**Instructor Guide**

Piping

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Overview and Goals

Cast iron mains which have been in service for over 100 years generally consist of single, cast iron pipe segments that range from 12 to 20 feet in length. Cast iron pipes are typically connected using bell and spigot joints commonly sealed with jute packing and a lead or cement plug between the bell and spigot.

Although cast iron pipe is no longer used, installers must know how to work with the cast iron pipes already in use to prevent leaks caused by aged.

In addition, with the changeover of manufactured gas to natural gas, the potential for leakage has increased through the caulked bell and spigot joints, used with steel pipe.

In this unit of work the instructor will:

* Highlight the concepts introduced in the online course.
* Demonstrate how to use the relevant tools and reference guides, applicable to the content and activities.
* Guide the participants through hands-on activities to work safely with natural gas, as a qualified operator would on the job.

Upon completion of this unit of work, participants will be able to:

* Identify mechanical joints, leak clamps on caulked bell and spigot joints; specific to cast iron pipe, including how to
	+ Fit a pipe following fitting requirements.
	+ Explain the encapsulation process.
	+ Discuss the requirements, regulations, and safety measures of cast iron pipe and joints.
	+ Recognize and react to abnormal operating conditions working with cast iron pipe.
	+ Outline appropriate project requirements and safety.
	+ Conduct a leak and clamp repair.
* Explain the handling, lowering in, and fitting of steel pipe in a ditch, after excavation, including, how to:
	+ Installation requirements
	+ Handle
	+ Inspect
	+ Provide firm pipe support
	+ Installation procedures
	+ Recognize and handle abnormal operating conditions
* Prepare pipes with threaded fittings and inspect completed joints.

Preparation – Facilitation Guidelines

Ensure the participants have completed:

* ASME-0831 Cast iron – Caulked Bell and Spigot Joints – Installation and Maintenance of Mechanical Leak Clamps, including the pre-test and 20 question course assessment.
* ASME-0841 Cast Iron Joints – Sealing: Encapsulation, including the pre-test and 20 question course assessment.
* ASME-0861 Installation of Steel Pipe in a Ditch, including the pre-test and 15 question course assessment.
* ASME-0721 Joining Pipe – Threaded Joints, including the pre-test and 10 question course assessment.

Conduct this training in a classroom setting, with a simulated lab and/or field site allowing the participants to work independently or in groups (dependent on number of participants) and then present findings to the workshop for further discussion.

Use a flipchart to capture key lessons learned from the group discussions, or to identify questions that will be answered in upcoming units of work or that require further research and discussion.

Reinforce the importance of damage prevention programs and the best practices and guidelines of the Compressed Gas Association (CGA), the Occupational Safety and Health Administration (OSHA), and the Federal Government.

Ensure the participants have a copy of the Common Ground Alliances (CGA) Best Practices guide: <http://www.commongroundalliance.com>

Review the following regulations as tasks are introduced, demonstrated, and practiced.

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| --- | --- |
| §192.53 General | §192.271 Scope. |
| §192.63 Marking of materials.  | §192.273 General.  |
| §195.112 New pipe.  | §192.275 Cast Iron Pipe |
| §192.143 General requirements. | §192.277 Ductile Iron Pipe.  |
| §195.214 Welding procedures. | §192.279 Copper Pipe.  |
| §192.225 Welding procedures.  | §192.281 Plastic Pipe |

Materials

Provide the following to each participant:

* A copy of the Activity Worksheets and Appendix 2 Performance Checklists.
* Access to the Internet, as needed, for OSHA, federal, and industry resources/references supporting course related discussions, demonstrations, and hands-on activities.
* Access to manufacturers’ instructions as needed.

Provide the following materials and tools used locally for the lab demonstrations and hands-on practice:

* Tools for cleaning
* Cast iron pipe (marked with letters to illustrate joints, caulk, etc.)
* Examples of corroded pipe
* Examples of pipes with leaks
* Mechanical leak clamps
* Gaskets
* Bolted coupling
* Boltless coupling
* Hydraulic coupling
* Flanges
* Soapy Detergent
* Coating solution
* Pipe coatings, for example:
* Tape
* Shrink
* Composite sleeve systems
* Mastic coatings
* Melt sticks
* 25 psi gauge
* Mold
* Welding Gun/Welding material (demonstration only)
* Appropriate PPE

