

COURSE MWA3400: RIGGING

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students develop knowledge of the correct and safe procedures that are necessary to move and accommodate equipment, components and machines using a mobile crane, shop overhead crane, a come-along or chain hoist, forklift, block and tackle, ropes, turfers or a floor gantry with a chain hoist attached in the millwright shop.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Rigging Procedures – Part A 160101dA; Rigging Procedures – Part B 160101dB; Cranes and Hoists 160101e

Outcomes: The student will:

1. describe rigging and hoisting equipment and procedures

- 1.1 describe the construction of the wire rope, including:
 - 1.1.1 wire rope; e.g., strength, flexibility, resistance to abrasion, crushing, rotation and corrosion, cores, strand construction (classification), ordinary, Warrington, Seale, filler
 - 1.1.2 wire rope size
 - 1.1.3 wire rope classification
- 1.2 describe the construction and use of steel and fibre slings, including:
 - 1.2.1 slings; e.g., metal slings, synthetic webbing slings
 - 1.2.2 sling configurations; e.g., wire rope slings, Flemish eye splice, chain slings and wire mesh slings, synthetic fibre slings
 - 1.2.3 protective devices for slings; e.g., sleeves, softeners
 - 1.2.4 wire rope and sling inspection; e.g., wire rope failure, inspection schedule, record keeping, criteria for repair or replacement
- 1.3 describe hoisting equipment hardware, including:
 - 1.3.1 eyebolts
 - 1.3.2 lift rings
 - 1.3.3 shackles; e.g., anchor and chain shackles, web sling shackles and round sling shackles
 - 1.3.4 wire rope clips; e.g., U-bolt type, J-clip
 - 1.3.5 hooks and swivels; e.g., swivels, headache ball, wedge socket
 - 1.3.6 blocks; e.g., wire rope blocks, crane blocks
 - 1.3.7 mechanical advantage using wire rope blocks
- 1.4 describe construction and use of chain and chain slings, considering:
 - 1.4.1 lifting chain
 - 1.4.2 chain grade identification
 - 1.4.3 chain inspection
 - 1.4.4 maximum safe working load for alloy steel lifting chain
 - 1.4.5 chain sling load leveller
 - 1.4.6 care, use and safety of lifting chain

- 1.5 describe the construction of fibre rope and the purpose and use of knots, including:
 - 1.5.1 fibre rope; e.g., natural fibre rope, synthetic fibre rope, rope inspection, whipping natural fibre rope, melting synthetic fibre rope, safety factors
 - 1.5.2 knots, hitches, and bends
- 1.6 estimate the weight of objects when given the size, shape and material
- 1.7 describe hand rigging equipment, including:
 - 1.7.1 chain hoists; e.g., spur-gearred chain hoist, electric chain hoist, come-along chain hoist, triformer, jacks
 - 1.7.2 tuggers
- 1.8 describe standard hand signals used for rigging and hoisting operations, including:
 - 1.8.1 stop
 - 1.8.2 emergency stop
 - 1.8.3 dog everything
 - 1.8.4 hoist load
 - 1.8.5 lower load
 - 1.8.6 boom up
 - 1.8.7 boom down
 - 1.8.8 swing
 - 1.8.9 make movements slowly
 - 1.8.10 raise load slowly
 - 1.8.11 lower load slowly
 - 1.8.12 lower boom slowly
 - 1.8.13 raise boom slowly
 - 1.8.14 lower the boom and raise the load
 - 1.8.15 raise the boom and lower the load
 - 1.8.16 shorten boom
 - 1.8.17 extend boom
- 1.9 demonstrate hoisting and load-moving procedures, including:
 - 1.9.1 moving a load
 - 1.9.2 turning a steel plate
 - 1.9.3 machine transporting devices
 - 1.9.4 tag lines
 - 1.9.5 turning the workpiece
 - 1.9.6 safety considerations

2. use cranes and hoists for lifting and moving objects

- 2.1 describe the types of mobile cranes, including:
 - 2.1.1 boom truck
 - 2.1.2 industrial crane
 - 2.1.3 rough-terrain crane
 - 2.1.4 carrier-mounted telescopic boom crane
 - 2.1.5 carrier-mounted lattice boom crane
 - 2.1.6 crawler-mounted lattice boom crane
- 2.2 describe the set-up and safety procedures for mobile cranes, including:
 - 2.2.1 responsibilities
 - 2.2.2 ground conditions
 - 2.2.3 crane levelling
 - 2.2.4 outriggers and stabilizers
 - 2.2.5 sweep area and quadrants
 - 2.2.6 load distance changes over the quadrants
 - 2.2.7 outrigger pressure points

- 2.2.8 factors that reduce the rated capacity of a crane; e.g., crane, setup, hoisting/rigging operations, environment
- 2.2.9 electrical hazards (overhead power lines)
- 2.2.10 absolute limit of approach
- 2.2.11 load charts (capacity charts)
- 2.2.12 net capacity, gross capacity and capacity reductions
- 2.3 describe the electric overhead travelling cranes, including:
 - 2.3.1 electric overhead travelling motions
 - 2.3.2 electric overhead travelling controls; e.g., cab, pendant, remote
 - 2.3.3 operators and signalers
 - 2.3.4 pendant control
 - 2.3.5 electric overhead travelling crane hand signals; e.g., raise load, lower load, bridge travel, trolley travel, stop, emergency stop, multiple trolleys, move slowly
 - 2.3.6 operating safety precautions
- 2.4 describe electric overhead travelling crane inspection procedures, including:
 - 2.4.1 crane lockout procedures
 - 2.4.2 crane inspection; e.g., operator and maintenance
- 3. demonstrate basic competencies**
 - 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
 - 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
 - 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks
- 4. create a transitional strategy to accommodate personal changes and build personal values**
 - 4.1 identify short-term and long-term goals
 - 4.2 identify steps to achieve goals

COURSE MWA3405: MEASUREMENT

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students understand the terminology associated with limits and fits and apply this knowledge to the assembly of components through the use of measuring tools. Knowing how to use precision and non-precision measuring tools reliably is essential to correct layout and fabrication in the millwright trade.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Measuring 160102a; Measuring Tools – Part A 160102bA; Measuring Tools – Part B 160102bB

Outcomes: The student will:

1. describe measuring fundamentals for the millwright trade

- 1.1 describe measurement units, standards and systems, including:
 - 1.1.1 the units of measurement; e.g., metric, imperial-decimal, imperial-fraction
 - 1.1.2 mating parts terminology; e.g. nominal size, actual size, basic size, limits of size, upper limit, lower limit, maximum material condition (MMC), tolerance, unilateral tolerance, bilateral tolerance, limit dimension, allowance, fit and fit code
- 1.2 describe the effect of temperature change on the dimensions of objects being measured, with regard to various materials, including:
 - 1.2.1 temperature change
 - 1.2.2 coefficient of linear expansion
 - 1.2.3 standard measuring temperature
 - 1.2.4 temperature effects on measurements

2. demonstrate measuring procedures used in the millwright trade

- 2.1. describe basic measuring tools and their uses, including:
 - 2.1.1. types of graduations used; e.g., imperial inch fractions, imperial inch decimal, metric
 - 2.1.2. six-inch steel rules; e.g., spring tempered, flexible, narrow rule and hook
 - 2.1.3. short-line and long-line measuring tapes
 - 2.1.4. angular measurement
 - 2.1.5. plate protractors
 - 2.1.6. bevel protractors
 - 2.1.7. reading protractor scales
- 2.2. describe precision measuring tools and their uses, including:
 - 2.2.1. categories of precision measuring tools; e.g., outside instruments, inside instruments, depth instruments, height instruments
 - 2.2.2. vernier scale and universal bevel protractor
 - 2.2.3. precision calipers; e.g., vernier, dial, electronic
 - 2.2.4. height gauges; e.g., vernier, dial, electronic
 - 2.2.5. outside micrometer caliper
 - 2.2.6. combination inch-metric micrometer

