



8877

INTRODUCTION TO PIPING
SYSTEMS AND THEORIES
(11A)

30S/30E/30M

A Plumbing and Pipe Trades Course

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Course Description

A student wanting to develop skills in plumbing and the pipe trades must have knowledge of the basic principles of layout, materials, codes, and design. The student will learn the procedures for servicing, repairing, and installing piping systems and their components.

Goal 1: Describe and apply **health and safety** practices.

GLO 1.1: Describe and apply health and safety practices.

SLO 11A.1.1.1 Demonstrate an understanding of, and adherence to, health and safety practices.

GLO 1.2: Demonstrate an understanding of the ***Trade Safety Awareness Curriculum for Level 1 Apprentices***.

No applicable SLOs.

Goal 2: Demonstrate the **use and management of equipment, tools, and materials**, including those used in **fuel brazing and cutting**.

GLO 2.1: Demonstrate the **use and management of equipment and tools**.

SLO 11A.2.1.1 Describe the selection, use, and maintenance of technical instruments, testers, and other tools and equipment, as specified by the instructor. (A2a.7)

SLO 11A.2.1.2 Demonstrate basic techniques for the selection, use, and maintenance of technical instruments, testers, and other tools and equipment, as specified by the instructor. (A2a.8)

GLO 2.2: Demonstrate the use and management of **fuel brazing and cutting equipment and tools**.

No applicable SLOs.

Goal 3: Demonstrate an understanding of the **properties and applications** of various types of **pipng and tubing**.

GLO 3.1: Demonstrate an understanding of the **properties and applications** of **pipng and tubing**.

- SLO 11A.3.1.1 Define terminology associated with pipe, tube, and tubing. (A5aPipe.1)
- SLO 11A.3.1.2 Identify types of pipe, tube, and tubing systems. (A5aPipe.2)
- water supply
 - sanitary drainage, waste and vent
 - storm drainage
 - heating
 - sprinkler
 - gas
 - process and power generating
 - refrigeration
 - compressed air
- SLO 11A.3.1.3 Identify types of pipe, tube, and tubing, and describe their applications. (A5aPipe.3)
- steel
 - plastic
 - copper
 - brass
 - aluminum
 - cast iron: ductile, duriron, and grey
 - historic
 - glass
 - asbestos-cement
 - reinforced concrete
 - stainless steel
 - fibreglass

- SLO 11A.3.1.4 Explain forces that have an impact on pipe, tube, and tubing systems, and perform associated calculations. (A5aPipe.4)
- thermal expansion
 - thermal contraction
 - weight
 - friction loss
 - turbulence
 - galvanic action
 - environmental
- SLO 11A.3.1.5 Perform calculations to determine pipe, tube, and tubing measurements. (A5aPipe.5)
- run and branch
 - fitting allowances
 - offsets including travel, rise and run, rolling, equal spread, unequal spread
- SLO 11A.3.1.6 Demonstrate pipe, tube, and tubing applications. (A5aPipe.6)
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GLO 3.2: Demonstrate an understanding of the **properties and applications of **plastic piping**.**

- SLO 11A.3.2.1 Identify the methods used to join plastic piping and describe their associated procedures. (A5aPlastic.16)
- heat fusion welding
 - threading
 - solvent welding
 - compression fittings
 - mechanical joints
- SLO 11A.3.2.2 Describe the procedures used to install fittings and accessories for plastic piping. (A5aPlastic.17)
- SLO 11A.3.2.3 Demonstrate the procedures used to measure, cut, and join plastic piping. (A5aPlastic.18)
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GLO 3.3: Demonstrate an understanding of the **properties and applications of **copper tubes and tubing**.**

- SLO 11A.3.3.1 Identify the methods used to join copper tubes and tubing, and describe their associated procedures. (A5aCopper.17)
- brazing
 - soldering
 - flaring
 - roll groove
 - compression fittings
 - mechanical joints
- SLO 11A.3.3.2 Describe the procedures used to install fittings and accessories for copper tubes and tubing. (A5aCopper.18)
- SLO 11A.3.3.3 Demonstrate the procedures used to measure, cut, and join copper tubes and tubing. (A5aCopper.19)
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GLO 3.4: Demonstrate an understanding of the **properties and applications of **steel piping**.**

- SLO 11A.3.4.1 Identify the methods used to join steel piping and describe their associated procedures. (A5aSteel.16)
- threading and grooving
 - welding
 - flanging
 - mechanical joints
 - roll groove
- SLO 11A.3.4.2 Describe the procedures used to install fittings and accessories for steel piping. (A5aSteel.17)
- SLO 11A.3.4.3 Demonstrate the procedures used to measure, cut, and join steel piping. (A5aSteel.18)
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GLO 3.5: Demonstrate an understanding of the **properties and applications** of **cast iron piping**.

