

Houston/Louisiana Millwrights Apprenticeship & Training Course Curriculum

First Year Students (1st & 2nd Period)

For Year 1, Class 1 through 4 must be taken in order

1. Applicant Course (40 hours)

New Member Orientation – 2hrs

Millwright 16 Hour Health and Safety (Includes OSHA 10)

Human Performance – 8hrs (Communication and Following Procedures)

Math for the Trades – 6hrs (Work Related)

Basic Tools and Basic Centrifugal Pumps – 8hrs

Applicant Course is a Prerequisite for Introduction to Millwright Classes

2. Introduction to Millwrighting-Part 1 (40 of 120 hours.)

Part 1 of this course is a formal introduction to the safe and proper use of hand and power tools. This manual provides Millwrights with a set of basic skills that demonstrate safe use of hand tools, measuring devices, portable power tools, light & heavy duty drills, pneumatic drills impact guns, tap & dies and torque wrenches. There are videos and “hands-on” projects that go along with this class such as a Measuring Instruments video, tape & scale project, Precision block, layout & drilling, layout, drilling & taping, and also a torque, lock & safety wire project

Introduction to Millwright Part 1 is a Prerequisite to Introduction to Millwright 2

3. Introduction to Millwrighting-Part 2 (40 of 120 hours.)

Part 2 of this course will cover the middle six chapters starting on chapter 7: Both chapters of Gang Box Hand tools, Both Chapters of Power tools, and both chapters of Precision tools. Apprentices will continue their learning of larger tools; the tools commonly provided by contractors. Tool Safety, care, inspection, and storage will be stressed. Larger cutting tools will be instructed and demonstrated before the apprentice can perform their practical testing. All precision tools will be demonstrated; where and how to use them, care, inspection, checking calibration, and storage. Attendees will then practice measuring various pieces and parts to gain confidence in the use of precision tools. The class ends with a practical test on the use of all these tools.

Introduction to Millwright Part 2 is a Prerequisite to Introduction to Millwright Part 3

4. Introduction to Millwrighting-Part 3 (40 of 120 hours.)

Part 3 of this course will cover the last four chapters starting on chapter 13: Hardware, Seals and Structural Materials, and both chapters of Basic Millwright Skills. This last segment of the class will lean heavy towards shop projects as apprentices will be busy completing several job sheets for grade and evaluation. There will be an introduction to Millwright Optics in this class. Students will learn the parts of the transit, how to level the tripod, and how to precision plumb the tool. The student will learn how to read the wyteface scale and perform common tasks with the instrument: level a baseplate and buck in three vertical I-beams.

Introduction to Millwrighting Part 3 is a Prerequisite for GE Gas Turbine Familiarization

5. GE Gas Turbine Familiarization (CITF) (32 hours.)

This workshop is for UBC members that work on GE Gas Turbines. Day-1 covers identification of GE Gas Turbine components, disassembly procedures, inspections, and re-assembly procedures. Day-2 covers new installations of GE Gas Turbines. This course is a prerequisite for the GE Gas Turbine and Steam Turbine Qualification Program

Hytorc Bolting Technician Qualification (CITF) (8 hours.)

This course details bolting, torque and load and their relationships, how the load affects the bolting process. Tensioning procedures are detailed and practiced. This course is a prerequisite for the GE Gas Turbine and Steam Turbine Qualification Program

Class 5. GE Gas Turbine Familiarization and Hytorc can be interchanged with Mechanical Print Reading

Second Year Students (3rd & 4th Period)

1. Mechanical Print Reading (40 hours.)

This course will present instructional methods and materials for students to work with all types of prints used in the Millwright trade including machine, machine parts, machine assembly, foundation drawings, as well as welding symbols and piping schematics, etc.

Mechanical Print Reading is a Prerequisite for Machinery Installation and all Machinery Alignment Classes

2. Machinery Installation (40 hours.)

This course begins with site management and layout for machinery installation, including taking precise machine locations from prints. Layout tools and equipment and the proper procedures for establishing and marking the location are then discussed and demonstrated. Site preparation is discussed and demonstrated. Finally, procedures for pre-operational tasks before and during setup are demonstrated. Preventive maintenance, along with all safety requirements, is emphasized. Safety and best practices are embedded throughout this course

3. Machinery Alignment Procedures-Part 1 (40 of 120 hours.)

Part 1 of this course will cover most of the classroom information part of the class. It begins with what alignment is, and its effect is on rotating equipment. Alignment methods are introduced with an emphasis on math and pre-alignment checks. Types of couplings and types of alignment will be introduced. Alignment procedures will begin with the explanation of bar sag and soft foot. Shop activities will include the types of tools used in alignment, leveling the baseplate, an exercise on determining bar sag, and correcting soft foot. Apprentices will rough align the machines and then align their machines using the rate of change alignment and the straight edge/feeler gauge methods.

