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INTRODUCTION

Brazing and soldering are some of the oldest methods for joining two metals. As early as 1475 B.C. soldering was being used to join gold and silver. The heat source for these early operations was usually a wood or charcoal fire fanned by the solderer's breath. Thankfully, the art of soldering has evolved since then.

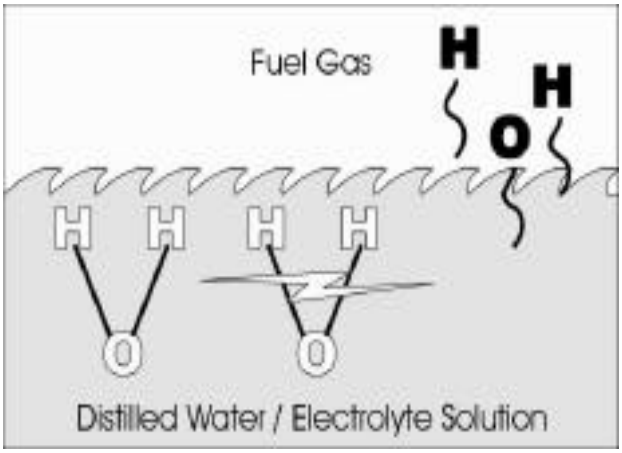
For many years standard soldering torches operated on a variety of combustible gasses. Natural gas, acetylene, methane, propane, and air/gas combinations were widely used throughout many industries. However, these gasses have drawbacks. They are usually bought in pressurized bottles that can be costly, dangerous and are prohibited in increasing numbers of municipalities and states. In addition, these gasses generally do not burn cleanly and can leave excessive oxidation and "fire scale" on articles. What the jewelry industry needed was a torch that could solder cleanly, effectively and safely.

The HydroFlame Torch answers all these needs and more. The HydroFlame is an oxyhydrogen generator that operates by converting distilled water into an oxygen/hydrogen fuel gas. The HydroFlame Torch creates gas on a demand basis. This means that there is no potentially dangerous stored gas.

Because the HydroFlame Torch burns a gas that has a high hydrogen content, it produces what is referred to as a "reducing" flame. What this means is that the flame of the HydroFlame Torch will actually eliminate oxides to some extent. Because it reduces or eliminates oxidation, soldering with the HydroFlame Torch is much cleaner than what can be achieved with traditional torches. However, the reducing flame of the HydroFlame is only effective where the flame is actually in contact with the piece. Because of this, it is always advisable to use a flux dip prior to soldering, and to use a suitable flux when soldering to ensure clean, perfect joints.

HOW THE HYDROFLAME TORCH WORKS

The HydroFlame Torch generates fuel gas by passing an electrical current through distilled water. To improve the electrical conductivity of the water, an electrolyte is added. The name of the electrolyte used in the HydroFlame Torch is Potassium Hydroxide.



As the electrical current passes through the electrolyte solution, it breaks the bonds between the oxygen and hydrogen atoms of the water molecule and releases them as a mixed gas. The HydroFlame never separates the oxygen and hydrogen gasses. The torch flame burns a mixture of 1 part oxygen and 2 parts hydrogen. The temperature of this flame, without flux, is approximately 5600^{o}F.

After generation, the gas is passed through a filter that removes any residual moisture from it. Then it is "bubbled" through a flux solution. The flux solution contains methol alcohol and boric acid. As the gas passes through this solution, it picks up some of the alcohol and some of the boric acid in the gas. These chemicals are burned in the flame at the torch tip. The flux serves two purposes. It lowers the temperature of the flame to approximately 4850^{o}F while increasing the BTU value of the flame. The boric acid is carried in the flame to the article being soldered. This helps protect the parts being soldered from excessive fire-scale. However, it is very important to note that the fluxing effect of the HydroFlame Torch is usually not sufficient to solder pieces without additional flux. It is always recommended that you use additional flux when soldering to obtain best results.

The HydroFlame Torch works with many different needle tips. By changing the tip size, you can work on a wide variety of pieces and precisely control how much heat is applied to your work.

SETTING-UP THE HYDROFLAME TORCH

1. Location

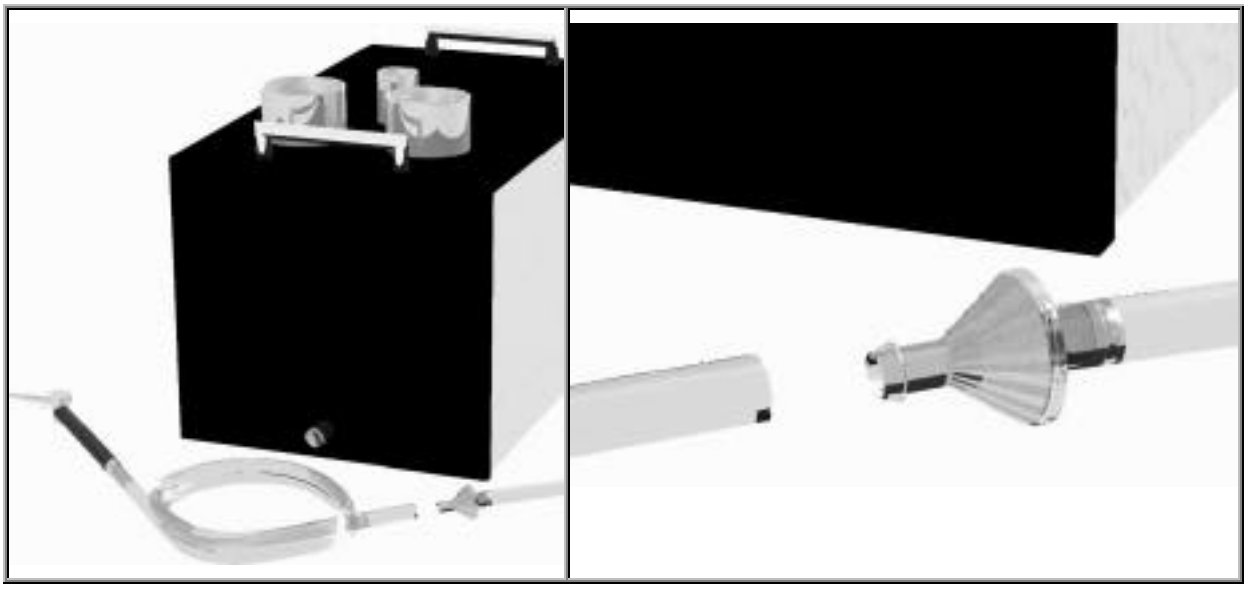
The HydroFlame Torch must be placed on a level surface with adequate ventilation. We recommend a minimum of 4 inches of clearance on each side. Using the HydroFlame Torch on a closed shelf or in a drawer will void all warranties. The HydroFlame requires cooling at all times.