- 2.2.7. electronic digital micrometer
- 2.2.8. using a micrometer
- 2.2.9. vernier micrometer
- 2.2.10. inside micrometer
- 2.2.11. intrimik
- 2.2.12. micrometer depth gauge
- 2.2.13. adjusting and calibrating micrometers
- 2.2.14. thickness gauges
- 2.2.15. taper gauges; e.g., leaf and shim styles
- 2.2.16. care of measuring tools
- 2.3. describe transfer measurement, including:
 - 2.3.1. transfer measurement using the transfer measuring tools; e.g., squares, drill size gauges, drill point gauges, radius gauges, calipers, telescope gauges, small hole gauges, surface finish indicators
- 2.4. describe measurement using dial indicators, including:
 - 2.4.1. dial indicators and dial gauges; e.g., dial test indicators, dial bore gauges, crankshaft deflection gauges
- 3. demonstrate basic competencies**
 - 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
 - 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
 - 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks
- 4. create a transitional strategy to accommodate personal changes and build personal values**
 - 4.1 identify short-term and long-term goals
 - 4.2 identify steps to achieve goals

COURSE MWA3410: LAYOUT

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students develop knowledge of the raw materials of the millwright trade and discover how to use precision and non-precision measuring tools reliably as an essential for correct layout and fabrication.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Layout 160102c; Metallurgy 160102d

Outcomes: The student will:

1. describe layout procedures and identify layout tools

- 1.1 describe tools used for layout procedures, including:
 - 1.1.1 surface plates and layout tables; e.g., cast-iron service plate, granite service plate
 - 1.1.2 scribes; e.g., pocket driver, double-end scriber, knife-end scriber
 - 1.1.3 divider and trammel
 - 1.1.4 hermaphrodite calipers; e.g., firm joint, lock joint with fine adjustment
 - 1.1.5 squares; e.g., solid square, combination square
 - 1.1.6 combination sets; e.g., square head, steel rule (blade), bevel protractor, centre head
 - 1.1.7 surface gauges
 - 1.1.8 height gauges; e.g., dial height gauge, electronic digital height gauge, vernier height gauge
 - 1.1.9 hammers
 - 1.1.10 prick and centre punches
 - 1.1.11 parallels
 - 1.1.12 v-blocks
 - 1.1.13 straightedges
 - 1.1.14 templates; e.g., anchor bolt template, pipe template, keyseat rule, keyseat clamp
 - 1.1.15 layout coatings (solutions); e.g., layout die (bluing), copper sulfate, vermilion powder and shellac, chalk, lime and alcohol
 - 1.1.16 toolmakers parallel clamps
- 1.2 demonstrate layout procedures, including:
 - 1.2.1 basic or semi-precision layout
 - 1.2.2 precision layout

2. describe composition and properties of metals

- 2.1 definition of a metal, including:
 - 2.1.1 ferrous metal
 - 2.1.2 non-ferrous metal
- 2.2 describe metals by visual appearance, colour, relative weight, typical shape and texture
- 2.3 describe the physical and mechanical properties of metals, including:
 - 2.3.1 hardness
 - 2.3.2 ductility

- 2.3.3 toughness
- 2.3.4 tensile strength
- 2.3.5 machinability
- 2.4 describe metal manufacturing processes, including:
 - 2.4.1 finishing of metal products
 - 2.4.2 structural steel shapes
 - 2.4.3 the steel-making process; e.g., hot-rolled steel, cold-rolled steel, turned, ground and polished shafting, cold-drawn wire and tubing, pipes and tubes, rounds, squares, flats, octagons and hexagons, sheet steel and steel plate
- 2.5 describe types and classifications of metals, including:
 - 2.5.1 classification of metals; e.g., carbon steel, alloy steel, tool steel, stainless steel, aluminum, copper, cast iron
 - 2.5.2 numbering systems for steel
- 2.6 describe the heat treatment of metals, considering:
 - 2.6.1 structure of steel
 - 2.6.2 heat treating processes; e.g., hardening, tempering, annealing, normalizing
- 2.7 describe tensile and hardness testing of metals, considering:
 - 2.7.1 hardness testing and tensile strength
 - 2.7.2 Rockwell hardness testing
 - 2.7.3 Brinell hardness testing
 - 2.7.4 tensile testing
- 2.8 describe chip, spark, file hardness and flame tests
- 2.9 describe use of mill test reports and metal specification tags
- 3. demonstrate basic competencies**
 - 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
 - 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
 - 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks
- 4. create a transitional strategy to accommodate personal changes and build personal values**
 - 4.1 identify short-term and long-term goals
 - 4.2 identify steps to achieve goals

COURSE MWA3415: PORTABLE TOOLS

- Level:** First Period Apprenticeship
- Prerequisite:** MWA3900: Apprenticeship Safety
- Description:** Students develop an understanding of versatile and essential pieces of portable equipment in all millwright shops, including how to safely operate and maintain.
- Parameters:** Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.
- ILM Resources:** Hand Tools – Part A 160103aA; Hand Tools – Part B 160103aB; Portable Power and Air Tools 160103b; Grinders 160103c; Power Saws 160103d.
- Outcomes:** The student will:

1. demonstrate use and maintenance of hand tools

- 1.1 describe hand-held tools used for performing bench-work procedures, including:
 - 1.1.1 hacksaws
 - 1.1.2 holesaws
 - 1.1.3 files; e.g., single-cut, double-cut, rasp and curved
 - 1.1.4 vises; e.g., bench and pipe
 - 1.1.5 hammers; e.g., ball-peen hammer, straight-peen hammer, cross-peen hammer, sledge hammer, soft-face hammer
 - 1.1.6 punches; e.g., centre and prick, automatic centre, pin, drift, transfer
 - 1.1.7 metal stamps
 - 1.1.8 screwdrivers; e.g., Allen, torx, Robertson, Frearson cross slot, Phillips cross slot, clutch, cabinet, standard, keystone or slotted
 - 1.1.9 wrenches; e.g., box-end, combination, open end, sockets, adjustable (Crescent), hexagon (Allen), torque, pipe, chain, strap, spanner, pin-faced, hammer
 - 1.1.10 pinch bars and pry bars
 - 1.1.11 pliers; e.g., tongue-and-groove, slip joint or combination, interlocking joint or water pump, lineman's, needle-nose, locking
 - 1.1.12 C-clamps
- 1.2 describe hydraulic jacks, pullers and presses, including:
 - 1.2.1 pullers; e.g., pressure screw, hydraulic, slide hammer, bar-style
 - 1.2.2 hydraulic jacks; e.g., porta-power, bottle
 - 1.2.3 hydraulic press
- 1.3 describe methods used for cleaning machine parts considering:
 - 1.3.1 safety
 - 1.3.2 cleaning methods; e.g., chemical and mechanical cleaning
- 1.4 describe the use of bonded abrasives in the process of hand lapping, including:
 - 1.4.1 abrasive products; e.g., abrasive discs, mounted grinding wheels, abrasive cloth, honing stones, lapping compound
 - 1.4.2 lapping
 - 1.4.3 lapping flat surfaces; e.g., roughing or blocking down plate, cast iron plate

