

Appendix 4 -Incumbent Worker Training – Student Learning Outcomes

Each mini-course is broken into topic modules with learnings objectives and estimated durations so you can select modules as desired to meet your specific needs.

Notes:

1. Learning Objectives: These are the primary learnings objectives identified for this topic. You can add or subtract learning objectives, but the estimated duration will alter accordingly.
2. Estimated Duration: Since the estimated duration might increase if the class size exceeds 10 trainees, contact us for specific pricing if the class exceeds 10 trainees.

Foundations

Basic Tools			
	Topic	Learning Objectives	Estimated Duration
1	Intro to Basic Hand Tools	<ul style="list-style-type: none"> • Introduction <ul style="list-style-type: none"> ○ Channel locks ○ Wrenches (pipe, open end, socket, etc.) ○ Screwdrivers 	30 mins
2	Using Basic Hand Tools	<ul style="list-style-type: none"> • Using hand tools safely <ul style="list-style-type: none"> ➢ Unbolting/rebolting a 2" flange ➢ Disconnecting/reconnecting 1" threaded piping ➢ Using a pipe wrench to open/close a valve 	2 hrs.
4	Intro to Basic Power Tools	•	
5	Using Basic Power Tools	•	
Total estimated duration			

Precision Measurement Instruments		
Topic	Learning Objectives	Duration
Precision Hand Tools	<p>PMI (Precision Measurement Instruments) Certification This program is designed to foster a solid understanding of the fundamentals of working with precision measurement instruments.</p> <ul style="list-style-type: none"> • Tape and Rule Measurement <i>Tape measures and scales</i> • Side Caliper Measurement <i>Standard dial type</i> • Gauge Measurement <i>Also called feeler gages</i> • Angle Measurement <i>Complete set of protractors</i> • Micrometer Measurement <i>OD, ID with Vernier</i> • Dial Gauge Measurement <i>Bore type</i> <p><u><i>Trainee receives Starrett Certification.</i></u></p>	32 hrs.

Advanced Measurement Instruments		
Topic	Learning Objectives	Duration
Precision Hand Tools	<p>AMI (Advanced Measurement Instruments) Certification</p> <p>This program is based on the expectations of globally-recognized companies that are designers and manufacturers of advanced measuring instruments.</p> <ul style="list-style-type: none"> • Primary Standards <i>Block and plate</i> • Flexible Measuring Instruments +/- <i>type gages</i> • Support and Layout • Surface Finish and Hardness • Data Acquisition Datasure tm • Optical Comparator/CNC operation <p><u>Trainee receives Starrett Certification.</u></p>	35 hrs.

Environmental Health Safety

Basic Process Equipment - Stationary

Pipe for Non-Pipefitters			
	Topic	Learning Objectives	Estimated Duration
1	Pipe, fittings, and flanges	<ul style="list-style-type: none"> • Identifying pipe diameters and schedules • Flanged, socket welded, and threaded fittings • Flange ratings and types 	1 hr
2	Gaskets	<ul style="list-style-type: none"> • Styles, sizes • Selecting the correct gasket for an application • Inspecting a gasket for damage before installation • Avoiding common mistakes 	1 hr
3	Breaking & reconnecting flanges (<2.5")	<ul style="list-style-type: none"> • Considering the hazards of opening a flange • Selecting the appropriate PPE • Breaking open a flange • Selecting the correct bolts • Inspecting a flange face for damage • Correctly reconnecting a flange (bolt make-up techniques) • Common mistakes (i.e.: short bolting) 	2 hrs
4	Threaded pipe (<1")	<ul style="list-style-type: none"> • Selecting appropriate threaded fittings • Replacing small sections of threaded piping 	2 hrs
5	Tubing	<ul style="list-style-type: none"> • Identifying tubing types and fittings • Connecting tubing fittings • Replacing small sections of tubing 	2 hrs
6	Simple maintenance	<ul style="list-style-type: none"> • Considering the hazards of clearing a plug • Selecting appropriate PPE • Clearing plugged drains and small sections of piping 	2 hrs
Total estimated duration			10 hrs