2. Electrical

The HydroFlame operates optimally on a grounded 110 volt, 60 Hz electrical line. It is advisable to check the building fuse or circuit breaker to ensure that there is sufficient current to operate the Welder (10 amps maximum). We recommend that you operate the unit on a dedicated power line in order to avoid power surges or dips which can be caused by other equipment in use. These fluctuations can affect the performance of your unit. Do not plug in your unit until after step 5.

3. Connecting the Handpiece

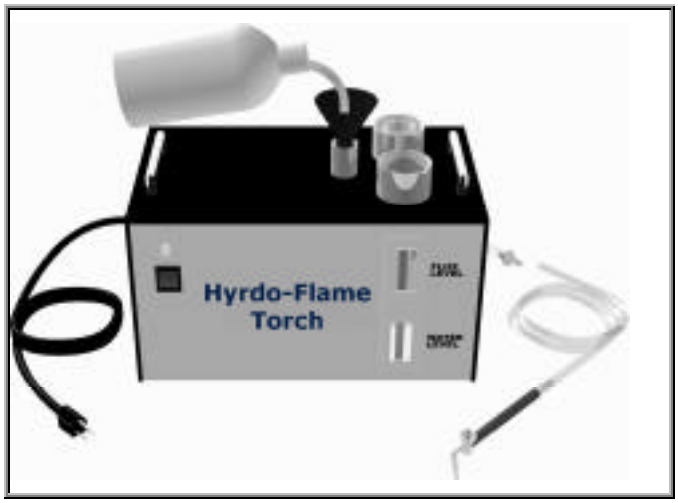
A piece of clear tubing is already connected to the unit. A plastic and metallic filter is connected to the end of this tubing. The clear tubing of the handpiece will fit snugly on the free end of this tubing. Press the tubing firmly over the filter. Check that the tubing is secure on both ends of the metallic filter and on the handpiece. Check that the screw cap on the bottom of the handpiece is snug.



4. Adding the Electrolyte Solution

*****CAUTION** The electrolyte is highly caustic and should always be handled using protective equipment such as rubber gloves and safety glasses or goggles, and protective clothing. When handling the electrolyte solution, be careful not to spill any. The electrolyte may damage any finished surfaces, clothing, etc. Electrolyte is highly corrosive to many metals, including copper, brass, zinc and aluminum, and reacts violently with acids. Electrolyte destroys human tissue on contact. It is odorless and colorless. Please refer to the Material Safety Data Sheet at the end of this manual for more specific health and safety information.***

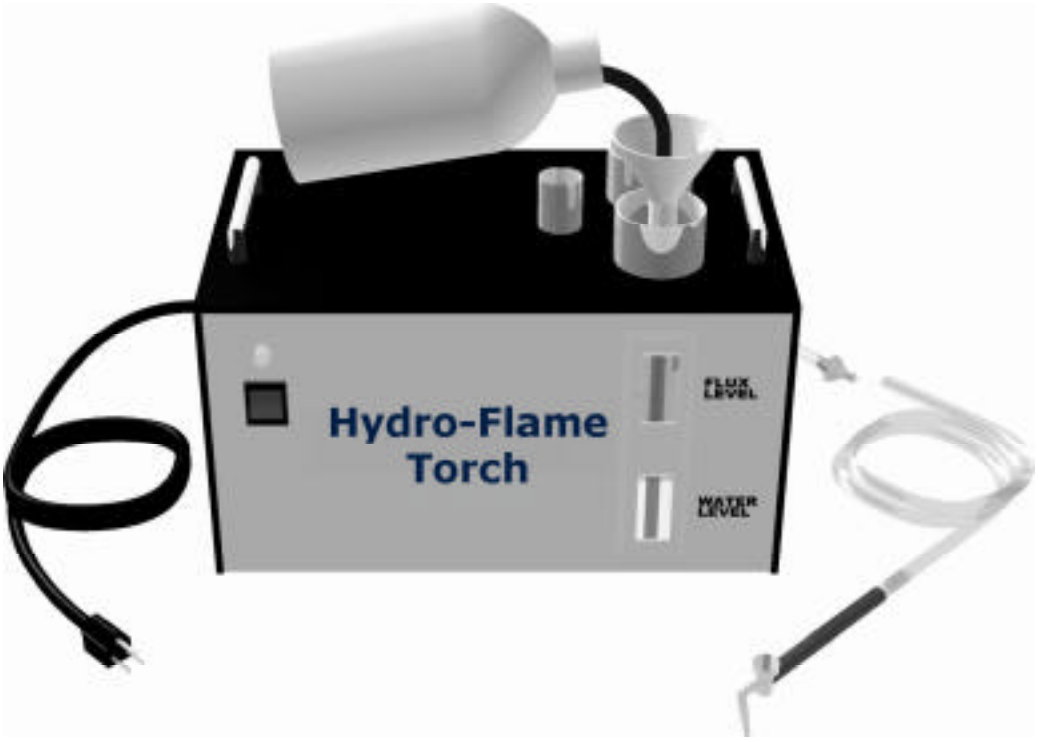
1. Put on safety glasses, gloves and protective clothing.
2. Move, or cover up anything that may be damaged by spilled electrolyte.
3. Check the drain plug in the side of the unit to make sure the plug is tight.
4. Unscrew the cap from the electrolyte chamber (the small cap).
5. Using a plastic funnel, slowly pour the solution into the *DISTILLED WATER CHAMBER*.
6. Carefully wipe up any electrolyte spills with a clean paper towel.
7. Pour the entire bottle of electrolyte into the *DISTILLED WATER CHAMBER*.
8. After filling the chamber, rinse the funnel with clean water and dry.
9. Do not use the funnel for any other application. Store the funnel for future use.
10. Rinse the electrolyte bottle in clean water. Replace cap and dispose in garbage. DO NOT REUSE ELECTROLYTE BOTTLE!
11. Replace the stainless steel cap on the *DISTILLED WATER CHAMBER*. Tighten until snug. Do not overtighten.