Note: These items, and any other materials used for demonstrations and participant activities, will be determined by the materials and tools used at the training facility.Schedule

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| **Time**  | **Topics for Discussion, Demonstrations, and Activities**  |
| **30 minutes**  | **Introduction** * Discuss the characteristics and uses of cast iron pipe.
* Point out the tools used with cast iron pipe.
* Review key vocabulary terms and acronyms, for example:
	+ Bell and spigot joints
	+ Gasket
	+ Mechanical leak clamps
	+ Jute and lead
* Encourage questions based on discussion and online course work.
* Present real-world examples when cast iron pipes are used.
* Talk about the problems of leaking with cast iron pipes today.
	+ Emphasize the importance of following the project requirements, safety guidelines, manufacturers’ instructions and business practices when handling the maintenance and installation of mechanical leak clamps.
	+ Point out:
		- Federal regulations require that each caulked bell and spigot joint in cast iron pipe is sealed with mechanical leak clamps.
			* Each leak clamp must have a gasket made of resilient material.
		- Cast iron caulked bell and spigot joints that are subject to pressures of 25 psi gauge or less and exposed for any reason must be sealed by a means other than caulking.
	+ Show “good repairs”-explain why.
* Show “bad repairs”-explain why (for example a poorly caulked joint and explain what will happen in the short term and long term).

***Note****: The tools, PPE and materials used in the demonstrations will be determined by the materials and tools used at the training facility.* |
| **60 minutes** | **Cast Iron Pipes-Evaluate, Prepare, Repair, and Test for Leaks** **Demonstration*** Demonstrate using the correct tools and PPE the steps installers take to prevent leakage with cast iron pipes.
* Point out during the demonstration the correct procedures/steps to follow/tools used to:
* Conduct a leakage survey to inspect the pipe condition for leakage, deterioration or damage.
	+ Show examples of failure pointing out colors and texture of rusting and potential defects
* Evaluate cast iron joints for leakage, deterioration or damage
* Inspect the gasket for damage and deterioration.
* Prepare the pipes to seat a gasket
* Point out that installers must clean the pipe joint thoroughly on back of bell, on bell face, and on spigot where gasket will seat.
* Show how to prep joint and then check for leaks.

**Demonstration, Continued** * Demonstrate how to clean and prepare to install a mechanical leak clamp
	+ Soap test for leaks
* Install the mechanical clamp and attach bolts
	+ Show where the mechanical clamp it is positioned and what happens when the clamp is tightened.
	+ Show how to measure the MAOP
* Demonstrate how to conduct a leak clamp repair and soap test for leaks.
	+ Apply coating
* Demonstrate how to repair a leak clamp
* Reinforce the importance of maintenance records and that repairs must be maintained throughout the life of the pipeline.

Instruct participants to complete **Activity Worksheet #1.** ***Note****: The tools, PPE and materials used in the demonstrations will be determined by the materials and tools used at the training facility.* |
| **30 minutes** | **Cast Iron Pipes-Sealing****Discussion*** Explain that a joint may be encapsulated as a permanent leak solution.
	+ Discuss when this occurs
* Present examples.
* Review the steps in the encapsulation process.

**Demonstration*** Demonstrate using the correct tools and PPE the steps installers take to seal cast iron pipes
	+ Point out abnormal operating conditions to look for and how to respond to, document and follow up based on company procedures for both remediation, preventive maintenance, and/ or immediate problems.
* Prepare a joint for encapsulation:
	+ Expose the joint
	+ Clean
	+ Inspect
* Attach a mold
* Apply sealant and pressurize
* Inspect and test

