Title: Welding, Torching, Burning - Hot Work

1.0 Purpose and Scope

2.0 Forms

HSF 4-0031 Hot Work Permit
HSF 4-0063 Fire System Down Permit

3.0 Definitions and Responsibilities

3.1 The Plant Safety Coordinator will include responsibility as the Plant Fire Protection coordinator in an advisory function. These responsibilities include but are not limited to:

- Advising management on best practices for fire protection prevention;
- Facilitation of fire inspections at regularly scheduled intervals;
- Informing management of fire protection deficiencies and recommended corrective action;
- Investigation of fires and recommended corrective action;
- Training of employees in fire protection.

3.2 Supervisors/Foremen shall make sure that employees are made aware of and have available proper Personal Protective Equipment, such as proper eye protection and welding respirators, & gloves.

4.0 Fire Prevention

4.1 Areas in the Maintenance Shops which are used for Hot Work shall be kept clean of combustible materials, and general good housekeeping practices by employees working in this area shall be maintained.

4.2 Dust collection pickups are to be secured if there is a risk of sparks or embers being picked up and sent to the dust collector during hot work.

4.3 Holes in the floors are to be covered, if possible welding blankets are to be laid out and wet down if possible. In the pit areas where items such as oil and scrap would hinder getting to an area under the burning/welding operation, the job shall not be started until the area has been cleaned up and made accessible. A fire watch shall be maintained for one half hour to insure there is no fire.

4.4 The area where burning or welding is to be done must be made fire safe. Combustible materials are to be removed or protected from ignition sources. Work will be immediately stopped if conditions should change which might endanger personnel or property.

4.5 After work is completed, a thorough inspection must be made until the possibility of fire has been eliminated. Where there is danger of smoldering fire, the area should be wet down completely and periodically rechecked.

4.6 When not in use, gas cylinders used in cutting and welding must be shut off at the cylinders and arc welding equipment should be shutdown.

4.7 No Hot work is to be performed in areas containing flammables or explosives and is not permitted in an area where sprinklers are out of service.

4.8 Burning and welding equipment shall be routinely checked to ensure it is in good working order and electrical grounding is properly maintained.

5.0 Hot-Work Permit

5.1 Any time burning/torching/cutting or welding is done outside of the Maintenance Shop; a Burning & Welding permit (HSF 4-0031) must be completed. Permission to perform hot work can only be given after a thorough review of the job and a checklist of hazards/precautions are satisfactorily completed by the supervision and personnel involved in the job.

5.2 Any time Burning, Torching, or Welding are to be done, the job assignment shall be reviewed to determine if a Permit is required. Burning or welding which is done outside a permanently established area for routine work of this nature (Maintenance shops), must be done under the authorization of appropriate personnel and requires completion of the Burning & Welding permit before the work can be started!

5.3 Prior to the start of any hot work a permit must be completed by the employee doing the work. This includes a survey of the work area, removal of combustible and flammable material, location of fire extinguishers etc. Coworkers in the area must be notified of the hot-work and any other precautions taken. The department foreman, designated leadperson or supervisor must sign and authorize the permit. The top copy is then retained until cancellation away from the area of hot work and then sent to Safety. The bottom copy is posted as a warning for people entering the work area and disposed of when the work is completed.

5.4 A Fire Watch should be provided during and for one (1) hour after hot work, including break activities. Fire watch shall be completed with an adequate number of suitable fire extinguishers. The personnel completing fire watch shall be trained to use the fire extinguisher, and aware of the means to sound the fire alarm. The hot work area shall continue to be monitored for three (3) additional hours after the one (1) hour fire watch.

In the case of the work shift ending prior to the completion of the fire watch and monitoring, precautions must be taken to either complete the work earlier and allow enough time to ensure a fire won't start; or to leave a person responsible for the fire watch and monitoring.

5.5 The bottom copy of the Permit shall be posted at the work site, and removed when the work is complete. Additional blank permits can be obtained from the Safety Department.

