Welding & Grinding – Safety Guidelines

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1.0 SCOPE

1.1 This procedure outlines the minimum guidelines for establishing safety practices when welding and grinding during or in support of natural gas pipeline construction activities.

1.2 This procedure outlines the minimum requirements for hand and power tools used in conjunction with welding and grinding during or in support of natural gas pipeline construction activities.

1.3 The guidelines in this document are not meant to supersede or replace regulatory requirements, (e.g., OSHA, DOT, PHMSA) nor are they intended to be all-inclusive of the applicable regulatory, site-specific hazard assessments/safety plans or company requirements. Rather, they are intended to be supportive and complimentary to such requirements. The guidelines in this document represent industry best practices and are not to be considered directives nor mandatory.

2.0 PURPOSE AND APPLICABILITY

2.1 This document establishes guidelines that should be followed whenever any employee works with welding and grinding equipment. The purpose is to establish uniform practices designed to ensure that welding and grinding safety training, operation, and maintenance practices are communicated and understood by the affected employees. These guidelines are designed to ensure that procedures are in place to safeguard the health and safety of all employees.

2.2 Tools are such a common part of daily work activities that it is difficult to remember that they may pose hazards. In the process of removing or avoiding the hazards, workers must learn to recognize the hazards associated with the different types of tools and the safety precautions necessary to prevent those hazards during welding and grinding.

3.0 ACRONYMS AND DEFINITIONS

3.1 **Hand Tools** – Are non-powered tools. They include anything from wire brushes to chipping hammers.

3.2 **Job Safety Analysis (JSA)** - JSAs are prepared for a specific work activity that will be performed. JSAs are performed to identify hazards (real and potential) that are, or may be, present at the specific work location under current environmental conditions (weather, external impacts, etc.) and to prescribe the appropriate mitigation of the identified potential hazard(s), before commencing a work activity. JSAs should be updated when activities or conditions (weather, soil conditions, etc.) change during performance of the task.

3.3 **Power Tools** – Are tools that require a power source to operate. Power sources include: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated.

3.4 **Root Cause Analysis (RCA)** – A method of problem solving aimed at identifying the root causes of problems or events. A deeper look into problems or defects to find out why they are happening.

3.5 **Weld** – a. The completed weld joining two sections of pipe, as section of pipe to a fitting, or two fittings. Source: API 1104. b. joining two pieces of metal together to cover plate or structural welding.

3.6 **Welding Repair** – Any rework on a completed weld that requires welding to correct a fault in the weld that has been discovered by visual or nondestructive testing and is beyond the limits of acceptability.

3.7 **Welding Defect** – An imperfection of sufficient magnitude to warrant rejection based on the stipulations in the standard used to evaluate weld.

4.0 ROLES AND RESPONSIBILITIES

4.1 Management Responsibilities *(Includes all personnel with a supervisory role)*

4.1.1 Confirm that appropriate procedures are designated for the project.

4.1.2 Ensure that personnel receive on-boarding and communication/training regarding welding and grinding per the overall safety program.

4.1.3 Verify that applicable employees are trained in the duties that they are to perform.

4.1.4 Hazards associated with welding and grinding are identified and discussed daily on crews' Job Safety Analyses (JSA) who are performing such work / task.

4.2 Health and Safety Personnel Responsibilities

4.2.1 Assist with developing JSA, including but not limited to providing technical support.

4.2.2 Perform periodic audits of the JSA.

4.2.3 Review mitigations to identified hazards.

4.2.4 Assist Management / Supervisors in the development / enforcement of Safe Work Practices (SWPs), Training Programs, and compliance with applicable regulations.

4.3 Employee Responsibilities

4.3.1 Review the JSA's prior to visiting a site / project (where applicable).

4.3.2 Abide by all guidance in the JSA applicable to the work scope / site.

4.3.3 Immediately notify supervisor of any unsafe conditions or acts that may be of danger to workers or others.

5.0 TRAINING

5.1 Only trained and authorized personnel should be permitted to operate welding and grinding equipment. Each project Safety Coordinator or designee should identify all new employees and make arrangements to ensure training is complete. It is necessary to ensure the instructor(s) has the necessary knowledge, training, and experience to train new welding and grinding equipment operators. Qualifications include: specific knowledge, training, and/or experience.

Note: Companies are encouraged to add additional training that is beneficial to their projects / operations.