SLO 11A.3.5.1 Identify the methods used to join cast iron and describe their associated procedures. (A5aCast.16)

- mechanical joints
- hub and spigot

SLO 11A.3.5.2 Describe the procedures used to install fittings and accessories for cast iron. (A5aCast.17)

SLO 11A.3.5.3 Demonstrate the procedures used to measure, cut, and join cast iron. (A5aCast.18)

GLO 3.6: Demonstrate an understanding of the **properties and applications** of **glass piping**.

No applicable SLOs.

GLO 3.7: Demonstrate an understanding of the **properties and applications** of **asbestos-cement piping**.

No applicable SLOs.

Goal 4: Demonstrate an understanding of the **properties and applications of various materials (other than piping and tubing)** used in plumbing and the pipe trades.

GLO 4.1: Demonstrate an understanding the **properties and applications of various materials (other than piping and tubing)** used in plumbing and the pipe trades.

SLO 11A.4.1.1 Demonstrate an understanding of oils and lubricants used in plumbing and the pipe trades.

Goal 5: Demonstrate an understanding of the **design and layout of piping systems.**

GLO 5.1: Demonstrate an understanding of the **design and layout of piping systems.**

- SLO 11A.5.1.1 Define terminology associated with drawings and sketches. (A3c.1)
- SLO 11A.5.1.2 Describe metric and imperial systems of measurement and the procedures used to perform conversions. (A3c.2)
- SLO 11A.5.1.3 Identify the types of drawings and describe their applications. (A3c.3)
 - civil/site
 - architectural
 - mechanical
 - structural
 - electrical
 - shop drawings
 - sketches
 - schematics/flow diagrams
- SLO 11A.5.1.4 Demonstrate basic sketching techniques. (A3c.12)

Goal 6: Demonstrate an understanding of the **joining, fabrication, and installation** of piping systems, including **hoisting, lifting, and rigging, and access equipment.**

GLO 6.1: Demonstrate an understanding of the **joining and fabrication** of piping systems.

No applicable SLOs.

GLO 6.2: Demonstrate an understanding of the **installation** of piping systems.

No applicable SLOs.

GLO 6.3: Demonstrate an understanding of **hoisting, lifting, and rigging.**

No applicable SLOs.

GLO 6.4: Demonstrate an understanding of **access equipment.**

No applicable SLOs.

Goal 7: Demonstrate an understanding of the **documentation and testing** of piping systems.

No applicable SLOs.

Goal 8: Describe and demonstrate the transferable **cross-curricular** knowledge and skills as they pertain to plumbing and the pipe trades.

GLO 8.1: Read, interpret, and communicate **information**.

No applicable SLOs.

GLO 8.2: Apply knowledge and skills from **mathematics**.

- SLO 11A.8.2.1 Identify and describe areas of rectangles, circles, triangles, trapezoids, and surface areas. (A8a.4)
 - SLO 11A.8.2.2 Identify and describe volumes of rectangular, cylindrical, and irregular objects. (A8a.5)
 - SLO 11A.8.2.3 Identify and describe Pythagoras's theorem. (A8a.6)
 - SLO 11A.8.2.4 Identify and describe special right-angle triangles. (A8a.7)
 - 45°
 - 30°–60°
 - 22-1/2°
 - SLO 11A.8.2.5 Identify and describe grade. (A8a.8)
 - simple
 - percentage
 - cm/m
 - in./ft.
 - SLO 11A.8.2.6 Identify and describe parallel offsets. (A8a.10)
 - SLO 11A.8.2.7 Identify and describe simple percentage, mark-up, net profit, and gross profit. (A8a.11)
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GLO 8.3: Apply knowledge and skills from the **sciences**.

SLO 11A.8.3.1 Identify and describe density, relative density, and pressure in liquids and gases (kpa), as well as Charles' and Boyle's gas laws. (A8a.9)

SLO 11A.8.3.2 Describe metals and alloys with respect to science. (A8a.12)

- define metals, alloys, conduction, melting point, specific heat, linear expansion, ductility, shear strength, tensile strength, compressive strength, working (safe) strength, malleable, ferrous, and non-ferrous, anneal, harden, temper
- identify the most common metals
- identify the most common alloys
- define cost effectiveness
- identify and describe properties of metals
- identify and describe problems in linear expansion
- identify and describe bi-metal strip and its uses
- identify and describe various solder
- identify and describe wrought iron
- identify and describe corrosion (oxidation): chemical and electrochemical
- identify and describe methods in preventing corrosion
- identify and describe galvanic series
- identify and describe factors aiding corrosion
- identify and describe corrosion resistant materials

GLO 8.4: Apply knowledge and skills from **information and communication technology**.