5.6 Permits are nontransferable from one site or project to another, and must be obtained at least weekly from the Company Project Supervisor.

6.0 Fire Extinguishers and Hoses

6.1 Appropriate fire extinguishers are to be immediately available at the job site. If building mounted area extinguishers are removed and used for this purpose a fully charged unit shall be obtained from the storage area of the plant to replace it.

6.2 Personnel performing cutting and welding shall be knowledgeable as to the types and proper use of fire extinguishers. Most Fire Extinguishers at Waupaca Foundry, Inc. are type ABC. They are capable of extinguishing fires consisting of Wood, Paper, Textiles etc. (A); Oils, Greases & Paints (B); or Electrical fires (C). Extinguishers in the Electrical departments and computer areas are either "Halon" or "CO2". They provide the same protection, however are classified as "non-residue" meaning they create less of a mess while extinguishing the fire.

6.3 Fire Extinguisher location and Markings: If not equipped with wheels, portable extinguishers weighing more than 39 pounds should be installed to the top is not more than 3.6 feet above the floor. Those weighing less than 39 pounds, should not be mounted more than 5 feet above the floor.

Signs shall be posted to show the location and identification of fire extinguishers. "Leave Clear" shall be posted on the fire extinguisher sign or marked on the floor near the base of the wall or column.

6.4 Fire hoses are not to be used by employees unless they have been trained specifically in their use and also the plant allows the use of this equipment.

7.0 Flammable Storage Cabinets

7.1 The cabinet shall not be located within 10 feet of an exit door and not underneath stairways.

7.2 Flammable storage cabinets must be approved by Factory Mutual, Underwriter's Laboratory, or other qualified testing agency.

7.3 Materials stored inside the cabinet shall be compatible with the cabinets design and construction. The maximum capacity of the cabinet storage area shall not be exceeded. Combustible materials such as paper, cardboard, wood, painting equipment, etc. shall NOT be stored in the Flammable Storage Cabinet.

7.4 The Flammable Storage Cabinet must be clearly labeled with a sign, which reads, "Flammable – Keep Fire Away."

7.5 All contents shall be labeled including stock number and min / max quantities or a visual reorder point shall be identified.

7.6 There will be one centralized paint storage within a facility. General painting supplies (i.e. gallons, cans of paint, brushes, trays, etc.) are contained in a designated area within the plant. Flammable cabinets in other locations are designated for non-general paint supplies.

8.0 Flammable aerosol storage - Flammable aerosols are more hazardous than most flammable liquids because aerosol containers rupture explosively when exposed to sufficient heat. Exploding containers become projectiles spraying burning liquids over a wide area causing multiple fires.

8.1 Level 1 (maximum 25% flammable base) examples: shaving cream, spray starch, window cleaner, alkaline oven cleaner, rug shampoo. These aerosols are water based and do not pose any unusual fire hazard. The may be treated as ordinary combustible material.

Level 2 examples: personal care products such as deodorants, hair spray, antiseptic, anesthetics, furniture polish, windshield deicers, and engine starter fluids.

Level 3 (greater than 55% flammable base) examples: Engine and carburetor cleaners, undercoatings, home products, wood polish, paints and lacquers, lubricants, and insecticides.

8.2 Incidental storage is defined as no more than 2 pallet loads of Level 2 and Level 3 aerosols. *One pallet load is approximately 4 feet by 4 feet by 4 feet with 100 cartons of 12 (nominal 12 oz) cans per carton, or approximately 112 gallons, or 900 pounds net weight.

8.3 Segregate and isolate the aerosol storage and keep inventory as low as practical. Outside storage in a building away from other buildings is preferred. If this is not practical or feasible, inside storage should be kept away from sources of ignition and arranged in one of the following ways:

8.3.1 In a separate room

8.3.2 In metal cabinets; or

8.3.3 In a secured chain link cage: or

8.3.4 In a designated area at least 8 feet from other combustible storage

8.3.5 In fire protected (sprinkler) areas of the building

8.4 Flammable aerosol products do not need to be removed from the manufacturers boxes or cartons while in storage in the stockroom and/or warehouse areas.