5.2 Initial Training

Initial training would include classroom instruction, e.g. lecture, video with discussion, classroom instruction. Classroom instruction should cover the following topics: personal protective equipment (PPE), hazard communication (HAZCOM), fire protection and other company specific safety topics.

5.3 General Safety Training Associated with Welding and Grinding

5.3.1 Only personnel that have completed safety training and show competence should operate or maintain welding and grinding equipment.

5.3.2 Practical training includes demonstrations, practical exercises, and hands-on instruction.

5.3.3 Practical training includes general welding and grinding procedures and proper PPE use.

5.3.4 Project specific JSA or JHA should be reviewed for specific hazards for welding and grinding equipment in the workplace.

5.3.5 Under no circumstance may an employee operate welding or grinding equipment until they have completed the training. This includes all new welders, journeyman, and helpers regardless of claimed previous experience.

5.3.6 All employees have a general obligation to work safely with and around welding and grinding operations.

6.0 GENERAL SAFETY PRECAUTIONS

6.1 Employees using welding equipment, hand tools, or power tools can be exposed to the hazard of falling, flying, abrasive and splashing objects, harmful dusts, fumes, mists, vapors, or gases and must be provided with the appropriate personal protection equipment necessary to protect them from these hazards.

6.2 The following five (5) basic safety rules could help prevent hazards involved in the use of equipment:

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before use.

- Operate according to the manufacturer's instructions.
- Provide and use the right protective equipment.

6.3 Employees and employers have a responsibility to work together to establish safe working procedures. If a hazardous situation is encountered, it should be brought to the attention of the proper individual immediately.

7.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

7.1 At a minimum, hard hat (when not welding), steel toe boots (worn under pant legs to keep from catching slag.), and safety glasses are required.

7.2 Long sleeves and pants without cuffs or front pockets are recommended to avoid catching sparks.

7.3 Flame resistant clothing (FRC) may also be required by the site operator or project sponsor.

7.4 During welding operations, welders should wear welding hood with appropriate filter lens.

7.5 During grinding, both a face shield or welding hood with a flip or auto-darkening lenses, and safety glasses or spoggles should be worn at all times to protect eyes from flying debris, i.e., Double Eye Protection.

7.6 Fall Protection is required in accordance with OSHA standards or site-specific safety program

7.6.1 A platform with railings, or safety harness and lifeline will be used when welding or grinding above ground or floor levels (6 ft or more) and there are falling hazards.

7.6.2 A clearly defined and marked welding or grinding area will be maintained under the platform to prevent slips, trips, falls, and burns from anyone walking by.

8.0 WELDING

8.1 Safe practices when using arc welders include:

8.1.1 Company specifications and/or project contracts should state type of welding to be used as well as specific welding parameters used during welding.

8.1.2 Use of holders, cable, and other apparatus specifically designed for the purpose, matched to the job and other components and in good repair.

- Defective equipment will not be used.
- No damaged or bare cables and connectors will be used.

8.1.3 Welding should not be done while standing in water or on surfaces holding water that could present electrical shock. Additional precautions should be taken when working on frozen soil, snow, or muddy conditions to avoid electrical shock.

8.1.4 Equipment should be properly grounded, installed, and operated. Be aware of additional requirements when working around overhead power lines.

8.1.5 U.S. Department of Transportation (PHMSA) regulations for welding on natural gas pipelines should be followed.

8.1.6 Well-insulated electrode holders and cables should be used. When leaving electrode holders unattended, electrodes are removed, and holders placed so that accidental electrical contact is not made.

8.1.7 Welding cables must not be wrapped around the welder's body.

8.1.8 Turn off the arc welding machine when it is to be left unattended for a substantial period of time or when it is being moved.

8.1.9 Immediate reporting of any defective equipment to the site supervisor.

8.1.10 Use of non-combustible or flameproof screens to protect employees and passersby from arc rays / flare whenever practicable.

8.1.11 In case of electric shock, a victim should not be touched. Current should be turned off at the control box and then help called for. After the power is off, cardio-pulmonary resuscitation (CPR) may be performed if necessary.

8.2 Fire watchers are required in many instances in welding operations. They must be familiar with the alarm system and only try to put out fires within the capability of the equipment available.