Machinery Alignment Procedures Part 1 is a Prerequisite for Machinery Alignment Part 2

4. Machinery Alignment Procedures-Part 2 (40 of 120 hours.)

Part 2 of this course will begin with the review of pre-alignment checks, soft foot, rate of change, and straight edge/feeler gauge methods. It will then resume in the book on chapter 6. It will go into depth with the introduction of dial indicating. Similar to level I, math is stressed and practiced. The classroom portion of the class will cover Rim & Face and Reverse Dial Indicating. The shop portion of the class will center around rim-face and reverse dial alignment. This class we will introduce laser alignment. Since the set-up and software knowledge are the main parts of this tool, all rim & face and reverse dial jobs will be checked independently with the laser.

Machinery Alignment Procedures Part 2 is a Prerequisite for Machinery Alignment Procedures Part 3

5. Machinery Alignment Procedures-Part 3 (40 of 120 hours.)

Part 3 of this course begins with a short review of pre-alignment checks, soft foot. Once this is complete, the core of the last third is to cover in depth thermal expansion and vertical alignment. More practice will be conducted with all forms of alignment. The instructor will assign at random a type of alignment procedure and machine to align. The student will be assigned a helper. They will be given a time limit to align the machine. There will be a comprehensive review after shop activities are complete. The primary focus is to get the student prepared for the Machinery Alignment Test.

Third Year Students (5th & 6th Period)

These classes can be taught in any order, except Rigging Fundamentals must be taught before Rigging Qualification

1. Rigging Fundamentals 40 hours

Class Description needed. Rigging Math, Equipment Identification, and inspection, Equipment Transfer, identifying center of gravity, Manual Rigging: The proper use of Chain falls and Coma-longs, Machine Movers, Hitch configurations,

Rigging Fundamentals is a prerequisite for Rigging Qualification

2. Rigging Qualification (CITF) (40 hours)

This course covers all aspects of our rigging certification course. The course begins with the history of rigging which is followed by chapters on safety, wire rope, chain construction, slings, hardware, and knot tying. The next four chapters explain rigging procedures and provide a thorough explanation of common hitch configurations, hardware and sling attachments, working with different types of cranes and directing crane movements with voice and hand signals. Safety precautions and practices are presented throughout the course, especially during the inspection and care of rigging hardware and other rigging equipment.

Apprentice must have scored an 80% or higher on their (ITC) International Training Center “Machinery Alignment Test to receive credit for Flowserve/Pump Repair Technician-Level 1

3. Flowserve/Pump Repair Technician-Level 1 (40 hours.)

The first part of this course teaches the student to remove, disassemble and reassemble pumps. Students successfully completing the workshop should be able to describe the purpose of packing and mechanical sealing, removal, and installation of compression packing; describe how mechanical seals work; explain how to remove, disassemble, and reassemble the pump with and without the pump case; perform as-found visual inspections and pump checks; show how to lay out and cut a gasket; and demonstrate how to read a seal print and install a mechanical seal with and without the print. The explanations and procedures are generously illustrated. Safety is emphasized throughout.

The last part of this course centers around the correct procedures to reassemble and measure the pump. Emphasis is given to historical records and documentation. Special attention to detail will be given in impeller and mechanical seal setting. There will be a section about gaskets; how to cut, handle, and install them. A lot of time will be spent on how to determine impeller setting dimensions. The last chapter is heavy on the mechanical seal. How a seal works. Installing a component with and without a print is covered. Finally, the student will set a cartridge mechanical seal. The course will conclude with a comprehensive final exam that covers the entire manual.

4. Reciprocal Compressor I Training (40 hours.)

This course covers safety, theory, operation and maintenance of reciprocating compressors. The course begins with an introduction to reciprocating compressors and their application. This is followed by basic theory, vocabulary, and essentials of compressor operation. Job site safety is emphasized throughout the course, Lock Out Tag Out (LOTO), Personal Protection Equipment (PPE), Tool Safety, and House Keeping are embedded throughout the course. During the lab portion of this course, students will, remove inspection plates, check match mark, inspect the condition of parts and do as Found Checks. The remainder of this course involves disassembling the compressor, Piston Rod Packing, Piston Rod Run-Out, Valves, Web

Deflection and Piston Rings and Bands. The course finishes with reassembly including Piston-Rod, Out-Board Head, Scraper Packing, Valves, and Final Inspection.

5. *Welding and Cutting (40 hours.)*

Oxy-Fuel Cutting/Burning~~ This course includes instruction in safety, theory and practical applications in oxy-fuel operations. Equipment and procedures are explained for making straight line cuts, bevels, gouging, operating the automatic cutting machine, piercing, cutting holes and circles.