9.0 Oxy-Fuel Cutting and Welding Equipment

9.1 Transporting, Moving and Storing Compressed Gas Cylinders - Oxygen cylinders shall be stored at least 20 feet from any flammable gases or petroleum products. Valve protection caps shall be in place and secured when cylinders are moved or not in use. When cylinders are hoisted, they shall be secured on a cradle, sling, board, pallet, welding cart designed for hoisting of materials, cage or basket. They shall not be hoisted or transported by means of magnets, choker slings, or by their caps. Cylinders shall be moved by tilting and rolling them on their bottom edges. They shall not be intentionally dropped, struck, or permitted to drop or strike each other. When cylinders are transported by power vehicles, they should be secured in a vertical position. If they must be laid down, they shall be secured and kept from rolling and striking one another or other objects. When and if acetylene bottles are laid down for transporting, they shall not be used for a minimum of four hours after being returned to their upright position. Fuel gas and oxygen cylinders should never be used in other than a vertical position. Regulators shall be removed and valve protection caps put in place before cylinders are moved, unless cylinders are firmly secured on a special carrier intended for this purpose. All compressed gas cylinders shall be secured in an upright position at all times, unless being transported.

9.2 Placing CylindersCylinders shall be kept far enough away from actual welding or cutting operation so that sparks, hot slag, or flame will not reach them. Electrodes shall not be struck against a cylinder to strike an arc. No welding, brazing, burning, etc. shall be done on any cylinder under any condition.

9.3 Treatment of Cylinders -Cylinders, whether full or empty, shall not be used as rollers or supports. No damaged or defective cylinder shall be used. Cylinders with leaking valves or safety pressure reliefs shall be removed as far away as possible from other bottles on the jobsite. The vendor should be notified immediately to pick up the defective unit.

9.4 Hose - All hoses in use carrying acetylene, oxygen, or any gas or substance which may ignite or enter into combustion, or be in any way harmful to employees, shall be inspected at the beginning of each working shift. Hoses which show evidence of damage or excessive wear should be repaired, replaced, or removed from service. Hose couplings shall be of the type that cannot be unlocked or disconnected by means of a straight pull without rotary motion. Boxes used for the storage of gas hoses shall be ventilated. Hoses, cables and other equipment shall be kept clear of passageways, ladders, and stairs. Hoses and couplings shall be color coded, reverse threaded, or otherwise noticeably different to prevent confusion or intermixing.

9.5 Torches Clogged torch tip openings shall be clean with suitable wires, drills, or other devices designed for such purposes. Torches in use shall be inspected at the beginning of each working shift for leaking cutoff valves, hose couplings, and tip connections. Defective torches shall not be used. Torches shall be lighted by friction lighters or other approved devices and not by matches or cigarette lighters. The use of hot work as a means of lighting torches in prohibited.

9.6 Regulators and Gauges - Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use. All oxygen and fuel cylinder assemblies shall be protected by and equipped with Flash Back Arrestors.

10.0 Electric Arc Cutting and Welding Equipment

10.1 Manual Electrode Holders Only manual electrode holders which are specifically designed for arc welding and cutting and which are of a capacity capable of safely handling the maximum rated current required by the electrodes shall be used. Any current carrying parts passing through the portion of the holder which the arc welder or cutter grips in his/her hand, and the outer

surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.

10.2 Welding Cables and Connectors All arc welding and cutting cables shall be of the completely insulated, flexible type, capable of handling the maximum current requirements of the work in progress, taking into account the duty cycle under which the arc welder or cutter is working. Cables in need of repair shall not be used; they shall be removed from service for repair or destruction.