8.2.1 Fire watch must be present when:

- Work is performed at a location where a fire might develop.
- Combustible materials are closer than 35 ft to point of operation.
- Combustibles are 35 ft or more away but are easily ignited.
- Wall or floor openings within 35 ft radius expose combustible materials.
- Combustible materials are adjacent to the opposite side of metal partitions, ceilings or roofs.
- For a minimum of 30 minutes following completion of the job.

8.2.2 Fire watch responsibilities:

- Understanding the location and nature of the hot work.
- Survey the area to be sure the necessary fire protection equipment is in place and ready for use.
- Survey the area for combustible or flammable materials.
- Remain in the area while the work is being performed and remain in constant communication range with person(s) doing the hot work.
- Never leave the area for any reason without a replacement.
- When bulkheads or walls are involved in hot work, both sides require a fire watch.

8.2.3 The fire watch must be attentive and have the fire extinguisher readily available prior to the start of work. The extinguisher must be returned to its assigned location when the hot work is complete.

8.2.4 A fire watch shall be maintained at least a half an hour after the welding or cutting operation was completed.

8.3 Prohibited Practices Include:

8.3.1 Using cables with repairs or splices within 10 feet of the holder that are not equivalent in insulating value to the original cable.

8.3.2 Use of pipeline with flammable gasses or liquids or conduits with electrical circuits as ground return.

8.3.3 Dipping hot electrode holders into water.

9.0 GRINDING

9.1 Powered Grinders / Abrasive Wheel Tools

9.1.1 Powered abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments. Before an abrasive wheel is mounted, it should be inspected closely and sound – or ping – tested to be sure that it is free from cracks or defects. To test, wheels should be tapped gently with a light non-metallic implement, if they sound cracked or dead they could fly apart in operation and so must not be used. A sound and undamaged wheel will give a clear metallic tone or "ring."

9.1.2 To prevent the wheel from cracking, the user should be sure it fits freely on the spindle. The spindle nut must be tightened enough to hold the wheel in place, but not tightened to distort the flange. Follow the manufacturer's recommendations. Care must be taken to ensure that the grinder spindle wheel RPMs will not exceed the abrasive grinding disk RPMs specification. Example of a hazard would be using a 9" grinding disc (max. 6600 rpm) on a 7" grinder (8500 rpm)

9.1.3 Due to the possibility of a wheel disintegrating (exploding) during start-up, the employee should never stand directly in front of the wheel as it accelerates to full operating speed. Portable grinding tools need to be equipped with safety guards to protect workers, not only from the moving wheel surface, but also from flying fragments in case of breakage.

9.1.4 In addition, when using a powered grinder:

- Always use eye protection.
- Turn off the power when not in use.
- Never clamp a hand-held grinder in a vise.
- Always stop the wheel before setting the grinder down.
- Never modify the guards or handles.
- Always follow manufacturer recommendations related to grinder handles.

9.1.5 Power tool users should observe the following general precautions:

- Never carry a tool by the cord or hose.
- Never pull the cord or the hose to disconnect from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not in use, before servicing, and when changing accessories such as blades, bits, and cutters.

- All observers should be kept at a safe distance from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.
- Avoid accidental starting. The workers should not hold a finger on the switch button while carrying a plugged-in tool.
- Tools should be maintained with care. They should be kept sharp and clean for the best performance. Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance.
- The proper apparel should be worn. Loose clothing, ties, or jewelry can become caught in moving parts.
- All portable electric tools that are damaged shall be removed and tagged "Do Not Use."

9.2 Guards

9.2.1 Hazardous moving parts of a power tool need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded if such parts are exposed to contact by employees.

9.2.2 Guards, as necessary, should be provided to protect the operator and others from:

- Point of operation.
- In-running nip points.
- Rotating parts.
- Flying chips and sparks.

10.0 CONFINED SPACES

10.1 When sufficient ventilation cannot be obtained without blocking the means of access, employees should follow site specific safety requirements for confined space work and the requirements of 29 CFR Part 1926, Subpart E. Requirements for working in confined spaces are beyond the scope of this document. Workers must be properly trained per the applicable regulations.

10.2 Where a welder must enter a confined space through a manhole or other small opening, an attendant with a pre-planned rescue procedure must be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect (1926.353(b)(3)). Workers must be properly trained per the applicable regulations.

10.3 Where welding, grinding, or heating in any enclosed spaces is to be performed involving metals of toxic significance according to 1926.353(c), local exhaust ventilation is required, or employees must be protected by air line respirators according to 1926, Subpart E.

