

HAZARD COMMUNICATION AND HAZARD DETERMINATION FOR BRAZING AND SOLDERING

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ABSTRACT

Hazard Communication (HazCom) in the workplace is always the employer's responsibility. The Code of Federal Regulations (CFRs) prescribes mandatory compliance for employers to ensure safety for workers, workplaces, emergency crews and the nearby communities. HazCom for brazing and soldering compliance addresses considerations for the environment, health and safety of personnel, and property.

Hazard Determination is a fundamental aspect of the Hazard Communication Standard (HCS) contained in the CFRs. Employers must comply with six fundamental areas: Hazard Determination, Chemical Labels, Material Safety Data Sheets (MSDS), Written Implementation Program, Employee Training, and Trade Secrets. These topics are reviewed in a straightforward manner with emphasis on hazard determination.

Employers must carefully analyze all the hazards associated with brazing and soldering operations to appropriately comply with hazard determination. Brazing and soldering processes use thermal and chemical reactions to facilitate joining. Assessment of the associated hazards must be rigorous and may require experienced, independent investigations.

When employers focus on HazCom and Hazard Determinations, safety compliance and overall performance generally improve. Employers and employees benefit from accurate determination of the brazing and soldering hazards that exist in the workplace, limiting exposure and implementing HazCom practices.

KEYWORDS

Brazing, Soldering, Hazard Communication, HazCom, Hazard Determination, Labeling, Material Safety Data Sheets (MSDS), Training, Trade Secrets

INTRODUCTION

Safety practices associated with brazing and soldering operations must protect personnel, property and the environment. Hazards from all chemicals produced or imported to the workplace must be evaluated and that hazard information transmitted to employers, employees, emergency crews and nearby communities. The transmittal of information about hazards is accomplished by means of hazard communication programs, which include container labeling, warnings, material safety data sheets and training.

Brazing and soldering processes use heat, metals and chemicals to facilitate the joining operations. Chemical reactions occur when brazing and soldering which can expose direct workers, employees in adjacent work areas, and the local community to health risks. In the United States of America (USA) The Code of Federal Regulations (CFRs) governs the protection from these exposures.

Brazing and soldering are safe operations when proper practices are followed. As in all operations, there are certain hazards which must be avoided. Safety compliance in the brazing and soldering workplace is no accident, it is a conscious choice. Hazard Communication (HazCom) addresses risk management considerations for the Environment, Health and Safety (EHS) of personnel and property during the performance of brazing or soldering. The Occupational Safety and Health Act of 1970 established the Occupational Safety and Health Administration (OSHA) within the US Department of Labor.

The original act included language to the effect that employees should be apprised of all hazards to which they are exposed on the job. In the early 80's, OSHA enacted the Hazard Communication Standard (HCS) because employees who may be exposed to hazardous chemicals in the workplace have a right to know about the hazards and how to protect themselves. The HCS was called the Worker's Right-to-Know Law. Originally HCS applied only to manufacturing; however, subsequent court challenges modified the scope of the law so that now the HCS applies to all sectors of the work force.

Employees, emergency crews and the nearby community have a right to know the hazards of chemicals in brazing and soldering workplaces. Knowledge required by the HCS creates safer workplaces for personnel and protects property.

Brazing and soldering operations require detailed planning to accomplish the intended work successfully. These operations require inputs from multi-disciplined professionals to implement defect-free brazing or soldering. In the past, operations' success was measured by quantity of parts produced and compensation was assigned accordingly. Today, the scope of performance measurement includes production quantities, risk reduction and adherence to HCS and environmental laws.

There are six fundamental areas in the HCS guidelines and requirements:

- Chemical Labeling
- Material Safety Data Sheets (MSDS)
- Hazard Determination
- Written Implementation Program
- Employee Training
- Trade Secrets

CHEMICAL LABELING

Chemical labeling applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency. The term chemical is

defined as any element, chemical compound or mixtures of elements and/or compounds.

Employers are required to maintain all MSDS with incoming shipments of hazardous chemicals, and ensure that they are readily accessible during each work shift to laboratory employees when they are in their work areas. It is important for management to correctly assign the proper terms in the laboratory and other workplaces. Unopened containers require labels and employees handling these containers must be suitably informed and trained. Employers must ensure that labels on incoming containers of hazardous chemicals are not removed or defaced. A label means any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.

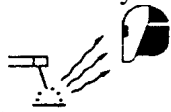
Employers must label all containers with hazardous chemicals that leave the workplace. Employers are responsible for specified hazard communication programs in the laboratory, production areas, shipping and receiving.

