFUL/FATAL IF ASPIRATED INTO LUNGS CAUSING CHEM PNEUMONIA/FATAL. 1STAID:EYE:FLUSH W/ PLENTY OF WATER.IRRIT PERSISTS GET MED ATTN.SKIN:WASH W/SOAP & WATER.REMOVE CONTAMIN CLOTH/SHOES.IRRIT DEVELOPS GET MED ATTN.INHAL:REMOVE TO UNCONTAMIN AREA.GIVE ARTIFICIAL RESP IF NOT BREATHING.GET MED ATTN.INGEST:DO NOT INDUCE VOMIT.GET IMMED MED ATTN.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AMOCO OIL COMPANY
Label Street: 200 EAST RANDOLPH DRIVE
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601
Label Country: US
Label Emergency Number: 800-447-8735 (HEALTH)

AIR BP BP OIL LTD -- JET A-1 - TURBINE FUEL, AVIATION

MATERIAL SAFETY DATA SHEET
NSN: 9130010315816
Manufacturer's CAGE: 0NDT1
Part No. Indicator: A
Part Number/Trade Name: JET A-1

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General Information

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Item Name: TURBINE FUEL, AVIATION
Company's Name: AIR BP, BP OIL LTD
Company's Street: CLEVELAND HOPKINS INTL AIRPORT
Company's City: CLEVELAND
Company's State: OH
Company's Country: US
Company's Zip Code: 44135
Company's Emerg Ph #: 216-267-3550
Company's Info Ph #: 216-267-3550
Distributor/Vendor # 1: BP OIL INTERNATIONAL LTD
Distributor/Vendor # 1 Cage: 7X331
Record No. For Safety Entry: 006
Tot Safety Entries This Stk#: 041
Status: SE
Date MSDS Prepared: 16AUG90
Safety Data Review Date: 22JAN93
Supply Item Manager: KY
MSDS Serial Number: BPVGD
Specification Number: MIL-T-83133
Spec Type, Grade, Class: CLASS JP-8
Hazard Characteristic Code: F4
Unit Of Issue: GL
Unit Of Issue Container Qty: BULK
Type Of Container: BULK
Net Unit Weight: BULK

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: KEROSENE, MAY CONTAIN SMALL AMOUNTS OF PROPRIETARY PERFORMANCE ADDITIVES.
Ingredient Sequence Number: 01
Percent: UNKNOWN
NIOSH (RTECS) Number: OA5500000
CAS Number: 8008-20-6
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM 9091
Other Recommended Limit: NONE RECOMMENDED

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Physical/Chemical Characteristics

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Appearance And Odor: PALE YELLOW LIQUID.
Boiling Point: 156 TO 258C
Specific Gravity: 0.804
Decomposition Temperature: UNKNOWN
Viscosity: 3.5 CST

Corrosion Rate (IPY): UNKNOWN

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Fire and Explosion Hazard Data

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Flash Point: 111F,44C

Extinguishing Media: EXTINGUISH USING DRY POWDER, FOAM, WATER FOG, OR (FOR SMALL FIRES) CARBON DIOXIDE OF BCF.

Special Fire Fighting Proc: FIRES IN CONFINED SPACES SHOULD BE DEALT WITH BY TRAINED PERSONNEL WEARING BREATHING APPARATUS. FOR MAJOR FIRES CALL THE FIRE SERVICE.

Unusual Fire And Expl Hazrds: INCOMPLETE COMBUSTION WILL GENERATE SMOKE & HAZARDOUS GASES, INCLUDING CARBON MONOXIDE. SPRAY APPLICATIONS INCREASES THE FIRE, & POSSIBLY EXPLOSION, HAZARD.

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Reactivity Data

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Stability: YES

Cond To Avoid (Stability): STABLE AT AMBIENT TEMPERATURES.

Materials To Avoid: AVOID CONTACT WITH STRONG OXIDIZING AGENTS.

Hazardous Decomp Products: THERMAL DECOMPOSITION CAN PRODUCE A VARIETY OF COMPOUNDS, THE PRECISE NATURE OF WHICH WILL DEPEND ON THE DEC. CONDITIONS

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT APPLICABLE

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Health Hazard Data

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LD50-LC50 Mixture: LD50 (ORAL RAT) IS UNKNOWN

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: PROLONGED OR REPEATED SKIN EXPOSURE MAY LEAD TO DERMATITIS. INGESTION OF LARGE AMOUNTS MAY CAUSE GASTRO-INTESTINAL EFFECTS. THIS MATERIAL WIIL INJURE THE LUNGS IF ASPIRATION OCCURS. MAY CAUSE IRRITATION TO THE EYES, NOSE & THROAT DUE TO EXPOSURE TO VAPOUR, MIST OR FUMES GENERATED DURING NORMAL USE.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: THIS COMPOUND CONTAINS NO INGREDIENTS AT CONCENTRATIONS OF 0.1% OR GREATER THAT ARE CARCINOGENS OR SUSPECT CARCINOGENS.

Signs/Symptoms Of Overexp: TRANSIENT STINGING OR REDNESS IF ACCIDENTAL EYE CONATCT OCCURS. INGESTION OF LARGE AMOUNTS MAY CAUSE DISCOMFORT, VOMITING AND DIARRHEA.

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: SKIN-WASH THOROUGHLY WITH SOAP/WATER AFTER CONTACT. EYES-WASH EYES THOROUGHLY WITH COPIOUS QUANTITIES OF WATER, ENSURING EYELIDS ARE OPEN. INGESTION-IF CONTAMINATION OFB THE MOUTH OCCURS, WASH IT OUT THOROUGHLY WITH WATER. OBTAIN MEDICAL ADVICE IF LARGE QUANTITIES ARE SWALLOWED -DO NOT INDUCE VOMITING. INHALATION-IF INHALATION CAUSES IRRITATION, REMOVE TO FRESH AIR. OBTAIN MEDICAL HELP IN ALL CASES

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: RECOVER ALL SPILLAGE USING ABSORBANTS OR OTHER APPROPIATE COLLECTION TECHNIQUES. DO NOT WASH INTO DRAINAGE SYSTEM.ISOLATE SPILLAGE FROM ALL IGNITION SOURCES. IN EVENT OF LARGE SPILL INFORM THE LOCAL AUTHORITY.

Neutralizing Agent: NOT APPLICABLE

Waste Disposal Method: DISPOSE OF BY INCINERATION OR OTHER SUITABLE MEANS UNDER CONDITIONS APPROVED BY THE LOCAL AUTHORITY. DISPOSAL OF LARGE QUANTITIES SHOULD BE AFFECTED BY SPECIALIST PERSONNEL.
Precautions-Handling/Storing: STORE AT AMBIENT TEMPERATURES AWAY FROM IGNITION SOURCES. ENSURE EQUIPMENT IS ELECTRICALLY BONDED & EARTHED TO PREVENT STATIC ACCUMULATION.
Other Precautions: CLEAN UP SPILLED MATERIAL IMMEDIATELY. DO NOT ENTER STORAGE TANKS BREATHING APPARATUS UNLESS THE TANKS HAS BEEN WELL VENTILATED & THE TANK ATMOSPHERE HAS BEEN SHOWN TO CONTAIN HYDROCARBON VAPORS LEVELS OF LESS THAN 1% OF THE LOW FLAME LIMIT

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Control Measures

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Respiratory Protection: WEAR A NIOSH/MSHA APPROVED CHEMICAL CARTRIDGE RESPIRATOR WITH FULL FACEPIECE AND ORGANIC VAPOR CARTRIDGES IN COMBINATION WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
Ventilation: LOCAL AND MECHANICAL(GENERAL) EXHAUST TO PROVIDE ADEQUATE VENTILATION.
Protective Gloves: IMPERVIOUS GLOVES HSOULD BE WORN
Eye Protection: WEAR FACE VISOR OR GOGGLES
Other Protective Equipment: PROTECTIVE CLOTHING SHOULD BE REGULARLY INSPECTED AND MAINTAINED; OVERALLS SHOULD BE DRY-CLEANED & LAUNDERED.
Work Hygienic Practices: WASH THOROUGHLY AFTER USE AND ALWAYS WASH HANDS BEFORE EATING, DRINKING OR USING THE TOILET.
Suppl. Safety & Health Data: AVOID INHALATION OF MISTS, FUMES OR VAPORS GENERATED DURING USE. AVOID EYE CONTACT. AVOID CONTACT WITH SKIN & OBSERVE GOOD PERSONNEL HYGIENE. ENSURE GOOD VENTILATION. USE SINGLE-USE DISPOSABLE CLOTHS & DISCARD WHEN SOILED.**UNLIKELY TO HARM AQUATIC ORGANISMS. SPILLED MATERIAL MAY MAKE SURFACE SLIPPERY.

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Transportation Data

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Trans Data Review Date: 93022
DOT PSN Code: GOA
DOT Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE
DOT Class: 3
DOT ID Number: UN1863
DOT Pack Group: III
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: HNZ
IMO Proper Shipping Name: FUEL OIL NO. 1
IMO Regulations Page Number: SEE 3375
IMO UN Number: 1223
IMO UN Class: 3.3
IMO Subsidiary Risk Label: -
IATA PSN Code: ZZZ
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI PSN Code: MMF
AFI Prop. Shipping Name: FUEL, AVIATION, TURBINE ENGINE
AFI Class: 3
AFI ID Number: UN1863
AFI Pack Group: III
AFI Basic Pac Ref: 7-7
MMAC Code: NR
N.O.S. Shipping Name: FUEL, AVIATION, TURBINE ENGINE, FLAMMABLE.

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 22JAN93
MFR Label Number: UNKNOWN
Label Status: F
Common Name: JET A-1
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-Moderate: X
Reactivity Hazard-None: X
Special Hazard Precautions: STORE AT AMBIENT TEMPERATURES AWAY FROM IGNITION SOURCES. ENSURE EQUIPMENT IS ELECTRICALLY BONDED & EARTHED TO PREVENT STATIC ACCUMULATION. INCOMPLETE COMBUSTION WILL GENERATE SMOKE & HAZARDOUS GASES, INCLUDING CARBON MONOXIDE. SPRAY APPLICATIONS INCREASES THE FIRE, & POSSIBLY EXPLOSION, HAZARD. IN CASE OF SPILL: RECOVER ALL SPILLAGE USING ABSORBANTS OR OTHER APPROPIATE COLLECTION TECHNIQUES. DO NOT WASH INTO DRAINAGE SYSTEM. ISOLATE SPILLAGE FROM ALL IGNITION SOURCES. IN EVENT OF LARGE SPILL INFORM THE LOCAL AUTHORITY.
Protect Eye: Y
Protect Skin: Y
Label Name: AIR BP, BP OIL LTD
Label Street: CLEVELAND HOPKINS INTL AIRPORT
Label City: CLEVELAND
Label State: OH
Label Zip Code: 44135
Label Country: US
Label Emergency Number: 216-267-3550

Page 1 of 5

AMOCO OIL -- JET FUEL JP-4 - TURBINE FUEL, AVIATION

MATERIAL SAFETY DATA SHEET
NSN: 9130002568613
Manufacturer's CAGE: 15958
Part No. Indicator: B
Part Number/Trade Name: JET FUEL JP-4

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General Information

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Item Name: TURBINE FUEL, AVIATION
Company's Name: AMOCO OIL CO
Company's Street: 200 E RANDOLPH DR MC 1408
Company's City: CHICAGO
Company's State: IL
Company's Country: US
Company's Zip Code: 60601-6401
Company's Emerg Ph #: 800-447-8735 (HEALTH)
Company's Info Ph #: 312-856-3907
Record No. For Safety Entry: 022
Tot Safety Entries This Stk#: 063
Status: FE
Date MSDS Prepared: 24SEP93
Safety Data Review Date: 29SEP94
Supply Item Manager: CX
MSDS Preparer's Name: G. I. BRESNICK
MSDS Serial Number: BNBZX
Specification Number: MIL-T-5624
Spec Type, Grade, Class: GRADE JP-4
Hazard Characteristic Code: F2
Unit Of Issue: GL
Unit Of Issue Container Qty: BULK
Type Of Container: NOT KNOWN
Net Unit Weight: NOT KNOWN

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: JET FUEL JP-4 (A WIDE BOILING ALIPHATIC AND AROMATIC DISTILLATE) SEE THE FOLLOWING IDENTIFIABLE COMPONENTS.
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: NY9340000
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: USAF 8HR TWA 200 PPM

Proprietary: NO
Ingredient: TOLUENE (SARA III)
Ingredient Sequence Number: 02
Percent: 22 %
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM/150 STEL
ACGIH TLV: 50 PPM; 9293
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 03
Percent: 10 %
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM/150 STEL
ACGIH TLV: 100 PPM/150STEL;9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: ETHYL BENZENE (SARA III)
Ingredient Sequence Number: 04
Percent: 2 %
NIOSH (RTECS) Number: DA0700000
CAS Number: 100-41-4
OSHA PEL: 100 PPM/125 STEL
ACGIH TLV: 100 PPM/125STEL 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 05
Percent: 4 %
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: 1PPM/5STEL;1910.1028
ACGIH TLV: 10 PPM; A2; 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: CYCLOHEXANE (SARA III)
Ingredient Sequence Number: 06
Percent: 5 %
NIOSH (RTECS) Number: GU6300000
CAS Number: 110-82-7
OSHA PEL: 300 PPM
ACGIH TLV: 300 PPM, 9192
Other Recommended Limit: NONE SPECIFIED

Proprietary: NO
Ingredient: METHYL TERT-BUTYL ETHER (SARA III)
Ingredient Sequence Number: 07
Percent: 7 %
NIOSH (RTECS) Number: KN5250000
CAS Number: 1634-04-4
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE SPECIFIED
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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS LIQUID, FUEL OIL ODOR
Boiling Point: 250-549F

Melting Point: NOT GIVEN
Vapor Pressure (MM Hg/70 F): 2-3 PSI
Vapor Density (Air=1): NOT GIVEN
Specific Gravity: 0.75 -0.8
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: NOT GIVEN
Solubility In Water: NEGLIGIBLE
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature: 468F

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Fire and Explosion Hazard Data

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Flash Point: -10F,-23C
Flash Point Method: CC
Lower Explosive Limit: 1.3 %
Upper Exp losive Limit: 8 %
Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZARDS (DRY CHEMICAL, CARBON DIOXIDE, HALOGENATED AGENTS, FOAM, STEAM) AND WATER FOG.
Special Fire Fighting Proc: FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO COOL NEARBY CONTAINERS EXPOSED TO FIRE.
Unusual Fire And Expl Hazrds: DO NOT USE DIRECT STREAM OF WATER ON FIRE. TOXIC GASES ARE RELEASED DURING COMBUSTION. VAPOR MAY EXPLODE IF IGNITED IN ENCLOSED AREA.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): HEAT, OPEN FLAME, SPARKS
Materials To Avoid: STRONG OXIDIZING AGENTS
Hazardous Decomp Products: CARBON MONOXIDE, CARBON DIOXIDE, UNIDENTIFIED ORGANIC COMPOUNDS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE. WILL NOT OCCUR.

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Health Hazard Data

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LD50-LC50 Mixture: NOT GIVEN FOR PRODUCT AS A WHOLE
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: MAY BE MILDLY IRRITATING TO THE EYES. PROLONGED OR REPEATED CONTACT MAY CAUSE DERMATITIS. VAPORS MAY IRRITATE THE NOSE, THROAT AND UPPER RESPIRATORY TRACTAND CAUSE CENTRAL NERVOUS SYSTEM DEPRESSION. ASPIRATION HAZARD.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: YES
Explanation Carcinogenicity: CONTAINS Benzene [71-43-2] WHICH IS LISTED BY NTP AND IARC AND REGULATED BY OSHA AS A CARCINOGEN.
Signs/Symptoms Of Overexp: EYE IRRITATION, SKIN IRRITATION, DERMATITIS, UPPER RESPIRATORY TRACT IRRITATION, NAUSEA, VOMITING, DIARRHEA, HEADACHES, DIZZINESS, DROWSINESS.
Med Cond Aggravated By Exp: PRE-EXISTING SKIN AND/OR RESPIRATORY DISORDERS MAY BE AGGRAVATED BY EXPOSURE TO THIS PRODUCT.

