



# Board/Authority Authorised Course Construction Trades Sampler - Plumbing

School District/Independent School Authority Name	Kamloops/Thompson
School District/Independent School Authority Number	#73
Developed by	Wendy Blaskovic
Date Developed	December 2013
School Name	NorKam Secondary
Principal's Name (District)	Sheryl Lindquist
Superintendent Approval Date (for School Districts only)	
Superintendent Signature (for School Districts only)	
Board/Authority Approval Date	
Board/Authority Chair Signature	
Course Name	Construction Trades Sampler – Plumbing
Grade Level of Course	11 and 12
Number of Course Credits	4
Number of Hours of Instruction	120
Prerequisite(s)	Completion of Grade 10



## Synopsis

This course has been developed to provide students with an opportunity to explore four common trades within the Construction Sector, in the following order – carpentry, plumbing, electrical (construction) and industrial, instrumentation mechanic (IIM). The second trade taught within the Construction Sampler, plumbing, will expose students to the foundation program offered at Thompson Rivers University (TRU) which follows sections of the ITA Level 1 curriculum. The ITA Level 1 curriculum has been utilized as a guide and framework for the content covered in the Sampler. In plumbing (as with the three accompanying trades taught within the Construction Sampler), students will cover: safe work practices (personal and shop), mathematical applications, tools and equipment, materials, cutting processes, and forming and joining processes. The approach supports safe workplace practices, student skill development and encourages meaningful methods of ideation, design, planning, production and evaluation of various construction sampler techniques and projects.

To provide students with tangible skills and assist their understanding of the trade, all trades covered within the Construction Sampler will build skills sets towards a common project. For example, a bathroom or kitchen unit framed to scale by the Carpentry trade with plumbing and electrical components installed over the course of the semester. Students will gain an understanding and appreciation for trades that are in their everyday lives.

## Rationale

This course will:

1. Provide students with an overview of the Plumbing Foundation Program .
2. Provide students with an introduction to safe work practices employed in a construction facility.
3. Provide students with an overview of the practices, skill sets needed for the plumbing trade.
4. Provide students with theory and practical applications within a major project which is inclusive with the accompanying trades in the Construction Sampler.
5. Provide direct exposure to foundation training content, post-secondary and job ready expectations; therefore, providing students with the ability to make informed choices regarding which direction they choose to embark on during Senior Secondary School and/or after.
6. Provide students with 20% theory and 80% practical content. The 20-80 approach supports the purpose of the sampler – a hands-on experiential program to excite students, yet be realistic in the expectations of the trade and program.



Unit/Topic	Title	Time
Unit 1	SAFE WORK PRACTICES 1.1 Use of WHMIS 1.2 Use of Personal Protective Equipment	5 hours
Unit 2	TOOLS AND EQUIPMENT 2.1 Use of hand tools 2.2 Use of ladders 2.3 Use of portable power tools 2.4 Use of soldering tools	5 hours
Unit 3	PREPARE AND ASSEMBLE PLUMBING COMPONENTS 3.1 Install pipe 3.2 Install fittings 3.3 Penetrate structures	25 hours
Unit 4	INSTALL PLUMBING EQUIPMENT 4.1 Major Project  *Final project will be in collaboration with Carpentry and Electrical Samplers (For example, Life-size framed bathroom/kitchen with plumbing and electrical installations. Details in development stages).	85 hours
	Total Hours	120 hours

## Grading

Although 50% is a passing grade for high school credit, recommendation for TRU's ACE IT Program will require a minimum grade of 70% per course. Students in the Construction Sampler will be encouraged and supported to meet TRU's 70% standard, but not halted by it.

## Unit 1 – Safe Work Practices - 1.1 Use of WHMIS

**Objective:** To be competent in this area, students will be able to:

- Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS) Regulations.
- Explain the contents of material safety data sheets (MSDS)
- Explain the contents of a WHMIS label.
- Apply WHMIS regulations

## Prescribed Learning Outcomes

It is expected that students will:

1. State the legislation that requires suppliers of hazardous materials to provide MSDS and label products as a condition of sale and importation.
  - Hazardous Product Act