Employers may use signs, placards, process sheets, procedures or other written materials in lieu of affixing labels to individual stationary process containers. The method of identification must identify the hazard and convey the information required by the CFR.

Free copies of the national welding safety standard, AWS Z49.1 Safety in Welding, Cutting and Allied Processes, are available from www.aws.org. The Code of Federal Regulations - Occupational Safety and Health Administration (OSHA) regulations are also free downloads listed as Title 29 CFR 1910 Subpart Q, Welding Cutting and Brazing www.osha.org. See Figure 1. Brazing, Soldering, Welding Hazards.

Figure 1. Examples of Brazing, Soldering and Welding Hazards

Burns - eyes and skin



Sparks & Fire



Explosion



Fumes and Gases



Cluttered Workplace
and Electric Shock



Confined Space



MATERIAL SAFETY DATA SHEETS

Employers shall maintain, develop or immediately obtain copies of any MSDS that are received with incoming shipments of sealed containers of hazardous chemicals. The MSDS must be written in English and readily accessible during each work shift to employees when they are in their work areas. The MSDS is written or printed material concerning a hazardous chemical as defined in the regulations.

For example, an MSDS contains the following information:

- Identity used on the label of the chemical as a single substance.
- The substance chemical name and common name.
- Hazardous chemical mixtures tested as a whole, must contain the ingredients which are known hazards and commons of the mixture.
- Individual components which comprise one percent or greater of the mixture. There is an exception when the mixture contains a carcinogenic component in

concentrations of 0.1 percent or greater as a hazardous designation.

- Physical and chemical characteristics of the hazardous chemical (vapor pressure, flash point, etc.)
- Physical hazards of the chemical including the potential for fire, explosion or reactivity.
- Health hazards of exposure to the chemical.
- OSHA permissible exposure limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV).
- Generally accepted precautions for safe handling practices, procedures and protective measures for spills and leaks.
- Applicable control measures for preparing and presenting MSDSs, engineering controls, work practices or personal protective equipment.
- Emergency and first aid procedures.
- Date of preparation and last date of changes.
- Name, address and telephone of the chemical manufacturer or responsible party.

Employers are required to provide information and training for the location and availability of the written hazard communication program to the extent necessary to protect employees in the event of a spill or leak of a hazardous chemical from a sealed container.

Hazardous substances are defined and listed in the Federal Hazardous Substances Act with appropriate safety standards and labeling requirements.

HAZARD DETERMINATION

From the beginning, it is very important to scientifically evaluate items in brazing or soldering to correctly assess the designation of a "hazardous" material. A hazardous chemical

has the broad definition of any chemical which is a physical hazard or a health hazard. The initial determination of a 'hazard' is perhaps the most significant designation for any solid, liquid or gas associated with brazing or soldering.

Several brazing and soldering hazards are base metals, filler metals, fluxes, heat, heat sources, gases, gas-handling equipment, fumes, and chemicals. Hazard determination is accomplished by the employer's evaluation of general area safe practices, personnel protection, electrical conditions, furnaces, furnace atmospheres, specialized processes, chemicals produced or imported into the workplace to determine if there are hazards. Employers are not required to evaluate chemicals when they choose to rely on the evaluation performed by the chemical manufacturer.

Employers must evaluate chemicals to identify and consider the available scientific evidence concerning such hazards. For health hazards, evidence which is statistically significant and based on at least one positive study conducted in accordance with established scientific principles is considered to be sufficient to establish a hazardous effect if the results of the study meet the definitions of health hazards in the appendices contained in the regulation.

TLV for chemical substances and physical agents in the work environment are contained in several CFRs and publications by the ACGIH.

The employer always remains responsible for evaluating the hazards associated with the chemicals used in brazing or soldering in accordance with the requirements of the HCS. Professional evaluations must be performed, especially when introducing new processes or metals into the brazing or soldering workplace. The CFRs contain several reference sources for determination of a chemical as a carcinogen or potential carcinogen for hazard communication purposes.

When a mixture used in brazing or soldering has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as the individual components which comprise one percent or greater of the mixture. There is an exception that when the mixture contains a carcinogenic component in concentrations of 0.1 percent or greater a hazardous designation is required as stated in the CFRs.

When a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture. Employers evaluating chemicals shall describe in writing the procedures used to determine the hazards of the chemical. The written procedures must be available, upon request, to employees. The written description may be incorporated into the written hazard communication program.