Introduction to Shielded Metal Arc Welding (SMAW)

This course uses hands-on welding with 6010 & 7018 rods in all positions to give the student experience and a general knowledge of welding, preparation of materials, and includes instruction on welding multiple pass joints in all positions.

Plasma Arc & Air Arc Cutting

This course includes the safety and set-up as well as “hands-on” use of the torches.

Fourth Year Students (7th & 8th)

These classes can be in any order except Mechanical Power Transmission Systems Part 1 must be taken before Mechanical Transmission System Part 2

1. *Centrifugal Compressor (40 hours.)*

This course covers safety, Lock Out Tag Out, Personal Protection Equipment, Tool Safety, and House Keeping. Upon completion of this course, students will be able to identify Centrifugal Compressors and their components and describe how a Centrifugal Compressor operates. This course includes theoretical studies as well as practical application. During the course of this program, students will disassemble a Centrifugal Compressor Case, Take Bearing Readings, check as Found Readings, remove the Radial and Thrust Bearing and the lower Bearing Housings. The Rotor will be removed along with either the Internal Contact Seal or ISO Carbon Seal (Labyrinth Seals will be discussed during assembly). All stationary and rotating parts will be inspected, and repairs or adjustments noted before Reassembly. Proper Rigging Techniques and procedures will be demonstrated during Disassembly and Reassembly of the Centrifugal Compressor.

2. *Mechanical Power Transmission Systems-Part 1 (40 of 80 hours.)*

Part 1 of this course explains how mechanical power transmissions work. It will cover the first seven chapters of the manual. In specific, we will discuss the overview; what power transmissions entail, shafts, keyways and keys, and what is both friction/anti-friction bearings and how they are installed. Shop projects will cover hand-on activities that support the classroom activities.

Mechanical Power Transmission System Part 1 is a Prerequisite for Mechanical Power Transmission System Part 2

3. Mechanical Power Transmission Systems-Part 2 (40 of 80 hours.)

Part 2 of this course covers the last six chapters of the book. Couplings will be covered in depth as well as sprockets & chains and pulleys & belts. Gears and Gearboxes will be covered next followed by lubrication. The last section is Brakes and Clutches. Half of the class will be shop activities. Apprentices will layout pillow blocks to install shafts. Gears, sprockets, and pulleys will be installed and aligned. These projects will be turned in for a grade.

ITC Las Vegas

4. GE Gas Turbine Qualification-CITF (40 hours.)

5. Steam Turbine Qualification-CITF (40 hours.)

Additional Classes Available
Contractor Requested

Reciprocal Compressor 2 Training (40 hours.)

This course builds on the knowledge and skills acquired in Reciprocal Compressor 1. As with Reciprocal Compressor 1, safety, Lock Out Tag Out, Personal Protection Equipment, Tool Safety, and House Keeping are embedded in the program. Students will remove inspection covers and guards, perform As Found Checks, and perform Motor to Compressor Alignment. Students will disassemble the Crankcase while observing Match Marks for Tie Bars, Main Caps, and Con-Rods. Crankcase will be reassembled; Bearing Shells will be replaced, Students will Check Bearing Alignment, and Adjust the Bearing to Shaft Clearance with shims. Bearing Crush (or draw) will be explained and demonstrated as well as Crankshaft Thrust adjustments as part of the reassembly process. Cylinders, Frame Extensions, and Crossheads will be removed, checking Vertical Indicated Piston Rod Runout and other critical measurements during the process. The course finishes with complete step by step reassembly.

Advanced Welding Techniques (40 hours.)

This course focuses on getting certification credentials in plate and pipe welding. There will be some time spent on GTAW set-up and procedures along with “hands on” activities.

Safety Course (40 hrs)

First Aid (CITF) (8 hours)

CPR (CITF) (4 hours)

AED (CITF) (4 hours)

Powered Industrial Truck Operator (PITO) (CITF) (8 hours)

Fall Protection (CITF) (8 hours)

Human Performance (CITF) (8 hours) or
Aerial Lift (CITF) (8 hours) or
Powered Industrial Truck Operator – Rough Terrain (PITO) (CITF) (8 hours)

Scaffold Erector/User Qualification-CITF (40 hours.)

The Scaffolding Erection/User course provides information and guidance for calculating capacity and contributory leg loads. It introduces criteria for all scaffold types and provides methods for platform construction and assembly techniques for frame, tube, and clamp, and systems scaffolds. It discusses scaffold access and egress and safe use guidelines, including fall protection and falling object protection. It presents the training requirements for scaffold erectors, dismantlers, and users and provides clarification of the difference between a competent person and a qualified person.