5. Adding the Flux Solution

****CAUTION** Flux solution is very flammable. Keep the GREEN flux solution away from open flames or sources of ignition at all times. Do not smoke or have open flames near the unit when filling the flux chamber.**

- Put on safety glasses, gloves and protective clothing.
- Unscrew the cap from the *FLUX CHAMBER*. (the large cap at the front of the unit)
- Slowly pour the GREEN flux solution into the *FLUX CHAMBER*.
- If you use the funnel from the electrolyte, make sure the funnel has been thoroughly rinsed with clean water and dried. Electrolyte contaminates the flux solution and makes it unusable.
- Fill the *FLUX CHAMBER* up to the MINIMUM level. DO NOT OVERFILL!
- Carefully wipe up any flux spills with a clean paper towel.
    - Rinse the funnel with clean water and dry with a paper towel.
    - Recap the flux bottle and store in a cool, dry place; away from open flames.

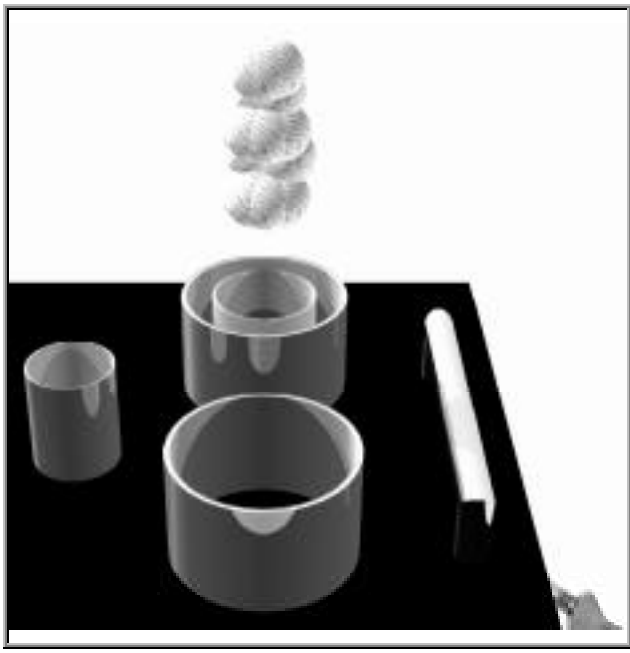


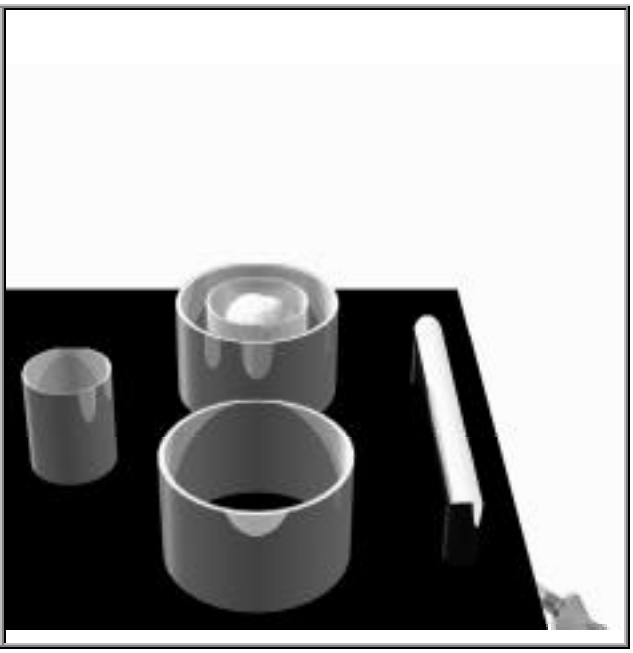
- Replace the stainless steel cap on the flux. Tighten until snug. Do not overtighten.

6. Adding the Filter Material

The filter is designed to remove any moisture and impurities from the incoming oxyhydrogen gas. The result is a clean, moisture-free flame with minimal contamination of the flux solution. The filter material is a micro-fiber that resembles cotton.

Take a small handful of the filter material and gently tamp it into the inner cylinder of the *FILTER CHAMBER*. Do not pack the filter too tightly. The entire inner chamber does not need to be filled with material.





7. Plug the unit into a grounded standard outlet (115-volt, 60 hz).

For best results, the outlet should be on a dedicated circuit. When possible, avoid plugging your HydroFlame Torch into circuits that also power other machinery or equipment. The power drains caused by the other equipment could cause your HydroFlame Torch to run slightly hotter than normal and may cause condensation in the tubing leading to the torch handpiece.

8.	**Installing the Torch Stand (optional)**	
	On either side of the HydroFlame Torch, you will find four screws holding the black cover in place. Determine which location is most convenient for you to mount your torch holder. Unscrew that screw and set aside. Locate the black torch holder in the accessory bag. Insert the screw through the hole in the torch holder, and screw it back in to the hole in the torch cover. Orient the torch holder so it is pointing straight up, and tighten the screw firmly.	

Using The HydroFlame Torch

1. Make sure the valve on the handpiece is turned completely off.

2. Choose a needle tip. The larger the tip, the greater the heat applied to the article being soldered.

3. To attach a tip, firmly press the tip onto the end of the torch handpiece and give a half turn. The friction will hold the tip firmly in place.

4. Make sure that all the caps are snug.

5. Check the level gauges on the front of the unit. Both levels should be between the minimum and maximum marks. *IMPORTANT* DO NOT RUN THE UNIT IF THERE IS INSUFFICIENT DISTILLED WATER!! SERIOUS DAMAGE TO THE HYDROFLAME TORCH WILL RESULT AND ALL WARRANTIES WILL BE VOID.

6. Turn the unit on. The power switch is on the upper left side of the front of the unit. The light should go on indicating that the unit is producing gas. After a few seconds, when the unit has built pressure, the light should go off.

7. Open the valve on the handpiece one full turn. Run without a flame for 30 seconds to bleed any entrapped air. Close the valve, wait 30 seconds and repeat. *CAUTION* do not bleed lines near an open flame - gas is present.