10.4 Employees performing such operations in the open air must be protected by filter-type respirators in accordance with the requirements of 1926, Subpart E, except that employees performing such operation on beryllium-containing base or filler metals must be protected by air line respirators according to 1926, Subpart E.

10.5 Other employees exposed to the same atmosphere as the welders or burners must be protected in the same manner as the welder or burner (1926.353(c) (3)-(4)). Workers must be properly trained per the applicable regulations.

10.6 Atmospheric Monitoring in Confined Spaces

10.6.1 Confined space atmospheres must be tested before entry is allowed. Where entry is required to test the atmosphere, the individual conducting the initial test shall wear a SCBA (self-contained breathing apparatus) or air line positive pressure respirator with egress bottle.

10.6.2 All equipment used for atmospheric testing shall be calibrated and operationally checked prior to use according to manufacturer's specifications. The atmospheric tests and operational checks that precede the issuing of a permit should be as close as practical to the time the work is to begin and recorded on the entry permit.

- Oxygen shall be no less than 19.5 percent and no greater than 22 percent. The oxygen level must be checked before the flammability test is conducted.
- Entry will not be allowed if LEL is greater than 10 percent unless the confined space has been rendered inert.

10.6.3 Those confined spaces that do not require respiratory protection based on the test results shall be continuously monitored with an atmospheric monitor.

10.6.4 If ventilation is utilized to maintain the atmosphere, all entrants will wear 4-gas monitors during the entire entry. These monitors will, at a minimum, check oxygen, LEL, hydrogen sulfide, and carbon monoxide.

10.6.5 Anyone asked to use an atmospheric monitor must be trained on the operation and operational limits of the device.

11.0 HOT WORK GUIDELINES

11.1 Employees should obtain authorization from the supervisor overseeing the work before beginning any hot work.

11.2 The company representative responsible for supervising hot work must complete the hot work permit before work may begin. (Host facility permits and gas tests are acceptable provided they meet the requirements of this section.)

11.3 The permit would be reviewed and signed by the person performing the work, the person authorizing the work, and the person approving the work to ensure his/her acknowledgment of the conditions set forth in the permit. If contract personnel are performing the hot work, the contractor's representative at the location where the hot work is being conducted must retain a copy of the permit.

11.4 The work area shall be re-surveyed following all breaks, meals, meetings or other interruptions in the work.

11.5 If the object to be welded cannot be moved, all moveable fire hazards would be removed. If all the fire hazards cannot be removed, then guards would be used to confine the heat sparks and slag and to protect the immovable fire hazards. If removal and/or guards are not feasible, then the work cannot be done.

11.6 While working in confined spaces, proper ventilation and lifelines must be utilized, and all gas cylinders must be secured. Buckets will be used for removal of electrodes. Gas cylinders must be able to be shut off immediately in the event of an emergency, and warning signs must be posted at the point of entry. Continuous monitoring should be provided in areas where conditions are likely to change, and in high-risk areas such as in tanks, or a plant's process area.

11.7 If hot work conditions change and a permit expires due to a potential danger (i.e., leak, hazardous fumes, gases or dust, lower explosive limit (LEL) reading above 10 percent, etc.), no work will be performed until additional testing is conducted. The source of the hazard must be determined, controlled and the area re-inspected and permitted before work can resume.

11.8 Each permit will be dated and will carry an expiration time. In the event the hot work will extend past the permit's expiration time, a new permit must be obtained.

11.9 When the work is complete, the company representative that is responsible for the hot work must be notified.

11.10 A first aid kit must be available at all times and for all work areas in case of an injury or emergency.

12.0 REFERENCES

The content of the standards and CFRs listed below are hereby incorporated by reference. Current versions of the references automatically supersede the references listed below.

12.1 Code of Federal Regulations (CFR)

12.1.1 Title 49 CFR Part 192: Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

12.1.2 Title 49 CFR Part 194: Response Plans for Onshore Oil Pipelines

12.1.3 Title 29 CFR 1926, Subpart D: Occupational Health and Environmental Controls

12.1.4 Title 29 CFR 1926, Subpart E: Personal Protective and Life Saving Equipment

12.2 American National Standards Institute (ANSI)

12.2.1 ANSI Z49.1-1967: Safety in Welding and Cutting

13.0 HISTORY OF REVISIONS

Number	Date	Description
0	May 2018	Initial publication
1	Nov. 2018	Revised Section 1.3 to clarify non-mandatory language