- 1.5 describe care and use of taps and dies for:
 - 1.5.1 hand-held thread cutting tools; e.g., hand tap
 - 1.5.2 threading devices; e.g., adjustable split die (button die), adjustable screw plate die, solid die
- 1.6 describe care and use of hand reamers and broaches for:
 - 1.6.1 hand reamers; e.g., solid, expansion, adjustable, taper
 - 1.6.2 broaching
- 1.7 demonstrate maintenance and use of hand-held tools
- 2. demonstrate and maintain portable power and air tools**
 - 2.1 describe safety rules pertaining to portable power and air tools
 - 2.2 describe portable power tools, their operation, application and attachments, considering:
 - 2.2.1 portable power tools; e.g., ground fault ,interrupter, electric impact wrench, portable drills, hammers drills, angle grinders, die grinders
 - 2.2.2 types of wheels; e.g., wire wheels, buffing wheels, grinding discs, sanding discs, flap wheels,
 - 2.2.3 cordless portable power tools; e.g., batteries and chargers, drills, reciprocating saws
 - 2.3 describe air tools, components, their operation, application and attachments, including:
 - 2.3.1 air tool safety
 - 2.3.2 operating procedures; e.g., impact wrenches, abrasive tools, ratchets, air drills, air hammers, air chisels, related accessories
 - 2.3.3 public protection; e.g., compressed air hazards, projectile hazards, breathing hazards, noise hazards, vibration hazards, entanglement hazards, additional hazards
 - 2.3.4 temporary shutdowns
 - 2.3.5 components and principles of pneumatic tools; e.g., rotary, percussive and nozzle
 - 2.3.6 impacts, splined drives and ratchet wrenches
 - 2.3.7 percussive and reciprocating tools
 - 2.3.8 other pneumatic tools; e.g., nibblers, air riveters
 - 2.3.9 describe and maintain grinders
 - 2.4 describe safety rules pertaining to offhand grinder use
 - 2.5 describe operation, types, parts and application of offhand grinders, considering:
 - 2.5.1 hand grinding machines and parts; e.g., bench and pedestal (floor) grinders, exhaust tube, water pots, eye shields, wheel guards, tool rests, side wheel grinders, belt grinders
 - 2.5.2 types of wheels; e.g., wire wheels, buffing wheels, grinding discs, sanding discs, flap wheels
 - 2.6 describe grinding wheel selection, installation and maintenance procedures, including:
 - 2.6.1 properties and abrasives; e.g., hardness, heat resistance, toughness, friability, grain, bonds
 - 2.6.2 grinding wheel markings
 - 2.6.3 inspecting the wheel and grinder; e.g., speed, tool rest, spark guard adjustment, ring test
 - 2.6.4 safely installing and using the grinding wheel; e.g., dressing a wheel, truing a wheel, balancing a wheel
- 3. demonstrate and maintain power saws**
 - 3.1 describe power hacksaws, their operation, application and attachments, including:
 - 3.1.1 primary parts; e.g., roller guide brackets, variable speed drive or step pulley, frame, coolant tank, vise clamp handle, blade tension handle
 - 3.1.2 power hack saw blades; e.g., fully-hardened blades, bimetal blades
 - 3.1.3 blade parts; e.g., blade pitch, blade gauge, blade width, blade kerf, blade set
 - 3.1.4 blade installation
 - 3.2 describe band saws their operation, application and attachments, including:
 - 3.2.1 band saws and primary parts

- 3.2.2 mounting a blade
- 3.2.3 horizontal band saw (cut-off saw) use
- 3.2.4 coolants and cutting fluids
- 3.2.5 contour sawing and techniques; e.g., notching, slotting, angular cutting, splinting, three-dimensional shaping, internal contour sawing
- 3.2.6 choose the correct blade; e.g., blade material, tooth forms, set, speed and feed, contour
- 3.2.7 welding blades
- 3.2.8 friction sawing
- 3.3 describe abrasive cut-off saws, their operation, application and attachments, including:
 - 3.3.1 safety guidelines
 - 3.3.2 choosing an abrasive wheel; e.g., abrasive grit, bonding material
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE MWA3420: FASTENERS

- Level:** First Period Apprenticeship
- Prerequisite:** MWA3900: Apprenticeship Safety
- Description:** Students learn the standard of performance and recommended methods of installation and removal of many different fasteners and locking devices used in the millwright trade.
- Parameters:** Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.
- ILM Resources:** Explosive Actuated Tools 160103e; Threaded Fasteners and Locking Devices 160103f; Non-Threaded Fasteners and Locking Devices 160103g; Installation and Removal of Fasteners 160103h

Outcomes: The student will:

- 1. demonstrate explosive actuated tools, loads and fasteners**
 - 1.1. describe explosive actuated tool power loads, power load strength and safety requirements
 - 1.2. describe explosive actuated tool fasteners, accessories and applications, including:
 - 1.2.1. fastener types; e.g., drive pins, threaded studs, drive pin assemblies
 - 1.2.2. light and heavy duty fasteners
 - 1.2.3. applied loads; e.g., tension, shear, bending
 - 1.2.4. fastener applications
 - 1.3. assess base material suitability and related fastening requirements, including:
 - 1.3.1. base materials
 - 1.3.2. masonry/concrete
 - 1.3.3. steel
 - 1.4. describe explosive actuated system safety, firing procedure and tool maintenance
 - 1.5. demonstrate maintenance and use the explosive actuated tools
- 2. demonstrate use of threaded fasteners and locking devices**
 - 2.1 describe personal safety equipment required when working with fasteners and anchors, considering:
 - 2.1.1 clothing; e.g., personal protective equipment (PPE)
 - 2.1.2 good housekeeping
 - 2.2 describe threaded fasteners and locking devices and their applications, including:
 - 2.2.1 external threaded fasteners; e.g. machine bolts, cap screws
 - 2.2.2 internal threaded fasteners; e.g., nuts, mounting small tapered bore bearings
 - 2.2.3 threaded fastener size and finished designations; e.g., imperial thread designations, metric thread designations, unified thread designations, International Standards Organization (ISO) metric thread form
 - 2.2.4 machine screws; e.g., drive type, head style, thread designation
 - 2.2.5 set screws; e.g., hex, square, point style
 - 2.2.6 studs
 - 2.2.7 self-threading screws

- 2.2.8 other threaded fasteners, anchors and locking devices; e.g., lead screw anchors, expansion shields, toggle bolts, hollow wall screw anchors, lag screws, multi-jackbolt tension nuts, multi-jackbolt tension bolts, threaded inserts
- 2.3 describe metric and imperial thread classes and fits, considering:
 - 2.3.1 terminology; e.g., nominal size, maximum metal condition, allowance, fit, tolerance, limits of size, actual size
 - 2.3.2 unified thread classes
 - 2.3.3 tolerance classes for International Standards Organization (ISO) metric threads
 - 2.3.4 bolt head markings; e.g., grade, class, tensile strength
- 2.4. describe types and purposes of thread and thread forms including:
 - 2.4.1. external and internal threads
 - 2.4.2. parts of a screw thread
 - 2.4.3. screw thread forms
 - 2.4.4. thread standards
 - 2.4.5. taper threads
 - 2.4.6. American National Standard taper pipe thread form
- 2.5. describe thread measuring tools, methods and procedures, including:
 - 2.5.1. methods and devices for measuring and gauging threads; e.g., major diameter, thread pitch
 - 2.5.2. screw thread micrometer
 - 2.5.3. plug and ring gauges; e.g., problems with fixed gauges, snap gauges
- 3. describe use of non-threaded fasteners and locking devices**
 - 3.1 describe non-threaded fasteners and locking devices and their applications, including:
 - 3.1.1 rivets and blind fasteners; e.g., rivets, solid rivets, semi-tubular rivets, compression rivets, self-piercing rivets, tubular rivets, blind rivets, structural breakstem rivets, explosive rivets, lockbolt fasteners
 - 3.1.2 keys; e.g., square and flat keys, Pratt and Whitney Keys, chamfered keys, Woodruff keys, gib-head keys, splines
 - 3.1.3 pins; e.g., dowel pins, tapered dowel pins, shear pins, radial locking pins, spring slot pins, cotter pins, clevis pins, locking-type pins
 - 3.1.4 snap rings; e.g., self-locking rings, spiral-wound rings
 - 3.1.5 washers; e.g., washers, helical spring washers, internal and external tooth washers, tab washers, Bellville washers, beveled washers, flat metal locks
 - 3.1.6 straps; e.g., clamps, pallet strapping (banding), tie wraps, clips
 - 3.1.7 lock wires
 - 3.1.8 adhesives
- 4. explain the installation and removal of fasteners**
 - 4.1 describe the theory and methods of tensioning considering:
 - 4.1.1 tensioning theory and terminology; e.g., toughness, hardness, malleability, ductility, tension, compression, torque, elasticity and elastic limit, proof load, yield point, tensile strength, shear strength and preload
 - 4.1.2 nut design; e.g., wall dilation, thread shear, torquing stress, crushing
 - 4.1.3 nuts; e.g., nut strength, coarse and fine threads, stress variation in threads
 - 4.1.4 selecting hex nuts; e.g., nut materials, special function nuts,
 - 4.1.5 torque procedures; e.g., torque wrenches, torque multipliers, expansions and adapters
 - 4.1.6 hydraulic tensioning; e.g., bold instead heating, , multi-jackbolt tensioning ,ultrasonic measurement
 - 4.1.7 studs, fasteners and wire locking including; purpose, general rules, procedure, blind rivets, installation of lockbolts
 - 4.2 describe the removal of broken fasteners, including;

