

**APPENDIX A
WORK PROCESS SCHEDULE
PLUMBER
O*NET SOC CODE: 47-2152.02 RAPIDS CODE: 0432**

This schedule is attached to and a part of these Standards for the above identified occupation.

1. TERM OF APPRENTICESHIP

The term of the occupation shall be four (4) years with an OJL attainment of not less than 8000 OJL hours supplemented by the required hours of related instruction.

2. RATIO OF APPRENTICES TO JOURNEYWORKERS

One (1) apprentice may be employed in each shop department, and/or jobsite employing a qualified journeyworker. This ratio will be defined as no more than one (1) apprentice for every one (1) journeyworker.

3. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages and fringe benefits based on a percentage of the current journeyworker wage rate.

4-Year Term Time-based:

1 st 6 months + OJL hours - 50%	5 th 6 months + OJL hours - 70%
2 nd 6 months + OJL hours - 55%	6 th 6 months + OJL hours - 75%
3 rd 6 months + OJL hours - 60%	7 th 6 months + OJL hours - 80%
4 th 6 months + OJL hours - 65%	8 th 6 months + OJL hours - 85%

**4. SCHEDULE OF WORK EXPERIENCE
(See attached Occupation Schedule)**

The Sponsor may modify the work processes to meet local needs prior to submitting these Standards to the appropriate Registration Agency for approval.

**5. SCHEDULE OF RELATED INSTRUCTION
(See attached Course Outline)**

**WORK PROCESS SCHEDULE
PLUMBER
O*NET-SOC CODE: 47-2152.02 RAPIDS CODE: 0432**

APPROXIMATE HOURS

1. Installation of piping for waste (500 hrs.), soil (500 hrs.), sewerage (100 hrs.), vent (300 hrs.), and leader lines (100 hrs.)	1,500
2. Installation of piping for hot (500 hrs.) and cold (750 hrs.) water for domestic purposes	1,250
3. Installation of lead pipe, tin pipe, lead joints, sheet lead, solder work and lead burning.....	10
4. Assembly in position and connection of fixtures and appliances used in domestic heating (200 hrs.), gas fittings (400 hrs.), plumbing and drainage system (1,900 hrs.)	2,500
5. Welding and brazing connected with the trade.....	250
6. Maintenance and repairing of heating, plumbing, gas fittings, and refrigeration service	800
7. Operation, care, and use of all tools and equipment connected with the trade	525
8. Operation and maintenance of complete repair service and drain cleaning	540
9. Code, blueprint reading and sketching, and safety requirements	625
TOTAL HOURS	8,000

ADVANCED TRAINING PROGRAM – OPTIONAL

A. Installation and maintenance of steam and hot water heating systems	1,000
B. Power and industrial process piping	200
C. High and low pressure boilers.....	250
D. Estimating.....	150
E. Supervisory training	100
F. Business administration	200
G. Solar	100
TOTAL HOURS	2,000

**RELATED INSTRUCTION OUTLINE
PLUMBER
O*NET-SOC CODE: 47-2152.02 RAPIDS CODE: 0432**

1st Year

SUBJECT	SUGGESTED TIME
Installation Practices	56 Hours
Mathematics	30 Hours
Related Science	10 Hours
Blueprint Reading and Sketching	18 Hours
Occupation Safety and Health Course.....	30 Hours
First Aid	12 Hours
TOTAL HOURS	156

2nd Year

SUBJECT	SUGGESTED TIME
Installation Practices	62 Hours
Mathematics	24 Hours
Blueprint Reading and Sketching	24 Hours
Related Science	18 Hours
Occupation Safety and Health	16 Hours
Rigging and Hoisting	12 Hours
TOTAL HOURS	156

**RELATED INSTRUCTION OUTLINE
PLUMBER
O*NET-SOC CODE: 47-2152.02 RAPIDS CODE: 0432**

3rd Year

SUBJECT	SUGGESTED TIME
Installation Practices	40 Hours
Mathematics.....	30 Hours
Fuel Gas & Gas Code	24 Hours
Related Science	36 Hours
Blueprint Reading and Sketching	26 Hours
TOTAL HOURS	156