Instruct participants to complete **Activity Worksheet #2.**  |
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| **Time**  | **Topics for Discussion, Demonstrations, and Activities**  |
| **60 minutes** | **Install Steel Pipes in a Ditch****Discussion*** Review the basic requirements for installing steel transmission, main, service, and hazardous liquid pipelines, according to the code of federal regulations outlined by the Office of Pipeline safety, including:
* Selection of pipe materials
	+ - * Show an example of how to calculate the design formula for steel pipe.
			* Pipe coatings
			* Tape
			* Shrink
			* Composite sleeve systems
			* Mastic coatings
			* Melt sticks
* Selection of backfill material
* Pipe handling storage, and transit guidelines
* Producing strong gas tight joints
* Protecting pipe from corrosion
* Protecting pipe from coating damage
* Testing new pipe
* Reinforce the importance that when transporting and storing steel pipe, protect pipe coatings from damage, since coating damage could lead to pipeline failure.
 |
| **120 minutes**  | **Joining Pipe****Demonstration*** Show participants
* How to join pipe, following CFR 192.273 and using the correct tools and PPE.
* How to weld pipe, following CFR 192.225 and 195.214 and using the correct tools and PPE, if trained personnel is available at the training facility.
* Show examples of
* Pipe joined through mechanical fitting, for example:
* Bolted coupling
* Boltless coupling
* Hydraulic coupling
* Flanges
* Display and point out the characteristics of a pipe that is cut and prepared for welding or the installation of a mechanical joint.
* Display and point out the characteristics and uses of:
* Insulated couplings.
* Noninsulated couplings.
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| **Time**  | **Topics for Discussion, Demonstrations, and Activities**  |
| **120 minutes** ***Note:****If there is not a field lab, review the online course materials and cover each of these steps with the participants*.  | **Underground Installation Guidelines and Safety Practices** **Demonstration*** Using the correct tools and PPE manage an installation once the trench is excavated.
	+ Inspect the trench for debris and proper grading, depth, sufficiently wide, and properly prepared.
	+ Configure the trench:
	+ Protect pipe joints; install padding in the trench
	+ Prepare the trench floor.
	+ Support around pipe with thrust blocks
	+ Inspect soil and protect against pipe damage.
* Install.
	+ Lower pipe in to the trench.
	+ Select the proper pipe joining method.
	+ Insulate between pipes.
	+ Close all sections of joined pipes.
	+ Provide adequate external load protection and pullout force resistance.
* Address through the demonstration how to watch for and manage any potential problems and/or AOCs with:
	+ Pipe length
	+ Damaged pipes/coatings
	+ Trench conditions
* Review how to handle excavated materials.
* Review the required documentation.

Instruct participants to complete **Activity Worksheet #3.** |
| **30 minutes** | **Joining Pipe** **Discussion*** Review the National Pipe Thread (NPT) and National Standard Free Fitting Straight Mechanical Pipe Thread (NPSM) standards for pipe threads along with the requirements and limitations for using threaded joints
* Review and reinforce the Code of Federal Regulations limits for the use of threaded joints in pipeline systems.
* Explain how each joint sustains the longitudinal pullout or thrust forces caused by contraction or expansion of the piping or by anticipated external or internal loading.
* Reinforce
* Threaded joints **are not allowed** for connecting plastic, cast iron, or ductile iron pipes.
* Only threaded copper pipe can be used for joining screw fittings or threaded valves, if the copper pipe meets 49 CFR §192.279 specified criteria for wall thickness.
* Each joint must be made in accordance with written procedures that will produce a strong, gas-tight/liquid- tight joint.
* Review key terms that are associated with pipe threads, for example:

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| * dry seal
 | * male fittings
 | * gas-tight seal
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| * wet seal
 | * female fittings
 | * liquid-tight seal
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| * leftover threads
 | * imperfect threads
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| **60 minutes** | **Joining Pipe – Threaded Joints** **Demonstration*** Point out the pipe threads on the end of the pipes.
* Demonstrate using the correct tools and PPE, the steps installers follow to join and thread cast iron pipes including how to:
* Prepare the pipes
	+ Cleaning
	+ Taping the tip
* Joining the pipes
	+ Alignment
	+ Manual Rotation
	+ Tightening
* Reinforce the guidelines to follow during inspection, including:
* Installers must comply with the manufacturer’s instructions.
* Carefully inspect joints and replace any defective joint, no matter what the reason, for example: corrosion, leakage, or improper installation
* Review
	+ The federal regulations (CFR 192.271, 273,275,277,279 and 281) set the standards for pipe thread requirements as appropriate during the demonstration
	+ Company procedures for responding to abnormal operating conditions that may be encountered during threaded pipe joint activities, including how to document and submit records according to the regional guidelines and tools used at the training facility.