Valves			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> • Applications and theory of operations • Types, purposes <ul style="list-style-type: none"> ○ Gate ○ Globe ○ Ball ○ Check ○ Butterfly ○ Plug ○ Diaphragm • Identifying valve types in the field • Explain the, and other issues that affect valve operation • Common mistakes (i.e.: using a ball valve for throttling) 	2 hrs
2	Inspection, Simple maintenance	<ul style="list-style-type: none"> • Impact of corrosion, thermal expansion • Inspecting for valve damage • Replacing flanged valves (<2.5") • Replacing threaded valves (<1") 	3 hrs
3	Control Valves	<ul style="list-style-type: none"> • 	
Total estimated duration			

Pressure Relieving Devices and Systems			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> • Purpose, applications • Applicable codes and standards 	
2	Relief Valves	<ul style="list-style-type: none"> • Types, applications, how they work • Sizing scenarios 	
3	Rupture Disks	<ul style="list-style-type: none"> • Types, applications, how they work 	
	Conservation Vents	<ul style="list-style-type: none"> • 	
	Flame Arrestors	<ul style="list-style-type: none"> • 	
	Pressure Relief Systems	<ul style="list-style-type: none"> • 	
	Inspecting, Maintenance	<ul style="list-style-type: none"> • Visual inspections • Disassembly, reassembly • Servicing an RV per manufacturer's guidelines or company policies and procedures 	
	Common Problems and Mistakes	<ul style="list-style-type: none"> • RV chatter • Installing rupture disk backward 	
Total estimated duration			

Basic Process Equipment – Non-Stationary

Pumps

	Topic	Learning Objectives	Estimated Duration
	Introduction	<ul style="list-style-type: none"> • Terminology and background <ul style="list-style-type: none"> ○ Pump curves ○ NPSHr • Types 	

		<ul style="list-style-type: none"> • Purposes • Advantages, disadvantages • Applications of different types <ul style="list-style-type: none"> ○ Dynamic ○ Centrifugal ○ Axial ○ Jet ○ Positive Displacement ○ Rotary ○ Reciprocating 	
	Basic Operations	<ul style="list-style-type: none"> • “Lining up” • Start-up • Shut-down • Switching to spare pump 	
	Common Problems	<ul style="list-style-type: none"> • Cavitation • Dead-heading • Troubleshooting methods 	
		Total estimated duration	

Seals			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> • types, functions, operations 	
2	Inspection, Troubleshooting	<ul style="list-style-type: none"> • Diagnosis and troubleshooting • Best practices and visual indicators of seal issues before a seal leak is observed 	
3	Simple Maintenance	<ul style="list-style-type: none"> • Seal repair • Remove and install different types of seals • Balance a mechanical seal • Lubricate mechanical seals 	
		Total estimated duration	

Bearings			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> • Two (2) basic classifications of bearings • Plain bearings: types, properties • Antifriction bearings: types, properties • Thrust bearings: purpose • Radial bearings: purpose 	
2	Inspection, Troubleshooting	<ul style="list-style-type: none"> • Determine cause of bearing failure 	
3	Simple Maintenance	<ul style="list-style-type: none"> • Perform bearing lubrication 	
		Total estimated duration	

Vibration Analysis – Rotating Equipment			
	Topic	Learning Objectives	Estimated Duration
1	Theory	<ul style="list-style-type: none"> • Vibration basics (oscillation, mass, spring, damper, sine waves, amplitude, frequency, random vibrations and shock pulse, time and frequency domains, vectors, displacement, velocity, and acceleration, and natural frequency and resonant frequency) 	

2	Measurement	<ul style="list-style-type: none"> Vibration measurement instruments and equipment 	
3	Maintenance	<ul style="list-style-type: none"> Typical vibration problems Types of deterioration in plant machinery Machine diagnostics Condition monitoring techniques to diagnose and predict operation failure Pro-active maintenance to improve plant productivity Predictive vs. preventative maintenance programs 	
			Total estimated duration

Process Systems

Process Operations

Process Operations Troubleshooting			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> Effect on a system due to equipment and/or instrument malfunctions Domino effect between interrelated systems Steps for effective troubleshooting 	
2	Practicing (Simtronics)	<ul style="list-style-type: none"> Given a problem scenario: <ul style="list-style-type: none"> Appropriate use of monitoring instruments and equipment Use of troubleshooting tools and steps to identify the most likely cause(s) Communicating effectively Taking appropriate corrective action(s) 	
3	Practicing (CPET Glycol Unit)	<ul style="list-style-type: none"> 	
			Total estimated duration