10.3 Operating Instructions When electrode holders are to be left unattended, the electrodes shall be removed and the holders shall be so placed or protected that they cannot make electrical contact with employees or conducting objects. Hot electrode holders shall not be dipped in water; to do so may expose the arc welder or cutter to electric shock. When the arc welder or cutter has occasion to leave work or to stop work for any appreciable length of time, or when the arc welding or cutting machine is to be moved, the power supply switch to the equipment shall be opened. Any faulty or defective equipment shall be reported to the supervisor.

10.4 Shielding - Whenever possible, all arc welding and cutting operations shall be shielded by non-combustible or flame resistant screens which will protect employees and other persons working in the area from the direct rays of the arc. Adequate exhaust to the outside should be provided where internal combustion engines are used to operate welding machines in enclosed areas.

11.0 Special Hazards

11.1 If work is to be performed in a High Hazard Area, such as a confined space, proper precautions must be taken, prior to the beginning of the work. For any confined space hot work, continuous ventilation and air monitoring must be performed.

12.0 Portable Heaters

12.1 The use of any portable open flame heaters such as salamanders, propane heaters or heating barrels shall require the implementation of the Hot Work permit system. This is to ensure that the area of use is compatible with an open flame. The permit may be authorized for a maximum of 1 week in the area of use. A new permit shall be issued after the one week period, or if surrounding conditions change in the area of use.

12.2 The immediate area around the heater shall be kept clear of debris and trash. The fuel source for the heater shall be stored as far away as possible from the heater to avoid possible ignition. All liquid flammables shall be stored in proper dispensing containers and kept in flammable cabinets when not in use.

12.3 If the area is deemed incompatible with open flame, an alternative method of heating/freeze protection should be used such as electric heat, pipe insulation, building insulation or draining of the affected lines as necessary.

13.0 Contractors

13.1 Contract personnel shall follow the same procedures required of in-plant personnel who do hot work.

14.0 Personal Protective Equipment

14.1 Eye Protection - Eye injury can occur from the intense light and radiation from a welding arc and from hot slag that can fly off from the weld during cooling, chipping or grinding. Protect your eyes from welding light by wearing a welder's helmet fitted with a filter shade that is suitable for the type of welding you are doing. ALWAYS wear safety glasses with side shields or goggles when chipping or grinding a work piece if you are not wearing a welding helmet. Helmet shell must be opaque to light and resistant to impact, heat and electricity. Outer cover plate made of polycarbonate plastic which protects from UV radiation, impact and scratches. Filter lens made of glass containing a filter which reduces the amount of light passing through to the eyes. Filters are available in different shade numbers ranging from 2 to 14. The higher the number, the darker the filter and the less light passes through the lens. Clear retainer lens made of plastic prevents any broken pieces of the filter lens from reaching the eye. Gasket made of heat insulating material between the cover lens and the filter lens protects the lens from sudden heat changes which could cause it to break. In some models the heat insulation is provided by the frame mount instead of a separate gasket.

14.2 Filter Shades - Provide additional task lighting that suits welders' needs. Use the same shade as the welder's if you are directly observing the welding arc. Do not use gas welding goggles for arc welding. Do not substitute modified glasses, sunglasses, smoked plastic or other materials for proper welding lenses. For gas cutting, welding and brazing, the intensity of the light is much less than from arc welding. Lighter shade filter lenses are used with goggles in place of a helmet. For Arc welding, the correct filter shade is selected according to the welding process, wire diameter, and operating current. ALWAYS use suggested shade numbers instead of minimum shades. The correct shade numbers for oxy-fuel cutting and arc welding and cutting are shown in the table below.