Instruct participants to complete **Activity Worksheet #4.** |

Boot Camp Activities

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| Working with a partner or partners, answer the following questions and complete the tasks, according to the materials, equipment, and manufacturers’ instructions. Activity Worksheet #1-Cast Iron Pipe Leaks |
| Lab | * Refer to **Appendix 2**-Performance Checklist – Cast Iron Pipes-Evaluate, Prepare, Repair, and Test for Leaks
	+ Perform the tasks.
	+ Identify the materials, tools and instructions used to complete the task(s).
	+ Answer any question presented.
* Take notes in the sections below (as needed).
* Address in the sections below any specific project requirements, instructions, and/ or safety precautions as the task is completed.
* Be prepared to participate in workshop discussions.
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| Tools used PPE |  |
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| Steps -actions  |  |
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| References/Guidelines including:* Industry sources
* Online course materials
* CFR

Indicate, if applicable, measures that appear to be a potential problem and or an abnormal operating condition (AOC). |  |
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| Lessons learned |  |
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| General discussion questions or notes |  |
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| Activity Worksheet #2-Cast Iron Pipe Sealing  |
| Lab | * Refer to **Appendix 2**-Performance Checklist –Cast Iron Pipe Sealing.
	+ Perform the tasks.
	+ Identify the materials, tools and instructions used to complete the task(s).
	+ Answer any question presented.
* Take notes in the sections below (as needed).
* Address in the sections below any specific project requirements, instructions, and/or safety precautions as the task is completed.
* Be prepared to participate in workshop discussions.
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| Tools used PPE |  |
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| Steps -actions  |  |
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| References/Guidelines including:* Industry sources
* Online course materials
* CFR

Indicate, if applicable, measures that appear to be a potential problem and or an abnormal operating condition (AOC). |  |
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| Lessons learned |  |
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| General discussion questions or notes |  |
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| Activity Worksheet #3-Underground Installation Guidelines and Safety Practices  |
| Field Lab | * Refer to **Appendix 2**-Performance Checklist –Underground Installation Guidelines and Safety Practices.
	+ Perform the tasks.
	+ Identify the materials, tools and instructions used to complete the task(s).
	+ Answer any question presented.
* Take notes in the sections below (as needed).
* Address in the sections below any specific project requirements, instructions, and/or safety precautions as the task is completed.
* Be prepared to participate in workshop discussions.
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| Tools used PPE |  |
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| Steps -actions  |  |
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| References/Guidelines including:* Industry sources
* Online course materials
* CFR

Indicate, if applicable, measures that appear to be a potential problem and or an abnormal operating condition (AOC). |  |
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| General discussion questions or notes |  |
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| Activity Worksheet #4-Joining Pipe-Threaded Joints |
| Lab | * Refer to **Appendix 2-**Performance Checklist –Joining Pipe-Threaded Joints
	+ Perform the tasks.
	+ Identify the materials, tools and instructions used to complete the task(s).
	+ Answer any question presented.
* Take notes in the sections below (as needed).
* Address in the sections below any specific project requirements, instructions, and/or safety precautions as the task is completed.
* Be prepared to participate in workshop discussions.
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| Tools used PPE |  |
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| Steps -actions  |  |
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| References/Guidelines including:* Industry sources
* Online course materials
* CFR

Indicate, if applicable, measures that appear to be a potential problem and or an abnormal operating condition (AOC). |  |
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| Lessons learned |  |
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| General discussion questions or notes |  |
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# Appendix 1

Appendix 1–Performance Checklist–Cast Iron Pipe Leaks (Instructor)

Natural gas is low in humidity and dries out the jute, creating the potential for gas leaks at the pipe joints.

Participants will complete the task(s) and answer the question(s). When finished, provide appropriate feedback.

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|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Inspect the: * Pipe
* Bell and spigot joints.
 | * How is the mating surface sealed?
* What do you see between the bell and the spigot?
 | *Mating surfaces are typically sealed by either a gasket or seal made of neoprene, rubber, or a material that is pliable and will not be damaged by gases.**Ensure the participant has indicated the federal code requirements for PSI* |
|  |  | * Indicate where the gasket or seal is compressed (write out the letter answer).
* When was this seal compressed?
 | *The gasket or seal is compressed into the annular cavity, between the bell and spigot, during the mechanical leak clamp installation process.**Ensure the participant has indicated the federal code requirements CFR §192.53 (a)* *and (b) and §192.143* |
|  |  | * Where is the mechanical clamp positioned?
* What happens when the clamp is tightened?
* How is the MAOP measured?
 | *On either side of the bell and spigot joint.**Tightening the clamp draws the bell and spigot segment ends tightly together, compressing the rubber gasket or seal around the annular space where the jute and lead have been installed, creating a tight seal.**Ensure the participant has indicated the federal code requirements CFR §192.275* |
| 2 | * Inspect the cast iron pipe.
* Review the project requirements and the federal code requirements:

§ 192.275§192.53 (a) and (b) §192.143 | * How is the caulked bell and spigot joint sealed?
* Which of the following statement(s) is true?
* Cast iron pipe may not be joined by threaded joints.
* Cast iron pipe may be joined by brazing.
* Each mechanical joint must have a resilient gasket or seal as the sealing medium.
 | *Each caulked bell and spigot joint in cast iron pipe must be sealed with mechanical leak clamps Answers-T-F-T* |
| 3 | * Inspect the cast iron pipe, for leakage, damage, and/or deterioration.
 | * Explain how you determine that the gasket is not damaged.
* If there is damage, explain the type and location of the damage, and how the determination was made to further investigate a potential problem and/or AOC.
 | *Inspect the cast iron pipe surrounding the caulked bell and spigot joint. The color and texture of rust deposits can indicate potential failure.* *Inspect the existing gasket to verify that it is pliable and free of cracks, paint, debris, gaps, shrinkage, grooves, cuts, and frayed edges.*  |
| 4 | Inspect the leak clamps, to determine if the sealing requirements are met.Inspect for failures: | * Explain the type and location of the leak, for example, is the fitting bent or corroded? Are there any broken bolts? Is there even alignment or “draw.”
* Evaluate the condition of the cast iron pipe surrounding the caulked bell and spigot joint.
* Inspect the following:
* Caulked bell and spigot joint
* Pipe
* Explain your findings.
 | *Evaluate the leak clamp by inspecting for bent or corroded fittings, broken bolt, and even alignment or draw.* *Failures can be identified by differences in the color and texture of the rust deposits along the surface of the pipe, cracks and other signs of potential or actual failure. Be especially aware of small defects that could be indicators of major failures in the future.* |
| 5 | Inspect a gasket. | What must be done before a gasket is seated? | *Clean pipe joint thoroughly on back of bell, on bell face, and on spigot where gasket will seat. Dirt, rust, and scale must be* *removed from the gasket seating area.* |
| 6 | Install a mechanical leak clamp. | List the steps you took in the chart below to install a mechanical leak clamp using the tools, materials, and guidelines typically used on the job.* Be sure to indicate:
* The tools used.
* Any problems and/or AOCs as the process is completed.

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| Steps | Notes |
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* Job specifications/company policies and procedures that are relevant to this task.
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| *Steps*  | *Successful Y/N* |
| 1. *Clean*
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| 1. *Prepare joint*
 |  |
| 1. *Caulk*
 |  |
| 1. *Leaks*
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| 1. *Install clamp*
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| 1. *Attach bolts*
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| 1. *Soap test*
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| 1. *Coat Test*
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| 7 | Conduct a leak clamp repair. | List the steps in the chart below you took to conduct a leak clamp repair, using the tools, materials, and guidelines typically used on the job.

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| Steps | Notes |
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* Indicate the tools used.
* Any problems and/or AOCs as the process are completed.
* Job specifications/company policies and procedures that are relevant to this task.
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| *Steps* | *Successful Y/N* |
| 1. *Prepare*
 |  |
| 1. *Clean clamp nuts and bolts*
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| 1. *Replace nuts and bolts if required*
 |  |
| 1. *Tighten nuts and bolts*
 |  |
| 1. *Soap test for leaks*
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Appendix 1–Performance Checklist–Cast Iron Pipe Sealing (Instructor)

Natural gas is low in humidity and dries out the jute, creating the potential for gas leaks at the pipe joints. Cast iron joints may require encapsulation to stop leakage. The following tasks and questions are about sealing cast iron joints using the encapsulation procedure.

Participants will complete the task(s) and answer the question(s). When finished, provide appropriate feedback.

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|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Inspect the: * Pipe
* Joints.
 | * How do you know if a pipe joint is encapsulated?
* When should encapsulation be used?
 | *The joints may be encapsulated in a durable layer of synthetic rubber that is permanently bonded to the pipe and remains flexible.**All repairs are determined by size, hazards, area, pressure, as per the job requirements.* |
| 2 | Prepare a joint for encapsulation. | List the steps you will take, in the chart below, to prepare a joint for encapsulation using the tools, materials, and guidelines typically used on the job.* Indicate the tools used.
* Any problems and/or AOCs as the process is completed.
* Job specifications/company policies and procedures that are relevant to this task.