- Controlled Products Regulations
  - Ingredient Disclosure List
  - Hazardous Materials Information Review Act.
  - Hazardous Materials Information Review Regulations.
2. State the purpose of the Workplace Hazardous Materials Information System (WHMIS).
    - Protection of Canadian workers from the adverse effects of hazardous materials through the provision of relevant information while minimizing the economic impact on industry and the disruption of trade.
    - Recognition of rights
      - Workers
      - Employers
      - Suppliers
      - Regulators
  3. Describe the key elements of WHMIS.
    - Material Safety Data Sheets (MSDS).
    - Labelling of containers of hazardous materials.
    - Worker education programs.
  4. Describe the responsibilities of suppliers under WHMIS.
    - Provide
      - MSDS
      - Labels
  5. Describe the responsibilities of employers under WHMIS.
    - Provide
      - MSDS
      - Labels
      - Work education programs in the workplace
  6. Describe information to be disclosed on a MSDS.
    - Hazardous ingredients
    - Preparation information
    - Product information
    - Physical data
    - Fire or explosion
    - Reactivity data
    - Toxicological properties
    - Preventative measures
    - First-aid measures
  7. Identify symbols on WHMIS labels and their meaning.
    - Compressed gases
    - Flammable and combustible materials
    - Oxidizing materials
    - Poisonous and infectious materials



- Materials causing immediate and serious toxic effects
  - Biohazardous infectious materials
  - Corrosive materials
  - Dangerously reactive materials
  - Use, storage, and disposal of shop materials
8. Apply WHMIS regulations as they apply to hazardous materials used in the shop.

### **Theory Assessment:**

The learner must score a minimum of 70 percent on a written examination.

## **Unit 1 – Safe Work Practices – 1.2 Use of Personal Protective Equipment (PPE)**

**Objective:** The student will be able to select and use personal protective equipment (PPE).

### **Prescribed Learning Outcomes**

It is expected that students will:

1. Describe personal protective equipment requirements.
  - Safety footwear
  - Eye protection
  - Ear protection
  - Head protection
  - Respiratory protection
  - Clothing
  - Fall protection (Note: Fall protection will be reviewed; certification not granted during this time.)
2. Use personal protective equipment.
  - Selection
  - Purpose
  - Operating procedures
  - Training requirements
  - Inspection
  - Maintenance
  - Storage

### **Theory Assessment:**

The learner must score a minimum of 70 percent on a written examination.

### **Achievement Criteria:**

**Performance:** The learner will use personal protective equipment.

**Conditions:** The learner will be given personal protective equipment.



**Criteria:** A suggested method of rating a student in this competency might be for the student to start with 100% and marks be deducted for each infraction that occurs while working in the shop. This would be reflected in the appropriate shop competencies.

## **Unit 2 – Tools and Equipment - 2.1 Use of Power Tools**

**Objective:** To be competent in this area, students will be able to:

- Select hand tools appropriate to plumbing processes.
- Use hand tools.
- The learner will be able to inspect and maintain hand tools.

### **Prescribed Learning Outcomes**

It is expected that students will:

1. Describe hand tools used in the trade.

- Cutting tools
- Measuring and marking tools
- Bracing and securing tools
- Hammering tools
- Levelling tools
  - Pitch levels
- Wrenches and pliers
- Screwdrivers
- Chiselling tools
- Squaring tools
- Threading tools
- Flaring and swaging tools
- Tubing benders
- Expanding and crimping tools

(Note: This is an expensive tool. Purchased for Construction Sampler, students will learn to use this. If not, it will not hinder the unit's value).

2. Use hand tools.

- Types
- Parts
- Purpose/uses
- Procedures/operations
- Safety
- Adjustment
- Inspection
- Maintenance
- Storage



### **Theory Assessment:**

The learner must score a minimum of 70 percent on a written examination.

## **Unit 2 – Tools and Equipment – 2.2 Use of Ladders**

**Objective:** To be competent in this area, students will be able to:

- Describe ladders and elevated platforms.
- Select and use ladders and platforms.

### **Prescribed Learning Outcomes**

It is expected that students will:

1. Describe ladders and elevated platforms.
  - Types
    - Ladders
    - Platforms
    - Lifts
  - Uses
  - Safety
  - Fall arrest equipment  
(Note: Fall protection will be reviewed; certification not granted during this time.)
  - Hazard recognition
  - Government regulations
2. Use ladders and elevated platforms
  - Selection
  - Operating procedures
  - Limitations
  - Securing
  - Inspection
  
  - Maintenance
  - Storage

### **Theory Assessment**

The student must score a minimum of 70 per cent on a written examination.