Emergency/First Aid Proc: EYES: FLUSH WITH WATER FOR 15 MINUTES WHILE HOLDING EYELIDS OPEN. GET MEDICAL ATTENTION. SKIN: REMOVE CONTAMINATED CLOTHING. WASH WITH SOAP AND WATER. IF IRRITATION PERSISTS, GET MEDICAL ATTENTION. INHALATION: REMOVE TO FRESH AIR. RESTORE BREATHING. GET MEDICALATTENTION. INGESTION: DO NOT INDUCE VOMITING. GET MEDICAL ATTENTION.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: ELIMINATE SOURCES OF IGNITION. EVACUATE AREA. WEAR PROPER PERSONAL PROTECTIVE EQUIPMENT. CONTAIN SPILL. STOP LEAK IF CAN DO SO WITHOUT RISK. ABSORB LIQUID WITH SUITABLE ABSORBENT MATERIAL. COLLECT FOR DISPOSAL.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: PREVENT WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD ANY PRODUCT, RESIDUE, DISPOSAL CONTAINER OR LINER IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN A FLAMMABLE LIQUIDS AREA. STORE AWAY FROM HEAT, IGNITION SOURCES AND OPEN FLAMES IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL RULES
Other Precautions: AVOID SKIN CONTACT. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

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Control Measures

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Respiratory Protection: AVOID BREATHING VAPOR AND/OR MIST. USE WITH ADEQUATE VENTILATION. IF VENTILATION IS INADEQUATE, USE NIOSH/MSHA CERTIFIED RESPIRATOR WHICH WILL PROTECT AGAINST ORGANIC VAPOR/MIST.
Ventilation: LOCAL EXHAUST AND MECHANICAL (GENERAL) VENTILATION TO MAINTAIN EXPOSURE LEVELS.
Protective Gloves: IMPERVIOUS
Eye Protection: SAFETY GLASSES OR GOGGLES
Other Protective Equipment: PROTECTIVE CLOTHING AS REQUIRED TO AVOID SKIN CONTACT. AN EMERGENCY EYE WASH STATION AND SHOWER SHOULD BE AVAILABLE.
Work Hygienic Practices: WASH WITH SOAP AND WATER AFTER HANDLING PRODUCT AND BEFORE EATING DRINKING OR SMOKING.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

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Transportation Data

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Trans Data Review Date: 93222
DOT PSN Code: GNZ
DOT Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE
DOT Class: 3
DOT ID Number: UN1863
DOT Pack Group: II
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: HNV
IMO Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE
IMO Regulations Page Number: 3271
IMO UN Number: 1863
IMO UN Class: 3.2
IMO Subsidiary Risk Label: -
IATA PSN Code: MMA
IATA UN ID Number: 1863
IATA Proper Shipping Name: FUEL, AVIATION, TURBINE ENGINE
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID

Page 5 of 5

AFI PSN Code: MMA

AFI Prop. Shipping Name: FUEL, AVIATION, TURBINE ENGINE
AFI Class: 3
AFI ID Number: UN1863
AFI Pack Group: II
AFI Basic Pac Ref: 7-7
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Disposal Data
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Label Data
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Label Required: YES
Technical Review Date: 06JUL92
MFR Label Number: UNKNOWN
Label Status: F
Common Name: TURBINE FUEL, AVIATION JP-4
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: EYE/SKIN/RESPIRATORY TRACT: IRRITATION. MOST HAZARDOUS IS EXPOSURE TO AIRBORNE MIST OR OTHER ASPIRATION INTO THE LUNGS. ONCE INTO THE LUNGS, THIS MATERIAL IS VERY DIFFICULT TO REMOVE AND CAN CAUSE DEATH. PROLONGED AND REPEATED EXPOSURES CAN CAUSE DAMAGES TO THE LIVER, KIDNEYS AND CENTRAL NERVOUS SYSTEM. THIS MATERIAL CONTAINS BENZENE, A KNOWN CARCINOGEN. STORE IN A COOL, DRY, WELL VENTILATED AREA AWAY FROM SOURCES OF IGNITION OR OXIDIZERS. KEEP CONTAINER CLOSED WHEN NOT IN USE. PROTECT FROM DAMAGE. FIRST AID: AVOID VOMITING. EYES/SKIN: REMOVE CONTAMINATED CLOTHING & FLUSH WITH WATER FOR 15 MINUTES. GET MEDICALATTENTION.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AMOCO OIL CO
Label Street: 200 E RANDOLPH DR MC 1408
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601-6401
Label Country: US
Label Emergency Number: 800-447-8735/800-424-9300 CHEMTREC

AMOCO OIL -- LS NO. 2 DIESEL FUEL - DIESEL FUEL

MATERIAL SAFETY DATA SHEET
NSN: 9140002865294
Manufacturer's CAGE: 15958
Part No. Indicator: A
Part Number/Trade Name: LS NO. 2 DIESEL FUEL

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General Information

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Item Name: DIESEL FUEL
Company's Name: AMOCO OIL COMPANY
Company's Street: 200 EAST RANDOLPH DRIVE
Company's City: CHICAGO
Company's State: IL
Company's Country: US
Company's Zip Code: 60601
Company's Emerg Ph #: 800-447-8735/800-424-9300
Company's Info Ph #: 312-856-3907
Distributor/Vendor # 1: AMOCO INTERNATIONAL OILCO
Distributor/Vendor # 1 Cage: 6G027
Distributor/Vendor # 2: SPENCER OIL CORP (810-775-5022)
Distributor/Vendor # 2 Cage: 5W753
Record No. For Safety Entry: 039
Tot Safety Entries This Stk#: 112
Status: SE
Date MSDS Prepared: 24SEP93
Safety Data Review Date: 07SEP94
Supply Item Manager: KY
MSDS Preparer's Name: DONALD M. BARKER,DIR
Preparer's Company: PRODUCT STWEARDSHIP & TOXICOLOGY, AMOCO
MSDS Serial Number: BJPSG
Specification Number: VV-F-800
Spec Type, Grade, Class: DF-2
Hazard Characteristic Code: F4
Unit Of Issue: GL
Unit Of Issue Container Qty: BULK
Type Of Container: BULK
Net Unit Weight: BULK

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: PETROLEUM DISTILLATE, NO. 2 FUEL OIL
Ingredient Sequence Number: 01
Percent: N/GIVEN
NIOSH (RTECS) Number: LS8930000
CAS Number: 68476-30-2
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: NAPHTHALENE (SARA III)
Ingredient Sequence Number: 02
Percent: 1

NIOSH (RTECS) Number: QJ0525000
CAS Number: 91-20-3
OSHA PEL: 10 PPM
ACGIH TLV: 10 PPM/15 STEL; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: XYLENES (O-,M-,P- ISOMERS) (SARA III)
Ingredient Sequence Number: 03
Percent: 1
NIOSH (RTECS) Number: ZE2100000
CAS Number: 1330-20-7
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM/150STEL;9394
Other Recommended Limit: NONE RECOMMENDED
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Physical/Chemical Characteristics
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Appearance And Odor: CLEAR, WATER SHITE TO BLUE-GREEN LIQUID.
Boiling Point: 340F,171C
Specific Gravity: 0.85-0.88
Solubility In Water: NEGLIGIBLE (<0.1%)
Viscosity: >1.8 CST
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Fire and Explosion Hazard Data
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Flash Point: 120F,49C
Flash Point Method: TCC
Lower Explosive Limit: 0.6
Upper Explosive Limit: 7.5
Extinguishing Media: AGENTS APPROVED FOR CLASS B HAZ (E.G. DRY CHEMICAL, CARBON DIOXIDE, HALOGENTATED AGENTS, FOAM, STEAM) OR WATER FOG.
Special Fire Fighting Proc: NONE SPECIFIED BY MFG; HOWEVER WEAR APPROPRIATE PROTECTIVE EQIPMENT.
Unusual Fire And Expl Hazrds: COMBUSTIBLE LIQUID.
==========
Reactivity Data
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Stability: YES
Cond To Avoid (Stability): KEEP AWAY FROM IGNITIN SOURCES (E.G. HEAT AND OPEN FLAMES).
Materials To Avoid: AVOID CHLORINE, FLUORINE, AND OTHER STRONG OXIDIZERS.
Hazardous Decomp Products: INCOMPLETE BURNING CAN PRODUCE CARBON MONOXIDE &/OR CARBON DIOXIDE AND OTHER HARMFUL PRODUCTS.
Conditions To Avoid (Poly): NONE SPEICIFED BY MFG.
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Health Hazard Data
==========
LD50-LC50 Mixture: LD50,ORA L FOR SIMILAR PRODUCT >5G/KG.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: NO SIGNIFICANT EYE HEALTH HAZ IDENTIFIED. CAN CAUSE SKIN IRRIT ON PROLONG/REPEAT CONTACT. NO SIGNIFICANT INHAL HEALTH HAZ IDENTIFIED FOR THE LIQUID FUEL.LOW VISCOSITY PRODUCT. HARMFUL OR FATAL IF SWALLOWED & THEN

ASPIRATED INTO LUNGS CAUSING CHEM PNEUMONIA & DEATH. KIDNEY DAMAGE IN MALE RATS W/MATLS OF THIS TYPE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: PER MSDS NO INGRED PRESENT @ LEVELS FOR CARCINO.NIOSH RECOMMENDS WHOLE DIESEL EXHAUST REGARDED AS POTENTIAL OCCUP CARCIN
Signs/Symptoms Of Overexp: INHAL OF VAPORS FROM HEATED MATL IN CONFINED AREA CAUSES DIZZINESS, HEADACHE, NAUSEA, POSSIBLE IRRIT OF EYE/NOSE/THROAT.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MFG.
Emergency/First Aid Proc: EYE: FLUSH W/PLENTY OF WATER. SKIN: WASH W/ SOAP & WATER. REMOVE CONTAMIN CLOTHING/SHOE. INHAL:IF ADVERSE EFFECTS OCCUR REMOVE TO UNCONTAMINATED AREA. INGEST: DO NOT INDUCE VOMIT. GET IMMED MED ATTN.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: REMOVE OR SHUT OFF ALL SOURCES OF IGNITION. PREVENT SPREADING BY DIKING, DITCHING, OR ABSORBING ON INERT MATERIALS. IF SPILLED INTO WATERS FO USA IT MAY BE REPORTABLE UNDER 33 CFR PART 153 IF IT PRODUCES A SHEEN.
Neutralizing Agent: NONE SPECIFIED BY MFG.
Waste Disposal Method: DISPOSAL MUST BE IN ACCORDANCE W/APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS. ENCLOSED-CONTROLLED INCINERATIN IS RECOMMNENDED UNLESS DIRECTED OTHERWISE BY APPLICABLE ORDINANCES. PRODUCT EXEMPT FROM CERCLA REPORTING REQMTS UNDER 40CFRPART302.4.
Precautions-Handling/Storing: STORE IN COMBUSTILBLE LIQUIDS STORAGE AREA. STORE AWAY FROM HEAT, IGNITIN SOURCES, AND OPEN FLAME IN ACCORDANCE W/ APPLICABLE FED/STATE/LOC REGS.
Other Precautions: THE CONTAINER FOR THIS PRODUCT CAN PRESENT EXPLOSION OR FIRE HAZARDS, EVEN WHEN EMPTIED. TO AVOID RISK OF INJURY, DO NOT CUT, PUNCTURE OR WELD ON OR NEAR THIS CONTIANER.

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Control Measures

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Respiratory Protection: NONE SPECIFIED BY MFG. HOWEVER, USE WITH ADEQUATE VENTILATION. IF AIR CONTAMINANTS LEVEL ABOVE ESTABLISHED EXPOUSRE LIMITS USE APPROPRIATE NIOSH APPROVED RESP.
Ventilation: USE WITH ADEQUATE VENTILATION.
Protective Gloves: WEAR PROTECTIVE GLOVES.
Eye Protection: NONE REQUIRED; HOWEVER USE EYE PROTECTION
Other Protective Equipment: WEAR PROTECTIVE CLOTHING IF PROLONG/REPEAT CONTACT. EYE PROTECTION IS GOOD INDUSTRIAL PRACTICE.
Work Hygienic Practices: WASH HANDS AFTER HANDLING.PRACTICE GOOD PERSONAL HYGENIC PRACTICES.THOROUGHLY CLEAN & DRY CONTAMIN CLOTHING BEFORE REUSE
Suppl. Safety & Health Data: BOILING PT RANGE: 340F-675F APPROX. FROM SKIN-PAINTING STUDIES OF PETRO DISTILLATES OF SIMILAR COMPOSITION & DISTILLATE RANGE HAS BEEN SHOWN THESE MATLS OFTEN POSSES WEAK CARCINOGENIC ACTIVITY IN LAB ANIMALS.MFG HAVE CHOSEN TO BE CAUTIOUS IN LIGHT OF FINDINGS W/OTHER DISTILLATED STREAMS.

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Transportation Data

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Trans Data Review Date: 94250
DOT PSN Code: EXF
DOT Symbol: D
DOT Proper Shipping Name: DIESEL FUEL
DOT Class: 3
DOT ID Number: NA1993

DOT Pack Group: III
DOT Label: NONE
IMO PSN Code: HIA
IMO Proper Shipping Name: FLAMMABLE LIQUID, N.O.S. o
IMO Regulations Page Number: 3345
IMO UN Number: 1993
IMO UN Class: 3.3
IMO Subsidiary Risk Label: -
IATA PSN Code: MCA
IATA UN ID Number: 1993
IATA Proper Shipping Name: FLAMMABLE LIQUID, N.O.S. *
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: JEV
AFI Symbols: D
AFI Prop. Shipping Name: DIESEL FUEL
AFI Class: 3
AFI ID Number: UN1202
AFI Pack Group: III
AFI Basic Pac Ref: 7-7
N.O.S. Shipping Name: FUEL OIL, NO.2
Additional Trans Data: PER MSDS:DOT SHIPPING DESCRIPTION DIESEL FUEL COMBUSTIBLE LIQUID NA1993, III. IMO & IATA DO NOT HAVE CODES FOR THIS THEREFORE USED FLAMM LIQ NOS, III.

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 07SEP94
Label Status: F
Common Name: LS NO. 2 DIESEL FUEL
Chronic Hazard: NO
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Moderate: X
Reactivity Hazard-None: X
Special Hazard Precautions: WARANING! COMBUSTIBLE. NO SIGNIFICANT EYE HEALTH HAZ IDENTIFIED. CAN CAUSE SKIN IRRIT ON PROLONG/REPEAT CONTACT. NO SIGNIFICANT INHAL HEALTH HAZ IDENTIFIED FOR THE LIQUID FUEL. LOW VISCOSITY PRODUCT. HARMFUL OR FATAL IF SWALLOWED & THEN ASPIRATED INTO LUNGS CAUSING FLUSH W/PLENTY OF WATER. SKIN:WASH W/SOAP & WATER. REMOVE CONTAMIN CLOTHING/SHOE. INHAL:IF ADVERSE EFFECTS OCCUR REMOVE TO UNCONTAMINATED AREA. INGEST: DO NOT INDUCE VOMIT. GET IMMED MED ATTN.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: AMOCO OIL COMPANY
Label Street: 200 EAST RANDOLPH DRIVE
Label City: CHICAGO
Label State: IL
Label Zip Code: 60601
Label Country: US
Label Emergency Number: 800-447-8735/800-424-9300

ALDRICH CHEMICAL SUB OF SIGMA-ALDRICH – 22346-8 POTASSIUM PERMANGANATE 99% A C S REAGENT

MATERIAL SAFETY DATA SHEET
NSN: 650500F037055
Manufacturer's CAGE: 60928
Part No. Indicator: A
Part Number/Trade Name: 22346-8 POTASSIUM PERMANGANATE 99% A C S REAGENT

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General Information

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Company's Name: ALDRICH CHEMICAL CO SUB OF SIGMA-ALDRICH
Company's Street: 1001 W ST PAUL AVE
Company's P. O. Box: 355
Company's City: MILWAUKEE
Company's State: WI
Company's Country: US
Company's Zip Code: 53201-5000
Company's Emerg Ph #: 414-273-3850/314-771-5765
Company's Info Ph #: 414-273-3850/314-771-5765
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 11JUL91
Safety Data Review Date: 27OCT94
Preparer's Company: ALDRICH CHEMICAL CO SUB OF SIGMA-ALDRICH
Preparer's St Or P. O. Box: 1001 W ST PAUL AVE
Preparer's City: MILWAUKEE
Preparer's State: WI
Preparer's Zip Code: 53201-5000
MSDS Serial Number: BVSYL

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Ingredients/Identity Information

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Proprietary: NO
Ingredient: POTASSIUM PERMANGANATE *94-3*
Ingredient Sequence Number: 01
Percent: 99
NIOSH (RTECS) Number: SD6475000
CAS Number: 7722-64-7

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Physical/Chemical Characteristics

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Appearance And Odor: BLACK/DEEP PURPLE CRYSTALS.
Specific Gravity: 2.7
Decomposition Temperature: 302F

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Fire and Explosion Hazard Data

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Extinguishing Media: WATER SPRAY
Special Fire Fighting Proc: WEAR SELF CONTAINED BREATHING APPARATUS & PROTECTIVE CLOTHING TO PREVENT CONTACT W/SKIN & EYES.
Unusual Fire And Expl Hazrds: STRONG OXIDIZER. CONTACT W/OTHER MATERIALMAY CAUSE FIRE.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): HEAT, SPARKS, OPEN FLAME, OTHER IGNITION SOURCES
Materials To Avoid: ACIDS, STRONG REDUCING AGENTS, FINELY POWDERED METALS, PEROXIDES, ALUMINUM, ZINC, LEAD, COPPER & THEIR ALLOYS.
Hazardous Poly Occur: NO
==========
Health Hazard Data
==========
LD50-LC50 Mixture: ORAL LD50(RAT): 1090 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: HARMFUL IF SWALLOWED, INHALED/ABSORBED THROUGH THE SKIN. EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES/ UPPER RESPIRATORY TRACT/EYES/SKIN. INHALATION MAY BE FATAL AS A RESULT OF SPASM, INFLAMMATION & EDEMA OF THE LARYNX & BRONCHI, CHEMICAL PNEUMONITIS &PULMONARY EDEMA. CORROSIVE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA & VOMITING.
Emergency/First Aid Proc: EYES/SKIN: IMMEDIATELY FLUSH W/COPIOUS AMOUNTS OF WATER FOR 15 MINS. INHALATION: REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE CPR/OXYGEN IF NECESSARY. INGESTION: WASH OUT MOUTH W/WATER IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.
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Precautions for Safe Handling and Use
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Steps If Matl Released/Spill: EVACUATE AREA. SHUT OFF ALL IGNITION SOURCES. WEAR SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. COVER W/DRY-LIME, SAND/SODA ASH. PLACE IN COVERED CONTAINERS USING NON-SPARKING TOOLS & TRANSPORT OUTDOORS. VENTILATE & WASH SITE AFTER MATERIAL PICKUP.
Waste Disposal Method: ACIDIFY A 3% SOLUTION/A SUSPENSION OF THE MATERIALTO PH 2 W/SULFURIC ACID. ADD A 50% EXCESS OF AQUEOUS SODIUM BISULFITE STIRRING AT ROOM TEMP. AN INCREASE IN TEMP INDICATES A REACTION. (SEE SUPPLEMENTAL DATA)
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED & AWAY FROM COMBUSTIBLE MATERIALS, HEAT, SPARKS & OPEN FLAME. STORE IN A COOL, DRY PLACE. AVOID BREATHING DUST.
Other Precautions: DON'T GET IN EYES, ON SKIN/ON CLOTHING. AVOID PROLONGED/REPEATED EXPOSURE.
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Control Measures
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Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD
Protective Gloves: CHEMICAL RESISTANT
Eye Protection: SAFETY GOGGLES
Other Protective Equipment: PROTECTIVE CLOTHING, SAFETY SHOWER & EYE BATH
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. WASH THOROUGHLY AFTER HANDLING.
Suppl. Safety & Health Data: IF NO REACTION IS OBSERVED ON THE ADDITION OF 10% SODIUM BISULFITE, ADD MORE ACID. IF MANGANESE/CHROMIUM/MOLYBDENUM ARE PRESENT ADJUST PH TO 7 & TREAT W/SULFIDE TO PRECIPITATE FOR BURIAL ASHAZARDOUS WASTE. DESTROY

EXCESS SULFIDE/NEUTRALIZE/FLUSH DOWN THE DRAIN IAW/LOCAL, STATE & FEDERAL REGULATIONS.