Instrumentation and Control Systems

Programmable Logic Controllers			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> Use of PLCs in process automation Basic introduction to the Allen Bradley RS Logic 500/5000 PLC functions of all of the components of an Allen Bradley PLC 5 and SLC 500 and tag-based Logix PLC system Describe the difference between PLCs and PCs Connect the input and output devices Interface basic hardware configurations: <ul style="list-style-type: none"> power supplies discrete input/output (IO) modules programming devices 	

		<ul style="list-style-type: none"> ○ processors ○ basic logic elements ○ timers ○ counters ○ manual and mechanical switches ○ solenoids ○ relays ○ contactors ○ motor starters ○ lamps ○ alarms 	
2	Programming	<ul style="list-style-type: none"> ● Designing control diagrams based upon requirements ● Contrasting PLC ladder and relay ladder logic ● using program design techniques to create simple ladder logic programs 	
	Troubleshooting	<ul style="list-style-type: none"> ● 	
			Total estimated duration

Electrical Systems

National Electric Code Overview			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> ● 	
2		<ul style="list-style-type: none"> ● 	
			Total estimated duration

Electrical: Reading/Interpreting Drawings			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> ● 	
	Codes and Standards	<ul style="list-style-type: none"> ● 	
	Prints and Diagrams	<ul style="list-style-type: none"> ● Introduction to reading and interpreting prints <ul style="list-style-type: none"> ● Single-line type diagrams ● Electrical blueprints ● Architectural electrical drawings ● Construction blueprints ● Review prints for errors and National Electric Code compliance 	
	Ladder diagrams and drawings	<ul style="list-style-type: none"> ● 	
	Troubleshooting	<ul style="list-style-type: none"> ● Basic troubleshooting of electrical systems 	
			Total estimated duration

Electrical Systems Overview

	Topic	Learning Objectives	Estimated Duration
1	Introduction	•	
	Electrical Systems	• Common components, devices, symbols	
	Designing electrical systems	<ul style="list-style-type: none"> Identify the operational requirements for: breakers, relays, switches, ATS, synchronizers, and transformers 	
	Troubleshooting electrical systems	<ul style="list-style-type: none"> Introduction to common test instruments Troubleshooting techniques and methods Identify the main focus of the problem 	
	Troubleshooting	• Basic troubleshooting of electrical systems	
		Total estimated duration	

Motors, Controls, and Drivers

	Topic	Learning Objectives	Estimated Duration
1	Introduction	• Basic introduction to electromechanical concepts	
2	Contactors, Relays	<ul style="list-style-type: none"> Identify physically and on schematics Operating principles Select and size for specific control system applications 	
	Pilot Devices	<ul style="list-style-type: none"> Identify physically and on schematics Operating principles 	
	Diagrams	<ul style="list-style-type: none"> Motor control wiring and connection diagrams Ladder diagrams 	
		Total estimated duration	

Inspection Technologies

Material Science for Non-Metallurgists

	Topic	Learning Objectives	Estimated Duration
1	Introduction to Metallurgy	<ul style="list-style-type: none"> Metals: from ore to the finished product Most common metal alloys and their applications 	
2	Mechanical Properties of Metals	<ul style="list-style-type: none"> Hardness Machinability Ductile vs. brittle <ul style="list-style-type: none"> Charpy testing How fabrication processes affect the mechanical properties 	
3	Post Weld Heat Treating	<ul style="list-style-type: none"> Overview and purpose Typical procedures 	
4	Introduction to Corrosion	• Internal, external, and atmospheric corrosion	

		<ul style="list-style-type: none"> • Terminology • Causes of common corrosion problems in industry • General remedies <ul style="list-style-type: none"> ○ Cathodic protection ○ Protective coatings ○ Proper material selection ○ Chemical treatments. 	
5	Case Studies	<ul style="list-style-type: none"> • Case studies, • Design errors 	
			Total estimated duration