## **Unit 2 – Tools and Equipment – 2.3 – Use of Portable Power Tools**

**Objective:** To be competent in this area, students will be able to:

- Select portable power tools appropriate to plumbing processes.
- Use portable power tools.
- Inspect and maintain power tools.



## Prescribed Learning Outcomes

It is expected that students will:

1. Describe portable power tools.
  - Types
    - Electric
    - Power- actuated
  - Certification requirements
  - Cutting tools
  - Grinding and abrasive tools
  - Hand crimpers
  - Threading tools

(Note: This is an expensive tool. If purchased for Construction Sampler, students will learn to use this. If not, it will not hinder the unit's value).
  - Drilling and boring tools
  - Specialty tools (demonstration purposes only)
    - Fusion tools
    - Grooving tools
2. Use portable power tools.
  - T-Drill Accessories (demonstration purposes only)
  - Types
  - Parts purpose/uses
  - Procedures/operations safety
  - Adjustment inspection maintenance storage

## Theory Assessment

The student must score a minimum of 70 per cent on a written examination.

## Unit 2 – Tools and Equipment – 2.4 Use of Soldering Tools

**Objective:** To be competent in this area, students will be able to:

- Select cutting, brazing and soldering equipment appropriate to plumbing processes.
- Use cutting brazing and soldering equipment.
- Inspect and maintain cutting, brazing and soldering equipment.

## Prescribed Learning Outcomes

It is expected that students will:

1. Describe oxy-acetylene equipment.
  - Parts
    - Acetylene cylinders
    - Regulators





- Gauges
  - torches
- Safety devices
- 2. Describe cutting, brazing, and soldering techniques.
  - Selection
  - Procedure
  - Limitations
  - Inspection
- 3. Use oxy-acetylene equipment.
  - Safety
  - Transportation of dangerous goods legislation
  - Ventilation
  - Flammable material recognition
  - Types
  - Parts
  - Purpose/uses
  - Procedures/operations
    - Setup
    - Takedown
    - Tip selection
    - Alloy selection
    - Flux selection
  - Adjustment
  - Inspection
  - Minor maintenance
  - Storage

### **Theory Assessment:**

The student must score a minimum of 70 per cent on a written examination.

### **Performance Conditions:**

The student will solder

- Materials
- Specifications

### **Criteria:**

The student will score 70% or better on a rating sheet that reflects the following criteria:

- Appearance
- Pressure test



### **Optional Section**

If covered during the sampler.

### **Performance Conditions**

The learner will:

- Cut carbon steel
- Be given materials and specifications

### **Criteria**

The learner will score 70% or better on a rating sheet that reflects the following criteria:

- Appearance
- Accuracy

## **Unit 3 – Prepare and Assemble Plumbing Equipment – 3.1 Install Pipe**

**Objective:** To be competent in this area, students will be able to:

### **Prescribed Learning Outcomes**

It is expected that students will:

1. Describe piping and tubing materials.
  - Copper pipe and tubing
2. Describe the method of manufacture.
  - Cast iron soil and pressure (demonstration)
  - Brass pipe and tubing
  - Thermoplastic pipe and tubing
  - Thermoset plastic pipe
  - Specialty piping and tubing
  - Copper pipe and tubing
  - Thermoplastic pipe and tubing
  - Cast iron pipe
  - Schedules
3. Describe methods of pipe support.
  - Types (will be reviewed)
    - Hangers
    - Supports
    - Seismic
    - Anchors
    - Guides
    - Slide plates
  - Compatibility with piping
  - Size
  - Spacing



- Fasteners
    - Beam clamps
    - Drop-in anchors
    - Draw bolts
    - Toggle bolts
  - To be discussed
    - Interferences
    - Insulation thickness
    - Elevation of hangers
    - Attachment methods
    - Tools and equipment
4. Describe methods of protecting piping.
- Frost protection  
(Note: fall protection will be reviewed; certification not granted during this time.)
    - Heat tape
    - Frost boxes
  - Ultraviolet protection
  - Corrosion protection
    - Coatings
    - Tape
  - Physical damage
    - Protective plates
    - Sleeving
    - Metal stud grommets
  - Protective measures
    - Insulating
    - Water treatment  
(Note: fall protection will be reviewed; certification not granted during this time).
    - Dielectric protection
5. Describe the inspection of pipe before installation.
- Potential defects
    - Pin holes
    - Cracked fittings
    - Bent ends
    - Uneven casting
    - Damaged pipe and coatings
  - Environment effects
  - Inspection techniques
    - Visual
    - Sounding of cast iron pipe and fittings