8. Open the valve one full turn. Using a "sparker" or other lighting device, carefully light the torch, making sure that it is facing away from you or any flammable surfaces. ***Never light the torch without a needle tip in place!!!*** If the torch does not light right away, try decreasing or increasing the pressure by closing or opening the valve on the handpiece. The flame should be bright green. Note: using a cigarette lighter to light the torch can be dangerous. There is a possibility that the lighter could explode if the flame from the torch comes too close to it. A sparker or other torch-lighting device is the safest means of lighting the HydroFlame .

9. Try changing tips. Turn the valve on the handpiece off using a smooth consistent motion. Do not close the valve slowly, as the flame may burn back into the tip. Occassionally, the torch may make a popping or snapping noise when it is extinquished. This is normal. Once the flame has shut off, remove the needle tip by twisting and gently pulling. Put on a new needle and light it as shown above. Notice that when a small tip (larger gauge) is on, the generator light cycles on and off much faster than when a large tip (smaller gauge) is on. This is because the large tips use more gas and the HydroFlame has to keep up with it.

10. When shutting the machine off, always extinguish the flame first by closing the valve on the handpiece, then turn off the power switch. When the machine is off, open the handpiece to bleed any residual pressure from the system. Be sure to close the handpiece when finished.

Maintenance

Daily

1. Close the valve on the handpiece and turn the unit on. Let the unit run for 20 seconds. You do not need to light the flame. Turn the machine off and open the valve on the handpiece to release pressure. Check the flux level gauge. The level should be between the minimum and maximum mark.

2. If necessary, add flux. Unscrew the cap on the flux chamber. For best results, add flux in small amounts (approximately 1 ounce at a time) until the gauge reads between the minimum and maximum mark. Be careful not to overfill. This can lead to moisture in the line and flooding of the system.

3. Check the distilled water level. Add distilled water if the level is below the minimum mark. Add distilled water slowly and watch the level gauge. *Use distilled water only.* Tap water contains impurities that can affect the performance of your unit.

4. Check the clear hose for any condensation that may have occurred. If condensation is present, turn the unit off and disconnect the hose at the rear check valve. Drain all fluid out of the hose. If possible, dry the hose using compressed air. Thoroughly dry the handpiece.

Weekly

1. Clean tips by placing them in an ultrasonic cleaner for a few minutes. For better results, clean tips using a steam cleaner.

2. Check the filter material in the dryer chamber for contaminants or moisture. If the filter shows signs of moisture or contaminants, remove it. Wear rubber gloves when doing this since the filter may contain traces of the caustic electrolyte. Replace the filter material taking care not to pack it too tightly. For best results, the filter should be changed after every 30 operating hours, regardless of appearance.

3. Check the flux in the chamber. If the flux shows signs of contaminants, or if the flame color has changed or weakened during the week, change the flux. Suction out old flux using a turkey baster. Wipe the inside of the chamber dry with a towel or rag. Refill the chamber with fresh flux.

Monthly

1. Clean the sintered metal check-valve in the torch handpiece. Unscrew the handpiece at the base near the black "O" ring. If the cylindrical check-valve does not come right out, tap the open of the torch into the palm of your hand. The filter will dislodge and fall out. Clean this under a steam cleaner for 1 minute or in an ultrasonic cleaner for 5 minutes.

2. Check the gaskets on the inside of the caps for any wear and tear.

CHANGING THE ELECTROLYTE SOLUTION

Depending on your use, the electrolyte may last for up to 1 year. We recommend changing the electrolyte at least each year to keep the unit operating at peak performance. When changing the electrolyte, the flux solution and filter material also must be changed. You will know the electrolyte needs to be changed when:

1. The flame becomes weaker

2. The pressure drops

3. The unit does not generate any gas

You will need:	
Rubber gloves	Turkey baster or large syringe
Eye protection	*1 quart of electrolyte**
Protection for your clothing	*Clean filter material**
Drop cloth or safe work area	*Fresh flux**
Plastic bucket	*Replacement rear check valve**
Plastic funnel	Warm distilled water

**All replacement parts are available through the distributor from whom you purchased your HydroFlame Torch.*

To change the electrolyte:

***CAUTION** The electrolyte is highly caustic and should always be handled using protective equipment such as rubber gloves and safety glasses or goggles. When handling the electrolyte solution, be careful not to spill any. The electrolyte may damage any finished surfaces, clothing, etc. Electrolyte is highly corrosive to many metals, including copper, brass, zinc and aluminum, and reacts violently with acids. Electrolyte destroys human tissue on contact. It is odorless and colorless.*

1. Unplug the unit. Put on protective equipment.

2. Remove all caps.

3. Use the turkey baster to remove all flux and discard in accordance with all applicable regulations. Wipe the inside of the chamber dry.

4. Remove all dryer filter material and discard. If there is any moisture in the dryer

chamber suction it out and wipe dry.

5. Place the plastic bucket under the drain plug. If possible, place the bucket close enough to avoid splashing. The electrolyte is a highly caustic material. See the MSDS at the end of this manual for safety and health precautions.

6. Raise the drainplug by tilting the unit. Open the drain plug with the wrench or pliers. Take care that the plug does not fall into the bucket. After a few turns with the wrench it should be only finger-tight. Remove the plug. It is **EXTREMELY IMPORTANT THAT YOU WEAR SAFETY GLASSES, GLOVES AND PROTECTION FOR YOUR CLOTING DURING THIS STEP! ELECTROLYTE IS CAUSTIC AND WILL IMMEDIATELY DAMAGE YOUR SKIN.**

7. Lower the unit and allow the chamber to drain. The electrolyte should be a muddy-brown to black color. Tip the unit slightly to facilitate draining.

8. With the drain still open, slowly pour approximately one quart of warm distilled water through the electrolyte chamber. Allow it to run through the unit and into the bucket. Repeat until the water is reasonably clear.

9. Replace the drain plug and tighten. The plug should be tightened to finger tight plus an additional 1/4 turn. The drain plug "O" ring can be damaged easily if the plug is too tight.

10. Remove the cover of the unit.

11. Carefully disconnect the clear tube that connects the flux chamber to the outside wall of the overflow reservoir. Drain any remaining flux from this tube. Replace the cover.

12. Replace the rear check valve filter by disconnecting the tubing from both ends and inserting a new filter.

13. Disconnect the tubing from the base of the handpiece. Unscrew the base of the handpiece at the black "O" ring. Tap out the gray sintered metal check valve filter and clean in an ultrasonic or steam cleaner.

14. Replace dryer filter material, taking care to pack it firmly, but not tightly. Check the inside gasket on the cap for cracks or tears. Replace if necessary.