- 4.2.1 nut removal
- 4.2.2 removing broken studs
- 4.2.3 removing damaged fasteners
- 4.3 describe thread reconditioning, considering:
 - 4.3.1 external threads
 - 4.3.2 internal threads
 - 4.3.3 restoring thread inserts
- 5. demonstrate basic competencies**
 - 5.1 demonstrate fundamental skills to:
 - 5.1.1 communicate
 - 5.1.2 manage information
 - 5.1.3 use numbers
 - 5.1.4 think and solve problems
 - 5.2 demonstrate personal management skills to:
 - 5.2.1 demonstrate positive attitudes and behaviours
 - 5.2.2 be responsible
 - 5.2.3 be adaptable
 - 5.2.4 learn continuously
 - 5.2.5 work safely
 - 5.3 demonstrate teamwork skills to:
 - 5.3.1 work with others
 - 5.3.2 participate in projects and tasks
- 6. create a transitional strategy to accommodate personal changes and build personal values**
 - 6.1 identify short-term and long-term goals
 - 6.2 identify steps to achieve goals

COURSE MWA3425: DRILLING & MILLING

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students develop an understanding of versatile and essential pieces of equipment in all millwright shops, including how to safely operate and care for drills and milling machines.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Drilling 160104a; Milling 160104b

Outcomes: The student will:

1. demonstrate procedures for operating drilling machines

- 1.1 describe safety, types, components and applications of drilling machines, considering:
 - 1.1.1 safety first
 - 1.1.2 types of drilling machines; e.g., sensitive drill presses, upright drill presses, hand drills, magnetic base drills, radial drilling machines
 - 1.1.3 sizing a drill press
- 1.2 describe work holding and tool holding devices, including:
 - 1.2.1 holding devices; e.g., drill chucks, drill sleeves and sockets, quick change toolholders, power tapping attachments, floating reamer holders,
 - 1.2.2 work holding devices; e.g., vises, clamping sets, jigs
- 1.3 describe drilling tools and their applications, including:
 - 1.3.1 twist drills; e.g., shank, body, point
 - 1.3.2 specialty drills; e.g., high helix drills, core drills, oil hole drills, straight fluted drills, step drills, saw-type hole cutter, masonry drill, center drill
- 1.4 explain operation, speeds and feeds of drilling machines, including:
 - 1.4.1 drill press operations; e.g., drilling, countersinking, counterboring, tapping, hole sawing
 - 1.4.2 speed and feeds; e.g., cutting speed, feed rates
- 1.5 describe care and maintenance of drilling tools and machines, considering:
 - 1.5.1 grind a drill
 - 1.5.2 drill problems; e.g., discoloration, broken or split web, poor tool life, bell-mouth hole, out-of-round hole, excessive drilling pressure, drill chatter, squeals and jams, burr, blue chips, oversize hole
 - 1.5.3 care and maintenance of drilling machines

2. describe procedures for operating milling machines

- 2.1 describe safety, types, components and applications of milling machines, including:
 - 2.1.1 milling machine safety; e.g., clothing, machine controls, cutters, workpieces, setups, cleaning the machine
 - 2.1.2 knee and column milling machines; e.g., plain horizontal, universal horizontal, standard vertical, ram type vertical
 - 2.1.3 parts of a knee and column milling machines; e.g., base, column, overarm, saddle, knee, table, backlash eliminator

- 2.1.4 hand and power feed mechanisms
- 2.1.5 parts of a portable keyseat mill
- 2.2 describe milling tools and accessories and their applications, including:
 - 2.2.1 materials used for milling cutters; e.g., solid high-speed steel, solid carbide, carbide cutting edges brazed onto a solid shank, indexable inserts clamped into a holder
 - 2.2.2 cutters used on horizontal milling machines; e.g., arbor-mounted type
 - 2.2.3 cutters used for vertical milling machines; e.g., solid endmills, woodruff keyseat cutters, fly cutters
 - 2.2.4 toolholding devices; e.g., arbors, collet chucks, adapters
 - 2.2.5 workholding devices; e.g., vises, clamps, T-bolts and T-nuts, parallels, jackscrews, step blocks, shims, angle plates, v-blocks
- 2.3 explain the operation, speeds and feeds of milling machines, including:
 - 2.3.1 cutting speed
 - 2.3.2 feed rate for milling cutter
 - 2.3.3 depth of cut
 - 2.3.4 conventional and climb milling
 - 2.3.5 setting up for milling operations; e.g., aligning the vertical milling head, aligning a vise using keys, dialing a vise
 - 2.3.6 face milling; e.g., setting up for a face milling
 - 2.3.7 keyseats; e.g., 3 styles, depth of keyseat, length of keyseat, centring the shaft under the cutter, cutting a keyseat with a side milling cutter, cutting a blind keyseat with an endmill, cutting a woodruff keyseat
 - 2.3.8 counterboring and spot facing
- 2.4 describe maintenance of milling machines, including:
 - 2.4.1 care and maintenance of milling machines
 - 2.4.2 care and handling of milling cutters
- 3. demonstrate basic competencies**
 - 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
 - 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
 - 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks
- 4. create a transitional strategy to accommodate personal changes and build personal values**
 - 4.1 identify short-term and long-term goals
 - 4.2 identify steps to achieve goals

COURSE MWA3430: LATHE INTRODUCTION

- Level:** First Period Apprenticeship
- Prerequisite:** MWA3900: Apprenticeship Safety
- Description:** Students will learn how to use a lathe and lathe accessories to help make better choices when approaching a job.
- Parameters:** Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journeyperson certification in the millwright trade.
- ILM Resources:** Lathe Components and Accessories 160104c
- Outcomes:** The student will:

1. describe lathe components and accessories

- 1.1 describe lathe safety
- 1.2 describe construction of lathes (engine lathe), including:
 - 1.2.1 sizing a lathe
 - 1.2.2 horsepower and weight of machines
 - 1.2.3 parts of a lathe; e.g., the bed, the ways, the headstock, the back gears, the quick-change gearbox, the lead screw, feed rod and rack, the carriage and the tailstock
 - 1.2.4 lathe controls
- 1.3 describe work holding and tool holding devices, including:
 - 1.3.1 work holding devices; e.g., holding work between centres, holding work in a chuck, holding work on faceplates, mandrels, catheads, spiders
 - 1.3.2 cutting toolholders; e.g., cutting off (parting) toolholders, boring bars and their holders
 - 1.3.3 tool posts; e.g., square quick-change, multi-position quick-change
- 1.4 describe lathe accessories, including:
 - 1.4.1 steady rest
 - 1.4.2 follower rest
 - 1.4.3 taper attachment
 - 1.4.4 tool post grinder
 - 1.4.5 thread chasing dial
- 1.5 describe cutting and forming tools and sharpening procedures, including:
 - 1.5.1 cutting tools; e.g., forming tools, knurling tools
 - 1.5.2 tool sharpening
- 1.6 describe lathe maintenance, including:
 - 1.6.1 cleaning
 - 1.6.2 oiling
- 1.7 describe the application of tapers, including:
 - 1.7.1 taper applications; e.g., cutting tool shanks (Morse), wedges, machine tool spindles (Morse and Steep machine tapers), tapered mandrills and arbors, taper pins, tapered gib-head keys
 - 1.7.2 parts of the taper; e.g., large diameter, small diameter, length
 - 1.7.3 measuring tapers

- 1.8 describe manufacture and repairs of tapers, including:
 - 1.8.1 using the tailstock offset for cutting a taper
 - 1.8.2 using a taper attachment
 - 1.8.3 compound rest
 - 1.8.4 form tool
- 2. demonstrate basic competencies**
 - 2.1 demonstrate fundamental skills to:
 - 2.1.1 communicate
 - 2.1.2 manage information
 - 2.1.3 use numbers
 - 2.1.4 think and solve problems
 - 2.2 demonstrate personal management skills to:
 - 2.2.1 demonstrate positive attitudes and behaviours
 - 2.2.2 be responsible
 - 2.2.3 be adaptable
 - 2.2.4 learn continuously
 - 2.2.5 work safely
 - 2.3 demonstrate teamwork skills to:
 - 2.3.1 work with others
 - 2.3.2 participate in projects and tasks
- 3. create a transitional strategy to accommodate personal changes and build personal values**
 - 3.1 identify short-term and long-term goals
 - 3.2 identify steps to achieve goals