- Interpretation of markings
- Checking against specifications
- 6. Install tubing and pipe.
  - Types
  - Sizes
  - Uses
  - Hazards
  - Safety
  - Measuring procedures
  - Selection for application
  - Calculations
    - Length
    - Fitting allowances
    - Offsets
    - Gain or loss
  - Cutting
  - Bending
  - Jointing methods
  - Common fitting angles
  - Tools and equipment

### **Theory Assessment:**

The student must score a minimum of 70 per cent on a written examination.

### **Performance Conditions:**

The student will install piping projects that include the following types of pipes:

- Plastic
- Copper
- Carbon steel (if threaders are available)

### **Conditions:**

The learner will be given:

- Project specifications
- Tools and materials

### **Criteria:**

The student will score 70% or better on a rating sheet that reflects the following criteria:

- Threading (if threaders are available)
- Soldering
- Silver Brazing
- Solvent welding



- Crimping/expanding
- Flaring
- Compression fittings
- Pressure testing
- Mechanical joints

### **Unit 3 – Prepare and Assemble Plumbing Equipment – 3.2 Prepare and Assemble Plumbing Equipment**

**Objective:** To be competent in this area, students will be able to:

- Describe fittings and connection methods used in the plumbing trade.
- Select and install fittings.

### **Prescribed Learning Outcomes**

It is expected that students will:

1. Describe fittings used in the plumbing trade.
  - Purpose
  - Types
  - Applications
  - Limitations
2. Describe connection methods of fittings.
  - Welded
  - Threaded (if threaders are available)
  - Compression
  - Flared
  - Soldered/brazed
  - Mechanical
  - Solvent welded
3. Select fittings.
  - Applications
  - Specifications

### **Theory Assessment:**

The student must score a minimum of 70 per cent on a written examination.

### **Unit 3 – Prepare and Assemble Plumbing Equipment – 3.3 Penetrate Structures**

**Objective:** To be competent in this area, students will be able to:

- Use acceptable methods of structure penetration



## Prescribed Learning Outcomes

It is expected that students will:

1. Describe considerations when making penetrations in structures.
  - Structural integrity
  - Interference with other building components and systems
  - Hidden components behind the surface
  - Sleeve installation
    - Fabrication
    - Timing
    - Sizing
    - Positioning
    - Fastening
    - Protection during concrete pour

## Theory Assessment:

The student must score a minimum of 70 per cent on a written examination.

## Unit 4 – Install Plumbing Equipment – 4.1 Major Project

### \*Note:

The final project will be in collaboration with Carpentry and Electrical Samplers. This project is to be determined once the instructors have been selected and they can discuss collaboratively in how their samplers will work together on a final common project.

For the purposes of this document, a tentative concept has been included on the following pages.

## COURSE COMPONENTS

### Instructional Components

- Direct instruction
- Indirect instruction
- Interactive (peer) instruction
- Independent instruction
- Modeling
- Practical creativity
- Brainstorming
- Group work
- Analysis of own and classmates' project work
- Project Based Learning

### Assessment Components:

- Twenty per cent (20%) of the grade will be based on safety tests, unit quizzes, skill-set evaluation through Units 1-3



- Eighty per cent (80%) of the grade will be based on demonstration of proper employability skills (proper industrial work habits ranging from the safe use of equipment to good “Housekeeping” techniques, project management), demonstration of skills related to practical activities.

### **Learning Resources**

- Teacher handouts
- Guest speakers from the community in related fields
- Visit/interview local trades people in related fields
- ITA Website: <http://www.itabc.ca/>
- ITA Essential Skills: <http://www.ita.essentialskillsgroup.com/>

### **Instructor Resources**

- Industry Learning Modules (ILM):  
[http://www.crownpub.bc.ca/product/listing/13557\\_Polumber-Alberta](http://www.crownpub.bc.ca/product/listing/13557_Polumber-Alberta)
- ITA Level 1 Program Outline  
[http://www.itabc.ca/sites/default/files/program-information/carpenter-outline-august-2013\\_0.pdf](http://www.itabc.ca/sites/default/files/program-information/carpenter-outline-august-2013_0.pdf)