15. Refill flux chamber to the halfway mark between minimum and maximum. Check the inside gasket on the cap for cracks or tears. Replace if necessary.

16. Using the plastic funnel, slowly fill the distilled water chamber with electrolyte. Check the inside gasket on the cap for cracks or tears. Replace if necessary.

17. Refer back to the sections on Setting-up Your Unit and Using the HydroFlame Torch to resume use.

Solutions

?	**WHEN I FIRST TURNED ON MY HYDROFLAME , IT SEEMED TO BE RUNNING HOT.**

This is normal for a new unit or one that has not been used in some time. The components of the unit are going through a 'breaking in' period that should not affect the performance of the unit. If this condition persists for more than two weeks of normal use, please contact our technical sales department.

?	**THE HOSE TO THE HANDPIECE FILLS UP WITH LIQUID**

This liquid is flux solution that has evaporated from the flux chamber and recondensed in the hose. It does not cause any serious problems, but it should be drained from the hose periodically. The handpiece hose can be drained by first extinguishing the flame at the handpiece, then disconnecting the hose either from the back of the handpiece, or at the check valve on the hose. The fluid can be drained from the open end of the hose. Once the hose has been drained and is dry, reconnect the tubing. Open the valve on the handpiece and let the gas run for a few moments. This will vent any air that got into the line during cleaning. You can then resume use.

?	**OVERFILLING THE DISTILLED WATER CHAMBER**

If the distilled water chamber should accidentally be overfilled, it will be necessary to completely flush the HydroFlame Torch. Follow the directions given under Changing The Electrolyte.

Do not siphon excess liquid from the machine. Do not attempt to partially drain the machine. Go immediately to the flushing procedure.

?	**OVERFILLING THE FLUX CHAMBER**

The most obvious symptom of this is liquid in the hose line that connects to the handpiece.

1. Remove excess flux from the chamber using the turkey baster. Bring the level to the halfway mark.

2. Disconnect the hose from the rear filter assembly and shake it vigorously. If possible, dry the hose and handpiece by blowing compressed air through both.

3. Repeat step 2 as many times as necessary to completely clear the line.

? THE TIPS GET HOT OR START TO BURN

When the needle tips begin to blacken or turn cherry red at the hot end it is because the flame is beginning to burn back up into the tip. This will happen for several reasons:

1. The knob on the handpiece has not been opened enough.

Slowly turn the knob on the handpiece counter-clockwise to open the valve more. If the flame does not immediately get stronger, and the tip continues to burn, check the next step.

2. Liquid in the hose has entered the handpiece and catches fire as it comes through the tip.

Disconnect the hose from the rear check valve and the handpiece. Drain any fluid from the hose. Dry the hose by blowing compressed air through it. Remove the filter from the back of the handpiece and air dry. Also thoroughly dry the handpiece and the tip. Reconnect everything and turn the unit on. Open the valve on the handpiece and let the gas free-flow for 15 seconds before lighting.

3. The torch is shut off before the flame is extinguished at the handpiece.

The gas must first be shut off at the handpiece, before turning the unit off. If the gas is left on while the unit is turned off, the flame will try to burn back into the tip. This will singe the end of the tip and can melt the plastic casing on the tip.

4. The electrolyte is contaminated or needs to be changed.

When there is a problem with the electrolyte, gas generation is impaired. The lack of sufficient pressure causes the flame to draw into the tip, burning the tip. Follow the instructions for changing the electrolyte.

? THE FLAME TAKES ON AN ORANGE COLOR, OR BEGINS TO OXIDIZE THE SOLDER

An orange flame develops generally from one or more of five causes:

1. Insufficient gas pressure causes the flame to burn backward into the torch tip and burn the tip. Causes are:

a. Gas leaks or blockages; check all hoses and connections.

b. Dirty filter element; replace filter.

c. Low water level in gas generator; add distilled water.

d. Low voltage; check line voltage and/or change lines.

e. Deformed torch tip; replace torch tip.

f. Corroded electrical connections; clean connections.

g. Electrical failure; check incoming power source.

2. Flux level low, or chamber empty; Add Flux.

3. Torch tip dirty; Clean tips in an ultrasonic or steam cleaner. Replace if necessary.

4. Gas generator overheated and delivering water vapor to the torch tip.

Turn unit off for a few minutes to allow it to cool. Check that the ventilation slots are not blocked. Check that the fan is still running.

?	**THE TORCH TIP IS SPITTING OR OVERHEATING**

Spitting of liquid from a torch tip during operation is often, but not always, associated with overheating of the gas generator. Possible causes of such overheating are:

1. Distilled water chamber overfilled with distilled water;

2. Too high a line voltage;

3. Contaminated electrolyte;

4. Corroded electrical connections inside the gas generating chamber;

5. High resistance short circuit inside gas generating chamber;

6. Operating environment too hot;

7. Fan failure;

8. Distilled water chamber excessively dirty; and/or

9. Power setting too high.

The first thing to check is the filter chamber. Spitting indicates that excess liquid is in the line. Check the filter to see if it has become moist and replace if necessary. The gas generator will generally run pretty hot and a temperature of 160^{o}F on the chamber surface is not unusual. This temperature can be achieved when the gas generator runs continuously at or near full load conditions. At this temperature the gas generator can be expected to deliver some water vapor into the lines along with the oxyhydrogen gas. However, the filter and flux booster will tend to trap this water vapor before it reaches the torch tip. If the filter is wet and is unable to trap all the moisture, it will pass into the flux chamber. The GREEN flux supplied by the factory will change in color when it has trapped significant quantities of water vapor. The change in color indicates that the flux

has become excessively contaminated and that the solution should be cleaned out and replenished with new, clean flux.

When electrolyte in the gas generator becomes even slightly contaminated, especially with flux solution, significant quantities of liquid and water vapor will be emitted from the gas generator at chamber temperatures even lower than 160^{o}F, and the flux chamber will require more frequent cleaning in order to serve effectively as a contaminant trap. Under certain conditions of electrolyte contamination, the chamber temperature can also rise above 160^{o}F, giving a doubly severe boiling condition inside the gas generator cell and the gas generator should then have its electrolyte changed or be returned to the factory for servicing and generator tank clean-out.