4th Year

SUBJECT	SUGGESTED TIME
Installation Practices	54 Hours
Related Science	12 Hours
Mathematics.....	12 Hours
Blueprint Reading.....	26 Hours
Plumbing Code.....	40 Hours
Plumbing Curriculum Review.....	12 Hours
TOTAL HOURS	156

APPENDIX A

WORK PROCESS SCHEDULE HEATING AND AIR CONDITIONING MECHANIC AND INSTALLER O*NET-SOC CODE: 49-9021.01 RAPIDS CODE: 0637

This schedule is attached to and a part of these Standards for the above identified occupation.

1. **TERM OF APPRENTICESHIP**

The term of the occupation shall be four (4) years with an OJL attainment of not less than 8000 OJL hours supplemented by the required hours of related instruction.

2. **RATIO OF APPRENTICES TO JOURNEYWORKERS**

One (1) apprentice may be employed in each shop department, and/or jobsite employing a qualified journeyworker. This ratio will be defined as no more than one (1) apprentice for every one (1) journeyworker.

3. **APPRENTICE WAGE SCHEDULE**

Apprentices shall be paid a progressively increasing schedule of wages and fringe benefits based on a percentage of the current journeyworker wage rate.

4-Year Term Time-based:

1 st 6 months + OJL hours - 50%	5 th 6 months + OJL hours - 70%
2 nd 6 months + OJL hours - 55%	6 th 6 months + OJL hours - 75%
3 rd 6 months + OJL hours - 60%	7 th 6 months + OJL hours - 80%
4 th 6 months + OJL hours - 65%	8 th 6 months + OJL hours - 85%

4. **SCHEDULE OF WORK EXPERIENCE** **(See attached Occupation Schedule)**

The Sponsor may modify the work processes to meet local needs prior to submitting these Standards to the appropriate Registration Agency for approval.

5. **SCHEDULE OF RELATED INSTRUCTION** **(See attached Course Outline)**

WORK PROCESS SCHEDULE
HEATING AND AIR CONDITIONING MECHANIC AND INSTALLER
O*NET-SOC CODE: 49-9021.01 RAPIDS CODE: 0637

APPROXIMATE HOURS

1. General trade orientation	350
a. Use and care of tools	
b. Test and measurement devices	
c. Types and sizes of piping, tubing, and fittings	
d. Introduction to refrigeration system components	
e. Safety procedures and first aid	
f. Equipment records and reports	
2. Fabrication of system components.....	550
a. Cut, thread, flare, bend, and shape piping and tubing	
b. Install fittings	
c. Solder, braze, and tin fittings and components	
d. Care and use of oxy-acetylene and air-acetylene torches	
e. Silver and soft soldering	
3. System installation and connection.....	1600
a. Electrical supply lines and cables	
b. Electrical connections	
c. Water service lines	
d. Air supply lines	
e. Steam lines	
f. Steam return lines	
g. Steam traps and strainers	
h. Pressure reduction, expansion, evaporator, stop valves	
i. Suction and discharge lines	
j. Gauges	
k. Dehydrators	
l. Filters and strainers	
m. Controls	
4. Equipment installation.....	950
a. Install condensers	
b. Prepare compressor and motor bases	
c. Install and align compressors and motors	
d. Install evaporators and other cooling coils	
e. Install and align centrifugal pumps and bases	
f. Safe equipment moving - slings, lines, blocks and falls, chain hoists, rollers, dollies, and skids	
5. System maintenance	1050
a. Troubleshoot field systems	
b. Test pressure, flow, etc.	
c. Check liquid levels	
d. Check repair leaks (refrigerants, liquids)	