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| Steps | Notes |
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| --- | --- |
| *Steps* | *Successful Y/N* |
| 1. *Expose the joint.*
 |  |
| 1. *Clean with a portable grit blaster.*
 |  |
| 1. *Inspect joint.*
 |  |
| 1. *Ensure all safety guidelines/mfg. instructions have been followed.*
 |  |

 |
| 3 | Attach a mold. | List the steps taken in the chart below to attach a mold, following the tools, materials, and guidelines typically used on the job.

|  |  |
| --- | --- |
| Steps | Notes |
|  |  |
|  |  |
|  |  |
|  |  |

* Indicate the tools used.
* Any problems and/or AOCs as the process are completed.
* Job specifications/company policies and procedures that are relevant to this task.
 |

|  |  |
| --- | --- |
| *Steps* | *Successful Y/N* |
| 1. *Consult job specifications/company policies, and procedures.*
 |  |
| 1. *Brush primer in joint area.*
 |  |
| 1. *Wrap mold around joint and secure.*
 |  |
| 1. *Fasten mold using plastic ties or steel bands and appropriate tools.*
 |  |

 |
| 4 | Apply sealant and pressurize. | List the steps taken in the chart below to apply sealant and pressure, following the tools, materials, and guidelines typically used on the job.

|  |  |
| --- | --- |
| Steps | Notes |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

* Indicate the tools used.
* Any problems and/or AOCs as the process are completed.
* Job specifications/company policies and procedures that are relevant to this task.
 |

|  |  |
| --- | --- |
| *Steps* | *Successful Y/N* |
| 1. *Prepare sealant.*
 |  |
| 1. *Inject sealant in to the mold opening.*
 |  |
| 1. *Pressurize the mold.*
 |  |
| 1. *Fasten mold using plastic ties or steel bands and appropriate tools.*
 |  |
| 1. *Verify mold pressure.*
 |  |

 |
| 1. 5
 | 1. Evaluate the joint.
 | Explain how, and then inspect the encapsulated area to verify the joint is leak free. | *Soap test for gas leakage , damages* |

Appendix 1–Performance Checklist– Underground Installation Guidelines and Safety Practices (Instructor)

The following tasks will enable you to use the tools, PPE, and follow the necessary regulations to:

* Join and weld pipes.
* Identify pipe coatings and couplings.

Participants will complete the task(s) and answer the question(s). When finished, provide appropriate feedback.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Join a pipe. | * Follow CFR 192.273 and using the correct tools and PPE, join a pipe.
* Be prepared to discuss any challenges you encountered completing this task.
 |  |
| 2 | Identify pipe coatings.  | Examine the pipes A –E and indicate how the pipe is coated.

|  |  |
| --- | --- |
| Coatings | A-E |
| Tape Wrap |   |
| Heat Shrink |  |
| Composite Sleeve Systems |  |
| Mastic Coatings |  |
| Melt Sticks |  |

 |

|  |  |
| --- | --- |
| *Coatings* | *A-E* |
| *Tape Wrap* |  |
| *Heat Shrink* |  |
| *Composite Sleeve Systems* |  |
| *Mastic Coatings* |  |
| *Melt Sticks* |  |

 |
| 3 | Identify types of couplings. | Examine the pipes A –B and indicate the type of coupling.

|  |  |
| --- | --- |
| Coupling | A-B |
| Insulated |  |
| Noninsulated |  |

  |

|  |  |
| --- | --- |
| *Coupling* | *A-B* |
| *Insulated* |  |
| *Noninsulated* |  |

 |
| 1. 4
 | 1. How to install pipe in an excavated trench.
 | Working with the tools, materials, and guidelines typically used on the job, install a pipe in an excavated trench and write out the steps you took in the chart below.

|  |  |
| --- | --- |
| Prepare |  |
|  |  |
|  |  |
| Inspect |  |
|  |  |
|  |  |
| Trench configuration, size |  |
|  |  |
|  |  |
| Backfill |  |
|  |  |
|  |  |
| Install |  |
|  |  |
|  |  |
| Support |  |
|  |  |
|  |  |
| Cover |  |
|  |  |

 |  |

Appendix 1–Performance Checklist–Joining Pipe-Threaded Joints (Instructor)

The following tasks will enable you to use the tools, PPE, and follow the necessary regulations to:

* Prepare pipes for sealing.
* Identify pipe coatings and couplings.