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Transportation Data

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Disposal Data

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Label Data

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Label Required: YES
Label Status: G
Common Name: 22346-8 POTASSIUM PERMANGANATE 99% A C S REAGENT
Special Hazard Precautions: HARMFUL IF SWALLOWED, INHALED/ABSORBED THROUGH THE SKIN. EXTREMELY DESTRUCTIVE TO TISSUE OF THE MUCOUS MEMBRANES/UPPER RESPIRATORY TRACT/EYES/SKIN. INHALATION MAY BE FATAL AS A RESULT OF SPASM, INFLAMMATION & EDEMA OF THE LARYNX & BRONCHI, CHEMICAL PNEUMONITIS & PULMONARY EDEMA. CORROSIVE. BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA & VOMITING.
Label Name: ALDRICH CHEMICAL CO SUB OF SIGMA-ALDRICH
Label Street: 1001 W ST PAUL AVE
Label P.O. Box: 355
Label City: MILWAUKEE
Label State: WI
Label Zip Code: 53201-5000
Label Country: US
Label Emergency Number: 414-273-3850/314-771-5765

Section 1 - Product and Company Identification
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Product Identification: INHIBITED ETHYLENE GLYCOL ANTIFREEZE
Date of MSDS: 01/01/1987 Technical Review Date: 04/10/1987
FSC: 6850 NIIN: 00-181-7940
Submitter: D DG
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: PRIORITY CHEMICAL COMPANY
Manufacturer's Address1:
Manufacturer's Address2: N/P, NK 00000
Manufacturer's Country: NK
General Information Telephone:
Emergency Telephone: 212 686 7690
Emergency Telephone: 212 686 7690
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: Y
Published: Y
CAGE: 49859
Special Project Code: N

Item Description

Item Name:
Item Manager: S9G
Specification Number: MIL-A-46153B
Type/Grade/Class: REV B, AMD 1
Unit of Issue: DR
Unit of Issue Quantity: 1
Type of Container: 55 GAL DRUM

Contractor Information

Contractor's Name: PRIORITY CHEMICAL CO
Contractor's Address1: 200 MADISON AVE SUITE 1904
Contractor's Address2: NEW YORK, NY 10016
Contractor's Telephone: 201-345-0991
Contractor's CAGE: 49859

Section 2 - Compositon/Information on Ingredients
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Ingredient Name: CORROSION INHIBITOR
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:

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% High Volume: % High Volume Code:
% Text: N/K
% Enviro mental Weight:
Other REC Limits: N/P
OSHA PEL: N/P OSHA PEL Code:
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name : DIETHYLENE GLYCOL;CAS #111-46-6
Ingredient CAS Number: 111-46-6 Ingredient CAS Code: M
RTECS Number: ID5950000 RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 05.0
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: N/P OSHA PEL Code:
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Ingredient Name: DYE
Ingredient CAS Number: Ingredient CAS Code: X
RTECS Number: RTECS Code: X
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: N/P OSHA PEL Code:
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K ACGIH TLV Code: M

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ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: ETHYLENE GLYCOL (SARA III)
Ingredient CAS Number: 107-21-1 Ingredient CAS Code: M
RTECS Number: KW2975000 RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 90.0
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: C 50 PPM OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: C 50 PPM,VAPOR; 9192 ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity: 1 LB
DOT Reporting Quantity: 1 LB
Ozone Depleting Chemical: N

Ingredient Name: WATER CAS #7732-18-5
Ingredient CAS Number: 7732-18-5 Ingredient CAS Code: M
RTECS Number: ZC0110000 RTECS Code: M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/P
OSHA PEL: N/P OSHA PEL Code:
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Health Hazards Acute & Chronic: N/P

Signs & Symptoms of Overexposure: SKIN:SLIGHT IRRIT;INGEST:CAUSES COMA,KIDNEY/LIVER DAMAGE,DIARR;EYES:CAUSES SEV IRRIT;INHAL:VAP DIZZ.

Medical Conditions Aggravated by Exposure: N/P

LD50 LC50 Mixture: N/P
Route of Entry Indicators:
- Inhalation: N/P
- Skin: N/P
- Ingestion: N/P

Carcinogenicity Indicators
- NTP: N/P
- IARC: N/P
- OSHA: N/P

Carcinogenicity Explanation: N/P

Section 4 - First Aid Measures
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

First Aid: SKIN: WASH W.SOAP & H*2O EYES: FLUSH W. H*2O. INGESTED:GIVE 2 GLASSES H*2O; INDUCE VOMITING.CALL A PHYSICIAN. INHALE: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEED. KEEP WARM & QUIET. REMOVE CONTAMINATED CLOTHING. IF UNCONS DO NOT TAKE ANYTHING BY MOUTH.

Section 5 - Fire Fighting Measures
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Fire Fighting Procedures: WEAR SELF-CNTD BRTHG, APP H*20 SPRAY TO COOL CONTR.
Unusual Fire or Explosion Hazard: NONE NOTED BY MANUFACTURER.
Extinguishing Media: CO*2,DRY CHEM,ALCOHOL,FOAM,WATER SPRAY
Flash Point: Flash Point Text: 225F/107C (TCC)
Autoignition Temperature:
- Autoignition Temperature Text: N/A
- Lower Limit(s): 3.0
- Upper Limit(s): 16.0

Section 6 - Accidental Release Measures
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Spill Release Procedures: ELIMINATE IGNITION SOURCES. STOP LEAK. EVACUATE AREA.DO NOT TOUCH SPILLAGE. SM SPILL: ABSORB W. INERT ABSORBENT. PLACE IN CLOSED CONTAINER. FLUSH AREA W. WATER. LG SPILL: DIKE AHEAD FOR LATER DISPOSAL. NOTIFY AUTHORITIES.

Section 7 - Handling and Storage
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Repiratory Protection: AIR SUPPLIED MASK IN HIGH CONCENTRATION OF VAPORS
Ventilation: LOCAL EXHAUST TO MAINTN BELOW TLV.
Protective Gloves: IMPERVIOUS
Eye Protection: CHEM SPLA SH GOGGLES
Other Protective Equipment: SAFETY SHOWER & EYE BATH
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: MSDS DATED:11/84

Section 9 - Physical & Chemical Properties
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

HCC: N1
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 320F/160C
Melting/Freezing Point: Melting/Freezing Text: N/A
Decomposition Point: Decomposition Text: N/A
Vapor Pressure: <.1 Vapor Density: 2.1
Percent Volatile Organic Content:
Specific Gravity: 1.12
Volatile Organic Content Pounds per Gallon:
pH: N/P
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: <1(BU-ACETATE)
Solubility in Water: COMPLETE
Appearance and Odor: BLUE/GREEN LIQUID;MILD ODOR
Percent Volatiles by Volume: N/K
Corrosion Rate: N/P

Section 10 - Stability & Reactivity Data
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Stability Indicator: YES
Materials to Avoid: NONE
Stability Condition to Avoid: HEAT, IGNITION SOURCES
Hazardous Decomposition Products: INCOMPLETELY BURNED CARBON PRODUCTS, CO*2, CO.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization: NOT KNOWN

Section 11 - Toxicological Information
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Toxicological Information: N/P

Section 12 - Ecological Information
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Ecological Information: N/P

Section 13 - Disposal Considerations
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Waste Disposal Methods: KEEP IN COVERED DRUMS,PENDING DISPOSAL. HANDLE & DISPOSE IN FULL COMPLIANCE WITH ALL APPLICABLE INTERNATIONAL,FEDERAL,STATE, & LOCAL REGULATIONS.

Section 14 - MSDS Transport Information
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Transport Information: N/P

Section 15 - Regulatory Information
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

SARA Title III Information: N/P
Federal Regulatory Information: N/P
State Regulatory Information: N/P

Section 16 - Other Information
INHIBITED ETHYLENE GLYCOL ANTIFREEZE

Other Information: N/P

HMIS Transportation Information

Product Identification: INHIBITED ETHYLENE GLYCOL ANTIFREEZE
Transporation ID Number: 54418
Responsible Party CAGE: 49859
Date MSDS Prepared: 01/01/1987
Date MSDS Reviewed: 04/10/1987
MFN: 04/10/1987
Submitter: D DG
Status Code: C
Container Information
- Unit of Issue: DR
- Container Quantity: 1
- Type of Container: 55 GAL DRUM
- Net Unit Weight: 55.0 GL

Article without MSDS: N
Technical Entry NOS Shipping Number:
Radioactivity:
Form:
Net Explosive Weight:
Coast Guard Ammunition Code:
Magnetism: N/P
AF MMAC Code:
DOD Exemption Number:
Limited Quantity Indicator:
Multiple Kit Number: 0
Kit Indicator: N
Kit Part Indicator: N
Review Indicator: Y
Additional Data:

Department of Transportation Information

DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
DOT PSN Code: ZZZ
Symbols: N/R
DOT PSN Modifier:

Hazard Class: N/R

UN ID Number: N/R
DOT Packaging Group: N/R
Label: N/R
Special Provision(s): N/R
Packaging Exception: N/R
Non Bulk Packaging: N/R
Bulk Packaging: N/R
Maximimum Quanity in Passenger Area: N/R
Maximimum Quanity in Cargo Area: N/R
Stow in Vessel Requirements: N/R
Requirements Water/Sp/Other: N/R

IMO Detail Information

IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
IMO PSN Code: ZZZ
IMO PSN Modifier:
IMDG Page Number: N/R
UN Number: N/R
UN Hazard Class: N/R
IMO Packaging Group: N/R
Subsidiary Risk Label: N/R
EMS Number: N/R
Medical First Aid Guide Number: N/R

IATA Detail Information

IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
IATA PSN Code: ZZZ
IATA PSN Modifier:
IATA UN Id Number: N/R
IATA UN Class: N/R
Subsidiary Risk Class: N/R
UN Packaging Group: N/R
IATA Label: N/R
Packaging Note for Passengers: N/R
Maximu m Quantity for Passengers: N/R
Packaging Note for Cargo: N/R
Maximum Quantity for Cargo: N/R
Exceptions: N/R

AFI Detail Information

AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
AFI Symbols:
AFI PSN Code: ZZZ
AFI PSN Modifier:
AFI UN Id Number: N/R
AFI Hazard Class: N/R
AFI Packing Group: N/R
AFI Label: N/R
Special Provisions: N/A
Back Pack Reference: N/A

HAZCOM Label Information

Product Identification: INHIBITED ETHYLENE GLYCOL ANTIFREEZE
CAGE: 49859
Assigned Individual: N
Comp any Name: PRIORITY CHEMICAL CO
Company PO Box:
Company Street Address1: 200 MADISON AVE SUITE 1904

Company Street Address2: NEW YORK, NY 10016 US
Health Emergency Telephone: 212 686 7690

Label Required Indicator: Y
Date Label Reviewed: 12/16/1998
Status Code: C
Manufacturer's Label Number:
Date of Label: 12/16/1998
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N/P
Eye Protection Indicator: N/P
Skin Protection Indicator: N/P
Respiratory Protection Indicator: N/P
Signal Word : N/P
Health Hazard:
Contact Hazard:
Fire Hazard:
Reactivity Hazard:

Fire-Trol Canada Company
www.firetrolcanada.com

PETROL JEL™
Page 1 of 4

MATERIAL SAFETY DATA
FICHE SIGNALÉTIQUE

SECTION 1: PRODUCT IDENTIFICATION AND USE

Product Identifier: **PETROL JEL™**

Product use: Petrol Jel™ is a liquid thickener for gelling petroleum fuels for use in prescribed burning or wildfires.

Manufacturers name: **CIRCLE PARK HOLDINGS LTD**
P.O. BOX 464
CLEARWATER BC
V0E 1N0

Suppliers name: **FIRE-TROL CANADA COMPANY**
455 DENE DRIVE
KAMLOOPS BC
V2H 1J1

Emergency Telephone Numbers: (24 Hours)

[250] 374-0379: FIRE-TROL CANADA COMPANY: KAMLOOPS, B.C.

[530] 865-4932: FIRE-TROL HOLDINGS L.L.C.: ORLAND, CALIFORNIA

GENERAL INFORMATION

WHMIS CLASSIFICATION: B3 and D1
DANGEROUS GOODS CLASS: 3.2 (6.1)

WARNING STATEMENT

Danger. Methanol solution. May be fatal if swallowed. May cause blindness. Cannot be made non-poisonous. Can be absorbed through the skin. Harmful if inhaled. Use only in a well ventilated area. Flammable. Keep away from heat and open flame.

SECTION 2: HAZARDOUS INGREDIENTS

Petrol Jel™ is a proprietary mixture of a powdered gelling agent and carrying agents and has no CAS number. The principal ingredients are Methyl Alcohol (CAS #67-56-1) and a powdered metal stearate.

SECTION 3: PHYSICAL DATA:

1. Physical State: Low viscosity slurry.
2. Odour and Appearance: Slight perfume. Blue/yellow liquid
3. Odour Threshold (ppm): No data available.
4. Vapor Pressure (mm Hg): 92 at 20 degrees C.
5. Vapor Density (Air = 1): 1.11
6. Evaporation Rate:(Butyl Acet=1): 3.5 Evaporates Readily
7. Boiling Point: 64.5C (148F)
8. Freezing point: -97.8C (-144F)
9. pH: 6.5

10. Specific Gravity: 1.035
11. Coeff. Water/Oil Dist.: No data available.

SECTION 4: FIRE AND EXPLOSION DATA:

1. Flammability: Very Flammable. Class 3.2

2. Extinguishing Media: Carbon dioxide, dry chemical, foam, or water spray. Class A, BC, or ABC fire extinguishers. Sand/earth.

3. Special Firefighting Procedures in Enclosed Areas: In case of accident or fire involving Petrol Jel™ use chemical extinguishers or water to keep fire-exposed containers cool and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition sources and flash back. Wear an approved self-contained breathing apparatus and protective clothing.

4. Flashpoint: 12.2C (54F): Open Cup

5. Upper Flammable Limit (%): 36

6. Lower Flammable Limit (%): 6.7

7. Autoignition Temp.: 464C (867F)

8. Hazardous Combustion Products: When Petrol Jel™ is heated to point of combustion, carbon dioxide (CO2) and carbon monoxide (CO) will be formed.

9. Explosion Data: Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat,sparks or flames.

Sensitivity to Impact: Not Applicable
Sensitivity to Static Discharge: Not Applicable

SECTION 5: REACTIVITY DATA:

1. Stability: Excellent long term stability. Petrol Jel™ will settle out but can be easily put back into suspension through agitation. Hazardous polymerization will not occur.

2. Incompatibility: Avoid strong oxidizers such as hydrogen peroxide, bromine, chromic acid, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber and coatings. May react with metallic aluminium and generate hydrogen gas.

3. Reactivity: Not Applicable.

4. Hazardous Decomposition Products: Carbon dioxide, carbon monoxide and formaldehyde.

5. Storage: Store in original container until used. Protect against physical damage. Outside or detached storage is preferred. Store in a cool well ventilated area. Inside storage should be in standard flammable liquids storage room or cabinet. Storage and use must be in " No Smoking" areas. Spark proof tools and explosion proof equipment must be used in storage areas.

SECTION 6: TOXICOLOGICAL PROPERTIES:

1. Routes of Entry: Vapors can be expected to be the most likely source of exposure to Petrol Jel™. Slight irritant to mucous membranes. Toxic effects if excessive amounts inhaled. Toxic effects if excessive amounts absorbed through the skin.

2. Toxicological Data estimated from the Methyl Alcohol carrying agent.

Oral LD50 (Rat): > 5000 mg/kg

Dermal LD50 (Rabbit): 2000 mg/kg

3. Effects of Acute Exposure: Affects central nervous system, especially the optic nerve. Causes dizziness, nausea, muscle weakness, narcosis and respiratory failure. Ingestion can produce blindness. (100 ml can be fatal.)

4. Effects of Chronic Exposure: Marked impairment of vision and enlargement of liver. Skin irritation from prolonged exposure.

5. Carcinogenicity: Not listed by NTP or IARC.

6. Teratogenicity: Not listed by NTP or IARC.

7. Mutagenicity: Not listed by NTP or IARC.

8. Reproductive toxicity: Not listed by NTP or IARC.

9. Synergistic Products: Not applicable.

SECTION 7: PREVENTIVE MEASURES:

1. Protective clothing and equipment must be utilized when handling Petrol Jel™.

(i) Gloves: Avoid skin contact. Use rubber or plastic gloves when handling.

(ii) Eye: Avoid eye contact. Use safety goggles offering a full seal around the eyes. Do not wear contact lenses. Keep eye wash bottle inwork area.

(iii) Clothing: Wear cotton coveralls to minimize exposure to Petrol Jel™.

(iv) Respirator: Avoid excessive inhalation of vapors. Use in a well ventilated area. OSHA permissible exposure limit 200 ppm (TIMEWEIGHTED AVERAGE), 250 ppm (STEL) skin. If the exposure limit is exceeded, use an air supplied, full-face respirator or self contained breathing apparatus.

2. Ventilation Type Required: Mechanical

3. Leak and Spill Procedure: Ventilate area of leak or spill. Remove all sources of ignition. Clean up personnel require protective clothing and respiratory protection from vapors. Contain and remove liquid where possible. ABSORB WITH SAWDUST OR VERMICULITE FOR DISPOSAL AS A HAZARDOUS WASTE IN A RCRA APPROVED FACILITY. Do not flush to sewer.

4. Waste Disposal: Dispose of in accordance with all Federal, Provincial and Local regulations.

5. Transportation Information:
Transport Canada: Dangerous Good
Freight class: Class 3.2 (6.1) Packing Group II

SECTION 8: ENVIRONMENTAL EFFECTS:

1. Do not dispose to sewer.

2. Relatively low toxicity to aquatic life

96 hr. LC50 Juvenile Rainbow Trout: >1000 mg/litre.