COURSE MWA3435: LATHE OPERATION

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students learn to effectively machine workpieces in a lathe. They learn the various operations and proper speeds and feeds and discover that following these practices will greatly improve efficiency and safety.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Lathe Operations 160104d

Outcomes: The student will:

1. demonstrate procedures for operating lathes

- 1.1 describe lathe turning operations, including:
 - 1.1.1 cutting speeds
 - 1.1.2 feed rates
 - 1.1.3 turning tools
 - 1.1.4 remove backlash
 - 1.1.5 roughing cuts
 - 1.1.6 finishing cuts
 - 1.1.7 facing
 - 1.1.8 parting off
- 1.2 describe lathe drilling, boring and reaming operations, considering:
 - 1.2.1 drilling
 - 1.2.2 boring
 - 1.2.3 reaming
- 1.3 describe lathe threading operations, including:
 - 1.3.1 quick-change gearboxes
 - 1.3.2 cut depth
 - 1.3.3 thread-chasing dial
- 1.4 describe lathe polishing, knurling and grinding operations, including:
 - 1.4.1 finishing; e.g., files, emery cloth
 - 1.4.2 knurling; e.g., diamond, straight
 - 1.4.3 grinding
- 1.5 describe application for cutting fluid, including:
 - 1.5.1 cutting fluid characteristics
 - 1.5.2 cutting fluid types
 - 1.5.3 potential health hazards

2. demonstrate basic competencies

- 2.1 demonstrate fundamental skills to:
 - 2.1.1 communicate
 - 2.1.2 manage information
 - 2.1.3 use numbers
 - 2.1.4 think and solve problems

- 2.2 demonstrate personal management skills to:
 - 2.2.1 demonstrate positive attitudes and behaviours
 - 2.2.2 be responsible
 - 2.2.3 be adaptable
 - 2.2.4 learn continuously
 - 2.2.5 work safely
- 2.3 demonstrate teamwork skills to:
 - 2.3.1 work with others
 - 2.3.2 participate in projects and tasks
- 3. create a transitional strategy to accommodate personal changes and build personal values**
 - 3.1 identify short-term and long-term goals
 - 3.2 identify steps to achieve goals

COURSE MWA3440: MACHINE INSTALLATION

Level:	First Period Apprenticeship
Prerequisite:	MWA3900: Apprenticeship Safety
Description:	Students learn how to install millwright equipment to be grouted, levelled and aligned correctly to design specifications in order to prevent premature equipment failure.
Parameters:	Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.
ILM Resources:	Grouting, Levelling and Anchoring 160105a; Rim and Face Shaft Alignment 160105b
Outcomes:	The student will:

1. describe machine levelling and grouting procedures

- 1.1 describe levelling tools, equipment and procedures, including:
 - 1.1.1 basic levelling devices; e.g., master precision level, precision level, bench and carpenter levels, plumb bob, wire alignment, straight edge
 - 1.1.2 mounting methods; e.g., baseplate mounting, sole plate mounting, levelling feet, wedges and shims, vibration isolators
 - 1.1.3 layout procedures; e.g., site preparation, templates, reference lines, installing anchor bolts in concrete
 - 1.1.4 levelling
- 1.2 describe types, purposes and procedures for grouting, including:
 - 1.2.1 cement-based grout
 - 1.2.2 polymeric grout
 - 1.2.3 grouting procedure
- 1.3 describe types of anchors and installation procedures, including:
 - 1.3.1 fixed anchor bolt
 - 1.3.2 grouted anchor bolt
 - 1.3.3 flexible anchor bolt
 - 1.3.4 boxed anchor bolt
 - 1.3.5 expansion bolt, drop-in anchor bolt
 - 1.3.6 adhesive anchor bolt

2. demonstrate rim and face shaft alignment

- 2.1 describe the reasons for aligning machine shafts, including:
 - 2.1.1 types of misalignment; e.g., offset, angular, combination
 - 2.1.2 couplings; e.g., rigid couplings, flexible couplings
 - 2.1.3 seals; e.g., lip seals, labyrinth seals, mechanical seals
 - 2.1.4 bearings
 - 2.1.5 vibration
 - 2.1.6 down time
 - 2.1.7 alignment accuracies

- 2.2 describe pre-alignment procedures; e.g., work permit, lockout, hazard assessment, foundation, base, hardware, pipe strain, soft foot, run out, end float, tools, dial bar sag
- 2.3 describe rim and face method of shaft alignment, considering:
 - 2.3.1 rim and face machine shaft alignment; e.g., straightedge alignment
 - 2.3.2 dial readings; e.g., initial horizontal alignment, formula application, calculating horizontal moves
- 2.4 demonstrate procedures to align two machine shafts using the rim and face formula method; e.g., calculating alignment tolerance
- 3. demonstrate basic competencies**
 - 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
 - 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
 - 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks
- 4. create a transitional strategy to accommodate personal changes and build personal values**
 - 4.1 identify short-term and long-term goals
 - 4.2 identify steps to achieve goals

COURSE MWA3445: NUMBERS

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students demonstrate fundamental mathematical concepts commonly used in the millwright trade, including whole numbers, integers, calculations, fractions and algebra.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Working with Numbers 160106a; Fractions and Decimals 160106b; Algebra 160106c

Outcomes: The student will:

1. perform mathematical operations with whole numbers

- 1.1 read whole numbers by using place values and perform rounding operations
- 1.2 perform addition and subtraction with whole numbers
- 1.3 perform multiplication and division with whole numbers
- 1.4 identify signed numbers and perform operations with such numbers, including:
 - 1.4.1 working with positive and negative numbers
 - 1.4.2 addition and subtraction with positive and negative numbers
 - 1.4.3 multiplication and division with positive and negative numbers

2. solve problems involving fractions and decimals

- 2.1 identify key terms and concepts when working with fractions, including:
 - 2.1.1 term
 - 2.1.2 numerator (dividend)
 - 2.1.3 denominator (divisor)
 - 2.1.4 fraction
 - 2.1.5 common fraction
 - 2.1.6 proper fraction
 - 2.1.7 improper fraction
 - 2.1.8 mixed number
 - 2.1.9 common denominator
 - 2.1.10 common factor
 - 2.1.11 relative size of fraction
 - 2.1.12 equivalent fraction
 - 2.1.13 prime number
 - 2.1.14 reciprocals
- 2.2 change fractions to common denominations
- 2.3 solve problems using fractions and mixed numbers by:
 - 2.3.1 changing fractions to higher terms
 - 2.3.2 changing fractions to lowest terms
 - 2.3.3 changing mixed numbers to improper fractions
 - 2.3.4 changing improper fractions to mixed numbers

- 2.3.5 adding fractions and mixed numbers
- 2.3.6 subtracting fractions and mixed numbers
- 2.3.7 multiplying fractions and mixed number
- 2.3.8 dividing fractions and mixed numbers
- 2.4 solve problems using decimal fractions and decimal numbers
- 2.5 round decimal numbers to specified place values
- 2.6 convert between decimal numbers and fractions
- 3. perform mathematical operations using algebra**
 - 3.1 describe algebraic functions; e.g., equation, formula, constant, variable, term, solution
 - 3.2 demonstrate the order of operations using BEDMAS (brackets, exponents, division, multiplication, addition, subtraction)
 - 3.3 solve problems using algebraic formulas
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE MWA3450: MATHEMATICS

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety
MWA3445: Numbers

Description: Students demonstrate fundamental mathematical problem-solving abilities commonly used in the millwright trade, including measurement and conversions, ratio and proportion, graphs, tables, triangles and trigonometry.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Measurement and Conversions 160106d; Ratio and Proportion, Graphs and Tables 160106e; Introduction to Triangles and Trigonometry 160106f

Outcomes: The student will:

1. solve problems involving measurement and conversion

- 1.1. describe systems for linear, angular, weight and capacity measurement
- 1.2. describe geometric shapes used in the millwright trade, including:
 - 1.2.1. rectangle
 - 1.2.2. square
 - 1.2.3. triangle
 - 1.2.4. trapezoid
 - 1.2.5. parallelogram
 - 1.2.6. circle
- 1.3. describe formulas and solve problems for perimeter
- 1.4. describe formulas and solve problems for area
- 1.5. describe formulas and solve problems for volume and capacity
- 1.6. describe formulas and solve problems for weight
- 1.7. convert between imperial and metric