Participants will complete the task(s) and answer the question(s). When finished, provide appropriate feedback.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Prepare a pipe for sealing**.** | * Inspect the pipe to and then, using the correct tools and PPE:, prepare a pipe for sealing.
* Be prepared to discuss any challenges you encountered completing this task.
 |  |
| 2 | Prepare, join, and inspect a pipe. | Working with the tools, materials, and guidelines typically used on the job, thread a pipe and write out the steps you took to prepare, join, and inspect threaded joints.

|  |  |
| --- | --- |
| Action  | Notes |
| Prepare |  |
|  |  |
|  |  |
| Join |  |
|  |  |
|  |  |
|  |  |
| Inspect |  |
|  |  |
|  |  |
|  |  |
|  |  |

 | ***Prepare the Threaded Pipes*** * *Ensure the pipe fittings are clean, dry, and free of obstructive materials.*
* *Apply sealing tape or compound.*

***Join the Threaded Pipes*** * *Align the segments.*
* *Manually rotate the male fitting into the female fitting.*
* *Tighten the joint with the appropriate tool.*

***Inspect the Threaded Joint*** * *Installed according to specifications.*
* *Mating surfaces clean.*
* *Pipe thread tape or compound used as specified.*
* *Completed joint inspected*
 |

# Appendix 2

Appendix 2–Performance Checklist–Cast Iron Pipe Leaks

Natural gas is low in humidity and dries out the jute, creating the potential for gas leaks at the pipe joints.

Complete the task(s) and answer the question(s). The instructor will provide appropriate feedback.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Inspect the: * Pipe
* Bell and spigot joints.
 | * How is the mating surface sealed?
* What do you see between the bell and the spigot?
 |  |
|  |  | * Indicate where the gasket or seal is compressed (write out the letter answer).
* When was this seal compressed?
 |  |
|  |  | * Where is the mechanical clamp positioned?
* What happens when the clamp is tightened?
* How is the MAOP measured?
 |  |
| 2 | * Inspect the cast iron pipe.
* Review the project requirements and the federal code requirements:

§ 192.275§192.53 (a) and (b) §192.143 | * How is the caulked bell and spigot joint sealed?
* Which of the following statement(s) is true?
* Cast iron pipe may not be joined by threaded joints.
* Cast iron pipe may be joined by brazing.
* Each mechanical joint must have a resilient gasket or seal as the sealing medium.
 |  |
| 3 | * Inspect the cast iron pipe, for leakage, damage, and/or deterioration.
 | * Explain how you determine that the gasket is not damaged.
* If there is damage, explain the type and location of the damage, and how the determination was made to further investigate a potential problem and/or AOC.
 |  |
| 4 | Inspect the leak clamps, to determine if the sealing requirements are met.Inspect for failures. | * Explain the type and location of the leak, for example, is the fitting bent or corroded? Are there any broken bolts? Is there even alignment or “draw.”
* Evaluate the condition of the cast iron pipe surrounding the caulked bell and spigot joint.
* Inspect the following:
* Caulked bell and spigot joint
* Pipe
* Explain your findings.
 |  |
| 5 | Inspect a gasket. | What must be done before a gasket is seated? |  |
| 6 | Install a mechanical leak clamp. | List the steps in the chart below you took to install a mechanical leak clamp using the tools, materials, and guidelines typically used on the job.

|  |  |
| --- | --- |
| **Steps** | **Notes** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

* Be sure to indicate:
* The tools used.
* Any problems and/or AOCs as the process is completed
* Job specifications/company policies and procedures that are relevant to this task.
 |  |
| 7 | Conduct a leak clamp repair. | List the steps in the chart below you took to conduct a leak clamp repair, using the tools, materials, and guidelines typically used on the job.

|  |  |
| --- | --- |
| **Steps** | **Notes** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

* Indicate the tools used.
* Any problems and/or AOCs as the process are completed.
* Job specifications/company policies and procedures that are relevant to this task.
 |  |

Appendix 2–Performance Checklist–Cast Iron Pipe Sealing

Natural gas is low in humidity and dries out the jute, creating the potential for gas leaks at the pipe joints. Cast iron joints may require encapsulation to stop leakage.

The following tasks and questions are about sealing cast iron joints using the encapsulation procedure.