SLO 11A.8.4.1 Explain requirements for loading software and for file management. (A4a.1)

SLO 11A.8.4.2 Explain Internet-access software. (A4a.2)

SLO 11A.8.4.3 Load software and use proper file management techniques. (A4a.3)

SLO 11A.8.4.4 Use Internet-access software. (A4a.4)

Goal 9: Demonstrate an understanding of the **structure and scope** of plumbing and the pipe trades.

GLO 9.1: Demonstrate an understanding of the **structure and scope of plumbing and the pipe trades, as well as associated occupations.**

No applicable SLOs.

GLO 9.2: Demonstrate an understanding of **training and employment opportunities** in plumbing and the pipe trades, as well as in associated occupations.

SLO 11A.9.2.1 Demonstrate an awareness of training opportunities available to tradespeople.

Goal 10: Demonstrate an awareness of **sustainability** as it pertains to plumbing and the pipe trades.

GLO 10.1: Describe the impact of **human sustainability** on the health and well-being of plumbers, tradespersons working in the pipe trades, and those who use the systems they construct.

SLO 11A.10.1.1 Demonstrate an awareness of the sustainable factors that influence human health and well-being for plumbers and pipe trade workers.

SLO 11A.10.1.2 Demonstrate an awareness of the long-term health concerns related to plumbing and the pipe trades.

SLO 11A.10.1.3 Demonstrate an awareness of the sustainability of plumbers' working conditions; explain working hours, out-of-town travel, and shift work.

SLO 11A.10.1.4 Demonstrate an awareness of the long-term health concerns related to the different materials used in plumbing and the pipe trades.

SLO 11A.10.1.5 Demonstrate an awareness of the sustainability of plumbers' working conditions; explain working hours, out-of-town travel, and shift work.

GLO 10.2: Describe plumbing and the pipe trades' **sustainability practices and impact on the environment.**

SLO 11A.10.2.1 Demonstrate an awareness of environmentally appropriate methods of disposing of plumbing and pipe materials.

SLO 11A.10.2.2 Demonstrate an awareness of how plumbing and the pipe trades can adapt to a changing economy.

GLO 10.3: Describe **sustainable business practices** within plumbing and the pipe trades.

SLO 11A.10.3.1 Demonstrate an awareness of how plumbing and the pipe trades can adapt to a changing economy.

Goal 11: Demonstrate an awareness of the **ethical and legal standards, including codes**, as they pertain to plumbing and the pipe trades.

GLO 11.1: Demonstrate an understanding of **ethical and legal standards**.

SLO 11A.11.1.1 Exhibit positive ethics by demonstrating quality workmanship.

SLO 11A.11.1.2 Demonstrate an awareness of the ethical and legal expectations of plumbers and pipe trade workers.

SLO 11A.11.1.3 Demonstrate an awareness of the legal requirements related to specialized procedures and testing.

Goal 12: Demonstrate **employability skills**.

GLO 12.1: Demonstrate fundamental **employability skills**.

SLO 11A.12.1.1 Demonstrate regular and punctual attendance.

SLO 11A.12.1.2 Communicate respectfully and effectively with teachers, supervisors, co-workers, and students.

SLO 11A.12.1.3 Demonstrate problem-solving skills.

SLO 11A.12.1.4 Demonstrate critical-thinking skills.

SLO 11A.12.1.5 Demonstrate the ability to accept and follow direction and feedback.

SLO 11A.12.1.6 Demonstrate teamwork skills.

GLO 12.2: Demonstrate an understanding of the **business operations** of a plumbing and pipe trades organization.

SLO 11A.12.2.1 Demonstrate an awareness of how each tradesperson's work affects the work of others, including those working in other trades.

Goal 13: Demonstrate an awareness of the **history, technological progression, and emerging trends** in plumbing and the pipe trades.

GLO 13.1: Demonstrate an awareness of the **history, technological progression, and emerging trends** in plumbing and the pipe trades.

SLO 11A.13.1.1 Demonstrate an awareness of the history, technological progression, and emerging trends in piping systems.