2. solve problems using ratio and percentage, graphs and tables

- 2.1. describe two quantities in the form of a ratio, including:
 - 2.1.1. converting to like units
 - 2.1.2. reducing the ratio
- 2.2. solve problems using ratio and proportion, including:
 - 2.2.1. direct proportion
 - 2.2.2. indirect proportion
 - 2.2.3. proportional form
- 2.3. convert between fractions, decimals, ratios and percents, including:
 - 2.3.1. converting a fraction to a percent
 - 2.3.2. converting a percent to a fraction
 - 2.3.3. converting a decimal to a percent
 - 2.3.4. converting a percent to a decimal
 - 2.3.5. converting a ratio to a percent
 - 2.3.6. converting a percent to a ratio
 - 2.3.7. solving percent problems

- 2.4. solve problems using taper ratios and systems
- 2.5. interpret information in tables graphs and charts, including:
 - 2.5.1. tables; e.g., tables without units, use tables in reverse, use formulas with tables, extend the use of tables, combine the information in the table, memorize data from tables, difficulties in using tables
 - 2.5.2. graphs; e.g., line graphs, bar graphs, circle graphs and nomographs
- 3. solve problems involving special triangles and elementary trigonometry**
 - 3.1 identify key terms and concepts when working with triangles and trigonometry; e.g., angle, acute angle, obtuse angle, right angle, triangle, right triangle, equilateral triangle, isosceles triangle, oblique triangle, scalene triangle
 - 3.2 identify special triangles and solve problems using related formulas
 - 3.3 identify the Pythagorean theory and use it to solve problems
 - 3.4 identify the parts of a triangle and demonstrate trigonometric formulas to solve problems, including:
 - 3.4.1 hypotenuse, opposite, adjacent
 - 3.4.2 sine, cosine, tangent
- 4. demonstrate basic competencies**
 - 4.1 demonstrate fundamental skills to:
 - 4.1.1 communicate
 - 4.1.2 manage information
 - 4.1.3 use numbers
 - 4.1.4 think and solve problems
 - 4.2 demonstrate personal management skills to:
 - 4.2.1 demonstrate positive attitudes and behaviours
 - 4.2.2 be responsible
 - 4.2.3 be adaptable
 - 4.2.4 learn continuously
 - 4.2.5 work safely
 - 4.3 demonstrate teamwork skills to:
 - 4.3.1 work with others
 - 4.3.2 participate in projects and tasks
- 5. create a transitional strategy to accommodate personal changes and build personal values**
 - 5.1 identify short-term and long-term goals
 - 5.2 identify steps to achieve goals

COURSE MWA3455: PRINT READING

Level: First Period Apprenticeship

Prerequisite: MWA3900: Apprenticeship Safety

Description: Students understand and interpret a variety of drawing techniques to illustrate parts that are difficult to visualize and to show the interior portions of complex machine parts. They learn to read and understand the instructions on working drawings regarding the proper sizing, work and fit of machine parts.

Parameters: Access to a material work centre, complete with basic millwright tools and materials, and to instruction from an individual with journey person certification in the millwright trade.

ILM Resources: Sketches, Drawing and Prints – Part A 160106gA; Sketches, Drawing and Prints – Part B 160106gB; Limits, Fits and Tolerances 160106h

Outcomes: The student will:

1. interpret prints, drawings and sketches

- 1.1 describe the six planes of an orthographic projection and the key view
- 1.2 describe first and third angle projection and recognize the ISO symbol for each projection, including:
 - 1.2.1 first and third angle projection
 - 1.2.2 top and right side views
 - 1.2.3 distance between views
 - 1.2.4 ISO projection symbols
- 1.3 describe three types of pictorial views, including:
 - 1.3.1 perspective
 - 1.3.2 oblique
 - 1.3.3 isometric
- 1.4 describe the types of lines used on prints and their application, including:
 - 1.4.1 object or visible line
 - 1.4.2 centre line
 - 1.4.3 hidden line
 - 1.4.4 dimension line
 - 1.4.5 extension line
 - 1.4.6 leader line
 - 1.4.7 cutting plane (viewing plane) lines
 - 1.4.8 phantom line
- 1.5 describe the application of text and dimensions to a drawing, including:
 - 1.5.1 text on drawings
 - 1.5.2 dimensions on drawings; e.g., holes, shafts, arcs, counterbores, countersinks, spotfaces, chamfers, keyseats and keyways, threads, springs, bearings
- 1.6 describe the methods used to express the amount of taper on a component drawing, including:
 - 1.6.1 taper length, taper, taper per foot, taper per inch, taper ratio, centerline angle (CLA)

- 1.7 describe the use of sectional views on a drawing, including:
 - 1.7.1 cutting plane lines; e.g., break lines, symmetry
 - 1.7.2 sectional drawings; e.g., full, half, removed, revolved, broken out, offset, aligned
 - 1.7.3 sectional view lines: e.g., steel, cast iron, general purpose, aluminum, aluminum alloys, magnesium, brass, copper, bronze, plastic, rubber, wood, lead, zinc, Babbitt
- 1.8 identify structural steel shapes and know how they are specified, including:
 - 1.8.1 standard beam (S)
 - 1.8.2 wide flange shape (W)
 - 1.8.3 miscellaneous shape (M)
 - 1.8.4 welded wide flange (WWF)
 - 1.8.5 standard channel (C)
 - 1.8.6 miscellaneous channel (MC)
 - 1.8.7 equal leg angle (L)
 - 1.8.8 unequal leg angle (L)
 - 1.8.9 welded wide flange tee (WWT)
 - 1.8.10 wide flange tee (WT)
 - 1.8.11 miscellaneous tee (MT)
 - 1.8.12 Z shape (Z)
 - 1.8.13 hollow structural section (HSS rectangles) (HSS square) (HSS round)
- 1.9 read dimensions on prints in both metric and imperial systems and dual dimensioning, including:
 - 1.9.1 units of measurement; e.g., metric, imperial fraction, imperial decimal
 - 1.9.2 dimensioning; e.g., unidirectional dimensioning, aligned dimensioning, dual dimensioning
- 1.10 calculate for missing dimensions on a drawing
- 1.11 demonstrate basic sketching
- 2. read, interpret and sketch machine shop drawings containing advanced terminology**
 - 2.1 describe limits and tolerances for parts on working drawings, considering:
 - 2.1.1 basic size
 - 2.1.2 tolerance
 - 2.1.3 limits of size
 - 2.2 describe allowances and fits for mating parts on working drawings, considering:
 - 2.2.1 allowance
 - 2.2.2 maximum material condition (MMC)
 - 2.2.3 fit; e.g., clearance fit, interference fit, transition fit
 - 2.3 describe the systems of fits in imperial and metric SI terms, including:
 - 2.3.1 standard thread fits
 - 2.3.2 metric thread fits
 - 2.4 apply all dimensions and tolerances to a set of working drawings
 - 2.5 interpret prints including all information generally provided on prints, shop drawings and sketches by:
 - 2.5.1 interpreting drawings
 - 2.5.2 surface texture
 - 2.5.3 machining symbols
 - 2.5.4 dimensions
- 3. demonstrate basic competencies**
 - 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems

- 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks
- 4. create a transitional strategy to accommodate personal changes and build personal values**
 - 4.1 identify short-term and long-term goals
 - 4.2 identify steps to achieve goals

COURSE MWA3460: MWA PRACTICUM A

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
 - 1.1 identify regulations and regulatory bodies related to the credential
 - 1.2 describe personal roles and responsibilities, including:
 - 1.2.1 key responsibilities
 - 1.2.2 support functions/responsibilities
 - 1.2.3 code of ethics
 - 1.3 describe personal work responsibilities and categorize them as:
 - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
 - 1.3.2 non-routine tasks; e.g., emergencies
 - 1.3.3 tasks requiring personal judgement
 - 1.3.4 tasks requiring approval of a supervisor
2. **analyze personal performance in relation to established standards**
 - 2.1 evaluate his or her application of competencies developed in related CTS courses
 - 2.2 evaluate standards of performance in terms of:
 - 2.2.1 quality of work
 - 2.2.2 quantity of work
 - 2.3 evaluate his or her adherence to workplace policies and procedures related to health and safety
 - 2.4 evaluate the work environment in terms of:
 - 2.4.1 location
 - 2.4.2 floor plan of work area
 - 2.4.3 analysis of workflow patterns