3. Use and disposal employing proper environmental control practices should not cause significant environmental impact.

SECTION 9: FIRST AID PROCEDURES:

1. Inhalation:	Remove to fresh air and give oxygen if breathing is difficult. If not breathing, give artificial respiration. Get medical attention.
2. Ingestion:	If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down the throat. Never give anything by mouth to an unconscious person. Get medical attention immediately.
3. Skin Contact:	Remove contaminated clothing. Wash with soap and water for at least 15 minutes. Get medical attention if irritation develops.
4. Eye Contact:	Flush eyes immediately with large amounts of water for at least 15 minutes, lifting upper and lower lids occasionally. Get medical attention immediately.

SECTION 10: PREPARATION DATE

Prepared By: Wally McCulloch
FIRE-TROL CANADA COMPANY [250] 374-0379

Effective Date: January 17, 2002 Supersedes: March 1, 1999

==========

NOTICE OF WARRANTY

FIRE-TROL CANADA COMPANY warrants that **Petrol Jel™** is reasonably fit for the purpose for which it was developed only when used in accordance with manufacturers recommended use practices and when used under normal conditions. The liability of **Fire-Trol Canada Company** with respect to the use and handling of this product is limited to the amount of the purchase price of the product to the user and **Fire-Trol Canada Company** will not be liable for consequential, special, or indirect damages resulting from such use or handling. **WARNING: Petrol Jel™** is flammable; is harmful and potentially fatal if swallowed; contact with the skin and eyes is to be avoided; **Fire-Trol Canada Company** will not be responsible for injury or deaths which occur as a result of the use or handling of this product.

Petrol Jel™ is a trademark of Circle Park Holdings Ltd.

FIRE-TROL CANADA COMPANY MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

FIRE-TROL HOLDINGS, L.L.C.
MATERIAL SAFETY DATA SHEET
FIRE-TROL® FIREGEL®

Fire-Trol Holdings, L.L.C.
2620 N. 37th Dr.
Phoenix, AZ 85009
(602) 262-5401
(530) 865-4932 (24 hr. number)

CAUTION

Avoid eye contact; may be irritating. Avoid unprotected exposure of the skin. Work in a ventilated area to avoid possible irritation of respiratory tract.

CLASSIFICATION: NON-HAZARDOUS

A. Product Identification. FIRE-TROL® FIREGEL® is an aluminum soap for use in thickening gasoline, kerosene or mineral spirits.

B. Occupational Control Procedures

1. Avoid eye contact. Wear goggles when handling.
2. Avoid skin contact. Use rubber or plastic gloves to avoid prolonged skin contact.
3. Avoid excessive inhalation of powder by wearing an OSHA approved dusk mask.
4. Handle product in a well ventilated area. Permissible concentration is airof 10 mg/m3. (Nuisance dust.)
5. Avoid ingestion. (Estimated LD_{50}>50 mg/kg;oral,rat)

C. Fire Protection Information

1. Extinguishing media for concentrate: Carbon dioxide, dry chemical, foam, or water spray. Class A, BC, or ABC fire extinguishers, sand/earth.
2. Special fighting procedures in enclosed areas: Fire fighters must be equipped to prevent breathing of vapors or products of combustion. Wear an approved self-contained breathing apparatus and protective clothing.
3. Unusual fire or explosion hazards: Hazardous only when present as a dust. Dust explosions can occur under conditions of high dust concentration in the presence of a spark or open flame.

FIRE-TROL® FIREGEL®
January 4, 200
Page 2 of 2

D. Physical Data

1.	Color:	Greenish powder
2.	Odor:	Mild fatty
3.		1.01 ro 1.03 (approximately) whereas water is 1.0
4.	Melting point:	Over 390° F
5.	pH:	5 to 6 in a 5% dispersion
6.	Percent violate by weight:	1.5% (moisture)

E. Reactivity Data

1. Stability: Product has excellent long-term stability for an indefinite period.
2. Hazardous decomposition products: Carbon monoxide, carbon dioxide – these gases can be harmful in enclosed areas so fire fighters must wear an approved self-contained breathing apparatus and protective clothing.
3. Hazardous polymerization will not occur.
4. Incompatability (keep away from): Flames and sparks under dusty conditions. Avoid strong acids and oxidizers.

F. Spill, Leak and Disposal Information. Sweep up and discard in closed containers. Dispose of in accordance with all applicable federal, state and local regulations.

G. Transportation Data

1.	DOT:	Not regulated
2.	Reportable Quantity:	Not applicable
3.	Freight Classification:	Metallic soaps of fatty acids
4.	Non-hazardous, non-flammable, non-corrosive	

H. Emergency & First Air Procedures (for Concentrate)

1. Eye Contact. Flush eyes immediately with plenty of water for at least fifteen minutes and call a physician.
2. Skin Contact. Wash off with detergent and water.
3. Inhalation. Remove person to fresh air and provide oxygen if breathing is difficult. Get medical attention.
4. If swallowed, call a physician immediately.

NOTICE OF WARANT: Fire-Trol Holdings, L. L.C. warrants that FIRE_TROL products are reasonably fir fot the purposes for which were developed only when used in accordance with recommended use practices under normal conditions. In no case shall Fire-Trol Holdings, L.L.C be liable for consequential, special, or indirect damages resulting from the use or handling of these products. All such risks shall be assumed by the buyer. FIRE-TROL HOLDINGS, L.L.C. MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTIULAR PURPOSE NOR ANY OTHER EXPRESSED OR IMPLIED WARRANT EXCEPT AS STATED ABOVE.

Effective Date: April 8, 2002
Superseded all previous dates for FIRE-TROL®FIREGEL®

Appendix D – Helitorch and Mix Transfer Systems Modifications

- BLM Instruction Memorandum on Aerial and Ground Ignition Equipment Direction

- USFS Memo on Required Safety Modifications: Batch Mixer, Terratorch, Mix Transfer System, and Helitorch

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Office of Fire and Aviation
3833 South Development Avenue
Boise, Idaho 83705

December 9, 2002

In Reply Refer To:
9210/9214 (FA-320) **N**

EMS Transmission 12/09/02
Instruction Memorandum No. OF&A 2003-007
Expires: 09/30/04

To: State Directors

From: Director, Office of Fire and Aviation
(Attn: Fire Management Officers and Fuels Management Specialists)

Subject: Aerial and Ground Ignition Equipment Direction

Program Area: Fire Management/Prescribed Fire Operations

Purpose: This Instruction Memorandum (IM) provides direction for bringing existing Bureau of Land Management (BLM) equipment into compliance with applicable regulations and nationally recognized standards. It also provides direction on procurement of new equipment.

Policy/Action:

1. Aerial and ground ignition equipment that has undergone all corrective actions identified in Attachment #1, "Corrective Actions for Aerial and Ground Ignition Equipment," may be put back into service. The following URL is a hotlink to a Power Point presentation with photos of aerial and ground ignition equipment features requiring corrective action:
http://web.blm.gov/internal/fire/drctv.htm

2. Field Offices must receive a written certification from the prescribed fire equipment manufacturers that their equipment includes all corrective actions identified in Attachment #1 prior to issuing a purchase order for that equipment.

3. A Job Hazard Analysis (JHA) will be completed prior to initiation of prescribed fire operations using this equipment. For additional guidance on the use of the JHA please refer to BLM Manual Handbook 1112-2, Topic 1, Job Hazard Analysis, and BLM Prescribed Fire Management Guidance, IM No. OF&A 2002-027, June 6, 2002.

Time Frame: This IM is effective upon receipt.

Budget Impact: Budget impact will vary depending on the age and condition of the equipment requiring corrective action. To determine best value, the field is encouraged to evaluate the cost of corrective action versus the purchase of new equipment that fully complies with the requirements of this IM.

Background: IM No. OF&A 2002-022, May 28, 2002, issued the Hazard Assessment and Proposed Resolution for Combination Gelled-Fuel Batch Mixer/Terratorch and Drip Fuel Transportation report and placed a moratorium on the use of existing batch mixing and terratorch equipment.

Interim direction for modification and resumed use of mix transfer systems was provided in IM No. OF&A 2002-031, June 27, 2002. This current IM supercedes IM No. OF&A 2002-031 and provides additional modifications that must be made prior to use of that equipment.

A follow-up technical evaluation of aerial and ground ignition equipment was conducted at the National Interagency Fire Center (NIFC) on October 16 – 18, 2002. The evaluation was conducted by an industry safety consultant, who serves as a member of the National Fire Protection Association (NFPA) Technical Committee that is responsible for NFPA Standard 385, Tank Vehicles for Flammable and Combustible Liquids. A list of corrective actions (Attachment #1) was developed to be implemented immediately. The safety consultant will provide a final report by January 24, 2003. This final report, along with the original hazard assessment, will serve as the basis for development of plans and specifications for the next generation of aerial and ground ignition equipment.

Manual/Handbook Sections Affected: No Manual/Handbook Sections are affected.

Coordination: Personnel from the BLM Compliance Assessment – Safety, Health, the Environment (CASHE) Program, the USDA Forest Service Missoula Technology and Development Center, and the safety consultant developed the corrective actions in Attachment #1. Input and information for the corrective actions was supplied by technical and operational specialists representing the National Wildfire Coordinating Group (NWCG), Aerial Ignition Working Team, San Dimas Technology and Development Center, the BLM Office of Fire and Aviation (Fire Operations, Aviation, and Planning and Resources), the Fish and Wildlife Service, the Forest Service, the Bureau of Indian Affairs, aerial and ground ignition equipment manufacturers, and a Private Contractor.

Contact: If you have any questions concerning this memorandum please contact Rick Jensen at (208) 387-5710.

Signed by:
Lynn P. Findley
Acting Director
Office of Fire and Aviation

Authenticated by:
Pat Lewis
Supervisory Mgmt. Asst.
Office Services

Distribution:
Anne Jeffery, FA-101, WO
Jay Thietten, FA-101, WO
WO-560
BLM ADs
BC Library
Group Manager, Fire Operations
Group Manager, Planning and Resources
Group Manager, Aviation
Group Manager, Support Services
Cyndie Hogg, NARTC
State FMOs

Attachment 1

Corrective Actions for Aerial and Ground Ignition Equipment

Fire Spec Systems: Spec 2000 Modular Transfer/Mixer
These retrofits will be accomplished by the field in coordination with Joe Rawitzer, Fire Spec Systems, (831) 455-2498

1. Provide bonding lug on each drum's dry break fitting. Test for continuity after installation. Drums to be bonded to each other and the fuel truck.
2. Install spark arrester on muffler.
3. Eliminate kink on bypass hose and modify shield if necessary to fully shield the hose from the engine.
4. Install shield separating fuel piping and pump from internal combustion engine, if not already provided.
5. Remove collar around the internal combustion engine's fuel tank.
6. Mount Clay and Bailey relief vents on cam locks to keep them out of the gel. Note: relief vents must be in place prior to use of equipment.
7. Secure levers on cam lock caps together with safety pin to prevent them from opening accidentally.
8. Label drum inlets, outlets, and valves as to their appropriate function. In addition, flow direction through valves to be labeled. Labels to be engraved plastic or metal.
9. Isolate pressure gauge from fuel to prevent gelled-fuel from clogging gauge. Source for Compliant Gage: **Noshok** , Pressure Range: 0 PSI to 150 PSI Diameter: 2-1/8 to 2-1/4 inch, Special Equipment: equipped with sealed diaphragm, 316 SS - Stainless Steel: filled with GY liquid, Style: Type 25. Noshok, 1010 W. Bagley Rd., Berea, OH 44017, (440) 243-0888.

Fire Spec Systems: Spec 2000 Helitorch
These retrofits will be accomplished by the field in coordination with Joe Rawitzer, Fire Spec Systems (831) 455-2498

1. Mount Clay and Bailey relief vents on cam locks to keep them out of the gel. Note: relief vents must be in place prior to use of equipment.
2. Secure levers on cam lock caps together with safety pin to prevent them from opening accidentally.
3. Replace clip pin on containment band securing the drum to the helitorch frame with a safety pin.
4. Install aviation grade bolts and nuts on all attachments.
5. Protect bolts in sleeves where they are subject to wear on the pear-link adapter.
6. Prevent the threaded portion of the bolts from becoming a load-bearing surface.
7. Improve access to the ignition and pump control box by mounting it so the door opens toward the torch not the drum.
8. Modify gelled-fuel piping and associated supports to prevent the discharge end or tip of the piping from hitting the ground during landing or takeoff. Modification must not result in the installation of loose parts that can be lost.

9. Secure electrodes so they cannot be accidentally knocked out of adjustment, but are still easy to adjust.
10. All hardware (e.g., nuts, bolts, cargo hook attachment ring, etc.) to meet MTDC specification for helitorch suspension system. For drawings and specifications regarding helitorch and suspension system assembly and suspension cable and adapter, separator bar, helitorch please contact Wes Throop, Missoula Technology and Development Center at (406) 329-3957 or e-mail at: wthroop@fs.fed.us
11. Inspect wire rope slings for broken strands, kinking, or other physical damage and replace as necessary.

Firecon: Portable Mix-Transfer System
These retrofits will be accomplished by the field in coordination with Gene Jones, Firecon (541) 889-8630.

1. Provide bonding lug on each drum's dry break fitting. Test for continuity after installation. Drums to be bonded to each other and the fuel truck.

2. Replace nonconductive plastic funnel with metal funnel.
3. Secure levers on cam lock caps together with safety pin to prevent them from opening accidentally.
4. Label all valves permanently as to their function and direction of flow.
5. Isolate pressure gauge from fuel to prevent gelled-fuel from clogging gauge. Source for Compliant Gage: **Noshok** , Pressure Range: 0 PSI to 150 PSI Diameter: 2-1/8 to 2-1/4 inch, Special Equipment: equipped with sealed diaphragm, 316 SS - Stainless Steel: filled with GY liquid, Style: Type 25. Noshok, 1010 W. Bagley Rd., Berea, OH 44017, (440) 243-0888.
6. Install shield separating fuel piping and pump from internal combustion engine, if not already provided.

Firecon: Batch Mixer
These retrofits will be accomplished by Gene Jones, Firecon (541) 889-8630. A first article inspection will be conducted by Robert Stroud, Equipment Development Group, NIFC. Field Offices must call Gene Jones to schedule work to be done.

1. Bolt or weld cargo tank to trailer frame, not its expanded metal decking.
2. Seal permanently, all electrical connections, including live reel connections, and install protective covers over switch housings and the live reel wiring junction.
3. Install bronze gear pump with viton seals replacing cast iron pump.
4. Relocate fuel tank allowing it to be filled more easily and without spillage.
5. Install solid metal shield across the back of the engine/pump compartment.
6. Install solid metal shield in engine/pump compartment separating gelled-fuel piping and pump from belts and engine.
7. Remove expanded metal guard on engine side of the compartment.
8. Relocate fire extinguisher to front of trailer.
9. Extend emergency shut-off lever making it more accessible and provide detachable 20-foot lanyard.

10. Replace all hose and clamps with swedged conductive hose.
11. Replace bottom valve on batch mixer with larger valve to improve mixing, if this has not been accomplished already.
12. Replace supply hose to hose reel with hard pipe or swedged conductive hose. Pipe to be supported and secured. Swedged conductive hose to be protected from abrasion.
13. Protect all trailer wiring with split loom and secure it to the trailer frame. All wires passing through trailer frame to be protected from abrasion using rubber grommets.
14. Relocate battery to front of trailer and permanently mount. Run #4 cables in plastic conduit and secure to deck.
15. Secure levers on cam lock caps together with safety pin to prevent them from opening accidentally.
16. Label all valves permanently as to their function and direction of flow.
17. Install live reel to protect hose from abrasion and maintain internal bonding within hose.
18. Placard tank on all four sides using self-adhesive placards.

Firecon: Terratorch

These retrofits will be accomplished by Gene Jones, Firecon, (541) 889-8630. A first article inspection will be conducted by Robert Stroud, Equipment Development Group, NIFC

1. Bolt or weld torch skid to vehicle body.
2. Seal permanently all electrical connections and install protective cover over switch housings.
3. Install bronze gear pump with viton seals replacing cast iron pump.
4. Relocate fuel tank allowing it to be filled more easily and without spillage.
5. Install solid metal shield across the back of the engine/pump compartment.
6. Install solid metal shield in engine/pump compartment separating gelled-fuel piping and pump from belts and engine.
7. Remove expanded metal guard on engine side of the compartment.
8. Mount fire extinguisher independent from terratorch skid. This corrective action must be accomplished at the Field Office.
9. Extend emergency shut-off lever making it more accessible and provide detachable 20-foot lanyard.

10. Replace all hoses and clamps with swedged conductive hose.
11. Replace bottom valve on terratorch with larger valve to improve mixing, if this has not been accomplished already.
12. Protect all wiring on “after market” vehicle flat bed with split loom and secure it to the trailer frame. All wires passing through bed frame to be protected from abrasion using rubber grommets. Field Offices not sending the flat bed vehicle to be used with the terratorch must accomplish this corrective action at the Field Office.
13. Placard tank on all four sides using self-adhesive placards.
14. Relocate battery to front of vehicle bed or skid. Run #4 cables in plastic conduit and secure to vehicle bed or skid. A standard vehicle power cord and plug-in may also be used.
15. Secure levers on cam lock caps together with safety pin to prevent them from opening accidentally.

16. Label all valves permanently as to their function and direction of flow.
17. Install DOT specification cargo tank, minimum size 120-gallons.

Firecon: Terratorch Wand
These retrofits will be accomplished by the field in coordination with Gene Jones, Firecon, (541) 889-8630

1. Attach spring or universal swivel on hose where it connects to trigger assembly to prevent kinking.

Note: NIFC is developing a new wand that will have to be purchased when its development is completed.

Simplex: Helitorch
These retrofits will be accomplished by the field in coordination with Gene Jones, Firecon, (541) 889-8630 or Joe Rawitzer, Fire Spec Systems, (831) 455-2498. The DOT retrofit kit referenced in number 10 below can be obtained from Gene Jones or Joe Rawitzer.