Once spitting has occurred, all gas lines and filter elements become wet and will continue to emit liquid through the system until they run themselves dry or until they are dried out by being removed and cleaned. Such removal and cleaning is only a temporary corrective measure unless the cause of the vapor emission from the generator tank is also eliminated.

Corrective measures for each of the above are described elsewhere in this manual under appropriate headings. A thorough study of the manual should be made to gain an overall understanding of the various causes and their respective corrective measures.

?	**THE GAS LIGHT REMAINS ON, BUT THE UNIT DOES NOT PRODUCE GAS**

First, remove each cap. The gasket under the cap should be intact and seated in the top of each cap. If the gasket is bent, disfigured or has any tears in it you must order a new gasket from your supplier. If the gasket is in good shape, replace each cap and screw down tightly. Try the unit again.

If the unit still does not generate any pressure at the handpiece, there may be a gas leak somewhere in the system. Turn the unit on. Open the cap on the flux chamber. There should be vigorous bubbling activity in the flux where the gas is being mixed. If there is no bubbling activity, then there is a leak prior to the flux chamber. Call the factory for assistance on checking internal components.

If there is bubbling activity in the flux, and there is still no pressure at the handpiece, then there is probably a leak between the flux chamber and the handpiece. Recap the chamber and hold portions of the clear hose under soapy water. Look for bubbles from the hose. These will indicate where a leak is. Check the entire hose this way.

If, after checking all tubing and connections, the same conditions occur there may be a problem with a diode. Contact the factory for assistance.

?	**INCORRECT FLAME SIZE AND/OR COLOR**

Incorrect flame size and color can be attributed to any of the following:

1. Dirty or clogged tips. Clean tips with copper wire.

2. The flux level is too low. Check the level and fill as necessary.

3. The check valve filters are dirty or clogged.

4. The water level in the gas generating cell is too low. Fill if necessary.

5. The power line voltage is too low to produce sufficient gas. Check the line voltage and relocate the unit if necessary.

6. The gas generating cell has overheated. See above section.

7. Electrolyte is old, or its effectiveness has been reduced by many hours of use and dilution. Flush the machine and replace the electrolyte.

The flame is the most reliable indicator of performance on the HydroFlame Torch. If any part of the unit is not performing up to standard, symptoms will appear in the flame. The color of the flame may change, the size of the flame may change, spitting may occur, or the flame may not generate at all. By keeping a close eye on the flame, you will be able to monitor the performance of the unit and spot any potential problems before they occur.

MATERIAL SAFETY DATA SHEETS

PRODUCT CHEMICAL

ELECTROLYTE POTASSIUM HYDROXIDE

MATERIAL SAFETY DATA SHEET

POTASSIUM HYDROXIDE

I. PRODUCT IDENTIFICATION

CHEMICAL NAME	Potassium Hydroxide	SYNONYMS	Caustic Potash, Flake
PRODUCT NAME	Potassium Hydroxide	CAS NUMBER	1310-58-3
CHEMICAL FAMILY	Alkaline Hydroxides	FORMULA	K O H

II. HAZARDOUS INGREDIENTS

INGREDIENT NAME	CAS NUMBER	OSHA PEL	ACGIH TLV	CONCENTRATION	
				SOLID	LIQUID
Potassium Hydroxide	1310-58-3	2 mg/cm^3	2 mg/cm^3	85-100 %	12.5-15.0%
Potassium Carbonate	584-8-7	None Known	None Known	0-1.5 %	0-0.25 %
Sodium Hydroxide	1310-73-2	2 mg/cm^3	2 mg/cm^3	0-0.5 %	0-0.10%
Water	7732-18-5	None Known	None Known	0-15%	85-90%

III. PHYSICAL PROPERTIES

PHYSICAL FORM	Solid Flake, or Liquid	VISCOSITY	No Data Available
COLOR	White Flake/ Clear liquid	SOLUBILTY IN WATER	53% at 20°C (68°F)

ODOR	None	SPECIFIC GRAVITY	No Data Available
MOL. WEIGHT	56.10	BULK DENSITY	2.04 (g/cc)
pH	@ 25°C Not Applicable	VAPOR PRESSURE	No Data Available
BOILING POINT	1320°C (2408°F)	EVAPORATION RATE	No Data Available
MELTING POINT	360-380°C (680-716°F)	% VOLATILE	No Data Available

IV. FIRE AND EXPLOSION DATA

FLASH POINT	Not Applicable	UPPER EXPLOSIVE LIMIT	Not Applicable
TEST CUP METHOD	Not Applicable	LOWER EXPLOSIVE LIMIT	Not Applicable
FLAMMABLE	No	AUTO-IGNITION TEMP	Not Applicable
COMBUSTIBLE	No	EXTINGUISHING MEDIA	All Extinguising Media

SPECIAL FIREFIGHTING PROCEDURES	Wear self-contained breathing apparatus
UNUSUAL FIRE AND EXPLOSION HAZARDS	Not combustible by itself. Contact with water can generate sufficient heat to ignite combustible materials. Contact with some metals can generate flammable hydrogen gas.

V. HUMAN HEALTH DATA

ROUTE(S) OF ENTRY: Eyes, Skin, Inhalation and Ingestion

HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE

INHALATION	May cause severe burns or deep ulcerations of respiratory tract. Inhalation of high concentrations can result in permanent lung damage.
INGESTION	Irritation and/or burns may occur to entire gastrointestinal tract, characterized by nausea, vomiting, diarrhea, abdominal pain.

SKIN CONTACT	May case severe burns or deep ulcerations. Prolonged skin exposure can cause destruction of dermis with impairment of the skin at site of contact to regenerate.
EYE CONTACT	May cause severe burns or deep ulcerations. Contact may cause impairment of vision and corneal damage.
CHRONIC EXPOSURE	Prolonged skin exposure is similar to similar exposure. Prolonged inhalation may cause impairment of lung function and permanent damage.
AGGRAVATION OF PRE-EXISTING CONDITIONS	Asthma and respiratory and cardiovascular disease.
CARCINOGENICITY	Not listed by NTP, IARC or regulated as a carcinogen.

VI. FIRST AID

INHALATION	Remove to fresh air. Call a physician. If breathing is difficult, give oxygen. If not breathing, give artificial respiration.
INGESTION	If swallowed call a physician. If person is conscious, immediately drink large quantities of water. *****DO NOT INDUCE VOMITING*****
SKIN CONTACT	In case of contact with skin, wash skin with soap and water. Wash clothing before reusing. Call a physician if irritation persists.
EYE CONTACT	Immediately flush eyes with running water for 15 minutes. Call a physician.