- 2.5 evaluate a professional in a related occupation in terms of:
 - 2.5.1 training and certification
 - 2.5.2 interpersonal skills
 - 2.5.3 technical skills
 - 2.5.4 professional ethics

3. demonstrate basic competencies

- 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
- 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks

COURSE MWA3465: MWA PRACTICUM B

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journey person certification or an experienced professional with journey person certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
 - 1.1 identify regulations and regulatory bodies related to the credential
 - 1.2 describe personal roles and responsibilities, including:
 - 1.2.1 key responsibilities
 - 1.2.2 support functions/responsibilities
 - 1.2.3 code of ethics
 - 1.3 describe personal work responsibilities and categorize them as:
 - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
 - 1.3.2 non-routine tasks; e.g., emergencies
 - 1.3.3 tasks requiring personal judgement
 - 1.3.4 tasks requiring approval of a supervisor
2. **analyze personal performance in relation to established standards**
 - 2.1 evaluate his or her application of competencies developed in related CTS courses
 - 2.2 evaluate standards of performance in terms of:
 - 2.2.1 quality of work
 - 2.2.2 quantity of work
 - 2.3 evaluate his or her adherence to workplace policies and procedures related to health and safety
 - 2.4 evaluate the work environment in terms of:
 - 2.4.1 location
 - 2.4.2 floor plan of work area
 - 2.4.3 analysis of workflow patterns

- 2.5 evaluate a professional in a related occupation in terms of:
 - 2.5.1 training and certification
 - 2.5.2 interpersonal skills
 - 2.5.3 technical skills
 - 2.5.4 professional ethics

3. demonstrate basic competencies

- 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
- 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks

COURSE MWA3470: MWA PRACTICUM C

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
 - 1.1 identify regulations and regulatory bodies related to the credential
 - 1.2 describe personal roles and responsibilities, including:
 - 1.2.1 key responsibilities
 - 1.2.2 support functions/responsibilities
 - 1.2.3 code of ethics
 - 1.3 describe personal work responsibilities and categorize them as:
 - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
 - 1.3.2 non-routine tasks; e.g., emergencies
 - 1.3.3 tasks requiring personal judgement
 - 1.3.4 tasks requiring approval of a supervisor
2. **analyze personal performance in relation to established standards**
 - 2.1 evaluate his or her application of competencies developed in related CTS courses
 - 2.2 evaluate standards of performance in terms of:
 - 2.2.1 quality of work
 - 2.2.2 quantity of work
 - 2.3 evaluate his or her adherence to workplace policies and procedures related to health and safety
 - 2.4 evaluate the work environment in terms of:
 - 2.4.1 location
 - 2.4.2 floor plan of work area
 - 2.4.3 analysis of workflow patterns

- 2.5 evaluate a professional in a related occupation in terms of:
 - 2.5.1 training and certification
 - 2.5.2 interpersonal skills
 - 2.5.3 technical skills
 - 2.5.4 professional ethics

3. demonstrate basic competencies

- 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
- 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks

COURSE MWA3475: MWA PRACTICUM D

Level: First Period Apprenticeship

Prerequisite: None

Description: Students, on the work site, continue to develop and refine those competencies developed in related Career and Technology Studies (CTS) occupational areas, previous practicums and other experiences.

Parameters: This course should be accessed only by students continuing to work toward attaining a recognized credential offered by an agency external to the school. Practicum courses extend the competencies developed in related CTS occupational areas. The practicum courses may not be delivered as stand-alone courses and may not be combined with core courses. This course may not be used in conjunction with Registered Apprenticeship Program courses. This practicum course may be delivered on- or off-campus. Instruction must be delivered by a qualified teacher with journeyperson certification or an experienced professional with journeyperson certification, who is under the supervision of the qualified teacher; both must be authorized to supervise trainees for the external credential.

Outcomes: The student will:

1. **perform assigned tasks and responsibilities efficiently and effectively, as required by the agency granting credentials**
 - 1.1 identify regulations and regulatory bodies related to the credential
 - 1.2 describe personal roles and responsibilities, including:
 - 1.2.1 key responsibilities
 - 1.2.2 support functions/responsibilities
 - 1.2.3 code of ethics
 - 1.3 describe personal work responsibilities and categorize them as:
 - 1.3.1 routine tasks; e.g., daily, weekly, monthly, yearly
 - 1.3.2 non-routine tasks; e.g., emergencies
 - 1.3.3 tasks requiring personal judgement
 - 1.3.4 tasks requiring approval of a supervisor
2. **analyze personal performance in relation to established standards**
 - 2.1 evaluate his or her application of competencies developed in related CTS courses
 - 2.2 evaluate standards of performance in terms of:
 - 2.2.1 quality of work
 - 2.2.2 quantity of work
 - 2.3 evaluate his or her adherence to workplace policies and procedures related to health and safety
 - 2.4 evaluate the work environment in terms of:
 - 2.4.1 location
 - 2.4.2 floor plan of work area
 - 2.4.3 analysis of workflow patterns

- 2.5 evaluate a professional in a related occupation in terms of:
 - 2.5.1 training and certification
 - 2.5.2 interpersonal skills
 - 2.5.3 technical skills
 - 2.5.4 professional ethics

3. demonstrate basic competencies

- 3.1 demonstrate fundamental skills to:
 - 3.1.1 communicate
 - 3.1.2 manage information
 - 3.1.3 use numbers
 - 3.1.4 think and solve problems
- 3.2 demonstrate personal management skills to:
 - 3.2.1 demonstrate positive attitudes and behaviours
 - 3.2.2 be responsible
 - 3.2.3 be adaptable
 - 3.2.4 learn continuously
 - 3.2.5 work safely
- 3.3 demonstrate teamwork skills to:
 - 3.3.1 work with others
 - 3.3.2 participate in projects and tasks

COURSE MWA3900: APPRENTICESHIP SAFETY

Level:	First Period Apprenticeship
Prerequisite:	None
Description:	Students develop knowledge, skills and attitudes in the practice of workshop health and safety, communication and career planning.
Parameters:	Access to a materials work centre and to instruction from an individual with specialized training in Occupational Health and Safety (and understanding of the Millwright industry) and/or a Millwright.
ILM Resources:	Safety Legislation, Regulations and Industry Policy in the Trades 650101a; Climbing, Lifting, Rigging and Hoisting 650101b; Hazardous Materials and Fire Protection 650101c; Communication 090101d
Note:	This course may promote discussions around sensitive topics (e.g., injury and death) in the context of student safety with respect to workplace hazards.
Outcomes:	The student will:

- 1. describe legislation, regulations and practices intended to ensure a safe workplace in the millwright apprenticeship trade**
 - 1.1 demonstrate the ability to apply the *Occupational Health and Safety (OHS) Act, Regulation and Code*, as well as the changes from Bill C-45
 - 1.2 explain the core requirements applicable to all industries, including:
 - 1.2.1 engineering controls
 - 1.2.2 administrative controls
 - 1.2.3 personal protective equipment (PPE)
 - 1.3 demonstrate an understanding of the 26 parts of the OHS Code requirements applicable to all industries
 - 1.4 demonstrate an understanding of the 12 parts of the OHS Code requirements applicable to specific industries and activities
 - 1.5 demonstrate an understanding of the 11 OHS Code Schedules that the Explanation Guide does not address
 - 1.6 explain the role of the employer and employee in regard to occupational health and safety legislation, considering:
 - 1.6.1 employer responsibilities (OHS Regulation)
 - 1.6.2 employee responsibilities (OHS Regulation)
 - 1.6.3 Workplace Hazardous Materials Information System (WHMIS)
 - 1.6.4 fire regulations
 - 1.6.5 Workers' Compensation Board (WCB)
 - 1.6.6 related advisory bodies and agencies; e.g., Alberta Construction Safety Association (ACSA), Construction Owners Association of Alberta (COAA), Occupational Health and Safety Council (OHSC), Work Safe Alberta, Safety Codes Council
 - 1.7 explain industry practices for hazard assessment and control procedures in four main hazard categories, including:
 - 1.7.1 biological
 - 1.7.2 chemical