1 Mount Clay and Bailey relief vents on cam locks to keep them out of the gel. Note: relief vents must be in place prior to use of equipment.
2. Secure levers on cam lock caps together with safety pin to prevent them from opening accidentally.
3. Install aviation grade bolts and nuts on all attachments.
4. Protect bolts in sleeves where they are subject to wear on the pear-link adapter.
5. Prevent the threaded portion of the bolts from becoming a load-bearing surface.
6. All hardware (e.g., nuts, bolts, cargo hook attachment ring, etc.) to meet MTDC specification for helitorch suspension system. For drawings and specifications regarding helitorch and suspension system assembly and suspension cable and adapter, separator bar, helitorch please contact Wes Throop, Missoula Technology and Development Center at (406) 329-3957 or e-mail at: wthroop@fs.fed.us
7. Inspect wire rope slings for broken strands, kinking, or other physical damage and replace as necessary.
8. Replace propane fuel line with double-walled metal braided propane line. New line to be routed without sharp bends and secured to prevent movement and abrasion.
9. Inspect power cord's outer insulation. Insulation to be continuous without cuts or gaps. Repairs to be made with insulating material equal to or great than the manufacturer's original outer insulation. Electrical tape is not acceptable.
10. Install DOT drum retrofit kit available from Firecon and Fire Spec Systems.

File Code: 5100 **Date:** January 6, 2003
Route To:

Subject: Required Safety Modifications: Batch Mixer, Terratorch, Mix Transfer System, and Helitorch

To: Regional Foresters, Station Directors, Area Director, IITF Director, Job Corps, and WO Staff

This letter provides guidance for required safety modifications to Forest Service batch mixers, terra torches, mix transfer systems, and helitorches. The *safety* modifications addressed in this letter and described in attachments must be accomplished no later than September 30, 2003. Each unit is responsible for the modification of their equipment.

The BLM commissioned a safety evaluation of its existing terra torches and batch mixers. As a result of this evaluation, the BLM terminated operations of its terra torches and batch mixers. The Forest Service chose not to take this action as a second evaluation was commissioned to resolve differences in interpretation of the NFPA codes. This evaluation was performed by a consultant who is a member of the NFPA technical committee on the transportation of flammable liquids. This committee is responsible for the preparation of NFPA 385, Standard for Tank Vehicles for Flammable and Combustible Liquids. As a result of this second evaluation, a list of modifications to improve the safety of gelled fuel mixing equipment and helitorches was developed. This work has included the involvement of MTDC specialists, Interagency Aerial Ignition Working Group members, and other Forest Service representatives from the initial phases.

In addition to the safety modifications required by this letter, the Missoula Technology and Development Center is currently working on modifications to enhance performance of existing batchmixers. Once these modifications have been developed and tested, a tech tip will be prepared outlining the suggested modifications. These *performance* modifications are not required but are intended to help field units improve the performance of equipment that is not working properly.

We will continue to work with BLM, other land management agencies, and the Aerial Ignition Working Group to develop improved standards, designs, and training for batch mixers, mix transfer systems, and helitorches that will address safety issues and performance issues identified by the field.

We also support efforts to formalize FEWT Firing Equipment Task Group to develop standards and training for ground firing equipment including terratorches, drip torches, flares, and other ignition devices.

Specific direction

1) Modify existing batch mixers and terra torches that have DOT 406 tanks per attachment 1.

2) Modify existing mix transfer systems per attachment 2.

3) Modify existing Fire Spec helitorches per attachment 3.

4) Modify existing Simplex helitorches per attachment 4.

5) Upgrade existing terra torches that are not DOT compliant to meet current DOT requirements or replace them with new DOT compliant equipment. All upgraded or new terratorches shall also include the modifications required in attachment 1.

New equipment may be ordered provided it includes the modifications required in attachments 1, 2, or 3.

If you have questions concerning policy, contact Neal Hitchcock at (208) 387-5949. For technical questions contact Wesley Throop at (406) 329-3957.

/s/ Tony Kern (for)
JERRY T. WILLIAMS
Director, Fire and Aviation Management

Attachment 1

Required Batchmixer and Terratorch Mods

For trailer-mounted units, the cargo tank must be bolted or welded to the trailer frame, not to the expanded metal decking. If necessary, supports may be welded to the trailer frame and the tank bolted or welded to these supports.

For skid-mounted units that are carried on a vehicle, the skid must be bolted or welded to the vehicle.

Permanently seal all electrical connections to prevent them from coming loose and sparking.

Install a protective cover over any switch housings to reduce sparking.

Replace the existing steel gear pump with a bronze gear pump with viton seals to eliminate potential sparking due to metal-to-metal contact.

Relocate the fuel tank of the gasoline engine that drives the pump as required to allow it to be more easily filled without spilling fuel on a hot engine.

Install a solid metal shield across the back of the engine/pump compartment to prevent leaks from piping or hoses from contacting a hot engine.

Modify the emergency shut-off lever as needed to provide ready access and provide a 20' lanyard to enable the tank to be shutoff in an emergency.

Install a solid metal shield in the pump/engine compartment between the pump and the engine to prevent gasoline from being sprayed on a hot engine in the event of piping leaks or pump seal failure.

Replace all hoses that have clamped end fittings with conductive hoses that have swedged end fittings to eliminate leakage points and insure electrical bonding throughout the system. Verify conductivity of the new hoses prior to installation.

Replace the supply hose to the batch mixer hose reel with hard pipe or swedged conductive hose to eliminate leakage points and insure electrical bonding throughout the system. If pipe is installed it must be supported and secured. If hose is installed it must be protected from abrasion.

Relocate the battery for the engine to the front of the trailer, vehicle bed, or terra torch skid and permanently mount it to reduce spark hazards near the pump and piping. Run #4 cables in plastic conduit and secure to the deck of the trailer.

Install split loom around all trailer or after market vehicle bed wiring and protect all wires passing through the trailer frame with grommets to prevent the wires from abrading on the frame and shorting out. Secure all wiring to the trailer.

Install safety pins on the cam lock cap levers to prevent them from opening during transportation.

Isolate the pressure gage from the gelled fuel to prevent the gel from clogging the gage.

Remove the expanded metal guard on the engine side of the compartment.

Permanently label all valves as to function and direction of flow.

Install a live reel on each batch mixer to protect the hose from abrasion and to maintain internal bonding within the hose.

Insure the tank is properly placarded on all four sides using self-adhesive placards.

Insure the fire extinguisher is permanently mounted near the front of the trailer or mounted independent of the terra torch skid.

Replace non-compliant tanks with DOT specification cargo tanks.

Install a spring or universal swivel on the terratorch wand hose where it connects to the trigger assembly to prevent kinking.

If the batch mixer or terratorch is trailer mounted, the trailer must be equipped with brakes if the gross trailer weight rating is 1500 lbs or more. The brake must be designed so the operator can activate them independently of the vehicle foot brakes. (FSH 7109.19,31.3)

Attachment 2

Required Mix Transfer System Modifications

Install bonding lugs on each drum's dry break fittings to prevent static electricity discharge. Verify continuity. During operation the drums must be bonded to each other and the fuel truck.

Insure a relief valve is installed on each drum to prevent collapsing the drum when gelled fuel is pumped out and the vapor hose connection port has been accidentally left capped. Each relief valve must be mounted on a cam lock fitting to prevent gelled gasoline from clogging the valve.

Install safety pins on the cam lock cap levers to prevent them from opening when the system is being transported.

Install an approved spark arrestor on the muffler of the gasoline engine.

Eliminate kinks in the bypass hose.

Label all drum connections, and valves as to their appropriate function and flow direction with engraved metal or plastic labels.

Isolate the pressure gage from the gelled fuel to prevent the gel from clogging the gage.

Install a shield between the pump and gasoline engine to prevent gasoline from being sprayed on a hot engine in the event of piping leaks or pump seal failure.

Replace the non-conductive plastic funnel used to add gelling agent to the gasoline with a metal funnel to prevent static discharge.

Install guards as needed over all rotating shafts.

Attachment 3

Fire Spec Helitorch Modifications

Insure the Clay and Bailey relief valve is installed. Mount the valve in a cam lock fitting to prevent it from being clogged by the gelled fuel.

Install safety pins on the cam lock cap levers to prevent them from opening when the helitorch is being transported.

Replace the clip pin on the drum containment band that secures the drum to the helitorch frame with a safety pin.

Replace standard grade bolts, nuts, and washers on helitorch suspension with aviation grade bolts, nuts, and washers (Parts 37, 38, 39, 40, 41, 42, and 44, Drawing MEDC-768).

Insure the spacer (Part 4, Drawing MEDC-768) is installed in the suspension adapter to prevent wear on the bolt from the pear link adapter.

Mount the ignition and pump electrical control box so that the door can be opened completely to allow access to the components inside.

Modify the fuel discharge piping so that the tip and electrodes do not hit the ground during take off and landing. This modification must not result in the installation of loose parts that can be lost.

Secure the electrodes so they cannot be accidentally knocked out of adjustment, but are still easy to adjust.

All suspension hardware to be per MTDC drawing MEDC-768.

Attachment 4

Simplex Helitorch Modifications

Install retrofit kit to make fuel drum DOT compliant. This kit is available from Firecon or Fire Spec.

Insure the Clay and Bailey relief valve is installed. Mount the valve in a cam lock fitting to prevent it from being clogged by the gelled fuel.

Install safety pins on the cam lock cap levers to prevent them from opening when the helitorch is being transported.

Inspect the suspension system wire ropes for broken stands, kinking, or other physical damage. Replace any defective wire rope.

Insure the nuts, bolts, and washers on the helitorch suspension with aviation grade (Parts 37, 38, 39, 40, 41, 42, and 44, Drawing MEDC-768).

Insure the spacer (Part 4, Drawing MEDC-768) is installed in the suspension adapter to prevent wear on the bolt from the pear link adapter.

All suspension hardware to be per MTDC drawing MEDC-768.

Inspect the insulation on the power cord. The insulation shall not have any cuts or cracks. Repair or replace as necessary. Electrical tape is not acceptable for repairing the insulation.

Replace the propane fuel line with a double walled metal braided line. Route the new line so that it does not have any sharp bends and secure the line to prevent movement and abrasion.

Appendix E – Regulatory Issues, Transportation Requirements and Inspection Checklists

- DOT Concerns and Transportation Requirements
    - Aerial Ignition Standards and Guidelines
    - Compliance Criteria
    - Helitorch Tank/Drum Compliance
    - Helitorch Operational Criteria
    - Helitorch Operational Training Criteria
- Mix Transfer System Drum Configuration
- Simplex 5400 and Fire Spec 2000 Helitorch Configuration
- Helitorch Inspection Checklist
- Batch Mixer Inspection Checklist
- Mix-Transfer System Inspection Checklist

Aerial Ignition Standards and Guidelines

	Drums or Tanks Less than 119 gallons	Tanks 119 gallons or greater
Markings	Tested and marked with DOT Performance Orientated Packaging Rating (POP) that usually starts with a UN1A1 or UN1A2 designation or has appropriate DOT designation.	Bulk Tank specification plate (MC306 or DOT406) or IBC.
Label	Labeled as "FLAMMABLE LIQUID" and marked " UN1203 – GASOLINE".	Placarded as "FLAMMABLE LIQUID" and Marked "UN1203"
Color	No color requirement.	No color requirement.
Sealed	Designed so that there is no leakage in case of rollover or accident. Not filled over 90% of volume. DOT approved Vacuum / Pressure Bypass valve NOT PERMITTED during transport (unless approved to POP standards). DOT approved Vacuum / Pressure Bypass valve REQUIRED during use and storage. Shut off valves that protected and not protruding from the vehicle.	Designed so that there is no leakage in case of rollover or accident. Shut-off valves that are protected and not protruding from the vehicle. Have appropriate fittings to accommodate bypass for vacuum and pressure (must meet DOT and NFPA Tank Standards). Have appropriate fittings to accommodate vapor removal or recovery.
Filling	Vapor control required either by removal or recovery. For tanks over 60 gallons, fill spout extends within 6 inches of bottom. Splash filling not permitted.	Vapor control required either by removal or recovery. Fill spout within extends within 6 inches of bottom. Splash filling not permitted. Bottom filling configuration is the preferred method.
Delivery And Static Control	Have approved (DOT, NFPA and within the scope of OSHA 29CFR 1910.106) petroleum fuel dispensing and vapor recovery / removal hoses and static bonding wire.	Have approved (DOT, NFPA and within the scope of OSHA 29CFR 1910.106) petroleum fuel dispensing and vapor recovery / removal hoses and static bonding wire.
Thickening Agents	A written procedure for dispensing thickening agent to comply with OSHA general requirements for minimizing inhalation / exposure as listed on the chemical's Material Data Safety Sheet. Dumping powder through manhole is not acceptable, use appropriate dispensing mechanism for dispensing power.	A written procedure for dispensing thickening agent to comply with OSHA general requirements for minimizing inhalation / exposure as listed on the chemical's Material Data Safety Sheet. Dumping powder through manhole is not acceptable, use appropriate dispensing mechanism for dispensing power.

Compliance Criteria

	Drums or Tanks Less than 119 gallons	Tanks 119 gallons or greater
Annually	Visually inspect tanks yearly for degradation and compliance.	Inspection - external visual (V) and leakage test (K)
Every 5 Years	None.	Inspection – Internal visual inspection (I) and pressure test (P)
Post Inspection Labeling	None.	Inspector will apply label with V, K, I, and P expiration dates.
Tank Modification Criteria	None.	Alteration of the tank original design specification (MC306 or DOT406) must be accomplished at DOT registered vendor.
General	Compliance with STANDARDS and GUIDELINES.	Permanent 2” cam lock fitting with recovery removal hose at least 50 feet in length and 2” in diameter. Compliance with STANDARDS and GUIDELINES.
Compliance	Tanks and Drums that do not comply with the STANDARDS and GUIDELINES and the COMPLIANCE CRITERIA, and which cannot be modified by a registered vendor to meet those requirements, shall be taken out of service.	Tanks that do not comply with the STANDARDS and GUIDELINES and the COMPLIANCE CRITERIA, and which cannot be modified by a registered vendor to meet those requirements, shall be taken out of service.

Helitorch Tank/Drum Compliance

	Drums or Tanks Less than 119 gallons	Tanks 119 gallons or greater
All Helitorch Drums and Tanks	Meet Standards and Guidelines, and the Compliance Criteria or be taken out of service.	Meet Standards and Guidelines, and the Compliance Criteria or be taken out of service.
UN Designation	Performance Orientated Packaging (POP) showing that testing was done in the "AS SUPPLIED" configuration. (Usually marked as 1A1 or 1A2).	Compliance with STANDARDS and GUIDELINES
Labeling/Placards and Markings	Flammable liquid label. Markings – G*asoline* and UN 1203. Exemption number if required. Two inch lettering for empty and full weight of helitorch.	Flammable liquid placard. Markings – UN 1203.
Vapor Control	Removable 2" cam lock fitting with recovery/removal hose at least 50 feet in length and 2" in diameter.	Permanent 2" cam lock fitting with recovery/removal hose at least 50 feet in length and 2" in diameter.
Volume Control	Site glass installed in drum bungs or other method to control volume not to exceed 90% of capacity. (Use 2" site glass, 3 ea. in drum bungs).	Do not exceed 90% tank capacity.
Vacuum/Pressure Relief Valves	Safety relief valve to allow air to enter and exit during gelled fuel pumping operations to prevent container implosion/explosion. (Clay Bailey type relief valve).	Safety relief valve to allow air to enter and exit during gelled fuel pumping operations to prevent container implosion/explosion.

Helitorch Operational Criteria

	Drums or Tanks Less Than 119 Gallons
Helitorch Filling or Emptying	Vapors shall be recovered or routed down wind from the operation a distance of 50 feet using petroleum rated hose. (Use 2-inch cam lock hose connected between the supply and receiving tanks. Place cam lock plugs in hose and tanks fittings when not in use.
Transportation of Helitorch Drums	Must be DOT approved and meet the STANDARDS and GUIDELINES. Must be located outside the crew compartment and securely fastened to prevent movement in the vehicle during transportation. Must be empty to the maximum possible extent.
Transportation of Non-Complying Helitorch Drums	**All non-complying drums and tanks must be taken out of service. Consult your local HazMat specialist for proper disposal procedures.**

Equipment Retrofit Options and Availability

Several vendors are currently working on equipment and procedures for retrofitting helitorches, batchmixers, and terratorches. Contact your Agency/Bureau Helicopter Operations Specialist for these companies prior to retrofitting existing equipment or the purchase of new equipment.

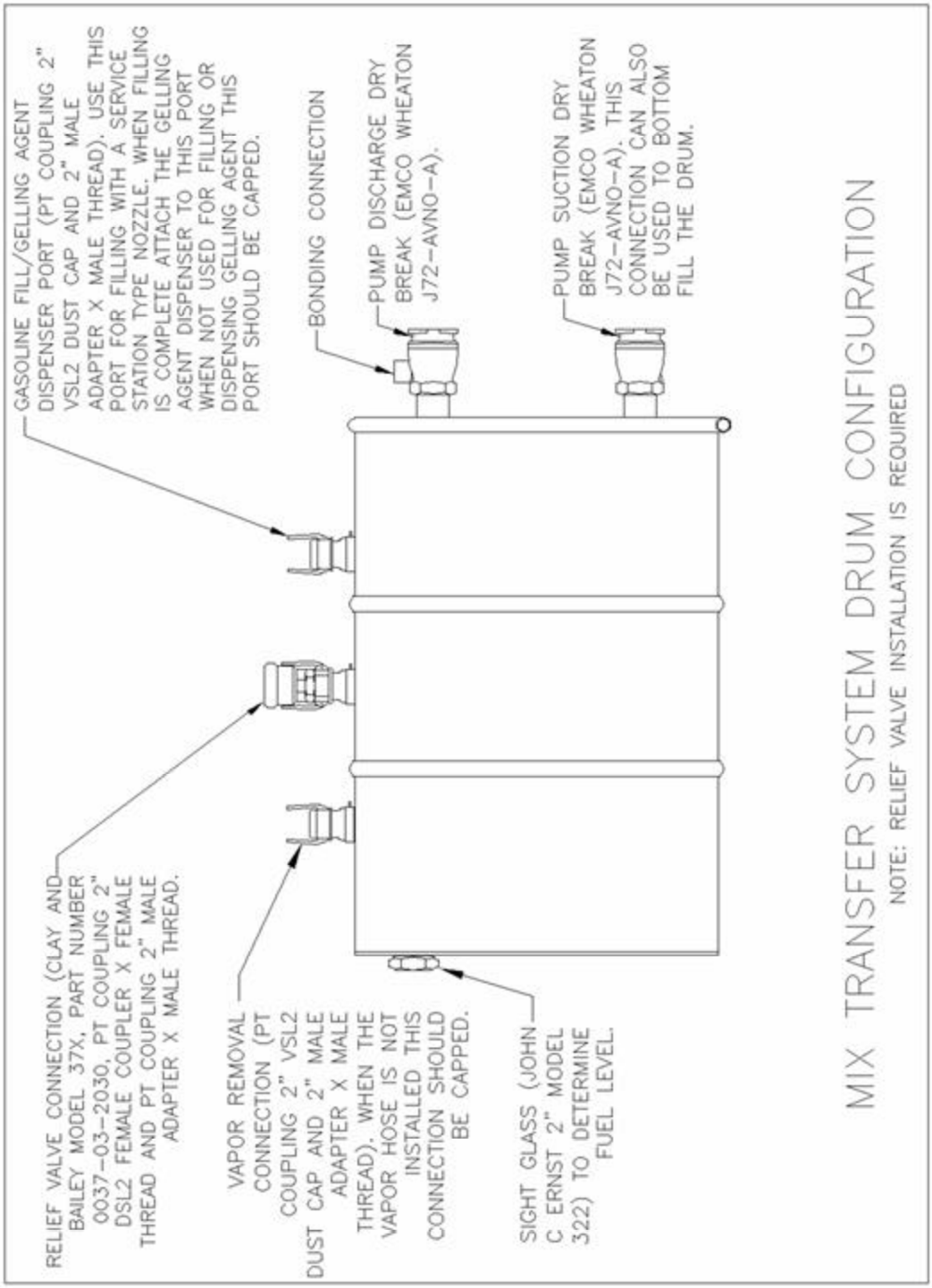
The approximate costs for a complete retrofit kit for the Simplex model #5400 helitorch (including DOT drum) is $1,000.