### **Additional Information**

FACILITY REQUIREMENTS (Based on ITA Plumbing Program Guidelines)

#### **Classroom Area**

- Minimum 22 square feet per student
- Comfortable seating and tables suitable for learning
- Compliance with the Local and National Fire Code and occupational safety requirements
- Meets applicable municipal zoning bylaws for technical instruction and education facilities
- Overhead and multimedia projectors with a projection screen and Smartboard technology
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/air conditioning for comfort all year round
- Acoustics in the room must allow audibility of the instructor

#### **Shop Area**

- Minimum 2400 square feet of shop area including a tool crib and work stations
- Minimum 15' 6" ceiling height in shop areas
- Minimum 8 foot ceiling in lab areas
- Adequate heating, lighting, and ventilation
- Refuse and recycling bins for used shop materials



- First-aid equipment
- Shops will support practical requirements as outlined in the program outline.

### **Student Facilities**

- Adequate eating area as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)
- Adequate washroom facilities as per WorkSafeBC requirements (4.85 OHS Regulation and Guidelines)
- Personal storage lockers

### **Instructor's Office Space**

- Adequate office space for student consultation
- Desk and filing space
- Computer
- Internet access
- Printer
- Adequate storage facilities for material and training aids
- Access to photocopier
- Telephone

## **Tools and Equipment**

(Based on ITA Plumbing Program Guidelines)

### **Hand Tools**

- Adjustable wrench
- Plumb bob
- Ballpeen hammer
- Pry bars
- Basin wrench
- Punch
- Broom
- Ratchet
- 1 caulking gun
- Rubber mallet
- Chalk line
- Scratch awl
- Chisels
- Screwdrivers (complete set)
- Claw hammer
- Shovel
- Combination wrench
- Sledgehammer
- Drywall saw
- Socket set (Imperial and Metric)
- 1 faucet seat wrench
- Spud wrench
- Files
- Square flashlight
- Striker
- Hacksaw
- Swedge (hand flaring tool)
- Hand saw
- T square
- Hex keys (set)
- Tap and die sets
- Hole saw
- Tin snips (set)
- Knife





- Torque wrench
- Levels (4 foot and Torpedo)
- Transfer pump (hand-operated)
- Pick
- Tri-square
- Pipe wrench (1 of each size – 12, 18, 24)
- Utility brushes
- Pliers (lineman, needle-nose, water)
- Wire brushes

#### Power Tools

- 1 air compressor and accessories
- Heat pump
- Impact wrench
- Mini grinder
- Bench grinder
- Power-actuated tools
- Portable band saw (hack saw)
- Power drills
- Chop saw
- Power hole saw
- Circular saw
- Rotary hammer
- Cordless drills
- Task lighting equipment
- Reciprocating saw
- Heat lamp
- Drill press

#### Hoisting, Rigging, and Access Tools and Equipment

- 1 block and tackle or 1 Tirfor Come-along (both not required)
- Ladders
- Lifting eyes
- Rope/cable

#### Personal Protective and Safety Equipment

- Eye wash kit (shop)
- Face shield (shop)
- Fire blanket (shop)
- Fire extinguisher (shop)
- First aid kit (shop)
- Gloves – industrial rubber (shop)
- Lock-out devices
- Overalls (1/student)
- Hearing protection (1/student)
- Respiratory mask (1/student)
- Safety boots (1/student)
- Safety glasses/goggles (1/student)
- Hard hat (1/student)
- Safety harness, lanyard, and lifeline (class set)

#### Cutting and Joining Equipment

- Copper tube cutter
- Pipe roller
- Crimpers
- Pipe stand
- PEX pipe expander (manual and power)
- Pipe vise
- Half-round file (shop tool)
- Plastic tube cutters (set)
- Flaring tools (shop tool)
- Power vise
- Gas cylinders and soldering and brazing equipment
- Ratchet cutter
- Hand-operated oiler
- Snap cutter
- Mechanical crimper



- Specialized assembly tools and equipment
- Pipe reamer
- Pipe cutter
- Tube bender
- Pipe groover
- Tube cutter

#### Testing and Measuring Equipment

- Builder's level
- Hand pump and accessories
- Hydrostatic pump & gauge (manual & power)
- Ruler
- Calculator
- Electronic leak detector
- Computer
- Measuring tape and makers