- 1.7.3 ergonomic
- 1.7.4 physical hazards
- 1.8 identify and describe hazard assessment tools that both employees and employers must use in assessing and controlling work site hazards, including:
 - 1.8.1 worksite hazard identification and assessment
 - 1.8.2 health and safety plan
 - 1.8.3 joint work site health and safety committee
 - 1.8.4 emergency response plans
 - 1.8.5 first-aid and incident reports
- 1.9 identify and describe employer engineering controls that provide the highest level of worker protection, including:
 - 1.9.1 elimination
 - 1.9.2 substitution
 - 1.9.3 redesign
 - 1.9.4 isolation
 - 1.9.5 automation
- 1.10 identify and describe employer administrative controls that limit hazards to the lowest level possible, including:
 - 1.10.1 safe work practices
 - 1.10.2 job procedures, policies and rules
 - 1.10.3 work/rest schedules to reduce exposure
 - 1.10.4 limiting hours of work
 - 1.10.5 scheduling hazardous work during non-peak times
 - 1.10.6 using optional methods; e.g., wet sanding as opposed to dry sanding or sweeping
- 1.11 describe the responsibilities of employees and employers to apply emergency procedures, including:
 - 1.11.1 emergency response plans
 - 1.11.2 first aid
- 1.12 describe positive tradesperson attitudes with respect to legal responsibilities for all workers, including:
 - 1.12.1 housekeeping
 - 1.12.2 lighting
 - 1.12.3 personal protective equipment (PPE)
 - 1.12.4 emergency procedures
- 1.13 describe the roles and responsibilities of employers and employees with respect to the selection and use of personal protective equipment (PPE), including:
 - 1.13.1 eye protection; e.g., class 1 (spectacles), class 2 (goggles), class 3 (welding helmets), class 4 (welding hand shields), class 5 (hoods), class 6 (face shields), class 7 (respirator face pieces)
 - 1.13.2 flame resistant clothing
 - 1.13.3 foot protection; e.g., category 1, 2 or 3 footwear requirements
 - 1.13.4 head protection; e.g., class G (general), class E (electrical), class C (conducting)
 - 1.13.5 hearing protection; e.g., earplugs or earmuffs
 - 1.13.6 life jackets and personal flotation devices (PFDs)
 - 1.13.7 limb and body protection
 - 1.13.8 respiratory protective equipment; e.g., particulate filters; chemical cartridges or canisters; airline respirators, hoods, helmets and suits; self-contained breathing apparatus (SCBA)
 - 1.13.9 a combination of any of the above

2. describe the use of personal protective equipment (PPE) and safe practices for climbing, lifting, rigging and hoisting in the millwright apprenticeship trade

- 2.1 select, use and maintain specialized PPE and materials for climbing, lifting and loading, including:
 - 2.1.1 full body harness
 - 2.1.2 body belt
 - 2.1.3 ladders
 - 2.1.4 scaffold systems
 - 2.1.5 lifting and moving equipment
 - 2.1.6 PPE for lifting
 - 2.1.7 materials handling equipment; e.g., forklift, four-wheel dolly, chain hoist, overhead crane
- 2.2 describe manual lifting procedures, including correct body mechanics, considering:
 - 2.2.1 back safety
 - 2.2.2 general procedure for lifting
 - 2.2.3 employer and employee preventive actions to avoid back injuries
- 2.3 describe rigging hardware and the safe work load associated with:
 - 2.3.1 wire rope slings
 - 2.3.2 synthetic fibre web slings
 - 2.3.3 chain slings
 - 2.3.4 rigging hardware inspection
- 2.4 select the correct equipment for rigging typical loads, including:
 - 2.4.1 eye bolts
 - 2.4.2 shackles
 - 2.4.3 rings and links
 - 2.4.4 hooks
 - 2.4.5 swivels
 - 2.4.6 spreader bars and equalization beams
 - 2.4.7 blocks
 - 2.4.8 sheaves
 - 2.4.9 turnbuckles
- 2.5 describe hoisting and load-moving procedures
- 2.6 explain the most commonly used sling configurations to connect a load to a hook, including:
 - 2.6.1 vertical hitch
 - 2.6.2 bridle hitch
 - 2.6.3 single and double basket hitch
 - 2.6.4 wrap hitch
 - 2.6.5 single and double choker hitch
- 2.7 demonstrate the standard movement signals a signaler is required to know to signal a crane operator, including:
 - 2.7.1 hoist and lower load
 - 2.7.2 raise and lower boom
 - 2.7.3 swing boom
 - 2.7.4 stop
 - 2.7.5 emergency stop
 - 2.7.6 dog everything

3. describe the safety practices for hazardous materials and fire protection in the millwright apprenticeship trade

- 3.1 describe the roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program, including:
 - 3.1.1 suppliers', employers' and employees' responsibilities
 - 3.1.2 WHMIS classifications
 - 3.1.3 health effects from exposure to chemicals
- 3.2 describe the three key elements of WHMIS, including:
 - 3.2.1 worker education
 - 3.2.2 supplier and workplace product labelling
 - 3.2.3 material safety data sheets
- 3.3 describe handling, storage and transportation procedures when dealing with hazardous material, including:
 - 3.3.1 handling, storing and transporting flammable liquids
 - 3.3.2 handling, storing and transporting compressed gas
 - 3.3.3 storing incompatible materials
- 3.4 describe safe venting procedure when working with hazardous materials, including:
 - 3.4.1 mechanical general ventilation
 - 3.4.2 local ventilation
 - 3.4.3 portable smoke extractor
 - 3.4.4 working in a confined space
- 3.5 describe fire hazards, classes, procedures and equipment related to fire protection, including:
 - 3.5.1 elements of a fire
 - 3.5.2 classes of fires
 - 3.5.3 fire extinguisher labels
 - 3.5.4 extinguishing small fires
 - 3.5.5 the PASS method

4. demonstrate communication skills and workshop safety as they pertain to occupational health and safety standards

- 4.1 use various types of communication to provide trade-related information, employing standard terms for components and operations, including:
 - 4.1.1 personal appearance
 - 4.1.2 business appearance
 - 4.1.3 suppliers and sales representatives
 - 4.1.4 customers
 - 4.1.5 tradespeople
- 4.2 identify key areas of responsibility that an employee has in regards to shop and trade safety, including:
 - 4.2.1 housekeeping
 - 4.2.2 waste containers
 - 4.2.3 power tools and rotating machinery
 - 4.2.4 compressed air
 - 4.2.5 exhaust gases
 - 4.2.6 control of carbon monoxide (CO)
 - 4.2.7 hazardous materials, dangerous goods and controlled products
- 4.3 explain the correct use of fire extinguishers and explain fire prevention techniques

- 5. demonstrate an understanding of the millwright apprenticeship trade and of apprenticeship opportunities that exist by creating a personal career portfolio**
 - 5.1 demonstrate an understanding of the millwright apprenticeship trade and related job opportunities
 - 5.2 describe what it means to be an apprentice and describe requirements for the employee and employer
 - 5.3 refine and present a personal career portfolio, showing evidence of strengths and competencies, including:
 - 5.3.1 application completion
 - 5.3.2 cover letter
 - 5.3.3 résumé with references
 - 5.4 demonstrate knowledge of workplace requirements, rights and responsibilities and relate this knowledge to personal career/employment expectations
 - 5.5 outline the educational requirements to move into the millwright apprenticeship trade and:
 - 5.5.1 conduct successful employment searches
 - 5.5.2 communicate in the language in which business is conducted
 - 5.5.3 prepare a personal employment search portfolio
 - 5.5.4 use technologies, tools and information systems appropriately for job preparation
- 6. demonstrate basic competencies**
 - 6.1 demonstrate fundamental skills to:
 - 6.1.1 communicate
 - 6.1.2 manage information
 - 6.1.3 use numbers
 - 6.1.4 think and solve problems
 - 6.2 demonstrate personal management skills to:
 - 6.2.1 demonstrate positive attitudes and behaviours
 - 6.2.2 be responsible
 - 6.2.3 be adaptable
 - 6.2.4 learn continuously
 - 6.2.5 work safely
 - 6.3 demonstrate teamwork skills to:
 - 6.3.1 work with others
 - 6.3.2 participate in projects and tasks
- 7. create a transitional strategy to accommodate personal changes and build personal values**
 - 7.1 identify short-term and long-term goals
 - 7.2 identify steps to achieve goals