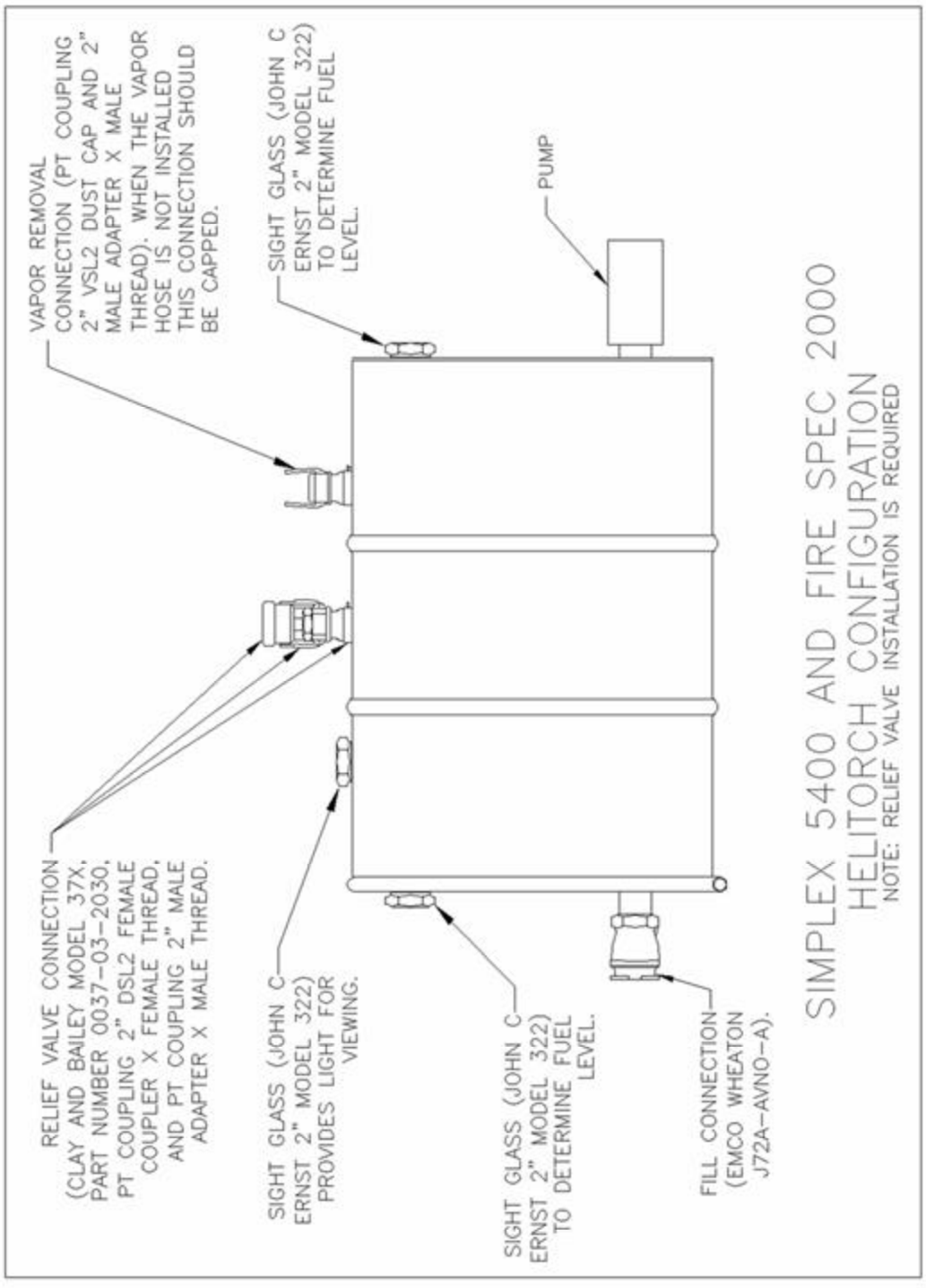
Retrofit Kit (includes)
UN 1A2 type DOT drum
2-inch site glass (3)
2-inch relief valve (Clay Bailey)
2-inch male Cam Lock fitting
2-inch Cam Lock dust cover (Cap)
Cable tie downs (drum) with nuts
Metal frame (adapter) with bolts

Accessories
Vapor removal/recovery hose
2-inch female Cam Lock fitting
2-inch Cam Lock dust plug
Emco Wheaton 2-inch adapter
Emco Wheaton 2-inch coupler
Civacon 2-inch male adapter
Civicon 2-inch coupler

Helitorch Operational Training Criteria

Training	**Programs that may apply under OSHA:** Right To Know – Hazardous Materials Awareness (Hazardous Waste and Toxic Substances) Material Data Safety Sheet compliance with dry and wet chemicals in use Personal Protective Equipment (PPE) for the chemicals in use General Health and Safety Standards (1910) Hand and Power Tool Use Fire Safety (extinguishers, prevention and survival) Machine (moving pump shaft, belt and wheel) Guarding Confined Space (if entering tanks) Respiratory Protection (if required on MSDS) and Fitting Program Lock Out Tag Out Program (control of unexpected equipment movement and power sources during repair, use, modification or cleaning). Ergonomics (proper body position, equipment use and lifting) ***Remember!*** *All training must be documented with the trainer's name, date of training, subjects covered, attendee's full name, signature and date. The key is "If the training was not documented, then it did not occur."* Additional training is required for all employees that fall outside of the "Materials of Trade" exceptions as outlined by the DOT. For flammable liquids, this includes any container larger than 8 gallons or any load larger than 440 pounds total aggregate weight including the containers. DOT has designated this training as "HM-126F" which includes four basic parts: 1. General Awareness 2. Safety Training 3. Function Specific Training and 4. Driver Training. oads greater than 119 gallons or 1000 pounds automatically require a commercial river's license with a hazardous materials endorsement, and additional driver training hich may include the requirement for tank endorsement.


GASOLINE FILL/GELLING AGENT DISPENSER PORT (PT COUPLING 2" VSL2 DUST CAP AND 2" MALE ADAPTER X MALE THREAD). USE THIS PORT FOR FILLING WITH A SERVICE STATION TYPE NOZZLE. WHEN FILLING IS COMPLETE ATTACH THE GELLING AGENT DISPENSER TO THIS PORT WHEN NOT USED FOR FILLING OR DISPENSING GELLING AGENT THIS PORT SHOULD BE CAPPED.
BONDING CONNECTION
PUMP DISCHARGE DRY BREAK (EMCO WHEATON J72-AVNO-A).
PUMP SUCTION DRY BREAK (EMCO WHEATON J72-AVNO-A). THIS CONNECTION CAN ALSO BE USED TO BOTTOM FILL THE DRUM.
RELIEF VALVE CONNECTION (CLAY AND BAILEY MODEL 37X, PART NUMBER 0037-03-2030, PT COUPLING 2" DSL2 FEMALE COUPLER X FEMALE THREAD AND PT COUPLING 2" MALE ADAPTER X MALE THREAD.
VAPOR REMOVAL CONNECTION (PT COUPLING 2" VSL2 DUST CAP AND 2" MALE ADAPTER X MALE THREAD). WHEN THE VAPOR HOSE IS NOT INSTALLED THIS CONNECTION SHOULD BE CAPPED.
SIGHT GLASS (JOHN C ERNST 2" MODEL 322) TO DETERMINE FUEL LEVEL.
MIX TRANSFER SYSTEM DRUM CONFIGURATION
NOTE: RELIEF VALVE INSTALLATION IS REQUIRED


VAPOR REMOVAL CONNECTION (PT COUPLING 2" VSL2 DUST CAP AND 2" MALE ADAPTER X MALE THREAD). WHEN THE VAPOR HOSE IS NOT INSTALLED THIS CONNECTION SHOULD BE CAPPED.
SIGHT GLASS (JOHN C ERNST 2" MODEL 322) TO DETERMINE FUEL LEVEL.
PUMP
RELIEF VALVE CONNECTION (CLAY AND BAILEY MODEL 37X, PART NUMBER 0037-03-2030, PT COUPLING 2" DSL2 FEMALE COUPLER X FEMALE THREAD, AND PT COUPLING 2" MALE ADAPTER X MALE THREAD.
SIGHT GLASS (JOHN C ERNST 2" MODEL 322) PROVIDES LIGHT FOR VIEWING.
SIGHT GLASS (JOHN C ERNST 2" MODEL 322) TO DETERMINE FUEL LEVEL.
FILL CONNECTION (EMCO WHEATON J72A-AVNO-A).
SIMPLEX 5400 AND FIRE SPEC 2000
HELITORCH CONFIGURATION
NOTE: RELIEF VALVE INSTALLATION IS REQUIRED

HELITORCH INSPECTION CHECKLIST

Company Name: _____

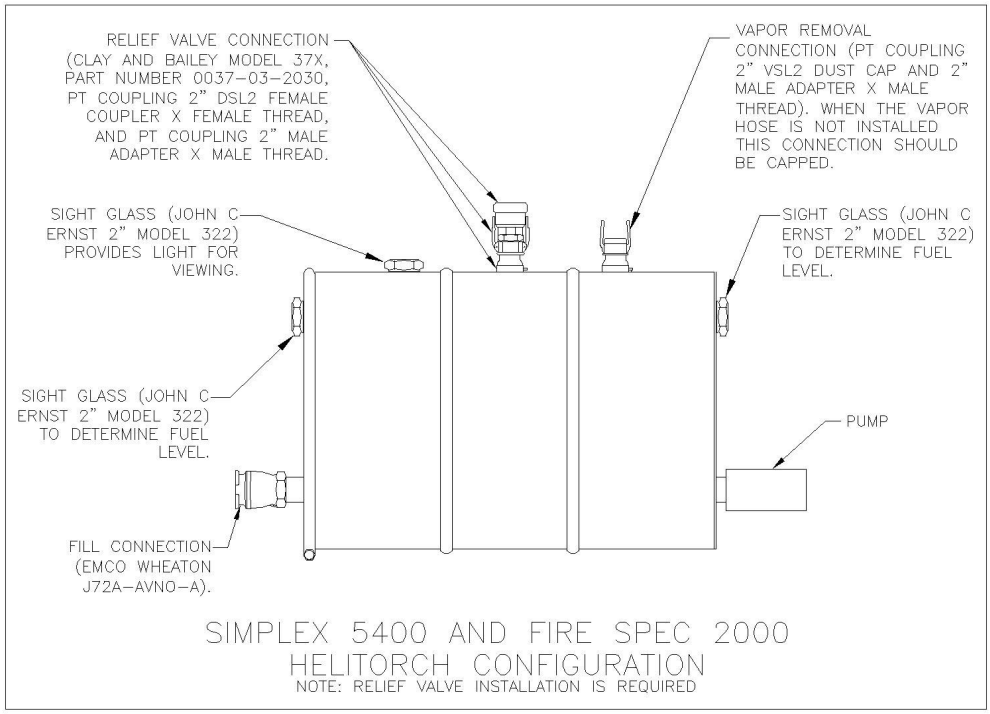
Helitorch Identification: _____

Inspection Location: _____

Date: _____

Inspector: _____

Tank (55 to 70 Gallons)



HELITORCH INSPECTION CHECKLIST (Continued)

_____ DOT Specification Drum (UN1A1 or UN1A2) or Exemption for Non-DOT Fuel Tank (Drum Spec or Exemption Number_____)

_____ Flammable Liquid" Label, "UN 1203" Marking, "Gasoline" Marking and Exemption Number (As Required) Applied to Drum or Tank

_____ 2" Male Cam & Groove Fitting Installed for Vapor Removal/ Recovery (Per Sketch for Fire Spec & Simplex, Vapor Removal/Recovery hoses minimum of 50 foot sections)

_____ Relief Valve Installed and Mounted on Cam and Groove Fittings to Prevent Clogging of Valve by Gel (Per Sketch for Fire Spec & Simplex)

_____ Cam and Groove Fitting Levers Secured With Safety Pins or Self Locking Levers Are Installed

_____ 2" Emco Wheaton Dry Break Adapter Installed for Fueling of Drum or Tank (Per Sketch for Fire Spec & Simplex)

_____ Filling of Drum of Tank by Bottom Filling – Either by Installation of Dry Break at Bottom of Drum or by a Fill Spout That Extends to Within 6" of Tank Bottom – Splash Filling Not Permitted

_____ Sight Glasses Installed to Determine Fuel Level in Drum or Tank

_____ Drum or Tank is Not Damaged and No Leakage is Visually Detectable

Comments:

HELITORCH INSPECTION CHECKLIST (Continued)

Suspension

_____ Wire Ropes Have No Physical Damage (Broken Strands, Kinks, Etc)

_____ Aviation Grade Bolts Installed – The Bolt Shoulders are Long Enough So That the Cable Ends Contact Only The Shoulder of the Bolts and the Bolt Threads are not a Load Bearing Surface

_____ The Pear Link Adapter Spacer is Installed so that the Pear Link Contacts Only the Spacer and Not the Bolt

Comments:

Electrical

_____ Power Cable in Good Condition – No Cuts or Gaps in Insulation

Comments:

Misc.

_____ Propane Hose - Hose is Compatible With Propane and Has a Braided Metal Cover

Comments:

BATCH MIXER INSPECTION CHECKLIST

Company Name: _____

Batch Mixer Identification: _____

Inspection Location: _____

Date: _____

Inspector: _____

Trailer Mounting

_____ Tank Connected to Trailer Frame Not Expanded Metal Decking

_____ Trailer Equipped With Brakes if Trailer Rating is 1500 lbs or More

_____ Trailer Wiring Protected from Abrasion

Comments:

Engine Installation

_____ Fuel Tank Located to Reduce Spillage of Gasoline on Hot Engine

_____ Shielding Installed Between Pump and Engine to Prevent Leaks From Contacting Hot Engine

_____ Shielding Installed Between Piping and Engine to Prevent Leaks From Contacting Hot Engine

Comments:

BATCH MIXER INSPECTION CHECKLIST (Continued)

Tank (Greater Than 119 Gallons)

_____ MC 306 or DOT 406 Specification Cargo Tank or IBC (Type_____)

_____ Emergency Shutoff Lever Accessible and Remotely Actuated More Than 10 Feet Away From Shutoff Valve or At End of Tank Furthest From Valve

_____ Tank and/or Vehicle Placarded on 4 Sides as "Flammable Liquid" and Marked on 4 Sides as "UN 1203"

_____ Shut Off Valves are Protected and Do Not Protrude from Vehicle

_____ 2" Cam & Groove Fitting Installed for Vapor Removal/Recovery (Vapor Removal/Recovery hoses minimum of 50 foot sections)

_____ Fill Spout Extends to Within 6" of Tank Bottom – Splash Filling Not Permitted

_____ V, K Inspection Current

_____ I, P Inspection Current

Comments:

Electrical

_____ All Electrical Connections Are Sealed and Secured

_____ Switch Housings Covered

_____ Battery Located Away From Piping Joints and Pump

Comments:

BATCH MIXER INSPECTION CHECKLIST (Continued)

Hoses

_____ Hoses Designed for Use With Gasoline (Hose Make & Model _____)

_____ Vapor Recovery/Removal Hose Designed for Use With Gasoline Vapor (Vapor Removal/Recovery hoses minimum of 50 foot sections) (Hose Make & Model _____)

_____ Swaged Hose Ends

_____ Electrically Conductive

_____ Live Reel Installed (Minimum of 60 foot hose)

Comments:

Pump

_____ Pump Internals are Non-Sparking (Pump Make & Model_____)

_____ Pump Seals are Compatible With Gasoline (Viton or Buna N)

Comments:

Misc

_____ Safety Pins Installed on Camlok Fittings or Self Locking Camlok Fittings Installed

_____ Pressure Gauge Isolated From Gel

_____ Valves Labeled As To Function and Flow Direction

_____ Fire Extinguisher Inspected, Mounted and Accessible

Comments:

MIX-TRANSFER SYSTEM INSPECTION CHECKLIST

Company Name: _____

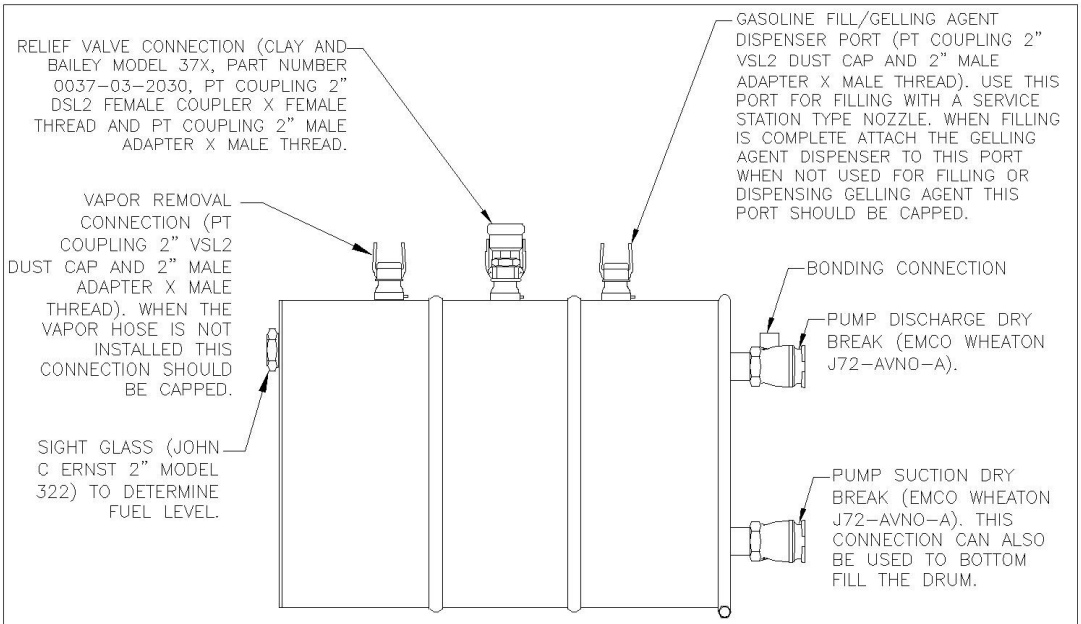
System Identification: _____

Inspection Location: _____

Date: _____

Inspector: _____

Drums



MIX TRANSFER SYSTEM DRUM CONFIGURATION

NOTE: RELIEF VALVE INSTALLATION IS REQUIRED

MIX-TRANSFER SYSTEM INSPECTION CHECKLIST (Continued)

_____ DOT Specification Drums

_____ "Flammable Liquid" Label, "UN 1203" Marking, "Gasoline" marking and Exemption Number (As Required) Applied to Each Drum

_____ 2" Male Cam & Groove Fitting Installed for Vapor Removal/Recovery (Per Sketch, Vapor Removal/Recovery hoses minimum of 50 foot sections)

_____ 2" Male Cam & Groove Fitting Installed for Gelling Agent Dispenser and Gasoline Fill Port (Per Sketch)

_____ Relief Valve Installed and Mounted on Cam and Groove Fittings to Prevent Clogging of Valve by Gel (Per Sketch)

_____ Cam and Groove Fitting Levers Secured With Safety Pins or Self Locking Levers Installed

_____ 2" Emco Wheaton Dry Break Adapter Installed for Pump Discharge and Pump Suction Connections (Per Sketch)

_____ Bonding Lugs Installed on Pump Discharge Dry Breaks

_____ Sight Glass Installed to Determine Fuel Level in Drum(Per Sketch)

_____ Drum is Not Damaged and No Leakage is Visually Detectable

Comments:

Engine Installation

_____ Shielding Installed Between Pump and Engine to Prevent Leaks From Contacting Hot Engine

Comments:

MIX-TRANSFER SYSTEM INSPECTION CHECKLIST (Continued)

Hoses

_____ Hoses Designed for Use With Gasoline (Hose Make & Model _____)

_____ Vapor Recovery/Removal Hose Designed for Use With Gasoline
Vapor (Vapor Removal/Recovery hoses minimum of 50 foot sections)
(Hose Make & Model _____)

_____ Swaged Hose Ends

_____ Electrically Conductive

Comments:

Pump

_____ Pump Internals are Non-Sparking (Pump Make and Model _____)

_____ Pump Seals are Compatible With Gasoline (Viton or Buna N)

Comments:

Misc

_____ Pressure Gauge Isolated From Gel

_____ Valves Labeled As To Function and Flow Direction

Comments:

Appendix F – Bonding Procedures

- Static Electricity Precautions for Batch Mixers
- Static Electricity Precautions Mix Transfer Systems
- Static Electricity Precautions While Fueling Helitorch with Vapor Recovery Hose Connected to Batch Mixer or Mix Transfer System
- Static Electricity Precautions While Fueling the Helitorch with Vapor Removal Hose (Vapor Hose Not Connected to Batch Mixer or Mix Transfer System)

Static Electricity Precautions for Batch Mixers

A. Check System Continuity

1. Verify that the hose connecting the suction side of the pump to the tank has continuity.
2. Verify that the hose connecting the discharge side of the pump to the tank has continuity.
3. Verify that the hose from the discharge side of the pump to the hose reel has continuity.
4. Verify that the helitorch fill hose has continuity from the hose reel to the dry break at the opposite end of the hose.
5. Verify vapor recovery/removal hose has continuity between the end fittings.

B. Attaching Vapor Removal/Recovery Hose to Camlok Fitting

1. Bond hose end fitting to tank prior to connecting hose to camlok fitting. Bonding shall be performed before the camlok cap on the tank is removed.

C. Fueling from Bulk Fueler

1. Bond the batch mixer to fuel truck using either electrically conductive hose or a bonding cable.

D. Placing Powder Dispenser on Batch Mixer Tank

1. Powder dispenser shall be made from electrically conductive material. Bond the powder dispenser to tank prior to opening manhole and placing powder dispenser over the manhole opening.

E. Powder Dispensing

1. Use only a metal can or bucket (no plastic) to pour powder into dispenser. Prior to pouring powder into dispenser, bond metal can or bucket to batch mixer.

Static Electricity Precautions for Mix Transfer Systems

A. Setting up the Drums

1. Bond all drums to each other.

B. Check Continuity of Hoses

1. Verify that the suction hose between the pump and the drum has continuity.

2. Verify that the helitorch fill/recirculation hose connecting the discharge side of the pump to the drum or the helitorch has continuity.

3. Verify vapor recovery/removal hose has continuity between the end fittings.

C. Attaching Vapor Removal/Recovery Hose to Camlok Fitting

1. Bond vapor hose end fitting to drum prior to connecting hose to camlok fitting.
2. Bonding shall be performed before the camlok cap on the drum is removed.

D. Fueling from Bulk Fueler

1. Bond batch mixer to fuel truck using either electrically conductive hose or a bonding cable.

E. Placing Powder Dispenser on Mix Transfer System Drum

1. Powder dispenser shall be made from electrically conductive material (not plastic).
2. Bond powder dispenser to drum prior to removing camlok cap and attaching dispenser to camlok on drum.

F. Powder Dispensing

1. Use only a metal can or bucket (no plastic) to pour powder into dispenser. Prior to pouring powder into dispenser, bond metal can or bucket to drum

Fueling the Helitorch with Vapor Recovery/Removal Hose Connected to Batch Mixer or Mix Transfer System

A. Hose Continuity Checks (These shall have been performed during setup of the batch mixer or mix transfer system.)

1. Verify continuity of the helitorch fill hose.

2. Verify continuity of vapor recovery/removal hose.

B. Hose Installation Sequence during Refueling

1. Connect helitorch fill hose to fill connection on helitorch drum.

2. Connect vapor recovery/removal hose to camlok fitting on helitorch drum.

Fueling the Helitorch with Vapor Recovery/Removal Hose

(Vapor Hose Not Connected to Batch Mixer or Mix Transfer System)

A. Hose Continuity Checks (These shall have been performed during setup of the batch mixer or mix transfer system.)

1. Verify continuity of the helitorch fill hose.

B. Hose Installation Sequence during Refueling

1. Connect helitorch fill hose to fill connection on helitorch drum.

2. Bond vapor recovery/removal hose to helitorch drum prior to removal of camlok cap or camlok relief valve fitting.

3. Connect vapor recovery/removal hose to camlok fitting on helitorch drum.

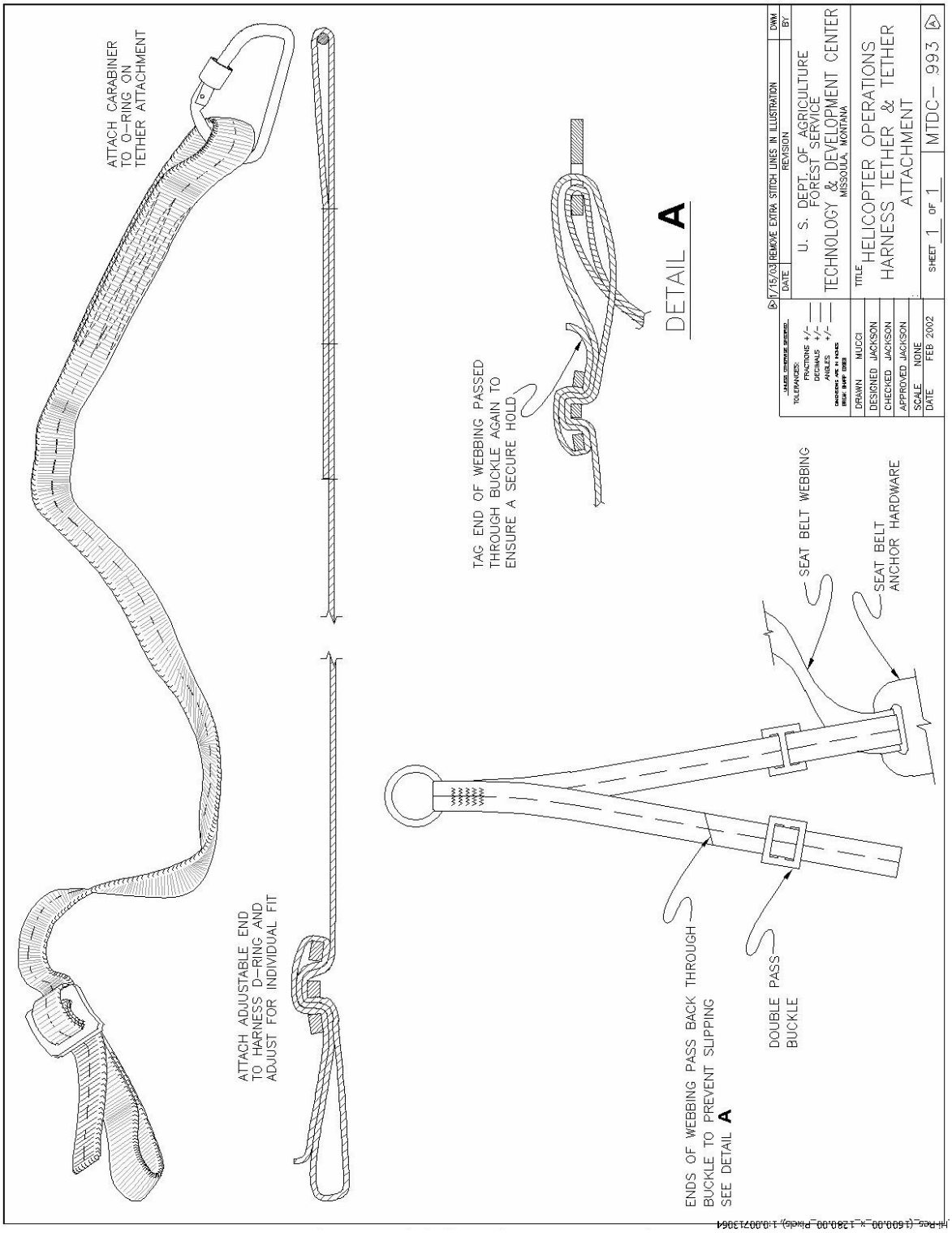
Appendix G – Miscellaneous

- Operator Harness Tether and Tether Attachment Schematic
- Emco Wheaton Dry-Break Parts List
- Emco Wheaton Dry-Break Schematic

Note: Emco Wheaton Dry-Break Adaptor Number J1404 has been changed to J72.

- MTDC Helitorch Suspension Drawing 968

Operator Harness Tether and Tether Attachment



EMCO WHEATON *PRODUCT BULLETIN:*
J72 & J79 SERIES COUPLER & ADAPTER REPAIR KITS

EMCO WHEATON CORP. - 2480 Bristol Circle, Oakville, Ontario, Canada, L6H 5S1 - Tel: 905-829-8619 Fax: 905-829-8620

Revised: May 2003, A Syltone Company - ***www.emcowheatoncanada.com***

To determine the correct repair kit for your coupler, find the coupler in the list and then follow the line to see all available kits. For example, the cross shaft seal kit for J72C-ABN1-B is 299786. *The DRY-BREAK-II™ "–B" variants are listed on the same line as the –A variants where the same kits are applicable.*

COUPLER PART #	Nose Seal Kit	Front End Repair Kit Minor	Front End Repair Kit Major	Nose Piece Kit	Cross Shaft Seal Kit	Lever Replacement Kit	Link & Stem Replacement Kit	Swivel Seal Kit	Swivel Replacement Kit	Bumper Ring Kit
	Kit #	Kit #	Kit #	Kit #	Kit #	Kit #	Kit #	Kit #	Kit #	Kit #
J72C-ABB0-A	800412	800174	299780	299813	299786	299789	299796	N/A	N/A	299785
J72C-ABI0-B								N/A	N/A	
J72C-ABI1-B								800532	299807	
J72C-ABI2-B								800533	299805	
J72C-ABN0-A or -B								N/A	N/A	
J72C-ABN0-A001 or -B001						299794		N/A	N/A	
J72C-ABN0-A002		800176	299782	299815		299789		N/A	N/A	
J72C-ABN1-A or -B		800174	299780	299813				299801	299811	
J72C-ABN1-A002		800176	299782	299815				299801	299811	
J72C-ABN2-A or -B		800174	299780	299813				299803	299809	
J72C-ABN2-A001 or -B001		800174	299780	299813		299794				
J72C-ABN2-A002 or -B002		800176	299782	299815		299789				
J72C-AVB0-A	800413	800175	299781	299814	299787	299790	299797	N/A	N/A	
J72C-AVB1-A								299802	299808	
J72C-AVI0-B								N/A	N/A	
J72C-AVI1-B								800536	299808	
J72C-AVI2-B								800537	299806	
J72C-AVN0-A or -B								N/A	N/A	
J72C-AVN0-A001 or B001		800175	299781			299795		N/A	N/A	
J72C-AVN0-A002 or B002		800177	299783	299816		299790		N/A	N/A	
J72C-AVN1-A or -B		800175	299781	299814				299802	299812	
J72C-AVN2-A or -B								299804	299810	
J72C-AVN2-A001 or B001						299795		299804	299810	
J72C-SBN0-A	800412	800176	299782	299815	299786	299791	299798	N/A	N/A	
J72C-SBN0-B	800412	800176	800272	800284	800274	800276	800282			
J72C-SPB0-A	800414	800178	299784	299817	299788	299793	299800			
J72C-SPI0-B			800285	800293	800286	800289	800291			
J72C-SPN0-A			299784	299817	299788	299793	299800			
J72C-SPN0-B			800285	800293	800286	800289	800291			
J72C-SVB0-A	800413	800177	299783	299816	299787	299792	299799			
J72C-SVI0-B			800288	800280	800287	800290	800292			
J72C-SVN0-A			299783	299816	299787	299792	299799			
J72C-SVN0-B			800288	800280	800287	800290	800292			
J79C-ABN0-A or -B	800412	800174	299780	299813	299786	299789	299796			
J79C-AVN0-A or -B	800413	800175	299781	299814	299787	299790	299797			

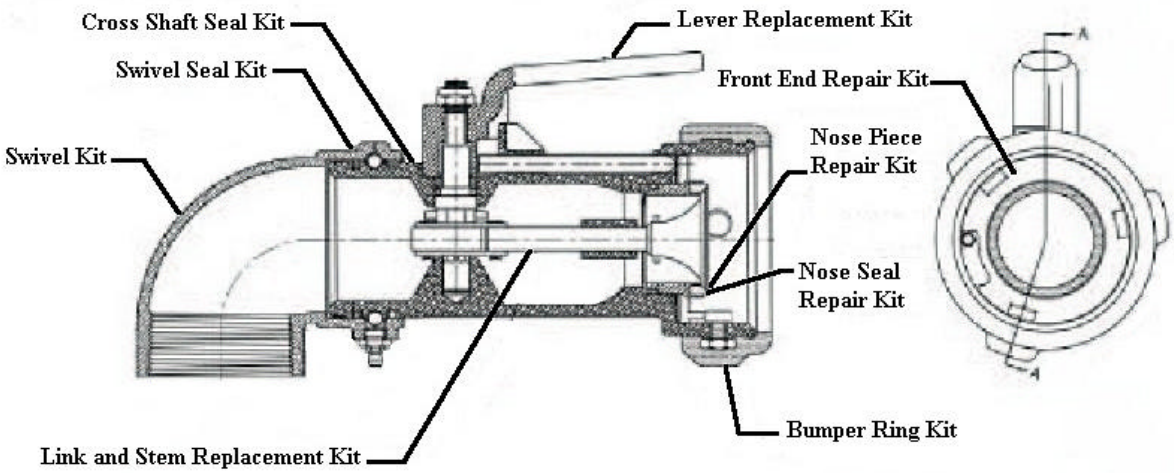
Below are the kits available for Emco Wheaton 1.5" and 2" Adapters.

Adapter Part #	Repair Kit No.	Adapter Part #	Repair Kit No.
All J1302 & J1304 Buna	**800530**	**J72 & J79 Buna REV. B Alum & Brass**	**800300**
All J1302 & J1304 Viton	**800529**	**J72 & J79 VITON REV. B Alum & Brass**	**800303**
J72 & J79 Buna REV. A Alum & Brass	**494118**	**J72 STAINLESS / VITON REV. A**	**800331**
J72 & J79 VITON REV. A Alum & Brass	**494119**	**J72 STAINLESS / CHEMRAZ REV. A**	**800333**

EMCO WHEATON *PRODUCT BULLETIN:*
J72 & J79 SERIES COUPLER & ADAPTER REPAIR KITS

EMCO WHEATON CORP. - 2480 Bristol Circle, Oakville, Ontario, Canada, L6H 5S1 - Tel: 905-829-8619 Fax: 905-829-8620

Revised: May 2003, A Syltone Company - ***www.emcowheatoncanada.com***



Emco Wheaton has developed a series of **REPAIR KITS** suitable for the field repair of J72 & J79 Series Couplers and Adapters. Our previous experience with this type of KIT PROGRAM has proven its value. If a Coupler or Adapter has a leaky seal or 'O'Ring, or a part worn, the installation of a complete REPAIR KIT in that area of concern will give the user far better value for the money, rather than just replacing one or two parts. The installation of the KIT renders a wear zone on the Coupler or Adapter completely rebuilt, and will consequently give longer service life. These KITS are available off the shelf, and come complete with instructions and diagram. The part number is prominently displayed for easy stock identification. Below is a summary of the usage and contents of each type of KIT:

Front End Repair Kits (Major): For rebuilding the front end of the coupler. Contains Wave springs (2), ORing, Wave washer, Interlock plate, Interlock Pin, Bayonet stud (3) Lock Nuts (3), Bumper ring, Nose seal, Nose Piece, Cotter Pin, and Grooved Pin.