- e. Purge, dehydrate, and charge systems
 - f. Repair, align, and adjust fans and blower sections
 - g. Align pulleys, bearing blocks, belt tension
6. Equipment repair 2900
- a. Disassemble and clean, repair, perform shop tests and run-in compressors
 - b. Repair, pressure test, dehydrate evaporators
 - c. Repair, acidize condensers, and roll condenser tubes
 - d. Remove, replace, disassemble, test, clean, calibrate, and renew defective parts on controls of all types including: pneumatic, electrical, electro-pneumatic, thermostatic, humidity, pressure, vacuum
7. Machine shop practice 300
- a. Use of grinders, drill presses, lathes
 - b. Tool and drill sharpening
8. Miscellaneous 300
- a. Orientation
 - b. Housekeeping
 - c. Safety
 - d. Activities not otherwise listed

TOTAL HOURS 8,000

ADVANCED TRAINING PROGRAM – OPTIONAL

- A. Installation and maintenance of steam and hydronic heating systems 1,000
- B. Power and industrial process piping 200
- C. High and low pressure boilers 250
- D. Estimating 150
- E. Supervisory training 100
- F. Business administration 200
- G. Solar 100

TOTAL HOURS 2,000

**RELATED INSTRUCTION OUTLINE
HEATING AND AIR CONDITIONING MECHANIC AND INSTALLER
O*NET-SOC CODE: 49-9021.01 RAPIDS CODE: 0637**

1st Year

SUBJECT	SUGGESTED TIME
Introduction to the Trade, Tools and Safety	40 Hours
Systems and Components	16 Hours
Basic Electricity	24 Hours
Mathematics	16 Hours
Basic Thermodynamics	12 Hours
Refrigeration Cycle	20 Hours
Maintenance and Inspection	10 Hours
Systematic Problem Solving	10 Hours
Energy Efficiency	8 Hours
TOTAL HOURS	156

**RELATED INSTRUCTION OUTLINE
HEATING AND AIR CONDITIONING MECHANIC AND INSTALLER
O*NET-SOC CODE: 49-9021.01 RAPIDS CODE: 0637**

2nd Year

SUBJECT	SUGGESTED TIME
Refrigeration Cycle.....	8 Hours
Compressors, Condensers, Metering Devices and Accessories.....	32 Hours
Evacuation, Charging and Refrigerant Handling.....	26 Hours
Heating and Cooling Equipment.....	12 Hours
Electricity and Electrical Troubleshooting.....	20 Hours
Motors.....	16 Hours
Control Systems.....	14 Hours
Psychrometrics.....	16 Hours
Basic Sizing.....	12 Hours
TOTAL HOURS	156

**RELATED INSTRUCTION OUTLINE
HEATING AND AIR CONDITIONING MECHANIC AND INSTALLER
O*NET-SOC CODE: 49-9021.01 RAPIDS CODE: 0637**

3rd Year

SUBJECT	SUGGESTED TIME
Servicing and Troubleshooting Systems.....	20 Hours
Testing and Balancing Systems	14 Hours
Energy Efficient Mechanical Systems.....	10 Hours
Fluid Handling Systems.....	8 Hours
Electrical Problem Solving.....	20 Hours
Refrigeration System Problem Solving	16 Hours
Troubleshooting with the Psychrometric Chart	10 Hours
Cooling Towers and Evaporative Condensers.....	10 Hours
Commercial Air Conditioning and Refrigeration Systems.....	12 Hours
Water Treatment	10 Hours
Indoor Air Quality.....	16 Hours
Blueprint Reading.....	10 Hours
TOTAL HOURS	156

**RELATED INSTRUCTION OUTLINE
HEATING AND AIR CONDITIONING MECHANIC AND INSTALLER
O*NET-SOC CODE: 49-9021.01 RAPIDS CODE: 0637**

4th Year

SUBJECT	SUGGESTED TIME
Refrigeration Cycle and Heat Pumps.....	16 Hours
Heat Pump Components, Motors, Compressors and Specific Defrost.....	32 Hours
Electrical Schematics and Blueprint Reading	16 Hours
Installation, Maintenance and Service	24 Hours
System Sizing and Design.....	12 Hours
Air Source Heat Pumps	10 Hours
Geothermal Heat Pumps	36 Hours
Energy and Efficiency Calculations.....	10 Hours
TOTAL HOURS	156