VII. EMPLOYEE PROTECTION RECOMMENDATIONS

EYE PROTECTION	Use chemical safety goggles. Do not wear contact lens if airborn dust is present.
SKIN PROTECTION	Use chemically resistent gloves and clothing. Wash face and hands before eating or drinking.

PERSONAL RESPIRATORS	Use a NIOSH/MSHA approved dust respirator.
VENTILATION SYSTEM	Use local exhaust if dust concentration exceeds nuisance exposure limit or if worker discomfort exists.
ADDITIONAL MEASURES	Prolonged skin exposure is similar to similar exposure. Prolonged inhalation may cause impairment of lung function and permanent damage.

VIII. REACTIVITY DATA

STABILITY	Stable under ordinary conditions of use and storage.
CONDITIONS TO AVOID	None Known
HAZARDOUS POLYMERIZATION	Will not occur.
INCOMPATIBILITIES	Acids, nitrogen containing organics, tin, zinc, carbohydrates, phosphorous, explosives, organic peroxides, aluminum
DECOMPOSITION TEMPERATURE	No data available.
DECOMPOSITION BYPRODUCTS	Carbon monoxide with carbohydrates, hydrogen with aluminum, zinc and tin.

IX. SPILL AND LEAK PROCEDURES

GENERAL SAFETY	Remove all sources of ignition; venitlate area. Provide protection from inhalation of dust or fumes.
SPILL OR LEAK RESPONSE	Utilize recommended protective clothing and equipment. Sweep up spill/leak and place in clean, dry containers. Avoid dispersing dust into air.
WASTE DISPOSAL	Check Federal, State, and local enviornmental regulations. Prevent wash water from entering ground water. Hazardous concentrations in air may be found in local spill area. This product may represent an explosion hazard if liquified and in contact with some metals. Remove all sources of ignition.

X. SPECIAL PRECAUTIONS AND STORAGE DATA

STORAGE TEMPERATURE	No data available.
SHELF LIFE	No limitation if tightly sealed.
SPECIAL SENSITIVITY	No data available.
HANDLING & STORAGE	Maintain safe housekeeping practices.
PRECAUTIONS	Do not store above 54^{o}C (130^{o}F)

XI. SHIPPING INFORMATION

D.O.T. SHIPPING NAME	Potassium Hydroxide, Solid
HAZARD CLASS	8
U.N. NUMBER	1,813
PACKING GROUP	II
LABELS	Corrosive
R Q ENTRY REQUIRED	Yes

XII. ANIMAL TOXICITY DATA

ORAL LD 50	365 mg/jg (RAT)
DERMAL LD 50	>2 g/kg (RABBIT)
INHALATION LD 50	No data available
SKIN EFFECTS	Causes burns
SENSITIZATION	No data available
EYE EFFECTS	Causes burns

OTHER TOXICITY

SUBCHRONIC TOXICITY	No data available
CHRONIC TOXICITY	No data available
AQUATIC TOXICITY	Rating:" 2 (TLM96: 100-10ppm)
OTHER TOXICITY DATA	(TLM96: 100-10ppm): Trout 50ppm; GREENgills 56ppm; Lepomis Pallidus (minnows) 28ppm

XIII. FEDERAL REGULATORY INFORMATION

OSHA STATUS	Hazardous
TSCA STATUS	Listed on TSCA inventory
CERCLA RQ	1000 Lbs
RCRA STATUS	Not hazardous waste in purchased form

SARA TITLE III

S302 EHS RQ	None established
S302 EHS TPQ	None established
S313 TOXIC CHEMICALS	None
S311/312 HAZARD CATEGORIES	Health: Immediate (acute); Physical: Reactivity

XIV. OTHER REGULATORY INFORMATION

THE FOLLOWING CHEMICALS ARE SPECIFICALLY LISTED BY INDIVIDUAL STATES; OTHER PRODUCT SPECIFIC HEALTH AND SAFETY DATA IN OTHER SECTIONS OF THIS MSDS MAY ALSO BE APPLICABLE FOR STATE REQUIREMENTS. FOR DETAILS ON YOUR REGULATORY REQUIREMENTS YOU SHOULD CONTACT THE APPROPRIATE AGENCY IN YOUR STATE.

NJ4	New Jersey; included in 5 predominent ingredients >1%
PA3	Pennsylvania; Non-hazardous present at 3% or greater
CA65	California Proposition 65; To our knowledge this product contains levels of listed substances which california has found to cause cancer, birth defects or other reproductive effects.
MSL	Massachusetts Substance List (MSL); Hazardous substances and extraordinarily hazardous substances on the MSL must be identified when present in products.

INGREDIENT NAME	CAS NUMBER	CONCENTRATION		STATE CODE
Potassium Hydroxide	1310-58-3	Between	85-100%	NJ4, PA3, MSL

Potassium Carbonate	584-8-7	Between	0-1.5%	NJ4, PA3, MSL
Sodium Hydroxide	1310-73-2	Between	0-0.5%	NJ4, PA3, MSL
Water	7732-18-5	Between	0-15%	NJ4, PA3

XV. ADDENDUM TO MSDS

V. Human Health Data Effects and Symptoms of Overexposure, Continued

Bleeding, and./or tissue ulceration. Ingestion causes severe damage to gastrointestinal tract with the potential to cause perforation. The approximate lethal dose for humans is 5 grams.

IX. Spill and Leak Procedures

Water Release: This material is heavier than water. It is soluble in water. Stop source of leak as soon as possible. Direct all water flow to a holding area for treatment and/or disposal.

Land Spill: Dike area if necessary. Keep material dry and free of contaminents. Clean up must be done utilizing clean, dry equipment and material placed in clean, dry containers for further handling.