Inspection for Non-Inspectors			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> • Purpose and History • Role of Governing Organizations (ASME, API, ASNT) • Your role in the inspection process 	30 min
2	Codes and Standards	<ul style="list-style-type: none"> • Design Codes: <ul style="list-style-type: none"> ➢ ASME Section VIII – Pressure Vessel Design ➢ API B31.3 – Piping Design • Inspection and Repair Codes: <ul style="list-style-type: none"> ➢ ASNT ➢ API 510 – Pressure Vessel Inspection Code ➢ API 570 – Piping Inspection Code ➢ API 653 – Tank Inspection Code 	30 min
3	Prints and Drawings	<ul style="list-style-type: none"> • Most common inspection drawings and prints 	30 min
4	Metrology	<ul style="list-style-type: none"> • Most common tools and their applications 	1 hr
5	Flaws	<ul style="list-style-type: none"> • Overview of typical flaws <ul style="list-style-type: none"> ○ slag, porosity, cracks, incomplete fusion, laminates, etc. ○ locating, sizing, characterizing 	30 min
6	NDT Techniques	<ul style="list-style-type: none"> • Overview of common techniques <ul style="list-style-type: none"> ○ Applications and limitations ○ Advantages and disadvantages 	30 min
7	Visual	<ul style="list-style-type: none"> • Demonstration and practice on a physical sample 	
8	Ultrasonic	<ul style="list-style-type: none"> • Straight, angle beam • Phased array • Augmented UT • Demonstration and practice on a physical sample 	
9	Dye-Penetrant	<ul style="list-style-type: none"> • Demonstration and practice on a physical sample 	
10	Magnetic Particle	<ul style="list-style-type: none"> • Demonstration 	
11	Radiography	<ul style="list-style-type: none"> • Reading and interpreting radiographic films 	
12	IRIS	<ul style="list-style-type: none"> • Internal Rotating Inspection System - Demonstration 	
13	Eddy Current	<ul style="list-style-type: none"> • Demonstration 	
			Total estimated duration

Crafts

Welding for Non-Welders			
	Topic	Learning Objectives	Estimated Duration
1	Introduction, Safety	<ul style="list-style-type: none"> • Proper clothing and PPE • JSA • Confined space entry 	
2	Codes, Standards, Specifications	<ul style="list-style-type: none"> • ASME Section IX • American Welding Society (AWS) • American Petroleum Institute (API) • Welding Procedure Specifications (WPS) 	
3	Welding Symbols	<ul style="list-style-type: none"> • Welding symbols • Reading drawings 	
	Preparing the work surface	<ul style="list-style-type: none"> • Plate, pipe 	
	Cutting	<ul style="list-style-type: none"> • Oxyfuel cutting <ul style="list-style-type: none"> ➢ Describe oxyfuel cutting and identify related safe work practices ➢ Identify and describe oxyfuel cutting equipment and consumables ➢ Explain how to properly setup, light, and shut down oxyfuel equipment ➢ Explain how to perform various oxyfuel cutting procedures ➢ Identify the appearance of both good and inferior cuts and their causes ➢ Explain how to cut both thick and thin steel • Plasma cutting • Arc gouging 	
	Different Types of Welding Processes	<ul style="list-style-type: none"> • Introduce common processes <ul style="list-style-type: none"> ○ Stick – Shielded metal arc welding (SMAW) ○ TIG – Gas tungsten arc welding (GTAW) ○ MIG – Gas metal arc welding (GMAW) • Advantages and disadvantages of each • How electrical characteristics apply • Tools, equipment, cables, connectors • Sample WPS • Typical applications 	
	Practice	<ul style="list-style-type: none"> • Making a t-joint • Making a butt-weld 	
	Quality assurance	<ul style="list-style-type: none"> • Heat affected zone • Defects and discontinuities • Inspection techniques to check weld quality 	
		Total estimated duration	

Millwrighting			
	Topic	Learning Objectives	Estimated Duration
1	Introduction	<ul style="list-style-type: none"> • 	
2	Applicable Codes and Standards	<ul style="list-style-type: none"> • 	
	Alignment	<ul style="list-style-type: none"> • Introduction • Purpose 	
3	Alignment: Rim and Face	<ul style="list-style-type: none"> • Basics of rim and face methods • Tools and instruments • Perform a simple alignment <ul style="list-style-type: none"> ○ Mount the dial indicators ○ Measure the A, B, & C dimensions 	

		<ul style="list-style-type: none"> ○ Obtain as-found readings ○ Determine the vertical foot positions ○ Make vertical corrections ○ Make horizontal corrections ○ Re-measure and record final alignment values 	
4	Alignment: Laser Alignment	<ul style="list-style-type: none"> ● Introduction to laser alignment ● Tools and instruments ● Perform a shaft alignment 	
		Total estimated duration	

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