WRITTEN IMPLEMENTATION PROGRAM

The 'Written Implementation Program' is sometimes called the 'Written Hazard Communication Program'. Brazing and soldering employers must develop, implement and maintain at each workplace, a written hazard communication program which at least describes how the criteria for labels and other forms of warning, MSDSs, and employee information and training are achieved.

The written program minimally contains the following:

- Address the base metals and possible reactions.
- Address the filler metals and possible reactions.
- List the hazardous chemicals known to be present in the workplace.
- Access to appropriate and current MSDS for each hazardous chemical.

- Methods of informing employees and contractors about hazards of non-routine tasks.
- Precautionary measures needed for personal protection during normal operating conditions and foreseeable emergencies.
- Mechanical devices, motions anticipated and safety shut-off switches.
- Exposure to corrosive fluxes and dangerous furnace atmospheres.
- Explanation of the labeling system used throughout the workplace.
- Proper ventilation for confined areas and fume precautions.
- Personal Protective Equipment requirements and location.
- Evidence that the program is being followed.

EMPLOYEE TRAINING

Brazing and soldering employers shall provide all employees with effective information and training on hazardous chemical in their work area at the time of their initial assignment and whenever a new physical or health hazard is introduced in the work area. Information and training shall cover categories of hazards, flammability, carcinogenicity or specific chemicals.

Employees may include researchers, process engineers, development personnel, temporary engineers, students and technical management.

Researchers and engineers must understand and be aware of the standard free energy of formation of oxides as a function of temperature in brazing and soldering processes. The Ellingham Diagram is useful for considering the development of oxides and residues.

Employees shall be informed of any operations in their work area where hazardous

chemicals are present and the location and availability of the written hazard communication program, lists of hazardous chemicals and MSDSs.

Employee training includes methods and observations used to detect the presence or release of a hazardous chemical in the work area.

Employees must be trained about the physical and health hazards of chemicals in the work area. Training shall include measures for employees to use to protect themselves from these hazards, appropriate work practices, emergency procedures and personal protective equipment to be used. The details of understanding the chemical labeling system must be explained and how to obtain appropriate hazard information when necessary.

Employees shall comply with the occupational safety and health standards and all rules, regulations, and orders issued pursuant to OSHA and the CFRs, which are applicable to the employee's own actions and conduct.

TRADE SECRETS

A 'trade secret' simply means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it.

The brazing or soldering company may withhold the specific chemical identity, including the chemical name and other specific identification of a hazardous chemical from the MSDS as long as the claim that the information withheld is a trade secret can be supported. There must be disclosure by an appropriate MSDS concerning the properties and effects of any hazardous chemicals contained in the trade secret formulation.

When a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a hazardous chemical for emergency treatment, the employer shall immediately disclose the specific identity being withheld as a trade secret regardless of any confidentiality agreement.

In non-emergency situations, the use of trade secret mixtures remain subject to reasonable detail of the MSDS, chemical hazards identity, sample assessments, employee exposure limits, medical surveillance of exposed employees, medical treatment and appropriate personal protective equipment for exposed employees.

Whenever possible design or assess engineering controls or other protective measures for employees exposed to hazardous chemicals and conduct studies to determine the health effects of exposure.

SUMMARY

Brazing and soldering operations must address personnel safety, chronic health considerations and environmental regulations. Managers and engineers must understand the importance of safe practices for employees, neighbors and emergency crews. Detailed guidance about specific applications is listed in The CFR Regulation, Hazard Communication - 1900.1200 and the associated references.

The largest cost in brazing and soldering is labor. Process designers try to make items simple, yet fail-safe as possible. It is important for management to communicate these concepts to the lowest level to ensure safety and improve performance. Safety management has the greatest potential for reducing accidents and overall costs.

Experience is the best teacher. Unfortunately, experience sometimes arrives too late, after an accident. Every person involved with brazing or soldering needs training and

must take the responsibility to know the hazards of every situation.

Education is the only way to address these potential hazards. Application of expert knowledge that is readily available to users offers a priceless opportunity to learn ahead of time the things that experience has taught others.

When brazing or soldering, use the recommended safeguards, methods and tools. Educated decisions avoid the almost inevitable consequences of personal injury and property damage. Every brazing and soldering company can benefit from the knowledge and application of the best practices available. Employee safety in brazing and soldering is a choice. Make good choices.

REFERENCES and SUPPLEMENTARY READING

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