MATERIAL SAFETY DATA SHEETS

PRODUCT CHEMICAL

ELECTROLYTE METHYL ALCOHOL / BORIC ACID

MATERIAL SAFETY DATA SHEET

METHYL ALCOHOL FLUX SOLUTION

I. PRODUCT IDENTIFICATION

CHEMICAL NAME	Methanol	CHEMICAL FAMILY	Alcohols
COMMON SYNONYMS	Methyl Alcohol; Wood Alcohol; Carbinol; Methylol; Wood Spirit		
FORMULA	CH_3OH	FORMULA WEIGHT	32.04
CAS No.	67-56-1	NIOSH/RTECS No.	PC1400000
PRODUCT USE:	Rectifying Solution		

II. HAZARDOUS INGREDIENTS

INGREDIENT NAME	CAS NUMBER	OSHA PEL	ACGIH TLV	CONCENTRATION
Methanol	67-56-1	200 ppm	200 ppm	90-100 %
Boric Acid	10043-35-3	None Established	None Established	0-10 %
GREEN Coloring	None Known	None Established	None Established	.05-.5 %

III. PHYSICAL PROPERTIES

PHYSICAL FORM	Liquid	SPECIFIC GRAVITY	0.79 (H_2O=1)
COLOR & ODOR	GREEN, Pungent Odor	VAPOR DENSITY	1.11 (air=1)
BOILING POINT	65°C (149°F)	VAPOR PRESSURE	(mmHg): 96@20°C
MELTING POINT	-98°C (-144°F)	EVAPORATION	4.6 (butyl acetate

		RATE=1)	
SOLUBILTY IN WATER	100%	% VOLATILE	100 %

IV. FIRE AND EXPLOSION DATA

FLASH POINT	12°C (54°F)	UPPER EXPLOSIVE LIMIT	36.0 %
TEST CUP METHOD	Closed Cup	LOWER EXPLOSIVE LIMIT	6.0 %
FLAMMABLE	Yes	AUTO-IGNITION TEMP	463°C (867°F)
COMBUSTIBLE	Yes	EXTINGUISHING MEDIA	All Extinguising Media

SPECIAL FIREFIGHTING PROCEDURES	Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in a positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.
UNUSUAL FIRE AND EXPLOSION HAZARDS	Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire. Burns with a clear, almost invisible flame.
TOXIC GASSES PRODUCED	Carbon Monoxide, Carbon Dioxide, Formaldehyde

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT	None Identifed	EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE	Yes

V. HUMAN HEALTH DATA

ROUTE(S) OF ENTRY: Eyes, Skin, Inhalation and Ingestion

HUMAN EFFECTS AND SYMPTOMS OF OVEREXPOSURE

INHALATION	Inhalation is harmful and may be fatal. Headache, nausea, vomiting, dizziness, narcosis, respiratory failure, low blood pressure, and central nervous system depression may occur.
INGESTION	Ingestion is harmful and may be fatal.

	Blindness, headache, nausea, vomiting, dizziness, gastrointestinal irritation, central nervous system depression and hearing loss may occur.
SKIN CONTACT	No hazards identified.
EYE CONTACT	May cause irritation and temporary corneal damage.
CHRONIC EXPOSURE	Chronic exposure may lead to kidney damage or liver damage.
AGGRAVATION OF PRE-EXISTING CONDITIONS	Eye disorders, skin disorders, liver or kidney disorders
CARCINOGENICITY	Not listed by NTP, IARC or regulated as a carcinogen.

VI. FIRST AID

INHALATION	Remove to fresh air. Call a physician. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Prompt action is essential.
INGESTION	If swallowed call a physician. If person is conscious, immediately drink large quantities of water. Induce vomiting.
SKIN CONTACT	In case of contact with skin, immediately flush skin with plenty of water for at least 15 minutes whle removing contaminated clothing and shoes. Wash clothing before reuse.
EYE CONTACT	Immediately flush eyes with running water for 15 minutes. Call a physician.

VII. EMPLOYEE PROTECTION RECOMMENDATIONS

EYE/SKIN PROTECTION	Use Safety goggles and face shield, uniform, protective suit, rubber gloves are recommended.
PERSONAL RESPIRATORS	Respiratory protection required if airborn concentration exceeds TLV. There are no cartridges for methanol vapors. Handling operations should be conducted with a chemical fume hood. At concentrations above

	200 ppm, a self-contained breathing apparatus is advised.
VENTILATION SYSTEM	Use general or local exhaust ventilation to meet TLV requirements.

VIII. REACTIVITY DATA

STABILITY	Stable under ordinary conditions of use and storage.
CONDITIONS TO AVOID	Heat, flame, other sources of ignition
HAZARDOUS POLYMERIZATION	Will not occur.
INCOMPATIBILITIES	Strong oxidizing agents, strong acids, zinc, aluminum, magnesium
DECOMPOSITION BYPRODUCTS	Carbon monoxide, carbon dioxide, formaldehyde

IX. SPILL AND LEAK PROCEDURES

GENERAL SAFETY	Remove all sources of ignition; venitlate area. Provide protection from inhalation of dust or fumes.
SPILL OR LEAK RESPONSE	Wear self-contained breathing apparatus and full protective clothing. Shut off ignition sources; no flares, smoking or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.
WASTE DISPOSAL	Check Federal, State, and local enviornmental regulations.

X. SPECIAL PRECAUTIONS AND STORAGE DATA

STORAGE TEMPERATURE	No data available.
SHELF LIFE	No limitation if tightly sealed.
SPECIAL SENSITIVITY	No data available.
HANDLING & STORAGE	Maintain safe housekeeping practices. Keep container tightly closed. Store in a cood, dry, well-ventilated, flammable liquid

	storage area.
PRECAUTIONS	Bond and ground containers when transferring liquid

XI. SHIPPING INFORMATION

D.O.T. SHIPPING NAME	Methanol
HAZARD CLASS	3
U.N. NUMBER	UN1230, Reportable Quantity: 5000 Lbs.
PACKING GROUP	II
LABELS	3 Flammable Liquid

XII. ANIMAL TOXICITY DATA

ORAL LD 50	5628 mg/k (RAT)
INTRAPERITONEAL LD 50	9540 mg/k (RAT)
SUBCUTANEOUS LD 50	9800 mg/kg (MOUSE)
SKIN LD 50	20 g/kg (RABBIT)

XIII. FEDERAL REGULATORY INFORMATION

OSHA STATUS	Hazardous
TSCA STATUS	Listed on TSCA inventory
CERCLA RQ	5000 Lbs
RCRA STATUS	Not hazardous waste in purchased form

SARA TITLE III

S302 EHS RQ	None established
S313 TOXIC CHEMICALS	Yes, Methanol
S311/312 HAZARD CATEGORIES	Acute: Yes, Chronic: Yes, Flammability: Yes, Pressure: No, Reactivity: No