Front End Repair Kits (Minor – Soft Parts): For repairing the front end of the coupler. Contains Wave springs (2), O-Ring, Wave washer, Bayonet studs (3) and Lock Nuts (3), Bumper ring, Nose seal, Cotter Pin, and Grooved Pin.

Nose Seal Kit: For replacing the Nose Seal. Contains Nose seal, O-Ring, and Cotter Pin.

Nose Piece Kit: For replacement of a damaged poppet and nosepiece. Contains Nose Piece, Nose Seal, ORing, Poppet, and Cotter Pin.

Bumper Ring Kit: For replacing bumper rings that are worn or damaged. Contains 4 Bumper rings

Cross S haft Seal Kit: For repairing leaks in the cross-shaft area. Contains O-Ring, Nylock Nut, Groove Pin, Roll Pin, Follower. "B" Version Stainless contains flat washer, shaft retainer, bearing bushing, collar, inner bushing, O-Ring, Nylock Nut.

Lever Replacement Kit: For replacing the lever and cross-shaft. Contains Lever, cross shaft and contents of "Cross Shaft Seal Kit" (see above)

Link & Stem Replacement Kit: For complete replacement of a damaged Link & Stem Assembly. Contains Link & Stem Assembly and contents of "Cross Shaft Seal Kit" (see above).

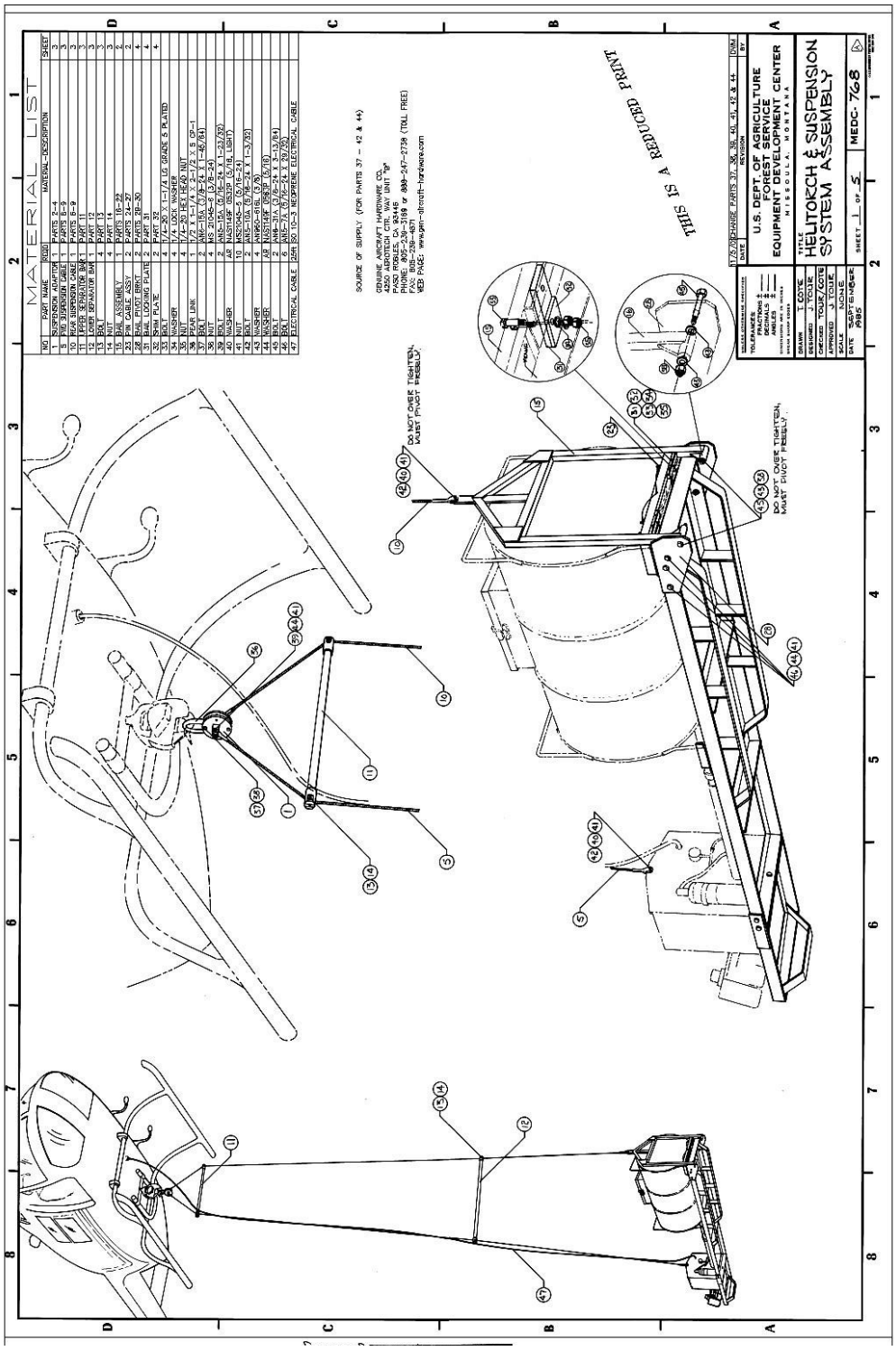
Swivel Seal Kit: For complete repair and rebuilding of either 90° or straight Swivel. Contains O-Ring, Quad Ring, Grease Fitting, Ball bearings (6), Bearing Strip, Ball Retainer Screw, and gasket (ISO / BSPP versions only).

Swivel Replacement Kit: For complete replacement of either 90° or straight Swivel. Contains Swivel Body and contents of "Swivel Seal Kit" (See above).

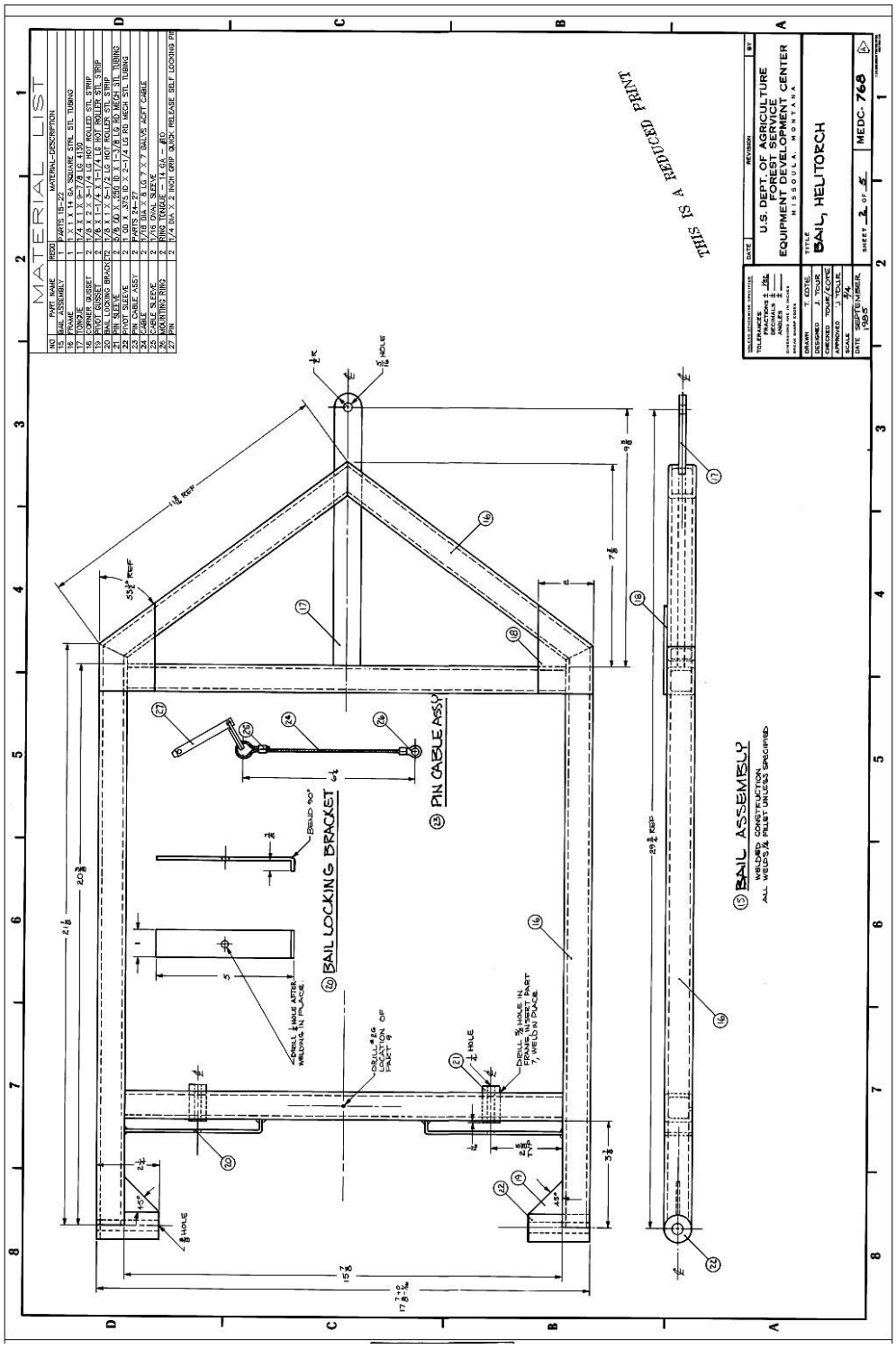
Adapter Kits: For repair of Adapter. Contains Seal O-Ring or Disc, Valve Spring, and Screw / retaining Ring / Nylon Insert / Nylon Washer (Where applicable).

All Kits include Silicone Oil, Diagram, and Instruction Sheet.

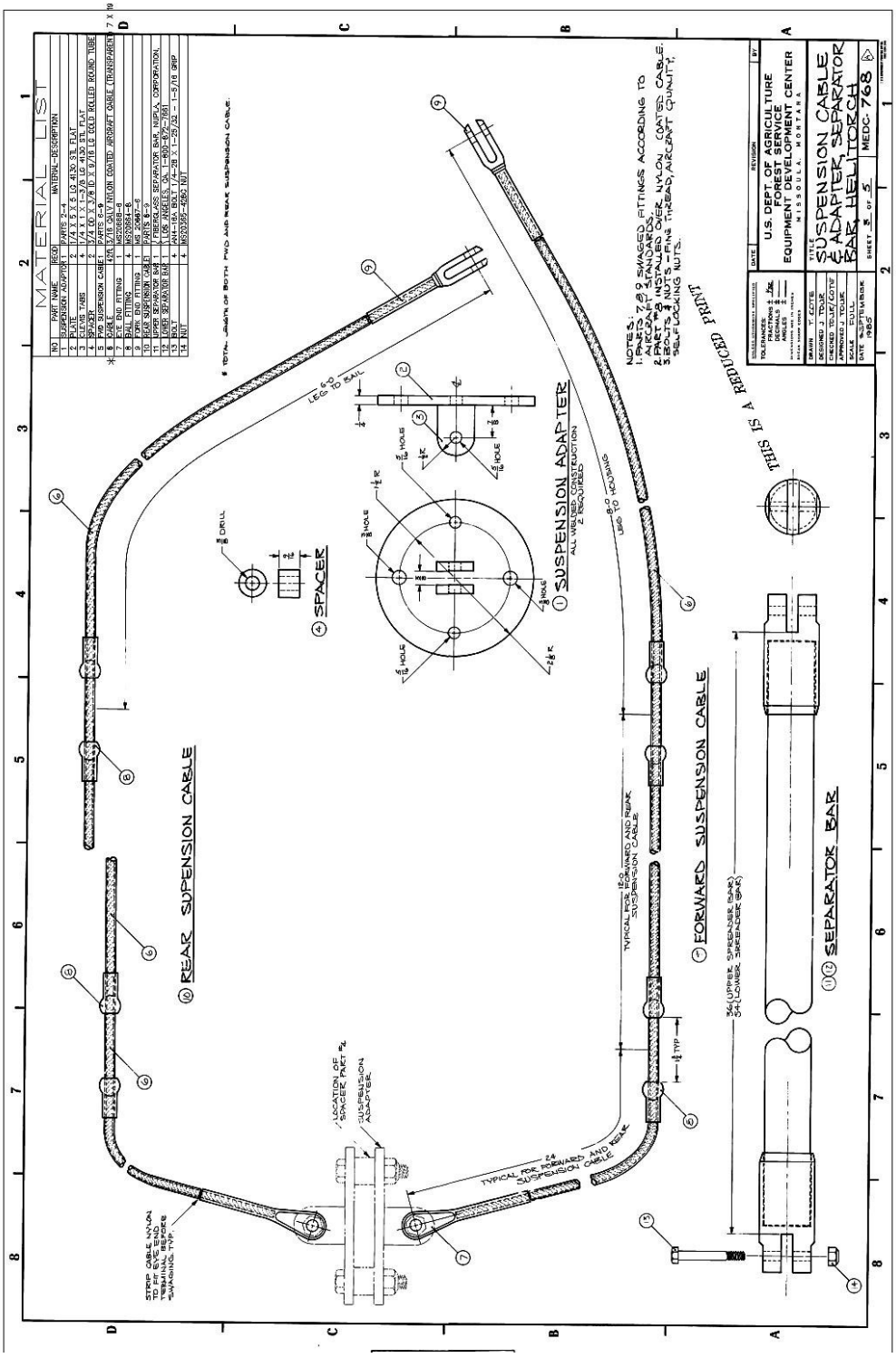
Helitorch & Suspension System Assembly
MTDC 968-01



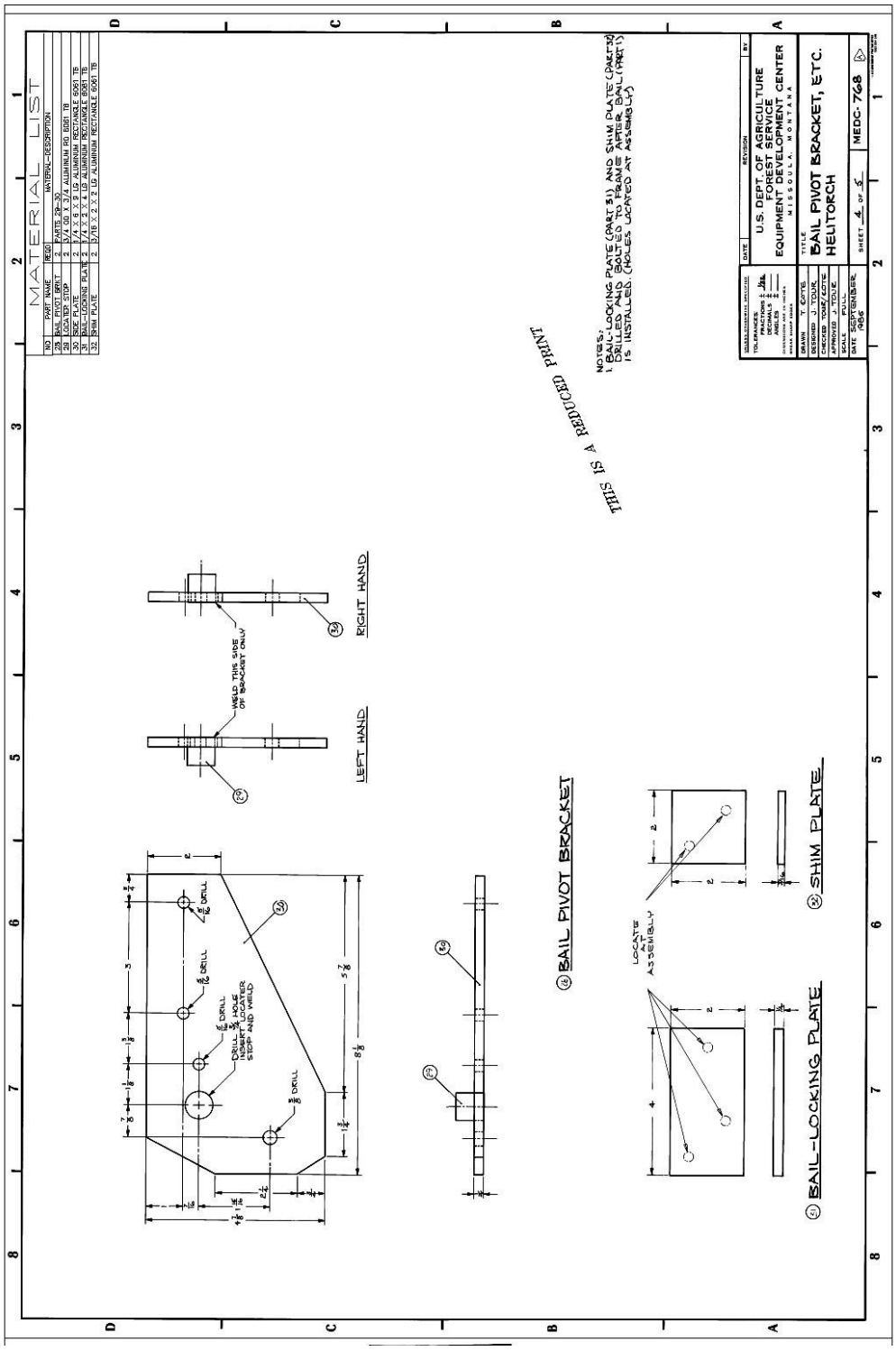
Helitorch & Suspension System Assembly
MTDC 968-02



Helitorch & Suspension System Assembly
MTDC 968-03



Helitorch & Suspension System Assembly
MTDC 968-04



Helitorch & Suspension System Assembly
MTDC 968-05