Complete the task(s) and answer the question(s). The instructor will provide appropriate feedback.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Inspect the: * Pipe
* Joints
 | * How do you know if a pipe joint is encapsulated?
* When should encapsulation be used?
 |  |
| 2 | Prepare a joint for encapsulation. | List the steps you will take, in the chart below, to prepare a joint for encapsulation using the tools, materials, and guidelines typically used on the job.* Indicate the tools used.
* Any problems and/or AOCs as the process is completed
* Job specifications/company policies and procedures that are relevant to this task.

|  |  |
| --- | --- |
| **Steps** | **Notes** |
|  |  |
|  |  |
|  |  |
|  |  |

 |  |
| 3 | Attach a mold. | List the steps taken in the chart below you took to attach a mold with the tools, materials, and guidelines typically used on the job.

|  |  |
| --- | --- |
| **Steps** | **Notes** |
|  |  |
|  |  |
|  |  |
|  |  |

* Indicate the tools used.
* Any problems and/or AOCs as the process are completed.
* Job specifications/company policies and procedures that are relevant to this task.
 |  |
| 4 | Apply sealant and pressurize. | List the steps taken in the chart below you took to apply sealant and pressure, with the tools, materials, and guidelines typically used on the job.

|  |  |
| --- | --- |
| **Steps** | **Notes** |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

* Indicate the tools used.
* Any problems and/or AOCs as the process are completed.
* Job specifications/company policies and procedures that are relevant to this task.
 |  |
| 1. 5
 | 1. Evaluate the joint.
 | Explain how, and then inspect the encapsulated area to verify the joint is leak free. |  |

Appendix 2–Performance Checklist– Underground Installation Guidelines and Safety Practices

The following tasks will enable you to use the tools, PPE, and follow the necessary regulations to:

* Join and weld pipes.
* Identify pipe coatings and couplings.
* Lower and fit the steel pipe in a ditch after a trench was excavated (simulated setting).

Complete the task(s) and answer the question(s). The instructor will provide appropriate feedback.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Join a pipe. | * Follow CFR 192.273 and using the correct tools and PPE, join a pipe.
* Be prepared to discuss any challenges you encountered completing this task.
 |  |
| 2 | Identify pipe coatings.  | Examine the pipes A –E and indicate how the pipe is coated.

|  |  |
| --- | --- |
| **Coatings** | **A-E** |
| Tape Wrap |   |
| Heat Shrink |  |
| Composite Sleeve Systems |  |
| Mastic Coatings |  |
| Melt Sticks |  |

 |  |
| 3 | Identify types of couplings. | Examine the pipes A –B and indicate the type of coupling.

|  |  |
| --- | --- |
| **Coupling** | **A-B** |
| Insulated |  |
| Noninsulated |  |

  |  |
| 1. 4
 | 1. How to install pipe in an excavated trench.
 | Working with the tools, materials, and guidelines typically used on the job, install a pipe in an excavated trench and write out the steps you took in the chart below.

|  |  |
| --- | --- |
| Prepare |  |
|  |  |
|  |  |
| Inspect |  |
|  |  |
|  |  |
| Trench configuration, size |  |
|  |  |
|  |  |
| Backfill |  |
|  |  |
|  |  |
| Install |  |
|  |  |
|  |  |
| Support |  |
|  |  |
|  |  |
| Cover |  |
|  |  |

 |  |

Appendix 2–Performance Checklist– Joining Pipe-Threaded Joints

The following tasks will enable you to use the tools, PPE, and follow the necessary regulations to:

* Prepare pipes for sealing.
* Identify pipe coatings and couplings.

Complete the task(s) and answer the question(s). The instructor will provide appropriate feedback.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tasks** | **Actions and Questions** | **Answers** |
| 1 | Prepare a pipe for sealing**.** | * Inspect the pipe to and then, using the correct tools and PPE:, prepare a pipe for sealing.
* Be prepared to discuss any challenges you encountered completing this task.
 |  |
| 2 | Prepare, join, and inspect a pipe. | Working with the tools, materials, and guidelines typically used on the job, thread a pipe and write out the steps you took to prepare, join, and inspect threaded joints.

|  |  |
| --- | --- |
| Action  | Notes |
| Prepare |  |
|  |  |
|  |  |
| Join |  |
|  |  |
|  |  |
|  |  |
| Inspect |  |
|  |  |
|  |  |
|  |  |
|  |  |

 |  |