Shade Numbers for Cutting (from CSA W117.2)

Process	Plate Thickness (in mm)	Minimum Shade #	Suggested Shade #
Light	< 25	3	4
Medium	25 - 150	4	5
Heavy	> 150	5	6

** In the US use ANSI/AWS Standard F2.2 for selecting filter lens shade.*

Shade Numbers for Arc Processes (from CSA W117.2)

Process	Electrode Diameter (mm)	Current (Amperes)	Minimum Shade	Suggested Shade
SMAW	< 2.5 2.5 - 4 4 - 6.4 > 6.4	< 60 60 - 160 160 -250 250 - 550	7 8 10 11	- 10 12 14
GMAW and FCAW		< 60 60 -160 160 -250 250 -500	7 10 10 10	- 11 12 14
Air Carbon Arc Cutting light heavy		< 500 500 -1000	10 11	12 14

**In the United States use ANSI/AWS Standard F2.2 for selecting filter lens shades.*

14.3 Face Protection - Choose a tight fitting helmet to help reduce light reflection into the helmet through the space between the shell and the head. Wear the helmet correctly. Do not use it as a hand shield. Protect the shade lens from impact and sudden temperature changes that could cause it to crack. Use a cover lens to protect the filter shade lens. Replace the cover lens if it gets scratched or hazy. Make sure to replace the gasket periodically if your helmet uses one. Replace the clear retaining lens to protect your eyes from broken pieces. Clean lenses periodically. Discard pitted or damaged lenses.

14.4 Skin Protection - Wear tightly woven work-weight fabrics to keep UV radiation from reaching your skin. Button up your shirt to protect the skin on the throat and neck. Wear long sleeves and pant legs. Cover your head with a fabric cap to protect the scalp from UV radiation. Protect the back of your head by using a hood. Protect your face from UV radiation by wearing a tight-fitting, opaque welder's helmet. Make sure that all fabric garments are resistant to spark, heat and flame. Keep the fabrics clean and free of combustible materials that could be ignited by a spark.

14.5 Protective Clothing - Wear clothing made from heavyweight, tightly woven, 100% wool or cotton to protect from UV radiation, hot metal, sparks and open flames. Flame retardant treatments become less effective with repeated laundering. Keep clothing clean and free of oils, greases and combustible contaminants. Wear long-sleeved shirts with buttoned cuffs and a collar to protect the neck. Dark colors prevent light reflection. Tape shirt pockets closed to avoid collecting sparks or hot metal or keep them covered with flaps. Pant legs must not have cuffs and must cover the tops of the boots. Cuffs can collect sparks. Repair all frayed edges, tears or holes in clothing. Wear high top boots fully laced to prevent sparks from entering into the boots. Use fire-resistant boot protectors or spats strapped around the pant legs and boot tops, to prevent sparks

from bouncing in the top of the boots. Remove all ignition sources such as matches and butane lighters from pockets. Hot welding sparks may light the matches or ignite leaking lighter fuel. Wear gauntlet-type cuff leather gloves or protective sleeves of similar material, to protect wrists and forearms. Leather is a good electrical insulator if kept dry. Direct any spark spray away from your clothing. Wear leather aprons to protect your chest and lap from sparks when standing or sitting. Wear layers of clothing. To prevent sweating, avoid overdressing in cold weather. Sweaty clothes cause rapid heat loss. Leather welding jackets are not very breathable and can make you sweat if you are overdressed. Wear a fire-resistant skull cap or balaclava hood under your helmet to protect your head from burns and UV radiation. Wear a welder's face shield to protect your face from UV radiation and flying particles. Do not wear rings or other jewelry. Do not wear clothing made from synthetic or synthetic blends. The synthetic fabric can burn vigorously, melt and produce bad skin burns.

14.6 Respiratory Protection - Respiratory protection is needed when ventilation is not sufficient to remove welding fumes. Select and use respirators in compliance with your workplace regulation. Seek expert advice and initiate a proper respiratory protection program.

15.0 Personnel Training Requirements

15.1 Employees with authority to use Oxy-Fuel equipment are trained annually. Training includes Burning and Welding procedures (including Permit System), Welding Equipment and Oxygen and Fuel gas safe work practices, and proper use of Fire Extinguishing Equipment including fire hoses (as applicable to the plant).

15.2 Fire Extinguisher training must be done every two years. Additional training will be provided if the extinguisher type differs.

15.3 Fire Hose use is restricted to ERT members or others with specific training on fire hose use providing the plant allows the use of such equipment.